Appendix D
Geotechnical Studies

GEOTECHNICAL EVALUATION REPORT

PALMDALE CIVIL BASE 9
MODEL

AT

NORTHWEST OF PEARBLOSSOM HIGHWAY
AND FORT TEJON ROAD
PALMDALE, CALIFORNIA

PREPARED FOR:

BROADBENT, INC.
WEST PACIFIC AVENUE
HENDERSON, NEVADA, 89015

PROJECT NO: G-5729-01

JUNE 17, 2020

PREPARED BY:

GEOTECHNICAL SOLUTIONS, INC.
GEOTECHNICAL & ENVIRONMENTAL
ENGINEERING

Geotechnical Solutions, Inc.
Geotechnical, Structural & Environmental Engineering

AASHTO ACCREDITED

June 17, 2020

Project No: G-5729-01

Broadbent, Inc.
8 West Pacific Avenue
Henderson, Nevada, 89015

Attention: Mr. Mark E. Kazelskis, PG, CHG, CEM

Re: Geotechnical Engineering Evaluation Report
Palmdale Civil Base 9 Model
Northwest of Pearblossom Highway &
Fort Tejon Road
Palmdale, California 93550

Gentlemen:

Submitted herewith is the report of the Geotechnical Engineering evaluation study conducted by this office for Palmdale – Civil Base 9 Model at the referenced site.

The project site is located just northwest of Pearblossom Highway and Fort Tejon Road in Palmdale, California as shown on Vicinity Map (Plate A) or Google Map (Plate D).

Based on our study findings, it is our opinion that the site is suitable for the proposed development from a geotechnical-engineering standpoint, provided that the recommendations of this report are successfully implemented.

The closest known active fault capable of producing a major earthquake is the S. San Andreas (NM + SM) Fault, which is located approximately 1.51 miles (2.42 km) away from the project site.

The site does not lie within Alquist-Priolo Earthquake Fault Zone as designated by the California Geological Survey (CGS). The potential for direct surface fault rupture at the site is considered likely.

The investigation was made in accordance with generally accepted geotechnical engineering principles and procedures and included such field and laboratory tests considered necessary under the circumstances.

In the opinion of the undersigned, the accompanying report has been substantiated by mathematical and other data and presents fairly the design information requested by your organization.

Respectfully Submitted,

Geotechnical Solutions, Inc.

Dharma Shakya, PhD, PE, GE
Principal Geotechnical Engineer

Abraham S. Baha, PE, M.ASCE
Sr. Principal

Distribution: (3+pdf) Addressee

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1.0 INTRODUCTION

1.1 **Purpose and Scope**

The primary objectives of this study were to explore subsurface conditions beneath the project site and evaluate the existing earth materials relative to foundation support and lateral pressure design factors, seismic conditions and earthquake-induced liquefaction potential.

In general, the study objectives were met by a visual reconnaissance of the site and vicinity, review of available tentative development plans, exploratory drilling and sampling of earth materials, laboratory testing, seismic evaluations, geologic hazards study, and engineering analysis. The general scope and objectives of the study were established in collaboration with the client/project team. Items considered in our study relevant to this site included the following:

- Near surface and subsurface soil types,
- Expansion potential,
- Settlement and hydro-collapse potential,
- Bearing capacity and Foundation Design Parameters,
- Slabs-on-grade,
- Lateral earth pressures,
- Drainage considerations,
- Temporary excavation support,
- Corrosion potential,
- Groundwater conditions,
- Likely excavation conditions,
- Seismic Conditions,
- Earthquake induced liquefaction potential,

- Pavements,
- Grading considerations, and
- Construction observation and testing considerations.

To address these, the following scope of work was executed:

1. Review of preliminary project plans, available documents, and coordination with the owner's representatives and project design professionals.
2. Site reconnaissance.
3. Evaluation of seismic conditions for the subject location.
4. Hollow Stem Auger drilling, sampling and logging of ten test holes to investigate subsurface conditions.
5. Laboratory testing of soil samples obtained from subsurface explorations, to determine their physical and engineering properties.
6. Geotechnical analysis of the data obtained.
7. Developing conclusions and recommendations for foundation design.
8. Preparation of this report.

1.2 Project Description

Based on the information provided, the proposed Truck Stop will be situated on 8.0 acres of area and will consist of a travel center building, underground fuel tanks, gasoline and diesel fuel islands, car canopy/diesel canopy concrete, and a stormwater retention basin or drainage pond.

On-site asphalt paved areas for 73 auto parking and driveways, heavy duty asphalt pavement for 45 truck parking and driveways, rigid pavement sections for loading/unloading and dumpster areas will be constructed.

1.3 Site Description and Topography

The project site is located just north of Pearblossom Highway, northeast of intersection of Falling Star Place and Pearblossom Highway, northwest of the intersection of Fort Tejon Road/Highway 138 and Pearblossom Highway, Palmdale, California as shown on Vicinity Map (Plate A) and Google Map (Plate D) in Appendix A. At the time of our field exploration, the site was vacant and covered with gravel all around.

No hilly terrain or drainage problems exist at the subject property.

1.4 Site Geologic Setting

Within the Palmdale Quadrangle, the oldest Quaternary unit is the Harold Formation, which is exposed along the San Andreas Fault Zone. It consists of Pleistocene alluvial and fluvial deposits that range from weakly consolidated sediments to sandstone (Barrows and others, 1985).

Other Pleistocene units within the Palmdale Quadrangle include weakly consolidated, uplifted, and moderately to severely dissected coarse alluvial and fluvial deposits (Q2c, Q3c) of Ponte and others (1981) and Ponte and Burke (1980).

Soils on these deposits are reddish brown and are moderately to well developed with well-formed horizons and clay accumulations. These units are exposed in the west-central part of the quadrangle and are also included within the undifferentiated older deposits (Qos and Qoa) of Dibblee (2001).

Late Pleistocene alluvial and fluvial deposits (Q4c) occur in the central and northwestern portion of the Palmdale Quadrangle. These deposits also correspond in part to deposits mapped as older alluvium (Qoa, Qos) by Dibblee (2001) and a variety of units mapped by Barrows and others (1985) south of the San Andreas Fault in the southern portion of the quadrangle.

The dominant structural feature within the Palmdale Quadrangle is the San Andreas Fault Zone. It diagonally crosses the quadrangle and separates geologic terranes with dissimilar rock assemblages. Topographically, the San Andreas Fault lies within the San Andreas Rift Zone, which is defined by linear ridges, troughs, and deflected and offset drainage courses. These features have resulted from numerous surface-faulting earthquakes in late Quaternary time. This segment includes traces that ruptured during the great 1857 Fort Tejon earthquake. Active faults within and adjacent to the rift zone have been included in the Official Earthquake Fault Zone prepared by CGS (DOC, 1974). The San Andreas Fault is considered to be a major potential seismic source (Petersen and others, 1996; also see section 3 of this report). Within the Palmdale Quadrangle, the San Andreas Fault Zone includes other regional faults tectonically associated with the main trace of the San Andreas Fault. These include the Little Rock Fault and the Cemetery Fault to the north of the main trace, and the Nadeau Fault to the south.

The most significant geologic hazard to the project is the potential for moderate to severe ground shaking resulting from earthquakes generated on the faults close to the site. The site is not located in an Alquist-Priolo Special Studies zone for earthquake rupture hazard. The potential for direct surface fault rupture in the project area is considered very low.

The site locally is underlain by Quaternary aged alluvial deposits. These materials encountered onsite generally consist mostly of gravel, sand and silt/clay of valleys and canyon flood plains with fine to coarse grained sand.

1.5 Other Geologic Hazards

Since the site is located in a relatively flat area, we do not consider landslides or other forms of natural slope instability to represent a hazard to the project. The site is not located near any impounded bodies of water therefore tsunamis and seiches are not considered a potential hazard to the project. The proposed project is an area of stable soil conditions with low shrink-swell potential; hence, no impact is anticipated.

The most significant geologic hazard to the project is the potential for moderate to strong ground shaking from earthquakes generated on the faults within the vicinity of the site. The project site is located in the highly seismic Southern California region within the influence of several fault systems that are considered to be active or potentially active.

In addition to possible strong earthquake ground motion at the site, the secondary effects of earthquake-induced liquefaction, and earthquake-induced landsliding, were considered. Guidelines for evaluating and mitigation seismic hazards in California (CGS, 2008, SP-117A) summarize procedures for evaluating the earthquake-induced landslide and liquefaction potential.

1.5.1 Earthquake-Induced Liquefaction

The site is not within a zone mapped as requiring evaluation of earthquake-induced liquefaction potential per CGS SP-117A, 2008 (Palmdale Quadrangle, Released October 17, 2003). Liquefaction is discussed in more detail in the proceeding sections.

1.5.2 Induced Flooding

The site lies far and/or high enough from the coast or large inland body of water to preclude the hazards of tsunami or seiche waves or inundation from the rupture of an up gradient reservoir.

1.5.3 Eathquake-Induced Landsliding

The site is not within a zone mapped as requiring evaluation of earthquake-induced landsliding potential per CGS SP 117A, 2008 (Palmdale Quadrangle, released October 17, 2003). Since the site is far enough from steep slopes, landsliding will be unlikely.

2.0 FIELD EXPLORATION

2.1 Scope

Ten (10) hollow stem auger borings were drilled to depths varying from 11.5 feet to 41.5 feet below the existing site ground level in the proposed building and pavement areas. The borings, B-1 through B-10 are shown on the Plot Plan and Boring Location Map (Plate B) in Appendix A. A continuous record of the materials encountered during the drilling was made by our field engineer and Log of all the test borings are presented on Appendix A

2.2 Drilling and Sampling Procedures

A truck-mounted CME-85 drill rig using 8-inch diameter hollow-stem augers was used to advance the borings.

The lines designating the interface between soil strata on the log of Test Holes represent approximate boundaries. The transition between strata may be gradual. Undisturbed samples were secured at frequent intervals from various locations for laboratory testing.

Core samples and bulk samples were secured at frequent depth intervals for laboratory examination and testing. Both California standard ring samples (CA) and split spoon samples with Penetration test (SPT) blow counts were obtained for further evaluation. Disturbed bulk samples, representative of the surficial subgrade materials were also obtained.

The relative sampler penetration resistance (SPT) exhibited by the deposits sample is tabulated in the Blow per Foot column of the pertinent test hole log. Recorded blow counts for 12 inches of sampler penetration were generally indicative of medium to high shear resistance (140 pounds hammer at a 30-inch drop).

2.3 Field Tests and Measurements

The test holes were examined and logged in the field. Representative samples were obtained to classify the soils. The Unified Soil Classification System (USCS) was used to classify the soils. The soil classification symbols appear on the boring logs and are briefly described in Appendix A. Local and regional geologic characteristics were used to estimate the seismic design criteria.

In addition, relatively undisturbed samples were obtained for laboratory testing. The attached logs tabulate data based on laboratory classification tests and visual observation by the field geologist at the site.

2.4 Standard Penetration Resistance

A sediment is considered to be susceptible to transformation to a fluid mass during a strong seismic event only if the packing of the grains (relative density) is relatively low. Sediments with high relative densities cannot reduce their total volume through the compactive effort induced by the ground shaking. The number of blows necessary to drive a standard sampler (1½" I.D.)-12 inches into the individual stratum is a measurement of a specific property that has been correlated to relative density. The sampling (penetration) resistance offered by sediment from successive blows delivered by a 140-pound hammer falling 30 inches is counted. The number of blows to drive the standard sampler full 12 inches is recorded as the N-Value.

The on-site material yielded penetration resistance which indicates medium dense to very dense sand with some gravel encountered at the depth. The standard penetration resistances of the on-site materials at 5-feet intervals are presented on the boring logs (Appendix A).

3.0 LABORATORY TESTING AND SUMMARY METHODS

Laboratory testing was programmed following a review of field investigation data and after considering the various foundations, floor slabs, and grading elements to be evaluated. In general, this includes physical testing to establish foundation-bearing characteristics, and classification tests.

A. In-Place Moisture & Density (ASTM D2216 & D2937)

In situ moisture content and density were determined for all the undisturbed core samples obtained during test boring drilling operations. Test results are tabulated on Plates I-1 through I-10, Log of Test Hole.

B. Mechanical Analysis (ASTM D422)

The texture composition of a selected typical sample determined by the hydrometer test method was as follows:

Boring No.		Depth (Feet)		Percent Sand		Percent Silt		Percent Clay
B-7		0-3		85		12		3

C. Direct Shear (ASTM D3080)

Direct shear tests were performed on undisturbed natural samples of soil encountered within the full depth explored and was considered most pertinent in the design of mat/ spread footings, and moderately deep pier. Tests were performed in the saturated condition at the field density. Individual test results are shown on Plate J.

D. Expansion (ASTM D4829)

Expansion characteristics were determined by the Expansion Index test of a typical bulk sample. The sample is sand with lots of gravel and thus the test was not performed. The soil underneath the project site is classified as non-expansive to very low expansive.

E. Consolidation (ASTM D2435)

Consolidation (load deformation) tests were performed on undisturbed samples at selected depths. Plotted test results are presented on Plates K and L.

F. Chemical Sulfate Analysis (CAL 417-A Method)

Chemical sulfate analysis was performed on a representative sample by the CAL 417-A method. A soluble sulfate of 430 parts per million was indicated, which is negligible exposure to concrete, however we recommend using Type II Portland cement for the foundation elements in contact with the underlying soil.

G. R-Value Test (ASTM D-2844)

Representative samples of the subgrade soils were obtained and tested to determine the R-value. The material is thought to be typical and presumed to be representative of the subgrade soils. Testing was performed in general accordance with the latest revisions to the Department of Transportation, State of California, Material & Research Test Method No. 301. Pavement design recommendations are based on the latest Traffic Indices (TI's) and recently tested R-value.

An R-Value test was conducted on a representative sample of the near surface soil consisting of sand, silty, and gravelly. The specimens were tested in a state as near to full saturation as possible to simulate the condition the soil might attain at typical field density and under adverse moisture conditions. The R-Value for a representative soil was determined to be 36. Test results are as follows:

Test Number	Moisture @ Compaction (%)	Density (pcf)	Exudation Pressure (psi)	Stabilometer "R"-Value
a	12.2	114.9	200	26
b	10.9	110.9	400	46
c	11.4	116.1	350	41
	*Interpolated 300 psi by exudation			36*

* Interpolated 300 psi by Exudation

4.0 SUBSURFACE DISCUSSION

4.1 General

The recommendations presented are based on entirely upon data derived from a limited number of samples obtained from widely spaced borings. The attached logs, B-1 through B-10 presented in Appendix A are indicators of subsurface conditions only at the specific locations and times noted. This report assumes the uniformity of the geology and soil structure between the borings, however variations can and often do exist. Whenever there is any deviation, difference or change is encountered or becomes known, we should be contacted.

4.2 Material and Soil Conditions Summary

No appreciable artificial fill was encountered at the boring locations during the exploratory drilling. The upper and underlying natural soils are alluvium, generally fine to coarse grained, medium dense to dense, sand, some gravel, silty and trace clayey. A more detailed soil profiles are shown on Plates I-1 through I-10, Log of Test Hole (Appendix A).

4.3 Groundwater

Surface water on this site is the likely result of precipitation or surface run-off from surrounding sites. Overall site drainage is in a north and northwesterly direction. Provisions for surface drainage will need to be accounted for by the project civil engineer.

We recommend that all surface runoff should not be allowed to pond above or flow freely over adjacent slope surfaces. Collected water should be conveyed via a non-erosive device to a suitable storm drain system.

Groundwater was not encountered within a drilled hole depth of 41.5-feet during the field study. No springs or perennial stream flow in local drainages exist based on older topographic maps. The historic groundwater depth is way deeper than 50-feet below existing ground surface.

The nearest well, 05N11W04P002S located about 0.15-mile northwest of the project area indicated the elevation depth to the highest groundwater level was at 2,544 feet above the mean sea level (Plates G-2 and G-3). The elevation of the project site is at 2755 feet above mean sea level indicating the ground water level about 200 feet below the existing project site.

Groundwater is not anticipated to affect the site adversely. However, these observations reflect site conditions at the time of the investigation and do not preclude changes in local groundwater conditions, localized seepage due to variations in rainfall, heavy irrigation, damaged structure (pipes, etc.), or altered site drainage pattern(s).

Proper surface drainage is imperative to collect and convey any surface water off site to a suitable storm drain system.

4.4 Faulting and Seismicity

The project site is located in the highly seismic Southern California region within the influence of several fault systems that are considered to be active or potentially active. An active fault is defined by the State of California as a "sufficiently active and well defined fault" that has exhibited surface displacement within the Holocene time (about the last 11,000 years).

A potentially active fault is defined by the State as a fault with a history of movement within Pleistocene time (between 11,000 and 1.6 million years ago).

No faults have been mapped trending towards or through the site area. The site area does not lie within an Alquist-Priolo Earthquake Fault Zone as designated by the California Geological Survey (CGS) (Hart, 1997). For this reason, the potential for direct surface rupture is considered unlikely.

4.4.1 Faults Close to the Site

USGS National Seismic Hazard Maps for Source parameters interactive query has been used to determine the closest fault to the site within 50 miles and has been tabulated on Table – 1 in Appendix B.

The closest known active fault capable of producing a major earthquake is the S. San Andreas; NM + SM Fault, which is located about 1.51 miles (2.42 km) away from the site. The S. San Andreas; NM + SM Fault has been assigned to 7.46 Mw magnitude and slip rate of N/A.

4.4.2 U.S.G.S. Earthquake Hazard Program

Latest Interactive U.S.G.S. Earthquake Hazard Program using Unified Hazard Tool has been utilized for Conterminous U.S. 2008 (v3.2.x) and peak ground acceleration.

Peak Horizontal Ground Acceleration for 10% probability of

exceedance in 50 years i.e. return period of 475 years 0.6071g

Peak Horizontal Ground Acceleration for 5% probability of

exceedance in 50 years i.e. return period of 975 years 0.8035g

Peak Horizontal Ground Acceleration for 2% probability of

exceedance in 50 years i.e. return period of 2,475 years 1.069g

Interactive **Hazard Curve** and **Uniform Hazard Response Spectrum** have been plotted and presented in Appendix B.

4.4.3 Seismic Factors

The following are the geotechnical parameters for earthquake design data in accordance with USGS Design Maps Summary and Detailed Report presented in Appendix B:

Latitude: **34.5438^0** and Longitude: **-118.0354^0**

NO.	PARAMETERS	VALUES	REFERENCE
1	0.2-Second Mapped Spectral Response Accelerations, **S_s (MCE$_R$ Ground Motion)**	**2.276g**	ASCE 7-16
2	1-Second Mapped Spectral Response Accelerations, **S_1 (MCE$_R$ Ground Motion)**	**0.967g**	ASCE 7-16
3	Site Class	**D**	ASCE 7-16
4	Site Amplification Factor at 0.2 sec, **F_a** According to Section 11.4.4, F_a should not be less than 1.2	**1.0** **1.2**	ASCE 7-16 Use
5	Site Amplification Factor at 1.0 sec, **F_v,** however, according to Table 11.4.2, **F_v should be 1.7**	**Null** **1.7**	ASCE 7-16 Use
6	Site Modified Spectral Acceleration Value, **S_{MS}** $S_{MS} = F_a\ S_s = 1.2 \times 2.276 = 2.731$	**2.276** **2.731**	ASCE 7-16 Use
7	Site Modified Spectral Acceleration Value, **S_{M1}** **$SM_1 = F_v\ S_1 = 1.7 \times 0.967 = 1.644$**	**Null** **1.644g**	ASCE 7-16 Use
8	Numeric Seismic Design value at 0.2 sec SA, **S_{DS} = 2/3 of S_{MS} = 2/3 x 2.731 = 1.821**	**1.517g** **1.821g**	ASCE 7-16 Use

9	Numeric Seismic Design value at 1.0 sec SA, **S_{D1} = 2/3 of SM_1 = 2/3 x 1.644 = 1.096**	**Null** **1.096**	ASCE 7-16 Use

Other seismic parameters are as follows:

Closest Fault Distance	1.51 mile (2.42 km)
Fault Name	S. San Andreas; NM + SM Fault
Earthquake Magnitude	7.46 M_w
Slip Rate (mm/year)	N/A
PGA_M Site Modified Peak Ground Acceleration	1.078g
5% Damped Design Spectral Acceleration at short period, S_{DS}	1.821g
5% Damped Design Spectral Acceleration at 1-sec period, S_{D1}	1.096g
Seismic Design Category	D
Risk Category	II
Soil Site Class	D

4.5 Design Values

Representative values were selected from the test data and other sources for design and is tabulated below:

Field Density	120 pcf
Expansion Index	0
Angle of Internal Friction (Ult/Peak)	34/35deg.
Cohesion	150/200 psf
Subgrade K-Value	100 pci

5.0 SITE CONSIDERATIONS

5.1 Site Preparation

5.1.1 General

It is our professional opinion that the proposed construction will not be subject to geologic hazard from settlement, slippage, or landslide, provided the recommendations of this report are incorporated into the proposed construction. It is also our opinion that the proposed construction will not adversely affect the geologic stability of the site or adjacent properties provided the recommendations contained in this report are incorporated into the proposed construction.

The validity of the conclusions contained in this report is based on compliance with the recommendations presented in this section. Any excavating, trenching, or disturbances that occur after completion of the earthwork must be backfilled, compacted and tested in accordance with the recommendations contained herein. If any unobserved and untested earthwork, trenching, or backfilling occurs, then the conclusions and recommendations in this report may not be relied on.

5.1.2 Site Clearing

Prior to grading, all debris including construction materials should entirely be removed from the site and disposed of off-site. Existing any undesirable materials should also be removed and hauled off-site. Existing utilities (if Any) should be removed and relocated as required. Any construction debris or ant buried or other contaminated exposed during site clearance should be removed and hauled away from the site. The resulting excavation from any removal should be cleared of loose material then backfilled with compacted soil. Oversized rocks greater than 6 inches should be removed.

5.1.3 Excavation

Excavations into the on-site soils may encounter a variety of conditions. Caving on clean sands may be encountered. The contractor should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of the excavation sides. All excavations should be sloped or shored in the interest of safety following local and federal regulations including current OSHA excavation and trench safety standards.

Conventional equipment can be used for the excavations for shallow foundations, drilled shafts, and utility trenches for the proposed construction. The speed and ease of excavation are dependent on the nature of the deposit, the type of equipment used, and the skill and experience of the equipment operator.

5.1.4 Building Pad Preparation

In the Travel Center building area, after site clearing operations are completed, proof-roll the exposed subgrade to observe for any loose or disturbed soils that may remain. Remove and replace any loose or disturbed soils prior to placing any additional fill materials required to reach the finished subgrade elevation.

5.1.5 Compliance

Recommendations for foundations and slabs-on-grade supported on compacted fills or prepared subgrade depend upon compliance with the **Site Preparation recommendations** and Recommended Earthwork Specifications in Appendix D.

To assess compliance, observation and testing should be performed under the direction of a geotechnical engineer. Please contact us to provide observation and testing services.

5.2 Lateral Earth Pressures

5.2.1 Lateral Passive Resistance

Horizontal forces may be resisted by passive pressure acting on the side and sliding resistance. The passive pressure may be 300 psf per foot of embedment from the lowest adjacent grade up to a maximum of 4,500 psf.

Friction between base of footings and/or floor slabs, and the underlying soils may be assumed to be 40 percent of the dead loads.

The allowable bearing capacity and the allowable resistance of horizontal forces may be increased one-third for transient forces.

Friction and lateral pressure may be combined, but not to exceed two-thirds of the allowable lateral pressure.

5.2.2 Retaining Wall Recommendations (If Any)

The retaining wall structures may be supported by shallow footings bearing on compacted fill or competent subgrade soil. Following bearing values may be used for foundation design.

Shallow footings for the wall and/or secondary structure may be designed for an allowable bearing value of 1,500 pounds per square foot (psf) embedded at least 18 inches, a minimum width of 12 inches, placed over a minimum 12-inch thick engineered fill compacted to 90% relative density or over a competent subgrade soil. This basic bearing value may be increased by 200 psf for each one-foot increase in depth, and by 100 psf for each additional 12 inches in width to a maximum value of 2,500 psf.

Recommended bearing values are for dead plus live loads and may be increased by one-third for combined dead, live, and transient forces such as wind load and seismic forces.

It is recommended that all foundations be reinforced per structural design, but no less than a minimum reinforcement of 2#5 bars top and 2#5 bars at the bottom.

It is estimated that total settlement will be less than 0.50" and differential settlement will be less than 0.25" over a horizontal distance of 30 feet.

5.2.3 Active Pressure

Recommended active lateral soil pressure values for design of drained retaining wall are as follows:

Surface Slope of Retained Material (Horizontal:Vertical)	Equivalent Fluid Weight (pcf) (Native Backfill)
Level	35
2:1	45

A Pipe and gravel drain (4" perforated PVC embedded in at least three cubic feet of gravel per lineal foot of pipe wrapped with Mirafi geofabric 10N or equivalent) should be provided on the retained earth side and near the base of all the retaining walls. Backfill should consist of sand and/or gravel. While all backfills should be compacted to the required degree, care should be taken when working close to the walls to prevent excessive pressure.

5.2.4 At-Rest Earth Pressure (If Any)

Retaining walls (basement walls, underground vault, if applicable) should be designed for at-rest conditions. The recommended earth pressure for at-rest conditions is an equivalent fluid density of 60 pounds per cubic foot without surcharge loading.

Note:

The equivalent fluid pressures presented herein do not include the lateral pressures arising from the presence of the following:

- Hydrostatic conditions, submergence or partial submergence
- Sloping backfill, positively or negatively
- Surcharge loading, permanent or temporary
- Seismic or dynamic conditions

5.2.5 Seismic Force

Lateral forces on retaining walls (exceeding 6 feet in height) due to earthquake movements in accordance with Section 1803A.5.12 of the 2019 CBC for active and at-rest conditions may be calculated as follows:

Seismic active Force = 11 H^2 pounds/ft of wall (Inverted triangular distribution, acting at 0.6H from bottom).

Seismic at-rest Force = 22 H^2 pounds/ft of wall (Rectangular Distribution, acting at 0.6H from bottom).

Where, H = Height of the retaining wall in feet

5.3 <u>On-Site Fill Soils</u>

5.3.1 Materials

On-site clean, low-expansive potential soils, or imported materials may be used as fill material for the following:

- Foundation Areas
- Interior Slab Areas
- Pavement Areas

- Backfill

Any earth materials imported or excavated on the property may be utilized in the fill provided that each material has been determined to be suitable by the soil engineer. These materials should be free of roots, tree branches, other organic matter or other deleterious materials. Soils of poor gradation, undesirable expansion potential, or substandard strength characteristics may be designated by the consultant as unsuitable and may require blending with other soils to serve as a satisfactory fill material.

Gradation (as per ASTM C136) should be as follows:

Size	% by Weight
6”	100
4”	85-100
¾”	70-100
No 4 Sieve	50-100
No. 200 Sieve	40 (max)

Any import material should have an expansion Index, EI less than 20.

5.3.2 Placement and Compaction

a. Place and compact approved fill material in nearly horizontal layers that when compacted should not exceed 6 inches in thickness.

b. Use appropriate equipment and procedures that will produce recommended densities and water contents throughout the lift. Moisture condition, blending, and mixing of the fill layer should continue until the fill materials have a uniform moisture content at or above optimum moisture.

c. Uncompacted fill lifts should not exceed 8 inches.

d. Materials should be compacted to the following:

- On-site or imported soil, reworked and fill:

	Minimum % (ASTM D-1557 Laboratory Standard)
Subgrade Below Footings	90
Subgrade Below Slab-on Grade	90
Subgrade Below Pavement	90
Crush Rock Below Slab-on-Grade	95
Aggregate Base below pavement	95

5.4 Soil Corrosivity

5.4.1 Corrosion and Sulfate Attack Protection

A major factor in determining soil corrosivity is electrical Resistivity. The electrical Resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. Corrosion currents, following Ohm's Law, are inversely proportional to soil Resistivity. Lower electrical resistivities result from higher moisture and chemical contents and indicate corrosive soil. Other soil characteristics that can influence corrosivity toward metals are pH, chemical content, soil types and site drainage.

Based on test results and our past experience at this site, soils are classified as corrosive to ferrous metals and negligible sulfate exposure to concrete. The type of alluvial deposits encountered at this site and in this area in general is known to cause corrosion problems. Reportedly, there has been such experience with metal pipes at this specific site. Ferrous metals and pipes should be properly coated and wrapped.

Please be advised that this firm does not practice corrosion engineering; therefore, we recommend that upon completion of precise grading, onsite soils be analyzed by a qualified corrosion engineer to evaluate the impact of chemical activity of these soils on buried metallic pipes and other underground structures. If necessary, more elaborate corrosion protection systems may be considered as may be recommended by a corrosion expert.

5.4.2 Concrete

Concrete for foundation where in contact with the underlying soils should be designed in accordance with the 2019 CBC, ACI 318 Section 4.3, Table 4.3.1 (2005). As the potential for sulfate attack on concrete appears negligible, however, we recommend that the use of type II Portland cement, with a maximum water-cement ratio of 0.50, and a minimum compressive strength of 3,000 psi should be taken into consideration for the foundation elements in contact with the soil.

For all concrete in contact with soil, concrete cover over rebar should be maintained per California Building Code (CBC 2019).

5.5 Building Foundation Recommendations

Based upon results of the field explorations, laboratory testing and engineering analysis, it is concluded that the site is suitable for the proposed development at the subject site. The site is subject to ground shaking typical of the Southern California area, any construction should conform to the current seismic design provision of the California Building Code (2019), and/or other regulatory codes.

Following are more specific recommendations:

5.5.1 Conventional/Spread Foundations

The planned building for Travel Center may be supported by conventional continuous and/or isolated shallow spread pad footings, bearing on certified compacted fill. The foundations should bear on engineered fills achieved by removal and re-compaction of the soils below foundation and slab elements.

Footings placed at least 18 inches below finish subgrade for Travel building Center and 3 feet x 3 feet spread footings, 24 inches deep may be designed for an allowable bearing value of 2,000 pounds per square foot (psf). The footing width should be a minimum of 18 inches. An increase of 100 psf and 200 psf are allowed for each additional foot of increase in width and depth, respectively to a maximum value of 3,000 psf.

This allowable bearing value is for dead plus live load and may be increased by one-third for combined dead, live, and transient loads such are wind or seismic forces.

All footings at minimum shall be incorporated with 2#5 bars at top and 2#5 bars at the bottom.

Isolated column footings should be connected to other foundation elements with reinforced grade beams.

Total settlement is estimated to be less than ½ inch for loading of 3 kips per square foot. Differential settlement will be 1/3 of an inch maximum for a horizontal distance of 30 feet. Additional foundation movements could occur if water from any source infiltrates the foundation soils. Therefore, proper drainage should be provided in the final design and during construction.

All footings, stem walls, and masonry walls should be steel-reinforced to reduce the potential for distress caused by differential foundation movements. The use of joints at openings or other discontinuities in masonry walls is recommended.

We recommend that geotechnical engineer, or his representative thereof, observe the footing excavations before reinforcing steel and concrete are placed. This observation is to assess whether the soils exposed are similar to those anticipated based on our exploration. Any soft, loose, or otherwise unacceptable soils should be undercut to suitable materials and backfilled with approved fill materials, or controlled density fill (i.e., lean concrete). Soil backfill should be properly placed and compacted.

5.5.2 Drilled Shafts for Canopy Foundation

Proposed signage and canopies e.g. car canopy, diesel canopy etc. may be supported by moderately deep cast-in-place concrete caisson bearing into natural subgrade materials.

The lateral forces will be the controlling element in this case depending on the height of the canopies, wind load, and/or seismic loads. Therefore, it is recommended that the minimum pier diameter should be 36 inches and should be extended to a minimum depth of 10 feet into native alluvial material.

The pier may be designed for an allowable end bearing of 3,000 pounds per square foot or for an average frictional resistance of 300 pounds per square foot. Either skin resistance or end bearing or combined will provide adequate foundation support for the proposed canopies. The uppermost length of the drilled shaft foundation equal to the diameter of the shaft should be ignored when evaluating allowable capacities.

For lateral support, a passive capacity of 350 pounds per square foot per foot to a maximum of 5,000 psf may be used.

It is recommended that concrete be placed immediately after drilling. The concrete for the pier should be placed through tremmie or other directional devices. Pier drilling operations should be subject to observation by this office to confirm the conditions encountered are consistent with the conclusions and recommendations of this report and/or to make any appropriate modifications, if necessary. Please note that caving is very likely to be encountered during caisson drilling. The contractor should be ready to provide either casing or other methods to prevent caving.

We anticipate that total settlement of the proposed structures, supported by drilled shaft foundations as recommended, should be less than ½-inch. Additional foundation could occur if water from any source infiltrates the foundation soils. Therefore, proper drainage should be provided in the final design and during construction.

5.6 Slab Design Recommendation

Based on test results, the underlying surface soils are low expansive, therefore it is recommended to maintain subgrade soil at near optimum moisture content during precise grading and / or by periodic watering following grading and incorporated slab reinforcement of No. 3 bars 18 inches center to center cross pattern. The building slab thickness should be 5 inches minimum. However, the thickness and reinforcement requirements of the slab should be evaluated by the project structural engineer.

It is further recommended that moisture retarder (Stego 15 mil or approved equivalent) be provided over a minimum of 6 inches of ¾" aggregate rock rolled and compacted to 95% relative compaction, with the gradation (90-100% passing on sieve ¾" size, 1-10% passing on No. 4 sieve, and 0-3% passing on No. 100 sieve) over the compacted fill subgrade compacted to 90% relative compaction.

The modulus of subgrade reaction (k) is estimated to be 100 pounds per cubic inch (pci).

All concrete placement and curing operations should follow the American Concrete Institute (ACI 318-19) manual recommendations. Improper curing techniques, high slump (high water-cement ratio), or both, could cause excessive shrinkage, cracking, or curling. Concrete slabs should be allowed to cure properly before placing vinyl or other moisture-sensitive floor coverings.

5.7 General Drainage and Moisture Protection

It is recommended to provide positive surface drainage systems consisting of a combination of sloped concrete flatwork, sheet flow gradients, swales, surface area drains (where needed) around the building structure. Ground surface should have a minimum gradient of 2 percent away from building foundations and similar structures. Surface waters should not be allowed to collect or pond against building foundations and within the level areas of the site. Buildings should be provided with gutters and downspouts. Downspouts shall be connected to area drains by pipes.

Planters near the building should be avoided if possible and if used, they should be water proofed. Irrigation should be controlled and an area drain system should be provided to avoid water intrusion beneath the structure.

5.8 Volume Changes

Based on our experience, there is typically a reduction in soil volume when the native soils are excavated and then compacted. Typical shrinkage percentages are usually in the range of 10 to 20 percent when the soils are compacted depending on the native in-place density.

5.9 Underground Utilities

Utility backfill should be placed and compacted by mechanical means as recommended in this report. Testing of the backfill should be conducted to verify conformance to the required specifications. Ponding or water jetting of the backfill should not be conducted.

Exterior trenches adjacent to, and within areas extending below a 1:1 plane projected from the outside bottom edge of the footing, and all trenches beneath hardscape features should be compacted to at least 90% of the laboratory standard. Sand backfill, unless excavated from the trench, should not be used in these backfill areas. Compaction testing and observations, along with probing, should be accomplished to verify the desired results.

All trench excavations should conform to CAL_OSHA and local safety codes.

5.10 Pavement Design

5.10.1 Pavement Section

The pavement sections presented on the following page are based on the R-value data tested, the assumed TI values, and the guidelines presented in the latest revision to the California Department of Transportation "Highway Design Manual," latest edition.

Typical categories of paved areas with corresponding traffic indices are listed as follows:

T.I.	5.0	Parking Stalls
T.I.	6.0	Driveways
T.I.	8.0	Trucks Route, Fire Lane, Truck Parking

The recommended pavement sections provided below are intended as a minimum guideline. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected.

If the ADT (average daily traffic) or ADTT (average daily truck traffic) increases beyond that intended, as reflected by the TI used for design, increased maintenance and repair could be required for the pavement sections.

Consideration should be given to the increased potential for distress from overuse of paved areas by heavy equipment and/or construction related traffic (e.g., concrete trucks, loaded supply trucks, etc.), particularly when the final section is not in place (i.e., topcoat). Best management construction practices should be followed at all times, especially during inclement weather.

Based on an "R" Value of 36, the following thickness of aggregate base was determined for vehicular and non-vehicular areas.

Asphalt Concrete Pavement Section Design

Pavement Areas	Traffic Index, TI	Asphalt Concrete AC (inch)	Aggregate Base AB (inch)
Truck Route, Fire lane Truck Parking	8	4"	11"
Driveway/Under Canopy	6	4"	6"
Parking Stall	5	4"	4"

Rigid Concrete Pavement Section Design

Pavement Areas	Traffic Index, TI	Concrete (inch)	Aggregate Base AB (inch)
Heavy Truck Vehicular Areas	6	6"	8"
Walkways	-	4"	4"

For concrete section, #4 reinforcement 12-inch center to center each way cross pattern are recommended. However structural design by structural engineer will suffix.

5.10.2 Pavement Grading Recommendations

5.10.3 General

A representative of Geotechnical Solutions, Inc. (GSI) should be present for the preparation of subgrade, aggregate base, and asphalt concrete for flexible pavement and concrete for rigid pavement.

5.10.4 Subgrade Preparation

After removing the existing deleterious materials on the pavement areas and hauled offsite, all surficial deposits of loose soil material should be removed and excavate 12 inches below the base and recompacted as recommended. The bottom is further scarified to a depth of at least 6 inches; moisture conditioned as necessary and compacted to 90 percent of the maximum laboratory density as determined by ASTM Test Method D-1557.

Deleterious material, excessively wet or dry pockets, concentrated zones of oversized rock fragments, and any other unsuitable materials encountered during excavation or grading should be removed. The compacted fill material should then be brought to the elevation of the proposed subgrade for the pavement. The subgrade should be proof-rolled in order to ensure a uniform, firm and unyielding surface. All grading and fill placement should be observed by the project soils engineer and/or his representative.

5.10.5 Aggregate Base

Compaction and rolling are required for the recommended base section. Minimum relative compaction required will be 95 percent of the laboratory maximum density as determined by ASTM Test Designation D-1557. Aggregate base should be in accordance with the Caltrans Class II base (minimum R-value=78) and sample should be brought for testing and approval prior to delivery to the site.

5.10.6 Asphalt Concrete Pavement

Asphalt concrete pavement should be Performance Grade PG 64-10 1/2" maximum aggregate size and should be placed and compacted in two layers. Asphalt concrete shall be compacted to 95 percent of the Hveem Laboratory Standard.

5.10.7 Concrete Pavement Areas:

Concrete flatwork including sidewalks, patio-type slabs and concrete sub-slabs to be covered with decorative pavers should be at least 4 inches thick and provided with construction joints or expansion joints every 6 feet or less.

Concrete driveway slabs should be at least 6 inches thick over 6 inches of aggregate base (for vehicular areas) and 4” of concrete over 4” of aggregate base (Non-vehicular areas) over approved subgrade, providing #4 reinforcement 12" center to center each way cross pattern and provided with construction joints or expansion joints every 10 feet or less.

At the driveway areas, the top 12 inches of subgrade should be excavated; moisture conditioned and recompacted with minimum 90% compaction immediately prior to placing the rock base and asphalt concrete. Rock-base material shall be class II aggregate base and to be compacted to 95 percent minimum.

Design section must be verified during site grading, based on R value test and appropriate modifications shall be made, if required.

5.11 Exterior Concrete Flatwork

In order to reduce the potential for unsightly cracking, concrete sidewalks, deck and patio slabs and concrete sub-slabs to be covered with decorative pavers should be at least 4 inches thick and provided with construction joints or expansion joints every 6 feet or less. Concrete driveway slabs should be at least 5 inches thick and provided with construction joints or expansion joints every 10 feet or less.

5.12 Underground Storage Tank

An underground storage tank is a container used to house liquid substances for preservation, treatment and use at a future date

5.12.1 Underground Storage Foundation Support

Proposed prefabricated storage tank may be supported on 12 inches of gravel resting on competent natural subgrade soil. Continuous or mat footing may be designed for a net allowable bearing value of 2,000 pounds per square foot.

Recommended bearing values are for dead plus live loads and may be increased one-third for combined dead, live, and temporary forces.

5.12.2 Lateral Resistance

Resistance to lateral loading may be provided by friction acting on the base of foundations. A coefficient of friction of 0.4 may be applied to dead load forces. Passive resistance on the sides of foundation equal to 300 pcf of equivalent fluid density may be included for resistance to lateral loads. However, when passive resistance is used in conjunction with friction, the coefficient of friction should be reduced by one-third (1/3) in determining the total lateral resistance.

A one-third (1/3) increase in the quoted passive value may be used when considering transient loads such as seismic or wind forces.

5.12.3 Retaining Conditions

The underground storage tank sidewalls should be designed for an at-rest earth pressure of 60 psf per foot of depth below grade for a level backfill. The tank walls should be provided with a backdrain. A vertical column of crushed rock should be placed adjacent to the wall with a minimum width of 12 inches. The backdrain should be a minimum 4-inch diameter perforated pipe with the holes placed downward. The crushed rock should be separated from the excavation by filter fabric. Any remaining void between the cut and the wall may be filled with gravel or crushed rock, if the void is less than 18 inches in width. The gravel backfill should be placed in lifts no thicker than 2 feet and compacted with vibratory equipment.

Proper drainage devices should be installed to prevent surface drainage from ponding and for directing subdrains to suitable drainage system to protect against seepage water, the storage tank wall can be waterproofed and designed to resist and/or a sump pump system can be provided against the wall. These measures may include the use of a sump pump system.

5.12.4 Stability of Adjacent Properties

The Contractor should be made responsible for maintaining the stability of all excavations, avoiding any impact on adjacent properties and utilities and complying with all applicable safety regulations and City of Palmdale shoring requirements. Due to competent natural subgrade soil, stable excavation slopes may be maintained. However, this can only be assessed during construction.

5.12.5 Temporary Excavations

Temporary shoring will be needed for the main vault/or tank construction. The Contractor should be made fully responsible for adequate support of the excavation at all times. Temporary support of excavation structures plans should be designed by a Professional Engineer licensed in the State of California and experienced in such work and these plans should be reviewed and approved by the City of Palmdale, if necessary.

The size of the underground storage tank is not yet known to us, however, 2 feet of clear distance on all sides for backfill plus the 1' leveling base of gravel, the clear excavation size should be estimated.

For temporary shoring design, it is recommended to use an active pressure of 35 psf/ft and a passive pressure of 350 psf/ft. No groundwater was encountered during our boring. It is also recommended to use an equivalent surcharge of 2' of additional soil height to account for traffic surcharge, if any.

6.0 GENERAL COMMENTS AND LIMITATIONS

6.1 Plan Review

Final project plans should be reviewed by this office prior to construction, so that construction is in accordance with the conclusions and recommendations of this report. Based on our review, supplemental recommendations and/or further geotechnical studies may be warranted.

6.2 Geotechnical Observation and Testing

All footing trenches for the proposed structure should be observed by a representative of this firm to verify that they were excavated into competent bearing soils per the recommendations of this report as well as to the minimum depths recommended above. These observations should be performed prior to the placement of forms or reinforcement. The excavations should be trimmed neat, level and square. All loose, sloughed or moisture softened soil should be removed prior to placing concrete.

6.3 Construction Verification Procedure

Construction of foundations and placement of engineered fill should be done under the observation and documentation of a representative of the project Geotechnical Engineer. The following are noted as items requiring verification during construction.

Pre-Grading Meeting:

A pre-grading meeting should be held prior to the start of any grading activities. Attendees of this meeting should include the Owner, the Architect, the Geotechnical Engineer, and the Contractor, to review procedures and scheduling.

Footing Observations:

Construction of foundation and slab should be performed under inspection of the Geotechnical Engineer. Footings should be observed and certified by Geotechnical Engineer of Record after excavation and prior to placement of reinforcing bars.

Earthwork Observations:

Relative compaction of all fill materials placed on site should be tested in accordance with ASTM D6938. All new fill shall be brought to near optimum moisture, placed in layers not exceeding six inches in thickness, and compacted to at least 90 percent relative compaction for subgrade and 95 percent relative compaction for aggregate base. No jetting or water tamping of fill soils shall be permitted. All imported soil for engineered fill should be pre-approved by the Geotechnical Engineer and consist of clean, granular, non-expansive soil, free of vegetation and other debris with an Expansion Index of 20 or less.

At all times, the contractor should have a responsible field superintendent on the project in full charge of the work, with authority to make decisions. He should cooperate fully with the Geotechnical Engineer in carrying out the work.

All footing trenches for continuous and spread footings and subgrade for the slab areas should be observed by the project Geotechnical Engineer to verify that over-excavation and re-compaction operations of adequate depth, thickness, and compaction have been performed as specified. All footing excavations should be trimmed neat, level and square. All loose, sloughed or moisture softened soil should be removed and replaced with properly compacted soil.

6.4 Recommendations for Construction

Surveying: The contractor shall set necessary stakes to verify lines and grades as shown on the plan.

Changed Conditions: Any changed conditions not found during exploration should be brought to the attention of the soil engineer. As a result of the changed conditions, the soil engineer will provide further recommendations.

Site Drainage: The site should be sloped to direct water away from all structures and divert to a positive drainage device at the street. Roof gutters and down spouts shall be provided for roof drainage. Down spouts shall be connected to the positive area drains.

Footing and Utilities Trenches. All the Footing excavations as well as utility trenches should be observed by a representative of Geotechnical Solutions, prior to placement of steel.

6.5 Limitations

This report is issued with the understanding that it is the responsibility of the owner or his representative to see that the information and recommendations contained herein are called to the attention of the other members of the design team for the project and that the applicable information is incorporated into the plans, and that the necessary steps are taken to see that the contractors and the subcontractors carry out such recommendations. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or in part, by changes outside of our control. The validity of the recommendations of this report assumes that Geotechnical Solutions, Inc. will be retained to provide construction monitoring services. The scope of our services did not include any investigation for the presence or absence of hazardous or toxic materials.

6.6 Closure

The Conclusions and recommendations contained herein are based on the findings and observations made at the test boring locations. It is not unusual to find conditions between and beyond such locations, which differ from the conditions encountered. If conditions are encountered during construction, which appear to differ from those previously disclosed, this office should be notified so as to consider the need for modifications. On-site construction observations and wherever appropriate, tests should be performed during the course of construction by a representative of this office to evaluate compliance with the design concepts, specifications, and recommendations contained herein.

This report has been compiled for the exclusive use of our client, it shall not be transferred to, or used by, other parties, or applied to any project on this site other than described herein without consent and /or thorough review by this office.

Geotechnical Solutions, Inc.

References

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http://wdl.water.ca.gov.

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U.S.G.S., Design Maps Summary & Detailed Report:

**http://ehp4-earthquake.cr.usgs.gov/designmaps/us/summary.php &
http://ehp4-earthquake.cr.usgs.gov/designmaps/us/report.php**

2008 National Seismic Hazard Maps – Source Parameters.
https://earthquake.usgs.gov/cfusion/hazfaults_2008_search/query_results.cfm

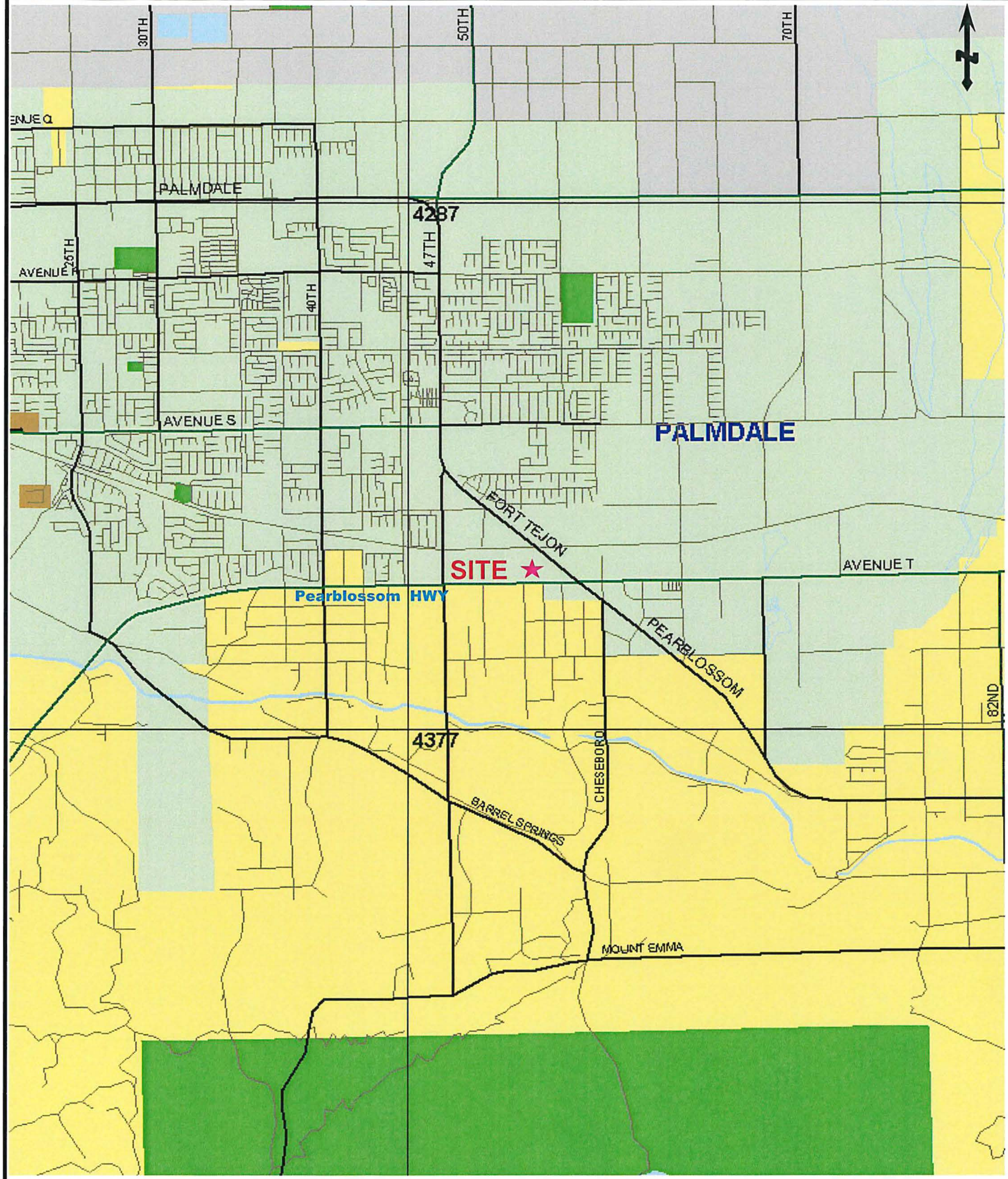
U.S.G.S., Earthquake Hazards Program, Unified Hazard Tool – Interactive Hazard Curve and Interactive Deaggregation web Site.
https://earthquake.usgs.gov/hazards/interactive/

Appendix A

Plates:

- Site Vicinity Map
- Plot Plan and Boring Location Map
- Topographic Map
- Google Map
- Site Regional Geology Map
- Seismic Hazard Map
- Historical High Groundwater (CGS)
- Ground Water Map - Well Data
- Historical High Groundwater (CGS Data)
- Quaternary Geology
- Log of Test Holes
- Direct Shear Tests
- Consolidation Tests

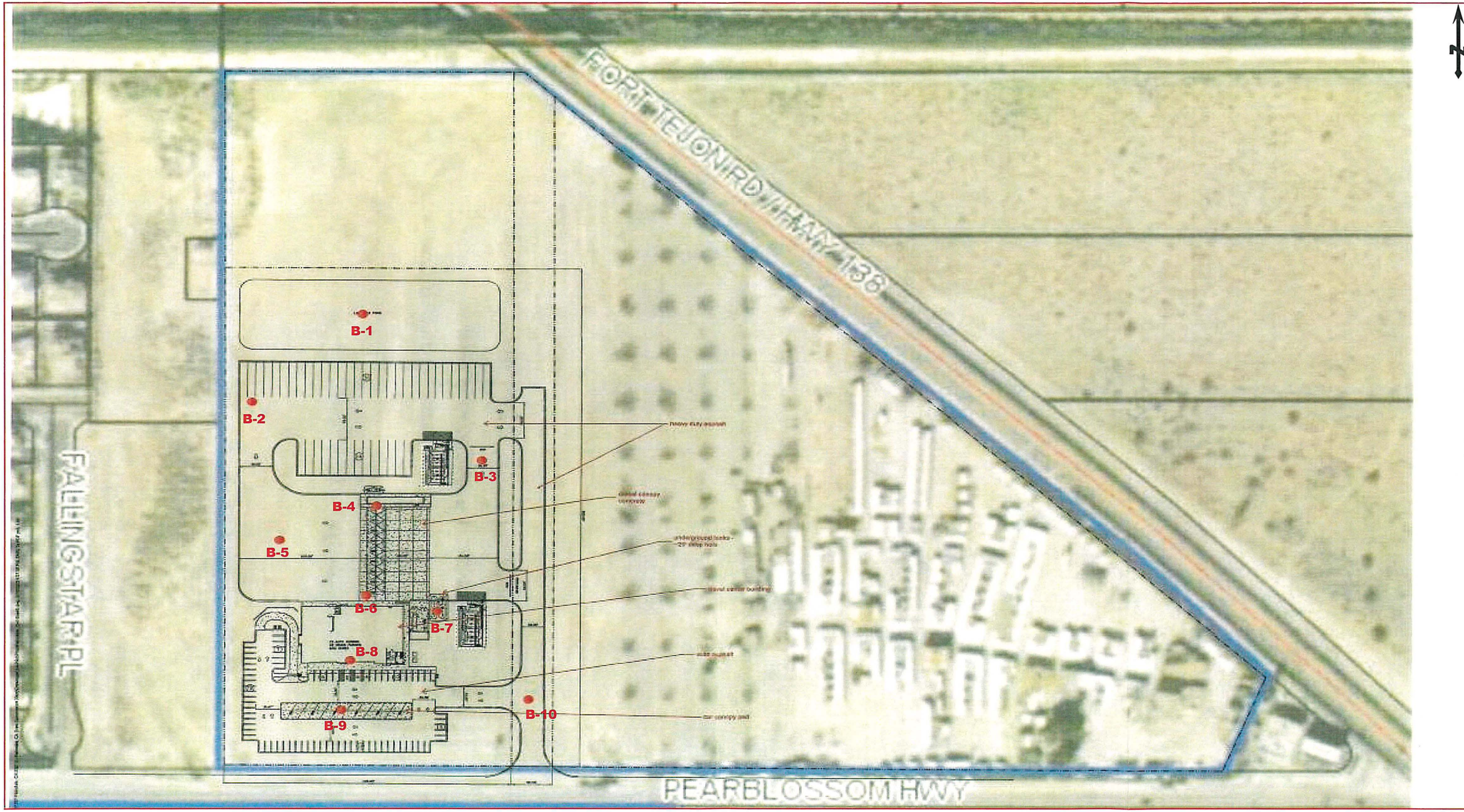
VICINITY MAP



Palmdale Civil Base 9 Model	Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA	Plate:	A

Geotechnical Solutions, Inc.

PLOT PLAN AND BORING LOCATION MAP



Test Borings

B-10

Approximate Scale: 1' = 40'

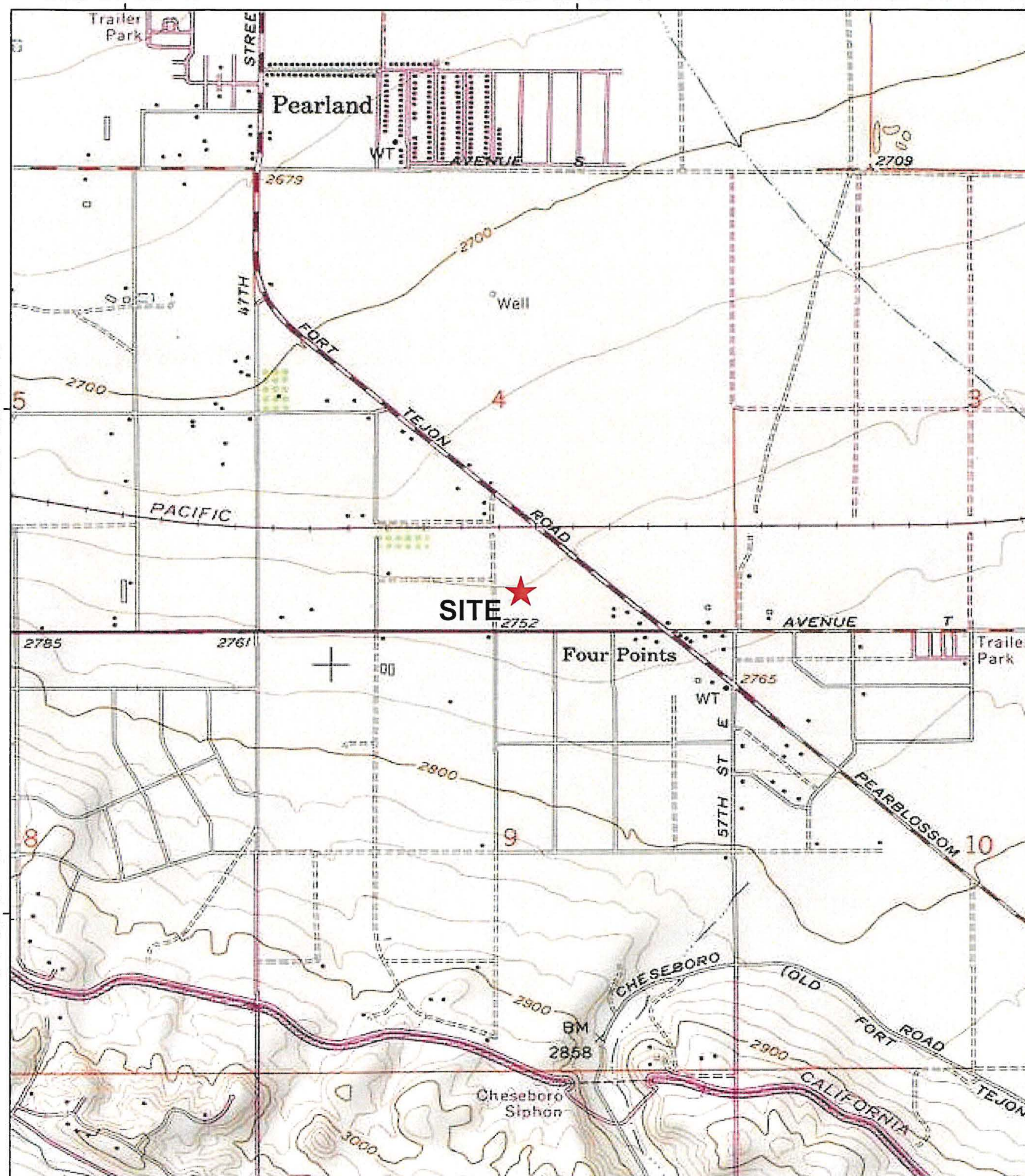
Palmdale Civil Base 9 Model		Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate:	B
Geotechnical Solutions, Inc.			

TOPOGRAPHIC MAP

118°03'00" W 118°02'00" W WGS84 118°01'00" W

34°33'00" N

34°32'00" N



118°03'00" W 118°02'00" W WGS84 118°01'00" W

TN MN 13°

0 .5 1 MILE

0 1000 FEET 0 500 1000 METERS

Scale 1" = 2,000'

Palmdale Civil Base 9 Model	Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA	Plate:	C

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GOOGLE MAP

Palmdale Civil Base 9 Model		Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate:	D

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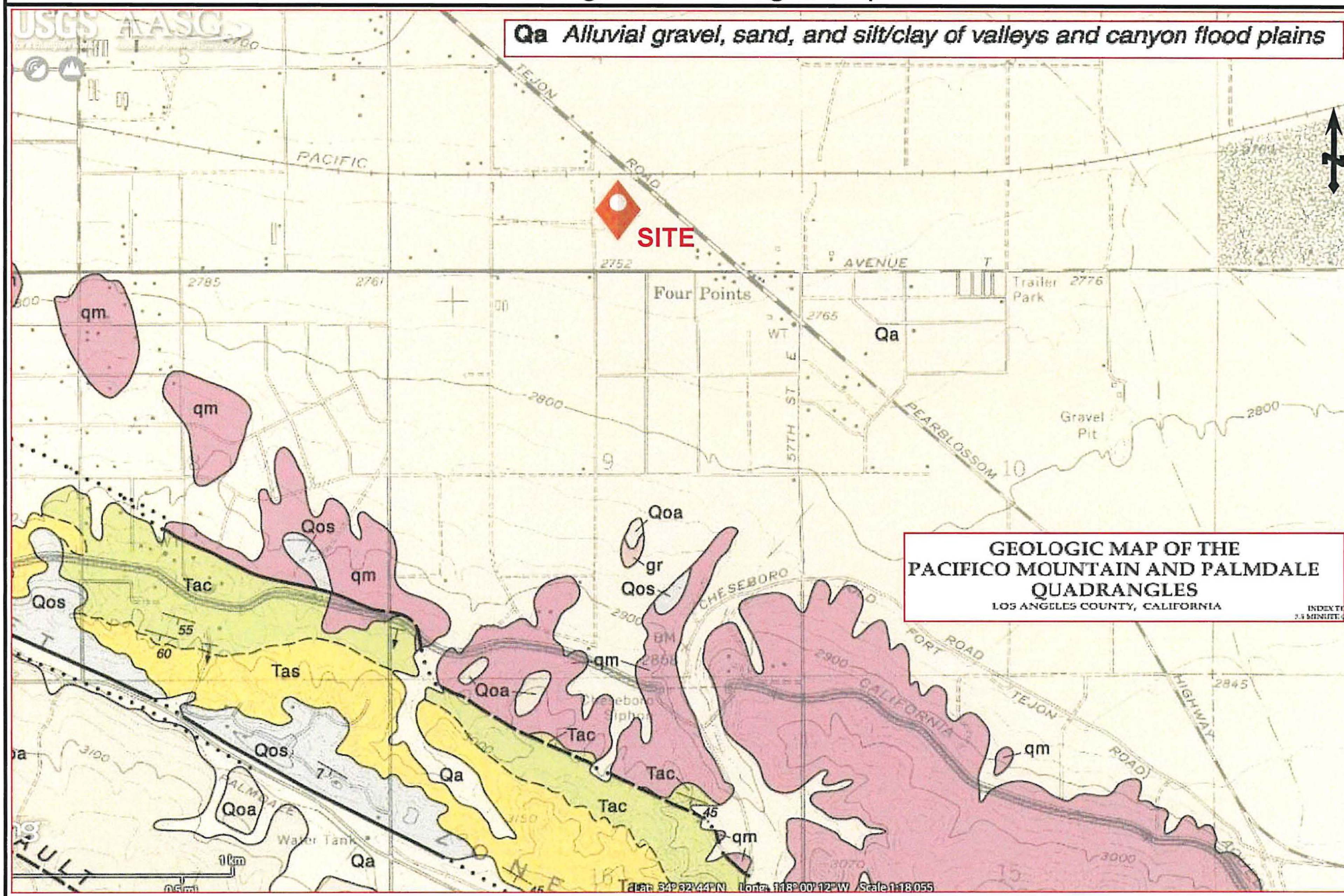
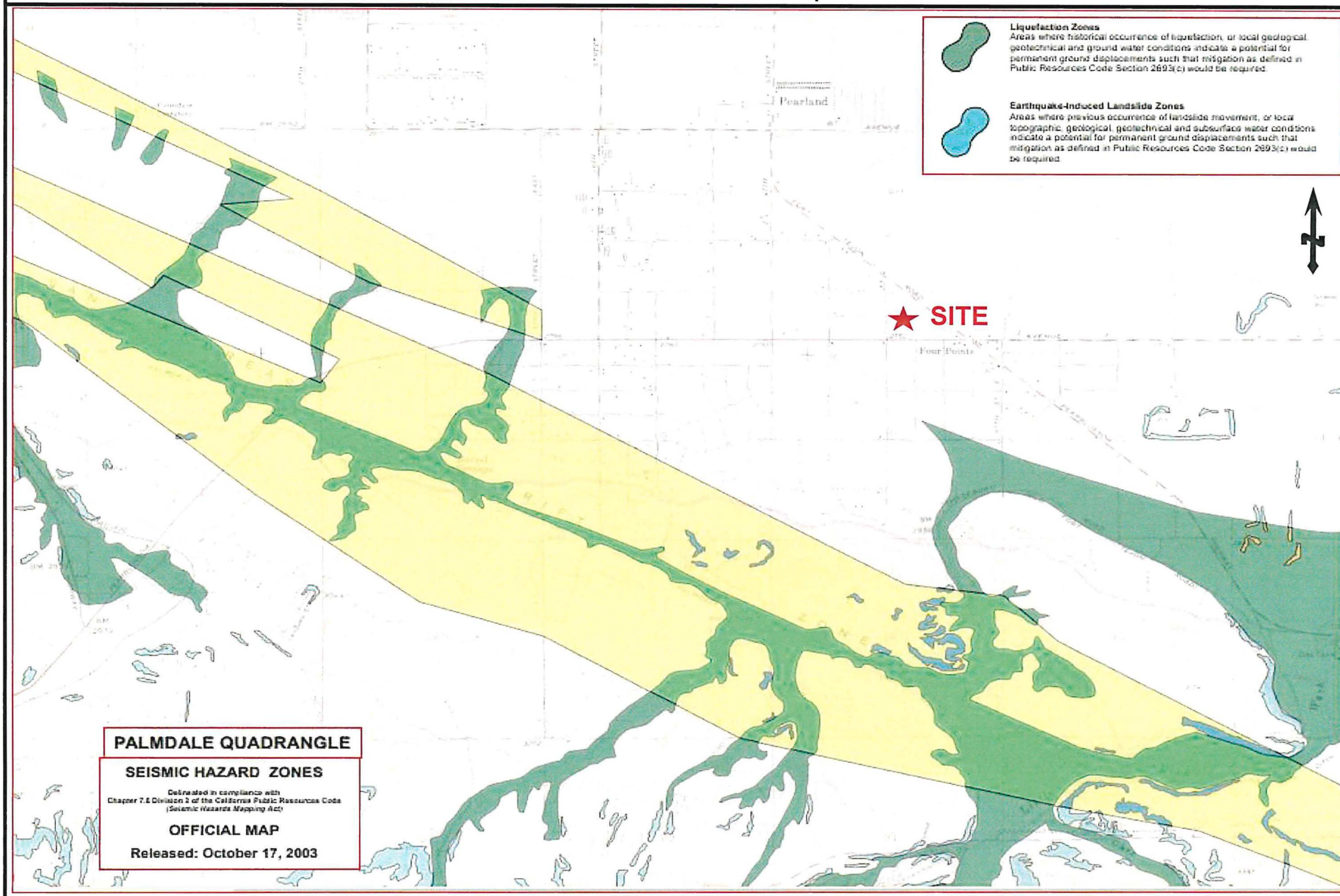
Site Regional Geologic Map



Palmdale Civil Base 9 Model	Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA	Plate:	E

Geotechnical Solutions, Inc.

Seismic Hazard Map



Palmdale Civil Base 9 Model	Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA	Plate:	F

Geotechnical Solutions, Inc.

Highest Ground Water Map - CGS Palmdale Quadrangle

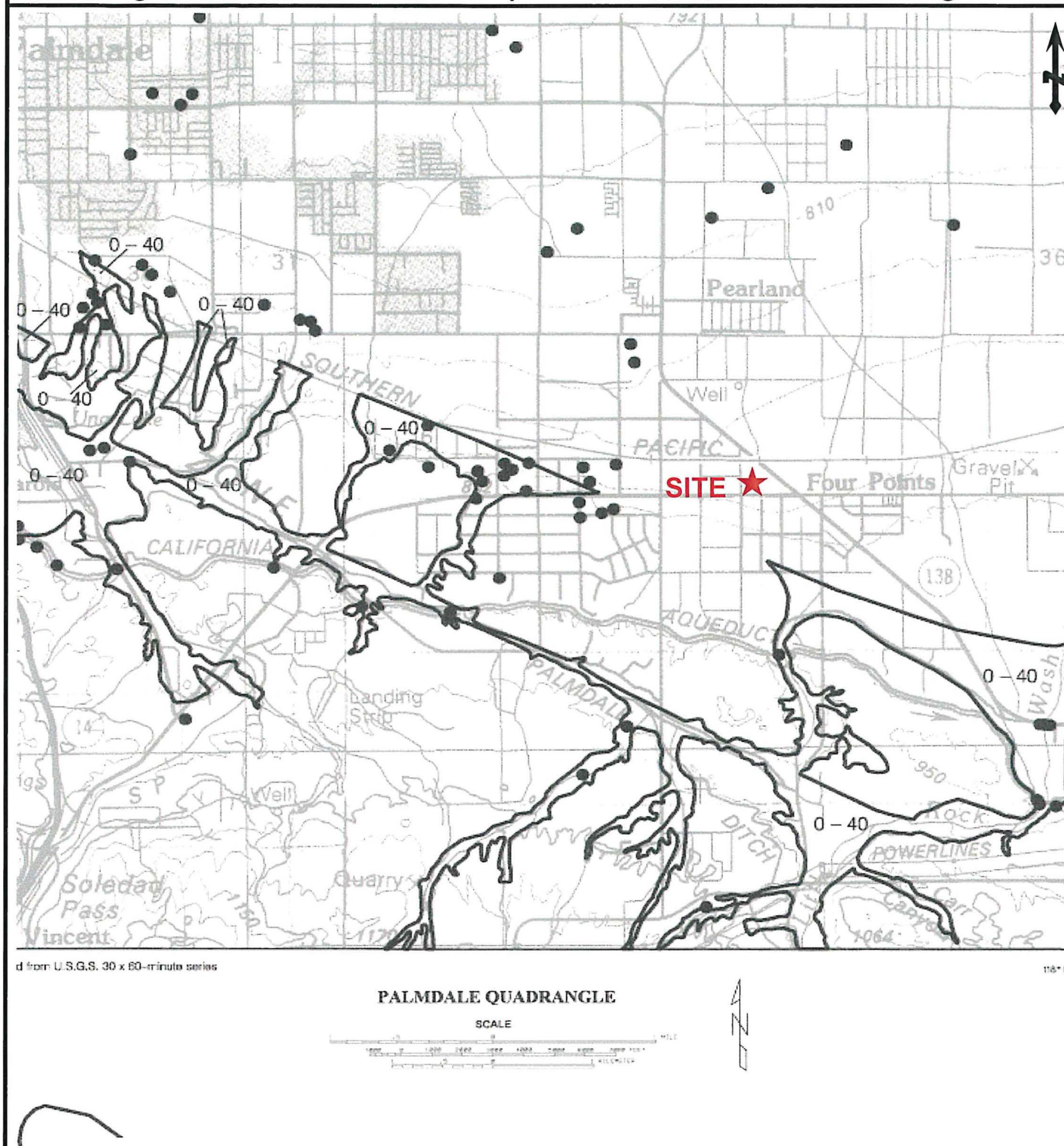


Plate 1.2 Historically Highest Ground Water Contours and Borehole Log Data Locations. Long Beach Quadrangle.

● Borehole Site

30 Depth to ground water in feet

X Site of historical earthquake-generated liquefaction. See "Areas of Past Liquefaction" discussion in text.

Palmdale Civil Base 9 Model		Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate:	G-1

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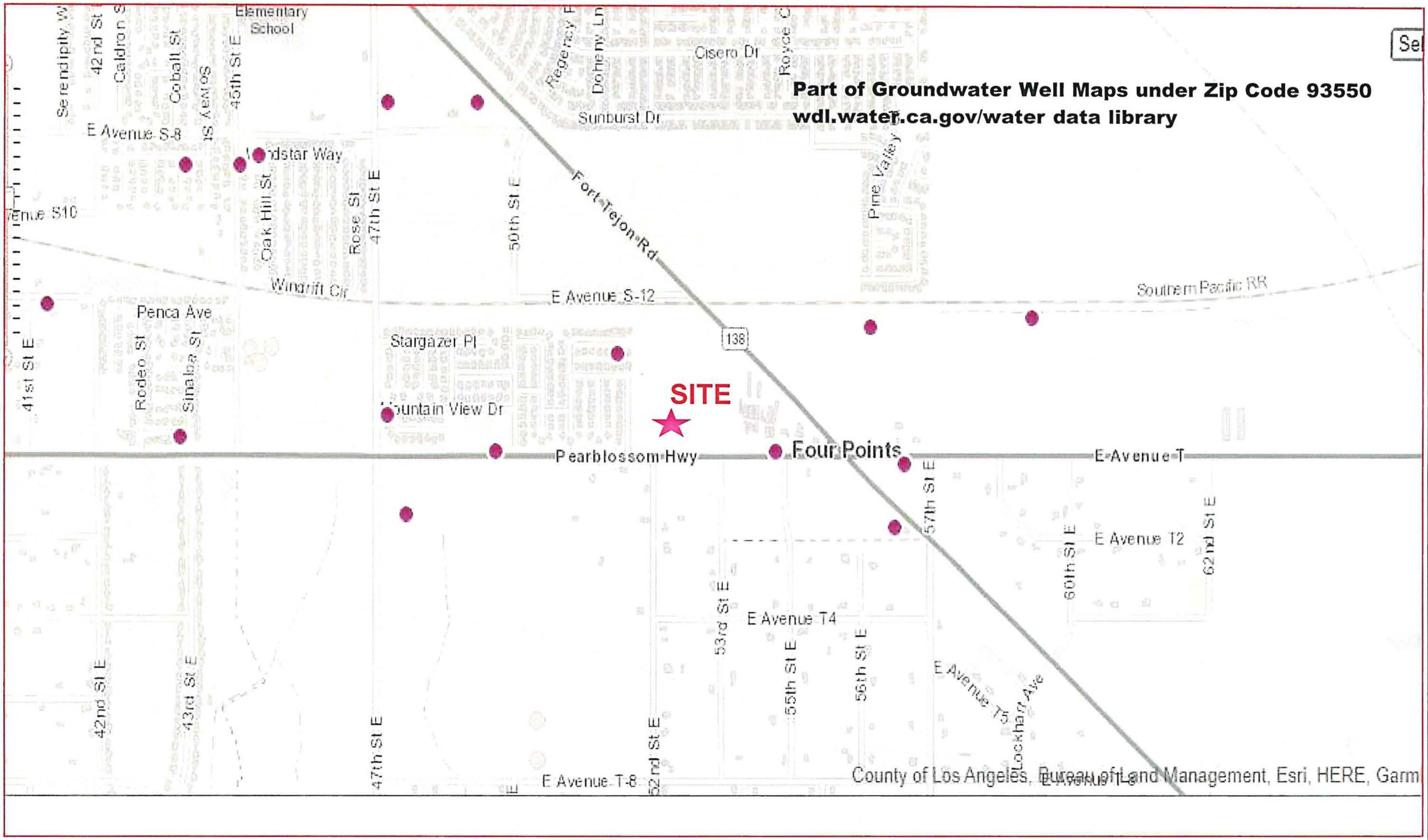
GROUNDWATER WELL LOCATION MAP



Palmdale Civil Base 9 Model	Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA	Plate:	G-2

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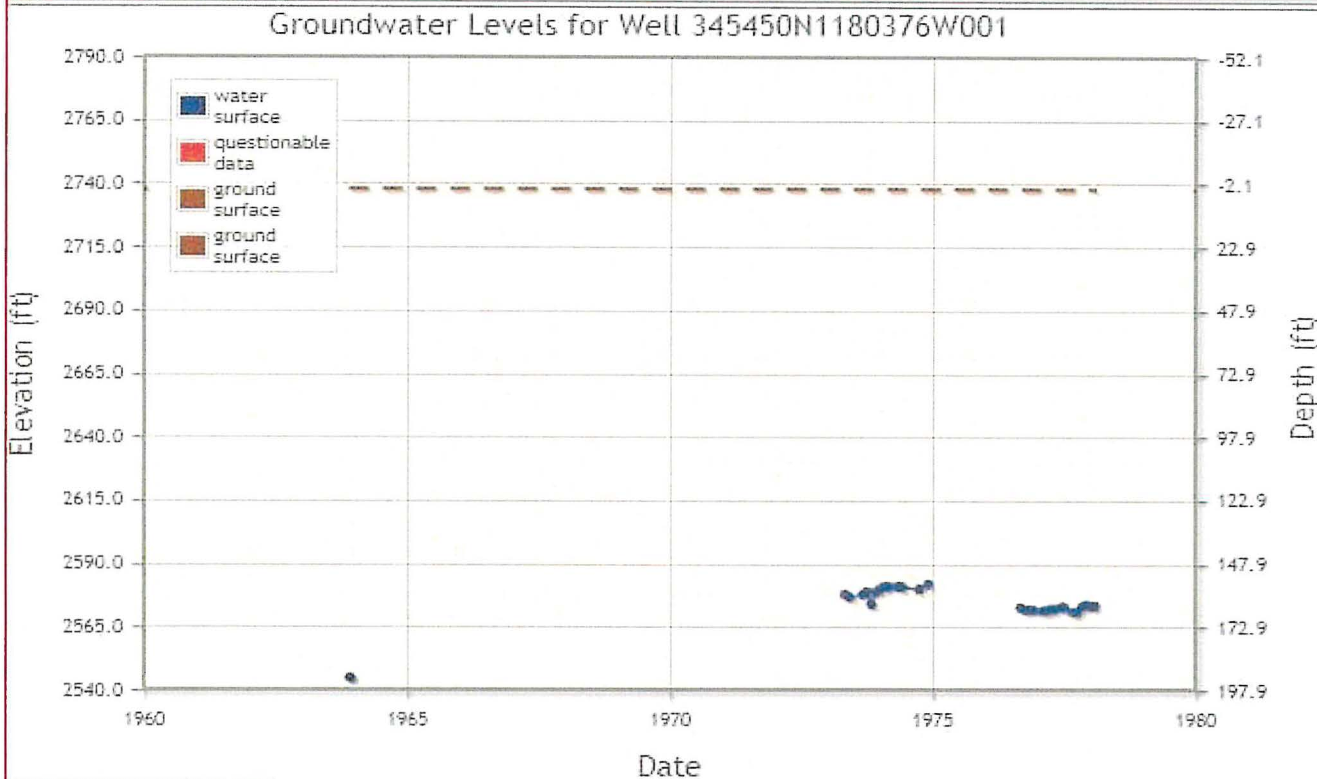
GROUNDWATER MAP - WELL DATA

Station Data | Recent Groundwater Level Data | Historical Groundwater Level Data



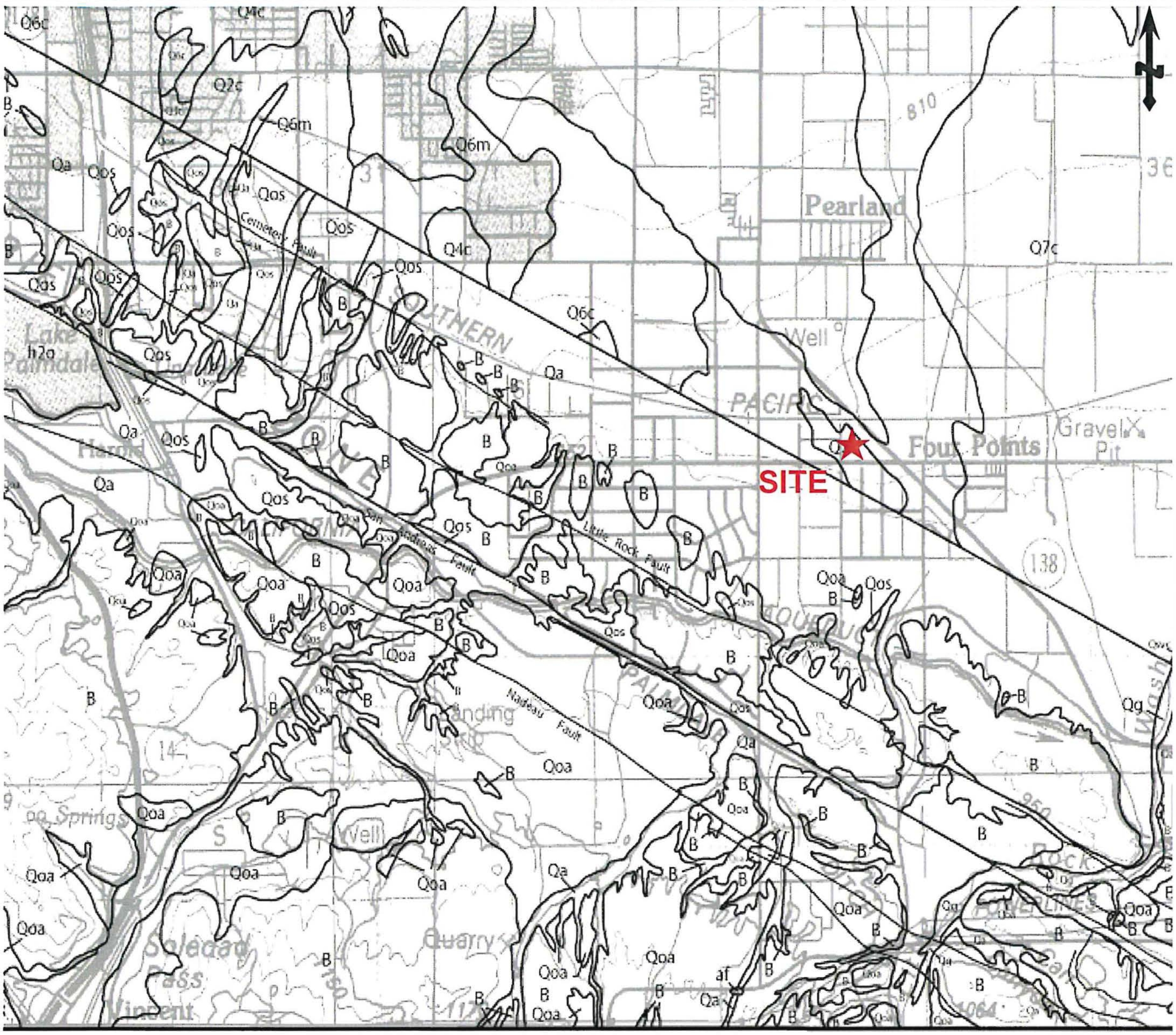
Download CSV File

Date	RPE	GSE	RPWS	WSE	GS to WS	Msmt Code	CASGEM Msmt	Agency	Comments
12/01/1963 00:00	2737.860	2737.860	193	2544.86	193		N	5167	
12/03/1963 00:00	2737.860	2737.860	193.25	2544.61	193.25		N	5167	

Palmdale Civil Base 9 Model	Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA	Plate:	G-3

Geotechnical Solutions, Inc.

Quaternery Geologic Map - Palmdale Quadrangle



ase map enlarged from U.S.G.S. 30 x 60-minute series

118

PALMDALE QUADRANGLE

= Pre-Quaternary bedrock.

See "Bedrock and Surficial Geology" in Section 1 of report for descriptions of units.

te 1.1 Quaternary Geologic Map of the Palmdale 7.5-Minute Quadrangle, California.

Palmdale Civil Base 9 Model	Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA	Plate:	H

Geotechnical Solutions, Inc.

Project :	Palmdale Civil Base 9 Model	LOG OF TEST HOLE	Borehole No.	B-1
Project Location :	Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate No.	I-1
Project Number :	G-5729-01		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						**Bareground / Gravel**				
			Bag #1				SAND (SP), gray, slightly moist, fine to medium			19	HD: 81(SA):16(SI):3(CL
	2										DS: P=Peak / Ult=Ultimate
			C-1	8-9-11		20	@2': SAND, fine to medium gray, slightly moist, medium dense	5	112		$\phi = 34^0$, c = 200 psf (P) $\phi = 33^0$, c = 150 psf (Ult)
830	5										
			C-2	5-5-6		11	@5':Sand (SP), fine to very fine, light brown, moist, loose	9	103		
825	10										
			C-3	10-16-27		43	@10': Beach Sand (SP), light gray, moist, medium dense	2	114		
							End of Boring = 11.5 feet No groundwater encountered No Caving but possible for bigger diameter hole				
820	15										
815	20										
810	25										
805	30										
800	35										
795	40										
790	45										

Project :	Palmdale Civil Base 9 Model	LOG OF TEST HOLE	Borehole No.	B-2
Project Location :	Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate No.	I-2
Project Number :	G-5729-01		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						**Bareground / Gravel**				
			Bag #1				SAND (SP), silty,medium brown, moist, fine to medium				
	2		C-1	5-3-3		6	@2': SAND, fine to medium gray, slightly moist, medium dense	8	108		
	4										
830	5		C-2	5-6-8		14	@5':Sand (SP), fine to very fine, light brown, moist, medium dense	8	116		
825	10		C-3	6-9-14		23	@10': Beach Sand (SP), light gray, moist, medium dense	2	110		
820	15						End of Boring = 11.5 feet No groundwater encountered No Caving but possible for bigger diameter hole				
815	20										
810	25										
805	30										
800	35										
795	40										
790	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	Palmdale Civil Base 9 Model	LOG OF TEST HOLE	Borehole No.	B-3
Project Location :	Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate No.	I-3
Project Number :	G-5729-01		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						**Bareground / Gravel**				
			Bag #1				SAND (SP), silty,medium brown, moist, fine to medium				
	2		C-1	3-4-4		8	@2': SAND, fine to medium gray, slightly moist, medium dense	12	102		
	4										
830	5		C-2	4-5-8		13	@5':Sand (SP), fine to very fine, light brown, moist, medium dense	15	100		
825	10		C-3				@10': Beach Sand (SP), light gray, moist, medium dense	-	-		
							End of Boring = 11.5 feet No groundwater encountered No Caving but possible for bigger diameter hole				
820	15										
815	20										
810	25										
805	30										
800	35										
795	40										
790	45										

Project :	Palmdale Civil Base 9 Model	LOG OF TEST HOLE	Borehole No.	B-4
Project Location :	Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate No.	I-4
Project Number :	G-5729-01		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						**Bareground / Gravel**				
			Bag #1				SAND (SP), silty,medium brown, moist, fine to medium				
	2		C-1	3-3-4		7	@2': SAND, fine to medium gray, slightly moist, medium dense	10	106		
	4										
830	5		C-2	4-6-10		16	@5':Sand (SP), fine to very fine, light brown, moist, medium dense	3	113		
825	10		C-3				@10': Beach Sand (SP), light gray, moist, medium dense	-	-		
							End of Boring = 11.5 feet No groundwater encountered No Caving but possible for bigger diameter hole				
820	15										
815	20										
810	25										
805	30										
800	35										
795	40										
790	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	Palmdale Civil Base 9 Model	LOG OF TEST HOLE	Borehole No.	B-5
Project Location :	Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate No.	I-5
Project Number :	G-5729-01		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						**Bareground / Gravel**				
			Bag #1				SAND (SP), silty,medium brown, moist, fine to medium				
	2		C-1	3-2-3		5	@2': SAND, fine to medium gray, slightly moist, medium dense	7	106		
830	5		C-2	4-6-6		12	@5':Sand (SP), fine to very fine, light brown, moist, medium dense	6	117		
825	10		C-3	5-7-9		16	@10': Beach Sand (SP), light gray, moist, medium dense	-	-		
820	15						End of Boring = 11.5 feet No groundwater encountered No Caving but possible for bigger diameter hole				
815	20										
810	25										
805	30										
800	35										
795	40										
790	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	Palmdale Civil Base 9 Model	LOG OF TEST HOLE	Borehole No.	B-6
Project Location :	Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate No.	I-6
Project Number :	G-5729-01		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Penetration Resistance, Blows / 6"	SAMPLES: Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						**Bareground / Gravel**				
			Bag #1				SAND (SP), silty,medium brown, moist, fine to medium				
	2		C-1	10-11-12		23	@2': SAND, fine to medium gray, slightly moist, medium dense	-	-		
830	5		C-2	5-7-8		15	@5':Sand (SP), fine to very fine, light brown, moist, medium dense	-	-		
825	10		C-3	11-15-25		40	@10': Beach Sand (SP), light gray, moist, medium dense	-	-		

End of Boring = 11.5 feet
No groundwater encountered
No Caving but possible for bigger diameter hole

GEOTECHNICAL SOLUTIONS, INC.

Project :	Palmdale Civil Base 9 Model	LOG OF TEST HOLE	Borehole No. B-7
Project Location :	Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate No. I-7
Project Number :	G-5729-01		Page 1 of 1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						Bareground / Gravel				
			Bag #1				SAND (SP), silty,medium brown, moist, fine to medium				
	2		C-1				@2': SAND, fine to medium gray, slightly moist, medium dense	7	115		
	4										
830	5		C-2	5-7-11		18	@5':Sand (SP), fine to very fine, light brown, moist, medium dense	6	114		
825	10		C-3	17-30-38		68	@10': Beach Sand (SP), light gray, moist, medium dense	7	127		
820	15		C-4	21-27-36		63		5	114		
815	20		S-1	11-18-19		37	20': Same as above	4	-		
810	25		S-2	17-50/5"		>100	No Sample	5			
805	30		S-3	37/50/5"		>100	No Sample	5			
800	35							5			
			S-4	22-27-49		76	@35': Beach Sand (SP), light gray, moist, very dense				
795	40						@40': Same as above	5			
790	45						End of Boring = 41.5 feet No groundwater encountered No Caving but possible for bigger diameter hole				

GEOTECHNICAL SOLUTIONS, INC.

Project :	Palmdale Civil Base 9 Model	LOG OF TEST HOLE	Borehole No.	B-8
Project Location :	Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate No.	I-8
Project Number :	G-5729-01		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Penetration Resistance, Blows / 6"	SAMPLES: Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						**Bareground / Gravel**				DS: P=Peak / Ult=Ultimate
			Bag #1				SAND (SP), silty,medium brown, moist, fine to medium				$\phi = 35^0$, c = 250 psf (P)
	2		C-1	2-5-7		12	@2': SAND, fine to medium gray, slightly moist, medium dense	6	112		$\phi = 34^0$, c = 200 psf (Ult) Remolded
830	5		C-2	7-7-7		14	@5':Sand (SP), fine to very fine, light brown, moist, medium dense	3	114		
825	10		C-3	6-6-8		14	@10': Beach Sand (SP), light gray, moist, medium dense	8	115		
820	15		C-4	21-27-36		63	@15': Same as above	8	-		
815	20		S-1	9-15-15		30	@20': Same as above	4	-		
810	25							5			
805	30		S-3	37/50/5"		>100	@30': Same as above	5			
800	35						End of Boring = 31.5 feet No groundwater encountered No Caving but possible for bigger diameter hole				
795	40										
790	45										

GEOTECHNICAL SOLUTIONS, INC.

Project :	Palmdale Civil Base 9 Model	LOG OF TEST HOLE	Borehole No.	B-9
Project Location :	Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate No.	I-9
Project Number :	G-5729-01		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						Gravel				
			Bag #1				SAND (SP), silty,medium brown, moist, fine to medium				
	2		C-1	2-5-7		12	@2': SAND, fine to medium gray, slightly moist, medium dense	6	112		
	4										
830	5		C-2	7-7-7		14	@5':Sand (SP), fine to very fine, light brown, moist, medium dense	3	114		
825	10		C-3	6-6-8		14	@10': Beach Sand (SP), light gray, moist, medium dense	8	115		
820	15						End of Boring = 11.5 feet No groundwater encountered No Caving but possible for bigger diameter hole				
815	20										
810	25										
805	30										
800	35										
795	40										
790	45										

Project :	Palmdale Civil Base 9 Model	LOG OF TEST HOLE	Borehole No.	B-10
Project Location :	Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA		Plate No.	I-10
Project Number :	G-5729-01		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						Gravel				
			Bag #1				SAND (SP), silty,medium brown, moist, fine to medium				
	2		C-1	2-5-7		12	@2': SAND, fine to medium gray, slightly moist, medium dense	6	112		
830	5		C-2	7-7-7		14	@5':Sand (SP), fine to very fine, light brown, moist, medium dense	3	114		
825	10		C-3	6-6-8		14	@10': Beach Sand (SP), light gray, moist, medium dense	8	115		
820	15						End of Boring = 11.5 feet No groundwater encountered No Caving but possible for bigger diameter hole				
815	20										
810	25										
805	30										
800	35										
795	40										
790	45										

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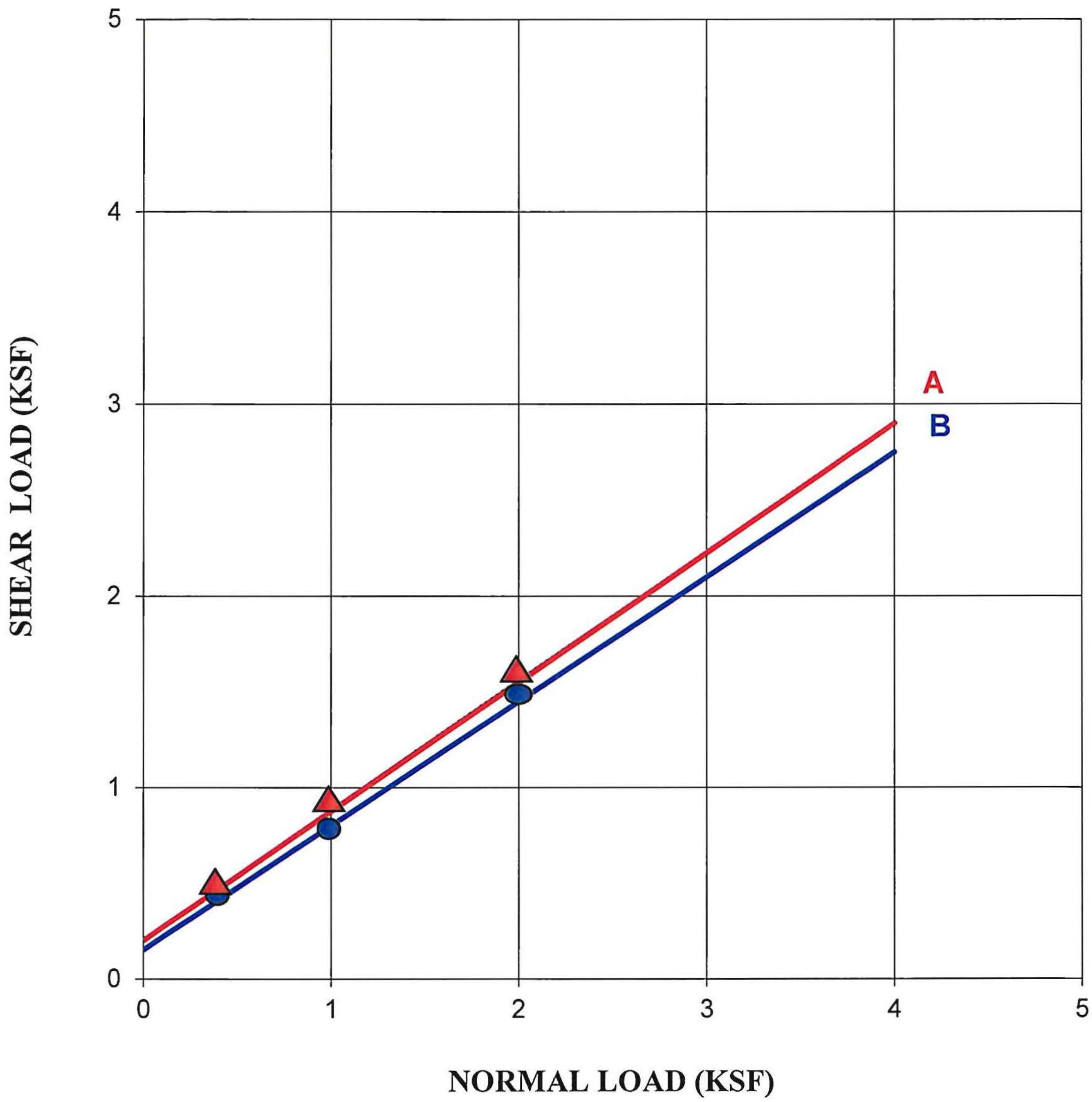
DIRECT SHEAR

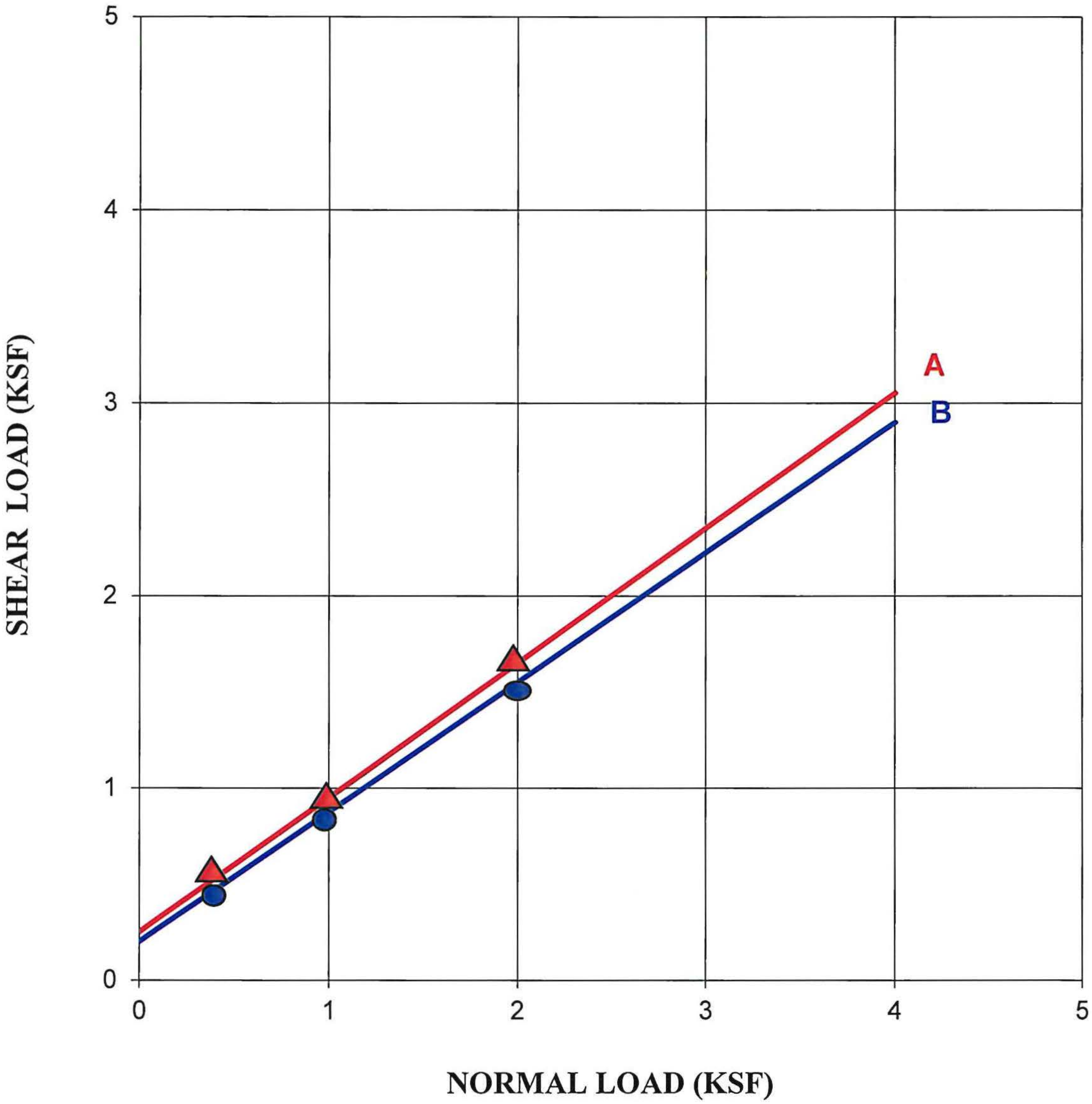


SYMBOL	LOCATION	DEPTH (FT)	TEST CONDITION		COHESION (PSF)	FRICTION (DEG)
A	Boring B-1	2'	Saturated - Drained	Peak	200	34
B	Boring B-1	2'	Saturated - Drained	Ultimate	150	33

Palmdale Civil Base 9 Model	Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA	Plate:	J-1

Geotechnical Solutions, Inc.

DIRECT SHEAR



SYMBOL	LOCATION	DEPTH (FT)	TEST CONDITION		COHESION (PSF)	FRICTION (DEG)
A	Boring B-8	0-3'	Remolded to 90%	Peak	250	35
B	Boring B-8	0-3'	ASTM D-1557	Ultimate	200	34

Palmdale Civil Base 9 Model	Project No.	G-5729-01
Northeast of Falling Star Place and PearBlossom Highway, Palmdale, CA	Plate:	J-2

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Appendix B

Seismic Data

- Table 1 - Faults Table
- Unified Hazard Tool – Hazard Curve
- U.S. Seismic Design Maps Summary & Detailed Report (SEAOC / OSHPD)

TABLE - 1
2008 National Seismic Hazard Maps - Source Parameters
Palmdale - Civil Base 9 Model

Distance in Miles	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
1.51	S. San Andreas;NM+SM	CA	n/a	90	V	strike slip	0	14	134
1.51	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	263
1.51	S. San Andreas;NM+SM+NSB+SSB+BG	CA	n/a	83		strike slip	0	14	271
1.51	S. San Andreas;NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	213
1.51	S. San Andreas;CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	306
1.51	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	512
1.51	S. San Andreas;SM	CA	29	90	V	strike slip	0	13	98
1.51	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	384
1.51	S. San Andreas;NM+SM+NSB	CA	n/a	90	V	strike slip	0	13	170
1.51	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14	321
1.51	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0	14	442
1.51	S. San Andreas;CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	243
1.51	S. San Andreas;CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	279
1.51	S. San Andreas;SM+NSB+SSB+BG+CO	CA	n/a	83		strike slip	0.1	13	303

1.51	S. San Andreas;SM+NSB+SSB+BG	CA	n/a	81		strike slip	0	13	234
1.51	S. San Andreas;SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	176
1.51	S. San Andreas;SM+NSB	CA	n/a	90	V	strike slip	0	13	133
1.51	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	220
1.51	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	548
1.51	S. San Andreas;CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	322
1.51	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13	479
1.51	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13	421
1.51	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13	377
1.51	S. San Andreas;PK+CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0.1	13	342
1.51	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390
1.51	S. San Andreas;BB+NM+SM	CA	n/a	90	V	strike slip	0	14	184
1.51	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	85		strike slip	0	14	380
1.51	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	449
1.51	S. San Andreas;CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	341
1.51	S. San Andreas;NM+SM+NSB+SSB+BG+CO	CA	n/a	84		strike slip	0.1	13	340

20.96	San Gabriel	CA	1	61	N	strike slip	0	15	71
23.26	Clamshell-Sawpit	CA	0.5	50	NW	reverse	0	14	16
23.58	Sierra Madre	CA	2	53	N	reverse	0	14	57
23.59	Sierra Madre Connected	CA	2	51		reverse	0	14	76
23.59	Sierra Madre (San Fernando)	CA	2	45	N	thrust	0	13	18
25.4	Northridge	CA	1.5	35	S	thrust	7.4	17	33
26.36	Raymond	CA	1.5	79	N	strike slip	0	16	22
28.03	Verdugo	CA	0.5	55	NE	reverse	0	15	29
29.06	S. San Andreas;CC+BB+NM	CA	n/a	90	V	strike slip	0	15	146
29.06	S. San Andreas;PK+CH+CC+BB+NM	CA	n/a	90	V	strike slip	0.1	12	245
29.06	S. San Andreas;BB+NM	CA	n/a	90	V	strike slip	0	15	87
29.06	S. San Andreas;NM	CA	27	90	V	strike slip	0	15	37
29.06	S. San Andreas;CH+CC+BB+NM	CA	n/a	90	V	strike slip	0	14	208
30.37	Santa Susana, alt 1	CA	5	55	N	reverse	0	16	27
30.6	Holser, alt 1	CA	0.4	58	S	reverse	0	19	20
31.32	Hollywood	CA	1	70	N	strike slip	0	17	17
31.86	S. San Andreas;NSB+SSB+BG+CO	CA	n/a	79		strike slip	0.2	12	206
31.86	S. San Andreas;NSB	CA	22	90	V	strike slip	0	13	35
31.86	S. San Andreas;NSB+SSB	CA	n/a	90	V	strike slip	0	13	79
31.86	S. San Andreas;NSB+SSB+BG	CA	n/a	75		strike slip	0	14	136
31.88	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16	181
31.88	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	215
31.88	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	241
31.88	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16	88
31.88	San Jacinto;SBV	CA	6	90	V	strike slip	0	16	45
31.88	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16	134
31.88	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17	181
32.97	Elysian Park (Upper)	CA	1.3	50	NE	reverse	3	15	20
33.17	Santa Monica Connected alt 2	CA	2.4	44		strike slip	0.8	11	93
33.73	Cucamonga	CA	5	45	N	thrust	0	8	28
35.18	San Jose	CA	0.5	74	NW	strike slip	0	15	20
36.29	Cleghorn	CA	3	90	V	strike slip	0	16	25
37.83	Elsinore;W+GI+T	CA	n/a	84	NE	strike slip	0	14	124
37.83	Elsinore;W	CA	2.5	75	NE	strike slip	0	14	46

37.83	Elsinore;W+GI+T+J+CM	CA	n/a	84	NE	strike slip	0	16	241
37.83	Elsinore;W+GI	CA	n/a	81	NE	strike slip	0	14	83
37.83	Elsinore;W+GI+T+J	CA	n/a	84	NE	strike slip	0	16	199
38.88	Chino, alt 2	CA	1	65	SW	strike slip	0	14	29
39	Chino, alt 1	CA	1	50	SW	strike slip	0	9	24
39.19	Santa Monica Connected alt 1	CA	2.6	51		strike slip	0	16	79
39.19	Santa Monica, alt 1	CA	1	75	N	strike slip	0	18	14
39.2	Puente Hills (LA)	CA	0.7	27	N	thrust	2.1	15	22
39.72	Garlock;GE+GC+GW	CA	n/a	90	V	strike slip	0.3	12	256
39.72	Garlock;GC+GW	CA	n/a	90	V	strike slip	0.4	12	210
39.72	Garlock;GW	CA	6	90	V	strike slip	0.7	14	98
40.03	Newport Inglewood Connected alt 1	CA	1.3	89		strike slip	0	11	208
40.03	Newport Inglewood Connected alt 2	CA	1.3	90	V	strike slip	0	11	208
40.03	Newport-Inglewood, alt 1	CA	1	88		strike slip	0	15	65
40.56	Oak Ridge Connected	CA	3.6	53		reverse	0.6	15	94
40.56	Oak Ridge (Onshore)	CA	4	65	S	reverse	1	19	49
41.24	Simi-Santa Rosa	CA	1	60		strike slip	1	12	39
42.18	San Cayetano	CA	6	42	N	thrust	0	16	42
42.24	Puente Hills (Santa Fe Springs)	CA	0.7	29	N	thrust	2.8	15	11
43.21	Helendale-So Lockhart	CA	0.6	90	V	strike slip	0	13	114
44.87	Puente Hills (Coyote Hills)	CA	0.7	26	N	thrust	2.8	15	17
45.26	Malibu Coast, alt 2	CA	0.3	74	N	strike slip	0	16	38
45.26	Malibu Coast, alt 1	CA	0.3	75	N	strike slip	0	8	38
46.43	North Frontal (West)	CA	1	49	S	reverse	0	16	50
46.67	Anacapa-Dume, alt 2	CA	3	41	N	thrust	1.2	12	65
46.79	Lenwood-Lockhart-Old Woman Springs	CA	0.9	90	V	strike slip	0	13	145
49.57	Palos Verdes	CA	3	90	V	strike slip	0	14	99
49.57	Palos Verdes Connected	CA	3	90	V	strike slip	0	10	285
49.66	Santa Ynez Connected	CA	2	70		strike slip	0	11	132
49.66	Santa Ynez (East)	CA	2	70	S	strike slip	0	13	68

TABLE - 1
2008 National Seismic Hazard Maps - Source Parameters
Palmdale - Civil Base 9 Model

Distance in Miles	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
1.51	S. San Andreas;NM+SM	CA	n/a	90	V	strike slip	0	14	134
1.51	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	263
1.51	S. San Andreas;NM+SM+NSB+SSB+BG	CA	n/a	83		strike slip	0	14	271
1.51	S. San Andreas;NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	213
1.51	S. San Andreas;CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	306
1.51	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB +BG+CO	CA	n/a	86		strike slip	0.1	13	512
1.51	S. San Andreas;SM	CA	29	90	V	strike slip	0	13	98
1.51	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	384
1.51	S. San Andreas;NM+SM+NSB	CA	n/a	90	V	strike slip	0	13	170
1.51	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14	321
1.51	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB +BG	CA	n/a	86		strike slip	0	14	442
1.51	S. San Andreas;CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	243
1.51	S. San Andreas;CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	279
1.51	S. San Andreas;SM+NSB+SSB+BG+CO	CA	n/a	83		strike slip	0.1	13	303

1.51	S. San Andreas;SM+NSB+SSB+BG	CA	n/a	81		strike slip	0	13	234
1.51	S. San Andreas;SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	176
1.51	S. San Andreas;SM+NSB	CA	n/a	90	V	strike slip	0	13	133
1.51	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	220
1.51	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	548
1.51	S. San Andreas;CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	322
1.51	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13	479
1.51	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13	421
1.51	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13	377
1.51	S. San Andreas;PK+CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0.1	13	342
1.51	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390
1.51	S. San Andreas;BB+NM+SM	CA	n/a	90	V	strike slip	0	14	184
1.51	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	85		strike slip	0	14	380
1.51	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	449
1.51	S. San Andreas;CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	341
1.51	S. San Andreas;NM+SM+NSB+SSB+BG+CO	CA	n/a	84		strike slip	0.1	13	340

20.96	San Gabriel	CA	1	61	N	strike slip	0	15	71
23.26	Clamshell-Sawpit	CA	0.5	50	NW	reverse	0	14	16
23.58	Sierra Madre	CA	2	53	N	reverse	0	14	57
23.59	Sierra Madre Connected	CA	2	51		reverse	0	14	76
23.59	Sierra Madre (San Fernando)	CA	2	45	N	thrust	0	13	18
25.4	Northridge	CA	1.5	35	S	thrust	7.4	17	33
26.36	Raymond	CA	1.5	79	N	strike slip	0	16	22
28.03	Verdugo	CA	0.5	55	NE	reverse	0	15	29
29.06	S. San Andreas;CC+BB+NM	CA	n/a	90	V	strike slip	0	15	146
29.06	S. San Andreas;PK+CH+CC+BB+NM	CA	n/a	90	V	strike slip	0.1	12	245
29.06	S. San Andreas;BB+NM	CA	n/a	90	V	strike slip	0	15	87
29.06	S. San Andreas;NM	CA	27	90	V	strike slip	0	15	37
29.06	S. San Andreas;CH+CC+BB+NM	CA	n/a	90	V	strike slip	0	14	208
30.37	Santa Susana, alt 1	CA	5	55	N	reverse	0	16	27
30.6	Holser, alt 1	CA	0.4	58	S	reverse	0	19	20
31.32	Hollywood	CA	1	70	N	strike slip	0	17	17
31.86	S. San Andreas;NSB+SSB+BG+CO	CA	n/a	79		strike slip	0.2	12	206
31.86	S. San Andreas;NSB	CA	22	90	V	strike slip	0	13	35
31.86	S. San Andreas;NSB+SSB	CA	n/a	90	V	strike slip	0	13	79
31.86	S. San Andreas;NSB+SSB+BG	CA	n/a	75		strike slip	0	14	136
31.88	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16	181
31.88	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	215
31.88	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	241
31.88	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16	88
31.88	San Jacinto;SBV	CA	6	90	V	strike slip	0	16	45
31.88	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16	134
31.88	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17	181
32.97	Elysian Park (Upper)	CA	1.3	50	NE	reverse	3	15	20
33.17	Santa Monica Connected alt 2	CA	2.4	44		strike slip	0.8	11	93
33.73	Cucamonga	CA	5	45	N	thrust	0	8	28
35.18	San Jose	CA	0.5	74	NW	strike slip	0	15	20
36.29	Cleghorn	CA	3	90	V	strike slip	0	16	25
37.83	Elsinore;W+GI+T	CA	n/a	84	NE	strike slip	0	14	124
37.83	Elsinore;W	CA	2.5	75	NE	strike slip	0	14	46

37.83	Elsinore;W+GI+T+J+CM	CA	n/a	84	NE	strike slip	0	16	241
37.83	Elsinore;W+GI	CA	n/a	81	NE	strike slip	0	14	83
37.83	Elsinore;W+GI+T+J	CA	n/a	84	NE	strike slip	0	16	199
38.88	Chino, alt 2	CA	1	65	SW	strike slip	0	14	29
39	Chino, alt 1	CA	1	50	SW	strike slip	0	9	24
39.19	Santa Monica Connected alt 1	CA	2.6	51		strike slip	0	16	79
39.19	Santa Monica, alt 1	CA	1	75	N	strike slip	0	18	14
39.2	Puente Hills (LA)	CA	0.7	27	N	thrust	2.1	15	22
39.72	Garlock;GE+GC+GW	CA	n/a	90	V	strike slip	0.3	12	256
39.72	Garlock;GC+GW	CA	n/a	90	V	strike slip	0.4	12	210
39.72	Garlock;GW	CA	6	90	V	strike slip	0.7	14	98
40.03	Newport Inglewood Connected alt 1	CA	1.3	89		strike slip	0	11	208
40.03	Newport Inglewood Connected alt 2	CA	1.3	90	V	strike slip	0	11	208
40.03	Newport-Inglewood, alt 1	CA	1	88		strike slip	0	15	65
40.56	Oak Ridge Connected	CA	3.6	53		reverse	0.6	15	94
40.56	Oak Ridge (Onshore)	CA	4	65	S	reverse	1	19	49
41.24	Simi-Santa Rosa	CA	1	60		strike slip	1	12	39
42.18	San Cayetano	CA	6	42	N	thrust	0	16	42
42.24	Puente Hills (Santa Fe Springs)	CA	0.7	29	N	thrust	2.8	15	11
43.21	Helendale-So Lockhart	CA	0.6	90	V	strike slip	0	13	114
44.87	Puente Hills (Coyote Hills)	CA	0.7	26	N	thrust	2.8	15	17
45.26	Malibu Coast, alt 2	CA	0.3	74	N	strike slip	0	16	38
45.26	Malibu Coast, alt 1	CA	0.3	75	N	strike slip	0	8	38
46.43	North Frontal (West)	CA	1	49	S	reverse	0	16	50
46.67	Anacapa-Dume, alt 2	CA	3	41	N	thrust	1.2	12	65
46.79	Lenwood-Lockhart-Old Woman Springs	CA	0.9	90	V	strike slip	0	13	145
49.57	Palos Verdes	CA	3	90	V	strike slip	0	14	99
49.57	Palos Verdes Connected	CA	3	90	V	strike slip	0	10	285
49.66	Santa Ynez Connected	CA	2	70		strike slip	0	11	132
49.66	Santa Ynez (East)	CA	2	70	S	strike slip	0	13	68

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

^ Input

Edition

Conterminous U.S. 2008 (v3.2.x)

Latitude

Decimal degrees

34.5438

Longitude

Decimal degrees, negative values for western longitudes

-118.0354

Site Class

259 m/s (Site class D)

Spectral Period

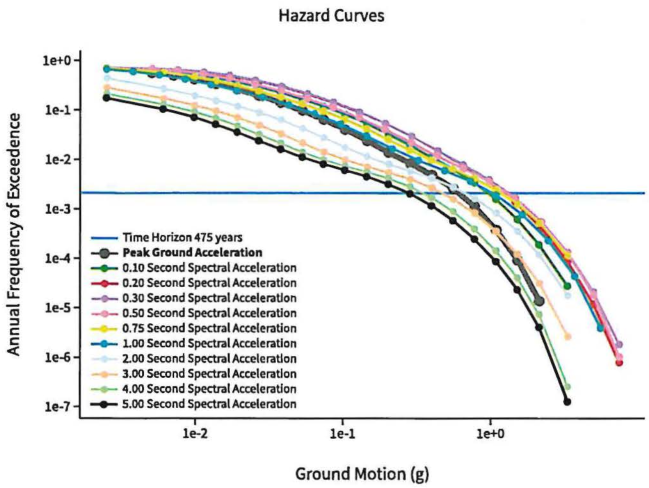
Peak Ground Acceleration

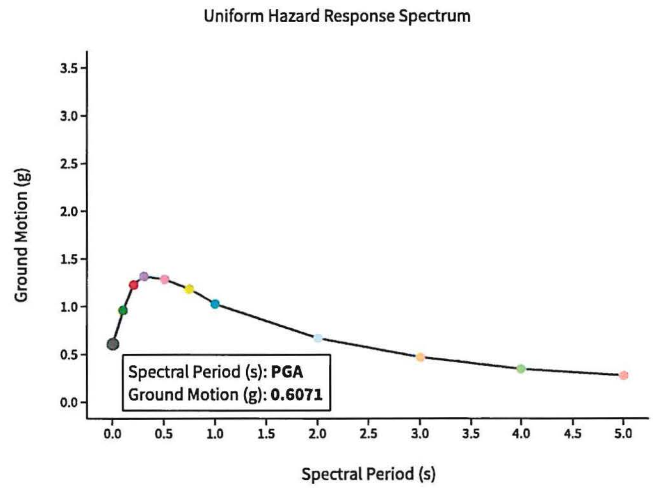
Time Horizon

Return period in years

475 Palmdale Civil Base-9 Model

Hazard Curve





View Raw Data

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Conterminous U.S. 2008 (v3.2.x)

Latitude

Decimal degrees

34.5438

Longitude

Decimal degrees, negative values for western longitudes

-118.0354

Site Class

259 m/s (Site class D)

Spectral Period

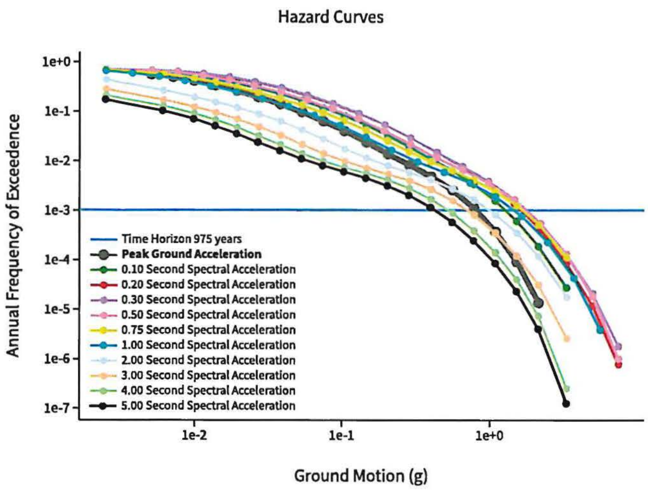
Peak Ground Acceleration

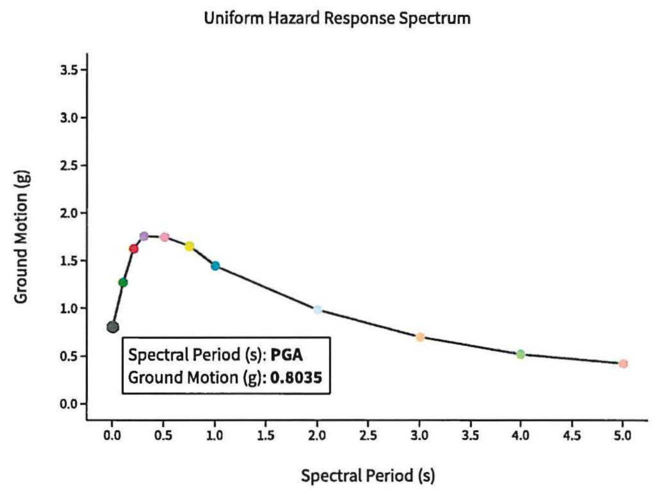
Time Horizon

Return period in years

975 Palmdale Civil Base-9 Model

Hazard Curve





View Raw Data

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Conterminous U.S. 2008 (v3.2.x)

Latitude

Decimal degrees

34.5438

Longitude

Decimal degrees, negative values for western longitudes

-118.0354

Site Class

259 m/s (Site class D)

Spectral Period

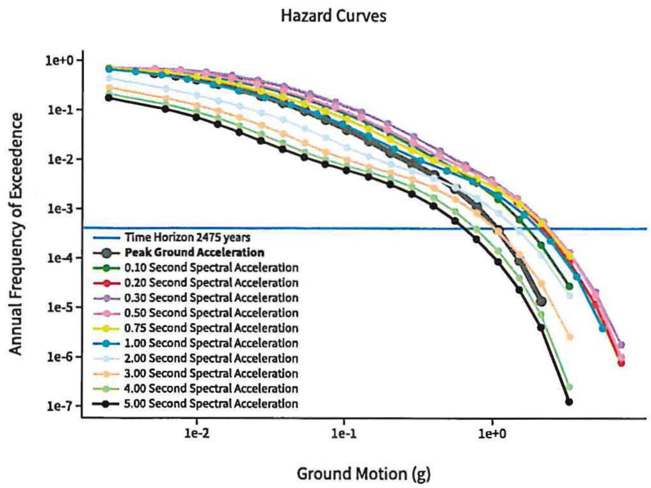
Peak Ground Acceleration

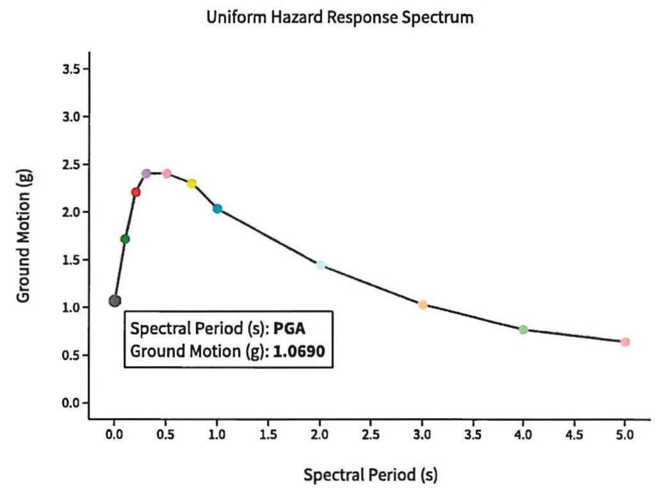
Time Horizon

Return period in years

2475 Palmdale Civil Base-9 Model

Hazard Curve





View Raw Data

Palmdale Civil Base 9 Model

Latitude, Longitude: 34.5438, -118.0354

Date	4/23/2020, 2:07:14 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	2.276	MCE_R ground motion. (for 0.2 second period)
S_1	0.967	MCE_R ground motion. (for 1.0s period)
S_{MS}	2.276	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.517	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.98	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	1.078	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	2.803	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	3.164	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.276	Factored deterministic acceleration value. (0.2 second)
S1RT	1.198	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	1.379	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.967	Factored deterministic acceleration value. (1.0 second)
PGAd	0.98	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.886	Mapped value of the risk coefficient at short periods
C_{R1}	0.869	Mapped value of the risk coefficient at a period of 1 s

Appendix C

Recommended Earthwork Specifications

RECOMMENDED EARTHWORK SPECIFICATIONS

1.0 General

1.1 Description

1.1.1 These specifications cover preparation of the subject site to receive fills, the type of soils suitable for use in fills, the compaction standards, and the methods of testing compacted fills.

1.1.2 The Contractor shall furnish all labor, supervision, equipment, operations, and materials to excavate to the required grade, support existing underground facilities, stockpile material, compact fill and backfill, and fine grade. The work of the Contractor shall include all clearing and grubbing, removing existing unsatisfactory material, preparing areas to be filled, spreading and compacting of fill in the areas to be filled and all other work necessary to complete the grading of the filled areas. It shall be the Contractor's responsibility to place, spread, moisten or dry, and compact the fill in strict accordance with these specifications to the lines and grades indicated on project plans or as directed in writing by the Civil Engineer.

1.1.3 Deviations from these specifications will be permitted only upon written authorization from the Owner or his representative.

1.2 Role of the Geotechnical Engineer

1.2.1 Construction - The Owner will employ a Geotechnical Consultant to observe and test this work as it is being performed. The Contractor shall cooperate with the Geotechnical Consultant and allow his unrestricted access to the site as required for the performance of his duties.

The Contractor shall provide a minimum notice of 48 hours to the Geotechnical Engineer before beginning or restarting earthwork operations that will require the presence of the Geotechnical Engineer or his representative on site.

1.2.2 Subsurface Investigations - A geotechnical engineering report for design purposes was prepared by Geotechnical Solutions, Inc., Irvine, California. Any recommendations made in the geotechnical report or subsequent reports are made part of these specifications. These reports are available for review upon request to the Owner.

1.2.3 Observation and Testing - The Geotechnical Engineer's representative shall observe the clearing and grubbing, excavation, filling and compacting operations and shall take density tests in the fill material so that he can state his opinion as to whether or not the fill was constructed in accordance with the specifications. All fill will be tested shortly after its placement to ascertain that the required compaction is achieved. A minimum of one density test will be made on each 500 cubic yards of fill placed, with a minimum of at least one test per every 2 feet of vertical height of fill. If the surface is disturbed, the density tests shall be made in the compacted materials below the disturbed zone. When these tests indicate that the density or water content of any layer of fill or portion thereof does not meet the specified density or water content, the particular layer or portions thereof shall be reworked until the specified density and water content have been obtained.

After the completion of grading, the Geotechnical Engineer will prepare a written opinion of grading. Neither the testing performed by the Geotechnical Consultant nor his opinion as to whether or not the fill was constructed in accordance with these Specifications shall relieve the Contractor of his responsibility to construct the fills in accordance with the Contract Documents.

1.3 Reference Standards

The following ASTM (American Society for Testing and Materials) codes and standards shall be used to the extent indicated by references herein. The most recent revision of the standards shall be used.

D 1556 - "Standard Test Method for Density of Soil in Place by the Sand-Cone Method"

D1557 - "Standard Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb (4.54 kg) and 18-inch (457-mm) Drop"

D2216 - "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures"

D4318 - "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"

D4718 - "Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles"

D4829 - "Standard Test Method for Expansion Index of Soils"

D4944 - "Standard Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester Method."

D5195 - "Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)"

D6938 - "Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)"

D7928 - "Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis"

1.4 Degree of Fill Compaction

The degree to which fill is to be compacted is expressed in terms of "relative compaction." Relative compaction is defined as the ratio; expressed in percent, of the in-place dry density of the compacted fill to the reference maximum dry density. The reference maximum dry density shall be obtained following ASTM D1557. Optimum water content shall be obtained in the same test used to obtain the reference maximum dry density. Correction of the maximum dry density and optimum water content for oversize particles of gravel and cobbles shall be made following ASTM D4718 when, in the opinion of the Geotechnical Engineer, such correction is appropriate. The in-place density shall be obtained following ASTM D1556 (sand cone method) or ASTM D6938 (nuclear method-shallow depth) test method. The in-place water content shall be obtained following ASTM D4944 (calcium carbide gas pressure meter), ASTM D5195 (nuclear method-shallow depth), or ASTM D2216 (oven drying). Correction of the in-place density and water content for oversize particles of gravel and cobbles shall be made following ASTM D4718 when, in the opinion of the Geotechnical Engineer, such correction is appropriate.

If any of the test methods specified in this section are judged by the Geotechnical Engineer to be impractical or unreliable because the material has a coarse particle size distribution, or for other reasons, the Geotechnical Engineer shall establish other procedures to obtain the required soil characteristics.

2.0 Products

2.1 Materials

2.1.1 General - During grading operations, soil types other than those identified in the geotechnical investigation report may be encountered by the Contractor. Consult the Geotechnical Consultant for his evaluation of the suitability of using these soils a fill material prior to placement or disposal.

2.1.2 General Fill - Materials for compacted fill shall consist of material imported from outside the site or excavated from the site that, in the opinion of the Geotechnical Engineer, is suitable for use in constructing engineered fills. The material shall not contain rocks or hard lumps greater than 6 inches in maximum dimension, and at least 70 percent (by weight) of its particles shall pass through a U.S. Standard 3/8 inch sieve. Material greater than 3 inches, but less than 6 inches in maximum dimension, shall be placed by the Contractor so that it is completely surrounded by compacted, finer material;

no nesting of rocks shall be permitted. Do not use any perishable, spongy, hazardous, or other undesirable materials as fill.

2.1.3 Select Fill - Select fill shall meet all criteria for general fill but shall also contain no rocks or hard lumps greater than 3 inches in maximum dimension, and at least 80 percent (by weight) shall pass through a U.S. Standard 3/8-inch sieve. The expansion index of select material shall be less than 50 (i.e., 5.0 percent swell) when tested in accordance with ASTM D4829.

3.0 Execution

3.1 Clearing and Grubbing

Within the project limits, tile Contractor shall demolish structures as specified on the Drawings.

Unless otherwise indicated on the Drawings or by the Owner in writing, the Contractor shall clear and grub all trees, stumps, roots, brush, grass, and other vegetation within construction, fill and stockpile areas to a minimum depth of 3 feet below the existing ground surface or below finished grade, whichever is deeper, unless otherwise recommended by the Geotechnical Engineer's Field Representative.

Remove cleared and grubbed materials from the site and dispose of them legally. No onsite burning or burying of cleared and grubbed materials is permitted. No placement of cleared and grubbed materials in topsoil stockpiles is permitted. No mulching of branches or roots is permitted. Incorporating vegetative matter into stockpiled materials, which are to be used in fill, is not permitted.

Stockpile organic-laden topsoil separate from other fill materials.

Remove any remaining vegetative matter from the deeper excavated soils, which may result from roots deeper than those encountered during clearing and grubbing operations.

All material thereby removed shall be piled at a location away from the immediate work area so as to avoid burying of piled material.

3.2 Compacted Fills

3.2.1 Preparing Areas to be Filled - Brush, grass, and other objectionable materials shall be collected, piled, and disposed of as indicated in Section 3.1 by the Contractor so as to leave the areas that have been cleared with a neat and finished appearance, free from unsightly debris.

Remove all loose soil, uncertified fill, landslide debris, and weathered bedrock to firm material or in-situ bedrock, as approved by the Geotechnical Consultant. The Contractor shall obtain approval from the Geotechnical Engineer or his representative of stripping and site preparation before the compaction of any fill subgrade begins. The surface shall then be scarified to a minimum depth of 6 inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment used, and shall be brought to the specified water content and relative compaction. Compact scarified materials to a minimum relative compaction of 90 percent, relative to ASTM D1557, prior to placement of any fill material.

3.2.2 Placing, Spreading, and Compacting, Fill Material - Onsite soil obtained from removals, borrow, or cut areas may be reused as compacted fill provided it is free from deleterious debris and meets the other requirements of the "Materials" portion of this Specification Section.

Use of soil containing deleterious debris from the clearing and grubbing operation or from other sources is not permitted. The fill materials shall be placed by the Contractor in horizontal layers not greater than 8 inches thick, measured before compaction. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material and moisture in each layer. The moisture content of material used for compacted fill should be adjusted to be at or above optimum water content as determined by ASTM D1557. When the water content of the fill material is too high, the fill materials shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the water content is as specified.

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent of the maximum dry density as determined by ASTM D1557 for general fill, and 95 percent of the maximum dry density as determined by ASTM D1557 for select fill, compacted fill pads, and the upper 1 foot of pavement subgrade. Compaction shall be accomplished by: sheepsfoot rollers; vibratory rollers; multiple-wheel, pneumatic-tired rollers; or other types of acceptable compacting equipment. Equipment shall be of such design that it is able to compact the fill to the specified density. Compaction shall be continuous over the entire area, and the equipment shall make sufficient passes to obtain the desired density uniformly. All fill placed on site shall be treated in like manner until finished grades are attained. Jetting, puddling, and hydro consolidation techniques shall not be used, including backfill of utility trenches.

The placement of topsoil is subject to the approval of the Geotechnical Engineer. Topsoil shall not be placed beneath concrete flatwork, beneath or behind retaining walls, or within structural fill. All topsoil material is subject to the same moisture conditioning, placement, and compaction requirements as General Fill. Roots, branches and other organic debris are not permitted within the compacted topsoil layer.

When backfilling around footings and compacting behind retaining walls and flexible retaining structures, the Contractor shall use lightweight compaction equipment such as hand-operated equipment, shoring, or other means to avoid over-stressing structural walls. When using lightweight compaction equipment, the fill materials shall be spread in horizontal layers not greater than 6 inches thick, measured before compaction.

As an alternative, sand-cement slurry may be used to backfill trenches. The slurry shall have minimum cement content of 3 sacks per cubic yard within the zone of influence of foundations and other settlement sensitive structures. A minimum of 2 sacks per cubic yard of slurry shall be used elsewhere within building limits, and a minimum of one sack per cubic yard of slurry shall be used elsewhere. Slurry shall not be used in those areas where such placement would result in the obstruction of water flow, and is subject to the approval of the Geotechnical Engineer.

3.3 Protection of Work and Adjacent Properties

3.3.1 During Construction - The Contractor shall grade all excavated surfaces to provide good drainage away from construction slopes and prevent ponding of water. He shall control surface water and the transport of silt and sediment to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control measures have been installed.

Dispose of all water resulting from dewatering operations legally and in ways that will not cause damage to public or private property, or constitute a nuisance or menace to the public, in accordance with municipal requirements.

The Contractor shall make every effort to minimize the amount of dust raised in excavating, on haul roads and access roads, and all other work areas in the course of construction activities.

Protect benchmarks, monuments, and other reference points against displacement or damage. Repair or replace benchmarks, monuments, and other permanent survey data that become displaced or damaged due to the performance of this work.

3.3.2 After Completion - After earthwork is completed and the, Geotechnical Engineer has finished his observations of the work, no further excavation, filling or backfilling shall be performed except under the observation of the Geotechnical Engineer.

GEOTECHNICAL ADDENDUM REPORT

PALMDALE CIVIL BASE 9
MODEL

AT

NORTHWEST OF PEARBLOSSOM HIGHWAY
AND FORT TEJON ROAD
PALMDALE, CALIFORNIA

PREPARED FOR:

BROADBENT, INC.
WEST PACIFIC AVENUE
HENDERSON, NEVADA, 89015

PROJECT NO: G-5729-01

JUNE 17, 2020

PREPARED BY:

GEOTECHNICAL SOLUTIONS, INC.
GEOTECHNICAL & ENVIRONMENTAL
ENGINEERING

Geotechnical Solutions, Inc.
Geotechnical, Structural & Environmental Engineering

AASHTO ACCREDITED

June 17, 2020

Project No: G-5729-01

Broadbent, Inc.
8 West Pacific Avenue
Henderson, Nevada, 89015

Attention: Mr. Mark E. Kazelskis, PG, CHG, CEM

Re: Geotechnical Engineering Addendum Report
Palmdale Civil Base 9 Model
Northwest of Pearblossom Highway &
Fort Tejon Road
Palmdale, California 93550

Gentlemen:

Submitted herewith is the addendum report to our geotechnical engineering report dated June 17, 2020 conducted by this office for Palmdale – Civil Base 9 Model at the referenced site.

Recommendations regarding over excavation have been included in this addendum report for the Palmdale Civil Base 9 model located just northwest of Pearblossom Highway and Fort Tejon Road in Palmdale, California as shown on Vicinity Map (Plate A) or Google Map (Plate D).

Site Clearing

Prior to grading, all debris including construction materials should entirely be removed from the site and disposed of off-site. Existing any undesirable materials should also be removed and hauled off-site. Existing utilities (if Any) should be removed and relocated as required. Any construction debris or ant buried or other contaminated exposed during site clearance should be removed and hauled away from the site. The resulting excavation from any removal should be cleared of loose material then backfilled with compacted soil. Oversized rocks greater than 6 inches should be removed.

Excavation

Excavations into the on-site soils may encounter a variety of conditions. Caving on clean sands may be encountered. The contractor should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of the excavation sides. All excavations should be sloped or shored in the interest of safety following local and federal regulations including current OSHA excavation and trench safety standards.

Conventional equipment can be used for the excavations for shallow foundations, drilled shafts, and utility trenches for the proposed construction. The speed and ease of excavation are dependent on the nature of the deposit, the type of equipment used, and the skill and experience of the equipment operator.

Building Pad Over-excavation (Travel Center Building)

After removal of existing debris, the Travel Center building areas should be over-excavated at least 2 feet below the lowest grade or 18 inches below the bottom of the footings whichever is greater. Excavation should be extended 3-feet outside building perimeters. Remove and replace any loose or disturbed soils prior to placing any additional fill materials required to reach the finished subgrade elevations. The over-excavation should be backfilled to the foundation base elevation with the compacted engineering fill or lean concrete in accordance with the recommendations presented in this report.

The stability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unstable conditions develop, workability may be improved by scarifying and drying. Alternatively, over-excavation of wet zones and replacement with granular materials may be used, or crushed gravel and/or rock can be tracked or "crowded' into the unstable surface soil until a stable working surface is attained. Lightweight excavation equipment may also be used to reduce subgrade pumping.

Compliance

Recommendations for foundations and slabs-on-grade supported on compacted fills or prepared subgrade depend upon compliance with the General Grading and Recommended Earthwork Specifications in Appendix A.

To assess compliance, observation and testing should be performed under the direction of a geotechnical engineer. Please contact us to provide observation and testing services.

Backfill Materials

On-site clean, low-expansive potential soils, or imported materials may be used as fill material for the following:

- Foundation Areas
- Interior Slab Areas
- Pavement Areas
- Backfill

Any earth materials imported or excavated on the property may be utilized in the fill provided that each material has been determined to be suitable by the soil engineer. These materials should be free of roots, tree branches, other organic matter or other deleterious materials. Soils of poor gradation, undesirable expansion potential, or substandard strength characteristics may be designated by the consultant as unsuitable and may require blending with other soils to serve as a satisfactory fill material.

Gradation (as per ASTM C136) should be as follows:

Size	% by Weight
6"	100
4"	85-100
¾"	70-100
No 4 Sieve	50-100
No. 200 Sieve	40 (max)

Any import material should have an expansion Index, EI less than 20. Import material should also meet the following criteria:

Soil Properties	**Values**
Liquid Limit	35 (Max)
Plastic Limit	6 (Max)

Placement and Compaction

Place and compact approved fill material in nearly horizontal layers that when compacted should not exceed 6 inches in thickness.

Use appropriate equipment and procedures that will produce recommended densities and water contents throughout the lift. Moisture condition, blending, and mixing of the fill layer should continue until the fill materials have a uniform moisture content at or above optimum moisture.

Uncompacted fill lifts should not exceed 8 inches.

Materials should be compacted to the following:

On-site or imported soil, reworked and fill:	Minimum % (ASTM D-1557 Laboratory Standard)
Subgrade Below Footings	90
Subgrade Below Slab-on Grade	90

Subgrade Below Pavement	90
Crush Rock Below Slab-on-Grade	95
Aggregate Base below pavement	95

Excavations at Pavement Areas

Subgrade Preparation

After removing the existing deleterious materials on the pavement areas and hauled offsite, all surficial deposits of loose soil material should be removed and excavate 12 inches below the base and recompacted as recommended. The bottom is further scarified to a depth of at least 6 inches; moisture conditioned as necessary and compacted to 90 percent of the maximum laboratory density as determined by ASTM Test Method D-1557.

Deleterious material, excessively wet or dry pockets, concentrated zones of oversized rock fragments, and any other unsuitable materials encountered during excavation or grading should be removed. The compacted fill material should then be brought to the elevation of the proposed subgrade for the pavement. The subgrade should be proof-rolled in order to ensure a uniform, firm and unyielding surface. All grading and fill placement should be observed by the project soils engineer and/or his representative.

Aggregate Base

Compaction and rolling are required for the recommended base section. Minimum relative compaction required will be 95 percent of the laboratory maximum density as determined by ASTM Test Designation D-1557. Aggregate base should be in accordance with the Caltrans Class II base (minimum R-value=78) and sample should be brought for testing and approval prior to delivery to the site.

Asphalt Concrete Pavement

Asphalt concrete pavement should be Performance Grade PG 64-10 1/2" maximum aggregate size and should be placed and compacted in two layers. Asphalt concrete shall be compacted to 95 percent of the Hveem Laboratory Standard.

Earthwork Observations:

Relative compaction of all fill materials placed on site should be tested in accordance with ASTM D6938. All new fill shall be brought to near optimum moisture, placed in layers not exceeding six inches in thickness, and compacted to at least 90 percent relative compaction for subgrade and 95 percent relative compaction for aggregate base. No jetting or water tamping of fill soils shall be permitted. All imported soil for engineered fill should be pre-approved by the Geotechnical Engineer and consist of clean, granular, non-expansive soil, free of vegetation and other debris with an Expansion Index of 20 or less.

At all times, the contractor should have a responsible field superintendent on the project in full charge of the work, with authority to make decisions. He should cooperate fully with the Geotechnical Engineer in carrying out the work.

All footing trenches for continuous and spread footings and subgrade for the slab areas should be observed by the project Geotechnical Engineer to verify that over-excavation and re-compaction operations of adequate depth, thickness, and compaction have been performed as specified. All footing excavations should be trimmed neat, level and square. All loose, sloughed or moisture softened soil should be removed and replaced with properly compacted soil.

General Grading

All grading should conform to the guidelines presented in the California Building Code (CBC, 2019), the City of Palmdale and County of Los Angeles, International Conference of Building Officials (ICBO, 2018), and Appendix A in this report, except where specifically superceded in the text of this report. When code references are not equivalent, the more stringent code should be followed. During earthwork construction, all site preparation and the general grading procedures of the contractor should be observed, and the fill selectively tested by a representative (s) of Geotechnical Solutions, Inc. (GSI). If unusual or unexpected conditions are exposed in the field, they should be reviewed by this office and if warranted, modified and /or additional recommendations will be offered. All applicable requirements of local and national construction and general industry safety orders, the Occupational Safety and Health Act and the construction Safety Act should be met.

Closure

The Conclusions and recommendations contained herein are based on the findings and observations made at the test boring locations. It is not unusual to find conditions between and beyond such locations, which differ from the conditions encountered. If conditions are encountered during construction, which appear to differ from those previously disclosed, this office should be notified so as to consider the need for modifications. On-site construction observations and wherever appropriate, tests should be performed during the course of construction by a representative of this office to evaluate compliance with the design concepts, specifications, and recommendations contained herein.

This report has been compiled for the exclusive use of our client, it shall not be transferred to, or used by, other parties, or applied to any project on this site other than described herein without consent and /or thorough review by this office.

The investigation was made in accordance with generally accepted geotechnical engineering principles and procedures and included such field and laboratory tests considered necessary under the circumstances.

In the opinion of the undersigned, the accompanying report has been substantiated by mathematical and other data and presents fairly the design information requested by your organization.

Respectfully Submitted,

Geotechnical Solutions, Inc.

Dharma Shakya, PhD, PE, GE
Principal Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
DHARMA R. SHAKYA
No. GE 2773
GEOTECHNICAL
STATE OF CALIFORNIA

Abraham S. Baha, PE, M. ASCE
Sr. Principal

REGISTERED PROFESSIONAL ENGINEER
ABRAHAM S. BAHA
No. C053067
CIVIL
STATE OF CALIFORNIA

Distribution: (3+pdf) Addressee

Appendix A

Recommended Earthwork Specifications

RECOMMENDED EARTHWORK SPECIFICATIONS

1.0 General

1.1 Description

1.1.1 These specifications cover preparation of the subject site to receive fills, the type of soils suitable for use in fills, the compaction standards, and the methods of testing compacted fills.

1.1.2 The Contractor shall furnish all labor, supervision, equipment, operations, and materials to excavate to the required grade, support existing underground facilities, stockpile material, compact fill and backfill, and fine grade. The work of the Contractor shall include all clearing and grubbing, removing existing unsatisfactory material, preparing areas to be filled, spreading and compacting of fill in the areas to be filled and all other work necessary to complete the grading of the filled areas. It shall be the Contractor's responsibility to place, spread, moisten or dry, and compact the fill in strict accordance with these specifications to the lines and grades indicated on project plans or as directed in writing by the Civil Engineer.

1.1.3 Deviations from these specifications will be permitted only upon written authorization from the Owner or his representative.

1.2 Role of the Geotechnical Engineer

1.2.1 Construction - The Owner will employ a Geotechnical Consultant to observe and test this work as it is being performed. The Contractor shall cooperate with the Geotechnical Consultant and allow his unrestricted access to the site as required for the performance of his duties.

The Contractor shall provide a minimum notice of 48 hours to the Geotechnical Engineer before beginning or restarting earthwork operations that will require the presence of the Geotechnical Engineer or his representative on site.

1.2.2 Subsurface Investigations - A geotechnical engineering report for design purposes was prepared by Geotechnical Solutions, Inc., Irvine, California. Any recommendations made in the geotechnical report or subsequent reports are made part of these specifications. These reports are available for review upon request to the Owner.

1.2.3 Observation and Testing - The Geotechnical Engineer's representative shall observe the clearing and grubbing, excavation, filling and compacting operations and shall take density tests in the fill material so that he can state his opinion as to whether or not the fill was constructed in accordance with the specifications. All fill will be tested shortly after its placement to ascertain that the required compaction is achieved. A minimum of one density test will be made on each 500 cubic yards of fill placed, with a minimum of at least one test per every 2 feet of vertical height of fill. If the surface is disturbed, the density tests shall be made in the compacted materials below the disturbed zone. When these tests indicate that the density or water content of any layer of fill or portion thereof does not meet the specified density or water content, the particular layer or portions thereof shall be reworked until the specified density and water content have been obtained.

After the completion of grading, the Geotechnical Engineer will prepare a written opinion of grading. Neither the testing performed by the Geotechnical Consultant nor his opinion as to whether or not the fill was constructed in accordance with these Specifications shall relieve the Contractor of his responsibility to construct the fills in accordance with the Contract Documents.

1.3 Reference Standards

The following ASTM (American Society for Testing and Materials) codes and standards shall be used to the extent indicated by references herein. The most recent revision of the standards shall be used.

D 1556 - "Standard Test Method for Density of Soil in Place by the Sand-Cone Method"

D1557 - "Standard Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb (4.54 kg) and 18-inch (457-mm) Drop"

D2216 - "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures"

D4318 - "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"

D4718 - "Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles"

D4829 - "Standard Test Method for Expansion Index of Soils"

D4944 - "Standard Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester Method."

D5195 - "Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)"

D6938 - "Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)"

D7928 - "Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis"

1.4 Degree of Fill Compaction

The degree to which fill is to be compacted is expressed in terms of "relative compaction." Relative compaction is defined as the ratio; expressed in percent, of the in-place dry density of the compacted fill to the reference maximum dry density. The reference maximum dry density shall be obtained following ASTM D1557. Optimum water content shall be obtained in the same test used to obtain the reference maximum dry density. Correction of the maximum dry density and optimum water content for oversize particles of gravel and cobbles shall be made following ASTM D4718 when, in the opinion of the Geotechnical Engineer, such correction is appropriate. The in-place density shall be obtained following ASTM D1556 (sand cone method) or ASTM D6938 (nuclear method-shallow depth) test method. The in-place water content shall be obtained following ASTM D4944 (calcium carbide gas pressure meter), ASTM D5195 (nuclear method-shallow depth), or ASTM D2216 (oven drying). Correction of the in-place density and water content for oversize particles of gravel and cobbles shall be made following ASTM D4718 when, in the opinion of the Geotechnical Engineer, such correction is appropriate.

If any of the test methods specified in this section are judged by the Geotechnical Engineer to be impractical or unreliable because the material has a coarse particle size distribution, or for other reasons, the Geotechnical Engineer shall establish other procedures to obtain the required soil characteristics.

2.0 Products

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2.1.1 General - During grading operations, soil types other than those identified in the geotechnical investigation report may be encountered by the Contractor. Consult the Geotechnical Consultant for his evaluation of the suitability of using these soils a fill material prior to placement or disposal.

2.1.2 General Fill - Materials for compacted fill shall consist of material imported from outside the site or excavated from the site that, in the opinion of the Geotechnical Engineer, is suitable for use in constructing engineered fills. The material shall not contain rocks or hard lumps greater than 6 inches in maximum dimension, and at least 70 percent (by weight) of its particles shall pass through a U.S. Standard 3/8 inch sieve. Material greater than 3 inches, but less than 6 inches in maximum dimension, shall be placed by the Contractor so that it is completely surrounded by compacted, finer material;

no nesting of rocks shall be permitted. Do not use any perishable, spongy, hazardous, or other undesirable materials as fill.

2.1.3 Select Fill - Select fill shall meet all criteria for general fill but shall also contain no rocks or hard lumps greater than 3 inches in maximum dimension, and at least 80 percent (by weight) shall pass through a U.S. Standard 3/8-inch sieve. The expansion index of select material shall be less than 50 (i.e., 5.0 percent swell) when tested in accordance with ASTM D4829.

3.0 Execution

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Remove cleared and grubbed materials from the site and dispose of them legally. No onsite burning or burying of cleared and grubbed materials is permitted. No placement of cleared and grubbed materials in topsoil stockpiles is permitted. No mulching of branches or roots is permitted. Incorporating vegetative matter into stockpiled materials, which are to be used in fill, is not permitted.

Stockpile organic-laden topsoil separate from other fill materials.

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All material thereby removed shall be piled at a location away from the immediate work area so as to avoid burying of piled material.

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Remove all loose soil, uncertified fill, landslide debris, and weathered bedrock to firm material or in-situ bedrock, as approved by the Geotechnical Consultant. The Contractor shall obtain approval from the Geotechnical Engineer or his representative of stripping and site preparation before the compaction of any fill subgrade begins. The surface shall then be scarified to a minimum depth of 6 inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment used, and shall be brought to the specified water content and relative compaction. Compact scarified materials to a minimum relative compaction of 90 percent, relative to ASTM D1557, prior to placement of any fill material.

3.2.2 Placing, Spreading, and Compacting, Fill Material - Onsite soil obtained from removals, borrow, or cut areas may be reused as compacted fill provided it is free from deleterious debris and meets the other requirements of the "Materials" portion of this Specification Section.

Use of soil containing deleterious debris from the clearing and grubbing operation or from other sources is not permitted. The fill materials shall be placed by the Contractor in horizontal layers not greater than 8 inches thick, measured before compaction. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material and moisture in each layer. The moisture content of material used for compacted fill should be adjusted to be at or above optimum water content as determined by ASTM D1557. When the water content of the fill material is too high, the fill materials shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the water content is as specified.

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent of the maximum dry density as determined by ASTM D1557 for general fill, and 95 percent of the maximum dry density as determined by ASTM D1557 for select fill, compacted fill pads, and the upper 1 foot of pavement subgrade. Compaction shall be accomplished by: sheepsfoot rollers; vibratory rollers; multiple-wheel, pneumatic-tired rollers; or other types of acceptable compacting equipment. Equipment shall be of such design that it is able to compact the fill to the specified density. Compaction shall be continuous over the entire area, and the equipment shall make sufficient passes to obtain the desired density uniformly. All fill placed on site shall be treated in like manner until finished grades are attained. Jetting, puddling, and hydro consolidation techniques shall not be used, including backfill of utility trenches.

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When backfilling around footings and compacting behind retaining walls and flexible retaining structures, the Contractor shall use lightweight compaction equipment such as hand-operated equipment, shoring, or other means to avoid over-stressing structural walls. When using lightweight compaction equipment, the fill materials shall be spread in horizontal layers not greater than 6 inches thick, measured before compaction.

As an alternative, sand-cement slurry may be used to backfill trenches. The slurry shall have minimum cement content of 3 sacks per cubic yard within the zone of influence of foundations and other settlement sensitive structures. A minimum of 2 sacks per cubic yard of slurry shall be used elsewhere within building limits, and a minimum of one sack per cubic yard of slurry shall be used elsewhere. Slurry shall not be used in those areas where such placement would result in the obstruction of water flow, and is subject to the approval of the Geotechnical Engineer.

3.3 Protection of Work and Adjacent Properties

3.3.1 During Construction - The Contractor shall grade all excavated surfaces to provide good drainage away from construction slopes and prevent ponding of water. He shall control surface water and the transport of silt and sediment to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control measures have been installed.

Dispose of all water resulting from dewatering operations legally and in ways that will not cause damage to public or private property, or constitute a nuisance or menace to the public, in accordance with municipal requirements.

The Contractor shall make every effort to minimize the amount of dust raised in excavating, on haul roads and access roads, and all other work areas in the course of construction activities.

Protect benchmarks, monuments, and other reference points against displacement or damage. Repair or replace benchmarks, monuments, and other permanent survey data that become displaced or damaged due to the performance of this work.

3.3.2 After Completion - After earthwork is completed and the, Geotechnical Engineer has finished his observations of the work, no further excavation, filling or backfilling shall be performed except under the observation of the Geotechnical Engineer.

GEOTECHNICAL ENGINEERING PERCOLATION / INFILTRATION TEST REPORT

CIVIL BASE 9 MODEL
PALMDALE

LOCATED AT

NE OF FALLING STAR PLACE &
PEARBLOSSOM HIGHWAY
PALMDALE, CALIFORNIA

FOR

BROADBENT, INC.
8 WEST PACIFIC AVENUE
HENDERSON, NEVADA 89015

PROJECT NO: G-5729-08

JUNE 17, 2020

GEOTECHNICAL SOLUTIONS, INC.
GEOTECHNICAL AND ENVIRONMENTAL
ENGINEERING

June 17, 2020

Project: G-5729-08

BROADBENT, INC.
8 West Pacific Avenue
Henderson, Nevada 89015

Attention: Mr. Mark E. Kazelskis, PG, CHG, CEM

Via Email: mkazelski@broadbentinc.com

Re: Geotechnical Engineering Percolation / Infiltration Report
Civil Base 9 Model - Palmdale
NE of Falling Star Place & Pearblossom Highway
Palmdale, California 93550

Gentlemen:

Per your authorization, we have performed our geotechnical engineering field percolation tests to evaluate the subgrade percolation and infiltration rate at the referenced Civil Base 9 Model site in the City of Palmdale, California. Proposed development consists of improving or incorporating Storm Water Permanent Best Management Practice (BMP).

The accompanying geotechnical engineering report presents the results of our field borings, sampling of subgrade material, field percolation tests, reviewing site plan, performing laboratory tests, analyzing field and laboratory data and our conclusions and recommendations for the project.

Our services were performed using the standard of care ordinarily exercised in this locality, at the time when the report was prepared.

The investigation was made in accordance with generally accepted geotechnical engineering principles and procedures and included such field and laboratory tests considered necessary in the circumstances.

In the opinion of the undersigned, the accompanying report has been substantiated by data, observations, analysis, and opinions and presents fairly the design information requested by you.

This completes our scope of services for the initial design phase of the project. We have appreciated this opportunity to be of service to you on this project.

Respectfully Submitted,

Geotechnical Solutions, Inc.

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Distribution: (3 +pdf) Addressee

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Introduction

Geotechnical Solutions, Inc. (GSI) has performed field investigation including borings and sampling of earth material and field percolation tests at the proposed locations as shown on Plot Plan & Percolation Tests Location Map (Plate B in Appendix A) at Civil Base 9 in the City of Palmdale, California.

The main purpose of this study is to provide infiltration rates of subgrade material based on field percolation tests so that an appropriate system incorporating Storm Water permanent best management practice (BMP) to manage surface water into the ground and the appropriate infiltration basin or any other approved system may be designed and existing drainage be improved.

Field Exploration

Field exploration consisted of drilling two borings, PC-1 and PC-2, 8-inches in diameter and extended 10-feet below existing ground as shown on Plot Plan and Percolation Tests Location Map (Plate B). Also shown one hollow stem auger boring, B-1 close to these percolation test areas and is presented on Plate E-1. The percolation test logs are presented on Plates D-1 and D-2 in Appendix A.

The attached logs tabulate data based on laboratory classification tests and visual observation by the field engineer at the site. During drilling bulk samples of earth material obtained for further laboratory test.

Groundwater

Groundwater was not encountered at a depth of 40-feet below grade in our borings (Borings drilled for this project). Historical high groundwater level in accordance with California Geologic Survey (CGS), Seismic Hazard, Palmdale 7.5-Minute Quadrangle, released October 17, 2003 was deeper than 50 feet below the ground surface (Plate C-1) in Appendix A. Also, in accordance with the available groundwater well maps data, http://wdl.water.ca.gov/water data library, historical high groundwater level as shown on Plates C-2 and C-3 presented in Appendix A are much deeper than 50 feet.

The potential for ground water to rise to the ground surface in the site area is considered to be very unlikely.

Laboratory Testing

Laboratory testing was programmed following a review of the field investigation data to be evaluated. Tests included physical testing to determine soil characteristics and selective tests. Test results are presented in Appendix A.

Mechanical Analysis (ASTM D-422)

Mechanical analyses by the hydrometer test method were performed to confirm field classifications. Test results are as follows:

Test Hole No.	Sample Depth (ft)	Sand Percent	Silt Percent	Clay Percent
PC-1	10.0	70	24	6
PC-2	10.0	72	21	7
B-1	0-3	81	16	3

Field Percolation Tests

We performed field percolation tests at PC-1 and PC-2 locations as shown on Plot Plan and Percolation Tests Location Map (Plate B). The percolation test procedure performed in accordance with the current acceptable method for shallow percolation test (less than 10 feet) by qualified personnel under the supervision of registered geotechnical engineer as per Technical Guidance Document, Orange County Public Works.

- Borehole diameter was 8 inches.

- Bottom elevation of test holes correspond to bottom elevation of proposed retention basins which are proposed at 10-feet in depth below the ground surface in accordance with the following locations:

PC-1	10 feet below the ground surface
PC-2	10 feet below the ground surface

- The bottom of the test hole was covered with 2 inches of gravel prior to testing.

- Sides of the hole were not smeared after drilling and there was no caving.

- Holes were filled with clear water to appropriate depths from the ground surface (Minimum required is 5 x radius of the hole (5 x 4" = 20 inches) from the bottom.

- On all these two locations, two consecutive measurements showed that more than 6 inches of water seeped away in 25 minutes test (Pre-Percolation Data Sheets, Plates 1 and 2). Thus, pre-soaking overnight for about 24 hours was not required.

- The tests were then run for an additional one-hour duration, measurements being taken every 10 minutes (Percolation Test Results). The drop that occurs during the final reading is used to calculate the percolation and then infiltration rate. Both Pre-Percolation data Sheets and Field Percolation

- Test Results are presented on Plates 1 through 4 in Appendix B, Infiltration calculations are presented on Plates 5 and 6 and presented in Appendix C. Infiltration results using another method, Reduction Factor Method, Rf are presented on Plates 7 and 8 in Appendix D.

- Measurements were taken with a precision of 0.25 inches or better.

- All the field percolation tests are tabulated and are presented in Appendix B.

- The holes were backfilled with soil cuttings.

Percolation Rate Evaluation

To evaluate the percolation rates, testing was performed by filling the borehole with water and observing the rate of water drop from the fixed reference point on the ground surface. The depths of water drop for every 10 minutes intervals were noted and tabulated and plotted as shown on Plates 2 and 4, respectively for PC-1 and PC-2 in Appendix B.

Percolation rate, k can be correlated with the data in the form of the straight line equation as shown below:

$$t/R = b + kt$$

Where, t = average time in minutes

$R = \Delta t / d$

Δt = Time Interval, minutes

d = drop in inch = $R1 - R2$

$R1$ = Initial Readings, inch

$R2$ = Final Readings, inch

k = Percolation Rate inch/minute

R = $1/k$ at equilibrium rate

t/R is plotted against t as shown on the plots (Plates 2 and 4 for PC-1 and PC-2, respectively) and the regression analyses were performed to interpolate the data obtained in the field. Straight line interpolation gives the slope as a percolation rate, k.

Results of the Tests

The results obtained from the analyses are as follows:

1. Near surface material consisted of sand with some silty sand, medium dense and gray in color generally.

2. Below 10 feet, the subgrade materials consisted of Sand with some gravel, medium dense to dense and medium gray in color.

3. Field Percolation tests at 10 feet depth show the following results:

Location	Coefficient of Permeability, k			
	Inch/minute	Cm/sec	**Inch/hour Average**	**Inch/hr** based on last 10 Minutes Reading
PC-1	**0.1414**	**6.0 x E-03**	**8.480**	**12.0**
PC-2	**0.1557**	**6.6 x E-03**	**9.342**	**12.0**
Average	**0.1486**	**6.3 x E-03**	**8.911**	**12.0**
		Average:	**10.455 inch/hour**	

4. Based on the data presented in this report and the testing information accumulated, it is our judgment that the percolation rate is an average of **10.455** inch per hour. It takes about **5.74 minutes to percolate 1 inch**. This conclusion regarding percolation rate is based on the results of our field exploration and testing.

5. General range of permeability for some of the subgrade soils are as follows:

Type of Soil	Permeability (Cm/Sec)
Medium to coarse gravel	> 10^{-1}
Coarse sand to fine sand	between $1x10^{-1}$ to $1x10^{-3}$
fine sand and silty sand	between $1x10^{-3}$ to $1x10^{-5}$
silt, clayey silt or silty clay	between $1x10^{-4}$ to $1x10^{-6}$

Clays $1x10^{-7}$ or less

Since the percolation rate average is **6.3 x E-03 Cm/Sec**, it falls into coarse Sand to fine Sand **category** as tabulated above.

As per Technical Guidance Document, Infiltration rate, I_t is calculated based on Percolation Rate Conversion using Porchet Method, aka Inverse Borehole Method.

The bottom of the proposed infiltration basin would be at 10-feet below the existing ground surface. Percolation tests were performed with the depth of the test hole set at the infiltration surface level (bottom of basin).

After the minimum required number of testing intervals, the test was complete. The data collected at the final interval was used to calculate infiltration rates.

The calculations and the results are tabulated and presented on Plates 5 and 6 in Appendix C.

Location	**Percolation Rate inch/hour Based on Average Reading**	**Infiltration Rate Inch/hour Based on Porchet Method aka Inverse Borehole Method**
PC-1	8.480	0.705
PC-2	6.423	0.750
Average	**7.452**	**0.727**

Using factor of safety of 2.0 for uncertainty and bias**, percolation test result is 3.226 inch per hour** and **Infiltration Rate = 0.363 "/ hour**, which is greater than **0.3"/hour** in accordance with **TGD VII.2.**

Thus, it **does meet** the standard criteria, hence **PASSED**.

Reduction Factor (R_f) Method

We have used Reduction Factor (R_f) Method which is another acceptable and approved method for calculating Infiltration Rate, I_f.

Infiltration Rates as calculated by this method have been tabulated on Plates 7 and 8 in Appendix D. The results are as follows:

Location	I_f Using (Reduction Factor Method) (inch/hour)
PC-1	0.6222
PC-2	0.6087
AVERAGE:	**0.6155**
With FOS = 2	**0.3077**
	> 0.3 inch/hour - "PASSED"

Conclusions

The subgrade soils consist of generally Sand (SP), medium dense to dense, brown to grayish in color, fine to coarse grained and slightly moist to moist. Percolation tests performed for two locations at 10 feet depth met the prescribed criteria.

Also, since the groundwater is very deep more than 50 feet, there is a room for the basin (Groundwater to be minimum of 10 feet below the bottom of the proposed basin at 10 feet which is required in accordance with the technical guidance document), hence the project is feasible.

Additional Services

This office will be available for further consultation.

Closure

Based on the data presented in this report and the testing information accumulated, it is the judgment of the writers of this report that BMP infiltration system seems to be **feasible** at these locations. The conclusions presented in this report are based on the results of our field exploration, percolation tests, and other laboratory tests.

This report has been compiled for the exclusive use on the above referenced site, for the purpose stated above. It should not be transferred to or used by another party, or applied to any other project on this site, other than as described herein, without consent and/or thorough review by this office.

Geotechnical Solutions, Inc.

References

California Building Code, 2019, California Code of Regulations, Title 24, Volume 2 of Part 2.

California Department of Water Resources groundwater well data http://wdl.water.ca.gov.

California Geological Survey (formerly CDMG), 2003, Seismic Hazard Zone Report, Palmdale 7.5-Minute Quadrangles, Palmdale, released October 17.

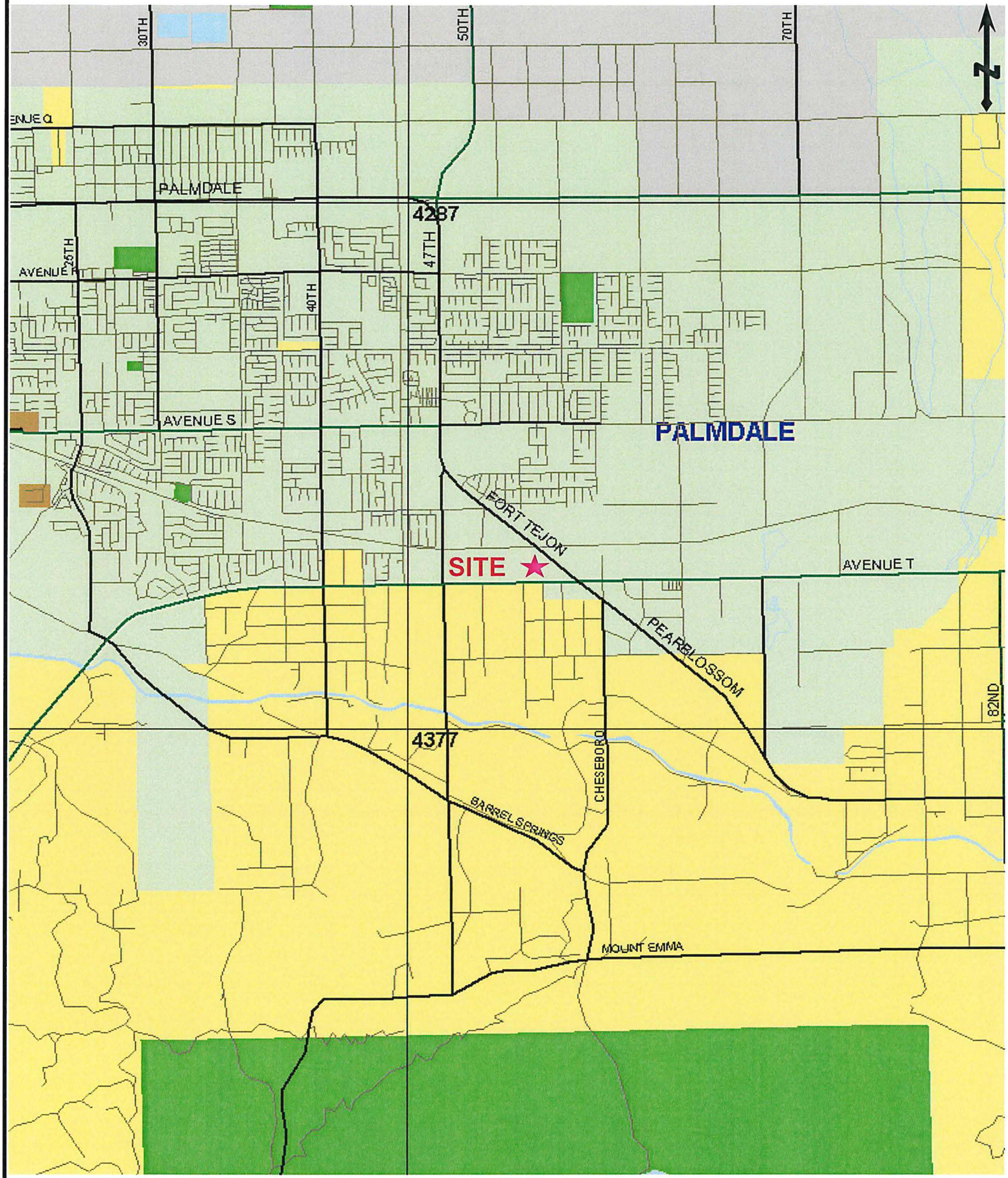
Orange County, Technical Guidance Document (TGD) for the Preparation of Conceptual / Preliminary and/or Project Water Quality Management Plans (WQMPs) dated December, 2013.

Appendix A

Plates:

- Vicinity Map
- Plot Plan & Percolation Tests Location Map
- Groundwater Map (CGS)
- Groundwater Well Location Map
- Groundwater Map – Well Data
- Hollow Stem Auger Boring Logs (Percolation Tests) PC-1 & PC-2
- Boring B-1

VICINITY MAP



Palmdale Civil Base 9 - Percolation Tests	Project No.	G-5729-08
NE of Falling Star Place and Pearblossom Highway, Palmdale, CA	Plate:	A

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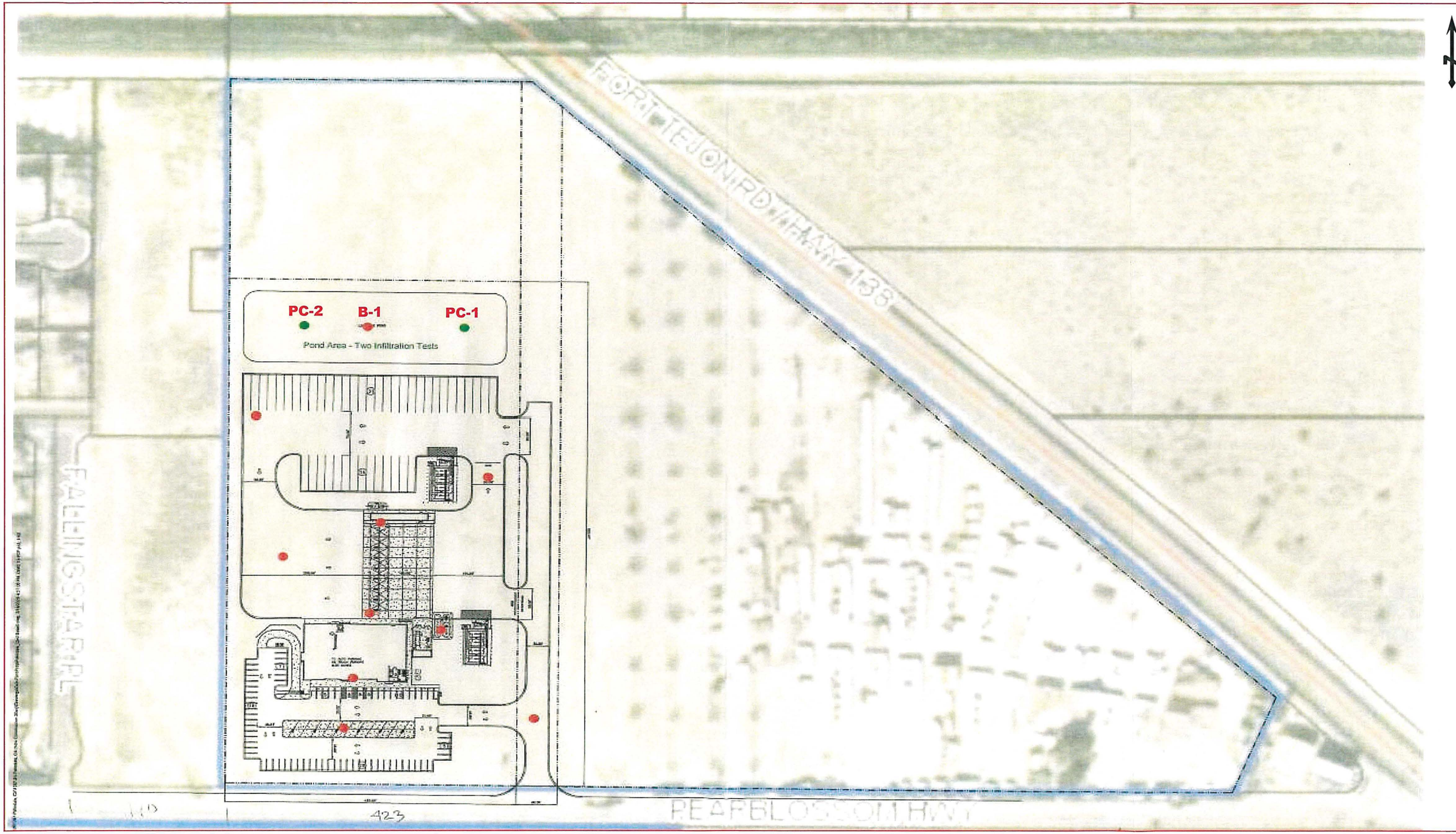
PLOT PLAN & PERCOLATION TESTS LOCATION MAP



PC-2 Percolation Tests B-1 Test Boring

Palmdale Civil Base 9 - Percolation Tests	Project No.	G-5729-08
NE of Falling Star Place and Pearblossom Highway, Palmdale, CA	Plate:	B

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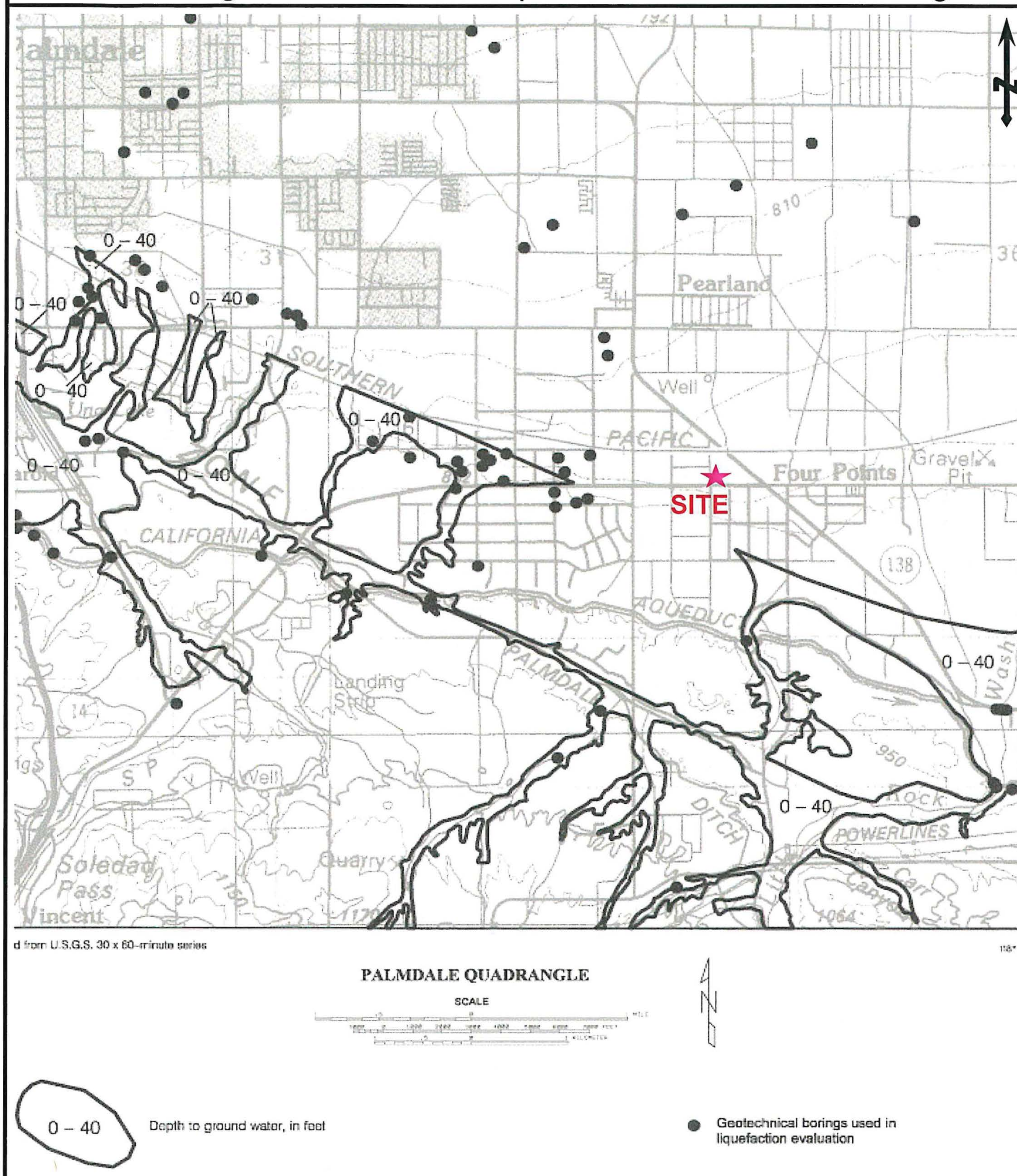
Historic High Groundwater Map - CGS Palmdale Quadrangle



Palmdale Civil Base 9 - Percolation Tests	Project No.	G-5729-08
NE of Falling Star Place and Pearblossom Highway, Palmdale, CA	Plate:	C-1

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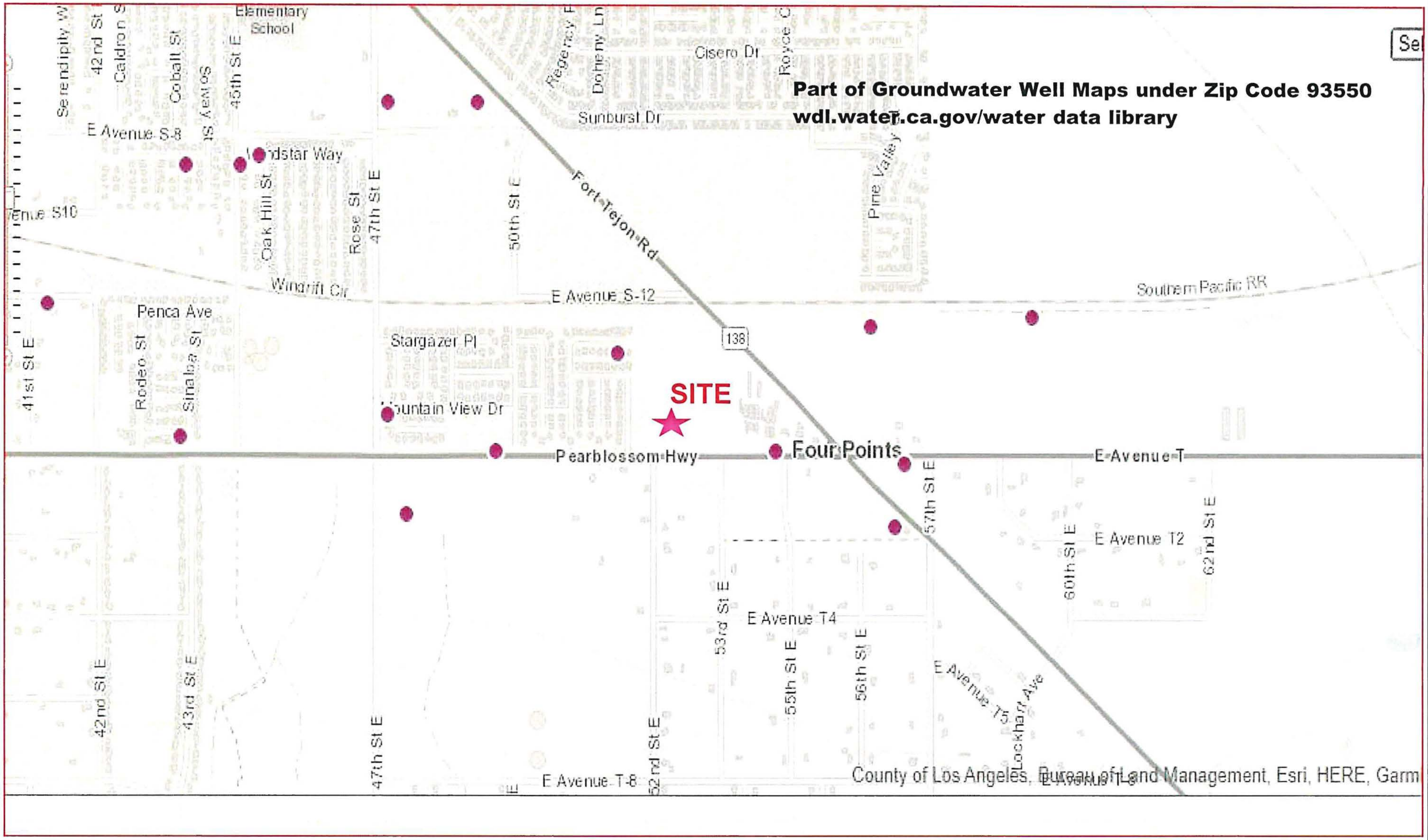
GROUNDWATER WELL LOCATION MAP

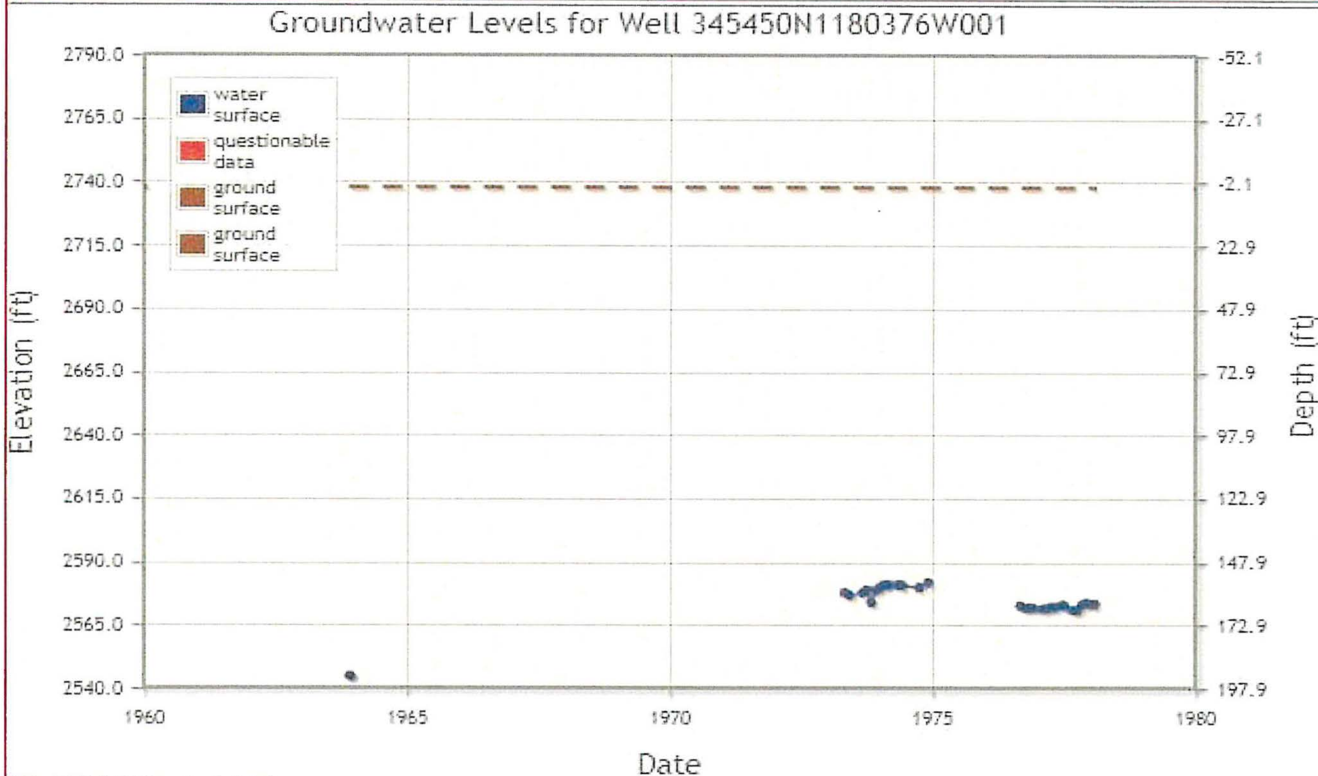


Palmdale Civil Base 9 - Percolation Tests	Project No.	G-5729-08
NE of Falling Star Place and Pearblossom Highway, Palmdale, CA	Plate:	C-2

Geotechnical Solutions, Inc.

GROUNDWATER MAP - WELL DATA

Station Data | Recent Groundwater Level Data | Historical Groundwater Level Data



Download CSV File

Date	RPE	GSE	RPWS	WSE	GS to WS	Msmt Code	CASGEM Msmt	Agency	Comments
12/01/1963 00:00	2737.860	2737.860	193	2544.86	193		N	5167	
12/03/1963 00:00	2737.860	2737.860	193.25	2544.61	193.25		N	5167	

Palmdale Civil Base 9 - Percolation Tests		Project No.	G-5729-08
NE of Falling Star Place and Pearblossom Highway, Palmdale, CA		Plate:	C-3

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Project:	Palmdale Civil Base 9 - Percolation Tests
Project Location:	NE of Falling Star Place and Pearblossom Highway, Palmdale, CA
Project Number:	D-1073-01

Key to Log of Test Hole
Plate No. D

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6 in.	Graphic Symbol	Blows / Last 12 in	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve	OTHER TESTS AND REMARKS
1	2	3	4	5	6	7	8	9	10	11	12

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number; "[NR]" after number indicates no sample recovery.

5 **Blows / 6 in.:** Number of blows to advance driven sampler each 6-inch drive interval, or distance notes, using a 140-lb hammer with a 30-inch drop (unless otherwise noted)

6 **Graphic Symbol** Soil Type Symbol

7 **Blows / 12 in.:** Blows per 12" based on Col. 5 equal to uncorrected N-Value where SPT used

8 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density / consistency. Approx. "and" = 35%-50%; "some" = 20%-35%; "little" = 10%-20%; "trace" = 0%-10%.

9 **Moisture Content:** Moisture content of sample, as percentage of dry weight of soil, meausred in lab according to ASTM D2937.

10 **Dry Unit Weight:** Dry unit weight of soil sample, in pounds per cubic foot, measured in lab according to ASTM D422.

11 **Percent Passing No. 200 Sieve:** Percent of soil by weight finer than the No. 200 sieve according to ASTM D422.

12 **Other Tests and Remarks:** Comments and observations regarding drilling or sampling made by driller or field personnel. Other lab tests are indicated using abbreviations explained below.

TYPICAL SAMPLER GRAPHIC SYMBOLS

- California (ring-lined)
- Modified California (brass tube-lined)
- Standard Penetration Test (SPT) split spoon
- Shelby Tube
- Bulk Sample
- Grab Sample

OTHER LABORATORY TEST ABBREVIATIONS

AL	Atterberg Limits Test (ASTM D4318)
COMP	Compaction test by modified effort (ASTM D1557)
CONS	One-dimensional consolidation test (ASTM D2435)
DS	Direct shear test (ASTM D3080)
EI	Expansion index test (ASTM 4829), index at 50% saturation
HD	Hydrometer analysis (ASTM D422), %<5 micros
LL	Liquid Limit from Atterberg Limites test
PI	Plasticity Index from Atterberg Limits test
SA	Sieve analysis (ASTM D422), %<#200 sieve
SE	Sand equivalent test for fines contamination (ASTM D2419)
UC	Unconfined compressive strength test (ASTM D2166)
WA	Wash analysis (ASTM D422), %<#200 sieve

OTHER GRAPHIC SYMBOLS

- ∇ First water encountered at time of drilling and sampling (ATD)
- ▼ Static water level measured at specified time after drilling
- Change in material properties within a lithologic stratum
- Inferred contact between soil strata or gradational lithologic change

Soil Classification are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced; they are not warranted to be representative of subsurface conditions between samples, at other locations, or times.

Project :	Palmdale Civil Base 9 - Percolation Tests	**LOG OF TEST HOLE**	Borehole No. PC-1
Project Location :	NE of Falling Star Place and Pearblossom Highway, Palmdale, CA		Plate No. D-1
Project Number :	G-5729-08		Page 1 of 1

Date(s) Drilled :	June 1, 2020	Logged By :	BA/ASB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch-Auger	Total Depth of Borehole, feet :	10'
Drill Rig Type :	Mbile B-57	Drilling Contractor :	Whitecomb Drilling, Inc.	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Ground Water Encountered	Sampling Method :	California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						Bare ground/ Gravel				
							SAND (SP), gray, slightly moist, fine to medium				
	2										
830	5						@5': Same as above				
825	10						Silty @10': Beach Sand (SP), med dense to dense, light gray, moist			30	HD:70(SA):24 (SI):6 (CL)
							Drilled for Percolation test to 10' Add 2" of gravel at the bottom Backfilled w/cuttings after percolation test. No Ground Water Encountered				
820	15										
815	20										
810	25										
	30										
	35										
	40										
	45										

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Project :	Palmdale Civil Base 9 - Percolation Tests	LOG OF TEST HOLE	Borehole No.	PC-2
Project Location :	NE of Falling Star Place and Pearblossom Highway, Palmdale, CA		Plate No.	D-2
Project Number :	G-5729-08		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA/ASB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch-Auger	Total Depth of Borehole, feet :	10'
Drill Rig Type :	Mbile B-57	Drilling Contractor :	Whitecomb Drilling, Inc.	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Ground Water Encountered	Sampling Method :	California (ring), bulk	Hammer Data :	Downhole wire 140 lbs / 30-inch drop
Borehole Backfill :	Drill cuttings	Comments :	Refer to site plan for location		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	No Recovery (NR)	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						Bare ground/ Gravel				
							SAND (SP), gray, slightly moist, fine to medium				
	2										
830	5						@5': Same as above				
825	10						Silty @10': Beach Sand (SP), med dense to dense, light gray, moist			28	HD:72(SA):21(SI):7(CL)
							Drilled for Percolation test to 10' Add 2" of gravel at the bottom Backfilled w/cuttings after percolation test. No Ground Water Encountered				
820	15										
815	20										
810	25										
	30										
	35										
	40										
	45										

Project :	Palmdale Civil Base 9 - Percolation Tests	LOG OF TEST HOLE	Borehole No.	B-1
Project Location :	NE of Falling Star Place and Pearblossom Highway, Palmdale, CA		Plate No.	E-1
Project Number :	G-5729-08		Page 1 of	1

Date(s) Drilled :	June 1, 2020	Logged By :	BA	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Randy - Whitcomb Drilling	Approx. Surface Elevation, feet :	835 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location; Blow Counts are converted to STD.		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
835	0						**Bareground / Gravel**				
			Bag #1				SAND (SP), gray, slightly moist, fine to medium			19	HD:81(SA):16 (SI):3 (CL)
	2		C-1	8-9-11		20	@2': SAND, fine to medium gray, slightly moist, medium dense	5	112		DS: P=Peak / Ult=Ultimate $\phi = 34^0$, c = 200 psf (P) $\phi = 33^0$, c = 150 psf (Ult)
830	5		C-2	5-5-6		11	@5':Sand (SP), fine to very fine, light brown, moist, loose	9	103		
825	10		C-3	10-16-27		43	@10': Beach Sand (SP), light gray, moist, medium dense	2	114		
							End of Boring = 11.5 feet No groundwater encountered No Caving but possible for bigger diameter hole				
820	15										
815	20										
810	25										
805	30										
800	35										
795	40										
790	45										

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Appendix B

Pre-Test & Percolation Test Results

- Pre-Test Percolation Data Sheet (PC-1)
- Percolation Test Result at Location PC-1
- Pre-Test Percolation Data Sheet (PC-2)
- Percolation Test Result at Location PC-2

PRE- PERCOLATION TEST DATA SHEET

Project:	Civil Base 9		Project No.:	G-5729-08		Date:	6/1/2020
Test Hole Number:		PC-1	Tested By:	BA/ASB			
Depth of Test Hole, DT		10'	USCS Soil Classification:		Sand (SP)		
Test Hole Dimensions (inches)					Length	Width	
Diameter (if Round) =		8"	Sides (if Rectangular) =				
Sandy Soil Criteria Test *							
Trial No.	Start Time	Stop Time	Time Interval (Min)	Initial Depth to Water (in)	Final Depth to Water (in)	Change in Water Level (in)	Greater than or Equal to 6"? y/n
1	7:40 AM	8:05 AM	25	50	73	23	> 6"
2	8:05 AM	8:30 AM	25	73	85	12	> 6"

* If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute Intervals) with a precision of at least 0.25".

PERCOLATION TEST

Borehole No. **PC-1** Depth **120** inch

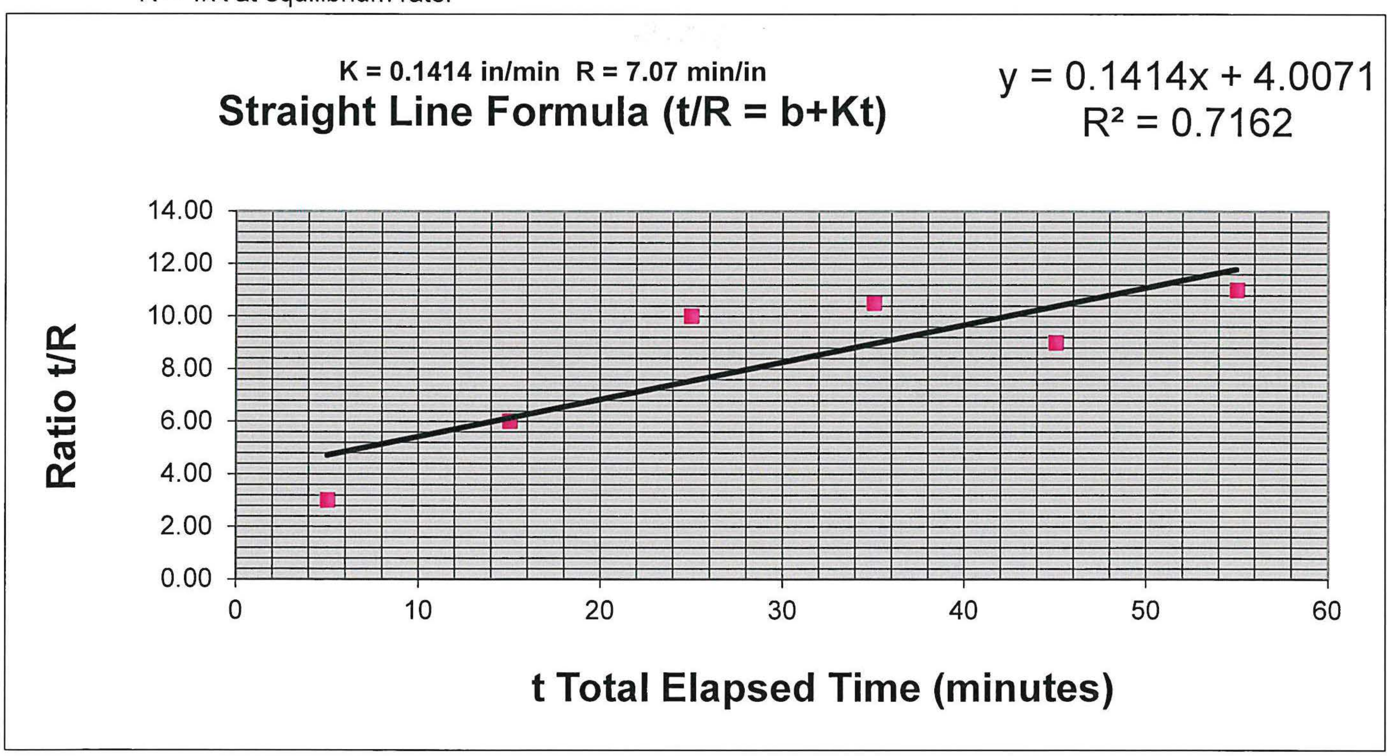
Date	Time of Reading	Δt (min.)	Total Elapsed Time (t)	Average t (minutes)	Reading R_1 (inches)	Reading R_2 (inches)	Drop d (inches)	R=Δt/d (min./in.)	t/R (in.)	k * 1000 (cm/s)
6/1/2020	8:32 AM	0	0							
	8:42 AM	10	10	5	68.00	74.00	6.00	1.67	3.00	25.4
	8:52 AM	10	20	15	74.00	78.00	4.00	2.50	6.00	16.9
	9:02 AM	10	30	25	78.00	82.00	4.00	2.50	10.00	16.9
	9:12 AM	10	40	35	82.00	85.00	3.00	3.33	10.50	12.7
	9:22 AM	10	50	45	85.00	87.00	2.00	5.00	9.00	8.5
	9:32 AM	10	60	55	87.00	89.00	2.00	5.00	11.00	8.5

Plot: t/R as ordinate vs. 't' as abscissa; tanOC = K.

R_1 = Vertical distance from reference point to water level after refilling at beginning of increment period.

R_2 = Vertical distance from reference point to water level at the end of increment period.

R = 1/K at equilibrium rate.



PRE- PERCOLATION TEST DATA SHEET

Project:	Civil Base 9		Project No.:	G-5729-08		Date:	6/1/2020
Test Hole Number:		**PC-2**	Tested By:	BA/ASB			
Depth of Test Hole, DT		10'	USCS Soil Classification:		Sand (SP)		
Test Hole Dimensions (inches)					Length	Width	
Diameter (if Round) =		8"	Sides (if Rectangular) =				
Sandy Soil Criteria Test *							
Trial No.	Start Time	Stop Time	Time Interval (Min)	Initial Depth to Water (in)	Final Depth to Water (in)	Change in Water Level (in)	Greater than or Equal to 6"? y/n
1	8:10 AM	8:35 AM	25	48	58	10	> 6"
2	8:35 AM	9:00 AM	25	58	69	11	> 6"

* If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute Intervals) with a precision of at least 0.25".

PERCOLATION TEST

Borehole No. **PC-2** Depth **120** inch

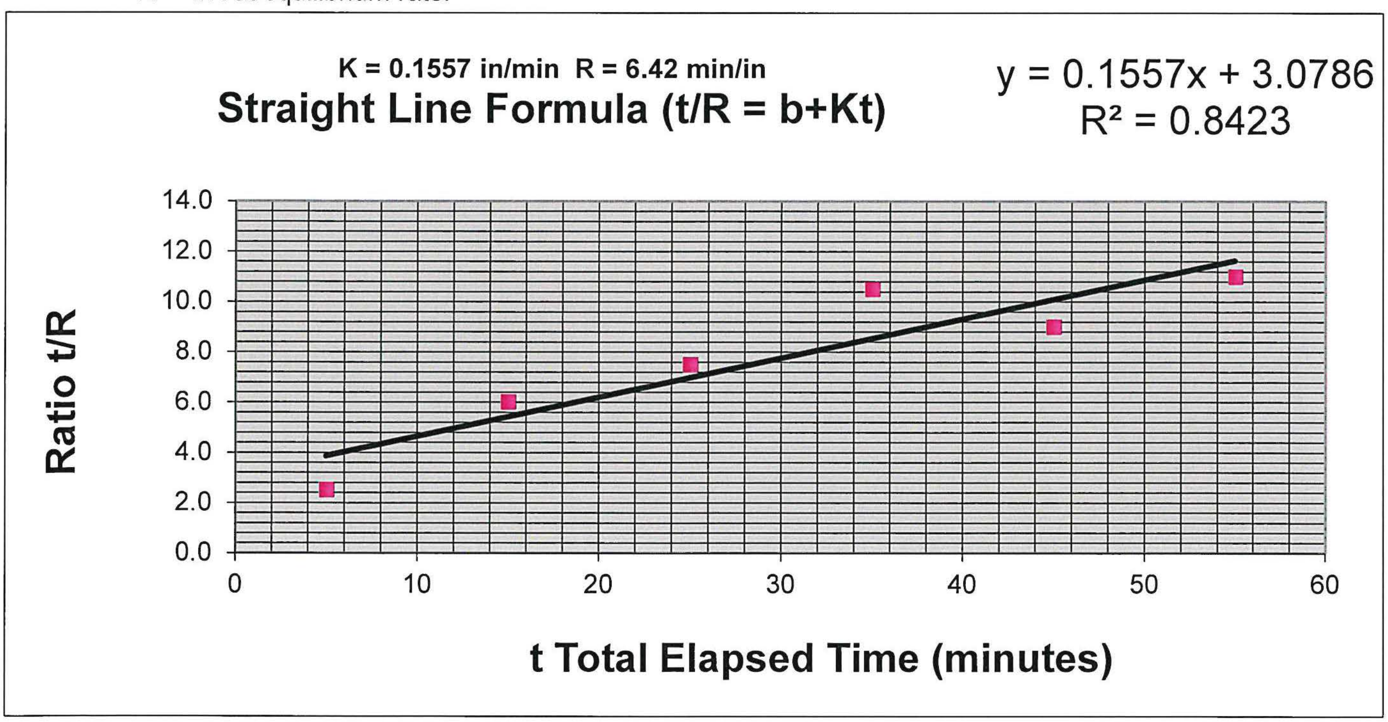
Date	Time of Reading	Δt (min.)	Total Elapsed Time (t)	Average t (minutes)	Reading R_1 (inches)	Reading R_2 (inches)	Drop d (inches)	$R=\Delta t/d$ (min./in.)	t/R (in.)	k * 1000 (cm/s)
2/15/2020	9:02 AM	0	0							
	9:12 AM	10	10	5	72.00	77.00	5.00	2.00	2.50	21.2
	9:22 AM	10	20	15	77.00	81.00	4.00	2.50	6.00	16.9
	9:32 AM	10	30	25	81.00	84.00	3.00	3.33	7.50	12.7
	9:42 AM	10	40	35	84.00	87.00	3.00	3.33	10.50	12.7
	9:52 AM	10	50	45	87.00	89.00	2.00	5.00	9.00	8.5
	10:02 AM	10	60	55	89.00	91.00	2.00	5.00	11.00	8.5

Plot: t/R as ordinate vs. 't' as abscissa; tanOC = K.

R_1 = Vertical distance from reference point to water level after refilling at beginning of increment period.

R_2 = Vertical distance from reference point to water level at the end of increment period.

R = 1/K at equilibrium rate.



Palmdale Civil Base 9 - Percolation Tests		Project:	G-5729-08
NE of Falling Star Place and Pearblossom Highway, Palmdale, CA		Plate:	4

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Appendix C – Infiltration Rates

Infiltration Rate I_f Calculations

- PC-1
- PC-2

Percolation Rate Conversion
Infiltration Rate, I_t
Porchet Method, aka Inverse Borehole Method

Palmdale Civil Base 9 - Percolation Tests
Project No: G-5729-08

Data collected at the Final Interval analysed:

Percolation Test PC-1

As per Test Result, Percolation Rate = 0.1414 inch/Min = 8.48 inch/hour

Time Interval, Δt	=	**10**	Minutes	Initial Depth to Water, D_0	= **87**	Inches
Total Depth of Test Hole, D_t	=	**120**	Inches	Final Depth to Water, D_f	= **89**	Inches
Test Hole Radius, r	=	**4**	Inches			

Initial Height of Water at the selected time interval, H_0	=	33	Inches	$(D_t - D_0)$
Final Height of Water at the Selected time interval, H_f	=	31	Inches	$(D_t - D_f)$
Change in Height over the time interval, ΔH	=	2	Inches	$(H_0 - H_f)$
Average Head Height over the time interval, H_{avg}	=	32	Inches	$(H_0 + H_f)/2$

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

Therefore, I_t = **0.705882 inch/hour**

I_t = **0.352941 inch/hour** **FS: 2**

> 0.3 inch/hour requirement
PASSED

Percolation Rate Conversion
Infiltration Rate, I_t
Porchet Method, aka Inverse Borehole Method

Palmdale Civil Base 9 - Percolation Tests
Project No: G-5729-08

Data collected at the Final Interval analysed:

Percolation Test PC-2

As per Test Result, Percolation Rate = 0.1557 inch/Min = 6.423 inch/hour

Time Interval, Δt	=	**10**	Minutes	Initial Depth to Water, D_0	=	**89**	Inches
Total Depth of Test Hole, D_t	=	**120**	Inches	Final Depth to Water, D_f	=	**91**	Inches
Test Hole Radius, r	=	**4**	Inches				

Initial Height of Water at the selected time interval, H_0	=	31	Inches	$(D_t - D_0)$
Final Height of Water at the Selected time interval, H_f	=	29	Inches	$(D_t - D_f)$
Change in Height over the time interval, ΔH	=	2	Inches	$(H_0 - H_f)$
Average Head Height over the time interval, H_{avg}	=	30	Inches	$(H_0 + H_f)/2$

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

Therefore, I_t = **0.7500 inch/hour**

I_t = **0.375000 inch/hour FS: 2**

> 0.3 inch/hour- PASSED

Appendix D

Infiltration Rates Using Reduction Factor Method R_f

- PC-1
- PC-2

REDUCTION FACTOR, R_f

Project:	Civil Base 9 - Palmdale	Project No.:	G-5729-08	Date:	6/1/2020
Test Hole Number:	**PC-1**	Tested By:	BA/ASB		
Depth of Test Hole, DT	10'	Initial Water Depth (Inches)	87		
Test Hole Dimensions (inches)				Length	Width
Diameter (if Round), Dia =	8	Sides (if Rectangular) =			

Percolation Test	Pre-Adjusted Percolation Rate, in/hr	Initial Depth to Water, **d1** (in)	Water level Drop, Δ**d** (in)	R_f	I_f
PC-1	14	87	2	22.50	0.6222

The average drop of the stabilized rate over the last three consecutive readings is the pre-adjusted percolation rate at the test location in inches per hour.

The pre-adjusted percolation rate must be reduced to account for the discharge of water from both the sides and bottom of the boring (non-vertical flow).

Use the Formula: Reduction Factor, $R_f = [(2d1 - \Delta d) / Dia] + 1$ where d_1 = Initial water Depth, in

Δd = Water level drop of Final Period or Stabilized Rate (in)

REDUCTION FACTOR, R_f						
Project:	Ascension Cemetery		Project No.:	G-5729-08	Date:	2/28/2020
Test Hole Number:		PC-2	Tested By:	BA/ASB		
Depth of Test Hole, DT		10'	Initial Water Depth (Inches)		89	
Test Hole Dimensions (inches)					Length	Width
Diameter (if Round), Dia =		8	Sides (if Rectangular)	=		
Percolation Test		Pre-Adjusted Percolation Rate, in/hr	Initial Depth to Water, **d1** (in)	Water level Drop, Δ**d** (in)	R_f	I_f
PC-2		14	89	2	23.00	0.6087

The pre-adjusted percolation rate must be reduced to account for the discharge of water from both the sides and bottom of the boring (non-vertical flow).

Use the Formula: Reduction Factor, $R_f = [(2d1 - \Delta d) / Dia] + 1$ where d_1 = Initial water Depth, in

Δd = Water level drop of Final Period or Stabilized Rate (in)