GEOTECHNICAL ENGINEERING STUDY UPDATE
FOR
MONTANO DE ELDORADO PHASE II
Latrobe Road
El Dorado Hills, California

Project No. E01414.001
June 2017

YOUNGDAHL
CONSULTING GROUP, INC.

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El Dorado Hills, California 95762

Project No. E01414.001
29 June 2017

Attention: Mr. Vinal Perkins

Subject: **MONTANO DE EL DORADO PHASE II**
Latrobe Road, El Dorado Hills, California
GEOTECHNICAL ENGINEERING STUDY UPDATE

References:
1. Proposal and Executed Contract for Montano III, prepared by Youngdahl Consulting Group, Inc., dated 6 June 2017 (Project No. PE15-208.000).
2. Refraction Seismic Investigation at the Latrobe & White Rock Road Site APN 107-001-016 prepared by Gasch and Associates, Dated September 2001 and revised July 2015.
3. Limited Rock Aggregate Study prepared by Youngdahl Consulting Group, Inc, dated 17 October 2001.
4. Geotechnical Engineering Study for Southeast Corner of White Rock and Latrobe Roads, prepared by Youngdahl Consulting Group, Inc, dated 26 April 2004.
5. Preliminary Site Plans prepared by RFE Engineering dated 23 November 2017.

Dear Mr. Perkins,

In accordance with your authorization, Youngdahl Consulting Group, Inc. has performed a Geotechnical Engineering Study Update for the project site located on the adjoining parcel south of Montano De El Dorado Phase 1 on Latrobe Road in El Dorado Hills, California. The purpose of this study was to perform a review of previous studies and subsurface explorations and provide geotechnical information and design criteria for the proposed project. Our scope was limited to preparation of this report per the Reference No. 1 proposal.

Based upon our experience at the project site and on our review of the site studies available to us, it is our opinion that the primary geotechnical issues to be addressed consist of addressing excavation of native shallow bedrock conditions and drainage related to the shallow bedrock and other geologic features. Due to the non-uniform nature of soils, other geotechnical issues may become more apparent during grading operations which are not listed above. The descriptions, findings, conclusions, and recommendations provided in this report are formulated as a whole; specific conclusions or recommendations should not be derived or used out of context. Please review the limitations and uniformity of conditions section of this report.

This report has been prepared for the exclusive use of Montano Venture II, LLC and their consultants, for specific application to this project, in accordance with generally accepted geotechnical engineering practice. Should you have any questions or require additional information, please contact our office at your convenience.

Very truly yours,
Youngdahl Consulting Group, Inc.

REGISTERED PROFESSIONAL ENGINEER
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Principal Engineer

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GEOTECHNICAL ENGINEERING STUDY UPDATE
FOR
MONTANO DE EL DORADO PHASE II

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering study update performed for the proposed commercial development planned to be constructed on the southerly adjoining parcel to Montano De El Dorado Phase I along the eastern side of Latrobe Road in El Dorado Hills, California. An annotated vicinity map is provided on Figure A-1 to identify the approximate project location.

Purpose and Scope

The purpose of this study was to review the surface and subsurface conditions at the site, to provide geotechnical information and design criteria, and to develop geotechnical recommendations for the proposed project. The scope of this study includes the following:

- A review of geotechnical and geologic data, including previous studies performed for the site and available to us at the time of our study;
- Engineering analysis of the data and information obtained from prior studies, laboratory testing, and literature review;
- Development of geotechnical recommendations regarding earthwork construction including, site preparation and grading, excavation characteristics, soil moisture conditions, engineered fill criteria, and drainage;
- Development of geotechnical design criteria for seismic conditions, shallow foundations, retaining walls, slabs on grade;
- Preparation of this report summarizing our findings, conclusions, and recommendations regarding the above described information.

Project Understanding

We understand that the proposed development will consist of the construction of a commercial center containing 10 buildings and approximately 124,000 square feet of retail, office, restaurant, and hotel space. The majority of the buildings are generally anticipated to be comprised of single or double story commercial construction of wood frame and or masonry construction and the hotel building is anticipated to be of 4 story wood frame construction. The development is anticipated to be graded with a series of cuts, fills and retaining walls in order to achieve the proposed pad and driveway grades. In general, cuts will be made from the east with engineered fills on the western portions of the pads. Retaining walls are proposed on the east and western perimeter of the site. The site currently is anticipated to have about 140,000 cubic yards of export and about 43,000 cubic yards of engineered fills. Reference No 5. Preliminary site plans were reviewed for preparation of this report.

Background

The prior development of Montano De El Dorado Phase 1 included the construction of Buildings A - E along White Rock Road and Latrobe Roads. Phase I development began grading in 2006. Grading consisted of similar construction as the proposed Phase II with cuts, fills and retaining walls in order to achieve building pad and driveway grades.

If studies or plans pertaining to the site exist and are not cited as a reference in this report, we should be afforded the opportunity to review and modify our conclusions and recommendations as necessary.

2.0 FINDINGS

The following section describes our findings regarding the site conditions based on our review of previous work completed for the site.

Surface Observations

The project site is located along the east side of Latrobe Road just south of the Montano De El Dorado commercial development on the southeast corner of White Rock Road and Latrobe in El Dorado Hills, California. The project site generally fronts residential development to the east, Latrobe Road to the west, and Montano De El Dorado Phase I to the north. The terrain at the project site generally slopes from the northeast to the southwest. The site was observed to be vegetated, with thick seasonal grasses and multiple rock outcrops.

Subsurface Conditions

Our prior field studies to date have included the excavation of 10 test pits on the Phase I project site with and 3 test pits on the Phase II site. All test pits and their approximate locations are shown on Figure A-2, Appendix A. A description of the field exploration is provided in Appendix A.

In general, the test pits in the vicinity of Phase II encountered soils composed silty SAND with gravel in a medium dense condition in the upper 2 to 3 feet. Underlying the native soils, highly weathered, moderately fractured metavolcanic BEDROCK was encountered to the maximum depth explored in each pit. The test pits were terminated when the competent BEDROCK was exposed. A detailed seismic refraction study was performed for the site in 2006 with revised reports provided in 2015 which provided more information regarding subsurface rock conditions and rippability. The bedrock graded highly weathered at the bottom of each pit.

A more detailed description of the subsurface conditions encountered during our subsurface exploration is presented graphically on the “Exploratory Test Pit Logs", Figures A-3 through A-15, Appendix A. These logs show a graphic interpretation of the subsurface profile, and the location and depths at which samples were collected.

Groundwater Conditions

Groundwater conditions were not observed at excavated test pit locations. Generally, subsurface water conditions vary in the foothill regions because of many factors such as, the proximity to bedrock, fractures in the bedrock, topographic elevations, and proximity to surface water. Some evidence of past repeated exposure to subsurface water may include black staining on fractures, clay deposits, and surface markings indicating previous seepage. Based on our experience in the area, at varying times of the year water will likely be perched on less weathered rock and/or present in the fractures and seems of the weathered rock found beneath the site.

Geologic Conditions

The geologic portion of this report included a review of geologic data pertinent to the site and an interpretation of our observations of the surface exposures and our observations in our exploratory test pits excavated during the field study.

The site is located at the foot of the Sierra Foothills region of the Sierra Nevada Mountain Range. According to the 1:250,000 scale Sacramento Quadrangle of the California State Geology map, the project site is underlain by metavolcanic rocks of the Copper Hill formation of the Jurassic Period (Wagner and others, 1987). Weathering of these bedrock materials has contributed largely to the overburden soils on the subject site.

Seismicity
According to the Fault Activity Map of California and Adjacent Areas (Jennings, 2010) and the Peak Acceleration from Maximum Credible Earthquakes in California (CDMG, 2007), no active faults or Earthquake Fault Zones (Special Studies Zones) are located on the project site. Additionally, no evidence of recent or active faulting was observed during our previous field studies.

Based on our literature review of shear-wave velocity characteristics of geologic units in California (Wills and Silva; August 1998: Earthquake Spectra, Volume 14, No. 3) and subsurface interpretations, we recommend that the project site be classified as Site Class C in accordance with Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10.

Earthquake Induced Liquefaction, Surface Rupture Potential, and Settlement
Liquefaction is the sudden loss of soil shear strength and sudden increase in porewater pressure caused by shear strains, as could result from an earthquake. Research has shown that saturated, loose to medium-dense sands with a silt content less than about 25 percent and located within the top 40 feet are most susceptible to liquefaction and surface rupture/lateral spreading.

Due to the absence of permanently elevated groundwater table, the relatively low seismicity of the area and the relatively shallow depth to rock, the potential for seismically induced damage due to liquefaction, surface ruptures, and settlement is considered negligible. For the above-mentioned reasons mitigation for these potential hazards is not required for the development of this project.

Static and Earthquake Induced Slope Instability
The existing slopes on the project site have been observed to have adequate vegetation on the slope face, appropriate drainage away from the slope face, and no apparent tension cracks or slump blocks in the slope face or at the head of the slope. No other indications of slope instability such as seeps or springs were observed. Additionally, due to the absence of permanently elevated groundwater table, the relatively low seismicity of the area, and the relatively shallow depth to rock, the potential for seismically induced slope instability for the existing slopes is considered negligible.

Laboratory Testing
Laboratory testing of prior collected samples was directed towards determining the physical and engineering properties of the soil underlying the site. A description of the tests performed for this project and the associated test results are presented in Appendix B. In summary, the results of previous testing is provided below:

Table 1: Laboratory Tests

Laboratory Test	Test Standard	Summary of Results	
Direct Shear	ASTM D3080	Bulk A:	Φ = 34.4°, c = 130 psf
Maximum Dry Density	ASTM D1557	Bulk A:	DD = 124.5 pcf, MC = 13.0 %
Maximum Dry Density	ASTM D1557	Bulk 1:	DD = 128.5 pcf, MC = 11.5 %
Maximum Dry Density	ASTM D1557	Bulk 2:	DD = 131.5 pcf, MC = 10.0 %
R-Value	ASTM D1140	Bulk A:	55

Soil Expansion Potential

The materials encountered during our previous work on site generally consisted of non-plastic rock, sand, and silt. The non-plastic materials are generally considered to be non-expansive; therefore, we do not anticipate that special design considerations for expansive soils will be required for the design or construction of the proposed improvements. If necessary, recommendations can be made based on our observations at the time of construction should greater quantities of expansive soils be encountered at the project site which were not encountered during our study.

Naturally Occurring Asbestos

Asbestos is classified by the EPA as a known human carcinogen. Naturally occurring asbestos (NOA) has been identified as a potential health hazard. The California Geological Survey published a map in 2000 (Open File Report 2000-02) that qualitatively indicates the likelihood for NOA in western El Dorado County. The project site is identified as <u>not</u> being in a NOA review zone based on the published map.

3.0 DISCUSSION AND CONCLUSIONS

General

Based upon the results of our field explorations, findings, and analysis described above, it is our opinion that construction of the proposed improvements is feasible from a geotechnical standpoint, provided the recommendations contained in this report are incorporated into the design plans and implemented during construction.

Approach to Development

We anticipate deepest cuts on the order of 25 to 27 feet near the northeast corner of building 3. The deepest fills appear to be behind the retaining walls for buildings 6 and 7 along the Latrobe entrance to the site. These fills and retaining walls appear to be in the magnitude of 14 to 19 feet in height. In general, the development is utilizing retaining walls to terrace the building pads and driveways from northeast to the southwest for development of interior pads as well as perimeter retaining walls along the east to lower the site and west to raise the site. Retaining walls are anticipated to be either mechanically stabilized earth (MSE) walls, concrete or CMU block walls.

The Refraction Seismic Survey performed for the site indicates marginally rippable materials at depths as shallow as 10 to 12 feet in the northeast to southwest direction, and 26 to 28 feet in the northwest to southeast direction. The survey indicates a ridge of hard rock in the northwest to southeast direction that is trending just south of the topographic high along the topographic ridgeline. We anticipate that the direction of ripping will play some role in the ability to rip the bedrock; however, blasting should be anticipated at the site to achieve grades in the deeper cut areas.

During the excavation of materials on site, attention should be paid to materials that could be used for the MSE wall backfills between the geogrid layers so that they can be set aside for later use. Generally, materials that have rocks and gravels that are less than 3 inch in dimension could be used for engineered fills within the reinforced zones of these walls. Depending on the design and grid selection, we have also observed soil fills with up to 6 inch rock placed in the reinforced zone.

Due to the thickness of the fills, the terraced nature of the site, and the potential for pads to contain cuts and fills, increased relative compaction levels to 95 percent are recommended.

Where structural retaining walls composed of either concrete or masonry are proposed, attention to appropriate back drainage of the walls will be important due to the anticipated shallow seepage from perched water conditions in the natural rock. Most cantilever foundations for walls that are creating a level pad surface are relatively flat. Due to the lack of a flow gradient to get water out from behind the walls, we typically recommend under drains periodically along the wall alignments. These drains can then be tied to tight pipes leading to the storm drainage system for the site. Plug and drains in storm drain trenches should also be anticipated to keep trench backfills drained.

4.0 SITE GRADING AND EARTHWORK IMPROVEMENTS

Site Preparation

Preparation of the project site should involve site drainage controls, dust control, clearing and stripping, and exposed grade compaction considerations. The following paragraphs state our geotechnical comments and recommendations concerning site preparation.

Site Drainage Controls: We recommend that initial site preparation involve intercepting and diverting any potential sources of surface or near-surface water within the construction zones. Because the selection of an appropriate drainage system will depend on the water quantity, season, weather conditions, construction sequence, and methods used by the contractor, final decisions regarding drainage systems are best made in the field at the time of construction. All drainage and/or water diversion performed for the site should be in accordance with the Clean Water Act and applicable Storm Water Pollution Prevention Plan.

Dust Control: Dust control provisions should be provided for as required by the local jurisdiction's grading ordinance (i.e. water truck or other adequate water supply during grading).

Clearing and Stripping: Clearing and stripping operations should include the removal of all organic laden materials including trees, bushes, root balls, root systems, and any soft or loose soil generated by the removal operations. Surface grass stripping operations are necessary based upon our observations during our site visit. Short or mowed dry grasses may be pulverized and lost within fill materials provided no concentrated pockets of organics result. It is the responsibility of the grading contractor to remove excess organics from the fill materials. **No more than 2 percent of organic material, by weight, should be allowed within the fill materials at any given location.**

General site clearing should also include removal of any loose or saturated materials within the proposed structural improvement and pavement areas. A representative of our firm should be present during site clearing operations to identify the location and depth of potential fills not disclosed by this report, to observe removal of deleterious materials, and to identify any existing site conditions which may require mitigation or further recommendations prior to site development.

Preserved trees may require tree root protection which should be addressed on an individual basis by a qualified arborist.

Exposed Grade Compaction: Exposed soil grades following initial site preparation activities should be scarified to a minimum depth of 8 inches and compacted to the requirements for engineered fill. Prior to placing fill, the exposed subgrades should be in a firm and unyielding state. Any localized zones of soft or pumping soils observed within a subgrade should either be scarified and recompacted or be overexcavated and replaced with engineered fill as detailed in the engineered fill section below.

Excavation Characteristics
The previous exploratory test pits were excavated using a backhoe equipped with an 18 inch wide bucket. The degree of difficulty encountered in excavating our test pits is an indication of the effort that will be required for excavation during construction. Additionally, a refraction seismic survey was performed in 2001 and then revised in 2015 (see attached in Appendix D). Based on our test pits and the seismic survey, we expect that large dozers such as a D10 and excavators such as Komatsu PC400 or CAT 345 (or equivalent) equipped with special rock excavation/trenching equipment may be more appropriate for excavations up to the depths of the marginally rippable rock.

Where hard rock cuts in fractured rock are proposed, the orientation and direction of excavation/ripping will likely play a large role in the rippability of the material as indicated on seismic survey. Blasting should be anticipated in the deeper rock cuts cannot be ruled out. When hard rock is encountered, we should be contacted to provide additional recommendations prior to performing an alternative such as blasting. Water inflow into any excavation approaching the hard rock surface is likely to be experienced in all but the driest summer and fall months.

Soil Moisture Considerations
The near-surface soils may become partially or completely saturated during the rainy season. Grading operations during this time period may be difficult since compaction efforts may be hampered by saturated materials. Therefore, we suggest that consideration be given to the seasonal limitations and costs of winter grading operations on the site. Special attention should be given regarding the drainage of the project site.

If the project is expected to work through the wet season, the contractor should install appropriate temporary drainage systems at the construction site and should minimize traffic over exposed subgrades due to the moisture-sensitive nature of the on-site soils. During wet weather operations, the soil should be graded to drain and should be sealed by rubber tire rolling to minimize water infiltration.

Compaction Equipment
In areas to receive structural fill with rock quantities greater than 30 percent by mass, a Caterpillar 825 steel-wheel compactor or approved equivalent should be employed as a minimum to facilitate breakdown of oversize bedrock materials and generation of soil fines during the fill placement process. If the quantity of rock fragments in the fills precludes traditional compaction testing, then the proposed fills should be compacted using method specifications as indicated below.

Due to the significant quantity of rock materials that will comprise a majority of the fills on the project site, a Caterpillar 825 steel-wheel compactor or approved equivalent should be employed as a minimum to facilitate breakdown of oversize bedrock materials and generation of soil fines during the fill placement process. If the quantity of rock fragments in the fills precludes traditional

compaction testing, then the proposed fills should be compacted using method specifications as indicated in the Engineered Fill Criteria section below.

In focused or isolated areas where significant rock quantities will not be present, we anticipate that a large vibratory padded drum compactor or approved equivalent will be capable of achieving the compaction requirements for engineered fill provided the soil is placed and compacted within 0 to 3 percent of the optimum moisture content as determined by the ASTM D1557 test method and in lifts not greater than 12 inches in uncompacted thickness. The use of handheld equipment such as jumping jack or plate vibration compactors may require thinner lifts of 6 inches or less to achieve the desired relative compaction parameters. This type of smaller compaction equipment will likely be necessary in trench configurations or retaining wall backfill areas.

Engineered Fill Criteria
All materials placed as fills on the site should be placed as “Engineered Fill" which is observed, tested, and compacted as described in the following paragraphs.

Suitability of Onsite Materials: We anticipate that a large amount of onsite soils will be generated during mass grading operations and off hauled. We expect that soil generated from excavations on the site, excluding deleterious material, may be used as engineered fill provided the material does not exceed the maximum size specifications listed below.

Import Materials: If imported fill material is needed for this project, import material should be approved by our firm prior to transporting it to the project. It is preferable that import material meet the following requirements:

1. Plasticity index not to exceed 12;
2. An angle of friction equal to or greater than 34 degrees;
3. Should not contain rocks larger than 6 inches in diameter;
4. Not more than 15 percent passing through the No. 200 sieve.

If these requirements are not met, additional testing and evaluation may be necessary to determine the appropriate design parameters for foundations, and other improvements.

Fill Placement and Compaction: All areas proposed to receive fill should be scarified to a minimum depth of 8 inches, moisture conditioned as necessary, and compacted to at least 95 percent of the maximum dry density based on the ASTM D1557 test method. The fill should be placed in thin horizontal lifts not to exceed 12 inches in uncompacted thickness. The fill should be moisture conditioned as necessary and compacted to a relative compaction of not less than 95 percent based on the ASTM D1557 test method. The upper 8 inches of fills placed under proposed pavement areas should be compacted to a relative compaction of not less than 95 percent based on the ASTM D1557 test method. Fill soil compaction should be evaluated by means of in-place density tests performed during fill placement so that adequacy of soil compaction efforts may be determined as earthwork progresses.

Slope Configuration and Grading
The project site is proposed to have cuts and fill with a maximum slope orientation of 2H:1V (Horizontal:Vertical). Generally a cut slope orientation of 2H:1V is considered stable with the material types encountered on the site. A fill slope constructed at the same orientation is considered stable if compacted to the engineered fill recommendations as stated in the recommendations section of this report. All slopes should have appropriate drainage and vegetation measures to minimize erosion of slope soils.

Surficial stability of steeper cut slopes may be achievable due to the geology of the cut materials. Steepening of slopes greater than 2H:1V will require design and observation during the proposed cut. Any slope excavations proposed to be greater than 10 feet in maximum height should be evaluated during and prior to completion of site grading for stability.

Placement of Fills on Slopes: Placement of fill material on natural slopes should be stabilized by means of keyways and benches. Where the slope of the original ground equals or exceeds 5H:1V, a keyway should be constructed at the base of the fill. The keyway should consist of a trench excavated to a depth of at least two feet into firm, competent materials. The keyway trench should be at least 10 feet wide or as designated by our firm based on the conditions at the time of construction. Benches should be cut into the original slope as the filling operation proceeds. Each bench should consist of a level surface excavated at least six feet horizontally into firm soils or four feet horizontally into rock. The rise between successive benches should not exceed 36 inches. The need for subdrainage should be evaluated at the time of construction. Refer to Figure C-1 in Appendix C for typical keyway and bench construction.

Slope Face Compaction: All slope fills should be laterally overbuilt and cut back such that the required compaction is achieved at the proposed finish slope face. As a less preferable alternative, the slope face could be track walked or compacted with a wheel. If this second alternative is used, additional slope maintenance may be necessary.

Slope Drainage: Surface drainage should not be allowed to flow uncontrolled over any slope face. Adequate surface drainage control should be designed by the project civil engineer in accordance with the latest applicable edition of the CBC. All slopes should have appropriate drainage and vegetation measures to minimize erosion of slope soils.

Underground Improvements

Trench Excavation: Trenches or excavations in soil should be shored or sloped back in accordance with current OSHA regulations prior to persons entering them. Where clay rind in combination with moist conditions is encountered in fractured bedrock, the project engineering geologist should be consulted for appropriate mitigation measures. The potential use of a shield to protect workers cannot be precluded. Refer to the Excavation Characteristics section of Site Grading and Improvements of this report for anticipated excavation conditions.

Backfill Materials: Backfill materials for utilities should conform to the requirements of the local jurisdiction. It should be realized that permeable backfill materials will likely carry water at some time in the future.

When backfilling within structural footprints, compacted low permeability materials are recommended to be used a minimum of 5 feet beyond the structural footprint to minimize moisture intrusion. If the materials are too rocky, they may need to be screened prior to backfill in order to limit pipe damage. If a permeable material is used as backfill within this zone, subdrainage mitigation may be required. In addition, if the structure is oriented below the roadway and associated utilities, grout cutoffs and/or plug and drains around all utility penetrations are useful to keep moisture out from underneath the structure.

Backfill Compaction: Backfill compaction should conform to the requirements of the local jurisdiction. Where backfill compaction is not specified by the local jurisdiction, the backfill should be compacted to a minimum of 90 percent relative compaction per the ASTM D1557 test method. Compaction should be accomplished using lifts which do not exceed 12 inches when compacting with a backhoe or larger equipment equipped with a compaction wheel. However, thickness of

the lifts should be determined by the contractor. If the contractor can achieve the required compaction using thicker lifts, the method may be judged acceptable based on field verification by a representative of our firm using standard density testing procedures. Lightweight compaction equipment may require thinner lifts to achieve the required densities.

Drainage Considerations: In developments with the potential for a perched groundwater condition (i.e. shallow bedrock), underground utilities can become collection points for subsurface water. Due to this condition, we recommend plug and drains within the utility trenches (Figure C-2, Appendix C) to collect and convey water to the storm drain system or other approved outlet. Temporary dewatering measures may be necessary and could include the installation of submersible pumps and/or point wells. Once plans are developed, the civil engineer should coordinate with us to discuss the locations of plug and drains.

5.0 DESIGN RECOMMENDATIONS

Seismic Criteria

Based on the 2016 California Building Code, Chapter 16, and our site investigation findings, the following seismic parameters are recommended from a geotechnical perspective for structural design. The final choice of design parameters, however, remains the purview of the project structural engineer.

Table 2: Seismic Design Parameters

2016 CBC	ASCE 7-10	Seismic Parameter	Recommended Value
	Table 20.3-1	Site Class	C
Figure 1613.3.1(1)		Short-Period MCE at 0.2s, S_S	0.458g
Figure 1613.3.1(2)		1.0s Period MCE, S_1	0.236g
Table 1613.3.3(1)		Site Coefficient, F_a	1.200
Table 1613.3.3(2)		Site Coefficient, F_v	1.564
Equation 16-37		Adjusted MCE Spectral Response Parameters, $S_{MS} = F_a S_s$	0.550g
Equation 16-38		Adjusted MCE Spectral Response Parameters, $S_{M1} = F_v S_1$	0.369g
Equation 16-39		Design Spectral Acceleration Parameters, $S_{DS} = ⅔ S_{MS}$	0.367g
Equation 16-40		Design Spectral Acceleration Parameters, $S_{D1} = ⅔ S_{M1}$	0.246g
Table 1613.3.5(1)		Seismic Design Category (Short Period), Occupancy I to III	C
Table 1613.3.5(1)		Seismic Design Category (Short Period), Occupancy IV	D
Table 1613.3.5(2)		Seismic Design Category (1-Second Period), Occupancy I to III	D
Table 1613.3.5(2)		Seismic Design Category (1-Second Period), Occupancy IV	D
	Figure 22-7	Maximum Considered Earthquake Geometric Mean (MCE_C) PGA	0.144g
	Table 11.8-1	Site Coefficient F_{PGA}	1.200
	Equation 11.8-1	$PGA_M = F_{PGA}$ PGA	0.173g

*Based on the online calculator available at http://earthquake.usgs.gov/designmaps/us/application.php

Shallow Conventional Foundations

We offer the following comments and recommendations for purposes of design and construction of shallow continuous and/or isolated pad foundations. The provided minimums do not constitute a structural design of foundations which should be performed by the structural engineer. Our firm should be afforded the opportunity to review the project grading and foundation plans to confirm the applicability of the recommendations provided below. Modifications to these recommendations may be made at the time of our review. In addition to the provided recommendations, foundation design and construction should conform to applicable sections of the 2016 California Building Code.

Continuous Foundation Bearing Capacities: An allowable dead plus live load bearing pressure of 3,000 psf may be used for design of conventional shallow foundations based on firm native soils or engineered fills and 4,000 for foundation based on weathered bedrock. The allowable pressures are for support of dead plus live loads and may be increased by 1/3 for short-term wind and seismic loads.

Foundation Lateral Pressures: Lateral forces on structures may be resisted by passive pressure acting against the sides of shallow footings and/or friction between the soil and the bottom of the footing. For resistance to lateral loads, a friction factor of 0.4 may be utilized for sliding resistance at the base of conventional shallow foundations in firm native materials or engineered fill and 0.45 pcf for weathered rock. A passive resistance of 400 pcf equivalent fluid weight may be used against the side of conventional shallow footings in firm native soil or engineered fill and 450 pcf for weathered bedrock conditions. If friction and passive pressures are combined, the lesser value should be reduced by 50 percent.

Foundation Settlement: A total settlement of less than 1 inch is anticipated; a differential settlement of ½ of the total is anticipated where foundations are bearing on like materials. This settlement is based upon the assumption that foundation will be sized and loaded in accordance with the recommendations in this report.

Foundation Configuration: Conventional shallow foundations should be a minimum of 12 inches wide and founded a minimum of 18 inches below the lowest adjacent soil grade for commercial structures. Isolated pad foundation should be a minimum of 24 inches in diameter. The hotel foundations are anticipated to be 24 inches minimum depth due to the number of floors supported.

Foundation reinforcement should be provided by the structural engineer. The reinforcement schedule should account for typical construction issues such as load consideration, concrete cracking, and the presence of isolated irregularities. At a minimum, we recommend that reinforcing steel for commercial structures should consist of a minimum of four No. 4 reinforcing bars; two each top and bottom at all areas of the foundation.

All footings should be founded below an imaginary 2H:1V plane projected up from the bottoms of adjacent footings and/or parallel utility trenches, or to a depth that achieves a minimum horizontal clearance of 6 feet from the outside toe of the footings to the slope face, whichever requires a deeper excavation.

Subgrade Conditions: Footings should never be cast atop soft, loose, organic, slough, debris, nor atop subgrades covered by ice or standing water. A representative of our firm should be retained to observe all subgrades during footing excavations and prior to concrete placement so that a determination as to the adequacy of subgrade preparation can be made.

Shallow Footing / Stemwall Backfill: All footing/stemwall backfill soil should be compacted to at least 95 percent of the maximum dry density (based on ASTM D1557).

Retaining Walls

Our design recommendations and comments regarding retaining walls for the project site are discussed below.

Foundation Design Parameters: An allowable dead plus live load bearing pressure of 3,000 psf may be used for design of conventional shallow foundations based on firm native soils or engineered fills and 4,000 for foundation based on weathered bedrock. The allowable pressures are for support of dead plus live loads and may be increased by 1/3 for short-term seismic loads.

Foundation Lateral Pressures: Lateral forces on structures may be resisted by passive pressure acting against the sides of shallow footings and/or friction between the soil and the bottom of the footing. For resistance to lateral loads, a friction factor of 0.40 may be utilized for sliding resistance at the base of conventional shallow foundations in firm native materials or engineered fill and 0.45 pcf for weathered rock. A passive resistance of 400 pcf equivalent fluid weight may be used against the side of conventional shallow footings in firm native soil or engineered fill and 450 pcf for weathered bedrock conditions. If friction and passive pressures are combined, the lesser value should be reduced by 50 percent.

Retaining Wall Lateral Pressures: Based on our observations and testing, the retaining wall should be designed to resist lateral pressure exerted from a soil media having an equivalent fluid weight provided in Table 3, below. In accordance with Section 1803.5.12.1 of the 2016 California Building Code, application of the seismic design values for earthquake loading are required for retaining walls supporting more than 6 feet of backfill.

Table 3: Retaining Wall Pressures

Wall Type	Wall Slope Configuration	Equivalent Fluid Weight (pcf)	Surcharge Load (psf)*	Lateral Pressure Coefficient	Earthquake Loading (plf)***	
Free Cantilever	Flat	38	per structural	0.28	$6H^2$	Applied 0.6H above the base of the wall
	2½H:1V	56	per structural	0.41		
Restrained**	Flat	60	per structural	0.44	$19H^2$	

* The surcharge loads should be applied as uniform loads over the full height of the walls as follows: Surcharge Load (psf) = (q) (K), where q = surcharge in psf, and K = coefficient of lateral pressure. Final design is the purview of the project structural engineer.

** Restrained conditions shall be defined as walls which are structurally connected to prevent flexible yielding, or rigid wall configurations (i.e. walls with numerous turning points) which prevent the yielding necessary to reduce the driving pressures from an at-rest state to an active state.

*** Section 1803.5.12 of the 2016 California Building Code states that a determination of lateral pressures on basement and retaining walls due to earthquake loading shall be provided for structures to be designed in Seismic Design Categories D, E or F (Load value derived from Wood (1973) and modified by Whitman (1991)).

Mechanically Stabilized Earth Walls: If keyed or interlocking non-mortared walls such as Keystone, Baselite, Allen Block, or rockery walls are utilized, the following soil parameters would be applicable for design within on-site, native materials:

Table 4: Modular Retaining Wall Design Parameters

Internal Angle of Friction	Cohesion	Bulk Unit Weight
34°	0 psf	125 psf

Site Wall Drainage: The above criteria are based on fully drained conditions as detailed in the attached Figure C-3, Appendix C. For these conditions, we recommend that a blanket of filter material be placed behind all proposed walls. The blanket of filter material should be a minimum of 12 inches thick and should extend from the bottom of the wall to within 12 inches of the ground surface. The filter material should conform to Class One, Type B permeable material as specified in Section 68 of the California Department of Transportation Standard Specifications, current edition. A clean ¾ inch crushed rock is also acceptable, provided filter fabric is used to separate the open graded gravel/rock from the surrounding soils. The top 12 inches of wall backfill should consist of a compacted soil cap. A filter fabric should be placed on top of the gravel filter material to separate it from the soil cap. A 4 inch diameter drain pipe should be installed near the bottom of the filter blanket with perforations facing down. The drainpipe should be underlain by at least 4 inches of filter-type material. An adequate gradient should be provided along the top of the foundation to discharge water that collects behind the retaining wall to a controlled discharge system.

The configuration of a long retaining wall generally does not allow for a positive drainage gradient within the perforated drain pipe behind the wall since the wall footing is generally flat with no gradient for drainage. Where this condition is present, to maintain a positive drainage behind the walls, we recommend that the wall drains be provided with a discharge to an appropriate non-erosive outlet a maximum of 50 feet on center. **In addition, if the wall drain outlets are temporarily stubbed out in front of the walls for future connection during construction, it is imperative that the outlets be routed into the tight pipe area drainage system and not buried and rendered ineffective.**

Basement Wall Drainage: Based on our experience in the project area, excavation into bedrock to create a daylight basement condition may have the potential for creating moisture related problems within the underlying slab on grade areas of the daylight basement (i.e. wet slab conditions associated with seepage through bedrock fractures, perched groundwater, etc.). The following recommendations have been provided to mitigate the potential for the abovementioned moisture related issues.

The configuration of a long retaining wall generally does not allow for a positive drainage gradient within the perforated drain pipe behind the wall since the wall footings are generally flat with no gradient for drainage. Where this condition is present, to maintain positive drainage behind the walls, we recommend that the length of the wall drain be broken up into segments of 20 foot lengths that will allow for drainage outlets within the central portion of the drain segment. To accomplish this, we recommend that the perforated pipe be installed in contact with the top of the footing and sleeved with a tight pipe through the footing as detailed on Figure C-4, Appendix C. The drain should be installed in a trench and directed to a non-erosive outlet. Once the drain enters the footing, the perforated drain pipe should transition to a non-perforated rigid wall pipe. A second perforated pipe should be installed within the trench as detailed on Figure C-4, Appendix C. The trench should be backfilled with crushed rock up to finished pad grade so that it contacts the crushed rock beneath the slab and functions as a slab underdrain system. The drain trenches should be excavated to a depth such that they are below any plumbing trenches, so that any water that may accumulate in those trenches can also be drained.

The final drainage configuration should be addressed prior to the completion of pad grading operations, so that a determination can be made, based on the geotechnical and/or geologic conditions observed, where installation of the wall drain outlets/slab underdrain system would be most beneficial. In addition, pre-excavation of the drainage trenches could be performed with the

large grading equipment on the site. A representative from our firm should be present during these operations to provide additional consultation services as field conditions dictate.

Slab-on-Grade Construction

It is our opinion that soil-supported slab-on-grade floors could be used for the main floors of the commercial structure, contingent on proper subgrade preparation. Often the geotechnical issues regarding the use of slab-on-grade floors include proper soil support and subgrade preparation, proper transfer of loads through the slab underlayment materials to the subgrade soils, and the anticipated presence or absence of moisture at or above the subgrade level. We offer the following comments and recommendations concerning support of slab-on-grade floors. The slab design (concrete mix, reinforcement, joint spacing, moisture protection, and underlayment materials) is the purview of the project Structural Engineer.

Slab Subgrade Preparation: All subgrades proposed to support slab-on-grade floors should be prepared and compacted to the requirements of engineered fill as discussed in the Site Grading and Improvements section of this report.

Slab Underlayment: As a minimum for slab support conditions, the slab should be underlain by a minimum 4 inch crushed rock layer and covered by a minimum 10-mil thick moisture retarding plastic membrane. An optional 1 inch blotter sand layer above the plastic membrane is sometimes used to aid in curing of the concrete in commercial structures. The blotter layer can become a reservoir for excessive moisture if inclement weather occurs prior to pouring the slab, excessive water collects in it from the concrete pour, or an external source of water enters above or bypasses the membrane. The membrane may only be functional when it is above the vapor sources. The bottom of the crushed rock layer should be above the exterior grade to act as a capillary break and not a reservoir, unless it is provided with an underdrain system. The slab design and underlayment should be in accordance with ASTM E1643 and E1745.

If the blotter sand layer is omitted (as may be required if slab design and construction is to be performed according to the 2016 Green Building Code), special wet curing procedures will be necessary. In all cases, development of appropriate slab mix design and curing procedures remains the purview of the project structural engineer.

Slab Moisture Protection: Due to the potential for landscape to be present directly adjacent to the slab edge/foundation or for drainage to be altered following our involvement with the project, varying levels of moisture below, at, or above the pad subgrade level should be anticipated. The slab designer should include the potential for moisture vapor transmission when designing the slab. Our experience has shown that vapor transmission through concrete is controlled through slab thickness as well as proper concrete mix design.

It should be noted that placement of the recommended plastic membrane, proper mix design, and proper slab underlayment and detailing per ASTM E1643 and E1745 will not provide a waterproof condition. If a waterproof condition is desired, we recommend that a waterproofing expert be consulted for slab design.

Slab Thickness and Reinforcement: Geotechnical reports have historically provided minimums for slab thickness and reinforcement for general crack control. The concrete mix design and construction practices can additionally have a large impact on concrete crack control. All concrete should be anticipated to crack. As such, these minimums should not be considered to be stand alone items to address crack control, but are suggested to be considered in the slab design methodology.

In order to help control the growth of cracks in interior concrete from becoming significant, we suggest the following minimums. Interior concrete slabs-on-grade not subject to heavy loads should be a minimum of 4 inches thick. A 4 inch thick slab should be reinforced. A minimum of No. 3 deformed reinforcing bars placed at 24 inches on center both ways, at the center of the structural section is suggested. Joint spacing should be provided by the structural engineer. Troweled joints recovered with paste during finishing or "wet sawn" joints should be considered every 10 feet on center. Expansion joint felt should be provided to separate floating slabs from foundations and at least at every third joint. Cracks will tend to occur at recurrent corners, curved or triangular areas and at points of fixity. Trim bars can be utilized at right angle to the predicted crack extending 40 bar diameters past the predicted crack on each side.

Vertical Deflections: Soil-supported slab-on-grade floors can deflect downward when vertical loads are applied, due to elastic compression of the subgrade. For design of concrete floors, a modulus of subgrade reaction of k = 150 psi per inch would be applicable for native soils and engineered fills.

Exterior Flatwork: Exterior concrete flatwork is recommended to have a 4 inch rock cushion. This could consist of vibroplate compacted crushed rock or compacted ¾ inch aggregate baserock.

If exterior flatwork concrete is against the floor slab edge without a moisture separator it may transfer moisture to the floor slab. Expansion joint felt should be provided to separate exterior flatwork from foundations and at least at every third joint. Contraction / groove joints should be provided to a depth of at least 1/4 of the slab thickness and at a spacing of less than 30 times the slab thickness for unreinforced flatwork, dividing the slab into nearly square sections. Cracks will tend to occur at recurrent corners, curved or triangular areas and at points of fixity. Trim bars can be utilized at right angle to the predicted crack extending 40 bar diameters past the predicted crack on each side.

Asphalt Concrete Pavement Design

We understand that asphalt pavements will be used for the associated driveways and parking areas. The following comments and recommendations are given for pavement design and construction purposes. All pavement construction and materials used should conform to applicable sections of the latest edition of the California Department of Transportation Standard Specifications.

Subgrade Compaction: After installation of any underground facilities, the upper 8 inches of subgrade soils under pavements sections should be compacted to a minimum relative compaction of 95 percent based on the ASTM D1557 test method at a moisture content near or above optimum. Aggregate bases should also be compacted to a minimum relative compaction of 95 percent based on the aforementioned test method.

Subgrade Stability: All subgrades and aggregate base should be proof-rolled with a full water truck or equivalent immediately before paving, in order to evaluate their condition. If unstable subgrade conditions are observed, these areas should be overexcavated down to firm materials and the resulting excavation backfilled with suitable materials for compaction (i.e. drier native soils or aggregate base). Areas displaying significant instability may require geotextile stabilization fabric within the overexcavated area, followed by placement of aggregate base. Final determination of any required overexcavation depth and stabilization fabric should be based on the conditions observed during subgrade preparation.

Design Criteria: Critical features that govern the durability of a pavement section include the stability of the subgrade; the presence or absence of moisture, free water, and organics; the fines content of the subgrade soils; the traffic volume; and the frequency of use by heavy vehicles. Soil conditions can be defined by a soil resistance value, or "R-Value," and traffic conditions can be defined by a Traffic Index (TI).

Design Values: The following table provides recommended pavement sections based on the R-Value test (CTM 301) performed on a bulk sample representative of the materials expected to be exposed at subgrade, as well as our experience with similar materials in the area. An R-value of 55 was determined for the silty SANDS tested; however, due to the variability of onsite soils and the potential redistribution of material typically encountered during grading, we used an R-Value of 40 in our design.

Design values provided are based upon properly drained subgrade conditions. Although the R-Value design to some degree accounts for wet soil conditions, proper surface and landscape drainage design is integral in performance of adjacent street sections with respect to stability and degradation of the asphalt. If clay soils are encountered and cannot be sufficiently blended with non-expansive soils, we should review pavement subgrades to determine the appropriateness of the provided sections, and provide additional pavement design recommendations as field conditions dictate. Even minor clay constituents will greatly reduce the design R-Value.

The recommended design thicknesses presented in the following table were calculated in accordance with the methods presented in the Sixth Edition of the California Department of Transportation Highway Design Manual. A varying range of traffic indices are provided for use by the project Civil Engineer for roadway design.

Table 5: Asphalt Pavement Section Recommendations

Design Traffic Indices	Alternative Pavement Sections (Inches)	
	Asphalt Concrete *	Aggregate Base **
4.5	2.5 3.0	4.0 4.0
5.0	2.5 3.0	5.0 4.0
5.5	3.0 3.5	5.5 4.5
6.0	3.0 3.5	6.5 5.5
6.5	3.5 4.0	7.0 6.0
7.0	4.0 4.5	8.0 6.5
8.0	4.5 5.0	9.0 8.0
9.0	5.0 6.0	10.5 9.0

* Asphalt Concrete: must meet specifications for Caltrans Hot Mix Asphalt Concrete
** Aggregate Base: must meet specifications for Caltrans Class II Aggregate Base (R-Value = minimum 78)

Due to the redistribution of materials that occurs during mass grading operations, we should review pavement subgrades to determine the appropriateness of the provided sections.

Portland Cement Concrete Pavement Design

We understand that Portland cement concrete pavements may be considered for various aspects of exterior paving for the site. The American Concrete Institute (ACI) Concrete Pavement Design method (ACI 330R-08) was used for design of the exterior concrete (rigid) pavements at the site. The pavement thicknesses were evaluated based on the soil design parameters provided in the following table.

Table 6: Soil Parameters

Subgrade Soil Description	k, Modulus of Subgrade Reaction*	Base Course
Silty SAND	170 pci	6 inches

* Based on an R-Value of 40 as recommended above and correlated to a k-Value recommended by ACI 330R.

Based on the subgrade soil parameters shown in the above table, the recommended concrete thicknesses for various traffic descriptions are presented in the table below. The recommended thicknesses provided below assume the use of plain (non-reinforced) concrete pavements.

We recommend that the rigid pavement be placed on at least 6 inches of aggregate base compacted to at least 95 percent of the maximum dry density per the ASTM D 1557 test method. From a geotechnical perspective, contraction joints should be placed in accordance with the American Concrete Institute (ACI) recommendations which include providing a joint spacing about 30 times the slab thickness up to a maximum of 10 feet. The joint patterns should also divide the slab into nearly square panels. If increased joint spacing is desired, reinforcing steel should be installed within the pavement in accordance with ACI recommendations. Final determination of steel reinforcement configurations (if used within the pavements) remains the purview of the Project Structural Engineer.

Table 7: Concrete Pavement Section Recommendations

Category	ADTT*	Pavement Traffic Description	Thickness (inches)	
			3000 psi**	4000 psi**
A	1	Car parking areas and access lanes	5.0	4.5
A	10	Autos, pickups, and panel trucks only	5.5	5.0
B	25	Shopping center entrance and service lanes Bus parking areas and interior lanes	6.0	5.5
B	300	Single-unit truck parking areas and interior lanes	7.0	6.0
C	100	Roadway Entrances and Exterior Lanes	7.0	6.5
C	300		7.5	6.5
C	700		7.5	7.0

* Average Daily Truck Traffic
** 28-day concrete compressive strength

Drainage

In order to maintain the engineering strength characteristics of the soil presented for use in this geotechnical engineering study, maintenance of the building pads will need to be performed. This maintenance generally includes, but is not limited to, proper drainage and control of surface and subsurface water which could affect structural support and fill integrity. A difficulty exists in determining which areas are prone to the negative impacts resulting from high moisture conditions due to the diverse nature of potential sources of water; some of which are outlined in the paragraph below. We suggest that measures be installed to minimize exposure to the adverse effects of moisture, but this will not guarantee that excessive moisture conditions will not affect the structure.

Some of the diverse sources of moisture could include water from landscape irrigation, annual rainfall, offsite construction activities, runoff from impermeable surfaces, collected and channeled water, and water perched in the subsurface soils on the bedrock horizon or present in fractures in the weathered bedrock. Some of these sources can be controlled through drainage features installed either by the owner or contractor. Others may not become evident until they, or the effects of the presence of excessive moisture, are visually observed on the property.

Some measures that can be employed to minimize the buildup of moisture include, but are not limited to proper backfill materials and compaction of utility trenches within the footprint of the proposed commercial structures; grout plugs at foundation penetrations; collection and channeling of drained water from impermeable surfaces (i.e. roofs, concrete or asphalt paved areas); installation of subdrain/cut-off drain provisions; utilization of low flow irrigation systems; education to the proposed homeowners of proper design and maintenance of landscaping and drainage facilities that they or their landscaper installs.

Pavement Improvements: At sites built on relatively poor draining soils (i.e. bedrock horizons), prolonged water seepage into pavement sections can result in softening of subgrade soils and subsequent pavement distress. In addition, where shallow bedrock conditions are present, water can become perched on the relatively impermeable bedrock horizon and eventually inundate utility trench backfill. The variable support condition between native soils and compacted trench backfill materials, coupled with prolonged water exposure can lead to subsidence of trench backfill materials if bridging of trench backfill occurs during placement or natural jetting of soils into voids around pipes occurs.

Some measures that can be employed to minimize the saturation of the subgrade and aggregate base materials include, but are not limited to, construction of cut-off drains or moisture barriers alongside the parking lot, around landscape islands, and installation of plug and drain systems within utility trenches. Due to the elusive and discontinuous nature of drainage related issues, a risk based approach should be determined by the developer based on consultation and discussions with the design professionals and the amount of protection of facilities that the developer may want to provide against potential moisture related issues.

Post Construction: All drainage related issues may not become known until after construction and landscaping are complete. Therefore, some mitigation measures may be necessary following site development. Landscape watering is typically the largest source of water infiltration into the subgrade. Given the soil conditions on site, excessive or even normal landscape watering may contribute to groundwater levels rising, which could contribute to moisture related problems and/or cause distress to foundations and slabs, pavements, and underground utilities, as well as creating a nuisance where seepage occurs. On foothill commercial developments constructed with cut/fill pads on shallow bedrock conditions, seepage may not be apparent until post construction. In order to mitigate these conditions additional subdrainage measures may be necessary. Any necessary measures to mitigate observed moisture conditions should be provided on an as requested and site specific basis.

6.0 DESIGN REVIEW AND CONSTRUCTION MONITORING

The design plans and specifications should be reviewed and accepted by Youngdahl Consulting Group, Inc. prior to contract bidding. A review should be performed to determine whether the recommendations contained within this report are still applicable and/or are properly reflected and incorporated into the project plans and specifications.

Construction Monitoring
Construction monitoring is a continuation of the findings and recommendations provided in this report. It is essential that our representative be involved with all grading activities in order for us to provide supplemental recommendations as field conditions dictate. Youngdahl Consulting Group, Inc. should be notified at least two working days before site clearing or grading operations commence, and should observe the stripping of deleterious material, overexcavation of existing fills and provide consultation to the Grading Contractor in the field.

Low Impact Development Standards
Low Impact Development or LID standards have become a consideration for many projects in the region. LID standards are intended to address and mitigate urban storm water quality concerns. These methods include the use of Source Controls, Run-off Reduction and Treatment Controls. For the purpose of this report use of Run-off Reduction measures and some Treatment Controls may impact geotechnical recommendations for the project.

Youngdahl Consulting Group, Inc. did not perform any percolation or infiltration testing for the site as part of the Geotechnical Investigation. A review of soil survey and the data collected from test pits indicate that soils within the project are Hydrologic Soil Group D (low permeability). Based on this condition, use of infiltration type LID methods (infiltration trenches, dry wells, infiltration basins, permeable pavements, etc.) should not be considered without addressing applicable geotechnical considerations/implications. As such, use of any LID measure that would require infiltration of discharge water to surfaces adjacent to structures/pavement or include infiltration type measures should be reviewed by Youngdahl Consulting Group, Inc. during the design process.

Post Construction Monitoring
As described in Post Construction section of this report, all drainage related issues may not become known until after construction and landscaping are complete. Youngdahl Consulting Group, Inc. can provide consultation services upon request that relate to proper design and installation of drainage features during and following site development. In addition, if the development includes use of LID measures maintenance of those features in conformance with the standard of practice and documentation from the designer will be necessary. The impact from infiltration or run-off reduction measures to engineered structures and foundations may not become apparent until after construction. We recommend that all LID measures be inspected and maintained as documented by the designer and if adverse impacts are noted related to the structure or site that Youngdahl Consulting Group, Inc. be retained to review the LID measure and provide additional consulting and options.

7.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. This report has been prepared for the exclusive use of Montano Venture II, LLC and their consultants for specific application to the Montano De El Dorado Phase II project. Youngdahl Consulting Group, Inc. has endeavored to comply with generally accepted geotechnical engineering practice common to the local area. Youngdahl Consulting Group, Inc. makes no other warranty, expressed or implied.

2. As of the present date, the findings of this report are valid for the property studied. With the passage of time, changes in the conditions of a property can occur whether they be due to natural processes or to the works of man on this or adjacent properties. Legislation or the broadening of knowledge may result in changes in applicable standards. Changes outside of our control may cause this report to be invalid, wholly or partially. Therefore, this report should

not be relied upon after a period of three years without our review nor should it be used or is it applicable for any properties other than those studied.

3. Section [A] 107.3.4 of the 2016 California Building Code states that, in regard to the design professional in responsible charge, the building official shall be notified in writing by the owner if the registered design professional in responsible charge is changed or is unable to continue to perform the duties.

   WARNING: Do not apply any of this report's conclusions or recommendations if the nature, design, or location of the facilities is changed. If changes are contemplated, Youngdahl Consulting Group, Inc. must review them to assess their impact on this report's applicability. Also note that Youngdahl Consulting Group, Inc. is not responsible for any claims, damages, or liability associated with any other party's interpretation of this report's subsurface data or reuse of this report's subsurface data or engineering analyses without the express written authorization of Youngdahl Consulting Group, Inc.

4. The analyses and recommendations contained in this report are based on limited windows into the subsurface conditions and data obtained from subsurface exploration. The methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Samples cannot be relied on to accurately reflect the strata variations that usually exist between sampling locations. Should any variations or undesirable conditions be encountered during the development of the site, Youngdahl Consulting Group, Inc. will provide supplemental recommendations as dictated by the field conditions.

5. The recommendations included in this report have been based in part on assumptions about strata variations that may be tested only during earthwork. Accordingly, these recommendations should not be applied in the field unless Youngdahl Consulting Group, Inc. is retained to perform construction observation and thereby provide a complete professional geotechnical engineering service through the observational method. Youngdahl Consulting Group, Inc. cannot assume responsibility or liability for the adequacy of its recommendations when they are used in the field without Youngdahl Consulting Group, Inc. being retained to observe construction. Unforeseen subsurface conditions containing soft native soils, loose or previously placed non-engineered fills should be a consideration while preparing for the grading of the property. It should be noted that it is the responsibility of the owner or his/her representative to notify Youngdahl Consulting Group, Inc., in writing, a minimum of 48 hours before any excavations commence at the site.

6. Our experience has shown that vapor transmission through concrete is controlled through proper concrete mix design. As such, proper control of moisture vapor transmission should be considered in the design of the slab as provided by the project architect, structural or civil engineer. It should be noted that placement of the recommended plastic membrane, proper mix design, and proper slab underlayment and detailing per ASTM E1643 and E1745 will not provide a waterproof condition. If a waterproof condition is desired, we recommend that a waterproofing expert be consulted for slab design.

7. Following site development, additional water sources (i.e. landscape watering, downspouts) are generally present. The presence of low permeability materials can prohibit rapid dispersion of surface and subsurface water drainage. Utility trenches typically provide a conduit for water distribution. Provisions may be necessary to mitigate adverse effects of perched water conditions. Mitigation measures may include the construction of cut-off

systems and/or plug and drain systems. Close coordination between the design professionals regarding drainage and subdrainage conditions may be warranted.

Seepage may be observed emanating from the cut slopes following their excavation during the following rainy season or following development of the areas above the cut. Generally this seepage is not enough flow to be a stability issue to the cut slope, but may be an issue for the owner of the lot at the base of the cut from a surface drainage and standing water (damp spot) standpoint. This amount of water is generally collected easily with landscaping drainage, surface drainage at the toe of the slope, or subsurface toe drains. Recommendations may be provided at the time of observed seepage; however, we recommend that the developer of the property disclose this possibility to future owners.

Table 8: Checklist of Recommended Services

Item Description		Recommended	Not Anticipated
1	Provide foundation design parameters	Included	
2	Review grading plans and specifications	✓	
3	Review foundation plans and specifications	✓	
4	Observe and provide recommendations regarding demolition	✓	
5	Observe and provide recommendations regarding site stripping	✓	
6	Observe and provide recommendations on moisture conditioning removal, and/or recompaction of unsuitable existing soils		✓
7	Observe and provide recommendations on the installation of subdrain facilities	✓	
8	Observe and provide testing services on fill areas and/or imported fill materials	✓	
9	Review as-graded plans and provide additional foundation recommendations, if necessary	✓	
10	Observe and provide compaction tests on storm drains, water lines and utility trenches	✓	
11	Observe foundation excavations and provide supplemental recommendations, if necessary, prior to placing concrete	✓	
12	Observe and provide moisture conditioning recommendations for foundation areas and slab-on-grade areas prior to placing concrete		✓
13	Provide design parameters for retaining walls	Included	
14	Provide finish grading and drainage recommendations	Included	
15	Provide geologic observations and recommendations for keyway excavations and cut slopes during grading	✓	
16	Excavate and recompact all test pits within structural areas	✓	

APPENDIX A

Field Study

Vicinity Map
Site Plan
Logs of Exploratory Test Pits
Soil Classification Chart and Log Exploration

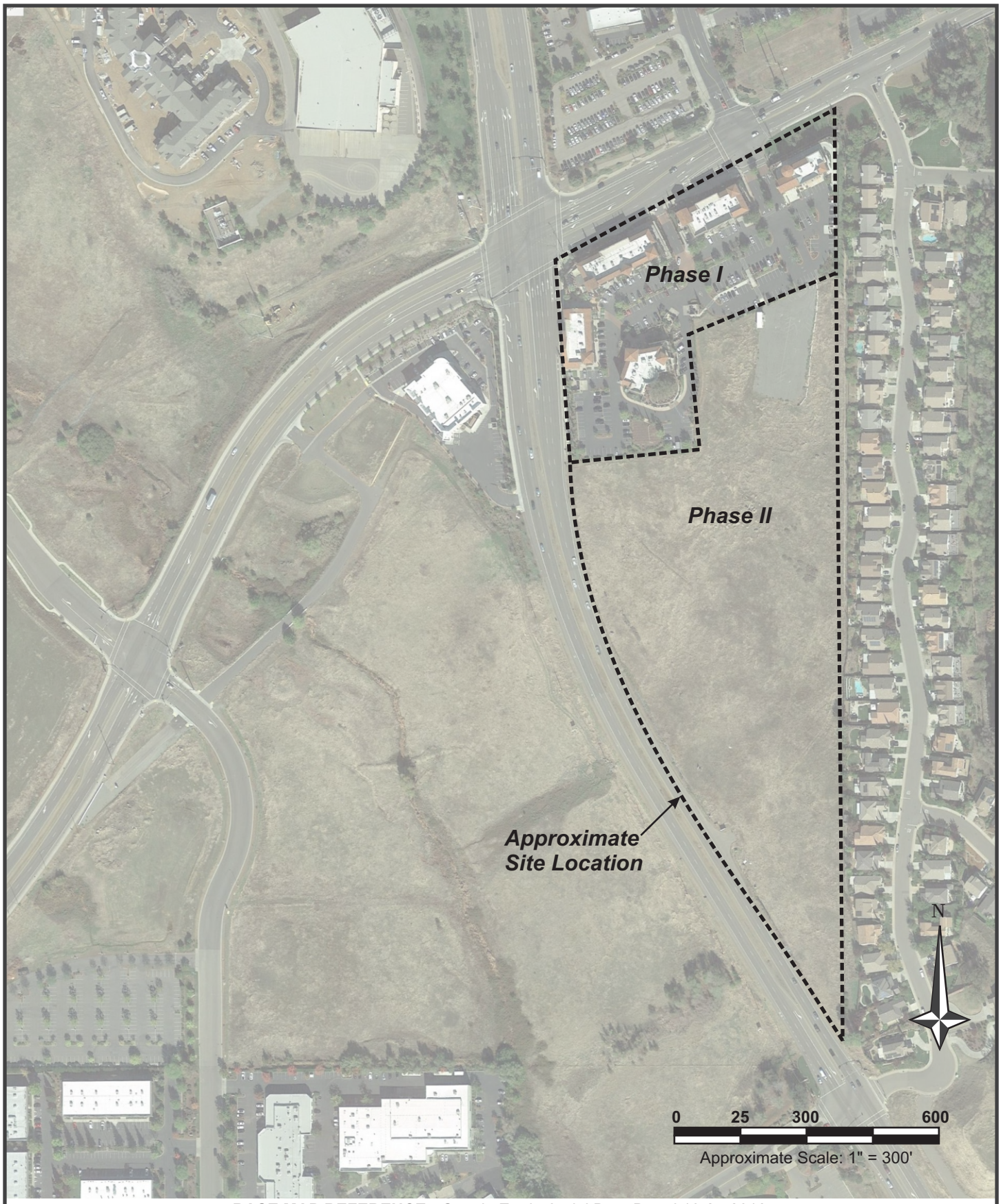
Introduction

The contents of this appendix shall be integrated with the geotechnical engineering study of which it is a part. They shall not be used in whole or in part as a sole source for information or recommendations regarding the subject site.

Our prior field studies included a site reconnaissance by a Youngdahl Consulting Group, Inc. representative followed by subsurface exploration programs, which included the excavation of 13 test pits at the approximate locations shown on Figure A-2, this Appendix. Excavation of the test pits was accomplished with a backhoe equipped with an 18 inch wide bucket. Bulk and bag samples collected from the test pits were returned to our laboratory for further examination and testing.

The Exploratory Test Pit Logs describe the vertical sequence of soils and materials encountered in each test pit, based primarily on our field classifications and supported by our subsequent laboratory examination and testing. Where a soil contact was observed to be gradual, our logs indicate the average contact depth. Our logs also graphically indicate the sample type, sample number, and approximate depth of each soil sample obtained from the test pits.

The soils encountered were logged during excavation and provide the basis for the "Logs of Test Pits", Figures A-3 through A-15, this Appendix. These logs show a graphic representation of the soil profile, the location, and depths at which samples were collected.



BASE MAP REFERENCE: Google Earth, Aerial Data Dated 10-25-2016

YOUNGDAHL CONSULTING GROUP, INC.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING

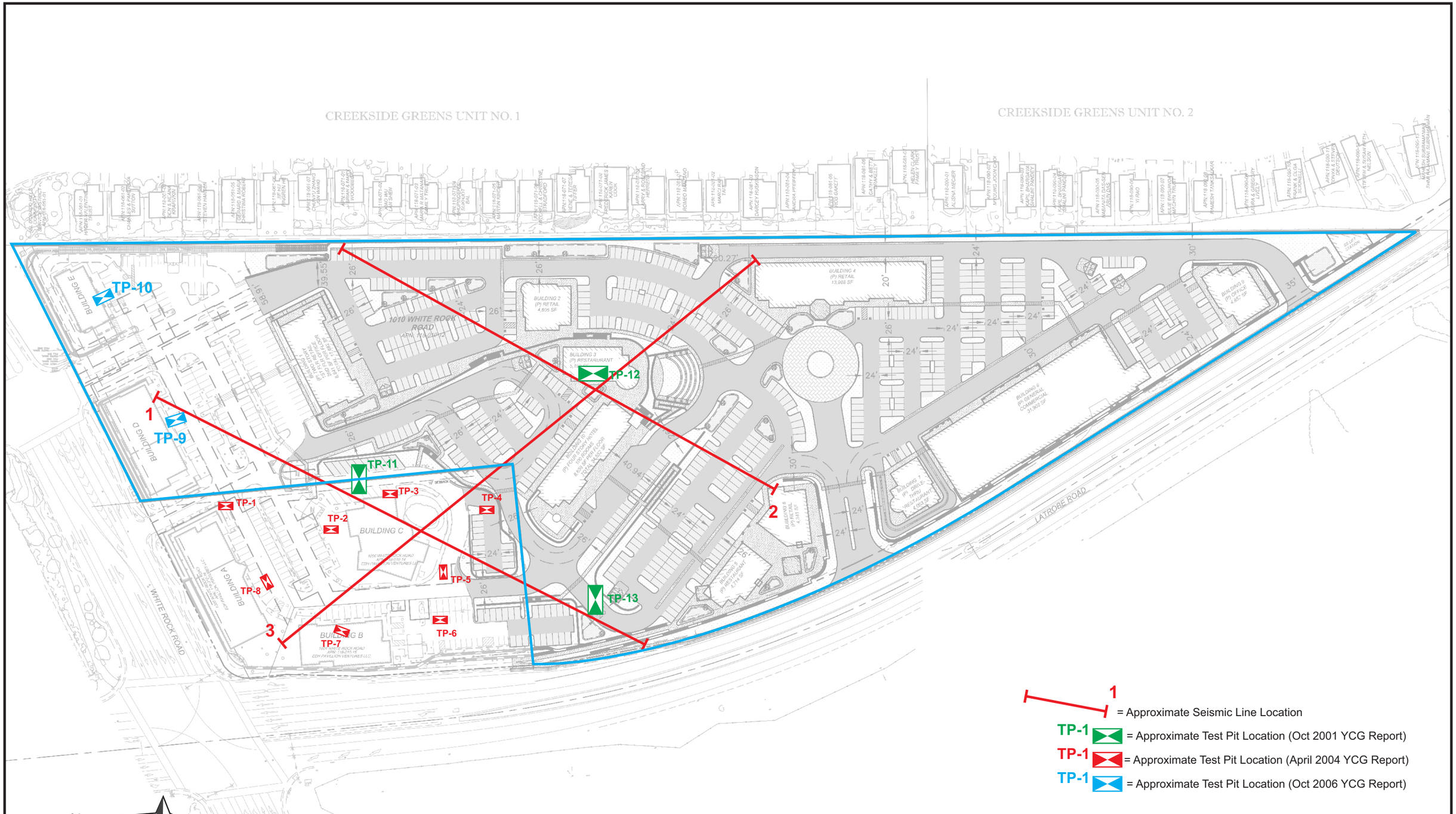
Project No.: E01414.001

June 2017

VICINITY MAP

Montano De El Dorado Phase II
El Dorado Hills, California

FIGURE
A-1



REFERENCE: Preliminary Site Plan, Montano De El Dorado Phase III RFE Engineering, Inc. Sheet C-1, Dated 11/23/2016

YOUNGDAHL CONSULTING GROUP, INC.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING

Project No.: E01414.001

June 2017

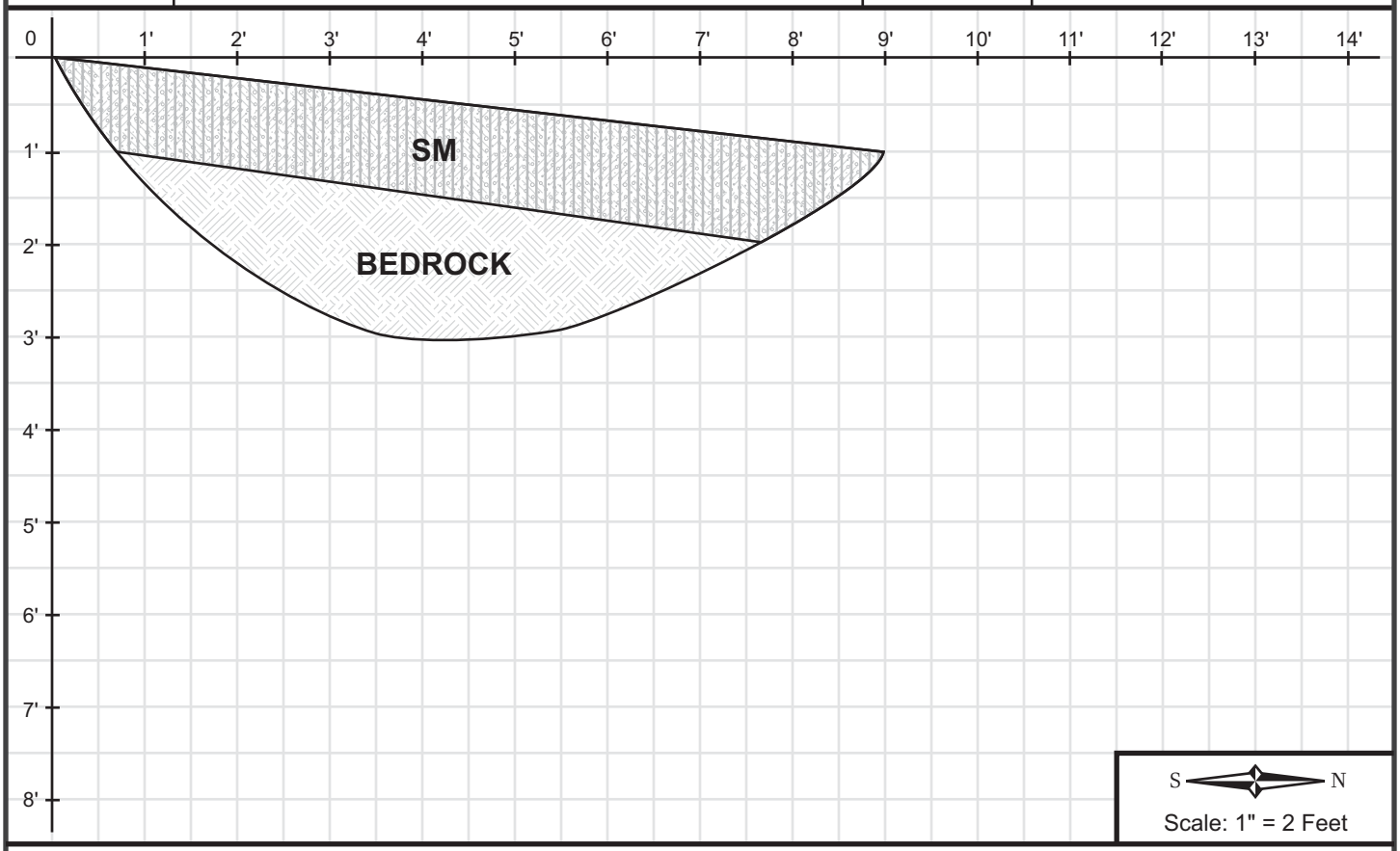
DRAINAGE PLAN

Montano De El Dorado Phase II
El Dorado Hills, California

FIGURE
A-2

Logged By: **KEM**	Date: **6 April 2004**	Elevation: -	Pit No.
Equipment: **John Deere 310SE with 24" Bucket**		Pit Orientation: **S - N**	**TP-1**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 1'	Red brown silty **SAND (SM)** with trace gravel, medium dense, slightly moist	**Bulk 1** @ 0 - 1'	**Field Moisture Density Test @ 0.0'** DD = 101.6 pcf MC = 9.8 %
@ 1' - 3'	Olive metavolcanic **BEDROCK**, highly weathered, indurated, moderately developed foliation, well developed fracturing, slightly moist, minor clay in upper 6"		
	Test pit terminated at 3' (practical refusal, >5 min./ft.) No free groundwater encountered No caving noted		

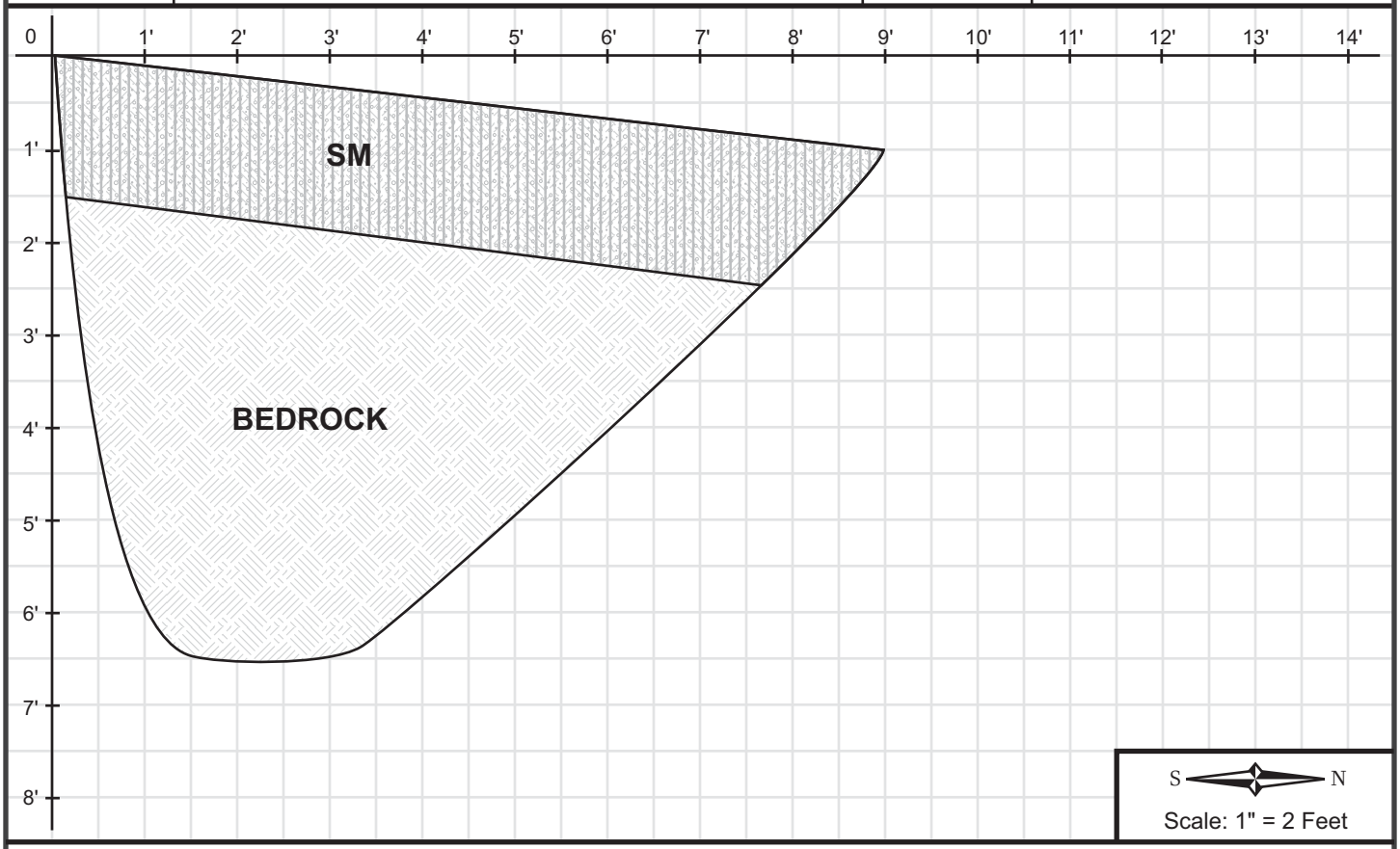


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations, Note, too, that the passage of time may affect conditions at the sampling locations.

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 04084.1 **April 2004**	**EXPLORATORY TEST PIT LOG** **Southeast Corner** **White Rock & Latrobe Roads** El Dorado Hills, California	**FIGURE** **A-3**

Logged By: **KEM**	Date: **6 April 2004**	Elevation: -	Pit No.
Equipment: **John Deere 310SE with 24" Bucket**		Pit Orientation: **S - N**	**TP-2**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 1.5'	Red brown silty **SAND (SM)** with trace gravel, medium dense, slightly moist		**Field Moisture Density Test @ 0.0'** DD = 104.1 pcf MC = 7.1 %
@ 1.5' - 6.5'	Olive metavolcanic **BEDROCK**, highly weathered, indurated, poorly developed foliation, well developed fracturing, slightly moist, minor clay in upper 6"		
	Test pit terminated at 6.5' (practical refusal, >5 min./ft.) No free groundwater encountered No caving noted		

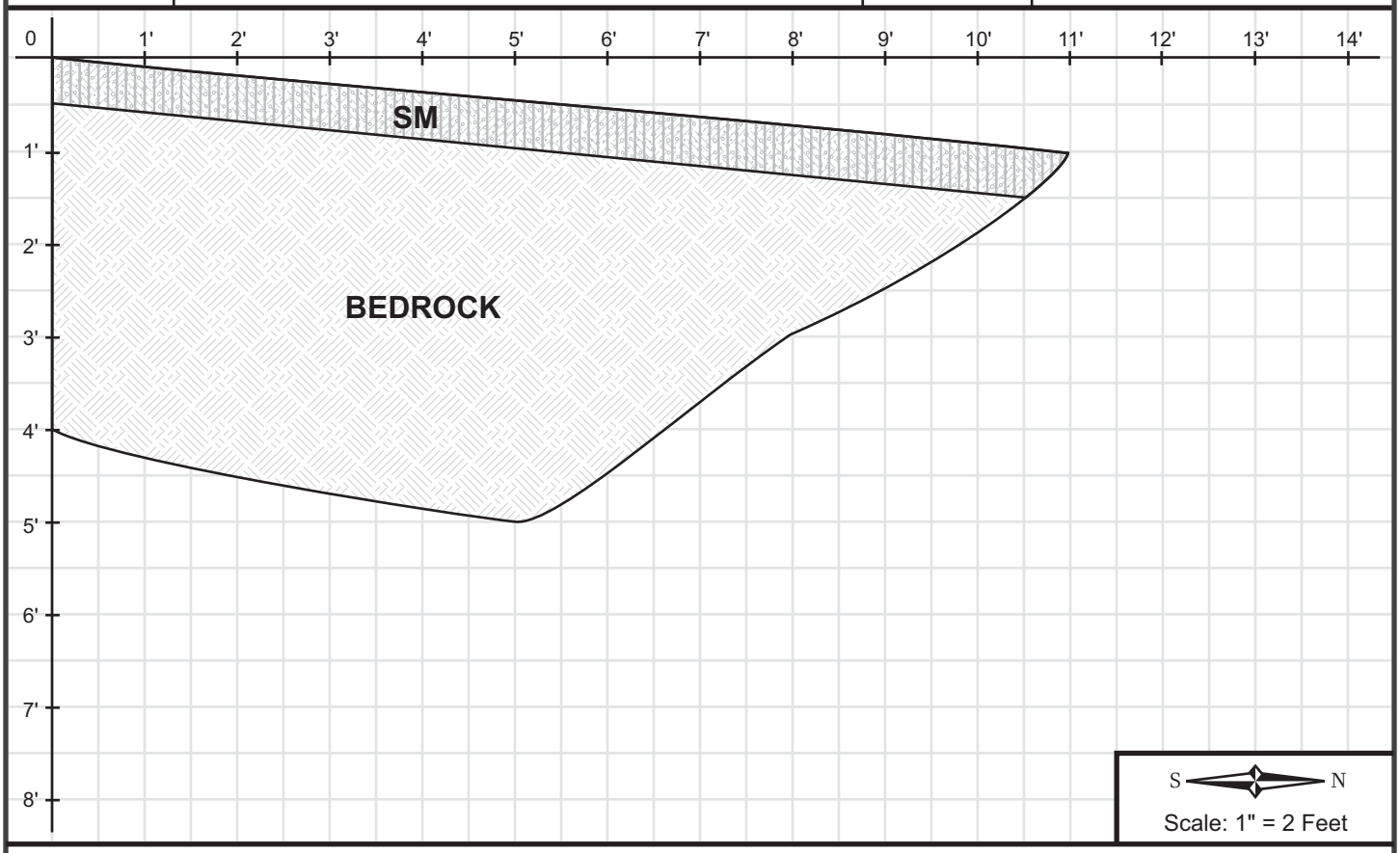


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations, Note, too, that the passage of time may affect conditions at the sampling locations.

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 04084.1 **April 2004**	**EXPLORATORY TEST PIT LOG** **Southeast Corner** **White Rock & Latrobe Roads** El Dorado Hills, California	**FIGURE** **A-4**

Logged By: **KEM**	Date: **6 April 2004**	Elevation: -	Pit No.
Equipment: **John Deere 310SE with 24" Bucket**		Pit Orientation: **S - N**	**TP-3**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 0.5'	Red brown silty **SAND (SM)** with trace gravel, medium dense, slightly moist		
@ 0.5' - 5'	Olive metavolcanic **BEDROCK**, highly weathered, indurated, poorly developed foliation, well developed fracturing, slightly moist		
	Test pit terminated at 5' (practical refusal, >5 min./ft.) No free groundwater encountered No caving noted		

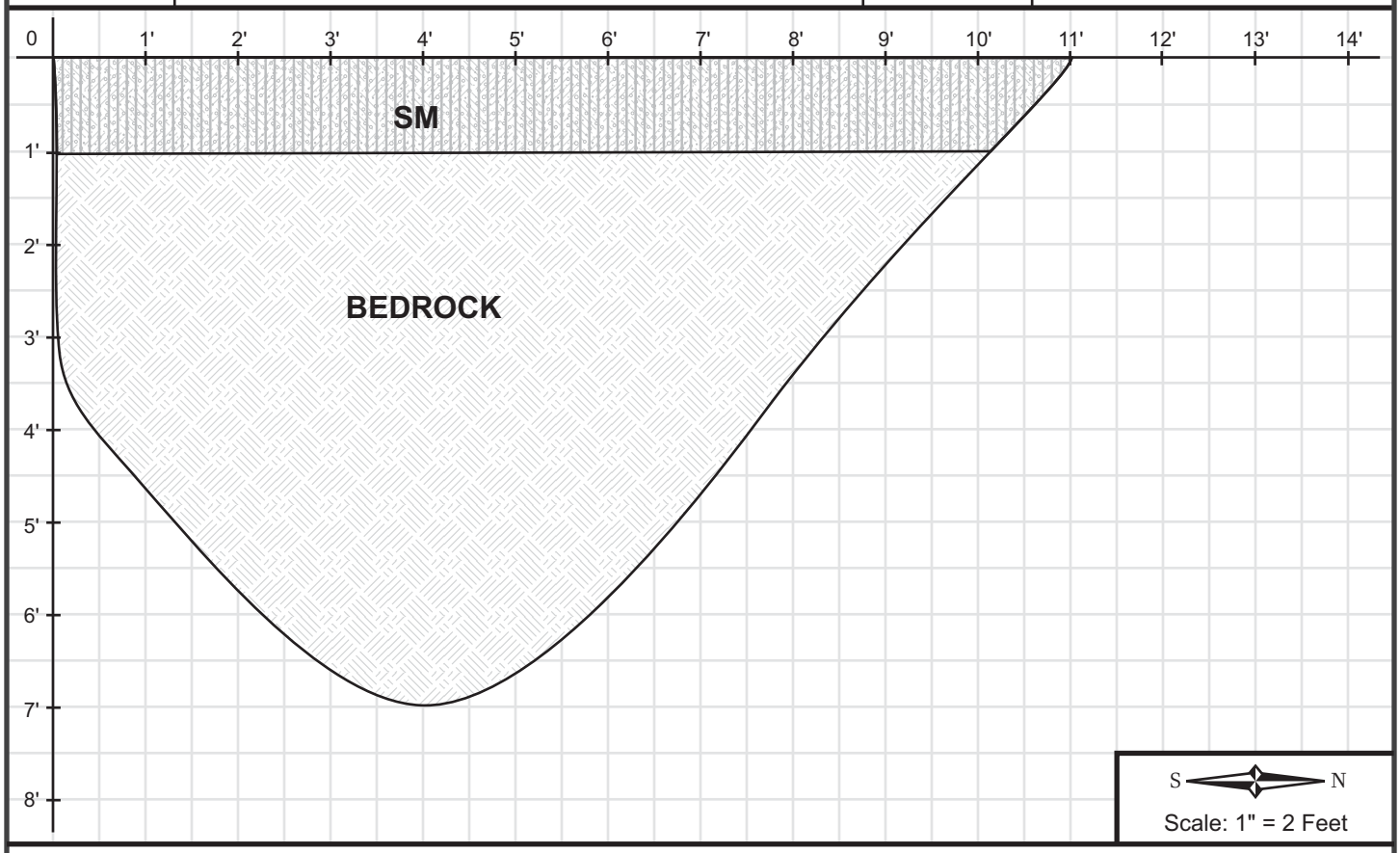


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations, Note, too, that the passage of time may affect conditions at the sampling locations.

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 04084.1 **April 2004**	**EXPLORATORY TEST PIT LOG** **Southeast Corner** **White Rock & Latrobe Roads** El Dorado Hills, California	**FIGURE** **A-5**

Logged By: **KEM**	Date: **6 April 2004**	Elevation: -	Pit No. **TP-4**
Equipment: **John Deere 310SE with 24" Bucket**		Pit Orientation: **S - N**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 1'	Red brown silty **SAND (SM)** with trace gravel, medium dense, slightly moist		
@ 1' - 7'	Olive metavolcanic **BEDROCK**, highly to completely weathered, indurated to moderately indurated, moderately developed foliation, well developed fracturing, slightly moist, minor clay in upper 12"		
	Test pit terminated at 7' (practical refusal, >5 min./ft.) No free groundwater encountered No caving noted		



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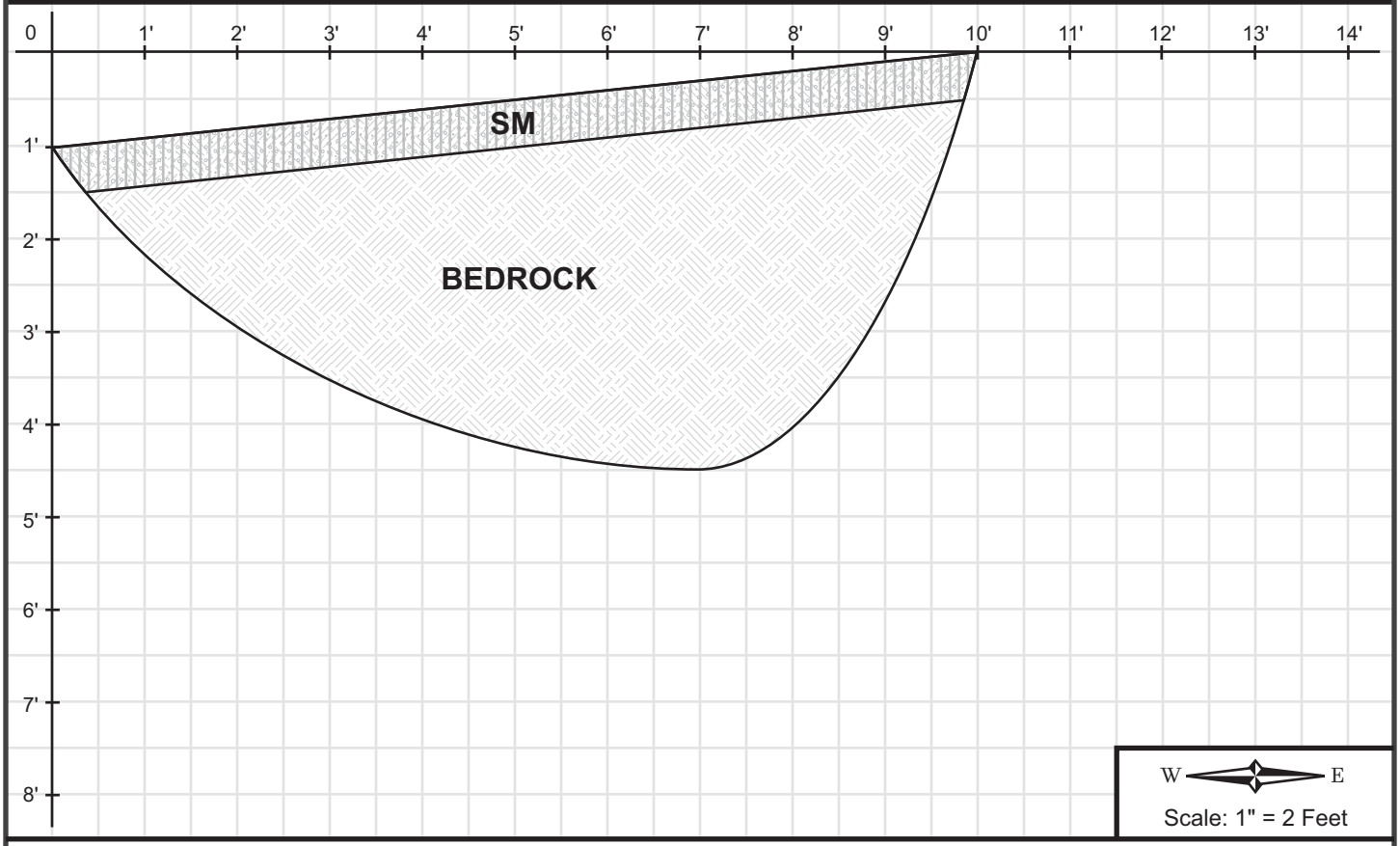
YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 04084.1 **April 2004**	**EXPLORATORY TEST PIT LOG** **Southeast Corner** **White Rock & Latrobe Roads** El Dorado Hills, California	**FIGURE** **A-6**

Logged By: **KEM**	Date: **6 April 2004**	Elevation: -	Pit No.
Equipment: **John Deere 310SE with 24" Bucket**		Pit Orientation: **W - E**	**TP-5**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 0.5'	Red brown silty **SAND (SM)** with trace gravel, medium dense, slightly moist		
@ 0.5' - 4.5'	Olive metavolcanic **BEDROCK**, highly weathered, indurated, poorly developed foliation, well developed fracturing, slightly moist, minor clay in upper 12"		
	Test pit terminated at 4.5' (practical refusal, >5 min./ft.) No free groundwater encountered No caving noted		

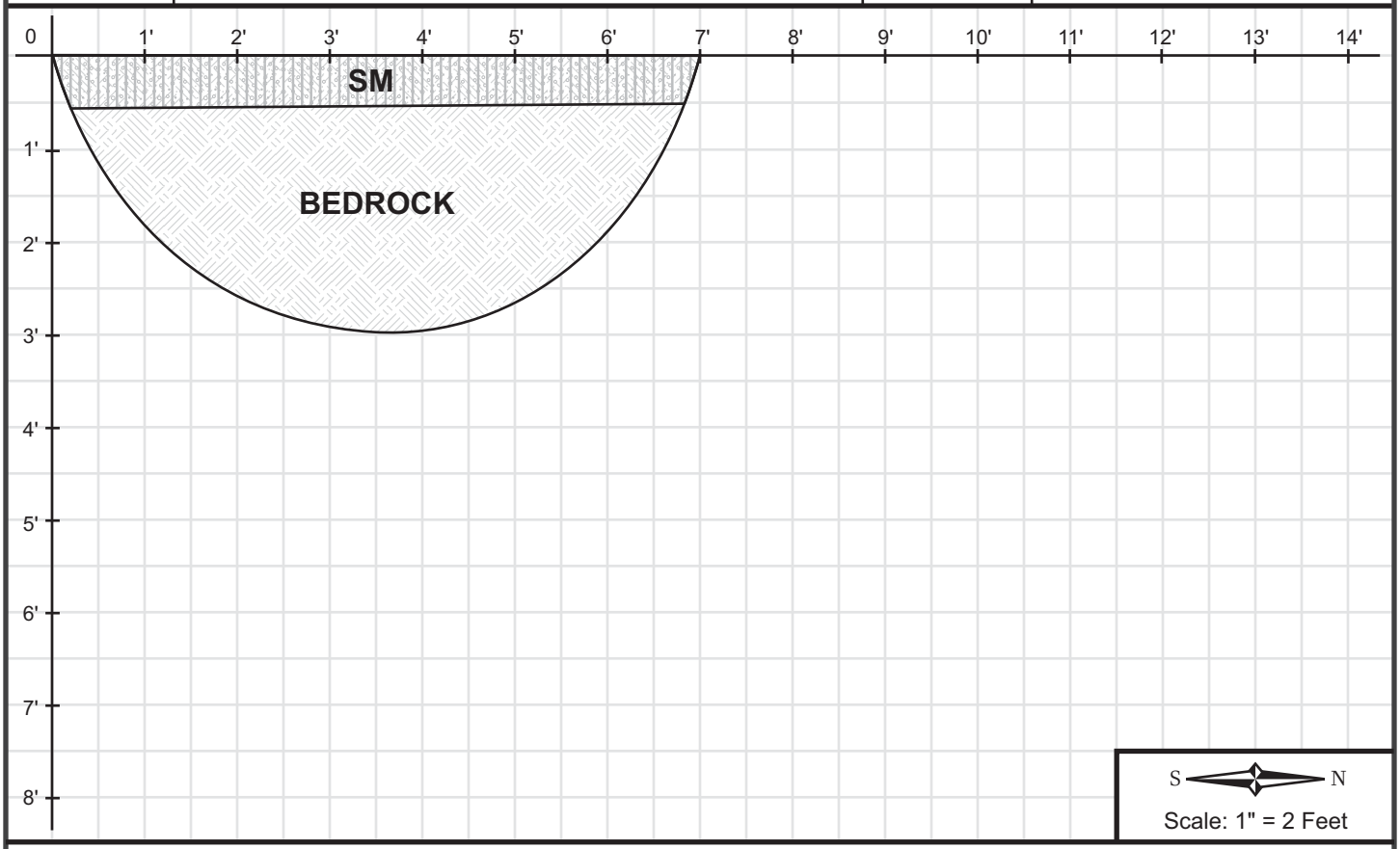


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations, Note, too, that the passage of time may affect conditions at the sampling locations.

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 04084.1 **April 2004**	**EXPLORATORY TEST PIT LOG** **Southeast Corner** **White Rock & Latrobe Roads** El Dorado Hills, California	**FIGURE** **A-7**

Logged By: **KEM**	Date: **6 April 2004**	Elevation: -	Pit No.
Equipment: **John Deere 310SE with 24" Bucket**		Pit Orientation: **S - N**	**TP-6**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 0.5'	Red brown silty **SAND (SM)** with trace gravel, medium dense, slightly moist		
@ 0.5' - 3'	Gray metavolcanic **BEDROCK**, highly weathered, indurated, moderately developed foliation, well developed fracturing, slightly moist		
	Test pit terminated at 3' (practical refusal, >5 min./ft.) No free groundwater encountered No caving noted		



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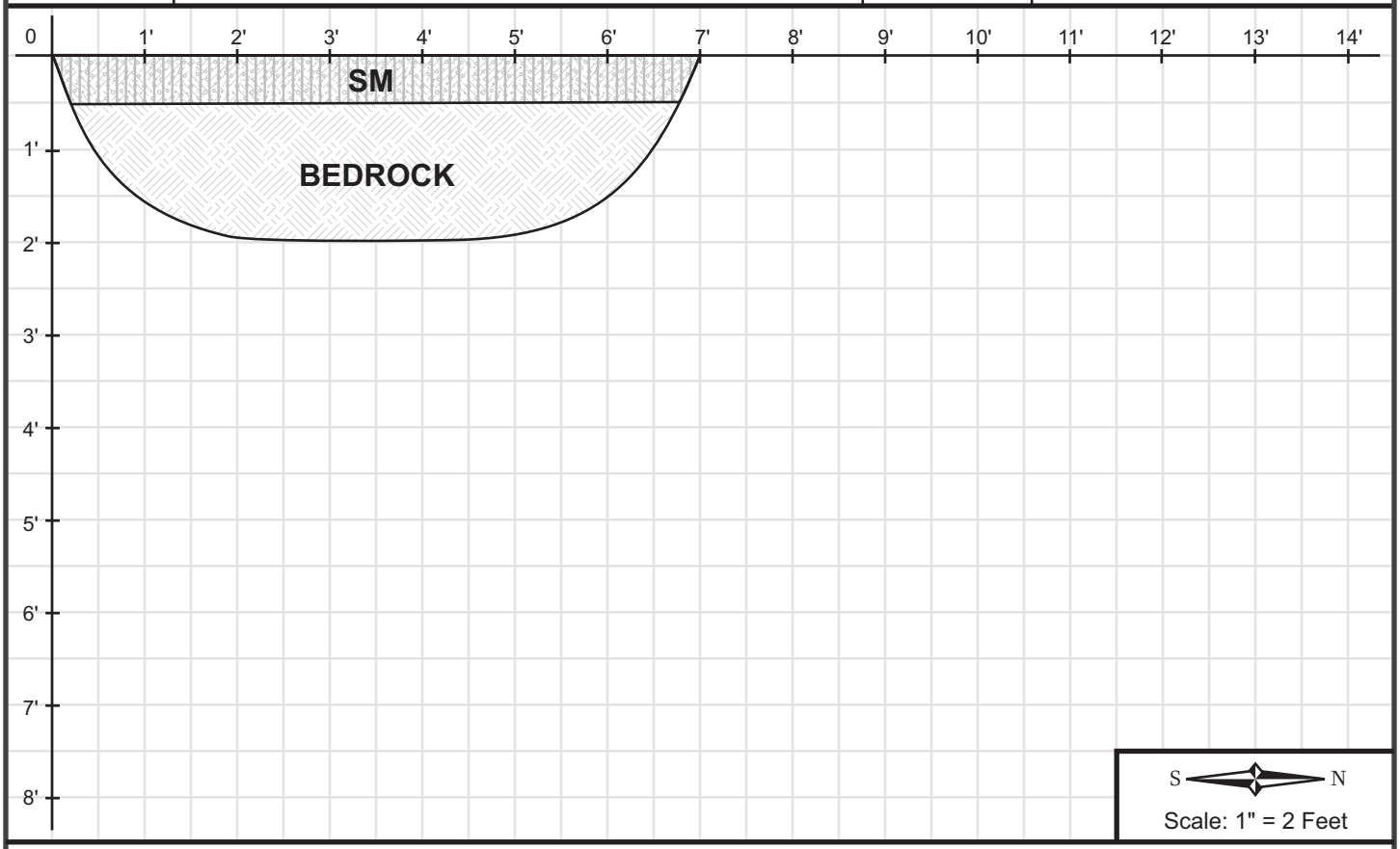
YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 04084.1 **April 2004**	**EXPLORATORY TEST PIT LOG** **Southeast Corner** **White Rock & Latrobe Roads** El Dorado Hills, California	**FIGURE** **A-8**

Logged By: **KEM**	Date: **6 April 2004**	Elevation: -	Pit No.
Equipment: **John Deere 310SE with 24" Bucket**		Pit Orientation: **S - N**	**TP-7**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 0.5'	Red brown silty **SAND (SM)** with trace gravel, medium dense, slightly moist		
@ 0.5' - 2'	Gray metavolcanic **BEDROCK**, highly weathered, indurated, moderately developed foliation, well developed fracturing, slightly moist		
	Test pit terminated at 2' (practical refusal, >5 min./ft.) No free groundwater encountered No caving noted		

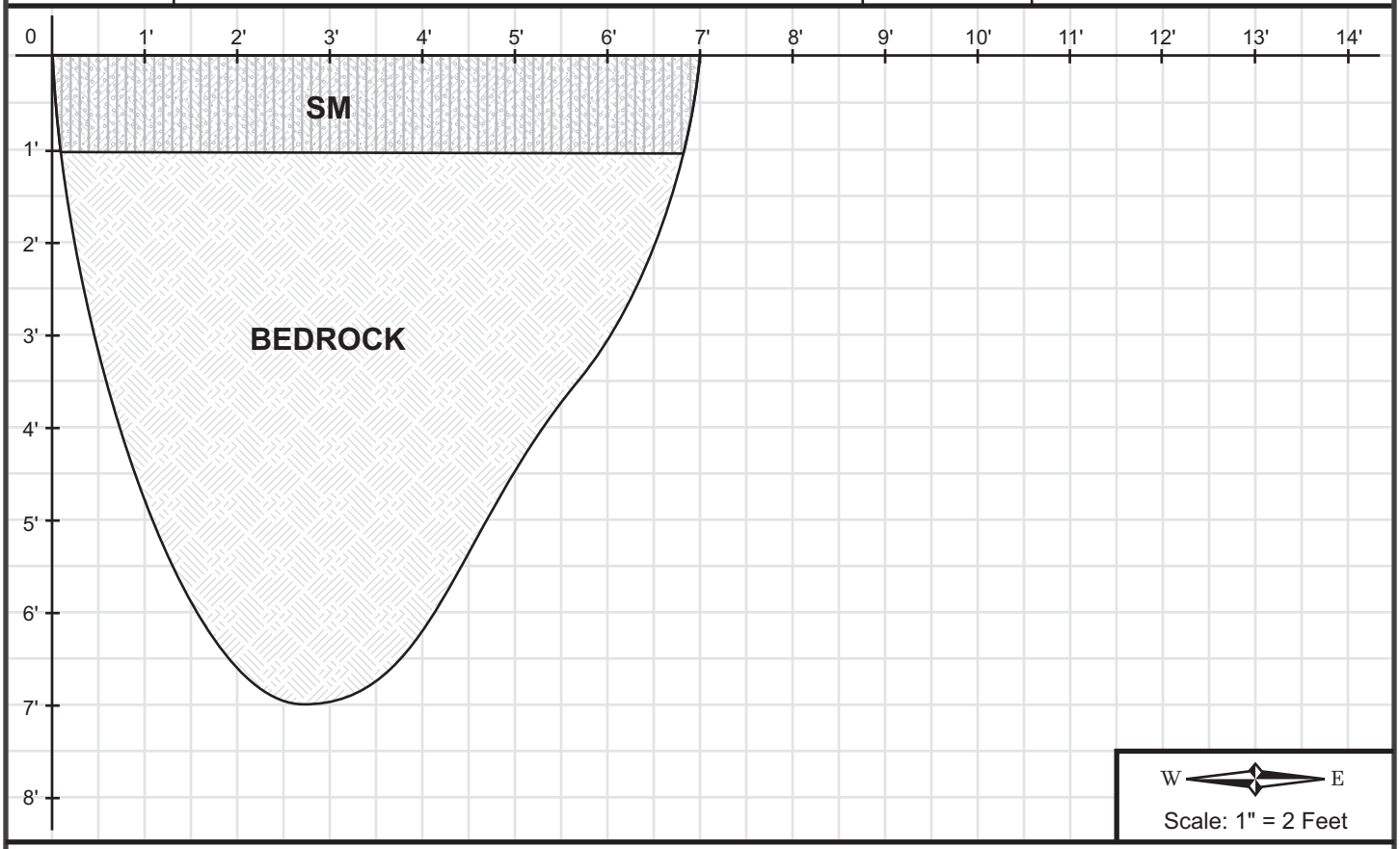


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations, Note, too, that the passage of time may affect conditions at the sampling locations.

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 04084.1 **April 2004**	**EXPLORATORY TEST PIT LOG** **Southeast Corner** **White Rock & Latrobe Roads** El Dorado Hills, California	**FIGURE** **A-9**

Logged By: **KEM**	Date: **6 April 2004**	Elevation: -	Pit No.
Equipment: **John Deere 310SE with 24" Bucket**		Pit Orientation: **W - E**	**TP-8**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 1'	Red brown silty **SAND (SM)** with trace gravel, medium dense, slightly moist		
@ 1' - 7'	Olive metavolcanic **BEDROCK**, highly to completely weathered, moderately indurated, poorly developed foliation, well developed fracturing, slightly moist, minor clay in upper 12"		
	Test pit terminated at 7' (practical refusal, >5 min./ft.) No free groundwater encountered No caving noted		



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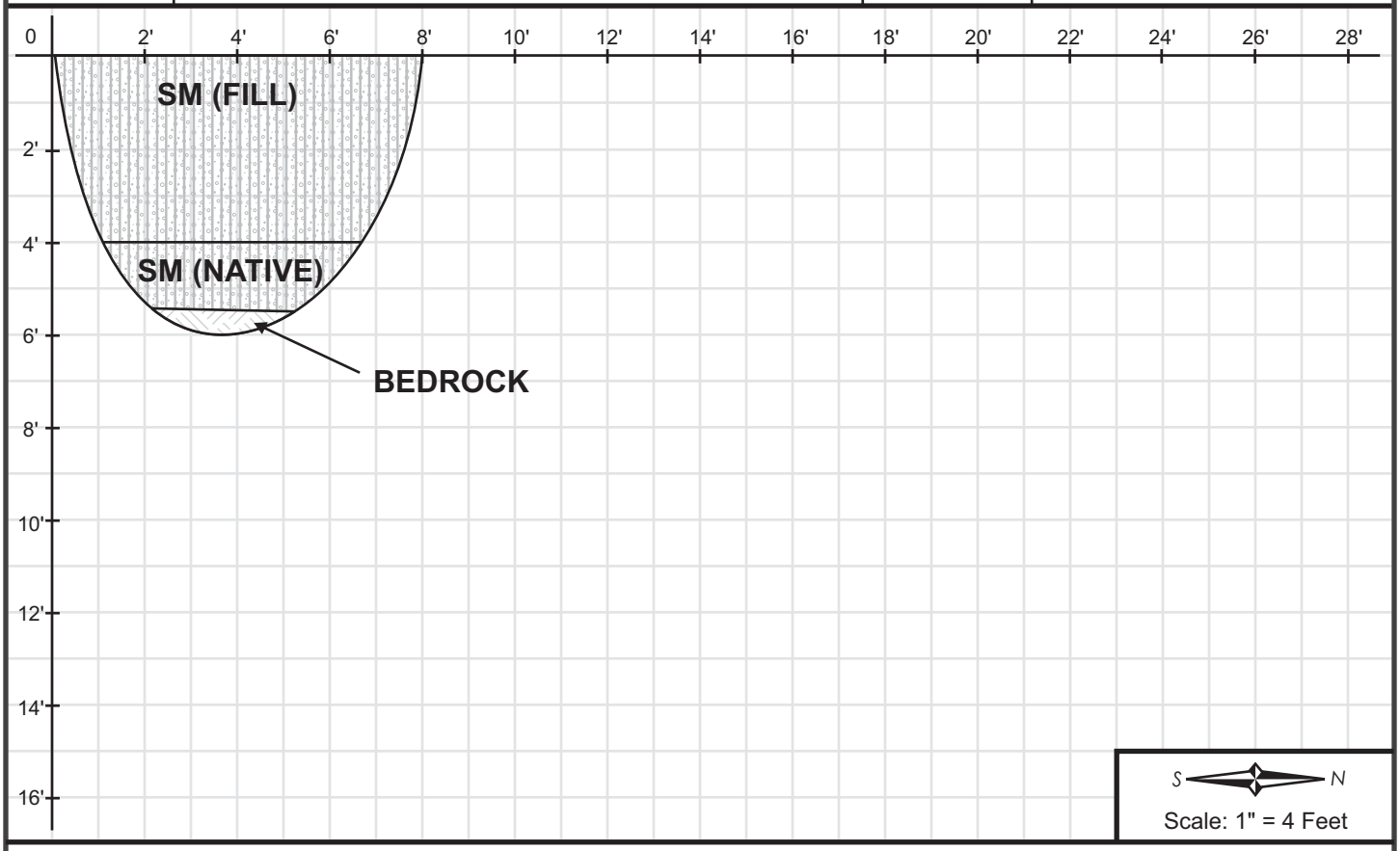
YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 04084.1 **April 2004**	**EXPLORATORY TEST PIT LOG** **Southeast Corner** **White Rock & Latrobe Roads** El Dorado Hills, California	**FIGURE** **A-10**

Logged By: **KEM**	Date: **25 September 2006**	Elevation:	Pit No.
Equipment: **John Deere 310SG Backhoe with 24" Bucket**		Pit Orientation: **S - N**	**TP-9**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 4'	Red brown silty **SAND (SM)** with some gravel and occasional cobbles, medium dense, dry (FILL)		
@ 4' - 5.5'	Red brown silty **SAND (SM)** with some gravel and occasional cobbles, medium dense, dry (NATIVE)		
@ 5.5' - 6'	Olive brown metavolcanic **BEDROCK**, highly weathered, indurated, poorly developed foliation, moderately developed fracturing, closed with black staining, slightly moist		
	Test pit terminated at 6' No free groundwater encountered No caving noted		

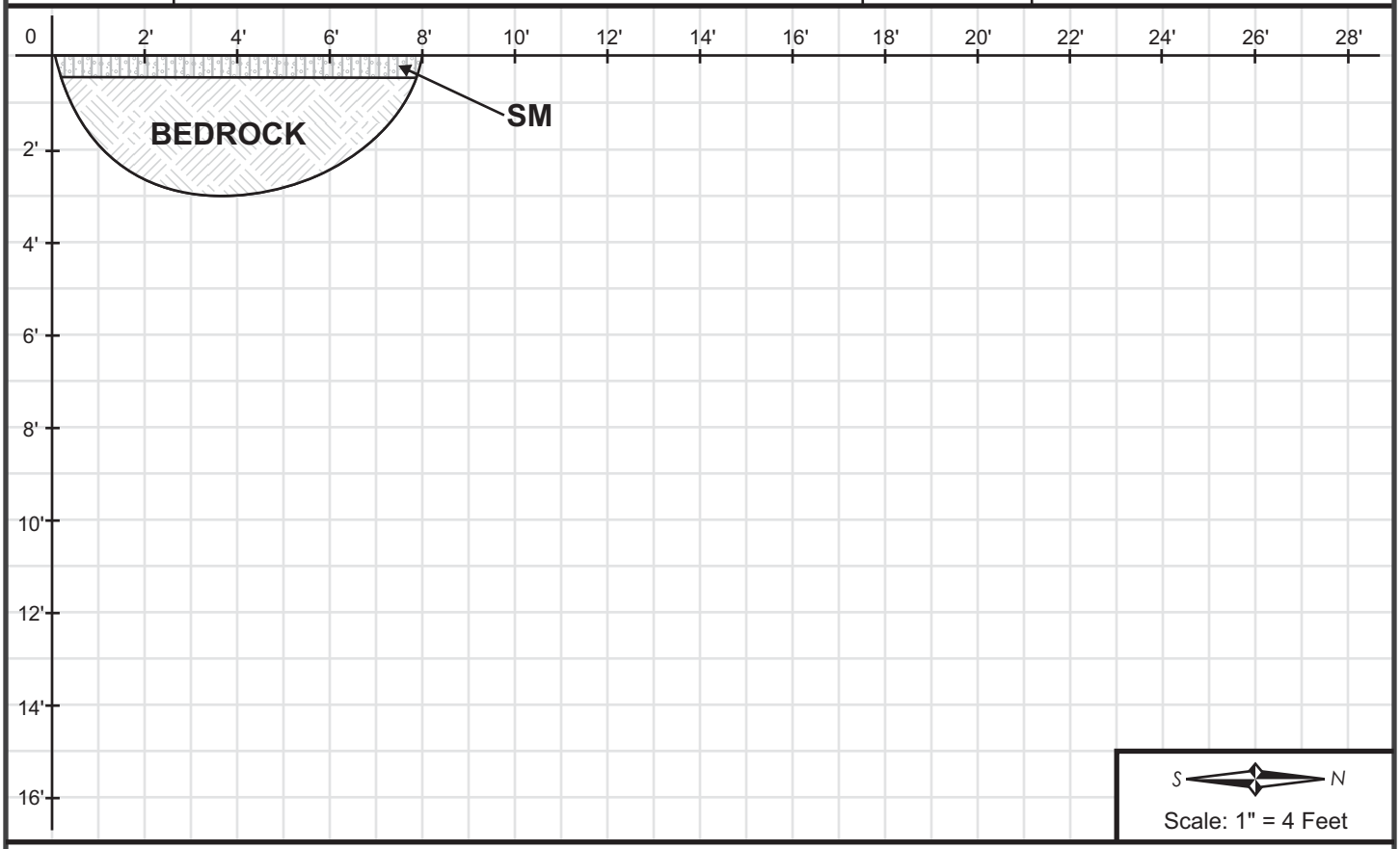


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations, Note, too, that the passage of time may affect conditions at the sampling locations.

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: E04084.002 **October 2006**	**EXPLORATORY TEST PIT LOG** **Montano De El Dorado** El Dorado Hills, California	**FIGURE** **A-11**

Logged By: **KEM**	Date: **25 September 2006**	Elevation:	Pit No.
Equipment: **John Deere 310SG Backhoe with 24" Bucket**		Pit Orientation: **S - N**	**TP-10**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 0.5'	Red brown silty **SAND (SM)** with some gravel and occasional cobbles, medium dense, dry		
@ 0.5' - 3'	Olive brown metavolcanic **BEDROCK**, highly weathered, indurated, poorly developed foliation, moderately developed fracturing, closed with black staining, dry		
	Test pit terminated at 3' No free groundwater encountered No caving noted		

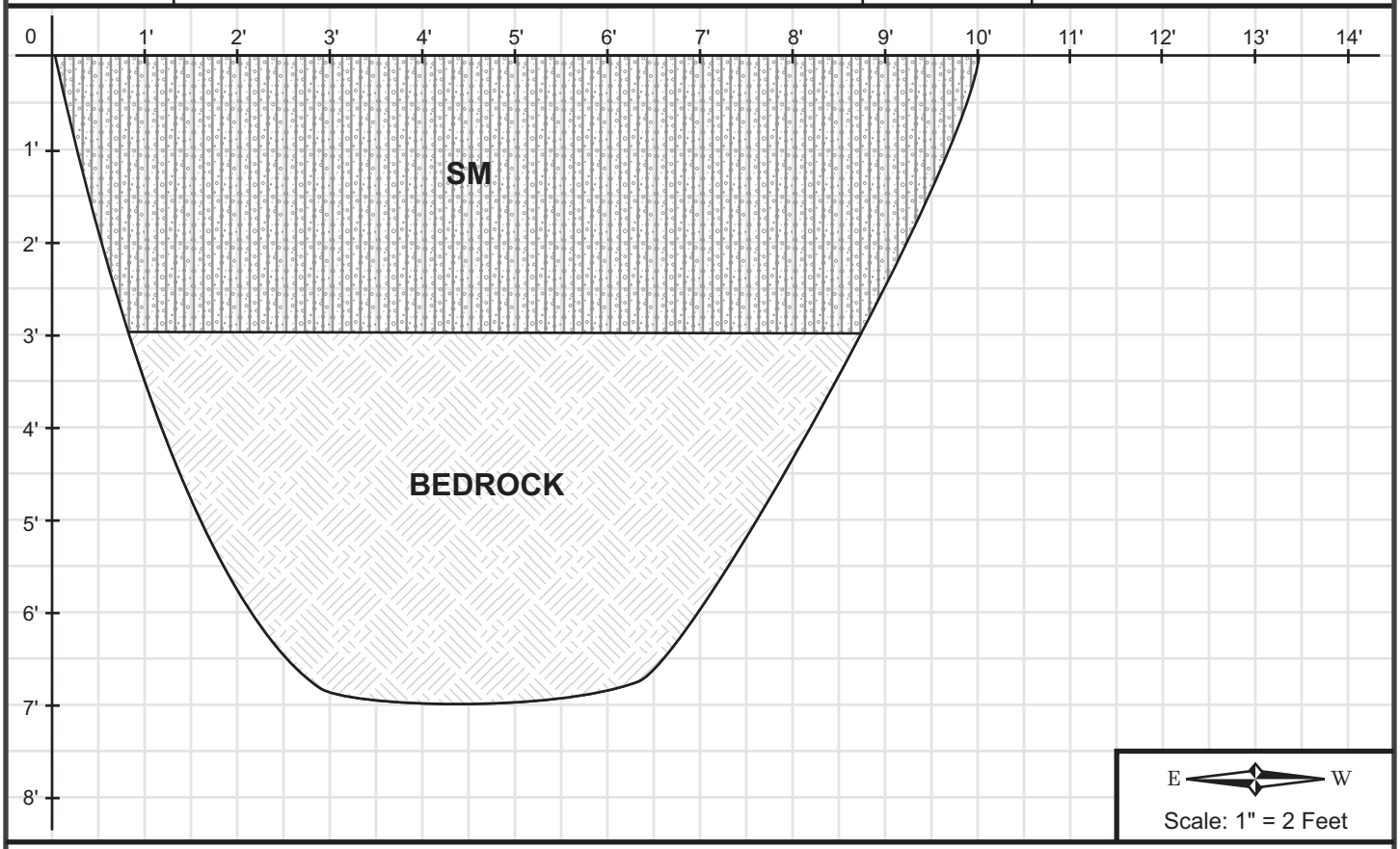


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations, Note, too, that the passage of time may affect conditions at the sampling locations.

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: E04084.002	**EXPLORATORY TEST PIT LOG**	**FIGURE**
	October 2006	**Montano De El Dorado** El Dorado Hills, California	**A-12**

Logged By: **RFB**	Date: **12 October 2001**	Elevation: -	Pit No.
Equipment: **John 310 SE With 18" Bucket & Ripper Shank**		Pit Orientation: **E - W**	**TP-11**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 3'	Brown silty **SAND (SM)** with gravel and weathered rock fragments, medium dense, damp		
@ 3' - 7'	Brown to gray metavolcanic **BEDROCK**, highly weathered, closely fractured, moderately weak to strong	**Bulk A** @ 3' - 7'	
	Test pit terminated at 7' No free groundwater encountered No caving noted		

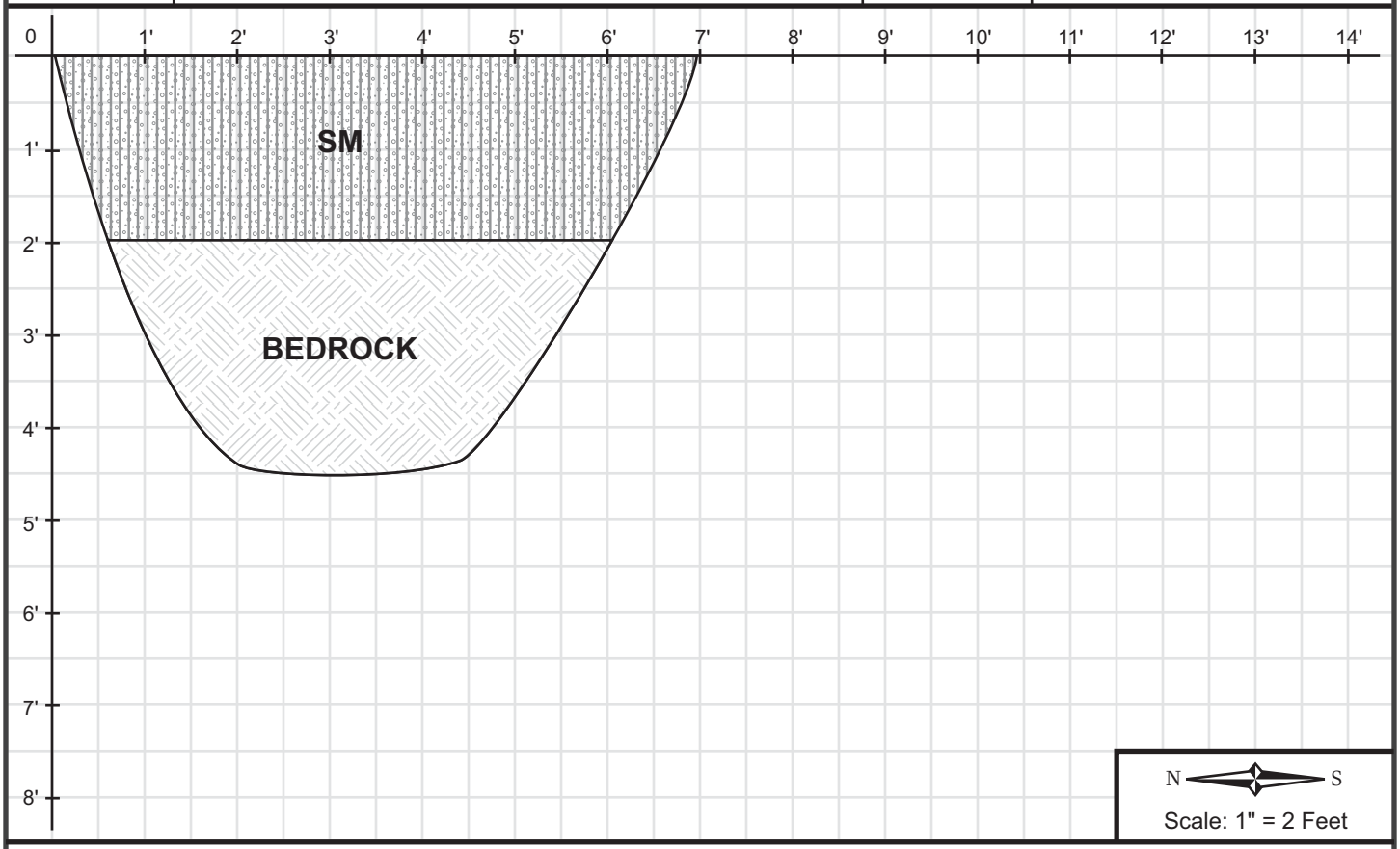


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations, Note, too, that the passage of time may affect conditions at the sampling locations.

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 01414 **October 2001**	**EXPLORATORY TEST PIT LOG** **Marantha Properties** El Dorado Hills, California	**FIGURE** **A-13**

Logged By: **RFB**	Date: **12 October 2001**	Elevation: -	Pit No.
Equipment: **John 310 SE With 18" Bucket & Ripper Shank**		Pit Orientation: **N - S**	**TP-12**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 2'	Brown silty **SAND (SM)** with gravel and weathered rock fragments, medium dense, damp		
@ 2' - 4.5'	Brown to gray metavolcanic **BEDROCK**, highly weathered, closely fractured, moderately strong to strong	**Bulk B** @ 2' - 4.5'	
	Test pit terminated at 4.5' (practical refusal) No free groundwater encountered No caving noted		

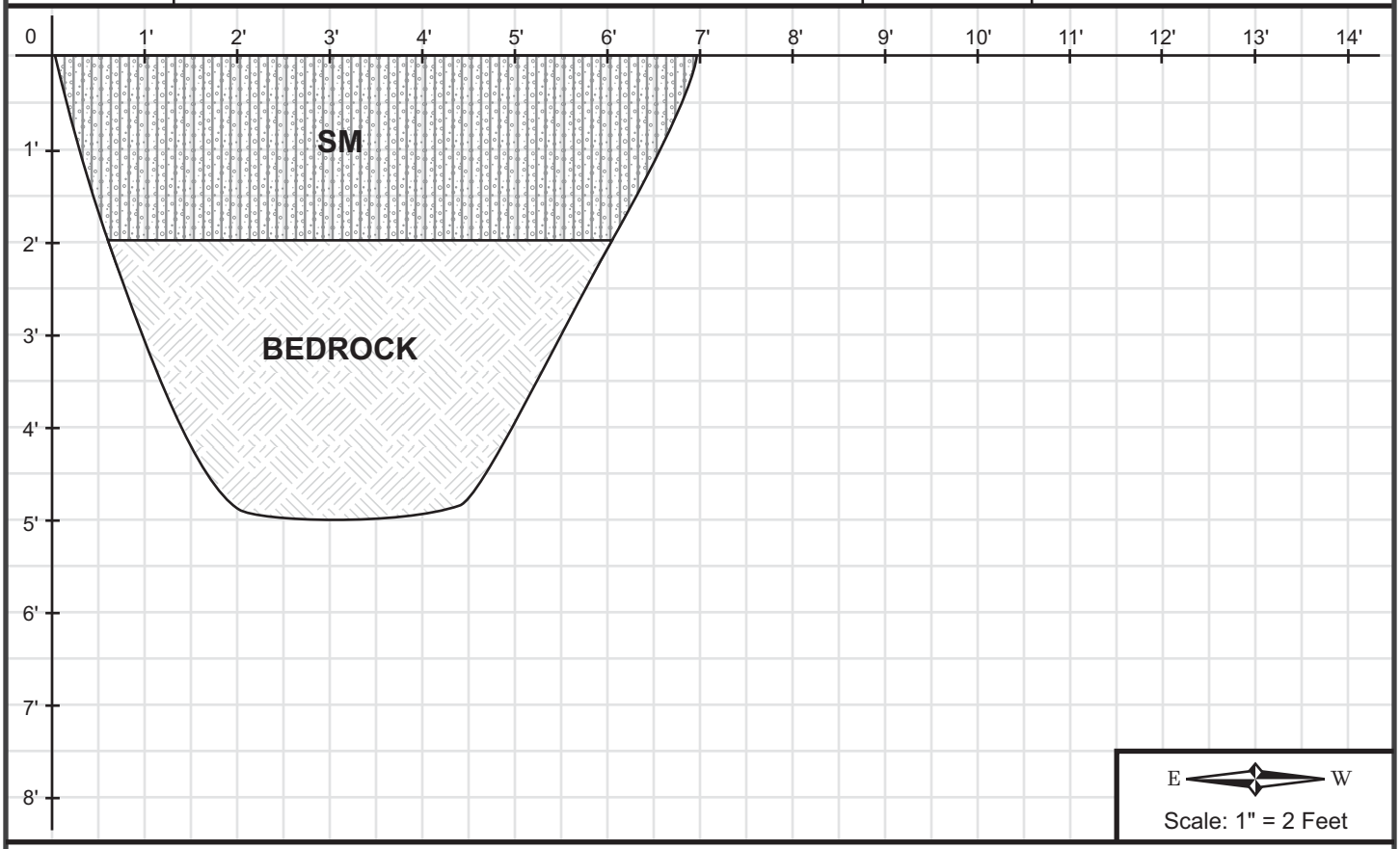


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations, Note, too, that the passage of time may affect conditions at the sampling locations.

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 01414 **October 2001**	**EXPLORATORY TEST PIT LOG** **Marantha Properties** El Dorado Hills, California	**FIGURE** **A-14**

Logged By: **RFB**	Date: **12 October 2001**	Elevation: -	Pit No.
Equipment: **John 310 SE With 18" Bucket & Ripper Shank**		Pit Orientation: **E - W**	**TP-13**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0 - 2'	Brown silty **SAND (SM)** with gravel and weathered rock fragments, medium dense, damp		
@ 2' - 5.5'	Gray to brown metavolcanic **BEDROCK**, highly weathered, closely fractured, moderately strong to strong	**Bulk C** @ 2' - 5.5'	
	Test pit terminated at 5.5' (practical refusal) No free groundwater encountered No caving noted		



Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations, Note, too, that the passage of time may affect conditions at the sampling locations.

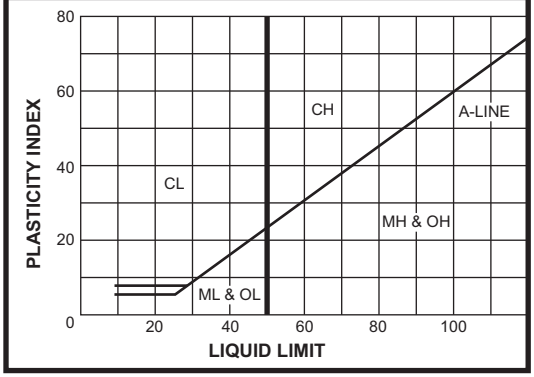
YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: 01414 **October 2001**	**EXPLORATORY TEST PIT LOG** **Marantha Properties** El Dorado Hills, California	**FIGURE** **A-15**

UNIFIED SOIL CLASSIFICATION SYSTEMS

MAJOR DIVISION			SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS Over 50% > #200 sieve	**GRAVELS** Over 50% > #4 sieve	Clean **GRAVELS** With Little Or No Fines	GW	Well graded **GRAVELS**, **GRAVEL-SAND** mixtures
			GP	Poorly graded **GRAVELS**, **GRAVEL-SAND** mixtures
		GRAVELS With Over 12% Fines	GM	Silty **GRAVELS**, poorly graded **GRAVEL-SAND-SILT** mixtures
			GC	Clayey **GRAVELS**, poorly graded **GRAVEL-SAND-CLAY** mixtures
	SANDS Over 50% < #4 sieve	Clean **SANDS** With Little Or No Fines	SW	Well graded **SANDS**, gravelly **SANDS**
			SP	Poorly graded **SANDS**, gravelly **SANDS**
		SANDS With Over 12% Fines	SM	Silty **SANDS**, poorly graded **SAND-SILT** mixtures
			SC	Clayey **SANDS**, poorly graded **SAND-CLAY** mixtures
FINE GRAINED SOILS Over 50% < #200 sieve	**SILTS & CLAYS** Liquid Limit < 50		ML	Inorganic **SILTS**, silty or clayey fine **SANDS**, or clayey **SILTS** with plasticity
			CL	Inorganic **CLAYS** of low to medium plasticity, gravelly, sandy, or silty **CLAYS**, lean **CLAYS**
			OL	Organic **CLAYS** and organic silty **CLAYS** of low plasticity
	SILTS & CLAYS Liquid Limit > 50		MH	Inorganic **SILTS**, micaceous or diamacious fine sandy or silty soils, elastic **SILTS**
			CH	Inorganic **CLAYS** of high plasticity, fat **CLAYS**
			OH	Organic **CLAYS** of medium to high plasticity, organic **SILTS**
HIGHLY ORGANIC CLAYS			PT	PEAT & other highly organic soils

PLASTICITY CHART

USED FOR CLASSIFICATION OF FINE GRAINED SOILS



SAMPLE DRIVING RECORD

BLOWS PER FOOT	DESCRIPTION
25	25 Blows drove sampler 12 inches, after initial 6 inches of seating
50/7"	50 Blows drove sampler 7 inches, after initial 6 inches of seating
50/3"	50 Blows drove sampler 3 inches during or after initial 6 inches of seating

Note: To avoid damage to sampling tools, driving is limited to 50 blows per 6 inches during or after seating interval.

SOIL GRAIN SIZE

U.S. STANDARD SIEVE	6"	3"	¾"	4	10	40	200	
	BOULDER	COBBLE	GRAVEL		SAND			SILT / CLAY
			COARSE	FINE	COARSE	MEDIUM	FINE	
SOIL GRAIN SIZE IN MILLIMETERS	150	75	19	4.75	2.0	.425	0.075	0.002

KEY TO TEST DATA

- Standard Penetration test
- 2.5" O.D. Modified California Sampler
- 3" O.D. Modified California Sampler
- Shelby Tube Sampler
- 2.5" Hand Driven Liner
- Bulk Sample
- Water Level At Time Of Drilling
- Water Level After Time Of Drilling
- P — Perched Water

KEY TO TEST DATA

- Water Seepage
- MD — Moisture Density Test

NFWE	No Free Water Encountered
FWE	Free Water Encountered
REF	Sampling Refusal
DD	Dry Density (pcf)
MC	Moisture Content (%)
LL	Liquid Limit
PI	Plasticity Index
PP	Pocket Penetrometer
UCC	Unconfined Compression (ASTM D2166)
TVS	Pocket Torvane Shear
EI	Expansion Index (ASTM D4829)

YOUNGDAHL CONSULTING GROUP, INC.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING

Project No.: E01414.001

June 2017

SOIL CLASSIFICATION CHART & LOG EXPLANATION
Montano De El Dorado Phase II
El Dorado Hills, California

FIGURE **A-16**

APPENDIX B

Laboratory Testing

Direct Shear Test
Modified Proctor Tests (3)
R-Value

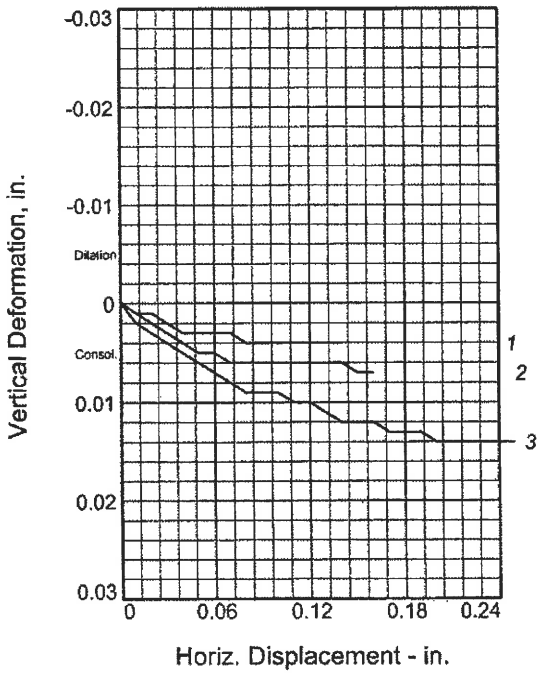
Introduction
Our laboratory testing program for this evaluation included numerous visual classifications, direct shear, R-Value, and modified proctor tests. The following paragraphs describe our procedures associated with each type of test. Graphical results of certain laboratory tests are enclosed in this appendix. The contents of this appendix shall be integrated with the geotechnical engineering study of which it is a part. They shall not be used in whole or in part as a sole source for information or recommendations regarding the subject site.

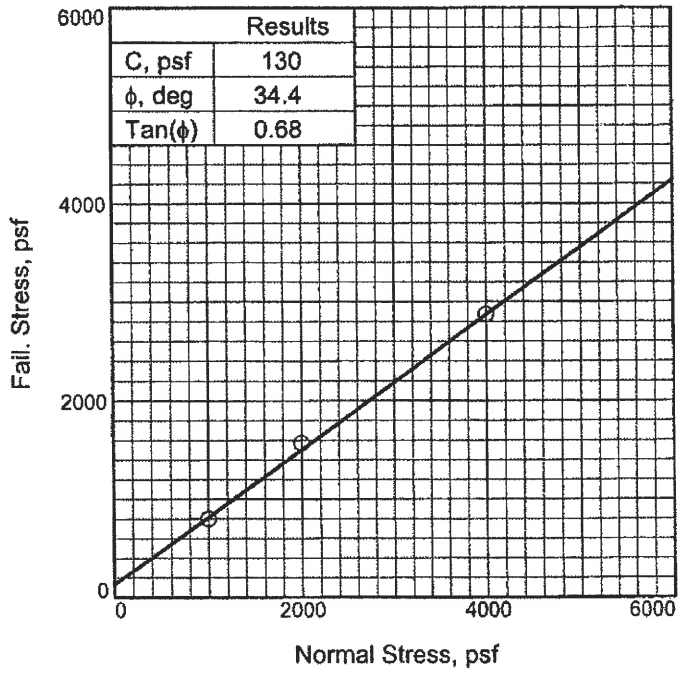
Laboratory Testing Procedures
Visual Classification: Visual soil classifications were conducted on all samples in the field and on selected samples in our laboratory. All soils were classified in general accordance with the Unified Soil Classification System, which includes color, relative moisture content, primary soil type (based on grain size), and any accessory soil types. The resulting soil classifications are presented on the exploration logs in Appendix A.

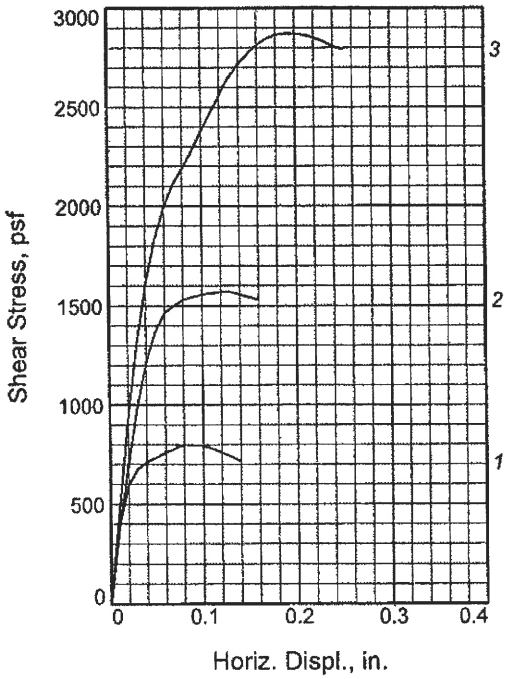
Soil Strength Determination: The strength parameters of the foundation soils were based on direct shear tests (ASTM D3080) performed on a representative remolded sample of the near-surface soils. The results of these tests are presented on Figure B-1, this Appendix.

Maximum Dry Density Determination: A modified proctor test (ASTM D1557) was conducted to provide the optimum moisture and maximum dry density on the near surface material. The results of this test are presented on Figures B-2 to B-4, this Appendix.

Resistance Value Determination: An R-Value test (California Test Method 301-F or ASTM D2844) was performed to obtain asphalt concrete pavement design parameters. The results of this test are presented on Figure B-5, this Appendix.







Sample No.		1	2	3
Initial	Water Content, %	12.8	12.8	11.9
	Dry Density, pcf	112.0	112.0	112.9
	Saturation, %	67.1	67.1	63.9
	Void Ratio	0.5214	0.5214	0.5091
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	18.6	18.3	17.1
	Dry Density, pcf	113.0	113.6	116.2
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5077	0.5001	0.4669
	Diameter, in.	2.500	2.500	2.500
	Height, in.	0.991	0.986	0.972
Normal Stress, psf		1000	2000	4000
Fail. Stress, psf		798	1570	2872
Displacement, in.		0.080	0.120	0.190
Ult. Stress, psf				
Displacement, in.				
Strain rate, in./min.		0.001	0.001	0.001

Sample Type: REMOLDED

Description: Red Brown Silty SAND w/trace clay & gravel

LL= **PL=** **PI=**

Specific Gravity= 2.73

Remarks:

Figure Number B-1

Client:

Project: WHITE ROCK ROAD (SEC) & LATROBE ROAD GES

Source of Sample: NATIVE MATERIAL

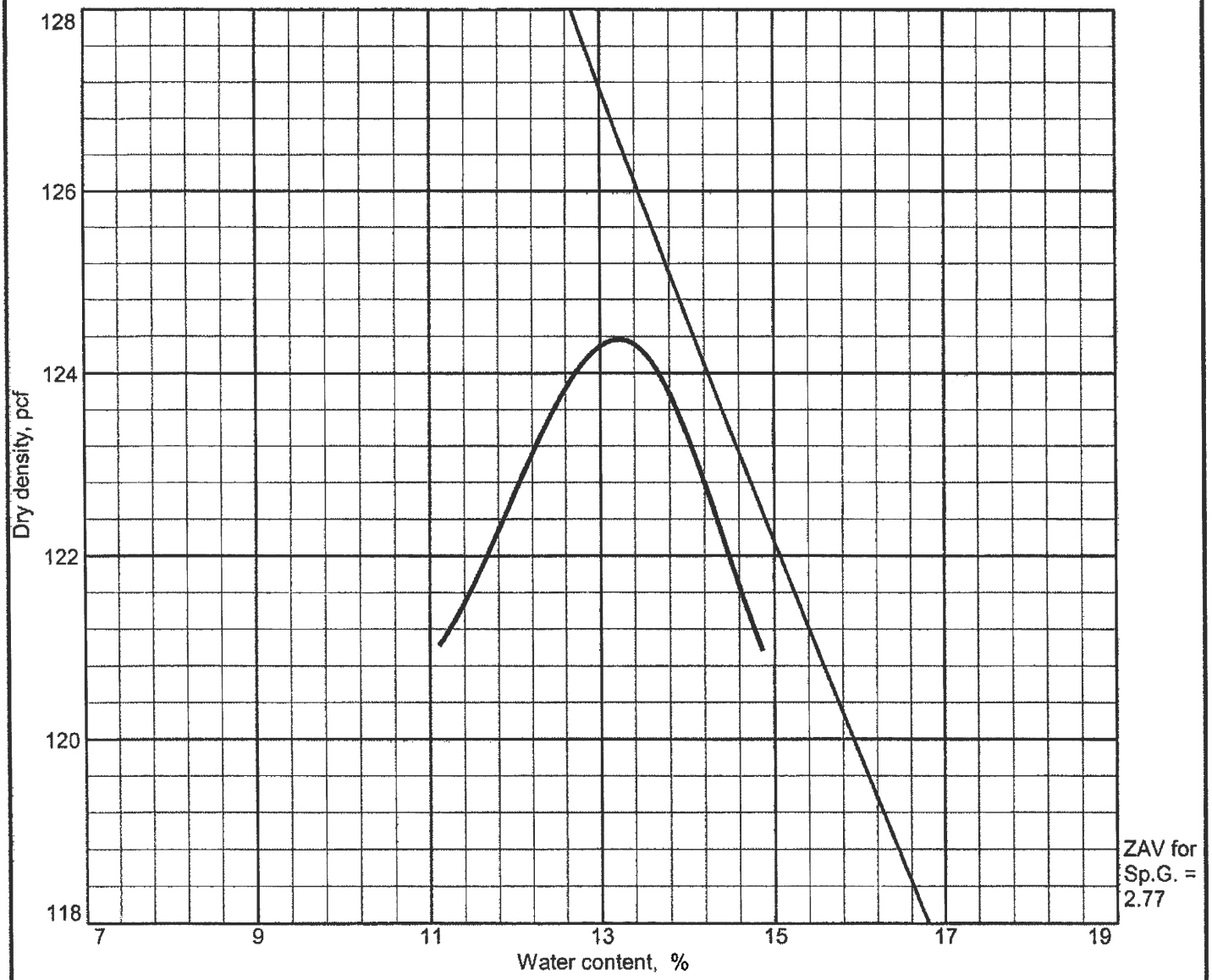
Sample Number: BKA, 4/7/04

Proj. No.: 04084.1 **Date:** 4/13/04

DIRECT SHEAR TEST REPORT

YOUNGDAHL CONSULTING GROUP, INC.

COMPACTION TEST REPORT



Test specification:

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% >	% < No.200
	USCS	AASHTO						
	SM			2.73				

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 124.5 pcf Optimum moisture = 13 %	Red Brown Silty SAND w/trace clay & gravel

Project No. 04084.1 **Client:**

Project: WHITE ROCK ROAD (SEC) & LATROBE ROAD GES

● **Source:** NATIVE MATERIAL **Sample No.:** BKA, 4/7/04

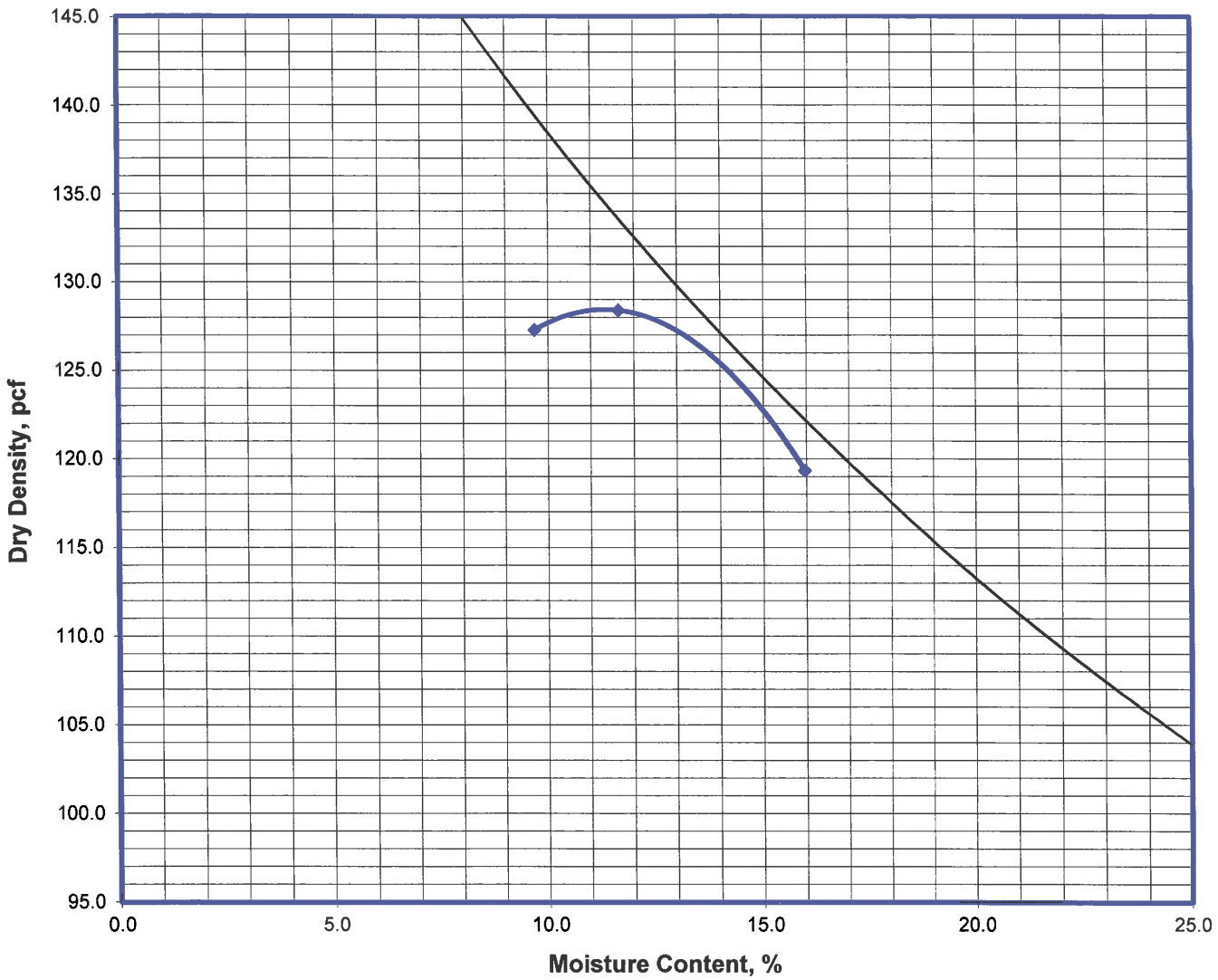
Remarks:

COMPACTION TEST REPORT

YOUNGDAHL CONSULTING GROUP, INC.

Figure Number B-2

Laboratory Compaction Characteristics of Soil
Using Modified Effort (56,000 lf-lbf/ft3), ASTM D1557, Method A



Maximum Dry Density, pcf:	**128.4**	Optimum Moisture Content, %:	**11.6**
Material Description:	**Brown Silty SAND w/ few clay & little gravel**		
Source:			
Notes:	Reproduced from historic lab data		

Sample No./Depth:	Bulk 1	USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4	% Less than No. 200
Date Sampled: 10/3/2006	Date Test Started:					

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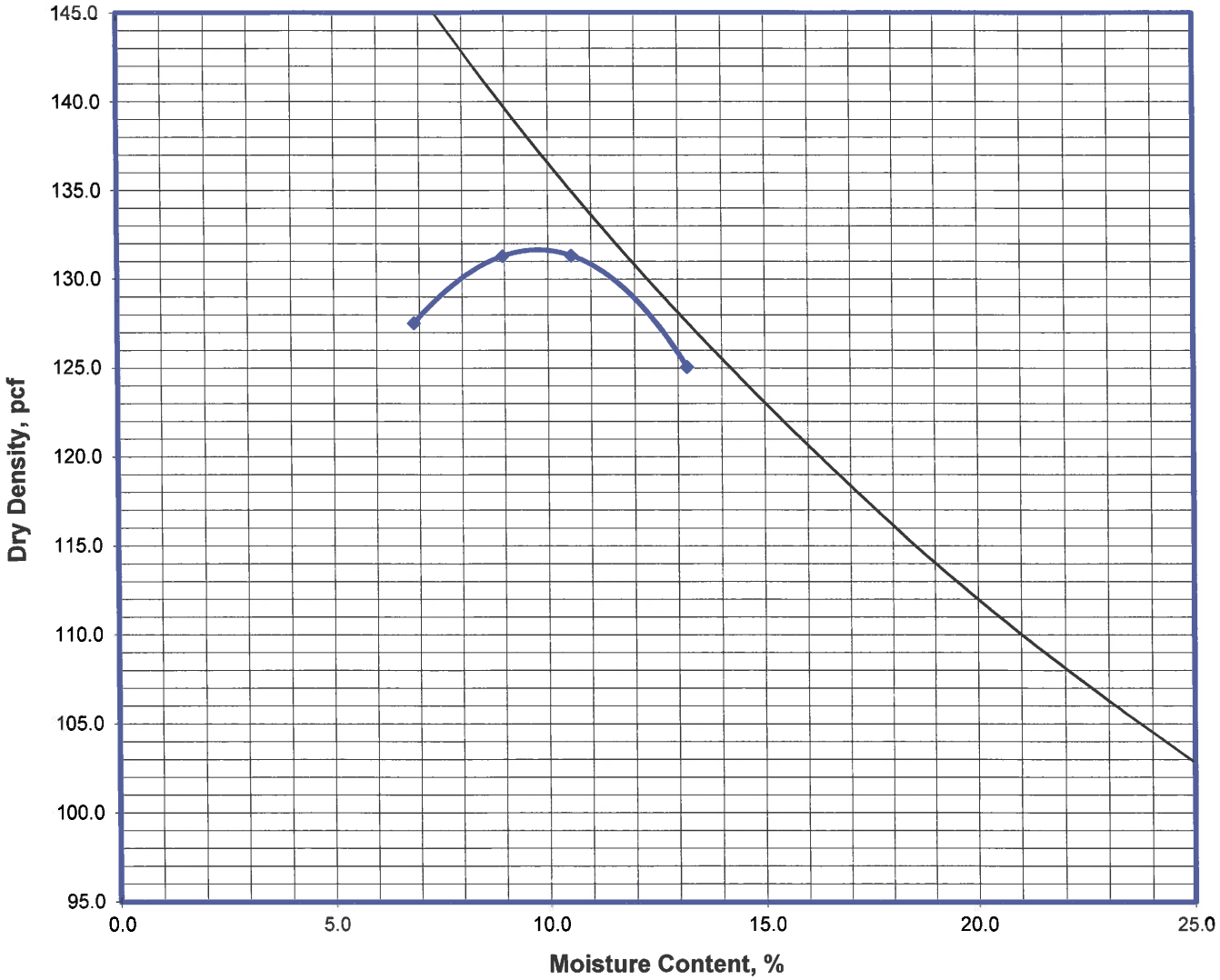
Building Innovative Solutions
30 YEARS
1234 Glenhaven Court, El Dorado Hills, CA 95762
ph 916.933.0633 • fx 916.933.6482 • www.youngdahl.net

Project:	**Montano De El Dorado**		
Project No.:	**E04084.002**		Figure
Reviewed By: BLM/MJG	Date: 7/3/2017		B-3

Laboratory Compaction Characteristics of Soil
Using Modified Effort (56,000 lf-lbf/ft3), ASTM D1557, Method A



Maximum Dry Density, pcf:	**131.6**	Optimum Moisture Content, %:	**9.8**

Material Description: **Brown Silty SAND w/ trace clay & some gravel**

Source:

Notes: Reproduced from historic lab data

Sample No./Depth:	Bulk 2	USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4	% Less than No. 200
Date Sampled: 11/6/2006	Date Test Started:					

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ph 916.933.0633 • fx 916.933.6482 • www.youngdahl.net

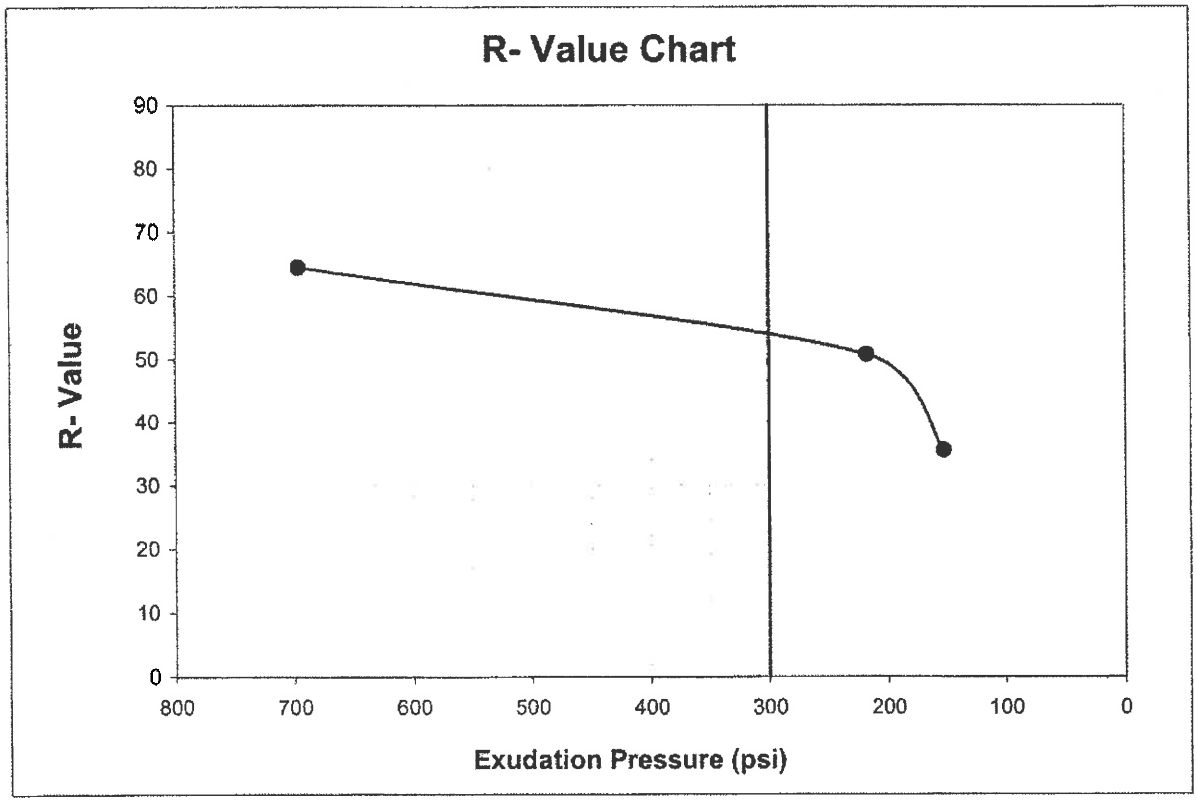
Project:	**Montano De El Dorado**		
Project No.:	**E04084.002**		Figure
Reviewed By: MJG	Date: 7/3/2017		B-4

RESISTANCE VALUE TEST (Cal Test 301, ASTM D2844)

Sample I.D.: BK 1 Depth:

Description: Red Brown Silty SAND w/ trace clay & gravel

Test Specimen	Q	R	E
Moisture Content (%)	15.8	14.7	14.1
Dry Density (pcf)	117.6	119.9	120.6
Expansion Dial (0.0001")	0	0	0
Expansion Pressure (psf)	0.0	0.0	0.0
Exudation Pressure (psi)	152.0	218.0	696.0
Resistance Value "R"	36	51	65
R Value at 300 psi Exudation Pressure:			**55**



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WHITE ROCK (SEC) & LATROBE RD.
El Dorado Hills, CA

PROJECT NO	DATE
04084.1	April 2004

FIGURE NO
B-5

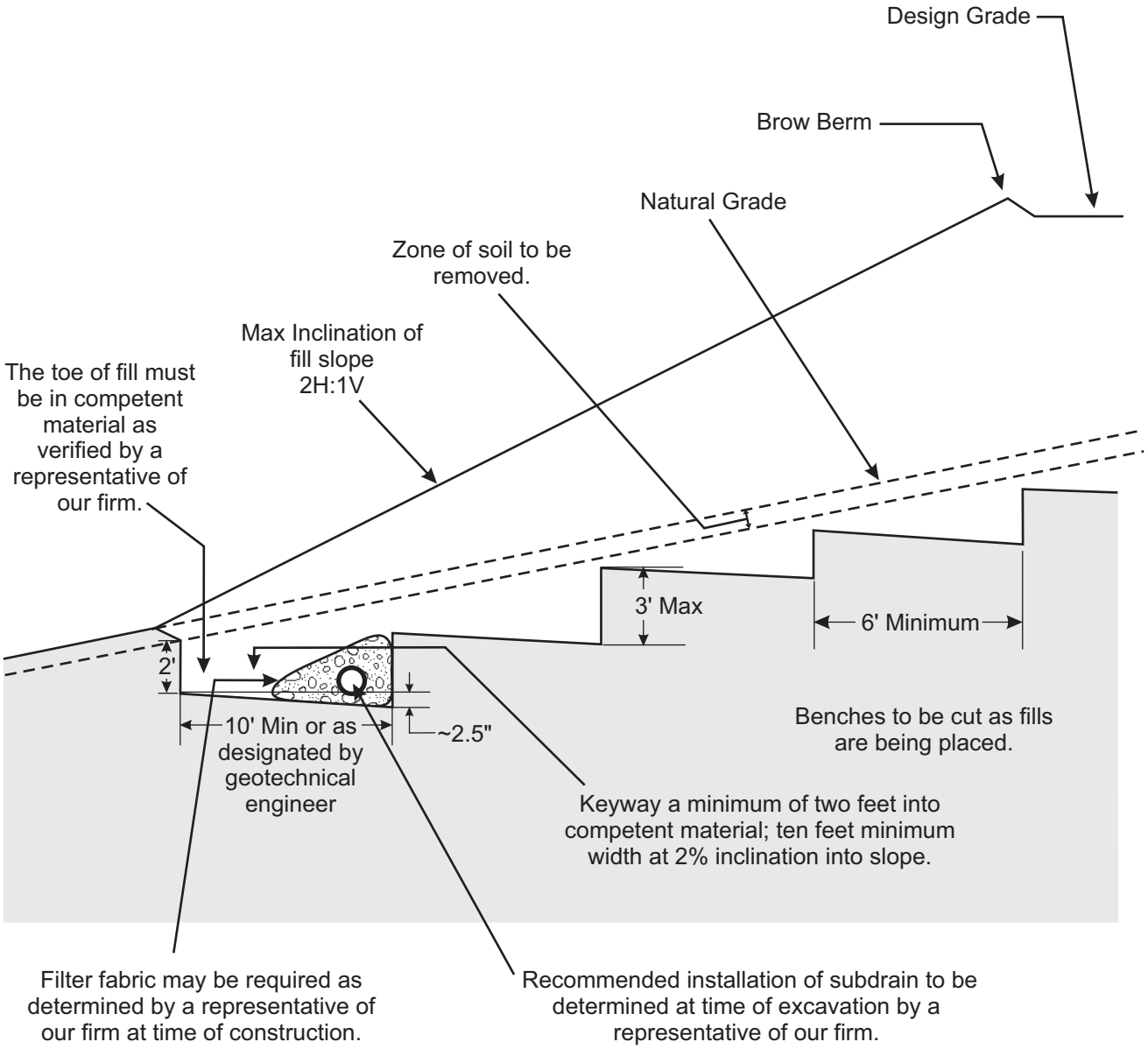
APPENDIX C

Details

Keyway and Bench with Drain
Plug and Drain
Site Wall Drainage
Basement Wall Drainage
Subdrain

PLACEMENT OF FILL ON NATURAL SLOPE
(Typical)

All keyways should be observed and approved prior to placement of fill.
A keyway is required by CBC for fills on natural slopes of 5H:1V or steeper.



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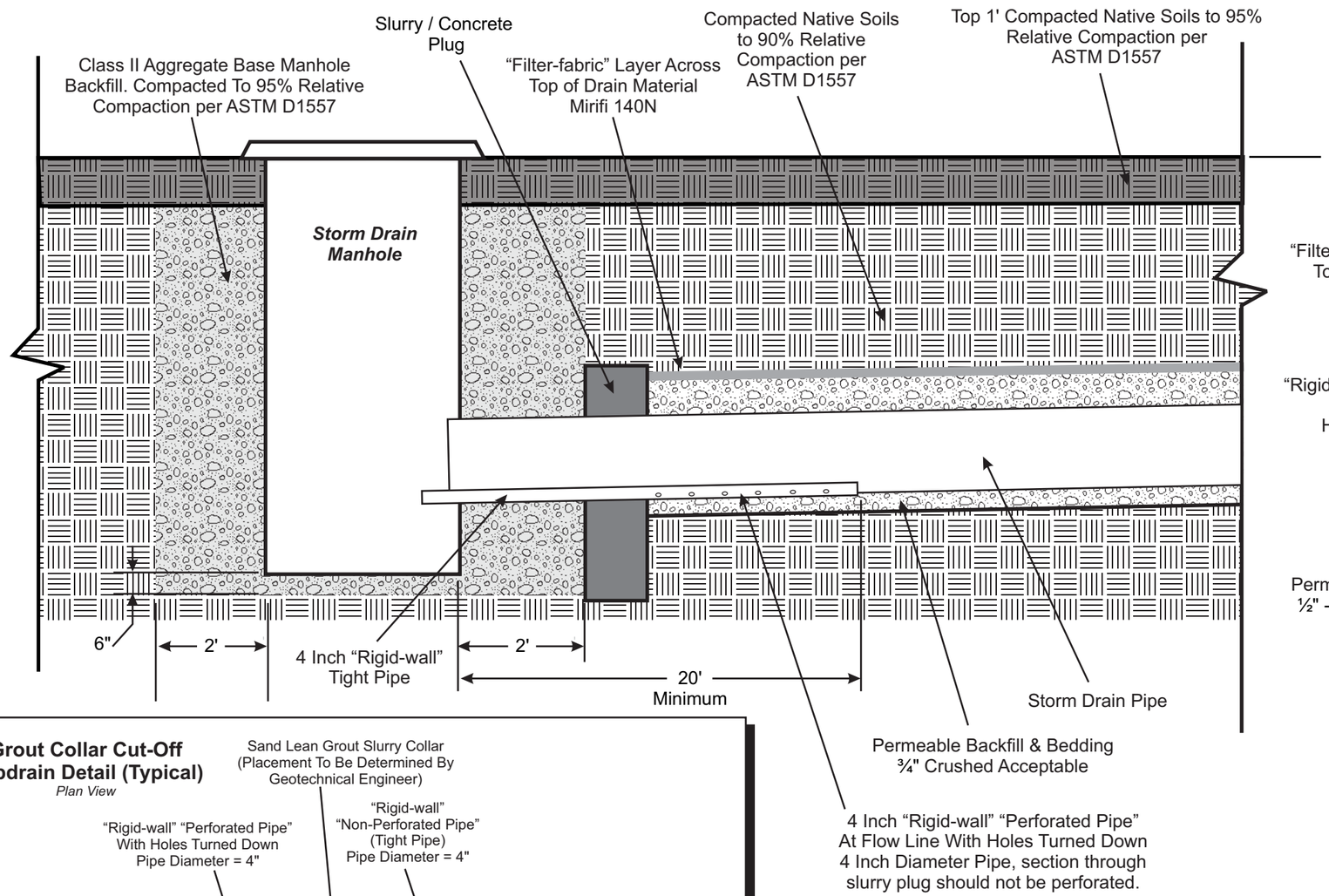
Project No.: E01414.001

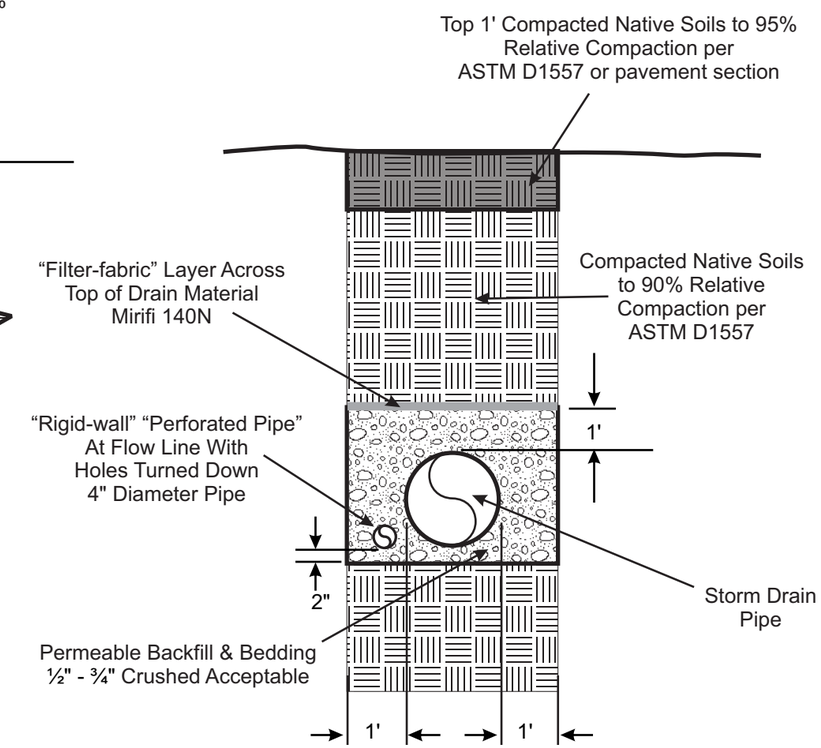
June 2017

KEYWAY & BENCH WITH DRAIN

Montano De El Dorado Phase II
El Dorado Hills, California

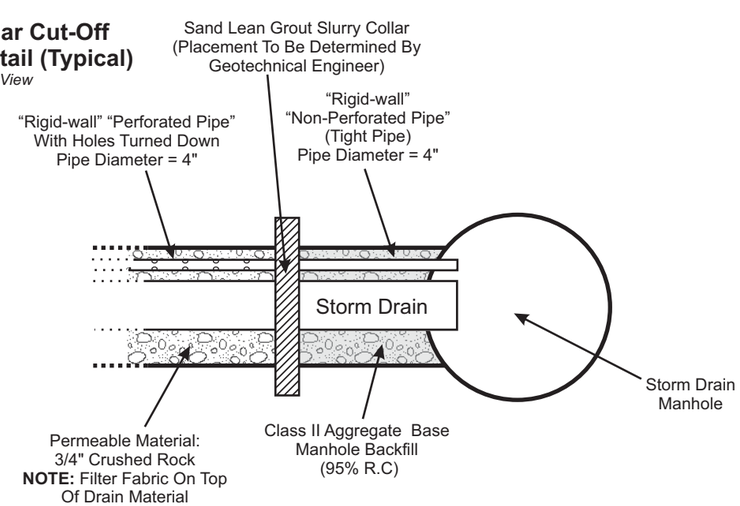
FIGURE
C-1





Grout Collar Cut-Off Subdrain Detail (Typical)

Plan View



Notes: *1. Slope trench and "rigid-wall" pipes at least 1% gradient to drain.*
2. Washed clean permeable material.
3. Slurry collar to extend into trench sidewalls and to top of pipe envelope.

Notes: *Slope trench and "rigid-wall" pipes at least 1% gradient to drain.*

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Project No.: E01414.001

June 2017

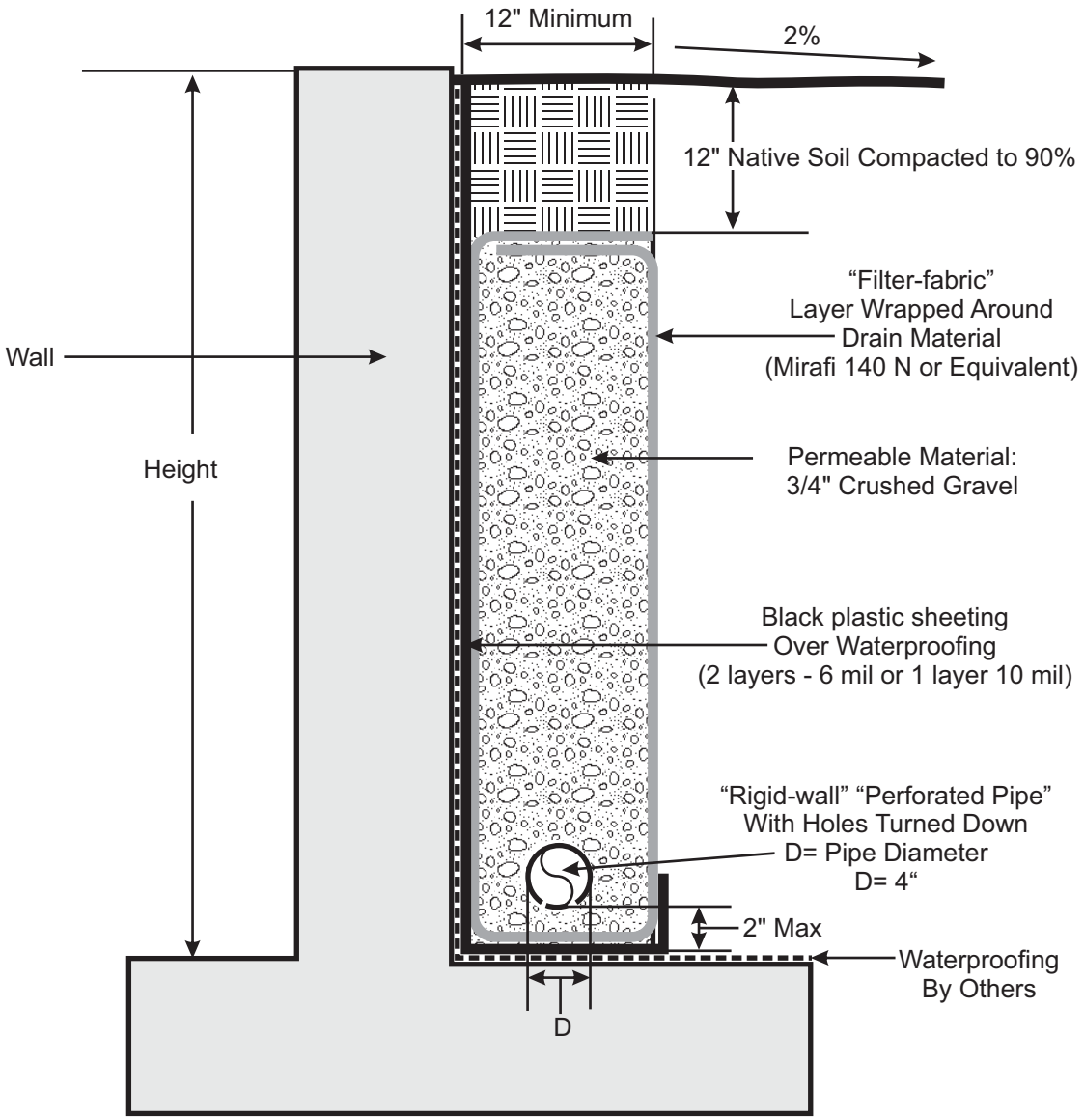
TYPICAL STORM DRAIN / SUB-DRAIN DETAIL

Montano De El Dorado Phase II
El Dorado Hills, California

FIGURE
C-2

Retaining Wall With "Perforated Pipe Sub-Drain"

(Typical Cross Section)

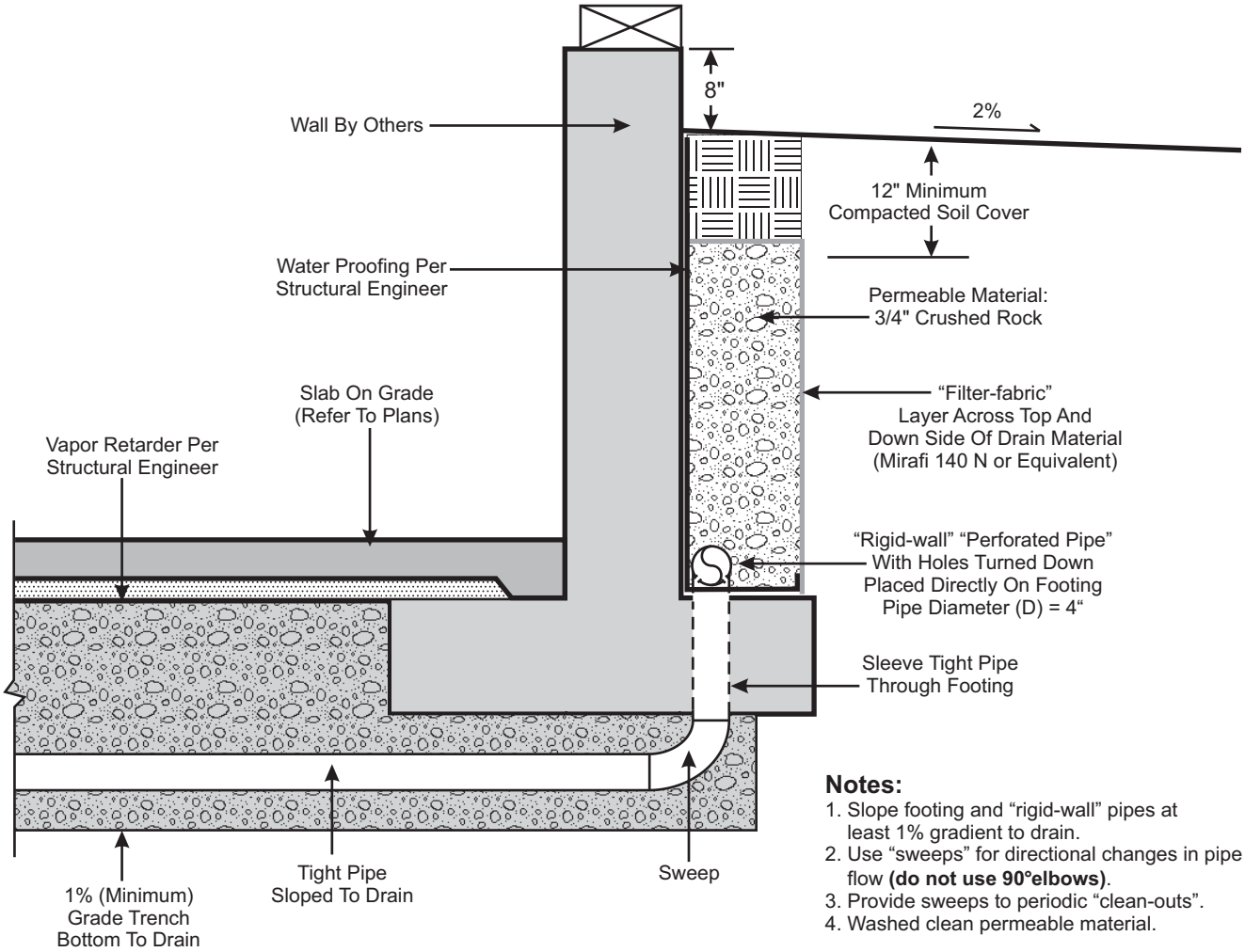


Notes:
1. Slope footing and "rigid-wall" pipes along flow line parallel to wall at least 1% gradient to drain to an appropriate outfall area away from residence.
2. Use "sweeps" for directional changes in pipe flow **(do not use 90°elbows)**.
3. Provide periodic "clean-outs".
4. Washed clean permeable material.

Not To Scale

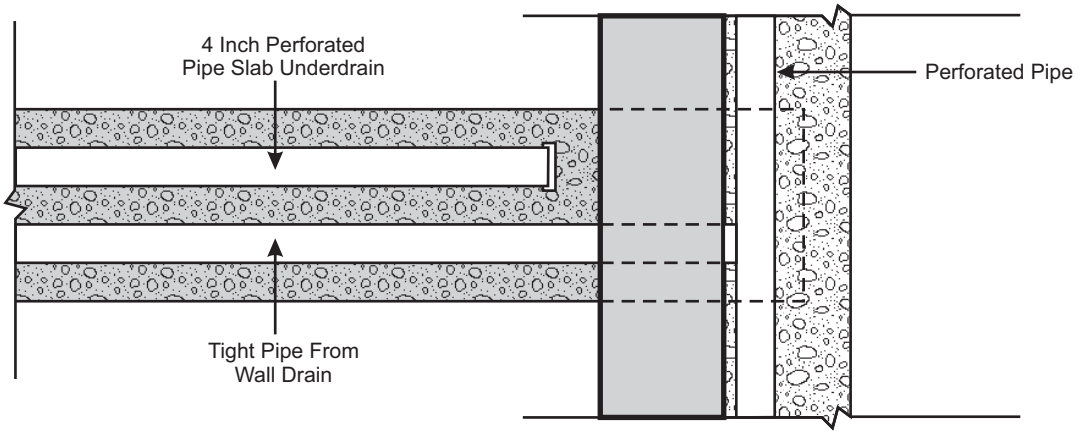
YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: E01414.001	**RETAINING WALL DRAIN DETAIL**	**FIGURE**
	June 2017	**Montano De El Dorado Phase II** El Dorado Hills, California	**C-3**

Profile View
(Typical)



Notes:
1. Slope footing and "rigid-wall" pipes at least 1% gradient to drain.
2. Use "sweeps" for directional changes in pipe flow **(do not use 90°elbows)**.
3. Provide sweeps to periodic "clean-outs".
4. Washed clean permeable material.

Plan View
(Typical)



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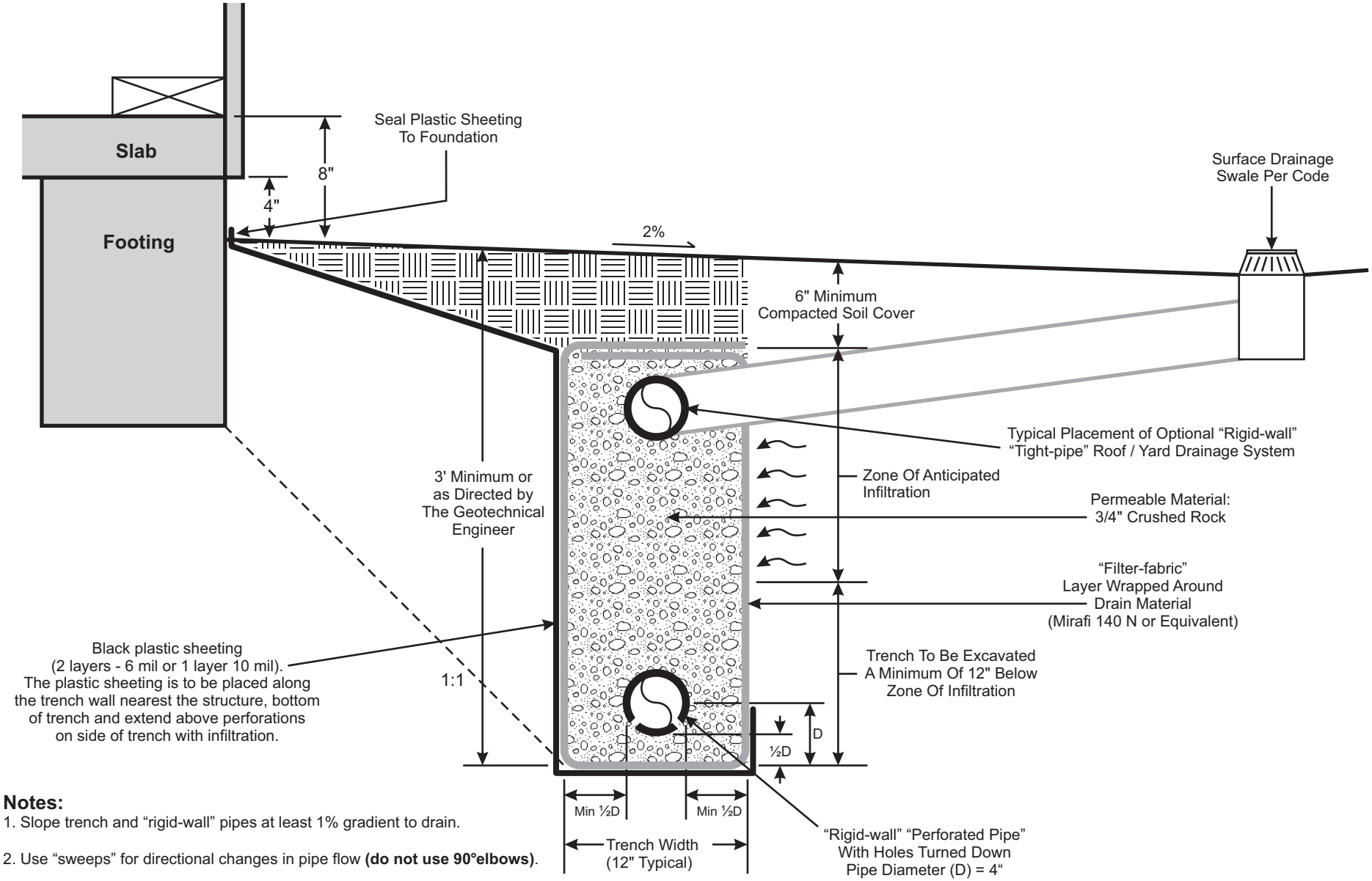
Project No.: E01414.001

June 2017

BASEMENT STEMWALL DRAIN

Montano De El Dorado Phase II
El Dorado Hills, California

FIGURE
C-4



Notes:

1. Slope trench and "rigid-wall" pipes at least 1% gradient to drain.
2. Use "sweeps" for directional changes in pipe flow **(do not use 90°elbows)**.
3. Provide sweeps to periodic "clean-outs".
4. Washed clean permeable material.

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Project No.: E01414.001

June 2017

SUB-DRAIN DETAIL

Montano De El Dorado Phase II
El Dorado Hills, California

FIGURE
C-5

APPENDIX D

Refraction Seismic Survey

Refraction Seismic Investigation at the Latrobe & White Rock Road Site APN 107-001-016 in El Dorado County, California

G&A Project No. 2001-38.01

Prepared by:

Gasch & Associates
Rancho Cordova, California 95742-6576

Submitted to:
Youngdahl Consulting Group, Inc.
Attn: Mr. Roy Kroll
1234 Glenhaven Court
El Dorado Hills, California 95762

September, 2001

GASCH & ASSOCIATES, INC.

October 1, 2001

Mr. Roy Kroll
Youngdahl Consulting Group, Inc.
1234 Glenhaven Court
El Dorado Hills, California 95762

Re: Refraction Seismic Investigation near the Intersection of Latrobe Road and White Rock Road, at A.P.N. 107-001-016, El Dorado County, California.
G&A Project No. 2001-38.01

Dear Mr. Kroll:

At your request and authorization, Gasch & Associates (G&A) has completed three refraction seismic (RS) lines, at locations jointly selected by Youngdahl Consulting and G&A personnel. RS data were acquired to provide rock competency, quantity and excavatability estimations for the site located near the intersection of Latrobe Road and White Rock Road, A.P.N. 107-001-016, in El Dorado County, California. Line locations were field staked, and their approximate locations and lengths are indicated on Figure 1.

Method

The RS method measures the velocity at which a seismic wave will propagate through a soil or rock medium. Higher seismic primary-wave velocities indicate material of higher density, typically indicating the competency, or strength of the material.

G&A's seismic data acquisition system was a digital, 60 channel, distributed 24-bit instrument with data output on magnetic media for later processing. Digital geophones were used and the energy source was an impact tool. All data were processed on our Seiswulf™ parallel processing supercomputer and plotted on our data reduction and plotting workstation.

Refraction seismic lines were acquired using 24, 27, and 30 active channels, with geophones placed at 25-foot intervals. Each line also had energy source points at 25-foot intervals, for a total of 29, 32 and 35 shot-points, respectively, per line. This thorough data saturation provided excellent resolution for each data set. Models created through the inversion process had very low error and correlated very well.

Findings

RS lines were arranged in a "double cross" formation (Figure 1) in order to provide an understanding of the excavatability aspects of the subsurface.

Figures 2, 3 and 4 show the Seismic Velocity Sections generated by processing. Examination of these sections will provide a good understanding of the velocity variations beneath the seismic lines. Seismic velocities are designated by color, and have been normalized for ease of comparison. For your convenience, the coloring has been scaled to indicate areas that are considered to be, rippable, marginal, or non-rippable by a Caterpillar D10R, as indicated in the Caterpillar Performance Handbook, Edition 29, October 1998 (Figure 5).

RS Line 1

RS Line 1 extends for a total length of 800 feet, in a southwest to northeast orientation. Passing over the most prominent "knob" on the site, it crosses RS Line 3 in a semi-perpendicular orientation. Figure 2 shows the model for RS Line 1 generated by the inversion process. Material with seismic velocities of approximately 3,500 feet per second (ft/s) to 7,000 ft/s, were measured to depths ranging from 15 to 45 feet below ground surface (bgs) over most of the line. Below the 7,000 ft/s horizon the material grades abruptly to over 10,000 ft/s. The included Caterpillar performance data suggests this higher velocity material to be marginal to non-rippable.

RS Line 2

The results of processing RS Line 2 are shown in Figure 3. This 725-foot line is oriented in a southwest-northeast direction. Seismic velocities, of 3,000 ft/s to 6,500 ft/s, were measured from near surface to about 40 feet in depth along most of this line. However, near the tie with RS Line 3, a local higher velocity mound is evident. Beneath this lower velocity horizon the deeper material velocities increase rapidly to greater than 10,000 ft/s, indicating non-rippable material.

RS Line 3

RS Line 3 extends for a total length of 875 feet, in a northwest to southeast orientation, across the two prominent outcrop "knobs" at the site. Figure 4 shows the model for RS Line 3 generated by the inversion process. Material with seismic velocities of approximately 3,300 feet per second (ft/s) to 7,000 ft/s, were measured to depths ranging from 15 to 45 feet below ground surface (bgs) over most of the line. This lower velocity material thickens slightly from the southeast to the northwest along this RS Line. Below the 7,000 ft/s horizon the material grades abruptly to over 10,000 ft/s. The included Caterpillar performance data suggests this higher velocity material to be marginal to non-rippable.

Conclusions and Recommendations

In summary, each refraction seismic line must be evaluated independently due to the unique and complex geologic character beneath each line. These variations in seismic velocity are typical for this geologic setting in the Sierra Nevada foothills.

The relatively high velocities measured are typical of the metamorphic rock throughout the area. In areas where cuts will intersect material with seismic velocities greater than 8,000 ft/s, drilling and blasting may be the most economic means of excavation. Additionally, this material may provide a considerable source of rock that is suitable for aggregate base.

We trust that this is the information you require; however, should you have comments or questions, please contact our Rancho Cordova office at your convenience. Thank you for this opportunity to be of service.

Sincerely,

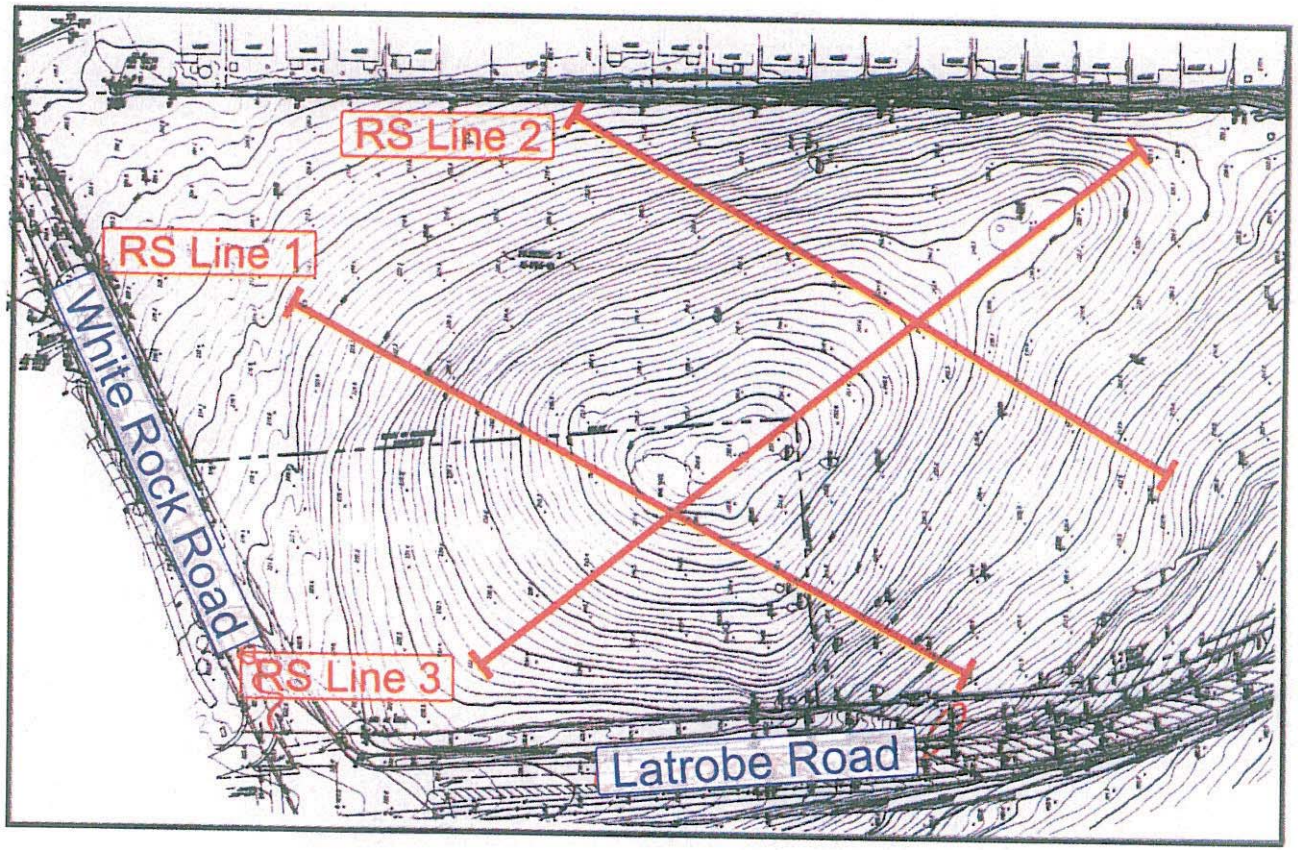
FOR JWG
Jerrie W. Gasch
Registered Geophysicist #516
Registered Geologist #1203
Engineering Geologist #450

Kent L. Gasch
Geophysicist
Geologist

David T. Hagin
Registered Geophysicist #1033
Geologist

John Busby
Geophysicist
Geologist

Seismic Line Location Map



0 500 Feet

Scale: 1" = 200'

North

Figure 1

Latrobe Road & White Rock Road Site:
APN: 107-001-016
Refraction Seismic Investigation

CONSULTANTS IN GEOPHYSICS AND GEOLOGY FOR THE ENGINEERING, GEOTECHNICAL, ENVIRONMENTAL and LEGAL PROFESSIONS.
GASCH & ASSOCIATES
3174 Luyung Drive, Building #2
Rancho Cordova, California 95742 U.S.A.
(916) 635-8906 • FAX (916) 635-8907

Prepared for: Youngdahl Consulting Group, Inc.

Project Number: 2001-38.01 **Date:** September, 2001

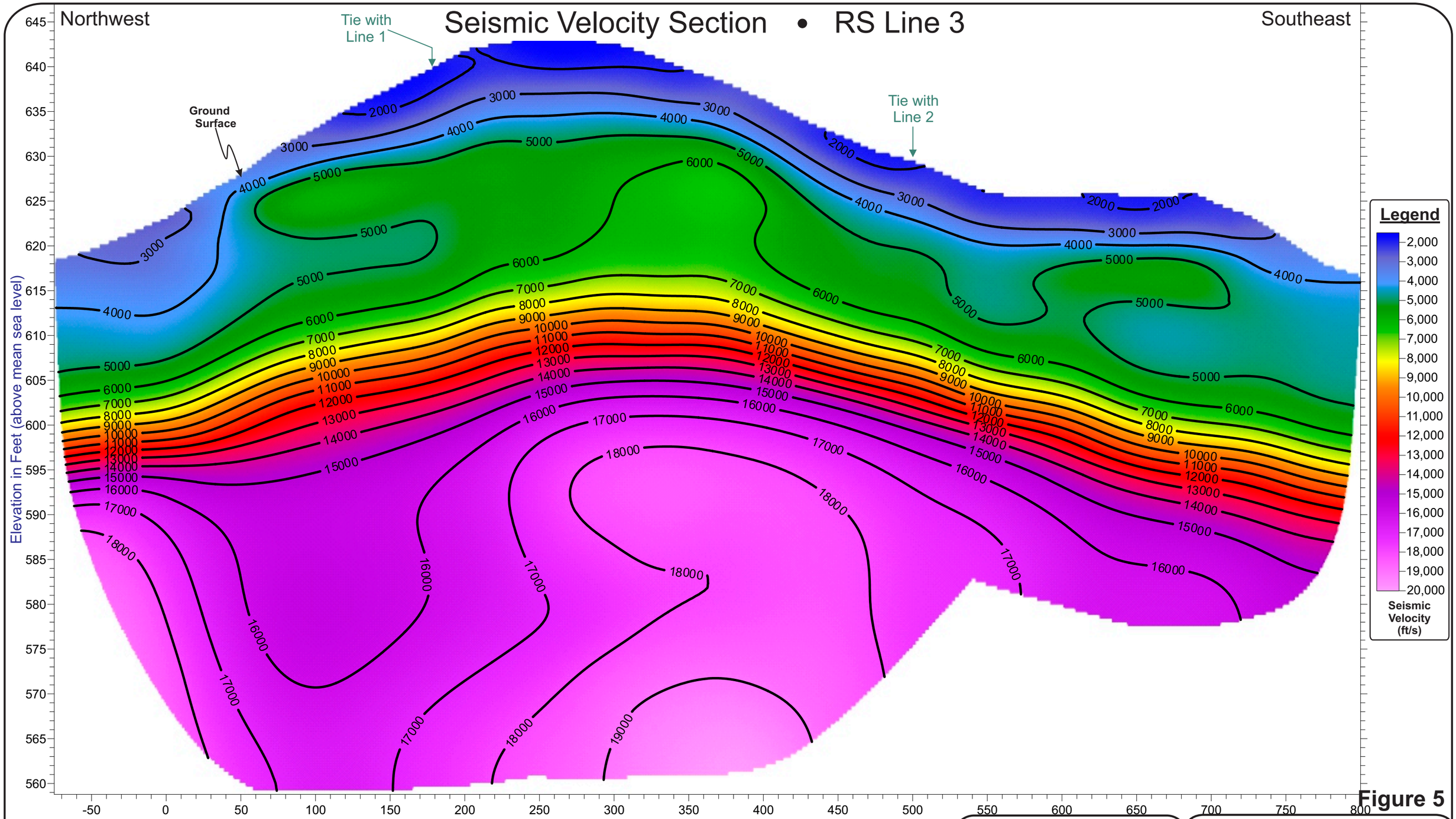


Figure 5

Scale:
Horizontal: 1" = 60'
Vertical: 1" = 10'
Geophone Station Interval = 25 feet

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Refraction Seismic Investigation:
Montano De El Dorado

Prepared for: Youngdahl Consulting Group

Project Number: 2001-38.15 ***Date:*** July, 2015

Seismic Velocity Section • RS Line 2

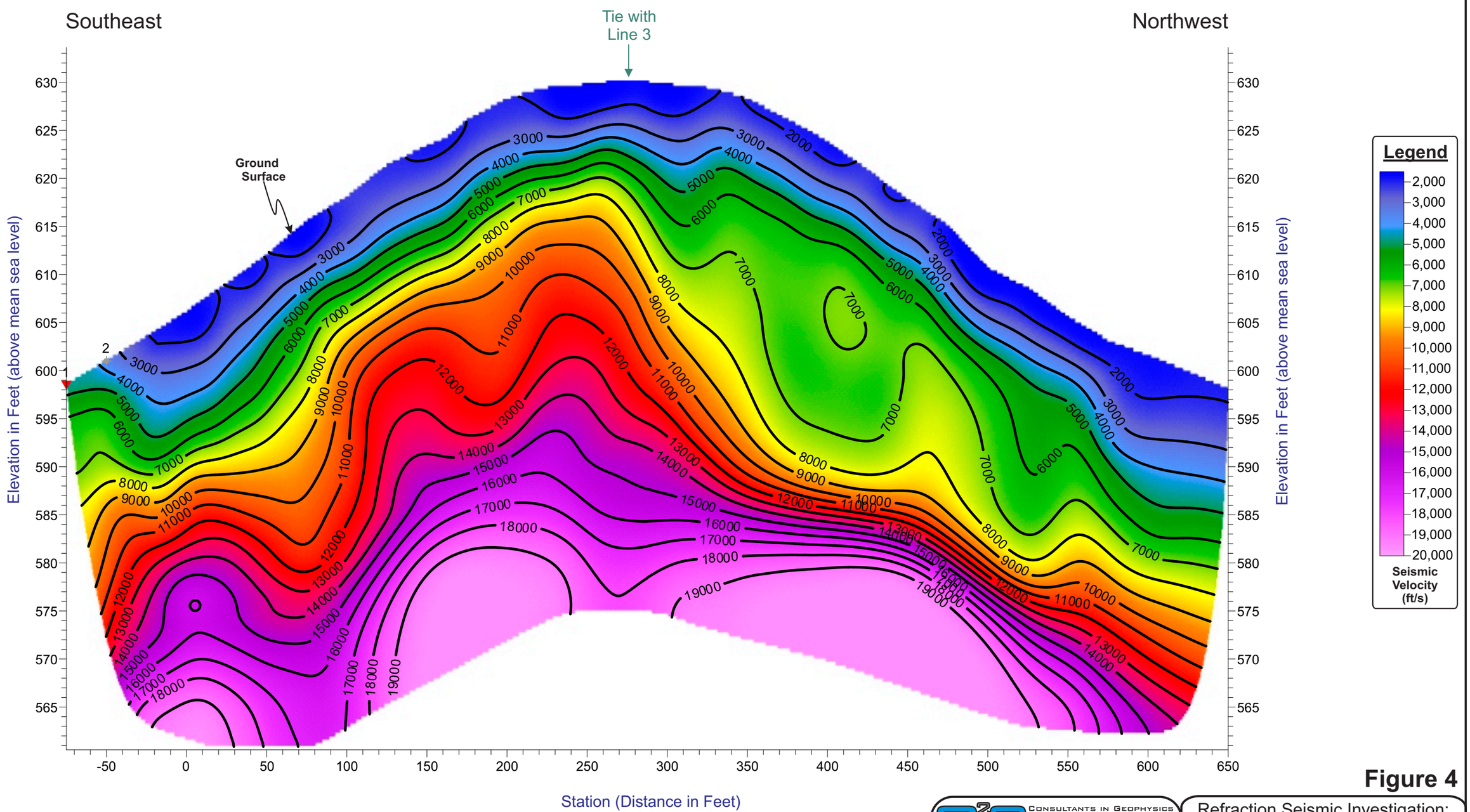

Figure 4

Scale:
Horizontal: 1" = 60'
Vertical: 1" = 10'
Geophone Station Interval = 25 feet

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Refraction Seismic Investigation: Montano De El Dorado

Prepared for: ***Youngdahl Consulting Group***

Project Number: 2001-38.15 ***Date:*** July, 2015

Seismic Velocity Section • RS Line 1

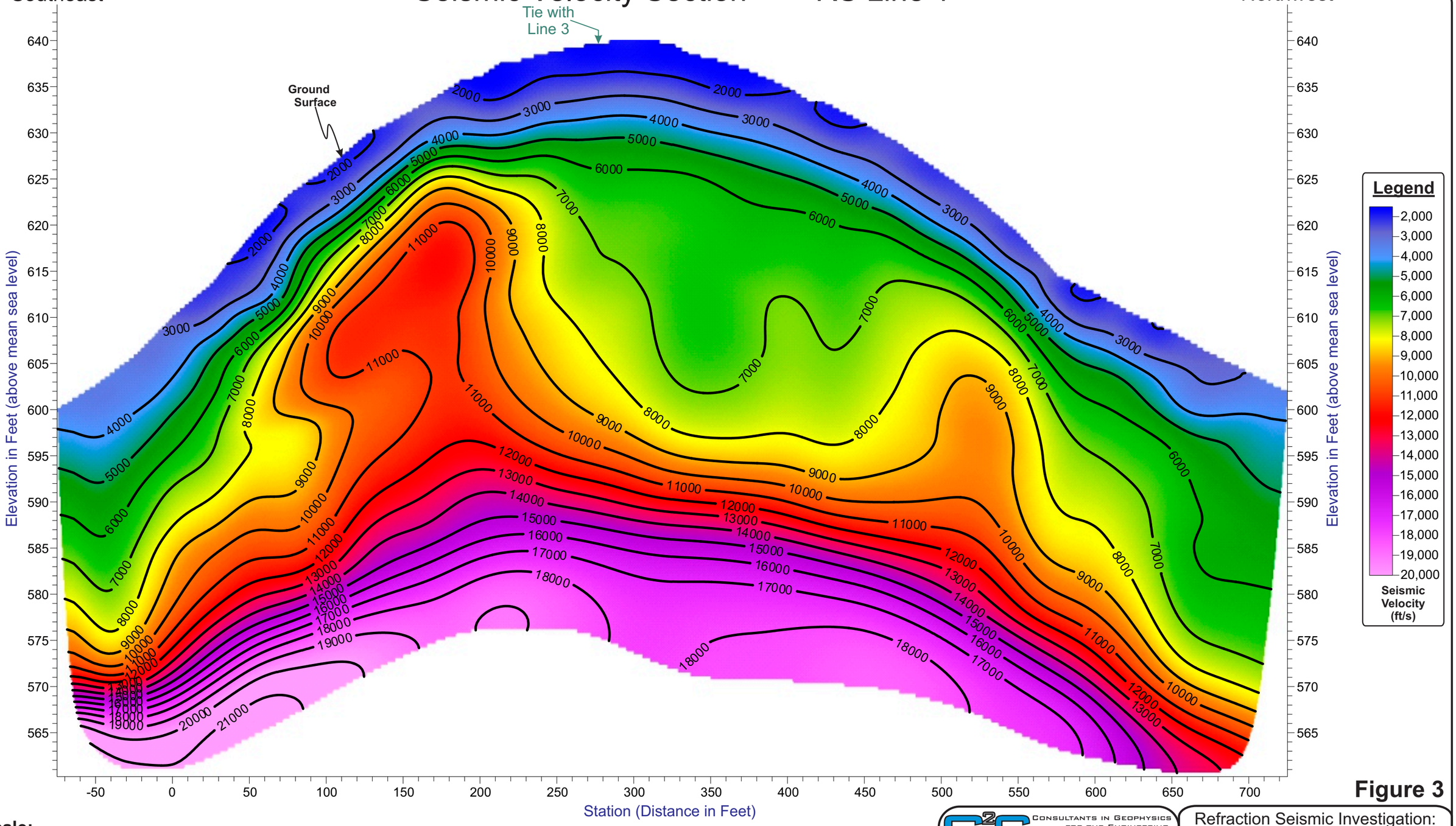

Figure 3

Scale:
Horizontal: 1" = 60'
Vertical: 1" = 10'
Geophone Station Interval = 25 feet

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(916) 635-8906 • FAX (916) 635-8907

Refraction Seismic Investigation: Montano De El Dorado

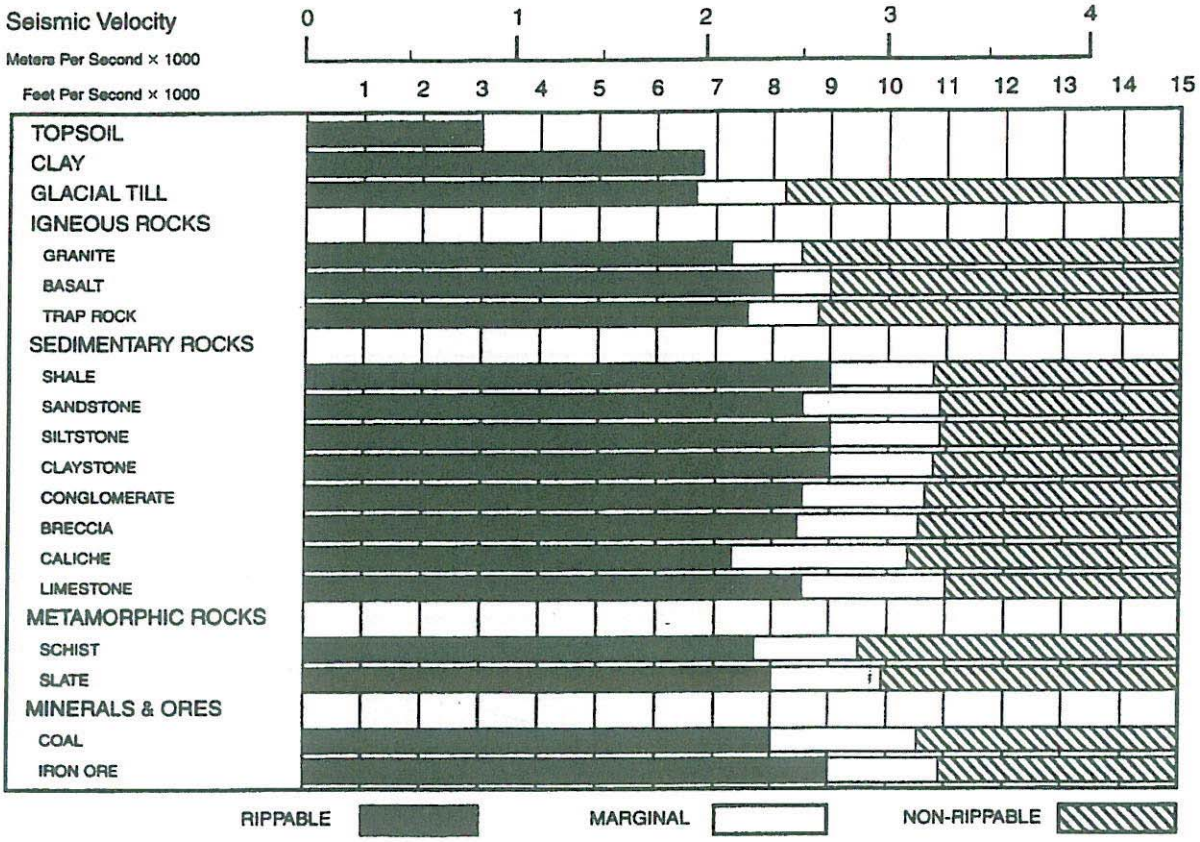
Prepared for: Youngdahl Consulting Group

Project Number: 2001-38.15 ***Date:*** July, 2015

Caterpillar D10R Ripper Performance Chart*

Rippers | Ripper Performance
• D10R

D10R
- **Multi or Single Shank No. 10 Ripper**
- **Estimated by Seismic Wave Velocities**



* Based on the Caterpillar Performance Handbook Edition 29

Figure 5

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Latrobe Road & White Rock Road Site:
APN 107-001-016
Refraction Seismic Investigation

Prepared for: Youngdahl Consulting Group, Inc.

Project Number: 2001-39.01 **Date:** September, 2001