Appendix F

Geotechnical Report

GEOTECHNICAL PLAN REVIEW

VESTING TENTATIVE TRACT MAP NO. 78248

PLANNING AREA OF 1-8

SANTA CLARITA, CALIFORNIA

FOR

SAND CANYON COUNTRY CLUB

SEPTEMBER 20, 2018

JOB NO. 2017-006-021

RTF&A

GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

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September 20, 2018

Sand Canyon Country Club
27734 Sand Canyon Road
Santa Clarita, CA 91387

2017-006-021

Attention: Mr. Steve Kim

Subject: Geotechnical Plan Review
Vesting Tentative Tract Map No. 78248
Planning Area OF 1-8
Santa Clarita, California

Ladies/Gentlemen:

We are pleased to submit our "Geotechnical Plan Review, Vesting Tentative Tract Map No. 78248, Planning Area OF 1-8, Santa Clarita, California." The purpose of this report is to evaluate the proposed resort development, and provide geotechnical recommendations as required.

Based on the findings summarized in this report, it is our professional opinion that the proposed project will be safe from hazards of landslide, settlement, or slippage. Furthermore, the proposed grading will not adversely affect adjacent property, provided our recommendations and the 2016 California Building Code, the 2017 Los Angeles County Building Code, and the 2017 City of Santa Clarita Building Code (herein collectively referred to as CBC) are followed.

It is our opinion that this report is suitable for regulatory submittal. However, this report was not and will not be submitted by R. T. Frankian & Associates for regulatory review. If an electronic submittal is not being performed, please contact us and request the number of needed wet signed hard copies of our report for regulatory submittal.

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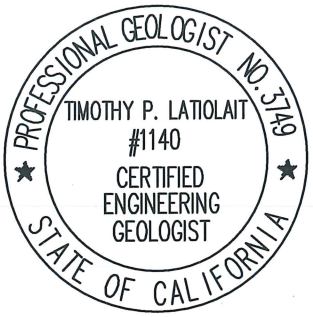
Should you have any questions regarding this project, please do not hesitate to contact our office.

Yours very truly,

R. T. FRANKIAN & ASSOCIATES

by: Alan W. Rasplicka
Principal Geotechnical Engineer



and: Timothy P. Latiolait
Principal Engineering Geologist

PDF Distribution via Email:
– Sand Canyon Country Club, Attn: Mr. Steve Kim
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GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

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INTRODUCTION

R. T. Frankian and Associates, Inc., (RTF&A) is pleased to present this Geotechnical Plan Review for Sand Canyon Country Club, Vesting Tentative Tract Map No. 78248, Planning Area OF 1-8 (herein referred to as "VTTM 78248), Santa Clarita, California. The report was based on the September 5, 2018 project plan titled *Major Land Division, Vesting Tentative Tract Map No. 78248, Planning Area OF 1-8*, prepared by Hunsaker & Associates at a scale of 1 inch = 40 feet. The project plan, consisting of four sheets, shows the general location and layout of VTTM 78248, and was used as the base map for the Geotechnical Map presented as Figures 1.1 through 1.4. The purpose of this report is to evaluate the proposed development and provide geotechnical recommendations as required.

Previous geotechnical studies conducted within VTTM 78248 were performed by G.C. Masterman and Associates, Inc. in 1989; Grover-Hollingsworth and Associates, Inc. in 1989; California Geosystems, Inc. in 1990; Gorian and Associates, Inc. (Gorian) in 1990, 1991, and 1995; and Geotechnical Associates, Inc. (GAI) in 1998. Numerous exploratory borings and test pits were excavated onsite during the course of these various studies. The logs of these exploratory excavations were presented in GAI's 1998 geotechnical investigation of the site (GAI, 1998a). Select logs from these reports, pertinent to the current study area, are re-presented in this Geotechnical Plan Review report. Data from the 1995 Gorian and 1998 GAI reports were reviewed and incorporated into this report, as appropriate.

The findings, conclusions, and recommendations presented in this report are based on data developed by RTF&A, Gorian, and GAI, as well as appropriate engineering and geologic analyses. The assessment of general site environmental conditions for the presence of contaminants in the soils and groundwater was beyond the scope of this investigation.

SCOPE OF WORK

The scope for the Tentative Map Geotechnical Plan Review consisted of:

- reviewing the Gorian and GAI geotechnical reports previously prepared for the site;
- reviewing State of California Alquist-Priolo Earthquake Fault Zone Maps and Seismic Hazard Maps to evaluate potential geologic hazards;
- reviewing geologic maps published by the California Geological Survey (formerly known as the California Division of Mines and Geology) and the Dibblee Foundation to assess regional geologic conditions;
- reviewing groundwater data from the Los Angeles County Department of Public Works Water Resources Division to establish high groundwater levels and trends in the area;
- excavating exploratory backhoe test pits to observe subsurface geologic structure and define fill limits;
- drilling four exploratory borings with a hollow stem auger drill rig;
- obtaining disturbed and undisturbed samples for laboratory testing;
- laboratory testing of representative samples for direct shear, consolidation, and in-place moisture and density;
- performing geologic and engineering analyses;

- providing recommendations for grading, including site preparation, excavation, anticipated removal depth, and the placing of required compacted fill; and

- preparing an engineering geologic and geotechnical report presenting the results and conclusions of our investigation and plan review.

SITE DESCRIPTION

VTTM 78248 is located in the City of Santa Clarita, situated immediately east of Sand Canyon and southwest of Oak Spring Canyon. Site topography is dominated by a major northwest-trending bedrock ridge between Sand and Oak Spring Canyons that descends towards the Santa Clara River, located approximately 1 mile north of the site. Several minor westerly- and easterly-trending ridges descend onto the site from the main northwest-trending ridge. The natural slopes onsite are inclined at gradients of approximately 4:1 (horizontal: vertical) to approximately 1½:1. Site elevations range from approximately 1,590 feet above mean sea level (msl) in the northwest portion of the site to approximately 1,740 feet msl in the southeast.

GEOLOGY

REGIONAL GEOLOGY

VTTM 78248 is located at the western end of the Soledad basin within the Transverse Ranges geomorphic province of California. The Soledad basin consists of an elongate, northeast trending basin, measuring approximately 30 miles long and 8 to 12 miles wide. The floor of the basin is irregular, with elevations ranging from 400 feet mean sea level (msl) at its western end to as much as 2,500 feet near the eastern end.

The basin is bounded on the north, east, and south by ridges and mountain masses of relatively old crystalline rocks that, along with ancestral highland masses, have contributed large quantities of Cenozoic age sediments to the basin (Jahns and Muehlberger, 1954). More than

20,000 feet of stratified rocks were deposited into the elongate lowland area of the basin, with an additional 4,500± feet of volcanic rocks accumulated locally (Jahns and Muehlberger, 1954).

Structurally, the Soledad basin is a westerly plunging open syncline with locally wrinkled flanks (Bailey and Jahns, 1954). The basin appears to have been defined as a trough of deposition mainly by faults, receiving its sedimentary fill in a manner that was very irregular in detail. Repeated episodes of primarily early Tertiary deformation, both within and along the margins of the basin, are indicated by numerous faults, folds, and unconformities, as well as by the distribution and lithology of the sedimentary rocks (Jahns and Muehlberger, 1954). The early Miocene and younger strata of the basin, although maintaining the broadly synclinal structure, have been considerably less deformed (Bailey and Jahns, 1954). These deposits blanket many of the older faults of the basin, but are themselves offset by other faults, such as the nearby San Gabriel fault zone.

The San Gabriel fault zone, the dominant geologic feature in the Santa Clarita Valley, forms the southwestern boundary of the Soledad basin and separates the basin from the structurally similar Ventura basin.

SITE GEOLOGY

Geologic Materials: Earth materials encountered on-site consist of artificial fill, alluvium, and bedrock units assigned to the Mint Canyon Formation. The areal extent of the various geologic units is depicted on the Geotechnical Map, Figure 1.1 to 1.4. Following is a brief description of the earth materials, with emphasis on their engineering geologic characteristics.

Mint Canyon Formation (Tmc): Sedimentary rock units of the Miocene age Mint Canyon Formation (designated map unit "Tmc") underlie VTTM 78248 at depth, and are exposed at ground surface in areas of higher topographic relief. This formation consists of fine to coarse grained arkosic sandstone interbedded with conglomerate, siltstone, and claystone. Beds are several inches to several feet thick and the color is light gray to brown. The rock mass shows few

widely spaced joints. Joint spacing is in excess of 20 feet. Joints are tight with no separation and continuous over 3 feet to 10 feet. Joint surfaces are rough and irregular and may show no coating or a coating of disseminated carbonate or oxide.

As a result of past site activities associated with grading and development of the golf course, there is a moderately thin cover of artificial fill materials over some of the areas identified as Mint Canyon Formation on the Geotechnical Map. The artificial fill over the Mint Canyon Formation generally varies in depth from 0.5 to 3 feet.

Alluvium (Qal): Prior to golf course grading Holocene age alluvial deposits (map unit "Qal") mantled all of the canyons and drainage courses within the project boundaries, but were either removed, or has been blanketed by artificial fill. As observed in exploratory excavations, the alluvium consists of fine to coarse sand and silty sand.

Artificial Fill (af): Artificial fill materials (map unit "af") are present over half of the site, placed within previous canyon areas or to establish the various golf course features. The artificial fill is composed of sand and silty sand mixtures derived from the onsite or nearby alluvial and bedrock materials.

Geologic Structure: The Mint Canyon Formation in the site vicinity has been warped into a north striking homoclinal structure with bedding dipping between 22 to 40 degrees west. Bedding planes within the Mint Canyon Formation vary from poorly defined and gradational to sharp and planar. The geologic structure beneath VTTM 78248 is shown on the Geologic Sections, presented as Figure 2.

Faults: Faults in southern California are classified as active, potentially active, and inactive, based on their most recent activity. As defined by the California Geological Survey (Hart and Bryant, 1999) for the Alquist-Priolo Earthquake Fault Zone program, a fault can be considered active if it has demonstrated movement within the Holocene epoch, or approximately the last 11,000 years. Faults that have demonstrated Quaternary movement (last 1.6 million years), but

lacking strong evidence of Holocene movement, are classified as potentially active. Faults that have not moved since the beginning of the Quaternary period are deemed inactive.

The active San Gabriel fault zone is located approximately 2.8 miles southwest of VTTM 78248 and consists of a northwest-trending zone of imbricate, steeply north-dipping faults. The fault has strong geomorphic expression characterized by displaced geologic units, deflected drainages, strike valleys, notched ridges, subparallel faulting, and fracturing and folding (Oakeshott, 1958; Wentworth and Yerkes, 1971). According to Oakeshott (1958), the zone of faulting ranges in width from a single plane with no more than a few inches of gouge, to a half-mile-wide area of several fault planes, zones of brecciation, and complex steep-limbed folds.

No known active faults project into or cross VTTM 78248, and the site is not located in a State of California Alquist-Priolo Earthquake Fault Zone. The potential for ground rupture due to faulting is considered remote.

Faults confined to the Miocene age Mint Canyon Formation (and by definition inactive) have been mapped by Saul and Wooten (1983) and included on Geotechnical Maps presented in the Gorian report; however, according to Gorian, direct evidence for the faults mapped by Saul and Wooten were not found onsite during their geotechnical investigation. Accordingly, although Gorian did depict the inactive faults on their maps, they indicated the faults as being questionable. The as-built geotechnical report prepared by GAI (1999) following grading of the golf course did not show the inactive faults. Accordingly, due to the uncertainty regarding the presence and location of these inactive faults, we have not shown them on the Geotechnical Map, Figure 11 through 1.4.

Gorian did encounter some minor bedrock faults in their exploratory borings, and a minor bedrock fault was encountered in RTF&A Test Pit TP-8. These minor bedrock faults are inactive and do not constitute a potential seismic hazard to VTTM 78248.

Landslides: No known landslides are located on-site. Any landslides that previously existed within the project boundaries were removed during development of the golf course.

GROUNDWATER

Water well records from the Los Angeles County Department of Public Works (LACDPW) indicate that there are no water wells monitored by LACDPW within the project site; however, one active LACDPW water well is located approximately 500 feet west-southwest of the western site boundary. This well is designated as Well No. 7188A (State Well ID 4N15W23Q02). Water levels in Well No. 7188A were measured from April, 1974 through November, 2011. During that period, the highest measured water level was 3.8 feet below ground surface, corresponding to a water surface elevation of 1583.2 feet above mean sea level (msl). This water level was recorded on November 27, 1978. The last measurement recorded in this well was 35.9 feet below ground surface (water surface elevation of 1551.1 feet msl) recorded on November 14, 2011.

According to Gorian (1995), groundwater was encountered in their boring B-16 (located within the western portion of VTTM 78248) at a depth of approximately 33.4 feet in 1991. Groundwater was not encountered in any of our borings or test pits, excavated to a maximum depth of 51 feet.

Plate 1.2 of the State of California Seismic Hazard Maps for the Mint Canyon Quadrangle (CDMG, 1998) indicates that the historic high groundwater site vicinity ranges from 5 to 10 feet below ground surface near the north east corner of Sand Canyon Road and Robinson Ranch Road. The site elevations have been increased as a result of the previous site grading. It is recommended that a historic high groundwater depth for liquefaction calculations of 15 feet below existing ground surface be used for the liquefaction evaluation at the site.

LIQUEFACTION

General: The State of California Seismic Hazard Maps for the Mint Canyon Quadrangle (CDMG, 1999) indicate that the alluviated canyon bottoms within the western portion of VTTM 78248 boundaries are considered potential liquefaction areas. Liquefaction may occur when saturated, loose to medium dense, cohesionless soils are densified by ground vibrations. The

densification results in increased pore water pressures if the soils are not sufficiently permeable to dissipate these pressures during, and immediately following, an earthquake. When the pore water pressure is equal to or exceeds the overburden pressure, liquefaction of the affected soil layers occurs. For liquefaction to occur, three conditions are required:

- ground shaking of sufficient magnitude and duration;
- soils that are susceptible to liquefaction; and
- a groundwater level at or above the level of the susceptible soils during the ground shaking.

For a site to be considered susceptible to liquefaction using the criteria and methodology initially developed by Seed and Idriss (1982), liquefaction of underlying soil layers must result in an observed surface effect such as sand boils, mud-spouts, surface water seepage, ground cracking, or quicksand-like conditions.

Lateral spreading can result in ground cracking, and may occur when a site is sloped or is near a free-face and there is a sufficiently continuous liquefiable layer on which the overlying soils can move laterally.

Ground settlement may occur during seismic shaking of an area. The settlement can be caused by liquefaction of loose granular soils and by compaction of soft or loose, but not necessarily liquefiable, soils.

The liquefaction potential at the site was previously evaluated by Gorian (1995) and GAI (1998a). Gorian concluded that the western portions of the site could be susceptible to liquefaction and provided recommendations for removal and recompaction of susceptible materials to mitigate the hazard. The GAI recommended removal depths ranged from 20 feet to 30 feet below existing ground surface.

Liquefaction regulatory requirements have been revised since liquefaction calculations were performed by Gorian (1995) and GAI (1998a). Accordingly, RTF&A conducted subsurface investigation and liquefaction evaluation as part of our geotechnical investigation of VTTM 78248. The evaluation utilized one 50-foot deep borings (designated Borings HS-1) and we also updated the liquefaction calculations using the using the blow counts and percent fines laboratory testing from Gorian rotary wash Boring B-16 G.

The locations of our recent hollow-stem auger borings that were drilled at the site are indicated on the attached Geotechnical Map, and the logs of borings are presented in Appendix A. The density and shear strength of the on-site soils in those areas were measured using Standard Penetration Tests (SPT).

The results of the laboratory tests are presented in Appendix B. The results of the liquefaction calculations are presented in Appendix D.

Ground Shaking: Ground shaking of sufficient magnitude and duration to cause liquefaction can occur virtually anywhere within the Santa Clarita Valley. Seismic parameters determined for the subject site resulted in a PGAm of 0.95g. The deaggregation obtained from the Unified Hazard Tool from the USGS website indicates that the mean magnitude contribution from all sources is 6.9 at a distance of about 11.7 kilometers. A magnitude weighted acceleration used by RTF&A for the liquefaction calculations presented in this report is 0.77g. The seismic data is presented in Appendix D.

ANALYSIS

The liquefaction evaluation was performed in general accordance with the 2017 Los Angeles County Building Code and the Los Angeles County Department of Public Works Geotechnical Materials Engineering Division (GMED) document GS 045.0, dated October 1, 2014. Liquefaction calculations are presented in Appendix E.

CONCLUSIONS

Based on the results of our analyses, some alluvial soils below the groundwater level at the site may liquefy in the event of a large earthquake on a nearby fault that produces the design-level ground motions. This will result in seismically induced ground settlement.

The results of our investigation, laboratory testing, and engineering analysis indicate that the maximum seismic-induced ground settlement is 2.85 inches, and this is at RTF&A hollow stem auger Boring HS-1. However, this boring is not within an area of proposed development and there is no removal recommendation for this area. Gorian Boring B-16 G is located within the same drainage canyon about 340 feet northwest of RTF&A HS-1. The existing elevation at this boring was raised about 7 feet above the elevation of the top of the original boring excavation. The liquefaction calculations for Gorian Boring B-16 G indicate 0.58 inches of seismic induced settlement after the recommended removal is performed. Gorian bucket auger Boring B-11 G is located in an undisturbed area that is just south of a proposed one-story building. It is recommended that the alluvium be completely removed within the limits of the proposed development north of Boring B-11 G. The depth of alluvium below the proposed one-story building is about 20 feet. The seismic-induced ground settlement within the proposed development area is expected to be less than about 0.75 inches after the recommended removal and recompaction of soil is performed.

The recommended liquefaction mitigation at this site consists of a combination of ground modification below the proposed subject areas and designing the proposed structures to withstand the anticipated settlements. Each of the liquefaction mitigation methods is discussed below.

Ground Improvement: The recommended grading will involve the removal of the upper soils in the proposed subject areas and their replacement with properly compacted fill. Properly compacted fill soils would not be subject to liquefaction or dry settlement. In addition, compacted fill soils are denser than the original alluvial soils, which may result in some densification of the

underlying alluvial soils and increase the effective stress of the remaining liquefiable layers, which is a benefit relative to liquefaction.

Structural Mitigation: According to GMED GS 045.0, dated October 1, 2014, structural mitigation alone is acceptable for up to 4 inches of total seismically induced settlement, with up to 1 inch of seismically induced differential vertical displacement over a horizontal distance of 30 feet. Anything in excess of these settlements requires a combination of ground modification and structural mitigation. It is recommended that the proposed structures and foundations be designed to resist the anticipated static and seismic settlements presented in this report.

DEBRIS FLOW HAZARD

Debris flows, consisting of a moving mass of heterogeneous debris lubricated by water, are generated by shallow soil slips in response to heavy rainfall. Debris flows "occur during, and only during, heavy rainfall" (Campbell, 1975). Landslides depend on deep percolation of groundwater and may not respond to the effects of heavy rainfall until long after a storm. According to Campbell (1975), damage from debris flows is due chiefly to inundation by, or high-velocity impact of, the debris mass. Campbell identifies three conditions for debris flow potential:

- a mantle of colluvial soil or a wedge of colluvial ravine soil;
- a slope angle ranging from 27 to 56 degrees (slopes steeper than 56 degrees generally do not have a continuous mantle of colluvium and are most commonly bare bedrock); and
- soil moisture equal to or greater than the colluvial soil's liquid limit.

In general, building lots most susceptible to potential debris flow are those lots located directly below and adjacent to natural slopes.

Based on our review of the current VTTM 78248 project plan, four of the future Lot 1 single-story building pads could be susceptible to debris flow hazard. As indicated on Sheet 3 of the VTTM 78248 plan (Figure 1.3) the four pads, as designated by their respective elevations, are Pad 1615, Pad 1619, Pad 1623, and Pad 1634. Test pits excavated to assess the depth of potential

debris flow material (i.e., loose to moderately dense soil) at the site, encountered soils susceptible to debris flow to depths ranging from 0.5 feet to 1.5 feet.

In general, debris flow hazard may be mitigated by one or a combination of the following measures:

- remove loose surficial material;
- construct diverter slough walls;
- construct an impact wall;
- construct debris basins;
- construct bulk flow channel;
- construct stabilization fill slopes;
- control run-off water; and
- plant selective deep-rooting vegetation.

Recommendations specific to controlling potential debris flows for the four lots are discussed in the Conclusions and Recommendations section of this report.

SLOPE STABILITY

GENERAL

Slope stability considerations typically include existing landslides, future cut-and-fill slopes, and rockfall hazard. No existing landslides or rockfalls were noted within the project site during our site reconnaissance. A few landslides existed onsite prior to development of the golf course; however, these landslides were removed during the golf course grading. Furthermore, VTTM 78248 is not in the path of any known landslides or areas of rockfall hazard.

Development of the site will include grading of 4 cut slopes. For the purposes of this report, a cut slope is defined as a slope 10 feet or more in height. The locations and designations of the cut slopes are shown on Figures 1.3 and 1.4. Proposed cut slope gradients will be 2:1. The maximum cut slope height is approximately 20 feet (Cut Slope CS-3). Data specific to the four cut slopes, including slope height, gradient, and underlying geologic conditions, are discussed

below in the "Geologic Factors" section of this report.

STABILITY ANALYSES

Slope stability analyses were performed using the program Slope/W by GEO-SLOPE International Ltd., which generally utilized Bishop's Simplified Method or Spencer's Method.

GEOLOGIC SECTIONS AND ASSUMED CRITICAL FAILURE SURFACE

The analyses were based on subsurface conditions as depicted on the Geologic Sections, Figure 2. The existing ground surface, proposed grading scheme, and subsurface geologic structure are shown on the geologic sections. For analyses where the location of weak bedding planes is unknown or uncertain, one is assumed to be located exactly at the critical location, typically near the toe of the slope. Although groundwater was not indicated on the Geologic Sections, the analyses assumed a phreatic surface above the critical failure surface for bedding plane failures. The critical failure surfaces, phreatic surfaces, factors of safety, and recommended mitigation measures (i.e., stabilization or buttress fills, if necessary) are added to the Geologic Sections for presentation as Geotechnical Sections in this report. The Geotechnical Sections with Slope Stability results are presented in Figures 3, and the computer printouts are presented in Appendix C.

SHEAR STRENGTH PARAMETERS

As part of the evaluation of shear strength parameters to be used in slope stability calculations, the referenced reports concerning the subject site were reviewed. The shear strength parameters are based on recent direct shear testing by RTF&A, as presented in Appendix B.

Presented below are the recommended shear strengths for use at the subject site.

MATERIAL	COHESION (psf)	ANGLE OF SHEARING RESISTANCE (degrees)
Mint Canyon Formation (along bedding)	150	25
Mint Canyon Formation (cross bedding)	650	32
Compacted Fill (SSR)	300	30
Alluvium (Qal)	125	32

GEOLOGIC FACTORS

Cut slopes proposed for the site will expose artificial fill, alluvium, bedrock of the Mint Canyon Formation, or some combination of these materials. The Mint Canyon Formation units can range from massive to thinly bedded sedimentary rock units of sandstone, conglomerate, and siltstone. Bedding planes within the Mint Canyon Formation range from poorly defined and gradational to sharp and planar and can constitute significant planes of weakness, particularly where sandstone/conglomerate beds are in contact with siltstone. Geologic slope stability of the Mint Canyon Formation is generally dependent on the orientation of the bedding structure of the underlying sedimentary rock units, relative to the gradient of natural or future graded slopes. Bedding planes dipping in the same general direction as natural or proposed cut slopes may be unstable when the bedding angle is less than the slope gradient. Geologic data obtained on site indicates that the bedding strikes generally north to northwest and dips between 22 and 40 degrees towards the west, although most of the observed bedding dips steeper than 30 degrees. Future cut slopes will likely be constructed at gradients of 2:1 (approximately 26 degrees), or flatter. Therefore, in most cases the bedding exposed in future cuts slopes will likely dip steeper than the cut slope gradient and be grossly stable, from a geologic standpoint. A discussion of the individual cut slopes is presented below.

The alluvial deposits and artificial fill are generally homogeneous materials with no well-defined plane of weakness. In general, the mode of failure in these materials is circular as opposed to translational failure which is more common in bedded sedimentary rock units.

Cut Slope CS-1: Cut Slope CS-1 (see Figure 1.3) will consist of a south-southeast-facing 2:1 cut slope that will attain a total height of approximately 18 feet. The cut slope will expose Mint Canyon Formation units and artificial fill. Bedding in the Mint Canyon Formation, in the vicinity of Cut Slope CS-1, strikes north to north-northeast and dips 26 to 31 degrees towards the west. As depicted on Geologic Section A-A' (Figure 2), this bedding orientation is favorable with respect to Cut Slope CS-1, and the cut slope is considered grossly stable from a geologic standpoint. The westerly half of the cut slope will likely encounter artificial fill materials that are susceptible to erosion and surficial failure. Therefore, it is recommended that a 15-foot-wide, 3-foot-deep stability fill slope with backdrains be constructed across the face of the cut slope where the fill material is exposed. The approximate location of the keyway for the recommended stability fill slope is shown on the Geotechnical Map (Figure 1.3).

Cut Slope CS-2: Cut Slope CS-2 (Figure 1.3) will consist of a 17-foot high, west-northwest-facing 2:1 cut slope above a retaining wall. The cut slope will expose Mint Canyon Formation units that dip 28 to 31 degrees to the west and northwest. An apparent bedding angle of 26 degrees or steeper will likely be encountered in the cut slope (see Geologic Section B-B', Figure 2). As the anticipated bedding is generally the same angle or steeper than the cut slope gradient, the cut slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-3: Cut Slope CS-6 (Figure 1.4) will consist of a 20-foot high, 2:1 south-southwest-facing cut slope, overlain by engineered fill. The cut slope will expose Mint Canyon Formation units in which the underlying bedding strikes northwest and dips 25 to 36 degrees towards the southwest. As depicted on Geologic Section C-C' (Figure 2), the bedding is favorably oriented with respect to the south-southwest-facing cut slope, and the slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-4: Cut Slope CS-4 (Figure 1.4) will consist of a northwest-facing 2:1 slope that will attain a height of approximately 18 feet. The cut slope will expose sedimentary rock units of the Mint Canyon Formation and artificial fill material. The underlying bedding in the Mint Canyon Formation strikes northwest and dips 25 to 36 degrees towards the southwest resulting in an apparent westerly dipping bedding angle (relative to Section D-D') of 18 degrees. This apparent bedding angle is adversely oriented, or "daylighted" with respect to the portion of the cut slope exposing the Mint Canyon Formation. Stability analyses for this possible daylighted bedding condition indicate that the proposed slope meets factor of safety requirements for 1.5 for static conditions and 1.1 for seismic conditions (see Appendix C). In addition, a slope stability calculation for a circular cross bedding failure was performed for Section D-D' which also met slope stability factor of safety requirements. The southerly portion of the cut slope will likely encounter artificial fill materials that are susceptible to erosion and surficial failure. Therefore, it is recommended that a 15-foot-wide, 3-foot-deep stability fill slope with backdrains be constructed across the face of the cut slope where the fill material is exposed. The approximate location of the keyway for the recommended stability fill slope is shown on the Geotechnical Map (Figure 1.4).

NATURAL SLOPES

Most of the natural slopes on or surrounding the project have slope gradients of 2:1 or flatter. As discussed above for proposed cut slopes, the bedding underlying the natural slopes typically dips steeper than the natural slope gradient and is considered geologically grossly stable.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Based on our review of previous geologic and geotechnical reports prepared for the project site, and analyses completed as part of this work, it is our opinion that the project site may be

developed as planned, provided our recommendations are incorporated in the design of the project.

GEOLOGIC CONSIDERATIONS

Faulting: No active or potentially active faults are known to exist within VTTM 78248 and VTTM 78248 is not located within an Alquist-Priolo Earthquake Fault Zone. In our opinion, there is little probability of surface fault rupture occurring on-site.

Landslides: No landslides have been mapped on or near VTTM 78248.

Debris Flows: Potential debris flow hazard has been identified for the natural slopes surrounding the perimeter of four of the Lot 1 single-story building pads (see "Potential Debris Flow Hazard Area" depicted on Figure 1.3). Future development for these lots should consider structures or devices to control and impound potential debris material, such as debris walls, berms, or basins.

Oil Wells: Data from the California Division of Oil, Gas and Geothermal Resources (DOGGR) indicate that that there are no known oil wells within the subject site. The nearest oil well, designated Fairview Exploration Co. Well No. "HCL" 1, is located approximately 700 feet north-northeast of VTTM 78248.

Water Wells: There are no known water wells within VTTM 78248.

Rockfalls: Areas of potential rock fall hazard were not identified within VTTM 78248 during our geologic reconnaissance. Cobble-size material is common within the conglomerate units of the Mint Canyon Formation; boulders are rare. If exposed in cut slopes the cobbles or boulders may become loosened and roll down the slope. Therefore, an engineering geologist should observe and map all cut slopes during site grading to identify areas of abundant cobbles and boulders that may be subject to rockfall. Mitigation for any identified rockfall can be provided at that time.

Rippability: The bedrock exposed within VTTM 78248 is weakly to moderately cemented and can likely be excavated with conventional grading equipment. Heavy single shank ripping may

be needed for massive conglomerate or well-cemented sandstone units within the Mint Canyon Formation. Should a well-cemented layer be encountered, the use of breakers or jackhammers may be necessary.

Restricted Use Areas (RUAs): There are no proposed RUAs within VTTM 78248.

GRADING

General: The following sections present recommendations for treatment of cut and fill slopes, and grading. The applicability of the preliminary recommendations given in the following sections for foundation and retaining wall design should be confirmed at the completion of grading. Paving studies and soil corrosivity tests should be performed at the completion of rough grading to develop detailed recommendations for protection of utilities and structures, and for construction of the proposed roads.

Site Preparation: Prior to performing earthwork, the existing vegetation and any deleterious debris should be removed from VTTM 78248. All unsuitable soils, in the areas of grading that are receiving fill should be removed to competent bedrock or alluvial materials and replaced with engineered fill. This includes the artificial fill materials, which range in depth from 5 to 55 feet, with the maximum fill depth in the northeast corner of the site within the proposed golf course. The depths of removal and recompaction of unsuitable soils are noted on the Geotechnical Map. Any fill required to raise the site grades should be properly compacted.

Removal of the exposed natural soils should extend to at least the depths indicated on the Geotechnical Map.

Removal Depths: The required depths of removal and recompaction of the natural soils are indicated on the Geotechnical Map. Deeper removals will be required if disturbed or unsuitable soils are encountered. After excavation of the upper natural soils on hillsides and in canyons, further excavation should be performed, if necessary, to remove slope wash or other unsuitable soils.

The Geotechnical Consultant of Record may require that additional shallow excavations be made periodically in the exposed bottom to determine that sufficient removals have been made prior to recompacting the soil in-place. Deeper removals may be recommended by RTF&A based on observed field conditions during grading. During grading operations, the removal depths should be observed by a representative of RTF&A and surveyed by the Project Civil Engineer for conformance with the recommended removal depths shown on the grading plan.

Material for Fill: The on-site soils, less any debris or organic matter, may be used in the required fills. Any expansive clays should be mixed with non-expansive soils to result in a mixture having an expansion index less than 30 if they are to be placed within the upper 8 feet of the proposed rough grades.

Rocks or hard fragments larger than 8 inches may not be placed in the fill without special treatment. Rocks or hard fragments larger than 4 inches shall not be clustered or compose more than 25 percent by weight of any portion of the fill or a lift. Soils containing more than 25 percent rock or hard fragments larger than 4 inches must be removed or crushed with successive passes (e.g., with a sheepsfoot roller) until rock or hard fragments larger than 4 inches constitute less than 25 percent of the fill or lift.

Oversized Material: Rocks or material greater than 8 inches in diameter, but not exceeding 4 feet in largest dimension, shall be considered oversized rock. The oversized rocks can be incorporated into deep fills where designated by the Geotechnical Consultant of Record. Rocks should be placed in the lower portions of the fill and should not be placed within the upper 10 feet of compacted fill or nearer than 15 feet to the surface of any fill slope as windrows. Windrows should be excluded from areas of proposed utilities, pools, and other types of future underground improvements. Additional costs and construction difficulties should be anticipated if future improvements are located in areas where there will be conflicts with existing windrows. Rocks between 8 inches and 4 feet in diameter shall be placed in windrows or shallow trenches located so that equipment can build up and compact fill on both sides. The width of the windrows

shall not exceed 4 feet. The windrows should be staggered vertically so that one windrow is not placed directly above the windrow immediately below. Rock greater than one foot in diameter shall not exceed 30 percent of the volume of the windrows. Granular fill shall be placed on the windrow, and enough water should be applied so that soil can be flooded into the voids. Fill should be placed along the sides of the windrows and compacted as thoroughly as possible. After the fill has been brought to the top of the rock windrow, additional granular fill should be placed and flooded into the voids. Flooding is not permitted in fill soils placed more than one foot above the top of the windrowed rocks.

Where utility lines or pipelines are to be located at depths greater than 15 feet, rock shall be excluded in that area. Excess rock that cannot be included in the fill, or that exceeds 4 feet in diameter, should be stockpiled for export or used for landscaping purposes.

The oversized material recommendations presented in this report provide for the geotechnical consultant to coordinate with the grading contractor to develop a procedure for construction of compacted fills that have a satisfactory fill performance for the intended use of the fill. It should be understood that it is not feasible and/or cost effective to eliminate all oversize material from constructed fills as part of a conventional grading operation. The exclusion of all oversize material is not necessary for satisfactory fill performance on the majority of projects.

Import Material: Import material should consist of relatively non-expansive soils with an expansion index less than 30. The imported materials should contain sufficient fines (binder material) so as to be relatively impermeable and result in a stable subgrade when compacted. The import material should be free of organic materials, debris, and rocks larger than 12 inches. A bulk sample of potential import material, weighing at least 25 pounds, should be submitted to the Geotechnical Consultant of Record at least 48 hours in advance of fill operations. All proposed import materials should be approved by the Geotechnical Consultant of Record prior to being placed at the site.

Compaction: After the site is cleared and excavated as recommended, the exposed soils should be carefully observed for the removal of all unsuitable material. Next, the exposed subgrade soils should be scarified to a depth of at least 6 inches, brought to above optimum moisture content, and rolled with heavy compaction equipment. The upper 6 inches of exposed soils should be compacted to at least 90 percent of the maximum dry density obtainable by the ASTM D1557 Method of Compaction.

After compacting the exposed subgrade soils, all required fills should be placed in loose lifts not more than 8 inches in thickness and compacted to at least 90 percent of their maximum density. For fills placed at depths greater than 40 feet below proposed finish grade, a minimum compaction of 93 percent of the maximum dry density is required. The moisture content of the fill soils at the time of compaction should be above the optimum moisture content. Compacted fill should not be allowed to dry out before subsequent lifts are placed.

Rough grades should be sloped so as not to direct water flow over slope faces. Finished exterior grades should be sloped to drain away from building areas to prevent ponding of water adjacent to foundations.

Shrinkage and Bulking: Shrinkage of about 8 to 12 percent is estimated for the on-site artificial fill material when removed and placed as compacted fill. A bulking value of about 2 to 6 percent is estimated for materials generated from Mint Canyon Formation bedrock cut areas for use as compacted fill. The actual shrinkage and bulking will depend upon the relative compaction obtained by the contractor during grading operations and would be expected to change on a daily basis.

Permanent Slopes: Permanent cut and fill slopes may be inclined at 2:1 or flatter. The current site plan indicates that the steepest slope to be constructed at the site during grading will be 2:1.

Proposed Cut Slopes: Cut slopes proposed for the rough grading of the project site have been designated as shown on the Geotechnical Map. Each cut slope is discussed with specific

recommendations presented in the "Slope Stability Analysis" section of this report. All grading should conform to the minimum recommendations presented in this report. If these slopes are modified from those that are discussed in this report, the modifications should be reviewed by RTF&A to ascertain the applicability of our recommendations.

Fill Slopes: Where the toe of a fill slope terminates on natural, fill, or cut materials, a keyway is required at the toe of the fill slope. The fill slope keyway should be a minimum width of 12 feet, be founded within competent material, and extend a horizontal distance beyond the toe of the fill to the depth of the keyway. The keyway should be sloped back at a minimum gradient of two percent into the slope. The widths of fill slopes shall be no less than 8 feet, and under no circumstances should the fill widths be less than what the compaction equipment being used can fully compact. Benches should be cut into the existing slope to bind the fill to the slope. Benches should be step-like in profile, with each bench not less than 4 feet in height and established in competent material. Compressible or other unsuitable soils should be removed from the slope prior to benching. Competent material is defined as being essentially free of loose soil, heavy fracturing, or erosion-prone material and is established by the Geotechnical Consultant of Record during grading.

Where the top or toe of a fill slope terminates on a natural or cut slope and the natural or cut slope is steeper than a gradient of 3:1, a drainage terrace with a width of at least 6 feet is recommended along the contact. As an alternative, the natural or cut portion of the slope can be excavated and reconstructed as a stability fill slope to provide an all-fill slope condition. Where the contact between the face of the fill slope and the face of a lower natural or cut slope is inclined at 45 degrees or steeper, a drainage terrace would not be required.

When constructing fill slopes, the grading contractor shall avoid spillage of loose material down the face of the slope during the dumping and rolling operations. Preferably, the incoming load shall be dumped behind the face of the slope and bladed into place. After a maximum of 4 feet of compacted fill has been placed, the contractor shall backroll the outer face of the slope by

backing the tamping roller over the top of the slope, thoroughly covering all of the slope surface with overlapping passes of the roller. The foregoing should be repeated after the placement of each 4-foot thickness of fill. As an alternative, the fill slope can be overbuilt and the slope cut back to expose a compacted core. If the required compaction is not obtained on the fill slope, additional rolling will be required prior to placement of additional fill, or the slope shall be overbuilt and cut back to expose the compacted core.

Stability Fills: Stability fills have been recommended for several of the cut slopes on-site, as discussed in the "Slope Stability" section of this report. The stability fill slopes should be constructed in accordance with Stability Fill Detail for Grossly Stable Slopes (Figure 4). Backdrains should be installed at the backcut of the stability fill as recommended below.

DRAINAGE

Subdrains: Based on the project plan, there are no deep canyon fills planned for the site, and anticipated fill depths over the site are not expected to exceed 15 feet. However, as our recommendations call for removal of all existing fill, RTF&A recommends subdrains within the former canyons within the project site. The approximate locations of the recommended subdrains is indicated on Figure 1. Recommendations associated with pipe type, pipe perforations/slots, and filter material also apply to backdrains for stability fills.

Canyon subdrains should extend up-canyon, with the drain inlet carried to within 15 feet of final pad grade. The subdrains should be surveyed by the Project Surveyor to establish line and grade during construction, and for future location reference. Subdrain and backdrain excavations should be observed by the Geotechnical Consultant.

The subdrains should be installed in accordance with the manufacturer's specifications. A minimum 2 percent gradient is to be maintained in the subdrain pipes and the pipe shall have at least eight uniformly spaced narrow slots per foot. The width of the slots should not exceed 1/16 of an inch. If PVC pipe with drilled perforations is utilized, the diameter of the holes should not

exceed 3/8 of an inch if gravel and filter fabric are used. The diameter of the holes should not exceed 1/8 inch if Los Angeles County Flood Control District (LACFCD) Designation F-1 Filter Material is used. There should be at least eight uniformly spaced sets of two perforations per lineal foot of pipe. When constructing the subdrain, the pipe should be placed so that the drilled perforations are positioned on the bottom half of the pipe. The upstream end of subdrains should be capped. The final 20 feet of pipe at the downstream end of canyon, stabilization, buttress, and side hill fills shall not be slotted or perforated. Provisions should be made at all times during construction to prevent damage to the subdrain from construction equipment, and to prevent soils from being washed into an exposed subdrain by surface waters.

For runs up to 500 feet, subdrains for the bottom of canyon fills should consist of at least 6-inch-diameter pipe. For runs of 500 to 1,500 feet, 8-inch-diameter pipe shall be used. For runs over 1,500 feet, 10-inch-diameter pipe shall be used.

Canyon subdrains may be installed in a rectangular trench excavated to expose competent material and shall be approved by the Geotechnical Consultant. The subdrains should be surrounded by at least 3 cubic feet per lineal foot of granular filter material and there should be at least 6 inches of compacted granular filter material or gravel on all sides of the pipe. The granular filter material for subdrains should meet the F1 material criteria, or have a gradation approved by the Geotechnical Consultant prior to placement.

As an alternative to the granular filter material, 3/4-inch-diameter gravel may be placed around the pipe. The gravel should be separated from the surrounding soils by a filter fabric such as Mirafi 140N, or equivalent, wrapped around the gravel ("burrito wrapped").

Backdrains: Backdrains should be installed at the backcut of the stability fills. The backdrains should consist of 4-inch-diameter perforated or slotted pipe. The vertical spacing of the backdrains should be a maximum of 15 feet, with a horizontal spacing of 100 feet. Backdrain outlets should consist of non-perforated pipe. The gradient should be at least 2 percent to the discharge end. The exact location of the backdrains should be determined in the field by the

Geotechnical Consultant, after the backcut has been made, so that it can be best positioned to intercept potential seepage.

Surface Drainage: All surface drainage should be directed away from proposed structures through non-erosive devices. The ponding of water must not be allowed, especially adjacent to foundations. The pad gradients should not slope toward any descending slopes in order to reduce the potential for surficial erosion. Water that flows towards slopes should be conducted to appropriate discharge locations via non-erodible drainage devices. Drainage devices, including drainage terraces on graded slopes, should be inspected periodically and should be kept clear of debris. Drainage and erosion control should be designed in accordance with the standards set forth in the CBC.

Any modification of the grades of building pads, parking areas, etc., could adversely affect drainage at the site. Future landscaping and construction of walkways, planters, and walls, etc., must never modify site drainage unless additional measures to enhance drainage (e.g., area drains, additional grading, etc.) are designed and constructed in accordance with the applicable CBC requirements.

Erosion Protection: In order to reduce the potential for erosion, all cut and fill slopes should be seeded or planted with proper ground cover as soon as possible following grading operations, in accordance with the County of Los Angeles Building Code. The ground cover should consist of drought-resistant, deep-rooting vegetation. A landscape architect should be consulted for ground cover recommendations, plant selection, installation procedures, and plant care requirements.

Excessive landscape irrigation or leakage from irrigation lines can cause localized slope failures. Therefore, irrigation systems for slope vegetation should be designed and maintained to minimize leakage onto graded slopes. If automatic sprinkler systems are used, they should be adjusted for seasonal variations in rainfall. Vegetation on natural slopes should remain natural and not be landscaped or irrigated in the same manner as graded slopes.

Rodent burrows are known to provide direct conduits for water flow that can decrease slope stability. Therefore, in order to maintain the integrity of graded slopes, a rodent abatement program should be instituted.

Even with the implementation of these recommendations, it is not possible to eliminate erosion within hillside developments. Removal of debris from drainage devices, slope maintenance, and landscaping will be required, especially after periods of heavy rainfall.

GENERAL GRADING REQUIREMENTS

1. All fills, unless otherwise specifically designed, shall be compacted to at least 90 percent of the maximum dry unit weight as determined by the ASTM D1557 Method of Soil Compaction.

2. No fill shall be placed until the area to receive the fill has been adequately prepared, and subsequently approved by the Geotechnical Consultant of Record or his representative.

3. Fill soils should be kept free of debris and organic material.

4. Rocks or hard fragments larger than 8 inches may not be placed in the fill without approval of the Geotechnical Consultant of Record or his representative, and in a manner specified for each occurrence.

5. Bedrock fragments larger than 8 inches, or fill soils containing greater than 25 percent of bedrock fragments larger than 4 inches in diameter, must be removed or processed using successive passes of a sheepsfoot compactor until rock fragments constitute less than 25 percent of the fill material.

6. The fill material shall be placed in layers which, when compacted, shall not exceed 8 inches per layer. Each layer shall be spread evenly and shall be mixed thoroughly during the spreading to ensure uniformity of material and moisture.

7. When moisture content of the fill material is too low to obtain adequate compaction, water shall be added and thoroughly dispersed until the soil is approximately two to four percent above optimum moisture content.

8. When the moisture content of the fill material is too high to obtain adequate compaction, the fill material shall be aerated by blading, or other satisfactory methods, until the soil is approximately two to four percent above optimum moisture content.

9. Fill and cut slopes should not be constructed at gradients steeper than 2:1 (horizontal: vertical).

GRADING OBSERVATION

Construction observation should be made by a Geotechnical Consultant of Record during any grading activities within the project site, to verify the findings within this report. Additional recommendations may be required for landfill design based on conditions uncovered during grading.

TEMPORARY EXCAVATIONS

Based on our review of the subject plans, it does not appear that significant temporary excavations will be required during the construction of the proposed development. However, the following recommendations are applicable in areas where excavations are to be made.

Temporary excavations are not expected to stand vertically in cuts that exceed 4 feet in height. Temporary excavations in excess of 4 feet may be sloped at a gradient of ¾:1, to a maximum height of 8 feet. Temporary slopes higher than 8 feet should be sloped at a gradient of 1:1. By temporary, we mean a period not exceeding 60 days. All regulations of State or Federal OSHA should be followed.

If excavations are made during the rainy season (normally from November through April), particular care should be taken to protect slopes against erosion. Measures to help mitigate erosion, such as the installation of berms, plastic sheeting, or other devices, may be warranted. Surface water should be prevented from flowing over or ponding at the tops of excavations.

EXPANSIVE BEDROCK

It is anticipated that bedrock materials exposed at pad grade may contain expansive claystone beds that could cause differential expansion. Therefore, within building areas at locations where expansive bedrock units are exposed at pad grade, it is recommended that the bedrock be removed and recompacted to a depth at least 8 feet below the proposed final pad elevations or 5 feet below the bottom of proposed footings, whichever is greater. It is also recommended that the bedrock be removed and recompacted to a depth at least 3 feet below the proposed soil subgrade in exposed bedrock areas receiving pavement or hardscape improvements. The soils generated by these over-excavations should be mixed with non-expansive soils to yield a relatively non-expansive mixture. Should the resulting fill soil still be expansive, special construction techniques, such as pad subgrade saturation or post-tensioned slabs, may be required to reduce the potential for expansive soil–related distress.

TRANSITION LOTS

Proposed building pads located in a cut and fill transition zone may experience cracking and movement of the footings and slab due to differing compressibility of the fill, as compared to the bedrock material. To reduce the potential for cracking and differential settlement, the portion of the lot in cut bedrock should be over-excavated to a depth at least 5 feet below the proposed finished pad elevation or 3 feet below the bottom of proposed footings, whichever is greater. The over-excavation should extend at least 5 feet laterally beyond the building limits. Where removal and recompaction for potentially expansive soils or bedrock are also required, it is recommended that the 8-foot removals be performed as described in the “Expansive Bedrock” section of this report.

EXPANSIVE SOILS

The on-site alluvial soils are expected to have a very low potential for expansion. Compacted fills generated from the Mint Canyon Formation are expected to have up to a medium potential for expansion. The compacted fills generated by the on-site materials are expected to be classified as having a very low to medium potential for expansion. Samples of the compacted fill should be obtained at the completion of the rough grading operations to support final foundation design.

FOUNDATIONS

General: Buildings may be supported on continuous or individual spread footings established in properly compacted fill soils. Foundations and floor slabs should be designed by a structural engineer, in accordance with the minimum requirements of the CBC.

Design Criteria: The recommendations presented in this section are based on the assumption that the proposed structures will have column loads not exceeding approximately 100 kips and continuous foundation loads not exceeding 3 kips per lineal foot. A bearing value of 2,000 pounds per square foot (psf) may be used in the design of spread foundations. This value can be increased by one-third when considering seismic and wind forces. The bearing material should consist of compacted fill soil. Individual column pads and continuous wall footings should be designed to meet the minimum width and depth requirements as set forth in the CBC. Foundation depths should be measured from the lowest adjacent final grade.

Building setbacks for structures located adjacent to either ascending or descending slopes should be in accordance with the standards set forth in the CBC. All foundation excavations should be observed and approved by a representative from our firm prior to placement of reinforcing steel. Foundations should be deepened, where necessary, to prevent surcharge loads from being imposed on adjacent foundations or utilities. Observation of foundation excavations may also be required by

the appropriate reviewing governmental agencies. The contractor should be familiar with the requirements of the governing reviewing agencies.

Lateral Design: Lateral restraint at the bases of footings or slabs may be assumed to be the product of the dead load and a coefficient of friction of 0.4. Passive pressure on the faces of footings may also be used to resist lateral forces. A passive pressure of zero at the surface of finished grade, increasing at the rate of 250 psf per foot of depth, to a maximum value of 2,500 psf, may be used at this site. The passive pressure and friction may be combined without reduction when evaluating lateral resistance.

Settlement: Provided that the proposed buildings are supported on shallow foundations established in compacted fill soils, as recommended, column loads do not exceed 100 kips, and continuous footings do not exceed 3 kips per lineal foot, we estimate that the static settlement will be about 1.0 inches. Seismic settlement is estimated to be less than 0.75 inches. Combined static and seismic total settlement is expected to be about 1.75 inches. The static and seismic differential settlements in some areas of the site are expected to be about 1 inch of vertical movement across a horizontal distance of 30 feet. Our firm should review the foundation loads after plans are developed, after the completion of grading, to verify the applicability of our recommendations to the proposed structures.

FLOOR SLAB SUPPORT

General: The floor slab design recommendations presented in this section are based upon the assumption that the soil subgrade in proposed floor slab areas will consist of compacted fill soil and that floor slabs will be subjected to normal loads with no special requirements. Any surficial soils that become dried or disturbed during the course of construction should be moisture-conditioned and compacted prior to casting the floor slab.

Conventional floor slabs may be utilized at the subject development, provided the subgrade soils consist of compacted fill soils with a very low (Expansion Index of 0 to 20) potential for

expansion. If the subgrade soils are determined to have an expansion potential in the low or higher range (Expansion Index greater than 21), post-tensioned floor slabs, as indicated below, are recommended.

Conventional Floor Slabs: Conventional slabs-on-grade should be designed per the recommendations of the CBC. However, as a minimum, the building floor slabs should have a nominal thickness of at least 4 inches and should be reinforced with a No. 4 rebar spaced at 18 inches on center, in each direction, or equivalent. Thicker slabs may be required, depending on the floor loads and the structural requirements; we defer to the Project Structural Engineer for design of the floor slabs.

Post-Tensioned Floor Slabs: Post-tensioned floor slabs should be designed per the recommendations of the CBC. The design values, presented following this paragraph, assume that the proposed floor slabs will be poured monolithic with continuous perimeter edge footings. Perimeter edge footings should have a minimum depth of 12 inches. Footing depths should be measured from the lowest adjacent grade for perimeter footings or the top of slab for interior footings.

Net Bearing Value:	An allowable net bearing value of 2,500 psf may be used for footings with a minimum depth of 18 inches below the top of slab or 12 inches below the lowest adjacent grade.
Coefficient of Friction:	0.75
Passive Pressure:	250 pcf for level ground condition
Modulus of Subgrade Reaction (K):	150 pounds per cubic inch (pci) for a footing width of one foot. For larger footings or floor slabs, this value should be reduced using the following equation:

$$Kr = K\left[\frac{(B+1)}{2B}\right]^2$$

where:

Kr = Reduced Modulus Value
K = Modulus of Subgrade Reaction for a One-Foot-Wide Plate
B = Width of Large Footing or Slab

Modulus of Elasticity:	1,000 pounds per square inch (psi)

Edge Moisture Variation Distance		
Me (Center Lift):	5.25 feet	
Me (Edge Lift):	2.5 feet	
Estimated Differential Movement	Low	Medium
My (swelling):	0.4	0.9
My (shrink):	0.3	0.7

Water Vapor Mitigation: Water vapor transmitted through floor slabs is a common cause of floor covering problems. An impermeable membrane "vapor barrier" should be installed to reduce excess vapor drive through all floor slabs. The function of the impermeable membrane is to reduce the amount of water vapor transmitted through the floor slab. Vapor-related impacts should be expected in areas where a vapor barrier is not installed.

Floor slabs should be underlain by a vapor barrier surrounded by 2 inches of sand above and below it. The membrane should be at least 10 millimeters thick; care should be taken to preserve the continuity and integrity of the membrane beneath the floor slab. The sand should be sufficiently moist to remain in place and be stable during construction; however, if the sand above the membrane becomes saturated before placing concrete, the moisture in the sand can become a source of water vapor.

Another factor affecting vapor transmission through floor slabs is a high water-to-cement ratio in the concrete used for the floor slab. A high water-to-cement ratio increases the porosity of the concrete, thereby facilitating the transmission of water and water vapor through the slab. The Project Structural Engineer or a concrete mix specialist should provide recommendations for design of concrete for footings and floor slabs in accordance with the CBC, with consideration of the above comments.

The above described recommendations have been successfully utilized on numerous project in Southern California to reduce excess moisture drive through floor slabs. Alternative methods of providing floor slab water vapor mitigation have also been successfully utilized and some are outlined in various codes and standards. If requested and authorized, we would be pleased to provide geotechnical comment if it is desired to utilize alternative mitigation methods. These recommendations may be superseded by the design team based on their experience with alternative mitigation methods. However, RTF&A assumes no responsibility related to adverse impacts associated with superseding the recommendations of this report.

RETAINING WALLS

General: A bearing value of 2,000 psf may be used in the design of retaining wall footings. Backfill placed behind retaining walls should be compacted to a minimum of 90 percent of the maximum dry density, as determined by the Soil Compaction Test Method (ASTM Standard D1557). When backfilling, walls should be braced. Heavy compaction equipment should not be used any closer to the back of the wall than the height of the wall. Soils that have an expansion index in excess of 50 should not be utilized for backfill behind walls that are greater than 3 feet in height. The backs of retaining walls should be water-proofed where aesthetics are concerned.

Lateral Earth Pressure: Cantilevered retaining walls separate and independent of buildings, where the surface of the backfill is level and the retained height of soils is less than 15 feet, may be designed assuming that drained non-expansive soils will exert a lateral pressure

equal to that developed by a fluid with a density of 30 pounds per cubic foot (pcf). The indicated pressure assumes that a lateral deflection of up to about one percent of the wall height is acceptable at the top of the wall. If it is desired to decrease the amount of potential wall deflection, a greater lateral pressure could be used in the wall design.

Where the surface of the backfill is inclined at 2:1, it may be assumed that drained soils will exert a lateral pressure equal to that developed by a fluid with a density of 45 pcf.

For the design of a rigid wall where rotation and lateral movement are not acceptable, as in the case of buildings, it may be assumed that drained, non-expansive soils will exert a rectangular lateral pressure with a maximum pressure equal to 22H psf, where "H" is the wall height in feet. The pressure value and distribution may vary significantly when considering wall rigidity and restraining conditions. The structural characteristics of the wall are referred to the Project Structural Engineer. If requested, we can provide additional geotechnical design parameters for specific restrained conditions.

In addition to the recommended earth pressure, walls should be designed to resist any lateral surcharges due to nearby buildings, storage, or traffic loads. A drainage system should be provided behind the walls to reduce the potential for development of hydrostatic pressure (see the following "Retaining Walls" section of this report). If a drainage system is not installed, walls should be designed to resist an additional hydrostatic pressure equal to that developed by a fluid with a density of 55 pcf for the full height of the wall.

Seismic Lateral Earth Pressure: The preceding recommended values indicate earth pressures for conventional static loading conditions. Ground shaking associated with earthquakes may cause additional pressure on walls. In addition to the previously mentioned lateral earth pressures, it is recommended that all rigid (building) walls of any height, and cantilevered retaining walls greater than 6 feet in height, be designed to support an additional seismic earth pressure equal to an inverted equivalent fluid pressure of 29 pcf.

Density of Backfill: When designing retaining walls to resist over-turning, it can be assumed that compacted, on-site soils will have a density of 125 pcf.

Drainage: A drainage system should be provided behind retaining walls, or the walls should be designed to resist hydrostatic pressures. The drainage system could consist of a 4-inch-diameter perforated pipe placed 6 inches from the base of the wall, with the perforations down, and connected to an outlet device. The pipe should be sloped at least 1 inch per 50 feet and surrounded on all sides by at least 6 inches of clean gravel. The gravel should be "burrito-wrapped" with filter fabric, such as Mirafi 140N, or equivalent. As an alternative to the gravel and filter fabric, filter material meeting the requirements of LACFCD Designated F-1 Filter Material, and slotted pipe, may be used. The backside of the wall should be water-proofed.

A vertical 6-inch-wide gravel chimney drain, or a drainage geocomposite such as Miradrain, should be placed against and behind retaining walls that are higher than 3 feet. The top of the back drain should be capped with 18 inches of on-site soils.

The installed drainage system should be observed by the Geotechnical Consultant of Record prior to backfilling the system. Inspection of the drainage system may also be required by the reviewing governmental agencies.

SEISMIC DESIGN

The following factors are recommended for seismic force design of structures at the subject site. The parameters were determined using the U. S. Seismic Design Maps at the United States Geological Survey (USGS) Earthquakes Hazard website.

Site Class	D
Ss	2.62
S1	0.93
SMs	2.62
SM1	1.39
SDs	1.75

SD1	0.93
PGA	0.95

PAVEMENT DESIGN

Samples of the on-site soil should be obtained from near final grade elevation in proposed pavement areas, following the grading operations, to perform R-value tests. The R-value test results would be used to prepare pavement section recommendations. The preliminary pavement section recommendations presented below are based on the assumption that the on-site soils have an R-value of at least 20. The final pavement section recommendations could vary depending on the results of the actual R-value tests. We would be pleased to provide pavement section recommendations for alternative Traffic Index values upon request.

Traffic Index	Asphalt Thickness (Inches)	(CAB) Base Course Thickness (Inches)
4	3	5
6	4	9
8	5	14

Base course material should consist of crushed aggregate base (CAB), as defined by Section 200-2.2 of the Standard Specifications for Public Works Construction ("Greenbook"), or crushed miscellaneous base (CMB), as defined by Section 200-2.4 of the Greenbook. Base course material should be compacted to at least 95 percent of the maximum dry density of that material.

Base course material should be purchased from a supplier who will certify that it will meet or exceed the specifications in the Greenbook, as indicated. We could, upon request, perform sieve analysis and sand equivalency tests on material delivered to the site that appears suspect. Additional tests could be performed, upon request, to determine if the material is in compliance with the remainder of the specifications indicated in the Greenbook.

The pavement section recommendations presented above are based upon assumed Traffic Index values. RTF&A does not take responsibility for the numerical determination of the Traffic Index values, nor the areas where they apply within the site.

GEOTECHNICAL CONSULTANT OF RECORD

This report has been prepared assuming that RTF&A will perform all geologic and geotechnically related field observations and testing. If the recommendations presented in this report are to be utilized but observation of the grading activities is performed by others, the parties performing the work must review this report and assume responsibility for recommendations contained herein or provide their own recommendations. That party would then assume the title "Geotechnical Consultant of Record" for the project.

A representative of the Geotechnical Consultant of Record should be present to observe all grading operations as well as test compacted fills. A report presenting the results of these observations and related testing should be issued upon completion of these operations. All footing excavations should be observed by a representative of the Geotechnical Consultant of Record prior to placing steel or pouring concrete into the excavations.

REGULATORY STATEMENT

Based on our review of the project plan and referenced reports, it is our finding that development of VTTM 78248, as depicted on the project plan, will be safe from hazard of landslide, settlement, or slippage, and will not adversely affect the geotechnical conditions of the nearby properties, provided our recommendations and the requirements of the CBC are followed.

LIMITATIONS

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers and engineering geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has been prepared for Sand Canyon Country Club and their design consultants, to be used solely for planning and design. The report has not been prepared for use by other parties and may not contain sufficient information for purposes of other parties or other uses.

-oOo-

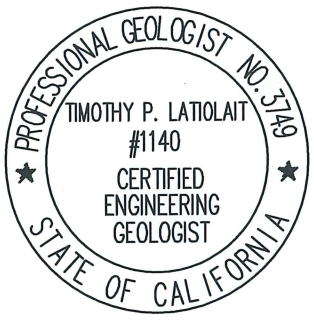
The following are attached and complete this report.

- References
- Geotechnical Map – Figures 1.1 through 1.4 (in pocket)
- Geologic Sections – Figure 2 (in pocket)
- Geotechnical Section – Figure 3
- Stability Fill Detail for Grossly Stable Slopes – Figure 4
- Appendix A – Field Explorations
- Appendix B – Laboratory Tests
- Appendix C – Slope Stability Calculations
- Appendix D – Seismic Design Calculations
- Appendix E – Liquefaction Calculations

Respectfully submitted,

R. T. FRANKIAN & ASSOCIATES

by: Alan W. Rasplicka
Principal Geotechnical Engineer



and: Timothy P. Latiolait
Principal Engineering Geologist

RT F&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

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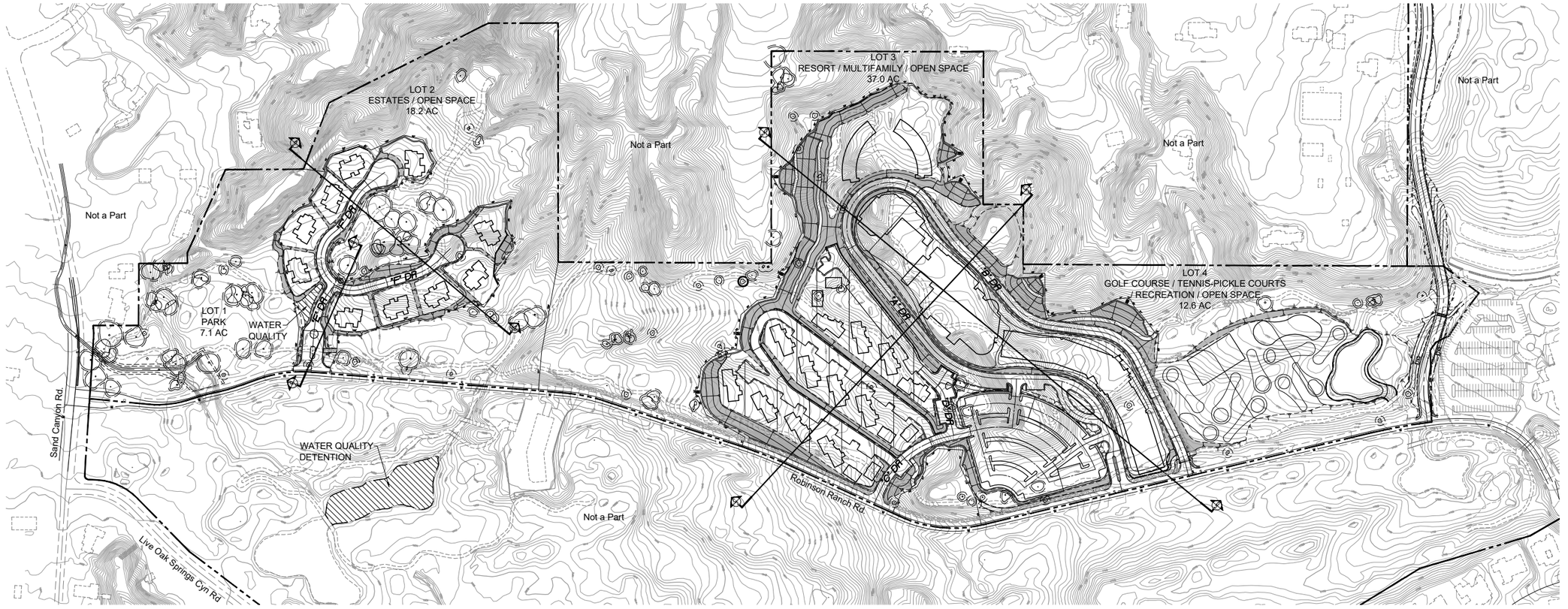
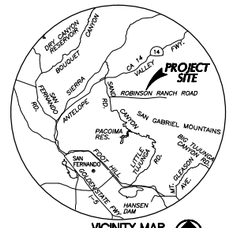




LEGEND:

100	LOT NO.
5000 SF	LOT AREA (SQUARE FEET)
PAD=1210.0 O.S.	PAD ELEVATION OR LOT TYPE
	VTTM 78248 BOUNDARY
	EXISTING PARCEL BOUNDARY
	PROPOSED PRIVATE DRIVE
87'	PROPOSED LOT LINE
	PROPOSED EASEMENT
	EXISTING EASEMENTS IDENTIFIED BY (3)
950	PROPOSED CONTOUR
	DAYLIGHT LINE
	STORM DRAIN CULVERT
SD	STORM DRAIN
S	SANITARY SEWER (SERVICE LOCAL)
FM	SEWER FORCE MAIN
W	WATER
RW	RECYCLED WATER
W	EXISTING WATER LINE
E	EXISTING POWER LINE
	FIRE DEPARTMENT ACCESS GATE
	LOW FLOW DIVERSION
	DEBRIS RISER
	RISER
	CATCH BASIN
3	SURVEYOR'S NOTES PER "EXCEPTIONS", PER SHT 2
	IMPACTED OAK TREE HERITAGE SIZE LABELED WITH "H"
	ENCROACHED OAK TREE HERITAGE SIZE LABELED WITH "H"
	PRESERVED OAK TREE HERITAGE SIZE LABELED WITH "H"
	EXISTING POWER POLE
	PROPOSED DRIVEWAY
	WATER TANK & STORM DRAIN ACCESS ROAD
	TRAIL, CONC OR DG PER PLAN
	SIGHT DISTANCE LINE (415')

BC	BEGIN CURVE
BVC	BEGIN VERTICAL CURVE
CONC	CONCRETE
DG	DECOMPOSED GRANITE
EC	END CURVE
ESMT	EASEMENT
EVC	END OF VERTICAL CURVE
EX	EXISTING
GB	GRADE BREAK
HP	HIGH POINT
L	LENGTH
LDZ	LANDSCAPE DEVELOPMENT ZONE
LP	LOW POINT
MIN	MINIMUM
O.S.	OPEN SPACE
P.F.	PUBLIC FACILITY
PRC	POINT REVERSE CURVE
PRVC	POINT REVERSE VERTICAL CURVE
PROP	PROPOSED
PVI	POINT OF VERTICAL INTERSECTION
PVT	PRIVATE
R	RADIUS
REC	RECREATION
SF	SQUARE FEET
SD	STORM DRAIN
SS	SANITARY SEWER
SWK	SIDEWALK
WS	WATER SURFACE

GENERAL NOTES:

1. GRADE ELEVATIONS SHOWN ON THE VTTM ARE APPROXIMATE. CHANGES IN THE ELEVATIONS DEPICTED ON THE TENTATIVE MAP WHICH WILL NOT SUBSTANTIALLY ALTER THE APPROVED GRADING PLAN OR RESULT IN PAD ELEVATION CHANGES OF MORE THAN 10 FEET ARE PERMITTED SUBJECT TO THE PROVISIONS OF SECTION 5.2 OF THE NEWHALL RANCH
2. LOT LINES CAN BE ADJUSTED PROVIDED NO ADDITIONAL LOTS ARE CREATED. THE DEGREE OF ADJUSTMENT SHALL BE CONSISTENT WITH THE INTENT OF THE SUBDIVISION MAP APPROVAL. THE SUBDIVISION MAP ACT AND TO THE SATISFACTION OF DRP.
3. ALIGNMENT AND GEOMETRICS OF STREETS AND TRAILS ARE APPROXIMATE. ADJUSTMENTS TO STREETS CAN BE MADE PROVIDED THE DEPARTMENT OF PUBLIC WORKS AND DRP DETERMINE THAT THE ADJUSTMENTS ARE CONSISTENT WITH THE INTENT OF THE SUBDMISION APPROVAL. ADJUSTMENTS TO TRAILS CAN BE MADE WITH APPROVAL BY DRP AND THE PARKS AND RECREATION DEPARTMENT.
4. BUILDING FOOTPRINTS SHOWN ON THE TENTATIVE MAP OR ACCOMPANYING SITE PLAN EXHIBIT MAPS ARE ONLY FOR ILLUSTRATIVE PURPOSES. RELOCATION OF BUILDINGS, OR ADJUSTMENTS IN BUILDING SQUARE FOOTAGE, NUMBER OF BUILDINGS, PARKING REQUIREMENTS AND OTHER FEATURES WHICH WILL NOT RESULT IN AN INCREASE IN TOTAL SQUARE FOOTAGE OR THE NUMBER OF DWELLING UNITS ARE PERMITTED SUBJECT TO THE PROVISIONS OF THE SECTION 5.2 OF THE NEWHALL RANCH SPECIFIC PLAN.
5. PERMISSION IS REQUESTED TO FILE "LARGE LOT" TRACT MAPS OF 20 ACRES OR MORE (WITHOUT IMPROVEMENTS) AS SPECIFIED IN THE COUNTY SUBDIVISION CODE.
6. THE RECORDATION OF A "LARGE LOT" PARCEL MAP SHALL BE CONSIDERED THE FILING OF THE FIRST UNIT FOR THE PURPOSE OF TIME EXTENSIONS PURSUANT TO THE SUBDIVISION MAP ACT. HOWEVER, THE RECORDATION OF A "LARGE LOT" PARCEL MAP SHALL NOT REQUIRE FULFILLMENT OF INFRASTRUCTURE REQUIREMENTS--IF CONSISTENT WITH THE COUNTY SUBDIVISION ORDINANCE--NOR THE DEDICATION OF PARKLAND OR IN LIEU PARK FEES.
7. PERMISSION IS REQUESTED TO COMBINE LOTS TO THE SATISFACTION OF DRP AND PUBLIC WORKS.
8. PERMISSION IS REQUESTED FOR UNIT PHASING TO THE SATISFACTION OF DRP AND PUBLIC WORKS.
9. PERMISSION IS REQUESTED TO RECORD ADDITIONAL OPEN SPACE LOTS TO THE SATISFACTION OF DRP AND PUBLIC WORKS.
10. PERMISSION IS REQUESTED TO RECORD ADDITIONAL UTILITY LOTS PROVIDED MAINTENANCE EASEMENTS ARE GRANTED TO THE SATISFACTION OF THE DRP.
11. THE LOCATIONS OF APPURTENANT STRUCTURES (E.G., PASEOS, PEDESTRIAN BRIDGES, TRANSIT SHELTERS, WATER QUALITY BASINS, WATER TANKS, ETC.) MAY BE RELOCATED TO THE SATISFACTION OF DPW AND DRP.
12. PERMISSION TO RECORD JOINT ACCESS EASEMENTS (20' WIDE) AS LOTS REQUESTED.
13. REQUEST PERMISSION TO PHASE MASS GRADE TO THE SATISFACTION OF DRP AND DPW AND THE PROVISIONS OF THE COUNTY CODE, APPROVED PROJECT CONDITIONS AND MITIGATION MEASURES.
14. PROPOSED STREET GRADING IS APPROXIMATE ONLY AND SUBJECT TO ADJUSTMENTS PENDING DETERMINATION OF FINAL DEVELOPMENT LAYOUT AND PLANS.
15. PROPERTY LINE RETURN RADII OF 13 FT. AT ALL LOCAL STREET INTERSECTIONS AND 27 FT AT THE INTERSECTION OF LOCAL STREETS WITH PLANNED HIGHWAYS (THOSE ON COUNTY HIGHWAY PLAN) AND WHERE ALL PLANNED HIGHWAYS INTERSECT OR WHERE ONE OF THE ROADS SERVES A COMMERCIAL OR INDUSTRIAL DEVELOPMENT PLUS ADDITIONAL RIGHT OF WAY FOR CORNER CUT-OFF TO MEET CURRENT GUIDELINES OF THE AMERICANS WITH DISABILITIES ACT (ADA) TO THE SATISFACTION OF PUBLIC WORKS.
16. MODIFIED STREET CROSS-SECTIONS AS SHOWN ON VESTING TENTATIVE TRACT MAP ARE REQUESTED, HOWEVER, PERMISSION IS SOUGHT TO CONSTRUCT STANDARD STREET CROSS-SECTIONS AT THE DISCRETION OF THE SUBDIVIDER.
17. ALL DIMENSIONS SHOWN ARE APPROXIMATE.
18. TOPOGRAPHY PROVIDED BY: CITY OF SANTA CLARITA
    DATE OF TOPOGRAPHY: 2006
    PHONE: N/A
19. ALL DRAINAGE TO BE MAINTAINED BY LACFCD, UNLESS OTHERWISE NOTED ON PLAN.
20. REQUEST STREET FRONTAGE WAIVER FOR LOTS FRONTING ON PRIVATE STREETS AND PRIVATE DRIVES PER CONDITIONS OF APPROVAL.
21. PERMISSION IS REQUESTED TO ALLOW FLAG LOTS PER CONDITIONS OF APPROVAL.
22. GRADING OF VTTM 78248 MAY BE DONE IN SUB-PHASES OVER TIME BUT SUCH GRADING WILL STILL BE BALANCED WITHIN THE GRADING LIMITS IDENTIFIED ON THE TENTATIVE TRACT MAP . ALL GRADING OF SLOPES WILL BE PERFORMED AS ENGINEERED GRADING. THE LIMIT OF A GRADING SUB-PHASE WILL BE ESTABLISHED TO ACHIEVE A BALANCED EARTHWORK FOR THAT SUB-PHASE AND MAY BE EXTEND BEYOND THE LIMITS OF A PARTICULAR FINAL UNIT MAP BOUNDARY IN ORDER TO ACHIEVE A PHASED GRADING BALANCE. AN INTERIM HYDROLOGY REPORT WILL BE PREPARED FOR EACH PHASE OF GRADING AREA AND REQUIRED DRAINAGE DEVICES WILL BE PROVIDED TO SUPPORT THE PHASED GRADING. DRAINAGE AND EROSION CONTROL FACILITIES WILL BE PROVIDED TO THE SATISFACTION OF DWP.

SPECIAL NOTES:

1. WATER QUALITY BASINS WILL PROVIDE FOR TREATMENT OF STORM WATER RUN OFF.
2. THE WATER QUALITY BASINS SHALL BE DEDICATED TO THE COUNTY WHEN COMPLETED AND ACCEPTED.
3. PROPOSED RECLAIMED WATER LINES WILL BE LOCATED IN PUBLIC STREETS AND TRAILS.

UTILITY PROVIDERS

PHONE: AT&T
SCHOOLS: SULPHUR SPRING UNION SCHOOL DISTRICT
ELECTRIC: SOUTHERN CALIFORNIA EDISON
SEWER TREATMENT: LA COUNTY SANITATION DISTRICT
GAS: SOUTHERN CALIFORNIA GAS COMPANY
WATER: SANTA CLARITA WATER DIVISION
POLICE PROTECTION: LA COUNTY SHERIFF
FIRE PROTECTION: LA COUNTY FIRE

SURVEY NOTES:

VERTICAL DATUM:
BENCH MARK: B.M. NO. LT143
LA CO BM BR DISK MRKD 7143, IN E. CURB SAND CYN RD. @SE COR COMET WAY, LOS ANGELES CO. ELEV. 1573.398
•DATUM USED FOR FIELD REFERENCE AND VERIFICATION

AERIAL PLANIMETRY:
TOPOGRAPHY PROVIDED BY: CITY OF SANTA CLARITA
DATE OF TOPOGRAPHY: 2006
PHONE: N/A

LEGAL DESCRIPTION:

REAL PROPERTY IN THE CITY OF SANTA CLARITA, COUNTY OF LOS ANGELES, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

LOT 79 OF AMENDING MAP OF TRACT NO. 52004, IN THE CITY OF SANTA CLARITA, IN THE COUNTY OF LOS ANGELES, STATE OF CALIFORNIA, AS PER MAP RECORDED IN BOOK 1253 PAGES 16 TO 34 INCLUSIVE OF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

EXCEPT FROM THAT PORTION OF SAID LAND LYING WITHIN THAT PORTION OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 23, TOWNSHIP 4 NORTH, RANGE 15 WEST, SAN BERNARDINO MERIDIAN, AS DESCRIBED IN THE DEED REFERRED TO HEREIN AN UNDIVIDED ONE- HALF OF ALL OIL, GAS AND OTHER MINERALS IN AND UNDER SAID LAND, AS GRANTED TO ALFRED J. KOLSCHOWSKY AND MARGARET KOLSCHOWSKY, HUSBAND AND WIFE, BY DEED RECORDED MARCH 1, 1949 AS INSTRUMENT NO. 1109 IN BOOK 29480 PAGE 175, OFFICIAL RECORDS.

EXCEPT FROM THAT PORTION OF SAID LAND LYING WITHIN THAT PORTION OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER AND THAT PORTION OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 23, TOWNSHIP 4 NORTH, RANGE 15 WEST, SAN BERNARDINO MERIDIAN, AS DESCRIBED IN THE DEED REFERRED TO HEREIN ONE-HALF OF ALL OIL, GAS, PETROLEUM, MINERALS AND HYDROCARBON SUBSTANCES IN OR UNDER SAID LAND AS RESERVED BY RUTH LOUISE MILLHITE, A MARRIED WOMAN WHO ACQUIRED TITLE AS RUTH LOUISE DAVIS AND R. LOUISE DAVIS, A SINGLE WOMAN BY DEED RECORDED APRIL 9, 1951 AS INSTRUMENT NO. 818 IN BOOK 35996 PAGE 22 OFFICIAL RECORDS.

EXCEPT FROM THAT PORTION OF SAID LAND LYING WITHIN THAT PORTION OF THE SOUTHEAST QUARTER OF SECTION 24 AND LYING WITHIN THAT PORTION OF THAT NORTHEAST QUARTER AND THE SOUTHEAST QUARTER OF SECTION 25, BOTH IN TOWNSHIP 4 NORTH, RANGE 15 WEST, SAN BERNARDINO MERIDIAN, AS DESCRIBED IN THE DEED REFERRED TO HEREIN ONE-HALF OF ALL MINERAL AND OIL RIGHTS IN SAID LAND, AS RESERVED BY ANTHONY L. LAWRENCE, IN DEED RECORDED OCTOBER 22, 1953 AS INSTRUMENT NO. 1382 IN BOOK 42985 PAGE 190, OFFICIAL RECORDS.

EXCEPT FROM THAT PORTION OF SAID LAND LYING WITHIN THAT PORTION OF THE WEST 15 ACRES OF THE NORTHEAST QUARTER OF THE SOUTHWEST QUARTER AND LYING WITHIN THAT PORTION OF THE NORTHWEST QUARTER OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER IN SECTION 24 TOWNSHIP 4 NORTH, RANGE 15 WEST, SAN BERNARDINO MERIDIAN, AS DESCRIBED IN THE DEEDS REFERRED TO HEREIN SIXTY-TWO AND ONE-HALF PERCENT OF ALL OF THE OIL, GAS, MINERALS AND OTHER HYDROCARBON SUBSTANCES IN, UPON AND UNDER SAID REAL ESTATE, AS RESERVED IN DEEDS FROM FRANK M. FERRELL AND DOROTHY E. FERRELL, HIS WIFE, RECORDED MAY 10, 1956 AS INSTRUMENT NOS. 1585 AND 1586 IN BOOK 51145 PAGES 6 AND 7 RESPECTIVELY OFFICIAL RECORDS.

EXCEPT FROM THAT PORTION OF SAID LAND LYING WITHIN THAT PORTION OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 23, TOWNSHIP 4 NORTH, RANGE 15 WEST, SAN BERNARDINO MERIDIAN, AS DESCRIBED IN THE DEED REFERRED TO HEREIN 50 PERCENT OF OIL, GAS, MINERAL, ASPHALTUM AND OTHER HYDROCARBON SUBSTANCES SAID PROPERTY OR THAT MAY BE PRODUCED THEREON BUT WITHOUT THE RIGHT OF ENTRY ABOVE THE DEPTH OF 500 FEET BELOW THE SURFACE OF SAID LAND, AS RESERVED BY FRED KOLSCHOWSKY AND MARGUERITE F. KOLSCHOWSKY, HUSBAND AND WIFE, IN DEED RECORDED MARCH 8, 1961 AS INSTRUMENT NO. 932 IN BOOK D-1148 PAGE 403, OFFICIAL RECORDS.

PROJECT SUMMARY:

GROSS AREA – 74.9 AC
TOTAL LOTS – 4 TOTAL D.U. – 392
EXISTING ZONING – OPEN SPACE
PROPOSED ZONING – REGIONAL COMMERCIAL
GENERAL PLAN LAND USE – VISITOR SERVING / RESORT

ASSESSOR'S PARCEL NUMBER (APN)

2840-022-025

APPROXIMATE EARTHWORK QUANTITIES:

	RAW CUT	RAW FILL	NET CUT
VTTM 78248: (WITHIN TRACT BOUNDARY)	228,000 CY	215,000 CY	13,000 CY
TOTALS:			•0 CY

•INCLUDES SOILS ENGINEERS FINDINGS FOR SUBSIDENCE, SHRINKAGE AND REMEDIAL GRADING

LOT NUMBERS	TYPE (USE)	DWELLING UNITS OR NON-RESIDENTIAL	DEVELOPED ACRES	OPEN SPACE ACRES	TOTAL ACRES
1	PARK	0	0	7.1	7.1
2	1-STORY SINGLE FAMILY, OAK TREE PRESERVE & OPEN SPACE	10	5.7	12.5	18.2
3	HOTEL, RESORT SPA, RESTAURANTS, 2-STORY MULTI-FAMILY & OPEN SPACE	382	26.0	11.0	37.0
4	9 HOLE GOLF COURSE, TENNIS/PICKLE COURTS, RECREATION AREA & OPEN SPACE	000	0	12.6	12.6
		392	31.7	43.2	74.9

DESIGNED:	NO.	REVISIONS	DATE	BY
JHF, PDO				
DRAFTED: PDO				
CHECKED: JHF				

OWNER/DEVELOPER:
SAND CANYON COUNTRY CLUB
27734 SAND CANYON ROAD
SANTA CLARITA, CA. 91387
TELEPHONE: (213) 700-6883
OWNER: STEVE KIM

PLANS PREPARED BY:
HUNSAKER & ASSOCIATES
IRVINE, INC.
PLANNING • ENGINEERING • SURVEYING
3090 Bristol Street, Ste 550 • Costa Mesa, CA 92626
PH (949) 250-0271 • FX (949) 250-0069

JASON H. FUKUMITSU — DATE

MAJOR LAND DIVISION
VESTING TENTATIVE TRACT MAP NO. 78248
TITLE SHEET

IN THE UNINCORPORATED AREA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

SCALE: PER PLAN
DATE: 09/05/2018
JOB NO. 0261-001-001
SHEET 1 OF 4 SHEETS

Geotechnical Map

Prepared for: Sand Canyon Country Club

Vesting Tentative Tract Map No. 78248
Planning Area OF 1-8
Santa Clarita, California

AS-SHOWN	Drawn by: JH	Checked by: TPL
9/20/2018	Figure 1.1	2017-006-021

R. T. FRANKIAN & ASSOCIATES
Civil Engineers • Land Surveyors • Land Planners
Santa Ana, California 92705
(818) 551-1501
www.RTFrankian.com

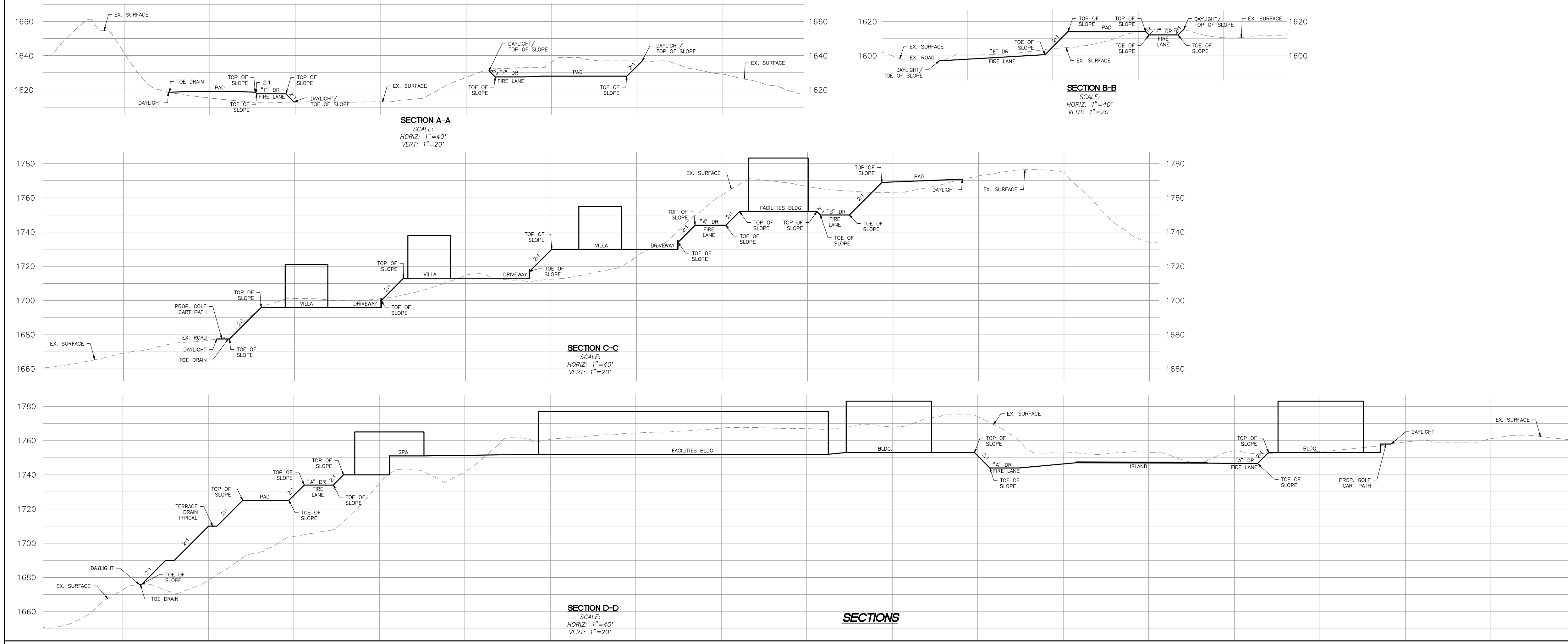
RTFA INC
ENGINEERING GEOLOGY & SOILS ENGINEERING

SHT 3 SHT 4

KEY MAP
NOT TO SCALE

SHEET INDEX

SHEET No.	DESCRIPTION
1	TITLE SHEET
2	DETAILS AND STREET / ROAD SECTIONS
	SECTIONS AND EASEMENT DESCRIPTIONS
3 AND 4	SAND CANYON RESORT



DISPOSITION LEGEND:

A	ABANDON
P	PROTECT IN PLACE
Q	QUIT CLAIM
R	REMOVE
RE	RELOCATE
RM	TO REMAIN
IN	INDETERMINATE IN NATURE
L	LEASE (OIL, GAS, MINERALS)
NA	NOT APPLICABLE TO PROJECT
LA	LINE OF SIGHT AIR SPACE EASEMENT

EASEMENTS

3. AN EASEMENT FOR POLES AND LINES AND INCIDENTAL PURPOSES, RECORDED AUGUST 14, 1956 AS INSTRUMENT NO. 3532 IN BOOK 52019, PAGE 419 OF OFFICIAL RECORDS.
   IN FAVOR OF:SOUTHERN CALIFORNIA EDISON COMPANY, A CORPORATION AFFECTS: AS DESCRIBED THEREIN

   SURVEYOR'S NOTE: PLOTTED HEREON AS ⟨3⟩

4. AN EASEMENT SHOWN OR DEDICATED ON THE MAP AS REFERRED TO IN THE LEGAL DESCRIPTION FOR: SANITARY SEWER AND SANITARY SEWER INGRESS AND EGRESS, PRIVATE DRIVEWAY AND FIRELANE AND INCIDENTAL PURPOSES.

   SURVEYOR'S NOTE: PLOTTED HEREON AS ⟨4⟩

5. ABUTTER'S RIGHTS OF INGRESS AND EGRESS TO OR FROM SAND CANYON ROAD, HAVE BEEN DEDICATED OR RELINQUISHED ON THE FILED MAP.

6. THE FOLLOWING MATTERS SHOWN OR DISCLOSED BY THE FILED OR RECORDED MAP REFERRED TO IN THE LEGAL DESCRIPTION: WE HEREBY DEDICATE TO THE CITY OF SANTA CLARITA THE RIGHT TO RESTRICT THE ERECTION OF BUILDINGS OR OTHER STRUCTURES WITHIN THOSE AREAS DESIGNATED ON THE MAP AS GEOLOGICAL RESTRICTED USE OR FLOOD HAZARD AREAS.

   WE ALSO HEREBY DEDICATE TO THE CITY OF SANTA CLARITA THE RIGHT TO RESTRICT RESIDENTIAL CONSTRUCTION OVER ALL OPEN SPACE.

   DRAINAGE NOTES: LOT OWNERS IN THIS SUBDIVISION SHALL NOT INTERFERE WITH THE ESTABLISHED DRAINAGE OF THIS SUBDIVISION. OWNERS OF LOTS SHALL NOT ERECT WALLS OR OTHER SOLID CONSTRUCTION WHICH WILL OBSTRUCT DRAINAGE EXCEPT AS APPROVED BY THE CITY ENGINEER.

   OPEN SPACE GOLF COURSE NOTE: IF ANY OF THE GOLF COURSE LOTS ARE CONVEYED, ACCESS SHALL BE AFFORDED BY MEANS OF RESERVATION OF GRANT IN THE DEEDS OR DEEDS OF CONVEYANCE.

   SURVEYOR'S NOTE: GEOLOGICAL RESTRICTED USE AREA IS BLANKET OVER LOT 79

   SURVEYOR'S NOTE: FLOOD HAZARD AREA IS PLOTTED HEREON AS ⟨6⟩

7. AN EASEMENT FOR FLOOD CONTROL PURPOSES AND INCIDENTAL PURPOSES, RECORDED OCTOBER 10, 2000 AS INSTRUMENT NO. 00-1585068 OF OFFICIAL RECORDS.
   IN FAVOR OF: LOS ANGELES COUNTY FLOOD CONTROL DISTRICT, A BODY CORPORATE AND POLITIC
   AFFECTS:AS DESCRIBED THEREIN

   DOCUMENT RE-RECORDED JULY 30, 2002 AS INSTRUMENT NO. 02-1777823 OF OFFICIAL RECORDS.

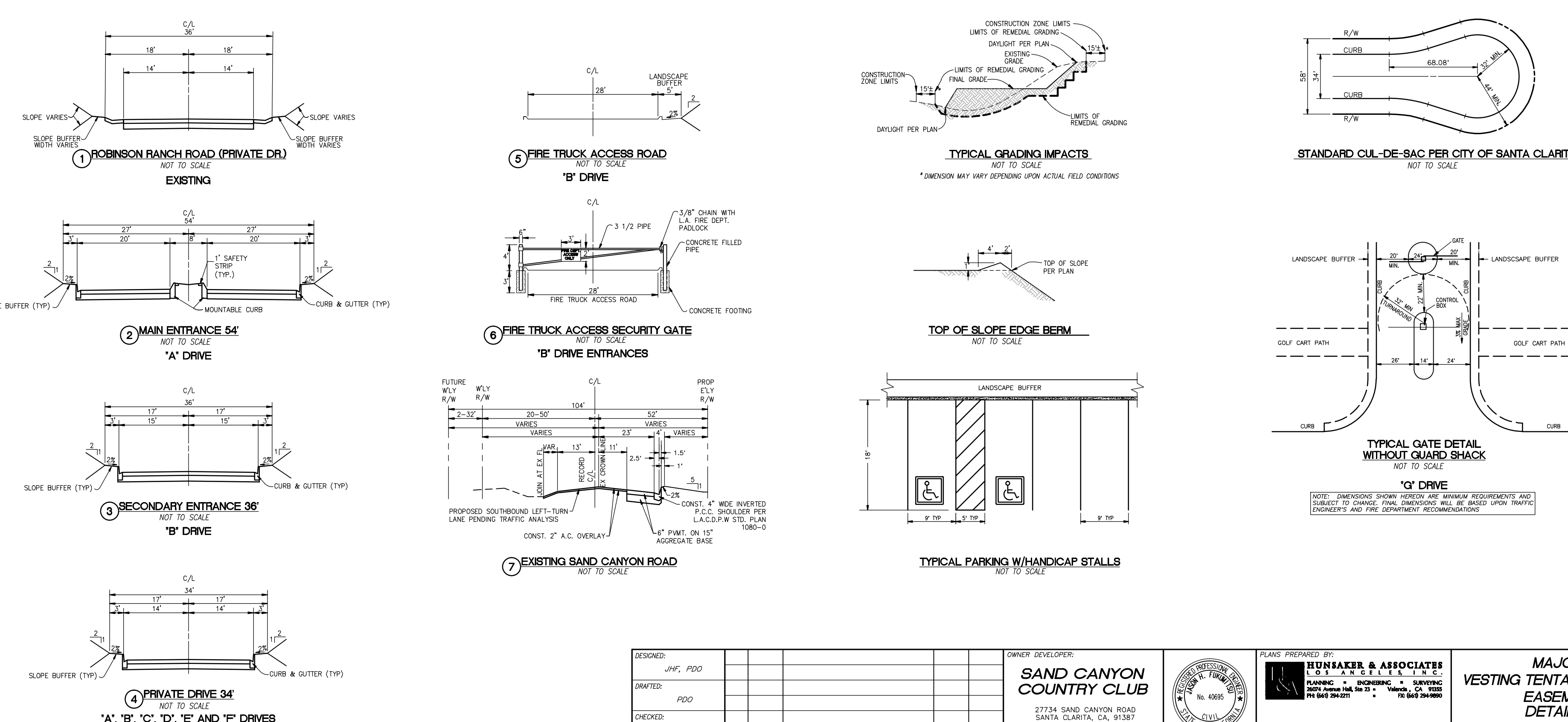
   SURVEYOR'S NOTE: FLOOD CONTROL EASEMENT PLOTTED HEREON AS ⟨7⟩

   SURVEYOR'S NOTE: TEMPORARY CONSTRUCTION EASEMENTS PLOTTED HEREON AS ⟨7A⟩

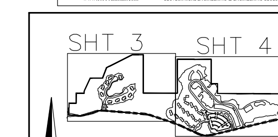
8. THE TERMS, PROVISIONS AND EASEMENT(S) CONTAINED IN THE DOCUMENT ENTITLED "ROAD EASEMENT AND MAINTENANCE AGREEMENT" RECORDED OCTOBER 31, 2000 AS INSTRUMENT NO. 00-1700352 OF OFFICIAL RECORDS.

9. AN EASEMENT FOR WATER LINE AND INCIDENTAL PURPOSES, RECORDED DECEMBER 11, 2000 AS INSTRUMENT NO. 00-1923801 OF OFFICIAL RECORDS.
   IN FAVOR OF:SANTA CLARITA WATER COMPANY, A CORPORATION, ITS SUCCESSORS AND ASSIGNS
   AFFECTS:AS DESCRIBED THEREIN

   SURVEYOR'S NOTE: PLOTTED HEREON AS ⟨9⟩



Geotechnical Map		
Prepared For: Sand Canyon Country Club		
Vesting Tentative Tract Map No. 78248 Planning Area OF 1-8 Santa Clarita, California		
Scale: AS-SHOWN	Drawn By: JH	Checked By: TPL
Date: 9/20/2018	Figure 1.2	2017-006-021
R. T. FRANKIAN & ASSOCIATES 26027 Huntington Lane, Unit A Santa Clarita, California 91355 (818) 531-1501 www.RTFrankian.com	RTFA GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY	



KEY MAP
NOT TO SCALE

DESIGNED: JHF, PDO DRAFTED: PDO CHECKED: JHF	NO.	REVISIONS	DATE	BY	OWNER DEVELOPER: SAND CANYON COUNTRY CLUB 27734 SAND CANYON ROAD SANTA CLARITA, CA, 91387 TELEPHONE: (213) 700-6883 OWNER: STEVE KIM	REGISTERED PROFESSIONAL ENGINEER JASON H. FUKUMITSU No. 40695 CIVIL STATE OF CALIFORNIA	PLANS PREPARED BY: HUNSAKER & ASSOCIATES LOS ANGELES, INC. PLANNING ▪ ENGINEERING ▪ SURVEYING 26074 Avenue Hall, Ste 23 ▪ Valencia, CA 91355 PH: (661) 294-2211 ▪ FX: (661) 294-9890 JASON H. FUKUMITSU DATE	MAJOR LAND DIVISION VESTING TENTATIVE TRACT MAP NO. 78248 EASEMENT DESCRIPTION DETAILS AND SECTIONS IN THE UNINCORPORATED AREA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA	SCALE: PER PLAN DATE: 09/05/2018 JOB No. 0261-001-001 SHEET 2 OF 4 SHEETS

EXPLANATION

- af — Artificial Fill
- Qal — Alluvium
- Tmc — Mint Canyon Formation
- Geologic Contact
- 22 — Strike and Dip of Bedding
- 44 — Strike and Dip of Minor Fault
- HS-3 — RTF&A Boring (2017)
- TP-2 — RTF&A Test Pit (2017)
- B-11 G — Gorian & Associates, Inc. Boring (1995)
- A — A' — Geologic Section Line
- Approximate Location of Recommended Subdrain
- Potential Debris Flow Source Area
- Stability Fill Keyway Area

DISPOSITION LEGEND:

- A — ABANDON
- P — PROTECT IN PLACE
- Q — QUIT CLAIM
- R — REMOVE
- RE — RELOCATE
- RM — TO REMAIN
- RY — INDETERMINATE IN NATURE
- L — LEASE (OIL, GAS, MINERALS)
- NA — NOT APPLICABLE TO PROJECT
- LA — LINE OF SIGHT AIR SPACE EASEMENT

LEGEND:

- 100 — LOT NO.
- 5303 SF — LOT AREA (SQUARE FEET)
- PAD=1210.0 C.O. — PAD ELEVATION OR LOT TYPE
- VTTM 78248 BOUNDARY
- EXISTING PARCEL BOUNDARY
- PROPOSED PRIVATE DRIVE
- PROPOSED LOT LINE
- PROPOSED EASEMENT
- EXISTING EASEMENTS IDENTIFIED BY (3)
- 950 — PROPOSED CONTOUR
- DAYLIGHT LINE
- STORM DRAIN CULVERT
- SD — STORM DRAIN
- S — SANITARY SEWER (SERVICE LOCAL)
- SM — SEWER FORCE MAIN
- W — WATER
- W/R — RECYCLED WATER
- W — EXISTING WATER LINE
- E — EXISTING POWER LINE
- FIRE DEPARTMENT ACCESS GATE
- LOW FLOW DIVERSION
- DEBRIS RISER
- RISER
- CATCH BASIN
- (3) — SURVEYOR'S NOTES PER "EXCEPTIONS" PER SHT 2
- IMPACTED OAK TREE HERITAGE SIZE LABELED WITH "H"
- ENCROACHED OAK TREE HERITAGE SIZE LABELED WITH "H"
- PRESERVED OAK TREE HERITAGE SIZE LABELED WITH "H"
- EXISTING POWER POLE
- PROPOSED DRIVEWAY
- WATER TANK & STORM DRAIN ACCESS ROAD
- TRAIL, CONC OR DG PER PLAN
- SIGHT DISTANCE LINE (415')

BC	BEGIN CURVE
BVC	BEGIN VERTICAL CURVE
CONC	CONCRETE
DG	DECOMPOSED GRANITE
EC	END CURVE
ESMT	EASEMENT
EVC	END OF VERTICAL CURVE
EX	EXISTING
GB	GRADE BREAK
HP	HIGH POINT
L	LENGTH
LDZ	LANDSCAPE DEVELOPMENT ZONE
LP	LOW POINT
MIN	MINIMUM
O.S.	OPEN SPACE
P.F.	PUBLIC FACILITY
PRC	POINT REVERSE CURVE
PRVC	POINT REVERSE VERTICAL CURVE
PROP	PROPOSED
PVI	POINT OF VERTICAL INTERSECTION
PVT	PRIVATE
R	RADIUS
REC	RECREATION
SF	SQUARE FEET
SD	STORM DRAIN
SS	SANITARY SEWER
SWK	SIDEWALK
WS	WATER SURFACE

NOTE:
EASEMENTS FOR INGRESS/EGRESS WILL BE BASED ON FINAL SITE PLAN AND DEDICATED ON THE FINAL TRACT MAP.

MATCH LINE SEE BOTTOM LEFT

MATCH LINE SEE TOP RIGHT

MATCH LINE SEE SHEET 4

Potential Debris Flow Source Area

Remove All "af" within Proposed Development Area

Stability Fill Keyway (3' Deep x 15' Wide)

LOT 2- SINGLE FAMILY ESTATES / OPEN SPACE 16.2 AC

LOT 1 - PARK 7.1 AC (BY OTHERS)

LOT 3- RESORT / MULTI FAMILY / OPEN SPACE 37.0 AC

Not a Part

Sand Canyon Rd.

Robinson Ranch Rd.

PROP. WATER QUALITY / DETENTION BASIN

LEFT TURN POCKET, SEE SHT 2

EX RESTROOMS TO REMAIN

L.A.C.D.P.W. EX DEBRIS BASIN PER PD046475

EX CART PATH TO REMAIN

EX CART PATH TO BE REMOVED

CART PATH / PATH TO REMAIN

EX BUILDING TO REMAIN

PRIVATE DR / FIRE LANE

E DR

F DR

CS-1

CS-2

TP-7 af=0'

TP-8 af=0'

TP-9 af=2'

TP-10 af=1'

TP-11 af=9'

TP-12 af=15'

TP-15 af=6'

TP-16 af=12'

TP-17 af=8.5'

TP-19 af=19'

TP-20 af=9.5'

TP-21 af=0'

TP-22 af=0'

TP-23 af=0'

HS-1 af=2'

HS-2 af=31'

af=2'-22' R=5'-25'

R=20'

R=6'-20'

R=5'

Geotechnical Map

Prepared for: Sand Canyon Country Club

Proposed Golf Course and Resort Development
Vesting Tentative Tract Map No. 78248
Santa Clarita, California

Scale	Drawn By	Checked By
AS SHOWN	JH	AWR
9/20/2018	Figure 1.3	2017-006-021

R.T. FRANKIAN & ASSOCIATES
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Santa Clarita, California 91355
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www.RTFrankian.com

RTFA — GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

S-T 3 SHT 4

KEY MAP
NOT TO SCALE

NORTH

FEET
40' 20' 0 40' 80'
1/2 0 INCHES

DESIGNED:	NO.	REVISIONS	DATE	BY
JHF, PDO				
DRAFTED: PDO				
CHECKED: JHF				

OWNER/DEVELOPER:
SAND CANYON COUNTRY CLUB
27734 SAND CANYON ROAD
SANTA CLARITA, CA. 91387
TELEPHONE: (213) 700-6883
OWNER: STEVE KIM

PLANS PREPARED BY:
HUNSAKER & ASSOCIATES
I R V I N E, I N C.
PLANNING • ENGINEERING • SURVEYING
9444 Jeronimo Road, Ste 250 • Irvine, CA 92618
PH (949) 583-1010 • FAX (949) 583-0759

JASON H. FORGARASSI — DATE

MAJOR LAND DIVISION
VESTING TENTATIVE TRACT MAP NO. 78248
PLANNING AREA OF 1-8
IN THE UNINCORPORATED AREA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

SCALE: PER PLAN
DATE: 09/25/2018
JOB No. 2261-001-001
SHEET 3 OF 4 SHEETS

MATCH LINE SEE RIGHT

MATCH LINE SEE LEFT

MATCH LINE SEE SHEET 3

LOT 3- RESORT / MULTI FAMILY / OPEN SPACE
37.0 AC

LOT 4- GOLF COURSE / PICKLE-TENNIS COURTS
RECREATION / OPEN SPACE
12.6 AC

Qal

Tmc

af
Remove All "af" within Proposed Development Area

ROBINSON RANCH ROAD

LEGEND:

- 100 — LOT NO.
- 5000 SF — LOT AREA (SQUARE FEET)
- #95=1216.0 — PAD ELEVATION OR LOT TYPE
- VTTM 78248 BOUNDARY
- EXISTING PARCEL BOUNDARY
- PROPOSED PRIVATE DRIVE
- PROPOSED LOT LINE
- PROPOSED EASEMENT
- EXISTING EASEMENTS IDENTIFIED BY (3)
- 950 — PROPOSED CONTOUR
- DAYLIGHT LINE
- STORM DRAIN CULVERT
- SD — STORM DRAIN
- S — SANITARY SEWER (SEEPAGE LOCAL)
- FM — SEWER FORCE MAIN
- W — WATER
- RW — RECYCLED WATER
- W — EXISTING WATER LINE
- E — EXISTING POWER LINE
- FIRE DEPARTMENT ACCESS GATE
- LOW FLOW DIVERSION
- DEBRIS RISER
- RISER
- CATCH BASIN
- (3) — SURVEYOR'S NOTES PER "EXCEPTIONS", PER SHT 2
- IMPACTED OAK TREE HERITAGE SIZE LABELED WITH "H"
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- PRESERVED OAK TREE HERITAGE SIZE LABELED WITH "H"
- EXISTING POWER POLE
- PROPOSED DRIVEWAY
- WATER TANK & STORM DRAIN ACCESS ROAD
- TRAIL, CONC OR DG PER PLAN
- SIGHT DISTANCE LINE (415')

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EC	END CURVE
ESMT	EASEMENT
EVC	END OF VERTICAL CURVE
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GB	GRADE BREAK
HP	HIGH POINT
L	LENGTH
LDZ	LANDSCAPE DEVELOPMENT ZONE
LP	LOW POINT
MAN	MANHOLE
O.S.	OPEN SPACE
P.F.	PUBLIC FACILITY
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SWK	SIDEWALK
WS	WATER SURFACE

NOTE:
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DISPOSITION LEGEND:

A	ABANDON
P	PROTECT IN PLACE
Q	QUIT CLAIM
R	REMOVE
RE	RELOCATE
RM	TO REMAIN
IN	INDETERMINATE IN NATURE
L	LEASE (OIL, GAS, MINERALS)
NA	NOT APPLICABLE TO PROJECT
LA	LINE OF SIGHT AIR SPACE EASEMENT

Geotechnical Map

Prepared For: Sand Canyon Country Club

Proposed Golf Course and Resort Development
Vesting Tentative Tract Map No. 78248
Santa Clarita, California

Scale	Drawn By	Checked By
AS SHOWN	JH	AWR
Date: 9/20/2018	Figure 1.4	2017-006-021

R.T. FRANKIAN & ASSOCIATES
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www.RTFrankian.com

RTFA — GEOTECHNICAL & GEOLOGICAL CONSULTANTS

SHT 3 SHT 4

KEY MAP
NOT TO SCALE

DESIGNED: JHF, PDO
DRAFTED: PDO
CHECKED: JHF

NO.	REVISIONS	DATE	BY

OWNER/DEVELOPER:
SAND CANYON COUNTRY CLUB
27734 SAND CANYON ROAD
SANTA CLARITA, CA. 91387
TELEPHONE: (213) 220-9682
OWNER: STEVE KIM

PLANS PREPARED BY:
HUNSAKER & ASSOCIATES
IRVINE, INC. PLANNING ENGINEERING SURVEYING
9620 Irvine Hill, Ste 23 Valencia, CA. 91355
PH (949) 294-2211 FX (661) 294-9610

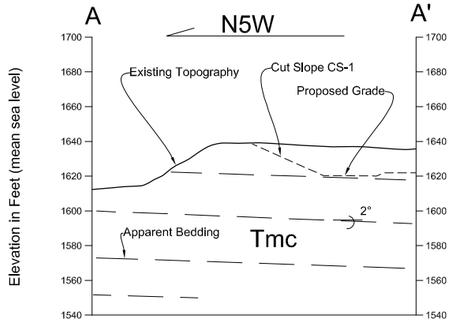
JASON R. FURUMITSU — DATE

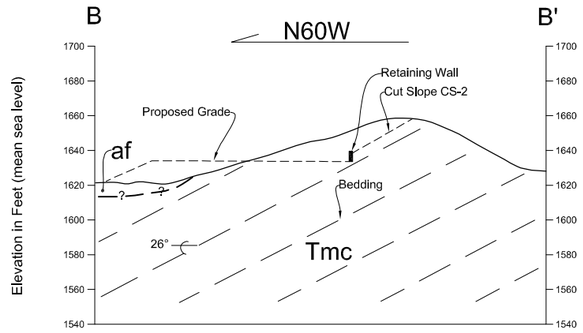
MAJOR LAND DIVISION
VESTING TENTATIVE TRACT MAP NO. 78248
PLANNING AREA OF 1-8

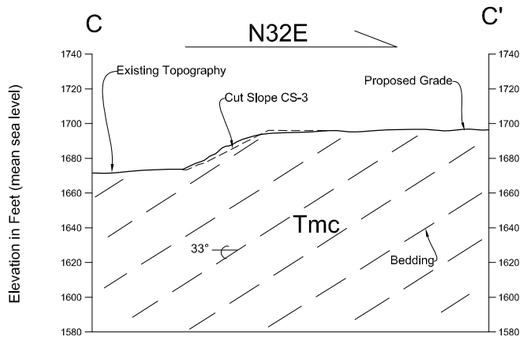
IN THE UNINCORPORATED AREA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

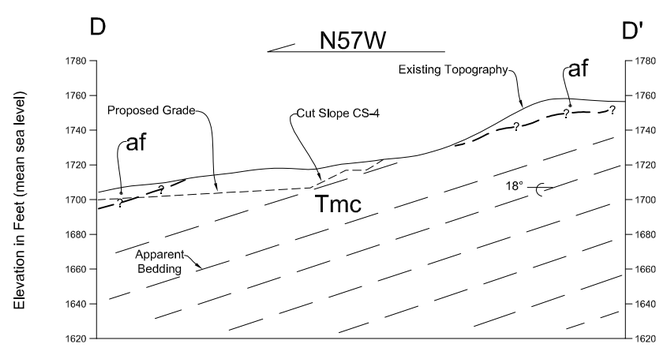
SCALE: PER PLAN
DATE: 09/05/2018
JOB No: 0261-001-08

SHEET 4 OF 4 SHEETS









Geologic Sections

Prepared For:

Sand Canyon Country Club

Proposed Golf Course and Resort Development
Vesting Tentative Tract Map No. 78248
Santa Clarita, California

Scale:	Drawn By:	Checked By:
AS SHOWN	JH	TPL
Date: 9/20/2018	Figure 2	2017-006-021

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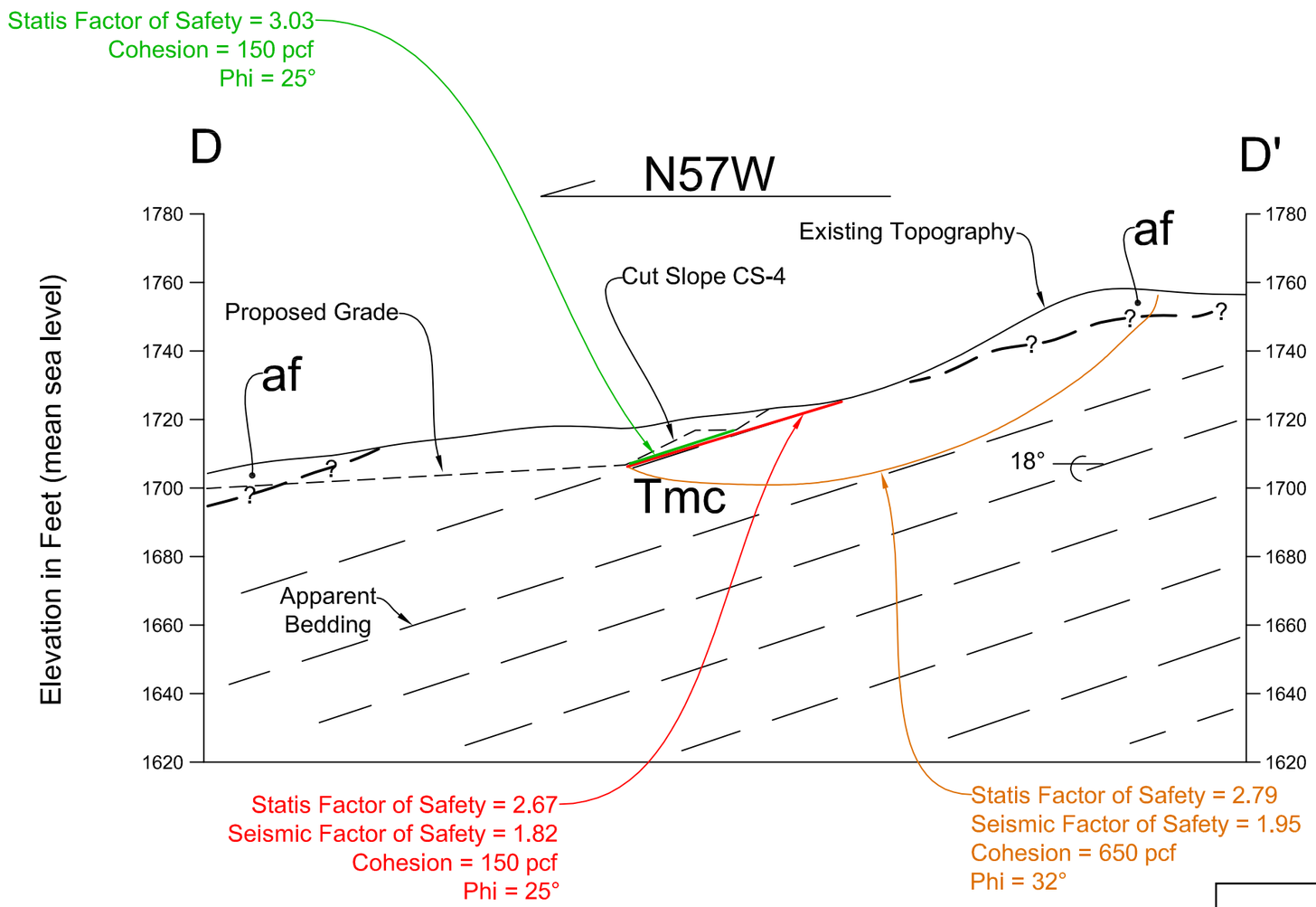
RTFA
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY



Geotechnical Section

Prepared For:

Sand Canyon Country Club

Proposed Golf Course and Resort Development
Vesting Tentative Tract Map No. 78248
Santa Clarita, California

Scale:	Drawn By:	Checked By:
AS SHOWN	JH	TPL
Date: 9/20/2018	Figure 3	2017-006-021

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RTF&A
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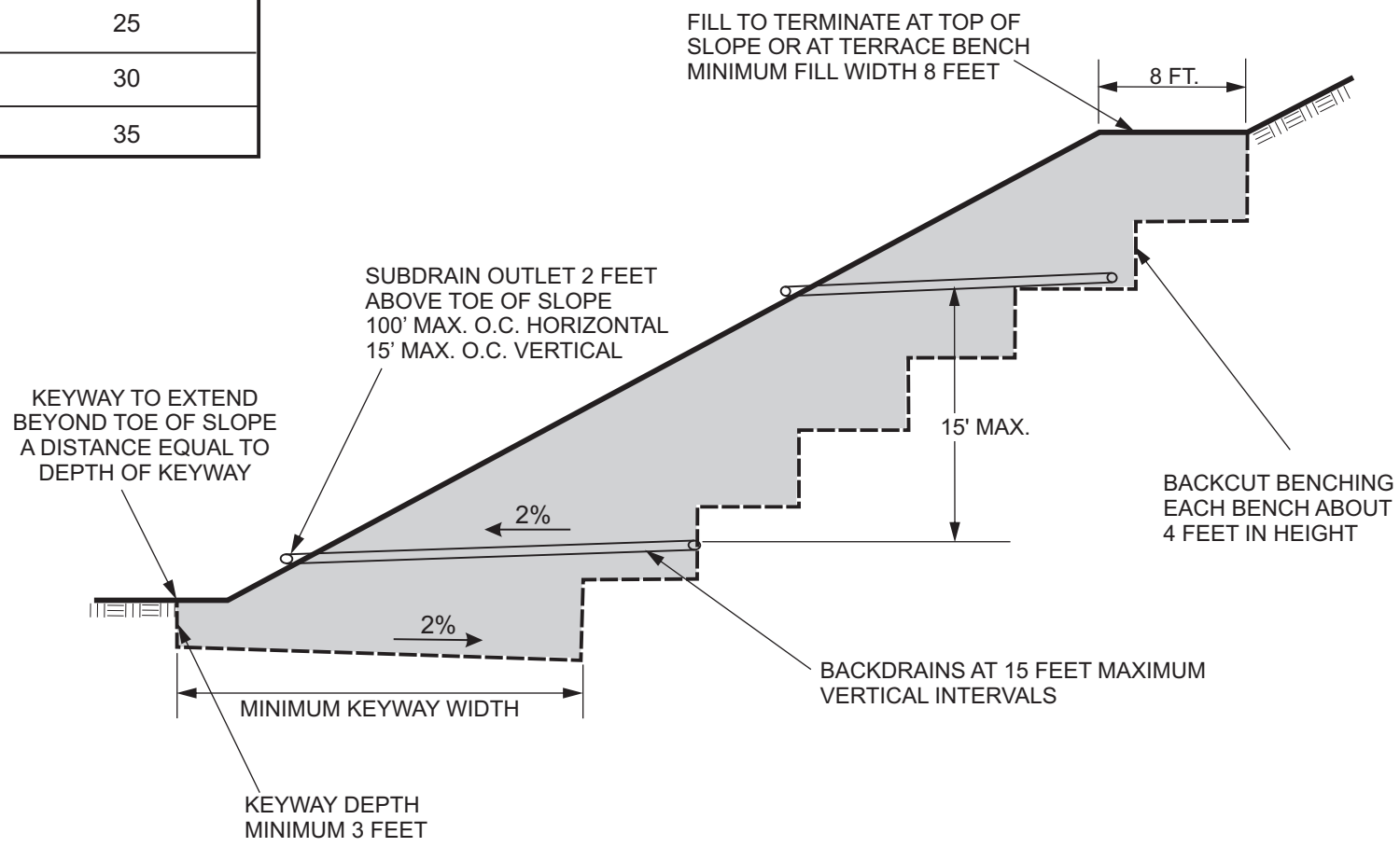
STABILITY FILL HEIGHT (FEET)	MINIMUM WIDTH OF KEYWAY (FEET)
0 - 20	15
20 - 30	20
30 - 50	25
50 - 75	30
75 - 100	35



STABILITY FILL DETAILS FOR GROSSLY STABLE SLOPES

N.T.S.

APPENDIX A

FIELD EXPLORATIONS

APPENDIX A

FIELD EXPLORATIONS

RECONNAISSANCE GEOLOGIC MAPPING

During geologic mapping, local surficial deposits (both natural and man-made) and bedrock units were mapped on a base map prepared by Hunsaker. Geologic structural features, including bedding, were observed, measured, and plotted on the base map.

LOGGING OF EXPLORATORY TEST PITS

Logging was performed for 27 exploratory test pits (TP-1 through TP-27) excavated at selected locations within the site. The test pits were excavated using a backhoe equipped with a 2-foot-wide bucket. Test Pits varied in depth from approximately 4 feet to 17 feet. Test Pits TP-1 through TP-11 were logged by a Certified Engineering Geologist. The locations of the test pits are indicated on the Geotechnical Map, Figure 1.

EXCAVATION AND LOGGING OF EXPLORATORY BORINGS

We explored the project site by drilling 4 hollow-stem auger borings, designated HS-1 through HS-4. The locations of the borings are shown on the attached Geotechnical Map, Figure 1. The soils encountered in the borings were classified in accordance with the Unified Soil Classification System. The boring logs are presented in this Appendix.

Undisturbed and bulk samples of the subsurface materials were collected for laboratory inspection and testing. The lined-barrel sampler used to take undisturbed samples has an external diameter of 3.25 inches and an internal diameter of 2.625 inches. The depths at which the undisturbed samples were obtained are indicated on the logs. The number of blows required to drive the sampler 12 inches with the hammer weight are also shown on the boring logs.

LOG OF TEST PIT TP-1

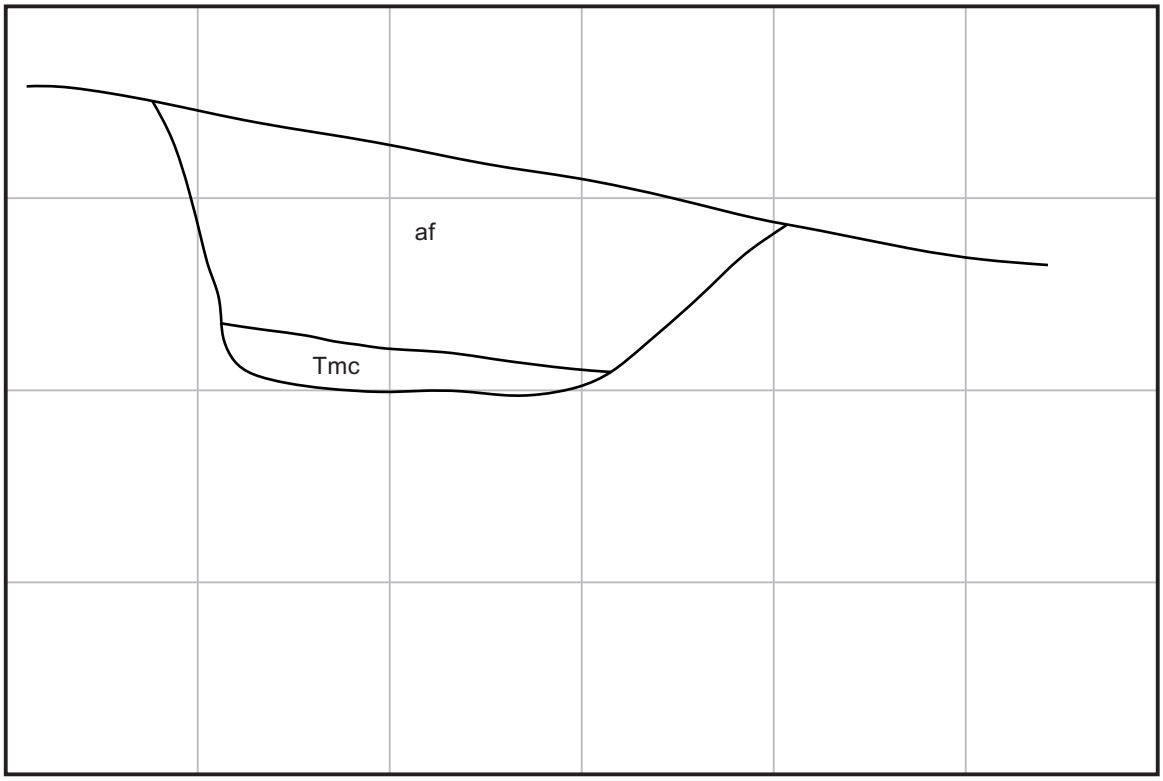
JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

LOCATION _____ **ELEVATION** 1745 **DATE LOGGED** 5/24/2017

0 - 5’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Occasional Gravel to 1”, Dry to Moist, Medium Dense, Medium Brown to Light Grayish Brown

5’ - 6’ **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Medium, Occasional Gravel to ½”, Friable, Moist, Dense

BEARING:



SCALE: 1’’ = 4’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-2

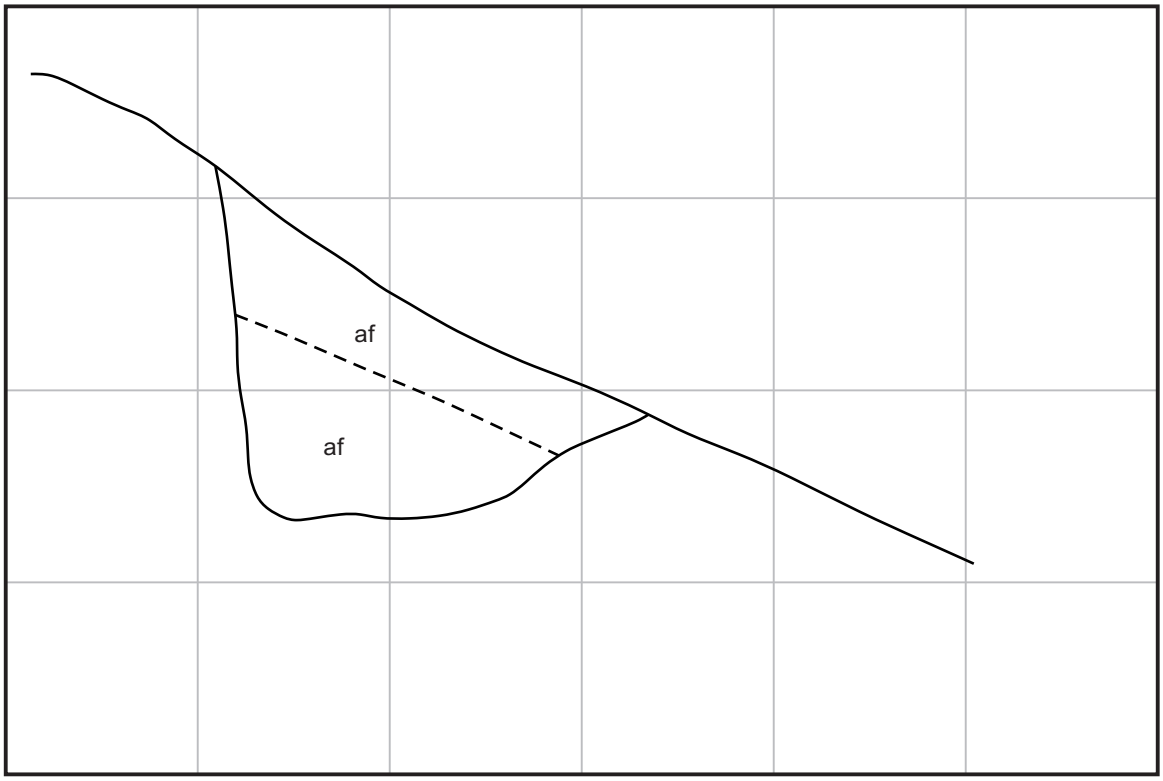
JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

LOCATION _____ **ELEVATION** 1710 **DATE LOGGED** 5/24/2017

0 - 2' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Occasional Gravel to 2", Damp to Moist, Medium Dense, Medium Brown

2' - 6' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Occasional Gravel to 1", Moist, Soft to Medium Dense, Light to Medium Gray Layered with Medium Brown

BEARING:



SCALE: 1" = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-3

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

LOCATION _____ **ELEVATION** 1780 **DATE LOGGED** 5/24/2017

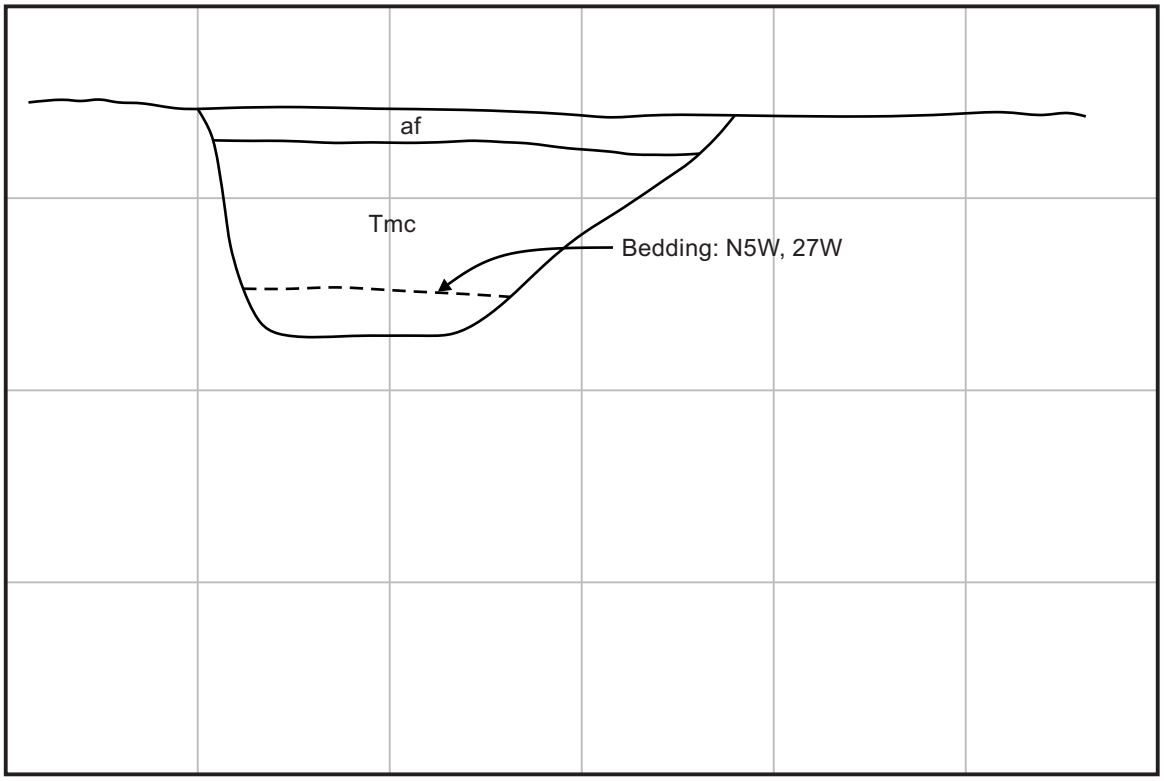
0 - 1' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Occasional Gravel to 1/2", Damp, Medium Dense, Medium Brown, Roots and Rootlets to 1/4"

1' - 4' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Medium, Silty to Slightly Silty, Friable to Low Hardness, Weathered, Light Brown

4' - 5' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Coarse, Slightly Silty, Low Hardness, Light Brown to Light Gray

Bedding @ 3 ½': N5W, 27W

BEARING:



SCALE: 1" = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-4

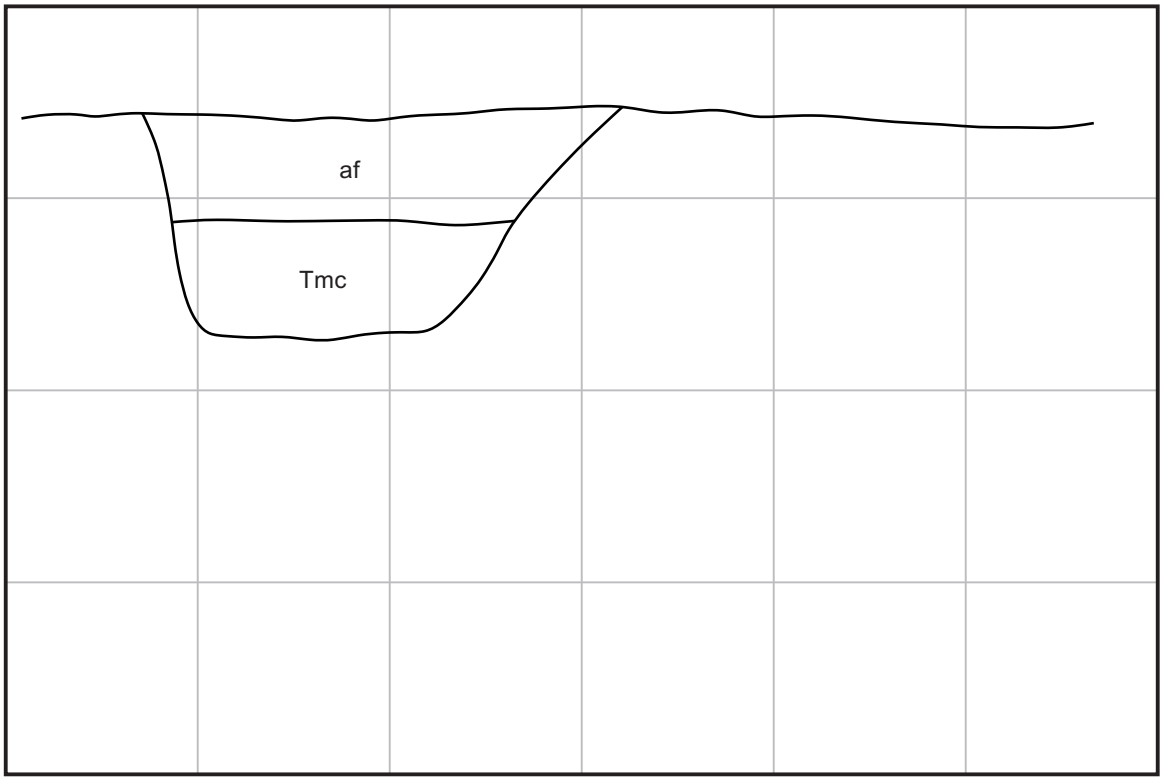
JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

LOCATION _____ **ELEVATION** 1772 **DATE LOGGED** 5/24/2017

0 - 2’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Damp, Medium Dense, Medium Brown

1’ - 4’ **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Medium, Occasional Coarse Sand, Slightly Silty, Damp, Moderately Hard, Light Gray

BEARING:



SCALE: 1’’ = 4’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-5

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

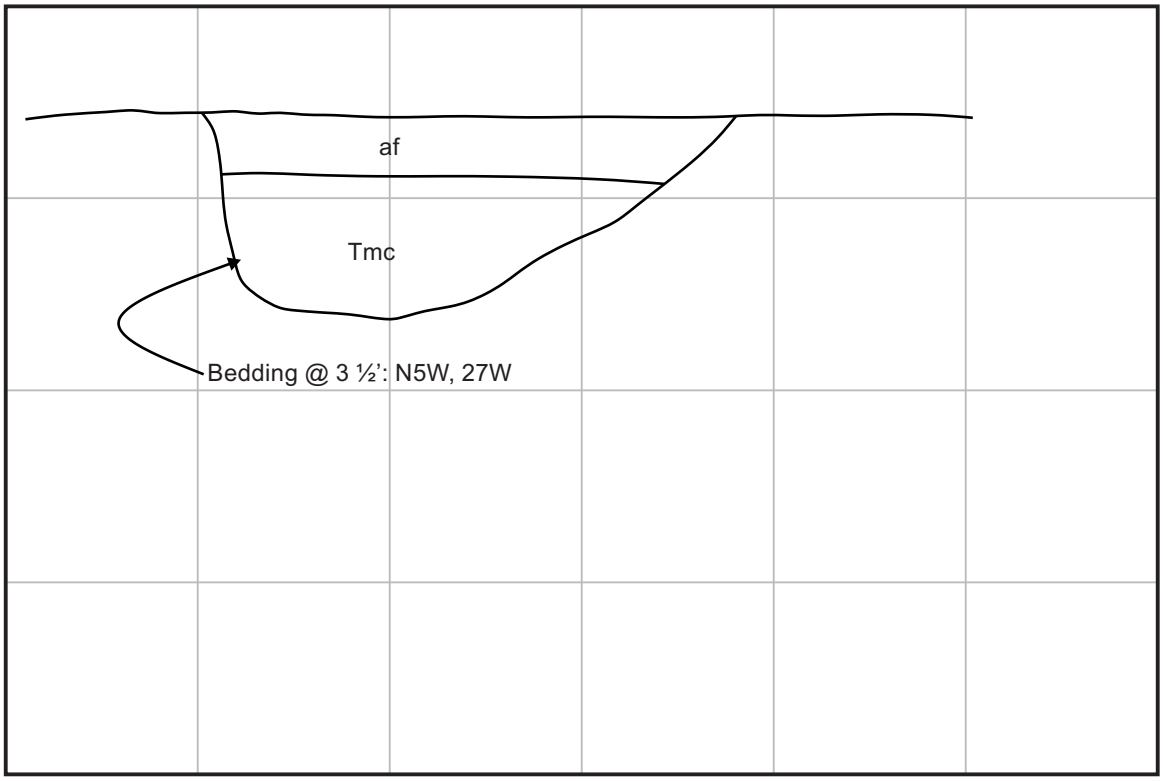
LOCATION _____ **ELEVATION** 1762 **DATE LOGGED** 5/24/2017

0 - 1 ½' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Occasional Gravel to 1", Damp, Medium Dense, Medium Brown

1 ½' - 4' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Coarse, Occasional Gravel to 2", Damp, Moderately Hard, Light Gray

Bedding @ 3': N10W, 26W

BEARING:



SCALE: 1" = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-6

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

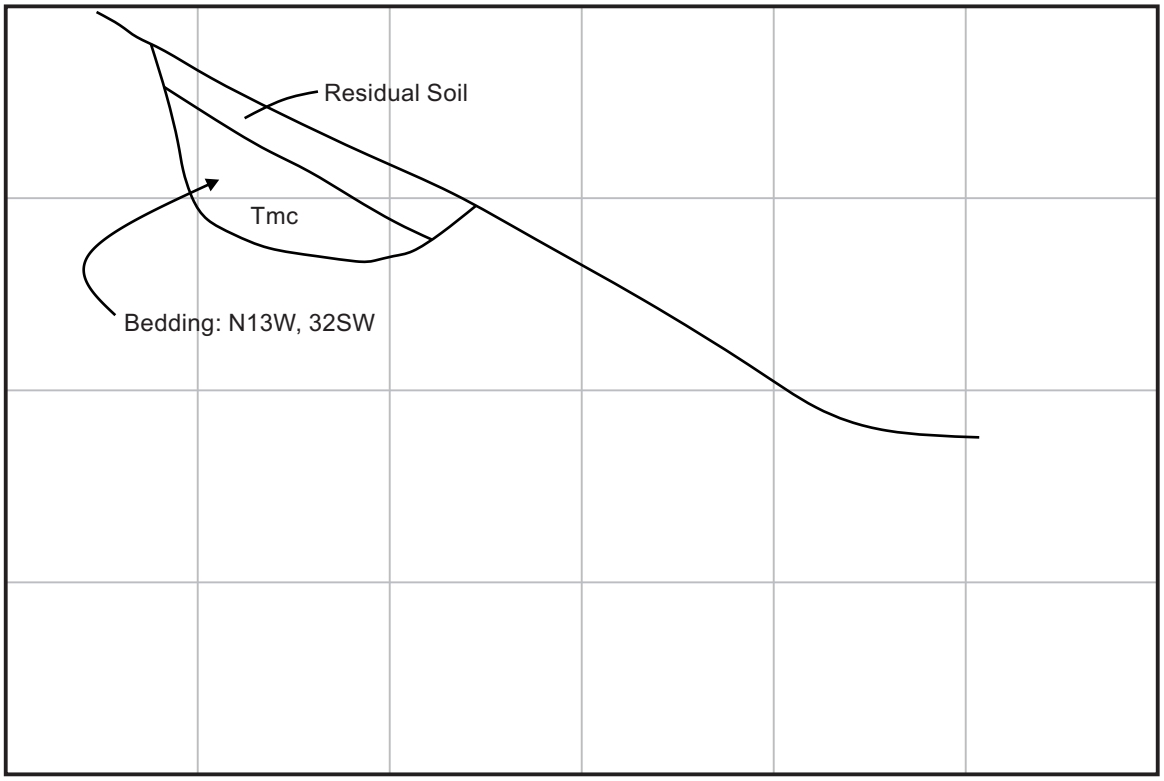
LOCATION _____ **ELEVATION** 1765 **DATE LOGGED** 5/24/2017

0 - 1’ **RESIDUAL SOIL**
SILTY SAND: Fine to Medium, Dry to Damp, Medium Dense, Medium Brown, Roots and Rootlets to 1/4”

1’ - 4’ **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine, Damp, Moderately Hard, Light Gray

Bedding @ 3’: N13W, 32SW

BEARING:



SCALE: 1’’ = 4’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-7

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

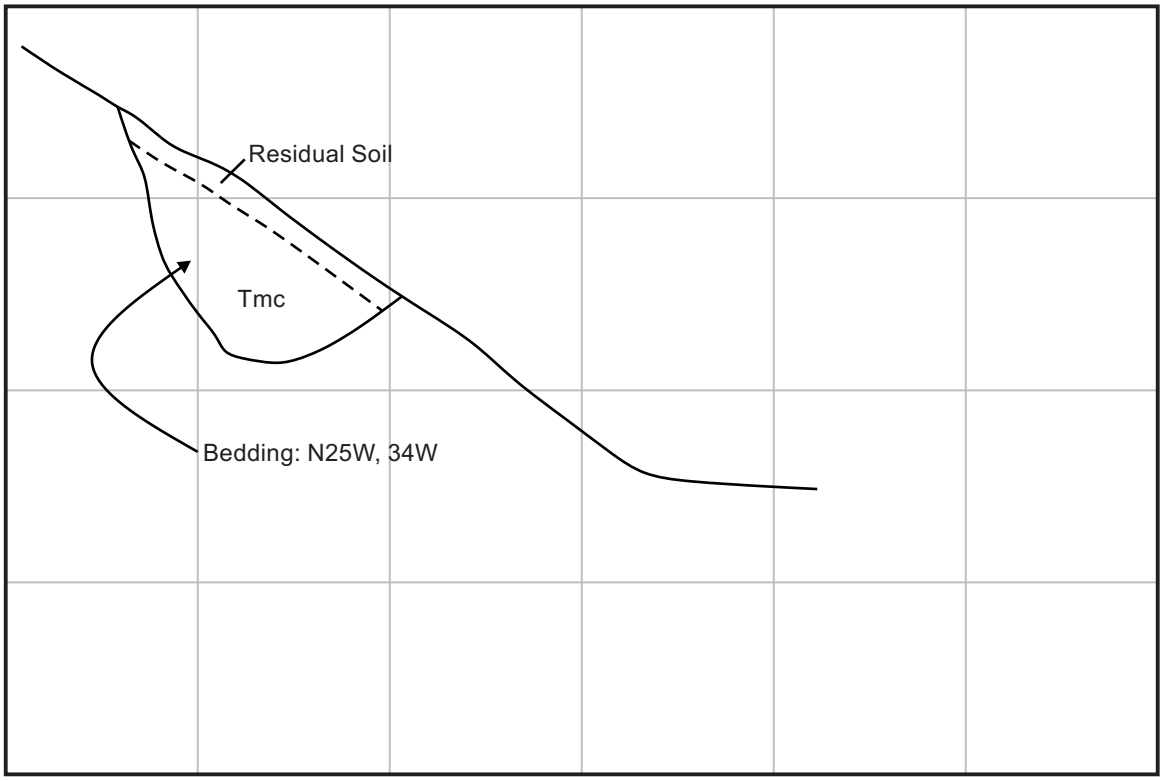
LOCATION _____ **ELEVATION** 1670 **DATE LOGGED** 5/24/2017

0 - ½' **RESIDUAL SOIL**
SILTY SAND: Fine to Medium, Occasional Gravel to 1", Dry, Medium Dense, Light Gray, Roots to 1/8"

½' - 5' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Coarse, Gravel to 1", Dry to Damp, Low to Moderately Hard, Light Gray

Bedding @ 3': N25W, 34SW

BEARING:



SCALE: 1" = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-8

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

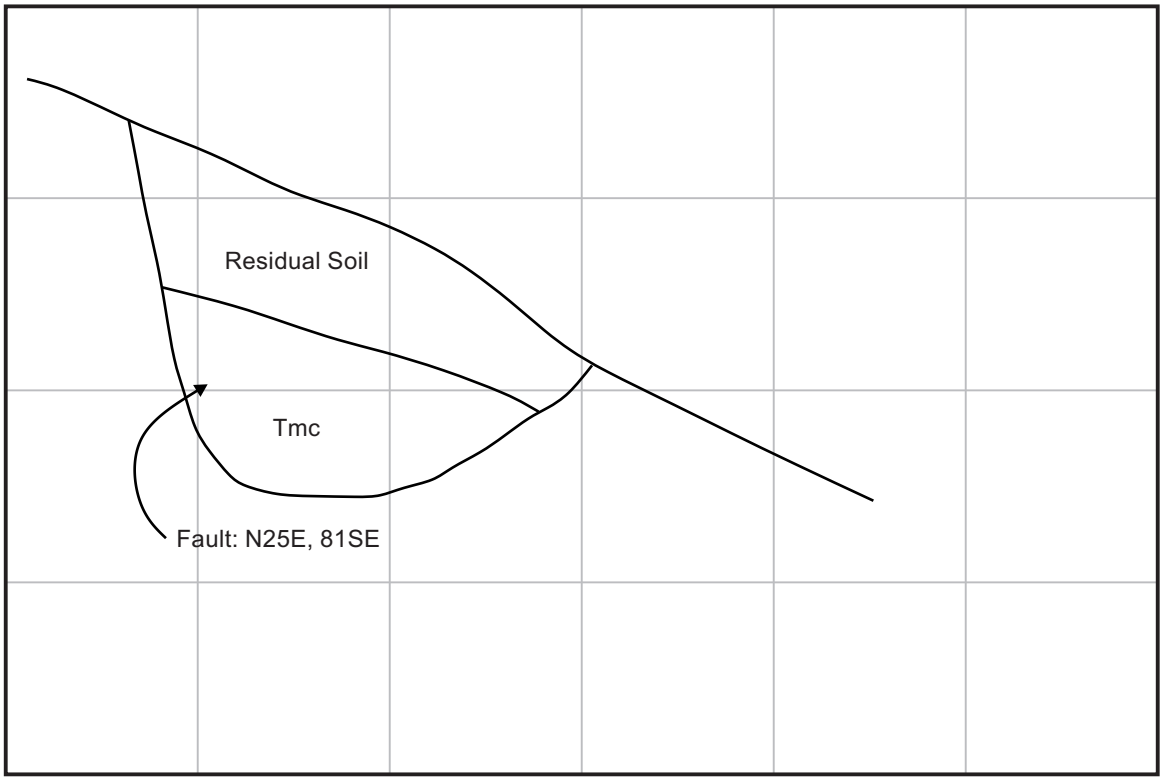
LOCATION _____ **ELEVATION** 1740 **DATE LOGGED** 5/24/2017

0 - 3' **RESIDUAL SOIL**
SILTY SAND: Fine to Coarse, Gravel to ½", Dry,
Medium Dense, Light Gray, Roots and Rootlets to 1/4"

3' - 6' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Medium, Damp to Moist, Moderately Hard,
Light Gray

Fault @ 5': N25E, 81SE

BEARING:



SCALE: 1" = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-9

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

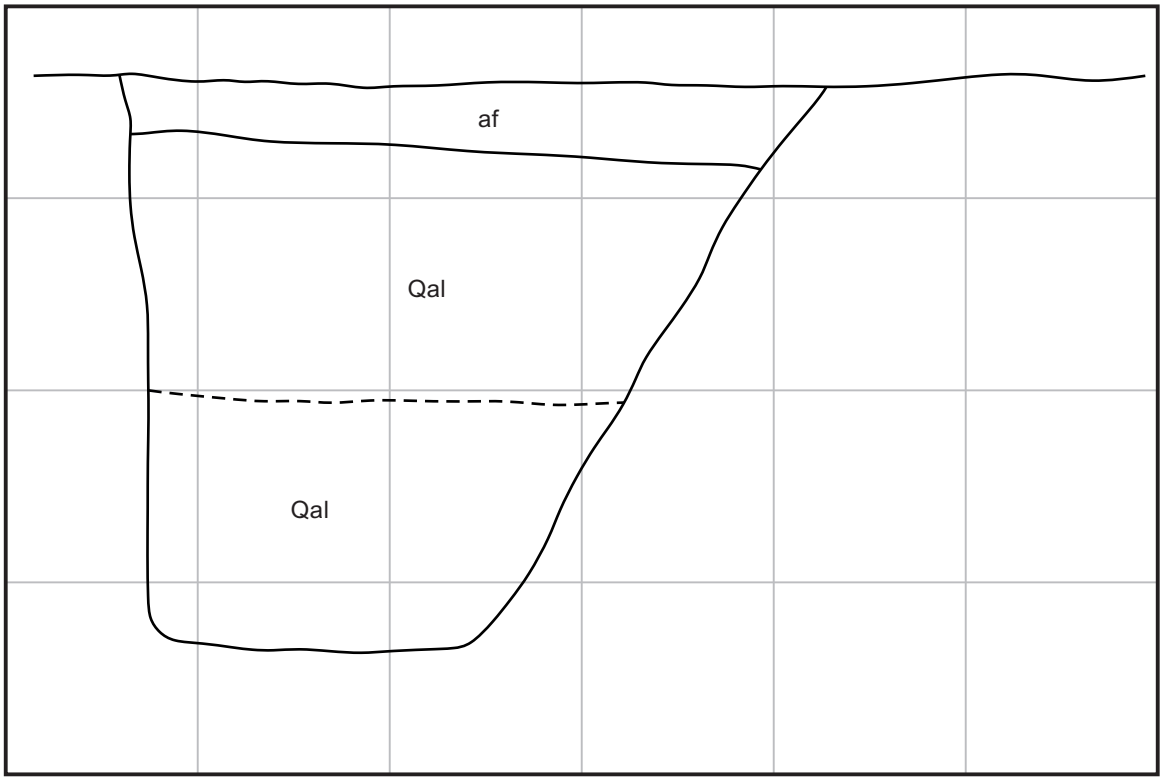
LOCATION _____ **ELEVATION** 1615 **DATE LOGGED** 5/24/2017

0 - 2’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Damp, Medium Dense, Medium Brown

2’ - 7 ½’ **ALLUVIUM (Qal)**
SILTY SAND: Fine to Medium, Damp, Medium Dense, Medium Brown, Tree Roots to 3” Diameter

7 ½’- 12 ½’ **ALLUVIUM (Qal)**
SILTY SAND: Fine, Damp, Medium Dense, Light Grayish Brown, Porosity to 1/8” (Backhoe Operator Indicated Denser @12’)

BEARING:



SCALE: 1’’ = 4’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-10

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

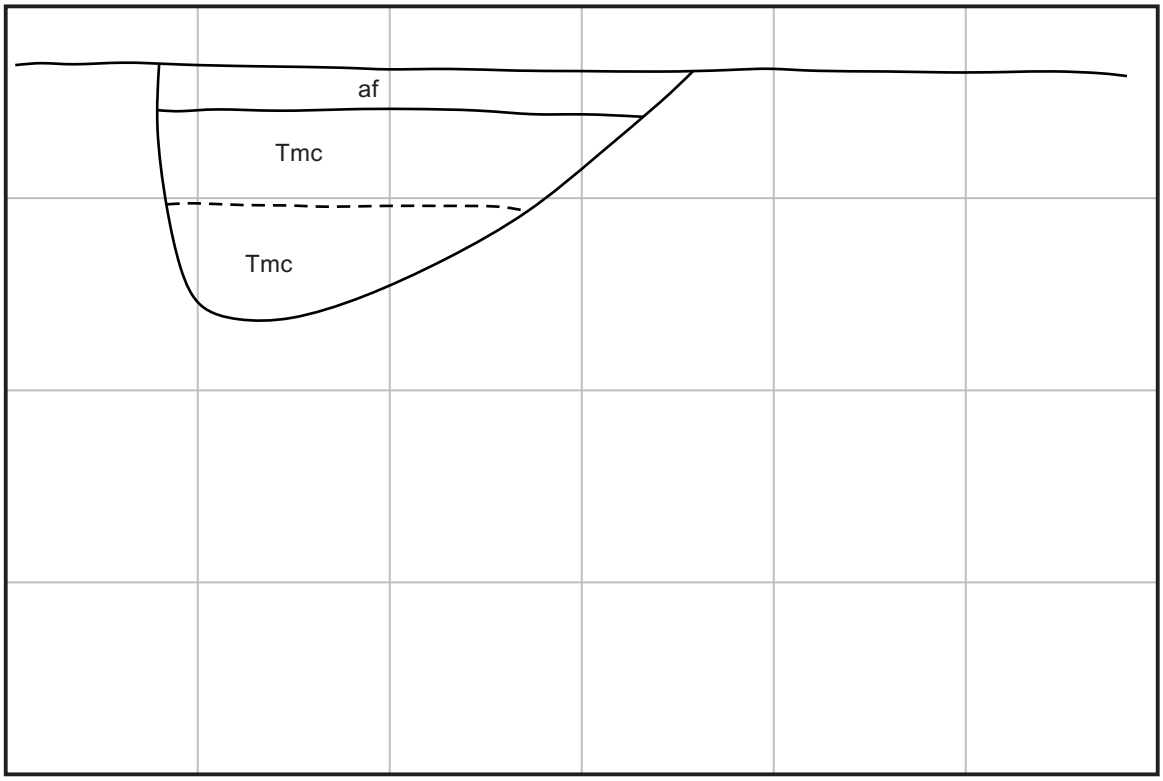
LOCATION _____ **ELEVATION** 1610 **DATE LOGGED** 5/24/2017

0 - 1’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Slightly Moist, Medium Dense, Light Grayish Brown

1’ - 3’ **MINT CANYON FORMATION (Tmc)**
WEATHERED BEDROCK: Fine to Medium, Friable, Slightly Silty, Damp to Slightly Moist, Light Grayish Brown

3’ - 5’ **MINT CANYON FORMATION (Tmc)**
BEDROCK: Fine to Coarse with Gravel, Friable, Damp to Slightly Moist, Light Grayish Brown

BEARING:



SCALE: 1’’ = 4’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-11

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

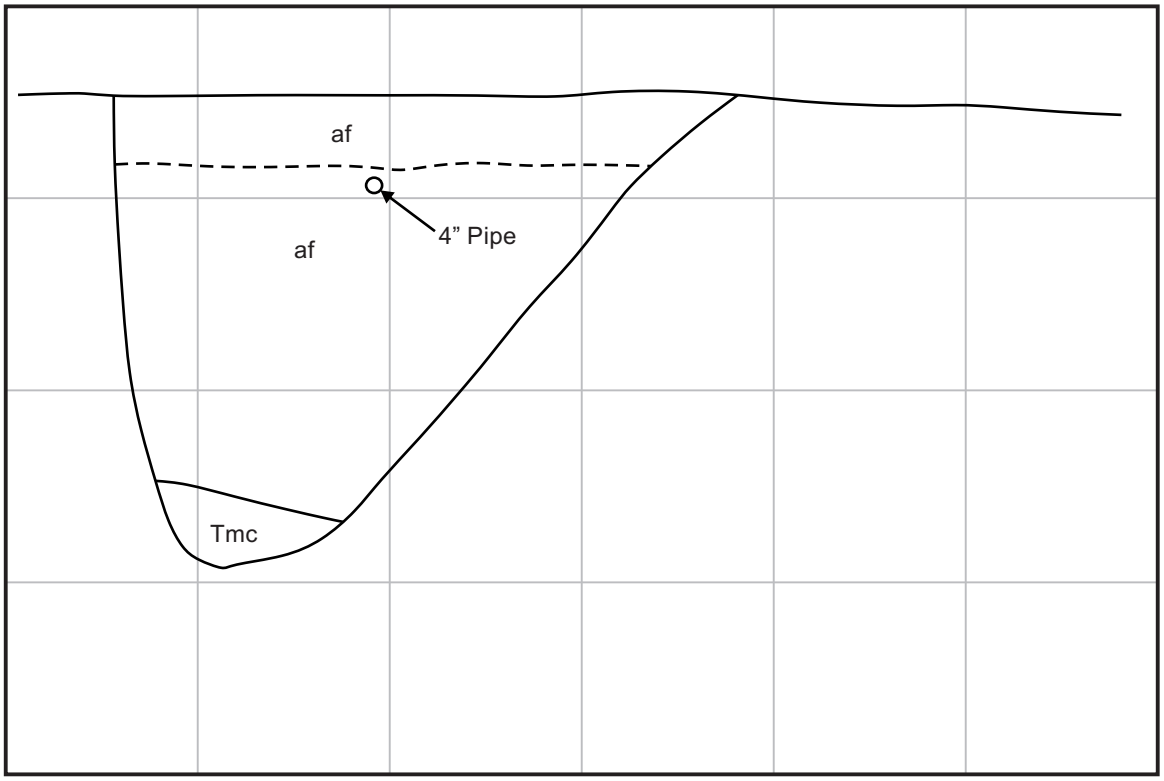
LOCATION _____ **ELEVATION** 1618 **DATE LOGGED** 5/24/2017

0 - 1 ½' **ARTIFICIAL FILL (af)**
SAND: Fine, Damp, Medium Dense, Light Gray, 4" Gravel Layer at Bottom

1 ½' - 9' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Moist, Medium Dense, Light Grayish Brown

9' - 10' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Coarse, Gravel to 1", Damp to Moist, Friable
Light Gray

BEARING:



SCALE: 1" = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-12

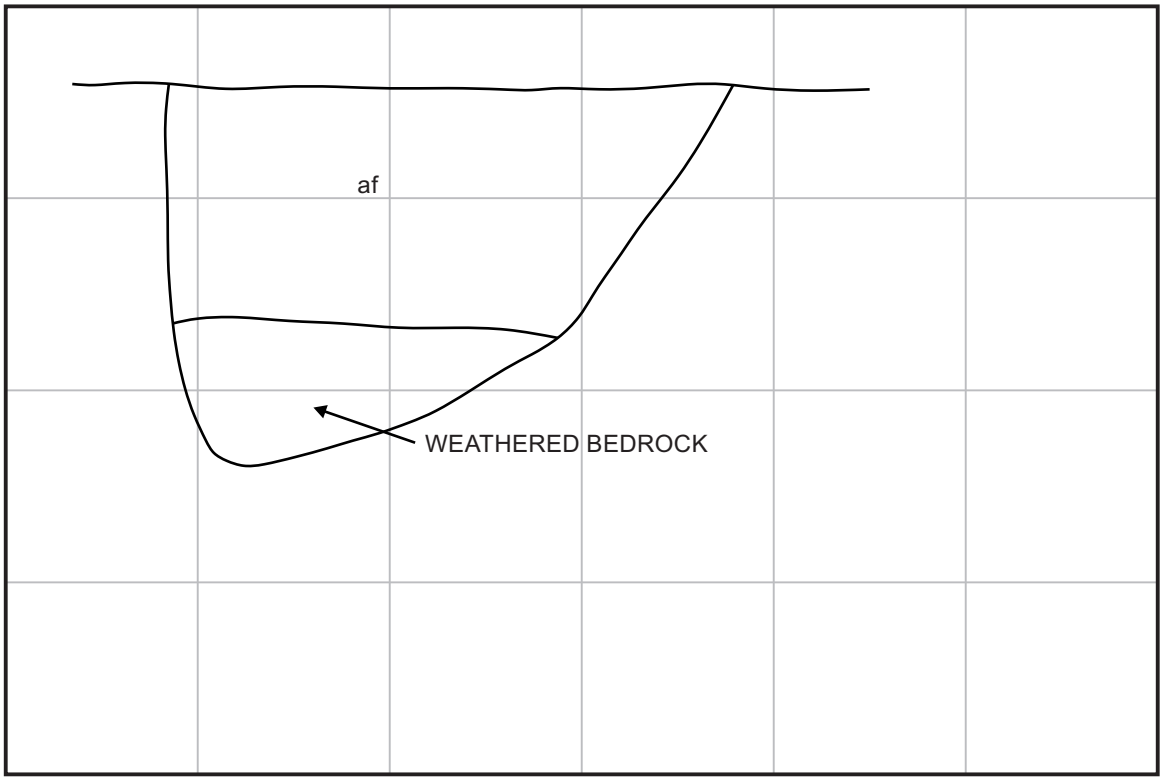
JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** JEF

LOCATION _____ **ELEVATION** 1752 **DATE LOGGED** 5/24/2017

0 - 5’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Moist, Medium Dense, Light Brown

5’-8’ **WEATHERED BEDROCK**
SILTY SAND: Fine to Coarse with Gravel and Cobbles, Damp, Medium Dense, Light Grayish Brown

BEARING:



SCALE: 1’’ = 4’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-13

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** JEF

LOCATION _____ **ELEVATION** 1734 **DATE LOGGED** 5/24/2017

0 - 2’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Moist, Medium Dense, Light Brown

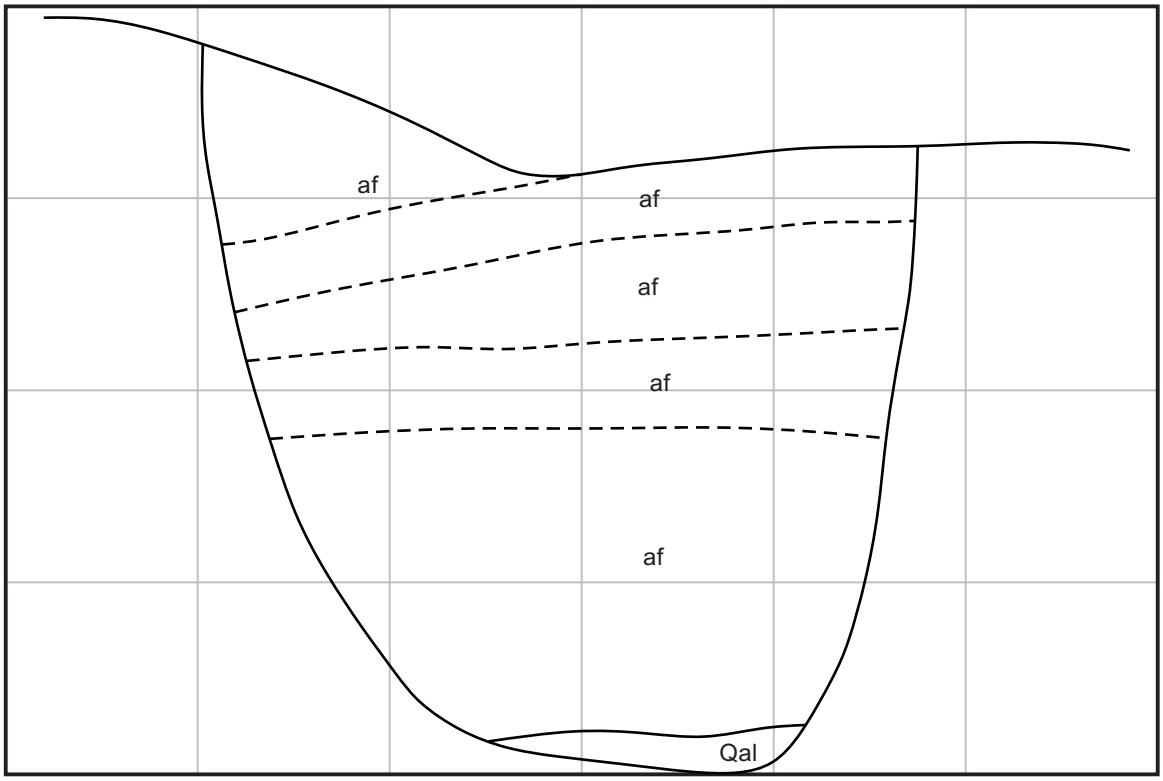
2’- 4’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Coarse with Gravel, Moist, Medium Dense, Light Gray

4’- 6’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Moist, Medium Dense, Medium Brown

6’- 16’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Coarse with Gravel and Cobbles, Moist, Medium Dense, Light Gray (Debris & Plastic Bottle Present)

16’- 17’ **ALLUVIUM (Qal)**
SILTY SAND: Fine to Coarse with Gravel, Moist, Medium Dense, Olive Gray

BEARING:



SCALE: 1’’ = 4’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-14

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** JEF

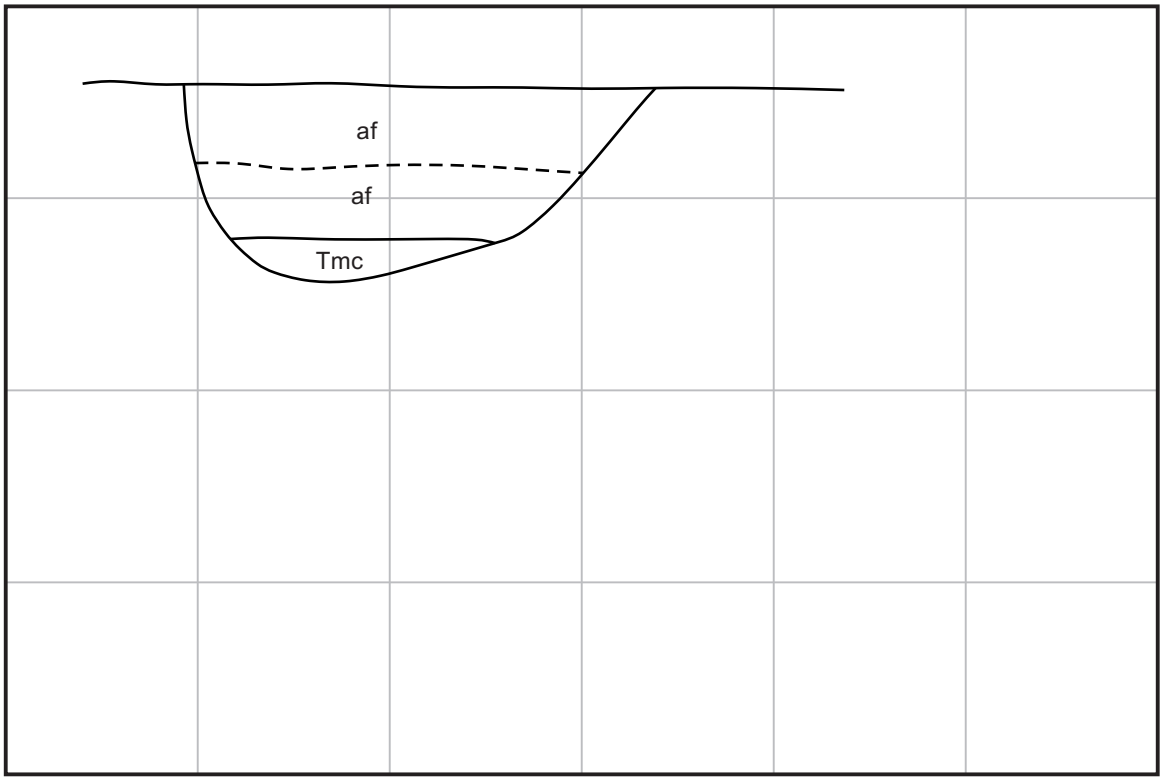
LOCATION _____ **ELEVATION** 1722 **DATE LOGGED** 5/25/2017

0 - 2’ **ARTIFICIAL FILL (af)**
SAND: Fine to Medium, Slightly Silty, Moist, Medium Dense, Yellowish Brown, 4” of Pea Gravel

2’-3’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Moist, Medium Dense, Light Grayish Brown

3’-4’ **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Medium, Low Hardness, Damp, Light Gray

BEARING:



SCALE: 1’’ = 4’

NOTE:
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LOG OF TEST PIT TP-15

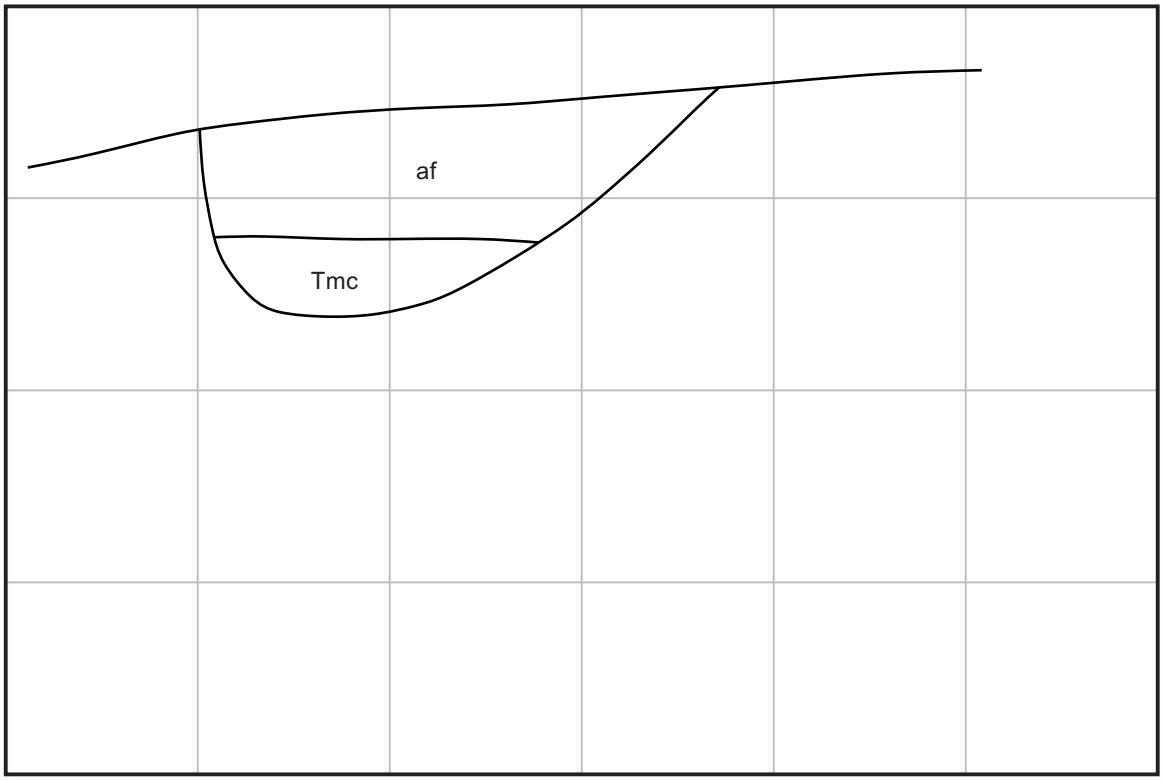
JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** JEF

LOCATION _____ **ELEVATION** 1680 **DATE LOGGED** 5/25/2017

0 - 2 ½' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Moist, Medium Dense, Light Grayish Brown

2 ½'-4' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Coarse, Occasional Gravel, Low Hardness, Damp, Light Gray

BEARING:



SCALE: 1'' = 4'

NOTE:
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LOG OF TEST PIT TP-16

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** JEF

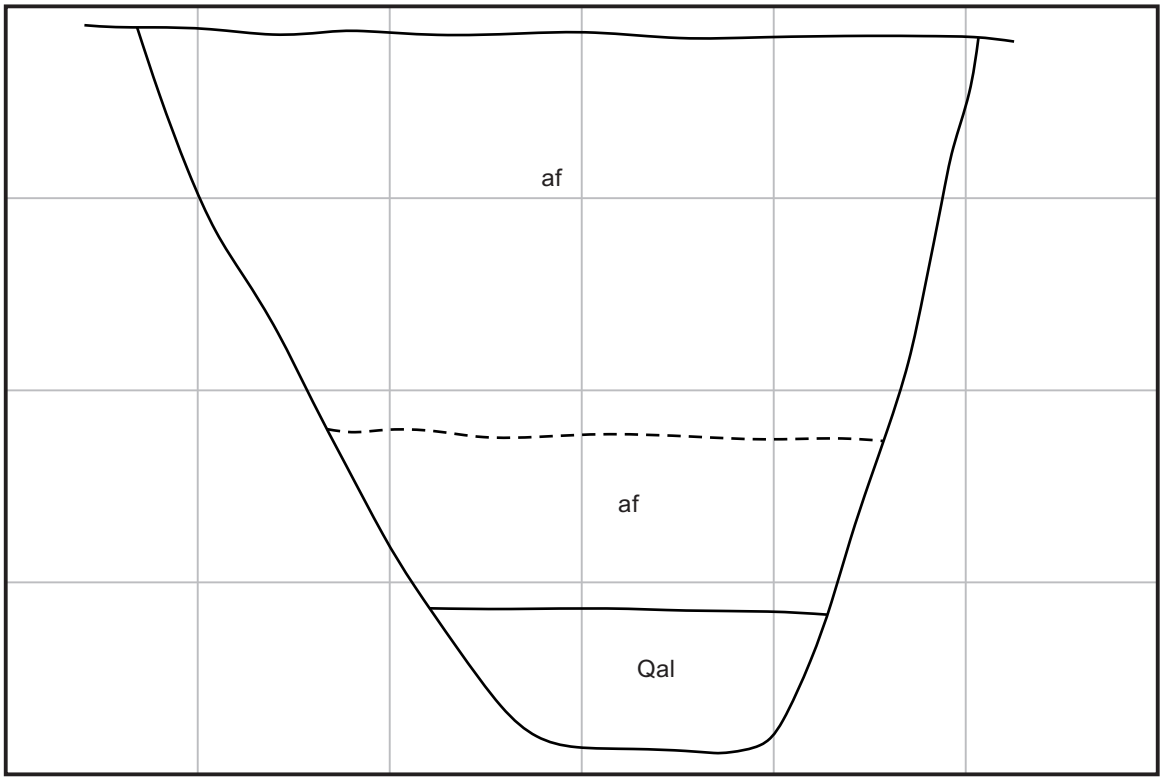
LOCATION _____ **ELEVATION** 1616 **DATE LOGGED** 5/25/2017

0 - 8 ½' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium with Occasional Gravel and Cobbles, Moist, Medium Dense, Light Grayish Brown

8 ½'- 12' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Organic Layer, Moist, Medium Dense, Dark Gray

12'- 15' **ALLUVIUM (Qal)**
SILTY SAND: Fine, Moist, Medium Dense, Light Gray, Porosity Less Than 1/8"

BEARING:



SCALE: 1'' = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-17

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** JEF

LOCATION _____ **ELEVATION** 1590 **DATE LOGGED** 5/25/2017

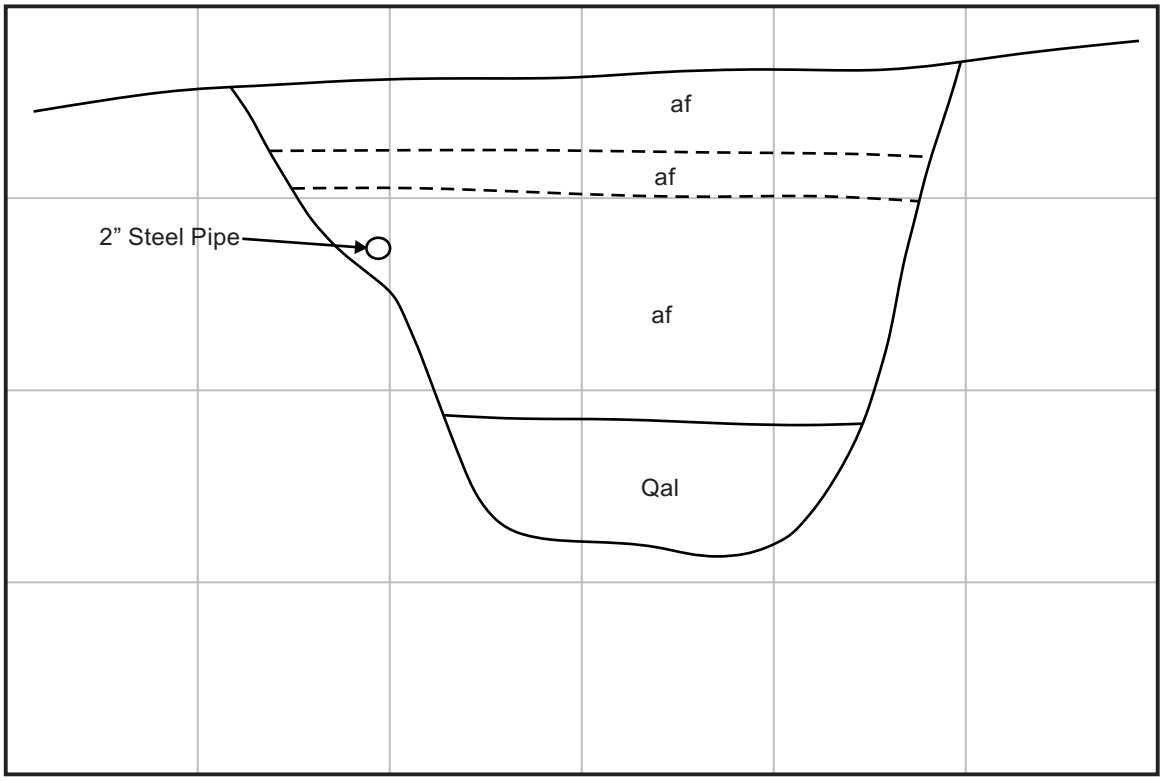
0 - 2' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Moist, Medium Dense, Light Brown, 4" Concrete Slab Alon Eastern Edge of Pit

2'- 3' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium with Occasional Gravel, Chunks of Formational Material, Damp, Medium Dense, Light Gray

3'- 8 ½' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Moist, Medium Dense, Light Grayish Brown

8 ½' - 11' **ALLUVIUM (Qal)**
SAND: Fine to Coarse with Gravel, Slightly Silty, Damp, Slight Raveling, Medium Dense, Yellowish Brown

BEARING:



SCALE: 1'' = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-18

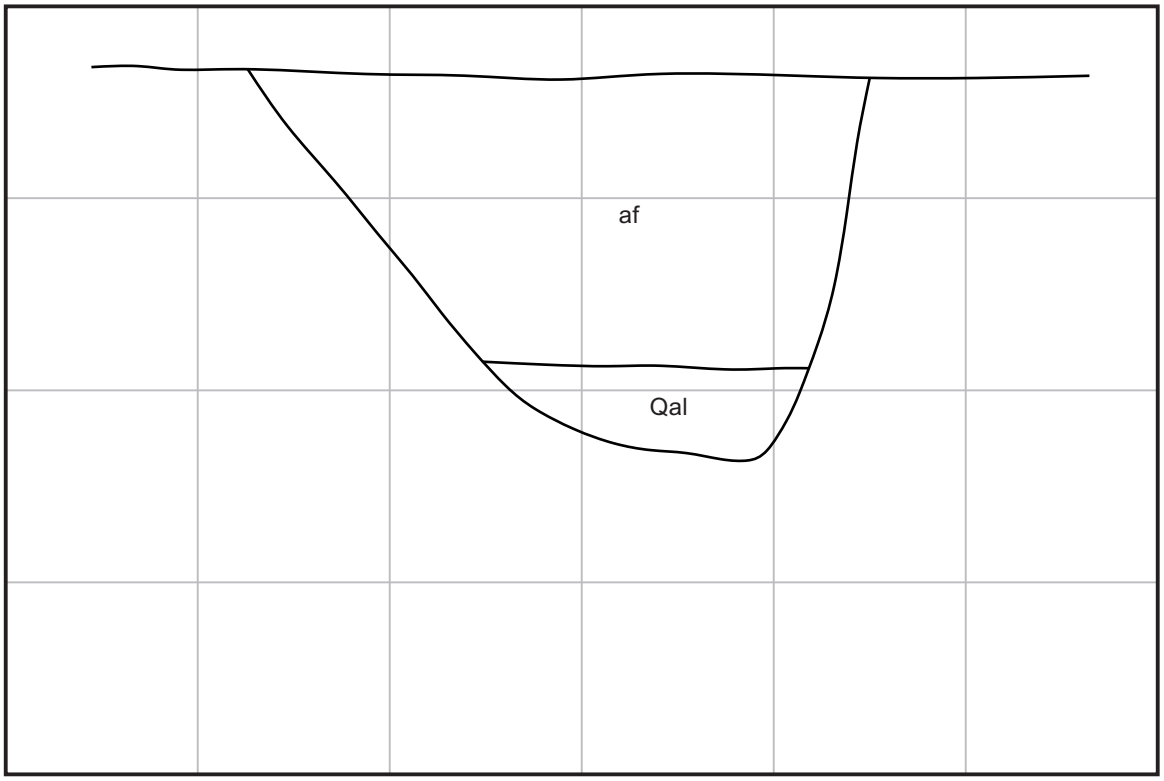
JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** JEF

LOCATION _____ **ELEVATION** 1606 **DATE LOGGED** 5/25/2017

0 - 6’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Occasional Gravel, Moist, Medium Dense, Light Grayish Brown

6’- 8’ **ALLUVIUM (Qal)**
SILTY SAND: Fine, Damp, Dense, Light Gray, Porosity Less Than 1/16”

BEARING:



SCALE: 1’’ = 4’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

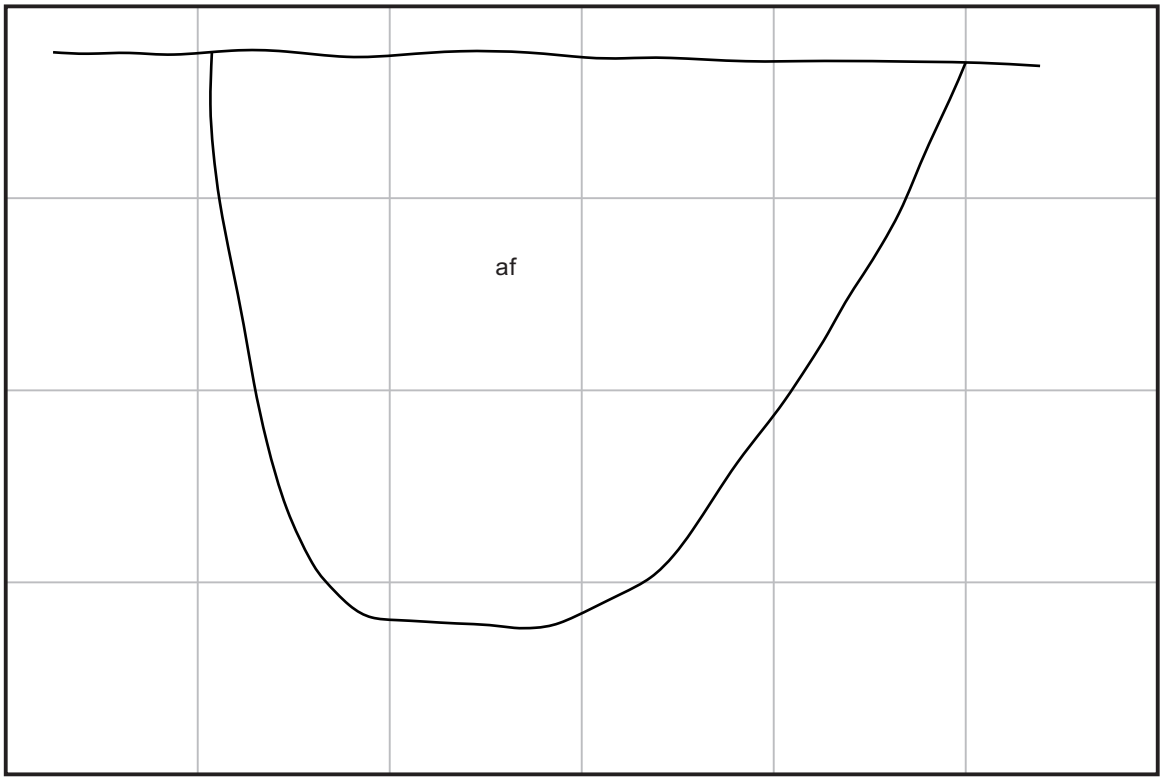
LOG OF TEST PIT TP-19

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** JEF

LOCATION _____ **ELEVATION** 1648 **DATE LOGGED** 5/25/2017

0 - 12’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Damp, Soft to Medium Dense, Light Grayish Brown

BEARING:



SCALE: 1’’ = 4’

NOTE:
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LOG OF TEST PIT TP-20

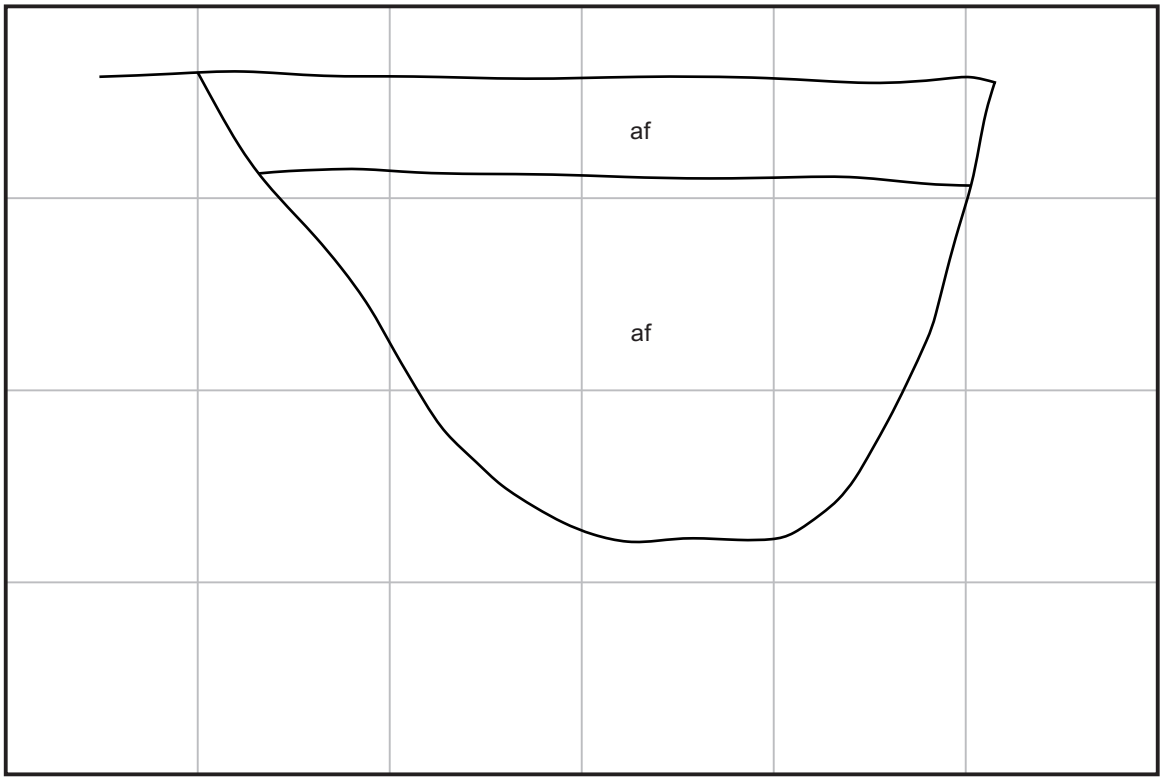
JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** JEF

LOCATION _____ **ELEVATION** 1645 **DATE LOGGED** 5/25/2017

0 - 2’ **ARTIFICIAL FILL (af)**
SAND: Fine, Damp, Slightly Silty, Damp, Medium Dense, Yellowish Brown, Over 4” of Pea Gravel

2’ - 9 ½’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Occasional Gravel and Cobbles, Moist, Medium Dense, Light Grayish Brown

BEARING:



SCALE: 1’’ = 4’

NOTE:
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LOG OF TEST PIT TP-21

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

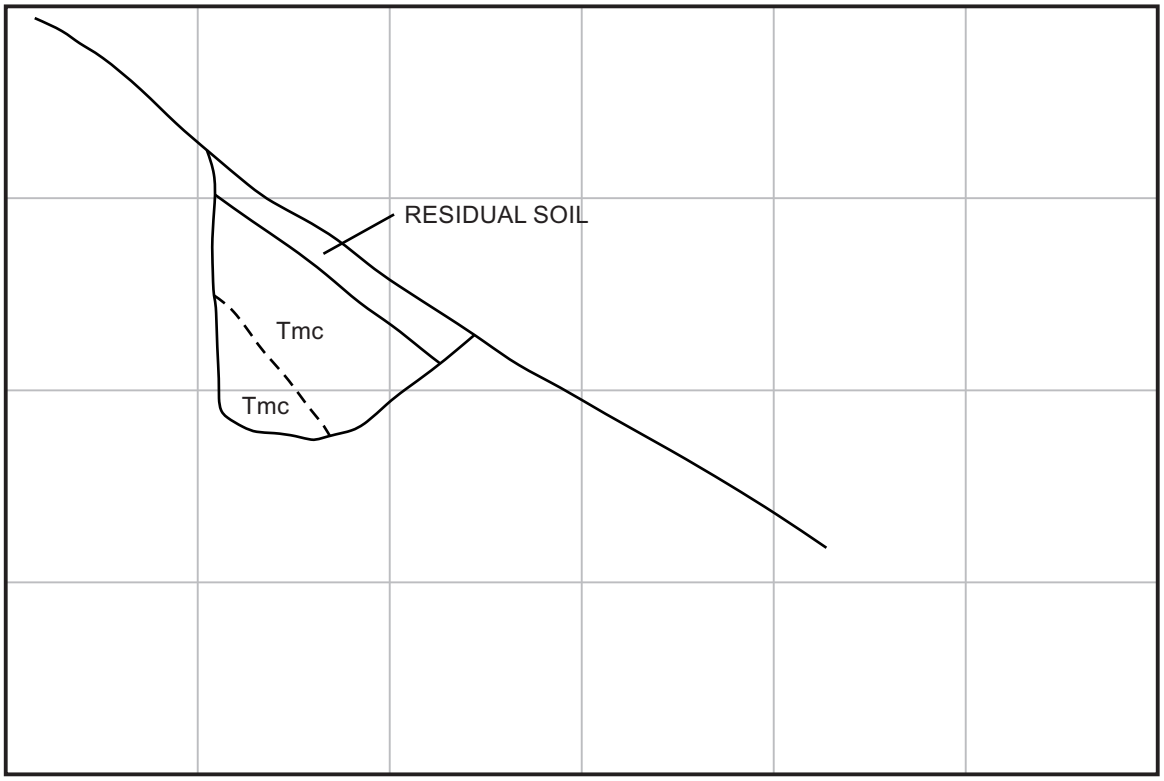
LOCATION _____ **ELEVATION** 1655 **DATE LOGGED** 5/25/2017

0 - 1' **RESIDUAL SOIL**
SILTY SAND: Fine, Damp, Damp, Medium Dense, Light Grayish Brown, Roots and Rootlets to 1/8"

1' - 3 ½' **MINT CANYON FORMATION (Tmc)**
SILTY SANDSTONE: Fine, Damp, Friable, Medium Grayish Brown

3 ½' - 6' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine, Damp, Low Hardness, Light Gray

BEARING:



SCALE: 1'' = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-22

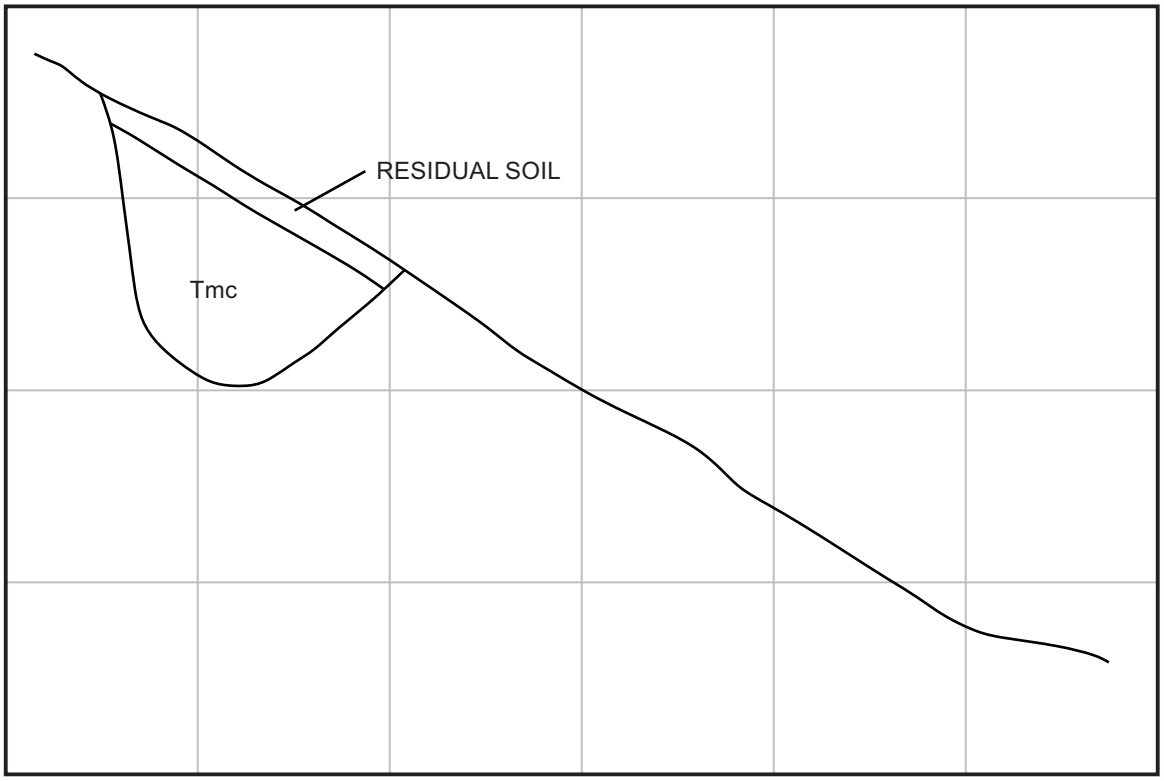
JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

LOCATION _____ **ELEVATION** 1660 **DATE LOGGED** 5/25/2017

0 - ½' **RESIDUAL SOIL**
SILTY SAND: Fine to Medium, Damp, Medium Dense, Light Grayish Brown,

1' - 3 ½' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Medium, Damp, Low Hardness, Medium Gray

BEARING:



SCALE: 1'' = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-23

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

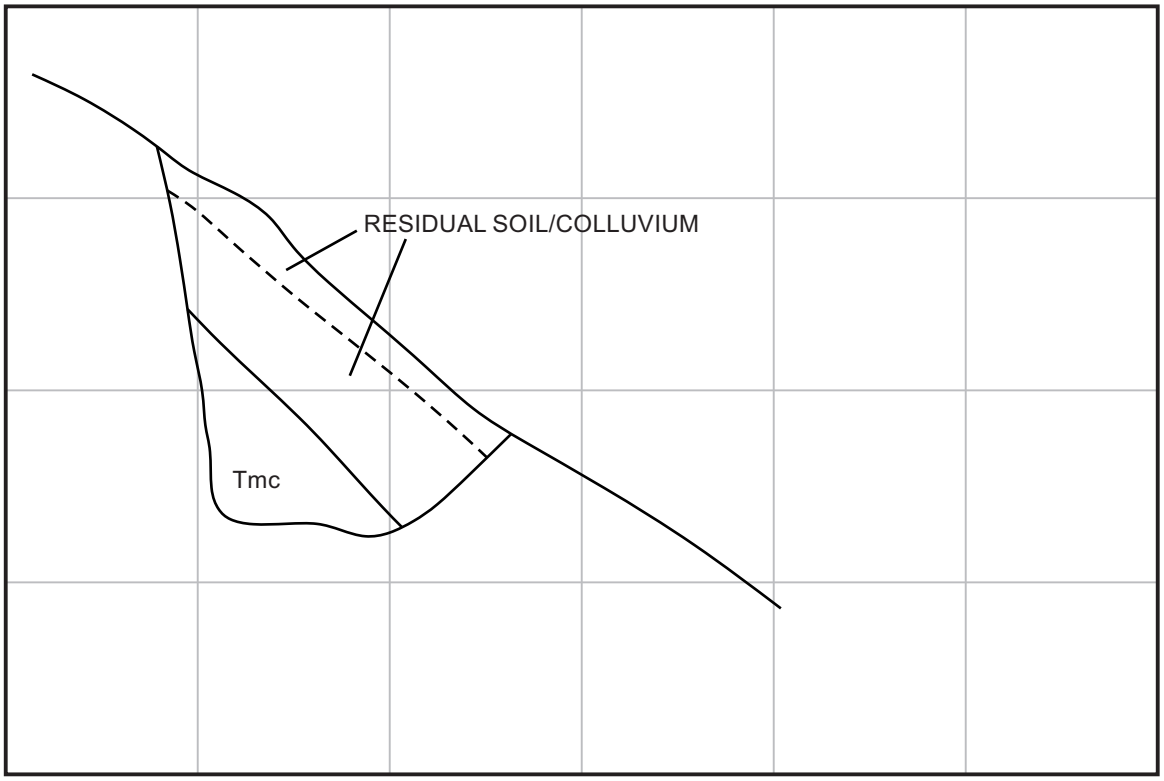
LOCATION _____ **ELEVATION** 1558 **DATE LOGGED** 5/25/2017

0 - 1 ½' **RESIDUAL SOIL / COLLUVIUM**
SILTY SAND: Fine to Medium, Damp, Medium Dense, Light Brown, Occasional Gravel to 2", Roots and Rootlets to ½'

1 ½' - 4 ½' **RESIDUAL SOIL / COLLUVIUM**
SILTY SAND: Fine to Medium, Damp, Medium Dense to Dense, Light Grayish Brown, Occasional Roots and Rootlets to 1/8"

4 ½' - 7' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine, Damp, Low Hardness, Light Gray

BEARING:



SCALE: 1" = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-24

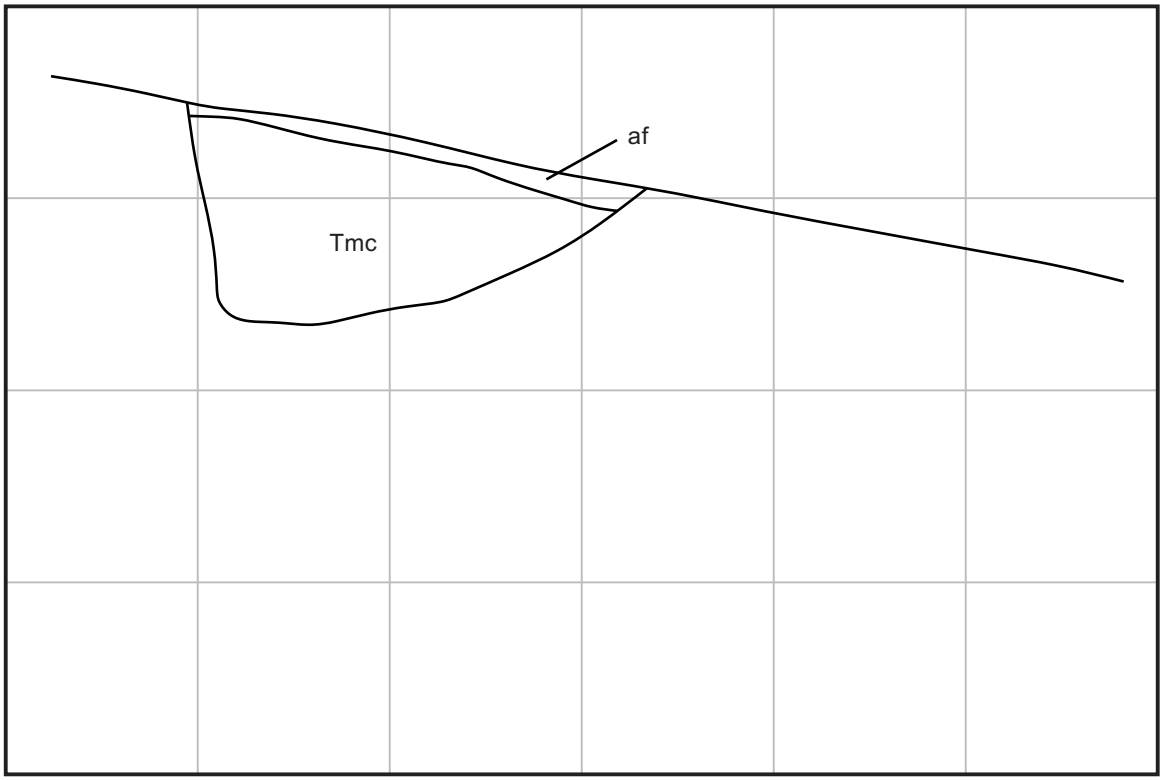
JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

LOCATION _____ **ELEVATION** 1690 **DATE LOGGED** 5/25/2017

0 - ½' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Damp, Medium Dense, Medium Brown

½' - 4' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine, Damp, Low Hardness, Light Gray

BEARING:



SCALE: 1'' = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-25

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

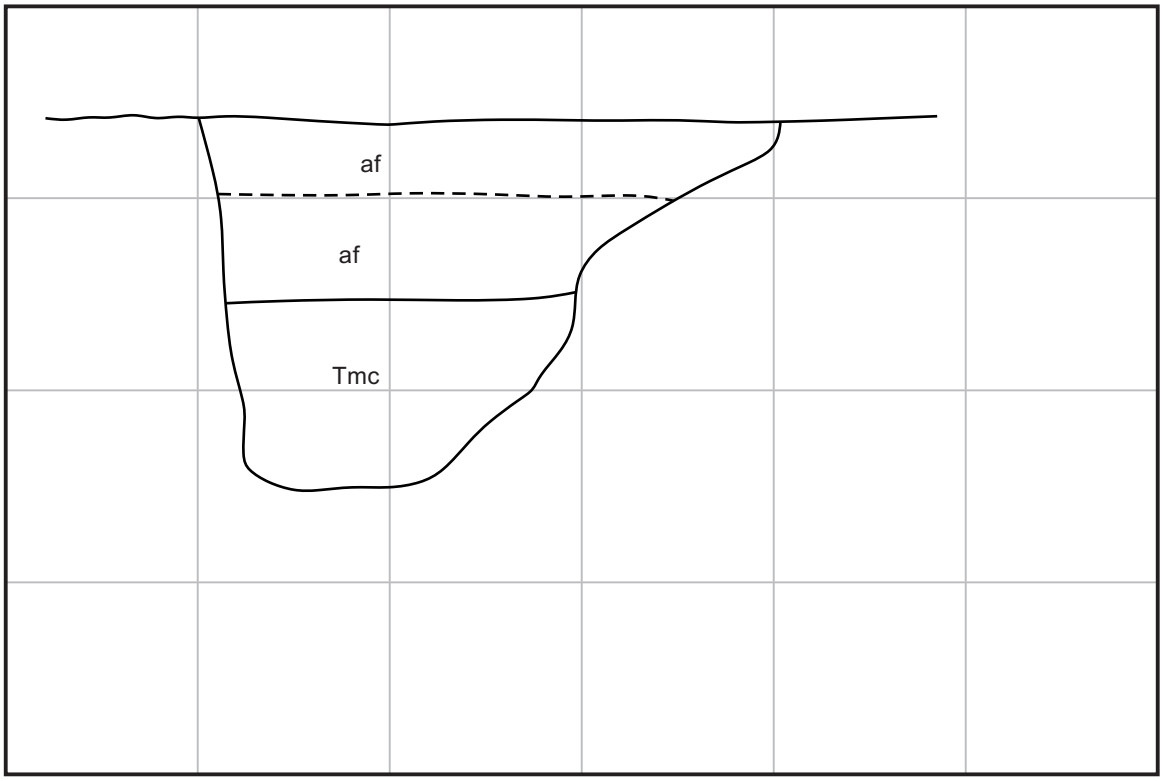
LOCATION _____ **ELEVATION** 1706 **DATE LOGGED** 5/25/2017

0 - 2' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine, Damp, Medium Dense, Light Brown, 4"
Layer of Gravel at 2'

2' - 4' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Medium Dense, Light Brown

4' - 8' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine to Medium, Damp, Low Hardness, Light Gray

BEARING:



SCALE: 1'' = 4'

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-26

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

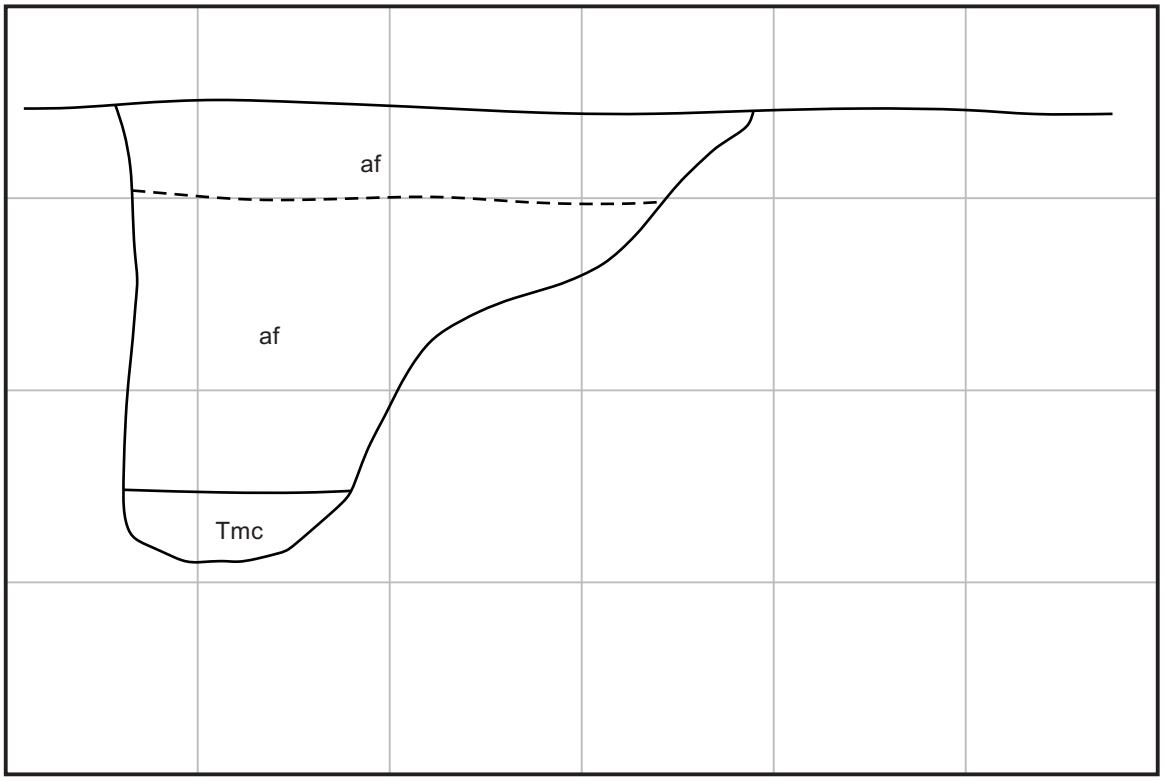
LOCATION _____ **ELEVATION** 1730 **DATE LOGGED** 5/25/2017

0 - 2' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Occasional Gravel to 1", Dry to Damp, Medium Dense, Medium Brown

2' - 8' **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Moist, Soft to Medium Dense, Medium Brown to Light Gray

8' - 9' **MINT CANYON FORMATION (Tmc)**
SANDSTONE: Fine, Damp, Friable, Light to Medium Gray

BEARING:



SCALE: 1" = 4'

NOTE:
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LOG OF TEST PIT TP-27

JOB NUMBER 2017-006-021 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

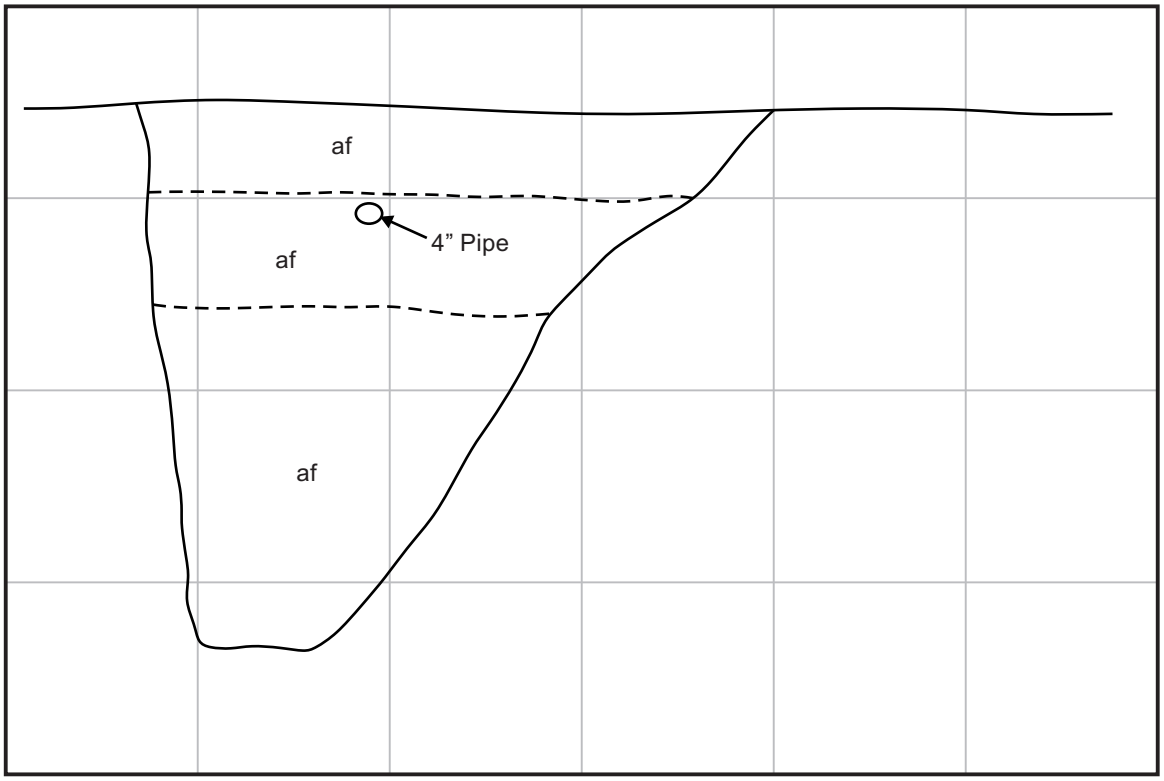
LOCATION _____ **ELEVATION** 1724 **DATE LOGGED** 5/25/2017

0 - 2’ **ARTIFICIAL FILL (af)**
SAND: Fine, Damp, Medium Dense, Light Grayish Brown, 4” Layer of Gravel at Bottom

2’ - 4’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Damp to Moist, Medium Dense, Light Brown

4’ - 12’ **ARTIFICIAL FILL (af)**
SILTY SAND: Fine to Medium, Damp to Moist, Soft to Medium Dense, Light Gray to Light Brown

BEARING:



SCALE: 1’’ = 4’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING HS-1

JOB NUMBER: 2017-006-021
DATE DRILLED: 5/22/17
EQUIPMENT USED: 8" Hollow-Stem Auger with Heavy Duty & SPT Samplers
ELEVATION: 1591'
DRILLING CO.: Geoboden
LOGGED BY: SDR/JEF
BORING DEPTH: 0-51'
HAMMER WEIGHT: 140 pounds
SURFACE CONDITIONS: Existing Golf Course Green, Light Weed Growth

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
					SM	**ARTIFICIAL FILL (af)** SILTY SAND: fine to medium, medium dense, dry, light brown
32	11.2	118	-		SM	**ALLUVIUM (Qal)** SILTY SAND: fine, medum dense, moderately moist, light gray
17	20.2	98	-	5		light brown and speckled tan
						slightly moist, grayish brown
11	12.7	114	-			
16	8	105	-	10		with fine gravel, dry, light gray
-	18.3		5			slightly moist, grayish brown
11	10	109	-	15		
-	13.9		9			
16	15.8	107	-	20		moderately moist
-	11.4		17	25		slightly moist, light yellowish brown
-	9.7		19	30		dry, light gray
-	12.2		21	35		moist, light yellowish brown
				40		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-1 (CONTINUED)

JOB NUMBER: 2017-006-021
DATE DRILLED: 5/22/17
EQUIPMENT USED: 8" Hollow-Stem Auger with Heavy Duty & SPT Samplers
ELEVATION: 1591'
DRILLING CO.: Geoboden
LOGGED BY: SDR/JEF
BORING DEPTH: 0-51'
HAMMER WEIGHT: 140 pounds
SURFACE CONDITIONS: Existing Golf Course Green, Light Weed Growth

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
-	11.4		18				SM	slightly moist, light grayish brown
-	8.3		22	45				occasional fine gravel, moderately moist
-	10.1		26	50				Bottom of Boring at 51 feet. No water. No caving.
				55				
				60				
				65				
				70				
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2017-006.GPJ FRANKIAN.GDT 6/28/17

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-2

JOB NUMBER: 2017-006-021
DATE DRILLED: 5/23/17
EQUIPMENT USED: 8" Hollow-Stem Auger with Heavy Duty & SPT Samplers
ELEVATION: 1644'
DRILLING CO.: Geoboden
LOGGED BY: JEF
BORING DEPTH: 0-51'
HAMMER WEIGHT: 140 pounds
SURFACE CONDITIONS: Grass, native vegetation

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
					SM	**ARTIFICIAL FILL (af)** SILTY SAND: fine with occasional coarse sand, medium dense, dry, light gray
18	7.4	112	-			
47	12.1	118	-	5		fine to medium
34	8.3	119	-			fine, with gravel, light grayish brown
39	7.4	115	-	10		fine with occasional coarse sand, olive gray
-	11.1		38			slightly moist
						dark organic layer
38	10.4	122	-	15		fine
-	10.2		37			occasional gravel
26	9.7	114	-	20		fine to medium with occasional gravel, voids present, loose
-	12.8		26	25		fine to medium, medium dense, dry, yellowish brown
-	9.8		33	30		**ALLUVIUM (Qal)** SILTY SAND: fine, medium dense, slightly moist, olive gray, organic debris
-	14.7		14	35		moderately moist
				40		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-2 (CONTINUED)

JOB NUMBER: 2017-006-021
DATE DRILLED: 5/23/17
EQUIPMENT USED: 8" Hollow-Stem Auger with Heavy Duty & SPT Samplers
ELEVATION: 1644'
DRILLING CO.: Geoboden
LOGGED BY: JEF
BORING DEPTH: 0-51'
HAMMER WEIGHT: 140 pounds
SURFACE CONDITIONS: Grass, native vegetation

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
-	10.6		14					
-	13.1		58	45				fine with gravel, dense, mottled yellowish brown to dark gray
-	25.8		50/5"	50				
								Bottom of Boring at 51 feet. No water. No caving.
				55				
				60				
				65				
				70				
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2017-006.GPJ FRANKIAN.GDT 6/28/17

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-3

JOB NUMBER: 2017-006-021
DATE DRILLED: 5/24/17
EQUIPMENT USED: 8" Hollow-Stem Auger with Heavy Duty & SPT Samplers
ELEVATION: 1732'
DRILLING CO.: Geoboden
LOGGED BY: JEF
BORING DEPTH: 0-50.5'
HAMMER WEIGHT: 140 pounds
SURFACE CONDITIONS: Dried grass

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	SOIL TYPE	
				SM	**ARTIFICIAL FILL (af)** SILTY SAND: fine with occasional coarse sand, loose, slightly moist, light gray
55	8.5	115	-		
				SP	SAND: fine with occasional coarse sand, dense, slightly moist, light olive gray
47	9.2	121	-		
					loose
42	10.8	117	-		
50	6.6	120	-		dense
-	5.3		25		
43	7.2	118	-		fine to coarse with fine gravel, medium dense, light gray
-	11.1		30		
34	8.8	116	-	SM	SAND: fine with coarse sand, medium dense, moderately moist, olive gray
					olive gray to grayish brown
-	10.5		45		
-	13.4		37		
-	13.1		66		

DEPTH (FEET): 5, 10, 15, 20, 25, 30, 35, 40

SAMPLE LOCATION / GRAPHIC LOG

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-3 (CONTINUED)

JOB NUMBER: 2017-006-021
DATE DRILLED: 5/24/17
EQUIPMENT USED: 8" Hollow-Stem Auger with Heavy Duty & SPT Samplers
ELEVATION: 1732'
DRILLING CO.: Geoboden
LOGGED BY: JEF
BORING DEPTH: 0-50.5'
HAMMER WEIGHT: 140 pounds
SURFACE CONDITIONS: Dried grass

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
-	6.9		57				SM	fine to coarse, light gray
-	5.3		*	45				fine to medium with occasional coarse sand, dense, light gray mottled with dark gray and yellow, (* 50 blows for the first 5")
-	7.7		*	50				(* 50 blows for the first 3")
								Bottom of Boring at 50.5 feet.
								No water. No caving.
				55				
				60				
				65				
				70				
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2017-006.GPJ FRANKIAN.GDT 6/28/17

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-4

JOB NUMBER: 2017-006-021
DATE DRILLED: 5/26/17
EQUIPMENT USED: 8" Hollow-Stem Auger with Heavy Duty & SPT Samplers
ELEVATION: 1738'
DRILLING CO.: Geoboden
LOGGED BY: JEF
BORING DEPTH: 0-25.5'
HAMMER WEIGHT: 140 pounds
SURFACE CONDITIONS: Dried grass, native vegetation

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	SOIL TYPE	
				SP	**ARTIFICIAL FILL (af)** SAND: fine with coarse, medium dense, damp, light grayish brown
61	7.7	107	-		
26	6.9	119	-	SM	SILTY SAND: fine to medium, medium dense, damp, olive gray
40	4.7	117	-		dry, yellowish brown
58	7.9	107	-		
72	8.7	117	-		**MINT CANYON FORMATION (Tmc)** SANDSTONE: fine, slightly silty, low hardness, dry, light gray and light brown
98/9"	11.1	117	-		
50/5"	10.2	110	-		fine to coarse, light gray and reddish gray
50/5"			-		Bottom of Boring at 25.5 feet. No water. No caving.

DEPTH (FEET): 5, 10, 15, 20, 25, 30, 35, 40

SAMPLE LOCATION / GRAPHIC LOG

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2017-006.GPJ FRANKIAN.GDT 6/28/17

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

SUB-SURFACE DATA

PROJECT: Sand Canyon Estates Ltd., Tract 47324 **W.O.#** 1805-1-10

Method of Drilling: 24" Diameter Bucket Auger **Logged by:** SR **LOG NO.** B-2

Ground Elevation: 1793'± **Location:** See Map **Date Observed:** 12/12/90

Depth	USC	S	U	B	MC	DD	Description	Attitudes on Bedding:
0					8.0	127	Mint Canyon Formation (Tmc): Alternating beds of greenish gray clayey to silty fine to coarse sandstone and light gray slightly silty fine sandstone. Damp, very dense, moderate to well indurated.	
					7.8	133		
5					6.4	133		
10					4.0	124	Predominantly light gray siltstone with interbeds of silty fine sandstone and gravelly sandstone. Damp, very dense, moderate to well indurated.	N56°W/37°SW (approximate) @9' on black mineral lamination
15					8.3	117		
20					8.8	128	Dark greenish gray muddy fine sandstone. Damp, very dense. Moderate to well indurated. Occassional interbeds of slightly silty fine sandstone. Grades to sandy, very silty mudstone.	N37°W/36°SW @16'
25					6.7	121	Light gray slightly silty fine sandstone. Damp, dense, massive. Well sorted.	N38°W/39°SW @29'
30					7.6	116	Dark brownish gray sandy siltstone and fine sandstone beds. Damp, well indurated. Approximately 1" thick bentonitic clay bed @30'- Soft, poorly indurated.	Attitude on shear at bottom of clay bed @ 29½':N19°W/64°SW
35					6.4	126		
40					4.2	121	Light gray conglomerate and interbedded fine to coarse sandstone. Damp, moderate to well indurated. Massive, coarsening with depth. Well rounded pebbles common.	N33°W/33°SW @30'on clay bed N55°W/31°SW (approximate)@40'on discontinuous sand lense

FIGURE 2-a

LEGEND:

USC - Unified Soil Classification System
S - Symbol
U - Undisturbed Sample
B - Bulk Sample
MC - Moisture Content (%)
DD - In place Dry Density

GORIAN & ASSOCIATES, INC

SUB-SURFACE DATA

PROJECT: Sand Canyon Estates Ltd., Tract 47324 **W.O.#** 1805-1-10

Method of Drilling: 24" Diameter Bucket Auger **Logged by:** SR **LOG NO.** B-2

Ground Elevation: 1793'± **Location:** See Map **Date Observed:** 12/12/90

USC	S	U	B	MC	DD	Description	Attitudes on Bedding:
				4.2	121	See Description on Page 1	
				7.3	117	Light gray fine to coarse sandstone with conglomerate interbeds. Sub-rounded to well rounded pebble to cobble clasts within conglomerate. Moderate to well indurated.	N36°W/31°SW @45' on 5" thick sand bed N43°W/38°SW @51'
				5.0	102	Dark greenish gray sandy siltstone interbedded with greenish gray to light gray fine sandstone. Moderate to well indurated.	N20°W/32°SW (approximate) @60'
						Light gray to light greenish gray gravelly fine to coarse sandstone and conglomerate. Damp to moist, dense.	
						Greenish gray silty fine sandstone to sandy siltstone.	
				8.6	116	Total Depth @71' No Caving No Groundwater	

40 45 50 55 60 65 70 75 80

FIGURE 2-b

LEGEND:

USC - Unified Soil Classification System
U - Undisturbed Sample
MC - Moisture Content (%)
S - Symbol
B - Bulk Sample
DD - In place Dry Density

GORIAN & ASSOCIATES, INC.

SUB-SURFACE DATA

PROJECT: Sand Canyon Estates Ltd., Tract 47324 **W.O.#** 1805-1-10

Method of Drilling: 24" Diameter Bucket Auger **Logged by:** SR **LOG NO.** B-3

Ground Elevation: 1731'± **Location:** See Map **Date Observed:** 12/13/90 - 12/14/90

USC	S	U	B	MC	DD	Description	Attitudes on Bedding:
				3.3	128	Mint Canyon Formation (Tmc): Light grayish brown conglomerate. Silty fine to coarse sand matrix with rounded pebbles and cobbles to 5" diameter. Moderate to well indurated. Scattered sandstone interbeds 4" to 8" thick.	N38°W/34°SW @4'
				2.2	129		
				3.5	126		
				5.0	130		N21°W/37°SW @11'
				7.4	130	Alternating beds of dark greenish gray siltstone and light gray silty fine sandstone. Very dense and tight. Top of 12" thick fine to coarse sandstone bed @13' to 14'.	N44°W/32°SW @14'
				7.9	123	Light greenish gray silty fine to coarse sandstone with gravel. Damp to moist, dense, massive.	N41°W/27°SW @19'
				4.9	117	Yellowish green very fine to fine sandstone. Damp, dense, well sorted, moderately indurated, massive.	N27°W/38°SW @26½
				13.5	123	Light gray conglomerate. Silty fine to coarse sand matrix with rounded pebbles and cobbles. Damp, dense, moderate to well indurated, massive.	N43°W/38°SW @29'
				11.7	120	Dark greenish gray sandy to clayey siltstone. Well indurated, very tight, massive.	
				7.6	125	Green to gray silty fine sandstone to sandy siltstone. Very hard and well indurated, tight, massive.	
						See Description on Page 2	

FIGURE 3-a

LEGEND:

USC - Unified Soil Classification System
S - Symbol
U - Undisturbed Sample
B - Bulk Sample
MC - Moisture Content (%)
DD - In place Dry Density

GORIAN & ASSOCIATES INC

SUB-SURFACE DATA

PROJECT: Sand Canyon Estates Ltd., Tract 47324 **W.O.#** 1805-1-10

Method of Drilling: 24" Diameter Bucket Auger **Logged by:** SR **LOG NO.** B-3

Ground Elevation: 1731'± **Location:** See Map **Date Observed:** 12/13/90 - 12/14/90

	USC	S	U	B	MC	DD	Description
40					7.6	125	Light greenish gray silty fine sandstone. Damp to moist, firm. Moderately consolidated, massive. Grades to siltstone @ 40½'.
45							Total Depth @41' No Caving No Groundwater
50							
55							
60							
65							
70							
75							
80							

FIGURE 3-b

LEGEND:

USC - Unified Soil Classification System
S - Symbol
U - Undisturbed Sample
B - Bulk Sample
MC - Moisture Content (%)
DD - In place Dry Density

GORIAN & ASSOCIATES INC

BORING LOG NUMBER 8

Drilling Date 3/15/89 Elevation

Project PRIME WEST - GH2881-G

Sample Depth ft.	Blows per ft.	Moisture Content %	Dry Unit Weight p.c.f.	Depth in feet	Graphic Log	Description Surface Conditions
				1		BEDROCK: Interbedded Sandstone and Conglomerate, mottled white to tan, hard to very hard, massive, slightly weathered, clasts to 4" in length
5	6	3.0	116.6	5		
						- - - very hard layer
10	12	6.3	113.5	10		
15	23	3.5	119.8	15		End at 15 feet No Water No Caving No Fill

SUB-SURFACE DATA

PROJECT: Sand Canyon Estates Ltd., Tract 47324 **W.O.#** 1805-1-10

Method of Drilling: 24" Diameter Bucket Auger **Logged by:** EAB **LOG NO.** B-11

Ground Elevation: 1614' ± **Location:** See Map **Date Observed:** 12/27/90

	USC	S	U	B	MC	DD	Description
0	SM				5.4	89	Alluvium (Qal): Light gray brown slightly clayey, very silty friable fine sand (dry, dense). Upper 18" has been disced and evidence of rodent borrowing. Scattered organic fragments. Visible porosity to 9', mostly pinhole size diameters.
5					5.0	97	
					6.0	94	
10	SM				3.3	103	Light gray brown silty fine to coarse sand with occasional gravel (damp, very dense). Trace of porosity. Gravels consist of rounded to well rounded granitics
15					3.4	103	Occasional very silty lenses. 3" to 4" diameter well rounded cobbles from 18' to 20'.
20					3.4	120	Mint Canyon Formation (Tmc): Light brown to slightly greenish brown medium to coarse grained sandstone. Very hard, well cemented.
					3.2	119	
25							Total Depth @23' No Groundwater No Caving
30							
35							
40							

FIGURE 11

LEGEND:

USC - Unified Soil Classification System
U - Undisturbed Sample
MC - Moisture Content (%)
S - Symbol
B - Bulk Sample
DD - In place Dry Density

GORIAN & ASSOCIATES INC

SUB-SURFACE DATA

PROJECT: Sand Canyon Estates Ltd., Tract 47324 **W.O.#** 1805-1-10

Method of Drilling: 24" Diameter Bucket Auger **Logged by:** EAB **LOG NO.** B-12

Ground Elevation: 1665'± **Location:** See Map **Date Observed:** 12/27/90

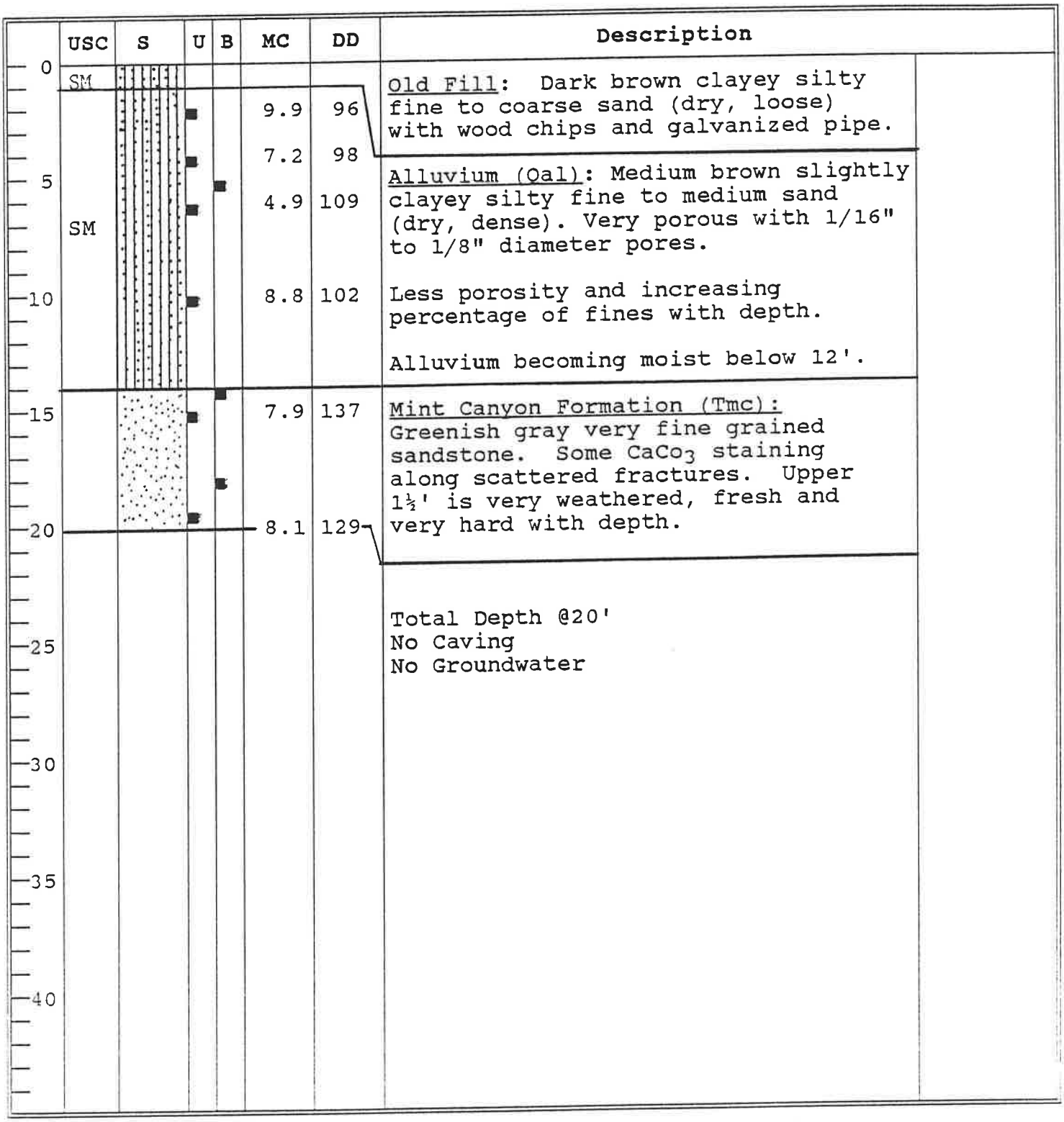


FIGURE 12

LEGEND:

USC - Unified Soil Classification System
U - Undisturbed Sample
MC - Moisture Content (%)
S - Symbol
B - Bulk Sample
DD - In place Dry Density

GORIAN & ASSOCIATES INC

SUBSURFACE DATA

PROJECT: Sand Canyon Estates Ltd., Tract 47324 **W.O.#** 1805-1-10

Method of Drilling: 24" Diameter Bucket Auger **Logged by:** EAB/SR **LOG NO.** B-15

Ground Elevation: 1683'± **Location:** See Loc Map **Date Observed:** 12/27/90 - 12/28/90

USC	S	U	B	MC	DD	Description	Attitudes on Bedding:
		■	■	6.7	104	Mint Canyon Formation (Tmc): Light greenish grey very silty fine to medium grained micaceous sandstone with interbedded silty claystone, clay, and siltstone beds. Poorly bedded to massive. Reddish brown silty clay beds @ 2'to 3'(½" to 6" thick) and @ 4½' to 6' (9" thick). Clay bed @ 2'to 3' is highly undulatory, very firm, massive.Clay bed @4½ to 6' mottles with greenish grey clay and is poorly indurated, firm, massive. 6" thick maximum fault zone at bottom of unit-consists of sand and small gravel overlying a reddish brown plastic clay seam.	N13°W/38°SW @1' (approximate)
		■		5.6	115		N34°W/16°-29°SW @2½' (approximate) on top of clay bed
		■		11.6	120		N12°E/22°NW @5'
		■		8.0	129		Attitude on fault: N-S/ 29°E @9½'
		■	■	11.1	125		
		■	■	8.9	115	Dark greenish grey clayey siltstone interbedded with light yellowish green silty fine sandstone. Well indurated, very firm, poorly bedded	Attitudes on Bedding:
		■		18.3	109	Light yellowish green silty fine sandstone with gravelly, fine to coarse sandstone interbeds and lenses. Moderately to well indurated, poorly bedded, locally cross bedded. Bottom of unit sharp, undulatory contact.	N15°W/22°-32°SW @17' (approximate)
		□					N2°W/22°SW @21½'
						Green-grey siltstone. Well indurated, very firm, massive.	N22°E/17°NW @24' (approximate)
						Light greenish grey conglomeratic fine to coarse sandstone. Damp, dense.	
						Total Depth @30½' No Caving No Groundwater	

FIGURE 15

LEGEND:

USC - Unified Soil Classification System
S - Symbol
U - Undisturbed Sample
B - Bulk Sample
MC - Moisture Content (%)
DD - In place Dry Density

GORIAN & ASSOCIATES INC

SUB-SURFACE DATA

PROJECT: Sand Canyon Estates Ltd., Tract 47324 **W.O.#** 1805-1-10

Method of Drilling: 4" Rotary Wash **Logged by:** AA **LOG NO.** B-16

Ground Elevation: 1593'± **Location:** See Map **Date Observed:** 1/07/91

	USC	S	DD	B	N	Description	%Sand/Silt/Clay
0						Alluvium:	
5	SM				14	Gray-brown clayey silty sand	72/16/12%
10	SM				11	Gray-brown clayey silty sand	58/26/16%
15	SM				17	Gray-brown clayey silty sand	66/22/12%
20	SM				12	Gray-brown clayey silty sand	50/36/14%
25	SM				34	Gray silty sand with clay	76/16/8%
30	SM				23	Gray silty sand with clay	70/20/10%
35	SM				23	Gray silty sand with clay	62/22/10%
40	SC				27	Brown silty clayey sand	68/16/22%

FIGURE 16a

LEGEND:

USC - Unified Soil Classification System S - Symbol

U - Undisturbed Sample B - Bulk Sample

N - Blow Counts SPT N Value 60 DD - In place Dry Density

GORIAN & ASSOCIATES INC

SUB-SURFACE DATA

PROJECT: Sand Canyon Estates Ltd., Tract 47324 W.O.# 1805-1-10

Method of Drilling: 4" Rotary Wash Logged by: AA LOG NO. B-16

Ground Elevation: 1593'± Location: See Map Date Observed: 1/07/91

	USC	S	DD	B	N	Description	%Sand/Silt/Clay
40					27	Brown silty clayey sand	62/16/22%
45						Total Depth 41½' Installed 2" Diameter Perforated PVC Pipe Backfilled with Sand For Water Level Measurements (Water Level Measured at 37.2' on 1/14/91)	
50							
55							
60							
65							
70							
75							
80							

FIGURE 16b

LEGEND:

USC - Unified Soil Classification System S - Symbol

U - Undisturbed Sample B - Bulk Sample

N - Blow Counts SPT N Value 60 DD - In place Dry Density

GORIAN & ASSOCIATES, INC

Sand Canyon Country Club
September 20, 2018
2017-006-021

APPENDIX B

LABORATORY TESTS

RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

APPENDIX B

LABORATORY TESTS

Laboratory tests were performed on selected samples obtained from the borings to aid in the classification of the soils and to determine their engineering properties.

Moisture and Density Tests: Moisture content and unit dry density tests were performed on samples of undisturbed soil obtained in the test borings. Dry density and field moisture information is useful in correlating field and laboratory data as well as providing a summary of the variations of soil characteristics. The results of these tests are shown on the Logs of Boring in Appendix A.

Direct Shear Tests: Direct shear tests were performed on selected undisturbed samples to determine the strength of the soils. The tests were performed by subjecting the samples to various surcharge pressures after the samples had been soaked to near-saturated moisture contents. The strength values determined from the direct shear tests are presented on the Shear Test Data page.

Consolidation Tests: Confined consolidation tests were performed on undisturbed samples that were obtained from near the proposed foundation elevations. Samples of bearing soils which may become inundated with water were also tested in an artificially saturated state. For purposes of presentation, the results of the pertinent consolidation tests are presented on the attached Consolidation Test Data sheets.

Maximum Dry Density Tests: The maximum dry density and optimum moisture content of a bulk soil sample obtained from one of our test borings were determined in our laboratory in accordance with ASTM Soil Compaction Method Standard D1557. The results of the test are as follows:

Sample No.	Soil Description and Classification	Max. Dry Density (lbs./cu. ft.)	Optimum Moisture Content (%)
HS-1 @ 1-10’	Fine to medium sand, silty, light grayish brown (SM)	125.5	10.0
HS-2 @ 1-10’	Fine sand, very silty, grayish brown (SM)	130.0	9.0
HS-3 @ 1-7’	Fine to coarse sand, silty, medium brown (SM)	132.5	9.0
HS-4 @ 1-5’	Fine to coarse sand, silty, medium gray brown (SM)	130.5	9.5

Sand Canyon Country Club
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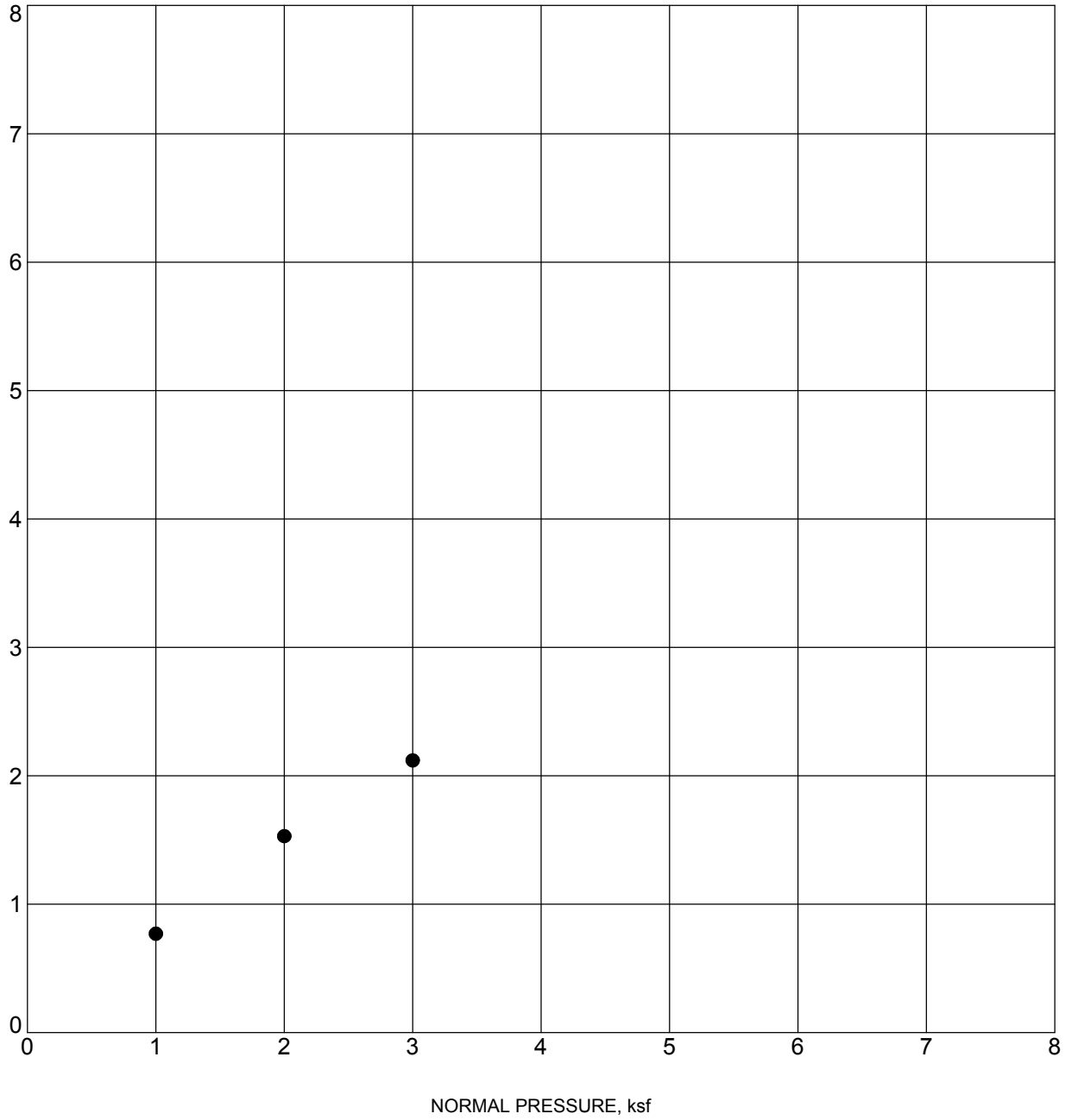
2017-006-021

Expansion Index Tests: Expansion Index tests provide an index to the expansion potential of soils when inundated with water. This test method controls variables that influence the expansive characteristics of soils. A bulk soil sample was obtained from one of the test borings drilled for the subject investigation and an Expansion Index test was performed on the sample in accordance with ASTM Standard D4829. The results of the test are presented below:

Sample No.	Expansion Index	Potential Expansion
HS-1 @ 1-10’	21	Low
HS-4 @ 1-5’	14	Very Low

RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY



Specimen Identification		Classification
● **HS-1** **10.0'**		**ALLUVIUM (Qal)**

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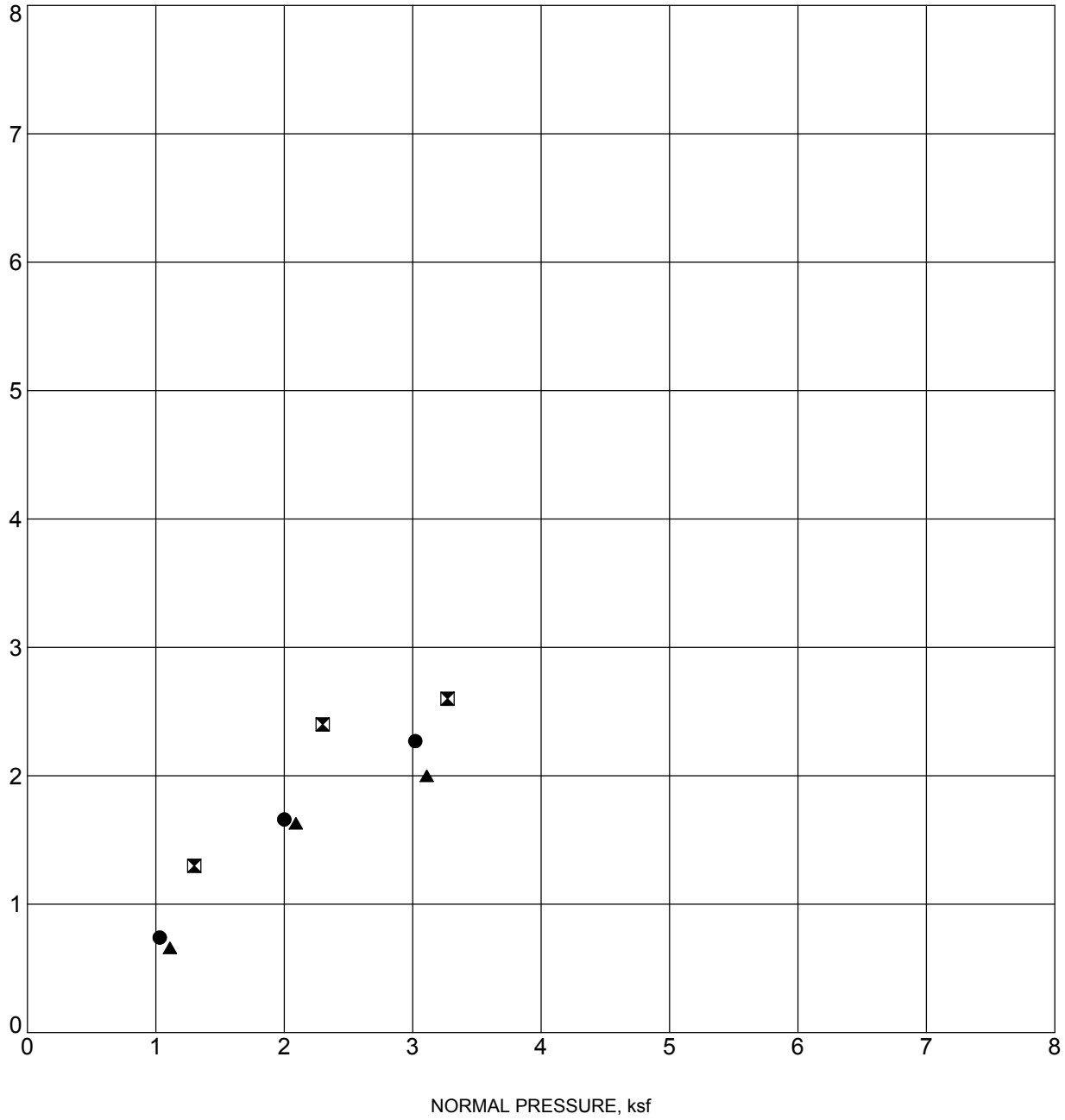
DIRECT SHEAR TEST

JOB NUMBER: 2017-006-021

REPORT DATED: 09-20-2018

US DIRECT SHEAR 2017-006.GPJ FRANKIAN.GDT 9/25/18



*** - Remolded to 90% Dry Density**

Specimen Identification			Classification				
●	**HS-1**	**1.0'**	**ARTIFICIAL FILL AND COMPACTED FILL***				
⊠	**HS-2**	**8.0'**	**ARTIFICIAL FILL AND COMPACTED FILL**				
▲	**HS-3**	**7.0'**	**ARTIFICIAL FILL AND COMPACTED FILL***				

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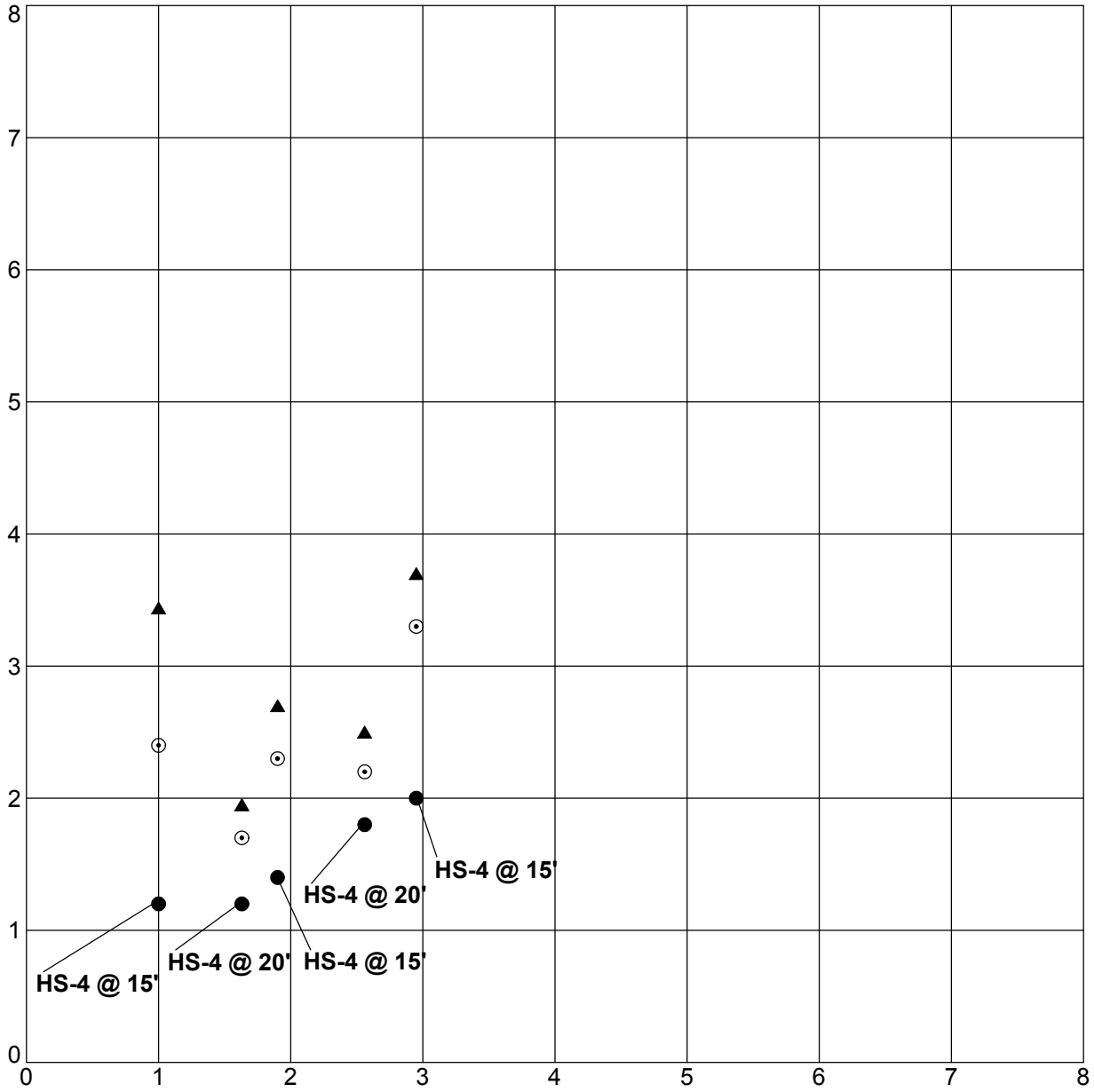
JOB NUMBER: 2017-006-021

REPORT DATED: 09-20-2018



Specimen Identification		Classification
HS-4	**15.0'**	**MINT CANYON FORMATION (Tmc)**
HS-4	**20.0'**	**MINT CANYON FORMATION (Tmc)**

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DIRECT SHEAR TEST

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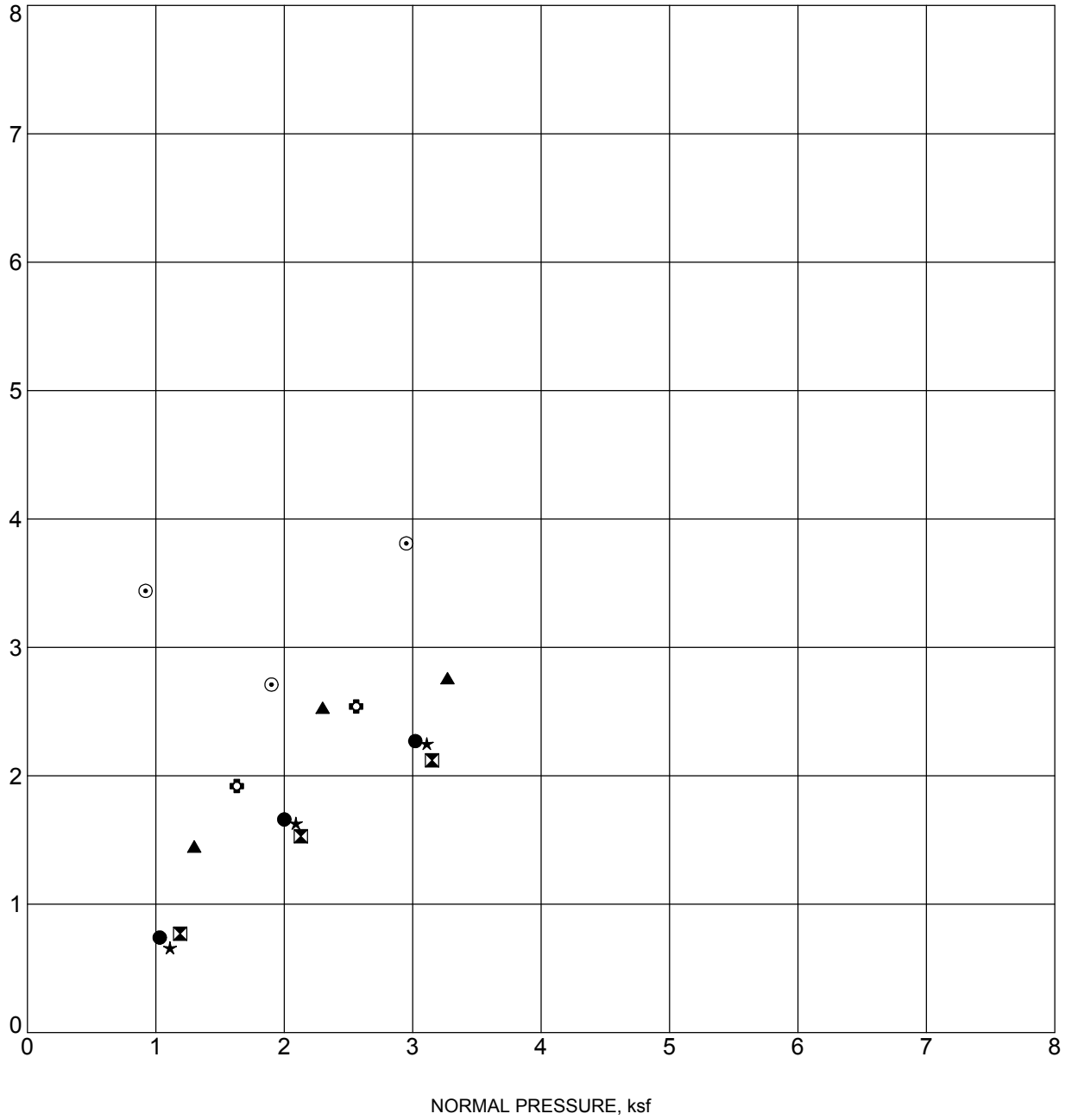
REPORT DATED: 09-20-2018



Specimen Identification			Classification				
●	**HS-1**	**1.0'**					
⊠	**HS-1**	**10.0'**					
▲	**HS-2**	**8.0'**					
★	**HS-3**	**7.0'**					
⊙	**HS-4**	**15.0'**					
✿	**HS-4**	**20.0'**					

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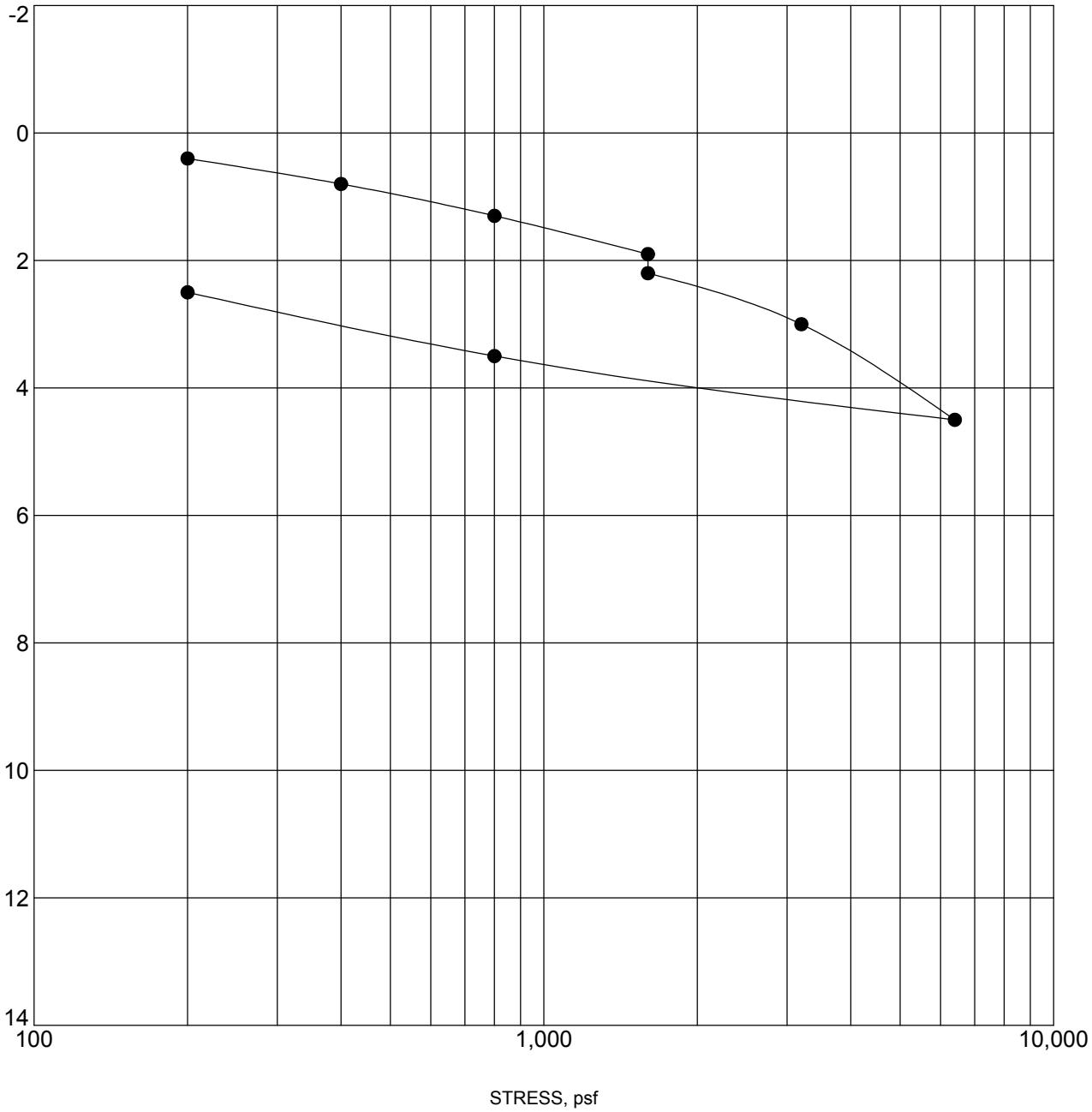
JOB NUMBER: 2017-006-021

REPORT DATED:



Water added at 1600 psf

Specimen Identification		Classification		
●	**HS-1 8.0'**			

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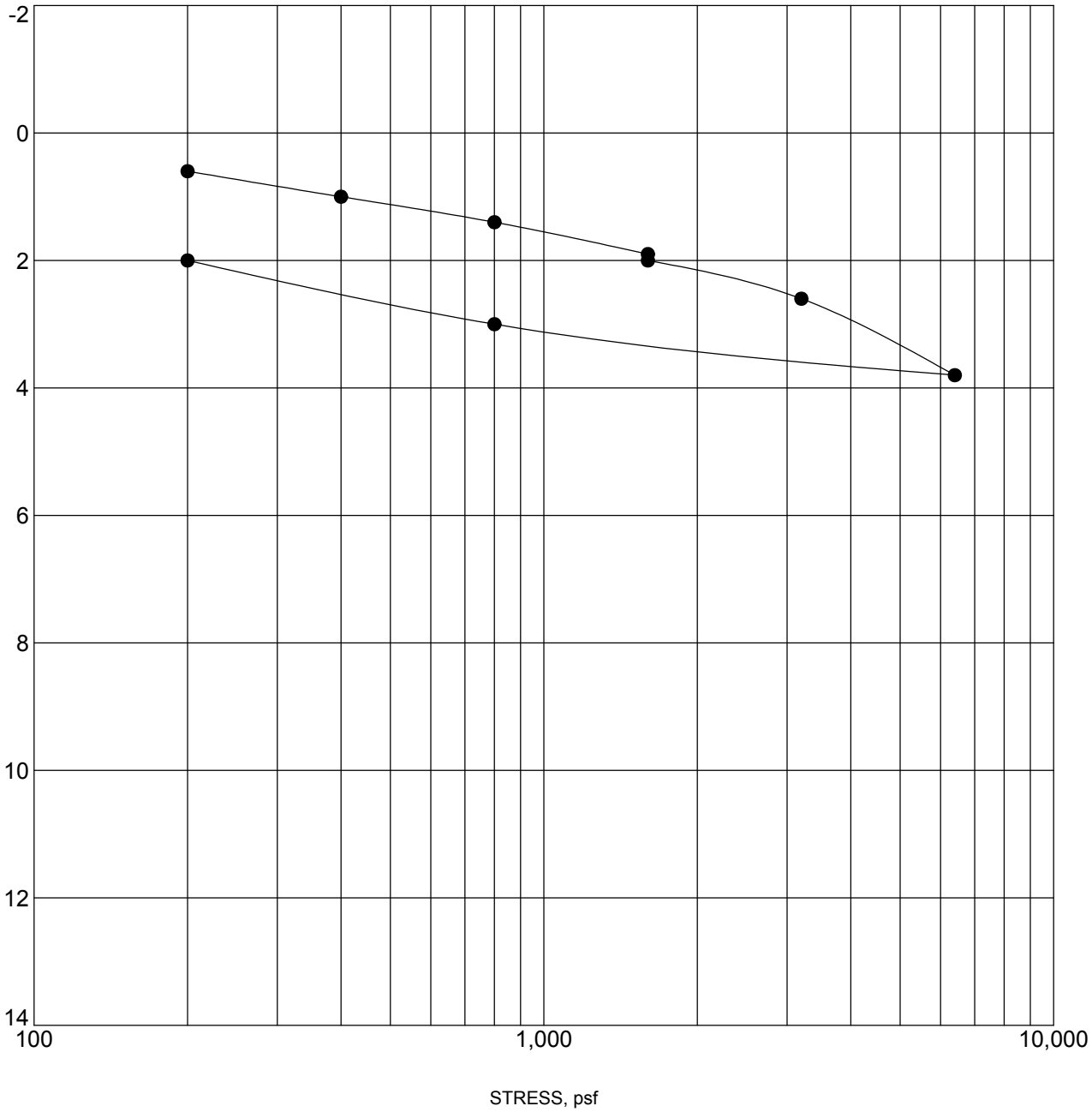
CONSOLIDATION TEST

JOB NUMBER: 2017-006-021

REPORT DATED:



Water added at 1600 psf

Specimen Identification		Classification		
●	**HS-2 5.0'**			

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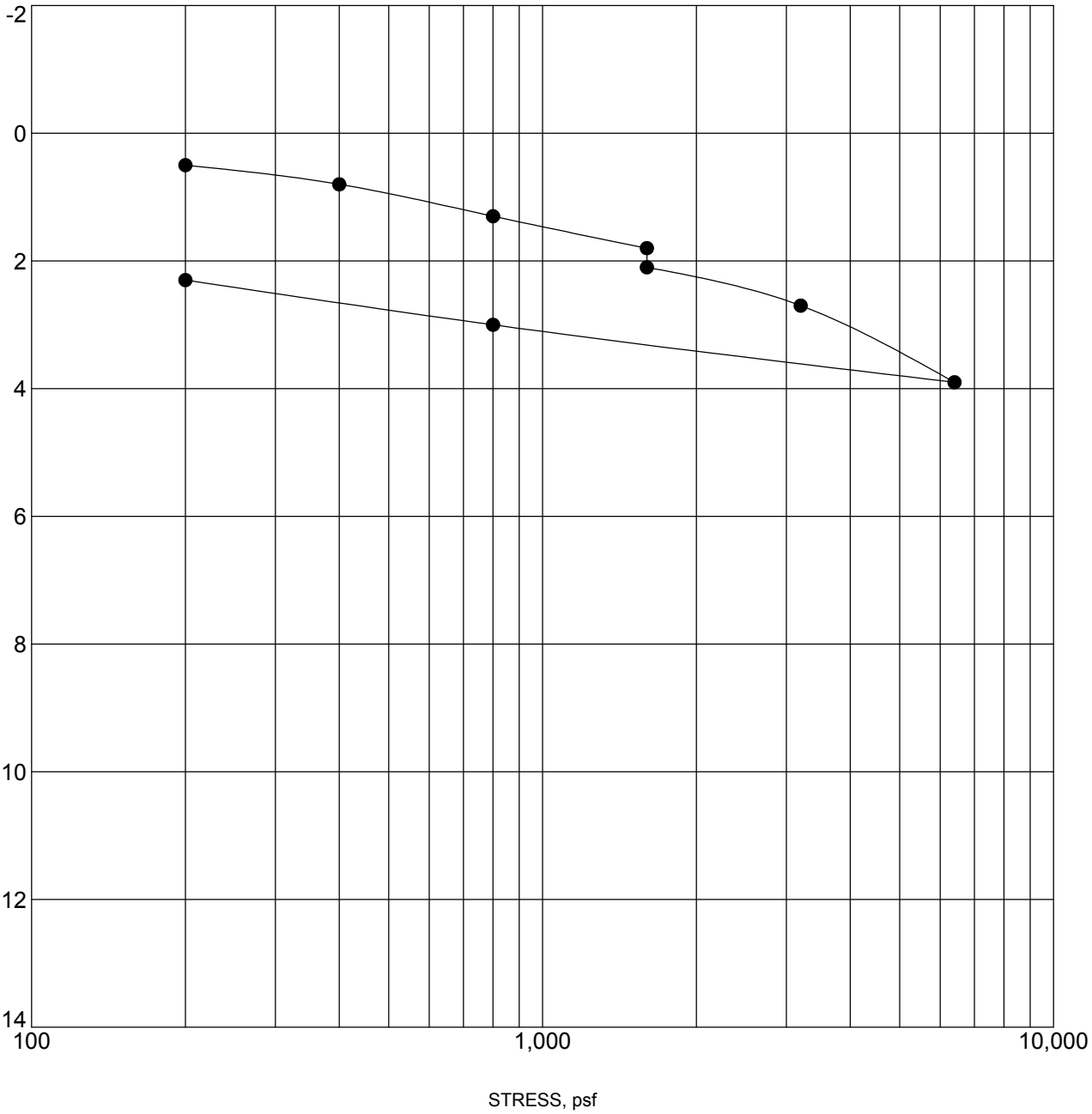
CONSOLIDATION TEST

JOB NUMBER: 2017-006-021

REPORT DATED:



Water added at 1600 psf

Specimen Identification		Classification		
●	**HS-2 15.0'**			

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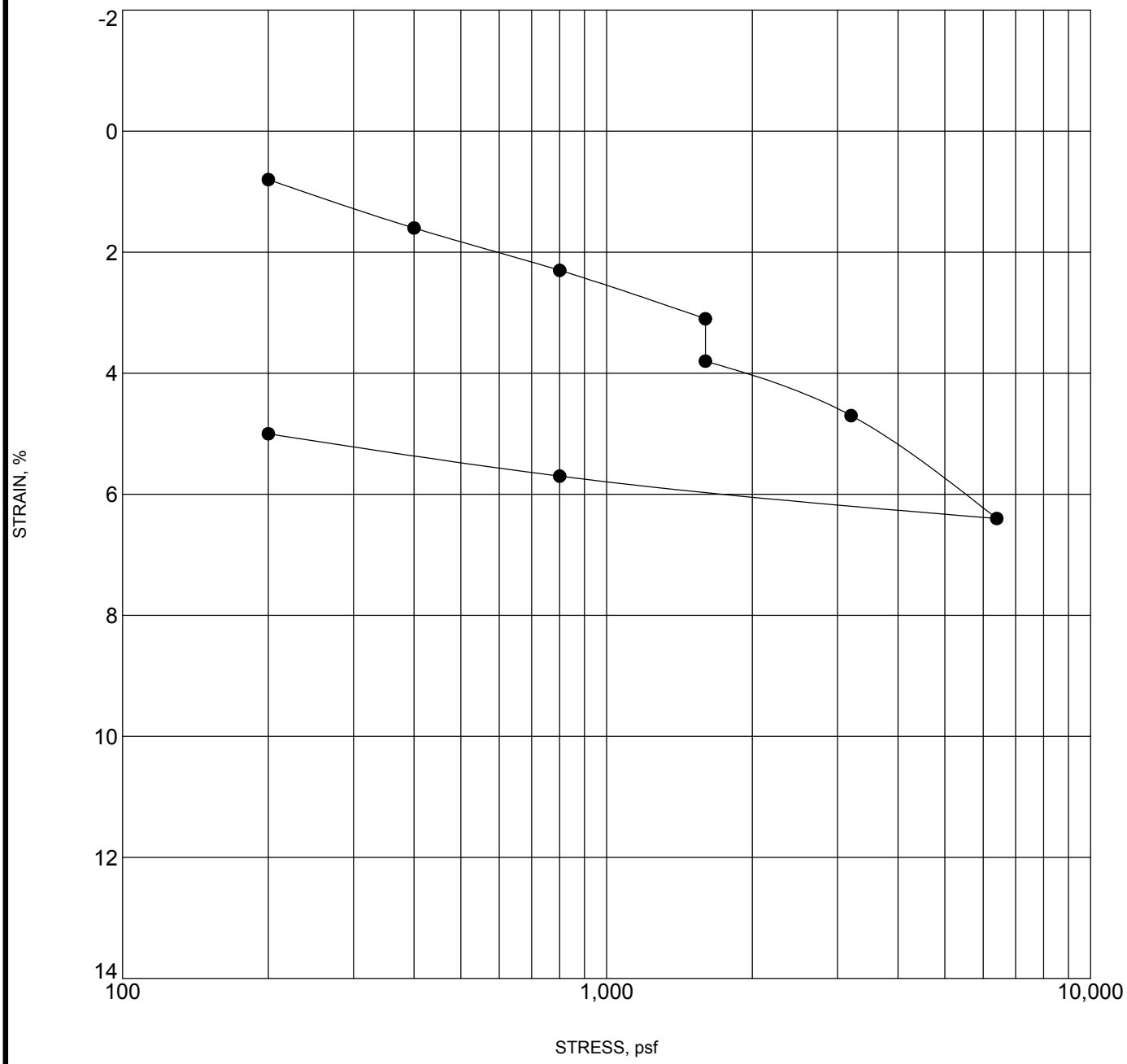
CONSOLIDATION TEST

JOB NUMBER: 2017-006-021

REPORT DATED:



Water added at 1600 psf

Specimen Identification		Classification		
●	**HS-2 20.0'**			

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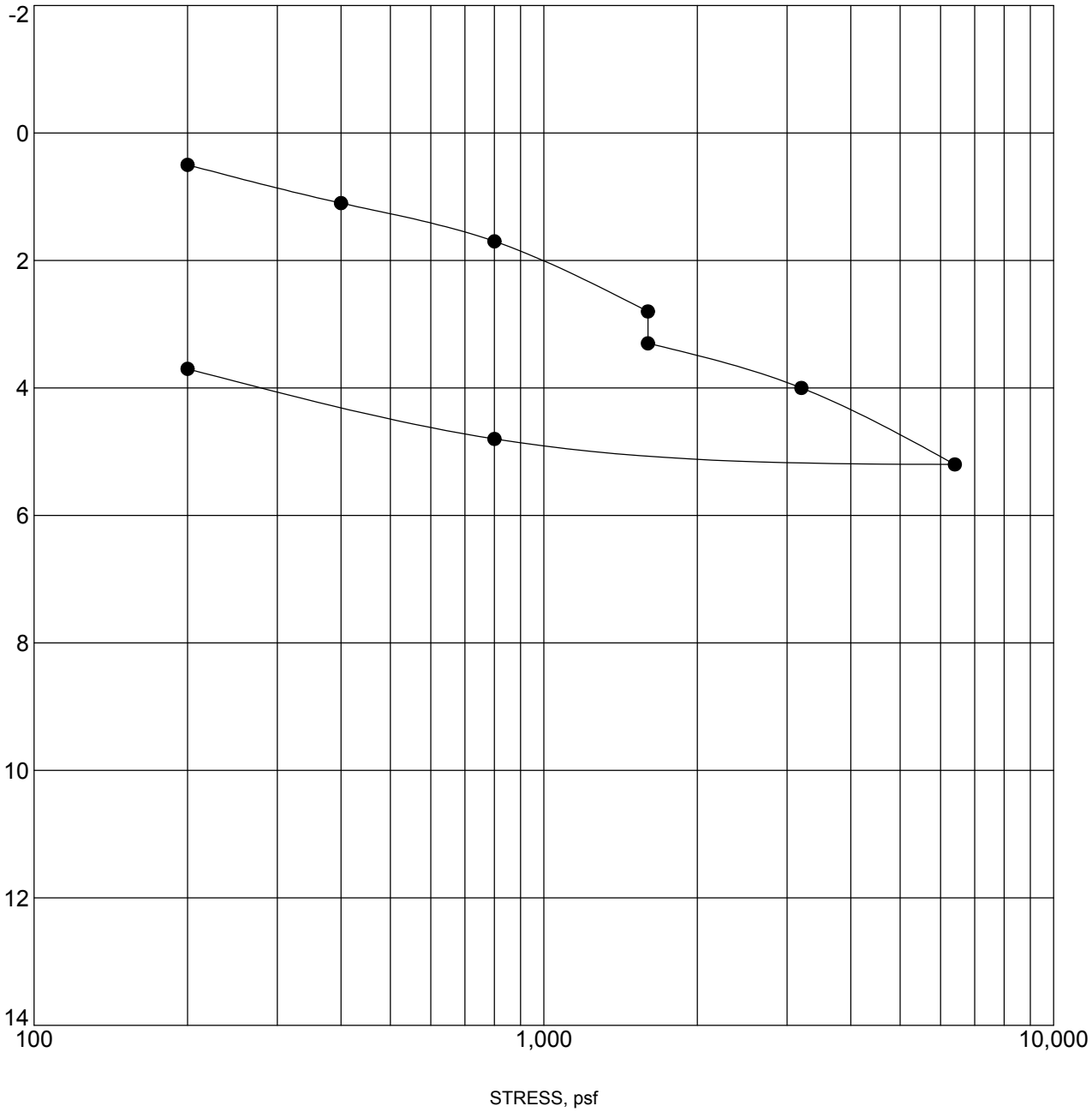
CONSOLIDATION TEST

JOB NUMBER: 2017-006-021

REPORT DATED:



Water added at 1600 psf

Specimen Identification		Classification		
●	**HS-3 5.0'**			

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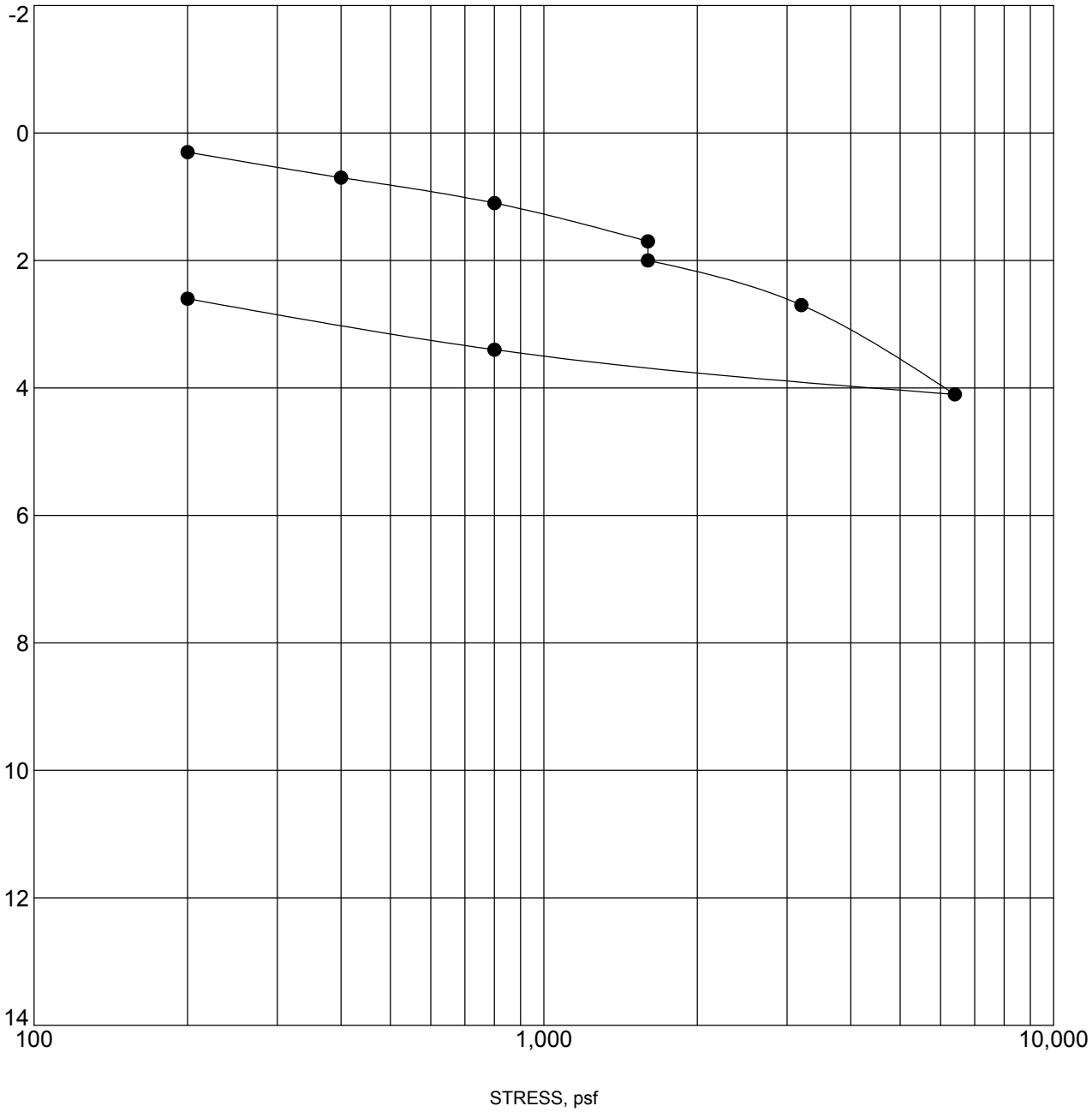
REPORT DATED:



Water added at 1600 psf

Specimen Identification		Classification		
●	**HS-3 10.0'**			

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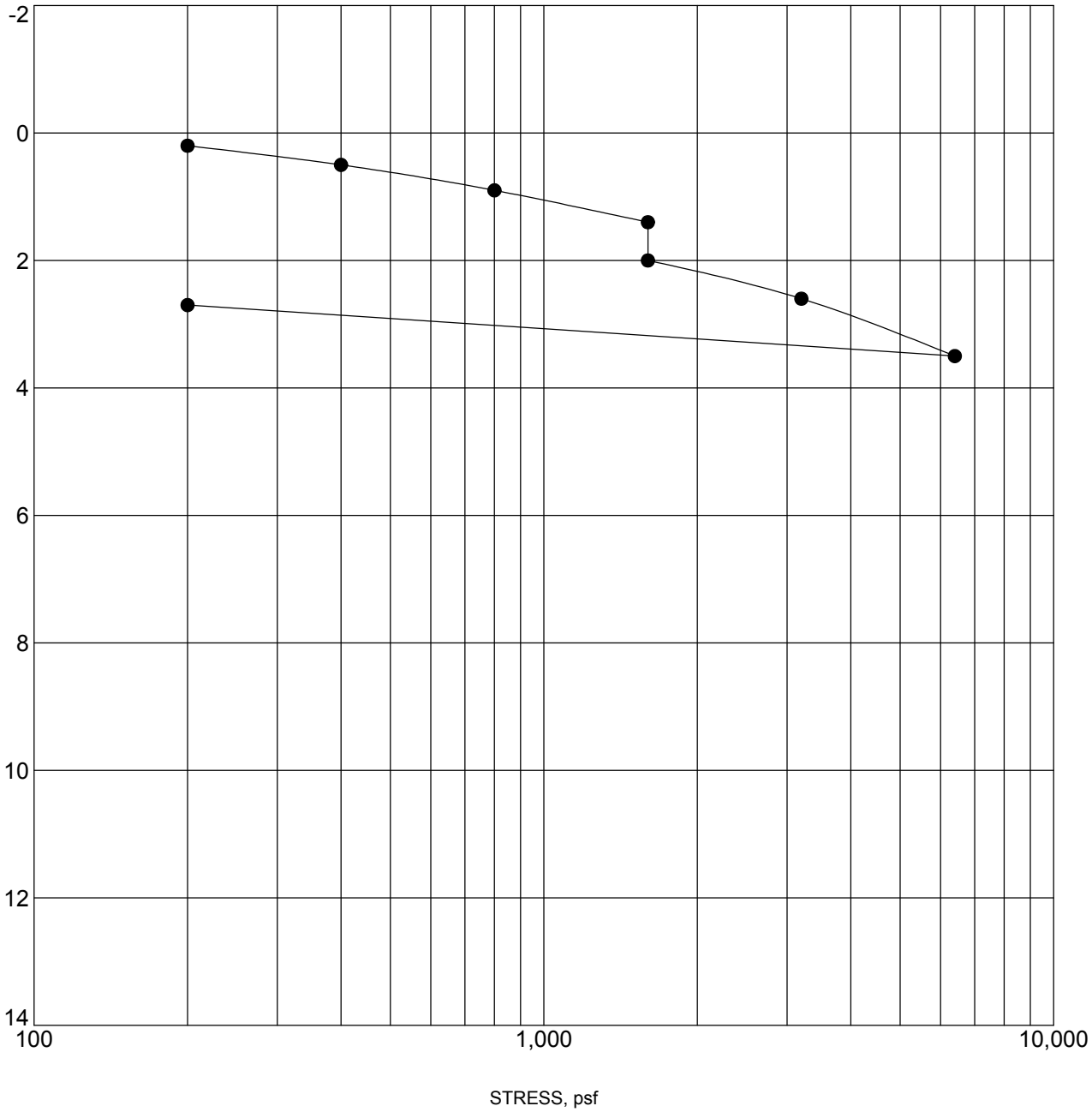
JOB NUMBER: 2017-006-021

REPORT DATED:



Water added at 1600 psf

Specimen Identification		Classification		
●	**HS-3 15.0'**			

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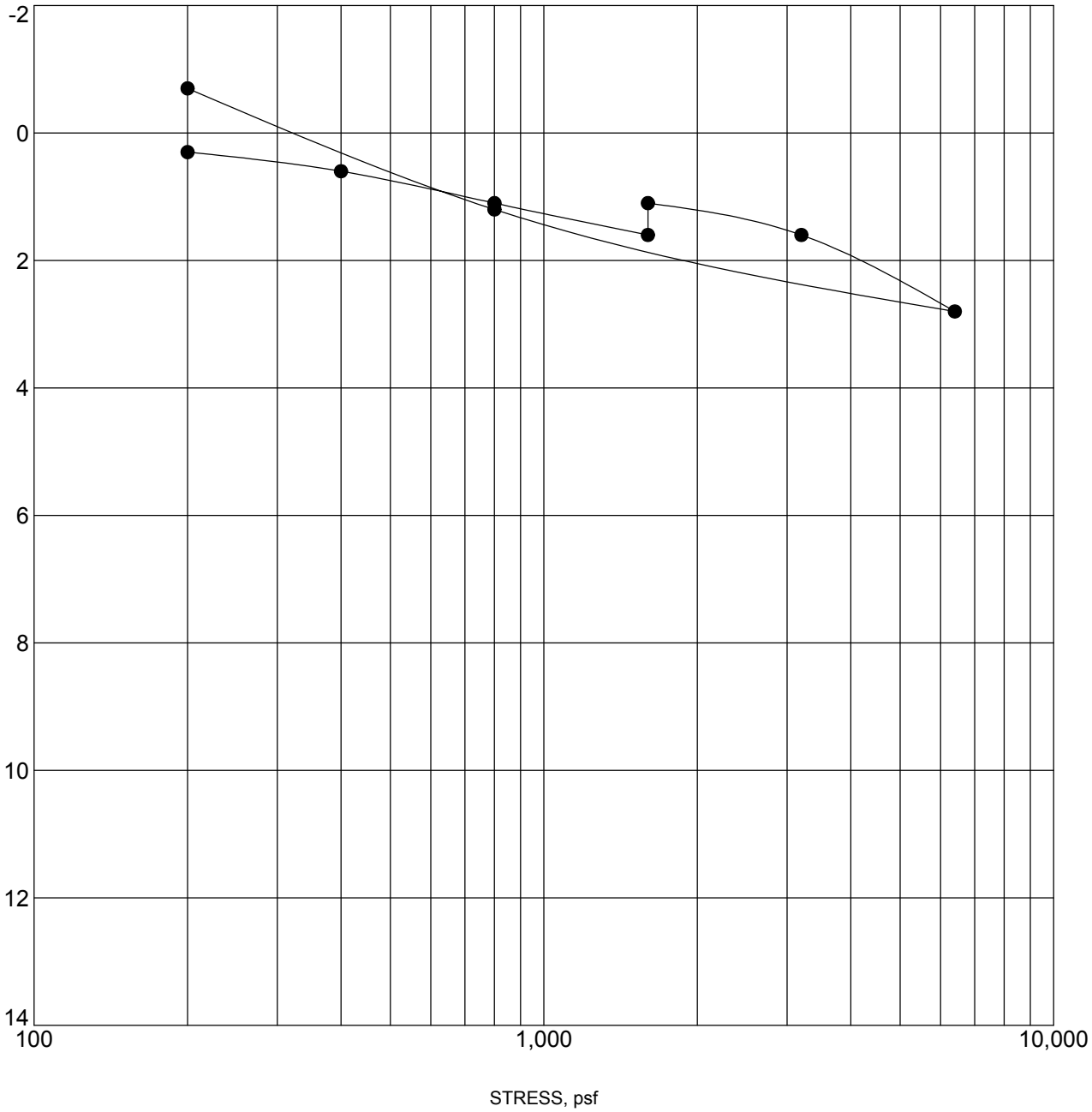
REPORT DATED: 09-20-2018



Water added at 1600 psf

Specimen Identification		Classification		
●	**HS-4 12.0'**			

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CONSOLIDATION TEST

JOB NUMBER: 2017-006-021

REPORT DATED:

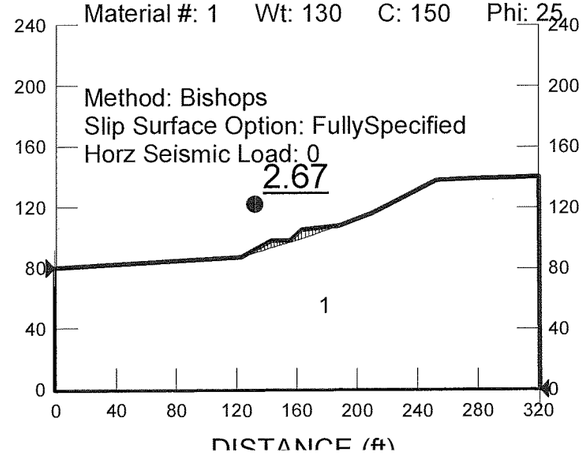
Sand Canyon Country Club
September 20, 2018
2017-006-021

APPENDIX C

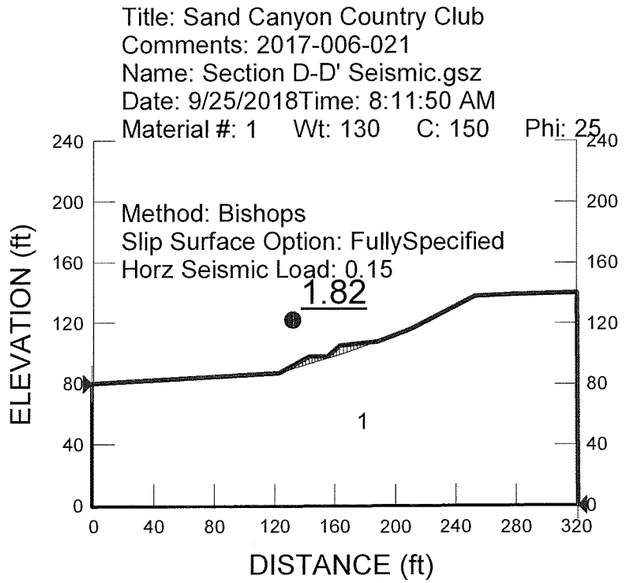
SLOPE STABILITY CALCULATIONS

RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

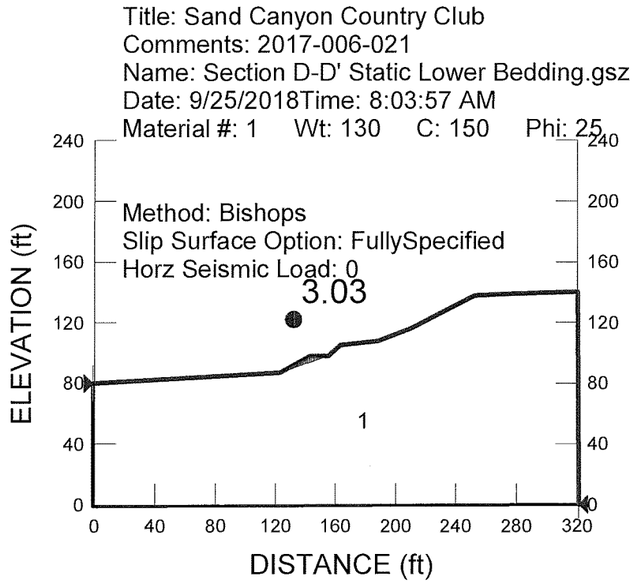
Title: Sand Canyon Country Club
Comments: 2017-006-021
Name: Section D-D' Static.gsz
Date: 9/25/2018Time: 8:03:57 AM
Material #: 1 Wt: 130 C: 150 Phi: 25



RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY



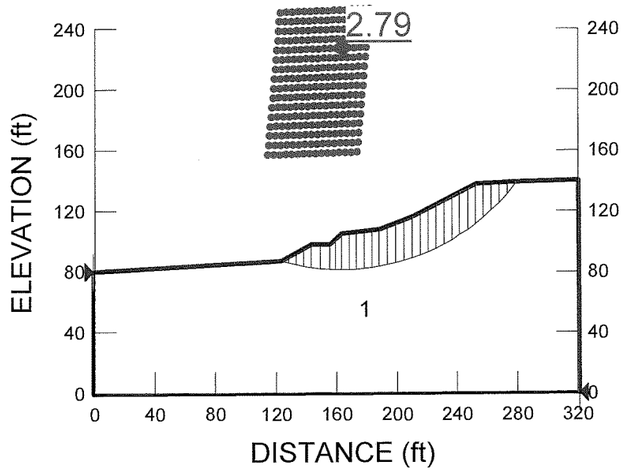
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY



GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

Title: Sand Canyon Country Club
Comments: 2017-006-021
Name: Section D-D' Static Circular.gsz
Date: 9/25/2018Time: 9:49:05 AM
Material #: 1 Wt: 130 C: 650 Phi: 32

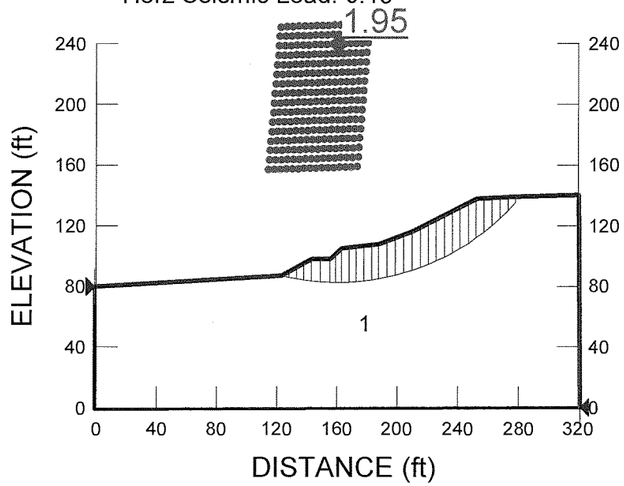
Method: Bishops
Slip Surface Option: GridAndRadius
Horz Seismic Load: 0



RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

Title: Sand Canyon Country Club
Comments: 2017-006-021
Name: Section D-D' Seismic Circular.gsz
Date: 9/25/2018Time: 10:02:24 AM
Material #: 1 Wt: 130 C: 650 Phi: 32

Method: Bishops
Slip Surface Option: GridAndRadius
Horz Seismic Load: 0.15



RTE&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

Sand Canyon Country Club
September 20, 2018
2017-006-021

APPENDIX D

SEISMIC DESIGN CALCULATIONS

RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

USGS Design Maps Summary Report

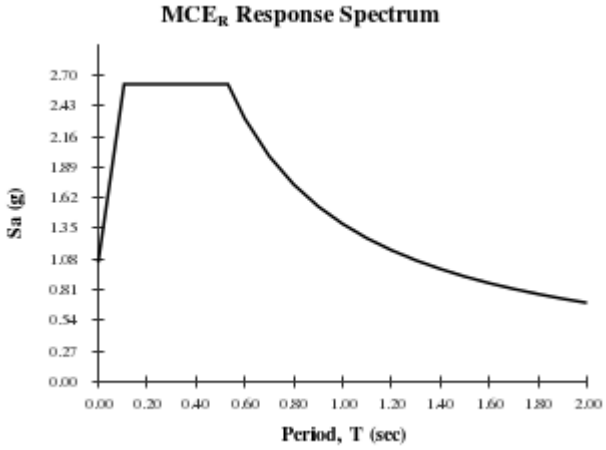
User–Specified Input

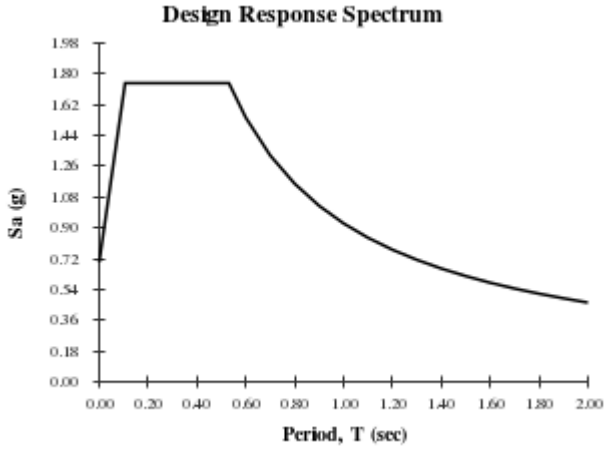
Report Title	Sand Canyon County Club 2017-006-021 Thu September 20, 2018 15:23:40 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	34.4124°N, 118.41366°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

USGS–Provided Output

S_S =	2.619 g	S_{MS} =	2.619 g	S_{DS} =	1.746 g
S_1 =	0.926 g	S_{M1} =	1.390 g	S_{D1} =	0.926 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (34.4124°N, 118.41366°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	S_S = 2.619 g
From Figure 22-2 [2]	S_1 = 0.926 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\overline{v}_s$	$\overline{N}$ or $\overline{N}_{ch}$	$\overline{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content w ≥ 40%, and • Undrained shear strength $\overline{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_s = 2.619 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.926 g, F_v = 1.500

Equation (11.4–1):	$S_{MS} = F_a S_S = 1.000 \times 2.619 = 2.619$ g
Equation (11.4–2):	$S_{M1} = F_v S_1 = 1.500 \times 0.926 = 1.390$ g

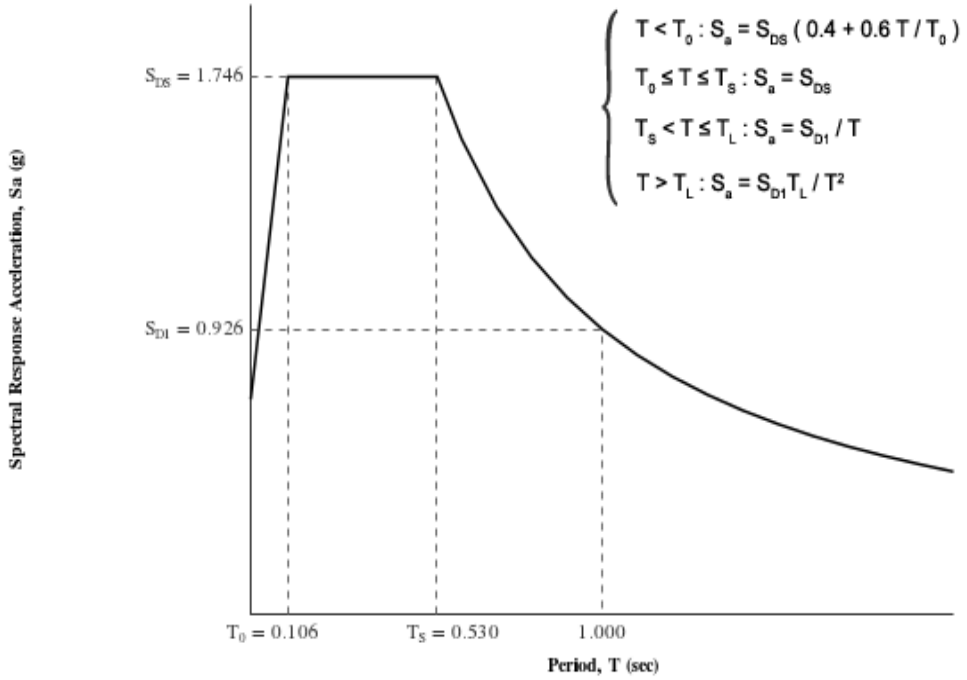
Section 11.4.4 — Design Spectral Acceleration Parameters

Equation (11.4–3):	$S_{DS} = ⅔ S_{MS} = ⅔ \times 2.619 = 1.746$ g
Equation (11.4–4):	$S_{D1} = ⅔ S_{M1} = ⅔ \times 1.390 = 0.926$ g

Section 11.4.5 — Design Response Spectrum

From Figure 22-12 [3]	$T_L = 8$ seconds

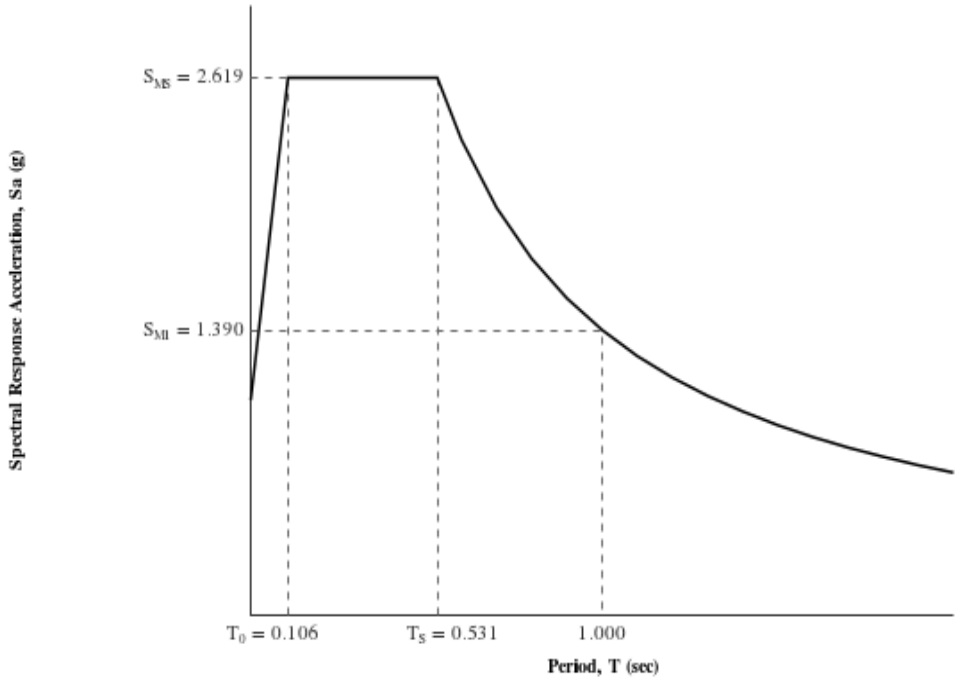
Figure 11.4–1: Design Response Spectrum



2017-006-021 9/20/2018

Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.953

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 0.953 = 0.953$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.953 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.965

From Figure 22-18 [6] C_{R1} = 0.984

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.746 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.926 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = E

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition
Dynamic: Conterminous U.S. 2014

Spectral Period
Peak ground acceleration

Latitude
Decimal degrees
34.412397

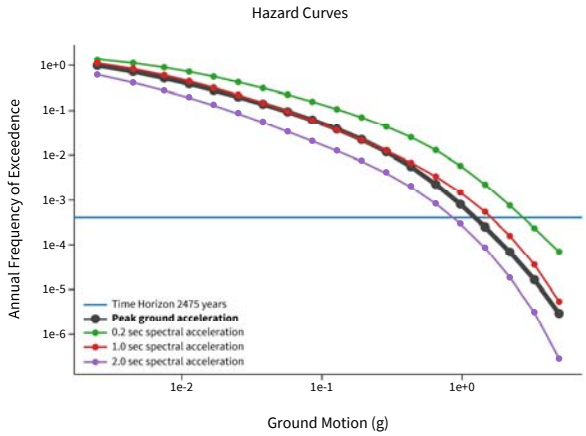
Time Horizon
Return period in years
2475

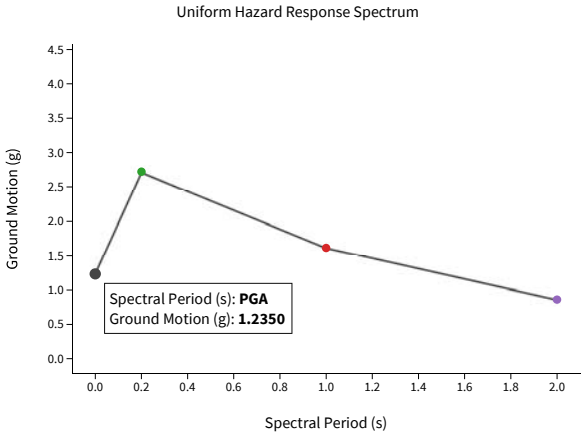
Longitude
Decimal degrees, negative values for western long…
-118.413659

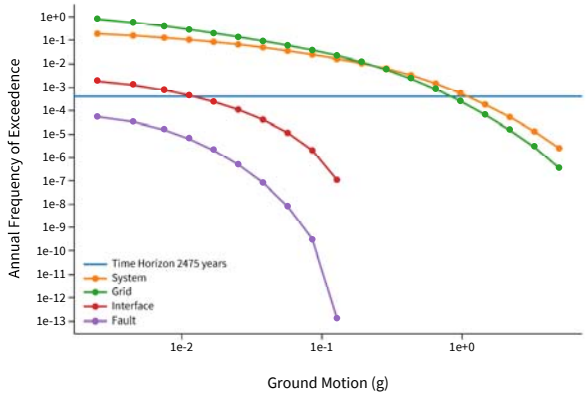
Site Class
259 m/s (Site class D)

2017-006-021 9/20/2018

Hazard Curve







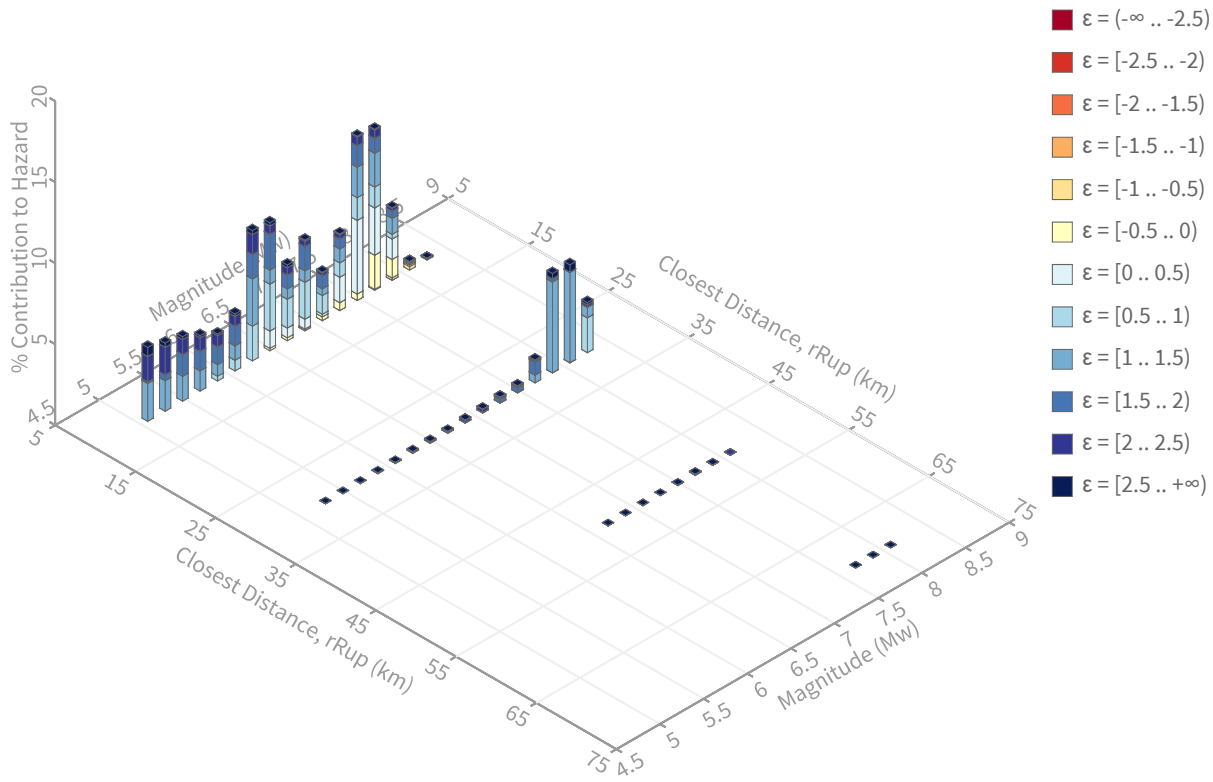
View Raw Data

2017-006-021 9/20/2018

Deaggregation

Component

Total



2017-006-021 9/20/2018

Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 1.2350098 g

Recovered targets

Return period: 2874.9491 yrs
Exceedance rate: 0.00034783225 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.07 %

Mean (for all sources)

r: 11.7 km
m: 6.91
ε_0: 1.22 σ

Mode (largest r-m bin)

r: 9.4 km
m: 7.51
ε_0: 0.82 σ
Contribution: 10.12 %

Mode (largest ε_0 bin)

2017-006-021 9/20/2018

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM32	System							41.06
Santa Susana alt 2 [1]		7.41	6.93	1.01	118.409°W	34.337°N	177.25	13.82
San Andreas (Mojave S) [3]		25.43	8.03	1.32	118.296°W	34.619°N	25.13	7.81
Sierra Madre (San Fernando) [2]		8.83	7.44	0.87	118.421°W	34.312°N	183.45	4.93
Santa Susana alt 2 [2]		9.18	6.87	1.07	118.477°W	34.336°N	214.10	3.31
San Gabriel [1]		4.21	7.34	0.45	118.432°W	34.380°N	205.05	3.20
Northridge [3]		13.46	7.44	1.07	118.450°W	34.322°N	198.33	1.53
Mission Hills 2011 [0]		12.73	7.15	1.25	118.455°W	34.287°N	195.12	1.36
UC33brAvg_FM31	System							30.90
San Andreas (Mojave S) [3]		25.43	8.03	1.31	118.296°W	34.619°N	25.13	7.80
Sierra Madre (San Fernando) [2]		8.83	7.56	0.80	118.421°W	34.312°N	183.45	5.83
Santa Susana alt 1 [0]		10.67	7.31	0.99	118.494°W	34.334°N	220.22	4.96
San Gabriel [1]		4.21	7.21	0.53	118.432°W	34.380°N	205.05	3.93
Northridge [3]		13.46	7.42	1.08	118.450°W	34.322°N	198.33	1.79
Mission Hills 2011 [0]		12.73	6.47	1.69	118.455°W	34.287°N	195.12	1.62
UC33brAvg_FM32 (opt)	Grid							14.26
PointSourceFinite: -118.414, 34.426		5.22	5.59	1.49	118.414°W	34.426°N	0.00	4.16
PointSourceFinite: -118.414, 34.426		5.22	5.59	1.49	118.414°W	34.426°N	0.00	4.16
PointSourceFinite: -118.414, 34.489		9.08	5.80	1.70	118.414°W	34.489°N	0.00	1.02
PointSourceFinite: -118.414, 34.489		9.08	5.80	1.70	118.414°W	34.489°N	0.00	1.02
UC33brAvg_FM31 (opt)	Grid							13.79
PointSourceFinite: -118.414, 34.426		5.21	5.61	1.48	118.414°W	34.426°N	0.00	3.71
PointSourceFinite: -118.414, 34.426		5.21	5.61	1.48	118.414°W	34.426°N	0.00	3.71
PointSourceFinite: -118.414, 34.489		9.04	5.82	1.69	118.414°W	34.489°N	0.00	1.20
PointSourceFinite: -118.414, 34.489		9.04	5.82	1.69	118.414°W	34.489°N	0.00	1.20

Sand Canyon Country Club
September 20, 2018
2017-006-021

APPENDIX E

LIQUEFACTION CALCULATIONS

GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

GENERAL INPUT DATA FOR THE SITE

LIQUEFACTION POTENTIAL AND SEISMIC SETTLEMENT EVALUATIONS

R. T. Frankian & Associates				Geotechnical Engineering Consultants			
PROJECT:	**Tentative Tract Map 78248**			Sand Canyon Country Club			Vista Canyon Ranch, LLC
Job No.:	**2017-014-001**			Calculated By.:	awr	Date:	9/20/2018
				Checked By:		Date	

Location (Boring No.)	HS-1	**Surcharge**	0.00	ksf	Ref. Earthquake Magnitude	7.5	
Type of Sampler (SPT/Other)	Various				Approx. Distance From Site		(optional)
Ground Surface Elevation	1591	ft. MSL (assumed?)			Site Earthquake Magnitude	6.9	
Existing Ground Water Depth	52	ft.(Minimum 0.1ft. below GL)			Peak Ground Accel (M = 7.5)	0.77	g.<<Calculated by program (=K10/M11), or entered by user.
					PGA (for site M = 6.9)	0.95	g
Historic High Ground Water Depth	15	ft.(Minimum 0.1ft. below GL)			Magnitude Scaling Factors (MSF)	1.0 (M=7.5)	1.24 <<<Calculated by program. (M= 6.9)

Agency-Required Factor of Safety (FS) to classify layers as "liquefiable": (min. 1.0)	
(enter 1 if no special agency-required FS, or enter your selection)>>>>	1.3

LiqueBrngb[nls]

PROGRAM

EQLIQUE & SETTLE2©

April 2005

613 W. Padilla Street, San Gabriel, CA. 91776

Fax & Phone (626) 308-1665 Cellular: (858) 220-3000; (909) 533-0504

For Order Form please send e-mail to: **applgeo@aol.com OR eguares@hotmail.com**

COMPUTER PROGRAM: "EQLique&Settle2"©

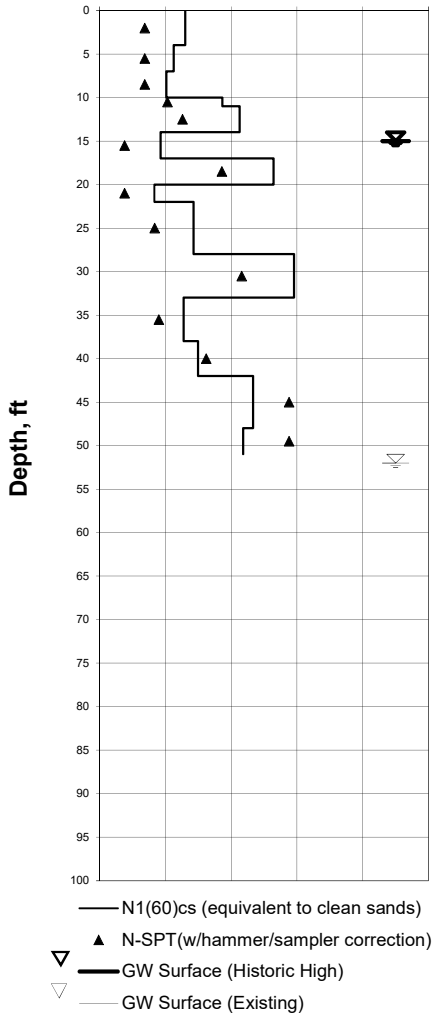
Location……. **HS-1** **Surcharge** 0.00 ksf

Elevation (MSL) (ft) 1591

NOTE: If the total settlement is very small (e.g.<0.05"), it will not be seen due to the scale used, and should be reported as "negligible".

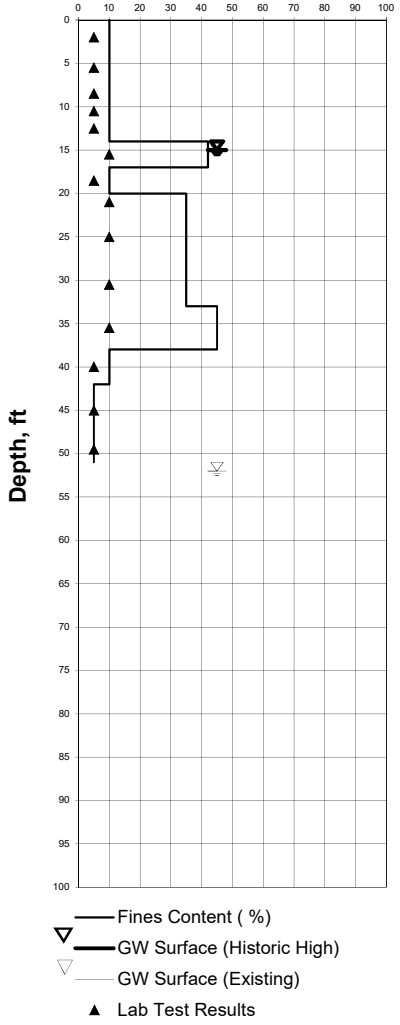
(a)

Blow Count



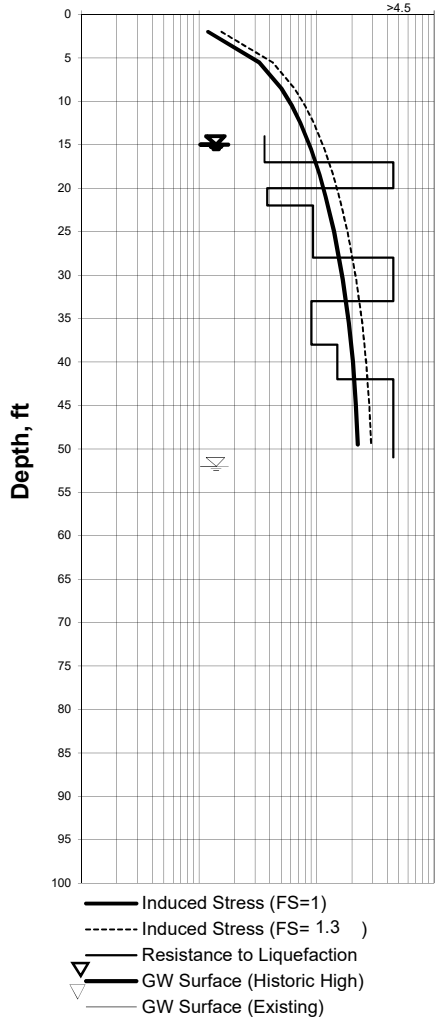
(b)

Fines Content (%)



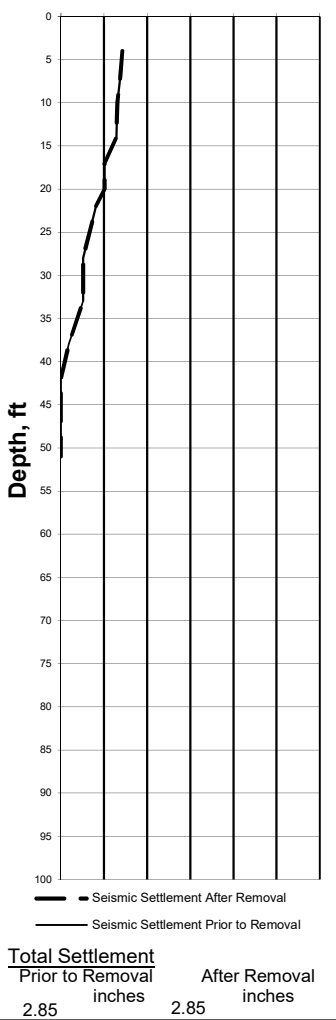
(c)

Stress or Resistance (ksf)



(d)

Cumulative Settlement of Layers (from bottom), inch



Total Settlement

Prior to Removal inches	After Removal inches
2.85	2.85

Removal & Recomp. Depth (ft) = 0

PROJECT: Tentative Tract Map 78248
Sand Canyon Country Club

Vista Canyon Ranch, LLC

Weighted Ground Accel. (M=7.5) = 0.77 g

Site Magnitude = 6.9

R. T. Frankian & Associates
Geotechnical Engineering Consultants

Job No.:	2017-014-001
Date:	9-20-2018
Figure No.	0

GENERAL INPUT DATA FOR THE SITE

LIQUEFACTION POTENTIAL AND SEISMIC SETTLEMENT EVALUATIONS

R. T. Frankian & Associates				Geotechnical Engineering Consultants			
PROJECT:	**Tentative Tract Map 78248**			Sand Canyon Country Club			Vista Canyon Ranch, LLC
Job No.:	**2017-014-001**			Calculated By.:	awr	Date:	9/20/2018
				Checked By:		Date	

Location (Boring No.)	B-16 G	**Surcharge**	0.00	ksf	Ref. Earthquake Magnitude	7.5	
Type of Sampler (SPT/Other)	Various				Approx. Distance From Site		(optional)
Ground Surface Elevation	1593	ft. MSL (assumed?)			Site Earthquake Magnitude	6.9	
Existing Ground Water Depth	37	ft.(Minimum 0.1ft. below GL)			Peak Ground Accel (M = 7.5)	0.77	g.<<Calculated by program (=K10/M11), or entered by user.
					PGA (for site M = 6.9)	0.95	g
Historic High Ground Water Depth	15	ft.(Minimum 0.1ft. below GL)			Magnitude Scaling Factors (MSF)	1.0 (M=7.5)	1.24 <<<Calculated by program. (M= 6.9)

Agency-Required Factor of Safety (FS) to classify layers as "liquefiable": (min. 1.0)	
(enter 1 if no special agency-required FS, or enter your selection)>>>>	1.3

LiqueBrngb[nls]

PROGRAM

EQLIQUE & SETTLE2©

April 2005

613 W. Padilla Street, San Gabriel, CA. 91776

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For Order Form please send e-mail to: **applgeo@aol.com OR eguares@hotmail.com**

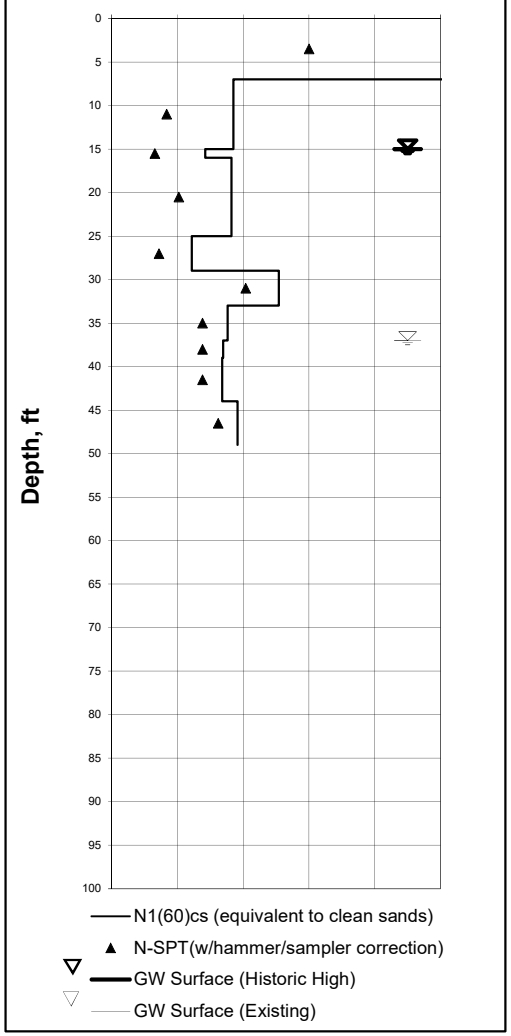
COMPUTER PROGRAM: "EQLique&Settle2"©

Location……. **B-16 G** **Surcharge** 0.00 ksf

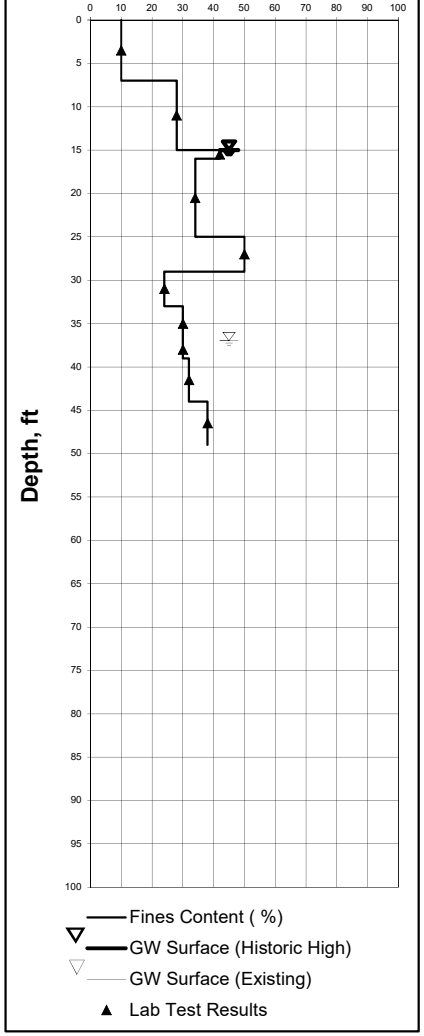
Elevation (MSL) (ft) 1593

NOTE: If the total settlement is very small (e.g.<0.05"), it will not be seen due to the scale used, and should be reported as "negligible".

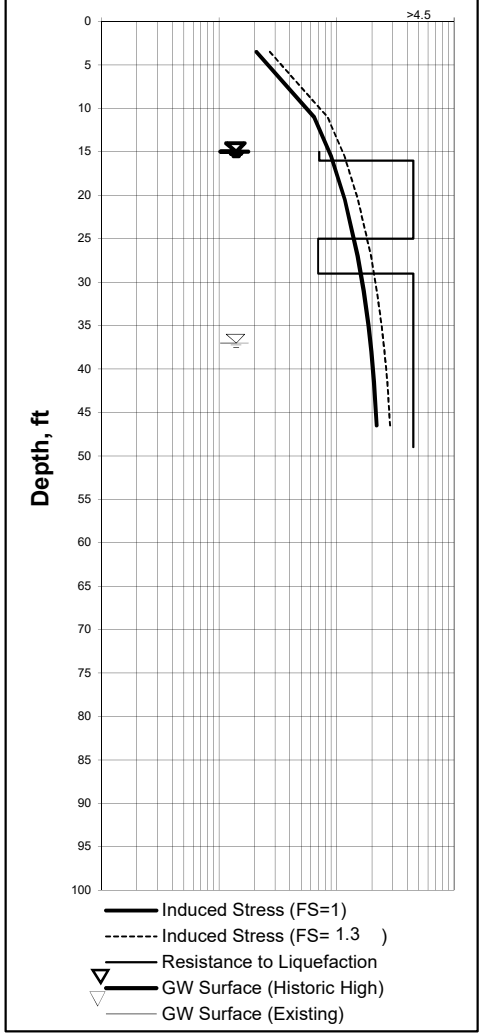
(a)



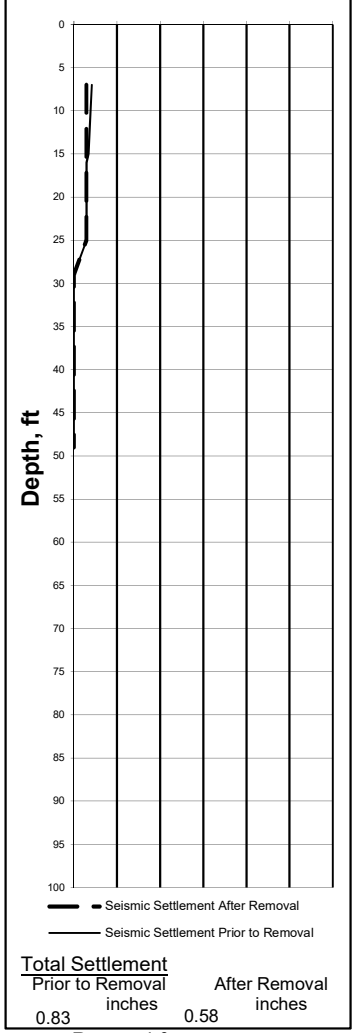
(b)



(c)



(d)



Total Settlement

Prior to Removal inches	After Removal inches
0.83	0.58

Removal & Recomp. Depth (ft) = 16

PROJECT: Tentative Tract Map 78248 Sand Canyon Country Club Vista Canyon Ranch, LLC	Weighted Ground Accel. (M=7.5) = 0.77 g Site Magnitude = 6.9	**R. T. Frankian & Associates** **Geotechnical Engineering Consultants**

Job No.:	2017-014-001
Date:	9-20-2018
Figure No.	0