GEOTECHNICAL ENGINEERING STUDY FOR DELMAR FARMS SUBDIVISION

Sierra College Boulevard and Bankhead Road
Loomis, California

Project No. E18269.000
October 2018

YOUNGDAHL
CONSULTING GROUP, INC.

Building Innovative Solutions

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B.E.M., Inc.
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Attention: Ms. Jane Rupp

Project No. 18269.000
26 October 2018

Subject: **GREEN BUSINESS PARK LOOMIS**
Sierra College Boulevard and Bankhead Road, Loomis, California
GEOTECHNICAL ENGINEERING STUDY

References:
1. Aerial Topography and Mapping, for Loomis Crossing, prepared by Aerotech Mapping, Inc., dated 29 June 2018.
2. Proposal and Contract for Green Business Park Loomis GES prepared by Youngdahl Consulting Group, Inc., executed 20 July 2018 (Project No. E18269.000).

Dear Ms. Rupp:

In accordance with your authorization, Youngdahl Consulting Group, Inc. has performed a geotechnical engineering study for the proposed Green Business Park Loomis located on the southwest side of Sierra College Boulevard in Loomis, California. The purpose of this study was to perform a subsurface exploration and evaluate the surface and subsurface soil conditions at the site and provide geotechnical information and design criteria for the proposed project. Our scope was limited to a subsurface investigation and preparation of this report per the Reference 2 proposal. Our scope of services to complete this study included a review of the documents provided to our firm, a site reconnaissance to observe the existing surface conditions, a subsurface exploration to evaluate the subsurface soil conditions, laboratory testing, and preparation of this report.

Based on our study, we anticipate that grading and excavation operations for the Green Business Park Loomis are likely to encounter shallow bedrock conditions associated with quartz diorite of the Penryn pluton. This bedrock was encountered in the all of the test pits, with varying degrees of weathering. The presence of this rock may result in slower grading and excavation operations requiring larger equipment. Other geotechnical issues could be encountered during grading and excavation operations which include the potential for water to perch on the soil/bedrock horizon and seepage through fractures in the bedrock. The descriptions, findings, conclusions, and recommendations provided in this report are formulated for the project 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 B.E.M., Inc. 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.

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GEOTECHNICAL ENGINEERING STUDY
FOR
GREEN BUSINESS PARK LOOMIS

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering study update performed for the proposed commercial development planned to be constructed along Sierra College Boulevard and Bankhead Road in Loomis, 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 existing information, explore and evaluate 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 available to us at the time of our study;
- A field study consisting of a site reconnaissance, followed by an exploratory test pit program to observe and characterize the subsurface conditions;
- A laboratory testing program performed on representative samples collected during our field study;
- Engineering analysis of the previous data and information obtained from our field study, 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, slope configuration and grading, underground improvements, and drainage;
- Development of geotechnical design criteria for seismic conditions, shallow foundations, differential support conditions, retaining walls, slabs on grade, and pavements;
- Preparation of this report summarizing our findings, conclusions, and recommendations regarding the above described information.

Project Understanding

The project consists of the construction of an approximate 85-acre commercial development to be located at the southwest corner of Sierra College Boulevard and Bankhead Road. The tentative project development map provided to our firm indicates that the development will consist of a series of office buildings and warehouse structures.

Development plans had not been finalized at the time this report was prepared. We anticipate the structures will be one to two story buildings of Structural Insulated Panels (SIPS) construction with slab-on-grade floors. Grading is anticipated to include earthwork cuts and fill on the order of 1 to 10 feet.

Infrastructure improvements are expected to include utilities, roadways, and parking as well as encroachments on to Sierra College Boulevard and Delmar Avenue. An emergency access road will also be constructed to access the site off of Bankhead Road.

Background

A portion of the site has been previously graded prior to 1993 in the northwestern portion fronting on Sierra College Boulevard. At least two residences and several outbuildings were located on the site from as early as 1952 through 2002. It appears that the site has generally been used for primarily agricultural purposes; orchards, cattle grazing, and other fruit crops. Currently the site is being used for cattle grazing and a fruit stand.

2.0 FINDINGS

The following section describes our findings regarding the site conditions that we observed during our site reconnaissance and subsequent subsurface exploration. In addition, this section also provides the results of our laboratory testing, geologic review, and engineering assessment related to the project site.

Surface Observations

The project site is located on the southwest corner of Sierra College Boulevard at Bankhead Road in Loomis, California and extends south to the business park at Alvis Court and to the west to Delmar Avenue. The development area is on a ridgeline which generally slopes slightly from the northeast to southwest through the middle of the development site and slopes down to the northwest and southeast at gentle gradients. Relief across the site ranged from 332 feet above mean sea level (amsl) at the northeast corner to 311 amsl at the southwest corner. Approximately half of the site drains to the south and west to Antelope Creek and to the south and east to an unnamed drainage. Access to the site was through locked gates at Sierra College Boulevard and Bankhead Road at the north end and Delmar Avenue, near the southwest corner.

Grading operations have occurred most recently on the northwest portion of the site where approximately 8 vertical feet was excavated and exported from the site to construct a portion of Sierra College Boulevard. The excavation exposed very fresh outcrops of light colored medium to fine grained quartz diorite bedrock. Concrete slab foundations were observed at the northwest and southwest corners of the site. Numerous stockpiles of rocks, concrete, wood and construction debris were primarily located in the southwest portion of the site. Gas lines were traced from the southwest corner access point off Delmar Avenue and terminated near the vicinity of Test Pit (TP) 7.

The terrain at the site is heavily vegetated with seasonal grasses and occasional collections of deciduous trees. The vegetation throughout the project generally consisted of oak trees, remaining orchard trees, and seasonal grasses. Numerous outcrops of massive quartz diorite in varying degrees of weathering were frequently spread across the site.

Subsurface Conditions

Our field study included a subsurface exploration program conducted on 26 and 27 September 2018. The exploration program included the excavation of 30 exploratory test pits under the direction of our representative at the approximate locations shown on Figure A-2, Appendix A to evaluate subsurface conditions. A description of the field exploration program is provided in Appendix A.

Subsurface soil conditions were relatively consistent over the site. The subsurface conditions within the test pits observed at the project site included a thin veneer of light brown to dark brown silty SANDS overlying quartz diorite bedrock. The surface soils were medium dense to dense condition to the maximum depth explored of 3 ½ feet in TP-25, but less than 1 feet in all other test pits. Less than 1 foot of fill was encountered in test pits TP-21 through 24 that may have been incidental to recent farming activities. Underlying the surface soils, relatively massive quartz-diorite bedrock was observed, in a moderately to highly weathered, moderately hard to hard condition. Resistant rock was encountered in test pits TP-5 and TP-22 ranging from 1 to 3½ feet below ground surface (bgs). Overall, the shallow bedrock was encountered less than a foot below ground surface and continued in to the maximum depth explored without caving or sloughing. Essential backhoe refusal was encountered at depths of 1½ to 10 feet with the relatively light backhoe used for this study. 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-33, Appendix A. These logs show a graphic interpretation of the subsurface profile, and the location and depths at which samples were collected. The subsurface logs for the original geotechnical engineering report are presented in Appendix B of this report.

Groundwater Conditions
Groundwater conditions were observed in two test pit locations; TP-26 and TP-29 at depths of 4 feet and 7½ feet bgs, respectively. Generally, subsurface water conditions vary in the foothill regions because of many factors such as, the proximity to bedrock or cemented soils, topographic elevations, and proximity to surface water. Some evidence of past repeated exposure to subsurface water may include black staining on fractures; red clay on rock fractures/joints, and surface markings indicating previous seepage. Based on our experience in the area, at varying times of the year water may be perched on less weathered cemented soils and/or present in the fractures and seems of the cemented soils 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. According to the U.S. Geologic Survey, Pre-Cenozoic Geology of the south half of the Auburn 15-Minute Quadrangle (Olmsted, F.H., 1971, US Geological Survey Bulletin 1341) this portion of the project area is underlain by quartz-diorite (Kjpl) from the Penryn Pluton of Jurassic age (199.6 to 145.5 million years ago).

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 field study. The nearest mapped potentially active and active faults pertinent to the site are summarized in the following table.

Table 1: Local Active and Potentially Active Faults

Activity	Fault Name	Distance	Direction
Historic	Dog Valley Fault	66 mi	NE
Historic	Cleveland Hill	40 mi	N
Active	Dunnigan Hills	38 mi	W
Active	West Tahoe	60 mi	E
Active	North Tahoe	64 mi	E
Potentially Active	Deadman Fault	6 mi	NE
Potentially Active	Bear Mountain Fault	7 mi	NE
Potentially Active	Spenceville	8 mi	N
Potentially Active	Wolf Creek	10 mi	NE

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 pore water 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 relatively low seismicity of the area and the relatively shallow depth to bedrock, 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 were 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 relatively low seismicity of the area, and the relatively shallow depth to bedrock, the potential for seismically induced slope instability for the existing slopes is considered negligible.

Laboratory Testing
Laboratory testing of the 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 following tests were performed for the preparation of this report:

Table 2: Laboratory Testing Summary

Laboratory Test	Test Standard	Summary of Results	
Direct Shear	ASTM D3080	TP1 @ 1-3 ft.	Φ = 45.9°, c = 0 psf
Direct Shear	ASTM D3080	TP17 @ 5-8 ft.	Φ = 44.6°, c = 0 psf
R-Value	Caltrans 301	TP3 @ 4-6 ft.	68
R-Value	Caltrans 301	TP27 @ ft.	65
Maximum Dry Density	ASTM D1557	TP1@1-3 ft.	γ_D = 131.6 pcf, MC = 7.8 %
Maximum Dry Density	ASTM D1557	TP1@1-3 ft.	γ_D = 126.7 pcf, MC = 10.4 %
Soil Resistivity/pH	CTM 643	TP1 &TP17:	pH = 5.46, Min. Resistivity = 11.79 pH = 5.66, Min. Resistivity = 16.08

Soil Expansion Potential
The materials encountered in our explorations were generally non-plastic (rock, sand, and non-plastic silt). The non-plastic materials are generally considered to be non-expansive.

Occasional pockets of plastic materials (clay soils) could be found in the soil matrix found in the quartz-diorite bedrock if the minerals within the matrix experience a high degree of weathering and are converted to clay minerals. Due to the absence of plastic materials observed, we do not anticipate that special design considerations for expansive soils will be required for the design or construction of the proposed improvements provided the plastic materials are adequately blended with the non-plastic site soils prior to use as engineered fill during the site grading procedures. 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 or identified for this study.

Soil Corrosivity

A corrosivity testing suite consisting of soil pH, resistivity, sulfate, and chloride content tests were performed on selected soil samples collected during our site exploration. We are not corrosion specialists and recommend that the results be evaluated by a qualified corrosion expert. The laboratory test results (provided by Sunlab, Inc.) are provided in Appendix B and are summarized in Table 3, below.

Table 3: Corrosivity Summary

Location	Soil pH	Minimum Resistivity ohm-cm (x1000)	Chloride (ppm)	Sulfate (ppm)	Caltrans Environment	ACI Environment
TP-1	5.46	11.79	1.6	4.4	Non Corrosive	Non Corrosive
TP-17	5.66	16.08	0.8	2.9	Non Corrosive	Non Corrosive

According to Caltrans Corrosion Guidelines Version 2.1, March 2018, the test results appear to indicate a non-corrosive environment with the exception of 1 location which was considered to be potentially corrosive due to a pH below 5.5. According to the 2016 California Building Code Section 1904.1 and ACI 318-14 Table 19.3.1.1, the test results indicate the onsite soils have a negligible potential for sulfide attack of concrete. Accordingly, Type I/II Portland cement is appropriate for use in concrete construction. A certified corrosion engineer should be consulted to review the above tests and site conditions in order to develop specific mitigation recommendations if metallic pipes or structural elements are designed to be in contact with or buried in soil.

3.0 GEOTECHNICAL APPROACH TO DEVELOPMENT

The information provided below is intended to provide a discussion of the intent of this report and some anticipated conditions which may be present during construction of the project site.

Approach to Development

We anticipate that grading and site improvement operations for the project site will be performed using large grading equipment such as scrapers, dozers, and excavators. We further anticipate that grading operations in some areas may be easier to perform than others due to the geology of the region and civil design requirements, particularly associated with underground utilities and slopes. During the initial phase of grading and site improvements, we anticipate that the focus will be directed to excavating or filling for the major roadways followed by excavations for the installation of the underground improvements. Retaining wall construction, if proposed, could be performed during or following the grading operations, depending on site conditions and access requirements.

Penryn Pluton geologic materials used for engineered fills has generally resulted in engineered fills having rock content less than 30 percent rock by mass. For conditions where the rock content exceeds 30 percent or more by mass, it is possible that the engineered fills may require full time inspection services by our firm to evaluate compaction effort and may require larger compaction equipment such as a CAT 825 compactor.

Anticipated Excavation Performance

The underlying rock materials can likely be excavated to depths of several feet using CAT D10 dozers with a single or multiple shank rippers and self-propelled or push/pull scrapers. We anticipate that a ripper equipped D10 can penetrate at least as deep as the test pits at most locations with moderate effort.

Where hard rock cuts in massive resistant bedrock are proposed, the orientation and direction of ripping will likely play a large role in the rippability of the material. When hard rock is encountered, we should be contacted to provide additional recommendations prior to performing an alternative such as blasting.

Based on our excavation of test pits within the area of development, the bedrock materials are generally anticipated to be rippable; however, the underlying dioritic bedrock may be significantly less weathered at depths greater than 10 feet in most areas except in the areas of TP-5 and TP-22, which encountered resistant bedrock at 1½ and 5 ½ feet below ground surface. These two areas were the local topographic high elevations. This condition could result in a restrictive excavation at the weathered/fresh bedrock contact and possibly some rock intrusions which may not be associated with a uniform rock mass.

Utility trenches will likely encounter hard rock excavation conditions especially in deeper cut areas. Utility contractors should be prepared to use special rock trenching equipment such as large excavators (Komatsu PC400 or CAT 345 or equivalent), equipped with standard size buckets and trapezoid buckets for deep trench utilities. Blasting to achieve utility line grades, especially in planned cut areas, cannot be precluded. Water inflow into any excavation within close proximity to local drainage areas or areas of high seasonal groundwater is likely to be experienced in all but the driest summer and fall months. Pre-ripping during mass grading may be beneficial and should be considered with the Geotechnical Engineer prior to, or during mass grading.

Selection of Retaining Wall Systems

We understand that retaining walls may be proposed for a portion of the site and anticipate that the common retaining wall systems that could be used including rockery walls, segmental walls, reinforced walls, and cast-in-place walls could be readily incorporated into the design elements of the site. Some difficultly may be encountered for the inclusion of rockery retaining walls due to the potentially limited source of suitable rock onsite. Our firm could provide design elements for these types of wall systems and, if necessary, work with the specialty wall designer in implementation of the wall at the project site.

4.0 SITE GRADING AND EARTHWORK IMPROVEMENTS

Site Preparation

Preparation of the project site should involve demolition, site drainage controls, dust control, clearing and stripping, overexcavation and recompaction of existing fills/loose native soils, and exposed grade compaction considerations. The following paragraphs state our geotechnical comments and recommendations concerning site preparation.

<u>Demolition</u>: As part of the demolition operation, any unwanted foundation, structural improvement, or site improvement elements (including underground utilities) should be exhumed and removed from the site. In addition, any underground storage tanks, abandoned wells or other utilities not intended for reuse should be removed or backfilled in accordance with the appropriate regulations.

Concrete and asphalt separated from the other debris, and adequately broken down in particle size, may be mixed thoroughly with soil and placed as engineered fill as described below. If this option is exercised, a representative from our firm should be contacted to observe the adequacy of grading operations associated with the breaking and mixing of these elements.

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.

Addressing Existing Fills: Following general site clearing, all existing fills and fill stockpiles should be overexcavated down to firm native materials. Any depressions extending below final grade resulting from the removal of fill materials or other deleterious materials should be properly prepared as discussed below and backfilled with engineered fill. Additional services are anticipated to evaluate and address existing fills as they are encountered during construction operations. A representative of our firm should be present during site clearing operations to help identify the location and depth of potential fills not encountered in preparation of this report.

Expansive Clay Mitigation: Proper disposition of clays on site should be documented by a representative of Youngdahl Consulting Group, Inc. We should be afforded the opportunity to review the project grading plans to make a preliminary determination where expansive soil mitigation measures may be warranted. Any final determination of mitigation measures should be based on the conditions observed during grading.

Overexcavation and Recompaction of Loose/Soft Native Soils: Any loose or saturated materials within the proposed structural improvement and pavement areas should be overexcavated to firm conditions and be restored with engineering fill. A representative of our firm should be present during site clearing operations to help 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 and overexcavation operations 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.

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.

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. 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.

Rock fragments or boulders exceeding 12 inches in maximum dimension should not be placed within the upper five feet of site grades or utility corridors. Boulders over 24 inches in maximum dimension should be placed within the deeper portions of fill embankments below a depth of 5 feet and a minimum of 5 feet from the finish slope face. The individual boulders should be spaced such that compaction of finer rock and soil materials between the boulders can be achieved with the equipment being used for compaction. Materials placed between the boulders should consist of predominantly soil and rock less than 12 inches in maximum dimension. The soil/rock mixture should be thoroughly mixed and placed between the boulders so as to preclude nesting or the formation of voids. Should insufficient deep fill areas exist for oversize rock disposal, the contractor should either dispose of the excess materials to an offsite location or mechanically reduce the rocks to less than 12 inches.

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. "R"-value of equal to or greater than 40;
3. An angle of friction equal to or greater than 32 degrees;

4. Should not contain rocks larger than 6 inches in diameter;
5. Not more than 30 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, pavement, 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 90 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 8 inches in uncompacted thickness. The fill should be moisture conditioned as necessary and compacted to a relative compaction of not less than 90 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.

To mitigate the potential for deep fill settlement, all fills placed deeper than 10 feet from finished grade should be compacted to a minimum of 95 percent relative compaction. The fills should be placed at a minimum of two percent over optimum moisture content.

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, or by method specification if the quantity of rock fragments in the fills preclude traditional compaction testing. This will likely include the excavation of test pits within the fill materials to observe and document that a uniform over-optimum moisture condition and absence of large and/or concentrated voids has been achieved prior to additional fill placement.

Method Specification: Soils exceeding 30 percent rock by mass may be considered non-testable by conventional methods. The materials may be placed as engineered fill if placed in accordance with the following method specification during full time observation by a representative of our firm.

Soils should be moisture conditioned and compacted in place by a minimum of four completely covering passes with a Caterpillar 825, or approved equivalent. The compactor’s last two passes should be at 90 degrees to the initial passes. In areas where 95 percent relative compaction is designated, an additional two passes should be applied in each direction, with three completely covering passes made at 90 degrees to the initial three passes. Engineered fill should be constructed in lifts not exceeding 12 inches in uncompacted thickness, moisture conditioned and compacted in accordance with the above specification. Additional passes as deemed necessary during fill placement to achieve the desired condition based upon field conditions may be recommended.

Slope Configuration and Grading

The following section addresses geotechnical aspects of grading and construction efforts for slopes proposed to be constructed at the Green Business Park Loomis. These recommendations are based on our observations and documentations provided to date. Due to the variability of natural materials, additional recommendations may be necessary depending on conditions observed at the time of grading.

Temporary Slopes: Trenches or excavations should be shored or sloped back in accordance with current OSHA regulations prior to persons entering them. Where a clay rind in combination with moist conditions is encountered in fractured rock, the project engineering geologist should be consulted for appropriate mitigation measures. The clay rind is most commonly encountered in dioritic rock type materials. The potential use of a shield to protect workers cannot be precluded.

It has been our experience that temporary excavations in the materials observed onsite have been capable of being temporarily stable at gradients of about 1H:1V. Steeper conditions could be realized when excavating into the moderately weathered rock; however, these steeper conditions could have variable results. Stability of temporary excavations and slopes is the purview of the contractor. A representative of our firm should be requested to provide consultation and observation of over-steepened configurations.

<u>Permanent Slopes</u>: We anticipate that the project site will 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.

<u>Placement of Fills on Slopes</u>: 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.

<u>Slope Face Compaction</u>: 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.

<u>Slope Drainage</u>: 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

<u>Trench Excavation</u>: 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.

A common problem occurs on sites graded with large equipment and rocky fill materials where the excavated spoils from the lot utilities are too rocky to place as engineered fill back in the trench with the common compaction practices employed by the subcontractors installing these utilities. We recommend that, where excavated soils are too rocky to place and compact to a tight condition with low void space, these materials be replaced with a proper import material for compaction.

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, springs), 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 4: 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	0.479g
Figure 1613.3.1(2)		1.0s Period MCE, S_1	0.243g
Table 1613.3.3(1)		Site Coefficient, F_a	1.200
Table 1613.3.3(2)		Site Coefficient, F_v	1.600
Equation 16-37		Adjusted MCE Spectral Response Parameters, $S_{MS} = F_aS_s$	0.575g
Equation 16-38		Adjusted MCE Spectral Response Parameters, $S_{M1} = F_vS_1$	0.378g
Equation 16-39		Design Spectral Acceleration Parameters, $S_{DS} = ⅔S_{MS}$	0.384g
Equation 16-40		Design Spectral Acceleration Parameters, $S_{D1} = ⅔S_{M1}$	0.252g
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	C
Table 1613.3.5(2)		Seismic Design Category (1-Second Period), Occupancy I to IV	D
	Figure 22-7	Maximum Considered Earthquake Geometric Mean (MCE_C) PGA	0.156g
	Table 11.8-1	Site Coefficient F_{PGA}	1.200
	Equation 11.8-1	$PGA_M = F_{PGA}$ PGA	0.188g

*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 5,000 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 0.40 may be utilized for sliding resistance at the base of conventional shallow foundations in firm native materials or engineered fill and 0.50 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 500 pcf for weathered bedrock conditions. If friction and passive pressures are combined, the lesser value should be reduced by 50 percent.

Foundation Settlement: Settlement on foundations bearing on bedrock is anticipated to be less than ½ an inch. A total settlement of less than 1 inch is anticipated on native soils or engineered fill; 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 one and two-story slab-on-grade buildings (one supported floor) or 18 inches for two supported floors. Isolated pad foundation should be a minimum of 24 inches in diameter.

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 continuous footing foundations be reinforced with two No. 4 reinforcing bars, one located near the bottom of the footing and one near the top of the stem wall. Where foundations are constructed within a cut-fill transition, soil to rock interface, or over minor surface irregularities (i.e. point load conditions within resistant bedrock), as a consideration to span these localized differential irregularities, we suggest that structural footing reinforcing steel be doubled top and bottom (minimum, four No. 4 reinforcing bars, two each top and bottom) extending a minimum of 10 feet continuous length on both sides of the transition/irregularity.

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 90 percent of the maximum dry density (based on ASTM D1557).

Differential Support Conditions: Differential support conditions may be a concern where fills are placed and compacted for construction of a building pad and the proposed building will span from a native to bedrock and/or deep fill condition (i.e. fills greater than 10 feet). In order to mitigate the potential for differential settlement, overexcavation of the cut portion of the building pad, deepening of the foundations or adjustment of compaction requirements may be recommended. We should be afforded the opportunity to review the construction plans in order to develop site specific recommendations regarding differential conditions.

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 5,000 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 0.40 may be utilized for sliding resistance at the base of conventional shallow foundations in firm native materials or engineered fill and 0.50 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 500 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 7, 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 5: Retaining Wall Pressures

Parent Material	Wall Type	Slope Configuration	Equivalent Fluid Weight (pcf)	Lateral Pressure Coefficient	Earthquake Loading (plf)***	
Engineered Fill	Free Cantilever	Flat	31	0.22	$11H^2$	Applied 0.6H above the base of the wall
		2H:1V	43	0.30		
	Restrained**	Flat	51	0.36	$20H^2$	

* 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 6: Mechanically Stabilized Earth Parameters

Internal Angle of Friction	Cohesion	Bulk Unit Weight
35 degrees	0 psf	130 pcf

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 home construction, it is imperative that the outlets be routed into the tight pipe area drainage system and not buried and rendered ineffective.**

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 structures, 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.

<u>Slab Subgrade Preparation</u>: 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.

We understand that the proposed slab configuration to be as follows:

- 6” concrete
- ½ “ sand
- 15 mil Stego® Wrap vapor barrier
- 2” EPS29 Insulafoam® GF, 1.8 lb density
- Leveling course of $^{3}/_{8}$ “ pea gravel
- 2” crushed rock

This slab profile is considered acceptable from a geotechnical standpoint; however, the design of the slab and underlayment is the purview of the structural engineer.

<u>Slab Moisture Protection</u>: 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.

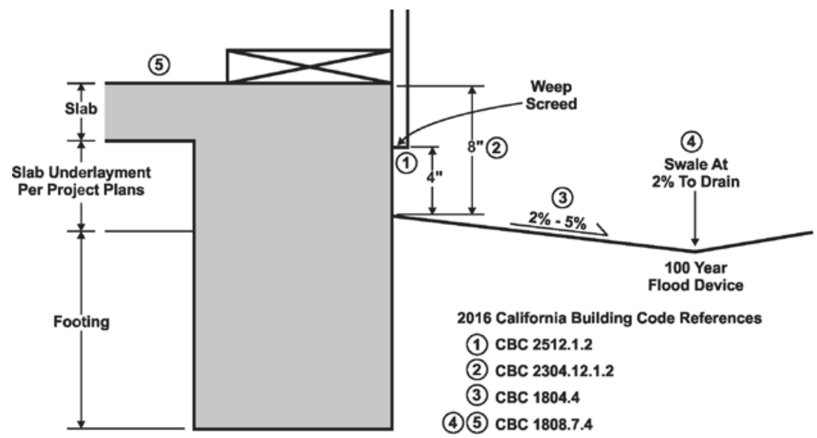
In order to help control the growth of cracks in interior concrete from becoming significant, we suggest the following minimums. Interior concrete slabs-on-grade not subject to heavy loads should be a minimum of 4 inches thick. A 4 inch thick slab should be reinforced. A minimum of No. 3 deformed reinforcing 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.

Drainage Adjacent to Slabs: All grades should provide rapid removal of surface water runoff; ponding water should not be allowed on building pads or adjacent to foundations or other structural improvements (during and following construction). All soils placed against foundations during finish grading should be compacted to minimize water infiltration. Finish and landscape grading should include positive drainage away from all foundations. Section 1808.7.4 of the 2016 California Building Code (CBC) states that for graded soil sites, the top of any exterior foundation shall extend above the elevation of the street gutter at the point of discharge or the inlet of an approved drainage device a minimum of 12 inches plus 2 percent. If overland flow is not achieved adjacent to buildings, the drainage device should be designed to accept flows from a 100 year event. Grades directly adjacent to foundations should be no closer than 8 inches from the top of the slab (CBC 2304.12.1.2), and weep screeds are to be placed a minimum of 4 inches clear of soil grades and 2 inches clear of concrete or other hard surfacing (CBC 2512.1.2). From this point, surface grades should slope a minimum of 2 percent away from all foundations for at least 5 feet but preferably 10 feet, and then 2 percent along a drainage swale to the outlet (CBC 1804.4). Downspouts should be tight piped via an area drain network and discharged to an appropriate non-erosive outlet away from all foundations.



Typical 2016 California Building Code
Drainage Requirements

The above referenced elements pertaining to drainage of the proposed structures is provided as general acknowledgement of the California Building Code requirements, restated and graphically illustrated for ease of understanding. Surface drainage design is the purview of the Project Architect/Civil Engineer. Review of drainage design and implementation adjacent to the building envelopes is recommended as performance of these improvements is crucial to the performance of the foundation and construction of rigid improvements.

Asphalt Concrete Pavement Design

We understand that asphalt pavements will be used for the associated roadways. 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 tests performed on bulk samples of 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 40 was used for (dioritic/granitic materials). Due to the redistribution of materials that occurs during mass grading operations and natural variability of materials, we should review pavement subgrades to determine the appropriateness of the provided sections.

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.

Structural Sections

The following structural sections are provided for the design and construction of the asphalt concrete pavements. The sections are calculated based on the design criteria and methodology and design values described above. Other sections could be calculated on an as requested basis, if required.

Table 7: Asphalt Pavement Section Recommendations

Parent Material	Design Traffic Indices	Pavement Sections (Inches)		Pavement Sections (Inches)	
		Asphalt Concrete *	Aggregate Base **	Asphalt Concrete *	Aggregate Base **
Mechanically Reduced Bedrock	5.0	2.5	5.0	3.0	4.0
	6.0	3.0	6.5	3.5	5.5
	7.0	4.0	7.0	4.5	6.0
	8.0	4.5	9.0	5.0	8.0
	9.0	5.5	9.5	6.0	9.0
	10.0	5.0	13.0	6.0	11.5
	11.0	5.0	15.5	7.0	12.0

* 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)

Portland Cement Concrete Pavements

We understand that Portland cement concrete pavements may be considered for various aspects of 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.

Design Criteria and Methodology

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. For preliminary design purposes, most roadways are anticipated to be in engineered fill derived from weathered diorite purposes, most roadways are anticipated to be in engineered fill derived from weathered diorite bedrock materials or bearing upon weathered bedrock. Sierra College Boulevard north of the proposed improvement at Bankhead Road and Delmar Avenue areas are anticipated to have subgrades composed of bedrock derived soils.

Design Values

The pavement thicknesses were evaluated based on the soil design parameters provided in the following table. The concrete materials were assumed to have an f'c compressive strength of 3,000 psi or 4,000 psi, as stated in the table of potential structural sections.

Table 8: Soil/Rock Parameters

Subgrade Soil Description	k, Modulus of Subgrade Reaction* (pci)	Base Course (inches)
Engineered Fill	150	6.0
Weathered Bedrock	330	6.0
* Based on R-Values as recommended above and correlated to a k-Value recommended by ACI 330R.		

Base Course and Jointing

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.

Structural Sections

The following structural sections could be incorporated into the design and construction of the portland cement concrete pavements. The sections are calculated based on the design criteria and methodology and design values described above. The presented sections are based on strengths of materials correlated to R-Values measured. Other sections could be calculated on an as requested basis, if required. The section for all material types were generally consistent between materials and resulted in no variation when rounded to ½ inches. For this reason, all of the design sections have been summarized in a single table.

Table 9: Concrete Pavement Section Recommendations

Category	ADTT*	Pavement Traffic Description	Thickness (inches) 3000 psi**	Thickness (inches) 4000 psi**
A	1	Car parking areas and access lanes Autos, pickups, and panel trucks only	4.5	4.0
A	10		5.0	4.5
B	25	Shopping center entrance and service lanes Bus parking areas and interior lanes Single-unit truck parking areas and interior lanes	6.0	5.5
B	300		6.5	6.0
C	100	Roadway Entrances and Exterior Lanes	6.5	6.0
C	300		7.0	6.5
C	700		7.0	8.0

* 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 update, 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 structures.

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 tenants or owners of proper design and maintenance of landscaping and drainage facilities that they or their landscaper installs.

Building Pad Subdrain: It has been our experience that sites constructed within this area generally have an increased potential for moisture related issues related to water perched on the bedrock horizon and/or present in the fractures of the bedrock as well as moisture transmission through utility trenches. To mitigate for the potential of these issues, subdrains can be constructed in addition to the drainage provisions provided in the 2016 CBC. Typical subdrain construction would include a 3 feet deep trench (or depth required to intercept the bottom of utility trenches) constructed as detailed on Figure C-4. The water collected in the subdrain pipe would be directed to an appropriate non-erosive outlet. We recommend that a representative from our firm be present during the subdrain installation procedures to document that the drain is installed in accordance with the observed field conditions, as well as to provide additional consultation as the conditions dictate.

As noted in the previous discussions, the moisture conditions may not manifest until after the site is developed. As such, any recommendations for the subdrain orientation and location to mitigate the moisture conditions can be provided on an as requested and lot by lot basis as the conditions arise.

Median and Roadway Landscaping Drainage: In developments built on relatively poor draining soils (i.e. shallow bedrock), 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 soil 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. Joint utility trenches are generally more susceptible to the jetting issues due to the quantity of pipe placed in the trench.

It is anticipated that heavy landscape watering could enter and pond within the street aggregate base section as it permeates through the aggregate base under the sidewalks and/or curbs. Prolonged seepage within the pavement section could cause distress to pavements in heavy traffic areas. 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 roadway adjacent to the roadway interface, construct of subdrains within landscape medians 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. In order to mitigate these conditions, additional subdrainage measures may be necessary.

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 or loose/soft soils and provide consultation to the Grading Contractor in the field.

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

7.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. This report has been prepared for the exclusive use of the B.E.M., Inc. and their consultants for specific application to the Green Business Park Loomis 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 are 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.

Table 10: 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

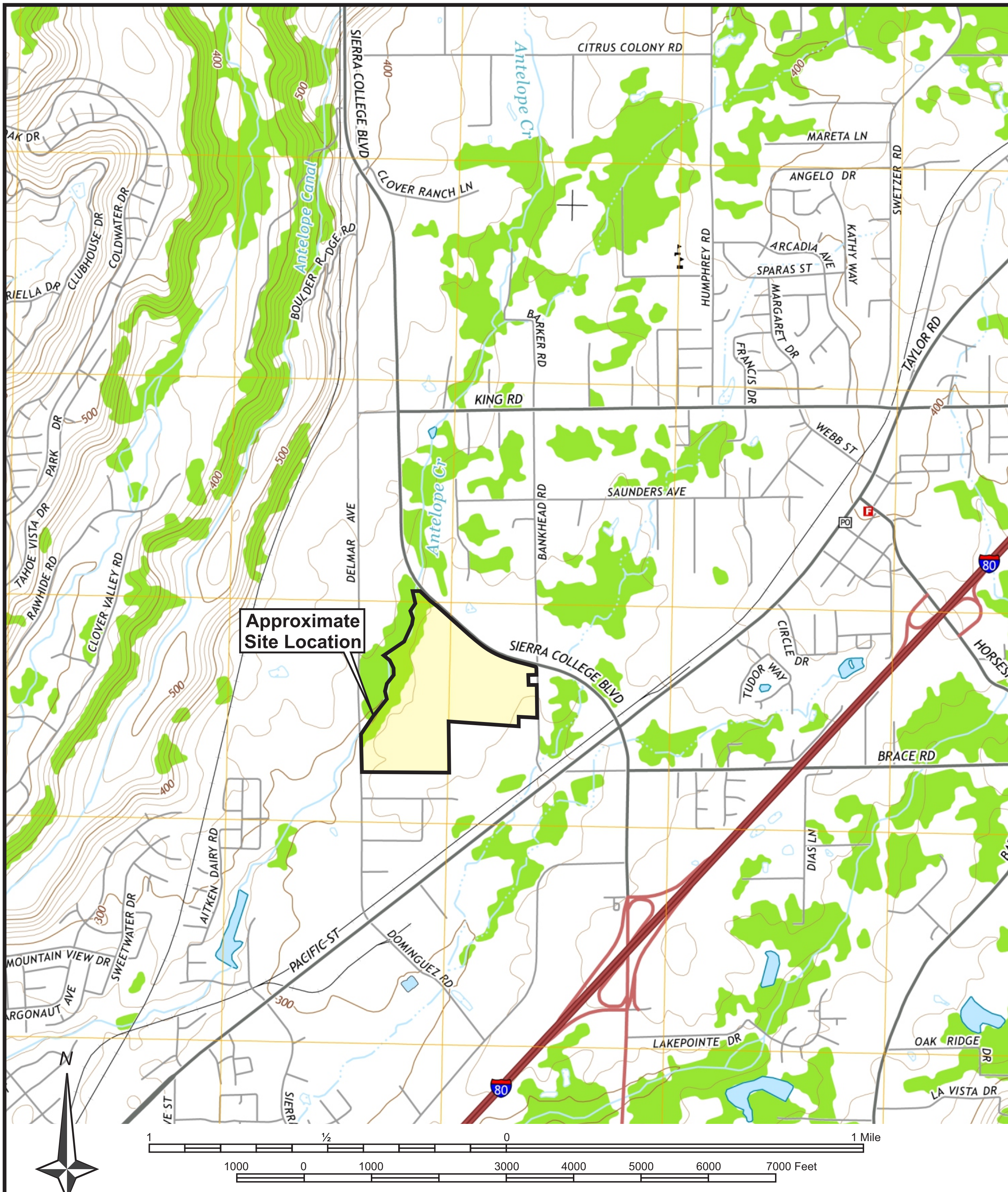
Introduction

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 field study included a site reconnaissance by a Youngdahl Consulting Group, Inc. representative followed by a subsurface exploration program conducted on 26 through 27 September 2018, which included the excavation of 30 test pits under his direction at the approximate locations shown on Figure A-2, this Appendix. Excavation of the test pits was accomplished with a Caterpillar 420 E rubber tire-mounted backhoe equipped with a 24 inch wide bucket. The bulk and bag samples collected from the test pits 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.

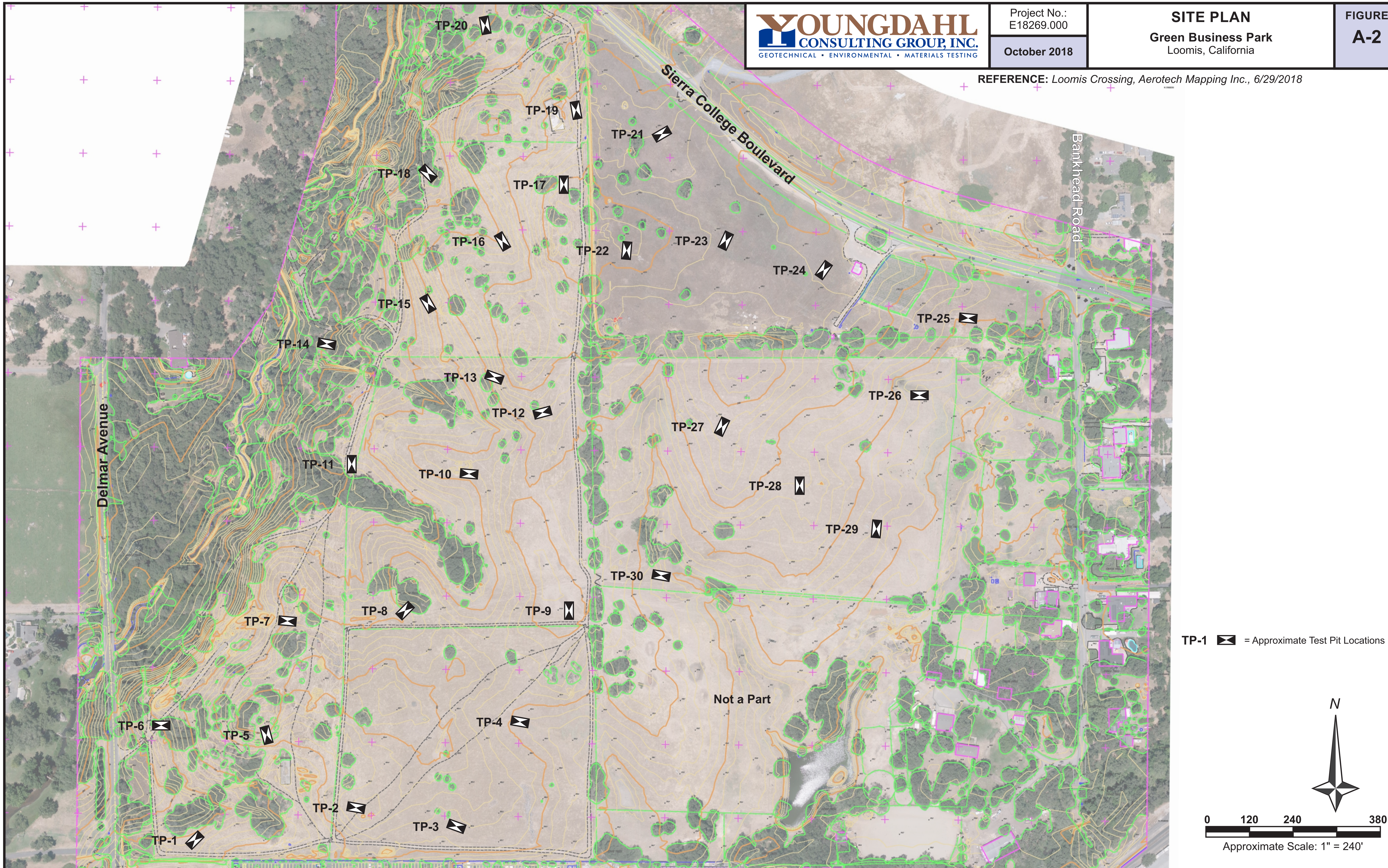
The soils encountered were logged during excavation and provide the basis for the "Logs of Test Pits", Figures A-3 through A-33, this Appendix. These logs show a graphic representation of the soil profile, the location, and depths at which samples were collected.



Scale: 1:24,000

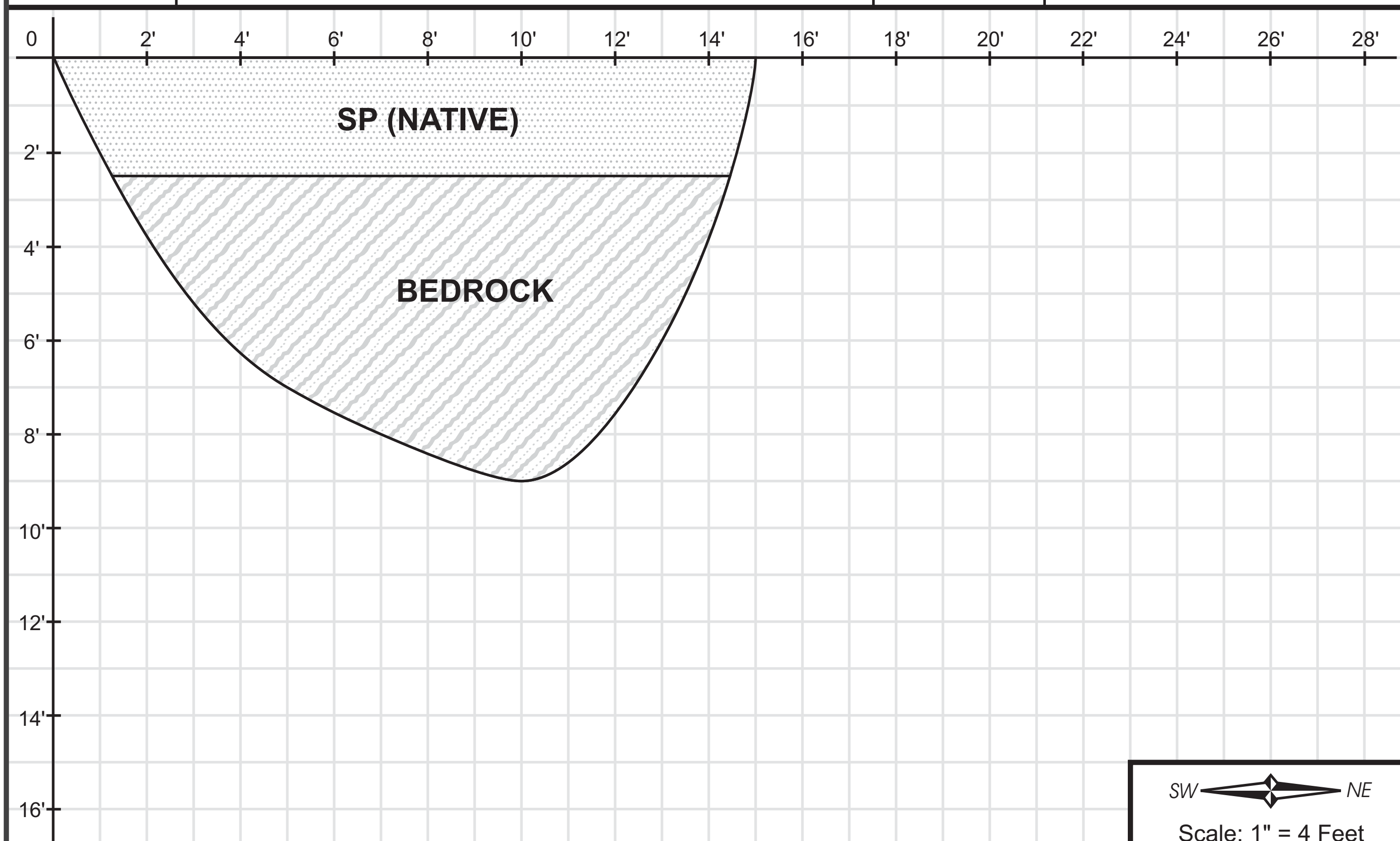
BASE MAP REFERENCE: *U.S.G.S. 7.5 Minute Topographic Series, Rocklin Quadrangle, Dated 2015*

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E18269.000 / **October 2018**	**VICINITY MAP** **Green Business Park** Loomis, California	**FIGURE A-1**


YOUNGDAHL CONSULTING GROUP, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING
Project No.: E18269.000
October 2018
SITE PLAN
Green Business Park
Loomis, California
FIGURE
A-2
REFERENCE: Loomis Crossing, Aerotech Mapping Inc., 6/29/2018
Sierra College Boulevard
Bankhead Road
Delmar Avenue
Not a Part
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10
TP-11
TP-12
TP-13
TP-14
TP-15
TP-16
TP-17
TP-18
TP-19
TP-20
TP-21
TP-22
TP-23
TP-24
TP-25
TP-26
TP-27
TP-28
TP-29
TP-30
TP-1 = Approximate Test Pit Locations
N
0
120
240
380
Approximate Scale: 1" = 240'

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-1**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **50°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 1.5'	Yellow brown **SAND (SP)** with trace gravel, dense, dry (NATIVE)		***Field moisture density test at 0'*** *DD = 104.4 pcf MC = 2.9%* *MaxDD = 131.6 pcf OptMC = 7.8%* *ϕ = 45.9°*
@ 1.5' - 9'	Red quartz diorite **BEDROCK**, moderately to highly weathered, massive, hard, with iron staining		
	Test pit terminated at 9' (practical refusal) No free groundwater encountered No caving noted		

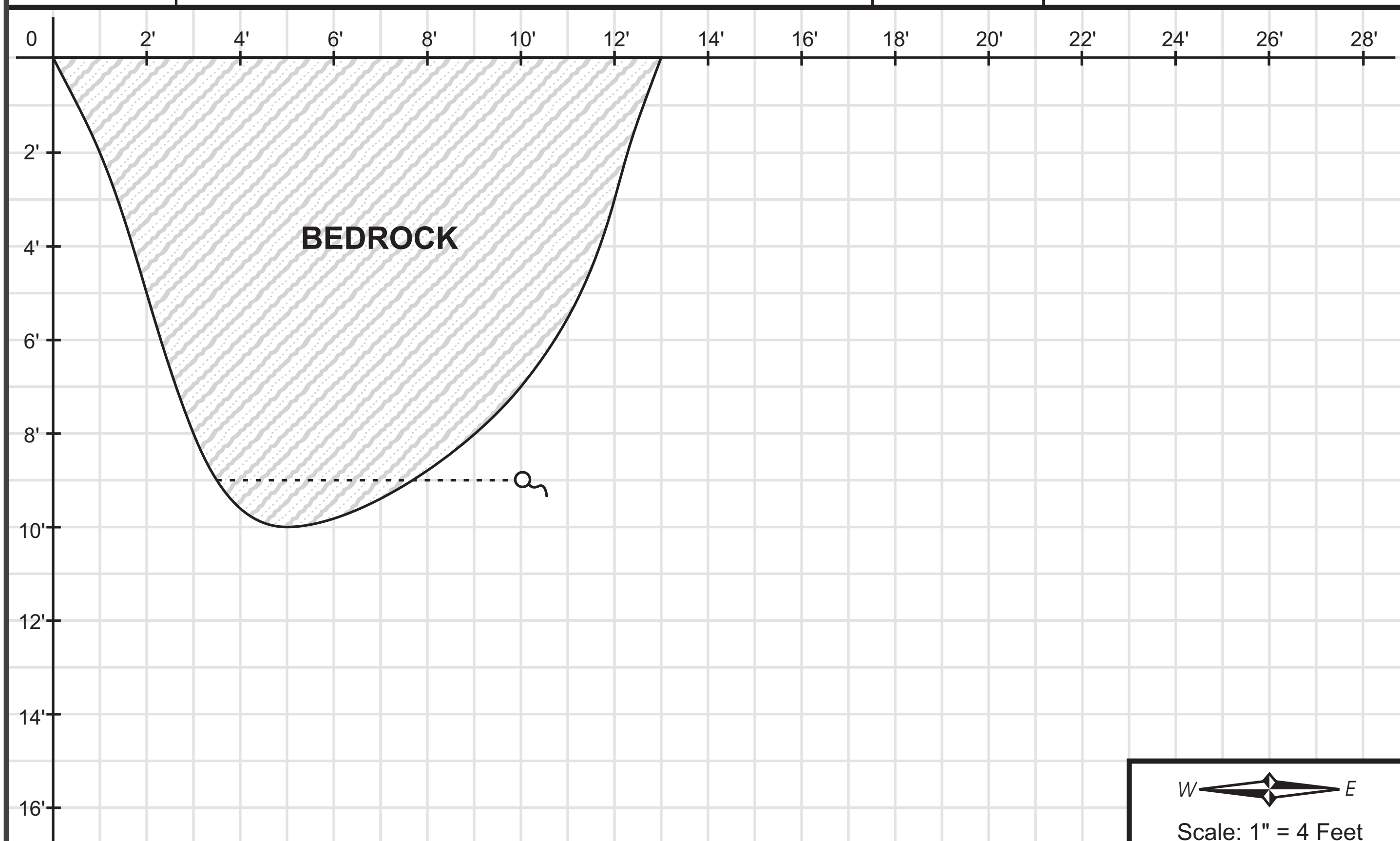


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-3**

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-2**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **100°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 9' *@ 9' - 10'*	Light brown olive medium quartz diorite **BEDROCK**, moderately weathered, massive, hard *Grades moist*		
	Test pit terminated at 10' (practical refusal) Free groundwater encountered at 9' No caving noted		

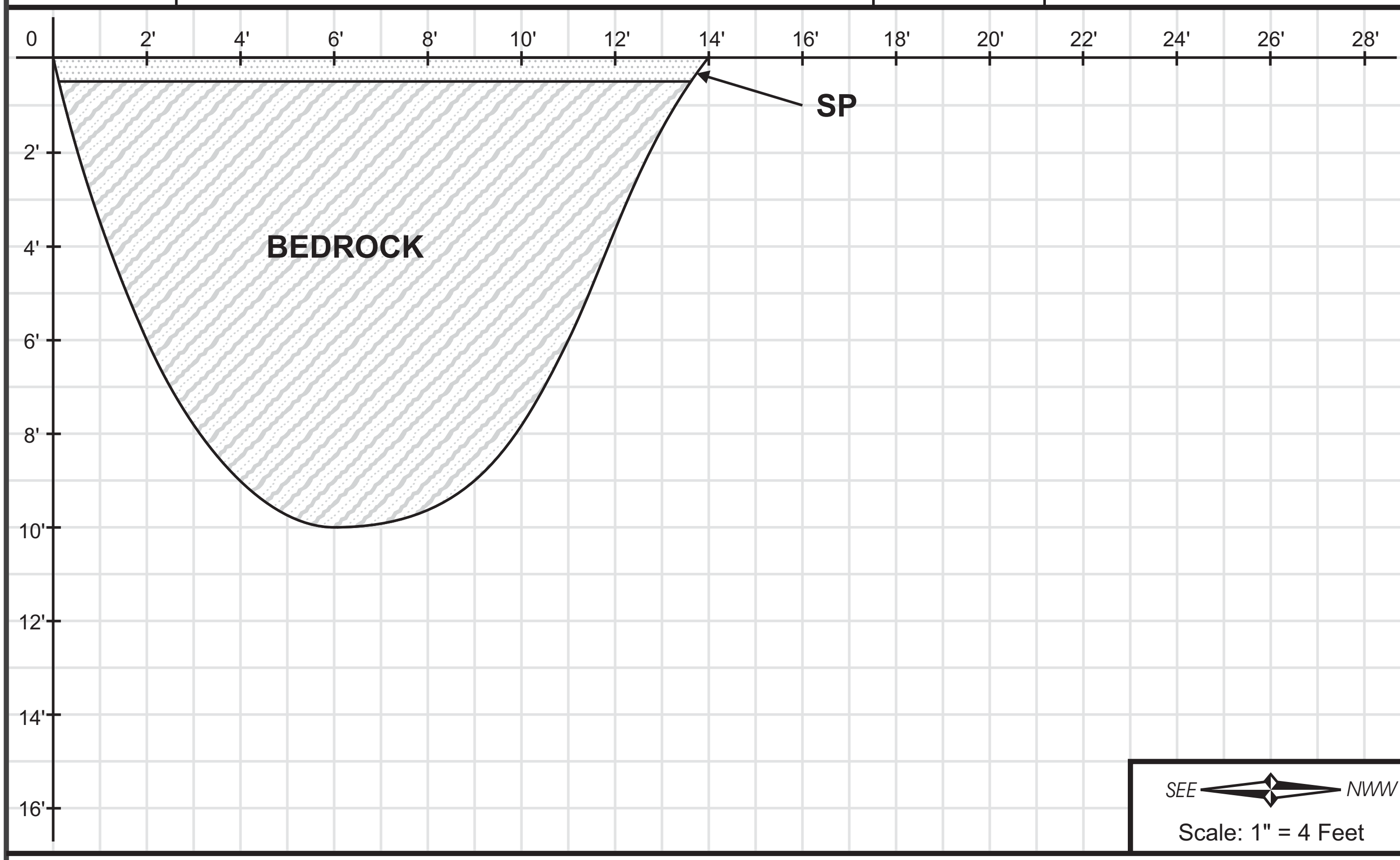


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-4**

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-3**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **290°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 0.5'	Olive fine **SAND (SP)**, medium dense, dry		*R-Value = 68* *4-6'*
@ 0.5' - 6'	Olive quartz diorite **BEDROCK**, moderately to highly weathered, massive, hard		
@ 6' - 10'	*Grades to grey, moderately hard*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

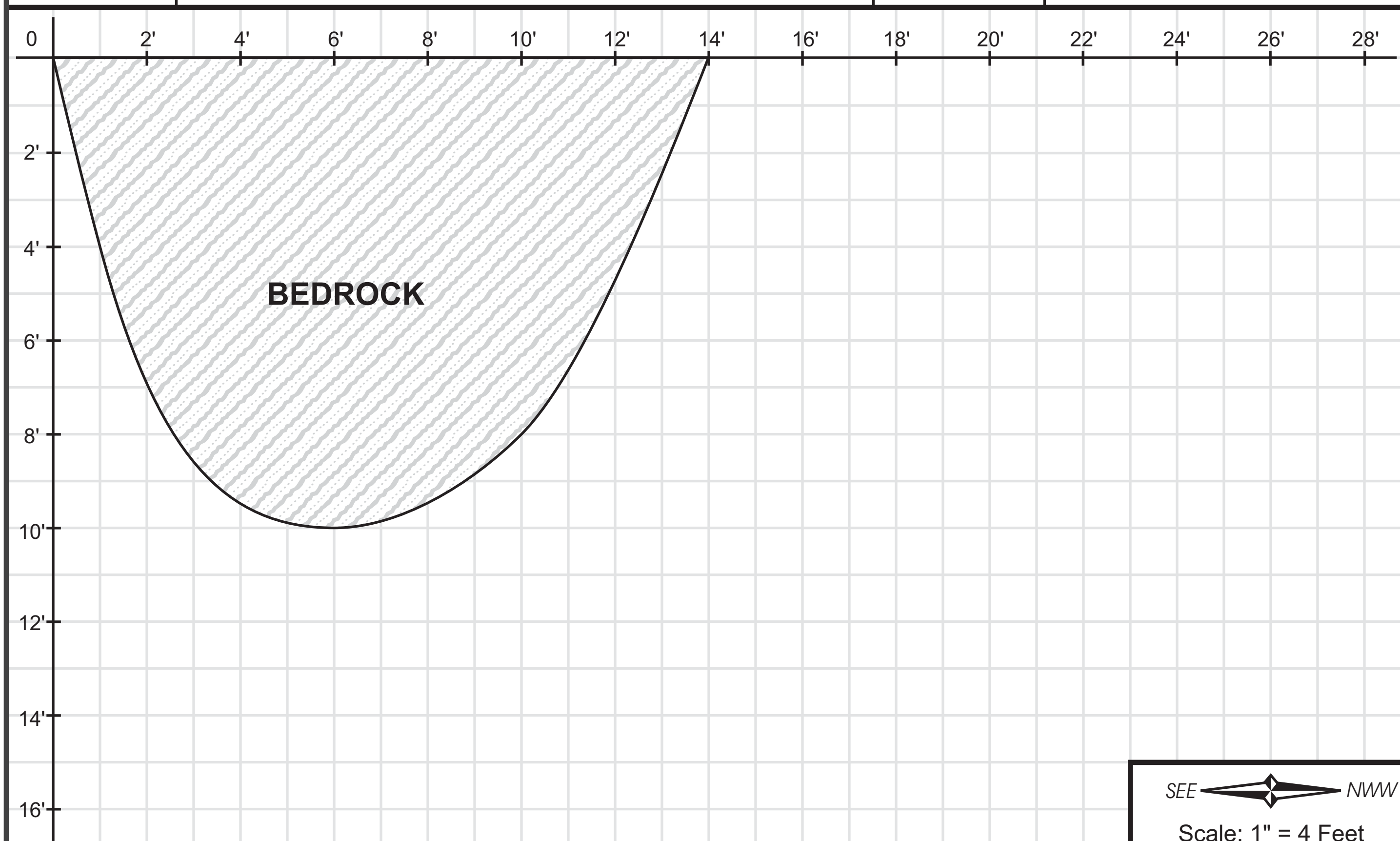


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-5**

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-4**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **285°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0.5' - 5'	Grey brown quartz diorite **BEDROCK**, moderately to highly weathered, moderately hard		
@ 5' - 10'	*Grades moderately weathered, hard*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

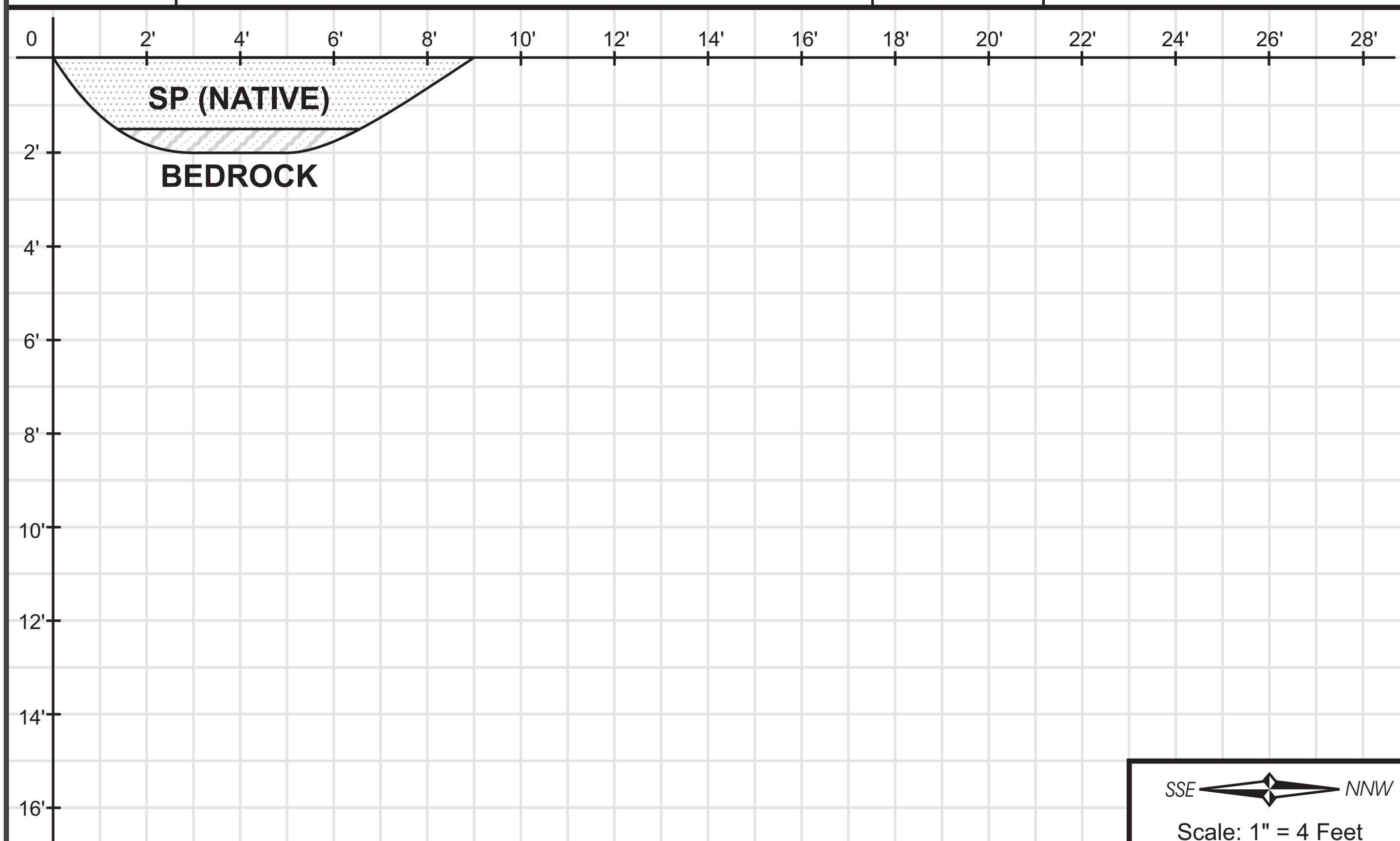


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE A-6**

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-5**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **345°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 1.5'	Light brown fine **SAND (SP)**, dense, dry (NATIVE)		***Field moisture density test at 0'*** *DD = 105.7 pcf MC = 3.0%*
@ 1.5' - 2'	White and black coarse quartz diorite **BEDROCK**, fresh, massive, extremely hard		
	Test pit terminated at 2' (practical refusal) No free groundwater encountered No caving noted		

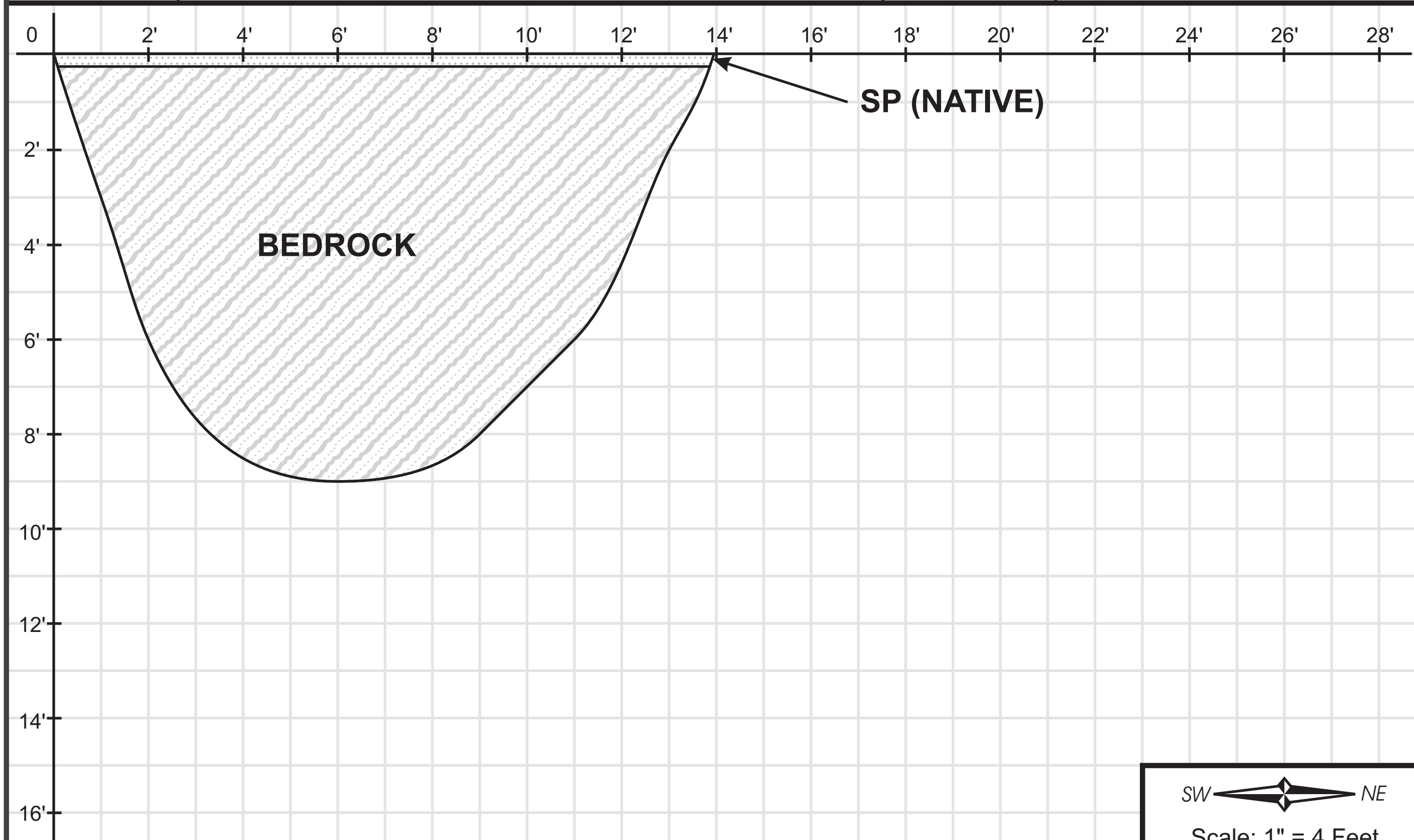


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000	**EXPLORATORY TEST PIT LOG**	**FIGURE**
	October 2018	**Green Business Park** Loomis, California	**A-7**

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-6**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **48°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0′ - 4″	Light brown fine **SAND (SP)**, dense, dry (NATIVE)		
@ 4″ - 9′	Light brown coarse quartz diorite **BEDROCK**, moderately weathered, massive, hard, with iron staining		
	Test pit terminated at 9' (practical refusal) No free groundwater encountered No caving noted		



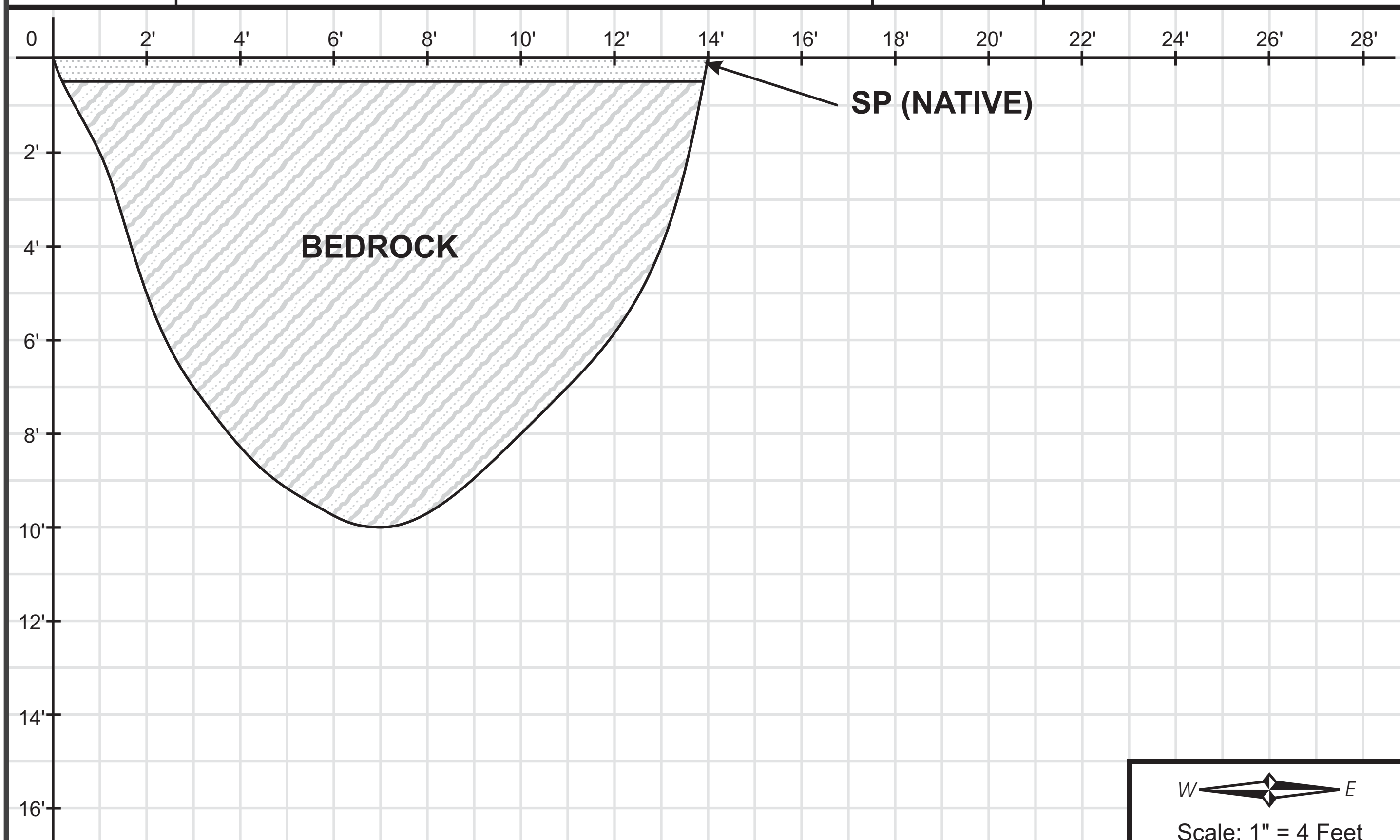
Scale: 1" = 4 Feet

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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-8**

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-7**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **95°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 0.5'	Light brown fine **SAND (SP)**, dense, dry (NATIVE)		
@ 0.5' - 5'	Red brown coarse quartz diorite **BEDROCK**, highly weathered, massive, moderately hard, with feldspar		
@ 5' - 10'	*Grades grey*		
	Test pit terminated at 9' (practical refusal) No free groundwater encountered No caving noted		

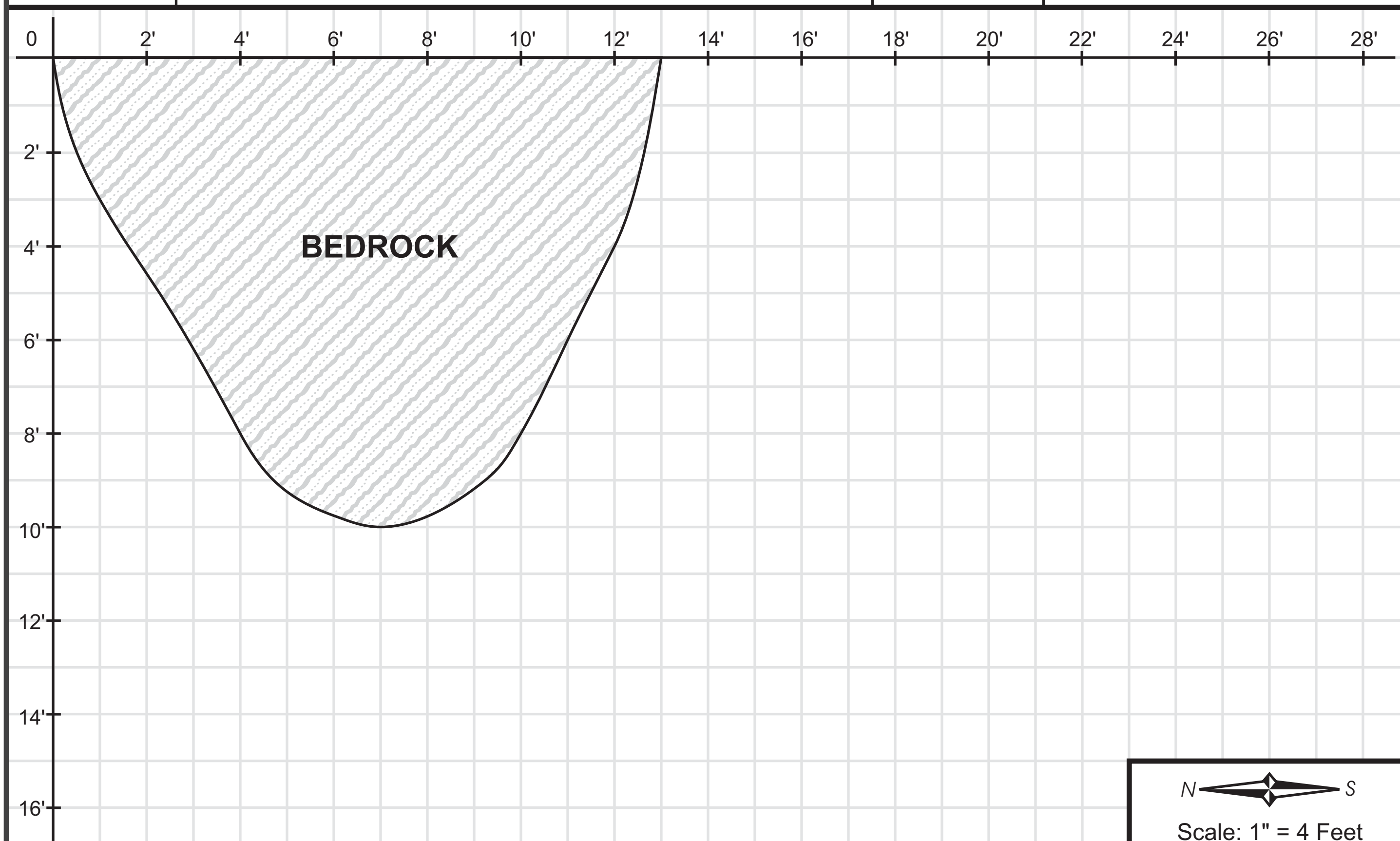


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-9**

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-8**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **180°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 1'	Brown fine quartz diorite **BEDROCK**, highly weathered, massive, dry, moderately hard		
@ 1' - 3'	*Grades slightly moist*		
@ 3' - 10'	*Grades coarse grained*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

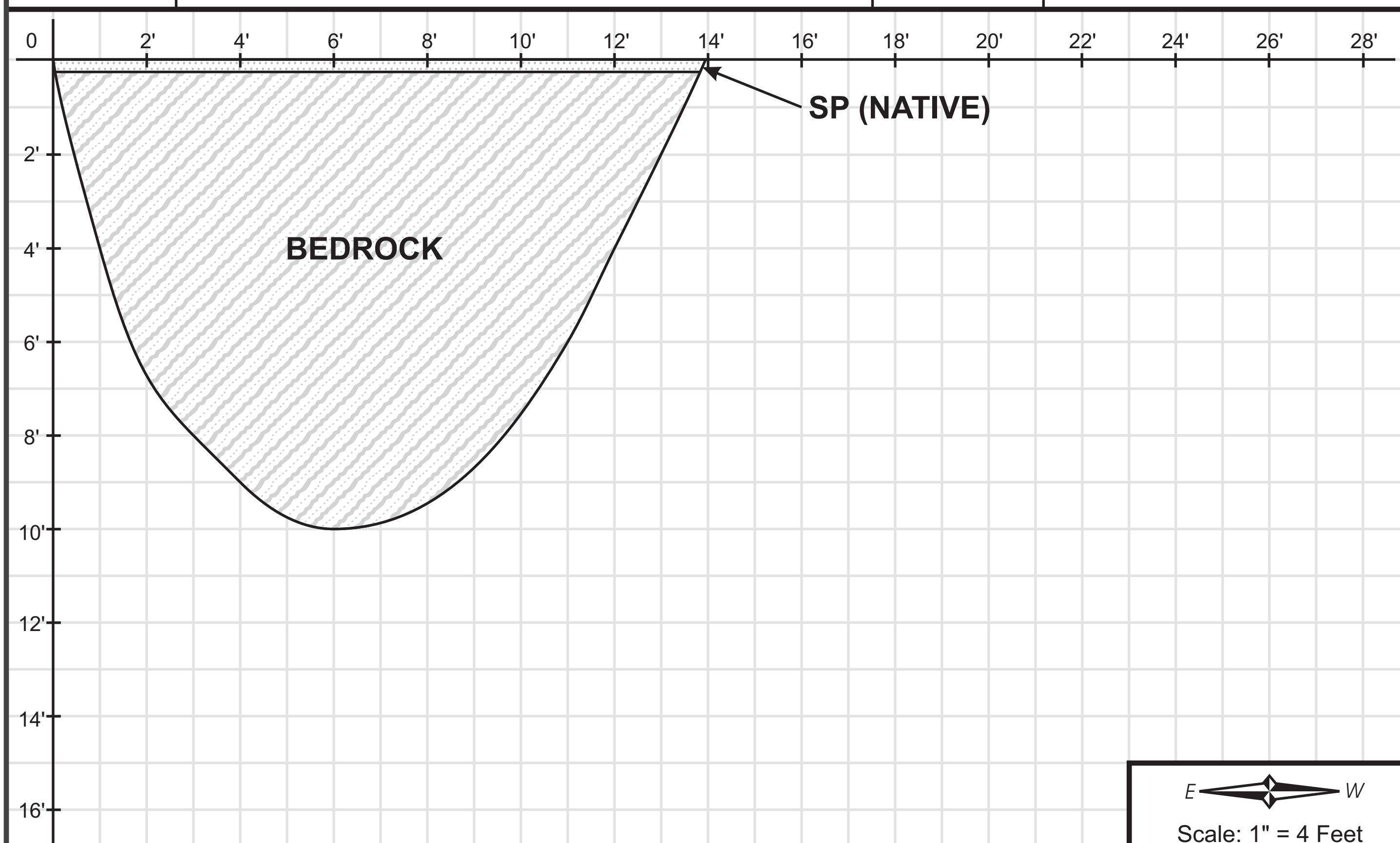


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE A-10**

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-9**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **282°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0′ - 2″	Light brown fine **SAND (SP)**, dense, dry (NATIVE)		
@ 2″ - 5′	Brown fine quartz diorite **BEDROCK**, highly weathered, massive, slightly moist, moderately hard (pyrite)		
@ 5′ - 10′	*Grades grey brown*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		



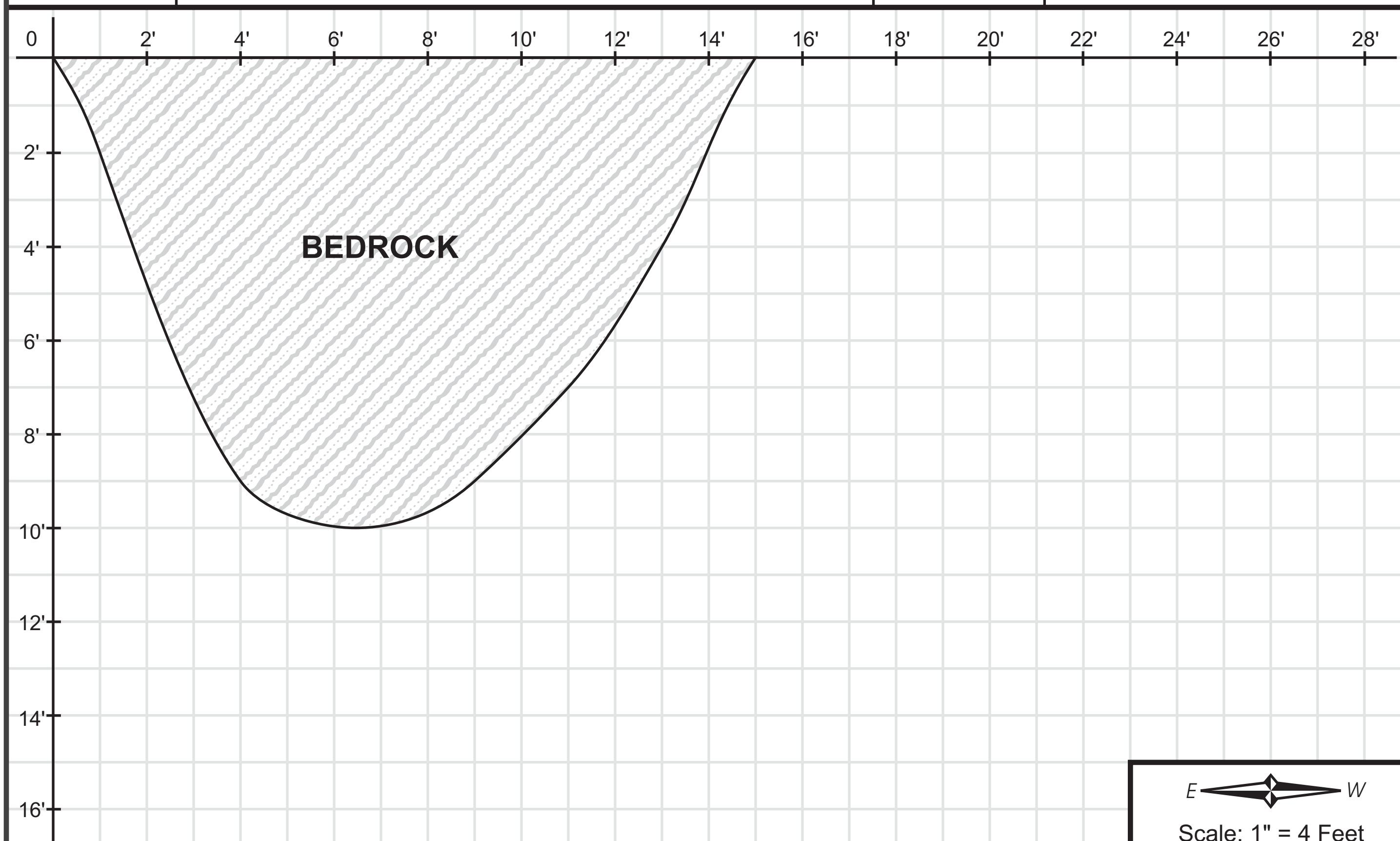
Scale: 1" = 4 Feet

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.: E18269.000	**EXPLORATORY TEST PIT LOG**	FIGURE
	October 2018	**Green Business Park** Loomis, California	**A-11**

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-10**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **275°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 4'	Brown and red fine quartz diorite **BEDROCK**, highly weathered, massive, slightly moist, moderately hard		
@ 4' - 10'	*Grades grey white*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

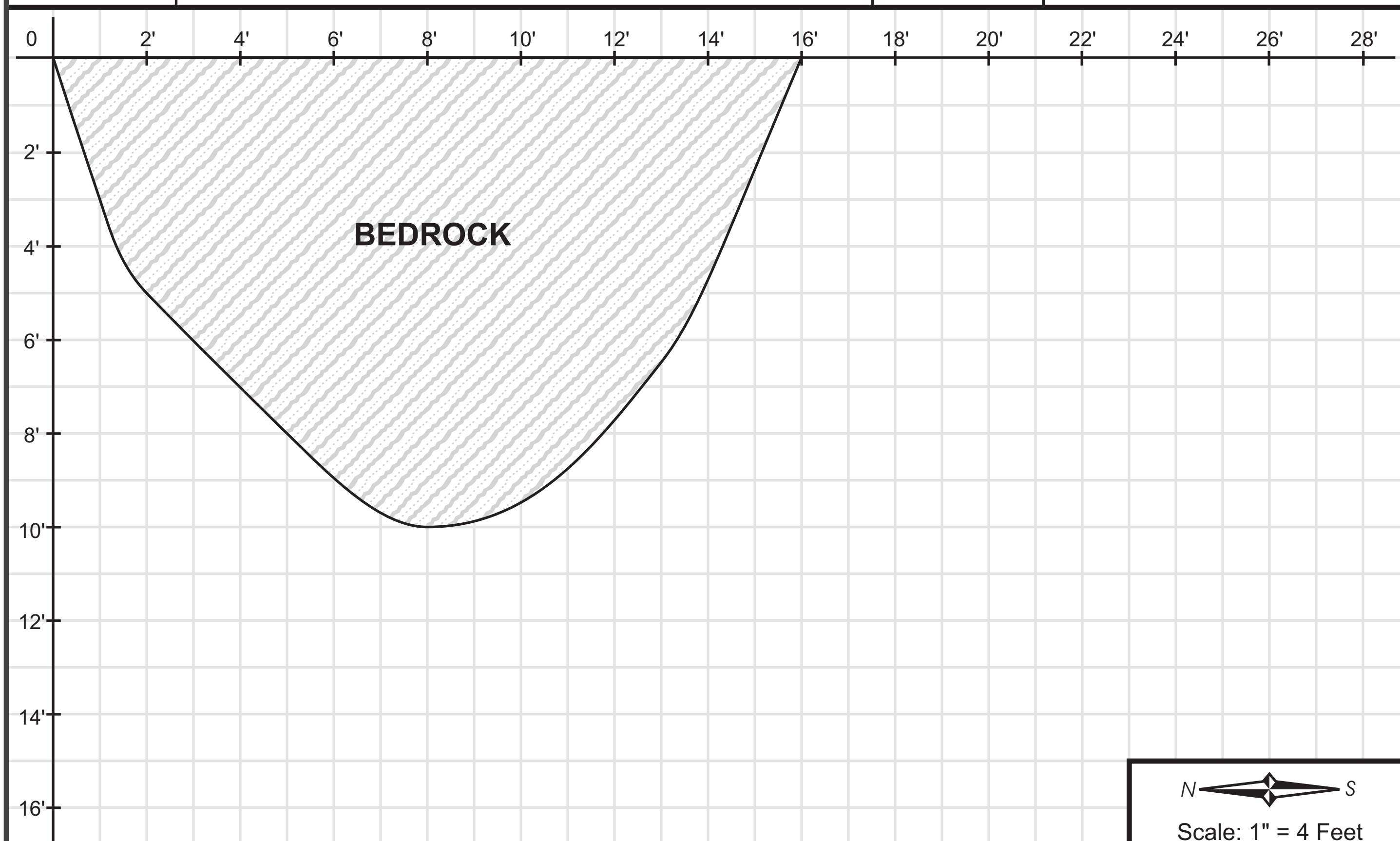


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-12**

Logged By: **KAW**	Date: **26 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-11**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **180°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 3'	Light brown fine quartz diorite **BEDROCK**, highly weathered, massive, moderately hard		
@ 3' - 5'	*Grades white brown, moderately weathered*		
@ 5' - 10'	*Grades grey white*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

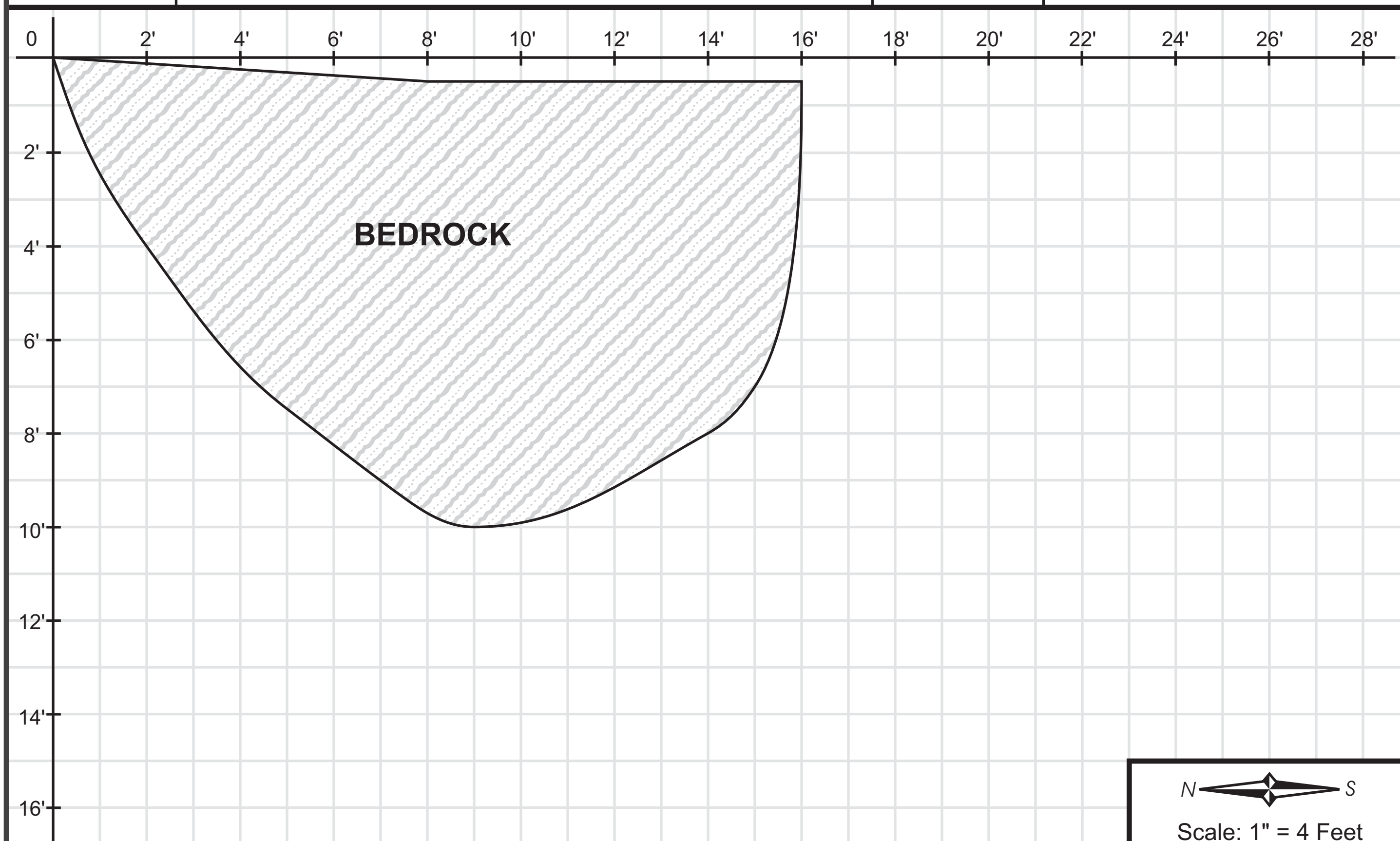


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000	**EXPLORATORY TEST PIT LOG**	**FIGURE**
	October 2018	**Green Business Park** Loomis, California	**A-13**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-12**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **255°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 2'	White and grey fine quartz diorite **BEDROCK**, highly weathered, dry, moderately hard		*4" Metal pipe observed @ 3'*
@ 2' - 4'	*Grades red and white brown*		
@ 4' - 10'	*Grades slightly moist*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

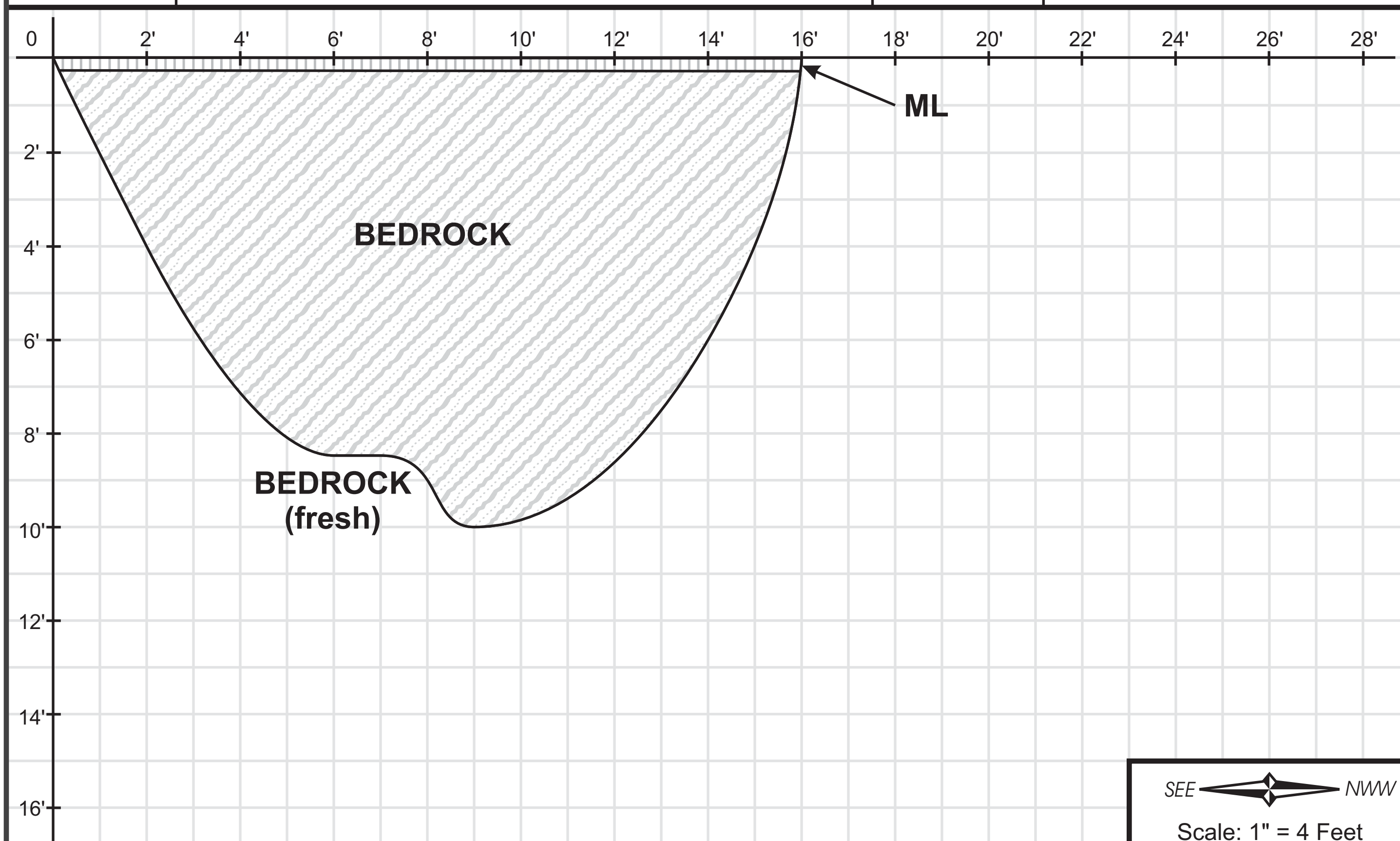


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-14**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**	Pit No. **TP-13**
Equipment: **CAT 420E Backhoe With 24" Bucket**	Pit Orientation: **290°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 4"	Light brown sandy **SILT (ML)**, stiff, dry		
@ 4" - 3'	Red brown quartz diorite **BEDROCK**, highly weathered, moderately hard		
@ 3' - 10'	*Grades red white*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

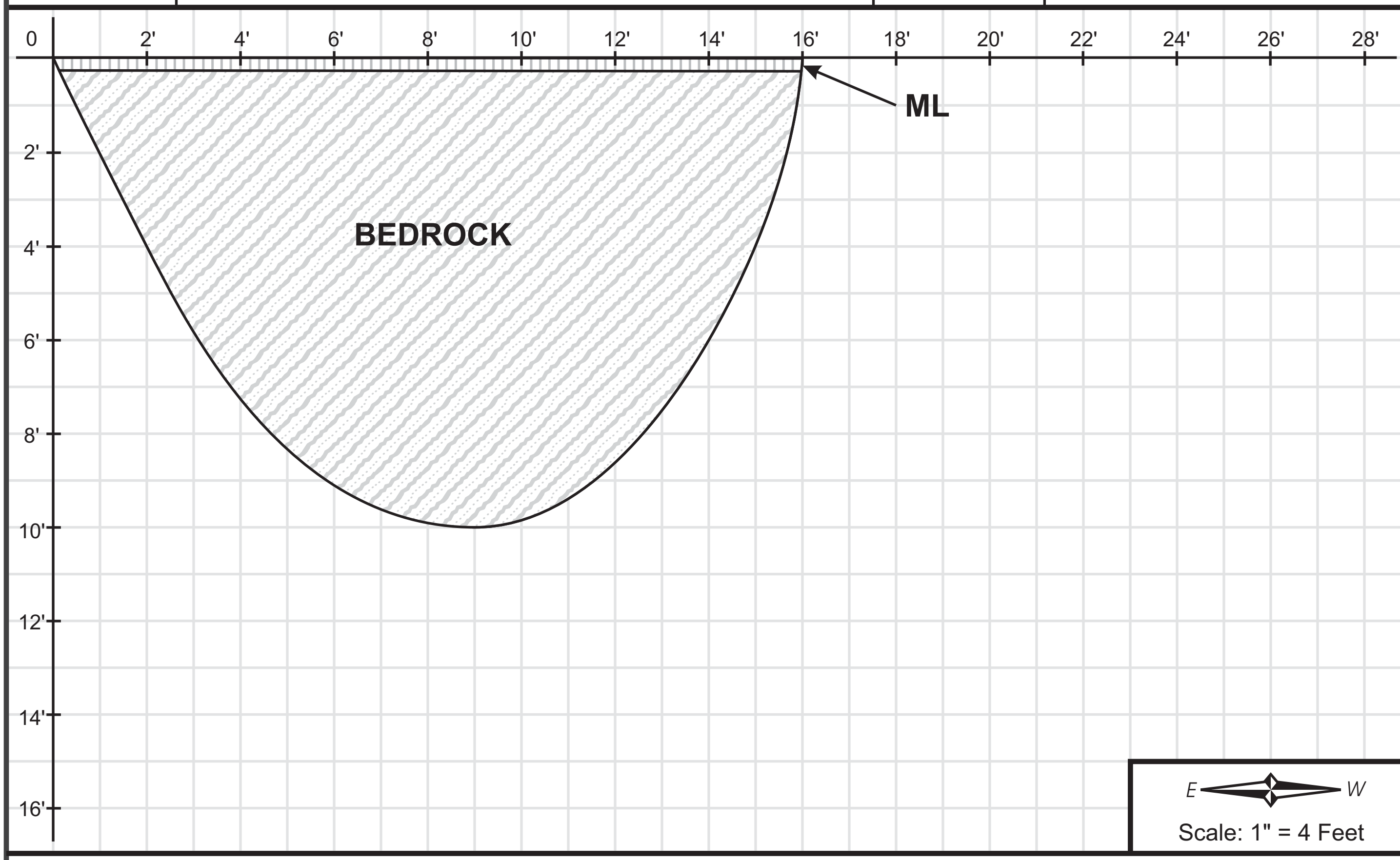


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE A-15**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-14**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **280°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 4"	Light brown sandy **SILT (ML)**, stiff, dry		
@ 4" - 3'	Red brown quartz diorite **BEDROCK**, highly weathered, moderately hard		
@ 3' - 10'	*Grades red white*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		



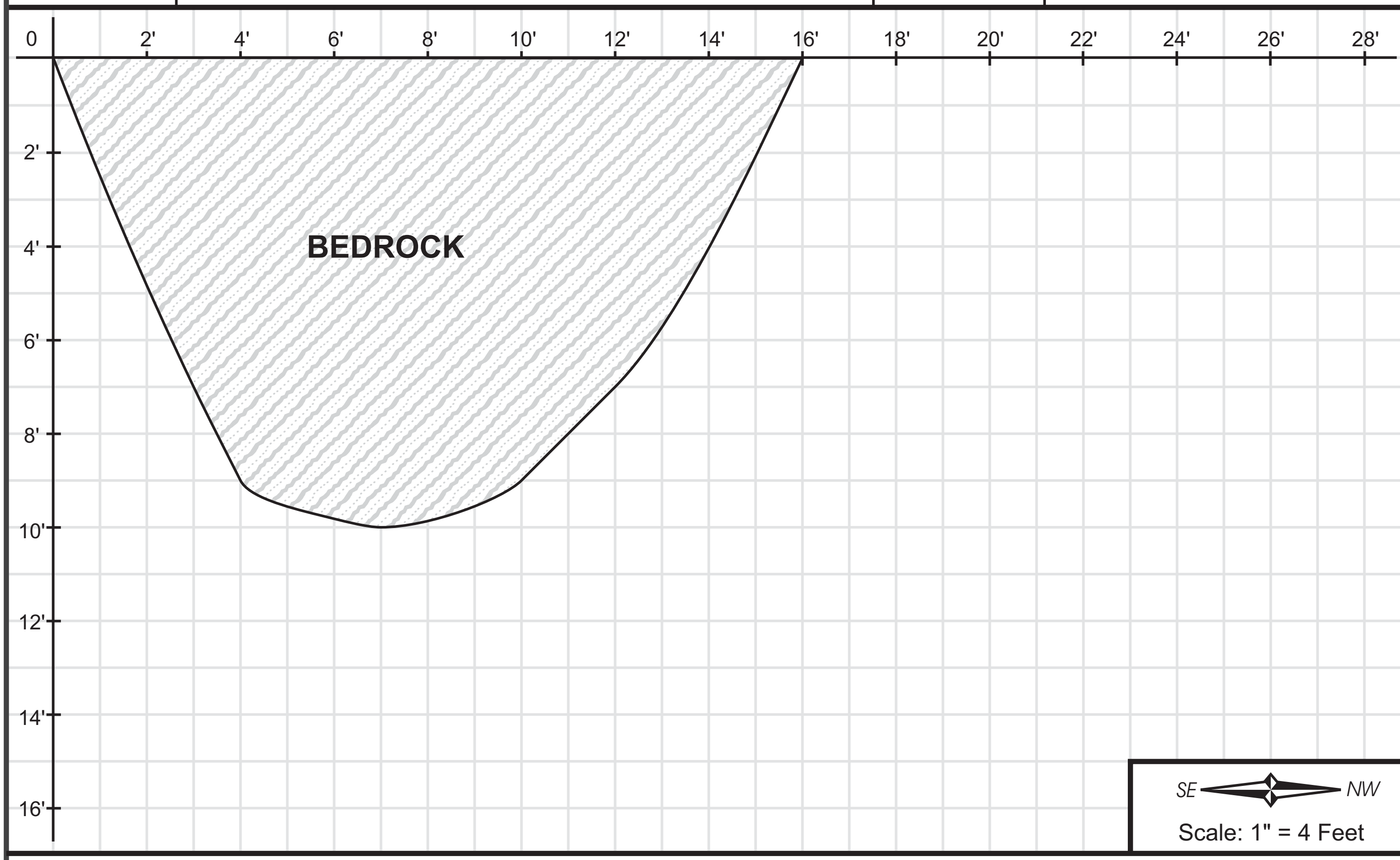
Scale: 1" = 4 Feet

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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE A-16**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-15**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **330°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 3'	Brown and olive brown medium quartz diorite **BEDROCK**, highly weathered, massive, moderately hard, with feldspar		
@ 3' - 10'	*Grades brown orange, angular*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		



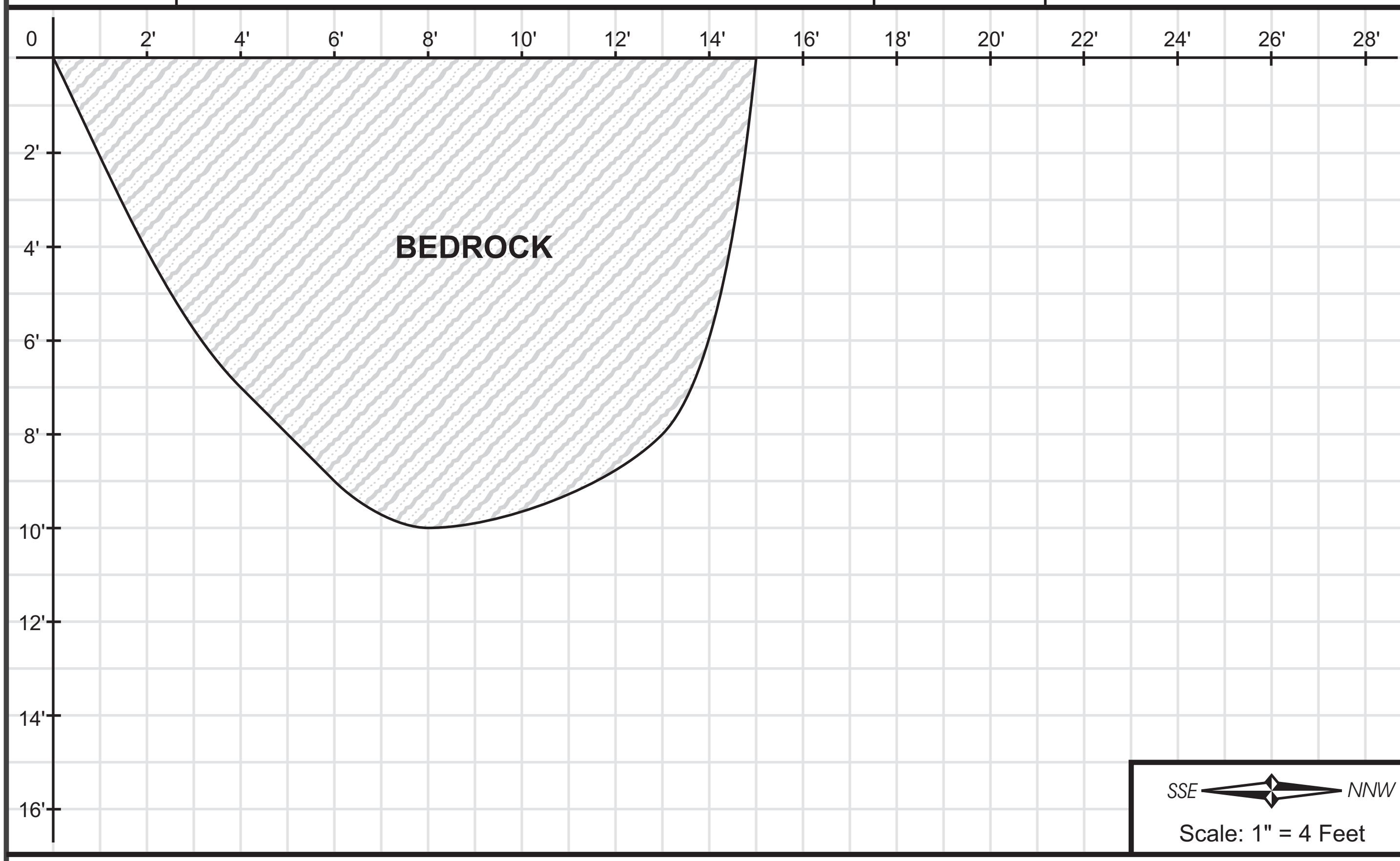
Scale: 1" = 4 Feet

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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-17**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**	Pit No. **TP-16**
Equipment: **CAT 420E Backhoe With 24" Bucket**	Pit Orientation: **335°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 4"	Light brown fine quartz diorite **BEDROCK**, highly weathered, dry, moderately hard		
@ 4" - 4.5'	*Grades beige, moderately weathered*		
@ 4.5' - 9'	*Grades red brown*		
@ 9' - 10'	*Grades grey*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

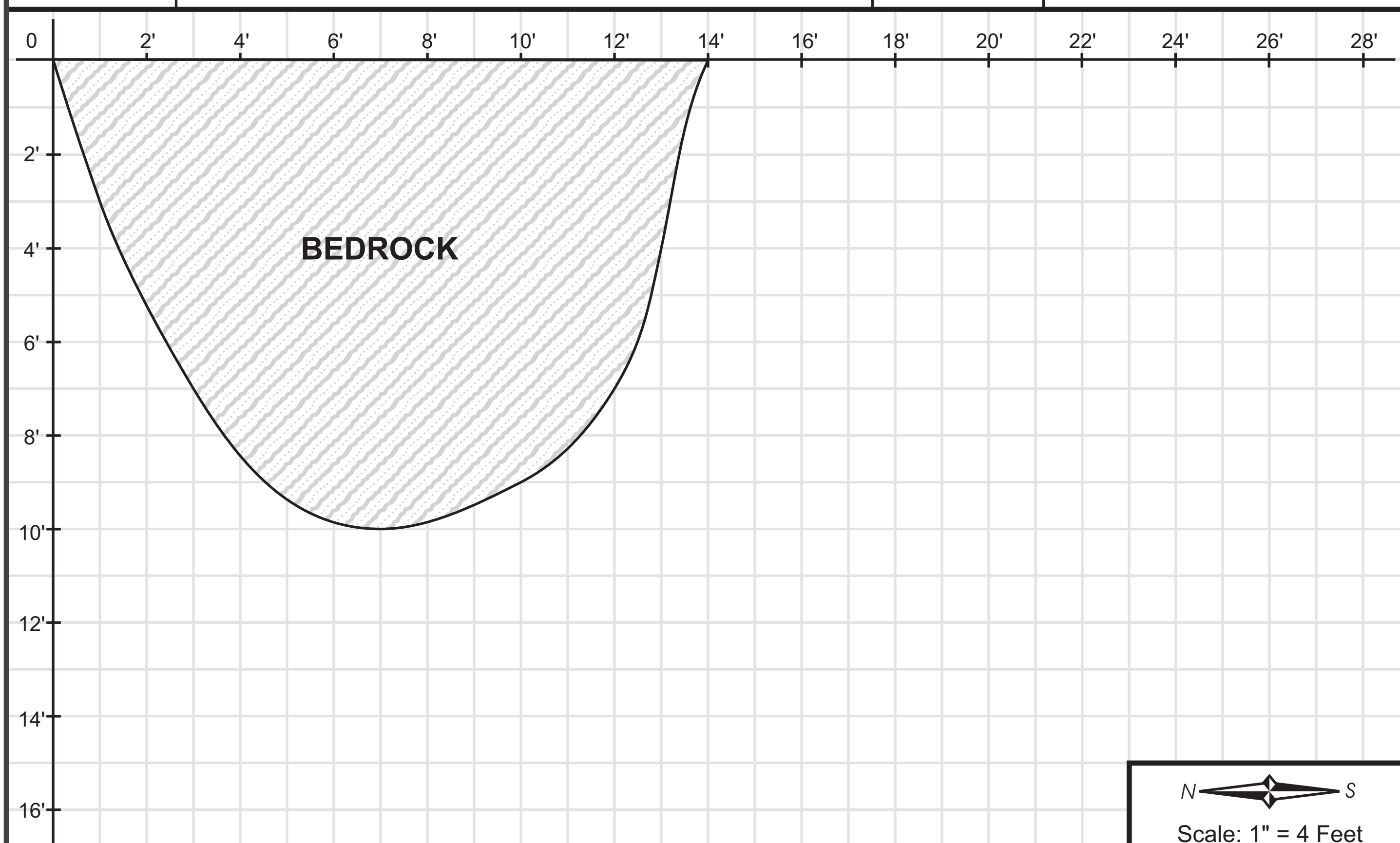


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000	**EXPLORATORY TEST PIT LOG**	FIGURE
	October 2018	**Green Business Park** Loomis, California	**A-18**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-17**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **180°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 10'	Yellow brown fine quartz diorite **BEDROCK**, highly weathered, massive, dry, moderately hard, with iron staining		*MaxDD = 126.7 pcf* *OptMC = 10.4%* *ϕ = 44.6°*
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

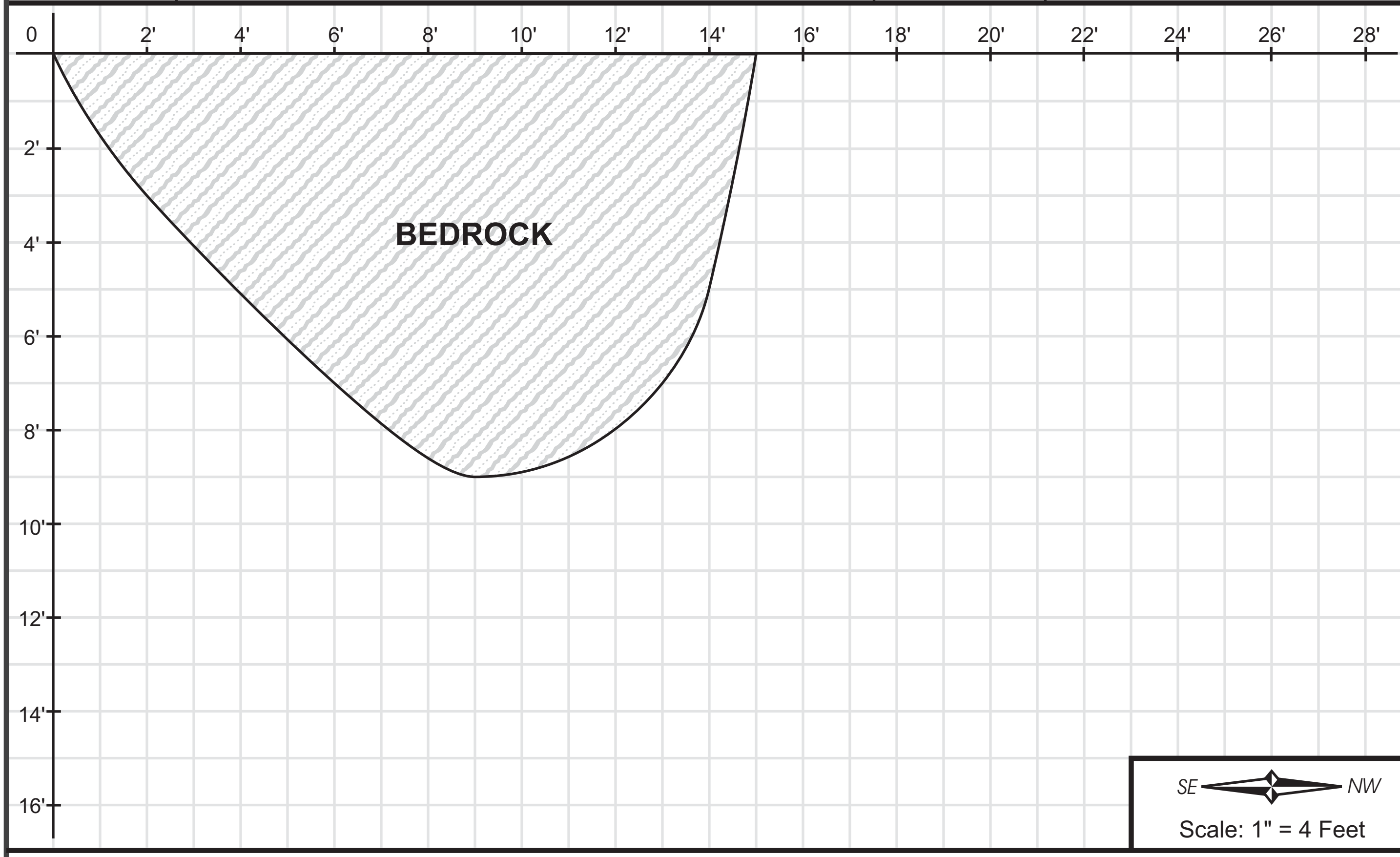


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-19**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No.
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **310°**	Elevation: **~**	**TP-18**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 1'	Grey brown fine quartz diorite **BEDROCK**, highly weathered, massively fractured, moderately hard, with roots		
@ 1' - 9'	*Grades without roots*	**TP-18** @ 1-2'	
	Test pit terminated at 9' (practical refusal) No free groundwater encountered No caving noted		



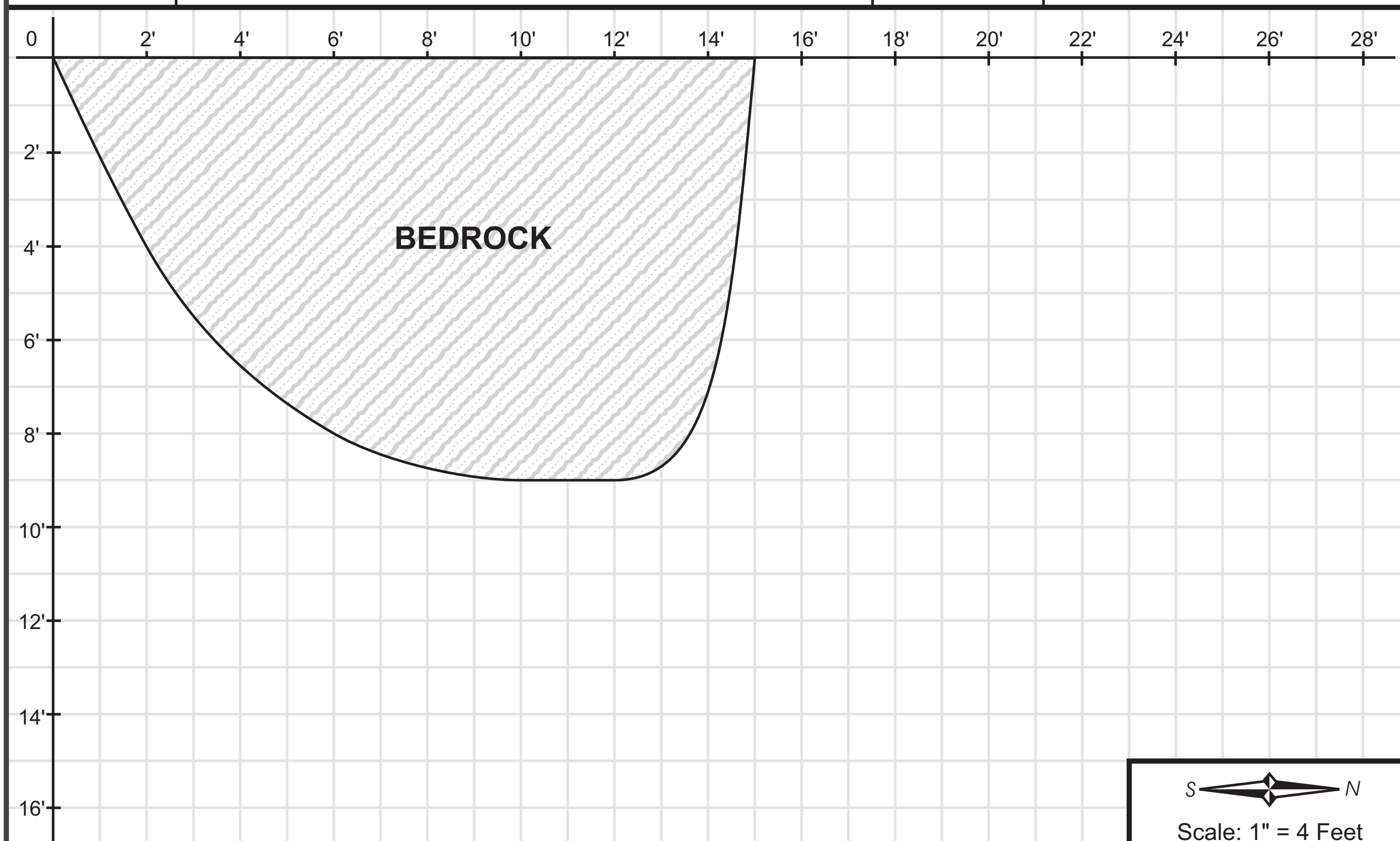
Scale: 1" = 4 Feet

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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-20**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-19**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **350°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 7'	Red brown medium quartz diorite **BEDROCK**, moderately weathered, massive, moderately hard, with iron staining		
@ 7' - 10'	*Grades grey white*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

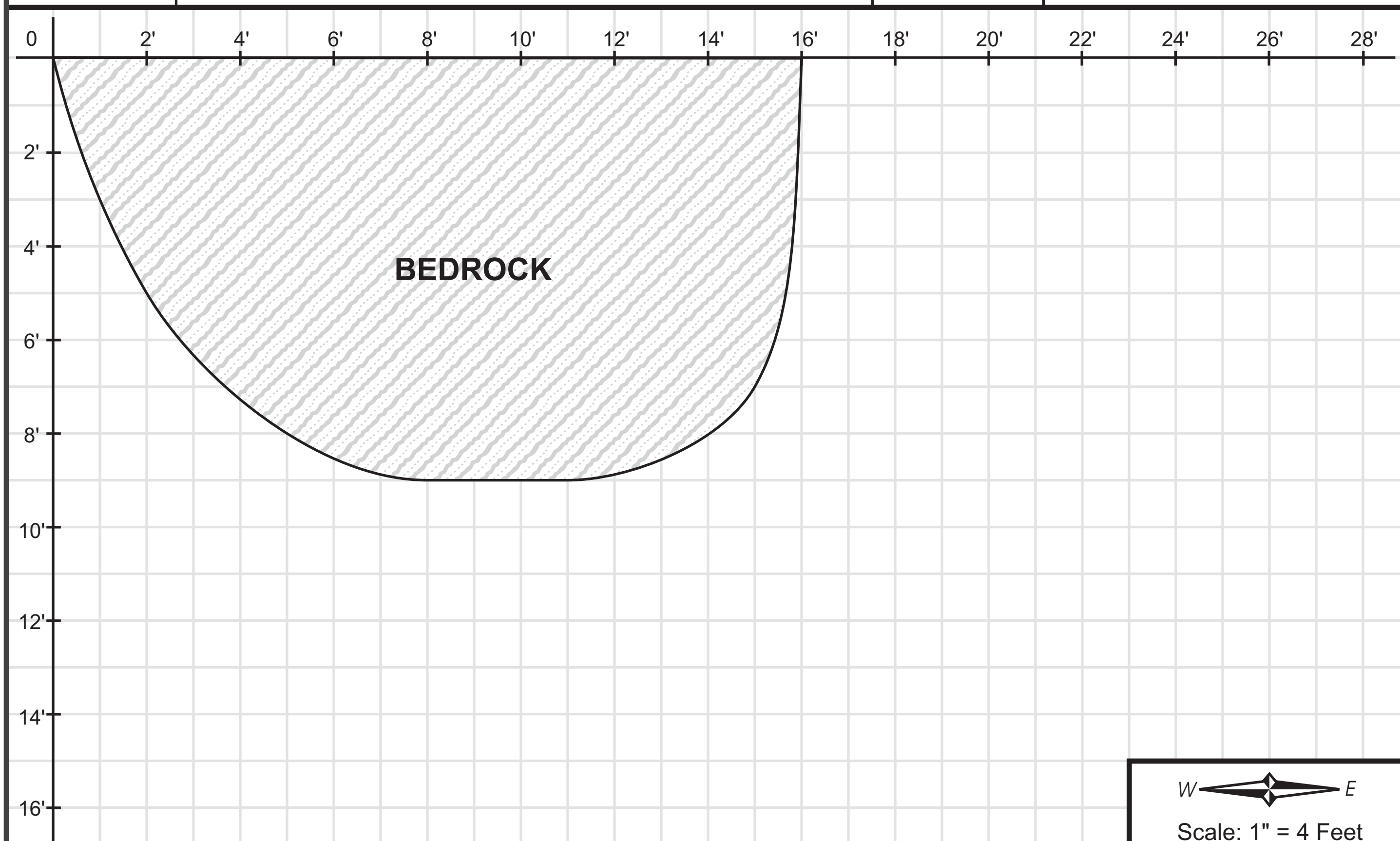


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-21**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-20**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **098°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 3'	Light brown fine quartz diorite **BEDROCK**, highly weathered, hard		
@ 3' - 9'	*Grades orange red, moderately hard*		
	Test pit terminated at 9' (practical refusal) No free groundwater encountered No caving noted		

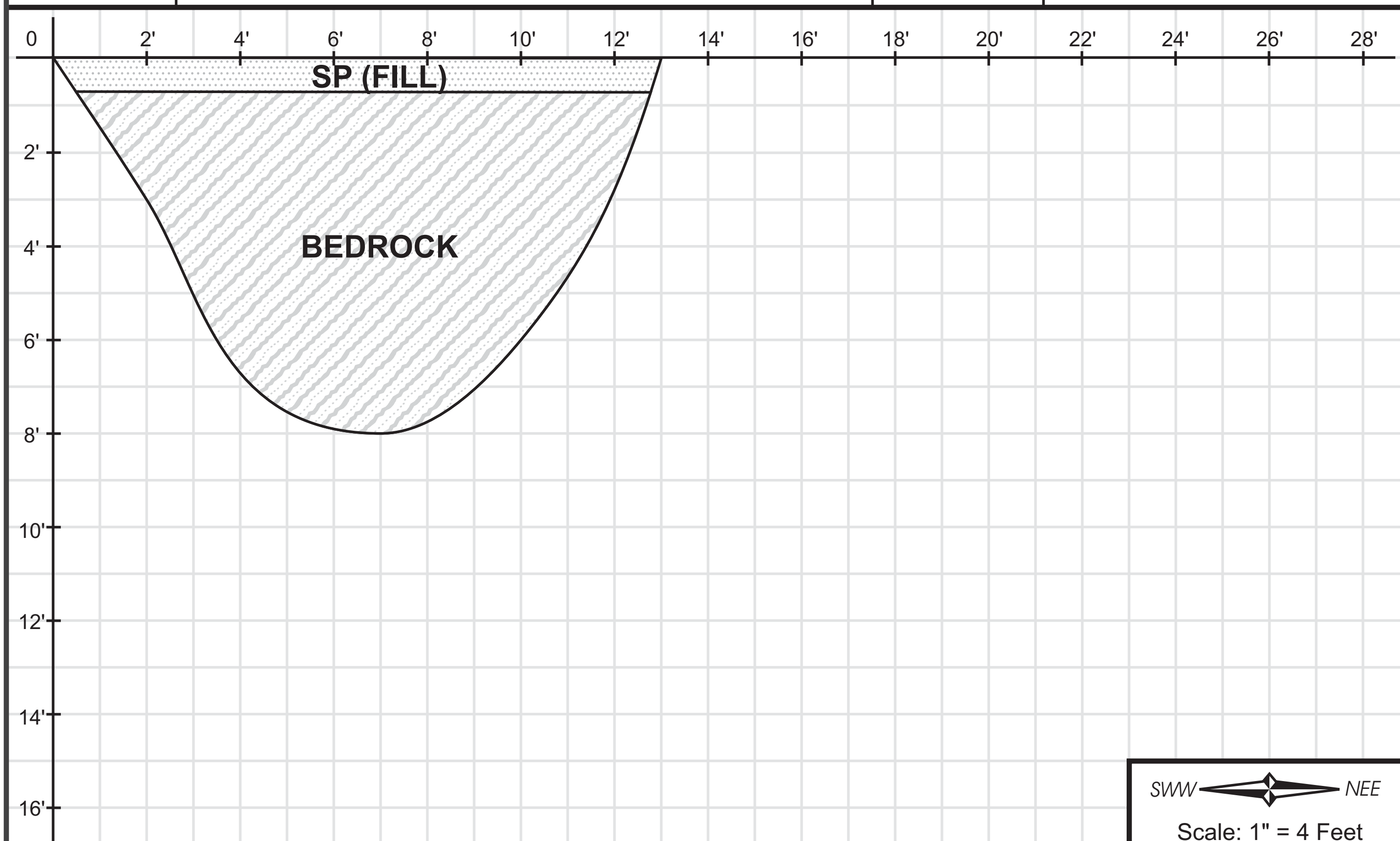


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE A-22**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-21**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **070°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0′ - 8″	Light brown **SAND (SP)**, dense, dry (FILL)		
@ 8″ - 6′	Red brown and white medium quartz diorite **BEDROCK**, moderately weathered, massive, hard		
@ 6′ - 8′	*Grades coarse grained*		
	Test pit terminated at 8' (practical refusal) No free groundwater encountered No caving noted		

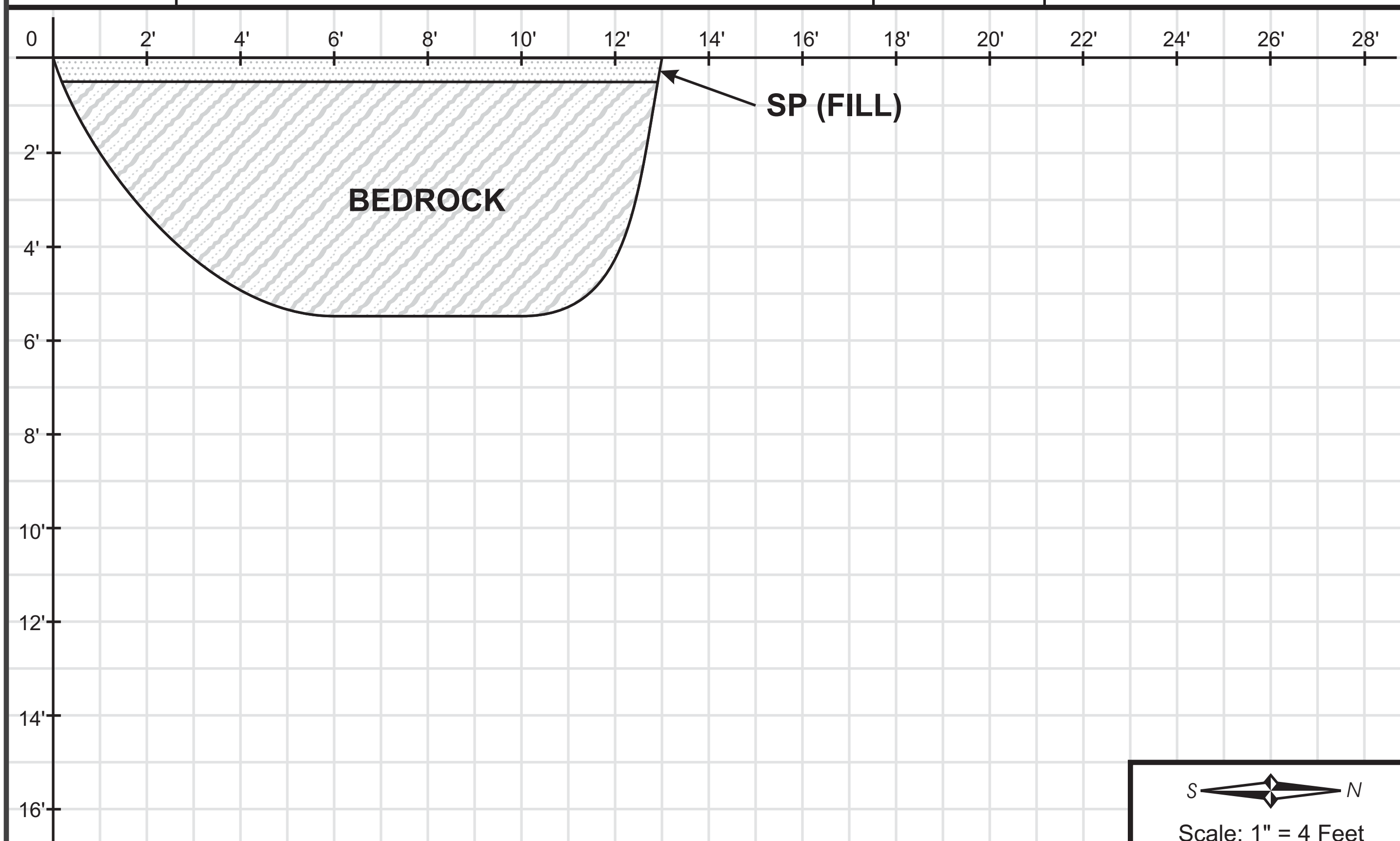


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE A-23**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No.
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **5°**	Elevation: **~**	**TP-22**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 0.5'	Light brown **SAND (SP)**, max clast size 6", dense, dry (FILL)		
@ 0.5' - 5.5'	Red brown and white fine quartz diorite **BEDROCK**, moderately weathered, massive, hard		
@ 5.5'	*Grades fresh, extremely hard*		
	Test pit terminated at 5.5' (practical refusal) No free groundwater encountered No caving noted		

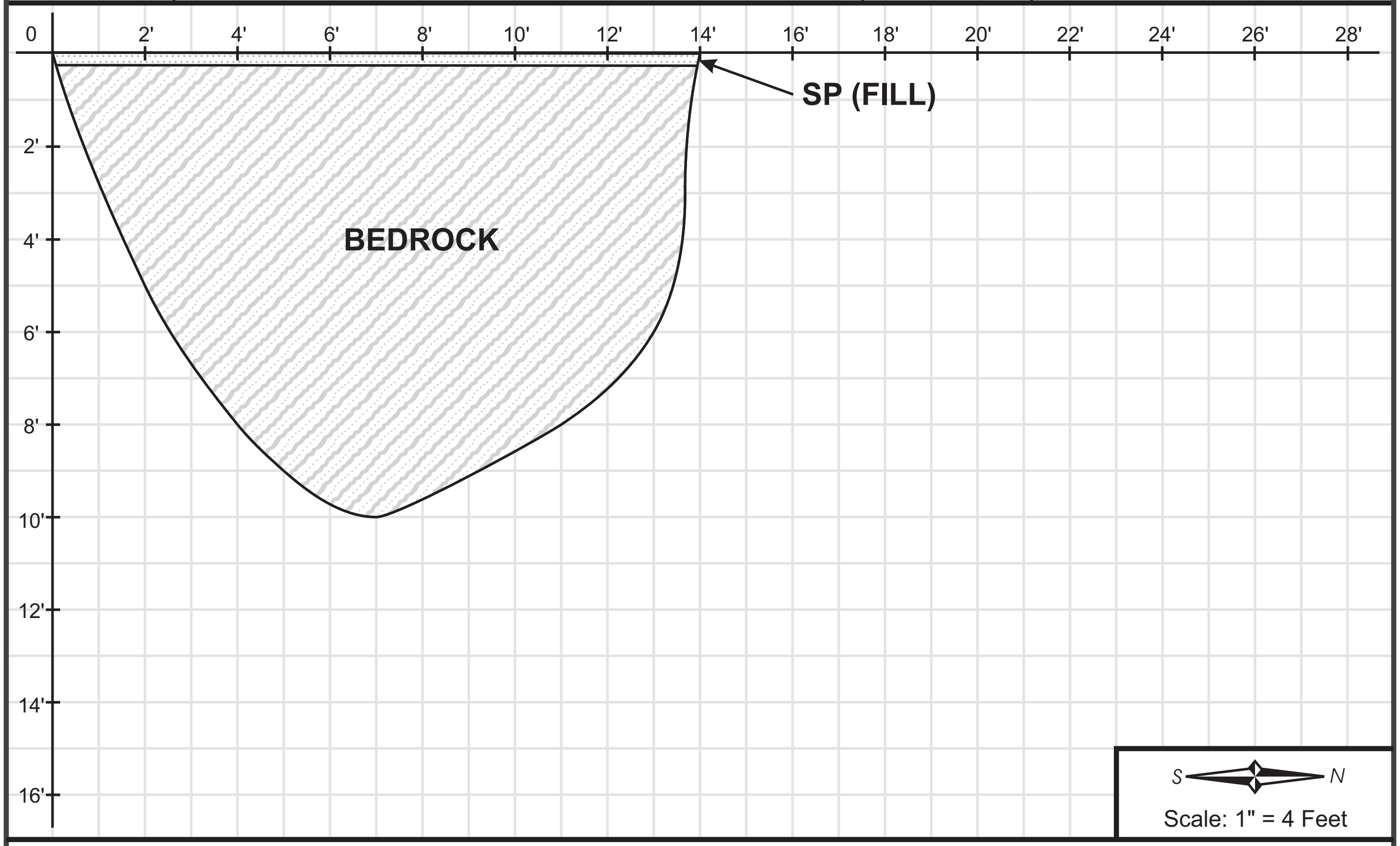


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-24**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No.
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **15°**	Elevation: **~**	**TP-23**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 4"	Light brown **SAND (SP)**, dense, dry (FILL)		
@ 4" - 6.5'	Brown and white fine quartz diorite **BEDROCK**, highly weathered, massive, hard		
@ 6.5' - 10'	*Grades grey black, moderately weathered (mafic intrusion)*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

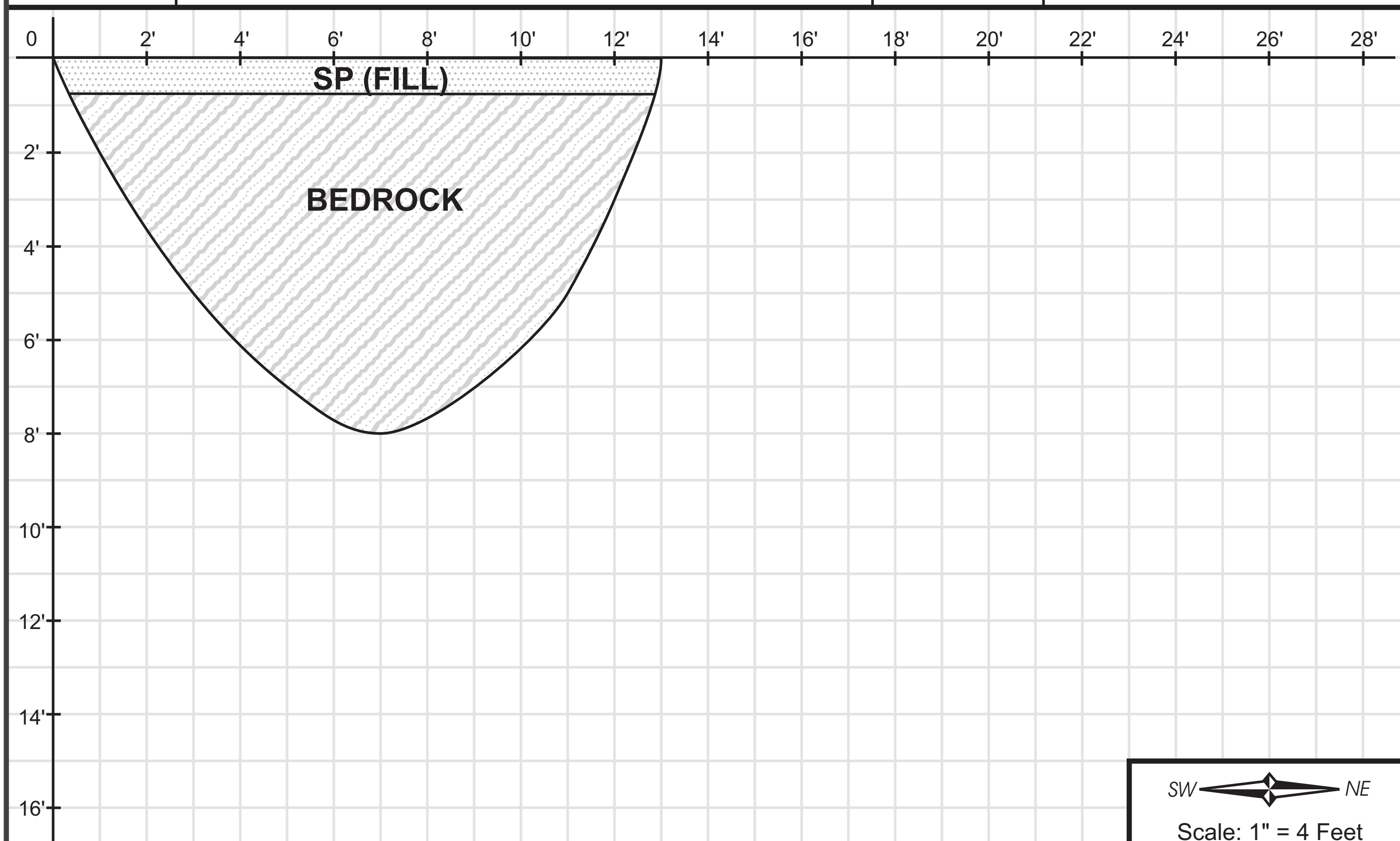


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	FIGURE **A-25**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**	Pit No.
Equipment: **CAT 420E Backhoe With 24" Bucket**	Pit Orientation: **34°**	Elevation: **~**	**TP-24**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0′ - 8″	Light brown **SAND (SP)**, loose, dry, with roots (FILL)		
@ 8″ - 8′	Brown, white, and red fine quartz diorite **BEDROCK**, highly weathered, moderately hard		
	Test pit terminated at 8' (practical refusal) No free groundwater encountered No caving noted		

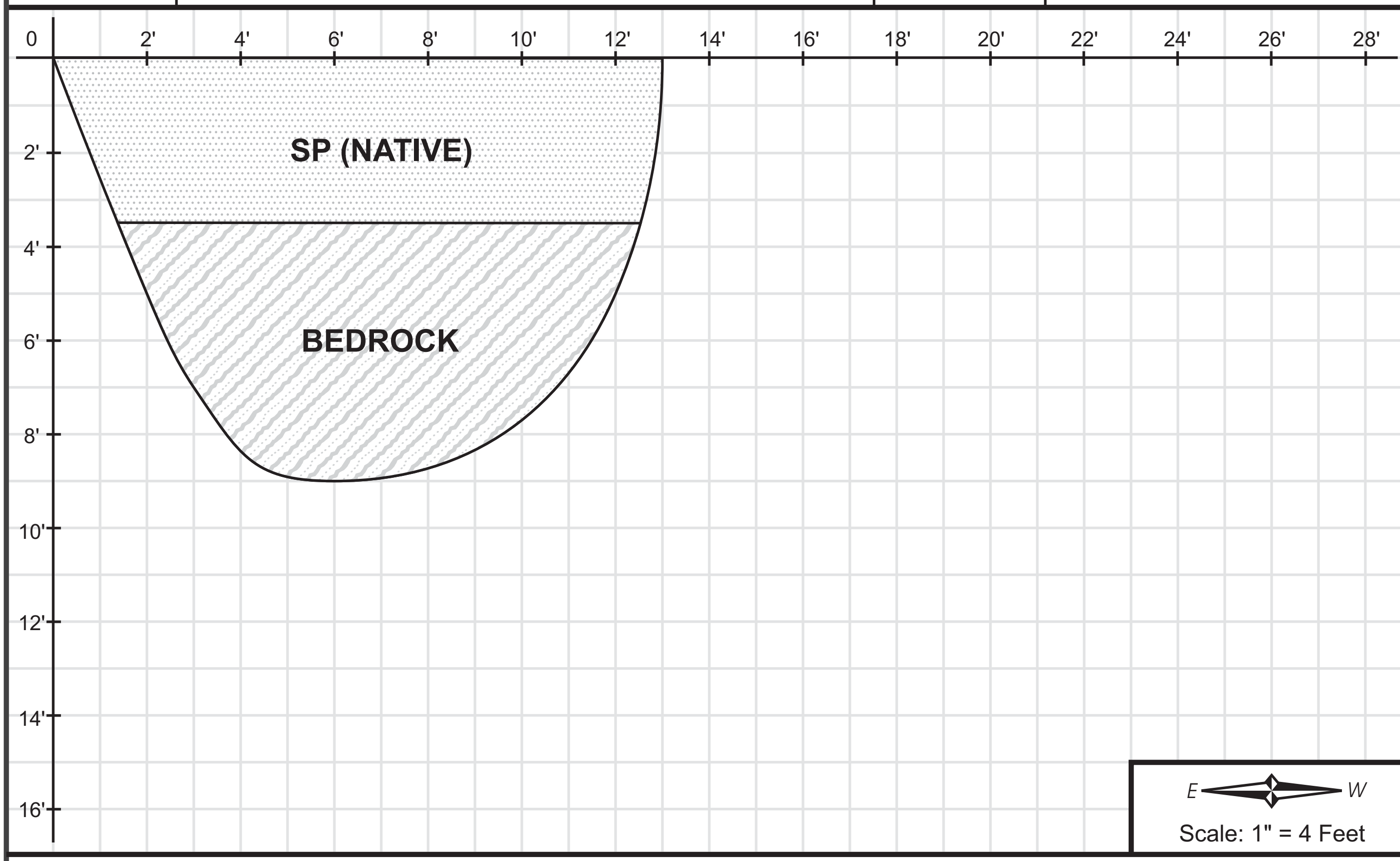


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	FIGURE **A-26**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No.
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **275°**	Elevation: **~**	**TP-25**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 3.5'	Dark brown **SAND (SP)**, medium dense, moist (NATIVE)		
@ 3.5' - 8'	Brown grey fine quartz diorite **BEDROCK**, highly weathered, massive, moderately soft		
@ 8' - 9'	*Grades moderately hard*		
	Test pit terminated at 9' (practical refusal) No free groundwater encountered No caving noted		

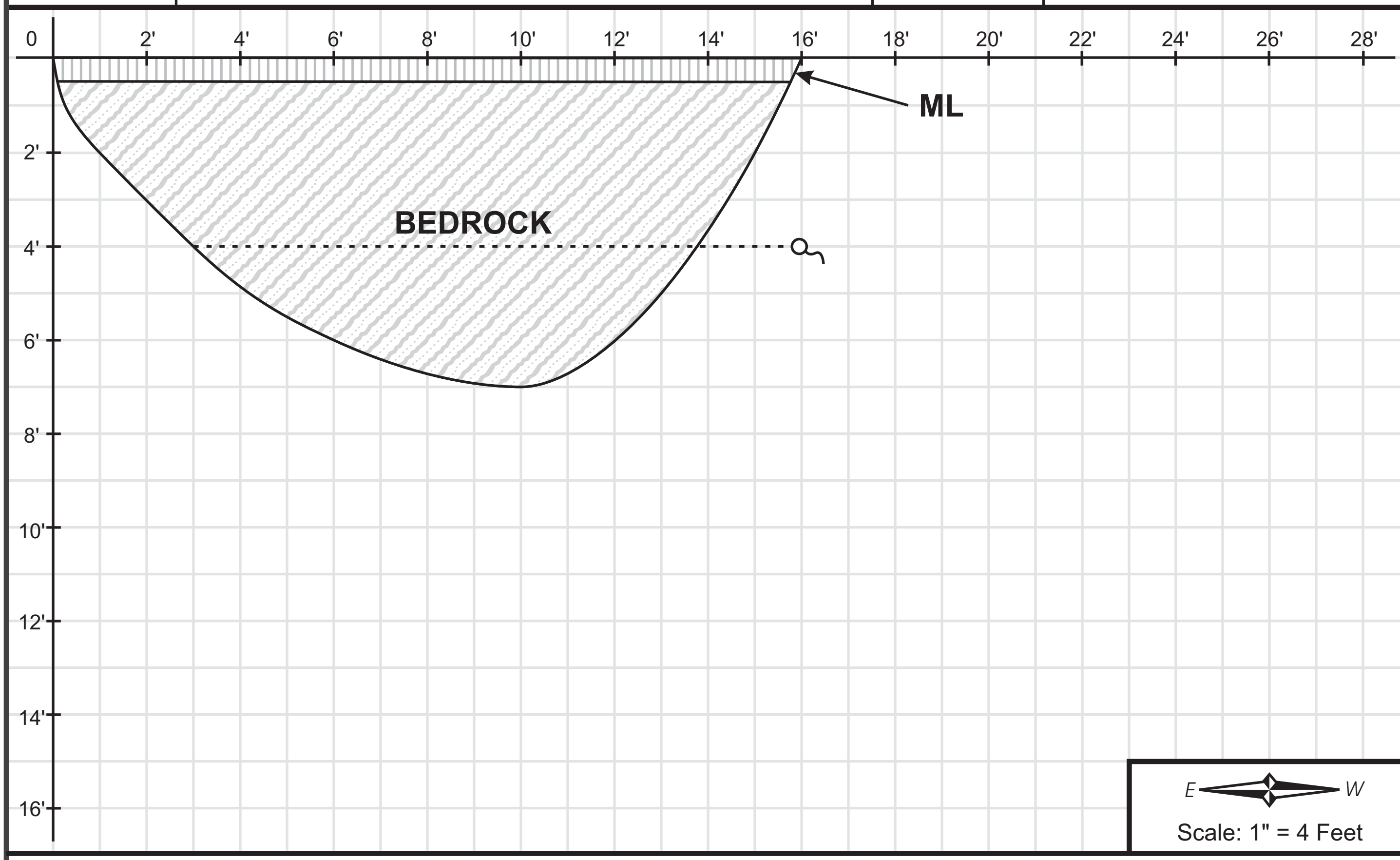


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-27**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-26**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **270°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 0.5'	Light brown sandy **SILT (ML)**, stiff, dry, with roots		
@ 0.5' - 2.5'	Orange and olive fine quartz diorite **BEDROCK**, highly weathered, moderately soft		
@ 2.5' - 4'	*Grades olive brown, moist*		
@ 4' - 5'	*Grades wet*		
@ 5' - 7'	*Grades moderately hard*		
	Test pit terminated at 7' (practical refusal) Seepage encountered at 4' No caving noted		

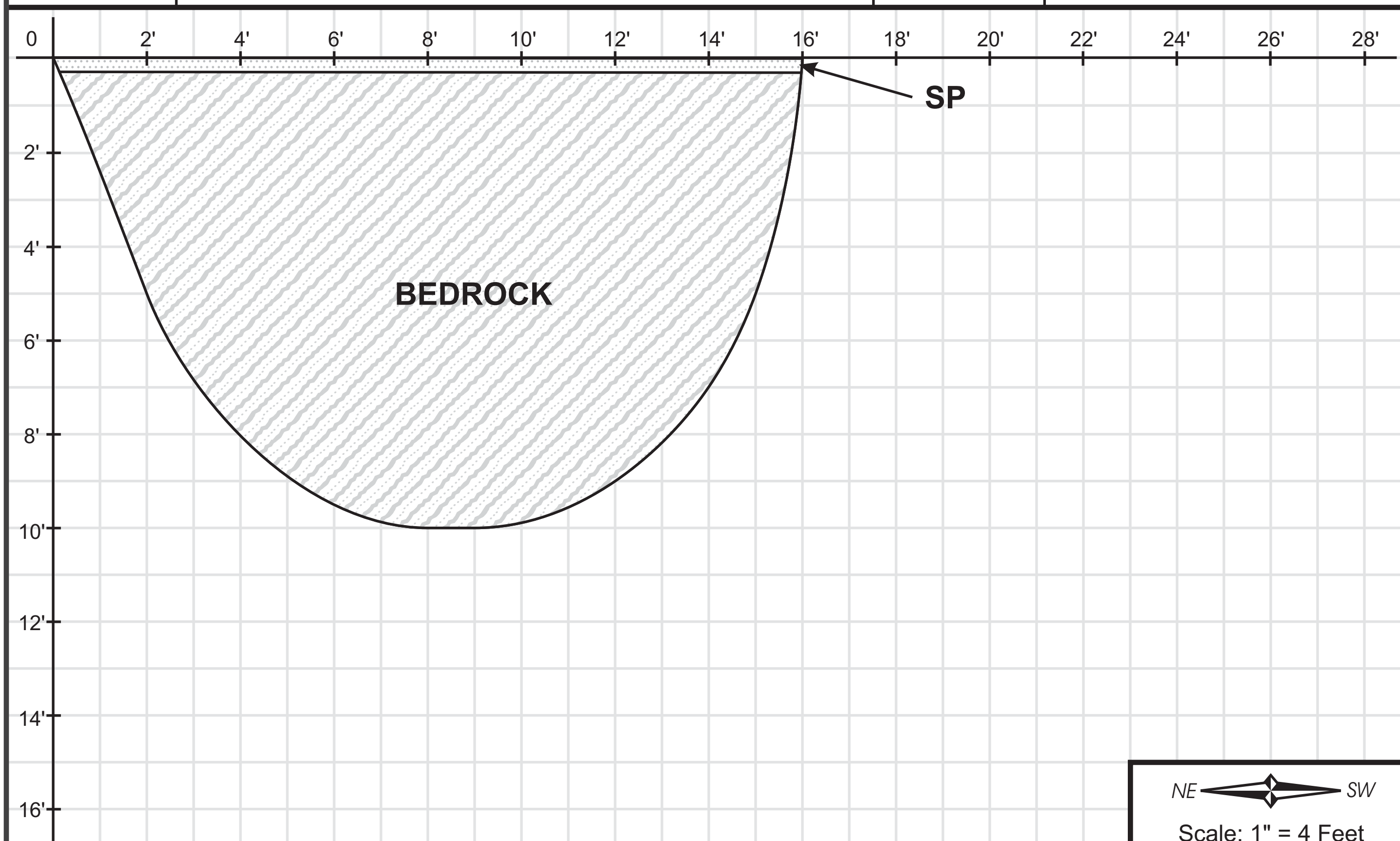


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	FIGURE **A-28**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-27**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **230°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 4"	Red brown **SAND (SP)** with silt and gravel, very dense, dry, with roots		*R-Value = 65*
@ 4" - 4.5'	Brown red fine quartz diorite **BEDROCK**, highly weathered, massive, moderately hard		
@ 4.5' - 6'	*Grades moist*		
@ 6' - 10'	*Grades olive grey to red*		
	Test pit terminated at 10' (practical refusal) No free groundwater encountered No caving noted		

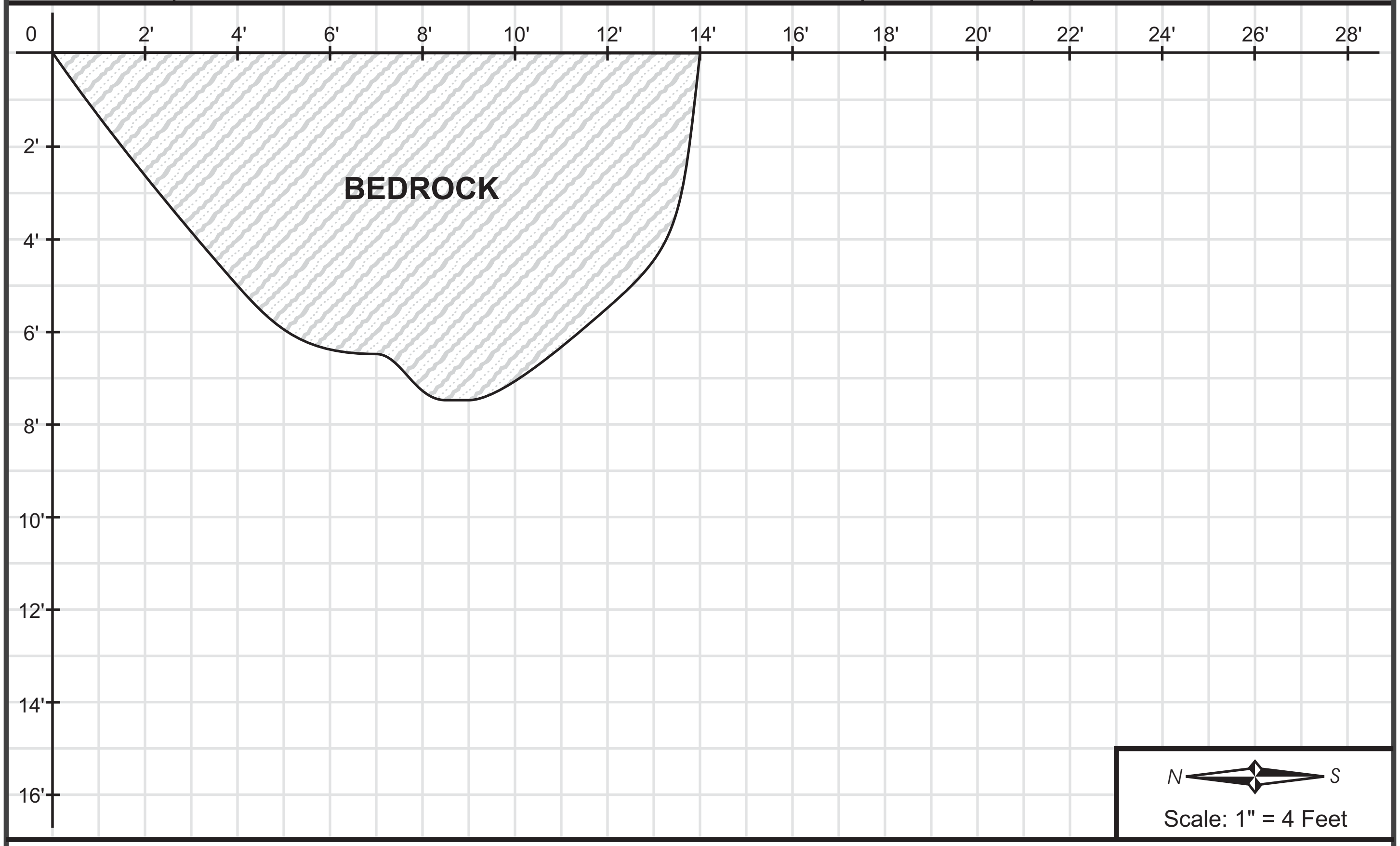


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE** **A-29**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No. **TP-28**
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **180°**	Elevation: **~**	

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 3'	Light brown fine quartz diorite **BEDROCK**, highly weathered, soft		
@ 3' - 7.5'	*Grades red brown, massive, moderately soft*	**TP-28** @ 3-4' **TP-28** @ 6-7'	
@ 7.5'	*Grades hard*		
	Test pit terminated at 7.5' (practical refusal) No free groundwater encountered No caving noted		



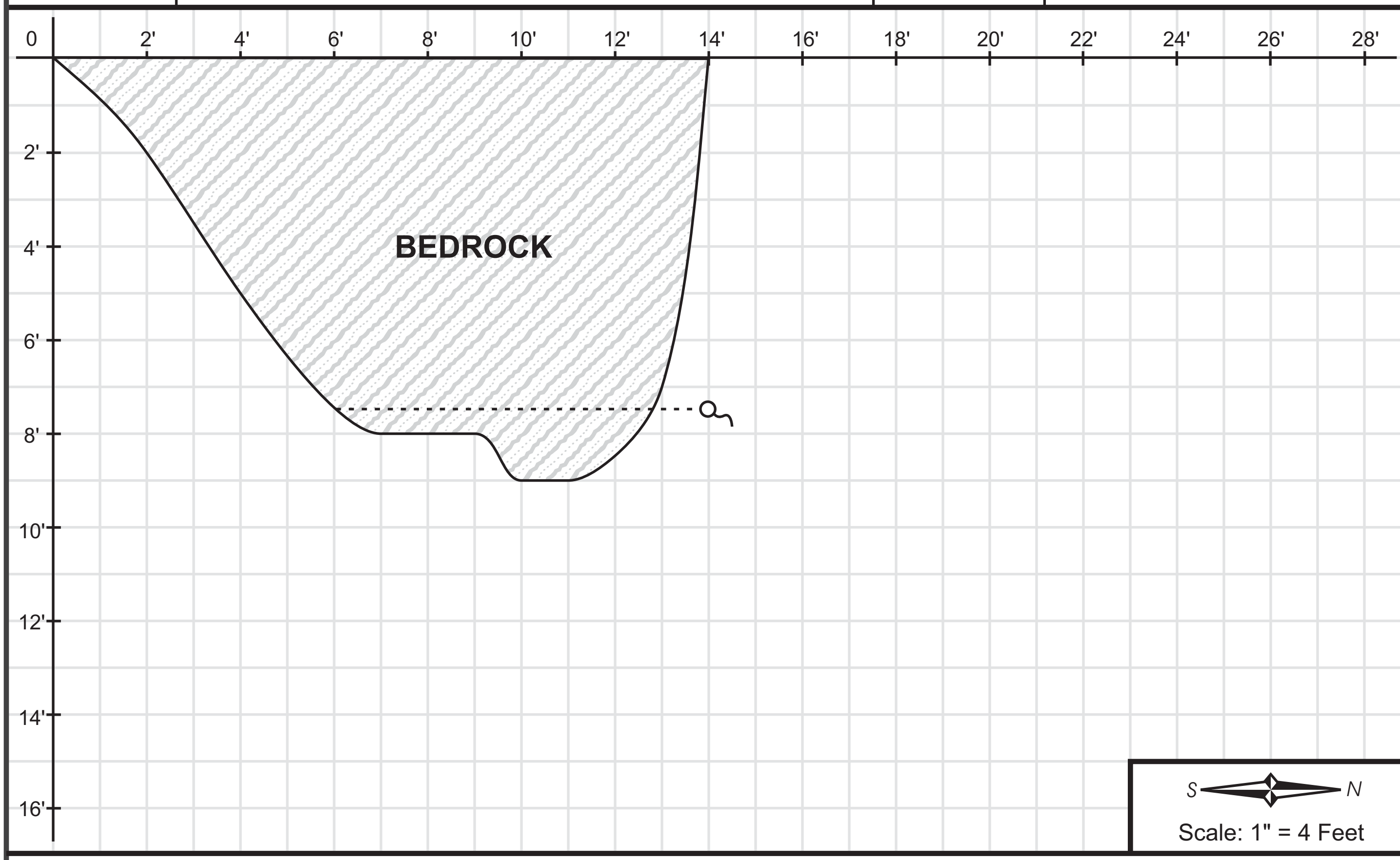
Scale: 1" = 4 Feet

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.: E18269.000 **October 2018**	**EXPLORATORY TEST PIT LOG** **Green Business Park** Loomis, California	**FIGURE A-30**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No.
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **5°**	Elevation: **~**	**TP-29**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' - 3'	Light brown fine quartz diorite **BEDROCK**, highly weathered, moderately soft		***Field moisture density test at 0'*** *DD = 104.3 pcf MC = 1.8%*
@ 3' - 8'	*Grades brown and orange, moderately weathered, massive, moderately hard*		
@ 8' - 9'	*Grades fresh*		
	Test pit terminated at 9' (practical refusal) Seepage encountered at 7.5' No caving noted		

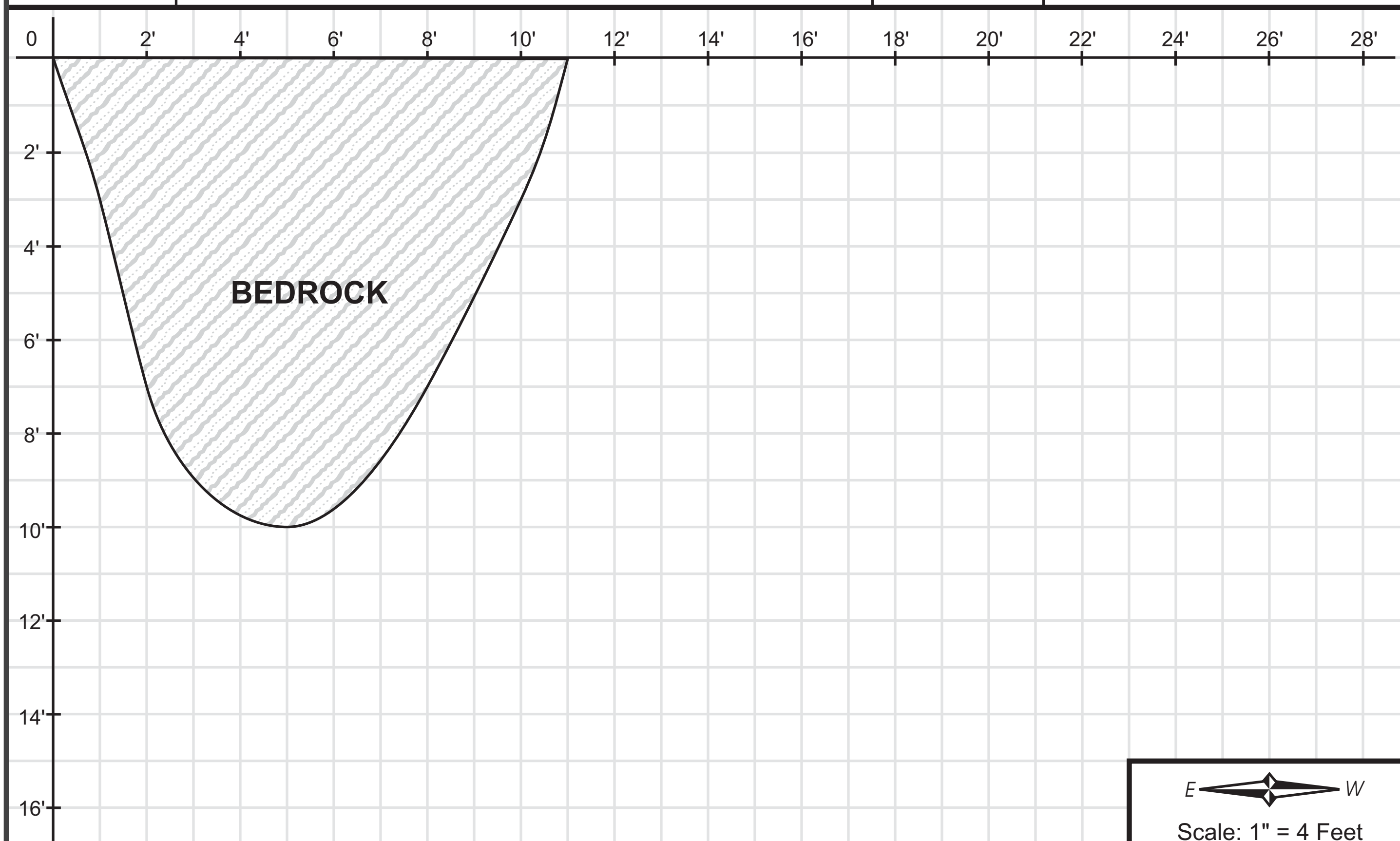


Note: The test pit log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at 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.: E18269.000	**EXPLORATORY TEST PIT LOG**	**FIGURE**
	October 2018	**Green Business Park** Loomis, California	**A-31**

Logged By: **KAW**	Date: **27 September 2018**	Lat / Lon: **~ / ~**		Pit No.
Equipment: **CAT 420E Backhoe With 24" Bucket**		Pit Orientation: **280°**	Elevation: **~**	**TP-30**

Depth (Feet)	Geotechnical Description & Unified Soil Classification	Sample	Tests & Comments
@ 0' -10'	Brown fine quartz diorite **BEDROCK**, moderately weathered, slightly moist, moderately hard		
	Test pit terminated at 10' (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.

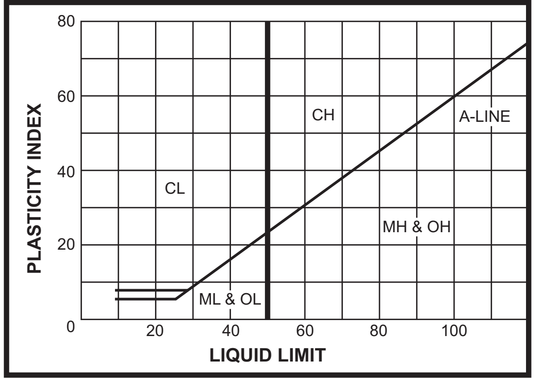
YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E18269.000	**EXPLORATORY TEST PIT LOG**	**FIGURE**
	October 2018	**Green Business Park** Loomis, California	**A-32**

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 COARSE		GRAVEL FINE		SAND COARSE		SAND MEDIUM		SAND FINE		SILT	CLAY
SOIL GRAIN SIZE IN MILLIMETERS		150		75		19		4.75		2.0		.425		0.075	0.002	

KEY TO PIT & BORING SYMBOLS

- Standard Penetration test
- 2.5" O.D. Standard 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 PIT & BORING SYMBOLS

	Joint
	Foliation
	Water Seepage
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)
Su	Undrained Shear Strength

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GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING

Project No.: E18269.000

October 2018

SOIL CLASSIFICATION CHART AND LOG EXPLANATION
Green Business Park
Loomis, California

FIGURE A-33

APPENDIX B

Laboratory Testing

Direct Shear Test
Modified Proctor Test
R-Value Test
Corrosivity Tests

Introduction

Our laboratory testing program for this evaluation included numerous visual classifications, direct shear, Atterberg limit, resistance value, modified proctor, and corrosivity 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.

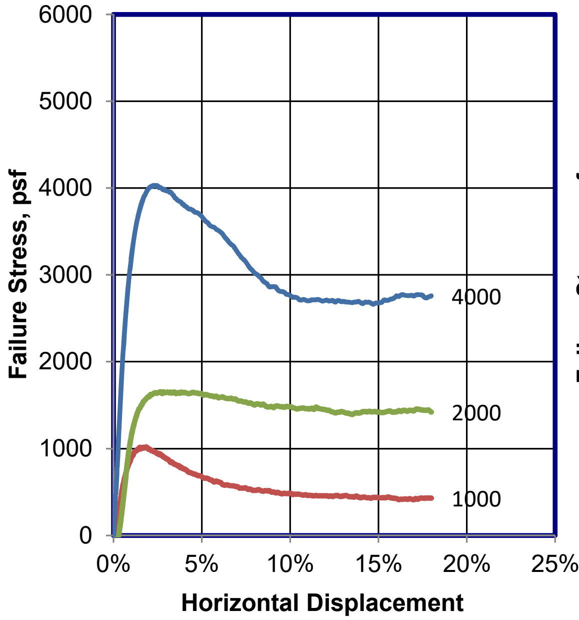
Soil Strength Determination: The strength parameters of the foundation soils were based on direct shear tests (ASTM D3080) performed on a representative remolded sample of the near-surface soils. The results of these tests are presented on Figures B-1 and B-2, this Appendix.

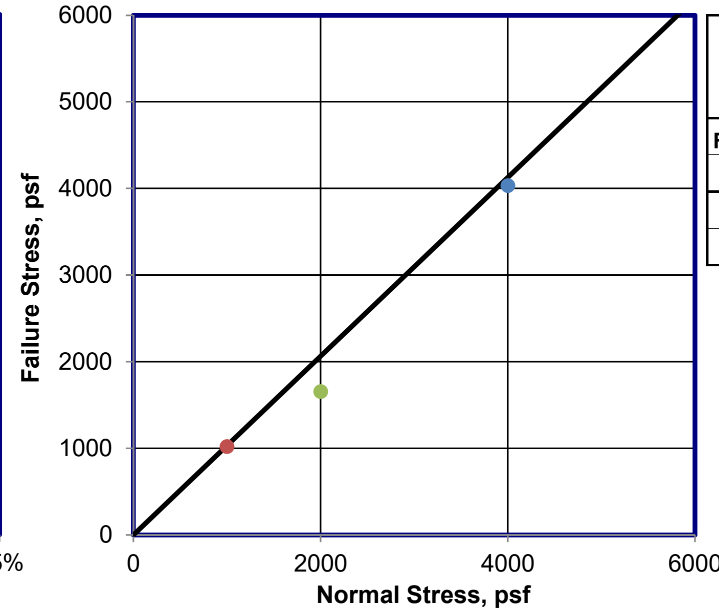
Resistance Value Determination: Resistance Value (R-Value) tests (California Test Method 301-F or ASTM D2844) were performed to obtain asphalt concrete pavement design parameters. The results of this test are presented on Figures B-3 and B-4, this Appendix.

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-5 and B-6, this Appendix.

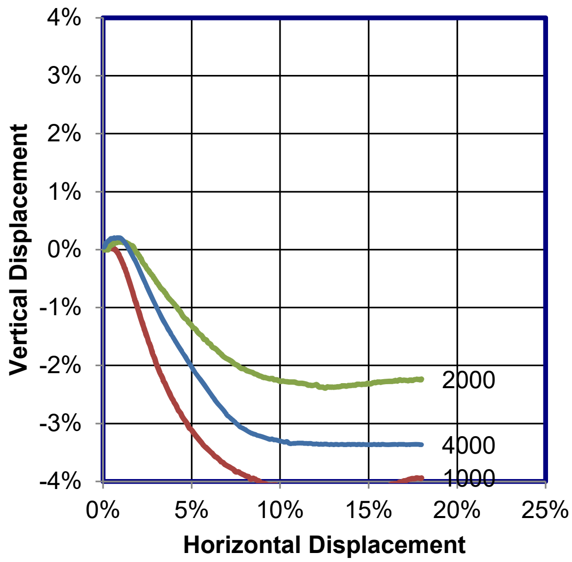
Corrosivity Tests: A corrosivity test typically comprises individual measurements of pH, electrical resistivity, sulfate content, and chloride content, which together indicate the corrosiveness of a soil. Corrosivity tests were performed on selected samples by an independent analytical laboratory working under subcontract to Youngdahl Consulting Group, Inc. The results of these tests are presented on the enclosed analytical certificates, this Appendix.

Direct Shear Test of Soils Under Consolidated Drained Conditions, ASTM D3080





Direct Shearbox Results
Friction Angle
45.9°
Cohesion
0 psf



	Test No.	1	2	3
Initial	Wet Density, pcf	134.6	134.6	134.6
	Dry Density, pcf	125.0	125.0	125.0
	Moisture Content, %	7.7	7.7	7.7
	Diameter, in	2.50	2.50	2.50
	Height, in	1.00	1.00	1.00
Pre Shear	Wet Density, pcf	147.7	150.3	150.4
	Dry Density, pcf	127.8	127.8	132.0
	Moisture Content, %*	15.6	17.6	14.0
	Diameter, in	2.50	2.50	2.50
	Height, in	0.98	0.98	0.95
	Normal Stress, psf	1000	2000	4000
	Failure Stress, psf	1019	1654	4031
	Failure Strain, %	1.85	2.81	2.27
	Rate, in/min		0.0025	

*Based on post shear moisture content

Sample Type:	Remolded to 95% RC
Material Description:	**Yellow Brown SAND (SP) with trace Gravel (Decomposed Quartz Diorite)**
Source:	
Notes:	Gravel removed from test sample.

Sample No./Depth: TP-1 @ 1-3'		USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4	% Less than No. 200
Date Sampled: 9/25/2018	Date Test Started:				2	

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30 YEARS
Building Innovative Solutions
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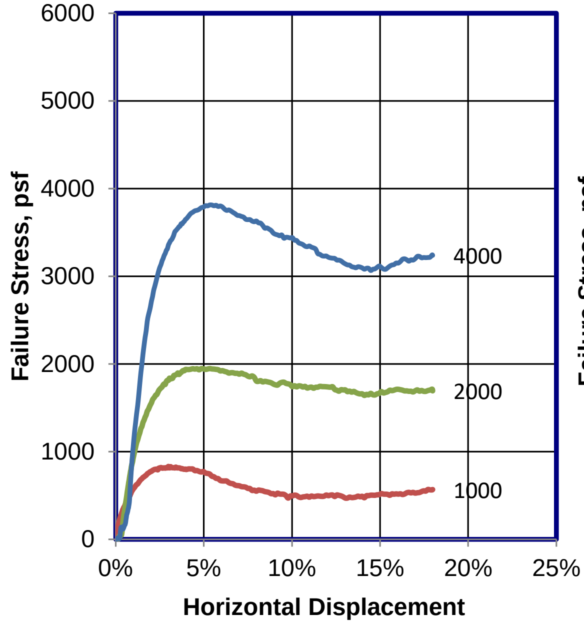
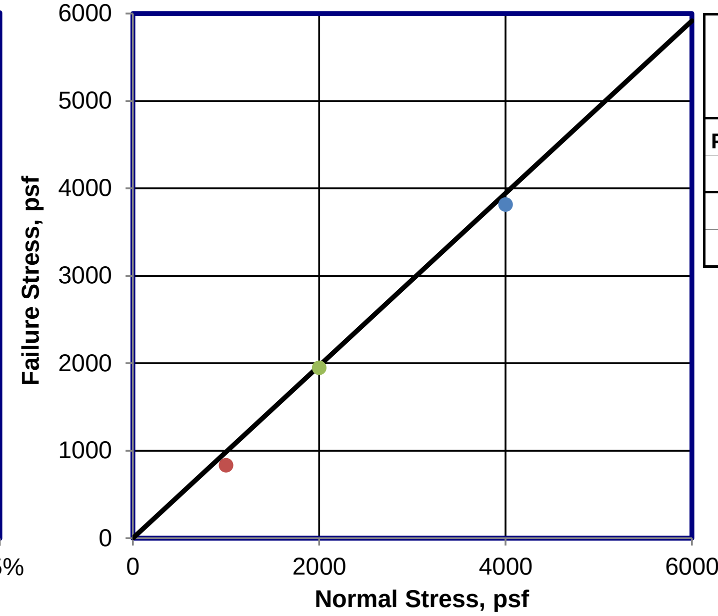
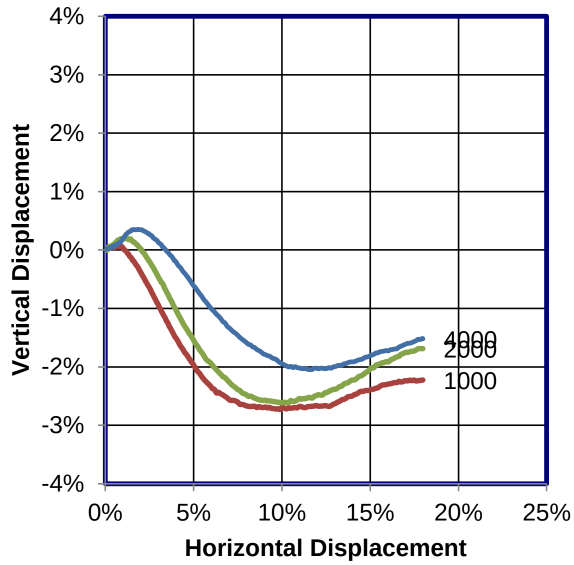
Project:	**Green Business Park Loomis**		
Project No.:	**E18269.000**		Figure
Reviewed By: DN	Date: 10/22/2018		B-1

Direct Shear Test of Soils Under Consolidated Drained Conditions, ASTM D3080





Direct Shearbox Results
Friction Angle
44.6°
Cohesion
0 psf



Test No.		1	2	3
Initial	Wet Density, pcf	132.9	132.9	132.9
	Dry Density, pcf	120.4	120.4	120.4
	Moisture Content, %	10.4	10.4	10.4
	Diameter, in	2.50	2.50	2.50
	Height, in	1.00	1.00	1.00
Pre Shear	Wet Density, pcf	147.5	145.4	148.0
	Dry Density, pcf	124.3	123.7	126.2
	Moisture Content, %*	18.6	17.6	17.3
	Diameter, in	2.50	2.50	2.50
	Height, in	0.97	0.97	0.95
Normal Stress, psf		1000	2000	4000
Failure Stress, psf		833	1949	3815
Failure Strain, %		2.99	5.34	5.34
Rate, in/min		0.0025		

*Based on post shear moisture content

Sample Type: Remolded to 95% RC

Material Description: **Yellow Brown SAND (SP) (Decomposed Quartz Diorite)**

Source:

Notes:

Sample No./Depth: TP-17 @ 5-8'	USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4	% Less than No. 200
Date Sampled: 9/25/2018 Date Test Started: 10/10/2018				0	

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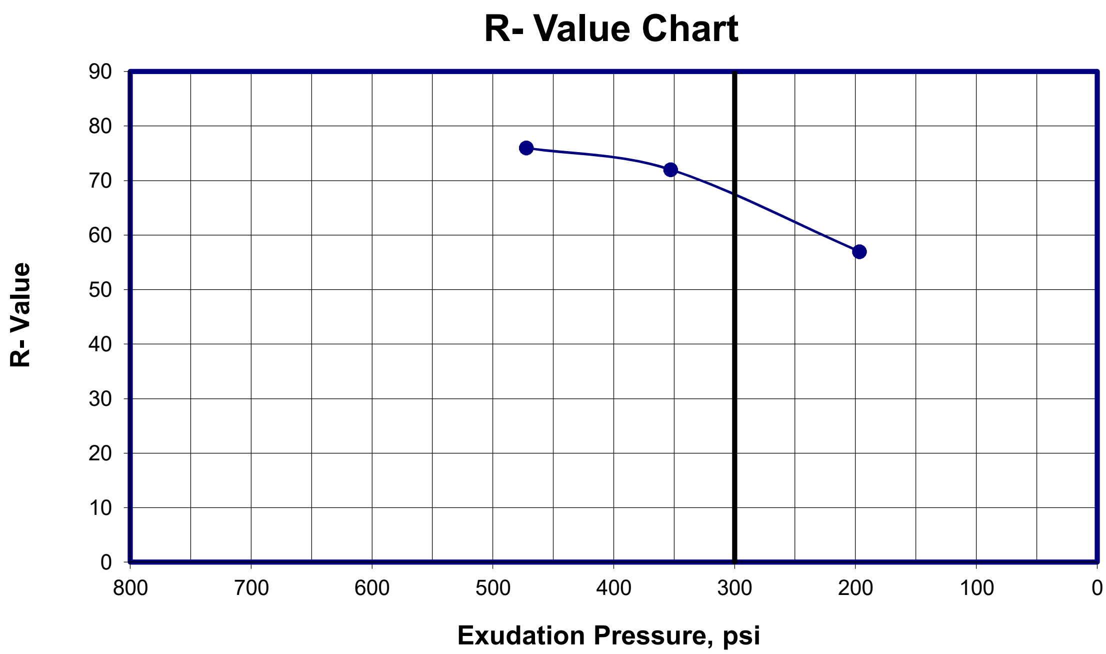
Project: **Sierra College Blvd. & Bankhead Rd. Commercial**

Project No.: **E18269.000**

Reviewed By: DN Date: 10/22/2018

Figure B-2

Resistance "R" Value of Soil and Soil-Aggregate Mixtures, CTM 301



Test Specimen No.:	1	2	3
Moisture Content at Test, %	11.5	12.2	13.8
Dry Density at Test, pcf	122.0	121.7	119.4
Expansion Pressure, psf	17	0	0
Exudation Pressure, psi	472	353	197
Resistance "R" Value	76	72	57
"R" Value at 300 psi Exudation Pressure			**68**

Material Description:	**Olive SAND (SP) (Decomposed Quartz Diorite)**					
Source:						
Notes:						
Sample No./Depth:	TP-3 @ 4-6'	USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4	% Less than No. 200
Date Sampled: 9/26/2018	Date Test Started: 10/18/2018				0	

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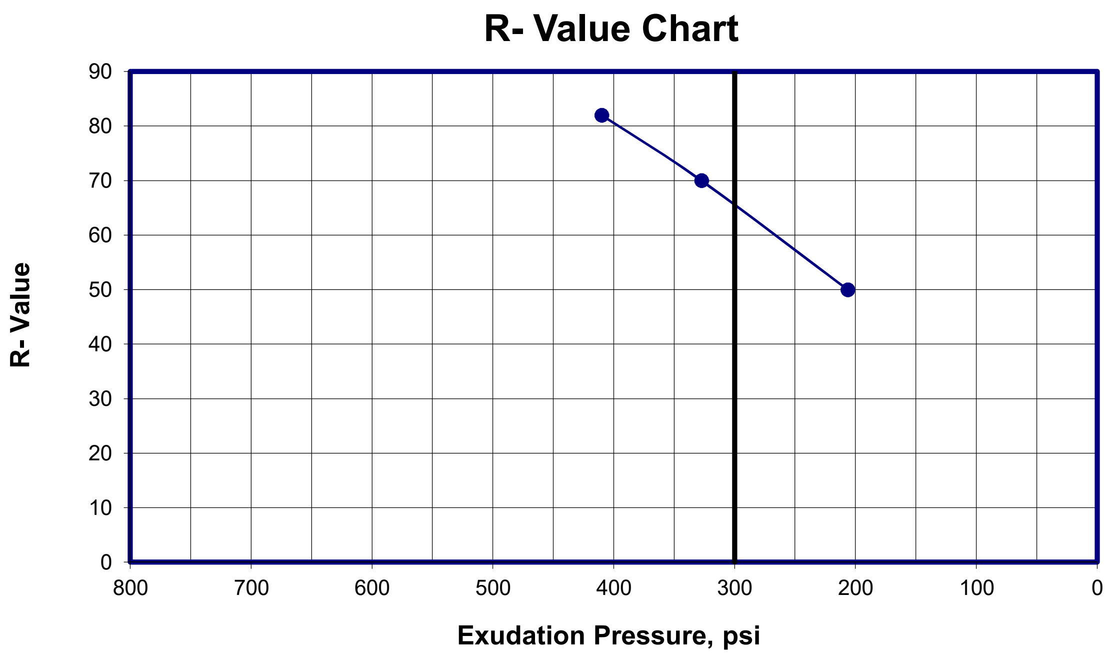
Project:	**Green Business Park Loomis**		
Project No.:	**E18269.000**		Figure
Reviewed By: JLC	Date: 10/23/2018		B-3

Resistance "R" Value of Soil and Soil-Aggregate Mixtures, CTM 301



Test Specimen No.:	1	2	3
Moisture Content at Test, %	4.0	4.7	5.3
Dry Density at Test, pcf	131.6	131.4	131.7
Expansion Pressure, psf	65	39	4
Exudation Pressure, psi	410	327	206
Resistance "R" Value	82	70	50
"R" Value at 300 psi Exudation Pressure			**66**

Material Description: **Red Brown SAND (SP) with Silt and Gravel (Decomposed Quartz Diorite)**

Source:

Notes:

Sample No./Depth:	TP-27 @ 1-4'	USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4	% Less than No. 200
Date Sampled: 9/26/2018	Date Test Started: 10/18/2018				3	

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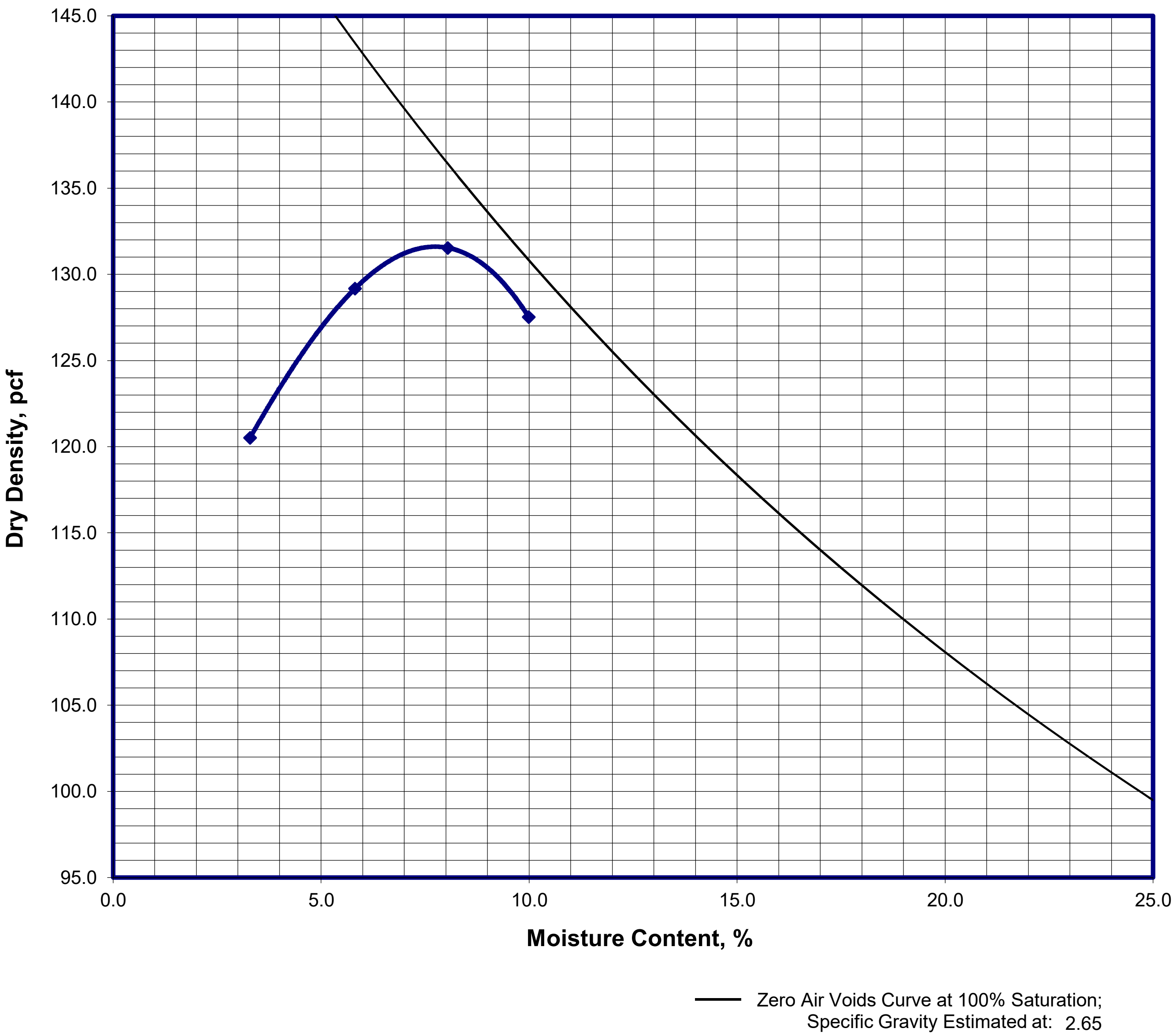
Project:	**Green Business Park Loomis**		
Project No.:	**E18269.000**		Figure
Reviewed By: JLC	Date: 10/23/2018		B-4

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, %:	**7.8**

Material Description: **Yellow Brown SAND (SP) with trace Gravel (Decomposed Quartz Diorite)**

Source:

Notes:

Sample No./Depth: TP-1 @ 1-3		USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4 :	% Less than No. 200
Date Sampled: 9/26/2018	Date Test Started: 9/27/2018				2	

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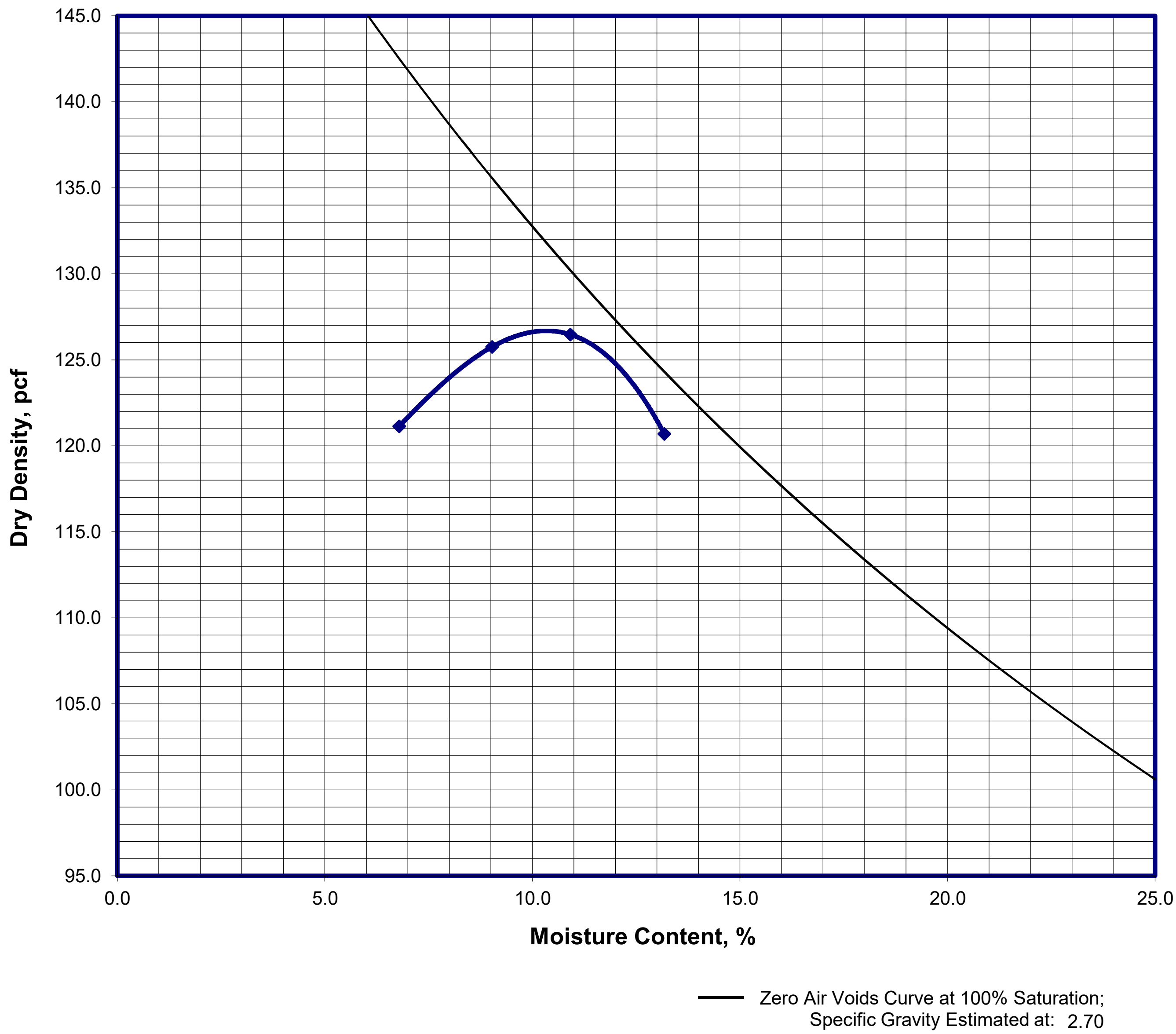
Project:	**Green Business Park Loomis**		
Project No.:	**E18269.000**		Figure
Reviewed By: JLC	Date: 10/10/2018		B-5

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



Maximum Dry Density, pcf:	**126.7**	Optimum Moisture Content, %:		**10.4**	
Material Description:	**Yellow Brown SAND (SP) (Decomposed Quartz Diorite)**				
Source:					
Notes:					

Sample No./Depth:	TP-17 @ 5-8			USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4 :	% Less than No. 200
Date Sampled:	9/25/2018	Date Test Started:	10/4/2018				0	

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Project:	**Green Business Park Loomis**		
Project No.:	**E18269.000**		Figure
Reviewed By: JLC	Date: 10/10/2018		B-6

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/12/2018
Date Submitted 10/08/2018

To: Jeffry Cannon
Youngdahl Consulting Group
1234 Glenhaven Ct.
El Dorado Hills, CA 95630

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : E18269.000 Site ID : TP-1 @ 1-3 FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 78246-163651.

EVALUATION FOR SOIL CORROSION

Soil pH	5.46	
Minimum Resistivity	11.79 ohm-cm (x1000)	
Chloride	1.6 ppm	00.00016 %
Sulfate	4.4 ppm	00.00044 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/12/2018
Date Submitted 10/08/2018

To: Jeffry Cannon
Youngdahl Consulting Group
1234 Glenhaven Ct.
El Dorado Hills, CA 95630

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : E18269.000 Site ID : TP17 @ 5-8 FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 78246-163652.

EVALUATION FOR SOIL CORROSION

Soil pH	5.66	
Minimum Resistivity	16.08 ohm-cm (x1000)	
Chloride	0.8 ppm	00.00008 %
Sulfate	2.9 ppm	00.00029 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX C

Details

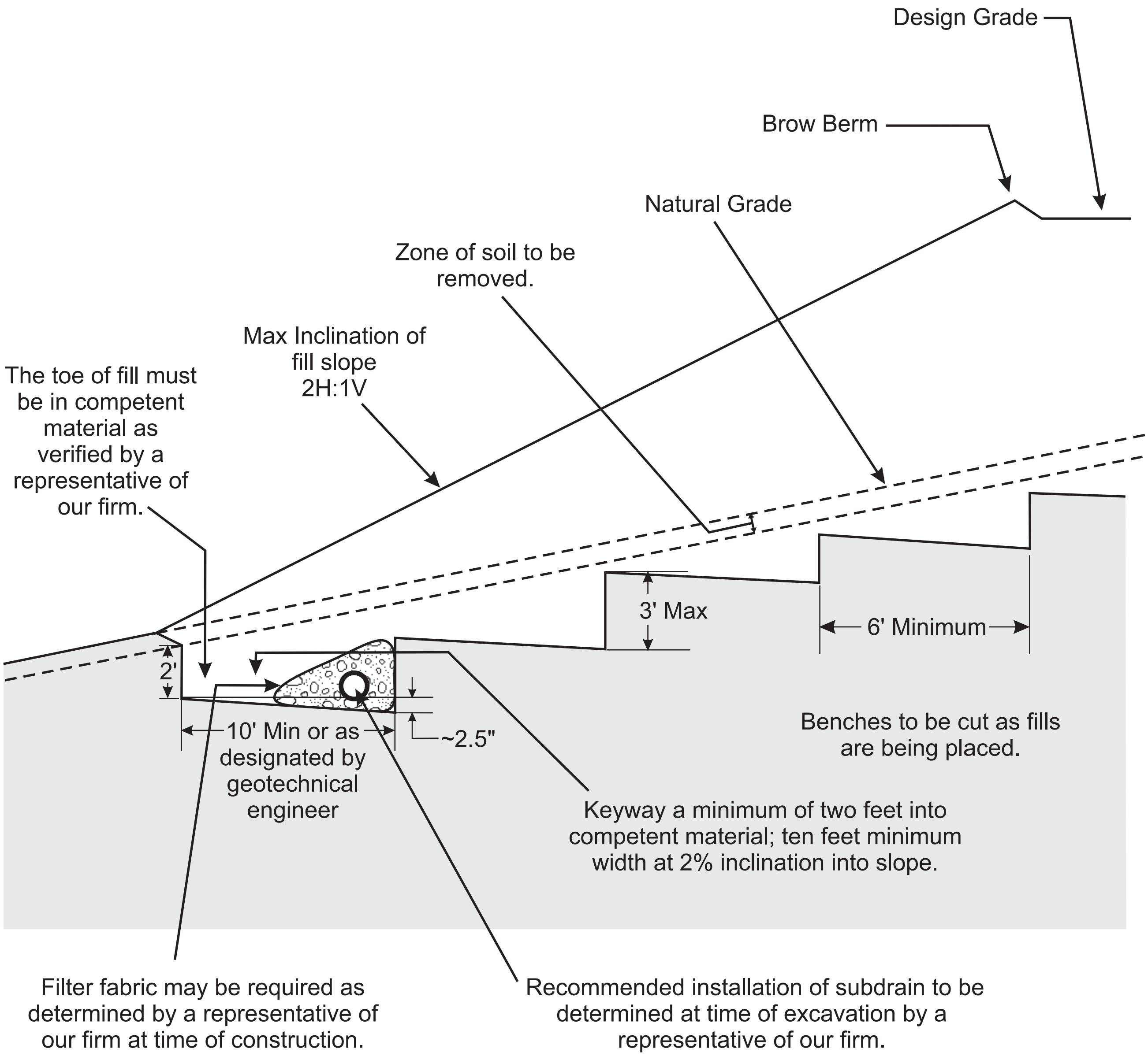
Keyway and Bench with Drain
Plug and Drain
Site Wall Drainage
Subdrain

PLACEMENT OF FILL ON NATURAL SLOPE

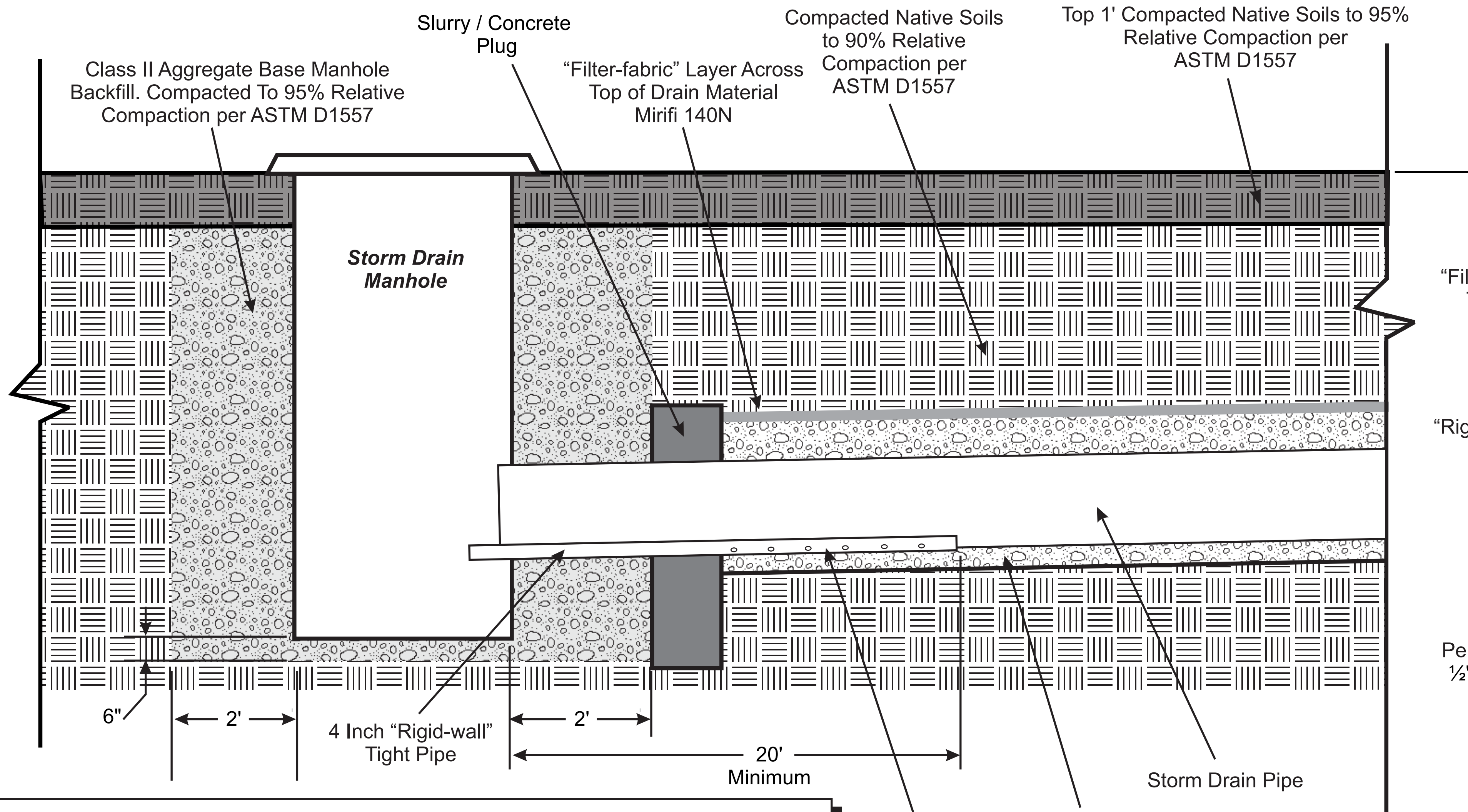
(Typical)

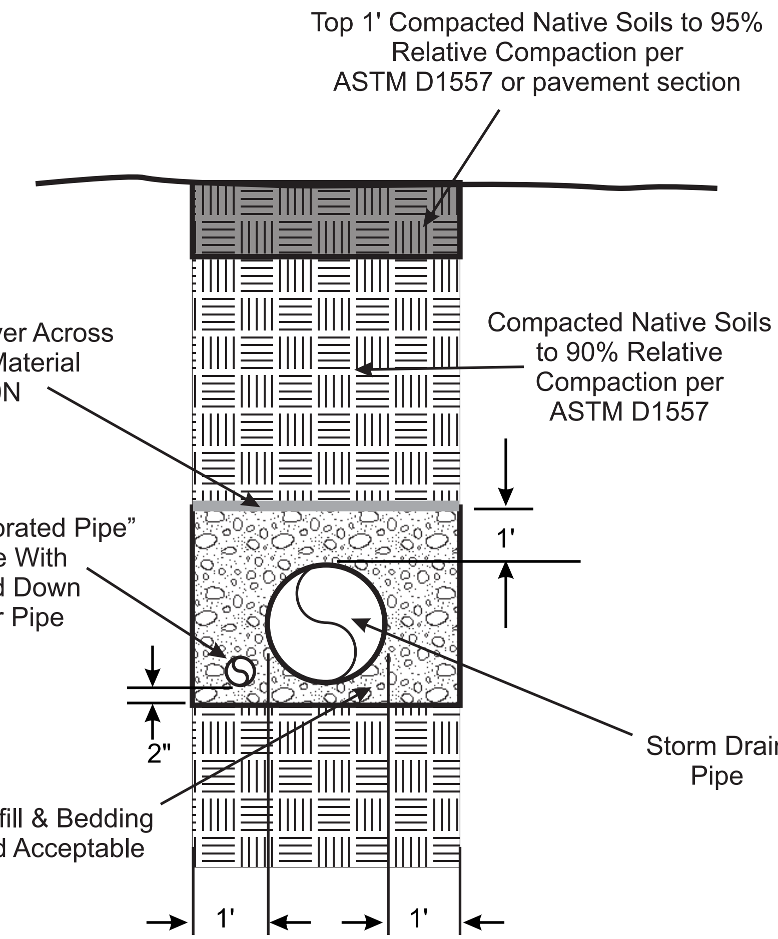
All keyways should be observed and approved prior to placement of fill.

A keyway is required by CBC for fills on natural slopes of 5H:1V or steeper.



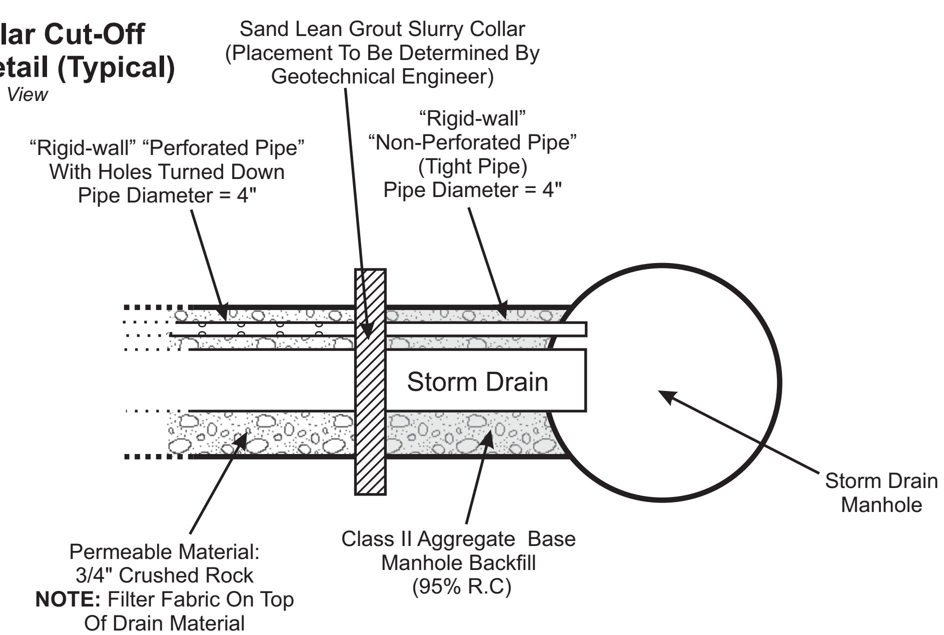
YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: E18269.000	**KEYWAY & BENCH WITH DRAIN**	**FIGURE**
	October 2018	**Green Business Park Loomis** Loomis, California	**C-1**





Grout Collar Cut-Off Subdrain Detail (Typical)

Plan View



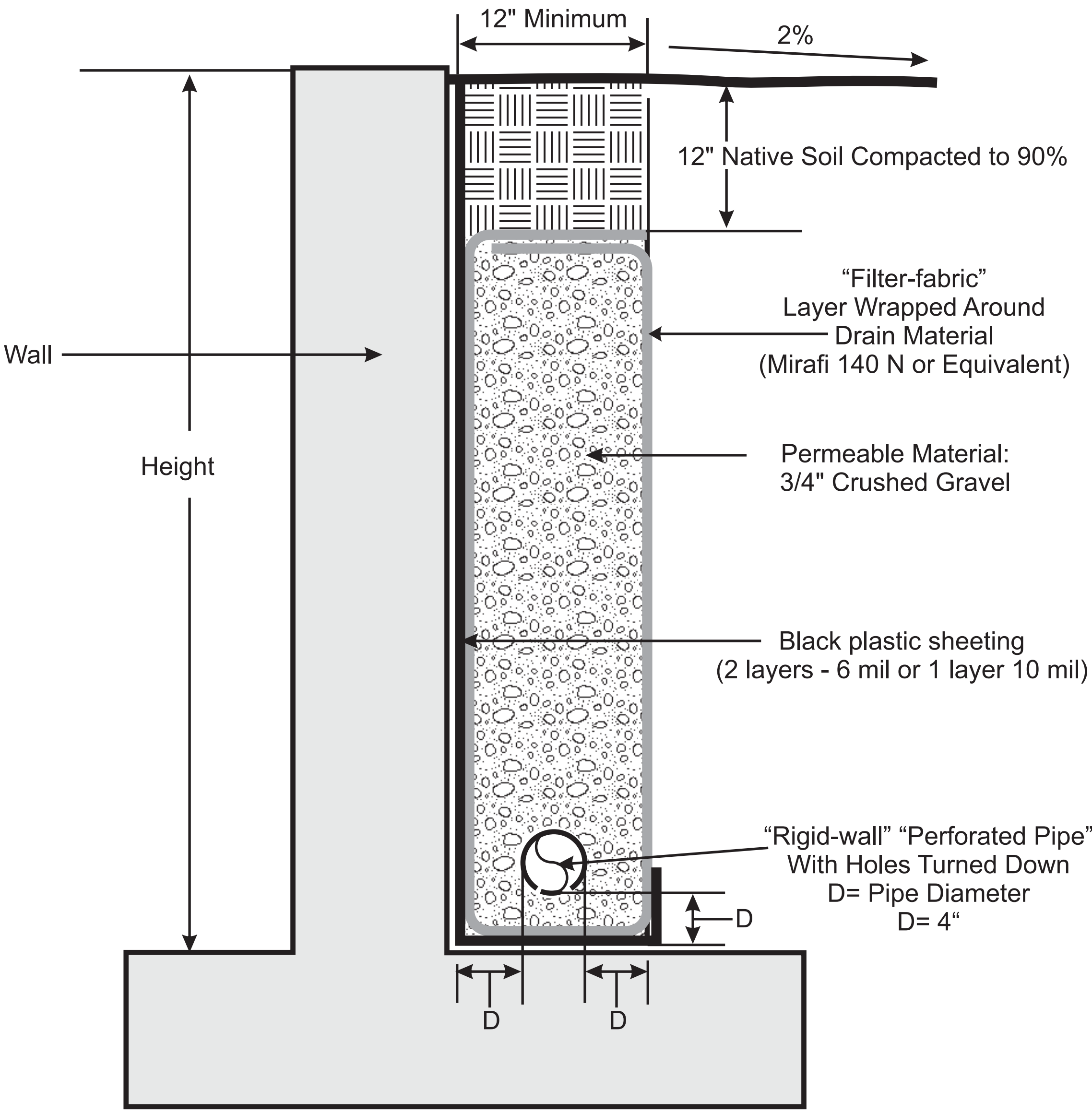
***Notes:** 1. Slope trench and "rigid-wall" pipes at least 1% gradient to drain.*
2. Washed clean permeable material.
3. Slurry collar to extend into trench sidewalls and to top of pipe envelope.

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

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E18269.000 / October 2018	**TYPICAL STORM DRAIN / SUB-DRAIN DETAIL** / **Green Business Park Loomis** / Loomis, California	**FIGURE** / **C-2**

Retaining Wall With "Perforated Pipe Sub-Drain"

(Typical Cross Section)

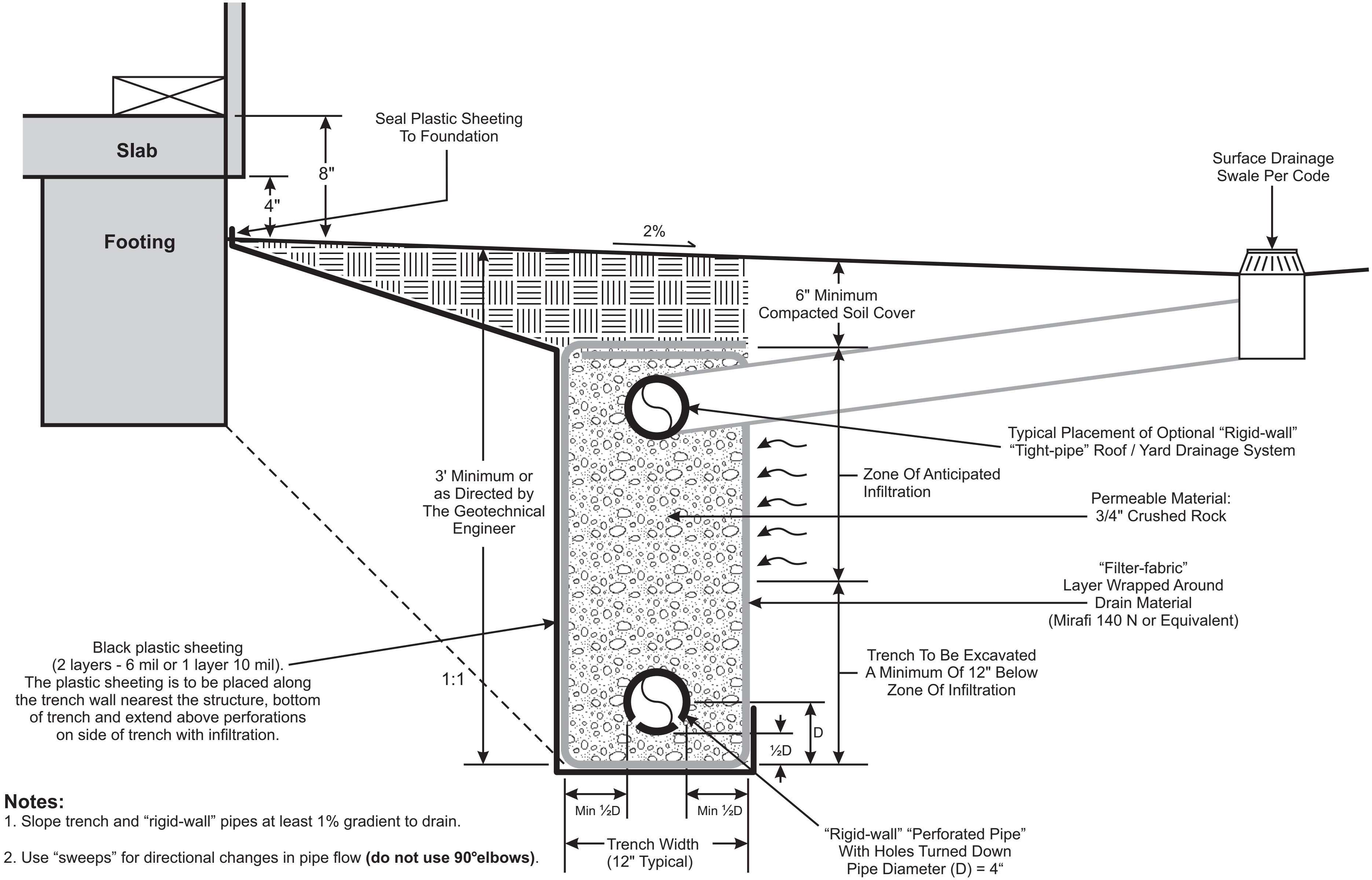


Notes:

1. Slope trench and "rigid-wall" pipes at least 1% gradient to drain to an appropriate outfall area away from the structure.
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.: E18269.000 **October 2018**	**RETAINING WALL DRAIN DETAIL** **Green Business Park Loomis** Loomis, California	**FIGURE** **C-3**



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.

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E18269.000	**SUB-DRAIN DETAIL**	**FIGURE**
	October 2018	**Green Business Park Loomis** Loomis, California	**C-4**