Appendix G Geotechnical Report

COSTCO WHOLESALE

GEOTECHNICAL INVESTIGATION SUMMARY CHECKLIST

General Information

Costco Wholesale Real Estate Main Contact: Michael Okuma

Geotechnical Main Contact: Andrea Traum, Kleinfelder

Geotechnical Engineer of Record: Brian Crystal, Kleinfelder

Project Location

CW #: 16-0132

Warehouse #:

Report Date: March 24, 2017

Consultant Project/Document Number: 20173273.001A

Addendums (List):

Report Purpose: ☐ Preliminary ■ Draft ☐ Final ☐ Addendum/Revision

Geotechnical Investigation Summary Checklist	Yes	No or NA	Describe / Comments	Report Section
Pre-existing Conditions / Information				
Developer provided geotechnical report (describe):	☐	■		
Pre-existing development (describe)	☐	■		
Foundation type (describe):	☐	■	Shallow spread footings	
Performance Issues (describe):	☐	■	Potential soils issues include shallow bedrock and gravel and cobbles in near surface onsite soils	
Environmental Issues (describe)	☐	■	Not addressed in this report	
Site Grading Records (stripping, compaction test results, field reports, etc.)	☐	■	No records available. Test pit excavations should be recompacted during construction	
Typical Building Structural Design Criteria				
Other (describe): Fuel facility				1.1
Building size (describe): 150,000 sq ft warehouse				1.1
Typical wall loading				
3,000 pounds per linear foot (1361 kilograms per 0.31 m) for Metal Buildings	☐	■		
4,500 pounds per linear foot (2041 kilograms per 0.31 m) CMU or pre-cast	■	☐	Shallow spread foundations	1.1
Typical column loading				
120,000 pounds (54430 kilograms) in non-snow regions	■	☐		1.1

COSTCO WHOLESALE

GEOTECHNICAL INVESTIGATION SUMMARY CHECKLIST

Geotechnical Investigation Summary Checklist	Yes	No or NA	Describe / Comments	Report Section
150,000 pounds (68040 kilograms) in snow regions	☐	■		
Typical canopy loading: 50,000 pounds (22680 kilograms)	■	☐		1.1
Typical floor slab loading				
500 pounds per square foot (24 kPa), (psf, total)	■	☐		1.1
250 pounds per square foot (12kPa) (dead) at rack areas	■	☐		1.1
150 pounds per square foot (7.2kPa) (dead) at non-rack areas	■	☐		
350 pounds per square foot (16.8kPa) (live)	■	☐		1.1
Paving Design (twenty (20) year life)				
Heavy Duty paving shall accommodate thirty (30) trucks per day (Traffic Index of 7.0)	■	☐	5.0 AC/12.0 AB (MS-1) 5.0 AC/10.0 AB (Caltrans)	4.8.2
Light Duty paving shall Accommodate 6,600 cars per day (Traffic Index of 5.0)	■	☐	4.0 AC/6.0 AB (MS-1) 3.5 AC/6.0 AB (Caltrans)	4.8.2
Performance Grade (PG) binder oil identified for local climate conditions	■	☐	PG 70-10	4.8.3
Site Grading Conditions/Assumptions				
Deviations to Typical Criteria (list / describe):	■	☐	Gravel, cobbles, and shallow bedrock may impact excavations for foundations and utilities. Cut/fill building pad may require overexcavation of cut portion of pad for uniform foundation support. FFE will affect cut/fill recommendation	5.2
Design Finished Floor Elevation (FFE) (describe):	■	☐	The provided FFE is Elevation 331.50.	1.1
Basis for FFE (assumed, per Civil) (describe):	■	☐	Kier & Wright Civil Engineers & Land Surveyors, Inc., dated March 6, 2017.	1.1
Effects of change to assumed FFE (describe):	■	☐	The amount of cut/fill transition will depend on the FFE. A lower FFE may decrease the amount of cut/fill transition	1.1
Maximum anticipated cuts (describe):	■	☐	5-10 feet for building pad and utilities and 20 feet USTs	1.1, 5.2
Maximum anticipated fills (describe):	■	☐	5-10 feet for warehouse pad	1.1, 5.2
Cross sections prepared for sites that are not essentially flat	■	☐	Cross section on Figures 3, 4, and 5	Figures 3, 4, 5
Amount of import / export anticipated (describe):	☐	■	unknown	
Frost Depth (describe):	☐	■		
Retaining walls				
Number of walls (describe):	☐	■	unknown	
Height / Length of walls (describe):	☐	■	unknown	
Wall construction / type (describe):	☐	■	unknown	
Cut / fill transition in pad (describe):	■	☐	5-10 feet cut/fil	5.2

COSTCO WHOLESALE

GEOTECHNICAL INVESTIGATION SUMMARY CHECKLIST

Geotechnical Investigation Summary Checklist	Yes	No or NA	Describe / Comments	Report Section
Offsite Improvements (describe)	☐	■	Not available. Will be addressed in final report	
Fieldwork / Results				
Due Diligence Design Criteria				
Version (describe): 1	■	☐	CWDR, Version 2016, September 19, 2016	1
Followed Criteria?	■	☐	yes	1
Deviations to standard investigation (describe):	■	☐	Infiltration testing could not be performed due to excessive rains and perched water condition and was removed from the scope of work	1
Groundwater				
Depth (describe):	■	☐	Regional groundwater greater than 50 feet,	3.3
Perched	■	☐	Perched groundwater observed above bedrock as shallow as 1 foot below surrounding grade	3.3
Expected seasonal fluctuation (describe):	■	☐	Can fluctuate based on precipitation	3.3
Piezometers installed?	☐	■		
Unusual / Challenging Soils conditions encountered				
Moisture-sensitive soils	☐	■	Not encountered	3.4.4
Undocumented fill	☐	■	Not observed	
Unsuitable soils (require removal)	■	☐	Cobbles in onsite soils	5.2.7
Wet soils	■	☐	Site is currently very wet to due to recent rainfall	3.3
Debris	☐	■		
Bedrock / potential non-rippable conditions	■	☐	Bedrock was encountered in the explorations.	1.2.2/ 3.2
Refusal	■	☐	Refusal with the drilling and excavation equipment was observed between depths of 7 to 22 feet.	1.2.2/ 3.2
Collapsible soils	☐	■		
Expansive soils	☐	■		
Compressible soils	☐	■		
Liquefaction	☐	■		3.4.3
Sinkholes	☐	■		
Other (describe):	☐	■		
Potential Contamination Identified				
Soil	☐	■	Not addressed in this report	
Groundwater	☐	■	Not addressed in this report	

COSTCO WHOLESALE

GEOTECHNICAL INVESTIGATION SUMMARY CHECKLIST

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Restoration of Disturbed Areas				
Backfilled with soil	■	☐	Test pits and borings outside the warehouse footprint were backfilled with soil. Test pits excavations should be recompacted during construction	1.2.2
Backfilled with grout	■	☐	Borings within the warehouse footprint were backfilled with grout.	1.2.2
Other (describe):	☐	■		
Topsoil samples collected / analyzed	■	☐	Lab results are presented in Appendix B	App B
Corrosivity testing performed/addressed	■	☐	Addressed in Section 4.9 and laboratory tests in Appendix B	4.9
Report				
Executive summary	■	☐		
Wet weather construction recommendations	■	☐	Provided in Section 5.3	5.3
Pad winterization/pad recommendations	☐	■		
Frost protection recommendations	☐	■		
Haul road recommendations	☐	■		
Site-specific best earthwork practices	■	☐	Discussed in executive summary and Section 5.2.1	5.2.1
Design Parameters				
Fill material parameters provided				
Structural fill (below foundations, slabs)	■	☐	Discussed in executive summary and Section 5.2.1	5.2.1
Site grading fill (below pavements, flatwork)	■	☐	Discussed in executive summary and Section 5.2.1	5.2.1
Select backfill (behind truck dock walls, foundations, grade beams, etc.)	■	☐	Discussed in executive summary and Section 5.2.1	5.2.1
Trench backfill	■	☐	Discussed in executive summary and Section 5.2.8	5.2.8
Drainage fill	☐	■		
Frost resistant fill	☐	■		
Slab base aggregate	■	☐	Discussed in executive summary and Section 4.4	4.4
Limits of debris / unsuitable removal provided	☐	■		
Over-excavation / recompaction required				
Depth (describe):	■	☐	Cut/fill pad transition; 24-inches. Oversize cobbles can be removed from excavation areas	5.2.2
Extent (include cross-section diagram)	■	☐	10' outside building pad, limits based on pad elevation	5.2.2
Pad subgrade stabilization required (describe):	☐	■		

COSTCO WHOLESALE

GEOTECHNICAL INVESTIGATION SUMMARY CHECKLIST

Geotechnical Investigation Summary Checklist	Yes	No or NA	Describe / Comments	Report Section
Surcharge				
Height (describe):	☐	■		
Lateral extent (describe):	☐	■		
Estimated duration (describe):	☐	■		
Shallow Foundations				
Pounds per square foot (kPa per m) allowable soil bearing pressure (describe):	■	☐	3,000 psf	4.3.2
Deep Foundations				
Type (describe):	■	☐	Drilled piles for light and other poles	4.3.3
Options and Value Engineering Matrix provided	☐	■		
Floor Slabs				
Unreinforced (>2500 pound per square foot) (>120 kPa)	■	☐		4.4
Reinforced (describe why)	☐	■		
Subgrade modulus (pounds per square inch per inch (kPa / mm) (describe):	■	☐	125 pci	4.4
Base Material thickness (minimum six (6) inch (152.4 mm)) (describe):	■	☐	6 inches minimum	4.4
Seismic Conditions				
Governing Building Code (IBC, UBC, other)	■	☐	2016 California Building Code	4.2
Geologic Hazard Identified	■	☐		3.4
Proximity to earthquake fault zone(s)	■	☐	Foothills Fault System 8 miles from site	3.4.1
Proximity to seismic hazard zone(s)	☐	■		3.4.1
Potential for liquefaction	☐	■		3.4.3
Potential for lateral spreading	☐	■		3.4.3
Potential for seismic settlement	☐	■		3.4.3
Potential for slope stability/landslides	☐	■		3.4.2
Potential for ground shaking or geologic hazards	■	☐	Moderate ground shaking from distant faults	3.4.3
Retaining Walls	■	☐		4.7
Recommended Wall Types	☐	■	unknown	
Recommend Kleinfelder Design	☐	■		
Lateral earth pressure design values				
Active:	■	☐	40 pcf equivalent fluid weight	4.7
At-rest:	■	☐	60 pcf equivalent fluid weight	4.7
Passive:	■	☐	250 pcf equivalent fluid weight	4.7
Seismic:	■	☐	8 pcf equivalent fluid weight	4.7

COSTCO WHOLESALE

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Geotechnical Investigation Summary Checklist	Yes	No or NA	Describe / Comments	Report Section
Backfill material, placement requirements	■	☐	On-site sandy (nonexpansive) backfill behind walls; placed per structural fill section	4.7
Drainage requirements and cross-section drawing	■	☐	Cross sections of site shown on Figures 3, 4, and 5	4.6, Figures 3, 4, 5
Finger Drains				
Required for frost	☐	■		
Recommended for long term maintenance and constructability	■	☐		4.6
Pavement				
Pavement subgrade stabilization required (describe):	☐	■		
Asphalt mix design specified	■	☐	Per Costco Wholesale Specifications Section 09	5.5
Heavy and light duty pavement sections specified	■	☐	Table 4 in report	4.8
Alternative pavement sections identified	■	☐	Recommendation for PCC pavement are in Table 5	4.8
Specification for offsite pavement sections included	☐	■	Offsite improvements not addressed in this report. They will be addressed in Final report.	
Light Pole Foundations (accounting for frost action)	■	☐		4.3.3
Data Gaps / Unknowns (describe):	☐	■		

March 24, 2017
Kleinfelder Project No. 20173273.001A

Costco Wholesale
9 Corporate Park, Suite 230
Irvine, California 92606

Attention: Mr. Michael Okuma
Director of Real Estate Development

SUBJECT: **DRAFT Geotechnical Study**
Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

Dear Mr. Okuma:

Kleinfelder is pleased to present this report summarizing our geotechnical study for the proposed Costco Wholesale Warehouse located southeast of the intersection of Sierra College Boulevard and Brace Road in Loomis, California. The site is currently very wet as a result of heavy rainfall causing perched groundwater near the ground surface and the planned infiltration tests could not be performed. However, based upon subsurface soil conditions, these tests are no longer considered necessary and, therefore, will not be performed. The conclusions and recommendations presented in this report are subject to the limitations presented in Section 7.

We appreciate the opportunity to provide geotechnical engineering services to you on this project. If you have any questions regarding this report or if we can be of further service, please do not hesitate to contact Andrea Traum at 408.595.3275, or Andy Franks, Kleinfelder's Client Account Manager for Costco, at 480.650.4905.

Sincerely,

KLEINFELDER

DRAFT

Rebecca L. Money, PE, GE
Senior Geotechnical Engineer

DRAFT

Andrea Traum, PE
Senior Project Manager

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DRAFT GEOTECHNICAL STUDY
PROPOSED COSTCO WHOLESALE WAREHOUSE
SIERRA COLLEGE BOULEVARD AND
BRACE ROAD
LOOMIS, CALIFORNIA
CW# 16-0132
KLEINFELDER PROJECT NO. 20173273.001A

MARCH 24, 2017

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A Report Prepared for:

Mr. Michael Okuma
Costco Wholesale
9 Corporate Park, Suite 230
Irvine, California 92606

DRAFT GEOTECHNICAL STUDY
PROPOSED COSTCO WHOLESALE WAREHOUSE
SIERRA COLLEGE BOULEVARD AND BRACE ROAD
LOOMIS, CALIFORNIA
CW# 16-0132
MG2# 16-5254-01

Prepared by:

DRAFT

Rebecca L. Money, PE, GE
Senior Geotechnical Engineer

Reviewed by:

DRAFT

Brian E. Crystal, PE, GE
Principal Geotechnical Engineer

KLEINFELDER
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March 24, 2017
Kleinfelder Project No. 20173273.001A

TABLE OF CONTENTS

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

TABLES

FIGURES

APPENDICES

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
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EXECUTIVE SUMMARY

This report presents the results of our geotechnical study for the proposed Costco Wholesale Warehouse (CW# 16-0132) located southeast of the intersection of Sierra College Boulevard and Brace Road in Loomis, California. The purpose of our study was to evaluate soil and groundwater conditions beneath the site and provide geotechnical recommendations for design and construction. We based our study on the Costco Wholesale Development Requirements (CWDRs), Version 2016, dated September 19, 2016. The site is currently very wet with perched groundwater near the ground surface and the planned infiltration tests could not be performed. However, based upon subsurface soil conditions, these tests are no longer considered necessary and, therefore, will not be performed.

Kleinfelder understands Costco plans to develop an approximately 18-acre site to construct a new, approximately 150,000-square-foot warehouse and fuel facility. The warehouse building will be a single-story, steel-framed structure (30 feet in height) with concrete masonry unit and metal walls. The fuel facility will contain 24 fueling locations, three underground storage tanks (USTs), a diesel UST, a fuel additive UST, four fueling islands, and a pre-manufactured metal canopy.

The building surroundings will consist mainly of surface parking with some landscape areas. Based on the CWDRs, we understand maximum column loads will be on the order of 120 kips, typical wall loads will be approximately 4.5 kips per lineal foot, canopy column loads will be approximately 50 kips, and the total slab load (dead plus live loads) will be approximately 500 psf.

Surface elevations interpreted from a preliminary grading plan prepared by Kier & Wright Civil Engineers & Land Surveyors, Inc., undated, indicate that existing surface elevations vary from a high of approximately Elevation 340 feet (datum not provided) in the south-eastern portion of the site to a low of approximately Elevation 320 feet in the north-western portion of the site. According to the preliminary grading plan, we understand that the finished floor elevation (FFE) for the warehouse will be established at approximately Elevation 331.50 feet. Based on the preliminary grading plan and approximate surface elevations, the warehouse building pad area will be raised as much as approximately 10 feet and cut as much as about 5 feet. The fuel facility area will be raised approximately 1 to 5 feet.

At the time of our field exploration, much of the site was undeveloped and covered by native grass and weeds with scattered clusters of trees. A foundation and miscellaneous improvements associated with a former residence is located on the northwest corner of the property. A concrete

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box culvert crosses Sierra College Boulevard with a drainage swale flowing on the west border of the site and crosses near the southwestern corner of the proposed Costco warehouse pad. A concrete pipe was encountered near the former residence in Test Pit TP-7 at a depth of approximately 7 feet. It is unknown if this utility pipe is in use.

Subsurface conditions at the site were explored by drilling 38 borings, excavating 10 test pits, and performing a seismic refraction survey. The seismic refraction survey consisted of six 230-foot long seismic lines located within/across the warehouse footprint and fuel facility. A total of 21 borings and 5 test pits were drilled/excavated in the warehouse building area; 13 borings and 3 test pits were drilled/excavated in the parking and drive areas; and 4 borings and 1 test pit were drilled/excavated in the fuel facility area. The borings were drilled using track-mounted hollow-stem-auger drilling and HQ-3 rock coring equipment to depths between approximately 7 and 30 feet below the existing ground surface (bgs) in the warehouse building area; approximately 10 feet bgs in the parking and drive areas; and between approximately 10 and 30 feet bgs in the fuel facility area. Seventeen of the borings (Borings B-1, B-4, B-6 through B-10, B-12 through B-19, B-22, and B-23) were terminated short of their planned depth due to practical auger refusal on bedrock. Eight of these borings that encountered refusal were cored to a depth of at least 4 feet into the bedrock (Borings B-4, B-7, B-9, B-17 through B-19, B-22, and B-23). Ten test pits were excavated to depths ranging from approximately 8 feet to 15 feet bgs. Five of these test pits were terminated short of their planned depth due to practical refusal on bedrock (Test Pits TP-2, TP-3, TP-7, TP-9, and TP-10). All test pits were backfilled with soil cuttings and borings were backfilled with neat cement grout or soil cuttings.

Perched water was encountered in a majority of our borings and test pits as shallow as 1 foot. Portions of the site had ponded surface water with small stream flowing through the low area in the middle of the site to a culvert beneath Sierra College Boulevard. This surface water infiltrated the near surface soils, collected on less permeable soil and rock at shallow depth, was observed seeping into the test pit excavations, and was encountered in the soil borings at various depths. The approximate locations of the borings and test pits are presented on Figure 2, Exploration Location Plan.

The soils across the site generally consist of loose to very dense sands with varying amounts of silt and clay. These sand soils are residual soils generated from weathering of the underlying granite bedrock. Gravel to cobble-sized rock fragments were commonly encountered below approximately 5 feet. Many of the soil samples exhibited faint bedrock structure typical of

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decomposed rock. The heterogeneous depth to bedrock encountered is typical of a granitic bedrock weathering profile. Due to bedrock fracture, weathering environment, and mineral composition, the bedrock surface can weather to soil at varying rates and depths resulting in an inconsistent bedrock surface. The bedrock encountered is consistent with the quartz diorite mapped by Olmsted (1971).

Based on the results of our field exploration, it is our professional opinion that the proposed project is geotechnically feasible, provided the recommendations presented in the geotechnical report are incorporated into the project design and construction. We identified the following key geotechnical considerations during our study.

- The proposed Costco warehouse building and fuel facility may be supported on a conventional shallow foundation system. Based on the preliminary grading plan, the warehouse building footprint is situated on a cut/fill transition with fills up to approximately 10 feet in the south-western corner of the building and cuts up to about 5 feet in the south-eastern corner. Overexcavation and recompaction of on-site soils/weathered bedrock is recommended to reduce the potential for differential settlement and provide relatively uniform support for the proposed warehouse and other improvements.

- Soils within 10 feet laterally of the warehouse pad (including the entrance canopy, building aprons, utility pads, stairs, ramps, stoops, and the loading dock) should be overexcavated to a depth of at least 2 feet below existing grade, 3 feet below the bottom of the footings, or 3 feet below the bottom of the floor slabs, whichever is deeper. If existing fill soils are encountered at the base of the overexcavation, the overexcavation should continue until the fill is removed. The overexcavated soils can be moisture conditioned and recompacted as structural fill.

- Gravel to cobble-sized rock fragments generated from weathering of the underlying granite bedrock were commonly encountered below approximately 5 feet and may impact excavations for foundations and utilities in the building pads and site. Depth to refusal in the soil borings and test pits ranged between 7 and 20 feet. The seismic refraction survey results (see Appendix C) indicate variability in depth to bedrock across the warehouse and fuel station sites and a general depth of rippability of approximately 12 feet. It should be noted that the depth to less weathered rock is highly variable and difficult excavation,

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which may require blasting, may be encountered at shallower depths. Further discussion is provided in Section 5.2.5.

- Rock or other soil fragments greater than 6 inches in size should not be used in fills. Within the upper 3 feet of building pads, rock or other soil fragments greater than 3 inches in size should not be used. Screening of oversized materials will be necessary to reuse the on-site material as structural fill. It is also likely that deeper onsite excavations may generate oversized material that will need to be disposed of off-site.

- For pavement, sidewalk, and other flatwork areas (including the fuel facility), soils should be overexcavated to a depth of at least 18 inches below existing grade. Overexcavation is not required in cut areas provided loose/soft shallow soils and organic rich materials are removed. The overexcavated soils can be moisture conditioned and recompacted as structural fill. The over-excavation should extend beyond the proposed improvements a horizontal distance of at least 2 feet.

- Rainfall will infiltrate near surface soils and collect on less permeable soil and rock at shallow depth. Therefore, the contractor will likely encounter shallow perched groundwater in excavations, particularly in the northern half of the site and the northern portion of the fuel facility following rainfall events and in the winter and spring months. During a large portion of our field work, a majority of the entire site was not drivable using trucks and truck mounted equipment due to multiple rainfall events passing through the area. The perched groundwater will likely be present at or near subgrade level across the entire site during and after rainfall events. Temporary and permanent drainage provisions will likely be required for these areas as discussed in Section 5.2.3

- Fill soils should be compacted to at least 95 percent of the maximum dry unit weight (ASTM D1557) in accordance with the Costco Wholesale Development Requirements (CWDRs). Fill soils should be compacted to moisture contents between -2 and +1 percent of the optimum moisture content during compaction. If both compaction and moisture content criteria are not within the specified tolerances, the fill should not be accepted, and the contractor should rework the material until the fill is placed within the specified tolerances.

- Import soils should have no particles greater than 3 inches in maximum dimension, no less than 70 percent of the particles passing the No. 4 sieve, no more than 25 percent of

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the particles passing the No. 200 sieve, and a Plasticity Index (PI) less than 5. The contractor should provide documentation that all imported soil is free of hazardous materials, including petroleum or petroleum byproducts, chemicals and harmful minerals. Test results with the geotechnical and analytical properties of the proposed import material should be provided to Costco for approval prior to transportation and use on site.

- The site soils contained approximately 25 to 30 fines and are moisture sensitive and susceptible to disturbance, rutting, and pumping during construction. The contractor should plan to repair subgrade conditions that become unstable/disturbed and should develop a plan to manage subgrade trafficability across the site throughout the construction period. Features of this plan may include temporary surface haul roads, limited traffic routes, etc.

- Should grading be performed during or following extended periods of rainfall, the moisture content of the near-surface soils will be significantly above the optimum moisture content. These conditions could seriously impede grading by causing an unstable subgrade condition. Typical remedial measures include deep scarification and drying, removal and replacement with crushed rock and geotextile fabric, and/or treatment with portland cement.

- Pursuant to current Costco Wholesale standard construction design practices, we have evaluated the necessity of using a steel-reinforced slab. Based on the geotechnical characteristics of the site, the proposed warehouse can be built with a non-reinforced slab.

- Kleinfelder typically recommends installation of a vapor barrier beneath the slab to mitigate potential moisture issues such as flooring performance and mold. However, we understand that Costco Wholesale has determined that moisture barriers are not to be used in construction of Costco Wholesale warehouses due to adverse effects on concrete curing and performance. Therefore, we have provided construction recommendations for the Costco warehouse that does not include installation of a moisture barrier with the understanding that there will be an increased risk for adverse moisture issues.

- Due to a poor draining subgrade as a result of near surface bedrock, we recommend installing perimeter foundation drains for the warehouse building and radial finger drains below new pavement sections. Additionally, planters should be detailed such that water exiting from them will not seep into the foundation areas or beneath slabs and pavement.

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- The Placer County, California currently uses the 2016 California Building Code (CBC) as the governing code.
- Based on our field exploration and understanding of the regional geology, we classify the site as Seismic Site Class C, Soft Rock.
- Performance Grade (PG) Binder oil of 70-10 may be used asphalt concrete pavements.
- The minimum resistivity of the samples tested indicate that the soil may be mildly corrosive towards ferrous metals (NACE, 2006). The concentrations of soluble sulfates indicate that the subsurface soils represent a Class S0 exposure to sulfate attack on concrete in contact with the soil based on ACI 318 Table 4.2.1 (ACI, 2011). Therefore, in accordance with ACI Building Code 318-11, no special provisions for selection of cement type are required.
- We have assessed the potential for storm water infiltration into the subgrade soils at the subject project site based on soil type and laboratory testing. The onsite soils in the upper 10 to 20 feet below the existing ground surface at the site are comprised primarily of clayey and silty sand. Seasonal perched groundwater was also observed within these sandy soils above the bedrock. Given the moderate infiltration capacity of the on-site soils and observed perched groundwater, we recommend alternatives to infiltration Best Management Practices (BMPs), such as bio-filtration/bio-retention systems (bio-swales and planter boxes), be implemented at the project site.

The findings, conclusions, and recommendations presented in this executive summary should not be relied upon without consulting our geotechnical report for more information. The conclusions and recommendations presented in this report are subject to the limitations presented in Section 7.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

1 INTRODUCTION

This report presents the results of Kleinfelder's geotechnical study for the proposed Costco Wholesale Warehouse (CW# 16-0132) located southeast of the intersection of Sierra College Boulevard and Brace Road in Loomis, California. The location of the project site is presented on Figure 1, Site Location Map. The purpose of our geotechnical study was to evaluate soil and groundwater conditions at the site and provide geotechnical recommendations for project design and construction. The scope of our services was presented in our proposal titled, "Proposal for Geotechnical Study, Proposed Costco Wholesale Warehouse, Sierra College Boulevard and Brace Road in Loomis, California, CW# 16-0132, MG2# 16-5254-01," dated December 14, 2016. We based our study on the Costco Wholesale Development Requirements (CWDRs), Version 2016, dated September 19, 2016. The site is currently very wet with perched groundwater near the ground surface and the planned infiltration tests could not be performed. However, based upon subsurface soil conditions, these tests are no longer considered necessary and, therefore, will not be performed.

This report presents a description of the services performed, a discussion of the geotechnical conditions observed at the site, and recommendations developed from our engineering analyses of field and laboratory data. Individuals using this report should read the limitations presented in Section 7.

1.1 PROJECT DESCRIPTION

Kleinfelder understands Costco plans to develop an approximately 18-acre site to construct a new approximately 150,000-square-foot warehouse, fuel facility, and parking lots. The warehouse building will be a single-story, steel-framed structure (30 feet in height) with concrete-masonry-unit (CMU) and metal walls. The fuel facility will contain three underground storage tanks (USTs), a diesel UST, a fuel additive UST, four fueling islands, and a pre-manufactured metal canopy. The building surroundings will consist mainly of surface parking with some landscape areas.

Based on the CWDRs, we understand maximum column loads will be on the order of 120 kips, typical wall loads will be approximately 4.5 kips per lineal foot, canopy column loads will be approximately 50 kips, and the total slab load (dead plus live loads) will be approximately 500 psf. Flood slab loading is anticipated to include 250 psf (total) at the rack areas and 350 psf (live). The warehouse surroundings will consist mainly of parking with a loading dock and some

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landscaped areas. Parking and driveway areas will be paved with either portland cement concrete or asphalt concrete pavements.

Based on our experience with fuel facilities in this area, the canopy for the service islands is typically founded on spread footings and the design is typically governed by overturning moments from wind loading. Typical column dead loads are anticipated to be approximately 4.5 kips and typical live loads are approximately 16 kips, which result in bearing pressures of less than 500 pounds per square (psf).

The 18-acre property is currently undeveloped and covered by native grass and weeds with scattered clusters of trees. An existing apartment complex is located immediately north of the property and a residential subdivision is located east of the property. Surface elevations interpreted from a preliminary grading plan prepared by Kier & Wright Civil Engineers & Land Surveyors, Inc., undated, indicate that existing surface elevations vary from a high of approximately Elevation 340 feet (datum not provided) in the south-eastern portion of the site to a low of approximately Elevation 320 feet in the north-western portion of the site. According to the preliminary grading plan, we understand that the finished floor elevation (FFE) for the warehouse will be established at approximately Elevation 331.50 feet. Based on the preliminary grading plan and approximate surface elevations, the warehouse building pad area will be raised as much as approximately 10 feet and cut as much as about 5 feet. The fuel facility area will be raised approximately 1 to 5 feet. We understand that fill material generated during grading of the site will be used to raise the site. Excavations for deep utilities and the loading dock may exceed 4 feet and installation of the USTs will require an excavation up to about 20 feet deep.

1.2 SCOPE OF SERVICES

The scope of our geotechnical study consisted of a literature review, subsurface explorations, geotechnical laboratory testing, engineering evaluation and analysis, and preparation of this report. Studies to assess environmental hazards that may affect the soil and groundwater at the site were beyond our geotechnical scope of services. The following paragraphs present a description of our services.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

1.2.1 Task 1 – Background Data Review

We reviewed readily-available published and unpublished geologic literature in our files and the files of public agencies, including selected publications prepared by the California Geological Survey and the U.S. Geological Survey. We also reviewed readily available seismic and faulting information, including data for designated earthquake fault zones as well as our in-house database of faulting in the general site vicinity.

1.2.2 Task 2a – Field Exploration (Soil Borings and Test Pits)

Subsurface conditions at the site were explored by drilling 38 borings and excavating 10 test pits. A total of 21 borings and 5 test pits were drilled/excavated in the warehouse building area; 13 borings and 3 test pits were drilled/excavated in the parking and drive areas; and 4 borings and 1 test pit were drilled/excavated in the fuel facility area. The borings were drilled using track-mounted hollow-stem-auger drilling with HQ-3 rock coring equipment used on selected borings to depths between approximately 7 and 30 feet below the existing ground surface (bgs) in the warehouse building area; approximately 10 feet bgs in the parking and drive areas; and between approximately 10 and 30 feet bgs in the fuel facility area. Seventeen of the borings (Borings B-1, B-4, B-6 through B-10, B-12 through B-19, B-22, and B-23) were terminated short of their planned depth due to practical auger refusal on bedrock. Eight of these borings that encountered refusal were cored to a depth of at least 4 feet into the bedrock (Borings B-4, B-7, B-9, B-17 through B-19, B-22, and B-23). Ten test pits were excavated to depths ranging from approximately 8 feet to 15 feet bgs. Five of these test pits were terminated short of their planned depth due to practical refusal on bedrock (Test Pits TP-2, TP-3, TP-7, TP-9, and TP-10). All test pits were backfilled with the excavated soil. Borings in the warehouse building area and tank excavation area were backfilled with neat cement grout and the remaining shallower borings were backfilled with the soil cuttings. The approximate locations of the borings and test pits are presented on Figure 2, Field Exploration Location Plan.

Prior to commencement of the fieldwork, Underground Service Alert (USA) was notified and various geophysical techniques were used at the boring and test pit locations to identify potential conflicts with subsurface structures. A Kleinfelder staff engineer supervised the field operations and logged the explorations. Selected bulk and drive samples were retrieved, placed in plastic bags or sealed in sample tubes, and transported to our laboratory for further evaluation. The number of blows necessary to drive a Standard Penetration Test (SPT) sampler or California-type sampler was recorded. Rock coring was performed in select borings using HQ-3 equipment when

the target depth was not reached due to auger refusal on bedrock. Soil descriptions used on the logs result from field observations and data, as well as from laboratory test data. Stratification lines on the logs represent the approximate boundary between soil and/or rock types, and the actual transition may vary and can be gradual. Appendix A presents a description of the field exploration program, exploration logs, test pit logs, and a legend of terms and symbols used on the logs.

1.2.3 Task 2b – Field Exploration (Seismic Refraction Survey)

Advanced Geological Services under subcontract to Kleinfelder performed a geophysical seismic refraction survey of the proposed Costco warehouse building pad and fuel facility areas to evaluate the excavatability (rippability) of the granitic rock material. The methodology, equipment, field procedures, data processing, analyses and results are presented in a report dated February 13, 2017. A copy of the report is included in Appendix C.

1.2.4 Task 3 – Laboratory Testing

Laboratory testing was performed on representative bulk and relatively undisturbed samples to assist in soil classification and development of engineering parameters for geotechnical design. Laboratory testing was comprised of moisture content, dry unit weight, sieve analysis, wash sieve (percent passing No. 200 sieve), Atterberg limits, maximum laboratory density, and R-values, which were performed in our Sacramento laboratory. Corrosivity testing was performed by Sunland Analytical of Rancho Cordova, California. Appendix B presents the results of the laboratory testing performed for this study.

1.2.5 Task 4 – Geotechnical Analyses

We analyzed field and laboratory data in conjunction with the assumed finished grades, warehouse and fuel facility layout, and structural loads to provide geotechnical recommendations for design and construction. We evaluated feasible foundation systems, concrete slab support, pavement design, infiltration design (removed from the field investigation plan), and earthwork. Seismic design parameters in accordance with the 2016 California Building Code (CBC) are also presented.

1.2.6 Task 5 – Report Preparation

This report summarizes the services performed, data acquired, and our findings, conclusions, and geotechnical recommendations for the design and construction of the proposed improvements.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

Our report includes the following items:

- Vicinity map and field exploration location map showing the approximate boring, test pit, and seismic refraction line locations;
- Boring and test pit logs (Appendix A);
- Results of laboratory testing (Appendix B);
- Results of the seismic refraction survey (Appendix C);
- Discussion of general site conditions;
- Discussion of general subsurface conditions as encountered in our field exploration;
- Discussion of regional and local geology;
- Recommendations for seismic design parameters in accordance with Chapter 16 of the 2016 CBC;
- Recommendations for foundation design, allowable bearing pressures, embedment depths, and compatibility constraints under various loading conditions;
- Anticipated total and differential static settlements;
- Recommendations for site preparation, earthwork, temporary slope inclinations, fill placement, and compaction specifications, including the excavation characteristics of subsurface soil deposits and bedrock materials;
- Recommendations for support of floor slabs and slabs-on-grade;
- Recommendations for flexible and rigid pavement structural sections for light- and heavy-duty pavement based on Equivalent Single Axle loading presented in the CWDRs;
- Recommendations for design of retaining structures, including active and at-rest lateral earth pressures, passive and frictional resistance, and applicable surcharge loads; and
- Preliminary evaluation of the corrosion potential of the on-site soils.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

2 SITE CONDITIONS

2.1 SITE DESCRIPTION

The proposed Costco site is located southeast of the intersection of Sierra College Boulevard in Loomis, California, as shown on Figure 1. The site is currently bounded by residential properties and Brace Road to the north, Sierra College Boulevard to the west, vacant properties and existing commercial properties to the south, and residential properties to the east. At the time of our field exploration, the site was vacant and much of the site was covered by native grass and weeds with scattered clusters of trees. The project site is gently rolling with about 10 to 15 feet of relief across the site. A concrete box culvert crosses Sierra College Boulevard with a drainage swale flowing on the west border of the site and crosses near the southwestern corner of the proposed Costco warehouse pad. A foundation and miscellaneous improvements associated with a former residence is located on the northwest corner of the property. A concrete pipe was encountered near the former residence in Test Pit TP-7 at a depth of approximately 7 feet. It is unknown if this utility pipe is in use.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

3 GEOLOGY

3.1 GEOLOGIC SETTING

3.1.1 Regional Geology

The project site lies within the foothills of the Sierra Nevada Province just east of the western boundary of the adjacent Sacramento Valley (northern) portion of the Great Valley geomorphic province. About 400 miles long and 40 miles wide, the Great Valley is an asymmetrical, synclinal trough formed by tilting of the Sierran block, with the western side dropping to form the valley and the eastern side abruptly uplifted to form the Sierra Nevada Mountains. Great Valley sediments consist of a thick sequence of alluvial, basin, and plain sediments eroded from the Sierra Nevada Mountains and transported primarily by the Sacramento River and its tributaries.

The Sierra Nevada province is approximately 40 to 100 miles wide east to west and 400 miles long trending north to south and parallels the Great Valley Province to the west. The Sierra Nevada Mountains within the Sierra Nevada province are comprised primarily of large, north-south elongated blocks of Mesozoic granitic terrain (composed of numerous granitic intrusions) forming the backbone of California. Separating the Sierran granitic basement rocks from the Great Valley sediments is the northwest trending belt of metamorphosed volcanic rocks and sediments forming the western slopes (foothills) of the Sierra Nevada Mountains. These rocks are distributed within three major fault-bounded lithologic terrains that extend along the length of the metamorphic belt. Rocks within these terrains have been isoclinally folded and metamorphosed on a regional scale and represent a “collage” of tectonically accreted blocks emplaced during convergent plate tectonism that occurred during the late Paleozoic and early Jurassic. Bedding, foliation and major structural features throughout the metamorphic belt normally trend northwest and dip steeply to the east. The site is situated on a granitic intrusion within the metamorphic belt.

3.1.2 Site Geology

The site has been mapped by multiple geologists, the map that provides the most detail is by Olmsted at a scale of 1:48,000 (Olmsted, 1971). This map indicates the proposed Costco development is underlain by the Upper Jurassic/Lower Cretaceous (approximately 128 million years ago) granitic rock classified as a quartz diorite and mapped as the Penryn Pluton. The Penryn Pluton is one of numerous plutons that compose the Sierra Nevada Batholith and is characterized as relatively shallow intrusion, approximately 6 – 10 km deep. Quartz diorite is medium to coarse-grained porphorytic intrusive rock composed of plagioclase, quartz,

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hornblende, and biotite minerals. The Penryn Pluton has varying degrees of weathering and fracturing in the project area which generates a gradational and heterogeneous weathering profile. Weathering tends to be more intense along fractures in the rock, which can result in blocks of less weathered rock separated by deeper highly weathered areas along vertical fractures.

3.2 SUBSURFACE CONDITIONS

The soils across the site generally consist of loose to very dense sands with varying amounts of silt and clay. These sand soils are residual soils generated from weathering of the underlying granite bedrock. Gravel to cobble-sized rock fragments were commonly encountered below approximately 5 feet. Many of the soil samples exhibited faint bedrock structure typical of decomposed rock. Seventeen of the borings were terminated due to practical auger refusal and five of the test pits were terminated due to practical equipment refusal on granitic bedrock above the targeted depth of exploration. These explorations are summarized in Table 1. It is likely refusal occurred when the borings encountered moderately weather to slightly weathered bedrock. The heterogeneous depth to bedrock encountered is typical of a granitic bedrock weathering profile. Due to bedrock fracture, weathering environment, and mineral composition, the bedrock surface can weather to soil at varying rates and depths resulting in an inconsistent bedrock surface. The bedrock encountered is consistent with the quartz diorite mapped by Olmsted (1971). Descriptions of the deposits are provided in our boring and test pit logs presented in Appendix A. Generalized geotechnical cross sections are presented on Figures 3 through 5.

TABLE 1
EXPLORATION REFUSAL SUMMARY

Exploration Number	Location	Approximate Depth to Refusal (feet)	Approximate Elevation of Refusal (feet)
Boring B-1	Building Pad	14	314
Boring B-4	Parking Field	15^	315
Boring B-6	Building Pad	14 ½	311 ½
Boring B-7	Building Pad	15^	311
Boring B-8	Building Pad	17	313
Boring B-9	Building Pad	11^	322
Boring B-10	Building Pad	12	312
Boring B-12	Building Pad	12	318
Boring B-13	Building Pad	22	313
Boring B-14	Building Pad	7	315
Boring B-15	Building Pad	13	313

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

TABLE 1
EXPLORATION REFUSAL SUMMARY (CONT.)

Exploration Number	Location	Approximate Depth to Refusal (feet)	Approximate Elevation of Refusal (feet)
Boring B-16	Building Pad	18	316
Boring B-17	Building Pad	12^	324
Boring B-18	Building Pad	7^	312
Boring B-19	Building Pad	13^	313
Boring B-22	Fuel Facility	16^	312
Boring B-23	Fuel Facility	20^	309
Test Pit TP-2	Building Pad	11	316
Test Pit TP-3	Building Pad	8	322
Test Pit TP-7	Parking Field	10	325
Test Pit TP-9	Parking Field	10	323
Test Pit TP-10	Parking Field	11	314

Note: ^ indicates rock coring was performed below the point of refusal.

3.3 GROUNDWATER

Permanent groundwater was not encountered in our borings or test pits, which were explored to a maximum depth of approximately 30 feet. Groundwater levels in the area have been measured at depths deeper than 50 feet below the existing ground surface. However, perched water was encountered in a majority of the explorations as shallow as 1 foot below site grade. This perched groundwater is likely a result of recent heavy rainfall and is seasonal in nature. This condition may occur on an annual basis and would depend upon regional precipitation.

Localized zones of perched water, increased soil moisture content and fluctuations of the groundwater level should be anticipated during and following the rainy season. Irrigation of landscaped areas on or adjacent to the site can also cause a fluctuation of local groundwater levels and result in a perched or shallow groundwater condition at the site.

3.4 ASSESSMENT OF POTENTIAL GEOLOGIC HAZARDS

3.4.1 Localized Faulting

The site is not located within the California Geologic Survey (CGS) designated Alquist-Priolo Earthquake Fault Zone, and no mapped active fault traces are known to project towards or transverse the site (Hart and Bryant, 2007, Jennings et al., 2010, USGS, 2016). Because there are no mapped active or potentially active faults in the general vicinity of the site, the potential for fault-related ground surface rupture at the site is considered low.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

Tectonically, the site is situated between major, fault systems including (from west to east) the San Andreas Fault System, Great Valley Fault Zone, Foothills Fault System, and Sierra Nevada Frontal Fault System that are responsible for the deformational history of California. Both the San Andreas and Sierra Nevada Frontal Fault Systems are well known for Holocene rupture that has continued into historical time and represent the source of most of California's seismic history. The Great Valley Fault Zone and the Foothills Fault System are more controversial in that only minor segments are suspected to have generated seismic activity in the recent geologic past and the frequency of rupture and/or seismic activity of each of these fault systems is considerably lower than the San Andreas and Sierra Nevada Frontal Fault systems. The closest of these fault systems to the subject sites is the Foothills Fault System, located about 8 miles east of the site. The Foothills Fault System consists multiple fault segments of which the Deadman, Maidu, Spenceville, and Rescue are the closest to the project site. The Foothills Fault System was generated by an eastward plate convergence and subduction between the late Paleozoic and early Mesozoic time (roughly 140 to 300 million years ago).

3.4.2 Landslides

Landslides and other forms of mass wasting, including mud flows, debris flows, soil slips, and rock falls occur as soil or rock moves down slope under the influence of gravity. Landslides are frequently triggered by intense rainfall or seismic shaking.

The site and surrounding area are relatively flat to gently sloping; therefore, landslides or other forms of natural slope instability do not represent a significant hazard to the project.

3.4.3 Liquefaction and Seismic Compression

The term liquefaction describes a phenomenon in which saturated, cohesionless soils temporarily lose shear strength (liquefy) due to increased pore water pressures induced by strong, cyclic ground motions during an earthquake. Structures founded on or above potentially liquefiable soils may experience bearing capacity failures due to the temporary loss of foundation support, vertical settlements (both total and differential), and/or undergo lateral spreading. The factors known to influence liquefaction potential include soil type, relative density, grain size, confining pressure, depth to groundwater, and the intensity and duration of the seismic ground shaking. Liquefaction is most prevalent in loose to medium dense, silty, sandy, and gravelly soils below the groundwater table. Based on our review of available groundwater well data, it is our opinion that the regional groundwater is approximately 50 feet or deeper. Therefore, based on the depth to groundwater

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and shallow rock encountered in the subsurface explorations, the potential for liquefaction is not considered a hazard at the site.

Seismic compression results from the accumulation of contractive volumetric strains in unsaturated soil during earthquake shaking. Loose to medium dense granular material with no fines or with low plasticity fines are most susceptible to seismic compression. Based on the shallow rock encountered in the subsurface explorations, the potential for seismic compression (dynamic dry settlement) is not considered a hazard at the site.

Lateral spreading is a movement in a nearly horizontal soil zone (usually attributable to liquefaction) that causes the overlying soil mass to shift down a gentle slope or toward a free face such as incised water bodies. Because the site and surrounding areas have generally insignificant topographic relief and no potentially liquefiable soils, the potential for lateral spreading is considered low.

3.4.4 Expansive Soils

Expansive soils are characterized by their ability to undergo significant volume changes (shrink or swell) due to variations in moisture content. Changes in soil moisture content can result from precipitation, landscape irrigation, utility leakage, roof drainage, perched groundwater, drought, or other factors and may result in unacceptable settlement or heave of structures or concrete slabs supported on grade. Clay soils were not observed at the site; therefore, the potential for expansive soils to affect the project are considered low.

3.4.5 Subsidence

The site is not located in an area of known significant ground subsidence due to the withdrawal of subsurface fluids. Therefore, the potential for subsidence occurring at the site due to the withdrawal of oil, gas, or water is considered low.

3.4.6 Flooding

The Flood Insurance Rate Map prepared by the Federal Emergency Management Agency (FEMA) was reviewed to identify the potential flood hazard for the project. This map indicates the site is within Zone X or D, defined as being an area outside the Special Flood Hazard Area and higher than the elevation of the 0.2-percent-annual-chance flood or being in an area in which flood hazards are undetermined, respectively. Based on this information the potential for the project site to be impacted by regional flooding is considered low. However, the accuracy of this

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

information should be confirmed by a qualified civil engineer/hydrologist. The need and/or method for mitigation of potential flooding should also be addressed.

3.4.7 Oil and Gas Fields

The California Division of Oil, Gas & Geothermal Resources (2016) has mapped oil, gas, and geothermal fields in the region. Based on the map, the site is not situated within an area of known abandoned oil wells. No active wells are known to exist within the project boundary. The nearest gas field is the Nicolaus Gas field located approximately 17 miles west of the project site. This site has three wells (DOGGR, 2016).

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

4 GEOTECHNICAL DESIGN RECOMMENDATIONS

4.1 GENERAL

Based on the results of our field exploration, it is our professional opinion that the proposed project is geotechnically feasible, provided the recommendations presented in the geotechnical report are incorporated into the project design and construction. We identified the following key geotechnical considerations during our study.

- The proposed Costco warehouse building and fuel facility may be supported on a conventional shallow foundation system. Based on the preliminary grading plan, the warehouse building footprint is situated on a cut/fill transitional area with fills up to approximately 10 feet in the south-western corner of the building and cuts up to about 5 feet in the south-eastern corner. Overexcavation and recompaction of on-site soils/weathered bedrock is recommended to reduce the potential for differential settlement and provide relatively uniform support for the proposed warehouse and other improvements.

- Soils within 10 feet laterally of the warehouse pad (including the entrance canopy, building aprons, utility pads, stairs, ramps, stoops, and the loading dock) should be overexcavated to a depth of at least 2 feet below existing grade, 3 feet below the bottom of the footings, or 3 feet below the bottom of the floor slabs, whichever is deeper. If existing fill soils are encountered at the base of the overexcavation, the overexcavation should continue until the fill is removed. The overexcavated soils can be moisture conditioned and recompacted as structural fill.

- Gravel to cobble-sized rock fragments generated from weathering of the underlying granite bedrock were commonly encountered below approximately 5 feet and may impact excavations for foundations and utilities in the building pads and site. Depth to refusal in the soil borings and test pits ranged between 7 and 20 feet. The seismic refraction survey results (see Appendix C) indicate variability in depth to bedrock across the warehouse and fuel station sites and a general depth of rippability of approximately 12 feet. It should be noted that the depth to less weathered rock is highly variable and difficult excavation, which may require blasting, may be encountered at shallower depths. Further discussion is provided in Section 5.2.5.

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- Rock or other soil fragments greater than 6 inches in size should not be used in fills. Within the upper 3 feet of building pads, rock or other soil fragments greater than 3 inches in size should not be used. Screening of oversized materials will be necessary to reuse the on-site material as structural fill. It is also likely that deeper onsite excavations may generate abundant boulders.

- For pavement, sidewalk, and other flatwork areas (including the fuel facility), soils should be overexcavated to a depth of at least 18 inches below existing grade. Overexcavation is not required in cut areas provided loose/soft shallow soils and organic rich materials are removed. The overexcavated soils can be moisture conditioned and recompacted as structural fill. The over-excavation should extend beyond the proposed improvements a horizontal distance of at least 2 feet.

- Rainfall will infiltrate near surface soils and collect on less permeable soil and rock at shallow depth. Therefore, the contractor will likely encounter shallow perched groundwater in excavations, particularly in the northern half of the site and the northern portion of the fuel facility following rainfall events and in the winter and spring months. During a large portion of our field work, a majority of the entire site was not drivable using trucks and truck mounted equipment due to multiple rainfall events passing through the area. The perched groundwater will likely be present at or near subgrade level across the entire site during and after rainfall events. Temporary and permanent drainage provisions will likely be required for these areas as discussed in Section 5.2.3.

- The site soils contained approximately 25 to 30 fines and are moisture sensitive and susceptible to disturbance, rutting, and pumping during construction. The contractor should plan to repair subgrade conditions that become unstable/disturbed and should develop a plan to manage subgrade trafficability across the site throughout the construction period. Features of this plan may include temporary surface haul roads, limited traffic routes, etc.

- Due to a poor draining subgrade as a result of near surface bedrock, we recommend installing perimeter foundation drains for the warehouse building and radial finger drains below new pavement sections. Additionally, planters should be detailed such that water exiting from them will not seep into the foundation areas or beneath slabs and pavement.

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- The minimum resistivity of the samples tested indicate that the soil may be mildly corrosive towards ferrous metals (NACE, 2006). The concentrations of soluble sulfates indicate that the subsurface soils represent a Class S0 exposure to sulfate attack on concrete in contact with the soil based on ACI 318 Table 4.2.1 (ACI, 2011). Therefore, in accordance with ACI Building Code 318-11, no special provisions for selection of cement type are required.

- We have assessed the potential for storm water infiltration into the subgrade soils at the subject project site based on soil type and laboratory testing. The onsite soils in the upper 10 to 20 feet below the existing ground surface at the site are comprised primarily of clayey and silty sand, with gravel to cobble size rock fragments. Seasonal perched groundwater was observed within these sandy soils above the bedrock. Given the moderate infiltration capacity of the on-site soils and observed perched groundwater, we recommend alternatives to infiltration Best Management Practices (BMPs), such as bio-filtration/bio-retention systems (bio-swales and planter boxes), be implemented at the project site.

The following opinions, conclusions, and recommendations are based on the properties of the materials encountered in the borings and test pits, the results of the laboratory-testing program, and our engineering analyses performed.

4.2 2016 CBC SEISMIC DESIGN PARAMETERS

Based on information obtained from the investigation, published geologic literature and maps, and on our interpretation of the 2016 California Building Code (CBC) criteria, it is our opinion that the project site may be classified as Site Class C, Soft Rock, according to Section 1613.3.2 of 2016 CBC and Table 20.3-1 of ASCE 7-10. Approximate coordinates for the site are noted below.

- Latitude: 38.81011° N
- Longitude: 121.20501° W

The Risk-Targeted Maximum Considered Earthquake (MCE_R) mapped spectral accelerations for 0.2 seconds and 1 second periods (S_s and S_1) were estimated using Section 1613.3 of the 2016 CBC and the U.S. Geological Survey (USGS) web based application (available at http://geohazards.usgs.gov/designmaps/us/application.php). The mapped acceleration values and associated soil amplification factors (F_a and F_v) based on the 2016 CBC and corresponding

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site modified spectral accelerations (S_{MS} and S_{M1}) and design spectral accelerations (S_{DS} and S_{D1}) are presented in Table 2.

According to Section 1803.5.12 of the 2016 CBC, in the absence of a site-specific ground motion hazard analysis, the MCE geometric mean peak ground acceleration adjusted for Site Class effects (PGA_M) can be determined based on Equation 11.8-1 in Section 11.8.3 of ASCE 7-10.

TABLE 2
2016 CBC SEISMIC DESIGN PARAMETERS

Design Parameter	Recommended Value
Site Class	C
S_s (g)	0.477
S_1 (g)	0.242
F_a	1.200
F_v	1.558
S_{MS} (g)	0.572
S_{M1} (g)	0.377
S_{DS} (g)	0.382
S_{D1} (g)	0.252
PGA_M (g)	0.186

4.3 FOUNDATIONS

4.3.1 General

Based on the results of our field exploration, laboratory testing, and geotechnical analyses, the proposed warehouse building and fueling facility may be supported on conventional shallow spread footing foundations founded on subgrade prepared in accordance with Section 5.2.2. Proposed light poles may be supported on short drilled pile foundations. Recommendations for the design and construction of shallow foundations and drilled pile foundations are presented below.

4.3.2 Shallow Foundations

Allowable Soil Bearing Pressure

Footings may be may be designed for a net allowable soil bearing pressure of 3,000 pounds per square foot (psf) for dead plus sustained live loads. Footings should be embedded at least

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18 inches below the lowest adjacent exterior grade. The footing dimension and reinforcement should be designed by the structural engineer; however, continuous and isolated spread footings should have minimum widths of 18 and 24 inches, respectively. A one-third increase in the above bearing pressures can be used for transient wind or seismic loads.

Estimated Settlements

We estimate total static settlement for foundations designed and constructed in accordance with the recommendations presented above to be less than 1 inch. Differential static settlement between similarly loaded footings is estimated to be less than ½ inch over 50 feet.

Lateral Resistance

Lateral load resistance may be derived from passive resistance along the vertical sides of the footings, friction acting at the base of the footing, or a combination of the two. An allowable passive resistance of 250 psf per foot of depth may be used for design. Allowable passive resistance values should not exceed 2,500 psf. An allowable coefficient of friction of 0.35 between the base of the footings and the engineered fill soils can be used for sliding resistance using the dead load normal stresses. Friction and passive resistance may be combined without reduction. We recommend that the first foot of soil cover be neglected in the passive resistance calculations if the ground surface is not protected from erosion or disturbance by a slab, pavement or in a similar manner.

4.3.3 Short Drilled Pile Foundations

Axial Capacity

The compressive axial capacity of drilled piles may be estimated based on an allowable skin friction capacity of 350 pounds per square foot. The upper 1 foot of the skin friction capacity should be ignored. The uplift capacity may be estimated as 70 percent of the allowable compressive axial capacity. A one-third increase in the allowable capacities may be used for transient loading conditions such as wind or seismic loads.

Settlement

Settlement of the proposed canopy supported on drilled piles, as recommended, is estimated to be less than ½ inch.

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Lateral Resistance

The drilled pile foundations lateral resistance can be designed in general accordance with Section 1807.3 of the 2016 CBC. We recommend a lateral soil bearing pressure of 250 psf per foot of depth below grade. The lateral soil bearing pressure should not exceed 2,500 psf. Since drilled piles will act as isolated pole foundations, the allowable lateral soil bearing pressure may be increased by a factor of 2 for short-term lateral loads provided the structure will not be adversely affected by ½ inch of lateral movement at the ground surface.

4.4 BUILDING SLAB-ON-GRADE

Concrete slab-on-grade floors are appropriate for the proposed warehouse, provided subgrade is prepared in accordance with Section 5.2.2. In accordance with the CWDRs, we recommend the slab be a minimum nominal thickness of 6 inches and underlain by at least 6 inches of aggregate base material. Aggregate base materials should meet current Caltrans specifications for Class 2 aggregate base. Please note that Caltrans Class 2 aggregate base may utilize recycled materials. The use of recycled material is typically not allowed under the warehouse building slab and requires Costco's approval.

A modulus of subgrade reaction of 125 pounds per cubic inch may be used for design of slabs underlain 6 inches of compacted aggregate base material. Pursuant to current Costco Wholesale standard construction design practices, we have evaluated the necessity of using a steel-reinforced slab. Based on the geotechnical characteristics of the site, the proposed warehouse can be built with a non-reinforced slab.

Floor slab control joints should be used to reduce damage due to shrinkage cracking. Control joint spacing is a function of slab thickness, aggregate size, slump, and curing conditions. The requirements for concrete slab thickness, joint spacing, and reinforcement should be established by the designer, based on experience, recognized design guidelines and the intended slab use. Placement and curing conditions will have a strong impact on the final concrete slab integrity.

Kleinfelder typically recommends installation of a vapor barrier beneath the slab to mitigate potential moisture issues such as flooring performance and mold. However, we understand that Costco Wholesale has determined that moisture barriers are not to be used in construction of Costco Wholesale warehouses due to adverse effects on concrete curing and performance. Therefore, we have provided construction recommendations that do not include installation of a

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moisture barrier, with the understanding that there will be an increased risk for adverse moisture issues.

4.5 EXTERIOR FLATWORK

Exterior concrete slabs for pedestrian traffic within the Costco development should be underlain by at least a 4-inch layer of crushed aggregate base. Exterior flatwork subject to traffic loading should be designed as pavement. The subgrade should be prepared in accordance with Section 5.2.2.

4.6 SITE DRAINAGE

Foundation and slab performance depends greatly on proper irrigation and how well runoff water drains from the site. This drainage should be maintained both during construction and over the entire life of the project. The ground surface around structures should be graded such that water drains away from structures without ponding. The surface gradient needed to do this depends on the landscaping type. Surface gradients should conform to current Costco Wholesale standards and the 2016 CBC.

Due to poor draining subgrade from shallow bedrock, we recommend installing perimeter foundation drains for the warehouse building and radial finger drains below the new pavement sections. Additionally, planters should be detailed such that water exiting from them will not seep into the foundation areas or beneath slabs and pavement.

Where slabs or pavement areas abut landscaped areas, the aggregate base and subgrade soil should be protected against saturation. Vertical cut off structures are recommended to reduce lateral seepage under slabs from adjacent landscaped areas. Vertical cut-off structures may consist of deepened concrete perimeters, or equivalent, extending at least three inches below the base/subgrade interface. Vertical cut-off structures should be poured neat against undisturbed native soil or compacted fill. The cut-off structures should be continuous.

Operations personnel should be instructed to limit irrigation to the minimum level necessary to properly sustain landscaping plants. Should excessive irrigation, waterline breaks or unusually high rainfall occur, saturated zones and “perched” groundwater may develop, which could soften the subgrade and reduce pavement life and could also create potholes. We also recommend that the downspouts from roof drains be connected to a designed subsurface drainage system such

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as a storm sewer, etc. to avoid discharging water onto pavement areas as well as backfill zones around the warehouse.

Potential sources of water such as water pipes, drains, and the like should be frequently examined for signs of leakage or damage. Any such leakage or damage should be promptly repaired.

Sewer lines beneath the warehouse should have a sufficient slope (at least 1 percent). Plumbing and utility lines should be provided with flexible joints or oversized sleeves where they penetrate floor slabs to prevent breakage caused by differential slab movement. In addition, utility trenches should be plugged with cohesive backfill where they enter the building to reduce moisture infiltration along pipe bedding material. The cohesive backfill materials should have a plasticity index (PI) between 15 and 30 and no less than 70 percent of the particles passing the No. 200 sieve.

4.7 RETAINING STRUCTURES

Design earth pressures for retaining structures depend primarily on the allowable wall movement, wall inclination, type of backfill materials, backfill slopes, surcharges, and drainage. The earth pressures provided assume that on-site granular (sandy) soils will used as backfill within a horizontal distance of at least one-half the height of the wall. The on-site clays should not be used as retaining wall backfill. If a drainage system is not installed, the wall should be designed to resist hydrostatic pressure in addition to the earth pressure. Determination of whether the active or at-rest condition is appropriate for design will depend on the flexibility of the walls. Walls that are free to rotate at least 0.002 radians (deflection at the top of the wall of at least 0.002 x H, where H is the unbalanced wall height) may be designed for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The recommended active and at-rest earth pressures and passive resistance values are provided in Table 3.

TABLE 3
LATERAL EARTH PRESSURES FOR RETAINING STRUCTURES
(ON-SITE GRANULAR BACKFILL)

Wall Movement	Backfill Condition	Equivalent Fluid Pressure (pcf)
Free to Deflect (active condition)	Level	40
Restrained (at-rest condition)		60
Passive		250

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Walls supporting more than 6 feet of backfill should be designed to support an incremental seismic lateral pressure of 8 pcf, applied as a regular triangle distribution (not inverted). The seismic lateral earth pressure was calculated using a pseudo-static acceleration corresponding to one-half of the Design Earthquake PGA, which is two-thirds of the PGA_M. When designing for seismic loads for restrained walls, the seismic lateral earth pressure should be combined with the active earth pressure. If designing for static loading only for restrained walls, the at-rest lateral earth pressure should be used.

The above lateral earth pressures do not include the effects of surcharges (e.g., traffic, footings), compaction, or truck-induced wall pressures. Any surcharge (live, including traffic, or dead load) located within a 1:1 (horizontal to vertical) plane drawn upward from the base of the excavation should be added to the lateral earth pressures. The lateral contribution of a uniform surcharge load located immediately behind walls may be calculated by multiplying the surcharge by 0.33 for cantilevered walls under active conditions and 0.50 for restrained walls under at-rest conditions. Walls adjacent to areas subject to vehicular traffic should be designed for a 2-foot equivalent soil surcharge (250 psf). Lateral load contributions from other surcharges located behind walls may be provided once the load configurations and layouts are known.

Walls should be properly drained or designed to resist hydrostatic pressures. Adequate drainage is essential to provide a free-drained backfill condition so that there is no hydrostatic buildup behind the wall. Walls should also be appropriately waterproofed to reduce the potential for staining. Drainage behind loading dock walls can consist of weep holes placed along the base of the wall. Weep holes should be spaced 10 to 15 feet apart and connected with a gravel drain consisting of approximately 3 cubic feet of clean gravel per foot of wall length wrapped with filter fabric. Other types of retaining walls should have a continuous back drain as described below.

Except for the upper 2 feet, the backfill immediately behind retaining walls (minimum horizontal distance of 2 feet measured perpendicular to the wall) should consist of free-draining ¾-inch crushed rock wrapped with filter fabric. The upper 2 feet of cover backfill should consist of relatively impervious material. A 4-inch-diameter perforated PVC pipe, placed perforations down at the bottom of the rock layer leading to a suitable gravity outlet, should be installed at the base of the walls.

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As an alternative to the gravel drain noted above, a manufactured drain panel may be utilized behind retaining walls in addition to normal waterproofing. This system generally consists of a prefabricated drain panel lined with filter fabric. At the wall base, we recommend that a gravel drain be installed to collect and discharge drainage to a suitable outlet. The drain should consist of a 4-inch-diameter perforated PVC pipe, perforations placed down at the bottom of approximately 3 cubic feet of clean gravel per foot of wall length. The gravel drain should be wrapped in filter fabric (Mirafi 140N or equivalent). The pipe should be sloped to drain to a suitable outlet and cleanouts should be provided at appropriate intervals. If drainage behind the wall is omitted, the wall should be designed for full hydrostatic pressure. The design of any drain panel system should be submitted to Kleinfelder for review to check that our recommendations have been properly incorporated into the design. Installation of the drainage system should be reviewed and documented by a Kleinfelder representative.

4.8 PAVEMENT SECTIONS

The required pavement structural sections will depend on the expected wheel loads, volume of traffic, and subgrade soils. We have provided asphalt concrete and portland cement concrete (PCC) pavement sections for traffic indices provided in the CWDRs (Costco, 2016).

Positive drainage of the paved areas should be provided since moisture infiltration into the subgrade may decrease the life of pavements. Curbing located adjacent to paved areas should be founded in the subgrade, not the aggregate base, in order to provide a cutoff, which reduces water infiltration into the base course.

The following pavement sections provided below are based on the soil conditions encountered during our field exploration, our assumptions regarding final site grades, and limited laboratory testing.

4.8.1 Costco Pavement Design Parameters

We developed pavement design recommendations using traffic loading parameters provided in the Costco Wholesale Development Requirements and the following test data:

- A 20-year pavement design life;
- Light-duty pavements subject to 6,600 passenger vehicle trips per day (Traffic Index of 5.0);
- Heavy-duty pavements subject to 30 tractor-trailer truck tips per day (Traffic Index of 7.0);

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- For asphalt concrete pavements, a design R-value of 20; and
- For portland cement concrete (PCC) Pavements, a 28-day flexural strength (modulus of rupture determined by the third-point method) of at least 550 pounds per square inch (psi) (approximate compressive strength of 4,000 psi); a modulus of subgrade reaction (k value) of 100 pounds per cubic inch (pci) for native subgrade; and interlock at the control joints.

4.8.2 Asphalt Concrete Pavement

We designed asphalt concrete pavement, also referred to as Hot Mix Asphalt (HMA), in accordance with the Asphalt Institute Manual Series (MS-1), Asphalt Pavements for Highways and Streets. Alternatively, asphalt concrete pavement sections were also designed using the Caltrans Highway Design Manual for comparison. HMA should conform to requirements of the Costco Wholesale Specification Section 321216, Asphalt Paving. Pavement lifts should not exceed three inches. Table 4 presents recommended minimum HMA pavement sections. The designer should select the appropriate pavement sections based on projects requirements. Prior to placement of aggregate base, pavement subgrade should be prepared in accordance with Section 5.2.2.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

TABLE 4
RECOMMENDED MINIMUM ASPHALT CONCRETE PAVEMENT SECTIONS

Traffic Use	Traffic Index, TI	Design Method	Asphalt Concrete* (inches)	Aggregate Base* (inches)
Light-Duty Pavement	5.0	MS-1	4.0	6.0
		Caltrans	3.5	6.0
Heavy-Duty Pavement	7.0	MS-1	5.0	12.0
		Caltrans	5.0	10.0

* Rounded to the closest ½ inch.

4.8.3 Asphalt Performance Grade Binder

Performance Grade (PG) Binder 70-10 may be used for the project. This recommendation was developed in accordance with Costco Wholesale Specifications Section 321216. This binder is commonly used throughout Northern California. Air temperature data nearest the project site was used with the MERRA Climate Data option and the PG was selected using the FHWA program LTTPBind Online web-based tool based on the AASHTO M323-13 standard. The high-end and low-end temperature ratings were selected to provide a reliability of at least 98 and 90 percent, respectively.

4.8.4 Portland Cement Concrete Pavement

We designed PCC pavement in accordance with the Portland Cement Association (PCA) Thickness Design for Concrete Pavements (PCA, 1984). The design assumes that the PCC will have a 28-day flexural strength (modulus of rupture determined by the third-point method) of at least 550 pounds per square inch (psi) (approximate compressive strength of 4,000 psi). A design modulus of subgrade reaction (k value) of 125 pounds per cubic inch (pci) was assumed for the top of the compacted aggregate base. It was also assumed that aggregate interlock would be developed at the control joints. The pavement sections are based on a theoretical design life of 20 years.

Recommended minimum PCC sections are presented in Table 5. Prior to placement of aggregate base, pavement subgrade should be prepared in accordance with Section 5.2.2.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

TABLE 5
RECOMMENDED MINIMUM PCC PAVEMENT SECTIONS

Traffic Use	Traffic Index, TI	PCC * (inches)	Aggregate Base* (inches)
Light-Duty Pavement	5.0	6.5	6.0
Heavy-Duty Pavement	7.0	7.0	6.0

* Rounded to the closest ½ inch.

4.8.5 Aggregate Base

Aggregate base materials should meet current Caltrans specifications for Class 2 aggregate base. Please note that Caltrans Class 2 aggregate base may utilize recycled materials. The use of recycled material requires Costco's approval.

4.8.6 Pavement Maintenance

Pavements may undergo movement due to changes in subgrade moisture content. This movement tends to accelerate pavement deterioration. A crack sealing program should be performed annually to slow pavement deterioration. Any areas where surface water stands on the surface should be remediated. Over time as cracking becomes more pronounced, a slurry seal coat should be applied

4.9 SOIL CORROSIVITY

We performed laboratory testing for parameters commonly used to evaluate corrosivity of soils, including pH, minimum resistivity, oxidation reduction potential, redox, chloride and soluble sulfate content. Table 6 presents the results.

TABLE 6
CORROSION TEST RESULTS

Location	Depth (ft)	Minimum Resistivity, (ohm-cm)		pH	Oxidation Reduction Potential, mV	Water-Soluble Ion Concentration ^, ppm		
		Saturated	In-Situ Moisture			Chloride	Sulfide	Sulfate
TP-4	0-2	No Test	No Test	5.71	377	No Test	Not Present	No Test
TP-5	0-1	No Test	No Test	5.61	331	No Test	Not Present	No Test
B-5	3-4	13,400	No Test	5.16	323	6.5	Not Present	2.2
B-17	3-4	20,640	No Test	5.35	309	6.1	Not Present	1.5

Note: ^ Water soluble ion concentrations are reported as % in soil by mass.

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These tests are a generalized indicator of soil corrosivity for the sample tested. Other soils on site may be more, less, or similarly corrosive in nature. Imported fill materials should be tested to confirm that their corrosion potential is not more severe than those noted.

Although Kleinfelder does not practice corrosion engineering, resistivity values greater than 10,000 ohm-cm are normally considered mildly corrosive to buried ferrous metals (NACE, 2006). The concentrations of soluble sulfates indicate that the subsurface soils represent a Class S0 exposure to sulfate attack on concrete in contact with the soil based on ACI 318 Table 4.2.1 (ACI, 2011). Therefore, in accordance with ACI Building Code 318-11, no special provisions for selection of cement type are required.

We understand gasoline station equipment is constructed of corrosion resistant synthetic materials. We recommend the gasoline station designer review these results and consult a corrosion expert for further evaluation, if necessary.

4.10 STORM WATER MANAGEMENT

We have assessed the potential for storm water infiltration into the subgrade soils at the subject project site based on soil type and laboratory testing. Pursuant to the current standard of practice, an infiltration evaluation is a two-step process. The first step is to characterize the site to assess whether infiltration is feasible. If infiltration is feasible, then infiltration testing is needed to provide a design infiltration rate (step two).

Based on visual soil classification and laboratory testing of the soil samples collected during our field exploration, the onsite soils in the upper 10 to 20 feet below the existing ground surface at the site are comprised primarily of silty and clayey sand with gravel to cobble sized rock fragments. Seasonal perched groundwater was also observed within these sandy soils above the bedrock. Given the moderate infiltration capacity of the on-site soils and observed perched groundwater, we recommend alternatives to infiltration Best Management Practices (BMPs), such as bio filtration/bio-retention systems (bio-swales and planter boxes), be implemented at the project site.

If bio-filtration/bio-retention systems are employed, we recommend that the BMPs be built such that water exiting from them will not seep into the foundation areas or beneath slabs and pavement. If planters are located within 10 feet of the structures, or adjacent to slabs and pavements, then some means of diverting water away from the building, building foundation soils, or soils that support slabs and pavements would be required, such as lining the planters.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

5 CONSTRUCTION RECOMMENDATIONS

5.1 GENERAL

The following recommendations should be used by the contractor for construction of the project, attention to excavatability and perched groundwater should be noted.

5.2 EARTHWORK

5.2.1 General

Site preparation and earthwork operations should be performed in accordance with applicable codes, safety regulations and other local, state or federal specifications, and the recommendations included in this report. References to maximum dry unit weights are established in accordance with the latest version of ASTM Test Method D1557 (Modified Proctor). The earthwork operations should be observed and tested by a representative of Kleinfelder.

5.2.2 Site Preparation

Abandoned utilities and other existing features within the proposed development areas (if any are encountered) should be removed and the excavation(s) backfilled with engineered fill. Debris produced by demolition operations, including wood, steel, piping, plastics, etc., should be separated and disposed of off-site. Existing utility pipelines or conduits that extend beyond the limits of the proposed construction and are to be abandoned in place, should be plugged with non-shrinking cement grout to prevent migration of soil and/or water. Demolition, disposal and grading operations should be observed and tested by a representative of Kleinfelder.

Prior to grading and subgrade preparation, all vegetation should be cut and removed from the site. Roots and vegetative matter in excess of one inch should be removed by screening or raking soils to a minimum depth of 12 inches. Additional stripping is not anticipated.

Based on the preliminary grading plan, the warehouse building footprint is be situated on a cut/fill transition with fills up to approximately 10 feet in the south-western corner of the building and cuts up to about 5 feet in the south-eastern corner. Overexcavation and recompaction of on-site soils/weathered bedrock is recommended to reduce the potential for differential settlement and provide relatively uniform support for the proposed warehouse and other improvements.

Soils within 10 feet of the warehouse pad (including the entrance canopy, building aprons, utility pads, stairs, ramps, stoops, and the loading dock) should be overexcavated to a depth of at least

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2 feet below existing grade, 3 feet below the bottom of the footings, or 3 feet below the bottom of the floor slabs, whichever is deeper. If existing fill soils are encountered at the base of the overexcavation, the overexcavation should continue until the fill is removed. The overexcavated soils can be moisture conditioned and recompacted as structural fill.

Gravel to cobble-sized rock fragments generated from weathering of the underlying granite bedrock were commonly encountered below approximately 5 feet below the existing grade and may significantly impact excavations for foundations and utilities in the building pad and fuel center site. Rock or other soil fragments greater than 6 inches in size should not be used in fills. Within the upper 3 feet of building pads, rock or other soil fragments greater than 3 inches in size should not be used. Screening of oversized materials will be necessary to reuse the on-site material as structural fill.

For pavement, sidewalk, and other flatwork areas (including the fuel facility), soils should be overexcavated to a depth of at least 18 inches below existing grade. Overexcavation is not required in cut areas provided loose/soft shallow soils and organic rich materials are removed. The overexcavated soils can be moisture conditioned and recompacted as structural fill. The over-excavation should extend beyond the proposed improvements a horizontal distance of at least 2 feet.

Following overexcavation and prior to replacing soils with compacted fill, the exposed subgrade should be proof-rolled with a fully-loaded tandem-axle dump truck or water truck. Areas identified as being soft or yielding may require additional compaction or over-excavation as determined by a representative of the geotechnical engineer.

The site soils contained approximately 25 to 30 fines and are moisture sensitive and susceptible to disturbance, rutting, and pumping during construction. The contractor should plan to repair subgrade conditions that become unstable/disturbed and should develop a plan to manage subgrade trafficability across the site throughout the construction period. Features of this plan may include temporary surface haul roads, limited traffic routes, etc.

5.2.3 Groundwater Impacts

Rainfall will infiltrate near surface soils and collect on less permeable soil and rock at shallow depth. Perched groundwater above the bedrock was encountered in the soil borings and test pits that were advanced following a period of heavy rainfall and may be encountered during

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construction. This is most likely to occur following periods of rainfall and in the winter and spring months. If encountered, excavations which extend below the perched groundwater level (currently estimated to be at approximately 1 to 10 feet below existing site grade) will need to be dewatered. In our opinion, dewatering of narrow trench excavations, which penetrate less than a few feet below the groundwater level and do not encounter loose and/or cohesionless soils, may be possible by directing inflow to a sump where water can be removed by a pump. Temporary dewatering of wider, deeper, and/or more extensive excavations may require well points, deep wells, and/or deep sumps. To help maintain bottom stability of wider, deeper, and/or more extensive excavations, groundwater levels should be drawn-down a minimum of 2 feet below the lowest portion of the excavation. Since temporary dewatering will impact and be dependent on construction methods and scheduling, we recommend the Contractor be solely responsible for the design, installation, maintenance, and performance of all temporary dewatering systems.

Perched groundwater levels can fluctuate depending on rainfall, runoff conditions, or other factors. Therefore, water levels presented in this report may not be representative of those encountered at the time of construction. We recommend the Contractor verify perched groundwater conditions and evaluate dewatering requirements prior to bidding and/or construction.

Depending on the depth of excavation below perched groundwater, soil conditions encountered along the excavation face, and slope inclination, caving or sloughing of excavation slopes is likely within the vicinity of a sump dewatering system. Sloughing or caving of excavation slopes could endanger personnel working within or adjacent to the excavation as well as nearby equipment, structures, or other existing improvements. The Contractor should be aware of the potential for caving and take appropriate precautions to insure the safety of site personnel as well as the integrity of the excavation slopes and any existing, nearby structures or other improvements.

5.2.4 Foundation Excavations

Shallow Foundations

Following excavation to the foundation subgrade elevations, the exposed subgrade should be observed by a representative of the geotechnical engineer to evaluate the presence of satisfactory materials at design elevations. If unsatisfactory material, such as soft or disturbed soil, debris or otherwise unsuitable soil is present at the base of footing excavations, it should be overexcavated and replaced with structural concrete, 2-sack sand-cement slurry, or structural fill to the depth determined by the geotechnical engineer.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

Drilled Pile Foundations

The performance and capacities of piles can be influenced significantly by the selected construction methods and procedures used. Construction methods that create large zones of disturbance around the drilled shafts can lead to lower than expected skin friction due to excessive stress relief around the shaft length. Drilling of the pile shafts should be accomplished using heavy-duty excavation equipment maintained in good condition. It should be noted that gravel- to cobble-sized rock fragments and granite bedrock were encountered in the test pits and borings below a depth of about 5 feet below existing grades and difficult excavation conditions may be encountered. In addition, practical auger refusal on bedrock was encountered at depths as shallow as approximately 7 feet below grade in the borings. The foundation drilling contractor should select equipment and tooling that is capable of reaching the planned foundation depths in such material, especially in cut areas.

Concrete should be placed immediately after drilling of the hole is complete. The concrete should be pumped to the bottom of the drilled shaft using a down-hole tremie.

5.2.5 Fill Material and Compaction Criteria

The on-site soils, minus debris, organic matter, or other deleterious materials, may be used as general engineered fill. Rock or other soil fragments greater than 6 inches in size should not be used in fills. Within the upper 3 feet of building pads, rock or other soil fragments greater than 3 inches in size should not be used. Screening of oversized materials will be necessary to reuse the on-site material as structural fill.

Import soils should have no particles greater than 3 inches in maximum dimension, no less than 70 percent of the particles passing the No. 4 sieve, no more than 25 percent of particles passing the No. 200 sieve, and a Plasticity Index (PI) less than 5. The contractor should provide documentation that all imported soil is free of hazardous materials, including petroleum or petroleum byproducts, chemicals and harmful minerals. Test results with the geotechnical and analytical properties of the proposed import material should be provided to Costco for approval prior to transportation and use on site.

Fill soils should be compacted to at least 95 percent of the maximum dry unit weight (ASTM D1557) in accordance with the Costco Wholesale Development Requirements (CWDRs). Fill soils should be compacted to moisture contents between -2 and +1 percent of the optimum moisture content during compaction. If both compaction and moisture content criteria are not

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

within the specified tolerances, the fill should not be accepted, and the contractor should rework the material until the fill is placed within the specified tolerances.

Processing may require ripping the material, disking to break up clumps, and blending to attain uniform moisture contents necessary for compaction. Utility trench backfill should be mechanically compacted. Flooding should not be permitted. Table 7 presents structural fill placement and compaction criteria.

TABLE 7
STRUCTURAL FILL PLACEMENT AND COMPACTION CRITERIA

Fill Location/Use	Material Type	Relative Compaction[1] (ASTM D1557)	Moisture Content Range	Minimum Compaction Testing Frequency Per Lift
Aggregate base for pavements and concrete slabs	Aggregate Base	At least 95 percent	-2 to +2% of optimum	10,000 Square Feet
Structural Areas (Warehouse Building Pad and Fuel Facility Canopy)	On-site Soils or Imported Material	At least 95 percent	-2 to +1% of optimum	10,000 Square Feet
Subgrade for Pavements, Sidewalks and Other Flatwork Areas	On-site Soils or Imported Material	At least 95 percent	-2 to +1% of optimum	15,000 Square Feet
Retaining Wall backfill	Imported Material	At least 92 percent	-2 to +1% of optimum	1,000 Square Feet
Utility trenches backfill	On-site Soils or Imported Material	At least 95 percent	-2 to +1% of optimum	150 Linear Feet
Lawns or Unimproved areas	On-site Soils or Imported Material	At least 90 percent	At least optimum	20,000 Square Feet

Note: [1] Where two or more compaction specifications coincide, the more stringent specification should be utilized.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

5.2.6 Excavation and Rippability

Thirty eight (38) borings drilled as part of our field exploration were advanced using hollow-stem-auger drilling equipment. Drilling effort was hard in the soils with significant gravel and cobble sized rock fragments and refusal on granitic bedrock was encountered in 18 of the borings. Ten (10) test pits were excavated to depths of about 8 to 15 feet using a John Deere 160 backhoe equipped with a 24-inch wide bucket. Bedrock was encountered in all of the test pits and refusal was encountered in five of the test pits. Bedrock encountered across the site includes variably fractured and weathered granite. The results of the seismic refraction survey (see Appendix C) indicate variability in depth to bedrock across the warehouse and fuel facility areas and a general depth of rippability of approximately 12 feet. The majority of the shallow rock is anticipated to be highly weathered and rippable to marginally rippable but will likely contain areas of less weathered rock that will be very hard and difficult to excavate. Hammering, pre-drilling and hammering, or similar procedures are anticipated to be required in such hard zones of the rock where excavation equipment meets with refusal. Blasting may be an option. It has been our experience that mechanical removal by hammering may be difficult in some cases and require pre-drilling to help break up the rock where blasting is not feasible. Rock trenchers (rock saws and belted trenchers) or large excavators equipped with rock buckets have generally been able to excavate within the highly weathered rock units but will likely not be able to remove very hard and less weathered zones of rock. Rock trenchers have the added advantage of pulverizing the soil and rock units such that they are generally suitable for trench backfill. This generally eliminates the need to screen out or crush rock fragments for use as trench backfill. It is also likely that deeper onsite excavations may generate abundant boulders. The contractor should consider the difficult excavation conditions to be encountered across a majority of the site when selecting construction equipment.

5.2.7 Temporary Excavations

For planning purposes, we estimate that temporary slopes up to 10 feet in height may be sloped back at an inclination of about 1.5:1 (horizontal to vertical). Sloughing and/or raveling of sandy slopes should be anticipated as they dry out. Where space for sloped embankments is not available, shoring will be necessary. Actual sloping requirements should be determined by contractor's competent person. A contingency should be considered in the event that flatter slopes and/or shoring are required.

If signs of slope instability are observed, the inclination recommended above should be decreased until stability of the slope is obtained. In addition, at the first signs of slope instability, the

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

geotechnical engineer should be contacted. Where space for sloped embankments is not available, shoring will be necessary. We recommend the design team and contractor consult with Kleinfelder during the bid development stage. The amount of room available for sloping excavations may dictate whether shoring should be included. Excavations within a 1:1 plane extending downward from a horizontal distance of 2 feet beyond the bottom outer edge of existing improvements should not be attempted without bracing and/or underpinning the improvements. Personnel from the geotechnical engineer should observe the excavations so that modifications can be made to the excavations, as necessary, based on variations in the encountered soil conditions. All applicable excavation safety requirements and regulations, including OSHA requirements, should be met.

Where sloped excavations are used, tops of the slopes should be barricaded so that vehicles and storage loads do not encroach within a distance equal to the depth of the excavation. Greater setback may be necessary when considering heavy vehicles, such as concrete trucks and cranes. The geotechnical engineer should be advised of such heavy vehicle loadings so that specific setback requirements can be established. If temporary construction slopes are to be maintained during the rainy season, berms are recommended along the tops of the slopes to reduce runoff that may enter the excavation and erode the slope faces.

All trench excavations should be braced and shored in accordance with good construction practice and all applicable safety ordinances and codes. The contractor should be responsible for the structural design and safety of the temporary shoring system, and we recommend that this design be submitted to Kleinfelder for review to check that our recommendations have been incorporated. For planning purposes, the upper on-site soils may be considered a Type C soil, as defined using the current OSHA soil classification.

5.2.8 Oversize Material

Cobble-sized rock fragments were observed during our field investigation and may significantly impact excavations for foundations and utilities in the warehouse pad, fuel facility, and site. Larger rock fragments may also be encountered. The contractor should consider the oversize material to be encountered across a majority of the site when selecting construction equipment. Screening of oversized materials will be necessary to reuse the on-site material as structural fill.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

5.2.9 Trench Backfill

Pipe zone backfill (i.e. material beneath and in the immediate vicinity of the pipe) should consist of imported or on-site sandy soil less than ¾-inch in maximum dimension. Trench zone backfill (i.e., material placed between the pipe zone backfill and finished subgrade) may consist of onsite soil or imported fill that meets the requirements for engineered fill provided above. Due to the coarse particles present in onsite fill material, we recommend that the pipe zone material extend a minimum of 1 foot above the top of the conduit. This will protect the conduit from point loads from individual large particles.

If imported or on-site material is used for trench zone backfill, we recommend it consist of silty sand. In general, gravel should not be used for trench zone backfill due to the potential for soil migration into the relatively large void spaces present in this type of material and water seepage along trenches backfilled with coarse-grained sand and/or gravel.

Recommendations provided above for pipe zone backfill are minimum requirements only. More stringent material specifications may be required to fulfill local building requirements and/or bedding requirements for specific types of pipes. We recommend the project civil engineer develop these material specifications based on planned pipe types, bedding conditions, and other factors beyond the scope of this study.

Trench backfill should be placed and compacted in accordance with recommendations provided for structural fill in Section 5.2.4. Mechanical compaction is recommended; ponding or jetting should not be performed, especially in areas supporting structural loads or beneath concrete slabs supported on grade, pavements, or other improvements.

5.3 UNSTABLE SUBGRADE CONDITIONS

Should grading be performed during or following extended periods of rainfall, the moisture content of the near-surface soils will also be significantly above the optimum moisture content. Additionally, some low lying areas of the site may become ponded with water and stream flow. These conditions could seriously impede grading by causing an unstable subgrade condition. Typical remedial measures include the following:

- Drying: Drying unstable subgrade involves disking or ripping wet subgrade to a depth of approximately 18 to 24 inches and allowing the exposed soil to dry. Multiple passes of the equipment (likely on a daily basis) will be needed because as the surface of the soil dries,

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a crust forms that reduces further evaporation. Frequent disking will help prevent the formation of a crust and will promote drying. This process could take several days to several weeks depending on the material, the depth of ripping, the number of passes, and the weather.

- Removal and Replacement with Crushed Rock and Geotextile Fabric: Unstable subgrade could be overexcavated 12 to 24 inches below existing grade and replaced with ¾- or 1-inch crushed rock underlain by geotextile fabric. The geotextile fabric should consist of a woven geotextile, such as Mirafi 600X or equivalent. The final depth of removal will depend upon the conditions observed in the field once overexcavation begins. The geotextile fabric should be placed in accordance with the manufacturer's recommendations.
- Cement Treatment: Unstable subgrade could be stabilized by mixing the upper 12 to 18 inches of the subgrade with portland cement. For estimating purposes, an application rate of 4 to 6 percent may be used. Final application rates should be determined in the field at the time of construction in consultation with the geotechnical engineer. Cement treatment should be performed by a specialty contractor experienced in this work and should be performed in accordance with Caltrans Standard Specifications. Since cement treatment uses the on-site soil, the expense of importing material can be avoided.

5.4 EXTERIOR FLATWORK

Prior to casting exterior flatwork, the subgrade soils should be prepared, as recommended in Section 5.2.2. The moisture content of the subgrade soils should be maintained around optimum for sandy subgrade soils prior to the placement of any flatwork or fill. Careful control of the water/cement ratio should be performed to avoid shrinkage cracking due to excess water or poor concrete finishing or curing.

5.5 PAVEMENTS

The pavement sections provided above are contingent on the following recommendations being implemented during construction.

- Pavement subgrade should be prepared as recommended in Section 5.2.2.
- Subgrade soils should be in a stable, non-pumping condition at the time the aggregate base materials are placed and compacted.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

- Aggregate base materials should be compacted to at least 95 percent relative compaction (ASTM D1557).
- Asphalt paving materials and placement methods should meet current Costco Wholesale Specifications Section 321216.
- Adequate drainage (both surface and subsurface) should be provided such that the subgrade soils and aggregate base materials are not allowed to become wet.

Note that pavement materials and construction must be completed in strict accordance with the Costco's specifications that contain very specific pavement material (asphalt, aggregate and concrete) criteria and construction practices to be used (compaction and material sampling). The general contractor and pavement construction subcontractor should be aware that asphalt and concrete mix designs must be submitted to the design architect and Kleinfelder at least 45 days prior to the scheduled production and laydown for review and approval.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

6 ADDITIONAL SERVICES

6.1 PLANS AND SPECIFICATIONS REVIEW

We recommend Kleinfelder perform a review of geotechnical related portions of the project plans and specifications before they are finalized to see that geotechnical recommendations have been properly interpreted and implemented during design. If we are not accorded the privilege of performing this review, we can assume no responsibility for misinterpretation of our recommendations.

6.2 CONSTRUCTION OBSERVATION AND TESTING

The construction process is an integral design component with respect to the geotechnical aspects of a project. Because geotechnical engineering is an inexact science due to the variability of natural processes, and because we sample only a limited portion of the soils affecting the performance of the proposed structure, unanticipated or changed conditions can be encountered during grading. Proper geotechnical observation and testing during construction are imperative to allow the geotechnical engineer the opportunity to verify assumptions made during the design process. Therefore, we recommend that Kleinfelder be retained during the construction of the proposed improvements to observe compliance with the design concepts and geotechnical recommendations, and to allow design changes in the event that subsurface conditions or methods of construction differ from those assumed while completing this study.

Our services are typically needed at the following stages of grading:

- After demolition and grubbing;
- During grading;
- After the overexcavation, but prior to subgrade preparation;
- During utility trench backfill;
- During base placement and site paving; and
- After excavation for foundations.

KLEINFELDER 40 Clark Street, Suite J, Salinas, CA 93901 **p** | 831.755.7900 **f** | 831.755.7909

7 LIMITATIONS

This geotechnical study has been prepared for the exclusive use of Costco Wholesale and their agents for specific application to the proposed Costco Wholesale Warehouse (CW# 16-0132) located southeast of the intersection of Sierra College Boulevard and Brace Road in Loomis, California. The findings, conclusions and recommendations presented in this report were prepared in accordance with generally accepted geotechnical engineering practice. No other warranty, express or implied, is made.

The scope of services was limited to a background data review and the field exploration described in Section 1.2. It should be recognized that definition and evaluation of subsurface conditions are difficult. Judgments leading to conclusions and recommendations are generally made with incomplete knowledge of the subsurface conditions present due to the limitations of data from field studies. The conclusions of this assessment are based on our field exploration and laboratory testing programs, and engineering analyses.

Kleinfelder offers various levels of investigative and engineering services to suit the varying needs of different clients. Although risk can never be eliminated, more detailed and extensive studies yield more information, which may help understand and manage the level of risk. Since detailed study and analysis involves greater expense, our clients participate in determining levels of service, which provide information for their purposes at acceptable levels of risk. The client and key members of the design team should discuss the issues covered in this report with Kleinfelder, so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk and expectations for future performance and maintenance.

Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory tests, and our present knowledge of the proposed construction. It is possible that soil or groundwater conditions could vary between or beyond the points explored. If soil or groundwater conditions are encountered during construction that differ from those described herein, the client is responsible for ensuring that Kleinfelder is notified immediately so that we may reevaluate the recommendations of this report. If the scope of the proposed construction, including the estimated Traffic Index or locations of the improvements, changes from that described in this report, the conclusions and recommendations contained in this report are not considered valid until the changes are reviewed, and the conclusions of this report are modified or approved in writing, by Kleinfelder.

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The scope of services for this subsurface exploration and geotechnical report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site.

Kleinfelder cannot be responsible for interpretation by others of this report or the conditions encountered in the field. Kleinfelder must be retained so that all geotechnical aspects of construction will be monitored on a full-time basis by a representative from Kleinfelder, including site preparation, preparation of foundations, and placement of engineered fill and trench backfill. These services provide Kleinfelder the opportunity to observe the actual soil and groundwater conditions encountered during construction and to evaluate the applicability of the recommendations presented in this report to the site conditions. If Kleinfelder is not retained to provide these services, we will cease to be the engineer of record for this project and will assume no responsibility for any potential claim during or after construction on this project. If changed site conditions affect the recommendations presented herein, Kleinfelder must also be retained to perform a supplemental e valuation and to issue a revision to our original report.

This report, and any future addenda or reports regarding this site, may be made available to bidders to supply them with only the data contained in the report regarding subsurface conditions and laboratory test results at the point and time noted. Bidders may not rely on interpretations, opinion, recommendations, or conclusions contained in the report. Because of the limited nature of any subsurface study, the contractor may encounter conditions during construction which differ from those presented in this report. In such event, the contractor should promptly notify the owner so that Kleinfelder's geotechnical engineer can be contacted to confirm those conditions. We recommend the contractor describe the nature and extent of the differing conditions in writing and that the construction contract include provisions for dealing with differing conditions. Contingency funds should be reserved for potential problems during earthwork and foundation construction.

This report may be used only by the client and only for the purposes stated, within a reasonable time from its issuance, but in no event later than one year from the date of the report. Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any party, other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of this report and the nature of the new project, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party

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and the client agrees to defend, indemnify, and hold harmless Kleinfelder from any claims or liability associated with such unauthorized use or non-compliance.

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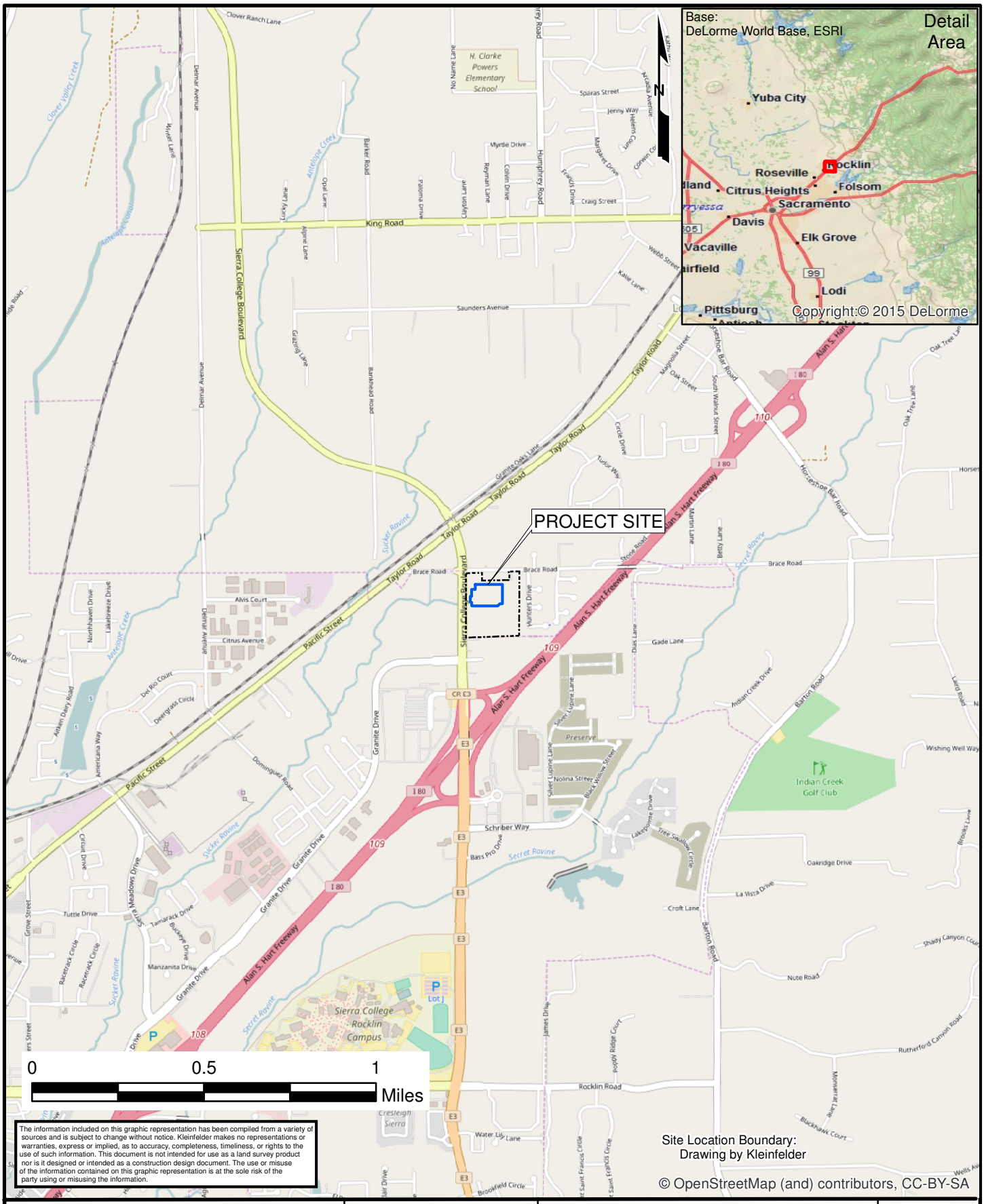
Figures



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DRAWN:	3/15/2017
DRAWN BY:	D. Ross
CHECKED BY:	B. Money
FILE NAME:	20173273_SLM.mxd

SITE LOCATION MAP

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
1

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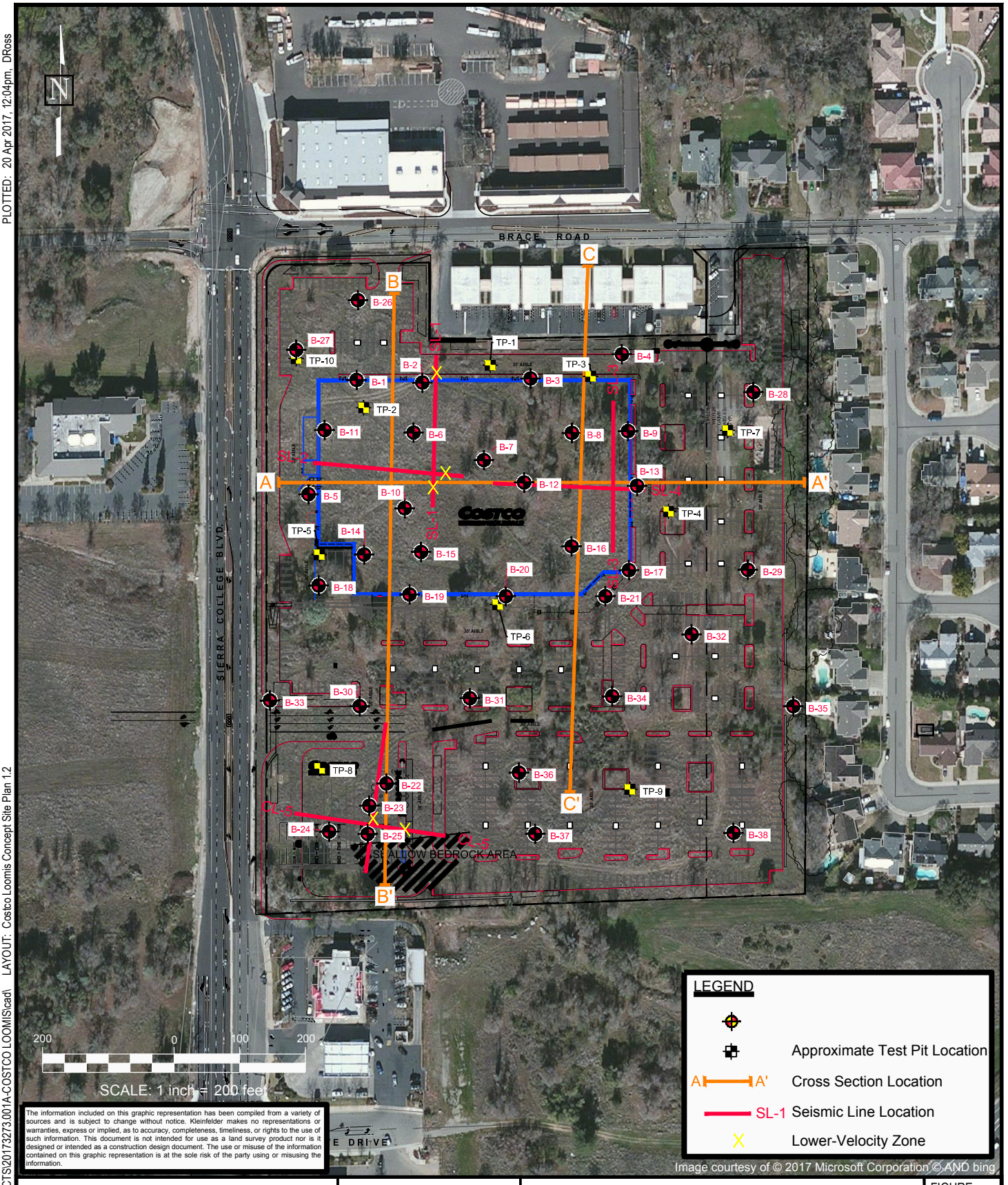

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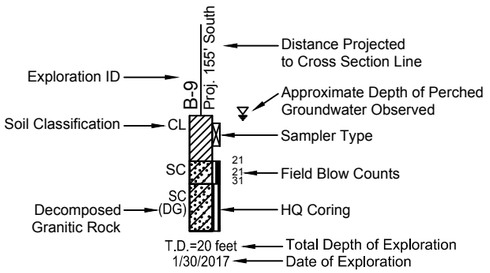
PROJECT NO.	20173273
DRAWN:	04/20/2017
DRAWN BY:	D. Ross
CHECKED BY:	B. Money
FILE NAME:	20173273_2b.dwg

EXPLORATION LOCATION MAP

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

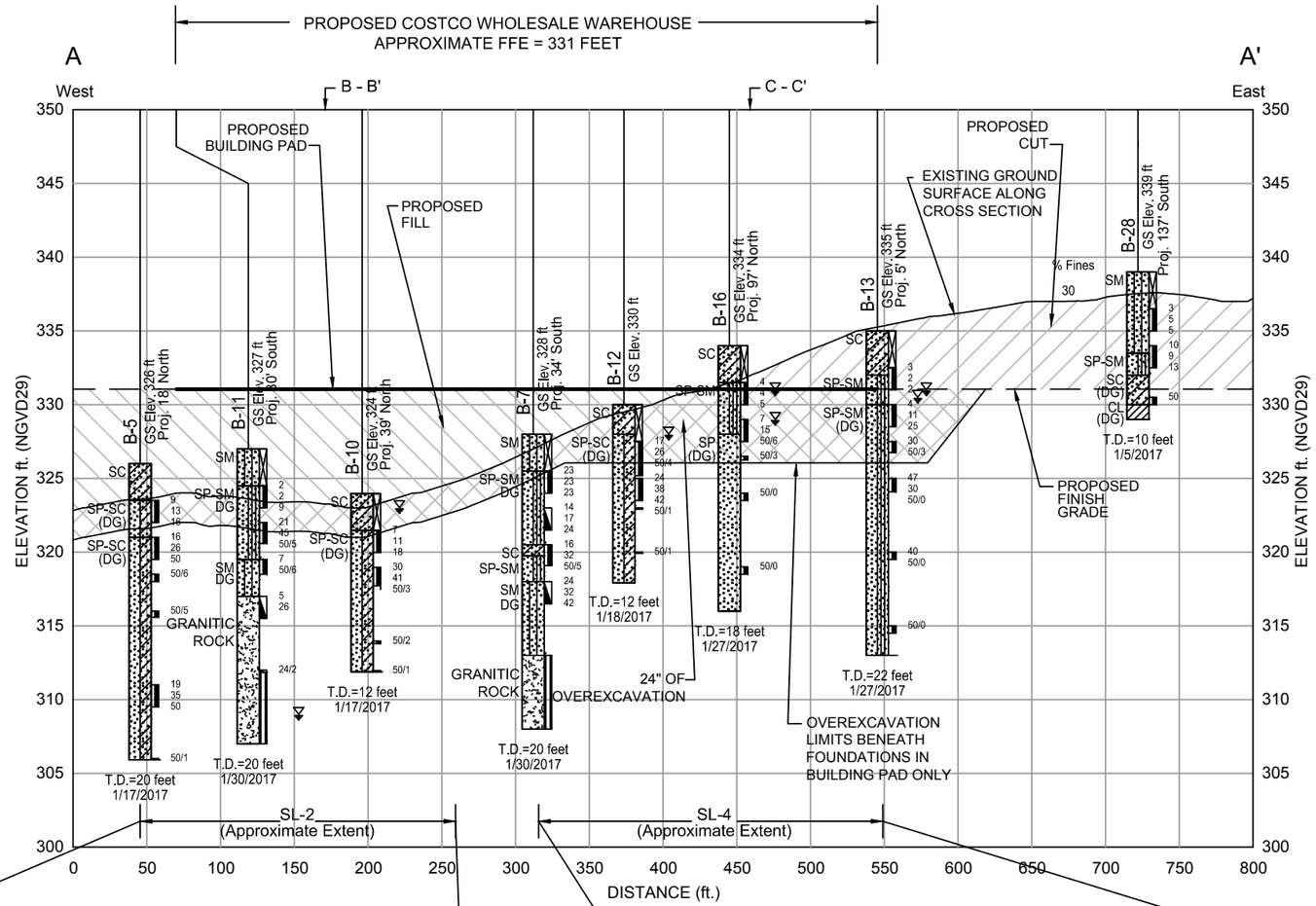
FIGURE
2

EXPLANATION



Notes:

1. Refer to Appendix A for detailed exploration descriptions.
2. Boring elevations approximated from Preliminary Costco Grading Plan prepared by Kier & Wright, dated 3/06/17.



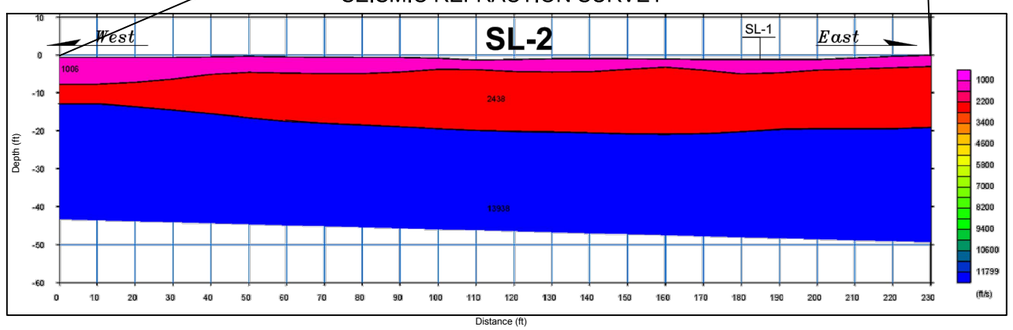
Notes:

1. Spread footings shall be overexcavated to a depth of at least 2 feet below existing grade, 3 feet below the bottom of the footings , or 3 feet below the bottom of the floor slabs, whichever is deeper.
2. Warehouse building slab shall be underlain by at least 6 inches of aggregate base materials supported on at least 6 inches of engineered fill.

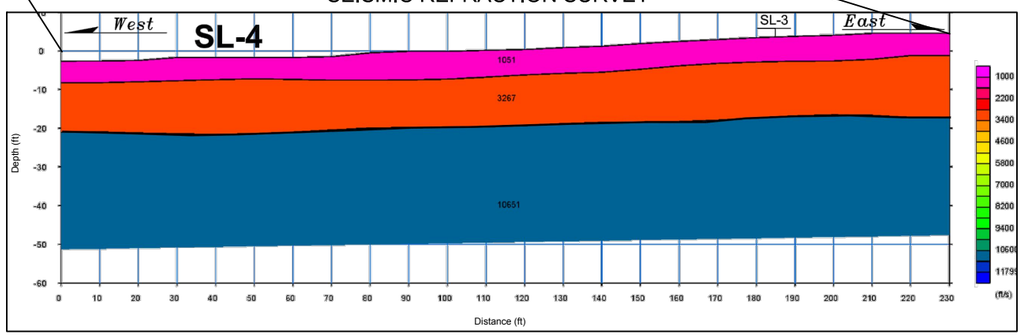
LEGEND

- Proposed Fill
- Proposed Cut
- 24" of over-excavation

SEISMIC REFRACTION SURVEY



SEISMIC REFRACTION SURVEY



APPROXIMATE VERTICAL SCALE: 1 inch = 10 feet

APPROXIMATE HORIZONTAL SCALE: 1 inch = 100 feet

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PROJECT NO.	20173273.001A
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CROSS SECTION A-A'

Proposed Costco Wholesale Warehouse
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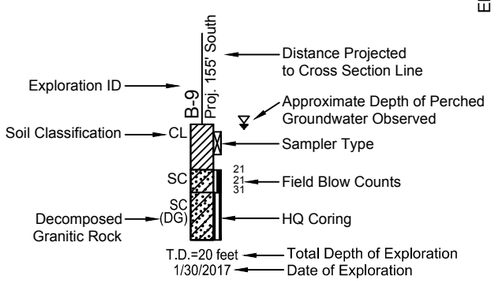
Loomis, California
CW# 16-0132

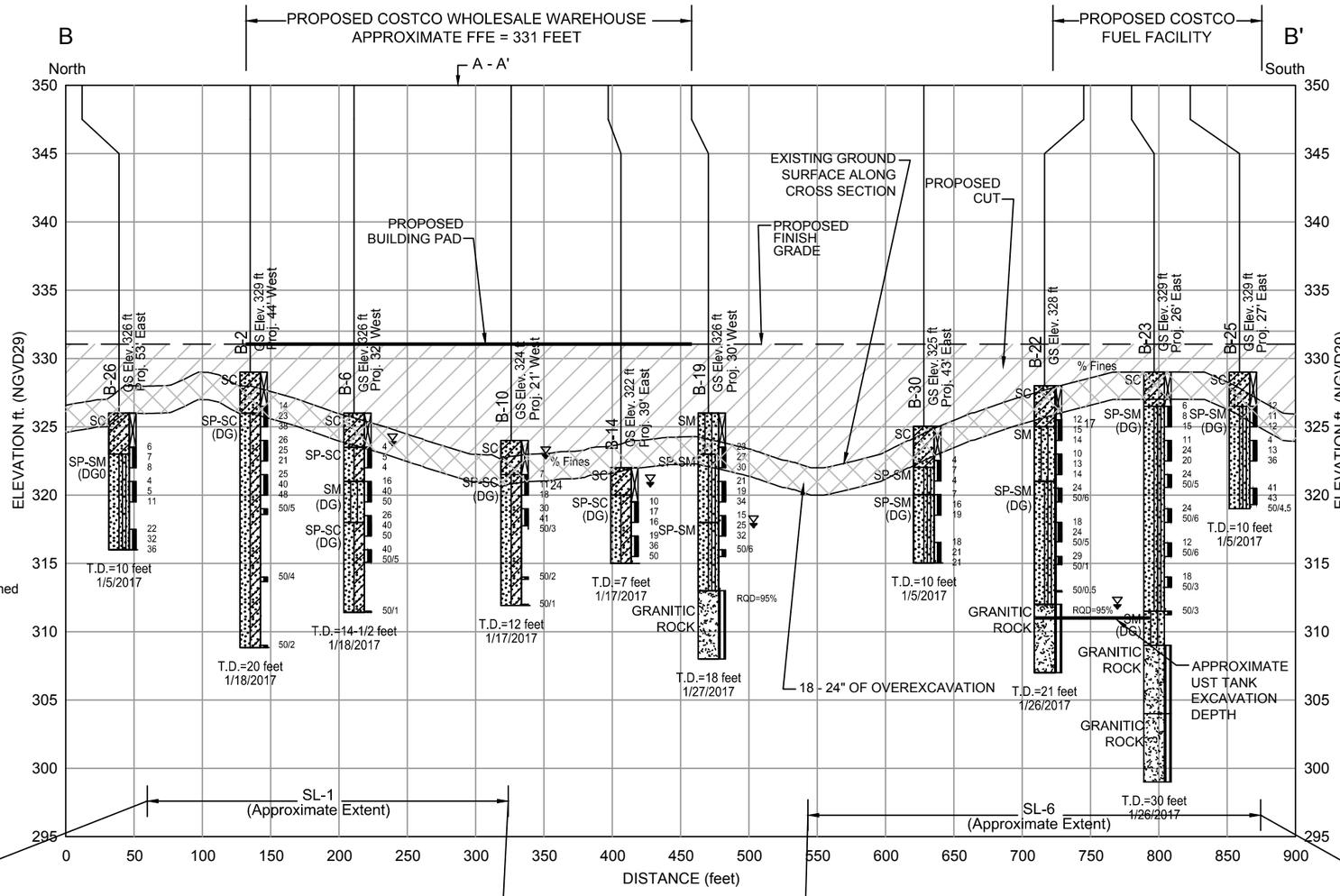
FIGURE
3

EXPLANATION



Notes:

1. Refer to Appendix A for detailed exploration descriptions.
2. Boring elevations approximated from Preliminary Costco Grading Plan prepared by Kier & Wright, dated 3/06/17.



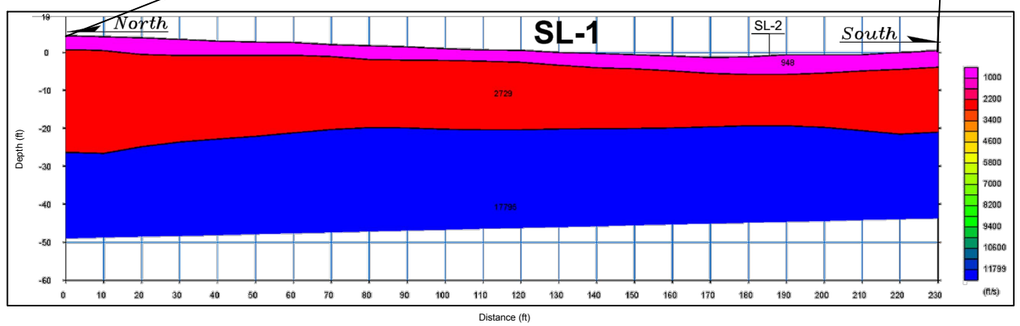
Notes:

1. Spread footings shall be overexcavated to a depth of at least 2 feet below existing grade, 3 feet below the bottom of the footings , or 3 feet below the bottom of the floor slabs, whichever is deeper.
2. Warehouse building slab shall be underlain by at least 6 inches of aggregate base materials supported on at least 6 inches of engineered fill.

LEGEND

- Proposed Fill
- Proposed Cut
- 24" of over-excavation

SEISMIC REFRACTION SURVEY



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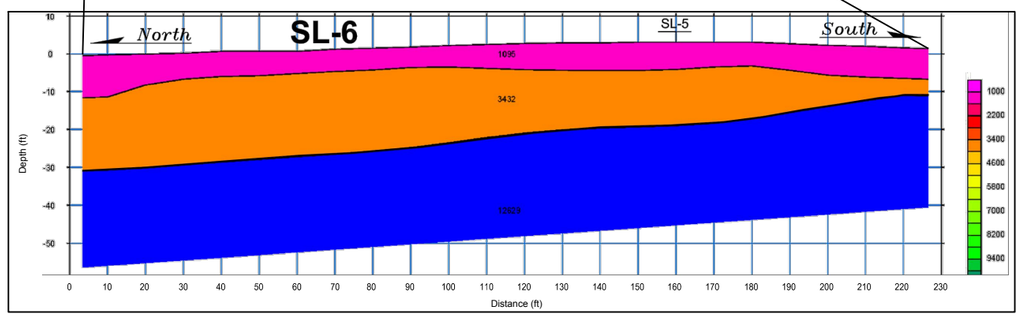

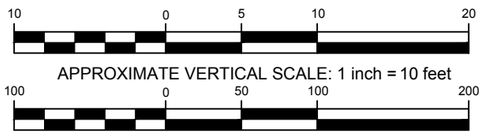

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PROJECT NO.	20173273.001A
DRAWN:	03/21/2017
DRAWN BY:	D. Ross
CHECKED BY:	B. Money
FILE NAME:	SECTIONS.dwg

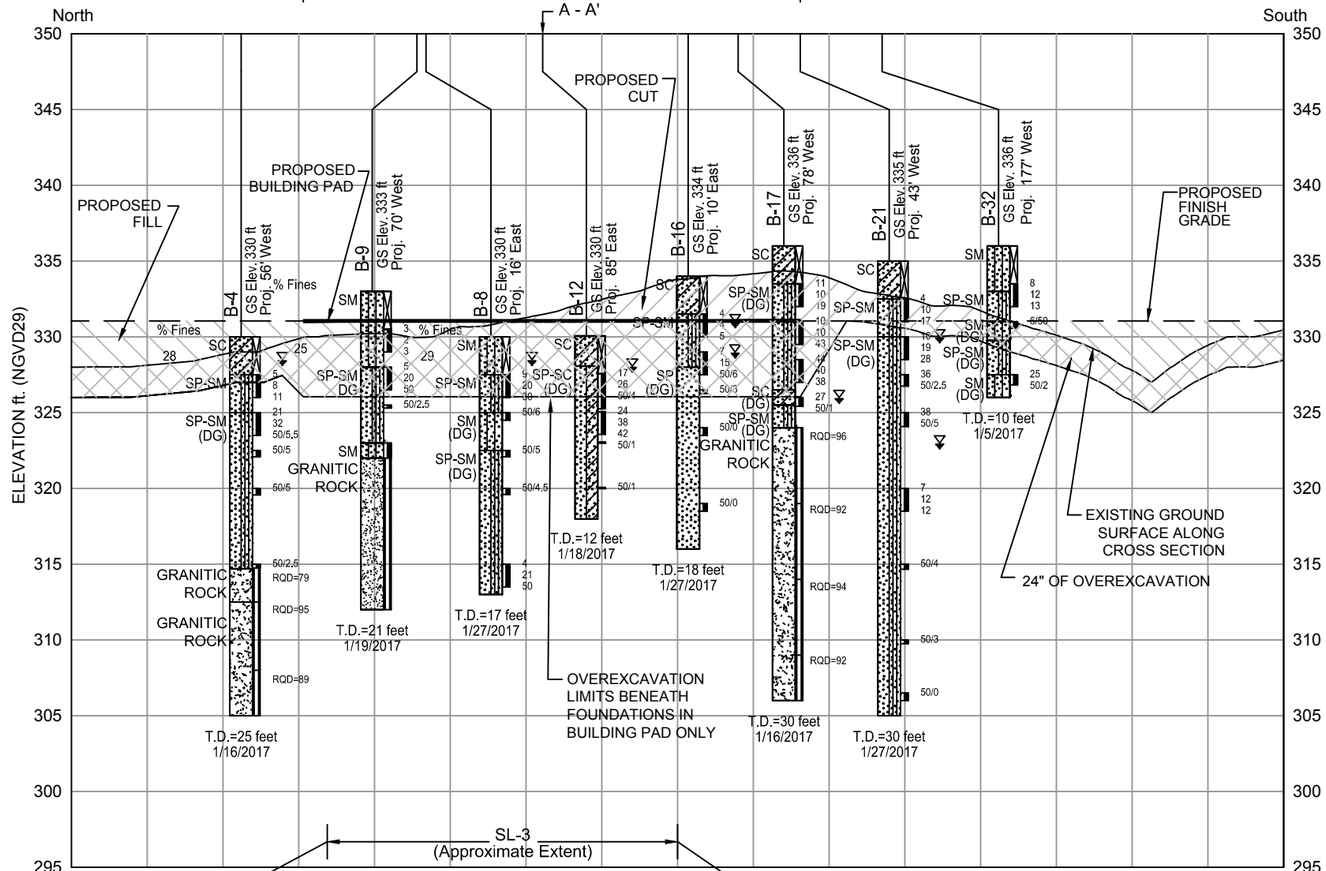
CROSS SECTION B-B'

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
4

PROPOSED COSTCO WHOLESALE WAREHOUSE
APPROXIMATE FFE = 331 FEET

C — North — A - A' — South — C'



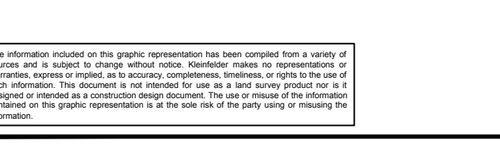
Notes:

1. Spread footings shall be overexcavated to a depth of at least 2 feet below existing grade, 3 feet below the bottom of the footings , or 3 feet below the bottom of the floor slabs, whichever is deeper.
2. Warehouse building slab shall be underlain by at least 6 inches of aggregate base materials supported on at least 6 inches of engineered fill.

LEGEND

- Proposed Fill
- Proposed Cut
- 24" of over-excavation

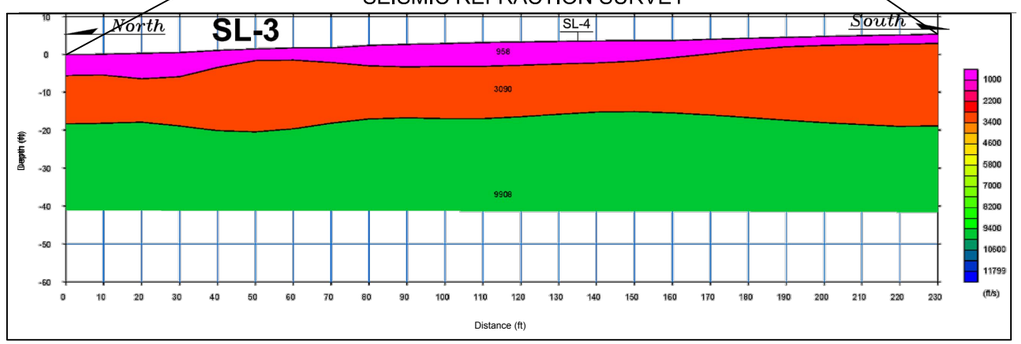
EXPLANATION



Notes:

1. Refer to Appendix A for detailed exploration descriptions.
2. Boring elevations approximated from Preliminary Costco Grading Plan prepared by Kier & Wright, dated 3/06/17.

SEISMIC REFRACTION SURVEY



APPROXIMATE VERTICAL SCALE: 1 inch = 10 feet

APPROXIMATE HORIZONTAL SCALE: 1 inch = 100 feet

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PROJECT NO.	20173273.001A
DRAWN:	03/21/2017
DRAWN BY:	D. Ross
CHECKED BY:	B. Money
FILE NAME:	SECTIONS.dwg

CROSS SECTION C-C'

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
5

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Appendix A

APPENDIX A
FIELD EXPLORATIONS

APPENDIX A
FIELD EXPLORATIONS

GENERAL

Subsurface conditions at the site were explored by drilling 38 borings and excavating 10 test pits. The borings were drilled by Taber Drilling of West Sacramento, California using a CME-55 track-mounted, hollow-stem auger drilling and HQ-3 coring equipment to depths between approximately 7 to 30 feet below the existing ground surface (bgs) in the warehouse building area; approximately 10 feet bgs in the parking and drive areas; and between approximately 10 and 30 feet bgs in the fuel facility area. Seventeen of the borings (Borings B-1, B-4, B-6 through B-10, B-12 through B-19, B-22, and B-23) were terminated short of their planned depth due to practical auger refusal on bedrock. Eight of these borings that encountered refusal were cored to a depth of at least 4 feet into the bedrock (Borings B-4, B-7, B-9, B-17 through B-19, B-22, and B-23). The test pits were excavated by RAH Environmental of Rocklin, California using a tire-mounted backhoe (John Deere 160). Ten test pits were excavated to depths ranging from approximately 8 feet to 15 feet bgs. Five of these test pits were terminated short of their planned depth due to practical refusal on bedrock (Test Pits TP-2, TP-3, TP-7, TP-9, and TP-10). The approximate locations of the borings and test pits are presented on Figure 2. Elevations shown on the boring logs were estimated from the Preliminary Grading and Drainage Plan prepared by Kier and Wright (K&W No. A16658, Print date 3/06/2017).

The borings were drilled using track-mounted hollow-stem-auger drilling and HQ-3 rock coring equipment to depths between approximately 7 and 30 feet below the existing ground surface (bgs) in the warehouse building area; approximately 10 feet bgs in the parking and drive areas; and between approximately 10 and 30 feet bgs in the fuel facility area.

Prior to commencement of the fieldwork, Underground Service Alert (USA) was notified to identify potential conflicts with subsurface structures. A private utility locator was also subcontracted to scan for existing utilities at each of the proposed exploration locations.

The boring and test pit logs are presented as Figures A-4 through A-51. An explanation to the log is presented as Figures A-1 and A-2 and a Rock Description Key is provided as Figure A-3. The Boring/Test Pit Log describes the earth materials encountered, samples obtained and show field and laboratory tests performed. The log also shows the location, boring/test pit number, drilling/excavation date and the name of the drilling/excavation subcontractor. The borings and test pits were logged by a Kleinfelder engineer or geologist using the Unified Soil Classification

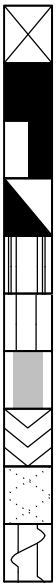
System. The boundaries between soil types shown on the logs are approximate because the transition between different soil layers may be gradual. Bulk and drive samples of selected earth materials were obtained from the borings and test pits.

A California sampler was used to obtain drive samples of the soil encountered. This sampler consists of a 3.0-inch O.D., 2.5-inch I.D. split barrel shaft that is driven a total of 18-inches into the soil at the bottom of the boring. The soil was retained in 6-inch brass tubes for laboratory testing. An additional 2 inches of soil from each drive remained in the cutting shoe and was usually discarded after visually classifying the soil. The sampler was driven using a 140-pound hammer falling 30 inches. The total number of blows required to drive the sampler the final 12 inches is termed blow count and is recorded on the Log of Boring. In some borings rock coring was performed when refusal was encountered above the target depth. This coring was completed using HQ-3 rock coring equipment and rock cores were collected, placed in cardboard core boxes, and transported to the Kleinfelder Sacramento laboratory.

The procedures we employed in the field are generally consistent with those described in ASTM Standard Test Method D1586.

Bulk and grab samples of the near-surface soils were directly retrieved from the auger cuttings from the borings and the excavated material in the test pits.

SAMPLER AND DRILLING METHOD GRAPHICS



- BULK / GRAB / BAG SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 or 2-1/2 in. (50.8 or 63.5 mm.) outer diameter)
- CALIFORNIA SAMPLER (3 in. (76.2 mm.) outer diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)
- HQ CORE SAMPLE (2.500 in. (63.5 mm.) core diameter)
- SHELBY TUBE SAMPLER
- PUSH TYPE SAMPLER
- SONIC CONTINUOUS SAMPLER
- HAND AUGER
- AUGER CUTTINGS

GROUND WATER GRAPHICS

- WATER LEVEL (level where first observed)
- WATER LEVEL (level after exploration completion)
- WATER LEVEL (additional levels after exploration)
- OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS
WOH - Weight of Hammer
WOR - Weight of Rod

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	**GRAVELS** (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu≥4 and 1≤Cc≤3		**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			Cu<4 and/ or 1>Cc>3		**GP**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH 5% TO 12% FINES	Cu≥4 and 1≤Cc≤3		**GW-GM**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
			Cu<4 and/ or 1>Cc>3		**GP-GM**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		GRAVELS WITH > 12% FINES			**GM**	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
					GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
					GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu≥6 and 1≤Cc≤3		**SW**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu<6 and/ or 1>Cc>3		**SP**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	Cu≥6 and 1≤Cc≤3		**SW-SM**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
			Cu<6 and/ or 1>Cc>3		**SP-SM**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		SANDS WITH > 12% FINES			**SM**	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
					SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
					SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES

FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)	**ML**	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid Limit greater than 50)	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

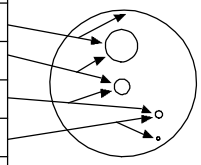
GRAPHICS KEY

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-1

GRAIN SIZE

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles		3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse	3/4 -3 in. (19 - 76.2 mm.)	3/4 -3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine	#4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine	#200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



SECONDARY CONSTITUENT

	AMOUNT	
Term of Use	Secondary Constituent is Fine Grained	Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	≥5 to <15%	≥15 to <30%
Modifier	≥15%	≥30%

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	SPT - N_{60} (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q_u)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed.
Soft	2 - 4	0.25≤ PP <0.5	500 - 1000	Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure.
Medium Stiff	4 - 8	0.5≤ PP <1	1000 - 2000	Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure.
Stiff	8 - 15	1≤ PP <2	2000 - 4000	Can be imprinted with considerable pressure from thumb.
Very Stiff	15 - 30	2≤ PP <4	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail.
Hard	>30	4≤ PP	>8000	Thumbnail will not indent soil.

FROM TERZAGHI AND PECK, 1948; LAMBE AND WHITMAN, 1969; FHWA, 2002; AND ASTM D2488

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N_{60} (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

FROM TERZAGHI AND PECK, 1948

PLASTICITY

DESCRIPTION	LL	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm.) thread cannot be rolled at any water content.
Low (L)	< 30	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	30 - 50	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit.
High (H)	> 50	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit.

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness.
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness.

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

SOIL DESCRIPTION KEY

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE

A-2

INFILLING TYPE

NAME	ABBR	NAME	ABBR
Albite	Al	Muscovite	Mus
Apatite	Ap	None	No
Biotite	Bi	Pyrite	Py
Clay	Cl	Quartz	Qz
Calcite	Ca	Sand	Sd
Chlorite	Ch	Sericite	Ser
Epidote	Ep	Silt	Si
Iron Oxide	Fe	Talc	Ta
Manganese	Mn	Unknown	Uk

DENSITY/SPACING OF DISCONTINUITIES

DESCRIPTION	SPACING CRITERIA
Unfractured	>6 ft. (>1.83 meters)
Slightly Fractured	2 - 6 ft. (0.061 - 1.83 meters)
Moderately Fractured	8 in - 2 ft. (203.20 - 609.60 mm)
Highly Fractured	2 - 8 in (50.80 - 203.30 mm)
Intensely Fractured	<2 in (<50.80 mm)

ADDITIONAL TEXTURAL ADJECTIVES

DESCRIPTION	RECOGNITION
Pit (Pitted)	Pinhole to 0.03 ft. (3/8 in.) (>1 to 10 mm.) openings
Vug (Vuggy)	Small openings (usually lined with crystals) ranging in diameter from 0.03 ft. (3/8 in.) to 0.33 ft. (4 in.) (10 to 100 mm.)
Cavity	An opening larger than 0.33 ft. (4 in.) (100 mm.), size descriptions are required, and adjectives such as small, large, etc., may be used
Honeycombed	If numerous enough that only thin walls separate individual pits or vugs, this term further describes the preceding nomenclature to indicate cell-like form.
Vesicle (Vesicular)	Small openings in volcanic rocks of variable shape and size formed by entrapped gas bubbles during solidification.

ADDITIONAL TEXTURAL ADJECTIVES

DESCRIPTION	CRITERIA
Unweathered	No evidence of chemical / mechanical alternation; rings with hammer blow.
Slightly Weathered	Slight discoloration on surface; slight alteration along discontinuities; <10% rock volume altered.
Moderately Weathered	Discoloring evident; surface pitted and alteration penetration well below surface; Weathering "halos" evident; 10-50% rock altered.
Highly Weathered	Entire mass discolored; Alteration pervading most rock, some slight weathering pockets; some minerals may be leached out.
Decomposed	Rock reduced to soil with relic rock texture/structure; Generally molded and crumbled by hand.

RELATIVE HARDNESS / STRENGTH DESCRIPTIONS

GRADE		UCS (Mpa)	FIELD TEST
R0	Extremely Weak	0.25 - 1.0	Indented by thumbnail
R1	Very Weak	1.0 - 5.0	Crumbles under firm blows of geological hammer, can be peeled by a pocket knife.
R2	Weak	5.0 - 25	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.
R3	Medium Strong	25 - 50	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of a geological hammer.
R4	Strong	50 - 100	Specimen requires more than one blow of geological hammer to fracture it.
R5	Very Strong	100 - 250	Specimen requires many blows of geological hammer to fracture it.
R6	Extremely Strong	> 250	Specimen can only be chipped with a geological hammer.

ROCK QUALITY DESIGNATION (RQD)

DESCRIPTION	RQD (%)
Very Poor	0 - 25
Poor	25 - 50
Fair	50 - 75
Good	75 - 90
Excellent	90 - 100

APERTURE

DESCRIPTION	CRITERIA [in (mm)]
Tight	<0.04 (<1)
Open	0.04 - 0.20 (1 - 5)
Wide	>0.20 (>5)

BEDDING CHARACTERISTICS

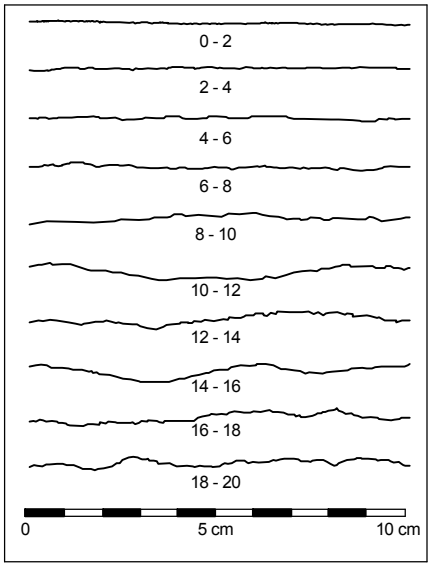
DESCRIPTION	Thickness [in (mm)]
Very Thick Bedded	>36 (>915)
Thick Bedded	12 - 36 (305 - 915)
Moderately Bedded	4 - 12 (102 - 305)
Thin Bedded	1 - 4 (25 - 102)
Very Thin Bedded	0.4 - 1 (10 - 25)
Laminated	0.1 - 0.4 (2.5 - 10)
Thinly Laminated	<0.1 (<2.5)

Bedding Planes — Planes dividing the individual layers, beds, or stratigraphy of rocks.

Joint — Fracture in rock, generally more or less vertical or traverse to bedding.

Seam — Applies to bedding plane with unspecified degree of weather.

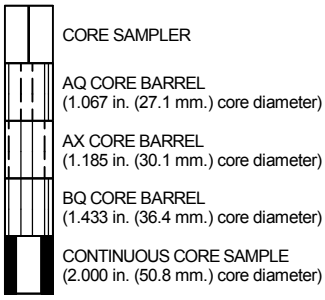
JOINT ROUGHNESS COEFFICIENT (JRC)

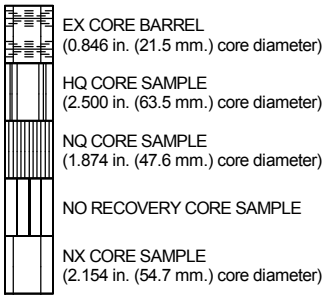


From Barton and Choubey, 1977

RQD — Rock-quality designation (RQD) Rough measure of the degree of jointing or fracture in a rock mass, measured as a percentage of the drill core in lengths of 10 cm. or more.

CORE SAMPLER TYPE GRAPHICS





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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

ROCK DESCRIPTION KEY

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE

A-3

Date Begin - End:	1/26/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-1**	
Logged By:	A. Tyler	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Clear	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057692.3755 (ft)
Easting: 6788165.0600 (ft)
Approximate Ground Surface Elevation (ft.): 328.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, medium dense, fine to medium grained, trace gravel	1				SC				29	26	9	
325			**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown to yellowish brown, moist, medium dense, fine to coarse grained	1c 1b		BC=13 20 20	18"								
	5			2c 2b		BC=13 16 13	18"		9.8						
320			**Silty SAND (SM)**: brown, moist, very dense, fine to medium grained, trace gravel (Decomposed Granitic Rock)	3c 3b		BC=6 50/6"	12"								
	10		**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown, moist, very dense, fine to coarse grained, angular to subangular gravel sized rock fragments (Decomposed Granitic Rock)	4c 4b		BC=31 36 36	18"								
315															
	15		The boring was terminated because of practical auger refusal ( ) at approximately 14 ft. below ground surface. The boring was backfilled with neat cement grout on January 26, 2017.												
310															
	20														
305															
	25														
300															
	30														
295															

LABORATORY RESULTS

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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DATE:	1/31/2017
REVISED:	3/21/2017

BORING LOG B-1

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-4

PAGE: 1 of 1

BORING LOG B-2

Date Begin - End:	1/18/2017	**Drilling Company:**	Taber Drilling		
Logged By:	B. Campbell	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Rainy	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057688.4470 (ft)
Easting: 6788208.2289 (ft)
Approximate Ground Surface Elevation (ft.): 329.00
Surface Condition: Weeds/soil

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, fine to medium grained, low plasticity fines												
325	5		**Poorly graded SAND with Clay (SP-SC)**: light brown, white and black, moist, dense, fine to coarse grained sand (Decomposed Granitic Rock)	1a		BC=14 23 38			7.1	133.1					
				2a		BC=26 25 21									
320	10		very dense	3a		BC=25 40 48									
				4a		BC=50/5"									
315	15			5a		BC=50/4"									
310	20			6a		BC=50/2"									
305	25														
300	30														
295															

The boring was terminated at approximately 20 ft. below ground surface. The boring was backfilled with neat cement grout on January 18, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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DATE:	1/25/2017
REVISED:	3/21/2017

BORING LOG B-2

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-5

Date Begin - End: 1/19/2017 **Drilling Company:** Taber Drilling

BORING LOG B-3

Logged By: M. Galouei **Drill Crew:**

Hor.-Vert. Datum: NAD83 - NGVD29 **Drilling Equipment:** CME-55 **Hammer Type - Drop:** 140 lb. Auto - 30 in.

Plunge: -90 degrees **Drilling Method:** Solid Flight Auger

Weather: Rainy **Auger Diameter:** 4 in. O.D.

FIELD EXPLORATION | LABORATORY RESULTS

NAD83 CA State Planes, Zone II
Northing: 2057694.7444 (ft)
Easting: 6788584.5365 (ft)
Approximate Ground Surface Elevation (ft.): 329.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
329	0		**Silty SAND (SM)**: dark brown, moist, fine to medium grained												
			▽												
325	5		**Poorly graded SAND with Silt (SP-SM)**: light brown, moist, loose, fine to medium grained sand (Decomposed Granitic Rock)	1c 1b		BC=3 3 7	18"		17.6	107.2					
			dense	2c 2b		BC=13 26 40	18"								
320	10			3c 3b		BC=22 39 50/5.5"	14"								
				4c 4b		BC=45 50/2"	9"								
315	15			5c 5b		BC=30 20 50/4"	11"								
310	20			6b		BC=50/5.5"	5"								
305	25														
300	30														
295															

The boring was terminated at approximately 21.5 ft. below ground surface. The boring was backfilled with neat cement grout on January 19, 2017.

GROUNDWATER LEVEL INFORMATION:
▽ Perched groundwater was observed at approximately 2.5 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
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DATE:	1/25/2017
REVISED:	3/21/2017

BORING LOG B-3

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-6

PAGE: 1 of 1

Date Begin - End:	1/16/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-4**	
Logged By:	A. Tyler	**Drill Crew:**	Chad, Sean, Stephen		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Overcast	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION | LABORATORY RESULTS

NAD83 CA State Planes, Zone II
Northing: 2057731.5907 (ft)
Easting: 6788125.0795 (ft)
Approximate Ground Surface Elevation (ft.): 330.00

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): dark brown, moist, fine to medium grained, trace gravel	1								28			
			Poorly graded SAND with Silt (SP-SM): light brown to dark brown, moist, medium dense, fine to coarse grained, trace gravel	1c 1b		BC=5 8 11	18"		13.2						
325	5		**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown, moist, very dense, fine to coarse grained sand, trace biotite minerals, angular to subangular gravel size rock fragments (Decomposed Granitic Rock)	2c 2b		BC=21 32 50/5.5"	18"								
				3b		BC=50/5"	5"								
320	10		light brown to brown	4b		BC=50/5"	5"								
315	15		**GRANITIC ROCK**: brown to gray, fine to medium grained sand, very weak. highly weathered, highly to intensely fractured	5b		BC=50/2.5"	3"								Auger refusal at 15' 3", start coring
				Run 1			79%								RQD=43
			GRANITIC ROCK: gray, medium grained, massive, highly weathered, very weak to weak, moderately to highly fractured	Run 2			95%								RQD=95
310	20		gray to dark gray	Run 3			89%								RQD=81
305	25														
300	30														

The boring was terminated at approximately 25 ft. below ground surface. The boring was backfilled with neat cement grout on January 16, 2017.

GROUNDWATER LEVEL INFORMATION:
▽ Perched groundwater was observed at approximately 1.5 ft. below ground surface during drilling.
▼ Perched groundwater was observed at approximately 1 ft. below ground surface after drilling completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
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DATE:	1/26/2017
REVISED:	3/21/2017

BORING LOG B-4

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-7
PAGE: 1 of 1

Date Begin - End:	1/17/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-5**	
Logged By:	B. Campbell	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Not Available	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION | LABORATORY RESULTS

NAD83 CA State Planes, Zone II
Northing: 2057518.5215 (ft)
Easting: 6788200.8520 (ft)
Approximate Ground Surface Elevation (ft.): 323.00
Surface Condition: Weeds/soil

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
320	0		**Clayey SAND (SC)**: brown, moist, fine to medium grained sand, low plasticity fines												
			Poorly graded SAND with Clay (SP-SC): light brown, white and black, moist, medium dense, fine to coarse grained sand (Decomposed Granitic Rock	1a		BC=9 13 16									
	5		**Poorly graded SAND with Clay (SP-SC)**: light brown, white and black, moist, very dense, fine to coarse grained sand (Decomposed Granitic Rock	2a		BC=16 26 50			9.1						
315				3a		BC=50/6"									
	10			4a		BC=50/5"									
310															
	15			5a		BC=19 35 50									
305															
	20			NR		BC=50/1"									
300															
	25														
295															
	30														
290															

The boring was terminated at approximately 20 ft. below ground surface. The boring was backfilled with neat cement grout on January 17, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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CHECKED BY:	BM
DATE:	1/26/2017
REVISED:	3/21/2017

BORING LOG B-5

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-8

PAGE: 1 of 1

Date Begin - End:	1/18/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-6**	
Logged By:	B. Campbell	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Rainy	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057612.3890 (ft)
Easting: 6788302.3834 (ft)
Approximate Ground Surface Elevation (ft.): 326.00
Surface Condition: Weeds/soil

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)
325	0		**Clayey SAND (SC)**: brown, moist, fine to medium grained				
			Poorly graded SAND with Clay (SP-SC): light brown, wet, loose, fine to coarse grained	1a		BC=4 5 4	
320	5		**Silty SAND (SM)**: light brown, wet, very dense, fine to coarse grained sand (Decomposed Granitic Rock)	2a		BC=16 40 50	
			Poorly graded SAND with Clay (SP-SC): light brown, white and black, wet, very dense, fine to coarse grained sand (Decomposed Granitic Rock)	3a		BC=26 40 50	
315	10			4a		BC=40 50/5"	
310	15			NR		BC=50/1"	
305	20						
300	25						
295	30						

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
	13.9	112.8					

The boring was terminated because of practical auger refusal ( ) at approximately 14.5 ft. below ground surface. The boring was backfilled with neat cement grout on January 18, 2017.

GROUNDWATER LEVEL INFORMATION:
Perched groundwater was observed at approximately 2 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/26/2017
REVISED:	3/21/2017

BORING LOG B-6

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-9

PAGE: 1 of 1

Date Begin - End:	1/30/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-7**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, Sean, Stephen		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057570.3686 (ft)
Easting: 6788276.2369 (ft)
Approximate Ground Surface Elevation (ft.): 326.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
325	0		**Silty SAND (SM)**: dark brown, moist, fine to coarse grained												
			Poorly graded SAND with Silt and Gravel (SP-SM): light brownish gray, moist, very dense, fine to coarse grained (Decomposed Granitic Rock)	1c 1b		BC=23 23 23	16"		8.3						
320	5			2b		BC=14 17 24									
			Clayey SAND (SC): moist, fine to coarse grained, medium plasticity fines	3c		BC=16 32 50/5"	14"								
			Poorly graded SAND with Silt and Gravel (SP-SM): moist, very dense, fine to medium grained (Decomposed Granitic Rock)	3b											
315	10			4b		BC=24 32 42									
			Silty SAND (SM): pale olive, dry, very dense, fine to coarse grained (Decomposed Granitic Rock)												
310	15		**GRANITE**: pale olive, dry, very dense, fine to coarse grained, medium plasticity fines, slightly weathered	Run 1			100%								RQD=39
305	20														
300	25														
295	30														

The boring was terminated at approximately 20 ft. below ground surface. The boring was backfilled with neat cement grout on January 30, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	2/1/2017
REVISED:	3/21/2017

BORING LOG B-7

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-10

PAGE: 1 of 1

Date Begin - End:	1/27/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-8**	
Logged By:	A. Tyler	**Drill Crew:**	Chad, Stephen		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Partly cloudy	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057611.8993 (ft)
Easting: 6788503.9972 (ft)
Approximate Ground Surface Elevation (ft.): 330.00
Surface Condition: Grass

Approx. Elevation (ft)	Depth (ft)	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Silty SAND (SM): brown to dark brown, moist, fine to medium grained, trace gravel	1				SM				29	NP	NP	
		Poorly graded SAND with Silt and Gravel (SP-SM): light brown to brown, wet, dense, fine to coarse grained	1c 1b		BC=9 20 30	18"		9.2	125.3					
325	5	**Silty SAND (SM)**: gray, moist, very dense, fine grained, trace gravel (Decomposed Granitic Rock)	2b		BC=50/6"	3"								
		Poorly graded SAND with Silt and Gravel (SP-SM): light brown to gray, moist, very dense, fine to coarse grained, subangular to angular gravel sized rock fragments (Decomposed Granitic Rock)	3b		BC=50/5"									
320	10		4b		BC=50/4.5"	3"								
315	15		5c 5b		BC=4 21 50	NR								
310	20													
305	25													
300	30													

The boring was terminated because of practical auger refusal ( ) at approximately 17 ft. below ground surface. The boring was backfilled with neat cement grout on January 27, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was observed at approximately 1.5 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/31/2017
REVISED:	3/21/2017

BORING LOG B-8

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-11
PAGE: 1 of 1

Date Begin - End: 1/19/2017 **Drilling Company:** Taber Drilling

BORING LOG B-9

Logged By: M. Galouei **Drill Crew:**

Hor.-Vert. Datum: NAD83 - NGVD29 **Drilling Equipment:** CME-55 **Hammer Type - Drop:** 140 lb. Auto - 30 in.

Plunge: -90 degrees **Drilling Method:** Solid Flight Auger

Weather: Rainy **Auger Diameter:** 4 in. O.D.

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057614.4943 (ft)
Easting: 6788645.8426 (ft)
Approximate Ground Surface Elevation (ft.): 333.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
330	0		**Silty SAND (SM)**: dark brown, moist, fine to coarse grained, non-plastic fines												
			yellowish brown	1c		BC=3	12"								
				1b		2 3			16.6	108.9		25			
	5		**Poorly graded SAND with Silt (SP-SM)**: olive, moist, fine to coarse grained sand (Decomposed Granitic Rock)	2c		BC=5	18"								
				2b		20 50									
325			very dense	3b		BC=50/2.5"	NR								
	10		**Silty SAND (SM)**: light brownish gray, wet, very loose, fine to coarse grained sand (Decomposed Granitic Rock)	4b			NR								
			GRANITIC ROCK: black, white and gray, medium grained, slightly weathered, strong to very strong, slightly fractured, well defined foliation of silica and biotite minerals form dark and light banding, approximately 40° dip	Run 1			87.5%								RQD=80
320	15			Run 2			100%								RQD=73
315	20														
310	25														
305															
300	30														

The boring was terminated at approximately 21 ft. below ground surface. The boring was backfilled with neat cement grout on January 19, 2017.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 2 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

KLEINFELDER
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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/26/2017
REVISED:	3/21/2017

BORING LOG B-9

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-12

PAGE: 1 of 1

Date Begin - End:	1/17/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-10**	
Logged By:	B. Campbell	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Not Available	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057497.0622 (ft)
Easting: 6788258.9676 (ft)
Approximate Ground Surface Elevation (ft.): 324.00
Surface Condition: Weeds/soil

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, fine to medium grained												
320	5		**Poorly graded SAND with Clay (SP-SC)**: light brown, white and black, wet, medium dense, fine to coarse grained (Decomposed Granitic Rock)	1a		BC=7 11 18			11.8						
			very dense	2a		BC=30 41 50/3"									
315	10			NR		BC=50/2"									
				NR		BC=50/1"									
310	15														
305	20														
300	25														
295	30														
290															

The boring was terminated because of practical auger refusal ( ) at approximately 12 ft. below ground surface. The boring was backfilled with neat cement grout on January 17, 2017.

GROUNDWATER LEVEL INFORMATION:
Perched groundwater was observed at approximately 1 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/26/2017
REVISED:	3/21/2017

BORING LOG B-10

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-13

PAGE: 1 of 1

Date Begin - End:	1/30/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-11**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, Sean, Stephen		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057616.1084 (ft)
Easting: 6788256.9070 (ft)
Approximate Ground Surface Elevation (ft.): 326.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
325	0	**Silty SAND (SM)**: light brown, moist, fine to medium grained												
		Poorly graded SAND with Silt and Gravel (SP-SM): olive, moist, loose, fine to medium grained (Decomposed Granitic Rock)	1c 1b		BC=2 2 9	18"		12.6	115.0					
320	5	very dense, (Decomposed Granitic Rock)	2c 2b		BC=21 45 50/5"	17"								
		Silty SAND (SM): light brown, moist, very dense, fine to medium grained (Decomposed Granitic Rock)	3c 3b		BC=7 50/6"	8"								
315	10	**GRANITE**: light brownish gray, dry, medium dense, fine to medium grained, medium plasticity fines	4b		BC=5 26									
310	15	dry to wet	5b		BC=24/2"									Difficult driling, rig shaking, sampler bouncing at 15 ft.
▽														
	20													
305														
	25													
300														
	30													
295														

The boring was terminated at approximately 20 ft. below ground surface. The boring was backfilled with neat cement grout on January 30, 2017.

GROUNDWATER LEVEL INFORMATION:
▽ Perched groundwater was observed at approximately 18 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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BORING LOG B-11

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-14
PAGE: 1 of 1

Date Begin - End: 1/18/2017 **Drilling Company:** Taber Drilling

BORING LOG B-12

Logged By: B. Campbell **Drill Crew:**

Hor.-Vert. Datum: NAD83 - NGVD29 **Drilling Equipment:** CME-55 **Hammer Type - Drop:** 140 lb. Auto - 30 in.

Plunge: -90 degrees **Drilling Method:** Solid Flight Auger

Weather: Rainy **Auger Diameter:** 4 in. O.D.

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057536.4161 (ft)
Easting: 6788183.8187 (ft)
Approximate Ground Surface Elevation (ft.): 330.00
Surface Condition: Weeds/soil

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)
			Clayey SAND (SC): brown, moist, fine to medium grained				
			Poorly graded SAND with Clay (SP-SC): light brown, white and black, wet, very dense, fine to coarse grained (Decomposed Granitic Rock)				
325	5		fine grained	1a		BC=17 26 50/4"	
			fine to coarse grained	2a		BC=24 38 42	
				NR		BC=50/1"	
320	10			NR		BC=50/1"	
315	15						
310	20						
305	25						
300	30						

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks

The boring was terminated because of practical auger refusal ( ) at approximately 12 ft. below ground surface. The boring was backfilled with neat cement grout on January 18, 2017.

GROUNDWATER LEVEL INFORMATION:
Perched groundwater was observed at approximately 2 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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REVISED:	3/21/2017

BORING LOG B-12

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-15

PAGE: 1 of 1

Date Begin - End:	1/27/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-13**	
Logged By:	A. Tyler	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Clear	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057531.2986 (ft)
Easting: 6788343.6995 (ft)
Approximate Ground Surface Elevation (ft.): 335.00
Surface Condition: Grass/weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, fine to medium grained, trace gravel												
			Poorly graded SAND with Silt (SP-SM): light brown to brown, moist, very loose, fine to coarse grained, trace gravel	1c 1b		BC=3 2 2	18"		14.3	113.9					
330	5		**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown, moist, medium dense, fine to coarse grained, angular to subangular gravel sized rock fragments (Decomposed Granitic Rock)	2c 2b		BC=4 11 25	18"								
				3c 3b		BC=30 50/3"	8"								
325	10		very dense	4c 4b		BC=47 30 50/0"	7"								
320	15			5b		BC=40 50/0"	5"								
315	20					BC=50/0"	NR								
310	25														
305	30														

The boring was terminated because of practical auger refusal ( ) at approximately 22 ft. below ground surface. The boring was backfilled with neat cement grout on January 27, 2017.

GROUNDWATER LEVEL INFORMATION:
- Perched groundwater was observed at approximately 4.5 ft. below ground surface during drilling.
- Perched groundwater was observed at approximately 4 ft. below ground surface at the end of drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-13

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-16
PAGE: 1 of 1

Date Begin - End:	1/17/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-14**	
Logged By:	B. Campbell	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Not Available	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057426.6927 (ft)
Easting: 6788267.7422 (ft)
Approximate Ground Surface Elevation (ft.): 322.00
Surface Condition: Weeds/soil

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
320	0		**Clayey SAND (SC)**: brown, wet, fine to medium grained	1								24			
			Poorly graded SAND with Clay (SP-SC): light brown, white and black, wet, medium dense, fine to coarse grained (Decomposed Granitic Rock)	1a		BC=10 17 16			11.8	121.9					
315	5		very dense	2a		BC=19 36 50									
310	10														
305	15														
300	20														
295	25														
290	30														

The boring was terminated because of practical auger refusal ( ) at approximately 7 ft. below ground surface. The boring was backfilled with neat cement grout on January 17, 2017.

GROUNDWATER LEVEL INFORMATION:
Perched groundwater was observed at approximately 1 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-14

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-17

PAGE: 1 of 1

BORING LOG B-15

Date Begin - End:	1/17/2017	**Drilling Company:**	Taber Drilling		
Logged By:	B. Campbell	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Not Available	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057430.6545 (ft)
Easting: 6788330.0907 (ft)
Approximate Ground Surface Elevation (ft.): 326.00
Surface Condition: Weeds/soil

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
325			**Clayey SAND (SC)**: dark brown, moist, fine to medium grained, low plasticity fines	1				SC-SM				31	25	7	
			Poorly graded SAND with Clay (SP-SC): light brown, white and black, moist, medium dense, fine to coarse grained (Decomposed Granitic Rock)	1a		BC=8 16 16			7.8	119.2					
	5		wet												
320			6 inch lens of Clayey SAND (SC)	2a		BC=5 5 19									
			very dense	3a		BC=50/6"									
	10			4a		BC=50/6"									
315															
	15														
310															
	20														
305															
	25														
300															
	30														
295															

The boring was terminated because of practical auger refusal (▲) at approximately 13 ft. below ground surface. The boring was backfilled with neat cement grout on January 17, 2017.

GROUNDWATER LEVEL INFORMATION:
▽ Perched groundwater was observed at approximately 3 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-15

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-18

PAGE: 1 of 1

Date Begin - End:	1/27/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-16**	
Logged By:	A. Tyler	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Clear	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057439.1497 (ft)
Easting: 6788200.0548 (ft)
Approximate Ground Surface Elevation (ft.): 334.00
Surface Condition: Grass/weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, fine to medium grained, trace gravel												
330	5		**Poorly graded SAND with Silt (SP-SM)**: reddish brown, moist, loose, fine to coarse grained, trace gravel	1c 1b		BC=4 4 5			14.0	114.5					
			Poorly graded SAND (SP): light brown to brown, moist, very dense, fine to coarse grained, trace angular to subangular gravel sized rock fragments (Decomposed Granitic Rock)	2c 2b		BC=7 15 50/6"									
				3b		BC=50/3"									
325	10					BC=50/0"	NR								
320	15					BC=50/0"	NR								
315	20		The boring was terminated because of practical auger refusal ( ) at approximately 18 ft. below ground surface. The boring was backfilled with neat cement grout on January 27, 2017.												
310	25														
305	30														
300															

GROUNDWATER LEVEL INFORMATION:
- Perched groundwater was observed at approximately 5 ft. below ground surface during drilling.
- Perched groundwater was observed at approximately 3 ft. below ground surface at the end of drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-16

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-19

PAGE: 1 of 1

Date Begin - End:	1/16/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-17**	
Logged By:	A. Tyler	**Drill Crew:**	Chad, Sean, Stephen		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Overcast	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057402.9397 (ft)
Easting: 6788199.1934 (ft)
Approximate Ground Surface Elevation (ft.): 336.00

Approx. Elevation (ft)	Depth (ft)	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
335		**Clayey SAND (SC)**: brown, dry, fine to medium grained, trace gravel												
		Poorly graded SAND with Silt (SP-SM): orange brown to brown, dry, medium dense, fine to coarse grained, trace gravel	1c 1b		BC=11 10 19	18"		9.3						
330	5	**Poorly graded SAND with Silt and Gravel**: light brown to brown, dry, dense, (Decomposed Granitic Rock)	2c 2b		BC=10 10 43	18"								
		moist, very dense	3c 3b		BC=44 40 38	18"								
325	10 ▽	**Clayey SAND (SC)**: brown, moist, very dense, fine to medium grained, trace gravel (Decomposed Granitic Rock)	4b		BC=27 50/1"									
		Poorly graded SAND with Silt and Gravel (SP-SM): light brown to brown, moist, fine to coarse grained, trace black mineral deposits (Decomposed Granitic Rock)	Run 1			96%								Auger refusal at 12 feet, start coring RQD=90
320	15	**GRANITIC ROCK**: gray, medium grained, slightly weathered, strong, moderately to highly fractured (Decomposed Granitic Rock) gray to dark gray, moderately weathered, moderately strong	Run 2			92%								RQD=88
315	20	fine to medium grained	Run 3			94%								RQD=90
310	25	gray, medium grained, slightly weathered, strong, slightly fractured	Run 4			92%								RQD=92
305	30													

The boring was terminated at approximately 30 ft. below ground surface. The boring was backfilled with neat cement grout on January 16, 2017.

GROUNDWATER LEVEL INFORMATION:
▽ Perched groundwater was observed at approximately 10 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-17

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-20
PAGE: 1 of 1

Date Begin - End:	1/30/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-18**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, Sean, Stephen		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057379.5768 (ft)
Easting: 6788337.4983 (ft)
Approximate Ground Surface Elevation (ft.): 319.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Silty SAND (SM): dark brown, wet, fine to coarse grained, medium plasticity fines, unpleasant odor												
315	5		**Poorly graded SAND with Silt (SP-SM)**: gray, moist, medium dense, fine to medium grained	1c 1b		BC=5 9 18	16"		14.9						
			Poorly graded SAND with Silt (SP-SM): gray, moist, very dense, fine to medium grained (Decomposed Granitic Rock)	2b		BC=15 40/6"									
310	10		**Granitic Rock**: white and gray, medium grained, slightly weathered, strong to very strong	Run 1			99%								RQD=82.5
305	15														
300	20														
295	25														
290	30														
285															

LABORATORY RESULTS

The boring was terminated at approximately 12 ft. below ground surface. The boring was backfilled with neat cement grout on January 30, 2017.

GROUNDWATER LEVEL INFORMATION:
▽ Perched groundwater was observed at approximately 1 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-18

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-21

PAGE: 1 of 1

BORING LOG B-19

Date Begin - End:	1/27/2017	**Drilling Company:**	Taber Drilling		
Logged By:	A. Tyler	**Drill Crew:**	Chad, Sean, Stephen		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Partly cloudy	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057365.9022 (ft)
Easting: 6788268.3901 (ft)
Approximate Ground Surface Elevation (ft.): 326.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
325			**Silty SAND (SM)**: brown, moist, fine to medium grained, trace gravel												
			Poorly graded SAND with Silt and Gravel (SP-SM): light brown, moist, dense, fine to coarse grained (Decomposed Granitic Rock)	1c 1b		BC=23 27 30	18"								
	5			2c 2b		BC=21 19 34	18"								
320			**Poorly graded SAND with Silt (SP-SM)**: light brown to brown, moist, dense, fine to coarse grained, trace gravel sized rock fragments (Decomposed Granitic Rock) wet very dense	3c 3b		BC=15 25 32	18"								
	10			4b		BC=50/6"	4"								
315			**GRANITE**: white, black and reddish brown, moderately to slightly weathered, medium strong to strong, slightly to highly fractured (Decomposed Granitic Rock)	Run 1			158%								RQD=92%
	15														
310															
	20														
305															
	25														
300															
	30														
295															

The boring was terminated at approximately 18 ft. below ground surface. The boring was backfilled with neat cement grout on January 27, 2017.

GROUNDWATER LEVEL INFORMATION:
▽ Perched groundwater was observed at approximately 8 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-19

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-22

PAGE: 1 of 1

Date Begin - End:	1/27/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-20**	
Logged By:	A. Tyler	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Partly cloudy	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057363.2852 (ft)
Easting: 6788471.7900 (ft)
Approximate Ground Surface Elevation (ft.): 330.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Clayey SAND (SC): brown, moist, fine to medium grained, trace gravel												
		Silty SAND (SM): light brown to brown, moist, medium dense, fine to coarse grained, trace gravel	1c 1b		BC=11 11 16	18"		10.5	119.2		18			
325	5	**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown to brown, moist, dense, fine to coarse grained, subangular to angular sized rock fragments (Decomposed Granitic Rock) very dense	2c 2b		BC=11 20 30	18"								
			3c 3b		BC=25 50/5"	11"								
320	10	**Silty SAND (SM)**: gray, dry, very dense, fine grained, trace gravel, decomposed to highly weathered (Decomposed Granitic Rock)	4b		BC=50/3.5"									
315	15				BC=50/0"	NR								
310	20				BC=50/3"	NR								
					BC=50/0"	NR								
305	25													
300	30													

The boring was terminated at approximately 25 ft. below ground surface. The boring was backfilled with neat cement grout on January 27, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/31/2017
REVISED:	3/21/2017

BORING LOG B-20

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-23

PAGE: 1 of 1

Date Begin - End:	1/27/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-21**	
Logged By:	A. Tyler	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Partly cloudy	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057363.3131 (ft)
Easting: 6788483.9803 (ft)
Approximate Ground Surface Elevation (ft.): 335.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, fine to medium grained, trace gravel												
			Poorly graded SAND with Silt (SP-SM): reddish brown, moist, medium dense, fine to coarse grained, trace gravel	1c 1b		BC=4 10 17	18"								
330	5		**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown to reddish brown, moist, medium grained, subangular to angular rock fragments (Decomposed Granitic Rock) coarse grained	2c 2b		BC=10 19 28	18"		9.9						
			very dense	3c 3b		BC=36 50/2.5"	9"								
325	10			4c 4b		BC=38 50/5"	11"								
			medium dense	5c 5b		BC=7 12 12	18"								
315	20		brown to gray, very dense	6b		BC=50/4"	NR								
310	25			7b		BC=50/3"	NR								
						BC=50/0"	NR								
305	30														

The boring was terminated at approximately 30 ft. below ground surface. The boring was backfilled with neat cement grout on January 27, 2017.

GROUNDWATER LEVEL INFORMATION:
▽ Perched groundwater was observed at approximately 12 ft. below ground surface during drilling.
▼ Perched groundwater was observed at approximately 5 ft. below ground surface at the end of drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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REVISED:	3/21/2017

BORING LOG B-21

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-24
PAGE: 1 of 1

Date Begin - End:	1/26/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-22**	
Logged By:	A. Tyler	**Drill Crew:**			
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Clear	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057078.3184 (ft)
Easting: 6788355.0874 (ft)
Approximate Ground Surface Elevation (ft.): 328.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, fine to medium grained, trace gravel												
325			**Silty SAND (SM)**: light brown to orange brown, moist, medium dense, fine to coarse grained, trace gravel	1c		BC=12	18"								
				1b		15						23			
	5					14									
				2c		BC=10	18"		12.6	115.5					
				2b		13									
						14									
320			**Poorly graded SAND with Silt and Gravel**: light brown to brown, moist, very dense, fine to coarse grained, subangular to angular rock fragments (Decomposed Granitic Rock)	3c		BC=24	12"								
				3b		50/6"									
	10			4c		BC=18	18"								
				4b		24									
						50/5"									
315				5c		BC=29	NR								
				5b		50/1"									
	15														
				6c		BC=50/0.5"	NR								
			GRANITIC ROCK: gray, white and black, medium grained, strong, moderately to highly weathered	Run 1			95%								RQD=92%
310															
	20														
305			The boring was terminated at approximately 21 ft. below ground surface. The boring was backfilled with neat cement grout on January 26, 2017.												
	25														
300															
	30														
295															

LABORATORY RESULTS

GROUNDWATER LEVEL INFORMATION:
▽ Perched groundwater was observed at approximately 16 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/31/2017
REVISED:	3/21/2017

BORING LOG B-22

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-25
PAGE: 1 of 1

PLOTTED: 03/21/2017 10:03 AM BY: DRoss
PROJECT NUMBER: 20173273.001A
gINT FILE: Klf_gint_master_2017
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2017.GLB [_KLF_BORING/TEST PIT SOIL LOG]

Date Begin - End: 1/26/2017 **Drilling Company:** Taber Drilling

BORING LOG B-23

Logged By: A. Tyler **Drill Crew:**

Hor.-Vert. Datum: NAD83 - NGVD29 **Drilling Equipment:** CME-55 **Hammer Type - Drop:** 140 lb. Auto - 30 in.

Plunge: -90 degrees **Drilling Method:** Solid Flight Auger

Weather: Clear **Auger Diameter:** 4 in. O.D.

FIELD EXPLORATION | LABORATORY RESULTS

NAD83 CA State Planes, Zone II
Northing: 2057044.2923 (ft)
Easting: 6788635.5245 (ft)
Approximate Ground Surface Elevation (ft.): 329.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, fine to medium grained												
325	5		**Poorly graded SAND with Silt (SP-SM)**: light brown to brown, moist, medium dense, fine to coarse grained, trace gravel (Decomposed Granitic Rock)	1c 1b		BC=6 8 15	18"		10.1	119.1		17			
				2c 2b		BC=11 24 20	18"		7.0	126.1					
320	10			3c 3b		BC=24 50/5"	11"								
				4c 4b		BC=24 50/6"	12"								
315	15			5c 5b		BC=12 50/6"	12"								
				6c 6b		BC=18 50/3"	9"								
310	20		**Silty SAND (SM)**: brown, dry, very dense, fine to medium grained, trace gravel (Decomposed Granitic Rock)	7b		BC=50/3"	3"								
			GRANITIC ROCK: gray, white and black, fine to medium grained, moderately to highly weathered, medium strong, moderately to highly fractured, moderately foliated	Run 1			93%								RQD=58%
305	25		**GRANITIC ROCK**: gray, white and black, medium grained, slightly weathered, strong, moderately fractured	Run 2			97%								RQD=85%
300	30														
295															

The boring was terminated at approximately 30 ft. below ground surface. The boring was backfilled with neat cement grout on January 26, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	2/1/2017
REVISED:	3/21/2017

BORING LOG B-23

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-26
PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-24**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057004.9583 (ft)
Easting: 6788584.1803 (ft)
Approximate Ground Surface Elevation (ft.): 328.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, fine to medium grained, medium plasticity fines	1											**R-Value=** 10
325			**Silty SAND (SM)**: brown, moist, dense, fine to coarse grained (Decomposed Granitic Rock)	1c 1b		BC=7 17 32	15"		15.0						
	5		very dense	2c 2b		BC=26 40 36	18"								
320				3c 3b		BC=15 50/5"	12"								
	10														
315															
	15														
310															

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

BORING LOG B-24

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-27
PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-25**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057001.3816 (ft)
Easting: 6788511.9588 (ft)
Approximate Ground Surface Elevation (ft.): 329.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, firm, fine to medium grained, medium plasticity fines												
			Poorly graded SAND with Silt (SP-SM): light brown, moist, medium dense, fine to coarse grained (Decomposed Granitic Rock)	1c 1b		BC=12 11 12	18"		11.0	118.3					
325	5		dense	2c 2b		BC=4 13 36	12"								
320	10		very dense	3c 3b		BC=41 43 50/4.5"	12"								
315	15														
310															

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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DATE:	1/18/2017
REVISED:	3/21/2017

BORING LOG B-25

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-28

PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-26**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057813.8003 (ft)
Easting: 6788450.5877 (ft)
Approximate Ground Surface Elevation (ft.): 326.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)
325	0		**Clayey SAND (SC)**: brown, moist, fine to medium grained				
						BC=6 7 8	18"
			Poorly graded SAND with Silt (SP-SM): brown, moist, medium dense, weakly cemented, fine to corase grained (Decomposed Granitic Rock)	1c 1b			
	5					BC=4 5 11	17"
320				2c 2b			
			very dense, strongly cemented			BC=22 32 36	18"
	10			3c 3b			
315							
	15						
310							

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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DATE:	1/18/2017
REVISED:	3/21/2017

BORING LOG B-26

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-29
PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-27**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057738.2118 (ft)
Easting: 6788460.2932 (ft)
Approximate Ground Surface Elevation (ft.): 325.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Clayey SAND (SC): brown, moist, fine to medium grained	1				SC				35	27	9	**R-Value=** 26
						BC=9 20 26	18"								
			Poorly graded SAND with Silt (SP-SM): brown, moist, dense, moderately cemented, fine to coarse grained (Decomposed Granitic Rock)	1c 1b											
320	5					BC=18 28 45	17"								
			very dense	2c 2b											
						BC=24 50 50/4.5"	18"								
				3c 3b											
315	10														
310	15														

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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BORING LOG B-27

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-30

PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-28**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057673.7481 (ft)
Easting: 6788521.5986 (ft)
Approximate Ground Surface Elevation (ft.): 333.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Silty SAND (SM): brown, fine to medium grained	1				SM				30	NP	NP	**R-Value=** 17
330				1c		BC=3 5 5	18"								
				1b											
	5		loose												
				2c		BC=10 9 13	18"								
			Poorly graded SAND with Silt (SP-SM): gray, moist, medium dense, fine to medium grained	2b											
325			**Clayey SAND (SC)**: gray, dry, very dense, fine to medium grained, low plasticity fines (Decomposed Granitic Rock)			BC=50	6"								
	10		**Sandy Lean CLAY (CL)**: medium plasticity, light brown, medium plasticity, dry, very hard, (Decomposed Granitic Rock)												
320															
	15														
315															

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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DATE:	1/18/2017
REVISED:	3/21/2017

BORING LOG B-28

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-31

PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-29**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057403.5313 (ft)
Easting: 6788612.9750 (ft)
Approximate Ground Surface Elevation (ft.): 339.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)
			Silty SAND (SM): brown, moist, fine to medium grained				
						BC=7 7 8	18"
335			**Poorly graded SAND with Silt (SP-SM)**: light brown, moist, medium dense, fine to medium grained (Decomposed Granitic Rock)	1c 1b			
	5			2c 2b		BC=26 50/5.5"	11"
			very dense				
330				3c 3b		BC=19 50/4"	12"
	10						
325	15						
320							

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

BORING LOG B-29

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-32
PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-30**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057195.8325 (ft)
Easting: 6788669.9373 (ft)
Approximate Ground Surface Elevation (ft.): 325.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)
			Clayey SAND (SC): brown, moist, fine to medium grained				
						BC=4 7 4	12"
			Poorly graded SAND with Silt (SP-SM): brown, moist, loose, fine to medium grained	1c 1b			
320	5		**Poorly graded SAND with Silt and Gravel (SP-SM)**: brown, moist, medium dense, fine to coarse grained, subangular to angular rock fragments (Decomposed Granitic Rock)	2c 2b		BC=7 16 19	15"
			dense	3c 3b		BC=18 21 21	18"
315	10						
310	15						

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

KLEINFELDER
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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

BORING LOG B-30

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-33
PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-31**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057208.0591 (ft)
Easting: 6788660.6181 (ft)
Approximate Ground Surface Elevation (ft.): 326.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)
325	0		**Silty SAND (SM)**: brown, moist, fine to medium grained				
			Poorly graded SAND with Silt (SP-SM): light brown, moist, very dense, fine to coarse grained (Decomposed Granitic Rock)	1c		BC=11 27 49	18"
				1b			
	5			2c		BC=42 50/4"	12"
320				2b			
				3b		BC=50/3"	3"
	10						
315			The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.				
	15						
310							

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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BORING LOG B-31

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-34
PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-32**	
Logged By:	A. Tyler	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057305.2054 (ft)
Easting: 6788821.4205 (ft)
Approximate Ground Surface Elevation (ft.): 336.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
335			**Silty SAND (SM)**: dark brown, moist, fine to coarse grained, trace gravel												
			Poorly graded SAND with Silt and Gravel (SP-SM): reddish brown to light brown, moist, medium dense, fine to coarse grained	1c 1b		BC=8 12 13	16"								
	5		**Silty SAND (SM)**: brown, moist, very dense, fine to medium grained, trace gravel (Decomposed Granitic Rock)	2b		BC=6/50"	6"								
330			**Poorly graded SAND with Silt and Gravel (SP-SM)**: brown to light brown, moist, fine to medium grained, subangular to angular rock fragments (Decomposed Granitic Rock)												
			Silty SAND (SM): light brown, moist, very dense, fine to medium grained (Decomposed Granitic Rock)	3c 3b		BC=25 50/2"	10"								
	10														
325															
	15														
320															

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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BORING LOG B-32

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-35
PAGE: 1 of 1

BORING LOG B-33

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling		
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057204.5618 (ft)
Easting: 6788731.6924 (ft)
Approximate Ground Surface Elevation (ft.): 324.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Silty SAND (SM): brown, moist, firm, fine to medium grained, medium plasticity fines	1				SM				29	NP	NP	**R-Value=** 18
			Poorly graded SAND with Silt (SP-SM): light brown, moist, medium dense, fine to coarse grained (Decomposed Granitic Rock)	1c		BC=9 14 16	18"								
320				1b											
	5			2c		BC=8 10 26	12"								
				2b											
315			very dense	3b		BC=50/6"	6"								
	10														
310															
	15														
305															

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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REVISED:	3/21/2017

BORING LOG B-33

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-36

PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-34**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057210.9812 (ft)
Easting: 6788683.6622 (ft)
Approximate Ground Surface Elevation (ft.): 332.00
Surface Condition: Grass

Approx. Elevation (ft)	Depth (ft)	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
330	0	**Silty SAND (SM)**: brown, moist, fine to medium grained	1				SM				30	NP	NP	**R-Value=** 30
					BC=4 3 4	16"								
		Poorly graded SAND with Silt (SP-SM): brown, moist, loose, fine to medium grained	1c											
			1b											
		Silty SAND (SM): brown, wet, loose, fine to medium grained												
	5		2c		BC=32 50/4"	9"								
		Poorly graded SAND with Silt and Gravel (SP-SM): light brown, moist, very dense, fine to coarse grained (Decomposed Granitic Rock)	2b											
325														
			3b		BC=50/5"	6"								
	10	**Sandy Lean CLAY (CL)**: medium plasticity, brown, moist, very hard, fine to coarse grained (Decomposed Granitic Rock)												
320														
	15													
315														

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-34

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-37

PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-35**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057195.7244 (ft)
Easting: 6788671.3991 (ft)
Approximate Ground Surface Elevation (ft.): 335.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)
			Silty SAND (SM): brown, moist, fine to medium grained				
			Poorly graded SAND with Clay (SP-SC): brown, moist, very dense, fine to medium grained, low plasticity fines (Decomposed Granitic Rock)	1c 1b		BC=8 50/5"	
330	5		**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown, moist, very dense, fine to coarse grained, subangular gravel (Decomposed Granitic Rock)	2c 2b		BC=28 50/4"	
				3b		BC=50/3.5"	
325	10						
320	15						

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-35

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-38
PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-36**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057094.7292 (ft)
Easting: 6788766.7562 (ft)
Approximate Ground Surface Elevation (ft.): 330.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)
			Silty SAND (SM): brown, moist, fine to medium grained				
			medium dense	1c		BC=9 11 15	17"
				1b			
325	5		**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown, moist, dense, fine to coarse grained (Decomposed Granitic Rock)	2c		BC=15 29 40	18"
				2b			
			very dense	2c		BC=47 50/4.5"	12"
				2b			
320	10						
315	15						

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-36

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-39
PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-37**	
Logged By:	A. Tyler	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

NAD83 CA State Planes, Zone II
Northing: 2057001.6168 (ft)
Easting: 6788429.3053 (ft)
Approximate Ground Surface Elevation (ft.): 332.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Silty SAND (SM): brown, moist, fine to medium grained												
330			**Poorly graded SAND (SP)**: yellowish brown, moist, dense, fine to medium grained	1c 1b		BC=9 22 38	12"								
	5		**Poorly graded SAND with Silt (SP-SM)**: olive brown, moist, very dense, fine to medium grained (Decomposed Granitic Rock)	2c 2b		BC=22 34 39	18"								
325			**Poorly graded SAND with Silt and Gravel (SP-SM)**: yellowish brown, moist, very dense, fine to coarse grained (Decomposed Granitic Rock)	3c 3b		BC=24 50/2.5"	12"								
	10														
320															
	15														
315															

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-37

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-40

PAGE: 1 of 1

Date Begin - End:	1/05/2017	**Drilling Company:**	Taber Drilling	**BORING LOG B-38**	
Logged By:	M. Galouei	**Drill Crew:**	Chad, David, Rick		
Hor.-Vert. Datum:	NAD83 - NGVD29	**Drilling Equipment:**	CME-55	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Flight Auger		
Weather:	Sunny	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057003.0856 (ft)
Easting: 6788261.6934 (ft)
Approximate Ground Surface Elevation (ft.): 338.00
Surface Condition: Grass

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)
335	0		**Silty SAND (SM)**: brown, moist, fine to medium grained				
	5		**Poorly graded SAND (SP)**: brown, moist, very dense, fine to medium grained (Decomposed Granitic Rock)	2c 2b		BC=40 50/4"	12"
			Poorly graded SAND with Silt (SP-SM): light brown, moist, very dense, fine to medium grained (Decomposed Granitic Rock)	3b		BC=50/5"	6"
330				4c 4b		BC=33 50/4.5"	12"
	10						
325	15						
320							

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks

The boring was terminated at approximately 10 ft. below ground surface. The boring was backfilled with soil cuttings on January 05, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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BORING LOG B-38

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-41
PAGE: 1 of 1

TEST PIT LOG TP-1

Date Begin - End:	1/13/2017	**Excavation Company:**	RAH
Logged By:	M. Galouei	**Excavation Crew:**	Craig
Hor.-Vert. Datum:	NAD83 - NGVD29	**Excavation Equip.:**	John Deere 160
Plunge:	N/A	**Excav. Dimensions:**	2 ft
Weather:	Sunny		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057714.8391 (ft)
Easting: 6788528.7631 (ft)
Approximate Ground Surface Elevation (ft.): 329.00
Surface Condition: Grass/mud

LABORATORY RESULTS

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Silty SAND (SM): dark brown, moist, fine to medium grained										
325			**Poorly graded SAND with Silt and Gravel (SP-SM)**: yellowish brown, moist, medium to coarse grained sand and gravel										
	5		∿										
320			**Poorly graded SAND with Silt and Gravel (SP-SM)**: yellowish brown, wet, fine to corase grained subangular to angular gravel sized rock fragments (Decomposed Granitic Rock)										
	10		increasing coarse gravel sized rock fragments										
315													
	15												
310													

The test pit was terminated at approximately 15 ft. below ground surface. The test pit was backfilled with soil on January 13, 2017.

GROUNDWATER LEVEL INFORMATION:
∿ Seepage was observed at approximately 5 ft. below ground surface during excavation.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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DATE:	1/18/2017
REVISED:	3/21/2017

TEST PIT LOG TP-1

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-42

PAGE: 1 of 1

Date Begin - End:	1/13/2017	**Excavation Company:**	RAH
Logged By:	M. Galouei	**Excavation Crew:**	Craig
Hor.-Vert. Datum:	NAD83 - NGVD29	**Excavation Equip.:**	John Deere 160
Plunge:	N/A	**Excav. Dimensions:**	2 ft
Weather:	Sunny		

TEST PIT LOG TP-2

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057650.2531 (ft)
Easting: 6788672.7414 (ft)
Approximate Ground Surface Elevation (ft.): 327.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
325	0		**Silty SAND (SM)**: dark brown, moist, fine to medium grained										
	5		**Poorly graded SAND with Silt (SP-SM)**: light brown, moist, fine to coarse grained										
320			**Poorly graded SAND with Silt (SP-SM)**: light brown, wet, fine to coarse grained (Decomposed Granitic Rock)										
	10	∿	saturated										
315			The test pit was terminated because of excavator refusal ( ) at approximately 11 ft. below ground surface. The test pit was backfilled with soil on January 13, 2017.										
	15												
310													

LABORATORY RESULTS

GROUNDWATER LEVEL INFORMATION:
∿ Seepage was observed at approximately 10 ft. below ground surface during excavation.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
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DATE:	1/18/2017
REVISED:	3/21/2017

TEST PIT LOG TP-2

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-43

PAGE: 1 of 1

Date Begin - End:	1/13/2017	**Excavation Company:**	RAH	**TEST PIT LOG TP-3**
Logged By:	M. Galouei	**Excavation Crew:**	Craig	
Hor.-Vert. Datum:	NAD83 - NGVD29	**Excavation Equip.:**	John Deere 160	
Plunge:	N/A	**Excav. Dimensions:**	2 ft	
Weather:	Sunny			

NAD83 CA State Planes, Zone II
Northing: 2057697.8134 (ft)
Easting: 6788215.1864 (ft)
Approximate Ground Surface Elevation (ft.): 330.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Silty SAND (SM): dark brown, moist, fine to coarse grained										
			Poorly graded SAND with Silt and Gravel (SP-SM): light brown, moist, fine to coarse gravel (Decomposed Granitic Rock)										
			GRANITIC ROCK: gray, fine to medium grained										
325	5												
320	10												
315	15												

The test pit was terminated because of excavator refusal ( ) at approximately 8 ft. below ground surface. The test pit was backfilled with soil on January 13, 2017.

GROUNDWATER LEVEL INFORMATION:
Seepage was observed at approximately 3 ft. below ground surface during excavation.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

TEST PIT LOG TP-3

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-44

PAGE: 1 of 1

TEST PIT LOG TP-4

Date Begin - End:	1/13/2017	**Excavation Company:**	RAH
Logged By:	M. Galouei	**Excavation Crew:**	Craig
Hor.-Vert. Datum:	NAD83 - NGVD29	**Excavation Equip.:**	John Deere 160
Plunge:	N/A	**Excav. Dimensions:**	2 ft
Weather:	Sunny		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057492.2498 (ft)
Easting: 6788273.7869 (ft)
Approximate Ground Surface Elevation (ft.): 337.00
Surface Condition: Grass/mud

LABORATORY RESULTS

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
335	0		**Silty SAND (SM)**: dark brown, moist, fine to coarse grained										
			Poorly graded SAND with Silt and Gravel (SP-SM): brown, moist, fine to coarse grained sand and gravel										
330	5		**Poorly graded SAND with Silt (SP-SM)**: light brown, moist, fine to coarse grained										
			Poorly graded SAND with Silt and Gravel (SP-SM): light brown, moist, fine to coarse subangular gravel sized rock fragments (Decomposed Granitic Rock)										
325	10		wet										
320	15												

The test pit was terminated at approximately 15 ft. below ground surface. The test pit was backfilled with soil on January 13, 2017.

GROUNDWATER LEVEL INFORMATION:
∿ Seepage was observed at approximately 5.5 ft. below ground surface during excavation.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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TEST PIT LOG TP-4

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-45

PAGE: 1 of 1

Date Begin - End:	1/13/2017	**Excavation Company:**	RAH	**TEST PIT LOG TP-5**
Logged By:	M. Galouei	**Excavation Crew:**	Craig	
Hor.-Vert. Datum:	NAD83 - NGVD29	**Excavation Equip.:**	John Deere 160	
Plunge:	N/A	**Excav. Dimensions:**	2 ft	
Weather:	Sunny			

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057426.4580 (ft)
Easting: 6788830.4943 (ft)
Approximate Ground Surface Elevation (ft.): 320.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	LABORATORY RESULTS: USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
320	0		**Silty SAND (SM)**: dark brown, moist, fine to medium grained										
			Poorly graded SAND with Silt and Gravel (SP-SM): light brown, moist, fine to coarse grained subangular to angular gravel sized rock fragments (Decomposed Granitic Rock)										
315	5												
310	10												
305	15		The test pit was terminated at approximately 14.5 ft. below ground surface. The test pit was backfilled with soil on January 13, 2017.										

GROUNDWATER LEVEL INFORMATION:
∿ Seepage was observed at approximately 1 ft. below ground surface during excavation.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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TEST PIT LOG TP-5

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-46

Date Begin - End:	1/12/2017	**Excavation Company:**	RAH	**TEST PIT LOG TP-6**
Logged By:	M. Galouei	**Excavation Crew:**	Craig	
Hor.-Vert. Datum:	NAD83 - NGVD29	**Excavation Equip.:**	John Deere 160	
Plunge:	N/A	**Excav. Dimensions:**	2 ft	
Weather:	Rainy			

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057350.7913 (ft)
Easting: 6788921.4444 (ft)
Approximate Ground Surface Elevation (ft.): 330.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Sandy SILT (ML): dark brown, wet										
			Silty SAND (SM): brown, fine to medium grained										
			Poorly graded SAND with Silt and Gravel (SP-SM): brown, fine to medium grained sand, subangular to angular gravel sized rock fragments (Decomposed Granitic Rock)										
			Poorly graded SAND with Silt (SP-SM): light brown, wet, fine to medium grained										
325	5		**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown, wet, fine to medium grained, subangular to angular gravel sized rock fragments (Decomposed Granitic Rock)										Difficult excavation conditions beginning at approximately 9 feet
320	10												
315	15												

The test pit was terminated at approximately 10 ft. below ground surface. The test pit was backfilled with soil on January 12, 2017.

GROUNDWATER LEVEL INFORMATION:
∿ Seepage was observed at approximately 3 ft. below ground surface during excavation.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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TEST PIT LOG TP-6

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-47

TEST PIT LOG TP-7

Date Begin - End:	1/13/2017	**Excavation Company:**	RAH
Logged By:	M. Galouei	**Excavation Crew:**	Craig
Hor.-Vert. Datum:	NAD83 - NGVD29	**Excavation Equip.:**	John Deere 160
Plunge:	N/A	**Excav. Dimensions:**	2 ft
Weather:	Sunny		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057615.5134 (ft)
Easting: 6788852.1899 (ft)
Approximate Ground Surface Elevation (ft.): 335.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type
			Sandy SILT with Gravel (ML): brown, medium to coarse grained		
			Silty SAND (SM): dark brown to brown, medium to coarse grained		
			Poorly graded SAND (SP): brown, medium to coarse grained		
330	5		**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown, wet, fine to coarse grained, subangular gravel sized rock fragments (Decomposed Granitic Rock)		
			Silty SAND with Gravel (SM): light brown, coarse sand, gsubangular gravel sized rock fragments (Decomposed Granitic Rock) concrete pipe at 7 feet		
325	10				
320	15				

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks

The test pit was terminated because of excavator refusal ( ) at approximately 10 ft. below ground surface. The test pit was backfilled with soil on January 13, 2017.

GROUNDWATER LEVEL INFORMATION:
Seepage was observed at approximately 4 ft. below ground surface during excavation.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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TEST PIT LOG TP-7

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
A-48

PAGE: 1 of 1

TEST PIT LOG TP-8

Date Begin - End:	1/12/2017	**Excavation Company:**	RAH
Logged By:	B. Anderson	**Excavation Crew:**	Craig
Hor.-Vert. Datum:	NAD83 - NGVD29	**Excavation Equip.:**	John Deere 160
Plunge:	N/A	**Excav. Dimensions:**	2 ft
Weather:	Rainy		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057101.2157 (ft)
Easting: 6788860.7550 (ft)
Approximate Ground Surface Elevation (ft.): 328.00
Surface Condition: Grass/mud

LABORATORY RESULTS

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
325	0		**Sandy SILT (ML)**: brown, moist, fine to coarse grained sand, organics in upper 6 inches										
			Silty SAND (SM): reddish brown, moist, fine to coarse grained, abundant mica										
320	5	∿	**Clayey SAND (SC)**: light brown, moist, fine to coarse grained, low plasticity fines (Decomposed Granitic Rock)										
315	10		**GRANITIC ROCK**: light brown to white, black and reddish brown, decomposed to highly weathered, very weak (R0), fine to coarse grained sand , occasional cobble and gravel sized rock fragments, intensely fractured										
310	15		highly weathered										

The test pit was terminated at approximately 15 ft. below ground surface. The test pit was backfilled with soil on January 12, 2017.

GROUNDWATER LEVEL INFORMATION:
∿ Seepage was observed at approximately 6 ft. below ground surface during excavation.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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TEST PIT LOG TP-8

Proposed Costco Wholesale Warehouse
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Loomis, California
CW# 16-0132

FIGURE
A-49

Date Begin - End:	1/12/2017	**Excavation Company:**	RAH
Logged By:	B. Anderson	**Excavation Crew:**	Craig
Hor.-Vert. Datum:	NAD83 - NGVD29	**Excavation Equip.:**	John Deere 160
Plunge:	N/A	**Excav. Dimensions:**	2 ft
Weather:	Rainy		

TEST PIT LOG TP-9

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057069.3849 (ft)
Easting: 6788357.0504 (ft)
Approximate Ground Surface Elevation (ft.): 333.00
Surface Condition: Grass/mud

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type
			Silty SAND (SM): wet, fine to medium grained		
			Sandy SILT (ML): reddish brown, moist, fine to coarse grained		
330			**Poorly graded SAND with Silt (SP-SM)**: brown, fine to coarse grained		
	5		**Poorly graded SAND with Gravel (SP)**: light brown, fine to coarse grained, subangular to angular gravel sized rock fragments (Decomposed Granitic Rock)		
325			**GRANITIC ROCK**: light brown to white, black and reddish brown, decomposed to highly weathered, very weak (R0), fine to coarse grained sand , occasional cobble and gravel sized rock fragments, intensely fractured		
	10				
320					
	15				
315					

LABORATORY RESULTS

USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks

The test pit was terminated because of excavator refusal ( ) at approximately 10 ft. below ground surface. The test pit was backfilled with soil on January 12, 2017.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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TEST PIT LOG TP-9

Proposed Costco Wholesale Warehouse
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Loomis, California
CW# 16-0132

FIGURE
A-50

PAGE: 1 of 1

TEST PIT LOG TP-10

Date Begin - End:	1/13/2017	**Excavation Company:**	RAH
Logged By:	B. Anderson	**Excavation Crew:**	Craig
Hor.-Vert. Datum:	NAD83 - NGVD29	**Excavation Equip.:**	John Deere 160
Plunge:	N/A	**Excav. Dimensions:**	2 ft
Weather:	Sunny		

FIELD EXPLORATION

NAD83 CA State Planes, Zone II
Northing: 2057738.2118 (ft)
Easting: 6788165.0600 (ft)
Approximate Ground Surface Elevation (ft.): 325.00
Surface Condition: Grass/mud

LABORATORY RESULTS

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Silty SAND (SM): dark brown										
			Poorly graded SAND with Silt (SP-SM): yellowish brown to brown, fine to medium grained										
320	5		**Poorly graded SAND with Silt and Gravel (SP-SM)**: light brown, fine to coarse grained sand, subangular to angular gravel sized rock fragments (Decomposed Granitic Rock)										
			Poorly graded SAND with Silt (SP-SM): light brown, fine to medium grained (Decomposed Granitic Rock)										
315	10												
310	15												

The test pit was terminated because of excavator refusal ( ) at approximately 11 ft. below ground surface. The test pit was backfilled with soil on January 13, 2017.

GROUNDWATER LEVEL INFORMATION:
Seepage was observed at approximately 3 ft. below ground surface during excavation.

GENERAL NOTES:
The exploration elevation is approximate and was estimated from the Preliminary Grading and Drainage Plan prepared by Kier & Wright.

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TEST PIT LOG TP-10

Proposed Costco Wholesale Warehouse
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CW# 16-0132

FIGURE
A-51

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Appendix B

APPENDIX B
LABORATORY TESTING

APPENDIX B
LABORATORY TESTING

GENERAL

Laboratory tests were performed on selected samples as an aid in classifying the soils and to evaluate physical properties of the soils that may affect foundation design and construction procedures. The tests were performed in general conformance with the current ASTM or Caltrans standards. A description of the laboratory-testing program is presented below.

MOISTURE AND UNIT WEIGHT

Moisture content and dry unit weight tests were performed on selected samples recovered from the borings. Moisture contents were determined in general accordance with ASTM Test Method D 2216; dry unit weight was calculated using the entire weight of the samples collected. Results of these tests are presented on the boring logs.

WASH SIEVE

Selected soil samples were tested for the percent passing the No. 200 sieve, which was performed by wash sieving in accordance with ASTM Standard Test Method D 1140. The test results are presented on the boring logs.

GRAIN SIZE DISTRIBUTION

The grain-size distribution was determined for selected samples of the materials encountered at the site to aid in their classification. The tests were performed in general accordance with ASTM Test Method D422. These tests were performed on the gravel to clay fraction of the sample, the cobbles and boulders were removed from the test. Results of the testing are attached to this appendix.

PLASTICITY INDEX

Plasticity Index (liquid and plastic limit) testing was performed on selected samples of the on-site soils to determine plasticity characteristics and to aid in the classification of the soil. The tests were performed in accordance with ASTM Standard Test Method D 4318. The results are presented on the boring logs and attached to this appendix.

R-VALUE

Resistance value (R-value) tests were performed on selected bulk soil samples obtained to evaluate pavement support characteristics of the near-surface onsite soils. R-value tests were performed in accordance with Caltrans Standard Test Method 301. The test results are attached.

PRELIMINARY SOIL CORROSIVITY

A series of chemical tests were performed on a selected sample of the near-surface soils to estimate pH, resistivity, oxidation reduction potential, redox, and soluble sulfate and chloride contents. The sample was tested in general accordance with California Test Methods 643, 422, and 417 for pH and minimum resistivity, soluble chlorides, and soluble sulfates, respectively, ASTM G-200 for Redox Potential, and AWWA C105/A25.5 for Sulfides. Test results may be used by a qualified corrosion engineer to evaluate the general corrosion potential with respect to construction materials. The tests were performed by Sunland Analytical of Rancho Cordova, California. The results of the tests are presented in Table 6 of Section 4.9 of the report and attached to this appendix.

TOPSOIL ANALYTICAL TESTS

Topsoil analytical testing was performed on 3 samples of the near-surface soils from the project site by Sunland Analytical of Rancho Cordova, California. The topsoil was tested for percentages of organic matter, percentages of macro and micro nutrients, deleterious material, pH, mineral content, and herbicide presence. The test results are attached to this appendix.

WATER QUALITY TESTS

Water quality testing was performed by the local water supply agency, Placer County Water Agency, on potable water samples collected within the area surrounding the project site. The public document provided by Placer County Water Agency is attached to this appendix.

Exploration ID	Depth (ft.)	Sample No.	Sample Description	Water Content (%)	Dry Unit Wt. (pcf)	Sieve Analysis (%)			Atterberg Limits			Additional Tests
						Passing 3/4"	Passing #4	Passing #200	Liquid Limit	Plastic Limit	Plasticity Index	
B-1	0.0 - 2.5	1	CLAYEY SAND (SC)					29	26	17	9	
B-1	5.5 - 6.5	2c	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	9.8								
B-2	3.5 - 4.0	1a	POORLY GRADED SAND WITH CLAY (SP-SC)	7.1	133.1							
B-3	3.0 - 4.0	1c	POORLY GRADED SAND WITH SILT (SP-SM)	17.6	107.2							
B-4	0.0 - 2.5	1	CLAYEY SAND (SC)					28				
B-4	3.0 - 4.0	1c	POORLY GRADED SND WITH SILT (SP-SM)	13.2								
B-5	6.0 - 6.5	2a	POORLY GRADED SAND WITH CLAY (SP-SC)	9.1								
B-6	3.5 - 4.0	1a	POORLY GRADED SAND WITH CLAY (SP-SC)	13.9	112.8							
B-7	3.0 - 4.0	1c	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	8.3								
B-8	0.0 - 2.5	1	SILTY SAND (SM)					29	NP	NP	NP	
B-8	3.0 - 4.0	1c	POORLY GRADED SAND WITH SILT (SP-SM)	9.2	125.3							
B-9	3.0 - 4.0	1c	SILTY SAND (SM)	16.6	108.9							
B-9	3.5 - 4.0	1b	SILTY SAND (SM)					25				
B-10	3.5 - 4.0	1a	POOTLY GRADED SAND WITH CLAY (SP-SC0	11.8								
B-11	3.0 - 4.0	1c	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	12.6	115.0							
B-13	3.0 - 4.0	1c	POORLY GRADED SAND WITH SILT (SP-SM)	14.3	113.9							
B-14	0.0 - 2.5	1	CLAYEY SAND (SC)					24				
B-14	3.5 - 4.0	1a	POORLY GRADED SAND WITH CLAY (SP-SC)	11.8	121.9							
B-15	0.0 - 2.5	1	SILTY CLAYEY SAND (SC-SM)					31	25	18	7	
B-15	3.5 - 4.0	1a	POORLY GRADED SAND WITH CLAY (SP-SC)	7.8	119.2							
B-16	3.0 - 4.0	1c	POORLY GRADED SAND WITH SILT (SP-SM)	14.0	114.5							
B-17	3.0 - 4.0	1c	POORLY GRADED SAND WITH SILT (SP-SM)	9.3								
B-18	3.0 - 4.0	1c	POORLY GRADED SAND WITH SILT (SP-SM)	14.9								
B-20	3.0 - 4.0	1c	SILTY SAND (SM)	10.5	119.2							
B-20	3.5 - 4.0	1b	SILTY SAND (SM)					18				
B-21	5.5 - 6.5	2c	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	9.9								
B-22	3.5 - 4.0	1b	SILTY SAND (SM)					23				
B-22	5.5 - 6.5	2c	SILTY SAND (SM)	12.6	115.5							

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.
NP = NonPlastic
NA = Not Available

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LABORATORY TEST RESULT SUMMARY

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE
B-1

Exploration ID	Depth (ft.)	Sample No.	Sample Description	Water Content (%)	Dry Unit Wt. (pcf)	Sieve Analysis (%)			Atterberg Limits			Additional Tests
						Passing 3/4"	Passing #4	Passing #200	Liquid Limit	Plastic Limit	Plasticity Index	
B-23	3.5 - 4.0	1b	POORLY GRADED SAND WITH SILT (SP-SM)	10.1	119.1			17				
B-23	5.5 - 6.5	2c	SILTY SAND (SM)	7.0	126.1							
B-24	0.0 - 2.0	1	CLAYEY SAND (SC)									**R-Value=** 10
B-24	3.0 - 4.0	1c	SILTY SAND (SM)	15.0								
B-25	3.0 - 4.0	1c	POORLY GRADED SAND WITH SILT 9SP-SM)	11.0	118.3							
B-27	0.0 - 5.0	1	CLAYEY SAND (SC)					35	27	18	9	**R-Value=** 26
B-28	0.0 - 5.0	1	SILTY SAND (SM)					30	NP	NP	NP	**R-Value=** 17
B-33	0.0 - 5.0	1	SILTY SAND (SM)					29	NP	NP	NP	**R-Value=** 18
B-34	0.0 - 5.0	1	SILTY SAND (SM)					30	NP	NP	NP	**R-Value=** 30

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.
NP = NonPlastic
NA = Not Available

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LABORATORY TEST RESULT SUMMARY

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
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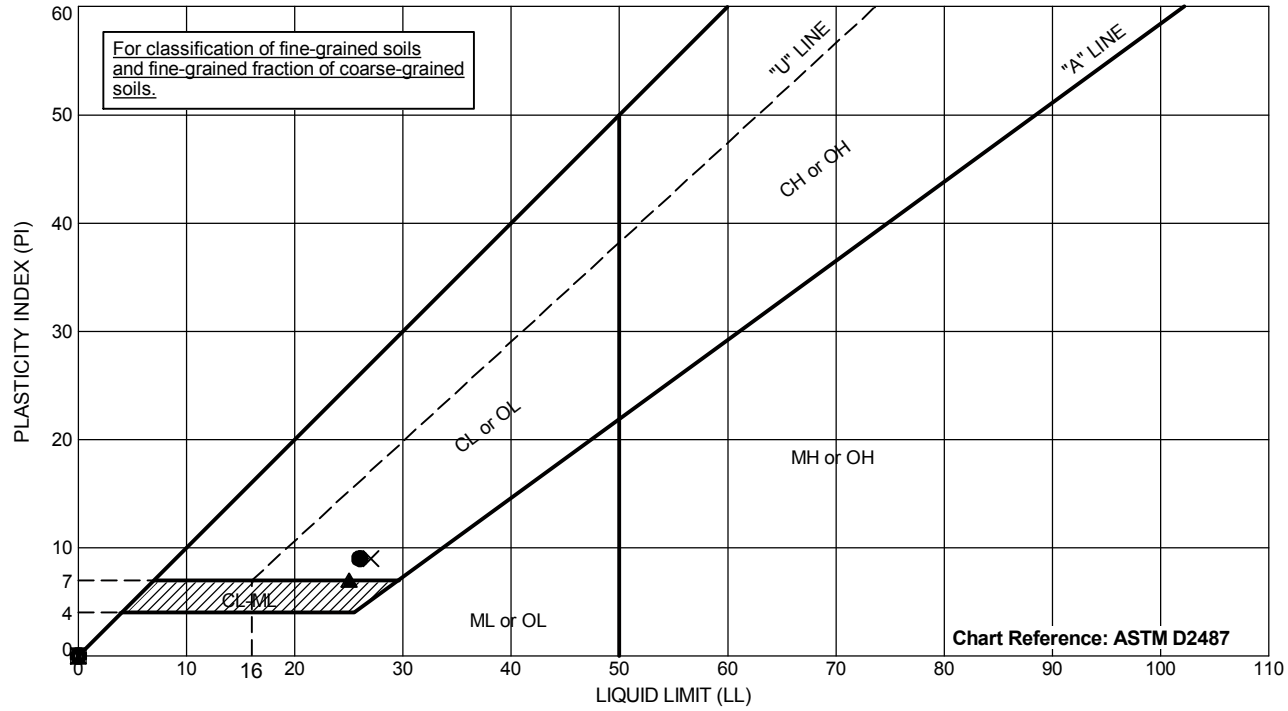
CW# 16-0132

FIGURE
B-2



Exploration ID		Depth (ft.)	Sample Number	Sample Description	Passing #200	LL	PL	PI
●	B-1	0 - 2.5	1	CLAYEY SAND (SC)	29	26	17	9
⊠	B-8	0 - 2.5	1	SILTY SAND (SM)	29	NP	NP	NP
▲	B-15	0 - 2.5	1	SILTY CLAYEY SAND (SC-SM)	31	25	18	7
×	B-27	0 - 5	1	CLAYEY SAND (SC)	35	27	18	9
⊙	B-28	0 - 5	1	SILTY SAND (SM)	30	NP	NP	NP
✿	B-33	0 - 5	1	SILTY SAND (SM)	29	NP	NP	NP
○	B-34	0 - 5	1	SILTY SAND (SM)	30	NP	NP	NP

Testing perfomed in general accordance with ASTM D4318.
NP = Nonplastic
NA = Not Available
NM = Not Measured

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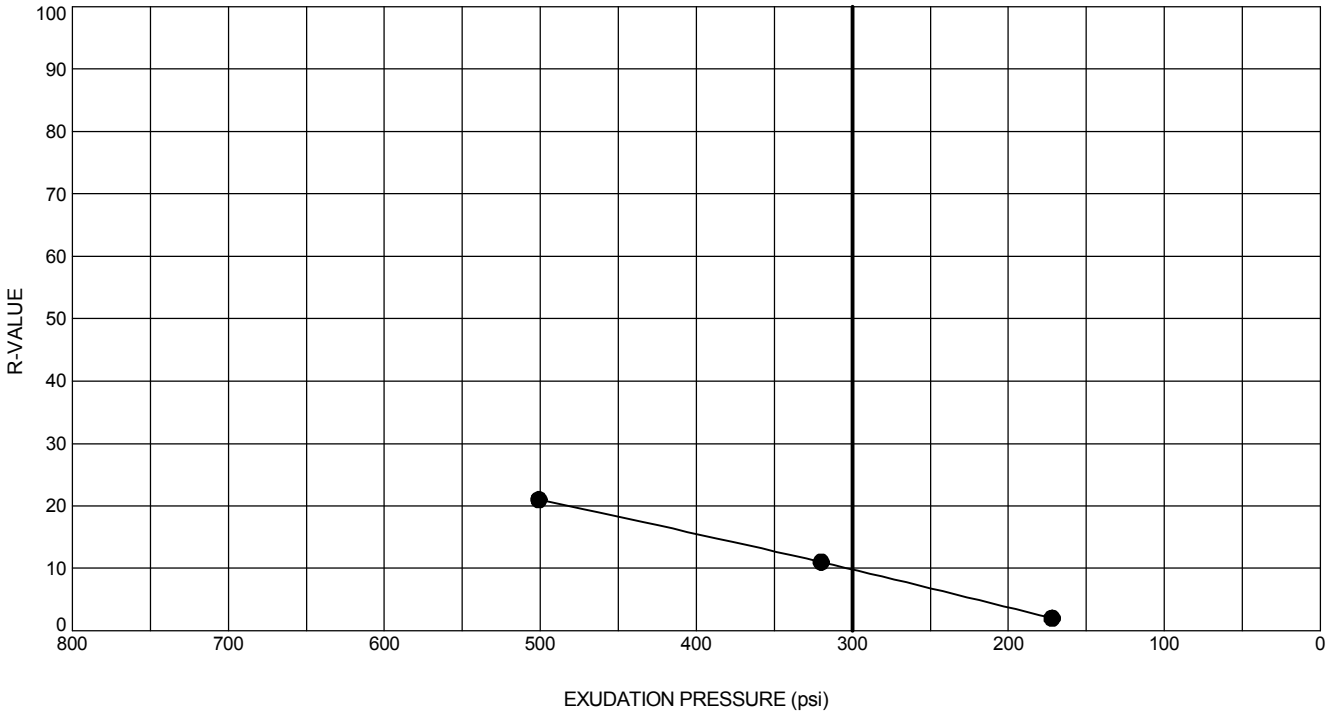
ATTERBERG LIMITS

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE

B-3



Exploration ID	Depth (ft.)	Sample Number	Sample Description	R-Value @ 300 psi Exudation Pressure
B-24	0 - 2	1	CLAYEY SAND (SC)	10

Specimen No.	Moisture at Time of Test (%)	Dry Unit Weight (pcf)	Expansion Pressure (psi)	Exudation Pressure (psi)	Corrected Resistance Value
1	10.3	129.9	160	501	21
2	12.1	122.9	30	320	11
3	13.9	114.7	0	172	2

Testing perfomed in general accordance with ASTM D2844.
NA = Not Available

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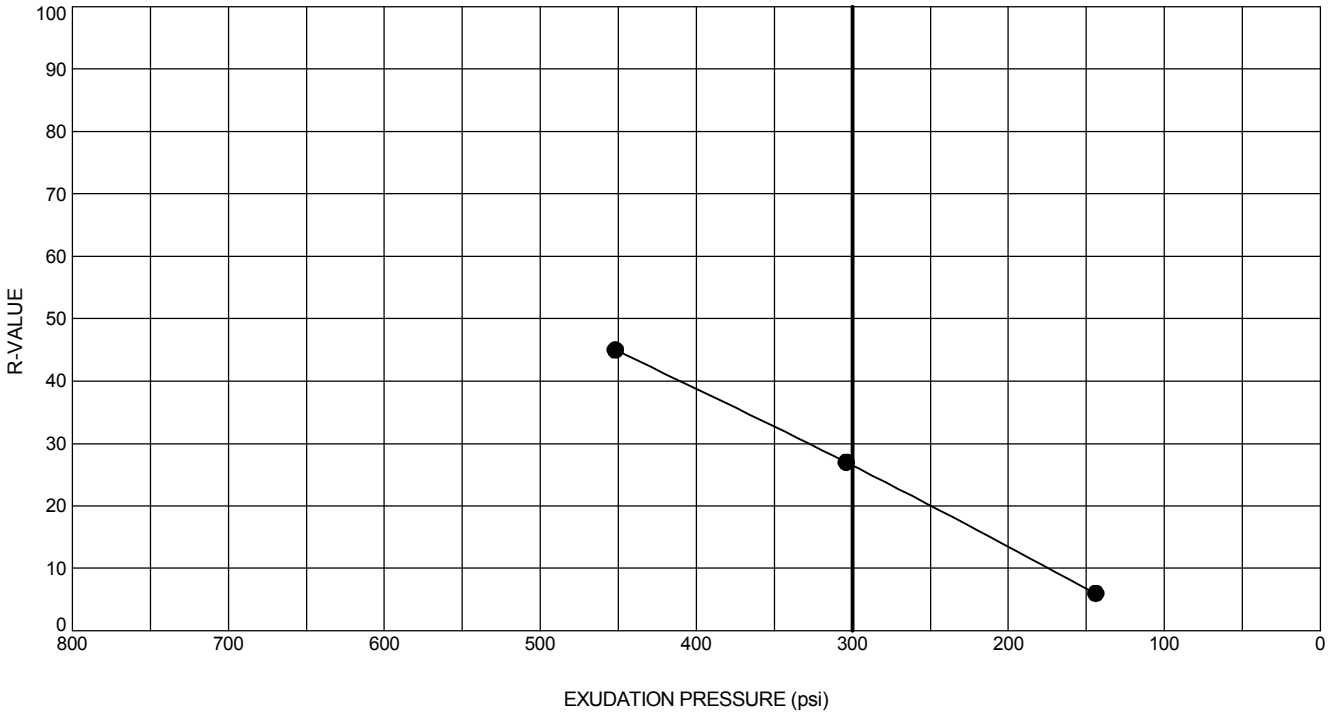
R-VALUE

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE

B-4



Exploration ID	Depth (ft.)	Sample Number	Sample Description	R-Value @ 300 psi Exudation Pressure
B-27	0 - 5	1	CLAYEY SAND (SC)	26

Specimen No.	Moisture at Time of Test (%)	Dry Unit Weight (pcf)	Expansion Pressure (psi)	Exudation Pressure (psi)	Corrected Resistance Value
1	10.8	127.0	178	452	45
2	11.7	125.3	156	304	27
3	12.6	121.8	35	144	6

Testing perfomed in general accordance with ASTM D2844.
NA = Not Available

KLEINFELDER
Bright People. Right Solutions.

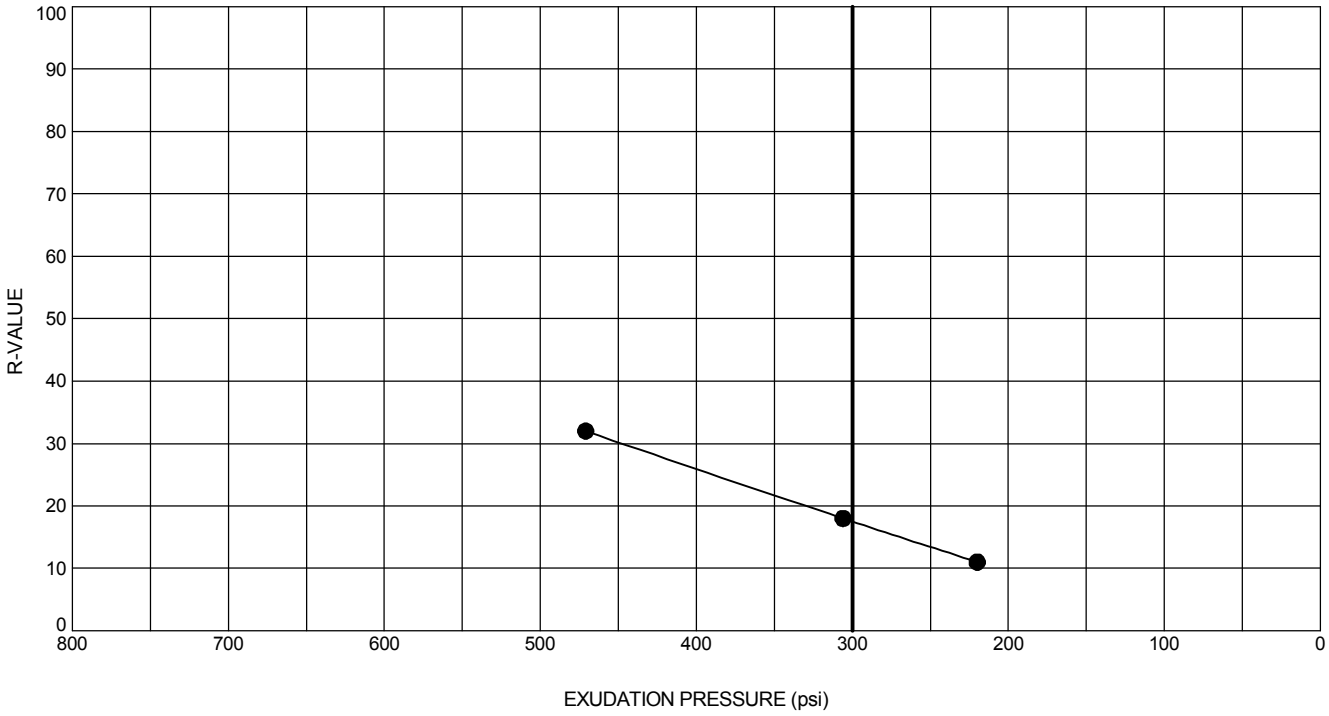
PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

R-VALUE

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE

B-5



Exploration ID	Depth (ft.)	Sample Number	Sample Description	R-Value @ 300 psi Exudation Pressure
B-28	0 - 5	1	SILTY SAND (SM)	17

Specimen No.	Moisture at Time of Test (%)	Dry Unit Weight (pcf)	Expansion Pressure (psi)	Exudation Pressure (psi)	Corrected Resistance Value
1	9.2	127.8	22	471	32
2	10.1	125.3	0	306	18
3	10.9	124.7	0	220	11

Testing perfomed in general accordance with ASTM D2844.
NA = Not Available

KLEINFELDER
Bright People. Right Solutions.

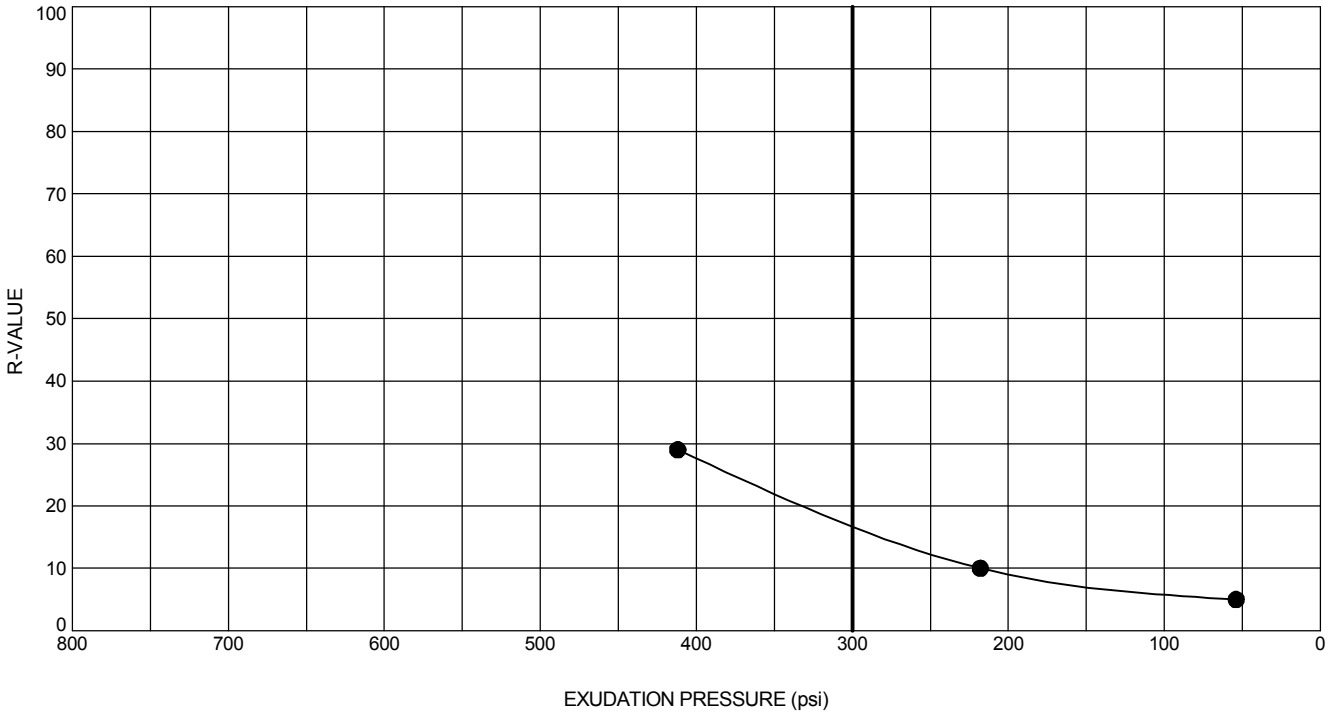
PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

R-VALUE

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE

B-6



Exploration ID	Depth (ft.)	Sample Number	Sample Description	R-Value @ 300 psi Exudation Pressure
B-33	0 - 5	1	SILTY SAND (SM)	18

Specimen No.	Moisture at Time of Test (%)	Dry Unit Weight (pcf)	Expansion Pressure (psi)	Exudation Pressure (psi)	Corrected Resistance Value
1	11.9	119.1	0	412	29
2	13.3	121.7	0	218	10
3	14.7	117.8	0	54	5

Testing perfomed in general accordance with ASTM D2844.
NA = Not Available

KLEINFELDER
Bright People. Right Solutions.

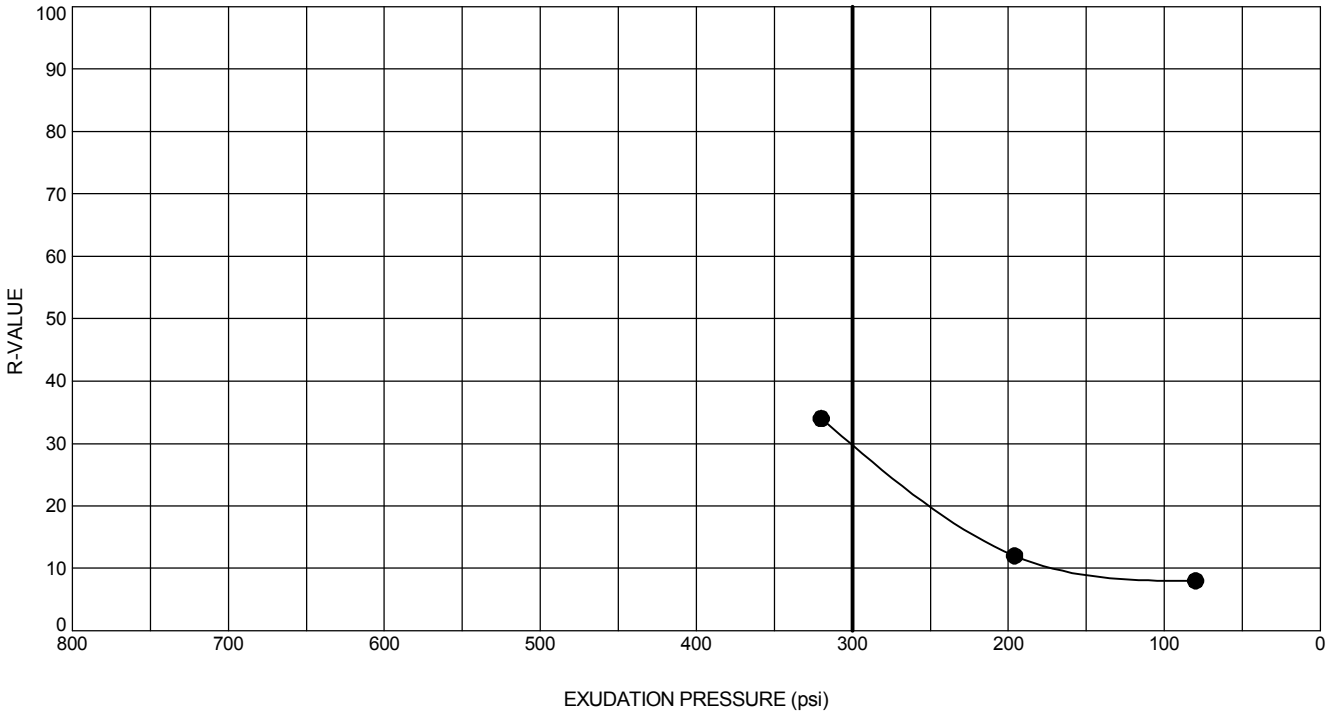
PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

R-VALUE

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE

B-7



Exploration ID	Depth (ft.)	Sample Number	Sample Description	R-Value @ 300 psi Exudation Pressure
B-34	0 - 5	1	SILTY SAND (SM)	30

Specimen No.	Moisture at Time of Test (%)	Dry Unit Weight (pcf)	Expansion Pressure (psi)	Exudation Pressure (psi)	Corrected Resistance Value
1	11.7	123.3	0	320	34
2	12.6	122.3	0	196	12
3	13.5	120.0	0	80	8

Testing perfomed in general accordance with ASTM D2844.
NA = Not Available

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20173273
DRAWN BY:	DR
CHECKED BY:	BM
DATE:	1/18/2017
REVISED:	3/21/2017

R-VALUE

Proposed Costco Wholesale Warehouse
Sierra College Boulevard and Brace Road
Loomis, California
CW# 16-0132

FIGURE

B-8

Sunland Analytical

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

Date Reported 01/25/2017
Date Submitted 01/20/2017

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following location:
Location : 20173273.001A Site ID : TP-4 @ 0-2FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 73533-153394.

EVALUATION FOR SOIL CORROSION

Soil pH	5.71	
Moisture	10.1	%
Minimum Resistivity		No Test
Chloride		No Test
Sulfate		No Test
Redox Potential	(+) 377	mv
Sulfides		Presence - NEGATIVE

METHODS
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422
Redox Potential ASTM G-200, Sulfides AWWA C105/A25.5

Sunland Analytical

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

Date Reported 01/25/2017
Date Submitted 01/20/2017

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following location:
Location : 20173273.001A Site ID : TP-5 @ 0-1 FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 73533-153395.

EVALUATION FOR SOIL CORROSION

Soil pH	5.61	
Moisture	11.3	%
Minimum Resistivity	No Test	
Chloride	No Test	
Sulfate	No Test	
Redox Potential	(+) 331	mv
Sulfides	Presence - NEGATIVE	

METHODS
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422
Redox Potential ASTM G-200, Sulfides AWWA C105/A25.5

Sunland Analytical

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

Date Reported 01/27/2017
Date Submitted 01/23/2017

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following location:
Location : 20173273.001A Site ID : B-5 1A-1B@3-4FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 73535-153397.

EVALUATION FOR SOIL CORROSION

Soil pH	5.16	
Moisture	11.3 %	
Minimum Resistivity	13.40 ohm-cm (x1000)	
Chloride	6.5 ppm	00.00065 %
Sulfate	2.2 ppm	00.00022 %
Redox Potential	(+) 323 mv	
Sulfides	Presence - NEGATIVE	

METHODS

pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422
Redox Potential ASTM G-200, Sulfides AWWA C105/A25.5

Sunland Analytical

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

Date Reported 01/27/2017
Date Submitted 01/23/2017

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following location:
Location : 20173273.001A Site ID : B-17 1A-1B@3-4.
Thank you for your business.

* For future reference to this analysis please use SUN # 73535-153398.

EVALUATION FOR SOIL CORROSION

Soil pH	5.35		
Moisture	9.0 %		
Minimum Resistivity	20.64 ohm-cm (x1000)		
Chloride	6.1 ppm	00.00061	%
Sulfate	1.5 ppm	00.00015	%
Redox Potential	(+) 309 mv		
Sulfides	Presence - NEGATIVE		

METHODS
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422
Redox Potential ASTM G-200, Sulfides AWWA C105/A25.5

Sunland Analytical

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

Date Reported 03/03/2017
Date Submitted 02/28/2017
Date Collected 02/27/2017
ELAP CERT # 2014

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following:
Location : 20173273.001A Site ID : B29@0-2.5F.
Your purchase order number is .
Thank you for your business.

* For future reference to this analysis please use SUN # 73697-153713.

ANALYSIS OF SOIL FOR 503 REGULATED METALS

Percent Moisture 3.5

* Sample analyzed as recieved and reported on a dry weight basis.

Regulated Limits ++		Values Determined +		Detection Limits
41	Arsenic (As)	1.912 mg/kg	******	0.011
39	Cadmium (Cd)	ND	*	0.04
1200	Chromium (Cr)	27.8 mg/kg	******	0.12
N.E.	Cobalt (Co)	No Test		0.07
1500	Copper (Cu)	8.2 mg/kg	******	0.06
300	Lead (Pb)	ND	*	0.06
17	Mercury (Hg)	0.05 mg/kg	******	0.01
N.E.	Molybdenum (Mo)	No Test		0.08
420	Nickel (Ni)	14.0 mg/kg	******	0.02
36	Selenium (Se)	14.348 mg/kg	*******	0.014
2800	Zinc (Zn)	30.4 mg/kg	******	0.02

ND	Below Limits	At Toxic Level

ND = value below detection limits
N.E. = value not established by regulatory agencies
Element/Methods Digest.Method 3050 A or B
EPA SW-846 ICP 6010 and EPA SW-846 7470A or 7470B

Sunland Analytical

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

Date Completed 03/03/2017
Date Submitted 02/28/2017
Date Collected 02/27/2017
ELAP Cert. #2014

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following:
Location : 20173273.001A Site ID : B29@0-2.5F.
Your purchase order number is . Thank you for your business.

* For future reference to this analysis please use SUN # 73697-153713.

ANALYSIS OF SOIL

TYPE OF TEST	RESULTS	UNITS
Silver (Ag)	ND	mg/kg
Vanadium (V)	42.187	mg/kg

DETECTION LIMITS
Silver (Ag) 0.03
Vanadium (V) 0.09

Digestion Method 3050 A/B, EPA SW 846 ICP 6010
ND = Below Detection Limits

Sunland Analytical

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

Date Reported 03/03/2017
Date Submitted 02/28/2017
Date Collected 02/27/2017
ELAP CERT # 2014

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following:
Location : 20173273.001A Site ID : B31@0-3FT.
Your purchase order number is .
Thank you for your business.

* For future reference to this analysis please use SUN # 73697-153714.

ANALYSIS OF SOIL FOR 503 REGULATED METALS

Percent Moisture 11.8

* Sample analyzed as recieved and reported on a dry weight basis.

Regulated Limits ++		Values Determined +		Detection Limits
41	Arsenic (As)	1.347 mg/kg	******	0.011
39	Cadmium (Cd)	ND	*	0.04
1200	Chromium (Cr)	11.1 mg/kg	******	0.12
N.E.	Cobalt (Co)	No Test		0.07
1500	Copper (Cu)	4.5 mg/kg	******	0.06
300	Lead (Pb)	ND	*	0.06
17	Mercury (Hg)	0.12 mg/kg	******	0.01
N.E.	Molybdenum (Mo)	No Test		0.08
420	Nickel (Ni)	6.2 mg/kg	******	0.02
36	Selenium (Se)	1.553 mg/kg	******	0.014
2800	Zinc (Zn)	12.5 mg/kg	******	0.02

ND = value below detection limits
N.E. = value not established by regulatory agencies

	ND	Below Limits	At Toxic Level

Element/Methods Digest.Method 3050 A or B
EPA SW-846 ICP 6010 and EPA SW-846 7470A or 7470B

Sunland Analytical

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

Date Completed 03/03/2017
Date Submitted 02/28/2017
Date Collected 02/27/2017
ELAP Cert. #2014

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following:
Location : 20173273.001A Site ID : B31@0-3FT.
Your purchase order number is . Thank you for your business.

* For future reference to this analysis please use SUN # 73697-153714.

ANALYSIS OF SOIL

TYPE OF TEST	RESULTS	UNITS
Silver (Ag)	ND	mg/kg
Vanadium (V)	23.774	mg/kg

DETECTION LIMITS
Silver (Ag) 0.03
Vanadium (V) 0.09

Digestion Method 3050 A/B, EPA SW 846 ICP 6010
ND = Below Detection Limits

Sunland Analytical

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

Date Reported 03/03/2017
Date Submitted 02/28/2017
Date Collected 02/27/2017
ELAP CERT # 2014

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following:
Location : 20173273.001A Site ID : B37@0-2.5F.
Your purchase order number is .
Thank you for your business.

* For future reference to this analysis please use SUN # 73697-153715.

ANALYSIS OF SOIL FOR 503 REGULATED METALS

Percent Moisture 3.8

* Sample analyzed as recieved and reported on a dry weight basis.

Regulated Limits ++		Values Determined +		Detection Limits
41	Arsenic (As)	3.049 mg/kg	******	0.011
39	Cadmium (Cd)	ND	*	0.04
1200	Chromium (Cr)	22.5 mg/kg	******	0.12
N.E.	Cobalt (Co)	No Test		0.07
1500	Copper (Cu)	9.0 mg/kg	******	0.06
300	Lead (Pb)	ND	*	0.06
17	Mercury (Hg)	0.12 mg/kg	******	0.01
N.E.	Molybdenum (Mo)	No Test		0.08
420	Nickel (Ni)	14.3 mg/kg	******	0.02
36	Selenium (Se)	3.324 mg/kg	******	0.014
2800	Zinc (Zn)	39.0 mg/kg	******	0.02

ND Below Limits | At Toxic Level

ND = value below detection limits
N.E. = value not established by regulatory agencies
Element/Methods Digest.Method 3050 A or B
EPA SW-846 ICP 6010 and EPA SW-846 7470A or 7470B

Sunland Analytical

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

Date Completed 03/03/2017
Date Submitted 02/28/2017
Date Collected 02/27/2017
ELAP Cert. #2014

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following:
Location : 20173273.001A Site ID : B37@0-2.5F.
Your purchase order number is . Thank you for your business.

* For future reference to this analysis please use SUN # 73697-153715.

ANALYSIS OF SOIL

TYPE OF TEST	RESULTS	UNITS
Silver (Ag)	ND	mg/kg
Vanadium (V)	40.576	mg/kg

DETECTION LIMITS
Silver (Ag) 0.03
Vanadium (V) 0.09

Digestion Method 3050 A/B, EPA SW 846 ICP 6010
ND = Below Detection Limits

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

03/03/2017

LABORATORY CONTROL REPORT
Metal Analysis and Preparation for Sun Nos. 153713,153714,153715.
Method of Sample Preparation:

Analyte	Conc. of Analyte	Accuracy %	Precision (+/- RPD)
Arsenic	5.000	104	4
Cadmium	5.000	100	<1
Chromium	5.000	101	1
Copper	2.500	105	2
Lead	5.000	96	2
Mercury	0.050	100	<1
Nickel	5.000	97	4
Selenium	5.000	93	2
Silver	1.000	104	<1
Vanadium	2.500	101	1
Zinc	5.000	98	<1

NOTES (All of the following are specific for the current analysis process.)

1. Analyte concentration is obtained from purchased Quality Control Standards
2. Accuracy is the percent of the known analyte concentration determined and should fall within the range of 85 - 115%.
3. Precision is the relative percent difference of two determinations (D1 & D2) of the know analyte. RPD= ((D1-D2)/(D1+D2)/2) * 100

Sunland Analytical

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

Date Reported 03/03/2017
Date Submitted 02/28/2017

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following:
Location : 20173273.001A Site ID : B-29@0-2.5FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 73699-153717.

SOIL ANALYSIS

Saturation Percent (SP)	39		Soil Texture Loam
pH	5.96		
E.C.	0.06	mmho/cm	
Tot.Dissolved Salts	38.4	ppm	
Infiltration Rate (0% Slope)	0.54	in/hr	
% Organic Matter	2.6		
C.E.C.	13.0	meq/100g	
Sodium Absorption Ratio (SAR)	1.6		
Exchangable Sodium Percent (ESP)	1.1		
Gypsum Req. (CaSO4*2H2O)	None Required		
est. Nitrogen Release	1.2	#/1000 sq.ft.	

Nitrate	0.41	ppm	*
Phosphorus	3.78	ppm	***
Potassium	71.17	ppm	**********
Sulfur	2.92	ppm	****
Chloride	10.48	ppm	********
Carbonates	13.12	ppm	**********
Sodium	34.24	ppm	
Calcium	2075.52	ppm	**********
Magnesium	284.55	ppm	**********
Boron	0.15	ppm	****
Copper	0.41	ppm	***
Iron	16.15	ppm	**********
Manganese	5.31	ppm	**********
Zinc	0.35	ppm	*********

Very Low	Low	Adequate	Excessive

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

DATE 03/03/2017
SUN NUMBER 153717

Information requested by:
Becky Money
Kleinfelder Group

Information for:
20173273.001A
Sample ID: B-29@0-2.5FT

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL pH (Acidity and Alkalinity)

The pH of this sample indicates the soil is moderately acid and should be modified for non acid-tolerant plants. Apply 28 pounds of Dolomite Lime per 1000 sq.ft. and work into ground before planting.

DISSOLVED SALTS (Indicated by E.C. & TDS)

These conditions are in the normal range for plant growth.

SOIL TEXTURE AND RATE OF WATER INFILTRATION

The infiltration rate for all soil textures decreases with increasing ground slope. At 0 to 4%, 5 to 8%, 9 to 12%, 13 to 16% and above 16% the infiltration rate of this sample decreases from 0.54 to 0.43, 0.32, 0.22, 0.14, respectively. Infiltration rate also decreases with percent of ground cover and by compaction.

WATER PENETRATION OF SOIL DUE TO CHEMICAL CHARACTERISTICS

When exchangable Sodium increases in the soil, water penetration decreases. Based on SAR and ESP values this sample has no penetration problem due to soil Sodium. No Gypsum required.

ORGANIC MATTER

Organic matter provides a slow nitrogen release and aids water retention. This sample has a moderate Organic Matter content.
To maintain moisture and provide sustained nitrogen release a level of 10% organic matter is recommended. Use amending material that is approximately 75% organic matter (i.e. many ground fir barks). Based on the analysis of this soil sample apply 4 yards per 1000 sq.ft. Spread evenly and blend into the top six inches of soil. It is a reasonable practice to apply a top dressing of 3 inches of organic mulches to aid water penetration and retention.

SOIL BORON

Boron concenrations are in a range allowing normal plant growth.

SOIL MICRONUTRIENTS

Micronutrients, Copper, Iron, Manganese and Zinc, in soil are present in small amounts. However, they play a necessary role in plant metabolism. Without appropriate amounts plants will not thrive. Apply the following per 1000/ sq.ft. Do not mix micronutrients during application (use a separate application for each element indicated).

Because copper, manganese and zinc are in very small amounts, dissolve (each) in 2 gallons of water and use a sprayer to obtain an even application.
Apply 0.2 # Copper Sulfate, 0.5 # Zinc Sulfate and water.

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

DATE 03/03/2017
SUN NUMBER 153717

Information requested by:
Becky Money
Kleinfelder Group

Information for:
20173273.001A
Sample ID: B-29@0-2.5FT

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL MACRONUTRIENTS : NITROGEN-PHOSPHORUS-POTASSIUM (N-P-K)

GENERAL N-P-K RECOMMENDATION

Use ONE of these NPK preparations for the first fertilizer application.

Standard NPK Fertilizer Preparations	6-20-20	5-20-10	16-16-16	0-10-10	28-3-4	21-0-0	Customer Choice None
#/1000 sq.ft.	21	25	N/A	N/A	N/A	N/A	**

GRASS OR SOD PREPARATION

Till in organic matter, N,P,K and micro nutrients in addition to any lime gypsum or sulfur as directed above. Smooth soil surface and follow seed or sod producers direction for moisture and product application.

TREES AND SHRUBS

Excavate holes for planting shrubs and trees to at least twice the volume of the container. Prepare backfill for tree and shrub planting holes by mixing three parts of native soil (or imported top soil) with one part organic amendment (preferably nitrogen and iron fortified) and 2.5 pounds of 6-20-20 per yard of mix. For extended fertilization, place slow release fertilizer tablets in each hole per manufacturer's instructions. If 6-20-20 was not directly added to backfill mix, during backfill apply uniformly 1/2 oz of 6-20-20 per gallon containers, 2.5 oz per 5 gallons, 6 oz per 24 inch boxes.

Summary and Suggested Sequence of Soil Improvements (#/1000 Sq.Ft.)

Dolimite Lime	28	#	
Organic Amendment	4	Yd./1000 Sq.Ft.	Bulk organic amendment (nitrofied).
N-P-K Fertilizer	See above chart		
Micro Nutrients			
Copper	0.2	#	Copper sulfate
Zinc	0.5	#	Zinc Sulfate
Sulfate-Sulfur	1	#	Ammonium Sulfate

Maintenance Fertilization

Apply 5 pounds of Ammonium sulfate (21-0-0) per 1000 sq.ft.every month until plants become established. After established, apply 28-3-4 (or similar preparation) to provide desired growth rate and color.

Sunland Analytical

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

Date Reported 03/03/2017
Date Submitted 02/28/2017

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following:
Location : 20173273.001A Site ID : B-29@0-2.5FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 73699-153717.

SOIL ANALYSIS

TYPE OF TEST	RESULTS	UNITS
Aluminum (Al)	9.24	ppm
Molybdenum (Mo)	0.216	ppm

Ammonium Bicarbonate/DTPA Extraction

Sunland Analytical

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

Date Reported 03/03/2017
Date Submitted 02/28/2017

To: Becky Money
Kleinfelder Group
2882 Prospect Dr. Ste 200
Rancho Cordova, CA 95670

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

The reported analysis was requested for the following:
Location : 20173273.001A Site ID : B-31@0-3FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 73699-153718.

SOIL ANALYSIS

Saturation Percent (SP)	23	Soil Texture	Sandy Loam
pH	6.40		
E.C.	0.15	mmho/cm	
Tot.Dissolved Salts	96	ppm	
Infiltration Rate (0% Slope)	0.75	in/hr	
% Organic Matter	1.5		
C.E.C.	5.8	meq/100g	
Sodium Absorption Ratio (SAR)	1.8		
Exchangable Sodium Percent (ESP)	1.4		
Gypsum Req. (CaSO4*2H2O)	None Required		
est. Nitrogen Release	1.0	#/1000 sq.ft.	

Nitrate	0.04	ppm	*
Phosphorus	14.10	ppm	**********
Potassium	49.47	ppm	*******
Sulfur	0.68	ppm	*
Chloride	16.35	ppm	**********
Carbonates	59.36	ppm	**********
Sodium	17.94	ppm	
Calcium	868.32	ppm	**********
Magnesium	147.94	ppm	*******
Boron	0.17	ppm	*****
Copper	1.01	ppm	*********
Iron	127.02	ppm	**********
Manganese	87.53	ppm	**********
Zinc	1.19	ppm	**********

Very Low	Low	Adequate	Excessive

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DATE 03/03/2017
SUN NUMBER 153718

Information requested by:
Becky Money
Kleinfelder Group

Information for:
20173273.001A
Sample ID: B-31@0-3FT

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL pH (Acidity and Alkalinity)

The pH of this sample indicates the soil is moderately acid and should be modified for non acid-tolerant plants. Apply 10 pounds of Dolomite Lime per 1000 sq.ft. and work into ground before planting.

DISSOLVED SALTS (Indicated by E.C. & TDS)

These conditions are in the normal range for plant growth.

SOIL TEXTURE AND RATE OF WATER INFILTRATION

The infiltration rate for all soil textures decreases with increasing ground slope. At 0 to 4%, 5 to 8%, 9 to 12%, 13 to 16% and above 16% the infiltration rate of this sample decreases from 1.06 to 0.85, 0.64, 0.42, 0.27, respectively. Infiltration rate also decreases with percent of ground cover and by compaction.

WATER PENETRATION OF SOIL DUE TO CHEMICAL CHARACTERISTICS

When exchangable Sodium increases in the soil, water penetration decreases. Based on SAR and ESP values this sample has no penetration problem due to soil Sodium. No Gypsum required.

ORGANIC MATTER

Organic matter provides a slow nitrogen release and aids water retention. This sample has a low Organic Matter content.
To maintain moisture and provide sustained nitrogen release a level of 10% organic matter is recommended. Use amending material that is approximately 75% organic matter (i.e. many ground fir barks). Based on the analysis of this soil sample apply 4 yards per 1000 sq.ft. Spread evenly and blend into the top six inches of soil. It is a reasonable practice to apply a top dressing of 3 inches of organic mulches to aid water penetration and retention.

SOIL BORON

Boron concenrations are in a range allowing normal plant growth.

SOIL MICRONUTRIENTS

Micronutrients, Copper, Iron, Manganese and Zinc, in soil are present in small amounts. However, they play a necessary role in plant metabolism. Without appropriate amounts plants will not thrive. Soil has adequate amounts - no application needed.

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Kleinfelder Group

Information for:
20173273.001A
Sample ID: B-31@0-3FT

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL MACRONUTRIENTS : NITROGEN-PHOSPHORUS-POTASSIUM (N-P-K)
GENERAL N-P-K RECOMMENDATION

Use ONE of these NPK preparations for the first fertilizer application.

Standard NPK Fertilizer Preparations	6-20-20	5-20-10	16-16-16	0-10-10	28-3-4	21-0-0	Customer Choice None
#/1000 sq.ft.	21	25	N/A	N/A	N/A	N/A	**

GRASS OR SOD PREPARATION

Till in organic matter, N,P,K and micro nutrients in addition to any lime gypsum or sulfur as directed above. Smooth soil surface and follow seed or sod producers direction for moisture and product application.

TREES AND SHRUBS

Excavate holes for planting shrubs and trees to at least twice the volume of the container. Prepare backfill for tree and shrub planting holes by mixing three parts of native soil (or imported top soil) with one part organic amendment (preferably nitrogen and iron fortified) and 2.5 pounds of 6-20-20 per yard of mix. For extended fertilization, place slow release fertilizer tablets in each hole per manufacturer's instructions. If 6-20-20 was not directly added to backfill mix, during backfill apply uniformly 1/2 oz of 6-20-20 per gallon containers, 2.5 oz per 5 gallons, 6 oz per 24 inch boxes.

Summary and Suggested Sequence of Soil Improvements (#/1000 Sq.Ft.)

Dolimite Lime	10 #	
Organic Amendment	4	Yd./1000 Sq.Ft. Bulk organic amendment (nitrofied).
N-P-K Fertilizer	See above chart	
Magnesium	Low Magnesium compensated for by Dolimite Lime	
Sulfate-Sulfur	1 #	Ammonium Sulfate

Maintenance Fertilization

Apply 5 pounds of Ammonium sulfate (21-0-0) per 1000 sq.ft.every month until plants become established. After established, apply 28-3-4 (or similar preparation) to provide desired growth rate and color.

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General Manager \ Lab Manager

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Location : 20173273.001A Site ID : B-31@0-3FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 73699-153718.

SOIL ANALYSIS

TYPE OF TEST	RESULTS	UNITS
Aluminum (Al)	6.63	ppm
Molybdenum (Mo)	0.054	ppm

Ammonium Bicarbonate/DTPA Extraction

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

The reported analysis was requested for the following:
Location : 20173273.001A Site ID : B-37@0-2.5FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 73699-153719.

SOIL ANALYSIS

Saturation Percent (SP)	37		Soil Texture Loam
pH	6.51		
E.C.	0.08	mmho/cm	
Tot.Dissolved Salts	51.2	ppm	
Infiltration Rate (0% Slope)	0.54	in/hr	
% Organic Matter	2.2		
C.E.C.	8.7	meq/100g	
Sodium Absorption Ratio (SAR)	2.0		
Exchangable Sodium Percent (ESP)	1.7		
Gypsum Req. ($CaSO_4*2H_2O$)	None Required		
est. Nitrogen Release	1.1	#/1000 sq.ft.	

Nitrate	0.55	ppm	*
Phosphorus	5.04	ppm	*****
Potassium	63.68	ppm	**********
Sulfur	2.12	ppm	***
Chloride	9.32	ppm	********
Carbonates	27.85	ppm	**********
Sodium	33.16	ppm	
Calcium	1308.68	ppm	**********
Magnesium	226.23	ppm	*********
Boron	0.15	ppm	****
Copper	0.41	ppm	***
Iron	13.83	ppm	**********
Manganese	5.13	ppm	**********
Zinc	0.32	ppm	********

Very Low	Low	Adequate	Excessive

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

DATE 03/03/2017
SUN NUMBER 153719

Information requested by:
Becky Money
Kleinfelder Group

Information for:
20173273.001A
Sample ID: B-37@0-2.5FT

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL pH (Acidity and Alkalinity)

The pH of this sample indicates the soil is in a range for normal growth of most plants. No modification is required.

DISSOLVED SALTS (Indicated by E.C. & TDS)

These conditions are in the normal range for plant growth.

SOIL TEXTURE AND RATE OF WATER INFILTRATION

The infiltration rate for all soil textures decreases with increasing ground slope. At 0 to 4%, 5 to 8%, 9 to 12%, 13 to 16% and above 16% the infiltration rate of this sample decreases from 0.54 to 0.43, 0.32, 0.22, 0.14, respectively. Infiltration rate also decreases with percent of ground cover and by compaction.

WATER PENETRATION OF SOIL DUE TO CHEMICAL CHARACTERISTICS

When exchangable Sodium increases in the soil, water penetration decreases. Based on SAR and ESP values this sample has no penetration problem due to soil Sodium. No Gypsum required.

ORGANIC MATTER

Organic matter provides a slow nitrogen release and aids water retention. This sample has a moderate Organic Matter content.
To maintain moisture and provide sustained nitrogen release a level of 10% organic matter is recommended. Use amending material that is approximately 75% organic matter (i.e. many ground fir barks). Based on the analysis of this soil sample apply 4 yards per 1000 sq.ft. Spread evenly and blend into the top six inches of soil. It is a reasonable practice to apply a top dressing of 3 inches of organic mulches to aid water penetration and retention.

SOIL BORON

Boron concenrations are in a range allowing normal plant growth.

SOIL MICRONUTRIENTS

Micronutrients, Copper, Iron, Manganese and Zinc, in soil are present in small amounts. However, they play a necessary role in plant metabolism. Without appropriate amounts plants will not thrive. Apply the following per 1000/ sq.ft. Do not mix micronutrients during application (use a separate application for each element indicated).

Because copper, manganese and zinc are in very small amounts, dissolve (each) in 2 gallons of water and use a sprayer to obtain an even application.
Apply 0.2 # Copper Sulfate, 0.5 # Zinc Sulfate and water.

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Information for:
20173273.001A
Sample ID: B-37@0-2.5FT

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL MACRONUTRIENTS : NITROGEN-PHOSPHORUS-POTASSIUM (N-P-K)

GENERAL N-P-K RECOMMENDATION

Use ONE of these NPK preparations for the first fertilizer application.

Standard NPK Fertilizer Preparations	6-20-20	5-20-10	16-16-16	0-10-10	28-3-4	21-0-0	Customer Choice None
#/1000 sq.ft.	21	25	N/A	N/A	N/A	N/A	**

GRASS OR SOD PREPARATION

Till in organic matter, N,P,K and micro nutrients in addition to any lime gypsum or sulfur as directed above. Smooth soil surface and follow seed or sod producers direction for moisture and product application.

TREES AND SHRUBS

Excavate holes for planting shrubs and trees to at least twice the volume of the container. Prepare backfill for tree and shrub planting holes by mixing three parts of native soil (or imported top soil) with one part organic amendment (preferably nitrogen and iron fortified) and 2.5 pounds of 6-20-20 per yard of mix. For extended fertilization, place slow release fertilizer tablets in each hole per manufacturer's instructions. If 6-20-20 was not directly added to backfill mix, during backfill apply uniformly 1/2 oz of 6-20-20 per gallon containers, 2.5 oz per 5 gallons, 6 oz per 24 inch boxes.

Summary and Suggested Sequence of Soil Improvements (#/1000 Sq.Ft.)

Organic Amendment	4	Yd./1000 Sq.Ft.	Bulk organic amendment (nitrofied).
N-P-K Fertilizer	See above chart		
Micro Nutrients			
Copper	0.2	#	Copper sulfate
Zinc	0.5	#	Zinc Sulfate
Sulfate-Sulfur	1	#	Ammonium Sulfate

Maintenance Fertilization

Apply 5 pounds of Ammonium sulfate (21-0-0) per 1000 sq.ft.every month until plants become established. After established, apply 28-3-4 (or similar preparation) to provide desired growth rate and color.

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Location : 20173273.001A Site ID : B-37@0-2.5FT.
Thank you for your business.

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SOIL ANALYSIS

TYPE OF TEST	RESULTS	UNITS
Aluminum (Al)	8.61	ppm
Molybdenum (Mo)	0.218	ppm

Ammonium Bicarbonate/DTPA Extraction

Water Quality Consumer Confidence Report

For samples collected during 2015 in the Foothill/Sunset Water System

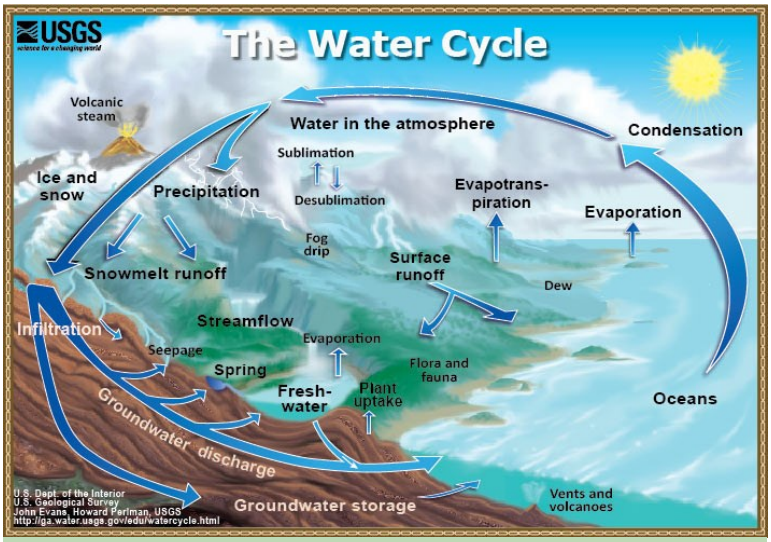
Placer County Water Agency is pleased to report this year - as we have each and every year since 1991 - that the drinking water supplied to you meets or exceeds state and federal public health standards for drinking water quality and safety. California water retailers, including PCWA, are required by law to inform customers about the quality of their drinking water. The results of PCWA's testing and monitoring programs of 2015 are reported in this newsletter. If you have any questions about this report, please contact the PCWA Customer Services Center at (530) 823-4850 or (800) 464-0030.

Ensuring The Safety of Your Drinking Water

In order to ensure that tap water is safe to drink, the U.S. Environmental Protection Agency (USEPA) and the State Water Resources Controll Board (State Board) prescribe regulations which limit the amount of certain contaminants in water provided by public water systems. State Board regulations also establish limits for contaminants in bottled water that must provide the same protection for public health.

About Your Drinking Water

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the U.S. Environmental Protection Agency's **Safe Drinking Water Hotline: 1-800-426-4791**

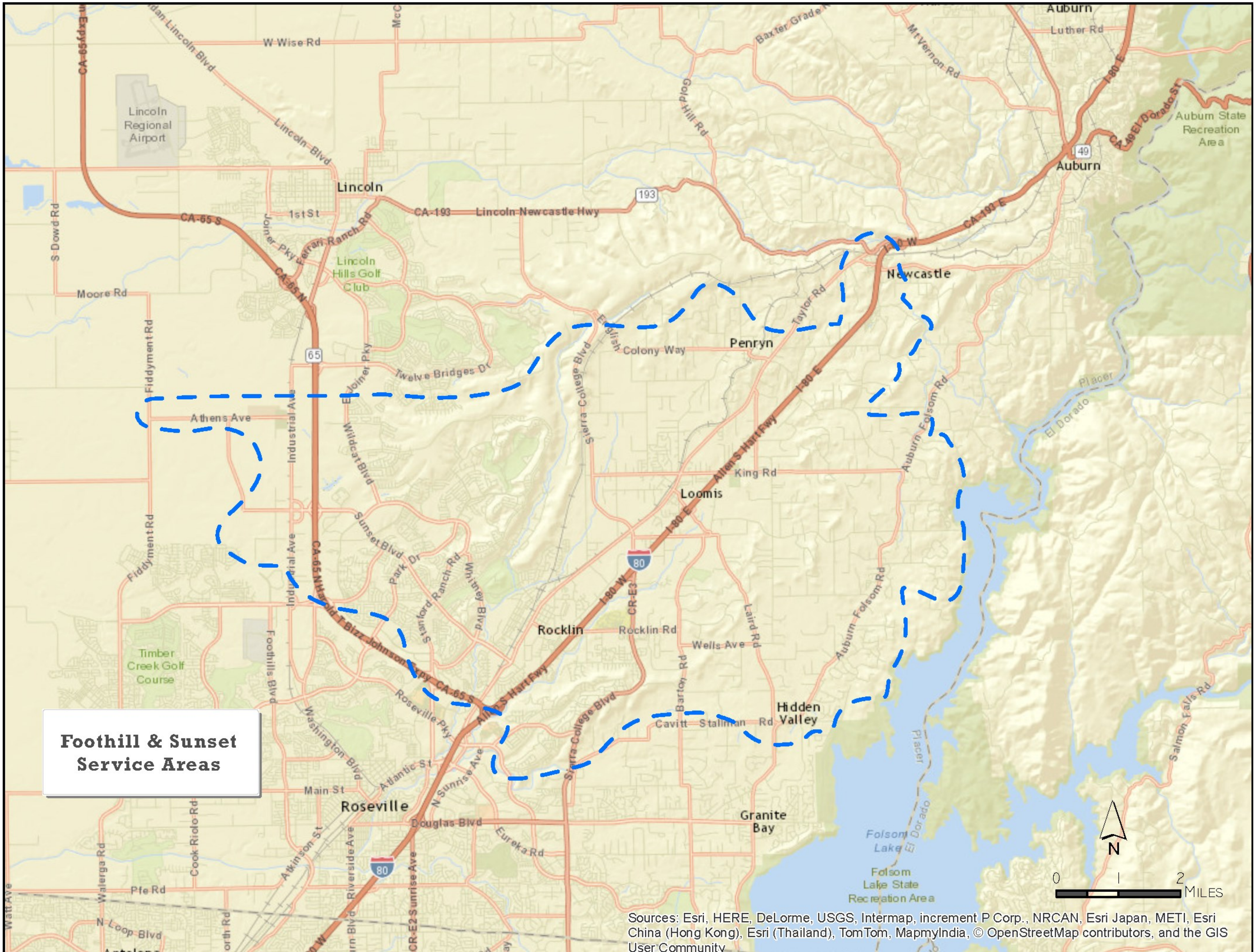


The Source of Your Water Supply

Your water originates in the Sierra snowpack. Surface water from the Yuba and Bear River watersheds and Lake Spaulding flows into the PG&E and PCWA delivery systems. This is supplemented with American River water. The water is treated at the water treatment plants listed in this report. PCWA has completed a Sanitary Survey and Source Water Assessment of the Yuba-Bear River watershed (2012) as well as for the American River watershed (2013). It was found the watersheds were vulnerable to contaminants from highways, roadways and railroads near rivers and canals, septic tanks, utility pipelines crossing canals, upstream recreation, historic and active mining operations, utility operations, and timber harvest. Contaminants associated with these activities that could pose a threat to source water include but are not limited to sediment, bacteria, viruses, parasites, pesticides, herbicides and trace metals. Historically, contaminant levels have been very low in the source water and watersheds. Full details of the Source Water Assessments may be seen at the Placer County Water Agency Business Center, 144 Ferguson Road, in Auburn.

Note about connection between PCWA and Roseville: During warm summer months, most customers in the area found at the link below receive City of Roseville water from about 6 a.m. to noon.

https://www.pcwa.net/files/docs/wq/Rocklin_Area.pdf


Foothill & Sunset
Service Areas
Lincoln
Auburn
Newcastle
Penryn
Loomis
Rocklin
Hidden Valley
Granite Bay
Roseville
Antelope
Lincoln Regional Airport
Lincoln Hills Golf Club
Timber Creek Golf Course
Auburn State Recreation Area
Folsom Lake
Folsom Lake State Recreation Area
N
0 1 2 MILES
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Foothill/Sunset Water Quality Results

Primary Drinking Water Standards

Turbidity Performance Standards (that must be met through the water treatment process)

Turbidity is a measurement of clarity or the level of suspended matter in the water. In reporting turbidity, the highest single measurement and the lowest monthly percentage of samples meeting the turbidity limits are specified.

Turbidity of the filtered water must:

1. Be less than or equal to 0.3 NTU in 95% of measurements in a month.
2. Not exceed 1 NTU at any time.

	PCWA	Roseville
Lowest monthly percentage of samples that met Turbidity Performance Standard No. 1	**100%**	**100%**
Highest single turbidity measurement during the year	**0.18**	**0.06**
Number of violations of any surface water treatment requirements	**0**	**0**

CONSTITUENT	UNITS	MCL or [MRDL]	PHG, (MCLG) or [MRDLG]	PCWA Range and Average or (HRAA)	Roseville Range and Average or (HRAA)	Typical Source of Contaminant
Total Trihalomethane	ug/L	80	None	36-83 (62.25)	N/A[1]	Byproduct of drinking water disinfection
Total Haloacetic Acids	ug/L	60	None	22-52 (39.75)	N/A[1]	Byproduct of drinking water disinfection
Chlorine	mg/L	[4]	[4]	0-1.22 (0.6)	N/A[1]	Drinking water disinfectant added for treatment
Total Organic Carbon	mg/L	TT=RAA<2	None	0.9-1.4 (1.1)	0.8-1.4 (1.1)	Various natural and manmade sources
Fluoride	mg/L	2	1	ND	0.05-1.2 0.76	Water additive that promotes strong teeth

[1]Samples are collected in the distribution system, so PCWA levels represent the quality of the water delivered to the customer.

Secondary Drinking Water Standards

Total Dissolved Solids	mg/L	1,000	None	50-53 51.5	55	Runoff / leaching from natural deposits
Specific Conductance	uS/cm	1,600	None	68-72 70	98	Substances that form ions when in water
Chloride	mg/L	500	None	4.9-5 4.95	4.3	Runoff / leaching from natural deposits
Sulfate	mg/L	500	None	6.7-8.1 7.4	7.3	Runoff / leaching from natural deposits
Odor	Units	3	None	ND	2.5	Naturally-occurring organic materials

Monitoring of Unregulated Substances

Sodium	mg/L	None	None	5.1-5.2 5.15	4.6	Runoff / leaching from natural deposits
Hardness	mg/L	None	None	17-18 17.5	37	Runoff / leaching from natural deposits

DEFINITIONS: Understanding Your Water Quality Report

MCL: Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water. Primary MCL's are set as close to the PHG's (or MCLG's) as is economically and technologically feasible. Secondary MCL's are set to protect the odor, taste and appearance of drinking water.

MCLG: Maximum Contaminant Level Goal. The level of a contaminant in drinking water below which there is no known or expected risk to health. Set by the U.S. Environmental Protection Agency.

MRDL: Maximum Residual Disinfectant Level. The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MRDLG: Maximum Residual Disinfectant Level Goal. The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLG's do not reflect the benefits of the use of disinfectants to control microbial contaminants.

Primary Drinking Water Standard. MCL's and MRDL's for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.

PHG: Public Health Goal. The level of a contaminant in drinking water below which there is no known or expected risk to health. PHG's are set by the California Environmental Protection Agency.

AL: Action Level. The concentration of a contaminant, which if exceeded, triggers treatment or other requirements which a water system must follow.

NTU: Nephelometric Turbidity Units. A measure of the clarity of water. Turbidity is monitored because it is a good indicator of water quality. High turbidity can hinder the effectiveness of disinfectants.

TT: Treatment Technique. A required process intended to reduce the level of a contaminant in drinking water.

pCi/L: picocuries per liter. A measure of radiation.

mg/L: milligrams per liter or parts per million (ppm)

ug/L: micrograms per liter or parts per billion (ppb)

uS/cm: MicroSiemens per centimeter

RAA: Running Annual Average

HRAA: Highest Running Annual Average

<: Less Than

ND: ND or Non-Detected: An analysis result below detectable levels.

NA: Non-Applicable

Environmental Influences on Drinking Water

The sources of drinking water (both tap and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity. Contaminants that may be present in source water include:

- **Microbial contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- **Inorganic contaminants**, such as salt and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.
- **Pesticides and herbicides**, that may come from a variety of sources such as agriculture, urban storm water runoff and residential uses.
- **Organic chemical contaminants**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, agricultural application and septic systems.
- **Radioactive contaminants**, that can be naturally-occurring or be the result of oil and gas production and mining activities.

Statement on Lead

(none found in this system)

Infants, young children, and pregnant women are typically more vulnerable to lead in drinking water than the general population. It is possible that lead levels at your home may be higher than at other homes in the community as a result of the materials used in your home's plumbing. If your water faucet has not been used for several hours, you can minimize the potential for lead exposure by flushing the faucet for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about elevated lead levels in your home's water, you may wish to have your water tested. Additional information is available from the USEPA Safe Drinking Water Hotline (1-800-426-4791) or at *http://www.epa.gov/safewater/lead*.

Note to At-Risk Water Users

Some people may be more vulnerable to contaminants in drinking water than the general population. Immune-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. USEPA/Centers for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline at (800) 426-4791.

What You Should Know About Cryptosporidium

Cryptosporidium is a microbial pathogen found in most surface waters throughout the U.S.. Although filtration removes Cryptosporidium, the most commonly used filtration methods cannot guarantee 100 percent removal. We conducted a two-year study on Cryptosporidium during 2006 and 2007, and our monitoring indicated the presence of these organisms in our source water in ranges from non-detect to 0.2 organisms per liter. We are in the middle of another 2 years of monitoring, and so far all results are non-detect. Again, these results are from the untreated, raw water. The design of the EPA study conducted here did not call for treated water samples. Current test methods do not allow us to determine if the organisms are dead or if they are capable of causing disease. Ingestion of Cryptosporidium may cause an abdominal infection. Symptoms of infection include nausea, diarrhea, and abdominal cramps. Most healthy individuals can overcome the disease within a few weeks. However, immune-compromised people are at greater risk of developing life-threatening illness. We encourage immune-compromised individuals to consult their health care provider regarding appropriate precautions to take to avoid infection. Cryptosporidium must be ingested to cause disease, and it may be spread through means other than drinking water.

2015 Testing Results

Measurements reported here were collected in 2015 (unless otherwise noted). In accordance with federal regulations, data is from the most recent tests. We are allowed to monitor for some contaminants less than once per year because concentrations of these contaminants do not change frequently.

Este informe contiene información muy importante sobre su agua potable. Tradúzcalo o hable con alguien que lo entienda bien.

Frequently Asked Questions About Water Quality

It is important for you to know that we take our customers' concerns very seriously. We feel that you wouldn't be calling if there weren't cause for concern, so we investigate every claim fully and in a timely manner before closing a case. Below are some answers to the most common questions or concerns. FOR INFORMATION about this report or to report any concerns with the quality of water in your home or a perceived risk to the quality of our water source, PCWA customers are invited to contact the PCWA Customer Service Center at (530) 823-4850 or (800) 464-0030.

Do we have hard water?

Most of the water served to you is less than 20 mg/L (milligrams per liter) PCWA water in general is on the low end of soft water. Roseville water, at 37 mg/L is still withing the soft range. General guidelines for classification of waters are: 0 to 60 mg/L as calcium carbonate is classified as soft; 61 to 120 mg/L as moderately hard; 121 to 180 mg/L as hard; and more than 180 mg/L as very hard.

Is there Fluoride in my water?

PCWA does not fluoridate its water. Fluoride does exist naturally in a PCWA well which was run briefly during the year. There is a very small portion of the City of Rocklin, which receives water from the City of Roseville during high demand in warm months only. In addition, our Bianchi system receives Roseville water at all times. Roseville is required to fluoridate its water. To find maps of these areas, you can go to: http://www.pcwa.net/water-resources/water-quality.html

My water smells like Chlorine!

Chlorine is required in the distribution system to keep bacteria from making it to your tap. We regulate our Chlorine dosage very strictly so that we have just enough without having too much. The maximum residual level for Chlorine is 4 mg/L (milligrams per liter), and a common level for our systems is between 0.5 and 1.5 mg/L. Some people are more sensitive to the smell of Chlorine in water. It is common for people to think that the level of the Chlorine must be too high under these circumstances; however, we've found that the most common reason for smelling Chlorine at your tap is when the Chlorine is dissipating or the level is dropping. The reason for this is that the water sits in your plumbing before you use it. Most likely, if you flush your taps out, the smell will disappear.

Why is my tap water milky or cloudy?

This is caused by tiny air bubbles in the water. It is completely harmless. Cold water from snowmelt has the potential to hold lots of air. As the water warms a bit on its way to your tap, it has more potential to release that air. When you turn on your tap, the rapid reduction in pressure causes the air to come out of solution, and creates the milky look you see. If this is the case, it will clear before your eyes as in the picture.

How do I know my water is safe?

Distribution operators and treatment plant operators certified by the State Water Resources Control Board collect hundreds of bacteriological samples each year throughout the water distribution systems as well as performing thousands of individual tests in the treatment facilities and in the distribution system, of which only the detected constituents are found in your annual Consumer Confidence Report. Field tests for things like temperature, turbidity, pH and chlorine residual help to let us know that our water is maintaining its quality throughout the distribution system.

Frequently Asked Questions About Water Quality

Continued...

My water is dirty!

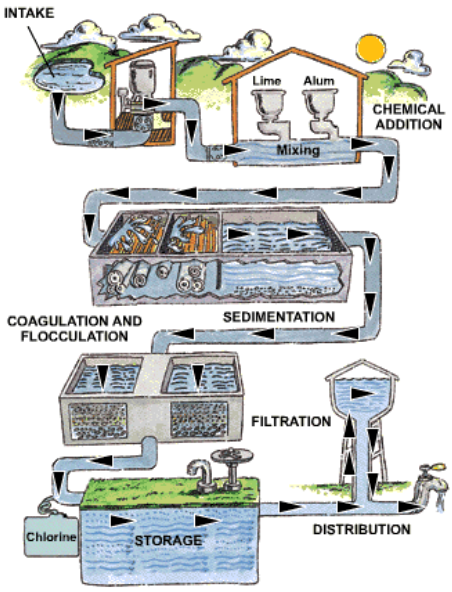
It is actually very common for people to experience discolored or "dirty" water at their tap. In most cases, we can trace this condition to a particular aspect of the household plumbing. It is very common for a water heater to corrode or rust and cause discolored water in the hot water. You can test this by turning your tap to the full hot position and observe whether the water is discolored. If the water is discolored in your hot water, but not cold, you can be reasonably certain the issue lies in your water heater. If the problem occurs in the cold water as well, and doesn't clear up after running for a few minutes, we may need to flush the main line. If you get discolored water out of your cold water tap and it clears up after running for several minutes, the main line is likely clean and you may have a plumbing fixture or an old galvanized line causing the problem.

Why are there pink or dark stains in my toilet or around my drains?

Airborne organisms are usually the cause. You will see grey, black, or sometimes pink filmy stains on surfaces that are regularly moist, including toilet bowls, shower heads, shower drains, sink drains, dishwashers, shower and bath floors and walls. These organisms are not in the drinking water, but they find moist areas of your house to thrive. The only way to control these organisms is to disinfect the surfaces regularly, and ventilate the area well.

How is my water treated?

Your water is treated by conventional methods, utilizing coagulation, flocculation, sedimentation, filtration, and finally disinfection. The facility or facilities serving your area are operated by State Water Resources Control Board certified operators. It may also be comforting for you to know that our facilities have built-in fail-safes which will immediately shut the treatment process down and not allow any water to the system if something within the facility is not operating correctly. The operators receive alarms for immediate intervention so they can correct the problem and begin treating water again.



My water tastes like chemicals!

Another common call we get is that the water has a strong chemically taste all of a sudden. Most times, this can be traced to the either the Chlorine topic covered earlier, or to a hose bib being left on. This is most common during warm times of year when the hot sun beats down on a pressurized hose and creates backpressure. When you open a tap inside the house, you can be sure that high pressure hose water feeds right into your house, and it doesn't taste good. The best way to avoid this is to always shut your hose off at the hose bib shut-off valve, and depressurize your hose. For this reason, it is not a good idea to have your hose bib set up as it is in the picture.

KLEINFELDER

Bright People. Right Solutions.

Appendix C

ADVANCED GEOLOGICAL SERVICES

1605 School Street, #4
Moraga CA 94556
925 (808-8965)

February 13, 2017

Mr. Tim Williams
Kleinfelder
2882 Prospect Park Drive, Suite 200
Rancho Cordova, CA 95670

Subject: Seismic Refraction Survey
Costco Loomis Site
Sierra College Blvd and Brace Road
Loomis, California

Dear Mr. Williams:

1.0 INTRODUCTION

This letter presents the results of Advanced Geological Services, Inc. (AGS) seismic refraction survey in support of planned grading operations for the development of a Costco store at the corner of Sierra College Boulevard and Brace road in Loomis, California (Figure 1). The objective was to assess the depth and excavation characteristics (rippability) of bedrock. The survey was performed on January 27 and 31, 2017 by AGS senior geophysicist Roark W. Smith and his assistant. As directed by Kleinfelder, the survey consisted of six 230-foot long seismic lines arranged in three groups of two lines configured in an "+" or cross pattern.

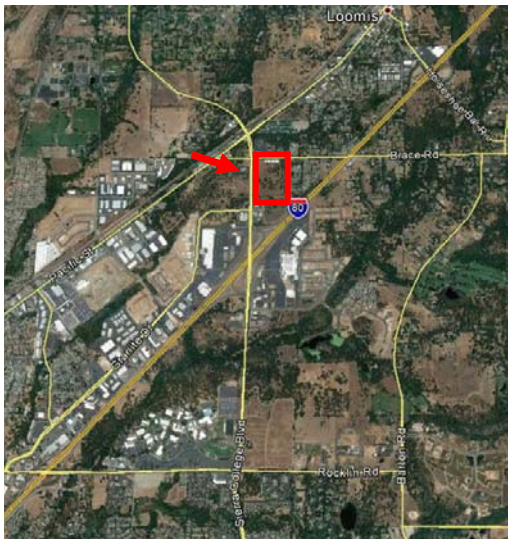


Figure 1- Site Location in Loomis CA

2.0 SUMMARY OF FINDINGS

The results of the seismic refraction survey are presented on Figures 2 through 6, which show the seismic line locations and profiles of subsurface velocity layering. In general, the refraction data indicate the presence of three velocity layers within the upper 40 feet of subsurface— Layer V_1 is the uppermost 2- to 10-foot thick low-velocity layer representing surficial soil and deeply-weathered bedrock. Layer V_2 is the middle, medium-velocity layer ranging from 5 to 27 feet in thickness that represents more compacted soil and weathered bedrock. Layer V_3 is the high-velocity basement layer ranging from 12 to 30 feet in depth that represents little-weathered bedrock.

Layer V_2 exhibits P-wave velocities ranging from 2,400 to 3,400 feet per second (fps), which indicates that the subsurface should be readily rippable through this layer to depths ranging from 12 to 30 feet; although, except for a small area, the entire site appears to be rippable to a depth of

at least 20 feet. Layer V_3 occurs at depths ranging from 12 to 30 feet below ground surface (bgs) and, exhibiting P-wave velocities in excess of 9,000 fps, is considered to be "non-rippable." The rippability assessment is made on the basis of the Caterpillar Performance Handbook "rip chart", which correlates seismic velocity and rippability.

3.0 SITE DESCRIPTION

The survey was performed within a roughly 800- by 1,000-foot undeveloped lot east of Sierra College Boulevard and south of Brace Road (Figure 2). At the time of the survey, the lot was largely an open, gently undulating grassy field with some trees, and standing water from a recent rainfall event was present in low-lying areas.

4.0 SEISMIC REFRACTION (SR) METHOD OVERVIEW

The seismic refraction method uses compressional (P-) wave energy to delineate seismic velocity layers within the subsurface. Interpretation entails correlating the velocity layers to geologic features such as soil and various types of bedrock. To perform a refraction survey, an elastic wave (compressional, or P-wave) is generated at certain locations (shotpoints) along a survey line. The P-wave energy is usually produced with a small explosion or by striking the ground with a sledgehammer. As the P-wave propagates through the ground it is refracted along boundaries between geologic layers with different seismic velocities.

Part of the refracted P-wave energy returns to the ground surface where it is detected by vibration-sensitive devices called geophones, which are placed in a co-linear array along the seismic survey line. The geophone data are fed to a seismograph, where they are recorded, and then to a computer, where they are analyzed to determine the depth and velocities of subsurface seismic layers. Key data for refraction analysis are the positions of the geophones and shotpoints along a seismic line, and the amount of time it takes for the refracted wave to travel from the shotpoint to each geophone location. Because the P-wave is the fastest traveling of all types of seismic waves, it can be readily identified as the first deflection ("first break") on a seismic trace.

Additional discussion of the refraction method, its limitations, and the relationship between seismic velocity and geologic materials is presented in Appendix A.

5.0 FIELD PROCEDURES

AGS obtained seismic refraction data along six lines as shown on an aerial image map that was emailed to AGS by Kleinfelder before the field work began. As shown on the map, the six lines were grouped into three sets of two perpendicular lines arranged in an "+" pattern; two pairs of lines were located in the northern half of the site and the third pair was located in southwest corner of the site.

Before beginning the seismic survey, AGS marked the line locations in the field using adjacent buildings and onsite trees for reference. Using a fiberglass tape measure, AGS then placed 24

geophones on the ground at 10-foot intervals to form a 230-foot long geophone array. The geophones were coupled to the ground by means of the 3-inch metal spikes attached to the geophone base. From five to seven shotpoints were used along each array, with shot points located 5 feet beyond each end geophone, at the midpoint of the geophone array, and at quarter-points along the array. Off-end shotpoints located 20 feet beyond the end geophones of the arrays were also used. AGS produced P-waves through multiple impacts with a 16-lb sledge hammer against a metal plate placed on the ground surface at each shotpoint location. Fifteen hammer blows were used ("stacked") at the off-end shotpoints, 10 blows were used for end shots, seven blows at the quarter shots, and five blows were used at the center shotpoint. The P-waves produced by the hammer impacts were detected using Mark Products 14-Hz high output geophones. The detected seismic signals were recorded using a DAQLink II seismic system connected to a laptop computer.

After the seismic data were obtained, AGS performed a hand-level survey to measure the relative elevation changes along the seismic line so the ground surface topography could be incorporated into the data analysis. After marking the shotpoint locations with florescent pink spray paint, AGS then picked up and moved the seismic gear to the next line and repeated the process until the survey was completed. After the seismic survey was completed AGS used a Trimble Pro-XR Global Positioning System (GPS) to record the seismic line locations. To help reference the seismic survey to the site AGS also GPS-mapped nearby survey lath marking test pit and control point locations.

6.0 DATA PROCESSING AND ANALYSIS

The seismic refraction data quality for this project was good and, for the most part, first break picks could be made with confidence. Data quality was enhanced by "stacking," which entailed using multiple hammer blows at each shotpoint location to improve the signal-to-noise ratio. The additive affect of stacking multiple hammer blows at the same location enhances or increases the amplitude of the signal (i.e., the refracted wave arrival) while amplitude of the background noise, which, being random in nature, tends to cancel itself on successive hammer blows and remains largely unchanged. Stacking was made necessary by the vibratory noise from the nearly constant vehicle traffic along the nearby Sierra College Boulevard. Kleinfelder's concurrent drilling activities also produced some noise but, for the most part, the drill crews silenced their equipment during seismic data acquisition.

Seismic data were transferred from the seismograph to a desktop computer where they were processed using the *SeisImager* software package by Geometrics, Inc. Briefly, *SeisImager* is a computer inversion program that generates an initial velocity layer model, produces synthetic data from the model, and then adjusts the model so that the synthetic data better matches the observed field data (i.e., the arrival times). The agreement between the synthetic and observed data provides an indication of how well the model represents the actual subsurface conditions.

First, AGS used the *SeisImager* module *PickWin* to interpret ("pick") the P-wave arrivals ("first breaks") for each of the shotpoint data sets ("shot gathers") per line. *PickWin* was also used to

check (against the geophysicist's field log) that the proper locations were assigned to the geophones and shotpoints. Next, the first break files were fed to the SeisImager module *PlotRefra*, which was used review time-distance (TD) plots for the seismic lines and assign a seismic layer to each arrival time. For the initial refraction analysis, each P-wave arrival is considered to have refracted from a distinct seismic layer. The number of layers resolved by the seismic survey, and their thickness and average velocity, is indicated by straight line segments on the TD plot; because these straight-line segments indicate a constant velocity condition within the subsurface, they tend to represent a distinct geologic layer. The topographic elevation files were incorporated into the analysis at this point. Next, a time-term inversion was performed to produce preliminary layered velocity models.

The layered velocity models were then used as starting models for the tomographic inversion process, which was used to assess lateral velocity variations along each seismic line. Briefly, tomographic inversion is a grid-based modeling process wherein the subsurface is divided into rectangular cells based on the geophone spacing. The tomography software assigns a velocity to each cell, produces a synthetic arrival-time data set based on seismic raypaths projected through the velocity grid, and then compares the synthetic data to the real data recorded in the field. The cell velocities are then adjusted and re-adjusted until the synthetic data achieve a "best fit" with the observed field data. Tomographic modeling is often used to complement layered modeling at sites where gradual velocity transitions, such as those often seen between weathered and unweathered bedrock, are expected. Tomographic modeling can also depict lateral velocity variations within the subsurface more accurately than a layered modeling approach.

7.0 RESULTS

The results of the seismic refraction survey are summarized on Table 1, below, and presented on Figures 2 through 5, which show the seismic line locations and models (profiles) of subsurface velocity layering that were calculated from the seismic refraction data. Figure 6 presents the tomographic models, which were prepared to assess localized velocity variations along the seismic lines.

In general, the refraction data indicate the presence of three velocity layers within the upper 40 feet of subsurface, which have been designated as V_1, V_2 and V_3. Layer V_1 is the uppermost 2- to 10-foot thick low-velocity layer representing surficial soil and deeply-weathered bedrock. Layer V_2 is the intermediate medium-velocity layer ranging from 5 to 27 feet in thickness representing compacted soil and/or weathered bedrock. Layer V_3 is the high-velocity basement layer ranging from 12 to 30 feet in depth that represents little-weathered bedrock.

Layer V_2 exhibits P-wave velocities ranging from 2,400 to 3,400 feet per second (fps), which indicates that the subsurface should be readily rippable through this layer to depths ranging from 12 to 30 feet; although, except for a small area (see Figure 2), the entire site appears to be rippable to a depth of at least 20 feet. Layer V_3 occurs at depths ranging from 12 to 30 feet below ground surface (bgs) and, exhibiting P-wave velocities in excess of 10,000 fps, is considered to be "non-rippable." It is worth noting that layer V_3 exhibits lower velocity along

lines SL-3 and SL-4 (in the northeast portion of the site), which may be caused by a natural geologic variation of bedrock properties across the site.

The rippability assessment is made on the basis of the Caterpillar Performance Handbook "rip chart", which correlates seismic velocity and rippability. The Handbook classifies granitic rock exhibiting a P-wave velocity less than 6,800 feet per second (fps) as "rippable" with a D9, while such rock exhibiting P-wave velocities between 6,800 and 8,000 fps is classified as "marginally rippable". Rock exhibiting P-wave velocities greater than 8,000 fps is classified as "non-rippable". Velocity information from the seismic survey is summarized in Table 1; rippability information is summarized in Table 2.

Table 1 Velocity Summary (feet per second) from Layer Models

Seismic Line	Layer V_1 (topsoil)	Layer V_2 (weathered bedrock)	Layer V_3 (little-weathered bedrock)	Approx depth to V_3 (feet)
SL-1	950	2,750	17,700	18 - 30
SL-2	1,000	2,400	13,900	12 - 20
SL-3	950	3,100	9,900	18 - 24
SL-4	1,050	3,250	10,600	18 - 21
SL-5	1,250	3,400	12,300	12 - 29
SL-6	1,100	3,400	12,600	19 - 25

The tomographic models (Figure 6) indicate that the boundary between layers V_1 (soil) and V_2 (weathered bedrock) is transitional in nature, while the boundary between layers V_2 (weathered bedrock) and V_3 (little-weathered bedrock) is more pronounced. A line showing the V_2 - V_3 boundary from the velocity layer models is shown on the tomographic models for reference. Localized lower-velocity zones in layer in V_3, indicative of more deeply-weathered bedrock, are evident along lines SL-1, SL-2, SL-5 and SL-6. These lower–velocity zones may be associated with more intense weathering along bedrock fractures.

8.0 EXCAVATION CHARACTERISTICS (RIPPABILITY)

Seismic velocity charts relating seismic velocity and excavation characteristics have been developed from field tests by others. These charts list the seismic velocity of various types of bedrock materials and their relative ease of excavation using different types of rippers. Caterpillar Tractor Company publishes a performance manual that lists ripper performance charts for various size tractors and types of rippers. The range of rippability obtained from the ripper performance chart from the Caterpillar Performance Handbook, 12th Edition (2000) is as follows (in feet per second):

Table 2 Rip Chart for Granitic Rock (from Caterpillar Performance Handbook)

Ripper	Rippable	Marginally Rippable	Non-Rippable
D8R	less than 5,800	5,800 to 6,800	greater than 6,800
D9R	less than 6,800	6,800 to 8,000	greater than 8,000
D10R	less than 7,200	7,200 to 8,500	greater than 8,500

This information should only be used as a general guide, however, as many other factors should also be considered. These factors include the rock jointing and fracture patterns, the experience of the equipment operator, and the equipment and excavation methods selected. Based on the observed velocities, it appears that the bedrock beneath the seismic refraction lines is rippable for a D9R to a depth of at least 40 feet. However, this information should be combined with a complete and thorough analysis of geotechnical boring data, as well as local ripping experience (if available) to make a final assessment.

9.0 CLOSING

All geophysical data and field notes collected as a part of this investigation will be archived at the AGS office. The data collection and interpretation methods used in this investigation are consistent with standard practices applied to similar geophysical investigations. The correlation of geophysical responses with probable subsurface features is based on the past results of similar surveys although it is possible that some variation could exist at this site. Due to the nature of geophysical data, no guarantees can be made or implied regarding the targets identified or the presence or absence of additional objects or targets.

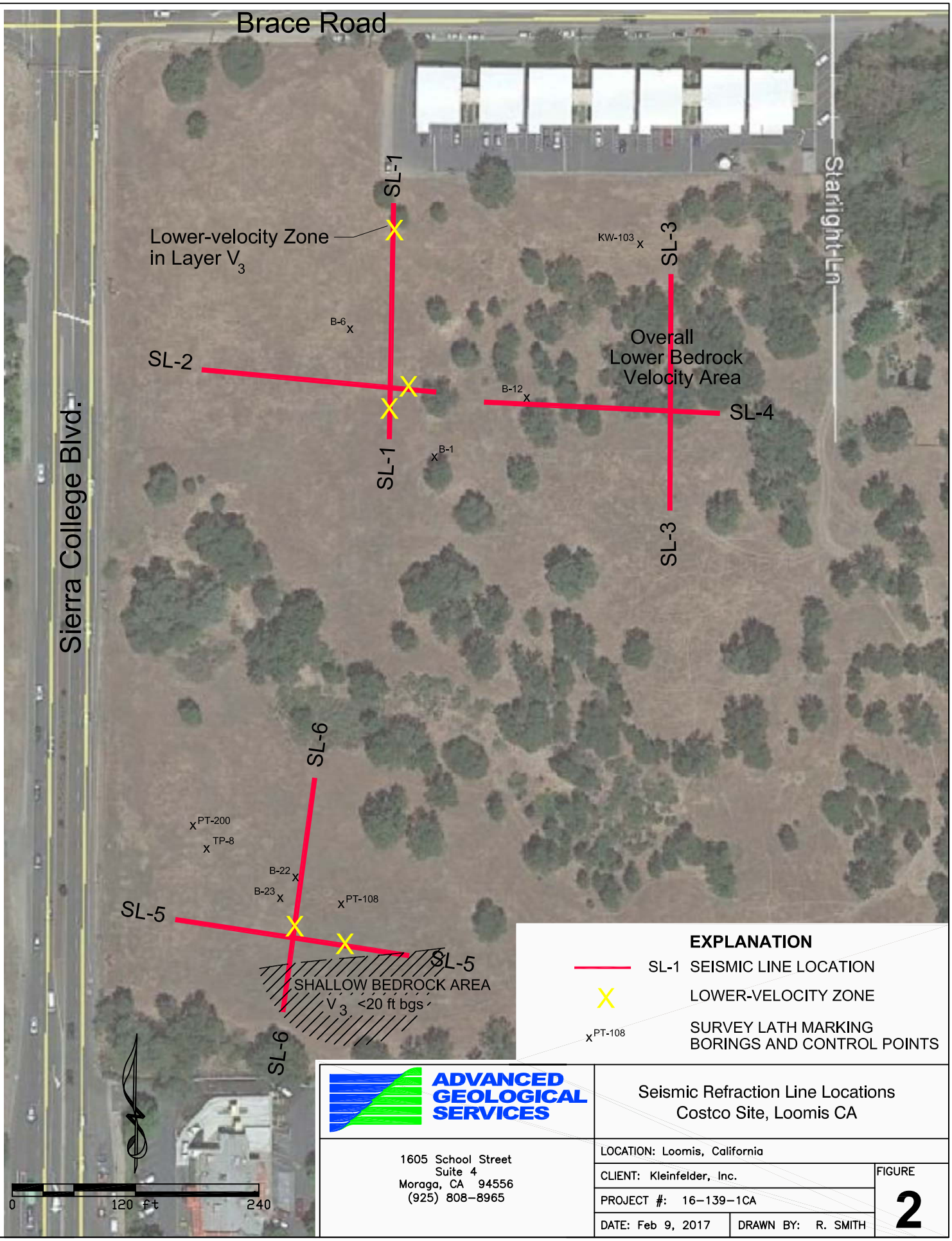
AGS appreciates working for you. We enjoyed this project and we look forward to working with you again.

Sincerely,

Roark W. Smith
Senior Geophysicist
Advanced Geological Services, Inc.

Figures:
- Figure 1 Seismic Refraction Survey Area (imbedded in Report text, above)
- Figure 2 Seismic Refraction Line Locations
- Figure 3 P-wave Velocity Layer Models, SL-1 and SL-2
- Figure 4 P-wave Velocity Layer Models, SL-3 and SL-4
- Figure 5 P-wave Velocity Layer Models, SL-5 and SL-6
- Figure 6 Tomographic Velocity Models- All Seismic Lines

Attachments: Appendix A: Seismic Velocity and Limitations of the Refraction Method



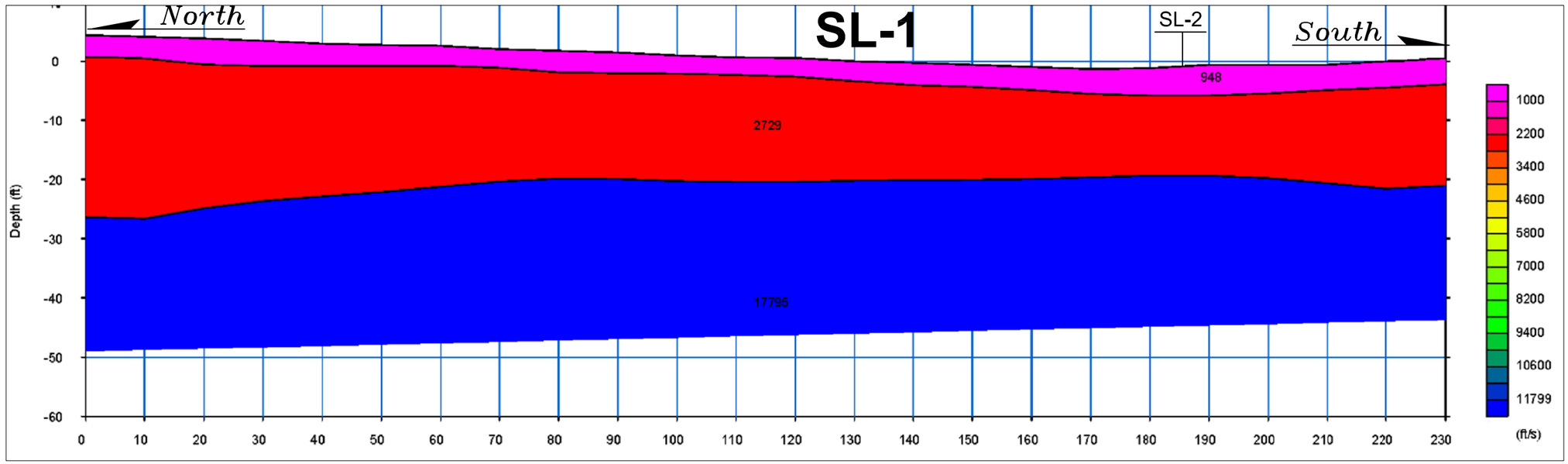
ADVANCED GEOLOGICAL SERVICES

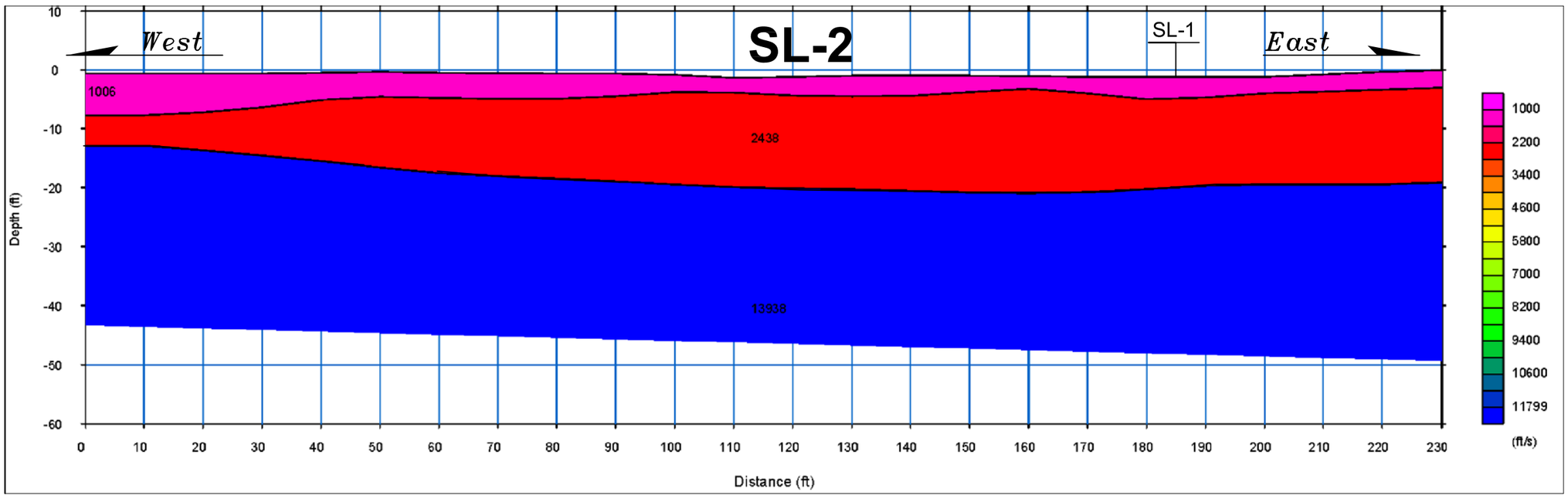
1605 School Street
Suite 4
Moraga, CA 94556
(925) 808-8965

Seismic Refraction Line Locations
Costco Site, Loomis CA

LOCATION: Loomis, California
CLIENT: Kleinfelder, Inc.
PROJECT #: 16-139-1CA
DATE: Feb 9, 2017
DRAWN BY: R. SMITH

FIGURE
2





SEISMIC LINE LOCATIONS

ADVANCED GEOLOGICAL SERVICES

1605 School Street
Suite 4
Moraga, CA 94556
(925) 808-8965

Seismic Refraction Survey Results-
P-wave Velocity Layer Models for
Lines SL-1 and SL-2

LOCATION: Loomis, California

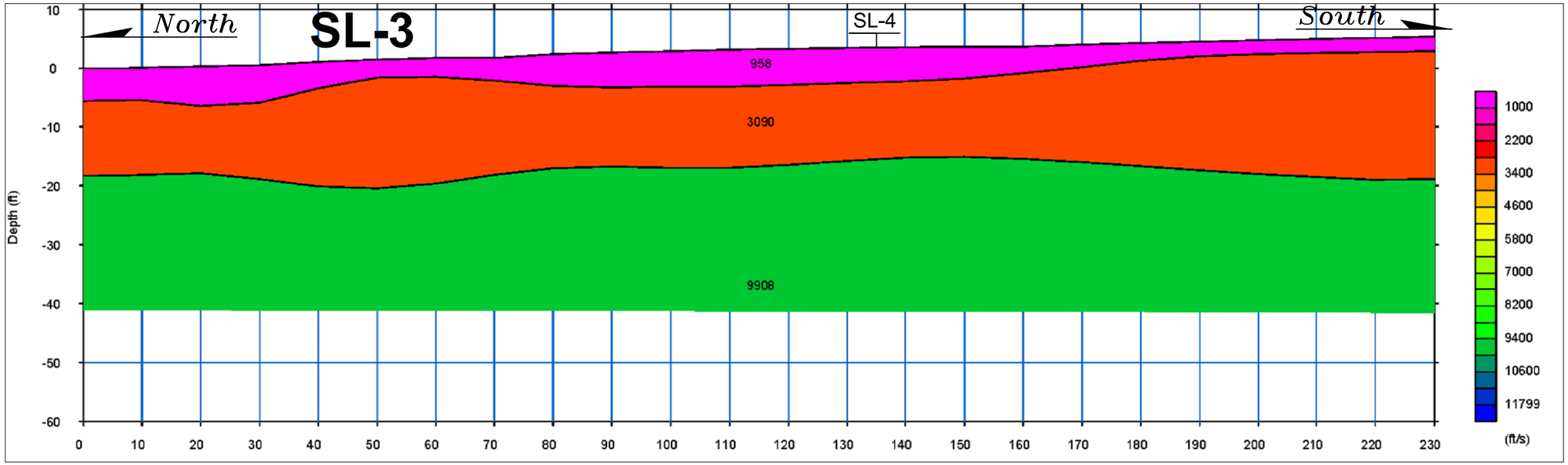
CLIENT: Kleinfelder, Inc.

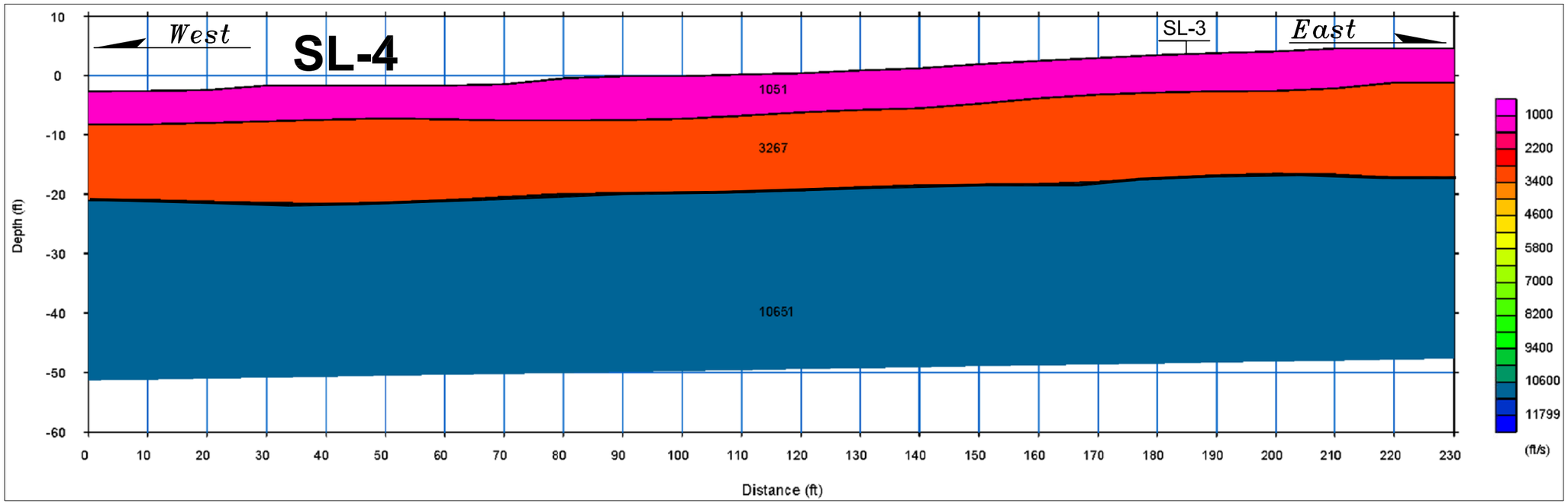
PROJECT #: 16-139-1CA

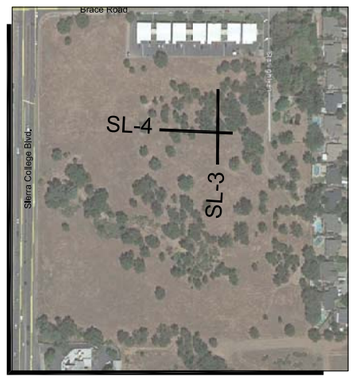
DATE: Feb 9, 2017

DRAWN BY: R. SMITH

FIGURE 3







SEISMIC LINE LOCATIONS

ADVANCED GEOLOGICAL SERVICES

1605 School Street
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(925) 808-8965

Seismic Refraction Survey Results-
P-wave Velocity Layer Models for
Lines SL-3 and SL-4

LOCATION: Loomis, California

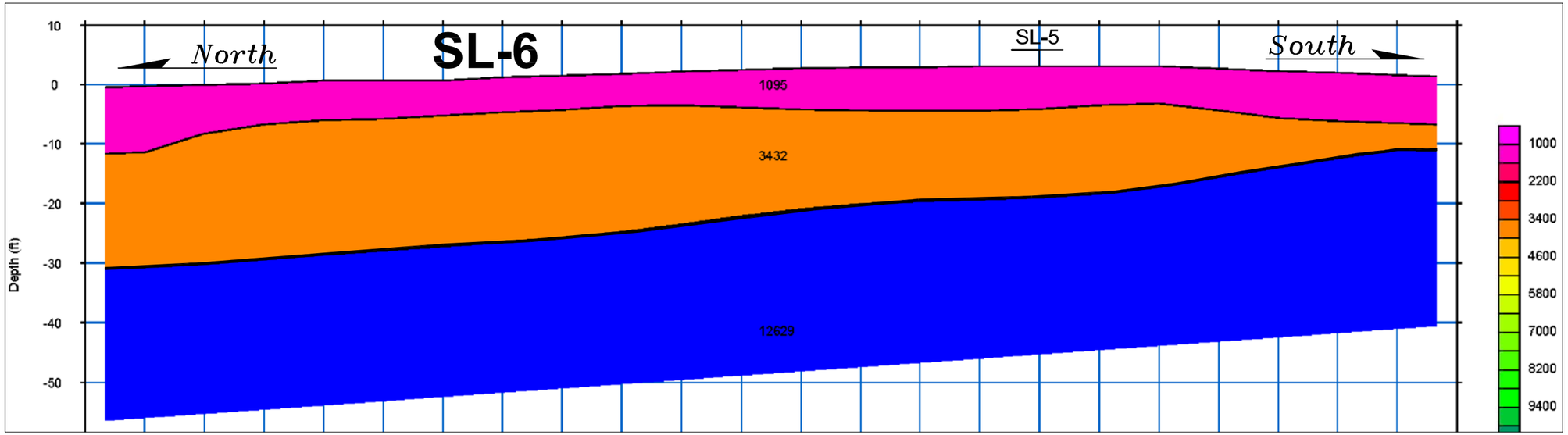
CLIENT: Kleinfelder, Inc.

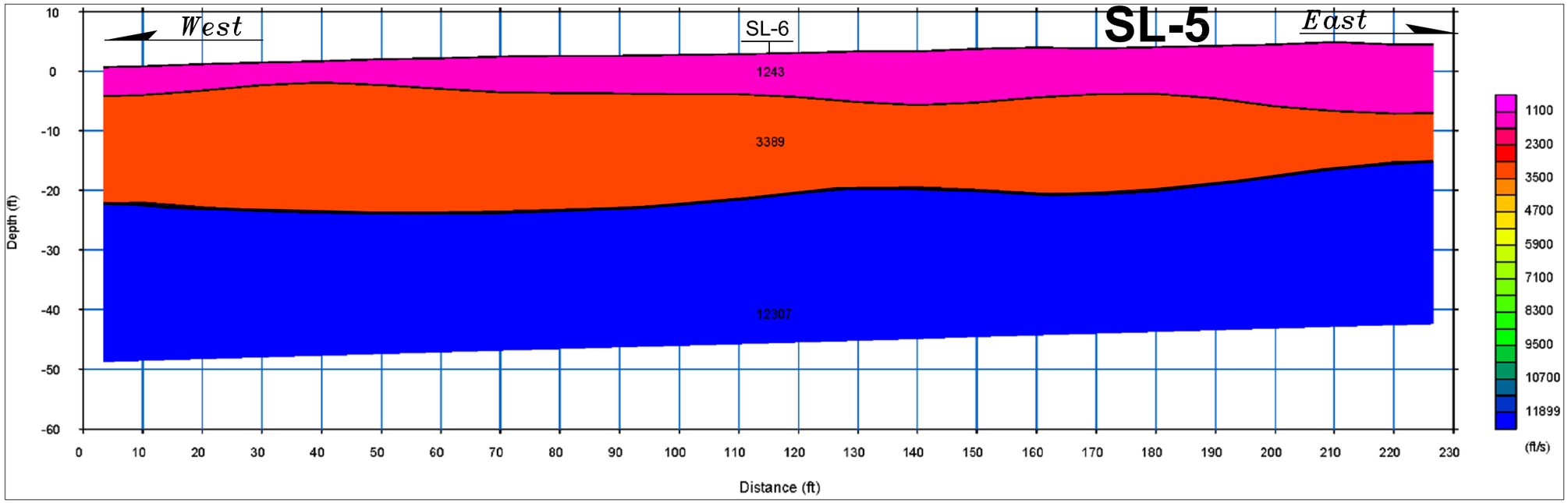
PROJECT #: 16-139-1CA

DATE: Feb 9, 2017

DRAWN BY: R. SMITH

FIGURE
4





SEISMIC LINE LOCATIONS

ADVANCED GEOLOGICAL SERVICES

1605 School Street
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Moraga, CA 94556
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Seismic Refraction Survey Results-
P-wave Velocity Layer Models for
Lines SL-5 and SL-6

LOCATION: Loomis, California

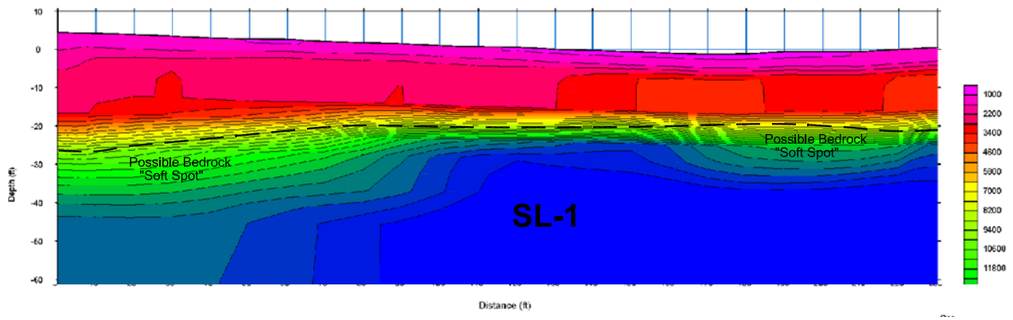
CLIENT: Kleinfelder, Inc.

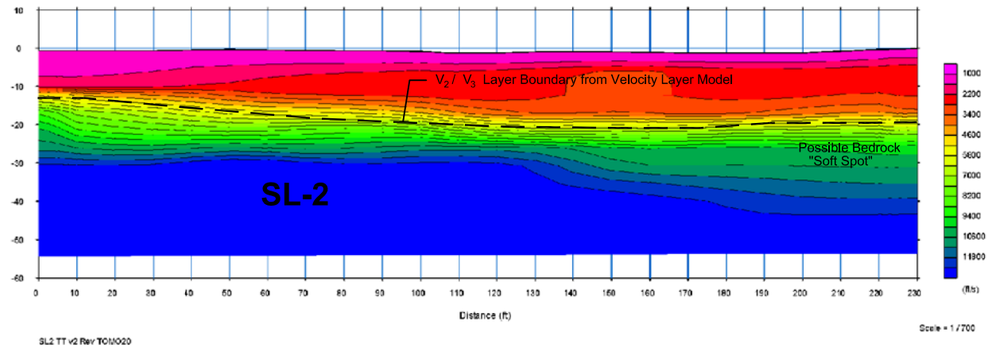
PROJECT #: 16-139-1CA

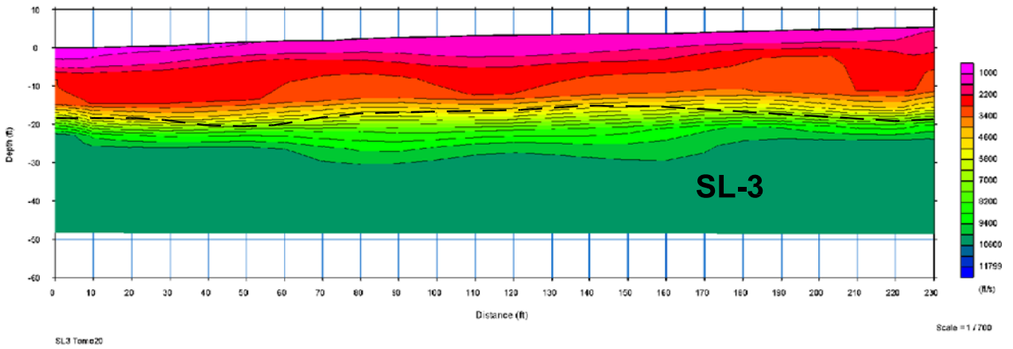
DATE: Feb 9, 2017

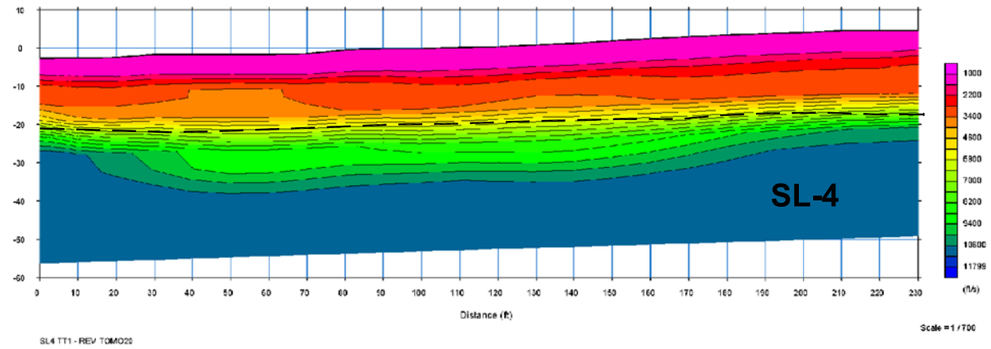
DRAWN BY: R. SMITH

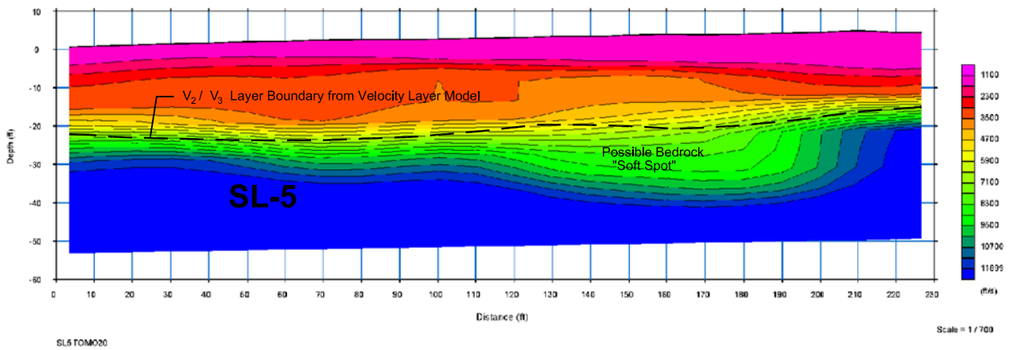
FIGURE
5

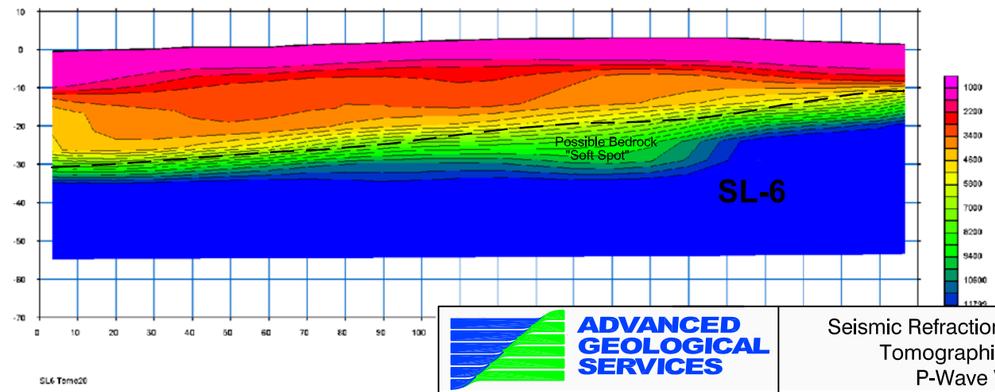












ADVANCED GEOLOGICAL SERVICES

1605 School Street
Suite 4
Moraga, CA 94556
(925) 808-8965

Seismic Refraction Survey Results-
Tomographic Models of
P-Wave Velocity

LOCATION: Loomis, California

CLIENT: Kleinfelder, Inc.

PROJECT #: 16-139-1CA

DATE: Feb 9, 2017 | DRAWN BY: R. SMITH

FIGURE
6

APPENDIX A

SEISMIC VELOCITY AND LIMITATIONS OF THE REFRACTION METHOD

The physical properties of earth materials (fill, sediment, rock) such as compaction, density, hardness, and induration dictate the corresponding seismic velocity of the material. Additionally, other factors such as bedding, fracturing, weathering, and saturation can also affect seismic velocity. In general, low velocities indicate loose soil, poorly compacted fill material, poorly to semi-consolidated sediments, deeply weathered, and highly fractured rock. Conversely, high velocities are indicative of competent rock or dense and highly compacted sediments and fill. The highest velocities are measured in unweathered and little fractured rock.

There are certain limitations associated with the seismic refraction method as applied for this investigation. These limitations are primarily based on assumptions that are made by the data analysis routine. The data analysis routine assumes that the velocities along the length of each spread are uniform. If there are localized zones within each layer where the velocities are higher or lower than indicated, the analysis routine will interpret these zones as changes in the surface topography of the underlying layer. A zone of higher velocity material would be interpreted as a low in the surface of the underlying layer. Zones of lower velocity material would be interpreted as a high in the underlying layer. The data analysis routine also assumes that the velocity of subsurface materials increase with depth. Therefore, if a layer exhibits velocities that are slower than those of the material above it, the slower layer will not be resolved. Also, a velocity layer may simply be too thin to be detected.

The quality of the field data is critical to the construction of an accurate depth and velocity profile. Strong, clear “first-break” information from refracted interfaces will make the data processing, analysis, and interpretation much more accurate and meaningful. Vibrational noise or poor subsurface conditions can decrease the ability to accurately locate and pick seismic waves from the interfaces.

Due to these and other limitations inherent to the seismic refraction method, resultant velocity cross-sections should be considered only as approximations of the subsurface conditions. The actual conditions may vary locally.