Environmental Geotechnology Laboratory, Inc.

June 18, 2018

Mr. Chao Di Su
5239 Temple City Boulevard
Temple City, California 91780

Subject: **Report of Geotechnical Engineering Investigation, Proposed Nine (9) Lot Subdivision, Tentative Tract No. 18012, APN: 0225-111-07, 12774 Banyan Street (Formerly Summit Avenue), Etiwanda, San Bernardino County, California, EGL Project No.: 14-181-001GE**

Ladies and Gentlemen:

In accordance with your request, Environmental Geotechnology Laboratory, Inc. (EGL) is pleased to submit this Geotechnical Engineering Report for the subject site. The purpose of this report was to evaluate the subsurface conditions and provide recommendations for foundation designs and other relevant parameters of the proposed construction.

Based on the findings of our field exploration, laboratory testing and engineering analysis, the proposed construction of the subject site for the intended use is considered feasible from the geotechnical engineering viewpoints, provided that specific recommendations set forth herein are followed.

This opportunity to be of service is sincerely appreciated. If you have any questions pertaining to this report, please call the undersigned.

Respectfully submitted,

Environmental Geotechnology Laboratory, Inc.

Ryan Jones, GE 2852
Project Engineer

Dist: (4) Addressee
HJ/RJ/ky

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REPORT OF GEOTECHNICAL ENGINEERING INVESTIGATION

Proposed

Nine (9) Lot Subdivision

Tentative Tract No. 18012

APN: 0225-111-07

At

12774 Banyan Street (Formerly Summit Avenue)
Etiwanda, California

Prepared by

ENVIRONMENTAL GEOTECHNOLOGY LABORATORY, INC.

Project No.: 14-181-001GE

June 18, 2018

TABLE OF CONTENT

1.0 INTRODUCTION

1.1 Purpose

This report presents a summary of our preliminary geotechnical engineering investigation for the proposed residential development at the subject site. The purposes of this investigation were to evaluate the subsurface conditions at the area of proposed construction and to provide recommendations pertinent to grading, foundation design and other relevant parameters of the proposed development.

1.2 Scope of Services

Our scope of services included:

- Review of available soil data of the area.
- Subsurface exploration consisting of logging and sampling of nine (9) backhoe test pits to a maximum depth of 17.0 feet below the existing grade at the subject site. The exploration was logged by an EGL engineer and presented in Appendix A.
- Infiltration testing on test pits TP-8 and TP-9 at a depth of 6.5 feet. Infiltration rate calculations are presented in Appendix C.
- Laboratory testing of representative samples to establish engineering characteristics of the on-site soil. The laboratory test results are presented in Appendix B and on the Test Pit Logs of Appendix A.
- Engineering analyses of the geotechnical data obtained from our background studies, field investigation, and laboratory testing.
- Preparation of this report presenting our findings, conclusions, and recommendations for the proposed construction.

1.3 Proposed Construction

It is our understanding that the proposed development at the site consists of subdividing the property into nine (9) single-family residential lots and associated structures. The proposed buildings are anticipated to be one and/or two-story wood frame structures with concrete slab-on-grade. Column loads are unknown at this time, but are expected to be light to medium. Cut/fill grading operation is anticipated to achieve the desired grades.

1.4 Site Conditions

The subject site is located on the north side of Banyan Street (formerly Summit Avenue) and at a relatively short distance west of Etiwanda Avenue in the unincorporated area of Etiwanda, County of San Bernardino, California. The approximate regional location is shown on the

attached Site Location Map (Figure 1). The project site is currently vacant covered with minimal bushes and some trees. Topographically, the subject site is relatively flat with a gentle slope to the south. Detailed configuration of the site is shown on the Site Plan, Figure 2.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

EGL preformed preliminary field subsurface exploration on June 1, 2018 with the aid of a rubber-tired backhoe equipped with a 36"-wide bucket of Best Bobcat Backhoe Services and consisted of excavating nine (9) backhoe test pits. Test pits extended to a maximum depth of 17.0 feet below the existing ground surface.

The test pits were supervised and logged by EGL's engineer. Relatively undisturbed ring samples and bulk samples were collected during excavation for laboratory testing. Upon completion of excavation, all test pits were logged, sampled and later backfilled with onsite soils cuttings and tamped. The approximate locations of these test pits are shown on the Site Plan (Figure 2). Logs of test pits are presented in Appendix A. Ring samples were taken at frequent intervals. The samples, advanced by hand-auger, were obtained by driving a split-tube ring sampler with successive blows of a 32-pound hammer dropping from a height of 48 inches.

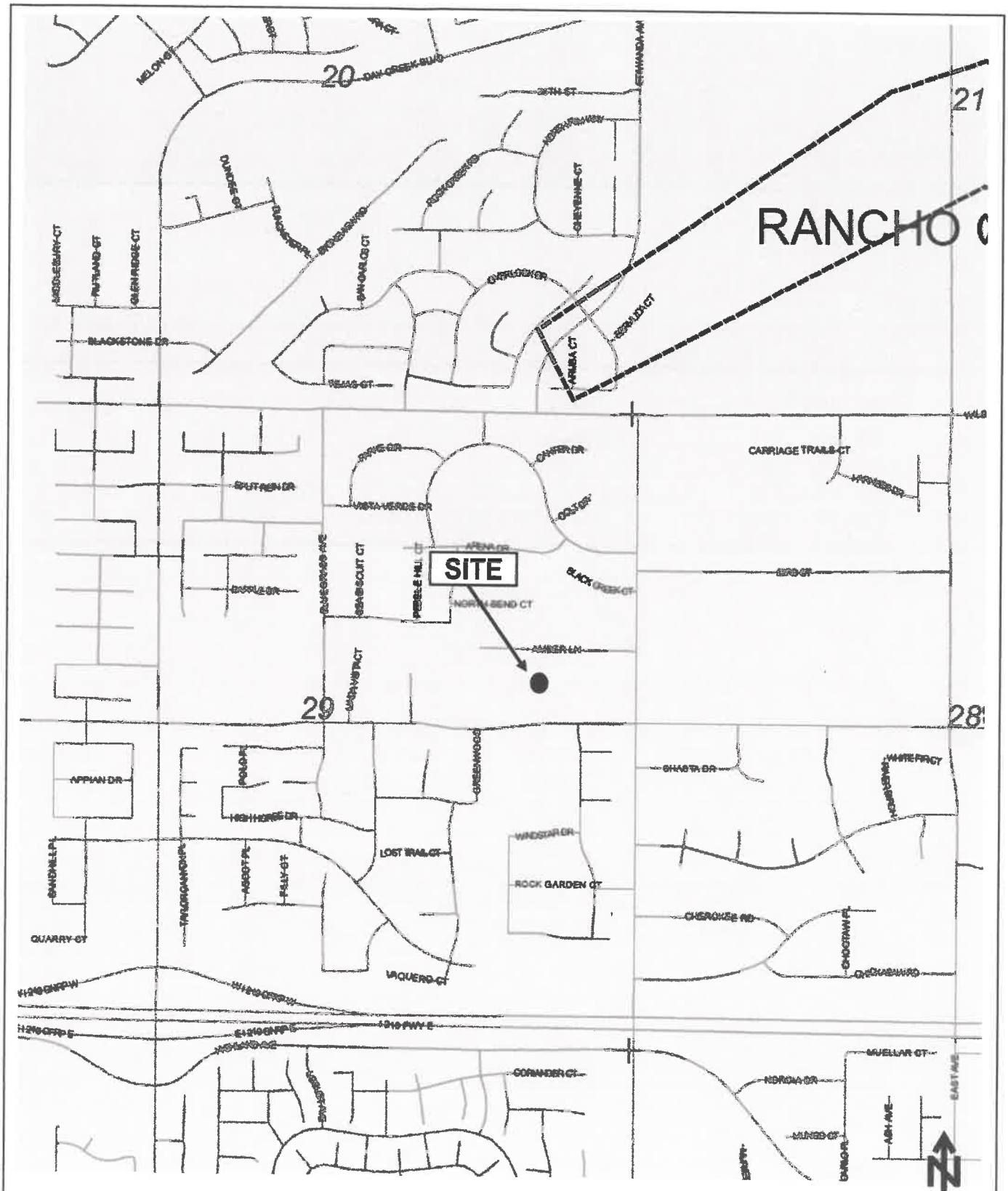
2.2 Laboratory Testing

Representative samples were tested for the following parameters: in-situ moisture content and density, direct shear strength, consolidation and corrosion potential. The results of our laboratory testing along with a summary of the testing procedures are presented in Appendix B. In-situ moisture and density test results are presented on the test pits logs in Appendix A.

3.0 SUMMARY OF GEOTECHNICAL CONDITIONS

3.1 Soil Conditions

Subsurface exploration was performed on June 1, 2018 with the aid of a rubber-tired backhoe equipped with a 36"-wide bucket of Best Bobcat Backhoe Services. Our subsurface exploration and testing program revealed the existence of alluvial soil to the maximum explored depth of 17 feet. The onsite soils consist predominantly of dark brown and light olive brown silty sand (SM) with some gravel, cobbles and boulders. In general, the surficial soils exist in a fine to coarse grained, medium dense to dense, and dry to slightly moist condition to a depth of approximately 3.0 feet. This was followed by layers of dark brown to light olive brown, dry to slightly moist, dense to very dense silty sand (SM) and well-graded sand (SW) with some gravel, cobbles and



Note: Map modified from "San Bernardino County Lan Use Plan, General Plan, Geologic Hazard Overlays, FH20 C, Rancho Cucamonga".

Approximate Scale: 1" = 1000'

Low
Medium
High
Potential Liquefaction Area

Low to moderate
Moderate to high
Mapped, Existing Landslide
Potential Earthquake-Induced Landslide Areas

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Project Address:
12774 Summit Avenue
Etiwanda, California

SITE LOCATION MAP

06/18

Figure 1

boulders to the maximum explored depth of 17 feet below the existing ground surface. Refusals were encountered within test pits TP-1, TP-3 and TP-4 at depths of 6', 5' and 8', respectively, due to the very dense soil and presence of gravel, cobbles and boulders.

3.2 Groundwater

No groundwater was encountered during our field investigation to a maximum depth of approximately 17 feet. Groundwater is therefore not expected to be a significant constraint during future construction. However, groundwater may be a significant constraint during raining season when high perched water may occur.

4.0 CONCLUSIONS

Based on the results of our subsurface investigation and engineering analyses, it is our opinion that the proposed construction is feasible from a geotechnical standpoint, provided the recommendations contained herein are incorporated in the design and construction. The following is a summary of the geotechnical design and construction factors that may affect the development of the site:

4.1 Seismicity

Our studies of regional and local seismicity indicate that there are no known active faults crossing the property. However, the site is located in a seismically active region and is subject to seismically induced ground shaking from nearby and distant faults, which is a characteristic of all Southern California communities.

4.2 Seismic Induced Hazards

Based on the San Bernardino County Land Use Plan, General Plan, Geologic Hazard Overlays, FH20 C (Ref. #6), the subject site is not located within an area susceptible to liquefaction. It is our understanding that a liquefaction study is not required by the county for the subject site.

4.3 Excavatability

Excavation of the subsurface materials should be able to be accomplished with conventional earthwork equipment. However, a significant amount of gravel, cobbles and boulders is anticipated. Based on the sandy and rocky conditions at the site some caving may occur.

4.4 Surficial Soil Removal and Recompaction

Based on our investigation, it is concluded that the existing surficial soils may not be suitable for structure support as they presently exist and will require remedial grading as discussed herein.

4.5 Groundwater

No groundwater was encountered during our field investigation to a maximum depth of approximately 17 feet. Groundwater is therefore not expected to be a significant constraint during future construction. However, groundwater may be a significant constraint during raining season when high perched water may occur.

5.0 RECOMMENDATIONS

Based on the subsurface conditions exposed during field investigation and laboratory testing program, it is recommended that the following recommendations be incorporated in the design and construction phases of the project.

5.1 Grading

5.1.1 Site Preparation

Prior to initiating grading operations, any existing vegetation, trash, debris, over-sized materials (greater than 6 inches), and other deleterious materials within construction areas should be removed from the site.

5.1.2 Surficial Soil Removals

Based on our field exploration and laboratory data obtained to date, it is recommended that the surficial soils be removed to a depth of at least three (3) feet below existing grade or one (1) foot below the bottom of the footing, whichever is deeper. Removal depth should be a minimum of three (3) feet below proposed footings' bottom for any cut and fill transition areas. The recommended removal should be extended at least five (5) feet beyond proposed building lines. It is also recommended that the top 12 inches be removed and recompacted within the proposed street and driveway areas. It is recommended that the construction areas be cut to over-excavation grade then observed by a representative of this office to verify the sub-grade soil conditions for any potential needs of removal of loose soils. All footings of proposed buildings should be a minimum of 18 inches below the lowest adjacent grade and founded into new certified compacted fill.

Locally deeper removals may be necessary to expose competent natural ground. The actual removal depths should be determined in the field as conditions are exposed. Visual inspection and/or testing may be used to define removal requirements.

5.1.3 Treatment of Removal Bottoms

Soils exposed within areas approved for fill placement should be scarified to a depth of 6 inches, conditioned to near optimum moisture content, and then compacted to minimum project standards.

5.1.4 Structural Backfill

The onsite soils may be used as compacted fill, provided they are free of organic materials and debris. It is recommended that the allowable size of cobbles to be used as fill material should not be greater than 6 inches within the building pad area and 10 inches within the landscape area. Cobbles and boulders should not exceed 20% by dry weight. Soils imported from offsite sources should be similar to the onsite soils and should be approved by the soil engineer prior to transporting to the site. Fills should be placed in relatively thin lifts (6 to 8 inches), brought to near optimum moisture content, then compacted to at least 90 percent relative compaction based on laboratory standard ASTM D-1557-12.

5.1.5 Fill Slopes

Permanent fill slopes should be constructed no steeper than 2:1 (horizontal to vertical) and should be keyed and benches into competent natural soils materials. Clean, cohesionless sand should not be used for fill slopes; some selective grading may be required in this regard. Minimum of 90 percent relative compaction is recommended for competent fill slope construction.

5.1.6 Cut Slopes

Permanent cut slopes should be no steeper than 2:1 (H:V) slope gradient, which is anticipated to be grossly stable. However, field observation will be necessary during grading, by the project geologist, to determine the need for slope stabilization.

5.2 Shallow Foundation Design

5.2.1 Bearing Value

An allowable bearing value of 1500 pounds per square foot (psf) may be used for design of the footings placed at a depth of at least 18 inches below the lowest adjacent ground and founded on the new certified compacted fill. Single spread footings should be at least 24 inches square and continuous footings should be at least 12 inches wide. This bearing value may be increased by 200 psf for each additional foot of depth or width to a maximum value of 2500 psf.

The above recommended value may be increased by one third (1/3) when considering short duration seismic or wind loads.

5.2.2 Settlement

Settlement of the footings placed as recommended and subject to no more than allowable loads is not expected to exceed 3/4 inch. Differential settlement between adjacent columns is not anticipated to exceed 1/4 inch for a span of 30 feet or less.

5.2.3 Lateral Pressures

Passive earth pressure may be computed as an equivalent fluid pressure of 300 pounds per cubic foot, with a maximum earth pressure of 2500 pounds per square foot. An allowable coefficient of friction between soil and concrete of 0.35 may be used with the dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one third (1/3).

Active earth pressure from horizontal backfill may be computed as an equivalent fluid weighting of 30 pounds per cubic foot (pcf). The above value assumes free-draining conditions.

5.3 Foundation Construction

It is anticipated that the entire structure will be underlain by onsite soils of very low expansion potential. The following presented our recommendations for the foundation construction.

All footings should be founded at a minimum depth of 18 inches below the lowest adjacent ground surface. All continuous footings should have at least one No. 4 reinforcing bar placed at the top and one No. 4 reinforcing bar placed at the bottom of the footings. A grade beam of at least 12 inches square, reinforced as recommended above for footings, should be utilized across the garage entrances. The base of the reinforced beam should be at the same elevation as the bottom of the adjoining footings.

5.4 Concrete Slab

Concrete slabs should be a minimum of 4 inches thick and reinforced with a minimum of #3 rebar spaced at 24" on center each way, or its equivalent. All slab reinforcement should be supported to ensure proper positioning during placement of concrete. Concrete slabs in moisture sensitive areas should be underlain with a vapor barrier consist of a minimum of six-mil polyethylene membrane with all laps sealed. A minimum of 2 inches of sand should be placed over the membrane to aid in uniform curing of concrete.

5.5 Retaining Wall

Wall should be provided with subdrains to reduce the potential for the buildup of hydrostatic pressure. Backdrains could consist of free drainage materials (SE of 30 or greater) or CalTrans Class 2 permeable materials immediately behind the wall and extending to within 18 inches of the ground surface. A 4-inch diameter perforated pipe should be installed at the base of the wall and sloped to discharge to a suitable collection facility or through weep holes. Alternatively, commercially available drainage fabric could be used. The fabric manufacturer's recommendations should be followed in the installation of the drainage fabric backdrain.

5.6 Temporary Excavation and Backfill

All trench excavations should conform to CAL-OSHA and local safety codes. All utilities trench backfill should be brought to near optimum moisture content and then compacted to obtain a minimum relative compaction of 90 percent of ASTM D-1557-12. All temporary excavations should be observed by a field engineer of this office so as to evaluate the suitability of the excavation to the exposed soil conditions.

6.0 SEISMIC DESIGN

Based on our studies on seismicity, there are no known active faults crossing the property. However, the subject site is located in Southern California, which is a tectonically active area. The following CBC 2016 (Chapter 16) & ASCE 7-10 (Chapter 20) seismic related values may be used:

Site Classification: (ASCE, Table 20.3-1)	D
Spectral Response Accelerations (g):	
(CBC, Figure 1613.3.1 (1) 0.2-Second, S_S	2.047
(CBC, Figure 1613.3.1 (2)) 1-Second, S_1	0.739
Site Coefficient:	
(CBC, Table 1613.3.3 (1)) F_a	1.0
(CBC, Table 1613.3.3 (2)) F_v	1.5

Based on the U.S. Seismic Design Maps (USGS, updated June 2014), the proposed structures may be designed to accommodate up to a maximum site horizontal acceleration of 0.777g with 2% probability of being exceeded in 50 years. However, the Project Structural Engineer should be aware of the information provided to determine if any additional structural strengthening is warranted.

7.0 TEMPORARY TRENCH EXCAVATION AND BACKFILL

All trench excavations should conform to CAL-OSHA and local safety codes. Based on our field investigation we believe some caving may occur in trenches. All utilities trench backfill should be brought to near optimum moisture content and then compacted to obtain a minimum relative compaction of 90 percent of ASTM D-1557-12.

8.0 CORROSION POTENTIAL

Chemical laboratory tests were conducted on the existing onsite near surface materials sampled during EGL's field investigation to aid in evaluation of soil corrosion potential and the attack on concrete by sulfate in the soils. The test results are presented in the Appendix B.

According to ACI 318-14 Table 19.3.1.1, a sulfate content of 0.001 percent by weight in soils is assigned to Class "S0" and the severity of exposure to sulfate for concrete placed in contact with the onsite soil is considered "Not Applicable". Based on the testing results and ACI 318-14 Table 19.3.2.1, it is concluded that there is no restriction on the type of cement ("No Type Restriction") to be used at the site; however EGL recommends that Type II cement be used.

Based on the minimum resistivity test results, the subsurface soils are moderately corrosive to buried metal pipe. Any underground steel utilities should be blasted and given protective coating. Should additional protective measures be warranted, a corrosion specialist should be consulted.

9.0 ASPHALT PAVEMENT

Preliminary structural pavement sections are designed according to the CalTrans Highway Design Manual and an assumed "R"-value of 55.

Location	Traffic Index	AC Thickness (inch)	Class 2 Aggregate Base Thickness (inch)
Parking Areas	4.5	4	4
Driveways	5.0	4	6

A traffic index of 4.5 is typically used for parking area for passenger vehicles with an average daily traffic of less than 200 trips. A traffic index of 5.0 is used for drive areas with an average daily traffic of less than 1,200 passenger vehicles with minor truck traffic. These pavement sections are considered preliminary and may be revised after the grading is completed provided additional testing is performed on the subgrade soil.

10.0 INSPECTION

As a necessary requisite to the use of this report, the following inspection is recommended:

- Temporary excavations.
- Removal of surficial and unsuitable soils.
- Backfill placement and compaction.
- Utility trench backfill.
- Foundation excavation.

The geotechnical engineer should be notified at least 1 day in advance of the start of construction. A joint meeting between the client, the contractor, and the geotechnical engineer is recommended prior to the start of construction to discuss specific procedures and scheduling.

11.0 106 STATEMENT

Based on our field investigation and the laboratory testing results, it is our opinion that the grading and proposed structures will be safe against hazard from landslide, settlement, or slippage and the proposed construction will have no adverse affect on the geologic stability of the adjacent properties provided our recommendations are followed.

12.0 DRAINAGE

The pad should be properly drained toward the street away from the slope and structure via swales or area drains. Positive pad drainage shall be incorporated into the final plans. In no cases should water be allowed to pond within the site, impound against structures, or flow in a concentrated and/or uncontrolled manner down the descending slope areas.

In order to evaluate the feasibility of the infiltration systems, EGL performed infiltration tests within the test pits TP-8 and TP-9 shown on the attached Site Plan per *Technical Guidance Documents for Water Quality Management Plans, County of San Bernardino.* A precise grading plan was not available at the time of preparing this report however; it is assumed that the base of the proposed infiltration/detention basin will be located approximately 6.5 feet below the existing grades. The infiltration testing program consisted of excavating two (2) test pits in the approximate location of the proposed infiltration systems to a depth of 6.5 feet below the existing grade. At the bottom of each test pit a 8" diameter hole was dug approximately 20" deep for the percolation testing. The test pits were presoaked and tested on June 1 & 2, 2018. Percolation test results are presented in Appendix C.

Based on the results of our preliminary infiltration test of the onsite material, the minimum infiltration rate is 19.13 in/hr. It is our opinion that dispersal of on-site storm water runoff by infiltration systems is considered feasible from a geotechnical engineering standpoint. The infiltration systems and the final plumbing plans should be designed and prepared by the project Civil Engineer.

Based on the consolidation test results presented in the Appendix B all the samples tested showed a deformation of less than 1.0% at the time of saturation. It is EGL's opinion that hydro-consolidation of the soil due to the proposed infiltration system is negligible and should not impact the proposed structure.

Based on the San Bernardino County Land Use Plan, General Plan, Geologic Hazard Overlays, FH20 C (Ref. #6), the subject site is not located within an area susceptible to liquefaction. It is EGL's opinion that the proposed infiltration systems will not increase the potential for liquefaction to occur at the site.

Due to the high percentage of sandy material at the site it is EGL's opinion that the infiltration system should be a minimum of 10 feet away from the building foundation and should not be surcharged by the building foundation. It is also recommended that the infiltration systems be placed within natural soil and not compacted fill material. The infiltration system should also have an overflow or bypass to protect the site from flooding. It is anticipated that the system will be placed below the proposed street; therefore, the system should be traffic rated.

13.0 REMARKS

The conclusions and recommendations contained herein are based on the findings and observations at the exploratory locations. However, soil materials may vary in characteristics between locations of the exploratory locations. If conditions are encountered during construction which appear to be different from those disclosed by the exploratory work, this office shall be notified so as to recommend the need for modifications.

This report has been prepared in accordance with generally accepted professional engineering principles and practice. No warranty is expressed or implied. This report is subject to review by controlling public agencies having jurisdiction.

REFERENCES:

1. American Concrete Institute, (2014), "*Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary*", Chapter 19: Durability Requirements, Sections 19.3.1: Exposure Categories and Classes & 19.3.2: Requirements for Concrete Mixtures; pages 317 to 323, Tables 19.3.1.1 and 19.3.2.1".
2. ASCE, (2010), "ASCE/SEI 7-10, Minimum Design Loads for Buildings and Other Structures: Third Printing, Errata incorporated, Includes Supplement No. 1; prepared and published by American Society of Civil Engineers.
3. CBC, (2016), "California Building Code: California Code of Regulations, Title 24, Part 2, Volume 2 of 2, California Building Standards Commission"; Section 1613 Earthquake Loads.
4. EGL Associates, (2018), "Conceptual Grading and Drainage Plan, 9 Lot Subdivision, 12774 Summit Avenue, Etiwanda, California", 30-scale, Job No. 14-181-001, revised 1/19/2018.
5. Orange County, (2011), "Exhibit 7.III, Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs), Appendix VII. Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations; dated May 19, 2011.
6. San Bernardino, (1989), " San Bernardino County Land Use Plan, General Plan, Geologic Hazard Overlays", FH20 C, Cucamonga Peak; Scale: 1:14,400, http://www.sbcounty.gov/Uploads/lus/GeoHazMaps/FH20C_20100309.pdf
7. San Bernardino, (2013), "Technical Guidance Document for Water Quality Management Plans, prepared by CDM Smith, Inc for The County of San Bernardino Areawide Stormwater Program, NPDES No. CAS618036, Order No. R8-2010-0036", Effective date September 19, 2013.
8. USGS, (2014), "US Seismic Design Maps"; updated 06-23-2014; prepared by United States Geological Survey; https://earthquake.usgs.gov/designmaps/us/application.php

APPENDIX A

FIELD INVESTIGATION

EGL preformed preliminary field subsurface exploration on June 1, 2018 with the aid of a rubber-tired backhoe equipped with a 36"-wide bucket of Best Bobcat Backhoe Services and consisted of excavating nine (9) backhoe test pits. Test pits extended to a maximum depth of 17.0 feet below the existing ground surface. Approximate locations shown on the enclosed Site Plan, Figure 2. Upon completion of drilling and percolation test, the test pits were backfilled with onsite soils that were removed from the excavations.

The excavating of the test pits was supervised by an EGL engineer, who continuously logged the borings and visually classified the soils in accordance with the Unified Soil Classification System. Ring samples were taken at frequent intervals. The samples, advanced by hand-auger, were obtained by driving a split-tube ring sampler with successive blows of a 32-pound hammer dropping from a height of 48 inches.

Representative undisturbed samples of the subsurface soils were retained in a series of brass rings, each having an inside diameter of 2.42 inches and a height of 1.00 inch. All ring samples were transported to our laboratory. Bulk surface soil samples were also collected for additional classification and testing.

EGL

TEST PIT LOG: TP-1

PROJECT LOCATION: 12774 Summit Avenue, Etiwanda, California

PROJECT NO: 14-181-001

DATE DRILLED: 06/01/2018
DATE LOGGED: 06/01/2018
EXCAVATION METHOD: Backhoe
SAMPLE METHOD: Split-Tube
ELEVATION: N/A
LOGGED BY: RA

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	*Earth Material Descriptions*
0 - 2		R	-	SM	-	-	@ 2.0' Silty sand, fine to coarse grained, dark brown, dry to slightly moist, medium dense; no sample was obtained due to very rocky and dense condition
4 - 6		R	-	SM	-	-	@ 5.0' Silty sand, fine to coarse grained, dark brown, slightly moist, medium dense to dense, gravel and cobbles up to 10" were commonly present; no sample was obtained due to very rocky and dense condition
8 - 10 - 12 - 14 - 16 - 18							Refusal @ 6.0 feet Total Depth = 6.0 feet No Caving No Groundwater Test Pit Backfilled Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches

TEST PIT LOG: TP-2

ELEVATION: N/A
LOGGED BY: RA

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	*Earth Material Descriptions*
0 - 2		R	60	SM/SP	No Recovery		@ 2.0' Silty sand and poorly graded sand, fine to coarse grained, dark brown, dry, medium dense to dense, gravel and cobbles up to 10" were commonly present
4 - 6		-	-	SM	-	-	@ 5.0' Silty sand, fine to coarse grained, brown to light brown, slightly moist, dense to very dense, gravel and cobbles were commonly present; no sample was obtained due to very rocky and dense condition
8 - 10		-	-	SM	-	-	@ 10.0' Silty sand, fine to coarse grained, dark olive brown, slightly moist, very dense, gravel and cobbles were commonly present; no sample was obtained due to very rocky and dense condition
12 - 14 - 16 - 18							Total Depth = 10.0 feet No Caving; No Groundwater Test Pit Backfilled Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches

EGL

TEST PIT LOG: TP-3

PROJECT LOCATION: 12774 Summit Avenue, Etiwanda, California

PROJECT NO: 14-181-001

DATE DRILLED: 06/01/2018
DATE LOGGED: 06/01/2018
EXCAVATION METHOD: Backhoe
SAMPLE METHOD: Split-Tube
ELEVATION: N/A
LOGGED BY: RA

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
0 - 2		-	-	SM	-	-	@ 2.0' Silty sand, fine to coarse grained, dark brown, dry to slightly moist, medium dense; no sample was obtained due to very rocky and dense condition
2 - 6		-	-	SM	-	-	@ 5.0' Silty sand, fine to coarse grained, dark brown, slightly moist, medium dense to dense, gravel and cobbles up to 10" were commonly present; no sample was obtained due to very rocky and dense condition
6 - 18							Refusal @ 5.0 feet Total Depth = 5.0 feet No Caving No Groundwater Test Pit Backfilled Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches

TEST PIT LOG: TP-4

ELEVATION: N/A
LOGGED BY: RA

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
0 - 2		R	15	SM/SP	No Recovery		@ 2.0' Silty sand and poorly graded sand, fine to coarse grained, light grayish brown, dry, medium dense to dense, gravel and cobbles up to 10" were commonly present
2 - 8		R	70	SM/SW	No Recovery		@ 5.0' Silty sand and well-graded sand, fine to coarse grained, brown to light brown, slightly moist, dense to very dense, gravel and cobbles were commonly present
8 - 18							Refusal @ 8.0 feet Total Depth = 8.0 feet No Caving; No Groundwater Test Pit Backfilled Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches

EGL

TEST PIT LOG: TP-5

PROJECT LOCATION: 12774 Summit Avenue, Etiwanda, California

PROJECT NO: 14-181-001

DATE DRILLED: 06/01/2018
DATE LOGGED: 06/01/2018
EXCAVATION METHOD: Backhoe
SAMPLE METHOD: Split-Tube
ELEVATION: N/A
LOGGED BY: RA

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
0 - 2		R	25	SM	105.9	0.7	@ 0.5' Silty sand, fine to coarse grained, dark brown, dry, medium dense, little gravel & cobbles up to 10" in size
4 - 6		-	-	SM	-	-	@ 5.0' Silty sand, fine to coarse grained, dark brown and brown, slightly moist, dense, gravel and cobbles up to were commonly present; no sample was obtained due to very rocky and dense condition
8 - 10		R	60	SM/SW	106.8	2.6	@ 9.0' Silty sand and well-graded sand, fine to coarse grained, dark brown, slightly moist, dense, cobbles and boulders up to 15" were commonly present
12 - 14							Total Depth = 9.0 feet No Caving; No Groundwater Test Pit Backfilled
16 - 18							Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches

TEST PIT LOG: TP-6

ELEVATION: N/A
LOGGED BY: RA

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
0 - 2	B	R	25	SM	106.0	2.9	@ 0.5' Silty sand, fine to coarse grained, dark olive brown, dry to slightly moist, medium dense, little gravel were commonly present
4 - 6		-	-	SM	-	-	@ 5.0' Silty sand, fine to coarse grained, dark brown and brown, slightly moist, dense, gravel and cobbles up to were commonly present; no sample was obtained due to very rocky and dense condition
8 - 10		-	-	SM/SW	-	-	@ 9.0' Silty sand and well-graded sand, fine to coarse grained, brown, slightly moist, very dense, cobbles and boulders up to 15" were commonly present; no sample was obtained due to very rocky and dense condition
12 - 14							Total Depth = 10.0 feet No Caving; No Groundwater Test Pit Backfilled
16 - 18							Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches

EGL

TEST PIT LOG: TP-7 (GW)

PROJECT LOCATION: 12774 Summit Avenue, Etiwanda, California

PROJECT NO: 14-181-001

DATE DRILLED: 06/01/2018
DATE LOGGED: 06/01/2018
EXCAVATION METHOD: Backhoe
SAMPLE METHOD: Split-Tube
ELEVATION: N/A
LOGGED BY: RA

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
0 - 2		R	15	SM	105.4	1.2	@ 0.5' Silty sand, fine to coarse grained, light olive brown, dry, loose to medium dense, little gravel & cobbles up to 10" in size
2 - 4		R	25	SM	109.1	2.5	@ 2.0' Silty sand, fine to coarse grained, light olive brown, dry to slightly moist, medium dense, little gravel & cobbles up to 10" in size
4 - 6							
6 - 8							
8 - 10		R	70	SM	110.8	2.2	@ 9.0' Silty sand, fine to coarse grained, light olive brown, dry to slightly moist, dense to very dense, cobbles and boulders up to 15" were commonly present
10 - 12							
12 - 14							Total Depth = 17.0 feet No Caving; No Groundwater Test Pit Backfilled
14 - 16							
16 - 18							Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches

TEST PIT LOG: TP-8 (Perc)

ELEVATION: N/A
LOGGED BY: RA

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	
0 - 2		R	40	SM	101.3	1.1	@ 0.5' Silty sand, fine to coarse grained, dark brown, dry, medium dense, little gravel were commonly present
2 - 4							
4 - 6		R	60	SM	112.8	4.4	@ 5.0' Silty sand, fine to coarse grained, dark brown, slightly moist, dense, gravel and cobbles up to were commonly present
6 - 8							
8 - 10							Total Depth = 5.0 feet No Caving; No Groundwater Test Pit Backfilled
10 - 12							
12 - 14							Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches
14 - 16							
16 - 18							

EGL

TEST PIT LOG: TP-9 (Perc)

PROJECT LOCATION: 12774 Summit Avenue, Etiwanda, California

PROJECT NO: 14-181-001

DATE DRILLED:	06/01/2018
DATE LOGGED:	06/01/2018
EXCAVATION METHOD:	Backhoe
SAMPLE METHOD:	Split-Tube
ELEVATION:	N/A
LOGGED BY:	RA

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
0		R	20	SM	100.7	2.1	@ 0.5' Silty sand, fine to coarse grained, light olive brown, dry, medium dense, little gravel & cobbles up to 10" in size
2							
4							
6		-	-	SM	-	-	@ 5.0' Silty sand, fine to coarse grained, dark brown, slightly moist, dense, gravel and cobbles up to were commonly present; no sample was obtained due to very rocky and dense condition
8							
10							Total Depth = 5.0 feet No Caving; No Groundwater Test Pit Backfilled
12							
14							Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches
16							
18							

APPENDIX B

LABORATORY TESTING

During the subsurface exploration, EGL personnel collected relatively undisturbed ring samples and bulk samples. The following tests were performed on selected soil samples:

Moisture-Density

The moisture content and dry unit weight were determined for each relatively undisturbed soil sample obtained in the test borings in accordance with ASTM D2937 standard. The results of these tests are shown on the boring logs in Appendix A.

Shear Tests

Shear tests were performed in a direct shear machine of strain-control type in accordance with ASTM D3080 standard. The rate of deformation was 0.025 inch per minute. Selected samples were sheared under varying confining loads in order to determine the Coulomb shear strength parameters: internal friction angle and cohesion. The shear test results are presented in the attached plates.

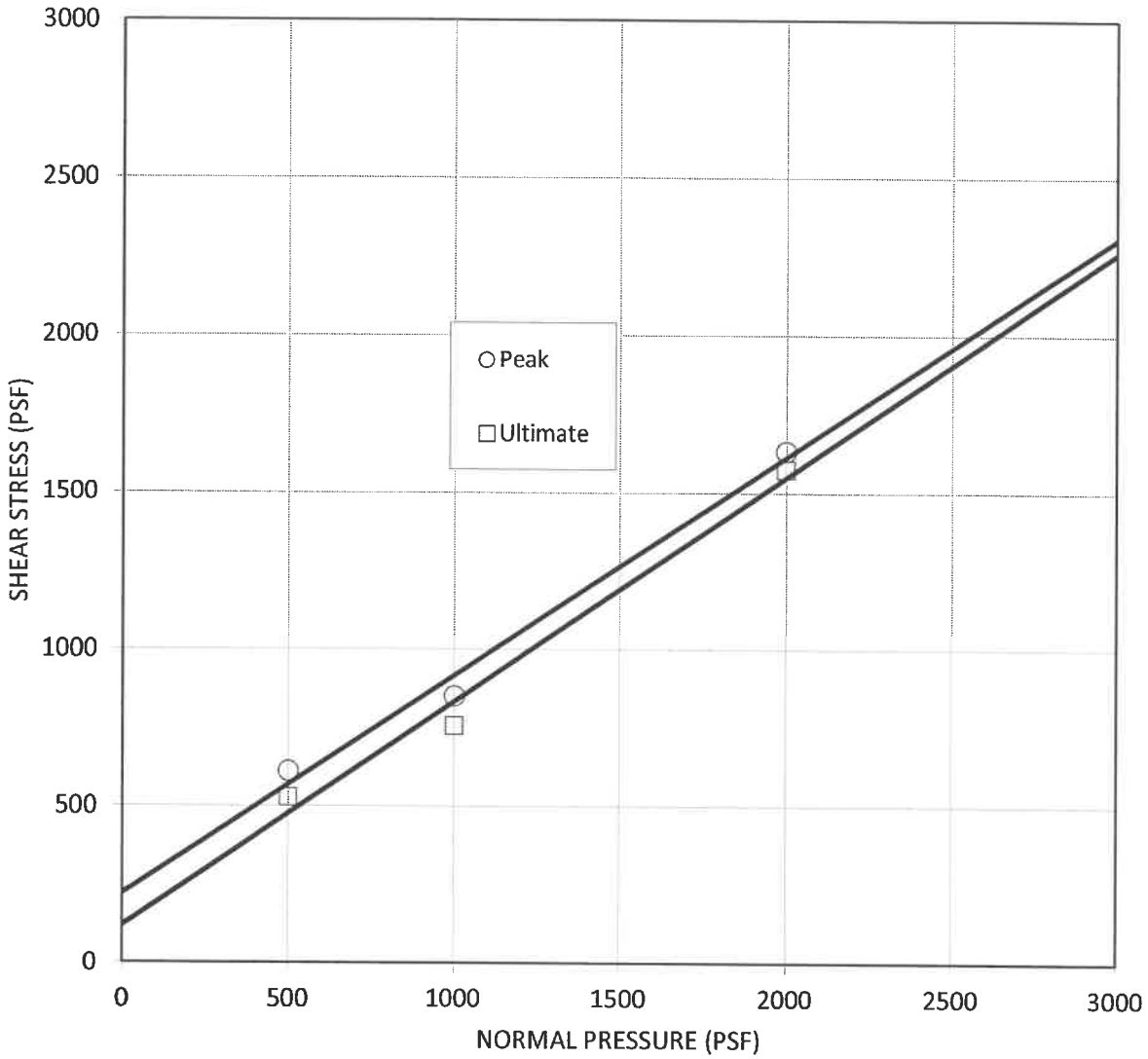
Consolidation Tests

Consolidation tests were performed on selected undisturbed soil samples in accordance with ASTM D2435 standard. The consolidation apparatus is designed for a one-inch high soil filled brass ring. Loads are applied in several increments in a geometric progression and the resulting deformations are recorded at selected time intervals. Porous stones are placed in contact with the top and bottom of each specimen to permit addition and release of pore fluid. The samples were inundated with water at a load of one kilo-pounds (kips) per square foot, and the test results are shown on the attached Figures.

Corrosion Potential

Chemical laboratory tests were conducted on the existing onsite near surface materials sampled during EGL's field investigation to aid in evaluation of soil corrosion potential and the attack on concrete by sulfate soils. These tests are performed in accordance with California Test Method 417, 422, 532, and 643. The testing results are presented below:

Sample Location	pH	Chloride (ppm)	Sulfate (% by weight)	Min. Resistivity (ohm-cm)
TP-6 @ 0'-5'	6.91	196	0.001	9,500



Boring No.:	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
TP-5	1	0.5	Ring	SM	○	222	35
					□	120	35

Normal Stress (psf)	Initial Moisture (%)	Final Moisture (%)	γ_d (pcf)	S (%)
500	0.7	21.6	107.8	100.0
1000	0.7	20.8	105.5	94.4
2000	0.7	21.8	105.4	98.1

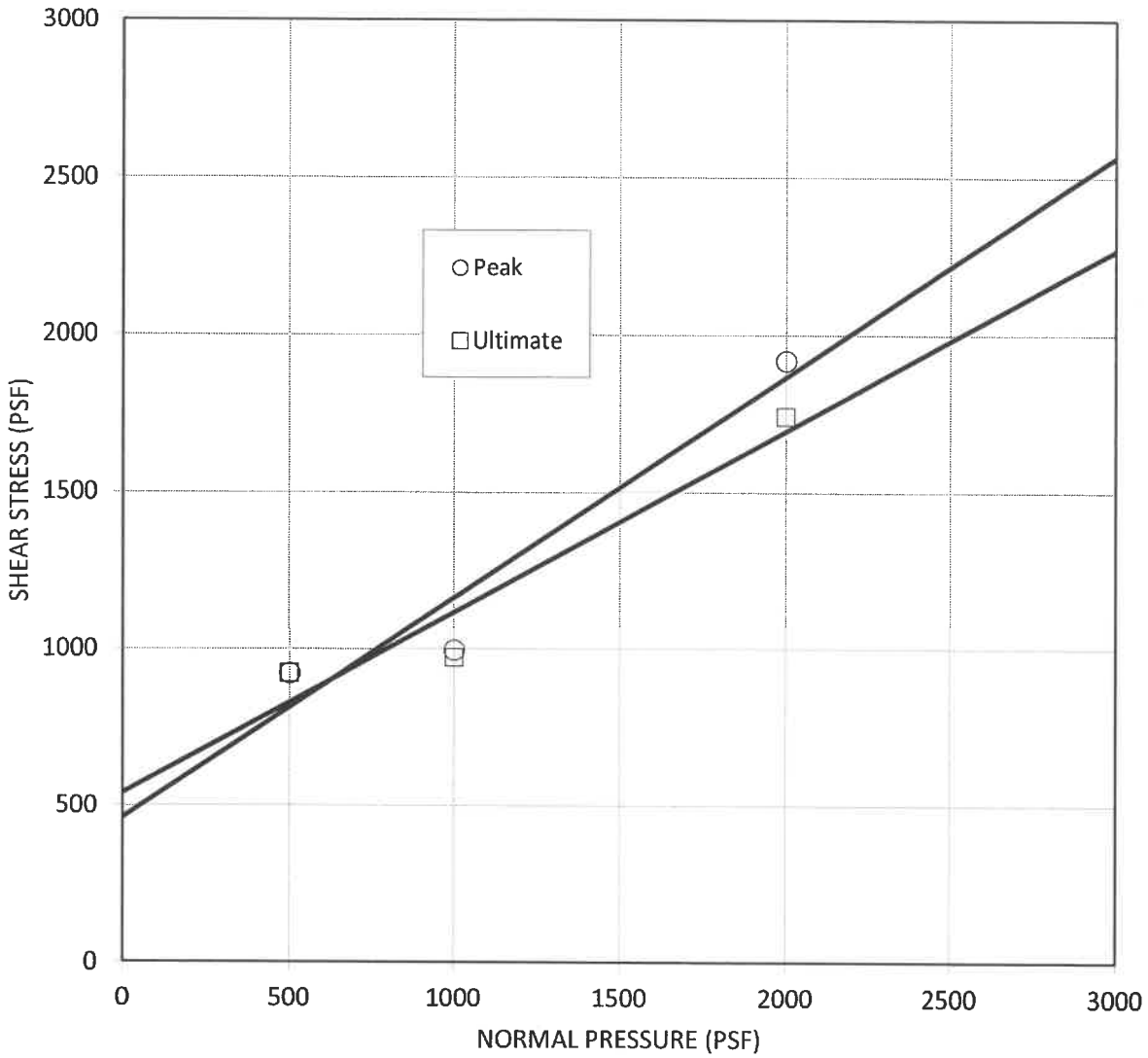
ENVIRONMENTAL GEOTECHNOLOGY LABORATORY

Project Address:
12774 Summit Avenue
Etiwanda, California

DIRECT SHEAR

06/18 (ASTM D3080) Figure

11819 Goldring Road, Unit A, Arcadia, California 91006; Phone (626) 263-3588; Fax (626) 263-3599



Boring No.:	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
TP-7	3	9.0	Ring	SM	○	462	35
					□	540	30

Normal Stress (psf)	Initial Moisture (%)	Final Moisture (%)	γ_d (pcf)	S (%)
500	2.2	17.5	114.7	100.0
1000	2.2	19.2	113.4	100.0
2000	2.2	20.0	111.0	100.0

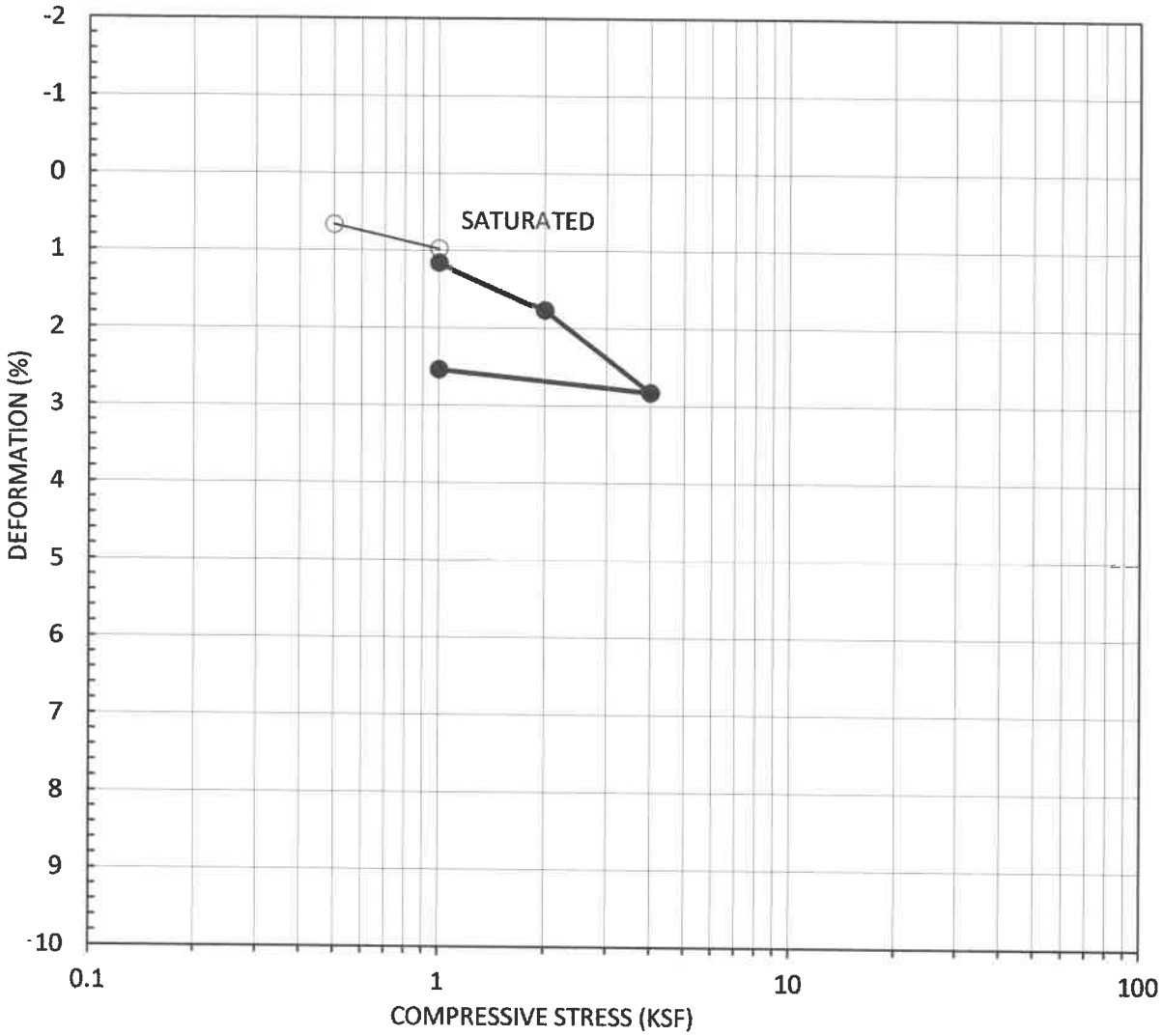
ENVIRONMENTAL
GEOTECHNOLOGY
LABORATORY

Project Address:
12774 Summit Avenue
Etiwanda, California

DIRECT SHEAR

06/18 (ASTM D3080) Figure

11819 Goldring Road, Unit A, Arcadia, California 91006; Phone (626) 263-3588; Fax (626) 263-3599



Symbol	Boring No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-5	2	9.0	SM/SW	2.6	107.4	0.569

ENVIRONMENTAL GEOTECHNOLOGY LABORATORY

Project Address:
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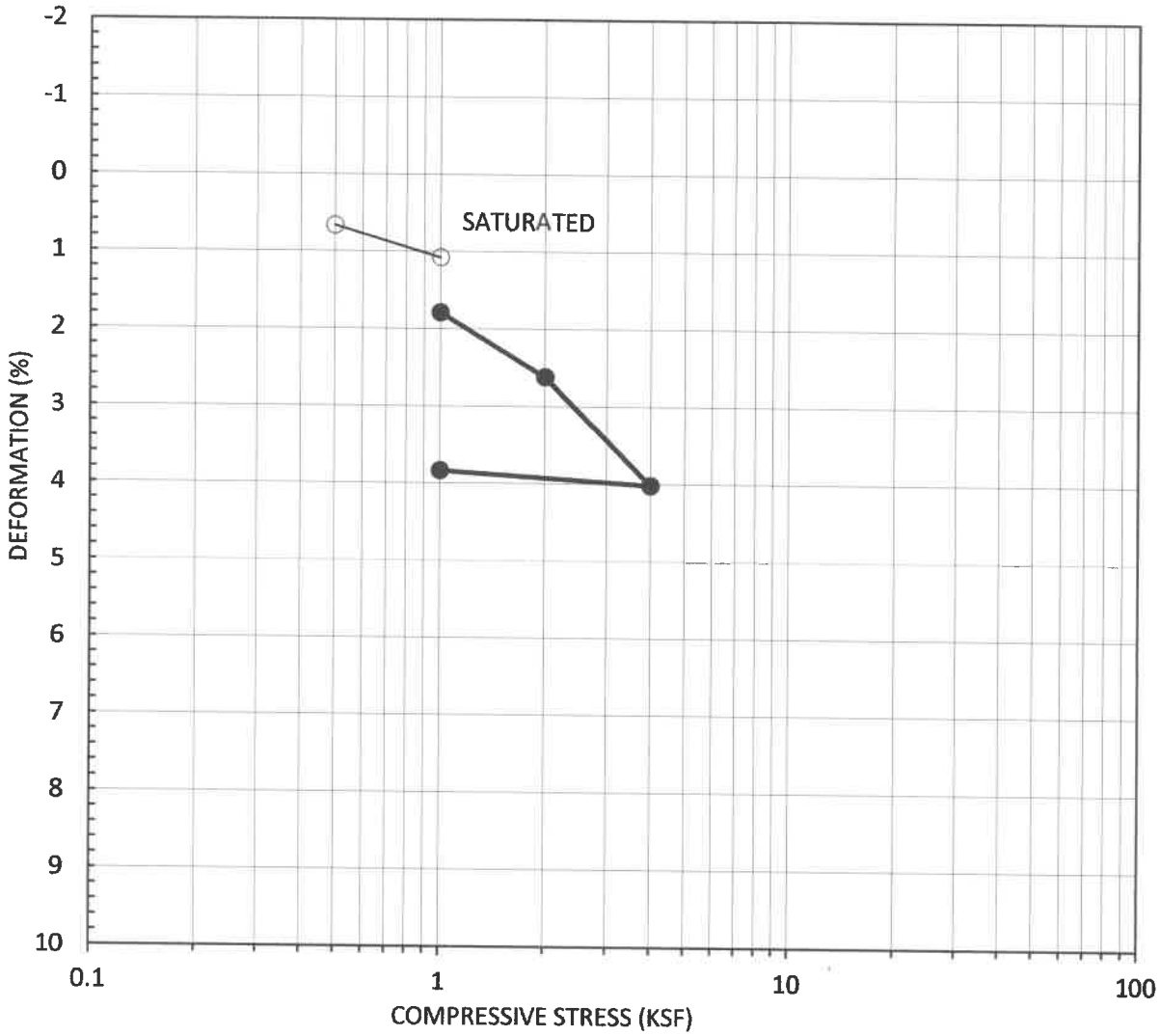
CONSOLIDATION

06/18 (ASTM D2435) Figure



Symbol	Boring No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-6	1	0.5	SM	2.9	107.4	0.569

ENVIRONMENTAL
GEOTECHNOLOGY
LABORATORY

Project Address:
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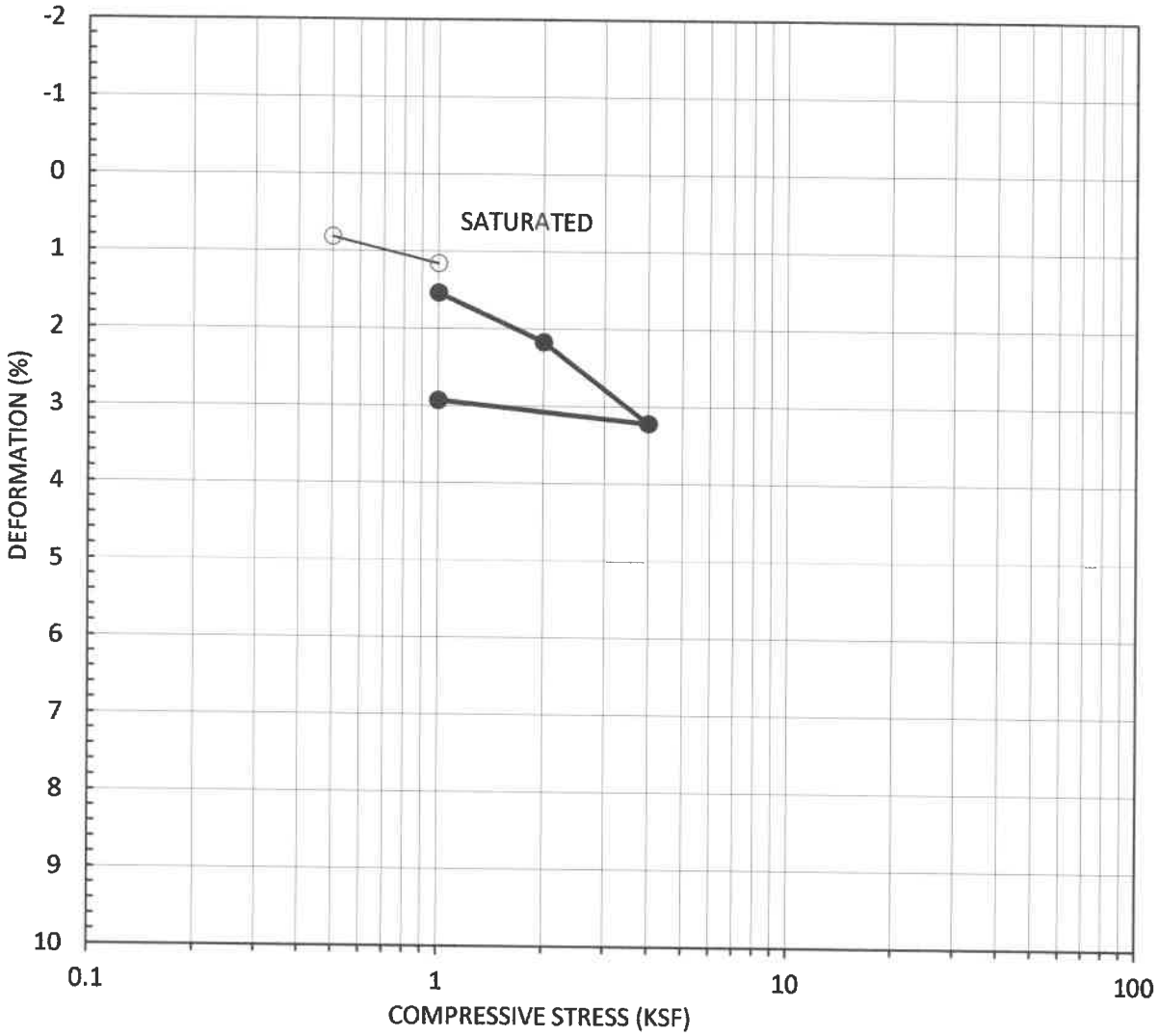
Etiwanda, California

CONSOLIDATION

06/18 (ASTM D2435) Figure



Symbol	Boring No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-7	2	2.0	SM	2.5	109.2	0.543

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Etiwanda, California

CONSOLIDATION

06/18 (ASTM D2435) Figure

APPENDIX C
INFILTRATION TEST RESULTS

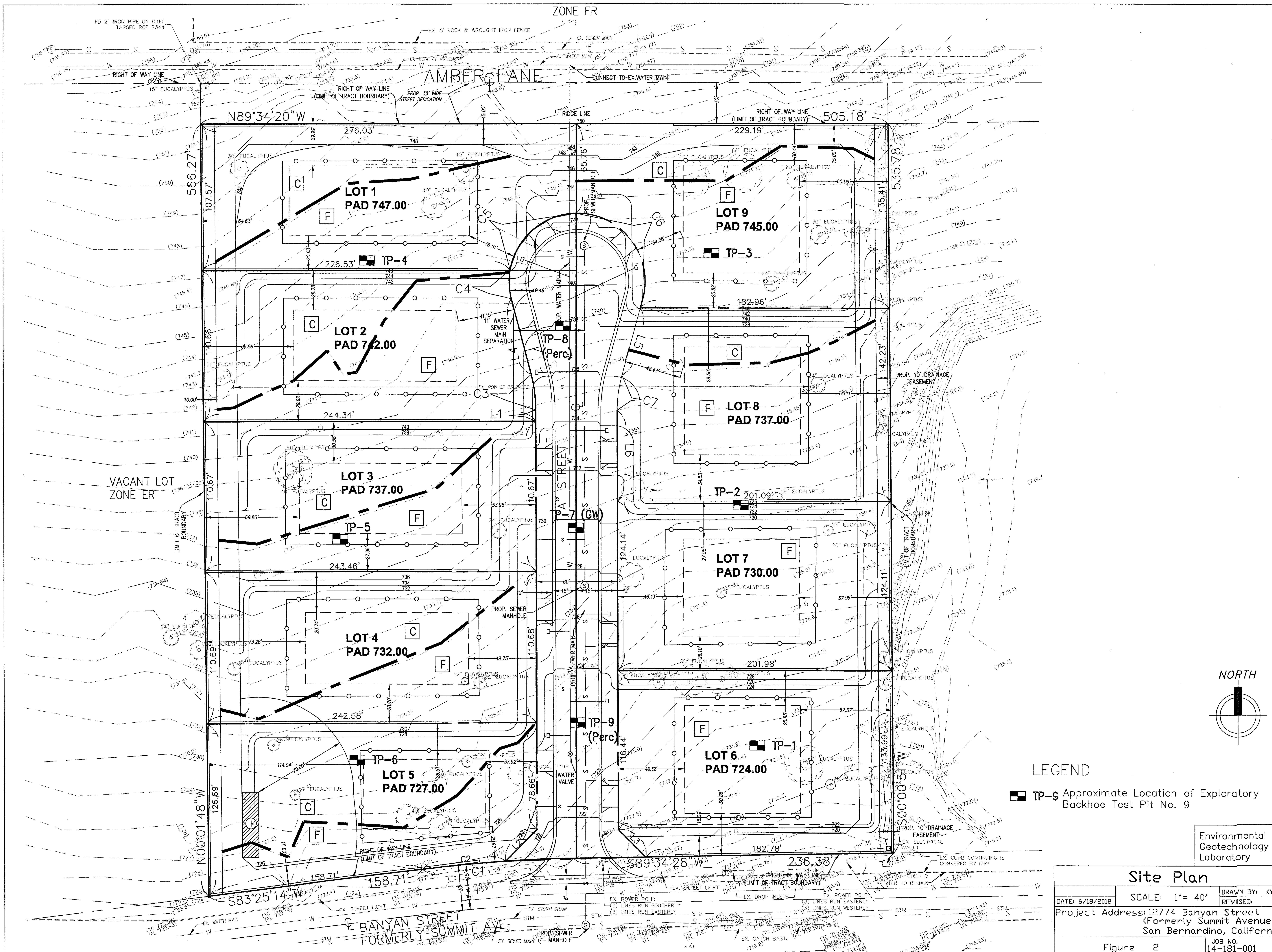
Infiltration Testing per San Bernardino Technical Guidance Document

r (in) = radius hole
t_i (hr:min) = intial time after filling or refilling
t_f (hr:min) = final time
d_b (ft) = depth to bottom
d_i (ft) = depth to water surface at ti
d_f (ft) = depth to water surface at tf
ΔH (in) = change in height over time
Have = average head height over the time interval
t (hr) = Time reading interval
It (in/hr) = (ΔHxr)/(Δt(r+2Havg)) tested infiltration rate

TP-9									
r (in)	t_i (hr:min)	t_f (hr:min)	Δt (hr)	d_b (in)	d_i (fin)	d_f (in)	ΔH (in)	H_{ave} (ft)	It (in/hr)
4	10:05	10:09	0.07	20	0	20.00	20.00	10.00	46.17
4	10:09	10:13	0.07	20	0	20.00	20.00	10.00	45.11
4	10:13	10:17	0.07	20	0	20.00	20.00	10.00	44.80
4	10:17	10:21	0.08	20	0	20.00	20.00	10.00	43.01
4	10:21	10:25	0.08	20	0	20.00	20.00	10.00	42.09
4	10:25	10:29	0.08	20	0	20.00	20.00	10.00	41.36
4	10:29	10:33	0.08	20	0	20.00	20.00	10.00	40.40
4	10:33	10:38	0.08	20	0	20.00	20.00	10.00	39.73

TP-8									
r (in)	t_i (hr:min)	t_f (hr:min)	t (hr)	d_b (in)	d_i (fin)	d_f (in)	ΔH (in)	H_{ave} (ft)	It (in/hr)
4	11:00	11:03	0.06	20	0	20.00	20.00	10.00	53.33
4	11:03	11:06	0.06	20	0	20.00	20.00	10.00	52.16
4	11:06	11:10	0.07	20	0	20.00	20.00	10.00	51.28
4	11:10	11:14	0.07	20	0	20.00	20.00	10.00	49.38
4	11:14	11:18	0.07	20	0	20.00	20.00	10.00	48.38
4	11:18	11:22	0.07	20	0	20.00	20.00	10.00	48.03
4	11:22	11:26	0.07	20	0	20.00	20.00	10.00	47.21
4	11:26	11:30	0.07	20	0	20.00	20.00	10.00	46.36

F.S. = 2.25
Average Infiltration Rate (in/hr) = 43.05
Infiltration Rate / FS (in/hour) = 19.13



ZONE ER
AMBER LANE
VACANT LOT
ZONE ER
"A" STREET
BANYAN STREET
FORMERLY SUMMIT AVE
N89°34'20"W
505.18'
566.27'
535.78'
S89°34'28"W
236.38'
S83°25'14"W
158.71'
N00°01'48"W
S00°00'51"W
LOT 1
PAD 747.00
LOT 2
PAD 742.00
LOT 3
PAD 737.00
LOT 4
PAD 732.00
LOT 5
PAD 727.00
LOT 6
PAD 724.00
LOT 7
PAD 730.00
LOT 8
PAD 737.00
LOT 9
PAD 745.00
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7 (GW)
TP-8 (Perc)
TP-9 (Perc)
RIGHT OF WAY LINE (LIMIT OF TRACT BOUNDARY)
PROP. 30' WIDE STREET DEDICATION
CONNECT TO EX. WATER MAIN
RIDGE LINE
PROP. SEWER MANHOLE
PROP. 10' DRAINAGE EASEMENT
LIMIT OF TRACT BOUNDARY
NORTH
LEGEND
TP-9 Approximate Location of Exploratory Backhoe Test Pit No. 9
Environmental Geotechnology Laboratory
Site Plan
DATE: 6/18/2018
SCALE: 1"= 40'
DRAWN BY: KY
REVISED:
Project Address: 12774 Banyan Street (Formerly Summit Avenue) San Bernardino, California
Figure 2
JOB NO. 14-181-001