REPORT OF GEOTECHNICAL / GEOLOGIC STUDY AND INFILTROMETER TESTING PROPOSED HEAVY DUTY TRUCK AND PARTS SALES/SERVICE FACILITY NORTHEAST CORNER OF CHERRY AVENUE AND RANDALL AVENUE FONTANA AREA SAN BERNARDINO COUNTY, CALIFORNIA

PROJECT NO.: 1032-A16
REPORT NO.: 1

MARCH 24, 2016

SUBMITTED TO:

TEC EQUIPMENT, C/O
THATCHER ENGINEERING & ASSOCIATES
1461 FORD STREET, SUITE 105
REDLANDS, CA 92373

PREPARED BY:

HILLTOP GEOTECHNICAL, INC.
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March 24, 2016

TEC Equipment, c/o
Thatcher Engineering & Associates
1461 Ford Street, Suite 105
Redlands, CA 92373

Project No.: 1032-A16
Report No.: 1

Attention: Ms. Kayla Jordan - Project Coordinator

Subject: **Report of Geotechnical / Geologic Study and Infiltrometer Testing, Proposed Heavy Duty Truck and Parts Sales/Service Facility, Northeast Corner of Cherry Avenue and Randall Avenue, Fontana Area, San Bernardino County, California.**

References:

1. **Thatcher Engineering & Associates, Inc.**, November 23, 2015, *APN 0231-24, 25, 32, 48, 54, 55, 57, 76, 82, 83, 84 Minor Use Permit Site Plan for Truck Sales, Service / Repair and Parts Sales Dealership*, Job No.: 56003, Reference No. 56003sp1.

2. **Thatcher Engineering & Associates, Inc.**, November 11, 2015, *Infiltration Test Location Exhibit APN 0231-24, 25, 32, 48, 54, 55, 57, 76, 82, 83, 84 Northeast Corner of Randall Avenue & Cherry Avenue, County of San Bernardino*, Job No.: 56003, Reference No. 56003infiltrationtesting.

3. **County of San Bernardino**, May 19, 2011, *Technical Guidance Document Appendices, Appendix VII, Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations*, VII-1 through VII-36.

4. Technical References - See Appendix 'B.'

Ms. Jordan:

According to your request, we have completed a geotechnical / geologic study and infiltration testing for the design and construction of the proposed heavy duty

truck and parts, sales/service facility. We are presenting, herein, our findings and recommendations.

The findings of this study indicate that the project site is suitable for the proposed heavy duty truck and parts, sales/service facility provided the recommendations presented in the attached report are complied with and incorporated into the design and construction of the project.

Copies of this report should be forwarded to the other consultants for the project (i.e., Civil Engineer, Architect, Structural Engineer, etc.) as needed to implement the recommendations presented. The required number of the original, wet ink signed reports should be saved for submittal, and the other required documentation to the appropriate agency having jurisdiction over the project for review and permitting purposes.

If you have any questions after reviewing the findings and recommendations contained in the attached report, please do not hesitate to contact this office. This opportunity to be of professional service is sincerely appreciated.

Respectfully Submitted,
HILLTOP GEOTECHNICAL, INC.

Mark Hulett, CEG No. 1623
President

Sundaramoorthy Srirajan, GE No. 2871
Senior Engineer
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Staff Geologist

MH/SS/AH/tr

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PROJECT NO.: 1032-A16
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March 24, 2016

INTRODUCTION

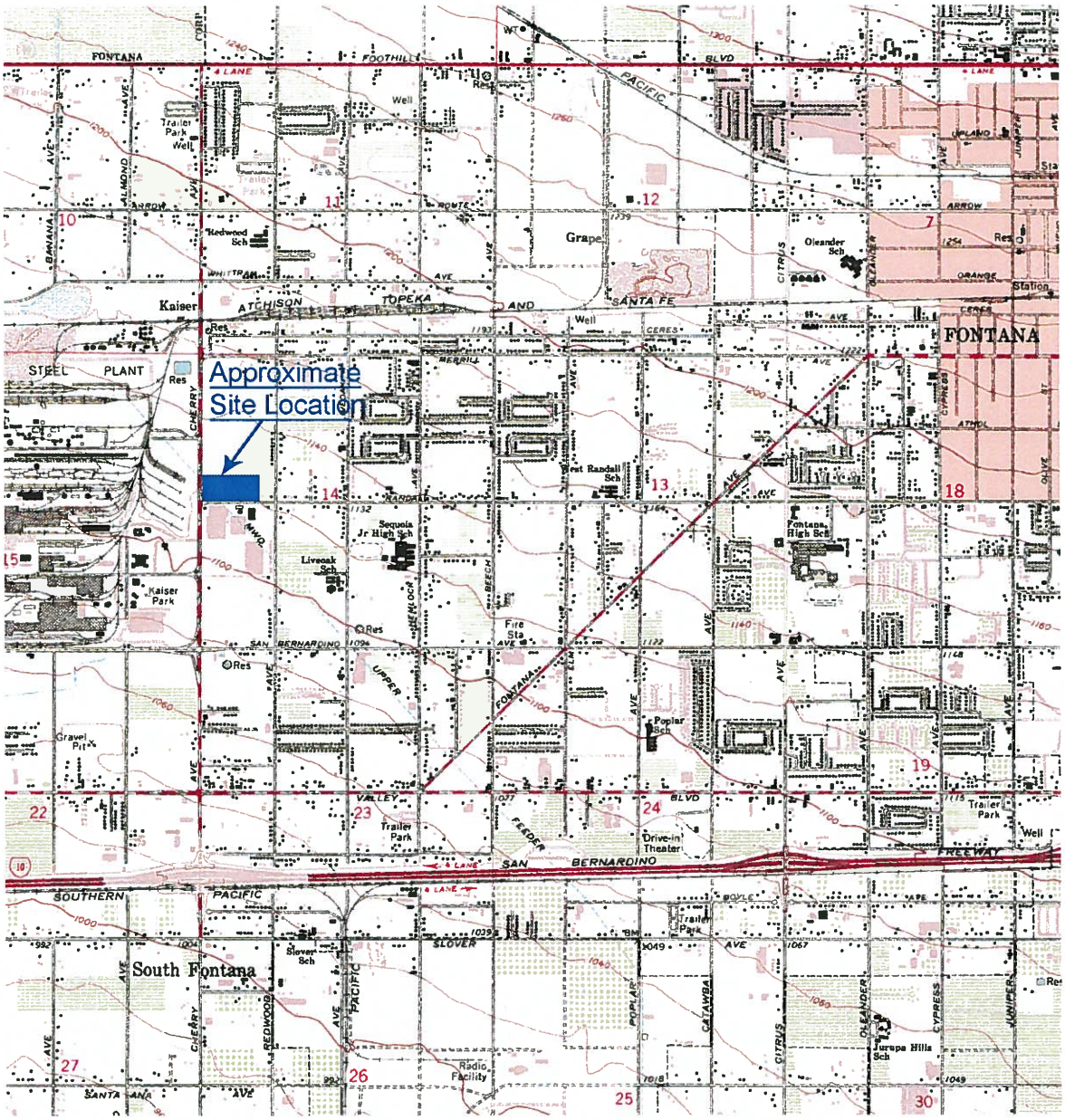
AUTHORIZATION

This report presents results of the geotechnical / geologic study conducted on the subject site for the proposed heavy duty truck and parts, sales/service facility to be located on northeast corner of Randall Avenue and Cherry Avenue in the Fontana area of San Bernardino County, California. The general location of the subject site is indicated on the 'Site Location Map,' Figure No. 1.

Authorization to perform this study was in the form of a signed proposal from **Hilltop Geotechnical, Inc. (HGI)** (Geotechnical / Geologic Consultant) to **TEC Equipment** (Client), dated November 24, 2015, Proposal Number: P15168.

PURPOSE AND SCOPE OF STUDY

The scope of work performed for this study was designed to determine percolation rates and evaluate the surface and subsurface conditions in the vicinity of the proposed structures on the subject site with respect to geotechnical characteristics, including potential geologic hazards that may effect the development of the site,



Reference: **United States Department of the Interior, Geologic Survey**, 1967, Photorevised 1980, *Fontana Quadrangle, California*, 7.5 Minute Topographic Series, Scale 1:24,000.

HILLTOP GEOTECHNICAL INCORPORATED	SITE LOCATION MAP	
	By: AH	Date: 03/2016
	Project No.: 1032-A16.1	Figure No.: 1

and to provide geotechnical recommendations and criteria for use in the design and construction of the proposed development. The scope of work included the following:

- Review of locally and easily available published and unpublished soil, geologic, and seismologic reports and data for the area (see References in Appendix 'B'), flood hazard maps, well data, etc. to ascertain earth material, geologic, and hydrologic conditions of the area.
- Telephone conversations with the client and/or representatives of the client.
- Site reconnaissance.
- Subsurface exploration by means of borings to characterize earth materials, geologic, and groundwater conditions that could influence the proposed development.
- Sampling of on-site earth materials from the exploratory excavations.
- Laboratory testing of selected earth material samples considered representative of the subsurface conditions to determine the engineering properties and characteristics.
- Define the general geology of the subject site and evaluate potential geologic hazards which would have an effect on the proposed site development.
- Determine seismic classification of the site to meet the requirements of the 2013 California Building Code (CBC), effective on January 1, 2014.
- Engineering analysis of field and laboratory data to provide a basis for geotechnical conclusions and recommendations regarding site grading and foundation, floor slab, retaining wall, pavement, etc. design parameters.
- Preparation of this report to present the geotechnical and geologic conclusions and recommendations for the proposed site development.

This report presents our conclusions and/or recommendations regarding:

- The geologic setting of the site.

- Potential geologic hazards (including landslides, seismicity, faulting, liquefaction potential, etc.)
- General subsurface earth conditions.
- Presence and effect of expansive, collapsible, and compressible earth materials.
- Groundwater conditions within the depth of our subsurface study.
- Excavation characteristics of the on-site earth materials.
- Characteristics and compaction requirements of proposed fill and backfill materials.
- Recommendations and guide specifications for earthwork.
- Seismic design coefficients for structural design purposes.
- Types and depths of foundations.
- Allowable bearing pressure and lateral resistance for foundations.
- Estimated total and differential settlements.
- Preliminary corrosion potential evaluation for concrete in direct contact with the on-site earth materials.
- Utility trench excavation and backfill recommendations.
- Slope maintenance and protection recommendations.
- Preliminary pavement recommendations.
- Percolation parameters for the design of the proposed recharge basin.

The scope of work performed for this report did not include any testing of earth materials or groundwater for environmental purposes, an environmental assessment of the property, or opinions relating to the possibility of surface or

subsurface contamination by hazardous or toxic substances. In addition, evaluation of on-site private sewage disposal systems for the proposed development was not part of this study.

This study was prepared for the exclusive use of **TEC Equipment** and their consultants for specific application to the development of the proposed project in accordance with generally accepted standards of the geotechnical and geologic professions and generally accepted geotechnical (soil and foundation) engineering and geologic principles and practices at the time this report was prepared. Other warranties, implied or expressed, are not made. Although reasonable effort has been made to obtain information regarding geotechnical / geologic and subsurface conditions of the site, limitations exist with respect to knowledge of unknown regional or localized off-site conditions which may have an impact at the site. The conclusions and recommendations presented in this report are valid as of the date of this report. However, changes in conditions of a property can occur with passage of time, whether they are due to natural processes or to works of man on this and/or adjacent properties.

If conditions are observed or information becomes available during the design and construction process which are not reflected in this report, **HGI**, as Geotechnical / Geologic Consultant of record for the project, should be notified so that supplemental evaluations can be performed and conclusions and recommendations presented in this report can be verified or modified in writing, as necessary. Changes in applicable or appropriate standards of care in the geologic / geotechnical professions occur, whether they result from legislation or the broadening of knowledge and experience. Accordingly, the conclusions and recommendations presented in this report may be invalidated, wholly or in part,

by changes outside the influence of the project Geotechnical / Geologic Consultant which occur in the future.

PREVIOUS SITE STUDIES

No previous geotechnical and/or geological studies for the subject site are known to have been performed or were made available for review at the time of this study, if any had been performed. However, it is our understanding buildings and other type structures previously existed on the site and had since been demolished. The size and configuration of the buildings are not known nor determined by this study.

PROJECT DESCRIPTION / PROPOSED DEVELOPMENT

As part of our study, we have discussed the project with Mr. Dave Thompson, the developer, and Ms. Kayla Jordan of Thather Engineering, Inc., the Civil Engineer for the project. We also have been provided with the Reference Nos.1 & 2 'Minor Use Permit Site Plan and Infiltration Test Location Exhibit' noted on the first page of the cover letter for this report.

Based on information presented to this firm, it is our understanding that the proposed project will consist of a two story office retail warehouse, repair bays, employee and tractor repair parking. The proposed two story structure will be square-shaped in plan dimensions of approximately 199 feet by 200 feet and consist of approximately 166,200 square feet of office area. No information is available at this time as to the type of building, pad grade, structural loads, etc. for the future building. The foundation loads are not anticipated to exceed 3,500 pounds per lineal foot (plf) for continuous footings and 200 kips for column footings. Finish floor elevation for the structure had not been furnished at the time of our study, but it is anticipated to be within 1.0 to 2.0 feet of existing site grades. Therefore, no cut or fill slopes are anticipated to be required for the development of the site.

The site will also be developed with accompanying Hot Mix Asphaltic (HMA) concrete and/or Portland Cement concrete (PCC) driveway and parking areas. A storm water infiltration basin is proposed to be constructed in the southwest portion of the subject site.

The above project description and assumptions were used as the basis for the field exploration, laboratory testing program, the engineering analysis, and the conclusions and recommendations presented in this report. **HGI** should be notified if structures, foundation loads, grading, and/or details other than those represented herein are proposed for final development of the site so a review can be performed, a supplemental evaluation made, and revised recommendations submitted, if required.

FIELD EXPLORATION AND LABORATORY TESTING

The field study performed for this report included a visual reconnaissance of existing surface conditions of the subject site and surrounding area. A study of the property's subsurface condition was performed to evaluate underlying earth strata and the presence of groundwater. Surface and subsurface conditions were explored on February 25, 2016.

The subsurface exploration consisted of excavating five (5) exploratory borings on the subject property. The locations of the percolation tests were selected by the client. The approximate locations of the exploratory excavations are shown on the 'Exploratory Excavation Location Plan,' Plate No. 1. The exploratory excavations were observed and logged by a representative of **HGI**. Earth materials encountered in the exploratory excavations were visually described in the field in

general accordance with the current Unified Soils Classification System (USCS), ASTM D2488, visual-manual procedures, as illustrated on the attached, simplified 'Subsurface Exploration Legend,' Plate No. 2, presented in Appendix 'A' of this report. The results are presented on the 'Subsurface Exploration Log,' Plate Nos. 3 through 7, presented in Appendix 'A' of this report.

A more detailed explanation of the field study which was performed for this report is presented in Appendix 'A'of this report.

Relatively undisturbed ring samples and representative bulk samples of on-site fill and natural earth materials were collected during the field exploration and returned to the laboratory for testing. Laboratory tests were conducted to evaluate the index and engineering properties of on-site earth materials and included in-situ dry density and moisture content tests, an expansion index test, a soluble sulfate test, a sieve analysis test, a resistance (R-Value) test, and a maximum dry density / optimum moisture content relationship test. A more detailed explanation of laboratory tests performed for this study and test results are presented in Appendix 'A' of this report, Plate Nos. 8 through 10.

FINDINGS

SITE DESCRIPTION

The subject property comprises approximately 15.79 acres was rectangular in shape and approximately 945 feet by 435 feet in plan dimension as shown on the Reference No. 1 'Minor Use Site Permit Plan' noted on the first page of the cover letter for this report. The subject property is located on the northeast corner of the intersection of Randall Avenue and Cherry Avenue in the Fontana area of San Bernardino County, California. The subject property is located in the northwest

quadrant of Section 14, T1S R4W of the San Bernardino Principle Meridian at Latitude: 34.085969° North, Longitude: -117.487199° West.

The legal description for the subject property as presented on the referenced 'Minor Use Permit Site Plan' is as follows:

(APN 0231-021-24, 25, 32, 48, 54, 55, 57, 76, 82, 83, & 84)

The subject property is bounded by an existing block wall to the north, a warehouse and parking area to the east, and Cherry Avenue and Randall Avenue to the south and west as shown on the Reference No. 1 'Minor Use Permit Site Plan'. The site was generally vacant with a wooden farm fence encompassing the area on the south and east. A chain link fence that was parallel to Cherry Avenue divided parcels 0231-021-82, 48 & 76 from parcels 0231-021-54, 55, 32, 25. The east portion of the site had some randomly located pcc concrete pads and asphalt leading to and from the parcels. More debris was noted on the east portion of the chain link fence.

The immediate area of the subject site was almost flat with a shallow, downward inclination toward the southwest at an average gradient of approximately 1.0 percent. Total on-site relief in the area of the proposed development was approximately 15 feet. The minimum and maximum elevations within the immediate area of the proposed development on the subject site was approximately 1118 and 1133 Mean Sea Level (MSL), respectively. On-site drainage was accomplished by sheetflow toward the southwest.

At the time the field exploration was made, the surface of the site was firm with minimal animal burrowing and the drilling equipment did not experience any

difficulty moving around on the site. The east portion of the site was bound by a chain link fence and was unaccessible at the time of this study.

Buildings or other type structures were not present on the site at the time of the field study. Underground Service Alert was notified prior to excavations. A representative of MWD notified **HGI** of a 144 inch diameter water pipe traversing the southwest portion of the site, as shown on Reference No. 2, "Infiltration Test Location Exhibit". Electric and telephone lines were observed above ground on Randall Avenue. Based upon google earth historic imagery, former buildings were located in the central and eastern portions of the site and had since been demolished. Utilities such as gas, sewer, water, as well as other unknown underground lines may be present on the site. It is anticipated that cisterns, leach lines, and septic tanks also may still be present on the site.

Several end dumped piles of construction debris, miscellaneous debris and refuse, soil, etc. were observed at various locations throughout the subject property. Some relatively large piles were noted in the proposed building footprint and in the east and southeast portions of the site.

Vegetation in the immediate vicinity of the proposed project was light and consisted of seasonal native grasses, weeds, and brush. A few randomly located trees were visible along the north block wall.

ENGINEERING GEOLOGIC ANALYSIS

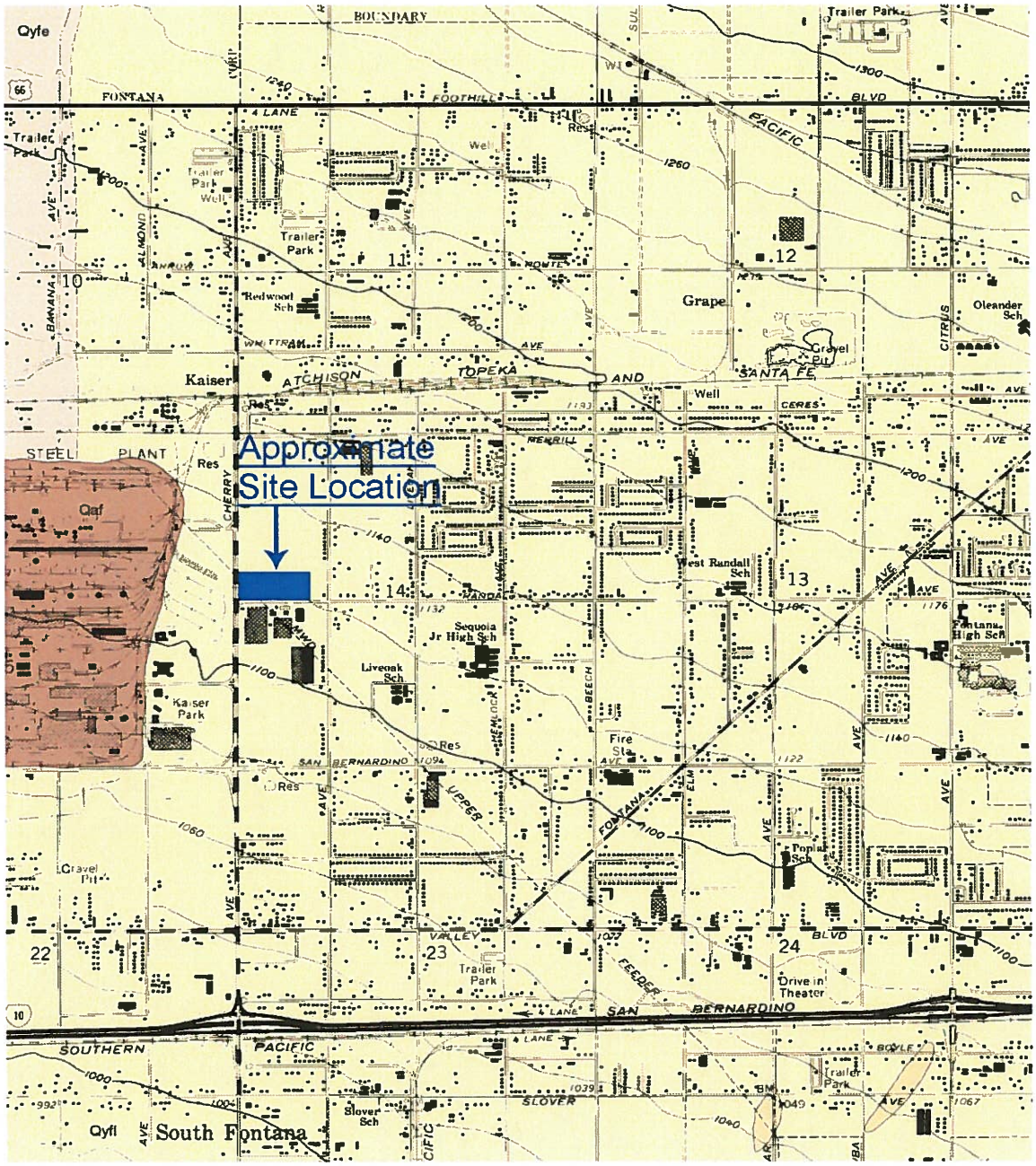
Regional Geologic Setting

The project site is situated within the northern portion of the Peninsular Ranges Geomorphic Province of Southern California. This province is a well-defined, geologic and physiographic unit that occupies the southwestern corner of California

and extends southward to include the Baja California Peninsula. It is characterized by elongated ranges and valleys whose general northwesterly trend is terminated abruptly on the north by the east-west grain of the Transverse Ranges. The portion of the province that lies above sea level is approximately 900 miles long, 140 miles in maximum width, and 55 miles in average width. An additional large part of the Peninsular Ranges Province lies mainly submerged beneath the Pacific Ocean. This portion of the province is represented by Santa Catalina, Santa Barbara, San Nicolas, and San Clemente Islands.

The province contains a diverse array of metamorphic, sedimentary, volcanic, and intrusive igneous rocks. In general, the metamorphic rocks represent the highly altered host rocks for the emplacement of very large masses of granitic rock of varying composition. Closer to the coastline, younger rocks include thick sequences of marine and non-marine clastic sedimentary rocks of Mesozoic and Tertiary age, ranging from claystones to conglomerate. Inland, the province is dominated by crystalline basement rocks, but the San Bernardino region, including the Fontana area, also contains thick sequences of pre-Quaternary, continental sedimentary rocks. These rocks are widely exposed in hills bounding the south side of the San Bernardino Valley, and are believed to underlie the valley floor at depth. The general geology in the area of the subject site is shown on the 'Regional Geology Map,'Figure No. 2a and 'Regional Geology Map Legend' Figure No. 2b.

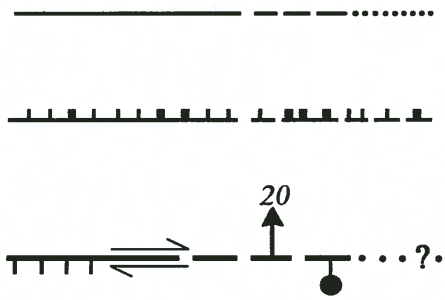
Coarse-grained Quaternary alluvium forms several massive fans extending from the mouths of Lytle Creek and canyons north of the Ontario area. The subject site has likely received material from more than some of these sources. The inferred depth of Quaternary alluvium at the subject site is several hundred feet, based on water well records in the area.



Reference: **U.S. Department of the Interior, U.S. Geological Survey,** Morton, D.M., digitally Bovard R.K., Preliminary Geologic Map of the Fontana 7.5' Quadrangle, San Bernardino and Riverside Counties, Open File Report 03-418, Scale: 1:24,000.

HILLTOP GEOTECHNICAL INCORPORATED	REGIONAL GEOLOGY MAP	
	By: AH	Date: 03/2015
	Project No.: 1032-A16.1	Figure No.: 2a

Legend for Geologic Symbols and Units



Separates geologic-map units. Solid where meets map-accuracy standard; dashed where may not meet map-accuracy standard; dotted where concealed

Contact—Separates terraced alluvial units where younger alluvial unit is incised into older alluvial unit; hachures at base of slope, point toward topographically lower surface. Solid where meets map-accuracy standard; dashed where may not meet map-accuracy standard

Fault—Solid where meets map-accuracy standard; dashed where may not meet map accuracy standard. Dotted where concealed by mapped covering unit; queried where existence uncertain. Hachures indicate scarp, with hachures on downdropped block. Paired arrows indicate relative movement; single arrow indicates direction and amount of fault-plane dip. Bar and ball on down-thrown block.

Qaf — Qaf - Artificial Fill (late Holocene).

Qyfe — Qyfe - Young alluvial fan deposits of Etiwanda Creek (Holocene and late Pleistocene).

Qyfl — Qyfl - Young alluvial fan deposits of Lytle Creek (Holocene and late Pleistocene).

Reference: **U.S. Department of the Interior, U.S. Geological Survey,** Morton, D.M., digitally Bovard R.K., Preliminary Geologic Map of the Fontana 7.5' Quadrangle, San Bernardino and Riverside Counties, Open File Report 03-418, Scale: 1:24,000.

HILLTOP GEOTECHNICAL INCORPORATED	REGIONAL GEOLOGY MAP LEGEND	
	By: AH	Date: 03/2016
	Project No.: 1032-A16.1	Figure No.: 2b

Local Subsurface Conditions

Earth Materials Description: Presented as follows are brief descriptions of the earth materials encountered in the exploratory excavations. More detailed descriptions of encountered earth materials are presented on the 'Subsurface Exploration Log,' Plate Nos. 3 through 7, presented in Appendix 'A' of this report. The earth material strata, as shown on the logs, represent conditions at the actual exploratory excavation locations. Other variations may occur beyond and/or between the excavations. Lines of demarcation between earth materials on the logs represented the approximate boundary between the material types; however, the transition may be gradual.

The earth materials encountered on the subject site during the field exploration were identified as man-made fill (af) and Young Alluvial Fan Deposits of Lytle Creek (Qyfl).

Man made fill was encountered at the location of borings B-1 through B-3. The fill extended to a depth of approximately 2.0 feet at the locations of the exploratory excavations. The fill generally consisted of silty, fine to medium sand with variable amounts of coarse sand and gravel (SM) which was brown in color, dry at the surface to moist with depth, and loose in relative density. The in-place density tests indicated that the fill had an average relative compaction of approximately 80 to 85 percent. The fill is considered to be undocumented and unsuitable for support of structural fill and/or a building structure.

The alluvium was generally encountered in the lower portions of the subject site and generally consisted of silty fine to coarse sands with varying amounts of gravel and cobbles (SM), and slightly silty, fine to coarse sand and gravels and with few to some cobbles (SP) and combinations of them both. The alluvium was light

brown, to brown in color and dry near the surface to moist with depth. Locally, the alluvium extended to depths in excess of 27.0 feet below the existing ground surfaces at the excavation locations on the subject site. The borings were terminated in the alluvial deposit.

Groundwater: Groundwater was not encountered in the exploratory excavations to the maximum depth explored of approximately 27.0 feet below existing ground surface at the boring locations at the time the field study was performed for this report.

Depth to groundwater data for the site area was available through the **California Department of Water Resources** internet web site. The depth to groundwater in State Well No. 01S06W11N001S, located approximately 0.5 mile north of the site, was at 469 feet on October 16, 2015. The surface elevation of this well is approximately 36 feet higher (topographically) than that of the site. Based on this information, the current depth to static groundwater beneath the site is estimated to be greater than 50 feet. Based on proposed site grading and the inferred groundwater depths, groundwater should not be a factor for project design or long-term performance.

Surface Water: Surface water was not observed on the subject site at the time the field study was performed for this report.

Site Variations: Based on results of our subsurface exploration and experience, variations in the continuity and nature of surface and subsurface conditions should be anticipated. Due to uncertainty involved in the nature and depositional characteristics of earth materials at the site, care should be exercised in

extrapolating or interpolating subsurface conditions between and beyond the exploratory excavation locations.

Groundwater observations were made in the exploratory excavations at times and under conditions stated on the boring logs. These data have been reviewed and interpretations made in the text in other sections of this report. However, it should be noted that fluctuations in levels of groundwater, springs, and/or perched water may occur due to variations in precipitation, temperature, and other factors.

Faulting and Regional Seismicity

The site is situated in an area of active and potentially active faults, as is most of metropolitan southern California. Active faults present a variety of potential risks to structures, the most common of which are strong ground shaking, dynamic densification, liquefaction, mass wasting, and surface rupture at the fault plane. Generally speaking, the following four (4) factors are the principal determinants of seismic risk at a given location:

- Distance to seismogenically capable faults.
- The maximum or "characteristic" magnitude earthquake for a capable fault.
- Seismic recurrence interval, in turn related to tectonic slip rates.
- Nature of earth materials underlying the site.

Surface rupture represents the primary potential hazard to structures built in an active fault zone. A review of official maps delineating State of California earthquake fault zones found that the subject site lies in the west portion of the Fontana Quadrangle. No Alquist-Priolo fault study zones are located within this quadrangle. In addition, the site is not located within a zone of mandatory study

for active faulting per the **San Bernardino County Planning Department**, *San Bernardino County Land Use Plan, GENERAL PLAN, Geologic Hazard Overlays*, Sheet F29 C Fontana, Plot Date: 05/30/2007, Scale: 1:14,400 (http://www.co.san-bernardino.ca.us/landuseservices/general). Reviews of other geology maps of the Fontana region revealed no known faults that cross the subject site.

The most recent, large earthquake that occurred in close proximity to the subject property was the June 28, 1992 Big Bear earthquake. The epicenter of this quake was located approximately 63 kilometers east of the subject property at Latitude: 34.2030° North, Longitude: 116.8270° West. The Big Bear quake had a measured magnitude of 6.7, had no surface rupture, and is believed to have occurred on a blind thrust fault, the exact location and geometry of which currently are unknown. Several aftershocks also were centered very near the epicenter, including a magnitude 5.6 aftershock.

Ground shaking is judged to be the primary hazard most likely to affect the site, based upon proximity to seven (7) regionally significant active faults as listed in the following table. Other significant fault zones, including the Elsinore fault, the Whittier fault, and several zones in the high desert area are located at distances exceeding 25 kilometers from the site. Greater distances, lower slip rates, and lesser maximum magnitudes indicate much lower risk to the site from the latter fault zones than the seven (7) closest faults including the regionally significant San Andreas fault. Characteristics of the major active fault zones selected for inclusion in analysis of strong ground shaking are listed in the following table:

Fault Zone[1]	Distance (km)[2] / Direction from Site	Fault Length (km)[1]	Slip Rate (mm/yr)[1]	Reference Earthquake $M_{(Max)}$[1]	Fault Type[1]
Cucamonga (r,45 N)	9.9 / North	28±3	5.0±2.0	6.9	B
San Jacinto (San Bernardino Segment) (rl-ss)	10.7 / Northeast	36±4	12.0±6.0	6.7	A
San Jose (ll-r-o, 75 NW)	18.9 / Northwest	20±2	0.5±0.5	6.4	B
San Andreas (San Bernardino Segment) (rl-ss)	19.7 / Northeast	103±10	24.0±6.0	7.5	A
Chino-Central Avenue (rl-r-o, 65 SW)	22.8 / Southwest	28±3	1.0±1.0	6.7	B
Sierra Madre (r, 45 N)	23.3 / West Northwest	57±6	2.0±1.0	7.2	B
Cleghorn (ll-ss)	24.0 / North	25±3	3.0±2.0	6.5	B
San Jacinto (San Jacinto Valley Segment) (rl-ss)	24.3 / Southwest	43±4	12.0±6.0	6.9	A

1. **Tianqing, C.W., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C.J.**, June 2003, *The Revised 2002 California Probabilistic Seismic Hazards Maps (Appendix A - 2002 California Fault Parameters).*
   California Department of Conservation, Division of Mines and Geology, 1996, *Probabilistic Seismic Hazard Assessment for the State of California*, DMG Open-File Report 96-08.
2. **Blake, Thomas F.**, 2000, *Preliminary Fault-Data for EQFault, EQSearch and FriskSP* and **Blake, Thomas, F.**, *Computer Services and Software, Users Manuals, FriskSP v. 4.00, EQSearch v. 3.00, and EQFault v. 3.00.*
3. Fault Geometry: (ss) strike slip; (r) reverse; (n) normal; (rl) right lateral; (ll) left lateral; (O) oblique; (45 N) direction.

Probabilistic seismic hazard maps and data files prepared by the **California Geological Survey (CGS)** determine ground motions with a 10-percent probability of being exceeded in the next 50 years (475 years mean return time) as a fraction of the acceleration due to gravity for peak ground acceleration (PGA) and

spectral accelerations (Sa) for short and moderately long periods, 0.2 seconds and 1.0 second, respectively. This data was available at the **CGS** 'PSHA Ground Motion Interpolator (2008)' web site (http://www.quake.ca.gov/gmaps/PSHA/psha_interpolator.html). The values are presented in the following table for reference:

GROUND MOTION*	SITE ACCELERATION Site Class D**
PGA	0.533g
Sa @ 0.2 Sec.	1.157g
Sa @ 1.0 Sec.	0.704g

* 10-percent probability of being exceeded in the next 50 years (475 years mean return time).
** Shear Wave Velocity of 274 m/sec was assumed for the on-site materials.

Probabilistic seismic hazard maps and data files prepared by the **U.S. Geological Survey (USGS)** assign a 2-percent likelihood that a Peak Horizontal Ground Acceleration (PGA) of approximately 0.799g will occur at this site within the next 50 years (2,475 years mean return time) due to a Model Magnitude earth quake of 7.8 located at a distance of approximately 16.2 km from the subject site. This data was available at the **U.S. Department of the Interior, U.S. Geological Survey,** Geologic Hazards Science Center's 2008 NSHMP PSHA Interactive Deaggregation Web Site (https://geohazards.usgs.gov/deaggint/2008/). The web site also assigns a 10-percent likelihood that a Peak Horizontal Ground Acceleration (PGA) of approximately 0.5228g will occur at this site within the next 50 years (475 years mean return time) due to a Model Magnitude earth quake of 6.58 located at a distance of approximately 8.9 km from the subject site. An average shear wave velocity (v_s) for the alluvial soils on the subject site of 274 meters per second (m/sec) (i.e., 900 ft/s) was assumed for the analysis.

Actual shaking intensities at the site from any seismic source may be substantially higher or lower than estimated for a given earthquake magnitude, due to complex and unpredictable effects from variables such as:

- Near-source directivity effects.
- Direction, length, and mechanism of fault rupture (strike-slip, normal, reverse).
- Depth and consistency of unconsolidated sediments.
- Topography.
- Geologic structure underlying the site.
- Seismic wave reflection, refraction, and interference.

Secondary Seismic Hazards

Secondary hazards include induced landsliding or mass wasting, liquefaction, flooding (from ruptured tanks and reservoirs, surface oscillations in larger lakes, or seismic sea waves), and subsidence as a result of soil densification. Landsliding and liquefaction susceptibility maps have been prepared for much of Los Angeles Riverside and San Bernardino Counties, California by the **CGS**, however as of the date of this report, the site has not been identified or excluded from a State-delineated zone of mandatory study for either landsliding or liquefaction.

Landslide: The subject site is not located within a designated area as having landslide susceptibility per **San Bernardino County Planning Department**, *San Bernardino County Land Use Plan, GENERAL PLAN, Geologic Hazard Overlays*, Sheet FH29 C Fontana Plot Date: 05/30/2007, Scale: 1:14,400 (http://www.co.san-bernardino.ca.us/landuseservices/general).

Due to the flat-lying nature of the site, on-site landsliding or debris flows sourced from higher elevations should not be considered to be a geologic constraint at this site.

Liquefaction: Liquefaction is a phenomenon in which cohesionless, saturated, fine-grained sand and sandy silt soils lose shear strength due to ground shaking. The subject site is not located within a designated area as having a liquefaction potential per **San Bernardino County Planning Department**, *San Bernardino County Land Use Plan, GENERAL PLAN, Geologic Hazard Overlays*, Sheet FH29 C Fontana Plot Date: 05/30/2007, Scale: 1:14,400 (http://www.co.san-bernardino.ca.us/landuseservices/general).

It is our opinion that liquefaction potential at the subject site is very low due to an estimated depth of groundwater of 50 feet or greater beneath the existing ground surface on the site.

Seismically Induced Subsidence: Loose sandy soils subjected to moderate to strong ground shaking can experience settlement. Experience from the Northridge Earthquake indicates that structural distress can result from such seismic settlement. Based upon the results of this study, the subject site is underlain at depth by dense to very dense, consolidated deposits that should not be prone to a significant degree of seismic settlement. Where applicable, loose, near-surface, alluvial soils and undocumented fills should be removed and recompacted to uniform high densities to mitigate both settlement and consolidation potentials.

Lateral Spreading: Lateral spread is the most pervasive type of liquefaction-induced ground failure. Lateral spreads can occur on gently sloping ground or where nearby drainage or stream channels can lead to static shear stress biases

on essentially horizontal ground. During lateral spread, blocks of mostly intact, surficial earth material displace downslope or towards a free face along a shear zone that has formed within the liquefied sediment. The resulting ground deformation typically has extensional fissures or a graben at the head of the failure, shear deformations along the side margins, and compression or buckling of the earth material at the toe. The amount of lateral displacement typically ranges from a few centimeters to several meters and can cause considerable damage to engineered structures and lifelines.

A formal lateral spread analysis was not performed as part of this study. The lateral spread potential of the subject site is not considered to be a geologic hazard for the proposed structure on the subject property.

Seiching: Seiching involves an enclosed body of water oscillating due to ground shaking, usually following an earthquake. Lakes and water towers are typical bodies of water affected by seiching. However, the site does not appear to be within the influence of large bodies of water and, as such, seiching should not be considered a geologic hazard for the development of the subject site.

Tsunamis: Because of the inland geographic location of the site, tsunamis are not considered a geologic hazard for the development of the subject site.

Lurching: Lurching is a phenomena in which ground cracking and/or secondary faulting occurs as a result of ground shaking. Generally, lurching primarily occurs in the immediate vicinity of faulting or within typical building setback zones or "No Human Occupancy" zones. No evidence of faulting was encountered on the site and although the potential for lurching cannot be entirely ruled out, the likelihood for lurching to impact the site is considered to be low.

OTHER GEOLOGIC HAZARDS

Flooding

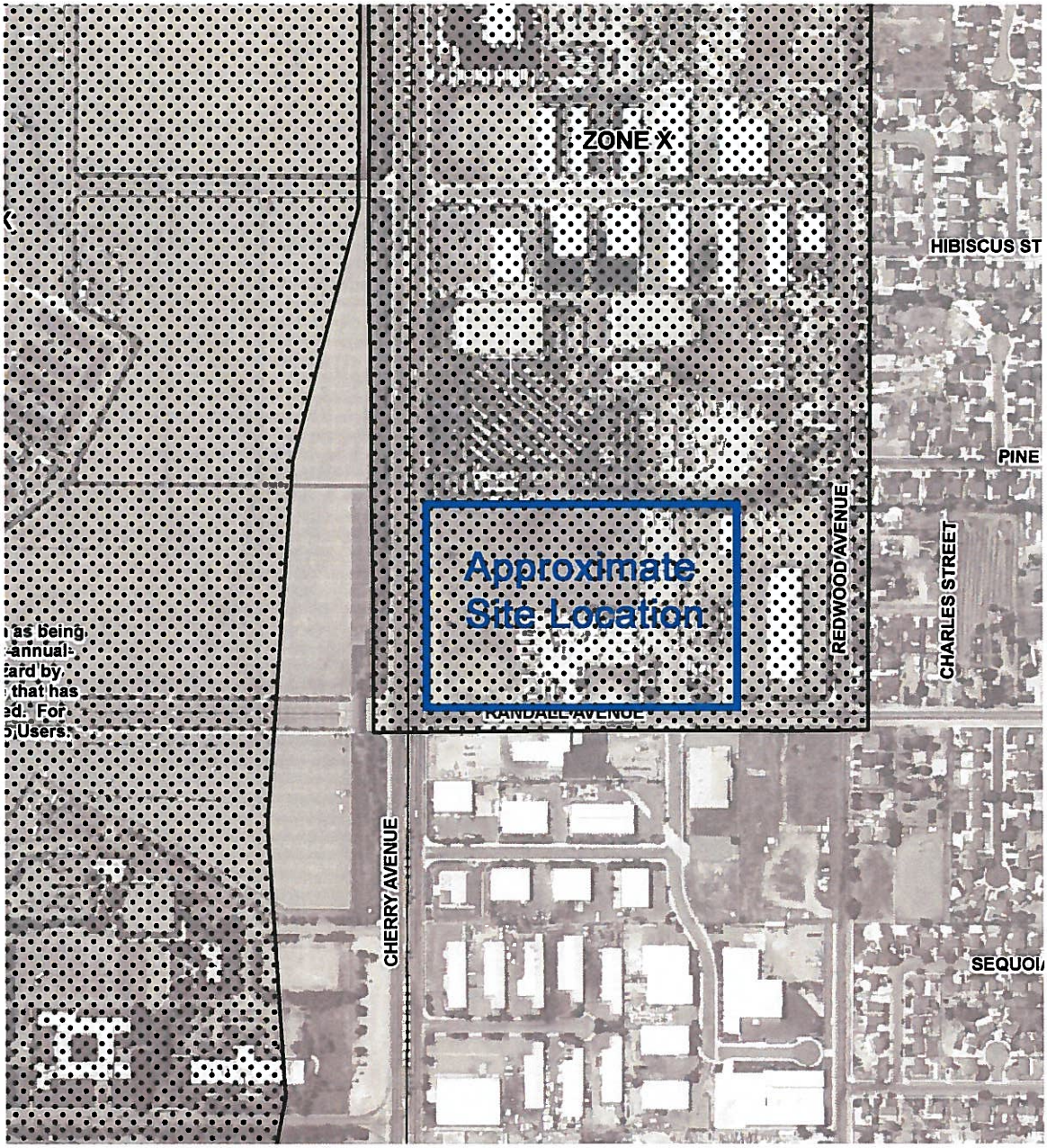
The subject site is located within an area inside the designated 500 year flood plain per **San Bernardino County Planning Department**, *San Bernardino County Land Use Plan, GENERAL PLAN, Hazard Overlays*, Sheet FH29 B Fontana, Plot Date: 03/09/2010, Scale: 1:14,400 (http://www.co.san-bernardino.ca.us/landuseservices/general).

Flood Insurance Rate Maps (FIRM) were compiled by the **Federal Emergency Management Agency (FEMA)** for the Flood Insurance Program and are available for most areas within the United States at the **FEMA** web site (http://msc.fema.gov/). The attached 'FEMA Flood Hazard Map' and 'FEMA Flood Hazard Map Legend,' Figure Nos. 3a and 3b, respectively, are based on FIRMs provided by **FEMA** and are specific to the area around the subject site. The 'FEMA Flood Hazard Map,' Figure 3a, indicates that the site is located within 'Zone X' (an area of 0.2-percent annual chance flood; an area of 1-percent annual chance flood (100 year flood) with average depths of less than 1.0 foot or with drainage areas less than 1.0 square mile; and an area protected by levees from the 1-percent annual chance flood).

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

The conclusions and recommendations presented in this report are preliminary since a grading plan, structural loads, finish floor elevations, etc. were not available and are, in part, based on information provided to this firm, the results of the field and laboratory data obtained from five (5) exploratory excavations



0 400 800

Scale Approximate in Feet

N

Reference: **U.S. Federal Emergency Management Administration (FEMA)**, Map Revised August 28, 2008, *Flood Insurance Rate Map*, Map No. 06071C 8653 H, Panel No. 8653 of 9400. Site specific information obtained through FEMA website, Map Service Center (http://msc.fema.gov/).

HILLTOP GEOTECHNICAL INCORPORATED	FEMA FLOOD HAZARD MAP	
	By: AH	Date: 03/2016
	Project No.: 1032-A16.1	Figure No.: 3a

LEGEND

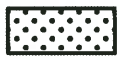
SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.



OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

HILLTOP GEOTECHNICAL INCORPORATED

FEMA FLOOD HAZARD MAP LEGEND	
By: AH	Date: 03/2016
Project No.: 1032-A16.1	Figure No.: 3b

located on the subject property, experience gained from work conducted by this firm on projects within the general vicinity of the subject site, the project description and assumptions presented in the 'Project Description / Proposed Development' section of this report, engineering analyses, and professional judgement. Based on a review of the field and laboratory data and the engineering analysis, the proposed development is feasible from a geotechnical / geologic standpoint. The subject property can be developed without adverse impact onto or from adjoining properties providing the recommendations contained within this report are adhered to during project design and construction.

The average in-situ moisture contents and in-situ dry densities of the upper 2.0 to 5.0 feet of the near-surface alluvial materials on the subject site suggests that the soils have an average relative compaction of less than 85 percent.

The field observations indicate that up to 2.0 feet of material present on the subject site was an undocumented fill material. The artificial fills on the site are also considered loose and compressible. The man-made fills are not considered suitable for the support of structural fills, fill slopes, foundations, slab-on-grade floor slabs, hardscape, and/or pavement.

Some remedial grading consisting of removals and replacement will have to be performed within loose, compressible, artificial fill and loose, near-surface alluvial materials in the area of proposed structural fills, structures, exterior hardscapes, and/or pavement.

The actual conditions of the near-surface supporting material across the site may vary. The nature and extent of variations of the surface and subsurface conditions between the exploratory excavations may not become evident until construction.

If variations of the material become evident during construction of the proposed development, **HGI** should be notified so that the project Geotechnical / Geologic Consultant can reevaluate the characteristics of the material and the conclusions and recommendations of this report, and, if needed, make revisions to the conclusions and recommendations presented herein.

Preliminary recommendations for site grading, foundations, slab support, pavement design, slope maintenance, etc., are presented in the subsequent paragraphs.

SITE PREPARATION RECOMMENDATIONS

General

The grading recommendations presented in this report are intended for: 1) the rework of unsuitable, near-surface, fill and alluvial earth materials to create a uniformly thick engineered building pads and satisfactory support for exterior hardscape (i.e., sidewalks, patios, etc.) and pavement; and 2) the use of a conventional shallow foundation system and concrete slabs cast on-grade for the proposed structures.

If hardscape and pavement subgrade earth materials are prepared at the time of grading of the building site, and the improvements are not constructed immediately, additional observations and testing of the subgrade earth material will have to be performed to locate areas which may have been damaged by construction traffic, construction activities, and/or seasonal wetting and drying. The additional observations and testing should be performed before placing aggregate base material, Hot Mix Asphalt (HMA) concrete, and/or Portland Cement concrete (PCC) in those areas.

The grading should be performed in accordance with the recommendations presented in this report. We recommend that **HGI**, as the Geotechnical Engineer / Geologist of Record, be retained by the owner of the proposed project to observe the excavation and grading operations, foundation preparation, and test the compacted fill and utility trench backfill. If **HGI** were not selected to perform the required observation and testing of earthwork construction, **HGI** would cease to be the Geotechnical Consultant of Record for the project. A pregrading conference should be held at the site with representatives of the owner, the grading contractor, the County of San Bernardino, the Civil Engineer, and a representative of **HGI** in attendance. Special grading procedures and/or concerns can be addressed at that time.

Earthwork observation services allow the testing of only a small percentage of the fill placed at the site. Contractual arrangements with the grading contractor by the project owner should contain the provision that he is responsible for excavating, placing, and compacting fill in accordance with the recommendations presented in this report and the approved project grading plans and specifications. Observation by the project Geotechnical / Geologic Consultant and/or his representatives during grading should not relieve the grading contractor of his responsibility to perform the work in accordance with the recommendations presented in this report and the approved project plans and specifications.

The following recommendations may need to be modified and/or supplemented during grading as field conditions require.

Final Grading Plan Review

The project Civil Engineer should review this report, incorporate critical information on to the grading plan and/or reference this geotechnical / geologic

study, by Company Name, Project No., Report No., and report date, on the grading plan. Final grading plans should be reviewed by **HGI** when they become available to address the suitability of our grading recommendations with respect to the proposed improvements.

Clearing and Grubbing

Debris, grasses, weeds, brush, trees, and other deleterious materials should be removed from the proposed building, exterior hardscape and pavement areas and areas to receive structural fill before grading is performed. Any organic material and miscellaneous / demolition debris should be legally disposed of off site. Any topsoil or highly organic soils encountered should be stripped and stockpiled for use on finished grades in landscape areas or exported from the site. Disking or mixing of organic material into the earth materials proposed to be used as structural fill should not be permitted. Trees, bushes, etc. and their roots should be completely removed, ensuring that 95 percent or more of the root systems are extracted.

Man-made objects encountered (i.e., septic tanks, leach lines, irrigation systems, underground utilities, old foundations, construction debris, etc.) should be overexcavated, exported from the site, and legally disposed of off site. Cesspools or seepage pits, if encountered (none were encountered during this study), should be abandoned and capped according to directions and supervision of San Bernardino County Department of Health, the State of California, and/or the appropriate governmental agency procedures which has jurisdiction over them before fill and/or pavement is placed over the area. If no procedures are required by the Health Department or if the following recommendations are more stringent, the cesspool or seepage pit should be pumped free of any liquid and filled with a low strength sand cement slurry to an elevation 5.0 feet below the final site grade in the area. The upper 5.0 feet of the cesspool or seepage pit should be excavated

and the area backfilled with a properly compacted fill material. The location of the cesspool or seepage pit should be surveyed and plotted on the final 'As-Graded' plan prepared by the project Civil Engineer.

Wells, if encountered, should be abandoned and capped according to directions and supervision of San Bernardino County Department of Health, the State of California, and/or the appropriate governmental agency procedures which has jurisdiction over the well before fill and/or pavement is placed over the area.

Excavation Characteristics

Excavation and trenching within the subject property to the depths anticipated for the proposed development is anticipated to be relatively easy in the near-surface undocumented fills, and alluvial materials on the subject site and should be accomplished with conventional earth-moving equipment since the drill rig equipped with flight augers was able to penetrate to the indicated depths. Materials were not encountered or are anticipated at shallow depths that would require heavy ripping or blasting to excavate. It is not anticipated that a significant amount of oversized rock material (i.e., 12 inches in greatest dimension) will be generated during the removal and replacement process within the alluvial materials which will require special handling during the development of the site.

Oversized rock materials are anticipated to be generated during the grading. Such materials will likely require special handling methods during site development. Disposal methods are presented in a subsequent section of this report.

Suitability of On-Site Materials as Fill

In general, the on-site earth materials present below any topsoil and/or highly organic materials are considered satisfactory for reuse as fill. Fill materials should

be free of significant amounts of organic materials and/or debris and should not contain rocks or clumps greater than 12 inches in maximum dimension. It is noted that the average in-situ moisture content of the near-surface fill and alluvial earth materials on the subject site at the time this field study was performed was below the optimum moisture content for the on-site materials and that moisture will have to be added to the on-site earth materials if the earth materials are to be used as compacted fill material in the near future. No significant amount of oversized rock materials are anticipated to be generated from the cuts performed in the local materials.

Removal and Recompaction

Uncontrolled or undocumented fills and/or unsuitable, loose, or disturbed near-surface alluvial earth material in proposed areas which will support structural fills, structures (i.e., buildings, decorative block walls, retaining walls, trash enclosure walls, etc.), fill slopes, exterior hardscape (i.e., sidewalks, patios, curb / gutters, etc.), and pavement should be prepared in accordance with the following recommendations for grading in such areas. If overexcavation of undocumented fill is elected not to be performed in hardscape, curb / gutter, pavement, and decorative block wall or fence areas, penetration of irrigation water with time may cause some settlement and distress to the improvements in those areas. The cost of the additional grading verses the risk of distress and cost of repairs to the structures needs to be evaluated by the project owner.

- The near-surface undocumented fill and the loose, near-surface colluvial materials on the site are recommended to be overexcavated and recompacted. Based upon our exploratory excavations borings and laboratory test results, we anticipate that the overexcavation will extend to a depth of approximately 4.0 feet below existing ground surface for proposed future building structure, retaining walls, trash enclosure walls, and decorative concrete block walls and 2.0 feet below existing ground surface for the proposed pavement areas on the subject site. A relative compaction

of 85 percent or greater should be obtained in the exposed earth material at the overexcavation depth prior to performing any scarification, moisture conditioning, and recompaction. If 85 percent relative compaction is not present, the overexcavation should be deepened until a minimum of 85 percent relative compaction is present. Moreover, the depth of the overexcavation within the perimeter of the proposed structures should be to a uniform elevation throughout the limits of the structures. It is noted that fill placed to construct slopes and/or support sidewalks, patios, retaining walls, block walls, driveways, and pavement are considered to be structural fill.

- In the proposed exterior hardscape (i.e., sidewalks, slabs, etc.) areas where structural fill will not be placed or cuts are proposed, the existing near-surface earth materials need only be processed to a depth of 6.0 to12 inches below existing site grades or proposed subgrade elevation, whichever is deeper unless old, undocumented fill materials are encountered at exposed grades. If undocumented fills are encountered, they will need to be overexcavated and properly compacted fill replaced to achieve proposed grades.

- Additional overexcavation will need to be performed in areas where the exposed subgrade can not be properly processed and recompacted per the following recommendations presented in this section of this report.

- The limits of overexcavation for the building pads should extend to a distance of 5.0 feet or to the depth of the overexcavation beneath the finish pad grade for the structure, whichever is greater, beyond the structure perimeter or footing edges. The limits of overexcavation for the decorative concrete block perimeter wall footings and/or retaining wall footings should extend to a distance of 4.0 feet beyond the footing edges or to the depth of the overexcavation beneath the footing grade, whichever is greater. The limits of processing or overexcavation for exterior hardscape, curb / gutter, and pavement areas should extend to a distance of 2.0 feet beyond the edge of the exterior hardscape, curb / gutter, or pavement, or to the depth of the overexcavation beneath the finish subgrade elevation, whichever is greater.

  In areas where overexcavation can not be performed to the required distance beyond the foundations, (i.e., perimeter project block walls, retaining walls, etc.) along property lines, the foundations should be deepened to extend through the loose, near-surface earth materials and be founded to a minimum depth of 1.0 foot into the firm underlying material.

- It is noted that localized areas, once exposed, may warrant additional overexcavation for the removal of existing undocumented fills, loose, near-surface earth material, porous, moisture sensitive alluvial earth materials, and subsurface obstructions and/or debris which may not have been located during the field study performed for this report. Actual depths of removals and the competency of the exposed overexcavation bottoms should be determined by the project Geotechnical / Geologic Consultant and/or his representative during grading operations at the time they are exposed and before scarification and recompaction or the placement of fill.

- Any underground fuel and waste oil storage tanks and contaminated material, if present, should be removed in accordance with County of San Bernardino Department of Environmental Health, Hazardous Materials Management Divisions criteria and procedures. The excavations should be cleaned of loose materials. It is recommended that tank removal excavations with depths of 5.0 feet or deeper be cut back according to the 'Temporary Construction Cut' section of this report or be properly shored during construction.

- The exposed overexcavation bottom surfaces should be scarified to a depth of 6.0 to 12 inches, brought to optimum moisture content to 3.0 percent above optimum moisture content, and compacted to 90 percent or greater relative compaction before placement of fill. Maximum dry density and optimum moisture content for compacted materials should be determined according to current ASTM D1557 procedures. The scarification and recompaction of the exposed overexcavation bottoms in alluvial materials may be deleted upon approval by the project Geotechnical / Geologic Consultant, and/or his representative when in-place density test results in the undisturbed alluvial materials indicate a relative compaction of 90 percent or greater.

Import Material

Import fill should not be more expansive in nature than the existing on-site material as determined by current ASTM D4829 procedures and have strength parameters equivalent to or greater than the on-site earth materials. Import fill material should be approved by the project Geotechnical / Geologic Consultant prior to it being brought on-site.

Fill Placement Requirements

Fill material, whether on-site material or import, should be approved by the project Geotechnical / Geologic Consultant and/or his representative before placement. Fill material should be free from vegetation, organic material, debris, and oversize material (i.e., 3 inches in maximum dimension). Approved fill material should be placed in horizontal lifts not exceeding 6.0 to 12 inches in compacted thickness or in thicknesses the grading contractor can demonstrate that he can achieve adequate compaction and watered or aerated to obtain optimum moisture content to 3.0 percent above optimum moisture content. Each lift should be spread evenly and should be thoroughly mixed to ensure uniformity of earth material moisture. Fill soils should be compacted to 90 percent or greater relative compaction. Maximum dry density and optimum moisture content for compacted materials should be determined in accordance with current ASTM D1557 procedures.

Compaction Equipment

It is anticipated that the compaction equipment to be used for the project will include a combination of rubber-tired, track-mounted, sheepsfoot, and/or vibratory rollers to achieve compaction. Compaction by rubber-tired or track-mounted equipment, by itself, may not be sufficient. Adequate water trucks, water pulls, and/or other appropriate equipment should be available to provide sufficient moisture and dust control. The actual selection of equipment and compaction procedures are the responsibility of the contractor performing the work and should be such that uniform compaction of the fill is achieved.

Shrinkage, Bulking, and Subsidence

There will be a material loss due to the clearing and grubbing operations. The following values are exclusive of losses due to clearing, grubbing, tree root removal,

or the removal of other subsurface features and may vary due to differing conditions within the project boundaries and the limitations of this study.

Volumetric shrinkage of the near-surface earth materials (i.e., undocumented fill and near-surface alluvium) on the subject site that are excavated and replaced as controlled, compacted fill should be anticipated. It is estimated that the average shrinkage of the near-surface earth materials within the upper 2.0 to 4.0 feet of the site which will be removed and replaced will be approximately 2.0 to 8.0 percent, based on fill volumes when compacted to 90 to 95 percent of maximum dry density for the earth material type based on current ASTM D1557 procedures. For example, a 10 percent shrinkage factor would mean that it would take 1.10 cubic yards of excavated material to make 1.0 cubic yard of compacted fill at 90 percent relative compaction. A higher relative compaction would mean a larger shrinkage value. Oversize rock removal and export will also result in additional shrinkage.

Subsidence of the site due to settlement from the placement of less than 3.0 feet of fill (not including the depth of overexcavation and replacement) during the planned grading operation is expected to be minimal.

Although the above values are only approximate, they represent the recommended estimate of some of the respective factors to be used to calculate lost volume that will occur during grading.

Abandonment of Existing Underground Lines

Abandonment of existing underground irrigation, utility, or pipelines, if present within the zone of construction, should be performed by either excavating the lines and filling in the excavations with documented, properly compacted fill or by filling the lines with a low strength sand / aggregate / cement slurry mixture. Filled lines

should not be permitted closer than 3.0 feet below the bottom of proposed footings and/or concrete slabs on-grade. The lines should be cut off at a distance of 5.0 feet or greater from the area of construction. The ends of the lines should be plugged with 5.0 feet or more of concrete exhibiting minimal shrinkage characteristics to prevent water or fluid migration into or from the lines. Capping of the lines may also be needed if the lines are subject to line pressures. The slurry should consist of a fluid, workable mixture of sand, aggregate, cement, and water. Plugs should be placed at the ends of the line prior to filling with the slurry mixture. Cement should be Portland cement conforming to current ASTM C150 specifications. Water used for the slurry mixture should be free of oil, salts, and other impurities which would have an adverse effect on the quality of the slurry. Aggregate, if used in the slurry, mixture should meet the following gradation or a suitable equivalent:

SIEVE SIZE	PERCENT PASSING
1.5"	100
1.0"	80-100
3/4"	60-100
3/8"	50-100
No. 4	40-80
No. 100	10-40

The sand, aggregate, cement, and water should be proportioned either by weight or by volume. Each cubic yard of slurry should not contain less than 188 pounds (2.0 sacks) of cement. Water content should be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed. The slurry should be placed within 1.0 hour of

mixing. The contractor should take precautions so that voids within the line to be abandoned are completely filled with slurry.

Local ordinances relative to abandonment of underground irrigation, utility, or pipelines, if more restrictive, supersede the above recommendations.

Over-Size Rock Disposal

Over-size rock material with measurements of 12 inches or greater in maximum dimension will have to be properly disposed of off site since it is anticipated that there will not be any deep fills to be placed in which to properly dispose of the over-size material as part of the site development.

Temporary Roads

Temporary roads created during grading should be removed in their entirety or replaced as documented compacted fill as part of the rough grading of the tract.

Protection of Work

During the grading process and prior to the completion of construction of permanent drainage controls, it is the responsibility of the grading contractor to provide good drainage and prevent ponding of water and damage to the in progress or finished work on the site and/or to adjoining properties.

Observation and Testing

During grading, observation and testing should be conducted by the project Geotechnical / Geologic Consultant and/or his representatives to verify that the grading is being performed according to the recommendations presented in this report. The project Geotechnical / Geologic Consultant and/or his representative should observe and test the overexcavation bottoms and the placement of fill and

should take tests to verify the moisture content, density, uniformity and degree of compaction obtained. The contractor should notify the project Geotechnical / Geologic Consultant when cleanout and/or overexcavation bottoms are ready for observation and prior to scarification and recompaction. Typically, one (1) in-place density test should be performed for every 2.0 vertical feet of fill material, or one (1) test for every 500 cubic yards of fill, which ever requires the greater number of tests. In-place density and moisture content tests should be performed during the placement of the fill materials during the grading operations in general accordance with the following current ASTM test procedures:

Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) - ASTM D6938.

Test Method for Density and Unit Weight of Soil in Place by Sand Cone Method - ASTM D1556.

Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock - ASTM D2216.

Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method - ASTM D4959.

Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method - ASTM D4643.

Where testing demonstrates insufficient density, additional compaction effort, with the adjustment of the moisture content when needed, should be applied until retesting shows that satisfactory relative compaction has been obtained. The results of observations and testing services should be presented in a formal 'Grading Report' following completion of the grading operations. Grading operations undertaken at the site without the project Geotechnical / Geologic Consultant and/or his representative present may result in exclusions of the

affected areas from the grading report for the project. The presence of the project Geotechnical / Geologic Consultant and/or his representative will be for the purpose of providing observations and field testing and will not include supervision or directing of the actual work of the contractor or the contractor's employees or agents. Neither the presence and/or the non-presence of the project Geotechnical / Geologic Consultant and/or his field representative nor the field observations and testing will excuse the contractor for defects discovered in the contractor's work. If **HGI** does not perform the observation and testing of the earthwork for the project and is replaced as Geotechnical / Geologic Consultant of record for the project, the work on the project should be stopped until the replacement Geotechnical / Geologic Consultant has reviewed the previous reports and work performed for the project, agreed in writing to accept the recommendations and prior work performed by **HGI** for the subject project, or has performed their own studies and submitted their revised recommendations. If **HGI** were not selected to perform the required observation and testing of earthwork construction, **HGI** would cease to be the Geotechnical Consultant of Record for the project.

Earth Material Expansion Potential

The preliminary expansion potential of the on-site earth materials is discussed in the subsequent foundation and floor slab recommendation sections of this report. Upon completion of grading for the building pad areas, near-surface samples should be obtained for expansion potential testing to verify the preliminary expansion test results and the foundation / slab-on-grade recommendations presented in this report.

Earth Material Corrosion Potential

The preliminary corrosion potential of the on-site earth material is discussed in the subsequent corrosion recommendation sections of this report. Upon completion of

grading for the building pad areas, near-surface samples should be obtained for corrosion potential testing to verify the preliminary chemical test results and the recommendations presented in this report for protection of concrete which will be in direct contact with the on-site earth materials and to present preliminary evaluation of the potential for corrosion of bare metal, if desired, which will be in direct contact with the on-site earth materials.

2013 CBC SEISMIC DESIGN CRITERIA

Per the **California Building Standards Commission**, *2013 California Building Code* (CBC), California Code of Regulations, Title 24, Part 2, Volume 2 of 2, Section 1613, 'Earthquake Loads,' the followings coefficients and factors relevant to seismic mitigation and design for new construction include:

- **Site Class**

  Categorizing the upper 30 meters (±100 ft.) of earth materials into one (1) of the Site Classes 'A,' 'B,' 'C,' 'D,' 'E,' and 'F' that are based on average shear wave velocities, Standard Penetration Test blow counts, or undrained shear strength.

- **Occupancy Category**

  Relationship between the number of lives placed at risk by a failure of the structure as determined from Figure C1-1, 'Approximate Relationship between Number of Lives Placed at Risk by a Failure and Occupancy Category,' in Chapter C1 of ASCE 7-10.

- **Mapped, Maximum Considered Earthquake (MSC), 5.0 Percent Damped, Spectral Response Acceleration Parameters at Short Period and at 1-Second Period**

  Mapped, Maximum Considered Earthquake (MSC), 5.0 percent damped, spectral response acceleration parameters at short period (0.2 second) and at long period (1-second), S_s and S_1, respectively, for Site Class 'B' are determined from Java Ground Motion Parameter Calculator - Version 5.0.9a available at the USGS web site (http://earthquake.usgs.gov/research/hazmaps/design/).

- **Site Coefficients**
  Short period site coefficient (at 0.2 second period), F_a, and long-period site coefficient (at 1.0 second period), F_v, are based on 'Site Class' and the 'Mapped Spectral Response Acceleration at Short Period and at 1-Second Period,' S_a and S_1, respectively.

- **Seismic Design Category**
  A classification assigned to a structure based on its 'Risk Category' and the severity of the design earthquake ground motion at the site (i.e., Short Period Response Acceleration (S_{DS}) and Long Period Response Acceleration (S_{D1}) Parameters).

Based on our understanding of local geologic conditions and limited in-situ penetration tests performed for this study, the 'Site Class' judged applicable to this site is 'D', with a soil profile name of 'Stiff Soil (D)' per Table 20.3-1, 'Site Classification,' in Chapter 20 of ASCE 7-10 with an average Shear Wave Velocity of 600 to 1,200 feet/second (ft./s) or an average Standard Penetration Test value of 15 to 50 blows per foot of penetration in the upper 100 feet (30.48 m) of the site.

The following table presents supplemental coefficients and factors relevant to seismic mitigation and design for new construction built according to the 2013 CBC based on a 2-percent probability of being exceeded in the next 50 years (2,475 years mean return time).

SEISMIC DESIGN CRITERIA	
Site Location	Latitude: 34.0860° North Longitude: 117.4872° West
Occupancy Category[1]	I, II, or III
Site Class[2]	D
Mapped, Maximum Considered Earthquake (MCE), 5.0 Percent Damped, Spectral Response Acceleration Parameter at Short Period (S_s)[3] (0.2 Second) for Site Class 'B.'	1.500
Mapped, Maximum Considered Earthquake (MCE), 5.0 Percent Damped, Spectral Response Acceleration Parameter at 1-Second (S_1)[3] for Site Class 'B.'	0.600

SEISMIC DESIGN CRITERIA	
Site Coefficients (F_a)[3] for Site Class 'D.'	1.0
Site Coefficients (F_v)[3] for Site Class 'D.'	1.5
The MSC, 5.0 Percent Damped, Spectral Response Acceleration Parameter at Short Periods Adjusted for Site Class 'D' Effects (S_{MS})[3].	1.500
The MSC, 5.0 Percent Damped, Spectral Response Acceleration Parameter at 1-Second Adjusted for Site Class 'D' Effects (S_{M1})[3]	0.900
Design, 5.0 Percent Damped, Spectral Response Acceleration Parameter at Short Periods (S_{DS})[3] for Site Class 'D.'	1.000
Design, 5.0 Percent Damped, Spectral Response Acceleration Parameter at 1-Second (S_{D1})[3] for Site Class 'D.'	0.600
Seismic Design Catagory[4]	D
Model Magnitude Earthquake (M)[5]	7.8
Average Shear Wave Velocity in the Top 30m of the Site for Site Class 'D.'[5]	274 m/s
Peak Ground Acceleration (PGA)[5]	0.799g
Site Coefficient (F_{PGA})[6]	1.0
$PGA_M = F_{PGA} * PGA$[7]	0.799

1. Determined from Figure C1-1, 'Approximate Relationship between Number of Lives Placed at Risk by a Failure and Occupancy Category,' in Chapter C1 of **ASCE 7-10**, 2010 Edition.
2. Per Table 20.3-1, 'Site Classification,' in Chapter 20 of **ASCE 7-10**, 2010 Edition.
3. Java Ground Motion Parameter Calculator - Version 5.1.0 (2-10-2011) available at **USGS** web site (http://earthquake.usgs.gov/research/hazmaps/design/). Data based on **ASCE 7-10**, 2010 Edition, 'Standard, Minimum Design Loads for Buildings and Other Structures.'
4. Per Table 11.6-1, 'Seismic Design Category Based on Short Period Response Acceleration Parameters' and Table 11.6-2, 'Seismic Design Category Based on 1-S Period Response Acceleration Parameters' in Chapter 11 of **ASCE 7-10**, 2010 Edition.
5. Probabilistic seismic hazard maps and data files prepared by the **USGS** assign a 2-percent likelihood that the PGA will occur at this site within the next 50 years (2,475 years mean return time). This data was available at the **USGS**, Geologic Hazards Science Center's 2008 NSHMP PSHA Interactive Deaggregation Web Site (https://geohazards.usgs.gov/deaggint/2008/).
6. Per Table 11.8-1, 'Mapped Maximum Considered Geometric Mean (MCE_G) Peak Ground Acceleration, PGA,' in Chapter 11 of **ASCE 7-10**, 2010 Edition.
7. Per Section 11.8.3 in Chapter 11 of **ASCE 7-10**, 2010 Edition.

Actual shaking intensities at the site from any seismic source may be substantially higher or lower than estimated for a given earthquake magnitude, due to complex and unpredictable effects from variables such as:

- Near-source directivity effects.
- Direction, length, and mechanism of fault rupture (strike-slip, normal, reverse).
- Depth and consistency of unconsolidated sediments.
- Topography.
- Geologic structure underlying the site.
- Seismic wave reflection, refraction, and interference.

FOUNDATION DESIGN RECOMMENDATIONS

General

The recommendations presented in the subsequent paragraphs for foundation design and construction are based on geotechnical characteristics and 'Non-Expansive' conditions for the supporting earth materials as defined in Section 1803.5.3, 'Expansive Soil,' in the 2013 CBC and should not preclude more restrictive structural requirements. Foundations for the proposed structures may consist of conventional column and continuous wall footings founded upon undisturbed, documented, properly, compacted fill, or firm, competent, undisturbed alluvial materials, but not a combination of earth material types within a structure.

The Structural Engineer for the project should determine the actual footing width, depth, and reinforcing to resist design vertical, horizontal, and uplift forces under static and seismic conditions. Reinforcement recommendations presented in this report are considered the minimum for the earth material conditions present on

the site and are not intended to supersede the design of the project Structural Engineer or the criteria of the governing agencies for the project.

Foundation Size

Continuous footings should have a width of 12 and 15 inches or greater for one-story and 2-story building structures, respectively supported by the foundations, respectively, in accordance with Table 1809.7, 'Prescriptive Footings Supporting Walls of Light-Frame Construction,' in the 2013 CBC. Footings supporting a roof only shall be as required for supporting one (1) floor. Continuous footings should be continuously reinforced with a minimum of one (1) No. 4 steel reinforcing bar located near the top and one (1) No. 4 steel reinforcing bar located near the bottom of the footings to minimize the effects of slight differential movements which may occur due to minor variations in the engineering characteristics or seasonal moisture change in the supporting soils. Column footings should have a width of 18 inches by 18 inches or greater and be suitably reinforced, based on structural requirements. The continuous footings should extend across doorway and garage entrances and should be founded at the same depths and reinforced the same as the adjacent footings.

Depth of Embedment

Exterior and interior footings supported in undisturbed, documented, properly compacted fill or undisturbed, firm, alluvial earth material should extend to a depth of 12 inches or greater below lowest adjacent finish grade. Footings should extend to a depth of 12 inches or greater into the bedrock material underlying the unsuitable on-site earth materials due to the expansion potential of the supporting earth materials. Frost is not considered a design factor for foundations in the Fontana area of San Bernardino County, California, since there will not be any significant frost penetration in the winter months.

Footings should be founded in undisturbed, documented, properly compacted fill or undisturbed, natural earth material, but not a combination of the different earth materials within the structure. Where building, decorative wall, or retaining wall footings will be constructed directly on the property line or where the limits of overexcavation do not extend sufficiently beyond the footing edges per the 'Earthwork Recommendations' section of this report, the footings should be deepened to extend through the unsuitable, earth material and be founded to a depth of 12 inches or greater into firm, competent, undisturbed, natural earth material.

Bearing Capacity

Provided the recommendations for site earthwork and for footing width and depth of embedment are incorporated into the project design and construction, the allowable bearing value for design of continuous and column footings for the total dead plus frequently-applied live loads is 2,000 pounds per square foot (psf) for footings that are 12 inches in width and a depth of embedment of 12 inches or greater below lowest adjacent finished grade in accordance with Table 1806.2, 'Presumptive Load-Bearing Values,' in the 2013 CBC for footings founded in undisturbed, documented, properly, compacted fill material (Class 4 Material). For eccentrically loaded footings and/or overturning moments, the resultant force should be in the middle one-third of the footing and the average bearing value across the footing should not exceed the recommended allowable bearing value. The allowable bearing value has a factor of safety of 3.0 or greater and may be increased by 33.3 percent for short durations of live and/or dynamic loading such as wind or seismic forces.

Settlement

Footings designed according to the recommended bearing value, the assumed maximum wall and column loads, and founded in undisturbed, documented,

properly, compacted fill material are not expected to exceed a total settlement of 1.0 inch or a differential settlement of 0.25 inch between similarly sized and loaded footings

Lateral Capacity

Resistance to lateral loads can be provided by a combination of friction acting at the base of the foundation and passive earth pressure on the sides of the footings and stem walls. Foundation design parameters, based on undisturbed, documented, properly compacted fill (Class 4 Material) for resistance to static lateral dead forces are as follows:

ALLOWABLE LATERAL BEARING PRESSURE (Equivalent Fluid Pressure), Passive Case	
Material Type	**Bearing Pressure**
Undisturbed, Documented, Compacted, 'Non-Expansive' Fill**	150 pcf*
Undisturbed, On-Site, 'Non-Expansive,' Alluvial Soil**	150 pcf
Undisturbed, Existing, On-Site Soil	***

* Pounds per square foot per foot of depth (pcf).
** Per Table 1806.2, 'Presumptive Load-Bearing Values,' for a Class 4 Material (SW, SP, SM, SC, GM, and GC) in the 2013 CBC with a relative compaction of 85% or greater.
**** Materials are to be removed and replaced as properly compacted fill to support foundations.

ALLOWABLE LATERAL SLIDING RESISTANCE BETWEEN SOIL AND CONCRETE	
Material Type	**Coefficient of Friction**
Undisturbed, Documented, Compacted, 'Non-Expansive' Fill*	0.25
Undisturbed, On-Site, 'Non-Expansive,' Alluvial Soil**	0.25
Undisturbed, Existing, On-Site Soil	**
* Per Table 1806.2, 'Presumptive Load-Bearing Values,' for a Class 4 Material (SW, SP, SM, SC, GM, and GC) in the 2013 CBC with a relative compaction of 85% or greater. ** Materials are to be removed and replaced as properly compacted fill to support foundations.	

The above values are allowable design values and have safety factors of 2.0 or greater incorporated into them and may be used in combination without reduction in evaluating the resistance to lateral loads. The recommended lateral resistance assumes a horizontal surface for the earth material mass extending to a distance of 10 feet or greater from the face of the footing, or three (3) times the height of the surface generating passive pressure, whichever is greater. The allowable values may be increased by 33.3 percent for short durations of live and/or dynamic loading, such as wind or seismic forces. For the calculation of the allowable lateral bearing pressure (passive earth resistance), the upper 1.0 foot of material should be neglected unless confined by a concrete slab or pavement. The largest recommended allowable lateral bearing pressure (passive earth resistance) is 15 times the recommended design value for the appropriate CBC class of material.

Interim Foundation Plan Review

It is recommended that **HGI** review the foundation plans for the structures as they become available. The purpose of this review is to determine if these plans have been prepared in accordance with the recommendations contained in this report. This review will also provide **HGI** an opportunity to submit additional recommendations as conditions warrant.

Final Foundation Design Recommendations

Final foundation recommendations should be made upon completion of grading and be included in the 'Report of Grading' prepared by the Geotechnical / Geologic Consultant for the project.

Foundation Excavations

Foundation excavations should be observed by the project Geotechnical / Geologic Consultant and/or his representative prior to placement of forms, reinforcing steel, or placement of concrete for the purpose of verification of the recommendations presented in this report and for compliance with the project plans and specifications. The foundation excavations should be trimmed neat, level, and square. Any loose or sloughed material and debris should be removed from the foundation excavations prior to placement of reinforcing steel and removed again prior to the placement of concrete. Earth materials removed from the foundation excavations should not be placed in slab-on-grade, hardscape, and/or pavement areas unless compacted to 90 percent or greater relative compaction. The maximum dry density and optimum moisture content for the earth material should be determined in accordance with current ASTM D1557 procedures.

SLAB-ON-GRADE FLOOR RECOMMENDATIONS

The recommendations for concrete slabs on-grade, both interior and exterior, excluding Portland Cement Concrete (PCC) pavement, are based on geotechnical

characteristics and 'Non-Expansive' conditions for the supporting earth material as defined in Section 1803.5.3, 'Expansive Soil,' in the 2013 CBC. The expansion potential of the slab subgrade areas should be verified at the completion of grading of the building pad areas. Concrete slabs should be designed to minimize cracking as a result of shrinkage. Joints (isolation, contraction, and construction) should be placed in accordance with the current **American Concrete Institute (ACI)** or **Portland Cement Association (PCA)** guidelines. Special precautions should be taken during placement and curing of concrete slabs. Excessive slump (high water / cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could result in excessive shrinkage, cracking, or curling in the slabs. It is recommended that concrete proportioning, placement, and curing be performed in accordance with ACI recommendations and procedures.

Interior Floor Slabs

Interior concrete floor slabs-on-grade should be 6.0 inches or greater in thickness and be placed on properly prepared subgrade per the 'Earthwork Recommendations' section of this report. The concrete for the floor slab should have a compressive strength of 2,500 pounds per square inch (psi) or greater at 28 days. Slab reinforcement should consist of a minimum of No. 3 reinforcing bars placed 30 inches on center in both directions, or an equivalent substitute. The amount of reinforcing in the floor slab should be increased as necessary based on the structural loads placed on the floors. The reinforcing should be placed at mid-depth to 1.5 inches below the top surface of the slab to minimize cracking. The concrete section, reinforcing steel, and/or design concrete compressive strength should be increased appropriately for anticipated excessive or concentrated floor loads. A Modulus of Subgrade Reaction (k_s) of 200 pounds per square inch per inch of deflection is recommended for the design of structural slabs cast on grade for excessive floor loads. A compacted sand or gravel bedding layer beneath lightly loaded floor slabs is not needed but may be desirable to enhance the design section

for heavy floor loads. If gravel bedding is used, it should consist of a well graded, crushed aggregate. The sand or gravel layer should be compacted to 90 percent or greater of maximum dry density, as determined by current ASTM D1557 procedures.

If a vapor barrier / moisture retarder is used under the floor slab and it is placed on well graded, crushed, gravel material, it is recommended that a 1.0 inch thick layer of sand or other approved granular material be placed beneath the vapor barrier / moisture retarder to prevent punctures from angular gravel fragments and projections. If open graded gravel (capillary break) is placed beneath the vapor barrier or retarder, the gravel layer should be 6.0 inches or greater in thickness. If open graded gravel is used, a separation fabric such as Mirafi 140N series, or an equivalent substitute, should be used in-leu of a sand cushion to protect the vapor barrier / moisture retarder from punctures.

If the floor slabs will be supporting live loads, such as moving forklift trucks or vehicles, it is recommended that construction joints in the floor be provided with a key or dowels to permit the transfer of loads. Keys should not be used unless the slab is 6.0 inches or greater in thickness. If tracked equipment will be using the facility, consideration should be given to the use of a surface hardener for the concrete slabs such Master Builders “Master Plate 200" or “Anviltop.”

Subgrade soils should be moisture conditioned to optimum moisture content to 3.0 percent above optimum moisture content to a depth of 12 inches and proof compacted to 90 percent or greater relative compaction based on current ASTM D1557 procedures immediately before placing the gravel material, the moisture barrier, or pouring concrete.

Vapor Barrier / Moisture Retarder Recommendations

HGI does not practice in the field of moisture vapor transmission evaluation / mitigation. Therefore, it is recommended that a qualified person or firm be engaged or consulted with to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person or firm should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate in accordance with ACI, PCA, ASTM, PTI, the California Building Code, and/or the International Residential Code.

In heated / air conditioned areas in a structure where moisture sensitive floor coverings are anticipated over the floor slab, the use of a vapor barrier / moisture retarder beneath the slab should be considered. Typically, a vapor retarder is not utilized under the floor slabs in garages, utility buildings, and other unheated accessory structures, driveways, walks, patios, and/or other flatwork not likely to be enclosed and heated at a later date. The use or non-use of a vapor barrier / moisture retarder, the thickness of the vapor barrier / moisture retarder, the use of a granular layer over the vapor barrier / moisture retarder, the thickness of the granular materials, the type of granular material, etc. should be determined by the Structural Engineer who is designing the floor slab in conjunction with the Architect who is specifying the use and the type of floor coverings to be placed over the floor slab, and/or a person or firm that practices in the field of moisture vapor transmission evaluation / mitigation. The vapor barrier / moisture retarder recommendations provided by the supplier of the flooring materials should also be incorporated into the project plans.

EXTERIOR CONCRETE FLATWORK

Exterior concrete slabs cast on finish subgrade (i.e., pedestrian walkways, patios, sidewalks, etc., with the exception of PCC pavement) should be 4.0 inches or

greater in thickness and be underlain by 12 inches or greater of earth material that has been prepared in accordance with the 'Earthwork Recommendation' section of this report. Reinforcing in the slab, the design compressive strength of the concrete, and the use of a compacted sand or gravel base beneath the slabs should be according to the current codes and ordinances of the San Bernardino County, California. Subgrade earth materials should be moisture conditioned to optimum moisture content to 3.0 percent above optimum moisture content to a depth of 12 inches or greater and proof compacted to 90 percent or greater relative compaction based on current ASTM D1557 procedures immediately before placing aggregate base material, placing reinforcing steel, or placing the concrete.

RETAINING WALL RECOMMENDATIONS

Retaining walls may be needed to achieve finish grades. Retaining walls should be designed in accordance with the recommendations in the following sections. If earth reinforced walls, crib wall, keystone walls, etc. are used for the development of the subject site, the design requirement of the proprietary retaining wall system should supercede the following recommendations if there are any conflicts.

Static Lateral Earth Pressures

Retaining walls backfilled with 'Non-Expansive' granular soil (i.e., Expansion Index (EI) ≤ 20 and Unified Soil Classifications of SP, SW, SM, GP, GW, and GM) within a zone extending upward and away from the heel of the footing at a slope of 0.5H:1V (Horizontal to Vertical) or flatter for level backfill behind the retaining wall can be designed to resist static lateral earth pressures equivalent to those recommended in the following table:

LATERAL EARTH PRESSURE						
Condition	Level Backfill and Soil Classification*			2H:1V Sloped Backfill and Soil Classification***		
	SP, SW, GP, GW	GM	SM	SP, SW, GP, GW	GM	SM
Active	30 pcf**	40 pcf	45 pcf	40 pcf	62 pcf	81 pcf
At-Rest	60 pcf	60 pcf	60 pcf	87 pcf	110 pcf	120 pcf

* Per Table 1610.1, 'Lateral Soil Load,' in the 2013 CBC.
** Equivalent fluid Pressure, pounds per square foot per foot of depth (pcf).
*** Based on a moist unit weight of 125 pcf and an Angle of Internal Friction of 38 degrees for SP, SW, GP, and GW backfill soils, 31 degrees an for GM backfill soils, and 28 for an Angle of Internal Friction of 28 for SM backfill soils.

The designer of the retaining wall should specify the type of backfill material to be used in the active / at-rest zone behind the retaining wall. Any expansive soils which may be encountered on the subject site should not be used as backfill for retaining walls. Retaining walls that are free to deflect 0.001 radian at the top should be designed for the above-recommended active condition. Retaining walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The above values assume well-drained backfill and that a buildup of hydrostatic pressure will not occur. Surcharge loads, dead and/or live (i.e., construction loads, etc.), acting on the backfill within a horizontal distance behind the retaining wall, equivalent to or less than the vertical height of the retaining wall, should also be considered in the design. Uniform surcharge pressures should be applied as an additional uniform (rectangular) pressure distribution. The lateral earth pressure coefficient for a uniform vertical surcharge load behind the retaining wall is 0.50. Seismic and wind loads should also be added to the design loads on the retaining walls, if applicable.

Seismic Lateral Earth Pressure

In accordance with Section 1803.5.12, 'Seismic Design Categories D through F,' in the 2013 CBC for the structures, seismic loads should also be added to the design loads on the retaining walls retaining more than 6.0 feet in height. Recommended seismic lateral earth pressures can be provided upon request.

Foundation Design

Retaining wall footings should be founded to the same depths below lowest adjacent finished grade and offsets from the face of slopes, and into, undisturbed, observed and tested, compacted fill, or firm, competent, undisturbed, alluvial earth material as standard foundations. The foundations may be designed for the same average allowable bearing value across the footing (as long as the resultant force is located in the middle one-third of the footing), and with the same allowable static and seismic allowable lateral bearing pressure, allowable passive earth pressure, and allowable sliding resistance as recommended in the 'Foundation Design Recommendations' section of this report. Retaining walls should be designed for a factor of safety of 1.5 against lateral sliding and overturning per Section 1807.2.3, 'Safety Factor,' in the 2013 CBC.

Foundation Size: Continuous footings should have a width of 12 inches or greater. Continuous footings should be continuously reinforced with a minimum of one (1) No. 4 steel reinforcing bar located near the top and one (1) No. 4 steel reinforcing bar located near the bottom of the footings to minimize the effects of slight differential movements which may occur due to minor variations in the engineering characteristics or seasonal moisture change in the supporting expansive earth materials.

Depth of Embedment: Footings should extend to a depth of 12 inches or greater below lowest adjacent finish grade. Frost is not considered a design factor for

foundations in the Fontana Area of San Bernardino County, California since there will not be any significant frost penetration in the winter months.

Bearing Capacity: Provided the recommendations for site earthwork and for footing width and depth of embedment are incorporated into the project design and construction, the allowable bearing value for design of retaining wall footings for the total dead plus frequently-applied live loads is 2,000 pounds per square foot (psf) for footings that are 12 inches in width and a depth of embedment of 12 inches below lowest adjacent finish grade in accordance with Table 1806.2, 'Presumptive Load-Bearing Values,' in the 2013 CBC for footings founded in undisturbed, documented, properly, compacted fill material (Class 4 Material). For eccentrically loaded footings and/or overturning moments, the resultant force should be in the middle one-third of the footing and the average bearing value across the footing should not exceed the recommended allowable bearing value. The allowable bearing values have a factor of safety of 3.0 or greater and may be increased by 33.3 percent for short durations of live and/or dynamic loading such as wind or seismic forces.

Settlement: Footings designed according to the recommended bearing values are not expected to exceed a total settlement of 1.0 inch or a differential settlement of 0.5 inch between similarly sized and loaded footings.

Lateral Capacity

Resistance to lateral loads can be provided by a combination of friction acting at the base of the foundation and passive earth pressure on the sides of the footings and stem walls. Foundation design parameters, based on undisturbed, documented, properly compacted fill (Class 4 Material) for resistance to static lateral dead forces per Table 1806.2, 'Presumptive Load-Bearing Values,' in the 2013 CBC are as follows:

Allowable Lateral Bearing Pressure
(Equivalent Fluid Pressure), Passive Case:

Undisturbed, Documented, Compacted, 'Non-Expansive' Fill - 150 pcf*
Undisturbed, On-Site, 'Non-Expansive,' Alluvial Soil** - 150 pcf
Undisturbed, Existing, On-Site Soil - ***

* Pounds per square foot per foot of depth (pcf).
** Per Table 1806.2, 'Presumptive Load-Bearing Values,' for a Class 4 Material (SW, SP, SM, SC, GM, and GC) in the 2013 CBC.
*** Materials are to be removed and replaced as properly compacted fill to support foundations.

Allowable Lateral Sliding Coefficient of Friction Between Soil and Concrete:

Undisturbed, Documented, Compacted, 'Non-Expansive' Fill* - 0.25
Undisturbed, On-Site, 'Non-Expansive,' Alluvial Soil** - 0.25
Undisturbed, Existing, On-Site Soil - **

* Per Table 1806.2, 'Presumptive Load-Bearing Values,' for a Class 4 Material (SW, SP, SM, SC, GM, and GC) in the 2013 CBC.
** Materials are to be removed and replaced as properly compacted fill to support foundations.

The above values are allowable design values and have safety factors of 2.0 or greater incorporated into them and may be used in combination without reduction in evaluating the resistance to lateral loads. The recommended lateral resistance assumes a horizontal surface for the earth material mass extending to a distance of 10 feet or greater from the face of the footing, or three (3) times the height of the surface generating passive pressure, whichever is greater. The allowable values may be increased by 33.3 percent for short durations of live and/or dynamic loading, such as wind or seismic forces. For the calculation of the allowable lateral bearing pressure (passive earth resistance), the upper 1.0 foot of material should be neglected unless confined by a concrete slab or pavement. The largest recommended allowable lateral bearing pressure (passive earth resistance) is 15 times the recommended design value for the appropriate class of material.

Subdrain

A subdrain system should be constructed behind, and at the base of retaining walls to allow drainage and to prevent the buildup of excessive hydrostatic pressures.

The subdrain system should be designed by the project Civil Engineer. The use of water-stops, impermeable barriers, or other dampproofing or waterproofing methods should be considered for any retaining walls where moisture migration through the retaining wall is considered critical to the performance and/or appearance of the retaining walls. A waterproofing consultant should be retained to provide specific waterproofing recommendations for the project, if required.

Typical subdrains may include weep holes with a continuous free draining gravel gallery, perforated pipe surrounded by free draining filter rock, or another approved system. The option of providing an ungrouted, open coarse of block at the bottom of a retaining wall is not a recommended drainage option since the openings in this coarse are so often covered by landscape soil, hardscape, and or pavement. Gravel galleries and/or filter rock, if not designed and graded for the on-site and/or import materials, should be enclosed in a geotextile fabric such as Mirafi 140N series, or an equivalent substitute, to prevent infiltration of fine soil particles into the subdrain and clogging of the system. Before placement of the fabric, the top of the footing should be cleared of loose soil materials, large stones, and/or other debris. Any large depressions or holes should be filled with a concrete slurry or a suitable equivalent to permit close contact of the fabric with the surrounding surface. The fabric should be placed smoothly without folds or excessive wrinkles. Successive sheets of the fabric should be placed with an overlap of 24 inches or more in the direction of the flow of the water in the pipe with the upstream layer overlapping the downstream layer. The fabric should be folded over the top of the free draining granular material producing an overlap of 12 inches or more. The perforated pipes should be Schedule 40 or stronger and 4.0 inches or greater in diameter. Perforations may be either bored 0.25-inch diameter holes or 0.1875-inch (3/16-inch) wide slots placed on the bottom one-third of the pipe perimeter. If the pipe is bored, a minimum of 10 holes per linear foot should be uniformly placed along the pipe. If slots are used, they should not exceed 2.0

inches in length and should not be closer than 2.0 inches on center along the length of the pipe. The total length of the slots should not be less than 50 percent of the pipe length and should be uniformly spaced along the length of the pipe. Pipe perforations should be placed downward. Gravel filters should have a volume of 3.0 cubic feet or greater per linear foot of pipe. Subdrains should maintain a positive flow gradient and have outlets that drain in a non-erosive manner.

Prefabricated drainage products such as 'Miradrain,' or a suitable equivalent, may also be used for the purpose of providing drainage behind retaining walls when installed in accordance with the manufacturers recommendations.

Backfill

Backfill directly behind retaining walls (if backfill width is less than 3.0 feet) may consist of 0.5- to 1.5-inch diameter, rounded to subrounded gravel with less than 5.0 percent passing the 0.5 inch sieve enclosed in a geotextile fabric such as Mirafi 140N series, or an equivalent substitute, or a clean sand (Sand Equivalent Value greater than 50) water jetted into place to obtain compaction. If water jetting is used, the subdrain system should be in place. Even if water jetting is used, the sand should be densified to 90 percent or greater relative compaction. If the specified density is not obtained by water jetting, mechanical methods will have to be used. If other types of soil or gravel are used for backfill, mechanical compaction methods will have to be used to obtain a relative compaction of 90 percent or greater of maximum dry density. Backfill directly behind retaining walls should not be compacted by wheel, track or other rolling by heavy construction equipment unless the retaining wall is designed for the surcharge loading. If gravel, clean sand, or other imported backfill is used behind retaining walls in unpaved areas, the upper 12 to 18 inches of backfill should consist of typical on-site material compacted to 90 percent or greater relative compaction to prevent the influx of surface run-off into the granular backfill and into the

subdrain system. Maximum dry density and optimum moisture content for backfill materials should be determined according to current ASTM D1557 procedures.

V-Drain Design

A V-drain should be constructed directly behind retaining walls which have a sloping backfill to intercept surface water and drain it from the back of the retaining wall. The V-drain should be designed and constructed in accordance with the current typical standards of San Bernardino County, California. The V-drain should direct water from the back of the retaining wall to an adequate down drain and discharge it in a non-erosive manner.

Observation and Testing

During retaining wall construction, observation and testing should be conducted by the project Geotechnical / Geologic Consultant and/or his representatives to verify that the work is being performed according to the recommendations presented in this report.

The foundation excavations should be observed by the project Geotechnical / Geologic Consultant and/or his representative prior to placement of forms, reinforcing steel, or placement of concrete for the purpose of verification of the recommendations presented in this report and for compliance with the project plans and specifications. The foundation excavations should be trimmed neat, level, and square. Any loose or sloughed material and debris should be removed from the foundation excavations prior to placement of reinforcing steel and removed again prior to the placement of concrete.

The placement and construction of the subdrain system behind the retaining walls

should be observed by the project Geotechnical / Geologic Consultant and/or his representatives to verify that the work is being performed according to the recommendations presented in this report.

During backfill of the retaining walls, observation and testing should be conducted by the project Geotechnical / Geologic Consultant and/or his representatives to verify that the backfilling is being performed according to the recommendations presented in this report. The project Geotechnical / Geologic Consultant and/or his representative should observe the placement of fill and should take tests to verify the moisture content, density, uniformity and degree of compaction obtained. Where testing demonstrates insufficient density, additional compaction effort, with the adjustment of the moisture content when needed, should be applied until retesting shows that satisfactory relative compaction has been obtained. The results of observations and testing services should be presented in a formal report following completion of the construction operations. Retaining wall backfill operations undertaken at the site without the project Geotechnical / Geologic Consultant and/or his representative present may result in exclusions of the affected areas from the final report for the project.

The presence of the project Geotechnical / Geologic Consultant and/or his representative will be for the purpose of providing observations and field testing and will not include supervision or directing of the actual work of the contractor or the contractor's employees or agents. Neither the presence and/or the non-presence of the project Geotechnical / Geologic Consultant and/or his field representative nor the field observations and testing will excuse the contractor for defects discovered in the contractor's work.

CORROSION POTENTIAL EVALUATION

The recommendations for corrosion protection should be verified at the completion of grading of the building pads on the subject site. Bulk samples of the near surface, on-site earth materials were obtained during the field study to evaluate the potential for corrosivity. Results from the tests are included in the 'Summary of Laboratory Test Results' presented in Appendix 'A.'

Concrete Corrosion Potential

A preliminary test on a sample of near-surface, on-site earth material suggest a soluble sulfate concentration of 0.0011 percent. Earth materials with a water soluble sulfate (SO_4) concentration of less than 0.10 percent are considered to be Category S, Class S0 in accordance with Table 19.3.1.1, 'Exposure Categories and Classes,' in **American Concrete Institute (ACI)** 318-14. Therefore the requirements in Table 19.3.2.1, 'Requirements for Concrete by Exposure Class,' in **ACI** 318-14 are applicable. The referenced **ACI** Table 19.3.2.1 should be used to determine the type cement, the maximum water cement ratio, and the minium compressive strength to be used for normal weight concrete which comes in direct contact with the on-site earth materials (i.e., foundations, floor slabs, driveway slabs, sidewalks, patios, curbs / gutters, etc.). A lower water / cement ratio or higher compressive strength may be required for design of concrete for water tightness or for protection against freezing and thawing, or for corrosion protection of concrete reinforcement per Section 1904, 'Durability Requirements,' in the 2013 CBC, if applicable.

Experience in the southern California area has shown that even though the earth materials do not contain levels of soluble sulfate which would require the use of sulfate resistant cement, maximum water cement ratios, or minimum compressive strength for concrete, concrete corrosion and erosion problems still occur. These problems are the result of concentrations of soluble sulfate, chloride, and other

salts and/or acids present in groundwater, irrigation water, rain water, and potable water sources, and in fertilizers or amendments used to promote plant growth (i.e., some domestic water sources contain levels of dissolved sulfate which would be a Class S1 exposure to concrete which comes in contact with it). Therefore, it may be wise to use a concrete designed for a Category S, Class S1 criteria that comes into contact with surface run-off or other sources of water. Higher strength, lower water / cement ratio, and denser concrete may also be effective in reducing the potential for corrosion to occur and preventing damage due to salt or acid exposure. The use of sulfate resistant concrete for non-structural elements (i.e., driveway slabs, sidewalks, patios, curbs / gutters, etc.), is considered to be a value / risk assessment and decision to be made by the client.

Metallic Corrosion Potential

The life of buried metals depends on type of material, thickness, and construction details. Tests were not performed as part of this study to evaluate the potential for corrosion of bare metal in direct contact with the on-site earth materials. If corrosion protection of metals in direct contact with the on-site earth materials is considered to be a design issue, tests should be performed at the completion of the grading for the building pads and/or an engineer specializing in corrosion should be consulted regarding the potential damage due to corrosion. The corrosion engineer should recommend appropriate types of piping and/or protective measures where needed.

Salt Crystallization Exposure

Damage of concrete, concrete masonry units, slump stone block, etc. surface can occur when evaporation of moisture takes place at the surface of the materials. As evaporation takes place, salts (i.e,. carbonates, chloride, sulfur, sodium, potassium, etc.) are deposited in or form on the surfaces. As the salts crystalize, they can exert extreme pressures in the pore spaces of the materials they are deposited in and/or

on. The formation of the crystals within the pore spaces of the material can result in what is generally called 'salt crystallization damage.' This results in the scaling and/or etching of the surface of the material on which they are deposited. The damaging effects of this phenomenon can be greatly reduced and/or even eliminated by the following or other such methods: 1) either using a higher strength concrete or a denser, low porosity product; 2) seal the surface of the material with a water proofing substance which will prevent the evaporation of the moisture from within the cementitious product. If 'salt crystallization damage' is considered to be an issue, an engineer or chemist specializing in this area should be consulted regarding the potential damage due evaporation and the deposition of salts. The engineer or chemist should recommend appropriate types of materials or protective measures where needed.

PRELIMINARY PAVEMENT RECOMMENDATIONS

The following are preliminary recommendations for the structural pavement sections for the proposed parking areas, and driveway areas for the subject development. The Hot Mix Asphalt (HMA) concrete pavement sections have been determined in general accordance with current **California Department of Transportation (CALTRANS)** design procedures using the CalFP Ver. 1.1 'Hot Mix Asphalt Empirical Design' computer program developed by the **CALTRANS, Office of Pavement Design** and are based on an assumed Traffic Indexes for a 20 year design life and R-Value of at least 70 based on the laboratory test results and past experience in the vicinity of the site and visual textural classification of the on-site earth material and/or import materials which are anticipated to be at subgrade elevation.

Portland Cement Concrete (PCC) pavement sections are based on an equivalent structural number as the recommended HMA concrete pavement sections and a compressive strength of 2,500 psi or greater at 28 days for the concrete.

RECOMMENDED PAVEMENT SECTIONS			
Site Area	**Traffic Index***	**Subgrade R-Value****	**Pavement Section**
Driveway and Parking Areas for Autos and Light Weight Vehicles Only.	≤5.0	≥70	3.0" Hot Mix Asphaltic (HMA) Concrete over 4.0" Aggregate Base (AB) or 4.6" PCC @ 2,500 psi over properly prepared subgrade.
Areas to Receive Solid Tired Forklift and/or Other Types of Material Handing Equipment.	≤7.0	≥70	4.0" HMA over 5.0" AB or 6.0" PCC @ 2,500 psi over properly prepared subgrade.
* Traffic Index was assumed for the project. ** R-Values based on the laboratory test results and past experience in the vicinity of the site.			

It is noted that the County of San Bernardino minimum pavement sections may override the above pavement recommendations without prior City review and approval.

HMA concrete pavement materials should be as specified in Section 39, 'Hot Mix Asphalt,' in the current CALTRANS 2010 'Standard Specifications' with the 7-18-2014 Revisions, or an equivalent substitute. Aggregate base should conform to Class 2 Material, 1-1/2" Maximum or 3/4" Maximum, as specified in Section 26-

1.02B, 'Class 2 Aggregate Base,' in the current, CALTRANS 2010 'Standard Specifications' with the 7-18-2014 Revisions, or an equivalent substitute.

Portland Cement Concrete sections are based on a compressive strength of 2,500 psi or greater at 28 days for the concrete. Higher strength design for the concrete can permit thinner pavement sections. Lower strength design for the concrete will require thicker pavement sections. Joints (longitudinal, transverse, construction, and expansion), jointing arrangement, joint type, pavement and/or joint reinforcing, as well as drainage, crowning, finishing and curing of PCC pavement should be in accordance with current Portland Cement Association (PCA) recommendations.

The subgrade earth material, including utility trench backfill, should be compacted to 90 percent or greater relative compaction to a depth of 1 foot or greater below the finish pavement subgrade elevation. The aggregate base material should be compacted to 95 percent or greater relative compaction. If asphaltic concrete and/or PCC pavement is placed directly on subgrade, the upper 1.0 foot of the subgrade should be compacted to 95 percent or greater relative compaction. Maximum dry density and optimum moisture content for subgrade and aggregate base materials should be determined according to current ASTM D1557 procedures. The asphalt concrete pavement should be densified to 95 percent or greater of the density obtained by current California Test 304 and 308 procedures (Hveem compacted laboratory samples).

If semi-trailers are to be parked on the asphalt concrete pavement, such that a considerable load is transferred from small, steel wheels, it is recommended that a strip of rigid Portland Cement concrete pavement with a thickness of 6.0 inches or greater be provided in these areas. This will provide for the distribution of loads to the subgrade without causing deformation of the pavement surface. Special

consideration should also be given to areas where truck traffic will negotiate small radius turns and/or in areas utilized by solid tired forklifts or other material handling equipment. HMA concrete pavement in these areas should utilize stiffer emulsions or the areas should be paved with Portland Cement concrete. Where HMA concrete pavement abuts concrete aprons, drives, walks, or curb and gutter sections, a thickened edge transition zone is recommended for the HMA concrete section to minimize the effects of impact loading as vehicles transition from PCC paving to HMA concrete paving. This thickened edge should consist of an increased thickness of 2.0 inches for parking areas and 4.0 inches for areas of heavy truck usage. This thickened edge should extend to a distance of 3.0 feet or greater from the edge of pavement and then gradually taper back to the design pavement thickness. If pavement subgrade earth materials are prepared at the time of grading of the building site and the areas are not paved immediately, additional observations and testing will have to be performed before placing aggregate base material, asphaltic concrete, or PCC pavement to locate areas that may have been damaged by construction traffic, construction activities, and/or seasonal wetting and drying. In the proposed pavement areas, earth material samples should be obtained at the time the subgrade is graded for Resistance (R-Value) testing according to current California Test 301 procedures to verify the pavement design recommendations.

Because the full design thickness of the HMA concrete is frequently not placed prior to construction traffic being allowed to use the parking lots, rutting and pavement failures can occur prior to project completion. To reduce this occurrence, it is recommended that either the full-design pavement section be placed prior to use by the construction traffic, or a higher Traffic Index (TI) be specified where construction traffic will use the pavement.

Surface water infiltration beneath pavements could significantly reduce the pavement design life. To limit the need for additional long-term maintenance of the pavement or pre-mature failure, it would be beneficial to protect at-grade pavements from landscape water infiltration by means of a concrete cutoff wall, deepened curbs, or equivalent. Pavement cut-off barriers should be considered where pavement areas are located downslope of any landscape areas that are to be irrigated. The cut-off barrier should extend to a depth of at least 4.0 inches below the pavement section aggregate base material.

Gradation is not the only quality guidelines for aggregate base material. The longevity and performance of pavements utilizing aggregate base material for support is dependent upon the quality of the material which composes the aggregate base. CALTRANS specifications do not specifically exclude the use of material other than a natural, crushed rock and rock dust for Class 2 Aggregate Base material as the 'Standard Specifications for Public Works Construction' (2012 Edition of the 'Greenbook' with the 2014 Cumulative Supplement), Section 200-2.2, does for Crushed Aggregate Base material. Often times, reclaimed Portland Cement concrete, Hot Mix Asphalt concrete, lean concrete base, and cement treated base are crushed, combined with broken stone, crushed gravel, natural rough surfaced gravel, and sand per the current Section 26-1.02B, 'Class 2 Aggregate Base,' of the current CALTRANS 2010 'Standard Specifications,' with the 7-18-2014 Revisions, and graded to produce a Class 2 Aggregate Base material per CALTRANS gradation specifications. Bricks, concrete masonry units, tile, glass, ceramics, porcelain, wood, plastic, metal, etc. **are not** an acceptable reclaimed material for use in a Class 2 Aggregate Base material per the current CALTRANS 2010 'Standard Specifications' with the 7-18-2014 Revision. If a reclaimed material is proposed for use on the project as a Class 2 Aggregate Base, the reclaimed materials should not exceed 50 percent of the total volume of the aggregate used. The aggregate base material should be tested prior to delivery to

the subject project site for the following quality requirements per the current, appropriate CALTRANS test procedures:

TEST	TEST METHOD NO.	QUALITY REQUIREMENT	
		OPERATING RANGE	CONTRACT COMPLIANCE
Resistance (R-Value)	Calif. Test 301	--	78 Minimum
Sand Equivalent	Calif. Test 217	25 Minimum	22 Minimum
Durability Index	Calif. Test 229	--	35 Minimum

If a reclaimed material or a pit run aggregate is proposed for use on the project as a 'Greenbook' Crushed Miscellaneous Base (CMB), the materials should be tested for the following quality requirements prior to delivery to the subject project, per the current 'Greenbook,' 2012 Edition with the 2014 Cumulative Supplement, Section 200-2.4.3, and appropriate procedures as well as the required gradation and other requirements:

TEST	TEST METHOD NO.	QUALITY REQUIREMENT
Resistance (R-Value)	Calif. Test 301	78 Minimum[1]
Sand Equivalent	Calif. Test 217	35 Minimum
Percent Wear[2] 100 Revolutions 500 Revolutions	ASTM C131	 15 Maximum 52 Maximum

1. R-Value requirement may be waived if Sand Equivalent is 40 or more.
2. The percentage wear requirements may be waived if the material has a minimum Durability Index of 40 in accordance with CALTRANS Test Method 229.

A 'Greenbook' CMB may contain broken or crushed asphalt concrete or Portland Cement concrete and may contain crushed aggregate base or other rock materials. The CMB may contain no more than 3.0 percent brick retained on the # 4 sieve by dry weight of the total sample.

Samples of the proposed aggregate base using reclaimed material should be sampled from the manufacturer's stockpiles and tested prior to delivery to the project. The samples should be obtained at a time as near the delivery to the project as possible but would allow enough time to complete the testing and report the results before delivery to the site. Samples should again be obtained and tested for quality compliance from the materials delivered to the project. In addition, per the current CALTRANS 2010 'Standard Specifications' with the 7-18-2014 Revisions, an aggregate grading and Sand Equivalent test shall not represent more than 500 cubic yards or one (1) days production if less than 500 cubic yards.

Concrete gutters should be provided at flow lines in paved areas. Pavements should be sloped to permit rapid and unimpaired flow of runoff water. In addition, paved areas should be protected from moisture migration and ponding from adjacent water sources. Saturation of aggregate base and/or subgrade materials could result in pavement failure and/or premature maintenance. The gutter material and construction methods should conform to the current standards of the San Bernardino County, California.

POST-GRADING CRITERIA

Earth materials generated from the excavation of foundations, utility trenches, to be used on-site, should be moisture conditioned to optimum moisture content to 3.0 percent above optimum moisture content and compacted to 90 percent or greater of the maximum dry density for the material type as determined by current ASTM D1557 procedures when it is to be placed under floor slabs, under hardscape areas,

and/or in paved areas. The placement of the excess material should not alter positive drainage away from structures and/or off the lot and should not change the distance from the weep screed on the structure to the finished adjacent earth material grade per the 'Finish Surface Drainage Recommendations' presented in a subsequent section of this report.

UTILITY TRENCH RECOMMENDATIONS

Utility trenches within the zone of influence of foundations or under building floor slabs, exterior hardscape, and/or pavement areas should be backfilled with documented, compacted earth material. Utility trenches within the building pad and extending to a distance of 5.0 feet beyond the building exterior footings should be backfilled with on-site or similar earth material. Where interior or exterior utility trenches are proposed to pass beneath or parallel to building, retaining wall, and/or decorative concrete block perimeter wall footings, the bottom of the trench should not be located below a 1H:1V (Horizontal to Vertical) plane projected downward from the outside bottom edge of the adjacent footing unless the utility lines are designed for the footing surcharge loads.

Trench Excavation

It is recommended that utility trench excavations be designed and constructed in accordance with current OSHA regulations. These regulations provide trench sloping and shoring design parameters for trenches up to 20 feet in vertical depth based on a description and field verification of the earth material types encountered. Trenches over 20 feet in vertical depth should be designed by the Contractor's Engineer based on site specific geotechnical analyses. For planning purposes, we recommend that the following OSHA earth material type designations and temporary slope inclinations be used:

EARTH MATERIAL	OSHA SOIL TYPE*	TEMPORARY SLOPE INCLINATION (H:V)**
Undocumented Fill	C	1.5:1
Compacted Fill	C	1.5:1
Alluvium	C	1.5:1

Type 'C': Cohesive soils with an unconfined compressive strength of 0.5 tsf or less: or Granular soils including sands, gravels, loamy, clayey or silty sands, etc.

** Steepest allowable slopes for excavations less than 20 feet in vertical height. Slopes for excavations greater than 20 feet in vertical height should be designed by a Registered Professional Engineer with experience in Geotechnical Consulting and Soil Mechanics.

Excavations of less than 5.0 feet in depth may also be subject to collapse due to water, vibrations, previously disturbed earth materials, or other factors and may require protection for workers such as temporary slopes, shoring, or a shielding protective system. The excavations should be observed by a qualified, competent person (as defined in the current OSHA regulations) looking for signs of potential cave-ins on a daily basis before start of work, as needed throughout the work shifts, and after every rainstorm or other hazard-increasing occurrence.

Surcharge loads (i.e., spoil piles, earthmoving equipment, trucks, etc,) should not be allowed within a horizontal distance measured from the top of the excavation slope equivalent to the vertical depth of the excavation 1.5 times the vertical depth of the excavation. Excavations should be initially observed by the project Geotechnical / Geologic Consultant and/or his representative to verify the recommendations presented or to make additional recommendations to maintain stability and safety. Moisture variations, differences in the cohesive or cementation characteristics, or changes in the coarseness of the deposits may require slope flattening or, conversely, permit steepening upon review and appropriate testing by the project Geotechnical / Geologic Consultant and/or his

representative. The excavations should be observed by a qualified, competent person (as defined in the current OSHA regulations) looking for signs of potential problems on a daily basis before start of work, as needed throughout the work shifts, and after every rainstorm or other hazard-increasing occurrence. Deep utility trenches may experience caving which will require special considerations to stabilize the walls and expedite trenching operations. Surface drainage should be controlled along the top of the construction slopes to preclude erosion of the slope face. If excavations are to be left open for long periods, the slopes should be sprayed with a protective compound and/or covered to minimize drying out, raveling, and/or erosion of the slopes.

Utility Line Foundation Preparation

If the utility trench excavation bottom is in material that is not suitable for support of the utility pipe, the material should be removed to a minimum depth of 1.0 foot below the bottom of the pipe and replaced with concrete slurry, sand, or crushed gravel meeting the following appropriate gradation limits or some other suitable equivalent as specified by the utility designer.

SIEVE SIZE	CRUSHED ROCK OR GRAVEL (PERCENT PASSING)
1"	100
3/4“	90-100
½“	30-60
3/8“	0-20
No. 4	0-5

SIEVE SIZE	SAND (PERCENT PASSING)
3/8"	100
No. 4	75-100
No. 30	12-50
No. 100	5-20
No. 200	0-15

Most of the granular native earth materials encountered on the subject site **are not** expected to meet the above granular earth material criteria.

We recommend, that where the bottom of the pipe foundation excavation is loose or soft, the foundation earth materials be removed to firm materials as determined by the Engineer. This condition would likely only apply where fill underlies the pipe in localized areas along a utility alignment. If firm material is not encountered within 24 inches of the bottom of the pipe zone, the contractor may then elect to stabilize the trench bottom with 24 inches of crushed rock as described above. Alternately, soft or loose material may be excavated to firm earth material and the overexcavation replaced with select earth material.

The bottom of the utility trench excavation should be proof compacted to 90 percent or greater relative compaction prior to placement of compacted fill. Maximum dry density and optimum moisture content for compacted materials should be determined according to current ASTM D1557 procedures.

Prior to placement of trench slurry or crushed rock, the bottom need only be cleaned of loose materials created by the excavation process. Where the bottom of the trench contains rocks or hard objects protruding above a depth of 6.0 inches

below the pipe bottom, such objects should be removed or broken and any resulting cavities filled to produce a smooth surface.

Bedding Requirements

It is recommended that the pipe be bedded on either clean sand, gravel, crushed rock or any approved suitable material in order to provide a smooth, firm, and uniform foundation for the pipe. The pipe bedding material, thickness, shaping, and placement should satisfy the design requirements as determined by the design Civil Engineer and/or in accordance with Section 306-1.2.1 of the 2012 Edition of the 'Greenbook' with the 2014 Cumulative Supplement. The majority of the man-made fills and alluvial soils on the subject site may not be suitable to be used as bedding and pipe zone backfill materials depending upon the bedding and pipe zone backfill specifications required by the project designer and/or the agency having jurisdiction over the utility line.

Trench Zone Backfill

The excavated earth materials from the trench may be used as backfill in the trench zone unless more restrictive specifications are required by the design engineer or the permitting agency. The trench backfill material should consist of approved earth materials free of trash debris, vegetation or other deleterious matter, and oversize particles (i.e., 12 inch in maximum dimension). Trench zone backfill should be compacted to 90 percent or greater relative compaction. Maximum density and optimum moisture content for compacted materials should be determined according to current ASTM D1557 procedures.

Trench backfill material should be placed in a lift thickness appropriate for the type of backfill material and compaction equipment used. Backfill material should be brought to optimum moisture content to 3.0 percent above optimum moisture content and compacted to 90 percent or greater relative compaction by mechanical

means. Jetting or flooding of the backfill material will **not** be considered a satisfactory method for compaction. Maximum dry density and optimum moisture content for backfill material should be determined according to current ASTM D1557 procedures.

FINISH SURFACE DRAINAGE RECOMMENDATIONS

Positive drainage should be established away from the exterior walls of structures, the back of retaining walls, trash enclosure walls, decorative concrete block walls, etc. Finish surface gradients in unpaved areas should be provided next to tops of slopes and buildings to guide surface water away from foundations, hardscape, and pavement. The surface water should be directed toward adequate drainage facilities. Ponding of surface water should not be allowed next to structures or on pavements. Design criteria for finish lot drainage away from structures and off the lots should be determined by the project Structural Engineer designing the foundations and slabs in conjunction with the project Civil Engineer designing the precise grading for lot drainage, respectively, in accordance with the 2013 CBC and/or the current County of San Bernardino, California codes and ordinances and the earth material types and expansion characteristics for the earth materials contained in this report. Finished landscaped and hardscape or pavement grades adjacent to the proposed structures should maintain a vertical distance below the bottom elevation of the weep screed per the 2013 CBC and/or the current County of San Bernardino codes and ordinances. Landscape plants with high water needs and trees should be planted at a distance away from the structure equivalent to or greater than the width of the canopy of the mature tree or 6.0 feet, whichever is greater. Downspouts from roof drains should discharge to a permanent all-weather surface which slopes away from the structure. Downspouts from roof drains should not discharge into planter areas immediately adjacent to the building unless there is positive drainage out of the planter and away from the structure in accordance

with the recommendations of the project foundation and slab designer and/or the project Civil Engineer designing the precise grades for the lot drainage.

PLANTER RECOMMENDATIONS

Planters around the perimeter of the structures should be designed so that adequate drainage is maintained and minimal irrigation water is allowed to percolate into the earth materials underling the buildings. This should include enclosed or trapped planter areas that are created as a result of sidewalks. Planters with solid bottoms, independent of the underlying earth material, are recommended within a distance of 6.0 feet from the buildings. The planters should drain directly onto surrounding paved areas or into a designed subdrain system. If planters are raised above the surrounding finished grades or are placed against the building structure, the interior walls of the planter should be waterproofed.

RECHARGE BASIN RECOMMENDATIONS

Location of Percolation Testing

Shallow percolation testing was conducted on the southeast portions of the site at depths of approximately 9.5 feet and 11.0 feet below existing site grades, per Reference No. 2, "Infiltration Test Location Exhibit," and the request of **Thatcher Engineering & Associates, Inc.**. A truck-mounted drill rig was used to excavate each test pit to the appropriate depth. The approximate shallow percolation test locations are shown on the 'Exploratory Excavation Location Plan', Plate No. 1, presented in Appendix 'A.'

Soil Characteristics of the Subject Site

- The soil characteristics for the subject site are defined as favorable.
- There was no visible evidence of shallow groundwater or impervious bedrock materials.

- Depth to groundwater data for the site area was available through the **California Department of Water Resources** internet web site. The depth to groundwater in State Well No. 01S06W11N001S, located approximately 0.5 mile north of the site, was at 469 feet on October 16, 2015. The surface elevation of this well is approximately 36 feet higher (topographically) than that of the site. Based on this information, the current depth to static groundwater beneath the site is estimated to be greater than 50 feet.

- Tests performed agreed with visual evidence.

- The natural slope of the ground surface above the proposed water infiltration areas are less than a 2.0 percent gradient.

- Soil conditions for the on-site, water infiltration systems were acceptable.

Soil Profile

- Percolation Hole No. 1 (B-4): Percolation test (P-1) was located in the southwestern portion of the site and tested in alluvial deposits. A truck mounted drill rig was used to excavate to a depth of 11.0 feet. Native alluvial soils in the test area consisted of slightly silty, fine to medium sand, trace coarse sand, trace gravel (SP-SM) brown in color and moist grading to fine to coarse grained sand, a little gravel, trace silt (SP) dark brown in color and moist. The test hole was classified in general accordance with the Unified Soil Classification System as an (SP-SM) and (SP).

- Percolation Hole No. 2 (B-5): Percolation test (P-2) was conducted in alluvial soils in the furthest southwestern portion of the site at approximately 9.5 feet beneath the existing grade. A truck mounted drill rig was used to excavate the test hole. Native alluvial soils in the test area consisted of silty, fine sand, trace medium and coarse sand, brown and moist grading to fine to coarse sand, a little gravel, trace cobbles gray brown in color and moist. The test hole was classified in general accordance with the Unified Soil Classification System as an (SM), (SP) and (SP-SM).

- No large plants or roots were encountered in the percolation test areas.

- There were no wet or saturated soils encountered in the percolation test areas.

- No groundwater was encountered within the percolation test areas.

Shallow Percolation Test Procedures

a) **Test Method**: Percolation testing was conducted in general accordance with the San Bernardino County Areawide Stormwater Program; NPDES No. CAS618036, ORDER No. R8-2010-0036, Appendix D: Section VII, Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations.

b) **Drilling**: The boreholes were approximately eight inches in diameter, dug by a truck mounted drill rig with eight inch diameter augers. Testing was performed at the proposed basin bottom elevations. After drilling, perforated three inch diameter PVC pipe was inserted into each bore hole. Two 2-inches of 3/4 inch gravel was placed around the perforated PVC pipe in each test hole.

c) **Soaking Period**: The test holes were pre-soaked by filling each borehole with water to the ground surface on February 24, 2016. Pre-soaking lasted for approximately two hours prior to testing. Prior to testing, no water remained in either of the percolation holes.

d) **Measurement of the Percolation Rate**: For the percolation test, the water level in each hole was adjusted to just below ground surface and measured with a 25 foot tape measure, or a 300 foot tape measure with a weight on the end when appropriate. After each measured water level drop, the water level was restored to approximately the initial level below the top of the hole. For both tests, measurements after two consecutive 25-minute readings revealed the water level had exceeded the minimum 6-inch water level change. Due to the sandy/coarse nature of the soils, the tests were completed by using 10-minute intervals between readings for a period of one hour.

Infiltrometer Test Results

The percolation rates were converted to infiltration rates by use of the Porchet Method and revealed the infiltration rates to be moderate. The infiltration rates were similar between the test holes and depths. The calculated average percolation rate in test holes P-1 and P-2 was 17.2 cm/hr and 12.0 cm/hr, respectively. The last reading obtained from each test hole were the slowest rates and found to be 15.15 cm/hr in P-1 and 10.28 in P-2. A detailed account of the percolation data can be found on the attached Plate Nos. 11 and 12, presented in Appendix 'C of this report.

Discussion

This area of Fontana is underlain by alluvial deposits of Lytle Creek that primarily consist of interbedded gravels, cobbles, and boulders, and sands to fine-grained silts. The subject areas tested contained siltier deposits toward the surface with a decrease in the amount of silt at depth. Soils encountered in the test pits were similar, and yielded favorable percolation rates. The rates presented above are generally consistent with the soil classifications in each area tested.

Field infiltration tests are subject to many factors that affect the infiltration rate, including soil texture, the condition of the soil surface, soil-moisture tension or the degree of saturation, the temperature of the water and soil, the percentage of entrapped air in the soil, and the head of the applied water. the soil, and the head of the applied water.

Infiltration Basin Recommendations

Percolation testing in the proposed infiltration areas indicated percolation rates that appear to be consistent with respect to there respective on-site soil classification. The Project Civil Engineer should evaluate this information for final infiltration design.

Caution should be used in determining a percolation rate for any proposed infiltration basin or structure. Eventual siltation, water-borne silt from irrigation and precipitation runoff, and the accumulation of organic material in surface soils due to landscape grass and plant growth, can drastically reduce percolation rates over time. We recommend that suitable methods to prevent siltation be considered in the project design.

LIMITATIONS

REVIEW, OBSERVATION, AND TESTING

The recommendations presented in this report are contingent upon review of final plans and specifications for the project by **HGI**. The project Geotechnical / Geologic Consultant should review and verify in writing the compliance of the final grading plan and the final foundation plans with the recommendations presented in this report.

It is recommended that **HGI** be retained to provide continuous Geotechnical / Geologic Consulting services during the earthwork operations (i.e., rough grading, utility trench backfill, subgrade preparation for slabs-on-grade and pavement areas, finish grading, etc.) and foundation installation process. This is to observe compliance with the design concepts, specifications and recommendations and to allow for design changes in the event that subsurface conditions differ from those anticipated prior to start of construction. If **HGI** is replaced as Geotechnical / Geologic Consultant of record for the project, the work on the project should be stopped until the replacement Geotechnical / Geologic Consultant has reviewed the previous reports and work performed for the project, agreed in writing to accept the recommendations and prior work performed by **HGI** for the subject project, or has submitted their revised recommendations.

UNIFORMITY OF CONDITIONS

The recommendations and opinions expressed in this report reflect our understanding of the project requirements based on an evaluation of subsurface earth material conditions encountered at the subsurface exploration locations and the assumption that earth material conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the foundations may be influenced by undisclosed or unforeseen variations in earth material conditions that may occur in intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the **HGI** so that we may make modifications, if necessary.

CHANGE IN SCOPE

HGI should be advised of any changes in the project scope of proposed site grading so that it may be determined if recommendations contained herein are valid. This should be verified in writing or modified by a written addendum.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the State-of-the-Art and/or government codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a period of two (2) years without a review by **HGI** verifying the validity of the conclusions and recommendations.

PROFESSIONAL STANDARD

In the performance of our professional services, we comply with the standard of care and skill ordinarily exercised under similar circumstances by members of the geologic / geotechnical professions currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the locations where our surveys and exploratory excavations were made, and that our data, interpretations, and recommendations are based solely on information obtained by us. We will be responsible for those data, interpretations, and recommendations, but should not be responsible for interpretations by others of the information presented and/or developed. Our services consist of professional consultation and observation only, and other warranties, expressed or implied, are not made or intended in connection with work performed by **HGI** or by the proposal for consulting or other services or by the furnishing of oral or written reports or findings.

CLIENT'S RESPONSIBILITY

It is the responsibility of the client and/or the client's representatives to ensure that information and recommendations contained herein are brought to the attention of the Engineers and Architect for the project and incorporated into project plans and specifications. It is further their responsibility to take measures so that the contractor and his subcontractors carry out such recommendations during construction.

APPENDIX A

FIELD EXPLORATION

The field study performed for this report included a visual reconnaissance of existing surface conditions of the subject site and surrounding area. Site observations were conducted on February 25, 2016 by a representative of **HGI**. The aerial distribution of the earth materials observed is shown on the 'Exploratory Excavation Location Plan,' Plate No. 1, presented in the map pocket in this Appendix.

A study of the property's subsurface condition was performed to evaluate underlying earth strata and the presence of groundwater. Five (5) exploratory borings were performed on the subject site on February 25, 2016. Locations of the exploratory excavations were determined in the field by pacing, tape measuring, and sighting from the adjacent existing streets, adjacent structures, and topographic features as shown on the Reference No.1, 'Minor Use Permit Site Plan,' noted on the first page of the cover letter for this report. Approximate locations of the exploratory excavations are denoted on the 'Exploratory Excavation Location Plan,' Plate No. 1, presented in this Appendix. Approximate elevations at the locations of the exploratory excavations were determined by interpolation to the closest one foot from a foot contour interval topographic plot of the site (Reference No. 1 noted on the first page of the cover letter for this report). Locations and elevations of the exploratory excavations should be considered accurate only to the degree implied by the method used in determining them.

The exploratory borings were performed by using a truck-mounted drill rig equipped with 8-inch outside-diameter, hollow-stem augers. The exploratory excavations were explored to depths ranging from approximately 9.5 to 27.0 feet below existing ground surface at the excavation locations. Bulk and relatively undisturbed samples of encountered earth materials were obtained at various

depths in the exploratory excavations and returned to our laboratory for testing and verification of field classifications. Bulk samples were obtained from cuttings developed during the excavation process and represent a mixture of earth materials within the depth indicated on the logs. Relatively undisturbed samples of encountered earth materials were obtained by driving a thin-walled, steel sampler lined with 1-inch high, 2.416-inch inside diameter brass rings. The sampler was driven with successive drops of a 140-pound weight having a free fall of approximately 30 inches. Blow counts for each successive 6.0 inches of penetration, or fraction thereof, are shown on the 'Subsurface Exploration Log,' Plate Nos. 3 through 7, presented in this Appendix. Ring samples were retained in close-fitting moisture-proof containers and returned to our laboratory for testing. Standard Penetration Tests were also performed at various depths in the borings. The test was performed in general accordance with current American Society of Testing Materials (ASTM) D1586 procedures using a standard penetration sampler (2.0-inch outside diameter, 1.375-inch inside diameter) driven with a 140 weight dropping 30 inches. The blow counts to drive the sampler for three (3) successive 6.0 inch intervals are recorded on the 'Subsurface Exploration Log,' Plate Nos. 3 through 7, presented in this Appendix. The standard penetration resistance ('N' value) is the sum of the blow counts for the last two (2) 6.0 inch intervals.

Groundwater observations were made during, and at the completion of the excavation process are noted on the 'Subsurface Exploration Log' presented in this Appendix, if encountered.

The exploratory excavations were logged by a representative of **HGI** for fill material, natural earth material, and subsurface conditions encountered. Earth materials encountered in the exploratory excavations were visually described in the field in general accordance with the current Unified Soils Classification System (USCS), ASTM D2488, visual-manual procedures, as illustrated on the attached,

simplified 'Subsurface Exploration Legend,' Plate No. 2, presented in this Appendix. The visual textural description, color of the earth material at natural moisture content, apparent moisture condition of the earth materials, and apparent relative density or consistency of the earth materials, etc., were recorded on the field logs. The 'Relative Density' of granular soils (SP, SW, SM, SC, GP, GW, GM, GC) is given as very loose, loose, medium dense, dense, or very dense and is based on the number of blows to drive the sampler 1.0 foot or fraction thereof. The 'Consistency' of silts or clays (ML, CL, MH, CH) is given as very soft, soft, medium stiff, stiff, very stiff, or hard and is also based on the number of blows to drive the sampler 1.0 foot or fraction thereof. The field log for each excavation contains factual information and interpretation of earth material conditions between samples. The 'Subsurface Exploration Log' presented in this Appendix represent our interpretation of the field log contents and results of laboratory observations and tests performed on samples obtained in the field from the exploratory excavations.

Perforated pipe was installed in the two (2) borings, B-4 and B-6, in the proposed recharge basin area. The pipe was installed for us in performing percolation tests in this area of the subject site. The remaining exploratory boring excavations were backfilled with excavated earth materials and with reasonable effort to restore the areas to their initial condition before leaving the site. In an area as small and deep as a boring excavation, consolidation and subsidence of backfill earth material may result in time, causing a depression of the excavation areas. The client is advised to observe exploratory excavation areas periodically and, when needed, backfill noted depressions.

Percolation tests were performed in the area of the recharge basin in general accordance with San Bernardino County Technical Guidance Document Appendices, Infiltration Rate Evaluation Protocal and Factor of Safety

Recommendation specifications and procedures on February 25, 2016. The 'Shallow Percolation Data Sheets' are presented in Appendix 'C' for reference.

LABORATORY TESTING PROGRAM

Laboratory tests were performed on selected, relatively undisturbed ring and bulk samples obtained from exploratory excavations during the field study. Tests were performed in general accordance with generally accepted American Society for Testing and Materials (ASTM), State of California - Department of Transportation (CALTRANS), Environmental Protection Agency (EPA) or other suitable test methods or procedures. The remaining samples obtained during the field study will be discarded 30 days after the date of this report. This office should be notified immediately if retention of samples will be needed beyond 30 days. A brief description of the tests performed is presented below:

CLASSIFICATION

The field classification of earth material materials encountered in the exploratory excavations was verified in the laboratory in general accordance with the current Unified Soils Classification System, ASTM D2488, 'Standard Practice for Determination and Identification of Soils (Visual-Manual Procedures).' The final classification is shown on the 'Subsurface Exploration Log,' Plate Nos.3 through 7, presented in this Appendix.

IN-SITU MOISTURE CONTENT AND DRY DENSITY

The in-situ moisture content and dry density were determined in general accordance with current ASTM D2216 (Moisture Content) and D2937 (Drive Cylinder) procedures, respectively, for selected undisturbed samples obtained. This information was an aid to classification and permitted recognition of variations in material consistency with depth. The dry density is determined in pounds per cubic foot and the moisture content is determined as a percentage of the oven dry weight of the earth material. Test results are shown on the 'Subsurface Exploration Log,' Plate Nos.3 through 7, presented in this Appendix.

EXPANSION TEST

A laboratory expansion test was performed on a selected sample of near-surface earth material in general accordance with the current ASTM D4829 procedures. In this testing procedure, a remolded sample is compacted in two (2) layers in a 4-inch inside diameter mold to a total compacted thickness of approximately 1.0 inch by using a 5.5-pound weight dropping 12 inches and with 15 blows per layer. The sample should be compacted at a saturation between 48 and 52 percent. After remolding, the sample is confined under a pressure of 144 pounds per square foot (psf) and allowed to soak for 24 hours. The resulting volume change due to the increase in moisture content within the sample is recorded and the Expansion Index (EI) calculated. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 8, presented in this Appendix.

SOLUBLE SULFATE TEST

The concentration of soluble sulfate was determined on a selected sample of near-surface earth material in general accordance with current EPA 300.0 procedures. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 8, presented in this Appendix.

SIEVE ANALYSIS

The percent by weight finer than a No. 200 sieve (silt and clay content) was determined for a selected sample of earth material in general accordance with current ASTM D1140 procedures. The test is performed by taking a known weight of an oven dry sample of earth material, washing it over a No. 200 sieve, and oven drying the earth material retained on the No. 200 sieve. The dry weight of earth material retained on the No. 200 sieve is measured and the resulting percentage retained is calculated based on the original total dry earth material sample weight. The percent passing the No. 200 sieve is determined by subtracting the percent

retained from 100. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 8, presented in this Appendix.

RESISTANCE (R-VALUE) TEST

A resistance (R-Value) test was performed on a selected sample of near-surface earth material that is anticipated to comprise the subgrade for proposed pavement areas. This test procedure measures the ability of earth materials and aggregate materials to resist lateral deformation under saturated conditions and applied vertical wheel loads. The R-Value is used in developing parameters for structural pavement sections. The R-Value is determined based on the following seperate measurements:

- The exudation pressure test determines the thickness cover or pavement structure required to prevent plastic deformation of the soil under imposed wheel loads.
- The expansion pressure test determines the pavement thickness or weight of cover required to withstand the expansion pressure of the soil.

Testing was performed in general accordance with current California Test 301 procedures. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 9, presented in this Appendix.

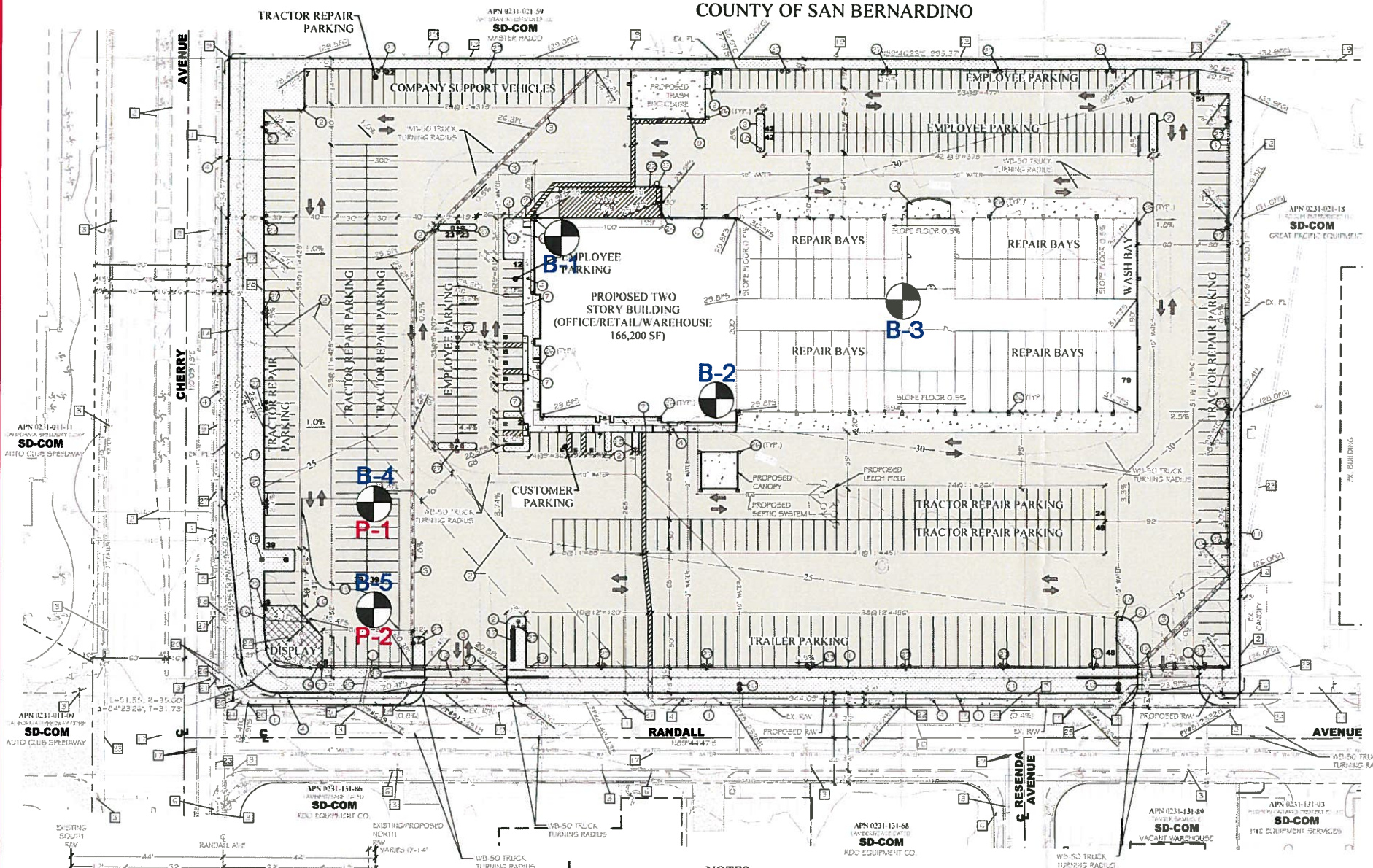
MAXIMUM DRY DENSITY / OPTIMUM MOISTURE CONTENT RELATIONSHIP TEST

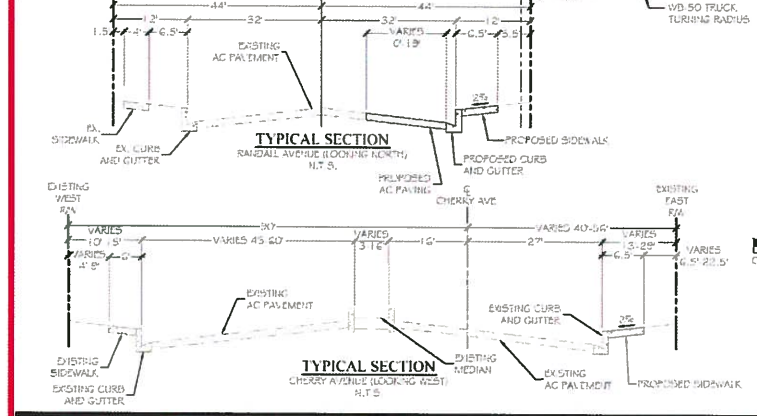
A maximum dry density / optimum moisture content relationship determination was performed on a samples of near-surface earth material in general accordance with current ASTM D1557 procedures using a 4-inch diameter mold. Samples were prepared at various moisture contents and compacted in five (5) layers using a 10-pound weight dropping 18 inches and with 25 blows per layer. A plot of the compacted dry density versus the moisture content of the specimens was

constructed and the maximum dry density and optimum moisture content determined from the plot. The test results are summarized in the 'Maximum Dry Density / Optimum Moisture Content Relationship Test Results,' Plate No. 10, presented in this Appendix.

MINOR USE PERMIT APPLICATION

USE CATEGORIES: TRUCK SALES, SERVICE/REPAIR, AND PARTS SALES DEALERSHIP
APN 0231-021-24, 25, 32, 48, 54, 55, 57, 76, 82, 83 & 84
NORTHEAST CORNER OF CHERRY AVENUE & RANDALL AVENUE
COUNTY OF SAN BERNARDINO





SOURCE OF SURVEY

TOPOGRAPHIC SURVEY
DATED OCTOBER, 2015
AS CONDUCTED BY
RATSON LAND SURVEYING
28346 REMAN RANCH ROAD
ROMOLAND, CALIFORNIA 92585
PHONE: (951) 678-9934

SCALE: 1"=50'

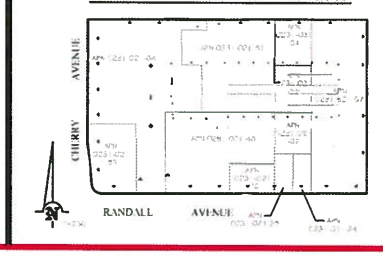
PRELIMINARY EARTHWORK QUANTITIES:

CUT: 17,400 CY
FILL: 18,300 CY
(RAW/UNADJUSTED)

*NOTE: THE PROPOSED GRADING ON THIS PLAN IS STRICTLY CONCEPTUAL AND SHOULD ONLY BE USED FOR PLANNING PURPOSES.

VICINITY MAP
Map #: Rand McNally & Company R.L.05-S-17

INTERIOR PROPERTY LINE EXHIBIT



NOTES:

1. ASSESSOR'S PARCEL NUMBERS: 0231-021-24, 25, 32, 48, 54, 55, 57, 76, 82, 83 & 84
2. PROPOSED LAND USE: TRUCK SALES, REPAIR, AND PARTS SALES FACILITY
3. EXISTING LAND USE: VACANT
4. EXISTING/PROPOSED ZONING DESIGNATION: SPECIAL DEVELOPMENT-COMMERCIAL (SD-COM)
5. NO PROTECTED PLANTS OR ENDANGERED SPECIES ARE KNOWN TO EXIST ON THE PROJECT SITE.
6. AREA SUMMARY:

LOT COVERAGE:		
EXISTING GROSS AREA:	661,516 SF = 15.19 AC	
EXISTING NET AREA:	620,501 SF = 14.24AC	
AREA TO BE DEDICATED:	5,011 SF = 0.12 AC	
PROPOSED NET AREA:	615,492 SF = 14.13 AC	
TOTAL NET AREA:	615,492 SF	100% OF SITE
PROPOSED BUILDING:	114,544 SF	18.61%
ACCESS / PARKING:	429,229 SF	69.74%
LANDSCAPING/HARDSCAPE:	71,719 SF	11.65%
TOTAL:	615,492 SF = 100%	

7. REQUIRED LANDSCAPING = 15% OF TOTAL AREA
TOTAL AREA (NOT INCLUDING PARKING AREA, OR PARKING LOT LANDSCAPING) = 176,449 SF
PROVIDED LANDSCAPING (NOT INCLUDING PARKING LOT LANDSCAPING) = 61,116 SF = 34.64% OF TOTAL AREA
8. TOTAL IMPERVIOUS AREA: 552,217 SF = 90%
9. EXISTING FLOOD ZONE DESIGNATION: ZONE "D" - AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE OF FLOOD WITH AVERAGE DEPTHS OF 1' OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL FLOOD CHANCE, AS PER FIRM COMMUNITY PANEL NO. 0671G0853H, PANEL 0853 OF 8400, DATED AUGUST 28, 2008.
10. NO STRUCTURES WITHIN 20' OF PROPERTY LINE ON ADJACENT PROPERTIES, UNLESS OTHERWISE SHOWN.
11. NO PHASING IS PROPOSED
12. BUILDING INFORMATION:
NUMBER OF STORIES: 2
BUILDING HEIGHTS: 40'
BUILDING TYPE: V-B
BUILDING FLOOR AREA RATIO (FAR): 172,213 SF/615,492 SF = 27.92%
TOTAL NUMBER OF EMPLOYEES: 120 (LARGEST SHIFT: 120)
OPERATING HRS: PARTS / SERVICE M-F 7AM TO MIDNIGHT, SAT 8AM - 4:30 PM, SUN 8AM - 4PM

PARKING SUMMARY:

LAND USE/REQUIREMENT	PARKING RATE	BUILDING SIZE/RATE	REQUIRED
RETAIL/OFFICE/DISPLAY	1/350 SF	28,400 SF	114
WAREHOUSE	1/1000 SF FOR FIRST 40,000 SF	40,000	40
WAREHOUSE	1/4000 SF AFTER FIRST 40,000 SF	28,800	8

TOTAL LOADING SPACES PROVIDED: (1) 20X100 SPACE PROVIDED

KEY NOTES- EXISTING IMPROVEMENTS

1	EXISTING 6" CURB & GUTTER TO REMAIN
2	EXISTING 6" CURB TO REMAIN
3	EXISTING STREET LIGHT TO REMAIN
4	EXISTING PCC DRIVEWAY TO BE REMOVED
5	EXISTING TELEPHONE RISER TO REMAIN
6	EXISTING FIRE HYDRANT TO REMAIN
7	EXISTING WATER METER TO REMAIN
8	EXISTING MWE MANHOLE TO REMAIN
9	EXISTING ELECTRIC RISER TO REMAIN
10	EXISTING EDGE OF PAVEMENT TO BE REMOVED
11	EXISTING PCC DRIVEWAY TO REMAIN
12	EXISTING 6' HIGH CHAIN LINK FENCE WITH BARBED WIRE TO REMAIN
13	EXISTING 6' HIGH CHAIN LINK FENCE WITH BARBED WIRE TO REMAIN
14	EXISTING 4' HIGH WOOD CORRAL FENCE TO BE REMOVED
15	EXISTING 6' HIGH CHAIN LINK FENCE TO BE REMOVED
16	EXISTING SIDEWALK TO REMAIN
17	EXISTING WATER CAP TO REMAIN
18	EXISTING EDISON MANHOLE TO REMAIN
19	EXISTING PARKING LOT LIGHT TO REMAIN
20	EXISTING TRAFFIC SIGNAL CONTROL PANEL TO REMAIN
21	EXISTING TRAFFIC SIGNAL TO REMAIN
22	EXISTING CABLE TELEVISION PULLBOX TO REMAIN
23	EXISTING RIBBON GUTTER TO REMAIN
24	EXISTING MAILBOX TO REMAIN
25	EXISTING GAS CAP TO REMAIN
26	EXISTING STREET LIGHT PULL BOX TO REMAIN
27	EXISTING SIGN TO REMAIN
28	EXISTING SIGN TO BE REMOVED
29	EXISTING 5" HIGH POLE TO BE REMOVED

KEY NOTES- PROPOSED IMPROVEMENTS

1	PROPOSED CURB & GUTTER
2	PROPOSED CURB
3	PROPOSED RIBBON GUTTER
4	PROPOSED PCC SIDEWALK
5	PROPOSED CURB OPENING
6	PROPOSED FIRE DEPARTMENT CONNECTION 4 POST INDICATOR VALVE
7	PROPOSED ADA RAMP
8	PROPOSED ADA SYMBOL AND SIGNAGE
9	PROPOSED TRASH ENCLOSURE
10	PROPOSED DOUBLE DETECTOR CHECK VALVE
11	PROPOSED TUBULAR STEEL FENCE
12	PROPOSED TUBULAR STEEL SLIDING GATE
13	PROPOSED CATCH BASIN
14	PROPOSED CUTDECK PATIO
15	PROPOSED EDISON SIGN
16	PROPOSED 4' HIGH RETAINING WALL
17	PROPOSED MONUMENT SIGN
18	PROPOSED FIRE HYDRANT
19	PROPOSED 60,000 CF UNDERGROUND INFILTRATION BASIN
20	PROPOSED UNDERSIDEWALK DRAIN
21	PROPOSED STORM DRAIN
22	PROPOSED 4'-2" RETAINING WALL
23	PROPOSED RAMP
24	PROPOSED GRATED INLET
25	OUTLET THROUGH CURB FACE
26	PROPOSED WALL LIGHT
27	PROPOSED PARKING LOT LIGHT

LEGAL DESCRIPTION

PARCEL 1:
PARCEL A:
ALL THAT PORTION OF FARM LOT 885, ACCORDING TO MAP OF LANDS BELONGING TO SEMI TROPIC LAND AND WATER COMPANY, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 11, PAGES 12 AND 13 OF MAPS, SAN BERNARDINO COUNTY RECORDS AND MORE PARTICULARLY DESCRIBED AS FOLLOWS: BEGINNING AT THE INTERSECTION OF THE CENTERLINE OF CHERRY AVENUE AND RANDALL AVENUE; THENCE SOUTH 89°42'10" EAST, 317.25 FEET ALONG THE NORTH LINE OF SAID LOT 885, ALSO BEING THE CENTERLINE OF RANDALL AVENUE TO THE TRUE POINT OF BEGINNING; THENCE CONTINUING SOUTH 89°42'10" EAST, 1,003.12 FEET ALONG THE EAST LINE OF SAID LOT 885 TO A POINT OF INTERSECTION WITH THE NORTHERLY PROLONGATION OF THE WESTERLY LINE OF PARCEL 1 OF PARCEL MAP NO. 13,732, AS SHOWN ON MAP RECORDED IN BOOK 165, PAGES 26 THROUGH 29, INCLUSIVE, OF PARCEL MAPS, RECORDS OF SAN BERNARDINO COUNTY, CALIFORNIA; THENCE SOUTH 00°17'50" WEST, 1,320.00 FEET ALONG SAID NORTHERLY PROLONGATION AND THE WESTERLY LINE OF SAID PARCEL 1 TO THE SOUTHWEST CORNER OF SAID PARCEL 1; THENCE NORTH 89°42'10" WEST, 1,003.12 FEET ALONG THE SOUTH LINE OF SAID LOT 885 TO THE CENTERLINE OF CHERRY AVENUE; THENCE NORTH 00°17'50" EAST, 1,320.00 FEET ALONG SAID CENTERLINE TO THE TRUE POINT OF BEGINNING.
EXCEPT THAT PORTION OF SAID LAND LYING WITHIN THE LINE OF CHERRY AVENUE AS DESCRIBED IN THE DEED TO THE COUNTY OF SAN BERNARDINO, RECORDED JULY 20, 1954 IN BOOK 3,736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND LYING WITHIN THE LINE OF RANDALL AVENUE AS DESCRIBED IN THE DEED TO THE COUNTY OF SAN BERNARDINO, RECORDED JULY 20, 1954 IN BOOK 3,736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND CONVEYED TO THE COUNTY OF SAN BERNARDINO BY GRANT DEED RECORDED AUGUST 2, 2007 AS INSTRUMENT NO. 2007-0327548 OF OFFICIAL RECORDS.
APN 0231-021-24, 0231-021-54

PARCEL 2:
THE SOUTH HALF OF THE WESTERLY PORTION OF FARM LOT 885 AND THE WESTERLY PORTION BEING DESCRIBED AS ALL OF SAID FIRST LOT ABOVE EXCEPT THE EAST 10 ACRES THEREOF ACCORDING TO MAP SHOWING SUBDIVISION OF LANDS BELONGING TO THE SEMI-TROPIC LAND AND WATER COMPANY, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 11, PAGE 12 OF MAPS, RECORDS OF SAID COUNTY, EXCEPTING THEREFROM THE WESTERLY 33 FEET AND THE SOUTHERLY 33 FEET THEREOF.
APN 0231-021-46

PARCEL 3:
PARCEL A:
ALL THAT PORTION OF LOT 885, ACCORDING TO MAP SHOWING SUBDIVISION OF LANDS BELONGING TO THE SEMI-TROPIC LAND AND WATER COMPANY, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 11 OF MAPS, PAGE 12, RECORDS OF SAID COUNTY, DESCRIBED AS FOLLOWS: BEGINNING AT THE INTERSECTION OF THE CENTERLINE OF CHERRY AVENUE AND THE SOUTHWARD PROLONGATION OF THE CENTERLINE OF RANDALL AVENUE, AS SHOWN ON SAID MAP; THENCE SOUTH 89°42'10" EAST ALONG THE CENTERLINE OF SAID RANDALL AVENUE, 1,320.00 FEET TO THE TRUE POINT OF BEGINNING; THENCE CONTINUING SOUTH 89°42'10" EAST ALONG SAID CENTERLINE, 330.00 FEET; THENCE SOUTH 00°17'50" WEST, 1,320.00 FEET TO THE SOUTH LINE OF SAID LOT 885; THENCE NORTH 89°42'10" WEST ALONG SAID SOUTH LINE, 330.00 FEET; THENCE NORTH 00°17'50" EAST, 1,320.00 FEET TO THE TRUE POINT OF BEGINNING.
EXCEPT THE SOUTH 33 FEET THEREOF AS GRANTED TO THE COUNTY OF SAN BERNARDINO BY DEED RECORDED JULY 20, 1954 IN BOOK 3736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THE WEST 33 FEET THEREOF AS GRANTED TO THE COUNTY OF SAN BERNARDINO BY DEED RECORDED JULY 20, 1954 IN BOOK 3736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND LYING WITHIN THE LINE OF CHERRY AVENUE AS DESCRIBED IN THE DEED TO THE COUNTY OF SAN BERNARDINO, RECORDED JULY 20, 1954 IN BOOK 3,736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND LYING WITHIN THE LINE OF RANDALL AVENUE AS DESCRIBED IN THE DEED TO THE COUNTY OF SAN BERNARDINO, RECORDED JULY 20, 1954 IN BOOK 3,736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND CONVEYED TO THE COUNTY OF SAN BERNARDINO BY GRANT DEED RECORDED AUGUST 2, 2007 AS INSTRUMENT NO. 2007-0327548 OF OFFICIAL RECORDS.
APN 0231-021-46

PARCEL 4:
ALL THAT PORTION OF FARM LOT 885, ACCORDING TO MAP OF LANDS BELONGING TO SEMI TROPIC LAND AND WATER COMPANY IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 11, PAGES 12 AND 13 OF MAPS, RECORDS OF SAID COUNTY, DESCRIBED AS FOLLOWS: BEGINNING AT THE INTERSECTION OF THE CENTERLINE OF CHERRY AVENUE AND THE SOUTHWARD PROLONGATION OF THE CENTERLINE OF RANDALL AVENUE, AS SHOWN ON SAID MAP; THENCE SOUTH 89°42'10" EAST ALONG THE CENTERLINE OF SAID RANDALL AVENUE, 1,320.00 FEET; THENCE SOUTH 00°17'50" WEST, 1,320.00 FEET TO THE SOUTH LINE OF SAID LOT 885; THENCE NORTH 89°42'10" WEST ALONG SAID SOUTH LINE, 330.00 FEET; THENCE NORTH 00°17'50" EAST, 330.00 FEET; THENCE NORTH 89°42'10" WEST, 330.00 FEET; THENCE NORTH 00°17'50" EAST, 330.00 FEET; THENCE NORTH 89°42'10" WEST, 660.00 FEET; THENCE NORTH 00°17'50" EAST, 330.00 FEET TO THE TRUE POINT OF BEGINNING.
EXCEPT THE NORTH 33 FEET THEREOF AS GRANTED TO THE COUNTY OF SAN BERNARDINO BY DEED RECORDED JULY 20, 1954 IN BOOK 3736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THE WEST 33 FEET THEREOF AS GRANTED TO THE COUNTY OF SAN BERNARDINO BY DEED RECORDED JULY 20, 1954 IN BOOK 3736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND LYING WITHIN THE LINE OF CHERRY AVENUE AS DESCRIBED IN THE DEED TO THE COUNTY OF SAN BERNARDINO, RECORDED JULY 20, 1954 IN BOOK 3,736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND LYING WITHIN THE LINE OF RANDALL AVENUE AS DESCRIBED IN THE DEED TO THE COUNTY OF SAN BERNARDINO, RECORDED JULY 20, 1954 IN BOOK 3,736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND CONVEYED TO THE COUNTY OF SAN BERNARDINO BY GRANT DEED RECORDED AUGUST 2, 2007 AS INSTRUMENT NO. 2007-0327548 OF OFFICIAL RECORDS.
APN 0231-021-46

PARCEL 5:
THE SOUTH HALF OF THE WESTERLY PORTION OF FARM LOT 885 AND THE WESTERLY PORTION BEING DESCRIBED AS ALL OF SAID FIRST LOT ABOVE EXCEPT THE EAST 10 ACRES THEREOF ACCORDING TO MAP SHOWING SUBDIVISION OF LANDS BELONGING TO THE SEMI-TROPIC LAND AND WATER COMPANY, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 11, PAGE 12 OF MAPS, RECORDS OF SAID COUNTY, EXCEPTING THEREFROM THE WESTERLY 33 FEET AND THE SOUTHERLY 33 FEET THEREOF.
APN 0231-021-46

PARCEL 6:
THE SOUTH 330 FEET OF THE WEST 330 FEET OF THE EAST 1,320 FEET OF THAT PORTION OF LOT 885, ACCORDING TO MAP SHOWING SUBDIVISION OF LANDS BELONGING TO THE SEMI-TROPIC LAND AND WATER COMPANY, AS SHOWN BY MAP ON FILE IN BOOK 11, PAGES 12 AND 13 OF MAPS, RECORDS OF SAN BERNARDINO COUNTY, CALIFORNIA, EXCEPTING THEREFROM THE SOUTH 33 FEET THEREOF AS GRANTED TO THE COUNTY OF SAN BERNARDINO BY DEED RECORDED JULY 20, 1954 IN BOOK 3736, PAGE 111 OF OFFICIAL RECORDS.
APN 0231-021-54

PARCEL 7:
THE SOUTH 330 FEET OF THE WEST 330 FEET OF THE EAST 1,320 FEET OF THAT PORTION OF LOT 885, ACCORDING TO MAP OF LANDS BELONGING TO SEMI TROPIC LAND AND WATER COMPANY IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 11, PAGES 12 AND 13 OF MAPS, RECORDS OF SAID COUNTY, DESCRIBED AS FOLLOWS: BEGINNING AT THE INTERSECTION OF THE CENTERLINE OF CHERRY AVENUE AND THE SOUTHWARD PROLONGATION OF THE CENTERLINE OF RANDALL AVENUE, AS SHOWN ON SAID MAP; THENCE SOUTH 89°42'10" EAST ALONG THE CENTERLINE OF SAID RANDALL AVENUE, 1,320.00 FEET; THENCE SOUTH 00°17'50" WEST, 1,320.00 FEET TO THE SOUTH LINE OF SAID LOT 885; THENCE NORTH 89°42'10" WEST ALONG SAID SOUTH LINE, 330.00 FEET; THENCE NORTH 00°17'50" EAST, 330.00 FEET; THENCE NORTH 89°42'10" WEST, 660.00 FEET; THENCE NORTH 00°17'50" EAST, 330.00 FEET TO THE TRUE POINT OF BEGINNING.
EXCEPT THE SOUTH 33 FEET THEREOF AS GRANTED TO THE COUNTY OF SAN BERNARDINO BY DEED RECORDED JULY 20, 1954 IN BOOK 3736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THE WEST 33 FEET THEREOF AS GRANTED TO THE COUNTY OF SAN BERNARDINO BY DEED RECORDED JULY 20, 1954 IN BOOK 3736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND LYING WITHIN THE LINE OF CHERRY AVENUE AS DESCRIBED IN THE DEED TO THE COUNTY OF SAN BERNARDINO, RECORDED JULY 20, 1954 IN BOOK 3,736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND LYING WITHIN THE LINE OF RANDALL AVENUE AS DESCRIBED IN THE DEED TO THE COUNTY OF SAN BERNARDINO, RECORDED JULY 20, 1954 IN BOOK 3,736, PAGE 111 OF OFFICIAL RECORDS.
ALSO EXCEPT THAT PORTION OF SAID LAND CONVEYED TO THE COUNTY OF SAN BERNARDINO BY GRANT DEED RECORDED AUGUST 2, 2007 AS INSTRUMENT NO. 2007-0327548 OF OFFICIAL RECORDS.
APN 0231-021-46

EASEMENTS

1 AN EASEMENT FOR THE PURPOSE OF PIPE LINES IN FAVOR OF THE FONTANA LAND COMPANY, A CORPORATION, AS RECORDED FEBRUARY 13, 1932, IN BOOK 605, PAGE 26 OF OFFICIAL RECORDS.
AFFECTS PARCEL 1
SAID EASEMENT IS BLANKET IN NATURE.

2 AN EASEMENT FOR THE PURPOSE OF PIPE LINES IN FAVOR OF THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA, RECORDED FEBRUARY 14, 1930, IN BOOK 1,128, PAGE 42, OFFICIAL RECORDS
AFFECTS PARCELS: 1, 2, 4, 5, 6

3 AN EASEMENT FOR THE PURPOSE OF PUBLIC UTILITY FACILITY IN FAVOR OF THE SEMI-TROPILAND AND WATER COMPANY, RECORDED OCTOBER 10, 2006, AS (2006-0396000) OF OFFICIAL RECORDS.
AFFECTS PARCEL(S):
SAID EASEMENT IS SHOWN IN THE CHERRY AVENUE RIGHT-OF-WAY.

4 AN EASEMENT FOR THE PURPOSE OF SURFACE DRAINAGE IN FAVOR OF MASTER-HALCO, INC., A CALIFORNIA CORPORATION, RECORDED MAY 14, 1982, AS BOOK 12963 OF OFFICIAL RECORDS.
AFFECTS PARCEL: 4
SAID EASEMENT IS BLANKET IN NATURE.

5 AN EASEMENT FOR THE PURPOSE OF PIPELINE IN FAVOR OF KERN RIVER GAS TRANSMISSION CORPORATION, RECORDED JULY 20, 1954, IN BOOK 1,600, PAGE 18 OF OFFICIAL RECORDS.
AFFECTS PARCELS: 2, 3, 4, 5, 6
SAID EASEMENT IS BLANKET IN NATURE.

6 AN EASEMENT FOR THE PURPOSE OF HIGHWAY AND RELATIVE PURPOSES IN FAVOR OF THE COUNTY OF SAN BERNARDINO, RECORDED FEBRUARY 27, 2003, AS 2003-0131995 OF OFFICIAL RECORDS.
AFFECTS PARCEL: 1
SAID EASEMENT IS CONTAINED WITHIN THE RIGHT-OF-WAY.

7 AN EASEMENT FOR THE PURPOSE OF HIGHWAY AND RELATIVE PURPOSES IN FAVOR OF THE COUNTY OF SAN BERNARDINO, RECORDED APRIL 14, 1970, IN BOOK 9125, PAGE 304 OF OFFICIAL RECORDS.
AFFECTS PARCEL: 5
SAID EASEMENT IS CONTAINED WITHIN THE RIGHT-OF-WAY.

8 AN EASEMENT FOR THE PURPOSES OF ROADS IN FAVOR OF THE COUNTY OF SAN BERNARDINO, RECORDED IN BOOK 3502, PAGE 198 OF OFFICIAL RECORDS.
AFFECTS PARCEL: 7
SAID EASEMENT IS CONTAINED WITHIN THE RIGHT-OF-WAY.

9 AN EASEMENT FOR THE PURPOSE OF ROADS IN FAVOR OF THE COUNTY OF SAN BERNARDINO, RECORDED IN BOOK 3502, PAGE 24, OF OFFICIAL RECORDS.
AFFECTS PARCEL: 7
SAID EASEMENT IS CONTAINED WITHIN THE RIGHT-OF-WAY.

BENCHMARK

MAG ALUMINUM DISK SET IN LIGHT STANDARD 239' E. OF CHERRY AND 34' N. OF RANDALL STAMPED "LF 636 1992".

NAVD 88 ELEV.: 1117.82'

BASIS OF BEARINGS

BEING THE CENTERLINE OF RANDALL AVE BEING N89°42'10"E PER PMB 160/63-64, 88-00 REC.

PAVING LEGEND

- PROPOSED AC PAVING
- PROPOSED PCC PAVING
- PROPOSED ENHANCED PAVING
- PROPOSED LANDSCAPING
- EXISTING PCC PAVING

LEGEND

AC	ASPHALT CONCRETE
EX.	EXISTING
PCC	PORTLAND CEMENT CONCRETE
PL	PROPERTY LINE
PP	POWER POLE
R/W	RIGHT OF WAY
SD-COM	SPECIAL DEVELOPMENT COMMERCIAL ZONING DESIGNATION

UTILITIES

ELECTRIC:
SOUTHERN CALIFORNIA EDISON COMPANY
7951 REDWOOD AVE.
FONTANA, CA 92335
(714) 796-5932

GAS:
SOUTHERN CALIFORNIA GAS COMPANY
1981 WEST LUGONIA AVENUE
REDLANDS, CA 92373
(800)427-2200

TELEPHONE:
AT&T
3233 E. COLORADO ST.
2ND FLOOR
ANAHEIM, CA 92807 (909)
(714)507-3626

CABLE:
TIME WARNER CABLE
1500 AUTO CENTER DRIVE
ONTARIO, CA 91761
(909) 975-3489

WATER:
FONTANA WATER COMPANY
15966 JURUPA ROAD
FONTANA, CA 92335
(909) 201-7397

SEWER:
CITY OF FONTANA
8353 SIERRA AVE.
FONTANA, CA 92335
(909) 350-7629

OFFICIAL USE ONLY

Legend

- * Approximate Boring Location — B-5
- ** Approximate Percolation Test Location — P-2

*Note: Boring locations are not drawn to scale

**Note: Borings 4 and 5 were converted to perolcation test location after drilling,

APN 0231-021-24, 25, 32, 48, 54, 55, 57, 76, 82, 83, & 84

MINOR USE PERMIT SITE PLAN
FOR TRUCK SALES, SERVICE/REPAIR, AND PARTS SALES DEALERSHIP

APPLICANT:
TEC EQUIPMENT, INC. ATTN: DAVID THOMPSON
750 NORTH EAST COLUMBIA BLVD, PORTLAND, CA 97211
PHONE: (503) 247-4355, FAX: (503) 972-4311

REPRESENTATIVE:
THATCHER ENGINEERING & ASSOCIATES, INC
1421 FORD STREET, STE 105, REDLANDS, CA 92373
PHONE: (909) 748-7777, FAX: (909) 748-7776

PROPERTY OWNERS:
(APN 023 1-021-76, 82, 83 & 84)
SAN BERNARDINO COUNTY REDEVELOPMENT AGENCY
(APN 0231-021-48):
THE COUNTY OF SAN BERNARDINO REDEVELOPMENT AGENCY
(APN 0231-021-24, 25, 32, 54, 55):
REDEVELOPMENT AGENCY OF THE COUNTY OF SAN BERNARDINO
(APN 023 1-021-57):
COUNTY OF SAN BERNARDINO

Exploratory Excavation Location Plan

HILLTOP GEOTECHNICAL INCORPORATED

By: AH | Date: 03/2016
Project No.: 1032-A16.1 | Plate No.: 1

thatcher engineering & associates, inc.
1421 Ford Street, Suite 105, Redlands, CA 92373
• land planning • civil engineering • landscape architecture
phone 909 748 7777 fax 909 748 7776

Job Number:	Date Prepared:	Drawn By:	Reference Number:
16003	11-23-15	BK	16003sp1

SUBSURFACE EXPLORATION LEGEND

UNIFIED SOIL CLASSIFICATION SYSTEM Visual-Manual Procedure (ASTM D2488-09a)					CONSISTENCY / RELATIVE DENSITY
MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES	CRITERIA
Coarse-Grained Soils* More than 50 % Retained on No. 200 Sieve	Gravels 50 % or more of Coarse Fraction Retained on No. 4 Sieve	Clean Gravels	GW	Well Graded Gravels and Gravel-Sand Mixtures, Little or no Fines	Reference: 'Foundation Engineering', Peck, Hansen, Thornburn, 2nd Edition.
			GP	Poorly Graded Gravels and Gravel-Sand Mixtures, Little or no Fines	Standard Penetration Test, Granular Soils
		Gravels with Fines	GM	Silty Gravels, Gravel-Sand-Silt Mixtures**	Penetration Resistance, N, (Blows / Foot) / Relative Density
			GC	Clayey Gravel, Gravel-Sand-Clay Mixtures**	0 - 4 Very Loose
	Sands More than 50 % of Coarse Fraction Passes No. 4 Sieve	Clean Sands	SW	Well Graded Sands and Gravely Sands, Little or no Fines	5 - 10 Loose
			SP	Poorly Graded Sands and Gravelly Sands, Little or no Fines	11 - 30 Medium Dense
		Sands with Fines	SM	Silty Sands, Sand-Silt Mixtures**	31 - 50 Dense
			SC	Clayey Sands, Sand-Clay Mixtures**	> 50 Very Dense
Fine Grained Soils* 50 % or more Passes No. 200 Sieve	Silts and Clays Liquid Limits 50 % or less		ML	Inorganic Silts, Sandy Silts, Rock Flour	Standard Penetration Test, Cohesive Soils
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays	Penetration Resistance, N, (Blows / Foot) / Consistency / Unconfined Compressive Strength, (Tons / Sq. Ft.)
			OL	Organic Silts and Organic silty Clays of Low Plasticity	< 2 Very Soft < 0.25
	Silts and Clays Liquid Limits Greater than 50 %		MH	Inorganic Silts, Micaceous or Diatomaceous silts, Plastic Silts	2 - 4 Soft 0.25 - 0.5
			CH	Inorganic Clays of High Plasticity, Fat Clays	5 - 8 Firm (Medium Stiff) 0.5 - 1.0
			OH	Organic Clays of Medium to High Plasticity	9 - 15 Stiff 1.0 - 2.0
					16 - 30 Very Stiff 2.0 - 4.0
Highly Organic Soils			PT	Peat, Muck, or Other Highly Organic Soils	> 31 Hard > 4.0

* Based on material passing the 3-inch sieve.

** More than 12% passing the No. 200 sieve; 5% to 12% passing No. 200 sieve requires use of duel symbols (i.e., SP-SM., GP-GM, SP-SC, GP-GC, etc.); Border line classifications are designated as CH/Cl, GM/SM, SP/SW, etc.

U.S. Standard Sieve Size 12" 3" 3/4" #4 #10 #40 #200

Unified Soil Classification Designation	Boulders	Cobbles	Gravel		Sand			Silt and Clay
			Coarse	Fine	Coarse	Medium	Fine	

Moisture Condition

Dry	Absence of moisture, dusty, dry to the touch.
Moist	Damp but no visible moisture.
Wet	Visible free water, usually below the water table.

Material Quantity

Trace	< 5 %
Few	5 - 10%
Little	15 - 25%
Some	30 - 45 %

Other Symbols

C - Core Sample
S - SPT Sample
B - Bulk Sample
CK - Chunk Sample
R - Ring Sample
N - Nuclear Gauge Test
∇ - Water Table

HILLTOP GEOTECHNICAL INCORPORATED

(Revised 11-23-2015)

Plate No. 2

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LOG
BORING NO. B-1

Project Name:	Proposed Heavy Duty Truck and Parts Sales/Service Facility, Fontana				
Project No.	1032-A16.1	Date:	2/25/2016	Logged By:	AH
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	± 1127
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	22.5

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	R/B	1 3 4	SM	99.4	2.4	af		ARTIFICIAL FILL: Silty, fine to medium sand, trace coarse sand, trace gravel; Brown; Moist; Loose.
3	S	9 11 13	SP/SM			Qyfl		YOUNG ALLUVIAL FAN DEPOSITS OF LYTLE CREEK: Slighlty silty, fine to coarse sand, gravel-cobble in nose of sampler; Gray brown; Moist; Medium dense.
5	R	7 19 21	SP	129.9	1.9			Gravelly, fine to coarse sand, trace silt; Orange brown; Moist; Medium dense to very dense.
8	S	13 16 17						A little cobbles in cuttings.
10	R	12 25 27		120.4	1.9			Color changed to dark brown to gray brown
13	S	17 50/5"						
15	R	50/5"						
20	S	34 50/3"						
23								Bottom of boring 22.5 feet due to refusal on cobbles or boulders. No groundwater encountered. Boring backfilled with excavated materials.

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 3

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LOG
BORING NO. B-2

Project Name:	Proposed Heavy Duty Truck and Parts Sales/Service Facility, Fontana				
Project No.	1032-A16.1	Date:	2/25/2016	Logged By:	AH
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	± 1125
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	27.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	S	3 2 2	SM			af		ARTIFICIAL FILL: Silty, fine sand, trace medium to coarse sand; Brown; Moist; Very loose.
3	R	15 21 17	SP/SM	120.1	3.3	Qyfl		YOUNG ALLUVIAL FAN DEPOSITS OF LYTLE CREEK: Slighlty silty, fine to coarse sand, a little gravel; Brown; Moist; Medium dense.
5	S	17 15 38	SP					Gravelly, fine to coarse sand, trace silt; Orange brown; Moist; Medium dense to Dense.
8	R	23 21 30		112.3	1.2			
10	S	11						
11		9 7	SM					Silty, fine sand, trace medium sand; Brown; Moist; Medium dense.
13	R	10 10 15		95.5	7.9			
15	S	9 11 14						
19			SP					Gravelly, fine to coarse sand, trace silt; Gray brown; Moist; Very dense.
20	R	50/5"		N.R.				

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 4a

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LOG
BORING NO. B-2

Project Name:	Proposed Heavy Duty Truck and Parts Sales/Service Facility, Fontana				
Project No.	1032-A16.1	Date:	2/25/2016	Logged By:	AH
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	± 1125
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	27.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
26	S	38 50/2"				Qyfl		YOUNG ALLUVIAL FAN DEPOSITS OF LYTLE CREEK (CONT.): Gravelly, fine to coarse sand, trace silt; Gray brown; Moist; Very dense.
27								Bottom of boring at 27.0 feet due to refusal on cobbles or boulders. No groundwater encountered. Boring backfilled with excavated material.
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 4b

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LOG
BORING NO. B-3

Project Name:	Proposed Heavy Duty Truck and Parts Sales/Service Facility, Fontana				
Project No.	1032-A16.1	Date:	2/25/2016	Logged By:	AH
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	± 1129
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	25.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	R	3 4 6	SM	105.3	3.9	af		ARTIFICIAL FILL: Silty, fine sand, trace medium sand; Brown; Moist; Loose.
2			SP			Qyfl		YOUNG ALLUVIAL FAN DEPOSITS OF LYTLE CREEK: fine to coarse sand, a little gravel, trace silt; Brown; Moist; Dense.
3	S	12 17 17						
4								
5			SP					Gravelly, fine to coarse sand; Gray brown; Moist; Dense.
6	R	12 17 26		119.3	1.4			
7								
8	S	14 23 20						
9								
10			SM					Silty, fine sand; Dark brown; Moist; Medium dense.
11	R	4 8 9		101.8	10.5			
12								
13	S	22 50/4"	SP	N.R.				Gravelly, fine to coarse sand; Gray brown; Moist; Dense to very dense.
14								Gravels and cobbles in cuttings prevalent.
15	R	50/5"						
16								
17								
18								
19								
20	S	19 22 26						
21								
22								
23								
24								Bottom of boring 25.0 feet due to refusal on cobbles or boulders. No groundwater encountered. Boring backfilled with excavated materials.
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 5

SUBSURFACE EXPLORATION LOG
BORING NO. B-4

HILLTOP GEOTECHNICAL INCORPORATED

Project Name:	Proposed Heavy Duty Truck and Parts Sales/Service Facility, Fontana				
Project No.	1032-A16.1	Date:	2/25/2016	Logged By:	AH
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	± 1122
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	11.5

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	R	6 10 10	SP/SM			Qyfl		YOUNG ALLUVIAL FAN DEPOSITS OF LYTLE CREEK: Slightyl silty, fine to medium sand, trace coarse sand, trace gravel; Brown; Moist; Medium dense.
3			SP					Fine to coarse sand, a little gravel, trace silt; Dark brown; Moist; Medium dense to dense.
5	S/B	7 12 15						
10	R	12 25 32						
12								Bottom of boring 11.5 feet. No groundwater encountered. Boring converted to percolation test hole, and backfilled after testing.

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 6

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LOG
BORING NO. B-5

Project Name:	Proposed Heavy Duty Truck and Parts Sales/Service Facility, Fontana				
Project No.	1032-A16.1	Date:	2/25/2016	Logged By:	AH
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	± 1120
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	9.5

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	S	3 5 6	SM			Qyfl		YOUNG ALLUVIAL FAN DEPOSITS OF LYTLE CREEK: Silty, fine sand, trace medium and coarse sand; Brown; Moist; Medium dense.
3			SP					Fine to coarse sand, a little gravel, trace cobbles; Gray brown; Moist; Medium dense.
5	R	20 20 20						
7			SP/SM					Slighty silty, fine to coarse sand; Brown; Moist; Dense.
8	S	7 18 20						
10								Bottom of boring 9.5 feet. No groundwater encountered. Boring converted to percolation test hole, and backfilled after testing.

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 7

SUMMARY OF LABORATORY TEST RESULTS

EXPANSION INDEX TEST RESULTS (ASTM D4829 Test Method)						
SAMPLE NO.	MOISTURE CONTENT PRIOR TO TEST (to 0.1%)	DRY DENSITY PRIOR TO TEST (to 0.1 pcf)	SATURATION PRIOR TO TEST (to 0.1% between 48% & 52%)*	MOISTURE CONTENT AFTER TEST (to 0.1%)	EXPANSION INDEX	EXPANSION POTENTIAL**
B-1, 0.0' - 4.5'	9.9	110.3	50.7	16.6	0	Non-Expansive

* Assumes a 2.70 Specific Gravity for the earth material.
** As defined in Section 1803.5.3, 'Expansive Soil,' in the 2013 California Building Code (CBC) (i.e., Non-Expansive: EI ≤20; Expansive: EI >20).

SOLUBLE SULFATE TEST RESULTS (EPA 300.0 Test Procedure)*		
SAMPLE	SOLUBLE SULFATE CONTENT (%)	CLASS**
B-1, 0.0'-4.5'	0.0011	S0

* Test performed by **A & R Laboratories**.
** Per Table 19.3.1.1, 'Exposure Categories and Classes,' in **American Concrete Institute (ACI)** 318-14.

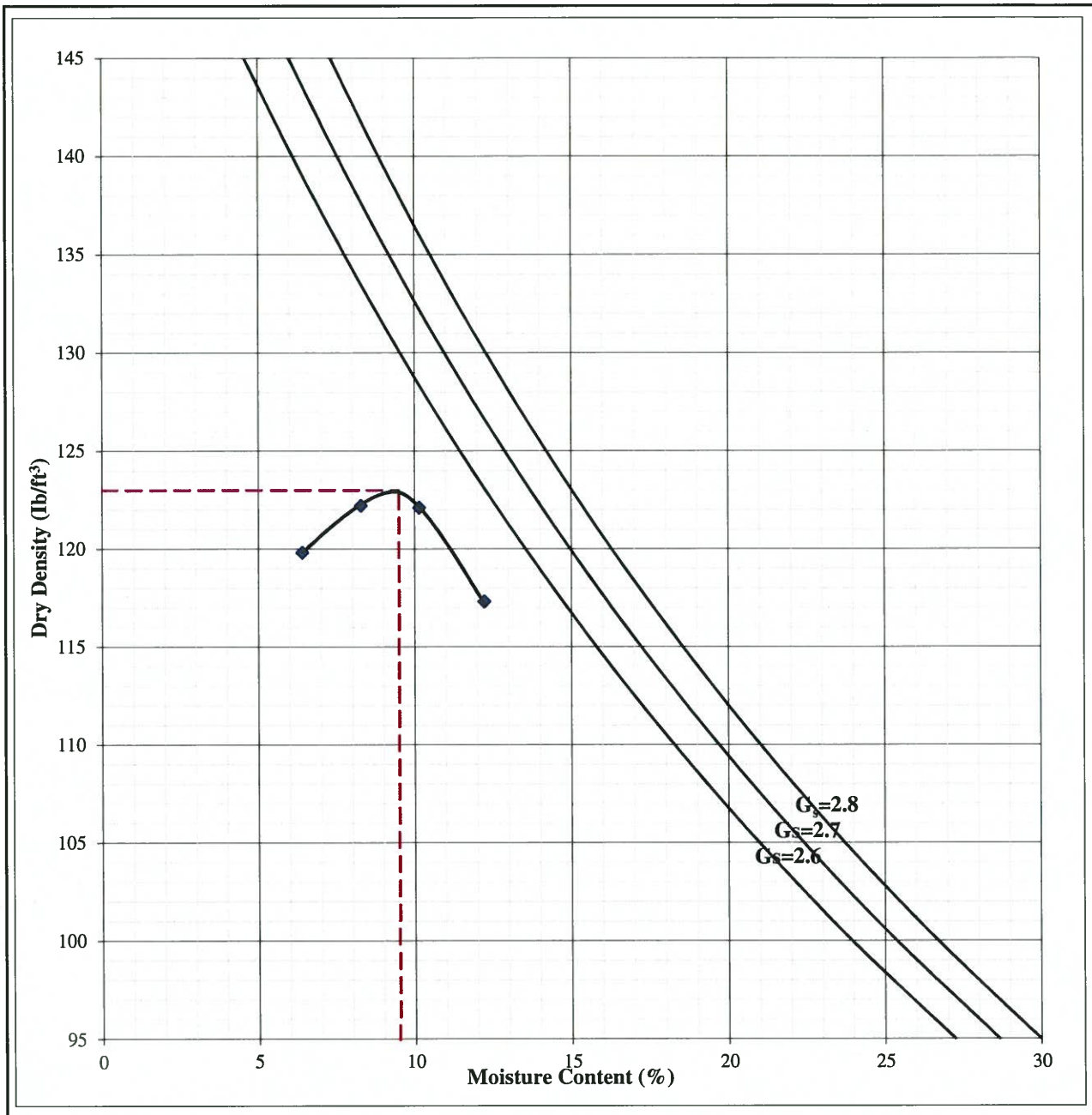
PERCENT PASSING #200 SIEVE TEST RESULTS (ASTM D1140 Test Method)		
SAMPLE	EARTH MATERIAL DESCRIPTION	PERCENT PASSING #200 SIEVE
B-1, 0.0-4.5'	Silty, fine to medium sand, trace coarse sand, trace gravel, brown (SM)	12.4

PLATE NO. 8

SUMMARY OF LABORATORY TEST RESULTS

RESISTANCE (R-VALUE) TEST RESULTS (California Test 301 Procedures)			
SAMPLE	EARTH MATERIAL DESCRIPTION	R-VALUE	
		BY EXUDATION PRESSURE AT 300 psi	BY EXPANSION PRESSURE
B-1, 0.0-4.5'	Silty, fine to medium sand, trace coarse sand, trace gravel, brown (SM)	74	NA
NA - Not applicable. Sample did not expand during test procedure.			

PLATE NO. 9



Maximum Dry Density (lb/ft^3)	123.0
Optimum Moisture Content (%)	9.5
Procedure	B

Corrected Maximum Dry Density for 20.6% +3/4" (lb/ft^3)	130.0
Corrected Optimum Moisture Content for 20.6% +3/4" (%)	7.7

HILLTOP GEOTECHNICAL
INCORPORATED

MAXIMUM DRY DENSITY / OPTIMUM MOISTURE CONTENT RELATIONSHIP TEST RESULTS (ASTM D1557 Test Method)

SAMPLE: B-1, 0.0'-4.5'			
SOIL DESCRIPTION:	Silty, fine to medium sand, trace coarse sand, trace gravel, brown (SM)		
BY: SS		DATE:	3/17/16
JOB NO.: 1032-A16.1		PLATE NO.:	10

APPENDIX B

TECHNICAL REFERENCES

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Boore, David M., Joyner, William B., and Fumal, Thomas E., January / February 1997, *Spectra and Peak Acceleration from Western North American Earthquakes: A Summary of Recent Work*: Seismological Research Letters, Volume 68, Number 1.

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TECHNICAL REFERENCES

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APPENDIX C

HILLTOP GEOTECHNICAL INCORPORATED

SHALLOW PERCOLATION DATA SHEET

Project Name: TEC Equipment, Cherry Avenue and Randall Avenue, Fontana

Project Number: 1032-A16.1

Test Hole Number: P-1

Date Tested: 2/24/16

Depth of Boring in feet: 11.5

Tested By: AH

Diameter of Boring in inch: 0.67

Hours Presaturation 1.5

Depth of Bottom (ft)	Time Initial	Time Final	Time Interval (minutes)	Depth of Water - Initial (ft)	Depth of Water - Final (ft)	Change in Water Level (ft)	$H_{average}$ (ft)	Rate, It (In/Hr)	Rate, It (Cm/Hr)
10.25	1:03	1:28	25.0	0.60	5.30	4.70	7.30	5.94	15.09
10.05	1:30	1:55	25.0	1.30	5.00	3.70	6.90	4.93	12.53
10.00	1:54	2:04	10.0	1.35	3.65	2.30	7.50	7.08	17.98
9.90	2:06	2:16	10.0	0.80	3.30	2.50	7.85	7.37	18.71
9.90	2:18	2:28	10.0	1.00	3.35	2.35	7.73	7.03	17.86
9.85	2:30	2:40	10.0	1.3	3.5	2.2	7.4	6.86	17.43
9.80	2:42	2:52	10.0	1.00	3.10	2.10	7.75	6.26	15.91
9.80	2:55	3:05	10.0	1.50	3.40	1.90	7.35	5.96	15.15

Average Rate (In/Hr): **6.8**

Average Rate (Cm/Hr): **17.2**

Plate No. 11

HILLTOP GEOTECHNICAL INCORPORATED

SHALLOW PERCOLATION DATA SHEET

Project Name: TEC Equipment, Cherry Avenue and Randall Avenue, Fontana

Project Number: 1032-A16.1

Test Hole Number: P-2

Date Tested: 2/24/16

Depth of Boring in feet: 9.5

Tested By: AH

Diameter of Boring in inch: 0.67

Hours Presaturation 1.5

Depth of Bottom (ft)	Time Initial	Time Final	Time Interval (minutes)	Depth of Water - Initial (ft)	Depth of Water - Final (ft)	Change in Water Level (ft)	$H_{average}$ (ft)	Rate, It (In/Hr)	Rate, It (Cm/Hr)
8.50	1:09	1:34	25.0	1.10	3.70	2.60	6.10	3.90	9.90
8.25	1:35	2:00	25.0	0.80	3.20	2.40	6.25	3.52	8.93
8.05	1:57	2:07	10.0	1.05	2.40	1.35	6.33	4.89	12.42
8.00	2:11	2:21	10.0	0.60	2.00	1.40	6.70	4.80	12.19
7.98	2:22	2:32	10.0	0.85	2.40	1.55	6.36	5.59	14.19
7.95	2:35	2:45	10.0	0.9	2.1	1.20	6.45	4.27	10.84
7.95	2:47	2:57	10.0	0.75	2.10	1.35	6.53	4.75	12.06
7.95	3:00	3:10	10.0	1.50	2.55	1.05	5.93	4.05	10.28

Average Rate (In/Hr): **4.7**

Average Rate (Cm/Hr): **12.0**

Plate No. 12