Geotechnical Engineering Investigation
Proposed Industrial Warehouse Development
Located at the Southeast Corner of
Seaton Avenue and Cajalco Road, Perris,
County of Riverside, California

Phelan Development Company
450 Newport Center Drive, Suite 405
Newport Beach, California 92660
Attn: Ms. Ashly McKinley

Project Number 22417-21
April 12, 2021

NorCal Engineering

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April 12, 2021 Project Number 22417-21

Phelan Development Company
450 Newport Center Drive, Suite 405
Newport Beach, California 92660

Attn.: Ms. Ashley McKinley

RE: **Geotechnical Engineering Investigation** - Proposed Industrial Warehouse Development - Located at the Southeast Corner of Seaton Avenue and Cajalco Road, Perris, in the County of Riverside, California (APN: 317-140-019, 317-140-046, 317-140-044, 317-140-045, 317-140-004, 317-140-005, 317-140-028 and 317-140-020)

Dear Ms. McKinley:

Pursuant to your request, this firm has performed a Geotechnical Engineering Investigation for the above referenced project in accordance with your approval of our proposal dated March 3, 2021. The purpose of this investigation is to evaluate the geotechnical conditions of the subject site and to provide recommendations for the proposed industrial warehouse development.

The scope of work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration and sampling; 3) laboratory testing; 4) soil infiltration testing; 5) engineering analysis of field and laboratory data; 6) preparation of a geotechnical engineering report. It is the opinion of this firm that the proposed development is feasible from a geotechnical standpoint provided that the recommendations presented in this report are followed in the design and construction of the project.

1.0 Project Description

It is proposed to construct an industrial warehouse development consisting of 365,046 square feet building as shown on the attached Site Plan by Carlile Coatsworth Architects, Inc. dated November 12, 2020. The proposed concrete tilt-up building will be supported by a conventional slab-on-grade foundation system with perimeter-spread footings and isolated interior footings. Other improvements will include asphalt and concrete pavement areas, screen walls, hardscape and landscaping. It is assumed that the proposed grading for the development will include cut and fill procedures on the order of a few feet to achieve finished grade elevations. Final building plans shall be reviewed by this firm prior to submittal for county approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

2.0 Site Description

The 17.5-acre subject property is located at the southeast corner of Seaton Avenue and Cajalco Road, Perris, in the County of Riverside. The generally rectangular-shaped parcel is elongated in a north to south direction with topography of the relatively level descending slightly from north to south direction on the order of a few feet. The northern portion of the property consists predominately of several single family dwellings on scattered large parcels. The southern half of the property is undeveloped land covered with a moderate vegetation growth of natural grasses and weeds.

3.0 Site Exploration

The investigation consisted of the placement of five (5) exploratory borings drilled by a truck mounted hollow stem auger to depths ranging from 5 to 35 feet in depth and nine (9) exploratory trenches excavated by a backhoe to depths ranging between 5 and 15 feet below current ground elevations. The explorations were visually classified and logged by a field engineer with locations of the subsurface explorations shown on the attached site plan. The exploratory borings/trenches revealed the existing earth materials to consist of fill and natural soil. Detailed descriptions of the subsurface conditions are listed on the boring/trench logs in Appendix A. It should be noted that the transition from one soil type to another as shown on the boring logs is approximate and may in fact be a gradual transition. The soils encountered are described as follows:

Fill: A fill soil classifying as a brown, sandy SILT to sandy CLAY was encountered across the site to a depth of one foot below ground surface. These soils were noted to be soft and moist.

Natural: A natural undisturbed soil classifying predominantly as a brown, sandy SILT to sandy CLAY was encountered beneath the fill soils. The native soils were observed to be stiff and damp to moist. Deeper soils consisted of a brown silty to clayey SAND which were noted to dense and damp to moist. A grey brown, fine to coarse grained, silty SAND (Decomposed Granite) was also encountered at a depth of 26.5 feet below ground surface in Exploratory Boring B-1 These materials were observed to be dense to very dense and damp.

The overall engineering characteristics of the earth material were relatively uniform with each excavation. No groundwater was encountered to the depth of explorations and no caving occurred.

4.0 Laboratory Tests

Relatively undisturbed samples of the subsurface soils were obtained to perform laboratory testing and analysis for direct shear, consolidation tests, and to determine in-place moisture/densities. These relatively undisturbed ring samples were obtained by driving a thin-walled steel sampler lined with one-inch long brass rings with an inside diameter of 2.42 inches into the undisturbed soils. Bulk bag samples were obtained in the upper soils for expansion index tests and maximum density tests. All test results are included in Appendix B, unless otherwise noted.

Standard penetration tests were obtained by driving a steel sampler unlined with an inside diameter of 1.5 inches into the soils. This standard penetrometer sampler was driven a total of eighteen inches with blow counts tallied every six inches. Blow count data is given on the Boring Logs in Appendix A. Bulk bag samples were obtained in the upper soils for expansion index tests and maximum density tests. All test results are included in Appendix B, unless otherwise noted.

4.1 **Field Moisture Content** (ASTM: D 2216) and the dry density of the ring samples were determined in the laboratory. This data is listed on the logs of explorations.

4.2 **Sieve analyses** (ASTM: D 422-63) and the percent by weight of soil finer than the No. 200 sieve (ASTM: 1140) were performed on selected soil samples. These results are shown later within the body of this report.

4.3 **Maximum Density tests** (ASTM: D 1557) were performed on typical samples of the upper soils. Results of these tests are shown on Table I.

4.4 **Expansion Index tests** (ASTM: D 4829) were performed on remolded samples of the upper soils to determine expansive characteristics. Results of these tests are provided on Table II.

4.5 **Atterberg Limits** (ASTM: D 4318) consisting of liquid limit, plastic limit and plasticity index were performed on representative soil samples. Results are shown on Table III.

4.6 **Corrosion tests** consisting of sulfate, pH, resistivity and chloride analysis to determine potential corrosive effects of soils on concrete and underground utilities. Test results are provided on Table IV.

4.7 **R-Value test** per California Test Method 301 was performed on a representative sample, which may be anticipated to be near subgrade to determine pavement design. Results are provided within the pavement design section of the report.

4.8 **Direct Shear tests** (ASTM: D 3080) were performed on undisturbed and/or remolded samples of the subsurface soils. The test is performed under saturated conditions at loads of 1,000 lbs./sq.ft., 2,000 lbs./sq.ft., and 3,000 lbs./sq.ft. with results shown on Plates A and B.

4.9 **Consolidation tests** (ASTM: D 2435) were performed on undisturbed samples to determine the differential and total settlement which may be anticipated based upon the proposed loads. Water was added to the samples at a surcharge of one KSF and the settlement curves are plotted on Plates C to E.

5.0 Seismicity Evaluation

The proposed development lies outside of any Alquist Priolo Special Studies Zone and the potential for damage due to direct fault rupture is considered unlikely. The site is situated in an area of high regional seismicity and the San Jacinto (San Jacinto Valley) fault is located about 15 kilometers from the site. Ground shaking originating from earthquakes along other active faults in the region is expected to induce lower horizontal accelerations due to smaller anticipated earthquakes and/or greater distances to other faults. The seismic design parameters are provided below and are based on the 2019 California Building Code (CBC) Standard ASCE/SEI 7-16. The data was obtained from the American Society of Civil Engineers (ASCE) website, https://asce7hazardtool.online/. The ASCE 7 Hazards Report is attached in Appendix C.

Seismic Design Acceleration Parameters

Latitude	33.836
Longitude	-117.261
Site Class	D
Risk Category	II
Mapped Spectral Response Acceleration	$S_S = 1.500$ $S_1 = 0.557$
Adjusted Maximum Acceleration	$S_{MS} = 1.500$
Design Spectral Response Acceleration Parameters	$S_{DS} = 1.000$
Peak Ground Acceleration	$PGA_M = 0.550$

Use of these values is dependent on requirements of ASCE 7-16, 11-4.8, Exception 2 that requires the value of the seismic response coefficient C_s be determined by Equation 12.8.2 for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either 12.8-3 for $T_L \geq T \geq 1.5T_s$ or Equation 12.8-4 for $T > T_L$. Computations and verification of these conditions is referred to the structural engineer.

6.0 Liquefaction Evaluation

The site is expected to experience ground shaking and earthquake activity that is typical of Southern California area. It is during severe ground shaking that loose, granular soils below the groundwater table can liquefy. A review of the exploratory boring log and the laboratory test results on selected soil samples obtained indicate the following soil classifications, field blowcounts and amounts of fines passing through the No. 200 sieve.

Field Blowcount and Gradation Data

Boring No.	Classification	Blowcounts (blows/ft)	Relative Density	% Passing No. 200 Sieve
B-1 @ 5'	ML	52	Very Stiff	51
B-1 @ 10'	SM	20	Dense	35
B-1 @ 15'	SC	32	Very Dense	49
B-1 @ 20'	SC	32	Very Dense	50
B-1 @ 25'	SC	27	Dense	42
B-1 @ 30'	SW/SM	57	Very Dense	11
B-1 @ 35'	SW/SM	>50	Very Dense	14

Based on review of the *County of Riverside– Liquefaction Zone Map (September 2019)*, the site is situated in an area of moderate liquefaction susceptibility. Our analysis indicates the potential for liquefaction at this site to be very low due to the dense and very dense subsurface soils. A very dense decomposed granite was encountered at 26.5 feet below ground surface and Exploratory Boring B-1 met refusal at a depth of 35 feet. No groundwater was encountered to the depth of our boring.

Based on our analysis, the seismic-induced settlements will be on the order of less than one inch and would occur rather uniformly across the site. Differential settlements would be on the order of ½ inch over a 50-foot (horizontal) distance. Thus, the design of the proposed construction in conformance with the latest Building Code provisions for earthquake design is expected to provide mitigation of ground shaking hazards that are typical to Southern California.

7.0 Geologic Setting

The property is located in the Peninsular Ranges geomorphic province of California. The Peninsular Ranges province extends from the Los Angeles Basin southeast to Baja California and from the Pacific Ocean eastward to the Coachella Valley and Colorado Desert. The province consists of numerous northwest to southeast-trending mountain ranges and valleys that are geologically controlled by several major active faults. The subject site is located in the central part of the Perris block, a generally stable area situated roughly midway between two of these major faults; the Chino /Elsinore and San Jacinto fault zones. More specifically, the property is situated on the western flank of the Perris Valley drainage.

7.1 Site Geology

The USGS Open File Reports for the Steele Peak 7.5' Quadrangle assigns the soil materials underlying the site as early Pleistocene older alluvial fan deposits. These sediments are, in turn, underlain by Cretaceous granitic rocks of the Val Verde Pluton. The older alluvium is described in general as mostly well-dissected, well-indurated sand deposits. The underlying bedrock is described as relatively homogeneous, massive- to well-foliated, medium- to coarse-grained, biotite-hornblende tonalite. Exploration at the property encountered the alluvium ("Natural Soils") to the maximum depth explored of 26.5 feet. The attached Regional Geologic Map shows the distribution of the alluvial sediments and bedrock in the vicinity of the property.

7.2 Faulting

The property is not located in an Alquist-Priolo (AP) earthquake fault zone. Several stereo pair aerial photographs, as referenced below, were reviewed to evaluate for any lineaments or fault-related geomorphic features within, adjacent or trending towards the property. No indications of natural lineaments or other fault-related features indicative of Holocene or older faulting were noted. No indications of faulting were noted during our reconnaissance at and in the vicinity of the site. No faults are shown trending towards or through the site on the referenced geologic maps.

Based on our evaluation, we conclude that there are no active or potentially active faults trending towards or through the property, and additional fault investigations are not necessary. The potential for surface fault rupture to occur at the site is considered low. As is the case with most of southern California, the property is expected to experience strong ground shaking during the lifetime of the project.

7.3 Subsidence

According to the Riverside County Hazards report (Earth Consultants International, 2001), subsidence in Riverside County has been linked to significant fluctuations in groundwater levels within deep alluvial basins, and generally, the subsidence occurs throughout the valley region. Three areas have been identified with documented subsidence; the Elsinore Trough, the San Jacinto Valley, and the southern Coachella Valley. The subject property is situated on shallow alluvium with no groundwater encountered to a maximum depth drilled of 35 feet. Additionally, the property is not situated within any of the three areas of Riverside County associated with documented subsidence. The potential for subsidence to impact the site is considered low.

7.4 Seiches

The property is not in proximity to an enclosed or partially enclosed body of water or basin with the potential to hold water; the property is not subject to seiche inundation. Water over-topping the Perris Reservoir to the east would flow down the Peris Valley drainage which is roughly 100 feet in elevation below the site.

7.5 Slope Stability – Landslides, Debris Flows and Rock Flows

The property is not in a Riverside County designated zone of landslide susceptibility. The property is situated on gently sloped ground well away from topography with any significant relief. The potential for landslides, debris flows or rock falls to impact the site is considered low.

8.0 Infiltration Characteristics

Infiltration tests within the site were performed to provide preliminary infiltration rates for the purpose of planning and design of an on-site water disposal system. The infiltration tests consisted of the double ring infiltration test per ASTM Method D 3385. The field infiltration rate was computed using a reduction factor – R_f based on the field measurements with our calculations given in Appendix D. Based upon the results of our testing, the soils encountered in the planned on-site drainage disposal system area exhibit the following infiltration rates.

Trench/Test No.	Depth	Soil Classification	Field Infiltration Rate	Design Rate
T-1/TH-1	5'	Silty SAND	18.8 in/hr	6.2 in/hr
T-2/TH-2	10'	Sandy CLAY	0.2in/hr	0.7 in/hr
T-3/TH-3	6'	Silty SAND	20.2 in/hr	6.7 in/hr
T-4/TH-4	5'	Sandy SILT	7.6 in/hr	2.5 in/hr

The correction factors CF_t, CF_v and CF_s are given below based on soils between 5 and 10 feet from our field tests.

a) $CF_t = R_f = 1.0$ for our double ring infiltration test holes.

b) $CF_v = 1.0$ based on uniform soils encountered in four (4) trenches for infiltration tests.

c) $CF_s = 3.0$ for long-term siltation, plugging and maintenance. The subsurface soils are likely to have some plugging and regular maintenance of storm water discharge devices is required.

All systems must meet the latest county specifications and the California Regional Water Quality Control Board (CRWQCB) requirements. It is recommended that foundations shall be setback a minimum distance of 10 feet from the drainage disposal system and the bottom of footing shall be a minimum of 10 feet from the expected zone of saturation. The boundary of the zone of saturation may be assumed to project downward from the top of the permeable portion of the disposal system at an inclination of 1 to 1 or flatter, as determined by the geotechnical engineer.

9.0 Conclusions and Recommendations

Based upon our evaluations, the proposed development is acceptable from a geotechnical engineering standpoint. By following the recommendations and guidelines set forth in our report, the structures will be safe from excessive settlements under the anticipated design loadings and conditions. The proposed development shall meet all requirements of the City Building Ordinance and will not impose any adverse effect on existing adjacent structures.

The following recommendations are based upon soil conditions encountered in our field investigation; these near-surface soil conditions could vary across the site. Variations in the soil conditions may not become evident until the commencement of grading operations for the proposed development and revised recommendations from the soils engineer may be necessary based upon the conditions encountered. It is recommended that site inspections be performed by a representative of this firm during all grading and construction of the development to verify the findings and recommendations documented in this report. Any unusual conditions which may be encountered in the course of the project development may require the need for additional study and revised recommendations.

9.1 Site Grading Recommendations

Any vegetation and/or demolition debris shall be removed and hauled from proposed grading areas prior to the start of grading operations. Existing vegetation shall not be mixed or disced into the soils. Any removed soils may be reutilized as compacted fill once any deleterious material or oversized materials (in excess of eight inches) is removed. Grading operations shall be performed in accordance with the attached *Specifications for Placement of Compacted Fill*.

9.1.1 Removal and Recompaction Recommendations

All disturbed soils and/or fill (about one foot below ground surface) shall be removed to competent native material (relative compaction > 90%), the exposed surface scarified to a depth of 12 inches, brought to within 2% of optimum moisture content and compacted to a minimum of 85% of the laboratory standard (ASTM: D 1557) prior to placement of any additional compacted fill soils, foundations, slabs-on-grade and pavement. Grading shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

It is possible that isolated areas of undiscovered fill not described in this report are present on site; if found, these areas should be treated as discussed earlier. A diligent search shall also be conducted during grading operations in an effort to uncover any underground structures, irrigation or utility lines. If encountered, these structures and lines shall be either removed or properly abandoned prior to the proposed construction.

Any imported fill material should be preferably soil similar to the upper soils encountered at the subject site. All soils shall be approved by this firm prior to importing at the site and will be subjected to additional laboratory testing to assure concurrence with the recommendations stated in this report.

If placement of slabs-on-grade and pavement is not completed immediately upon completion of grading operations, additional testing and grading of the areas may be necessary prior to continuation of construction operations. Likewise, if adverse weather conditions occur which may damage the subgrade soils, additional assessment by the soils engineer as to the suitability of the supporting soils may be needed.

Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase. Adequate drainage away from the structures, pavement and slopes should be provided at all times.

9.1.2 **Fill Blanket Recommendations**

Due to the potential for differential settlement of foundations placed on compacted fill and native materials, it is recommended that all foundations including floor slab areas be underlain by a uniform compacted fill blanket at least two feet in thickness. This fill blanket shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

9.2 Shrinkage and Subsidence

Results of our in-place density tests reveal that the soil shrinkage will be on the order of 5 to 10% due to excavation and recompaction, based upon the assumption that the fill is compacted to 92% of the maximum dry density per ASTM standards. Subsidence should be 0.2 feet die to earthwork operations. The volume change does not include any allowance for vegetation or organic stripping, removal of subsurface improvements, or topographic approximations. Although these values are only approximate, they represent our best estimate of lost yardage, which will likely occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field testing the actual equipment and grading techniques should be conducted.

9.3 Temporary Excavations

Temporary unsurcharged excavations in the existing site materials may be made at vertical inclinations up to 4 feet in height unless cohesionless soils are encountered. In areas where soils with little or no binder are encountered, where adverse geological conditions are exposed, or where excavations are adjacent to existing structures, shoring or flatter excavations may be required. The temporary cut slope gradients given above do not preclude local raveling and sloughing. All excavations shall be made in accordance with the requirements of the soils engineer, CAL-OSHA and other public agencies having jurisdiction. Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase.

9.4 Foundation Design

All foundations may be designed utilizing the following allowable bearing capacities for an embedded depth of 24 inches into approved engineered fill with the corresponding widths:

Allowable Bearing Capacity (psf)		
Width (feet)	Continuous Foundation	Isolated Foundation
1.5	2000	2500
2.0	2075	2575
4.0	2375	2875
6.0	2500	3000

The bearing value may be increased by 500 psf for each additional foot of depth in excess of the 24-inch minimum depth, up to a maximum of 4,000 psf. A one-third increase may be used when considering short-term loading and seismic forces. Any foundations located along property line may utilize an allowable bearing capacity of 2,000 psf and embedded into competent native soils. All foundations shall be reinforced a minimum of one, No. 4 bar, top and bottom. A representative of this firm shall inspect all foundation excavations prior to pouring concrete.

9.5 Settlement Analysis

Resultant pressure curves for the consolidation tests are shown on Plates C to E. Computations utilizing these curves and the recommended allowable soil bearing capacities reveal that the foundations will experience settlements on the order of ¾ inch and differential settlements of less than ¼ inch.

9.6 Lateral Resistance

The following values may be utilized in resisting lateral loads imposed on the structure. Requirements of the California Building Code should be adhered to when the coefficient of friction and passive pressures are combined.

Coefficient of Friction - 0.35
Equivalent Passive Fluid Pressure = 200 lbs./cu.ft.
Maximum Passive Pressure = 2,000 lbs./cu.ft.

The passive pressure recommendations are valid only for approved compacted fill soils or competent native materials.

9.7 Retaining Wall Design Parameters

Active earth pressures against retaining walls will be equal to the pressures developed by the following fluid densities. These values are for **approved granular backfill material** placed behind the walls at various ground slopes above the walls.

Surface Slope of Retained Materials (Horizontal to Vertical	Equivalent Fluid Density (lb./cu.ft.)
Level	30
5 to 1	35
4 to 1	38
3 to 1	40
2 to 1	45

Any applicable short-term construction surcharges and seismic forces should be added to the above lateral pressure values. An equivalent fluid pressure of 45 pcf may be utilized for the restrained wall condition with a level grade behind the wall.

The seismic-induced lateral soil pressure for walls greater than 6 feet may be computed using a triangular pressure distribution with the maximum value at the top of the wall. The maximum lateral pressure of (20 pcf) H where H is the height of the retained soils above the wall footing should be used in final design of retaining walls. Sliding resistance values and passive fluid pressure values may be increased by 1/3 during short-term wind and seismic loading conditions.

All walls shall be waterproofed as needed and protected from hydrostatic pressure by a reliable permanent subdrain system. The granular backfill to be utilized immediately adjacent to retaining walls shall consist of an approved select granular soil with a sand equivalency greater than 30. This backfill zone of free draining material shall consist of a wedge beginning a minimum of one horizontal foot from the base of the wall extending upward at an inclination of no less than ¾ to 1 (horizontal to vertical).

9.8 **Slab Design**

All concrete slabs shall be a minimum of six inches in thickness in the proposed warehouse areas and four inches in office and hardscape both reinforced a minimum of No. 3 bars, sixteen inches in each direction and positioned in the center of slab and placed on approved subgrade soils moisture conditioned to 3% over optimum moisture content to a depth eighteen inches.

Additional reinforcement requirements and an increase in thickness of the slabs-on-grade may be necessary based upon soils expansion potential and proposed loading conditions in the structures and should be evaluated further by the project engineers and/or architect.

A vapor retarder (10-mil minimum thickness) should be utilized in areas which would be sensitive to the infiltration of moisture. This retarder shall meet requirements of ASTM E 96, *Water Vapor Transmission of Materials* and ASTM E 1745, *Standard Specification for Water Vapor Retarders used in Contact with Soil or Granular Fill Under Concrete Slabs.* The vapor retarder shall be installed in accordance with procedures stated in ASTM E 1643, *Standard practice for Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slabs.*

The moisture retarder may be placed directly upon compacted subgrade soils conditioned to near optimum moisture levels, although one to two inches of sand beneath the membrane is desirable. The subgrade upon which the retarder is placed shall be smooth and free of rocks, gravel or other protrusions which may damage the retarder. Use of sand above the retarder is under the purview of the structural engineer; if sand is used over the retarder, it should be placed in a dry condition.

9.9 Pavement Section Design

The table on the following page provides a preliminary pavement design based upon an R-Value of 7 for the subgrade soils for the proposed pavement areas. Final pavement design may need to be based on R-Value testing of the subgrade soils near the conclusion of site grading to assure that these soils are consistent with those assumed in this preliminary design.

The recommendations are based upon estimated traffic loads. Client should submit any other anticipated traffic loadings to the geotechnical engineer, if necessary, so that pavement sections may be reviewed to determine adequacy to support the proposed loadings.

Type of Traffic	Traffic Index	Asphalt (in.)	Base Material (in.)
Automobile Parking Stalls	4.0	3.0	7.0
Light Vehicle Circulation Areas	6.0	4.0	12.0
Heavy Truck Access Areas	7.0	4.5	16.0

Any concrete slab-on-grade in pavement areas shall be a minimum of seven inches in thickness and may be placed on approved subgrade soils. All pavement areas shall have positive drainage toward an approved outlet from the site. Drain lines behind curbs and/or adjacent to landscape areas should be considered by client and the appropriate design engineers to prevent water from infiltrating beneath pavement. If such infiltration occurs, damage to pavement, curbs and flow lines, especially on sites with expansive soils, may occur during the life of the project.

Any approved base material shall consist of a Class II aggregate or equivalent and should be compacted to a minimum of 95% relative compaction. All pavement materials shall conform to the requirements set forth by the County of Riverside. The base material; and asphaltic concrete should be tested prior to delivery to the site and during placement to determine conformance with the project specifications. A pavement engineer shall designate the specific asphalt mix design to meet the required project specifications.

9.10 Utility Trench and Excavation Backfill

Trenches from installation of utility lines and other excavations may be backfilled with on-site soils or approved imported soils compacted to a minimum of 90% relative compaction. All utility lines shall be properly bedded with clean sand having a sand equivalency rating of 30 or more. This bedding material shall be thoroughly water jetted around the pipe structure prior to placement of compacted backfill soils.

9.11 Corrosion Design Criteria

Representative samples of the surficial soils, typical of the subgrade soils expected to be encountered within foundation excavations and underground utilities were tested for corrosion potential. The minimum resistivity value obtained for the samples tested is representative of an environment that may be severely corrosive to metals. The soil pH value was considered mildly acidic and may not have a significant effect on soil corrosivity. Consideration should be given to corrosion protection systems for buried metal such as protective coatings, wrappings or the use of PVC where permitted by local building codes.

According to Table 4.3.1 of ACI 318 Building Code and Commentary, these contents revealed negligible sulfate concentrations. Therefore, a Type II cement according to latest CBC specifications may be utilized for building foundations at this time. It is recommended that additional sulfate tests be performed at the completion of site grading to assure that the as graded conditions are consistent with the recommendations stated in this design. Corrosion test results may be found on the attached Table IV.

9.12 Expansive Soil

Since expansive soils were encountered, special attention should be given to the project design and maintenance. The attached *Expansive Soil Guidelines* should be reviewed by the engineers, architects, owner, maintenance personnel and other interested parties and considered during the design of the project and future property maintenance.

10.0 Closure

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and geotechnical engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D Tucker

KEITH D. TUCKER
No. 841
Exp. 12/31/2022

Keith D. Tucker
Project Engineer
R.G.E. 841

Scott D. Spensiero
Project Manager

SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

Excavation

Any existing low-density soils and/or saturated soils shall be removed to competent natural soil under the inspection of the Geotechnical Engineering Firm. After the exposed surface has been cleansed of debris and/or vegetation, it shall be scarified until it is uniform in consistency, brought to the proper moisture content and compacted to a minimum of 90% relative compaction (in accordance with ASTM: D 1557).

In any area where a transition between fill and native soil or between bedrock and soil are encountered, additional excavation beneath foundations and slabs will be necessary in order to provide uniform support and avoid differential settlement of the structure.

Material for Fill

The on-site soils or approved import soils may be utilized for the compacted fill provided they are free of any deleterious materials and shall not contain any rocks, brick, asphaltic concrete, concrete or other hard materials greater than eight inches in maximum dimensions. Any import soil must be approved by the Geotechnical Engineering firm a minimum of 72 hours prior to importation of site.

Placement of Compacted Fill Soils

The approved fill soils shall be placed in layers not excess of six inches in thickness. Each lift shall be uniform in thickness and thoroughly blended. The fill soils shall be brought to within 2% of the optimum moisture content, unless otherwise specified by the Soils Engineering firm. Each lift shall be compacted to a minimum of 90% relative compaction (in accordance with ASTM: D 1557) and approved prior to the placement of the next layer of soil. Compaction tests shall be obtained at the discretion of the Geotechnical Engineering firm but to a minimum of one test for every 500 cubic yards placed and/or for every 2 feet of compacted fill placed.

The minimum relative compaction shall be obtained in accordance with accepted methods in the construction industry. The final grade of the structural areas shall be in a dense and smooth condition prior to placement of slabs-on-grade or pavement areas. No fill soils shall be placed, spread or compacted during unfavorable weather conditions. When the grading is interrupted by heavy rains, compaction operations shall not be resumed until approved by the Geotechnical Engineering firm.

Grading Observations

The controlling governmental agencies should be notified prior to commencement of any grading operations. This firm recommends that the grading operations be conducted under the observation of a Soils Engineering firm as deemed necessary. A 24-hour notice must be provided to this firm prior to the time of our initial inspection.

Observation shall include the clearing and grubbing operations to assure that all unsuitable materials have been properly removed; approve the exposed subgrade in areas to receive fill and in areas where excavation has resulted in the desired finished grade and designate areas of overexcavation; and perform field compaction tests to determine relative compaction achieved during fill placement. In addition, all foundation excavations shall be observed by the Geotechnical Engineering firm to confirm that appropriate bearing materials are present at the design grades and recommend any modifications to construct footings.

EXPANSIVE SOIL GUIDELINES

The following expansive soil guidelines are provided for your project. The intent of these guidelines is to inform you, the client, of the importance of proper design and maintenance of projects supported on expansive soils. ***You, as the owner or other interested party, should be warned that you have a duty to provide the information contained in the soil report including these guidelines to your design engineers, architects, landscapers and other design parties in order to enable them to provide a design that takes into consideration expansive soils.***

In addition, you should provide the soil report with these guidelines to any property manager, lessee, property purchaser or other interested party that will have or assume the responsibility of maintaining the development in the future.

Expansive soils are fine-grained silts and clays which are subject to swelling and contracting. The amount of this swelling and contracting is subject to the amount of fine-grained clay materials present in the soils and the amount of moisture either introduced or extracted from the soils. Expansive soils are divided into five categories ranging from "very low" to "very high". Expansion indices are assigned to each classification and are included in the laboratory testing section of this report. *If the expansion index of the soils on your site, as stated in this report, is 21 or higher, you have expansive soils.* The classifications of expansive soils are as follows:

Classification of Expansive Soil*

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

*From Table 18A-I-B of California Building Code (1988)

When expansive soils are compacted during site grading operations, care is taken to place the materials at or slightly above optimum moisture levels and perform proper compaction operations. Any subsequent excessive wetting and/or drying of expansive soils will cause the soil materials to expand and/or contract. These actions are likely to cause distress of foundations, structures, slabs-on-grade, sidewalks and pavement over the life of the structure. ***It is therefore imperative that even after construction of improvements, the moisture contents are maintained at relatively constant levels, allowing neither excessive wetting or drying of soils.***

Evidence of excessive wetting of expansive soils may be seen in concrete slabs, both interior and exterior. Slabs may lift at construction joints producing a trip hazard or may crack from the pressure of soil expansion. Wet clays in foundation areas may result in lifting of the structure causing difficulty in the opening and closing of doors and windows, as well as cracking in exterior and interior wall surfaces. In extreme wetting of soils to depth, settlement of the structure may eventually result. Excessive wetting of soils in landscape areas adjacent to concrete or asphaltic pavement areas may also result in expansion of soils beneath pavement and resultant distress to the pavement surface.

Excessive drying of expansive soils is initially evidenced by cracking in the surface of the soils due to contraction. Settlement of structures and on-grade slabs may also eventually result along with problems in the operation of doors and windows.

Projects located in areas of expansive clay soils will be subject to more movement and “hairline” cracking of walls and slabs than similar projects situated on non-expansive sandy soils. There are, however, measures that developers and property owners may take to reduce the amount of movement over the life the development. The following guidelines are provided to assist you in both design and maintenance of projects on expansive soils:

- Drainage away from structures and pavement is essential to prevent excessive wetting of expansive soils. Grades should be designed to the latest building code and maintained to allow flow of irrigation and rain water to approved drainage devices or to the street. Any "ponding" of water adjacent to buildings, slabs and pavement after rains is evidence of poor drainage; the installation of drainage devices or regrading of the area may be required to assure proper drainage. Installation of rain gutters is also recommended to control the introduction of moisture next to buildings. Gutters should discharge into a drainage device or onto pavement which drains to roadways.

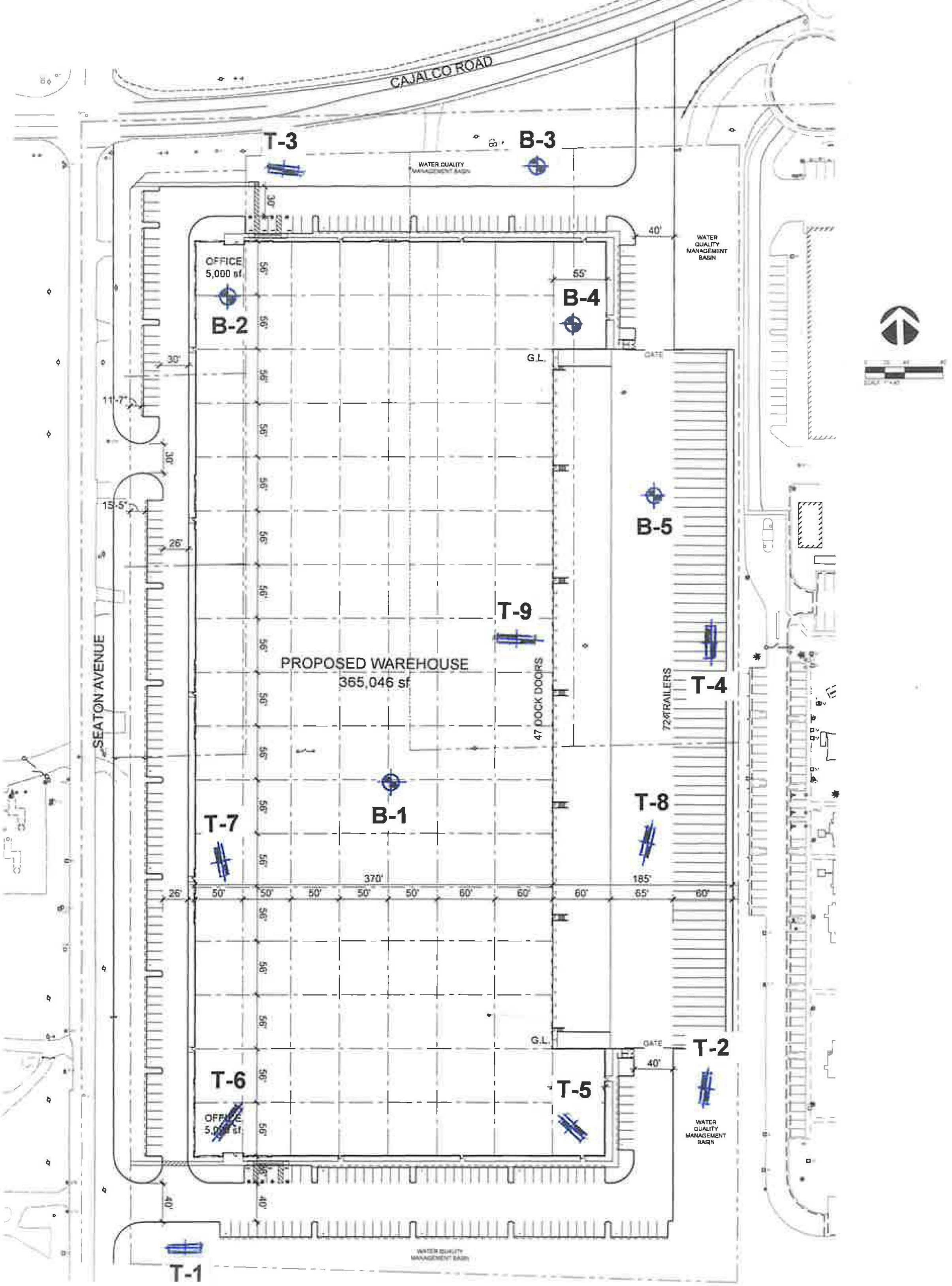
- Irrigation should be strictly controlled around building foundations, slabs and pavement and may need to be adjusted depending upon season. This control is essential to maintain a relatively uniform moisture content in the expansive soils and to prevent swelling and contracting. Over-watering adjacent to improvements may result in damage to those improvements. NorCal Engineering makes no specific recommendations regarding landscape irrigation schedules.

- Planting schemes for landscaping around structures and pavement should be analyzed carefully. Plants (including sod) requiring high amounts of water may result in excessive wetting of soils. Trees and large shrubs may actually extract moisture from the expansive soils, thus causing contraction of the fine-grained soils.

- Thickened edges on exterior slabs will assist in keeping excessive moisture from entering directly beneath the concrete. A six-inch thick or greater deepened edge on slabs may be considered. Underlying interior and exterior slabs with 6 to 12 inches or more of non-expansive soils and providing presaturation of the underlying clayey soils as recommended in the soil report will improve the overall performance of on-grade slabs.

- Increase the amount of steel reinforcing in concrete slabs, foundations and other structures to resist the forces of expansive soils. The precise amount of reinforcing should be determined by the appropriate design engineers and/or architects.

- Recommendations of the soil report should always be followed in the development of the project. Any recommendations regarding presaturation of the upper subgrade soils in slab areas should be performed in the field and verified by the Soil Engineer.



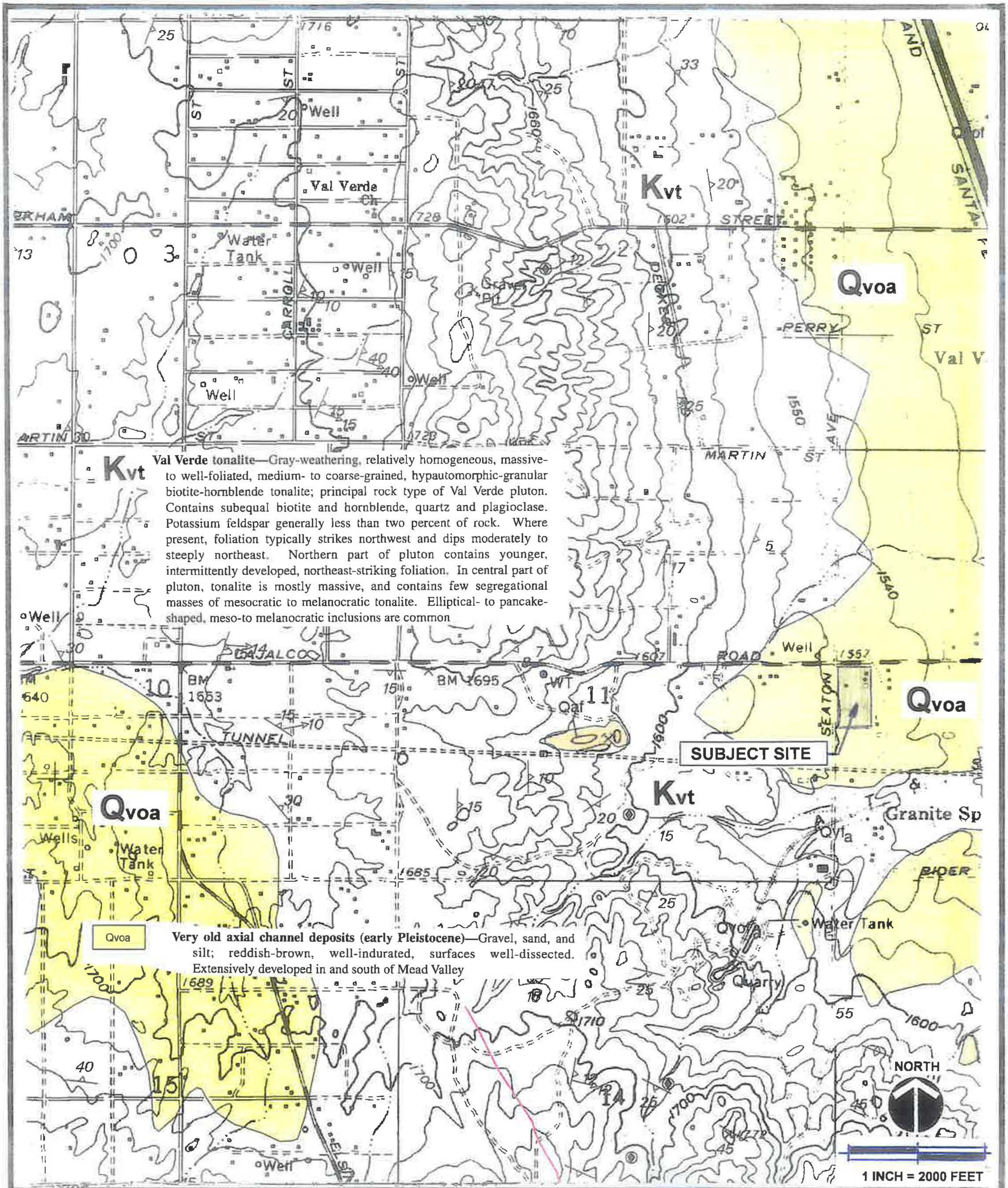
NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

SITE PLAN

PROJECT: 22417-21

DATE: APRIL 2021



Kvt **Val Verde tonalite**—Gray-weathering, relatively homogeneous, massive- to well-foliated, medium- to coarse-grained, hypautomorphic-granular biotite-hornblende tonalite; principal rock type of Val Verde pluton. Contains subequal biotite and hornblende, quartz and plagioclase. Potassium feldspar generally less than two percent of rock. Where present, foliation typically strikes northwest and dips moderately to steeply northeast. Northern part of pluton contains younger, intermittently developed, northeast-striking foliation. In central part of pluton, tonalite is mostly massive, and contains few segregational masses of mesocratic to melanocratic tonalite. Elliptical- to pancake-shaped, meso-to melanocratic inclusions are common

Qvoa **Very old axial channel deposits (early Pleistocene)**—Gravel, sand, and silt; reddish-brown, well-indurated, surfaces well-dissected. Extensively developed in and south of Mead Valley

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT: 22417-21

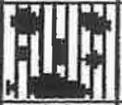
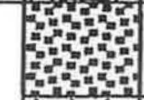
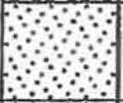
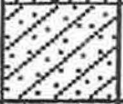
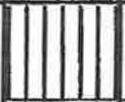
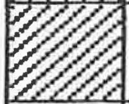
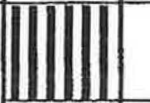
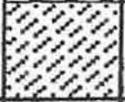
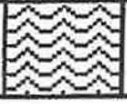
DATE:

GEOLOGIC MAP

STEELE PEAK 7.5' QUADRANGLE
RIVERSIDE COUNTY
MODIFIED PORTION OF USGS OFR 01-449

List of Appendices
(in order of appearance)

Appendix A
Log of Excavations

MAJOR DIVISION			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL. SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINE (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	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 SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

■ Indicates 2.5-inch Inside Diameter. Ring Sample.

☒ Indicates 2-inch OD Split Spoon Sample (SPT).

⧅ Indicates Shelby Tube Sample.

◫ Indicates No Recovery.

◧ Indicates SPT with 140# Hammer 30 in. Drop.

🖂 Indicates Bulk Sample.

◩ Indicates Small Bag Sample.

◨ Indicates Non-Standard

⧗ Indicates Core Run.

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1 - 5%
Few	5 - 10%
Little	10 - 20%
Some	20 - 35%
And	35 - 50%

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

COHESIONLESS SOILS		COHESIVE SOILS		
Density	N (blows/ft)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	Very Soft	0 to 2	< 250
Loose	4 to 10	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	Very Stiff	15 to 30	2000 - 4000
		Hard	over 30	> 4000

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22417-21

Log of Boring B-1

Boring Location: SEC of Seaton and Cajalco, Perris
Date of Drilling: 3/23/21
Groundwater Depth: None Encountered
Drilling Method: Simco 2800HS
Hammer Weight: 140 lbs.
Drop: 30"
Surface Elevation: Not Measured

GWT not encountered

Depth (feet)	Lith-ology	Material Description	Samples Type	 Blow Counts	Laboratory Moisture	 Dry Density	 Fines Content %
0		FILL SOILS Sandy SILT Brown, soft, damp					
		NATURAL SOILS Sandy SILT Brown, stiff, damp to moist slightly clayey	☒	20/22/30	8.7		51
5							
		Silty SAND Brown, dense, damp					
10			☒	10/10/10	7.5		35
		Clayey SAND Brown, dense, slightly moist					
15			☒	14/16/16	8.2		49
20			☒	13/14/18	8.2		50
25			☒	8/9/18	7.1		42
		Decomposed Granite SAND, medium to coarse grained Grey brown, dense to very dense, damp, slightly silt					
30			☒	15/20/37	5.1		11
35							

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Log of Boring B-1

Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 | **Groundwater Depth: None Encountered**

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs. | **Drop: 30"**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
35	▨	Decomposed Granite SAND, medium to coarse grained Grey brown, dense to very dense, damp, slightly silt Boring completed at depth of 35.5' Refusal at 35.5'	☒	50-3"	4.3		14
40							
45							
50							
55							
60							
65							
70							

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Log of Boring B-2

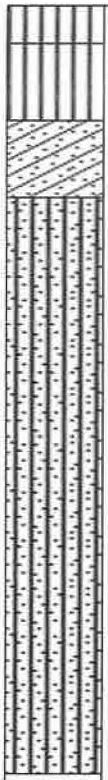
Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 | **Groundwater Depth: None Encountered**

Drilling Method: Hand Auger

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured



GWT not encountered

Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL SOILS Sandy SILT Brown, soft, moist					
	NATURAL SOILS Sandy SILT Brown, stiff, damp					
5	Clayey SAND Brown, dense, moist	■		7.6	106.3	
	Silty SAND Brown, dense, damp to moist	■		5.4	110.1	
10		■		7.5	106.4	
15						
		■		7.9	112.3	
20	Boring completed at depth of 20'					
25						
30						
35						

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22417-21

Log of Boring B-3

Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 **Groundwater Depth: None Encountered**

Drilling Method: Hand Auger

Hammer Weight: **Drop:**

Surface Elevation: Not Measured

GWT not encountered

Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL SOILS Sandy SILT Brown, soft, moist					
	NATURAL SOILS Sandy SILT Brown, stiff, damp	■		6.6	111.3	
5	Clayey SAND Brown, dense, moist	■		5.2	107.7	
	Silty SAND Brown, dense, damp to moist					
10	Boring completed at depth of 10'	■		8.3	115.7	
15						
20						
25						
30						
35						

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Log of Boring B-4

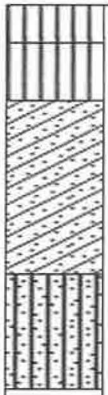
Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 | **Groundwater Depth:** None Encountered

Drilling Method: Hand Auger

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured



GWT not encountered

Depth (feet)	Material Description	Samples		Laboratory		
		Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	FILL SOILS Sandy SILT Brown, soft, moist					
	NATURAL SOILS Sandy SILT Brown, stiff, damp	■		2.8	110.6	
5	Clayey SAND Brown, dense, moist	■		9.7	114.2	
	Silty SAND Brown, dense, damp to moist					
10	Boring completed at depth of 10'					
15						
20						
25						
30						
35						

Phelan Development Co.
22417-21

Log of Boring B-5

Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21

Groundwater Depth: None Encountered

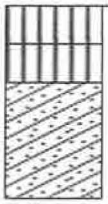
Drilling Method: Hand Auger

Hammer Weight:

Drop:

Surface Elevation: Not Measured

GWT not encountered

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL SOILS Sandy SILT Brown, soft, moist					
		NATURAL SOILS Sandy SILT Brown, stiff, moist	■		8.3	117.3	
5		Clayey SAND Brown, dense, moist					
		Boring completed at depth of 5'					
10							
15							
20							
25							
30							
35							

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Log of Trench T-1

Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21

Groundwater Depth: None Encountered

Drilling Method: Hand Auger

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	▨	GWT not encountered	FILL SOILS Sandy CLAY Brown, soft, moist					
	▨		NATURAL SOILS Sandy CLAY Brown, dense, damp to moist					
5			Silty SAND Brown, dense, moist					
			Boring completed at depth of 5'					
10								
15								
20								
25								
30								
35								

NorCal Engineering

Phelan Development Co.
22417-21

Log of Trench T-2

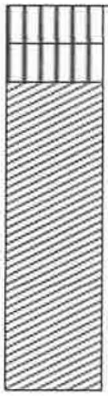
Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 **Groundwater Depth: None Encountered**

Drilling Method: Hand Auger

Hammer Weight: **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		GWT not encountered	FILL SOILS Sandy SILT Brown, soft, moist					
			NATURAL SOILS Sandy SILT Brown, stiff, damp					
5			Sandy CLAY Brown, dense, moist					
10			Boring completed at depth of 10'					
15								
20								
25								
30								
35								

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Phelan Development Co.
22417-21

Log of Trench T-3

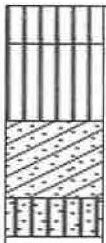
Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 | **Groundwater Depth: None Encountered**

Drilling Method: Hand Auger

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lithology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0 5 10 15 20 25 30 35		GWT not encountered	FILL SOILS Sandy SILT Brown, soft, moist NATURAL SOILS Sandy SILT Brown, stiff, damp Clayey SAND Brown, dense, moist Silty SAND Brown, dense, damp to moist Boring completed at depth of 6'					

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Phelan Development Co.
22417-21

Log of Trench T-4

Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 | **Groundwater Depth: None Encountered**

Drilling Method: Hand Auger

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith- ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		GWT not encountered	FILL SOILS Sandy SILT Brown, soft, moist					
			NATURAL SOILS Sandy SILT Brown, stiff, damp					
5			Boring completed at depth of 5'					
10								
15								
20								
25								
30								
35								

NorCal Engineering

Phelan Develop...ent Co.
22417-21

Log of Trench T-5

Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 **Groundwater Depth:** None Encountered

Drilling Method: Hand Auger

Hammer Weight: **Drop:**

Surface Elevation: Not Measured

GWT not encountered

Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
FILL SOILS Sandy SILT Brown, soft, moist					
NATURAL SOILS Sandy SILT Brown, stiff, damp	■		6.8	115.9	
Sandy CLAY Brown, stiff, moist	■		6.1	113.9	
Clayey SAND Brown, dense, damp to moist	■		8.0	115.8	
Boring completed at depth of 15'	■		9.8	117.7	

Depth (feet): 0, 5, 10, 15, 20, 25, 30, 35

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22417-21

Log of Trench T-6

Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 **Groundwater Depth:** None Encountered

Drilling Method: Hand Auger

Hammer Weight: **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	▨	GWT not encountered	FILL SOILS Sandy CLAY Brown, soft, moist					
	▨		NATURAL SOILS Sandy CLAY Brown, stiff, damp to moist	■		6.9	106.7	
5	▨		Clayey SAND Brown, dense, damp to moist	■		4.1	108.3	
10				■		10.1	114.6	
15			Boring completed at depth of 15'					
20								
25								
30								
35								

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22417-21

Log of Trench T-7

Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 | **Groundwater Depth: None Encountered**

Drilling Method: Hand Auger

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	▨	GWT not encountered	FILL SOILS Sandy CLAY Brown, soft, moist	■		8.6	117.2	
	▨		NATURAL SOILS Sandy CLAY Brown, stiff, damp to moist					
5								
	▨		Clayey SAND Brown, dense, moist	■		10.3	112.3	
10			Boring completed at depth of 10'					
15								
20								
25								
30								
35								

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22417-21.log Date: 4/14/2021

Phelan Development Co.
22417-21

Log of Trench T-8

Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 | **Groundwater Depth: None Encountered**

Drilling Method: Hand Auger

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	▥	GWT not encountered	FILL SOILS Sandy SILT Brown, soft, moist					
	▨		NATURAL SOILS Sandy SILT Brown, stiff, damp	■		3.6	110.8	
5			Sandy CLAY Brown, stiff, moist					
			Boring completed at depth of 5'					
10								
15								
20								
25								
30								
35								

Phelan Development Co.
22417-21

Log of Trench T-9

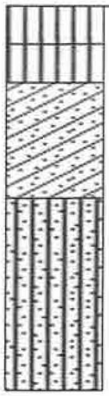
Boring Location: SEC of Seaton and Cajalco, Perris

Date of Drilling: 3/23/21 | **Groundwater Depth:** None Encountered

Drilling Method: Hand Auger

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured



Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	GWT not encountered	FILL SOILS Sandy SILT Brown, soft, moist	■		6.5	115.6	
		NATURAL SOILS Sandy SILT Brown, stiff, damp					
5		Clayey SAND Brown, dense, moist	■		8.9	112.3	
		Silty SAND Brown, dense, damp to moist Slightly clayey					
10		Boring completed at depth of 10'	■		8.3	114.5	
15							
20							
25							
30							
35							

Appendix B
Laboratory Tests

TABLE I
MAXIMUM DENSITY TESTS

Sample	Classification	Optimum Moisture (%)	Maximum Dry Density (lbs/cu.ft)
B-2 @ 2'	Sandy SILT	12.5	118.0
T-5 @ 2'	Sandy CLAY	15.0	122.0
T-9 @ 2'	Clayey SAND	11.5	126.0

TABLE II
EXPANSION TESTS

Sample	Classification	Expansion Index
B-2 @ 2'	Sandy SILT	25
T-5 @ 2'	Sandy CLAY	74
T-9 @ 2'	Clayey SAND	15

TABLE III
ATTERBERG LIMITS

Sample	Liquid Limit	Plastic Limit	Plasticity Index
T-5 @ 5'	35	23	12
T-5 @ 10	25	19	6

TABLE IV
CORROSION TESTS

Sample	pH	Electrical Resistivity	Sulfate (%)	Chloride (ppm)
B-2 @ 2'	6.9	2,190	0.007	290
T-5 @ 2'	6.8	1,765	0.002	239
T-9 @ 2'	6.9	2,570	0.002	190

% by weight
ppm – mg/kg

GMU

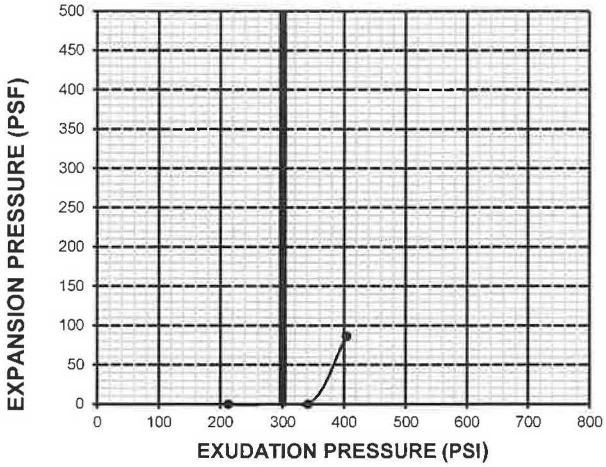
R-VALUE TEST REPORT

☑ CT-301 ☐ ASTM-D2844

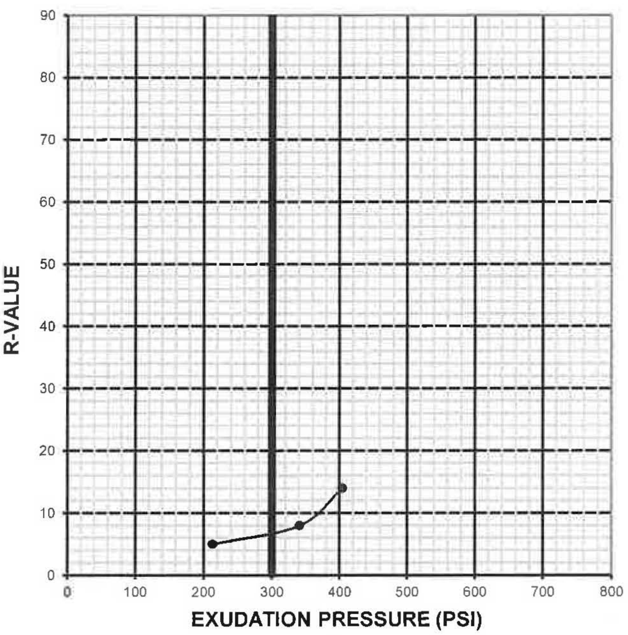
PROJECT NAME:	Norcal Phelan Development Company 22417-21	PROJECT NUMBER:	L-210301
SAMPLE LOCATION:	SEC of Seaton Ave and Cajalco Rd, Perris, CA	SAMPLE NUMBER:	T-1
SAMPLE DESCRIPTION:	SANDY CLAY (CL), brown	SAMPLE DEPTH:	2'
SAMPLED BY:	Norcal JS 3/24/21	TESTED BY:	ER
		DATE TESTED:	3/29/2021

TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	15.1	13.5	12.4
WEIGHT OF SAMPLE, grams	1146	1137	1094
HEIGHT OF SAMPLE, Inches	2.63	2.55	2.40
DRY DENSITY, pcf	114.7	119.1	122.9
COMPACTOR AIR PRESSURE, psi	90	120	150
EXUDATION PRESSURE, psi	213	341	404
EXPANSION, Inches x 10exp-4	0	0	20
STABILITY Ph 2,000 lbs (160 psi)	144	133	118
TURNS DISPLACEMENT	6.16	5.60	4.72
R-VALUE UNCORRECTED	4	8	16
R-VALUE CORRECTED	5	8	14
EXPANSION PRESSURE (psf)	0.0	0.0	86.4

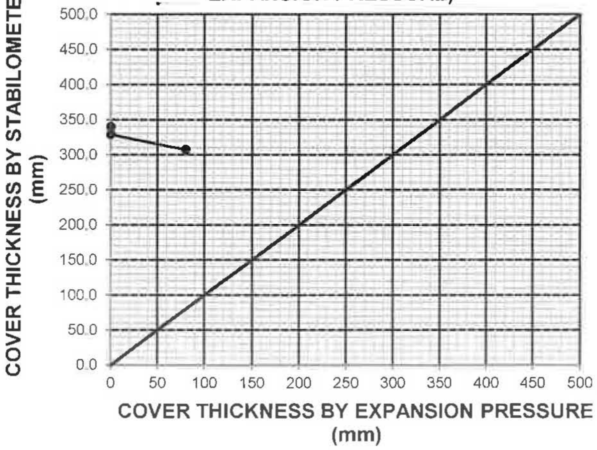
EXPANSION PRESSURE VS. EXUDATION PRESSURE



R-VALUE VS. EXUDATION PRESSURE



COVER THICKNESS (STABILOMETER BY EXPANSION PRESSURE)

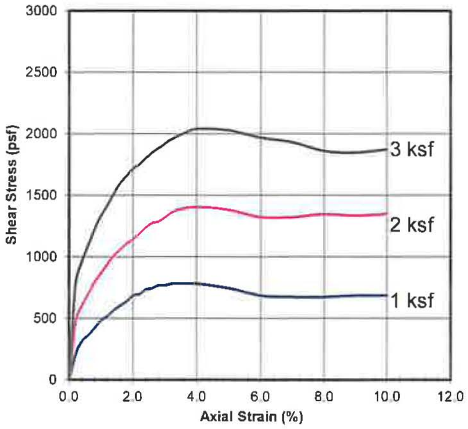


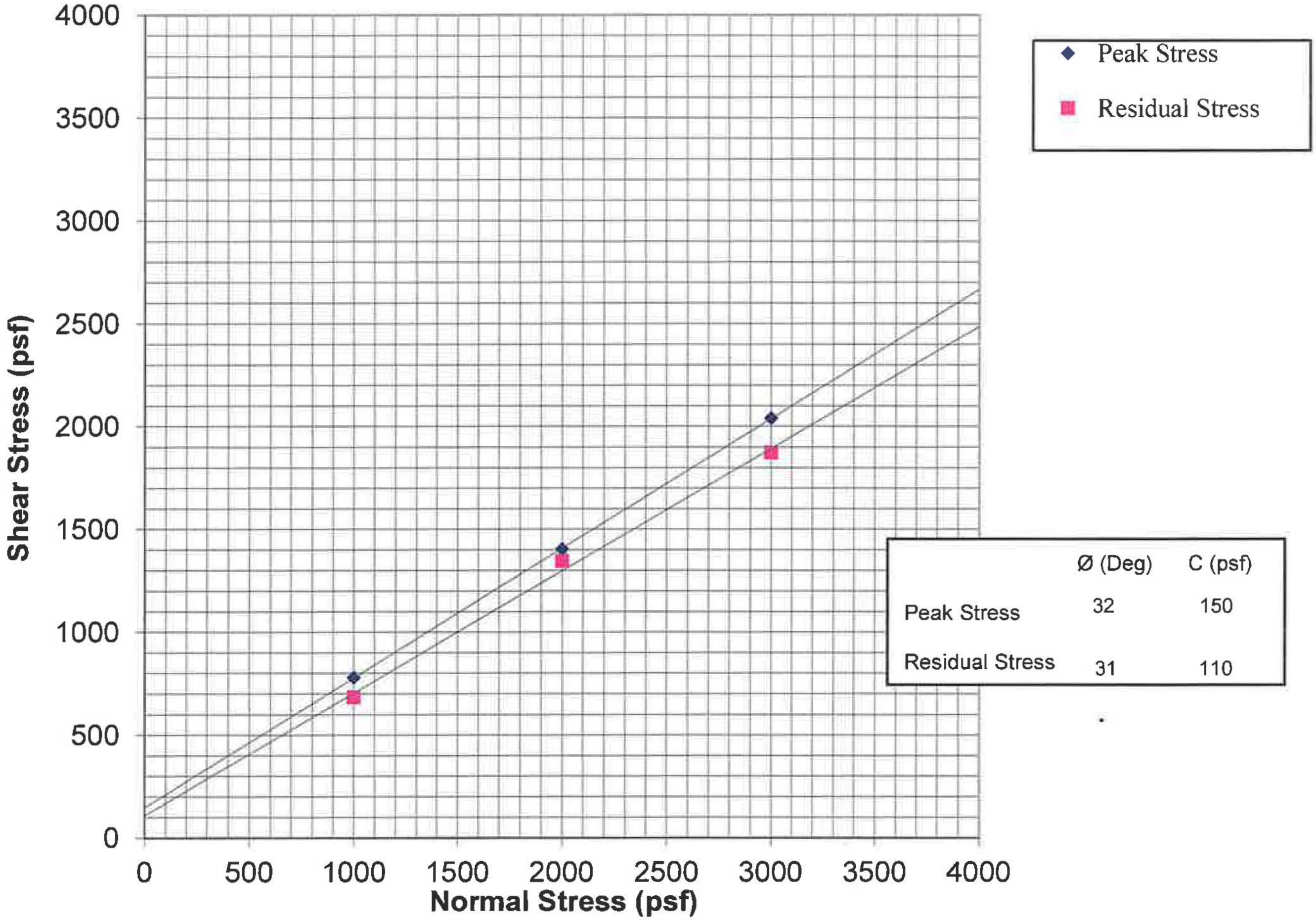
R-VALUE AT EQUILIBRIUM:	**7**

R-VALUE BY EXUDATION PRESSURE:	**7**
R-VALUE BY EXPANSION PRESSURE:	**N.A.**
EXPANSION PRESSURE AT 300 PSI EXUDATION:	**0**
TRAFFIC INDEX (Assumed):	**5.5**
GRAVEL FACTOR (Assumed):	**1.5**
UNIT MASS OF COVER MATERIAL, kg/m^3 (Assumed):	**2100.0**

Sample No. B4@3'
Sample Type: Undisturbed-Saturated
Soil Description: Sandy Silt

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	780	1404	2040
Displacement	(in.)	0.080	0.100	0.100
Residual Stress	(psf)	684	1344	1872
Displacement	(in.)	0.250	0.250	0.250
Initial Dry Density	(pcf)	110.6	110.6	110.6
Initial Water Content	(%)	2.8	2.8	2.8
Strain Rate	(in./min.)	0.020	0.020	0.020





	Ø (Deg)	C (psf)
Peak Stress	32	150
Residual Stress	31	110

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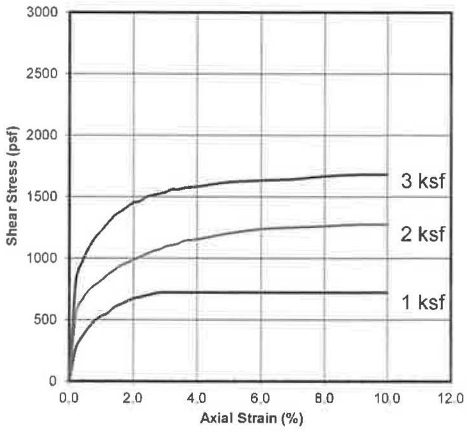
Phelan Development Company

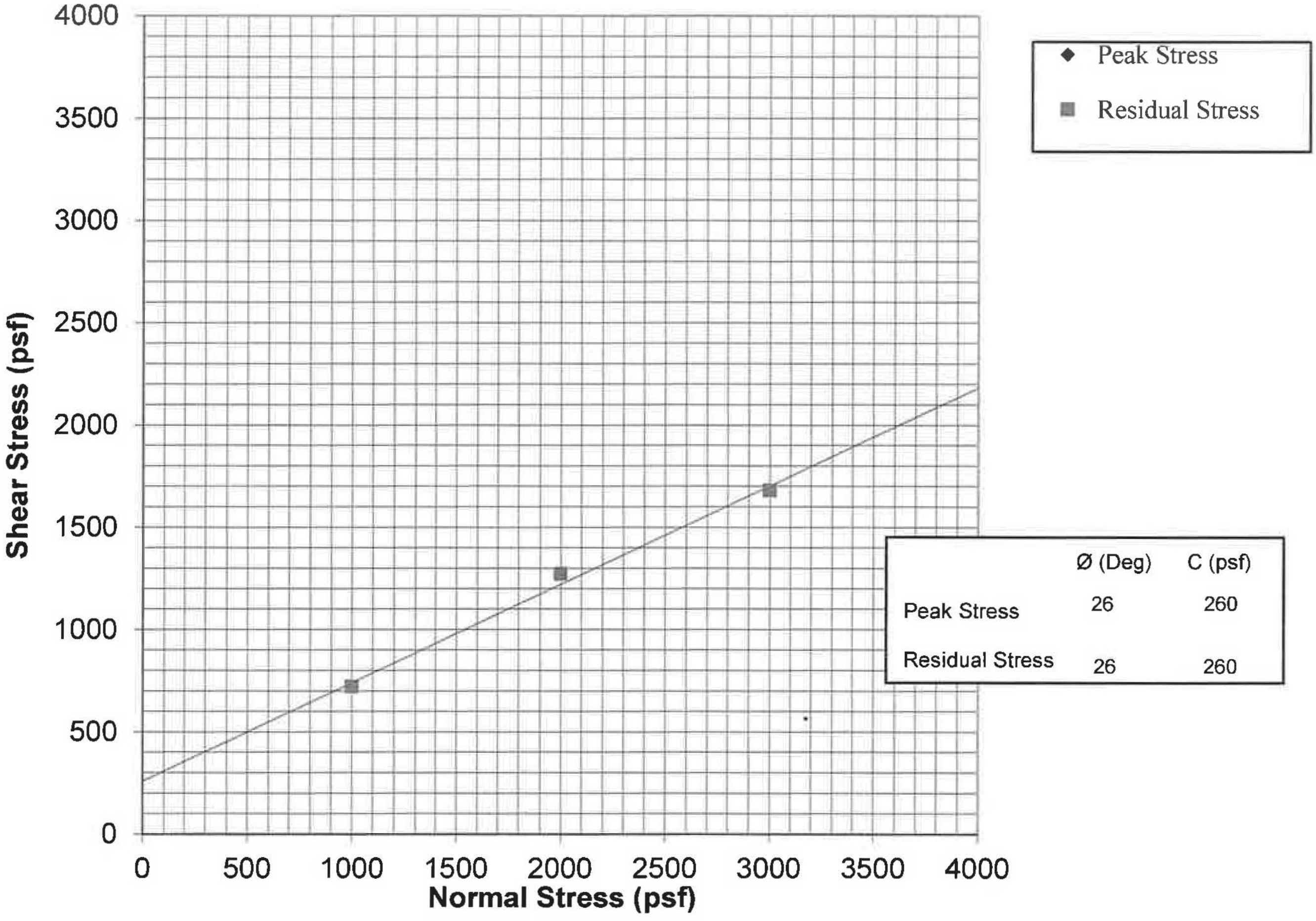
PROJECT NUMBER: 22417-21 DATE: 4/12/2021

DIRECT SHEAR TEST
ASTM D3080
Plate A

Sample No. T5@2'
Sample Type: Undisturbed-Saturated
Soil Description: Sandy Clay

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	720	1272	1680
Displacement	(in.)	0.070	0.225	0.225
Residual Stress	(psf)	720	1272	1680
Displacement	(in.)	0.250	0.250	0.250
Initial Dry Density	(pcf)	115.9	115.9	115.9
Initial Water Content	(%)	6.8	6.8	6.8
Strain Rate	(in./min.)	0.020	0.020	0.020





	Ø (Deg)	C (psf)
Peak Stress	26	260
Residual Stress	26	260

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PROJECT NUMBER: 22417-21 DATE: 4/12/2021

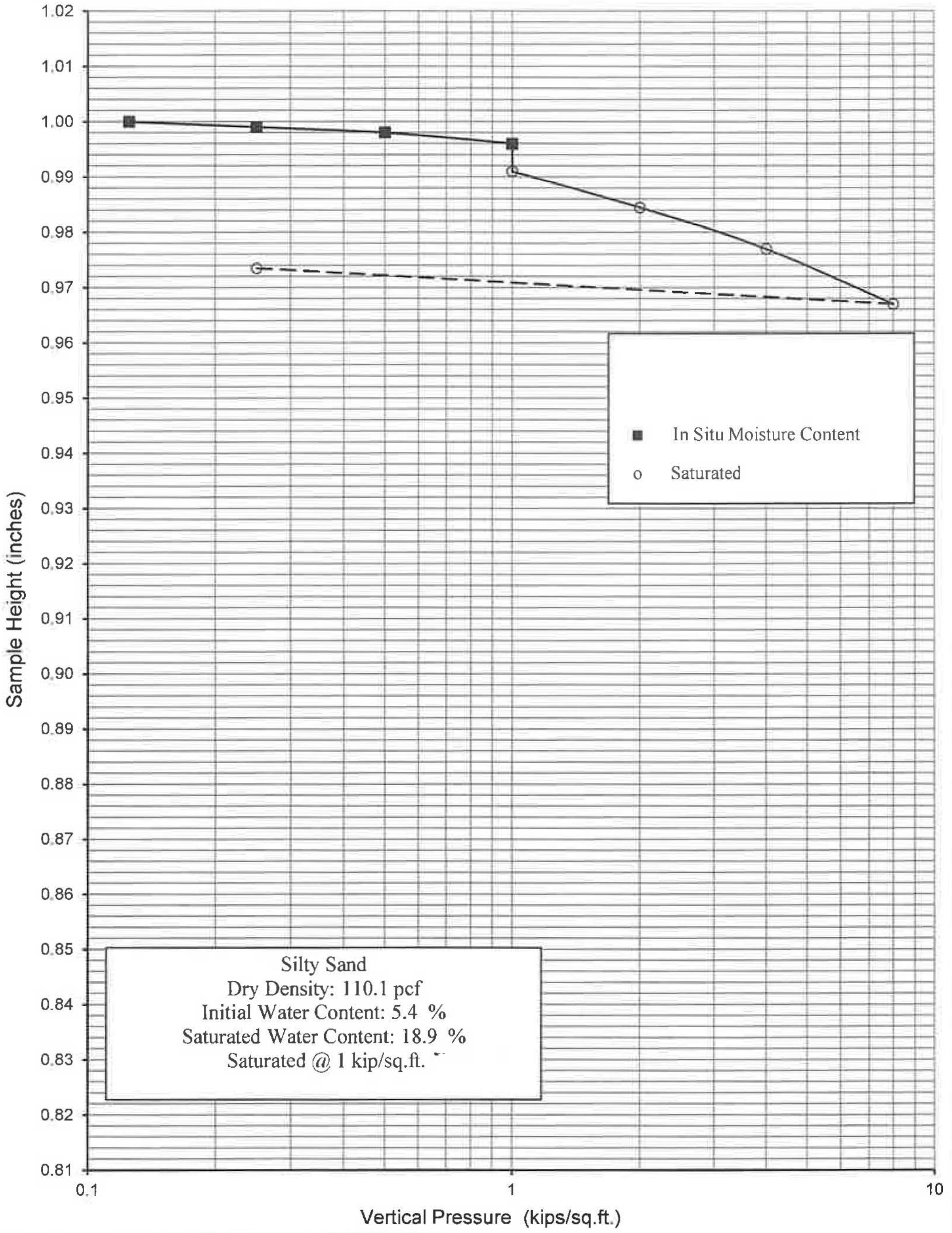
DIRECT SHEAR TEST
ASTM D3080
Plate B

Sample No. B2 | Depth 8' | Date 4/12/2021

Vertical Pressure **(kips/sq.ft.)**	Sample Height **(inches)**	Consolidation **(percent)**
0.125	**1.0000**	**0.0**
0.25	**0.9990**	**0.1**
0.5	**0.9980**	**0.2**
1	**0.9960**	**0.4**
1	**0.9910**	**0.9**
2	**0.9845**	**1.6**
4	**0.9770**	**2.3**
8	**0.9670**	**3.3**
0.25	**0.9735**	**2.7**

Saturated

Date Tested: 4/8/2021
Sample: B2
Depth: 8'



Silty Sand
Dry Density: 110.1 pcf
Initial Water Content: 5.4 %
Saturated Water Content: 18.9 %
Saturated @ 1 kip/sq.ft.

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SOILS AND GEOTECHNICAL CONSULTANTS

Phelan Development Company

PROJECT NUMBER: 22417-21 DATE: 4/12/2021

CONSOLIDATION TEST

ASTM D2435

Plate C

Sample No. T5

Depth 5'

Date 4/12/2021

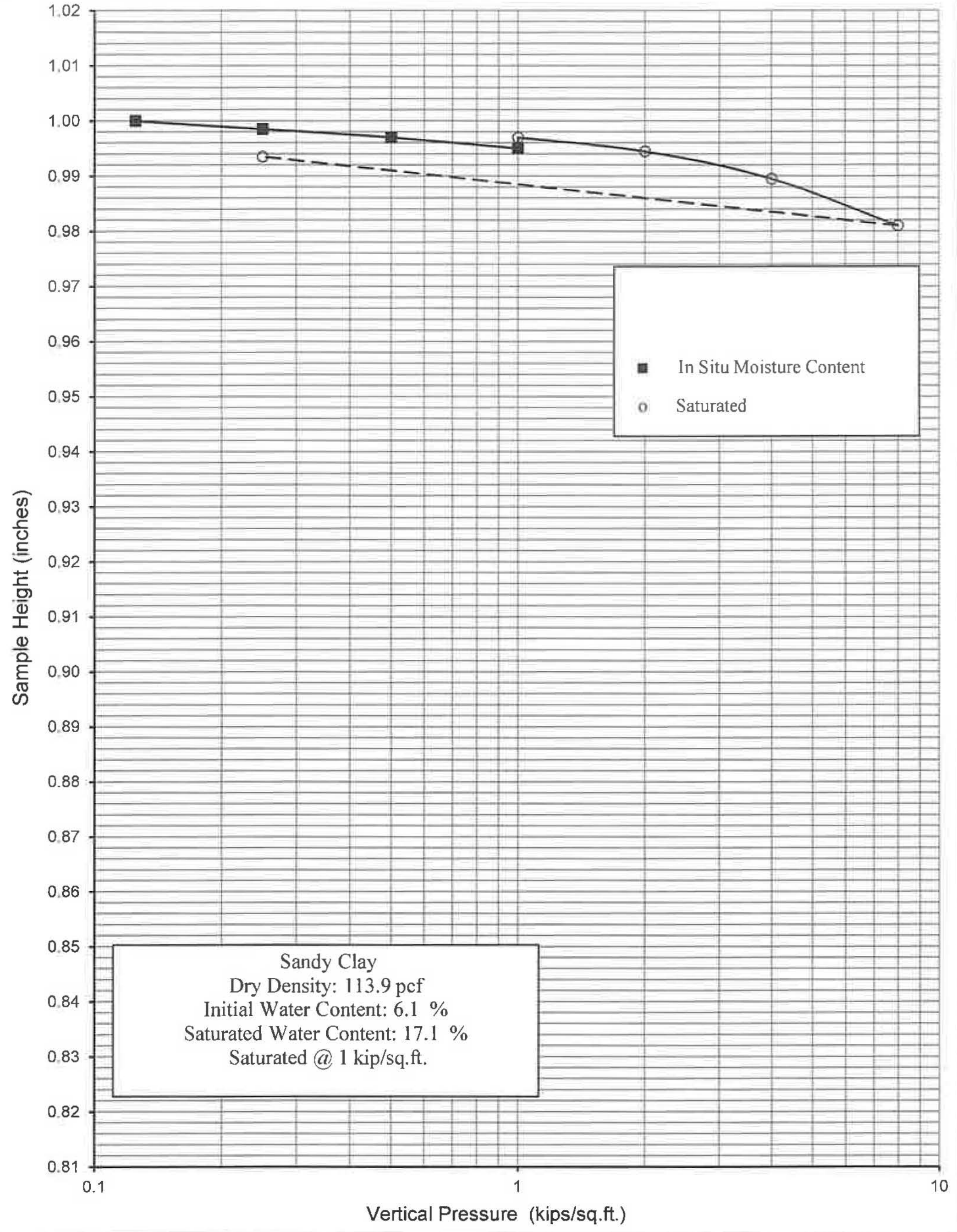
Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9985	0.2
0.5	0.9970	0.3
1	0.9950	0.5
1	0.9970	0.3
2	0.9945	0.6
4	0.9895	1.1
8	0.9810	1.9
0.25	0.9935	0.6

Saturated

Date Tested: 4/9/2021

Sample: T5

Depth: 5'



Sandy Clay
Dry Density: 113.9 pcf
Initial Water Content: 6.1 %
Saturated Water Content: 17.1 %
Saturated @ 1 kip/sq.ft.

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Phelan Development Company

PROJECT NUMBER: 22417-21 DATE: 4/12/2021

CONSOLIDATION TEST

ASTM D2435

Plate D

Sample No. T5

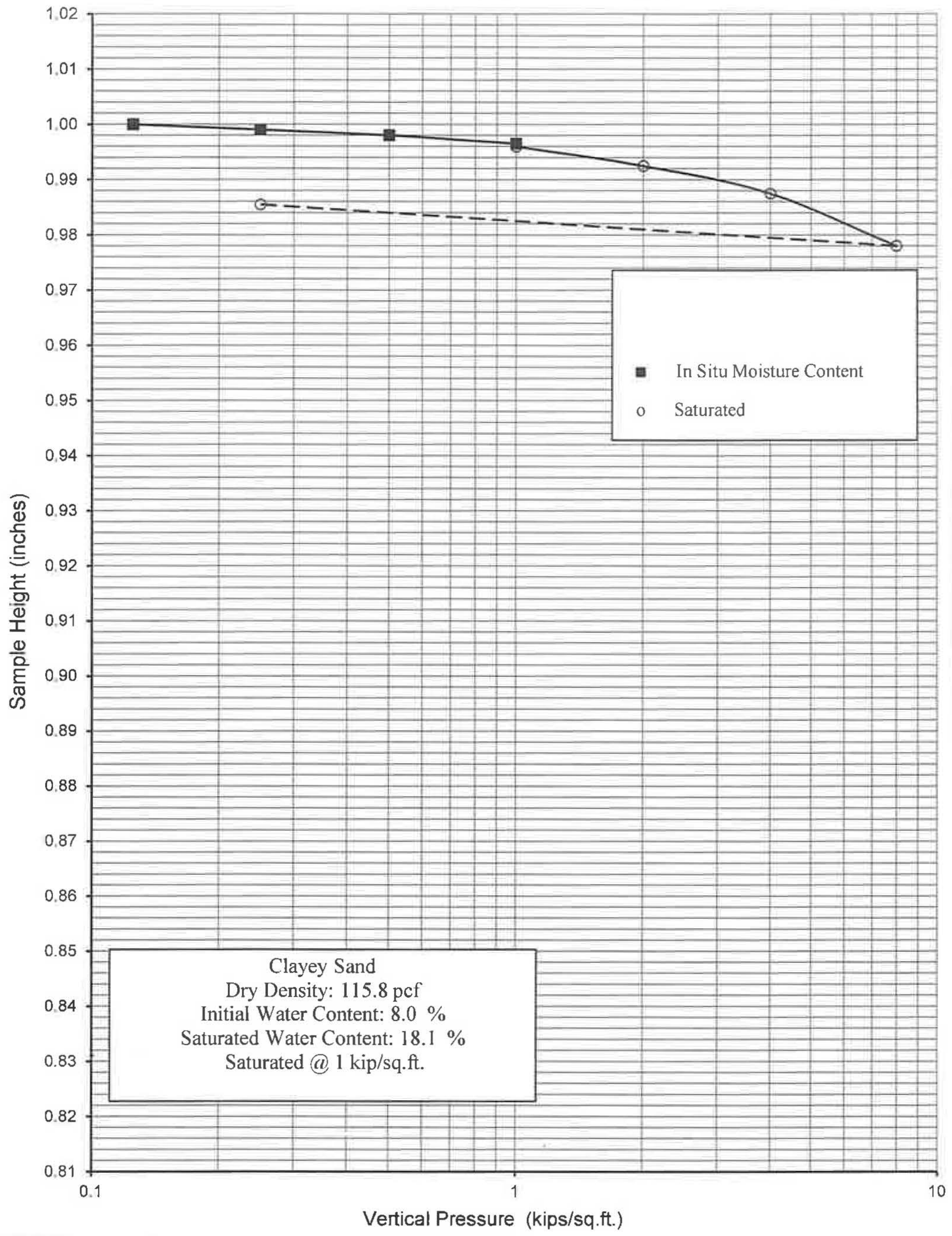
Depth 10'

Date 4/12/2021

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9990	0.1
0.5	0.9980	0.2
1	0.9965	0.4
1	0.9960	0.4
2	0.9925	0.8
4	0.9875	1.3
8	0.9780	2.2
0.25	0.9855	1.5

Saturated

Date Tested:	**4/9/2021**
Sample:	**T5**
Depth:	**10'**



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Phelan Development Company

PROJECT NUMBER: 22417-21 DATE: 4/12/2021

CONSOLIDATION TEST

ASTM D2435

Plate E

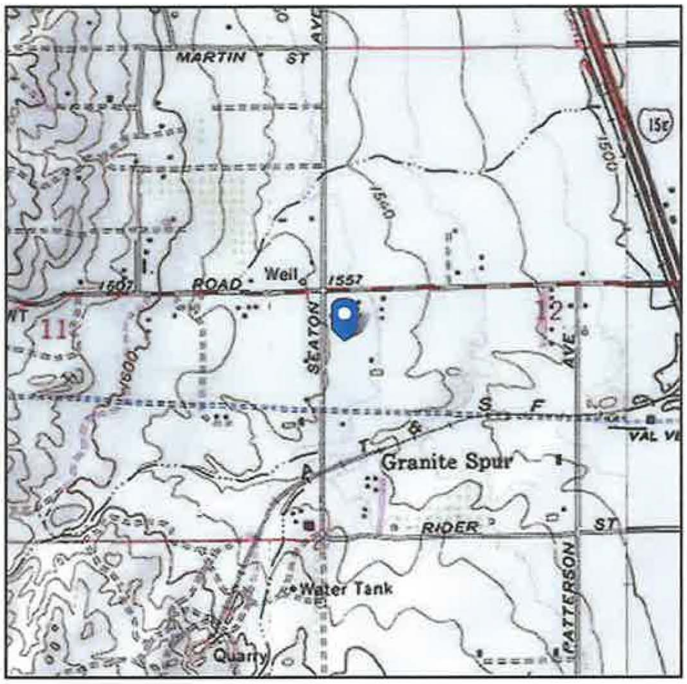
Appendix C
Seismic Design Report

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Stiff Soil

Elevation: 1558.42 ft (NAVD 88)
Latitude: 33.835842
Longitude: -117.26078



Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	1.5	S_{D1} :	N/A
S_1 :	0.557	T_L :	8
F_a :	1	PGA :	0.5
F_v :	N/A	PGA_M :	0.55
S_{MS} :	1.5	F_{PGA} :	1.1
S_{M1} :	N/A	I_e :	1
S_{DS} :	1	C_v :	1.4

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Wed Mar 31 2021

Date Source: USGS Seismic Design Maps

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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Appendix D
Soil Infiltration Data

NORCAL
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Project: Phelan Development Company
Project No.: 22417-21
Date: 3/24/2021
Test No. 1
Depth: 5'
Tested By: J.O.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
7:33			128.6			39.4					
7:38	5	5	133.9	5.3		45.0	5.6				
7:38			128.1			42.2					
7:43	5	10	133.4	5.3		48.2	6.0				
7:43			128.6			42.9					
7:48	5	15	133.2	4.6		47.7	4.8				
7:48			127.1			43.1					
7:53	5	20	131.9	4.8		47.3	4.2				
7:53			128.4			41.5					
7:58	5	25	132.3	3.9		47.9	6.4				
7:58			127.7			39.7					
8:03	5	30	131.7	4.0		44.6	4.9				
8:03			128.3			40.2					
8:08	5	35	132.1	3.8		45.0	4.8		45.6	57.6	
8:08			128.8			39.6					
8:13	5	40	132.6	3.8		44.4	4.8		45.6	57.6	
8:13			128.4			39.4					
8:18	5	45	132.1	3.7		43.7	4.3		44.4	51.6	
8:18			126.8			39.3					
8:23	5	50	131.1	4.3		43.4	4.1		51.6	49.2	
8:23			131.8			43.4					
8:28	5	55	135.7	3.9		47.7	4.3		46.8	51.6	
8:28			128.8			39.5					
8:33	5	60	132.8	4.0		43.7	4.2		48.0	50.4	

Average = 47.0 / 53.0 cm/hr

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SOILS AND GEOTECHNICAL CONSULTANTS

Project: Phelan Development Company
Project No.: 22417-21
Date: 3/24/2021
Test No. 2
Depth: 10'
Tested By: J.C.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
9:38			128.5			39.5					
9:48	10	10	129.0	0.5		40.0	0.5				
9:48			129.0			40.0					
9:58	10	20	129.0	0.0		40.0	0.0				
9:58			129.0			40.0					
10:08	10	30	129.0	0.0		40.0	0.0				
10:08			129.0			40.0					
10:18	10	40	129.0	0.0		40.0	0.0				
10:18			129.0			40.0					
10:28	10	50	129.0	0.5		40.0	0.0				
10:28			129.5			40.0					
10:38	10	60	129.5	0.0		40.0	0.0				
10:38			129.5			40.0					
10:48	10	70	129.5	0.0		40.0	0.0		0.0	0.0	
10:48			129.5			40.0					
10:58	10	80	129.5	0.0		40.0	0.0		0.0	0.0	
10:58			129.5			40.0					
11:08	10	90	129.5	0.5		40.3	0.3		3.0	1.8	
11:08			130.0			40.3					
11:18	10	100	130.0	0.0		40.5	0.2		0.0	1.2	
11:18			130.0			40.5					
11:28	10	110	130.0	0.0		40.5	0.0		0.0	0.0	
11:28			130.0			40.5					
11:38	10	120	130.0	0.0		40.5	0.0		0.0	0.0	

Average = 0.5 / 0.5 cm/hr

Project: Phelan Development Company
Project No.: 22417-21
Date: 3/24/2021
Test No. 3
Depth: 6'
Tested By: J.O.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
9:58			100.2			38.1					
10:03	5	5	109.7	9.5		47.8	9.7				
10:03			98.6			37.6					
10:08	5	10	107.9	9.3		45.2	7.6				
10:08			100.1			38.2					
10:13	5	15	106.6	6.5		43.8	5.6				
10:13			100.4			38.8					
10:18	5	20	106.5	6.1		43.4	4.6				
10:18			99.4			39.6					
10:23	5	25	105.6	6.2		44.9	5.3				
10:23			97.6			37.9					
10:28	5	30	103.3	5.7		42.3	4.4				
10:28			98.5			37.6					
10:33	5	35	103.6	5.1		41.6	4.6		61.2	55.2	
10:33			98.1			37.0					
10:38	5	40	102.7	4.6		41.5	4.5		55.2	54.0	
10:38			97.1			37.0					
10:43	5	45	101.3	4.2		41.1	4.1		50.4	49.2	
10:43			98.5			37.0					
10:48	5	50	102.8	4.3		41.3	4.3		51.6	51.6	
10:48			92.0			37.0					
10:53	5	55	101.4	3.4		40.3	3.9		40.8	46.8	
10:53			97.5			36.2					
10:58	5	60	101.1	3.6		40.0	3.8		43.2	45.6	

Average = 50.4 / 50.4 cm/hr

NORCAL
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SOILS AND GEOTECHNICAL CONSULTANTS

Project: Phelan Development Company
Project No.: 22417-21
Date: 3/24/2021
Test No. 4
Depth: 5'
Tested By: J.C.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
12:36			130.0			40.1					
12:41	5	5	134.0	4.0		45.0	4.9				
12:41			134.0			45.0					
12:46	5	10	136.5	2.5		47.0	2.0				
12:46			133.0			45.0					
12:51	5	15	134.0	1.0		45.5	0.5				
12:51			134.0			45.5					
12:56	5	20	136.0	2.0		47.4	2.9				
12:56			130.2			45.0					
1:01	5	25	131.9	1.7		47.1	2.1				
1:01			129.8			42.0					
1:06	5	30	132.5	2.7		44.5	2.5				
1:06			132.5			44.5					
1:11	5	35	134.5	2.0		46.5	2.0		24.0	24.0	
1:11			134.5			46.5					
1:16	5	40	135.5	1.0		47.5	1.0		12.0	12.0	
1:16			135.5			47.5					
1:21	5	45	137.0	1.5		48.5	1.0		18.0	12.0	
1:21			133.0			44.5					
1:26	5	50	134.5	1.5		45.5	1.0		18.0	12.0	
1:26			134.5			45.5					
1:31	5	55	136.0	1.5		47.5	2.0		18.0	24.0	
1:31			136.0			47.5					
1:36	5	60	138.0	2.0		48.5	1.0		24.0	12.0	

Average = 19.0 / 16.0 cm/hr