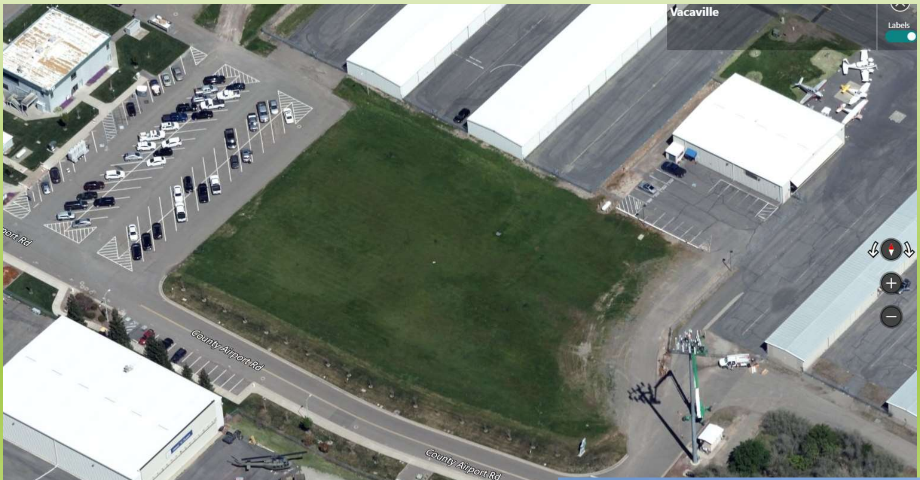
Geotechnical Investigation Report

Aeronautics Sewer Connection and Parking Lot Expansion Project

Vacaville, California



Reference: BING.com/maps, Microsoft, 2020.

Reference: Site photograph (12/2/19)

Reference: Site photograph (11/22/19)

SUBMITTED TO:

Mr. Noe Ramos
Project Manager
Kitchell CEM
c/o Solano Community College District
4000 Suisun Valley Road, Building 1102
Fairfield, CA 94534

January 13, 2020

A3GEO

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c/o Solano Community College District
4000 Suisun Valley Road, Building 1102
Fairfield, CA 94534

RE: Geotechnical Report
Aeronautics Sewer Connection and Parking Lot Expansion Project
Solano Community College District (Nut Tree Airport)
County Airport Road
Vacaville, California

Dear Noe Ramos:

This report presents the results of A3GEO's geotechnical investigation and evaluation for the Aeronautics Sewer Connection and Parking Lot Expansion Project (Project) for the Solano Community College District at the Nut Tree Airport in Vacaville, California.

In preparing this report, we reviewed the Request for Proposal (RFP), dated October 11, 2019, geologic and historical information relevant to the site, and the findings of our geotechnical investigation. At the time of this report, the Project consisted of the expansion of the current parking lot and the installation of about 780 feet of new 4-inch and 8-inch diameter sewer lines from the main line in the street to Solano Community College District's hanger. The proposed parking lot expansion area is a rectangular shaped area of about 75 feet by 100 feet.

The findings and conclusions presented in this report were developed in accordance with generally accepted geotechnical principles and practices at the time that the report was prepared. Should you have questions or comments concerning our findings, conclusions, or recommendations, please do not hesitate to call.

Sincerely,

A3GEO, Inc.

Timothy P. Sneddon, PE, GE
Principal Engineer
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REGISTERED PROFESSIONAL ENGINEER
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1. INTRODUCTION

1.01 Overview

This report presents the results of a geotechnical investigation by A3GEO, Inc. (A3GEO) for the proposed Aeronautics Sewer Connection and Parking Lot Expansion project in Vacaville, CA. The services described herein were provided under A3GEO's October 23, 2019 proposal.

1.02 Project Description

We understand that the project will include expansion of the current parking lot at the Solano Community College District (District) hanger facility at the Nut Tree Airport by the addition of sixteen standard parking spaces and two ADA Spaces. The proposed parking area is approximately 75 feet by 100 feet. The parking lot work will include paving, striping, drainage and exterior lighting. The project also includes the installation of a new 4-inch and 8-inch diameter sewer line from the main sewer line in the street to near the exterior of the northern corner of the District's hangar building. A sewer lift station may also be included if appropriate slope of the sewer pipe cannot be achieved. Based on our review of documents, the length of the new sewer line will be about 780 feet. Assuming a slope of 1 percent, we anticipate the depth of the trench for the new sewer line would be up to about 10 feet.

1.03 Purpose and Scope of Services

The primary purpose of our services was to explore and characterize geotechnical, geologic, and seismic conditions at the site and prepare this report presenting data, conclusions, and recommendations for the Project. The scope of services included:

- Reviewing reports, literature, maps, photographs, plans and other relevant information;
- Exploring subsurface conditions with four exploratory borings;
- Characterizing geotechnical, geologic and seismic conditions at the site;
- Conducting geotechnical engineering analyses;
- Developing geotechnical conclusions and construction recommendations for the project; and
- Preparing this geotechnical investigation report.

Please note that our scope was limited to aspects of the project that are geotechnical and/or geologic in nature. The scope of our services did not include an environmental assessment or investigation for the presence of hazardous, toxic, or corrosive materials on, below, or around the site.

1.04 Site Overview

The site is located near the Nut Tree Airport in Vacaville California (Figure 1). Based on a review of documents, the Nut Tree Airport opened in 1955. Prior to the airport development, the land in the vicinity of the project site primarily consisted of rural agricultural land. Review of historical aerial photographs indicate that there has not been previous development in the area of the unimproved grass field. Based on an aerial photograph from 1949, a creek or drainage channel was previously located about 200 feet to the northwest of the project site prior to development of the site as an airport.

Existing features of the project site include the District's aeronautics hangar in the northeastern portion of the site, a paved parking lot and driveway to the south of the hangar building, and an unimproved grass field between the parking lot and County Airport Road (Figure 2). The parking lot expansion will be located in the northeast corner of the grass field area. The approximate location of the new sewer line extension will be along the perimeter of the grass field and then crossing County Airport Road near the connection to the main sewer line, as depicted in Figure 2.

The site is situated at an elevation of about 108 feet above mean sea level (NAVD88 datum) and is relatively flat with slope gradients of less than 1 percent across the grass field area (CSW/ST2, 2019). The topographic map for the site indicates that the ground surface elevation near the corner of the hangar building where the new sewer line will start is about 108 feet and the elevation near where the connection to the existing main sewer line is at about 109.5 feet (CSW/ST2, 2019).

Maps published by the U.S. Geological Survey (USGS) indicate the near-surface soils in the site area are mapped as consisting predominantly of alluvial deposits. The site is located in an area that has not yet been evaluated by the California Geological Survey (CGS) for seismic hazards.

2. METHODS OF INVESTIGATION

2.01 Review of Existing Information

We reviewed a variety of materials containing information relevant to the geologic and seismic setting of the site, including maps and literature published by the United States Geological Survey (USGS) and California Geological Survey (CGS). We obtained information on the site development history by reviewing historical aerial photographs available through Google Earth, USGS, and other sources. A list of selected references is available at the end of this report.

2.02 Subsurface Investigations

Prior to conducting field activities, we reviewed the drawing of the available utility records by BESS Utility Solutions dated 7/19/19, marked exploration locations, and contacted Underground Service Alert (USA) to screen each location for underground utilities.

On December 2, 2019, we conducted a subsurface investigation at the project site consisting of four exploratory borings. The approximate locations of the borings are shown on Figure 2. The exploration locations shown on Figure 2 were estimated by measuring from existing site features and should be considered approximate. At each boring location, the upper five feet was excavated with hand-auger equipment to check for potential underground utilities. For depths greater than 5 feet below ground surface, the drilling subcontractor, Geo-Ex Subsurface Exploration, used a Modified California sampler, a flight auger, and a track rig to advance the borings. An A3GEO engineer logged the borings and obtained samples at frequent intervals. Borings B-1, B-2, and B-3 were excavated to a depth of 10 feet below ground surface. Boring B-4 was excavated to a depth of 5 feet below ground surface. During drilling, an A3GEO engineer visually/manually classified the soil in general accordance with ASTM D2488 classifications which are based on the Unified Soil Classification System (USCS). The logs of the borings are attached in Appendix A and are preceded by a Key to Exploratory Boring Logs that describes the USCS and the symbols used on the logs. After completing the borings, the holes were grouted.

The boring logs in Appendix A present data and interpretations pertaining to subsurface conditions at the indicated locations at the time the subsurface exploration was performed; the passage of time may result in changes in the subsurface conditions.

3. GEOLOGIC, SEISMIC, AND HISTORICAL SETTING

3.01 Regional Active Faults

Faults that are defined as active exhibit one or more of the following: (1) evidence of Holocene-age (within about the past 11,000 years) displacement, (2) measurable aseismic fault creep, (3) close proximity to linear concentrations or trends of earthquake epicenters, and (4) prominent tectonic-related aseismic geomorphology. Potentially active faults are defined as those that are not known to be active, but have evidence of Quaternaryage displacement (within about the past 2 million years).

The major active faults near the site, shown on Figure 3, include the Great Valley Fault, Rio Vista Fault, Lagoon Valley, Midland Range, and Green Valley faults. Approximate distances and directions from the site to major Northern California active faults as evaluated using the USGS Quaternary Faults Map shown in Figure 3 are provide in Table 1.

Table 1 - Approximate Distances to Principal Active Faults

Fault System	Approximate Distance from Site	Approximate Direction from Site
Great Valley Thrust Fault	1.9 miles	West
Rio Vista	3.0 miles	West
Lagoon Valley	3.6 miles	West
Midland Range	8.5miles	East
Green Valley Fault	12.6 miles	West

4. SITE CONDITIONS

4.01 Surface Conditions

The project site is presently occupied by an airport hangar building, asphalt concrete paved parking areas and driveway, and an unimproved grass field between the parking lot and County Airport Road. During the subsurface investigation, the grass field was not accessible by car or truck due to the wet and soft ground conditions. Consequently, a track-mounted rig was used to conduct the investigation.

4.02 Existing Underground Utilities

The drawing of the available utility records by BESS Utility Solutions dated 7/19/19 and USA markings at the site indicate that there are several existing below grade utilities at the site. According to BESS's drawing, the existing below grade utilities include telephone, electrical, storm sewer, and water lines.

4.03 Site Soil Conditions

Geologic maps indicate the near-surface soils in the site area are mapped as consisting predominantly of alluvial deposits (Figure 4). The subsurface conditions encountered generally correlate reasonably well to available geologic and historic information. Subsurface conditions encountered in borings B-1 to B-4 are described below, in the order of occurrence below ground surface:

> **Alluvium** – below the grass covered ground surface, we encountered alluvium deposits to the depths explored. As encountered, the alluvium consisted of a dark brown, moist, medium stiff fat clay (CH); a light brown, moist, very stiff lean clay (CL); a light brown, moist, medium dense silty gravel with sand (GM); and a light brown, moist, medium dense clayey sand (SC) and silty sand (SM) silty gravel with sand. The clay materials encountered generally have moderate to high expansivity and plasticity.

4.04 Geotechnical Laboratory Testing

Our geotechnical laboratory testing program was directed toward a quantitative and qualitative evaluation of the physical properties of the soils at the Site. The following geotechnical laboratory tests were performed:

- Atterberg Limits by ASTM D4318;

- Sieve analysis by ASTM D422 or D1140;
- Moisture content by ASTM D2216;
- Dry density by ASTM D2937; and
- R-Value by ASTM D2844.

Geotechnical laboratory testing was performed by B. Hillebrandt Soils Testing, Inc., of Alamo, California and Inspection Services, Inc. of Berkeley, California. Geotechnical laboratory testing data sheets from this study are presented in Appendix B.

4.05 Groundwater

During our subsurface exploration, we did not encounter groundwater in our borings. Our borings were drilled to a total depth of 10 feet below grade. Based on the clay materials encountered and the relatively short time period that the holes were open, measurements of groundwater during our subsurface exploration may not accurately reflect in situ conditions.

We reviewed groundwater measurements in nearby wells on the Groundwater Information System (California Water Board, 2020a) and the Geotracker database (California Water Board, 2020b). The groundwater measurements in nearby wells indicate that groundwater may be encountered at depths of about 7 to 30 feet below the existing ground surface.

Groundwater levels can fluctuate significantly with location, season, precipitation, leakage in and out of utilities, and other factors. Groundwater levels at the site may be significantly higher in the late winter and spring, especially in wetter seasons and following prolonged or particularly heavy rainfall. It should be anticipated that groundwater levels at the site will vary by location.

5. GEOLOGIC AND GEOTECHNICAL HAZARDS

5.01 Earthquake Ground Shaking

Strong earthquake shaking is a hazard shared throughout the region and the direct risks posed to structures by ground shaking are mitigated through the structural design provisions of the California Building Code (CBC). The seismic design provisions of the 2019 CBC include a methodology based on ASCE 7-16 by which sites are classified as A through F based on geotechnical properties within the upper 100 feet of the subsurface profile.

We do not anticipate that the proposed project will include structures or improvements subject to CBC provisions. CBC 2019 seismic design parameters can be provided upon request.

5.02 Other Geologic Hazards *Not* Analyzed or *Not* Present

Liquefaction and Liquefaction Related Hazards – Based on a qualitative analysis of the proposed improvements, subsurface materials encountered, and review of regional groundwater data, we do not regard liquefaction or liquefaction related hazards as a design consideration for the project.

Faulting and Ground Surface Rupture - The site is not within an AP Zone and no active faults are mapped in the direct vicinity of the site. The closest AP Zone surrounds the active Great Valley fault, which is approximately 1.9 miles from the project site. Based on the foregoing, we consider there to be very low hazard for surface fault rupture at the site.

Landsliding – Based on the relatively flat topography of the site and vicinity, we consider there to be essentially no potential for large-scale landsliding to affect the site.

Tsunami and Seiche Inundation – The site is located at an elevation of approximately 108 feet above mean sea level and is inland from the tsunami zone shown on the CGS Tsunami Inundation Map (CGS, 2009).

Flooding – A flood map by FEMA shows the site outside of areas considered susceptible to significant flooding. We consider there to be a low potential for flooding to affect the project site.

6. GEOTECHNICAL DESIGN CONSIDERATIONS

6.01 Expansive Near-Surface Clays

The near-surface soils in the project area are variable and include materials that are moderately to highly expansive (expansive soils shrink and swell with changes in moisture content and can damage overlying improvements unless appropriately mitigated). The damaging effects of expansive soils on pavement can be mitigated in a variety of ways, the most common of which include removal and replacement with non-expansive material, lime treatment, or an increased pavement section design.

Recommendations are provided for pavement sections to mitigate the expansive soil concerns with a layer of non-expansive material (select fill or lime treatment) or use of a geotextile reinforcement.

6.02 Compaction

The near-surface soils in the project area are variable and include materials that consist of clay materials that are moderately to highly expansive. Based on moisture content test results from our investigation, the contractor should anticipate that on-site materials may need to be dried out before re-use as fill.

6.03 Groundwater

The groundwater measurements in nearby wells indicate that groundwater may be encountered at depths of about 7 to 30 feet below the existing ground surface. Groundwater levels can fluctuate significantly with location, season, precipitation, leakage in and out of utilities, and other factors. Groundwater levels at the site may be significantly higher in the late winter and spring, especially in wetter seasons and following prolonged or particularly heavy rainfall. It should be anticipated that groundwater levels at the site will vary by location.

The pipe alignment and excavations may encounter groundwater. We anticipate that the overburden pressures at the proposed depths of the new pipeline alignments will balance the buoyancy-related uplift forces due to submergence. Manholes and access vaults below the groundwater table; however, might be impacted by uplift forces.

6.04 Construction Considerations

6.04.1 Excavation and Shoring

We anticipate that soil at the site can be excavated with conventional earth-moving equipment; although, it is possible that if undocumented fill is encountered, obstructions could be encountered that would require jack-hammering, hoe-ramming and/or cutting tools to excavate. In general, the contractor is responsible for independently assessing and implementing safe and appropriate means and methods to accomplish the work described in the Contract Documents and may utilize existing information and any supplemental investigations deemed necessary at the time of construction.

We anticipate that shoring or other stabilization methods will need to be utilized to prevent sloughing of the materials exposed on excavation sidewalls.

The contractor is responsible for shoring, excavation safety, and the protection of adjacent offsite improvement throughout all phases of construction. All excavations deeper than 4 feet that will be entered by workers must be shored or sloped for safety in accordance with the applicable: 1) California Occupational Safety and Health Administration (Cal-OSHA) standards; and 2) any site-specific health and safety protocols and procedures required by the applicable permitting agency. Based on the materials encountered in our subsurface investigation, we recommend that the soil be considered an OSHA Type C soil. In all cases, the design, installation, monitoring, and abandonment of site shoring systems are the contractor's responsibilities.

6.04.2 Excavation Bottom Stability

Based on the subsurface materials encountered during our investigation, we anticipate that the bottom of the pipeline trenches will remain stable and provide suitable support for the proposed sewer pipes. However, excavations that extend near or below the water table may experience bottom instability. Unstable bottom conditions can be improved with over-excavation and replacement with crushed, angular rock wrapped in filter fabric. Recommendations for stabilizing excavation bottoms should be based on an evaluation in the field by A3GEO at the time of construction.

6.04.3 Wet Weather Construction

Although it is possible for excavation and/or construction to proceed during or immediately following the wet winter months, a number of geotechnical problems may occur which may increase costs and cause project delays. The water content of onsite soils may increase during the winter and rise significantly above optimum moisture content for compaction of subgrade or backfill materials. If this occurs, the contractor may be unable to achieve the specified levels of compaction. Dewatering requirements will potentially increase due to rainfall, surface runoff, seepage and rises in groundwater level. The stability of temporary slopes will decrease, potentially increasing the lateral extent of excavation required. If utility trenches are open during winter rains, caving of the trench walls may occur. Subgrade preparation beneath pavement sections may prove difficult or infeasible. In general, we note that it has also been our experience that increased clean-up costs may be incurred, and greater safety hazards may exist, if the work proceeds during the wet winter months.

7. GEOTECHNICAL RECOMMENDATIONS

7.01 Earthwork

7.01.1 Site Preparation and Excavation

Areas within the site limits should be cleared of concrete, asphalt concrete, aggregate base, and other near-surface improvements as needed to construct the improvements. Any trees present should be cleared and grubbed and any soils containing vegetation and/or organic matter should be stripped.

Cleared materials should be removed from the site unless they are specifically identified as suitable for re-use by the District and A3GEO. Site strippings and grubbed materials are not suitable for re-use as engineered fill and should be removed from the site or stockpiled for later use as landscape material (at the District's discretion). The contractor should document the condition of existing improvements located outside of the site limits and should perform any and all monitoring activities required by the District.

Excavations will be required to construct the new utility line and pavement. The contractor is responsible for the design, implementation and safety of all site excavations; this responsibility includes (but is not necessarily limited to) excavation shoring, temporary cut slopes and construction-phase dewatering.

7.01.2 Remedial Grading for Expansive Soil Mitigation

Expansive soils should be overexcavated from beneath pavements and flatwork and replaced with a zone of non-expansive fill. Alternatively, the on-site soil may be chemically treated by mixing the soil with lime per Section 7.01.3 to reduce the expansion characteristic and create the zone of low-expansion material. We recommend that: 1) the depth of overexcavation extend a minimum of 18 inches below the bottom of vehicular pavement/concrete and 12 inches below flatwork; and 2) the width of overexcavation extend at least 2 feet, horizontally, beyond the pavement and flatwork perimeter (where feasible) unless a deepened curb or other moisture cutoff (at least 24 inches deep) is provided. The aggregate base in the pavement section may be considered part of the non-expansive zone. The zone of exclusion/removal or lime treatment should be detailed on the construction plans to reduce the potential that these recommendations are overlooked during construction bidding.

7.01.3 Lime Treatment

The on-site soil may be chemically treated with quicklime to reduce the expansion characteristic of the soil as an alternative to importing select fill to create a zone of low expansion potential below building flatwork and pavement. Cement treatment may also be utilized for chemical treatment of the soil. The quicklime should conform with the American Society of Testing and Materials (ASTM) standard C977. On-site materials containing roots or other organic matter are not suitable for chemical treatment and should be stripped from the area at which the treatment is to be performed. The chemical treatment should be performed by an experienced contractor that specializes in the chemical treatment of soil. The chemical agent should be proportioned and spread with a mechanical spreader and mixed into the soil on a mixing table or in place to produce consistent distribution of the agent within the treated layer. The depth of mixing should not exceed 18 inches per lift or the capacity of the mixer if less. Precautions to reduce the potential for dusting of quicklime or cement, such as scheduling or suspending operations to avoid windy weather, should be taken. Casting or tailgating of the chemical agent should not be permitted. The mixer should be equipped with a rotary cutting/mixing assembly, grade checker, and an automatic water distribution system. Mixing or spreading operations should not be performed during inclement weather or when the ambient temperature is less than 35 degrees Fahrenheit or during foggy or rainy weather. Adjacent passes of the mixer should overlap by 4 inches or more.

The contractor should determine the percentage of lime needed to achieve a treated soil that results in a plasticity index of 12 or less. For preliminary planning purposes, we anticipate that quicklime mixed into the soil at a rate of about 5 percent by dry weight of soil may result in a suitable design. Mixing and pulverizing should continue until the treated soil does not contain untreated soil clods larger than 1 inch and the quantity of untreated soil clods retained on the No. 4 sieve is less than 40 percent of the dry soil mass. Water should be added as needed during the mixing process to achieve a moisture content above the optimum, as evaluated by ASTM D1557, for the lime-soil mixture. The lime-soil mixture should be re-mixed following a 16-hour mellowing period after the initial mixing. The lime-soil mixture should be compacted within 3 days after initial mixing.

Vehicular traffic and heavy construction equipment should not be allowed on the treated material for a 1-hour period after compaction. The treated material should be maintained in a moist condition for a 7-day curing period by routinely sprinkling water, covering the treated material with moist straw, or placing fill over the treated subgrade. Treated subgrade for pavements should be proof-rolled with a loaded water truck to check for yielding conditions. Mitigation of yielding areas by pulverizing and re-mixing with additional stabilizing agent should be anticipated.

7.01.4 Fill Materials

Geotechnical requirements for fill materials are provided below:

General Fill - General fill material should have an organic content of less than 3 percent by volume and should not contain environmental contaminants or rocks or lumps larger than 6 inches in greatest dimension. From a geotechnical standpoint, onsite materials can be reused as General Fill if they meet or can be processed (e.g. by sorting and/or crushing) to meet the above requirements. General fill can be used anywhere except where non-expansive fill is required.

Non-Expansive Fill - Non-expansive fill should conform to the requirements for General Fill and be close-graded with 35 percent or more passing No. 4 sieve and conform with either of the following criteria: an Expansion Index of 50 or less, Plasticity Index of 12 or less, or less than 10 percent, by dry weight, passing No. 200 sieve. Caltrans Class 2 Aggregate Base meets the requirements for Non-Expansive fill.

Imported Fill – Imported fill should conform to the requirements for Non-Expansive Fill and should be evaluated by our firm and the project environmental consultant prior to its importation to the site.

Proposed import fill materials should be approved by A3GEO and the Project Environmental Consultant prior to their importation to the Site or use. Materials from the site may be suitable for re-use as fill, from a geotechnical standpoint, if they can be processed (i.e. by crushing or blending) to meet the above requirements.

7.01.5 Fill Placement

Fill should be placed on nearly-level, non-yielding subgrades that have been checked and approved by A3GEO. Fill materials should be placed in a manner that minimizes lenses, pockets, and/or layers of materials differing substantially in texture or gradation from the surrounding fill materials. The soils should be spread in uniform layers not exceeding 8 inches in loose thickness prior to compaction. Each layer should be compacted using mechanical means in a uniform and systematic manner. The fill should be constructed in layers such that the surface of each layer is nearly level. Fill should be placed and compacted based on the following requirements (per ASTM D-1557 Test Methods):

- General Fill that is predominantly cohesive (>15 percent passing the No. 200 sieve) should be moisture conditioned, as necessary, to between 3 and 5 percent over optimum moisture content, and compacted to at least 95 percent within 6 inches of the bottom of the pavement section (asphalt concrete and aggregate base) and at least 90 percent relative compaction in other areas, on a dry unit weight basis;

- General Fill that is predominantly granular (<15 percent passing the No. 200 sieve) should be moisture conditioned, as necessary, to near or over optimum moisture content and compacted to at least 95 percent relative compaction on a dry unit weight basis;

- Lime Treated Fill should be moisture conditioned, as necessary, to between 3 and 5 percent over optimum moisture content, and compacted to at least 95 percent relative compaction on a wet unit weight basis; and

- Non-Expansive Fill should be moisture conditioned, as necessary, to near optimum moisture content and compacted to at least 95 percent relative compaction on a dry unit weight basis.

It is possible that the soil to be compacted may be excessively wet or dry depending on the moisture content at the time of construction. If the soils are too wet, they may be dried by aeration or by mixing with drier materials. If the soils are too dry, they may be wetted by the addition of water or by mixing with wetter materials.

7.01.6 Utility Trenches

Utility trenches should be backfilled with fill placed in lifts not exceeding 8 inches in uncompacted thickness. Trenches should be filled by placing a granular layer (shading) beneath and around the pipe, and then 6 to 12 inches of shading should be carefully placed and tamped above the pipe. The remaining portion of the trench should be backfilled with onsite or import soil conforming with Section 7.01.4. The backfill (above shading layers) should be placed and compacted per Section 7.01.5. The compaction requirements given above should be considered minimum recommended requirements. If local agency and/or utility company specifications require more stringent backfill requirements, those specifications should be followed.

If imported granular soil is used, sufficient water should be added during the trench backfilling operations to prevent the soil from “bulking” during compaction. All compaction operations should be performed by mechanical means only. We recommend against jetting.

Where granular backfill is used in utility trenches, we recommend an impermeable plug or mastic sealant be used where utilities pass beneath shallow improvements (e.g. pavements, slabs, shallow foundations) to minimize the potential for free water or moisture to affect any underlying or adjacent expansive soil materials.

The contractor should carefully evaluate the stability of all trenches and use temporary shoring, where appropriate. The design and installation of the temporary shoring should be wholly the responsibility of the contractor. In addition, all state and local regulations governing safety around such excavations should be carefully followed.

7.01.7 Subgrades below Pavement

The pavement subgrade should be observed by a representative of A3GEO during grading to check that the exposed materials are consistent with the findings from our subsurface exploration and the support characteristics assumed for pavement design. R-value testing may be needed, based on these observations, with subsequent revision to the pavement sections.

The upper 6 inches of subgrade beneath planned pavements should be scarified, moisture conditioned as needed, and compacted per Section 7.01.5. Pavement subgrades should be proof rolled and confirmed to be uniformly firm and non-yielding prior to the placement of aggregate base.

7.02 Thermoplastic Pipe

Thermoplastic pipe, consisting of either PVC or HDPE, is considered to be a flexible conduit. Flexible conduits should be designed or specified with particular consideration of (1) the load on the pipe including traffic and soil overburden, (2) soil stiffness in the pipe zone, and (3) stiffness of the pipe material. The thermoplastic pipes on this project should be designed or specified with due consideration for these factors.

The modulus of soil reaction is used to characterize the stiffness of soil backfill placed at the sides of buried flexible pipelines for the purpose of evaluating lateral deflection caused by the weight of the backfill above the pipe. We recommend that a modulus of soil reaction of 1,000 pounds per square inch be used for design, provided that the pipe embedment material (including bedding and pipe zone backfill) and general trench backfill conform to and are compacted in accordance with the recommendations provided in this report.

7.03 Uplift Resistance

Underground structures, including vaults or pipelines, that extend below the groundwater table will experience buoyancy-related uplift forces that might lead to upward movement. Based on our subsurface investigation and review of documents, groundwater may be encountered at depths of up to about 7 feet below the existing ground surface. Groundwater levels can fluctuate significantly with location, season, precipitation, leakage in and out of utilities, and other factors. Underground structures below the groundwater table should be designed to resist uplift forces related to the buoyancy effect. Uplift forces may be resisted by the weight of the vault plus contents, the weight of soil above the vault, and friction along the sides of the vault. The unit weight of the soil may be considered to be 120 pounds per cubic foot (pcf) above the groundwater table and 62 pcf below the groundwater table. Frictional uplift resistance is the product of the friction coefficient and the effective contact pressure. A friction coefficient of 0.30 may be assumed for uplift resistance for mass or formed concrete against soil. The effective contact pressure may be calculated using an equivalent fluid pressure of 60 pcf above the groundwater table and 32 pcf below the groundwater table. We do not anticipate that static uplift will be a design consideration for pipelines with embedment equivalent to twice the pipe diameter due to the magnitude of the overburden pressures.

7.04 Lateral Pressures for Thrust Blocks

Thrust restraint for buried pipelines may be achieved by transferring the thrust force to the soil outside the pipe through a thrust block. Thrust blocks in alluvium soil conditions may be designed using a passive equivalent fluid lateral earth pressure of 300 pcf above the groundwater level and 150 pcf below the groundwater level. Thrust blocks should be backfilled and compacted with non-expansive fill or Controlled-Low-Strength-Material (CLSM).

7.05 Exterior Flatwork and Pavements

7.05.1 Exterior Slabs-on-Grade

We recommend that sidewalks and other exterior slabs-on-grade be supported on a minimum of 12 inches of non-expansive fill or lime-treated soil. Slab reinforcing should be provided in accordance with the anticipated use and loading of the slab. We recommend that exterior slabs-on-grade be at least 4 inches thick and reinforced with steel bar reinforcement. Exterior slabs should be structurally independent from buildings. Concrete slabs that may be subject to vehicle loadings should be designed in accordance with the recommendations for rigid Portland cement concrete pavements.

7.05.2 Asphalt Pavements

Flexible asphalt concrete (AC) pavements may be used for parking areas and driveways. We developed the following recommended pavement sections for various traffic indices using the Caltrans R-value design method for flexible pavements. The pavement sections presented are based on an assumed subgrade R-value of 5 for the subgrade materials.

Table 2 - Asphalt Concrete Pavement Section Design

Traffic Index	Alternative 1	Alternative 2	Alternative 3	Alternative 4
3	4½ inches AC	2 inches AC 5½ inches AB	2 inches AC 4 inches AB SEG	2 inches AC 4 inches AB 8 inches TS
4	6 inches AC	2½ inches AC 8 inches AB	2½ inches AC 6 inches AB SEG	2½ inches AC 5 inches AB 8 inches TS
5	7½ inches AC	3 inches AC 11 inches AB	3 inches AC 8 inches AB SEG	3 inches AC 6 inches AB 8 inches TS
6	9½ inches AC	3½ inches AC 13½ inches AB	3½ inches AC 10 inches AB SEG	3½ inches AC 8 inches AB 8 inches TS

Notes:

[1] AC is Type A, Dense-Graded Hot Mix Asphalt complying with Caltrans Standard Specification (CSS) 39-2 (2018).

[2] AB is Class II Aggregate Base complying with CSS 26-1.02 (2018).

[3] SEG is subgrade enhancement geotextile consistent with CSS 96-1.02O Class B2.

[4] TS is chemically treated subgrade generally consistent with CSS 24-3 (2018).

The project civil engineer should choose the appropriate traffic indices for the pavement areas of the site and then use the given section for that traffic index. Aggregate base for use in pavements should conform to Caltrans Standard Specifications for Class 2 ¾-inch Aggregate Base (Caltrans, 2018). The aggregate base used in pavement sections should be compacted to at least 95 percent relative compaction as determined by ASTM D-1557.

7.05.3 Concrete Pavements

Rigid Portland cement concrete (PCC) pavements may also be used in driveway/loading areas. Concrete pavement sections based on methodologies developed by the Portland Cement Associate (PCA) and American Concrete Institute (ACI, 2008) are presented in Table 3 for a 20 year design period with appropriate periodic maintenance. The recommended sections presume that the concrete will have a 28-day flexural strength of 550 psi or an equivalent compressive strength of 4,000 psi at 28 days

Table 3 - Portland Cement Concrete Pavement Thickness Design

Loading Condition[1]	Design Period	Subgrade Modulus[2]	Concrete Pavement Section
ADTT = 10 (Traffic Category A - car parking areas and access lanes)	20 years	50 pci	5½ inches PCC³ 6 inches AB⁴
ADTT = 300 (Traffic Category B – bus parking areas)	20 years	50 pci	7 inches PCC³ 6 inches AB⁴
ADTT = 300 (Traffic Category C- truck parking areas, bus entrance lanes)	20 years	50 pci	7½ inches PCC³ 6 inches AB⁴

Notes:

[1] ADTT = Average Daily Truck Traffic. Trucks defined as vehicles with at least six wheels; excludes panel trucks, pickup trucks, and other four-wheel vehicles.

[2] Modulus of Subgrade Reaction in pounds per cubic inch (pci).

[3] PCC is Portland Cement Concrete complying with Caltrans Standard Specification Section 90 (2018).

[4] AB is Class II Aggregate Base complying with Caltrans Standard Specification Section 26 (2018).

Appropriate jointing of concrete pavement can reduce the potential for crack development between joints. Joints should be laid out in a consistent square pattern. Contraction, construction, and isolation joints should be detailed and constructed in accordance with the guidelines of the ACI Committee 302 (ACI, 2015). Contraction joints formed by premolded inserts, grooving plastic concrete, or saw-cutting at initial hardening, should extend to a depth equivalent to 25 percent of the slab thickness and 1 inch or more for thin slabs. Contraction joints should be reinforced with smooth dowels placed across the joint at mid-slab height. Construction joints subject to traffic loading should be reinforced with smooth dowels as for contraction joints. Construction joints within the middle third of the typical joint spacing pattern should be reinforced with tiebars. Recommendations for contraction joint spacing, dowel dimensions, dowel spacing, tiebar dimensions, and tiebar spacing are provided in Table 4. Isolation joints should consist of full-depth premolded joint filler placed where the pavement abuts structures or other fixed objects. At isolation joints where the edge of the pavement will be subjected to traffic loading, the thickness of the slab should be increased by 20 percent at the edge of the pavement with a 40:1 taper (horizontal to vertical) to the nominal slab thickness.

Table 4 - Concrete Pavement Joints and Reinforcement

Slab Thickness	Contraction Joint Spacing	Dowels	Tiebars at 12 feet or less to free edge	Tiebars at 25 feet to free edge	Distributed Steel
6 inches	12 feet or less	3/4 x 14 at 12 inches	½ x 24 at 30 inches	½ x 24 at 23 inches	#4 at 18 inches both ways
7 inches	14 feet or less	1 x 14 at 12 inches	½ x 24 at 30 inches	½ x 24 at 20 inches	#5 at 18 inches both ways
8 inches	15 feet or less	1¼ x 14 at 12 inches	½ x 24 at 30 inches	½ x 24 at 17 inches	#5 at 18 inches both ways

Notes:
Dowels and Tiebars specified in nominal diameter x length at spacing along joint in inches. The designer may interpolate between the values provide for an intermediate distance to the free edge of pavement.

The pavement surface and subgrade should be sloped to provide positive drainage toward suitable drainage devices. To reduce the potential for subsurface water intrusion into the subgrade and base layer, curbs or similar cutoff devices should be provided and joints should include a formed or sawcut reservoir for placement of foam backer rod and recessed, self-leveling silicone sealant. Periodic maintenance of the pavement should include sealing cracks that develop and replacement of joint sealant as-needed.

7.06 Future Geotechnical Services

7.06.1 Design Consultation and Plan Reviews

At the time of this report, various details involving the design of the project had not yet been determined. A3GEO should continue to provide geotechnical consultation to the Project team during the design phase in order to: 1) check that the design recommendations presented in this report are appropriately incorporated into the Project plans and specifications; and 2) provide supplemental geotechnical recommendations, as needed. We recommend that we review the Project plans and specifications as they are being developed so that we may provide timely input. We should also perform a general review of the geotechnical aspects of the final plans and specifications, the results of which we should document in a formal plan review letter.

7.06.2 Review of Contractor Requests and Submittals

During the bidding and construction phases, we should review all Requests for Clarification (RFCs) and Requests for Information (RFIs) that are geotechnical in nature. We recommend that we also review all geotechnical submittals from the contractor, including (but not necessarily limited to) those pertaining to excavations and geotechnical materials.

7.06.3 Construction Observation

As Geotechnical Engineer of Record, it is essential that A3GEO provide geotechnical services during construction to check whether geotechnical conditions are as anticipated, provide supplemental recommendations where necessary, and document that the geotechnical aspects of the work substantially conform to the approved Contract Documents and the intent of our geotechnical recommendations. Critical aspects of construction that A3GEO should observe and/or test excavation, backfilling, and subgrade preparation below slabs and pavements.

8. LIMITATIONS

This geotechnical investigation report has been prepared for the exclusive use of Solano Community College District and their consultants for specific application to the Aeronautics Sewer Connection and Parking Lot Expansion Project described herein. The opinions presented in this report were developed in accordance with generally-accepted geotechnical and engineering geologic principles and practices. No other warranty, expressed or implied, is made. In the event that any changes in the nature or design of the Project are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed, and the conclusions of this report are modified or verified in writing.

The findings of this report are valid as of the present date. However, the passing of time will likely change the conditions of the existing property due to natural processes or the works of man. In addition, due to legislation or the broadening of knowledge, changes in applicable or appropriate standards will occur. Accordingly, this report should not be relied upon after a period of three years without being reviewed by this office.

9. REFERENCES

1. American Concrete Institute, 2008, Guide for the Design and Construction of Concrete Parking Lots, ACI Committee 330, ACI 330R-08, June.
2. American Concrete Institute, 2014, Building Code Requirements for Structural Concrete (ACI 318-14) - Commentary on Building Code Requirements for Structural Concrete (ACI 318R-14).
3. American Concrete Institute, 2015, Guide to Concrete Floor and Slab Construction, 302.1R-15.
4. American Concrete Institute, 2016, ACI Manual of Concrete Practice.
5. BESS Utility Solutions, 2019, Utility Map Solano C.C. – Aeronautic Facility, Vacaville, July 19.
6. California Building Standards Commission, 2016, California Building Code (CBC): California Code of Regulations, Title 24, Part 2, Volumes 1 and 2.
7. California Building Standards Commission, 2019, California Building Code (CBC): California Code of Regulations, Title 24, Part 2, Volumes 1 and 2.
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11. California Water Board, 2020a, GAMA Groundwater Information System, on-line application, https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/.
12. California Water Board, 2020b, Geotracker, on-line application, https://geotracker.waterboards.ca.gov/.
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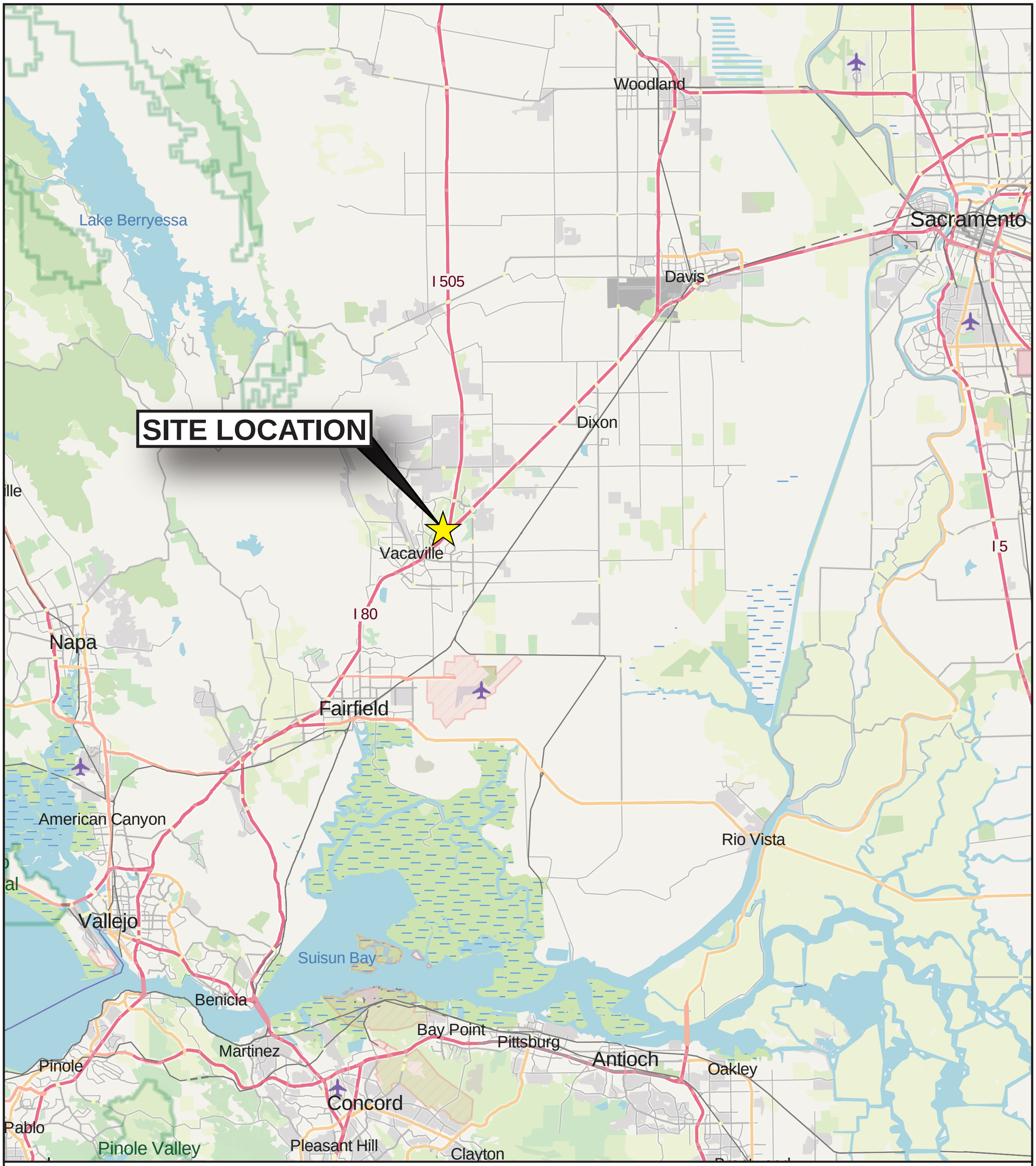
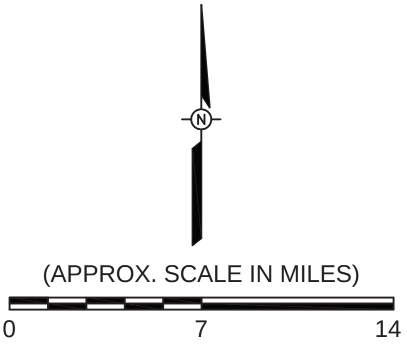
14. Google Earth, 2020, Version No. 7.3.2.5776.
15. Jennings, C.W., and Bryant, W.M., 2010, Fault Activity Map of California, California Geological Survey, Geologic Data Map No. 6.
16. Occupational Safety and Health Administration (OSHA), 1989, Occupational Safety and Health Standards – Excavations, Department of Labor, Title 29 Code of Federal Regulations (CFR) part 1926, dated October 31.

FIGURES





Date: 12/6/2019

AERONAUTICS SEWER CONNECTION AND
PARKING LOT EXPANSION PROJECT
VACAVILLE, CALIFORNIA

Project No. 1168-1A

SITE LOCATION MAP

A3GEO

FIGURE 1

LEGEND:

B-4 ⊕	APPROXIMATE BORING LOCATION AND BORING ID
S.S	PROPOSED 4" SANITARY SEWER LINE
S.S	PROPOSED 8" SANITARY SEWER LINE
S.S	EXISTING 8" SANITARY SEWER LINE
▭	PROPOSED PARKING LOT

Notes:

1. Aerial photograph modified from Google Earth, September 1, 2018

(SCALE IN FEET)

0 60 120

AERONAUTICS SEWER CONNECTION AND
PARKING LOT EXPANSION PROJECT
VACAVILLE, CALIFORNIA

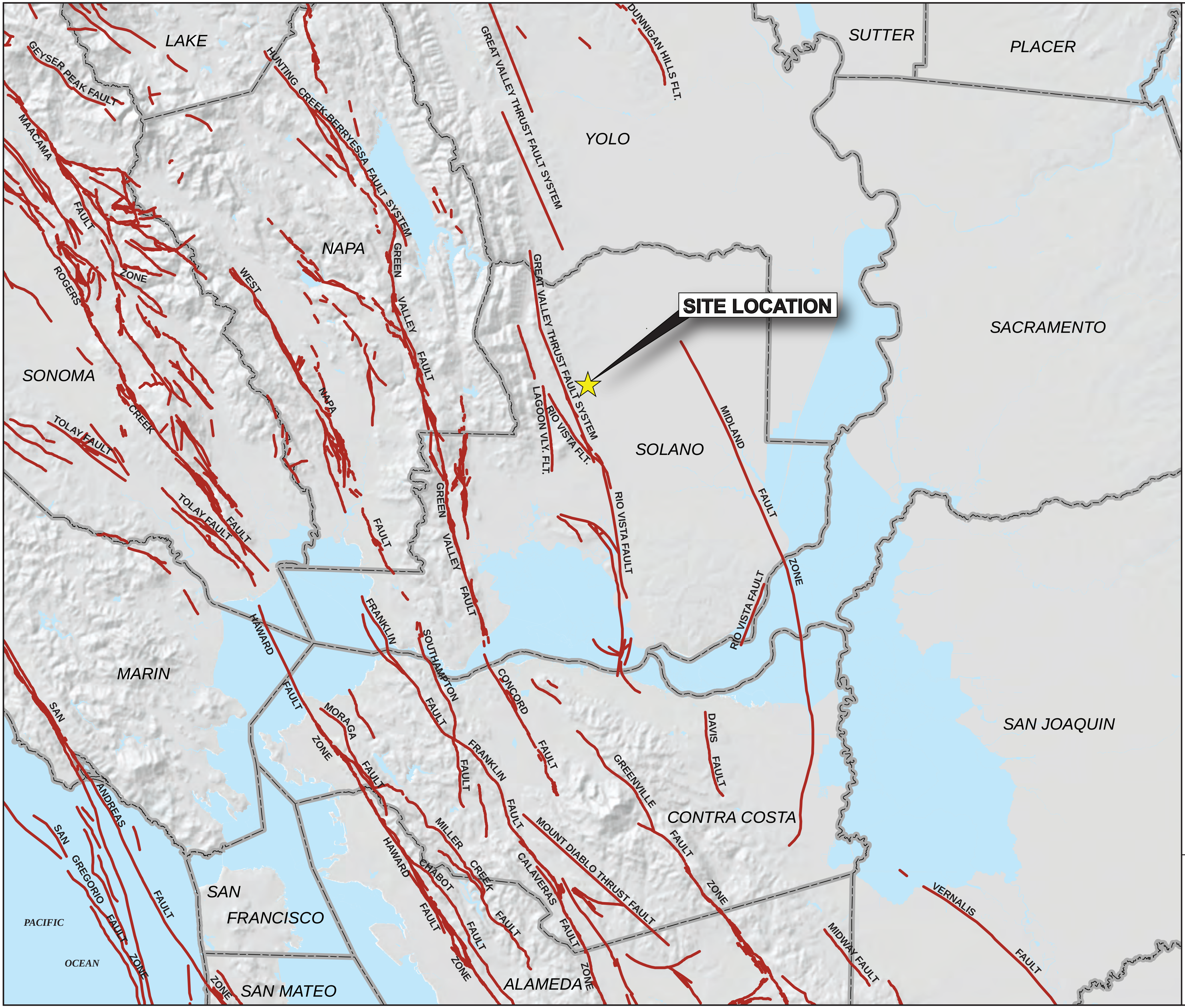
Project No. 1168-1A

SITE PLAN

A3GEO

FIGURE 2

Date: 12/6/2019



LEGEND:

QUATERNARY FAULT

COUNTY BOUNDARY

NOTES:

1. Base map modified from USGS and California Geological Survey, 2006, Quaternary fault and fold database for the United States, accessed 25 January, 2018, from USGS website: http://earthquake.usgs.gov/hazards/qfaults/

N

(SCALE IN MILES)

0 8 16

AERONAUTICS SEWER CONNECTION AND
PARKING LOT EXPANSION PROJECT
VACAVILLE, CALIFORNIA

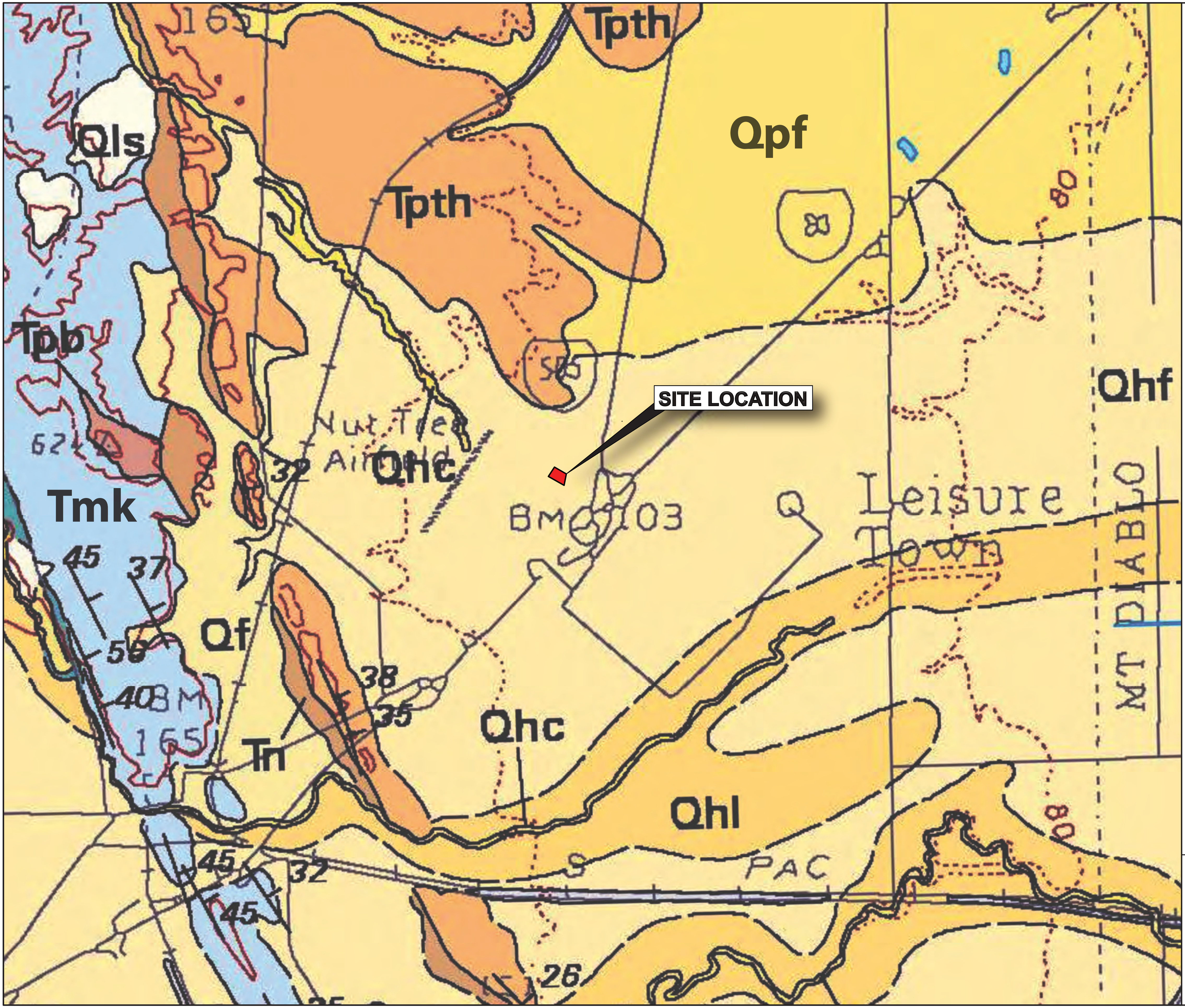
Project No. 1168-1A

QUATERNARY FAULT MAP

A3GEO

FIGURE 3

Date: 12/3/2019



LEGEND:

MAP SYMBOLS

GEOLOGIC CONTACT, DASHED WHERE APPROXIMATELY LOCATED

45 STRIKE AND DIP OF BEDROCK

SURFICIAL DEPOSITS

Qhf	ALLUVIAL FAN DEPOSITS (HOLOCENE)
Qhc	STREAM CHANNEL DEPOSITS (HOLOCENE)
Qhl	NATURAL LEVEE DEPOSITS (HOLOCENE)
Qf	ALLUVIAL FAN DEPOSITS (HOLOCENE & PLEISTOCENE)
Qls	LANDSLIDE DEPOSITS (HOLOCENE & PLEISTOCENE)
Qpf	ALLUVIAL FAN DEPOSITS (LATE PLEISTOCENE)

PITTSBURG ASSEMBLAGE

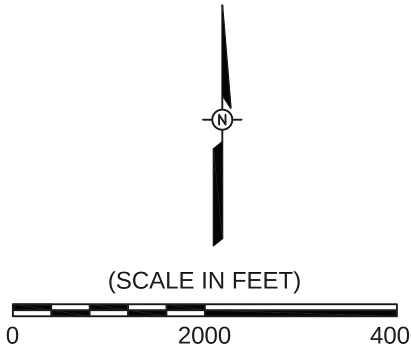
Tpth	TEHEMA FORMATION (PLIOCENE)
Tn	NEROLY SANDSTONE (LATE MIOCENE)

VACAVILLE ASSEMBLAGE

Tpb	PUTNAM PEAK BASALT (MIOCENE)
Tmk	MARKLEY SANDSTONE (EOCENE)

Notes:

1. Base map modified from Graymer, Jones and Brabb, Geologic Map and Map Database of Northeastern San Francisco Bay Region, California, dated 2002



AERONAUTICS SEWER CONNECTION AND
PARKING LOT EXPANSION PROJECT
VACAVILLE, CALIFORNIA

Project No. 1168-1A

REGIONAL GEOLOGIC MAP

A3GEO

FIGURE 4

Date: 12/3/2019

APPENDIX A

A3GEO BORING LOGS

UNIFIED SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYM	TYPICAL NAMES
COARSE GRAINED SOILS: more than 50% retained on No. 200 sieve	COARSE GRAINED SOILS: 50% or more of coarse fraction on No. 4 sieve	CLEAN GRAVELS	GW	Well graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH SAND	GM	Silty gravels and gravel-sand-silt mixtures
			GC	Clayey gravels and gravel-sand-clay mixtures
	SANDS: more than 50% passing on No. 4 sieve	CLEAN SANDS	SW	Well graded sands and gravelly sand, little or no fines
			SP	Poorly graded sands and gravelly sand, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS: 50% or more passing No. 200 sieve	SILTS AND CLAY: Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAY: Liquid Limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic clays
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			PT	Peat, muck, and other highly organic soils

BOUNDARY CLASSIFICATION AND GRAIN SIZES

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

U.S. Standard No. 200 No. 40 No. 10 No. 4 3/4" 3" 12"
Sieve Sizes 0.075 mm 0.425 mm 2 mm 3/16"

SYMBOLS

⧗ Modified California (MC) Sampler (3" O.D.)	▯ Thin-walled tube using Pitcher Barrel	✋ Disturbed Sample
◧ Standard Penetration Test: SPT (2" O.D.)	■ Shelby Tube, pushed or used Ostenberg Sampler	Water Levels ▽ At time of drilling ▼ At end of drilling ▼ After drilling

ABBREVIATIONS

Item	Meaning
LL	Liquid Limit (%) (ASTM D 4318)
PI	Plasticity Index (%) (ASTM D 4318)
-200	Passing No. 200 (%) (ASTM D 1140)
TXCU	Laboratory consolidated undrained triaxial test of undrained shear strength (psf) (D 4767)
TXUU	Laboratory unconsolidated, undrained triaxial test of undrained shear strength (psf) (ASTM D 2850)
psf/tsf	pounds per square foot / tons per square foot
psi	pounds per square inch
OD	Outside Diameter
ID	Inside Diameter

NOTES

1. Stratification lines represent the approximate boundaries between material types and the transitions may be gradual.
2. Modified California (MC) blow counts were adjusted by multiplying field blow counts by a factor of 0.63.
3. Recorded blow counts have not been adjusted for hammer energy.

A3GEO

KEY TO EXPLORATORY BORING LOGS

A3GEO

A3GEO, Inc.
1331 Seventh Ave, Suite E
Berkeley, CA 94710
Telephone: 510-705-1664

BORING NUMBER B-1

PAGE 1 OF 1

CLIENT Solano Community College District

PROJECT NAME Aeronautics Sewer Connection and Parking Lot Expansion

PROJECT NUMBER 1168-1A

PROJECT LOCATION Vacaville, California

DATE STARTED 12/2/19 **COMPLETED** 12/2/19

GROUND ELEVATION 105 ft NAVD88 **HOLE SIZE** 4"

DRILLING CONTRACTOR Geo-Ex Subsurface Exploration

GROUND WATER LEVELS:

DRILLING METHOD Solid Stem Auger

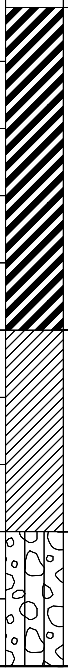
AT TIME OF DRILLING --- Not Encountered

LOGGED BY MLW **CHECKED BY** TPS

AT END OF DRILLING --- Not Encountered

NOTES Hand Augered from 0-5' below surface grade

AFTER DRILLING --- Not Encountered



DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	ADJUSTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	RECOVERY % (RQD)	OTHER LAB TESTS / NOTES
0		Grass							
		ALLUVIUM: FAT CLAY (CH) - dark brown, moist, medium stiff, some silt, trace gravel, trace roots and plant fibers, trace sand.	GB				26 28		
			GB						
			GB						
5		LEAN CLAY with SAND (CL) - light brown, moist, very stiff, some silt.	MC	21				100	Gravel=0% Sand=28% -#200=72%
		SILTY GRAVEL with SAND (GM) - light brown, moist, medium dense.	MC	17				100	Gravel=48% Sand=39% -#200=13%
10									

Bottom of borehole at 10.0 feet.
Hole grouted upon completion of boring
Modified California (MC) blow counts were adjusted by multiplying field blow counts by a factor of 0.63

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BORING NUMBER B-2

PAGE 1 OF 1

CLIENT Solano Community College District

PROJECT NAME Aeronautics Sewer Connection and Parking Lot Expansion

PROJECT NUMBER 1168-1A

PROJECT LOCATION Vacaville, California

DATE STARTED 12/2/19 **COMPLETED** 12/2/19

GROUND ELEVATION 105 ft NAVD88 **HOLE SIZE** 4"

DRILLING CONTRACTOR Geo-Ex Subsurface Exploration

GROUND WATER LEVELS:

DRILLING METHOD Solid Stem Auger

AT TIME OF DRILLING --- Not Encountered

LOGGED BY MLW **CHECKED BY** TPS

AT END OF DRILLING --- Not Encountered

NOTES Hand Augered from 0-5' below surface grade

AFTER DRILLING --- Not Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	ADJUSTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	RECOVERY % (RQD)	OTHER LAB TESTS / NOTES
0		Grass							
	▨	ALLUVIUM: FAT CLAY (CH) - dark brown, moist, medium stiff, some silt, trace gravel, trace roots and plant fibers, trace sand.	GB						
			GB						
5	▨	CLAYEY SAND (SC) light brown, moist, medium dense, some silt.	MC	25		112	17	100	
	▨	SILTY SAND (SM) - light brown, moist, medium dense.	MC	23				100	
10									

Bottom of borehole at 10.0 feet.
Hole grouted upon completion of boring
Modified California (MC) blow counts were adjusted by multiplying field blow counts by a factor of 0.63

A3GEO, Inc.
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Berkeley, CA 94710
Telephone: 510-705-1664

BORING NUMBER B-3

PAGE 1 OF 1

CLIENT Solano Community College District

PROJECT NAME Aeronautics Sewer Connection and Parking Lot Expansion

PROJECT NUMBER 1168-1A

PROJECT LOCATION Vacaville, California

DATE STARTED 12/2/19 **COMPLETED** 12/2/19

GROUND ELEVATION 105 ft NAVD88 **HOLE SIZE** 4"

DRILLING CONTRACTOR Geo-Ex Subsurface Exploration

GROUND WATER LEVELS:

DRILLING METHOD Solid Stem Auger

AT TIME OF DRILLING --- Not Encountered

LOGGED BY MLW **CHECKED BY** TPS

AT END OF DRILLING --- Not Encountered

NOTES Hand Augered from 0-5' below surface grade

AFTER DRILLING --- Not Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	ADJUSTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	RECOVERY % (RQD)	OTHER LAB TESTS / NOTES
0	▨	Grass ALLUVIUM: LEAN CLAY (CL) - dark brown, moist, medium stiff, some silt, trace gravel, trace roots and plant fibers, trace sand.							LL=48, PI=27
	▨		GB						
	▨		GB				30		
5	▨	CLAYEY SAND (SC) - light brown, moist, medium dense, some silt.	MC	26				100	
	▨								
	░	SILTY SAND (SM) - light brown, moist, medium dense.							
10	░		MC	25				100	

Bottom of borehole at 10.0 feet.
Hole grouted upon completion of boring
Modified California (MC) blow counts were adjusted by multiplying field blow counts by a factor of 0.63

A3GEO, Inc.
1331 Seventh Ave, Suite E
Berkeley, CA 94710
Telephone: 510-705-1664

BORING NUMBER B-4

PAGE 1 OF 1

CLIENT Solano Community College District
PROJECT NAME Aeronautics Sewer Connection and Parking Lot Expansion
PROJECT NUMBER 1168-1A
PROJECT LOCATION Vacaville, California
DATE STARTED 12/2/19 **COMPLETED** 12/2/19
GROUND ELEVATION 105 ft NAVD88 **HOLE SIZE** 4"
DRILLING CONTRACTOR Geo-Ex Subsurface Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hand Auger
AT TIME OF DRILLING --- Not Encountered
LOGGED BY MLW **CHECKED BY** TPS
AT END OF DRILLING --- Not Encountered
NOTES Two holes were hand augered within 2 feet of eachother
AFTER DRILLING --- Not Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	ADJUSTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	RECOVERY % (RQD)	OTHER LAB TESTS / NOTES
0	▨	Grass							
	▨	ALLUVIUM: LEAN CLAY (CL) - dark brown, moist, medium stiff, some silt, trace gravel, trace roots and plant fibers, trace sand.							Note two holes hand augered about 2-feet apart from each other to collect a sufficient quantity of soil in sample bags
	▨		✋ GB						
5	▨		✋ GB						

Bottom of borehole at 5.0 feet.
Hole grouted upon completion of boring
Modified California (MC) blow counts were adjusted by multiplying field blow counts by a factor of 0.63

APPENDIX B

LABORATORY TEST RESULTS

B. HILLEBRANDT SOILS TESTING, INC.

29 Sugarloaf Terrace, Alamo, CA 94507 - Tel: (510) 409-2916 - Fax: (925) 891-9267 - Email: soiltesting@aol.com

LAB RESULTS SUMMARY FORM

Project Number: 1168-1A **Project Name:** Aeronautics Sewer Connection and Parking Lot
Requested By: MW **Request Date:** 12/3/2019 **Throw Samples Out On:**

					Atterberg			-200			Compaction				
Boring #	Sample Depth (feet)	Dry Density (pcf)	Moisture Content (%)	TxUU Shear Strength (psf)	Liquid Limit	Plastic Limit	Plasicity Index	Passing #4 Sieve (%)	Passing #40 sieve (%)	Passing #200 sieve (%)	Maximum Dry Density (pcf)	Optimum Moisture (%)	Pocket Penetrometer (tsf)	Torvane (tsf)	Remarks
B-1	0.0 - 1.0		28.2												
B-1	1.0 - 2.0		26.3												
B-1	6.0 - 6.5							100	97	72					
B-1	9.0 - 9.5							52	30	13					
B-2	6.0 - 6.5	112	16.7												
B-3	1.0 - 3.0				48	21	27								
B-3	3.0 - 5.0		30.0												

B. HILLEBRANDT SOILS TESTING, INC.

29 Sugarloaf Terrace, Alamo, CA 94507 - Tel: (510) 409-2916 - Fax: (925) 891-9267 - Email: soiltesting@aol.com

MOISTURE CONTENT/DRY DENSITY

Job #: 1168-1A
Job Name: Aeronautics Sewer Connection and Parking Lot
Date: 12/3/2019
Tested by: Brad Hillebrandt

Additional Tests:						
Boring #:	B-2					
Depth:	6.0 - 6.5					
Sample Description:	Brown sandy CLAY					
Can #:	418					
Wet Sample + can	268.1					
Dry Sample + can	234.5					
Weight can	33.4					
Weight water	33.6					
Weight Dry Sample	201.1					
WATER CONTENT (%)	**16.7%**					
Weight Sample + Liner	1201.5					
Weight Liner	277.1					
Sample Length	6.0					
Sample Diameter	2.39					
DRY DENSITY (pcf)	**112.1**					

B. HILLEBRANDT SOILS TESTING, INC.

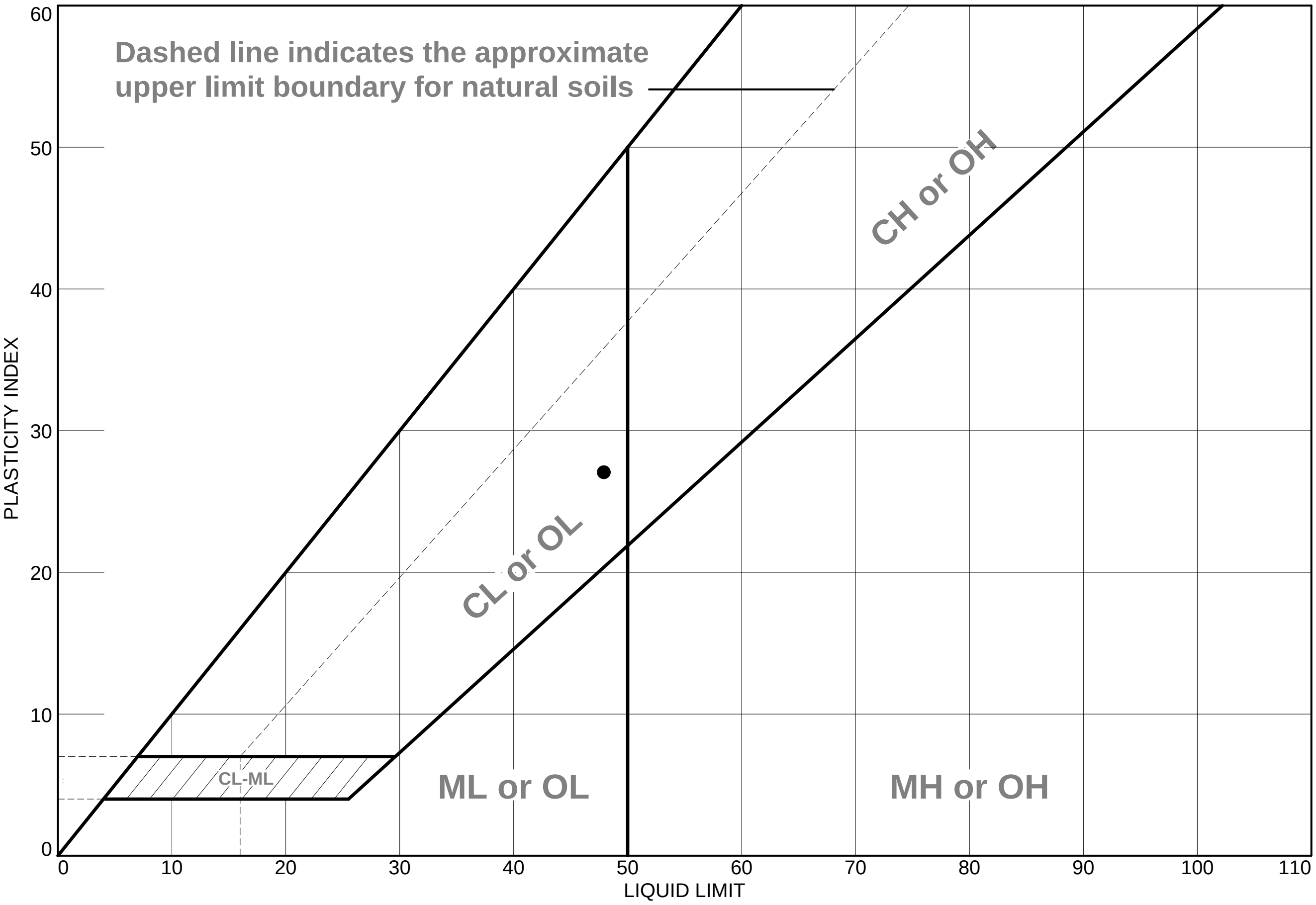
29 Sugarloaf Terrace, Alamo, CA 94507 - Tel: (510) 409-2916 - Fax: (925) 891-9267 - Email: soiltesting@aol.com

MOISTURE CONTENT WORKSHEET

Job #: **1168-1A**
Job Name: **Aeronautics Sewer Connection and Parking Lot**
Date: **12/3/2019**
Tested by: **B. Hillebrandt**

Additional Tests:									
Boring #:	B-1	B-1	B-3						
Depth:	0.0 - 1.0	1.0 - 2.0	3.0 - 5.0						
Sample Description:	Dark grayish brown CLAY	Grayish brown CLAY	Dark brown CLAY						
Can #:	307	354	327						
Wet Sample + can	251.1	258.5	209.8						
Dry Sample + can	204.1	211.5	170.2						
Weight can	37.5	33.1	38.4						
Weight water	47	47	39.6						
Weight Dry Sample	166.6	178.4	131.8						
WATER CONTENT (%)	**28.2%**	**26.3%**	**30.0%**						

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark grayish brown CLAY with sand	48	21	27			CL

Project No. 1168-1A **Client:** A3Geo

Project: Aeronautics Sewer Connection and Parking Lot Expansion

●**Source of Sample:** B-3 **Depth:** 1.0 - 3.0'

Remarks:

B. HILLEBRANDT SOILS TESTING, INC.
+1 510-409-2816
SoilTesting@aol.com

Figure

Tested By: BH

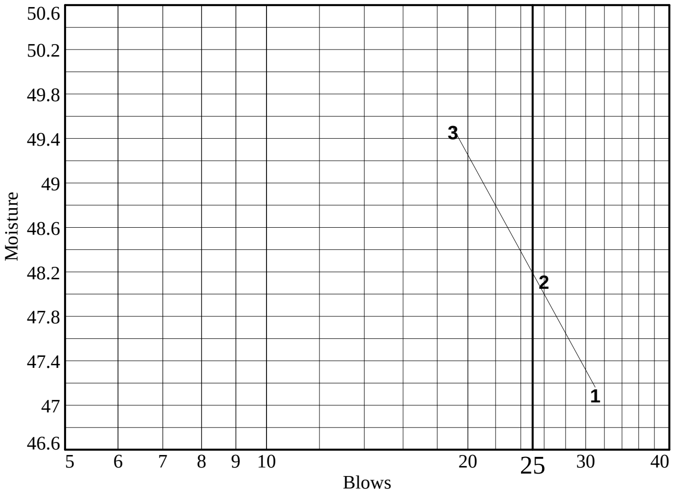
LIQUID AND PLASTIC LIMIT TEST DATA

12/10/2019

Client: A3Geo
Project: Aeronautics Sewer Connection and Parking Lot Expansion
Project Number: 1168-1A
Location: B-3
Depth: 1.0 - 3.0'
Material Description: Dark grayish brown CLAY with sand
USCS: CL
Tested by: BH

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	27.17	30.92	31.98			
Dry+Tare	22.07	24.55	25.14			
Tare	11.24	11.31	11.31			
# Blows	31	26	19			
Moisture	47.1	48.1	49.5			

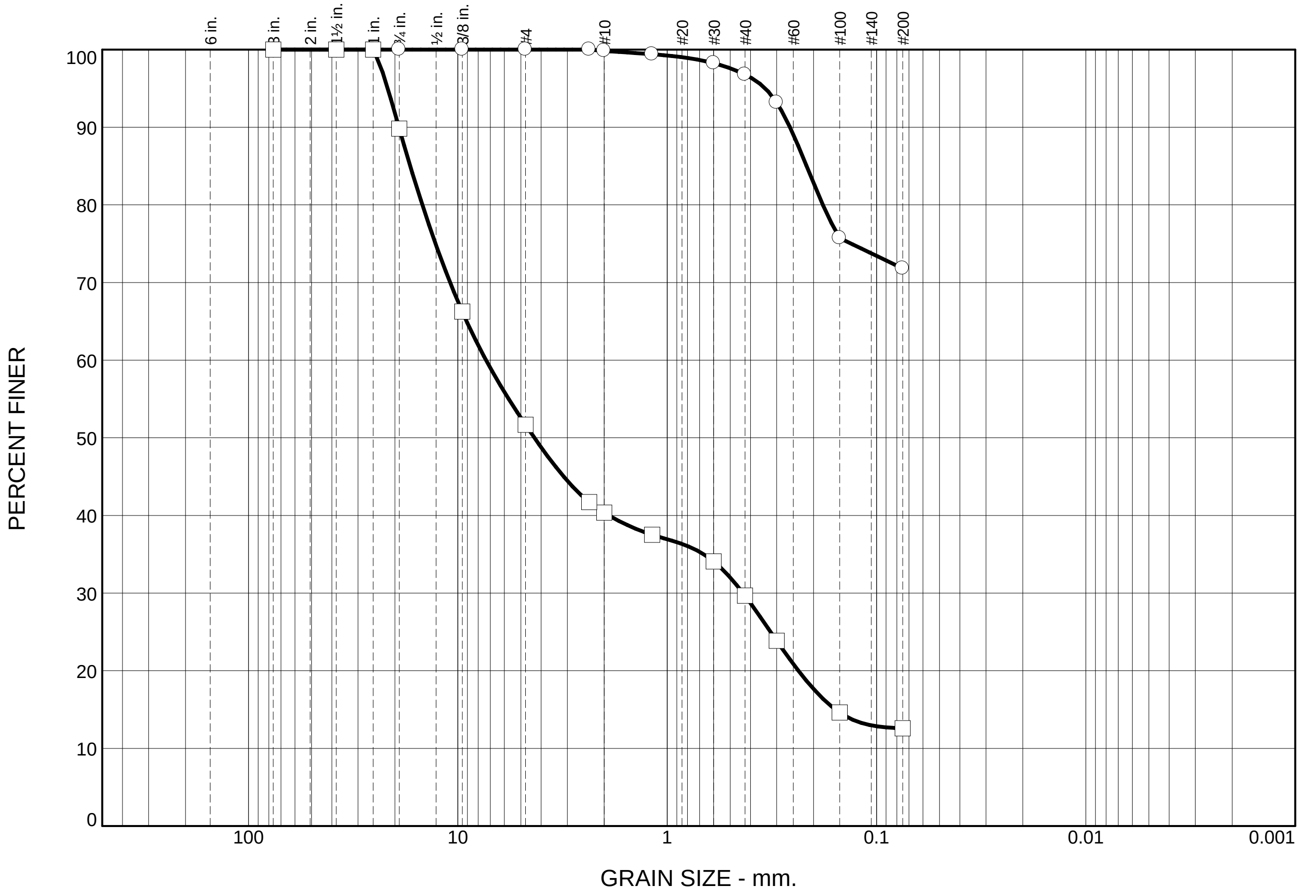


Liquid Limit= 48
Plastic Limit= 21
Plasticity Index= 27

Plastic Limit Data

Run No.	1	2	3	4
Wet+Tare	17.71	17.11		
Dry+Tare	16.60	16.09		
Tare	11.25	11.31		
Moisture	20.7	21.3		

Particle Size Distribution Report



	% +3"	% Gravel	% Sand	% Silt	% Clay
○	0.0	0.0	28.2	71.8	
□	0.0	48.3	39.1	12.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1		6.0 - 6.5'	Brown CLAY with sand	CL
□	B-1		9.0 - 9.5'	Light brown silty GRAVEL with sand	GM

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Client: A3Geo
Project: Aeronautics Sewer Connection and Parking Lot Expansion

Project No.: 1168-1A **Figure**

Tested By: BH

GRAIN SIZE DISTRIBUTION TEST DATA

12/10/2019

Client: A3Geo
Project: Aeronautics Sewer Connection and Parking Lot Expansion
Project Number: 1168-1A
Location: B-1
Depth: 6.0 - 6.5'
Material Description: Brown CLAY with sand
USCS: CL

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
231.60	38.80	0.00	3"	0.00	100.0
			1.5"	0.00	100.0
			1"	0.00	100.0
			3/4"	0.00	100.0
			3/8"	0.00	100.0
			#4	0.00	100.0
			#8	0.00	100.0
			#10	0.30	99.8
			#16	1.15	99.4
			#30	3.38	98.2
			#40	6.19	96.8
			#50	13.17	93.2
			#100	46.80	75.7
			#200	54.35	71.8

Fractional Components

Cobbles	Gravel	Sand	Silt	Clay
0.0	0.0	28.2		

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
								0.1804	0.2157	0.2593	0.3402

Fineness Modulus
0.33

GRAIN SIZE DISTRIBUTION TEST DATA

12/10/2019

Client: A3Geo
Project: Aeronautics Sewer Connection and Parking Lot Expansion
Project Number: 1168-1A
Location: B-1
Depth: 9.0 - 9.5'
Material Description: Light brown silty GRAVEL with sand
USCS: GM
Tested by: BH

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
626.40	227.70	0.00	3"	0.00	100.0
			1.5"	0.00	100.0
			1"	0.00	100.0
			3/4"	40.57	89.8
			3/8"	134.54	66.3
			#4	192.66	51.7
			#8	232.36	41.7
			#10	237.77	40.4
			#16	249.12	37.5
			#30	262.83	34.1
			#40	280.40	29.7
			#50	303.60	23.9
			#100	340.42	14.6
			#200	348.52	12.6

Fractional Components

Cobbles	Gravel	Sand	Silt	Clay
0.0	48.3	39.1		

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
		0.1570	0.2361	0.4342	1.8995	4.3074	7.3367	14.7776	16.8902	19.1310	21.6175

Fineness Modulus
4.40

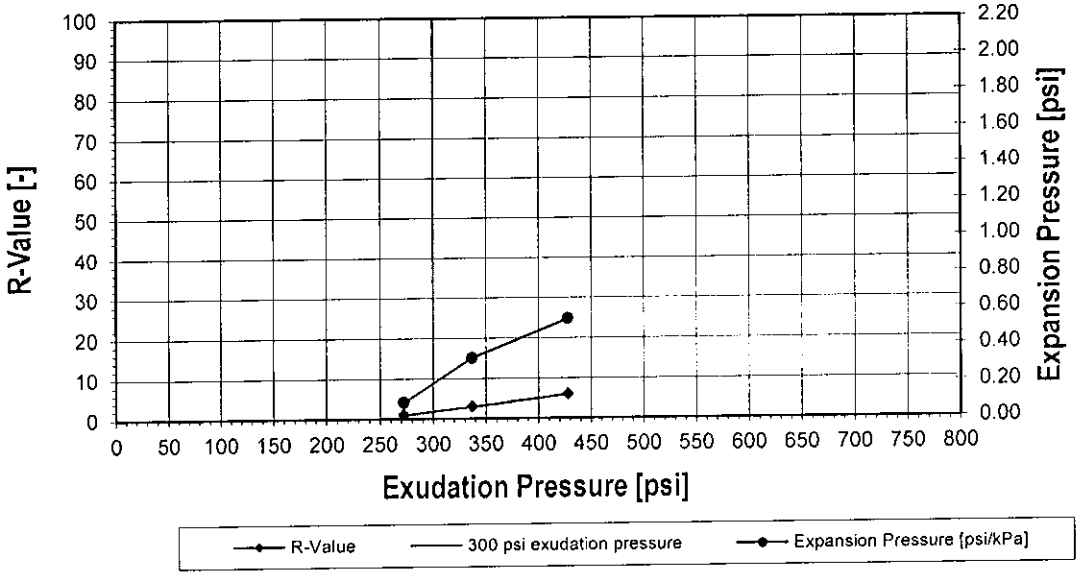
R-Value ASTM D2844 / CT301

Clients Project No.: 1168-1A
ISI Project No.: 2530-047.0
ISI Lab No.: G-64197

Project Name: Aeronautics Sewer Connection
Client Name: A3GEO
Descripton (Visual): Grayish brown clay
Boring: Onsite
Sample No.: 1
Depth (ft): Bulk

Test Date: 12/16/19
Run By: JH
Checked By: JH

Specimen #	1		2		3	
Compaction Pressure [psi/kPa]	**50**	345	**70**	483	**100**	690
Total Moisture [%]	26.1		24.3		22.6	
Density[pcf]	93.1		95.4		98.7	
Expansion Pressure [psi/kPa]	**0.09**	0.63	**0.33**	2.30	**0.55**	3.77
Horizontal Pressure at 160 psi [psi/kPa]	**153**	1055	**150**	1034	**144**	993
Number of Turns D [-]	**4.98**		**4.77**		**4.38**	
Sample Height [in./mm]	**2.65**	67.3	**2.46**	62.5	**2.58**	65.5
Exudation Pressure [psi/kPa]	**272**	1878	**337**	2322	**428**	2950
R-Value [-]	2.2		3.4		6.0	
Corrected R-Value [-]	1		3		6	



Corrected R-Value at 300 psi / 2.07 MPa Exudation Pressure = Less Than 5

END OF REPORT