

November 5, 2014

Ms. Marie Silveira
Jacobs
1050 20th Street, Suite 200
Sacramento, CA 95811

Re: Geotechnical Investigation
Section 21 Crypt Area Expansion
San Joaquin Valley National Cemetery, Santa Nella, California
SFB Project No.: 361-19

Ms. Silveira:

As requested, Stevens, Ferrone & Bailey Engineering Company, Inc. has performed a geotechnical investigation for the Section 21 Crypt Area Expansion project at San Joaquin Valley National Cemetery, Santa Nella, California. The accompanying report presents the results of our field investigation, laboratory tests, and engineering analysis. The geotechnical conditions are discussed, and recommendations for the geotechnical engineering aspects of the project are presented. Conclusions and recommendations contained herein are based upon applicable standards of our profession at the time this report has been prepared. Should you have any questions or require additional information, please do not hesitate to contact me.

Sincerely,
Stevens, Ferrone & Bailey
Engineering Company, Inc.



Ken Ferrone
President

TC/KCF:lc\encl.
Copies: Addressee (1 by email)

November 5, 2014

**GEOTECHNICAL INVESTIGATION
SECTION 21 CRYPT AREA EXPANSION
SAN JOAQUIN VALLEY NATIONAL CEMETERY
SANTA NELLA, CALIFORNIA
SFB PROJECT NO. 361-19**

Prepared For:

Jacobs
1050 20th Street, Suite 200
Sacramento, California 95811

Prepared By:

Stevens, Ferrone & Bailey Engineering Company, Inc.



Taiming Chen, P.E., G.E.
Civil/Geotechnical Engineer



Kenneth C. Ferrone, P.E., G.E., C.E.G.
*Civil/Geotechnical Engineer
Certified Engineering Geologist*

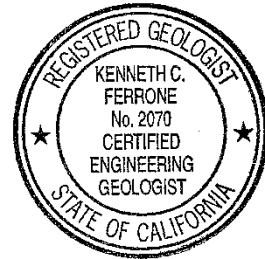


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1.0 INTRODUCTION

This report presents the results of our geotechnical investigation for the proposed Section 21 Crypt Area Expansion project at the San Joaquin Valley National Cemetery in Santa Nella, California, California as shown on the Site Plan, Figure 1. The purpose of our investigation was to evaluate the geotechnical conditions at the site and provide recommendations regarding the geotechnical engineering aspects of the project.

Based on the information indicated on the Site Plan, as well as information provided by Ms. Marie Silveira of Jacobs, it is our understanding that the project will consist of expanding the Section 21 area for 4,000 crypts. Paved access roadways are also proposed in the area. Nominal grading is anticipated.

The conclusions and recommendations provided in this report are based upon the information presented above; Stevens, Ferrone & Bailey Engineering Company, Inc. (SFB) should be consulted if any changes to the project occur to assess if the changes affect the validity of this report.

2.0 SCOPE OF WORK

This investigation included the following scope of work:

- Reviewing available published and unpublished geotechnical and geological literature relevant to the site, including the previous geotechnical investigation report of the adjacent Section 20 Crypt Area prepared by SFB and dated April 17, 2009;
- Performing reconnaissance of the site and surrounding area;
- Performing a subsurface exploration program, including drilling three exploratory borings to a maximum depth of about 26-1/2 feet;
- Performing laboratory testing of samples retrieved from the borings;
- Performing engineering analysis of the field and laboratory data; and
- Preparing this report.

The data obtained and the analyses performed were for the purpose of providing geotechnical design and construction criteria for site earthwork, installation of underground utilities, drainage, foundations, and pavements. Toxicity potential assessment of onsite materials or groundwater (including mold) was beyond our scope of work.

3.0 SITE INVESTIGATION

Reconnaissance of the site and surrounding area was performed on October 28, 2014. Subsurface exploration was performed using a truck-mounted drill rig equipped with 4-inch diameter, continuous flight, solid stem augers. Three exploratory borings were drilled on October 28, 2014 to a maximum depth of about 26-1/2 feet. Previously, three exploratory borings were drilled by SFB in the site vicinity on April 3, 2009 to a maximum depth of about 25-1/2 feet. In addition, two piezometers were previously installed at site by others on an unknown date. According to our field measurements in 2009, one piezometer (PZ-1) is about 20 feet deep and the other (PZ-2) is about 51-1/2 feet deep. The approximate locations of all SFB's borings and piezometers by others are shown on the Site Plan, Figure 1. Logs of SFB's borings and details regarding SFB's field investigation are included in Appendix A. The results of SFB's laboratory tests are discussed in Appendix B. Logs of the SFB's previous borings and results of previous laboratory testing are also provided in Appendix C for reference. It should be noted that changes in the surface and subsurface conditions can occur over time as a result of either natural processes or human activity and may affect the validity of the conclusions and recommendations in this report.

3.1 Surface

At the time of our investigation and as shown on Figure 1, the proposed Section 21 crypt area was bounded by Tres Cerritos Boulevard on the northwest, undeveloped land on the northeast and east, South Loop Road on the southeast, and the developed Section 20 crypt area on the southwest. The general grades of the proposed site sloped slightly downward toward the northeast. The road embankments of Tres Cerrito Boulevard was about 6 to 10 feet high and sloped downward toward the site with inclinations of about 5:1 to 10:1 (horizontal to vertical).

At the time of our field exploration, the site was vacant except for an area located along the southwestern site boundary was covered by gravel and used as an access way for the Section 20 crypt area. Three to five feet of fill materials have been placed within the access way area during the grading of adjacent Section 20. Two existing piezometers still remained near the edge of the access way. Conditions of the piezometers are unknown due to either blockage of the casing pipe at the top or casing pipe cap being stuck. The site vegetation generally consisted of a sparse to low growth of weeds and grasses. Some small diameter trees were located to the north of the site. Wire fencing was also observed within the northeastern portion of the site.

3.2 Subsurface

The near-surface materials encountered in our exploratory Borings B-1 through B-3 on the proposed crypt site generally consisted of stiff to hard clays interbedded with dense to very dense sand and gravel layers that extended to a maximum depth explored of about 26-1/2 feet. Drilling refusal was also encountered by a truck-mounted Mobile B-24 drill rig at the bottoms of Borings B-1 and B-2 at depths of about 20 to 22 feet. The subsurface materials encountered by previous borings in the site vicinity are generally similar to those encountered by our recent borings at the site.

According to the results of laboratory testing, the near surface more clayey materials have a high to very high plasticity and high to critical expansion potential; however, the more silty and sandy materials have a low to moderate expansion potential. Detailed descriptions of the materials encountered in our exploratory borings are presented on the boring logs in Appendix A. Our attached boring logs and related information depict location specific subsurface conditions encountered during our field investigation. The approximate locations of our borings were determined using pacing or landmark references and should be considered accurate only to the degree implied by the method used.

3.3 Groundwater

Groundwater was encountered in SFB's Borings B-1 through B-3 in the proposed crypt site during drilling. Groundwater was also recorded by SFB in 2009 in the three previous borings and two existing piezometers. A summary of the groundwater depths in the borings and piezometers during our filed explorations on October 28, 2014 and April 3, 2009 are presented in the table below.

Boring No.	Approximate Ground Elevation**	Boring Depth Below Ground Surface	Approximate Depth to Groundwater Below Ground Surface on 10/28/14	
			Initially Encountered During Drilling	Measured at the End of Drilling
B-1	275 ft	22.2 ft	21.0 ft	16.0 ft
B-2	273 ft	20.0 ft	20.0 ft	17.0 ft
B-3	272 ft	26.5 ft	20 ft	17.5 ft
Boring No.	Approximate Ground Elevation**	Boring Depth Below Ground Surface	Approximate Depth to Groundwater Below Ground Surface on 4/3/09	
			Initially Encountered During Drilling	Measured at the End of Drilling
SFB-1	278 ft	25.4 ft	20.0 ft	10.0 ft
SFB-2	279 ft	18.5 ft	10.0 ft	7.5 ft
SFB-3	274 ft	12.9 ft	Not Encountered	N/A
Piezometer No.	Top of Pipe/Riser Elevation**	Piezometer Depth Below Ground Surface	Approximate Depth to Groundwater Below Ground Surface on 4/3/09	
PZ-1*	277.16 ft	19.7 ft	12.6 ft	
PZ-2*	276.53 ft	51.6 ft	13.6 ft	

*Installed by others on an unknown date; Unknown screen detail.

**Elevation information provided by Jacobs.

The measured groundwater depths generally indicated the groundwater at the site may vary from about Elevation 255 to 271 feet (datum unknown). It should be noted that the borings might not have been left open for a sufficient period of time to establish equilibrium groundwater conditions. In addition, fluctuations in the groundwater level could occur due to change in seasons, variations in rainfall, and other factors. All of SFB's borings were backfilled prior to leaving the site.

3.4 Hydrologic Soil Group

The surface soils at the site have been mapped as Herito Loam by USDA Web Soil Survey (WSS) and were assigned to Hydrologic Soil Group C by the USDA Natural Resources

Conservation Service (NRCS); the soils have been categorized as having moderately low to moderately high transmission rates (approximately 0.06 to 0.2 inches per hour). The Group C soil is defined as having a slow infiltration rate when thoroughly wet and may consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. According to the results of our subsurface exploration, it is our opinion that the onsite Group C soils generally consist of the near-surface clays, silts, and clayey sands and extend to depths varying from 10 to 18 feet below the existing ground surface. The underlying gravelly sand and sandy gravel layers can be classified as Group B soils and considered as a water-bearing layer and having a moderate water transmission rate.

3.5 Geology and Seismicity

According to Wagner, et al. (1990), the proposed crypt site is underlain by Pleistocene to Early Holocene San Luis Ranch alluvium which generally consists of fine- to coarse-grained fan, mudflow, terrace, and floodplain deposits¹.

The site is located in the San Joaquin Valley. Significant earthquakes have occurred in the San Joaquin Valley and are believed to be associated with crustal movements along a system of subparallel fault zones that generally trend in a northwesterly direction. The approximate direction and distance from the site to nearby active faults are summarized in the table below².

Fault Name	Approximate Distance to Fault (Miles)	Direction to Fault
Ortogonalita	3.5	Southwest
Quien Sabe	20.8	Southwest
Calaveras	23.8	Southwest
Sargent	26.1	Southwest
Paicines	27.6	Southwest
San Andreas	31.0	Southwest

¹Wagner, Bortugno, and McJunkin, 1990, *Geologic Map of San Francisco-San Jose Quadrangle, California, 1:250000*, CDMG Regional Geologic Map Series, Map No. 5A (Geology).

²Information based on Jennings and Bryant, 2010, *Fault Activity Map of California*, CGS Geological Data Map No.6.

According to the Alquist-Priolo Earthquake Fault Zone Map of the San Luis Dam Quadrangle, the site is not located in an earthquake fault zone as designated by the State of California³.

Earthquake intensities will vary throughout the San Joaquin Valley, depending upon numerous factors including the magnitude of earthquake, the distance of the site from the causative fault, and the type of materials underlying the site. The development will probably be subjected to earthquakes that will cause moderate to strong ground shaking. According to the Probabilistic Seismic Hazard Analysis (NSHMP PSHA) interactive deaggregation model developed by U.S. Geological Survey (2008), the site has a 10% probability of exceeding a peak ground acceleration of about 0.4g in 50 years (design basis ground motion based on stiff soil site condition; mean return time of 475 years). The actual ground surface acceleration might vary depending upon the local seismic characteristics of the underlying bedrock and the overlying unconsolidated soils.

3.6 Liquefaction

Soil liquefaction is a phenomenon primarily associated with saturated, cohesionless, soil layers located close to the ground surface. These soils lose strength during cyclic loading, such as imposed by earthquakes. During the loss of strength, the soil acquires mobility sufficient to permit both horizontal and vertical movements. Soils that are most susceptible to liquefaction are clean, loose, uniformly graded, saturated, fine-grained sands that lie close to the ground surface. As of the date of this report, the liquefaction potential of the site has not been evaluated by the State of California⁴.

Based on the combined results of our review of available literature, our understanding of the site's geology, the borings, and the in-situ standard penetration tests, it is our opinion that the potential for ground surface damage at the site resulting from liquefaction is low

³Hart and Bryant, *Fault-Rupture Hazard Zones in California*, CDMG Special Publication 42, Interim Revision 2007.

⁴Seismic Hazards Mapping Act, 1990.

4.0 CONCLUSIONS AND RECOMMENDATIONS

It is our opinion that the site is suitable for the proposed project from a geotechnical engineering standpoint. The conclusions and recommendations presented in this report should be incorporated in the design and construction of the project to reduce soil or foundation related issues. The following are the primary geotechnical considerations for development of the site.

DIFFERENTIAL EXPANSION POTENTIAL: The expansion potential of the near surface soils at the site varies from low to very high. The more clayey, expansive surface materials could be subjected to volume changes during seasonal fluctuations in moisture content. In order to reduce the potential for post-construction distress to building foundations (if planned), we recommend building pads be over-excavated 3 feet below the proposed pad grades and re-compacted as new engineered fill to provide a layer of relatively uniform, moisture conditioned engineered fill below the pad. The over-excavation should be performed so that no more than 5 feet of differential fill thickness exists below foundations. The over-excavation should extend at least 5 feet beyond building footprints or 3 feet beyond the outer edge of the surrounding exterior flatwork, whichever is greater. Our representative should be on site during over-excavation and replacement to observe and test the operation. The actual depth and lateral extent of over-excavation should be determined in the field by SFB at the time of the earthwork operations. The removed fills and soils can be used as new fill provided they are placed and compacted in accordance with the recommendations presented in this report.

The relatively uniform, moisture conditioned, engineered fill could still be subjected to volume changes during seasonal fluctuations in moisture content. To reduce the potential for post-construction distress to proposed buildings resulting from swelling and shrinkage of these materials, we recommend that buildings be supported on foundations that are designed to reduce the expansion potential impact of the onsite soils and fills. It should be noted that special design considerations would be required for exterior slabs

SHALLOW GROUNDWATER: Groundwater was encountered in SFB's borings and was recorded in the piezometers at elevations varying from about 255 to 271 feet (datum unknown). In addition, fluctuations in the groundwater level could occur due to change in seasons, variations in rainfall, and other factors. Dewatering of excavations in the shallow groundwater areas will be needed where excavations extend below the groundwater level. Installing shoring and/or dewatering wells may also be necessary to aid in the stabilization of excavation. Raising grades may preclude the need for dewatering within excavations if the bottoms of the excavations are located above the groundwater level.

CRYPT INSTALLATION EXCAVATION: Temporary construction slopes can be used at the perimeter of the crypt installation excavation. We recommend the slopes be no steeper than 1 horizontal to 1 vertical. The top of the slopes should be appropriately setback from existing improvements, such as adjacent roadways. All temporary construction slopes and existing improvements should be monitored during the construction process and appropriate remedial measures should be immediately installed if detrimental movements are observed or measured. Where construction slopes cannot be used due to space constraints, temporary shoring should be installed. We recommend current OSHA standards be followed during the design and construction of any temporary construction slopes and/or shoring.

The base of the excavations may be wet and unstable. SFB should be consulted at the time of construction to provide recommendations for excavation base stabilization measures if unstable conditions are encountered.

ADDITIONAL RECOMMENDATIONS: Detailed drainage, earthwork, foundation, and pavement recommendations for use in design and construction of the project are presented below. We recommend SFB review the design and specifications to verify that the recommendations presented in this report have been properly interpreted and implemented in the design, plans, and specifications. We also recommend SFB be retained to provide consulting services and to perform construction observation and testing services during the construction phase of the project to observe and test the implementation of our recommendations, and to provide supplemental or revised recommendations in the event conditions different than those described in this report are encountered. We assume no responsibility for misinterpretation of our recommendations if we do not review the plans and specifications and are not retained during construction.

4.1 Earthwork

4.1.1 Clearing and Site Preparation

The site should be cleared of all obstructions, including fencing and debris. Holes resulting from the removal of underground obstructions extending below the proposed finish grade should be cleared and backfilled with fill materials as specified in **Section 4.1.4, Fill Material**, and compacted to the requirements in **Section 4.1.5, Compaction**. We recommend backfilling operations for any excavations be performed under the observation and testing of SFB. Vegetation that remains after the clearing process should be stripped and stockpiled to use in landscaping; stripping should extend to the depth of the root structures.

4.1.2 Building Pads

As described previously, soils with highly variable expansion characteristics exist near the surface. In order to reduce the potential for differential movement of buildings due to soil expansion, we recommend proposed building pads be over-excavated at least 3 feet below the proposed pad grades and re-compacted as new engineered fill to provide a layer of relatively uniform, moisture conditioned engineered fill below the pad. The over-excavation should be performed so that no more than 5 feet of differential fill thickness exists below the proposed building foundations. The over-excavation should extend at least 5 feet beyond the building footprints or 3 feet beyond the outer edge of the surrounding exterior flatwork, whichever is greater.

The process of creating the engineered fill layer should consist of over-excavating to the recommended depths and lateral extent, scarifying and moisture conditioning the exposed subgrade, and replacing the excavation with well mixed, moisture conditioned fill materials. Removed soils or existing fill materials may be used as new fill onsite provided it satisfies the recommendations provided in **Section 4.1.4, Fill Material**. The fill materials should be placed and compacted in accordance with the recommendations provided in **Section 4.1.5, Compaction**. A representative from our office should observe and test the over-excavation and re-compaction process.

4.1.3 Subgrade Preparation

After the completion of clearing and site preparation, soil exposed in areas to receive improvements such as structural fill, slabs-on-grade, or pavements should be scarified to a depth of about 12 inches, moisture conditioned to approximately 3 to 5 percent over optimum water content, and compacted to the requirements for structural fill. If improvement or pavement subgrade are allowed to remain exposed to sun, wind or rain for an extended period of time, or are disturbed by borrowing animals, the exposed improvement or pavement subgrade may need to be reconditioned (moisture conditioned and/or scarified and recompacted) prior to foundation or pavement construction. SFB should be consulted on the need for subgrade reconditioning when the subgrade is left exposed for extended periods of time.

4.1.4 Fill Material

From a geotechnical and mechanical standpoint, onsite fills and soils having an organic content of less than 3 percent by volume can be used as fill. Fill should not contain rocks or lumps larger than 6 inches in greatest dimension with not more than 15 percent larger than 2.5 inches. Non-expansive fill should have a plasticity index of 12 or less and have a significant amount of

cohesive fines. Imported fill should not have a plasticity greater than 15 unless approved by our firm.

In addition to the mechanical properties specifications, all imported fill material should have a resistivity (100% saturated) no less than the resistivity for the onsite soils, a pH of between approximately 6.0 and 8.5, a total water soluble chloride concentration less than 300 ppm, and a total water soluble sulfate concentration less than 500 ppm. We recommend import samples be submitted for corrosion and geotechnical testing at least two weeks prior to being brought onsite.

4.1.5 Compaction

Within the upper 5 feet of the finished ground surface, we recommend structural fill be compacted between 88 and 92 percent relative compaction, and structural fill below a depth of 5 feet be compacted to at least 90 percent relative compaction, as determined by ASTM D1557 (latest edition). We recommend the new fill be moisture conditioned approximately 3 to 5 percent over optimum water content. The upper 6 inches of subgrade soils beneath pavements should be compacted to at least 95 percent relative compaction. Fill material should be spread and compacted in lifts not exceeding approximately 8 to 12 inches in uncompacted thickness.

4.1.6 Utility Trench Backfill

Pipeline trenches should be backfilled with fill placed in lifts of approximately 8 inches in uncompacted thickness. Thicker lifts can be used provided the method of compaction is approved by SFB and the required minimum degree of compaction is achieved. Backfill should be placed by mechanical means only. Jetting is not permitted.

Onsite trench backfill should be compacted to at least 90 percent relative compaction. Imported sand trench backfill should be compacted to at least 95 percent relative compaction and sufficient water is added during backfilling operations to prevent the soil from "bulking" during compaction. The upper 3 feet of trench backfill in foundation, slab, and pavement areas should be entirely compacted to at least 95 percent relative compaction. To reduce piping and settlement of overlying improvements, we recommend rock bedding and rock backfill (if used) be completely surrounded by a filter fabric such as Mirafi 140N (or equivalent); alternatively, filter fabric would not be necessary if Caltrans Class 2 permeable material is used in lieu of rock bedding and rock backfill.

Sand or gravel backfilled trench laterals that extend toward driveways, exterior slabs-on-grade, or under the building foundations, and are located below irrigated landscaped areas such as lawns or planting strips, should be plugged with onsite clays, low strength concrete, or sand/cement slurry. The plug for the trench lateral should be located below the edge of

pavement or slabs, and under the perimeter of the foundation. The plug should be at least 24 inches thick, extend the entire width of the trench, and extend from the bottom of the trench to the top of the sand or gravel backfill.

4.1.7 Exterior Flatwork

We recommend that exterior slabs (including patios, sidewalks, and driveways) be placed directly on the properly compacted fills. We do not recommend using aggregate base, gravel, or crushed rock below these improvements. If imported granular materials are placed below these elements, subsurface water can seep through the granular materials and cause the underlying soils to saturate or pipe. Prior to placing concrete, subgrade soils should be moisture conditioned to increase their moisture content to approximately 3 to 5 percent above laboratory optimum moisture (ASTM D-1557).

The more expansive clayey soils at the site could be subjected to volume changes during fluctuations in moisture content. As a result of these volume changes, some vertical movement of exterior slabs (such as driveways, sidewalks, patios, exterior flatwork, etc.) should be anticipated. This movement could result in damage to the exterior slabs and might require periodic maintenance or replacement. Adequate clearance should be provided between the exterior slabs and building elements that overhang these slabs, such as window sills or doors that open outward.

Consideration should be given to reinforcing exterior slabs (including the concrete trash enclosure slab) with steel bars in lieu of wire mesh. To reduce potential crack formation, the installation of #4 bars spaced at approximately 18 inches on center in both directions should be considered. Score joints and expansion joints should be used to control cracking and allow for expansion and contraction of the concrete slabs. We recommend appropriate flexible, relatively impermeable fillers be used at all cold/expansion joints. The installation of dowels at all expansion and cold joints will reduce differential slab movements; if used, the dowels should be at least 30 inches long and should be spaced at a maximum lateral spacing of 18 inches. Although exterior slabs that are adequately reinforced will still crack, trip hazards requiring replacement of the slabs will be reduced if the slabs are properly reinforced.

4.1.8 Construction during Wet Weather Conditions

If construction proceeds during or shortly after wet weather conditions, the moisture content of the onsite soils could be significantly above optimum. Consequently, subgrade preparation, placement and/or reworking of onsite soil or fills as structural fill might not be possible. Alternative wet weather construction recommendations can be provided by our representative in the field at the time of construction, if appropriate. All the drainage measures recommended in

this report should be implemented and maintained during and after construction, especially during wet weather conditions.

4.1.9 Surface Drainage, Irrigation, and Landscaping

Ponding of surface water must not be allowed adjacent to foundations, at the top or bottom of slopes, and at the top or adjacent to retaining walls. Ponding of water should also not be allowed on the ground surface adjacent to or near exterior slabs, including driveways, walkways, and patios. Surface water should not be allowed to flow over the top of slopes, down slope faces, or over retaining walls.

We recommend positive surface gradients of at least 2 percent be provided adjacent to foundations to direct surface water away from the foundations and toward suitable discharge facilities. We recommend the surface drainage be designed in accordance with the latest edition of the California Building Code.

In order to reduce differential foundation movements, landscaping should be placed uniformly adjacent to the foundation and exterior slabs. We recommend trees be no closer to the structure or exterior slabs than half the mature height of the tree; in no case should tree roots be allowed to extend near or below the foundations or exterior slabs.

Landscaping drainage inlets and/or drainage swales should be provided and maintained around structures at all times that adequately collect irrigation and storm water and direct the water onto pavement or into storm water collection systems. Drainage inlets should be provided within enclosed planter areas and the collected water should be discharged onto pavement, into drainage swales, or into an enclosed storm drain system. The drainage inlets and associated swales should be designed and constructed so that the moisture content of the soils surrounding the foundations do not become elevated and no ponding of water occurs. The inlets should be kept free of debris and be lower in elevation than the adjacent ground surface.

We recommend regular maintenance of the drainage systems be performed, including maintenance prior to rainstorms. The inspection should include checking drainage patterns to make sure they are performing properly, making sure drainage systems and inlets are functional and not clogged, and checking that erosion control measures are adequate for anticipated storm events. Immediate repairs should be performed if any of these measures appears to be inadequate.

Irrigation should be performed in a uniform, systematic manner as equally as possible on all sides of the foundations and exterior slabs to maintain moist soil conditions. Over-watering must be avoided. To reduce moisture changes in the natural soils and fills in landscaped areas, we

recommend that drought resistant plants and low flow watering systems be used. All irrigation systems should be inspected for leakage regularly.

4.1.10 Future Maintenance

In order to reduce water created issues, we recommend regular maintenance of the site be performed, including maintenance prior to rainstorms. Maintenance should include the recompaction of loosened soils, collapsing and infilling holes with compacted soils or low strength sand/cement grout, removal and control of digging animals, modifying storm water drainage patterns to allow for sheet flow into drainage inlets or ditches rather than concentrated flow or ponding, removal of debris within drainage ditches and inlets, and immediately repairing any erosion or soil flow. The inspection should include checking drainage patterns, making sure drainage systems are functional and not clogged, and erosion control measures are adequate for anticipated storm events. Immediate repair should be performed if any of these measures appears to be inadequate. Temporary and permanent erosion and sediment control measures should be installed over any exposed soils immediately after repairs are made.

Differential movement of exterior slabs can occur over time as a result of numerous factors. We recommend the project owners perform inspections and maintenance of the slabs, including infilling significant cracks, providing fillers at slab offsets, and replacing slabs if severely damaged.

4.1.11 Additional Recommendations

We recommend the drainage, irrigation, landscaping, and maintenance recommendations provided in this report be forwarded to your designers and contractors.

4.2 Foundation Support

4.2.1 Conventional Spread Footings

New buildings (if planned) can be supported on spread footing foundations bearing on properly compacted engineered fills. Recommendations for building pad preparation are described previously in **Section 4.1.2, Building Pads**, and **Section 4.1.3, Subgrade Preparation**. Prior to the concrete pour, we recommend the subgrade materials be moisture conditioned to approximately 3 to 5 percent above laboratory optimum moisture. If the building pad is left exposed for an extended period of time prior to constructing foundations, we recommend SFB be contacted for recommendations to re-condition the pads in order provide adequate building support.

Footings should be at least 12 inches wide and should be founded at least 24 inches below lowest adjacent finished grade. A continuous footing should be provided around the perimeter of the proposed buildings. Continuous footings should be designed with steel reinforcing, both top and bottom, to provide structural continuity and permit spanning of local irregularities.

The footings for the buildings should be designed for an allowable bearing pressure of 2,000 pounds per square foot due to dead loads, 3,000 pounds per square foot due to dead plus live loads, and 4,000 pounds per square foot for all loads, including wind or seismic. These allowable bearing pressures are net values; therefore, the weight of the footing can be neglected for design purposes.

Lateral load resistance can be developed by friction between the footing foundation bottom and the supporting subgrade. A friction coefficient of 0.35 is considered applicable. As an alternative, a passive resistance equal to an equivalent fluid weighing 300 pcf acting against the vertical face of the foundations can be used; however the upper 24 inches should be ignored in the passive resistance design. If foundations are poured neat against the subgrade, the friction and passive resistance can be used in combination.

At least 10 feet of soil cover must be provided between the face of the footings and the face of slopes, as measured horizontally. The portion of the footing located closer than 10 feet from the face of slopes should be ignored in both the vertical and lateral load design.

Where foundations are located adjacent to utility trenches, the foundation bearing surface should bear below an imaginary 1 horizontal to 1 vertical plane extending upward from the bottom edge of the adjacent utility trench. Alternatively, the foundation reinforcing could be increased to span the area defined above assuming no soil support is provided.

Wetting prior to construction of the foundations should close any visible cracks in the bottoms of the footing excavations. We recommend that we observe the footing excavations prior to placing reinforcing steel or concrete to check that footings are founded on appropriate material.

Settlement of spread footing foundations under the proposed building loads is anticipated to be within tolerable limits for the proposed structure.

4.2.2 Interior Slab-On-Grade

We recommend that interior slabs-on-grade (used in conjunction with footing foundations) be at least 5 inches thick and be supported on at least 12 inches of non-expansive fill. The actual thickness of the slabs should be based upon the actual use and loading of the slabs. All slabs

should be reinforced with at least #4 bars on 18-inch centers, both ways; however, the actual reinforcing should be provided with the anticipated use and loading of the slab.

A vapor retarder must be placed between the subgrade and the bottom of the interior slabs-on-grade. We recommend the vapor retarder consist of a single layer of Stego Wrap Vapor Barrier 15 mil or equivalent provided the equivalent satisfies the following criteria: a permeance as tested before and after mandatory conditioning of less than 0.01 Perms and strength of Class A as determined by ASTM E 1745 (latest edition), and a thickness of at least 15 mils. Installation of the vapor retarder should conform to the latest edition of ASTM E 1643 (latest edition) and the manufacturers requirements, including all joints should be lapped at least 6 inches and sealed with Stego Tape or equal in accordance with the manufacturer's specifications. Protrusions where pipes or conduit penetrate the membranes should be sealed with either one or a combination of Stego Tape, Stego Mastic, Stego Pipe Boots, or a product of equal quality as determined by the manufacturer's instructions and ASTM E 1643. Care must be taken to protect the membrane from tears and punctures during construction.

We do not recommend placing sand or gravel over the membrane. We recommend that 4 inches of ½ to ¾ inch drain rock be placed below the vapor retarder where interior slabs-on-grade are used. The drain rock can be considered part of the non-expansive fill layer described above. Prior to placement of the vapor retarder, the subgrade surfaces should be proof-rolled to provide a smooth, unyielding surface for slab support. The edges of the vapor retarder membrane should be draped over the interior side of the footing excavations at least 12 inches below the pad grade prior to pouring the concrete. We recommend that the interior slabs-on-grade be poured monolithically with the footings.

Concrete slabs retain moisture and often take many months to dry; construction water added during the concrete pour further increases the curing time. If the slabs are not allowed to completely cure prior to constructing the super-structure, the concrete slabs will expel water vapor and the vapor will be trapped under impermeable flooring. The concrete mix design for the slabs should have a maximum water/cement ratio of 0.45; the actual water/cement ratio may need to be reduced if the concentration of soluble sulfates or chlorides in the supporting subgrade is detrimental to the concrete. We recommend you consult with your concrete slab designers and concrete contractors regarding methods to reduce the potential for differential concrete curing.

4.3 Seismic Design Criteria

For seismic resistance design in accordance with 2012 International Building Code (IBC) and 2013 California Building Code (CBC), we recommend the following seismic design values be used. The following parameters are calculated using the U.S. Seismic Design Map program

(Version 3.1.0)⁵, and the 2012 IBC data set, and are based on the site being located at approximate latitude 37.115°N and longitude 121.075°W.

2012 IBC AND 2013 CBC SEISMIC PARAMETERS		
Seismic Parameter	Design Value	Reference
Site Class	D	Section 1613.3.2
S _s	2.11	Figure 1613.3.1(1)
S ₁	0.70	Figure 1613.3.1(2)
F _a	1.0	Table 1613.3.3(1)
F _v	1.5	Table 1613.3.3(2)

4.4 Pavements

Our pavement recommendations provided below are based on the assumption that traffic will consist mainly of relatively light vehicles and equipment such as “bobtail” dump trucks, rubber tired backhoes, pickup trucks, flatbed trucks, and other similar light weight maintenance vehicles. We also assumed that heavy vehicles such as fully loaded ten wheel dump trucks or other similar heavy construction equipment will not use the pavement. We should be consulted if the pavement use will differ than what we have assumed.

We recommend regular maintenance of the asphalt concrete be performed at approximately five year intervals. Maintenance may include sand slurry sealing, crack filling, and chip seals as necessary. If regular maintenance is not performed, the asphalt concrete layer could experience premature degradation requiring more extensive repairs.

Based on the results of laboratory testing of onsite subgrade materials, we recommend that an R-value of 5 be used in asphalt concrete pavement design. We recommend additional R-value tests be performed once the pavement subgrade is established to confirm the R-value used in the design.

We developed the following alternative preliminary pavement sections using Topic 608 of the State of California Department of Transportation Highway Design Manual, the recommended R-value, and an assumed Traffic Index (T.I.) of 6.0 for typical cemetery operations as described in previous section. The project’s Civil Engineer or appropriate agency should determine actual traffic indices. The pavement thicknesses shown below are SFB’s recommended minimum values.

⁵USGS Website, <http://earthquake.usgs.gov/hazards/designmaps/usdesign.php>, Version 3.1.0, last updated 7/11/13.

PRELIMINARY PAVEMENT DESIGN ALTERNATIVES SUBGRADE R-VALUE = 5			
Location	Pavement Components		Total Thickness (inches)
	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	
T.I. = 6.0	3.0	14.0	17.0

Pavement baserock and asphalt concrete should be compacted to at least 95 percent relative compaction. The asphalt concrete compacted unit weight should be determined using Caltrans Test Method 308-A or ASTM Test Method D1188. Asphalt concrete should also satisfy the S-value requirements by Caltrans.

5.0 CONDITIONS AND LIMITATIONS

SFB is not responsible for the validity or accuracy of information, analyses, test results, or designs provided to SFB by others or prepared by others. The analysis, designs, opinions, and recommendations submitted in this report are based in part upon the data obtained from our field work and upon information provided by others. Site exploration and testing characterizes subsurface conditions only at the locations where the explorations or tests are performed; actual subsurface conditions between explorations or tests may be different than those described in this report. Variations of subsurface conditions from those analyzed or characterized in this report are not uncommon and may become evident during construction. In addition, changes in the condition of the site can occur over time as a result of either natural processes (such as earthquakes, flooding, or changes in groundwater levels) or human activity (such as construction adjacent to the site, dumping of fill, or excavating). If changes to the site's surface or subsurface conditions occur since the performance of the field work described in this report, or if differing subsurface conditions are encountered, we should be contacted immediately to evaluate the differing conditions to assess if the opinions, conclusions, and recommendations provided in this report are still applicable or should be amended.

We recommend SFB be retained to provide geotechnical services during design, reviews, earthwork operations, paving operations, and foundation installation to confirm and observe compliance with the design concepts, specifications and recommendations presented in this report. Our presence will also allow us to modify design if unanticipated subsurface conditions are encountered or if changes to the scope of the project, as defined in this report, are made.

This report is a design document that has been prepared in accordance with generally accepted geological and geotechnical engineering practices for the exclusive use of Jacobs for specific application to the proposed Section 21 Crypt Area Expansion project at the San Joaquin Valley National Cemetery in Santa Nella, California, and is intended to represent our design recommendations to Jacobs for specific application to the Section 21 Crypt Area Expansion project. The conclusions and recommendations contained in this report are solely professional opinions. It is the responsibility of Jacobs to transmit the information and recommendations of this report to those designing and constructing the project. We will not be responsible for the misinterpretation of the information provided in this report. We recommend SFB be retained to review geological and geotechnical aspects of the construction calculations, specifications, and plans; we should also be retained to participate in prebid and preconstruction conferences to clarify the opinions, conclusions, and recommendations contained in this report.

It should be understood that advancements in the practice of geotechnical engineering and engineering geology, or discovery of differing surface or subsurface conditions, may affect the validity of this report and are not uncommon. SFB strives to perform its services in a proper and professional manner with reasonable care and competence but we are not infallible. Geological engineering and geotechnical engineering are disciplines that are far less exact than other engineering disciplines; therefore we should be consulted if it is not completely understood what the limitations to using this report are.

In the event that there are any changes in the nature, design or location of the project, as described in this report, or if any future additions are planned, the conclusions and recommendations contained in this report shall not be considered valid unless we are contacted in writing, the project changes are reviewed by us, and the conclusions and recommendations presented in this report are modified or verified in writing. The opinions, conclusions, and recommendations contained in this report are based upon the description of the project as presented in the introduction section of this report.





This report does not necessarily represent all of the information that has been communicated by us to Jacobs Engineering and their consultants during the course of this engagement and our rendering of professional services to Jacobs. Reliance on this report by parties other than those described above must be at their own risk unless we are first consulted as to the parties' intended use of this report and only after we obtain the written consent of Jacobs to divulge information that may have been communicated to Jacobs. We cannot accept consequences for use of segregated portions of this report.

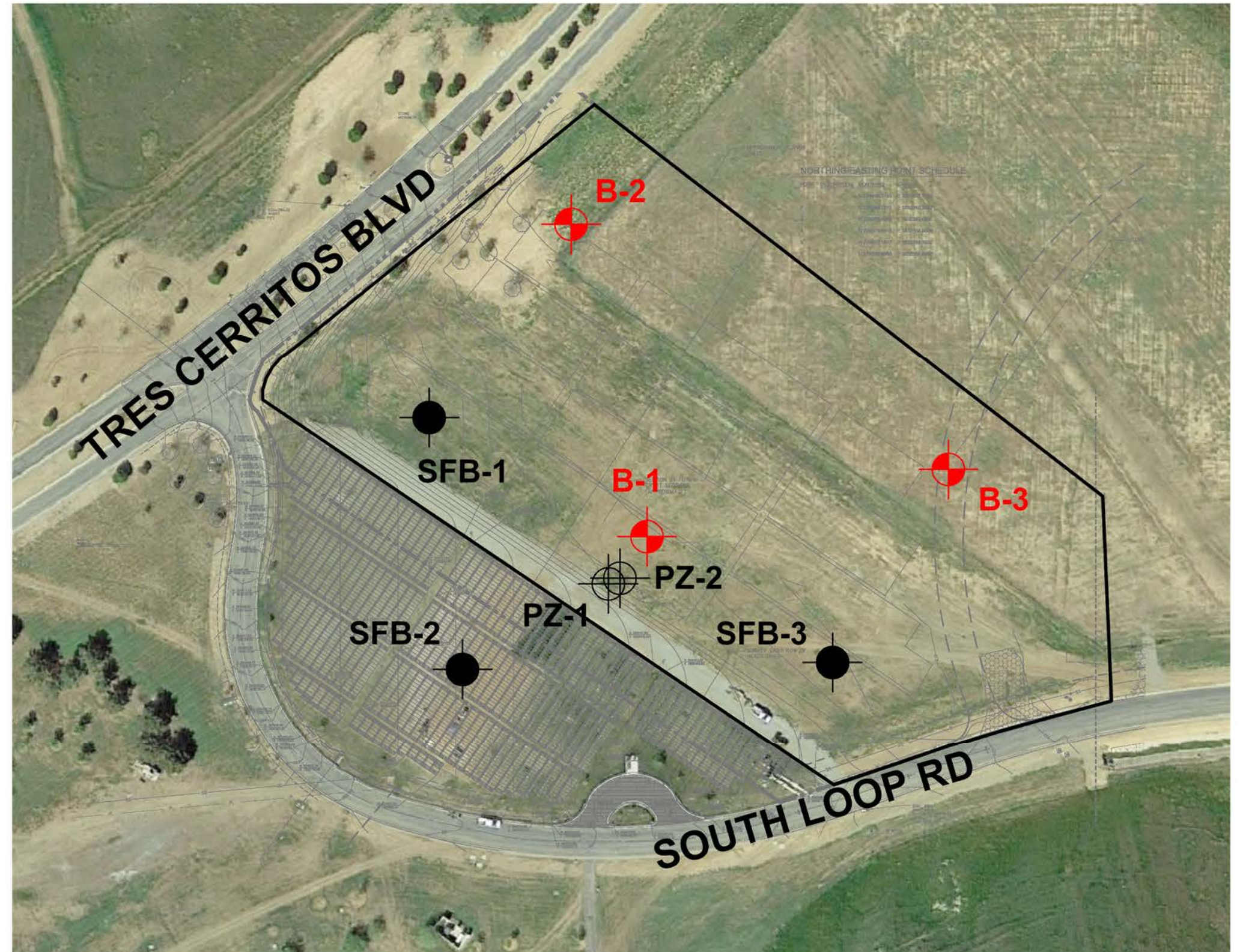
Please refer to Appendix D for additional guidelines regarding use of this report.

FIGURE



KEY


- B-3**  APPROXIMATE LOCATION OF SFB EXPLORATORY BORING (10/28/14)
- SFB-3**  APPROXIMATE LOCATION OF SFB PREVIOUS EXPLORATORY BORING (4/3/09)
- PZ-2**  APPROXIMATE LOCATION OF PIEZOMETER BY OTHERS (UNKNOWN DATE)
-  APPROXIMATE PROJECT LIMIT



Note: Base map was created by overlaying the project schematic design plan prepared by Jacobs Engineering and printed on 10/27/14 on Google Earth Image dated 3/20/13.

APPROXIMATE SCALE: 1" = 100'

0 100' 200'



DATE
November 2014
PROJECT NO.
361-19

Stevens
Serrone &
Bailey
Engineering Company, Inc

1600 Willow Pass Court
Concord, CA 94520
Tel 925.688.1001
Fax 925.688.1005
www.SFandB.com

SITE PLAN

SAN JOAQUIN VALLEY NATIONAL CEMETERY
Santa Nella, California

FIGURE

1

APPENDIX A
Field Investigation

APPENDIX A

Field Investigation

Our field investigation for the proposed Section 21 Crypt Area Expansion project at the San Joaquin Valley National Cemetery in Santa Nella, California, consisted of surface reconnaissance and a subsurface exploration program. Geotechnical reconnaissance of the site and surrounding area was performed on October 28, 2014. Subsurface exploration was performed using a truck-mounted drill rig equipped with 4-inch diameter, continuous flight, solid stem augers. Three exploratory borings were drilled on October 28, 2014 to a maximum depth of about 26-1/2 feet. Our representative continuously logged the soils encountered in the borings in the field. The soils are described in general accordance with the Unified Soil Classification System (ASTM D2487). The logs of the borings as well as a key for the classification of the soil (Figure A-1) are included as part of this appendix.

Representative samples were obtained from our exploratory boring at selected depths appropriate to the investigation. Relatively undisturbed samples were obtained using a 3-inch O.D. split barrel sampler with liners, and disturbed samples were obtained using the 2-inch O.D. split spoon sampler. All samples were transmitted to our offices for evaluation and appropriate testing. Both sampler types are indicated in the "Sampler" column of the boring logs as designated in Figure A-1. The elevations discussed in this report and shown on the boring logs in this appendix were obtained from the base map shown on Figure 1; datum unknown.

Resistance blow counts were obtained in our boring with the samplers by dropping a 140-pound safety hammer through a 30-inch free fall. The sampler was driven 18 inches and the number of blows were recorded for each 6 inches of penetration. The blows per foot recorded on the boring logs represent the accumulated number of converted blows that were required to drive the last 12 inches, or the number of inches indicated where hard resistance was encountered. The blow counts recorded on the boring logs have been converted to equivalent SPT field blowcounts, but have not been corrected for overburden, silt content, or other factors.

The attached boring logs and related information show our interpretation of the subsurface conditions at the dates and locations indicated, and it is not warranted that they are representative of subsurface conditions at other locations and times.

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		grf	ltr	Description	Major Divisions		grf	ltr	Description	
Coarse Grained Soils	Gravel		GW	Well-graded gravels or gravel sand mixtures, little or no fines	Soils	Sils And Clays LL < 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			GP	Poorly-graded gravels or gravel sand mixture, little or no fines				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
	Gravelly Soils		GM	Silty gravels, gravel-sand-silt mixtures					OL	Organic silts and organic silt-clays of low plasticity
			GC	Clayey gravels, gravel-sand-clay mixtures					Sils And Clays LL > 50	
	Sand And Sandy Soils		SW	Well-graded sands or gravelly sands, little or no fines			CH	Inorganic clays of high plasticity, fat clays		
			SP	Poorly-graded sands or gravelly sands, little or no fines			OH	Organic clays of medium to high plasticity		
			SM	Silty sands, sand-silt mixtures			Highly Organic Soils			PT
		SC	Clayey sands, and-clay mixtures							

GRAIN SIZES

U.S. STANDARD SERIES SIEVE

CLEAR SQUARE SIEVE OPENINGS

	200	40	10	4	3/4"	3"	12"	
Sils and Clays	Sand			Gravel		Cobbles	Boulders	
	Fine	Medium	Coarse	Fine	Coarse			

RELATIVE DENSITY

Sands and Gravels	Blows/Foot*
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

CONSISTENCY

Sils and Clays	Blows/Foot*	Strength (tsf)**
Very Soft	0 - 2	0 - 1/4
Soft	2 - 4	1/4 - 1/2
Firm	4 - 8	1/2 - 1
Stiff	8 - 16	1 - 2
Very Stiff	16 - 32	2 - 4
Hard	Over 32	Over 4

*Number of Blows for a 140-pound hammer falling 30 inches, driving a 2-inch O.D. (1-3/8" I.D.) split spoon sampler.

**Unconfined compressive strength.

SYMBOLS & NOTES

	Standard Penetration sampler (2" OD Split Barrel)		Shelby Tube
	Modified California sampler (3" OD Split Barrel)		Pitcher Barrel
	California Sampler (2.5" OD Split Barrel)		HQ Core
	Ground Water level initially encountered		
	Ground Water level at end of drilling		

Increasing Visual Moisture Content

↑ Saturated
Wet
Moist
Damp
Dry

Constituent Percentage

PI = Plasticity Index
LL = Liquid Limit
R = R-Value

trace <5%
some 5-15%
with 16-30%
-y 31-49%

**Stevens,
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Bailey**
Engineering Company, Inc.









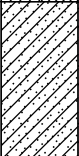



1600 Willow Pass Court
Concord, CA 94523
Tel: 925-688-1001

KEY TO EXPLORATORY BORING LOGS

SAN JOAQUIN VALLEY NATIONAL CEMETERY
Santa Nella, CA

PROJECT NO.	DATE	FIGURE NO.
361-19	November 2014	A-1

DRILL RIG Mobile B-24 CFA	SURFACE ELEVATION 275 feet	LOGGED BY TC
DEPTH TO GROUND WATER 16 feet	BORING DIAMETER 4-inch	DATE DRILLED 10/28/14

DESCRIPTION AND CLASSIFICATION			DEPTH (FEET) ELEVATION	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE							
CLAY (CL), brown, silty, with sand(fine- to medium-grained), trace gravel(fine, angular), dry to damp.	very stiff		0 275		25	9	103	5.1	
CLAY (CH), orange red brown with white mottles, silty, with to sandy(fine- to medium-grained), some caliche, dry to damp.	hard		5 270		33	17	112	7.4	
CLAY(CL)/SAND(SC), brown, sandy(fine- to medium-grained), silty, dry to damp.	very stiff		10 265		30	15	112	4.6	
Trace small siltstone fragments, damp.	hard		15 260		30/6"	16	116		
SAND (SC), mottled gray brown, fine- to coarse-grained, gravelly(fine, angular to subangular), with clay and silt, dry to damp.	very dense		20 255		50/6"				
Drilling refused at 22', gravels up to 2" diameter.					36/2"				
Bottom of Boring = 22.2 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			25 250						
			30 245						

EXPLORATORY BORING LOG 361-19.GPJ STEVENS FERRONE BAILEY.GDT 11/5/14

**Stevens,
Ferrone &
Bailey**
Engineering Company, Inc.

1600 Willow Pass Court
Concord, CA 94523
Tel: 925-688-1001

EXPLORATORY BORING LOG

**SAN JOAQUIN VALLEY NATIONAL CEMETERY
Santa Nella, CA**

PROJECT NO.

DATE

BORING NO.

361-19

November 2014

B-1

DRILL RIG	Mobile B-24 CFA	SURFACE ELEVATION	273 feet	LOGGED BY	TC
DEPTH TO GROUND WATER	17 feet	BORING DIAMETER	4-inch	DATE DRILLED	10/28/14

DESCRIPTION AND CLASSIFICATION			DEPTH (FEET) ELEVATION	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE							
CLAY (CL), brown, silty, with to sandy(fine- to medium-grained), dry.	stiff		0						
CLAY (CL), mottled red brown, silty, with sand(fine- to medium-grained), dry to damp.	hard		270		51	14	104		
Change color to orange brown.			5						
CLAY (CH), reddish brown with white mottles, silty, with to sandy(fine- to medium-grained), some caliche, dry to damp.	hard		265		45/11"	20	106		
SAND (SC), mottled gray reddish brown, fine- to coarse-grained, clayey, gravelly(fine, subangular to subrounded), with silt, dry to damp.	very dense		10		30/6"				
Harder drilling below 14'.			260						
GRAVEL (GC), mottled gray brown, fine, angular to subrounded, sandy(fine- to coarse-grained), with clay and silt, dry to damp.	very dense		15		36/4"				
Gravels up to 3" diameter, wet.			255						
Drilling refused at 20'.			20						
Bottom of Boring = 20 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			250		50/0"				
			25						
			245						
			30						
			240						

EXPLORATORY BORING LOG 361-19.GPJ STEVENS FERRONE BAILEY.GDT 11/5/14



1600 Willow Pass Court
Concord, CA 94523
Tel: 925-688-1001

EXPLORATORY BORING LOG

SAN JOAQUIN VALLEY NATIONAL CEMETERY
Santa Nella, CA

PROJECT NO.

DATE














BORING NO.

361-19


November 2014

B-2

DRILL RIG Mobile B-24 CFA	SURFACE ELEVATION 272 feet	LOGGED BY TC
DEPTH TO GROUND WATER 17.5 feet	BORING DIAMETER 4-inch	DATE DRILLED 01/28/14

DESCRIPTION AND CLASSIFICATION			DEPTH (FEET) ELEVATION	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE							
CLAY (CL), mottled red brown, silty, with to sandy(fine- to coarse-grained), dry to damp.	stiff very stiff		0 270		31	77	99		At 2': Liquid Limit = 26 Plasticity Index = 14 Fine gravel = 1% Coarse Sand = 1% Medium Sand = 5% Fine Sand = 24% Silt = 40% Clay = 29%
GRAVEL (GC), mottled gray brown, fine to coarse, angular to subangular, clayey, with sand(fine- to coarse-grained), dry to damp.	very dense		5 265		60/3"				
CLAY(CL)/SAND(SC) brown, sandy(fine- to medium-grained), silty, dry to damp.	hard		10 260		48				
SAND (SP), mottled gray brown, fine- to medium-grained, some coarse-grained, with gravel(fine, angular to subangular), trace silt, dry. Gravels below 16'.	very dense		15 255		30/6"				
CLAY (CL), mottled gray yellowish brown, silty, with sand(fine- to medium-grained), damp to moist.	hard		20 250		60/5"				
GRAVEL (GC), mottled gray brown, fine, subangular to subrounded, clayey, sandy(fine- to coarse-grained), moist.	very dense		25						
CLAY (CL), brown, silty, with sand(fine- to medium-grained), trace gravel(fine, subangular), moist.	hard		25 245		35				
Bottom of Boring = 26.5 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			30 240						

EXPLORATORY BORING LOG 361-19.GPJ STEVENS FERRONE BAILEY.GDT 11/5/14

 <div> 1600 Willow Pass Court Concord, CA 94523 Tel: 925-688-1001 </div>	EXPLORATORY BORING LOG		
	SAN JOAQUIN VALLEY NATIONAL CEMETERY Santa Nella, CA		
	PROJECT NO.	DATE	BORING NO.
	361-19	November 2014	B-3

APPENDIX B
Laboratory Investigation

APPENDIX B

Laboratory Investigation

Our laboratory testing program for the Section 21 Crypt Area Expansion project at the San Joaquin Valley National Cemetery in Santa Nella, California was directed toward a quantitative and qualitative evaluation of the physical and mechanical properties of the soils underlying the site.

The natural water content was determined on eight samples of the subsurface soils. The water contents are recorded on the boring logs at the appropriate sample depths.

Dry density determination was performed on eight samples of the subsurface soils to evaluate their physical properties. The results of the tests are shown on the boring logs at the appropriate sample depths.

Unconfined compression test was performed on three relatively undisturbed samples of the subsurface soils to evaluate the undrained shear strengths of these materials. Failure was taken as the peak normal stress. The results of the tests are presented on the boring logs at the appropriate sample depths.

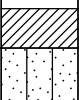















Atterberg Limit determinations were performed on one sample of the subsurface soils to determine the range of water content over which these materials exhibit plasticity. These values are used to classify the soil in accordance with the Unified Soil Classification System and to indicate the soil's compressibility and expansion potentials. The results of the test are presented on the boring log at the appropriate sample depth.

Gradation and hydrometer tests were performed on one sample of the subsurface soils. These tests were performed to assist in the classification of the soils and to determine their grain size distribution. The results of the tests are presented on the boring log at the appropriate sample depth.


APPENDIX C

Logs of Previous Field Explorations and Results of Previous Lab Testing












DRILL RIG Mobile B-24 CFA	SURFACE ELEVATION 278 feet	LOGGED BY TC
DEPTH TO GROUND WATER 10 feet	BORING DIAMETER 3-inch	DATE DRILLED 04/03/09

DESCRIPTION AND CLASSIFICATION			DEPTH (FEET) ELEVATION	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE							
FILL: CLAY (CL), mottled gray brown, silty, sandy(fine- to coarse-grained), trace gravel(fine, subangular to subrounded), trace rootlet, dry to damp.	stiff		0		27	5	111		LL= 24, PI= 9 See Figure B-1 for Gradation Test Results
SAND (SM), brown, fine- to coarse-grained, silty, dry.	medium dense		275		32				
CLAY (CL), mottled orange reddish brown, silty, with to sandy(fine- to coarse-grained), trace gravel(fine, subangular to subrounded), dry.	hard		5		87				
Change color to yellowish brown, more sandy, trace carbonates.			270						
SILT (ML), reddish brown, sandy(fine- to coarse-grained), with clay, damp.	very stiff		265			17			
Dry to damp at 11'.			260		57	16			
CLAY (CL), reddish brown, silty, with sand(fine- to medium-grained), trace gravel(fine, angular to subangular), dry to damp.	hard		15		35				
SAND (SC), mottled gray brown, fine- to coarse-grained, gravelly(fine, angular to subangular), with clay and silt, moist to wet.	very dense		20		50/6"				
Gravelly(fine to coarse), wet.			255						
Bottom of Boring = 25.4 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			25		50/5"				
			250						
			30						
			245						

EXPLORATORY BORING LOG 361-9.GPJ STEVENS FERRONE BAILEY GDT 11/5/14

 <div> 1600 Willow Pass Court Concord, CA 94523 Tel: 925-688-1001 </div>	EXPLORATORY BORING LOG		
	SAN JOAQUIN VALLEY NATIONAL CEMETERY Santa Nella, CA		
	PROJECT NO.	DATE	BORING NO.
	361-9	April 2009	SFB-1

DRILL RIG Mobile B-24 CFA	SURFACE ELEVATION 279 feet	LOGGED BY TC
DEPTH TO GROUND WATER 7.5 feet	BORING DIAMETER 3-inch	DATE DRILLED 04/03/09

DESCRIPTION AND CLASSIFICATION			DEPTH (FEET) ELEVATION	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE							
CLAY (CL), brown, silty, sandy(fine- to medium-grained), trace gravel(fine, subangular), trace rootlet, dry.	very stiff		0		16	8	107		LL = 62, PI = 45 See Figure B-1 for Gradation Test Results
CLAY (CH), reddish brown, with silt, with sand(fine- to coarse-grained), trace carbonates, dry.	very stiff		275		25	19			
SILT (ML), brown, clayey, with sand(fine- to medium-grained), damp to moist.	stiff		270		16				LL = 27, PI = 15 See Figure B-1 for Gradation Test Results
	very stiff		265		50/6"	11			
SAND (SC), mottled gray brown, fine- to coarse-grained, with to gravelly(fine, angular to subangular), with silt and clay, moist to wet.	dense		260		50/4.5"				
Moist. Drilling refusal.			255						
Bottom of Boring = 18.5 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			250						
			245						

EXPLORATORY BORING LOG 361-9.GPJ STEVENS FERRONE BAILEY.GDT 11/5/14

**Stevens,
Ferrone &
Bailey**
Engineering Company, Inc.

1600 Willow Pass Court
Concord, CA 94523
Tel: 925-688-1001

EXPLORATORY BORING LOG

**SAN JOAQUIN VALLEY NATIONAL CEMETERY
Santa Nella, CA**

PROJECT NO.

361-9

DATE

April 2009


BORING NO.

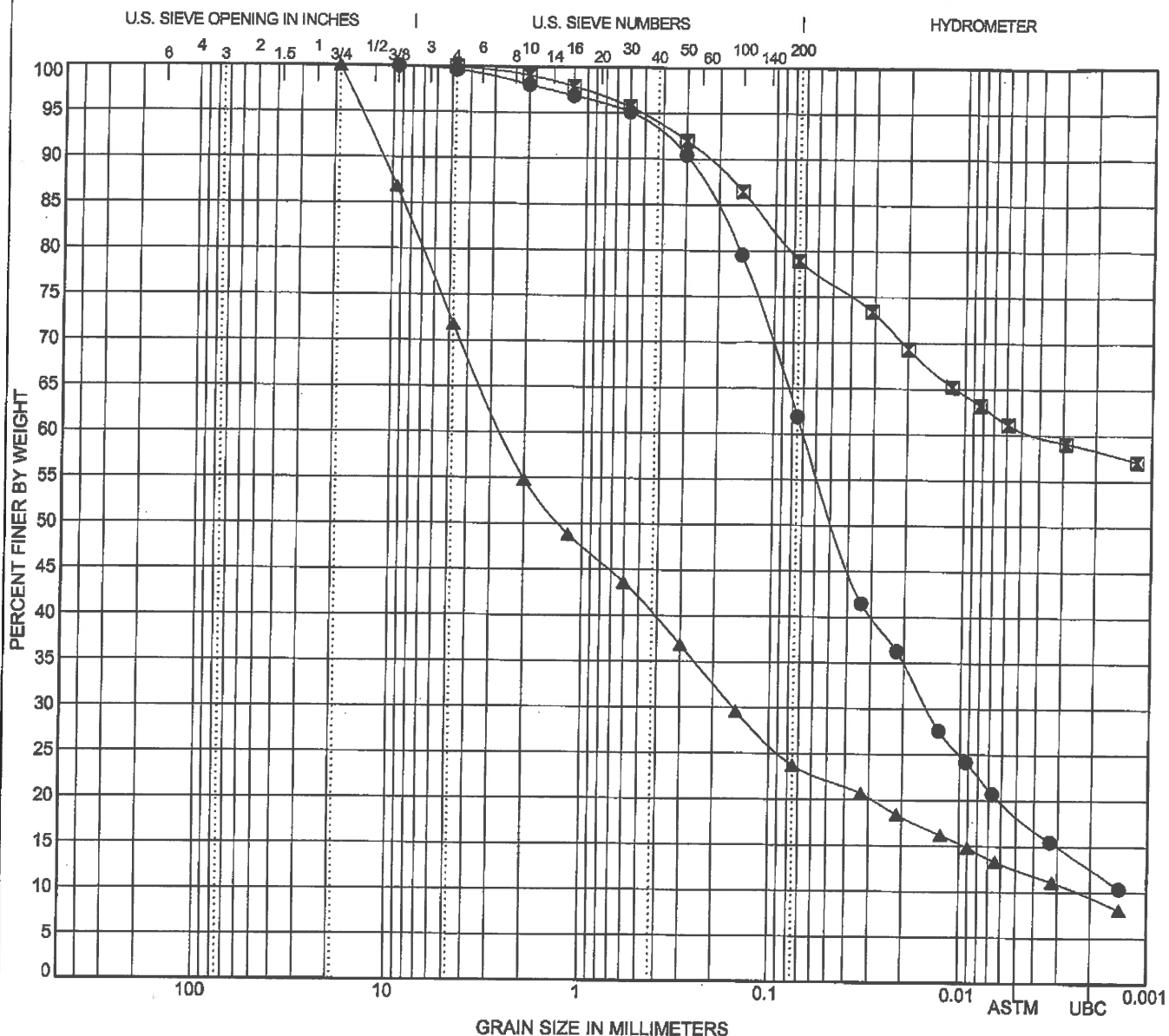
SFB-2

DRILL RIG	Mobile B-24 CFA	SURFACE ELEVATION	274 feet	LOGGED BY	TC
DEPTH TO GROUND WATER	Not Encountered	BORING DIAMETER	3-inch	DATE DRILLED	04/03/09

DESCRIPTION AND CLASSIFICATION			DEPTH (FEET) ELEVATION	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE							
FILL: SILT (ML), brown, sandy(fine-grained), some clay, dry.	very stiff		0		40	12	104		
CLAY (CH), reddish brown, silty, with sand(fine- to coarse-grained), trace rock fragments, tract rootlet, dry.	hard								
SAND (SM), orange brown, fine- to medium-grained, silty, cemented, dry. Hard drilling below 4'.	very dense		270		50/5"				
			5						
CLAY (CL), yellowish brown, sandy(fine- to medium-grained), trace gravel(fine, subangular), dry.	hard								
More sandy at 9'.			265		87				
			10						
SAND (SC), mottled gray brown, fine- to coarse-grained, gravelly(fine, angular to subangular), with clay and silt, dry.	very dense								
Drilling refusal.									
Bottom of Boring = 12.9 feet									
Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.									
			260		50/5"				
			15						
			255						
			20						
			250						
			25						
			245						
			30						
			240						

EXPLORATORY BORING LOG 361-9.GPJ STEVENS FERRONE BAILEY.GDT 11/5/14

 <div> 1600 Willow Pass Court Concord, CA 94523 Tel: 925-688-1001 </div>		EXPLORATORY BORING LOG		
		SAN JOAQUIN VALLEY NATIONAL CEMETERY Santa Nella, CA		
		PROJECT NO.	DATE	BORING NO.
		361-9	April 2009	SFB-3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Location	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
● SFB-1	11.0	Orange brown sandy silty CLAY (CL)	24	15	10		
☒ SFB-2	4.0	Red brown silty CLAY with sand (CH)	62	17	46		
▲ SFB-2	14.0	Light brown SAND with gravel and clay some silt (SC)	27	12	15	3.94	1103.47

Location	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	ASTM		UBC
								%Silt	%Clay	%-200<0.002mm
● SFB-1	11.0	9.5	0.07	0.015		0.3	37.8	43.3	18.6	20.2
☒ SFB-2	4.0	4.75	0.004			0.0	21.1	18.3	60.6	73.8
▲ SFB-2	14.0	19	2.608	0.156	0.002	28.2	48.1	11.2	12.5	39.6

**Stevens,
Ferrone &
Bailey**
Engineering Company, Inc.

1600 Willow Pass Court
Concord, CA 94520
Telephone: 925-688-1001
Fax: 925-688-1005

GRAIN SIZE DISTRIBUTION

**SAN JOAQUIN VALLEY NATIONAL CEMETERY
Santa Nella, CA**

PROJECT NO.

361-9

DATE

April 2009

FIGURE NO.

B-1

APPENDIX D
ASFE Guidelines

Important Information about Your Geotechnical Engineering Report

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

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

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply the report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/The Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE THE GEOPROFESSIONAL BUSINESS ASSOCIATION

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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