June 20, 2019 Project No. 3.31594

Mammoth Lakes Foundation
Post Office Box 1815
Mammoth Lakes CA 93546

Attention: Mr. Rich Boccia

Subject: **GEOTECHNICAL INVESTIGATION**
Proposed Mammoth Arts and Cultural Center (MACC)
Mammoth Lakes, California

Dear Mr. Boccia:

Submitted herein is our geotechnical investigation for the proposed Mammoth Arts and Cultural Center project. We performed our work in general accordance with our proposal dated April 22, 2019.

Based upon the results of our investigation, we consider planned construction feasible from a geotechnical standpoint provided the recommendations of this report are followed. The primary geotechnical constraint to development is the potential seismic hazard associated with strong ground shaking.

As part of this study, SGSI reviewed the Architectural Site Plans, prepared by Woodward Architecture, and Grading and Drainage Plans, prepared by Triad-Holmes Associates, both dated Augusts 24, 2018. Foundation plans are however presently unavailable. SGSI should review foundation plans prior to construction in order to verify that they are in conformance with this report; some of the geotechnical recommendations contained herein may need to be revised after reviewing.

The conclusions and recommendations presented herein are considered site specific and based upon the subsurface conditions encountered at the locations of the explorations. The conclusions and recommendations should not be extrapolated to other areas or used for other projects.

We appreciate the opportunity to be of service to you. Should you have any questions regarding this report, please do not hesitate to contact us.

Respectfully,

SIERRA GEOTECHNICAL SERVICES, INC.

Joseph A. Adler
CEG 2198

Thomas A. Platz
PE C41039

GEOTECHNICAL INVESTIGATION

FOR THE

PROPOSED MAMMOTH ARTS AND CULTURAL CENTER

MAMMOTH LAKES, CALIFORNIA

JUNE 20, 2019

PROJECT NO. 3.31594

Prepared By:

SIERRA GEOTECHNICAL SERVICES, INC.
P.O. Box 5024
Mammoth Lakes, California 93546
(760) 937-4608

www.sgsi.us

TABLE OF CONTENTS

PAGE

SIERRA GEOTECHNICAL SERVICES, INC.

LIST OF ATTACHMENTS

1. PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for the proposed Mammoth Arts and Cultural Center project to be located at 100 College Parkway in Mammoth Lakes, Mono County, California (37.6396, -118.9585) (Figures 1 and 2). The purpose of this study was to obtain information on the subsurface conditions within the project area; to evaluate the competency of the soils to support the proposed structure(s); evaluate data relative to site geologic and seismic hazards; evaluate data relative to foundation design; and provide conclusions and geotechnical recommendations for grading, foundation design, and construction of the proposed structure(s) as influenced by subsurface conditions.

Specifically, our scope of work consisted of:

- A review of readily available published and unpublished geotechnical literature, topographic maps, geologic maps, fault maps, and aerial photographs.
- Performance of a subsurface exploration consisting of the excavation, logging, and sampling of six exploratory test pits with backhoe. Bulk soil samples were obtained at selected intervals from the test pits. The collected samples were transported to our in-house geotechnical laboratory for analysis.
- Laboratory testing of representative soil samples obtained during our field investigation to evaluate soil properties for design purposes.
- Geologic and geotechnical evaluation and analysis of the collected field and laboratory data.
- Preparation of this written report presenting the results of our findings, conclusions, geotechnical recommendations, and construction considerations for the proposed development.

2. SITE DESCRIPTION

The project site is located west of the intersection of Wagon Wheel Road and Meridian Boulevard on the eastern side of the Town of Mammoth Lakes, Mono County, California (Figures 1 and 2). The proposed improvements will be located on the easterly half of the approximate 7.9-acre parcel located at 100 College Parkway (APN 035-010-049). Land use surrounding the site is developed with the existing Edison Theater and Cerro Coso Community College Housing Building located west and south of the site, respectively. Site access is from College Parkway immediately adjacent the south side of the property.

Site topography in the building pad area is characterized by a low relief ground surface that slopes slightly down toward the southeast. The proposed east parking area slopes gradually to the northeast. The average ground surface elevation is approximately 7846' MSL. Site vegetation includes a moderate growth of natural grasses, shrubs, and Pine trees. Map coordinates are 37.6396, -118.9585.

3. PROPOSED DEVELOPMENT

It is our understanding that the proposed development will include construction of a new 25, 494 sf Performing Arts and Cultural Center, which includes a 298-seat Performing Arts Theatre, 500-seat outdoor amphitheater, and associated new parking lot. Additionally, the project proposes renovations to the existing Edison Theatre parking lot. The new structure will likely be supported on a combination of shallow concrete spread footings, grade beams, and concrete slab-on-grade floors.

Grading will be relatively minor (generally less than 5-foot cut/fill), as most of the structure will be at or close to existing grades. Tiered rock stack walls up to 3-feet tall are proposed to support the north side of the building pad as well as west side of the east parking lot. As previously noted, detailed plans for construction are currently not available. SGSI should review grading and foundation plans prior to construction in order to verify that they will be in conformance with our recommendations.

4. AERIAL PHOTOGRAPHIC REVIEW

Prior to our field investigation, we acquired and reviewed aerial photographs to assist in our evaluation of geomorphic features that could be indicative of geologic hazards at the property. Details from the earliest available photographs did not show evidence of lineations, scarps, or other ground-surface fault, landslide, or recent avalanche related features.

5. GEOLOGIC AND GEOTECHNICAL SITE CONSTRAINTS

Geotechnical constraints to development include the potential for moderate ground shaking (M_W 6.0+) along the nearby Hilton Creek fault zone located approximately 1.70 mi northeast of the subject site. The above concern is addressed in the site seismicity section (see Sections 8 and 9) of this report.

6. GEOLOGY AND SUBSURFACE CONDITIONS

The project site is located within the Sierra Nevada province, a generally north to northwesterly trending, asymmetric, and tilted fault-block, bordered on the east by the Sierra Nevada frontal-fault system. Predominant basement rock types of the Sierra Nevada include Cretaceous granitics with associated Paleozoic roof pendants along the west margin of Mono Basin, and to a lesser degree, Paleozoic meta-sedimentary formations mantled by Pleistocene glacial tills.

More specifically, the project site is located at the southwestern edge of the Long Valley caldera near the eastern flank of the Sierra Nevada. The caldera (collapsed volcano) is an east-west elongate, oval depression formed approximately 760,000 years ago with continued volcanic activity to the present (Bailey, 1989). The pre-volcanic basement rock in the Mammoth Lakes area is predominantly Mesozoic granitic rocks of the Sierra Nevada batholith. The batholith is a series of intrusions that displaced overlying ancient sedimentary sea floor rocks (roof pendants) during the Jurassic and Cretaceous Periods. Piedmont glaciation occurred throughout the Pleistocene leaving a mantle of glacial till covering the basement and volcanic rocks throughout the area now occupied by the Town of Mammoth Lakes.

The site is underlain by shallow topsoil and Glacial deposits. Both materials are granular. Descriptions of the materials are presented below. Approximate locations of the exploratory test pits are shown on the Subsurface Geotechnical Map (Figure 3). Logs of the subsurface conditions encountered in exploratory test pits are provided in Appendix A.

6.1 Topsoil

Topsoil was encountered in all the test pits to an approximate depth of 1-feet below existing grades. In general, this deposit consisted of dark brown, loose, moist, silty, very fine to coarse-grained SAND (Unified Soil Classification Symbols: SM), with minor organics. The topsoil is considered unsuitable for foundation and should be removed from all structural areas.

6.2 Glacial Deposits

Glacial deposits were encountered in all the test pits below the topsoil. In general, the glacial deposits consisted of reddish-brown to grayish-brown, and gray, moist, medium dense to dense, silty, very fine to coarse SAND (SM, SM-ML) with abundant cobble clasts and boulders to 36-inches diameter. Rock refusal was encountered in Test Pit TP- 4 at 10-feet below the ground grade. Large boulders to approximately 10-feet in diameter where noted at the ground surface near TP-3, TP-5, and TP-6. The thickness of the glacial till was not determined during this investigation but based on research (Rinehart and Ross, 1964; CWDR, 1973) likely extends greater than 100-feet below the ground surface.

This material is considered suitable for both foundation and fill support provided the grading and foundations recommendations provided within this report are adhered to during site development.

6.3 <u>Groundwater</u>

Based upon a review of the "Mammoth Basin Water Resources Environmental Study" prepared by the California Department of Water Resources (CDWR, 1973), and water well records from the Mammoth Community Water District for wells in the site vicinity, depth to permanent groundwater beneath the site is estimated at greater 250-feet.

Groundwater was not encountered during our field investigation. Groundwater is not anticipated to be encountered during site development due to the location of the site with respect to overall drainage. Minor amounts of seepage from localized snowmelt percolation may be encountered if construction takes place during the snow-melt period from April to July. Since the prediction of the location of such conditions is difficult to determine, they are typically mitigated if or when they occur during and/or after construction.

7. <u>FAULTING</u>

The site is not located in an Alquist-Priolo Earthquake fault zone. The closest active fault to the site is the Hilton Creek Fault zone located approximately 1.70 mi to the northeast. No active faults are known to underlie or project to the site. A brief description of the Hilton Creek fault zone is included herein.

7.1 <u>Hilton Creek Fault Zone</u>

The Hilton Creek fault is a significant range-bounding normal fault along the eastern side of the Sierra Nevada. The fault is characterized by down-to-the-east normal displacement and it offsets late Tioga lateral moraines and outwash deposits. Surface-fault rupture was associated with four Mw 6+ earthquakes that occurred in May 1980 (Taylor and Bryant, 1980 #5586). Latest Pleistocene vertical slip rates range from 0.9 mm/yr to 4.2 mm/yr (Berry, 1990 #5582; Clark and Gilliespie, 1993 #5584).

8. CBC SEISMIC DESIGN PARAMETERS

Site coordinates of 37.6396, -118.9585 were obtained using the computer program **Google Earth**. Table I presents the Seismic Parameters for use in preparing a Design Response Spectra for the site.

TABLE I

SEISMIC PARAMETER (ASCE 7-10)	RECOMMENDED VALUE
Site Class	D
F_a	1.0 g
F_v	1.5 g
S_S	1.616 g
S_1	0.508 g
S_{MS}	1.616 g
S_{M1}	0.761 g
S_{DS}	1.078 g
S_{D1}	0.508 g
PGA/PGA_M	0.596 g
Occupancy Category	II
Seismic Design Category	D

Conformance to the above criteria for strong ground shaking does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur during a large magnitude earthquake. Design of structures should comply with the requirements of the governing jurisdictions, building codes, and standard practices of the Structural Engineers Association of California.

9. SECONDARY EARTHQUAKE EFFECTS

Secondary effects that can be associated with severe ground shaking following a relatively large earthquake include shallow ground rupture; soil lurching, liquefaction, dynamic settlement, and lateral spreading. These secondary effects of seismic shaking are discussed in the following sections.

9.1 Shallow Ground Rupture

Ground surface rupture results when the movement along a fault is sufficient to cause a gap or break along the upper edge of the fault zone on the surface. Our review of available geologic literature indicated that there are no known active, potentially active, or inactive faults that transect the subject site. The nearest known active regional fault is the Hilton Creek fault zone. The closest projected trace for this fault zone is located approximately 1.70 mi northeast of the site.

9.2 Soil Lurching

Soil lurching refers to the rolling motion on the ground surface by the passage of seismic surface waves. Effects of this nature are likely to be most severe where the thickness of soft sediments varies appreciably under structures. In its present condition, the potential for lurching at the subject site is considered low due to the shallow nature of potentially compressible soils below existing grades. The potential for lurching will be nominal at best if the potentially compressible soils, present on site, are removed and properly compacted during grading, as per the earthwork recommendations provided herein.

9.3 Liquefaction and Seismically Induced Settlement

The project site is not located within an area zoned for liquefaction hazards by local/state jurisdictions.

Liquefaction of cohesionless soils can be caused by strong vibratory motion due to earthquakes. Research and historical data indicate that loose granular soils and nonplastic silts that are saturated by a relatively shallow groundwater table are susceptible to liquefaction. The known depth to a permanent groundwater table is greater than 50 feet (Diment and Urban, 1990). The average known shear wave velocity derived from the testing at the College Apartments structure, across College Parkway, is approximately 1,576 ft/s (SGSI, 2004).

Based on the relatively dense nature of the underlying earth materials and the absence of shallow groundwater, it is our opinion that the potential for liquefaction and seismically induced settlement to occur at the site is not a design consideration. In addition, the potential for ground failures associated with liquefaction, i.e post liquefaction reconsolidation, and sand boils are also considered insignificant.

9.4 Lateral Spreading

Lateral spreading refers to landslides that form on gentle slopes as a result of seismic activity and have a fluid like movement. It differs from slope failure in that complete ground failure involving large movement does not occur due to the relatively smaller gradient of the initial ground surface. Soil types that are highly susceptible to lateral spread include silts and shale. Soils in the immediate vicinity of the building site consist of dense, sands with minor amounts of fines. Based on these findings, lateral spreading is not expected to occur on the site.

9.5 Seiches

The potential for seiches as the result of the design level earthquake in a nearby fault are considered non-existent, due to the distance of the ocean or large open bodies of water from the project site.

10. LANDSLIDES

The project site is not located within an area zoned for landslide hazards by local/state jurisdictions. Evidence of past landslides was not observed either during aerial photographic review or in the field.

11. VOLCANIC HAZARDS

The Mammoth Lakes area is surrounded by territory having shown evidence of volcanic activity during the Quaternary and Holocene (approximately 1.8 ma through the present). At least nineteen episodes of volcanism during the past approximately 3,000 years have been determined by radiocarbon dating methods (Kilbourne, Chesterman, and Wood, 1980). The most significant potential sources of volcanic activity are the Mono-Inyo Craters and the resurgent dome within the Long Valley caldera. Basaltic, rhyolitic, and phreatic volcanism can be anticipated throughout the region. Basaltic eruptions tend to be least violent while rhyolitic and phreatic eruptions can be very explosive and are associated with large volumes of ejecta that can travel great distances. The Plinian eruption of the Long Valley caldera about 764,000 years ago is one such example where over 500 km^3 of ash and debris were sent hundreds of kilometers away (Bailey, 1989).

Explosive eruptions along the Inyo Craters volcanic chain occurred as recently as approximately 550 to 600 years ago (Miller, 1985). The most recent regional volcanic eruptions occurred between approximately 550 and 800 years ago along the Inyo Craters fracture zone (Rinehart and Huber, 1965; Miller, 1985; Sieh and Bursik, 1986). Historic non-eruptive volcanic activity occurred during the 1980 Mammoth Lakes earthquake sequence and during the 1989 Mammoth Mountain earthquake sequence (Sorey et al., 1999). Magmatic gas emissions associated with fumarolic activity have been documented on Mammoth Mountain and at Horseshoe Meadows (Sorey et al., 1999), approximately 6.5 km to the west. Fumarolic activity is also located near Shady Rest Campgrounds (1.5 km to the north) and at Casa Diablo geothermal area (4 km to the east).

According to Miller (1989) and Hill (2002), the subject site is located within volcanic hazard zones for all of the following:

- <u>Debris avalanches</u>: Flowing or sliding, wet, or dry mixture of soil and rock debris that moves away from a volcano at high speeds.

- <u>Pyroclastic flows</u>: Mass of hot, dry rock fragments mixed with hot gases that move away from a volcano at high speeds.

- <u>Directed blasts</u>: A hot, low-density mixture of rock debris, ash, and gases that move away from an exploding volcano at high speeds.

- <u>Pyroclastic surges</u>: Turbulent, low-density cloud of hot rock debris and gases that moves over the ground surface away from a volcano at high speeds (also known as a nueé ardant or Plinian eruption).

- <u>Lava flows</u>: Streams of molten rock that erupts relatively non-explosively from a volcano and moves slowly down slope.

- <u>Lava domes</u>: A steep-sided mass of viscous lava that extrudes from a volcanic vent at slow speeds.

- <u>Debris flows</u>: A flowing mixture of water-saturated debris (often from melted snow) that moves down slope at high speeds under the force of gravity (also known as a lahar).

- <u>Tephra falls</u>: Materials of all sizes and types that are erupted from a volcano and deposited from the air.

- Poisonous gas emissions: Volcanic gases including radon and carbon dioxide that escape from an opening in the ground called a fumarole.

Unlike earthquakes, most volcanoes provide various types of warnings before eruptions begin. Phreatic or phreatomagmatic eruptions (steam-blasts), however, like those of the Inyo Crater chain, can occur with little or no warning as superheated water flashes to steam when magma comes into contact with groundwater. The most common precursors to eruptions come in the form of earthquakes, steaming, or fumarolic activity. The more subtle precursory changes are monitored by geophysical and geodetic instruments to measure ground swelling, changes in slope, and changes in elevation.

The Mono Lake-Long Valley region is currently being monitored by several agencies and institutions to detect signs of any magmatic unrest and approaching eruptions. Future eruptions in the Mammoth Lakes area are certain to occur like those in the past, but they can be neither reliably predicted nor prevented at this time. Future volcanic eruptions are more likely to occur along the Mono-Inyo Craters volcanic chain than from the resurgent dome or south moat area of the Long Valley caldera. The odds of an eruption occurring in any given year along the chain are one in a few hundred, and the odds that a small eruption at one location on the chain will have a significant impact on any specified place on or near the chain are roughly one in a thousand in any given year (Miller, 1985; 1989). Massive eruptions of the size similar to that of the Long Valley caldera are extremely rare, and current research shows no evidence that an eruption of such catastrophic proportions are brewing beneath the caldera (Miller, 1985; 1989).

12. SUBSIDENCE

The subject site is not within an area known for past cases of substantial subsidence due to fluid removal. It is our opinion that the potential for significant subsidence due to the extraction of fluids is negligible. Soils subject to hydro-collapse, such as loose cemented silty and clayey soils were not noted in the borings drilled at the site. The site is not located in an area noted for hydro-collapse. Significant soil settlement associated with wetting of the subgrade materials is not anticipated.

13. FLOOD HAZARDS

Based upon a review of the FEMA Flood Insurance Rate Map, Mono County Panel 1389D, Map No. 06051C1389D, for the Mammoth Lakes area of Mono County (2011); the site is located in Zone X - outside the 0.2% annual chance flood plain. The nearest 100- and 500-year special flood zone hazard areas are located along Mammoth Creek to the south.

14. EXPANSIVE SOILS

Expansive soils are soils that swell when subjected to moisture. Shrink/swell potential is the relative change in volume to be expected with changes in moisture content; that is, the extent to which the soil shrinks as it dries or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes damage to building foundations, roads, and other structures. Soils in the immediate vicinity of the building site consist of dense, sands and gravels with minor fines. Based on these findings, there is a very low shrink/swell potential at the site.

15. ASBESTOS

Naturally occurring Asbestos is not known to be present in the project area.

16. RADON-222

Radon gas is known to be present in the Mammoth Lakes area. However, the presence and amounts of the gas can be highly variable over short distances. So, while one site or structure may contain high concentrations of the gas, an adjacent building may contain limited amounts. With respect to the site area, Radon levels are unknown. A passive mitigation system may need to be incorporated during construction. Therefore, a Radon specialist should be consulted.

17. CONCLUSIONS

Based upon the results of this study, it is our opinion that geologic hazards at the site area are nominal and any future construction within, is feasible from a geologic and geotechnical standpoint. The following more explicitly summarize our findings.

- There are no known active, potentially active, or inactive faults that transect the subject site. Evidence of past soil failures, or landslides on the site was not encountered.
- Seismic hazards at the site may be caused by ground shaking during seismic events on regional active faults. The nearest known active regional fault is the Hilton Creek fault located approximately 1.70 mi northeast of the site.
- A volcanic eruption could occur somewhere along Mono-Inyo Craters volcanic chain producing pyroclastic flows and surges, as well as volcanic ash and pumice fallout,

which could significantly impact the subject site. The odds however, of such an eruption are roughly one in a thousand in a given year (Miller, 1985; 1989).

- Based upon findings, the building site is underlain by up to 1-foot of loose surficial soils considered unsuitable for the support of new structural loads. Where these soils will be subjected to increased loads, remedial grading is recommended to improve bearing capacity. Remedial grading recommendations are provided in this report.

- Groundwater was not encountered. Minor amounts of seepage may be encountered if the site is graded during the snowmelt runoff period between April and July. In addition, locally perched groundwater could also develop with increased irrigation runoff infiltration. Since the prediction of the location of such conditions is difficult to determine, they are typically mitigated if or when they occur.

- Site soils will generally consist of loose to dense, granular deposits. Excavations at the site should be generally achievable using standard earthmoving equipment. However large boulders may be encountered which could necessitate the use of an alternative removal method (e.g. ramp-hoe, drill and expansion foam, etc.).

- Large boulders to approximately 10-feet in diameter where noted at the ground surface near TP-3, TP-5, and TP-6. Large boulders may therefore be encountered during excavation.

- Subsurface strata which would retard the flow of water downward were not observed during the investigation. Drywells should therefore function as designed.

- Due to the semi-cohesionless nature of the site soils, some sloughing or riling may occur in the excavations. Shoring or forming may be required. Per CAL/OSHA the on-site soils can be classified as a Type B material (maximum allowable slope 1:1).

- This study did not include an environmental review of the Site area. Though not observed during the reconnaissance or subsurface investigation it is possible that some dump fill soils may exist on the site. Since the prediction of the location of such conditions is difficult to determine, they are typically mitigated if or when they occur.

18. <u>RECOMMENDATIONS</u>

The following recommendations should be adhered to during site development. These recommendations are based on empirical and analytical methods typical of the standard of practice in California. If these recommendations appear not to cover any specific feature of the project, please contact our office for additions or revisions to the recommendations.

18.1 Plan and Specification Review

Foundation plans were not available at the time of this report. SGSI should review foundation plans prior to construction in order to verify that they are in conformance with this report; some of the recommendations contained herein may need to be revised after reviewing.

18.2 Earthwork

Site grading should be observed by SGSI. Such observations are considered essential to identify field conditions that may differ from those anticipated by the investigation, to adjust design to actual field conditions, and to determine that the grading is accomplished in general accordance with the recommendations of this report. Earthwork and grading recommendations which include guidelines for site preparation fill compaction, temporary excavations, and trench backfill are provided in Appendix C.

The recommendations contained in Appendix C are general grading specifications provided for typical grading projects. Some of the recommendations may not be strictly applicable to this project. The specific recommendations contained in the text of this report supersede the general recommendations in Appendix C. The contract between the developer and earthwork contractor should be worded such that it is the responsibility of the contractor to place the fill properly in accordance with the recommendations of this report and the specifications in Appendix C, notwithstanding the testing and observation of the geotechnical consultant.

18.2.1 Site Preparation

Prior to grading, the proposed structural improvement areas (i.e. all structural fill, pavements areas and structural building, etc.) of the site should be cleared of surface and subsurface obstructions, including vegetation. Vegetation and debris should be disposed of offsite. Holes resulting from removal of buried obstructions, which extend below the recommended removal depths described herein or below finished site grades (whichever is lower) should be filled with properly compacted soil. Should existing underground utilities be encountered they should be completely removed and properly backfilled.

18.2.2 Removals

Up to approximately 1-foot of loose surficial deposits were observed during our investigation. These soils will need to be over-excavated and removed from within all structural areas. Where not constrained at junctions with existing structures, excavations should extend to a minimum horizontal distance of at least 5-feet outside any building footprints. The actual depth of removal may vary and should be field verified and approved by the geotechnical consultant prior to fill placement. Removals and compaction recommendations are provided in Appendix C.

Cut-Fill transitions shall not be allowed to occur below foundations. We recommend that the subgrade materials be made uniform. For building pads located across a cut-fill transition, this can be accomplished by excavating the native materials to at least 2-foot below the bottom of the deepest footing and extending to 5-foot beyond the building corners. The bottom of the excavation should then be scarified, moisture conditioned, and replaced as a uniform layer of engineered fill.

Site soils are suitable for use as compacted fill if they are processed in accordance with the recommendations in Appendix C. Approved fill soils should be placed in thin lifts (≤ 8-inches loose thickness) and moisture conditioned to at least optimum moisture content. All fill should be compacted to a minimum of 90-percent relative compaction.

18.2.3 Temporary Construction Excavation

Site soils consist of very fine to coarse sands with moderate to abundant amounts of rock fragments. In general, these soils are grossly stable and can be classified as type B soil per Cal/OSHA Appendix A of Section 1541.1. In our opinion, temporary shoring is **not** required if the following recommendations are adhered to during site development.

- Excavations for retaining walls must extend to at least 5-feet beyond the building footprint.

- Any retaining wall excavations shall be laid back to a maximum slope angle of 1:1 (H:V) from either a point of elevation equivalent to the top-of-footing, or to the top of a minimum 4-foot vertical bench.

18.3 Foundations

Shallow, spread or continuous footings may be used to support the proposed structure provided they are founded entirely upon properly compacted fill, or competent native deposits. Continuous and isolated column foundations should be sized according to the allowable soil bearing pressures shown in Table II below. The pressures shown on Table II are for dead loads plus long-term live load.

TABLE II

Depth Below Existing Ground Surface	Allowable Soil Bearing Pressure (psf)	Lateral Resistance (psf)	Friction Coefficient
Compacted Fill	2,500	250	0.30
Embedment into Competent Glacial Deposits	3,000	300	0.35

When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third. In addition, when passive resistance is calculated, the upper one foot of soil should be neglected unless the ground surface is covered by pavement.

Footings may be constructed according to California Building Code requirements regarding width (minimum 12-inches). Exterior foundations shall have a minimum embedment depth of 18-inches below outside adjacent grade. Interior foundation depths shall also be a minimum of 12-inches below adjacent grade.

Continuous and isolated footings should be designed in accordance with the structural engineer requirements. Reinforcement of footings should be per the structural engineer's design.

18.4 Anticipated Settlement

We estimate that the proposed structure(s), designed and constructed as recommended herein, and founded in compacted fill will undergo total settlement on the order of 1-inch. Differential settlement on the order of ½-inch over a horizontal span of 30-feet should be expected for compacted fills over glacial materials. The total settlement of the conventional foundations bearing into competent glacial deposits is anticipated to be less than ½-inch.

18.5 Lateral Earth Pressures and Resistance

The recommended equivalent fluid pressure for each case for walls founded above the static ground water and backfilled with select soils is provided in Table III. Wall footings should be designed in accordance with structural considerations.

Slope of Backfill Behind Retaining Wall	Lateral Earth Pressure in Equivalent Fluid Weight (pcf)
Horizontal or Active	30
2:1 or At-Rest	45

The select backfill should have an expansion index (EI) of no greater than 50 and a sand equivalent (SE) greater than 15. The backfill soils should be tested by the soils engineer prior to backfill operations starting for the retaining wall/basement wall structures.

Walls subjected to surcharge loads should be designed for an additional uniform lateral pressure equal to one-third the anticipated surcharge load for unrestrained walls, and one-half the anticipated surcharge load for restrained walls. Surcharge loading effects from the adjacent structures should be evaluated by the structural engineer.

All retaining wall structures should be provided with appropriate drainage and waterproofing. Drainage should consist of continuous drains installed along the base of the wall out-letting to a storm drain system or the surface if grade allows. Waterproofing shall be designed by the project Architect but should consist of no less than placement of a flexible adhesive waterproofing membrane (Mel-Rol, Bituthene or eq), overlain by dimpled drainboard. Additionally, all cold joints (especially at any footing/wall interfaces) should be appropriately sealed with a concrete joint sealer (WR Meadows SealTight or eq.) prior to placement of the adhesive waterproofing membrane.

18.5.1 Earthquake Induced Lateral Earth Pressures

During an earthquake an additional lateral earth pressure will be applied to the wall. Experience has shown that walls adequately designed for static loading have generally performed well during earthquake loading. However, if walls are to be designed for seismic loading, the magnitude of the seismic pressure can be evaluated using the procedures developed by Mononobe-Okabe which consider that the seismic pressure is approximated using a lateral pressure coefficient of 0.75x the effective ground acceleration. The effective ground surface acceleration is taken as equal to 2/3 the maximum expected ground acceleration.

For this project, the PGA_M is 0.596g. The effective ground surface acceleration is therefore 0.396g. Considering an average laboratory derived soil unit weight of 112 pcf, we recommend an equivalent fluid pressure of 33 pcf be used to calculate the lateral seismic pressure. The resultant of the seismic pressure should be applied at a height of 0.6x the wall height above the base of the wall.

The pressure increment for cantilevered retaining walls should be taken as an inverted triangular distribution from the stem of the cantilevered retaining wall to the top of the cantilevered retaining wall. For resistive walls, i.e. basement walls, the pressure increment should be taken as a rectangular force applied from the stem of the basement wall to the top of the basement wall.

18.6 Foundation Construction

The following preliminary recommendations assume very low expansive soils near finish pad grade.

- All footing excavations should be observed by the geotechnical consultant prior to placement of reinforcing steel, in order to verify proper embedment into suitable soils.

- Footing trenches should not have any rocks or boulders protruding into the trench bottom. Soft soil pockets created by rock removal during foundation excavation shall be replaced with approved fill material and compacted to 90-percent relative compaction.

- Site soils are suitable for use as compacted fill if they are processed in accordance with the recommendations in Appendix C.

- Approved fill soils should be placed in thin lifts (≤ 8-inches loose thickness) and moisture conditioned to at least optimum moisture content. All fill should be compacted to a minimum of 90-percent relative compaction.

- Any import soils shall be tested for suitability in advance by the project Geotechnical Engineer. Earth fill material shall not contain more than 1-percent of organic materials (by volume). Imported fill shall have a maximum plasticity index of ≤ 12, and a liquid limit less than 40 when measured in accordance with ASTM D 4318.

18.7 <u>Foundation Setback</u>

We recommend a minimum horizontal setback distance from the face of slopes for all structural footings and settlement-sensitive structures (i.e. fences, walls, signs, etc.). This distance is measured from the outside edge of the bottom of the footing, horizontally to the slope face (or to the face of a retaining wall). A **5-foot minimum** setback shall be established for the outside footing face (bearing elevation) to the finished grade slope face. We should note that the soils within a slope setback area possess poor long-term lateral stability, and improvements (such as retaining walls, walkways, fences, pavement, underground utilities, etc.) constructed within this setback area may be subject to lateral movement and/or differential settlement.

Utility trenches that parallel or nearly parallel structural footings should not encroach within a 1:1 plane extending downward and outward to a lateral distance of 5-feet from the outside edge of the bottom of the footing.

18.8 <u>Concrete Slab-on-Grade Floors</u>

Interior: Building slabs may be supported on-grade by compacted fill. Cut/fill transitions below slabs should be avoided. Subgrade soils should have a very low expansion potential (EI < 20). Slabs should be designed for anticipated loading and thickness shall meet the requirements of the Structural Engineer of record.

Likewise, control joints and reinforcement should be designed by the Structural Engineer.

Concrete slabs should be underlain by a vapor barrier/retarder (Stego Wrap or equivalent - 15 mil minimum thickness), which is in turn underlain by a 4-inch layer of ¾" crushed stone. All penetrations and laps in the moisture barrier should be appropriately sealed. The membrane should have a high puncture resistance and should be installed so that there are no openings or holes. All seams should be overlapped and sealed at the laps per the manufacturer's recommendations. Where pipes extend through the membrane, the barrier should be sealed to the pipes.

Moisture retarders can reduce, but not eliminate moisture vapor movement from the underlying soils up through the slab. We recommend that the floor coverings installer test the moisture vapor flux rate prior to attempting application of the flooring. "Breathable" floor coverings should be considered if the vapor flux rates are high. A slip-sheet should be used if crack sensitive floor coverings are planned.

The use of reinforcement in slabs and foundations will generally reduce the potential for drying and shrinkage cracking. However, some cracking may be expected as the concrete cures. Concrete cracking and/or spalling is often aggravated by a high cement ratio, high or low concrete temperature at the time of placement, small nominal aggregate size, rapid moisture loss, or the addition of water during placement. The use of low slump concrete (not exceeding 4-inches at the time of placement), a water-cement ratio no greater than 0.45 by weight, and proper curing methods can reduce the potential for shrinkage cracking.

Exterior Concrete Flatwork: Concrete flatwork should be a minimum 4-inches in thickness and should be supported by very low expansion subgrade soils (EI < 20) compacted to at least 90-percent relative compaction. Flatwork should be reinforced with at least #3 rebar placed at slab mid-height on 18-inch centers, both ways. Flatwork subjected to vehicle traffic should be a minimum of 5-inches thick and underlain by at least 4-inches of Class II Base, compacted to at least 95-percent relative compaction. Crack control joints should be used and should have a maximum spacing of 5-foot on center each way for sidewalks, and 10-foot on center each way for slabs. A vapor retarder is not needed. Actual crack control joints and reinforcing should be designed by the project Civil Engineer.

Sand-Set Pavers: If sand-set pavers or flagstones are used for some exterior hardscape we recommend that they be placed in accordance with the manufacturer's recommendations. At a minimum, we also recommend that pavers be underlain by at least 4-inches of compacted Class II Aggregate Base, compacted to at least 95-percent relative compaction. A representative from our office should observe the subgrade conditions for all hardscape prior to placement of Base. Prior to placement of the Base, the subgrade soils should be scarified, and moisture conditioned to a depth of at least 6-inches, as necessary, and compacted in accordance with the compaction section of this report.

18.9 Drainage

We recommend that measures be taken to properly finish grade the building areas such that drainage water is directed away from building foundations. Positive drainage away from adjacent structures should be established and maintained at a gradient of 5-percent or steeper for 10-feet or more outside the building perimeter, or 2-percent or steeper for 10-feet or more outside the building perimeter, if paved.

In addition, roof and surface drainage should be provided so that water is not permitted to pond adjacent foundations after construction. Drainage should be diverted away from structures by non-erodible devices (e.g. gutters, downspouts, concrete swales, etc.) and conveyed to an approved disposal area.

19. FLEXIBLE PAVEMENT RECOMMENDATIONS

SGSI recommends the following pavement section:

Standard Duty Roads and Parking Areas (TI = 5.0)
3-inches Asphalt Concrete / 4-inches Caltrans Class II Aggregate Base

Access Driveways, Bus traffic, Bus Parking, Loading Docks (TI = 7.0)
4-inches Asphalt Concrete / 4-inches Caltrans Class II Aggregate Base

The upper 12-inches of subgrade material along with the Caltrans specification for Class II Aggregate Base and the Asphaltic concrete shall be compacted to a minimum of 95-percent of the materials maximum dry density as determined by ASTM D1557. The subgrade and aggregate base shall be moisture-conditioned and compacted to 95-percent of the material's maximum dry density as determined by ASTM D-1557 to a depth of 12-inches.

If pavement areas are adjacent to heavily watered landscape areas, some deterioration of the subgrade load bearing capacity may result. We recommend some measures of moisture control (such as deepened curbs or other moisture barrier materials) be provided to prevent the subgrade soils from becoming saturated.

20. BULK/SHRINK AND ROCK LOSS ESTIMATES

Based upon estimated densities of compacted fills, native soils (3” minus) will shrink on the order of approximately 12-15% when over-excavated and compacted. Rock loss is estimated near 5-10% of the over-excavated material.

21. GEOTECHNICAL OBSERVATION AND TESTING DURING CONSTRUCTION

The recommendations provided in this report are based on limited subsurface observations and geotechnical analysis. The interpolated subsurface conditions should be checked in the field during construction by SGSI. Geotechnical observation and testing is required per the California Building Code (CBC). Geotechnical observation and/or testing should be performed by SGSI at the following stages:

- During grading (removal bottoms, fill placement, etc);
- During backfill and compaction;
- After presoaking building pads (if needed) and other concrete-flatwork subgrades, and prior to placement of aggregate base or concrete;
- Preparation of pavement subgrade and placement of aggregate base;
- After footing excavation and prior to placing concrete and/or reinforcement; and
- When any unusual soil conditions are encountered during any construction operation subsequent to issuance of this report.

22. LIMITATIONS

This report has been prepared for the sole use and benefit of our client. The conclusions of this report pertain only to the site investigated. The intent of the report is to advise our client of the geologic and geotechnical recommendations relative to the future development of the proposed project. It should be understood that the consulting provided and the contents of this report are not perfect. Any errors or omissions noted by any party reviewing this report, and/or any other geotechnical aspects of the project, should be reported to this office in a timely fashion. The client is the only party intended by this office to directly receive this advice. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Sierra Geotechnical Services Incorporated from and against any liability, which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Sierra Geotechnical Services Incorporated.

Conclusions and recommendations presented herein are based upon the evaluation of technical information gathered, experience, and professional judgment. Other consultants could arrive at different conclusions and recommendations. Final decisions on matters presented are the responsibility of the client and/or the governing agencies. No warranties in any respect are made as to the performance of the project.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings within this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

23. REFERENCES

Bailey, R.A., (1989). Geologic Map of the Long Valley Caldera, Mono-Inyo Craters Volcanic Chain, and Vicinity, Eastern California: U.S. Geological Survey, Map I-1933, 1:1,000,000

California Building Code (2016). California Code of Regulations, Title 24, Part 2, Volume 1.

California Geological Survey, (1997). Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117, 74p.

CWDR (1973). Mammoth Basin water resources environmental study: California Department of Water Resources and Mammoth County Water District, p. 41, 44, 69, 70.

Diment, W.H., and T.C. Urban, 1990, Temperatures and natural gamma-ray logs obtained in boreholes MLGRAP #1 and #2, Mammoth Lakes, California: data and preliminary interpretations: U.S. Geological Survey Open-File Report 90-460, p. 3, 4, 9, 25 and 34.

FEMA (2011). FEMA Flood Insurance Rate Map, Mono County Panel 1389D, Map No. 06051C1389D.

Hart, Earl W., and Bryant, William A (1999). Fault-rupture Hazard Zones in California, California Geological Survey Special Publication 42, 38p.

Hill, D.P., D. Dzurisin, W.L. Ellsworth, E.T. Endo, D.L. Galloway, T.M. Gerlach, M.J.S. Johnston, J. Langbein, K.A. McGee, C.D. Miller, D. Oppenheimer, and M.L. Sorey, 2002, Response plan for volcano hazards in the Long Valley caldera and Mono Craters region, California: U.S. Geological Survey Bulletin 2185, 58 p.

Howle, J.F., and C.D. Farrar, 2001, Hydrologic data for Long Valley caldera, Mono County, California, 1994-96: U.S. Geological Survey Open-File Report 00-230, 155 p.

Miller, C.D., 1985, Holocene eruptions at the Inyo volcanic chain, California: Implications for possible eruptions in Long Valley caldera: Geology, v. 13, pp. 14-17.

Miller, C.D., 1989, Potential hazards from future volcanic eruptions in California: U.S. Geological Survey Bulletin 1847, 17 p.

Jennings, C.W., 1994, Fault activity map of California and adjacent areas: California Division of Mines and Geology Geologic Data Map No. 6, 1:750,000 scale.

Kilbourne, R.T., C.W. Chesterman and S.H. Wood, 1980, Recent volcanism in the Mono Basin-Long Valley region of Mono County, California, *in* Sherburne, R.W., ed., Mammoth Lakes, California earthquakes of May 1980: California Geological Survey Special Report 150, p. 7-22.

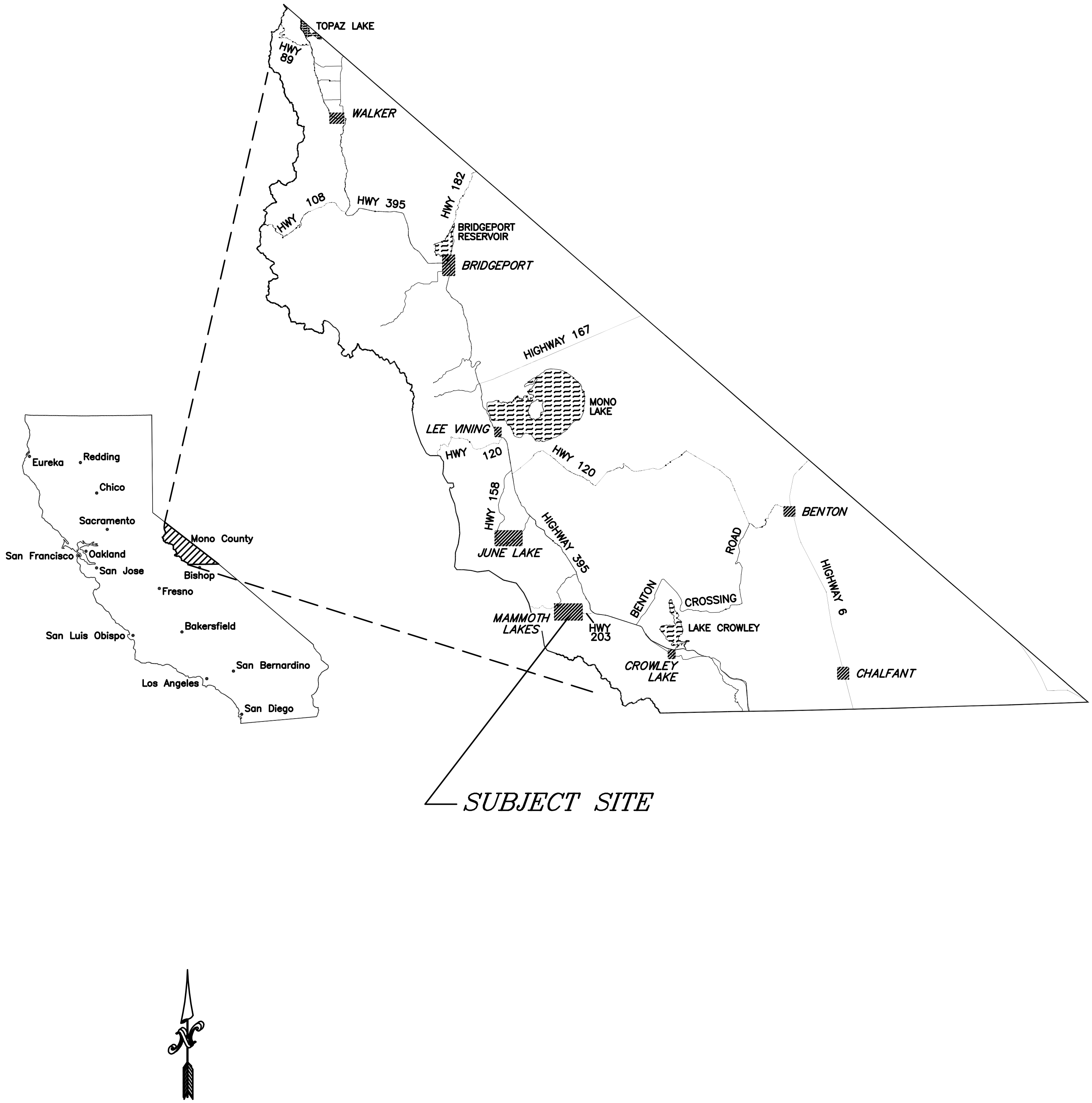
Kistler, R.W., 1966, Geologic map of the Mono Craters quadrangle, Mono and Tuolumne counties, California: U.S. Geological Survey Geologic Quadrangle Map GQ-462, 1:62,500 scale.

Rinehart, C.D., and D.C. Ross, 1964, Geology and mineral deposits of the Mount Morrison quadrangle, Sierra Nevada, California: U.S. Geological Survey Professional Paper 385, 106 p.

Sieh, K.E., and M.I. Bursik, 1986, Most recent eruption of the Mono Craters, eastern central California: Journal of Geophysical Research, v. 91, n. B12, p. 12539-12571.

Sorey, M.L., B. Evans, M. Kennedy, J. Rogie, and A. Cook, 1999, Magmatic gas emissions from Mammoth Mountain, Mono County, California: California Geology, v. 52, n. 5, p. 4-16.

State of California, California Division of Mines and Geology, Open File Report 96-08, p.1-59.



NOT TO SCALE

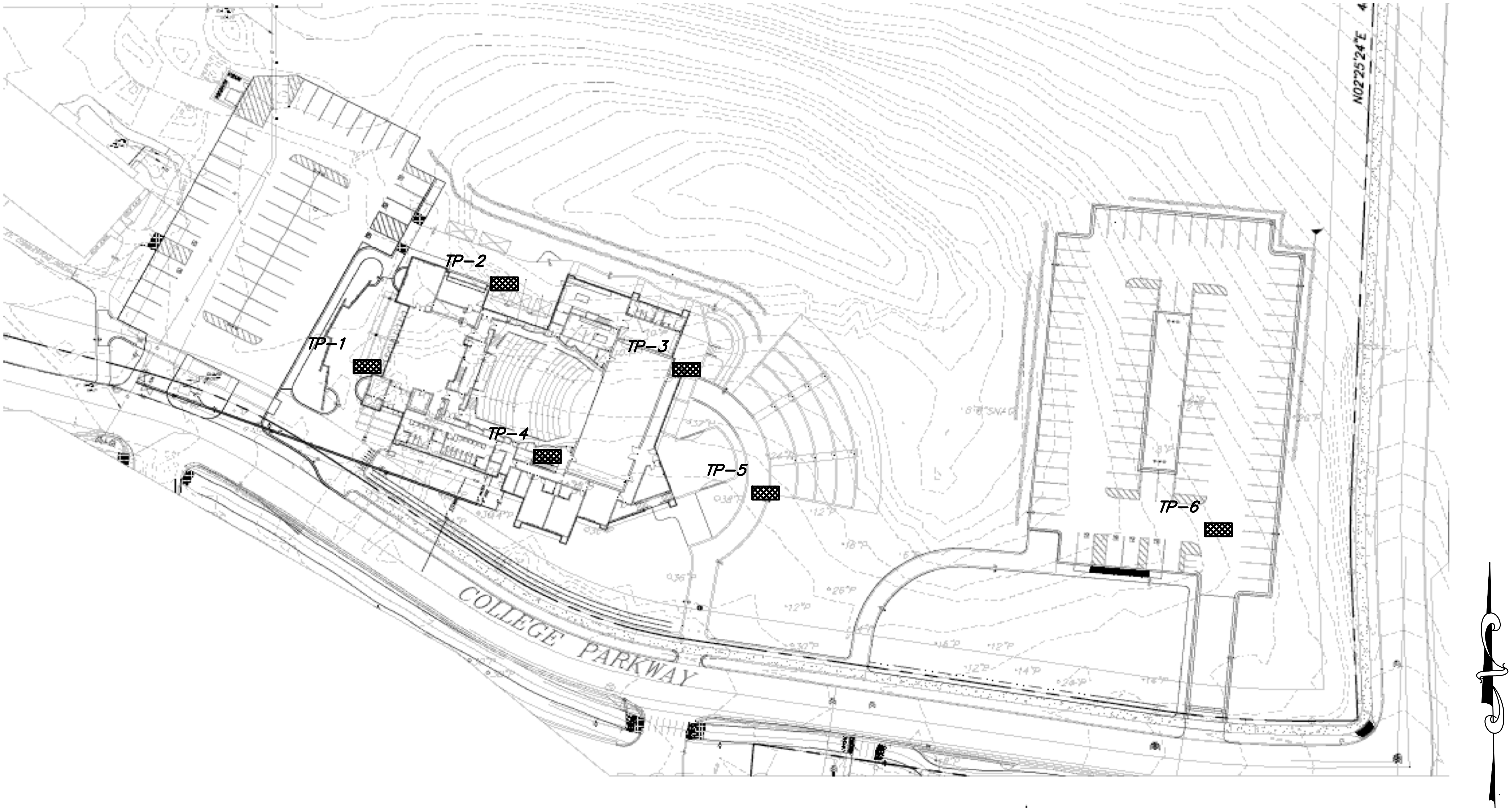
PROJECT: REGIONAL MAP MACC	
SCALE: NTS	DATE: 6/2019
DRAWING: FIGURE 1.DWG	DRAWN BY: JAA
JOB NO.: 3.31594	FIGURE: FIGURE 1

SIERRA GEOTECHNICAL SERVICES, INC.

NOT TO SCALE

SGS
SIERRA GEOTECHNICAL SERVICES, INC.

PROJECT: LOCATION MAP MACC	
SCALE: NTS	DATE: 6/2019
DRAWING: FIGURE 2.DWG	LAT/LONG: 37.6396,-118.9585
JOB NO.: 3.31594	FIGURE: FIGURE 2



LEGEND

TP-6 APPROXIMATE LOCATION OF EXPLORATORY TEST PIT

SIERRA GEOTECHNICAL SERVICES, INC.

PROJECT: SUBSURFACE GEOTECHNICAL MAP MACC	
SCALE: NTS	DATE: 6/2019
DRAWING: FIGURE 3.DWG	DRAWN BY: JAA
JOB NO.: 3.31594	FIGURE: FIGURE 3

APPENDIX A

EXPLORATORY TEST PIT LOGS

A subsurface field investigation was performed on May 15th, 2019 that included the excavation of six exploratory test pits with a Case Backhoe and 24-inch bucket. Exploratory test pits were selected over “borehole” drilling due to the large number of boulders observed at the surface and during other subsurface investigations conducted, near the site. Logs of the exploratory test pits are presented herein. The approximate locations of the exploratory test pits are shown on the Subsurface Geotechnical Map (Figure 3).

Bulk samples of the soils encountered were obtained during the field investigation for laboratory testing. Details of the laboratory testing are presented in Appendix B.

SIERRA GEOTECHNICAL SERVICES INC.
P.O. BOX 5024
MAMMOTH LAKES, CA 93546
760 937-4608

APPENDIX A

TEST PIT LOGS

JOB NO: 3.31594
DATE: 5/15/19

PROJECT: MACC
LOGGED BY: JA

TEST PIT	DEPTH (FT)	U.S.C.S. GROUP SYMBOL	SAMPLE DEPTH	PERCENT MOISTURE	DRY DENSITY (pcf)	DESCRIPTION
1	0 – 6”	SM				**TOPSOIL** Dark brown, loose, moist, silty, very fine SAND, minor organics.
	6” - 7	SM				**GLACIAL DEPOSITS** Reddish brown to grayish-brown, medium-dense to dense, moist, silty, very fine to coarse SAND, massive, few roots to 4’ below grade. -- *Total Depth = 7-feet. No groundwater encountered*
2	0 – 6”	SM				**TOPSOIL** Dark brown, loose, moist, silty, very fine SAND, minor organics.
	6” - 5	SM				**GLACIAL DEPOSITS** Dark brown to reddish-brown, medium-dense to dense, moist, silty, very fine to coarse SAND, moderate amounts of sub-rounded gravels, cobble clasts, and boulders to 36” diameter, massive. -- *Total Depth = 5-feet. No groundwater encountered.*

SIERRA GEOTECHNICAL SERVICES INC.
P.O. BOX 5024
MAMMOTH LAKES, CA 93546

APPENDIX A

TEST PIT LOGS

JOB NO: 3.31594 **PROJECT:** MACC
DATE: 5/15/19 **LOGGED BY:** JA

TEST PIT	DEPTH (FT)	U.S.C.S. GROUP SYMBOL	SAMPLE DEPTH	DRY PERCENT MOISTURE	DENSITY (pcf)	DESCRIPTION
						TOPSOIL
3	0 – 6”	SM				Dark brown, loose, moist, silty, very fine SAND, minor organics.
						GLACIAL DEPOSITS
	6” - 7	SM				Reddish brown, medium-dense to dense, moist, silty, very fine to coarse SAND, massive, few roots to 4’ below grade.
	7 - 10	SM				Dark gray, abundant cobbles and boulders to 24” diameter.
						Total Depth = 10-feet. No groundwater encountered.
						TOPSOIL
4	0 – 6”	SM				Dark brown, loose, moist, silty, very fine- to medium SAND, minor organics.
						GLACIAL DEPOSITS
	6”- 5	SM				Reddish brown to grayish-brown, medium-dense to dense, moist, silty, very fine to coarse SAND, massive, few roots to 4’ below grade.
	5 – 10	SM				Medium gray, moist, dense, silty, very fine to fine SAND and SILT. Small laminations.
	10					Cobbles and boulders to 36” diameter. Rock refusal.
						Total Depth = 10-feet. No groundwater encountered.

SIERRA GEOTECHNICAL SERVICES INC. **APPENDIX A**
P.O. BOX 5024
MAMMOTH LAKES, CA 93546

TEST PIT LOGS

JOB NO: 3.31594 **PROJECT:** MACC
DATE: 5/15/19 **LOGGED BY:** JA

TEST PIT	DEPTH (FT)	U.S.C.S. GROUP SYMBOL	SAMPLE DEPTH	DRY PERCENT MOISTURE	DENSITY (pcf)	DESCRIPTION
5	0 - 1	SM				**TOPSOIL** Dark brown, loose, moist, silty, very fine SAND, minor organics.
	1 - 5	SM				**GLACIAL DEPOSITS** Reddish brown, medium-dense to dense, moist, silty, very fine to coarse SAND, massive, few roots to 4' below grade. ---------- *Total Depth = 5-feet. No groundwater encountered.*
6	0 - 1	SM				**TOPSOIL** Dark brown, loose, moist, silty, very fine SAND, minor organics.
	1 - 4	SM				**GLACIAL DEPOSITS** Reddish brown, medium-dense to dense, moist, silty, very fine to coarse SAND, massive, few roots throughout. ---------- *Total Depth = 4-feet. No groundwater encountered.*

Notes: Abundant boulders (up to 10' diameter) at surface near TP-3, TP-5, and TP-6.

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed on the representative test samples to provide a basis for development of design parameters. Soil materials were visually classified in the field according to the Unified Soil Classification System (USCS). Laboratory tests were performed in general accordance with the American Society of Testing and Materials (ASTM) procedures. The results of our laboratory testing are presented herein. USCS classifications are presented on the test pit logs (Appendix A). Selected samples were tested for the following parameters:

Classification
Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488.

Gradation Analysis
Gradation analysis tests were performed on a selected representative soil sample in general accordance with ASTM D 422. These test results were utilized in evaluating the soil classifications in accordance with the USCS.

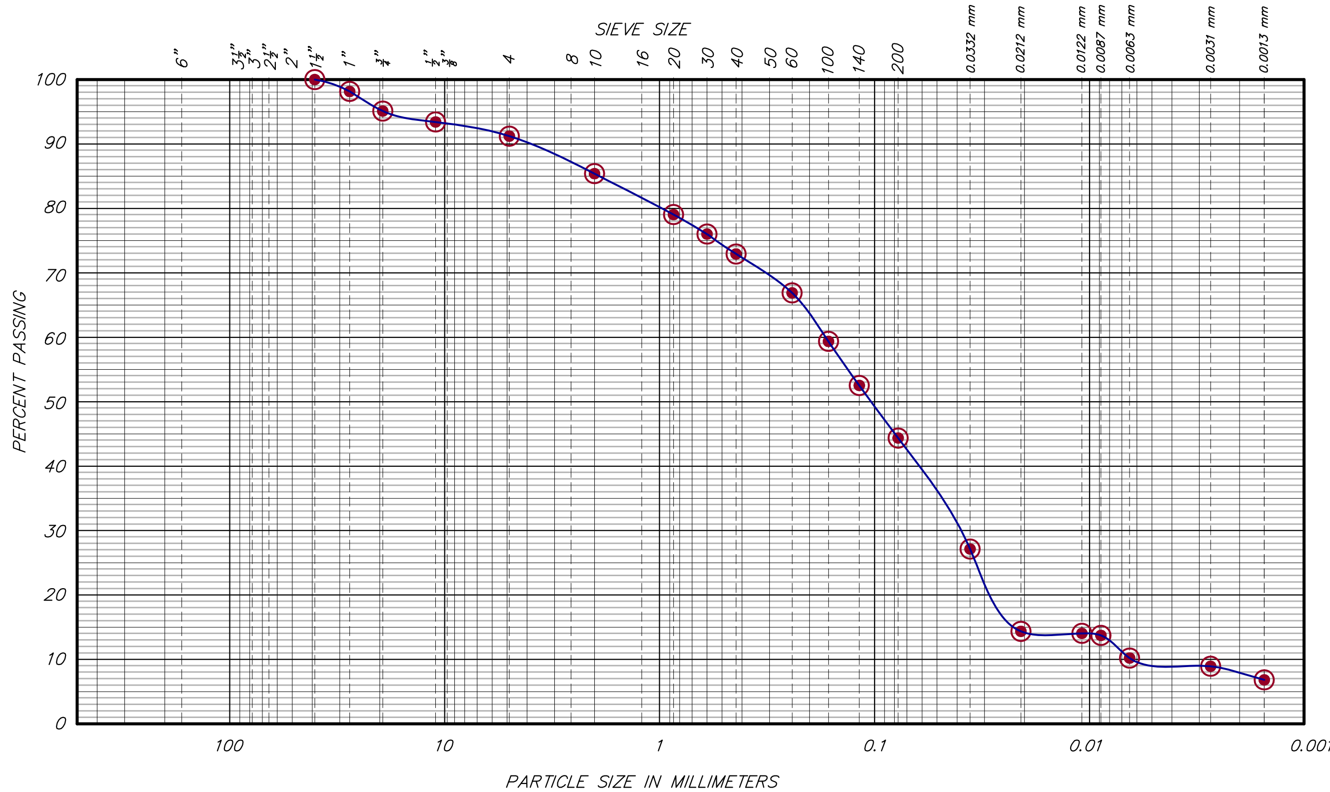
Direct Shear Test
Direct shear tests were performed on relatively undisturbed samples in general accordance with ASTM D 3080 to evaluate the shear strength characteristics of the selected materials.

Proctor Density Tests
The maximum dry density and optimum moisture content of selected representative soil samples were evaluated using the Modified Proctor method in general accordance with ASTM D 1557.

**Soil samples will be discarded 30 days after the date of this report unless this office receives a specific request and fee to retain the samples for a longer period.

PARTICLE SIZE DISTRIBUTION REPORT

PER ASTM TEST METHODS D2487 & D6913



% >3"	% GRAVEL		% SAND			% FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	4.9	4.0	5.8	12.5	28.6	44.3	n/a

SIEVE SIZE	PERCENT RETAINED	PERCENT PASSING	SPECIFIED PERCENT	PASS? (Yes or No)
1-1/2"	0	100		
1"	1.9	98.1		
3/4"	4.9	95.1		
1/2"	6.6	93.4		
No. 4	8.8	91.2		
No. 10	14.6	85.4		
No. 20	21.0	79.0		
No. 30	24.0	76.0		
No. 40	27.1	72.9		
No. 60	33.2	66.8		
No. 100	40.7	59.3		
No. 140	47.5	52.5		
No. 200	55.7	44.3		
0.0332 mm	72.9	27.1		
0.0212 mm	79.0	21.0		
0.0122 mm	85.0	15.0		
0.0087 mm	87.1	12.9		
0.0063 mm	91.1	8.9		
0.0031 mm	92.5	7.5		
0.0013 mm	93.5	6.5		

SOIL DESCRIPTION

Silty SAND

ATTERBERG LIMITS

PL = 0 LL = 0 PI = NP

COEFFICIENTS

D_{85}=	n/a	D_{60}=	0.16	D_{50}=	0.10
D_{30}=	0.038	D_{15}=	n/a	D_{10}=	0.0062
C_U =	n/a	C_C =	1.46		

CLASSIFICATION

USCS = SM AASHTO = n/a

REMARKS

Specific Gravity (per ASTM D854) = n/a

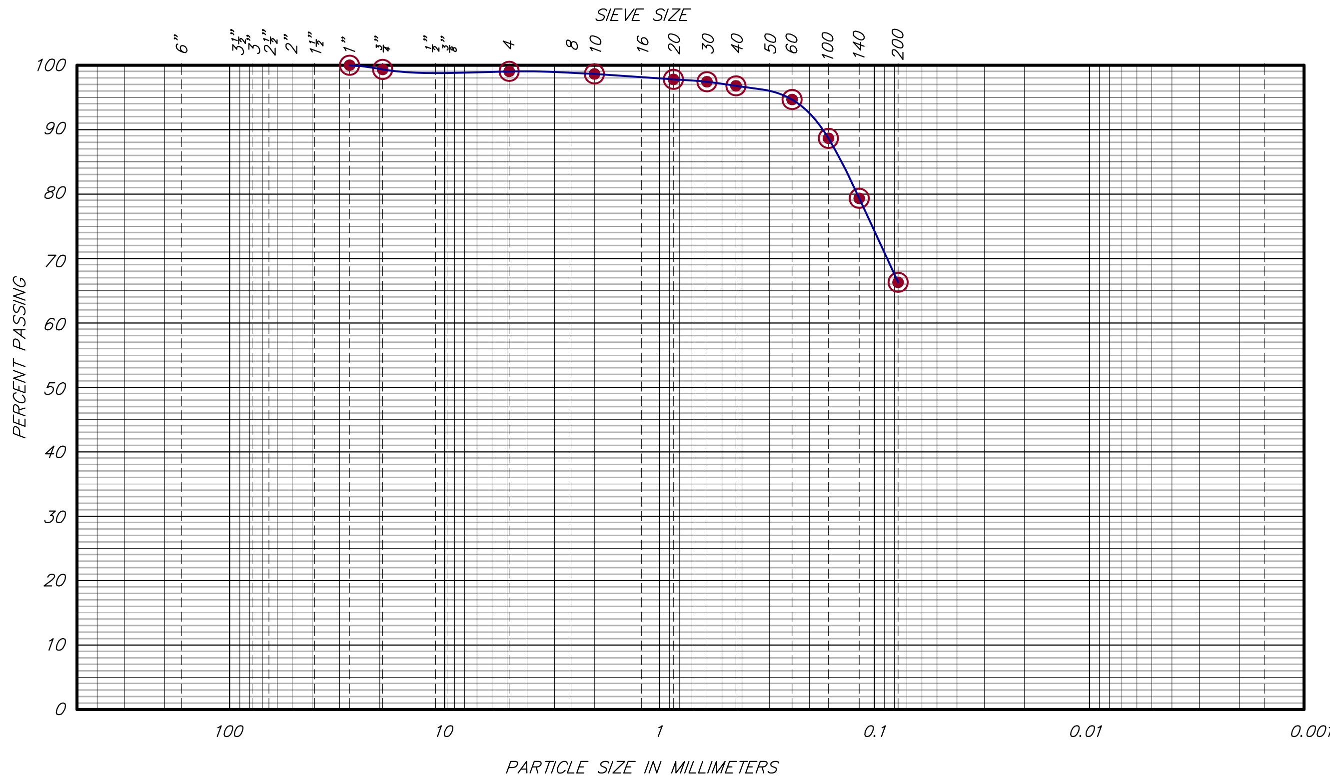
SIERRA GEOTECHNICAL SERVICES, INC.

ENVIRONMENTAL GEOTECHNICAL GEOLOGY GROUNDWATER MINING MATERIALS
873 NORTH MAIN STREET, SUITE 150, BISHOP, CALIFORNIA 93514
PO BOX 5024, MAMMOTH LAKES, CALIFORNIA 93546
www.sgsi.us

PROJECT: MACC Performing Arts Theatre	CLIENT: Mammoth Lakes Foundation
SAMPLE DEPTH: TP-1 at 2-4 feet deep	MATERIAL: Native Subgrade
SAMPLE DATE: 5/18/2019	TESTED BY: GC
JOB NO.: 3.31594	REVIEWED BY: DD/JA

PARTICLE SIZE DISTRIBUTION REPORT

PER ASTM TEST METHODS D2487 & D6913



% >3"	% GRAVEL		% SAND			% FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0.7	0.3	0.4	1.8	30.5	66.3	n/a

SIEVE SIZE	PERCENT RETAINED	PERCENT PASSING	SPECIFIED PERCENT	PASS? (Yes or No)
3-1/2"				
3"				
2-1/2"				
2"				
1-1/2"				
1"	0	100		
3/4"	0.7	99.3		
1/2"	–	–		
3/8"	–	–		
No. 4	1.0	99.0		
No. 8	–	–		
No. 10	1.4	98.6		
No. 16	–	–		
No. 20	2.2	97.8		
No. 30	2.6	97.4		
No. 40	3.2	96.8		
No. 50	–	–		
No. 60	5.3	94.7		
No. 100	11.3	88.7		
No. 140	20.7	79.3		
No. 200	33.7	66.3		

SOIL DESCRIPTION

Silt

ATTERBERG LIMITS

PL = 0 LL = 0 PI = NP

COEFFICIENTS

D_{85} = n/a D_{60} = n/a D_{50} = n/a

D_{30} = n/a D_{15} = n/a D_{10} = n/a

C_U = n/a C_C = n/a

CLASSIFICATION

USCS = ML AASHTO = n/a

REMARKS

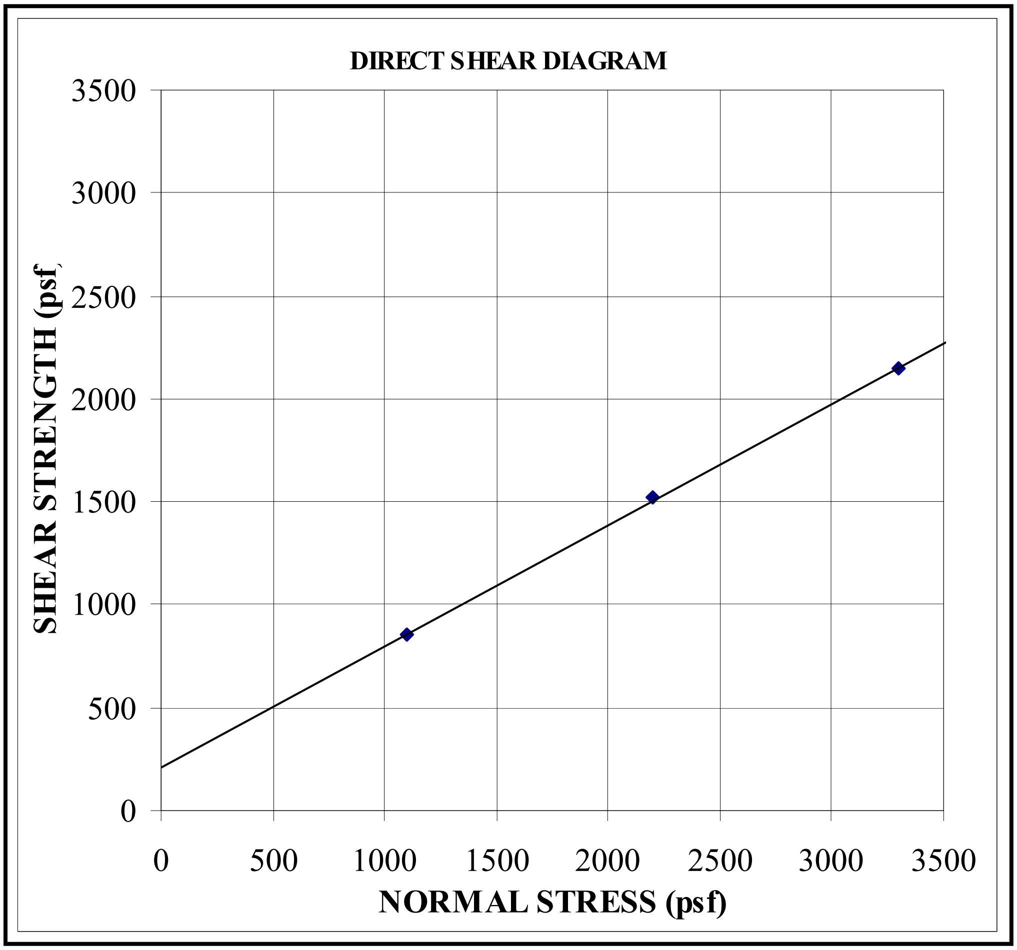
Specific Gravity (per ASTM D854) = n/a

SIERRA GEOTECHNICAL SERVICES, INC.

ENVIRONMENTAL GEOTECHNICAL GEOLOGY GROUNDWATER MINING MATERIALS
873 NORTH MAIN STREET, SUITE 150, BISHOP, CALIFORNIA 93514
PO BOX 5024, MAMMOTH LAKES, CALIFORNIA 93546
www.sgsi.us

PROJECT: MACC Performing Arts Theatre	CLIENT: Mammoth Lakes Foundation
SAMPLE DEPTH: TP-4 at 5-7 feet deep	MATERIAL: Native Subgrade
SAMPLE DATE: 5/18/2019	TESTED BY: GC
JOB NO.: 3.31594	REVIEWED BY: DD/JA

SIERRA GEOTECHNICAL SERVICES, INC.



Boring No: TP-1

Sample Depth: 3-4 feet

Friction Angle: 29 degrees

Cohesion: 225 psf

Dry Density: 94.4 pcf

Remolded to 90%

Date Tested: 5/2019

PROJECT: MACC

Project No. 3.31594

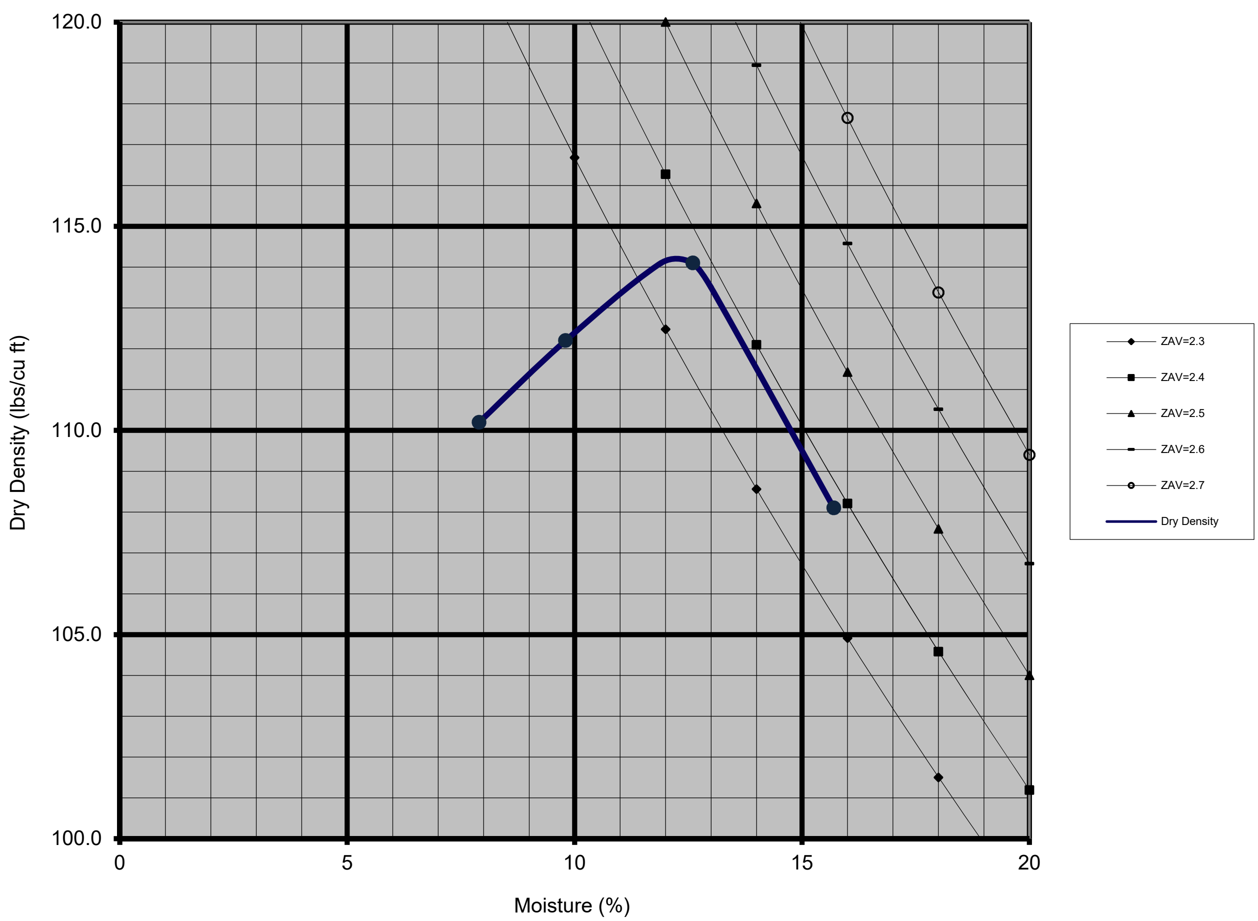
SIERRA GEOTECHNICAL SERVICES

GEOTECHNICAL • GEOLOGY • HYDROGEOLOGY • ENVIRONMENTAL • MINING • MATERIALS

Caltrans Lab #214 AMRL Lab #2460 CCRL Lab #2081 DSA LEA Lab #189

MAXIMUM DENSITY-MOISTURE CURVE (PROCTOR)

Project Name								Project No.	
MACC								3.31594	
Client								Deliver Date	
Mammoth Lakes Foundation								5/18/2019	
Material								Sampled By	Delivered By
Native Subgrade - Test Pit 1 at 2-4 feet deep								JA	JA
Proctor No	Test Date	Native	Belt Cut	Screen	Chute	Stockpile	Truck	Tested By	Reviewed By
1	5/20/19	X						GC	DD/JA



Laboratory Data:

Test #	Soil & Mold (lb)	Mold (lb)	Soil (lb)	Wet Density (pcf)	Percent Moisture	Dry Density (pcf)	Mold Volume (cf)	Max. Dry Density (pcf)	Optimum Moisture (%)
1	13.620	9.698	3.922	118.8	7.9	110.2	0.03300	114.1	12.2
2	13.765	9.698	4.067	123.2	9.8	112.2			
3	13.936	9.698	4.238	128.4	12.6	114.1		With Rock	
4	13.820	9.698	4.122	124.9	15.5	108.1		Correction	
								n/a	

Note: ZAV=Zero Air Voids per Specific Gravity of Soil Solids

Thomas A Platz, PE C41039

SIERRA GEOTECHNICAL SERVICES, INC.

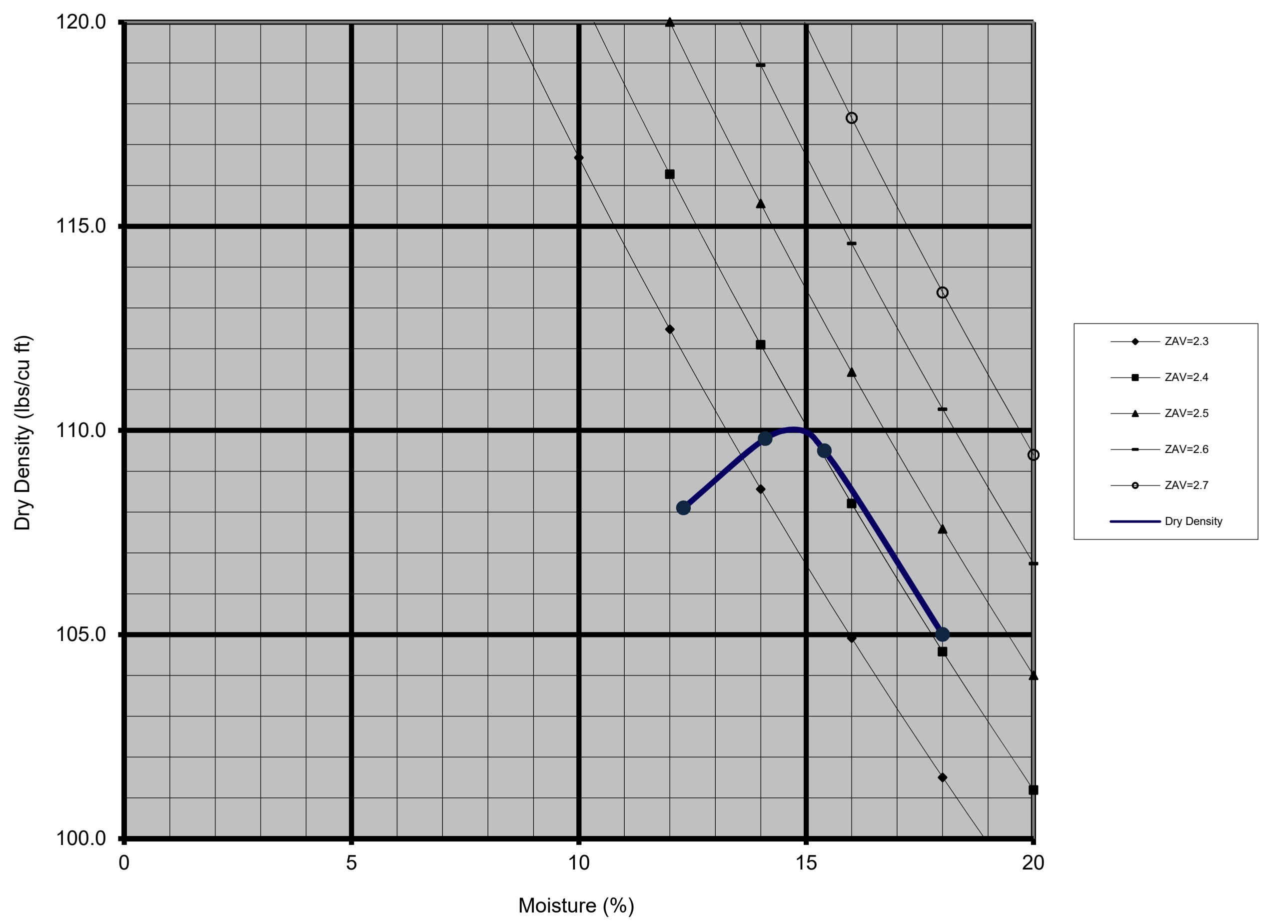
SIERRA GEOTECHNICAL SERVICES

GEOTECHNICAL • GEOLOGY • HYDROGEOLOGY • ENVIRONMENTAL • MINING • MATERIALS

Caltrans Lab #214 AMRL Lab #2460 CCRL Lab #2081 DSA LEA Lab #189

MAXIMUM DENSITY-MOISTURE CURVE (PROCTOR)

Project Name								Project No.	
MACC								3.31594	
Client								Deliver Date	
Mammoth Lakes Foundation								5/18/2019	
Material								Sampled By	Delivered By
Native Subgrade - Test Pit 4 at 5-7 feet deep								JA	JA
Proctor No	Test Date	Native	Belt Cut	Screen	Chute	Stockpile	Truck	Tested By	Reviewed By
2	5/22/19	X						GC	DD/JA



Laboratory Data:

Test #	Soil & Mold (lb)	Mold (lb)	Soil (lb)	Wet Density (pcf)	Percent Moisture	Dry Density (pcf)	Mold Volume (cf)	Max. Dry Density (pcf)	Optimum Moisture (%)
1	13.702	9.698	4.004	121.3	12.3	108.1	0.03300	110.0	14.9
2	13.834	9.698	4.136	125.3	14.1	109.8			
3	13.850	9.698	4.152	125.8	16.3	108.2		With Rock	
4	13.784	9.698	4.086	123.8	18.0	105.0		Correction	
								n/a	

Note: ZAV=Zero Air Voids per Specific Gravity of Soil Solids

Thomas A Platz, PE C41039

SIERRA GEOTECHNICAL SERVICES, INC.

APPENDIX C

GENERAL EARTHWORK AND GRADING

These general earthwork and grading specifications are for the grading and earthwork shown on the approved grading or construction plan(s) and/or indicated in the geotechnical report(s). Earthwork and grading should be conducted in accordance with applicable grading ordinances, the current California Building Code, and the recommendations of this report. The following recommendations are provided regarding specific aspects of the proposed earthwork construction. These recommendations should be considered subject to revision based on field conditions observed by the geotechnical consultant during grading.

Geotechnical Consultant of Record

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

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

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

The Earthwork Contractor

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

Site Preparation

General: Site preparation includes removal of deleterious materials, unsuitable materials, and existing improvements from areas where new improvements or new fills are planned. Deleterious materials, which include vegetation, trash, and debris, should be removed from the site and legally disposed of off-site. Unsuitable materials include loose or disturbed soils, undocumented fills, contaminated soils, or other unsuitable materials. The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1-percent of organic materials (by volume). Nesting of the organic materials shall not be allowed.

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

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

Any existing subsurface utilities that are to be abandoned should be removed and the trenches backfilled and compacted. If necessary, abandoned pipelines may be filled with grout or slurry cement as recommended by, and under the observation of, the Geotechnical Consultant.

Excavation

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

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

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

Compaction

The onsite soils are suitable for placement as compacted fill provided the organics, oversized rock (greater than 6-inches in diameter) and deleterious materials are removed. Rocks greater than 6-inches and less than 2-feet in diameter can be placed in the bottom of deeper fills or approved areas provided they are selectively placed in such a manner that no large voids are created. All rocks shall be placed a minimum of 4-feet below finish grade elevation unless used for landscaping purposes. Any import soils shall be tested for suitability in advance by the project Geotechnical Engineer.

After making the recommended removals prior to fill placement, the exposed ground surface should be scarified to a depth of approximately 8-inches, moisture conditioned as necessary, and compacted to at least 90-percent of the maximum dry density obtained using ASTM D1557 as a guideline. Surfaces on which fill is to be placed which are steeper than 5:1 (Horizontal to vertical) should be benched so that the fill placement occurs on relatively level ground.

For the parking areas and other improvements a one-foot removal is recommended depending on site conditions (i.e. depth of root zone, and depth of disturbance which may have locally deeper removal depths). The removal bottom should be observed (tested as needed) by the geotechnical consultant prior to placing fill soils. The upper 12-inches of subgrade material along with the Class II Aggregate Base and the Asphaltic concrete shall be compacted to a minimum of 95-percent of the materials maximum dry density as determined by ASTM D1557. The subgrade and aggregate base shall be moisture-conditioned and compacted to 95-percent of the material's maximum dry density as determined by ASTM D-1557 to a depth of 12-inches.

All fill and backfill to be placed in association with the proposed construction should be accomplished slightly over optimum moisture content using equipment that is capable of producing a uniformly compacted product throughout the entire fill lift. Fill materials at less than optimum moisture should have water added and the fill mixed to result in material that is uniformly above optimum moisture content. Fill materials that are too wet can be aerated by blading or other satisfactory methods until the moisture content is as required. The wet soils may be mixed with drier materials in order to achieve acceptable moisture content.

The fill and backfill should be placed in horizontal lifts at a thickness appropriate for equipment spreading, mixing, and compacting the material, but generally should not exceed 8-inches in loose thickness. Retaining wall backfill shall be composed of a granular material (maximum ≤ 3-inch rock) with an expansion index (EI) of no greater than 50 and a sand equivalent (SE) greater than 30.

No fill soils shall be placed during unfavorable weather conditions. When work is interrupted by rains or snow, fill operations shall not be resumed until the field tests by the geotechnical engineer indicate that the moisture content and density of the fill are as previously specified.

Slopes

All slopes shall be compacted in a single continuous operation upon completion of grading by means of sheepsfoot or other suitable equipment, or all loose soils remaining on the slopes shall be trimmed back until a firm compacted surface is exposed. Slope compaction tests shall be made within one foot of slope surface.

Cut and fill slopes shall be a maximum of 2:1 (horizontal to vertical) unless approved by the Geotechnical Consultant.

Planting and irrigation of cut and fill slopes and/or installation of erosion control and drainage devices should be completed due to the erosion potential of the soil.

Temporary Excavations

Temporary excavation shall be made no steeper than 1:1 (horizontal to vertical). The recommended slope for temporary excavations does not preclude local raveling and sloughing. Where wet soils are exposed, flatter excavation of slopes and dewatering may be necessary. In areas of insufficient space for slope cuts, or where soils with little or no binder are encountered, shoring shall be used.

All large rocks exposed above temporary cuts shall be removed prior to foundation excavation. In addition any rocks exposed during development from raveling and sloughing should be removed immediately.

All excavations should comply with the requirements of the California Construction and General Industry Safety Orders and the Occupational Safety and Health Act and other public agencies having jurisdiction.

Trench Backfill

Exterior trenches, paralleling a footing and extending below a 1:1 plane projected from the outside bottom edge of the footing, shall be compacted to a minimum of 95-percent per ASTM D1557. All trenches in structural areas and under concrete flatwork shall be compacted to a minimum of 95-percent per ASTM D1557. All trenches in non-structural areas shall be compacted to a minimum of 85-percent per ASTM D1557.

All material used for trench backfill shall be approved by the Geotechnical Engineer prior to placement. All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1-foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 95-percent of maximum from 1-foot above the top of the conduit to the surface.

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

Regulations of the governing agency may supersede the above, and all trench excavations should conform to all applicable safety codes. The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations.