Appendix D

Geotechnical Due-Diligence Investigation and Percolation Study
Mr. Joshua Haskins  
740 E. La Palma, LLC  
2390 E. Orangewood Ave., Suite 510  
Anaheim, CA 92806

Subject: Response to Geotechnical Review Comments, City of Anaheim OTH 2018-01084, Proposed Residential Development, 740 East La Palma Avenue, City of Anaheim California.


Dear Mr. Haskins,

Albus-Keefe & Associates, Inc. is pleased to present to you our response to the referenced review document prepared by Leighton and Associates, Inc. dated August 14, 2018. A copy of the review comments is attached.

Comment #1

The consultant should provide seismic design parameters for use in the structural design in addition to what is presented in Section 4.1.

Response #1

Our referenced report dated January 15, 2018 was prepared to determine feasibility of future site development from a geotechnical perspective as part of the owner’s due-diligence assessment. Specific design parameters, including CBC seismic parameters, are not deemed necessary to address geotechnical feasibility of the proposed site development. If the project advances to development of construction documents, a comprehensive design-level geotechnical report should be prepared and specific recommendations provided at that time, including seismic design parameters. However, to address the reviewer’s comment, the following is presented on a preliminary basis.
For design of the project in accordance with Chapter 16 of the 2016 CBC, the table below presents the seismic design factors. The values presented below may require revision depending on applicable CBC requirements at the time a design-level geotechnical report is prepared for the subject development.

**CBC 2016**

**SEISMIC DESIGN PARAMETERS**

<table>
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<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
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<td>Site Class</td>
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</tr>
<tr>
<td>Mapped MCE Spectral Response Acceleration, short periods, S_s</td>
<td>1.530</td>
</tr>
<tr>
<td>Mapped MCE Spectral Response Acceleration, at 1-sec. period, S_1</td>
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</tr>
<tr>
<td>Site Coefficient, F_a</td>
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<tr>
<td>Site Coefficient, F_v</td>
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<tr>
<td>Design Spectral Response Acceleration, at 1-sec. period, S_D1</td>
<td>0.590</td>
</tr>
</tbody>
</table>

MCE = Maximum Considered Earthquake

**Closing**

We appreciate this opportunity to be of service to you. If you have any questions regarding the contents of this report, please do not hesitate to call.

Sincerely,

**ALBUS-KEEFE & ASSOCIATES, INC.**

[Signature]

David E. Albus
Principal Engineer
GE 2455

Enclosures:

Review Letter by Leighton and Associates, Inc., dated August 14, 2018
August 27, 2018

To: IDS Group
1 Peters Canyon Road, Suite 130
Irvine, CA 92606

RE: Geotechnical Investigation
Downtown Anaheim 39.
740 E. La Palma Avenue
OTH 2018-01084
First Review

Dear IDS Group:

The first plan check was completed on the following:

The following comments are provided:
1. The consultant should provide seismic design parameters for use in structural design in addition to what is presented in Section 4.1.
2. The following are general comments that need not be addressed prior to the City’s acceptance of the referenced report, though they should be addressed prior to construction:
   2.1.1 Prior to construction, the consultant should issue a statement that they have reviewed the geotechnically pertinent aspects of the plans and specifications and that the plans and specifications are acceptable from a geotechnical standpoint.
   2.1.2 The recommendations of the geotechnical consultant should be implemented, as applicable, during design and construction of the project.
   2.1.3 If a different consultant is retained to provide geotechnical observation and testing during construction of the project, it is industry standard that they become familiar with the project and assume the responsibility of geotechnical consultant (for instance, see Orange County grading code section 7-1-841). If applicable, we recommend that such new consultant review the applicable geotechnical reports, confirm their concurrence with the findings and recommendations, or provide revised findings/recommendations as they deem appropriate, and state their responsibility/role as the geotechnical consultant.

3. Please contact Jim Prendergast, IMEG, at 714.350.8747 regarding any questions on comments provided.
Sincerely,

[Signature]

Esperanza Rios
Assistant Engineer

Attachments: Geotechnical review letter

CC Raul Garcia, Development Service Manager
       Mike Eskander, Principal Civil Engineer
       File
August 14, 2018

City of Anaheim No. OTH 2018-01084
Leighton Project No. 11702.016

To: I MEG Engineers
222 South Harbor Boulevard, Suite 800
Anaheim, California 92805

Attention: Mr. James T. Prendergast, PE
Project Manager

Subject: Review of Geotechnical Due-Diligence and Percolation Study Report on Behalf of City of Anaheim, Proposed Residential Development, 740 East La Palma Avenue, City of Anaheim, California


Leighton and Associates, Inc. (Leighton) hereby presents this geotechnical review of the referenced Albus-Keefe and Associates, Inc. (Albus-Keefe) report for the proposed residential development at 740 East La Palma Avenue, in the City of Anaheim, California. The purpose of our work has been to provide a third-party geotechnical review of the referenced report with respect to the proposed project on behalf of the City of Anaheim. Below are our review comments. We recommend that these comments be addressed by the geotechnical consultant prior to the City’s acceptance.

1. The consultant should provide seismic design parameters for use in structural design in addition to what is presented in Section 4.1
The following are general comments that need not be addressed prior to the City’s acceptance of the referenced report, though they should be addressed prior to construction:

2. Prior to construction, the consultant should issue a statement that they have reviewed the geotechnically pertinent aspects of the plans and specifications and that the plans and specifications are acceptable from a geotechnical standpoint.

3. The recommendations of the geotechnical consultant should be implemented, as applicable, during design and construction of the project.

4. If a different consultant is retained to provide geotechnical observation and testing during construction of the project, it is industry standard that they become familiar with the project and assume the responsibility of geotechnical consultant (for instance, see Orange County grading code section 7-1-841). If applicable, we recommend that such new consultant review the applicable geotechnical reports, confirm their concurrence with the findings and recommendations, or provide revised findings/recommendations as they deem appropriate, and state their responsibility/role as the geotechnical consultant.

We appreciate this opportunity to be of service to IMEG and the City of Anaheim during this review process. Please contact us if you have any questions or if we can be of further assistance.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

Jason D. Hertzberg, GE 2711
Principal Engineer

MM/SD/JDH/rsm

Distribution: (1) Addressee
January 15, 2018
J.N.: 2693.00

Mr. Joshua Haskins
740 E. La Palma, LLC
2390 E. Orangewood Ave., Suite 510
Anaheim, CA 92806

Subject: Geotechnical Due-Diligence Investigation and Percolation Study, Proposed Residential Development, 740 East La Palma Avenue, Anaheim, California.

Dear Mr. Haskins,

Albus-Keefe & Associates, Inc. is pleased to present to you our geotechnical due-diligence report for the proposed residential development at the subject site. This report presents the results of our review of historical photographs, subsurface exploration, laboratory testing, and engineering analyses. Conclusions relevant to the feasibility of the proposed site development are also presented in this report based on the findings of our work.

We appreciate this opportunity to be of service to you. If you have any questions regarding the contents of this report, please do not hesitate to call.

Sincerely,

ALBUS-KEEFE & ASSOCIATES, INC.

Patrick M. Keefe
Principal Engineering Geologist
CEG 2022
TABLE OF CONTENTS

REPORT

1.0 INTRODUCTION ..................................................................................................................... 1
  1.1 PURPOSE AND SCOPE ......................................................................................................... 1
  1.2 SITE LOCATION AND DESCRIPTION ............................................................................... 1
  1.3 PROPOSED DEVELOPMENT .............................................................................................. 3

2.0 INVESTIGATION .................................................................................................................... 3
  2.1 RESEARCH ............................................................................................................................ 3
  2.2 SUBSURFACE EXPLORATION .......................................................................................... 3
  2.3 LABORATORY TESTING .................................................................................................... 4

3.0 SUBSURFACE CONDITIONS ............................................................................................... 4
  3.1 SOIL CONDITIONS ............................................................................................................... 4
  3.2 GROUNDWATER .................................................................................................................. 4
  3.3 FAULTING ............................................................................................................................. 5

4.0 ANALYSES ............................................................................................................................... 5
  4.1 SEISMICITY ........................................................................................................................... 5
  4.2 SETTLEMENT ....................................................................................................................... 5

5.0 CONCLUSIONS ....................................................................................................................... 6
  5.1 FEASIBILITY OF PROPOSED DEVELOPMENT ............................................................... 6
  5.2 GEOLOGIC HAZARDS ....................................................................................................... 6
    5.2.1 Ground Rupture ............................................................................................................ 6
    5.2.2 Ground Shaking ............................................................................................................ 6
    5.2.3 Landsliding .................................................................................................................... 6
    5.2.4 Liquefaction .................................................................................................................. 6
  5.3 STATIC SETTLEMENT ......................................................................................................... 7
  5.4 EXCAVATION AND MATERIAL CHARACTERISTICS .................................................. 7
  5.5 SHRINKAGE AND BULKAGE ........................................................................................... 8
  5.6 SOIL EXPANSION ............................................................................................................... 8
  5.7 FOUNDATIONS .................................................................................................................... 8
  5.8 CONCRETE MIX DESIGN ................................................................................................... 8
  5.9 CORROSION POTENTIAL .................................................................................................. 9
  5.10 PAVEMENT SECTIONS .................................................................................................... 9
  5.11 PERCOLATION CHARACTERISTICS ............................................................................. 9

6.0 LIMITATIONS .......................................................................................................................... 9

REFERENCES .................................................................................................................................. 11

FIGURES AND PLATES

Figure 1 - Site Location Map
Plate 1 - Geotechnical Map

APPENDICES

APPENDIX A - Exploration Logs
  Plates A-1 through A-7 - Boring Logs

APPENDIX B - Laboratory Test Program
  Table B - Summary of Laboratory Test Results
  Plate B-1 – Grain Size Distribution Plot
  Plate B-2 - Direct Shear Plot

ALBUS-KEEFE & ASSOCIATES, INC.
1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of our work was to evaluate the feasibility of proposed site development in order to assist you in your land acquisition evaluation and due-diligence review. The scope of our work for this investigation was focused primarily on the geotechnical issues that we expect could have significant fiscal impacts on future site development. While this report is comprehensive for the intended purpose, it is not intended for final design purposes. As such, additional geotechnical studies may be warranted based on our review of future rough grading plans and foundation plans. The scope of our geotechnical due-diligence work included the following:

- Review of published geologic and seismic data for the site and surrounding area
- Review of historical photos for the surrounding area
- Exploratory drilling and sampling
- Engineering analyses of data from the exploration and laboratory testing
- Evaluation of site seismicity, liquefaction potential, and settlement potential
- Preparation of this report

1.2 SITE LOCATION AND DESCRIPTION

The site is located at 740 E. La Palma Avenue in the city of Anaheim, California. The site is bordered by E. La Palma Avenue and an adjoining parcel of the Anaheim Fullerton Storage facility to the north, an alleyway followed by single-family residences to the west, an unimproved lot used for storage to the south, and a railroad easement to the east. The location of the site and its relationship to the surrounding areas is shown on the Site Location Map, Figure 1.

The property is about 850 feet long by 100 feet wide and comprises approximately 1.7 acres of land. The site is asphalt-paved and is currently utilized by Anaheim Fullerton Storage for storage of automobiles, recreational vehicles (RV’s), and boats. On-site improvements include various underground utilities, iron-clad fencing, chain-link fencing, and/or masonry block walls along the east, west, and south property lines.

The subject site is relatively level with an elevation of approximately 167 feet above mean sea level (MSL). Drainage at the site appears to be directed as sheet flow to the north and west towards the adjacent alleyway and streets. Vegetation on site is sparse and primarily consists of wall-shrubs and vines around the perimeter of the site.
SITE LOCATION MAP
740 E La Palma, LLC
Proposed Residential Development
740 East La Palma Avenue
Anaheim, California

NOT TO SCALE

FIGURE 1

ALBUS-KEEFE & ASSOCIATES, INC.
1.3 PROPOSED DEVELOPMENT
Based on our review of the referenced conceptual site plan, the proposed site development will consist of 3 multi-family residential buildings including 31 townhome units. We understand that all proposed structures will be constructed on grade with no subterranean elements. Associated interior driveways, perimeter/retaining walls, storm water infiltration system, and underground utilities are also planned.

No grading or structural plans were available in preparation of this report. However, we anticipate that minor rough grading of the site will be required to achieve future surface configuration and we expect the proposed residential dwellings will be 3-story; wood-framed structures with concrete slabs on grade yielding relatively light foundation loads.

2.0 INVESTIGATION

2.1 RESEARCH
We have reviewed the referenced geologic publications and maps for the site and vicinity. Data from these sources were utilized to develop some of our findings and conclusions presented in this report.

We have also reviewed the referenced aerial photographs from our in-house library. The earliest available aerial photograph taken circa 1952 shows that the site was included within a wider railroad easement that included rail tracks running through the subject site. The site appears to have been relatively unchanged from 1952 to the early 1990’s. Sometime in the early 1990’s the railroad tracks within the property were abandoned and/or removed. Sometime between 1997 and 1999, the site was developed into the asphalt-paved lot. By 2003 the site was utilized for RV and automobile storage.

2.2 SUBSURFACE EXPLORATION
Subsurface exploration for this investigation was conducted at the site on December 21, 2017, and consisted of drilling three (3) exploratory borings and two (2) percolation test wells. The borings were drilled to maximum depths of approximately 51.5 feet below the existing ground surface utilizing a truck-mounted, hollow-stem-auger drill rig. A representative of Albus-Keefe & Associates, Inc. logged the exploratory excavations. Visual and tactile identifications were made of the materials encountered, and their descriptions are presented on the Exploration Logs in Appendix A. The approximate locations of the exploratory excavations completed by this firm are shown on the enclosed Geotechnical Map, Plate 1.

Bulk, relatively undisturbed and Standard Penetration Test (SPT) samples were obtained at selected depths within the exploratory borings for subsequent laboratory testing. Relatively undisturbed samples were obtained using a 3-inch O.D., 2.5-inch I.D., California split-spoon soil sampler lined with brass rings. SPT samples were obtained from the borings using a standard, unlined SPT soil sampler. During each sampling interval, the sampler was driven 18 inches with successive drops of a 140-pound automatic hammer falling 30 inches. The number of blows required to advance the
Sampler was recorded for each six inches of advancement. The total blow count for the lower 12 inches of advancement per soil sample is recorded on the exploration log. Samples were placed in sealed containers or plastic bags and transported to our laboratory for analyses. All borings were backfilled with auger cuttings and capped with cold-patch asphaltic-concrete upon completion of sampling and percolation testing.

Upon completion of drilling, two percolation tests were conducted at boring P-1 drilled within the vicinity of boring B-1 in the middle of the site and at boring B-3 toward the north side of the site. The tests were conducted using 2-inch diameter casings installed in the boreholes after completion of drilling and sampling. Details of percolation testing are not included in this report, however, a brief discussion of our test results and recommended BMP systems are summarized in Section 5.11.

2.3 LABORATORY TESTING

Selected samples of representative earth materials from the borings were tested in our laboratory. Tests consisted of in-situ moisture and dry density, maximum dry density and optimum moisture content, expansion index, soluble sulfate content, direct shear strength, corrosivity (pH, minimum resistivity, chloride content), and grain size analysis. Descriptions of laboratory testing and a summary of the test results are presented in Appendix B and on the exploration log in Appendix A.

3.0 SUBSURFACE CONDITIONS

3.1 SOIL CONDITIONS

Earth materials encountered at the site consist of native alluvial deposits mantled by artificial fills. The artificial fill materials are generally comprised of brown and dark brown clayey sand, silty sand and sandy clay. These materials were typically damp to moist and loose to medium dense. The thickness of the artificial fill encountered ranged from 3.0 to 5.5 feet below the existing ground surface. Artificial fills of greater thickness may also locally be present beneath the site.

The native alluvial deposits are predominately comprised of brown and light gray to gray, silty sand, sand with silt, and sand that are dry to moist and medium dense to very dense. A brown, moist, very stiff clay layer was also encountered in boring B-1 at approximately 51.0 feet below the existing ground surface.

A more detailed description of the interpreted soil profile at each of the boring locations, based upon the borehole cuttings and soil samples, are presented in Appendix A. The stratigraphic descriptions in the logs represent the predominant materials encountered and relatively thin, often discontinuous layers of different material may occur within the major divisions.

3.2 GROUNDWATER

Groundwater was not encountered during this firm’s subsurface exploration to the maximum depth explored, approximately 51.5 feet below the existing ground surface. A review of the CDMG Seismic Hazard Zone Report 003 indicates that historical high groundwater levels for the general site
area are greater than 50 feet below the existing ground surface. Research of groundwater data in the vicinity of the site indicates groundwater levels in excess of 80 feet below the existing ground surface.

3.3 FAULTING

Geologic literature and field exploration do not indicate the presence of active faulting within the site. The site does not lie within an "Earthquake Fault Zone" as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act. Table 3.1 presents a summary of all the known seismically active faults within 10 miles of the site based on the 2008 National Seismic Hazards Maps.

TABLE 3.1
Summary of Faults

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<thead>
<tr>
<th>Name</th>
<th>Distance (miles)</th>
<th>Slip Rate (mm/yr.)</th>
<th>Preferred Dip (degrees)</th>
<th>Slip Sense</th>
<th>Rupture Top (km)</th>
<th>Fault Length (km)</th>
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<tr>
<td>Puente Hills (Coyote Hills)</td>
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<td>Elsinore; W+GI+T+J</td>
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<td>84</td>
<td>strike slip</td>
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<td>Puente Hills (Santa Fe Springs)</td>
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<td>thrust</td>
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4.0 ANALYSES

4.1 SEISMICITY

We have performed probabilistic seismic analyses utilizing the U.S. Seismic Design Maps web application by the U.S. Geological Survey (USGS). From our analyses, we obtain a PGA of 0.579 in accordance with Figure 22-7 of ASCE 7-10. The $F_{PGA}$ factor for site class D is 1.0. Therefore, the $PGA_M = 1.0 \times 0.579 = 0.58g$. The mean event associated with a probability of exceedance equal to 2% over 50 years has a moment magnitude of 6.64 and the mean distance to the seismic source is 8.3 miles.

4.2 SETTLEMENT

Based on the anticipated relatively light foundation loads and provided the upper 4 to 6 feet (which includes all existing artificial fill and the weathered/disturbed near-surface alluvium) of existing soils are removed and replaced as engineered compacted fill, the total and differential static settlements...
are not anticipated to exceed 1 inch and ½-inch over 30 feet, respectively, for the proposed residential structures.

5.0 CONCLUSIONS

5.1 FEASIBILITY OF PROPOSED DEVELOPMENT

From a geotechnical point of view, the proposed site development is considered feasible provided appropriate geotechnical recommendations are incorporated into the design and construction of the project. Key issues that could have significant fiscal impacts on the geotechnical aspects of the proposed site development are discussed in the following sections of this report.

5.2 GEOLOGIC HAZARDS

5.2.1 Ground Rupture

No known active faults are known to project through the site nor does the site lie within the boundaries of an “Earthquake Fault Zone” as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act. Therefore, the potential for ground rupture due to an earthquake beneath the site is considered low. The nearest zoned fault is the Puente Hills (Coyote Hills) fault located approximately 1.96 miles to the north.

5.2.2 Ground Shaking

The site is situated in a seismically active area that has historically been affected by generally moderate to occasionally high levels of ground motion. The site lies in relative close proximity to several seismically active faults; therefore, during the life of the proposed structures, the property will probably experience similar moderate to occasionally high ground shaking from these fault zones, as well as some background shaking from other seismically active areas of the Southern California region. Potential ground accelerations have been estimated for the site and are presented in Section 4.1 of this report. Design and construction in accordance with the current California Building Code (C.B.C.) requirements is anticipated to adequately address potential ground shaking.

5.2.3 Landsliding

Geologic hazards associated with landsliding are not anticipated at the site. Furthermore, the site is not located within an area identified by the California Geologic Survey (CGS) as having potential for seismic slope instability.

5.2.4 Liquefaction

Engineering research of soil liquefaction potential (Youd, et al., 2001) indicates that generally three basic factors must exist concurrently in order for liquefaction to occur. These factors include:

- A source of ground shaking, such as an earthquake, capable of generating soil mass distortions.
- A relatively loose silty and/or sandy soil.
- A relative shallow groundwater table (within approximately 50 feet below ground surface) or completely saturated soil conditions that will allow positive pore pressure generation.

The liquefaction susceptibility of the onsite subsurface soils was evaluated by analyzing the potential concurrent occurrence of the above-mentioned three basic factors. The liquefaction evaluation for this site was completed under the guidance of Special Publication 117A: Guidelines for Evaluating and Mitigating Seismic Hazards in California (CDMG, 2008).

Groundwater was not encountered during this firm’s subsurface exploration. Moreover, historical high groundwater has been documented at a depth greater than 50 feet below the site. In addition, the site is not located within a mapped liquefaction hazard zone by the California Geologic Survey and Anaheim Safety Element. Therefore, the potential for liquefaction at the site is not considered as a seismic hazard.

5.3 STATIC SETTLEMENT

Provided all undocumented artificial fill and weathered alluvium is removed (generally the upper 4 to 6 feet) and replaced as engineered compacted fill and based on the anticipated relatively light foundation loads, total and differential static settlements are not anticipated to exceed 1 inch and ½-inch over 30 feet, respectively, for the proposed residential structures.

5.4 EXCAVATION AND MATERIAL CHARACTERISTICS

In general, all existing artificial fills and the upper weathered/disturbed near-surface alluvium are considered unsuitable in their existing condition to support proposed structural fills and site improvements. Based on our subsurface exploration, we anticipate these materials to range from 4 to 6 feet in thickness across the site. These materials should be removed from below future building sites, retaining walls, screen walls, pavement, and any other “structural” areas, and replaced as engineered compacted fill. The actual depth of removal should be determined by the geotechnical consultant during grading. Removals should extend laterally beyond the limits of the proposed structure no less than 5 feet or distance equal to the depth of removal (i.e. 1:1 projection) if the removals are greater than 5 feet.

Off-site improvements exist near and along the property lines. The presence of the existing offsite improvements will limit removals of unsuitable materials adjacent the property lines. As such, future grading along the margins of the site will need to be performed in such a manner as to not adversely impact adjacent existing improvements. Where removals for future residential improvements are limited by existing improvements or property lines, special grading techniques such as slot cutting, shoring or other acceptable design criteria may be required. Under such conditions, specific recommendations should be provided by this firm during review of final grading plan. Construction of perimeter site walls will likely require deepened footings or caissons and grade beams where removals are restricted by property boundaries.

Following removals, the exposed grade should first be scarified to a depth of 6 inches; moisture conditioned to at least 110 percent of the optimum moisture content, and then compacted to at least 90 percent of the laboratory determined maximum dry density.
Temporary construction slopes and trench excavations can likely be cut vertically up to a height of 4 feet within the onsite materials provided that no surcharging of the excavations is present. Temporary excavations greater than 4 feet in height but no greater than 10 feet will likely need to be laid back to 1.5:1 (H:V) or flatter. Site materials may be prone to sloughing and possible caving if allowed to dry.

Demolition of the existing site improvements will generate a considerable amount of asphaltic concrete debris. Significant portions of concrete and asphaltic concrete debris can likely be reduced in size to less than 4 inches and incorporated within fill soils during earthwork operations.

Onsite disposal systems, clarifiers and other underground improvements may be present on site. If encountered during future rough grading, these improvements will require proper abandonment or removal.

Subsurface soils are anticipated to be relatively easy to excavate with conventional heavy earthmoving equipment.

5.5 SHRINKAGE AND BULKAGE
Volumetric changes in earth quantities will occur when excavated onsite soil materials are replaced as properly compacted fill. We estimate the existing upper 4 to 6 feet of earth materials will shrink 5 to 10 percent. Subsidence of removal bottoms is considered to be negligible. The estimates of shrinkage and bulkage are intended as an aid for project engineers in determining earthwork quantities. However, these estimates should be used with some caution since they are not absolute values. Contingencies should be made for balancing earthwork quantities based on actual swelling and bulkage that occurs during the grading process.

5.6 SOIL EXPANSION
Based on our laboratory test results and the USCS visual manual classification, the near-surface soils within the site are generally anticipated to possess a Low expansion potential. Additional testing for soil expansion may be required subsequent to rough grading and prior to construction of foundations and other concrete work to confirm these conditions.

5.7 FOUNDATIONS
Conventional shallow spread and continuous footings may be utilized to support the proposed residential buildings and wall structures at the site. Considering the Low expansion potential, the foundations for the proposed structures and other site improvements, such as retaining walls, screen walls, and flatwork, will likely require nominal reinforcement and depths.

5.8 CONCRETE MIX DESIGN
Laboratory testing of onsite soil indicates Negligible soluble sulfate content. Concrete designed to follow the procedures provided in ACI 318, Section 4.3, Table 4.3.1 for negligible sulfate exposure are anticipated to be adequate for mitigation of sulfate attack on concrete. Upon completion of
rough grading, an evaluation of as-graded conditions and further laboratory testing will be required for the site to confirm or modify the conclusions provided in this section.

5.9  CORROSION POTENTIAL

Laboratory testing of onsite soil indicates a minimum resistivity of approximately 1,100 ohm-cm, pH of 7.9, and a soluble chloride content of 18 ppm. Based on laboratory test results, site soils are Corrosive to metals. Structures fabricated from metals should have appropriate corrosion protection if they will be in direct contact with site soils. Under such conditions, a corrosion specialist should provide specific recommendations.

5.10  PAVEMENT SECTIONS

Existing near-surface soils are anticipated to have a moderate R-value. Based on the assumed R-value of 10 and a traffic index of 5.5, a preliminary pavement structural section of 3 inches asphaltic concrete over 12 inches of aggregate base may be used for planning and estimating purpose. R-value testing will be required subsequent to rough grading and prior to construction of interior driveways to confirm these conditions.

5.11  PERCOLATION CHARACTERISTICS

Most of the site soils include coarse-grained soil starting at about 6 feet below the ground surface and extending at to at least 50 feet below the ground surface. Therefore, shallow infiltration chamber systems and/or deeper dry wells systems are considered feasible options to satisfy infiltration requirements for WQMP purposes. Specific design criteria can be provided upon review of future grading plans.

6.0  LIMITATIONS

This report is based on the proposed development and geotechnical data as described herein. The materials described herein and in other literature are believed representative of the total project area, and the conclusions contained in this report are presented on that basis. However, soil materials can vary in characteristics between points of exploration, both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein. As such, observation and testing by a geotechnical consultant prior to and during the grading and construction phases of the project are essential to confirming the basis of this report.

This report summarizes several geotechnical topics that should be beneficial for project planning and budgetary evaluations. The information presented herein is intended only for a preliminary feasibility evaluation and is not intended to satisfy the requirements of a site specific and detailed geotechnical investigation required for further planning and permitting.

This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty.
This report should be reviewed and updated after a period of one year or if the site ownership or project concept changes from that described herein.

This report has been prepared for the exclusive use of 740 E. La Palma, LLC to assist the project consultants in determining the feasibility of the proposed development. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

Respectfully submitted,

ALBUS-KEEFE & ASSOCIATES, INC

Mark Principe
Staff Engineer

David E. Albus
Principal Engineer
GE 2455
REFERENCES

Publications

California Department of Conservation, Division of Mines and Geology, Seismic Hazard Report 03, “Seismic Hazard Zone Report for the Anaheim and Newport Beach 7.5-Minute Quadrangles, Orange County, California”, 1997.


Plans

D33 Design & Planning Inc., Conceptual Site Plan, La Palma Townhomes, Anaheim, California, dated August 24, 2017 (Project No. 20170064).

Aerial Photographs

<table>
<thead>
<tr>
<th>Photo Source</th>
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<th>Photo No.</th>
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</table>
EXPLANATION
(Locations Approximate)

B-3
- Exploratory Boring

P-1
- Percolation Test Boring

B-3/P-2
- Exploratory & Percolation Test Boring

ALBUS-KEEFE & ASSOCIATES, INC.
GEOTECHNICAL CONSULTANTS

GEOTECHNICAL MAP
Job No.: 2693.00  Date: 01/15/18  Plate: 1
APPENDIX A

EXPLORATION LOGS
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Lithology</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>EXPLANATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solid lines separate geologic units and/or material types.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dashed lines indicate unknown depth of geologic unit change or material type change.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solid black rectangle in Core column represents California Split Spoon sampler (2.5in ID, 3in OD).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Double triangle in core column represents SPT sampler.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solid black rectangle in Bulk column represents large bag sample.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Other Laboratory Tests:</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Max = Maximum Dry Density/Optimum Moisture Content</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>EI = Expansion Index</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SO4 = Soluble Sulfate Content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DSR = Direct Shear, Remolded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DS = Direct Shear, Undisturbed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SA = Sieve Analysis (1” through #200 sieve)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hydro = Particle Size Analysis (SA with Hydrometer)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200 = Percent Passing #200 Sieve</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consol = Consolidation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SE = Sand Equivalent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rval = R-Value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATT = Atterberg Limits</td>
</tr>
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</table>
**EXPLORATION LOG**

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Lithology</th>
<th>Material Description</th>
<th>Blows Per Foot</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Other Lab Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>Asphalt Concrete (AC): 4 inches</td>
<td>16</td>
<td>16</td>
<td>107.7</td>
<td>Max EI SO4 DS pH Resist Ch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Crushed Aggregate Base (CAB): 2 inches</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ARTIFICIAL FILL (Af)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clayey Sand/Sandy Clay (SC/CL): Brown, damp to moist, medium dense, fine grained sand, trace gravel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>@ 4 ft, loose, intermixed silty sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>ALLUVIUM (Qal)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sand with Silt (SP-SM): Gray, dry, medium dense, fine to coarse grained sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sand (SP): Light gray, dry to damp, medium dense, fine to medium grained sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>@ 15 ft, damp</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Albus-Keefe & Associates, Inc.**

Plate A-2
## Exploration Log

**Project:** 751-775 E La Palma Ave, Anaheim, CA 92801  
**Location:** B-1  
**Address:** 751-775 E La Palma Ave, Anaheim, CA 92801  
**Elevation:** 166.5  
**Job Number:** 2693.00  
**Date:** 12/21/2017  
**Client:** 740 E. La Palma, LLC  
**Logged By:** RM  
**Driving Weight:** 140 lbs / 30 in

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Lithology</th>
<th>Material Description</th>
<th>Blows Per Foot</th>
<th>Core</th>
<th>Bulk</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Other Lab Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ 25 ft, dense</td>
<td>@ 25 ft, dense</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Sand with Silt (SP-SM): Light brown, damp to moist, dense, fine grained sand</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Sand (SP): Light gray, damp, dense, fine to medium grained sand</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>@ 45 ft, very dense</td>
<td>@ 45 ft, very dense</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Plate A-3
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Lithology</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Clay (CL): Brown, moist, very stiff, laminated, with silt</td>
</tr>
</tbody>
</table>

End of boring at 51.5 feet.
No groundwater encountered.
Installed percolation test well (P-1) offset approx. 50 feet south of boring.
Backfilled with soil cuttings and capped with asphalt cold patch.
**EXPLORATION LOG**

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Lithology</th>
<th>Material Description</th>
<th>Blows Per Foot</th>
<th>Core</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Laboratory Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>Asphalt Concrete (AC): 3 inches</td>
<td>8</td>
<td>14.3</td>
<td>110.3</td>
<td></td>
<td>SA Hydro</td>
</tr>
<tr>
<td></td>
<td>ARTIFICIAL FILL (AF)</td>
<td>Silty Sand (SM): Brown, moist, loose, fine grained sand, gravel up to 2 inches, trace charcoal, with clay</td>
<td>13</td>
<td>14.3</td>
<td>105.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Silty Sand (SM): Brown to dark brown, moist, medium dense, fine grained sand, trace gravel, trace glass debris</td>
<td>14</td>
<td>1.6</td>
<td>Dist.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ALLUVIUM (Qal)</td>
<td>Sand (SP): Light gray, dry to damp, medium dense, fine to medium grained sand</td>
<td>10</td>
<td>3.6</td>
<td>93.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>@ 15 ft, damp</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>@ 20 ft, dense</td>
<td>26</td>
<td></td>
<td></td>
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</table>


Plate A-5
**EXPLORATION LOG**

<table>
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<tr>
<th>Depth (feet)</th>
<th>Lithology</th>
<th>Material Description</th>
<th>Blows Per Foot</th>
<th>Core Moisture Content (%)</th>
<th>Bulk Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Other Lab Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>@ 25 ft, damp to moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>@ 30 ft, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>@ 31.5 ft</td>
<td></td>
<td>End of boring at 31.5 feet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No groundwater encountered.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Backfilled with soil cuttings and capped with asphalt cold patch.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Project:**

- **Address:** 751-775 E La Palma Ave, Anaheim, CA 92801
- **Job Number:** 2693.00
- **Drill Method:** Hollow-Stem Auger
- **Client:** 740 E. La Palma, LLC
- **Driving Weight:** 140 lbs / 30 in
- **Date:** 12/21/2017
- **Logged By:** RM

**Location:** B-2

**Elevation:** 168.1

**Laboratory Tests**

- **Samples**
  - **Blows Per Foot**
  - **Core Moisture Content (%)**
  - **Bulk Moisture Content (%)**
  - **Dry Density (pcf)**
  - **Other Lab Tests**

# Exploration Log

**Project:**

**Address:** 751-775 E La Palma Ave, Anaheim, CA 92801

**Job Number:** 2693.00

**Client:** 740 E. La Palma, LLC

**Drill Method:** Hollow-Stem Auger

**Driving Weight:** 140 lbs / 30 in

**Date:** 12/21/2017

**Location:** B-3

**Elevation:** 168.6

**Logged By:** RM

## Material Description

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Lithology</th>
<th>Blows Per Foot</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Other Lab Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Asphalt Concrete (AC): 4 inches</td>
<td>17</td>
<td>2</td>
<td>111.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ALLUVIUM (Qal)</td>
<td>19</td>
<td>N.R.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Silty Sand (SM): Light brown, dry, medium dense, fine to medium grained sand, trace gravel up to 2 inches, weathered</td>
<td>14</td>
<td>N.R.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Sand (SP): Light gray, dry, medium dense, fine to medium grained sand, trace gravel</td>
<td>16</td>
<td>1.8</td>
<td>102</td>
<td>SA Hydro</td>
</tr>
<tr>
<td>15</td>
<td>@ 10 ft, damp</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>End of boring at 15 feet. No groundwater encountered. Installed percolation test well (P-2) within boring. Backfilled with soil cuttings and capped with asphalt cold patch upon completion of testing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Plate A-7
APPENDIX B

LABORATORY TEST PROGRAM
LABORATORY TESTING PROGRAM

Soil Classification
Soils encountered within the exploratory borings were initially classified in the field in general accordance with the visual-manual procedures of the Unified Soil Classification System (ASTM D 2487). The samples were re-examined in the laboratory and classifications reviewed and then revised where appropriate. The assigned group symbols are presented on the Exploration Logs provided in Appendix A.

In-Situ Moisture Content and Dry Density
Moisture content and dry density of in-place soil materials were determined in representative strata. Test data are presented on the Exploration Logs provided in Appendix A.

Laboratory Maximum Dry Density
Maximum dry density and optimum moisture content of onsite soils were determined for selected samples in general accordance with Method A of ASTM D 1557. Pertinent test values are given on Table B-1.

Direct Shear
The Coulomb shear strength parameters, angle of internal friction and cohesion, were determined for a bulk sample obtained from one our borings. The tests were performed in general conformance with Test Method ASTM D 3080. The sample was remolded to 90 percent of maximum dry density and at the optimum moisture content. Three specimens were prepared for each test, artificially saturated, and then sheared under varied loads at an appropriate constant rate of strain. Results are graphically presented on Plate B-4.

Soluble Sulfate Content
Chemical analysis was performed on selected samples to determine soluble sulfate content. The tests were performed in accordance with California Test Method No. 417. The test results are included on Table B-1.

Expansion Potential
An Expansion Index test was performed on a selected sample in accordance with ASTM D 4829. The test result and expansion potential are presented on Table B-1.

Corrosion
Select samples were tested for minimum resistivity, chloride, and pH in accordance with California Test Method 643. Results of these tests are provided in Table B-1.

Particle-Size Analyses
Particle-size analyses were performed on selected samples in accordance with ASTM D 422-63. The results are presented graphically on the attached Plates B-1.
Hydrometer

Hydrometer analyses were performed on representative samples of site materials in accordance with ASTM D 7928. The results are presented graphically on the attached Plate B-1.

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample Depth (ft.)</th>
<th>Soil Description</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>0-4</td>
<td>Clayey Sand/Sandy Clay (SC/CL)</td>
<td>Maximum Dry Density: 129.5 pcf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Optimum Moisture Content: 9.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Expansion Index: 31</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Expansion Potential: Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>pH: 7.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Resistivity: 1,100 ohm-cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chloride Content: 18 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Soluble Sulfate Content: 0.002%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sulfate Exposure: Negligible</td>
</tr>
</tbody>
</table>

Note: Additional laboratory test results are provided on the boring logs in Appendix A.
# Unified Soil Classification

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>SAMPLE</th>
<th>SYMBOL</th>
<th>LL</th>
<th>PI</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>6 feet</td>
<td>•   •</td>
<td></td>
<td></td>
<td>Sand with Silt (SP-SM)</td>
</tr>
<tr>
<td>B-2</td>
<td>0 - 4 feet</td>
<td>• • •</td>
<td></td>
<td></td>
<td>Silty Sand (SM)</td>
</tr>
<tr>
<td>B-3</td>
<td>10 feet</td>
<td>▲ ▲ ▲</td>
<td></td>
<td></td>
<td>Sand (SP)</td>
</tr>
</tbody>
</table>

## U.S. Standard Sieve Sizes

<table>
<thead>
<tr>
<th>Size</th>
<th>6&quot;</th>
<th>3&quot;</th>
<th>1.5&quot;</th>
<th>3/4&quot;</th>
<th>3/8&quot;</th>
<th>4</th>
<th>10</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>100</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Retained</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
<td>40</td>
<td>30</td>
<td>20</td>
<td>10</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

## Grain Size Distribution

- **Unified Soil Classification**
  - **Cobble**
  - **Gravel**
  - **Sand**
  - **Silt and Clay**

## Graphical Representation

- **Percent Passing** vs. **Percent Retained**
- **Grain Size in Millimeters**
- **Location**:
  - Plate No: B-1
  - Job No: 2693.00
<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Stress (ksf)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Peak Shear Stress (ksf)</td>
<td>0.84</td>
<td>1.296</td>
<td>2.232</td>
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<tr>
<td>Peak Displacement (in)</td>
<td>0.005</td>
<td>0.002</td>
<td>0.013</td>
</tr>
<tr>
<td>Ultimate Shear Stress (ksf)</td>
<td>0.648</td>
<td>1.248</td>
<td>2.196</td>
</tr>
<tr>
<td>Ultimate Displacement (in)</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Initial Dry Density (pcf)</td>
<td>116.5</td>
<td>116.5</td>
<td>116.5</td>
</tr>
<tr>
<td>Initial Moisture Content (%)</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Strain Rate (in/min)</td>
<td>0.01</td>
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</tr>
</tbody>
</table>

**SAMPLE LOCATION**
B-1 @ 0-4 feet

**SAMPLE TYPE**
90% of 129.5 pcf @ 9%

**SAMPLE DESCRIPTION**
Clayey Sand/Sandy Clay (SC/CL)

**Strain Legend**
- 1
- 2
- 4

**Strength Legend**
- Peak
- Ultimate

**Job No:** 2693.00

**Plate No:** B-2