Geotechnical Engineering Exploration and Analysis

Proposed Commercial Tilt-up Building
23628 Water Street
Perris, CA

Prepared For:

Thrifty Oil Company
Santa Fe Springs, CA

Project No. G-021422
March 26, 2022

GEO
ENVIRONMENTAL
RESOURCES
INC

GEOTECHNICAL
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CONSULTANTS

GEO ENVIRONMENTAL RESOURCES INC
GEOTECHNICAL ENVIRONMENTAL CONSULTANTS

March 26, 2022

Thrifty Oil Company
Santa Fe Springs, California

Attention: Mrs. Jamie Jones
Project Manager

Subject: Geotechnical Engineering Exploration and Analysis
Proposed Commercial Tilt-up Building
23628 Water Street, Perris, California
Project No. G-021422

Dear Mrs. Jones:

In accordance with your request and authorization, **Geotechnical Engineering Exploration and Analysis** has been conducted for the above referenced site. Conclusions and recommendations developed from the exploration and analysis are discussed in the accompanying report.

We appreciate the opportunity to be of service on this project. If we may be of additional assistance, should geotechnical related problems occur or to provide observation and testing services during construction, please do not hesitate to call at any time.

Very truly yours,
GEO ENVIRONMENTAL RESOURCES, INC.

Alexander A. Rastegar
Project Engineer

S. Dorvash. P.E.

REGISTERED PROFESSIONAL ENGINEER
SIAVASH DORVASH
ENGINEER NO. C 81485
CIVIL
STATE OF CALIFORNIA

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1.0 PROPOSED DEVELOPMENT

Based on the information obtain from proposed plan (SHEET DAB-A1.1), which was received by the project manager, the proposed development consists of construction of 194,479 S.F. of commercial concrete tilt-up building within the above subject property.

Based on the information obtained during our site reconnaissance, the subject property is a vacant parcel located within the southwest corner of the Water Street and Tobacco Road. It appears that the subject property use to be part of a larger parcel, which was bordered by Water Street to the south, Placentia Avenue to the north, Harvill Avenue to the east and Tobacco Road to the west.

However, as indicated above, our subject property lies within the southwest portion of the original parcel and it is bordered by the Water Street to the south, Tobacco Road to the west and vacant parcels to the east and north. Our subject property is relatively flat and is covered with grass, vegetation and various size trees. In addition, we will also provide infiltration rate for potential retention basin located along the east side of the subject property.

2.0 SCOPE OF SERVICES

This report provides the results of a geotechnical engineering exploration and analysis for the construction of the proposed commercial building and other related improvements. We performed a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis in order to provide geotechnical grading and design recommendations for the proposed commercial building and other related improvement.

3.0 SITE LOCATION

The subject property is located at address of 23628 Water Street in Perris, California. The subject property is bordered by an existing vacant parcels to the east, north, Water Street to the south and Tobacco Road to the west.

4.0 SUBSURFACE EXPLORATION

4.1 Subsurface Exploration

Total of five (6) Borings were excavated within the area of the proposed developments to the depths ranging from of 11½ -to-29 ½ feet below existing backyard grade. The approximate boring locations are shown on the boring location plan **(Figure 1, Appendix C).** The Borings was advanced by the drilling rig. Boring No.6 was conducted for the purpose of the Infiltration Tests.

The relatively undisturbed soil samples were collected at approximate every 1½-3 ½ ft. Soil sampling was conducted in accordance with ASTM D1587 and D3550 Standard Specifications. Soil sample was visually reviewed and classified in the field pursuant to ASTM D2488, placed in sealed containers and transported to our laboratory for further review and testing. **Field and laboratory testing is enclosed in Appendix B**. The terms and symbols on the test boring logs are defined in the **General Notes in Appendix D**.

4.2 Local Geology

Based on review of the **GEOLOGIC MAP OF THE PERRIS QUADRANGLE BY THOMAS W. DIBBLEE, JR., 2003,** the native material was identified as **Alluvial fan Deposits (Qoa). However, CGS SEISMIC ZONATION** Identify the native material as either **Qof, which is Old Alluvial Fan Deposits or Qvof-Very Old Alluvial Fan Deposits.**

4.3 Subsurface Conditions

The subsurface soil profile at test boring No.1 consists of silty fine to coarse sand, light to orange brown in color, dry to damp and loose to very dense extended to the maximum explored depth of 29 ½ feet below existing grade.

4.4 Groundwater

Ground water was not encountered during our sub surface exploration. However, it is not uncommon for groundwater or seepage conditions to develop where none previously existed. Groundwater elevations are dependent on seasonal precipitation, irrigation; land use, among other factors, and vary as a result.

4.5 Expansive Potential

Expansion Index (EI) test was conducted according to the ASTM (D-2429) on bulk samples (1-4 feet) from Boring No.1 of the near-surface materials. Results indicated that the near-surface material are low expansive with in expansion potential of (EI = 10).

4.6 Laboratory Testing

The relatively undisturbed soil samples were subjected to various laboratory tests such as Water-Content Determination (ASTM D2216), Moisture-Unit Weight Relationships (ASTM D-1557), Consolidation Test (ASTM D-2435) and Direct-Shear Test (ASTM D-3080).

4.7 Sulfate Potential

Based on our review of laboratory testing result, the water-soluble sulfate (SO4) content is (17.6 mg/kg), according to ACI 318 Section 4.3.1 (type V) concrete is not required to be utilized due to the Sulfate content of soil for the proposed project.

4.8 Corrosion Potential

Based on the review of laboratory test result the on- site soil possess a PH of **7.2** (EPA 9045B) and Resistivity of 9300 (Ohm-cm). Therefore, the on-site soil has been classified as having "**Mildly Corrosive"** potential. And the project Structural Engineer should provide specific recommendation for mitigation and protection, as necessary.

5.0 PERCOLATION FEASIBILITY STUDY

Percolation feasibility study for design for the proposed retention basin has been conducted in accordance with County of Riverside retention basin design guidelines. A copy of Percolation Feasibility Study and its result is referenced in **Appendix F** of this report under "Percolation Feasibility Study".

6.0 GEOLOGIC AND SEISMICITY

6.1 Seismic Design Parameters

The site is located at approximately 33.7825 Latitude and -117.2286 longitudes. Any new structural related construction must be designed in accordance with the requirements of the latest edition of the California Uniform Building Code (CBC). The CBC provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, seismic zoning, occupancy, and the seismic design parameters.

The Site Seismic Parameters presented below are based on the Mapped Acceleration Parameters (Ss and S1) as well as the Site Coefficients and Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameters. Based on the California Building Code, the site is classified as class D based on Table 1613.5.2 (Site Class definitions).

The following parameters may be utilized for the subject site. In addition, copies of most current USGS Design Maps Summary is in Appendix E of this report.

SITE SEISMIC PARAMETERS	
Mapped 0.2 second Period Spectral Acceleration, Ss	1.455
Mapped 1.0 second Period Spectral Acceleration, S1	0.548
Site Coefficient for Site Class “D”, Fa	1.2
Site Coefficient for Site Class “D”, Fv	Null-See Section 11.4.8
Maximum Considered Earthquake Spectral Response Acceleration Parameters at 0.2 second, SMS	1.746
Maximum Considered Earthquake Spectral Response Acceleration Parameters at 1 second, SM1	Null-See Section 11.4.8
Design Spectral Response Acceleration parameter for 0.2 Second, SDS	1.164
Design Spectral Response Acceleration parameter for 0.2 Second, SD1	Null-See Section 11.4.8

6.2 Geological Hazards

It is our judgment, that based on the specific data and information contained or referenced in this report, the construction of the proposed commercial building will be safe against hazards from landslides, settlement or slippage, and they would not adversely affect the stability of the existing and adjacent structures, provided the recommendations presented herein are properly interpreted and implemented.

7.0 SECONDARY SEISMIC EFFECTS

The primary geologic hazard at the sites is moderate to strong ground shaking caused by an earthquake on any of the local or regional faults. The potential for secondary geologic hazards was also evaluated including, liquefaction, dynamic settlement.

7.1 Liquefaction

Liquefaction is the loss of strength in generally cohesion less, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors in which influence the potential for liquefaction include groundwater table elevation, soil type and grain size characteristics, and relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface.

However, based on the review of **“CGS Seismic Zonation Program”** as well as the **GEOLOGIC MAP OF PERRIS QUADRANGLE BY THOMAS W. DIBBLEE, JR., 2005**, the subject property is NOT located within “Liquefiable” area.

7.2 Surface Rupture

Based on research of available literature and results of site reconnaissance, no known active or potentially active faults underlie the subject site. In addition, the subject site is not located within any **Alquist-Priolo** Earthquake Fault Zone. Based on these considerations, the potential for surface ground rupture at the subject site is considered moderate.

7.3 Landslide

As indicated previously, the subject property is relatively flat. In addition, based on review of “CGS Seismic Hazards Zonation “the subject property is NOT located within potential “Landslide” area.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the result of sub-surface exploration, laboratory testing, and research, it is the finding of this firm that the construction of the proposed commercial building is considered feasible from a geotechnical engineering standpoint provided the advice and recommendations presented herein are followed and implemented during construction.

Results of moisture-density testing revealed that majority of the near-surface material are in dry to damp condition. In addition, results of Consolidation Tests, which were conducted on the randomly selected soil samples at various depths also indicated excessive consolidation under potential building pressure.

Therefore, we are recommending that in order to develop a uniform sub-surface layer with increased support characteristics with proper in-situ moisture content, following completion of the existing vegetation and tree removal, the proposed building pad area should be over-excavated to approximate depth of **eight (8) feet below proposed Rough Finished Grade (RFG)** elevation or an equivalent of **four (4) feet below the proposed foundation subgrade (whichever is lower in elevation).**

Upon completion of the over-excavation, the exposed subgrade within the entire pad area should be scarified to depth of 12-inch, moisture conditioned as necessary and poof-rolled and compacted to at least 90 percent of its Maximum Laboratory dry Density as determined by the (ASTM D-1557) Test Method. The scarification should be conducted on both directions of the proposed building area.

The main purpose of the compaction and/or proof rolling is to detect any yielding and/or loose soils, which should be remove to depth of firm subgrade, which should be determined and confirmed by a representative from this office.

The foundation system may consist of either independently poured spread footings or a monolithically poured foundation and floor slab thereby using a turned-down slab construction technique. The parameter and column pad footings should be embedded at least 30- inch into the newly placed and compacted structural fill material. However, the actual depth of embedment should be provided by the project structural engineer. Column and continuous footings may be designed for a maximum, allowable soil bearing strength of 2,000 pounds per square foot (psf).

8.1 Site Preparation and Grading

Subgrade Preparation within the Building pad Area

As indicated in section 7.0, we are recommending that in order to develop a uniform sub-surface layer with increased support characteristics, following completion of the trees and vegetation removal, the proposed building area should be over-excavated to approximate depth of eight (8) feet below proposed Rough Finished Grade (RFG) elevation or an equivalent of four (4) feet below the proposed foundation subgrade (whichever is lower in elevation).

Upon completion of over-excavation, the exposed subgrade within the entire pad area should be scarified to depth of 12-inch, moisture conditioned as necessary and compacted to 90 percent of Maximum Laboratory Dry Density, as determined by (ASTM D-1557) Test Method.

Any loose or otherwise unsuitable soil that is encountered during compaction and proof rolling should be removed to depth of firm subgrade, which should be determined and confirmed by a representative from this office.

The entire grading operation should be conducted in presence of a representative from this office. And the ultimate depth of removal as well as bottom scarification and compacting should be verified and confirmed by our representative as well.

8.2 Pavement Grading Recommendation

Following removal of all the grass, vegetation and trees and necessary cuts. We are recommending that the entire new pavement area should be over-excavated to depth of 24-inch below its Proposed Rough Finished Grade (RFG). Upon completion, the exposed subgrade should be scarified to depth of 12-inch, moisture conditioned, and compacted to at least 90 percent of its Maximum Dry Density as Determined by the (ASTM D 1557-12) Test Method.

8.3 Fill Placement

All the new fill soils should be placed in 8-10 inches thick loose lift and each lift should be Moisture conditioned to the suitable moisture content and compacted to at least 90 percent of the Maximum Laboratory Dry Density as determined by (ASTM D 1557-12) Test Method.

On-site soils may be utilized as structural fill provided they are free of debris and moisture conditioned as necessary to the satisfaction of our field representative.

All grading and fill placement activities should be completed in accordance with the requirements of the City of Perris and/or County of Riverside Grading Guidelines. All fill soils should be compacted to at least 90 percent of the Maximum Laboratory Dry Density as determined by (ASTM D 1557-12).

Compaction tests should be performed periodically by a representative from this office as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at random locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the project specification.

8.4 Imported Structural Fill

In general, all imported structural fill soils (If needed) should consist of low to non-expansive (EI<20), well-graded soil. Imported soils should be evaluated by a geotechnical engineer or his representative prior to placement.

8.5 Utility Trench Backfill

In general, all the new utility trench backfill should also be compacted to at least 90 percent of the Maximum Laboratory Dry Density as determined by (ASTM D- 1557-12). Compacted trench backfill should be performed to the requirement of the local grading guidelines. The trench backfill soils should be compaction tested where possible, probed and visually evaluated elsewhere.

8.6 Temporary Excavation

In general, temporary excavation higher than four (4) feet should be sloped back to 1:1(Vertical: Horizontal).

9.0 CONSTRUCTION CONSIDERATION

9.1 Excavation Difficulties

During our subsurface exploration very dense material was encountered at approximate depths of 7-to-10 feet below existing grade. Therefore, some excavation difficulties should be anticipated.

9.2 Over-Sized Partials

During the demolition of the current structure, if “over-sized” particles encountered in excessive quantities, proper segregation should be conducted in order to make the excavated materials suitable for fill placement or remove them from the excavation area.

10.0 FOUNDATION DESIGN AND CONSTRUCTION

10.1 Shallow Foundation Parameters for the Building (Structural Fill)

1- An allowable Soil Bearing pressure of 2,000 (psf)
2- An allowable At-Rest pressure of 56.5 (psf) **USE 60** (psf)
3- An allowable Active pressure of 66.5 (psf) **USE 70** (psf)
4- An allowable passive pressure of 390.0 (psf) **USE 300** (psf)
5- Friction angle of 32 degree
6- The proposed footing dimension should be provided by the project structural engineer, however, the proposed continuous and column pad footing should be embedded at least 36-inch into newly placed and compacted structural fill soil.

10.2 Footing Reinforcement

The minimum longitudinal steel reinforcing within proposed wall and column pad footing should be performed by the project structural engineer. The Bearing suitability of the exposed subgrade within the footing excavation should be evaluated by a representative from this office prior to placement of the reinforcement.

10.3 Floor Slab Design and Construction for Commercial Building

Based on the recommended subgrade preparation and the anticipated live floor loading, a 6-inch thick concrete slab over 6-inch aggregate base course, which have been moisture conditioned and compacted is considered to be suitable. It is recommended that the Concrete control joints at 30 times slab thickness (per foot) be provided in order to lower the potential of concrete slab shrinkage.

One (1)-inch thick layer of sand may be needed between the slab and the aggregate base course to promote proper curing. The minimum slab reinforcing should be No. 3 bars at 18-inch on-center spacing each way with the slab structurally connected to the perimeter footings. However, the actual size of the slab reinforcement should be provided by the project structural engineer.

10.4 Foundation Static Settlement

The majority of settlement will occur during the initial application of the load, which is during the construction of the new tilt-up building. Following completion of the tilt-up Construction, we expect no more than 1-inch total and ¾ -inch differential for the static settlement over span 100 feet.

10.5 Drainage

All the site drainage should be collected and transferred to the street in non-erosive drainage devices. The proposed tilt-up building should be provided with roof drainage as well.

Drainage should not be allowed to pond anywhere on the site, and especially not against any foundation. The ground immediately adjacent to the foundation shall be sloped away from the new structure at a slope of not less than one-unit vertical in 20 units horizontal (5 percent slope) for a minimum distance of 10 feet of horizontal distance measured perpendicular to the face of the wall.

If physical obstructions or lot lines prohibit 10 feet of horizontal distance, a 5-percent slope shall be provided to an approved alternative method of diverting water away from the foundation.

10.11 Grading and Foundation Plan Review

It is recommended that proposed grading and foundation plans be reviewed by this office prior to finalization to verify that the plans have been prepared in conformance with the geotechnical recommendations presented in this report and if necessary to provide additional analyses or recommendations.

11.0 RETAINING WALL DESIGN

11.1 Wall Design

For simplicity and ease of report interpretation the following chart had been prepared to show the at rest, active and passive lateral pressures for the proposed retaining walls up to 10 feet high. The design is based on the compacted soil parameters, assuming level-backfill.

ITEM	VALUE1
At-Rest Case	56.5psf/ft (use 60) psf/ft
Active Case	66.5 psf/ft (use 70) psf/ft
Passive Case	390.0 (use 300) psf/ft
*Note: The values are based on Compacted Soil.	

Retaining walls greater than 6 feet in height should be designed for seismic lateral earth pressures. The "**Total seismic earth pressure",** which is a combination of "static earth pressure' and "**incremental seismic pressure".** The pressure distribution may be considered to be a triangle with the maximum pressure at the bottom. The resultant of this force may be assumed to be at 1/3 the height of the wall from the bottom of the wall.

The **“incremental seismic pressure”** can be calculated as the difference of “total seismic earth pressure” and “static earth pressure. Note**, Any computed seismic increment of lateral earth pressure should not be added to the static (at-rest) lateral earth pressures”.**

11.2 General requirement for wall design

Foundation and retaining walls shall be designed to resist live loads surcharge from sidewalk pedestrian traffic and street traffic according to **LADBS P/BC 2017- 141** besides lateral soil load according **LADBS P/BC 2011-083** which are minimum design loads for lateral soil pressure.

In General, and if needed, surcharge loads shall be applied where vehicular load or pedestrian loads are expected to act on the surface behind a shored excavation or retaining wall within a distance equal to the height of the excavation or wall. In the case of the live load:

Method B of the LADBS (P/BC 2017- 141) is applicable where site-specific lateral earth pressure coefficients are provided in the Soils Report.

$$q = k \times \gamma_s \times H_{eq}$$

Where:

q = lateral surcharge pressure (psf) in rectangular distribution
k = active or at-rest earth pressure coefficient from Soils Report
γ_s = total unit weight of soil (pcf)
H_{eq} = equivalent height of soil from “Table 1” below

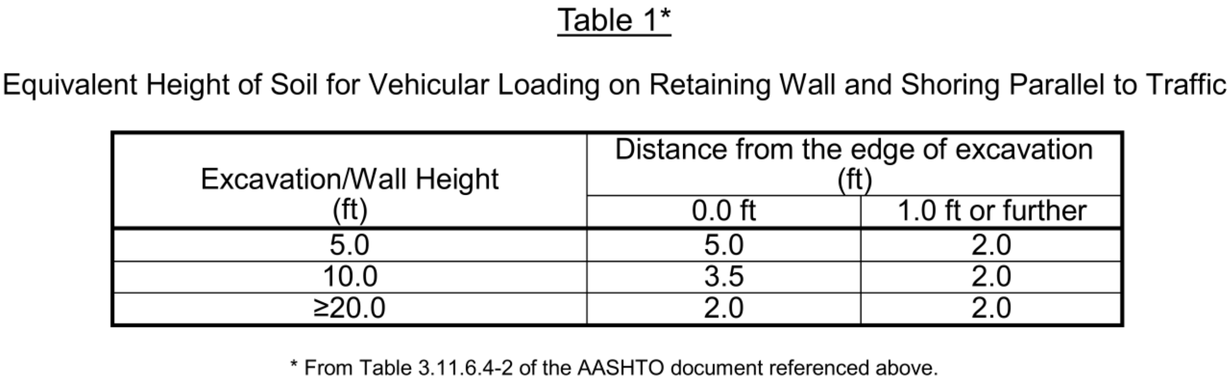

Table 1*

Equivalent Height of Soil for Vehicular Loading on Retaining Wall and Shoring Parallel to Traffic

Excavation/Wall Height (ft)	Distance from the edge of excavation (ft)	
	0.0 ft	1.0 ft or further
5.0	5.0	2.0
10.0	3.5	2.0
≥20.0	2.0	2.0

* From Table 3.11.6.4-2 of the AASHTO document referenced above.

Additional design Requirement

L.A.B.C. Sections 1610.1 and 1807.2 cover the design of retaining walls as follows:

1610.1 General. Basement, foundation and retaining walls shall be designed to resist lateral soil loads. Soil loads specified in **Table 1610.1** shall be used as the minimum design lateral soil loads unless specified otherwise in a soil calculation approved by the building designer. Basement walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top are permitted to be designed for active pressure.

Design lateral pressure from surcharge loads shall be added to the lateral earth pressure load. Design lateral pressure shall be increased if soils with expansion potential are present at the site.

Retaining walls should also be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. In addition, retaining walls should also be designed to resist lateral pressure of the retained material determined in accordance with accepted engineering principles.

Additionally, unless a soil report is submitted to and approved by the department indicating that expansive soils do not exist, the footings for all retaining walls must extend a minimum of 24-inch below the natural and finish grades in accordance with the requirements contained **in IB P/BC 2011-116 FOR EXPANSIVE SOIL CONDITIONS.**

11.3 Retaining Wall Drainage

Retaining walls should be provided with a drainage system at the base of the walls. The drainage should consist of a 4-inch in diameter-perforated pipe, embedded within a 12-inch thick clean gravel wrapped in a geosynthetic filtration fabric.

11.4 Retaining Wall Backfill

The following is our general guidelines for the backfill within all the proposed retaining wall (s) regardless of their heights. Following placement of the drainage system the on-site soils may be utilized as backfill material behind the proposed retaining walls. The backfill material should be free of any debris as well as the over-sized particles to satisfactory of the project geotechnical engineer.

If needed, the fill material should be moisture conditioned as necessary, placed in thin lifts (8-to-10 inches) and each lift should be compacted with grading equipment to 90 percent of its Maximum Laboratory Dry Density.

As an alternative, the proposed retaining walls may be backfilled with import material with low expansion (EI<20). The imported soil should be evaluated and confirmed by the Geotechnical engineer prior to usage.

12.0 PAVEMENT RECOMMENDATION

12.1 Asphalt Pavement

Based on these findings and assuming traffic index (TI=7) the following table presents the recommended thickness for the new flexible pavement structure consisting of asphaltic concrete over a granular base, along with the appropriate CALTRANS specifications for proper materials and placement procedures.

Preliminary Pavement Recommendations

	Parking Spots (Light Traffic Area)	**Driveways and aprons (Heavy Traffic Areas)**
PCC Section: Portland Cement Concrete	6.0-Inch Thick PCC over 6.0-Inch thick Layer of Aggregate Base Course, which had been reinforced	8.0-Inch Thick over 6.0-inch Thick Layer of Aggregate Base Course, which had been reinforced
Asphalt Section Asphaltic Concrete	4-Inch Thick AC over 8-Inch thick layer of Aggregate Base Course	4-Inch Thick AC over 12-Inch Thick Layer of Aggregate Base Course

The underlying subgrade should be scarified to depth of 12-inch, moisture conditioned as necessary and Compacted to at least 90 percent of Maximum Laboratory Dry Density as Determined by (ASTM D-1557-12) Test Method.

The new Aggregate Base Course material should be moisture conditioned as necessary and compacted to at least 95 percent of the Maximum Laboratory Dry Density as determined by (ASTM D-1557-12) test method. Asphalt Concrete (AC) should be compacted to a minimum of 95 percent of the laboratory Marshall Density.

12.2 Exterior Concrete Flat Work

The preparation of the subgrade soils within the flat work area such as side walk is as follows, the upper 6-inch of pavement over subgrade soils, which had been scarified to depth of 12-inch, moisture conditioned as necessary and compacted to at least 90 percent of the Maximum Laboratory Dry Density as determined by (ASTM D 1557-12) test method.

13.0 EXPLORATION LIMITATIONS

The conclusions and recommendations presented in this report are based on the findings and observations in the field and the results of laboratory tests performed on representative samples. The soils encountered in the boreholes are believed to be representative of the investigated area; however, soil characteristics can vary throughout the site. Geo Environmental Resources Inc. should be notified if subsurface conditions are encountered which differ from those described in this report.

This report has not been prepared for use by parties or projects other than those named and described above. It may not contain sufficient information for other parties or other purposes.

The conclusions and recommendations presented in this report are professional opinions. These opinions have been derived in accordance with current standards of geotechnical engineering and engineering geology practice, field observations and laboratory test results. No other warranty is expressed or implied.

Samples secured for this investigation will be retained in our laboratory for a period of thirty (30) days from the date of this report and will be disposed after this period unless other arrangements are made.

14.0 REFERENCES

a) United States Geologic Survey (USGS),
b) 2008b, National Seismic Hazards Maps-Fault Parameters
c) California Building Code (CBC) latest addition
d) Geologic Map of the Perris Quadrangle
e) Perris Quadrangle by (Thomas W. Dibblee, Jr., 2003)
f) California Geological Survey (Cgs Seismic Zonation)

APPENDIX A

Boring Log

LOG OF BORING

B-1

Project Location:23628 Water Street, Perris
Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022
Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Wet Unit Wt. (pcf)
-1	SM	Brown Silty Fine Sand, Trace Roots(Top Soil) Dry to Damp, Loose To the depth of (1 1/2) ft	-1	S	8	2.3	
-3	SM/SC	Orange Brown Silty Fine Sand with Clay to Clayey Fine Sand, Alluvial Deposits(Qof) Dry to Damp, Dense	-3	S	34	3.4	
-5	SM/SC	Same Alluvial deposits (Qof) Damp very Dense	-5	S	70	2.7	119.8
-7		Same Alluvial Deposits (Qof) Damp, Dense	-7	S	46	3.7	123.2
-9		To the depth of (9 1/2) ft					
		Light Brown Silty Fine to Coarse Sand (Cemeneted) Alluvial Deposits (Qof) Damp to moist, Very Dense	-10	S	68	5.3	
-15		Same Alluvial deposits (Qof) Damp to Moist, Very Dense	-15	S	67	5.3	134.2
-20		Light Brown Silty Fine to Coarse Sand (Cemeneted) with CALICHÉ Damp to moist, Very Dense	-20	S	3"/64	5.2	-
-25		Same Damp to Moist, Very Dense	-25	S	5"/69	5.7	126.7
-30		Terminated at the depth of 29 1/2 ft					

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D =Drive sample
S = SPT sample

Plate

LOG OF BORING

B-2

Project Location:23628 Water Street, Perris
Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022
Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Wet Unit Wt. (pcf)
-1	SM	Top Soil Brown to Orange Brown Silty Fine Sand Trace Root, Dry, Loose To the depth of (1 1/2) ft	-1	S	6	2.1	
-3	SM	Orange Brown Silty Fine to Coarse sand, Trace to little Clay Dry to Damp, Dense	-3	S	32	3.3	119.2
-5	SM	Same Dry to Damp, Dense	-5	S	48	3.9	
-7	SM	Same Dry, Very Dense	-7	S	54	2.7	126.3
-10	SM	Orange Brown Silty Fine to Coarse Sand Trace Clay with CALICHE Alluvial Deposit (Qof) Damp to Moist, Very Dense	-10	S	4"/63	5.7	129.5
-15	SM	Same Alluvial Deposits (Qof) Damp to Moist, Very Dense	-15	S	5"/56	5.3	--
-20	SM	Same Alluvial Deposits, Damp to Moist, Very Dense Terminated at the depth of (23 1/2) ft	-20	S	64	5.4	132.6
-25							
-30							
-35							

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D =Drive sample
S = SPT sample

Plate

LOG OF BORING

B-3

Project Location:23628 Water Street, Perris

Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022

Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Dry Unit Wt. (pcf)
-1	SM	Top Soil Brown Silty Fine Sand, Trace Roots Dry, Loose	-1	S	8	2.3	--
-3	SM	Orange Brown Silty Fine to Medium Sand (Cemented), Alluvial Deposite (Qof) Damp to Moist, Very Dense	-3	S	55	4.7	--
-5	SM	Same Damp to Moist, Very Dense, Alluvial Deposite,	-5	S	51	4.6	--
-9							
-10		Same Moist, Very Dense Terminated at the depth of (11 1/2) ft	-10	S	54	5.7	
		.					

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D =Drive sample
S = SPT sample

Plate

LOG OF BORING

B-4

Project Location:23628 Water Street, Perris — Date Drilled: 2/20/2022
Surface Elevation (ft): EL:100.0 — Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Dry Unit Wt. (pcf)
-1	SM	Top Soil Brown Silty Fine Sand, Trace Root Dry, Loose To the depth of (1 1/2) ft	-1	S	5	2.1	--
-3	SM/SC	Orange Brown Silty Fine to Coarse Sand, Trace Clay to Clayey Fine Coarse sand Alluvial Deposits (Qof), Damp, Dense	-3	S	45	2.9	122.7
-5		Same Damp, Dense Alluvial Deposits (Qof)	-5	S	50	3.2	
-7	SM/SC	Light Brown Silty Fine to medium Sand (Cemented), Trace CALICHE Damp to Moist, Very Dense	-7	S	4"/64	4.3	
-9							
	SM/SC	Damp to Moist, Very Dense	-10	D		4.5	124.6
-10							
		To the depth of (14 1/2) ft					
-15	SM	Brown Silty Fine to Coarse Sand, Trace Clay with CALICHE (Cemented) Damp to Moist, Very Dense	-15	D	65	5.3	126.7
-20	SM	Same Damp to Moist, Very Dense Alluvial Deposit (Qof) Terminated at the depth of (23 1/2) ft	-20	D	5"/69	5.6	133.4
-25							

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Anaheim, California 92801

D =Drive sample
S = SPT sample

Plate

LOG OF BORING

B-5

Project Location:23628 Water Street, Perris
Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022
Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Dry Unit Wt. (pcf)
-1	SM	Brown Silty Fine to Coarse Sand, Trace Clay Alluvial Deposits (Qof) Dry to damp, Dense					
-3			-3	S	41	3.1	
-5	SM	Orange Brown Silty Fine to Coarse Sand (Cemented) with CALICHE Alluvial Deposit (Qof) Moist, Very Dense	-5	S	56	7.5	130.9
-7	SM	Same Alluvial Deposit (Qof) Moist, Very Dense	-7	S	5"/56	8.2	--
-10	SM	Light Brown Silty Fine to Coarse Sand (Cemented) Alluvial Deposit (Qof) Moist, Very Dense	-10	S	3"/64	9.3	--
-15	SM	Same Alluvial Deposite (Qof) Moist, Very Dense	-15	S	71	6.1	133.5
-20	SM	Same Alluvial Deposit Damp to Moist, Very Dense	-20	S	59	5.8	
-25	SM	Same Cemeneted with CALICHE Damp to Moist, Very Dense Terminated at the depth of (29 1/2) ft	-25	S	3"/61	5.6	
-30							

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D =Drive sample
S = SPT sample

Plate

LOG OF BORING

B-6

Project Location:23628 Water Street, Perris
Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022
Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Wet Unit Wt. (pcf)
-1	SM	Brown Silty Fine Sand, Trace Roots(Top Soil) Dry to Damp, Loose To the depth of (1 1/2) ft	-1	D		3.5	
-3	SM/SC	Orange Silty Fine Sand with Clay to Clayey Fine Sand, Alluvial Deposits(Qof) Dry to Damp, Dense	-3	D		2.9	
-5	SM/SC	Same Alluvial deposits (Qof) Damp very Dense	-5	D		3.2	120.1
-7		Same Alluvial Deposits (Qof) Damp, Dense	-7	D		3.9	123.1
-10		To the depth of (10) ft					

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Anaheim, California 92801

D =Drive sample
S = SPT sample

Plate

APPENDIX B

Laboratory Testing

Geo Environmental Resources Inc.

CONSOLIDATION TEST NO.1

Location: Perris-23628 Water Street

Boring No: B-1

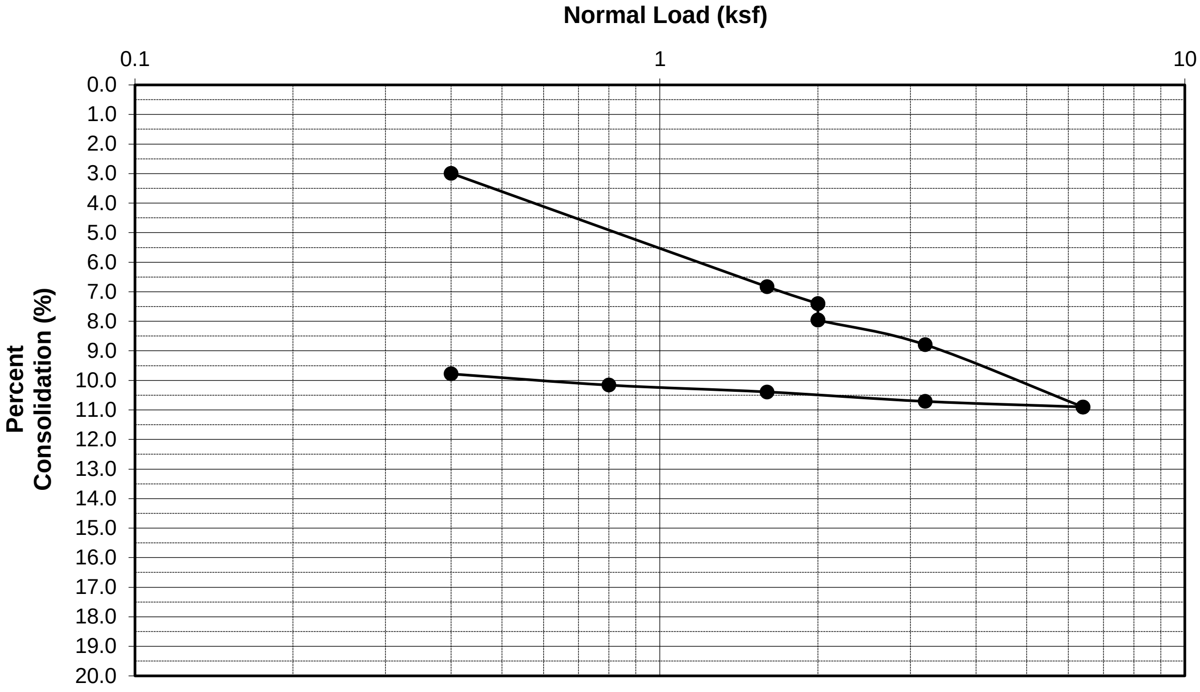
Soil Type: Light Brown Silty fine Sand

Tested By: RK

Project No G-021422

Depth: 5feet

Date: 2/22/2022



Geo Environmental Resources Inc.

CONSOLIDATION TEST NO.2

Location: Perris-23628 Water Street

Boring No: B-2

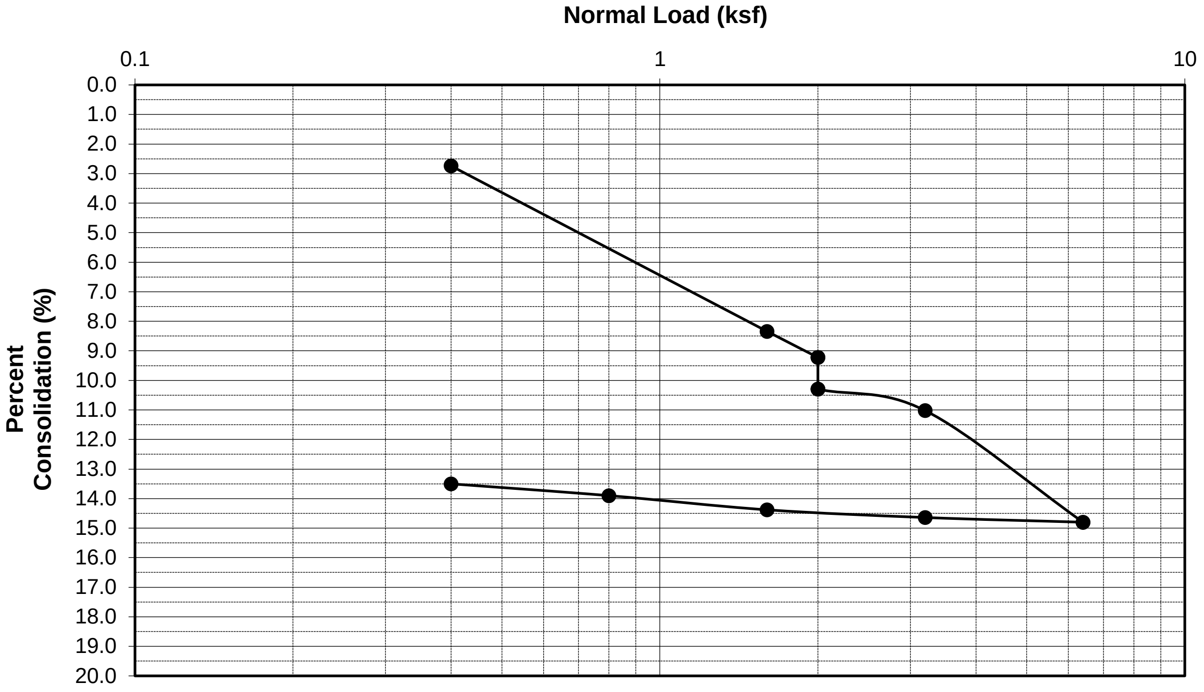
Soil Type: Olive-brown silty f-sand

Tested By: RK

Project No G-021422

Depth: 7 feet

Date: 2/23/2022



Geo Environmental Resources Inc.

CONSOLIDATION TEST NO.3

Location: Perris-23628 water Street

Boring No: B-1

Soil Type: Orange brown silty fine to coarse sand

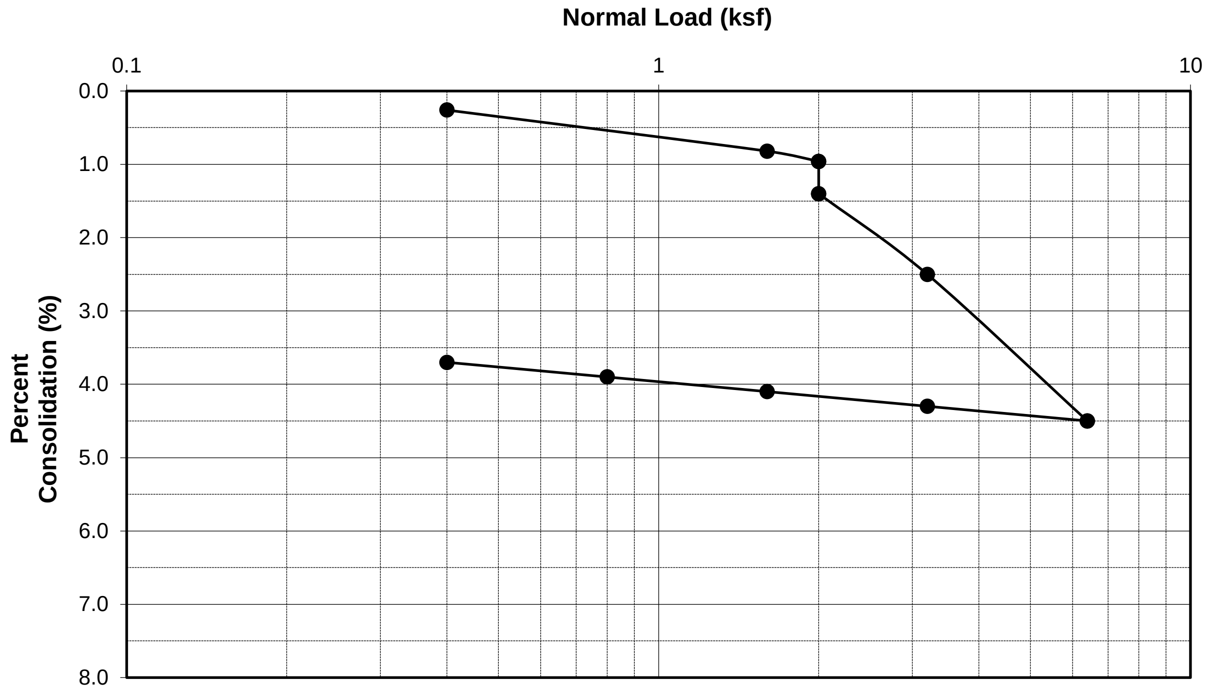
Tested By: RK

Project No G-021422

Depth: Bulk Sample

Date: 2/25/2022

REMOLDED SAMPLE



Geo Environmental Resources Inc.

DIRECT SHEAR TEST NO.1

Location : Perris-23628 Water Street

Boring No: B-1

Soil Type: Orange brown silty f-c sand

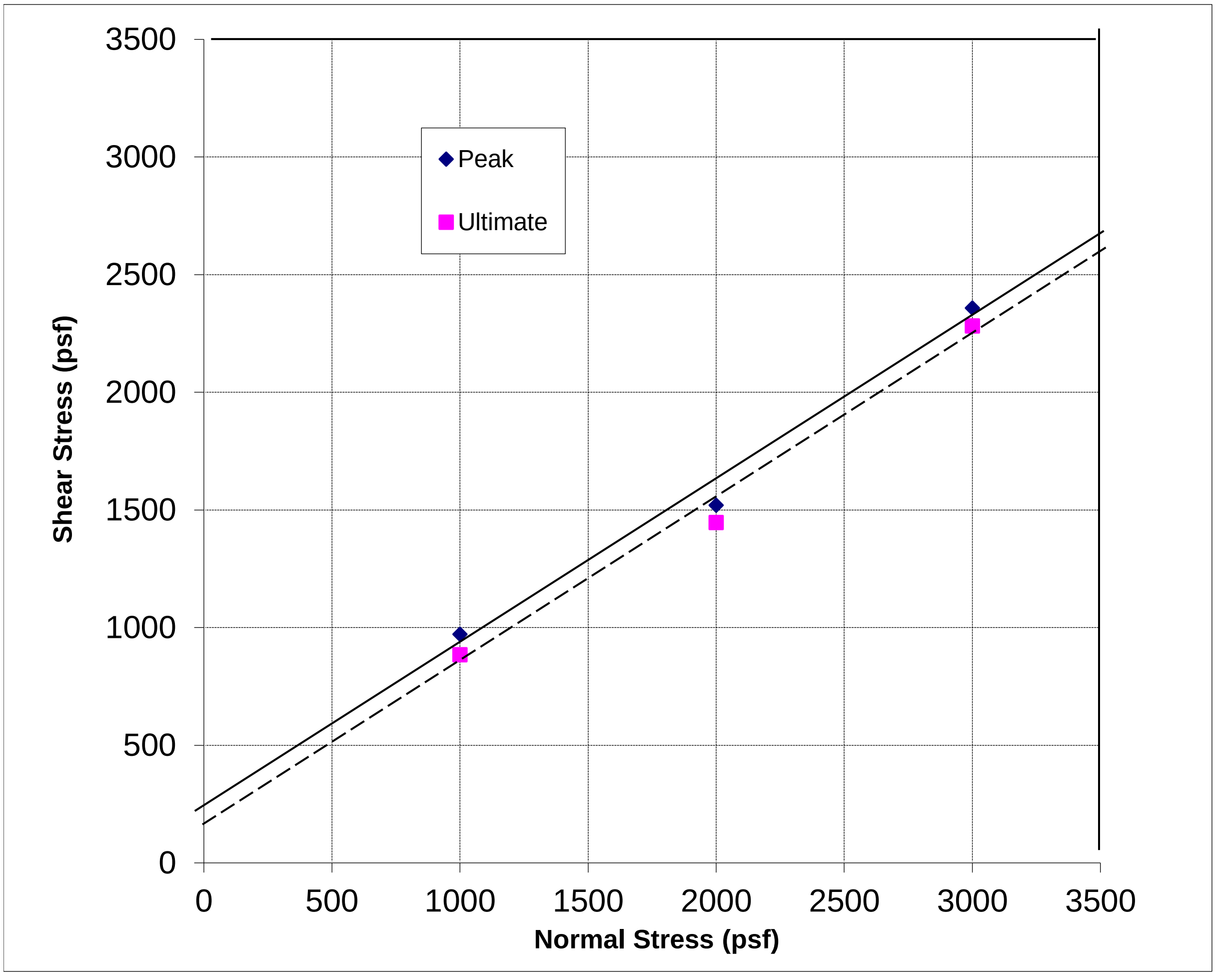
Tested by: RK

Project No: G-021422

Depth: Bulk (3-7 feet)

Date: 2/27/2022

REMOLDED SAMPLE



	Peak	Ultimate
Cohesion (psf)	220	160
Friction Angle (deg.)	32	32

Geo Environmental Resources Inc.

MAXIMUM DENSITY TEST

Location : Perris-23628 Water Street

Boring No: B-1

Soil Type: Orange brown silty f-c sand

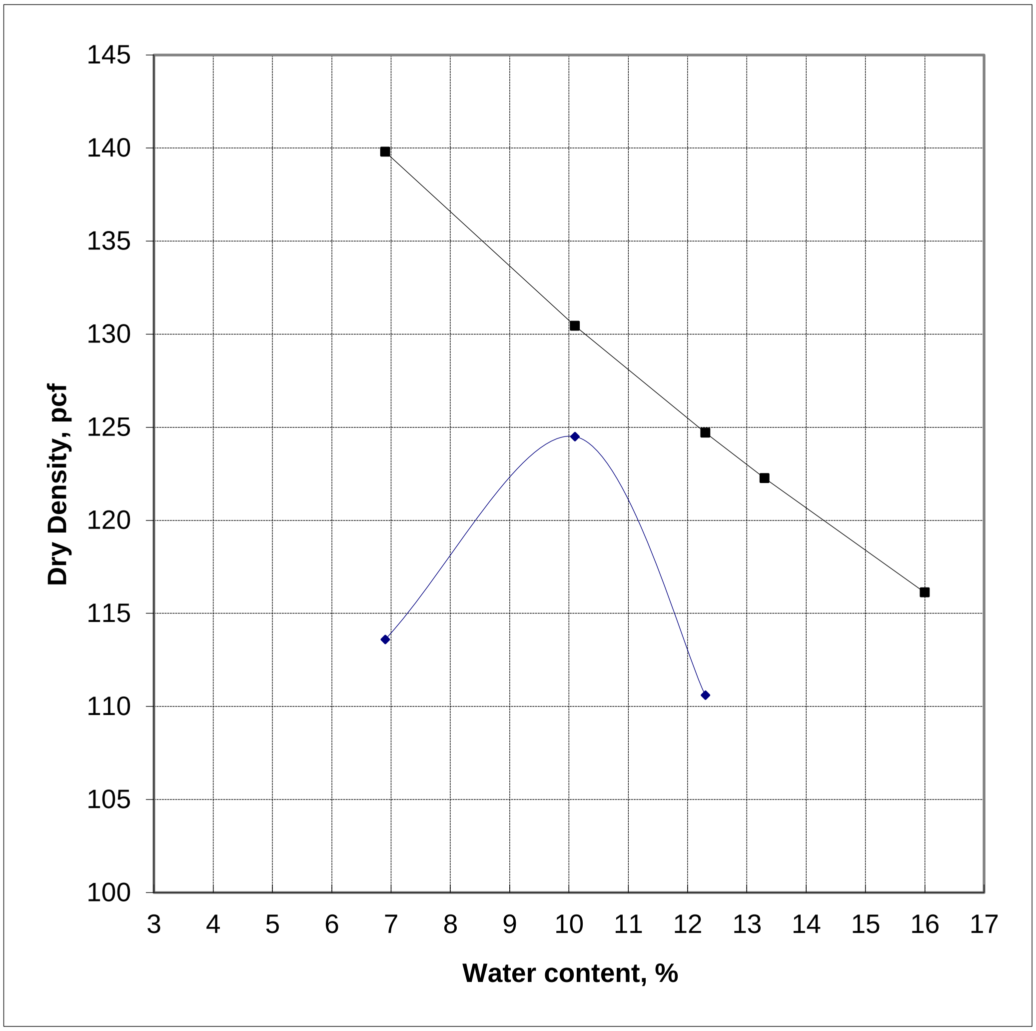
Tested by: MG

Project No G-021422

Depth: Bulk (3-7) feet

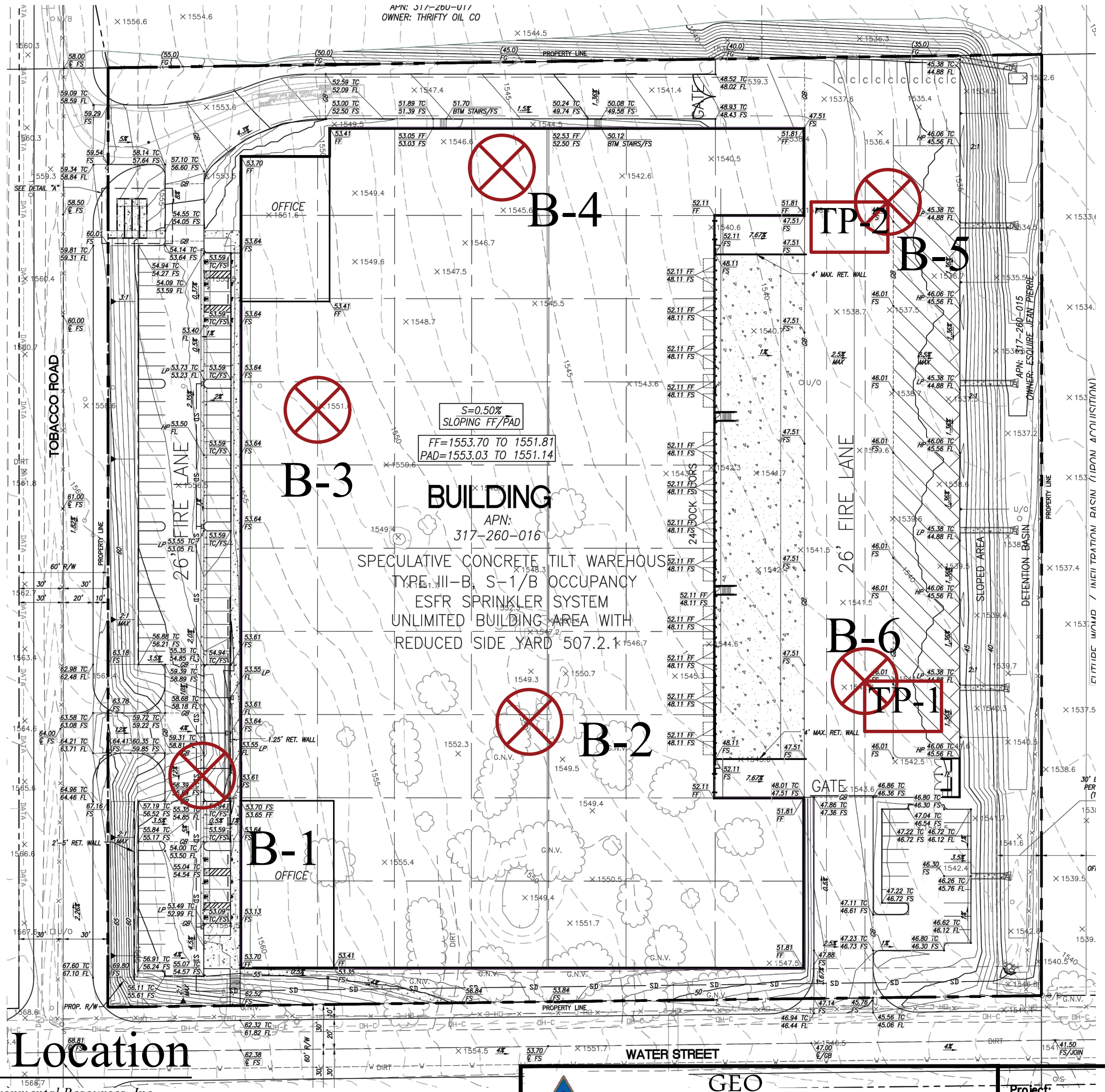
Date: 2/21/2022

Proctor No.1 124.5 @ 10.0



APPENDIX C

Figures



Plan & Boring Location

Based on the drawing that was sent to GEO Environmental Resources, Inc

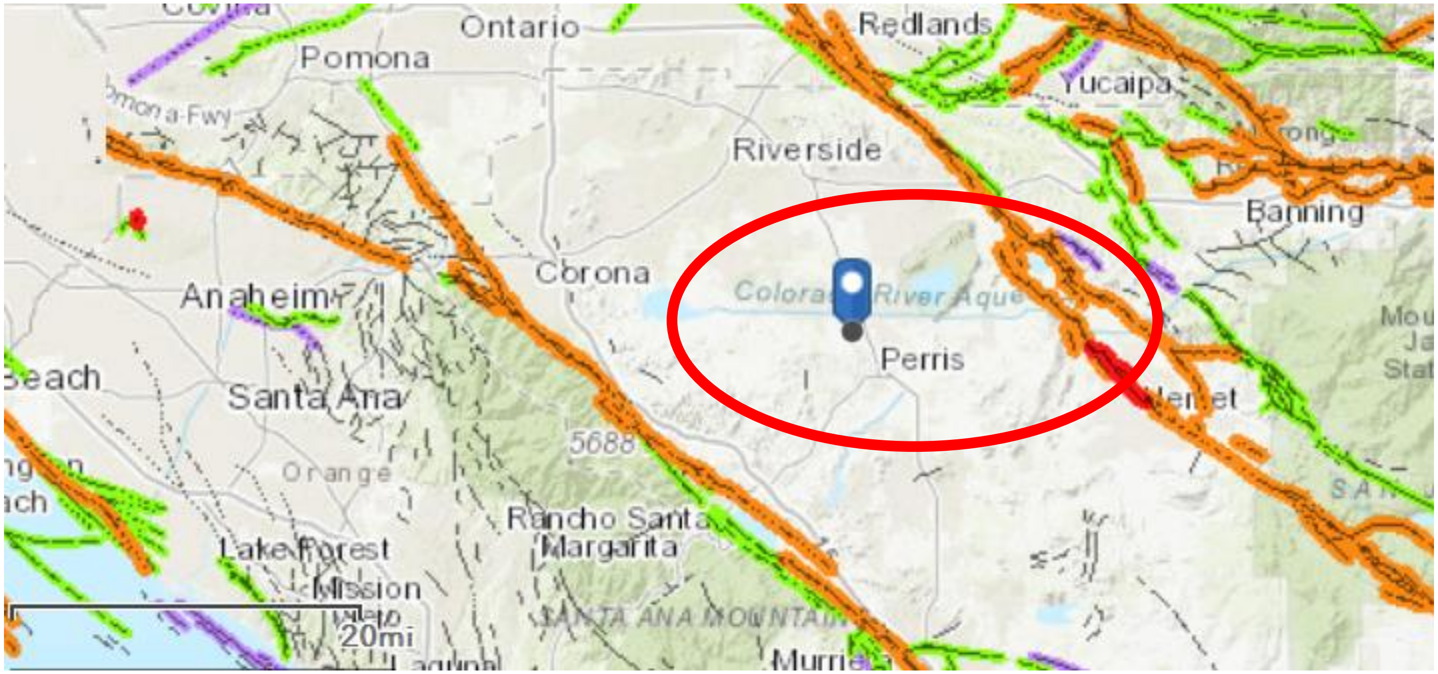
B-1 *Approximate Boring Location*

P-1 *Approximate Percolation Test Location*

GEO ENVIRONMENTAL RESOURCES INC
GEOTECHNICAL ENVIRONMENTAL CONSULTANTS

GEO
ENVIRONMENTAL
RESOURCES, INC.
TEL: (714) 995-9001 FAX: (714) 995-9008

Project: Proposed Tiltup
ADDRESS: 23628 Water Street, Perris
Project NO: G-021422
SCALE: As Mentioned
FIG.:1



SYMBOL EXPLANATION

Fault traces on land are indicated by solid lines where well located, by dashed lines where approximately located or inferred, and by dotted lines where concealed by younger rocks or by lakes or bays. Fault traces are queried where continuation or existence is uncertain. All offshore faults based on seismic reflection profile records are shown as solid lines where well defined, dashed where inferred, queried where uncertain.

——— — — — ········?··

Holocene fault displacement (during past 11,700 years) without historic record.

——— — — — ········?··

Late Quaternary fault displacement (during past 700,000 years).

——— — — — ········?··

Quaternary fault (age undifferentiated).

——— — — — ········?··

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement.

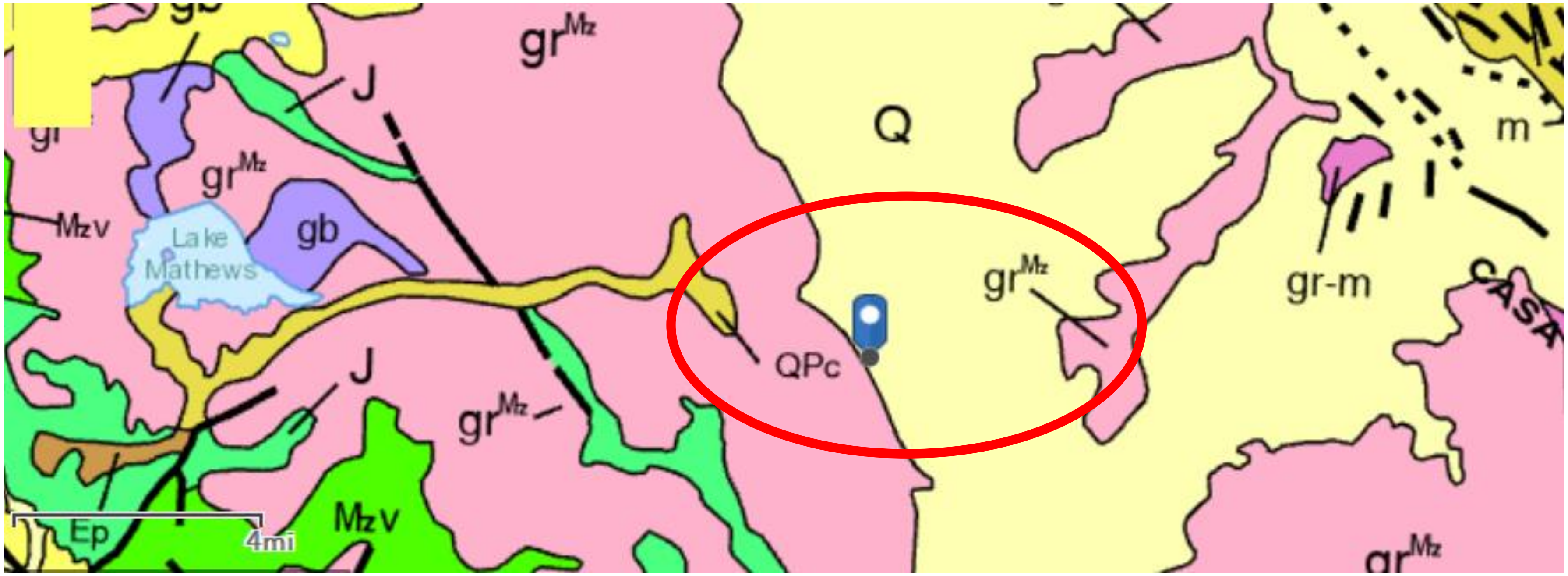
491

——— — — — ········?··

Numbers refer to annotations listed in the appendices of the accompanying report.

Geo Environmental Resources, Inc

Figure 2	Fault Activity Map of California (2010)
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	California Department of Conservation



DESCRIPTION OF MAP UNITS

QUATERNARY DEPOSITS

Qs	Extensive marine and nonmarine sand deposits, generally near the coast or desert playas
Q	Alluvium, lake, playa, and terrace deposits; unconsolidated and semi-consolidated
Qls	Selected large landslides
Qg	Glacial till and moraines. Found at high elevations mostly in the Sierra Nevada and Klamath Mountains
Qoa	Older alluvium, lake, playa, and terrace deposits
QPc	Pleistocene and/or Pliocene sandstone, shale, and gravels deposits; mostly loosely consolidated

MESOZOIC PLUTONIC ROCKS

gr^{Mz}	Mesozoic granite, quartz monzonite, granodiorite, and quartz diorite
um	Ultramafic rocks, mostly serpentine. Minor peridotite, gabbro, and diabase; chiefly Mesozoic
gb	Gabbro and dark dioritic rocks; chiefly Mesozoic
gr	Undated granitic rocks

- ✓ California Geological Survey, Geologic Data Map No. 2
- ✓ Compilation and Interpretation by: Charles W. Jennings (1977)
- ✓ Updated version by: Carlos Gutierrez, William Bryant, George Saucedo, and Chris Wills
- ✓ Graphics by: Milind Patel, Ellen Sander, Jim Thompson, Barbara Wanish and Milton Fonseca

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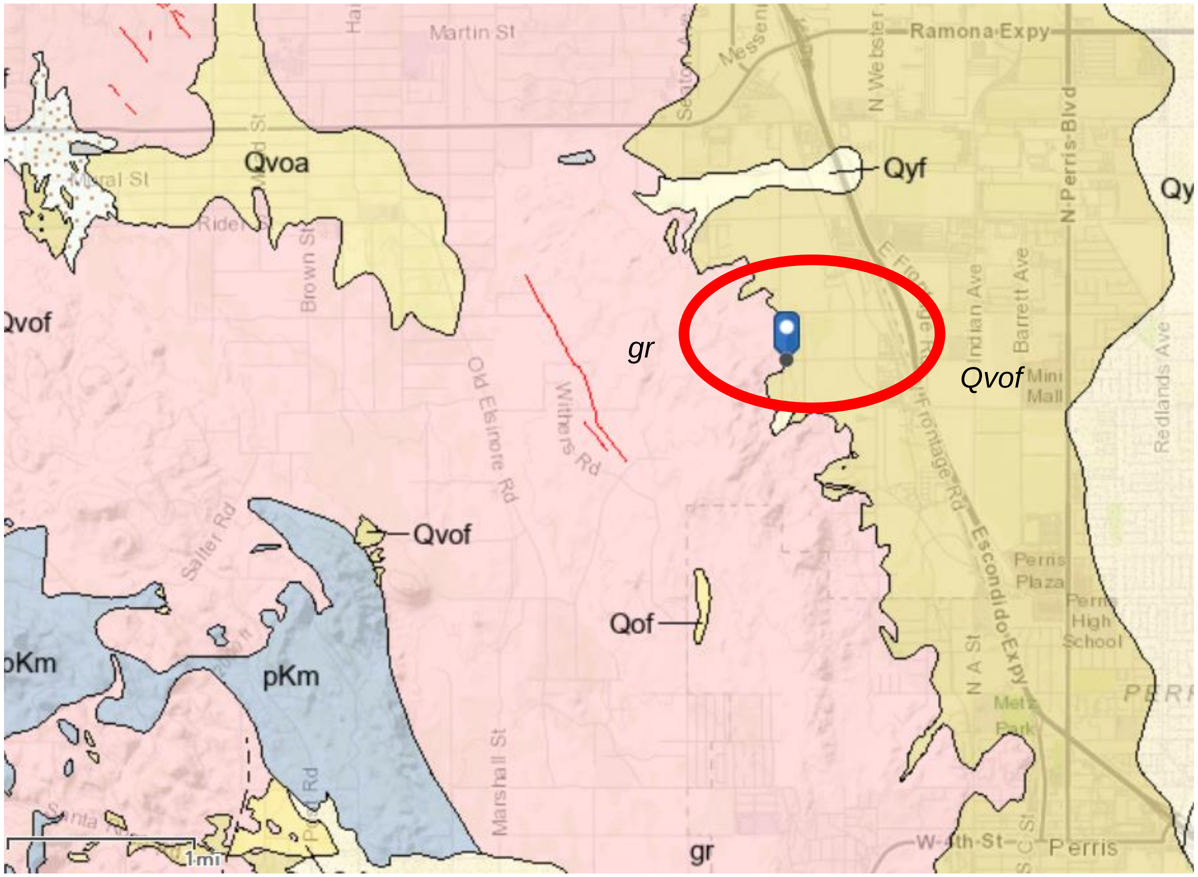
Figure 3	Local Geology Map of California (2010)
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	California Department of Conservation



Middle to Early Pleistocene (Surficial Deposits)

Qvow	Very Old Alluvial Wash Deposits
Qvof	Very Old Alluvial Fan Deposits
Qvoa	Very Old Alluvial Valley Deposits
Qvot	Very Old Terrace Deposits
Qvol	Very Old Lacustrine, Playa, and Estuarine (Paralic) Deposits
Qvoe	Very Old Eolian and Dune Deposits

Mesozoic and Older (Bedrock)

Kss	Coarse-grained Cretaceous age formations of sedimentary origin
Ksh	Fine-grained Cretaceous age formations of sedimentary origin
Kv	Cretaceous age formations of volcanic origin
pKm	Cretaceous and pre-Cretaceous metamorphic formations of sedimentary and volcanic origin
sp	Serpentinite of all ages
gr	Granitic and other intrusive crystalline rocks of all ages

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Figure 4	USGS
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	GEOLOGIC MAP OF LOS ANGELES COUNTY, CALIFORNIA

Active Fault Zone

Fault Zone

🟨

Liquefaction Zone

🟩

Landslide Zone

🟦

Liquefaction Landslide Overlap Zone

🟧

Area Not Evaluated for Liquefaction or Landslides

☐

Geo Environmental Resources, Inc

Figure 5	Hazard map/Active fault
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	California Department of Conservation

Fault Zone

🟨

Liquefaction Zone

🟩

Landslide Zone

🟦

Liquefaction Landslide Overlap Zone

🟧

Area Not Evaluated for Liquefaction or Landslides

⬜

Geo Environmental Resources, Inc	
Figure 6	Hazard map/Liquefaction Zone
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	California Department of Conservation

Fault Zone

🟨

Liquefaction Zone

🟩

Landslide Zone

🟦

Liquefaction Landslide Overlap Zone

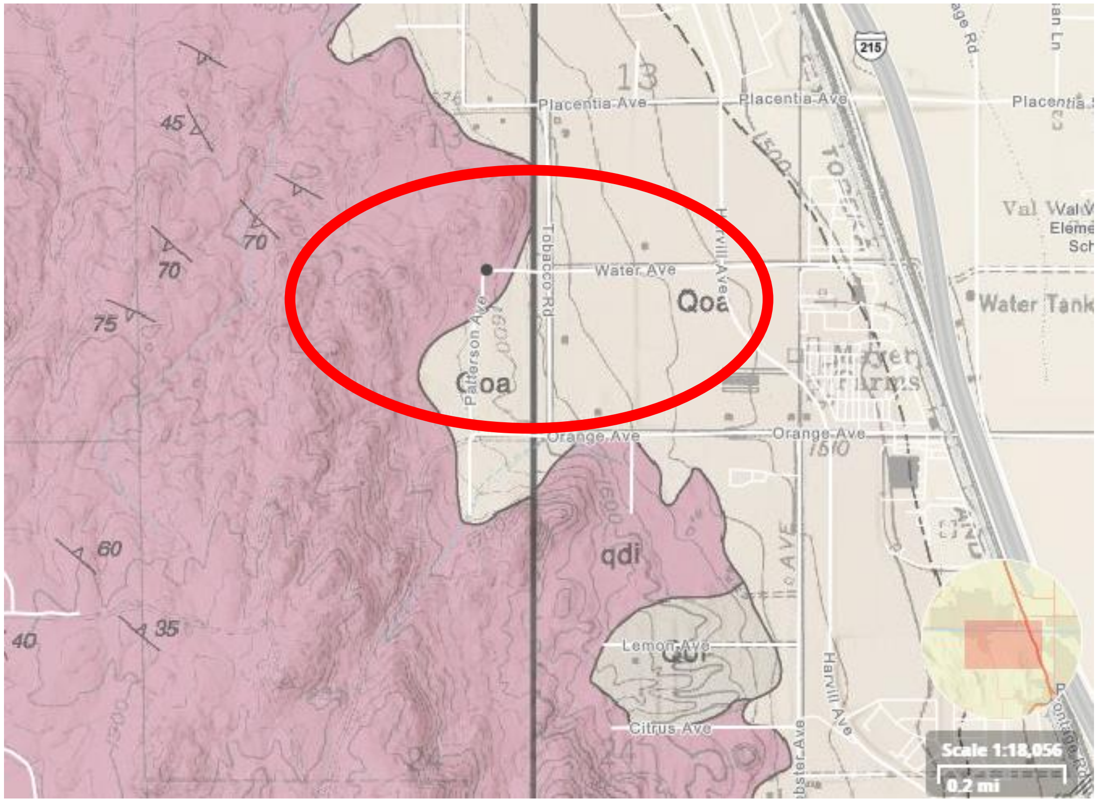
🟧

Area Not Evaluated for Liquefaction or Landslides

☐

Geo Environmental Resources, Inc

Figure 7	Hazard map/Landslide Zone
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	California Department of Conservation



qdi *Quartz diorite (includes Perris quartz diorite of Dudley, 1935, renamed Vat Verde Tonalite by Osborn, 1939, included in Bonsal Tonalite of Larsen, 1948, and Val Verde Tonalite by Morton and Cox, 2001, in east area: gray to light gray, massive to more commonly gneissoid, composed mostly of sodic plagioclase feldspar and the remainder of quartz, biotite and hornblende, and very minor potassic feldspar, contains few to abundant dark gray discoid inclusions; (xenoliths) oriented parallel to gneissoid structure of rock; radiometric age 105.7 MA, Ar 40/Ar 39 age of hornblende, 100 MA, biotite 95 MA, and potassic feldspar 85.5 MA (Morton 2001)*

Qoa

OLDER SURFICIAL SEDIMENTS

Slightly indurated, much dissected alluvial sediments

Qoa *Alluvial sand, commonly pebbly, light reddish brown, arkosic, includes alluvial fan gravel at base of hill terranes*

Geo Environmental Resources, Inc	
Figure 8	Geology Map
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	USGS

APPENDIX D

General Notes

GENERAL NOTES

SAMPLE IDENTIFICATION

All samples are visually classified in general accordance with the Unified Soil Classification System (ASTM D-2487-75 or D-2488-75)

DESCRIPTIVE TERM (% BY DRY WEIGHT)

Trace:	1-10%
Little:	11-20%
Some:	21-35%
And/Adjective	36-50%

PARTICLE SIZE (DIAMETER)

Boulders:	8 in and larger
Cobbles:	3 in to 8 in
Gravel:	coarse - ¾ to 3 in
	fine - No. 4 (4.76 mm) to ¾ in
Sand:	coarse - No. 4 (4.76 mm) to No. 10 (2.0 mm)
	medium - No. 10 (2.0 mm) to No. 40 (0.42 mm)
	fine - No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt:	No. 200 (0.074 mm) and smaller (Non-plastic)
Clay:	No. 200 (0.074 mm) and smaller (Plastic)

SOIL PROPERTY SYMBOLS

Dd:	Dry Density (pcf)
LL:	Liquid Limit, percent
PL:	Plastic Limit, percent
PI:	Plasticity Index (LL-PL)
LOI:	Loss on Ignition, percent
Gs:	Specific Gravity
K:	Coefficient of Permeability
w:	Moisture content, percent
qp:	Calibrated Penetrometer Resistance, tsf
qs:	Vane-Shear Strength, tsf
qu:	Unconfined Compressive Strength, tsf
qc:	Static Cone Penetrometer Resistance Correlated to Unconfined Compressive Strength, tsf
PID:	Results of vapor analysis conducted on representative samples utilizing a Photoionization Detector calibrated to a benzene standard. Results expressed in HNU-units (BDL=Below Detection Limits)
N:	Penetration Resistance per 6 inch interval, or fraction thereof, for a standard 2 inch O.D. (1⅜ inch I.D.) split spoon sampler driven with a 140 pound weight free-falling 30 inches. Performed in general accordance with Standard Penetration Test Specifications (ASTM D-1586). N in blows per foot equals sum of N values where plus sign is shown
Nc:	Penetration Resistance per 1¾ inches of Dynamic Cone Penetrometer. Approximately equivalent to Standard Penetration Test N-Value in blows per foot.
Nr:	Penetration Resistance per 6 inch interval, or fraction thereof, for California Ring Sampler driven with a 140 pound weight free-falling 30 inches per ASTM D-3550. Not equivalent to Standard Penetration Test N-Value.

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon
ST:	Shelby Tube - 3" O.D. (except where noted)
CS:	3" O.D. California Ring Sampler
DC:	Dynamic Cone Penetrometer per ASTM Special Technical Publication No. 399
AU:	Auger Sample
DB:	Diamond Bit
CB:	Carbide Bit
WS:	Wash Sample
RB:	Rock-Roller Bit
BS:	Bulk Sample
Note:	Depth intervals for sampling shown on Record of Subsurface Exploration are not indicative of sample recovery, but position where sampling initiated

SOIL STRENGTH CHARACTERISTICS

COHESIVE (CLAYEY) SOILS

COMPARATIVE CONSISTENCY	**BLOWS PER FOOT (N)**	**UNCONFINED COMPRESSIVE STRENGTH (TSF)**
Very Soft	0-2	0-0.25
Soft	3-4	0.25-0.50
Medium Stiff	5-8	0.50-1.00
Stiff	9-15	1.00-2.00
Very Stiff	16-30	2.00-4.00
Hard	31+	4.00+

NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	**BLOWS PER FOOT (N)**
Very Loose	0-4
Loose	5-10
Firm	11-30
Dense	31-50
Very Dense	51+

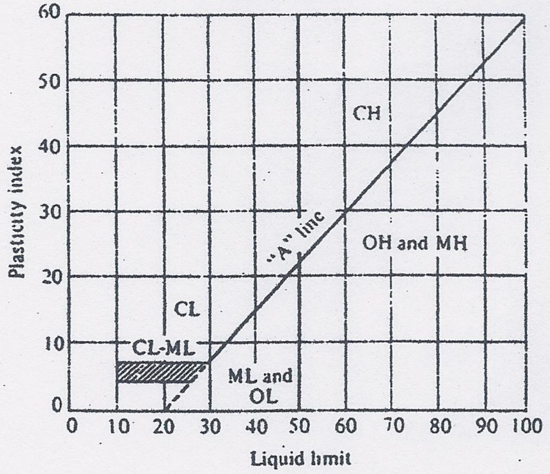
DEGREE OF PLASTICITY	**PI**
None to Slight	0-4
Slight	5-10
Medium	11-30
High to Very High	31+

DEGREE OF EXPANSIVE POTENTIAL	**PI**
Low	0-15
Medium	15-25
High	25+

UNIFIED SOIL CLASSIFICATION SYSTEM. (ASTM D-2487)

Major Divisions			*Group Symbols*		*Typical Names*	*Laboratory Classification Criteria*		
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 per cent GW, GP, SW, SP More than 12 per cent GM, GC, SM, SC 5 to 12 per cent *Borderline* cases requiring dual symbols[b]	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a]	d	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
				u				
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a]	d	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
				u				
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt		Peat and other highly organic soils			

Plasticity Chart



[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

CHARACTERISTICS AND RATINGS OF UNIFIED SOIL SYSTEM CLASSES FOR SOIL CONSTRUCTION *

Class	Compaction Characteristics	Max. Dry Density Standard Proctor (pcf)	Compressibility and Expansion	Drainage and Permeability	Value as an Embankment Material	Value as Subgrade When Not Subject to Frost	Value as Base Course	Value as Temporary Pavement	
								With Dust Palliative	With Bituminous Treatment
GW	Good: tractor, rubber-tired, steel wheel or vibratory roller	125-135	Almost none	Good drainage, pervious	Very stable	Excellent	Good	Fair to Poor	Excellent
GP	Good: tractor, rubber-tired, steel wheel or vibratory roller	115-125	Almost none	Good drainage, pervious	Reasonably stable	Excellent to good	Poor to fair	Poor	
GM	Good: rubber-tired or light sheepsfoot roller	120-135	Slight	Poor drainage, semipervious	Reasonably stable	Excellent to good	Fair to poor	Poor	Poor to fair
GC	Good to fair: rubber-tired or sheepsfoot roller	115-130	Slight	Poor drainage, impervious	Reasonably stable	Good	Good to fair **	Excellent	Excellent
SW	Good: tractor, rubber-tired or vibratory roller	110-130	Almost none	Good drainage, pervious	Very stable	Good	Fair to poor	Fair to poor	Good
SP	Good: tractor, rubber-tired or vibratory roller	100-120	Almost none	Good drainage, pervious	Reasonably stable when dense	Good to fair	Poor	Poor	Poor to fair
SM	Good: rubber-tired or sheepsfoot roller	110-125	Slight	Poor drainage, impervious	Reasonably stable when dense	Good to fair	Poor	Poor	Poor to fair
SC	Good to fair: rubber-tired or sheepsfoot roller	105-125	Slight to medium	Poor drainage, impervious	Reasonably stable	Good to fair	Fair to poor	Excellent	Excellent
ML	Good to poor: rubber-tired or sheepsfoot roller	95-120	Slight to medium	Poor drainage, impervious	Poor stability, high density required	Fair to poor	Not suitable	Poor	Poor
CL	Good to fair: sheepsfoot or rubber-tired roller	95-120	Medium	No drainage, impervious	Good stability	Fair to poor	Not suitable	Poor	Poor
OL	Fair to poor: sheepsfoot or rubber-tired roller	80-100	Medium to high	Poor drainage, impervious	Unstable, should not be used	Poor	Not suitable	Not suitable	Not suitable
MH	Fair to poor: sheepsfoot or rubber-tired roller	70-95	High	Poor drainage, impervious	Poor stability, should not be used	Poor	Not suitable	Very poor	Not suitable
CH	Fair to poor: sheepsfoot roller	80-105	Very high	No drainage, impervious	Fair stability, may soften on expansion	Poor to very poor	Not suitable	Very poor	Not suitable
OH	Fair to poor: sheepsfoot roller	65-100	High	No drainage, impervious	Unstable, should not be used	Very poor	Not suitable	Not suitable	Not suitable
Pt	Not suitable		Very high	Fair to poor drainage	Should not be used	Not suitable	Not suitable	Not suitable	Not suitable

* "The Unified Classification: Appendix A - Characteristics of Soil, Groups Pertaining to Roads and Airfields, and Appendix B - Characteristics of Soil Groups Pertaining to Embankments and Foundations," Technical Memorandum 357, U.S. Waterways Ixperiment Station, Vicksburg, 1953.

** Not suitable if subject to frost.

APPENDIX E

USGS Seismic Design Parameters

Proposed Tilt up

Perris, CA, USA

Latitude, Longitude: 33.7825194, -117.2286478

Date	4/6/2022, 4:24:57 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.455	MCE_R ground motion. (for 0.2 second period)
S_1	0.538	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.746	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.164	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	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.455	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.554	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.538	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.585	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.936	Mapped value of the risk coefficient at short periods
C_{R1}	0.919	Mapped value of the risk coefficient at a period of 1 s

DISCLAIMER

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APPENDIX F

Percolation Feasibility Study

Geotechnical Engineering Exploration and Analysis

Percolation Feasibility Study Results

23628 Water Street,
Perris, CA

Prepared For:
Thrifty Oil Company
Santa Fe Springs, CA

Project No. G-021422
April 20, 2022

GEO ENVIRONMENTAL RESOURCES INC

GEOTECHNICAL
ENVIRONMENTAL
CONSULTANTS

1. PURPOSE AND SCOPE

This report provides the results of our recent percolation feasibility study for the proposed Tilt-up Commercial structure. The purpose of the study is to present the results of the field evaluation for the infiltration rate for the storm water runoff at the subject property.

Peculation test was conducted in accordance with **ASTM D 3385 "STANDARD TEST METHOD FOR INFILTRATION RATE OF SOILS IN FIELD USING DOUBLE-RING INFILTROMETER".** Two (2) locations have been designated to conduct the percolation test procedure. Please review the "Site Location Plan" Figure No.1 to review the approximate percolation tests location. The main purpose of multiple-locations is to obtain additional infiltration rates.

2. SUBSURFACE EXPLORATION

Percolation test No.1 was conducted next to Boring No.6 and Percolation No.2 was performed adjacent to the Boring No.5. For percolation, No.1 Test Pit No.1 was excavated to an approximate depth of 80 inches below the existing grade. Test pit Number 2, which was excavated for per was excavated to an approximate depth of 84 inches below the existing grade. Both two test pits were excavated with the help of backhoe and field equipment. The exposed subgrade within both locations were saturated 24-hours prior to actual percolation test.

3. SUBSURFACE CONDITION

The subsurface soil encountered in Test Pit No 1 (TP-1) consisted of Brown Silty Fine to Coarse Sand, Trace Clay Alluvial Deposits (Qof) Dry to damp to the depth of about 18 inches, which was underlain by Orange Silty Fine Sand with Clay to Clayey Fine Sand, Alluvial Deposits (Qof) to the depth of 8 feet. The samples were obtain by the help of the hand auger and field equipment and it was obtained at the corner of test pit, where the percolation had been performed.

In case of Test pit No 2 (TP-2), Soil classified as Brown Silty Fine to Coarse Sand, Trace Clay

Alluvial Deposits (Qof), Dry to damp and dense. This layer was continued to the depth of 3 feet. Then after that we observed Cemented soil with CALICHE, Alluvial Deposit (Qof) and moist which was very dense as well

Detailed geotechnical subsurface condition was originally discussed in our original geotechnical report (G-021422), which was prepared as Proposed Tilt up.

According to attached figure 6, the subject site is not located within a "Liquefaction Zone" based on the review of the liquefaction map of California (California Department of Conservation). Also there is no evidence of near-surface groundwater in our subsurface exploration. Within Test Pit No.1 and 2 there was no groundwater encountered to maximum explored depth.

4. GEOTECHNICAL CONSIDERATIONS

The followings were considered prior to test procedure. :

1. Water infiltration into the ground should be at least 10 feet above the groundwater table.
2. The distance between the infiltration facility and the adjacent private property lines should be at least 10 feet.
3. The minimum foundation set back should be at least 10 feet from the infiltration facility.

4. Test Procedure

The double ring infiltrometer test (ASTM D 3385) is a well recognized and documented technique for directly measuring the soil infiltration rate of a site. Double ring infiltration was developed in response to the fact that smaller (less than 40 inch diameter) single ring infiltrometers tend to overestimate vertical infiltration rates. This has been attributed to the fact that the flow of water beneath the cylinder is not purely vertical and diverges laterally.

Double ring infiltrometers minimize the error associated with the single-ring method because the water level in the outer ring forces vertical infiltration of water in the inner ring. Care should be taken when driving the rings into the ground as there can be a poor connection between the ring wall and the soil. This poor connection can cause a leakage of water along the ring wall and an overestimation of the infiltration rate. Another potential source of error is attributed to the size of the cylinders. As such, the use of cylinder sizes less than those prescribed in ASTM D 3385 is not recommended by most codes.

Geo Environmental Resources, double ring infiltrometer consists of a 12-inch inner ring and a 24-inch outer ring. While there are two operational techniques used with the double-ring infiltrometer, the constant head method and the falling head method; ASTM D3385 mandates the use of the constant head method.

With the constant head method, water is consistently added to both the outer and inner rings to maintain a constant level throughout the testing. The volume of water needed to maintain the fixed level of the inner ring is measured. To help maintain a constant head, a variety of devices may be used. A hook gauge, steel tape or rule, or length of steel or plastic rod pointed on one end, can be used for measuring and controlling the depth of liquid (head) in the infiltrometer ring. If available, a graduated Mariotte tube or automatic flow control system may also be used.

On the other hand and with the falling head method, which has been used in this report, the falling level of the water is measured in each time interval and ultimately, as shown in following tables, a final report shall be provided and, based on the test results, an infiltration rate shall be recommended. The final number is average of previous 4-infiltration rate.

5. FINDINGS AND CONCLUSIONS

Result of Percolation test **No.1 indicates 5.25 inch/hr.** with a percolation **No.2 indicating 4.7 inch/hr.** Attached please see percolation tables and graphs.

($\boldsymbol{Final\ Infiltration\ rate = \frac{Infiltration\ rate\ from\ test}{Factor\ of\ safety}}$) **The minimum recommended factor of safety will be two (2).** Therefore, the actual infiltration rate of subject property will be half of the obtained infiltration rate**.**

It is our opinion that due the variability within the near-surface soil, the lower infiltration rate (Infiltration No.2) should be considered to utilize in the design. Therefore, the recommended infiltration rate is 2.35 Inch/hr.

1. The infiltration of the storm water will not result in ground settlement that could affect adversely the proposed structure.
2. All results and findings are based on level (Horizontal) surface area. Effect of any slope or inclination shall be considered to evaluate the final Percolation rate.
3. The proposed infiltration facility should be designed in such way that in case of "Drainage Capacity Failure" overflow to street.

	
Figure 20: Approximate location and depth of the test.	Figure 21: Using bentonite to seal the apparatus, Soil was firm and dry
	
Figure 22: Position of laser meter and method of reading level of the water.	Figure 23: Accuracy of Reading water level by laser meter. Test was done by reading level of the water at specific time intervals

We appreciate the opportunity to be of service on this report. If we may be of additional Assistance, should Geotechnical Related problems occurs, please do not hesitate to contact us at Any time.

Very truly yours,

GEO ENVIRONMENTAL RESOURCES, INC.

Alexander A. Rastegar

Project Engineer

REGISTERED PROFESSIONAL ENGINEER
SIAVASH DORVASH
ENGINEER NO. C 81485
CIVIL
STATE OF CALIFORNIA

S. Dorvash, P.E.

GEO ENVIRONMENTAL RESOURCES INC
GEOTECHNICAL ENVIRONMENTAL CONSULTANTS

Double Ring Infiltration Test Data

ASTM D3385 – 18 & City Guide

Date of Test **4/14/2021**

Project Name: **Proposed Tilt-up**
Project Address: **23628 Water Street, Perris**
Project number: **G-021422**

Inner Ring Diameter: 12 inch
Outer Ring Diameter: 24 inch
Height Of Ring: 24 inch
Depth to the Soil: 6 Inch
Method of measuring the surface of the water : Laser

Liquid: Tap Water
Liquid Temperature: 63°-70° f
Type of Test: Falling Head
Weather Temperature: 65°-90° f
Weather: Sunny
Soil Type: Native Soil

Percolation Location 1 (TP-1)

				Inner Ring		*Annular Ring*				
Trial Number	***Time (hour:min)***		***Elapsed time (Δt)***	***Elevation Inch(H)***	***ΔH***	***Elevation Inch(H)***	***ΔH***	***Liquid Temperature***	***Infiltration Rate - Annular (Inch/hour)***	***Infiltration Rate -Inner (Inch/hour)***
1	Start	9:30	0:15	5 3/16		6 4/16			-	-
	End	9:45		7 2/16	1 15/16	8 9/16	2 5/16	64	-	-
2	Start	10:00	0:15	9 3/16	2 1/16	11	2 7/16	64	-	-
	End	10:15		11 4/16	2 1/16	13 7/16	2 7/16	64	-	-
3	Start	10:30	0:15	13 5/16	2 1/16	Water (5 9/16))	2 8/16	64	9 11/16	**8 2/16**
	End	10:45		15 5/16	2	8	2 7/16	64	9 13/16	**8 3/16**
4	Start	11:00	0:15	Water(5 4/16)	2 1/16	10 6/16	2 6/16	64	9 12/16	**8 3/16**
	End	11:15		7 5/16	2 1/16	12 12/16	2 6/16	65	9 10/16	**8 3/16**
5	Start	11:30	0:15	9 5/16	2	15 1/16	2 5/16	65	9 7/16	**8 2/16**
	End	11:45		11 4/16	1 15/16	Water (6 3/16))	2 7/16	65	9 7/16	**8 1/16**
6	Start	12:00	0:15	13 3/16	1 15/16	8 10/16	2 7/16	65	9 8/16	**7 15/16**
	End	12:15		15 1/16	1 14/16	10 15/16	2 5/16	65	9 8/16	**7 12/16**
7	Start	12:30	0:15	Water(5 4/16)	2	13 5/16	2 6/16	66	9 9/16	**7 12/16**
	End	12:45		7 4/16	2	15 10/16	2 5/16	66	9 7/16	**7 13/16**
8	Start	13:00	0:15	9 2/16	1 14/16	(Water)5 3/16	2 7/16	66	9 7/16	**7 12/16**
	End	13:15		10 14/16	1 12/16	7 8/16	2 5/16	66	9 7/16	**7 10/16**
9	Start	13:30	0:15	12 8/16	1 10/16	9 13/16	2 5/16	66	9 6/16	**7 4/16**
	End	13:45		14 1/16	1 9/16	12	2 3/16	70	9 4/16	**6 13/16**
10	Start	14:00	0:15	Water(5 10/16)	1 14/16	14 1/16	2 1/16	70	8 14/16	**6 13/16**
	End	14:15		7 4/16	1 10/16	(Water)5 3/16	2	70	8 9/16	**6 11/16**
11	Start	14:30	0:15	8 13/16	1 9/16	7 5/16	2 2/16	70	8 6/16	**6 10/16**
	End	14:45		10 6/16	1 9/16	9 5/16	2	70	8 3/16	**6 10/16**
12	Start	15:00	0:15	11 14/16	1 8/16	11 3/16	1 14/16	70	8	**6 4/16**
	End	15:15		13 5/16	1 7/16	13	1 13/16	72	7 13/16	**6 1/16**
13	Start	15:30	0:15	14 11/16	1 6/16	(Water)5 7/16	1 12/16	72	7 8/16	**5 14/16**
	End	15:45		Water(6 6/16)	1 7/16	7 2/16	1 13/16	72	7 5/16	**5 12/16**
14	Start	16:00	0:15	7 12/16	1 6/16	8 12/16	1 10/16	72	7 1/16	**5 10/16**
	End	16:15		9 1/16	1 5/16	10 4/16	1 8/16	73	6 8/16	**5 8/16**
15	Start	16:30	0:15	10 6/16	1 5/16	11 12/16	1 8/16	74	6 5/16	**5 7/16**
	End	16:45		11 11/16	1 5/16	13 4/16	1 8/16	75	6 2/16	**5 5/16**
16	Start	17:00	0:15	13	1 5/16	14 12/16	1 8/16	76	6	**5 4/16**
	End	17:15		14 5/16	1 5/16	16 4/16	1 8/16	77	6	**5 4/16**

Infiltration Rate (Inch/Hour): *5 5/16*
5.25

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Double Ring Infiltration Test Data

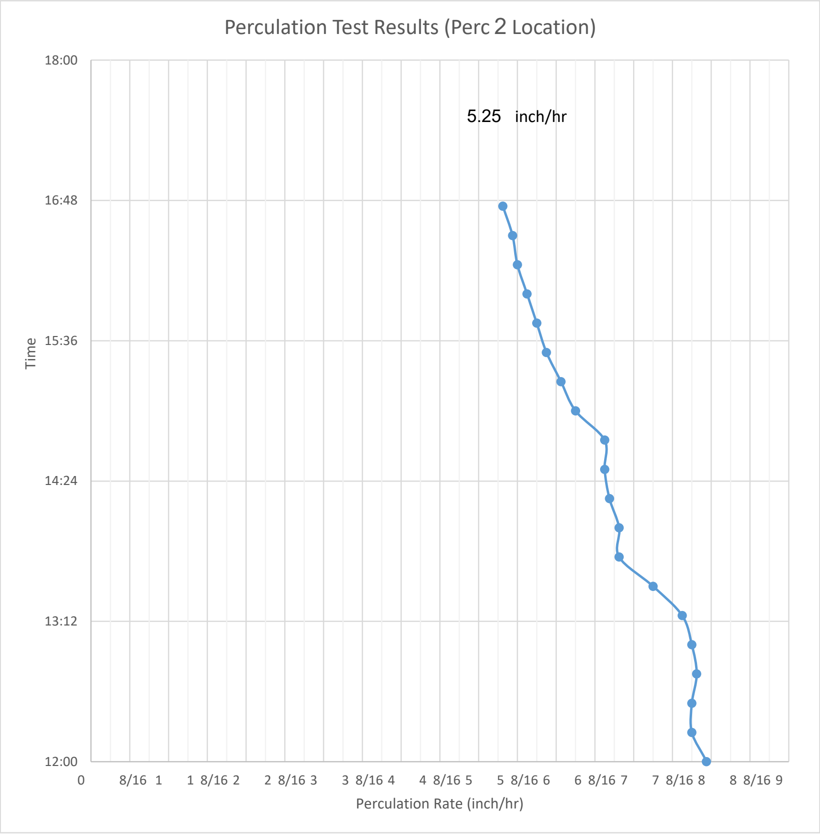
ASTM D3385 – 18 & City Guide

Date of Test **4/14/2021**

Project Name: **Proposed Tilt-up**
Project Address: **23628 Water Street, Perris**
Project number: **G-021422**

Inner Ring Diameter: 12 inch
Outer Ring Diameter: 24 inch
Height Of Ring: 24 inch
Depth to the Soil: 6 Inch
Method of measuring the surface of the water : Laser

Liquid: Tap Water
Liquid Temperature: 63°-70° f
Type of Test: Falling Head
Weather Temperature: 65°-90° f
Weather: Sunny
Soil Type: Native Soil



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Double Ring Infiltration Test Data

ASTM D3385 – 18 & City Guide

Date of Test **4/15/2021**

Project Name: **Proposed Tilt-up**
Project Address: **23628 Water Street, Perris**
Project number: **G-021422**

Inner Ring Diameter: 12 inch
Outer Ring Diameter: 24 inch
Height Of Ring: 24 inch
Depth to the Soil: 6 Inch
Method of measuring the surface of the water : Laser

Liquid: Tap Water
Liquid Temperature: 63°-70° f
Type of Test: Falling Head
Weather Temperature: 67°-87° f
Weather: Sunny
Soil Type: Native Soil

Percolation Location TP-2

				Inner Ring		***Annular Ring***				
Trial Number	***Time (hour:min)***		***Elapsed time (Δt)***	***Elevation Inch(H)***	***ΔH***	***Elevation Inch(H)***	***ΔH***	***Liquid Temperature***	***Infiltration Rate - Annular (Inch/hour)***	***Infiltration Rate -Inner (Inch/hour)***
	Start	9:00	0:15	5 14/16		5 11/16			-	-
1	End	9:15		8	2 2/16	7 15/16	2 4/16	64	-	-
	Start	9:30	0:15	10 4/16	2 4/16	10 6/16	2 7/16	64	-	-
2	End	9:45		12 6/16	2 2/16	12 11/16	2 5/16	64	-	-
	Start	10:00	0:15	14 8/16	2 2/16	Water (5 1/16)	2 4/16	64	9 4/16	**8 10/16**
3	End	10:15		16 8/16	2	7 7/16	2 6/16	64	9 6/16	**8 8/16**
	Start	10:30	0:15	Water(5 8/16)	2 2/16	9 10/16	2 3/16	64	9 2/16	**8 6/16**
4	End	10:45		7 8/16	2	11 14/16	2 4/16	65	8 15/16	**8 4/16**
	Start	11:00	0:15	9 9/16	2 1/16	14	2 2/16	65	8 13/16	**8 3/16**
5	End	11:15		11 9/16	2	Water (5 1/16))	2 3/16	65	8 10/16	**8 3/16**
	Start	11:30	0:15	13 8/16	1 15/16	7 5/16	2 4/16	65	8 11/16	**8**
6	End	11:45		15 7/16	1 15/16	9 6/16	2 1/16	65	8 10/16	**7 15/16**
	Start	12:00	0:15	Water(5 15/16)	1 14/16	11 6/16	2	66	8 8/16	**7 12/16**
7	End	12:15		7 15/16	2	13 4/16	1 14/16	66	8 3/16	**7 12/16**
	Start	12:30	0:15	9 13/16	1 14/16	15 2/16	1 14/16	66	7 13/16	**7 11/16**
8	End	12:45		11 9/16	1 12/16	Water(5 5/16)	1 12/16	66	7 8/16	**7 8/16**
	Start	13:00	0:15	13 5/16	1 12/16	7 2/16	1 12/16	66	7 4/16	**7 6/16**
9	End	13:15		15	1 11/16	8 13/16	1 11/16	70	7 1/16	**7 1/16**
	Start	13:30	0:15	Water(5 2/16)	1 11/16	9 8/16	11/16	70	5 14/16	**6 14/16**
10	End	13:45		6 15/16	1 13/16	11 2/16	1 10/16	70	5 12/16	**6 15/16**
	Start	14:00	0:15	8 8/16	1 9/16	12 11/16	1 9/16	70	5 9/16	**6 12/16**
11	End	14:15		10 1/16	1 9/16	14 3/16	1 8/16	70	5 6/16	**6 10/16**
	Start	14:30	0:15	11 8/16	1 7/16	Water (5 5/16)	1 8/16	70	6 3/16	**6 6/16**
12	End	14:45		12 13/16	1 5/16	6 15/16	1 10/16	72	6 3/16	**5 14/16**
	Start	15:00	0:15	14 1/16	1 4/16	8 6/16	1 7/16	72	5 14/16	**5 9/16**
13	End	15:15		Water(5 12/16)	1 3/16	9 10/16	1 4/16	72	5 10/16	**5 3/16**
	Start	15:30	0:15	7	1 4/16	10 15/16	1 5/16	72	5 7/16	**5**
14	End	15:45		8 3/16	1 3/16	12 3/16	1 4/16	73	5 5/16	**4 14/16**
	Start	16:00	0:15	9 5/16	1 2/16	13 7/16	1 4/16	74	5	**4 12/16**
15	End	16:15		10 7/16	1 2/16	14 11/16	1 4/16	75	5 1/16	**4 11/16**
	Start	16:30	0:15	11 9/16	1 2/16	15 15/16	1 4/16	76	5	**4 9/16**
16	End	16:45		12 11/16	1 2/16					

Infiltration Rate (Inch/Hour): *4 11/16*
=4.7

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Double Ring Infiltration Test Data

ASTM D3385 – 18 & City Guide
Date of Test **4/14/2021**

		Inner Ring Diameter:	12 inch	Liquid:	Tap Water
Project Name:	**Proposed Tilt-up**	Outer Ring Diameter:	24 inch	Liquid Temperature:	63°-70° f
Project Address:	**23628 Water Street, Perris**	Height Of Ring:	24 inch	Type of Test:	Falling Head
		Depth to the Soil:	6 Inch	Weather Temperature:	65°-90° f
Project number:	**G-021422**	Method of measuring the surface of the water :	Laser	Weather:	Sunny
				Soil Type:	Native Soil