ATTACHMENT 7 Geotechnical Engineering Report

Geotechnical Engineering Report

For

Proposed Residential Development

Bullock Lane APN 076-481-008 and 076-491-001

San Luis Obispo, California

October 1, 2018

F-101919

Prepared For

Bullock Ranch, LLC

By

Beacon Geotechnical, Inc.
P.O. Box 4814
Paso Robles, California 93447

BEACON
GEOTECHNICAL, INC

October 1, 2018 F-101919

Bullock Ranch, LLC
125 South Bowling Green Way
Los Angeles, CA 90049

Project: Proposed Residential Development
Bullock Lane APN 076-481-008 and 076-491-001
San Luis Obispo, California

Subject: Geotechnical Engineering Report

As authorized, we have performed a Geotechnical Study for the above referenced project. The accompanying Geotechnical Engineering Report presents the results of our subsurface exploration, laboratory-testing program and conclusions and recommendations for geotechnical engineering aspects of project design. Our services were performed using the standard of care ordinarily exercised in this locality at the time this report was prepared.

Based on our study, it is our opinion that the site is suitable for the proposed development from a geotechnical engineering standpoint provided the recommendations of this report are successfully implemented.

We have appreciated this opportunity to be of service to you on this project. Please call if you have any questions, or if we can be of further service.

Respectfully submitted,
Beacon Geotechnical, Inc.

Greg McKay
Project Manager

Copies: 3-Bullock Ranch, LLC
1-File

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1. INTRODUCTION

This report presents results of a Geotechnical Engineering Study performed for the proposed residential development to be located in San Luis Obispo, California.

1.1 Description

1.1.1. It should be noted that grading and foundation plans were not provided for the purpose of this report. Prior to any construction, this firm should review the grading and foundation plans to verify or modify the recommendations offered herein. We anticipate that the site will be developed by cutting and filling to create level pads.

1.1.2. The proposed structures are assumed to be one (1) or two (2) stories of wood framed construction.

1.1.3. Structural considerations for maximum wall loads of 1.75 kips per square foot and maximum point loads of 25.0 kips were used as a basis for the recommendations of this report. If actual loads vary significantly from these assumed loads, Beacon Geotechnical, Inc. should be notified as re-evaluation of the recommendations contained herein may be required.

2 SCOPE OF WORK

2.1 The purpose of the geotechnical investigation that led to this report was to evaluate the soil conditions of the site with respect to the proposed development. These conditions include surface and subsurface soil types, expansion potential, settlement potential, bearing capacity, and presence or absence of subsurface water. The scope of our work included:

- Reconnaissance of the site.
- Drilling, sampling and logging of twelve (12) borings to investigate soils and groundwater conditions.
- Laboratory testing of soil samples obtained from subsurface exploration to determine their physical and engineering properties.
- Geotechnical analysis of the data obtained.
- Consultation with owner representatives and design professionals.
- Preparation of this report.

2.2 Contained in the report are:

- Discussions on local soil and groundwater conditions.
- Results of laboratory and field tests.
- Conclusions and recommendations pertaining to site grading and structural design.

3 SITE SETTING

3.1 The site of the proposed development is located in San Luis Obispo, California, with the approximate geographical coordinates 35°15'24.50"N and 120°38'21.50"W. See the Vicinity Map in Appendix A.

3.2 The site is approximately ten (10) acres slightly sloping from east to west with existing structures that are to be demolished and hauled away prior to preparation of the site for the proposed residential development.

4 SITE CONDITIONS

4.1 Soil Conditions

4.1.1 Evaluation of the subsurface indicates that soils are generally light brown and light gray silty clayey sands overlain by dark brown silty sandy clay.

4.1.2 Soils encountered at approximate bearing depths should be designed as Site Classification D in accordance with the local building code.

4.1.3 Expansion determination indicates that the bearing soils lie in the "Medium" range.

4.2 Groundwater

4.2.1 Groundwater was not encountered to a maximum depth of twenty (20) feet.

4.3 Infiltration Testing

4.3.1 Infiltration testing was done on the site in accordance with the Central Coast Low Impact Development Initiative standards. Four (4) infiltration borings were drilled with their locations shown on the Site Map in Appendix A. The borings were presaturated and subsequently tested. The resulting infiltrating rates are as follows:

Test No.	Depth (Ft.)	Rate (Inch/Hour)
A	5.0'	1.00
B	5.0'	1.25
C	5.0'	1.00
D	5.0'	1.50

4.3.2 Based on the resulting infiltration rates, we recommend that the system be designed using a rate of one (1) inch per hour.

4.3.3 Greater than ten (10) percent of a representative sample in the proposed infiltration area passed through the #200 sieve.

5 SEISMIC HAZARDS

This portion of Central California is subject to significant seismic hazards from moderate to large earthquake events. Ground shaking resulting from earthquakes is the primary geologic hazard at the project site. Ground displacement resulting from faulting is a potential hazard at or near faults.

5.1 Nearby Faults

5.1.1 The site does not lie within an Earthquake Fault Zone identified on a State of California Earthquake Fault Zone Map.

5.1.2 Faults closest to the site, which would most affect the proposed project:

Nearby Active Faults	Approximate Distance (km)	Magnitude M_W
Los Osos Fault	3.7	6.9
San Luis Range Fault	8.4	7.1
Rinconada Fault	11.8	7.5
Hosgri Fault	24.6	7.3
San Andreas Fault Zone	58.3	8.0

5.2 Liquefaction

Earthquake-induced vibrations can be the cause of several significant phenomena, including liquefaction in fine sands and silty sands. Liquefaction results in a complete loss of strength and can cause structures to settle or even overturn if it occurs in the bearing zone. If liquefaction occurs beneath sloping ground, a phenomenon known as lateral spreading can occur. Liquefaction is typically limited to the upper 50 feet of the subsurface soils and to soils that have a relative density of less than 70%.

5.2.1 Based on the quality and conditions of the in-place soils and the absence of groundwater in our boring explorations, it is our opinion that the potential for liquefaction and/or lateral spreading is low at this site.

5.3 Landslide Hazards

5.3.1 The site topography and exposed soils types indicate that the potential for landslides is minimal at this site. Furthermore, no evidence of previous landslides was observed at the site.

5.4 Seismic Design Parameters

The following estimated ground motion parameters have been established using the methods outlined in the 2016 California Building Code with reference to the acceleration contour maps provided by the U.S. Geological Survey (USGS) and the National Seismic Hazard Mapping Project (NSHMP). These ground motion parameters represent the Maximum Considered Earthquake (MCE) spectral response of seismic events experiencing 5 percent damped acceleration and having a 2 percent probability of exceedance within a 50 year period.

2016 California Building Code Seismic Parameters	
Parameter	**Value**
Seismic Design Category	D
Site Class	D
Short Period Spectral Acceleration, S_s	1.159
1-second period spectral acceleration, S_1	0.443
Short period site coefficient, F_a	1.037
1-second period site coefficient, F_v	1.557
Adjusted short period spectral acceleration, S_{ms}	1.201
Adjusted 1-second period spectral acceleration, S_{m1}	0.690
Short period design spectral acceleration, S_{DS}	0.801
1-second period design spectral acceleration, S_{D1}	0.460

6 CONCLUSIONS AND RECOMMENDATIONS

The site is suitable for the proposed development from a geotechnical engineering standpoint provided the recommendations contained herein are properly implemented into the project.

6.1 General Grading

6.1.1 Grading, at a minimum, should conform to Chapter 18, and any additional locally approved appendices relating to grading, of the 2016 California Building Code.

6.1.2 The existing ground surface should be initially prepared for grading by removing all vegetation, trees, large roots, debris, non-complying fill and all other organic material. Voids created by removal of such material should not be backfilled unless the underlying soils have been observed by a representative of this firm.

6.1.3 **The bottom of all excavations should be observed by a representative of this firm prior to processing or placing fill.**

6.1.4 Fill and backfill placed at near optimum moisture in layers with loose thickness not greater than eight (8) inches should be compacted to a minimum of 90% of maximum dry density obtainable by the ASTM D 1557 Test Method.

6.1.5 Import soils used to raise site grade should be equal to or better than on-site soils in strength, expansion and compressibility characteristics. Import soils can be evaluated, but will not be pre-qualified by the geotechnical engineering firm. Final comments on the characteristics of the import soils will be offered after the material is at the project site.

6.1.6 Roof draining systems should be designed so that water is not discharged onto bearing soils or near structures.

6.1.7 Final site grade should be such that all water is permanently diverted away from the structure and is not allowed to pond. The ground immediately adjacent to the building shall be sloped 5% for a minimum of ten (10) feet measured perpendicular to the face of the wall. All diverted water is to be directed to an approved drainage. Alternative grading methods can be found in 2016 California Building Code Section 1804.4.

6.1.8 It should be noted that uniform soil moisture conditions around the perimeter of the structure will help decrease the potential for differential swelling and heaving associated with expansive soils. Post-construction care should be taken to create long-term landscaping and irrigation solutions that do not allow for frequent changes in soil moisture content or irregular application of water around the perimeter of the structure.

6.1.9 The above referenced site drainage conditions should be maintained over the course of the life of the structure. Proper long term performance of the foundation and building pad may be compromised if the surrounding site drainage and grading is adversely modified.

6.1.10 It is recommended that Beacon Geotechnical, Inc. be retained to provide intermittent geotechnical engineering services during site development, grading and foundation construction phases of the work to observe compliance with the design concepts, specifications and recommendations, and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

6.1.11 Plans and specifications should be provided to Beacon Geotechnical, Inc. prior to grading. Plans should include the grading plans, and foundation details. Structural loads should be shown on the foundation plans.

6.1.12 Should soils become unstable during grading due to excessive subsurface moisture, alternatives to correct instability may include aeration or the use of gravels and/or geotextiles as stabilizing measures. Recommendations for stabilization should be provided by this firm as needed during construction.

6.1.13 All water associated with drainage and runoff should not be discharged onto slope faces. All outflow of drainage structures and drainage facilities should be designed by the project Civil Engineer to minimize erosion.

6.2 Specific Site Development, Grading Pads, and Foundation Excavations

6.2.1 Due to the presence of low density near surface soils and a cut/fill situation at shallow bearing depths, overexcavation and recompaction of soils in the building areas (including covered deck areas) will be necessary to decrease the potential for differential settlement and to provide more uniform bearing conditions. Soils should be overexcavated to a depth of two (2) feet below the bottom of footings, four (4) feet below existing grade, through the dark brown topsoil (denoted as material type C1 in the boring logs), or 75% of the deepest fill thickness, whichever is greater. The over-excavation should extend to a distance of five (5) feet beyond the building perimeter. The resulting surface should be scarified to a depth of one (1) foot, moisture conditioned and recompacted to a minimum of 90% of maximum dry density. The intent of these recommendations is to provide a minimum of two (2) feet of compacted soils below the bottom of all footings, and recompact the loose topsoil.

6.2.2 **It should be noted that overexcavation, recompaction, and presaturation of soils below slab areas does not mitigate the effects of the expansive soils.**

6.2.3 In order to help mitigate the effects of the expansive soils below concrete slabs within the residence or surrounding flatwork areas, the upper twenty (20) inches of fill directly below concrete slab areas shall be non-expansive (EI < 10) import. It should be noted that the four (4) inch sand layer directly below the slab may be included in the measurement of the twenty (20) inch non-expansive section. The lower sixteen (16) inches of fill should be recompacted to 90% of maximum dry density and the upper four (4) inches of fill should be clean free draining sand.

6.2.4 Any excavated material from foundation and septic or drainage systems should be properly recompacted in accordance with all the recommendations for engineered fill. Alternatively, excavated soil may be hauled off site when adequate placement area is not available at the project location.

6.2.5 Areas outside the building area to receive fill, exterior slabs-on-grade, sidewalks and paving should be overexcavated to a depth of one (1) foot below finish subgrade or existing grade whichever is deeper. The exposed surface should be scarified, moisture conditioned and recompacted.

6.2.6 On-site soils may be used for fill once they are cleaned of all organic material, rock, debris and irreducible material larger than eight (8) inches.

6.2.7 Although not encountered in our borings, should any trash, debris or subsurface structures be encountered during grading, removals will be necessary to adequate depths and horizontal limits as recommended by this firm at the time of grading.

6.2.8 Grading inspections shall be performed in accordance with the 2016 California Building Code Table 1705.6. See Appendix B for project specific grading observation requirements.

6.3 Slope Construction

6.3.1 All hillside grading and construction of fill slopes should conform to the minimum standards listed in Chapter 18 of the 2016 California Building Code. It is recommended that a representative of this firm review the grading plans prior to grading and site development.

6.3.2 Fill slopes should be keyed and benched into firm natural ground when the existing slope to receive fill is 10:1, horizontal to vertical, or steeper. The keys should be tilted into the slope, should be a minimum of one equipment width wide, and should extend a minimum of three (3) feet deep at the outside edge.

6.3.3 Fill slopes should be overfilled, compacted and cut back to planned configurations. This will yield better compaction on the slope faces than other methods.

6.3.4 Lined drainage swales and down drains should be provided at the tops of all cut and fill slopes to divert drainage away from the slope faces.

6.3.5 Cut and fill slopes should not be constructed steeper than 2:1 (horizontal to vertical). Setbacks of structures from slopes should be maintained as per the 2016 California Building Code.

6.4 Utility Trenches

6.4.1 Utility trench backfill should be governed by the provisions of this report relating to minimum compaction standards. In general, service lines inside of the property lines may be backfilled with native soils and compacted to a minimum of 90% of maximum dry density. Backfill of offsite service lines will be subject to the specifications of the jurisdictional agency or this report, whichever is more stringent.

6.4.2 A representative of this firm is to monitor compliance with these recommendations.

6.5 Structural Design – Foundations: Minimum Design Recommendations

6.5.1 Conventional interconnected continuous footings may be used for support of the structure.

6.5.2 Footings shall extend a minimum of twenty-four (24) inches below lowest adjacent grade or six (6) inches minimum below the base of the non-expansive fill layer, whichever is deeper.

6.5.3 Based on the project expansive soil conditions and considering the expected footing depths, footings should be reinforced with a minimum of two (2) #5 bars at the top and bottom.

6.5.4 Due to the expansive soils present at the project site, all concrete slabs-on-grade shall be securely connected to footings with reinforcement matching slab reinforcement size and spacing.

6.5.5 Conventional interconnected continuous footings may be designed based on an allowable bearing value of 1750 psf.

6.5.6 Allowable bearing values are net (weight of footing and soils surcharge may be neglected) and are applicable for dead plus reasonable live loads.

6.5.7 Bearing values may be increased by one-third when transient loads such as wind and/or seismicity are incorporated into designs using the alternate load combinations in 2016 California Building Code Section 1605.3.2.

6.5.8 For structures to be constructed above slopes, the outside faces at the bottom of footings should provide a minimum horizontal distance of ten (10) feet from the slope face.

6.5.9 Lateral loads may be resisted by soils friction on floor slabs and foundations and by passive resistance of the soils acting on foundation stem walls. Lateral capacity is based on the assumption that any required backfill adjacent to foundations and grade beams is properly compacted.

6.5.10 Conventional continuous footings for buildings where the ground surface slopes at 10:1, horizontal to vertical, or steeper should be stepped so that both top and bottom are level.

6.5.11 Reinforcement of footings bottomed in soils in the "Medium" expansion range should be designed by the Project Structural Engineer to properly resist the effects of the expansive soil. Additionally, soils should be presaturated to 130% of optimum moisture content to a depth of thirty (30) inches below lowest adjacent grade.

6.5.12 **Foundation excavations should be observed by a representative of Beacon Geotechnical, Inc. after excavation, but prior to placing reinforcing steel or forms.**

6.6 Structural Design – Foundations: Optional Design Recommendations

6.6.1 Although supporting the structure on deepened footings and recompacting imported non-expansive soils below slabs as recommended earlier in this report will provide a foundation system that mitigates the effects of the expansive soils and satisfies the minimum intent of the building code, it should be noted that slabs requiring improved performance may be designed and constructed implementing some or all of the additional optional design recommendations provided below.

6.6.2 The structural engineer should note that the site specific expansive soils represent an active and significant design condition and may be adversely affected by prolonged unseasonably wet seasons followed by years of prolonged drought. Coordination with the client and project architect should be provided to consider the cost-benefit relationship between incorporating the following recommendations and the long term performance expectations for the reinforced concrete slab-on-grade.

6.6.3 In order to provide improved performance and resistance to potential sub-surface expansive pressures, the concrete slab thickness may be increased to a minimum of five to six (5-6) inches with a minimum of #4 bars placed at twelve (12) inches on center each way, centered in the slab section.

6.6.4 In addition to or in lieu of the thickened slab section, interior footings may be added so that the maximum distance between footings in any direction does not exceed fifteen (15) feet. Where these footings are **not** also required to support building loads, they may be reduced in depth to twenty-one (21) inches below lowest adjacent grade and be reinforced with one (1) #5 bar at the top and bottom of the footing section.

6.6.5 Additional and/or alternative means of providing further expansive soil mitigation may be provided and coordinated with this office upon request.

6.7 Slabs on Grade

6.7.1 Concrete slabs should be supported by compacted structural fill as recommended earlier in this report.

6.7.2 The plans and details shall clearly denote non-expansive import soils below slab areas.

6.7.3 Slabs constructed over non-expansive import should be directly underlain with a minimum of four (4) inches of clean and free draining sand. Areas where floor wetness would be undesirable should be underlain with a 10mil moisture barrier to reduce moisture transmission from the subgrade soils to the slab. The membrane should be placed at mid-height in the clean sand.

6.7.4 Prior to setting the vapor barrier, soils below slab areas shall be presaturated so that the expansive sub-grade soils below the non-expansive import are presaturated to 130% of optimum moisture content to a depth of twenty-seven (27) inches below lowest adjacent grade.

6.7.5 Reinforcement and slab thickness should be determined by the Project Structural Engineer.

6.8 Structural Design – Lateral Resistance Parameters

6.8.1 Resistance to lateral loading may be provided by friction acting on the base of foundations. A coefficient of friction of 0.32 may be applied to dead load forces. This value does not include a factor of safety.

6.8.2 Passive resistance acting on the sides of foundation stems equal to 300 pcf of equivalent fluid weight may be included for resistance to lateral load. This value does not include a factor of safety.

6.8.3 A one-third increase in the quoted passive value may be used when considering transient loads such as wind and seismicity.

6.9 Structural Design – Settlement Considerations

6.9.1 Maximum expected settlements approximately 3/4 inches are anticipated for foundations and floor slabs designed as recommended.

6.9.2 Differential settlement between adjacent load bearing members should be less than one-half the total settlement.

6.9.3 The majority of settlement should occur during construction. Post construction settlement should be minimal.

6.10 Structural Design – Retaining Walls

6.10.1 Conventional cantilever retaining walls bearing in soils prepared in accordance with the "Grading Pads – Site Development and Foundation Excavations" section of this report and backfilled with **very low to low imported compacted soils** may be designed for the lateral pressures listed below:

Active Case	40 pcf (very low –low EI backfill)
At Rest Case	60 pcf (very low –low EI backfill)
Passive Case	300 pcf
Max. Toe Pressure	1750 psf
Coefficient of Sliding Friction	0.32

6.10.2 Retaining walls extending greater than six (6) feet in height should be designed for an additional seismic horizontal line load of $18H^2$ (#/ft-of-wall) assumed to be acting at a height of 0.33H (ft) above the base of the wall, where H is the height of the wall in feet. This seismic surcharge should be added to an active pressure design utilizing an active pressure of 40 psf.

6.10.3 It should be noted that where structural retaining walls would otherwise be designed based on an at-rest pressure case, the seismic-and-active design results should be compared to the at-rest design results and the governing conditions should be used for the purpose of the project.

6.10.4 In addition to the static soil pressures described above, it is important to note that the active pressure condition will only fully develop if the retaining wall structure is allowed to move a sufficient distance. The necessary lateral movements required to establish the active pressure condition are shown below,

Non-Expansive Granular Soil	0.001H – 0.004H
Expansive Cohesive Soil	0.01H – 0.04H

where H represents the height of the wall. At-rest pressures should be used for design purposes where retaining wall systems connected or adjacent to building structures would be adversely affected by the above referenced lateral displacements.

6.10.5 Design pressures noted above are applicable to a horizontally retained surface behind the wall. Walls having a retained surface that slopes upward from the wall should be designed for an additional equivalent fluid pressure of 1 pcf for the active case and 1.5 pcf for the at-rest case, for every two degrees of slope inclination. Walls positioned on or near descending slopes should be evaluated by this firm on an individual basis.

6.10.6 The pressures listed above were based on the assumption that backfilled soils will be compacted to 90% of maximum dry density as determined by ASTM D 1557 Test Method.

6.10.7 The lateral earth pressure to be resisted by the retaining walls or similar structures should include the loads from any structures or temporary loads that influence the wall design.

6.10.8 A back drain or an equivalent system of backfill drainage should be incorporated into the retaining wall design. Backfill immediately behind the retaining structure should be a free-draining granular material. Alternatively, the back of the wall could be lined with a geodrain system.

6.10.9 Compaction on the uphill side of the wall within a horizontal distance equal to one wall height should be performed by hand-operated or other lightweight compaction equipment. This is intended to reduce potential "locked-in" lateral pressures caused by compaction with heavy grading equipment.

6.10.10 Water should not be allowed to pond near the top of the wall. To accomplish this, the final backfill site grade should be such that all water is diverted away from the retaining wall.

7 REFERENCES CITED

USGS, Online, Geologic Hazards Science Center, United States Geological Society, in Cooperation with California Geological Society (CGS), www.geohazards.usgs.gov/qfaults/ca/California.php

8 ADDITIONAL SERVICES

This report is based on the assumption that an adequate program of monitoring and testing will be performed by Beacon Geotechnical, Inc. during construction to check compliance with the recommendations given in this report. The recommended tests and observations include, but are not necessarily limited to the following:

8.1 Review of the building and grading plans during the design phase of the project.

8.2 Observation and testing during site preparation, grading, placing of engineered fill, and foundation construction.

8.3 Consultation as required during construction.

PROJECT LIMITATIONS AND UNIFORMITY OF CONDITIONS

9.1 The analysis and recommendations submitted in this report are based in part upon the data obtained from the borings drilled on site. The nature and extent of variations between and beyond the borings may not become evident until construction. If variations then appear evident, it may be necessary to re-evaluate the recommendations of this report.

9.2 The scope of our services did not include environmental assessment or geological study. The scope of services did not include investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater or air. Any statements in this report or on the soil boring logs regarding odors, unusual or suspicious items or conditions observed are strictly for the information of the client.

9.3 Findings of this report are valid as of this date, however, changes in a condition of a property can occur with passage of time whether they be due to natural processes or works of man on this or adjacent properties. In addition, changes in applicable or appropriate standard may occur whether they result from legislation or broadening knowledge. Accordingly, findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of one (1) year.

9.4 In the event that any changes in the nature, design, or location of the structure and other improvements are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

9.5 This report is issued with the understanding that it is the responsibility of the owner or his representatives to insure the information and recommendations offered herein are called to the attention of the project architect and engineers. It is also the responsibility of the owner or his representatives to insure the information and recommendations offered herein are incorporated into the project plans and specifications and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

9.6 Beacon Geotechnical, Inc. has prepared this report for the exclusive use of the client and authorized agents. This report has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranties, either expressed or implied, are made as to the professional advice provided under the terms of this agreement.

9.7 It is recommended that Beacon Geotechnical, Inc. be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications. If Beacon Geotechnical, Inc. is not accorded the privilege of making this recommended review, we can assume no responsibility for misinterpretation of our recommendations.

END OF TEXT
Appendices

APPENDIX A

Vicinity Map

Site Plan

Quaternary Fault Map

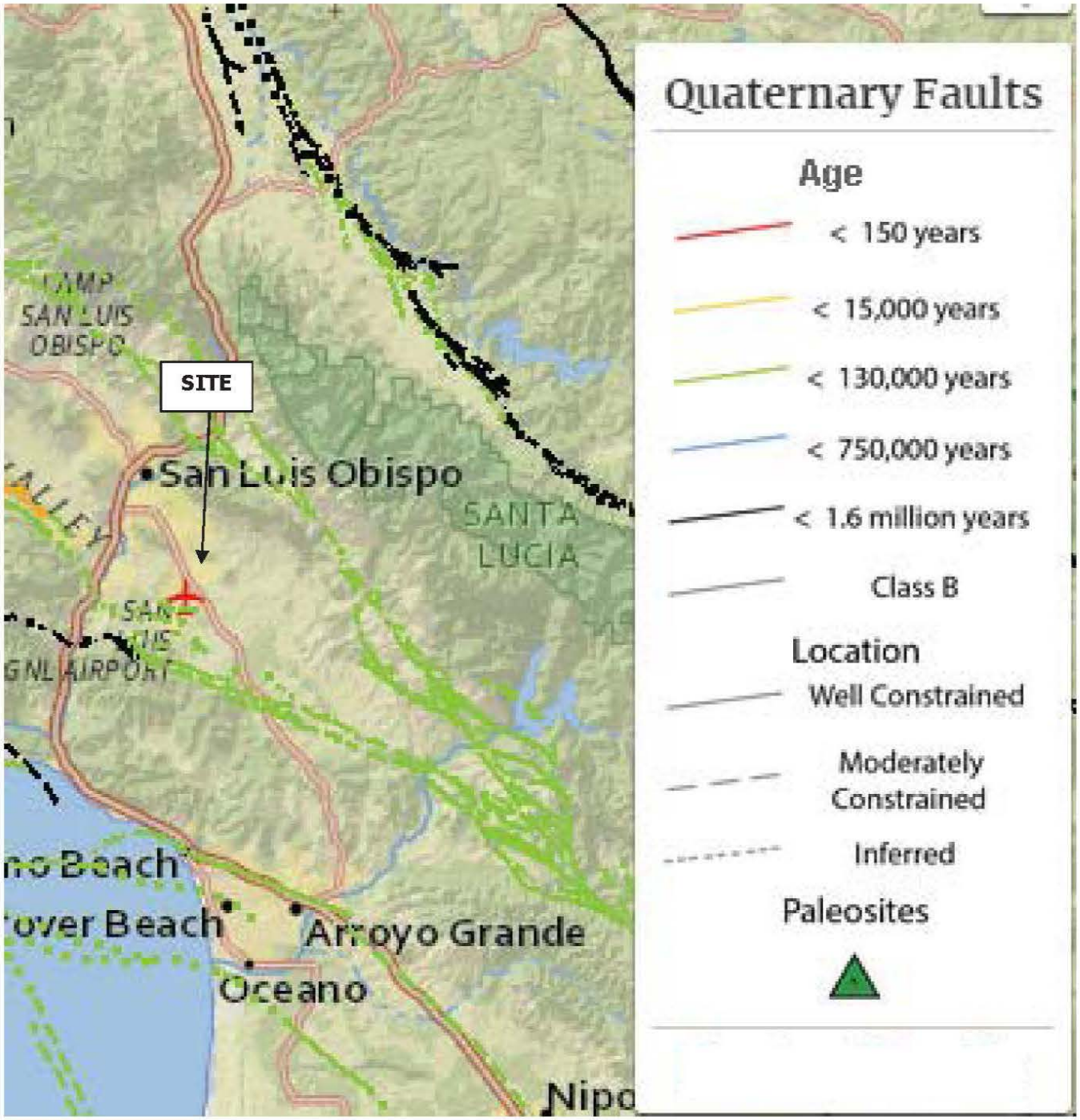
Investigation Parameters

Unified Soil Classification Table

Boring Logs

PROJECT #: F-101919	VICINITY MAP
BEACON GEOTECHNICAL, INC.	

PROJECT #: F-101919	SITE MAP
BEACON GEOTECHNICAL, INC.	



Map Showing Nearby Quaternary Aged Faults (USGS, Online)

PROJECT #: F-101919	**QUATERNARY FAULT MAP**
BEACON GEOTECHNICAL, INC.	

INVESTIGATION PARAMETERS

- The borings were drilled to a maximum depth of twenty (20) feet below the existing ground surface to observe the soil profile and to obtain samples for laboratory analysis. The borings were drilled on August 28 and 29, 2018 using a mobile drill rig. The approximate locations of the borings were determined in the field by pacing and sighting, and are shown on the Site Plan in this Appendix.

- Blow counts were obtained within the test borings with Standard Penetration Test (S.P.T.) equipment. The blow counts were obtained by driving the sampler with a 140 pound hammer dropping thirty (30) inches in accordance with ASTM D 1586-11.

- Bulk samples of the soils encountered were gathered from the auger cuttings.

- The final logs of borings represent our interpretation of the contents of the field logs and the results of laboratory testing performed on the samples obtained during the subsurface investigation. The final logs are included in this Appendix.

UNITED SOIL CLASSIFICATION (ASTM D-2487)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	$C_u \geq 4$ AND $1 \leq C_c \leq 3$	GW	WELL-GRADED GRAVEL
			$C_u \geq 4$ AND/OR $1 \geq C_c \geq 3$	GP	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	$C_u \geq 6$ AND $1 \leq C_c \leq 3$	SW	WELL-GRADED SAND
			$C_u \geq 6$ AND/OR $1 \geq Cc \geq 3$	SP	POORLY-GRADED SAND
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR MH	SM	SILTY SAND
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY
			PI>4 AND PLOTS<"A" LINE	ML	SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY
			PI PLOTS <"A" LINE	MH	ELASTIC SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT

PENETRATION RESISTANCE (RECORDED AS BLOWS / 0.5 FT)				
SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 4	0.25 - 0.50
MEDIUM DENSE	10 - 30	FIRM	4 - 8	0.50 - 1.0
DENSE	30 - 50	STIFF	8 - 15	1.0 - 2.0
VERY DENSE	OVER 50	VERY STIFF	15 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

F-101919

BEACON GEOTECHNICAL, INC.

UNITED SOIL CLASSIFICATION CHART

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 1
Auger Diameter: 4"
Date: August 28, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
	SPT	14			-6%			
	SPT	10			-5%			
			Medium Dense			Light brown silty clayey sand	SM-SC	A1
5	SPT	25			-3%			
						Light gray silty clayey sand	SM-SC	A2
10	SPT	29			-2%			
15						Total Depth @ 15.0'		
20								
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 2 and A
Auger Diameter: 4"
Date: August 28, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
	SPT	10	↓		-5%	↓		
			Medium Dense			Light brown silty clayey sand	SM-SC	A1
	SPT	22	↓		-4%	↓		
			↓			↓		
5			↓			↓		
						Total Depth @ 5.0'		
10								
15								
20								
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 3
Auger Diameter: 4"
Date: August 28, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
	SPT	8			-6%			
			Medium Dense			Light brown silty clayey sand	SM-SC	A1
	SPT	20			-3%			
5	SPT	28			-3%			
						Light gray silty clayey sand	SM-SC	A2
10	SPT	27			-2%			
15								
20						Total Depth @ 20.0'		
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 4
Auger Diameter: 4"
Date: August 28, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
			↓			↓		
			Medium Dense			Light brown silty clayey sand	SM-SC	A1
			↓			↓		
5								
						Total Depth @ 5.0'		
10								
15								
20								
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 5 and B
Auger Diameter: 4"
Date: August 28, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
			↓			↓		
			↓			↓		
			Medium Dense			↓		
			↓			Light brown silty clayey sand	SM-SC	A1
5			↓			↓		
						Total Depth @ 5.0'		
10								
15								
20								
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 6
Auger Diameter: 4"
Date: August 28, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
			↓			↓		
			↓			↓		
			Medium Dense			Light brown silty clayey sand	SM-SC	A1
5	SPT	22	↓		-4%	↓		
			↓			↓		
			↓			↓		
			↓			↓		
			↓			↓		
10	SPT	26	↓		-2%	Light gray silty clayey sand	SM-SC	A2
			↓			↓		
			↓			↓		
			↓			↓		
			↓			↓		
15						Total Depth @ 15.0'		
20								
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 7
Auger Diameter: 4"
Date: August 29, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
	SPT	10			-5%			
	SPT	10			-4%			
			Medium Dense			Light brown silty clayey sand	SM-SC	A1
5	SPT	21			-2%			
						Light gray silty clayey sand	SM-SC	A2
10	SPT	27			-1%			
15						Total Depth @ 15.0'		
20								
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 8
Auger Diameter: 4"
Date: August 29, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
	SPT	24	Medium Dense			Light brown silty clayey sand	SM-SC	A1
5	SPT	22						
						Total Depth @ 10.0'		
10								
15								
20								
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 9 and C
Auger Diameter: 4"
Date: August 29, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
			Medium Dense			Light brown silty clayey sand	SM-SC	A1
5								
						Total Depth @ 5.0'		
10								
15								
20								
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 10
Auger Diameter: 4"
Date: August 29, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
	SPT	15			-6%			
	SPT	8			-6%			
			Medium Dense			Light brown silty clayey sand	SM-SC	A1
5	SPT	25			-4%			
10	SPT	30			-2%	Light gray silty clayey sand	SM-SC	A2
15						Total Depth @ 15.0'		

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA F-101919
Driller/Helper:
Rig Type: Giddings BORING NO. 11
Auger Diameter: 4″
Date: August 29, 2018

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
	SPT	10			-5%			
			Medium Dense			Light brown silty clayey sand	SM-SC	A1
5	SPT	28			-3%			
10						Total Depth @ 10.0′		
15								
20								
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered** SAMPLE TYPE
Time Depth SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

LOG OF BORING
for:
Bullock Lane APN 076-481-008 and 076-491-001

Site Location: San Luis Obispo, CA
Driller/Helper:
Rig Type: Giddings
Auger Diameter: 4"
Date: August 29, 2018

F-101919

BORING NO. 12 and D

Depth (ft.)	Blow Type	Blows per ft.	Drilling comments	Voids	Moisture	Description	USCS	Beacon Soil ID
0			Stiff			Dark brown silty sandy clay	CL	C1
			Medium Dense			Light brown silty clayey sand	SM-SC	A1
5								
						Total Depth @ 5.0'		
10								
15								
20								
25								
30								
35								
40								
45								
50								

GROUNDWATER **Not Encountered**
Time Depth

SAMPLE TYPE
SPT=Standard Penetration Test (uncorrected value, N/**corrected value, N**)

APPENDIX B

Laboratory Testing Parameters

Laboratory Results

Bench & Keyway Detail

Transition Lot Detail

2016 CBC -- Table 1705.6

LABORATORY PARAMETERS

- Samples were reviewed along with field logs to determine which would be analyzed further. Those chosen for laboratory analysis were considered representative of soils that would be exposed and/or used during grading, and those deemed to be within the influence of the proposed structure. Test results are presented in this Appendix.

- ASTM D2487-11 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

- ASTM D1557-12e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

- ASTM D2216-10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

- ASTM D4318-10e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

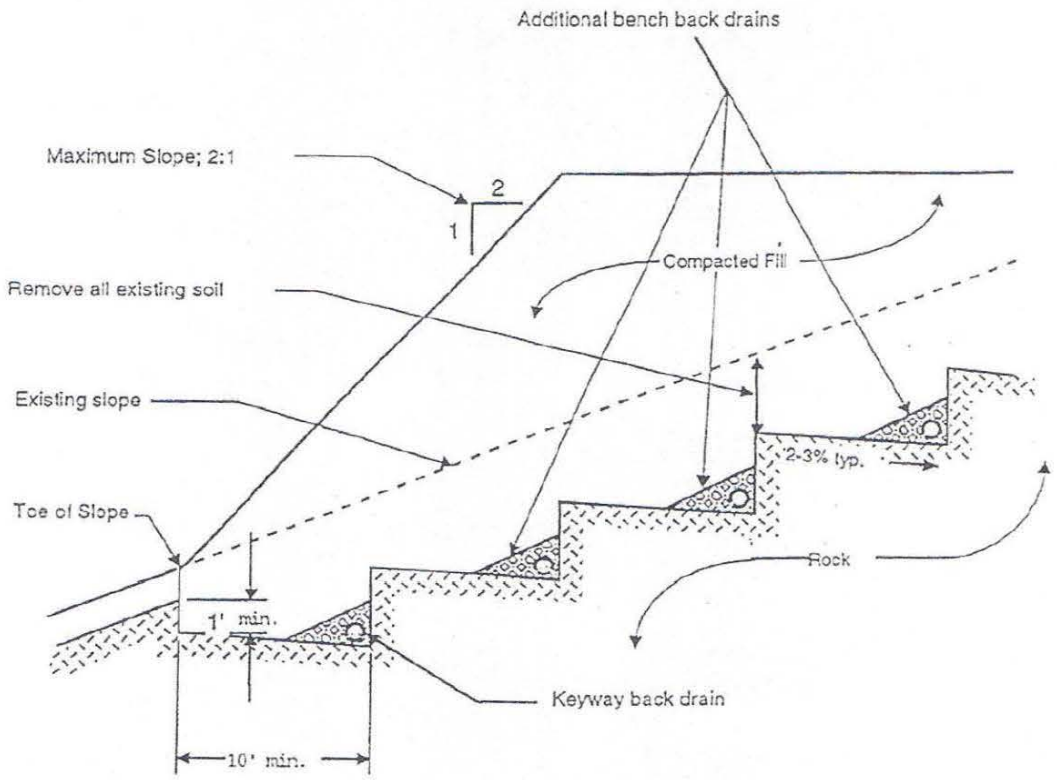
- ASTM D4829-11 Standard Test Method for Expansion Index of Soils

- ASTM D422-63(2007)e2 Historical Version Standard Test Method for Particle Size Analysis of Soils

LABORATORY RESULTS

	Boring Depth	USCS	Max. Density (pcf)	Opt. Moisture (%)	E.I.	P.I.
Material C1	1@0'-4'	CL	106.6	15.6	74	16
Material A1	1@4'-9'	SM-SC	122.7	10.9	28	5
Material A2	1@9'-15'	SM-SC	123.0	10.8	--	--

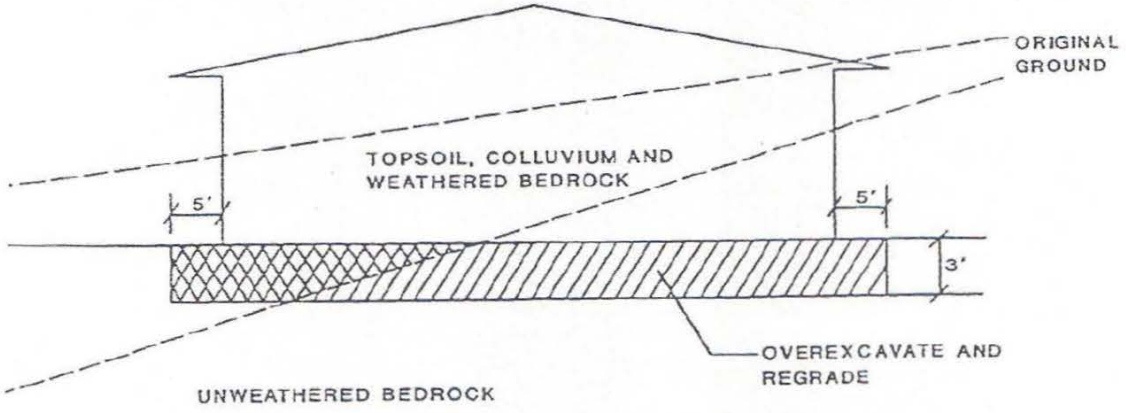
BENCH AND KEYWAY DETAIL
(Typical)
NOT TO SCALE



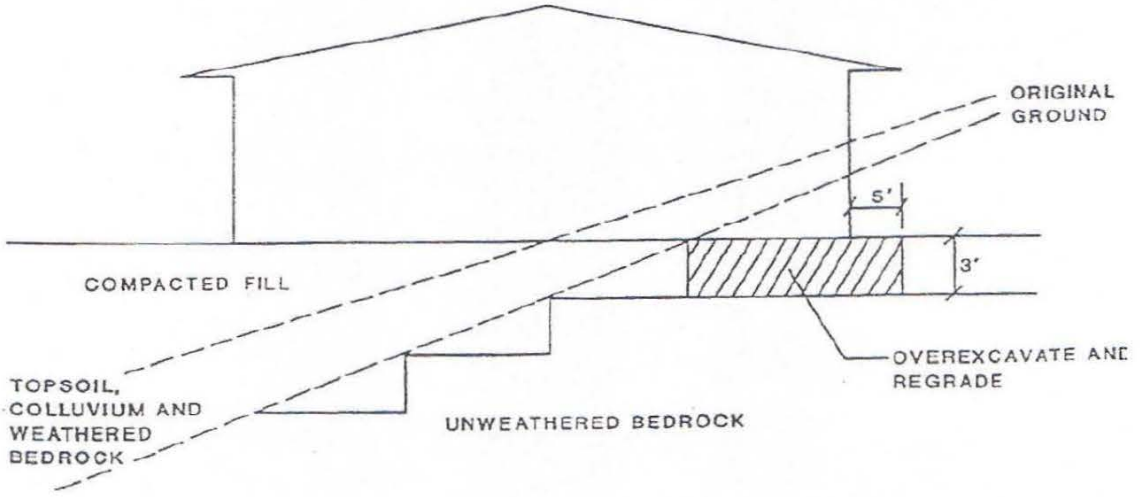
PROJECT #: F-101919	BENCH AND KEYWAY DETAIL
BEACON GEOTECHNICAL, INC.	

GENERAL GRADING RECOMMENDATIONS

CUT LOT



CUT/FILL LOT (TRANSITION)



PROJECT #: F-101919	TRANSITION LOT DETAIL
BEACON GEOTECHNICAL, INC.	

TABLE 1705.6
REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	—	X
2. Verify excavations are extended to proper depth and have reached proper material.	—	X
3. Perform classification and testing of compacted fill materials.	—	X
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill.	X	—
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	—	X