GEOTECHNICAL INVESTIGATION

Bretton Woods
West Covell Boulevard and Risling Court
Davis, California

PREPARED FOR:

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GEOCON

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CONSULTANTS, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

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VIA ELECTRONIC MAIL

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Subject: GEOTECHNICAL INVESTIGATION
BRETTON WOODS
WEST COVELL BOULEVARD AND RISLING COURT
DAVIS, CALIFORNIA

Mr. Taormino:

In accordance with your authorization of our proposal (Geocon Proposal No. LS-18-345), dated November 14, 2018, we performed a geotechnical investigation for the proposed Bretton Woods development located at the northwest corner of the intersection of West Covell Boulevard and Risling Court in Davis, California.

The accompanying report presents our findings, conclusions, and recommendations regarding geotechnical aspects of developing the site as presently proposed. In our opinion, no adverse geotechnical conditions were encountered that would preclude development at the site provided recommendations of this report are incorporated into the design and construction of the project.

Please contact us if you have any questions regarding this report or if we may be of further service.

Respectfully Submitted,

GEOCON CONSULTANTS, INC.

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GEOTECHNICAL INVESTIGATION

1.0 PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for the proposed Bretton Woods development at the northwest corner of the intersection of West Covell Boulevard and Risling Court in Davis, California. The approximate site location is depicted on the Vicinity Map, Figure 1.

The purpose of our investigation was to evaluate subsurface soil and geologic conditions at the site and provide conclusions and recommendations relative to the geotechnical aspects of designing and constructing the project as presently proposed.

To prepare this report, we:

- Performed a limited geologic literature review to aid in evaluating the geologic and seismic conditions present at the site. A list of referenced material is included in Section 9.0 of this report.
- Reviewed available conceptual plans to select exploratory boring locations.
- Performed a site reconnaissance to review project limits, determine exploration equipment access, and mark out exploratory excavation locations.
- Notified subscribing utility companies via Underground Service Alert (USA) a minimum of two working days (as required by law) prior to performing excavations at the site.
- Paid required fees and obtained a soil boring permit from the Yolo County Environmental Health Department (YCEHD).
- Performed one exploratory boring (Boring B1) with a track-mounted drill rig equipped with 6-inch diameter hollow-stem augers to a depth of approximately 48 feet.
- Performed 15 exploratory test pits (TP1 through TP15) using a track-mounted mini-excavator with a 12-inch bucket to depths ranging from 6 to 8 feet.
- Obtained representative samples from the exploratory boring and test pits.
- Logged the boring and test pits in general accordance with the Unified Soil Classification System (USCS).
- Upon completion, backfilled the exploratory boring with soil neat cement grout per YCEHD and test pits with the excavated soil.
- Performed laboratory tests to evaluate pertinent geotechnical parameters.
- Prepared this report summarizing our findings, conclusions, and recommendations regarding the geotechnical aspects of site improvements as presently proposed.

Details of our field exploration program including boring and test pit logs are presented in Appendix A. Approximate locations of our exploratory boring and test pits are shown on the Site Plan, Figure 2 and Proposed Development Plan, Figure 3. Details of our laboratory testing program and test results are summarized in Appendix B. Landscape soil suitability test results and recommendations performed by Sunland Analytical Laboratory are presented in Appendix C.

2.0 SITE AND PROJECT DESCRIPTION

The approximate 75-acre site consists of mostly agricultural land with a former construction staging/laydown area within the southeast portion, now used as a parking area (see Figure 2). Near-surface soil across the site has been repeatedly loosened and disturbed as a result of tilling, discing, and planting associated with agricultural practices. The site is bounded by West Covell Boulevard to the south, Risling Court to the east, and agricultural land to the west and north. Approximate site coordinates are 38.5649˚N latitude and -121.7745˚W longitude (WGS84 coordinates). The site is relatively flat and level with approximate surface elevations on the order of 46 to 52 feet above mean sea level (MSL) according to web-based mapping. The current site configuration is shown on the Site Plan, Figure 2.

The project consists of developing approximately 561 residential units consisting of a mix of single-family units, custom builder units, bungalows, cottages, multi-family units, condominiums, affordable apartments, and specialized senior care units or facility. We expect that the single-family, bungalow, and cottage units will be 1- to 2-story buildings and the multi-family, condominium, and apartments will be 2- to 4-story buildings. We expect conventional wood-frame construction, supported on either post-tensioned (PT) slabs or conventional reinforced slab-on-grade foundations with continuous perimeter footings. Other planned improvements will include underground utility infrastructure, roadways/street improvements, and landscaping. We anticipate that site grading will include cuts and fills on the order of 3 to 5 feet or less. Some underground utility infrastructure may require deeper excavations; up to 8 feet anticipated at this time. Excavation around the perimeter of the site and in an anticipated offsite basin will be on the order of 10 feet below existing grade. The proposed site configuration is shown on the Proposed Development Plan, Figure 3.

3.0 SOIL AND GEOLOGIC CONDITIONS

We identified geologic and soil conditions by observing and sampling our test pits and boring and reviewing the referenced geologic literature (Section 9.0). Soil descriptions below include the USCS symbol where applicable.

3.1 Site and Regional Geology

The site is located within the Great Valley Geomorphic Province of California, more commonly referred to as the Sacramento Valley. The Sacramento Valley is a broad depression bounded by the Sierra Nevada range to the east and the Coast Ranges to the west. The Sacramento Valley has been filled with a thick sequence of sediments derived from weathering of adjacent mountain ranges resulting in a stratigraphic section of Cretaceous, Tertiary, and Quaternary deposits.

Based on the *Preliminary Geologic Map of the Sacramento 30' x 60' Quadrangle*, California Geological Survey (CGS), 2011, the site is underlain by Quaternary-aged Alluvial Basin Deposits in the northern portion of the site and Older Alluvium in the southern portion of the site (map symbols Qhb and Qoa, respectively) described as interbedded layers of clay, silt, sand and gravel deposited by rivers and streams. A portion of the geologic map covering the site vicinity is presented as Figure 4.

3.2 Fill

Although not encountered in our borings or test pits, fill may be encountered during grading within the former construction staging area/parking lot depicted on the Site Plan, Figure 2. If encountered, removal and re-compaction will be required in development areas during site grading.

3.3 Alluvium

We encountered alluvium in our exploratory boring and test pits to the maximum depth explored of approximately 48 feet. The alluvium generally consists of interbedded layers of stiff to hard lean clay with sand (CL), fat clay (CH), silty clay (CL-ML) and medium dense clayey sand (SC). Laboratory Plasticity Index (PI) and Expansion Index (EI) Tests indicate moderate to high plasticity and expansion potential.

The near-surface soils have been repeatedly disturbed as a result of past agricultural discing/tilling operations ("Till Zone"). Because of the variably loose and disturbed consistency, tilled alluvial soils, in their existing condition, are not suitable for direct support of additional fill or building improvements. Preliminary overexcavation, scarification, and re-compaction recommendations are provided in this report.

Soil conditions described in the previous paragraphs are generalized. The exploratory boring and test pit logs included in Appendix A detail soil type, color, moisture, consistency, and USCS classification of the soils encountered at specific locations and elevations.

3.4 Landscape Soil Suitability

The project team selected samples from the test pit locations (TP1, TP2, TP6, TP8, TP12, and TP15) for landscape soil suitability analyses. The samples were placed in re-sealable plastic bags, labeled, and transported to Sunland Analytical Laboratory in Rancho Cordova, California. The approximate sample locations are depicted on the Site Plan, Figure 2. The laboratory analytical report, prepared by Sunland Analytical, is attached as Appendix C.

4.0 GROUNDWATER

We encountered groundwater in Boring B1 at approximately 28 feet on February 7, 2019. We did not encounter groundwater in our exploratory test pits (TP1 through TP15) performed on April 15, 2019 to a maximum depth of explored of 8 feet.

We reviewed available depth-to-groundwater data on the California Department of Water Resources (DWR) Groundwater Information Center Interactive Map Application (GICIMA) (https://gis.water.ca.gov/app/gicima/#bookmark_DepthBelowGroundSurface). The GICIMA website indicates depth to groundwater at the site ranges from approximately 30 feet to 40 feet (Spring 2018).

It should be noted that fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors. Depth to groundwater can also vary significantly due to localized pumping, irrigation practices, and seasonal fluctuations. Therefore, it is possible that groundwater may be higher or lower than the level observed during our investigation.

5.0 SEISMICITY AND GEOLOGIC HAZARDS

5.1 Regional Active Faults

Based on our research, analyses, and observations, the site is not located on any known "active" earthquake fault trace. In addition, the site is not contained within an Alquist-Priolo Earthquake Fault Zone. Therefore, we consider the potential for ground rupture due to onsite active faulting to be low. In order to determine the distance of known active faults within 30 miles of the site, we used the 2013 Caltrans Fault Database KML overlay file for Google Earth. Principal references used within the 2013 Caltrans Fault Database are Jennings and Bryant Fault Activity Map of California (2010) and Working Group on California Earthquake Predictions (WGCEP), Uniform California Earthquake Rupture Forecast Version 3. Results are summarized in Table 5.1.

TABLE 5.1
REGIONAL ACTIVE FAULTS

Fault Name	Approximate Distance from Site (miles)	Maximum Moment Magnitude, M_W
Great Valley 03a Dunnigan Hills	6.8	6.4
Great Valley 04a Trout Creek	12.2	6.5
Dunnigan Hills Fault	13.9	6.4
Great Valley 04b Gordon Valley	14.7	6.7
Great Valley 03 Mysterious Ridge	17.1	7.0
Vaca Fault Zone	19.0	6.4
Great Valley 05 Pittsburg Kirby Hills	22.0	6.6
Cordelia Fault	24.0	6.5
Green Valley 2011	26.9	6.8
Great Valley 06 (Midland)	28.4	6.8

5.2 Historical Earthquakes and Ground Shaking

The Sacramento region has a history of relatively low seismicity in comparison with more active seismic regions such as the San Francisco Bay Area or Southern California. The two most commonly referred to earthquakes that resulted in some reported building damage in Sacramento are the Winters and Vacaville events in 1892. There are no reported occurrences of seismic-related ground failure in the Sacramento region due to earthquakes.

We used the United States Geological Survey (USGS) *Unified Hazard Tool* (https://earthquake.usgs.gov/hazards/interactive/) to determine the deaggregated seismic source parameters including controlling magnitude and fault distance. The USGS estimated modal magnitude is 6.5 and the estimated Peak Ground Acceleration (PGA) for the Maximum Considered Earthquake (MCE) with a 2,475-year return period is 0.44g.

5.3 Liquefaction

Liquefaction is a phenomenon in which loose, saturated, cohesionless soil deposits located beneath the groundwater table lose strength when subjected to intense and prolonged ground shaking.

The site is not located in a currently established State of California Seismic Hazard Zone for liquefaction. Based on the subsurface conditions encountered in Boring B1, including stiff to hard predominantly cohesive soils, liquefaction potential at the site is expected to be low during seismic events. Mitigation and specific design measures with respect to liquefaction are not necessary for the project.

5.4 Expansive Soil

Laboratory Plasticity Index and Expansion Index tests on selected near-surface soil samples indicate moderate to high plasticity and expansion potential (Appendix B). Specific recommendations with respect to expansive soil are provided in this report.

5.5 Soil Corrosion Screening

We performed soil corrosion potential screening by conducting laboratory testing on representative near-surface soil samples. The laboratory test results and published screening levels are presented in Appendix B. Geocon does not practice in the field of corrosion engineering. If corrosion sensitive improvements are planned, it is recommended that further evaluations by a corrosion engineer be performed to incorporate the necessary precautions to avoid premature corrosion on buried metal pipes and concrete structures in direct contact with the soils.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General

6.1.1 No soil or geologic conditions were encountered during our investigation that would preclude development of the site as planned, provided the recommendations contained in this report are incorporated into the design and construction of the project.

6.1.2 The primary geotechnical constraints identified in our investigation are the presence of (1) disced/disturbed near-surface soil throughout the site, (2) expansive soils blanketing the site, and (3) possible fill within the former construction staging area/parking lot. Mitigation recommendations for these constraints are provided in this report.

6.1.3 Conclusions and recommendations provided in this report are based on our review of referenced literature, analysis of data obtained from our field exploration, laboratory testing program, and our understanding of the proposed development at this time. We should review the project plans as they develop further, provide engineering consultation as needed during final design, and perform geotechnical observation and testing services during construction.

6.2 Seismic Design Criteria

6.2.1 Seismic design of the structure should be performed in accordance with the provisions of the 2016 California Building Code (CBC) which is based on the American Society of Civil Engineers (ASCE) publication: *Minimum Design Loads for Buildings and Other Structures* (ASCE 7-10). We used the Structural Engineers Association of California (SEAOC) and Office of Statewide Health Planning and Development (OSHPD) web application *Seismic Design Maps* (https://seismicmaps.org/) to evaluate site-specific seismic design parameters in accordance with the 2016 CBC/ASCE 7-10. We assumed a seismic Risk Design Category III (per 2016 CBC Table 1604.5) for the project. Results are summarized in Table 6.2.1. The values presented are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 6.2.1
2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC / ASCE 7-10 Reference
Site Class	D	Section 1613.3.2/ Table 20.3-1
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	1.026g	Figure 1613.3.1(1) / Figure 22-1
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.383g	Figure 1613.3.1(2) / Figure 22-2
Site Coefficient, F_A	1.090	Table 1613.3.3(1) / Table 11.4-1
Site Coefficient, F_V	1.633	Table 1613.3.3(2) / Table 11.4-2
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.118g	Eq. 16-37 / Eq. 11.4-1
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.626g	Eq. 16-38 / Eq. 11.4-2
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.745g	Eq. 16-39 / Eq. 11.4-3
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.417g	Eq. 16-40 / Eq. 11.4-4

6.2.2 Table 6.2.2 presents additional seismic design parameters for projects with Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

TABLE 6.2.2
2016 CBC SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.369g	Figure 22-7
Site Coefficient, F_{PGA}	1.131	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.417g	Section 11.8.3 (Eq. 11.8-1)

6.2.3 Conformance to the criteria presented in Tables 6.2.1 and 6.2.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and not to avoid structural damage, since such design may be economically prohibitive.

6.3 Soil Excavation Characteristics

6.3.1 In our opinion, grading and excavations at the site may be accomplished with standard effort using heavy-duty grading/excavation equipment. We do not anticipate project excavations to generate oversized rock material (greater than 6 inches in dimension) or boulders.

6.3.2 Temporary excavations must meet Cal-OSHA requirements as appropriate. Excavation sloping, benching, the use of trench shields, and the placement of trench spoils should conform to the latest applicable Cal-OSHA standards. The contractor should have a Cal-OSHA-approved "competent person" onsite during excavation to evaluate trench conditions and to make appropriate recommendations where necessary. It is the contractor's responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth movements.

6.3.3 The excavation support recommendations provided by Cal-OSHA are generally geared towards protecting human life and not necessarily towards preventing damage to nearby structures or surface improvements. The contractor should be responsible for using the proper active shoring systems or sloping to prevent damage to any structure or improvements near underground excavations.

6.3.4 Permanent cut and fill slopes should be constructed no steeper than 2H:1V (horizontal to vertical). To mitigate potential erosion, slopes should be vegetated as soon as possible and surface drainage should be directed away from the tops of slopes.

6.3.5 If grading occurs during or after the wet season (typically winter and spring), or in periods of precipitation, in-place and excavated soils will likely be wet. Earthwork contractors should be aware of moisture sensitivity of clayey and fine-grained soils and potential compaction/workability difficulties.

6.3.6 Earthwork and pad preparation operations in these conditions will likely be difficult with low productivity. Often, a period of at least one month of warm and dry weather is necessary to allow the site to dry sufficiently so that heavy grading equipment can operate effectively. Conversely, during dry summer and fall months, dry clay soils may require additional grading effort (discing, mixing, or other means) to attain proper moisture conditioning.

6.3.7 Based on laboratory testing, in-situ moisture content of site soils ranges from about 17% to 28%, which is higher than optimum moisture content, which is approximately 12%. Due to the fine-grained nature of the soils and measured in-situ moisture contents above optimum, additional drying effort to attain moisture contents suitable for compaction should be anticipated regardless of the time of year. Mitigation alternatives may include aerating/drying the exposed soils (assuming favorable weather conditions), or chemical treatment (e.g. lime treatment). Unstable excavation bottoms may require overexcavating 12 to 18 inches and placing geotextile fabric/geogrid covered with aggregate, for stabilization. We can provide specific recommendations during construction based on conditions encountered.

6.4 Materials for Fill

6.4.1 Excavated soils generated from cut operations at the site are suitable for use as fill in structural areas provided they do not contain deleterious matter, organic material, or cementations larger than 6 inches in maximum dimension. Due to high in-situ moisture content, native soils reused as engineered fill will likely require aerating/drying to attain suitable moisture content for compaction, regardless of the time of year.

6.4.2 Import soil for general use (if needed) should be similar to onsite, native soils (e.g. similar plasticity and grain size distribution characteristics). Import soil should be free of organic material and construction debris, and not contain rock/cementations larger than 6 inches in greatest dimension.

6.4.3 Low-expansive import fill (LEF) material should be primarily granular with a "very low" expansion potential (Expansion Index less than 20), a Plasticity Index less than 15, be free of organic material and construction debris, and not contain rock/cementations larger than 6 inches in greatest dimension. Low-expansive fill may also consist of lime-treated native soils. If lime-treatment is selected, additional laboratory testing will be required to determine the percentage of lime required to meet the intent of our low-expansive fill recommendations. For planning purposes, typical lime application rates for soil stabilization range from 3 to 5 percent.

6.4.4 Environmental characteristics and corrosion potential of import soil materials should also be considered. Proposed import material should be sampled, tested, and approved by Geocon prior to its transportation to the site.

6.5 Grading

6.5.1 All earthwork operations should be observed and all fills tested for recommended compaction and moisture content by a representative of Geocon.

6.5.2 All references to relative compaction and optimum moisture content in this report are based on the latest ASTM D1557 Test Procedure. Structural areas should be considered the areas extending a minimum of 5 feet beyond the outside dimensions of structures, including footings or overhangs carrying structural loads.

6.5.3 Prior to commencing grading, a pre-construction conference with representatives of the client, grading contractor and Geocon should be held at the site. Site preparation, soil handling and/or the grading plans should be discussed at the pre-construction conference.

6.5.4 Site preparation should begin with removal of existing pavements (loose gravel, fill, etc.), underground utilities, and debris primarily within the former construction staging area/parking lot (see Site Plan, Figure 2). Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with engineered fill in accordance with the recommendations of this report.

6.5.5 At the time of our investigation, the site was vegetated with a moderate to heavy growth of annual grasses and some mature trees along the southern edge of the site. Existing trees and associated root systems within proposed development areas should be removed. Surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. We estimate required stripping depths will range from approximately 2 to 4 inches. The actual stripping depth should be determined based on site conditions prior to grading. Material generated during stripping is not suitable for use within 5 feet of building pads or within pavement areas but may be placed in landscaped or non-structural areas or exported from the site.

6.5.6 Alternatively, surface vegetation may be mowed such that 1 to 2 inches of stubble remains. After removing mowed vegetation, the ground surface should be thoroughly disced in two perpendicular directions to a depth of 12 inches to blend the remaining grass and roots into the surface soil such that resulting organic content is less than 3 percent.

6.5.7 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.

6.5.8 Within proposed development areas (building pads, flatwork and pavement areas) existing loose/disturbed soils (tilled alluvium) should be removed to expose firm, undisturbed native soils and replaced as engineered fill. We anticipate an average removal depth of about 12 inches. This depth is subject to change based on conditions exposed during grading and may be adjusted by Geocon during grading. The over-excavated soil may be used as engineered fill provided it is screened/processed to be relatively free of organic matter (less than 3 percent) or other deleterious material and does not contain rock or cementations larger than 6 inches in maximum dimension.

6.5.9 Over-excavation bottoms, areas to receive fill, or areas left at-grade should be thoroughly scarified to a minimum depth of 12 inches, uniformly moisture-conditioned at least 2% over optimum moisture content, and compacted to at least 90% relative compaction. Our representative should observe scarification and re-compaction operations to evaluate performance of the subgrade under compaction equipment loading and to identify any areas that may require additional removals.

6.5.10 Due to the expansive clay soils at the site, the upper 12 inches of building pads should consist of LEF meeting the requirements of Section 6.4.3 of this report. The LEF should be moisture-conditioned at or above optimum moisture content and compacted to at least 90% relative compaction. If lime-treatment is desired for expansive soil stabilization, additional laboratory testing will be required to determine the typical lime application rates (ranging from 3 to 5 percent). LEF is not required if PT slabs are used.

6.5.11 The top 6 inches of final vehicular pavement subgrade, whether completed at-grade, by excavation, or by filling, should be uniformly moisture-conditioned at least 2% above optimum moisture content and compacted to at least 95% relative compaction. Final pavement subgrade should be finished to a smooth, unyielding surface. We further recommend proof-rolling the subgrade with a loaded water truck (or similar equipment with high contact pressure) to verify the stability of the subgrade prior to placing AB.

6.5.12 Underground utility trenches within structural areas should be backfilled with properly compacted material. Pipe bedding, shading, and trench backfill should conform to the requirements of the appropriate utility authority. Material excavated from trenches should be adequate for use as general backfill above shading provided it does not contain deleterious matter, vegetation, or cementations larger than 6 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches, moisture-conditioned at or above optimum and compacted to at least 90% relative compaction. Compaction should be performed by mechanical means only; jetting of trench backfill is not recommended.

6.6 Foundations

6.6.1 Based on soil conditions at the site and our experience with residential developments with similar soil conditions, we recommend using either PT slabs or conventional reinforced slab-on-grade foundations with continuous perimeter footings for the proposed structures. If conventional foundations are used, the top 12 inches of building pads should be comprised of LEF meeting the requirements of Paragraph 6.4.3 of this report.

Post-Tensioned Slabs

6.6.2 PT slab foundations should be designed by a structural engineer experienced in PT slab design and design criteria of the Post-Tensioning Institute (PTI) DC 10.5-12 *Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive Soils* or WRI/CRSI *Design of Slab-on-Ground Foundations*, Third Edition, as required in Section 1808.6 of the 2016 CBC. PT foundation design should incorporate the geotechnical parameters presented in Table 6.6.2.

TABLE 6.6.2
POST-TENSIONED SLAB DESIGN PARAMETERS

Design Parameter (PTI 3rd Edition)	Recommended Value
1. Thornthwaite Index	-20
2. Equilibrium Suction	3.9 pF
3. Edge Lift Moisture Variation Distance, $\mathbf{e_M}$	5.3 feet
4. Edge Lift, $\mathbf{y_M}$	1.6 inches
5. Center Lift Moisture Variation Distance, $\mathbf{e_M}$	9.0 feet
6. Center Lift, $\mathbf{y_M}$	0.7 inches
Minimum Slab Thickness	10 inches

6.6.3 Allowable bearing capacity for PT slabs should not exceed 1,500 pounds per square foot (psf) for dead plus live load conditions. This value may be increased by one-third to evaluate all transient loads, including wind or seismic forces. The structural engineer should determine slab thickness and reinforcing based on anticipated use and loading of the slab.

6.6.4 The allowable coefficient of friction to resist sliding is 0.30 for concrete against soil/aggregate and 0.20 for concrete against a vapor retarder membrane. Since PT slab foundations are typically not embedded into the building pad, resistance to sliding from passive soil resistance does not apply. If a uniform-thickness PT mat foundation system is planned (most common in Northern California), the slab should include thickened edges extending below the crushed rock underlayment layer.

6.6.5 Assuming the PT slabs are 10 inches thick (or thicker), the slabs should be underlain by a minimum of 2 inches of ½-inch or ¾-inch crushed rock with no more than 5 percent passing the No. 200 sieve to serve as a capillary break. The crushed rock should be subjected to several passes with a walk-behind vibratory compactor or similar equipment prior to placing a vapor barrier or reinforcement/PT tendons for the slab.

6.6.6 Migration of moisture through concrete slabs or moisture otherwise released from slabs is not a geotechnical issue. However, for the convenience of the owner and design team, we are providing the following general suggestions for consideration by the owner, architect, structural engineer, and contractor. The suggested procedures may reduce the potential for moisture-related floor covering failures on concrete slabs-on-grade, but moisture problems may still occur even if the procedures are followed. If more detailed recommendations are desired, we recommend consulting a specialist in this field.

6.6.7 In areas where floor coverings are planned, a minimum 10-mil-thick vapor retarder meeting ASTM E1745 Class C requirements may be placed directly below the slab provided the water-cement ratio of the concrete is 0.45 or less. To reduce the potential for punctures, a higher quality vapor barrier (15 mil, Class A or B) may be used. The vapor retarder, if used, should extend to the edges of the slab, and should be sealed at all seams and penetrations.

6.6.8 The concrete water/cement ratio should be as low as possible. The water/cement ratio should not exceed 0.45 for concrete placed directly on the vapor retarder. This is critically important to reduce the potential for differential curing and subsequent excessive shrinkage cracking. Midrange plasticizers could be used to facilitate concrete placement and workability.

6.6.9 Proper finishing, curing, and moisture vapor emission testing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

6.6.10 Our experience indicates PT slabs are potentially susceptible to excessive edge lift, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings/thickened edges and the interior stiffener beams may reduce this potential. Current PTI design procedures primarily address the potential center lift of slabs but, because of the placement of the reinforcing tendons near the top of the slab, the resulting eccentricity after tensioning reduces the ability of the system to reduce edge lift.

6.6.11 During the construction of the PT foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints be allowed to form.

6.6.12 The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building (such as covered porches), are not recommended. Where this condition cannot be avoided, the isolated footings should be embedded at least 18 inches below pad grade and be connected to the building foundation with reinforced concrete grade beams. In addition, consideration should be given to connecting/dowling patio slabs to the building foundation to reduce the potential for future separation to occur.

6.6.13 Prior to placing the vapor barrier, pad subgrade soil should be moisture-conditioned to at least 2% above optimum moisture content to a depth of at least 12 inches. Geocon should confirm the moisture content of the subgrade soils at least 24 hours prior to placing the moisture retarder.

Conventional Foundations

6.6.14 As an alternative to PT slabs, the new buildings may be supported on reinforced conventional foundations bearing on engineered fill or undisturbed native soil. The top 12 inches of building pads should be comprised of LEF meeting the requirements of Paragraph 6.4.3 of this report.

6.6.15 To reduce potential for moisture variations beneath the buildings, foundations should consist of continuous perimeter strip footings with interior spread footings. Perimeter strip footings should be continuous around the entire perimeter of the structure without breaks or discontinuities. Attached garage areas should also have a continuous perimeter strip footing including a trenched grade beam beneath garage door entrances.

6.6.16 Continuous perimeter strip footings should be at least 12 inches wide and interior spread footings should be at least 18 inches square. All footings should be embedded at least 18 inches below pad grade. Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom of the footing.

6.6.17 Continuous footings should be reinforced with at least four No. 5 reinforcement bars, two each placed near the top and bottom of the footing to reduce the effects of expansive clay soils and to allow footings to span isolated soil irregularities. Consideration should be given to using slab tie reinforcing bars between the perimeter foundation and the interior slab. The reinforcement recommended above is for soil characteristics only and is not intended to replace reinforcement required for structural considerations. The project structural engineer should evaluate the need for additional reinforcement.

6.6.18 Foundations may be designed using an allowable bearing capacity of 2,000 psf for dead plus live load conditions with a one-third increase for short-term transient loading such as wind and seismic.

6.6.19 Allowable passive pressure used to resist lateral movement of the footings may be assumed to be equal to a fluid weighing 300 pounds per cubic foot (pcf). The coefficient of friction to resist sliding is 0.30 for concrete against soil. Combined passive resistance and friction may be utilized for design provided that the frictional resistance is reduced by 50%.

6.6.20 Foundations designed in accordance with the recommendations above should experience total post-construction settlement due to building loads of less than one inch and differential settlement of ½ inch or less over a distance of 50 feet. The majority of settlement will be immediate and occur as the building is constructed.

6.6.21 A Geocon representative should observe foundation excavations prior to placing reinforcing steel or concrete to observe that the exposed soil conditions are consistent with those anticipated. If unanticipated soil conditions are encountered, foundation modifications may be required.

6.7 Interior Slabs-on-Grade

6.7.1 Conventional interior concrete slabs-on-grade are suitable for the building pads provided the upper 12 inches of the building pads consist of LEF meeting the requirements of Section 6.4.3 of this report. This recommendation is based on the assumption that slabs will be at least 5 inches thick, and be supported on a minimum 4-inch-thick section of crushed rock. The 4-inch-thick rock section is in addition to the 18 inches of LEF. If a thinner or thicker slab or rock section is planned, we should be consulted to provide revised recommendations.

6.7.2 Slab thickness and reinforcement should be determined by the structural engineer based on anticipated loading. However, based on our experience, slabs are typically at least 5 inches thick and reinforced with at least No. 4 reinforcing bars placed 18 inches on center, each way. Control joints should be provided at periodic intervals in accordance with American Concrete Institute (ACI) or Portland Cement Association (PCA) recommendations, as appropriate.

6.7.3 If near-surface soils of building pads become dry prior to constructing the slab-on-grade, the building pads should be re-moistened by soaking or sprinkling such that the upper 12 inches of soil is at least 2% above optimum moisture content at least 24 hours before concrete placement. Our representative should verify moisture conditions prior to slab-on-grade construction.

6.8 Concrete Sidewalks and Flatwork

6.8.1 Sidewalk, curb, and gutter within City right-of-way should be designed and constructed in accordance with the latest City of Davis standards and details as applicable.

6.8.2 Due to the presence of expansive near-surface soils, concrete driveways and flatwork will likely experience seasonal movement. Therefore, some cracking and/or vertical offset should be anticipated. We are providing the following recommendations to reduce distress to concrete flatwork. Recommendations include moisture conditioning subgrade soils, using aggregate base (AB) underlayment, providing thickened edges, and providing adequate construction and control joints. It should be noted that even with implementation of these measures, minor slab movement or cracking could still occur.

- Concrete flatwork and sidewalks should be at least 4 inches thick and underlain by 6 inches of AB properly-moisture-conditioned and compacted to at least 95% relative compaction. In addition, doweling could be provided at joints to reduce the potential for vertical offset.
- The upper 12 inches of subgrade soil for exterior flatwork and sidewalks should be uniformly moisture-conditioned at or above optimum moisture content and compacted to at least 90% relative compaction prior to placing AB.
- We recommend using construction and control joints in accordance with ACI and/or PCA guidelines. Construction joints that abut building foundations should include a felt strip, or approved equivalent, that extends the full depth of the exterior slab. Exterior slabs should be structurally independent of building foundations except at doorways, where vertical movement could impact doorway operation.

6.9 Pavement – Hot Mix Asphalt

6.9.1 We performed Resistance-Value (R-Value) testing on a representative composite bulk soil sample from proposed at-grade pavement areas. Our testing resulted in an R-Value of <5 (Appendix B).

6.9.2 To improve pavement support characteristics, the subgrade soil may be chemically treated with high calcium quicklime. Lime-treatment stabilizes clayey soils and increases pavement support characteristics; therefore, a thinner AB section may be used in the pavement structural section. Lime-treatment should be performed by a qualified soil stabilization contractor in accordance with Caltrans' *Standard Specifications*, or similar specification. For planning purposes, treating the upper 12 inches of subgrade with 3% to 5% quicklime (by dry weight) will likely produce an improved pavement section subgrade. We should collect subgrade soil samples after grading and perform additional laboratory testing to determine the percent lime required.

6.9.3 The recommended pavement sections shown in Table 6.9.3 are based on procedures of Caltrans' *Highway Design Manual.* Per the City of Davis' *2016 Street Standards, Section E: Street Structural Design, Traffic Index Requirements,* a Traffic Index (TI) of 4.0, 4.5, 5.0, 6.0, 7.0, or 9.0 is likely applicable for the project.

TABLE 6.9.3
FLEXIBLE PAVEMENT SECTIONS

Street Type	Traffic Index	HMA[1] (inches)	AB[2] (inches)	Lime Treated Subgrade (inches)
Private	4.0	3.0	6.5	--
		3.0	4.0	12
Cul-de-Sacs	4.5	3.0	8.0	--
		3.0	4.0	12
Locals	5.0	3.0	10.0	--
		3.0	4.0	12
Modified Locals	6.0	3.5	12.5	--
		3.5	4.0	12
Collectors/ Minor Arterials	7.0	4.0	15.5	--
		4.0	4.5	12
Major Arterials	9.0	5.5	20.5	--
		5.5	6.5	12

Notes:
1. HMA = Hot Mix Asphalt (Type A or B) conforming to Section 39 of Caltrans' latest *Standard Specifications*. Rubberized HMA (RHMA) conforming to Section 39 of Caltrans' latest *Standard Specifications* may be used in place of HMA.
2. AB = Class 2 Aggregate Base conforming to Section 26 of Caltrans' latest *Standard Specifications*.

6.9.4 The recommended pavement section is based on the following assumptions:

1. Subgrade soil has a minimum R-Value of 5.
2. Class 2 AB has a minimum R-Value of 78 and meets the requirements of Section 26 of the latest Caltrans *Standard Specifications*.
3. Class 2 AB and subgrade is compacted to 95% or higher relative compaction at or near optimum moisture content. Prior to placing AC, the AB should be proof-rolled with a loaded water truck to verify stability.
4. Lime-Treated Subgrade (LTS) should develop a minimum R-value of 50. LTS should extend at least 2 feet laterally beyond the edge of pavement.
5. Subgrade soil is scarified at least 6 inches, uniformly moisture-conditioned above optimum moisture content and compacted to 95% or higher relative compaction. Prior to placing AB, subgrade soil should be proof-rolled with a loaded water truck to verify stability.
6. Periodic maintenance of HMA pavements is performed.

6.9.5 To reduce the potential for water from landscaped areas migrating under pavement into the AB, consideration should be given to using full-depth curbs in areas where pavement abuts irrigated landscaping. The full-depth curbs should be at least 4 inches wide and extend at least 4 inches or more into the soil subgrade beneath the AB. Alternatively, drop-inlets with weep-holes at the approximate AB-subgrade interface may be used to encourage accumulated water to drain from beneath the pavement.

6.10 Pavement – Rigid Concrete

6.10.1 If rigid Portland cement concrete (PCC) pavement is used in automobile, light-truck traffic areas, and in front of trash bin areas, we recommend that the concrete be at least 6 inches thick. PCC pavement should be underlain by at least 6 inches of Class 2 AB meeting the requirements of Section 26 of Caltrans' *Standard Specifications* and compacted to at least 95% relative compaction at or near optimum moisture content. Subgrade soils should be prepared and compacted in accordance with the recommendations of this report.

6.10.2 PCC should have a minimum 28-day compressive strength of 3,500 pounds per square inch. Adequate construction and crack control joint should be used to control cracking inherent in concrete construction. It would be advantageous to provide minimal reinforcement, such as No. 3 steel bars placed 18 inches on center in both horizontal directions to help control cracking. Adequate dowels should also be used at joints to facilitate load transfer and reduce vertical offset.

6.11 Site Drainage and Moisture Protection

6.11.1 Adequate site drainage is critical to reduce the potential for differential soil movement, soil expansion, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to building foundations. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with the 2016 CBC or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices.

6.11.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

6.11.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend use of area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes. In addition, where landscaping is planned adjacent to the pavement or flatwork, we recommend construction of a cutoff wall (deepened curb) along the edge of the pavement/flatwork that extends at least 4 inches into the soil subgrade below the bottom of the base material.

6.11.4 The soil conditions at the site (low-permeability clays) are not conducive to water infiltration devices such as vegetated swales. However, Low Impact Development (LID) devices can be installed to reduce velocity and the amount of water entering the storm drain system. The LID devices should be properly constructed to prevent water infiltration into the surrounding soil. If water infiltrates the expansive soils, distress may be caused to adjacent pavements, flatwork, or structures. Vegetated swales and basin areas (if used) should be lined with an impermeable liner (e.g. high-density polyethylene, HDPE, with a thickness of about 12 mil or equivalent polyvinyl chloride liner) to reduce infiltration.

6.11.5 We recommend that roof drains be connected to water-tight subdrains that direct the water to the storm drain system. However, we understand that LID and Leadership in Engineering and Environmental Design (LEED) requests disconnecting the roof drains to help obtain certification. The water from the roof drains should be directed away from buildings. Consideration should be given to draining roofs to lined planter boxes or placing liners below the proposed landscape areas to prevent infiltration of the water. Geocon can be contacted for additional recommendations.

6.11.6 We recommend implementing measures to reduce infiltrating irrigation water near buildings, flatwork, or pavements. Such measures may include:

- Selecting drought-tolerant plants that require little or no irrigation, especially within 3 feet of buildings, slabs-on-grade, or pavements.
- Using drip irrigation or low-output sprinklers.
- Using automatic timers for irrigation systems.
- Using appropriately spaced area drains.

The project landscape architect should consider incorporating these measures into the landscaping plans.

6.11.7 Experience has shown that even with these provisions, subsurface seepage may develop in areas where no such water conditions existed prior to site development. This is particularly true where a substantial increase in surface water infiltration has resulted from an increase in landscape irrigation.

7.0 FURTHER GEOTECHNICAL SERVICES

7.1 Plan and Specification Review

7.1.1 We should review the foundation and grading plans prior to final design submittal to assess whether our recommendations have been properly incorporated and evaluate if additional analysis and/or recommendations are required.

7.2 Testing and Observation Services

7.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered during construction are similar to those anticipated during design. Testing and observation services by the Geotechnical Engineer of Record are necessary to verify that construction has been performed in accordance with this report, approved plans, and specifications. If we are not retained for these services, we cannot assume any responsibility for other's interpretation of our recommendations or the future performance of the project.

8.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, we should be notified so that supplemental recommendations can be given.

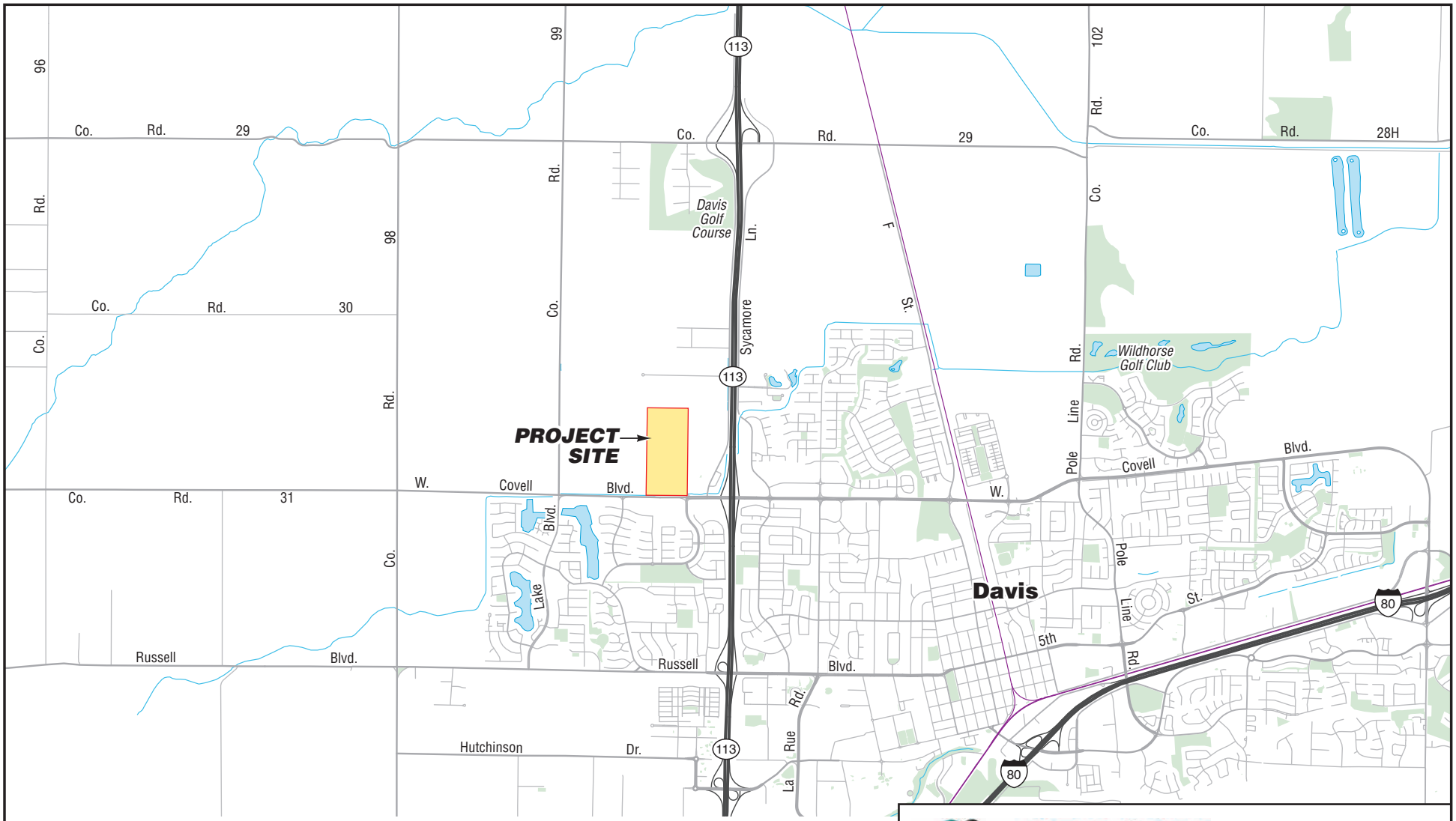
This report is issued with the understanding that it is the responsibility of the owner or their representative to ensure that the information and recommendations contained herein are brought to the attention of the design team for the project and incorporated into the plans and specifications and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

The recommendations contained in this report are preliminary until verified during construction by representatives of our firm. Changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. Additionally, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated partially or wholly by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices used in the site area at this time. No warranty is provided, express or implied.

9.0 REFERENCES

1. American Society of Civil Engineers, *ASCE 7-10 Minimum Design Loads for Buildings and Other Structures,* Sections 11.4 and 21.4, 2006.
2. American Concrete Institute, ACI 318-05, *Building Code Requirements for Structural Concrete and Commentary*, 2005.
3. California Building Standards Commission, *2016 California Building Code*, based on *2015 International Building Code,* International Code Council.
4. California Department of Transportation, *Highway Design Manual, Chapter 600*, updated December 20, 2004.
5. California Department of Transportation, *Standard Specifications, Section 26*, 2010.
6. City of Davis, *Public Works Department Standard Specifications, Curb, Gutter, and Sidewalk*. July 11, 2017.
7. Gutierrez, C.I., *Preliminary Geologic Map of the Sacramento 30' x 60' Quadrangle,* California Geological Survey, 2011.
8. Hart, Earl W., Bryant, William A. "Alquist-Priolo Earthquake Fault Zone Program." California Division of Mines and Geology, 1999.
9. Jennings, C.W. (compiler), *Fault Map of California*, California Division of Mines and Geology, 1982.
10. Structural Engineers Association of California (SEAOC) and Office of Statewide Health Planning and Development (OSHPD), Seismic Design Maps, https://seismicmaps.org/, accessed January 11, 2019.
11. United States Geological Survey, Unified Hazard Tool https://earthquake.usgs.gov/hazards/interactive/.
12. Unpublished reports, aerial photographs, and maps on file with Geocon.



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Bretton Woods

Davis,
California

VICINITY MAP

S1704-05-01	August 2019	Figure 1

LEGEND:

- Approximate Site Boundary
- B1 — Approximate Boring Location
- TP15 — Approximate Test Pit Location

0 200

Scale in Feet

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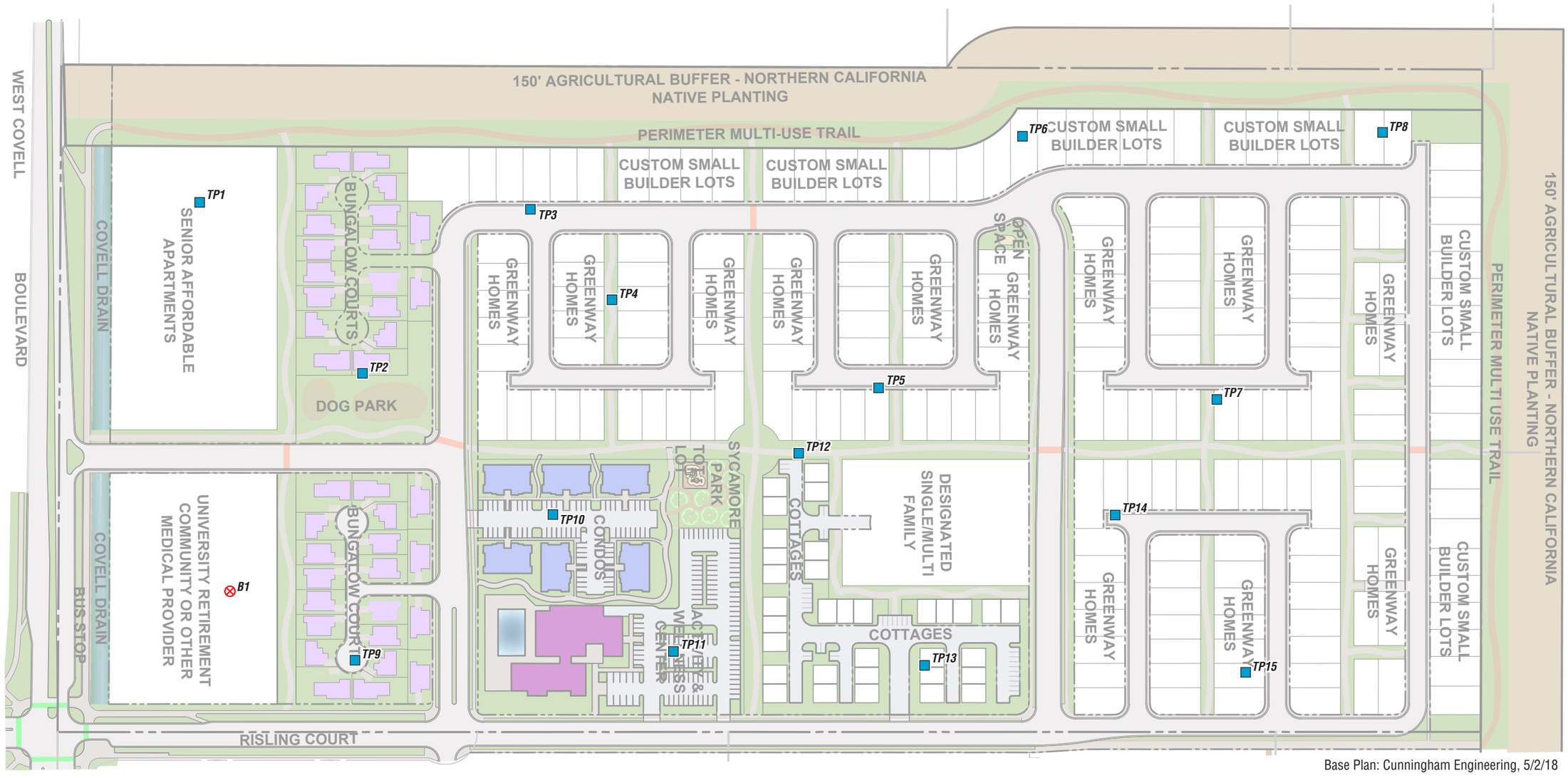
SITE PLAN

S1704-05-01	August 2019	Figure 2



Base Plan: Cunningham Engineering, 5/2/18

LEGEND:

B1 ⊗ Approximate Boring Location

TP15 ■ Approximate Test Pit Location

N

0 200

Scale in Feet

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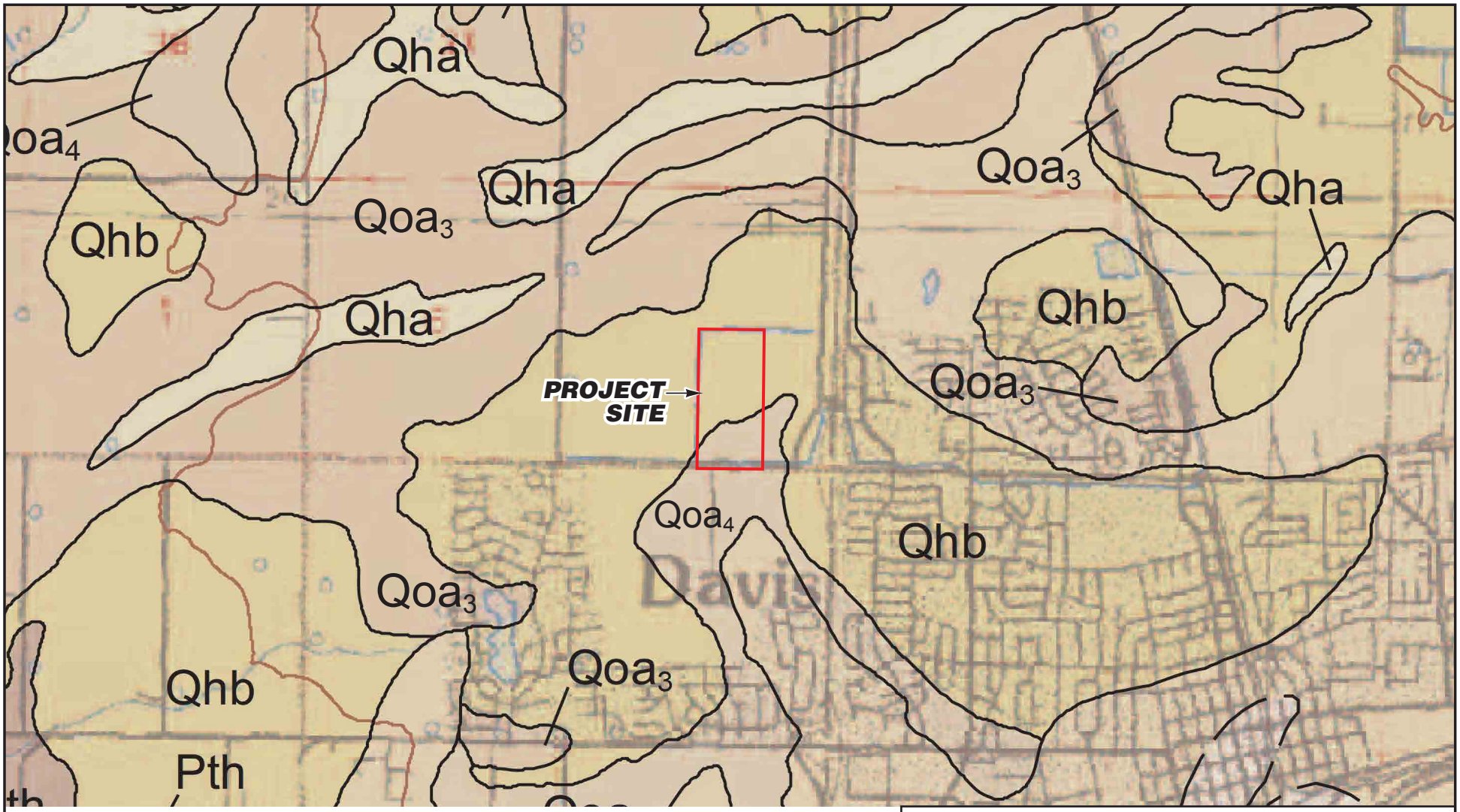
PROPOSED DEVELOPMENT PLAN

S1704-05-01	August 2019	Figure 3



Ref: Preliminary Geologic Map of the Sacramento 30' x 60' Quadrangle, California, 2011

Qha	Holocene alluvium
Qhb	Holocene basin deposits
Qoa_3	Older alluvium - Unit 3
Qoa_4	Older alluvium - Unit 4

N

0 1

Scale in Miles

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GEOLOGIC MAP

S1704-05-01	August 2019	Figure 4

APPENDIX A

APPENDIX A

FIELD EXPLORATION

We performed our geotechnical field exploration on February 7, 2019 and April 15, 2019. Our field exploration program consisted of performing one exploratory boring (B1) and 15 exploratory test pits (TP1 through TP15) at the approximate locations depicted on the Site Plan, Figure 2 and Proposed Development Plan, Figure 3.

The test pits were excavated using a track-mounted Bobcat 430 mini-excavator equipped with a 12-inch bucket. Upon completion, the test pits were backfilled with the excavated soil.

The exploratory boring was performed using a track-mounted CME 55 drill rig equipped with 6-inch outside diameter (OD) hollow-stem augers. Soil sampling was performed using an automatic 140-pound hammer with a 30-inch drop. We obtained samples using a 3-inch OD split-spoon (California Modified) sampler or a 2-inch OD Standard Penetration Test (SPT) sampler. We recorded the number of blows required to drive the sampler the last 12 inches (or portion thereof) of the 18-inch sampling interval on the boring logs. Upon completion, the boring was backfilled with neat cement grout.

We visually examined, classified, and logged the subsurface conditions in the exploratory borings in general accordance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D2488-90). This system uses the Unified Soil Classification System (USCS) for soil designations. The logs depict soil and geologic conditions encountered and depths at which we obtained samples. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, drill rig penetration rates, excavation characteristics, and other factors. The transition between materials may be abrupt or gradual. Where applicable, we revised the field logs based on subsequent laboratory testing.

UNIFIED SOIL CLASSIFICATION

MAJOR DIVISIONS					TYPICAL NAMES
COARSE-GRAINED SOILS (MORE THAN HALF IS COARSER THAN NO. 200 SIEVE)	GRAVELS (MORE THAN HALF COARSE FRACTION IS LARGER THAN NO.4 SIEVE SIZE)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
			GP		POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM		SILTY GRAVELS, SILTY GRAVELS WITH SAND
			GC		CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND
	SANDS (MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO.4 SIEVE SIZE)	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
			SP		POORLY GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM		SILTY SANDS WITH OR WITHOUT GRAVEL
			SC		CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS (MORE THAN HALF IS FINER THAN NO. 200 SIEVE)	SILTS AND CLAYS (LIQUID LIMIT 50% OR LESS)		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS
			OL		ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (LIQUID LIMIT GREATER THAN 50%)		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH		ORGANIC CLAYS OR CLAYS OF MEDIUM TO HIGH PLASTICITY
	HIGHLY ORGANIC SOILS		PT		PEAT AND OTHER HIGHLY ORGANIC SOILS

BORING/TRENCH LOG LEGEND

- No Recovery
- Shelby Tube Sample
- Bulk Sample
- SPT Sample
- Modified California Sample
- Groundwater Level (At Completion)
- Groundwater Level (Seepage)

PENETRATION RESISTANCE

SAND AND GRAVEL			SILT AND CLAY			
RELATIVE DENSITY	BLOWS PER FOOT (SPT)*	BLOWS PER FOOT (MOD-CAL)*	CONSISTENCY	BLOWS PER FOOT (SPT)*	BLOWS PER FOOT (MOD-CAL)*	COMPRESSIVE STRENGTH (tsf)
VERY LOOSE	0 - 4	0 - 6	VERY SOFT	0 - 2	0 - 3	0 - 0.25
LOOSE	5 - 10	7 - 16	SOFT	3 - 4	4 - 6	0.25 - 0.50
MEDIUM DENSE	11 - 30	17 - 48	MEDIUM STIFF	5 - 8	7 - 13	0.50 - 1.0
DENSE	31 - 50	49 - 79	STIFF	9 - 15	14 - 24	1.0 - 2.0
VERY DENSE	OVER 50	OVER 79	VERY STIFF	16 - 30	25 - 48	2.0 - 4.0
			HARD	OVER 30	OVER 48	OVER 4.0

*NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE LAST 12 INCHES OF AN 18-INCH DRIVE

MOISTURE DESCRIPTIONS

FIELD TEST	APPROX. DEGREE OF SATURATION, S (%)	DESCRIPTION
NO INDICATION OF MOISTURE; DRY TO THE TOUCH	S<25	DRY
SLIGHT INDICATION OF MOISTURE	25≤S<50	DAMP
INDICATION OF MOISTURE; NO VISIBLE WATER	50≤S<75	MOIST
MINOR VISIBLE FREE WATER	75≤S<100	WET
VISIBLE FREE WATER	100	SATURATED

QUANTITY DESCRIPTIONS

APPROX. ESTIMATED PERCENT	DESCRIPTION
<5%	TRACE
5 - 10%	FEW
11 - 25%	LITTLE
26 - 50%	SOME
>50%	MOSTLY

GRAVEL/COBBLE/BOULDER DESCRIPTIONS

CRITERIA	DESCRIPTION
PASS THROUGH A 3-INCH SIEVE AND BE RETAINED ON A NO. 4 SIEVE (#4 TO 3")	GRAVEL
PASS A 12-INCH SQUARE OPENING AND BE RETAINED ON A 3-INCH SIEVE (3"-12")	COBBLE
WILL NOT PASS A 12-INCH SQUARE OPENING (>12")	BOULDER

LABORATORY TEST KEY

CP – COMPACTION CURVE (ASTM D1557)
CR – CORROSION ANALYSIS (CTM 422, 643, 417)
DS – DIRECT SHEAR (ASTM D3080)
EI – EXPANSION INDEX (ASTM D4829)
GSA – GRAIN SIZE ANALYSIS (ASTM D422)
MC – MOISTURE CONTENT (ASTM D2216)
PI – PLASTICITY INDEX (ASTM D4318)
R – R-VALUE (CTM 301)
SE – SAND EQUIVALENT (CTM 217)
TXCU – CONSOLIDATED UNDRAINED TRIAXIAL (ASTM D4767)
TXUU – UNCONSOLIDATED UNDRAINED TRIAXIAL (ASTM D2850)
UC – UNCONFINED COMPRESSIVE STRENGTH (ASTM D2166)

BEDDING SPACING DESCRIPTIONS

THICKNESS/SPACING	DESCRIPTOR
GREATER THAN 10 FEET	MASSIVE
3 TO 10 FEET	VERY THICKLY BEDDED
1 TO 3 FEET	THICKLY BEDDED
3 ⅝-INCH TO 1 FOOT	MODERATELY BEDDED
1 ⅛-INCH TO 3 ⅝-INCH	THINLY BEDDED
⅜-INCH TO 1 ⅛-INCH	VERY THINLY BEDDED
LESS THAN ⅜-INCH	LAMINATED

STRUCTURE DESCRIPTIONS

CRITERIA	DESCRIPTION
ALTERNATING LAYERS OF VARYING MATERIAL OR COLOR WITH LAYERS AT LEAST ¼-INCH THICK	STRATIFIED
ALTERNATING LAYERS OF VARYING MATERIAL OR COLOR WITH LAYERS LESS THAN ¼-INCH THICK	LAMINATED
BREAKS ALONG DEFINITE PLANES OF FRACTURE WITH LITTLE RESISTANCE TO FRACTURING	FISSURED
FRACTURE PLANES APPEAR POLISHED OR GLOSSY, SOMETIMES STRIATED	SLICKENSIDED
COHESIVE SOIL THAT CAN BE BROKEN DOWN INTO SMALLER ANGULAR LUMPS WHICH RESIST FURTHER BREAKDOWN	BLOCKY
INCLUSION OF SMALL POCKETS OF DIFFERENT SOIL, SUCH AS SMALL LENSES OF SAND SCATTERED THROUGH A MASS OF CLAY	LENSED
SAME COLOR AND MATERIAL THROUGHOUT	HOMOGENOUS

CEMENTATION/INDURATION DESCRIPTIONS

FIELD TEST	DESCRIPTION
CRUMBLES OR BREAKS WITH HANDLING OR LITTLE FINGER PRESSURE	WEAKLY CEMENTED/INDURATED
CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE	MODERATELY CEMENTED/INDURATED
WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE	STRONGLY CEMENTED/INDURATED

IGNEOUS/METAMORPHIC ROCK STRENGTH DESCRIPTIONS

FIELD TEST	DESCRIPTION
MATERIAL CRUMBLES WITH BARE HAND	WEAK
MATERIAL CRUMBLES UNDER BLOWS FROM GEOLOGY HAMMER	MODERATELY WEAK
½-INCH INDENTATIONS WITH SHARP END FROM GEOLOGY HAMMER	MODERATELY STRONG
HAND-HELD SPECIMEN CAN BE BROKEN WITH **ONE** BLOW FROM GEOLOGY HAMMER	STRONG
HAND-HELD SPECIMEN CAN BE BROKEN WITH **COUPLE** BLOWS FROM GEOLOGY HAMMER	VERY STRONG
HAND-HELD SPECIMEN CAN BE BROKEN WITH **MANY** BLOWS FROM GEOLOGY HAMMER	EXTREMELY STRONG

IGNEOUS/METAMORPHIC ROCK WEATHERING DESCRIPTIONS

DEGREE OF DECOMPOSITION	FIELD RECOGNITION	ENGINEERING PROPERTIES
SOIL	DISCOLORED, CHANGED TO SOIL, FABRIC DESTROYED	EASY TO DIG
COMPLETELY WEATHERED	DISCOLORED, CHANGED TO SOIL, FABRIC MAINLY PRESERVED	EXCAVATED BY HAND OR RIPPING (Saprolite)
HIGHLY WEATHERED	DISCOLORED, HIGHLY FRACTURED, FABRIC ALTERED AROUND FRACTURES	EXCAVATED BY HAND OR RIPPING, WITH SLIGHT DIFFICULTY
MODERATELY WEATHERED	DISCOLORED, FRACTURES, INTACT ROCK-NOTICEABLY WEAKER THAN FRESH ROCK	EXCAVATED WITH DIFFICULTY WITHOUT EXPLOSIVES
SLIGHTLY WEATHERED	MAY BE DISCOLORED, SOME FRACTURES, INTACT ROCK-NOT NOTICEABLY WEAKER THAN FRESH ROCK	REQUIRES EXPLOSIVES FOR EXCAVATION, WITH PERMEABLE JOINTS AND FRACTURES
FRESH	NO DISCOLORATION, OR LOSS OF STRENGTH	REQUIRES EXPLOSIVES

IGNEOUS/METAMORPHIC ROCK JOINT/FRACTURE DESCRIPTIONS

FIELD TEST	DESCRIPTION
NO OBSERVED FRACTURES	UNFRACTURED/UNJOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT 1 TO 3 FOOT INTERVALS	SLIGHTLY FRACTURED/JOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT 4-INCH TO 1 FOOT INTERVALS	MODERATELY FRACTURED/JOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT 1-INCH TO 4-INCH INTERVALS WITH SCATTERED FRAGMENTED INTERVALS	INTENSELY FRACTURED/JOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT LESS THAN 1-INCH INTERVALS; MOSTLY RECOVERED AS CHIPS AND FRAGMENTS	VERY INTENSELY FRACTURED/JOINTED

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PHONE 916.852.9118 – FAX 916.852.9132

KEY TO LOGS | Figure A1

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

BORING B1

ELEV. (MSL.) **~50** DATE COMPLETED **2/7/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Slagle Drilling**

EQUIPMENT **Track Mounted CME-55 w/ 6" HSA** HAMMER TYPE **Automatic | 140lb**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	B3-Bulk			CL	**ALLUVIUM** Very stiff, moist, dark yellowish brown, Lean CLAY with sand, trace fine gravel, PP=2.75 tsf			17.6	CP, EI, PI, #200 wash
1	B3-1								
	B3-1.5					21	98.6	23.0	
2									
3	B3-3								
	B3-3.5					14			
4					- PP=2.5 tsf				
5	B3-5						102.6	22.5	
	B3-5.5								
6	B3-6					22			
7					- hard, PP=4.0 tsf				
8	B3-8						98.4	22.8	
	B3-8.5					19			
9					- very stiff, PP=3.5 tsf				
10	B3-10								
	B3-10.5								
11	B3-11					25			
12					- PP=3.0 tsf				
13									
14									
15	B3-15								
	B3-15.5				- poorly graded sand lens				
16	B3-16				- stiff, PP=1.25 tsf	13			
17									
18									
19									

Figure A2, Log of Boring, page 1 of 3

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

BORING B1

ELEV. (MSL.) **~50** DATE COMPLETED **2/7/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Slagle Drilling**

EQUIPMENT **Track Mounted CME-55 w/ 6" HSA** HAMMER TYPE **Automatic | 140lb**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
20									
21	B3-20.5 B3-21				- hard, black mottling, white sand clasts and concretions, increase in fine to medium sand, PP=4.25 tsf	20			
22									
23									
24									
25					- stiff, yellowish brown, PP=1.25 tsf				
26	B3-25.5 B3-26					16			
27									
28			▼						
29									
30				CH	Hard, moist, olive brown with blue and black, white sand clasts, Fat CLAY, trace fine to medium sand, PP=4.25 tsf			27.9	PI
31	B3-30.5 B3-31					32			
32									
33				CL-ML	Very stiff, moist, olive brown with blue and black, SILTY CLAY, trace fine to medium sand				
34									
35									
36	B3-35.5 B3-36				- PP=2.25 tsf	24			
37									
38									
39									

Figure A3, Log of Boring, page 2 of 3

GEOCON

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL ◧ ... STANDARD PENETRATION TEST ■ ... DRIVE SAMPLE (UNDISTURBED)
▩ ... DISTURBED OR BAG SAMPLE ◥ ... CHUNK SAMPLE ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

BORING B1

ELEV. (MSL.) **~50** DATE COMPLETED **2/7/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Slagle Drilling**

EQUIPMENT **Track Mounted CME-55 w/ 6" HSA** HAMMER TYPE **Automatic | 140lb**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
40									
41	B3-40.5 B3-41				- stiff, PP=1.75 tsf	28			
42									
43									
44									
45					- moist to wet - stiff to very stiff, PP=2.0 tsf				
46	B3-45.5 B3-46					25			
47	B3-47 B3-47.5					27			
48					BORING TERMINATED AT 48 FEET GROUNDWATER ENCOUNTERED AT 28.3 FEET BACKFILLED WITH NEAT CEMENT GROUT VIA TREMMIE PIPE AND SOIL CUTTINGS				

Figure A4, Log of Boring, page 3 of 3

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◪ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP1

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP1-BULK			CL	**ALLUVIUM** Medium stiff, moist, dark brown, Lean CLAY, few sand, trace rootlets				PI, GSA, CP, EI
1									
2									
3									
4									
5									
6	TP1-6				- very stiff, PP=3.5 tsf			21.6	
					TEST PIT TERMINATED AT 6.5 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A5, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ▨ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP2

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP2-BULK			CL	**ALLUVIUM** Medium stiff to stiff, moist, dark brown, Lean CLAY, few sand				PI, GSA, CP, EI
1									
2									
3									
4									
5									
6	TP2-6				- hard, brown, PP=4.25 tsf			22.5	
					TEST PIT TERMINATED AT 6.5 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A6, Log of Test Pit, page 1 of 1

IN PROGRESS S1704-05-01 BRETTON WOODS.GPJ 04/29/19

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP3

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP3-BULK			CL	**ALLUVIUM** Medium stiff to stiff, moist, dark brown, Lean CLAY with sand				GSA, CR, R
1									
2									
3					- very stiff, brown				
4									
5									
6									
7									
8					TEST PIT TERMINATED AT 8 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A7, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP4

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP4-BULK			CL	**ALLUVIUM** Stiff, moist, dark brown, Lean CLAY with sand				GSA, CR, R
1									
2									
3									
4					- very stiff, brown				
5									
6									
7	TP4-7			SC	Medium dense, moist, yellowish brown, Clayey SAND, fine to coarse sand, few fine to medium gravel			18.0	PI, GSA
8					TEST PIT TERMINATED AT 8 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A8, Log of Test Pit, page 1 of 1

IN PROGRESS S1704-05-01 BRETTON WOODS.GPJ 04/29/19

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◪ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP5

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP5-BULK			CH	**ALLUVIUM** Medium stiff to stiff, moist, dark brown, Fat CLAY, few sand				PI, GSA, EI
1									
2									
3									
4					- very stiff, brown				
5									
6									
7									
8					TEST PIT TERMINATED AT 8 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A9, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP6

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP6-BULK			CL	**ALLUVIUM** Medium stiff, moist, dark grayish brown, Lean CLAY with sand				PI, GSA, EI
1									
2	TP6-2				- very stiff, PP=2.75 tsf			23.3	
3									
4					- brown				
5									
6	TP6-6							25.0	
					TEST PIT TERMINATED AT 6.5 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A10, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP7

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP7-BULK			CH	**ALLUVIUM** Medium stiff to stiff, moist to wet, dark brown, Fat CLAY, few sand				PI, GSA, CP, EI, R
1									
2									
3									
4									
5					- very stiff, brown				
6					TEST PIT TERMINATED AT 6 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A11, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP8

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP8-BULK			CL	**ALLUVIUM** Medium stiff, moist, dark grayish brown, Lean CLAY with sand				PI, GSA, EI
1									
2									
3					- stiff, brown				
4									
5									
6					TEST PIT TERMINATED AT 6 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A12, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP9

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP9-BULK			CL	**ALLUVIUM** Medium stiff, moist, dark brown, Lean CLAY, trace fine sand				
1									
2									
3									
4									
5									
6					TEST PIT TERMINATED AT 6.5 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A13, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP10

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP10-BULK			CL	**ALLUVIUM** Medium stiff, moist, dark brown, Lean CLAY, little sand				PI, GSA, CR
1									
2									
3									
4									
5									
6	TP10-6				- hard, brown, PP>4.5 tsf			22.7	
					TEST PIT TERMINATED AT 6.5 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A14, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ▨ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP11

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP11-BULK			CL	**ALLUVIUM** Stiff, moist, dark brown, Lean CLAY, little sand				PI, GSA, CR
1									
2									
3									
4									
5									
6					- very stiff, brown				
					TEST PIT TERMINATED AT 6.5 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A15, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP12

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP12-BULK			CH	**ALLUVIUM** Medium stiff, moist, dark brown, Fat CLAY. few sand				PI, GSA, EI
1									
2									
3	TP12-3				- very stiff, PP=3.5 tsf			21.6	
4									
5									
6	TP12-6				- stiff, brown			23.2	
					TEST PIT TERMINATED AT 6.5 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A16, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ▨ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP13

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP13-BULK			CL	**ALLUVIUM** Stiff, moist, dark brown, Lean CLAY				
1									
2									
3									
4									
5					- very stiff, brown				
6					TEST PIT TERMINATED AT 6 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A17, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP14

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP14-BULK			CH	**ALLUVIUM** Medium stiff to stiff, moist, dark brown, Fat CLAY, few sand				PI, GSA, CP, EI, R
1									
2	TP14-1.5				- stiff, PP=1.5 tsf			27.3	
3									
4									
5									
6	TP14-5.5				- very stiff, brown, PP=3.75 tsf			21.3	
					TEST PIT TERMINATED AT 6 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A18, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

PROJECT NO. **S1704-05-01** PROJECT NAME **Bretton Woods**

TEST PIT TP15

ELEV. (MSL.) **~50** DATE COMPLETED **4/15/2019**

ENG./GEO. **Tyler Henderson** DRILLER **Independent Engineering, Inc.**

EQUIPMENT **Bobcat 430 Mini-Excavator w/ 12" bucket** HAMMER TYPE **N/A**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	TP15-BULK			CL	**ALLUVIUM** Stiff, moist, dark brown, Lean CLAY				
1									
2	TP15-1.5				- PP=1.75 tsf			27.8	
3									
4									
5					- very stiff, brown				
6	TP15-5.5							22.3	
					TEST PIT TERMINATED AT 6.5 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH EXCAVATED SOIL				

Figure A19, Log of Test Pit, page 1 of 1

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ▨ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

APPENDIX B

APPENDIX B

LABORATORY TESTING PROGRAM

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected soil samples were tested for their in-place dry density and moisture content, plasticity characteristics, grain size distribution, expansion potential, corrosion potential, density-moisture relationship, and pavement support characteristics. The results of the laboratory tests are presented on the following pages.

TABLE B1
EXPANSION INDEX TEST RESULTS
ASTM D4829

Sample Number	Depth (feet)	Moisture Content (%)		Expansion Index	Classification*
		Before Test	After Test		
B1-Bulk	0 – 5	12.0	30.4	49	Low
TP1&2-Bulk	0 – 5	13.0	30.4	85	Medium
TP5&12-Bulk	0 – 5	13.2	30.2	50	Low
TP6&8-Bulk	0 – 5	12.0	26.7	88	Medium
TP7&14-Bulk	0 – 5	12.5	15.4	138	Very High

**Expansion Potential Classification per ASTM D4829.*

TABLE B2
SOIL CORROSION PARAMETER TEST RESULTS
(CALIFORNIA TEST METHODS 643, 417, AND 422)

Sample Number.	Depth (feet)	pH	Minimum Resistivity (ohm-cm)	Chloride (ppm) / (%)	Sulfate (ppm) / (%)
TP3&4-Bulk	0 – 5	7.5	1,470	2.3 / 0.00023	9.9 / 0.00099
TP10&11-Bulk	0 – 5	7.7	1,660	2.8 / 0.00028	71.4 / 0.00714

*Caltrans considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil samples at the site:

- The pH is equal to or less than 5.5.
- The resistivity is equal to or less than 1,000 ohm-cm.
- Chloride concentration is equal to or greater than 500 parts per million (ppm).
- Sulfate concentration is equal to or greater than 2,000 ppm.

According to the 2016 California Building Code Section 1904.1 which refers to the durability requirements of American Concrete Institute (ACI) 318 (Chapter 4), Type II cement may be used where soluble sulfate levels in soil are below 2,000 ppm.

TABLE B3
R-VALUE TEST RESULTS
ASTM D2844

Sample Number	Depth (feet)	Sample Description	R-Value
TP3&4-Bulk	0 – 5	Dark brown Lean CLAY with sand (CL)	<5
TP7&14-Bulk	0 – 5	Dark brown Fat CLAY	<5

Sample ID	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index	Expansion Index	%<#200 Sieve	Water Content (%)	Dry Density (pcf)
B1-Bulk	0-5	45	22	23	49	76.6	17.6	
B1-1.5							23.0	98.6
B1-5.0							22.5	102.6
B1-8.0							22.8	98.4
B1-30.5	30.5	61	26	35			27.9	
TP1&TP2-Bulk	0-5	47	19	28	85	94.3		
TP1-6.0	6						21.6	
TP10&TP11	0	43	18	25		88.4		
TP10-6.0	6						22.7	
TP12-3.0	3						21.6	
TP12-6.0	6						23.2	
TP14-1.5	1.5						27.3	
TP14-5.5	5.5						21.3	
TP15-1.5	1.5						27.8	
TP15-5.5	5.5						22.3	
TP2-6.0	6						22.5	
TP3&4-Bulk	0-5					83.5		
TP4-7.0	7	27	15	12		45.5	18.0	
TP5&12-Bulk	0-5	51	20	31	50	92.2		
TP6&TP8-Bulk	0-5	38	17	21	88	79.0		
TP6-2.0	2						23.3	
TP6-6.0	6						25.0	
TP7&14-Bulk	0-5	54	19	35	138	92.5		

GEOCON

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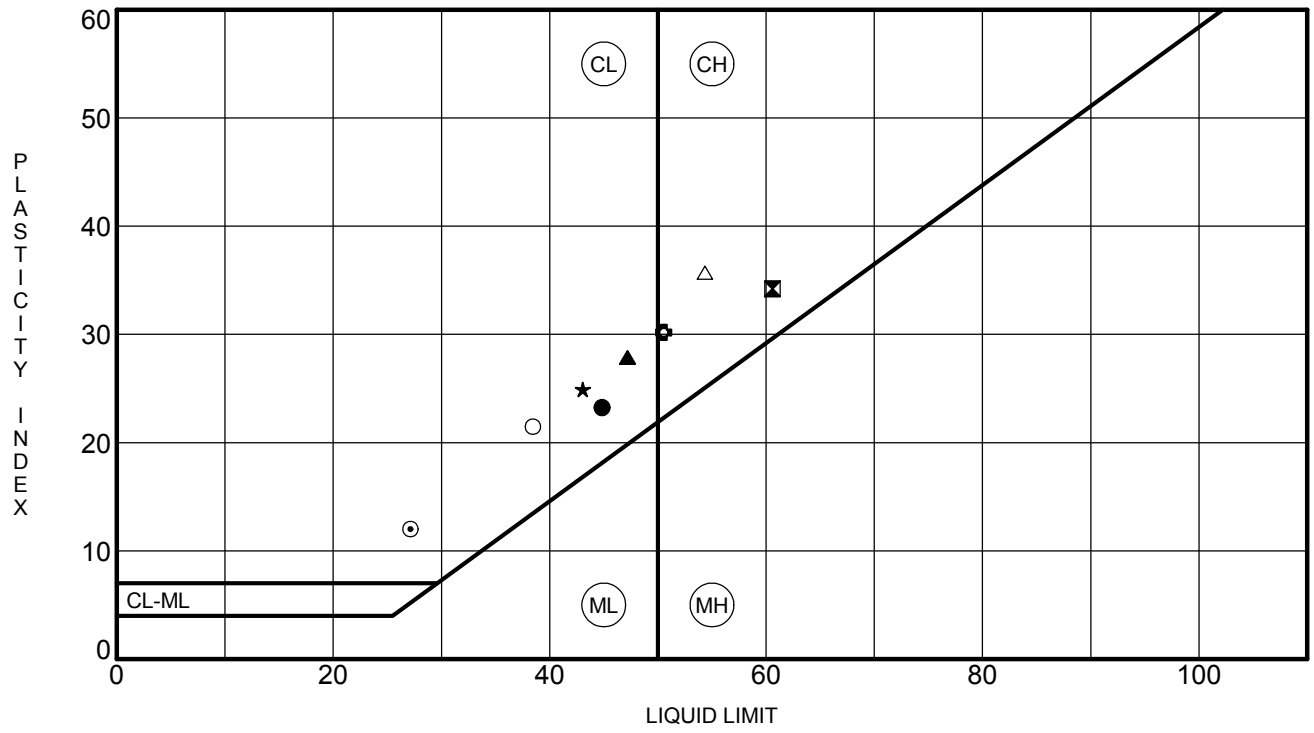
Telephone: 916-852-9118

Summary of Laboratory Results

Project: Bretton Woods
Location: Davis, CA
Number: S1704-05-01
Figure: B1



	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description	Preparation Method
●	**B1-Bulk**	**45**	**22**	**23**	**76.6**	**LEAN CLAY with SAND(CL)**	**dry**
⊠	**B1-30.5**	**61**	**26**	**35**		**FAT CLAY (CH)**	**dry**
▲	**TP1&TP2-Bulk**	**47**	**19**	**28**	**94.3**	**LEAN CLAY(CL)**	**dry**
★	**TP10&TP11**	**43**	**18**	**25**	**88.4**	**LEAN CLAY(CL)**	**wet**
⊙	**TP4-7.0**	**27**	**15**	**12**	**45.5**	**CLAYEY SAND(SC)**	**dry**
✿	**TP5&12-Bulk**	**51**	**20**	**31**	**92.2**	**FAT CLAY(CH)**	**dry**
○	**TP6&TP8-Bulk**	**38**	**17**	**21**	**79.0**	**LEAN CLAY with SAND(CL)**	**dry**
△	**TP7&14-Bulk**	**54**	**19**	**35**	**92.5**	**FAT CLAY(CH)**	**dry**

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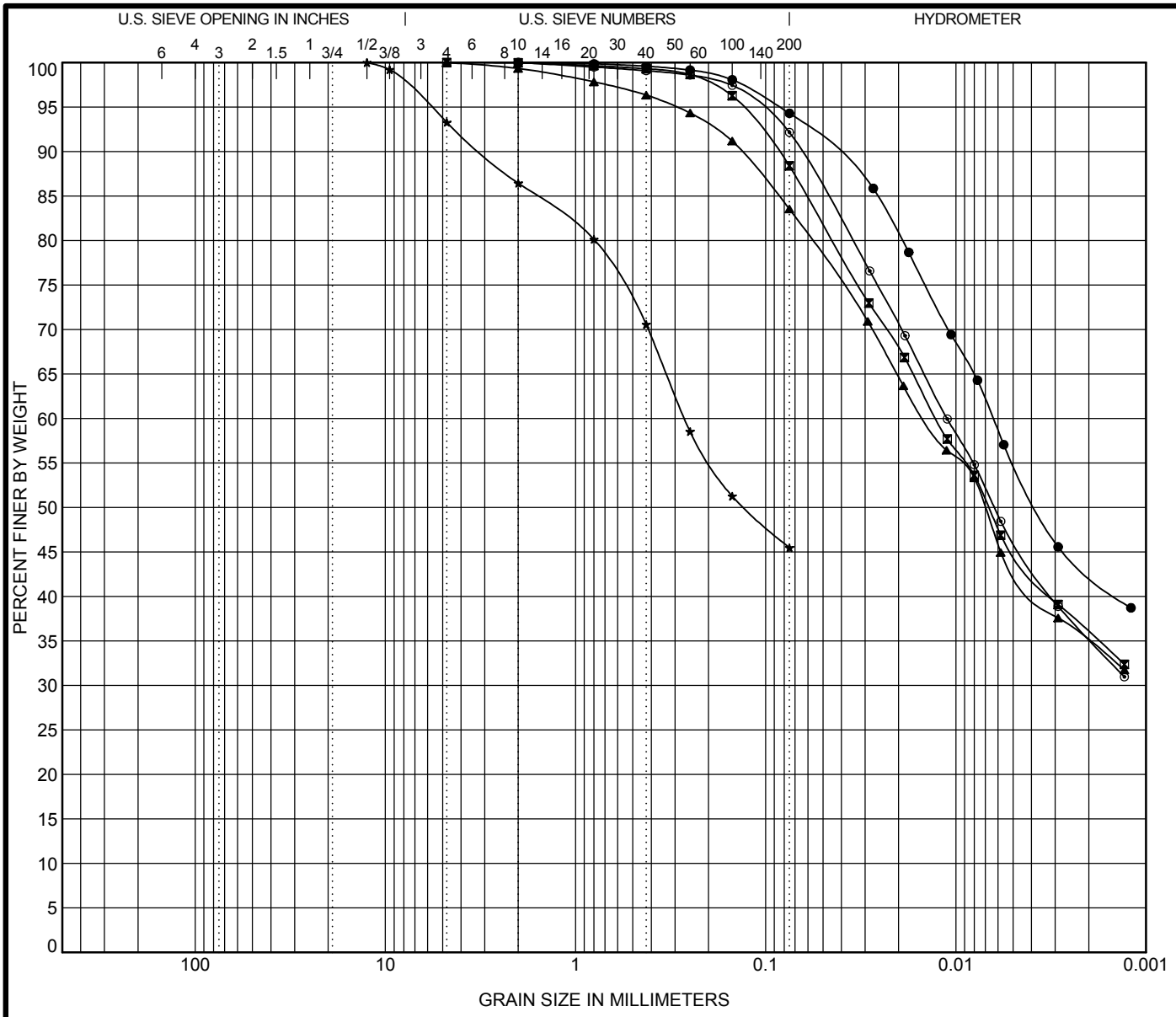
ATTERBERG LIMITS (ASTM D4318)

Project: Bretton Woods
Location: Davis, CA
Number: S1704-05-01
Figure: B2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	TP1&TP2-Bulk	LEAN CLAY(CL)	47	19	28		
⊠	TP10&TP11	LEAN CLAY(CL)	43	18	25		
▲	TP3&4-Bulk	LEAN CLAY with SAND (CL)					
★	TP4-7.0	CLAYEY SAND(SC)	27	15	12		
⊙	TP5&12-Bulk	FAT CLAY(CH)	51	20	31		

	Sample No.	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP1&TP2-Bulk	2	0.006			0.0	5.7	39.2	55.1
⊠	TP10&TP11	4.75	0.013			0.0	11.6	43.2	45.2
▲	TP3&4-Bulk	4.75	0.014			0.0	16.5	40.2	43.4
★	TP4-7.0	12.5	0.267			6.7	47.8	45.5	
⊙	TP5&12-Bulk	2	0.011			0.0	7.8	45.8	46.4

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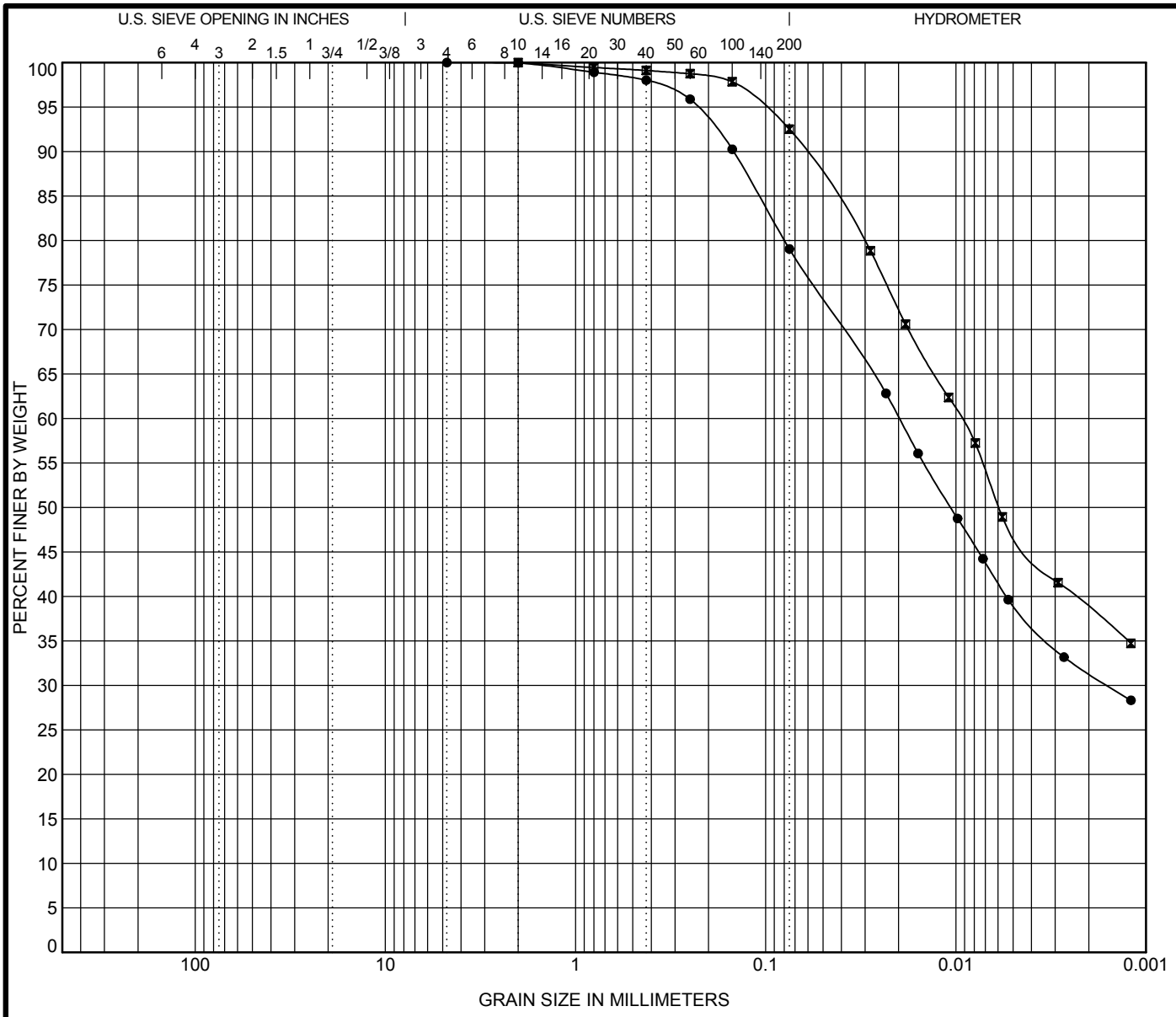
GRAIN SIZE DISTRIBUTION (ASTM D422, D6913)

Project: Bretton Woods
Location: Davis, CA
Number: S1704-05-01
Figure: B3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	**TP6&TP8-Bulk**	**LEAN CLAY with SAND(CL)**	**38**	**17**	**21**		
⊠	**TP7&14-Bulk**	**FAT CLAY(CH)**	**54**	**19**	**35**		

	Sample No.	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP6&TP8-Bulk**	**4.75**	**0.02**	**0.002**		**0.0**	**21.0**	**40.0**	**39.1**
⊠	**TP7&14-Bulk**	**2**	**0.009**			**0.0**	**7.5**	**45.0**	**47.5**

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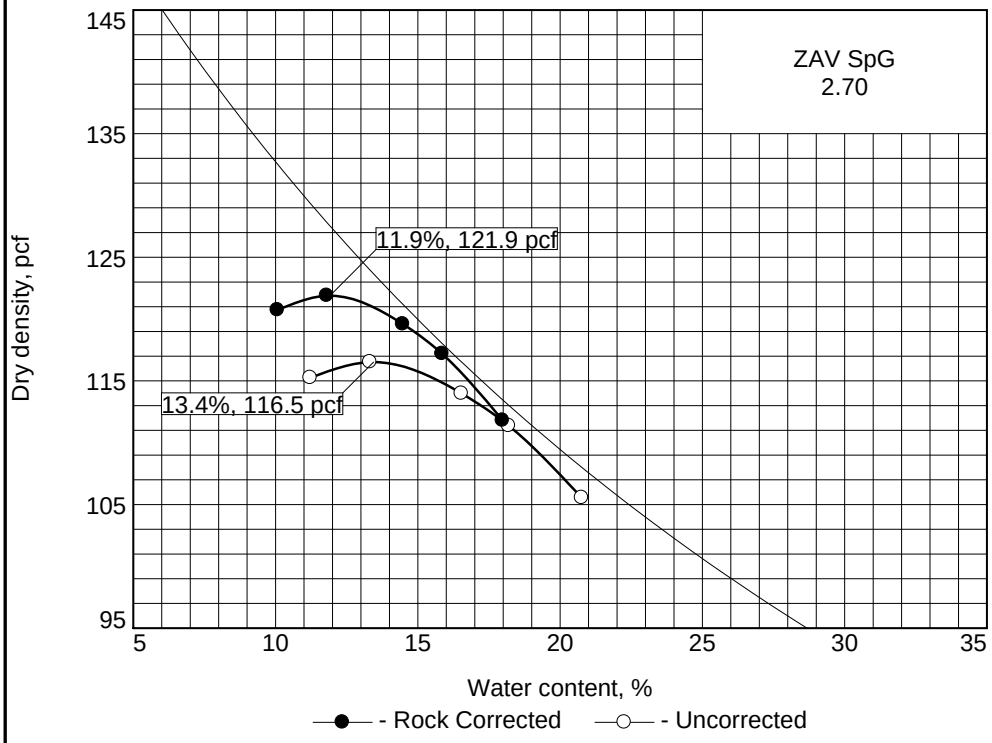
GRAIN SIZE DISTRIBUTION (ASTM D422, D6913)

Project: Bretton Woods
Location: Davis, CA
Number: S1704-05-01
Figure: B3

COMPACTION TEST REPORT



Curve No.
1

Test Specification:
ASTM 1557 Method A 2019 Mold 2
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method
Hammer Wt. 10.00
Hammer Drop 18
Number of Layers 5
Blows per Layer 25
Mold Size 0.03321 cu. ft.

Test Performed on Material Passing #4 **Sieve**

NM **LL** **PI**
Sp.G. (ASTM D 854) 2.7
%>#4 17 **%<No.200**
USCS **AASHTO**
Date Sampled
Date Tested 2/12/2019
Tested By HL

TESTING DATA

	1	2	3	4	5	6
WM + WS	4016.0	3953.0	4034.0	4022.0	3964.0	
WM	2033.0	2033.0	2033.0	2033.0	2033.0	
WW + T #1	2440.0	2379.0	2460.0	2443.0	2541.0	
WD + T #1	2135.0	2049.1	2176.2	2209.8	2331.0	
TARE #1	459.0	460.0	460.0	459.0	460.0	
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	15.9	18.0	14.5	11.8	10.1	
DRY DENSITY	117.2	111.8	119.6	121.9	120.7	

ROCK CORRECTED TEST RESULTS	UNCORRECTED
Maximum dry density = 121.9 pcf	116.5 pcf
Optimum moisture = 11.9 %	13.4 %

Material Description

Remarks:

Project No. S1704-05-01 **Client:** Taormino and Associates, Inc.
Project: Bretton Woods

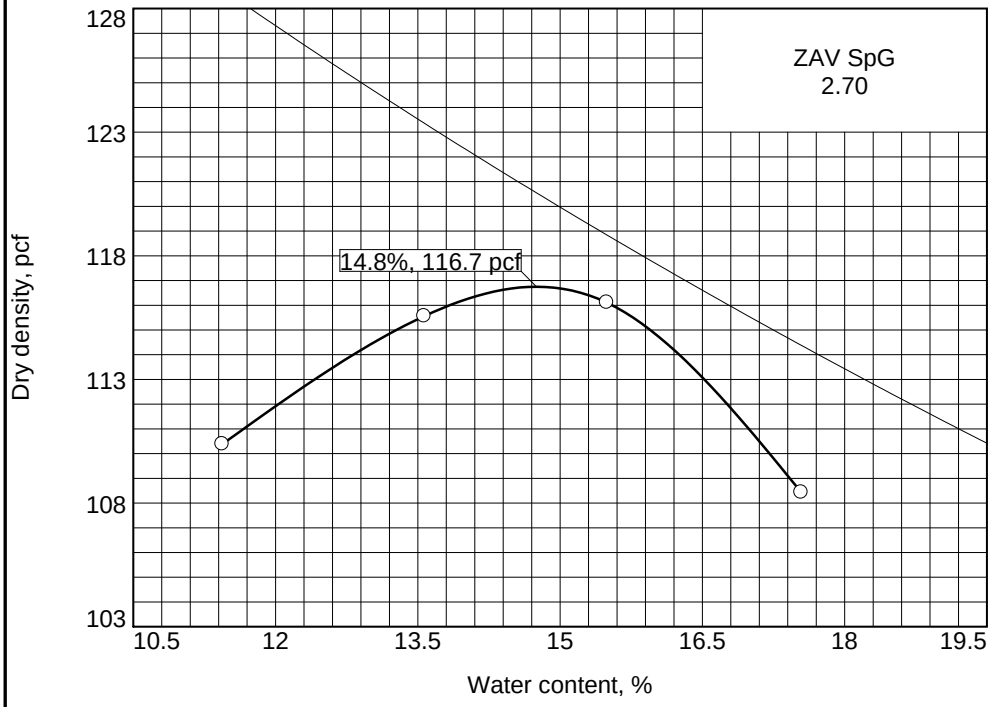
○ **Depth:** 0-5' **Sample Number:** B1-Bulk

Checked by: BPF
Title: Sr. Staff Engineer

GEOCON CONSULTANTS, INC.

Figure B4

COMPACTION TEST REPORT



Curve No.
2

Test Specification:
ASTM 1557 Method A 2019 Mold 2

Preparation Method
Hammer Wt. 10.00
Hammer Drop 18
Number of Layers 5
Blows per Layer 25
Mold Size 0.03321 cu. ft.

Test Performed on Material Passing #4 **Sieve**

NM **LL** **PI**
Sp.G. (ASTM D 854) 2.7
%>#4 **%<No.200**
USCS **AASHTO**
Date Sampled
Date Tested 4/23/2019
Tested By HL

TESTING DATA

	1	2	3	4	5	6
WM + WS	4051.0	4008.0	3884.0	3951.0		
WM	2031.0	2031.0	2031.0	2031.0		
WW + T #1	2241.0	2290.0	2015.0	2076.0		
WD + T #1	1970.7	2053.8	1825.2	1789.9		
TARE #1	226.0	313.0	166.0	159.0		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	15.5	13.6	11.4	17.5		
DRY DENSITY	116.1	115.6	110.4	108.4		

TEST RESULTS

Maximum dry density = 116.7 pcf

Optimum moisture = 14.8 %

Material Description

Remarks:

Project No. S1704-05-01 **Client:** Taormino and Associates, Inc.
Project: Bretton Woods

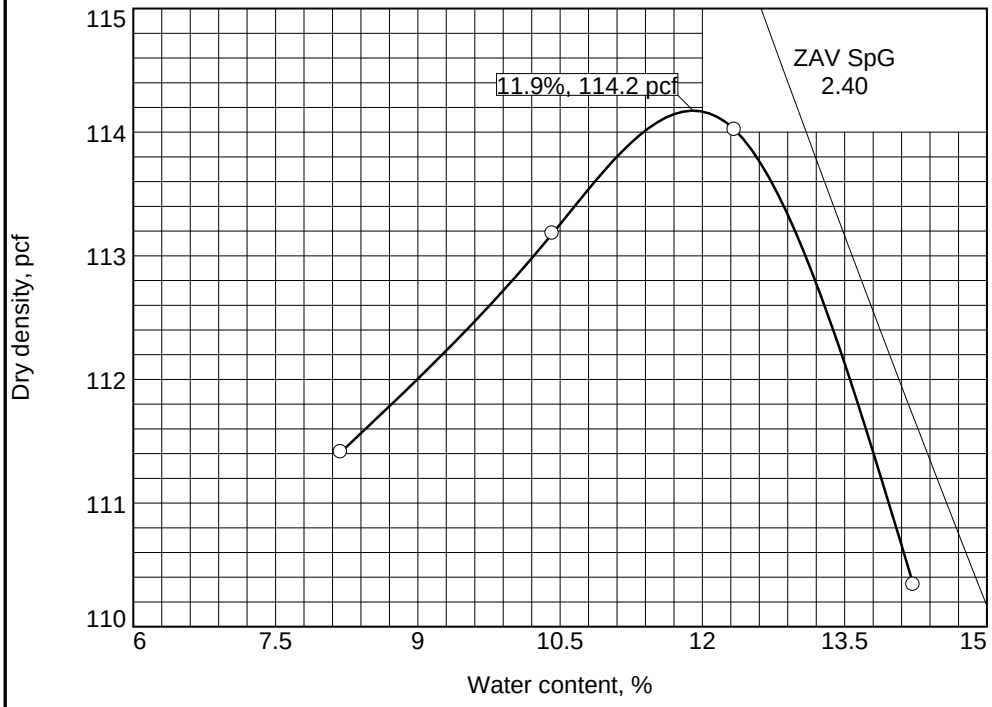
○ **Depth:** 0-5' **Sample Number:** TP1&2-Bulk

Checked by: BPF
Title: Sr. Staff Engineer

GEOCON CONSULTANTS, INC.

Figure B5

COMPACTION TEST REPORT



Curve No.
3

Test Specification:
ASTM 1557 Method A 2019 Mold PM1

Preparation Method	
Hammer Wt.	10.00
Hammer Drop	18
Number of Layers	5
Blows per Layer	25
Mold Size	0.03327 cu. ft.

Test Performed on Material Passing #4 **Sieve**

NM		**LL**	**PI**
Sp.G. (ASTM D 854)	2.7		
%>#4		**%<No.200**	
USCS		**AASHTO**	
Date Sampled			
Date Tested	4/23/2019		
Tested By	HL		

TESTING DATA

	1	2	3	4	5	6
WM + WS	3885.0	3818.0	3932.0	3901.0		
WM	1999.0	1999.0	1999.0	1999.0		
WW + T #1	2092.0	2020.0	2139.0	2056.0		
WD + T #1	1914.3	1882.7	1926.8	1819.4		
TARE #1	209.0	206.0	207.0	156.0		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	10.4	8.2	12.3	14.2		
DRY DENSITY	113.2	111.4	114.0	110.3		

TEST RESULTS

Maximum dry density = 114.2 pcf

Optimum moisture = 11.9 %

Material Description

Remarks:

Project No. S1704-05-01 **Client:** Taormino and Associates, Inc.
Project: Bretton Woods

○ **Depth:** 0-5' **Sample Number:** TP7&14-Bulk

Checked by: BPF
Title: Sr. Staff Engineer

GEOCON CONSULTANTS, INC.

Figure B6

APPENDIX C

APPENDIX C

LANDSCAPE SOIL SUITABILITY TEST RESULTS

SUNLAND ANALYTICAL LABORATORY

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 05/03/2019
Date Submitted 04/30/2019

To: Mark Repking
Geocon
3160 Gold Valley Dr. #800
Rancho Cordova, CA 95742

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : S1704-05-01 Site ID : TP-1.
Thank you for your business.

* For future reference to this analysis please use SUN # 79536-166157.

SOIL ANALYSIS

Saturation Percent (SP)	60		Soil Texture Clay Loam
pH	7.32		
E.C.	0.21	mmho/cm	
Tot.Dissolved Salts	134.4	ppm	
Infiltration Rate (0% Slope)	0.25	in/hr	
% Organic Matter	6.5		
C.E.C.	15.7	meq/100g	
Sodium Absorption Ratio (SAR)	2.1		
Exchangable Sodium Percent (ESP)	1.7		
Gypsum Req. (CaSO4*2H2O)	None Required		
est. Nitrogen Release	2.0	#/1000 sq.ft.	

Nitrate	3.19	ppm	*
Phosphorus	4.12	ppm	****
Potassium	167.61	ppm	**********
Sulfur	2.14	ppm	***
Chloride	1.19	ppm	****
Carbonates	89.97	ppm	******
Sodium	62.18	ppm	
Calcium	1893.32	ppm	**********
Magnesium	669.64	ppm	**********
Boron	0.54	ppm	**********
Copper	2.98	ppm	**********
Iron	65.22	ppm	**********
Manganese	5.81	ppm	**********
Zinc	1.36	ppm	**********

Very Low	Low	Adequate	Excessive

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166157

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-1

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL pH (Acidity and Alkalinity)

The pH of this sample indicates the soil is in a range for normal growth of most plants. No modification is required.

DISSOLVED SALTS (Indicated by E.C. & TDS)

These conditions are in the normal range for plant growth.

SOIL TEXTURE AND RATE OF WATER INFILTRATION

The infiltration rate for all soil textures decreases with increasing ground slope. At 0 to 4%, 5 to 8%, 9 to 12%, 13 to 16% and above 16% the infiltration rate of this sample decreases from 0.25 to 0.20, 0.15, 0.10, 0.06, respectively. Infiltration rate also decreases with percent of ground cover and by compaction.

WATER PENETRATION OF SOIL DUE TO CHEMICAL CHARACTERISTICS

When exchangable Sodium increases in the soil, water penetration decreases. Based on SAR and ESP values this sample has no penetration problem due to soil Sodium. No Gypsum required.

ORGANIC MATTER

Organic matter provides a slow nitrogen release and aids water retention. This sample has a moderate Organic Matter content.
To maintain moisture and provide sustained nitrogen release a level of 10% organic matter is recommended. This can be accomplished by adding 2 yards per 1000 sq.ft. of ground fir bark that is approximately 75% organic matter (i.e. typically found in ground fir bark which also has naturally low salt and boron concentrations). In California, the MWELO ordenance requires a fixed application of four yards of COMPOST if the soil organic matter is less than 6%. However, of significant concern when applying COMPOST is the potential for the compost to have high salt, high boron content, high C to N ratio and having a higly variable pH (very high to very low). All of these COMPOST characteristics can have very negative affect on plant growth. Take care by having the compost analyzed or by seeing a recent analysis of the compost to be used.

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166157

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-1

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL BORON

Boron concenrations are in a range allowing normal plant growth.

SOIL MICRONUTRIENTS

Micronutrients, Copper, Iron, Manganese and Zinc, in soil are present in small amounts. However, they play a necessary role in plant metabolism. Without appropriate amounts plants will not thrive. Soil has adequate amounts - no application needed.

SOIL MACRONUTRIENTS : NITROGEN-PHOSPHORUS-POTASSIUM (N-P-K)

GENERAL N-P-K RECOMMENDATION

Use ONE of these NPK preparations for the first fertilizer application.

Standard NPK Fertilizer Preparations	6-20-20	5-20-10	16-16-16	0-10-10	28-3-4	21-0-0	Customer Choice None
#/1000 sq.ft.	19	22	N/A	N/A	N/A	N/A	**

GRASS OR SOD PREPARATION

Till in organic matter, N,P,K and micro nutrients in addition to any lime gypsum or sulfur as directed above. Smooth soil surface and follow seed or sod producers direction for moisture and product application.

TREES AND SHRUBS

Excavate holes for planting shrubs and trees to at least twice the volume of the container. Prepare backfill for tree and shrub planting holes by mixing three parts of native soil (or imported top soil) with one part organic amendment (preferably nitrogen and iron fortified) and 2.5 pounds of 6-20-20 per yard of mix. For extended fertilization, place slow release fertilizer tablets in each hole per manufacturer's instructions. If 6-20-20 was not directly added to backfill mix, during backfill apply uniformly 1/2 oz of 6-20-20 per gallon containers, 2.5 oz per 5 gallons, 6 oz per 24 inch boxes.

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166157

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-1

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

Summary and Suggested Sequence of Soil Improvements (#/1000 Sq.Ft.)

Organic Amendment	2	Yd./1000 Sq.Ft. Bulk organic amendment (nitrified). or in Calif. if Org.Mat. less than 6% use 4 yd compost.
N-P-K Fertilizer	See above chart	
Sulfate-Sulfur	2	# Ammonium Sulfate

Maintenance Fertilization

Apply 5 pounds of Ammonium sulfate (21-0-0) per 1000 sq.ft.every month until plants become established. After established, apply 28-3-4 (or similar preparation) to provide desired growth rate and color.

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 05/03/2019
Date Submitted 04/30/2019

To: Mark Repking
Geocon
3160 Gold Valley Dr. #800
Rancho Cordova, CA 95742

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : S1704-05-01 Site ID : TP-2.
Thank you for your business.

* For future reference to this analysis please use SUN # 79536-166158.

SOIL ANALYSIS

Saturation Percent (SP)	62		Soil Texture Clay Loam
pH	7.10		
E.C.	0.14	mmho/cm	
Tot.Dissolved Salts	89.6	ppm	
Infiltration Rate (0% Slope)	0.25	in/hr	
% Organic Matter	6.4		
C.E.C.	15.5	meq/100g	
Sodium Absorption Ratio (SAR)	2.2		
Exchangable Sodium Percent (ESP)	1.9		
Gypsum Req. (CaSO4*2H2O)	None Required		
est. Nitrogen Release	2.0	#/1000 sq.ft.	

Nitrate	3.32	ppm	*
Phosphorus	6.26	ppm	******
Potassium	171.61	ppm	**********
Sulfur	1.80	ppm	***
Chloride	1.46	ppm	*****
Carbonates	56.08	ppm	**********
Sodium	69.21	ppm	
Calcium	1964.47	ppm	**********
Magnesium	600.63	ppm	**********
Boron	0.61	ppm	**********
Copper	3.07	ppm	**********
Iron	66.97	ppm	**********
Manganese	10.54	ppm	**********
Zinc	1.23	ppm	**********

Very Low	Low	Adequate	Excessive

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166158

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-2

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL pH (Acidity and Alkalinity)

The pH of this sample indicates the soil is in a range for normal growth of most plants. No modification is required.

DISSOLVED SALTS (Indicated by E.C. & TDS)

These conditions are in the normal range for plant growth.

SOIL TEXTURE AND RATE OF WATER INFILTRATION

The infiltration rate for all soil textures decreases with increasing ground slope. At 0 to 4%, 5 to 8%, 9 to 12%, 13 to 16% and above 16% the infiltration rate of this sample decreases from 0.25 to 0.20, 0.15, 0.10, 0.06, respectively. Infiltration rate also decreases with percent of ground cover and by compaction.

WATER PENETRATION OF SOIL DUE TO CHEMICAL CHARACTERISTICS

When exchangable Sodium increases in the soil, water penetration decreases. Based on SAR and ESP values this sample has no penetration problem due to soil Sodium. No Gypsum required.

ORGANIC MATTER

Organic matter provides a slow nitrogen release and aids water retention. This sample has a moderate Organic Matter content.
To maintain moisture and provide sustained nitrogen release a level of 10% organic matter is recommended. This can be accomplished by adding 2 yards per 1000 sq.ft. of ground fir bark that is approximately 75% organic matter (i.e. typically found in ground fir bark which also has naturally low salt and boron concentrations). In California, the MWELO ordenance requires a fixed application of four yards of COMPOST if the soil organic matter is less than 6%. However, of significant concern when applying COMPOST is the potential for the compost to have high salt, high boron content, high C to N ratio and having a higly variable pH (very high to very low). All of these COMPOST characteristics can have very negative affect on plant growth. Take care by having the compost analyzed or by seeing a recent analysis of the compost to be used.

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166158

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-2

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL BORON

Boron concenrations are in a range allowing normal plant growth.

SOIL MICRONUTRIENTS

Micronutrients, Copper, Iron, Manganese and Zinc, in soil are present in small amounts. However, they play a necessary role in plant metabolism. Without appropriate amounts plants will not thrive. Soil has adequate amounts - no application needed.

SOIL MACRONUTRIENTS : NITROGEN-PHOSPHORUS-POTASSIUM (N-P-K)

GENERAL N-P-K RECOMMENDATION

Use ONE of these NPK preparations for the first fertilizer application.

Standard NPK Fertilizer Preparations	6-20-20	5-20-10	16-16-16	0-10-10	28-3-4	21-0-0	Customer Choice None
#/1000 sq.ft.	18	22	N/A	N/A	N/A	N/A	**

GRASS OR SOD PREPARATION

Till in organic matter, N,P,K and micro nutrients in addition to any lime gypsum or sulfur as directed above. Smooth soil surface and follow seed or sod producers direction for moisture and product application.

TREES AND SHRUBS

Excavate holes for planting shrubs and trees to at least twice the volume of the container. Prepare backfill for tree and shrub planting holes by mixing three parts of native soil (or imported top soil) with one part organic amendment (preferably nitrogen and iron fortified) and 2.5 pounds of 6-20-20 per yard of mix. For extended fertilization, place slow release fertilizer tablets in each hole per manufacturer's instructions. If 6-20-20 was not directly added to backfill mix, during backfill apply uniformly 1/2 oz of 6-20-20 per gallon containers, 2.5 oz per 5 gallons, 6 oz per 24 inch boxes.

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166158

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-2

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

Summary and Suggested Sequence of Soil Improvements (#/1000 Sq.Ft.)

Organic Amendment	2	Yd./1000 Sq.Ft. Bulk organic amendment (nitrified). or in Calif. if Org.Mat. less than 6% use 4 yd compost.
N-P-K Fertilizer	See above chart	
Sulfate-Sulfur	2	# Ammonium Sulfate

Maintenance Fertilization

Apply 5 pounds of Ammonium sulfate (21-0-0) per 1000 sq.ft.every month until plants become established. After established, apply 28-3-4 (or similar preparation) to provide desired growth rate and color.

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 05/03/2019
Date Submitted 04/30/2019

To: Mark Repking
Geocon
3160 Gold Valley Dr. #800
Rancho Cordova, CA 95742

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : S1704-05-01 Site ID : TP-6.
Thank you for your business.

* For future reference to this analysis please use SUN # 79536-166159.

SOIL ANALYSIS

Saturation Percent (SP)	59		Soil Texture Clay Loam
pH	7.88		
E.C.	0.25	mmho/cm	
Tot.Dissolved Salts	160	ppm	
Infiltration Rate (0% Slope)	0.25	in/hr	
% Organic Matter	4.8		
C.E.C.	10.5	meq/100g	
Sodium Absorption Ratio (SAR)	5.3		
Exchangable Sodium Percent (ESP)	6.1		
Gypsum Req. (CaSO4*2H2O)	20.	#/1000 sq.ft.	
est. Nitrogen Release	1.7	#/1000 sq.ft.	

Nitrate	1.65	ppm	*
Phosphorus	9.51	ppm	********
Potassium	169.61	ppm	************************
Sulfur	3.67	ppm	*****
Chloride	1.66	ppm	*****
Carbonates	115.56	ppm	********************
Sodium	148.98	ppm	
Calcium	1307.01	ppm	*****************
Magnesium	356.10	ppm	************
Boron	0.73	ppm	**********************
Copper	1.89	ppm	*****************
Iron	41.69	ppm	*****************
Manganese	4.66	ppm	************
Zinc	0.50	ppm	**********

Very Low	Low	Adequate	Excessive

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166159

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-6

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL pH (Acidity and Alkalinity)

The pH of this sample indicates the soil is moderately alkaline, a condition negatively affecting some plants. Apply 9 pounds of soil sulfur per 1000 sq.ft. Spread evenly and work into the top six inches. Recall that sulfur alteration of pH is a slow process. For more rapid effect Sulfuric Acid may be used.

DISSOLVED SALTS (Indicated by E.C. & TDS)

These conditions are in the normal range for plant growth.

SOIL TEXTURE AND RATE OF WATER INFILTRATION

The infiltration rate for all soil textures decreases with increasing ground slope. At 0 to 4%, 5 to 8%, 9 to 12%, 13 to 16% and above 16% the infiltration rate of this sample decreases from 0.25 to 0.20, 0.15, 0.10, 0.06, respectively. Infiltration rate also decreases with percent of ground cover and by compaction.

WATER PENETRATION OF SOIL DUE TO CHEMICAL CHARACTERISTICS

When exchangable Sodium increases in the soil, water penetration decreases. Based on SAR and ESP values this sample will have increasing problems with water penetration. Apply 20 pounds of Gypsum per 1000 sq.ft., work into soil, and leach with good quality water. Have the water analyzed before use to insure that the water is not the cause of the high Sodium in the soil. Leaching requires good quality water and adequate drainage through the root zone.

ORGANIC MATTER

Organic matter provides a slow nitrogen release and aids water retention. This sample has a moderate Organic Matter content.
To maintain moisture and provide sustained nitrogen release a level of 10% organic matter is recommended. This can be accomplished by adding 3 yards per 1000 sq.ft. of ground fir bark that is approximately 75% organic matter (i.e. typically found in ground fir bark which also has naturally low salt and boron concentrations). In California, the MWELO ordenance requires a fixed application of four yards of COMPOST if the soil organic matter is less than 6%. However, of significant concern when applying COMPOST is the potential for the compost to have high salt, high boron content, high C to N ratio and having a higly variable pH (very high to very low). All of these COMPOST characteristics can have very negative affect on plant growth. Take care by having the compost analyzed or by seeing a recent analysis of the compost to be used.

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166159

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-6

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL BORON

Boron concenrations are in a range allowing normal plant growth.

SOIL MICRONUTRIENTS

Micronutrients, Copper, Iron, Manganese and Zinc, in soil are present in small amounts. However, they play a necessary role in plant metabolism. Without appropriate amounts plants will not thrive. Apply the following per 1000/ sq.ft. Do not mix micronutrients during application (use a separate application for each element indicated).

Because copper, manganese and zinc are in very small amounts, dissolve (each) in 2 gallons of water and use a sprayer to obtain an even application.
Apply , 1.0 # Manganese Sulfate, 0.5 # Zinc Sulfate and water.

SOIL MACRONUTRIENTS : NITROGEN-PHOSPHORUS-POTASSIUM (N-P-K)

GENERAL N-P-K RECOMMENDATION

Use ONE of these NPK preparations for the first fertilizer application.

Standard NPK Fertilizer Preparations	6-20-20	5-20-10	16-16-16	0-10-10	28-3-4	21-0-0	Customer Choice None
#/1000 sq.ft.	20	24	N/A	N/A	N/A	N/A	**

GRASS OR SOD PREPARATION

Till in organic matter, N,P,K and micro nutrients in addition to any lime gypsum or sulfur as directed above. Smooth soil surface and follow seed or sod producers direction for moisture and product application.

TREES AND SHRUBS

Excavate holes for planting shrubs and trees to at least twice the volume of the container. Prepare backfill for tree and shrub planting holes by mixing three parts of native soil (or imported top soil) with one part organic amendment (preferably nitrogen and iron fortified) and 2.5 pounds of 6-20-20 per yard of mix. For extended fertilization, place slow release fertilizer tablets in each hole per manufacturer's instructions. If 6-20-20 was not directly added to backfill mix, during backfill apply uniformly 1/2 oz of 6-20-20 per gallon containers, 2.5 oz per 5 gallons, 6 oz per 24 inch boxes.

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166159

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-6

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

Summary and Suggested Sequence of Soil Improvements (#/1000 Sq.Ft.)

Gypsum	20 #	- leach soil
Soil Sulfur	9.0 #	for pH modification, repeat as above
Organic Amendment	3	Yd./1000 Sq.Ft. Bulk organic amendment (nitrified). or in Calif. if Org.Mat. less than 6% use 4 yd compost.
N-P-K Fertilizer	See above chart	
Micro Nutrients		
Manganese	1.0 #	Manganese Sulfate
Zinc	0.5 #	Zinc Sulfate
Sulfate-Sulfur	Low sulfate compensated by other soil improvements.	

Maintenance Fertilization

Apply 5 pounds of Ammonium sulfate (21-0-0) per 1000 sq.ft.every month until plants become established. After established, apply 28-3-4 (or similar preparation) to provide desired growth rate and color.

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 05/03/2019
Date Submitted 04/30/2019

To: Mark Repking
Geocon
3160 Gold Valley Dr. #800
Rancho Cordova, CA 95742

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : S1704-05-01 Site ID : TP-8.
Thank you for your business.

* For future reference to this analysis please use SUN # 79536-166160.

SOIL ANALYSIS

Saturation Percent (SP)	96		Soil Texture Clay
pH	8.90		
E.C.	4.15	mmho/cm	
Tot.Dissolved Salts	2656	ppm	
Infiltration Rate (0% Slope)	0.13	in/hr	
% Organic Matter	3.9		
C.E.C.	32.0	meq/100g	
Sodium Absorption Ratio (SAR)	51.6		
Exchangable Sodium Percent (ESP)	42.7		
Gypsum Req. (CaSO4*2H2O)	1004.	#/1000 sq.ft.	
est. Nitrogen Release	1.3	#/1000 sq.ft.	

Nitrate	7.62	ppm	****
Phosphorus	17.44	ppm	**********
Potassium	108.75	ppm	**********
Sulfur	519.10	ppm	**********
Chloride	196.77	ppm	**********
Carbonates	271.00	ppm	**********
Sodium	3138.41	ppm	
Calcium	1325.98	ppm	**********
Magnesium	1394.59	ppm	**********
Boron	8.28	ppm	**********
Copper	0.92	ppm	********
Iron	40.45	ppm	**********
Manganese	6.76	ppm	**********
Zinc	0.71	ppm	**********

Very Low	Low	Adequate	Excessive

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166160

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-8

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

The chemical characteristics of this sample are those of a Sodic Soil. This condition is the result of accumulation of Sodium, which has resulted in the breakdown of normal soil structure. The result of this breakdown is lack of water penetration. As water is applied to this soil the lack of movement through the soil provides the time for evaporation of most of the water. This evaporation has the effect, over time, of accumulation of salts, boron and produces an environment unsuitable for plant growth. Any remediation of this soil is contingent on the depth to which the soil has been affected, the availability of good quality water, whether suitable drainage can be constructed or is available, and the economic commitment to the effort. No specific recommendations can be made for this soil from this analysis.

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 05/03/2019
Date Submitted 04/30/2019

To: Mark Repking
Geocon
3160 Gold Valley Dr. #800
Rancho Cordova, CA 95742

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : S1704-05-01 Site ID : TP-12.
Thank you for your business.

* For future reference to this analysis please use SUN # 79536-166161.

SOIL ANALYSIS

Saturation Percent (SP)	63		Soil Texture Clay Loam
pH	8.05		
E.C.	0.35	mmho/cm	
Tot.Dissolved Salts	224	ppm	
Infiltration Rate (0% Slope)	0.25	in/hr	
% Organic Matter	5.7		
C.E.C.	10.0	meq/100g	
Sodium Absorption Ratio (SAR)	6.6		
Exchangable Sodium Percent (ESP)	7.8		
Gypsum Req. (CaSO4*2H2O)	23.	#/1000 sq.ft.	
est. Nitrogen Release	1.9	#/1000 sq.ft.	

			Very Low	Low	Adequate	Excessive
Nitrate	1.44	ppm	*			
Phosphorus	8.89	ppm	********			
Potassium	148.52	ppm			************************	
Sulfur	12.07	ppm			***************	
Chloride	1.46	ppm	*****			
Carbonates	131.40	ppm			*********************	
Sodium	180.07	ppm				
Calcium	1221.50	ppm			**********	
Magnesium	336.84	ppm			**********	
Boron	1.10	ppm			**************************	
Copper	1.86	ppm			*****************	
Iron	37.17	ppm			*****************	
Manganese	5.45	ppm			************	
Zinc	0.67	ppm	**********			

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166161

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-12

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL pH (Acidity and Alkalinity)

The pH of this sample indicates the soil is moderately alkaline, a condition negatively affecting some plants. Apply 11 pounds of soil sulfur per 1000 sq.ft. Spread evenly and work into the top six inches. Recall that sulfur alteration of pH is a slow process. For more rapid effect Sulfuric Acid may be used.

DISSOLVED SALTS (Indicated by E.C. & TDS)

These conditions are in the normal range for plant growth.

SOIL TEXTURE AND RATE OF WATER INFILTRATION

The infiltration rate for all soil textures decreases with increasing ground slope. At 0 to 4%, 5 to 8%, 9 to 12%, 13 to 16% and above 16% the infiltration rate of this sample decreases from 0.25 to 0.20, 0.15, 0.10, 0.06, respectively. Infiltration rate also decreases with percent of ground cover and by compaction.

WATER PENETRATION OF SOIL DUE TO CHEMICAL CHARACTERISTICS

When exchangable Sodium increases in the soil, water penetration decreases. Based on SAR and ESP values this sample will have increasing problems with water penetration. Apply 23 pounds of Gypsum per 1000 sq.ft., work into soil, and leach with good quality water. Have the water analyzed before use to insure that the water is not the cause of the high Sodium in the soil. Leaching requires good quality water and adequate drainage through the root zone.

ORGANIC MATTER

Organic matter provides a slow nitrogen release and aids water retention. This sample has a moderate Organic Matter content.
To maintain moisture and provide sustained nitrogen release a level of 10% organic matter is recommended. This can be accomplished by adding 2 yards per 1000 sq.ft. of ground fir bark that is approximately 75% organic matter (i.e. typically found in ground fir bark which also has naturally low salt and boron concentrations). In California, the MWELO ordenance requires a fixed application of four yards of COMPOST if the soil organic matter is less than 6%. However, of significant concern when applying COMPOST is the potential for the compost to have high salt, high boron content, high C to N ratio and having a higly variable pH (very high to very low). All of these COMPOST characteristics can have very negative affect on plant growth. Take care by having the compost analyzed or by seeing a recent analysis of the compost to be used.

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166161

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-12

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL BORON

Boron concentrations will not adversly affect most plants. Avoid use of very Boron sensitive plants.

SOIL MICRONUTRIENTS

Micronutrients, Copper, Iron, Manganese and Zinc, in soil are present in small amounts. However, they play a necessary role in plant metabolism. Without appropriate amounts plants will not thrive. Apply the following per 1000/ sq.ft. Do not mix micronutrients during application (use a separate application for each element indicated).

Because copper, manganese and zinc are in very small amounts, dissolve (each) in 2 gallons of water and use a sprayer to obtain an even application.
Apply , 1.0 # Manganese Sulfate, 0.5 # Zinc Sulfate and water.

SOIL MACRONUTRIENTS : NITROGEN-PHOSPHORUS-POTASSIUM (N-P-K)

GENERAL N-P-K RECOMMENDATION

Use ONE of these NPK preparations for the first fertilizer application.

Standard NPK Fertilizer Preparations	6-20-20	5-20-10	16-16-16	0-10-10	28-3-4	21-0-0	Customer Choice None
#/1000 sq.ft.	20	24	N/A	N/A	N/A	N/A	**

GRASS OR SOD PREPARATION

Till in organic matter, N,P,K and micro nutrients in addition to any lime gypsum or sulfur as directed above. Smooth soil surface and follow seed or sod producers direction for moisture and product application.

TREES AND SHRUBS

Excavate holes for planting shrubs and trees to at least twice the volume of the container. Prepare backfill for tree and shrub planting holes by mixing three parts of native soil (or imported top soil) with one part organic amendment (preferably nitrogen and iron fortified) and 2.5 pounds of 6-20-20 per yard of mix. For extended fertilization, place slow release fertilizer tablets in each hole per manufacturer's instructions. If 6-20-20 was not directly added to backfill mix, during backfill apply uniformly 1/2 oz of 6-20-20 per gallon containers, 2.5 oz per 5 gallons, 6 oz per 24 inch boxes.

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166161

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-12

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

Summary and Suggested Sequence of Soil Improvements (#/1000 Sq.Ft.)

Gypsum	23	# - leach soil
Soil Sulfur	11.0	# for pH modification, repeat as above
Organic Amendment	2	Yd./1000 Sq.Ft. Bulk organic amendment (nitrified). or in Calif. if Org.Mat. less than 6% use 4 yd compost.
N-P-K Fertilizer	See above chart	
Micro Nutrients		
Manganese	1.0	# Manganese Sulfate
Zinc	0.5	# Zinc Sulfate
Sulfate-Sulfur	Low sulfate compensated by other soil improvements.	

Maintenance Fertilization

Apply 5 pounds of Ammonium sulfate (21-0-0) per 1000 sq.ft.every month until plants become established. After established, apply 28-3-4 (or similar preparation) to provide desired growth rate and color.

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 05/03/2019
Date Submitted 04/30/2019

To: Mark Repking
Geocon
3160 Gold Valley Dr. #800
Rancho Cordova, CA 95742

From: Gene Oliphant, Ph.D. \ General Manager
Randy Horney \ Lab Manager

The reported analysis was requested for the following:
Location : S1704-05-01 Site ID : TP-15.
Thank you for your business.

* For future reference to this analysis please use SUN # 79536-166162.

SOIL ANALYSIS

Saturation Percent (SP)	107		Soil Texture Clay
pH	9.07		
E.C.	2.01	mmho/cm	
Tot.Dissolved Salts	1286.4	ppm	
Infiltration Rate (0% Slope)	0.13	in/hr	
% Organic Matter	4.4		
C.E.C.	31.5	meq/100g	
Sodium Absorption Ratio (SAR)	38.9		
Exchangable Sodium Percent (ESP)	35.8		
Gypsum Req. (CaSO4*2H2O)	809.	#/1000 sq.ft.	
est. Nitrogen Release	1.4	#/1000 sq.ft.	

Nitrate	5.37	ppm	**
Phosphorus	16.70	ppm	**********
Potassium	113.76	ppm	**********
Sulfur	216.50	ppm	**********
Chloride	67.02	ppm	**********
Carbonates	311.36	ppm	**********
Sodium	2594.49	ppm	
Calcium	1043.65	ppm	**********
Magnesium	1795.21	ppm	**********
Boron	13.29	ppm	**********
Copper	1.37	ppm	**********
Iron	33.97	ppm	**********
Manganese	3.72	ppm	**********
Zinc	0.74	ppm	**********

Very Low	Low	Adequate	Excessive

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 05/03/2019
SUN NUMBER 166162

Information requested by:
Mark Repking
Geocon

Information for:
S1704-05-01
Sample ID: TP-15

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

The chemical characteristics of this sample are those of a Sodic Soil. This condition is the result of accumulation of Sodium, which has resulted in the breakdown of normal soil structure. The result of this breakdown is lack of water penetration. As water is applied to this soil the lack of movement through the soil provides the time for evaporation of most of the water. This evaporation has the effect, over time, of accumulation of salts, boron and produces an environment unsuitable for plant growth. Any remediation of this soil is contingent on the depth to which the soil has been affected, the availability of good quality water, whether suitable drainage can be constructed or is available, and the economic commitment to the effort. No specific recommendations can be made for this soil from this analysis.