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Geotechnical Study

Chateauneuf du Pott Winery P19-00408 & P19-00409
Planning Commission Hearing July 21, 2021

RGH CONSULTANTS

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GEOTECHNICAL STUDY REPORT

MT. VEEDER ROAD WINERY
2072 MT. VEEDER ROAD
NAPA, CALIFORNIA

Project Number:

6442.01.04.2

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INTRODUCTION

This report presents the results of our geotechnical study for the proposed winery to be constructed at 2072 Mt. Veeder Road in Napa, California. The property extends over generally level to steeply sloping terrain. The planned building site is relatively level and was formerly occupied by residential structures and a barn that were destroyed by fire in October 2017. The site location is shown on Plate 1, Appendix A.

We understand development plans include the construction of a winery facility and parking lot in the vicinity of the former residence and barn. We anticipate that the winery will be wood or steel framed construction with concrete slab-on-grade floors. Actual foundation loads are not known at this time. We anticipate the loads will be typical for the light to moderately heavy type of construction planned and that wall loads will range from about ½ to 1½ kips per lineal foot.

Grading plans are not available, but we anticipate that the planned grading will be the minimum amount needed to construct a level building pad and provide the building site and paved areas with positive drainage and could include cuts and fills on the order of 3 to 5 feet.

SCOPE

The purpose of our study as outlined in our proposal dated March 7, 2017, was to evaluate the geologic hazards within the property and comment on the geotechnical feasibility of the project. Per your request, our scope was changed to generate geotechnical information for the design and construction of the project. Our scope of services included reviewing selected published geologic data pertinent to the site; evaluating the subsurface conditions with borings, test pits and laboratory tests; analyzing the field and laboratory data; and presenting this report with the following geotechnical information:

1. A brief description of the soil, bedrock and groundwater conditions observed during our study;

2. A discussion of seismic hazards that may affect the proposed improvements; and

3. Conclusions and recommendations regarding:

    a. Primary geotechnical engineering concerns and mitigating measures, as applicable;

    b. Site preparation and grading including remedial grading of weak, porous, compressible and/or expansive, surface soil;

    c. Foundation type(s), design criteria, and estimated settlement behavior;

    d. Lateral loads for retaining wall design;

    e. Support of concrete slabs-on-grade;

    f. Utility trench backfill;

    g. Geotechnical engineering drainage improvements; and

    h. Supplemental geotechnical engineering services.

STUDY

Site Exploration

We reviewed our previous geotechnical studies in the vicinity and selected geologic references pertinent to the site. The geologic literature reviewed is listed in Appendix B. On March 17th, 2017, and August 24, 2018, we performed a geotechnical reconnaissance of the site and explored the subsurface conditions by drilling three borings to depths ranging from about 16 to 21½ feet. The borings were drilled with a limited access drill rig equipped with 6-inch diameter solid stem augers. Additionally, we excavated 9 test pits to depths ranging from about 4½ to 10½ feet using a track mounted mini-excavator. The borings and test pits were completed at the approximate locations shown on the Exploration Plan, Plate 2. The boring and test pit locations were determined approximately by pacing their distance from features shown on the Exploration Plan and should be considered accurate only to the degree implied by the method used. Our field geologist and field engineer located and logged the borings and test pits and obtained samples of the materials encountered for visual examination, classification and laboratory testing.

Relatively undisturbed samples were obtained from the borings at selected intervals by driving a 2.43-inch inside diameter, split spoon sampler, containing 6-inch long brass liners, using a 140-pound hammer dropping approximately 30 inches. The sampler was driven 12 to 18 inches. The blows required to drive each 6-inch increment were recorded and the blows required to drive the last 12 inches, or portion thereof, were converted to equivalent Standard Penetration Test (SPT) blow counts using a conversion factor of 0.65 (Burmister, 1948) for correlation with empirical data. Disturbed samples were also obtained at selected depths by driving a 1.375-inch inside diameter (2-inch outside diameter) SPT sampler, without liners or rings, using a 140-pound hammer dropping approximately 30 inches. The sampler was driven 12 to 18 inches, the blows to drive each 6-inch increment were recorded, and the blows required to drive the final 12 inches, or portion thereof, are provided on the boring logs. Disturbed "bulk" samples were collected from the test pits and placed in plastic bags.

The logs of the borings and test pits showing the materials encountered, groundwater conditions, converted blow counts and sample depths are presented on Plates 3 through 9. The soil is described in accordance with the Unified Soil Classification System, outlined on Plate 10. Bedrock is described in accordance with Engineering Geology Rock Terms, shown on Plate 11.

The boring and test pit logs show our interpretation of the subsurface soil and groundwater, and bedrock conditions on the date and at the locations indicated. Subsurface conditions may vary at other locations and times. Our interpretation is based on visual inspection of soil and bedrock samples, laboratory test results, and interpretation of drilling, excavation and sampling resistance. The location of the soil and bedrock boundaries should be considered approximate. The transition between soil and bedrock types may be gradual.

Laboratory Testing

The samples obtained from the borings and test pits were transported to our office and re-examined to verify soil classifications, evaluate characteristics, and assign tests pertinent to our analysis. Selected samples were laboratory tested to determine their classification (Atterberg Limits, percent of silt and clay) and expansion potential (Expansion Index - EI). Results of the classification and expansion potential tests are presented on Plate 12.

SITE CONDITIONS

General

Napa County is located within the California Coast Range geomorphic province. This province is a geologically complex and seismically active region characterized by sub-parallel northwest-trending faults, mountain ranges and valleys. The oldest bedrock units are the Jurassic-Cretaceous Franciscan Complex and Great Valley sequence sediments originally deposited in a marine environment. Subsequently, younger rocks such as the Tertiary-age Sonoma Volcanics group, the Plio-Pleistocene-age Clear Lake Volcanics and sedimentary rocks such as the Guinda, Domengine, Petaluma, Wilson Grove, Cache, Huichica and Glen Ellen formations were deposited throughout the province. Extensive folding and thrust faulting during late Cretaceous through early Tertiary geologic time created complex geologic conditions that underlie the highly varied topography of today. In valleys, the bedrock is covered by thick alluvial soil.

Geology

Published geologic maps (Wagner et al., 2004) indicate the building site is located at the base of a large quaternary age landslide that extends downslope from the slopes to the west. The geology to the west of the landslide consist of Early Cretaceous to Late Jurassic bedrock of the Great Valley Sequence. The Great Valley Sequence is described as mostly greenish silty mudstone with sandstone interbeds.

Landslides

Published landslide maps by Wagner et al, 2004, indicate that the winery site is located at the base of a large landslide. Published maps by Dwyer, 1976, do not indicate large-scale slope instability at the winery site, but does identify “probable” and “definite” landslide zones to the north, south, east and west of the winery site. We did not observe active landslides at the proposed winery site during our study. However, we did encounter dormant and ancient landslide deposits along the western portion of the planned winery site within our test pits and borings.

Surface

The winery site extends primarily over a relatively level bench cut into a moderately steeply sloping hillside. In general, the ground surface is soft and spongy. This is a condition generally associated with weak, porous surface soil. The surface soil is disturbed by randomly arrayed shrinkage cracks generally associated with expansive soil. Locally, expansive soil shrinks and swells with the weather cycle. The cyclic shrinking and swelling tends to disturb the upper portion of the expansive clay. This zone is defined hereinafter as the active layer.

Natural drainage consists of sheet flow over the ground surface slopes that concentrates in man made surface drainage elements such as roadside ditches, canals and gutters, and natural drainage elements such as swales, ravines, and creeks.

Subsurface

Our borings, test pits and laboratory tests indicate that the portion of the site we studied is blanketed by 1 to 4 feet of weak, porous, compressible, clayey soil. Porous soil appears hard and strong when dry but becomes weak and compressible as its moisture content increases towards saturation. This surface soil is underlain by stiff to very stiff clayey dormant landslide deposits to depths ranging from about 9 to 11 feet in the vicinity of the former residence. This soil exhibits high plasticity (LL = 78.5; PI = 47.4) and very high expansion potential (EI = 156). Hard ancient landslide deposits were encountered locally in this area to the maximum depths explored (16½ feet).

Mudstone and tuff bedrock were encountered near the ground surface along the western portion of the planned development area and at a depth of about 10 feet near the center of the planned development area. The bedrock is generally soft to moderately hard, plastic to weak and moderately to highly weathered. A detailed description of the subsurface conditions found in our borings and test pits is given on Plates 3 through 9, Appendix A. Based on Table 20.3-1 of American Society of Civil Engineers (ASCE) Standard 7-10, titled “Minimum Design Loads for Buildings and Other Structures” (2010), we have determined a Site Class of D should be used for the site.

Corrosion Potential

Mapping by the Natural Resources Conservation Service (2018) indicates that the corrosion potential of the near surface soil is moderate for uncoated steel and low for concrete. Performing corrosivity tests to verify these values was not part of our requested and/or proposed scope of work. Should the need arise, we would be pleased to provide a proposal to evaluate these characteristics.

Groundwater

Seepage was encountered between 3 and 4 feet below the ground surface in test pits TP-1, TP-2, TP-4 and TP-6. On hillsides, rainwater typically percolates through the porous surface materials and migrates downslope in the form of seepage at the interface of the surface materials and bedrock, and through fractures in the bedrock. Fluctuations in the seepage rates typically occur due to variations in rainfall intensity, duration and other factors such as periodic irrigation.

DISCUSSION AND CONCLUSIONS

Seismic Hazards

General

We did not observe subsurface conditions within the portion of the property we studied that would suggest the presence of materials that may be susceptible to seismically induced densification or liquefaction. Therefore, we judge the potential for the occurrence of these phenomena at the site to be low.

Faulting and Seismicity

The site is not within a current Alquist-Priolo Earthquake Fault Zone for active faults as defined by CGS. However, the site is within an area affected by strong seismic activity. In addition, Several northwest-trending Earthquake Fault Zones exist in close proximity to, and within several miles of, the site (Bortugno, 1982). The shortest distances from the site to the mapped surface expression of these faults are presented in the table below.

ACTIVE FAULT PROXIMITY		
Fault	**Direction**	**Distance-Miles**
San Andreas	SW	31
Healdsburg-Rodgers Creek	SW	10
Concord-Green Valley	E	12
Cordelia	E	15
West Napa	E	3
Maacama	NW	22

Lurching

Seismic slope failure or lurching is a phenomenon that occurs during earthquakes when slopes or man-made embankments yield and displace in the unsupported direction. Provided the foundations are installed as recommended herein, and the proposed fills are adequately keyed into underlying bedrock or ancient landslide material, as subsequently discussed, we judge the potential for impact to the proposed improvements from the occurrence of this phenomenon at the site is low. However, some of these secondary earthquake effects are unpredictable as to location and extent, as evidenced by the 1989 Loma Prieta Earthquake.

Geotechnical Issues

General

Based on our study, we judge the proposed improvements can be built as planned, provided the recommendations presented in this report are incorporated into their design and construction. The primary geotechnical concerns during design and construction of the project are:

1. The presence of 1 to 4 feet of weak, porous, compressible, highly expansive clayey surface soil;

2. The presence of 9 to 11½ feet of dormant landslide deposits;

3. The detrimental effects of uncontrolled surface runoff and groundwater seepage on the long-term satisfactory performance of wineries given the erosion potential and porous nature of the surface soil and dormant landslide deposits; and

4. The strong ground shaking predicted to impact the site during the life of the project.

Weak, Porous Surface Soil

Weak, porous surface soil, such as that found at the site, appears hard and strong when dry but will lose strength rapidly and settle under the load of fills, foundations and slabs as its moisture content increases and approaches saturation. The moisture content of this soil can increase as the result of rainfall, periodic irrigation or when the natural upward migration of water vapor through the soil is impeded by, and condenses under fills, foundations and slabs. The detrimental effects of such movements can be reduced by strengthening the soil during grading. This can be achieved by excavating the weak soil and replacing it as properly compacted (engineered) fill. Alternatively, satisfactory foundation support could be obtained below the weak surface soil.

Dormant and Ancient Landslide Deposits

Although signs of recent landslide movement at the planned winery site were not observed during our exploration, the dormant landslide deposits found in our borings and test pits are inherently unstable. Fills and foundations deriving support from these materials will be susceptible and contribute to reactivation of the landslide unless properly embedded in bedrock or ancient landslide deposits and buttressed fill (keyed, benched, drained and compacted).

Based on our study, we believe the more recent dormant landslide deposits encountered at the site are underlain by ancient landslides that could extend to the bottom of Redwood Creek (bedrock is exposed in the creek bottom). These ancient landslide deposits were developed during an older geologic regime that included different atmospheric conditions and have obtained a degree of stability higher than that of the dormant landslide deposits. However, we cannot predict when conditions such as prolonged periods of intense rainfall, long-term deep irrigation, changed drainage conditions and/or grading above or below the property or strong ground shaking would reactivate the landslide and therefore, the recommended foundations are not intended to preclude the landslide reactivation.

Expansive Soil

The site surface soil is expansive. Expansive soils shrink and swell as they lose and gain moisture throughout the yearly weather cycle. Near the surface, the resulting movements can heave and crack lightly loaded shallow foundations (spread footings) and slabs. The zone of significant moisture variation (active layer) is dependent on the expansion potential of the soil and the extent of the dry season. In the project area, the active layer is generally considered to range in thickness from about 2 to 3 feet. The detrimental effects of the above-described movements can be reduced by pre-swelling the expansive soil and covering it with a moisture fixing and confining blanket of properly compacted select fill, as subsequently defined. In building areas, the blanket thickness required depends on the expansion potential of the soil and the anticipated performance of the foundations and slabs. In order to effectively reduce foundation and slab heave given the expansion potential of the site's soil, a blanket thickness of 30 inches will be needed. In exterior slab and paved areas, the select fill blanket need only be 18 inches thick.

Foundation Support - Provided the remedial grading is performed as discussed above, satisfactory foundation support can be obtained from spread footings that bottom on select engineered fill at least 12 inches below pad subgrade. Alternatively, in areas outside the dormant landslide deposits the winery structures can be supported on spread footings or drilled, cast-in-place, reinforced concrete friction piers or mat slabs that gain support in stiff native soil, engineered fill, undisturbed bedrock.

On-Site Soil Quality

All fill materials used in the upper 30 inches of interior or 18 inches of exterior slab subgrade must be select, as subsequently described in "Recommendations." We anticipate that, with the exception of organic matter and of rocks or lumps larger than 6 inches in diameter, the excavated material will be suitable for re-use as general fill but will not be suitable for use as select fill.

Engineered Fill

Engineered fill can consist of approved on-site soil or import materials with a low expansion potential. The geotechnical engineer must approve the use of on-site or import soil as engineered fill during grading.

Settlement

We estimate that post-construction differential settlements across the building should be about ½ inch.

Surface Drainage

Surface runoff typically sheet flows over the ground surface but can be concentrated by the planned site grading, landscaping, and drainage. The surface runoff can pond against structures and seep into the slab rock. Therefore, strict control of surface runoff is necessary to provide long-term satisfactory performance of the project. It will be necessary to divert surface runoff around slopes and improvements, provide positive drainage away from structures, and install energy dissipaters at discharge points of concentrated runoff. This can be achieved by constructing the building pad several inches above the surrounding area and conveying the runoff into man made drainage elements or natural swales that lead downgradient of the site.

Groundwater

We anticipate that rainwater will percolate through the topsoil and migrate downslope at the interface of the topsoil and bedrock and through fractures in the bedrock and seep into the slab rock. Therefore, it will be necessary to intercept, collect and divert groundwater outside of the proposed improvements. This can be accomplished by installing perimeter foundation drains as recommended herein.

RECOMMENDATIONS

Seismic Design

Seismic design parameters presented below are based on Section 1613 titled "Earthquake Loads" of the 2016 California Building Code (CBC). Based on Table 20.3-1 of American Society of Civil Engineers (ASCE) Standard 7-10, titled "Minimum Design Loads for Buildings and Other Structures" (2010), we have determined a Site Class of D should be used for the site. Using a site latitude and longitude of 38.3630°N and 122.4041°W, respectively, and the U.S. Seismic Design Maps from the United States Geological Survey (USGS) website (http://earthquake.usgs.gov/designmaps/us/application.php), we recommend that the following seismic design criteria be used for structures at the site.

2016 CBC Seismic Criteria	
Spectral Response Parameter	**Acceleration (g)**
S_S (0.2 second period)	1.639
S_1 (1 second period)	0.601
S_{MS} (0.2 second period)	1.639
S_{M1} (1 second period)	0.901
S_{DS} (0.2 second period)	1.093
S_{D1} (1 second period)	0.601

Grading

Site Preparation

Areas to be developed should be cleared of vegetation and debris including that left by the removal of obsolete structures. Trees and shrubs that will not be part of the proposed development should be removed and their primary root systems grubbed. Cleared and grubbed material should be removed from the site and disposed of in accordance with County Health Department guidelines. We did not observe septic tanks, leach lines or underground fuel tanks during our study. Any such appurtenances found during grading should be capped and sealed and/or excavated and removed from the site, respectively, in accordance with established guidelines and requirements of the County Health Department. Voids created during clearing should be backfilled with engineered fill as recommended herein.

Stripping

Areas to be graded should be stripped of the upper few inches of soil containing organic matter. Soil containing more than two percent by weight of organic matter should be considered organic. Actual stripping depth should be determined by a representative of the geotechnical engineer in the field at the time of stripping. The strippings should be removed from the site, or if suitable, stockpiled for re-use as topsoil in landscaping.

Excavations

Following initial site preparation, excavation should be performed as recommended herein. Excavations extending below the proposed finished grade should be backfilled with suitable materials compacted to the requirements given below.

Within the building area, where spread footings bottomed at minimum depth are chosen for foundation support, and within fill and interior slab-on-grade areas, the dormant landslide deposits and weak, porous, compressible, expansive surface soil should be excavated to within 6 inches of its entire depth (about 9 to 10½ feet in our borings). Additional excavation should be performed, as necessary, to allow space for the installation of a blanket of select fill, at least 30 inches thick, beneath the building pad subgrade. The excavation of weak, compressible, expansive soil should also extend at least 18 inches below exterior slab subgrade (where planned excavations do not completely remove the weak soil) to allow space for the installation of the select fill blanket discussed in the conclusions section of this report. On sloping terrain 10:1 or steeper, fills should be constructed by excavating level keyways that expose undisturbed bedrock or ancient landslide deposits. The keyways should be at least 10 feet wide, extend at least 2 feet below the bedrock or ancient landslide surface on the downhill side and should be sloped to drain to the rear. Keyway excavations should extend laterally to at least a 1:1 imaginary line extending down from the toe of the fill. Keyway subdrains are discussed hereinafter in "Subsurface Drainage."

The excavation of weak, porous, compressible, expansive surface materials should extend at least 5 feet beyond the outside edge of the exterior footings of the proposed buildings and 3 feet beyond the edge of exterior slabs. The excavated materials should be stockpiled for later use as compacted fill, or removed from the site, as applicable.

At all times, temporary construction excavations should conform to the regulations of the State of California, Department of Industrial Relations, Division of Industrial Safety or other stricter governing regulations. The stability of temporary cut slopes, such as those constructed during the installation of underground utilities, should be the responsibility of the contractor. Depending on the time of year when grading is performed, and the surface conditions exposed, temporary cut slopes may need to be excavated to 1½:1, or flatter. The tops of the temporary cut slopes should be rounded back to 2:1 in weak soil zones.

Subsurface Drainage

A subdrain should be installed at the rear of the keyways and/or where evidence of seepage is observed. The subdrain should consist of a 4-inch diameter (minimum) perforated plastic pipe with SDR 35 or better embedded in Class 2 permeable material. The permeable material should be at least 12 inches thick and extend at least 48 inches above the bottom of the keyway (see Plate 13) and/or 12 inches above and below the seepage zone.

The depth and extent of subdrains should be determined and approved by the geotechnical engineer in the field during construction. In addition, subdrains should be installed at a minimum slope of 1 percent and should have cleanouts located at their ends and at turning points. “Sweep” type elbows and wyes should be used at all turning points and cleanouts, respectively. Subdrain outlets and riser cleanouts should be fabricated of the same material as the subdrain pipe as specified herein. Outlet and riser pipe fittings should not be perforated. A licensed land surveyor or civil engineer should provide “record drawings” depicting the locations of subdrains and cleanouts.

Fill Quality

All fill materials should be free of perishable matter and rocks or lumps over 6 inches in diameter and must be approved by the geotechnical engineer prior to use. The upper 30 inches of fill beneath and within 5 feet of the building area and the upper 18 inches of fill beneath and within 3 feet of exterior slabs edges should be select fill. We judge the on-site soil is generally suitable for use as general fill but will not be suitable for use as select fill. The suitability of the on-site soil for use as select fill should be verified during grading.

Select Fill

Select fill should be free of organic matter, have a low expansion potential, and conform in general to the following requirements:

SIEVE SIZE	PERCENT PASSING (by dry weight)
6 inch	100
4 inch	90 – 100
No. 200	10 – 60

Liquid Limit – 40 Percent Maximum
Plasticity Index – 15 Percent Maximum

In general, imported fill, if needed, should be select. Material not conforming to these requirements may be suitable for use as import fill; however, it shall be the contractor's responsibility to demonstrate that the proposed material will perform in an equivalent manner. The geotechnical engineer should approve imported materials prior to use as compacted fill. The grading contractor is responsible for submitting, at least 72 hours (3 days) in advance of its intended use, samples of the proposed import materials for laboratory testing and approval by the soils engineer.

Fill Placement

The surface exposed by stripping and removal of dormant landslide deposits and weak, compressible, expansive surface soil should be scarified to a depth of at least 6 inches, uniformly moisture-conditioned to at least 4 percent above optimum and compacted to at least 90 percent of the maximum dry density of the materials as determined by ASTM Test Method D-1557. In expansive soil areas, moisture conditioning should be sufficient to completely close all shrinkage cracks for their full depth within exterior slab and building areas. If grading is performed during the dry season, the shrinkage cracks may extend to a few feet below the surface. Therefore, it may be necessary to excavate a portion of the cracked soil to obtain the proper moisture condition and degree of compaction. Approved fill material should then be spread in thin lifts, uniformly moisture-conditioned to near optimum and properly compacted. All structural fills, including those placed to establish site surface drainage, should be compacted to at least 90 percent relative compaction. Expansive soil used as fill should be moisture-conditioned to at least 4 percent above optimum. Only approved select materials should be used for fill within the upper 30 inches of interior slab subgrades and within the upper 18 inches of exterior slabs subgrades. Fills placed on terrain sloping at 10:1 or steeper should be continually keyed and benched into firm, undisturbed bedrock. The benches should allow space for the placement of select fill of even thickness under settlement sensitive structural elements supported directly on the fill. An illustration of this grading technique is shown on Plate 13.

SUMMARY OF COMPACTION RECOMMENDATIONS	
Area	**Compaction Recommendation (ASTM D-1557)**
Preparation for areas to receive fill	After preparation in accordance with this report, compact upper 6 inches to a minimum of 90 percent relative compaction.
General fill (native or import)	Compact to a minimum of 90 percent relative compaction.
Structural fill beneath buildings, extending outward to 5' beyond building perimeter	Compact to a minimum of 90 percent relative compaction. Compact to a minimum of 95 percent where building pad transitions between bedrock and fill.
Structural fill beneath building pads that transition between bedrock and fills less than 3 feet thick	Compact to a minimum of 95 percent relative compaction.
Trenches	Compact to a minimum of 90 percent relative compaction. Compact the top 6 inches below vehicle pavement subgrade to a minimum of 95 percent relative compaction.
Retaining wall backfill	Compact to a minimum of 90 percent relative compaction, but not more than 95 percent.
Concrete flatwork and exterior slabs, extending outward to 3' beyond edge of slab	Compact subgrade to a minimum of 90 percent relative compaction. Where subject to vehicle traffic, compact upper 6 inches of subgrade to at least 95 percent relative compaction.
Aggregate Base	Compact aggregate base to at least 95 percent relative compaction.

Permanent Cut and Fill Slopes

In general, cut and fill slopes should be designed and constructed at slope gradients of 2:1 (horizontal to vertical) or flatter, unless otherwise approved by the geotechnical engineer in specified areas. In expansive soil areas cut and fill slopes should be no steeper than 3:1. Where steeper slopes are required, retaining walls should be used. Fill slopes steeper than 2:1 will require the use of geogrid to increase stability. Providing recommendations for grid type and spacing was not part of our requested and/or proposed scope of work. Should the need to use geogrid arise, additional laboratory testing and stability analyses will be required. Fill slopes should be constructed by overfilling and cutting the slope to final grade. "Track walking" of a slope to achieve slope compaction is not an acceptable procedure for slope construction. Permanent cut slopes should be observed in the field by the geotechnical engineer to verify that the exposed soil or bedrock conditions are as anticipated. The geotechnical engineer is not responsible for measuring the angles of these slopes. Denuded slopes should be planted with fast-growing, deep-rooted groundcover to reduce sloughing or erosion. The cut and fill slope inclinations recommended herein address only the stability of the slopes. It should not be inferred that they address the feasibility of landscaping and weed control. Where these are concerns, the slopes should be flattened accordingly.

Wet Weather Grading

Generally, grading is performed more economically during the summer months when the on-site soil is usually dry of optimum moisture content. Delays should be anticipated in site grading performed during the rainy season or early spring due to excessive moisture in on-site soil. Special and relatively expensive construction procedures, including dewatering of excavations and importing granular soil, should be anticipated if grading must be completed during the winter and early spring or if localized areas of soft saturated soil are found during grading in the summer and fall.

Open excavations also tend to be more unstable during wet weather as groundwater seeps towards the exposed cut slope. Severe sloughing and occasional slope failures should be anticipated. The occurrence of these events will require extensive clean up and the installation of slope protection measures, thus delaying projects. The general contractor is responsible for the performance, maintenance and repair of temporary cut slopes.

Foundation Support

Provided remedial grading is performed that will replace the dormant landslide deposits with engineered fill, including a 30-inch-thick blanket of select fill, the winery structures can be supported by spread footings that gain support in select engineered fill. Alternatively, in areas outside the dormant landslide deposits the winery structures can be supported on spread footings or drilled, cast-in-place, reinforced concrete friction piers or mat slabs that gain support in stiff native soil, engineered fill, undisturbed bedrock.

Spread Footings

Spread footings should be at least 12 inches wide and should bottom on select engineered fill or on undisturbed bedrock, as applicable, at least 12 inches below pad subgrade. Additional embedment or width may be needed to satisfy code and/or structural requirements. Footings should be deepened as necessary to provide at least 7 feet of horizontal confinement between the footing bottoms and the face of the nearest slope. Confinement in bedrock can be reduced to 5 feet.

The bottoms of all footing excavations should be thoroughly cleaned out or wetted and compacted using hand-operated tamping equipment prior to placing steel and concrete. This will remove the soil disturbed during footing excavations, or restore their adequate bearing capacity, and reduce post-construction settlements. Footing excavations should not be allowed to dry before placing concrete. If shrinkage cracks appear in soil exposed in the footing excavations, the soil should be thoroughly moistened to close all cracks prior to concrete placement. The moisture condition of the foundation excavations should be checked by the geotechnical engineer no more than 24 hours prior to placing concrete.

Bearing Pressures - Footings installed in accordance with these recommendations may be designed using allowable bearing pressures of 2000, 3000 and 4000 pounds per square foot (psf), for dead loads, dead plus code live loads, and total loads (including wind and seismic), respectively.

Lateral Pressures - The portion of spread footing foundations extending into undisturbed bedrock or select engineered fill may impose a passive equivalent fluid pressure and a friction factor of 350 pcf and 0.35, respectively, to resist sliding. Passive pressure should be neglected within the upper 12 inches, unless the soil is confined by concrete slabs or pavements.

Drilled Piers

Drilled, cast-in-place, reinforced concrete piers can be used for foundation support where grading is not used to control expansive soil heave and/or strengthen the weak, compressible surface soils. Drilled piers should not be used in areas underlain by dormant landslide deposits. Drilled piers should be at least 12 inches in diameter and should extend at least 8 feet below planned pad elevation with at least 5 feet embedment into firm soil or bedrock. Larger piers and deeper embedment may be needed to resist the lateral forces imposed by earthquakes per the 2016 California Building Code. Piers should be spaced no closer than 3 pier diameters, center to center.

Skin Friction - The portion of the piers extending below the weak surface soil may be designed using an allowable skin friction of 600 psf for dead load plus long term live loads. This value can be increased by ⅓ for total loads, including downward vertical wind or seismic forces. A skin friction value of 400 psf should be used to resist uplift forces. End bearing should be neglected because of the difficulty of cleaning out small diameter pier holes, and the uncertainty of mobilizing end bearing and skin friction simultaneously.

Lateral Forces - Lateral loads on piers will be resisted by passive pressure on the soil/bedrock. An equivalent fluid pressure of 350 pcf acting on two pier diameters should be used. Confinement for passive pressure may be assumed from 3 feet below the lowest adjacent finished ground surface.

The piers should be interconnected with grade beams to support building loads and to redistribute stresses imposed by wind or earthquakes. The grade beams should be designed to span between the piers in accordance with structural requirements. The steel from the piers should extend sufficient distance into the grade beams to develop its full bond strength.

Uplift Forces - The piers and grade beams should be designed to resist uplift pressures imposed by expansive soils. The uplift pressure should be assumed to be 2,000 psf of grade beam surface contact.

Pier Drilling - We did not encounter groundwater and/or caving-prone soil within the planned pier depth during our study. If groundwater is encountered during drilling, it may be necessary to de-water the holes and/or place the concrete by the tremie method. If caving soil is encountered, it may be necessary to case the holes. Difficult drilling may be required to achieve the required penetration. The drilling subcontractor should review this report, become familiar with site conditions as they pertain to his operation and draw his own conclusions regarding drilling difficulty, suitable drill rigs and the need for casing and dewatering prior to bidding.

Concrete - Concrete mix design and placement should be done in accordance with the current ADSC and/or ACI specifications. Concrete should not be allowed to mushroom at the top of the piers or below the bottom of grade beams.

Mat Slabs

Mat slabs required for expansive soil are typically double mat reinforced slabs with thickened areas at the edges and where heavier loads are anticipated, such as at columns and stem walls. The bottoms of all excavations for thickened areas should be thoroughly cleaned out or wetted and compacted using hand-operated tamping equipment prior to placing steel and concrete. This will remove the soils disturbed during excavations, restore their adequate bearing capacity, and reduce post-construction settlements.

A mat slab installed in accordance with the recommendations presented herein may be designed using allowable bearing pressures of 2000, 3000 and 4000 pounds per square foot (psf), for dead loads, dead plus code live loads, and total loads (including wind and seismic), respectively. In addition, a modulus of subgrade reaction (k) of 60 pounds per cubic inch (pci) can be used for design. The foundation extending into the building pad may impose a passive equivalent fluid pressure and a friction factor of 350 pounds per cubic foot (pcf) and 0.35, respectively, to resist sliding. The mat slab should be designed to cantilever 5 feet at the edges and span 10 feet of non-support and for differential settlement of 1 inch along the length of the structure.

Mat slabs should be underlain with a capillary moisture break consisting of at least 4 inches of clean, free-draining crushed rock or gravel (excluding pea gravel) at least ¼-inch and no larger than ¾-inch in size. The subgrade soils within and for a distance of 5 feet beyond the footprint of the building should be kept pre-swelled until the capillary moisture break is placed. The moisture content of the subgrade soils should be approved by the geotechnical engineer within 24 hours prior to placing the capillary moisture break. Where migration of moisture vapor through slabs would be detrimental, a moisture vapor barrier should be provided. A vapor barrier should be placed under all mat slabs that are likely to receive an impermeable floor finish or be used for any purpose where the passage of water vapor through the floor is undesirable. RGH does not practice in the field of moisture vapor transmission evaluation or mitigation. Therefore, we recommend that a qualified person be consulted to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person should provide recommendations for mitigation of the potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

Structural elements that are attached to the structure but have their own foundation should not be used or should be founded on the mat slab. Exterior flatwork and concrete walkway subgrades should be underlain by at least 12 inches of select fill and be pre-swelled by soaking prior to installation of the walkway. In addition, concrete walkways should be:

1. Cast separate from the mat slab to allow differential settlement to occur without distressing the walkway;

2. Reinforced to reduce cracks; and

3. Grooved to induce cracking in a non-obtrusive manner.

Retaining Walls

Retaining walls constructed at the site must be designed to resist lateral earth pressures plus additional lateral pressures that may be caused by surcharge loads applied at the ground surface behind the walls. Retaining walls free to rotate (yielding greater than 0.1 percent of the wall height at the top of the backfill) should be designed for active lateral earth pressures. If walls are restrained by rigid elements to prevent rotation, they should be designed for "at rest" lateral earth pressures.

Retaining walls should be designed to resist the following earth equivalent fluid pressures (triangular distribution):

EARTH EQUIVALENT FLUID PRESSURES		
Loading Condition	**Pressure (pcf)**	**Additional Seismic Pressure (pcf)***
Active - Level Backfill	42	20
Active - Sloping Backfill 3:1 or Flatter	53	59
At Rest - Level Backfill	63	54

* If required

These pressures do not consider additional loads resulting from adjacent foundations or other loads. If these additional surcharge loadings are anticipated, we can assist in evaluating their effects. Where retaining wall backfill is subject to vehicular traffic, the walls should be designed to resist an additional surcharge pressure equivalent to two feet of additional backfill.

Retaining walls will yield slightly during backfilling. Therefore, walls should be backfilled prior to building on, or adjacent to, the walls. Backfill against retaining walls should be compacted to at least 90 and not more than 95 percent relative compaction. Over-compaction or the use of large compaction equipment should be avoided because increased compactive effort can result in lateral pressures higher than those recommended above.

Foundation Support

Retaining walls should be supported on spread footings or drilled piers, as applicable, designed in accordance with the recommendations presented in this report. Retaining wall foundations should be designed by the project civil or structural engineer to resist the lateral forces set forth in this section.

Wall Drainage and Backfill

Retaining walls should be backdrained as shown on Plate 14, Appendix A. The backdrains should consist of 4-inch diameter, rigid perforated pipe embedded in Class 2 permeable material. The pipe should be PVC Schedule 40 or ABS with SDR 35 or better, and the pipe should be sloped to drain to outlets by gravity. The top of the pipe should be at least 8 inches below lowest adjacent grade. The Class 2 permeable material should extend to within 1½ feet of the surface. The upper 1½ feet should be backfilled with compacted soil to exclude surface water. Expansive soil should not be used for wall backfill. Where expansive soil is present in the excavation made to install the retaining wall, the excavation should be sloped back 1:1 from the back of the footing or grade beam. The ground surface behind retaining walls should be sloped to drain. Where migration of moisture through retaining walls would be detrimental, retaining walls should be waterproofed.

Slab-On-Grade

Provided grading is performed in accordance with the recommendations presented herein, interior and exterior slabs should be underlain by undisturbed bedrock or select engineered fill. Interior slab-on-grade floors should be underlain by 30 inches of select engineered fill. Exterior slabs should be underlain by 18 inches of select engineered fill.

Slab-on-grade subgrade should be rolled to produce a dense, uniform surface. The future expansion potential of the subgrade soil should be reduced by thoroughly presoaking the slab subgrade prior to concrete placement. The moisture condition of the subgrade soil should be checked by the geotechnical engineer no more than 24 hours prior to placing the capillary moisture break. The slabs should be underlain with a capillary moisture break consisting of at least 4 inches of clean, free-draining crushed rock or gravel (excluding pea gravel) at least ¼-inch and no larger than ¾-inch in size. Interior slabs subject to vehicular traffic may be underlain by Class 2 aggregate base. The use of Class 2 aggregate base should be reviewed on a case by case basis. Class 2 aggregate base can be used for slab rock under exterior slabs. Interior area slabs should be provided with an underdrain system. The installation of this subdrain system is discussed in the "Geotechnical Drainage" section.

Slabs should be designed by the project civil or structural engineer to support the anticipated loads, reduce cracking and provide protection against the infiltration of moisture vapor. Winery slabs subjected to heavy concentrated wheel loads, such as forklift or trailer-trucks, should be designed to carry the anticipated wheel loads.

A vapor barrier should be placed under all slabs-on-grade that are likely to receive an impermeable floor finish or be used for any purpose where the passage of water vapor through the floor is undesirable. RGH does not practice in the field of moisture vapor transmission evaluation or mitigation. Therefore, we recommend that a qualified person be consulted to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person should provide recommendations for mitigation of the potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

Utility Trenches

The shoring and safety of trench excavations is solely the responsibility of the contractor. Attention is drawn to the State of California Safety Orders dealing with "Excavations and Trenches."

Unless otherwise specified, on-site, inorganic soil may be used as utility trench backfill. Where utility trenches support pavements, slabs, and foundations, trench backfill should consist of aggregate baserock. The baserock should comply with the minimum requirements in Caltrans Standard Specifications, Section 26 for Class 2 Aggregate Base. Trench backfill should be moisture-conditioned as necessary, and placed in horizontal layers not exceeding 8 inches in thickness, before compaction. Each layer should be compacted to at least 90 percent relative compaction as determined by ASTM Test Method D-1557. Jetting or ponding of trench backfill to aid in achieving the recommended degree of compaction should not be attempted.

Geotechnical Drainage

This section presents recommendations for surface and subsurface drainage. For the discussion of subsurface drainage related to grading, especially on hillsides, refer to the "Subsurface Drainage" section.

Surface

Surface water should be diverted away from slopes, foundations and edges of pavements. Surface drainage gradients should slope away from building foundations in accordance with the requirements of the CBC or local governing agency. Roofs should be provided with gutters and the downspouts should be connected to closed (glued Schedule 40 PVC or ABS with SDR of 35 or better) conduits discharging well away from foundations, onto paved areas or erosion resistant natural drainages or into the site's surface drainage system. Roof downspouts and surface drains must be maintained entirely separate from the slab underdrains recommended hereinafter.

Water seepage or the spread of extensive root systems into the soil subgrade of footings, slabs or pavements could cause differential movements and consequent distress in these structural elements. Landscaping should be planned with consideration for these potential problems.

Slab Underdrains

Where migration of moisture through the slab would be detrimental, slab underdrains should be installed to dispose of surface and/or groundwater that may seep and collect in the slab rock. Slab underdrains should consist of 6-inch wide trenches that extend at least 6 inches below the bottom of the slab rock and slope to drain by gravity. The slab underdrain trenches should be spaced no further than 15 feet, both ways. Additional drain trenches should be installed, as necessary, to drain all isolated under slab areas. Four-inch diameter perforated pipe (SDR 35 or better) sloped to drain to outlets by gravity should be placed in the bottom of the trenches. Slab underdrain trenches should be backfilled to subgrade level with clean, free draining slab rock. An illustration of this system is shown on Plate 15. If slab underdrains are not used, it should be anticipated that water will enter the slab rock, permeate through the concrete slab and ruin floor coverings.

Maintenance

Periodic land maintenance, especially on hillsides, will be required. Surface and subsurface drainage facilities should be checked frequently, and cleaned and maintained as necessary or at least annually. A dense growth of deep-rooted ground cover must be maintained on all slopes to reduce sloughing and erosion. Sloughing and erosion that occurs must be repaired promptly before it can enlarge.

Supplemental Services

Pre-Bid Meeting

It has been our experience that contractors bidding on the project often contact us to discuss the geotechnical aspects. Informal contacts between RGH Consultants (RGH) and an individual contractor could result in incomplete or misinterpreted information being provided to the contractor. Therefore, we recommend a pre-bid meeting be held to answer any questions about the report prior to submittal of bids. If this is not possible, questions or clarifications regarding this report should be directed to the project owner or their designated representative. After consultation with RGH, the project owner or their representative should provide clarifications or additional information to all contractors bidding the job.

Plan and Specifications Review

Coordination between the design team and the geotechnical engineer is recommended to assure that the design is compatible with the soil, geologic and groundwater conditions encountered during our study. RGH recommends that we be retained to review the project plans and specifications to determine if they are consistent with our recommendations. In the event we are not retained to perform this recommended review, we will assume no responsibility for misinterpretation of our recommendations.

Construction Observation and Testing

Prior to construction, a meeting should be held at the site that includes, but is not limited to, the owner or owner's representative, the general contractor, the grading contractor, the foundation contractor, the underground contractor, any specialty contractors, the project civil engineer, other members of the project design team and RGH. This meeting should serve as a time to discuss and answer questions regarding the recommendations presented herein and to establish the coordination procedure between the contractors and RGH.

In addition, we should be retained to monitor all soil related work during construction, including:

- Site stripping, over-excavation, grading, and compaction of near surface soil;
- Placement of all engineered fill and trench backfill with verification field and laboratory testing;
- Observation of all foundation excavations; and
- Observation of foundation and subdrain installations.

If, during construction, we observe subsurface conditions different from those encountered during the explorations, we should be allowed to amend our recommendations accordingly. If different conditions are observed by others, or appear to be present beneath excavations, RGH should be advised at once so that these conditions may be evaluated and our recommendations reviewed and updated, if warranted. The validity of recommendations made in this report is contingent upon our being notified and retained to review the changed conditions.

If more than 18 months have elapsed between the submission of this report and the start of work at the site, or if conditions have changed because of natural causes or construction operations at, or adjacent to, the site, the recommendations made in this report may no longer be valid or appropriate. In such case, we recommend that we be retained to review this report and verify the applicability of the conclusions and recommendations or modify the same considering the time lapsed or changed conditions. The validity of recommendations made in this report is contingent upon such review.

These supplemental services are performed on an as-requested basis and are in addition to this geotechnical study. We cannot accept responsibility for items that we are not notified to observe or for changed conditions we are not allowed to review.

LIMITATIONS

This report has been prepared by RGH for the exclusive use of the property owner and their consultants as an aid in the design and construction of the proposed improvements described in this report.

The validity of the recommendations contained in this report depends upon an adequate testing and monitoring program during the construction phase. Unless the construction monitoring and testing program is provided by our firm, we will not be held responsible for compliance with design recommendations presented in this report and other addendum submitted as part of this report.

Our services consist of professional opinions and conclusions developed in accordance with generally accepted geotechnical engineering principles and practices. We provide no warranty, either expressed or implied. Our conclusions and recommendations are based on the information provided to us regarding the proposed construction, the results of our field exploration, laboratory testing program, and professional judgment. Verification of our conclusions and recommendations is subject to our review of the project plans and specifications, and our observation of construction.

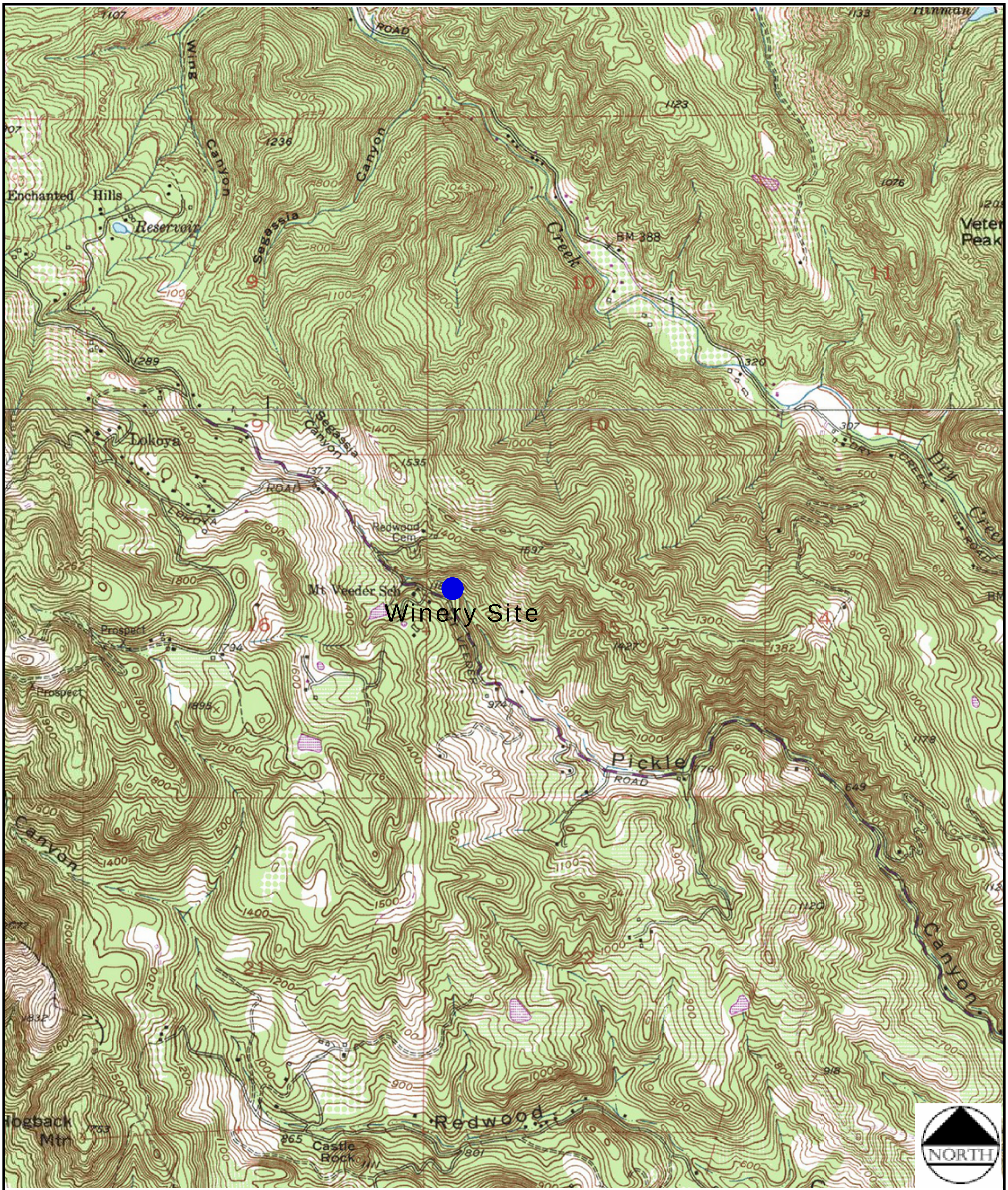
The **Subsurface** section of this report represents the subsurface conditions at the locations and on the date indicated. It is not warranted that they are representative of such conditions elsewhere or at other times. Site conditions and cultural features described in the text of this report are those existing at the time of our field exploration and may not necessarily be the same or comparable at other times.

It should be understood that slope failures including landslides, debris flows and erosion are on-going natural processes which gradually wear away the landscape. Residual soil and weathered bedrock can be susceptible to downslope movement, even on apparently stable sites. Such inherent hillside and slope risks are generally more prevalent during periods of intense and prolonged rainfall, which occasionally occur, in northern California and/or during earthquakes. Therefore, it must be accepted that occasional, unpredictable slope failure and erosion and deposition of the residual soil and weathered bedrock materials are irreducible risks and hazards of building upon or near the base of any hillside or any steeper slope area throughout northern California. By accepting this report, the client and other recipients acknowledge their understanding and acceptance of these risks and hazards, and the terms and conditions herein.

The scope of our services did not include an environmental assessment or a study of the presence or absence of toxic mold and/or hazardous, toxic or corrosive materials in the soil, surface water, groundwater or air (on, below or around this site), nor did it include an evaluation or study for the presence or absence of wetlands. These studies should be conducted under separate cover, scope and fee and should be provided by a qualified expert in those field.

APPENDIX A - PLATES

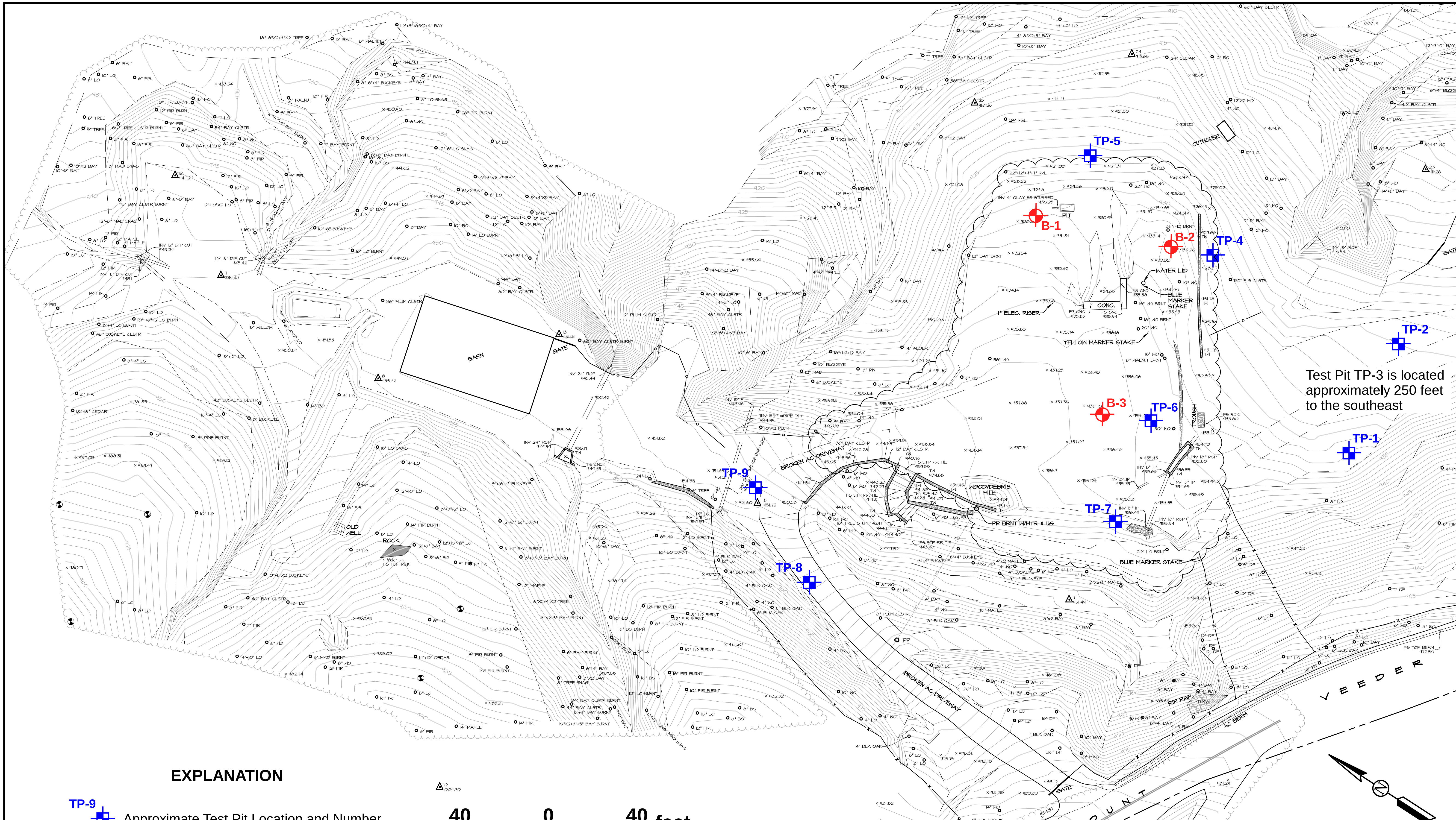
LIST OF PLATES



Reference: Maptech Topoquad, Sonoma, California Quadrangle

Scale: 1" = 2000'

RGH CONSULTANTS	SITE LOCATION MAP	PLATE
Job No: 6442.01.04.2 — Date: NOV 2018	Mt. Veeder Road Winery 2072 Mount Veeder Road Napa, California	1



EXPLANATION

TP-9 Approximate Test Pit Location and Number

B-3 Approximate Boring Location and Number

40 0 40 feet

Scale: 1" = 40'

Reference: Topographic Map by RSA+ dated April 2017

RGH CONSULTANTS	EXPLORATION PLAN Mt. Veeder Road Winery 2072 Mount Veeder Road Napa, California	PLATE 2
Job No: 6442.01.04.2 Date: NOV 2018		

Date(s) Drilled	8/24/2018	Logged By	KU	Checked By	REP
Drilling Method	Soild-Stem Auger	Drill Bit Size/Type	4"	Total Depth of Borehole	16 1/2 feet
Drill Rig Type	Portable	Drilling Contractor	Benevent Drilling	Approximate Surface Elevation	Existing Ground Surface
Groundwater Level and Date Measured	No Groundwater Encountered	Sampling Method(s)	Modified California, SPT	Hammer Data	140lb, 30" drop

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
	0				LIGHT GRAY BROWN CLAYEY SAND WITH GRAVEL (SC), medium dense, moist								
			21		BROWN SANDY CLAY (CL), very stiff, moist (dormant landslide deposit)								
	5		19		DARK BROWN CLAY WITH SAND (CH), very stiff, moist (dormant landslide deposit)								
					LIGHT BROWN SANDY CLAY (CL), very stiff, moist (dormant landslide deposit)								
	10		31		LIGHT GRAY BROWN SANDY CLAY (CL), hard, moist (Ancient landslide deposit)								
	15		38										
					Boring terminated at 16 1/2 feet No groundwater encountered								
	20												

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Job No: 6442.01.04.2 | Date: NOV 2018

LOG OF BORING B-1
Mt. Veeder Road Winery
2072 Mount Veeder Road
Napa, California

PLATE
3

Date(s) Drilled	8/24/2018	Logged By	KU	Checked By	REP
Drilling Method	Soild-Stem Auger	Drill Bit Size/Type	4"	Total Depth of Borehole	16 1/2 feet
Drill Rig Type	Portable	Drilling Contractor	Benevent Drilling	Approximate Surface Elevation	Existing Ground Surface
Groundwater Level and Date Measured	No Groundwater Encountered	Sampling Method(s)	Modified California, SPT	Hammer Data	140lb, 30" drop

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
	0				GRAY BROWN SANDY CLAY (CH), stiff to very stiff, moist, mottled orange (dormant landslide deposit)								
			13						47.4	75.5	156		
	5		17										
					LIGHT BROWNISH GRAY SANDY CLAY (CL), very stiff, moist (Ancient landslide deposit)								
	10		28										
	15		28										
					Boring terminated at 16 1/2 feet No groundwater encountered								
	20												

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CONSULTANTS

Job No: 6442.01.04.2 Date: NOV 2018

LOG OF BORING B-2
Mt. Veeder Road Winery
2072 Mount Veeder Road
Napa, California

PLATE
4

Date(s) Drilled	8/24/2018	Logged By	KU	Checked By	REP
Drilling Method	Soild-Stem Auger	Drill Bit Size/Type	4"	Total Depth of Borehole	21 1/2 feet
Drill Rig Type	Portable	Drilling Contractor	Benevent Drilling	Approximate Surface Elevation	Existing Ground Surface
Groundwater Level and Date Measured	No Groundwater Encountered	Sampling Method(s)	Modified California, SPT	Hammer Data	140lb, 30" drop

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
	0				DARK BROWN CLAY WITH SAND (CH), stiff to very stiff, moist, mottled orange (dormant landslide deposit)								
			14										
	5		14										
	10		19										
			19		GRAY GREEN SILTSTONE, friable, plastic, highly weathered								
	15		32										
	20		22										
					Boring terminated at 21 1/2 feet No groundwater encounted								

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Job No: 6442.01.04.2 Date: NOV 2018

LOG OF BORING B-3

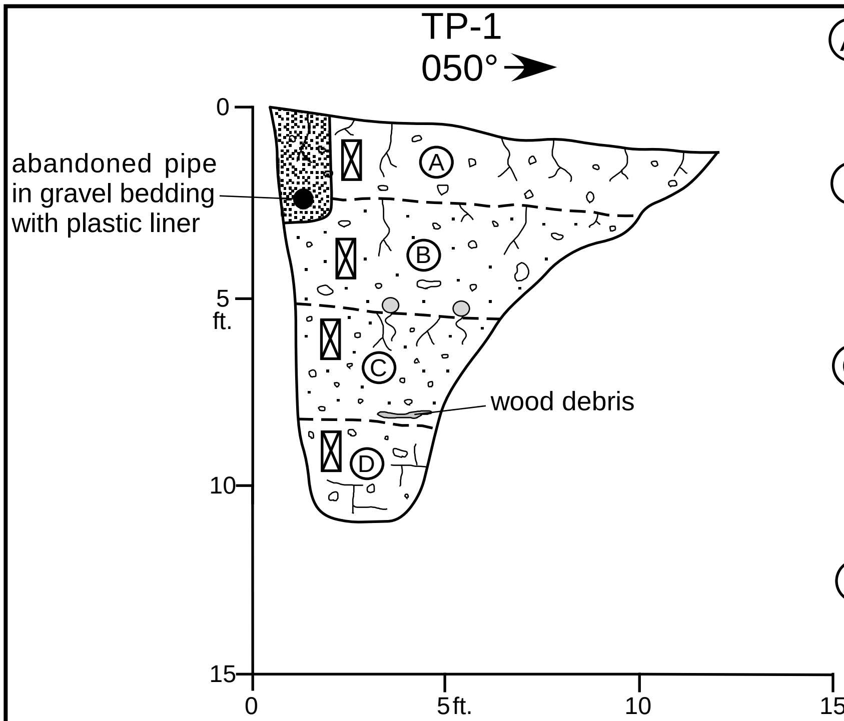
Mt. Veeder Road Winery

2072 Mount Veeder Road

Napa, California

PLATE

5

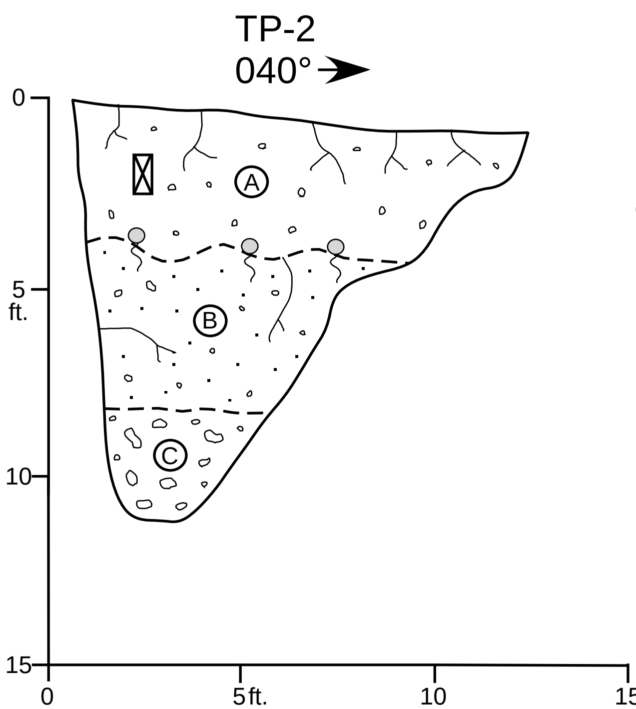


(A) GRAY-BROWN CLAY WITH GRAVEL (CH), soft to stiff, moist, fine to coarse gravels, roots/rootlets to 1 1/2', porous

(B) OLIVE-GRAY CLAY WITH GRAVEL (CH), medium stiff to stiff, moist, fine to coarse gravel, few angular cobbles to 8", porous, few rootlets (ancient landslide deposit)

(C) MOTTLED DARK BROWN CLAY (CH), medium stiff to stiff, moist, fine to coarse gravel, few angular cobbles to 8" diameter, porous, few rootlets (ancient landslide deposit)

(D) MOTTLED OLIVE AND DARK BROWN CLAY WITH GRAVEL (CH), stiff to very stiff, moist, fine to coarse gravel, "blocky texture" (ancient landslide deposit)



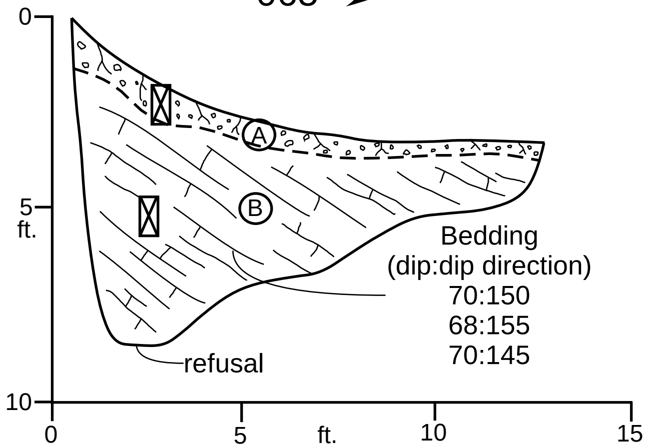
(A) MOTTLED GRAY-BROWN AND OLIVE GRAY CLAY WITH GRAVEL (CH), soft to stiff, moist, fine to coarse gravel, roots/rootlets to 1 1/2", porous

(B) MOTTLED DARK BROWN CLAY (CH), medium stiff to stiff, moist, fine to coarse gravels, few angular cobbles to 8" diameter, porous, few rootlets (ancient landslide deposit)

(C) MOTTLED OLIVE AND DARK BROWN CLAY WITH GRAVEL (CH), stiff to very stiff, moist, fine to coarse gravel, cobbles to 8" diameter, "blocky texture" (ancient landslide deposit)

RGH CONSULTANTS Job No: 6442.01.04.2 — Date: NOV 2018	**LOG OF TEST PITS TP-1 AND TP-2** Mt. Veeder Road Winery 2072 Mount Veeder Road Napa, California	PLATE 6

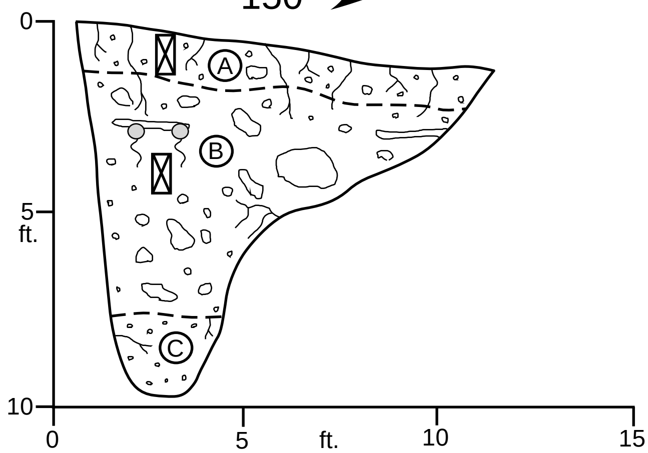
TP-3
065° ➤



Ⓐ MOTTLED BROWN GRAVELY CLAY (CH), soft, moist, fine to coarse gravel, many rootlets, porous

Ⓑ MOTTLED DARK BROWN AND GRAY MUDSTONE, very thinly bedded, very closely to closely spaced fractures, firm to moderately hard, weak, moderately weathered

TP-4
150° ➤

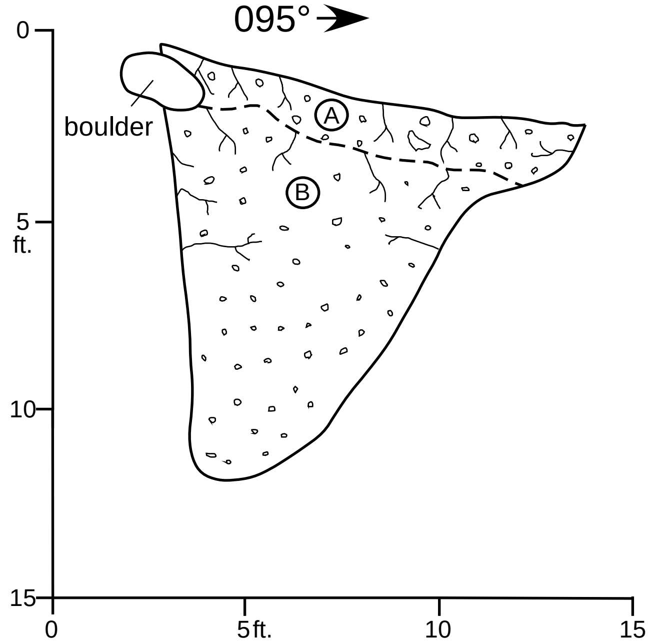


Ⓐ DARK BROWN AND GRAY BROWN CLAY WITH GRAVEL (CH), very soft to medium stiff, moist, gravels and cobbles to 10" diameter, abundant root/rootlets, porous

Ⓑ MOTTLED OLIVE, GRAY AND GRAY-BROWN GRAVELLY CLAY (CH), moderately stiff to stiff, gravels, cobbles and boulders to 2" diameter, roots and rootlets to 4', porous to 3', water seeping with roots (ancient landslide deposit)

Ⓒ MOTTLED OLIVE-GRAY AND DARK BROWN CLAY (CH), medium stiff to stiff, moist, few fine to coarse gravel, few rootlets (ancient landslide deposit)

TP-5
095° ➤

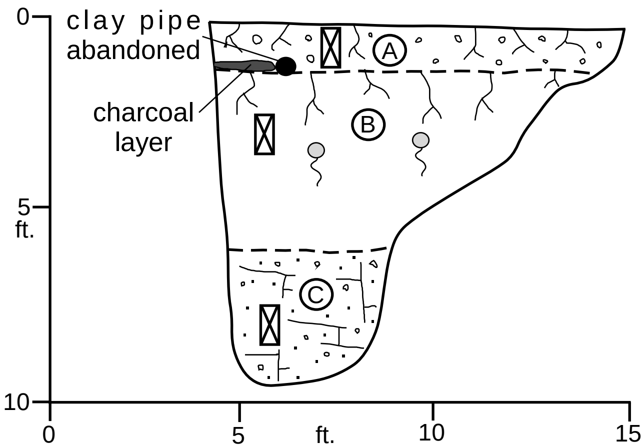


Ⓐ DARK BROWN AND GRAY BROWN CLAY WITH GRAVEL (CH), very soft to medium stiff, moist, gravel and cobbles to 10" diameter, boulders to 3' diameter, abundant root/rootlets, porous

Ⓑ MOTTLED OLIVE, GRAY AND GRAY-BROWN GRAVELLY CLAY (CH), moderately stiff to stiff, with angular gravel and cobbles to 10" diameter, few roots/rootlets, increasing fine to medium angular gravels @ 10' (ancient landslide deposit)

RGH CONSULTANTS Job No: 6442.01.04.2 Date: NOV 2018	**LOG OF TEST PITS TP-3, TP-4 AND TP-5** Mt. Veeder Road Winery 2072 Mount Veeder Road Napa, California	PLATE 7

TP-6
240°

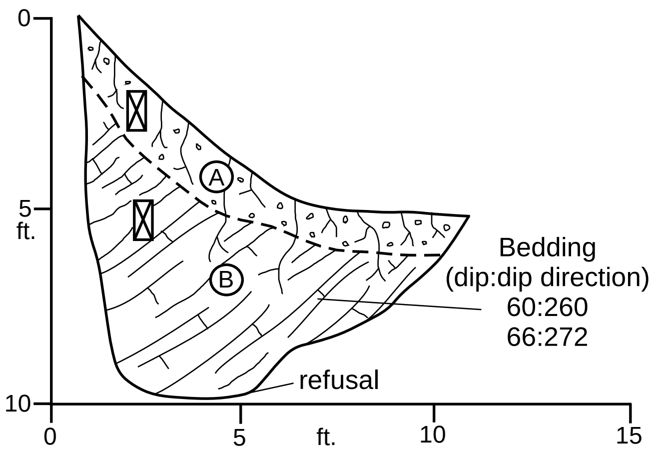


Ⓐ DARK BROWN AND OLIVE-BROWN CLAY WITH GRAVEL (CH), medium stiff to stiff, moist, fine to coarse gravel, roots/rootlets, porous

Ⓑ MOTTLED DARK-BROWN CLAY (CH), stiff, moist, few roots/rootlets to 3', porous to 3', water seeping @ 3 1/2' (ancient landslide deposit)

Ⓒ MOTTLED DARK-BROWN CLAY WITH SAND (CH), very stiff to hard, moist to dry, coarse sand sized rocks and few fine gravels, old rootlets, “blocky texture” (ancient landslide deposit)

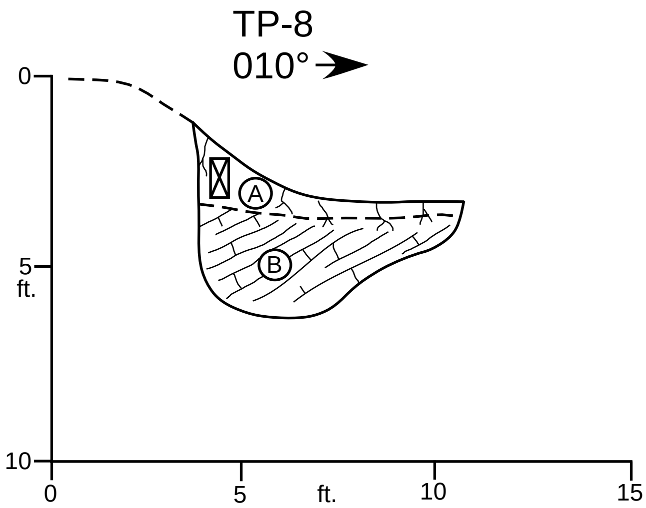
TP-7
055°



Ⓐ OLIVE-BROWN AND GRAY CLAY WITH GRAVEL (CH), very soft to soft, moist, fine to coarse angular gravels, abundant roots/rootlets, porous

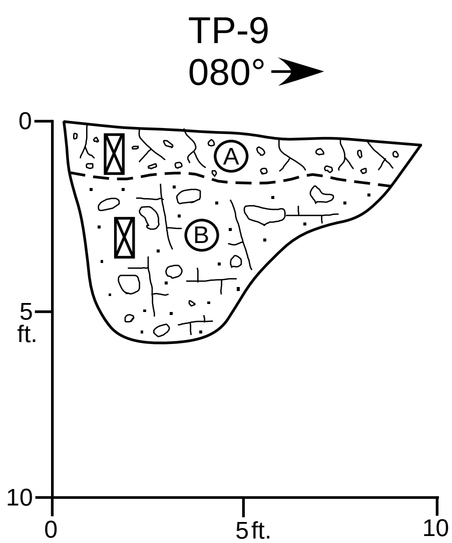
Ⓑ MOTTLED DARK BROWN AND YELLOW-BROWN MUDSTONE, thinly to very thinly bedded, very closely spaced fractures, soft to moderately hard, plastic to weak, moderately to highly weathered, clay and root infill fractures, rootlets to 4'

RGH CONSULTANTS	**LOG OF TEST PITS TP-6 AND TP-7** Mt. Veeder Road Winery 2072 Mount Veeder Road Napa, California	PLATE **8**
Job No: 6442.01.04.2 / Date: NOV 2018		



Ⓐ LIGHT GRAY CLAY WITH GRAVEL (CH), moist, roots/rootlets, fine to coarse gravel, porous

Ⓑ MOTTLED DARK BROWN MUDSTONE, thinly to very thinly bedded, very closely spaced fractures, firm to moderately hard, weak to moderately strong, moderately weathered



Ⓐ MOTTLED OLIVE-BROWN GRAVELLY CLAY (CH), medium stiff, moist, fine to coarse gravel and cobbles to 10', roots/rootlets, porous

Ⓑ MOTTLED RED-GRAY AND OLIVE-BROWN ANDESITIC TUFF, massive, contains clasts to basaltic andesite tuff and KJgv mudstone, firm to hard, friable to strong, moderately weathered

RGH CONSULTANTS	**LOG OF TEST PITS TP-8 AND TP-9** Mt. Veeder Road Winery 2072 Mount Veeder Road Napa, California	PLATE **9**
Job No: 6442.01.04.2 / Date: NOV 2018		

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL (LITTLE OR FINES)		GW	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVEL, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVEL WITH FINES (OVER 12% OF FINES)		GM	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GC	CLAYEY GRAVEL, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SAND, GRAVELLY SAND, LITTLE OR NO FINES
				SP	POORLY-GRADED SAND, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (OVER 12% OF FINES)		SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
				SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANICS SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	ORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS AND OTHER SOILS WITH HIGH ORGANIC-CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

KEY TO TEST DATA

Consol - Consolidation
Gs - Specific Gravity
SA - Sieve Analysis
■ - "Undisturbed" Sample
⊠ - Bulk or Disturbed Sample
◥ - Standard Penetration Test
⧄ - Sample Attempt With No Recovery
▯ - Sample Recovered But Not Retained

	Shear Strength, psf	Confining Pressure, psf	
Tx	320	(2600)	- Unconsolidated Undrained Traixial
TxCU	320	(2600)	- Consolidated Undrained Triaxial
DS	2750	(2600)	- Consolidated Drained Direct Shear
UC	2000		- Unconfined Compression
FVS	470		- Field Vane Shear
LVS	700		- Laboratory Vane Shear
SS			- Shrink Swell
EXP			- Expansion
P			- Permeability

Note: All strength tests on 2.8-in. or 2.4-in. diameter sample, unless otherwise indicated.

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Job No: 6442.01.04.2 | Date: NOV 2018

SOIL CLASSIFICATION AND KEY TO TEST DATA
Mt. Veeder Road Winery
2072 Mount Veeder Road
Napa, California

PLATE 10

LAYERING

MASSIVE	Greater than 6 feet
THICKLY BEDDED	2 to 6 feet
MEDIUM BEDDED	8 to 24 inches
THINLY BEDDED	2½ to 8 inches
VERY THINLY BEDDED	¾ to 2½ inches
CLOSELY LAMINATED	¼ to ¾ inches
VERY CLOSELY LAMINATED	Less than ¼ inch

JOINT, FRACTURE, OR SHEAR SPACING

VERY WIDELY SPACED	Greater than 6 feet
WIDELY SPACED	2 to 6 feet
MODERATELY SPACED	8 to 24 inches
CLOSELY SPACED	2½ to 8 inches
VERY CLOSELY SPACED	¾ to 2½ inches
EXTREMELY CLOSELY SPACED	Less than ¼ inch

HARDNESS

Soft - pliable; can be dug by hand
Firm - can be gouged deeply or carved with a pocket knife
Moderately Hard - can be readily scratched by a knife blade; scratch leaves heavy trace of dust and is readily visible after the powder has been blown away
Hard - can be scratched with difficulty; scratch produces little powder and is often faintly visible
Very Hard - cannot be scratched with pocket knife, leaves a metallic streak

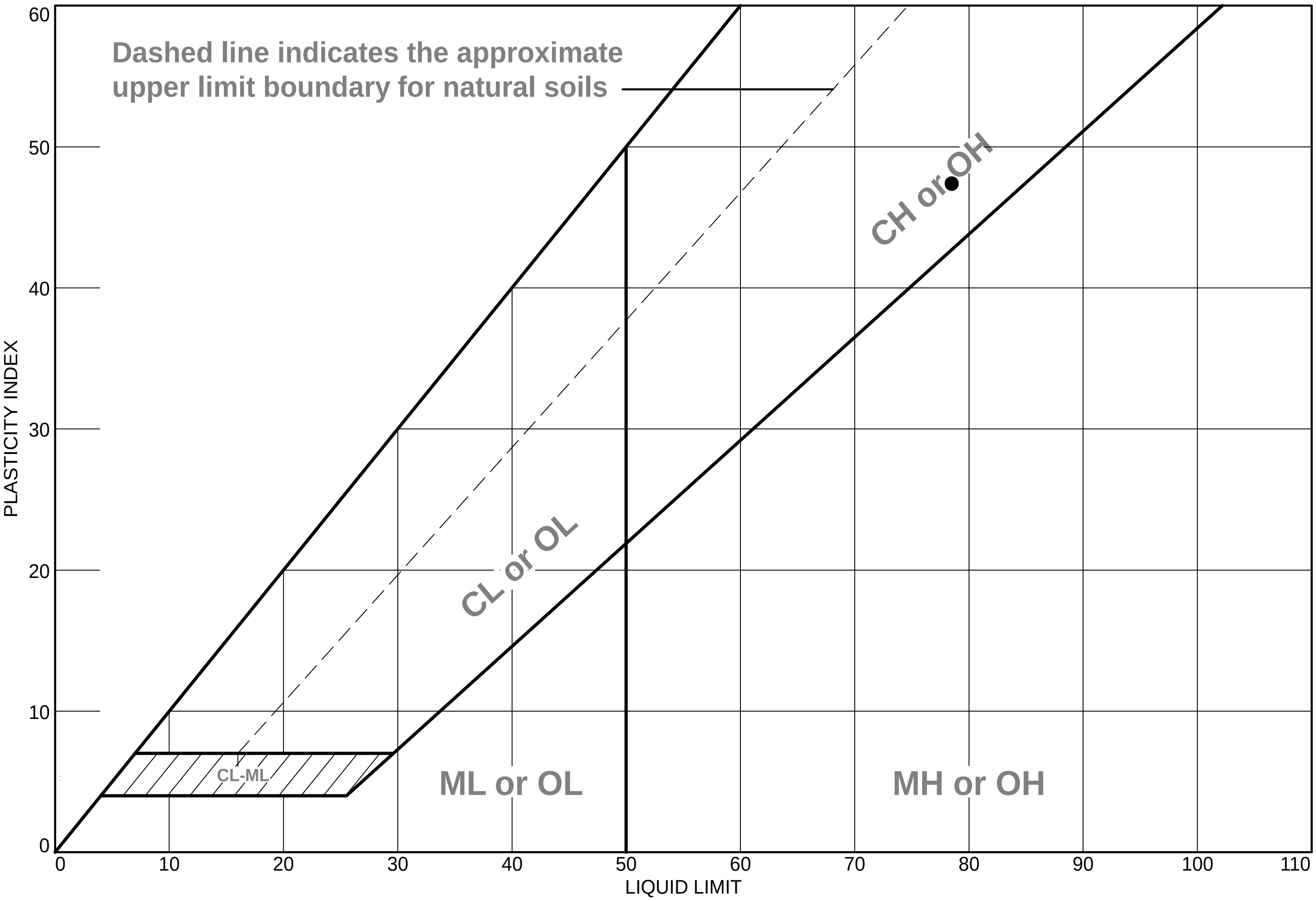
STRENGTH

Plastic - capable of being molded by hand
Friable - crumbles by rubbing with fingers
Weak - an unfractured specimen of such material will crumble under light hammer blows
Moderately Strong - specimen will withstand a few heavy hammer blows before breaking
Strong - specimen will withstand a few heavy ringing hammer blows and usually yields large fragments
Very Strong - rock will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments

DEGREE OF WEATHERING

Highly Weathered - abundant fractures coated with oxides, carbonates, sulphates, mud, etc., thorough discoloration, rock disintegration, mineral decomposition
Moderately Weathered - some fracture coating, moderate or localized discoloration, little to no effect on cementation, slight mineral decomposition
Slightly Weathered - a few stained fractures, slight discoloration, little or no effect on cementation, no mineral composition
Fresh - unaffected by weathering agents; no appreciable change with depth

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Clay W/ Sand (CH)	78.5	31.1	47.4		80.0	CH

Project No. 6442.01.04.2 **Client:** RGH Consultants

Project: Mt. Veeder Road Winery

● **Source of Sample:** B-2 **Depth:** 2.5'

Remarks:

● Expansion Index= 156 (Very High)

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Job No: 6442.01.04.2 | Date: NOV 2018

CLASSIFICATION TEST DATA
Mt. Veeder Road Winery
2072 Mount Veeder Road
Napa, California

PLATE

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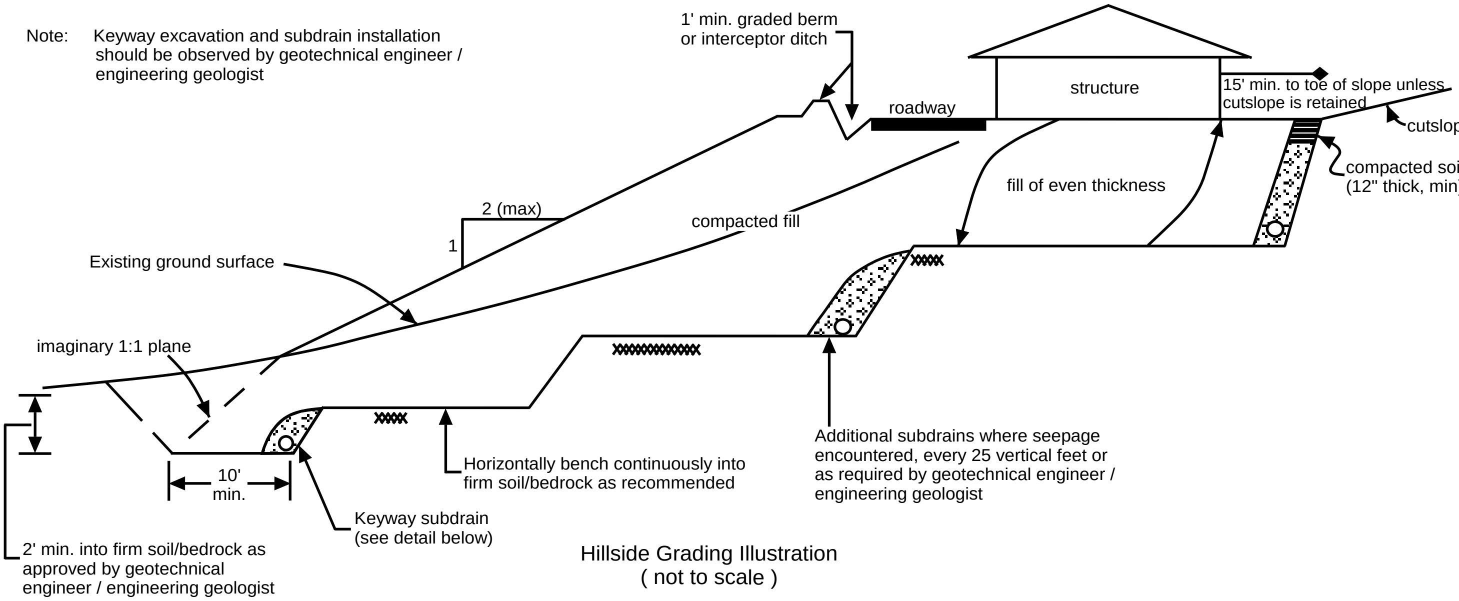
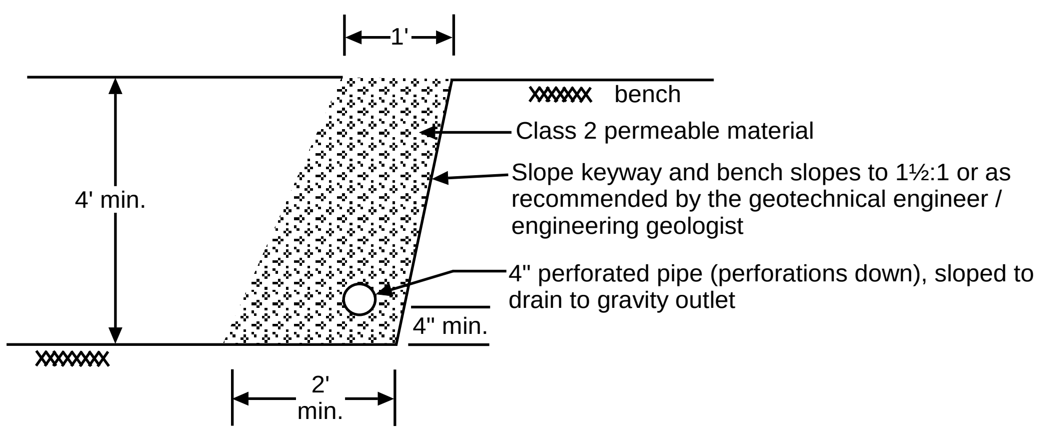
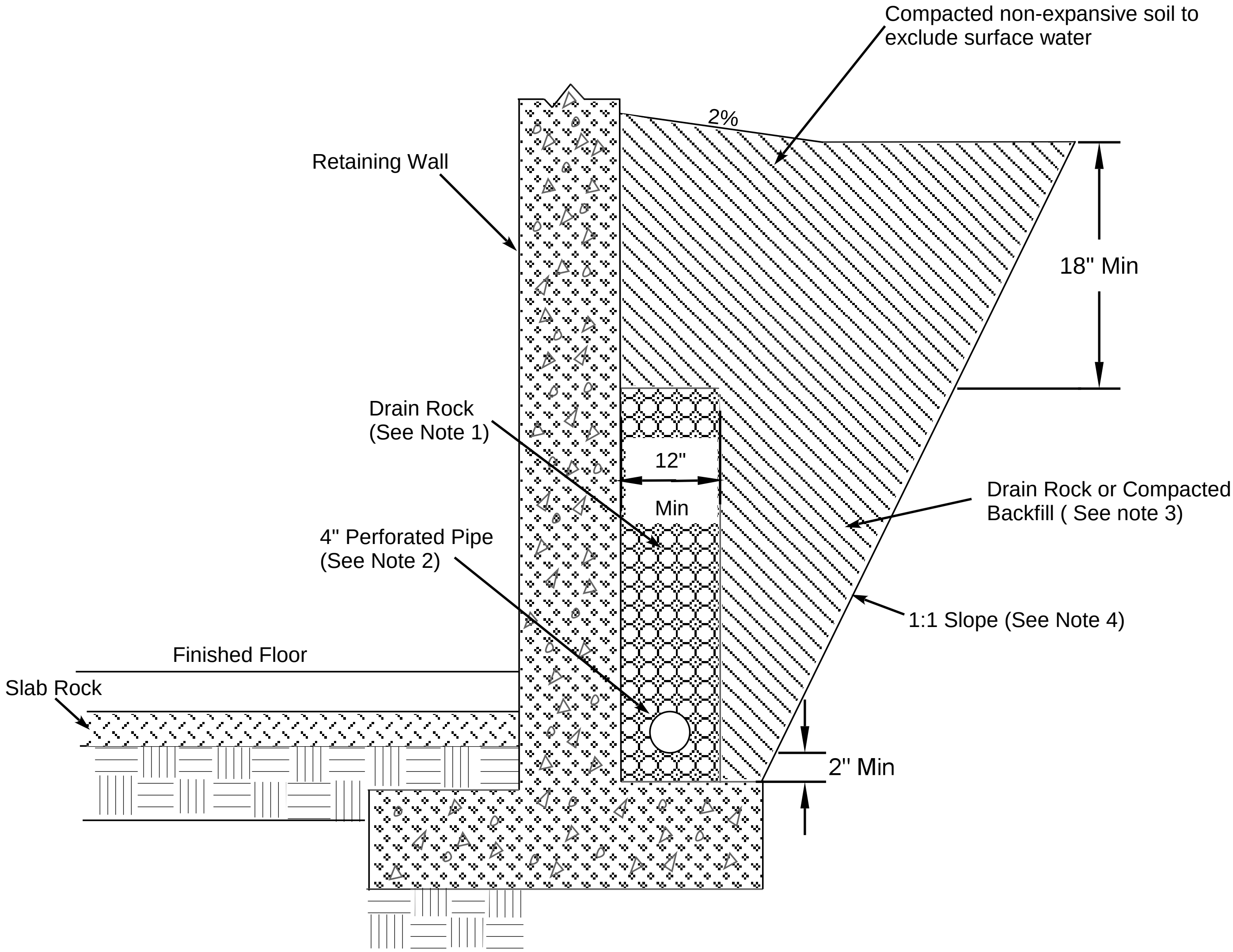


Hillside Grading Illustration
(not to scale)



Keyway Subdrain
(not to scale)

RGH CONSULTANTS	**HILLSIDE GRADING ILLUSTRATION** Mt. Veeder Road Winery 2072 Mount Veeder Road Napa, California	PLATE **13**
Job No: 6442.01.04.2 / Date: NOV 2018		



Notes:

1. Drain rock should meet the requirements for Class 2 Permeable Material, Section 68, State of California "Caltrans" Standard Specification, latest edition. Drain rock should be placed to approximately three-quarters the height of the retaining wall.

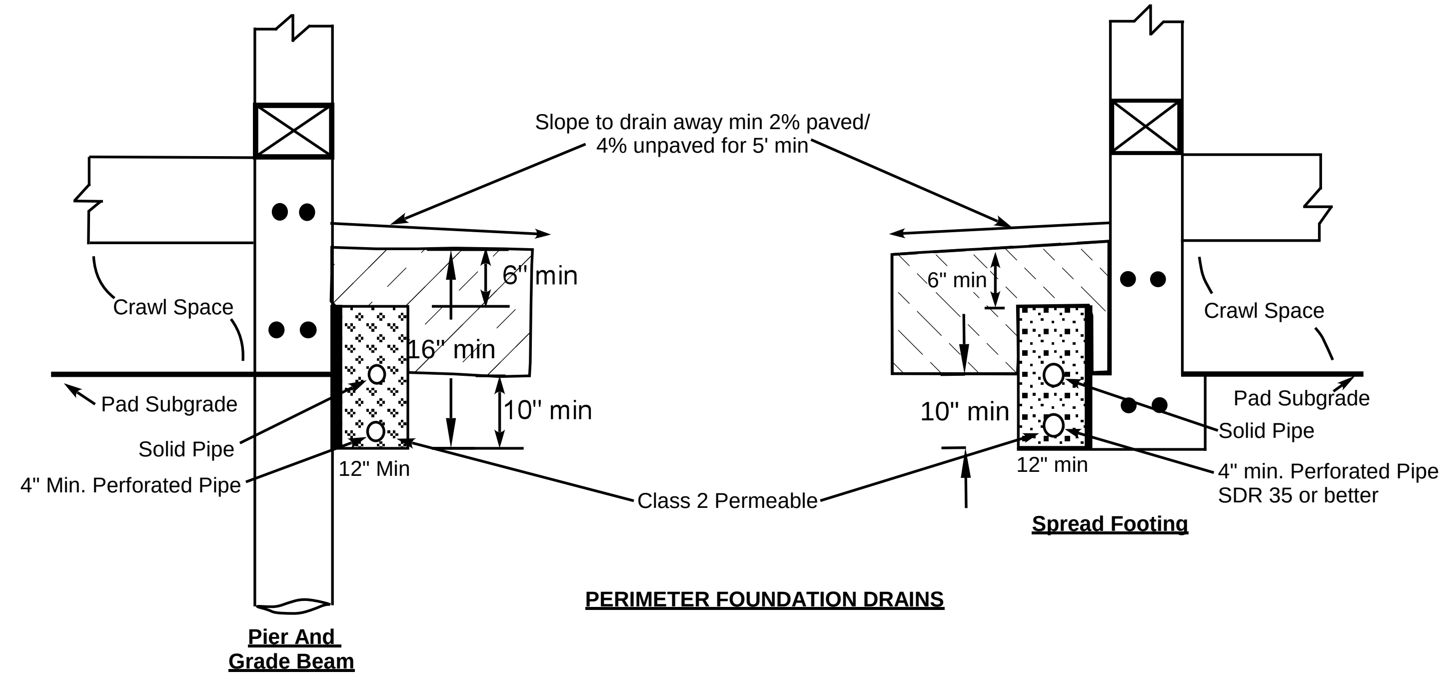
2. Pipe should conform to the requirements of Section 68 of State of California "Caltrans" Standards, perforations placed down, sloped at 1% for gravity flow to outlet or sump with automatic pump. The pipe invert should be located at least 8 inches below the lowest adjacent finished surface.

3. During construction the contractor should use appropriate methods such as temporary bracing and/or light compaction equipment to avoid overstressing the walls. Non-expansive soils to be used as backfill.

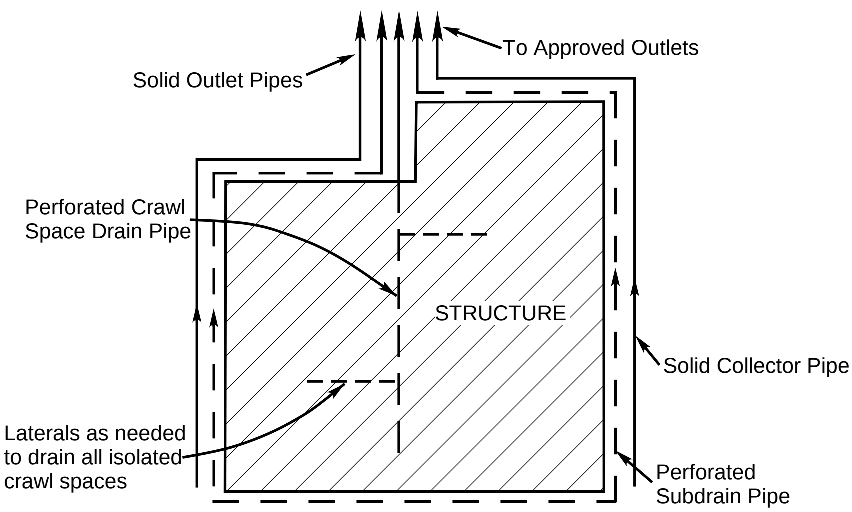
4. Slope excavation back at a 1:1 gradient from the back of footing where expansive materials are exposed.

Not to Scale

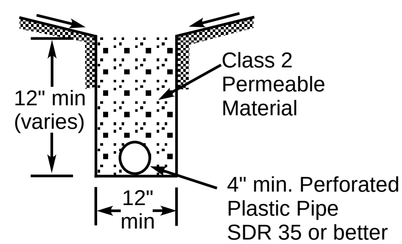
RGH CONSULTANTS	RETAINING WALL BACKDRAIN ILLUSTRATION Mt. Veeder Road Winery 2072 Mount Veeder Road Napa, California	PLATE 14
Job No: 6442.01.04.2 / Date: NOV 2018		



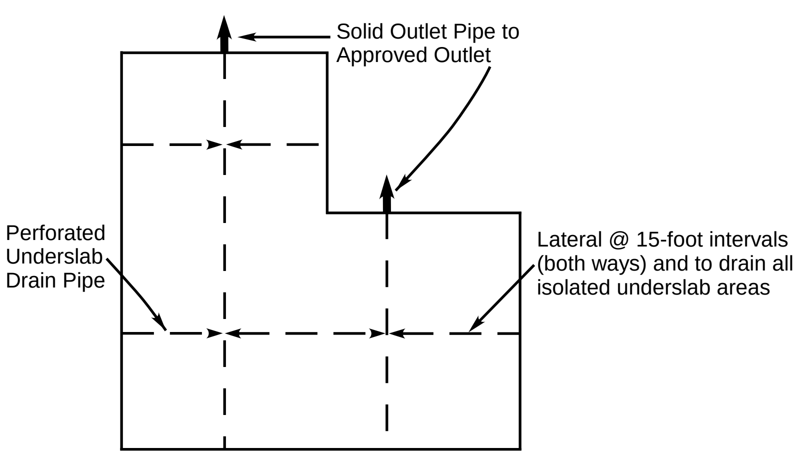
PERIMETER FOUNDATION DRAINS



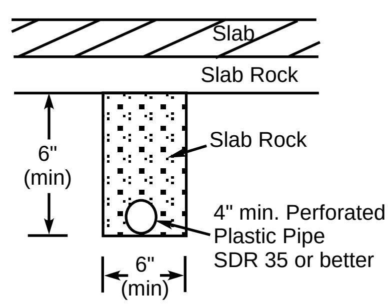
TYPICAL FOUNDATION DRAIN PLAN



CRAWL SPACE DRAIN



TYPICAL UNDERSLAB DRAIN PLAN



SLAB UNDERDRAIN

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TYPICAL SUBDRAIN DETAILS
Mt. Veeder Road Winery
2072 Mount Veeder Road
Napa, California

PLATE
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APPENDIX B - REFERENCES

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APPENDIX C - DISTRIBUTION

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November 6, 2020 (Revised January 4, 2021)

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Geotechnical Recommendations
Site Improvements
Mt. Veeder Road Winery
2072 Mt. Veeder Road
Napa, California

Project Number: 6442.01.06.2

This letter documents our response to the County comments of the site improvements for the winery at 2072 Mt. Veeder Road in Napa, California. The results of our geotechnical study for the project were presented in a report dated November 5, 2018.

The planned site improvements have been designed as to not increase surface water flow to the erosional features shown on the site plan or they will divert existing flow paths away from the erosional features. Additionally, the improvements constructed above those features will be founded in bedrock and will not impose an additional load to the surface soil. Therefore, the stability of the erosional features should not be decreased by the planned improvements. Additionally, provided concentrated flows to the erosional features are mitigated and that the proposed improvements will be supported on undisturbed bedrock, we judge that the erosional features should not have long term negative impacts on the planned improvements.

We trust this provides the information you require at this time. Please call the undersigned if you have questions.

Very truly yours,
RGH Consultants

Ryan E. Padgett
Project Manager
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
RYAN E. PADGETT
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CIVIL
STATE OF CALIFORNIA

cc: Applied Civil Engineering
Attention: Mike Muelrath
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REP:JJP:aku:brw

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