Appendix D

Geotechnical Study

SOIL
EXPLORATION
COMPANY, INC.

OTH 2016-00919

Soil Engineering, Environmental Engineering, Materials Testing, Geology

September 12, 2016

Project No. 16155-01

TO: Environmental Engineering Enterprises, Inc.
P.O. Box 18021
Anaheim, CA 92817-8021

ATTENTION: Doug Browne

SUBJECT: Preliminary Soil Investigation, Liquefaction Evaluation and Infiltration Test Report, Proposed Two-Story Apartment Complex with Partial Subterranean Parking, 3175 W. Ball Road, City of Anaheim, California

Introduction

In accordance with your authorization, Soil Exploration Co., Inc. has performed a preliminary soil investigation, liquefaction evaluation and infiltration test for the subject site. The accompanying report presents a summary of our findings, conclusions, recommendations and limitations of our work for construction of proposed two-story, wood frame apartment complex with partial subterranean parking.

Scope of Work

- Review soils, seismic, geologic, groundwater data, maps and nearby site reports in our files.
- Perform exploration of the site by means of two 8" diameter borings, 50 feet and 21.5 feet below existing ground surface, at readily accessible locations.
- Field Engineer (California Registered RCE) for logging, sampling of select soils, observation of excavation resistance, record SPT blow counts, and water seepage (if any).
- Perform basic laboratory testing on select soil samples, including moisture, sieve analysis, expansion index and water soluble sulfates.
- Perform digitized search of known faults within a 50-mile radius of the site.
- Determine California Building Code (CBC) 2013 seismic parameters for the site.
- Consult with project architect/civil engineer.
- Perform one shallow infiltration test at location of proposed retention basin.
- Prepare a report of our findings, conclusions and recommendations for site preparation, including overexcavation/removal depth, allowable bearing value, foundation/slab-on-grade depth/thickness recommendations, excavation characteristics, earth pressures for retaining walls design, liquefaction evaluation, general earthwork and grading specifications, California Building Code (2013) seismic design coefficients, Cal/OSHA soil classification and infiltration rate in inches per hour.

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Site Conditions

The subject, square shaped, flat site is located on the northeast corner of W. Ball Road and S. Western Avenue in the City of Anaheim, California. W. Ball Road and S. Western Avenue are paved roads with curbs, gutters and sidewalks. A block wall borders the site on the north and east sides and a chain link fence on the west side. Existing apartments are located on adjacent properties to the north and east. Vegetation consists of medium dense weeds. Minor debris was noted on the site at the time of our investigation.

The approximate locations of the above and other features are shown on the Exploratory Boring and Infiltration Test Location Map, Plate 1. The base map is a copy of Site Plan provided by you.

Proposed Development

We understand that the site is proposed for a two-story, 12-unit apartment complex with partial subterranean parking. The structure will be wood frame construction. A grading plan is not yet available, however based on flat topography of the site, modest cut and fill grading and no cut or fill slopes will be proposed.

Field Work

Two exploratory borings (B-1 and B-2) were drilled on August 31, 2016, to a depth of 50 feet and 21.5 feet below existing ground surface, respectively, utilizing a B-53 mobile drill rig equipped with 8-inch diameter hollow stem augers. Refer to Plate 1 for boring locations. The borings were logged by a California Registered Civil Engineer. Standard Penetration Tests (SPT) blow counts were recorded for the earth materials. Relatively undisturbed samples of the soils were also obtained by utilizing California Ring Sampler.

In general, these borings revealed that the site area is underlain by alluvial soils consisting of interbedded silty sand, silty clayey sand, sand and sand with silt (USCS "SM", "SM-SC", "SP" and "SP-SM"). The earth materials are loose to dense. USGS Quarternary Geologic Map of the Los Alamitos Quadrangle shows the site area is underlain with younger alluvium deposits (see Figure 2). Detailed descriptions of the earth materials encountered are presented in the form of Geotechnical Boring Logs in Appendix B.

Laboratory Testing

Basic laboratory tests were performed for select soil samples. The tests consisted primarily of natural moisture contents, sieve analysis and water soluble sulfates.

Groundwater/Liquefaction

Groundwater was encountered in both of our exploratory borings at a depth of 16 feet below ground surface. Please note that a groundwater study is not within the scope of this work, however groundwater data from State well in the vicinity of the site (see Figure 1 for location) is tabulated as follows:

State Well ID No.	Depth to Water (ft)	Date Measured	Distance/Location Relative to Site
04S11W14Q004S	34	2/7/1971	See Figure 1
	20.7	5/1/1985	

Based on USGS Historically Highest Ground Water Contours map, water was at a depth of 10± feet in the vicinity of the site (see Figure 3).

Based on State of California Seismic Hazard Zones Map, the site is located within a zone of liquefaction potential (Figure 4).

Liquefaction Evaluation

Soil liquefaction is a process by which loose, saturated, fine/uniform, granular deposits lose a significant portion of their shear strength due to pore water pressure buildup resulting from cyclic loading, such as that caused by an earthquake. Soil liquefaction can lead to foundation bearing failures and excessive settlements. Liquefaction potential is greatest in poorly graded fine sand with a mean (D_{50}) grain size in the range of 0.075 to 0.20 mm.

The alluvial materials encountered in our deep boring B-1 were classified as interbedded silty sand, silty clayey with sand, sand and sand with silt (USCS "SM", "SM-SC, "SP" and "SP-SM"). In general, the earth materials have an overall compactness of loose to dense.

Summary of conditions for the deep boring B-1 are as follows:

Depth (ft)	Class (USCS)	SPT Count (blows/foot)	Moisture (%)	Passing 200 Sieve (%)	Compactness/ Consistency
2.5	SM	41	3.6	27	Dense
5	SM	38	3.1	-	Dense
10	SM-SC	12	21.2	10	Medium dense
15	SM-SC	16	21.6	-	Medium dense
20	SP	21	24.1	2	Medium dense
25	SP	13	22.2	-	Medium dense
30	SP	8	25.4	-	Loose
35	SP	10	25.1	-	Loose
40	SP	18	-	-	Medium dense
45	SM	18	22.6	-	Medium dense
50	SP-SM	21	-	-	Medium dense

Liquefaction Analysis: LiquefyPro

Liquefaction susceptibility using Standard Penetration Test data and laboratory grain size test results were analyzed using LiquefyPro software (Version 5.5g). Liquefaction analysis performed for this evaluation included: [1] evaluation of soil consistency and compactness influencing liquefaction, [2] correction of penetration resistance data to convert measured SPT N-values to standard N_{60}-values, [3] calculating the earthquake induced stress ratio (CSR), [4] calculating cyclic resistance ratio (CRR), [5] assume water table at 10 feet below the ground surface, and [6] evaluation of liquefaction potential by calculating a factor of safety against liquefaction (FS), by dividing CRR by CSR. The software output is presented in Appendix E.

The main observations of the results are as follows:

- Onsite soils at the site in general have a Safety Factor of less than 1.0 against liquefaction. Indicated total settlement of saturated and unsaturated sands is 13.19 inch, with differential settlement of 6.593 to 8.703 inch.
- Liquefaction also involves lateral or horizontal displacement (lateral spreading) of essentially intact blocks of surficial soils on slopes or toward a free-face slope such as river or canal bank. The potential for and magnitude of lateral spreading is dependent upon many conditions, including the presence of a relatively thick, continuous, potentially liquefiable sand layer and high slopes. Subsurface information obtained for this study indicates that loose sands are not present and high slopes are not anticipated. Based on currently available procedures, the site does not appear to be susceptible to (lateral spread) ground surface disruption during a moderate seismic event.

Seismicity/Faulting

A computer search of known Quaternary major faults within 50 miles of the site from USGS Earthquake Hazards Program is presented in Appendix D. Please note that it is probable that not all-active or potentially active faults in the region have been identified. Furthermore, seismic potential of the smaller and less notable faults is not sufficiently developed for assignment of maximum magnitudes and associated levels of ground shaking that might occur at the site due to these faults.

Secondary Seismic Hazards

Ground Rupture

The surface fault rupture occurs along traces of active or potentially active faults. The site is not located within any State of California fault hazard zone and no active or potentially active faults are known to exist at the site. The potential for surface fault rupture at the site is therefore considered low.

Tsunamis/Seiches/Flooding

The elevation and inland location of the site and absence of upstream dams or other nearby large bodies of water precludes these earthquake induced hazards to the site.

Landsliding/Lateral Spreading

Considering the flat topography and the absence of significant slopes in the vicinity of the site, the potential for landsliding and lateral spreading is considered very low.

Conclusions

- Vegetable matter, existing structures, old foundations, underground structures, cesspools, leach fields, seepage pits, old fills, buried utilities/irrigation lines, etc. and deleterious materials associated with any structures would require removal from the proposed building/grading areas
- Overexcavation and recompaction of the natural surficial soils should be anticipated to provide adequate and uniform support for the proposed structure.
- The onsite soils exclusive of deleterious material may be used as compacted fill materials.
- Based on observation and soil classification, the expansion potential of the near-surface soils at the site is expected to be very low (EI<20).
- Based on our analysis, site soils are susceptible to liquefaction, considering historic highest groundwater at 10 feet.
- The site is located approximately 4.29 miles from the Puente Hills (Coyote Hills) fault. The site is located in a region of generally high seismicity, as is all of Southern California. During its design life, the site is expected to experience moderate to strong ground motions from earthquakes on regional and/or local causative faults.
- There is a 2 percent probability in 50 years (2475 year return period) that peak ground acceleration at the site will exceed 0.5g (see Appendix D).
- Flooding potential of the site should be evaluated and considered in planning and design by civil engineering consultant.

Recommendations

Site Preparation

All grading and backfills should be performed in accordance with our General Earthwork and Grading Specifications (Appendix F), except as modified in the text of this report. Undocumented fills, trash, vegetation, trees, roots, underground/basement structures, old foundations, leach fields, seepage pits, septic tanks and any deleterious material associated with previous/current use of the site should be traced and removed offsite. Suitable soils (free from debris/deleterious materials) may be used for compacted fills.

After site clearance, as described above, residential pad, including at least 5 feet outside building lines in plan (including any canopies and extended foundations where practical) should be overexcavated to a depth of at least 4 feet below existing ground or proposed grade, whichever is deeper. Where proposed building is adjacent to existing structures or block walls, the overexcavation should be conducted safely and in sections on the order of 10 feet in length or as appropriate to protect existing structures in-place. Deeper overexcavation should not be precluded specially to expose competent soils. Vegetation roots should be traced and completely removed if encountered in bottom of the overexcavated areas.

After any overexcavation, the exposed surfaces should be further scarified to a depth of at least 12-inches, watered as necessary, and recompacted to at least 95 percent of the maximum dry density, as determined by ASTM D1557-12 Test Method, prior to placement of fill. All fills should be compacted to at least 95 percent of the maximum dry density. Deeper overexcavations, specially to remove unsuitable soils, roots, remove existing deep structures or clean the bottom, may be required depending upon field observations of excavated bottoms during site preparation by the soil engineer or his representative.

The purpose of the above recommendations is to provide at least 3 feet of compacted fill below the foundation bottoms.

Foundation Design

Following site preparation and soil modification indicated below in this report, a maximum allowable bearing value of 1500 psf is recommended.

Please note that foundation design is under the purview of the structural engineer and structural considerations may require a foundation mat or the need for post-tensioned foundation system in order to mitigate the differential settlement.

Slabs-On-Grade/Moisture Barrier

Where moisture intrusion is objectionable, slabs-on-grade/foundation mat should be underlain with 10-mil Visqueen moisture barrier. The moisture barrier should be overlain by two-inch layer of clean rolled sand to aid in concrete curing and underlain by two inches of rolled clean sand.

Soil Modification/Geogrid Reinforcement

In addition to the use of foundation mat or post-tension foundation system, Geogrid reinforcement of the foundation soils may be a consideration. As indicated above, the existing soil in the building area should be overexcavated to a depth of at least 4 feet (below existing ground or pad elevation, whichever is deeper), and extend at least 5 feet beyond building lines in plan. The exposed ground should be further scarified to a depth of 12 inches and compacted to at least 95 percent relative compaction prior to placement of the Geogrid and engineered fill.

We recommend two layers of Geogrid reinforcement, one at the bottom of the overexcavation and the other 12 inches above. Geogrid should be at least Mirafi 10XT (or equivalent) and the joints should be overlapped a minimum distance of 3 feet.

Special Considerations/Excess Soils from Foundation Excavations

Excess soils generated from foundation excavations should not be placed on slabs subgrade without proper moisture and compaction. Slab subgrade should be verified to contain 1.2 times the soil optimum moisture content to a depth of 12 inches prior to placement of slab building materials. Moisture content must be tested in the field by the soil engineer. Slabs subgrade should be kept moist and the surface should not be allowed to desiccate.

In hot or windy weather, the contractor must take appropriate curing precautions after the placement of concrete. The use of mechanically compacted low slump concrete (not exceeding 4 inches at the time of placement) is recommended. We recommend that a slipsheet (or equivalent) be utilized if grouted tiles or other crack sensitive flooring (such as marble tiles) is planned directly on concrete slabs.

Lateral Earth Pressures/Retaining Walls

The following lateral earth pressures and soil parameters in conjunction with the above recommended bearing value (1500 psf), may be used for design of subterranean retaining walls with free draining compacted backfills. If passive earth pressure and friction are combined to provide required resistance to lateral forces, the value of the passive pressure should be reduced to two-thirds the following recommendations:

Active Earth Pressure with level backfill (P_a)	40 psf (EFP), drained, yielding
At Rest Pressure (P_o)	50 psf (EFP), drained, non-yielding (part of building wall)
Passive Earth Pressure (P_p)	250 psf (EFP), drained, maximum of 2500 psf
Horizontal Coefficient of Friction (μ)	0.25
Unit Soil Weight (γ_t)	120 pcf

We recommend drainage for retaining walls to be provided in accordance with Plate 2 of this report. Maximum precautions should be taken when placing drainage materials and during backfilling. Retaining walls should be waterproofed in accordance with project architect recommendations. All wall backfills should be properly compacted to at least 90 percent relative compaction.

Seismic Considerations

The site is located approximately 4.29 miles from the Puente Hills (Coyote Hills) fault. Moderate to strong ground shaking can be expected at the site and there is a 2 percent probability in 50 years that peak ground acceleration at the site will exceed 0.5g. The site soil profile is Class D. The structural engineer should consider city/county local codes, California Building Code (CBC) 2013, seismic data presented in this report (Appendix D), the latest requirements of the Structural Engineers Association, and any other pertinent data in selecting design parameters.

Expansion Index/Soluble Sulfates

Based on observation and soil classification, the expansion potential of the onsite sandy soils is anticipated to be very low. The results of soluble sulfate tests on a select soil sample, performed by Cal Land Engineering of Brea, California, indicate negligible sulfate exposure (less than 0.1% by weight). The laboratory test results are presented in Appendix C. The cement mix/strength should meet the ACI guidelines and recommendations of the structural design engineer. Tentatively we recommend Type II cement and concrete slump not exceeding 4 inches at the time of placement. If critical these should be further verified by your structural and/or a corrosion engineer.

Surface Drainage/Groundwater

The surface of the site should be graded to provide positive drainage away from structures and foundations. Drainage should be directed to established swales and then to appropriate drainage structures to minimize the possibility of serious erosion. Surface drainage must be directed and maintained away from the foundations. Water, either natural or by irrigation, should not be permitted to pond or saturate the foundation soils.

Groundwater was encountered during our subsurface investigation at a depth of 16 feet. Our experience indicates that surface or near surface groundwater conditions can develop in areas where near surface groundwater conditions did not exist prior to site development, especially in areas where a substantial increase in surface water infiltration results from landscape irrigation. We therefore recommend that landscape irrigation be kept to the minimum necessary to maintain plant vigor and that any leaking pipes/sprinklers, etc. should be promptly repaired. The depth to the groundwater may fluctuate with seasonal changes and from one year to the next. Subdrains, horizontal drains or other devices may be recommended for graded areas that exhibit seepage, groundwater, past evidence for shallow water, or areas with a potential for future nuisance shallow groundwater conditions.

Concrete Joints/Flatwork

The joints spacing for concrete should be determined by the project architect. Joints should be laid out to form approximately square panels (equal transverse and longitudinal joint spacing). Rectangular panels, with the long dimension no more than one-and-one-half times the short, may be used when square panels are not feasible. The depth of longitudinal and transverse joints should be one-fourth the depth of the slab thickness.

Joint layout should be adjusted so that the joints will line up with the corners of structures, small foundations and other built-in structures. Acute angles or small pieces of slab curves as a result of joints layout should not be permitted.

Concrete Curing

Fresh concrete should be cured by protecting it against loss of moisture, rapid temperature change and mechanical injury for at least 3 days after placement. Moist curing, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used. After finishing operations have been completed, the entire surface of the newly place concrete should be covered by whatever curing medium is applicable to local conditions and approved by the engineer. The edges of concrete slabs exposed by the removal of forms should be protected immediately to provide these surfaces with continuous curing treatment equal to the method selected for curing the slab surfaces. The contractor should have at hand, and ready to install before actual placement begins, the equipment needed for adequate curing of the concrete.

Cal/OSHA Classification/Trench Excavations/Backfills

In general Cal/OSHA classification of onsite soils appears to be Type B.

Temporary trench excavations deeper than 5 feet should be shored or sloped at 1:1 or flatter in compliance with Cal/OSHA requirements:

a.) The shoring should be designed by a qualified engineer experienced in the shoring design.

b.) The tops of any temporary unshored excavations should be barricaded to prevent vehicle and storage loads within a 1:1 line projected upward from the bottom of the excavation or a minimum of 5 feet, whichever is greater. If the temporary construction embankments, including shored excavations, are to be maintained during the rainy season, berms are suggested along the tops of the excavations where necessary to prevent runoff from entering the excavation and eroding the slope faces.

c.) The soils exposed in the excavations should be inspected during excavation by the soils engineer so that modifications can be made if variations in the soil conditions occur.

d.) All unshored excavations should be stabilized within 30 days of initial excavation.

Additional Observations and Testing

The recommendations provided in this report are based on preliminary design information and subsurface conditions as interpreted from limited exploratory work. Our conclusions and recommendations should be reviewed, verified during grading and construction, and revised as necessary.

Soil Exploration Co., Inc. should review the foundation plans and observe and/or test at the following stages of construction:

- During all overexcavation and grading.
- Following foundation excavations and prior to placement of foundation materials.
- During wetting of slab subgrade and prior to placement of slab materials.
- During all trench and retaining wall backfills.
- When any unusual conditions are encountered.

Final Compaction Report

A final report of compaction control should be prepared subsequent to the completion of grading. The report should include a summary of work performed, laboratory test results, and the results, locations and elevations of field density tests performed during grading.

Limitation of Investigation

Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Engineers practicing in this or similar locations. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

The field and laboratory test data are believed representative of the project site; however, soil conditions can vary significantly. As in most projects, conditions revealed during grading may be at variance with preliminary findings. If this condition occurs, the possible variations must be evaluated by the Project Geotechnical Engineer and adjusted as required or alternate design recommended.

This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractor carry out such recommendations in the field.

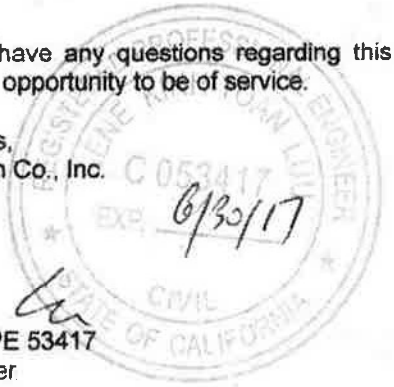
This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we cannot be responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any of the recommended actions presented herein to be unsafe.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In additions, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge.

Closure

If you should have any questions regarding this report, please do not hesitate to call our office. We appreciate this opportunity to be of service.

Very truly yours,
Soil Exploration Co., Inc.

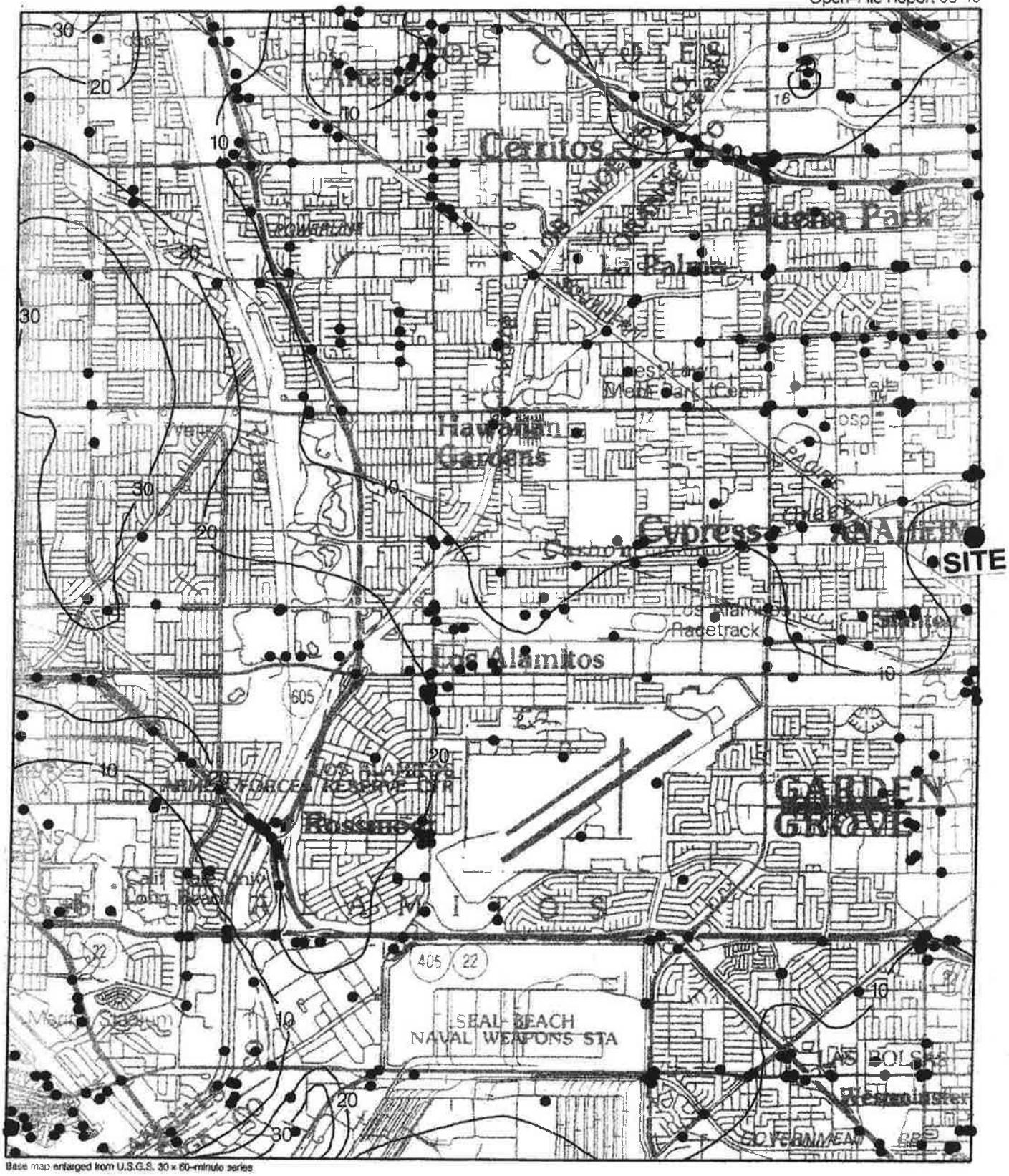


Gene K. Luu, PE 53417
Project Engineer

Distribution: [3] Addressee

Attachments:

Figure 1	Site Location Map
Figure 2	Geologic Map
Figure 3	Historically Highest Ground Water Contours
Figure 4	Orange County Geohazards and Fault Zones Map
Figure 5	State of California Special Studies Zones Map
Plate 1	Exploratory Boring and Infiltration Test Location Map
Plate 2	Retaining Wall Backfill and Subdrain Detail
Appendix A	References
Appendix B	Exploratory Boring Logs
Appendix C	Laboratory Test Results
Appendix D	USGS Earthquake Hazards Program/Source Parameters and CBC (2013) Seismic Parameters
Appendix E	Liquefaction Analysis
Appendix F	General Earthwork and Grading Specifications
Appendix G	Infiltration Test Procedure and Test Results



Base map enlarged from U.S.G.S. 30 × 60–minute series

Plate 1.2 Historically Highest Ground Water Contours and Borehole Log Data Locations, Los Alamitos Quadrangle.

● Borehole Site

30 Depth to ground water in feet

Figure 3

ONE MILE

SCALE

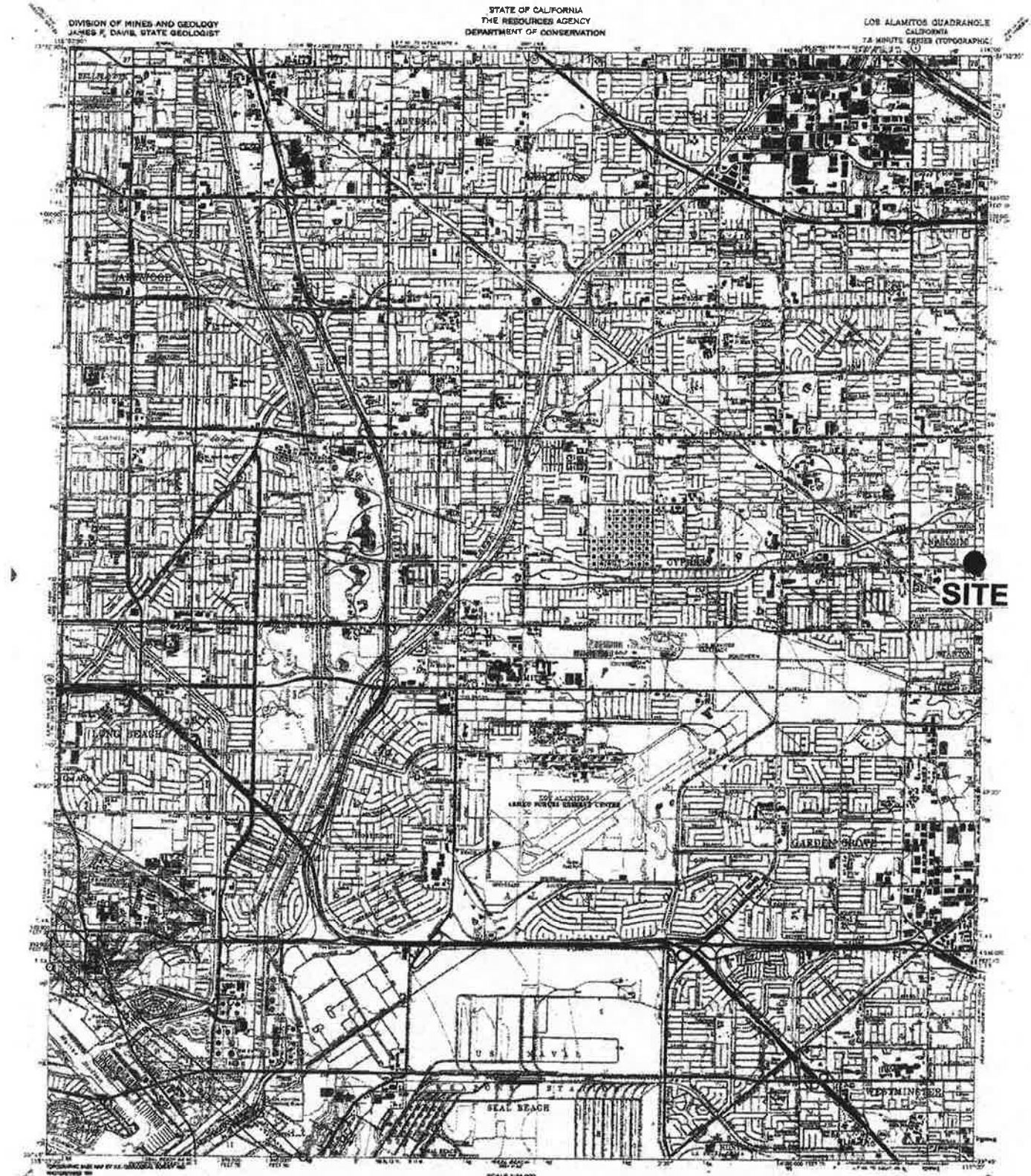

DIVISION OF MINES AND GEOLOGY
JAMES F. DAVIS, STATE GEOLOGIST
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF CONSERVATION
LOS ALAMITOS QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SITE
LONG BEACH
SEAL BEACH
GARDEN GROVE
WESTMINSTER
CYPRESS
ANAHEIM
ADDISON
LOS ALAMITOS ARMED FORCES RESERVE CENTER
SCALE 1:24,000
1 MILE
1 KILOMETER
CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
REFERENCES USED TO COMPILE FAULT DATA
MAP EXPLANATION
Potentially Active Faults
Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated events or D for displacement caused by creep or possible creep.
Special Studies Zone Boundaries
Those are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.
Surveyed projection of zone boundary.
STATE OF CALIFORNIA
SPECIAL STUDIES ZONES
Delineated in accordance with
Chapter 7.5, Division 2 of the California Public Resources Code
(Alquist-Priolo Special Studies Zones Act)
LOS ALAMITOS QUADRANGLE
REVISED OFFICIAL MAP
Effective: July 1, 1986
State Geologist
IMPORTANT - PLEASE NOTE
1) This map may not show all faults that have the potential for surface fault rupture, either within the special studies zones or outside their boundaries.
2) Faults shown are the basis for establishing the boundaries of the special studies zones.
3) The identification and location of these faults are based on the best available data. However, the quality of data used is varied. Traces have been drawn as accurately as possible at this map scale.
4) Fault information on this map is not sufficient to serve as a substitute for the geologic site investigations (special studies) required under Chapter 7.5 of Division 2 of the California Public Resources Code.

Figure 5

PLUMBING FIXTURE CALCS — PER CBC TABLE A AND TABLE 422.1 CPC 2013

OCCUPANCY GROUP: CG (GENERAL PLAN CHANGE APPLICATION SUBMITTED)

OCCUPANT LOAD: 119.83

FIXTURES	COMMON BATHROOM	
	REQUIRED	PROVIDED
WATER CLOSET UNIT 1-12 (2(12) = 24)	24	24
LAVATORY UNIT 1-12 (2(12) = 24)	24	24
SHOWER UNIT 1-12 (1(12) = 12)	12	12
TUB UNIT 1-12 (1(12) = 12)	12	12

(CALCS PER CPC TABLE 4-1)

PARKING ANALYSIS: BUILDING A-C

BLDG. S.F. TOTAL	ACCESSIBLE REQUIRED	PROVIDED	PARKING REQUIRED	PROVIDED
14,983.07/500 = 29.96	1	1	29.96	32

BUILDING DATA :

OCCUPANCY CLASSIFICATION : CG (GENERAL PLAN CHANGE APPLICATION SUBMITTED)

CONSTRUCTION TYPE : SPRINKLERED

SQUARE FOOTAGE : 14,983.07

NUMBER OF STORIES :

FIRE SPRINKLER :

SITE DATA

SITE AREA	15,625 SQ. FT.
L.S. REQ'D @ 10%	1,562.60 SQ. FT.
L.S. PROVIDED	3,456.24 SQ. FT.

CURRENT CODES :

2013 CALIFORNIA BUILDING CODE
2013 CALIFORNIA FIRE CODE
2013 CALIFORNIA ELECTRICAL CODE
2013 CALIFORNIA MECHANICAL CODE
2013 CALIFORNIA PLUMBING CODE
2013 CALIFORNIA ENERGY CODE
2013 CALIFORNIA RESIDENTIAL CODE
2013 CALIFORNIA GREEN BLDG. CODE

FIRE DEPARTMENT NOTES:

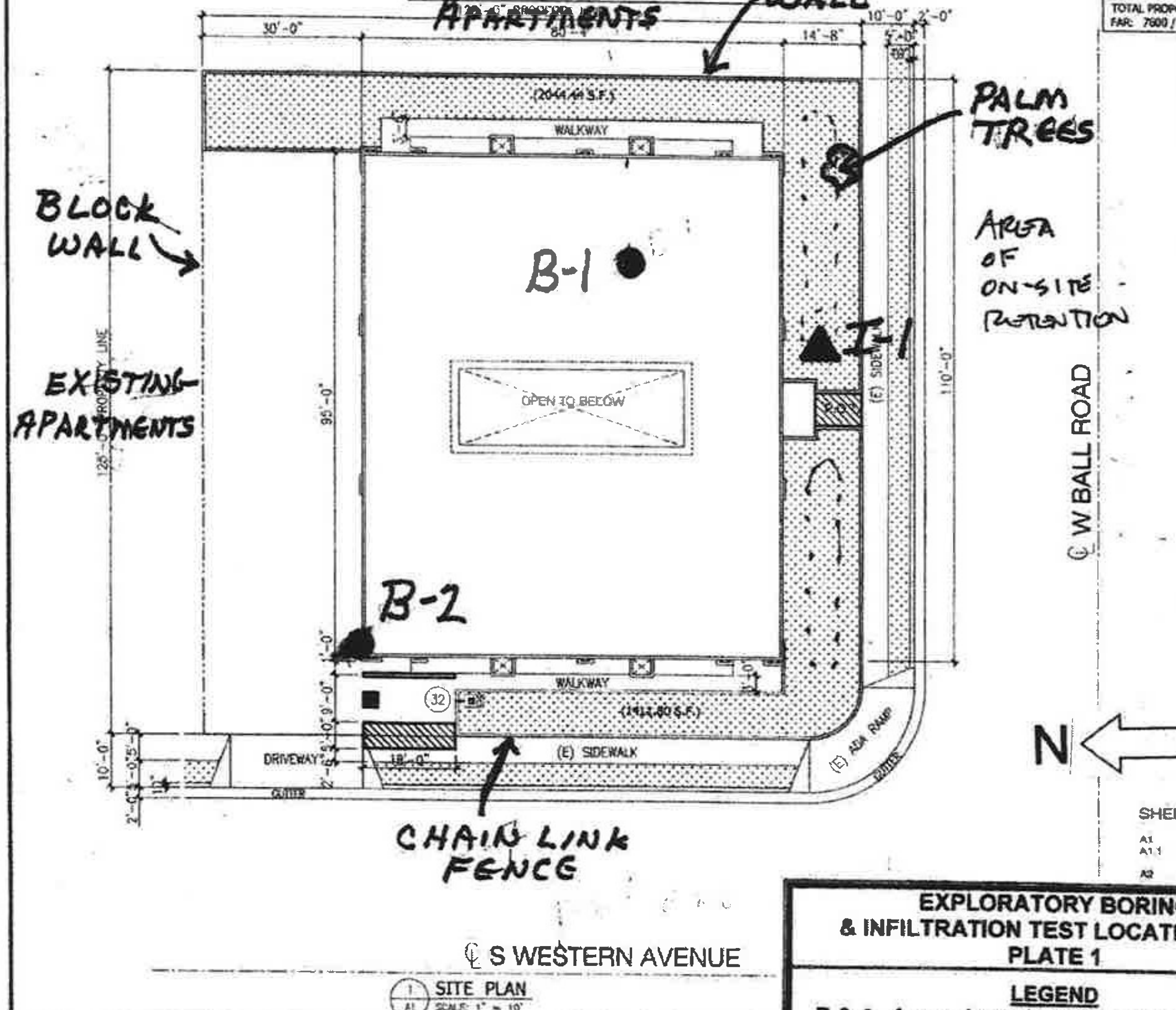
1. ADDRESS TO BE VISIBLE FROM THE STREET FRONTING THE PROPERTY.
2. FIRE EXTINGUISHER REQUIRED. PROVIDE ONE 2A10 BE FOR EVERY 75 FEET OF TRAVEL DISTANCE AND A CLASS K FOR THE KITCHEN.
3. PROVIDE SIGN STATING "THIS DOOR TO REMAIN UNLOCKED WHEN THE BUILDING IS OCCUPIED", TO BE POSTED ABOVE THE MAIN ENTRANCE DOOR.

FLOOR AREA ANALYSIS

ZONE: CG
LOT SIZE: 15,625 S.F.
TOTAL PROPOSED FLOOR AREA: 7600 S.F.
FAR: 7600 / 15,625 = .48

BUILDING OCCUPANCY ANALYSIS:

OCCUPANCY	DESCRIPTION	AREA	FACTOR	OCC. LOAD
CG	UNIT 1	933.33	200	4.66
	UNIT 2	933.33	200	4.66
	UNIT 3	933.33	200	4.66
	UNIT 4	933.33	200	4.66
	UNIT 5	933.33	200	4.66
	UNIT 6	933.33	200	4.66
	UNIT 7	933.33	200	4.66
	UNIT 8	933.33	200	4.66
	UNIT 9	933.33	200	4.66
	UNIT 10	933.33	200	4.66
	UNIT 11	933.33	200	4.66
	UNIT 12	933.33	200	4.66
	ATRIUM	2000	200	10
	PARKING GARAGE AT BASEMENT	10,782.50	200	53.91
	STAIRS AND HALLWAYS	775.13		
	COVERED PATIO (UNIT 1-12)	42(12) = 504		
	COVERED BALCONY (UNIT 1-12)	52.50(12) = 630		
GROSS FLOOR AREA		25,891.57		
TOTAL OCCUPANT LOAD				119.83



SITE PLAN — SCALE: 1" = 10'

SCOPE OF WORK: CONSTRUCT NEW APARTMENT BUILDING

OWNER: POOLEY, CLINT & CARMA, 3175 W BALL RD, ANAHEIM CA 92804, PARCEL #: 079-682-34

SHEET CONTENTS:

A1 12-UNIT APARTMENT BUILDING SITE PLAN
A1.1 12-UNIT APARTMENT BUILDING SUBTERRANEAN PARKING GARAGE
A2 BASEMENT FLOOR PLAN

VICINITY MAP — SCALE: NTS

12-UNIT APARTMENT BUILDING SITE PLAN

APARTMENT BUILDING
3175 W BALL RD ANAHEIM, CA 92804

A1

EXPLORATORY BORING & INFILTRATION TEST LOCATION MAP
PLATE 1

LEGEND

B-2 ● Approximate Location of Boring

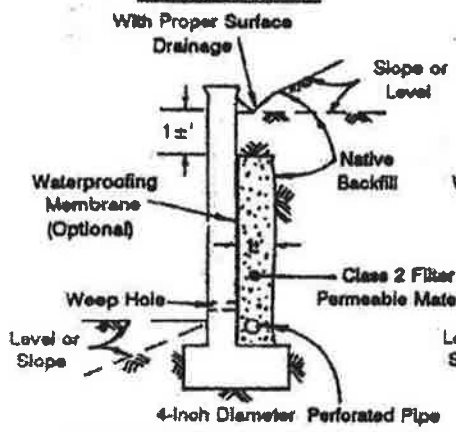
I-1 ▲ Approximate Location of Infiltration Test

Soil Exploration Co., Inc.

Project No. 16155-01 | September 12, 2016

SUBDRAIN OPTIONS FOR NATIVE MATERIAL BACKFILL

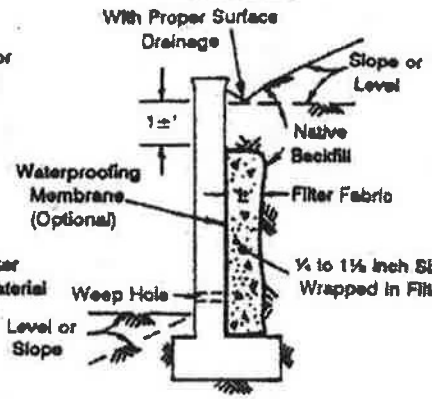
OPTION N2: Pipe Surrounded with Class 2 Material



Class 2 Filter Permeable Material Grading Per Caltrans Specifications

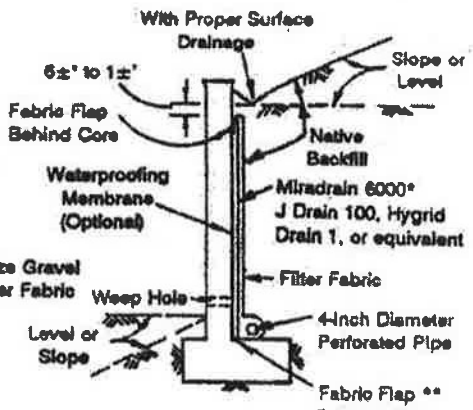
Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

OPTION N1: Gravel Wrapped in Filter Fabric



Proper Outlet Should be Provided for Gravel Subdrain (See Notes)

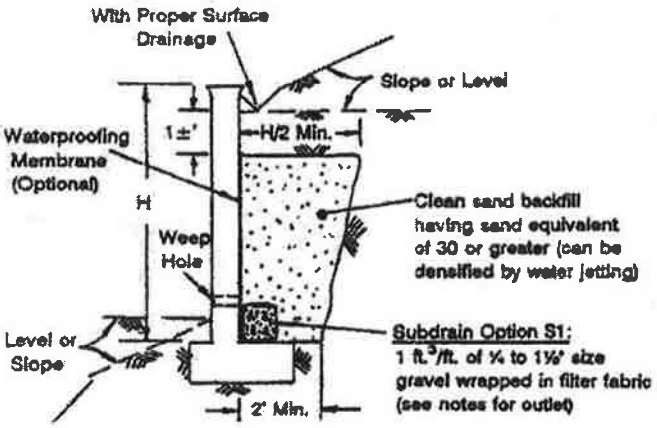
OPTION N3: Geotextile Drain

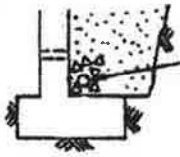


*Miradrain 6000 or J Drain 100 for non-waterproofed walls; Miradrain 6200 or J Drain 200 for completed waterproofed walls

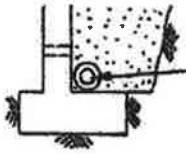
**Peel back the bottom fabric flap, place pipe next to core, wrap fabric around pipe and tuck behind core.

SUBDRAIN OPTIONS FOR CLEAN SAND BACKFILL





Subdrain Option S2:
4" diameter perforated pipe surrounded with 1 ft³/ft. of Class 2 filter material per Caltrans specifications as above



Subdrain Option S3:
4" diameter perforated pipe wrapped in filter fabric

Notes:

- Pipe type should be ASTM D1527 Acrylonitrile Butediene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Amco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down.
- Filter fabric should be Mirafi 140N, 140NS, Supac 4NP, Amoco 4545, Trevira 1114, or approved equivalent.
- All drains should have a gradient of 1 percent minimum.
- Outlet portion for gravel subdrain should have a 4"-diameter pipe with the perforated portion inserted into the gravel approximately 2' minimum and the nonperforated portion extending approximately 1' outside the gravel. Proper sealing should be provided at the pipe insertion enabling water to run from the gravel portion into rather than outside the pipe.
- Waterproofing membrane may be required for a specific retaining wall such as a stucco or basement wall.
- Weephole should be 2" minimum diameter and provided at 25' minimum in length of wall. If exposure is permitted, weephole should be located at 3±' above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to discharge through the curb face or equivalent should be provided, or for a basement-type wall, a proper subdrain outlet system should be provided. Open vertical masonry joints (i.e., omit mortar from joints of first course above finished grade) at 32" maximum intervals may be substituted for weepholes. Screening such as with a filter fabric should be provided for weepholes/open joints to prevent earth materials from entering the holes/joints.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL

Soil Exploration Co. Inc.

Plate: 2

APPENDIX A

REFERENCES

- CDMG, The Resources Agency, Department of Conservation, Earthquake Epicenters in Southern California, Special Report 113, Plate 7, Dated 1974.
- CDMG, Geologic Map of Orange County California, Showing Mines and Mineral Deposits, Compiled by P. Morton and R. V. Miller, Dated 1981.
- CDMG, The Resources Agency, Department of Conservation, Geologic Map of the Santa Ana 1:100,000 Quadrangle, California, Dated 1991.
- CDMG, Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, Dated February 1998.
- USGS Quarternary Geologic Map of the Los Alamitos Quadrangle, Open File Report 98-10.
- Historically Highest Ground Water Contours and Borehole Log Data Locations, Los Alamitos Quadrangle, Open-File Report 98-10.
- Orange County Geohazards and Fault Zones Map.

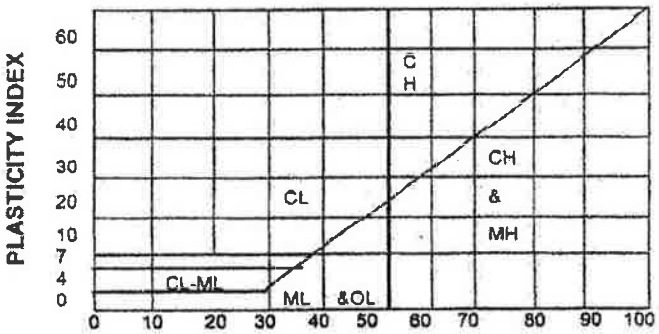
APPENDIX B

MAJOR DIVISIONS			SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (More than ½ of soil < No. 200 sieve)	GRAVELS (More than ½ of coarse fraction > No. 4 sieve size)	GW		Well-graded gravels or gravel-sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM		Silty gravels, gravel-sand-silt mixtures
		GC		Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than ½ of coarse fraction < No. 4 sieve size)	SW		Well-graded sands or gravely sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand-salt mixtures
		SC		Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (More than ½ of soil < No. 200 sieve)	SILTS & CLAYS LL < 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL		Organic silts and organic silty clays of low plasticity.
	SILTS & CLAYS LL > 50	MH		Inorganic silts, caceous or diatonaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of medium to high plasticity, organic silty clays, organic silts
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
	HIGHLY ORGANIC SOILS	Pt		Peat and other highly organic soils

CLASSIFICATION CHART
(UNIFIED SOIL CLASSIFICATION SYSTEM)

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDER	ABOVE 12"	ABOVE 305
COBBLES	3" to 12"	305 to 76.2
GRAVEL	3" to No. 4	762 to 4.76
COARSE	3" TO ¾"	76.2 to 19.1
FINE	¾"to No. 4	19.1 to 4.76
SAND	No. 4 to 200	4.76 to 0.074
COARSE	No. 4 to 10	4.76 to 2.00
MEDIUM	No. 10 to 40	2.00 to 0.420
FINE	No. 40 to 200	0.420 to 0.074
SILT & CLAY	BELOW No. 200	BELOW 0.074

GRAIN SIZE CHART



PLASTICITY CHART

Ring Sample	Bag Sample	NR No Recovery	Classification in accordance with ASTM D2487
SPT Sample	Seepage		Description and visual observation in accordance with ASTM D2488
			All Sieve Sizes shown are US Standard
			SPT Refusal is defined as one of the following:
			10 blows for no apparent displacement
			50 blows for less than 6 inches advancement
			100 blows for 6 to 18 inches advancement

GEOTECHNICAL BORING LOGS

Drill Hole No. B-1

Date: August 31, 2016
Drilling Company: Larry Harklerode
Hole Diameter: 8" **Drive Weight:** 140 lbs. **Drop:** 30"

Project No. 16155-01
Type of Rig: B-53
Elevation: Existing Ground

DEPTH (feet)	TYPE OF TEST	SAMPLE TEST	BLOWS PER 6 INCH	DRY DENSITY (%)	MOISTURE (%)	SOIL CLASSIFICATION USCS	GEOTECHNICAL DESCRIPTION LOGGED BY: GL SAMPLED BY: GL
1						SM	**SILTY SAND:** Light brown, fine to medium grained, slightly moist, dense
2							
3							
4		X	16/18/23	-	3.6		Dry, dense % Passing No. 200 Sieve = 27
5							
6		X	8/15/23	-	3.1		Dry, dense
7							
8							
9						SM-SC	**SILTY CLAYEY SAND:** Gray, fine to medium grained, moist, medium dense, petroleum smell
10							
11		X	4/5/7	-	21.2		% Passing No. 200 Sieve = 49
12							
13							
14							
15							
16	▼	X	6/7/9	-	21.6		Gray, petroleum smell
17							
18							
19							
20							
21		X	9/9/12	-	24.1	SP	**SAND:** Light gray, fine to medium grained, wet, medium dense % Passing No. 200 Sieve = 2
22							
23							
24							
25							

GEOTECHNICAL BORING LOGS

Drill Hole No. B-1

Date: August 31, 2016
Drilling Company: Larry Harklerode
Hole Diameter: 8" **Drive Weight:** 140 lbs. **Drop:** 30"

Project No. 16155-01
Type of Rig: B-53
Elevation: Existing Ground

DEPTH (feet)	TYPE OF TEST	SAMPLE TEST	BLOWS PER 6 INCH	DRY DENSITY (%)	MOISTURE (%)	SOIL CLASSIFICATION USCS	GEOTECHNICAL DESCRIPTION LOGGED BY: GL SAMPLED BY: GL
26		X	5/6/7	-	22.2	SP	Gray, wet, medium dense
27							
28							
29							
30							
31		X	3/4/4	-	25.4		Wet, loose
32							
33							
34							
35							
36		X	4/4/6	-	25.1		Wet, loose
37							
38							
39							
40							
41		X	5/9/9	-	-		Wet, medium dense
42						SM	**SILTY SAND:** Grayish brown, fine to medium grained, wet, medium dense
43							
44							
45							
46		X	9/9/9	-	22.6		Wet, medium dense
47							
48							**SAND WITH SILT:** Gray, fine to medium grained, wet, medium dense
49							TOTAL DEPTH = 50 FEET GROUNDWATER AT 16 FEET NO CAVING BORING BACKFILLED
50		X	9/10/11	-	-	SP-SM	

Soil Exploration Co., Inc.

GEOTECHNICAL BORING LOGS

Drill Hole No. B-2

Date: August 31, 2016
Drilling Company: Larry Harklerode
Hole Diameter: 8" **Drive Weight:** 140 lbs. **Drop:** 30"

Project No. 16155-01
Type of Rig: B-53
Elevation: Existing Ground

DEPTH (feet)	TYPE OF TEST	SAMPLE TEST	BLOWS PER 6 INCH	DRY DENSITY (%)	MOISTURE (%)	SOIL CLASSIFICATION USCS	GEOTECHNICAL DESCRIPTION LOGGED BY: GL SAMPLED BY: GL
1						SM	**SILTY SAND:** Light brown, fine to medium grained, slightly moist, dense
2							
3							
4			35/35	-	-		Slightly moist, dense
5							
6			17/21/30	-	-		Slightly moist, dense
7							
8							
9							
10							
11			7/7/9	-	-		Slightly moist, medium dense
12							
13							
14							
15							
16	▼		6/7/8	-	-		Gray, medium dense, wet, petroleum smell
17							
18							
19							
20							
21			7/9/9	-	-		Wet, medium dense
22							
23							TOTAL DEPTH = 21.5 FEET GROUNDWATER AT 16 FEET NO CAVING BORING BACKFILLED
24							
25							

Soil Exploration Co., Inc.

APPENDIX C

Proposed Two-Story Apartment Complex
3175 W. Ball Road
City of Anaheim, California

LABORATORY TEST RESULTS

SIEVE SIZE	B-1 @ 2.5' % PASSING	B-1 @ 10' % PASSING	B-1 @ 20' % PASSING
No. 4	100	100	100
No. 8	99.9	99.9	99.9
No. 16	99	99.5	99.4
No. 30	96	96	94
No. 50	83	85	55
No. 100	49	63	16
No. 200	27	49	2
SIEVE ANALYSIS TEST DATA			

Cal Land Engineering, Inc.
dba Quartech Consultants
Geotechnical, Environmental & Civil Engineering

September 6, 2016

Soil Exploration Company Inc.
7535 Jurupa Avenue, Unit C
Riverside, California 92504

Attn: Mr. Gene Luu

RE: LABORATORY TEST RESULTS/REPORT
Client: Environmental Engineering Enterprises, Inc
Project: Sulfate
Project No.: 16155-01
QCI Job No.: 16-183-008I

Gentlemen:

We have completed the testing program conducted on sample for above project. The tests were performed in accordance with testing procedures as follows:

TEST	METHOD
Sulfate	CT- 417

Enclosed is Summary of Laboratory Test Results.

We appreciate the opportunity to provide testing services to Soil Exploration Company Inc. Should you have any questions, please call the undersigned.

Sincerely yours,
Cal Land Engineering, Inc. (CLE)
dba Quartech Consultants (QCI)

Keith Au
Project Engineer

Enclosure

576 E. Lambert Road, Brea, CA 92821; Tel: 714-671-1050, Fax: 714-671-1090

Cal Land Engineering, Inc.
dba Quartech Consultants
Geotechnical, Environmental, and Civil Engineering

Soil Exploration Company Inc.
7535 Jurupa Avenue, Suite C
Riverside, California 92504

QCI Project No.: 16-183-008I
Date: September 6, 2016
Summarized by: KA

Client: Environmental Engineering Enterprises, Inc.
Project: Sulfate Test
Project No.: 16155-01

(Sulfate)

Sample ID	Sample Depth (ft)	Sulfate CT-417 (% By Weight)
T-1	0-2'	0.0440

576 East Lambert Road, Brea, California 92821; Tel: 714-671-1050; Fax: 714-671-1090

APPENDIX D

USGS
science for a changing world

Earthquake Hazards Program

2008 National Seismic Hazard Maps - Source Parameters

New Search

Distance in Miles	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
4.29	Puente Hills (Coyote Hills)	CA	0.7	28	N	thrust	2.8	15	17
6.99	Newport Inglewood Connected alt 2	CA	1.3	90	V	strike slip	0	11	208
7.09	Newport Inglewood Connected alt 1	CA	1.3	89		strike slip	0	11	208
7.09	Newport-Inglewood, alt 1	CA	1	88		strike slip	0	15	65
7.77	Puente Hills (Santa Fe Springs)	CA	0.7	29	N	thrust	2.8	15	11
9.31	San Joaquin Hills	CA	0.5	23	SW	thrust	2	13	27
10.14	Elsinore:W+GI+T+J+CM	CA	n/a	84	NE	strike slip	0	16	241
10.14	Elsinore:W+GI	CA	n/a	81	NE	strike slip	0	14	83
10.14	Elsinore:W	CA	2.5	75	NE	strike slip	0	14	46
10.14	Elsinore:W+GI+T	CA	n/a	84	NE	strike slip	0	14	124
10.14	Elsinore:W+GI+T+J	CA	n/a	84	NE	strike slip	0	16	199
12.66	Puente Hills (LA)	CA	0.7	27	N	thrust	2.1	15	22
15.36	Palos Verdes Connected	CA	3	90	V	strike slip	0	10	285
15.36	Palos Verdes	CA	3	90	V	strike slip	0	14	99
16.39	Newport-Inglewood (Offshore)	CA	1.5	90	V	strike slip	0	10	66
16.60	San Jose	CA	0.5	74	NW	strike slip	0	15	20
18.20	Elysian Park (Upper)	CA	1.3	50	NE	reverse	3	15	20
19.67	Chino, alt 1	CA	1	50	SW	strike slip	0	9	24
19.82	Chino, alt 2	CA	1	65	SW	strike slip	0	14	29
21.99	Raymond	CA	1.5	79	N	strike slip	0	16	22
23.17	Sierra Madre Connected	CA	2	51		reverse	0	14	76
23.17	Sierra Madre	CA	2	53	N	reverse	0	14	57
23.33	Verdugo	CA	0.5	55	NE	reverse	0	15	29
23.64	Elsinore:GI	CA	5	90	V	strike slip	0	13	37
23.64	Elsinore:GI+T	CA	5	90	V	strike slip	0	14	78
23.64	Elsinore:GI+T+J+CM	CA	n/a	86	NE	strike slip	0	16	195
23.64	Elsinore:GI+T+J	CA	n/a	86	NE	strike slip	0	17	153
24.61	Hollywood	CA	1	70	N	strike slip	0	17	17
24.81	Clamshell-Sawpit	CA	0.5	50	NW	reverse	0	14	16
25.86	Santa Monica Connected alt 2	CA	2.4	44		strike slip	0.8	11	93
26.33	Cucamonga	CA	5	45	N	thrust	0	8	26
29.28	Santa Monica, alt 1	CA	1	75	N	strike slip	0	18	14

-/-

29.28	Santa Monica Connected alt 1	CA	2.6	51		strike slip	0	16	79
33.45	Malibu Coast, alt 1	CA	0.3	75	N	strike slip	0	8	38
33.45	Malibu Coast, alt 2	CA	0.3	74	N	strike slip	0	16	38
34.62	Anacapa-Dume, alt 2	CA	3	41	N	thrust	1.2	12	65
35.96	Sierra Madre (San Fernando)	CA	2	45	N	thrust	0	13	18
36.71	Elsinore;T+J+CM	CA	n/a	85	NE	strike slip	0	16	169
36.71	Elsinore;T+J	CA	n/a	86	NE	strike slip	0	17	127
36.71	Elsinore;T	CA	5	90	V	strike slip	0	14	52
37.38	Coronado Bank	CA	3	90	V	strike slip	0	9	166
38.01	San Gabriel	CA	1	61	N	strike slip	0	15	71
40.23	Northridge	CA	1.5	35	S	thrust	7.4	17	33
41.22	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16	181
41.22	San Jacinto;SBV	CA	6	90	V	strike slip	0	16	45
41.22	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16	88
41.22	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16	134
41.22	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17	181
41.22	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	215
41.22	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	241
41.50	Anacapa-Dume, alt 1	CA	3	45	N	thrust	0	16	51
42.39	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390
42.39	S. San Andreas;PK+CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0.1	13	342
42.39	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13	377
42.39	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13	421
42.39	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13	479
42.39	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	548
42.39	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	220
42.39	S. San Andreas;SM+NSB	CA	n/a	90	V	strike slip	0	13	133
42.39	S. San Andreas;SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	176
42.39	S. San Andreas;SM+NSB+SSB+BG	CA	n/a	81		strike slip	0	13	234
42.39	S. San Andreas;SM+NSB+SSB+BG+CO	CA	n/a	83		strike slip	0.1	13	303
42.39	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	263
42.39	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14	321
42.39	S. San Andreas;SM	CA	29	90	V	strike slip	0	13	98
42.39	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	512
42.39	S. San Andreas;CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	306
42.39	S. San Andreas;CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	243

42.39	S. San Andreas;CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	279
42.39	S. San Andreas;CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	322
42.39	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	85		strike slip	0	14	380
42.39	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	449
42.39	S. San Andreas;CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	341
42.39	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	384
42.39	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0	14	442
42.39	S. San Andreas;NM+SM	CA	n/a	90	V	strike slip	0	14	134
42.39	S. San Andreas;NM+SM+NSB	CA	n/a	90	V	strike slip	0	13	170
42.39	S. San Andreas;NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	213
42.39	S. San Andreas;NM+SM+NSB+SSB+BG	CA	n/a	83		strike slip	0	14	271
42.39	S. San Andreas;NM+SM+NSB+SSB+BG+CO	CA	n/a	84		strike slip	0.1	13	340
42.39	S. San Andreas;BB+NM+SM	CA	n/a	90	V	strike slip	0	14	184
43.04	S. San Andreas;NSB+SSB	CA	n/a	90	V	strike slip	0	13	79
43.04	S. San Andreas;NSB+SSB+BG	CA	n/a	75		strike slip	0	14	136
43.04	S. San Andreas;NSB+SSB+BG+CO	CA	n/a	79		strike slip	0.2	12	206
43.04	S. San Andreas;NSB	CA	22	90	V	strike slip	0	13	35
44.99	Santa Susana, alt 1	CA	5	55	N	reverse	0	16	27
45.87	Cleghorn	CA	3	90	V	strike slip	0	16	25
45.99	San Jacinto;SJV+A+C	CA	n/a	90	V	strike slip	0	17	138
45.99	San Jacinto;SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	196
45.99	San Jacinto;SJV+A	CA	n/a	90	V	strike slip	0	17	89
45.99	San Jacinto;SJV+A+CC	CA	n/a	90	V	strike slip	0	16	136
45.99	San Jacinto;SJV	CA	18	90	V	strike slip	0	16	43
45.99	San Jacinto;SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	170

2013 CBC – SEISMIC PARAMETERS		
Site Coordinates	**Latitude**	**Longitude**
	33.8177	**-118.0017**
Mapped Spectral Response Acceleration	**S_S = 1.500**	**S_1 = 0.553**
Site Coefficients (Class "D")	**F_a = 1.00**	**F_v = 1.50**
Maximum Considered Earthquake (MCE) Spectral Response Acceleration	**S_{MS} = 1.500**	**S_{M1} = 0.829**
Design Spectral Response Acceleration Parameters	**S_{DS} = 1.000**	**S_{D1} = 0.553**
Seismic Design Category	**D**	
Peak Ground Acceleration (PGA)	**0.5g**	

References:

- Earthquake.usgs.gov/research/hazmaps/design
- 2013 California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2 of 2, Section 1613, Earthquake Loads

APPENDIX E

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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: UNTITLED
Title: Enviromental Engineering Enterprises, Inc.
Subtitle: Proj No. 16155-01

Surface Elev.=Existing Ground
Hole No.=B-1
Depth of Hole= 50.00 ft
Water Table during Earthquake= 10.00 ft
Water Table during In-Situ Testing= 16.00 ft
Max. Acceleration= 0.5 g
Earthquake Magnitude= 6.50

Input Data:
Surface Elev.=Existing Ground
Hole No.=B-1
Depth of Hole=50.00 ft
Water Table during Earthquake= 10.00 ft
Water Table during In-Situ Testing= 16.00 ft
Max. Acceleration=0.5 g
Earthquake Magnitude=6.50

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 0.88
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
   Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	41.00	120.00	27.00
5.00	38.00	120.00	27.00
10.00	12.00	120.00	49.00
15.00	16.00	120.00	49.00
20.00	21.00	120.00	2.00
25.00	13.00	120.00	2.00
30.00	8.00	120.00	2.00
35.00	10.00	120.00	2.00
40.00	18.00	120.00	49.00
45.00	18.00	120.00	49.00
50.00	21.00	120.00	2.00

Output Results:

Settlement of Saturated Sands=13.16 in.
Settlement of Unsaturated Sands=0.02 in.
Total Settlement of Saturated and Unsaturated Sands=13.19 in.
Differential Settlement=6.593 to 8.703 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.88	0.32	5.00	13.16	0.02	13.19
5.00	2.88	0.32	5.00	13.16	0.02	13.18
10.00	0.29	0.32	0.93*	13.16	0.00	13.16
15.00	0.34	0.38	0.91*	12.28	0.00	12.28
20.00	0.26	0.42	0.63*	11.31	0.00	11.31
25.00	0.15	0.44	0.35*	9.53	0.00	9.53
30.00	0.10	0.46	0.23*	7.13	0.00	7.13
35.00	0.12	0.46	0.25*	4.51	0.00	4.51
40.00	0.31	0.45	0.68*	2.77	0.00	2.77
45.00	0.29	0.44	0.66*	1.46	0.00	1.46
50.00	0.20	0.43	0.47*	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

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1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user

request factor of safety)

F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

APPENDIX F

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1.0 GENERAL INTENT

These specifications present general procedures and requirements for grading and earthwork as shown on the approved grading plans, including preparation of areas to be filled, placement of fill, installations of subdrains, and excavations. The recommendations contained in the geotechnical report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict. Evaluations performed by the consultant during the course of grading may result in new recommendations which could supersede these specifications or the recommendations of the geotechnical report.

2.0 EARTHWORK OBSERVATIONS AND TESTING

Prior to the commencement of grading, a qualified geotechnical consultant (soils engineer and engineering geologist, and their representatives) shall be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report and these specifications. It will be necessary that the consultant provide adequate testing and observations so that he may determine that the work was accomplished as specified. It shall be the responsibility of the contractor to assist the consultant and keep him apprised of work schedules and changes so that he may schedule his personnel accordingly.

It shall be the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and approved grading plans. If, in the opinion of the consultant, unsatisfactory conditions, such as questionable soil, poor moisture conditions, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the consultant will be empowered to reject the work and recommend that construction be stopped until the unsatisfactory conditions are rectified.

Maximum dry density tests used to determine the degree of compaction will be performed in accordance with the American Society of Testing and Materials, test method ASTM D1557-12.

3.0 PREPARATION OF AREAS TO BE FILLED

3.1 Clearing and Grubbing

All brush, vegetation, and debris shall be removed or piled and otherwise disposed of.

3.2 Processing

The existing ground which is determined to be satisfactory for support of fill shall be scarified to a minimum depth of 6 inches. Existing ground which is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until the soils are broken down and free of large clay lumps or clods and until the working surface is reasonably uniform and free of uneven features which would inhibit uniform compaction.

3.3 Overexcavation

Soft, dry, spongy, highly fractured or otherwise unsuitable ground, extending to such depth that surface processing cannot adequately improve the condition, shall be overexcavated down to firm ground, approved by the consultant.

3.4 Moisture Conditioning

Overexcavated and processed soils shall be watered, dried-back, blended, and/or mixed, as required to attain a uniform moisture content near optimum.

3.5 Recompaction

Overexcavation and processed soils which have been properly mixed and moisture-conditioned shall be recompacted to a minimum relative compaction of 90 percent.

3.6 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal : vertical), the ground shall be stepped or benched. The lowest bench shall be a minimum of 15 feet wide, shall be at least 2 feet deep, shall expose firm materials, and shall be approved by the consultant. Other benches shall be excavated in firm materials for a minimum width of 4 feet. Ground sloping flatter than 5:1 (horizontal : vertical) shall be benched or otherwise overexcavated when considered necessary by the consultant.

3.7 Approval

All areas to receive fill, including processed areas, removal areas and toe-of-fill benches shall be approved by the consultant prior to fill placement.

4.0 FILL MATERIAL

4.1 General

Material to be placed as fill shall be free of organic matter and other deleterious substances, and shall be approved by the consultant. Soils of poor gradation, expansion, or strength characteristics shall be placed in areas designated by consultant or shall be mixed with other soils to serve as satisfactory fill material.

4.2 Oversize

Oversize materials defined as rock, or other irreducible material with maximum dimension greater than 12 inches, shall not be buried or placed in fills, unless the location, materials, and disposal methods are specifically approved by the consultant. Oversize disposal operations shall be such that nesting of oversize material does not occur, and such that the oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet vertically of finish grade or within the range of future utilities or underground construction, unless specifically approved by the consultant.

4.3 Import

If importing of fill material is required for grading, the import material shall meet the requirements of Section 4.1.

5.0 FILL PLACEMENT and COMPACTION

5.1 Fill Lifts

Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 6 inches in compacted thickness. The consultant may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.

5.2 Fill Moisture

Fill layers at a moisture content less than optimum shall be watered and mixed, and wet fill layers shall be aerated by scarification or shall be blended with drier material. Moisture conditioning and mixing of fill layers shall continue until the fill material is at a uniform moisture content at or near optimum.

5.3 Compaction of Fill

After each layer has been evenly spread, moisture-conditioned, and mixed, it shall be uniformly compacted to not less than 90 percent of maximum dry density. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.

5.4 *Fill Slopes*

Compacting of slopes shall be accomplished, in addition to normal compacting procedures, by backrolling of slopes with sheepsfoot rollers at frequent increments of 2 to 3 feet in fill elevation gain, or by other methods producing satisfactory results. At the completion of grading, the relative compaction of the slope out to the slope face shall be at least 90 percent.

5.5 *Compaction Testing*

Field-tests to check the fill moisture and degree of compaction will be performed by the consultant. The location and frequency of tests shall be at the consultant's discretion. In general, the tests will be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of embankment.

6.0 SUBDRAIN INSTALLATION

Subdrain systems, if required, shall be installed in approved ground to conform to the approximate alignment and details shown on the plans or herein. The subdrain location or materials shall not be changed or modified without the approval of the consultant. The consultant, however, may recommend and upon approval, direct changes in subdrain line, grade or material. All subdrains should be surveyed for line and grade after installation and sufficient time shall be allowed for the surveys, prior to commencement of filling over the subdrain.

7.0 EXCAVATION

Excavations and cut slopes will be examined during grading. If directed by the consultant, further excavation or overexcavation and refilling of cut areas shall be performed, and/or remedial grading of cut slopes shall be performed. Where fill-over-cut slopes are to be graded, unless otherwise approved, the cut portion of the slope shall be made and approved by the consultant prior to placement of materials for construction of the fill portion of the slope.

8.0 TRENCH BACKFILLS

Trench excavations for utility pipes shall be backfilled under engineering supervision.

After the utility pipe has been laid, the space under and around the pipe shall be backfilled with clean sand or approved granular soil to a depth of at least one foot over the top of the pipe. The sand backfill shall be uniformly jetted into place before the controlled backfill is placed over the sand.

The onsite materials, or other soils approved by the soil engineer, shall be watered and mixed as necessary prior to placement in lifts over the sand backfill.

The controlled backfill shall be compacted to at least 90 percent of the maximum dry density as determined by the ASTM D1557-12 test method.

Field density tests and inspection of the backfill procedures shall be made by the soil engineer during backfilling to see that proper moisture content and uniform compaction is being maintained. The contractor shall provide test holes and exploratory pits as required by the soil engineer to enable sampling and testing.

APPENDIX G

Infiltration Test (Percolation Test Procedure)

One 8-inch diameter, 6-feet deep test hole (I-1) was drilled at suggested location. The soil at the test location was visually classified as silty sand (USCS "SM"). To mitigate any possible caving or sloughing of the test hole, a 6-inch diameter perforated pipe was placed in the hole. The bottom of the hole was covered with 2 inches of gravel.

The testing was conducted after presoaking with water. Two consecutive measurements showed that 6 inches of water seeped away in less than 25 minutes. The tests were run an additional one hour with measurements taken at 10 minute intervals. Water level was adjusted to 20 inches above the bottom of the test hole after each measurement. The drop that occurred during the final reading was used for design rate purposes.

Infiltration Tests/Tabulated Test Results

Test No.	Depth of Test (feet)	Earth Material	Infiltration Rate (in/hr)
I-1	6	Silty Sand ("SM")	2.9

We recommend that a suitable factor of safety should be applied to the rate in design of the system.