SIERRA GEOTECHNICAL SERVICES, INC.

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February 4, 2021 Project No. 3.30496.5

Mammoth Springs Resorts LLC
223 E Thousand Oakes Blvd, Suite 412
Thousand Oaks, California 91360

Subject: **PRELIMINARY GEOTECHNICAL INVESTIGATION**
The Villas at Obsidian - Phase 3
LLA PAR 1 LLA 19-002; 4.07-Acres, APN 033-330-087
Mammoth Lakes, California

Submitted herein are the results of our preliminary geotechnical investigation for the proposed thirty-four-unit multi-family residential project to be constructed at the subject site. The purpose of this study was to assess the geotechnical constraints to development and provide geotechnical recommendations relative to the future development of the proposed project.

Based upon our field and laboratory investigation, engineering analyses and professional judgment, it is our opinion that the site is suitable for construction provided the recommendations included within this report are incorporated into the design and construction. The primary geologic and geotechnical constraint to development of the subject property is the potential seismic hazard associated with ground shaking from nearby regional faults.

As part of this study SGSI reviewed the Conceptual Grading and Drainage plan prepared by Triad/Holmes Associates, dated February 2nd, 2021 for the project. Foundation plans however were unavailable. SGSI should review foundation plans prior to construction to assure 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 and 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 (exp 3/31/21)

Thomas A. Platz
PE C41039 (exp 3/31/21)

PRELIMINARY GEOTECHNICAL INVESTIGATION

THE VILLAS AT OBSIDIAN - PHASE 3

Mammoth Lakes, California

prepared for:

Mammoth Springs Resorts LLC.
223 E Thousand Oakes Blvd, Suite 412
Thousand Oaks, California 91360

By:

Sierra Geotechnical Services, Inc.
P.O. Box 5024
Mammoth Lakes, California 93546

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www.sgsi.us

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1. PURPOSE AND SCOPE

This report presents the results of our preliminary geotechnical investigation for the proposed thirty-four-unit multi-family project to be constructed within the approximate 4.07-acre parcel subject parcel (Figure 1). 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 structures; evaluate data relative to site geologic and seismic hazards; evaluate data relative to foundation design; and provide conclusions and 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 ten exploratory test pits. 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 subject property is located at 100 Callahan Way in Mammoth Lakes, California. More specifically the 4.07-acres site is bounded by the Sierra Star Golf Course to the west, San Joaquin Villas to the north, Sierra Valley sites to the east, and Obsidian development to the south (Figure 1). The Assessor's Parcel Number is 033-330-087. Site coordinates toward the middle of the site are 37.6466, -118.9780. The site is undeveloped, and topography is relatively flat to slightly sloping. Site slopes vary from 7 to 11-percent. Vegetation includes scattered pine trees and some small scrub and sage brush.

3. PROPOSED DEVELOPMENT

It is our understanding that the proposed project may include the construction of thirty-four, multi-level units (18 building) with attached garages, paved driveways, a 24-foot-wide paved road, and typical utility infrastructure. Foundations will likely consist of concrete perimeters and interior piers. Grading is expected to be minor with buildings set at or near existing grade. maximum cuts and fills are ≤ 5-feet.

SGSI should review final foundation plans prior to construction to assure 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 photographs did not show any evidence of lineation's, scarps, or other ground-surface fault, landslide, or avalanche related features.

5. GEOLOGIC AND GEOTECHNICAL SITE CONSTRAINTS

Geotechnical constraints to development include the potential for moderate to severe ground shaking along the nearby faults; notably the Hartley Springs fault located approximately 1.25-mi west of the subject site, and the Hilton Creek fault located 2.8-miles to the east. In addition, the property is located within an active volcanic area. Figure 2 shows the site relative to the regional faults and volcanic hazards.

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 proximally to the east flank of Mammoth Mountain, which straddles the southwest rim of the Long Valley caldera. Mammoth Mountain was built by a series of approximately 25 separate eruptive episodes between

100,000 and 51,000 years ago. These eruptions created at least 12 overlapping volcanic domes which consist of flows and pyroclastic deposits.

6.1 Subsurface Exploration

Our subsurface exploration was conducted on January 18th, 2021 and consisted of excavation, logging, and sampling of ten exploratory test pits within the proposed development areas. Bulk soil samples were obtained from the excavations at selected intervals. The samples were then transported to our in-house geotechnical laboratory for testing. Logs of the subsurface conditions encountered in the exploratory test pits are provided in Appendix A. The approximate location of the test pits is shown on the Subsurface Geotechnical Map (Figure 3). Details of the laboratory testing are presented in Appendix B.

The site is underlain by very shallow granular topsoil (≤ 3-feet thick) and granular pyroclastic deposits with abundant subangular rock fragments. The pyroclastic deposits are considered suitable for the support of foundations and/or fill provided the foundation and earthwork recommendations included herein are incorporated during construction.

6.2 Groundwater

Groundwater seepage was not encountered during this field investigation and groundwater is known to be greater than 100-feet in depth below the site (Howle, J.F., and C.D. Farrar, 2001). Groundwater seepage may however be encountered during construction as well as after construction as a result of snowmelt runoff, rainfall, and/or landscape irrigation. To mitigate against any seepage, a perimeter subdrain should be installed surrounding the structure in accordance the recommendations included in Section 19.1 of this report.

Subsurface strata which would retard the flow of water downward were not observed during the investigation.

7. FAULTING

Our discussion of faults on the site is prefaced with a discussion of California legislation and state policies concerning the classification and land-use criteria associated with faults. By definition of the California Geological Survey, an "active fault" is a fault that has had surface displacement within Holocene time (about the last 11,000 years); hence constituting a potential hazard to structures that might be located across it. This definition is used in delineating Earthquake Fault Zones as mandated by the Alquist-Priolo Geologic Hazards Zones Act of 1972, which is detailed in the California Geological Survey Special Publication SP-42 (Hart and Bryant, 1999). The intent of this act is to assure that unwise urban development does not occur across the traces of active faults. Based on our review, the site is **not** located within any "Earthquake Fault Zones" or Alquist-Priolo Hazard Zones as identified in this document. Recent faulting (surface rupture less than 11,000 years ago) and historic faults (surface rupture less than 200 years ago) are located regionally near the site. The closest active fault to the site is the Hartley Springs and Hilton Creek fault zones. Brief descriptions of these fault zones are included herein.

7.1 Hartley Springs Fault Zone

The nearest splay of the Hartley Springs fault is located 1.25-mi west of the subject site. The Hartley Springs fault is a significant high-angle, down-to-east normal fault along the eastern front of central Sierra Nevada, extending from the Mono Craters ring-fracture system into Long Valley caldera.

Although no detailed studies have been conducted along the Hartley Springs fault zone, the offset of several middle Pleistocene to latest Holocene deposits have been measured (Bailey and others, 1976; Clark and others, 1984; Bryant, 1984). Significant spatial and temporal variability in slip rates (Bryant, 1984), rate may have increased during middle Pleistocene (following Bishop tuff eruption) and decreased during late Pleistocene. Estimates of vertical slip-rate range from 0.15 mm/yr (Clark and others, 1984) to 0.4 mm/yr (Kistler, 1966 #5580; in Bryant, 1984).

7.2 Hilton Creek Fault Zone

The nearest splay of the Hilton Creek fault is located 2.8-mi east of the subject site. The Hilton Creek 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 37.6466, -118.9780 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. The site class is based upon visual observations and excavation characteristics of the soils from the exploratory test pits.

TABLE I

SEISMIC PARAMETER (ASCE 7-16)	RECOMMENDED VALUE
Risk Category	II
Site Class	D – Stiff Soil
F_a	1.0 g
S_S	1.597 g
S_1	0.513 g
S_{MS}	1.597 g
S_{DS}	1.065 g
PGA/ PGA_M	0.682/0.75 g

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 Association of Structural Engineers 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 avalanches (rockfall and snow). 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.

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 very low due to the minor presence of potentially compressible soils within the upper few feet of material 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 or foundations embedded below these soils, as per the removal and earthwork recommendations provided herein.

9.3 Liquefaction

Liquefaction of cohesionless soils can be caused by strong vibratory motion due to earthquakes. Research and historical data indicate that loose granular soils below a near-surface groundwater table are most susceptible to liquefaction. Liquefaction is characterized by a loss of shear strength in the affected soil layers, thereby causing the soil to behave as a viscous liquid. This effect may be manifested at the ground surface by settlement and, possibly, sand boils where insufficient confining overburden is present over layers.

The project site is not located within any areas zoned for liquefaction hazards by local/state jurisdictions. The potential for liquefaction is not a design consideration given the lack of a static or perched water table and the relatively dense nature of bearing soils on-site. Further, the potential for ground failures associated with liquefaction, i.e post liquefaction reconsolidation, and sand boils, is also not a consideration.

9.4 Dynamic Settlement

Portions of the shallow granular on-site soils may be loose and susceptible to dynamic settlement if strongly shaken by the design level earthquake. The potential for dynamic settlement will be greatly reduced if the loose and compressible soils near the surface are removed and properly compacted or foundation extended into competent glacial deposits observed at depth. The potential for dynamic settlement in the underlying Pyroclastic deposits is very low.

9.5 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.

10. LANDSLIDES

The project site is not located within any areas 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 Town of Mammoth Lakes sits within an active volcanic area. The most significant potential sources of volcanic activity are the Mono-Inyo Craters and the resurgent dome within the Long Valley caldera.

Future eruptions in the Mammoth Lakes area are certain to occur, but they can be neither reliably predicted nor prevented. The odds of an eruption occurring in any given year are very low. 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.

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 test pits. 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 Hazards areas map (Map No 06051C1388D, 2012) the site is located within Zone X - Area of Minimal Flood Hazard.

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 with minor fines and gravels. Based on these findings, there is a very low shrink/swell potential at the site.

15. ASBESTOS

Naturally occurring Asbestos is not present in the project area.

16. RADON

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 and therefore a Radon specialist should be consulted. A passive mitigation system may need to be incorporated during construction.

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, landslides, or active faulting on the site was not encountered. Seismic hazards at the site may be caused by ground shaking during seismic events on regional active faults.

- 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 very low.

- Based upon our subsurface investigation, the building area is underlain by up to approximately 3-feet of loose and heavy rooted soils underlain by competent volcanic pyroclastic deposits.

- The depth and extent of the unsuitable soils is based upon the areas observed during the field investigation. It should be anticipated that the overall depth and extent of the unsuitable materials exposed during construction may vary from that encountered.

- Groundwater was not encountered within the excavations. Minor to moderate amounts of seepage may be encountered if the site is graded during the peak snowmelt runoff period between April and July. Temporary “nuisance” groundwater may reach depths seasonally whereby it should be intercepted by a permanently installed sub drains or perimeter footing drain systems.

- Subsurface strata which would retard the flow of water downward were not observed during the investigation.

- Reasonably continuous construction observation and review during site grading and foundation installation allows for evaluation of the actual soil conditions and the ability to provide appropriate revisions where required during construction.

- This study did not include an environmental review of the Site area.

18. RECOMMENDATIONS

The following sections provide preliminary geotechnical design recommendations which should be implemented during site development to mitigate site geologic constraints. Implementation of the recommendations included within this report and adherence to the CBC, does not however preclude property damage during or following a natural hazard.

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 Geotechnical Review

Geotechnical review is of paramount importance in engineering practice. The poor performance of many foundation and earthwork projects has been attributed to inadequate construction review. SGSI should be provided the opportunity to review the following items or we waive all liability for any and all geotechnical issues associated with grading or construction relative to the subject site.

18.1.1 Plan and Specification Review

Neither structural plans or final grading plans were available at the time of this report. SGSI should review these plans prior to construction to assure that they are in conformance with this report; some of the recommendations contained herein may need to be revised after reviewing.

18.2 General Earthwork

Earthwork should be performed in accordance with the General Earthwork and Grading Specifications in Appendix C and the following recommendations. 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.

18.3 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.

18.4 Remedial Earthwork

Site grading and excavation should be observed by SGSI. Such observations are considered essential to identify field conditions that 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, slope work, temporary excavations, and trench backfill are provided in Appendix C.

Up to approximately 3-feet of loose and heavy rooted soils, considered unsuitable for the support of new fill or structural loads, were observed on-site. These soils shall be over-excavated and removed from within all structural areas. Excavations should extend to a minimum horizontal distance of at least 3-feet outside any building footprints. Removals and compaction recommendations are provided in Appendix C.

Cut/fill transitions shall not be allowed below foundation elements. If this will occur, we recommend that all footings be deepened to extend into uniform competent native soils, and that all soils below interior concrete slabs be undercut/removed so that slabs will be supported on an at least a 2-foot-thick compacted fill mat. As an alternative to the 2-foot fill mat, the slab may be designed to accommodate for differential settlements which conservatively speaking may be 1” static over 30’.

For paved roadways, driveway, parking areas, and other improvements, a 1 to 2-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 should also extend a minimum horizontal distance of 2-feet beyond the back of curbs and pavement. Removals and compaction recommendations are provided in Appendix C.

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 of the laboratory maximum dry density per ASTM D 1557.

18.5 Preliminary Foundation Preparation and Design

The following preliminary recommendations are presented as minimum design recommendations; they are not intended to supersede design by the structural engineer. Preliminary foundations should be designed in accordance with structural considerations and the following recommendations. Upon the completion of the grading and structural plans, SGSI should review the foundation loads and embedment in order to confirm the implementation of the recommendations herein.

Continuous or pad footings may be used to support the proposed structures provided they are founded entirely upon either properly compacted fill, or competent volcanic 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 load and frequently applied live loads.

TABLE II

Allowable Soil Bearing Pressure (psf)	Lateral Resistance (psf/ft)	Friction Coefficient
3,000	300	0.35

The allowable pressure may be increased by one-third when considering transient loads such as wind or seismic forces. Continuous and isolated footings should be designed in accordance with the structural engineer requirements.

Required reinforcement shall be determined by the structural engineer.

18.6 Lateral Earth Pressures and Resistance

Retaining walls should be designed using a triangular distribution pressure. 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. Wall footings shall be embedded in competent native soils.

TABLE III

Slope of Backfill Behind Retaining Wall	Equivalent Fluid Pressure Active Pressure non restrained (psf/ft)	Equivalent Fluid Pressure At-Rest Pressure restrained walls (psf/ft)
Level	30	45
2:1 Slope	45	60

Passive Resistance – 300 psf/ft;
Coefficient of friction against sliding - 0.35
Soil Unit Weight - 110 pcf

The passive resistance and coefficient of friction may be used in combination if there is a fixed structure, such as a floor slab over the toe of the retaining wall. If the two values are used in combination, the passive resistance value should be reduced by one-third.

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 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.

18.6.1 Dynamic 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 acceleration is taken as equal to 2/3rds the maximum expected ground acceleration.

For this project the site specific PGA_M is 0.75g. The effective ground surface acceleration is therefore 0.50g. Considering a soil unit weight of 110 pcf, we recommend an additional fluid pressure of 41 pcf (added to the pressures shown in Table III) 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.

18.7 Wall Drainage

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, overlain (Mel-Rol, Bituthene or eq) 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.

18.8 Anticipated Static Settlement

The total settlement of the conventional foundations bearing into competent native deposits is anticipated to be less than ½-inch. Differential settlement on the order of ½-inch over a horizontal span of 30-feet should be expected for any compacted fills over formational materials.

18.9 Foundation Construction

Based upon our observations and past experience relative to the general site area, very low expansive soils exists onsite. The following preliminary recommendations assume very low to low expansive soils near finish pad grade.

- Footings should be designed in accordance with the structural engineer requirements. Exterior and interior foundations shall be founded within compacted fill or competent native soils.

- Exterior foundations shall have a minimum embedment depth of 24-inches below outside adjacent grade. Interior foundations shall have a minimum embedment depth of 12-inches below outside adjacent grade.

- All footing excavations should be observed by a representative of SGSI prior to placement of reinforcing steel, in order to assure 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 of the material's maximum dry density.

- 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 of the laboratory maximum dry density per ASTM D1557.

- 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.

18.10 Foundation Setback

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.

18.11 Concrete Slab-on-Grade Floors

Interior: Building slabs may be supported either on-grade by compacted fill or competent native deposits. Subgrade soils should have a very low expansion potential (EI < 20). Slabs should be designed for anticipated loading. For design of concrete slab-on-grade floors and estimating their deflections, a modulus of subgrade reaction (Ks) of 250 pci may be used for native soils, and 150 pci re-compacted materials.

Slab thickness, control joints, and reinforcement shall meet the requirements of the Structural Engineer of record. Concrete slabs should be underlain by a vapor barrier/retarder (Stego Wrap or equivalent - 10 mil minimum thickness), which is in turn, underlain by a single layer of filter fabric (Mirafi) over a 4-inch layer of ¾" crushed stone. The filter fabric will help protect the vapor barrier from puncture. 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 manufacturers 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. Flatwork should be reinforced with at minimum #3 rebar placed at slab mid-height on 24-inch centers, both ways. 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.

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.

18.12 Preliminary Pavement Recommendations

For preliminary planning purposes SGSI recommends the following pavement sections.

TABLE IV

Traffic Index	Pavement Section
≤ 5	3-in Asphalt Concrete / 4-in Class II Aggregate Base
≥ 7	4-in Asphalt Concrete / 6-in Class II Aggregate Base

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. 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.

18.13 Construction Considerations

Excavations will be required to construct footings and retaining walls, install utilities, and to remove locally weak or unsuitable soils. All excavations that will be deeper than 4-feet and will be entered by workers should be shored or sloped for safety in accordance with Occupational Safety and Health Administration (OSHA) standards.

Upon making the excavations, the soil classifications and excavation performance should be evaluated in the field by the geotechnical consultant on a case-by-case basis in accordance with the OSHA regulations. For trench or other excavations, OSHA requirements regarding personnel safety should be met using appropriate shoring (including trench boxes) or by laying back the slopes to no steeper than 1:1 in native deposits. Temporary excavations that encounter seepage may be shored or stabilized by placing sandbags or gravel along the base of the seepage zone. Excavations encountering seepage should be evaluated on a case-by-case basis. On-site safety of personnel is the responsibility of the contractor.

Excavation spoils should not be stockpiled adjacent to excavations as they can surcharge the soils and trigger failure. In addition, proper erosion protection, is recommended to reduce the possibility for erosion of slopes during grading and building construction. Ultimately, it is the contractor's responsibility to maintain safe working conditions for persons on-site.

If earthwork is performed during the dry season, moisture conditioning will be required to raise the in-situ moisture contents to near optimum moisture content (per ASTM D1557). If earthwork is performed during or shortly after wet weather conditions, the moisture content of the onsite soils could be appreciably above optimum. Consequently, subgrade preparation and fill placement may be difficult.

Additional recommendations for wet weather construction can be provided at the time of construction, if required.

19. DRAINAGE

Roof, pad, and slope drainage should be diverted away from slopes and structures to suitable discharge areas by non-erodible devices (e.g., gutters, downspouts, concrete swales, etc.). Positive drainage adjacent to structures should be established and maintained. Positive drainage may be accomplished by providing drainage away from the foundations of the structure at a gradient of 5-percent or steeper for a distance of 10-feet or more outside the building perimeter, or 2-percent or steeper for a distance of 10-feet or more outside the building perimeter if paved. Drainage should be further maintained by a graded swale leading to an appropriate outlet, in accordance with the recommendations of the project civil engineer and/or landscape architect. Surface drainage on the site should be provided so that water is not permitted to pond. A gradient of 2-percent or steeper should be maintained over the pad area and drainage patterns should be established to divert and remove water from the site to appropriate outlets.

19.1 Sub-drainage

Groundwater seepage may be encountered during construction as well as after construction as a result of snowmelt runoff, rainfall, and/or landscape irrigation. In an effort to mitigate against any seepage, a perimeter subdrain should be installed surrounding the structure in accordance with the following recommendations:

- A 4-inch PVC or SDR 35 perforated pipe encapsulated within 12-inches of "clean" ¾ to 1-inch crushed aggregate, wrapped with filter fabric, should be placed at/or within 6-inches below the bottom of the continuous building perimeter footings.

- The maximum lateral distance away from the bottom of the footing, should be no greater than 12-inches.

- The pipe should outlet away from the building perimeter via a 4-inch non-perforated PVC "tight-line". The tight-line should be outlet into an approved drainage device.

- Gradient of pipe flow should be maintained at a minimum of 1-percent. Following placement, the pipe should be field surveyed to ensure proper gradient of flow.

20. QUALITY CONTROL

The recommendations in this report are based on limited subsurface information. The nature and extent of variation across the site may not become evident until construction. If variations are exposed during construction, it may be necessary to re-evaluate our recommendations.

In addition, the recommendations presented herein assume that sufficient field testing and construction review will be provided during all phases of construction. We should review the final plans and specifications to check for conformance with the intent of our recommendations.

21. LIMITATIONS

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. 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.

22. <u>REFERENCES</u>

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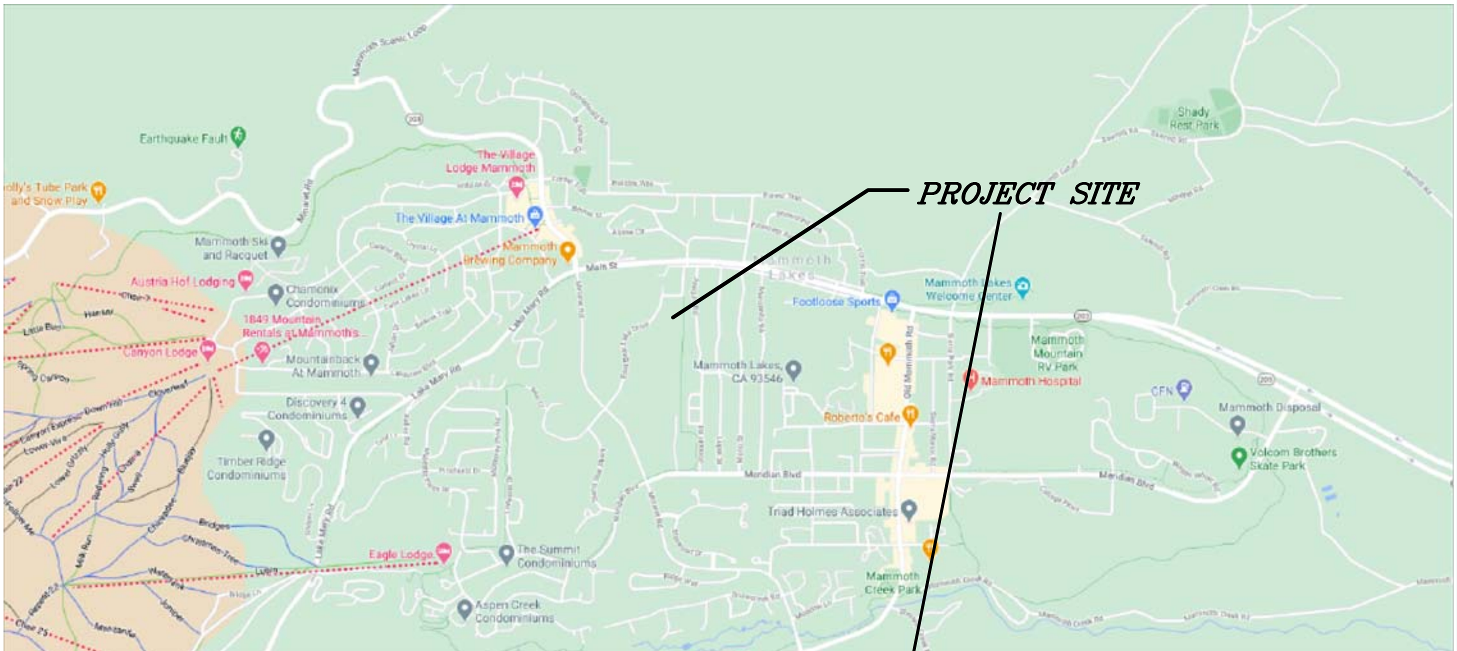
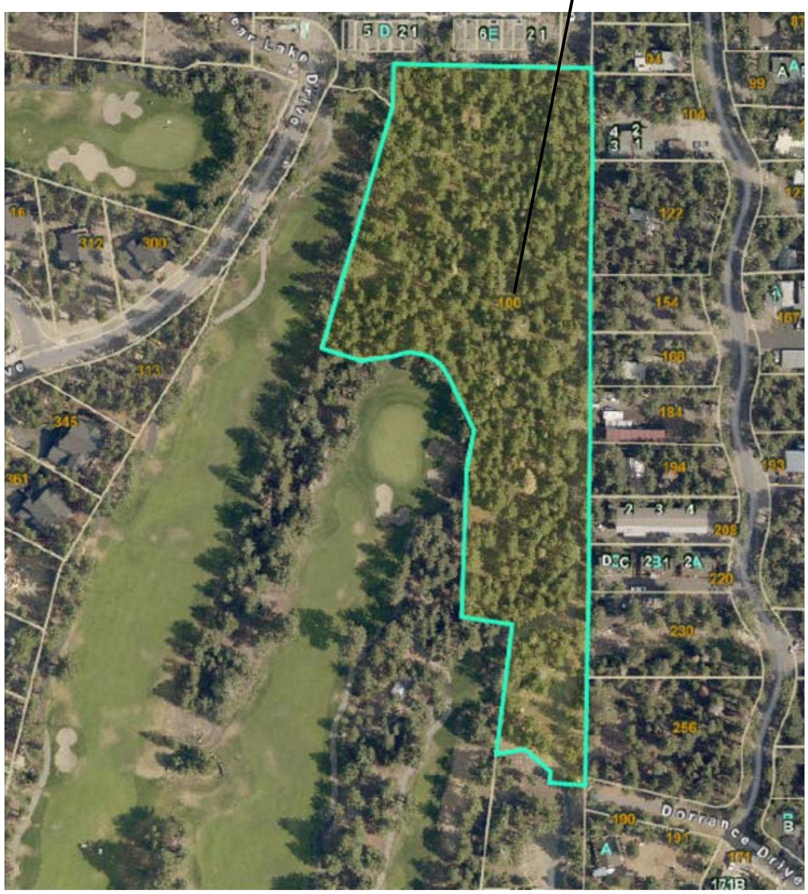
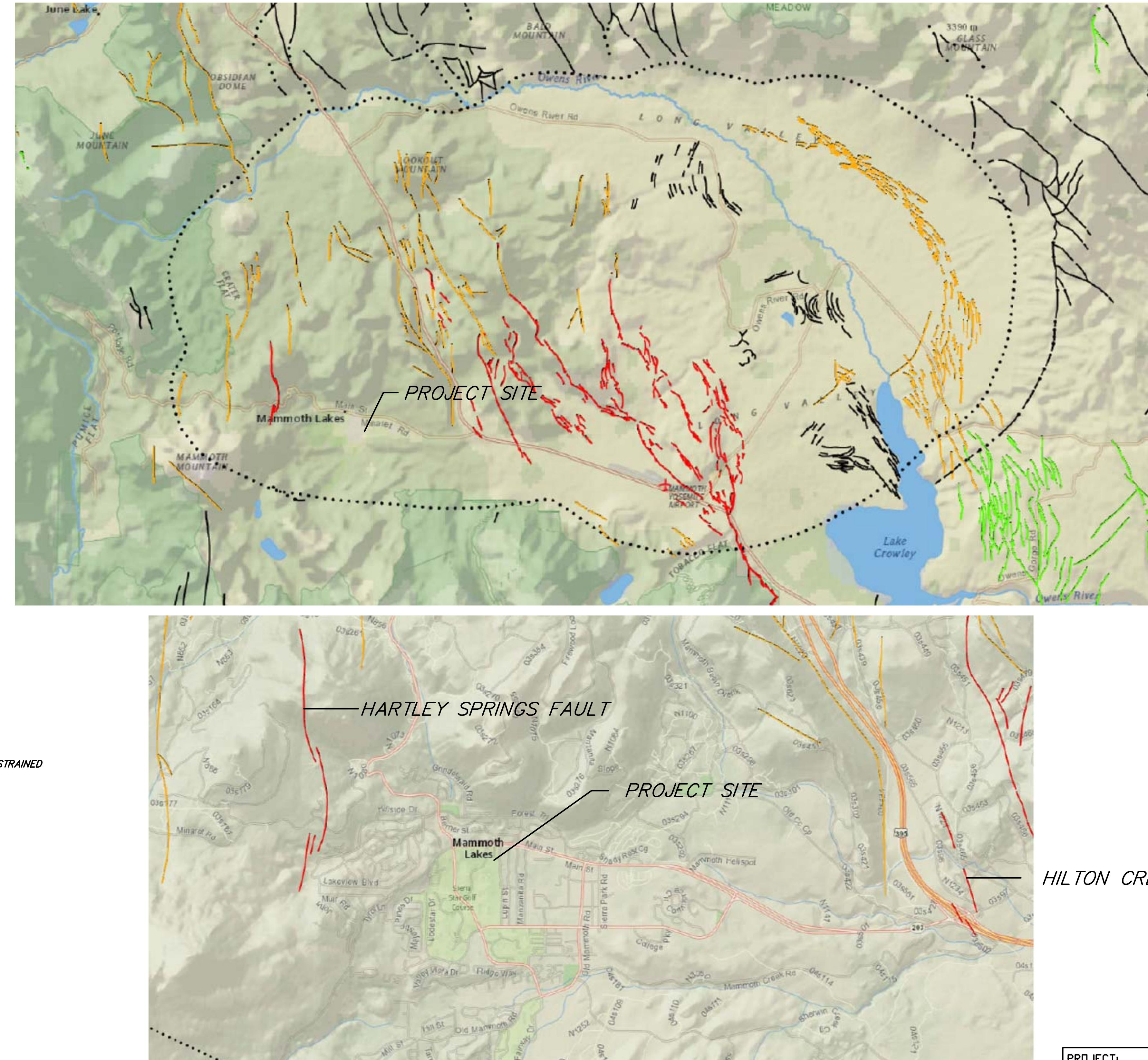




NOT TO SCALE

SIERRA GEOTECHNICAL SERVICES, INC.

PROJECT: VICINITY MAP THE VILLAS AT OBSIDIAN – PHASE 3	
SCALE: NTS	DATE: 2/2021
COORDINATES: 37.6466, –118.9780	DRAWN BY: JAA
JOB NO.: 3.30496.5	FIGURE: FIGURE 1



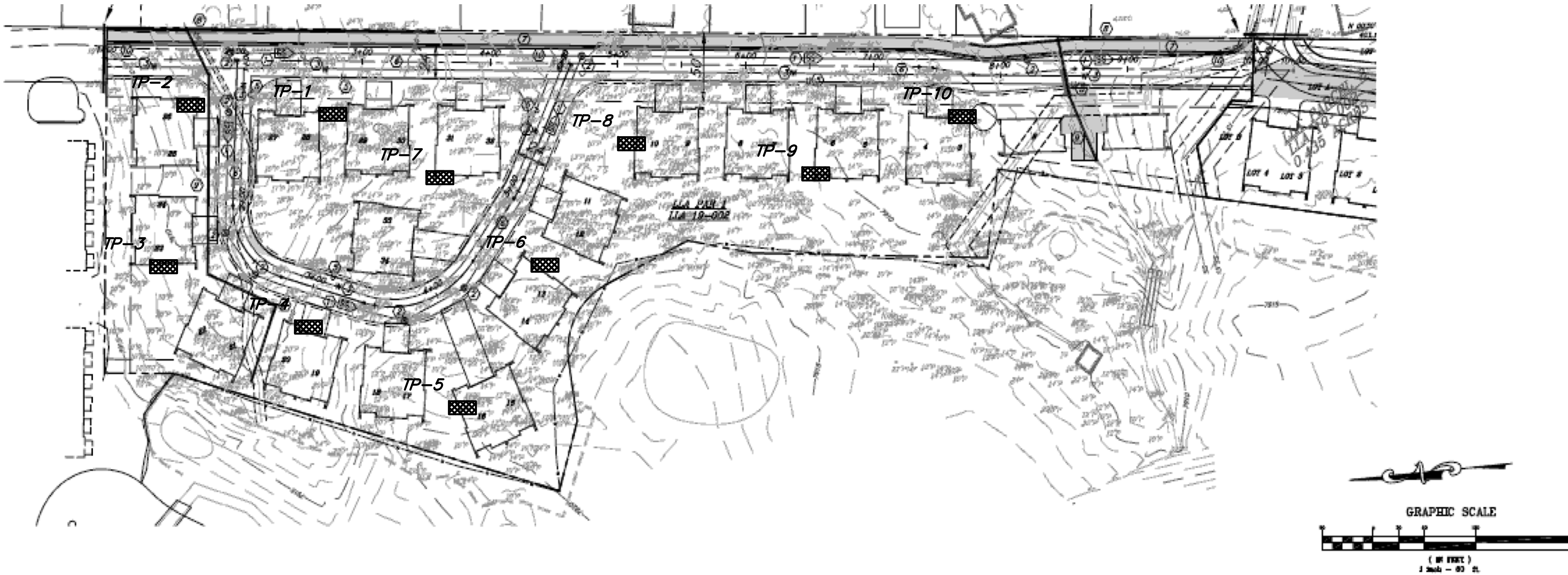
HISTORIC FAULTS, WELL CONSTRAINED

LATEST QUATERNARY, (<15000 YEARS) WELL CONSTRAINED

BOUNDARY OF LONG VALLEY CALDERA

SIERRA GEOTECHNICAL SERVICES, INC.

PROJECT: GEOLOGIC HAZARDS MAP THE VILLAS AT OBSIDIAN – PHASE 3	
SCALE: NTS	DATE: 2/2021
COORDINATES: 37.6466,–118.9780	DRAWN BY: JAA
JOB NO.: 3.30496.5	FIGURE: FIGURE 2



LEGEND

TP-10

APPROXIMATE LOCATION OF EXPLORATORY TEST PIT

SGS
SIERRA GEOTECHNICAL SERVICES, INC.

PROJECT: SUBSURFACE GEOTECHNICAL MAP THE VILLAS AT OBSIDIAN– PHASE 3	
SCALE: NTS	DATE: 2/2021
DRAWING: FIGURE 3.DWG	DRAWN BY: JAA
JOB NO.: 3.30496.5	FIGURE: FIGURE 3

APPENDIX A

EXPLORATORY TEST PIT LOGS

A subsurface field investigation was performed on January 18th, 2021 that included the excavation of ten exploratory test pits with a CAT trackhoe. Soil materials were visually classified in the field according to the Unified Soil Classification System (USCS). Logs of the exploratory test pits are presented herein.

Representative soil samples were obtained during the field investigation for laboratory testing (Appendix B). The approximate location of the exploratory test pits are shown on the Subsurface Location Map (Figure 3).

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

TEST PIT LOGS

JOB NO: 3.30496.5 **PROJECT:** The Villas at Obsidian - Phase 3
DATE: 1/18/2021 **LOGGED BY:** JA
EQUIP: CAT 308

TEST PIT	DEPTH (ft)	U.S.C.S. GROUP SYMBOL	SAMPLE DEPTH (ft)	PERCENT MOISTURE	DRY DENSITY (pcf)	DESCRIPTION
1	0 – 2	SM				**TOPSOIL** Dark brown, frozen to moist, loose to medium dense, silty, very fine to medium SAND, abundant roots.
	2 – 3½	SM				**PYROCLASTIC DEPOSITS** Light to medium brown, moist, dense, silty, very fine SAND and ASH. Few subangular rock fragments to 14” diameter. *Total Depth – 3½’. No groundwater.*
2	0 – 2	SM				**TOPSOIL** Dark brown, frozen to moist, loose to medium dense, silty, very fine to medium SAND, abundant roots.
	2 – 4	SM				**PYROCLASTIC DEPOSITS** Light to medium brown, moist, dense, silty, very fine SAND and ASH. Few to abundant subangular rock fragments to 14” diameter. Rock content is 10-15% of deposit. *Total Depth – 4’. No groundwater.*
3	0 – 2	SM				**TOPSOIL** Dark brown, frozen to moist, loose to medium dense, silty, very fine to medium SAND, abundant roots.
	2 – 4½	SM				**PYROCLASTIC DEPOSITS** Light to medium brown, moist, dense, silty, very fine SAND and ASH. Few to abundant subangular rock fragments to 18” diameter. Rock content is 10% of deposit. *Total Depth – 4½’. No groundwater*

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

TEST PIT LOGS

JOB NO: **3.30496.5**
DATE: **1/18/2021**
EQUIP: **CAT 308**

PROJECT: **The Villas at Obsidian - Phase 3**
LOGGED BY: **JA**

TEST PIT	DEPTH (ft)	U.S.C.S. GROUP SYMBOL	SAMPLE DEPTH (ft)	PERCENT MOISTURE	DRY DENSITY (pcf)	DESCRIPTION
4	0 – 2	SM				**TOPSOIL** Dark brown, frozen to moist, loose to medium dense, silty, very fine to medium SAND, abundant roots.
	2 – 4½	SM				**PYROCLASTIC DEPOSITS** Light to medium brown, moist, dense, silty, very fine SAND and ASH. Few to abundant subangular rock fragments to 36” diameter. Rock content is 15-20% of deposit. *Total Depth – 4½’. No groundwater*
5	0 – 3	SM				**TOPSOIL** Dark brown, frozen to moist, loose to medium dense, silty, very fine to medium SAND, abundant roots.
	3 – 4	SM				**PYROCLASTIC DEPOSITS** Light to medium brown, moist, dense, silty, very fine SAND and ASH. Few subangular rock fragments to 15” diameter. Rock content is 5% of deposit. *Total Depth – 4’. No groundwater.*
6	0 – 2	SM				**TOPSOIL** Dark brown, frozen to moist, loose to medium dense, silty, very fine to medium SAND, abundant roots.
	2 – 3½	SM				**PYROCLASTIC DEPOSITS** Light to medium brown, moist, dense, silty, very fine SAND and ASH. Few subangular rock fragments to 14” diameter. *Total Depth – 3½’. No groundwater.*

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

TEST PIT LOGS

JOB NO: **3.30496.5** **PROJECT:** **The Villas at Obsidian - Phase 3**
DATE: **1/18/2021** **LOGGED BY:** **JA**
EQUIP: **CAT 308**

TEST PIT	DEPTH (ft)	U.S.C.S. GROUP SYMBOL	SAMPLE DEPTH (ft)	PERCENT MOISTURE	DRY DENSITY (pcf)	DESCRIPTION
7	0 – 2½	SM				**TOPSOIL** Dark brown, frozen to moist, loose to medium dense, silty, very fine to medium SAND, abundant roots.
	2½ – 3½	SM				**PYROCLASTIC DEPOSITS** Light to medium brown, moist, dense, silty, very fine SAND and ASH. Few subangular rock fragments to 14” diameter. *Total Depth – 3½’. No groundwater.*
8	0 – 2½	SM				**TOPSOIL** Dark brown, frozen to moist, loose to medium dense, silty, very fine to medium SAND, abundant roots.
	2½ – 3½	SM				**PYROCLASTIC DEPOSITS** Light to medium brown, moist, dense, silty, very fine SAND and ASH. Few to moderate subangular rock fragments to 14” diameter. Rock content is 10% of deposit. *Total Depth – 3½’. No groundwater.*
9	0 – 18”	SM				**TOPSOIL** Dark brown, frozen to moist, loose to medium dense, silty, very fine to medium SAND, abundant roots.
	18” – 4	SM				**PYROCLASTIC DEPOSITS** Light to medium brown, moist, dense, silty, very fine SAND and ASH. Few to abundant subangular rock fragments to 20” diameter. Rock content is 15% of deposit. *Total Depth – 4’. No groundwater.*

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

TEST PIT LOGS

JOB NO: 3.30496.5
DATE: 1/18/2021
EQUIP: CAT 308

PROJECT: The Villas at Obsidian - Phase 3
LOGGED BY: JA

TEST PIT	DEPTH (ft)	U.S.C.S. GROUP SYMBOL	SAMPLE DEPTH (ft)	PERCENT MOISTURE	DRY DENSITY (pcf)	DESCRIPTION
10	0 – 2	SM				**TOPSOIL** Dark brown, frozen to moist, loose to medium dense, silty, very fine to medium SAND, abundant roots.
	2 – 4	SM				**PYROCLASTIC DEPOSITS** Light to medium brown, moist, dense, silty, very fine SAND and ASH. Few to abundant subangular rock fragments to 20" diameter. Rock content is 15-20% of deposit. *Total Depth – 4'. No groundwater.*

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

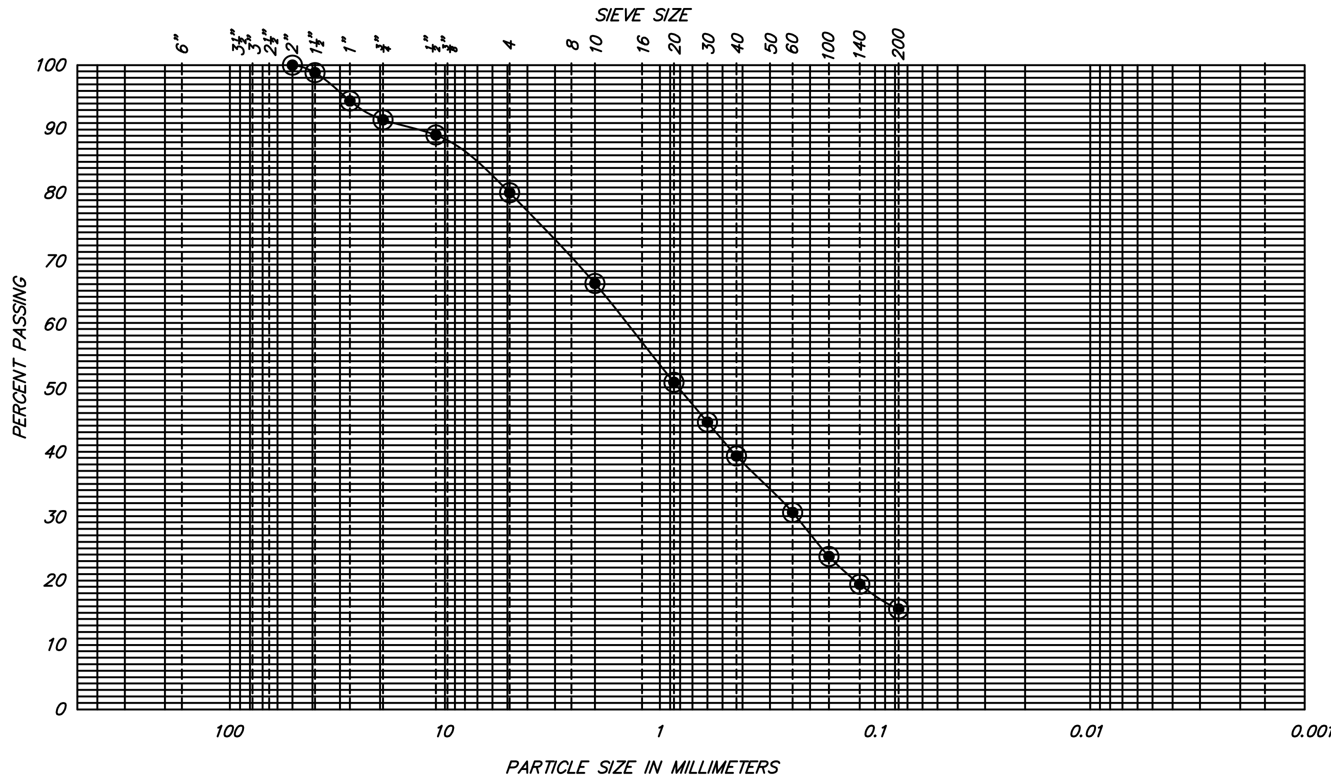
Gradation analysis tests were performed on a selected representative soil sample in general accordance with ASTM D 422. These test results were utilized in evaluating the soil classifications in accordance with the USCS.

Proctor Density Test

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.

PARTICLE SIZE DISTRIBUTION REPORT

PER ASTM TEST METHODS D2487 & D6913



% >3"	% GRAVEL		% SAND			% FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	7.5	12.3	14.1	26.8	23.7	15.6	n/a

SIEVE SIZE	PERCENT RETAINED	PERCENT PASSING	SPECIFIED PERCENT	PASS? (Yes or No)
3-1/2"				
3"				
2-1/2"				
2"	0	100		
1-1/2"	1.2	98.8		
1"	5.6	94.4		
3/4"	7.5	92.5		
1/2"	10.9	89.1		
3/8"	–	–		
No. 4	19.8	80.2		
No. 8	–	–		
No. 10	33.9	66.1		
No. 16	–	–		
No. 20	49.2	50.8		
No. 30	55.4	44.6		
No. 40	60.7	39.3		
No. 50	–	–		
No. 60	69.4	30.6		
No. 100	76.3	23.7		
No. 140	80.6	19.4		
No. 200	84.4	15.6		

SOIL DESCRIPTION

Silty SAND

ATTERBERG LIMITS

PL = 0 LL = 0 PI = NP

COEFFICIENTS

D_{85}= n/a D_{60}= 1.3 D_{50}= n/a

D_{30}= 0.22 D_{15}= n/a D_{10}= n/a

C_U = n/a C_C = n/a

CLASSIFICATION

USCS = SM AASHTO = n/a

REMARKS

Specific Gravity (per ASTM D854) = n/a

SIERRA GEOTECHNICAL SERVICES, INC.

ENVIRONMENTAL GEOTECHNICAL GEOLOGY GROUNDWATER MINING MATERIALS
PO BOX 5024, MAMMOTH LAKES, CALIFORNIA 93546
www.sgsi.us

PROJECT: OBSIDIAN – PHASE 3	CLIENT: MAMMOTH SPRINGS RESORTS
SAMPLE DEPTH: TP-6 at 3'	MATERIAL: Native
SAMPLE DATE: 1/18/2021	TESTED BY: GC
JOB NO.: 3.30496.5	REVIEWED BY: DD/JA

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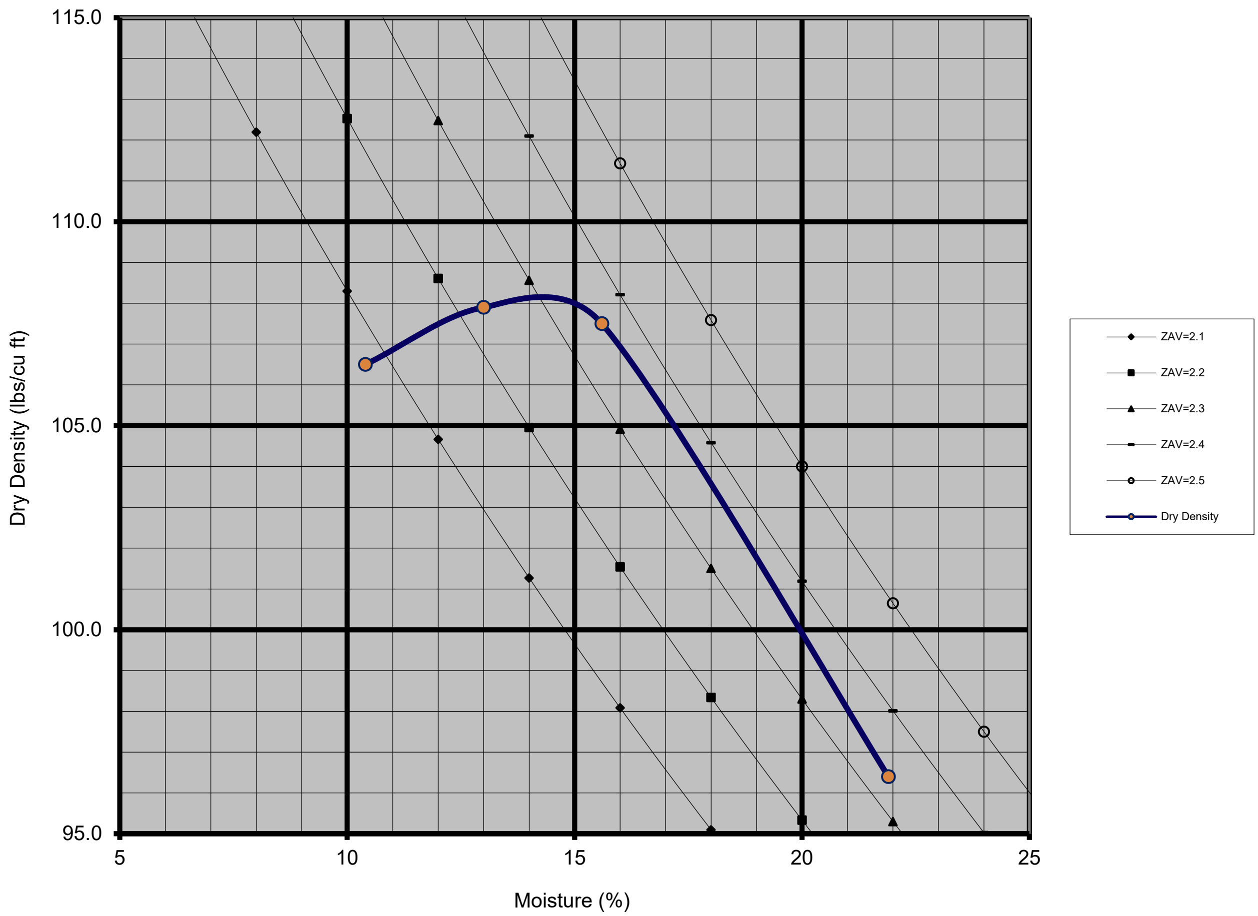
Caltrans Lab #214

MAXIMUM DENSITY-MOISTURE CURVE (PROCTOR)

Project Name								Project No.	
The Villas at Obsidian- Phase 3								3.30496.5	
Client				Contact				Deliver Date	
Mammoth Springs Resorts LLC								1/18/2021	
Material								Sampled By	Delivered By
Native Subgrade - TP-2 @ 2 to 4 feet deep								JA	JA
Proctor No	Test Date	Native	Belt Cut	Screen	Chute	Stockpile	Truck	Tested By	Reviewed By
1	1/20/21	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	13.575	9.696	3.879	117.5	10.4	106.5	0.03300	107.5	15.6
2	13.720	9.696	4.024	121.9	13.0	107.9			
3	13.796	9.696	4.100	124.2	15.6	107.5		With Rock	
4	13.572	9.696	3.876	117.5	21.8	96.4		Correction	
								n/a	

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

Thomas A Platz, PE C41039

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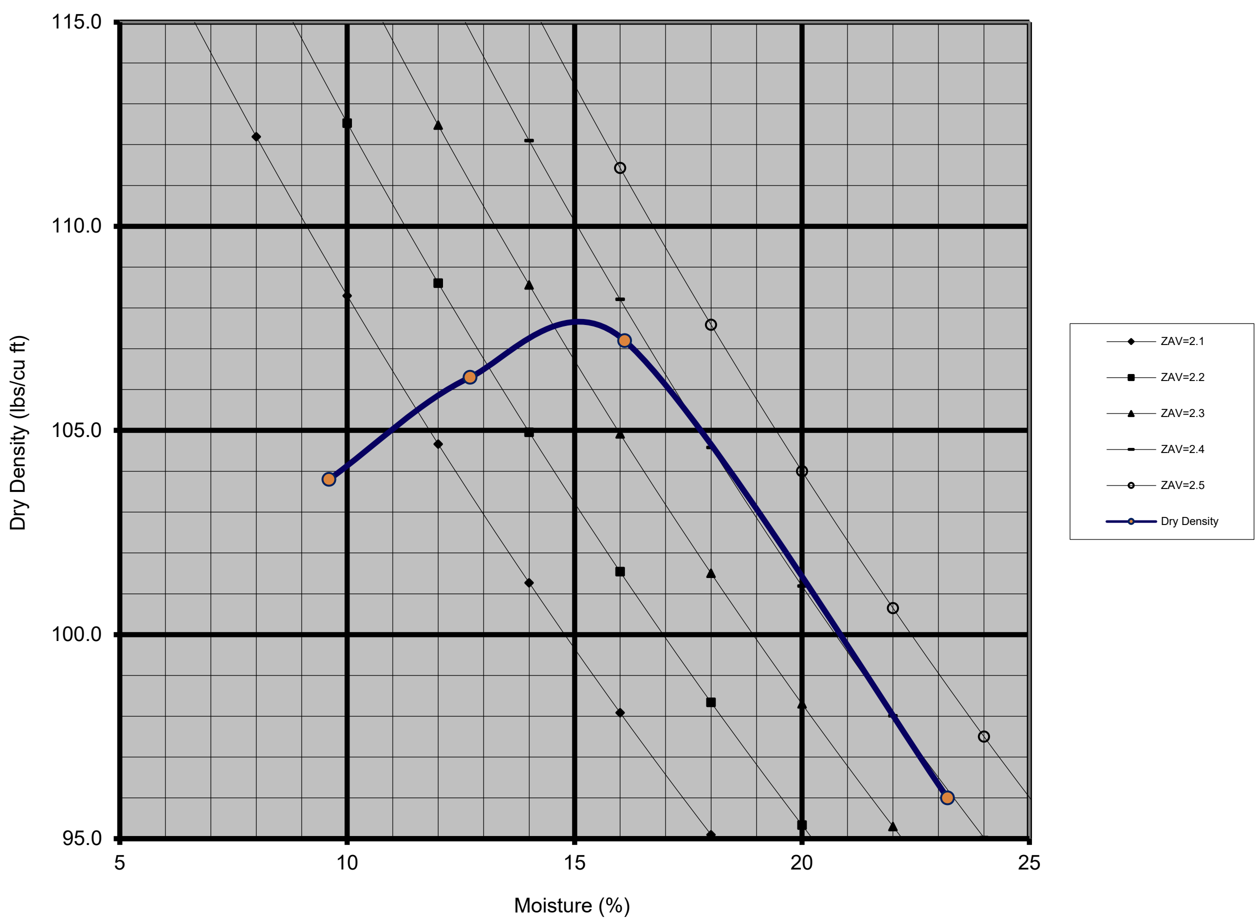
Caltrans Lab #214

MAXIMUM DENSITY-MOISTURE CURVE (PROCTOR)

Project Name: The Villas at Obsidian- Phase 3								Project No.: 3.30496.5	
Client: Mammoth Springs Resorts LLC			Contact:					Deliver Date: 1/18/2021	
Material: Native Subgrade - TP-10 @ 2 to 4 feet deep								Sampled By: JA	Delivered By: JA
Proctor No: 1	Test Date: 1/20/21	Native: X	Belt Cut:	Screen:	Chute:	Stockpile:	Truck:	Tested By: GC	Reviewed By: 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	13.575	9.696	3.754	113.8	9.6	103.8	0.03300	107.2	16.1
2	13.651	9.696	3.955	119.8	12.7	106.3			
3	13.800	9.696	4.104	124.4	16.1	107.2		With Rock	
4	13.565	9.696	3.869	117.2	23.2	96.0		Correction	
								n/a	

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

Thomas A Platz, PE C41039

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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 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 over-excavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured, or otherwise unsuitable ground shall be over-excavated to competent ground as evaluated by 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 D1557 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.

<u>Slopes</u>

All slopes shall be compacted in a single continuous operation upon completion of grading by means of sheeps-foot 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.