GEOTECHNICAL EVALUATION REPORT
WINGSWEEP ENTITLEMENT - COMMERCIAL SITE
(PA-11)
CITY OF TEMECULA, CALIFORNIA

Prepared for

WINGSWEEP CORPORATION
C/O DECATUR ADVISORS, LLC
P.O. Box 2016
Carlsbad, CA 92018

Project No. 12673.001

July 15, 2020

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

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Wingsweep Corporation
c/o Decatur Advisors, LLC
P.O. Box 2016
Carlsbad, CA 92018

Attention: Mr. Thom Fuller

Subject: Geotechnical Evaluation Report
Wingsweep Entitlement - Commercial Site (PA-11)
City of Temecula, California - JDA Job # 2003

In accordance with your request, we are pleased to provide this geotechnical evaluation report for the subject development located in the City of Temecula, California (see Figure 1). This report summarizes our geotechnical findings, conclusions and recommendations regarding the design and construction of the proposed commercial development and associated improvements. Based on the results of our review, it is our opinion that the site is suitable for the intended use provided the recommendations included in this report are implemented during design and construction phases of development.

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

Respectfully submitted,
LEIGHTON AND ASSOCIATES, INC.

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1.0 INTRODUCTION

1.1 Purpose and Scope

This geotechnical evaluation report is for Planning Area (PA) 11 within the Roripaugh Ranch Development located in the City of Temecula, California. Our scope of services for this geotechnical evaluation included the following:

- Review of previous geotechnical reports, available site-specific geologic information and provided site plans.
- A site geologic reconnaissance and visual observations of surface conditions.
- Excavation, sampling and logging of 5 exploratory geotechnical hollow stem auger borings (LB-13 to LB-17). These borings were excavated as part of the overall exploration for adjacent PA's 10, 12 and 33A. Logs of boring specific to PA-11 are included in Appendix A.
- Field percolation/infiltration testing to a depth of approximately 5 feet below existing ground surface (P-3).
- Laboratory testing of representative soil samples obtained from the subsurface exploration program. A brief description of laboratory testing procedures and laboratory test results are presented in Appendix B.
- Geotechnical engineering analyses performed or as directed by a California registered Geotechnical Engineer (GE) including preliminary foundation and seismic design parameters based on the 2019 California Building Code (CBC). A California Certified Engineering Geologist (CEG) performed engineering geology review of site geologic hazards.
- Preparation of this report, which presents the results of our exploration and provides preliminary geotechnical recommendations for the proposed development.

This report is not intended to be used as an environmental assessment (Phase I or other), or foundation/precise grade plan review.

1.2 Project and Site Description

As shown on Figure 1, PA-11 is located southwest of the intersection of Butterfield Stage Road (BSR) and Murrieta Hot Springs Road (MHSR). Previous site grading has created a sheet graded pads and a detention basin. The site was graded to its current condition as part of the overall Roripaugh Ranch residential development (Byerly, 2012). Moderate growth of weeds/grasses and local dense shrubs are scattered throughout the site. Erosion protection features (sand bags, plastic liners, etc.) were also noted throughout the site. We understand that this parcel will be developed to host typical commercial/retail buildings with associated driveways, parking, basins, and landscape areas. Grading plan was not available at the time of this review.

Future site grading is expected to consist of minor cuts and fills (±5 feet), not including remedial grading, where applicable. If site development significantly differs from the assumptions made and the plans referenced herein, the recommendations included in this report should be subject to further evaluation.

1.3 Background

Based on our review of referenced reports and aerial images (Google Earth Pro, 2020), we understand that PA-11 was graded to its current configuration during the period between 2003 and 2006. Based on our review, perimeter slopes are either cut slopes into Pauba formation of comprised of compacted fill. Observations of site concrete lined v-ditches did not reveal any subdrain outlets. Although no documentation is available for the original site grading work prior to 2005, previous reports provided field density testing until 2007 (Byerly, 2012a). Grading required the excavation of approximately 53 feet in central portion of the lot and fill of approximately 55 feet in the south east corner (DEA, 2005) .

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Our field exploration program consisted of 5 hollow-stem auger borings (LB-13 thru LB-17). During hollow stem auger excavation, bulk samples and relatively “undisturbed” Ring samples were collected from the exploration borings for further laboratory testing and evaluation. The relatively undisturbed samples were obtained utilizing a modified California drive sampler (2⅜-inch inside diameter and 3-inch outside diameter) driven 18 inches in general accordance with ASTM Test Method D3550. The number of blows to drive the samplers are recorded on the boring logs for each 6-inch increment (unless encountering practical refusal or >50 blows per 6 inches). Sampling was conducted by a staff geologist from our firm. After logging and sampling, the excavations were loosely backfilled with spoils generated during excavation. The logs of exploratory borings are presented in Appendix A and locations are shown on Figure 5.

2.2 Laboratory Testing

Laboratory tests were performed on representative bulk and undisturbed drive samples to provide a basis for development of remedial earthwork and geotechnical design parameters. Selected samples were tested for the following parameters: insitu moisture and density, maximum dry density (Proctor), R-Value, direct shear, collapse, soluble sulfate, pH, resistivity and chloride content. The results of our laboratory testing are presented in Appendix B.

3.0 GEOTECHNICAL AND GEOLOGIC FINDINGS

3.1 Regional Geology

The site is located within a prominent natural geomorphic province in southwestern California known as the Peninsular Ranges. It is characterized by steep, elongated ranges and valleys that trend northwestward. More specifically, the site is situated within the Perris Block, an eroded mass of Cretaceous and older crystalline rock.

The Perris Block, approximately 20 miles by 50 miles in extent, is bounded by the San Jacinto Fault Zone to the northeast, the Elsinore Fault Zone to the southwest, the Cucamonga Fault Zone to the northwest, and the Temecula Basin to the southeast. The southeast boundary of the Perris block is poorly defined. The Perris Block has had a complex tectonic history, apparently undergoing relative vertical land movements of several thousand feet in response to movement on the Elsinore and San Jacinto Fault Zones. Thin sedimentary materials locally mantle the crystalline bedrock and alluvial and colluvial deposits fill the lower valley areas.

3.2 Site Specific Geology

3.2.1 Earth Materials

Based on our field explorations and review of previous site-specific geotechnical reports, the site is generally covered by artificial fill underlain by Pleistocene-aged Pauba Formation. These units are discussed in the following sections in order of increasing age.

- **Artificial Fill:** As encountered in our borings, the artificial fill ranges in thickness from 5 to 15±-feet. The fill generally consists of medium dense to dense, silty to clayey sand (SM/SC). Based on the results of the laboratory testing, these materials appear to generally possess adequate relative density and very low expansion potential.

- **Pauba Formation:** Where encountered in our borings, Pleistocene-aged Pauba Formation was encountered below the artificial fill at depths ranging from 5 to 15 feet. These materials generally consist of medium-dense to very dense poorly and silty to clayey sand (SM/SC), well graded sand (SW) and interbedded layers of stiff to hard sandy/silt (ML).

3.3 Groundwater and Surface Water

Surface water was observed during recent site visit standing in the existing storm water basin in the southwestern portion of the site. Groundwater was not encountered during this exploration to a depth of approximately 21.5 feet below the existing ground surface. The Department of Water Resource data for Well 335412N1170712W001 indicates a depth to groundwater on the order of 339 feet in September 2017. The well is located along Vino Way, approximately 1 mile east of the site. Fluctuations in ground water should be expected due to site irrigation and infiltration of storm water.

3.4 Regional Faulting and Local Fault Activity

The subject site, like the rest of Southern California, is located within a seismically active region as a result of being located near the active margin between the North American and Pacific tectonic plates.

The principal source of seismic activity to affect the site is movement along the northwest-trending regional fault systems such as the San Andreas, San Jacinto, and Elsinore Fault Zones. Based on published geologic maps, this site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone (CGS, 2018) or Riverside County Fault Hazard Zone (Riverside, 2020).

The nearest active State Zoned fault is the Elsinore Fault Zone located approximately 3.9 miles southwest of the site. The nearest County Fault Zone is the Murrieta Hot Springs Fault Zone located approximately 0.2 miles (1,025 feet) west of the site. The nearest known active strand of the Murrieta Hot Springs fault is approximately 1.5 Miles (7,800 feet) northwest of the site (Leighton, 1999). No active fault traces are known to traverse or project into the project site (CGS, 2018, County of Riverside, 2020 and Leighton, 1990, 1999, 2001).

3.5 Ground Shaking

Strong ground shaking can be expected at the site during moderate to severe earthquakes in this general region. This is common to virtually all of Southern California. Intensity of ground shaking at a given location depends primarily upon earthquake magnitude, site distance from the source, and site response (soil type) characteristics. The site-specific seismic coefficients provided in table below are based on an interactive tools/programs currently available on USGS website and OSHPD seismic maps. The above site-specific ground motion analyses were based on Site Class C since underlain by dense Pauba formation.

Table 1. 2019 CBC Site Specific Seismic Coefficients

Site Seismic Coefficients / Coordinates	PA-11
Latitude	33.5509
Longitude	-117.0997
Site Class	**C**
Spectral Response (short), SS	1.41g
Spectral Response (1 sec), S_1	0.52g
Site Modified Peak Ground Acceleration, PGA_M	0.73
Short Period Site Coefficient at 0.2s Period, Fa	*1.20*
Long Period Site Coefficient at 1s Period, Fv	*1.48*
Max. Considered Earthquake Spectral Response Acceleration (short), S_{MS}	1.69g
Max. Considered Earthquake Spectral Response Acceleration – (1 sec), S_{M1}	0.77g
5% Damped Design Spectral Response Acceleration (short), S_{DS}	**1.13g**
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	**0.52g**
Site-Specific Peak Ground Acceleration, PGA	0.61

g = Gravity Acceleration

3.6 Dynamic Settlement (Liquefaction and Dry Settlement)

PA-11 is located in areas of very low to low susceptibility to liquefaction (see Figure 4). Due to the absence of shallow groundwater, and dense Pauba formation underlying the site, the potential for liquefaction is considered very low. Dynamic induced settlement is not considered a geologic hazard due to underlying dense shallow fill and Pauba formation.

3.7 Flooding

The site is not within a flood plain and potential for flooding is considered very low.

3.8 Seiche and Tsunami

Due to the sites elevated location and lack of nearby open bodies of water, the possibility of the affects due to seiches or tsunami is considered nil.

3.9 Slope Stability

The existing cut and fill 21 slopes are considered stable in their current configuration. As shown on Cross-Section AA' (see Appendix D), the approximately 55-foot high slope descending from Murrieta Hot Springs Road is cut into dense Pauba formation whereas the approximately 45-foot high slope in the southeast corner consist of compacted fill over Pauba formation at depth. The results of our analyses indicate that both cut and fill slopes are considered stable under static and pseudo-static conditions. The results of our slope stability analysis are presented in Appendix D.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 General

The proposed site development appears feasible from a geotechnical viewpoint provided that the following recommendations are incorporated into the design and construction phases of the proposed development. Grading plans should be reviewed by Leighton prior to construction to provide additional recommendations, if needed.

4.2 Earthwork

Earthwork should be performed in accordance with the following recommendations and the *Earthwork and Grading Specifications* included in Appendix E of this report. In case of conflict, the following recommendations should supersede those in Appendix E. The contract between the Owner and the earthwork contractor should be worded such that it is the responsibility of the contractor to place fill properly and in accordance with recommendations presented in this report, including the guide specifications in Appendix E, notwithstanding the testing and observation of the geotechnical consultant.

4.2.1 Site Preparation and Remedial Grading

Prior to grading, the proposed structural improvement areas (i.e. all-structural fill areas, pavement areas, buildings, etc.) should be cleared of surface and subsurface pipes, obstructions and erosion control materials. Heavy vegetation, roots, sand bags, straw waddles and debris should be disposed of offsite. Voids created by removal of buried/unsuitable materials should be backfilled with properly compacted soil in general accordance with the recommendations of this report. Area specific remedial grading recommendations are provided as follows:

- **Fill Areas**: In areas requiring additional fill greater than 2 feet, the upper 12 inches of soils should be removed/over-excavated and recompacted. Localized areas of deeper removals/ over-excavation may be required in existing basins or localized loose areas depending on actual conditions encountered and verification by our field representative during grading.
- **Cut Condition:** In cuts greater than 2 feet exposing Pauba formation or dense artificial fill, the exposed surface should be scarified and recompacted. If cut is less than 2 feet, then the existing subgrade should be over-excavated to a minimum of 2 feet below pad grade. Localized areas of deeper over-excavation may be required pending verification by our field representative during grading.

- **Pavement Areas:** Whether exposing fill or Pauba formation, the cleared and exposed surface should be scarified to a minimum depth of 12 inches, moisture conditioned and compacted to minimum 90 percent compaction or to an unyielding condition.

Geotechnical observation of removal or over-excavation bottoms should be performed during grading to confirm the competency of the materials being left in place. After completion of the recommended removal of unsuitable or surficial soils and prior to fill placement, the exposed surface should be scarified to a minimum depth of 8-inches, moisture conditioned and compacted using heavy pneumatic compaction equipment to minimum 90 percent compaction of the laboratory maximum dry density (ASTM D1557) and to an unyielding condition. In general, all structural fill should be compacted throughout to 90 percent.

4.2.2 Suitability of Site Soils for Fills

Topsoil and vegetation layers, root zones, and similar surface materials should be striped and stockpiled or removed from the site. Existing fill should be considered suitable for re-use as compacted fills provided the recommendations contained herein are followed. Fill materials with expansion index greater than 21 should not be used in subgrade soils below building pads. If cobbles and boulders larger than 6-inches in largest diameter are encountered or produced during grading, these oversized cobbles and boulders should be reduced to less than 6 inches or placed in structural fill as outlined in Appendix E.

4.2.3 Rippability

The onsite Pauba formation and existing fill soils are considered rippable with typical conventional grading equipment. Isolated lenses of dense or gravelly or well cemented Pauba can be expected but are anticipated to be rippable with typical heavy duty earth moving equipment.

4.2.4 Slope Construction

The existing and proposed 2:1 slopes are considered grossly stable. Any new 2:1 slopes using the onsite soils compacted to minimum 90 percent should also be stable under short and long-term conditions. The outer portion of fill slopes should be either overbuilt by 2 feet (minimum) and trimmed back to the finished slope configuration or compacted in vertical increments of 5 feet (maximum) by a weighted sheeps-foot roller as the fill is placed. The slope face should then be track-walked by dozers of appropriate weight to achieve the final slope configuration and compaction to the slope face.

Slope faces are inherently subject to erosion, particularly if exposed to rainfall and irrigation. Landscaping and slope maintenance should be conducted as soon as possible in order to increase long-term surficial stability. Berms should be provided at the top of fill slopes and drainage should be directed such that surface runoff over slopes is prevented.

4.2.5 Import Soils

Import soils and/or borrow sites, if needed, should be evaluated by us prior to import. Import soils should be uncontaminated, granular in nature, free of organic material (loss on ignition less-than 2 percent), have low expansion potential (E<21) and have a low corrosion impact to the proposed improvements and R-value greater than 30 if to be used in upper 12 inches of street subgrade.

4.2.6 Utility Trenches

Utility trenches should be backfilled with compacted fill in accordance with the *Standard Specifications for Public Works Construction,* (“Greenbook”), 2018 Edition. Fill material above the pipe zone should be placed in lifts not exceeding 8 inches in uncompacted thickness and should be compacted to at least 90 percent relative compaction (ASTM D 1557) by mechanical means only. Site soils may generally be suitable as trench backfill provided these soils are screened of rocks over 3 inches in diameter and organic matter. If imported sand is used as backfill, the upper 3 feet in building and pavement areas should be compacted to 95 percent. The upper 6 inches of backfill in all pavement areas should be compacted to at least 95 percent relative compaction.

Where granular backfill is used in utility trenches adjacent moisture sensitive subgrades and foundation soils, we recommend that a cut-off “plug” of impermeable material be placed in these trenches at the perimeter of buildings, and at pavement edges adjacent to irrigated landscaped areas. A “plug” can consist of a 5-foot long section of clayey soils with more than 35-percent passing the No. 200 sieve, or a Controlled Low Strength Material (CLSM) consisting of one sack of Portland-cement plus one sack of bentonite per cubic-yard of sand. CLSM should generally conform to requirements of the “Greenbook”. This is intended to reduce the likelihood of water permeating trenches from landscaped areas, then seeping along permeable trench backfill into the building and pavement subgrades, resulting in wetting of moisture sensitive subgrade earth materials under buildings and pavements.

Excavation of utility trenches should be performed in accordance with the project plans, specifications and the *California Construction Safety Orders* (latest Edition). The contractor should be responsible for providing a "competent person" as defined in Article 6 of the *California Construction Safety Orders*. Contractors should be advised that sandy soils (such as fills generated from the onsite alluvium) could make excavations particularly unsafe if all safety precautions are not properly implemented. In addition, excavations at or near the toe of slopes and/or parallel to slopes may be highly unstable due to the increased driving force and load on the trench wall. Spoil piles from the excavation(s) and construction equipment should be kept away from the sides of the trenches.

4.2.7 Shrinkage

The volume change of excavated onsite soils upon recompaction is expected to vary with materials, density, insitu moisture content, and location and compaction effort. The in-place and compacted densities of soil materials vary and accurate overall determination of shrinkage and bulking cannot be made. Therefore, we recommend site grading include, if possible, a balance area or ability to adjust grades slightly to accommodate some variation. Based on our geotechnical laboratory results, we expect recompaction shrinkage (when recompacted to an average 92 percent of ASTM D1557) of 5- to 10-percent by volume for the existing fill. The Pauba formation can experience up to 5 percent shrink for highly weathered materials and up to 5 percent bulk for less weathered or excavations deeper than 5 to 10 feet.

4.2.8 Drainage

All drainage should be directed away from structures, slopes and pavements by means of approved permanent/temporary drainage devices. Adequate storm drainage of any proposed pad should be provided to avoid wetting of foundation soils or slopes. Irrigation adjacent to buildings should be avoided when possible. As an option, sealed-bottom planter boxes and/or drought resistant vegetation should be used within 5-feet of buildings.

4.3 Foundation Design

4.3.1 General

The footing width, depth, reinforcement, slab reinforcement, and the slab-on-grade thickness should be designed by the structural consultant based on recommendations and soil characteristics indicated herein. Based on our testing, very low expansive soils (0<EI<21) should be anticipated at foundation levels. The proposed foundations and slabs should be designed in accordance with the structural consultants' design, the minimum geotechnical recommendations presented herein, and the applicable CBC. In utilizing the minimum geotechnical foundation recommendations, the structural consultant should design the foundation system to acceptable deflection criteria as determined by the architect.

4.3.2 Allowable Bearing and Lateral Pressures

The following bearing pressures may be used for design of foundations. Foundation footings may be designed with the following geotechnical design parameters:

- Allowable Bearing Capacity: 2,000 psf at a minimum depth of embedment of 12 inches (minimum width of 12 inches). The bearing pressure value may be increased by 250 psf for each additional foot of embedment or each additional foot of width to a maximum vertical bearing value of 3,000 psf. This bearing capacity may be increased by ⅓ for short-term loading conditions (e.g., wind, seismic).
- Lateral bearing pressure: 3,000 psf/foot per foot of depth and embedment to a maximum of 3,000 psf.
- Sliding Coefficient: 0.35
- Differential Settlement: 0.5-inch in 30 feet horizontal distance

The footing width, depth, reinforcement, slab reinforcement, and the slab-on-grade thickness should be designed by the structural consultant based on recommendations and soil characteristics indicated herein.

4.4 Foundation Setback from Slopes

We recommend a minimum horizontal setback distance from the face of slopes for all structural footings (retaining and decorative walls, flatwork, building footings, pools, etc.). This distance is measured from the outside bottom edge of the footing horizontally to the slope face (or the face of a retaining wall) and should be a minimum of H/2, where H is the slope height (in feet).

Table 2. Footing Setbacks

Slope Height	Recommended Footing Setback
<5 feet	5 feet minimum
5 to 15 feet	7 feet minimum
>15 feet	H/2, where H is the slope height, not to exceed 10 feet to 2:1 slope face

The soils within the structural setback area generally possess poor lateral stability and improvements (such as retaining walls, sidewalks, fences, pavements, decorative flatwork, etc.) constructed within this setback area will be subject to lateral movement and/or differential settlement. Potential distress to such improvements may be mitigated by providing a deepened footing or a pier and grade-beam foundation system to support the improvement. The deepened footing should meet the setback described above. Modifications of slope inclinations near foundations may increase the setback and should be reviewed by the design team prior to completion of design or implementation.

4.5 Vapor Retarder

It has been a standard of care to install a moisture-vapor retarder underneath all slabs where moisture condensation is undesirable. Moisture vapor retarders may retard but not totally eliminate moisture vapor movement from the underlying soils up through the slabs. Moisture vapor transmission may be additionally reduced by use of concrete additives. Leighton and Associates, Inc. does not practice in the field of moisture vapor transmission evaluation/mitigation. Therefore, we recommend that a qualified person/firm be engaged/consulted with to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person/firm should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

However, based on our experience, the standard of practice in Southern California has evolved over the last 15 to 20 years into a construction of a vapor retarder system that generally consisted of a membrane (such as 10-mil thick or greater), underlain by a capillary break consisting of 4 inches of clean ½-inch-minimum gravel or 2-inch sand layer (SE>30). The structural engineer/architect or concrete contractor often require a sand layer be placed over the membrane (typically 2-inch thick layer) to help in curing and reduction of curling of concrete. If such sand layer is placed on top of the membrane, the contractor should not allow the sand to become wet prior to concrete placement (e.g., sand should not be placed if rain is expected).

In conclusion, the construction of the vapor barrier/retarder system is dependent on several variables which cannot be all geotechnically evaluated and/or tested. As such, the design of this system should be a design team/owner decision taking into consideration finish flooring materials and manufacture's installation requirements of proposed membrane. Moreover, we recommend that the design team also follow ACI Committee 302 publication for "Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials" (ACI 302.2R-06) which includes a flow chart that assists in determining if a vapor barrier /retarder is required and where it is to be placed.

4.6 Retaining Walls

Retaining wall earth pressures are a function of the amount of wall yielding horizontally under load. If the wall can yield enough to mobilize full shear strength of backfill soils, then the wall can be designed for "active" pressure. If the wall cannot yield under the applied load, the shear strength of the soil cannot be mobilized and the earth pressure will be higher. Such walls should be designed for "at rest" conditions. If a structure moves toward the soils, the resulting resistance developed by the soil is the "passive" resistance. Retaining walls backfilled with non-expansive soils can be designed using the following equivalent fluid pressures:

Table 3. Retaining Wall Design Earth Pressures (Static, Drained)

Loading Conditions	Equivalent Fluid Density (pcf)	
	Level Backfill	2:1 Backfill
Active	36	55
At-Rest	55	85
Passive*	350	125 (2:1, sloping down)

* This assumes level condition in front of the wall will remain for the duration of the project, not to exceed 2,000 psf at depth.

For walls retaining more than 6 feet of soils, we recommend for non-restrained walls with level backfill, a uniform pressure distribution of 13H psf with resultant force applied at mid-height of wall, where H is the retaining wall stem height in feet. For walls with 2:1 sloping backfill, a uniform pressure distribution of 28H psf with resultant force applied at mid-height. These seismic pressures should be added to static pressures above or any applicable surcharge loads.

Unrestrained (yielding) cantilever walls should be designed for the active equivalent-fluid weight value provided above for very low to low expansive soils that are free draining. In the design of walls restrained from movement at the top (non-yielding) such as basement or elevator pit/utility vaults, the at-rest equivalent fluid weight value should be used. Total depth of retained earth for design of cantilever walls should be measured as the vertical distance below the ground surface measured at the wall face for stem design, or measured at the heel of the footing for overturning and sliding calculations. Should a sloping backfill other than a 2:1 (horizontal:vertical) be constructed above the wall (or a backfill is loaded by an adjacent surcharge load), the equivalent fluid weight values provided above should be re-evaluated on an individual case basis by us. Non-standard wall designs should also be reviewed by us prior to construction to check that the proper soil parameters have been incorporated into the wall design.

All retaining walls should be provided with appropriate drainage. The outlet pipe should be sloped to drain to a suitable outlet. Wall backfill should be non-expansive (EI $\leq$ 21) sands compacted by mechanical methods to a minimum of 90 percent relative compaction (ASTM D 1557). Clayey site soils should not be used as wall backfill. Walls should not be backfilled until wall concrete attains the 28-day compressive strength and/or as determined by the Structural Engineer that the wall is structurally capable of supporting backfill. Lightweight compaction equipment should be used, unless otherwise approved by the Structural Engineer.

4.7 Sulfate Attack

The results of the laboratory testing on representative soils samples indicate negligible exposure to concrete per ACI 318. Further testing should be performed at the completion of site grading to confirm soluble-sulfate content of finish subgrade soils.

4.8 Concrete Flatwork

Sidewalk/Flatwork should conform to City of Temecula standards. A representative of Leighton should verify subgrade soil expansion, moisture conditions and compaction prior to formwork and reinforcement placement. If subgrade soils possess expansion index greater than 21, we recommend a minimum 8-inch deepened edge be constructed for all flatwork to reduce moisture variation in subgrade soils along concrete edges adjacent to open (unfinished) or irrigated landscape areas.

Concrete flatwork should be constructed of uniformly cured, low-slump concrete and should contain sufficient control/contraction joints. Additional provisions such as ascending/descending slope conditions, perched (irrigation) water, special surcharge loading conditions, potential expansive soil pressure and differential settlement/heave should be incorporated into the design of exterior improvements. Additional exterior slab details are suggested in the American Concrete Institute (ACI) guidelines. Homeowners (HOA) should be advised of their maintenance responsibilities as well as geotechnical issues that could affect performance of site improvements.

4.9 Preliminary Pavement Design

Based on our laboratory testing, an assume R-vale of 40 is considered for pavement design for this project. For planning purposes, the pavement sections are calculated based on Caltrans Highway Design Manual and Traffic Indexes (TI) listed in Table below.

Table 4. Asphalt Pavement Sections

General Traffic Condition	Traffic Index (TI)	AC Thickness (inch)	AB Thickness (inch)
Automobile Parking Lanes	4.5	3.0	6.0
	5.0	3.0	6.0
Truck Access & Driveways	6.0	3.5	6.0
	6.5	4.0	6.0

Appropriate Traffic Index (TI) should be selected or verified by the project civil engineer and actual R-value of the subgrade soils should be verified after completion of site grading to confirm or revise pavement sections. Pavement design and construction should also conform to applicable local City of Temecula standards. The pavement design calculations were based on a pavement life of approximately 20 years with periodic flexible pavement maintenance.

For rigid pavement design, we recommend that a minimum of 7 inches of PCC pavement be used, in high impact load areas or if to be subjected to truck traffic. The PCC pavement should be placed on a minimum 4-inch aggregate base. The PCC pavement may be placed directly on a compacted subgrade with an R-Value of 40 or higher. The PCC pavement should have a minimum of 28-day compressive strength of 3500 psi. Aggregate base should conform to the Standard Specifications for Public Works Construction (Green Book), 2018 Edition. Placement of concrete materials should follow applicable ACI and County standards.

The upper 6 inches of the subgrade soils should be moisture-conditioned to near optimum moisture content, compacted to at least 95 percent relative compaction (ASTM D1557) and kept in this condition until the pavement section is constructed. Minimum relative compaction requirements for aggregate base should be 95 percent of the maximum laboratory density as determined by ASTM D1557. If applicable, aggregate base should conform to the "Standard Specifications for Public Works Construction" (Greenbook) current edition or Caltrans Class 2 aggregate base and applicable City standards

If pavement areas are adjacent to watered landscape areas, some deterioration of the subgrade load bearing capacity may result. Moisture control measures such as deepened curbs or other moisture barrier materials may be used to prevent the subgrade soils from becoming saturated. The use of concrete cutoff or edge barriers should be considered when pavement is planned adjacent to either open (unfinished) or irrigated landscaped areas.

4.10 Percolation/Infiltration Test Results

One percolation test was performed to provide a general screening characterization of infiltration rates of onsite materials. The percolation test was performed in accordance with procedures of Section 2.3 of the Riverside County Flood Control and Water Conservation District (RCFC&WCD) Design Handbook (RCFC, 2011). Results indicate a very low infiltration rate (<0.1 in/hr). The infiltration rates were estimated using the Porchet Method. No factor of Safety was applied to this value.

5.0 GEOTECHNICAL CONSTRUCTION SERVICES

Geotechnical review is of paramount importance in engineering practice. Poor performances of many foundation and earthwork projects have been attributed to inadequate construction review. We recommend that Leighton and Associates, Inc. be provided the opportunity to review the grading plan and foundation plan(s) prior to bid.

Reasonably-continuous construction observation and review during site grading and foundation installation allows for evaluation of the actual soil conditions and the ability to provide appropriate revisions where required during construction. Geotechnical conclusions and preliminary recommendations should be reviewed and verified by Leighton and Associates, Inc. during construction, and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Geotechnical observation and testing should be provided:

- After completion of site demolition and clearing,
- During over-excavation of compressible soil,
- During compaction of all fill materials,
- After excavation of all footings and prior to placement of concrete,
- During utility trench backfilling and compaction, and
- When any unusual conditions are encountered.

Additional geotechnical exploration and analysis may be required based on final development plans, for reasons such as significant changes in slopes locations, heights or proposed structure locations/footprints. We should review grading (civil) and foundation (structural) plans, and comment further on geotechnical aspects of this project.

6.0 LIMITATIONS

This report was based in part on data obtained from a limited number of observations, site visits, soil excavations, samples and tests. Such information is, by necessity, incomplete. The nature of many sites is such that differing soil or geologic conditions can be present within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, our findings, conclusions and recommendations presented in this report are based on the assumption that we (Leighton and Associates, Inc.) will provide geotechnical observation and testing during construction as the Geotechnical Engineer of Record for this project. Please refer to Appendix F, GBA's *Important Information About This Geotechnical-Engineering Report*, prepared by the Geoprofessional Business Association (GBA) presenting additional information and limitations regarding geotechnical engineering studies and reports.

This report was prepared for the sole use of Client and their design team, for application to design of the proposed development, in accordance with generally accepted geotechnical engineering practices at this time in California. Any unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton and Associates, Inc. from and against any liability, which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Leighton and Associates, Inc.

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Project: 12673.001	Geol: SIS/RFR
Scale: 1 " = 4,000 '	Date: July 2020

Base Map: Bing Maps 2020

Author: Leighton Geomatics (mmurphy)

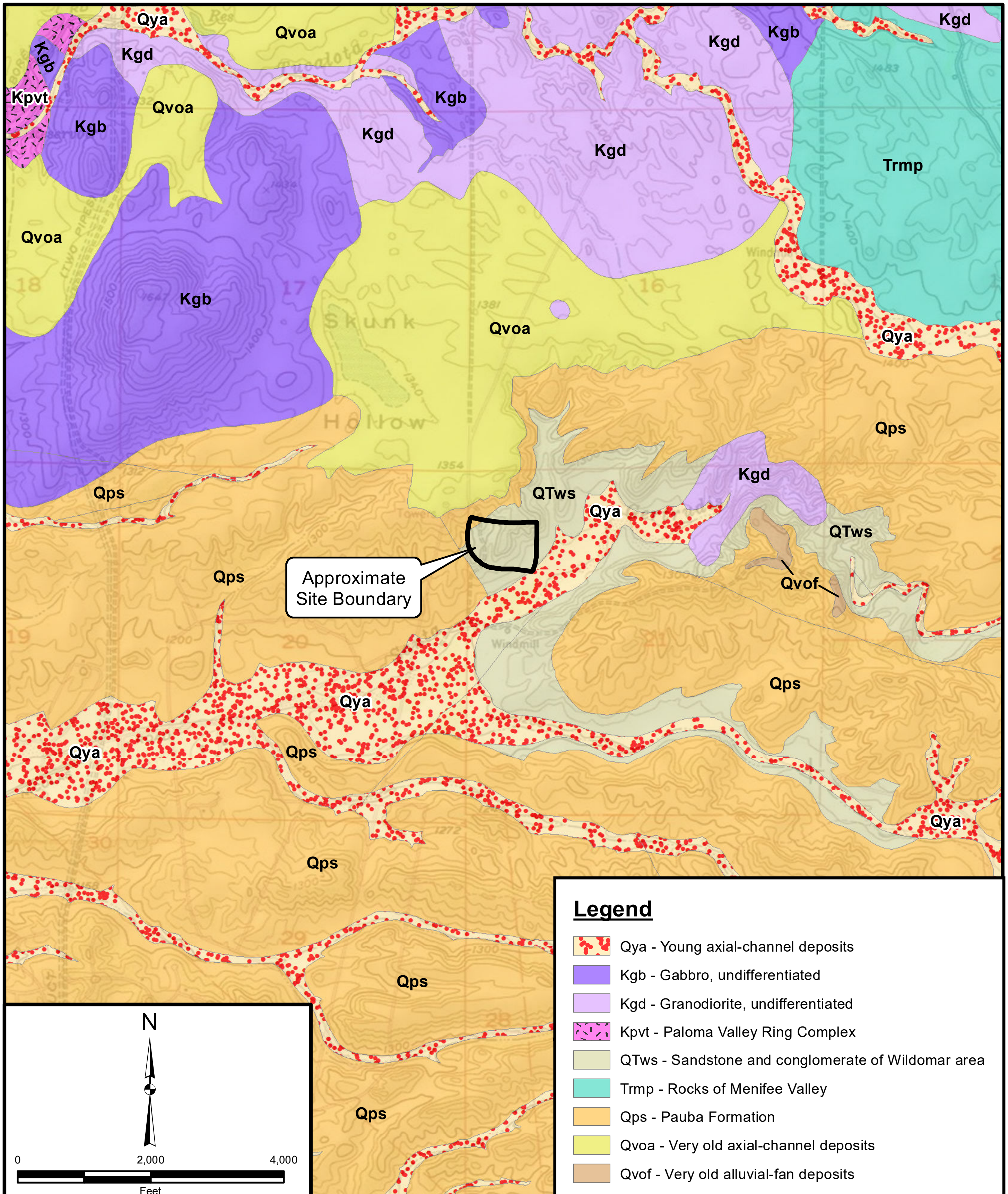
SITE LOCATION MAP

Roripaugh Ranch PA 11
City of Temecula, California

Figure 1

Leighton

Map Saved as P:\Drafting\12673\001\Maps\12673-001_F01_SLM_2020-04-09.mxd on 4/9/2020 8:54:27 AM



Project: 12673.001	Geol: SIS/RFR	
Scale: 1 " = 2,000 '	Date: July 2020	

Reference: USGS, 2006 Geologic map of the San Bernardino and Santa Ana 30'x60 quadrangle, California Version 1,0 Open File Report 2006-1217.

Author: Leighton Geomatics (mmurphy)

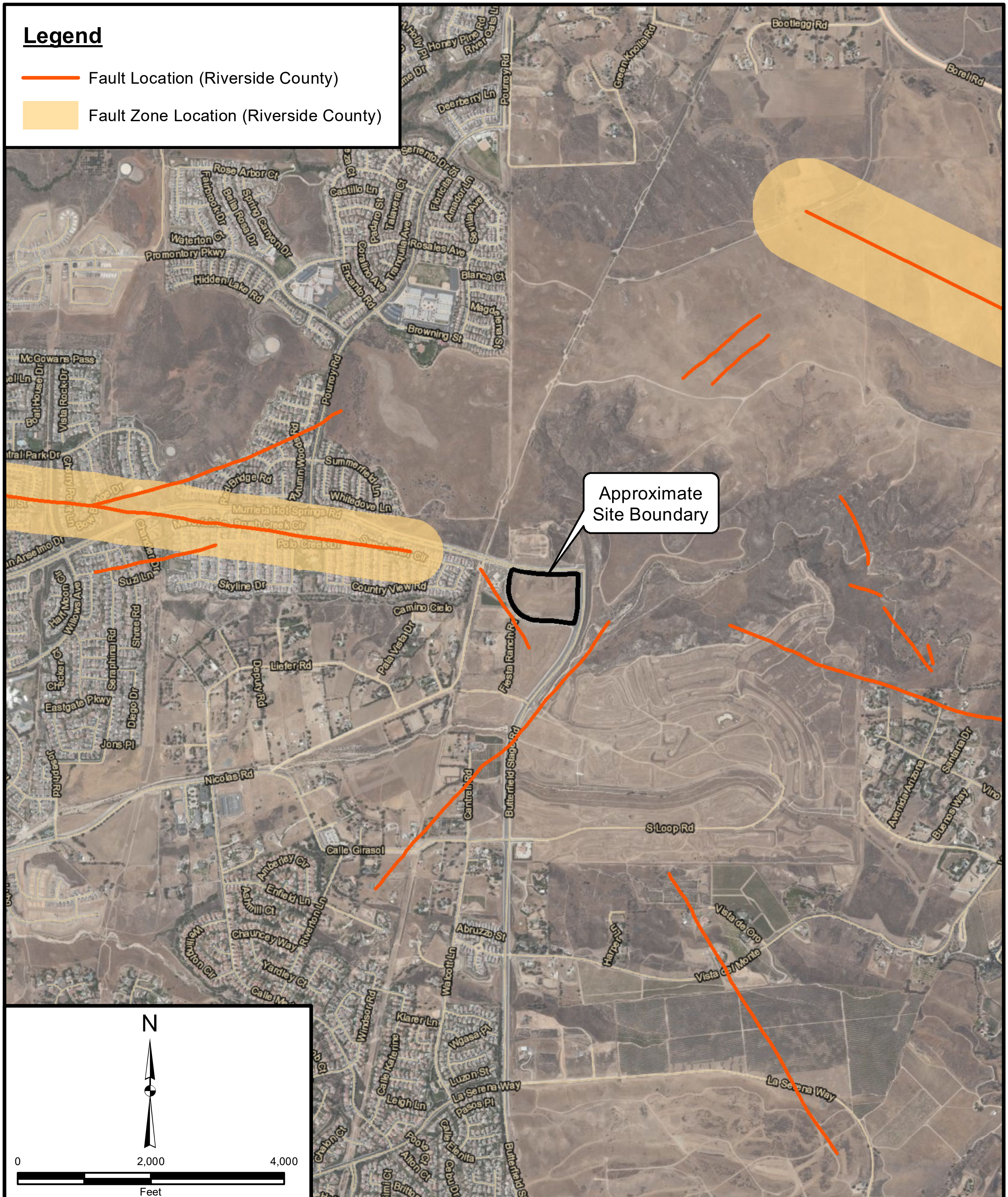
REGIONAL GEOLOGY MAP

Roripaugh Ranch PA 11
City of Temecula, California

Figure 2

Leighton

Map Saved as P:\Drafting\12673\001\Maps\12673-001_F02_RGM_2020-04-09.mxd on 4/9/2020 8:28:51 AM



Project: 12673.001	Geol: SIS/RFR
Scale: 1 " = 2,000 '	Date: July 2020

Base Map: Bing Maps 2020

Author: Leighton Geomatics (mmurphy)

REGIONAL FAULT MAP

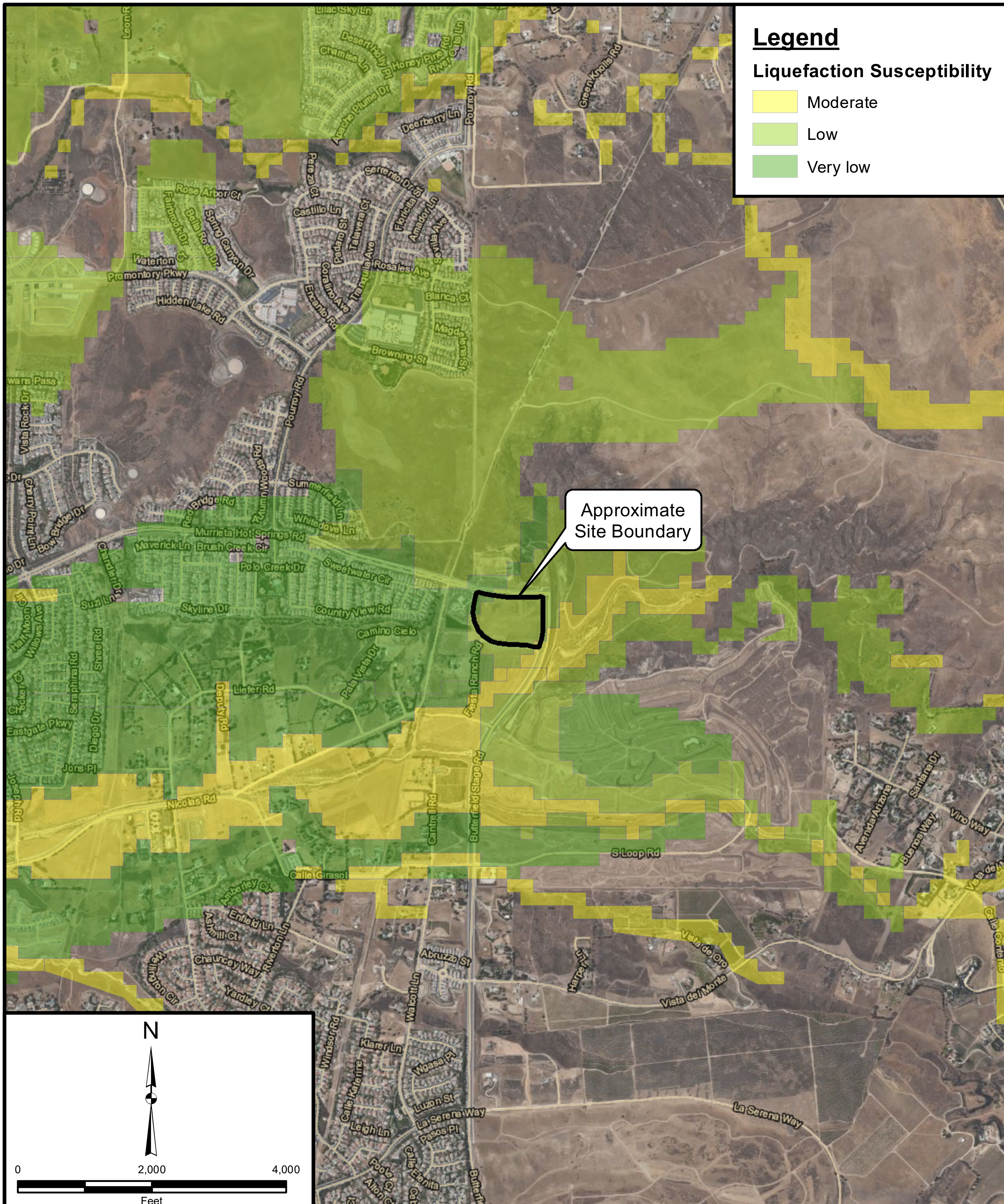
Roripaugh Ranch PA 11

City of Temecula, California

Figure 3

Leighton

Map Saved as P:\Drafting\12673\001\Maps\12673-001_F03_RFM_2020-04-09.mxd on 4/9/2020 8:31:36 AM



Project: 12673.001	Geol: SIS/RFR
Scale: 1 " = 2,000 '	Date: July 2020

Base Map: Bing Maps 2020

Author: Leighton Geomatics (mmurphy)

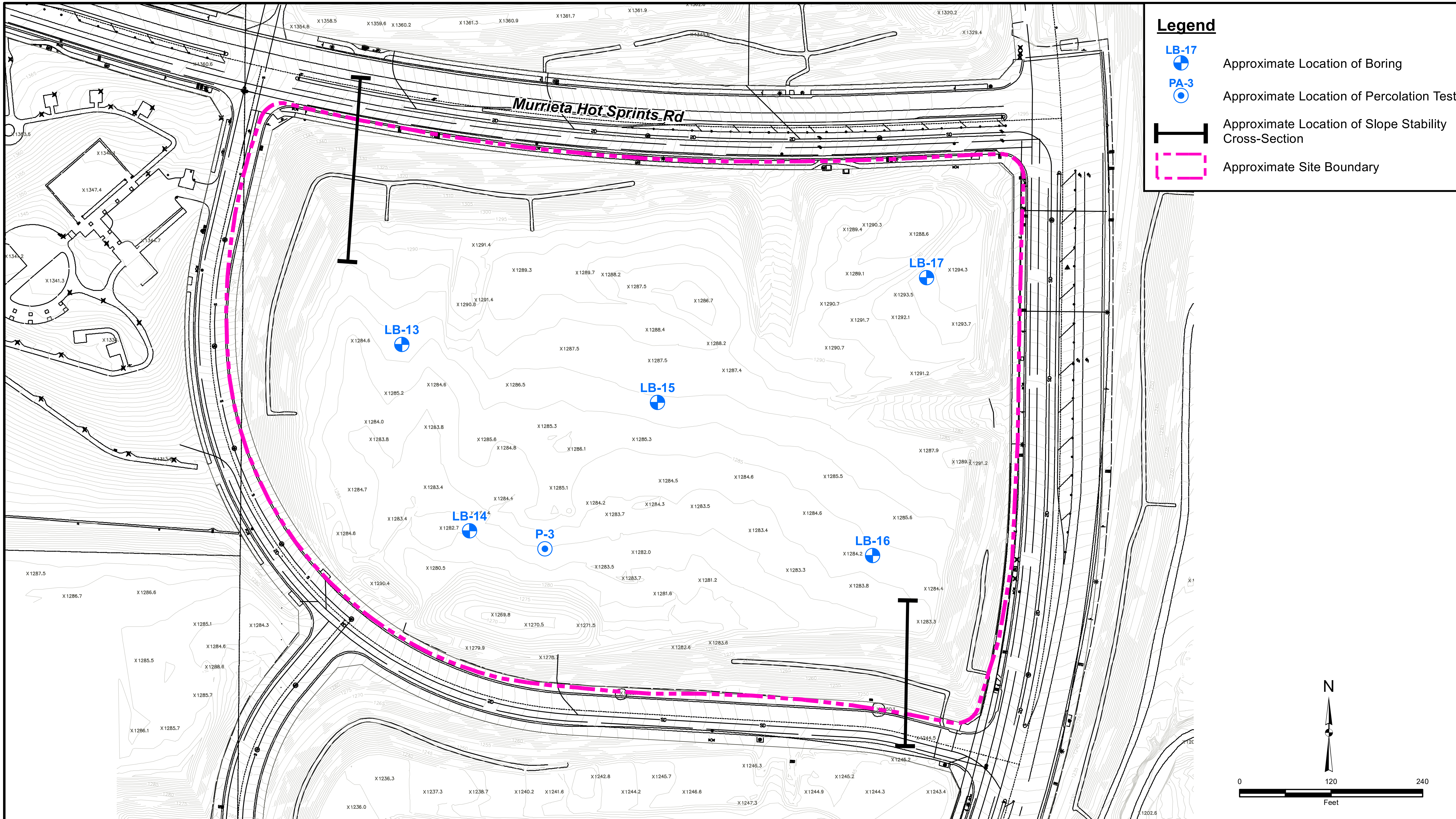
LIQUEFACTION MAP

Roripaugh Ranch PA 11
City of Temecula, California

Figure 4

Leighton

Map Saved as P:\Drafting\12673\001\Maps\12673-001_F04_LM_2020-04-09.mxd on 4/9/2020 8:33:01 AM



Project: 12673.001	Eng/Geol: SIS/RFR
Scale: 1 " = 120 '	Date: July 2020

Base Map: Rick Engineering, 2020.

Author: (mmurphy)

BORING LOCATION MAP

Roripaugh Ranch PA 11

City of Temecula, California

Figure 5

Leighton

Map Saved as P:\Drafting\12673\001\Maps\12673-001_F05_BLM_2020-07-02-PA11.mxd on 7/2/2020 4:06:26 PM

APPENDIX A

LOGS OF TEST BORINGS

GEOTECHNICAL BORING LOG LB-13

Project No.	12673.001	**Date Drilled**	2-11-20
Project	Wingsweep	**Logged By**	JTD
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
	0			B-1				SM	**Artificial Fill (Af)**; SILTY SAND with GRAVEL, dark grayish brown, moist, fine to coarse grained sand with fine gravel, MD = 134.9 @ 7.1%, EI = 4, RV = 42, 33% -200CR	MD, EI, RV, -200
								SC	CLAYEY SAND, dark brown, moist, fine to coarse grained sand	
	5			R-1	15 18 26			SM	**Pauba Formation (Qps)**; SILTYSAND, medium dense, yellowish brown, moist, fine to medium grained sand	
	10			R-2	50/5"	103	5		SILTY SAND, dense, grayish brown, moist, fine grained sand	
									Drilled to 10.42' Sampled to 10.42' Groundwater not encountered Backfilled with cuttings	
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-14

Project No. 12673.001
Project Wingsweep
Drilling Co. 2R Drilling
Drilling Method Hollow Stem Auger - 140lb - Autohammer - 30" Drop
Location See Boring Location Map
Date Drilled 2-11-20
Logged By JTD
Hole Diameter 8"
Ground Elevation '
Sampled By JTD

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	**Artificial Fill (Af)**; SILTY SAND with GRAVEL, grayish brown, moist, fine to coarse grained sand	
				R-1	15 29 30				SILTY SAND, dense, dark grayish brown, moist, fine to medium grained sand	
	5			R-2	24 22 15	106	7		SILTY SAND, medium dense, dark grayish brown, moist, fine to medium grained sand, organics	
	10			R-3	11 15 18	94	14	ML	**Pauba Formation (Qps)**; SANDY SILT, stiff, light gray and yellowish brown, moist, fine to medium grained sand, CO = -0.15%	CO
	15			R-4	28 50/6"			SM	SILTY SAND, dense, light brownish gray, moist, very fine to fine grained sand	
									Drilled to 16' Sampled to 16' Groundwater not encountered Backfilled with cuttings	
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-15

Project No.	12673.001	**Date Drilled**	2-11-20
Project	Wingsweep	**Logged By**	JTD
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	**Artificial Fill (Af)**; SILTY SAND with GRAVEL, dark grayish brown, moist, fine to coarse grained sand with fine gravel	
				R-1	10 39 50/4"	107	7		SILTY SAND, dense, light gray, moist, very fine to fine grained sand	
	5			R-2	22 25 44				SILTY SAND, dense, dark brown, moist, fine to medium grained sand, organics	
								SW	**Pauba Formation (Qps)**; Well-graded SAND, dense, light brownish gray, slightly moist, fine to coarse grained sand	
	10			R-3	18 26 30			ML	SANDY SILT, hard, gray, moist, very fine to fine grained sand, caliche nodules	
									Drilled to 11.5' Sampled to 11.5' Groundwater not encountered Backfilled with cuttings	
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-16

Project No.	12673.001	**Date Drilled**	2-11-20
Project	Wingsweep	**Logged By**	JTD
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	**Artificial Fill (Af)**; SILTY SAND with GRAVEL, grayish brown, moist, fine to coarse grained sand	
									SILTY SAND, dark yellowish brown, moist, fine to coarse grained sand	
	5			R-1 B-1	28 30 50	121	7		SILTY SAND, dense, grayish brown, moist, fine to coarse grained sand	
	10			R-2	12 19 21	117	8	SC	CLAYEY SAND, medium dense, dark brown, moist, fine to coarse grained sand	
	15			R-3	21 29 31	125	7	SM	SILTY SAND, dense, dark yellowish brown, moist, fine to medium grained sand	
	20			R-4	15 24 23				SILTY SAND, medium dense, dark yellowish brown, moist, fine to medium grained sand	
									Drilled to 21.5' Sampled to 21.5' Groundwater not encountered Backfilled with cuttings	
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-17

Project No.	12673.001	**Date Drilled**	2-11-20
Project	Wingsweep	**Logged By**	JTD
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			B-1				SM	**Artificial Fill (Af)**; SILTY SAND with GRAVEL, light brownish gray, slightly moist, fine to coarse grained sand with fine gravel	
				R-1	19 32 48	118	7		SILTY SAND, dense, grayish brown, moist, fine to coarse grained sand	
	5			R-2	29 36 39			SM	**Pauba Formation (Qps)**; SILTY SAND, dense, light gray, moist, fine to medium grained sand, few caliche	
	10			R-3	12 26 36				SILTY SAND, dense, light brownish gray, moist, fine to medium grained sand, few caliche	
									Drilled to 11.5' Sampled to 11.5' Groundwater not encountered Backfilled with cuttings	
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG P-3

Project No.	12673.001	**Date Drilled**	2-11-20
Project	Wingsweep	**Logged By**	JTD
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

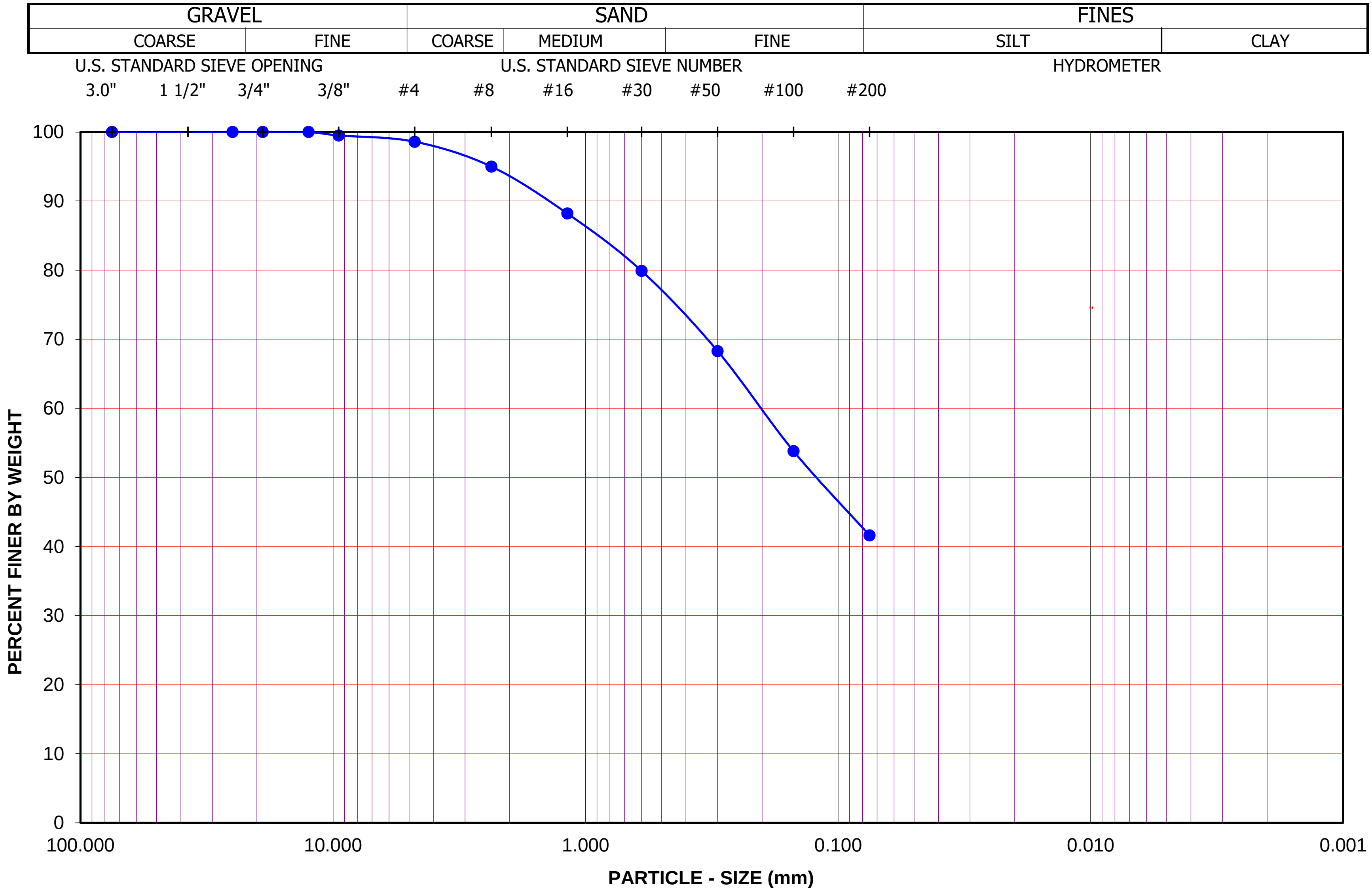
Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
	0							SM	**Artificial Fill (Af)**; SILTY SAND with GRAVEL, dark grayish brown, moist, fine to coarse grained sand	
								SC	CLAYEY SAND, dark brown, moist, fine to coarse grained sand	
				S-1				SC-SM	SILTY, CLAYEY SAND, dark yellowish brown, moist, fine to medium grained sand	SA
	5									
									Drilled to 5' Sampled to 5' Groundwater not encountered Backfilled with cuttings	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

APPENDIX B

LABORATORY TEST RESULTS



Project Name: Wingsweep Commons Ent Geo

Project No.: 12673.001

Boring No.: P-3 Sample No.: S-1

Depth (feet): 4.0 - 5.0 Soil Type : SC-SM

Soil Identification: Silty, Clayey Sand (SC-SM), Brown.

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 1 : 57 : 42

Feb-20

Sieve; P-3, S-1 (02-10 & 02-11-20)

Boring No.	LB-13	LB-22						
Sample No.	B-1	B-1						
Depth (ft.)	0 - 5.0	0 - 5.0						
Sample Type	BULK	BULK						
Visual Soil Classification	SM	SM						
Soak Time (min)	10	10						
Moisture Correction								
Wet Weight of Soil + Container (gm.)	566.3	627.0						
Dry Weight of Soil + Container (gm.)	546.8	605.9						
Weight of Container (gm)	277.5	277.5						
Moisture Content (%)	7.2	6.4						
Container No.:	AB	BA						
Sample Dry Weight Determination								
Weight of Sample + Container (gm.)	546.8	605.9						
Weight of Container (gm.)	277.5	277.5						
Weight of Dry Sample (gm.)	269.3	328.4						
Container No.:	AB	BA						
After Wash								
Dry Weight of Sample + Container (gm)	458.2	532.9						
Weight of Container (gm)	277.5	277.5						
Dry Weight of Sample (gm)	180.7	255.4						
% Passing No. 200 Sieve	**33**	**22**						
% Retained No. 200 Sieve	67	78						

PERCENT PASSING No. 200 SIEVE
ASTM D 1140

Leighton

Project Name: Wingsweep Common Ent Geo
Project No.: 12673.001
Client Name: Wingsweep Corporation
Tested By: G. Davila Date: 02/14/20
Rev. 08-04

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Leighton

Project Name:	Wingsweep Commons Ent Geo	Tested By:	F. Mina	Date:	02/18/20
Project No.:	12673.001	Input By:	M. Vinet	Date:	02/20/20
Boring No.:	LB-13	Depth (ft.):	0 - 5.0		
Sample No.:	B-1				
Soil Identification:	Silty Sand (SM), Dark Yellowish Brown.				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03340

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5608	5757	5739			
Weight of Mold (g)	3572	3572	3572			
Net Weight of Soil (g)	2036	2185	2167			
Wet Weight of Soil + Cont. (g)	1075.1	1013.6	1261.9			
Dry Weight of Soil + Cont. (g)	1040.3	967.5	1174.6			
Weight of Container (g)	309.3	311.4	217.4			
Moisture Content (%)	4.8	7.0	9.1			
Wet Density (pcf)	134.4	144.2	143.0			
Dry Density (pcf)	128.3	134.8	131.1			

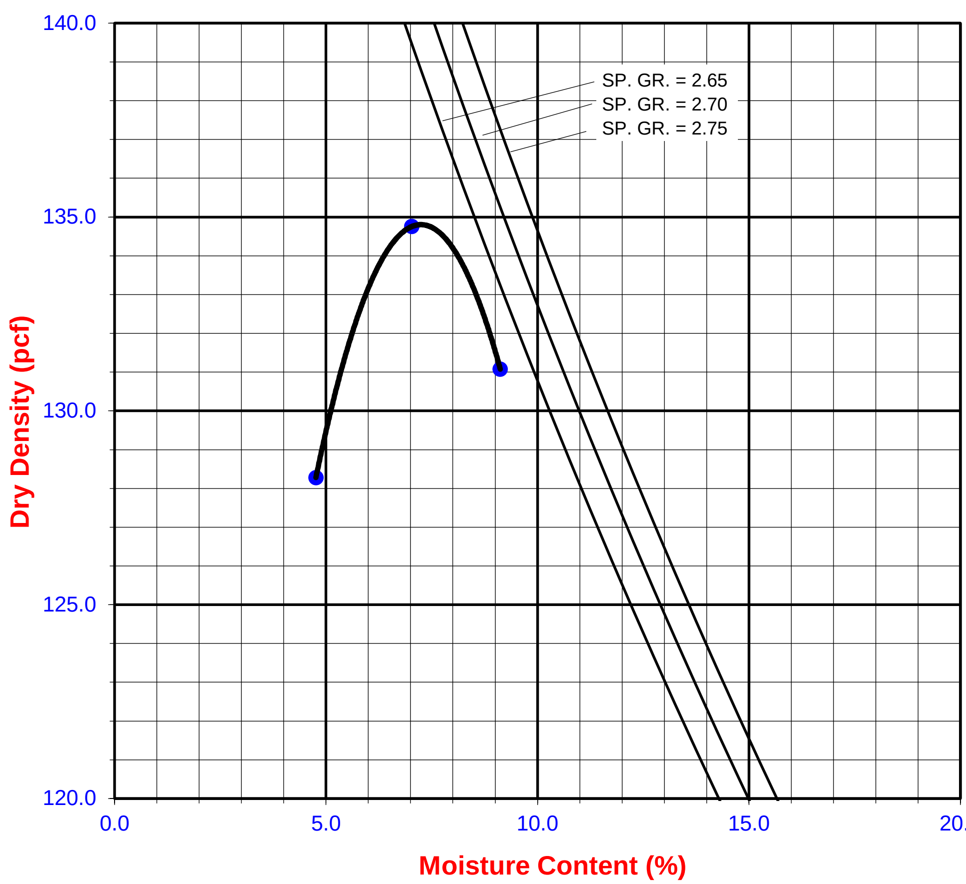
Maximum Dry Density (pcf) 134.9 **Optimum Moisture Content (%)** 7.1

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

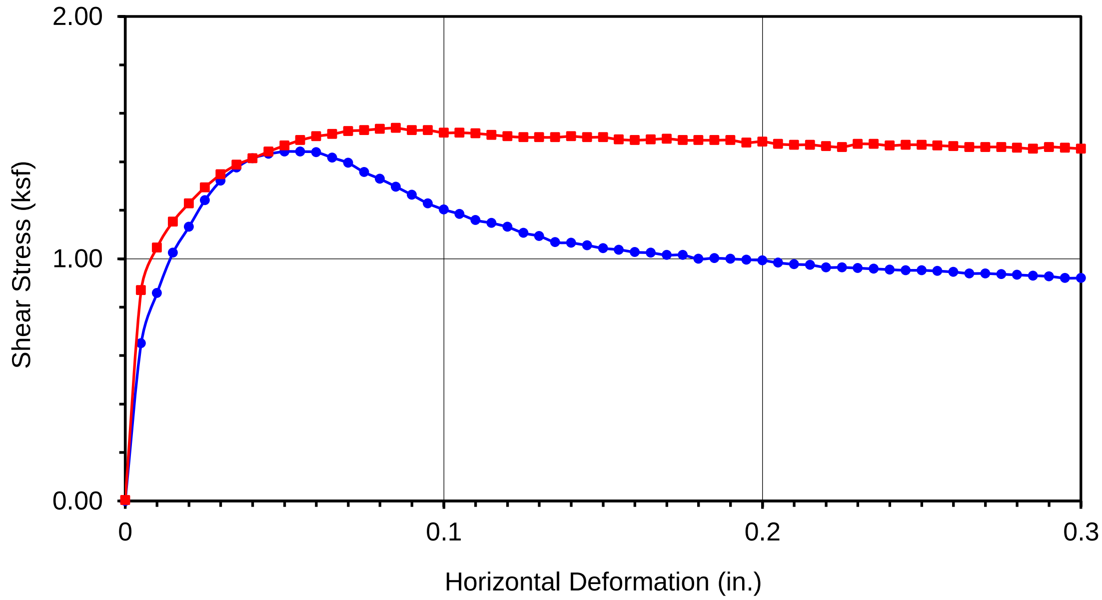


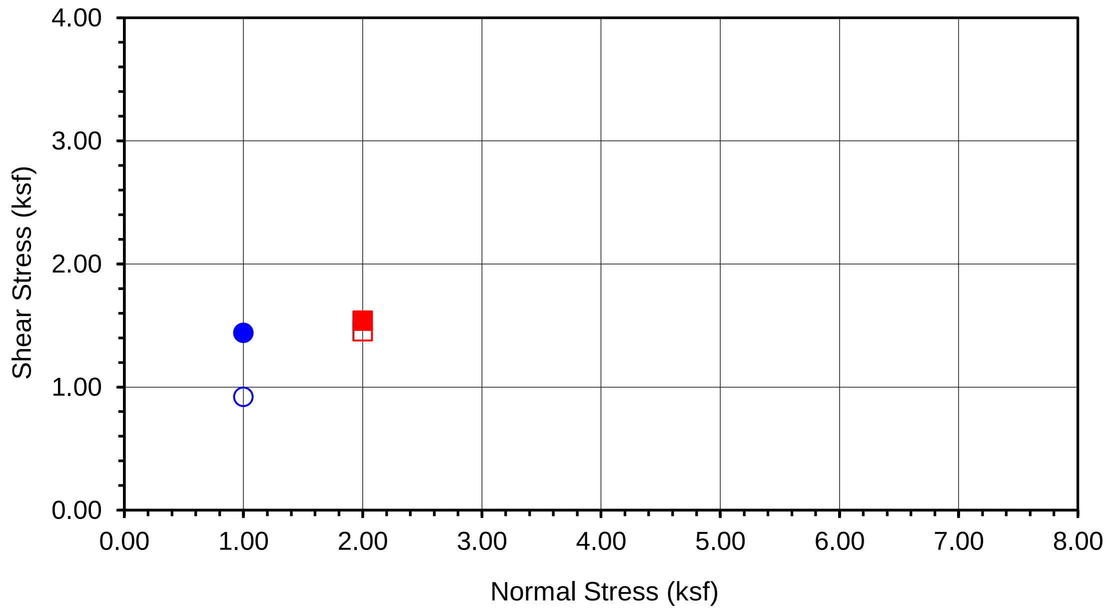
Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI





Boring No.	**LB-14**
Sample No.	**R-3**
Depth (ft)	**10**
Sample Type: Ring	
Soil Identification: Silt (ML), White	

Normal Stress (kip/ft²)	1.000	2.000	
Peak Shear Stress (kip/ft²)	● 1.442	■ 1.539	▲
Shear Stress @ End of Test (ksf)	○ 0.920	□ 1.454	△
Deformation Rate (in./min.)	0.0033	0.0033	
Initial Sample Height (in.)	1.000	1.000	
Diameter (in.)	2.415	2.415	
Initial Moisture Content (%)	13.63	13.63	
Dry Density (pcf)	90.2	79.9	
Saturation (%)	42.3	33.2	
Soil Height Before Shearing (in.)	0.9976	0.9764	
Final Moisture Content (%)	35.9	41.0	

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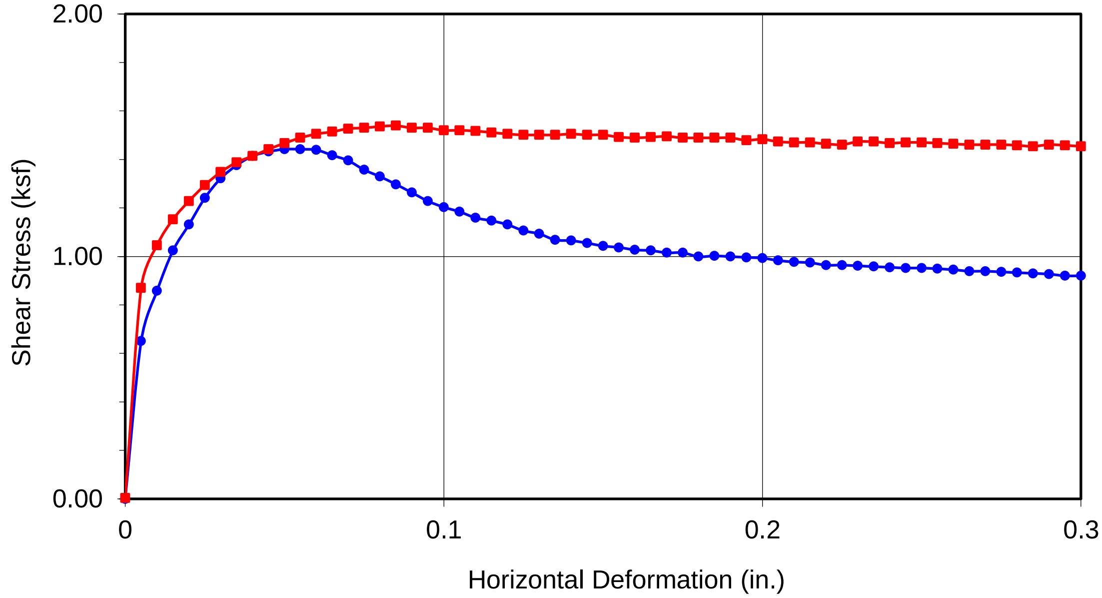
DIRECT SHEAR TEST RESULTS

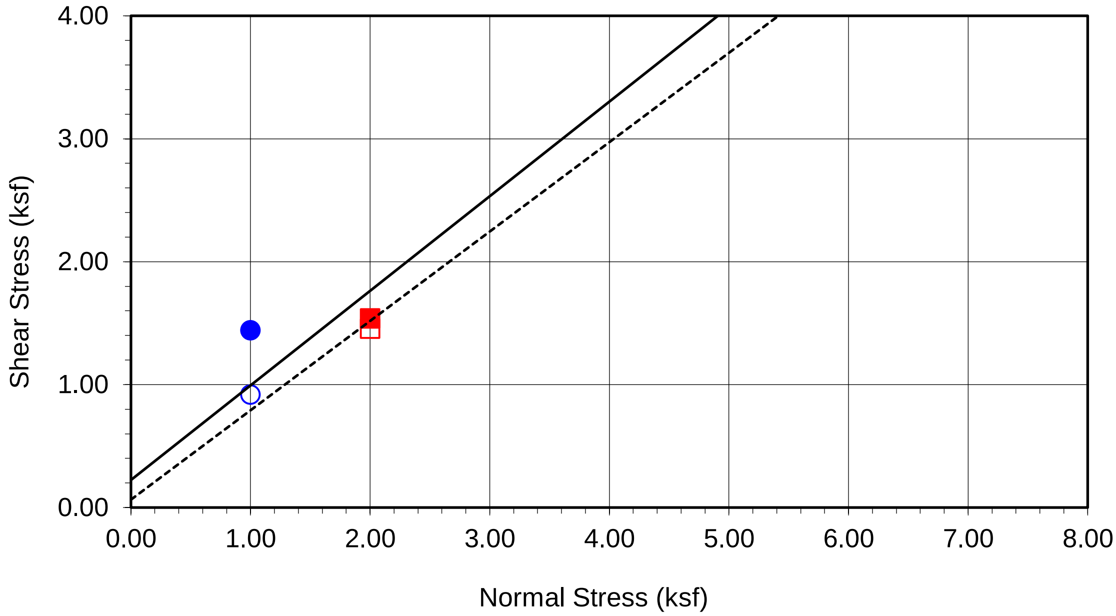
Consolidated Drained - ASTM D 3080

Project No.: 12673.001

Wingsweep Commons Ent Geo

03-20





Boring No.	**LB-14**
Sample No.	**R-3**
Depth (ft)	**10**
Sample Type:	Ring
Soil Identification:	Silt (ML), White

Strength Parameters

	C (psf)	ϕ (°)
Peak	224	38
Ultimate	64	36

Normal Stress (kip/ft²)	1.000	2.000	
Peak Shear Stress (kip/ft²)	● 1.442	■ 1.539	▲
Shear Stress @ End of Test (ksf)	○ 0.920	□ 1.454	△
Deformation Rate (in./min.)	0.0033	0.0033	
Initial Sample Height (in.)	1.000	1.000	
Diameter (in.)	2.415	2.415	
Initial Moisture Content (%)	13.63	13.63	
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Leighton

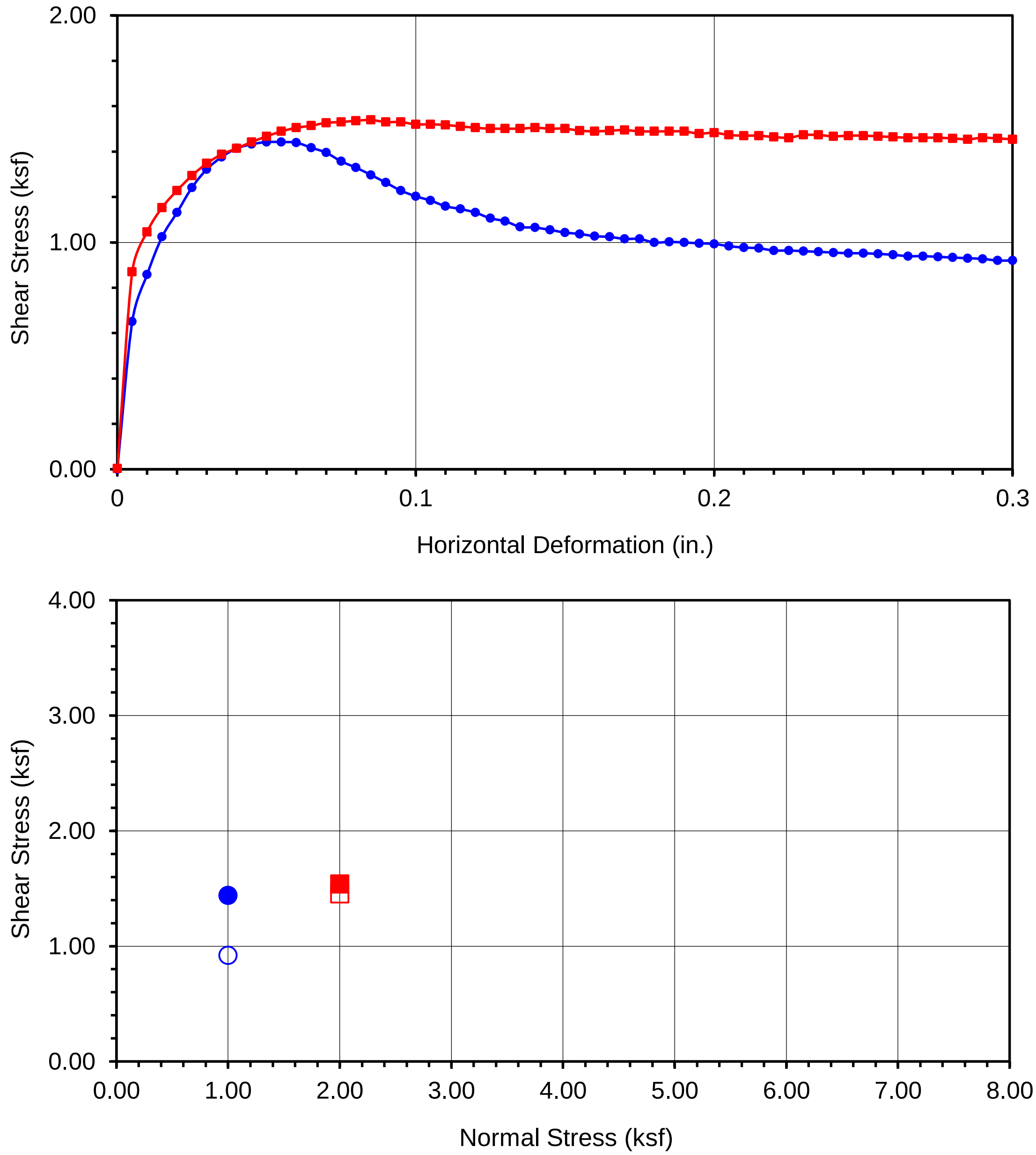
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 12673.001

Wingsweep Commons Ent Geo

03-20



Boring No.	**LB-14**
Sample No.	**R-3**
Depth (ft)	**10**

Sample Type:

Ring

Soil Identification:
Silt (ML), White

Normal Stress (kip/ft²)	1.000	2.000	
Peak Shear Stress (kip/ft²)	● 1.442	■ 1.539	▲
Shear Stress @ End of Test (ksf)	○ 0.920	□ 1.454	△
Deformation Rate (in./min.)	0.0033	0.0033	
Initial Sample Height (in.)	1.000	1.000	
Diameter (in.)	2.415	2.415	
Initial Moisture Content (%)	13.63	13.63	
Dry Density (pcf)	90.2	79.9	
Saturation (%)	42.3	33.2	
Soil Height Before Shearing (in.)	0.9976	0.9764	
Final Moisture Content (%)	35.9	41.0	

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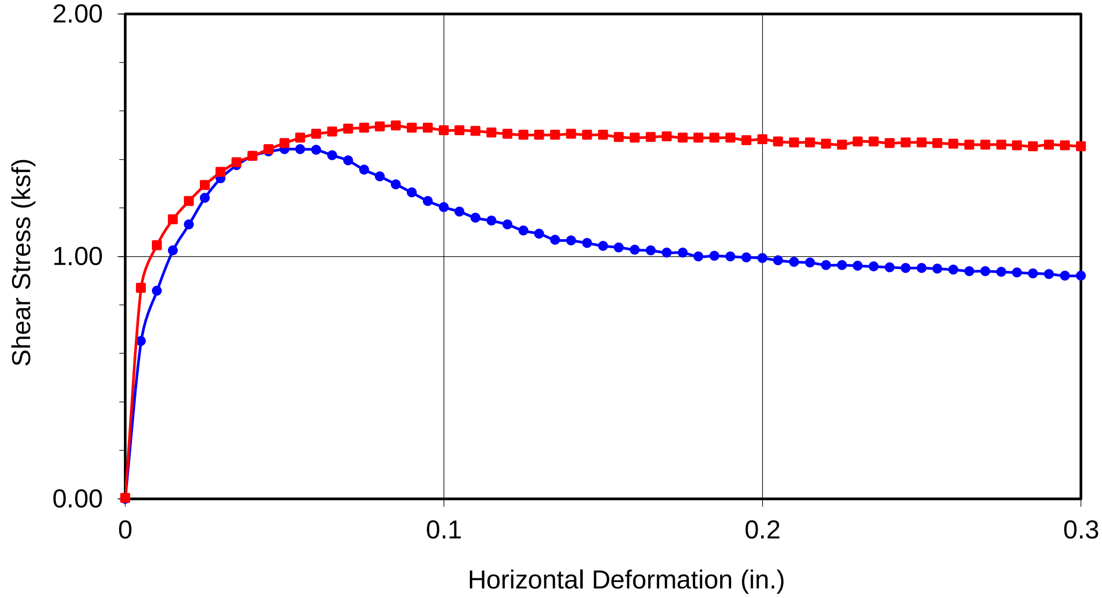
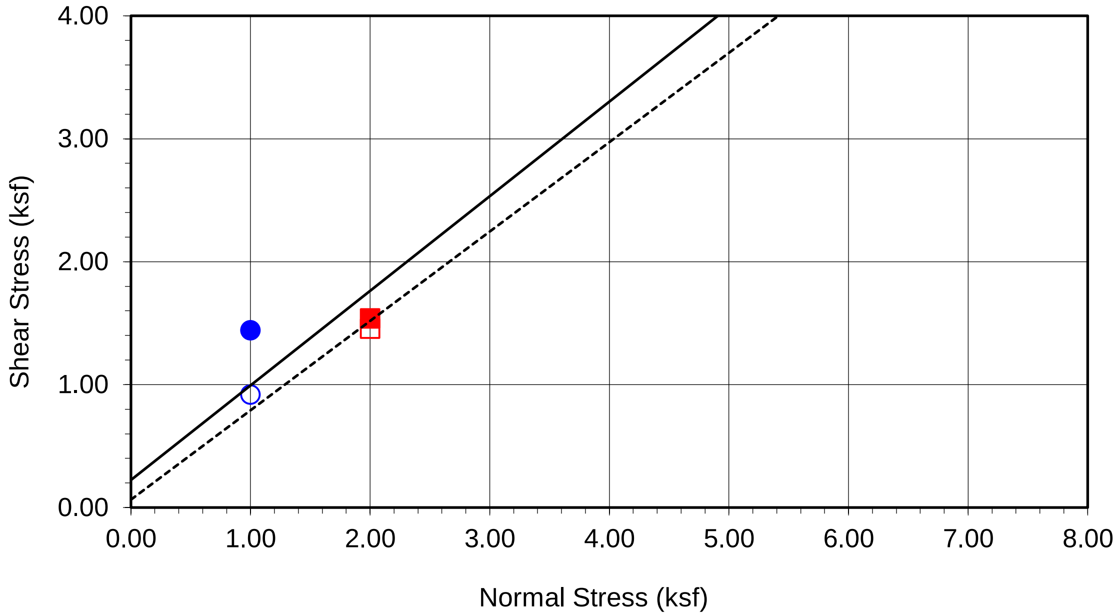
DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 12673.001

Wingsweep Commons Ent Geo

03-20





Boring No.	**LB-14**
Sample No.	**R-3**
Depth (ft)	**10**
Sample Type:	Ring
Soil Identification: Silt (ML), White	

Strength Parameters

	C (psf)	ϕ (°)
Peak	224	38
Ultimate	400	28

Normal Stress (kip/ft²)	1.000	2.000	
Peak Shear Stress (kip/ft²)	● 1.442	■ 1.539	▲
Shear Stress @ End of Test (ksf)	○ 0.920	□ 1.454	△
Deformation Rate (in./min.)	0.0033	0.0033	
Initial Sample Height (in.)	1.000	1.000	
Diameter (in.)	2.415	2.415	
Initial Moisture Content (%)	13.63	13.63	
Dry Density (pcf)	90.2	79.9	
Saturation (%)	42.3	33.2	
Soil Height Before Shearing (in.)	0.9976	0.9764	
Final Moisture Content (%)	35.9	41.0	

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 12673.001

Wingsweep Commons Ent Geo

03-20

R-VALUE TEST RESULTS
ASTM D 2844

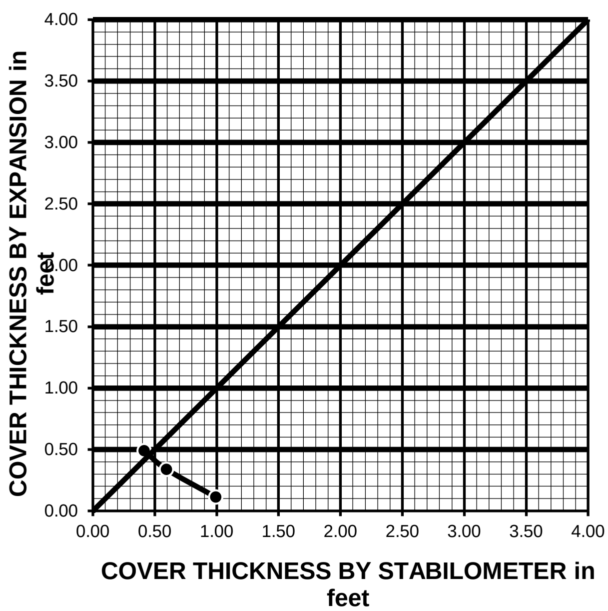
Leighton

Project Name:	Wingsweep Commons Ent Geo	Date:	2/18/20
Project Number:	12673.001	Technician:	F. Mina
Boring Number:	LB-13	Depth (ft.):	0 - 5.0
Sample Number:	B-1	Sample Location:	N/A
Sample Description:	Silty Sand (SM), Dark Yellowish Brown.		

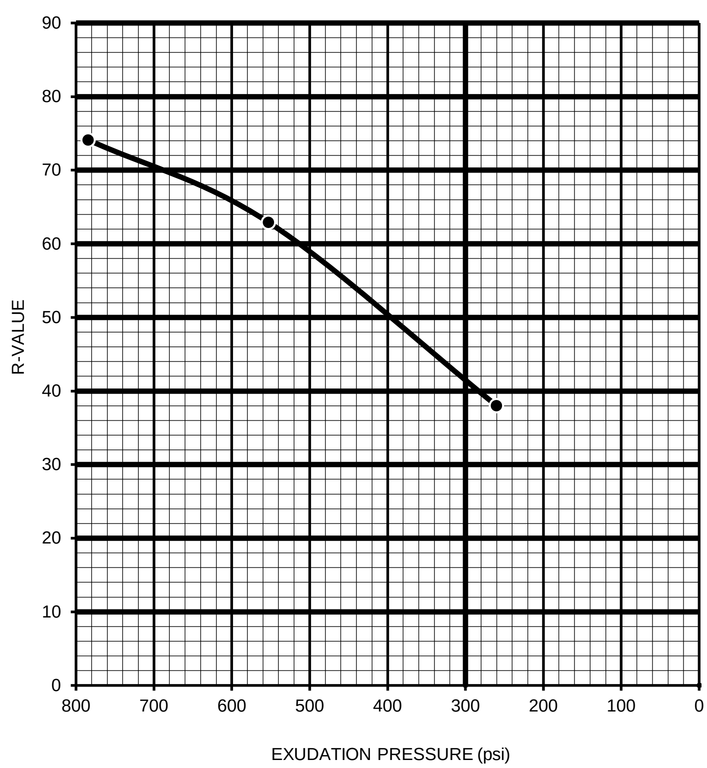
TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	8.8	9.4	10.5
HEIGHT OF SAMPLE, Inches	2.50	2.45	2.48
DRY DENSITY, pcf	120.0	116.7	117.5
COMPACTOR AIR PRESSURE, psi	200	150	125
EXUDATION PRESSURE, psi	784	553	260
EXPANSION, Inches x 10exp-4	13	9	3
STABILITY Ph 2,000 lbs (160 psi)	27	40	75
TURNS DISPLACEMENT	4.30	4.42	4.62
R-VALUE UNCORRECTED	74	63	38
R-VALUE CORRECTED	74	63	38

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.41	0.59	0.99
EXPANSION PRESSURE THICKNESS, ft.	0.49	0.34	0.11

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	69
R-VALUE BY EXUDATION:	42
EQUILIBRIUM R-VALUE:	42

EXPANSION INDEX of SOILS

ASTM D 4829

Leighton

Project Name:	Wingsweep Commons Ent Geo	Tested By: F. Mina	Date: 2/19/20
Project No. :	12673.001	Checked By: M. Vinet	Date: 2/20/20
Boring No.:	LB-13	Depth: 0 - 5.0	
Sample No. :	B-1	Location: **	
Sample Description:	Silty Sand (SM), Dark Yellowish Brown.		

Dry Wt. of Soil + Cont. (gm.)	2123.2
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2123.2
Weight Soil Retained on #4 Sieve	25.3
Percent Passing # 4	98.8

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0040
Wt. Comp. Soil + Mold (gm.)	611.3	631.5
Wt. of Mold (gm.)	188.0	188.0
Specific Gravity (Assumed)	2.70	2.70
Container No.	7	7
Wet Wt. of Soil + Cont. (gm.)	577.5	631.5
Dry Wt. of Soil + Cont. (gm.)	555.3	391.9
Wt. of Container (gm.)	277.5	188.0
Moisture Content (%)	8.0	13.2
Wet Density (pcf)	127.7	133.2
Dry Density (pcf)	118.2	117.8
Void Ratio	0.426	0.432
Total Porosity	0.299	0.301
Pore Volume (cc)	61.8	62.7
Degree of Saturation (%) [S meas]	**50.7**	**82.3**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
2/19/20	11:00	1.0	0	0.5000
2/19/20	11:10	1.0	10	0.5000
	Add Distilled Water to the Specimen			
2/20/20	6:00	1.0	1130	0.5040
2/20/20	7:00	1.0	1190	0.5040

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	4.0
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**4**

Rev. 03-08

Leighton

One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546) -- Method 'B'

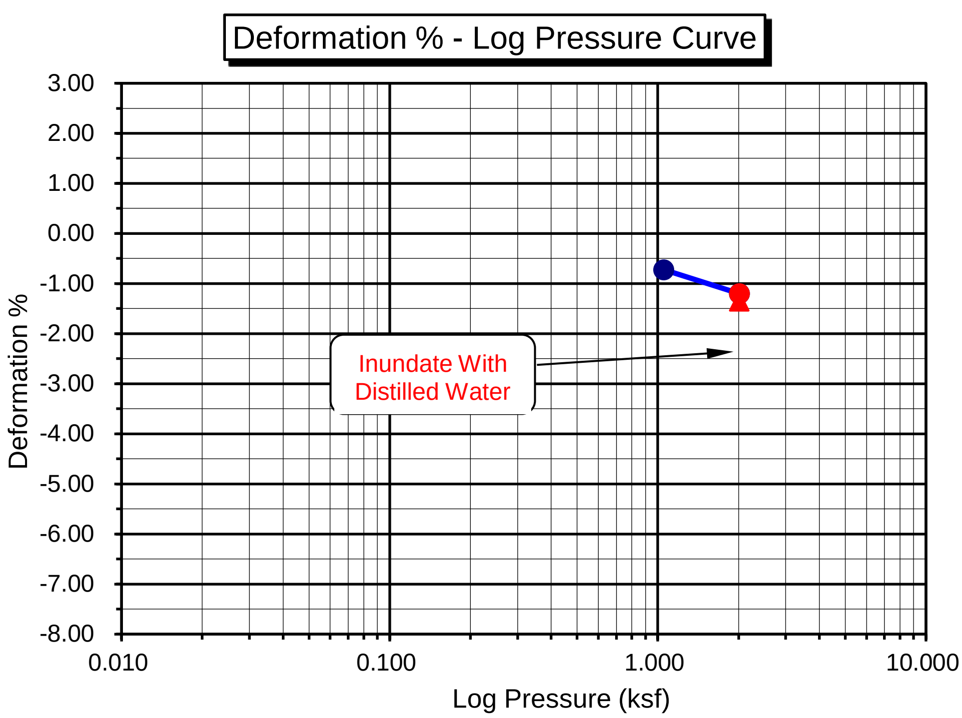
Project Name: Wingsweep Commons Ent Geo Tested By: M. Vinet Date: 2/20/20
Project No.: 12673.001 Checked By: M. Vinet Date: 2/21/20
Boring No.: **LB-14** Sample Type: IN SITU
Sample No.: **R-3** Depth (ft.) 10.0
Sample Description: Silt (ML), White.
Source and Type of Water Used for Inundation: Arrowhead (Distilled)
** Note: Loading After Wetting (Inundation) not Performed Using this Test Method.

Initial Dry Density (pcf):	82.3
Initial Moisture (%):	27.7
Initial Height (in.):	1.0000
Initial Dial Reading (in):	0.0000
Inside Diameter of Ring (in):	2.416

Final Dry Density (pcf):	83.4
Final Moisture (%) :	40.7
Initial Void ratio:	1.0483
Specific Gravity (assumed):	2.70
Initial Degree of Saturation (%):	71.4

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.050	0.0072	0.9928	0.00	-0.72	1.0335	-0.72
2.013	0.0120	0.9880	0.00	-1.20	1.0237	-1.20
H2O	0.0135	0.9865	0.00	-1.35	1.0206	-1.35

Percent Swell / Settlement After Inundation = -0.15



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	Wingsweep Common Ent Geo	Tested By :	M. Vinet	Date:	02/20/20
Project No. :	12673.001	Data Input By:	M. Vinet	Date:	02/21/20
Boring No.:	LB-13	Depth (ft.) :	0.0		
Sample No. :	B-1				

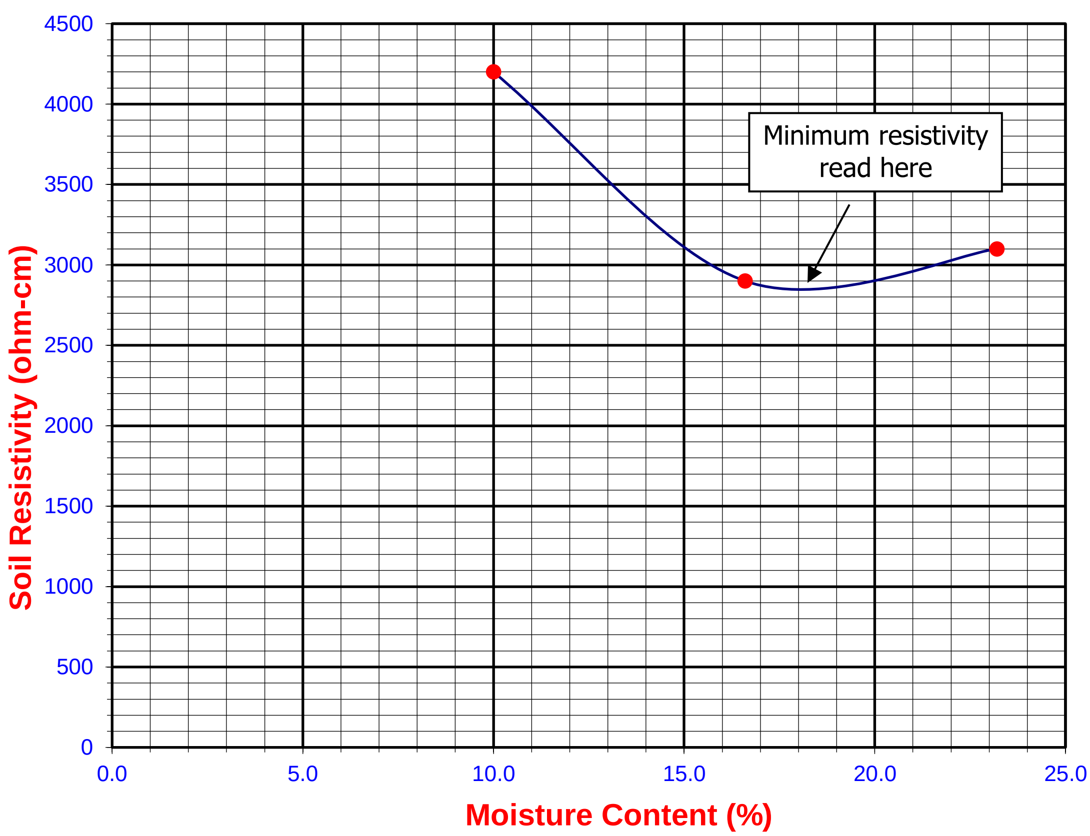
Soil Identification:* Silty Sand (SM)

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	50	10.00	4200	4200
2	83	16.60	2900	2900
3	116	23.20	3100	3100
4				
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	100.00
Dry Wt. of Soil + Cont. (g)	100.00
Wt. of Container (g)	0.00
Container No.	A
Initial Soil Wt. (g) (Wt)	500.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
2850	**18.0**	**107**	**20**	**6.23**	**21.0**



APPENDIX C

SITE-SPECIFIC SEISMIC ANALYSES

Wingsweep PA11

Latitude, Longitude: 33.5509, -117.0997

Date	4/8/2020, 3:46:01 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S_S	1.412	MCE_R ground motion. (for 0.2 second period)
S_1	0.523	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.694	Site-modified spectral acceleration value
S_{M1}	0.773	Site-modified spectral acceleration value
S_{DS}	1.129	Numeric seismic design value at 0.2 second SA
S_{D1}	0.515	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	1.477	Site amplification factor at 1.0 second
PGA	0.614	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.737	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.412	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.554	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.732	Factored deterministic acceleration value. (0.2 second)
S1RT	0.523	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.578	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.674	Factored deterministic acceleration value. (1.0 second)
PGAd	0.733	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.909	Mapped value of the risk coefficient at short periods
C_{R1}	0.906	Mapped value of the risk coefficient at a period of 1 s

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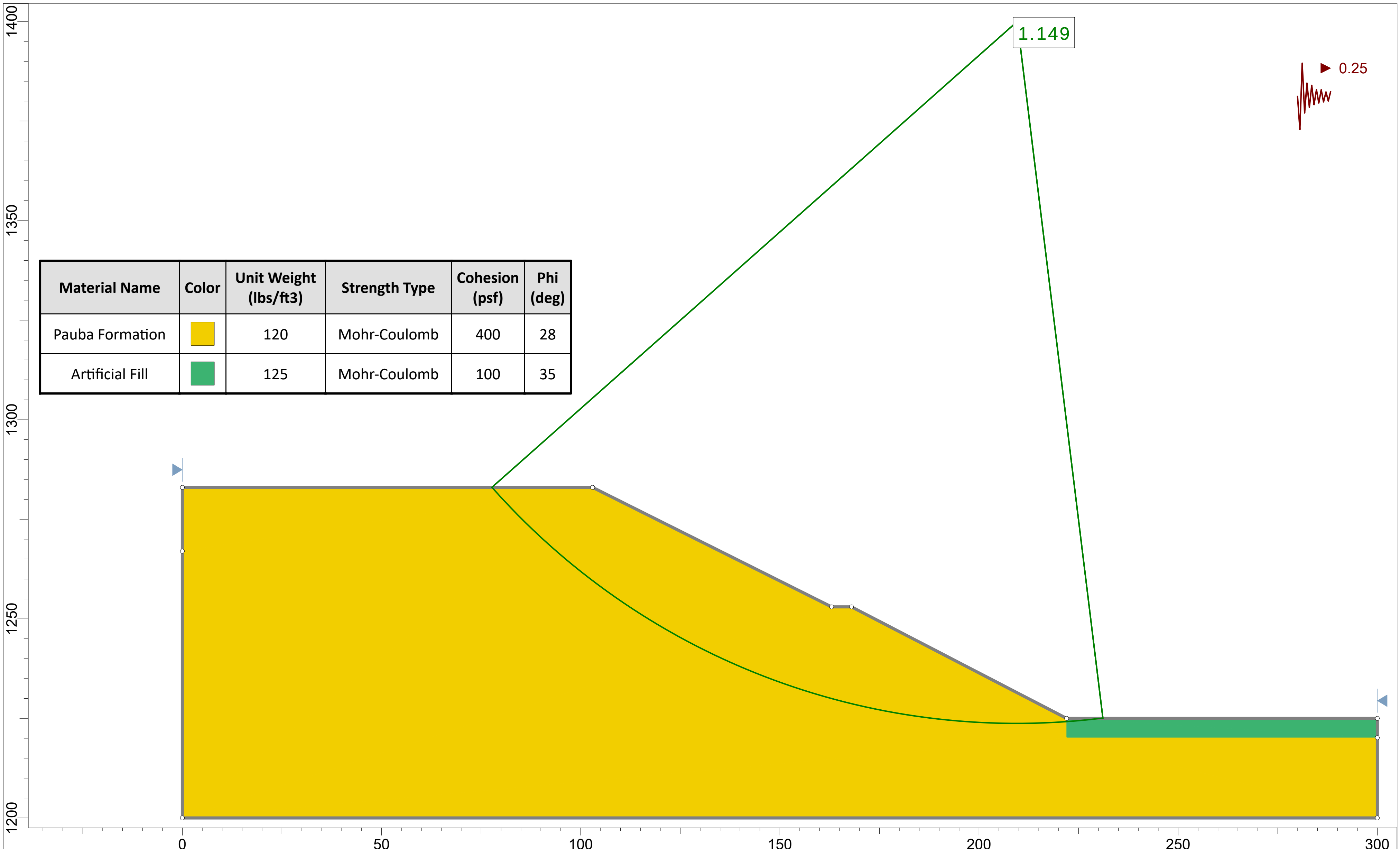
APPENDIX D

SLOPE STABILITY ANALYSIS

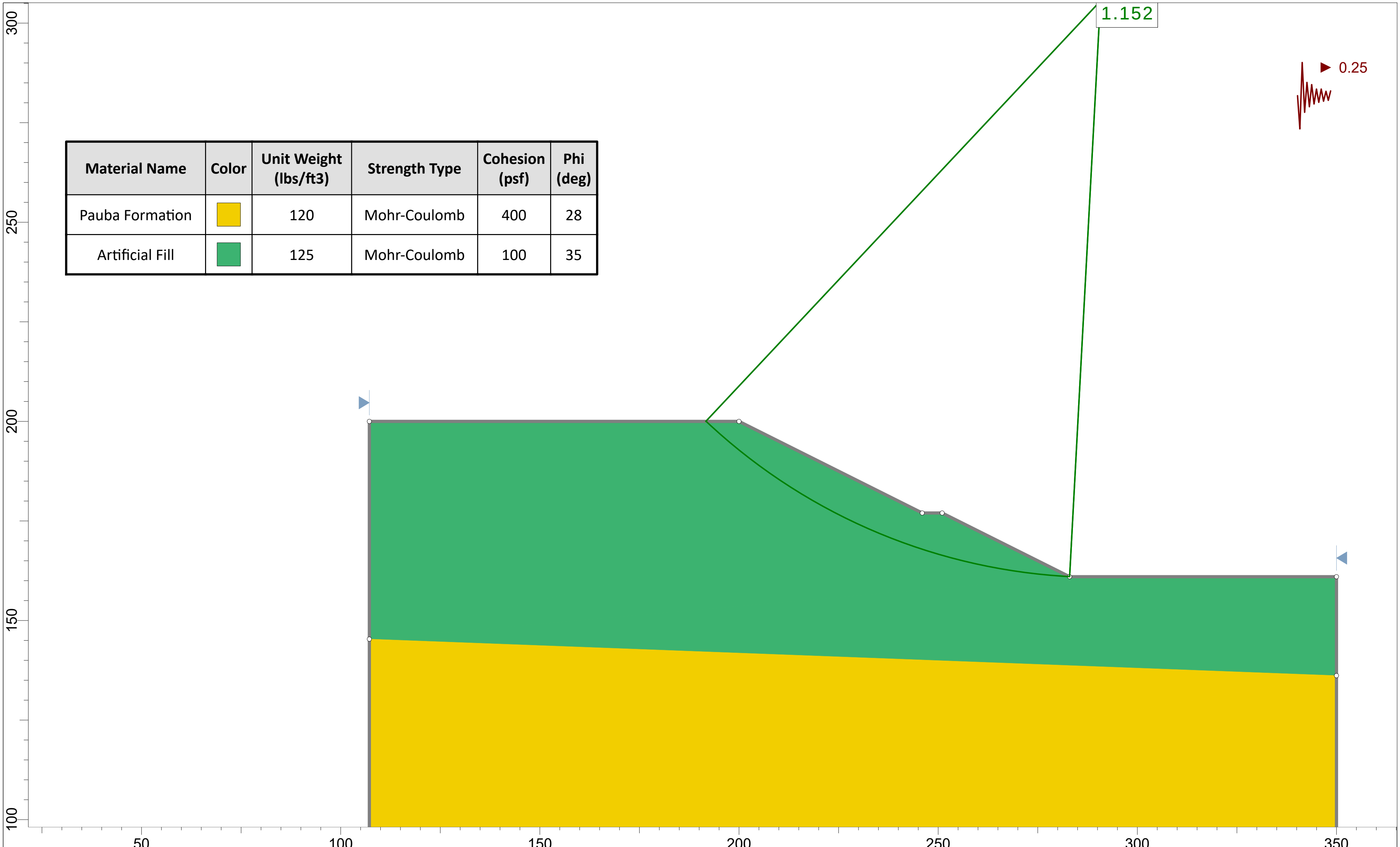


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pauba Formation		120	Mohr-Coulomb	400	28
Artificial Fill		125	Mohr-Coulomb	100	35

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

SLIDEINTERPRET 8.022

Project	Wingsweep - PA11		
Analysis Description	NWC Cut Slope - Seismic		
Drawn By	BSS	*Scale*	1:400
Company	Leighton and Associates		
Date	7/1/2020	*Project Number*	12673.001

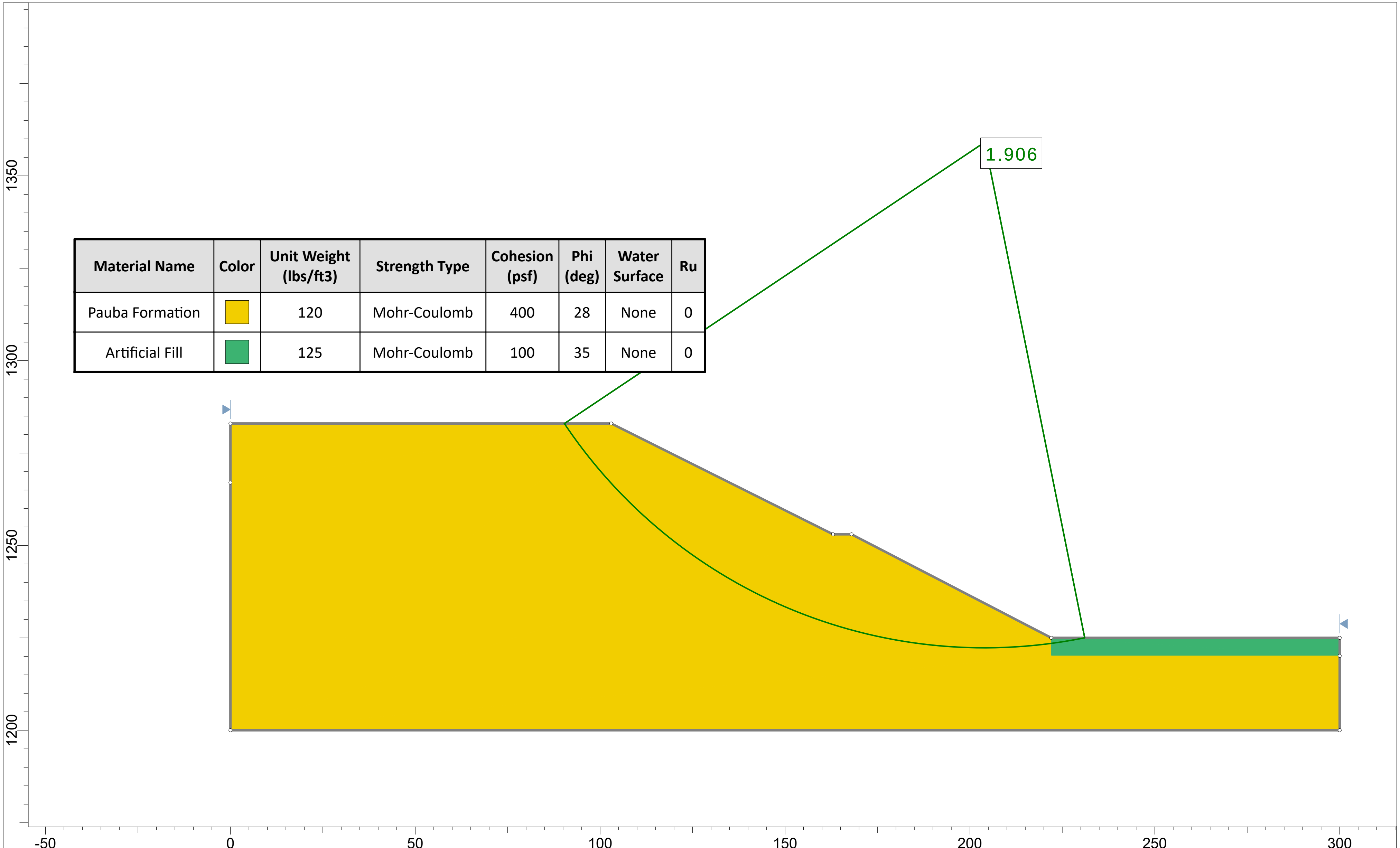


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pauba Formation		120	Mohr-Coulomb	400	28
Artificial Fill		125	Mohr-Coulomb	100	35

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

SLIDEINTERPRET 8.022

Project	Wingsweep - PA11
Analysis Description	SEC Fill Slope - Seismic
Drawn By	BSS
Scale	1:400
Company	Leighton and Associates
Date	7/1/2020
Project Number	12673.001

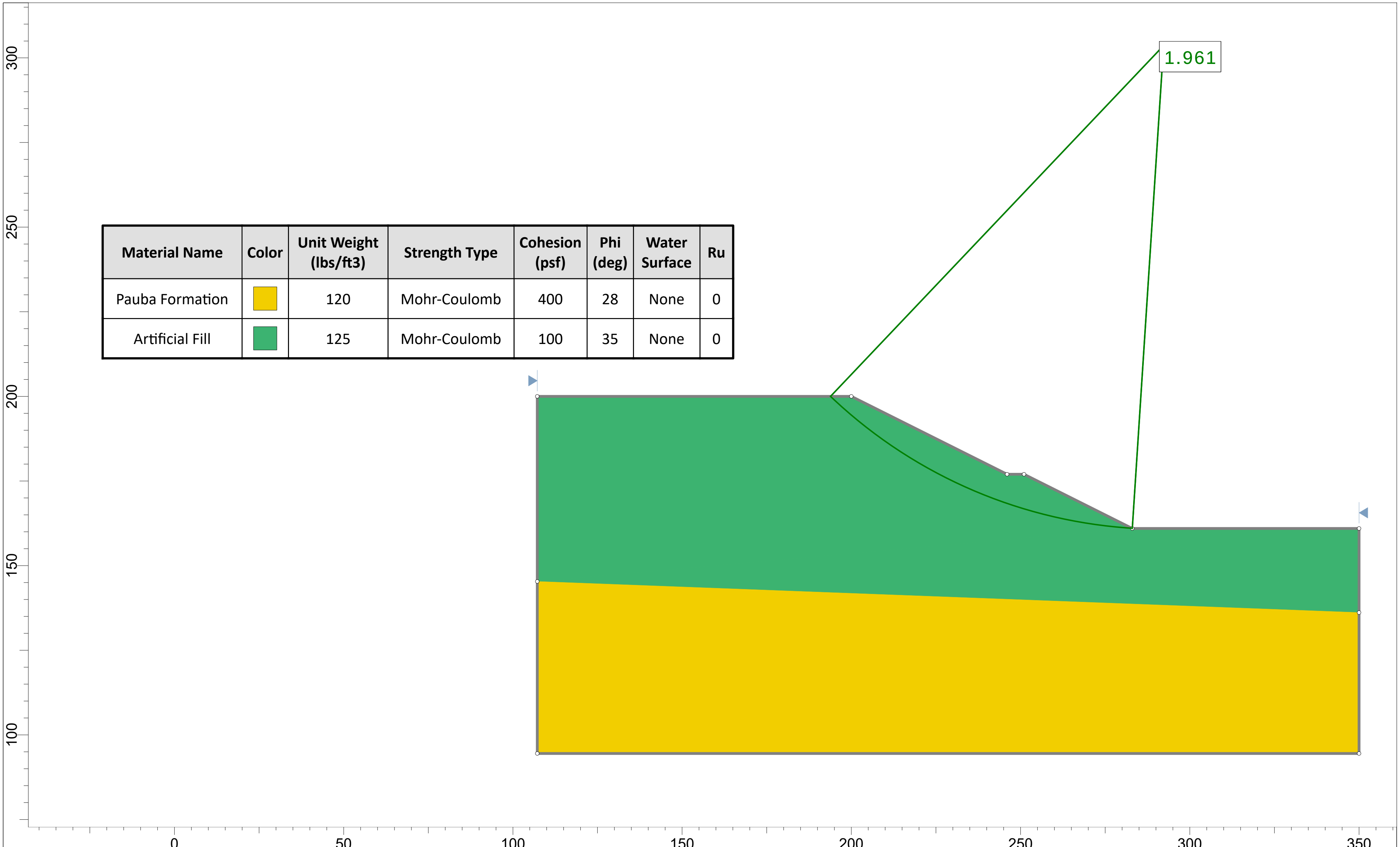


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Pauba Formation		120	Mohr-Coulomb	400	28	None	0
Artificial Fill		125	Mohr-Coulomb	100	35	None	0

rocscience

SLIDEINTERPRET 8.023

Project	Wingsweep PA11 NWC		
Analysis Description	Static		
Drawn By	JTD	*Scale*	1:431
Company	Leighton and Associates		
Date	2/28/2020, 12:41:32 PM	*Project Number*	12673.001



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Pauba Formation		120	Mohr-Coulomb	400	28	None	0
Artificial Fill		125	Mohr-Coulomb	100	35	None	0

rocscience

SLIDEINTERPRET 8.023

Project	Wingsweep PA11 SEC		
Analysis Description	Static		
Drawn By JTD	*Scale* 1:471	*Company*	Leighton and Associates
Date	4/10/2020, 8:01:04 AM	*Project Number*	12673.001

APPENDIX E

EARTHWORK AND GRADING SPECIFICATIONS

LEIGHTON AND ASSOCIATES, INC.
GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

TABLE OF CONTENTS

Standard Details

1.0 General

1.1 Intent

These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record

Prior to commencement of work, the owner shall employ the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing

Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation

In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).

4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing

Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations

The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations.

7.2 Bedding and Backfill

All bedding and backfill of utility trenches shall be performed in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of relative compaction from 1 foot above the top of the conduit to the surface.

The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

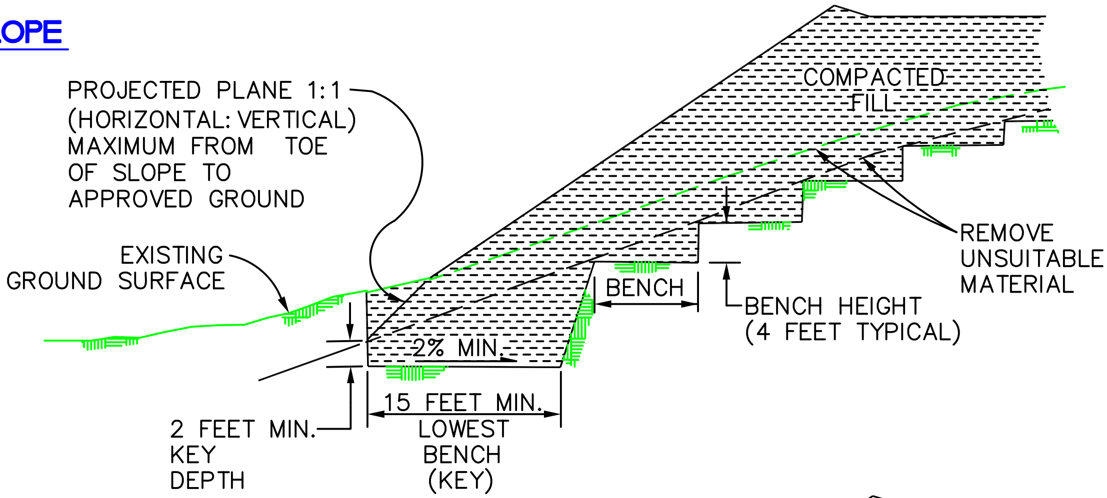
7.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

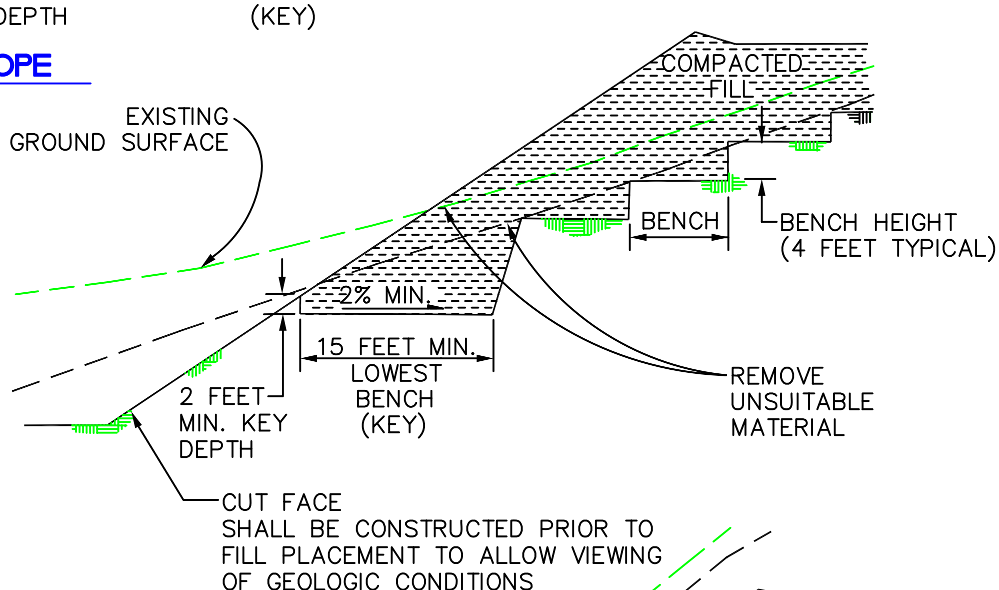
7.4 Observation and Testing

The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

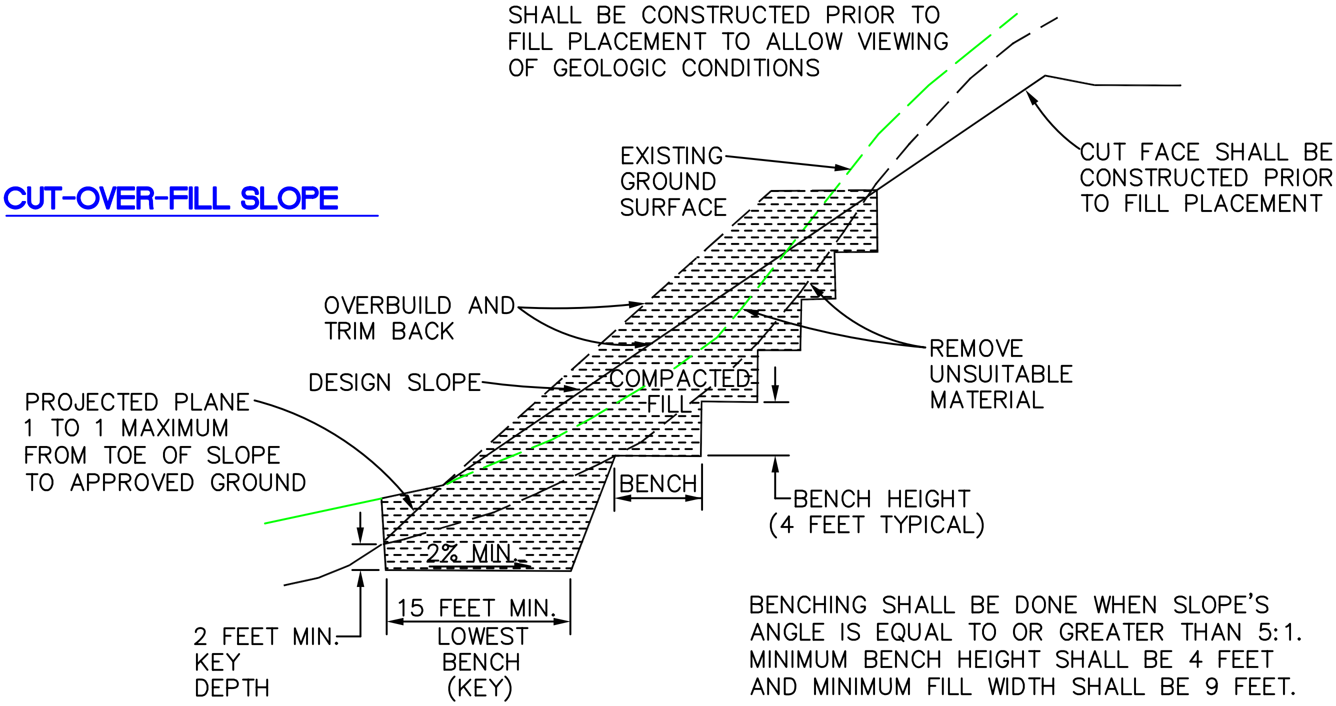
FILL SLOPE



FILL-OVER-CUT SLOPE



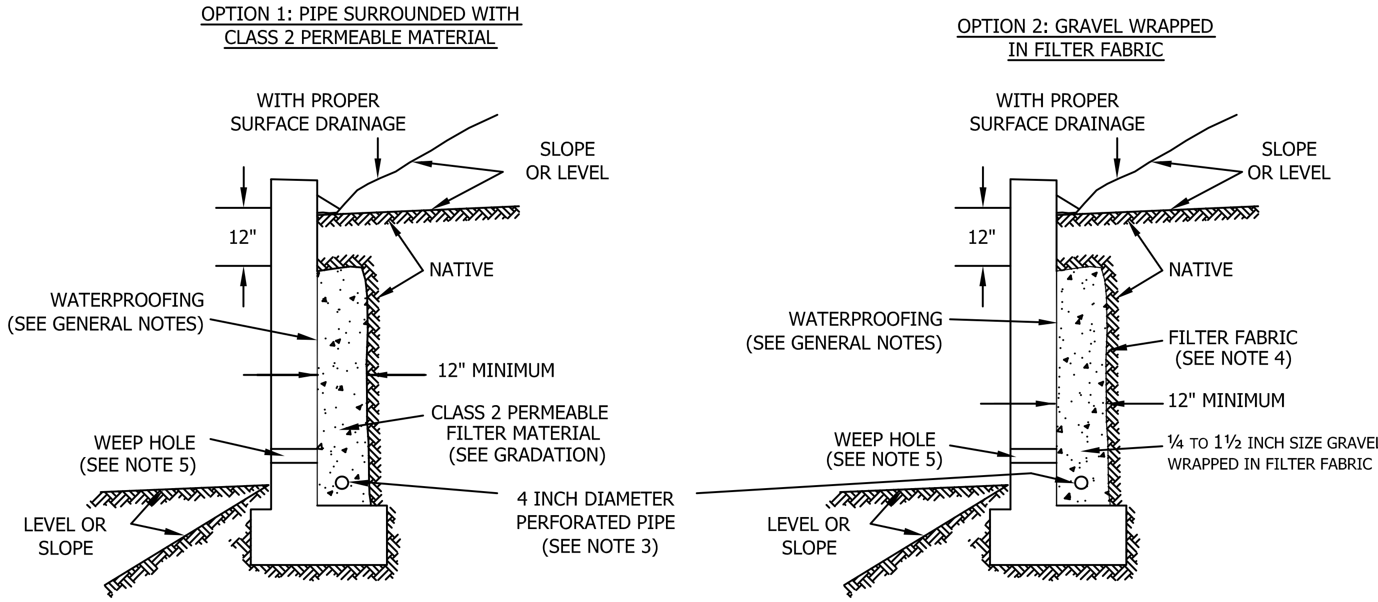
CUT-OVER-FILL SLOPE



BENCHING SHALL BE DONE WHEN SLOPE'S ANGLE IS EQUAL TO OR GREATER THAN 5:1. MINIMUM BENCH HEIGHT SHALL BE 4 FEET AND MINIMUM FILL WIDTH SHALL BE 9 FEET.

KEYING AND BENCHING	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS A	Leighton

SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum
*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:
1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

Leighton

Figure

APPENDIX F

GBA - IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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