SOILS SOUTHWEST, INC.
SOILS, MATERIALS AND ENVIRONMENTAL ENGINEERING CONSULTANTS

897 VIA LATA, SUITE N • COLTON, CA 92324 • (909) 370-0474 • (909) 370-0481 • FAX (909) 370-3156

Feasibility Study

Report of Soils and Foundation Evaluations, and
Soils Infiltration Testing for WQMP Storm Water Disposal Design
Proposed Southland Pipe Office/ Warehouse Facility
8575 Ilex Avenue, Fontana, California
APN: 178-222-010

Project No. 19030-F/BMP

August 1, 2019

Prepared for:

Lord Constructors, Inc.
1920 West Eleventh Street
Upland, California 91786

SOILS SOUTHWEST, INC.

SOILS, MATERIALS AND ENVIRONMENTAL ENGINEERING CONSULTANTS

897 VIA LATA, SUITE N • COLTON, CA 92324 • (909) 370-0474 • (909) 370-0481 • FAX (909) 370-3156

August 1, 2019

Project No. 19030-F/BMP

Lord Constructors, Inc.
1920 West Eleventh Street
Upland, California 91786

Attention: Ms. Gloria Loofbourrow, Project Manager

Subject: Feasibility Study- Report of Soils and Foundation Evaluations, and Infiltration Testing for Storm Water Disposal Design
Proposed Southland Pipe Office/ Warehouse Facility
8575 Ilex Avenue, Fontana, California
APN: 178-222-010

Reference: Site Plan Prepared Van Dam Engineering

Gentlemen:

Presented herewith are the Preliminary Report of Soils and Foundation Evaluations and Soils Infiltration Testing for WQMP-BMP storm water disposal design for the site of the proposed Southland Pipe office/warehouse facility to be developed at 8575 Ilex Avenue, City of Fontana, California. In absence of detailed grading and/or development plans, the findings and opinions supplied should be considered as "preliminary" subject to revision following grading plan review.

Based on test explorations and necessary laboratory testing completed at this time, it is our opinion that the soils encountered primarily consist upper dry, loose to medium dense, compressible and collapsible slightly silty fine to medium coarse gravelly sands, overlying deposits of moderately dense to very dense gravelly medium coarse to coarse riverbed type sand with scattered cobbles, rocks and minor boulders to the maximum depth of 31 feet explored. No shallow depth groundwater or bedrock aws encountered.

Based on review of the available published documents, it is our opinion that the site is not situated within an A-P Special Study Zone, where an earthquake fault passes through the site or it's adjacent. With groundwater table at a depth in excess of 100 feet, it is our opinion that potential for site soil's susceptibility to seismically induced soils liquefaction should be considered remote.

The near grade soils encountered as described are considered unsuitable for directly supporting structural loadings without excessive differential foundation settlements. However, when graded in form of subexcavations of the upper compressible soils and their replacement as engineered fills as described herein, it is our opinion that the structural pad thus constructed should be adequate for the development planned.

Respectfully submitted,
Soils Southwest, Inc.

Moloy Gupta, RCE 31708

REGISTERED PROFESSIONAL ENGINEER
MOLOY K. GUPTA
No. 31708
Exp. 12-31-20
CIVIL
STATE OF CALIFORNIA

John Flippin
Project Coordinator

1.0 Introduction

Presented herewith are the Preliminary Report of Soils and Foundation Evaluations and Soils Infiltration Testing for WQMP-BMP storm water disposal design for the site of the proposed Southland Pipe office/warehouse facility to be developed at 8575 Ilex Avenue, City of Fontana, California. In absence of detailed grading and development plan, the findings and opinions supplied should be considered "preliminary", subject to revision following detailed plans review.

The purpose of this evaluation is to determine the nature and engineering properties of the near grade and subsurface soils, and to provide geotechnical recommendations for site preparations and grading, foundation design, concrete slab-on-grade, paving and parking, utility trench backfill and inspection during construction. No site-specific geologic evaluations are made and none such should be warranted.

The recommendations contained in this report reflect our best estimate of the soils conditions as encountered during field investigations conducted for the site. It is not to be considered as a warranty of the soils for other areas, or for the depths beyond the explorations advanced at this time.

The recommendations supplied should be considered valid and applicable when the following conditions, are fulfilled:

i. *Pre-grade meeting with contractor, public agency and soils engineer,*
ii. *Excavated bottom inspections and verifications by soils engineer prior to backfill placement,*
iii. *Continuous observations and testing during site preparation and structural fill soils placement,*
iv. *Observation and inspection of footing trenching prior to steel and concrete placement,*
v. *Plumbing trench backfill placement prior to concrete slab-on-grade placement,*
vi. *On and off-site utility trench backfill testing and verifications, and*
vii *Consultations as required during construction, or upon your request.*

1.1 Proposed Development

Based on the preliminary project information supplied, it is understood that the subject development will primarily include a two-story 1500 sft each office structure, along with an attached 7800 sft of industrial structure assumed of concrete tilt-up or concrete block construction with concrete slab-on-grade. Associated construction is to include flexible a.c. paving and supplemental slag/Class II base surfaced parking and driveways for conventional auto and industrial truck traffic. Supplemental installation is planned to include shallow-depth WQMP-BMP storm water detention basin/filtration trench. Moderate site clearance and grading should be expected with the development planned. For preliminary purpose, structural loadings of 40 kip and 4 klf are assumed for isolated column and spread footings, respectively.

1.2 Site Description

The rectangular L-shaped 1.95-acre parcel of is currently vacant and undeveloped. In general, the site is bounded by single-family dwellings and commercial/Industrial properties to the north, south and to east, and by Ilex Street to the west. Overall vertical relief within the property is estimated to about 5-6 feet with surface water appears to flow to the south and to the southwest. Other than ground surface weeds and scattered debris, no other significant features are noted.

2.0 Scope of Work

Being beyond scope of work, no geologic or Phase I Environmental Site Assessment is included. Reports on such will be provided on request.

Geotechnical evaluation included subsurface explorations, soil sampling, necessary laboratory testing, engineering analyses and the preparation of this report. In general, scope of work included the following tasks:

- **Field Explorations**

  Field investigations included four (4) test borings (B-1 to B-4) explored using a Hollow-Stem Auger (HSA) drill-rig equipped for undisturbed soils sampling and Standard Penetration Test (SPT). Supplemental two (2) shallow test pits were excavated using a backhoe for soils infiltration percolation testing. Approximate test excavation locations are shown on Plate 1.

  During excavations, the soils encountered were continuously logged, bulk and undisturbed samples were procured and Standard Penetration Test (SPT) blow-counts were recorded. Collected samples were subsequently transferred to our laboratory for necessary testing. Description of the soils encountered is shown on the Log of Boring in Appendix A.

- **Laboratory Testing**

  Representative samples on selected bulk and undisturbed site soils were tested in the laboratory to aid in the soils classification and to evaluate relevant engineering properties of the existing site soils pertaining to the project requirements. These tests may include some or all of the following tests depending upon site requirements:

  - In-situ moisture contents and dry density (ASTM Standard D2216),
  - Maximum dry density and optimum moisture content (ASTM Standard D1557),
  - Direct Shear (ASTM Standard D3080),
  - Soil consolidation (ASTM Standard D2435),
  - Soil Sand Equivalent, SE (ASTM D2419), and
  - Soil Grain size analysis (ASTM D422)

  Applicable description of the test results and test procedures used are provided in Appendix B of this report.

- Based on the field investigation and laboratory testing, engineering analyses and evaluations were made on which to base our preliminary recommendations for foundation design, concrete slab-on-grade, paving and parking, utility trench backfill, site preparations and grading, and monitoring during construction.

The opinions and recommendations supplied are for initial use by the project design professionals. The recommendations supplied should be considered "tentative" and may require revision and/or upgrading following precise grading plan review.

3.0 Existing Site Conditions

3.1 Subsurface Conditions

Based on the test explorations conducted at the locations and to the depths described, it is our opinion that the soils encountered primarily consist of upper dry, loose to medium dense, compressible and collapsible slightly silty fine to medium coarse gravelly sands, overlying deposits of moderately dense to very dense gravelly medium coarse to coarse riverbed type sand with scattered cobbles, rocks and minor boulders. No shallow depth groundwater or bedrock is encountered.

Based on the information published by the Department of Conservation, State of California, it is understood that the site is not situated within an A-P Special Study Zone, and with historical groundwater table at a depth in excess of 50 feet, the site is considered non-susceptible to soils liquefaction in event of a strong motion earthquake.

It is our opinion that the upper soils encountered up to about 4 to 5 feet existing as described are relatively dry, non-homogeneous and compressible in nature, and such should be considered inadequate for directly supporting structural loadings without excessive differential settlements to load bearing footings and concrete slab-on-grade. For adequate structural support, it is our opinion that when graded in form of subexcavations of the near grade loose and compressible soils existing as described, and their replacement as engineered fills compacted to 95%, the structural pads thus prepared should be considered adequate for the assumed structural loadings of 40 kips and 4 klf for isolated column and wall footings, respectively.

The detailed grading including subexcavation requirements are described in Section 4 of this report. It is recommended that subexcavation depths for planned structural pads should be verified and approved by soils engineer prior to structural fill soils placement. Local soils free of organic, debris or rocks larger than 8–inch in overall diameter should be considered suitable for re-use as compacted structural backfills.

Laboratory shear tests conducted on the upper bulk soil sample remolded to 90 percent indicate moderate shear strength under increased moisture conditions. Results of the laboratory shear tests are provided in Plate B-1 of this report.

Consolidation tests conducted on the upper soils remolded to 90% indicate low to moderate potential for compressibility under anticipated structural loadings. Results of the laboratory determined soils consolidation potential is shown on in Appendix B of this report.

3.1.1 Compressible and Collapsible Soils

Based upon exploratory test excavations and laboratory testing completed at this time, it is our opinion that the upper 4 to 5 feet of the local soils existing should be considered compressible in nature and may be susceptible to excessive settlements under the assumed conventional structural loadings described. For adequate load bearing, it is our opinion that the upper compressible soils should be reworked in form of sub-excavations and their replacement as engineered fills compacted to higher relative density described. Deeper subexcavations may be warranted within areas underlain by buried undetected fills, abandoned septic systems, buried utilities and others.

In general, the sub-excavations described should encompass, in minimum, the planned building foot-print areas and feet beyond. Where restricted due to exiting development, the lateral extents beyond footing may be compensated by using deepened foundations.

3.1.2 Expansive Soils

Considering the gravely sand in nature, the site soils encountered are considered "very low" in expansion potential with Expansion Index, EI, less than 20, thereby requiring no special construction requirements other than those as described herein. Supplemental soils expansion potential evaluation, however, is suggested following mass grading completion.

3.2 Excavatability

It is our opinion that the grading required for the project may be accomplished using conventional heavy-duty construction equipment.

3.3 Groundwater

No groundwater was encountered within the maximum depth explored and none such is anticipated within the maximum excavations that will be required during grading and construction. Use of no special construction requirements including de-watering, etc., are expected, however, it is our opinion that provisions should be made to dispose of surface runoff away from the structural pads planned.

Fluctuations in groundwater levels can occur due to seasonal variations in the amount of rainfall, runoff, altered natural drainage paths, and other factors not evident at this time. Consequently, the designer and contractor should be aware of such possibility for the project under study.

The following table lists the historical groundwater table based on the information as supplied by the local reporting agency.

GROUNDWATER TABLE	
Reporting Agency	Water Master Support Services-San Bernardino Valley Conservation District/Western Municipal Water District Cooperative Well Measuring Program, Fall 2018
Well Number	01S/06W-10H003S #07A, 28th Street
Well Monitoring Agency	San Gabriel Valley Water Co. (FWCo)
Well Location: Township/Range/Section	T1S-R6W-Section 10
Well Elevation:	1211
Current Depth to Water (Measured in feet)	512
Current Date Water was Measured	November 2018
Depth to Water (Measured in feet) (Shallowest)	482
Date Water was Measured (Shallowest)	April 9, 2007

3.4 Subsurface Variations

Based on the results of subsurface explorations and on past experience, it is our opinion that variations in subsoils continuity and depths of subsoil deposits may be expected. Due to the nature and depositional characteristics of the soils underlying, care should be exercised in interpolating or extrapolating of the subsurface conditions existing in between and beyond the test explorations completed as described. Although not encountered, based on historical use of the property presence of underlying buried utilities or organic may be encountered during grading and construction.

3.5 Soil Corrosivity Analyses

Since soils chemical compositions are expected to change considerably during mass grading, no soils chemical analyses are currently initiated. It is recommended, that during and following mass grading completion, the representative soils anticipated directly in contact with footings, concrete slab-on-grade and buried metal utilities should be laboratory tested to determine pH, sulfate, chloride and resistivity. Following mass grading completion, results of such will be supplied on request.

3.6 Faulting and Seismicity

3.6.1 Direct or Primary Seismic Hazards

Surface ground rupture along with active fault zones and ground shaking represent primary or direct seismic hazards to structures. There are no known active or potentially active faults that pass through or towards the subject site, and the site is not situated within an AP Special Studies Zone.

According to the current CBC, the site is considered to be within Seismic Zone 4. As a result, it is likely that during the life expectancy of the proposed construction, "moderate" ground shaking may have relatively adverse effects requiring appropriate structural design as per the current CBC.

3.6.2 Induced or Secondary Seismic Hazards

In addition to ground shaking, effects of seismic activity may include surface fault rupture, soil liquefaction, and differential settlement, ground lurching, landslides, lateral spreading, and earthquake induced flooding. Results of a site-specific evaluation of these secondary effects are explained as follows.

3.6.3 Surface Fault Rupture

The site is not situated within an AP Special Studies Zone, where a known earthquake fault passes through the site or it's adjacent. Potential for surface rupture resulting from known nearby earthquake fault is not known for certain, but is considered "low".

3.7 Flooding

Flooding hazards include tsunamis (seismic sea waves), seiches, and failure of manmade reservoirs, tanks and aqueducts. The potential for these hazards is considered remote due to the inland site location and the distance to any known nearby bodies of water.

3.8 Land-Sliding

Seismically induced landslides and other slope failures are common occurrences during or soon after and earthquake. The site and adjacent properties being relatively flat, the potential for seismically induced landslide, is considered remote.

3.9 Lateral Spreading

Seismically induced lateral spreading involves lateral movement of existing soils due to ground shaking. Lateral spreading is demonstrated by near vertical cracks with predominantly horizontal movement of the soil mass involved. The topography of the subject site and the adjacent properties has a near-zero slope ratio. Accordingly, it is our opinion that the potential for seismically induced lateral spreading of the subject site is considered remote.

3.10 Settlement and Subsidence

Although remote, considering the upper existing dry, loose, compressible and variable consistency site soils existing as encountered, it is our opinion that potential/possibility for ground settlement due to strong motion earthquake, can not be ignored. However, it is our opinion that magnitude of such may be minimized to within tolerable limits when site preparations and grading are performed as recommended herein.

3.11 Liquefaction

Liquefaction is caused by build-up of excess hydrostatic pressure in saturated cohesion-less soils due to cyclic stress generated by ground shaking during an earthquake. The significant factors on which soil liquefaction potential depends include, among others, soils type, soil relative density, intensity of earthquake, duration of ground-shaking, and depth of groundwater.

Based on DMG Special Publication 117A, “Guidelines for Analyzing and Mitigating Liquefaction in California”, and with the groundwater table at a depth in excess of 50 feet as described, it is our opinion that seismically induced site soils liquefaction susceptibility potential is “remote”.

3.7 Seismically Induced Settlement and Subsidence

The site is situated at about 4.84 miles from the nearby Cucamonga Fault capable of generating an earthquake magnitude M=6.7 and Peak Ground Acceleration, PGA of 0.538g. Considering the proximity of the earthquake fault as described, it is our opinion that potential for some total and differential settlements due to ground shaking may be expected. It is our opinion that over a span of 40 feet, the total and differential ground settlements are ¾” and ½-inch, respectively, should be considered structurally “tolerable” for the construction proposed.

3.8 Seismic Design Coefficients

Using the site Coordinates of 34.097824°N, -117.513386°W, it is our pinion that the site is situated at about 4.84 miles from the nearest Cucamonga Fault. For foundation and structural design, uses of the following seismic parameters are suggested based on the 2016 CBC.

Recommended values are based upon the ATCouncil.org Hazard Design Map and the California Geologic Survey: PSHA Ground Motion Interpolator Supplemental seismic parameters as described in Appendix C of this report. The following presents the seismic design parameters based on the California Geological Survey (CGS), the current CBC and the ASCE Standard 7-10.

TABLE 3.8.1 Seismic Design Parameters

CBC Chapter 16	2016 ASCE 7-10 Standard Seismic Design Parameters	Recommended Values
1613A.5.2	Site Class	D
1613.5.1	The mapped spectral accelerations at short period	S_s
1613.5.1	The mapped spectral accelerations at 1.0-second period	S_1
1613A5.3(1)	Site Class B / Seismic Coefficient, S_s	1.500g
1613A5.3(2)	Site Class B / Seismic Coefficient, S_1	0.600 g
1613A5.3(1)	Site Class D / Seismic Coefficient, F_a	1.000 g
1613A5.3(2)	Site Class D / Seismic Coefficient, F_v	1.500 g
16A-37 Equation	Spectral Response Accelerations, $S_{Ms} = F_a S_s$	1.500 g
16A-38 Equation	Spectral Response Accelerations, $S_{M1} = F_v S_1$	0.900 g
16A-39 Equation	Design Spectral Response Accelerations, $S_{Ds} = 2/3 \times S_{Ms}$	1.000 g
16A-40 Equation	Design Spectral Response Accelerations, $S_{D1} = 2/3 \times S_{M1}$	0.600 g

TABLE 3.8.2 Seismic Source Type

Based on California Geological Survey-Probabilistic Seismic Hazard Assessment Peak Horizontal Ground Acceleration (PHGA) having a 10 percent probability of exceedance in a 50 year period is described as below:

Seismic Source Type / Appendix C	
Nearest Maximum Fault Magnitude	M>\=6.7
Peak Horizontal Ground Acceleration	0.538g

In design, vertical acceleration may be assumed to about 1/3 to 2/3 of the estimated Peak Horizontal Ground Acceleration described.

It should be noted that lateral force requirement in design by structural engineer should be intended to resist seismically induced total structural collapse. However, during life time use of the structure built, it is our opinion that some structural damage may be anticipated requiring some repair.

4.0 Evaluations and Recommendations

4.1 General Evaluations

The conclusions contained herein are base upon surface and subsurface explorations at the test locations described. Although no significant variations in soil conditions are anticipated, actual soils conditions may, however, vary. In event subgrades exposed during grading are found different from those as described in this report, it will be the subcontractor's responsibility to notify Soils Southwest about such for revised/updated geotechnical recommendations.

While caving was not encountered, it is possible that a trench, exploratory borings or excavations may react in an entirely different manner. All shoring and bracing, if required, shall be in accordance with the current requirements of the State of California Division of Industrial Safety and other public agencies having jurisdiction.

Based on field explorations, laboratory testing and subsequent engineering analysis, the following opinions, conclusions and recommendations are presented for the site under study:

(i) Moderate site clearance should be expected, including, but not be limited to, minor constructions related debris, roots, stumps, buried utilizes and others.

(ii) From geotechnical viewpoint, the site is considered grossly stable for the development proposed.

(iii) Because of the near surface compressible soils existing as described, conventional grading should be in form of subexcavations, scarification and moisturization, followed by the excavated local soils replacement as engineered fills compacted to higher density. In event new fill soils are required such should be placed following subgrade preparations as described. No footings and/or new fills should be placed directly bearing on the upper loose, dry compressible surface soils existing.

(iv) The sub-excavation depths described should be considered as "minimum". During grading localized deeper sub-excavations may be warranted following removal of buried debris, utilities and others. It will be the responsibility of the grading contractor to inform the project soils engineer.

(v) In order to minimize potential excessive differential settlements to load bearing foundations, it is recommended that structural footings should be established exclusively into engineered fills of local sandy soils or its equivalent or better, compacted to the minimum percent compaction. Construction of footings and slabs straddling over cut/fill transition should be avoided.

(vi) Structural design considerations should include probability for "moderate to high" peak ground acceleration from relatively active nearby earthquake faults. The effects of ground shaking, however, can be minimized by implementation the seismic design requirements and the procedures as outlined in the current CBC and as described in earlier sections of this report.

(vii) Provisions should be maintained during construction to divert incidental rainfall away from the structural pad constructed.

(viii) It is our opinion that, if site preparations and grading are performed as per the generally accepted construction practices, the proposed development will not adversely affect the stability of the site, or the properties existing adjacent.

It is recommended that following mass-grading completion, soil chemical testing and supplemental soil expansion potential should be further verified based on which revised recommendations may be warranted.

4.1.1 Preparations for Structural Pads

For load bearing foundations with the assumed structural loadings as described, site preparations and grading should include sub-excavations of the near grade soils either **(i)** to about 5 feet below grade, or **(ii)** to the depth of underlying moist and dense subgrades when exposed as approved by soils engineer, or **(iii)** to the depth as required to maintain a minimum 24-inch thick compacted fill mat blanket underneath load bearing foundations, whichever is greater. Localized additional subexcavations may be warranted within areas of buried un-engineered fills, buried organic debris, roots and others as determined by soils engineer during mass grading. The site grading should also include replacement of local clean soils as load bearing structural fills compacted to the minimum 95% of the soils' Maximum Dry Density at near Optimum Moisture conditions as determined by the ASTM test method D1557.

For reference, supplemental General Earthwork Recommendations are enclosed in Section 5 of this report.

4.2 Structural Fills

4.2.1 Structural Fill Material

The local and/or imported fills, if required, should be free of organic, roots, debris and rocks larger than 8-inch in diameter. Gravelly sandy soils as approved by soils engineer should be considered for structural backfills.

Although no significant variations in soil conditions are anticipated, actual soils conditions may vary during grading. It will be the subcontractor's responsibility to notify Soils Southwest about such variations for revised/updated geotechnical recommendations.

Load bearing structural backfills placed should be compacted to minimum 90% of the soil's Maximum Dry Density as determined by the ASTM D1557 test method. Import soils, if required, should be gravelly sandy in nature similar to local soils as exposed, or better as approved by soils engineer. In general, fill soils for structural support shall be non-expansive in nature meeting the following criteria:

Liquid Limit	<35
Plasticity Index	<15
Expansion Index	<20

4.2.2 Structural Fill Placement

Structural fills shall be placed in 6 to 8-inch lifts, with near Optimum moisture conditions compacted to minimum 95 percent. No structural fills shall be placed during unfavorable weather conditions.

4.3 Structural Foundations

The proposed structures may be supported by continuous wall and/or isolated spread footings founded exclusively into engineered fills of local soils compacted to minimum 95%.

Use of footings straddling over cut/fill transition, shall be avoided. Excavated footings trenches should be sufficiently "moistened", re-compacted if necessary and verified and approved in writing by soils engineer immediately prior to concrete placement. Use of low-slump concrete is suggested.

4.3.1 Spread Foundations

The planned structures may be supported by continuous wall and/or isolated spread footings founded exclusively into compacted engineered fills. Under static loading conditions, load bearing structural footings should be sized to minimum 15-inch wide, embedded to at least 18-inch below the lowest adjacent final grades. To minimize differential settlements construction of footings and concrete slabs construction straddling over cut/fill transition shall be avoided. Actual foundation dimensions, however, should be determined by the project structural engineer based on anticipated structural loading, soil vertical bearing capacity and soils active PGA lateral pressures as described along with the estimated passive resistance as described. Structural design should conform, in minimum, to the current 2016 CBC Seismic Design requirements as described in earlier section of this report.

In general, under static loading conditions, load bearing footings placed into engineered fills of local soils may be calculated from the following equations:

Continuous Footings: $q_{allowable} = 550 + 650d + 300b$, and

Isolated Square Foundations: $q_{allowable} = 710 + 650d + 120b$,

where

q = allowable soil vertical bearing capacity, in psf.
d = footing depth in ft., minimum recommended 1.5 ft.,
b = smallest width of footing in ft., minimum recommended is 1.25 ft.

The recommended bearing capacities may be increased for each increment in footing depth in excess of the minimum depths recommended.

The bearing values indicated are for total dead and frequently applied live loads. However, to minimize settlements, total maximum bearing values should be limited to 3000 pounds per square foot.

If normal code requirements are applied, the above capacities may further be increased by an additional 1/3 for short duration of loadings such as wind and seismic forces.

From geotechnical view point, footing reinforcements consisting of 2-#4 rebar near top and 2-#4 rebar near the bottom of continuous footings, are recommended. Additional reinforcements as specified by project structural engineer should be incorporated in construction.

Under the assumed static loadings of 30 kips and 4 klf for isolated column and wall footings, respectively, over a span of 40 ft, estimated total and differential settlements are about 1 and 1/2-inch, respectively.

Should the project structural engineer determine that more stringent design criteria should be required then the above recommendations should be superseded at the discretion of the project design engineer.

4.4 Concrete Slabs-on-Grade

No concrete slabs-on-grade for proposed office and warehouse should be placed bearing directly on the surface soils currently existing. The prepared subgrades to receive footings should be considered adequate for concrete slab-on-grade placement.

For office and warehouse, recommended thickness for concrete slab-on-grade is minimum 6-inch thick (net), placed over local sandy structural fills compacted to at least 95%. Actual slab thickness should be supplied by the project structural engineer based on anticipated heavy-duty equipment traffic and on an estimated soil Subgrade Modulus, k_c, of 300 kcf.

Within moisture sensitive areas, concrete slabs should be underlain by 2-inch of compacted clean sand, followed by 10-mil thick commercially available approved vapor barrier and vapor retarder, such as StegoWrap or Visqueen. The installations of such should be as per manufacturer's specifications. The gravelly sands used, should have a Sand Equivalent, SE, of 30 or greater.

Subgrades to receive concrete should be "pre-moistened" as would be expected in any such concrete placement. Use of low-slump concrete is recommended. In addition, it is recommended that utility trenches underlying concrete slabs and driveways should be thoroughly backfilled with gravelly sandy soils mechanically compacted to minimum 95% immediately prior to concrete pour.

Rigid concrete driveways planned should be minimum 8-inch thick with thickened edges to prevent potential for lateral sliding under auto and truck load traffic. Driveway reinforcing should be as recommended by the project structural engineer.

4.4.1 Concrete Curing and Crack Control

The recommendations presented in this report are intended to reduce the potential for cracking of concrete slabs-on-grade due to concrete curing or settlement. However, even when the following recommendations have been implemented; foundations, stucco walls and concrete slabs-on-grade may display some minor cracking due to minor soil movement and/or concrete shrinkage.

The occurrence of concrete cracking may also be reduced and/or controlled by limiting the slump of the concrete used, proper concrete placement and curing along with using crack control joints at reasonable intervals, in particular, where re-entrant slab corners occur. For standard crack control, maximum expansion/construction joint spacing is recommended not the exceed 24-30 time the concrete thickness. Shorter distance between joint spacing would provide greater crack control. Joints at curves and angle points are suggested as required by the project structural engineer.

To minimize potentials for "warping", subgrade soils to receive concrete shall be free of excess water. Concrete placements during adverse weather conditions should not be allowed.

4.5 Resistance to Lateral Loads

Resistance to lateral loads can be restrained by friction acting at the base of foundation and by passive earth pressure. A coefficient of friction of 0.35 may be assumed with normal dead load forces for footing established on local gravelly sandy soils compacted to the minimum described.

An allowable passive lateral earth resistance of 250 pounds per square foot per foot of depth may be assumed for the sides of foundations poured against compacted fill local soils or its similar. The maximum lateral passive earth pressure is recommended not to exceed 2500 pounds per square foot.

For design, lateral pressures from local soils when used as level backfill may be estimated from the following equivalent fluid density:

Active:	35 pcf
At Rest:	60 pcf

The above values may be increased by 1/3 when designing for short duration wind or seismic forces. The above values are based on footings placed on compacted engineered fills. Where footing sides are formed, all backfill placed against the footings should be compacted to at least 95 percent of maximum dry density.

4.6 Shrinkage and Subsidence

Based on the results of field observations and laboratory testing, it is our opinion that the upper soils when used in grading may be subjected to a volume change. Assuming a 95% relative compaction for structural fills and assuming an over-excavation and recompaction depth of about 5 feet, such volume change due to shrinkage may be on order of 15 percent. Supplemental shrinkage is expected during preparation of the underlying natural soils prior to compacted fill soils placement. For estimation purposed, subsidence may be approximated to about 2.5-inch when conventional construction equipments are used. Lesser shrinkage and subsidence is expected for the soil existing a 4.5 feet and below.

4.7 Construction Consideration

4.7.1 Unsupported Excavation

Temporary construction excavation up to a depth of 4 feet may be made without any lateral support. It is recommended that no surcharge loads such as construction equipments, be allowed within a line drawn upward at 45 degree from the toe of temporary excavations. Use of sloping for deep excavation may be considered where plan excavation dimensions are not constrained by any existing structure.

4.7.2 Supported Excavations

If vertical excavations exceeding 4 feet in depths become warranted, such should be achieved using shoring to support side walls.

4.8 Site Preparations

The site preparation should include subexcavation of the upper loose compressible soils during mass grading to the vertical extent described, stock-piling, miniaturization and/or aeration to 5% to 8% over Optimum Moisture Content. Site preparation should also include replacement of the excavated soils and approved imported fills, if any, compacted to 95 percent or better. Earth work should be in accordance with the applicable grading recommendations as provided in the current CBC and as recommended in this report.

4.9 Soil Caving

Considering the gravelly sandy site soils, some caving may be expected during deep excavations. Temporary excavations in excess of 5 feet should be made at a slope ratio of 2 to 1 (h:v) or flatter, or as per the construction guidelines as provided by Cal-Osha.

4.10 Structural Pavement Thickness

Flexible Asphalt Paving: Based on estimated Traffic Index (TI), and on an estimated soil the R-value of 60 for the local soils existing as encountered, for preliminary estimation purpose, the following flexible pavement sections may be considered.

Service Vehicle	Traffic Index, TI	Pavement Type	Paving Thickness (inch)
Auto/Truck Traffic	7.0	a.c. over Class II Base	5.5 over 6.0

Within paving areas, subgrade soils should be scarified/subexcavated to minimum 12-18 inches, moisture conditioned to near Optimum Moisture content, followed by recompaction to at least 95 percent relative soil maximum Dry Density as determined by the method ASTM D1557. Class II base placed over subgrade soils should be compacted to 95% in minimum unless otherwise required by the local governing agency having jurisdiction. Uses of thicker/deepened paving edges are recommended to minimize potential for edge movement and paving distress.

The pavement evaluations are based on estimated Traffic Index (TI) as shown and on the estimated, soil R-value as described. It is recommended that following mass grading completion, representative site soils should be laboratory tested to determined actual soil R-value, based on which actual paving thickness should be determined.

Concrete Paving, if considered, should be at least 8-inch thick reinforced as recommended by the project structural engineer, placed directly over the local sandy gravelly soils compacted to minimum 95%. Actual paving thickness and reinforcement requirements should be supplied by the project structural engineer using soil Subgrade Reaction, kcf, of 300.

4.11 Retaining Wall

Retaining walls, if planned, should be designed using the following equivalent active pressures in form of fluid density:

Slope Surface of Retained Material (horz. to vert.)	Equivalent Fluid Density (pcf) Imported Clean Sand	Local Site Soil
Level	30	45
2:1	35	45

Retaining wall foundation design may be based on soil vertical bearing capacity as described earlier.

The recommended lateral pressures do not include any surface surcharge load. Use of heavy equipment near retaining wall may develop lateral pressure in excess of the parameters described above. Installation of "french-drain" behind retaining walls is recommended to minimize water pressure build-up. Use of impervious material is preferred within upper 18 inches of the wall backfills placed.

Backfill behind retaining wall should be compacted to a minimum 95 percent relative laboratory Maximum Dry Density as determined by the ASTM D1557 test method. Flooding and/or jetting behind wall should not be permitted. Local sandy soils may be used as backfill. Supplemental detailed retaining wall design and construction will be supplied, if and when, requested.

4.12 Utility Trench Backfill

Utility trench backfill within the structural pad and beyond should be placed in accordance with the following recommendations:

- Trench backfill should be placed in thin lifts compacted to 90 percent or better of the laboratory maximum dry density for the soils used. As an alternative; clean granular sand may be used having Sand Equivalent, SE, of minimum 30. Jetting is not recommended within utility trench backfill.
- Exterior trenches along a foundation or a toe of a slope and extending below a 1:1 imaginary line projected from the outside bottom edge of the footing or toe of the slope should be compacted to 90 percent of the Maximum Dry Density for the soils used during backfill. All trench excavations should conform to the requirements and safety as specified by the Cal-Osha

4.13 Pre-construction Meeting

It is recommended that no clearing of the site or any grading operation be performed without the presence of a representative of this office. An on-site pre-grading meeting should be arranged between the soils engineer and the grading contractor prior to any construction.

4.14 Seasonal Limitations

No fill shall be placed, spread or rolled during unfavorable weather conditions. Where the work is interrupted by heavy rains, fill operations shall not be resumed until moisture conditions are considered favorable by the soils engineer.

4.15 Planters

To minimize potential differential settlement to foundations, planters requiring heavy irrigation should be restricted from using adjacent to footings. In event such becomes unavoidable, planter boxes with sealed bottoms, should be considered.

4.16 Landscape Maintenance

Only the amount of irrigation necessary to sustain plant life should be provided. Pad drainage should be directed towards streets and to other approved areas away from foundations. Slope areas should be planted with draught resistant vegetation. Over watering landscape areas could adversely affect the proposed site development during its life-time use.

4.17 Observations and Testing During Construction

Recommendations provided are based on the assumption that structural footings and slab-on-grade be established exclusively into compacted fills. Excavated footings should be inspected, verified and certified by soils engineer prior to steel and concrete placement to ensure their sufficient embedment and proper bearing as recommended. Structural backfills discussed should be placed under direct observations and testing by this facility. Excess soils generated from footing excavations should be removed from pad areas and such should not be allowed on planned subgrades to receive concrete slabs.

In event other geotechnical consultants are retained during grading, Soils Southwest, Inc. will not be held responsible for any distress that may occur during life-time use of the structures constructed.

4.18 Plan Review

In absence of grading and development plan review, the recommendations supplied should be considered "preliminary". When prepared, such grading and development plans should be reviewed in order verify adequacy of the geotechnical recommendations supplied. Where warranted, supplemental recommendations will be supplied following grading and development plans review.

5.0 Design Recommendations for WQMP-BMP Storm Water Infiltration based on Soils infiltration testing using Double-Ring Infiltrometer

Presented herewith are the results of soils percolation testing performed for the proposed WQMP-BMP storm water disposal system design based on two (2) soil infiltration testing (BMP-1 andBMP-2) conducted within the areas as delineated by the site plan provided by Van Dam Engineering as shown on the attached Plate A.

The in-situ soil infiltration rate is established by testing near surface using the standardized and well-documented Double-Ring Infiltrometer testing in general conformance to the ASTM Standard D3385.

The near surface soils encountered primarily consist of fine to medium sands with traces of silts, pebbles, scattered rocks and cobbles overlying gravely medium to coarse gravely sands with 1-2" rocks and scattered cobbles. No shallow depth groundwater was encountered. Descriptions of the soils encountered are provided in the attached Log of Test Pit P-1 and P-2.

Based on the field infiltration testing completed, it is our opinion that the observed average soils infiltration rate is 68.25 in/hr. For design, it is suggested that, use of an appropriate factor of safety should be considered for the observed rate as selected by design engineer to account for long-term saturation, inconsistencies in subsoil conditions, potential for silting and lack of maintenance.

5.1 Excavated Test Pits (BMP-1 and BMP-2)

For soil infiltration testing using percolation testing using Double-Ring Infiltrometer two (2) test-excavations were made measuring about 8'x8' to about maximum 5 feet below grade. Water used during percolation testing was supplied by a portable water tank.

Supplemental equipment used are as follows:

- Double Ring Infiltrometer with inner and outer rings of 12 inch and 24 inch (2 to 1 ratio) diameter, respectively
- Shovel (flat head)
- Level
- Mallet-like small sledge hammer
- 2" x 4" timber (for protecting plate while hammering in rings)
- Plastic measuring rulers (30 cm/12-inc) with millimeter and centimeter scale ruler
- Watch
- Rubber plash guards

5.2 Methodology and Test Procedures

Soil infiltration test was performed using two described concentric rings established at the bottom of test excavation pit excavated as described. During testing, the 12-inch diameter inner ring was centered inside the 24-inch diameter outer-ring. Prior to actual testing, the outer ring was driven into local soils to about 10 centimeters, followed by the inner ring to about ½ of the outer ring penetration depth stated. Both the rings were pushed into soil using a sledge hammer and driving plate with a 2" x 4" timber for protecting the driving plate.

A soil berm, using local soils was formed and compacted around the outer annular ring. Water was used to fill the annular-space to about 4-inch, followed by the inner-ring to the same level described. Testing time intervals were based on observation of the existing dense fine silty calcium cemented sandy soils as encountered.

5.3 Infiltration Test Results

Based on the soils infiltration testing completed, for WQMP-BMP design the following infiltration rates may be considered. Actual field test data are attached.

Observed Infiltration Rate for Design

Test Date Test No. (7-10-19)	Test Depth (ft.) Below Grade	Observed Rate (inch/hour.) (Inner Ring)
P-1	4.5	58.5
P-2	3.0	78.0

For design, based on the testing completed for the test locations described the observed average infiltration rate is 68.25 inch/hour .

For design, it is suggested that, use of an appropriate factor of safety should considered to the observed average rate due to the potentials for future accumulation of silts, fines, oil, grease and others. Regular maintenance of the basins surfaces in form of removal of debris, oil and fines are strongly recommended. A maintenance record of such is suggested for future use, if any.

<u>Suggested Site Requirements for Stormwater BMP installation</u>

The invert of stormwater infiltration shall be at least 10 feet above the groundwater elevation. Stormwater infiltration BMPs shall not be placed on steep slopes and shall not create the condition or potential for slopes instability.

Stormwater infiltration shall not increase the potential for static or seismic settlement of structures on or adjacent to the site. Potential geotechnical hazards that shall be addressed including potentials for collapsible and liquefaction, if any.

Stormwater infiltration shall not place an increased surcharge on structures or foundations on or its adjacents. The pore-water pressure shall not be increased on soil retaining structures on or adjacent to the site.

The invert of stormwater infiltration shall be set back at least 15 feet, and outside a 1:1 plan drawn up from the bottom of adjacent foundations.

Stormwater infiltration shall not be located near utility lines where the introduction of stormwater could cause damage to utilities or settlement of trench backfill. Stormwater infiltration is not allowed within 100 feet of any potable groundwater production well.

6.0 Earth Work/General Grading Recommendations

Site preparations and grading should involve over-excavation and replacement of local soils as structural fill compacted to 90% or better. Although no significant variations in soil conditions are anticipated, actual soils conditions may vary in the event subgrades exposed during construction are found different from those as described in this report. It will be the subcontractor's responsibility to notify Soils Southwest about sub soil variation, if any, for revised/updated recommendations.

Structural Backfill:

Local soils free of debris, large rocks and organic should be considered suitable for reuse as backfill. Loose soils, formwork and debris should be removed prior to backfilling retaining walls. On-site sand backfill should be placed and compacted in accordance with the recommended specifications provided below. Where space limitations do not allow conventional backfilling operations, special backfill materials and procedures may be required. Pea gravel or other select backfill can be used in limited space areas. Additional recommendations on such will be supplied when requested.

Site Drainage:

Adequate positive drainage should be maintained away from the structural pads constructed. A 2% desirable slope for surface drainage is recommended. Planters and landscaped areas adjacent to building should be designed as such so as to minimize water infiltration into sub-soils. Adjacent to footings, use of planter areas with closed bottoms and controlled drainage, should be considered.

Utility Trenches:

Buried utility conduits should be bedded and backfilled around the conduit in accordance with the project specifications. Where conduit underlies concrete slab-on-grade and pavement, the remaining trench backfill above the pipe should be mechanically compacted.

General Grading Recommendations:

Recommended general specifications for surface preparation to receive fill and compaction for structural and utility trench backfill and others are presented below.

1. Areas to be graded, backfilled or paved, shall be grubbed, stripped and cleaned of all buried and undetected debris, structures, concrete, vegetation and other deleterious materials prior to grading.

2. Where compacted fill is to provide vertical support for foundations, all loose, soft and other incompetent soils should be removed to full depth as approved by soils engineer, or at least up to the depth as previously described in this report. The areas of such removal should extend at least 5 feet beyond the perimeter of exterior foundation limit or to the extent as approved by soils engineer during grading.

3. The fills to support foundations and slab-on-grade should be compacted to the minimum as recommended. In order to minimize potential differential settlements to foundations and slabs straddling over cut and fill transition. Where warranted, cut portions following cut, should be further over excavated and such be replaced as engineered fill compacted to the minimum percentage requirements recommended eartlier.

4. Utility trenches within building pad areas and beyond should be backfilled with granular material and such should be mechanically compacted to minimum percentage compaction requirement as described.

5. Compaction for structural fills shall be determined relative to the maximum dry density as determined by ASTM D1557 compaction methods. In-situ field density of compacted fill shall be determined by the ASTM D1556-82 standard methods or by other approved procedures.

6. Use of the imported soils, if required, shall be clean granular non-expansive in nature as approved by the soils engineer.

7. During grading, fill soils shall be placed as thin layers, thickness of which following compaction shall not exceed six to eight inches.

8. No rocks over six to eight inches in diameter shall be permitted to use as a grading material without prior approval of soils engineer.

9. No jetting and/or water tampering be considered for backfill compaction for utility trenches without prior approval of the soils engineer. For such backfill, hand tampering with fill layers of 8 to 12 inches in thickness, or as approved by the soils engineer is recommended.

10. Utility trenches at depth and cesspool and abandoned septic tank existing within building pad areas and beyond, should be excavated and removed, or such should be backfilled with gravel, slurry or by other material as approved by soils engineer.

11. Imported fill soils if required, should be equivalent to site soils or better. Such should be approved by the soils engineer prior to their use.

12. Grading required for pavement, side-walk or other facilities to be used by general public, should be constructed under direct observation of soils engineer or as required by the local public agencies.

13. A site meeting should be held between grading contractor and soils engineer prior to actual construction. Two days of prior notice will be required for such meeting.

7.0 Closure

The conclusions and recommendations presented are based on the findings and observations made at the time of subsurface test explorations. The recommendations should be considered 'preliminary' since they are based on soil samples only. Supplemental investigation and engineering evaluations may be required following grading plan review.

Recommendations provided are based on the assumptions that structural footings will be established exclusively into compacted fill. No footings and/or slabs are allowed straddling over cut/fill transition interface.

Final grading and foundation plans should be reviewed by this office when they become available. Site grading must be performed under inspection by geotechnical representative of this office. Excavated footings should be inspected and approved by soils engineer prior to steel and concrete placement to ensure that foundations are founded into satisfactory soils and excavations are free of loose and disturbed materials.

A pre-grading meeting between grading contractor and soils engineer is recommended prior to construction preferably at the site, to discuss the grading procedures to be implemented and other requirements described in this report to be fulfilled.

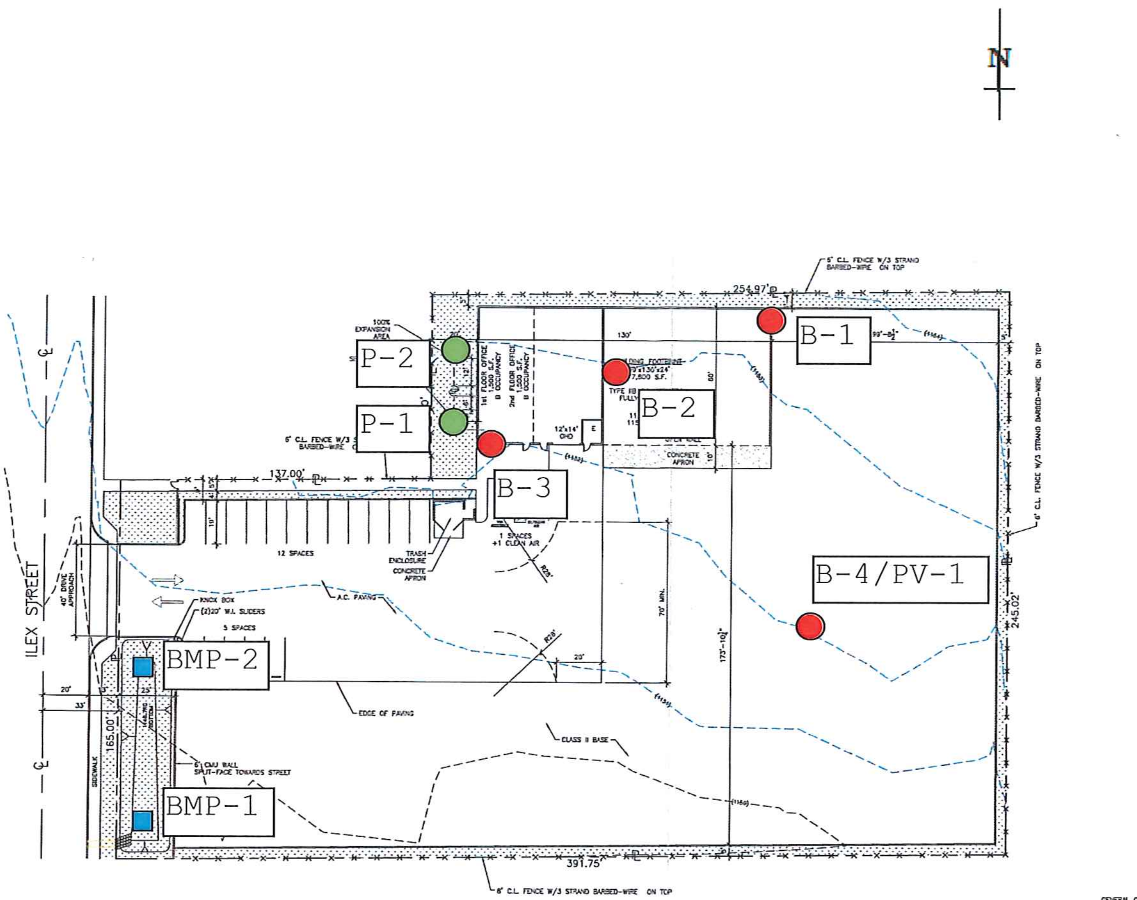
This report has been prepared exclusively for the use of the addressee for the project referenced in the context. It shall not be transferred or be used by other parties without a written consent by Soils Southwest, Inc. We cannot be responsible for use of this report by others without inspection and testing of grading operations by our personnel.

Should the project be delayed beyond one year after the date of this report; the recommendations presented shall be reviewed to consider any possible change in site conditions.

The recommendations presented are based on the assumption that the necessary geotechnical observations and testing during construction will be performed by a representative of this office. The field observations are considered a continuation of the geotechnical investigation performed.

IF ANOTHER FIRM IS RETAINED FOR GEOTECHNICAL OBSERVATIONS AND TESTING, OUR PROFESSIONAL LIABILITY AND RESPONSIBILITY SHALL BE LIMITED TO THE EXTENT THAT SOILS SOUTHWEST, INC. WOULD NOT BE THE GEOTECHNICAL ENGINEER OF RECORD. FURTHER, USE OF THE GEOTECHNICAL RECOMMENDATIONS BY OTHERS WILL RELIEVE SOILS SOUTHWEST, INC. OF ANY LIABILITY THAT MAY ARISE DURING LIFETIME USE OF THE STRUCTURES CONSTRUCTED.

PLOT PLAN AND TEST LOCATIONS
Proposed Southland Pipe Facility
8575 Ilex Avenue
Fontana, California
APN: 178-222-010



Legend:

- 🔴 TP-1 Approximate Location of Test Borings
- 🟦 BMP-1 Approximate Location of BMP Infiltration Test Pit
- 🟢 P-1 Approximate Location

Plate 1

8.0 APPENDIX A

Field Explorations

Field evaluations included site reconnaissance and four (4) soil exploratory test borings and two (2) seepage pit percolation test borings using a truck mounted hollow-stem auger drill-rig advanced to maximum depth of 31 feet below grade due to resistance. Two (2) infiltration percolation test pits were excavated using a backhoe. During site reconnaissance, the surface conditions were noted and test excavation locations were determined.

Soils encountered during explorations were logged and such were classified by visual observations in accordance with the generally accepted classification system. The field descriptions were modified, where appropriate, to reflect laboratory test results. Approximate test locations are shown on Plate 1.

Where feasible, relatively undisturbed soils were sampled using a drive sampler lined with soil sampling rings. The split barrel steel sampler was driven into the bottom of test excavations at various depths. Soil samples were retained in brass rings of 2.5 inches in diameter and 1.00 inch in height. The central portion of each sample was enclosed in a close-fitting waterproof container for shipment to our laboratory. In addition to undisturbed sample, bulk soil samples were procured as described.

Logs of test explorations are presented in the following summary sheets that include the description of the soils and/or of the fill materials encountered.

LOG OF TEST EXPLORATIONS

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-1

Project: Lord Constructors/Southland Pipe | **Job No.:** 19030-F/PRC

Logged By: Marco C. | **Boring Diam.:** 8" HSA | **Date:** July 19,2019

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			weeds, scattered debris
								SAND - light brown to grayish light brown, traces of silt, fine to medium, scattered pebbles, occasional rock and cobbles, slightly damp
							5	
	California sampler	4.5	107.9	90.7				- color change to light yellowish gray brown traces of silt, gravely, fine to coarse, pebbles, rocks, occasional rock and cobble
					SM			- color change to light brown, silty, fine to medium, scattered rock
							10	- low to medium dense
11	Standard penetration test							
					SP			- color change to light gray, fine to medium coarse, with rocks and cobbles
							15	
					GP-SP			- gravely, coarse, rocks and cobbles
							20	- gravely, very coarse, rocks and cobbles 2"-3"
79	Standard penetration test							
							25	
					SP			- color change to light brown, fine to medium coarse with rocks and cobbles, 3" - 4"
							30	
50	Standard penetration test							
								- End of test boring @ 31.0 ft. - no bedrock - no groundwater

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: 1153.5

Site Location

Proposed Commercial Development
8575 Ilex Avenue
Fontana, California

Plate #

■ California sampler   ◩ Standard penetration test

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-2

Project: Lord Constructors/Southland Pipe | **Job No.:** 19030-F/PRC
Logged By: Marco C. | **Boring Diam.:** 8" HSA | **Date:** July 19,2019

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Depth in Feet	Description and Remarks
					SM	0	weeds and scattered debris SAND - light brown to light gray, silty, slightly gravely, fine to medium, scattered pebbles
9	Bulk/Grab sample; Standard penetration test	3.6	113.3	95.2	SP	3–8 (5)	- color change to brown, traces of silt, fine to medium coarse, pebbles, rock 1"-2" - (Max Dry Density = 119 pcf @ 11.0%) - loose
	California sampler	6.1	108	90.7	GP-SP	8–12 (10)	- color change to light gray, gravely, coarse, rocks and cobbles
41	Standard penetration test				SP	12–16 (15)	- color change to dark brown to gray, fine to medium coare, rocks 2"-4", cobbles - dense
						16	- End of test boring @ 16.0 ft. - no bedrock - no groundwater

Depth scale: 5, 10, 15, 20, 25, 30

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: +/- 1153

Site Location
Proposed Commercial Development
8575 Ilex Avenue
Fontana, California

Plate #

Legend: California sampler | Standard penetration test | Bulk/Grab sample

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-3

Project: Lord Constructors/Southland Pipe		**Job No.:** 19030-F/PRC
Logged By: Marco C.	**Boring Diam.:** 8" HSA	**Date:** July 19,2019

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SM		0	weeds and scattered debris SAND - brown to light gray, silty, scattered pebbles, damp
11	Standard penetration test				SP		3–8 (5)	- color change to light brown to light gray traces of silt, fine to medium coarse, occasional cobbles
14	Standard penetration test				SM		8–13 (10)	- color change to brown, silty, fine to medium with scattered pebbles, medium dense
41	Standard penetration test				GP-SP		13–16 (15)	- color change to light gray, gravely, medium to coarse, rocks 3"-4", cobbles - dense
							16	- End of test boring @ 16.0 ft. - no bedrock - no groundwater
							20	
							25	
							30	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: +/- 1152

Site Location

Proposed Commercial Development
8575 Ilex Avenue
Fontana, California

Plate #

California sampler   Standard penetration test   Bulk/Grab sample

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-4/PV-1

Project: Lord Constructors/Southland Pipe
Job No.: 19030-F/PRC
Logged By: Marco C.
Boring Diam.: 8" HSA
Date: July 19,2019

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
	Bulk/Grab sample				SP			weeds and scattered debris
								SAND - light brown to gray, traces of silt fine to medium with scattered pebbles dry
							5	- color change to light gray, gravely, medium to coarse, occasional cobbles
								- End of test boring @ 5.0 ft. - no bedrock - no groundwater
							10	
							15	
							20	
							25	
							30	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: +/- 1152

Site Location

Proposed Commercial Development
8575 Ilex Avenue
Fontana, California

Plate #

California sampler | Standard penetration test | Bulk/Grab sample

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF TEST PIT BMP-1

Project: Lord Constructors/Southland Pipe | **Job No.:** 19030-F/PRC

Logged By: Marco C. | **Boring Diam.:** 8" HSA | **Date:** July 19,2019

Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
				SP			weeds and scattered debris
							SAND - light brown to grayish light brown, traces of silt, fine to medium with pebbles, scattered rock and cobbles dry to damp
				GP-SP			- gravely, medium to medium coarse, pebbles and rock fragments
				SP		5	- color change to lt gray brown, gravely, medium to coarse, rock fragments 1"-2" rock, scattered cobbles, dry
							- return to medium to medium coarse, pebble rock fragments, scattered rock
						10	- End of infiltration test pit @ 4.5 ft. - no bedrock - no groundwater
						15	
						20	
						25	
						30	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: +/- 1149.5

Site Location

Proposed Commercial Development
8575 Ilex Avenue
Fontana, California

Plate #

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF TEST PIT BMP-2

Project: Lord Constructors/Southland Pipe		Job No.: 19030-F/PRC
Logged By: Marco C.	Boring Diam.: 8" HSA	Date: July 19,2019

Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
							weeds and scattered debris
				SP			SAND - light brown, traces of silt, fine to medium with pebbles and scattered rock fragments, dry
				GP-SP		5	- color change to light gray brown, gravely, medium to coarse,rocks and scattered cobbles, dry
							- End of infiltration test pit @ 3.0 ft. - no bedrock - no groundwater
						10	
						15	
						20	
						25	
						30	

Groundwater: n/a Approx. Depth of Bedrock: n/a Datum: n/a Elevation: +/- 1149.5	**Site Location** Proposed Commercial Development 8575 Ilex Avenue Fontana, California	**Plate #**

KEY TO SYMBOLS

Symbol Description

Strata symbols

Poorly graded sand

Silty sand

Poorly graded gravel and sand

Poorly graded sand with silt

Soil Samplers

California sampler

Standard penetration test

Bulk/Grab sample

Notes:

1. Exploratory borings were drilled on July 19,2019 using a 4-inch diameter continuous flight power auger.
2. No free water was encountered at the time of drilling or when re-checked the following day.
3. Boring locations were taped from existing features and elevations extrapolated from the final design schematic plan.
4. These logs are subject to the limitations, conclusions, and recommendations in this report.
5. Results of tests conducted on samples recovered are reported on the logs.

9.0 APPENDIX B

Laboratory Test Programs

Laboratory tests were conducted on representative soils for the purpose of classification and for the determination of the physical properties and engineering characteristics. The number and selection of the types of testing for a given study are based on the geotechnical conditions of the site. A summary of the various laboratory tests performed for the project is presented below.

Moisture Content and Dry Density (D2937):

Data obtained from these test, performed on undisturbed samples are used to aid in the classification and correlation of the soils and to provide qualitative information regarding soil strength and compressibility.

Direct Shear (D3080):

Data obtained from this test performed at increased and field moisture conditions on relatively remolded soil sample is used to evaluate soil shear strengths. Samples contained in brass sampler rings, placed directly on test apparatus are sheared at a constant strain rate of 0.002 inch per minute under saturated conditions and under varying loads appropriate to represent anticipated structural loadings. Shearing deformations are recorded to failure. Peak and/or residual shear strengths are obtained from the measured shearing load versus deflection curve. Test results, plotted on graphical form, are presented on Plate B-1 of this section.

Consolidation (D2835):

Drive-tube samples are tested at their field moisture contents and at increased moisture conditions since the soils may become saturated during life-time use of the planned structure.

Data obtained from this test performed on relatively undisturbed and/or remolded samples, were used to evaluate the consolidation characteristics of foundation soils under anticipated foundation loadings. Preparation for this test involved trimming the sample, placing it in one inch high brass ring, and loading it into the test apparatus which contained porous stones to accommodate drainage during testing. Normal axial loads are applied at a load increment ratio, successive loads being generally twice the preceding.

Soil samples are usually under light normal load conditions to accommodate seating of the apparatus. Samples were tested at the field moisture conditions at a predetermined normal load. Potentially moisture sensitive soil typically demonstrated significant volume change with the introduction of free water. The results of the consolidation tests are presented in graphical forms on Plate B-2.

Potential Expansion (D4829)

Considering silty gravelly sandy nature, the site soils are considered non-expansive in contact with water, and consequently, no expansion tests are performed and none such are considered necessary at this time.

Laboratory Test Results

A. Table 1: Moisture-Density Determinations
(by ASTM D2216)

Sample Location & Sample Depth (ft)	Dry Density, Pcf	Moisture Content (%)	Laboratory Maximum Dry Density, pcf	Percent Compaction (%)
B-2 @ 5.0	107.9	4.48	119	90.7
B-3@3.0	113.3	3.59	"	95.2
B-2@ 10.0	108.0	6.06	"	90.8

B. Table II: Max. Density/Optimum Moisture Content (ASTM D1557)

Sample Location, @ Depth, ft.	Max. Dry Density, pcf	Opt. Moisture (%)
B-2 @ 3-5 Light brown traces of silt, fine to medium, pebble, occas.rock fragments and 1"-2" rock	119	11.0

C. Table IV: Direct Shear (ASTM D3080)

Test Boring & Sample Depth	Test Condition	Cohesion (PSF)	Friction (Degree)
B-2 @ 3-5 ft	Remolded to 90%	500.0	43.60

D.

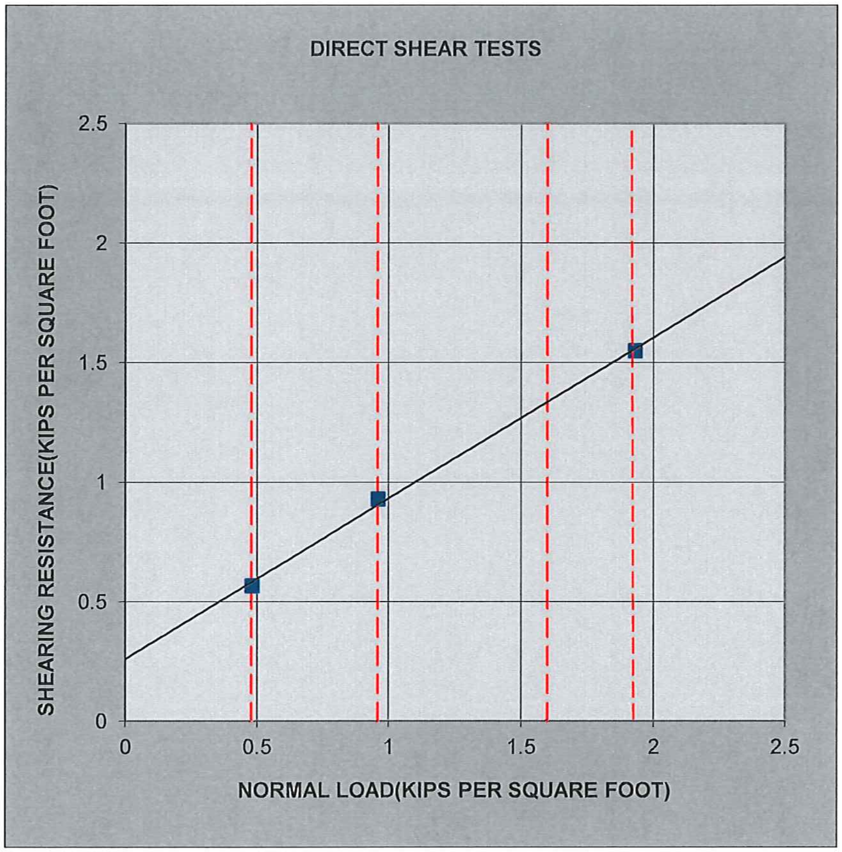
Table V: Consolidation (D2435)

Boring B #	Depth (ft.)	Consolidation prior to saturation (%) @ 2 kips	Hydro collapse (%) @ 2 kips	Total Consolidation (%@ 8 kips) (saturated)
1 (remolded)	3-5	0.1	0.1	1.1
1 (undisturbed)	5.0	0.5	1.0	3.6

E.

Table VI: Sand Equivalent

Sample Location @ depth, ft.	Sand Equivalent Average
B-4/PV-1 @ 0-5	26.11

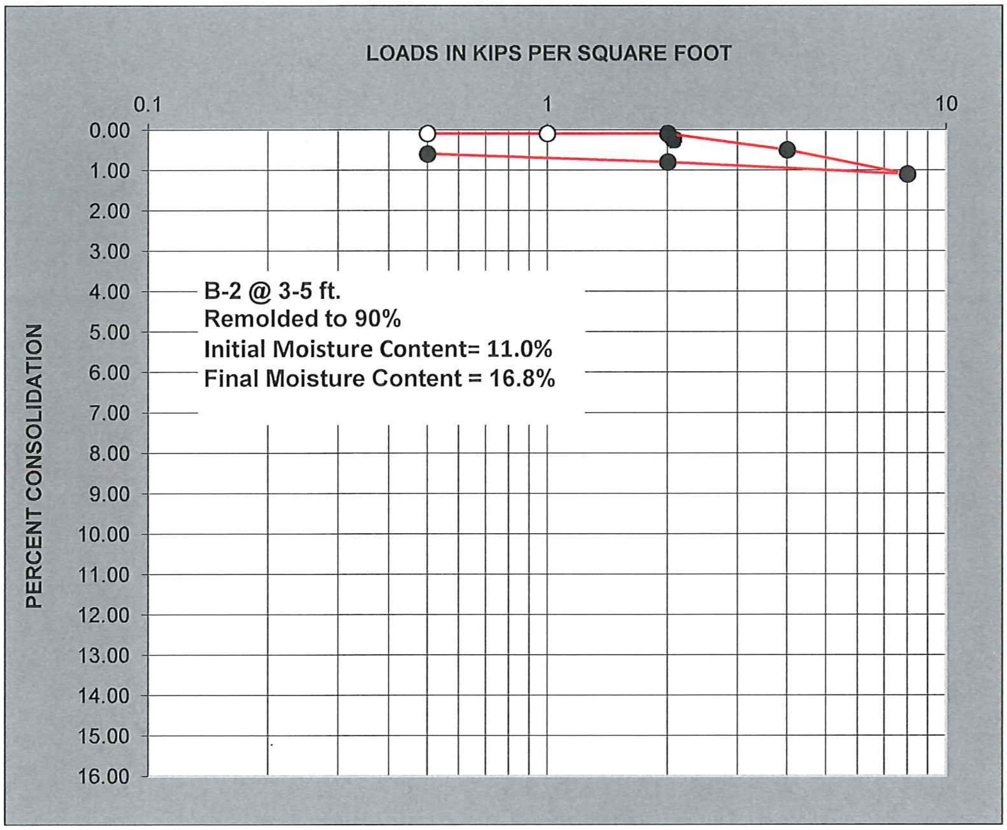


SYMBOL	LOCATION	DEPTH (FT)	TEST CONDITION	COHESION (psf)	FRICTION (degree)
■	B-2	3 to 5	Remolded to 90%	260.44	33.91

Proposed Commercial Development 8575 Ilex Avenue Fontana, California	PROJECT NO.	19030-F
	PLATE	B-1

SOILS SOUTHWEST, INC.
Consulting Foundation Engineers

CONSOLIDATION TESTS

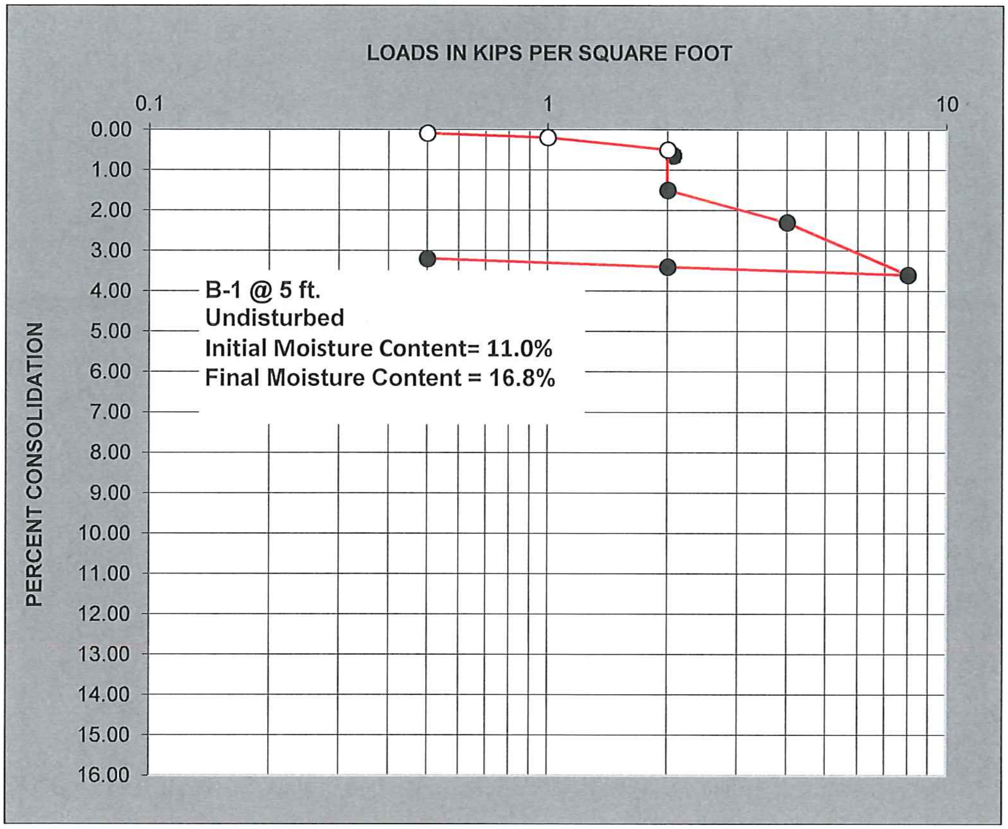


● WATER PERMITTED TO CONTACT SAMPLE

PROJECT	Proposed Commercial Development 8575 Ilex Avenue, Fontana			
PROJECT NO.	19030-F	PLATE	B-2	

SOILS SOUTHWEST INC.
Consulting Foundation Engineers

CONSOLIDATION TESTS



● WATER PERMITTED TO CONTACT SAMPLE

PROJECT	Proposed Commercial Development 8575 Ilex Avenue, Fontana			
PROJECT NO.	19030-F	PLATE	B-2-1	

SOILS SOUTHWEST INC.

Consulting Foundation Engineers

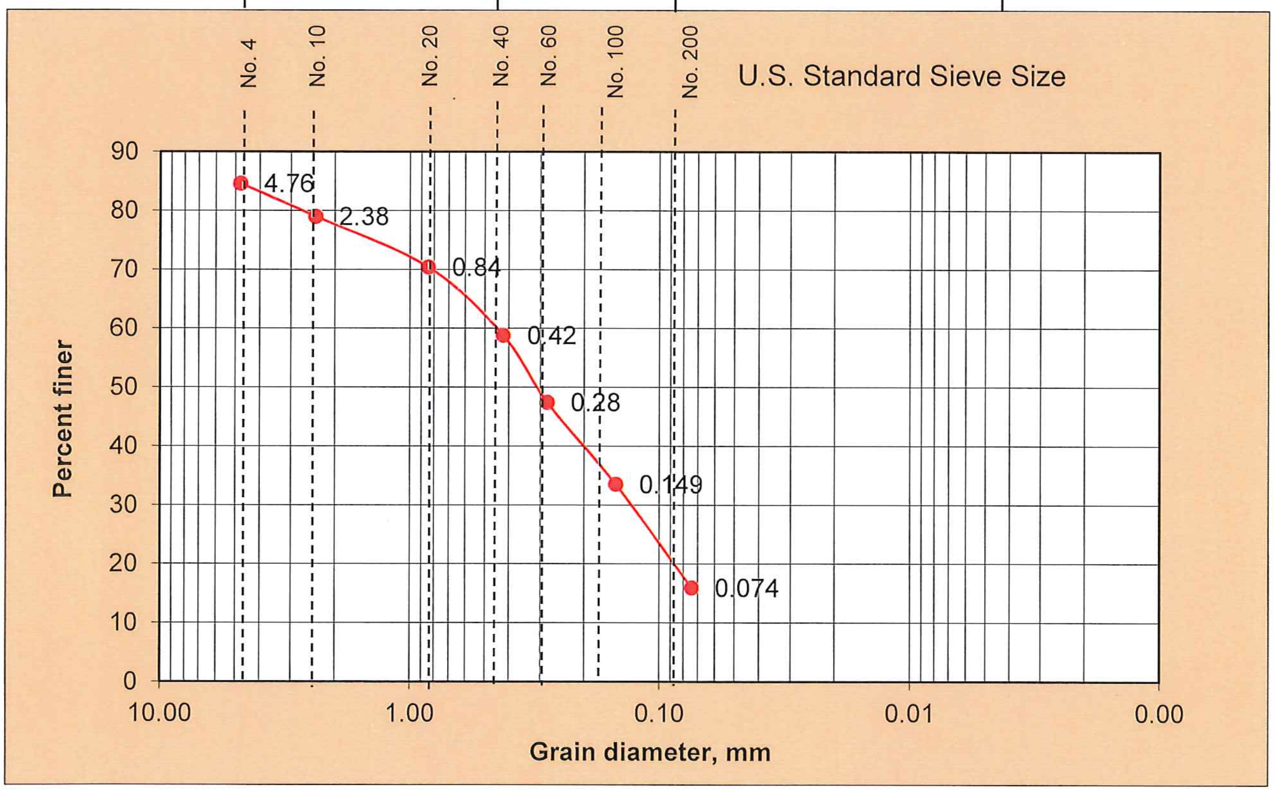
GRAIN SIZE DISTRIBUTION ASTM D422

Project: Lord Constructors/Southland Pipe **Job #** 19030-F
Location: 8575 Ilex Avenue, Fontana **Boring No:** B-4 @0-5' **Sample No:** 2
Description of Soil: SM- Silty, fine to medium coarse
Date of Sample: 7/19/2019
Tested By: RM **Date of Testing:** 7/22/2019

Sieve No.	Sieve Openings in mm	Percent Finer
4	4.76	84.70
10	2.38	79.10
20	0.84	70.50
40	0.42	58.90
60	0.28	47.50
100	0.149	33.60
200	0.074	16.00

Grain Size	% Retained
Gravel	15
Med. to Crs	24
Fines	41
Silts	20

Gravel	Sand			
	Coarse to Medium	Fine	Silt	Clay



Visual Soil Description : SM-Silty sand- fine to medium coarse with some pebbles, rock fragments occasional rocks and cobbles

Soil Classification: SM

System: USC

SOILS SOUTHWEST INC.
Consulting Foundation Engineers

APPENDIX C

Supplemental Seismic Design Parameters

2008 National Seismic Hazard Maps - Source Parameters

New Search

Distance in Miles	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
4.84	Cucamonga	CA	5	45	N	thrust	0	8	28
8.48	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16	88
8.48	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16	134
8.48	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	215
8.48	San Jacinto;SBV	CA	6	90	V	strike slip	0	16	45
8.48	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16	181
8.48	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17	181
8.48	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	241
10.24	San Jose	CA	0.5	74	NW	strike slip	0	15	20
11.71	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390
11.71	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	512
11.71	S. San Andreas;NSB+SSB+BG+CO	CA	n/a	79		strike slip	0.2	12	206
11.71	S. San Andreas;SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	176
11.71	S. San Andreas;SM+NSB+SSB+BG	CA	n/a	81		strike slip	0	13	234
11.71	S. San Andreas;SM+NSB+SSB+BG+CO	CA	n/a	83		strike slip	0.1	13	303
11.71	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	263
11.71	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14	321

2008 National Seismic Hazard Maps - Source Parameters

New Search

Fault Name	State
Cucamonga	California

GEOMETRY	
Dip (degrees)	45
Dip direction	N
Sense of slip	thrust
Rupture top (km)	0
Rupture bottom (km)	8
Rake (degrees)	90
Length (km)	28

MODEL VALUES		
Slip Rate	5	
Probability of activity	1	
	ELLSWORTH	HANKS
Minimum magnitude	6.5	6.5
Maximum magnitude	6.70	6.50

Ground Motion Interpolator (2008)

Longitude: -117.513386

Latitude: 34.097824

VS30: 270 (180-1050 m/sec)

Return Period:

2% in 50 years   10% in 50 years

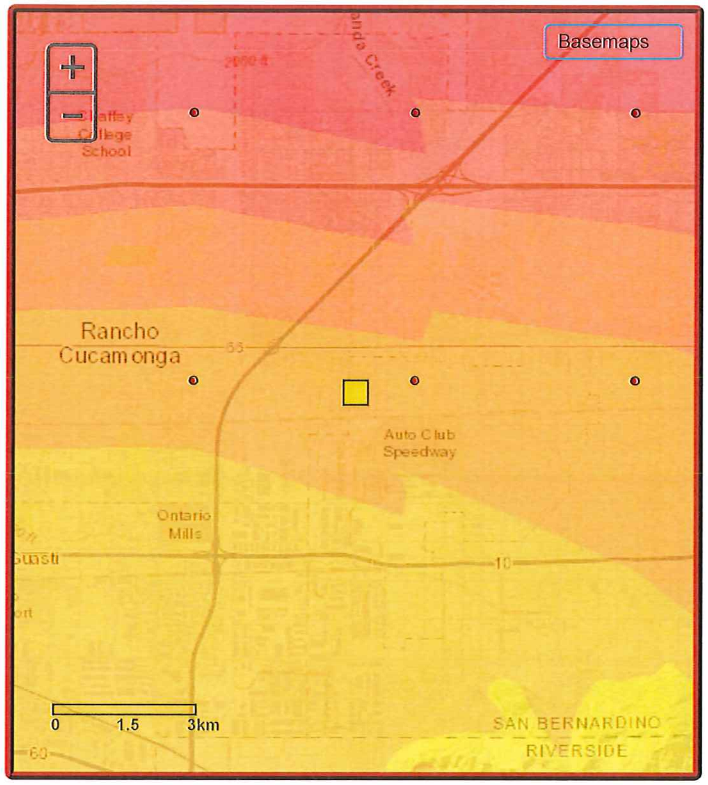
Spectral Acceleration:

PGA   0.2 second SA   1.0 second SA

Submit

Inputs:	**Result:**
-117.513386, 34.097824 vs30: 270 m/sec 10% in 50 years PGA	**0.538 g**

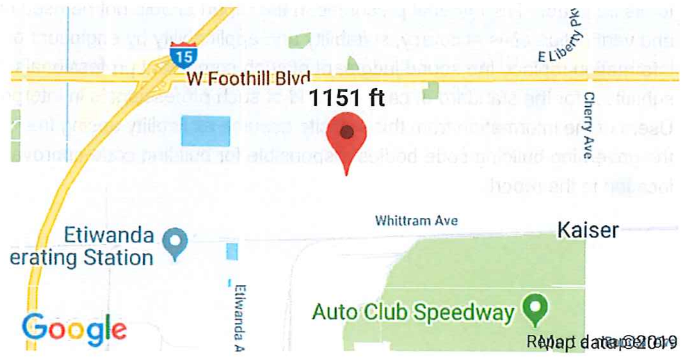
Information and Disclaimer



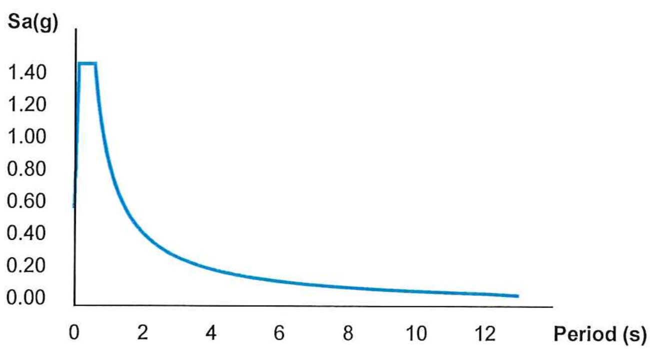
ATC Hazards by Location

Search Information

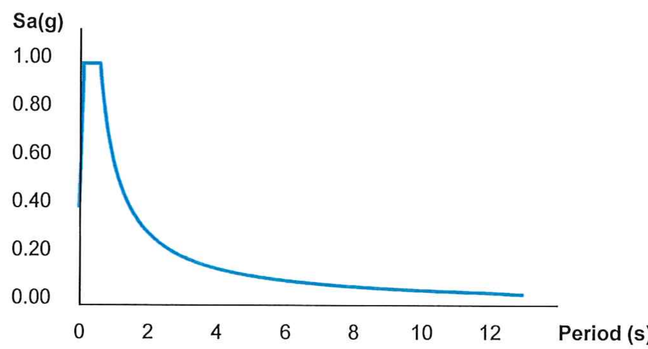
Address:	15102 Ceres Ave, Fontana, CA 92335, USA
Coordinates:	34.097824, -117.513386
Elevation:	1151 ft
Timestamp:	2019-07-19T20:35:33.310Z
Hazard Type:	Seismic
Reference Document:	ASCE7-10
Risk Category:	III
Site Class:	D



MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	1.5	MCE_R ground motion (period=0.2s)
S_1	0.6	MCE_R ground motion (period=1.0s)
S_{MS}	1.5	Site-modified spectral acceleration value
S_{M1}	0.9	Site-modified spectral acceleration value
S_{DS}	1	Numeric seismic design value at 0.2s SA
S_{D1}	0.6	Numeric seismic design value at 1.0s SA

▾Additional Information

Name	Value	Description
SDC	D	Seismic design category
F_a	1	Site amplification factor at 0.2s
F_v	1.5	Site amplification factor at 1.0s
CR_S	1.087	Coefficient of risk (0.2s)
CR_1	1.063	Coefficient of risk (1.0s)

APPENDIX D

Field Infiltration Test Data

Double Ring Infiltrometer- BMP

Field Data Sheet

TEST PIT : P-1

Job No. 19030-BMP

Lord Constructors/Southland Pipe

8575 Ilex Avenue, Fontana

Date of Test: 7/10/2019

Tested By: JF

Test Depth (ft) 4.5

Soil Description: SAND-medium to medium coarse gravely sand

Trial No.	1 Test Time	2	3 Time	Flow Reading ANNULAR SPACE/Field 4	5	Flow Reading INNER RING/Field 6	7	Flow Rate Inner 8 (7)/1	Flow Rate Inner 9 ((8)x60x0.39)	Remarks (weather conditions,etc.
	Interval (min)	Start/End	hr/min	cm	(cm/min)	cm	DROP (cm)	cm/ minute	in/hr	1 cm = 0.39-in
1	3	S	2:06	10.00		10.00				sunny, hot
		E	2:09	0.00	3.33	0.00	10.00	3.33	78.00	
2	3	S	2:16	10.00		10.00				refill
		E	2:19	0.00	3.33	0.00	10.00	3.33	78.00	
3	4	S	2:26	10.00		10.00				refill
		E	2:30	0.00	2.50	0.00	10.00	2.50	58.50	
4	4	S	2:38	10.00		10.00				refill
		E	2:41	0.00	2.50	0.00	10.00	2.50	58.50	
5	4	S	2:54	10.00		10.00				refill
		E	2:58	0.00	2.50	0.00	10.00	2.50	58.50	

S = Start

E = End

Double Ring Infiltrometer- BMP

Field Data Sheet

TEST PIT : P-2

Job No. 19030-BMP

Lord Constructors/Southland Pipe

8575 Ilex Avenue, Fontana

Date of Test: 7/10/2019

Tested By: RM

Test Depth (ft) 3.0

Soil Description: SAND-medium to coarse gravely sand

Trial No.	1 Test Time	2 Start/End	3 Time	Flow Reading ANNULAR SPACE/Field 4	5	Flow Reading INNER RING/Field 6	7	Flow Rate Inner 8 (7)/1	Flow Rate Inner 9 ((8)x60x0.39)	Remarks (weather conditions,etc.
	Interval (min)		hr/min	cm	(cm/min)	cm	DROP (cm)	cm/ minute	in/hr	1 cm = 0.39-in
1	2	S	9:32	10.00		10.00				sunny, warm
		E	9:47	0.00	5.00	0.00	10.00	5.00	117.00	
2	2	S	9:47	10.00		10.00				refill
		E	10:02	0.00	5.00	0.00	10.00	5.00	117.00	
3	3	S	10:02	10.00		10.00				refill
		E	10:17	0.00	3.33	0.00	10.00	3.33	78.00	
4	3	S	10:21	10.00		10.00				refill
		E	10:36	0.00	3.33	0.00	10.00	3.33	78.00	
5	3	S	10:40	10.00		10.00				refill
		E	11:10	0.00	3.33	0.00	10.00	3.33	78.00	
6	3	S	11:12	10.00		10.00				refill
		E	11:42	0.00	3.33	0.00	10.00	3.33	78.00	

S = Start

E = End

PROFESSIONAL LIMITATIONS

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

The investigations are based on soil samples only, consequently the recommendations provided shall be considered 'preliminary'. The samples taken and used for testing and the observations made are believed representative of site conditions; however, soil and geologic conditions can vary significantly between test excavations. If this occurs, the changed conditions must be evaluated by the Project Soils Engineer and designs adjusted as required or alternate design recommended.

The report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the project architect and engineers. Appropriate recommendations should be incorporated into structural plans. The necessary steps should be taken to see that out such recommendations in field.

The findings of this report are valid as of this present date. However, changes in the conditions of a property can occur with the passage of time, whether they due to natural process or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur from legislation or broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by change outside of our control. Therefore, this report is subject to review and should be updated after a period of one year.

RECOMMENDED SERVICES

The review of grading plans and specifications, field observations and testing by a geotechnical representative of this office is integral part of the conclusions and recommendations made in this report. If Soils Southwest, Inc. (SSW) is not retained for these services, the Client agrees to assume SSI's responsibility for any potential claims that may arise during and after construction, or during the life-time use of the structure and its appurtenant.

The recommendations supplied should be considered valid and applicable, provided the following conditions, in minimum, are met:

- i. Pre-grade meeting with contractor, public agency and soils engineer,
- ii. Excavated bottom inspections and verification s by soils engineer prior to backfill placement,
- iii. Continuous observations and testing during site preparation and structural fill soils placement,
- iv. Observation and inspection of footing trenching prior to steel and concrete placement,
- v. Subgrade verifications including plumbing trench backfills prior to concrete slab-on-grade placement,
- vi On and off-site utility trench backfill testing and verifications,
- vii Precise-grading plan review, and
- viii. Consultations as required during construction, or upon your request.

Soils Southwest, Inc. will assume no responsibility for any structural distresses during its life-time use in event the above conditions are not strictly fulfilled.