Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

January 17, 2020
Project No. 108748001

Mr. Jason Runyan
Helix Environmental Planning, Inc.
7578 El Cajon Boulevard
La Mesa, California 91942

Subject: Clarification to Geotechnical Evaluation
Sycuan-Sloane Canyon Trail Improvements
Dehesa Road and Sloane Canyon Road
San Diego County, California

References: Ninyo & Moore, 2019, Geotechnical Evaluation, Sycuan-Sloane Canyon Trail Improvements, Dehesa Road and Sloane Canyon Road, San Diego County, California, Project No. 108748001: dated May 10.

Dear Mr. Runyan:

In accordance with your request, we have prepared this letter to clarify our referenced geotechnical evaluation report (Ninyo & Moore, 2019) performed under contract with Helix Environmental Planning, Inc. At the time of our geotechnical evaluation, the pedestrian trail was considered to be in the planning stages and the trail alignments presented in our report were schematic in nature. We understand that following the completion of our evaluation, the County of San Diego altered the alignment of some of the trail segments based in part on results of the environmental surveys/studies performed by Helix. Additionally we understand that the County will be moving forward on the project in phases, with the first phase focused on Segments 1 and 4. Design level, segment-specific geotechnical evaluations may be performed in the future at the request of the County, if appropriate. At the time of this letter, an additional geotechnical evaluation of Segments 1 and 4 is currently being performed by Ninyo & Moore under contract with Rick Engineering Company. Segment-specific geotechnical evaluation reports may be obtained from the County of San Diego upon completion.

We appreciate the opportunity to be of service.

Respectfully submitted,
NINYO & MOORE

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Geotechnical Evaluation

Sycuan-Sloane Canyon Trail Improvements
Dehesa Road and Sloane Canyon Road
San Diego County, California

Helix Environmental Planning, Inc.

7578 El Cajon Boulevard | La Mesa, California 91942

May 10, 2019 | Project No. 108748001

Geotechnical | Environmental | Construction Inspection & Testing | Forensic Engineering & Expert Witness

Geophysics | Engineering Geology | Laboratory Testing | Industrial Hygiene | Occupational Safety | Air Quality | GIS

Ninyo & Moore

Geotechnical & Environmental Sciences Consultants

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

Geotechnical Evaluation

Sycuan-Sloane Canyon Trail Improvements
Dehesa Road and Sloane Canyon Road
San Diego County, California

Ms. Andrea Bitterling

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May 10, 2019 | Project No. 108748001

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1 INTRODUCTION

In accordance with your request, Ninyo & Moore has performed a geotechnical evaluation for the proposed Sycuan-Sloane Canyon Trail Improvements project located along Dehesa Road and Sloane Canyon Road in San Diego County, California (Figure 1). The purpose of our evaluation was to assess the subsurface conditions along the proposed trail alignment and to provide geotechnical recommendations for design and construction of proposed improvements. This report presents the results of our evaluation and our geotechnical conclusions and recommendations regarding the proposed construction.

2 SCOPE OF SERVICES

The scope of our services for this project generally included:

- Reviewing available topographic information, soil surveys, geologic literature, and aerial photographs of the project area.
- Coordination with County of San Diego and Sycuan Band of the Kumeyaay Nation (Sycuan) personnel to arrange site access.
- Performing a field reconnaissance to observe site conditions and to locate and mark proposed exploratory borings. Contact Underground Service Alert to clear our borings for the presence of utilities.
- Geologic mapping and photodocumentation of the trail alignment.
- Performing a subsurface exploration consisting of the drilling, logging, and sampling of 20 exploratory borings. Relatively undisturbed and bulk soil samples were obtained at selected intervals from the borings. The collected samples were transported to our in-house geotechnical laboratory for testing.
- Performing geotechnical laboratory testing on representative soil samples to evaluate design parameters and soil characteristics.
- Compiling and performing engineering analysis of the data obtained from our background review, field activities, and geotechnical laboratory testing.
- Preparing this report presenting our findings, conclusions, and recommendations regarding the geotechnical aspects of the design and construction of the project.

2.1 Site and Project Description

The project alignment is located along Dehesa Road and Sloane Canyon Road in San Diego County, California (Figures 1 and 2). The alignment is separated into six segments (Segment 1 through Segment 6). The elevations along the alignment range from approximately 460 feet above mean sea level (MSL) along Dehesa Road on Segment 6 to approximately 1030 feet MSL on Segment 3.

Based on our review of the preliminary engineering report (Nasland, 2018), we understand the proposed project will include the construction of approximately 26,000 linear feet of new trails and improvements to existing trails. Trail construction is anticipated to consist of decomposed granite (DG) covered trail surfaces, drainage crossings, bench cuts into existing slopes, and split rail fencing. Additional details regarding project alignments and proposed improvements are presented in the subsequent sections.

2.1.1 Segment 1

Segment 1 is located near an existing maintenance road on Sycuan and the Kumeyaay Diegueno Land Conservancy property. Segment 1 joins with Segment 6 on the west end and Segment 2 on the east end (Figures 2 and 3). Elevations along the alignment range from approximately 470 feet MSL on the west end to approximately 500 feet MSL on the east end. Slopes and bluffs are located on the south side of the alignment that descends down towards the Sweetwater River at an approximate elevation of 450 feet MSL. Improvements for Segment 1 are anticipated to consist of minor grading along the existing terrain and include an 8-foot wide trail and split-rail fencing. Areas of erosion along the slopes and/or bluffs were observed along the south side of Segment 1 above the Sweetwater River (Photographs 1 through 3).

2.1.2 Segment 2

Segment 2 is located along Sloane Canyon Road and the northern end of the alignment joins with Segment 1 south of Dehesa Road. The southern end of Segment 2 joins with the connection point between Segments 3 and 4 (Figures 2 and 4). Sloane Canyon Road has elevations along the alignment that range from approximately 485 feet MSL on the north end to approximately 545 feet MSL on the south end. Sloane Canyon Road includes an asphalt paved portion in the northern end and gravel paved portion in the southern end. A concrete drainage crossing is located on Sloane Canyon Road near the northern end of Segment 2. The Sweetwater River crosses near the center of the proposed alignment and a concrete bridge is located on Sloane Canyon Road crossing the Sweetwater River. The portion of the alignment north of the Sweetwater River crossing is bounded to the west by slopes that gently descend towards the Sweetwater River and to the east by ascending granitic rock slopes. The portion of the alignment south of the Sweetwater River Crossing is bounded to the west by ascending granitic rock slopes and to the east by slopes that descend down towards the Sweetwater River.

Improvements for Segment 2 are anticipated to consist of minor grading along the existing road. The trail is proposed to follow the existing alignment and gradient of Sloane Canyon Road. The trail is anticipated to be primarily located on the west side of Sloane Canyon Road and include a 5-foot wide trail separated from the road. An alternative alignment could shift the southern end of the alignment to the east side of Sloane Canyon Road and would include the construction of retaining walls and fill slopes to construct the trail and may involve widening Sloane Canyon Road to provide a 24-foot wide roadway, a 3-foot wide vegetated buffer, and a 5-foot wide trail. Construction of the trail may include 1:1 (horizontal:vertical) cut slopes to achieve the desired grades.

2.1.3 Segment 3

Segment 3 is located along an abandoned maintenance road on the west side of Sloane Canyon Road and joins with the connection point between Segments 2 and 4 (Figures 2 and 5). The alignment along the maintenance road is moderately to steeply sloping with elevations along the alignment ranging from approximately 1,030 feet MSL on the west end down to approximately 545 feet MSL on the east end. The maintenance road has not been maintained and has experienced erosion in several areas of the alignment. The erosional features were measured up to 3 feet deep (Photographs 4 through 6). The erosion severity generally decreases towards the western portion of the trail.

Improvements for the trail are anticipated to consist of clearing vegetation, repairing the erosional features, and regrading the trail along the existing alignment and gradient. The improvements will include a 5 to 10 foot wide trail with possible split rail fencing.

2.1.4 Segment 4

Segment 4 is located adjacent to Sloane Canyon Road on a steep, vegetated hillside. Segment 4 joins with Segments 2 and 3 on the north end and Segment 5 on the southern end near Model A Ford Lane (Figures 2 and 6). The existing land along the proposed alignment is steeply sloping with elevations along the alignment ranging from approximately 540 feet MSL to approximately 700 feet MSL.

Improvements for Segment 4 are anticipated to include bench cuts with 1:1 cut slopes into the existing slope to create a 5-foot wide graded pad with a 3-foot wide trail. The northern portion of Segment 4 is anticipated to follow the existing San Diego Gas & Electric (SDG&E) maintenance trail. The southern end of the trail is anticipated to include switchbacks from the end of the SDG&E maintenance trail towards Model A Ford Lane.

2.1.5 Segment 5

Segment 5 is located along Sloane Canyon Road and the western end of the alignment joins with Segment 4 near Model A Ford Lane and extends east to the end of the trail near the intersection of Sloane Canyon Road and Beaver Hollow Road (Figures 2 and 6). Sloane

Canyon Road along the proposed alignment is gently to moderately sloping with elevations along the alignment ranging from approximately 535 feet MSL to approximately 590 feet MSL. Sloane Canyon Road along the alignment is gravel paved and includes a concrete drainage crossing at Beaver Hollow Creek. The alignment is bounded to the north by slopes and bluffs that descend towards the Sweetwater River and to the south by gently ascending granitic rock slopes.

Improvements for Segment 5 are anticipated to consist of minor grading along the existing road. The trail is anticipated to be generally located on the south side of Sloane Canyon Road and construction may include bench cuts with 1:1 cut slopes into the existing slope to create a 5-foot wide graded trail. Alternative improvements may involve widening Sloane Canyon Road to provide a 24-foot wide roadway, a 3-foot wide vegetated buffer, and a 5 foot wide trail. Construction of the alternative road widening may include 2:1 (horizontal to vertical) fill slopes to achieve the desired grades

2.1.6 Segment 6

Segment 6 is located along Dehesa Road within the northwest portion of the project area. The eastern end of the alignment joins with Segment 1 near the existing maintenance road on Sycuan and the Kumeyaay Diegueno Land Conservancy property and extends west to the end of the trail at the intersection of Dehesa Road and Willow Glen Drive (Figures 2 and 7). Dehesa Road along the proposed alignment is a relatively flat lying to gently sloping, asphalt paved, two lane road with paved bike lanes and shoulders. Elevations along the alignment range from approximately 460 feet MSL to approximately 475 feet MSL. The alignment is bounded to the south residential properties and the Singing Hills Golf Resort at Sycuan. The eastern end of the alignment is bounded to the north by residential properties. The western portion of the alignment is bounded to the north by gently to moderately ascending granitic rock slopes.

Segment 6 is proposed to include trail improvements to both the north and south sides of Dehesa Road. Improvements along the side south side of Dehesa Road are anticipated to include minor grading along the existing road to construct a 5-foot wide trail with a 3-foot wide buffer. Construction may include 2:1 (horizontal to vertical) fill slopes or retaining walls to achieve the desired grades. Existing sidewalks would be incorporated into the proposed trail.

Improvements on the north side of the road are anticipated to include a 5-foot wide trail with a 3-foot wide buffer that meanders adjacent to Dehesa Road. Where the trail is adjacent to the residential development in the eastern portion of the alignment, the trail is anticipated to be located between Dehesa Road and the existing sidewalk. Construction may include 2:1 (horizontal to vertical) cut slopes or retaining walls to achieve the desired grades.

3 FIELD EXPLORATION

Our field exploration consisted of the performance of a geologic reconnaissance and mapping and subsurface exploration, which are discussed further in the following sections.

3.1 Subsurface Evaluation

Our subsurface exploration was conducted on March 13 and March 14, 2019 and included the drilling, logging, and sampling of 20 small-diameter borings (B-1 through B-20) spread across Segments 1, 2, 3, 5, and 6. Field evaluation along Segment 4 did not include exploratory borings and was limited to geologic mapping. The borings were advanced using 4-inch diameter, hand auger boring equipment and advanced to depths up to approximately 10 feet. Ninyo & Moore personnel logged the borings in general accordance with the Unified Soil Classification System (USCS) and ASTM International (ASTM) Test Method D 2488 by observing cuttings and drive samples. Representative bulk and in-place soil samples were collected at selected depths from within the exploratory borings and were transported to our in-house geotechnical laboratory for analysis. The approximate locations of the exploratory borings are shown on Figures 2 through 7. Logs of the borings are included in Appendix A.

3.2 Laboratory Testing

Geotechnical laboratory testing was performed on representative soil samples collected from our subsurface exploration. Testing included an evaluation of in-situ dry density and moisture content, gradation, shear strength, soil corrosivity, and R-value. The results of the in-situ dry density and moisture content tests are presented on the boring logs in Appendix A. The results of the other laboratory tests that we performed are presented in Appendix B.

3.3 Geologic Reconnaissance and Mapping

Our geologic reconnaissance and mapping at the site was performed on March 15, 2019. Geologic mapping was performed by a licensed geologist from our office. Granitic rock outcrops were identified in the field and photodocumented. Selected photographs are included in Appendix C. Where applicable, the geologic mapping is presented on Figures 3 through 7.

4 GEOLOGY

Our findings regarding regional and site geology at the project location are provided in the following sections.

4.1 Regional Geologic Setting

The project area is situated in the coastal foothill section of the Peninsular Ranges Geomorphic Province. This geomorphic province encompasses an area that extends approximately 900 miles from the Transverse Ranges and the Los Angeles Basin south to the southern tip of Baja California (Norris and Webb, 1990; Harden, 2004). The province varies in width from approximately 30 to 100 miles. In general, the province consists of rugged mountains underlain by Jurassic-aged metavolcanic and metasedimentary rocks, and Cretaceous-aged igneous rocks of the southern California batholith. The portion of the province in San Diego County that includes the project area consists generally of young alluvium deposits and Cretaceous-aged granitic rock (Figure 8).

4.2 Site Geology

Based on our subsurface evaluation, the project alignment is underlain by fill soils, colluvium, alluvium, residual soil, and Cretaceous-aged granitic rock. Generalized descriptions of the earth units encountered during our field reconnaissance and subsurface exploration are provided in the subsequent sections. Additional descriptions of the subsurface units are provided on the boring logs in Appendix A. The geology of the site is shown on Figure 8.

4.2.1 Fill

Fill soils were encountered in borings located along Segments 1, 2, 5, and 6. Where encountered, the fill soils generally consisted of various shades of brown, dry to moist, loose to medium dense, silty sand. Scattered amounts of gravel were encountered in the fill soils. Fill soils extended to depths more than 5 feet below the ground surface.

4.2.2 Alluvium

Alluvium was encountered in borings located along Segments 1, 2, 5, and 6. Where encountered, the alluvium generally consisted of various shades of brown and gray, dry to moist, loose to medium dense, sandy silt, silty sand, poorly graded sand, poorly graded sand with silt, and well graded sand with silt, and stiff, sandy clay. Scattered amounts of gravel and cobbles were encountered in the alluvium.

4.2.3 Colluvium

Colluvium was encountered in borings located along Segments 2, 5, and 6 and was observed overlying rock outcrops along Segment 4. Where encountered, the colluvium generally consisted of various shades of yellow and brown, moist, loose to medium dense, clayey to silty sand, and soft to stiff, silt and lean clay.

4.2.4 Residual Soil

Residual Soil was encountered in borings located along Segments 2 and 3. Where encountered, the residual soil generally consisted of various shades of brown, moist, loose to medium dense, silty sand. Scattered amounts of granitic rock fragments were observed in the residual soil.

4.2.5 Granitic Rock

Granitic rock materials were encountered in borings located along Segments 2, 3, 5, and 6, and observed in rock outcrops along Segment 4. Where encountered, the materials generally consisted of various shades of brown and gray, dry, slightly weathered to decomposed, granitic rock. Outcrops of granitic rock and intact granitic materials were observed on the surface along the east side of the alignment of Segment 2 and along the alignment of Segment 4 (Figures 4 and 6; Photographs 7 through 12). Cobble and boulder sized fragments of granitic rock were observed in colluvial deposits on the south side of the alignment of Segment 5 (Photographs 13 through 15). Several outcrops of large granite boulders were observed on the surface along the northern alignment of Segment 6 (Figure 7; Photographs 16 through 20).

4.3 Groundwater

Groundwater was not encountered in our subsurface evaluation. Groundwater is anticipated to generally coincide with the water surface elevation of the Sweetwater River. Fluctuations in the groundwater level and local perched conditions may occur due to variations in ground surface topography, subsurface geologic conditions and structure, rainfall, irrigation, and other factors.

4.4 Flood Hazards

Based on review of Federal Emergency Management Agency (FEMA) Mapping Information Platform website (2012), Segment 1 and portions of Segment 2 alignments are located within Special Flood Hazard Areas. The portions of the alignment are mapped as Zone AE and classified as Regulatory Floodway and Special Flood Hazard Areas with Base Flood Elevations between 476 feet and 523 feet. A portion of the Segment 5 alignment near Beaver Hollow Creek is mapped within the mapped 500-year flood zone. Additionally, based on a review of the Multi-Jurisdictional Hazard Mitigation Plan (County of San Diego, 2017), the Segment 1 and 2 alignments along Sweetwater River are mapped as lying inside the mapped dam failure inundation zone for the Lake Loveland Reservoir. Therefore, flooding should be a design consideration for the project.

4.5 Landsliding

Based on our review of referenced geologic maps, literature, topographic maps, and stereoscopic aerial photographs, no landslides or indications of deep-seated landsliding were noted underlying the project site. As such, the potential for significant large-scale slope instability at the site is not a design consideration.

4.6 Erosion

As previously described, areas of bluff and slope erosion were observed adjacent to the Segment 1 alignment (Photographs 1 through 3) and along the alignment of Segment 3 (Photographs 4 through 6). Due to the presence of loose, surficial soils, the potential for surficial erosion along the proposed alignment should be a design consideration. Efforts to mitigate the erosion potential adjacent to the proposed trail should be incorporated into the design.

5 FAULTING AND SEISMICITY

Based on our review of the referenced geologic maps and stereoscopic aerial photographs, as well as on our geologic review, the site is not underlain by known active or potentially active faults (i.e., faults that exhibit evidence of ground displacement in the last 11,000 years and 2,000,000 years, respectively). The site is not located within a State of California Earthquake Fault Zone (EFZ) (formerly known as an Alquist-Priolo Special Studies Zone) (Hart and Bryant, 1997). However, like the majority of Southern California, the site is located in a seismically active area and the potential for strong ground motion is considered significant during the design life of the proposed structure. Figure 9 shows the approximate site location relative to the major faults in the region. The nearest known active fault is the Rose Canyon fault, located approximately 16.9 miles west of the site. In general, hazards associated with seismic activity include strong ground motion, ground surface rupture, liquefaction, seismically induced settlement, and tsunamis. These hazards are discussed in the following sections.

In addition, an unnamed, pre-Quaternary aged fault is mapped crossing the western portion of the proposed trail alignment along Dehesa Road. The fault is not included in the USGS or CGS databases as “active” faults and the fault is not mapped as an Earthquake Fault Zone. Since the fault is not considered to be active as defined by the CGS, it is not considered to have an impact on the project.

5.1 Strong Ground Motion

The 2016 CBC specifies that the Risk-Targeted, Maximum Considered Earthquake (MCER) ground motion response accelerations be used to evaluate seismic loads for design of buildings and other structures. The MCER ground motion response accelerations are based on the spectral response accelerations for 5 percent damping in the direction of maximum horizontal response and incorporate a target risk for structural collapse equivalent to 1 percent in 50 years with deterministic limits for near-source effects. The horizontal peak ground acceleration (PGA) that corresponds to the MCER for the site was calculated as 0.40g using a web-based seismic design tool (SEAOC/OSHPD, 2019).

The 2016 CBC specifies that the potential for liquefaction and soil strength loss be evaluated, where applicable, for the Maximum Considered Earthquake Geometric Mean (MCEG) peak ground acceleration with adjustment for site class effects in accordance with the American Society of Civil Engineers (ASCE) 7-10 Standard. The MCEG peak ground acceleration is based on the geometric mean peak ground acceleration with a 2 percent probability of exceedance in 50 years. The MCEG peak ground acceleration with adjustment for site class effects (PGAM) was calculated as 0.38g using a web-based seismic design tool that yielded a mapped MCEG peak ground acceleration of 0.327g for the site and a site coefficient (FPGA) of 1.173 for Site Class D (SEAOC/OSHPD, 2019).

5.2 Ground Surface Rupture

As previously mentioned, a pre-Quaternary aged fault is mapped crossing the western portion of the proposed trail alignment along Dehesa Road. However, the fault is not considered “active”. Based on our review of the referenced literature and our site reconnaissance, active faults are not known to cross the project vicinity. Therefore, the potential for ground surface rupture due to faulting at the site is considered low. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

5.3 Liquefaction and Seismically Induced Settlement

Liquefaction of cohesionless soils can be caused by strong vibratory motion due to earthquakes. Research and historical data indicate that loose granular soils and non-plastic silts that are saturated by a relatively shallow groundwater table are susceptible to liquefaction. Liquefaction and seismically induced settlement are not anticipated where the trail alignment is underlain by shallow, relatively dense granitic rock or where shallow groundwater is absent. Sections of the trail alignment where shallow groundwater and loose fill, alluvial, colluvial, and/or residual soils are present may be subject to liquefaction and seismically induced settlement. However, evaluation of the magnitude and effects of liquefaction and seismically induced settlement was not part of our evaluation, since no structures for human occupancy are planned as part of this project. Additionally, the types of improvements being proposed may not be subject to design considerations associated with liquefaction and seismically induced settlement

5.4 Tsunamis and Seiches

Tsunamis are long wavelength seismic sea waves (long compared to the ocean depth) generated by sudden movements of the ocean bottom during submarine earthquakes, landslides, or volcanic activity. Seiches are similar oscillating waves on inland or enclosed bodies of water. Based on the location and elevation of the site, the potential for a tsunami or seiche to affect the site is not a design consideration.

6 CONCLUSIONS

Based on our review of the referenced background data, subsurface exploration, and laboratory testing, it is our opinion that the construction of the proposed improvements for the Sycuan-Sloane Canyon Trail are feasible from a geotechnical standpoint provided the recommendations presented in this report are incorporated into the design and construction of the project. In general, the following conclusions were made:

The project site is underlain by fill, alluvium, colluvium, residual soil, and granitic rock materials.

As previously mentioned, granitic rock outcrops were observed on the surface within Segments 2, 3, 4, and 6 in the project area. These areas are anticipated to be very difficult to excavate. Heavy ripping, blasting, or rock breaking should be anticipated. The contractor should anticipate difficulty in performing excavations. The presence of resistant boulders and/or corestones can be problematic in a narrow trench and should be anticipated by the contractor. Rippability will also be dependent on the excavation equipment used and the skill and experience of the equipment contractor.

Oversized materials will be generated from excavations and blasting operations performed at the site. Oversized materials should be screened, crushed, or otherwise processed prior to their reuse as compacted fill.

On-site materials may be suitable for reuse as compacted fill, provided that they are screened of oversized materials and they meet the criteria for compacted fill materials presented in the following earthwork recommendations, including presence of deleterious material and organic content.

Based on the results of our soil corrosivity tests presented in Appendix B the site soils are not considered corrosive based on the California Department of Transportation (Caltrans, 2018) corrosion guidelines.

7 RECOMMENDATIONS

Based on our understanding of the project, the following recommendations are provided for the design and construction of the proposed improvements at the project site. The proposed site improvements should be constructed in accordance with the requirements of the applicable governing agencies and the recommendations of this report.

7.1 Earthwork

In general, earthwork should be performed in accordance with the recommendations presented in this report. The geotechnical consultant should be contacted for questions regarding the recommendations or guidelines presented herein.

7.1.1 Pre-Construction Conference

We recommend that a pre-construction meeting be held prior to the commencement of grading. The owner and/or their representative, the governing agencies' representatives, the civil engineer, Ninyo & Moore, and the contractor should be in attendance to discuss the work plan and project schedule and earthwork requirements.

7.1.2 Site Preparation

Site preparation should begin with the removal of vegetation, utility lines, asphalt, concrete, and other deleterious debris from areas to be graded. Tree stumps and roots should be removed to such a depth that organic material is generally not present. Clearing and grubbing should extend to the outside of the proposed excavation and fill areas. The debris and unsuitable material generated during clearing and grubbing should be removed from areas to be graded and disposed of at a legal dumpsite away from the project area.

7.1.3 Remedial Grading

We recommend that remedial grading be performed in areas where fill, alluvium, colluvium, and/or residual soils are exposed at planned subgrade elevations. In these areas, we recommend that the fill, alluvium, colluvium, and/or residual soils be overexcavated, moisture conditioned, and recompacted in order to provide a suitable subgrade for the proposed trail improvements. In general, we recommend that the overexcavation extend to a depth of 3 feet or to competent granitic rock, whichever is less. The overexcavation should extend laterally 3 feet from the exterior limits of the improvements. The extent and depth of removals should be evaluated by the geotechnical consultant's representative in the field based on the material exposed.

Unless competent granitic rock is exposed at the resulting overexcavation bottom, the exposed bottom should be scarified 8 inches, moisture conditioned, and compacted to a relative compaction of 90 percent as evaluated by American Society for Testing and Materials International (ASTM) Test Method D 1557. In areas where granitic bedrock is exposed, scarification, moisture conditioning, and recompaction is not needed. Compacted fill may then be placed in accordance with the recommendations presented herein.

7.1.4 Excavation Characteristics

Based on our field exploration and experience, we anticipate that excavations within the fill, alluvium, colluvium, and residual soil may be accomplished with heavy-duty earthmoving equipment in good working condition. However, the contractor should anticipate caving and/or sloughing conditions when performing excavations in these materials due to the presence of loose soil. Very difficult excavation conditions should be anticipated within the granitic rock and heavy ripping, rock breaking, coring, and/or blasting should be expected. Additionally, zones containing more resistant, less weathered rock and "corestones" should be anticipated in the granitic rock. Oversize cobbles and boulders could be generated during excavation within these materials.

7.1.5 Materials for Fill

Materials for fill may be obtained from on-site excavations or may be import materials. Fill soils should possess an organic content of less than approximately 3 percent by volume (or 1 percent by weight). In general, fill material should not contain rocks or lumps over approximately 3 inches in diameter, and not more than approximately 30 percent larger than ¾ inch. Oversize materials should be separated from material to be used for fill and removed from the site.

Imported fill material should generally be granular soils with a low expansion potential (i.e., an expansion index [EI] of 50 or less). Additionally, import material should not be considered corrosive as defined by Caltrans (2018) corrosion guidelines and ACI 318. The contractor should be responsible for the uniformity of import material brought to the site. We recommend that materials proposed for use as import fill be evaluated from a contractor's stockpile rather than in-place materials. Materials for use as fill should be evaluated by Ninyo & Moore's representative prior to filling or importing.

7.1.6 Compacted Fill

Prior to placement of compacted fill, the contractor should request an evaluation of the exposed ground surface by Ninyo & Moore. Unless otherwise recommended, the exposed ground surface should then be scarified to a depth of approximately 8 inches and watered or dried, as needed, to achieve moisture contents generally above the optimum moisture content. The scarified materials should then be compacted to a relative compaction of 90 percent as evaluated in accordance with the ASTM D 1557. The evaluation of compaction by the geotechnical consultant should not be considered to preclude any requirements for observation or approval by governing agencies. It is the contractor's responsibility to notify this office and the appropriate governing agency when project areas are ready for observation, and to provide reasonable time for that review.

Fill materials should be moisture conditioned to generally above the laboratory optimum moisture content prior to placement. The optimum moisture content will vary with material type and other factors. Moisture conditioning of fill soils should be generally consistent within the soil mass.

Prior to placement of additional compacted fill material following a delay in the grading operations, the exposed surface of previously compacted fill should be prepared to receive fill. Preparation may include scarification, moisture conditioning, and recompaction.

Compacted fill should be placed in horizontal lifts of approximately 8 inches in loose thickness. Prior to compaction, each lift should be watered or dried as needed to achieve a moisture content generally above the laboratory optimum, mixed, and then compacted by mechanical methods to a relative compaction of 90 percent as evaluated by ASTM D 1557. The upper 12 inches of fill beneath the trail surface should be compacted to a relative compaction of 95 percent as evaluated by ASTM D 1557. Successive lifts should be treated in a like manner until the desired finished grades are achieved.

7.1.7 Temporary Excavations

For temporary excavations, we recommend that the following Occupational Safety and Health Administration (OSHA) soil classifications be used:

Fill, Alluvium Colluvium, and Residual Soil	*Type C*
Granitic Rock	*Type B*

Upon making the excavations, the soil classifications and excavation performance should be evaluated in the field by the geotechnical consultant in accordance with OSHA regulations. Temporary excavations should be constructed in accordance with OSHA recommendations.

For trenches or other excavations, OSHA requirements regarding personnel safety should be met using appropriate shoring (including trench boxes) or by laying back the slopes to no steeper than 1:1 in granitic rock and 1.5:1 in other soil materials. Temporary excavations that encounter seepage may be shored or stabilized by placing sandbags or gravel along the base of the seepage zone. Excavations encountering seepage should be evaluated on a case-by-case basis. On-site safety of personnel is the responsibility of the contractor.

7.1.8 Cut and Fill Slopes

Unless otherwise recommended by Ninyo & Moore and approved by the County of San Diego/Sycuan Band of Kumeyaay Nation, cut and fill slopes should not be constructed steeper than 2:1 (horizontal to vertical). The faces of cut slopes should be observed by a representative of Ninyo & Moore to see whether jointing, bedding planes, or other adversely-oriented planes of weakness are exposed. If excavations for cut slopes expose loose, cohesionless, significantly fractured, or otherwise unsuitable materials, overexcavation of the unsuitable material and replacement with a compacted stabilization fill should be considered.

A key, inclined gently into the slope, should be constructed at the toe of fill slopes, in accordance with the California Building Code. The keyway should extend to a depth of 2 feet into competent bedrock materials and extend the width of the fill slope. The length of the key, as measured into the slope will depend on the proposed fill slope height and geometry, the type of equipment being used, and other factors; however, for planning purposes a key length of 10 feet can be assumed. In addition to the keyway, the fill slope should be benched into competent natural materials as the fill slope construction progresses. Benches should be inclined slightly into slope and have a width of 4 feet or more. However, the actual extent of key and benches should be evaluated in the field at the time of construction by representatives of Ninyo & Moore. Further removals may be recommended based on the observed conditions exposed during grading, and the contractor should plan for these removals.

Compaction of the face of fill slopes should be performed by backrolling at intervals of 4 feet or less in vertical slope height or as dictated by the capability of the available equipment, whichever is less. Fill slopes should be backrolled. Care should be taken in maintaining the desired moisture conditions and/or reestablishing them as needed, prior to backrolling.

Alternatively, compacted fill slopes may be overbuilt and cut back to grade, exposing firm compacted fill. The actual amount of overbuilding will vary as field conditions dictate. If the desired results are not achieved, the existing slopes should be overexcavated and reconstructed in accordance with the recommendations of Ninyo & Moore or the County's designated representative. The degree of overbuilding may be increased until the desired compacted slope face condition is achieved. Care should be taken by the contractor to provide mechanical compaction as close to the outer edge of the overbuilt slope surface as practical. The placement, moisture conditioning, and compaction of fill slope materials should be done in accordance with the recommendations presented in the Compacted Fill section of this report.

7.1.9 Drainage

Site drainage should be directed such that runoff water is diverted away from slopes and structures to suitable discharge areas by nonerodible devices (e.g., gutters, concrete swales, etc.). Positive drainage adjacent to structures should be established and maintained. Positive drainage may be accomplished by providing drainage away from the foundations of structures at a gradient of 2 percent or steeper for a distance of 5 feet or more outside building perimeters, and further maintained by a graded swale leading to an appropriate outlet, in accordance with the recommendations of the project civil engineer and/or landscape architect.

Surface drainage on the site should be provided so that water is not permitted to pond. A gradient of 2 percent or steeper should be maintained over the pad area and drainage patterns should be established to divert and remove water from the site to appropriate outlets.

Care should be taken by the contractor during final grading to preserve any berms, drainage terraces, interceptor swales or other drainage devices of a permanent nature on or adjacent to the property. Drainage patterns established at the time of final grading should be maintained for the life of the project. The property owner and the maintenance personnel should be made aware that altering drainage patterns might be detrimental to foundation performance.

7.2 Seismic Design Considerations

Design of the proposed improvements should be performed in accordance with the requirements of governing jurisdictions and applicable building codes. Table 1 presents the seismic design parameters for the site in accordance with the CBC (2016) guidelines and adjusted MCER spectral response acceleration parameters (SEAOC/OSHPD, 2019).

Table 1 – 2016 California Building Code Seismic Design Criteria	
Seismic Design Factors	Value
Site Class	D
Site Coefficient, Fa	1.151
Site Coefficient, Fv	1.731
Mapped Spectral Acceleration at 0.2-second Period, Ss	0.873g
Mapped Spectral Acceleration at 1.0-second Period, S1	0.335g
Spectral Acceleration at 0.2-second Period Adjusted for Site Class,	1.005g
Spectral Acceleration at 1.0-second Period Adjusted for Site Class,	0.579g
Design Spectral Response Acceleration at 0.2-second Period, SDS	0.670g
Design Spectral Response Acceleration at 1.0-second Period, SD1	0.386g

7.3 Retaining Walls

We understand that retaining walls may be constructed as part of this project. Yielding retaining walls that are not restrained against movement by rigid corners or structural connections may be designed using the earth pressures presented in Figure 10. These pressures do not include surcharge loads. The designer should evaluate the surcharge pressures from traffic, buildings, and other structures as warranted. These pressures also assume low-expansive, granular backfill with free-draining conditions.

7.3.1 Retaining Wall Foundations

Retaining walls may be supported on conventional shallow foundations supported entirely on granitic rock or compacted fill materials. Shallow, spread or continuous footings, founded entirely on granitic rock may be designed using an allowable bearing capacity of 4,000 pounds per square foot (psf). Shallow, spread or continuous footings, founded on 2 feet or more of compacted fill may also be designed using an allowable bearing capacity of 3,000 psf. These allowable bearing capacities may be increased by one-third when considering loads of short duration such as wind or seismic forces. Retaining wall footings should be founded 18 inches or more below the lowest adjacent grade and have a width of 18 inches or more. The spread footings should be reinforced in accordance with the recommendations of the project structural engineer. Total settlement is estimated to be approximately 1 inch. Differential settlement is estimated to be approximately ½ inch over a horizontal span of 40 feet.

7.3.2 Lateral Resistance

For resistance of retaining wall footings to lateral loads, we recommend an allowable passive pressure of 350 psf per foot of depth be used with a value of up to 3,500 psf. This value assumes that the ground is horizontal for a distance of 10 feet, or three times the height generating the passive pressure, whichever is greater. We recommend that the upper 1 foot of soil not protected by pavement or a concrete slab be neglected when calculating passive resistance. For frictional resistance to lateral loads, we recommend a coefficient of friction of 0.35 be used between soil and concrete. The allowable lateral resistance can be taken as the sum of the frictional resistance and passive resistance provided the passive resistance does not exceed one-half of the total allowable resistance. The passive resistance values may be increased by one-third when considering loads of short duration such as wind or seismic forces.

7.3.3 Retaining Wall Drainage

Measures should be taken to reduce the potential for build-up of moisture behind the retaining walls. Drainage design should include free-draining backfill materials and perforated drains as depicted on Figure 11. Solid outlet pipes should be connected to the perforated drains and then routed to a suitable area for discharge of accumulated water. The portions of retaining walls supporting backfill should be coated with an appropriate waterproofing compound or covered with a similar material to inhibit infiltration of moisture through the walls. It is the responsibility of the project structural engineer and/or the retaining wall contractor to provide specifications for waterproofing materials and methods of application.

7.3.4 Retaining Wall Backfill

Materials for retaining wall backfill should be generally granular materials that does not contain rocks or lumps over 3 inches in largest dimension and not more than 30 percent larger than ¾ inch by weight. Imported backfill material, if used, should also possess a low expansion potential (EI of 50 or less as evaluated by ASTM D 4829) and be non-corrosive in accordance with the Caltrans (2018) corrosion guidelines.

Backfill materials should be moisture conditioned to near optimum moisture content prior to placement. The optimum moisture content will vary with material type and other factors. Moisture conditioning of fill soils should be generally consistent within the soil mass. Backfill should be placed in horizontal lifts of approximately 8 inches in loose thickness. Prior to compaction, each lift should be watered or dried as needed to achieve near optimum moisture condition, mixed, and then compacted by mechanical methods, to a 90 percent of its modified Proctor density as evaluated by ASTM D 1557. Successive lifts should be treated in a like manner until the desired finished grades are achieved.

7.4 Exterior Concrete Flatwork

Exterior concrete flatwork, if planned, should be 4 inches in thickness and should be reinforced with No. 3 reinforcing bars placed at 24 inches on-center both ways. Exterior slabs should be underlain by 4 inches of clean sand. A vapor retarder is not needed for exterior flatwork. To reduce the potential manifestation of distress to exterior concrete flatwork due to movement of the underlying soil, we recommend that such flatwork be installed with crack-control joints at appropriate spacing as designed by the structural engineer. Before placement of concrete, the subgrade soils consisting of low expansive materials should be scarified to a depth of 8 inches, moisture conditioned to generally above the laboratory optimum moisture content, and compacted to a relative compaction of 90 percent as evaluated by ASTM D 1557. As previously described, concrete flatwork should be underlain by 1 foot of low expansion material. Positive drainage should be established and maintained adjacent to flatwork.

7.5 Soil Corrosion

Laboratory testing was performed on a representative sample of the on-site earth materials to evaluate pH and electrical resistivity, as well as chloride and sulfate contents. The pH and electrical resistivity tests were performed in accordance with CT 643 and the sulfate and chloride content tests were performed in accordance with CT 417 and CT 422, respectively. These laboratory test results are presented in Appendix B.

The results of the corrosivity testing indicated electrical resistivity of 4,000 ohm-cm, soil pH value of 6.4, chloride content of 20 parts per million (ppm), and sulfate content of 0.001 percent (i.e., 10 ppm). Based on the Caltrans corrosion (2018) criteria, the site would not be classified as corrosive. Caltrans (2018) defines corrosive soils as soil with an electrical resistivity less than 1,100 ohm-cm, a chloride content greater than 500 ppm, greater than 0.15 percent sulfates (1,500 ppm), and/or a pH less than 5.5.

7.6 Concrete

Concrete in contact with soil or water that contains high concentrations of water-soluble sulfates can be subject to premature chemical and/or physical deterioration. As noted, the soil sample tested in this evaluation indicated water-soluble sulfate content of 0.001 percent by weight (i.e., 10). Based on the ACI 318 criteria, the potential for sulfate attack is negligible for water-soluble sulfate contents in soils less than about 0.10 percent by weight. Therefore, the site soils may be considered to have a negligible potential for sulfate attack. However, due to the potential variability of site soils, consideration should be given to using Type II/V or Type V cement for normal weight concrete in contact with soil.

8 PLAN REVIEW AND CONSTRUCTION OBSERVATION

The conclusions and recommendations presented in this report are based on analysis of observed conditions in widely spaced exploratory borings. If conditions are found to vary from those described in this report, Ninyo & Moore should be notified, and additional recommendations will be provided upon request. Ninyo & Moore should review the final project drawings and specifications prior to the commencement of construction. Ninyo & Moore should perform the needed observation and testing services during construction operations.

The recommendations provided in this report are based on the assumption that Ninyo & Moore will provide geotechnical observation and testing services during construction. In the event that it is decided not to utilize the services of Ninyo & Moore during construction, we request that the selected consultant provide the client and Ninyo & Moore with a letter indicating that they fully understand Ninyo & Moore's recommendations, and that they are in full agreement with the design parameters and recommendations contained in this report. Construction of proposed improvements should be performed by qualified subcontractors utilizing appropriate techniques and construction materials.

9 LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed 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 encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

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. Ninyo & Moore 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 for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

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.

10 REFERENCES

American Concrete Institute (ACI), 2014, ACI 318 Building Code Requirements for Structural Concrete and Commentary.

American Society of Civil Engineers (ASCE), 2010, Minimum Design Loads for Buildings and Other Structures, ASCE 7-10.

Building News, 2018, "Greenbook," Standard Specifications for Public Works Construction: BNI Publications.

California Building Standards Commission, 2016, California Building Code, Title 24, Part 2, Volumes 1 and 2.

California Department of Transportation (Caltrans), 2018, Corrosion Guidelines (Version 3.0), Division of Engineering and Testing Services, Corrosion Technology Branch: dated March.

California Geological Survey (CGS), 1998, Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada: dated February.

County of San Diego, 2017, Multi-Jurisdictional Hazard Mitigation Plan, https://www.sandiegocounty.gov/oes/emergency_management/oes_jl_mitplan.html.

Geotracker website, 2019, www.geotracker.waterboards,ca.gov: accessed in April.

Google Earth, 2019, https://www.google.com/earth/: accessed in April.

Harden, D.R., 2004, California Geology, 2nd edition: Prentice Hall, Inc.

Hart, E.W., and Bryant, W.A., 1997, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zone Maps: California Geological Survey, Special Publication 42, with Supplements 1 and 2 added in 1999.

Historic Aerials website, 2019, www.historicaerials.com: accessed in April.

Jennings, C.W., 2010, Fault Activity Map of California and Adjacent Areas: California Geological Survey, California Geological Map Series, Map No. 6.

Nasland Engineering, 2018, Preliminary Engineering Report for Sycuan/Sloane Canyon Trail Improvements (Draft), dated July 24.

Ninyo & Moore, In-House Proprietary Data.

Ninyo & Moore, 2018, Proposal for Geotechnical Evaluation, Sycuan-Sloane Canyon Trail Improvements, San Diego County, California, Proposal No. 02-01557: dated December 11.

Norris, R. M. and Webb, R. W., 1990, Geology of California, Second Edition: John Wiley & Sons, Inc.

SANGIS, 2009, Draft – Liquefaction County of San Diego Hazard Mitigation Planning Map.

SEAOC/OSHPD, 2019, Seismic Design Maps, https://seismicmaps.org/: accessed April.

Tan, S.S., 1995, Landslide Hazards in the Southern Part of the San Diego Metropolitan Area, San Diego County, California, El Cajon Quadrangle, Plate C, California Geological Survey: Landslide Hazards Identification Map No. 33, DMG OFR 95-03.

Todd, V.R., 2004, Preliminary Geologic Map of the El Cajon 30' x 60' Quadrangle, California: California Geological Survey Open-File Report 2004-1361, Version 1.0, Scale 1:100,000.

Treiman, J.A., 1993, The Rose Canyon Fault Zone, Southern California: California Geological Survey, Open File Report 93-02.

United States Department of the Interior, Bureau of Reclamation, 1989, Engineering Geology Field Manual.

United States Federal Emergency Management Agency (FEMA), 2019, FEMA Mapping Information Platform, World Wide Web, https://hazards.fema.gov/femaportal/wps/portal/: accessed in February.

United States Geological Survey, 2018, El Cajon, California, San Diego County, 7.5-Minute Series (Topographic): Scale 1:24,000.

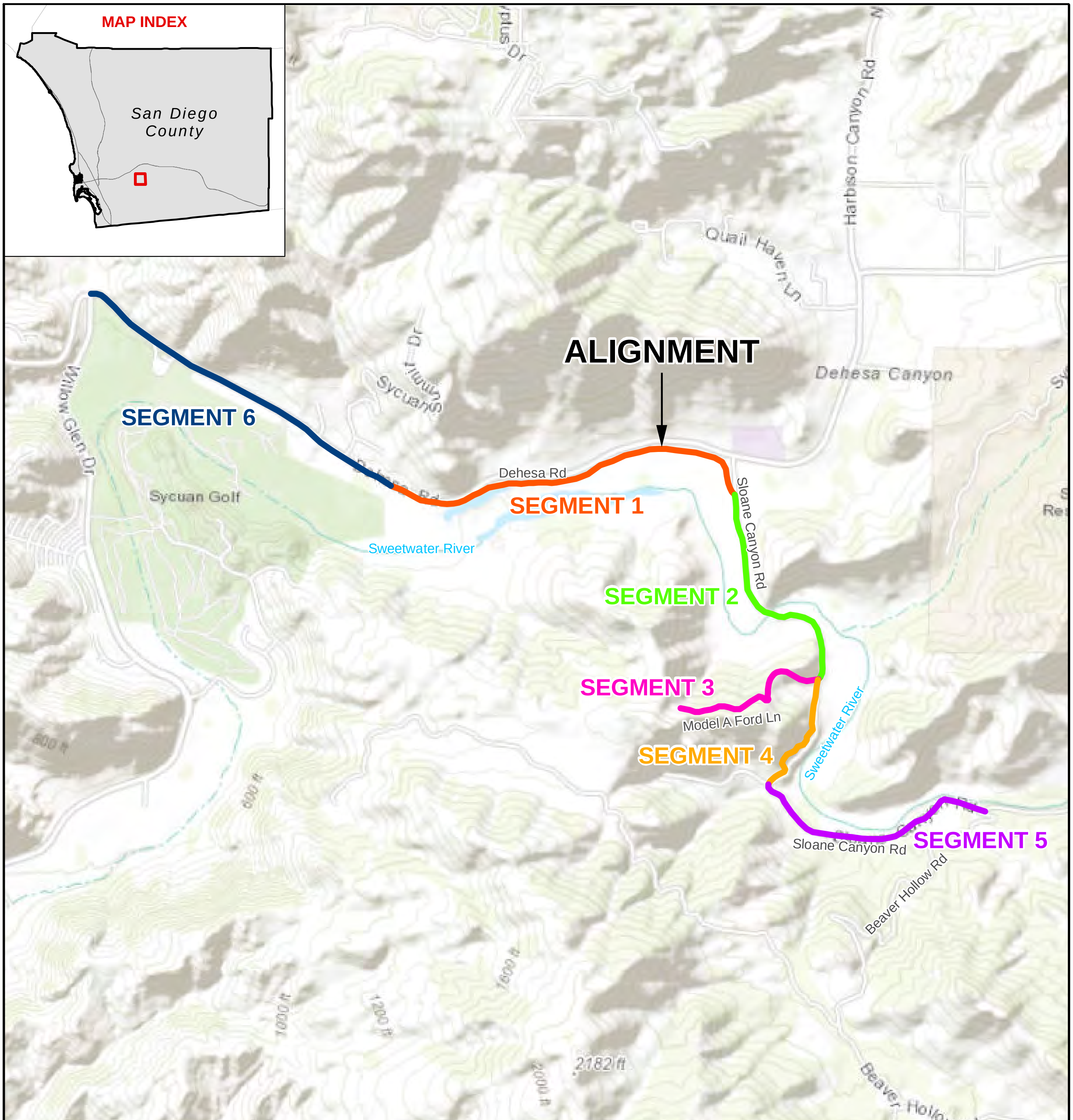
United States Geological Survey, 2018, Alpine, California, San Diego County, 7.5-Minute Series (Topographic): Scale 1:24,000.

United States Geological Survey, 2019, 2008 National Seismic Hazard Maps - Source Parameters, https://earthquake.usgs.gov/cfusion/hazfaults_2008_search/query_main.cfm: accessed in April.

USDA, Aerial Photograph, Date 4-2-53, Flight AXN-5M, Numbers 148, 149, 169, and 170, Scale 1:20,000.

USDA, Aerial Photograph, Date 4-2-53, Flight AXN-6M, Numbers 141 and 142, Scale 1:20,000.

FIGURES



1_108748001_SL.mxd 5/10/2019 AOB

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: ESRI WORLD TOPO, 2017

FIGURE 1

ALIGNMENT LOCATION

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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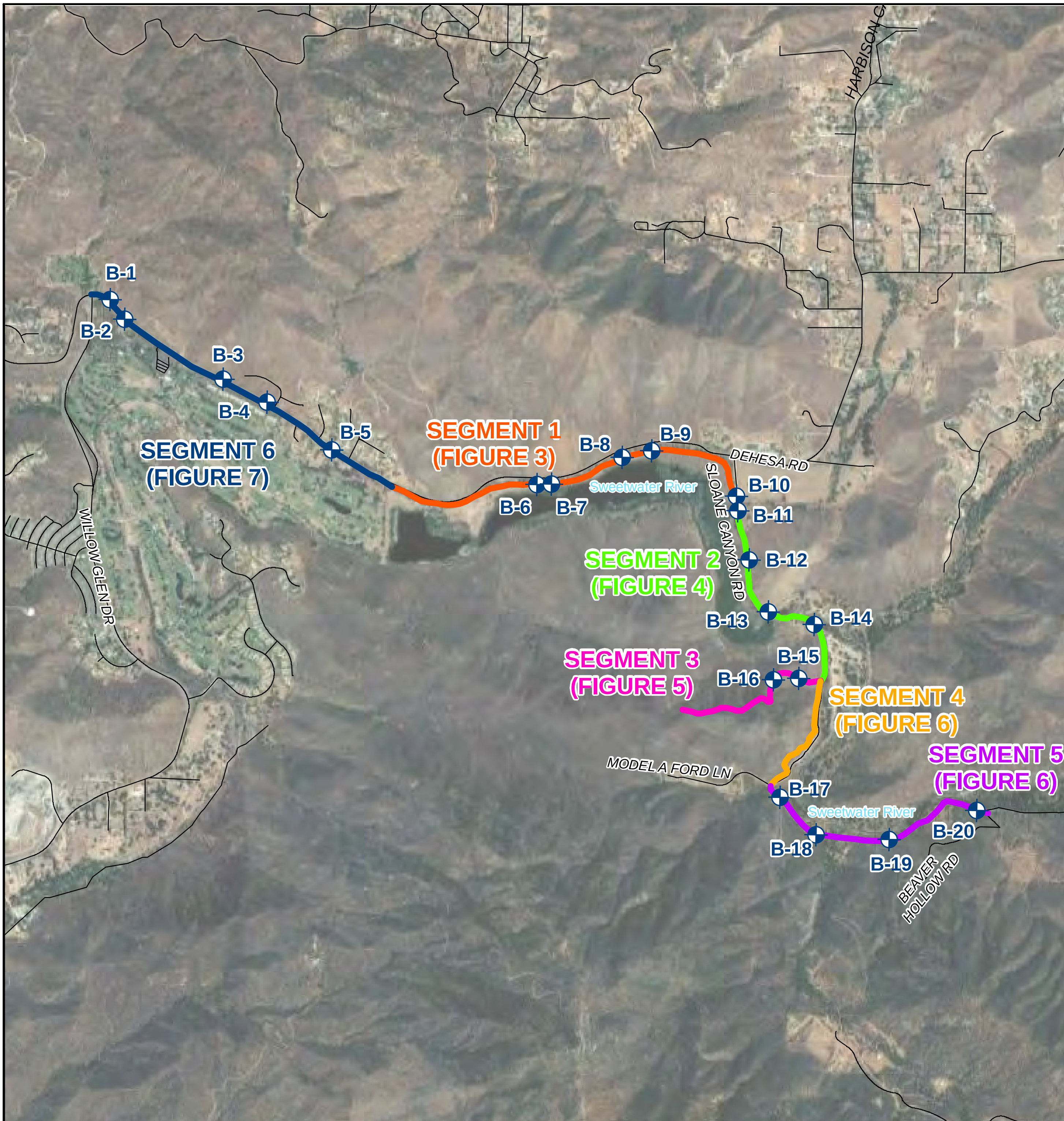

LEGEND

B-20 BORING

TRAIL ALIGNMENT

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: GOOGLE EARTH, 2019.

N

FEET
0 2,400 4,800

2_108748001_BV.mxd 5/10/2019 AOB

FIGURE 2

BORING VICINITY

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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LEGEND

B-10 TD=10.0 BORING
TD=TOTAL DEPTH IN FEET

TRAIL ALIGNMENT, SEGMENT 1

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: GOOGLE EARTH, 2019.

N

FEET
0 1,000 2,000

3_108748001_BL_Seg_1.mxd 5/10/2019 AOB

FIGURE 3

BORING LOCATIONS, SEGMENT 1

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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LEGEND

B-14 TD=5.0 BORING
TD=TOTAL DEPTH IN FEET

TRAIL ALIGNMENT, SEGMENT 2

GEOLOGIC CONTACT

Kgr GRANITIC ROCK

N

FEET
0 600 1,200

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: GOOGLE EARTH, 2019.

4_108748001_BL_Seg_2.mxd 5/10/2019 AOB

FIGURE 4

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BORING LOCATIONS, SEGMENT 2

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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LEGEND

B-16 TD=3.5	BORING TD=TOTAL DEPTH IN FEET	Qal	ALLUVIUM
(pink line)	TRAIL ALIGNMENT, SEGMENT 3	Kgr	GRANITIC ROCK
(dashed line)	GEOLOGIC CONTACT		

N

FEET

0 500 1,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: GOOGLE EARTH, 2019.

5_108748001_BL_Seg_3.mxd 5/10/2019 AOB

FIGURE 5

BORING LOCATIONS, SEGMENT 3

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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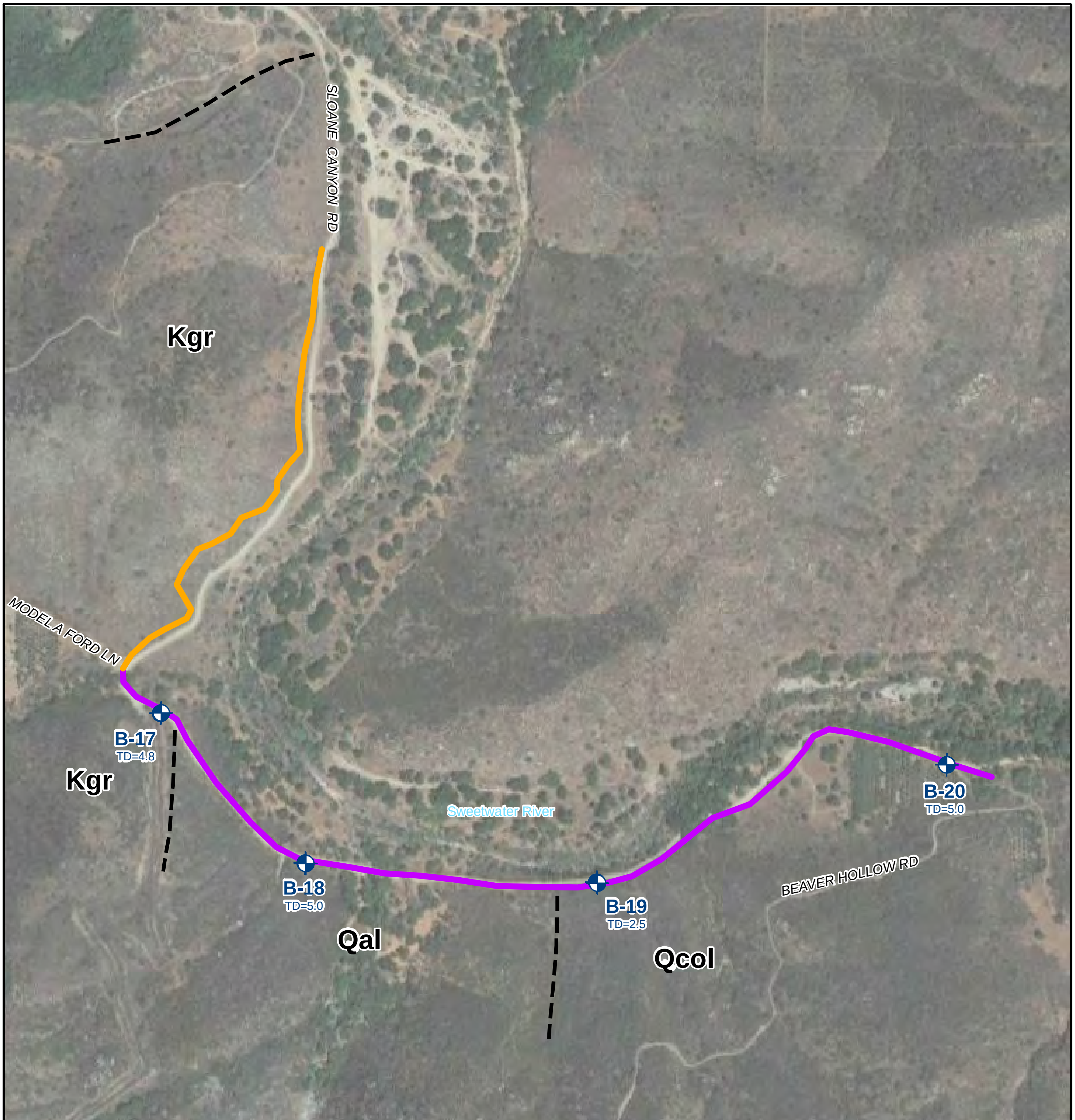

LEGEND

B-20 TD=5.0	BORING TD=TOTAL DEPTH IN FEET	Qal	ALLUVIUM
	TRAIL ALIGNMENT, SEGMENT 4	Qcol	COLLUVIUM
	TRAIL ALIGNMENT, SEGMENT 5	Kgr	GRANITIC ROCK
	GEOLOGIC CONTACT		

N

FEET
0 600 1,200

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: GOOGLE EARTH, 2019.

6_108748001_BL_Seg_4,5.mxd 5/10/2019 AOB

FIGURE 6

BORING LOCATIONS, SEGMENT 4 AND 5

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

108748001 | 5/19

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LEGEND

B-5 TD=6.0	BORING TD=TOTAL DEPTH IN FEET	Qal	ALLUVIUM
(line)	TRAIL ALIGNMENT, SEGMENT 6	Kgr	GRANITIC ROCK
(dashed line)	GEOLOGIC CONTACT		

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: GOOGLE EARTH, 2019.

N

FEET
0 1,000 2,000

7_108748001_BL_Seg_6.mxd 5/10/2019 AOB

FIGURE 7

BORING LOCATIONS, SEGMENT 6

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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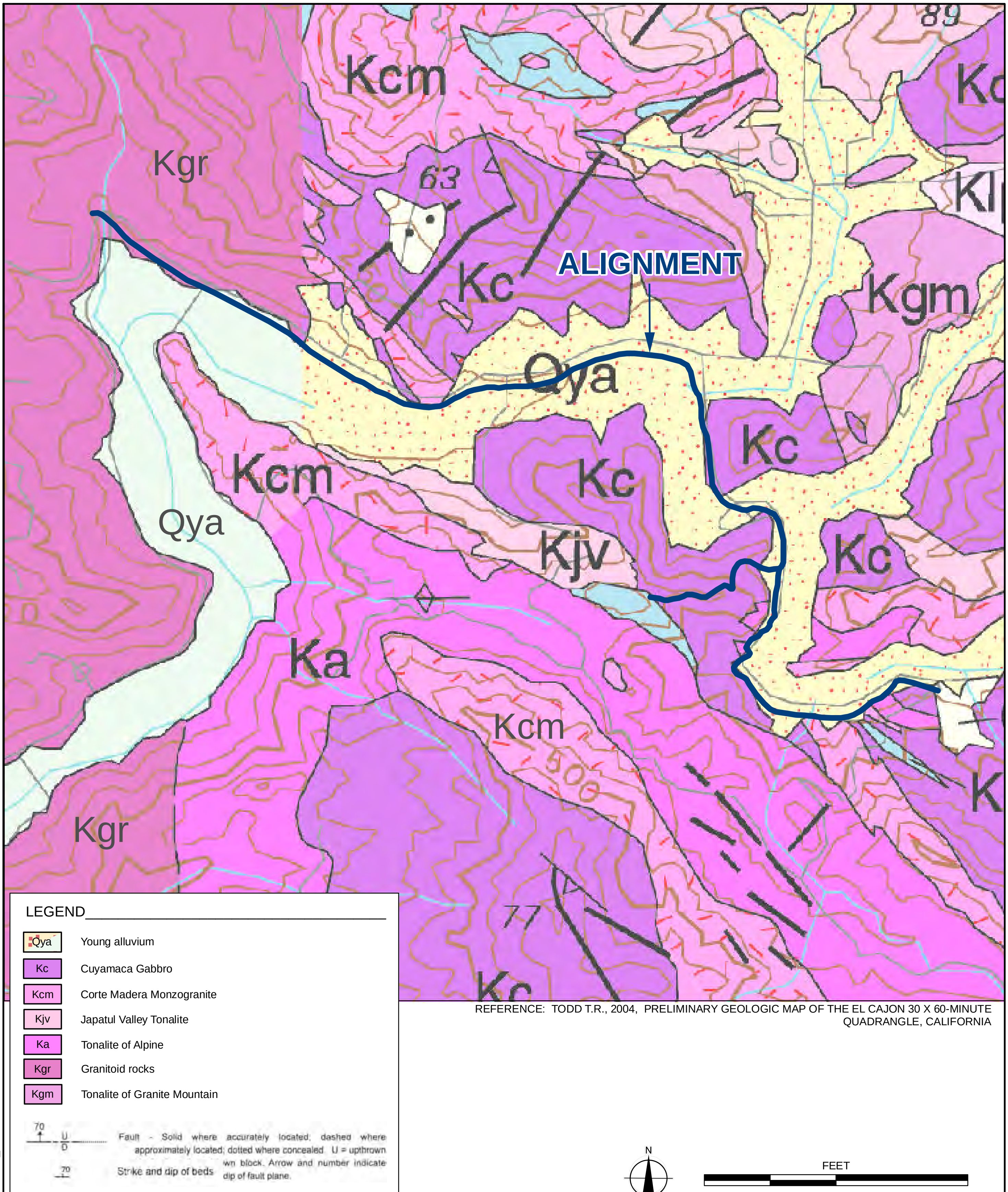
Geotechnical & Environmental Sciences Consultants



REFERENCE: TODD T.R., 2004, PRELIMINARY GEOLOGIC MAP OF THE EL CAJON 30 X 60-MINUTE QUADRANGLE, CALIFORNIA

N

FEET

0 2,400 4,800

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

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FIGURE 8

GEOLOGY

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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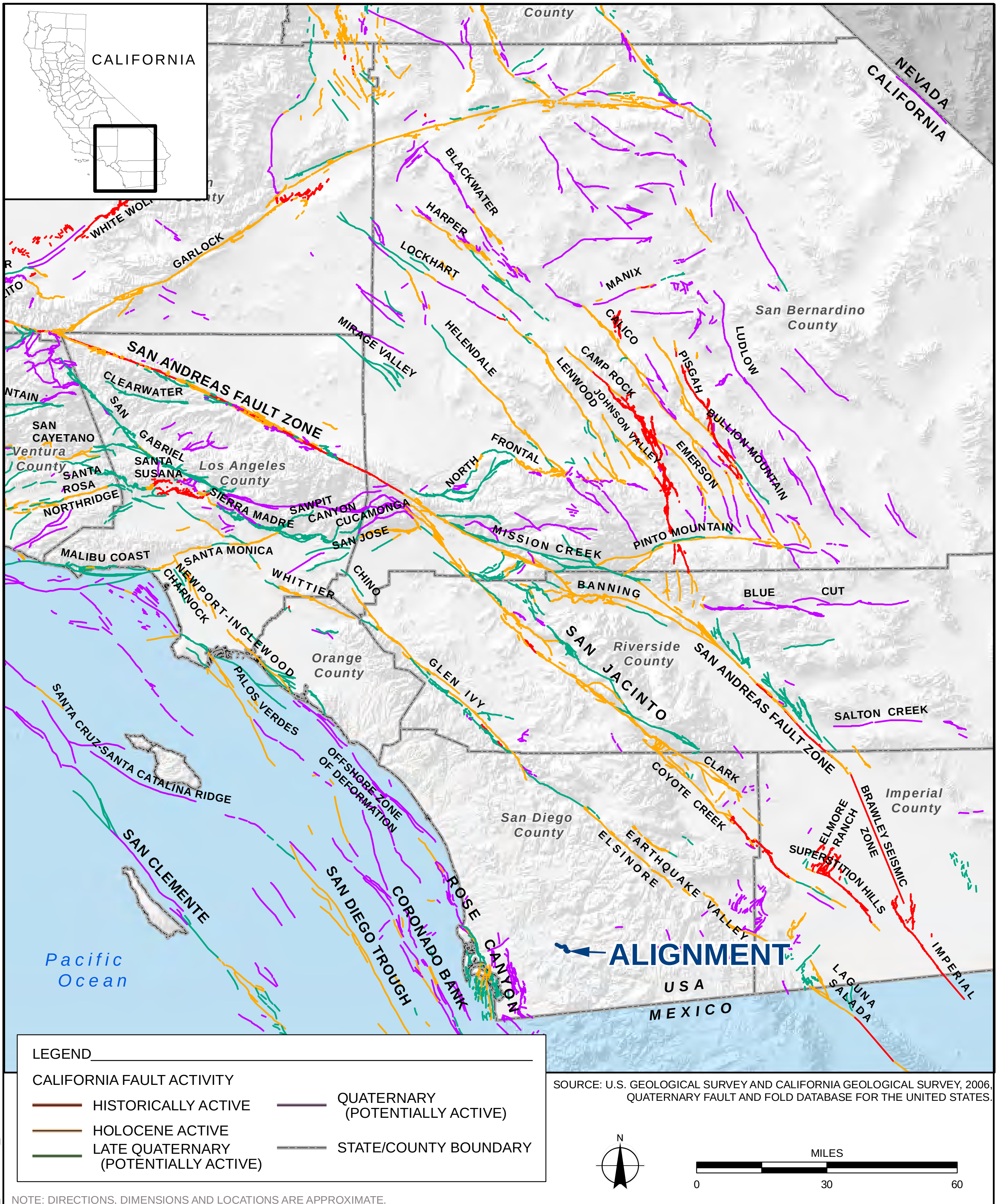

SOURCE: U.S. GEOLOGICAL SURVEY AND CALIFORNIA GEOLOGICAL SURVEY, 2006, QUATERNARY FAULT AND FOLD DATABASE FOR THE UNITED STATES.

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

9_108748001_FL.mxd 5/2/2019 AOB

FIGURE 9

FAULT LOCATIONS

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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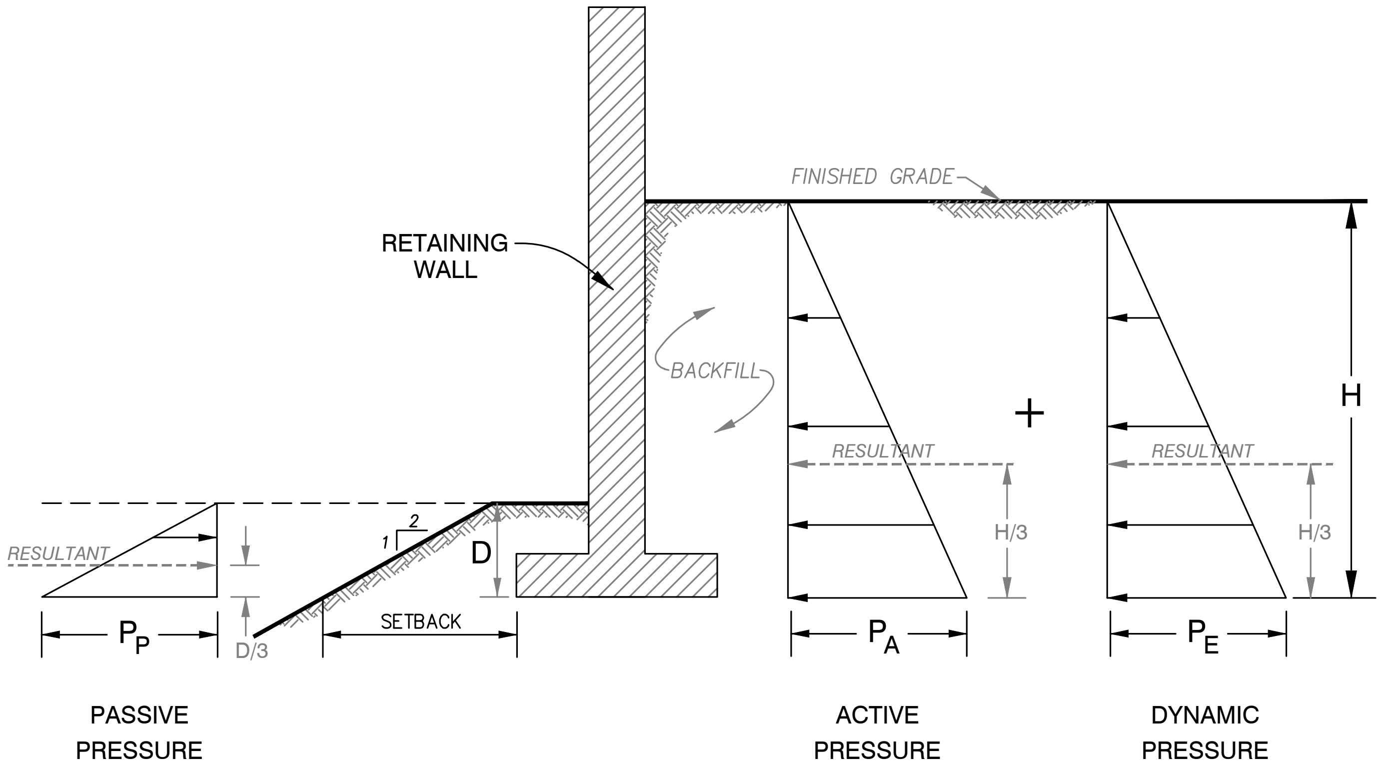

NOTES:

1. ASSUMES NO HYDROSTATIC PRESSURE BUILD-UP BEHIND THE RETAINING WALL
2. STRUCTURAL, GRANULAR BACKFILL MATERIALS SHOULD BE USED FOR RETAINING WALL BACKFILL
3. DRAINS AS RECOMMENDED IN THE RETAINING WALL DRAINAGE DETAIL SHOULD BE INSTALLED BEHIND THE RETAINING WALL
4. DYNAMIC LATERAL EARTH PRESSURE IS BASED ON A PEAK GROUND ACCELERATION OF 0.4g
5. P_E IS CALCULATED IN ACCORDANCE WITH THE RECOMMENDATIONS OF MONONOBE AND MATSUO (1929), AND ATIK AND SITAR (2010).
6. SURCHARGE PRESSURES CAUSED BY VEHICLES OR NEARBY STRUCTURES ARE NOT INCLUDED
7. H AND D ARE IN FEET
8. SETBACK SHOULD BE IN ACCORDANCE WITH THE CBC

RECOMMENDED GEOTECHNICAL DESIGN PARAMETERS

Lateral Earth Pressure	Equivalent Fluid Pressure ($lb/ft^2/ft$) (1)	
P_A	Level Backfill with Granular Soils (2)	2H:1V Sloping Backfill with Granular Soils (2)
	40 H	65 H
P_E	17 H	
P_P	Level Ground	2H:1V Descending Ground
	350 D	130 D

NOT TO SCALE

10 108748001 D-YRW.DWG

FIGURE 10

LATERAL EARTH PRESSURES FOR YIELDING RETAINING WALLS

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS

SAN DIEGO COUNTY, CALIFORNIA

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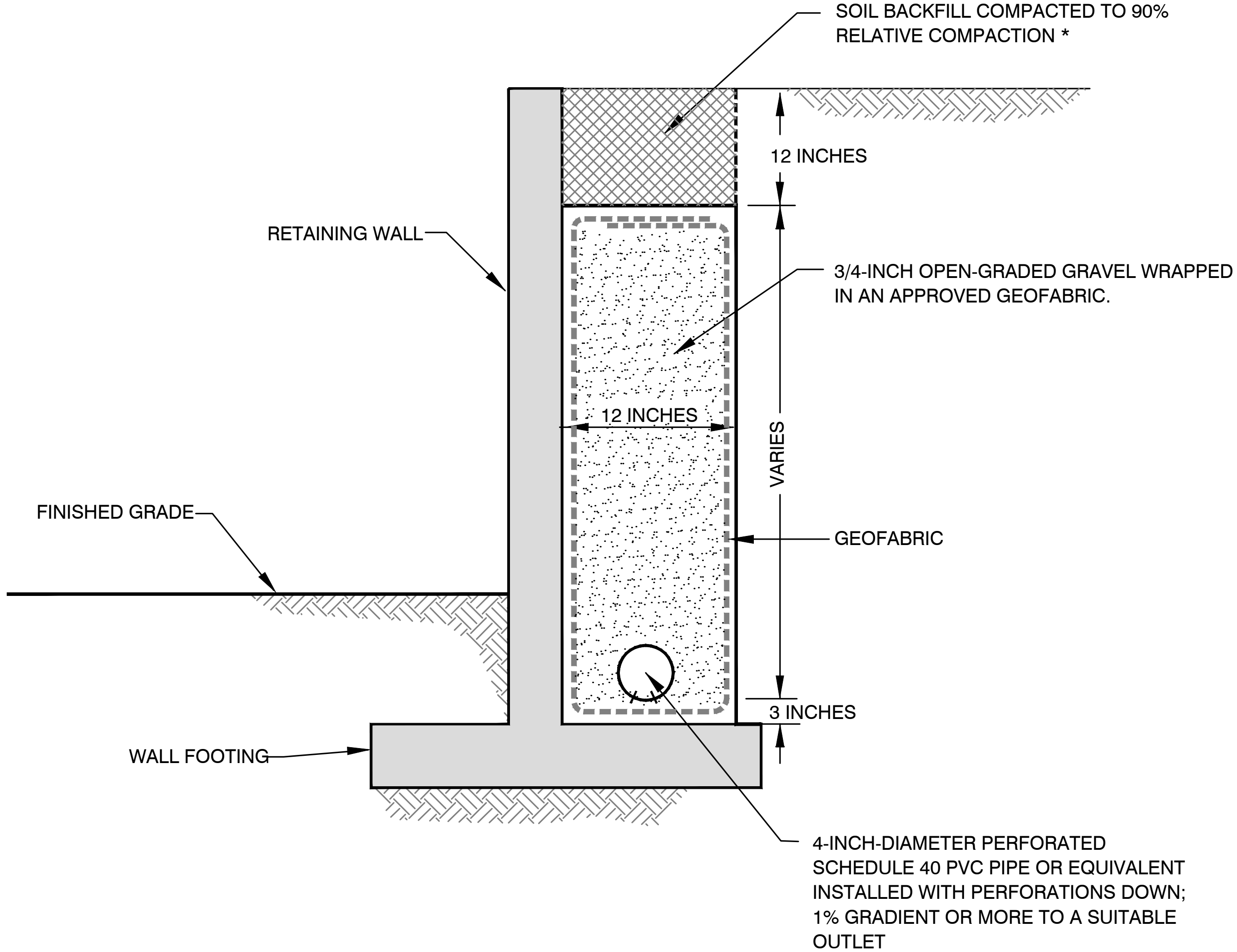

*BASED ON ASTM D1557

NOT TO SCALE

11 108748001 D-RW.DWG

FIGURE 11

RETAINING WALL DRAINAGE DETAIL

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS

SAN DIEGO COUNTY, CALIFORNIA

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APPENDIX A

Boring Logs

BORING LOG EXPLANATION SHEET

DEPTH (feet)	SAMPLES: Bulk	SAMPLES: Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	
0								Bulk sample.
								Modified split-barrel drive sampler.
								No recovery with modified split-barrel drive sampler.
								Sample retained by others.
								Standard Penetration Test (SPT).
5								No recovery with a SPT.
			XX/XX					Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.
								No recovery with Shelby tube sampler.
								Continuous Push Sample.
								Seepage.
10								Groundwater encountered during drilling.
								Groundwater measured after drilling.
							SM	MAJOR MATERIAL TYPE (SOIL): Solid line denotes unit change.
							CL	Dashed line denotes material change.
15								Attitudes: Strike/Dip b: Bedding c: Contact j: Joint f: Fracture F: Fault cs: Clay Seam s: Shear bss: Basal Slide Surface sf: Shear Fracture sz: Shear Zone sbs: Shear Bedding Surface
								The total depth line is a solid line that is drawn at the bottom of the boring.
20								

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BORING LOG

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 3/14/19 BORING NO. B-1 GROUND ELEVATION 490 ± (MSL) SHEET 1 OF 1 METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation) DRIVE WEIGHT N/A DROP N/A SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT DESCRIPTION/INTERPRETATION
0	■						SM	COLLUVIUM: Yellowish brown, moist, loose, silty SAND.
	■							GRANITIC ROCK: Yellowish brown, moist, decomposed GRANITIC ROCK.
5								Total Depth = 3.3 feet. (Refusal) Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/14/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
10								
15								
20								

BORING LOG FIGURE A- 1

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SYCUAN-SLOAN CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0				5.0			SM	FILL: Brown, moist, loose, silty SAND.
							SM	ALLUVIUM: Brown, moist, loose to medium dense, silty SAND. Finer sand.
5								Total Depth = 5.0 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/14/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DATE DRILLED 3/14/19 BORING NO. B-2

GROUND ELEVATION 486 ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation)

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■						SM	FILL: Brown, moist, loose, silty SAND.
	■						SM	ALLUVIUM: Brown, moist, loose, silty SAND.
5								Total Depth = 5 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/14/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DATE DRILLED 3/14/19 BORING NO. B-3

GROUND ELEVATION 467 ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation)

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 3/14/19 BORING NO. B-4 GROUND ELEVATION 477 ± (MSL) SHEET 1 OF 1 METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation) DRIVE WEIGHT N/A DROP N/A SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT **DESCRIPTION/INTERPRETATION**
0							SM	ALLUVIUM: Light brown, moist, loose, silty SAND. Trace gravel.
5								Total Depth = 5 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/14/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 3/14/19 BORING NO. B-5 GROUND ELEVATION 476 ± (MSL) SHEET 1 OF 1 METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation) DRIVE WEIGHT N/A DROP N/A SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT **DESCRIPTION/INTERPRETATION**
0							SM	FILL: Brown, moist, loose, silty SAND.
				6.0			SW-SM	ALLUVIUM: Light brown, moist, loose, well graded SAND with silt. Trace gravel.
5								
								Total Depth = 6 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/14/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SM	FILL: Brown, moist, loose, silty SAND.
							SM	ALLUVIUM: Brown, moist, loose, silty SAND; trace gravel.
							ML	Brown, moist, loose, sandy SILT; trace gravel. Trace cobbles.
5								Total Depth = 3.5 feet. (Refusal) Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DATE DRILLED 3/13/19 BORING NO. B-6

GROUND ELEVATION 480 ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation)

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT

BORING LOG FIGURE A- 6

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SYCUAN-SLOAN CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

DATE DRILLED 3/13/19 BORING NO. B-7

GROUND ELEVATION 477 ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation)

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■						SM	FILL: Brown, moist, loose, silty SAND.
	■						SM	ALLUVIUM: Brown, moist, loose, silty SAND; trace gravel.
	■			8.0				
	■							Dry to moist.
5								Medium dense; few to little gravel.
								Total Depth = 6 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DATE DRILLED	3/13/19	BORING NO.	B-8
GROUND ELEVATION	483 ± (MSL)	SHEET 1 OF 1	
METHOD OF DRILLING	4" Diameter Hand Auger (Manual Excavation)		
DRIVE WEIGHT	N/A	DROP	N/A
SAMPLED BY ZH	LOGGED BY ZH	REVIEWED BY	CAT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	X						ML	ALLUVIUM: Brown, moist, loose, sandy SILT; trace gravel.
	X							Medium dense.
	X						SM	Brown, dry to moist, medium dense, silty SAND; little gravel.
5								Total Depth = 3.5 feet. (Refusal) Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 3/13/19 BORING NO. B-9 GROUND ELEVATION 482 ± (MSL) SHEET 1 OF 1 METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation) DRIVE WEIGHT N/A DROP N/A SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT **DESCRIPTION/INTERPRETATION**
0							ML	ALLUVIUM: Brown, moist, loose, sandy SILT; trace gravel.
							SM	Brown, moist, medium dense, silty SAND; few to little gravel.
								Total Depth = 3.5 feet (Refusal). Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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BORING LOG FIGURE A- 9

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SYCUAN-SLOAN CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SM	FILL: Brown, dry to moist, medium dense, silty SAND; few gravel.
							SP-SM	ALLUVIUM: Light brown, moist, medium dense, poorly graded SAND with silt.
5								
				4.2	96.3			
10								Total Depth = 10 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DATE DRILLED 3/13/19 BORING NO. B-10

GROUND ELEVATION 499 ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation)

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT

DATE DRILLED	3/13/19	BORING NO.	B-11
GROUND ELEVATION	499 ± (MSL)	SHEET	1 OF 1
METHOD OF DRILLING	4" Diameter Hand Auger (Manual Excavation)		
DRIVE WEIGHT	N/A	DROP	N/A
SAMPLED BY	ZH	LOGGED BY	ZH
REVIEWED BY	CAT		

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	X						SM	FILL: Light grayish brown, moist, loose, silty SAND; trace gravel.
	X						SP	ALLUVIUM: Gray, moist, loose, poorly graded SAND; fine sand.
5	X	X					ML	Brown, moist, loose, sandy SILT.
	X	X		25	100.9		SM	Brown, moist, loose to medium dense, silty SAND. Gray; dry.
10								Total Depth = 10 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 3/13/19 BORING NO. B-12 GROUND ELEVATION 514 ± (MSL) SHEET 1 OF 1 METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation) DRIVE WEIGHT N/A DROP N/A SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT **DESCRIPTION/INTERPRETATION**
0				16.6			CL	<u>COLLUVIUM:</u> Reddish brown and yellowish brown, moist, stiff, lean CLAY.
								<u>GRANITIC ROCK:</u> Reddish brown and gray, dry, slightly weathered, GRANITIC ROCK.
								Total Depth = 2 feet. (Refusal) Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. <u>Note:</u> Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 3/13/19 BORING NO. B-13 GROUND ELEVATION 519 ± (MSL) SHEET 1 OF 1 METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation) DRIVE WEIGHT N/A DROP N/A SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT **DESCRIPTION/INTERPRETATION**
0							SM	FILL: Grayish brown, moist, loose, silty SAND; few to little gravel.
							SM	RESIDUAL SOIL: Brown, moist, loose to medium dense, silty SAND; trace gravel-sized fragments of granitic rock.
5								
								Total Depth = 7 feet. (Refusal) Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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BORING LOG FIGURE A- 13

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SAN DIEGO COUNTY, CALIFORNIA

DATE DRILLED	3/13/19	BORING NO.	B-14
GROUND ELEVATION	519 ± (MSL)	SHEET 1 OF 1	
METHOD OF DRILLING	4" Diameter Hand Auger (Manual Excavation)		
DRIVE WEIGHT	N/A	DROP	N/A
SAMPLED BY ZH	LOGGED BY ZH	REVIEWED BY	CAT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■			10.9			SM	FILL: Brown, moist, loose, silty SAND.
	■			12.8			CL	ALLUVIUM: Reddish brown, moist, stiff, sandy CLAY.
5								Total Depth = 5 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DATE DRILLED	3/13/19
BORING NO.	B-15
GROUND ELEVATION	620 ± (MSL)
SHEET	1 OF 1
METHOD OF DRILLING	4" Diameter Hand Auger (Manual Excavation)
DRIVE WEIGHT	N/A
DROP	N/A
SAMPLED BY	ZH
LOGGED BY	ZH
REVIEWED BY	CAT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	Bulk			9.2			SM	RESIDUAL SOIL: Brown, moist, loose, silty SAND.
								GRANITIC ROCK: Gray, dry, decomposed GRANITIC ROCK. @ 4.5': Weathered.
5								Total Depth = 5 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DATE DRILLED	3/13/19	BORING NO.	B-16
GROUND ELEVATION	720 ± (MSL)	SHEET 1	OF 1
METHOD OF DRILLING	4" Diameter Hand Auger (Manual Excavation)		
DRIVE WEIGHT	N/A	DROP	N/A
SAMPLED BY ZH	LOGGED BY ZH	REVIEWED BY	CAT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SM	RESIDUAL SOIL: Grayish brown, moist, loose, silty SAND; trace gravel to cobble sized fragments of granitic rock.
	■							GRANITIC ROCK: Gray, dry, decomposed GRANITIC ROCK.
								Total Depth = 3.5 feet. (Refusal) Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/13/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0				14.8			SC	COLLUVIUM: Reddish brown, moist, loose to medium dense, clayey SAND.
								GRANITIC ROCK: Orangish gray, dry, weathered to decomposed, GRANITIC ROCK.
5								Total Depth = 4.8 feet. (Refusal) Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/14/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DATE DRILLED 3/13/19 BORING NO. B-17

GROUND ELEVATION 574 ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation)

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT

DATE DRILLED	3/13/19	BORING NO.	B-18
GROUND ELEVATION	551 ± (MSL)	SHEET 1 OF 1	
METHOD OF DRILLING	4" Diameter Hand Auger (Manual Excavation)		
DRIVE WEIGHT	N/A	DROP	N/A
SAMPLED BY ZH	LOGGED BY ZH	REVIEWED BY	CAT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	X						ML	ALLUVIUM: Brown, moist, loose, sandy SILT.
	X						SM	Brown, moist, loose, silty SAND.
	X							
		X						
	X							Reddish brown.
5								Total Depth = 5 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/14/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 3/14/19 BORING NO. B-19 GROUND ELEVATION 583 ± (MSL) SHEET 1 OF 1 METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation) DRIVE WEIGHT N/A DROP N/A SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT **DESCRIPTION/INTERPRETATION**
0							ML	COLLUVIUM: Dark brown, moist, soft, SILT.
							SC	Reddish yellow and yellowish brown, moist, loose to medium dense, clayey SAND.
								Total Depth = 2.5 feet. (Refusal) Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/14/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■			9.9			SM	FILL: Dark brown, moist, loose, silty SAND.
5								Total Depth = 5 feet. Groundwater not encountered during drilling. Backfilled with onsite soil shortly after drilling on 3/14/19. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
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DATE DRILLED 3/14/19 BORING NO. B-20

GROUND ELEVATION 571 ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 4" Diameter Hand Auger (Manual Excavation)

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY ZH LOGGED BY ZH REVIEWED BY CAT

APPENDIX B

Geotechnical Laboratory Testing

APPENDIX B

LABORATORY TESTING

Classification
Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

In-Place Moisture and Density Tests
The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937. The test results are presented on the logs of the exploratory excavations in Appendix A.

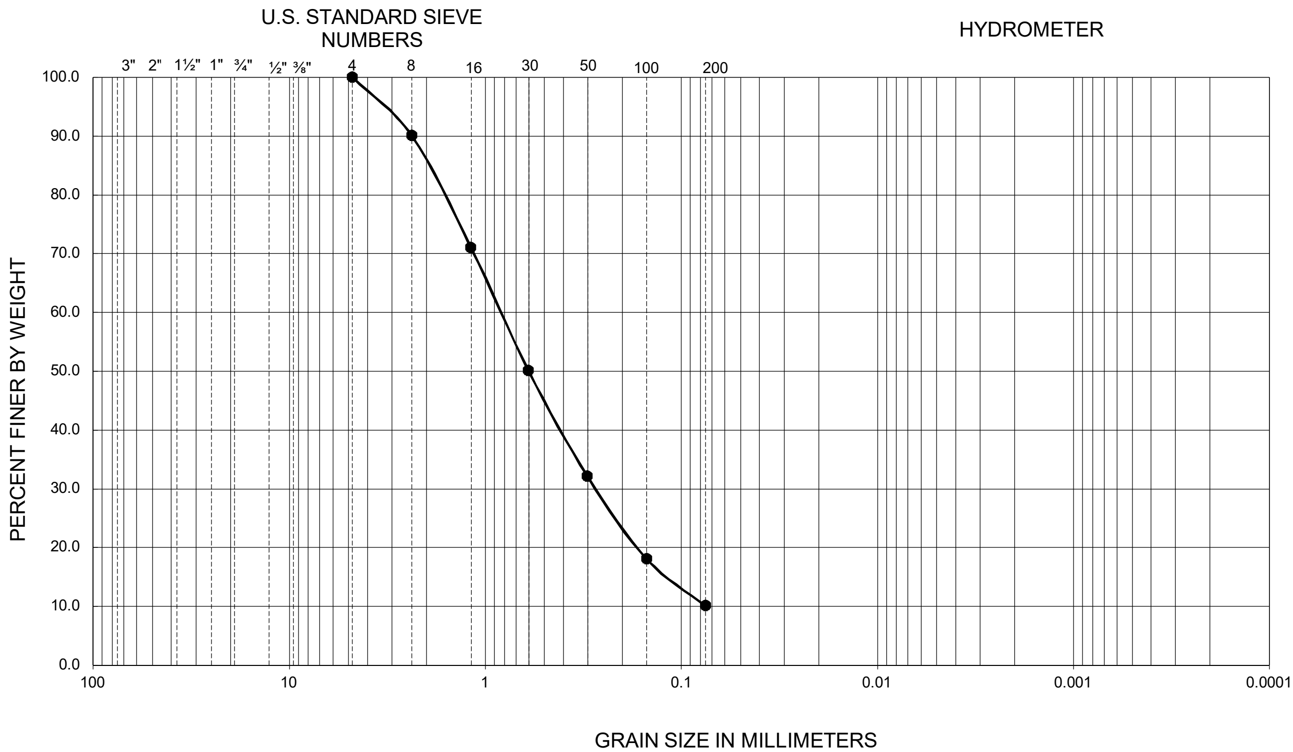
Gradation Analysis
Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422. The grain-size distribution curves are shown on Figures B-1 through B-4. These test results were utilized in evaluating the soil classifications in accordance with the USCS.

Direct Shear Tests
Direct shear tests were performed on relatively undisturbed and/or remolded samples in general accordance with ASTM D 3080 to evaluate the shear strength characteristics of selected materials. The samples were inundated during shearing to represent adverse field conditions. The results are shown on Figures B-5 and B-6.

Soil Corrosivity Tests
Soil pH, and resistivity tests were performed on representative samples in general accordance with California Test (CT) 643. The soluble sulfate and chloride contents of selected samples were evaluated in general accordance with CT 417 and CT 422, respectively. The test results are presented on Figure B-7.

R-Value
The resistance value, or R-value, for site soils was evaluated in general accordance with California Test (CT) 301. Samples were prepared and evaluated for exudation pressure and expansion pressure. The equilibrium R-value is reported as the lesser or more conservative of the two calculated results. The test results are shown on Figure B-8.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-5	1.0-2.0	--	--	--	0.08	0.30	0.84	10.7	1.4	10	SW-SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

FIGURE B-1

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GRADATION TEST RESULTS

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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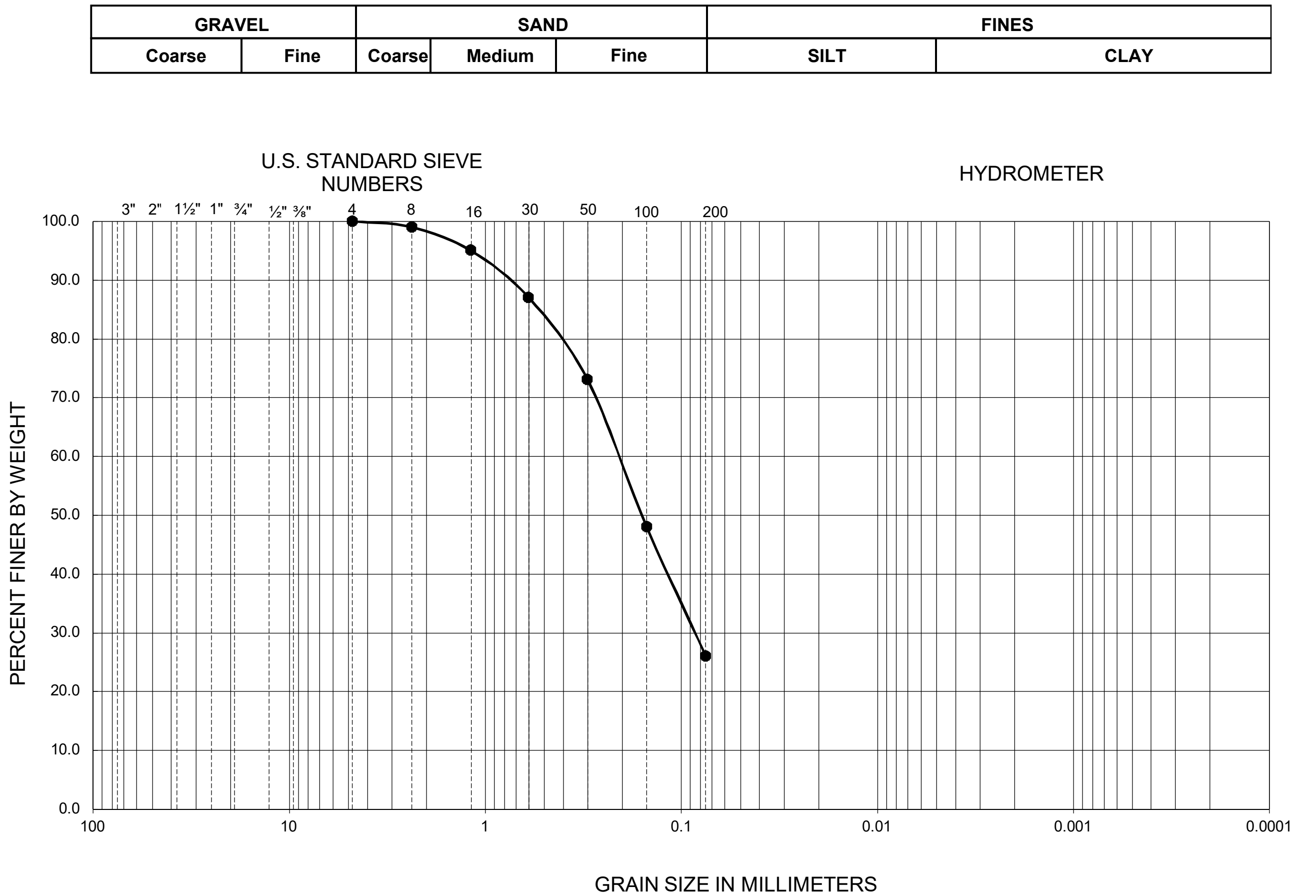
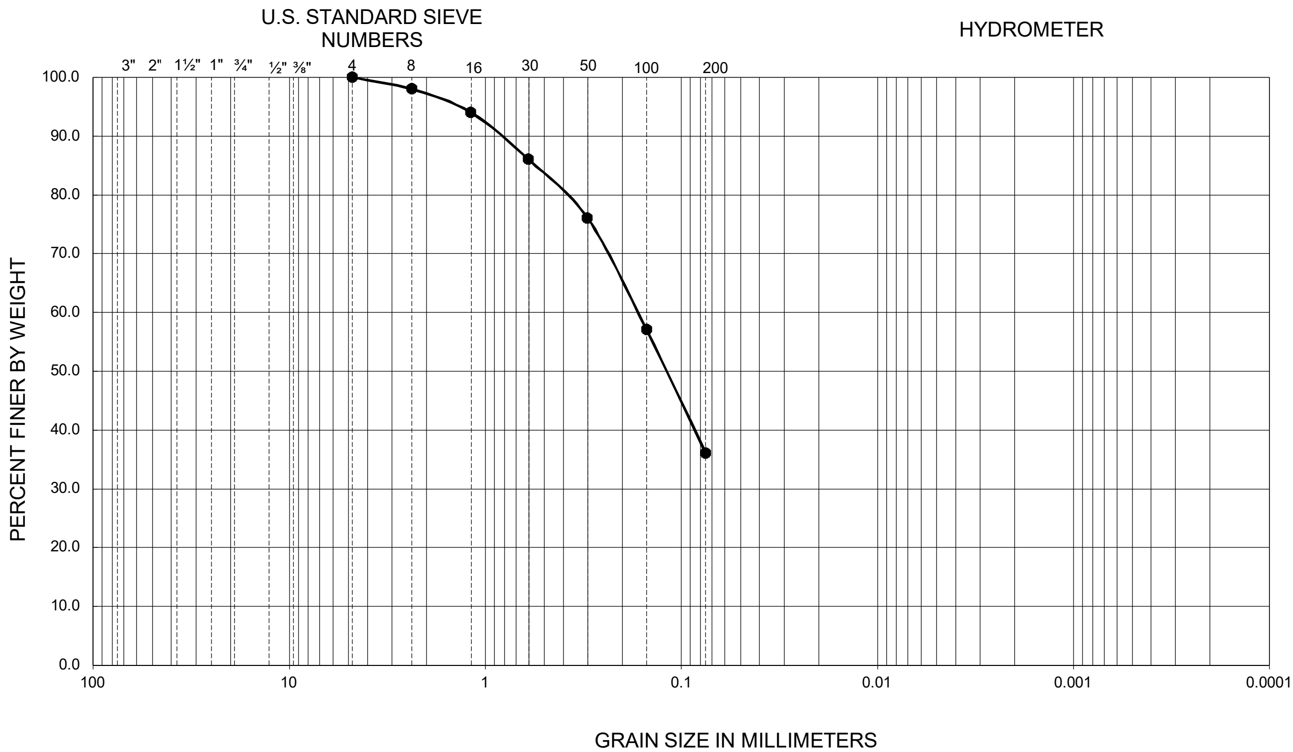


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-7	1.0-2.0	--	--	--	--	--	--	--	--	26	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-14	1.0-2.0	--	--	--	--	--	--	--	--	36	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

FIGURE B-3

GRADATION TEST RESULTS

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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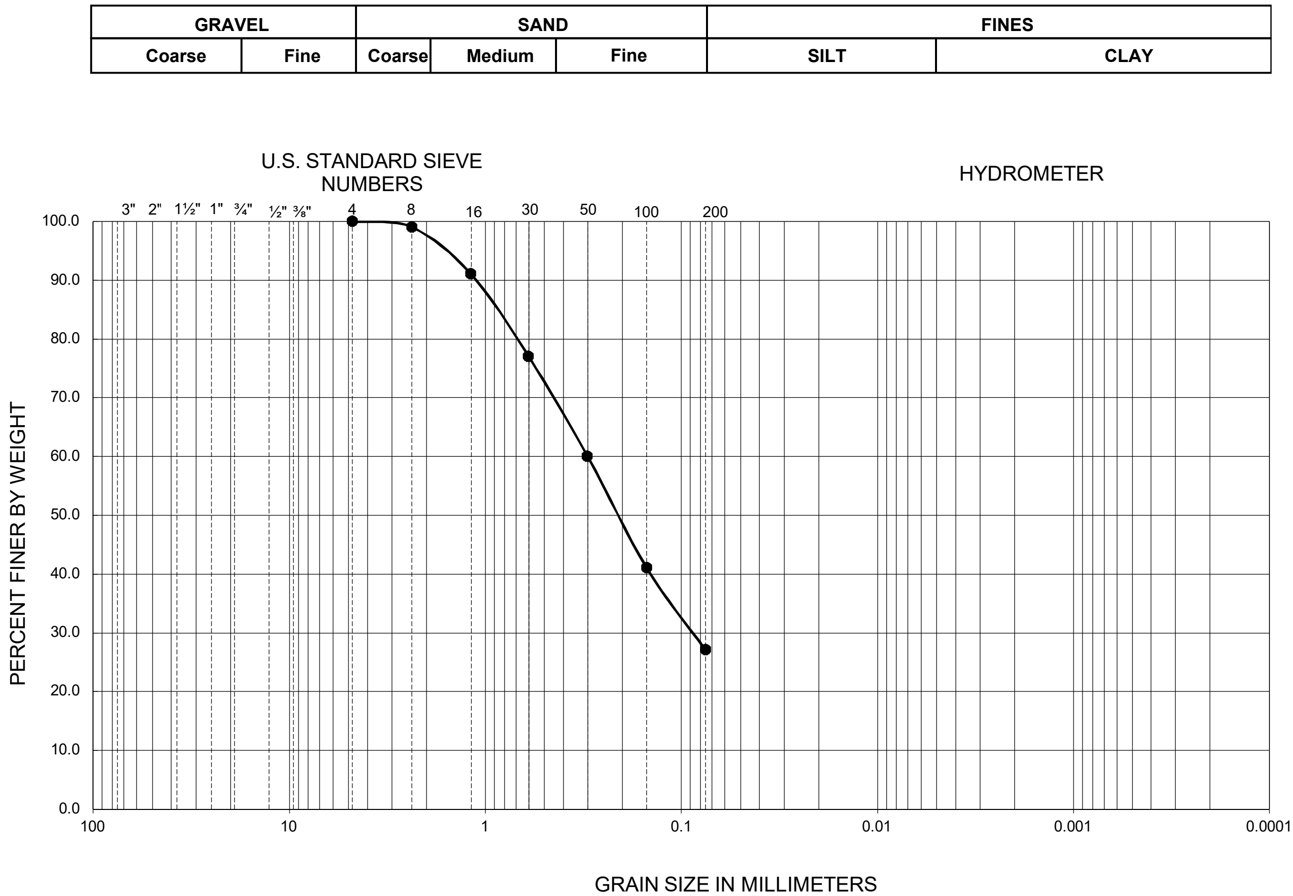
108748001 5/19

108748001_SIEVE w No 8 B-14 @ 1.0-2.0.xlsx



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-20	1.0-2.0	--	--	--	--	--	--	--	--	27	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

FIGURE B-4

GRADATION TEST RESULTS

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SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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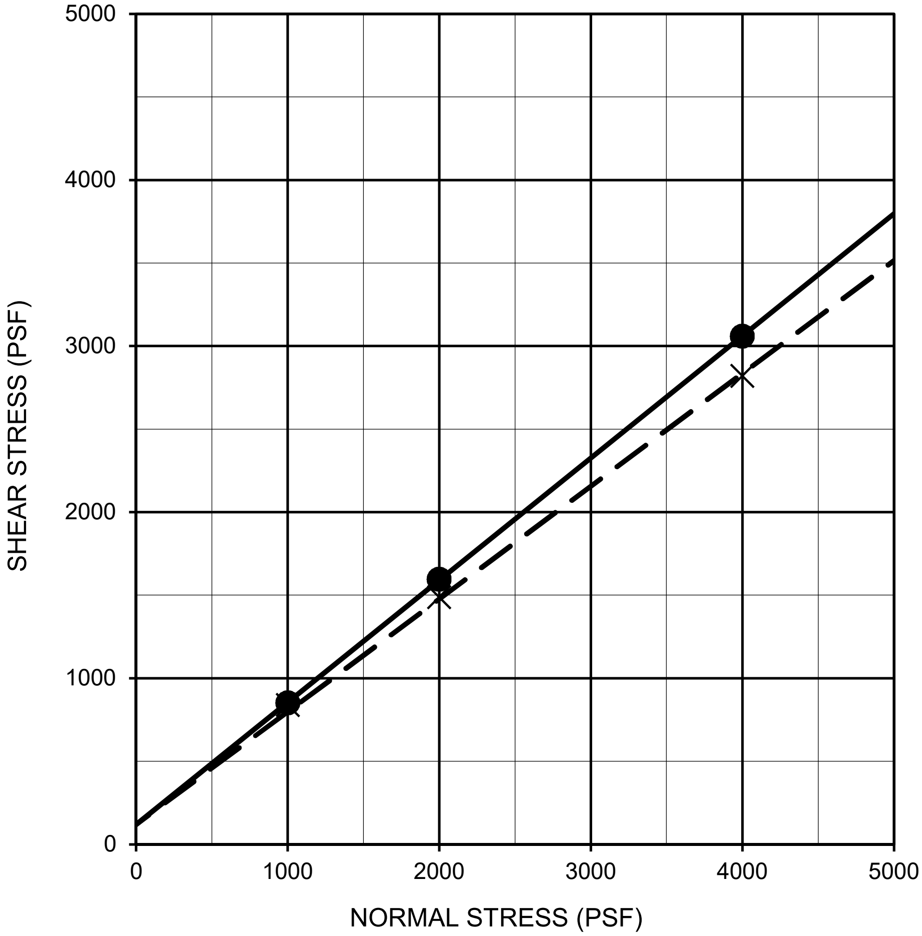

Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (degrees)	Soil Type
Silty SAND	——●——	B-10	9.0-10.0	Peak	120	36	SM
Silty SAND	– – X – –	B-10	9.0-10.0	Ultimate	120	34	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080

FIGURE B-5

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DIRECT SHEAR TEST RESULTS

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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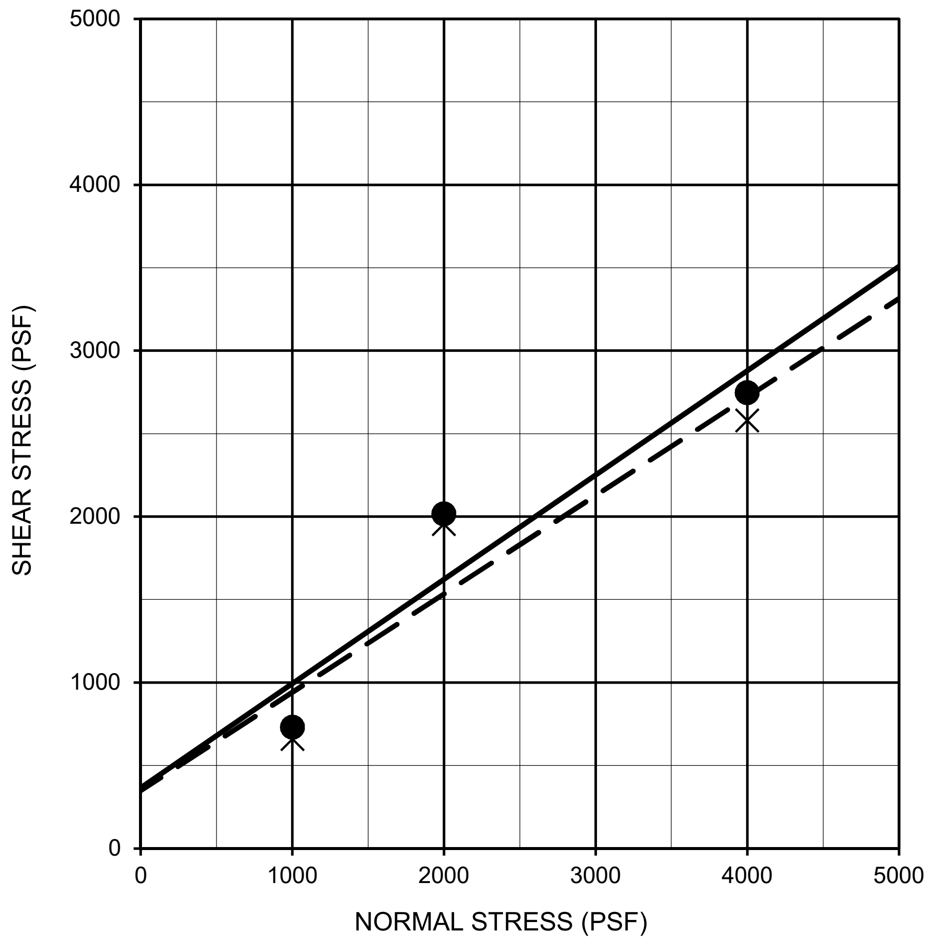

Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (degrees)	Soil Type
Silty SAND	——●——	B-11	5.5-6.5	Peak	370	32	SM
Silty SAND	– – X – –	B-11	5.5-6.5	Ultimate	350	31	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080

FIGURE B-6

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DIRECT SHEAR TEST RESULTS

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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SAMPLE LOCATION	SAMPLE DEPTH (ft)	pH [1]	RESISTIVITY [1] (ohm-cm)	SULFATE CONTENT [2]		CHLORIDE CONTENT [3] (ppm)
				(ppm)	(%)	
B-11	0.0-3.0	6.4	4,000	10	0.001	20

[1] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 643
[2] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 417
[3] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 422

FIGURE B-7

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CORROSIVITY TEST RESULTS

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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SAMPLE LOCATION	SAMPLE DEPTH (ft)	SOIL TYPE	R-VALUE
B-12	0.0-1.5	CLAY	LEES THAN 5

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2844/CT 301

FIGURE B-8

R-VALUE TEST RESULTS

SYCUAN-SLOANE CANYON TRAIL IMPROVEMENTS
SAN DIEGO COUNTY, CALIFORNIA

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APPENDIX C

Select Photographs

Photograph 1: **View looking south at bluff erosion near the alignment of Segment 1.**

Photograph 2: **View looking south at bluff erosion near the alignment of Segment 1.**

Photograph 3: **View looking south at bluff erosion near the alignment of Segment 1.**

Photograph 4: **View of erosion near drainage pipe along the abandoned maintenance trail in the eastern portion of Segment 3. Erosion measures up to 3 feet deep.**

Photograph 5: **View of erosion along the abandoned maintenance trail in the eastern portion of Segment 3. Erosion measures up to 3 feet deep.**

Photograph 6: **View of erosion along the abandoned maintenance trail in the central portion of Segment 3.**

FIGURE C-3

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PHOTOGRAPHS

DEHESA ROAD AND SLOANE CANYON ROAD
SAN DIEGO COUNTY, CALIFORNIA

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Photograph 7: **View of granitic rock outcrops on the east side of the alignment on Segment 2. Contact with colluvium shown with dashed line.**

Photograph 8: **View of granitic rock outcrops on the east side of the alignment on Segment 2 near the existing bridge.**

Photograph 9: **View of granitic rock outcrops in the hillside on Segment 4. Contact with colluvium shown with dashed line.**

Photograph 10: **View of granitic rock outcrops in the hillside on Segment 4. Contact with colluvium shown with dashed line.**

Photograph 11: **View of granitic rock outcrops in the hillside on Segment 4.**

Photograph 12: **View of granitic rock outcrops in the hillside on Segment 4. Contact with colluvium shown with dashed line.**

Photograph 13: **View of cobble- and boulder-sized fragments of granitic rock in the colluvium deposits on the south side of the alignment of Segment 5.**

Photograph 14: **View of cobble- and boulder-sized fragments of granitic rock in the colluvium deposits on the south side of the alignment of Segment 5.**

Photograph 15: **View of granitic rock outcrops on the south side of the alignment on Segment 5 near the connection to Segment 4.**

Photograph 16: **View of weathered to decomposed granitic rock outcrops in the slope along the northern alignment of Segment 6.**

Photograph 17: **View of granitic rock outcrops along the northern alignment of Segment 6.**

Photograph 18: **View of granitic rock outcrops along the northern alignment of Segment 6.**

Photograph 19: **View of granitic rock outcrops along the northern alignment of Segment 6.**

Photograph 20: **View of granitic rock outcrops along the northern alignment of Segment 6.**

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