Appendix H-1: EIR-Level Geotechnical Study

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EIR-LEVEL GEOTECHNICAL STUDY
PROPOSED GREEN RIVER RANCH BUSINESS PARK DEVELOPMENT
SOUTHWEST OF GREEN RIVER AND DOMINGUEZ ROADS
CITY OF CORONA, RIVERSIDE COUNTY, CALIFORNIA

PSIP WR GREEN RIVER, LLC

August 12, 2020
J.N. 20-252

August 12, 2020
J.N. 20-252

PSIP WR GREEN RIVER, LLC
c/o Western Realco
500 Newport Center Drive, Suite #630
Newport Beach, California 92660

Attention: Mr. Jeremy Mape

Subject: EIR-Level Geotechnical Study, Proposed Green River Ranch Business Park Development, Southwest of Green River and Dominguez Roads, City of Corona, Riverside County, California

Reference: Petra Geosciences, Inc., 2019, Draft Due Diligence/Feasibility Level Geotechnical Assessment, Proposed Green River Ranch Commercial Development, Southwest of Green River and Dominguez Roads, City of Corona, Riverside County, California; J.N. 19-286, dated December 20, 2019.

Dear Mr. Mape:

Petra Geosciences, Inc. (Petra) is presenting herein our geotechnical feasibility and EIR-level assessment of the 33.2 acres of the northern portion of the property that are proposed to be developed into five large building pads. The purposes of our study were to evaluate the geotechnical feasibility of development of the site for commercial warehouse/office building construction, and to determine what geotechnical constraints are inherent to the property that may influence the proposed development.

It should be noted that this evaluation pertains only to engineering geotechnical aspects of the site and does not address soil contamination or other environmental issues that may affect the property.

It is a pleasure to be of continued service to you on this project. Should you have any questions regarding the contents of this report, or should you require additional information, please do not hesitate to contact us.

Respectfully submitted,

PETRA GEOSCIENCES, INC.

J. Montgomery Schultz
Associate Engineer

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INTRODUCTION

The following EIR-level assessment report presents our findings and opinions with respect to the geotechnical feasibility of the proposed project and constraints that may have an impact on the development of the subject property. This evaluation is based on our review of published geotechnical maps and literature pertinent to the area of the subject site, limited subsurface investigation, and our previous experience with similar projects in the area. The design concept assumed for purposes of this study is based on the current conceptual site plan prepared by KWC Engineers (dated June 12, 2020).

The site plan shows the development of 5 parcels for construction of large warehouse type structures, that is currently planned at this time. Parcels 1 through 5 are part of a larger Specific Plan area, that includes the 5 parcels, plus two additional ones. Parcel 6 is located to the south and is intended for future residential development, and Parcel 7 is located to the northwest between the freeway and Green River Road, for future commercial development. The layout of the 7 parcels is shown on a map prepared by KWC labeled "Green River Ranch Project Development Exhibit" last printed July 7, 2020. The 5 parcels currently planned for development are part of planning areas PA 1, PA 2 and PA 3, as shown on the specific plan designated as Exhibit 3, labeled "Conceptual Development Plan (Planning Area Land Use Plan), provided to us by T & B Planning in July of 2020.

PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to collect the required regional and site-specific geotechnical data in order to provide an assessment of potential geologic and seismic-related constraints that may affect the development as currently proposed. The results of our assessment, as well as preliminary mitigation measures intended to reduce the impact of the identified geologic constraints, are provided in this report.

This study has been performed in general accordance with relevant provisions of the California Environmental Quality Act (CEQA) of 1970, and the guidelines for implementation of CEQA as amended. In preparing this report, our scope of services has included the following:

a. Review of available published and unpublished literature and maps pertaining to regional faulting, seismic hazards and soil and geologic conditions within and adjacent to the site that could have an impact on the proposed development.

b. Review of the referenced site-specific geotechnical report prepared by Neblett and Associates, 1999 (Reference)

c. Reconnaissance of the subject site and surrounding areas.

d. Performing 9 exploratory test pits, 3 exploratory bucket auger borings and 3 hollow-stem borings (advanced primarily for percolation testing) at pre-selected locations within the project site.

e. Engineering and geologic analyses of the field data as they pertain to the proposed construction.

f. Evaluation of faulting and seismicity of the region and the possible impact of regional seismicity on the site and the proposed construction.

g. Analysis of liquefaction and its potential impact on the site and proposed construction.

h. Preparation of this report presenting our findings, conclusions and recommendations.

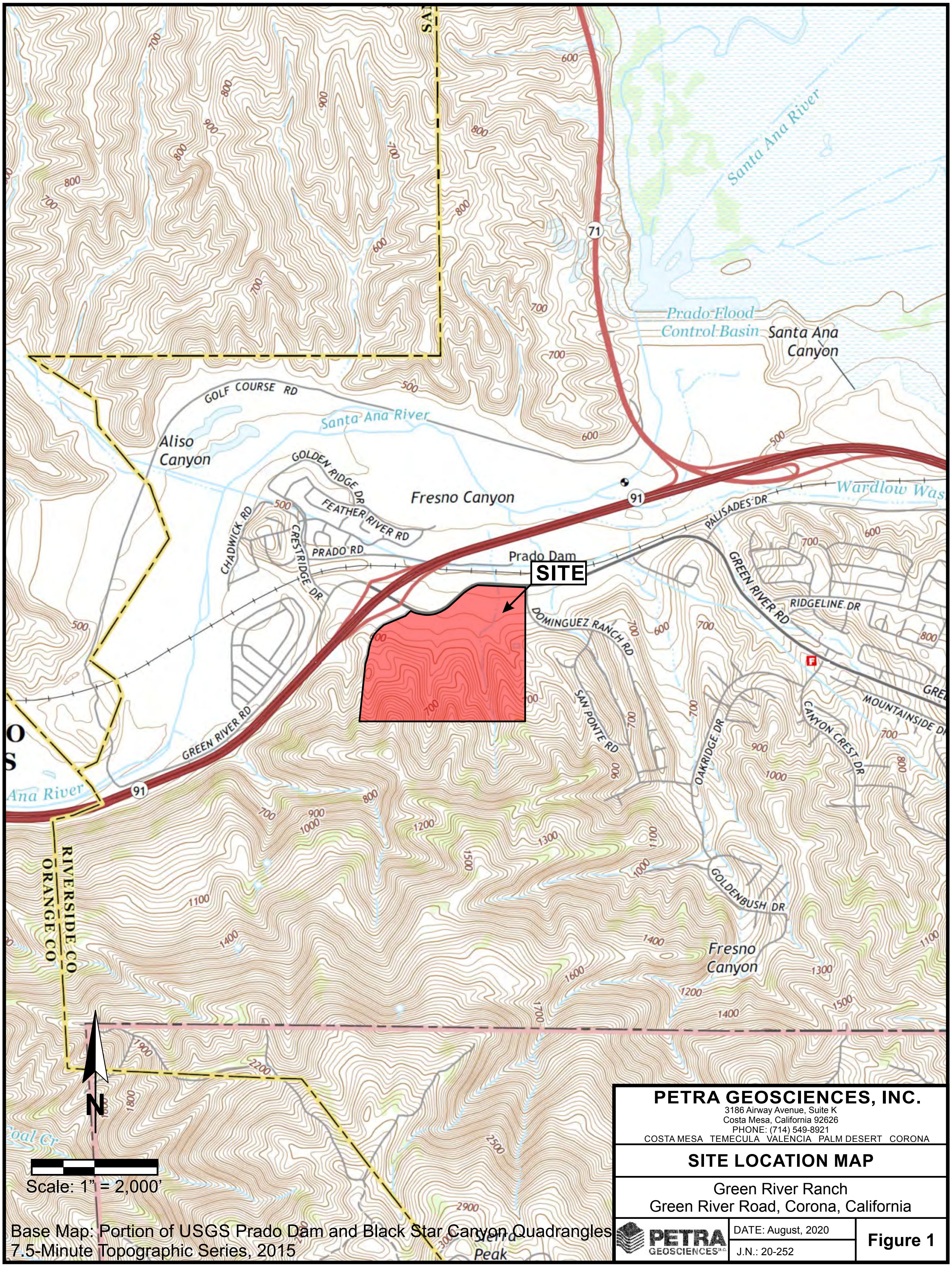
LOCATION AND SITE DESCRIPTION

The subject property is located on the south side of Green River Drive between Fresno Road on the west and Dominguez Ranch Road on the east and extends approximately 1,800 feet to the south into the foothills of the Santa Ana Mountains. The location of the site is shown on Figure 1. Elevations onsite range from approximately 1,110 +/- feet in the southwest corner of the property to 515 +/- feet in the northeast corner of the property with a maximum relief of roughly 595 +/-feet. Generally, the southern portion of the site is undeveloped hillside terrain with natural slopes ascending to the south at slope ratios ranging from 4:1 to 1.5:1 (horizontal to vertical). The northerly portion of the site is relatively flat and has had some previous improvements. The improvements include a number of horse pens, several barb wire and/or chain link fences, an old asphaltic concrete-capped parking lot, a concrete building slab where a previous restaurant reportedly used to exist, several mobile homes, and a variety of trailers, vehicles, and storage containers. An empty, concrete-lined reservoir and water tank are located on the northeastern side of the property. One of the north-south trending canyons appears to have received a significant quantity of undocumented fill material. Vegetation mostly consists of a variety of native grasses and bushes with a few mature trees in canyon areas and at the north end of the site. Drainage is provided by several relatively large and steep natural canyons descending from the south that transition to a sheet-flow dominated drainage in the flatter portion of the site which similarly drains to the north.

BACKGROUND INFORMATION

Previous Site Usage

A review of Google Earth historical photographs reveals the site has been used as an agricultural area for horses and corrals from the present back to before 1994, the earliest photo available on Google Earth. We have reviewed additional older historical photographs for the area as outlined in Table 1.



Base Map: Portion of USGS Prado Dam and Black Star Canyon Quadrangles
7.5-Minute Topographic Series, 2015

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COSTA MESA TEMECULA VALENCIA PALM DESERT CORONA

SITE LOCATION MAP

Green River Ranch
Green River Road, Corona, California

PETRA GEOSCIENCES

DATE: August, 2020

J.N.: 20-252

Figure 1

TABLE 1

Historic Aerial Photographs Reviewed

Flight Number	Date	Scale	Series Number(s)
C-133	2/23/1999	1" = 2,000'	33-232
C84	6/12/1990	Unknown	14-23
F108	12/30/1986	Unknown	742
218	4/8/1983	Unknown	12
AMI-SBD-80	6/7/1980	1:36,000	10681
AXM-4HH	5/15/1967	1:20,000	211, 212
AXM_AXK-4F	5/5/1949	Unknown	29
AXK-1938	5/23/1938	1:20,000	39-58
C-5029	3/4/1938	1:30,000	148
C-2580	4/13/1933	1:14,400	47, 48, 49
C-388	10/21/1928	1:18,000	A-14, A-15

Frame A-15 from Flight C-388 available from the UCSB collection is shown below in Figure 2. The primary land use may be agriculture or vacant land in in 1928. In the photographs from 1938 the site appears not to have experienced any flooding from the Santa Ana River channel. By 1967 the land still appears to be generally vacant, however a few small structures appear to be present in the northeastern part of the site. By 1980 the horse operation begins to appear with a few corrals and stock tanks.

There was no visible evidence of faulting in the air photos of the site to be currently developed (Parcels 1 through 5). The site geology appears to be dominated by the flood plain deposits that form the lower base of the flatter terrain at the base of the southern hills, with an additional older terrace on the hills above.

Figure 2 – Portion of Frame A-15, from Flight C-388, year 1928, with specific plan property boundaries approximately located. Land use appears to be minimal.

Previous Geotechnical Studies

A previous Geologic/Geotechnical Feasibility Level Study of the property was performed by Neblett & Associates, Inc. (Neblett, 1999) [N& A]. This report was reviewed as part of this due diligence/feasibility geotechnical assessment. Noteworthy findings made from reviewing this report are discussed below with any comments by Petra in *italics* and parentheses.

- Neblett performed their geologic and geotechnical assessment of the property for the development of proposed retail, commercial, and industrial buildings in the northern portion of the site and equestrian estate lots in the southern portion of the property.

- Neblett's field work consisted of 6 rotary wash borings drilled to depths of up to 77 feet, 12 exploratory test pits excavated to depths of up to 16 feet, and cursory geologic field mapping. The approximate locations of these exploration points from Neblett (1999) are provided on the Geotechnical Map, Plate 1, included herein. Reproductions of their boring and test pit logs are provided within Appendix C.

- Neblett performed laboratory testing that included maximum density/optimum moisture content, sulfate content, expansion index, moisture/density determinations, grain size analyses, consolidation potential, and direct shear. Reproductions of the laboratory test results from Neblett are provided within Appendix C.

- Neblett also reviewed aerial photographs, prepared a geologic map and geologic cross sections, evaluated slope stability, provided a limited seismicity evaluation, and provided conclusions and recommendations for site development within their geologic/geotechnical report (Neblett, 1999).

- Neblett found no evidence of active faulting onsite. They found that the potential for ground rupture hazard related to an earthquake was considered unlikely. Similarly, they found that liquefaction beneath the site was considered unlikely due to the absence of groundwater to the maximum depth explored (77 feet).

- Neblett considerations included that hard bedrock may be encountered, and special processing/ripping may be required, along with the disposal of oversized material (boulders).

- Neblett recommended that the upper 5 to 8 feet of alluvial soils be removed and replaced as engineered fill.

- Neblett recommended that cut areas be overexcavated a minimum of 5 feet and replaced with compacted fill in building pad areas. Where steep cut/fill transitions occurred, the cut portions of the building pads were recommended to be overexcavated 1/3 of the total fill depth (minimum 5 feet).

- Neblett laboratory tests provided Expansion Indices of 0, 0, and 12, and sulfate contents of 12, 16, and 20 parts per million (ppm).

- Neblett provided slope stability analyses of the major cut and fill slopes proposed at that time. They estimated static factors of safety just above 1.5 for each slope (1.5 minimum required). The pseudo-static (seismic) factor of safety for each slope was calculated at a minimum of 1.1 (1.1 minimum required). The pseudo-static loading assumed a Kh coefficient of 0.15, as was typical. (*However, considering how close the site is to known, active faults a higher value may be warranted.)* Neblett included a stabilization fill key at the contact with the older alluvium/bedrock contact on the slope.

REGULATORY ENVIRONMENT

Construction projects of the type presently being considered in this report are regulated by the local permitting agency, in this case the Public Works Department/Building Division of the City of Corona. Prior to issuing grading and building permits, the City is tasked with ensuring that structural design is in compliance with all applicable provisions of the state and local regulatory standards listed below.

California Building Code (CBC)

The California Building Code (Title 24 of the California Code of Regulations) provides the regulatory framework for building code enforcement within the City of Corona. The various requirements contained within the CBC are based on the International Building Code and are intended to provide minimum standards to protect public property and welfare by regulating the design and construction of excavations, structural foundations and building framing systems to mitigate the effects of strong ground shaking and adverse soil conditions. By order of the California legislature, the CBC is published by the California Building Standards Commission every three years. The regulations contained in each revision take effect 180 days after the publication date. The current 2019 revision of the CBC was adopted by the City of Corona to go into effect in January 2020.

California Alquist-Priolo Earthquake Fault Zoning Act

In December 1972, the State legislature enacted the Alquist-Priolo Earthquake Fault Zoning Act which directed the State Geologist to begin compiling maps of known surface traces of active faults within the urbanized areas of California. The intent of this law was to improve earthquake safety by prohibiting the construction of buildings intended for human occupancy across the traces of known active earthquake faults. The term "Earthquake Fault Zones" refers to areas established by the California Geologic Survey (CGS) wherein comprehensive geologic investigations are required in order to demonstrate that locations designated for new construction are not traversed by active fault traces. The Alquist-Priolo Earthquake Fault Zoning Act also requires property owners or their representatives to disclose whether or not their property is situated within an established Earthquake Fault Zone prior to selling the property. Local regulatory agencies (such as city- or county-level building departments) are responsible for local implementation of the Act and must regulate development projects within the zones.

California Seismic Hazards Mapping Act

As a further means to protect public safety and property from seismic hazards, the California legislature adopted the Seismic Hazards Mapping Act in 1990. In contrast to the Alquist-Priolo Act, the Seismic Hazards Mapping Act specifically addresses potential hazards posed by secondary effects of seismic activity including strong ground shaking, soil liquefaction and associated ground failure, and seismically-induced landslides. Maps showing zones of required investigation for one or more of these hazards are prepared and published by the California Geologic Survey and, like the Alquist-Priolo maps, are available to the public via an online resource. Inclusion within a designated seismic hazard zone does not necessarily indicate that such hazards have been confirmed within the zone, but only that the prevalent soil and groundwater conditions within the zone render the area susceptible to the hazard. The local jurisdiction (i.e., the city or county permitting agency) is responsible for ensuring that the required site-specific geotechnical investigations have been performed for construction projects proposed within these seismic hazard zones.

City of Corona General Plan and Municipal Code

The Safety Element of the City of Corona General Plan provides a means by which known natural and manmade hazards can be related to city planning and land use issues (City of Corona, 2004). The most recent update was from 2008. The goal of the Safety Element (Goal 11.3) requires that natural hazards be mitigated in accordance with the Local Hazard Mitigation Plan. Natural hazards considered include flooding, seismicity and associated secondary seismic effects, and inherent geologic conditions such as landslide susceptibility. Policies 11.3.8 and 11.3.9 require that the natural hazards be mitigated by participation in the Riverside County Operational Area Multi-Jurisdictional Local Hazard Mitigation Plan. The ultimate purpose of the Safety Element is to serve as an official guide to the City Council and the local planning and permitting agencies, and to drive the adoption of official codes and implementation measures to reduce the potential impact of such hazards.

The official codes that govern construction projects within the City of Corona are contained within Chapter 15.04 through 15.70 of the City's Municipal Code. The following State of California building codes have been adopted by reference (and amended by Section 15.04.040 to 15.04.157 of that chapter) as the Building Codes of the City of Corona:

a. California Building Code, 2019 edition, Part 2, Volumes I and II (based on the 2018 International Building Code).

b. California Residential Code, 2019 edition (based on the 2018 International Residential Code). {City of Corona Municipal Code Chapter 15.07}

c. California Green Building Standards Code (2019 edition) {City of Corona Municipal Code Chapter 15.05}

d. California Mechanical, Plumbing and Electrical Codes, 2019 edition (based on the 2018 Uniform Mechanical, Plumbing and Electrical Codes). {City of Corona Municipal Code Chapters 15.08, 15.20, 15.28}

e. Uniform Housing Code, 1997 edition. {City of Corona Municipal Code Chapter 15.06}

PROPOSED CONSTRUCTION AND GRADING

Based on a review of the conceptual site plan provided by Bastien and Associates, Inc. (2019) and the grading plan prepared by KWC Engineers (6/12/20) only the northern 33.2 acres of the property are proposed to be developed into five large building pads at this time. Associated improvements include an access street, parking lots, planters, and above- and below-ground utilities. Design cuts and fills of up to approximately 87 and 49 feet, respectively are anticipated to achieve design grades. Fill slopes ranging up to approximately 50 feet in height are proposed along the northern property line while cut and fill slopes up to about 180 and 50 feet are proposed south of the proposed building pads, respectively. Approximate proposed building pad elevations are at 563 feet.

INVESTIGATION PROGRAM

Petra's scope of geotechnical services on this project site has included performing a Due Diligence-level study with a limited subsurface investigation. The geotechnical testing was performed in an effort to provide a preliminary characterization of subsurface soil and groundwater conditions within the project site. Details pertaining to our field methodology are presented in the following sections.

Subsurface Exploration

A subsurface exploration program was performed within the proposed area of site development by representatives of Petra on July 23rd and August 6th through the 9th, 2019. In addition, based on a conversation with the project civil engineer, three percolation tests were performed at the desired locations and depths, on August 6th. Our field investigation included the excavation of 9 exploratory test pits (TP-1 through TP-9), 3 exploratory bucket auger borings (B-1 through B-3) and 3 hollow-stem borings (P-1 through P-3) advanced primarily for percolation testing. The test pits were excavated to depths ranging between 10½ and 15½ feet below existing grades utilizing a rubber-tired backhoe with geotechnical sampling equipment operated by Mike’s Geotechnical Backhoe Service out of Chino, California. The bucket auger borings were advanced by means of a truck mounted EZ Bore drill rig with a 30-inch diameter auger operated by Dave’s Drilling out of Ramona, California to depths between 57 and 87 feet where refusal was encountered due to hard bedrock and/or boulders. All of the bucket auger borings were down-hole logged by a geologist. The hollow-stem borings (P-1 through P-3) were drilled to depths between 8 and 20 feet by means of a truck mounted, CME-75 hollow-stem drill rig with 8-inch diameter augers operated by 2R Drilling of Chino, California. Following our exploration, the borings and test pits were backfilled with the soil cuttings. The boring and test pit locations are shown on Plate 1 and the exploration logs are included as Appendix A.

Sample Collection

Earth materials encountered in the exploratory borings and test pits were field classified and logged in accordance with the visual-manual procedures of the Unified Soil Classification System. Associated with the subsurface exploration was the collection of bulk samples and relatively undisturbed samples of the subsurface soil materials for laboratory testing. Bulk samples consisted of selected earth materials obtained at various depth intervals from selected borings. Relatively undisturbed samples were collected using a 3-inch, outside-diameter, modified California split-spoon soil sampler lined with 1-inch high brass rings as well as a 2-inch, outside diameter, standard penetration test (SPT) sampler lined with 6-inch high brass rings. Drive samples collected from the hollow-stem borings were driven with successive 30-inch drops of a hydraulically operated 140-pound automatic trip hammer and with successive 12-inch drops of the drill rig Kelly bar in the bucket auger borings. The weight of the Kelly bar for different depth intervals are noted in the exploration logs. Blow counts for each 6-inch driving increments were recorded on the exploration logs. The central portions of the driven core samples were placed in sealed containers and transported to our laboratory for testing.

Laboratory Testing

The laboratory program consisted of testing select undisturbed and/or bulk samples of onsite native soil and bedrock materials for in-situ dry density and moisture content, expansion index, consolidation potential, Atterberg limits, direct shear, and general corrosion potential (sulfate, chloride, pH, resistivity). A description of laboratory test methods is provided in the Laboratory Test Procedures section of this report (Appendix B). Summaries of the test data are presented on the exploration logs (Appendix A) and in Appendix B, and are discussed as applicable below.

Percolation Testing

Three percolation tests (P-1 through P-3) were completed at the approximate locations and depths requested by the project civil engineer. The percolation tests were performed in general conformance with the referenced Technical Guidance Document, prepared by the Riverside County Flood Control and Water Conservation District (RCFCWCD, 2014). The percolation rates acquired were converted to infiltration rates by means of the Porchet Method. Due to the very slow percolation rate observed in boring P-1 a modified test method was utilized where the change in water head was measured overnight. The infiltration rates calculated from the percolation tests are summarized in Table 2, below:

TABLE 2

Summary of Percolation Test Results*

Test Location	Approximate Surface Elevation (ft., MSL)	Total Depth (ft.)	Approximate Bottom Elevation (ft., MSL)	Infiltration Rate (in./hr.)
P-1	545	8	537	0.003
P-2	533	10	523	0.39
P-3	516	20	496	5.13

*** Note –See Figures PC-1 through PC-3 for details**

The approximate locations of these test boreholes are depicted on the attached Plate 1. Please note that these are raw results and do not include factors of safety. Grain size analysis was performed on Standard Penetration Test (SPT) drive samples of onsite soils collected near the bottom of each boring in accordance with the current version of Test Method ASTM D 422. The test results are graphically presented in Appendix B of this report. Detailed percolation test results are provided on Figures PC-1 through PC-3 at the end of this report. These results are subject to review by the controlling authorities for the subject project.

FINDINGS

Regional Geologic Setting

Regionally, the subject site is located within the northeastern foothills of the Santa Ana Mountains within the Peninsular Ranges Geomorphic Province, essentially at the boundary between the Santa Ana Mountain Block and the Corona-Chino Valley Block. The Elsinore, Chino and Whittier fault zones form the boundary of the block which extends northwestward from Corona and towards the City of Chino Hills. The Elsinore fault is a complex zone of faulting including reverse and strike-slip movement, which has uplifted the Santa Ana Mountains along its trace. It has been mapped as distinct segments along the northern front of the Santa Ana Mountains where it splinters and extends northwestward to the southeast side of the Santa Ana Canyon where it is believed to connect with the Whittier fault.

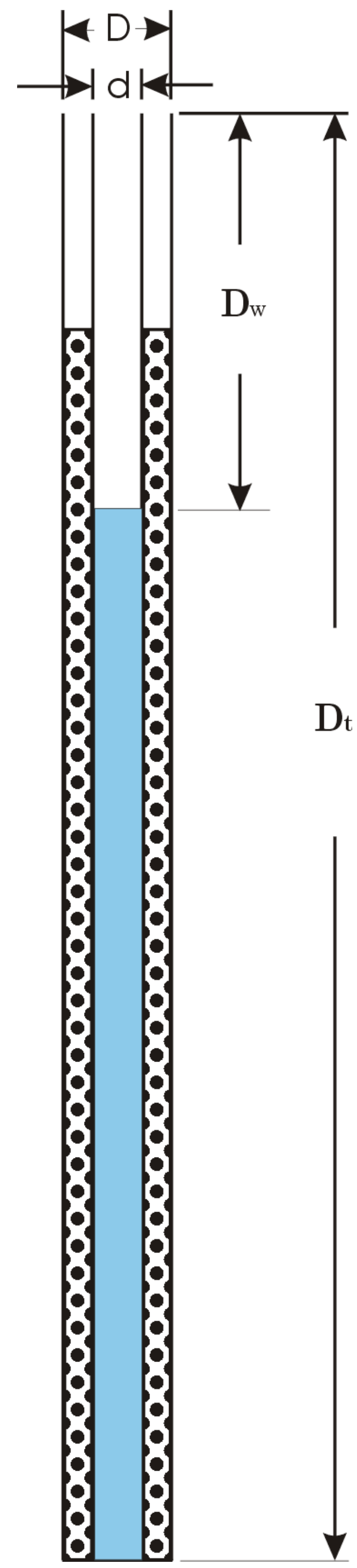
The main structural feature within the area of the site, is the Whittier-Elsinore fault zone. The northern branch of this fault transverses the Santa Ana Mountains with the main branch located approximately 2,200 feet south of the southern property boundary. The Whittier-Elsinore fault is a steeply dipping east-west trending fault. Bedrock north of the fault has been uplifted relative to bedrock to the south of the fault. The fault is not zoned as an Alquist-Priolo Earthquake Fault Zone within the area of the subject site. It is located within an Alquist-Priolo Earthquake Fault Zone to the northwest and southeast. Bedrock materials of the

Test Number: P-1

Deep Percolation Test Method

Total Depth of Boring, D_t (ft): 8
Diameter of Hole, D (in): 8
Diameter of Pipe, d (in): 3
Agg. Correction (% Voids): 42
Pre-soak depth (ft): 3.4

Time Interval (min)	Depth to Water Surface D_w (ft)		Change in Head (in)	Perc. Rate (min/in)	Perc. Rate (gal/day/ft^2)
	1st Reading	2nd Reading			
115	3.49	3.52	0.36	319.44	0.05
910	3.52	3.63	1.32	689.39	0.02



Percolation Rate: 689 Minutes/Inch
0.02 gal/day/ft^2

Infiltration Rate: 0.003 Inches/Hour*
(Porchet Method)

where Infiltration Rate, $I_t = \Delta H\,(60r) / \Delta t\,(r + 2H_{avg})$

$r = D / 2$
$H_o = D_t - D_o$
$H_f = D_t - D_f$
$\Delta H = \Delta D = H_o - H_f$
$H_{avg} = (H_o + H_f) / 2$

*Raw Number, Does Not Include a Factor of Safety

Reference: RCFCWCD, Design Handbook for LIDBMP, dated September, 2014

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PERCOLATION TEST SUMMARY

Green River Ranch Project
Green River Road, Corona, California

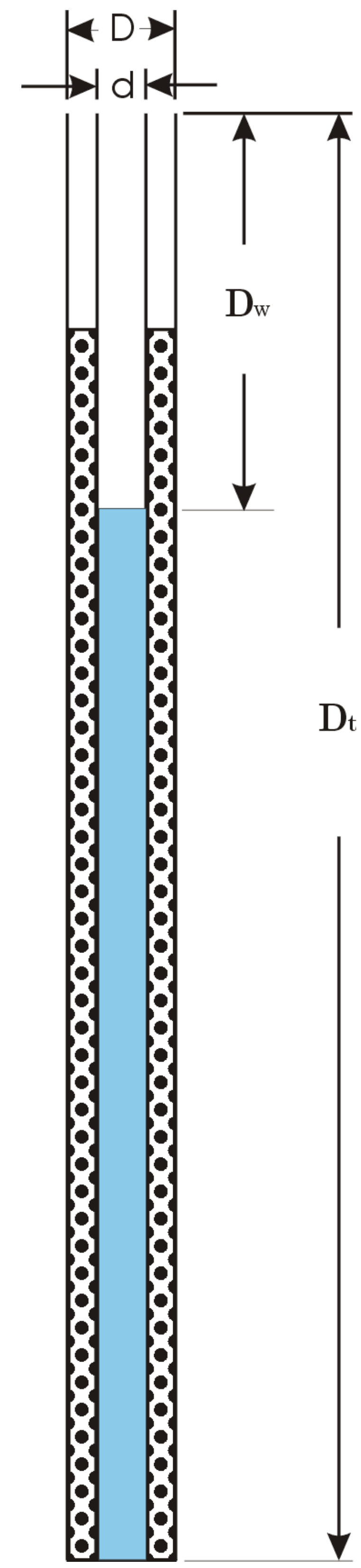
PETRA GEOSCIENCES INC.
DATE: Dec., 2019
J.N.: 19-286

Figure PC-1

Test Number: P-2

Deep Percolation Test Method

Total Depth of Boring, D_t (ft): 10
Diameter of Hole, D (in): 8
Diameter of Pipe, d (in): 3
Agg. Correction (% Voids): 42
Pre-soak depth (ft): 4.5



Time Interval (min)	Depth to Water Surface D_w (ft)		Change in Head (in)	Perc. Rate (min/in)	Perc. Rate (gal/day/ft^2)
	1st Reading	2nd Reading			
10	4.60	4.76	1.92	5.21	2.63
10	4.60	4.79	2.28	4.39	3.13
10	4.60	4.79	2.28	4.39	3.13
10	4.60	4.78	2.16	4.63	2.96
10	4.60	4.79	2.28	4.39	3.13
10	4.60	4.78	2.16	4.63	2.96

Percolation Rate: 4.63 Minutes/Inch
2.96 gal/day/ft^2

Infiltration Rate: 0.39 Inches/Hour*
(Porchet Method)

where Infiltration Rate, $I_t = \Delta H\,(60r) / \Delta t\,(r + 2H_{avg})$

$r = D / 2$
$H_o = D_t - D_o$
$H_f = D_t - D_f$
$\Delta H = \Delta D = H_o - H_f$
$H_{avg} = (H_o + H_f) / 2$

*Raw Number, Does Not Include a Factor of Safety

Reference: RCFCWCD, Design Handbook for LIDBMP, dated September, 2014

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PERCOLATION TEST SUMMARY

Green River Ranch Project
Green River Road, Corona, California

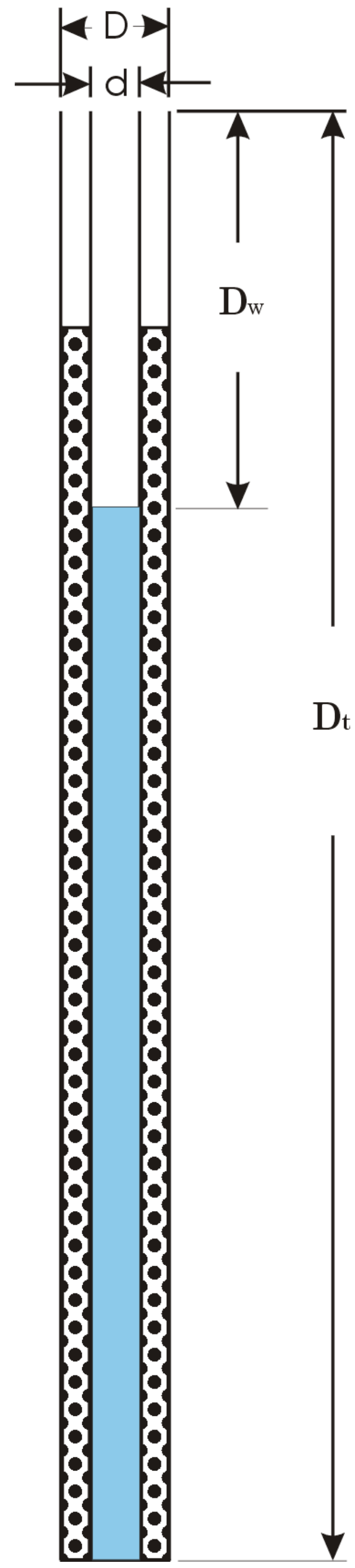
PETRA GEOSCIENCES INC.
DATE: Dec., 2019
J.N.: 19-286
Figure PC-2

Test Number: P-3

Deep Percolation Test Method

Total Depth of Boring, D_t (ft): 20
Diameter of Hole, D (in): 8
Diameter of Pipe, d (in): 3
Agg. Correction (% Voids): 42
Pre-soak depth (ft): 10

Time Interval (min)	Depth to Water Surface D_w (ft)		Change in Head (in)	Perc. Rate (min/in)	Perc. Rate (gal/day/ft^2)
	1st Reading	2nd Reading			
10	12.50	15.64	37.68	0.27	46.39
10	12.50	15.53	36.36	0.28	44.36
10	12.50	15.43	35.16	0.28	42.55
10	12.50	15.32	33.84	0.30	40.60
10	12.50	15.28	33.36	0.30	39.89
10	12.50	15.20	32.40	0.31	38.50



Percolation Rate: 0.31 Minutes/Inch

38.50 gal/day/ft^2

Infiltration Rate: 5.13 Inches/Hour*
(Porchet Method)

where Infiltration Rate, $I_t = \Delta H\,(60r) / \Delta t\,(r + 2H_{avg})$

$r = D / 2$
$H_o = D_t - D_o$
$H_f = D_t - D_f$
$\Delta H = \Delta D = H_o - H_f$
$H_{avg} = (H_o + H_f) / 2$

*Raw Number, Does Not Include a Factor of Safety

Reference: RCFCWCD, Design Handbook for LIDBMP, dated September, 2014

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PERCOLATION TEST SUMMARY

Green River Ranch Project
Green River Road, Corona, California

PETRA GEOSCIENCES INC.

DATE: Dec., 2019
J.N.: 19-286

Figure PC-3

Santa Ana Mountains can be divided into two basic groups. The older group consists of middle Jurassic meta-sedimentary rocks and Upper Jurassic meta-volcanic rocks which form much of the mass of the Santa Ana Mountains and underlie all of the younger rocks at the boundary of the Riverside/Orange County area. The younger group, comprised of Upper Cretaceous and Tertiary bedrock units, form a blanket over the older group. Deformation resulting from broad, gentle folding, faulting and regional uplift in the last four million years has exposed these younger bedrock materials at the surface where they have been subsequently modified by erosion, landslides and development. Within the vicinity of the site, steeply-dipping sedimentary bedrock consisting of Cretaceous through Eocene age units of the Ladd, Silverado, Vaqueros Sespe and Santiago Formations, are juxtaposed against each other by a number of fault segments. According to regional geologic maps (Schoellhamer, 1981), the bedrock materials within the vicinity of the site generally dip towards the north to northeast at angles of approximately 55 to 75 degrees. However locally, bedding is vertical to overturned to the south due to existing folding and faulting. Quaternary deposits within the area consist of older alluvium deposited from ancestral stream channels related to the Santa Ana River and younger alluvium deposited by the Santa Ana River and tributary canyons from the Santa Ana Mountains.

The site lies along the base of rugged mountainous terrain located just to the south of the east-west-trending Santa Ana River, which is the major drainage course of the area. Generally, the site consists of a series of northerly trending ridgelines and associated canyon drainages that empty onto a relatively gradual slope. The drainages are filled with colluvium and alluvium while the ridges are composed of older alluvium and sedimentary bedrock materials. Canyons in the site vicinity form a drainage network which descends from the ridgelines northward toward the Santa Ana River valley.

Local Geology

Based on our subsurface investigation, as well as a review of the geotechnical investigation provided by Neblett & Associates (N&A, 1999), the northern-most, relatively flat portion of the property proposed for development is underlain by a relatively thick section of alluvial soil (map symbol Qal), which is underlain by bedrock associated with the undifferentiated Vaqueros-Sespe Formations (map symbol Tvs) and/or the Santiago Formation (map symbol Tsa). Regional mapping indicates that a buried contact between these two formations may exist onsite (Morton, 2004, Schoelhamer et. al., 1981, Durham and Yerkes, 1964). N&A advanced 6 rotary wash borings within this portion of the site to depths ranging between 26 and 77 feet. Bedrock was only encountered in two of the borings, RW-1 and RW-2 at depths of 62 and 76 feet, respectively. The natural canyon areas that extend from this relatively flat area toward the south are likewise underlain by alluvial materials (Qal) and in turn by bedrock of the Vaqueros-Sespe and/or Santiago

Formations. It should be noted that the largest canyon, located near the center of the property, has been filled with a relatively significant amount of undocumented fill (afu).

The hills and ridges located within the southern portion of the proposed development area are underlain primarily by very old alluvial fan deposits (map symbol Qoal), which caps bedrock materials belonging to the undifferentiated Vaqueros-Sespe and or Santiago Formations. Bedrock was not encountered in boring B-1 to the total depth explored (87 feet) but was observed at depths of 40 and 51 feet in borings B-2 and B-3, respectively. A relatively thin (8-foot thick) landslide was observed between the fan deposits and bedrock in boring B-3. It should be noted that even though bedrock was not encountered in Boring B-1, there was evidence that the contact between the old alluvial fan deposits and bedrock was in close proximity to the bottom of this boring (see Plate 2). The very old alluvial fan deposits were not fully penetrated by any of the test pits advanced by N&A (1999). Preliminary geologic information based on these sources is provided on Plates 1 and 2.

Local Groundwater Conditions

Groundwater was not encountered within our borings to a maximum depth of approximately 87 feet below grade nor in the borings advanced by N&A to a maximum depth of 77 feet in 1998. Based on recent well data on the California Department of Water Resources website the closest wells to the site, located about a mile and a half to the west, indicate that groundwater is generally below an elevation of 400 feet, which is at least about 100 feet below the existing ground surface at the site. Regional groundwater is not anticipated to impact the proposed development; however, seepage or perched groundwater could occur within deeper cuts in the bedrock hillsides.

Regional Surface Fault Systems

The geologic structure of Southern California is dominated by northwest-trending faults associated with the San Andreas system. Faults such as the Newport-Inglewood, the Whittier-Elsinore, the San Jacinto, and various segments of the San Andreas Fault itself are all major faults associated with this system. They are all known to be seismically active, and most are known to have ruptured the ground surface in historic time. Also, within the southern California region are a number of west-trending, low-angle reverse (thrust) faults that are similarly active. The majority of these faults occur as north-dipping planes which trend along the south-facing flanks of the Transverse Ranges. Among the known active thrust faults in the region include the Cucamonga, Sierra Madre, Santa Monica, and Hollywood faults.

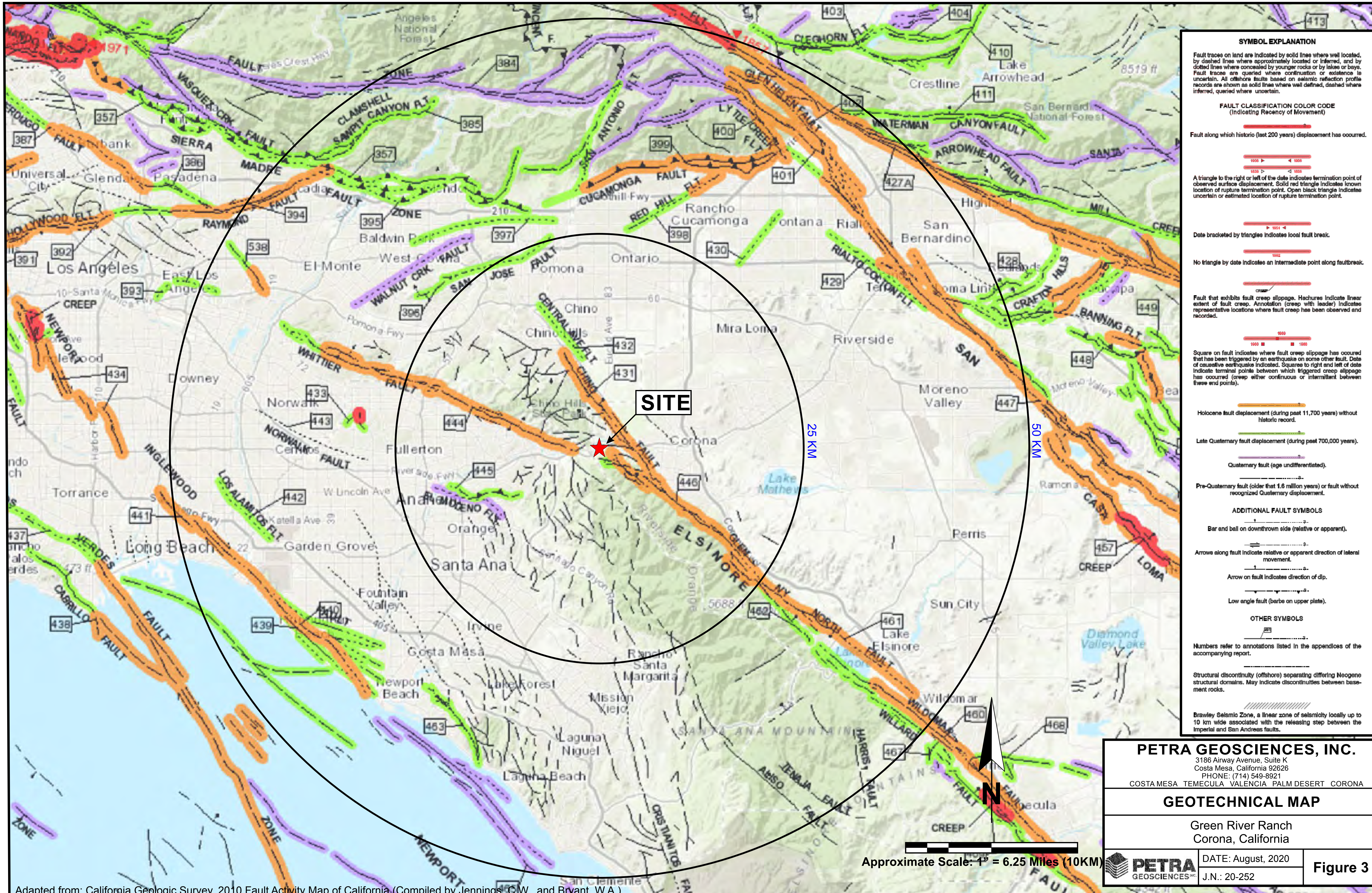
Concealed Faults

Another category of fault known as the "blind thrust" became recognized as a significant seismic hazard as a result of the 1987 moment magnitude (Mw) 6.0 Whittier Narrows earthquake. Blind thrusts are concealed beneath the earth's surface and are defined as dip-slip faults that tend to fold and/or uplift the near surface sediments during moderate to large magnitude earthquakes (Shaw and Suppe, 1996). In 1994, the Mw 6.7 Northridge earthquake occurred along what researchers have interpreted as a south-dipping thrust ramp beneath the San Fernando Valley. Together, these events caused more than $25 billion in property damage and clearly demonstrate the risks that blind thrusts pose to the greater Los Angeles metropolitan area.

Recent structural models of the Los Angeles basin suggest that deep-seated, blind thrust sheets underlie portions of Orange and Los Angeles Counties. These structures are apparently accommodating north-south compression with slip rates of several millimeters per year (Hauksson, 1992; Petersen and Wesnouski, 1994). The Puente Hills and Upper Elysian Park blind thrust systems represent two such blind thrusts that are reported to be in the general area (less than 50 km) of the site (Dolan et al, 2003, Shaw et al, 2002, and Oskin et al 2000). A similar system underlies the San Joaquin Hills (Grant et al., 1999). Structural models and seismicity values for these three blind thrust systems and the Northridge blind thrust have been incorporated into the California Geological Survey seismic model, which was updated in April 2003 (Cao, et al., 2003).

Nearby Seismic Sources

Published geologic maps and literature indicate that the site lies within 50 kilometers of a number of significant active and potentially active faults that, in addition to the various segments of the more distant San Andreas fault zone, are considered capable of generating strong ground motion at the subject site. The locations of these faults are graphically depicted on Figure 3. Additionally, faults within close proximity of the site (less than 10 km) are shown in more detail on Figure 4.



Adapted from: California Geologic Survey, 2010 Fault Activity Map of California (Compiled by Jennings, C.W., and Bryant, W.A.)

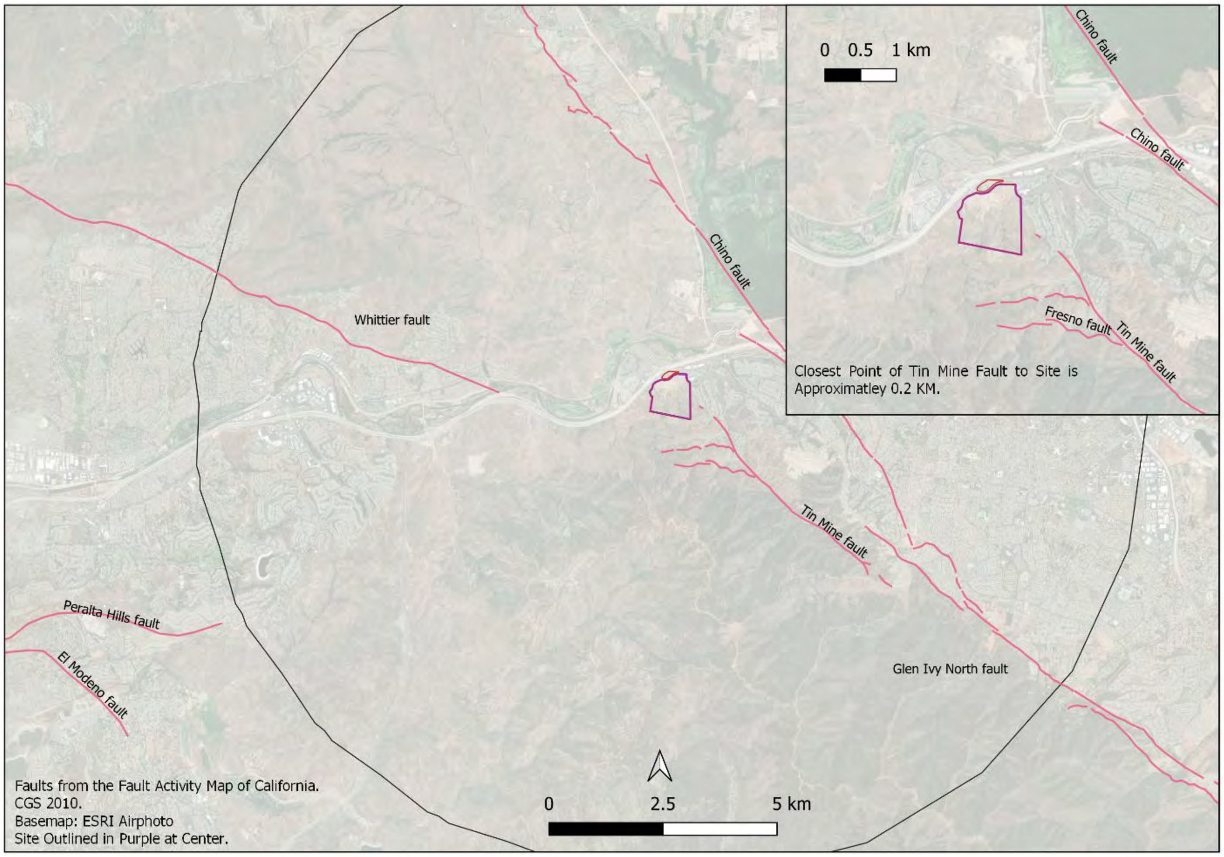


Figure 4 – Faults within 10 KM of Site

Based on a review of published geotechnical maps and literature pertaining to regional faulting, the closest known fault considered capable of causing strong ground motion at the subject site is the Tin Mine fault splay of the Glen Ivy North fault segment of the Elsinore Fault Zone approximately 0.2 kilometers to the east.

The USGS simplifies the locations and segment of the know seismic sources in order to make models for determining the likely ground motions and the associated hazards. The location of the site in relation to the simplified USGS fault models (USGS 2014) is shown on Figure 5. The names and locations of these faults relative to the subject property are provided in Table 3.

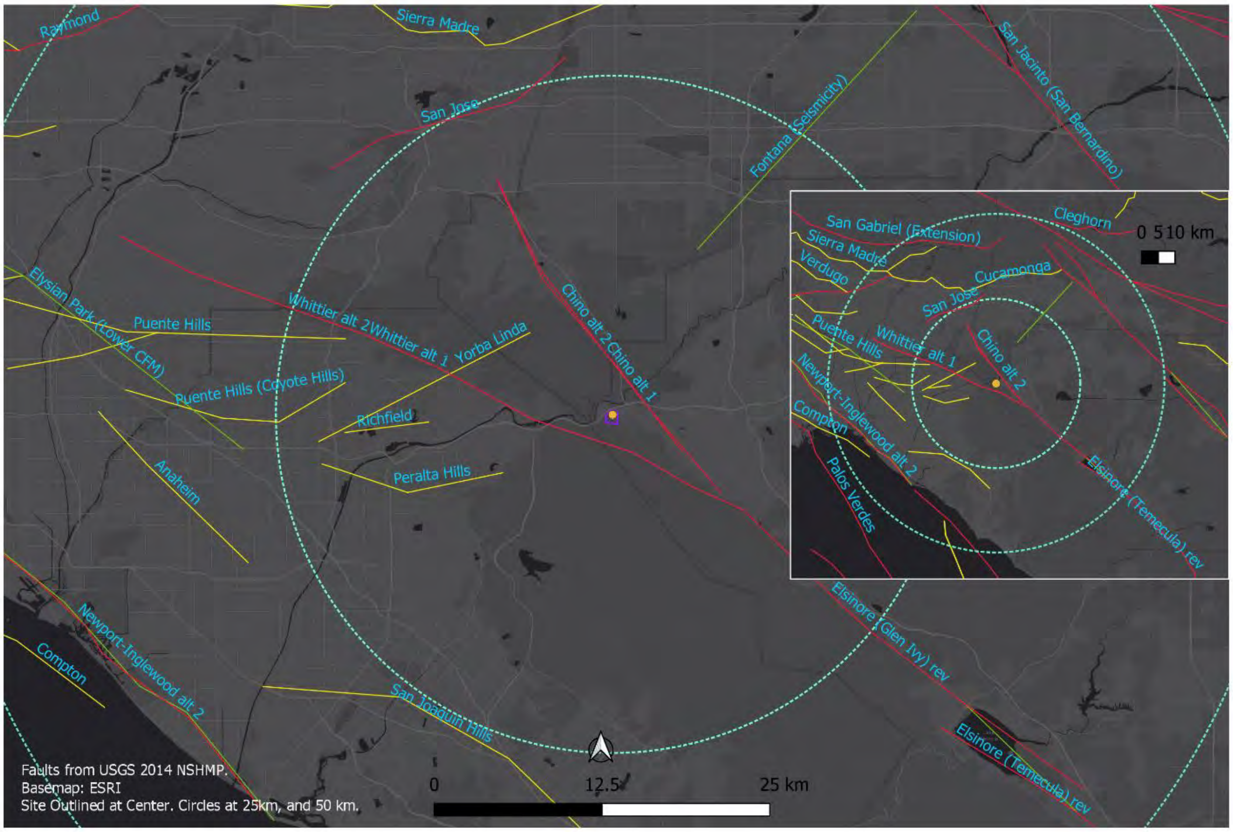


Figure 5 – USGS Fault Model Segments within 50 km. Strike Slip Faults Shown in Red. Thrust Faults Shown in Yellow. Undifferentiated Shown in Light Green.

TABLE 3

Significant Nearby Seismic Sources

Fault	Slip Type	Distance	UCERF3 Slip Rate Bounds (mm/yr)	UCERF3 Best Estimate Rate (mm/yr)
Whittier	Strike Slip	2.2	1 - 5	2.50
Chino	Strike Slip	2.3	0.2 - 2.0	1.00
Elsinore (Glen Ivy)	Strike Slip	8.4	3 - 7	5.00
Yorba Linda	Thrust	8.6	< 0.2	0.01
Peralta Hills	Thrust	9.1	0.2 - 1.0	0.39
Fontana (Seismicity)	Undifferentiated	13.7	0.2 - 1.0	0.39
Richfield	Thrust	13.7	< 0.2	0.01
Puente Hills (Coyote Hills)	Thrust	20.6	0.2 - 1.5	0.90
Puente Hills	Thrust	20.8	0.2 - 1.5	0.90
San Jose	Strike Slip	24.2	0.2 - 1.0	0.39
San Joaquin Hills	Thrust	25.9	0.2 - 1.0	0.60

Fault	Slip Type	Distance	UCERF3 Slip Rate Bounds (mm/yr)	UCERF3 Best Estimate Rate (mm/yr)
Elysian Park (Lower CFM)	Undifferentiated	27.5	< 0.2	0.01
Sierra Madre - Cucamonga	Thrust	28.5	1 - 3	2.00
Anaheim	Thrust	29.2	< 0.2	0.15
Elsinore (Temecula)	Strike Slip	33.6	3 - 7	5.00
Puente Hills (Santa Fe Springs)	Thrust	34.3	0.2 - 1.5	0.90
Newport-Inglewood	Strike Slip	38.4	0.5 - 3.0	1.00
San Jacinto (Lytle Creek)	Strike Slip	38.5	1 - 5	2.50
San Jacinto (San Bernardino)	Strike Slip	39.3	2 - 10	6.00
San Gabriel (Extension)	Strike Slip	39.9	0.2 - 1.0	0.39
Compton	Thrust	43.5	0.3 - 1.4	0.90
Oceanside	Thrust	43.5	0.2 - 1.1	1.00
Clamshell-Sawpit	Thrust	43.8	0.2 - 1.0	0.39
Raymond	Strike Slip	44.5	1 - 5	2.00
Puente Hills (LA)	Thrust	44.9	0.2 - 1.5	0.90
Elysian Park (Upper)	Thrust	46.5	0.8 - 2.2	1.90
San Andreas	Strike Slip	46.5	20 - 30	19.00

*Rates based on the UCERF3 Model – USGS Open File Report 2013-1165

Historical Seismicity

As is the case with most locations in Southern California, the subject site is located in a region that is characterized by moderate to high seismic activity. The site is located in relatively close proximity to the Whittier, Glen Ivy, and Chino sections of the Elsinore Fault Zone. The project site and vicinity have experienced strong ground shaking due to earthquakes on a number of occasions in historic time. The locations of larger earthquakes that have occurred in historical times within Southern California with respect to the subject site are shown graphically on Figure 6. This map shows earthquakes greater than magnitude 5 from the time period of 1800 to 1999.

Some of the more significant historic seismic events are listed in Table 4, along with the corresponding approximate epicentral distances to the subject site, the calculated moment magnitude, and the approximate peak horizontal site accelerations based on various published earthquake databases.

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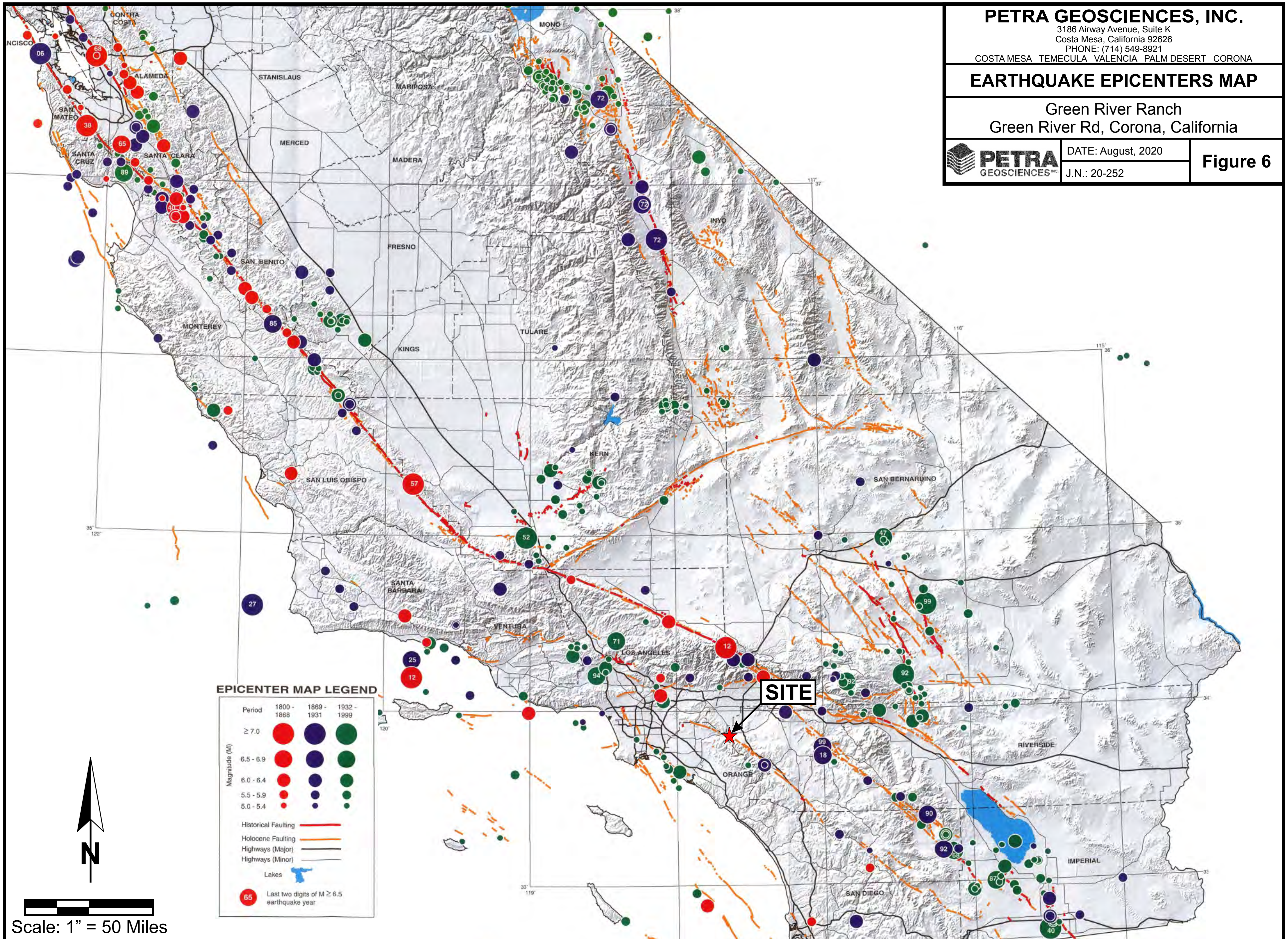
COSTA MESA TEMECULA VALENCIA PALM DESERT CORONA

EARTHQUAKE EPICENTERS MAP

Green River Ranch
Green River Rd, Corona, California

PETRA GEOSCIENCES INC.	DATE: August, 2020	Figure 6
	J.N.: 20-252	



Adapted from: California Geologic Survey, 2000 Epicenters of Areas Damaged by M>= Earthquakes, 1800-1999, CGS Map Sheet 49

TABLE 4

Significant Historic Earthquakes

Time	Latitude	Longitude	Depth	Mag	Mag Type	Place	Aprx. PGA (%g)
5+ Magnitude Events within 25 km of Site							
2014-03-29	33.9325	-117.916	5.09	5.1	mw	2km NW of Brea, CA	0.05
2008-07-29	33.9485	-117.766	15.503	5.44	mw	5km S of Chino Hills, CA	0.11
1938-05-31	33.69933	-117.511	10.19	5.23	ml	8km ENE of Trabuco Canyon, CA	-
6+ Magnitude Events within 50 km of Site							
1933-03-11	33.63083	-118	6	6.4	mw	Long Beach, California Earthquake	0.08
1899-07-22	34.3	-117.5		6.36	mw	Southern California	-
1858-12-16	34.2	-117.4		6	ml	Near San Bernardino, California	-
1855-07-11	34.1	-118.1		6	ml	Greater Los Angeles area, California	-
7+ Magnitude Events within 200 km of Site							
1999-10-16	34.60333	-116.265	13.73	7.1	mw	Hector Mine, CA Earthquake	0.03
1992-06-28	34.2	-116.437	-0.097	7.3	mw	Landers, California Earthquake	0.08
1952-07-21	34.95817	-118.998	6	7.5	mw	6km WNW of Grapevine, CA	0.03

Notes: 1 Earthquake table derived from USGS catalog search tool: https://earthquake.usgs.gov/earthquakes/search/
2 PGA estimated from USGS shake maps:
https://earthquake.usgs.gov/earthquakes/eventpage/ci3319401/shakemap/pga - Typical

Review of the earthquake catalog available from the USGS indicates that for smaller magnitude events closer to the site that there were approximately 25 earthquakes between magnitude 4 and 5 within a distance of 30 km or less within the last 120 years. For magnitude less than 4 earthquakes, there were approximately 262 events cataloged within the same time frame within 5 km of the site.

Active Fault Zonation

No portion of the area of study is located within the boundaries of an "Earthquake Fault Zone" as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 1997). The site is, located approximately 1.9 kilometers to the southwest of the active Chino Fault (Elsinore Fault Zone). The location of A-P zones is shown on Figure 7 below.

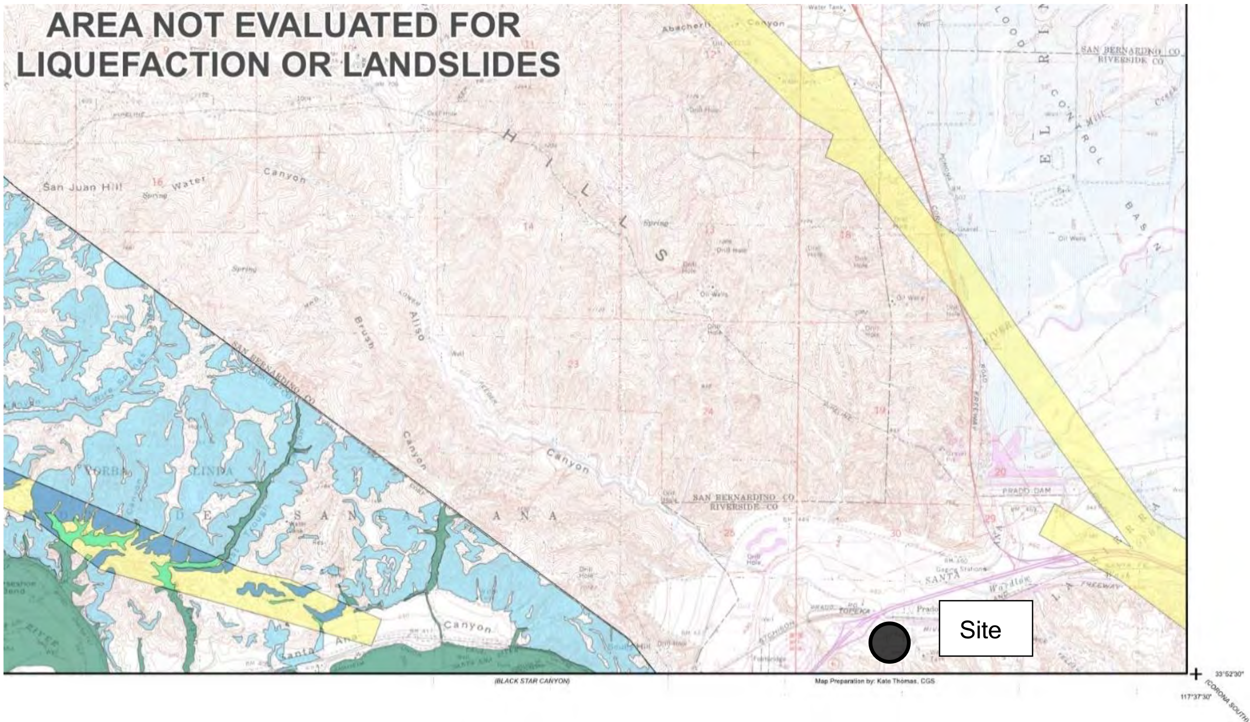


Figure 7 – Earthquake Zones of Required Investigation (California Geological Survey, 2019, 2003, 2001, Earthquake Zones of Required Investigation Map – Prado Dam Quadrangle.)

We also reviewed the CGS Fault Evaluation Report for the Chino fault which shows splays of faulting nearer to the site than those shown within the A-P zones. However, CGS has not chosen to place them in a zone of required investigation. The location of the site in relation to the fault strands evaluated by CGS is shown on Figure 8.

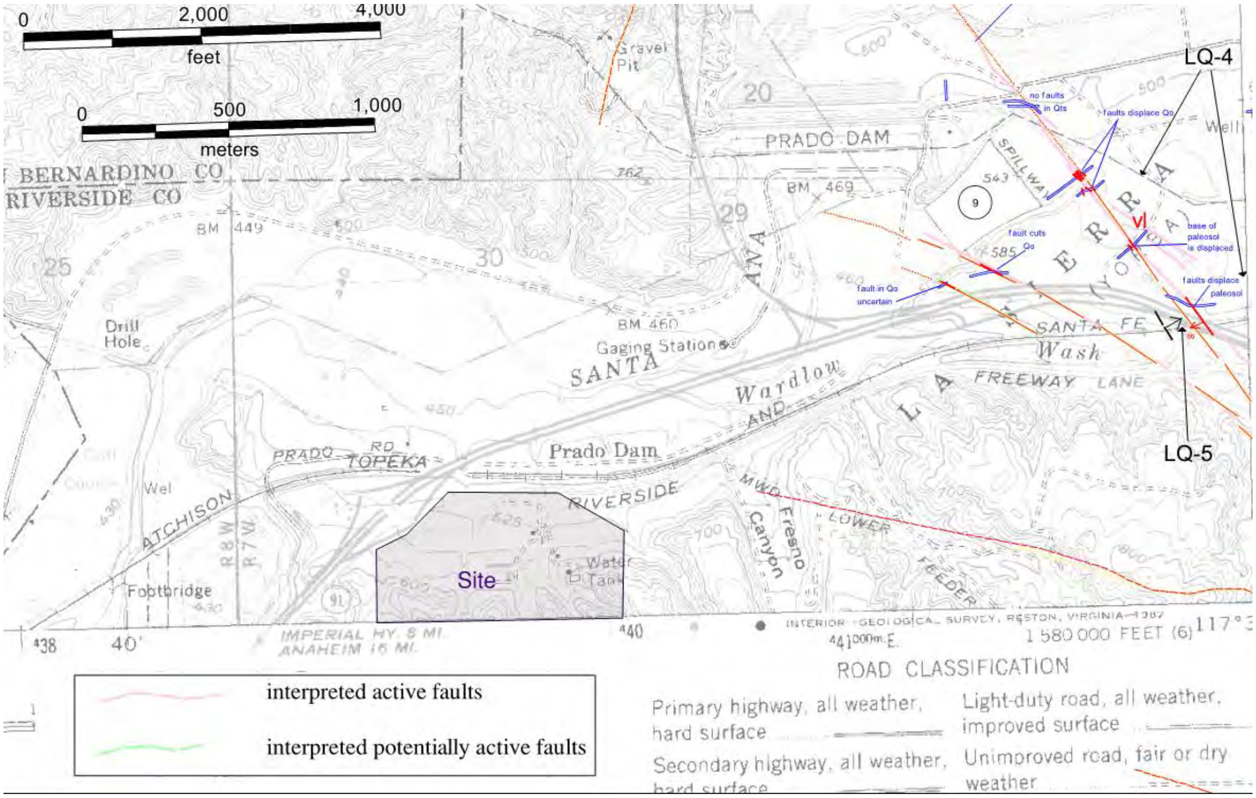


Figure No. 8 – Portion of Plate Ib from Fault Evaluation Report No. 247 (California Geological Survey 2002). The site is located about 1,500 feet west of closest interpreted active fault on this map.

In addition, a number of historical aerial photographs of the site vicinity were reviewed as part of this due diligence investigation. No indications of recent faulting within, or immediately adjacent to the site were observed. A table of the historical aerial photographs reviewed was previously provided in Table 1.

On the basis of our review of the current revision of the Technical Background Report of the City of Corona for the draft General Plan update, no active faults have been identified within the site boundaries. However, the City has shown designated zones wherein additional subsurface investigation may be required to determine the presence and level of activity of suspected active branches of local fault systems based on the Riverside County mapping, (City of Corona Planning Division, 2020). This is shown on Figure 5-1 of the draft Technical Background Report. The site in relation to faults and fault zones of Riverside County is shown on Figure 9.

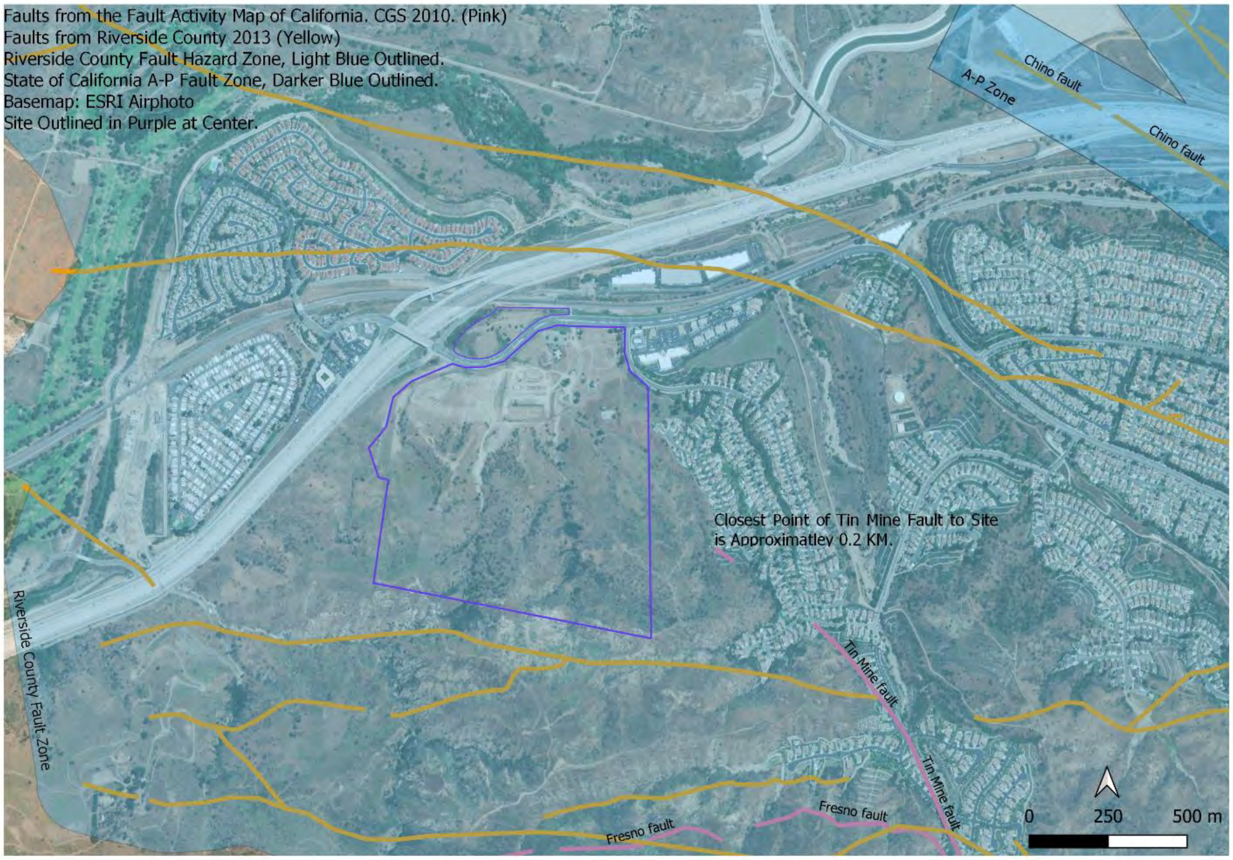


Figure 9 – Riverside County Mapped Faults and Fault Zones

The results of all of the various sources of maps for faults do not indicate any faults onsite. The site is not located within a state designated fault zone; however, it is within a zone designated by the county. Further detailed studies could be required at the design level by the City.

<u>Secondary Seismic Hazard Zonation</u>

The State of California has mapped much of Los Angeles and Orange counties for hazards related to liquefaction and seismic slope stability, in addition to more statewide mapping for earthquake fault zones. The state has produced a map of the Prado Dam Quadrangle (CGS 2001, 2003, 2019) showing such zones of required investigation (see Figure 7). However, because the site lies within Riverside County, the map specifically excludes that portion as not being mapped for liquefaction or seismic slope stability where the site is located. A portion of the map depicting the site and surrounding area in relation to the hazards was shown previously. The County of Riverside has mapped the area to assess the potential for liquefaction. The site is in an area designed as having a low susceptibility, primarily due to the lack of shallow groundwater. The City Technical Background Report Figure 5-2 also shows the liquefaction potential as low. The source of the data within the figure is Riverside County.

Neither the State, nor the County, nor the City, designate the site as susceptible to seismically induced slope instability.

Liquefaction and Dynamic Settlement Potential

Based on our research and field data, liquefaction and dynamic settlement is not considered a hazard to site development due to the lack of shallow groundwater and relatively dense alluvial soil underlying the site. Dynamic settlement of the dry sandy soils near to the surface may be possible during strong shaking. This should be evaluated further during a design level investigation. It may be noted that subsurface conditions will be improved following remedial rough grading. Therefore, dynamic settlement potential remaining after grading will be reduced from that based on current conditions.

Seismically-Induced Flooding

The types of seismically induced flooding which may be considered as potential hazards to a particular site normally include flooding due to a tsunami (seismic sea wave), a seiche, or failure of a major reservoir or other water retention structure upstream of the site. Since the site lies 30.5 miles inland from the Pacific Ocean at a minimum elevation of approximately 500 feet above sea level, and since it does not lie in close proximity to an enclosed body of water, the probability of flooding from a tsunami or seiche is considered to be very low. In addition, the site is not located within a designated tsunami inundation area as identified on published Tsunami Inundation maps (CEMA, 2009).

One major flood control dam lies upstream of the site - Prado Dam (1.3 kilometers to the northeast). In the event that a seismically-induced failure of the Prado Dam facility was to occur when this dam basin was filled to capacity, most, if not all, of the resulting flood waters would be expected to be discharged within the Santa Ana River. The flood inundation maps prepared by the Army Corps of Engineers do not indicate that a failure of the Prado Dam could cause extensive flooding within the site (U.S. Army Corps of Engineers, 1985).

The potential for seismically induced flooding within the boundaries of the City of Corona in the Technical Background Report. The location of the site is shown on Figure 10 below.

Figure 10- Portion of Figure 5-7 from the General Plan Update – Technical Background Report, the site is shown on the left.

__Flooding Not Related to Seismicity__

As part of this investigation, we conducted an independent review of the applicable FEMA flood insurance rate map for the area of the subject site (Panel 06065C0669G) (FEMA, 2008). This map indicates that the project site is located within an area with minimal flood hazard (Zone X). The location of the site on the FEMA map is shown on Figure 11 below.

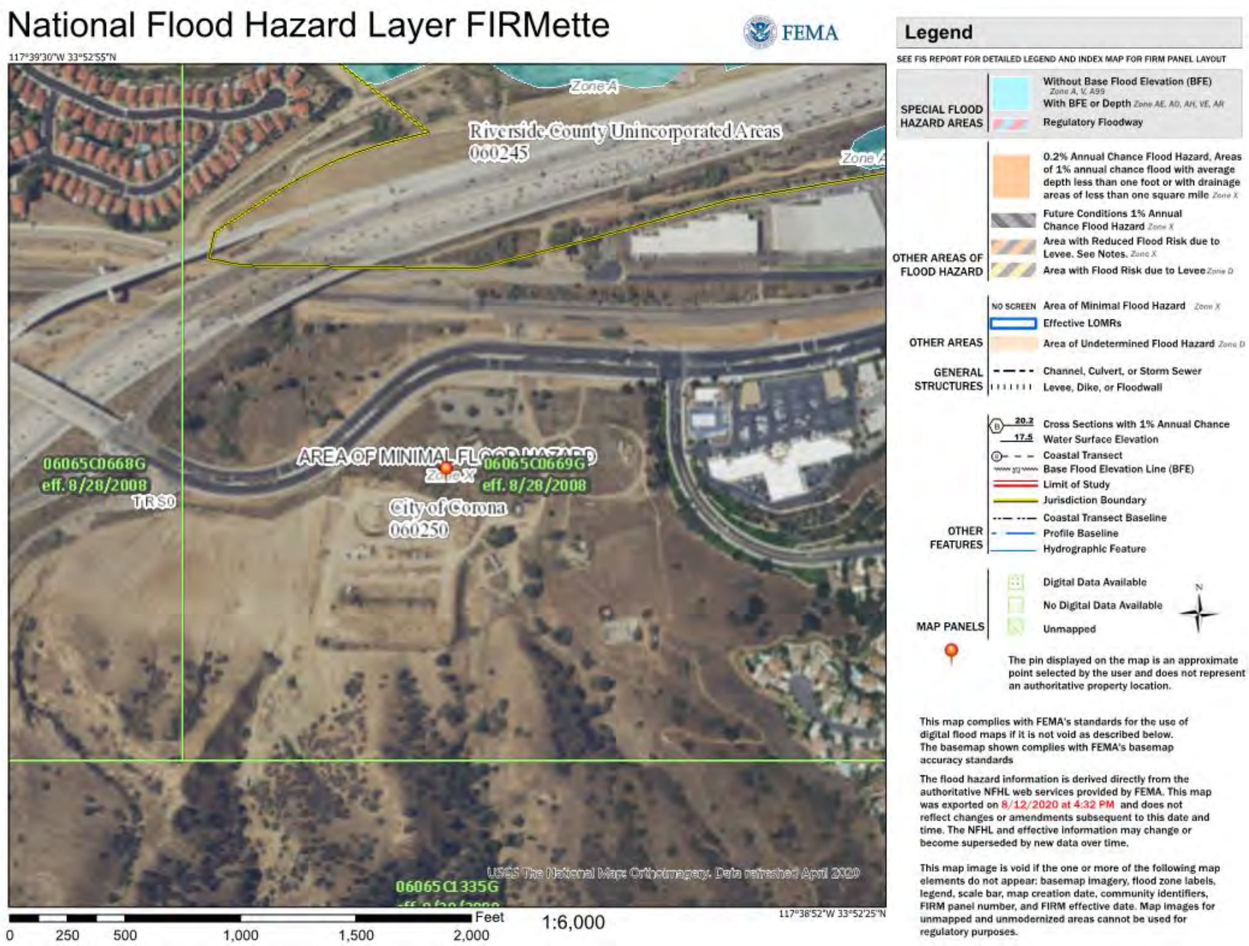


Figure 11 – FEMA Flood Map
(https://msc.fema.gov/portal/firmette?latitude=33.87769999999999&longitude=-17.65310000000001

<u>Expansive Soils</u>

Based on the laboratory testing performed by both Petra and N&A, near-surface soil and bedrock is anticipated to generally have a very low expansion potential (i.e. EI between 0 and 20). However, clayey alluvial materials were observed in Boring P-1 so soil and/or bedrock with higher expansion potentials may exist onsite. Selective grading can keep any soils with higher expansive characteristics within the deeper fill zones where they are less likely to influence surface improvements.

<u>Compressible/Collapsible Soils</u>

Based on our test pits and laboratory testing, and a review of the borings and laboratory testing provided by N&A (Neblett, 1999), the existing soils (i.e., topsoil, low-density/hydro-collapsible alluvial fan soils) within the low-lying/northerly portion of the site are considered unsuitable for support of proposed fills, structures, flatwork, pavement or other improvements and should be removed to underlying competent alluvial fan soils and replaced as properly compacted fill. Based on the limited laboratory collapse potential tests within samples in the upper 10 to 15 feet of the existing ground surface, site soils have collapse potentials between approximately 1 and 3 percent. Limited consolidation testing conducted on samples 15 feet and deeper below the existing ground surface exhibited minimal collapse potential.

Corrosive Soils

Based on the preliminary testing within the upper 5 feet from existing ground surface, site soils have a negligible corrosive potential to concrete materials and have a corrosive potential to buried metallic elements. The site is located in an area mapped by the city as potentially having highly corrosive soils. The location of the site in relation to the city map is shown on Figure 12 below.

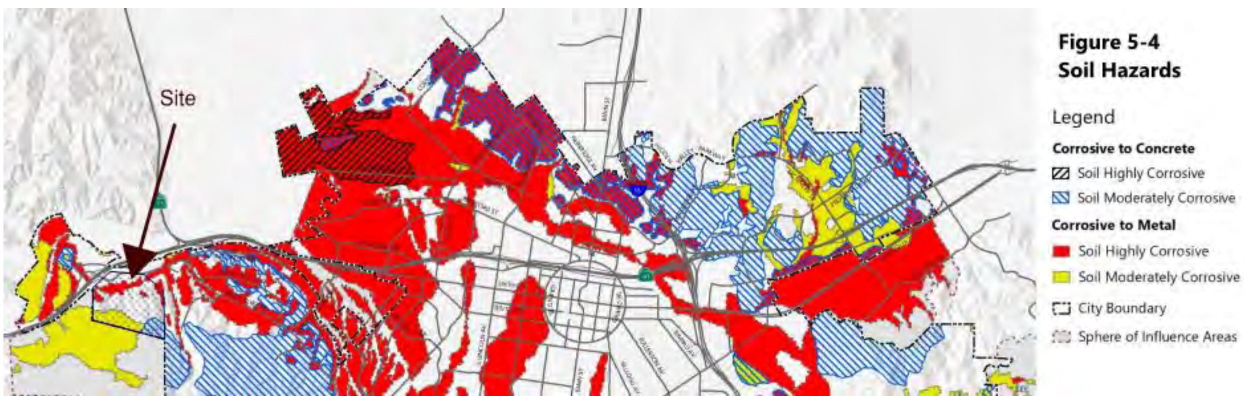


Figure 12 – Corrosive Soils Distribution (Part of Figure 5-4, Technical Background Report, City of Corona 2020).

Further soil tests may be advised after grading is completed and the soils have been redistributed within the site.

Landslide Hazards

The area of the site is mapped by the City of Corona as having slopes with a higher risk of having deep seated landslides present. Our field observations did not reveal the presence of any landslides at the surface within the 5 Parcel site currently planned for development. We did, however, encounter a small buried slide within one our exploratory borings. Therefore, landslides may be present throughout the remaining parcels. Further investigation of landslide presence and slope stability evaluations should be conducted during detailed design phase work.

Rockfall Potential and Oversized Material

A relatively significant quantity of gravel through large cobbles was observed to be resting on the ridgeline areas, and encountered in the exploratory bucket auger borings by Petra and test pits by N&A. While some oversized (about 12 inches in the largest diameter) material may exist onsite, it is not anticipated to constitute a significant hazard due to rockfall. However, if significant quantities of cobbles and boulders are encountered during grading, they may need to either be mechanically reduced in size or buried in deeper fill areas. Additional recommendations may be provided at the design-level phase of work.

Debris Flows

Debris flows are bulked materials such as soil, rocks, logs, and debris carried by water downslope or down a channel. Debris flows can cause injury to persons and property. The city has mapped the area for debris flow potential. The majority of the canyons on the southern side of the property have been mapped as moderate potential for debris flows (see Figure 5-5 of the Technical Background Report).

The conceptual grading plan prepared by KWC Engineers shows the installation of debris catchments at the mouths of the canyons as they enter the area to be developed. The potential for debris flows should be considered in future developments of the southern parcel (Parcel 6).

Methane Gas

The property is located near an area where minor petroleum exploration and production has occurred in the past. According to an online source, the closest oil and/or gas exploration well (Savi No. 2, API: 06520015) was located approximately 1,700 feet to the north. This was a core hole and is now plugged and abandoned (http://maps.conservation.ca.gov/doggr/wellfinder last accessed August 12, 2020). The site is not known to be located within a designated oil field and not in an area where hazards associated with surface seepage of methane gas from natural or artificial sources have been identified.

Tar Seeps

Natural tar and oil seeps typically occur as deposits of pure oil, asphaltum, semi-solid bitumens or combinations of these substances that are mixed with surficial organic debris, clay, peat and other materials. No evidence of such seepage was observed during our surface reconnaissance of the site, nor was any tar-like substance present in any of the soil samples retrieved during our subsurface investigations. No onshore seeps are mapped onsite or in the vicinity (CalGEM, 2020).

Mineral Resources

The state and the city have mapped the general area for significant mineral resources. The city mapping indicates there are some useful mineral resources potentially present onsite. The location of the site and identification of the type and approximate location of mineral resources is shown on Figure 13 below.

Figure 13 – Portion of Figure 4-1a from the Technical Background Report showing Mineral Resources, A portion of the site along the southern side is within an area designated at MRZ-3a.

MRZ zone are classified into 4 categories, with MRZ-3 classified as "Areas of Undetermined Mineral Resource Significance" with the additional subclassification for zone MRZ-3a as "Known Mineral Occurrence."

Regional Subsidence and Fissuring

Fissuring has been known to occur in southern California largely as a result of ground water or other subsurface fluid (e.g. oil) withdrawals. Hydrocompaction is a common cause of subsidence but earthquakes may also cause subsidence. Ground water held in pore spaces between sediment grains maintains the open internal structure of the sediments; and when the water is extracted, grains compact causing subsidence at the surface. Subsidence has occurred widely in desert basins both as a result of natural dessication as the late Quaternary climate has become warmer and drier (post ice age), and as a result of groundwater extraction by man for agricultural purposes and drinking water. Subsidence caused by fluid withdrawal may only be partially reversible.

According to the County of Riverside Safety Element, Chapter 6.0 of the General Plan (adopted October 7, 2003), Policy S-3.8 of the General Plan requires a geotechnical evaluation of subsidence if a project site lies within a documented area or a susceptible area according to Figure S-7. As stated in the General Plan, "differential displacement and fissures occur at or near the valley margin, and along faults. In the County of Riverside, the worst damage to structures, as a result of regional subsidence, may be expected at the valley margins".

According to the most recent version of the Safety Element (last updated August 6, 2019), the site is located in an area not mapped, as it is shown as being part of the City of Corona. Based on the information developed through our studies, we do not have any reasons to suspect subsidence at the site from fluid withdrawal.

Volcanic Activity

The nearest volcanic areas are within the Mojave Desert (Amboy, Pisgah) and Obsidian Buttes at the southern end of the Salton Sea.

The volcanic activity in the Salton Trough has been of the slow, low-energy type in contrast to explosive volcanism that typifies the Cascade Range or the Mono Basin/Long Valley area of northern and central California. There is little risk to the Project from the type of volcanism seen in the Salton Trough.

DEFINITION AND USE OF SIGNIFICANCE CRITERIA

This section provides an evaluation of the potential impacts of the proposed project with regard to geologic and geotechnical features and processes. The guidelines provided in the following three publications served as a basis for identifying potential impacts:

1. State CEQA Guidelines, Appendix G (Environmental Checklist Form), Section VI (Geology and Soils).
2. City of Corona General Plan (2004) & Technical Background Report (2020) for the General Plan Update.
3. California Division of Mines and Geology Note 46, "Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports" (currently in revision).

Generally speaking, geological and seismological impacts occur as two basic categories: natural events which may occur whether or not the project advances to the construction phase, and second impacts that occur as a direct result of construction of the project. Examples of the former include fault displacement, earthquake shaking, liquefaction, and landslides. These can often be reduced to a level of insignificance through avoidance or by proper engineering design. Examples of potential geological impacts that can occur as a result of project construction are typically related to disturbance of surficial geologic formations and include induced hydroconsolidation of collapsible soils, induced slope instability, and increased soil erosion. Regardless of whether the impact is due to a natural event or a direct result of the proposed development, Appendix G of the State CEQA Guidelines state that implementation of the project would normally result in a significant impact if the one or more of the following conditions is identified:

1. The project will expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

    a. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area, or based on other substantial evidence from a known fault;
    b. Strong seismic ground shaking;
    c. Seismically-induced ground failure, including liquefaction; and
    d. Landslides.

2. The project results in substantial soil erosion or the loss of topsoil.

3. The project is located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.

4. The project is located on expansive soil as defined in Table 18-1-B of the California Building Code (2019), creating substantial risks to like and property.

5. The project is underlain by soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

Generic examples of potentially significant impacts from natural geologic conditions include the following:

- Ground rupture occurs beneath proposed structures for human occupancy or support infrastructure as a result of surface displacement along active earthquake faults.

- Earthquake-induced ground shaking causes landslides, liquefaction, settlement, lateral spreading and/or surface cracking that damages project structures or facilities.

- Failure of construction excavations resulting from the presence of loose or saturated sand, soft clay, or highly fractured or weathered rock.

- Differential subsidence or hydroconsolidation of collapsible soil results in excessive differential settlement directly under project structures or facilities.

Examples of potentially significant impacts of a particular project on the geological environment include the following:

- Unique geologic features or geologic features of unusual scientific value for study or interpretation would be disturbed or otherwise adversely affected by the project or the associated construction activities.

- Adverse geological processes such as landslides would be triggered or accelerated by construction or disturbance of landforms.

- Substantial alteration of topography would be required or could occur beyond that which would result from natural erosion and deposition.

- Shallow, hard bedrock is encountered during grading that requires blasting.

SITE-SPECIFIC GEOLOGIC IMPACTS AND MITIGATION MEASURES

The following paragraphs provide our assessment of the potential geologic impacts of the proposed project in consideration of the significance thresholds described above. This assessment is based on our review of available geologic literature and maps, as well as our subsurface investigation, laboratory testing and engineering analysis completed to date. The range of potential impacts with respect to the proposed project are *No Impact, Less than Significant*, *Less than Significant with Compliance with Regulatory Standards*, and *Less than Significant with Mitigation*. Proposed mitigation measures are recommended where appropriate that would reduce the effect of potentially significant impacts to a less-than-significant level.

Impact No. 1(a) – Fault Rupture

Level of Significance: *Less than Significant with Compliance with Regulatory Standards*

Nature of Concern

No portion of the area of proposed construction is located within the boundaries of an "Earthquake Fault Zone" as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 1997). The site is, however, located approximately 1.4 kilometers to the southwest of the earthquake fault zone that has been established around the active traces of the Chino fault. Additionally, the site is located within an area that is zoned by Riverside County for closer study of faulting.

Impact

Our research included a review of published geological maps that depict the locations of known active and potentially-active fault traces in the area of the subject site. The referenced literature indicates that no known surface traces of active or potentially active faults traverse any portion of the subject site. Our onsite observations did not reveal evidence of ground rupturing faulting at the surface.

For this reason, the potential for substantial adverse effects due to surface rupture along a known earthquake fault is considered to be low. Additionally, further study may be conducted during the design level investigation if required by the local jurisdiction.

Mitigation

If any evidence is found of faulting contrary to the data developed to date, the proposed buildings could be set-back from any faulting deemed active to avoid the risk. Therefore, the risk is less than significant with compliance with the regulatory standards and mitigation.

Impact No. 1(b) - Strong Ground Shaking

Level of Significance: Less than Significant with Compliance with Regulatory Standards

Nature of Concern

The subject site is located in a seismically active area of southern California. The type and magnitude of seismic hazards that may affect the site are dependent on both the distance to causative faults and the intensity and duration of the seismic event. Although the probability of primary surface rupture is considered very low, ground shaking hazards posed by earthquakes occurring along regional active faults do exist and should be taken into account in the design and construction of the proposed structures within the subject site.

Impact

Earthquake loads on earthen structures and buildings are a function of ground acceleration which may be determined from the site-specific ground motion analysis. Alternatively, a design response spectrum can be developed for certain sites based on the code guidelines. To provide the design team with the parameters necessary to construct the design acceleration response spectrum for this project, we used two computer applications. Specifically, the first computer application, which was jointly developed by Structural Engineering Association of California (SEAOC) and California's Office of Statewide Health Planning and Development (OSHPD), the SEA/OSHPD Seismic Design Maps Tool website, https://seismicmaps.org/, is used to calculate the ground motion parameters. The second computer application, the United Stated Geological Survey (USGS) Unified Hazard Tool website, https://earthquake.usgs.gov/hazards/interactive/, is used to estimate the earthquake magnitude and the distance to surface projection of the fault.

To run the above computer applications, site latitude and longitude, seismic risk category and knowledge of site class are required. The site class definition depends on the direct measurement and the ASCE 7-16 recommended procedure for calculating average small-strain shear wave velocity, Vs30, within the upper 30 meters (approximately 100 feet) of site soils.

A seismic risk category of II was assigned to the proposed buildings in accordance with 2019 CBC, Table 1604.5. No shear wave velocity measurement was performed at the site, however, the subsurface materials at the site appear to exhibit the characteristics of stiff soils condition for Site Class D designation. Therefore, an average shear wave velocity of 259 meter per second (850 feet per second) for the upper 100 feet was assigned to the site based on engineering judgment and geophysical experience. As such, in accordance with ASCE 7-16, Table 20.3-1, Site Class D (D- Default as per SEA/OSHPD software) has been assigned to the subject site.

The following table, Table 5, provides parameters required to construct the seismic response coefficient, C_s, curve based on ASCE 7-16, Article 12.8 guidelines.

TABLE 5

Seismic Design Parameters

Ground Motion Parameters	Specific Reference	Parameter Value	Unit
Site Latitude (North)	-	33.8777	°
Site Longitude (West)	-	-117.6531	°
Site Class Definition	Section 1613.2.2 (1), Chapter 20 (2)	D-Default (4)	-
Assumed Seismic Risk Category	Table 1604.5 (1)	II	-
M_w - Earthquake Magnitude	USGS Unified Hazard Tool (3)	7.26 (3)	-
R – Distance to Surface Projection of Fault	USGS Unified Hazard Tool (3)	2.26 (3)	km
S_s - Mapped Spectral Response Acceleration Short Period (0.2 second)	Figure 1613.2.1(1) (1)	2.187 (4)	g
S_1 - Mapped Spectral Response Acceleration Long Period (1.0 second)	Figure 1613.2.1(2) (1)	0.774 (4)	g
F_a – Short Period (0.2 second) Site Coefficient	Table 1613.2.3(1) (1)	1.2 (4)	-
F_v – Long Period (1.0 second) Site Coefficient	Table 1613.2.3(2) (1)	Null (4)	-
S_{MS} – MCE_R Spectral Response Acceleration Parameter Adjusted for Site Class Effect (0.2 second)	Equation 16-36 (1)	2.625 (4)	g
S_{M1} - MCE_R Spectral Response Acceleration Parameter Adjusted for Site Class Effect (1.0 second)	Equation 16-37 (1)	Null (4)	g
S_{DS} - Design Spectral Response Acceleration at 0.2-s	Equation 16-38 (1)	1.75 (4)	g
S_{D1} - Design Spectral Response Acceleration at 1-s	Equation 16-39 (1)	Null (4)	g
$T_o = 0.2\ S_{D1}/ S_{DS}$	Section 11.4.6 (2)	Null	s
$T_s = S_{D1}/ S_{DS}$	Section 11.4.6 (2)	Null	s
T_L - Long Period Transition Period	Figure 22-14 (2)	8 (4)	s
PGA - Peak Ground Acceleration at MCE_G (*)	Figure 22-9 (2)	0.927	g
F_{PGA} - Site Coefficient Adjusted for Site Class Effect (2)	Table 11.8-1 (2)	1.2 (4)	-
PGA_M –Peak Ground Acceleration (2) Adjusted for Site Class Effect	Equation 11.8-1 (2)	1.112 (4)	g
Design PGA ≈ (⅔ PGA_M) - Slope Stability (†)	Similar to Eqs. 16-38 & 16-39 (2)	0.741	g
Design PGA ≈ (0.4 S_{DS}) – Short Retaining Walls (‡)	Equation 11.4-5 (2)	0.696	g
C_{RS} - Short Period Risk Coefficient	Figure 22-18A (2)	0.905 (4)	-
C_{R1} - Long Period Risk Coefficient	Figure 22-19A (2)	0.903 (4)	-
SDC - Seismic Design Category (§)	Section 1613.2.5 (1)	Null (4)	-

References:
(1) California Building Code (CBC), 2019, California Code of Regulations, Title 24, Part 2, Volume I and II.
(2) American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI), 2016, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, Standards 7-16.
(3) USGS Unified Hazard Tool - https://earthquake.usgs.gov/hazards/interactive/
(4) SEI/OSHPD Seismic Design Map Application – https://seismicmaps.org

Related References:
Federal Emergency Management Agency (FEMA), 2015, NEHERP (National Earthquake Hazards Reduction Program) Recommended Seismic Provision for New Building and Other Structures (FEMA P-1050).

Notes:
* PGA Calculated at the MCE return period of 2475 years (2 percent chance of exceedance in 50 years).
† PGA Calculated at the Design Level of ⅔ of MCE; approximately equivalent to a return period of 475 years (10 percent chance of exceedance in 50 years).
‡ PGA Calculated for short, stubby retaining walls with an infinitesimal (zero) fundamental period.
§ The designation provided herein may be superseded by the structural engineer in accordance with Section 1613.2.5.1, if applicable.

Compliance with Regulatory Standards

City approval of the plans and specifications for this project is predicated upon compliance with all applicable State and local building codes. The design-phase geotechnical report for the project will provide the required engineering geotechnical input to assist the project designers (including the architect, structural engineer and civil engineer) in achieving this compliance with applicable State and local codes, regulations and ordinances. Provided that the structures proposed within the site are designed and constructed in accordance with the California Building Code as adopted by the City of Corona in its Municipal Code, and the site-specific recommendations to achieve such compliance that will be provided in the comprehensive design-phase geotechnical report for the project, the potential impact with respect to seismically-induced strong ground shaking at the project site would be less than significant.

Impact No. 1(c) – Seismically-Induced Ground Failure (Including Liquefaction)

Level of Significance: Less than Significant with Mitigation

Nature of Concern

The secondary effects of seismic activity that are typically considered as potential hazards to a particular site include several types of ground failure. The general types of ground failure that can occur as a consequence of severe ground shaking include landsliding, ground subsidence, ground lurching and shallow ground rupture, as well as liquefaction-induced vertical settlement, lateral spreading, and surface manifestation of liquefaction. The probability of occurrence of each type of ground failure depends on the severity of the earthquake, distance from the causative fault, topography, soil, and groundwater conditions and other factors.

Impact

Of the seismically-induced ground failure modes listed above, only dry-sand settlement appears to be a potential concern with respect to development of the proposed project. Liquefaction occurs when dynamic loading of a saturated sand or silt causes pore-water pressures to increase to levels where grain-to-grain contact is lost or significantly reduced and material temporarily behaves as a viscous fluid. Liquefaction can cause settlement of the ground surface, settlement and tilting of engineered structures, flotation of buoyant buried structures and fissuring of the ground surface. A common surface manifestation of liquefaction is the formation of sand boils (short-lived fountains of soil and water that emerge from fissures or vents and leave freshly deposited conical mounds of sand or silt on the ground surface). Groundwater is relatively deep at the site, and generally below depth where liquefaction can be detected at the surface by scientific investigators, for inclusion in liquefaction assessment techniques. Therefore it is not considered as an impact for this site.

Standards for Mitigation of Liquefaction Hazards

In April 1991, the State of California enacted the Seismic Hazards Mapping Act (California Public Resources Code, Division 2, Chapter 7.8, subsequently referred to herein as the "SHMA"). The purpose of the SHMA is to protect the public safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure. The SHMA defines mitigation as "… those measures that are consistent with established practice and that will reduce seismic risk to acceptable levels" (California Public Resources Code, Division 2, Chapter 7.8, Section 2693[c]). Acceptable level of risk is defined as "that level that provides reasonable protection of the public safety, though it does not necessarily ensure continued structural integrity and functionality of the project (California Code of Regulations Volume 18, Title 14, Article 10, Section 3721[a])." Within the context of the Act, mitigation of the project's potential liquefaction impact to an acceptable level of risk (to the extent that mitigation is required as described herein) can be accomplished through appropriate foundation design and subsurface soil improvement.

Mitigation

Based on our research and field data, liquefaction and dynamic settlement is not considered a hazard to site development due to the lack of shallow groundwater and relatively dense alluvial soil underlying the site. Dynamic settlement of the dry sandy soils near to the surface may be possible during strong shaking. This should be evaluated further during a design level investigation.

The potentially less-than-significant impact would be remediated through remedial grading, and the incorporation of strengthened foundation systems (i.e. mat or post-tensioned) into the project design. Remedial grading would include excavation and recompaction of near-surface soils to increase the relative density of the surficial dry sandy soils.

The design of the foundation systems will be required to comply with applicable State and local laws and ordinances, including Chapter 18 of the California Building Code, as adopted by the City of Corona in its Municipal Code. Recommendations for remedial grading and foundation design should be presented in the design-phase geotechnical report.

Impact No. 1(d) – Slope Instability and Landslides

Level of Significance: Less than Significant with Mitigation

Nature of Concern

Landslides or large unstable slopes can result in soil movement downslope that damages property or results in injury to persons located downslope if sudden movement occurs. Therefore, study of the potential for such soil movements cab be conducted to evaluate the presence of weak soil or rock layers, or unstable materials that may be located in place above the planned development.

Impact

Cut slopes up to approximately 180 feet in height have been proposed on the southern boundary of the area to be graded to facilitate building pad construction. It is anticipated that the upper portion of these slopes will consist of very old alluvial fan deposits, while the lower portions and the toe of these slopes are likely to expose bedrock. Geologic cross sections depicting our interpretation of subsurface conditions along the north – south axis of the proposed western cut slope are shown on Plate 2 attached. We evaluated several of the proposed slope configurations and determined that they are likely to be grossly stable with adequate factors of safety under static conditions. However, the site is very close to active faulting and therefore the seismic shaking potential at the site is very high. For slope stability purposes, higher levels of ground shaking must be considered in the analysis. Preliminary results indicated that typical 2:1 (H:V) slopes of this height may not achieve adequate factors of safety.

Mitigation

Mitigation of the slope stability issues will be a key component of this project. One landslide surface was identified within the proposed southwesterly cut slope; however, it will be removed during designed grading of the cut slope. Evaluation of the slope stability and any landslides at the site for determination of appropriate mitigation measures will include a pseudo-static analysis which takes into account the potential ground shaking at the site. If the stability analysis does not meet an adequate factor of safety the slope will either be laid back or stabilized such that the potential for seismically induced slope failure will be less than significant.

Impact No. 2 – Soil Erosion or Loss of Topsoil

Level of Significance: Less than Significant with Compliance with Regulatory Standards

Nature of Concern:

There are proposed slopes of moderate to significant height within the project site; therefore, the potential for erosion and downslope transport of soil material is considered significant. Additionally, under conditions where runoff from precipitation or uncontrolled irrigation is concentrated over an extended period of time, some localized erosion of graded areas could occur that would result in offsite transport of the non-cohesive surface soils within the site. This could be particularly problematic during the rough grading phase of the project when permanent storm water controls have not yet been constructed.

Compliance with Regulatory Standards

The localized soil erosion and loss of topsoil associated with the project would be less than significant because the project would be required to comply with applicable regulatory standards relating to erosion control and storm water management. Such standards include proper implementation of storm water Best Management Practices (as mandated by the City's water quality ordinance) prior to commencement of earthwork operations within the project site, as well as diligent maintenance of erosion control devices throughout the early phases of construction until such time as the permanent storm water conveyance system has been constructed and activated. During the post-construction and occupancy period, the potential for soil erosion and loss of topsoil would remain less than significant through proper maintenance of irrigation systems and permanent storm water conveyance devices, as well as though compliance with the City's water quality ordinance.

Impact No. 3 – Stability of Geologic Unit or Soil

Level of Significance: Less than Significant with Mitigation

Nature of Concern and Impacts to Project

Based on our test pits and laboratory testing, and a review of the borings and laboratory testing provided by N&A (Neblett, 1999), the existing soils (i.e., topsoil, low-density/hydro-collapsible alluvial fan soils) within the low-lying/northerly portion of the site are considered unsuitable for support of proposed fills, structures, flatwork, pavement or other improvements and should be removed to underlying competent alluvial fan soils and replaced as properly compacted fill. Based on the limited laboratory collapse potential tests within samples in the upper 10 to 15 feet of the existing ground surface, site soils have collapse potentials between approximately 1 and 3 percent. Limited consolidation testing conducted on samples 15 feet and deeper below the existing ground surface exhibited minimal collapse potential.

Proposed Mitigation

Based on these laboratory results, the upper 10 to 15 feet of site soils should be uniformly removed and replaced with compacted fill. Prior to placement of compacted fill, the overexcavation bottom should be tested by the geotechnical consultant to confirm the native soils have a minimum in-situ density equivalent to 85 percent relative compaction, and an in-situ degree of saturation of greater than 70 percent and there is no visible porosity. The bottom surface should then be properly processed and recompacted to at least 10 inches in depth and then placement of engineered fill may commence. Localized areas of deeper excavation of unsuitable soils may be necessary and should be planned for. It should be noted that in the natural canyon areas that extend southward into the hilly portion of the site that removals in this area will likely be required down to bedrock. The depth of these removals is anticipated to generally be in the 10- to 20-foot range. Additionally, overexcavation of cut/fill and shallow fill/deep fill transition pads should generally be one-half the thickness of the fill to a minimum and maximum depth of 5 and 15 feet, respectively.

In order to provide suitable support for the proposed new engineered fills, structural foundations and exterior site improvements, existing compressible materials should be over-excavated and the excavated material replaced as properly compacted, engineered fill. The results of our field investigation and laboratory testing indicate that the depth of required over-excavation will vary from 10 to 20 feet below existing grades; however, the actual remedial grading depths will need to be determined during supplemental investigations and during grading based on field observations by the project geotechnical consultant. Overexcavation and recompaction of the unsuitable materials generally should extend beyond the proposed grading limits in order to provide adequate support for the proposed improvements. The distance that removals extend beyond the grading limits is function of a variety of factors; but is generally on the order of two times the thickness of the unsuitable materials. Detailed recommendations for remedial and design grading should be provided in the comprehensive design-phase geotechnical report. Where necessary, the remedial recommendations should consider the need to protect any adjacent offsite properties and other restrictions that may be imposed by property limit boundaries.

Provided that remedial and design grading within the site are performed in accordance with local grading ordinances, current standards of practice in the area, and the site-specific recommendations to be provided by the project geotechnical professional, it is expected that excessive settlement resulting from compression and/collapse of existing near surface soils will be reduced to a less than significant level.

Impact No. 4 – Expansive Soils

Level of Significance: Less than Significant with Compliance with Regulatory Standards

Nature of Concern and Project Impact

Expansive soils are soils that experience volumetric changes in response to increases or decreases in moisture content. Relatively thin, rigid structural elements such as building floor slabs and exterior concrete flatwork may experience uplift, shifting, or cracking as a result of swelling or contraction of expansive soils. Based on the laboratory testing performed by both Petra and N&A, near-surface soil and bedrock are anticipated to generally have a very low expansion potential (i.e. EI between 0 and 20). However, clayey alluvial materials were observed in Boring P-1 so soil and/or bedrock with higher expansion potentials may exist onsite. In recognition of these issues, Section 1808.6 of the current California Building Code (CBC), as adopted by the City of Corona in its Municipal Code, contains provisions for design of building foundations and floor slabs to address the potential detrimental effects of expansive soils.

Compliance with Regulatory Standards

Construction at the site will include mass grading and mixing of the various materials that are currently beneath the site. During and after completion of grading the expansion potential of the materials encountered should be characterized and determined based on testing. If, after completion of grading, it is determined that near-surface soils within building pad areas exhibit an elevated expansion potential, the potential impact of those expansive soils would be addressed through design of structural foundations and floor slabs in compliance with the provisions of Section 1808.6 of the CBC, as adopted by the City of Corona in its Municipal Code, and the other publications that are incorporated therein by reference. The purpose of Section 1808.6 is to provide guidelines for the design of structural foundations and concrete floor slabs that are capable of resisting the differential volume changes that can develop in expansive soils and to prevent structural damage to the structures supported thereon. With the implementation of Section 1808.6 (as applicable), the project's impact with respect to expansive soils would be less than significant.

Impact No. 5 – Suitability of Site to Support Wastewater Disposal Systems

Level of Significance: No Impact

Discussion

The proposed commercial development on the project site would be served by the local municipal sewer system. Therefore, the project would not include the use of private on-site septic systems or alternative wastewater disposal systems.

RECOMMENDATIONS FOR ADDITIONAL STUDY

Once a final grading plan has been developed for the proposed project, a design-phase engineering geotechnical investigation should be prepared. Further exploratory work should be conducted. The results of the exploratory work discussed in this report, and any further exploratory work, will form the basis of a comprehensive site-specific geotechnical engineering report that provides detailed recommendations for site grading and ground improvement, design of structural foundations and floor slabs for the proposed buildings, and design and construction of exterior concrete flatwork, masonry walls, and asphalt pavement surfaces.

CONCLUSIONS

Based on the results of our review of available geotechnical literature and maps and the results of our limited subsurface investigation within the subject site, it is our opinion that development of the subject site with the proposed residential and commercial structures is feasible from a geotechnical standpoint. In addition, with the implementation of the mitigation measures/performance standards described in this study and the final recommendations to be provided in the comprehensive design-phase geotechnical report, the potentially significant geologic and seismic impacts identified in this report would be reduced to a less-than-significant level.

REPORT LIMITATIONS

This report is based on the proposed project and geotechnical data as described herein. The materials encountered on the project site, described in other literature, and utilized in our liquefaction analysis are assumed to be representative of the entire project site, and the conclusions and recommendations contained in this report are presented on that basis. However, the engineering characteristics of soil materials typically vary between points of exploration, both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein.

This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and time period. The contents of this report are professional opinions and as such, are not to be considered a guarantee or warranty. This report should be reviewed and updated after a period of one year or if the general project design concept changes from that described herein.

Respectfully submitted,

PETRA GEOSCIENCES, INC.

8/12/2020

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APPENDIX A

EXPLORATION LOGS

EXPLORATION LOG

Project: **Green River Ranch**		Boring No.:	**B-1**
Location: **Green River Road, Corona**		Elevation:	**+/- 730**
Job No.: **19-286**	Client: **Western Realco**	Date:	**8/6/19**
Drill Method: **36" Bucket Auger**	Driving Weight: **See Notes**	Logged By:	**KTM/SHW**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ARTIFICIAL FILL (af)** Silty Sand (SM): Yellowish-brown, dry, loose, fine- to coarse-grained sand, trace rootlets, trace pinhole porosity.							
		VERY OLD ALLUVIAL FAN DEPOSITS (Qvof) Silty Sand (SM): Dark yellowish-brown, dry, fine- to coarse-grained sand.							
5		@ 5': Becomes slightly moist, with zones of dark orange and black oxidation staining, trace rootlets.		3	■		6.7	111.3	
		Sand (SP): Yellowish-brown, dry to slightly moist, medium-dense, fine-grained sand, with trace coarse-grained sand, trace silt. @ 7.5': gravel lens, Bedding: N80W/20NE.							
10		@ 10': Beecomes dry, with fine- to coarse-grained sand, few gravel.		4	■		1.7	113.7	
		@ 11': Same as above with trace cobbles.							
		Gravelly Sand (GP-SP): Yellowish-brown, dry, medium-dense, fine-grained sand, subrounded to rounded gravel up to 4" in diameter.							
		Silty Sand (SM): Dark yellowish-brown, slightly moist, medium-dense, fine-grained sand.							
15		@ 15': Same as above, with trace coarse-grained sand.		3	■		6.3	109.5	
		@ 16': Becomes orangish-brown. @ 16.5': Silt content increases. @ 17': Same as above with trace clay. @ 18': Becomes dark yellowish-brown.							
20				4	■		7.4	122.5	
		@ 22': Gravel becomes abundant with trace weathered cobbles up to 6" in diameter.							
25		@ 25': Same as above, with trace gravel.		4	■		7.7	123.6	
30				5	■	■	5.5	120.6	
						■			DSR
		Gravelly Sand (GP-SP): Yellowish-brown, slightly moist, very dense, fine- to				■			

PLATE A-1

Petra Geosciences, Inc.

EXPLORATION LOG

Project:	**Green River Ranch**	Boring No.:	**B-1**
Location:	**Green River Road, Corona**	Elevation:	**+/- 730**
Job No.:	**19-286**	Client: **Western Realco**	Date: **8/6/19**
Drill Method:	**36" Bucket Auger**	Driving Weight: **See Notes**	Logged By: **KTM/SHW**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
35		coarse-grained sand and gravel.		10	■		4.9	109.4	DSU
		Silty Sand (SM): Dark Yellowish-brown, slightly moist, dense, fine-grained sand.							
40		Sand (SP): Dark yellowish-brown, slightly moist, dense, fine- to medium-grained sand, with trace gravel.		8	■		5.2	125.0	
		Gravelly Sand (GP-SP): Yellowish-brown, slightly moist, dense, fine- to coarse-grained sand.							
45				5	■		4.1	120.9	
		Silty Sand (SM): Yellowish-brown, slightly moist, dense, fine-grained, with trace medium- to coarse-grained sand, trace gravel.							
50		Gravelly Sand (GP-SP): Yellowish-Brown, slightly moist, very dense, fine-grained sand.		10	■		3.2	130.4	
		Sand (SP): Yellowish-brown, slightly moist, dense, fine- to medium-grained sand, with trace coarse-grained sand, trace gravel.							
55		Silty Sand (SM): Dark yellowish-brown, slightly moist, dense, fine- to medium-grained sand.		15	■		4.3	129.7	
60		@ 60': Same as above, with few to some gravel.		10	■		4.7	124.9	
65		Sand (SP): Yellowish-brown, slightly moist, dense, fine- to medium-grained, with trace coarse-grained sand and fine- grained gravel.		8	■		4.6	119.1	
		Silty Sand (SM): Yellowish-brown, moist, dense, very fine- to fine-grained sand, with trace gravel.							

PLATE A-1

EXPLORATION LOG

Project: **Green River Ranch**		Boring No.:	**B-1**
Location: **Green River Road, Corona**		Elevation:	**+/- 730**
Job No.: **19-286**	Client: **Western Realco**	Date:	**8/6/19**
Drill Method: **36" Bucket Auger**	Driving Weight: **See Notes**	Logged By:	**KTM/SHW**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
70		Sand (SP): Yellowish-brown, dry to slightly moist, dense, fine- to medium-grained sand, with trace gravel.		15	■		2.4	124.3	DSU
75		Silty Sand (SM): Dark yellowish-brown, slightly moist, very dense, fine- to medium-grained sand, with trace gravel. Bedding @ 77': N10E/4NW, very fine- to fine-grained sand lens.		20	■		4.7	115.4	
80		Sand (SP): Yellowish-brown, slightly moist, very dense, fine- to coarse-grained sand. Bedding @ 81': N50E/12NW, sand lens. @ 82.5': 6" thick layer of Silt, yellowish-brown, Bedding: N-S/5W.		25	■		2.6	114.1	
85		@ 85': Same as above. @ 86.5': Drill begins to chatter.		20	■		5.0	113.5	
		Total Depth = 87 Feet Refusal Due to Oversized Rock No Groundwater Encountered Boring Backfilled with Cuttings NOTES - Kelly Bar Weight 0-27': 4,500 lbs. 27-52': 3,500 lbs. 52-79': 2,500 lbs. 79-104': 1,000 lbs.							
90									
95									
100									

EXPLORATION LOG

Project: **Green River Ranch**		Boring No.:	**B-2**
Location: **Green River Road, Corona**		Elevation:	**+/- 670**
Job No.: **19-286**	Client: **Western Realco**	Date:	**8/7/19**
Drill Method: **36" Bucket Auger**	Driving Weight: **See Notes**	Logged By:	**KTM**

Depth (Feet)	Material Description	WATER	Blows per foot	Core	Bulk	Moisture Content (%)	Dry Density (pcf)	Other Lab Tests
0	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Silty Sand (SM): Yellowish-brown, dry, medium-dense, fine- to medium-grained sand, trace gravel.							
5	@ 5': Same as above, with trace pinhole porosity.		4	■		4.0	114.3	
10	@ 10': Same as above, with no visible porosity.		5	■		2.0	118.4	
15	@ 15': Becomes fine-grained sand.		4	■		3.3	112.8	
20	Sand (SP): Yellowish-brown, dry, medium-dense, fine-grained sand, with trace medium- to coarse-grained sand and gravel.		5	■		2.8	113.0	
25	Silt (ML): Brown, slightly moist, firm.		3	■		11.2	106.7	
30	Sand (SP): Gray, dry to slightly moist, dense, very fine- to fine-grained sand, with trace silt.		11	■		2.0	93.9	DSU

Petra Geosciences, Inc.

EXPLORATION LOG

Project:	**Green River Ranch**	Boring No.:	**B-2**
Location:	**Green River Road, Corona**	Elevation:	**+/- 670**
Job No.: **19-286**	Client: **Western Realco**	Date:	**8/7/19**
Drill Method: **36" Bucket Auger**	Driving Weight: **See Notes**	Logged By:	**KTM**

Depth (Feet)	Lithology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
35		Silty Sand (SM): Pale yellowish-brown, dry, dense, very fine- to coarse-grained sand, few pebbles.		8	■		0.7	110.4	
		Gravelly Sand (GP-SP): Gray, dry, loose, coarse-grained sand, Few cobbles, caving condition.							
40		**BEDROCK - Santiago Formation (Tsa)** Siltstone: Dark yellowish-brown & orangish-brown, dry to slightly moist, moderately hard, poorly bedded to massive, highly weathered. Bedding @ 42': N50E/16NW.		10	■		1.3	130.5	
45		@ 45': Becomes very hard, disturbed sample.		10	■		9.7	124.3	
50		@ 50': Becomes bluish-gray, slightly moist, very hard, fresh, trace fine-grained sand, disturbed sample.		10	■		9.0	122.6	
55		@ 55': Same as above.		20	■		8.4	129.1	
60		@ 60': Same as above.		25	■		8.6	125.1	
65		@ 65': Same as above, sample not disturbed.		20	■		9.4	122.5	DSU

PLATE A-2

EXPLORATION LOG

Project: **Green River Ranch**		Boring No.:	**B-2**
Location: **Green River Road, Corona**		Elevation:	**+/- 670**
Job No.: **19-286**	Client: **Western Realco**	Date:	**8/7/19**
Drill Method: **36" Bucket Auger**	Driving Weight: **See Notes**	Logged By:	**KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
70		@ 70': Same as above.		12	■		11.3	125.4	DSU
		Total Depth = 71 Feet Refusal Due to Hard Bedrock No Groundwater Encountered Boring Backfilled with Cuttings <u>NOTES</u> - Kelly Bar Weight 0-27': 4,500 lbs. 27-52': 3,500 lbs. 52-79': 2,500 lbs. 79-104': 1,000 lbs.							
75									
80									
85									
90									
95									
100									

Petra Geosciences, Inc.

EXPLORATION LOG

Project: **Green River Ranch**			Boring No.: **B-3**
Location: **Green River Road, Corona**			Elevation: **+/- 689**
Job No.: **19-286**	Client: **Western Realco**		Date: **8/9/19**
Drill Method: **36" Bucket Auger**	Driving Weight: **See Notes**		Logged By: **KTM/SHW**

Depth (Feet)	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Silty Sand (SM): Yellowish-brown, dry, medium-dense, fine- to coarse-grained sand, with few gravel, trace cobbles.							
8	Sand and Gravel (GP-SP): yellowish-brown to gray, fine- to coarse-grained, bedding: N75W/9NE.							
9	Silty Sand (SM): Yellowish-brown, dry, medium-dense, fine- to medium-grained sand, with trace gravel.							
10			6	■		1.8	125.4	
15	@ 15': with decreased gravel content.							
20	@ 20': becomes slightly moist.		5	■		5.0	117.8	
30	Sand (SP): Dark yellowish-brown, dry to slightly moist, dense, fine- to coarse-grained sand, with few gravel.		10	■		5.3	116.6	
31	Gravelly Sand (GP-SP): Yellowish-Brown, slightly moist, dense, fine- to coarse-grained sand, roughly horizontal.							
33	Sand (SP): Yellowish-brown, fine- to medium-grained sand, with trace gravel.							

PLATE A-3

Petra Geosciences, Inc.

EXPLORATION LOG

Project:	**Green River Ranch**	Boring No.:	**B-3**
Location:	**Green River Road, Corona**	Elevation:	**+/- 689**
Job No.:	**19-286** Client: **Western Realco**	Date:	**8/9/19**
Drill Method:	**36" Bucket Auger** Driving Weight: **See Notes**	Logged By:	**KTM/SHW**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
35									
40		Silty Sand (SM): Yellowish-brown, dry to slightly moist, dense, fine- to medium-grained sand, with trace gravel. @ 41': Becomes gray and off white. Bedding @ 42.5': N75W/3NE, clean sand lens.		8	■		2.6	119.6	
		LANDSLIDE DEBRIS (Qls) Siltstone: Gray, dry, moderately hard, moderately weathered, trace fine-grained sand, contact with above : N70W/1-2NE.							
45		Sandstone: Gray, moderately hard, very fine- to fine-grained sand, with orange oxidation staining and few clay.							
		Siltstone: gray, moderately hard, highly weathered.							
		Sandstone: Yellowish-brown, highly weathered. Clay seam @ 49.5': N10E/7SE, 1/2" thick, brownish-gray, with few rootlets between seams. Clay seam @ 51': N35E/14SE, 1" thick, brownish-brown.							
50				8	■	▬	6.1	113.7	DSU AT
		BEDROCK - Santiago Formation (Tsa) Sandstone: Off-white to light gray, very fine-grained sand, very hard, massive, moderately weathered, lightly cemented.							
55				7	■		15.9	110.1	DSU
		Total Depth = 57 Feet Refusal Due to Hard Bedrock No Groundwater Encountered Boring Backfilled with Cuttings							
60		NOTES - Kelly Bar Weight 0-27': 4,500 lbs. 27-52': 3,500 lbs. 52-79': 2,500 lbs. 79-104': 1,000 lbs.							
65									

Petra Geosciences, Inc.

TEST PIT LOG

Project:	Green River Ranch		Boring No.:	TP-1
Location:	Green River Road, Corona		Elevation:	+/- 585
Job No.:	19-286	Client: Western Realco	Date:	7/23/19
Drill Method:	Backhoe	Driving Weight: 140 lbs / 30"	Logged By:	KTM

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per ft.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Light brown, dry, medium-dense, fine- to medium-grained sand, with few porosity, trace roots. @ 1': Same as above, with trace gravel and cobbles up to 5" in diameter. @ 1.5': Becomes brown, with no cobbles but trace gravel.							
2.5									
		@ 3.5': Becomes yellowish-brown.							
5		@ 5': Same as above, with trace rootlets.		26			5.7	97.5	
7.5									
10									
		Total Depth = 11 Feet No Groundwater Encountered Test Pit Backfilled with Cuttings.							
12.5									
15									
17.5									

PLATE A-4

Petra Geosciences, Inc.

TEST PIT LOG

Project: **Green River Ranch**		Boring No.:	**TP-2**
Location: **Green River Road, Corona**		Elevation:	**+/- 577**
Job No.: **19-286**	Client: **Western Realco**	Date:	**7/23/19**
Drill Method: **Backhoe**	Driving Weight: **140 lbs / 30"**	Logged By:	**KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per ft.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Grayish-brown, dry, medium-dense, fine-grained sand, with abundant porosity, trace gravel.							
2.5									
4		Sand with trace Clay (SP): Orangish-brown, moist, very dense, fine- to medium-grained sand, with trace gravel.							
5				50	■	■	8.0	125.1	
6		@ 6': Same as above, with trace porosity.				■			
7.5						■			
8		@ 8': Becomes yellowish-brown.				■			
10									
12.5									
13		Total Depth = 13 Feet No Groundwater Encountered Test Pit Backfilled with Cuttings.							
15									
17.5									

PLATE A-5

T E S T P I T L O G

Project:	**Green River Ranch**	Boring No.:	**TP-3**
Location:	**Green River Road, Corona**	Elevation:	**+/- 610**
Job No.: **19-286**	Client: **Western Realco**	Date:	**7/23/19**
Drill Method: **Backhoe**	Driving Weight: **140 lbs / 30"**	Logged By:	**KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per ft.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ARTIFICIAL FILL (af)** Sandy Clay with trace Silt (CL): Brown, dry, firm, very fine- to fine-grained sand, with abundant gravel.							
2.5		Silty Sand to Sandy Silt (SM/ML): Olive gray to gray, moist, firm, very fine-grained sand, with trace gravel.							
		Sand (SP): Dark brown, moist, medium-dense, fine-grained sand, with abundant roots, trace landscape netting debris.							
		Silty Sand (SM): Gray, moist, loose, fine-grained sand.							
5		Sand (SP): Dark brown, moist, medium-dense, fine-grained sand, with abundant roots, trace landscape nettings debris.							
7.5		Silty Sand (SM): Gray, moist, loose, fine-grained sand.							
		Sand (SP): Dark brown, moist, medium-dense, fine-grained sand, abundant roots, trace lanscape nettings debris.							
10		@ 10': Becomes light brown, with few roots and no landscape netting debris.							
12.5		@ 12': Becomes dark brown with trace landscape netting debris.							
15		Total Depth = 15 Feet No Groundwater Encountered Test Pit Backfilled with Cuttings.							
17.5									

PLATE A-6

Petra Geosciences, Inc.

TEST PIT LOG

Project:	Green River Ranch		Boring No.:	TP-4
Location:	Green River Road, Corona		Elevation:	+/- 550
Job No.:	19-286	Client: Western Realco	Date:	7/23/19
Drill Method:	Backhoe	Driving Weight: 140 lbs / 30"	Logged By:	KTM

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per ft.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**TOPSOIL** Silty Sand (SM): Grayish-brown, dry, loose, fine- to coarse-grained sand, with few rootlets, trace gravel.							
		ALLUVIUM (Qal) Silty Sand (SM): Brownish-gray, dry, medium-dense, fine- to medium-grained sand.							
2.5		Sand (SP): Reddish-brown, dry to slightly moist, medium-dense, fine-grained sand, trace rootlets. @ 1.3': Becomes olive gray, moist, medium-dense, very fine- to fine-grained sand, with trace silt and clay.							
5				23	■		16.0	107.7	
		@ 6.5': Becomes dark brown to reddish-brown.							
7.5									
		@ 8': Same as above, with trace pinhole porosity, trace gravel.		19	■		5.5	109.9	CON
10									
		@ 11': Becomes light brown.							
12.5									
15		Total Depth = 15 Feet No Groundwater Encountered Test Pit Backfilled with Cuttings.							
17.5									

PLATE A-7

Petra Geosciences, Inc.

TEST PIT LOG

Project: **Green River Ranch**		Boring No.: **TP-5**
Location: **Green River Road, Corona**		Elevation: **+/- 570**
Job No.: **19-286**	Client: **Western Realco**	Date: **7/23/19**
Drill Method: **Backhoe**	Driving Weight: **140 lbs / 30"**	Logged By: **KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per ft.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ARTIFICIAL FILL (af)** Silty Sand (SM): Gray, dry, medium-dense, fine- to coarse-grained sand, with trace organics, trace gravel and cobbles up to 6" in diameter.							
2.5		Sand (SP): Brown, moist, medium-dense, fine-grained sand, with trace silt.							
5		**ALLUVIUM (Qal)** Sand (SP): Dark brown, dry, medium-dense, fine-grained sand, with trace porosity. @ 6': Becomes reddish-brown, moist, with trace clay.		15	■		9.7	124.8	
7.5		@ 8.5': Becomes pale yellowish-brown, with trace clay.							
10									
		Total Depth = 10.5 Feet No Groundwater Encountered Test Pit Backfilled with Cuttings.							
12.5									
15									
17.5									

PLATE A-8

TEST PIT LOG

Project:	**Green River Ranch**	Boring No.:	**TP-6**
Location:	**Green River Road, Corona**	Elevation:	**+/- 519**
Job No.: **19-286**	Client: **Western Realco**	Date:	**7/23/19**
Drill Method: **Backhoe**	Driving Weight: **140 lbs / 30"**	Logged By:	**KTM**

Depth (Feet)	Lithology	Material Description	WATER	Samples: Blows per ft.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ARTIFICIAL FILL (af)** Silty Gravel & Sand (GM-SM): Brown, dry, loose, fine-grained sand, with abundant gravel.							
2.5		**ALLUVIUM (Qal)** Sand (SP): Orangish-brown, moist, medium-dense, fine-grained sand, with trace coarse-grained sand, trace pinhole porosity, trace rootlets, trace clay. @ 3': Becomes orangish-brown, dark brown, and light brown mottled.							
				20	■		10.5	118.7	
5									
7.5									
		Gravelly Sand (GP-SP): Light brown, moist, medium-dense, fine-grained sand, moderately porous, with abundant gravel up to 3" in diameter.				■			
		Sand (SP): Light brown, moist, medium-dense, fine-grained sand, with trace porosity, trace roots.				■			
10						■			MAX, EXP, AT, CR
12.5		@ 12': Becomes yellowish-brown, fine- to medium-grained, with abundant porosity, trace rounded gravel.				■			
15									
		Total Depth = 15.5 Feet No Groundwater Encountered Test Pit Backfilled with Cuttings.							
17.5									

PLATE A-9

Petra Geosciences, Inc.

TEST PIT LOG

Project: **Green River Ranch**		Boring No.: **TP-7**
Location: **Green River Road, Corona**		Elevation: **+/- 516**
Job No.: **19-286**	Client: **Western Realco**	Date: **7/23/19**
Drill Method: **Backhoe**	Driving Weight: **140 lbs / 30"**	Logged By: **KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per ft.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**TOPSOIL** Silty Sand (SM): Brown, dry, loose, fine-grained sand, with abundant roots and organics.							
		ALLUVIUM (Qal) Sand (SP): Light brown, dry, medium-dense, very fine- to fine-grained sand. @ 1.8': Becomes brown to dark brown, moist, with trace pinhole porosity.							
2.5		@ 2.5': Becomes dark brown.							
5				8	■		9.7	103.3	
		@ 6.5': Becomes fine- to coarse-grained sand, with abundant pinhole porosity.							
7.5									
		Sand with Silt (SM): Yellowish-brown, dry, medium-dense, very fine- to fine-grained sand, trace pinhole porosity.							
10				20	■		3.5	104.8	CON
12.5		Sand (SP): Yellowish-brown, dry, medium-dense, fine- to coarse-grained sand, with trace pinhole porosity.							
15									
		Total Depth = 15.5 Feet No Groundwater Encountered Test Pit Backfilled with Cuttings.							
17.5									

PLATE A-10

Petra Geosciences, Inc.

TEST PIT LOG

Project: **Green River Ranch**		Boring No.:	**TP-8**
Location: **Green River Road, Corona**		Elevation:	**+/- 527**
Job No.: **19-286**	Client: **Western Realco**	Date:	**7/23/19**
Drill Method: **Backhoe**	Driving Weight: **140 lbs / 30"**	Logged By:	**KTM**

Depth (Feet)	Lithology	Material Description	WATER	Samples: Blows per ft.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Grayish-brown, dry, medium-dense, very fine- to fine-grained sand, with trace rootlets, trace porosity.							
2.5		Sand (SP): Reddish-brown to brown, moist, medium-dense, fine-grained sand, with trace gravel, trace rootlets, trace porosity.							
				15	■		11.7	120.7	
5						■			
7.5						■			
		VERY OLD ALLUVIAL FAN DEPOSITS (Qvof) Sand (SP): Reddish-brown to brown, moist, medium-dense, fine- to coarse-grained sand.		15	■	■	12.8	107.7	
10						■			
		Total Depth = 10.5 Feet No Groundwater Encountered Test Pit Backfilled with Cuttings.							
12.5									
15									
17.5									

PLATE A-11

Petra Geosciences, Inc.

TEST PIT LOG

Project:	Green River Ranch	Boring No.:	TP-9
Location:	Green River Road, Corona	Elevation:	+/- 538
Job No.: 19-286	Client: Western Realco	Date:	7/23/19
Drill Method: Backhoe	Driving Weight: 140 lbs / 30"	Logged By:	KTM

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per ft.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**TOPSOIL** Silty Sand (SM): Brown, dry, loose, very fine- to coarse-grained sand, with abundant roots, trace angular gravel.							
		ALLUVIUM (Qal) Sand (SP): Yellowish-brown, moist, medium-dense, fine- to coarse-grained sand, with trace pinhole porosity.							
2.5									
		@ 4': with 3" thick layer of gravelly sand, yellowish-brown, moist, medium-dense fine- to coarse-grained sand.							
5		@ 5': Same as above, with some porosity.							
				16	■		6.5	112.4	
7.5									
10									
		@ 11': Becomes yellowish-brown and brown, mottled.							
12.5									
		@ 13': Becomes yellowish-brown.							
		Total Depth = 14 Feet No Groundwater Encountered Test Pit Backfilled with Cuttings.							
15									
17.5									

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EXPLORATION LOG

Project:	**Green River Ranch**	Boring No.:	**P-1**
Location:	**Green River Road, Corona**	Elevation:	**±545'**
Job No.:	**19-286** Client: **Western Realco**	Date:	**8/6/19**
Drill Method:	**8" Hollow Stem Auger** Driving Weight: **140lbs/30"**	Logged By:	**SHW**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Olive gray, slightly moist, loose, fine- to medium-grained sand, rootlets visible. Becomes olive brown to brown.							
5		Sandy Clay (CL): Brown to dark brown, slightly moist to moist, medium-dense, fine- to medium-grained sand.		2 3 3					HYD
		Total Depth= 8' No groundwater encountered Boring converted to percolation test hole Backfilled using cuttings.							
10									
15									
20									
25									
30									

Petra Geosciences, Inc.

EXPLORATION LOG

Project:	**Green River Ranch**	Boring No.:	**P-2**
Location:	**Green River Road, Corona**	Elevation:	**±533'**
Job No.: **19-286**	Client: **Western Realco**	Date:	**8/6/19**
Drill Method: **8" Hollow Stem Auger**	Driving Weight: **140lbs/30"**	Logged By:	**SHW**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Light gray to orangish-brown, dry to slightly moist, loose, very fine- to fine-grained sand. Becomes yellowish-brown to orangish-brown, slightly moist. Becomes dark grayish-brown and moist.							
5		Becomes yellowish-brown, very fine- to medium-grained sand.		6 7 4			9.0		
		Same as above.		3 4 4					HYD
10		Total Depth= 10' No groundwater encountered Boring converted to percolation test hole Backfilled using cuttings.							
15									
20									
25									
30									

Petra Geosciences, Inc.

EXPLORATION LOG

Project:	Green River Ranch			Boring No.:	P-3
Location:	Green River Road, Corona			Elevation:	±516'
Job No.:	19-286	Client:	Western Realco	Date:	8/6/19
Drill Method:	8" Hollow Stem Auger	Driving Weight:	140lbs/30"	Logged By:	SHW

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ASPHALT** 3" thick. **BASE** 6" thick.							
		ARTIFICIAL FILL (af) Silty Sand (SM): Orangish-brown, slightly moist, medium-dense, very fine- to fine-grained sand.							
5		**ALLUVIUM (Qal)** Silty Sand (SM): Dark grayish-brown, moist, medium-dense, very fine- to fine-grained sand. Becomes yellowish-brown and very fine- to medium-grained.							
10									
15		Same as above.		9 13 15			5.1	108.6	
		Same as above.		6 3 4					HYD
20		Total depth= 20' No groundwater encountered Boring converted to percolation test hole Backfilled using cuttings.							
25									
30									

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APPENDIX B

LABORATORY TEST PROCEDURES

LABORATORY DATA SUMMARY

LABORATORY TESTING

Associated with the subsurface exploration was the collection of bulk and relatively undisturbed samples of soil materials for laboratory testing. The relatively undisturbed samples were obtained using a 3-inch, outside-diameter, modified California split-spoon soil sampler lined with 1-inch-high brass rings. The driven ring samples were placed in sealed containers and transported to our laboratory located at 1251 W. Pomona Road, Unit #103, Corona, CA 92882, for testing.

Our laboratory testing capabilities include Soil Classifications, Moisture Content and In-Situ Moisture Content and Dry Unit Weight, Organic Content, Laboratory Maximum Dry Unit Weight and Optimum Moisture Content, Expansion Index, Corrosivity Screening (Soluble Sulfate and Chloride Content, pH, Resistivity), Atterberg Limits, Grain Size Distribution, Direct Shear, Consolidation and Permeability; all in accordance with the latest procedures of American Society for Testing and Materials (ASTM) and California Department of Transportation (Caltrans).

To evaluate the engineering properties of site soils, laboratory testing was performed on selected samples of soil considered representative of those encountered. Appropriate tests were assigned by the project engineer and geologist based on project plans and specifications including the level of anticipated loads, when available, and subsurface stratigraphy. Test results were reviewed by the laboratory manager and engineer-in-charge of the laboratory or his qualified designee for completeness and accuracy. A description of laboratory test procedures and summaries of the test data are presented in the following pages.

LABORATORY TEST PROCEDURES

Soil Classification

Soils and bedrock materials encountered within the property were classified and described in accordance with the Unified Soil Classification System and the Engineering Geology Field Manual by the U.S. Department of the Interior, Bureau of Reclamation, respectively, and in general accordance with the current version of Test Method ASTM D 2488. The assigned group symbols are presented in the exploration logs, Appendix A.

Moisture Content and In Situ Moisture Content and Dry Unit Weight

Moisture content of selected bulk samples and in- place moisture content and dry unit weight of selected, relatively undisturbed soil and bedrock samples were determined in accordance with the current version of the Test Method ASTM D 2435 and Test Method ASTM D2216, respectively. Test data are presented in the exploration logs, Appendix A.

Laboratory Maximum Dry Unit Weight and Optimum Moisture Content

The maximum dry unit weight and optimum moisture content of the on-site soils and bedrock were determined for selected bulk samples in accordance with current version of Method A of ASTM D 1557. The results of these tests are presented on Plates B-1 and B-2.

Expansion Index

Expansion index tests were performed on selected bulk samples of the on-site soils and bedrock in accordance with the current version of Test Method ASTM D 4829. The test results are presented on Plate B-1.

Atterberg Limits

The Atterberg limits (liquid limit and plastic limit) were determined for selected bulk samples of representative materials in accordance with the current version of Test Method ASTM D 4318. The results of these tests are included on Plates B-1, B-3 and B-4.

Corrosivity Screening

Chemical and electrical analyses were performed on selected bulk samples of onsite soils to determine their soluble sulfate content, chloride content, pH (acidity) and minimum electrical resistivity. These tests were performed in accordance with the current versions of California Test Method Nos. CTM 417, CTM 422 and CTM 643, respectively. The results of these tests are included on Plate B-1.

Grain Size Distribution

Grain size analysis was performed on selected bulk samples of onsite soils in accordance with the latest versions of Test Method ASTM D 136 and/or ASTM C 117, or Test Method ASTM D 422 and/or ASTM D 6913. The test result is graphically presented on Plates B-5 through B-7.

Direct Shear

The Coulomb shear strength parameters, i.e., angle of internal friction and cohesion, were determined for selected, relatively undisturbed and/or reconstituted-bulk samples of onsite soils and bedrock. This test was performed in general accordance with the current version of Test Method ASTM D 3080. Three specimens were prepared for each test. The test specimens were inundated and then sheared under various normal loads at a constant strain rate of 0.005 inch per minute. The results of the direct shear test are graphically presented on Plates B-8 through B-15.

Consolidation

Volume change (settlement or heave) characteristics of selected undisturbed soils and bedrock were determined by one-dimensional consolidation tests. These tests were performed in general accordance with the current version of the Test Method ASTM D 2435. Additionally, heave or hydro-consolidation tests were performed in general accordance with the current version of Test Method ASTM D 4546, or ASTM D 5333 respectively. Axial loads were applied in several increments to laterally restrained 1-inch-high samples. The resulting deformations were recorded at selected time intervals. The test samples were inundated at the approximate in-situ and/or anticipated design overburden pressure in order to evaluate the effect of an increase in moisture content, e.g., hydro-consolidation potential or heave. Results of these tests are graphically presented on Plates B-16 through B-17.

LABORATORY DATA SUMMARY																			
Boring/ Test Pit/ Sample/ Number	Sample Depth (ft.)	Soil/ Bedrock Description[1]	Specific Gravity[2]	Compaction[3]		Expansion[4]		Atterberg Limits[5]			Corrosivity Screening				Percent Passing No. 200 Sieve[9]	Sand Equivalent[10]	R-Value[11]	Organic Content[12] (%)
				Maximum Dry Unit Weight (pcf)	Optimum Moisture (%)	Index	Potential	LL	PL	PI	Soluble Sulfate Content[6] (%)	Chloride Content[7] (ppm)	pH[8] (Acidity)	Minimum Resistivity[8] (Ohm-cm)				
B-3	51	Clay Seam, Brown	-	-	-	-	-	65	20	45	-	-	-	-	-	-	-	-
TP-6	8-13	Sand (SP), Light Brown	-	130.0	8.5	2	Very Low	NP	NP	NP	0.0012	105	7.7	3,200	-	-	-	-

- Did Not Run
NP – Non-Plastic

Test Procedures:

1 Per Test Method ASTM D 2488
2 Per Test Method ASTM D 854
3 Per Test Method ASTM D 1557
4 Per Test Method ASTM D 4829
5 Per Test Method ASTM D 4318
6 Per California Test Method CTM 417
7 Per California Test Method CTM 422
8 Per California Test Method CTM 643
9 Per Test Method ASTM C 117
10 Per Test Method ASTM D 2419
11 Per California Test Method CTM 301
12 Per Test Method ASTM D 2974

COMPACTION TEST REPORT

Project No.: 19-286 **Date:** 8-6-19

Project: Green Valley Ranch

Client: Western Realco

Source of Sample: TP-6 **Depth:** 8-15

Remarks:

MATERIAL DESCRIPTION

Description:

Classifications - **USCS:** **AASHTO:**

Nat. Moist. = **Sp.G. =**

Liquid Limit = **Plasticity Index =**

% < No.200 =

TEST RESULTS
Maximum dry density = 130.0 pcf
Optimum moisture = 8.5 %

Test specification:
ASTM D 1557-12 Method A Modified

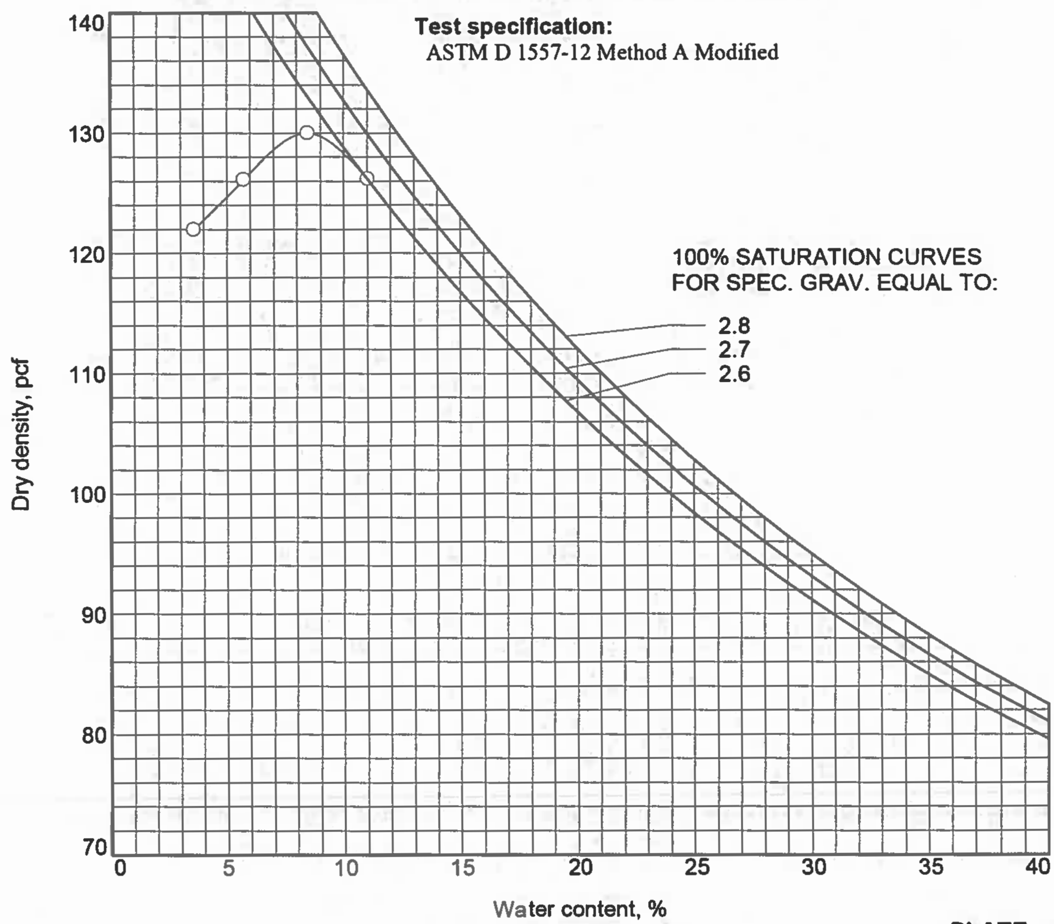
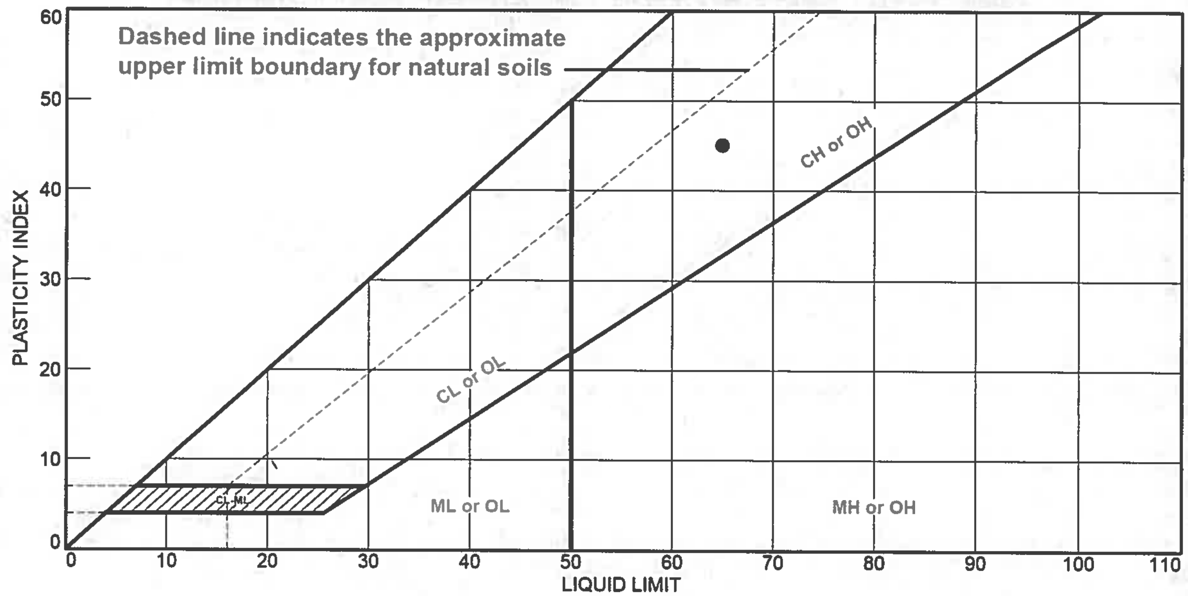


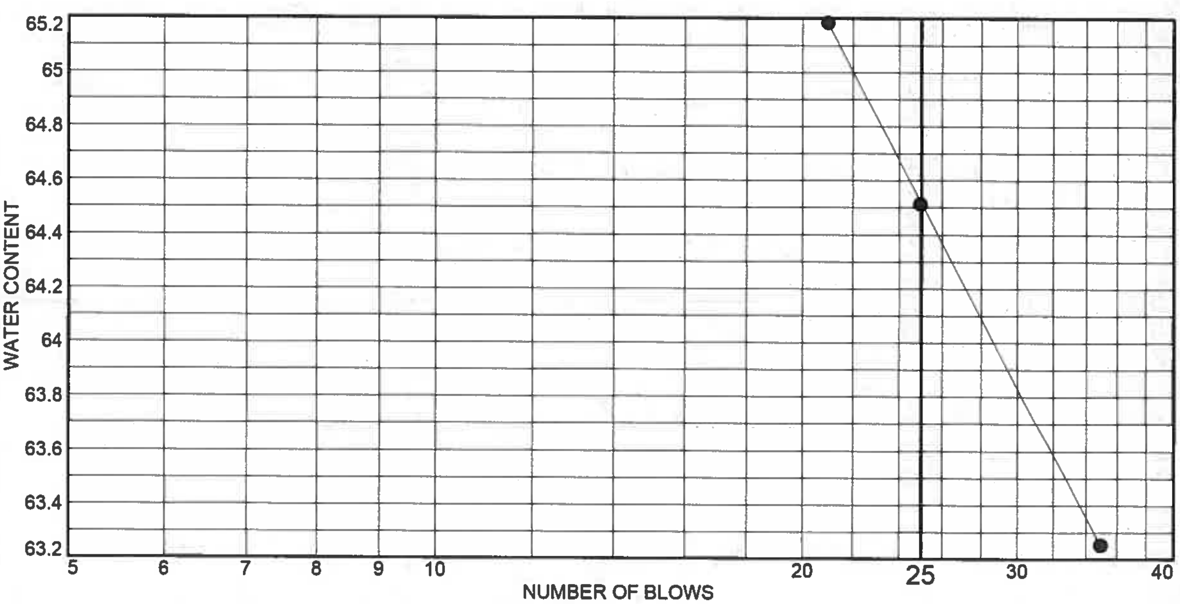
PLATE B-2

Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

Petra Geosciences, Inc.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●		65	20	45			

Project No. 19-286 **Client:** Western Realco

Project: Green Valley Ranch

Source of Sample: B-3 **Depth:** 51

Remarks:

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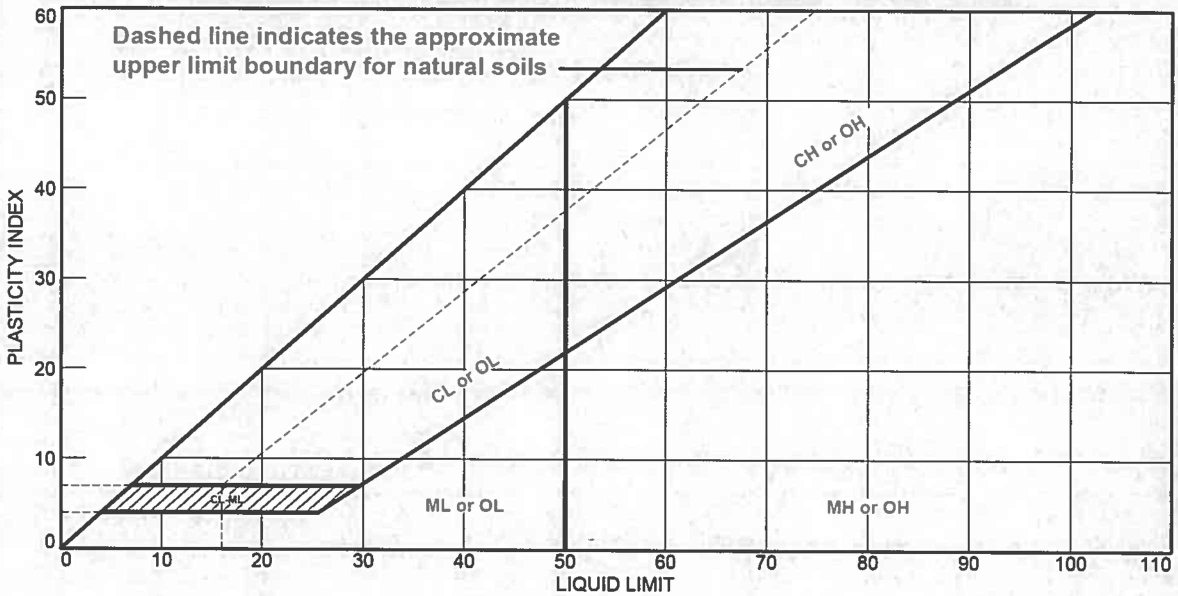
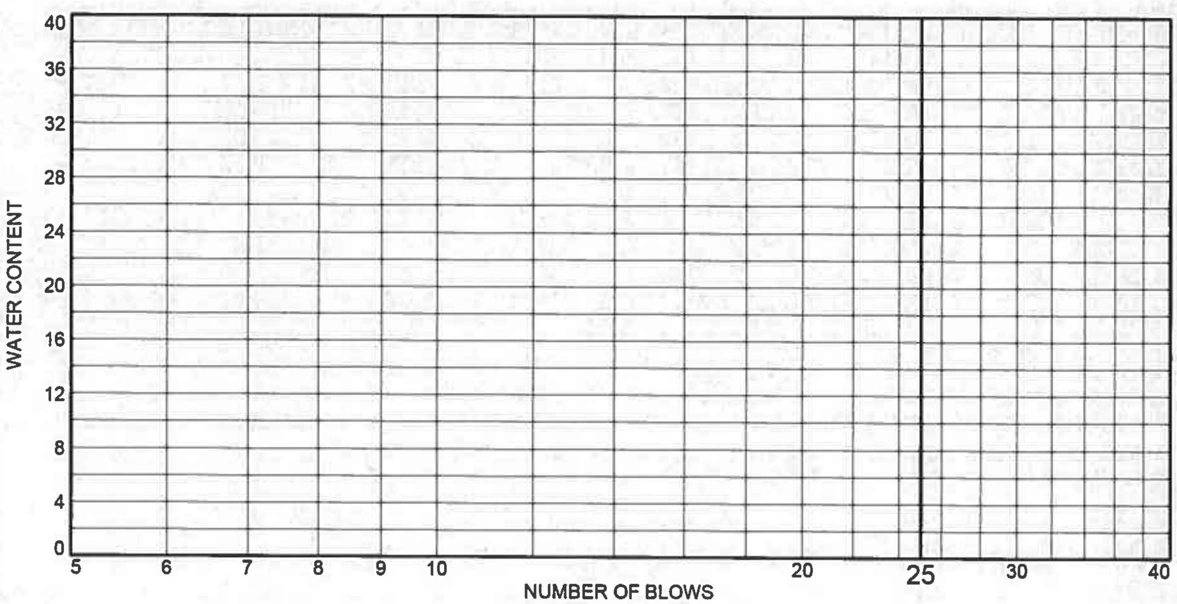
PLATE B-3

Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●			NP				

Project No. 19-286 **Client:** Western Realco

Project: Green Valley Ranch

Source of Sample: TP-6 **Depth:** 8-15

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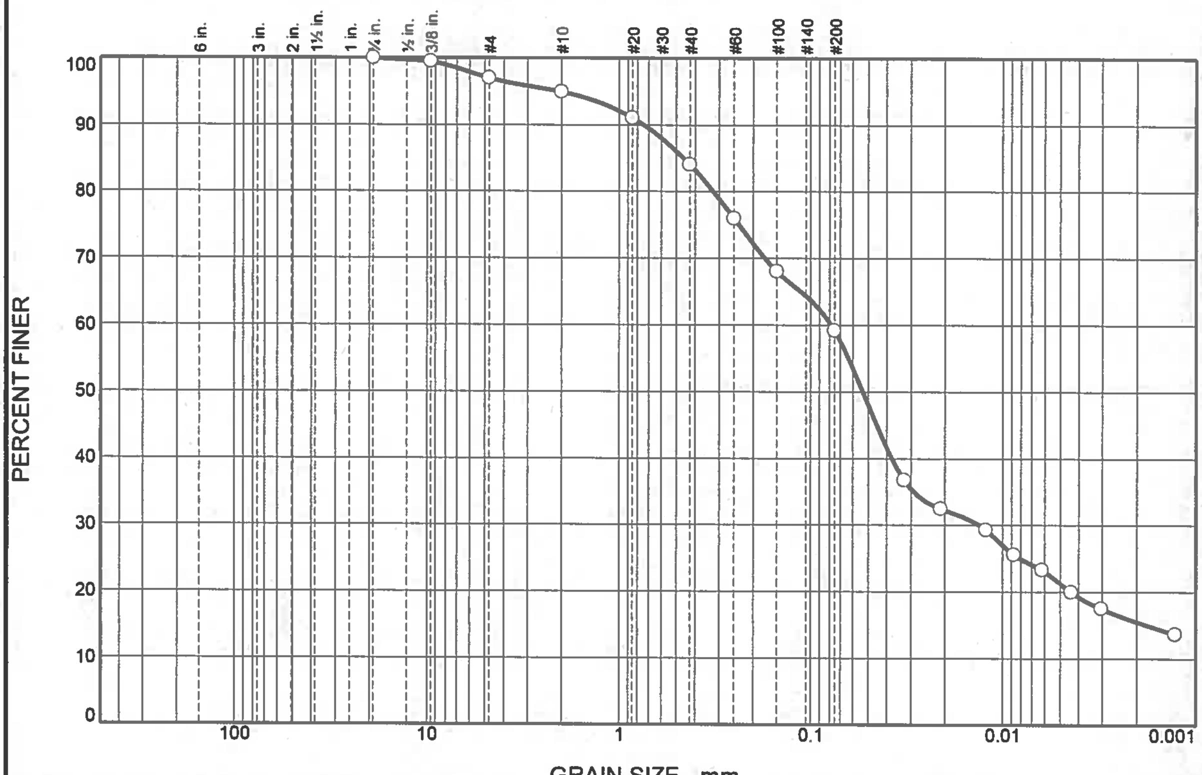
Remarks:

PLATE B-4

Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.0	2.1	10.9	24.8	37.9	21.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
3/8	99.5		
#4	97.0		
#10	94.9		
#20	91.0		
#40	84.0		
#60	76.0		
#100	68.0		
#200	59.2		
0.0325 mm.	36.7		
0.0210 mm.	32.5		
0.0122 mm.	29.3		
0.0087 mm.	25.6		
0.0062 mm.	23.3		
0.0044 mm.	20.0		
0.0030 mm.	17.5		
0.0013 mm.	13.7		

* (no specification provided)

Soil Description

Brown, Clayey fine to medium Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.7444 D_{85}= 0.4578 D_{60}= 0.0782
D_{50}= 0.0533 D_{30}= 0.0132 D_{15}= 0.0018
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

Source of Sample: P-1 **Depth:** 6.5'

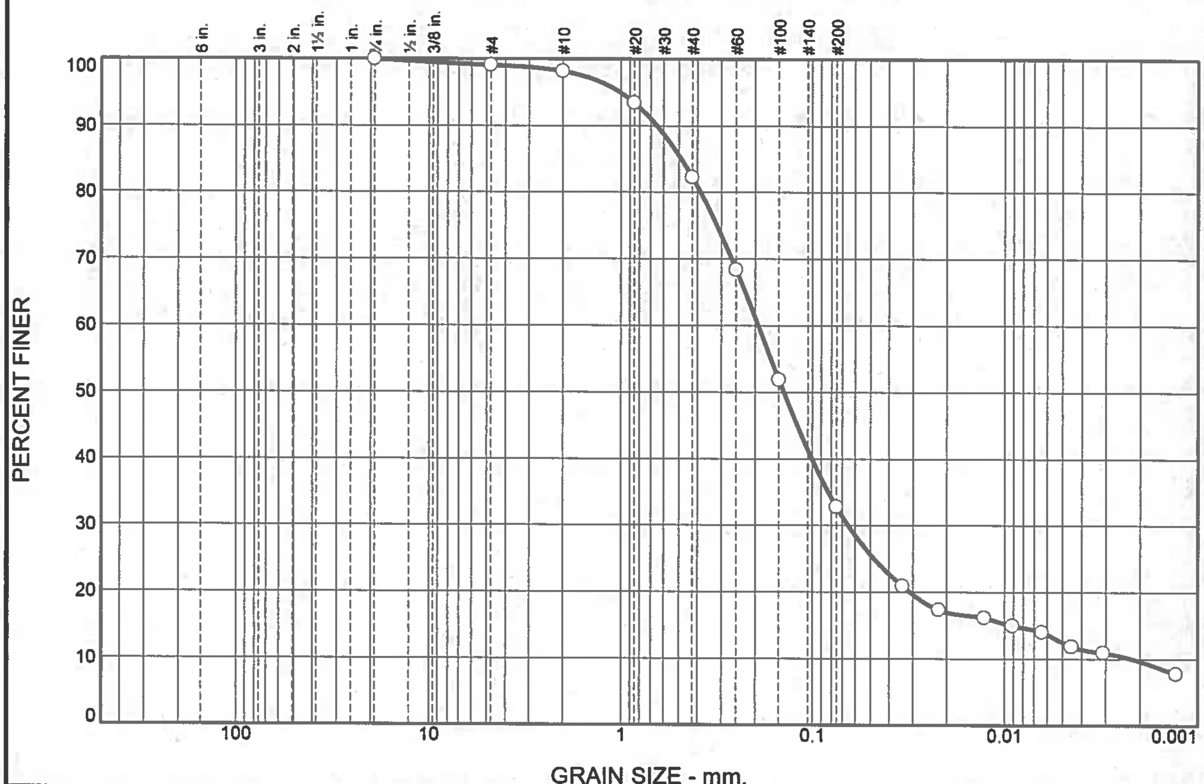
Date: 9-12-19

PETRA GEOSCIENCES INC

Client: Western Realco
Project: Green Valley Ranch
Project No: 19-286 **PLATE** B-5

Laboratory: 1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.9	0.9	15.9	49.5	20.3	12.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
#4	99.1		
#10	98.2		
#20	93.4		
#40	82.3		
#60	68.4		
#100	51.9		
#200	32.8		
0.0340 mm.	20.9		
0.0219 mm.	17.3		
0.0127 mm.	16.1		
0.0091 mm.	15.0		
0.0064 mm.	14.0		
0.0045 mm.	11.8		
0.0031 mm.	10.9		
0.0013 mm.	7.8		

* (no specification provided)

Soil Description

Olive brown, Clayey fine to medium Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6490 D_{85}= 0.4851 D_{60}= 0.1924
D_{50}= 0.1415 D_{30}= 0.0653 D_{15}= 0.0092
D_{10}= 0.0022 C_u= 87.21 C_c= 10.06

Classification

USCS= SC AASHTO=

Remarks

Source of Sample: P-2 **Depth:** 8.5'

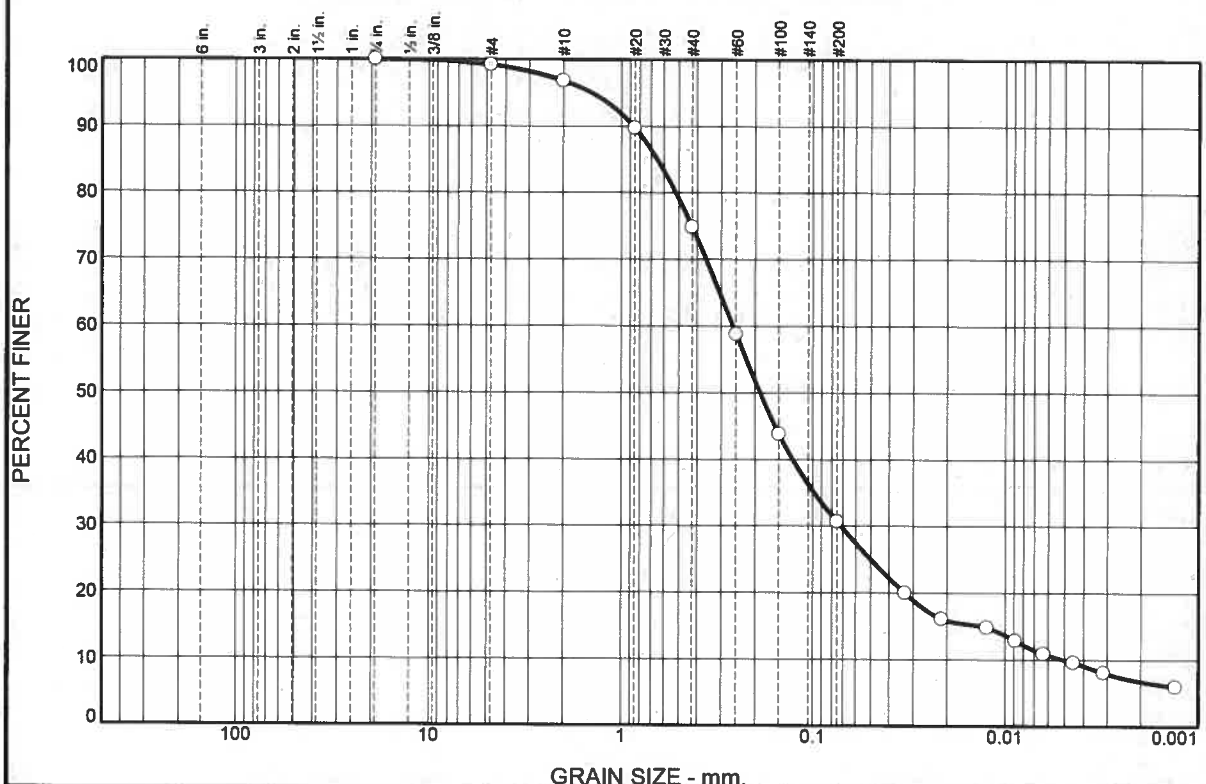
Date: 9-15-19

Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

PETRA GEOSCIENCES INC

Client: Western Realco
Project: Green Valley Ranch
Project No: 19-286 PLATE B-6

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	2.4	21.9	44.2	20.7	10.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
#4	99.2		
#10	96.8		
#20	89.7		
#40	74.9		
#60	58.8		
#100	43.8		
#200	30.7		
0.0331 mm.	20.0		
0.0213 mm.	16.1		
0.0124 mm.	14.8		
0.0088 mm.	12.9		
0.0063 mm.	10.9		
0.0045 mm.	9.6		
0.0031 mm.	8.1		
0.0013 mm.	6.0		

* (no specification provided)

Soil Description

Brown, Silty fine to medium Sand with Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.8668 D_{85}= 0.6491 D_{60}= 0.2596
D_{50}= 0.1879 D_{30}= 0.0716 D_{15}= 0.0131
D_{10}= 0.0050 C_u= 51.54 C_c= 3.91

Classification

USCS= SM/SC AASHTO=

Remarks

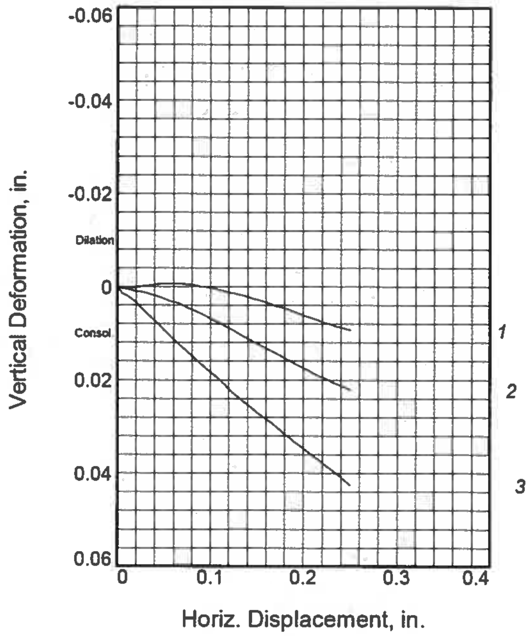
Source of Sample: P-3 **Depth:** 18.5'

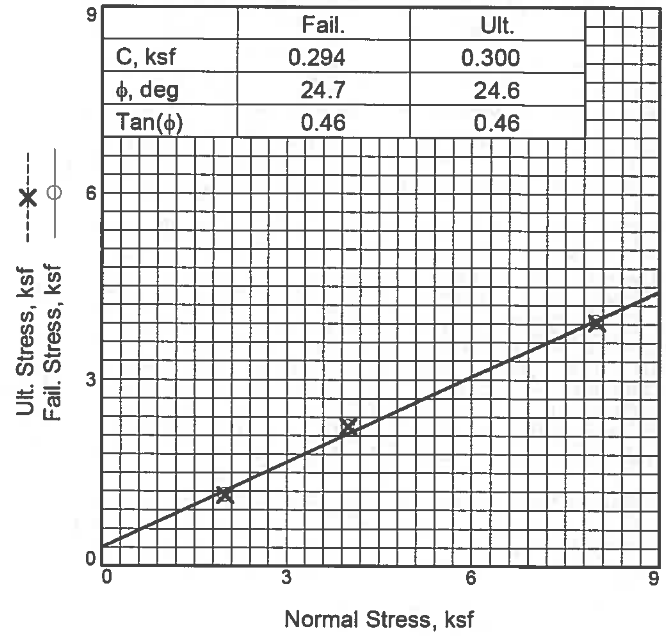
Date: 9-16-19

Laboratory: 1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #: 714.549.8921

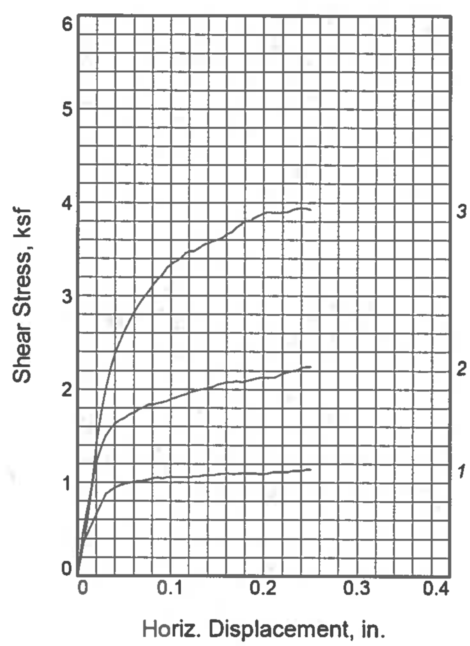
PETRA GEOSCIENCES INC.

Client: Western Realco
Project: Green Valley Ranch
Project No: 19-286 **PLATE** B-7





	Fail.	Ult.
C, ksf	0.294	0.300
ϕ, deg	24.7	24.6
Tan(ϕ)	0.46	0.46



	Sample No.	1	2	3
Initial	Water Content, %	5.5	5.5	5.5
	Dry Density, pcf	117.9	117.5	117.8
	Saturation, %	36.5	36.0	36.3
	Void Ratio	0.4026	0.4082	0.4045
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	14.9	15.4	15.0
	Dry Density, pcf	117.9	117.5	117.8
	Saturation, %	97.8	99.8	98.0
	Void Ratio	0.4026	0.4082	0.4045
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
	Normal Stress, ksf	2.000	4.000	8.000
	Fail. Stress, ksf	1.140	2.244	3.936
	Displacement, in.	0.250	0.250	0.246
	Ult. Stress, ksf	1.140	2.244	3.924
	Displacement, in.	0.250	0.250	0.250
	Strain rate, in./min.	0.005	0.005	0.005

Sample Type: Remolded to 90% RC
Description: Yellowish brown, Clayey fine to medium Sand

Assumed Specific Gravity= 2.65
Remarks:

PLATE B-8

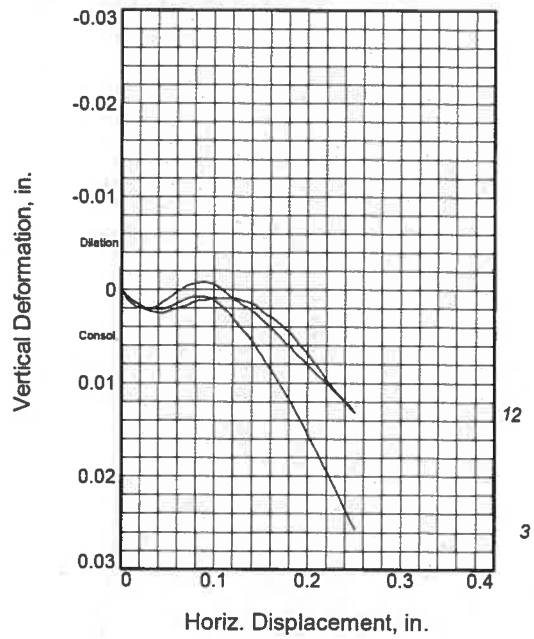
Client: Western Realco

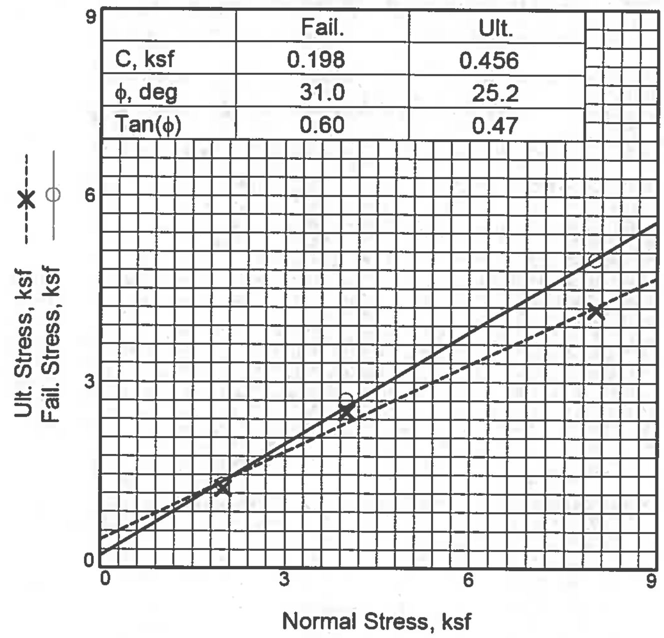
Project: Green Valley Ranch

Source of Sample: B-1 **Depth:** 30

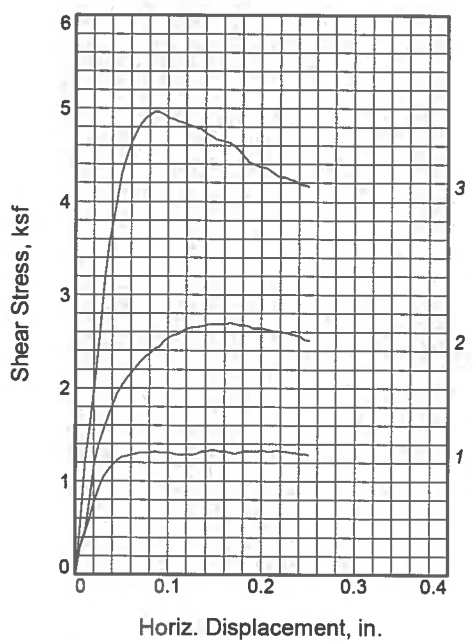
Proj. No.: 19-286 **Date Sampled:** 7-23-19

PETRA GEOSCIENCES INC





	Fail.	Ult.
C, ksf	0.198	0.456
ϕ, deg	31.0	25.2
Tan(ϕ)	0.60	0.47



	Sample No.	1	2	3
Initial	Water Content, %	4.9	4.9	4.9
	Dry Density, pcf	108.5	118.7	116.4
	Saturation, %	25.0	33.3	31.1
	Void Ratio	0.5251	0.3938	0.4213
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	19.5	14.7	14.0
	Dry Density, pcf	108.5	118.7	116.4
	Saturation, %	98.3	99.2	88.0
	Void Ratio	0.5251	0.3938	0.4213
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
	Normal Stress, ksf	2.000	4.000	8.000
	Fail. Stress, ksf	1.332	2.700	4.968
	Displacement, in.	0.200	0.166	0.086
	Ult. Stress, ksf	1.284	2.508	4.164
	Displacement, in.	0.250	0.251	0.251
	Strain rate, in./min.	0.005	0.005	0.005

Sample Type: Undisturbed

Description: Brown, Clayey fine to medium Sand

Assumed Specific Gravity= 2.65

Remarks:

PLATE B-9

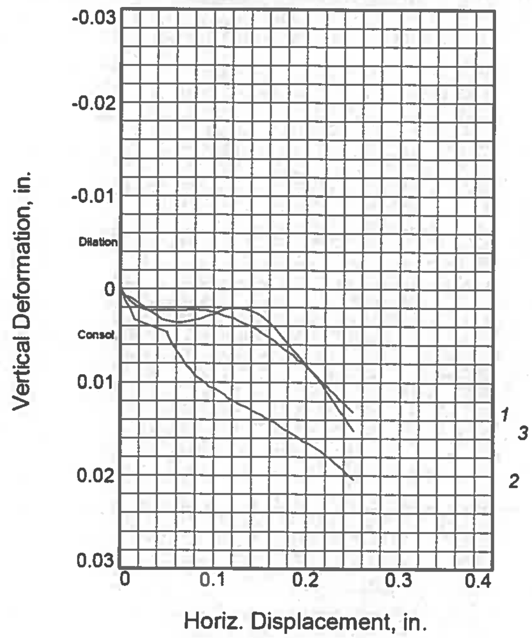
Client: Western Realco

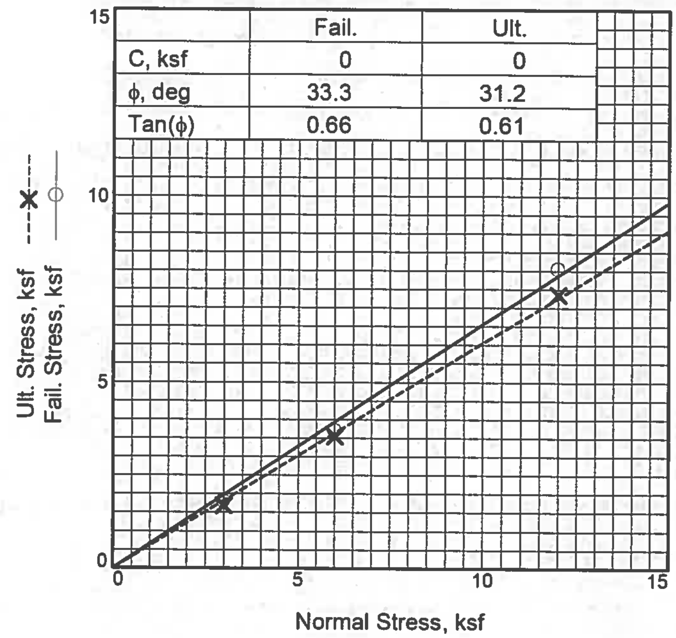
Project: Green Valley Ranch

Source of Sample: B-1 **Depth:** 35

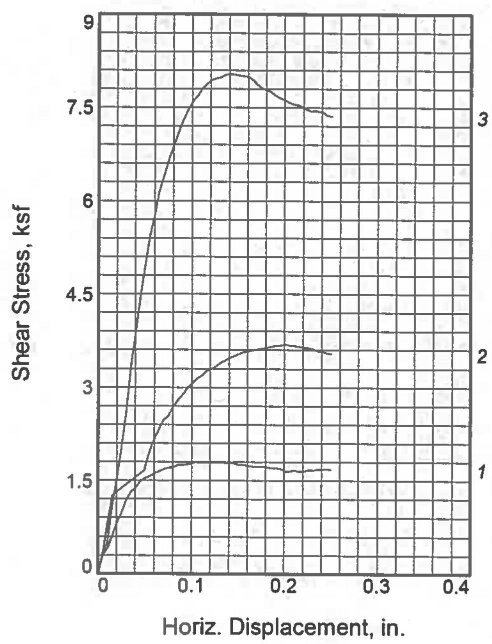
Proj. No.: 19-286 **Date Sampled:**

PETRA GEOSCIENCES INC





	Fail.	Ult.
C, ksf	0	0
ϕ, deg	33.3	31.2
Tan(ϕ)	0.66	0.61



	Sample No.	1	2	3
Initial	Water Content, %	4.7	4.7	4.7
	Dry Density, pcf	105.5	107.2	115.4
	Saturation, %	21.9	22.9	28.7
	Void Ratio	0.5683	0.5427	0.4334
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	21.4	19.9	16.6
	Dry Density, pcf	105.5	107.2	115.4
	Saturation, %	99.7	97.0	101.7
	Void Ratio	0.5683	0.5427	0.4334
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
	Normal Stress, ksf	3.000	6.000	12.000
	Fail. Stress, ksf	1.800	3.696	8.040
	Displacement, in.	0.106	0.201	0.141
	Ult. Stress, ksf	1.680	3.540	7.356
	Displacement, in.	0.250	0.251	0.251
	Strain rate, in./min.	0.005	0.005	0.005

Sample Type: Undisturbed

Description: Yellowish brown, Silty fine to coarse Sand

Assumed Specific Gravity= 2.65

Remarks:

PLATE B-10

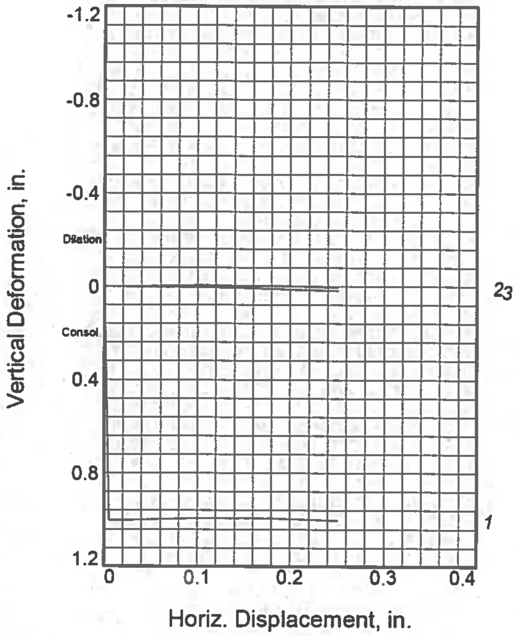
Client: Western Realco

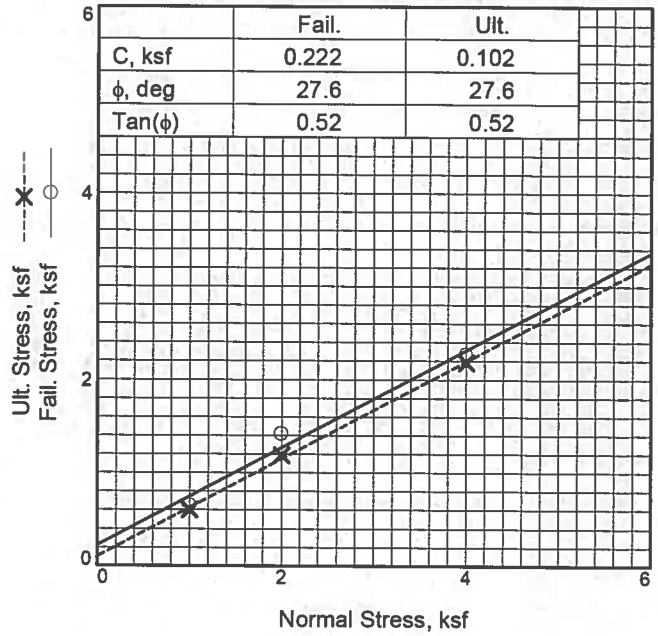
Project: Green Valley Ranch

Source of Sample: B-1 **Depth:** 75

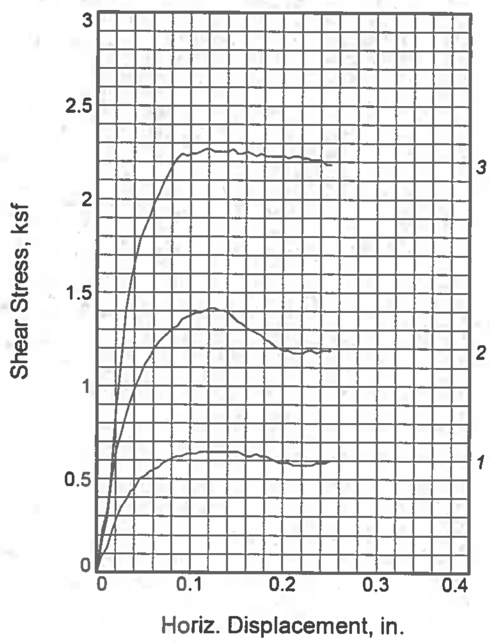
Proj. No.: 19-286 **Date Sampled:**

PETRA GEOSCIENCES INC





	Fail.	Ult.
C, ksf	0.222	0.102
ϕ, deg	27.6	27.6
Tan(ϕ)	0.52	0.52



	Sample No.	1	2	3
Initial	Water Content, %	2.0	2.0	2.0
	Dry Density, pcf	97.1	101.5	91.6
	Saturation, %	7.6	8.4	6.6
	Void Ratio	0.7037	0.6298	0.8051
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	25.4	23.5	30.5
	Dry Density, pcf	97.1	101.5	91.6
	Saturation, %	95.8	98.8	100.4
	Void Ratio	0.7037	0.6298	0.8051
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
	Normal Stress, ksf	1.000	2.000	4.000
	Fail. Stress, ksf	0.648	1.416	2.268
	Displacement, in.	0.111	0.121	0.146
	Ult. Stress, ksf	0.600	1.188	2.184
	Displacement, in.	0.251	0.251	0.251
	Strain rate, in./min.	0.010	0.010	0.010

Sample Type: Undisturbed

Description: Olive brown, Poorly Graded fine to medium Sand

Assumed Specific Gravity= 2.65

Remarks:

PLATE B-11

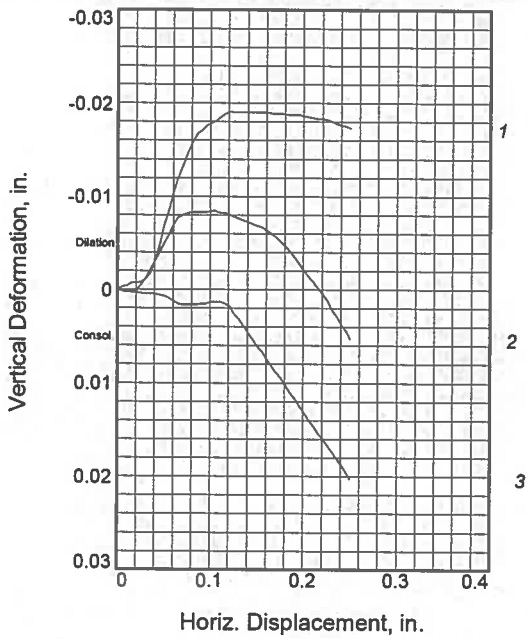
Client: Western Realco

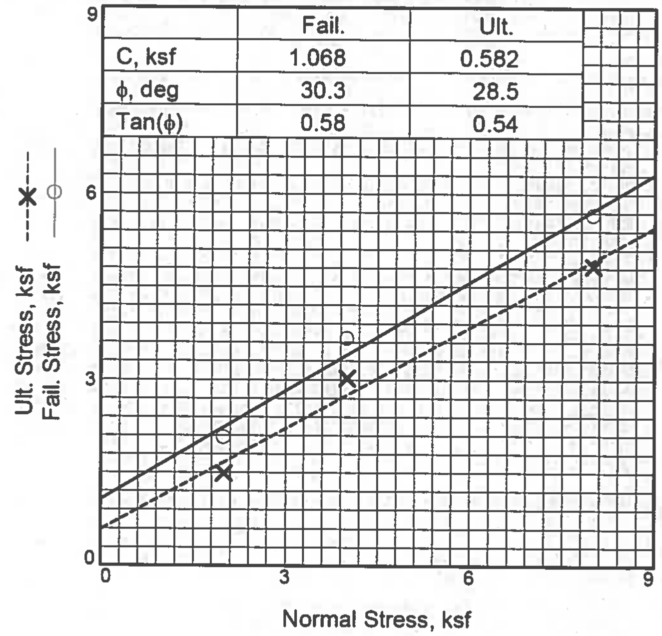
Project: Green Valley Ranch

Source of Sample: B-2 **Depth:** 30

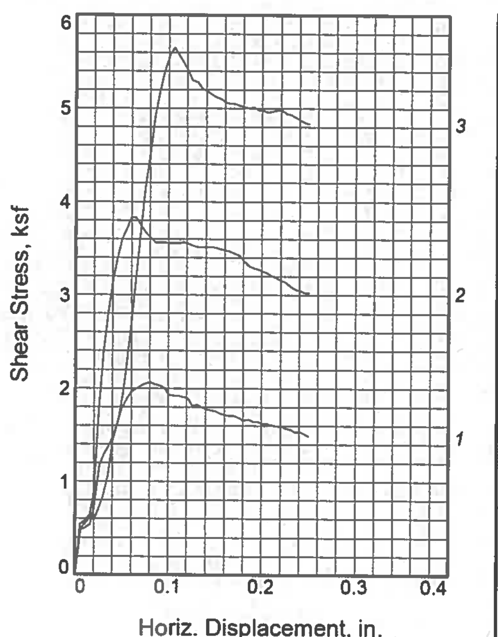
Proj. No.: 19-286 **Date Sampled:** 7-23-19

PETRA GEOSCIENCES INC





	Fail.	Ult.
C, ksf	1.068	0.582
ϕ, deg	30.3	28.5
Tan(ϕ)	0.58	0.54



	Sample No.	1	2	3
Initial	Water Content, %	9.4	9.4	9.4
	Dry Density, pcf	117.2	121.5	119.2
	Saturation, %	60.5	68.8	64.2
	Void Ratio	0.4114	0.3620	0.3880
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	16.1	14.5	15.4
	Dry Density, pcf	117.2	121.5	119.2
	Saturation, %	104.0	106.5	105.0
	Void Ratio	0.4114	0.3620	0.3880
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
	Normal Stress, ksf	2.000	4.000	8.000
	Fail. Stress, ksf	2.064	3.660	5.652
	Displacement, in.	0.081	0.076	0.106
	Ult. Stress, ksf	1.488	3.024	4.836
	Displacement, in.	0.250	0.250	0.250
	Strain rate, in./min.	0.005	0.005	0.005

Sample Type: Undisturbed

Description: Very dark gray, Clay with fine Sand and Silt

Assumed Specific Gravity= 2.65

Remarks:

PLATE B-12

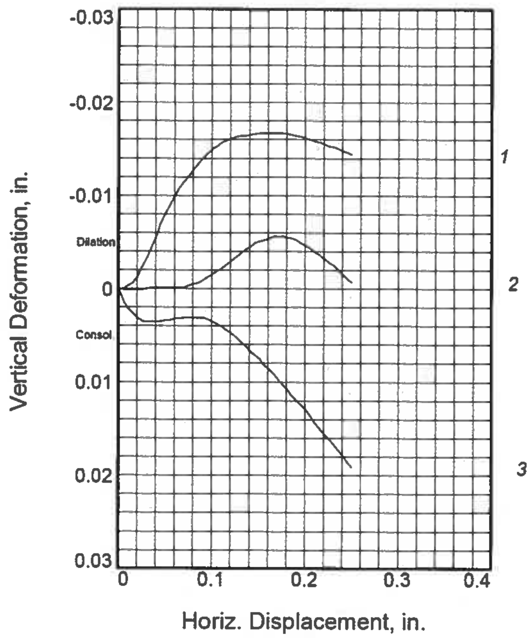
Client: Western Realco

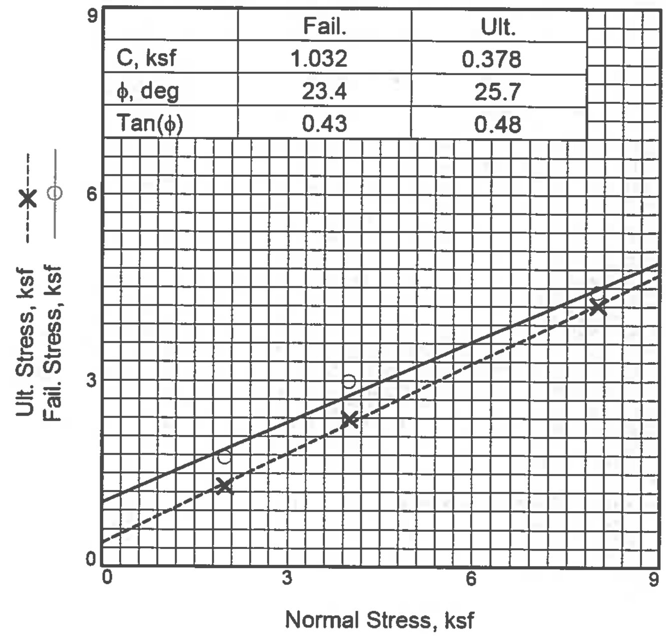
Project: Green Valley Ranch

Source of Sample: B-2 **Depth:** 65

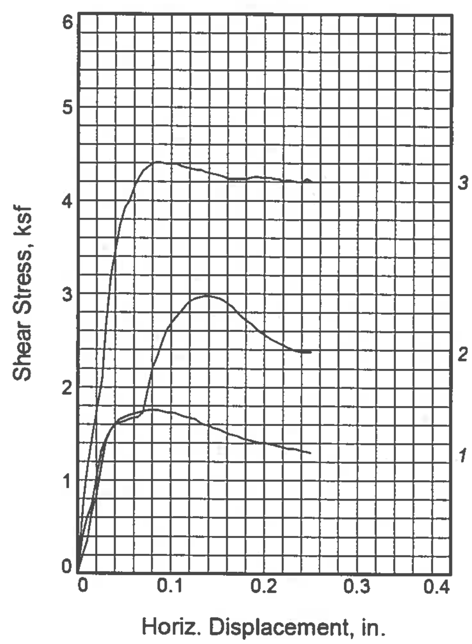
Proj. No.: 19-286 **Date Sampled:** 7-23-19

PETRA GEOSCIENCES INC.





	Fail.	Ult.
C, ksf	1.032	0.378
ϕ, deg	23.4	25.7
Tan(ϕ)	0.43	0.48



	Sample No.	1	2	3
Initial	Water Content, %	11.6	11.6	11.6
	Dry Density, pcf	122.8	121.5	124.1
	Saturation, %	88.3	84.7	92.0
	Void Ratio	0.3468	0.3617	0.3331
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	13.1	13.5	12.4
	Dry Density, pcf	122.8	121.5	124.1
	Saturation, %	99.8	98.6	98.6
	Void Ratio	0.3468	0.3617	0.3331
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
	Normal Stress, ksf	2.000	4.000	8.000
	Fail. Stress, ksf	1.752	2.976	4.416
	Displacement, in.	0.086	0.136	0.086
	Ult. Stress, ksf	1.296	2.376	4.212
	Displacement, in.	0.250	0.250	0.250
	Strain rate, in./min.	0.005	0.005	0.005

Sample Type: Undisturbed
Description: Gray, Silty fine Sand

Assumed Specific Gravity= 2.65
Remarks:

Client: Western Realco

Project: Green Valley Ranch

Source of Sample: B-2 **Depth:** 70

Proj. No.: 19-286 **Date Sampled:**

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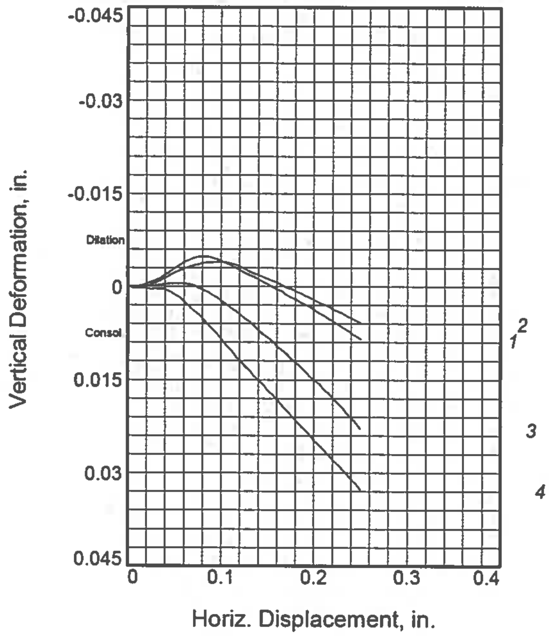
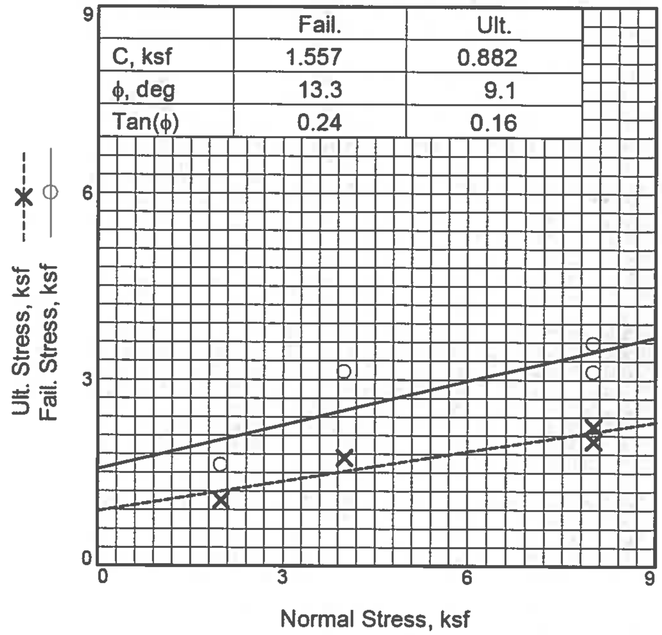
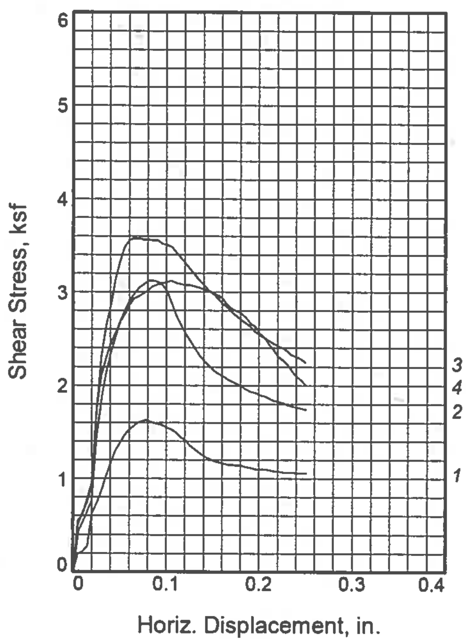
PLATE B-13





	Fail.	Ult.
C, ksf	1.557	0.882
ϕ, deg	13.3	9.1
Tan(ϕ)	0.24	0.16



	Sample No.	1	2	3	4
Initial	Water Content, %	6.1	6.1	6.1	6.1
	Dry Density, pcf	112.9	113.1	117.1	117.1
	Saturation, %	34.7	34.9	39.1	39.1
	Void Ratio	0.4657	0.4627	0.4128	0.4128
	Diameter, in.	2.416	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000	1.000
At Test	Water Content, %	32.2	34.6	25.0	25.0
	Dry Density, pcf	112.9	113.1	117.1	117.1
	Saturation, %	183.1	198.2	160.2	160.2
	Void Ratio	0.4657	0.4627	0.4128	0.4128
	Diameter, in.	2.416	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000	1.000
Normal Stress, ksf		2.000	4.000	8.000	8.000
Fail. Stress, ksf		1.620	3.120	3.576	3.120
Displacement, in.		0.076	0.081	0.065	0.105
Ult. Stress, ksf		1.056	1.740	2.244	2.004
Displacement, in.		0.251	0.251	0.250	0.250
Strain rate, in./min.		0.005	0.005	0.005	0.005

Sample Type: Undisturbed
Description: Brown, Clay with fine Sand and Caliche

Assumed Specific Gravity= 02.65
Remarks:

PLATE B-14

Client: Western Realco

Project: Green Valley Ranch

Source of Sample: B-3 **Depth:** 50

Proj. No.: 19-286 **Date Sampled:** 8-20-19

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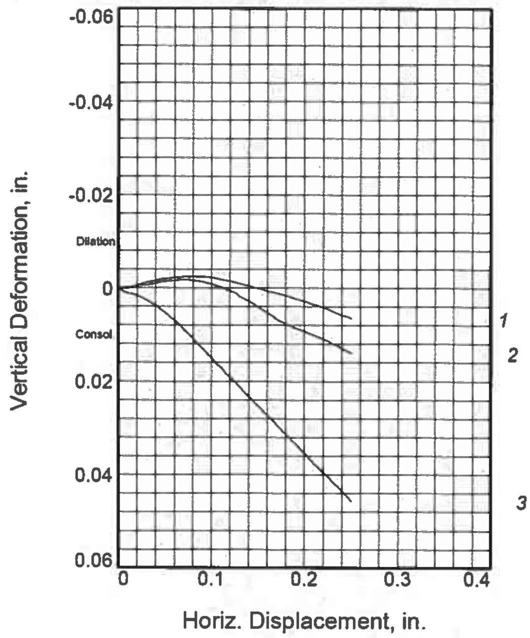
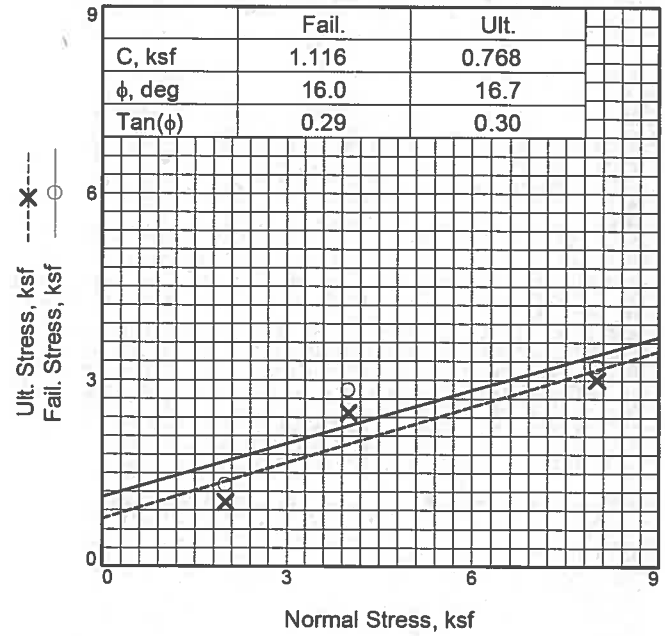
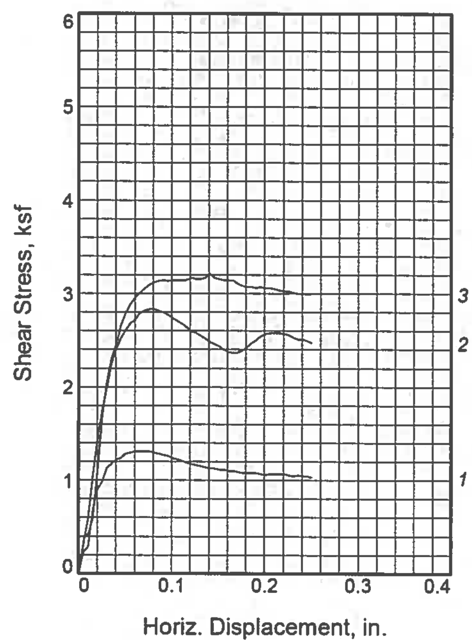




	Fail.	Ult.
C, ksf	1.116	0.768
ϕ, deg	16.0	16.7
Tan(ϕ)	0.29	0.30



	Sample No.	1	2	3
Initial	Water Content, %	15.9	15.9	15.9
	Dry Density, pcf	108.7	112.7	111.0
	Saturation, %	80.8	90.2	86.0
	Void Ratio	0.5225	0.4683	0.4910
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	20.8	18.3	18.6
	Dry Density, pcf	108.7	112.7	111.0
	Saturation, %	105.4	103.8	100.2
	Void Ratio	0.5225	0.4683	0.4910
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
	Normal Stress, ksf	2.000	4.000	8.000
	Fail. Stress, ksf	1.308	2.832	3.216
	Displacement, in.	0.060	0.076	0.141
	Ult. Stress, ksf	1.032	2.472	3.000
	Displacement, in.	0.250	0.250	0.250
	Strain rate, in./min.	0.005	0.005	0.005

Sample Type: Undisturbed
Description:

Assumed Specific Gravity= 2.65
Remarks:

PLATE B-15

Client: Western Realco

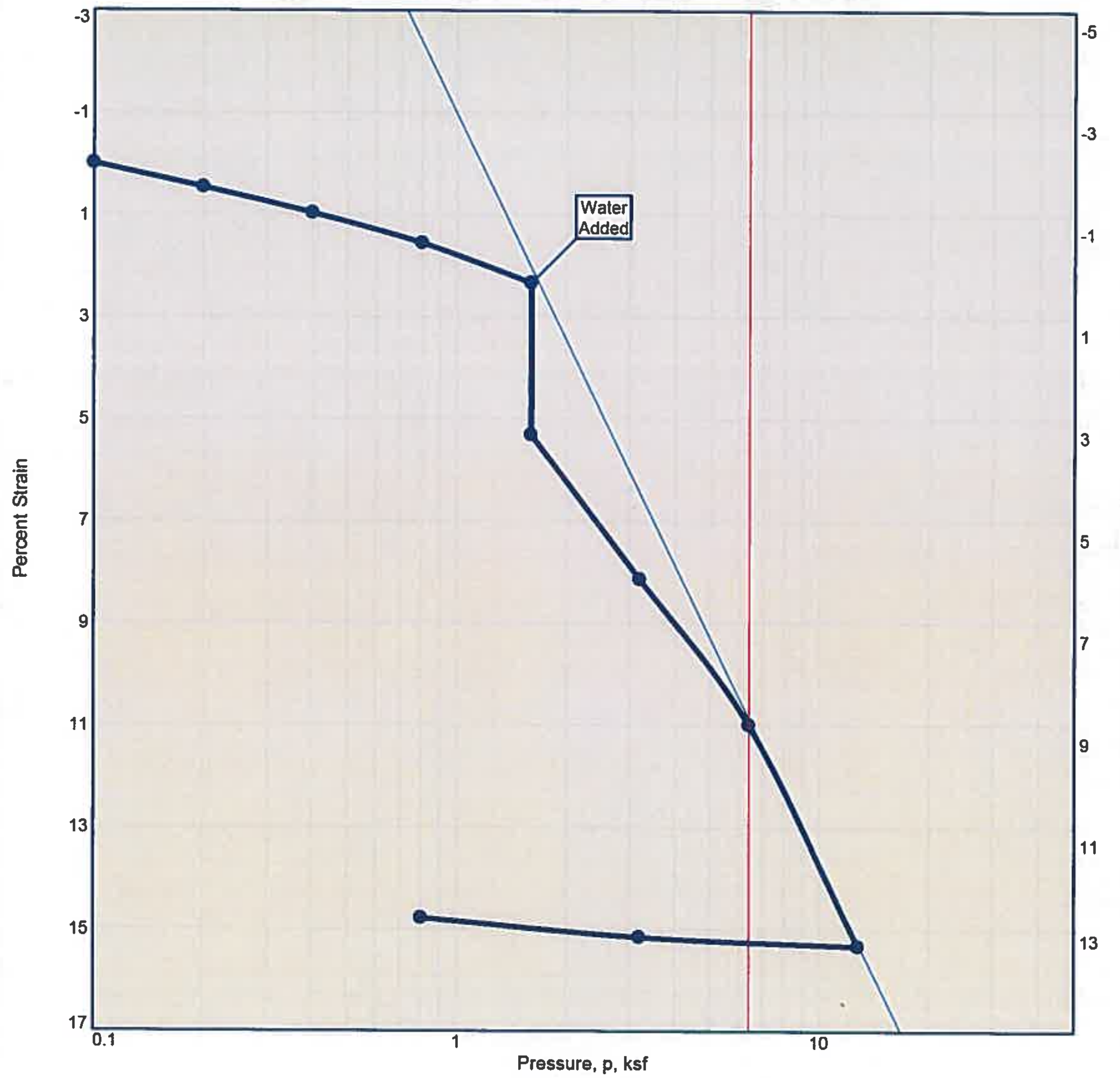
Project: Green Valley Ranch

Source of Sample: B-3 **Depth:** 56

Proj. No.: 19-286 **Date Sampled:**

PETRA GEOSCIENCES INC

CONSOLIDATION TEST REPORT



SUMMARY OF TEST RESULTS

	DRY DENSITY (pcf)	MOISTURE CONTENT, (%)	SATURATION (%)	VOID RATIO	SPECIFIC GRAVITY	OVERBURDEN (ksf)	P_C (ksf)	C_C	SWELL PRESS. (ksf)
INITIAL	107.8	5.5	27.2	0.535	2.65	.9	6.6	0.23	
FINAL		13.8	100.0	0.308					

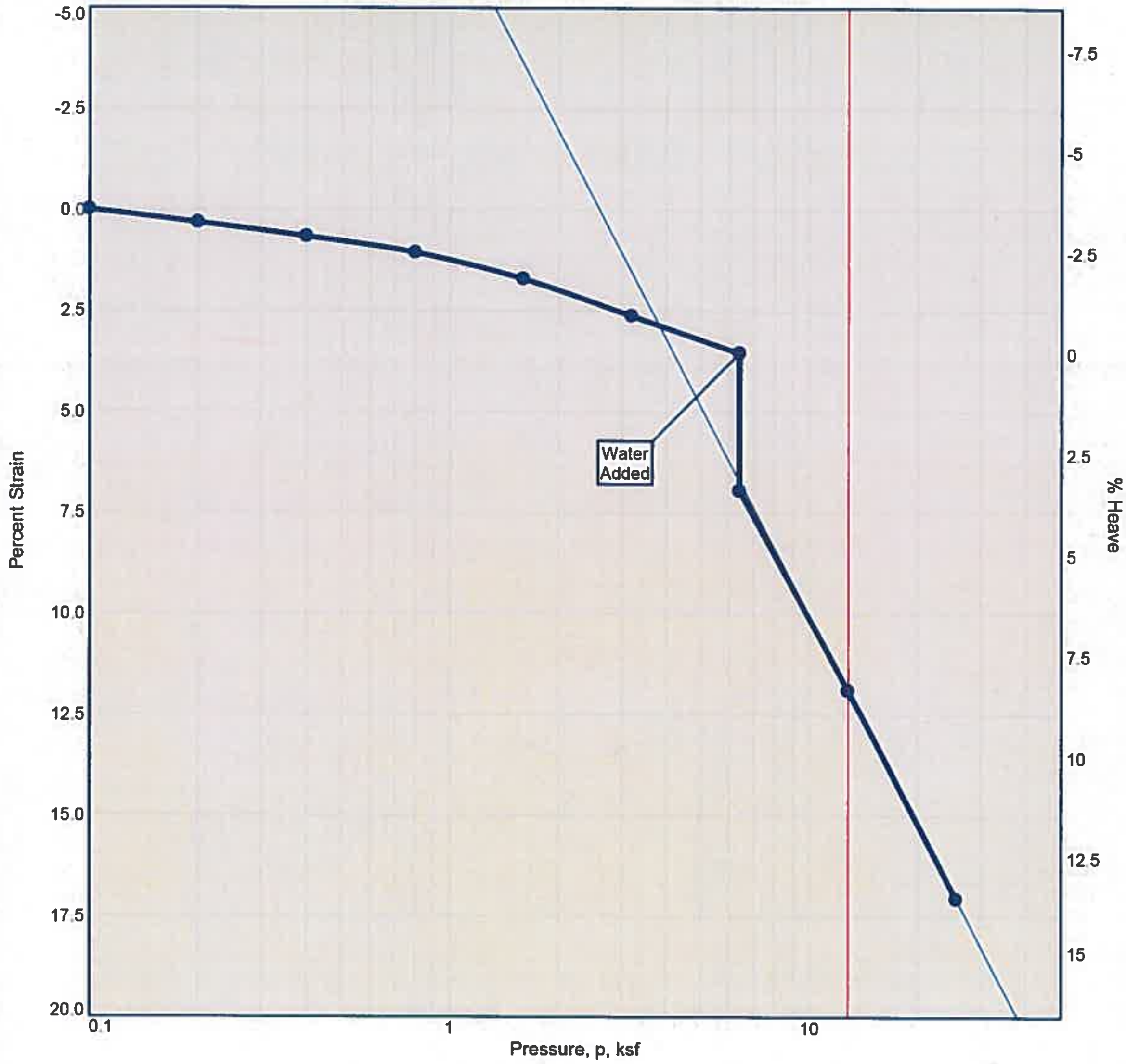
Source of Sample: TP-4 **Depth:** 8
Material Description: Brown, Silty fine to coarse Sand **USCS:** SM **AASHTO:**
Remarks:

Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

PETRA GEOSCIENCES INC

Client: Western Realco
Project: Green Valley Ranch
Project No.: 19-286 **PLATE** B-16

COLLAPSE TEST REPORT



SUMMARY OF TEST RESULTS

	DRY DENSITY (pcf)	MOISTURE CONTENT, (%)	SATURATION (%)	VOID RATIO	SPECIFIC GRAVITY	OVERBURDEN (ksf)	P_C (ksf)	C_C	SWELL PRESS. (ksf)
INITIAL	95.2	3.5	12.4	0.737	2.65	.99	12.9	0.30	
FINAL		17.5	100.0	0.441					

Source of Sample: TP-7 **Depth:** 10
Material Description: Brown, Silty fine to medium Sand **USCS:** SM **AASHTO:**
Remarks:

Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

PETRA GEOSCIENCES

Client: Western Realco
Project: Green Valley Ranch
Project No.: 19-286 **PLATE** B-17

APPENDIX C

BORING LOGS AND LABORATORY TEST RESULTS (NEBLETT & ASSOCIATES, 1999)

GEOTECHNICAL BORING LOG

PROJECT NO.	206	PROJECT NAME	Regent Homes
DATE STARTED	12/8/98	GROUND ELEV.	514
DATE FINISHED	12/8/98	GW DEPTH (FT)	
DRILLER	A&W DRILLING	DRIVE WT.	140 lb.
TYPE OF DRILL RIG	ROTARY WASH	DROP	30 in.
BORING DESIG.	RW-1	LOGGED BY	CAG
NOTE			

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	Other Tests
						Alluvium (Qal):				
		R	12		SM	0-2' silty sand, dark yellowish brown (10YR, 3/4), moist, dense, occasional pebble. @2' silty sand, dark yellowish brown (10YR, 3/4), moist, dense, occasional pebble.	13.8	97.1	52	
5	509	R	15			@5' silty sand, dark yellowish brown (10YR, 3/4), moist, dense, occasional pebble.	12.7	95.2	45	
10	504	R	16			@10' silty sand, dark yellowish brown (10YR, 4/4), moist, dense, fine grained.	13.4	94.8	48	
15	499	R	17			@15' silty sand, dark yellowish brown (10YR, 4/4), moist, dense, fine grained.	21.4	82.4	56	
20	494	R	20			@20' silty sand, yellowish brown (10YR, 5/6), moist, dense, fine grained, trace of clay.	22.0	86.3	64	
25	489	R	37			@25' silty sand, yellowish brown (10YR, 5/6), moist, dense, fine grained, trace of clay.	13.7	96.6	51	
30	484	R	39			@30' silty sand, dark yellowish brown (10YR, 4/6), moist, dense, moderately graded, scattered pebbles and gravels, trace of clay.	13.2	100.8	54	
35	479	R	100		GP	@35' cobbles, dark yellowish brown (10YR, 4/6), moist, dense, subangular to subrounded, trace of clay.	19.6	93.8	68	
40	474	R	40		CL	@40' silty clay, dark yellowish brown (10YR, 4/4), moist, stiff, medium plasticity, occasional organic stringer (to 10 mm).	12.4	101.9	53	
45	469									
50	464	R	100		SM	@50' silty sand with clay, dark yellowish brown (10YR, 4/4), moist, dense, scattered organic stains, fine grained.	13.8	103.0	60	
55	459									

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
GS - Grain Size Analysis
EI - Expansion Index
CONS - Consolidation

NEBLETT & ASSOCIATES, INC.
4911 WARNER AVENUE, SUITE 218
HUNTINGTON BEACH, CA 92649 714-840-8286

PLATE B-1

GEOTECHNICAL BORING LOG

PROJECT NO.	206	PROJECT NAME	Regent Homes		
DATE STARTED	12/8/98	GROUND ELEV.	514	BORING DESIG.	RW-1
DATE FINISHED	12/8/98	GW DEPTH (FT)		LOGGED BY	CAG
DRILLER	A&W DRILLING	DRIVE WT.	140 lb.	NOTE	
TYPE OF DRILL RIG	ROTARY WASH	DROP	30 in.		

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	Other Tests
		R	80			**Bedrock: Silverado Fm. (Ts)** @60' siltstone, dark yellowish brown (10YR, 4/4), slightly moist, dense, moderately laminated.	11.7	113.9	68	
65	449	R	80/6"			@66' sandstone, light yellowish brown (2.5Y, 6/4), hard, very dense, mica fragments (muscovite?) throughout.				
						Total Depth 66 feet. No groundwater encountered.				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
GS - Grain Size Analysis
EI - Expansion Index
CONS - Consolidation

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HUNTINGTON BEACH, CA 92649 714-840-8286

GEOTECHNICAL BORING LOG

PROJECT NO.	206	PROJECT NAME	Regent Homes
DATE STARTED	12/8/98	GROUND ELEV.	524
DATE FINISHED	12/8/98	GW DEPTH (FT)	
DRILLER	A&W DRILLING	DRIVE WT.	140 lb.
TYPE OF DRILL RIG	ROTARY WASH	DROP	30 in.

BORING DESIG. RW-2
LOGGED BY CAG
NOTE

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	Other Tests
		R	6		SM	**Alluvium (Qal):** 0-2' silty sand, dark brown (10YR, 3/3), moist, moderately dense, occasional gravel. @2' silty sand, dark brown (10YR, 3/3), moist, moderately dense, occasional gravel.	14.0	91.1	45	
5	519	R	5			@5' silty sand, dark brown (10YR, 3/3), moist, moderately dense, occasional gravel.	13.1	98.2	51	
10	514	R	15			@10' silty sand, dark yellowish brown (10YR, 4/4), moist, moderately dense, fine to coarse grained.	11.5	104.4	52	
15	509	R	20			@15' silty sand, dark yellowish brown (10YR, 4/4), moist, moderately dense, fine grained.	12.4	100.2	50	
					GP	@18' cobble layer.				
20	504	R	60			@20' Sample refusal (rock in shoe).				
25	499	R	60			@25' gravelly sand, yellowish brown (10YR, 5/6), slightly moist, dense, subangular.	11.2	101.9	48	
30	494	R	77		SM	@30' silty sand, dark yellowish brown (10YR, 4/6), slightly moist, dense, fine grained.	14.1	106.6	68	
					GP	@32' cobble layer.				
35	489	R	100/6"			@35' Sample refusal (rock in shoe)				
40	484	R	100/6"			@40' Sample refusal (rock in shoe).				
45	479	R	100/6"			@45' sandy gravel, yellowish brown (10YR, 5/6), moist, dense, subangular, matrix is fine to coarse grained.	14.1			
50	474									
55	469	R	100		SM	@55' silty sand, yellowish brown (10YR, 5/6), moist, dense, occasional gravel, fine to coarse grained.	15.4	92.2	51	

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
GS - Grain Size Analysis
EI - Expansion Index
CONS - Consolidation

NEBLETT & ASSOCIATES, INC.
4911 WARNER AVENUE, SUITE 218
HUNTINGTON BEACH, CA 92649 714-840-8286

PLATE B-3

GEOTECHNICAL BORING LOG

PROJECT NO.	206	PROJECT NAME	Regent Homes		
DATE STARTED	12/8/98	GROUND ELEV.	524	BORING DESIG.	RW-2
DATE FINISHED	12/8/98	GW DEPTH (FT)		LOGGED BY	CAG
DRILLER	A&W DRILLING	DRIVE WT.	140 lb.	NOTE	
TYPE OF DRILL RIG	ROTARY WASH	DROP	30 in.		

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	Other Tests
65	459	R	100			@65' silty sand, yellowish brown (10YR, 5/6), moist, dense, occasional gravel, fine to coarse grained.	13.5	108.4	68	
70	454									
75	449	R	100/6"			@75' Sample refusal (bedrock?).				
						Bedrock: Silverado Fm. (Ts) sandstone, light greenish gray (2 for grey, 7/1), massive, slightly moist, hard, mica fragments (muscovite ?) throughout.	12.1			
						Total depth 77 feet. No groundwater encountered.				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
GS - Grain Size Analysis
EI - Expansion Index
CONS - Consolidation

NEBLETT & ASSOCIATES, INC.
4911 WARNER AVENUE, SUITE 218
HUNTINGTON BEACH, CA 92649 714-840-8286

GEOTECHNICAL BORING LOG

PROJECT NO. 206
DATE STARTED 12/9/98
DATE FINISHED 12/9/98
DRILLER A&W DRILLING
TYPE OF DRILL RIG ROTARY WASH

PROJECT NAME Regent Homes
GROUND ELEV. 548
GW DEPTH (FT)
DRIVE WT. 140 lb.
DROP 30 in.

BORING DESIG. RW-3
LOGGED BY CAG
NOTE

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	Other Tests
						Alluvium (Qal):				
		R	20		SM	0-2' silty sand with clay, brown (10YR, 4/3), slightly moist, dense, fine grained, numerous voids to 2 mm. @2' silty sand with clay, brown (10YR, 4/3), slightly moist, dense, fine grained, numerous voids to 2 mm.	9.0	100.3	37	
5	543	R	24			@5' silty sand with clay, brown (10YR, 4/3), slightly moist, dense, fine grained, numerous voids to 2 mm.	12.8	107.2	63	
10	538	R	26			@10' silty sand, strong brown (10YR, 4/6), moist, dense, fine grained, occasional voids to 2 mm.	13.9	97.7	53	
15	533	R	28			@15' silty sand, strong brown (10YR, 4/6), moist, dense, fine grained, occasional voids to 2 mm.	14.8	90.6	48	
20	528	R	36		GP	@20' gravelly sand, yellowish brown (10YR, 5/6), moist, dense, subangular, occasional organic stains.	13.3	100.5	54	
25	523	R	30		SM	@25' silty sand, strong brown (7.5YR, 4/6), moist, dense, fine grained.	14.0	101.7	59	
30	518	R	40			@30' silty sand, strong brown (7.5YR, 4/6), moist, dense, fine grained.	14.6	100.3	60	
35	513									
40	508	R	80			@40' silty sand with clay, strong brown (7.5YR, 4/6), moist, dense, fine to coarse grained, occasional subangular to subrounded gravel.	12.1	102.6	52	
45	503									
50	498	R	100			@50' silty sand with clay, strong brown (7.5YR, 4/6), dense, moist, fine grained.	11.3	107.5	56	
						Total depth 50 feet. No groundwater encountered.				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
GS - Grain Size Analysis
EI - Expansion Index
CONS - Consolidation

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GEOTECHNICAL BORING LOG

PROJECT NO. 206
DATE STARTED 12/9/98
DATE FINISHED 12/9/98
DRILLER A&W DRILLING
TYPE OF DRILL RIG ROTARY WASH

PROJECT NAME Regent Homes
GROUND ELEV. 572
GW DEPTH (FT)
DRIVE WT. 140 lb.
DROP 30 in.

BORING DESIG. RW-4
LOGGED BY CAG
NOTE

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	Other Tests
						Alluvium (Qal):				
		R	29		SM	0-2' silty sand with clay, light olive gray (2.5Y, 5/3), slightly moist, dense, subangular gravel (~5%). @2' silty sand with clay, light olive gray (2.5Y, 5/3), slightly moist, dense, subangular gravel (~5%).	14.4	99.8	58	
5	567	S	31			@5' silty sand, yellowish brown (10YR, 5/6), moist, dense. fine grained.				
10	562	R	21			@10' silty sand, yellowish brown (10YR, 5/6), moist, dense. fine grained.	13.5	110.7	73	
15	557	S	45			@15' silty sand, yellowish brown (10YR, 5/6), moist, dense. fine grained.				
20	552	R	42		GP	@20' silty sand, yellowish brown (10YR, 5/6), moist, dense. fine grained. @21' difficult drilling, cobble layer.	10.2	114.4	61	
25	547	R	90			@25' clayey sand with gravels, brown (10YR, 4/3), moist, dense, subangular, medium plasticity clay, approximately 70% matrix, 30% gravels. Total Depth 26 feet. No groundwater encountered.				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
GS - Grain Size Analysis
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GEOTECHNICAL BORING LOG

PROJECT NO. 206
DATE STARTED 12/9/98
DATE FINISHED 12/9/98
DRILLER A&W DRILLING
TYPE OF DRILL RIG ROTARY WASH

PROJECT NAME Regent Homes
GROUND ELEV. 543
GW DEPTH (FT)
DRIVE WT. 140 lb.
DROP 30 in.

BORING DESIG. RW-5
LOGGED BY CAG
NOTE

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	Other Tests
						Alluvium (Qal):				
		R	21		SM	0-2' silty sand with clay, dark brown (10YR, 3/3), slightly moist, dense, fine grained. @2' silty sand with clay, dark brown (10YR, 3/3), slightly moist, dense, fine grained.	9.4	101.3	39	
5	538	S	33			@5' silty sand with clay, dark brown (10YR, 3/3), slightly moist, dense, fine grained.				
10	533	R	23			@10' silty sand, yellowish brown (10YR, 5/6), moist, dense, occasional pebble.	8.9	111.1	48	
15	528	S	30			@15' silty sand, yellowish brown (10YR, 5/6), moist, dense, occasional pebble.				
						@18' difficult drilling, cobble layer.				
20	523	R	60		GP	@20' Sample refusal (cobble in shoe).				
25	518	S	40			@25' silty sand, yellowish brown (10YR, 5/6), moist, dense, occasional pebble.				
						Total Depth 26 feet. No groundwater encountered.				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
GS - Grain Size Analysis
EI - Expansion Index
CONS - Consolidation

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GEOTECHNICAL BORING LOG

PROJECT NO. 206
DATE STARTED 12/9/98
DATE FINISHED 12/9/98
DRILLER A&W DRILLING
TYPE OF DRILL RIG ROTARY WASH

PROJECT NAME Regent Homes
GROUND ELEV. 538
GW DEPTH (FT)
DRIVE WT. 140 lb.
DROP 30 in.

BORING DESIG. RW-6
LOGGED BY CAG
NOTE

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	Other Tests
		R	10		SM	**Alluvium (Qal):** 0-2' silty sand, yellowish brown (10YR, 5/4), slightly moist, dense, scattered voids (1-2mm). @2' silty sand, yellowish brown (10YR, 5/4), slightly moist, dense, scattered voids (1-2mm).	7.9	110.1	42	
5	533	R	20			@5' silty sand with gravel, light yellowish brown (10YR, 6/4), moist, dense, subangular to angular.	8.4	113.8	49	
10	528	R	14			@10' silty sand, yellowish brown (10YR, 5/6), moist, dense, fine grained.	13.3	110.8	71	
15	523	R	16			@15' silty sand, brown (7.5YR, 5/4), moist, dense, fine grained.	13.2	113.6	77	
20	518	R	21			@20' silty sand, strong brown (7.5YR, 5/6), moist, dense, fine grained.	14.0	114.9	84	
25	513	R	31			@25' silty sand, yellowish brown (10YR, 5/6), moist, dense, fine grained.	9.3	100.9	38	
						Total depth 26 feet. No groundwater encountered.				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
GS - Grain Size Analysis
EI - Expansion Index
CONS - Consolidation

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LOG OF EXPLORATORY TEST PITS

Test Pit T-1 **Date Excavated: 12-9-98**

Depth (feet)	Description
0 - 7.0	**Older Alluvium (Qoa):** Silty Sand, reddish brown, moist, medium dense to dense, fine- to coarse-grained, common pebbles and cobbles, cobble layers display approximate horizontal stratification.
	Total Depth 7.0 feet. No water, no caving, test pit backfilled.

Test Pit T-2 **Date Excavated: 12-9-98**

Depth (feet)	Description
0 - 1.0	**Soil:** Silty Sand, brown to dark brown, fine- to coarse-grained, loose to medium dense, common pebbles and cobbles, roots.
1.0 - 7.0	**Older Alluvium (Qoa):** Silty Sand, reddish brown, damp to moist, medium dense to dense, fine- to coarse-grained, common pebble and cobble beds and lenses, pebble and cobble beds display approximate horizontal stratification.
	Total Depth 7.0 feet. No water, no caving, test pit backfilled.

Test Pit T-3 **Date Excavated: 12-9-98**

Depth (feet)	Description
0 - 2.0	**Soil:** Silty Clay, dark brown, damp, loose, porous, roots.
2.0 - 6.0	**Older Alluvium (Qoa):** Silty to Clayey Sand, reddish brown, fine- to medium-grained, moist, medium dense to dense, abundant well rounded pebbles and cobbles, pebble and cobble layers display approximate horizontal stratification.
	Total Depth 6.0 feet. No water, no caving, test pit backfilled.

LOG OF EXPLORATORY TEST PITS (cont.)

Test Pit T-4 **Date Excavated: 12-9-98**

Depth (feet)	**Description**
0 - 7.0	**Artificial Fill (af):** Silty Sand, gray to reddish brown, loose, damp, horse bones and carcasses, malodorous.
7.0 - 12.0	**Alluvium (Qal):** Silty Sand, brown, fine- to coarse-grained, moist, loose pebbles and cobbles, pebble and cobble layers display approximate horizontal stratification.
	Total Depth 12.0 feet. No water, no caving, test pit backfilled.

Test Pit T-5 **Date Excavated: 12-9-98**

Depth (feet)	**Description**
0 - 0.5	**Soil:** Silty Sand, brown to dark brown, fine- to medium-grained, dry, loose, common pebbles and cobbles, roots.
0.5 - 8.0	**Older Alluvium (Qoa):** Clayey Sand, pale reddish brown, fine- to coarse-grained, damp to moist, medium dense to dense, moderately hard, abundant well rounded pebbles and cobbles, occasional boulders to 1 foot diameter, pebble and cobble layers display approximate horizontal stratification.
	Bulk Sample obtained at 6 feet.
	Total Depth 8.0 feet. No water, no caving, test pit backfilled.

Test Pit T-6 **Date Excavated: 12-9-98**

Depth (feet)	**Description**
0 - 0.5	**Soil:** Silty to Clayey Sand, dark reddish brown, fine- to medium-grained, dry, loose, porous, common pebbles and cobbles, roots.
0.5 - 6.0	**Older Alluvium (Qoa):** Silty Sand, reddish brown, fine- to coarse-grained, damp to moist, medium dense to dense, moderately hard, abundant well rounded pebbles and cobbles, pebble and cobble layers display approximate horizontal stratification.
	Total Depth 6.0 feet. No water, no caving, test pit backfilled.

LOG OF EXPLORATORY TEST PITS (cont.)

Test Pit T-7 **Date Excavated: 12-9-98**

Depth (feet) **Description**

0 - 1.0 **Soil:** Clayey Sand, dark brown, fine- to medium-grained, damp to moist, loose, porous, roots.

1.0 - 8.0 **Alluvium (Qal):** Silty Sand, brown, medium- to coarse-grained, moist, loose, abundant pebble and cobble beds and lenses.

8.0 – 15.0 **Alluvium (Qal):** Silty Sand, reddish brown, fine- to coarse grained, moist, loose to medium dense, common pebbles and cobbles, occasional boulders to 1.5 feet diameter.

Total Depth 15.0 feet. No water, no caving, test pit backfilled.

Test Pit T-8 **Date Excavated: 12-9-98**

Depth (feet) **Description**

0 – 3.0 **Soil:** Silty Sand, dark brown, fine- to medium-grained, dry, loose, porous, common pebbles and cobbles, roots.

3.0 - 8.0 **Older Alluvium (Qoa):** Clayey Sand, reddish brown, fine- to medium-grained, moist, medium dense, common well rounded pebbles and cobbles, pebble and cobble layers display approximate horizontal stratification.

Total Depth 8.0 feet. No water, no caving, test pit backfilled.

LOG OF EXPLORATORY TEST PITS (cont.)

Test Pit T-9 **Date Excavated: 12-9-98**

Depth (feet)	Description
0 – 3.0	**Alluvium (Qal):** Silty Sand, grey brown, fine- to medium-grained, dry, loose, porous, roots, common pebbles and cobbles.
3.0 - 7.0	**Alluvium (Qal):** Silty Sand, reddish brown, fine- to coarse-grained, moist, loose, abundant pebbles and cobbles.
7.0 – 12.0	**Alluvium (Qal):** Clayey Sand, reddish brown, fine- to medium-grained, moist, loose, porous, abundant pebbles and cobbles.
12.0 – 16.0	**Weathered Bedrock:** Silty Pebbly Sandstone, light grey, medium- to coarse-grained, moist, loose, porous, increase in density and hardness with depth.

Bulk sample obtained at 16 feet.

Total Depth 16.0 feet. No water, no caving, test pit backfilled.

Test Pit T-10 **Date Excavated: 12-9-98**

Depth (feet)	Description
0 – 3.0	**Alluvium (Qal):** Clayey Sand, reddish brown, fine- to coarse-grained, dry to damp, loose, porous, roots, abundant pebbles and cobbles.
3.0 - 8.0	**Alluvium (Qal):** Clayey Sand, reddish brown, fine- to very coarse-grained, moist, loose, abundant rounded pebbles and cobbles.
8.0 – 15.0	**Alluvium (Qal):** Clayey Sand, reddish brown, coarse- to very coarse -grained, very moist to wet, loose to medium dense, abundant rounded pebbles and cobbles, common boulders to 1.5 feet diameter, increase in moisture with depth.
15.0 – 16.0	**Weathered Bedrock:** Silty Sandstone, light grey, fine- to coarse-grained, moist, medium dense, common pebbles and cobbles.

Total Depth 16.0 feet. No water, no caving, test pit backfilled.

LOG OF EXPLORATORY TEST PITS (cont.)

Test Pit T-11 **Date Excavated: 12-9-98**

Depth (feet)	**Description**
0 – 1.0	**Soil:** Silty to Clayey Sand, dark reddish brown, fine-grained, dry, loose, porous, roots.
1.0 - 8.0	**Older Alluvium (Qoa):** Clayey Sand, reddish brown, fine-grained, damp to moist, loose to medium dense, medium hard, porous, roots, common well rounded pebbles, moisture increases with depth.
	Total Depth 8.0 feet. No water, no caving, test pit backfilled.

Test Pit T-12 **Date Excavated: 12-9-98**

Depth (feet)	**Description**
0 – 2.0	**Soil:** Silty Sand, grey brown, fine-grained, dry to damp, loose, porous, roots, occasional pebbles.
2.0 - 10.0	**Alluvium (Qal):** Silty Sand, reddish brown, fine- to medium-grained, moist, loose, porous, roots, occasional pebbles and cobbles.
10.0 – 15.0	**Alluvium (Qal):** Silty Sand, reddish brown, fine- to medium-grained, moist, loose to medium dense, occasional pebbles and cobbles.
	Bulk sample obtained at 15 feet.
	Total Depth 15.0 feet. No water, no caving, test pit backfilled.

LABORATORY INVESTIGATION

The samples obtained from exploratory rotary wash borings and test pits during the field investigation were transported to the laboratory for testing and analysis. The laboratory testing program included maximum density/optimum moisture determination, in-situ moisture density determination, grain size analysis, expansion index, sulfate content, remolded and undisturbed direct shear and consolidation testing. The in-situ moisture/density tests are provided on the exploratory boring logs (Appendix B). The results of the other tests are presented in the following pages. The laboratory testing program consisted of the following:

- **Maximum Density/Optimum Moisture:** Maximum density/optimum moisture test were conducted on bulk samples obtained from Test Pits T-5, T-9 and T-12. The materials tested include alluvium, older alluvium and Santiago Formation bedrock. The tests were conducted in accordance with ASTM D-1557. The results of the tests are provided in Table C.

- **Sulfate Content**: Results of sulfate testing indicates negligible sulfate exposure. Sulfate testing should be performed at the completion of grading to confirm the results presented herein. Concrete mix design should conform to the recommendations presented in 1994 UBC Table No. 19-A-3. Results of Sulfate testing are provided in Table C.

- **Expansion Index:** Laboratory tests performed on samples collected during Phase I grading indicate that the existing site soils exhibit "very low" expansion potential, as described in 1994 UBC Table 18-I-B. Samples should be collected at the completion of grading and tested to verify expansion potential. Results of Expansion Index testing are provided in Table C.

- **Moisture/Density:** Selected relatively "undisturbed" samples were tested to determine in situ moisture and density relationships. Results are presented on the Logs of Exploratory Borings (Appendix B).

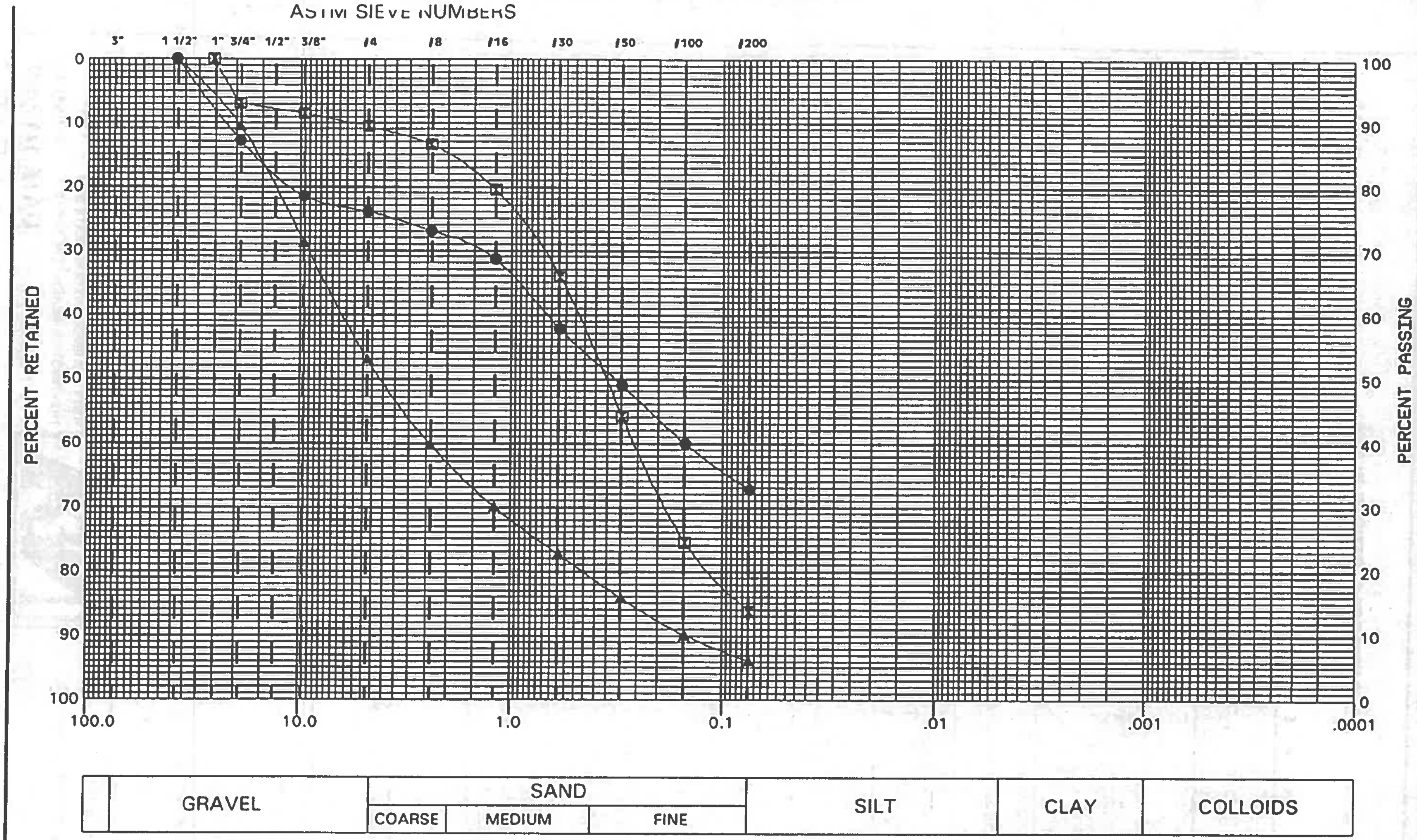
- **Grain Size Analyses:** Grain size sieve analyses were conducted on bulk samples of older alluvium, bedrock and alluvium obtained from Test Pits T-5, T-9 and T-12. The results of the grain size analyses are provided in Plates C-1.

- **Consolidation:** Selected "undisturbed" samples were loaded to near their natural loads, water was added, and progressive loading was continued to a maximum of 4 and 6.4 KSF to simulate expected additional loading due to the proposed improvements. Loading was then reduced to determine rebound characteristics. Consolidation test results are presented graphically on Plates C-2 through C-7.

- **Direct Shear Testing:** Direct shear testing were conducted on representative undisturbed and remolded samples obtained from the exploratory borings and test pits. Undisturbed residual shear testing was conducted on Alluvium obtained from Boring RW-2 at 10 feet and RW-3 at 5 feet. Results of these shear tests are provided on Plate C-8. Residual direct shear testing was conducted on bedrock obtained from Boring RW-2 at 77 feet. The results of this test is provided on Plate C-9. Remolded direct shear testing was conducted on bulk samples obtained from older alluvium, bedrock, and alluvium from Test Pits T-5, T-9 and T-12. The results of these tests are provided in Plate C-10.

TABLE C. RESULTS OF LABORATORY TESTING

Sample	Description	Maxiumum Dry Density/Optimum Moisture (ASTM D1557)	Expansion Index (UBC 18-2)	Sulfate Content (ppm)
T-5 @ 6 feet	**Older Alluvium (Qoa):** Orange tan silty sand	126.3 pcf @ 11%	0	12
T-9 @ 16 feet	**Santiago Fm (Tsa):** Light grey silty sand	132.9 pcf @ 7.5%	0	20
T-12 @ 15 feet	**Alluvium (Qal):** Tan silty sand	130.8 pcf @ 9.6%	12	16



symbol	boring or trench	depth (ft.)	L.L.	P.L.	sand equiv.	% passing #200 sieve	group symbol	typical names
●	T-12	15.00				32.8	SM	Alluvium (Qal)
⊠	T-5	6.00				14.0	GP	Older Alluvium (Qoa)
▲	T-9	16.00				6.2	SP	Bedrock (Tsa)

GRAIN SIZE DISTRIBUTION

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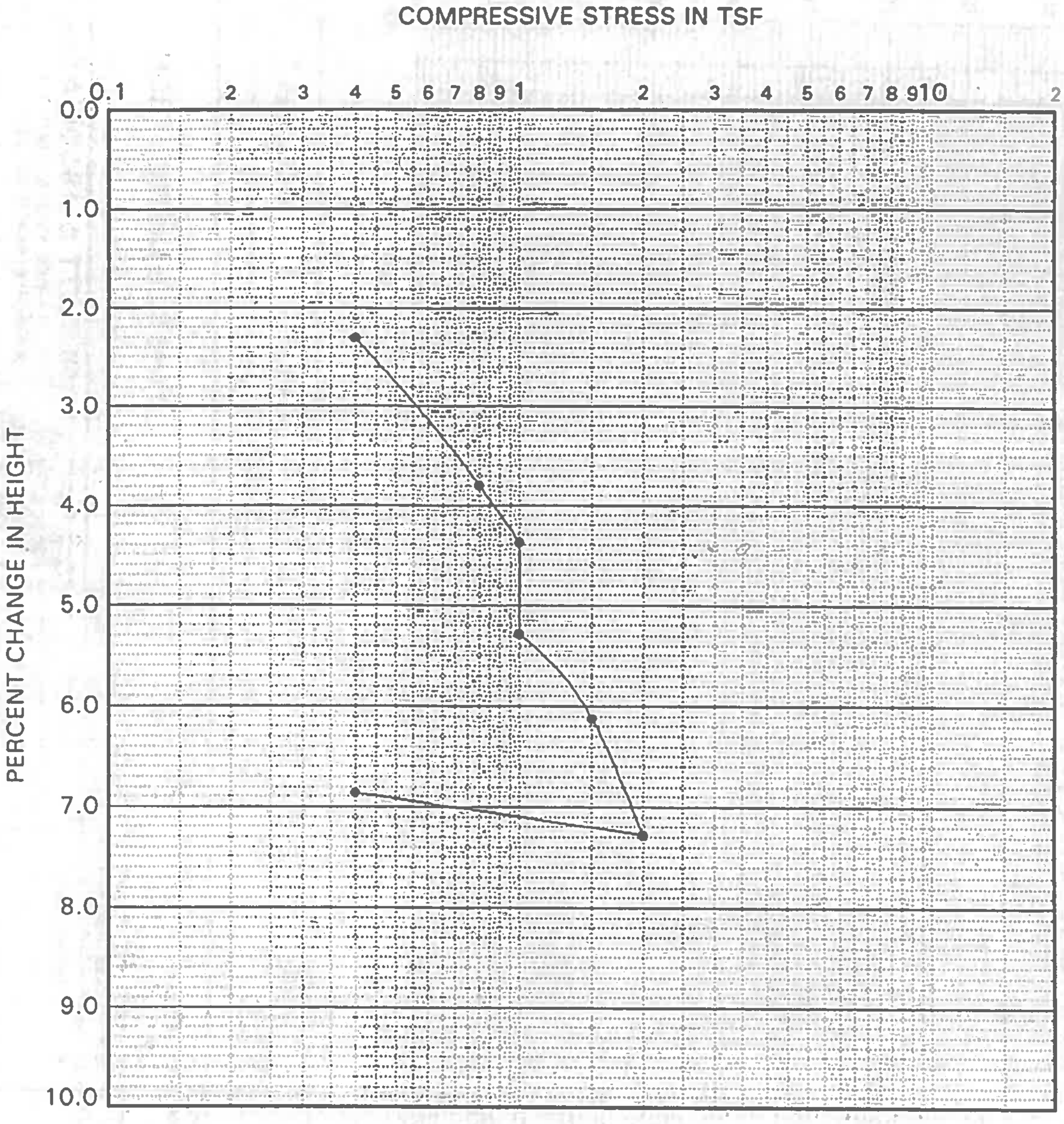
PLATE C-1



Boring	Depth(ft.)	Dry Density	in situ Moist.	-200 sieve	Group Symbol	Typical Names
RW-1	5.0	95.2	12.7			

WATER ADDED AT 1 TSF.

CONSOLIDATION CURVE

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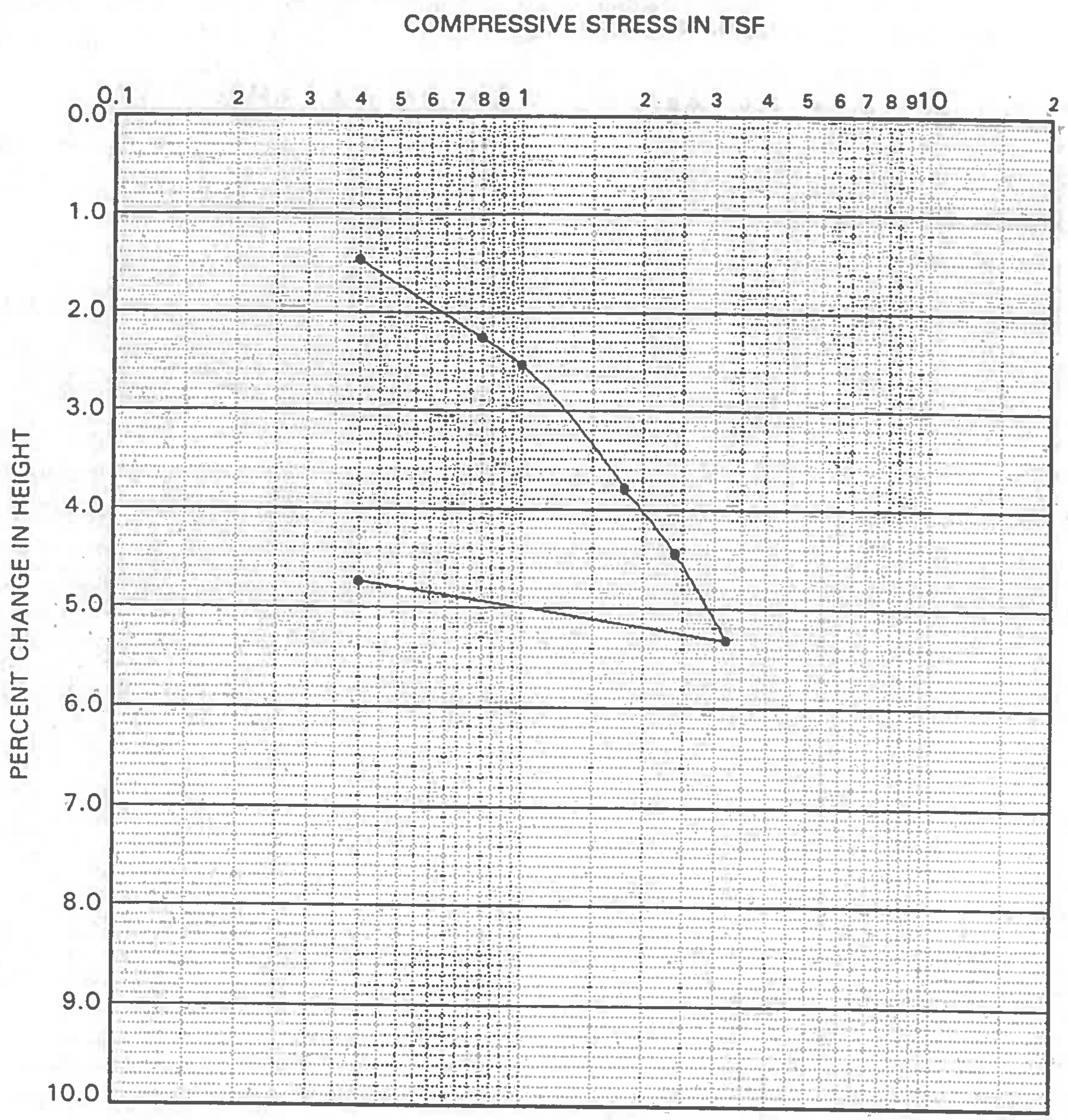
PLATE C-2



Boring	Depth(ft.)	Dry Density	in situ Moist.	-200 sieve	Group Symbol	Typical Names
RW-1	40.0	101.9	12.4			

WATER ADDED AT 1.8 TSF.

CONSOLIDATION CURVE

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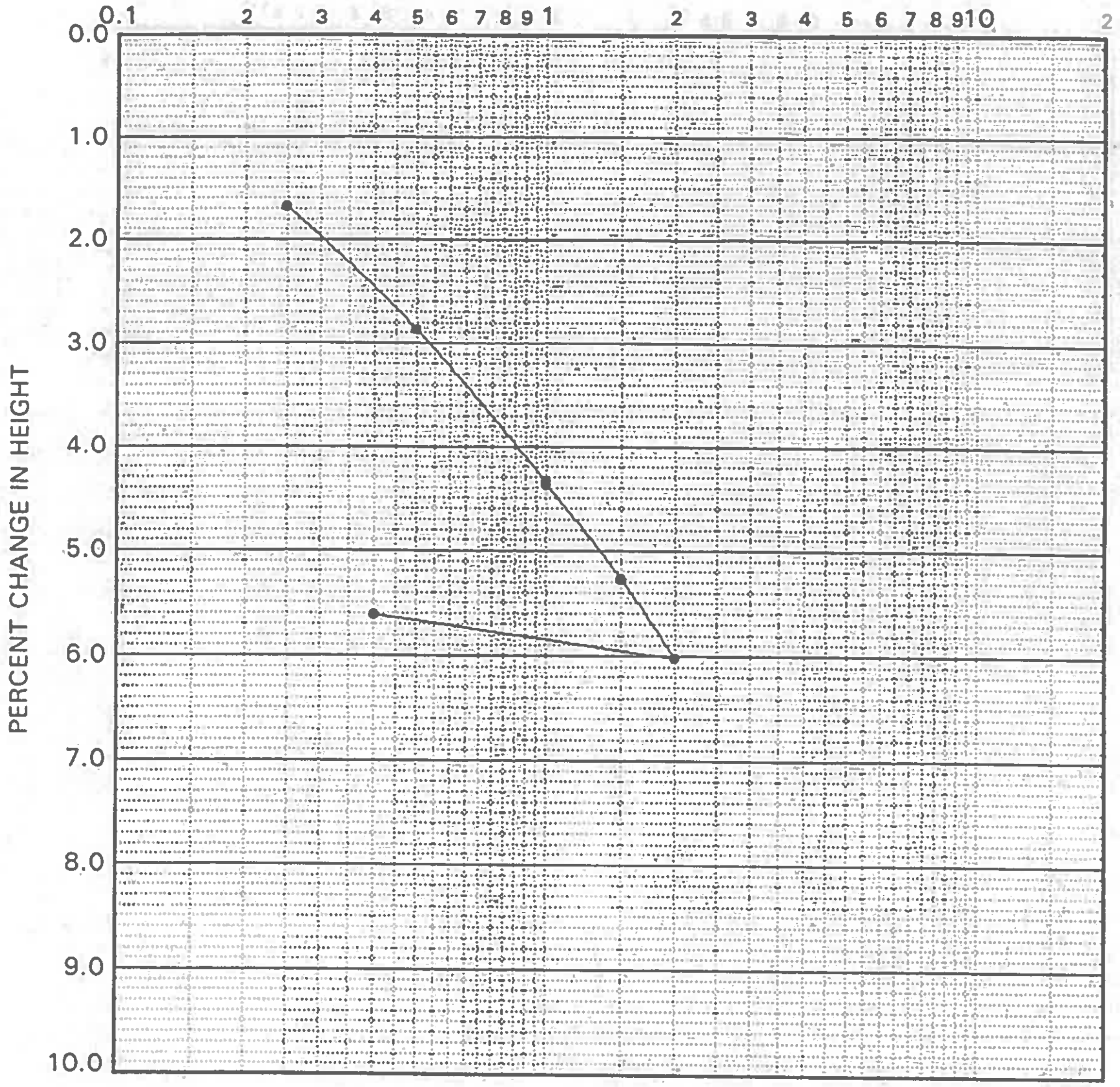
PLATE C-3



Boring	Depth(ft.)	Dry Density	in situ Moist.	-200 sieve	Group Symbol	Typical Names
RW-2	15.0	100.2	12.4			

WATER ADDED AT 1 TSF.

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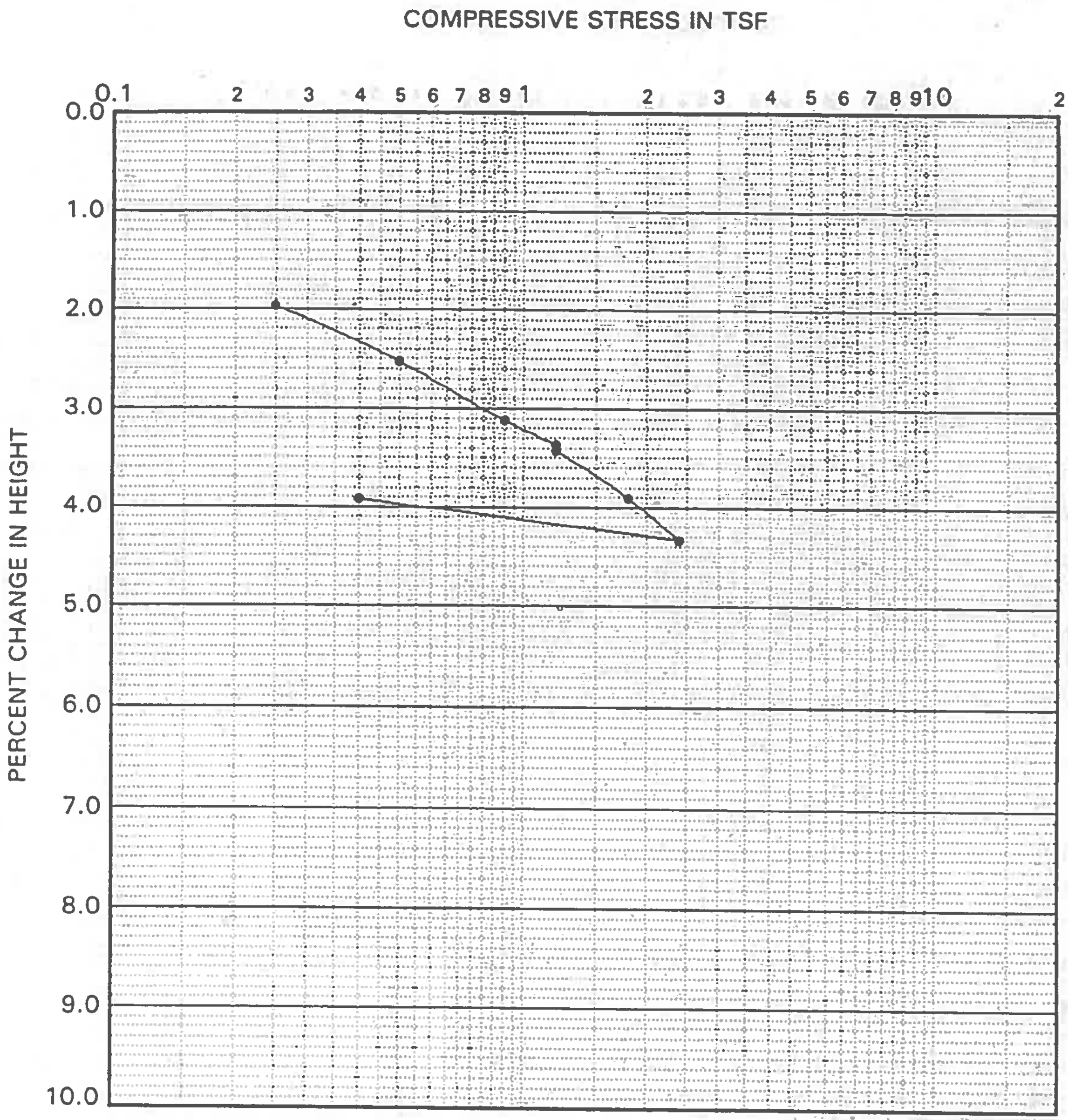
PLATE C-4



Boring	Depth(ft.)	Dry Density	in situ Moist.	-200 sieve	Group Symbol	Typical Names
RW-2	30.0	106.6	14.1			Alluvium (Qal)

WATER ADDED AT 1.2 TSF.

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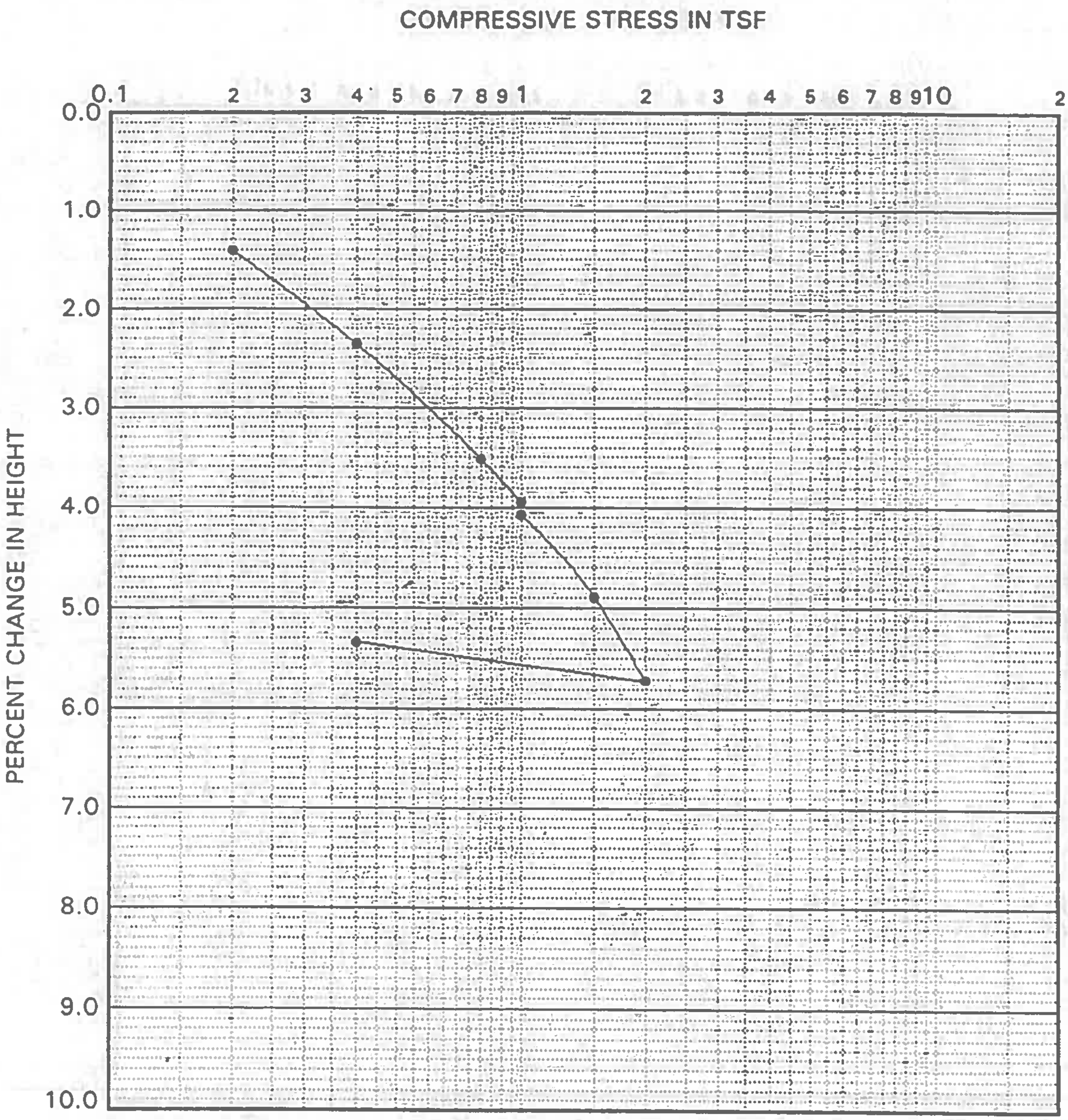
PLATE C-5



Boring	Depth(ft.)	Dry Density	in situ Moist.	-200 sieve	Group Symbol	Typical Names
RW-4	10.0	110.7	13.5			

WATER ADDED AT 1 TSF.

CONSOLIDATION CURVE

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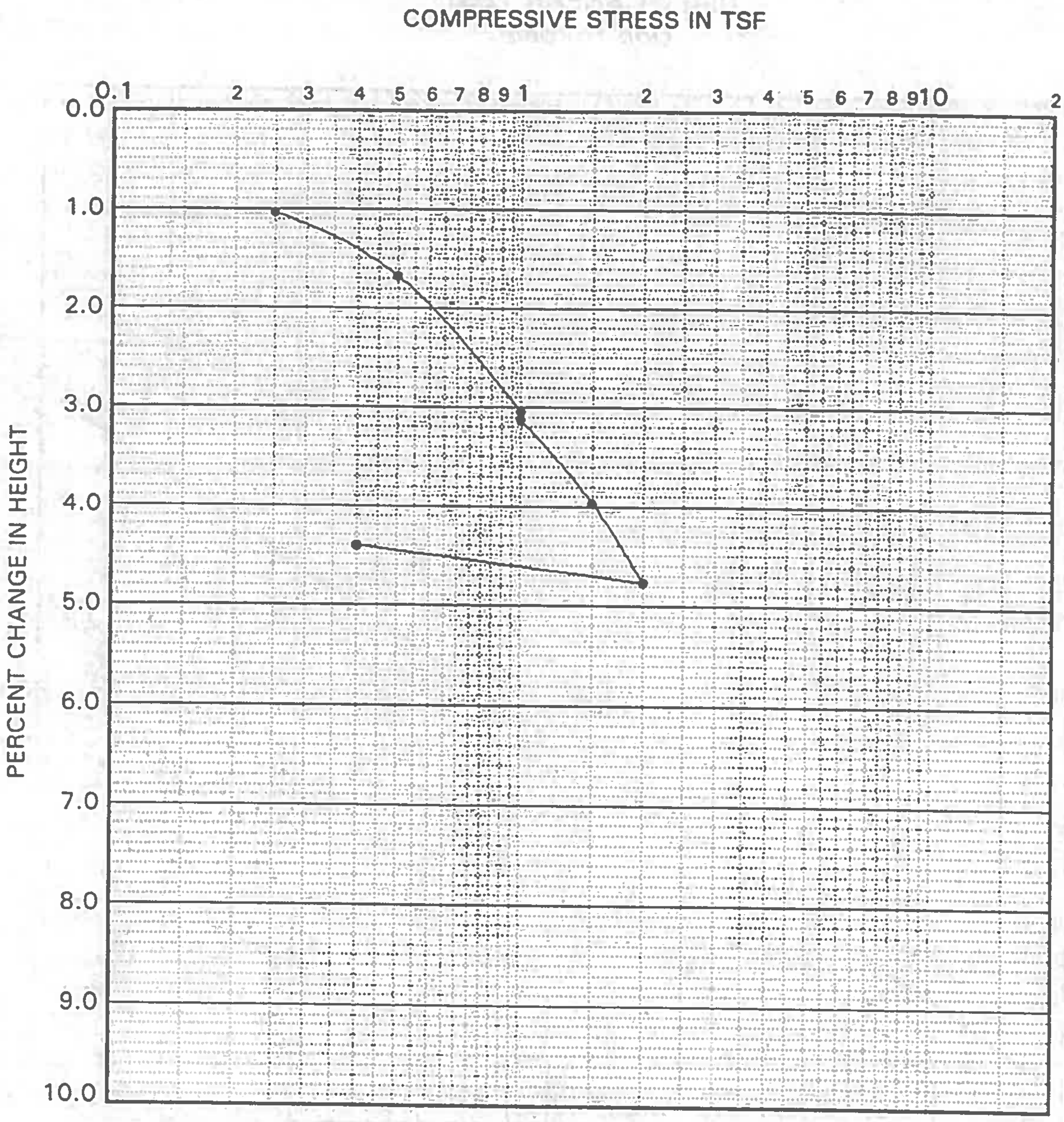
PN 206 DATE 1/12/99

PLATE C-6



Boring	Depth(ft.)	Dry Density	in situ Moist.	-200 sieve	Group Symbol	Typical Names
RW-6	10.0	110.8	13.3			

WATER ADDED AT 1 TSF.

CONSOLIDATION CURVE

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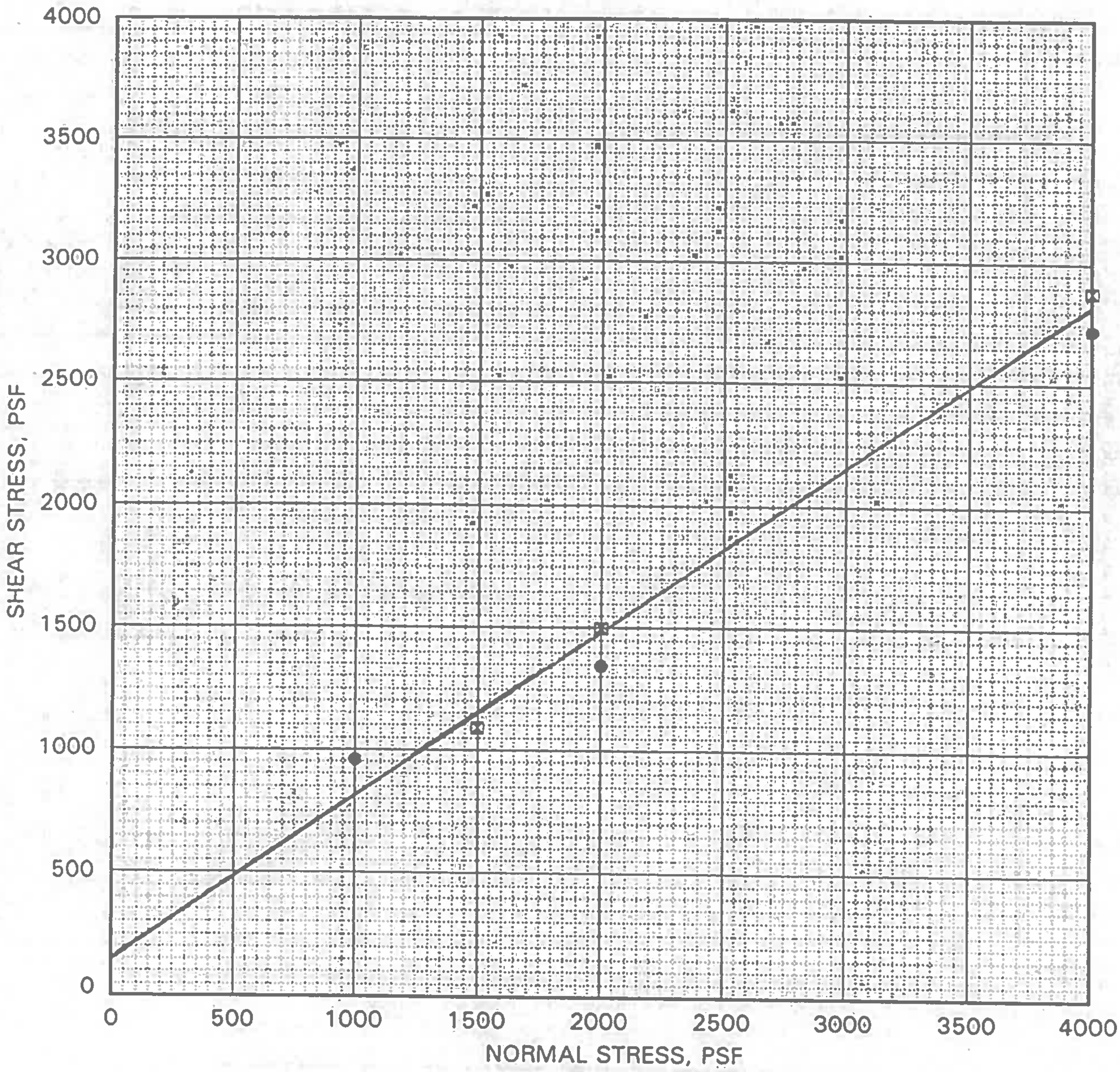
PLATE C-7

DIRECT SHEAR TEST
Undisturbed



Alluvium (Qal)	COHESION 150 psf.
Residual	FRICTION ANGLE 33.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	RW-2	10.0			
⊠	RW-3	5.0			

DIRECT SHEAR TEST

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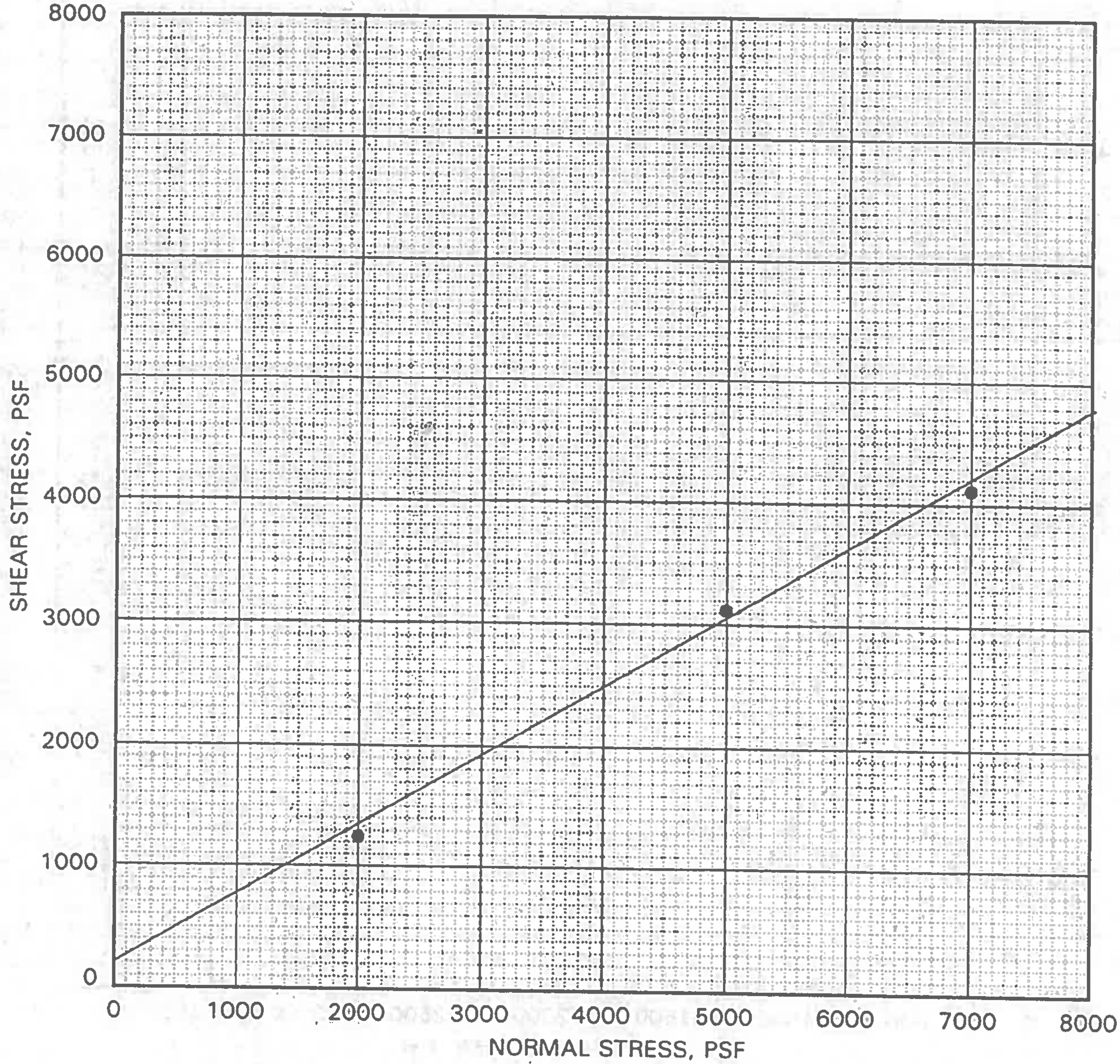
PLATE C-8

DIRECT SHEAR TEST
Undisturbed



Bedrock (Tsa)	COHESION 200 psf.
Residual	FRICTION ANGLE 29.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	RW-2	77.0	1vs		

DIRECT SHEAR TEST

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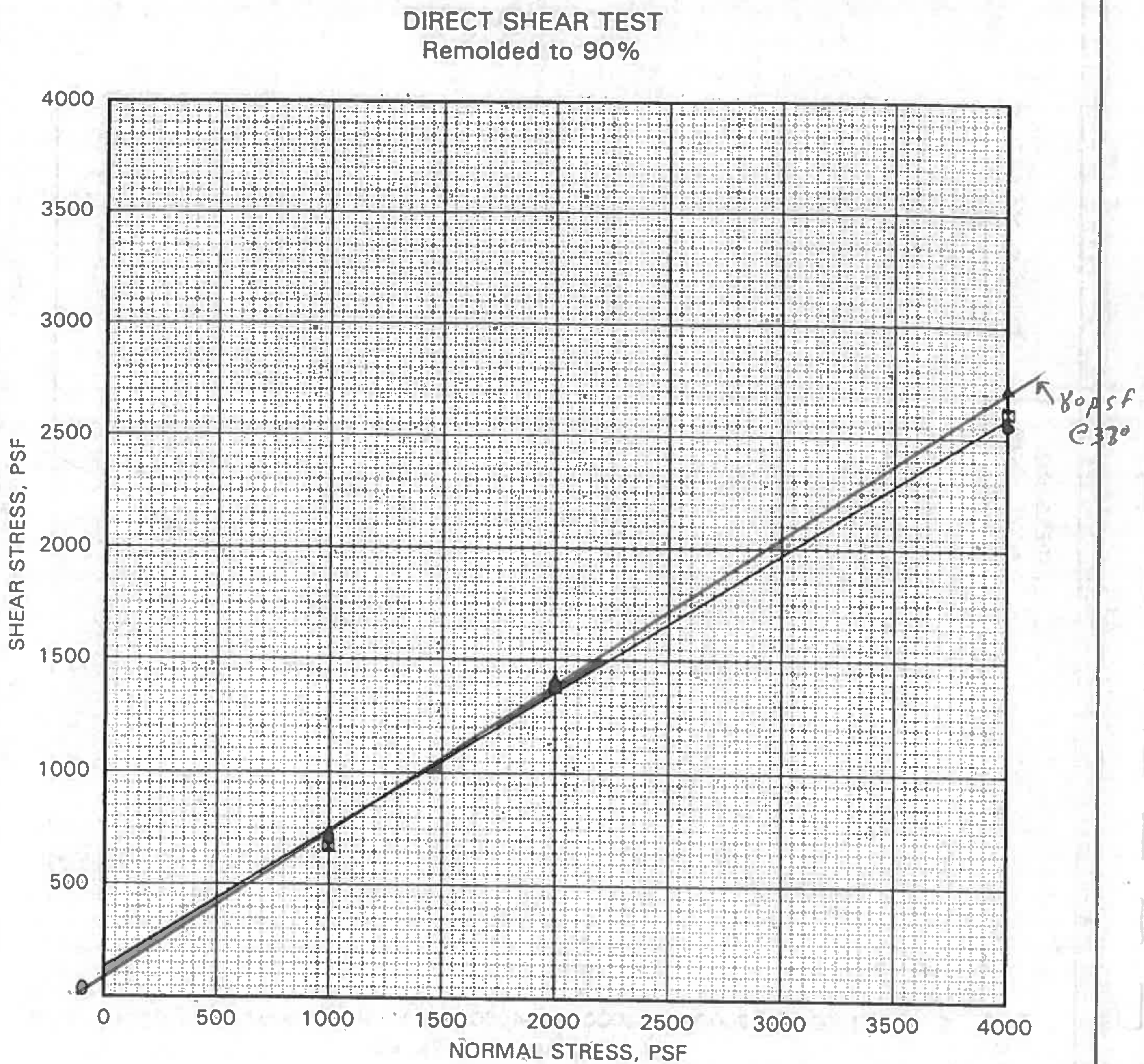
P.N. 206 DATE 1/12/99

PLATE C-9



Alluvium (Qal)	COHESION 130 psf.
Residual	FRICTION ANGLE 31.0 degrees

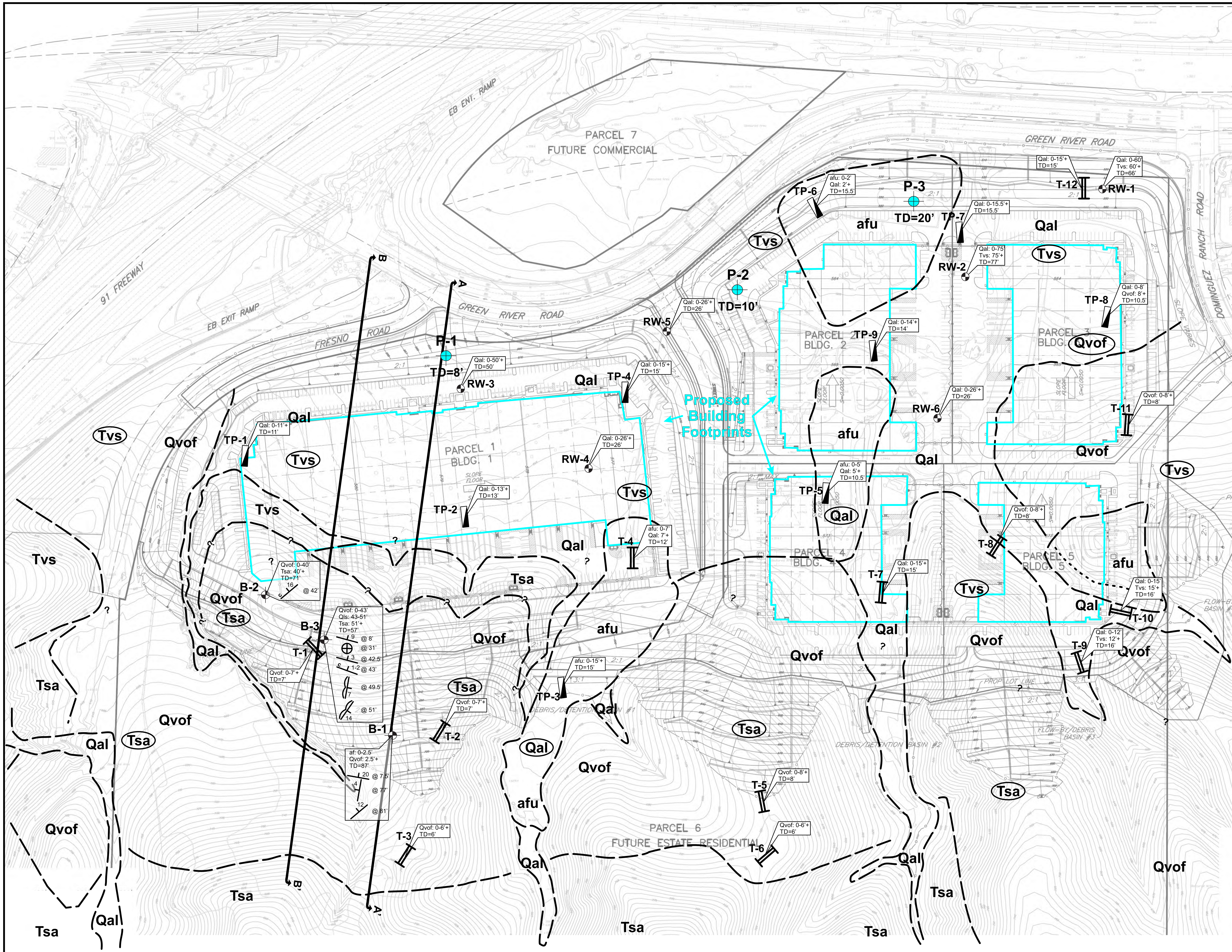
symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	T-12	15.0			
⊠	T-5	6.0			
▲	T-9	16.0	Tusp		

DIRECT SHEAR TEST

NEBLETT & ASSOCIATES, INC.
4911 WARNER AVENUE, SUITE 218
HUNTINGTON BEACH, CA, 92649 714 840-8286

P.N. 206 DATE 1/12/99

PLATE C-10



EXPLANATION

afu	Artificial Fill - Undocumented
Qal	Alluvium
Qvof	Very Old Alluvial Fan Deposits
Tvs	Bedrock - Vaqueros and Sespe Formations, Undifferentiated, Circled Where Buried
Tsa	Bedrock - Santiago Formation, Circled Where Buried
	Approximate Geologic Contact, Dotted Where Buried
9	Bedding Attitude as Observed in Exploratory Boring Depth in Feet
	Horizontal Bedding Attitude as Observed in Exploratory Boring, Depth in Feet
19	Contact Attitude as Observed in Exploratory Boring Depth in Feet
14	Clay Seam/Rupture Surface Attitude as Observed in Exploratory Boring, Depth in Feet
B-3 TD=57'	Approximate Location of Exploratory Bucket Auger Boring, TD = Total Depth (Current Investigation)
TP-9 TD=14'	Approximate Location of Exploratory Test Pit TD = Total Depth (Current Investigation)
P-3 TD=20'	Approximate Location of Percolation Test TD = Total Depth (Current Investigation)
RW-6 TD=26'	Approximate Location of Exploratory Rotary Wash Boring, TD = Total Depth (Neblett, 1999)
T-12 TD=15'	Approximate Location of Exploratory Test Pit TD = Total Depth (Neblett, 1999)

PETRA GEOSCIENCES, INC.
3186 Airway Avenue, Suite K
Costa Mesa, California 92626
PHONE: (714) 549-8921
COSTA MESA TEMECULA VALENCIA PALM DESERT CORONA

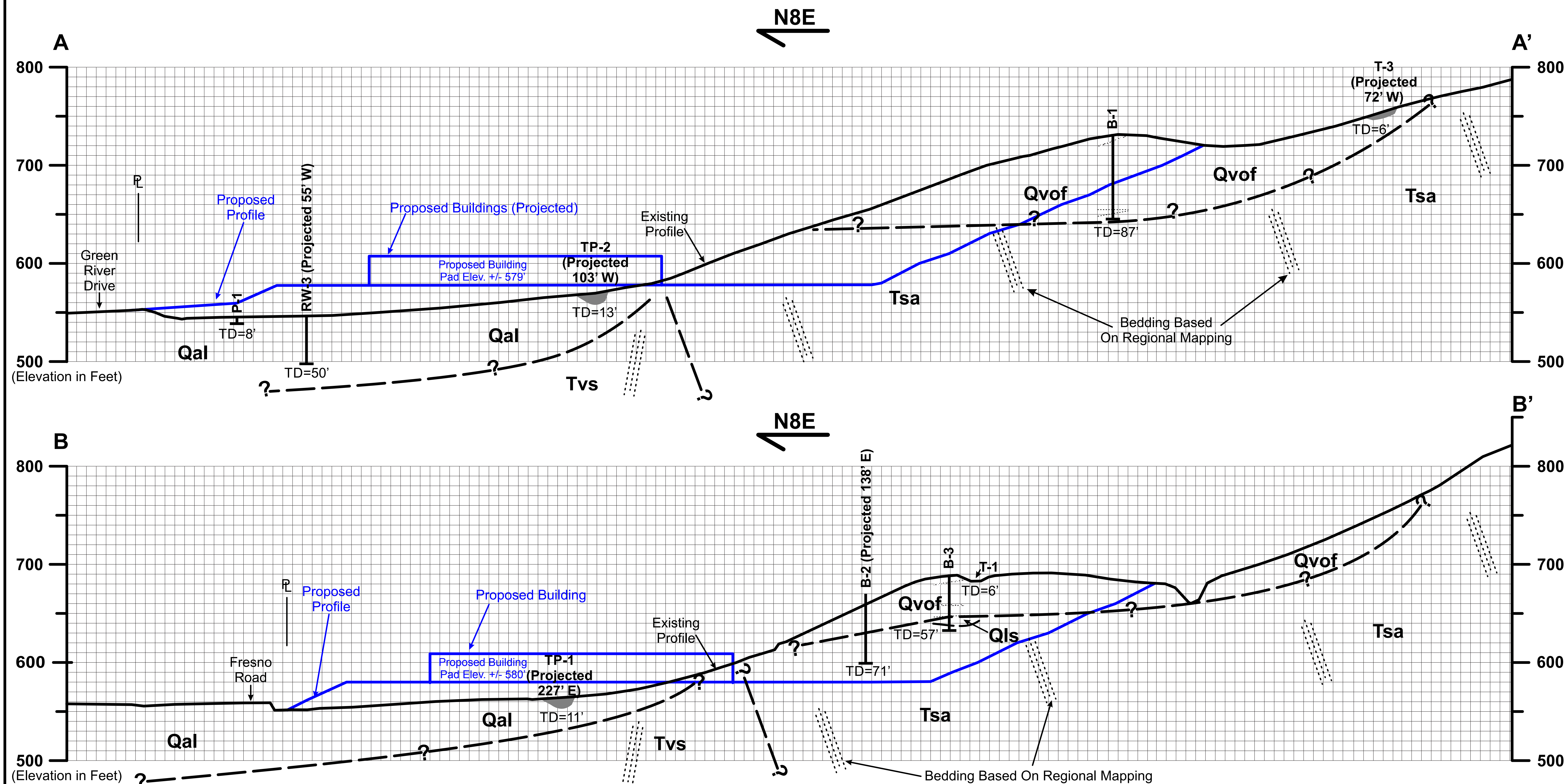
GEOTECHNICAL MAP

Green River Ranch Project
Green River Road, Corona, California

DATE: August, 2020
J.N.: 20-252

Plate 1

Base Image Reference: KWC Engineers, 2020, Green River Road, Grading Study E, 1 Sheet, 100 Scale, dated July 6.



EXPLANATION

Qal	Alluvium
Qvof	Very Old Alluvial Fan Deposits
Tvs	Bedrock - Vaqueros and Sespe Formations, Undifferentiated
Tsa	Bedrock - Santiago Formation
— — ?	Approximate Geologic Contact, Dotted Where Buried
B-3	Approximate Location of Exploratory Bucket Auger Boring, TD = Total Depth (Current Investigation)
TP-2	Approximate Location of Exploratory Test Pit TD = Total Depth (Current Investigation)
P-1	Approximate Location of Percolation Test TD = Total Depth (Current Investigation)
RW-1	Approximate Location of Exploratory Rotary Wash Boring, TD = Total Depth (Neblett, 1999)
T-3	Approximate Location of Exploratory Test Pit TD = Total Depth (Neblett, 1999)

0 100 200

Scale: 1" = 100'
Horizontal and Vertical

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GEOLOGIC CROSS SECTIONS

Green River Ranch Project
Green River Road, Corona, California

PETRA GEOSCIENCES INC.

DATE: August, 2020

J.N.: 20-252

Plate 2

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