

UPDATE GEOHAZARD REPORT  
PROPOSED WINCHESTER STEAM ACADEMY  
NWC OF WASHINGTON STREET AND ABELIA STREET  
RIVERSIDE COUNTY, CALIFORNIA

Prepared for

**TEMECULA VALLEY UNIFIED SCHOOL  
DISTRICT**

31350 Rancho Vista Road  
Temecula, California 92592

Project No. 12236.002

March 20, 2019



Leighton Consulting, Inc.

A LEIGHTON GROUP COMPANY



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Temecula Valley Unified School District  
31350 Rancho Vista Road  
Temecula, California 92592

Attention: Ms. Janet Dixon

**Subject: Update Geohazard Report  
Proposed Winchester STEAM Academy  
NWC of Washington Street and Abelia Street  
Riverside County, California  
Site coordinates: Lat 33.6071°, Long 117.0851°.**

In accordance with your request and authorization, we are pleased to present herewith our Update Geohazard Report for the proposed Winchester STEAM Academy site located northwest of the intersection of Washington Street and Abelia Street in the French Valley area of Riverside County, California. This report summarizes our geotechnical/geologic findings, conclusions and recommendations regarding the proposed new school campus. Based on our findings, the site appears to be generally in the same conditions as those described in the as-graded soils report (Geocon, 2006).

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 CONSULTING, INC.

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## 1.0 INTRODUCTION

### 1.1 Purpose and Scope

This geotechnical/geologic hazard report is for the proposed Winchester STEAM Academy campus located northwest of the intersection of Washington Street and Abelia Street in the French Valley area of Riverside County, California (see *Figure 1, Site Location Map*). Our scope of services included the following:

- Review of available site-specific geologic information, including previous geotechnical reports listed in the references at the end of this report.
- A site reconnaissance and excavation of nine (9) exploratory borings. Approximate locations of these exploratory borings are depicted on Figure 7.
- Geotechnical laboratory testing of selected soil samples obtained from this exploration. Test procedures and results are presented in Appendix B.
- Geotechnical engineering analyses performed or as directed by a California registered Geotechnical Engineer (GE) and reviewed by a California Certified Engineering Geologist (CEG).
- Preparation of this report which presents our geotechnical conclusions and recommendations regarding the proposed structures.

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

### 1.2 Site and Project Description

The proposed Winchester STEAM Academy campus is located northwest of the intersection of Washington Street and Abelia Street in the French Valley area of Riverside County, California (See Figure 1). The site is currently vacant and sheet graded. Sparse vegetation/ seasonal weeds covering some areas of the site. At the time of our recent site visit (February 11, 2019), standing water was observed in the middle portion of the site. The site is accessible from the adjacent Abelia Street.

Based on our review of a conceptual site plan prepared by MPGA Architecture, Inc. (see Figure 7), the project generally includes the construction of the following:

- Buildings 1S, 23, 45, 67 8S (each at 15,106 SF),
- Administration Building (7,701 SF),
- Kindergarten Building (~7,000 SF),

- Multipurpose and Food Service Building (~15,000 SF),
- Locker Building (~5,000 SF)
- Media Building (~3,000 SF) and,
- Associated parking facilities for visitors/staff and athletic play courts including hardscape and turf playfields.

The proposed buildings are expected to consist of single-story wood or steel framed structures and be founded on isolated/spread or continuous wall footings with typical structural loads.

### **1.3 Previous Reports**

As indicated previously, the site (Lot 219) has been sheet graded in 2005/2006 during the grading of the adjacent residential tract (#30069-2) under the observation and testing services of Geocon Inland Empire Inc. (Geocon, 2006). Based on Geocon's report, the grading began with the removal of 6 feet of surficial soils below site grades at that time to expose dense alluvium and/or Bedford Canyon formation. After removal, 5 to 20 feet of compacted fill was placed at a minimum relative compaction of 90 percent. After completion of grading, a settlement monitoring program was established to monitor deep fills (Ninyo & Moore, 2007). Five settlement monuments were installed on-site and survey data indicates settlement of less than 3/8-inch over a period of six months. Rock fills were placed on the site with the majority of rock fragments not exceeding 12 inches in diameter in the upper 10 feet. A canyon subdrain was installed within a drainage course located in the south-central portion of the site at the interface of artificial fill and underlying dense older alluvium/Bedford Canyon. The subdrain was connected to a storm drain catch basin in Abelia Street. Laboratory testing indicated that the site soils exhibit very low to low expansion potential and may be considered "mildly corrosive" and "corrosive" to buried metal piping.

## 2.0 FIELD EXPLORATION AND LABORATORY TESTING

### 2.1 Field Exploration

Our field exploration consisted of the excavation of nine (9) borings within selected areas of the site to verify subsurface conditions and provide basis for ground preparation and foundation design. During excavation, in-situ undisturbed (Cal Ring) and disturbed/bulk samples were collected from the exploration borings for further laboratory testing and evaluation. Approximate locations of these exploratory borings along with previous site borings are depicted on the *Boring Location Map* (Figure 7). Sampling was conducted by a staff geologist/engineer from our firm. After logging and sampling, the excavations were loosely backfilled with spoils generated during excavation. The exploration logs from this and previous explorations are included in Appendix A.

### 2.2 Laboratory Testing

Laboratory tests were performed on representative bulk samples to provide a basis for development of remedial earthwork and geotechnical design parameters. Selected samples were tested to determine the following parameters: maximum dry density and optimum moisture, in-situ moisture and density, expansion index, Atterberg limits, collapse potential, R-value and soluble sulfate 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. This province is characterized by steep, elongated ranges and valleys that trend northwestward. More specifically, the site is situated within the southern portion of the Perris Block, an eroded mass of Cretaceous and older crystalline rock.

The Perris Block is 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 south. 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 and volcanic materials locally mantle crystalline bedrock. Young and older alluvial deposits fill the lower valley areas, as mapped regionally on Figure 4, *Regional Geologic Map*.

### 3.2 Site Specific Geology

#### 3.2.1 Earth Materials

Our field exploration, observations, and review of the pertinent literature indicate that the site is underlain at depth by dense older alluvial deposits and metasedimentary bedrock materials locally known as Bedford Canyon formation. Artificial fill associated with previous grading mantles the site. The following is a summary of the geologic conditions based on our borings and previous borings and/or as-graded soils report:

- **Compacted Fill (Afd):** Existing compacted fill soil was encountered within the upper 4 to 14 feet below ground surface in our exploratory borings. As encountered, these fills consist of moist, medium dense to dense, silty to clayey sand with gravel and cobble. Based on the results of our laboratory testing, these materials are expected to possess low to medium expansion potential ( $0 < EI < 90$ ) and relative compaction of at least 90 percent per ASTM 1557.
- **Alluvium/Older Alluvium (Qalo):** The alluvial deposits were encountered below the artificial fill and above the bedrock. As encountered, these soils consist of medium dense to dense silty to clayey sand and stiff to hard sandy

clay with varying amounts of gravel. Based on our laboratory testing, the older alluvial materials possess a collapse potential of less than 0.6 percent.

- **Bedford Canyon Formation (Jbc):** Metamorphic Bedrock locally known as Bedford Canyon is exposed in the existing cut slopes on the western margin of the site. This slate-type bedrock is generally brown, orange-brown to dark gray in color, well-foliated, or structured, and slightly moist. The bedrock materials are moderately to highly-weathered for several feet near the soil/alluvium contact. The highly weathered bedrock has been reduced to clay and clayey sand as produced in auger borings. Foliation within the bedrock was generally consistent across the site. Foliation, or relict bedding planes, follow a consistent northwest trend across the site and dip very steeply to both the north and south. Such an orientation produces “bedding” planes that are expected to dip more steeply than the proposed cut slope surfaces. As encountered in our borings, the bedrock materials consist of silty and clayey sands with gravel to poorly graded gravel with clay and sand.

### 3.3 Groundwater and Surface Water

Locally ponded surface water was observed during our field exploration in the west-central portion of the site due to recent rain. Perched groundwater was locally encountered at a depth of 27.6 feet below the ground surface in LB-3 at the fill to bedrock contact. Groundwater may fluctuate due to seasonal variations and is not expected to be a constraint during continued development of the site.

### 3.4 Faulting

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 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 or Riverside County Fault Hazard Zone (see Figure 5). No indications of faulting or fault related fissuring or fracturing was observed onsite during this investigation. The nearest known active fault is the Temecula Segment of the Elsinore Fault Zone located approximately 7.3 miles (11.8 kilometers) west of the site.

Historically, the Elsinore fault zone has produced earthquakes in the magnitude range of 6.5Mw to 7.1Mw (‘Mw’ is the Moment Magnitude as defined by the U.S.G.S). A table of

major quakes (>5.5 Mw) within 30 miles of the site in the last 150 years (per CGS Website, February, 2019), is presented in table below:

**Table 1. Major Quakes (>5.5 Mw) in the last 150 years**

Date	Moment Magnitude (Mw)	Approx. Distance from Site (km)	General Location
1880-12-19	6.0	34.2	East San Bernardino
1899-12-25	6.4	22.8	San Jacinto / Hemet
1910-05-15	6.0	30.9	North Lake Elsinore
1918-04-21	6.8	17.7	San Jacinto
1923-07-23	6.25	46.2	Moreno Valley North

### 3.5 Ground Shaking / Site-Specific Ground Motion Analysis

Based on ASCE 7 as the Design Code Reference Document and site Class **D**, the seismic coefficients for this site are as listed in the following table:

**Table 2. Site-Specific Seismic Coefficients**

CBC Categorization/Coefficient		USGS General Procedure (g)
Site Longitude (decimal degrees)	-117.08512	
Site Latitude (decimal degrees)	33.60706	
Site Class Definition	<b>D</b>	
Mapped Spectral Response Acceleration at 0.2s Period, $S_s$		<b>1.50</b>
Mapped Spectral Response Acceleration at 1s Period, $S_1$		<b>0.60</b>
Short Period Site Coefficient at 0.2s Period, $F_a$		1.00
Long Period Site Coefficient at 1s Period, $F_v$		1.50
Adjusted Spectral Response Acceleration at 0.2s Period, $S_{MS}$		1.50
Adjusted Spectral Response Acceleration at 1s Period, $S_{M1}$		0.90
Design Spectral Response Acceleration at 0.2s Period, $S_{DS}$		<b>1.00</b>
Design Spectral Response Acceleration at 1s Period, $S_{D1}$		<b>0.60</b>

\*g- Gravity acceleration

Since this site is assigned a Seismic Design Category is D ( $S_1 < 0.75$ ), a site-specific ground motion analysis is not required per CGS Note 48. As such, the above site-specific seismic coefficients following this USGS general procedure presented should be used in design. The results of this analysis also indicate that the adjusted Peak Ground Acceleration ( $PGA_M$ ) for this site is 0.51g (see Appendix C).

### 3.6 Secondary Seismic Hazards

Ground shaking can induce “secondary” seismic hazards such as liquefaction, dynamic densification, and differential subsidence along ground fissures, seiches and tsunamis, as discussed in the following subsections:

#### 3.6.1 Dynamic Settlement (Liquefaction and Dry Settlement)

Liquefaction-induced or dynamic dry settlement is not considered a hazard at this site due to the lack of shallow groundwater and dense fill and underlying formation. The seismic settlement is expected to be less than 0.5 inch with differential settlement less than 0.25-inch in a 40-foot horizontal distance.

#### 3.6.2 Lateral Spreading

The potential for lateral spreading is considered non-existent on this site.

#### 3.6.3 Ground Rupture

Since no active faults are known to cross or trend into the site, the possibility of damage due to ground surface-fault-rupture at this site is considered very low.

#### 3.6.4 Seiches, Tsunamis, Inundation Due to Large Water Storage Facilities

Although Lake Skinner Reservoir is located approximately 1.0 mile southeast, the possibility of seiches and tsunamis impacting the site is considered remote. This report does not address conventional flood hazard risk.

#### 3.6.5 Rock Falls

The potential for rock fall due to either erosion or seismic ground shaking is considered non-existent on this area.

#### 3.6.6 Slope Stability and Landslides

All existing cut and fill slopes were created at inclinations of 2:1 or flatter. Due to the relatively modest relief across the site, the risk of deep-seated slope failure on this site or adjacent sites is considered non-existent. The site is not considered susceptible to seismically induced landslides.

#### 3.6.7 Dam Inundation/Flood Hazard

This report does not address conventional flood hazard risk associated with this site. However, per the official FEMA Flood Hazard Areas Map (FIRM Panel 06065C2730G), this site is located in Zone X – “Area with flood risk due to levee.” Lake Skinner Reservoir is located approximately 1 mile southeast of the site. In accordance with Figure 4, the site is not located within a flood hazard zone.

### 3.6.8 Subsidence

In accordance with County of Riverside Geologic Hazard Maps (Riverside, 2003), the site is located within an area susceptible to subsidence. However, based on the results of our subsurface evaluation and lack of evidence of differential subsidence and associated ground fissuring, we consider the potential for differential subsidence and ground fissuring on this site to be very low

## 4.0 CONCLUSIONS AND RECOMMENDATIONS

### 4.1 General

The proposed school site appears feasible from a geotechnical viewpoint provided that the following recommendations are incorporated into the design and construction phases of development. The previously placed fill appears to be engineered fill and possess adequate relative density.

### 4.2 Earthwork

Earthwork should be performed in accordance with the following recommendations and the *Earthwork and Grading Specifications* included in Appendix D of this report. In case of conflict, the following recommendations should supersede those in Appendix D. 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 D, 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.) of the site should be cleared of surface and subsurface obstructions. Heavy vegetation, roots and debris should be disposed of offsite. Voids created by removal of buried material 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:

- **Building Footprints:** Within the building footprint, the upper 2 feet of soils should be removed/over-excavated (OX) and recompacted prior to foundation construction or placement of any additional fill. The over-excavation and recompaction should extend a minimum horizontal distance equal to the depth of removal. Localized areas of deeper removals/over-excavation may be required depending on the actual conditions encountered pending verification by our field representative during grading to confirm encountered soils are suitable.
- **Flatwork/Pavement:** In areas of proposed concrete flatwork or pavement, a minimum remedial removal/OX of 1-foot or 12-inches below proposed subgrade elevation, whichever is deeper, should be performed. This remedial removal should be performed to a minimum of 2 feet beyond the limits of improvements. The bottom of the removal should be proof-rolled with heavy equipment to identify yielding subgrade conditions (for additional removal, if necessary) under the observation of the geotechnical consultant.

After completion of the recommended removal of existing fill soils and prior to fill placement, the exposed surface should be scarified to a minimum depth of 8-inches, moisture conditioned as necessary to near optimum moisture content and recompacted using heavy compaction equipment to an unyielding condition. All structural fill within the building footprints should be compacted throughout to 90 percent per ASTM D 1557.

#### 4.2.2 Suitability of Site Soils for Fills

Topsoil and vegetation layers, root zones, and similar surface materials should be striped and stockpiled for either reuse in landscape surface areas or removed from the site. Site existing fill should be considered suitable for re-use as compacted fills provided the recommendations contained herein are followed. If cobbles/boulders larger than 6-inches in largest diameter and expansive soils (EI>51) are encountered, these materials should not be placed with the upper 3 feet of subgrade soils.

#### 4.2.3 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 very low expansion potential (EI<21) and have a low corrosion impact to the proposed improvements.

#### 4.2.4 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 1½ inches in diameter and organic matter. 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 “Greenbook”, latest Edition. 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*. 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. Leighton Consulting, Inc. does not consult in the area of safety engineering.

#### 4.2.5 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 a recompaction shrinkage (when recompacted at 90 to 95 percent of ASTM D 1557) of 0- to 10-percent by volume, for the onsite fill. Subsidence due solely to scarification, moisture conditioning and recompaction of the exposed bottom of over-excavation, is expected to be on the order of 0.10 foot. This should be added to the above shrinkage value for the recompacted fill zone, to calculate overall recompaction subsidence.

#### 4.2.6 Drainage

All drainage should be directed away from structures 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. 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**

Shallow spread footings bearing on a newly placed and properly compacted fill are anticipated for the proposed structures.

#### 4.3.1 Design Parameters – Spread/Continuous Shallow Footings

Conventional spread/continuous shallow footings appear to be feasible to support the proposed structures. Footings should be embedded at least 12-inches below lowest adjacent grade for the proposed structure. Footing embedments should be

measured from lowest adjacent finished grade, considered as the top of interior slabs-on-grade or the finished exterior grade, excluding landscape topsoil, whichever is lower. Footings located adjacent to utility trenches or vaults should be embedded below an imaginary 1:1 (horizontal:vertical) plane projected upward and outward from the bottom edge of the trench or vault, up towards the footing.

- **Bearing Capacity**: A net allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design assuming that footings have a minimum base width of 18 inches for continuous wall footings and a minimum bearing area of 3 square feet (1.75-ft by 1.75-ft) for pad foundations. 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. These bearing values may also be increased by one-third when considering short-term seismic or wind loads. All continuous perimeter or interior footings should be reinforced with at least one No. 5 bar placed both top and bottom.
- **Lateral loads**: Lateral loads may be resisted by friction between the footings and the supporting subgrade. A maximum allowable frictional resistance of 0.35 may be used for design. In addition, lateral resistance may be provided by passive pressures acting against foundations poured neat against properly compacted granular fill. We recommend that an allowable passive pressure based on an equivalent fluid pressure of 300 pounds-per-cubic-foot (pcf) be used in design. These friction and passive values have already been reduced by a factor-of-safety of 1.5.

#### 4.3.2 Settlement Estimates

For settlement estimates, we assumed that column loads will be no larger than 100 kips, with bearing wall loads not exceeding 5 kips per foot of wall. If greater column or wall loads are required, we should re-evaluate our foundation recommendation, and re-calculate settlement estimates.

Buildings located on compacted fill soils (as recommended in Section 4.2.1) should be designed in anticipation of 1-inch of total settlement and ½- inch of differential settlement within a 30-foot horizontal run. These settlement estimates should be reevaluated by this firm when foundation plans and actual loads for the proposed structure(s) become available.

## 4.4 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 should 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	50
At-Rest	55	85
Passive*	300	150 (2:1, sloping down)

\* This assumes level condition in front of the wall will remain for the duration of the project, not to exceed 4,500 psf at depth.

Unrestrained (yielding) cantilever walls should be designed for the active equivalent-fluid weight value provided above for very 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.

The above equivalent fluid pressures do not include the effect of earthquake loading. Based on recent studies (Sitar, et. al., 2013), a uniform pressure distribution of 12H (psf) may be considered to estimate seismic lateral pressures acting against retaining walls. These pressures need only to be applied to walls supporting more than 6 feet of level backfill per the 2016 California Building Code.

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 Engineer.

#### **4.5 Vapor Retarder**

It has been a standard of care to install a moisture 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 Consulting, 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.

#### **4.6 Footing Setbacks**

We recommend a minimum horizontal setback distance from the face of slopes for all structural footings (including retaining and decorative walls, building footings, etc.). This distance is measured from the outside bottom edge of the footing horizontally to the slope face (or to the face of a retaining wall) and should be a minimum of  $H/2$ , where  $H$  is the slope height (in feet). The setback should not be less than 7 feet and need not be greater than 15 feet.

The soils within the structural setback area may possess poor lateral stability and improvements (such as retaining walls, decks, sidewalks, fences, pavements, etc.) constructed within this setback area may 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 as described above.

#### **4.7 Sulfate Attack**

The results of our laboratory testing indicate that the onsite soils have soluble sulfate content of less than 1,000 ppm (<0.01%). Type II cement or similar may be used for design of concrete structures in contact with the onsite soils.

#### 4.8 Preliminary Pavement Design

Our preliminary pavement design is based on an R-value of 11 and the guidelines included in Caltrans Highway Design Manual. For planning and estimating purposes, the pavement sections are calculated based on Traffic Indexes (TI) as indicated in Table below:

**Table 4. Asphalt Pavement Sections**

<b>General Traffic Condition</b>	<b>Design Traffic Index (TI)</b>	<b>Asphalt Concrete (inches)</b>	<b>Aggregate Base* (inches)</b>
Automobile Parking Lanes	4.5	3.0	7.0
	5.0	3.0	8.5
Truck/Bus Access & Driveways	5.5	3.5	9.5
	6.0	4.0	10.0

Appropriate Traffic Index (TI) should be selected or verified by the project civil engineer or traffic engineering consultant and appropriate R-value of the subgrade soils will need to be verified after completion of rough grading to finalize the pavement design. Pavement design and construction should also conform to applicable local, county and industry standards. The Caltrans pavement section design calculations were based on a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance

For preliminary planning purposes, fire lanes and truck loading areas may be constructed of Portland Cement Concrete (PCC) with a minimum thickness of 7.0 inches assuming light axle loads and an average daily truck traffic (ADTT) of less than 100. For medium/heavy axle loads and an ADT of 100 or more, a minimum PCC thickness of 8 inches should be used, such as for trash corrals and trash truck aprons, loading docks, etc. All PCC pavement should have a minimum 28-day concrete compressive strength of 3,250 psi and have appropriate joints and saw cuts in accordance with either Portland Cement Association (PCA) or American Concrete Institute (ACI) guidelines. PCC subgrade should be compacted to 95 percent relative compaction in the upper 6 inches. For truck lanes and ramps, a 6-inch (minimum) layer of Class 2 aggregate base at 95 percent relative compaction should be considered beneath the PCC paving. This 6-inch layer of Class 2 aggregate may be used beneath other areas of PCC pavement to improve performance. The upper 6 inches of the underlying subgrade soils should also be compacted to at least 95 percent relative compaction (ASTM D1557). 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” (green book) current edition or Caltrans Class 2 aggregate base.

If pavement areas are adjacent to heavily 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.

## 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 Consulting, 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 Consulting, 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 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 Consulting, Inc.) will provide geotechnical observation and testing during construction as the Geotechnical Engineer of Record for this project.

This report was prepared for the sole use of Client and their design team, for application to design of the Proposed Winchester STEAM Academy, in accordance with generally accepted geotechnical engineering practices at this time in California. In addition, since this is a public school project, our report may be subject to review by the California Geological Survey (CGS) and/or the California Division of the State Architect (DSA). As such, we recommend that geologic/geotechnical data in this report be only used in the design of this project after review and approval by CGS. Any premature (before CGS approval) or unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton Consulting, 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 Consulting, Inc.

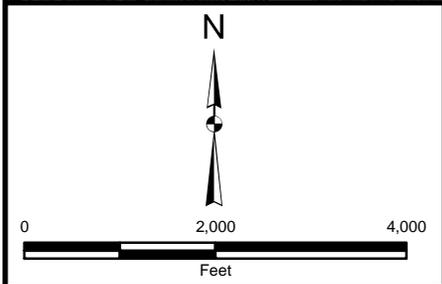
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Approximate Site Boundary  
(Lat. 33.6071, Long. 117.0851)



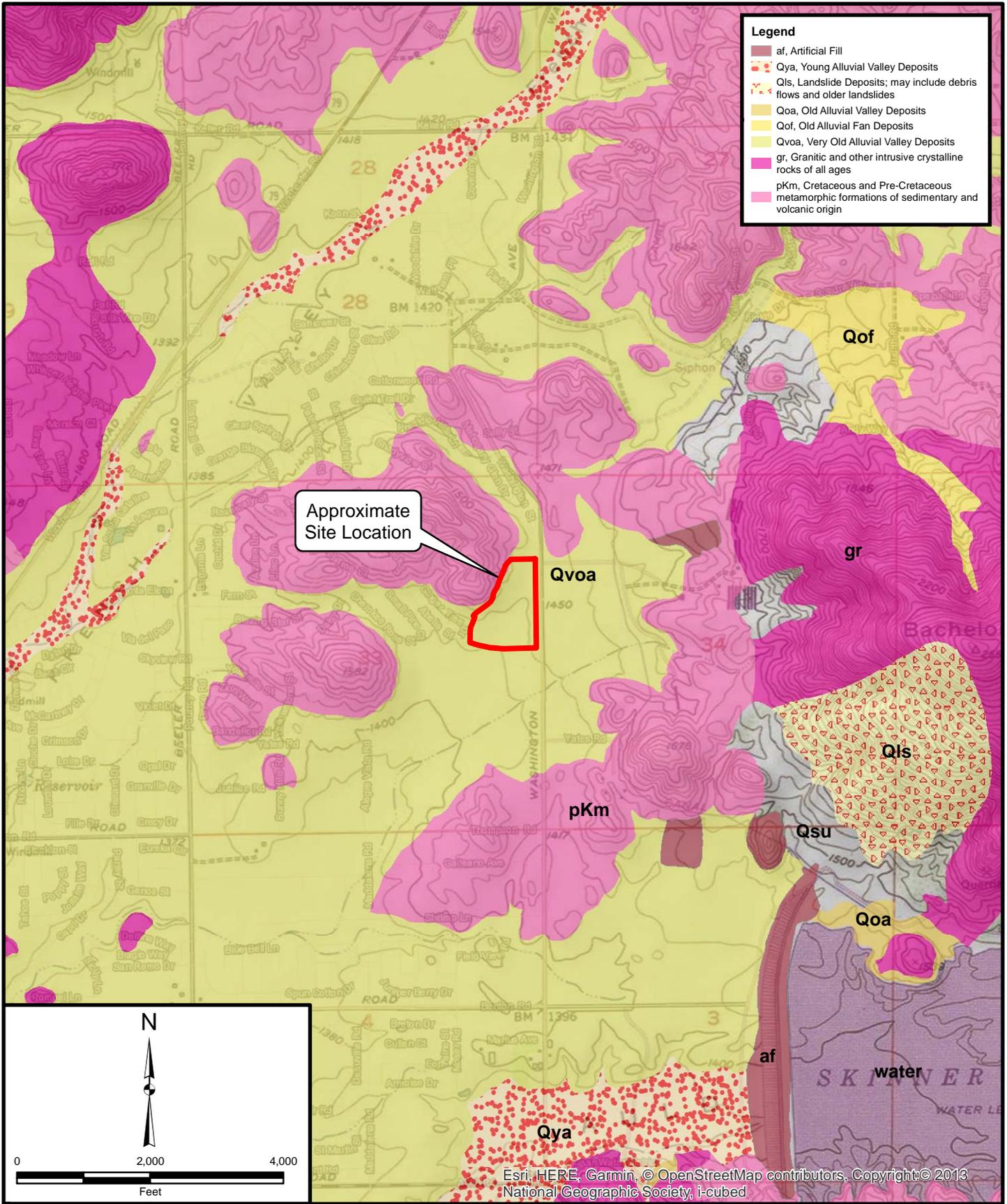
Esri, HERE, Garmin, © OpenStreetMap contributors, © 2019 Microsoft Corporation © 2019 DigitalGlobe © CNES (2019) Distribution Airbus DS

Project: 12236.002	Eng/Geol: SIS/RFR
Scale: 1" = 2,000'	Date: March 2019
Base Map: ESRI ArcGIS Online 2019	
Thematic Information: Leighton	
Author: Leighton Geomatics (btran)	

**SITE LOCATION MAP**  
 Temecula Valley Unified School District  
 Winchester STEAM Academy  
 NWC Washington Street and Abelia Street  
 Temecula, California

Figure 1

Leighton



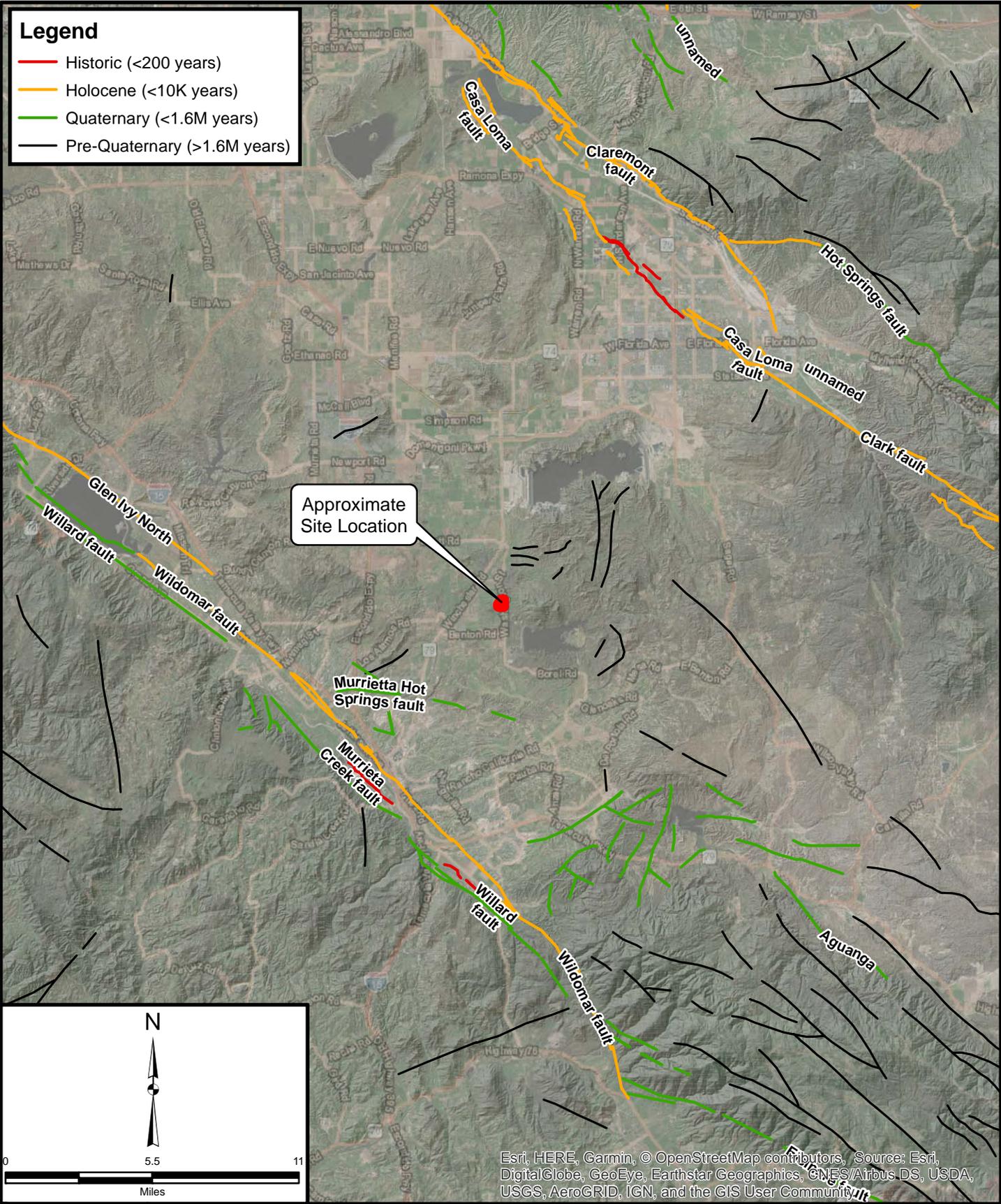
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Base Map: ESRI ArcGIS Online 2019 Thematic Information: Leighton, USGS Author: Leighton Geomatics (btran)	

# REGIONAL GEOLOGY MAP

Temecula Valley Unified School District  
Winchester STEAM Academy  
NWC Washington Street and Abelia Street  
Temecula, California

Figure 2

Leighton



Esri, HERE, Garmin, © OpenStreetMap contributors, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Project: 12236.002	Eng/Geol: SIS/RFR
Scale: 1" = 5 miles	Date: March 2019
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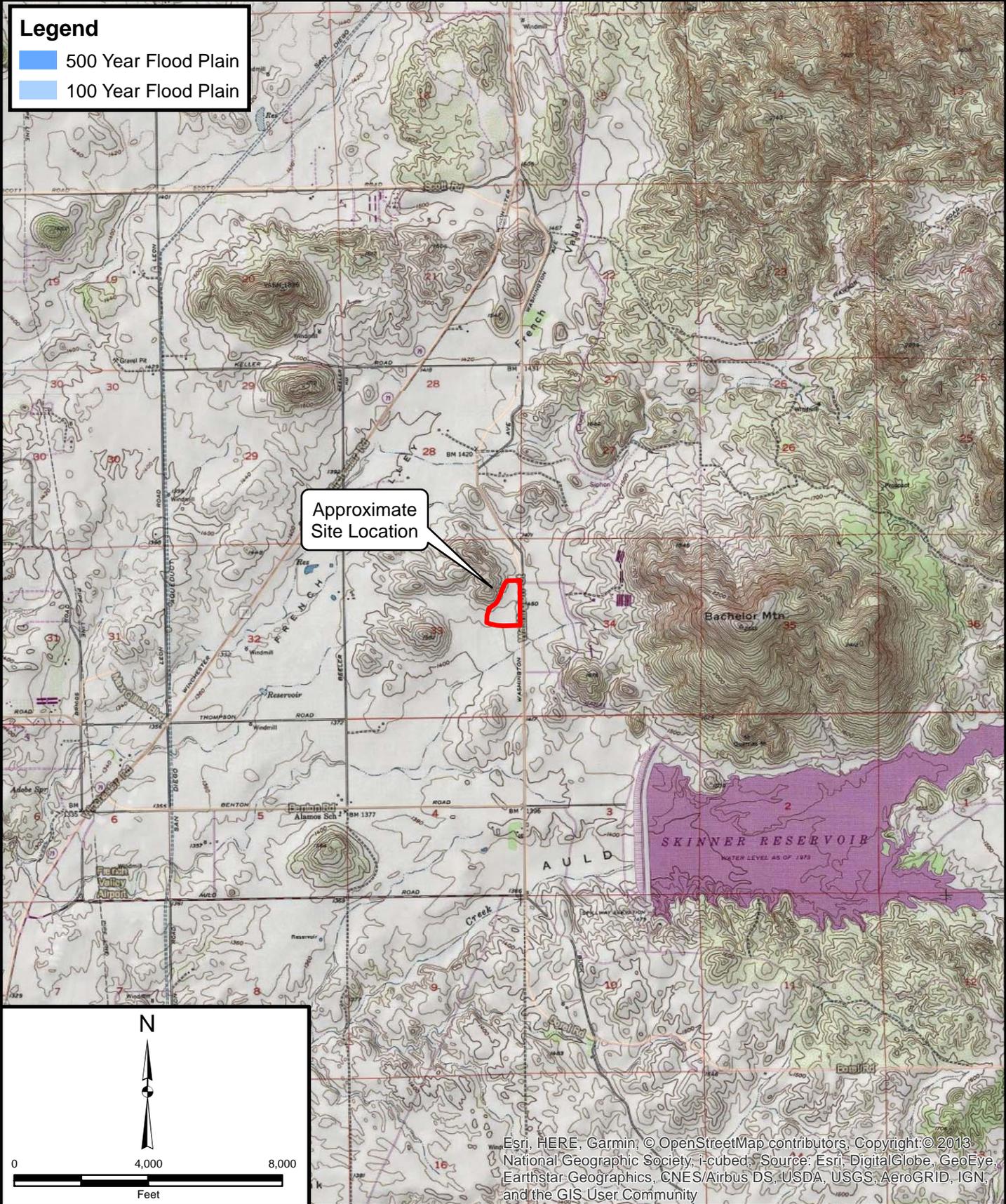
# REGIONAL FAULT MAP

Temecula Valley Unified School District  
 Winchester STEAM Academy  
 NWC Washington Street and Abelia Street  
 Temecula, California

Figure 3



Leighton



Project: 12236.002	Eng/Geol: SIS/RFR
Scale: 1" = 4,000'	Date: March 2019
Base Map: ESRI ArcGIS Online 2019 Thematic Information: Leighton, CA DWR, FEMA Author: Leighton Geomatics (btran)	

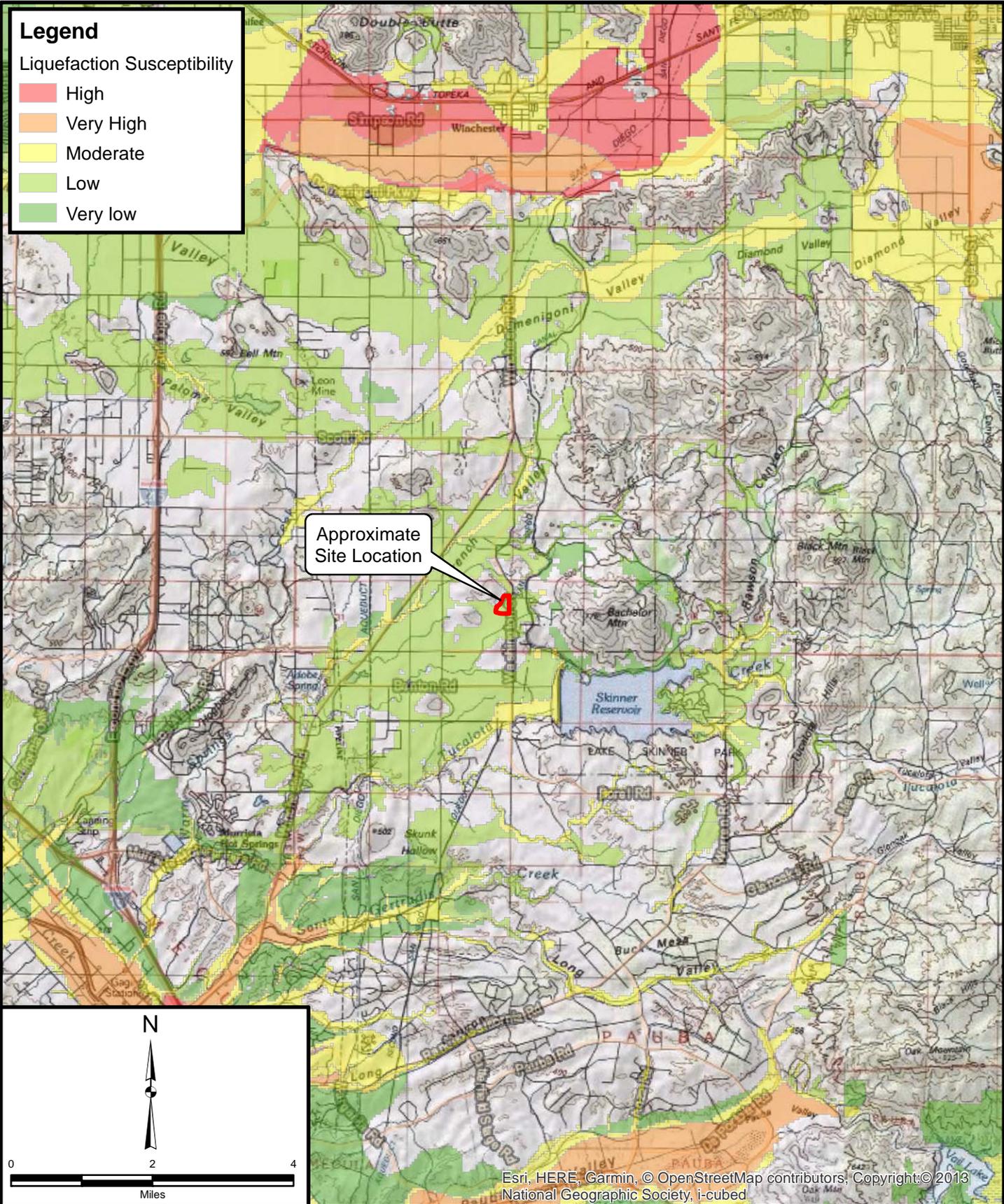
# FLOOD HAZARD ZONE MAP

Temecula Valley Unified School District  
 Winchester STEAM Academy  
 NWC Washington Street and Abelia Street  
 Temecula, California

Figure 4



Leighton

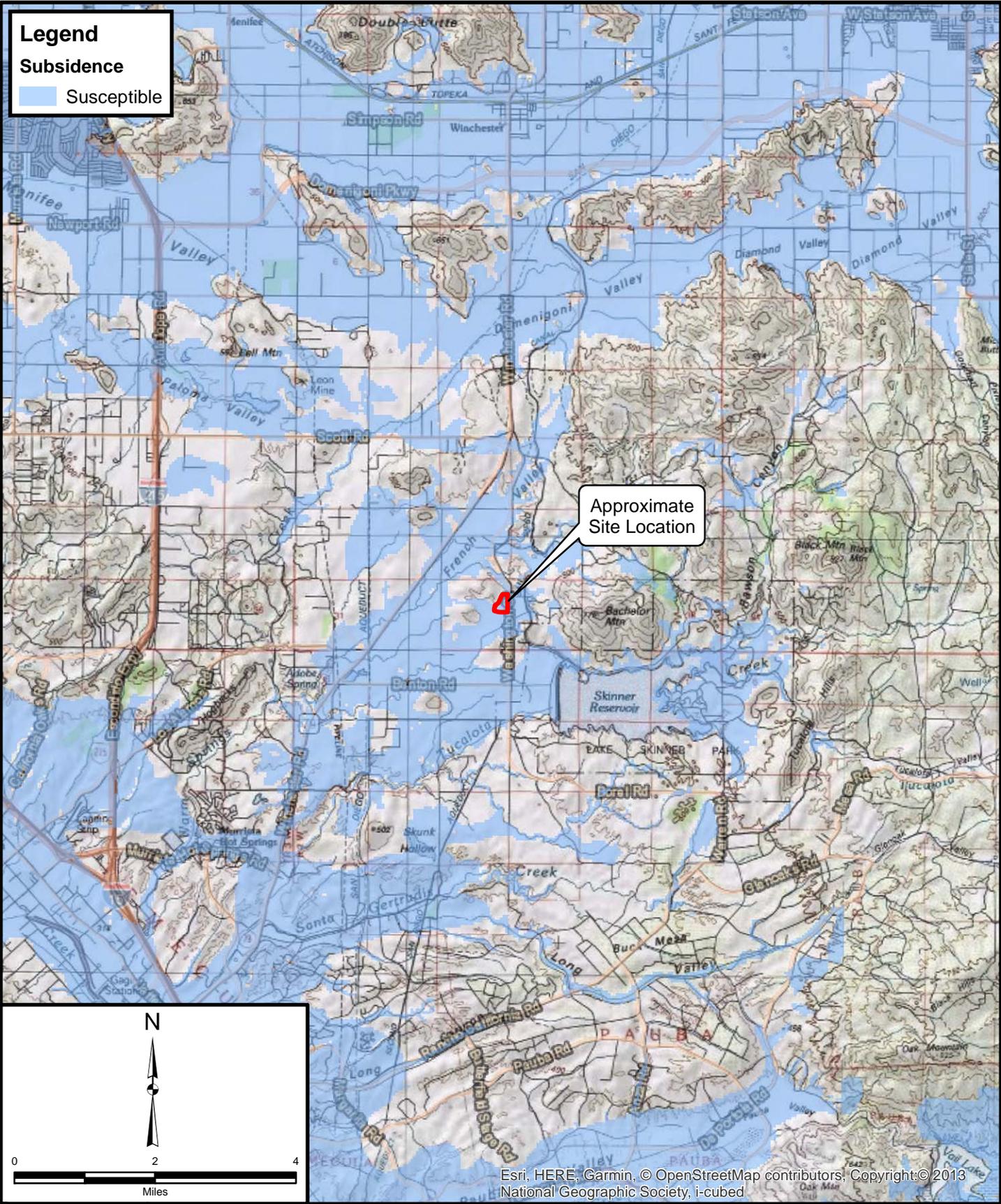


Project: 12236.002	Eng/Geol: SIS/RFR
Scale: 1" = 2 miles	Date: March 2019
Base Map: ESRI ArcGIS Online 2019 Thematic Information: Leighton, CGS Author: Leighton Geomatics (btran)	

**LIQUEFACTION MAP**  
 Temecula Valley Unified School District  
 Winchester STEAM Academy  
 NWC Washington Street and Abelia Street  
 Temecula, California

Figure 5

Leighton



Esri, HERE, Garmin, © OpenStreetMap contributors, Copyright © 2013 National Geographic Society, i-cubed

Project: 12236.002	Eng/Geol: SIS/RFR
Scale: 1" = 2 miles	Date: March 2019
Base Map: ESRI ArcGIS Online 2019	
Thematic Information: Leighton, County of Riverside	
Author: Leighton Geomatics (btran)	

**SUBSIDENCE MAP**  
 Temecula Valley Unified School District  
 Winchester STEAM Academy  
 NWC Washington Street and Abelia Street  
 Temecula, California

Figure 6

Leighton

Figure 7

### BORING LOCATION MAP

Temecula Valley Unified School District  
Winchester STEAM Academy  
NWC Washington Street and Abelia Street, Temecula, California

Proj: 12236.002

Eng/Geol: SIS/RFR

Scale: NTS

Date: March 2019

Drafted By: BOT Checked By: BOT V:\DRAFTING\12236002\2019-03-08\12236-002\_FIG\_06\_M\_2019-03-08.DWG (3:58:13.47:56PM) Plotted by: steve



### LEGEND

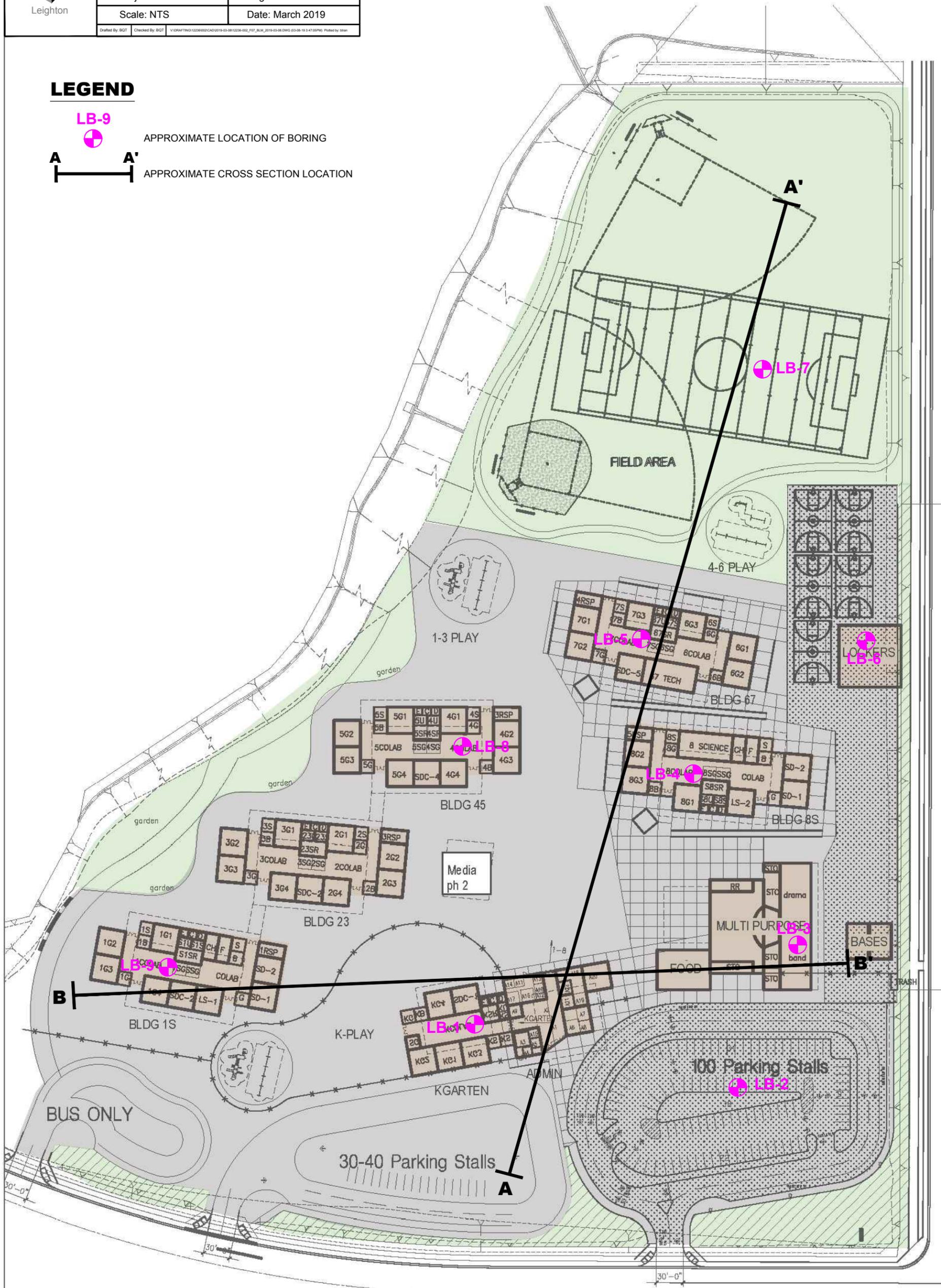
LB-9

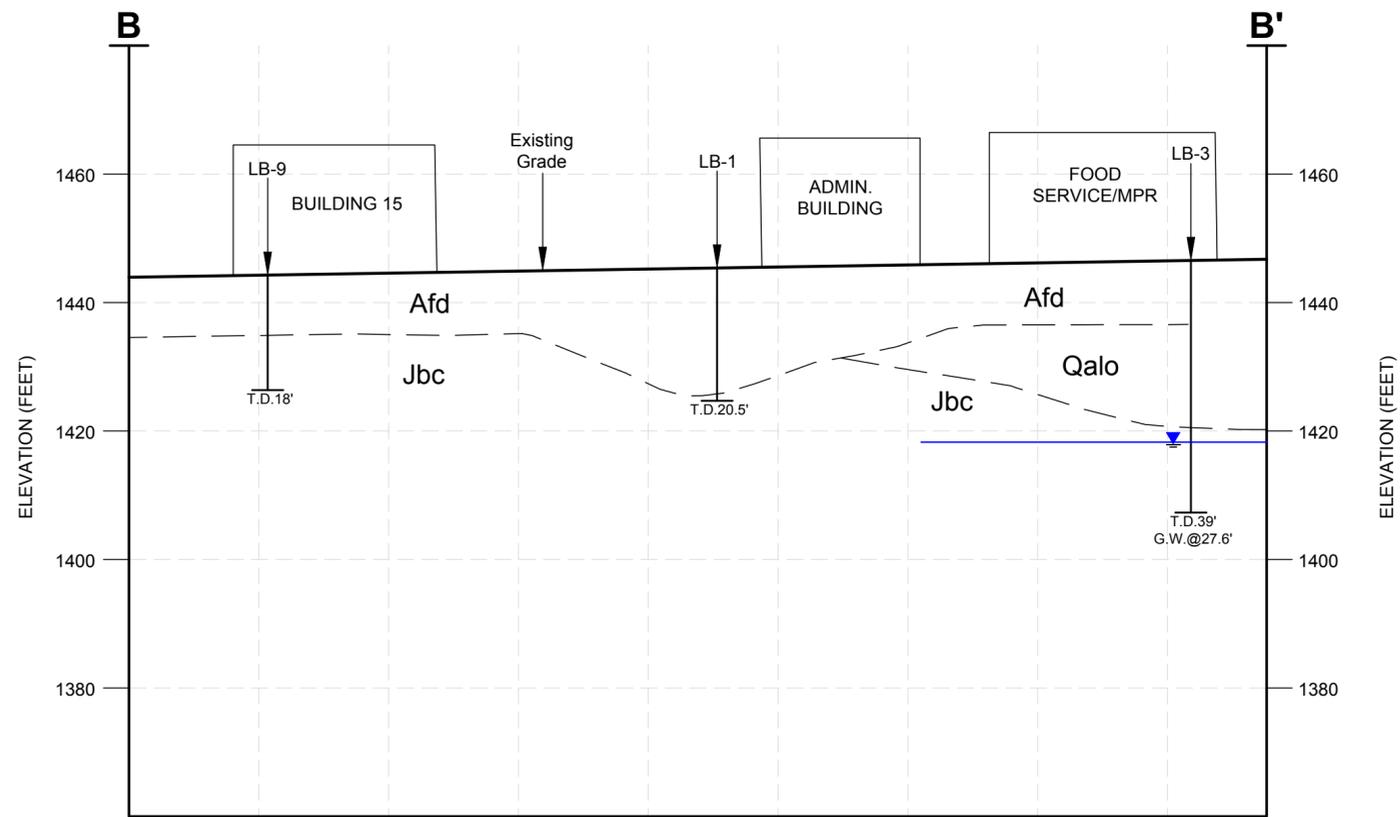
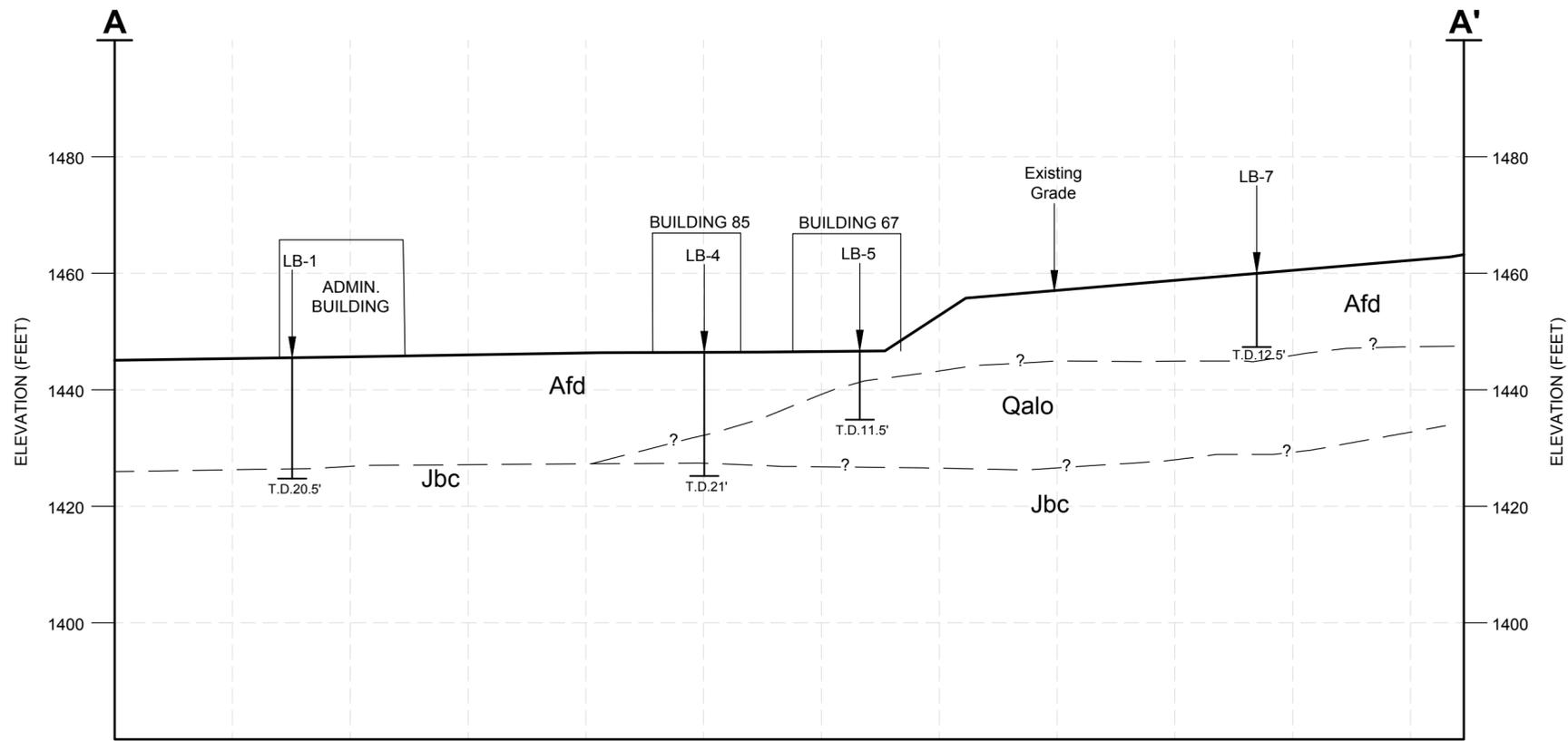


APPROXIMATE LOCATION OF BORING



APPROXIMATE CROSS SECTION LOCATION





**LEGEND**

- Afd Compacted Fill by Others, (Geocon, 2006)
- Qalo Older Alluvium
- Jbc Bedford Canyon Formation

<b>GEOLOGIC CROSS SECTIONS A-A' AND B-B'</b>	
Temecula Valley Unified School District Winchester STEAM Academy NWC Washington Street and Abelia Street, Temecula, California	
Proj: 12236.002	Eng/Geol: SIS/RFR
Scale: H: 1"=100' V: 1"=20'	Date: March 2019

Plate-1



Leighton

## APPENDIX A

### **LOGS OF EXPLORATORY BORINGS (THIS AND PREVIOUS INVESTIGATION)**

Encountered earth materials were continuously logged and sampled in the field by our representative and described in accordance with the Unified Soil Classification System (ASTM D 2488). During drilling, bulk and relatively undisturbed ring-lined split-barrel driven earth material samples were obtained from our borings for geotechnical laboratory testing and classification. Drive-samples were driven with a 140-pound auto-hammer falling 30-inches. Samples were transported to our in-house Temecula laboratory for geotechnical testing. After logging and sampling, our borings were backfilled with spoils generated during drilling.

The attached subsurface exploration logs and related information depict subsurface conditions only at the locations indicated and at the particular date designated on these logs. Subsurface conditions at other locations may differ from conditions occurring at these logged locations. Passage of time may result in altered subsurface conditions due to environmental changes. In addition, any stratification lines on these logs represent an approximate boundary between sampling intervals and soil types; and transitions may be gradual.



# GEOTECHNICAL BORING LOG LB-1

**Project No.** 12236.002  
**Project** Proposed Winchester STEAM Academy  
**Drilling Co.** 2R Drilling  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map

**Date Drilled** 2-28-19  
**Logged By** BSS  
**Hole Diameter** 8"  
**Ground Elevation** ~1446'  
**Sampled By** BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	<b>SOIL DESCRIPTION</b>	Type of Tests
	0	N S						SC-SM	<i>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.</i> <b>Compacted Fill (Afd):</b> SILTY, CLAYEY SAND, medium dense, dark grayish brown, moist, fine sand	
				R-1	7 8 14	108	21	CL	SANDY Lean CLAY, stiff, dark grayish brown to brown, moist, fine sand	
	5			R-2	15 15 25	133	7	SC-SM	SILTY, CLAYEY SAND with GRAVEL, dense, dark gray, moist, fine sand, some fragments gravel, trace oxidation	
	10			R-3	20 28 50-6"			GP-GC	Poorly graded GRAVEL with CLAY and SAND, dense, dark gray, moist, fine to medium sand, angular, fragments	
	15			R-4	10 19 31			SC	CLAYEY SAND, dense, dark olive gray, moist, fine sand, angular, some gravel	
	20			R-5	50-4"			GC	<b>Bedford Canyon Formation (Jbc):</b> CLAYEY GRAVEL with SAND, hard, dark gray, moist, fine sand, angular Drilled to 20' Sampled to 20.5' Groundwater not encountered Backfilled with soil cuttings (2/28/19)	
	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-2

**Project No.** 12236.002  
**Project** Proposed Winchester STEAM Academy  
**Drilling Co.** 2R Drilling  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map

**Date Drilled** 2-28-19  
**Logged By** BSS  
**Hole Diameter** 8"  
**Ground Elevation** ~1447'  
**Sampled By** BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							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		N S		B-1	9			SC-SM	<b>Compacted Fill (Afd):</b> SILTY, CLAYEY SAND with GRAVEL, medium dense, dark gray, slightly moist, fine to medium sand, (RV=11)	RV
				R-1	15 18	128	10		medium dense, dark gray to brown, moist, fine sand	
5		N S		R-2	21			SC	CLAYEY SAND with GRAVEL, very dense, dark gray, moist, fine sand, fragments gravel  gravel layer	
				S-3	50-6"					
10		N S			8				CLAYEY SAND with gravel, dense, dark gray, slightly moist, fine to medium sand, subangular	
					15 15				Drilled to 10' Sampled to 11.5' Groundwater not encountered Backfilled with soil cuttings (2/28/19)	
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-3

**Project No.** 12236.002  
**Project** Proposed Winchester STEAM Academy  
**Drilling Co.** 2R Drilling  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map

**Date Drilled** 2-28-19  
**Logged By** BSS  
**Hole Diameter** 8"  
**Ground Elevation** ~1446'  
**Sampled By** BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	<b>SOIL DESCRIPTION</b>	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		N S		B-1				CL	<b>Compacted Fill (Afd):</b> SANDY CLAY with GRAVEL, dense, dark gray, moist, fine sand, (35% fines, EI=47, PI=20)	MD, SA, AL, EI, CR
5				R-1	23 35 42	137	6	SC	CLAYEY SAND with GRAVEL, dense, dark gray, moist, fine to medium sand, angular  gravel layer	
10				R-2	24 20 17	108	6	GP-GC	<b>Older Alluvium (Qalo):</b> Poorly graded GRAVEL with CLAY and SAND, dense, dark grayish brown, slightly moist, fine to medium sand, angular  more gravel and cobbles	
15				R-3	21 28 38			CL	Lean CLAY, stiff, gray, moist, some caliche (no recovery)	
20				R-4	30 34 37		27		very stiff, brown, moist, fine to medium sand, some caliche and gravel (sample disturbed)	
25				R-5	7 14 26			SC	CLAYEY SAND, dense, light brown, moist, fine sand, some caliche	
30									<b>Bedford Canyon (Jbc):</b>	

**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-3

**Project No.** 12236.002  
**Project** Proposed Winchester STEAM Academy  
**Drilling Co.** 2R Drilling  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map

**Date Drilled** 2-28-19  
**Logged By** BSS  
**Hole Diameter** 8"  
**Ground Elevation** ~1446'  
**Sampled By** BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							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.	
30				R-6	27 50-4"			SC-SM	SILTY, CLAYEY SAND with GRAVEL, dense, light yellowish brown, moist to wet, fine to medium sand, formational	
35				S-7	17 21 24				same as above	
40									Refusal at 39' Sampled to 35' Groundwater at 27.6' Backfilled with soil cuttings (2/28/19)	
45										
50										
55										
60										

**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-4

**Project No.** 12236.002  
**Project** Proposed Winchester STEAM Academy  
**Drilling Co.** 2R Drilling  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map

**Date Drilled** 2-28-19  
**Logged By** BSS  
**Hole Diameter** 8"  
**Ground Elevation** ~1447'  
**Sampled By** BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	<b>SOIL DESCRIPTION</b>	Type of Tests
	0	N S						SC	<p><i>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.</i></p> <p><b>Compacted Fill (Afd):</b> CLAYEY SAND, medium dense, dark gray, moist, fine sand, some gravel</p>	
	5			R-1	22 32 47	119	14	CL	<p>SANDY Lean CLAY with GRAVEL, very stiff, brown, moist, fine sand, subangular</p>	
	10			R-2	31 48 15	134	3	GP-GC	<p>Poorly graded GRAVEL with CLAY and SAND, dense, dark gray, slightly moist, fine to medium sand</p> <p>very hard to drill, more gravel</p>	
	15			R-3	18 24 24	106	19	CL-ML	<p><b>Older Alluvium (Qalo):</b> SILTY CLAY with sand, very stiff, grayish brown, slightly moist, fine sand</p>	
	20			R-4	26 50-6"			SC	<p><b>Bedford Canyon (Jbc):</b> CLAYEY SAND with GRAVEL, very dense, moist, fine sand, angular</p> <p>Drilled to 20' Sampled to 21' Groundwater not encountered Backfilled with soil cuttings (2/28/19)</p>	
	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-5

**Project No.** 12236.002  
**Project** Proposed Winchester STEAM Academy  
**Drilling Co.** 2R Drilling  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map

**Date Drilled** 2-28-19  
**Logged By** BSS  
**Hole Diameter** 8"  
**Ground Elevation** ~1447'  
**Sampled By** BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	<b>SOIL DESCRIPTION</b>	Type of Tests
		N S							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				SC	<b>Compacted Fill (Afd):</b> CLAYEY SAND with GRAVEL, dense, dark gray, moist, fine sand, (EI=52, MD: 126.5 @ 9.0)	MD, EI, CO, CR
5				R-1	12 18 21	87	32	CL-ML	<b>Older Alluvium (Qalo):</b> SILTY CLAY, stiff, light brownish gray, moist, some caliche (CO=0.60%)	
10				R-2	11 13 34	100	26	CL	SANDY Lean CLAY, very stiff, brown, moist, fine sand, trace calcium carbonate	
15									Drilled to 10' Sampled to 11.5' Groundwater not encountered Backfilled with soil cuttings (2/28/19)	
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-6

**Project No.** 12236.002  
**Project** Proposed Winchester STEAM Academy  
**Drilling Co.** 2R Drilling  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map

**Date Drilled** 2-28-19  
**Logged By** BSS  
**Hole Diameter** 8"  
**Ground Elevation** ~1448'  
**Sampled By** BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	<b>SOIL DESCRIPTION</b>	Type of Tests
		N S							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								SC	<b>Compacted Fill (Afd):</b> CLAYEY SAND, medium dense, gray, moist, fine sand, some gravel  dense, dark gray to brown, moist, fine to medium sand, more clay	
5				R-1  R-2 B-1	7 11 25  50-6"	103  109	25  4		CLAYEY SAND with GRAVEL, dense, dark gray, slightly moist, fine to medium sand, sample disturbed (MD: 137.0 @ 6.3)	MD
10				R-3	7 10 14	94	28	CL	<b>Older Alluvium (Qalo):</b>  SANDY Lean CLAY, stiff, dark gray, moist, fine sand, some caliche	CO
15									Drilled to 10' Sampled to 11.5' Groundwater not encountered Backfilled with soil cuttings (2/28/19)	
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
- DS DIRECT SHEAR
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- SE SAND EQUIVALENT
- CN CONSOLIDATION
- H HYDROMETER
- SG SPECIFIC GRAVITY
- CO COLLAPSE
- MD MAXIMUM DENSITY
- UC UNCONFINED COMPRESSIVE STRENGTH
- CR CORROSION
- PP POCKET PENETROMETER
- RV R VALUE
- CU UNDRAINED TRIAXIAL



# GEOTECHNICAL BORING LOG LB-7

**Project No.** 12236.002  
**Project** Proposed Winchester STEAM Academy  
**Drilling Co.** 2R Drilling  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map

**Date Drilled** 2-28-19  
**Logged By** BSS  
**Hole Diameter** 8"  
**Ground Elevation** ~1456'  
**Sampled By** BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							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								SC	<b>Compacted Fill (Afd):</b> CLAYEY SAND, dense, dark grayish brown, moist, fine sand  some gravel  very dense, dark grayish brown, moist, fine sand, gravel 2 inches in diameter	
5				R-1	50-4"				no recovery	
10				R-2	50-3"					
				S-3	24 24 21			GP-GM	Poorly graded GRAVEL with SILT and SAND, dense, dark gray, slightly moist, fine to medium sand, some clay	
15									Drilled to 11' Sampled to 12.5' Groundwater not encountered Backfilled with soil cuttings (2/28/19)	
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-8

**Project No.** 12236.002  
**Project** Proposed Winchester STEAM Academy  
**Drilling Co.** 2R Drilling  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map

**Date Drilled** 2-28-19  
**Logged By** BSS  
**Hole Diameter** 8"  
**Ground Elevation** ~1447'  
**Sampled By** BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	<b>SOIL DESCRIPTION</b>	Type of Tests
		N S							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		[Hatched Pattern]						SC-SM	<b>Compacted Fill (Afd):</b> SILTY, CLAYEY SAND with GRAVEL, dense, dark gray, slightly moist, fine to medium sand	
5		[Hatched Pattern]		R-1	50-5"	117	5	SC	<b>Bedford Canyon (Jbc):</b> CLAYEY SAND with GRAVEL, very dense, dark gray, slightly moist, fine to medium sand	
10		[Hatched Pattern]		R-2	50-3"			GP-GC	Poorly graded GRAVEL with CLAY and SAND, very dense, dark gray, slightly moist, fine sand	
15									Drilled to 10' Sampled to 11.5' Groundwater not encountered Backfilled with soil cuttings (2/28/19)	
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-9

**Project No.** 12236.002  
**Project** Proposed Winchester STEAM Academy  
**Drilling Co.** 2R Drilling  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map

**Date Drilled** 2-28-19  
**Logged By** BSS  
**Hole Diameter** 8"  
**Ground Elevation** ~1445'  
**Sampled By** BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							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								SC-SM	<b>Compacted Fill (Afd):</b> SILTY, CLAYEY SAND, medium dense, dark gray, slightly moist, fine to medium sand  some gravel no recovery, sampling on gravel	
5	R-1		50-5"					CL	SANDY Lean CLAY with GRAVEL, very stiff, dark grayish brown, moist  dry, fine sand	
10	R-2		50-3"					SC	<b>Bedford Canyon:</b> CLAYEY SAND with GRAVEL, very dense, dark brown, slightly moist, fine to medium sand, angular, to Sandy GRAVEL, some oxidation	
15				R-3	33 50-4"			GP-GC	Poorly graded GRAVEL with CLAY and SAND, very dense, dark gray, moist, fine to coarse sand, some oxidation  hard drilling	
20									Refusal at 18' Sampled to 15' Groundwater not encountered Backfilled with soil 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



## **APPENDIX B**

### **GEOTECHNICAL LABORATORY TEST RESULTS**





**PARTICLE-SIZE DISTRIBUTION (GRADATION)  
of SOILS USING SIEVE ANALYSIS  
ASTM D 6913**

Project Name: TVUSD Winchester Steam      Tested By: MRV      Date: 03/08/19  
 Project No.: 12236.002      Checked By: MRV      Date: 03/14/19  
 Boring No.: LB-3      Depth (feet): 1.0 - 5.0  
 Sample No.: B-1  
 Soil Identification: Sandy Lean Clay s(CL), Dark Grayish Brown.

		Moisture Content of Total Air - Dry Soil	
Container No.:	M	Wt. of Air-Dry Soil + Cont. (g)	1044.7
Wt. of Air-Dried Soil + Cont.(g)	1044.7	Wt. of Dry Soil + Cont. (g)	993.3
Wt. of Container (g)	666.3	Wt. of Container No. _____ (g)	666.3
Dry Wt. of Soil (g)	327.0	Moisture Content (%)	15.7

After Wet Sieve	Container No.	M
	Wt. of Dry Soil + Container (g)	815.8
	Wt. of Container (g)	666.3
	Dry Wt. of Soil Retained on # 200 Sieve (g)	149.5

U. S. Sieve Size		Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
(in.)	(mm.)		
3"	75.000		100.0
1"	25.000		100.0
3/4"	19.000		100.0
1/2"	12.500	0.0	100.0
3/8"	9.500	8.0	97.6
#4	4.750	21.3	93.5
#8	2.360	42.2	87.1
#16	1.180	67.9	79.2
#30	0.600	89.2	72.7
#50	0.300	109.1	66.6
#100	0.150	128.2	60.8
#200	0.075	148.5	54.6
PAN			

GRAVEL: 7 %  
 SAND: 38 %  
 FINES: 55 %

GROUP SYMBOL: s(CL)      Cu = D60/D10 = N/A  
 Cc = (D30)<sup>2</sup>/(D60\*D10) = N/A

Remarks: \_\_\_\_\_

GRAVEL			SAND				FINES	
COARSE	FINE		COARSE	MEDIUM	FINE		SILT	CLAY

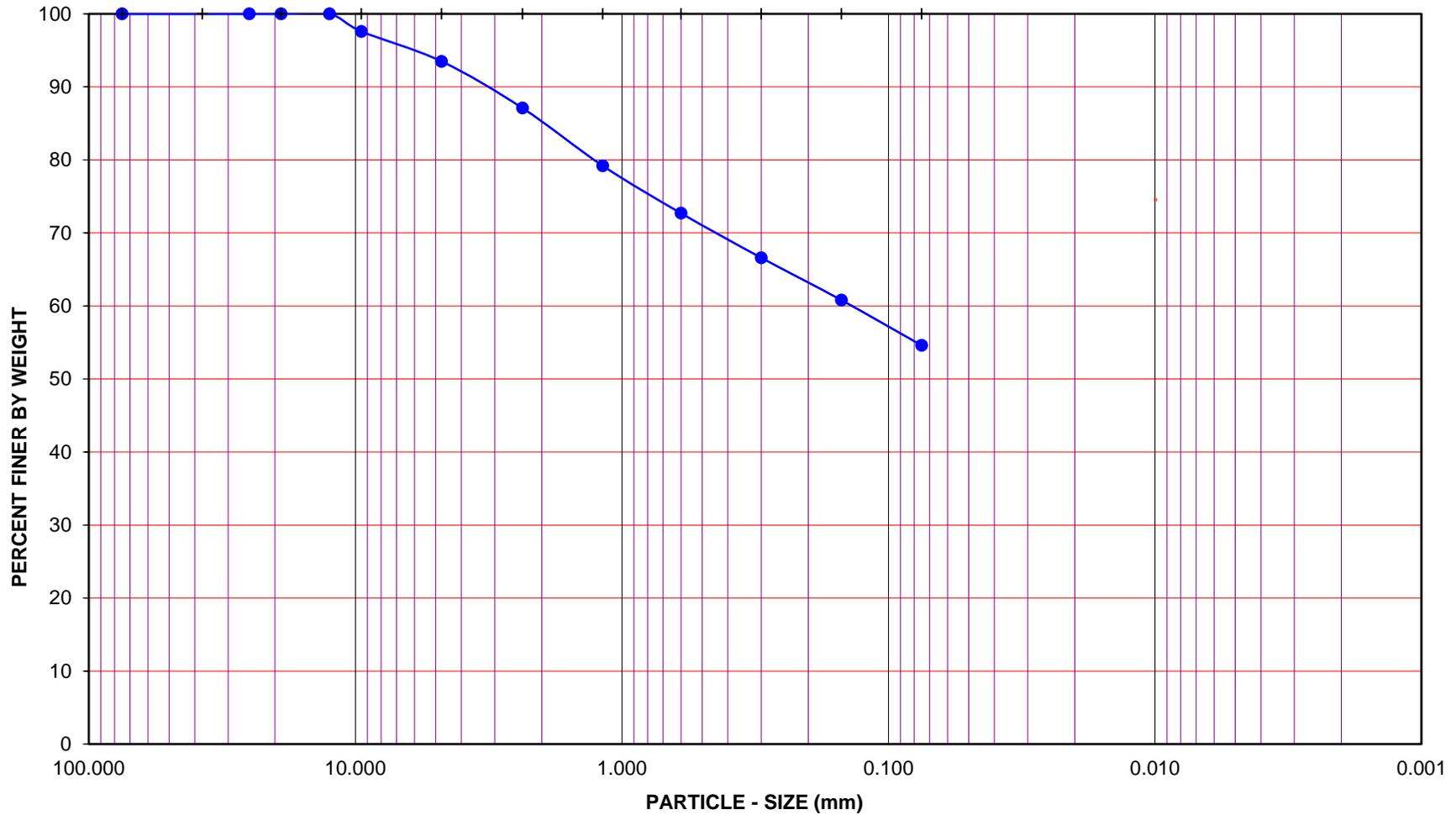
U.S. STANDARD SIEVE OPENING

3.0" 1 1/2" 3/4" 3/8"

U.S. STANDARD SIEVE NUMBER

#4 #8 #16 #30 #50 #100 #200

HYDROMETER



Project Name: TVUSD Winchester Steam

Project No.: 12236.002

Boring No.: LB-3

Sample No.: B-1

Depth (feet): 1.0 - 5.0

Soil Type : s(CL)

Soil Identification: Sandy Lean Clay s(CL), Dark Grayish Brown.

**GR:SA:FI : (%)      7 : 38 : 55**



**PARTICLE - SIZE  
DISTRIBUTION  
ASTM D 6913**

Mar-19

# ATTERBERG LIMITS

ASTM D 4318

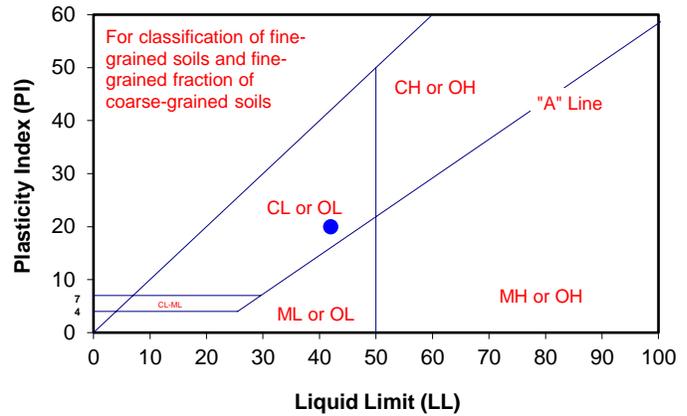
Project Name: TVUSD Winchester STEAM Tested By: M. Vinet Date: 3/14/19  
 Project No. : 12236.002 Input By: M. Vinet Date: 3/14/19  
 Boring No.: LB-3 Checked By: M. Vinet Date: 3/14/19  
 Sample No.: B-1 Depth (ft.) 1.0 - 5.0  
 Sample Description: Sandy Lean Clay s(CL), Dark Brown.

TEST NO.	PLASTIC LIMIT		LIQUID LIMIT			**IN-SITU
	1	2	1	2	3	MOISTURE
Number of Blows [N]			18	28	35	
Wet Wt. of Soil + Cont. (gm)	26.009	24.612	20.667	23.622	22.029	
Dry Wt. of Soil + Cont. (gm)	23.743	22.636	18.515	20.656	19.570	
Wt. of Container (gm)	13.397	13.615	13.563	13.512	13.491	
Moisture Content (%) [Wn]	21.9	21.9	43.5	41.5	40.5	

**Liquid Limit**  
**Plastic Limit**  
**Plasticity Index**  
**Classification**

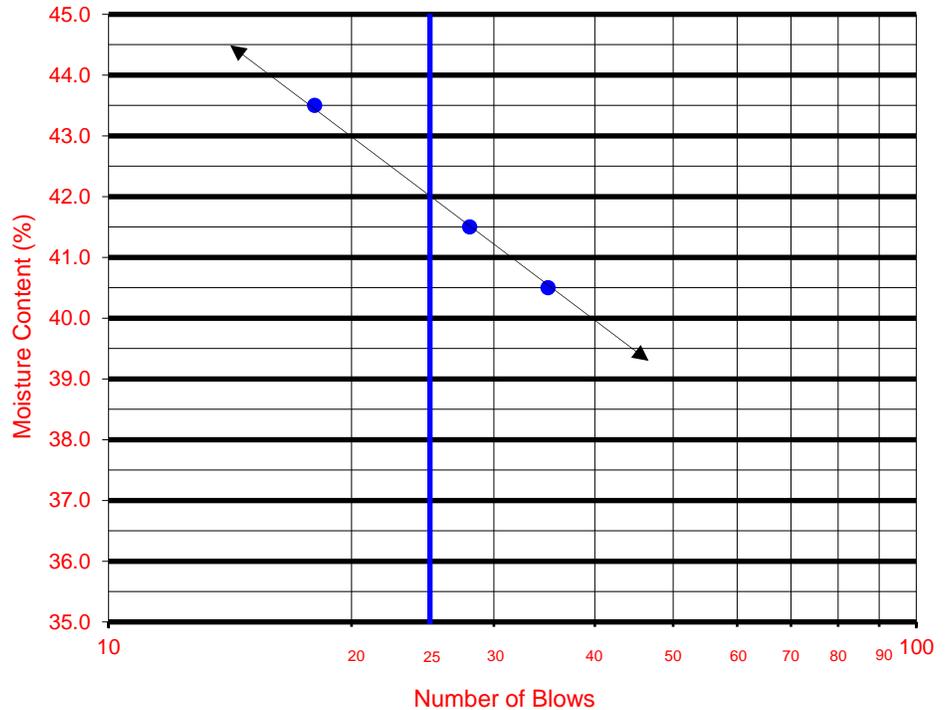
<b>42</b>
<b>22</b>
<b>20</b>
<b>CL</b>

PI at "A" - Line =  $0.73(LL-20)$  = **16.06**  
 One - Point Liquid Limit Calculation  
 $LL = Wn(N/25)^{0.121}$



**PROCEDURES USED**

- Wet Preparation Multipoint - Wet
- Dry Preparation Multipoint - Dry
- Procedure A Multipoint Test
- Procedure B One-point Test





# MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name: TVUSD Winchester STEAM Tested By: F. Mina Date: 03/07/19  
 Project No.: 12236.002 Input By: M. Vinet Date: 03/14/19  
 Boring No.: LB-3 Depth (ft.): 1.0 - 5.0  
 Sample No.: B-1  
 Soil Identification: Sandy Lean Clay s(CL), Dark Grayish Brown.

Preparation Method:

Moist  
 Dry

Mechanical Ram  
 Manual Ram

Mold Volume (ft<sup>3</sup>)

0.03340

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

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5470	5534	5542			
Weight of Mold (g)	3524	3524	3524			
Net Weight of Soil (g)	1946	2010	2018			
Wet Weight of Soil + Cont. (g)	2290.5	2403.5	2167.6			
Dry Weight of Soil + Cont. (g)	2135.2	2202.1	1937.6			
Weight of Container (g)	420.0	408.7	200.0			
Moisture Content (%)	9.1	11.2	13.2			
Wet Density (pcf)	128.4	132.7	133.2			
Dry Density (pcf)	117.8	119.3	117.6			

Maximum Dry Density (pcf)

119.3

Optimum Moisture Content (%)

11.2

### PROCEDURE USED

**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 +3/4 in. is <30%

### Particle-Size Distribution:

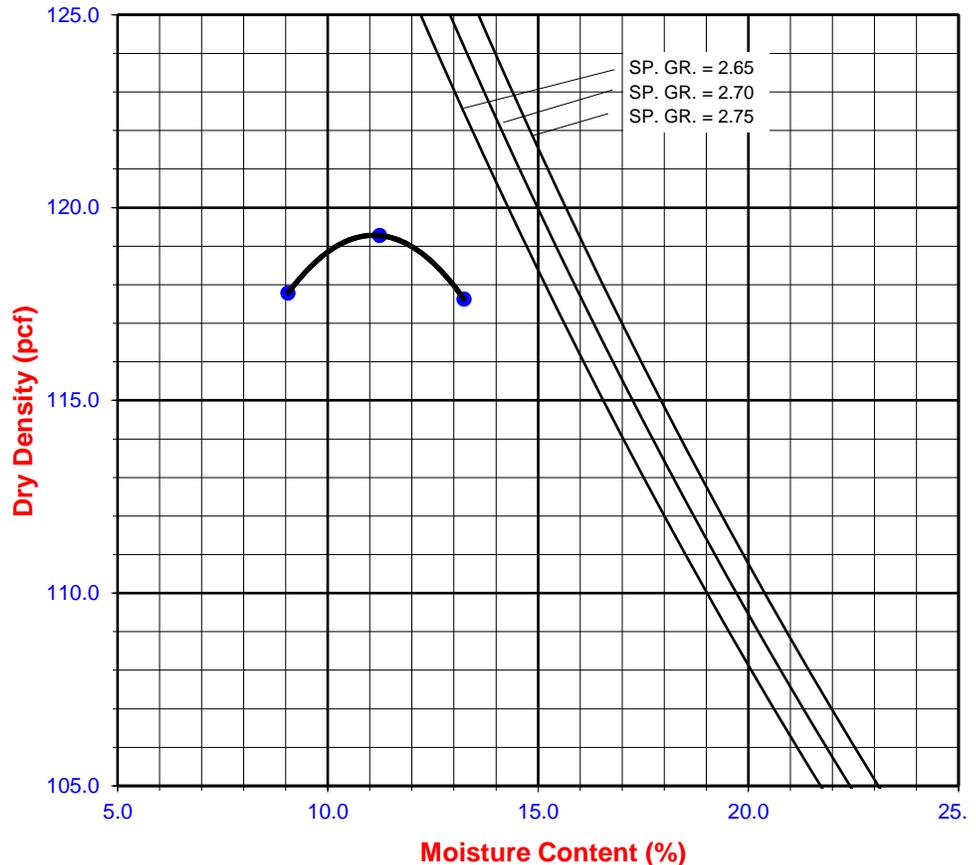
7:38:55

GR:SA:FI

### Atterberg Limits:

42:22:20

LL,PL,PI





# MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name: TVUSD Winchester STEAM Tested By: F. Mina Date: 03/07/19  
 Project No.: 12236.002 Input By: M. Vinet Date: 03/14/19  
 Boring No.: LB-5 Depth (ft.): 1.0 - 5.0  
 Sample No.: B-1  
 Soil Identification: Clayey Sand (SC), Dark Brown.

Preparation Method:

Moist  
 Dry

Mechanical Ram  
 Manual Ram

Mold Volume (ft<sup>3</sup>)

0.03340

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

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5500	5597	5624	5577		
Weight of Mold (g)	3524	3524	3524	3524		
Net Weight of Soil (g)	1976	2073	2100	2053		
Wet Weight of Soil + Cont. (g)	2290.5	2377.8	2400.8	2232.6		
Dry Weight of Soil + Cont. (g)	2155.2	2217.8	2202.2	2000.7		
Weight of Container (g)	85.1	312.1	309.2	217.1		
Moisture Content (%)	6.5	8.4	10.5	13.0		
Wet Density (pcf)	130.4	136.8	138.6	135.5		
Dry Density (pcf)	122.4	126.2	125.5	119.9		

Maximum Dry Density (pcf)

126.5

Optimum Moisture Content (%)

9.0

### PROCEDURE USED

**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

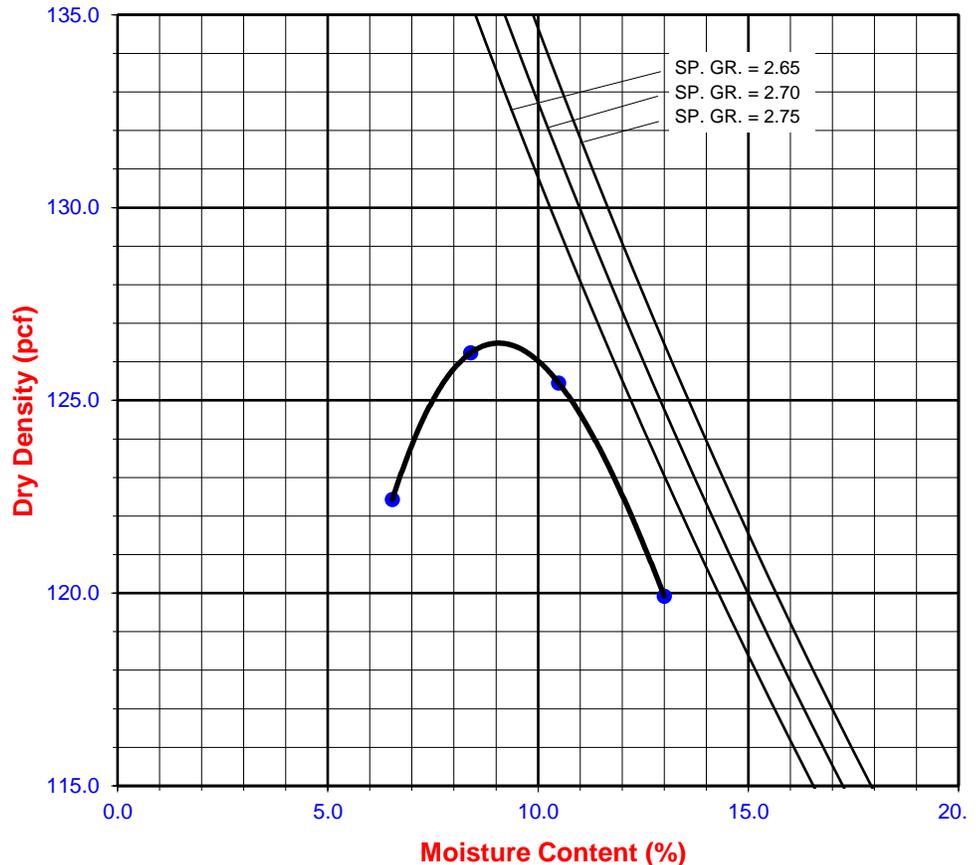
**Procedure C**  
 Soil Passing 3/4 in. (19.0 mm) Sieve  
 Mold : 6 in. (152.4 mm) diameter  
 Layers : 5 (Five)  
 Blows per layer : 56 (fifty-six)  
 Use if +3/8 in. is >20% and +3/4 in. is <30%

### Particle-Size Distribution:

GR:SA:FI

### Atterberg Limits:

LL,PL,PI





# MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name: TVUSD Winchester STEAM Tested By: F. Mina Date: 03/07/19  
 Project No.: 12236.002 Input By: M. Vinet Date: 03/14/19  
 Boring No.: LB-6 Depth (ft.): 5.5 - 8.0  
 Sample No.: B-1  
 Soil Identification: Clayey Sand (SC), Dark Brown.

Preparation Method:

Moist  
 Dry

Mechanical Ram  
 Manual Ram

Mold Volume (ft<sup>3</sup>)

0.03340

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

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5625	5725	5743	5670		
Weight of Mold (g)	3524	3524	3524	3524		
Net Weight of Soil (g)	2101	2201	2219	2146		
Wet Weight of Soil + Cont. (g)	2290.5	2316.4	2354.4	2272.6		
Dry Weight of Soil + Cont. (g)	2219.0	2191.1	2190.1	2072.6		
Weight of Container (g)	420.0	130.6	137.2	144.3		
Moisture Content (%)	4.0	6.1	8.0	10.4		
Wet Density (pcf)	138.7	145.3	146.5	141.6		
Dry Density (pcf)	133.4	137.0	135.6	128.3		

Maximum Dry Density (pcf)

137.0

Optimum Moisture Content (%)

6.3

### PROCEDURE USED

**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

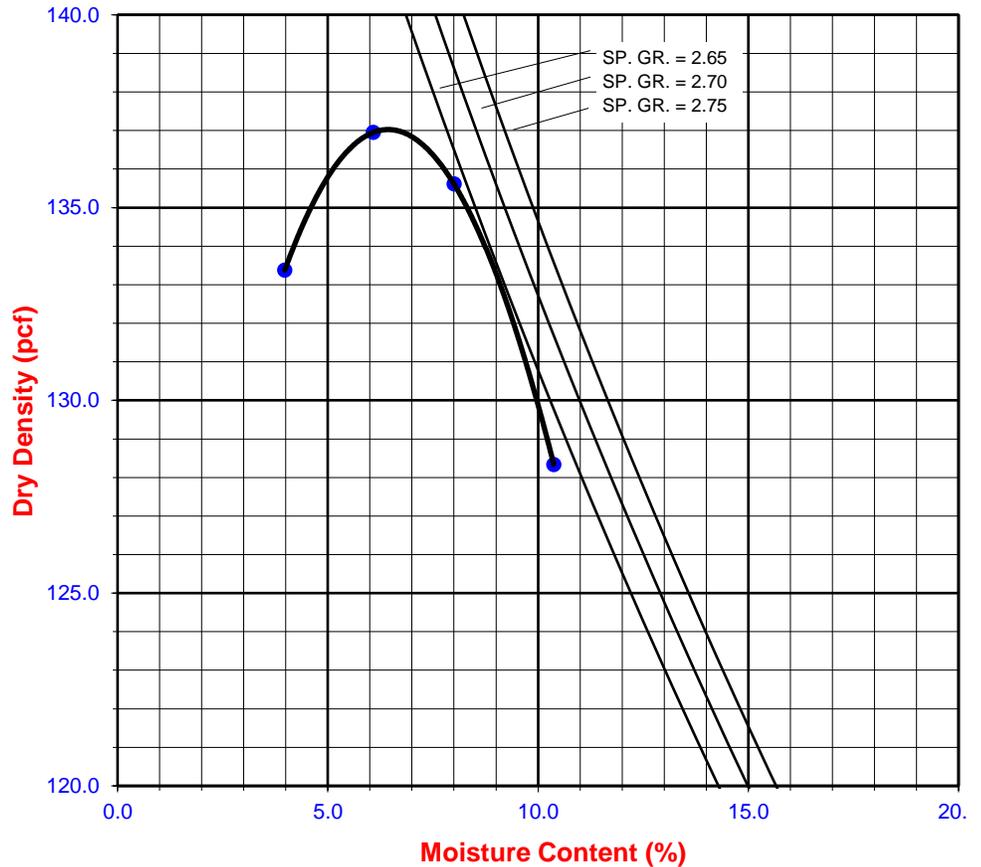
**Procedure C**  
 Soil Passing 3/4 in. (19.0 mm) Sieve  
 Mold : 6 in. (152.4 mm) diameter  
 Layers : 5 (Five)  
 Blows per layer : 56 (fifty-six)  
 Use if +3/8 in. is >20% and +3/4 in. is <30%

### Particle-Size Distribution:

GR:SA:FI

### Atterberg Limits:

LL,PL,PI





Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name: TVUSD Winchester STEAM Tested By: F. Mina Date: 3/7/19  
 Project No. : 12236.002 Checked By: M. Vinet Date: 3/14/19  
 Boring No.: LB-3 Depth: 1.0 - 5.0  
 Sample No. : B-1 Location: N/A  
 Sample Description: Sandy Lean Clay s(CL), Dark Grayish Brown.

Dry Wt. of Soil + Cont. (gm.)	2124.8
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2124.8
Weight Soil Retained on #4 Sieve	131.8
Percent Passing # 4	93.8

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0469
Wt. Comp. Soil + Mold (gm.)	560.8	605.1
Wt. of Mold (gm.)	180.3	180.3
Specific Gravity (Assumed)	2.70	2.70
Container No.	9	9
Wet Wt. of Soil + Cont. (gm.)	350.2	605.1
Dry Wt. of Soil + Cont. (gm.)	316.9	338.2
Wt. of Container (gm.)	50.2	180.3
Moisture Content (%)	12.5	25.6
Wet Density (pcf)	114.8	122.4
Dry Density (pcf)	102.0	97.5
Void Ratio	0.652	0.730
Total Porosity	0.395	0.422
Pore Volume (cc)	81.7	91.4
Degree of Saturation (%) [ S meas]	<b>51.7</b>	<b>94.7</b>

**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.)
3/7/19	11:30	1.0	0	0.5000
3/7/19	11:40	1.0	10	0.5000
Add Distilled Water to the Specimen				
3/8/19	9:00	1.0	1280	0.5469
3/8/19	10:00	1.0	1340	0.5469

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	<b>46.9</b>
Expansion Index ( Report ) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Height	<b>47</b>



Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name: TVUSD Winchester STEAM Tested By: F. Mina Date: 3/7/19  
 Project No. : 12236.002 Checked By: M. Vinet Date: 3/14/19  
 Boring No.: LB-5 Depth: 1.0 - 5.0  
 Sample No. : B-1 Location: N/A  
 Sample Description: Clayey Sand (SC), Dark Brown.

Dry Wt. of Soil + Cont. (gm.)	8359.5
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	8359.5
Weight Soil Retained on #4 Sieve	1970.0
Percent Passing # 4	76.4

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0515
Wt. Comp. Soil + Mold (gm.)	590.6	630.6
Wt. of Mold (gm.)	200.6	200.6
Specific Gravity (Assumed)	2.70	2.70
Container No.	11	11
Wet Wt. of Soil + Cont. (gm.)	339.4	630.6
Dry Wt. of Soil + Cont. (gm.)	308.5	349.8
Wt. of Container (gm.)	39.4	200.6
Moisture Content (%)	11.5	22.9
Wet Density (pcf)	117.6	123.4
Dry Density (pcf)	105.5	100.3
Void Ratio	0.598	0.680
Total Porosity	0.374	0.405
Pore Volume (cc)	77.4	88.1
Degree of Saturation (%) [ S meas]	<b>51.9</b>	<b>91.1</b>

**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.)
3/7/19	9:30	1.0	0	0.5000
3/7/19	9:40	1.0	10	0.5000
Add Distilled Water to the Specimen				
3/8/19	9:00	1.0	1400	0.5515
3/8/19	10:00	1.0	1460	0.5515

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	<b>51.5</b>
Expansion Index ( Report ) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Height	<b>52</b>



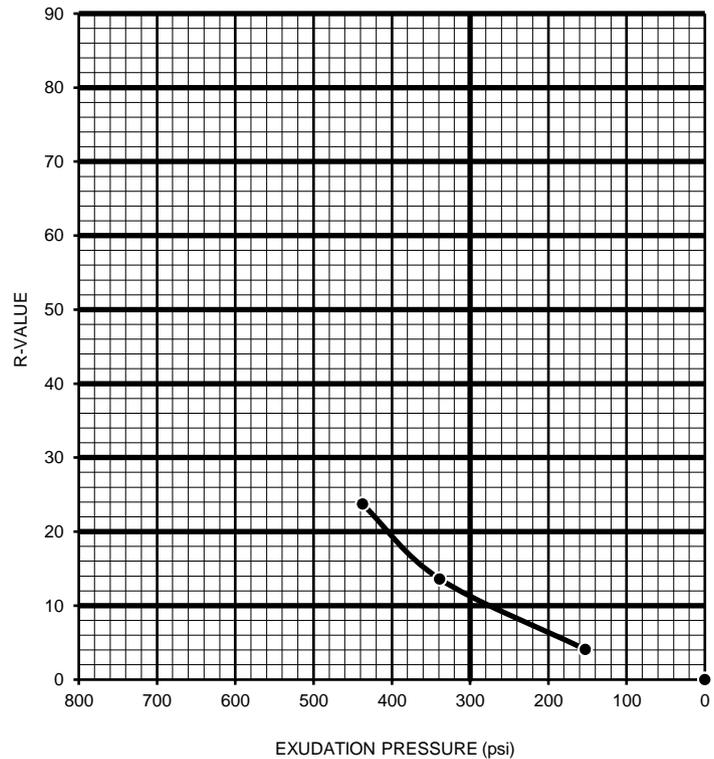
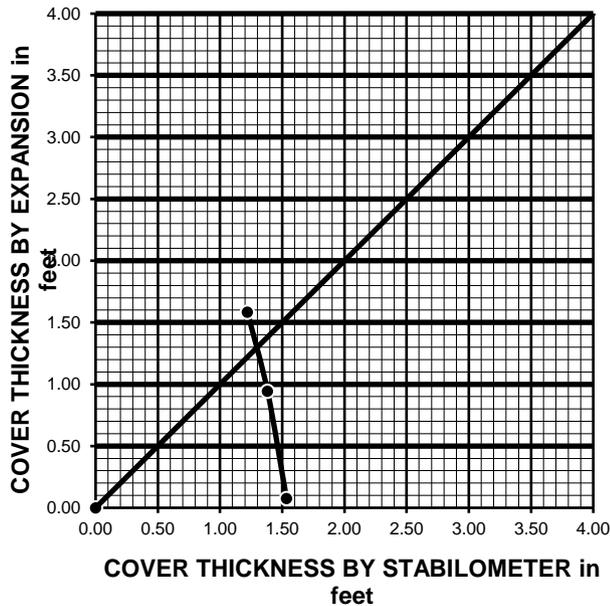
Leighton

# R-VALUE TEST RESULTS

Project Name:	<u>TVUSD Winchester STEAM</u>	Date:	<u>3/7/19</u>
Project Number:	<u>12236.002</u>	Technician:	<u>F. Mina</u>
Boring Number:	<u>LB-2</u>	Depth (ft.):	<u>1.0 - 5.0</u>
Sample Number:	<u>B-1</u>	Sample Location:	<u>N/A</u>
Sample Description:	<u>Sandy Lean Clay s(CL), Grayish Blue</u>		

TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	10.1	10.7	12.8
HEIGHT OF SAMPLE, Inches	2.51	2.50	2.52
DRY DENSITY, pcf	118.8	117.3	114.4
COMPACTOR AIR PRESSURE, psi	135	125	75
EXUDATION PRESSURE, psi	438	339	153
EXPANSION, Inches x 10exp-4	42	25	2
STABILITY Ph 2,000 lbs (160 psi)	107	126	149
TURNS DISPLACEMENT	3.98	4.28	4.34
R-VALUE UNCORRECTED	24	14	4
R-VALUE CORRECTED	24	14	4

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.	1.22	1.38	1.53
EXPANSION PRESSURE THICKNESS, ft.	1.58	0.94	0.08



R-VALUE BY EXPANSION: 19

R-VALUE BY EXUDATION: 11

EQUILIBRIUM R-VALUE: 11



# One-Dimensional Swell or Settlement Potential of Cohesive Soils (ASTM D 4546) -- Method 'B'

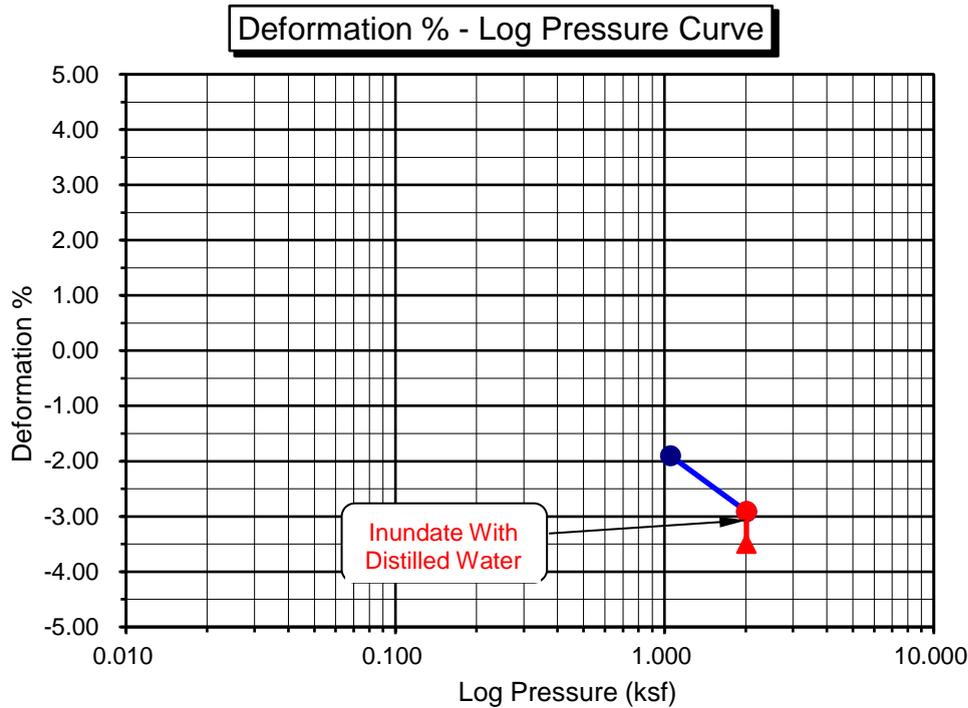
Project Name: TVUSD Winchester STEAM      Tested By: M. Vinet      Date: 3/8/19  
 Project No.: 12236.002      Checked By: M. Vinet      Date: 3//14  
 Boring No.: LB-5      Sample Type: IN SITU  
 Sample No.: R-1      Depth (ft.) 5.0  
 Sample Description: Silty Clay (CL-ML), Dark Brown.  
 Source and Type of Water Used for Inundation: Arrowhead ( Distilled )  
 \*\* Note: Loading After Wetting (Inundation) not Performed Using this Test Method.

Initial Dry Density (pcf):	85.8
Initial Moisture (%):	31.0
Initial Height (in.):	1.0000
Initial Dial Reading (in):	0.0000
Inside Diameter of Ring (in):	2.416

Final Dry Density (pcf):	88.9
Final Moisture (%) :	32.9
Initial Void ratio:	0.9636
Specific Gravity (assumed):	2.70
Initial Degree of Saturation (%):	86.8

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.050	0.0190	0.9810	0.00	-1.90	0.9263	-1.90
2.013	0.0291	0.9709	0.00	-2.91	0.9065	-2.91
H2O	0.0349	0.9651	0.00	-3.49	0.8951	-3.49

**Percent Swell / Settlement After Inundation = -0.60**





# One-Dimensional Swell or Settlement Potential of Cohesive Soils (ASTM D 4546) -- Method 'B'

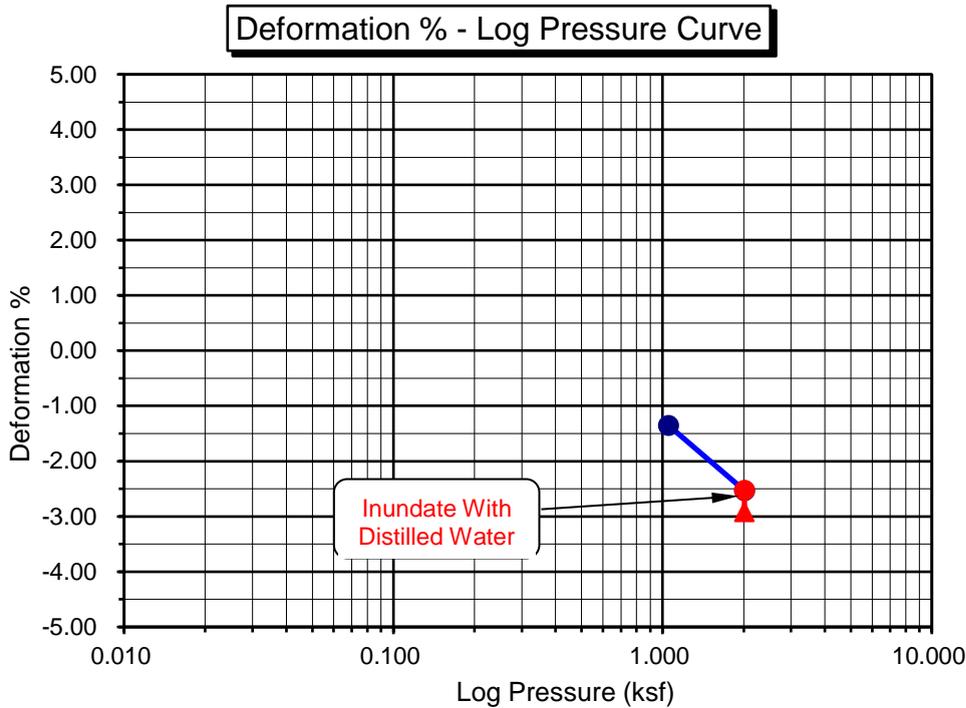
Project Name: TVUSD Winchester STEAM      Tested By: M. Vinet      Date: 3/8/19  
 Project No.: 12236.002      Checked By: M. Vinet      Date: 3//14  
 Boring No.: LB-6      Sample Type: IN SITU  
 Sample No.: R-3      Depth (ft.) 10.0  
 Sample Description: Lean Clay (CL), Yellowish Gray  
 Source and Type of Water Used for Inundation: Arrowhead ( Distilled )  
 \*\* Note: Loading After Wetting (Inundation) not Performed Using this Test Method.

Initial Dry Density (pcf):	91.5
Initial Moisture (%):	28.8
Initial Height (in.):	1.0000
Initial Dial Reading (in):	0.0000
Inside Diameter of Ring (in):	2.416

Final Dry Density (pcf):	94.2
Final Moisture (%) :	30.2
Initial Void ratio:	0.8423
Specific Gravity (assumed):	2.70
Initial Degree of Saturation (%):	92.3

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.050	0.0135	0.9865	0.00	-1.35	0.8175	-1.35
2.013	0.0253	0.9747	0.00	-2.53	0.7957	-2.53
H2O	0.0292	0.9708	0.00	-2.92	0.7885	-2.92

**Percent Swell / Settlement After Inundation = -0.40**





## TESTS for SULFATE CONTENT

Project Name: TVUSD Winchester STEAM  
 Project No. : 12236.002

Tested By : F. Mina Date: 03/11/19  
 Data Input By: M. Vinet Date: 03/14/19

Boring No.	LB-3	LB-5		
Sample No.	B-1	B-1		
Sample Depth (ft)	1.0 - 5.0	1.0 - 5.0		
Soil Identification:				
	s(CL)	SC		
Wet Weight of Soil + Container (g)	100.00	100.00		
Dry Weight of Soil + Container (g)	100.00	100.00		
Weight of Container (g)	0.00	0.00		
Moisture Content (%)	0.00	0.00		
Weight of Soaked Soil (g)	100.00	100.00		

### SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	1	2		
Crucible No.	1	2		
Furnace Temperature (°C)	850	850		
Time In / Time Out	Timer	Timer		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	26.0980	24.4722		
Wt. of Crucible (g)	26.0940	24.4667		
Wt. of Residue (g) (A)	0.0040	0.0055		
PPM of Sulfate (A) x 41150	164.60	226.33		
<b>PPM of Sulfate, Dry Weight Basis</b>	<b>165</b>	<b>226</b>		

## **APPENDIX C**

### **SETTLTMENT AND SEISMIC ANALYSIS**

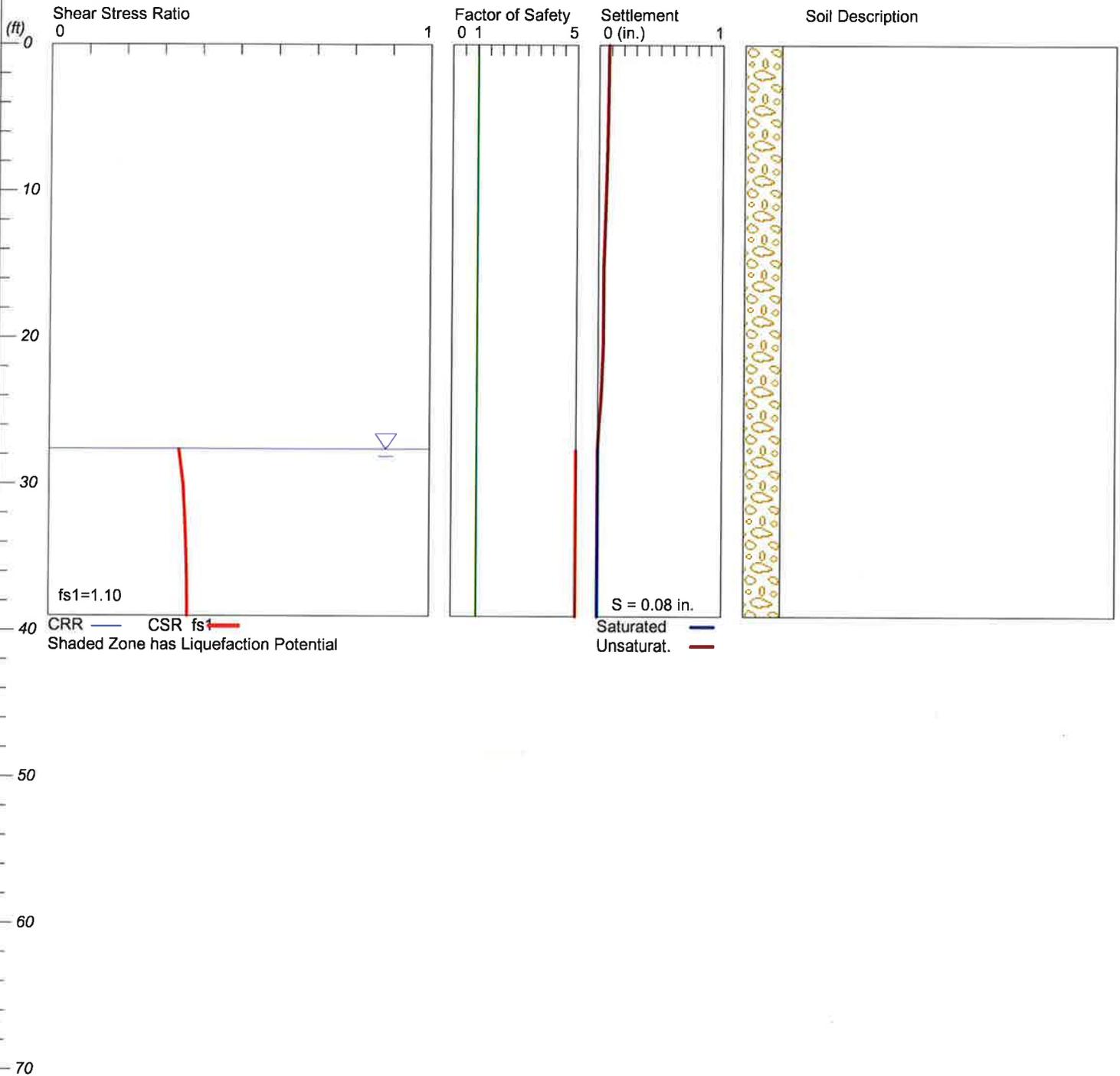


# DRY SETTLEMENT ANALYSIS

## Winchester STEAM Academy

Hole No.=LB-3 Water Depth=27.6 ft Surface Elev.=1446

Magnitude=7.2  
Acceleration=0.51g



LiquefyPro CivilTech Software USA www.civilttech.com

**▲ This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.**

**ATC Hazards by Location**

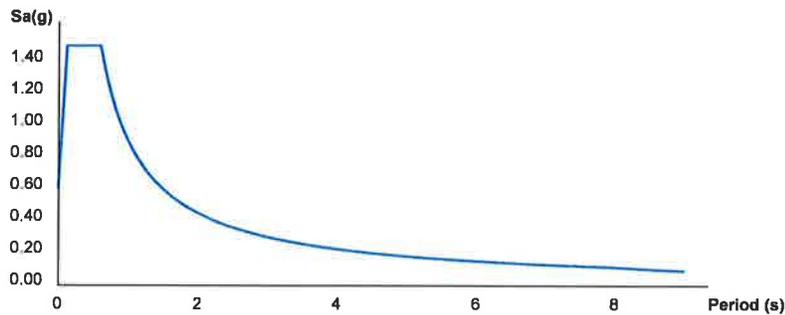
**Search Information**

Coordinates: 33.60706, -117.08512  
 Elevation: 1447 ft  
 Timestamp: 2019-02-18T20:09:23.379Z  
 Hazard Type: Seismic  
 Reference Document: ASCE7-10  
 Risk Category: III  
 Site Class: D  
 Report Title: Not specified

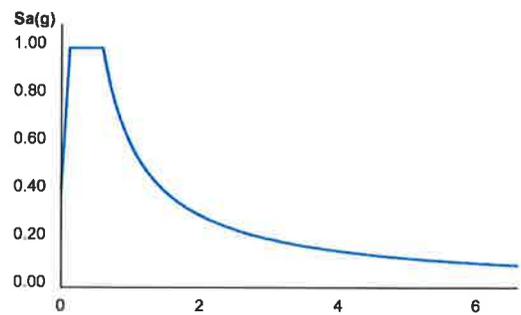
**Map Results**



**MCE<sub>R</sub> Horizontal Response Spectrum**



**Design Horizontal Response Spectrum**



**Text Results**

**Basic Parameters**

Name	Value	Description
S <sub>s</sub>	1.5	MCE <sub>R</sub> ground motion (period=0.2s)
S <sub>1</sub>	0.6	MCE <sub>R</sub> ground motion (period=1.0s)
S <sub>MS</sub>	1.5	Site-modified spectral acceleration value
S <sub>M1</sub>	0.9	Site-modified spectral acceleration value
S <sub>DS</sub>	1	Numeric seismic design value at 0.2s SA
S <sub>D1</sub>	0.6	Numeric seismic design value at 1.0s SA

**Additional Information**

Name	Value	Description
SDC	D	Seismic design category
F <sub>a</sub>	1	Site amplification factor at 0.2s

F <sub>v</sub>	1.5	Site amplification factor at 1.0s
CR <sub>S</sub>	1.034	Coefficient of risk (0.2s)
CR <sub>1</sub>	1.017	Coefficient of risk (1.0s)
PGA	0.509	MCE <sub>G</sub> peak ground acceleration
F <sub>PGA</sub>	1	Site amplification factor at PGA
PGA <sub>M</sub>	0.509	Site modified peak ground acceleration
T <sub>L</sub>	8	Long-period transition period (s)
SsRT	1.68	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.624	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.645	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.634	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGA <sub>d</sub>	0.509	Factored deterministic acceleration value (PGA)

*The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.*

**Disclaimer**

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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## **APPENDIX D**

### **EARTHWORK AND GRADING SPECIFICATIONS**



APPENDIX D

LEIGHTON CONSULTING, INC.  
EARTHWORK AND GRADING GUIDE SPECIFICATIONS

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## D - 1 . 0 G E N E R A L

### **D-1.1 Intent**

These Earthwork and Grading Guide Specifications are for grading and earthwork shown on the current, approved grading plan(s) and/or indicated in the Leighton Consulting, Inc. geotechnical report(s). These Guide Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the project-specific recommendations in the geotechnical report shall supersede these Guide Specifications. Leighton Consulting, Inc. shall provide geotechnical observation and testing during earthwork and grading. Based on these observations and tests, Leighton Consulting, Inc. may provide new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

### **D-1.2 Role of Leighton Consulting, Inc.**

Prior to commencement of earthwork and grading, Leighton Consulting, Inc. shall meet with the earthwork contractor to review the earthwork contractor's work plan, to schedule sufficient personnel to perform the appropriate level of observation, mapping and compaction testing. During earthwork and grading, Leighton Consulting, Inc. shall observe, map, and document subsurface exposures to verify geotechnical design assumptions. If observed conditions are found to be significantly different than the interpreted assumptions during the design phase, Leighton Consulting, Inc. shall inform the owner, recommend appropriate changes in design to accommodate these observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include (1) natural ground after clearing to receiving fill but before fill is placed, (2) bottoms of all "remedial removal" areas, (3) all key bottoms, and (4) benches made on sloping ground to receive fill.

Leighton Consulting, Inc. shall observe moisture-conditioning and processing of the subgrade and fill materials, and perform relative compaction testing of fill to determine the attained relative compaction. Leighton Consulting, Inc. shall provide *Daily Field Reports* to the owner and the Contractor on a routine and frequent basis.

### **D-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 Guide

Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing grading and backfilling in accordance with the current, approved plans and specifications.

The Contractor shall inform the owner and Leighton Consulting, Inc. of changes in work schedules at least one working day in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that Leighton Consulting, Inc. is aware of all grading operations.

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

## D - 2 . 0 P R E P A R A T I O N O F A R E A S T O B E F I L L E D

### **D-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 Leighton Consulting, Inc.. Care should be taken not to encroach upon or otherwise damage native and/or historic trees designated by the Owner or appropriate agencies to remain. Pavements, flatwork or other construction should not extend under the “drip line” of designated trees to remain.

Leighton Consulting, Inc. shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 3 percent of organic materials (by dry weight: ASTM D 2974). 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.

### **D-2.2 Processing**

Existing ground that has been declared satisfactory for support of fill, by Leighton Consulting, Inc., shall be scarified to a minimum depth of 6 inches (15 cm). Existing ground that is not satisfactory shall be over-excavated as specified in the following Section D-2.3. 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.

### **D-2.3 Overexcavation**

In addition to removals and over-excavations 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 over-excavated to competent ground as evaluated by Leighton Consulting, Inc. during grading. All undocumented fill soils under proposed structure footprints should be excavated

### **D-2.4 Benching**

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), (>20 percent grade) the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet (4.5 m) wide and at least 2 feet (0.6 m) deep, into competent material as evaluated by Leighton Consulting, Inc.. Other benches shall be excavated a minimum height of 4 feet (1.2 m) into competent material or as otherwise recommended by Leighton Consulting, Inc.. Fill placed on ground sloping flatter than 5:1 (horizontal to vertical units), (<20 percent grade) shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

### **D-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 Leighton Consulting, Inc. as suitable to receive fill. The Contractor shall obtain a written acceptance (*Daily Field Report*) from Leighton Consulting, Inc. prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys and benches.

## D - 3 . 0 F I L L M A T E R I A L

### **D-3.1 Fill Quality**

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by Leighton Consulting, Inc. 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 Leighton Consulting, Inc. or mixed with other soils to achieve satisfactory fill material.

### **D-3.2 Oversize**

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 6 inches (15 cm), shall not be buried or placed in fill unless location, materials and placement methods are specifically accepted by Leighton Consulting, Inc.. 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 feet (3 m) measured vertically from finish grade, or within 2 feet (0.61 m) of future utilities or underground construction.

### **D-3.3 Import**

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section D-3.1, and be free of hazardous materials (“contaminants”) and rock larger than 3-inches (8 cm) in largest dimension. All import soils shall have an Expansion Index (EI) of 20 or less and a sulfate content no greater than ( $\leq$ ) 500 parts-per-million (ppm). A representative sample of a potential import source shall be given to Leighton Consulting, Inc. at least four full working days before importing begins, so that suitability of this import material can be determined and appropriate tests performed.

## D - 4 . 0 F I L L P L A C E M E N T A N D C O M P A C T I O N

### **D-4.1 Fill Layers**

Approved fill material shall be placed in areas prepared to receive fill, as described in Section D-2.0, above, in near-horizontal layers not exceeding 8 inches (20 cm) in loose thickness. Leighton Consulting, Inc. may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers, and only if the building officials with the appropriate jurisdiction approve. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

**D-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 D 1557.

**D-4.3 Compaction of Fill**

After each layer has been moisture-conditioned, mixed, and evenly spread, each layer shall be uniformly compacted to not-less-than ( $\geq$ ) 90 percent of the maximum dry density as determined by ASTM Test Method D 1557. In some cases, structural fill may be specified (see project-specific geotechnical report) to be uniformly compacted to at-least ( $\geq$ ) 95 percent of the ASTM D 1557 modified Proctor laboratory maximum dry density. For fills thicker than ( $>$ ) 15 feet (4.5 m), the portion of fill deeper than 15 feet below proposed finish grade shall be compacted to 95 percent of the ASTM D 1557 laboratory maximum density. 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.

**D-4.4 Compaction of Fill Slopes**

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by back rolling of slopes with sheepfoot rollers at increments of 3 to 4 feet (1 to 1.2 m) in fill elevation, or by other methods producing satisfactory results acceptable to Leighton Consulting, Inc.. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of the ASTM D 1557 laboratory maximum density.

**D-4.5 Compaction Testing**

Field-tests for moisture content and relative compaction of the fill soils shall be performed by Leighton Consulting, Inc.. Location and frequency of tests shall be at our field representative(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).

**D-4.6 Compaction Test Locations**

Leighton Consulting, Inc. shall document the approximate elevation and horizontal coordinates of each density test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that Leighton

Consulting, Inc. can determine the test locations with sufficient accuracy. Adequate grade stakes shall be provided.

#### D - 5 . 0 E X C A V A T I O N

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by Leighton Consulting, Inc. during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by Leighton Consulting, Inc. 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, then observed and reviewed by Leighton Consulting, Inc. prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by Leighton Consulting, Inc..

#### D - 6 . 0 T R E N C H B A C K F I L L S

##### **D-6.1 Safety**

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations. Work should be performed in accordance with Article 6 of the *California Construction Safety Orders*, 2009 Edition or more current (see also: <http://www.dir.ca.gov/title8/sb4a6.html> ).

##### **D-6.2 Bedding and Backfill**

All utility trench bedding and backfill shall be performed in accordance with applicable provisions of the 2015 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Bedding material shall have a Sand Equivalent greater than 30 (SE>30). Bedding shall be placed to 1-foot (0.3 m) over the top of the conduit, and densified by jetting in areas of granular soils, if allowed by the permitting agency. Otherwise, the pipe-bedding zone should be backfilled with Controlled Low Strength Material (CLSM) consisting of at least one sack of Portland cement per cubic-yard of sand, and conforming to Section 201-6 of the 2015 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Backfill over the bedding zone shall be placed and densified mechanically to a minimum of 90 percent of relative compaction (ASTM D 1557) from 1 foot (0.3 m) above the top of the conduit to the surface. Backfill above the pipe zone shall **not** be jetted. Jetting of the bedding around the conduits shall be observed by Leighton Consulting, Inc. and backfill above the pipe zone (bedding) shall be observed and tested by Leighton Consulting, Inc..

**D-6.3 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 Leighton Consulting, Inc. that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method, and only if the building officials with the appropriate jurisdiction approve.

## APPENDIX E

### GBA – IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL 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, clients can benefit from a lowered exposure to the subsurface problems 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 below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## **Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects**

Geotechnical engineers structure their services to meet the specific needs 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. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

## **Read this Report in Full**

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

## **You Need to Inform Your Geotechnical Engineer about Change**

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project 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.*

## **This Report May Not Be Reliable**

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

- for a different client;
- for a different project;
- 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, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been 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 your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

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

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment 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 from project start to project finish, so the individual can provide 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 judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed 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 full-time 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 on hand quickly 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 observation.

## 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 informational 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, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. 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. 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 relate any 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 yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

## 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, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled 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*.



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