# APPENDIX C
# GEOTECHNICAL ENGINEERING REPORT

# Geotechnical Engineering Report

**Grocery Outlet Warehouse**
**Sacramento, Sacramento County, California**
November 11, 2020
Terracon Project No. NB205060

**Prepared for:**
Read Investments, LLC
Berkeley, Ca

**Prepared by:**
Terracon Consultants, Inc.
Sacramento, CA

November 11, 2020

Read Investments, LLC
2025 4th Street
Berkeley, Ca 94710

Attn: Mr. Scott Huffman
P: (510) 704-5700
E: shuffman@readinvestments.com

Re: Geotechnical Engineering Report
Grocery Outlet Warehouse
4400 Florin Perkins
Sacramento, Sacramento County, California
Terracon Project No. NB205060

Dear Mr. Huffman:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PNB205060 dated September 18, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
**Terracon Consultants, Inc.**

Beau D. Donaldson, P.E. 91954
Senior Staff Engineer

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Principal

11/11/2020

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## REPORT TOPICS



**Note:** This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

## ATTACHMENTS



**Note:** Refer to each individual Attachment for a listing of contents.

# Geotechnical Engineering Report
**Grocery Outlet Warehouse**
**4400 Florin Perkins**
**Sacramento, Sacramento County, California**
**Terracon Project No. NB205060**
**November 11, 2020**

## INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed expansion to the Grocery Outlet Warehouse to be located at 4400 Florin Perkins in Sacramento, Sacramento County, California. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Site preparation and earthwork
- Demolition considerations
- Excavation considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per 2019 CBC
- Lateral earth pressures
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of 20 test borings to depths ranging from approximately 5 to 26½ feet below existing site grades. As part of our exploration, we also performed five (5) percolation tests and three (3) infiltration tests at the site.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and separate graphs in the **Exploration Results** section.

## SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

| Item | Description |
|---|---|
| **Parcel Information** | ■ The project is located at 4400 Florin Perkins in Sacramento, Sacramento County, California.<br>■ Assessor Parcel Numbers (APN): 06102300100000, 06102300050000<br>■ The site is approximately 36.67 acres in area<br>■ Latitude and Longitude (approximate): 38.5356° N, 121.3936° W<br>■ See Exhibit See **Site Location** |
| **Existing Improvements** | The site is currently developed with existing buildings, parking and drive areas and sidewalks. The site is surrounded by other existing developments and is bordered to the east by Florin Perkins Road. |
| **Current Ground Cover** | Concrete and asphalt paved parking lot with a compacted soil parking area and lightly vegetated earthen areas. |
| **Existing Topography** | The site is relatively flat with a ±2 foot change in elevation across the site. |
| **Geology** | The project area is situated within the Great Valley Geomorphic Provence of California. The Great Valley is an alluvial plain located between the Coast Ranges and the Sierra Nevada and consists of an alluvial basin and flood plain.<br>The native materials underlying the site are considered to consists of Riverbank Formation (Qr1), as described in the geologic map of the site[1]. According to the map, the Riverbank Formation is Pleistocene in age (duration about 2.6 million years ago to 12,000 years ago) and consists primarily of arkosic sediments derived mainly from the interior of the Sierra Nevada, underlying terraces and coalescing alluvial fans among most of the Easter San Juaquin Valley. The subsurface materials encountered in our investigation are generally consistent with the mapped geology.<br>The site is not located within an Alquist Priolo Fault zone or a mapped liquefaction hazard zone as determined by the California Geological Survey. |

# PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

[1] Helley, E.J., 1979, Preliminary geologic map of Cenozoic deposits of the Davis, Knights Landing, Lincoln, and Fair Oaks quadrangles, California: U.S. Geological Survey, Open-File Report OF-79-583, scale 1:62,500

| Item | Description |
|---|---|
| **Information Provided** | Emails sent by Gerry Parco of Ware Malcomb dated September 3rd and 9th, 2020 providing a brief project description and site plan. |
| **Project Description** | The project will consist of constructing additional warehouse space to the east and south of the existing Grocery Outlet distribution center. Associated pavements and landscaped areas will be constructed surrounding the proposed developments. The project will also consist of the construction of three bio-detention swales along the north, south and east property lines. |
| **Proposed Structures** | The proposed additions to the existing distribution center will include the following:<br>■ East Warehouse Expansion: 179,760 SF<br>■ South Warehouse Expansion: 82,472 SF |
| **Building Construction** | The proposed additions will include two single story warehouse expansions using concrete tilt-up wall construction methods with slab-on-grade floors. Interior steel columns founded on shallow spread footings will be used to support the interior roof systems. We anticipate that the existing buildings exterior walls and foundations abutting the new additions will be demolished and replaced. New foundations constructed to support the additions will act separately from existing foundations. |
| **Finished Floor Elevation** | Within 2 feet of existing grades. |
| **Maximum Loads** (Assumed) | ■ Columns: 120 to 150 kips<br>■ Walls: 5 to 7 kips per linear foot (klf)<br>■ Slabs: 200 pounds per square foot (psf) |
| **Grading/Slopes** | Cuts and fills on the order of ±2 feet. |
| **Bio-Detention Swales** | Three bio-detention swales are to be constructed as a part of the project. The swales will be located along the north, east and south borders of the site. The swales will be approximately 3 feet deep and with bottoms consisting of native subsurface soils. |
| **Pavements** | Both rigid (concrete) and flexible (asphalt) pavement sections are being considered as a part of the proposed developments.<br>Anticipated Traffic Indices (TIs) are follows:<br>■ Autos/light trucks parking: TI = 4.5<br>■ Autos/light trucks driving: TI = 5.5<br>■ Tractor-trailer truck Parking: TI = 6.5<br>■ Moderate 5-axle truck traffic (AADT ≈ 70): TI = 9.0<br>The pavement design period is 20 years. |

## GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

| Model Layer | Layer Name | General Description |
|---|---|---|
| 1 | Topsoil | Approximately 8 inches in thickness |
| 2 | Surface Course | Asphalt and concrete pavements 3½ to 8½ inches in thickness |
| 3 | Base Course | Aggregate base course 6 to 18 inches in thickness |
| 4 | Lean Clay with Sand | Very stiff to hard, low to medium plasticity, varying sand content, varying cementation |
| 5 | Silty Sand | Medium dense to very dense, fine to medium grained, varying fines content |
| 6 | Silt with Sand | Very stiff to hard, low plasticity, varying sand content, varying cementation |
| 7 | Poorly Graded Sand | Medium dense to dense, fine to coarse grained |
| 8 | Poorly Graded Gravel | Very dense, fine to coarse grained, subrounded |

Conditions encountered at each boring location are indicated on the individual boring logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

## Lab Results

Laboratory tests were conducted on selected soil samples and the test results are shown in the **Exploration Results** section and on the boring logs. Atterberg limit test results indicate that the on-site soils generally range from being non-plastic to having medium plasticity. We anticipate the near surface clay soils have low to medium swell potential.

## Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Groundwater was not encountered in our test borings while drilling, or for the short duration the borings could remain open. Groundwater data obtained from the State of California's

Department of Water Resources SGMA Data Viewer[2] indicates the depth to high groundwater is estimated between 50 and 60 feet bgs at the site.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than anticipated. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

## GEOTECHNICAL OVERVIEW

Potentially expansive soils are present on this site. This report provides recommendations to help mitigate the effects of soil shrinkage and expansion; however, even if these procedures are followed, some movement and at least minor cracking in the structure should be anticipated. The severity of cracking and other cosmetic damage such as uneven floor slabs will probably increase if any modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement and cosmetic distress may not be feasible, but it may be possible to further reduce the risk of movement if significantly more expensive measures are used during construction. We would be pleased to discuss other construction alternatives with you upon request.

Due to the expansion potential of the near surface soils, floor slabs should bear on engineered fill extending to a minimum depth of 12 inches below the bottom of slab and underlayment (vapor barrier and capillary break gravel).

Spread footing foundations may bear on moist (greater than 2% above optimum moisture content) undisturbed native soils or new non-expansive engineered fill if required to raise grades. Terracon should be retained to perform footing inspections, prior to reinforcement placement, to ensure soils are in a firm, moist condition and to verity soils are as anticipated and designed for.

Estimated movements described in this report are based on effective drainage for the life of the structure and cannot be relied upon if effective drainage is not maintained. Exposed ground, extending at least 10 feet from the perimeter, should be sloped a minimum of 5% away from the building to provide positive drainage away from the structure. Grades around the structure should be periodically inspected and adjusted as part of the structure's maintenance program.

[2] *https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#gwlevels*

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results** section), engineering analyses, and our current understanding of the proposed project.

The **General Comments** section provides an understanding of the report limitations.

## EARTHWORK

The following recommendations include site preparation, excavation, subgrade preparation and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements including foundations, slabs and pavements are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

### Site Preparation

Strip and remove existing vegetation, demolition debris, pavements and other deleterious materials from proposed building and pavement areas. Exposed surfaces should be free of mounds and depressions which could prevent uniform compaction. The site should be initially graded to create a relatively level surface to receive fill, and provide for a relatively uniform thickness of fill beneath proposed building structures.

Demolition of the existing building walls should include complete removal of all foundation systems and remaining underground utilities within the proposed construction area. This should include removal of any loose backfill found adjacent to existing foundations. All materials derived from the demolition of existing structures and pavements should be removed from the site and not be allowed for use as on-site fill, unless processed in accordance with the fill requirements included in this report.

Although no evidence of fills or underground facilities such as septic tanks, cesspools and basements were observed during the site reconnaissance, such features could be encountered during construction. If unexpected fills, utilities, or underground facilities are encountered, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

### Subgrade Preparation

Spread footing foundations may bear on moist (greater than 2% above optimum moisture content), undisturbed native soils, or new non-expansive engineered fill if required to raise grades.

Terracon should be retained to perform footing inspections to ensure soils are in a firm, moist condition and to verity soils are as anticipated and designed for.

Areas of loose soils may be encountered at foundation bearing depths. When such conditions exist beneath planned footing areas the subgrade soils should be surficially compacted prior to placement of the foundation system. If sufficient compaction cannot be achieved in-place, the loose soils should be removed and replaced as engineered fill. The excavation should be widened laterally at least 8 inches for each 12 inches of fill placed below footing base elevations.

Due to the expansion potential of the near surface soils, floor slabs should bear on engineered fill extending to a minimum depth of 12 inches below the bottom of slab, or 18 inches below existing grades, whichever is greater.

Once cuts have been made, and prior to placing any fill, the subgrade soil should be scarified, moisture conditioned, if needed, and compacted. The depth of scarification of subgrade soils and moisture conditioning of the subgrade is highly dependent on the time of year of construction and the site conditions that exist immediately prior to construction. If construction occurs during the winter or spring, when the subgrade soils are typically already in a moist condition, scarification and compaction may only be 12 inches. If construction occurs during the summer or fall when the subgrade soils have been allowed to dry out deeper, the depth of scarification and moisture conditioning may be as much as 18 inches or more. A representative from Terracon should be present to observe the exposed subgrade and specify the depth of scarification and moisture conditioning required.

Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively workable. However, the workability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unworkable conditions develop, workability may be improved by scarifying and drying.

## Excavation

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Individual contractors are responsible for designing and constructing stable, temporary excavations. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

### Fill Material and Placement

All fill materials should be inorganic soils free of vegetation, debris, and fragments larger than 6 inches in size. Pea gravel or other similar non-cementatious, poorly-graded materials should not be used as fill or backfill without the prior approval of the geotechnical engineer.

Due to the on-site clay soils, they are not recommended for use as engineered fill within 12 inches of the building pad finished subgrade. Such soils may be used as fill materials for the following:

- general site grading
- exterior slab areas
- pavement areas

Imported low volume change soils should be used as engineered fill for:

- interior floor slab areas
- foundation backfill
- foundation areas

Imported soils for use as fill material within proposed building and structure areas should conform to low volume change materials as indicated in the following specifications:

| Gradation | Percent Finer by Weight (ASTM C 136) |
|---|---|
| 3” | 100 |
| No. 4 Sieve | 50-100 |
| No. 200 Sieve | 10-40 |
| ■ Liquid Limit | 30 (max) |
| ■ Plasticity Index | 12 (max) |
| ■ Maximum expansion index* | 20 (max) |

*ASTM D 4829

The contractor shall notify the Geotechnical Engineer of import sources sufficiently ahead of their use so that the sources can be observed and approved as to the physical characteristic of the import material. For all import material, the contractor shall also submit current verified reports from a recognized analytical laboratory indicating that the import has a "not applicable" (Class S0) potential for sulfate attack based upon current ACI criteria and is "mildly corrosive" to ferrous metal and copper. The reports shall be accompanied by a written statement from the contractor that the laboratory test results are representative of all import material that will be brought to the job.

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Fill lifts should not exceed 10 inches loose thickness.

## Compaction Requirements

Recommended compaction and moisture content criteria for engineered fill materials are as follows:

| Material Type and Location | Per the Modified Proctor Test (ASTM D 1557) | | |
|---|---|---|---|
| | Minimum Compaction Requirement | Range of Moisture Contents for Compaction Above Optimum | |
| | | Minimum | Maximum |
| Approved imported fill soils: | | | |
| Beneath foundations: | 90% | 0% | +4% |
| Beneath slabs: | 90% | 0% | +4% |
| Utility trenches (pavement and structural areas)*: | 90% | 0% | +4% |
| On-site native soils: | | | |
| Beneath asphalt pavements: | 95% | +2% | +5% |
| Beneath concrete pavements: | 95% | +2% | +5% |
| Utility trenches (Landscape areas): | 90% | +2% | +5% |
| Beneath foundations: | 90% | +2% | +4% |
| Miscellaneous backfill: | 90% | +2% | +4% |
| Aggregate base (beneath pavements): | 95% | 0% | +4% |

* Upper 12 inches should be compacted to 95% within pavement and structural areas. Low-volume change imported soils should be used in structural areas.

## Grading and Drainage

Positive drainage should be provided during construction and maintained throughout the life of the development. Infiltration of water into utility trenches or foundation excavations should be prevented during construction. Planters and other surface features which could retain water in areas adjacent to the building or pavements should be sealed or eliminated. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum grade of approximately 5 percent for at least 10 feet from perimeter walls. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

Roof drainage should discharge onto pavements or be tied to tight lines that discharge into the storm system. i Sprinkler systems and landscaped irrigation should not be installed within 5 feet of foundation walls.

Trees or other vegetation whose root systems have the ability to remove excessive moisture from the subgrade and foundation soils should not be planted next to the structure. Trees and shrubbery should be kept away from the exterior of the structure a distance at least equal to their expected mature height.

## Utility Trench Backfill

It is anticipated that the on-site soils will provide suitable support for underground utilities and piping that may be installed. Any soft and/or unsuitable material encountered at the bottom of excavations should be removed and be replaced with an adequate bedding material. A non-expansive granular material with a sand equivalent greater than 30 should be used for bedding and shading of utilities, unless allowed or specified otherwise by the utility manufacturer.

On-site materials are considered suitable for backfill of utility and pipe trenches from one foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances. Imported low volume change soils should be used for trench backfill in structural areas.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the gradation and expansion index requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath the building should be effectively sealed to restrict water instruction and flow through the trenches, which could migrate below the building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consists of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line.

## Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction.

On-site clay soils may pump and unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. The use of light construction equipment would aid in reducing subgrade disturbance. The use of remotely operated equipment, such as a backhoe, would be beneficial to perform cuts and reduce subgrade disturbance.

Should unstable subgrade conditions develop stabilization measures will need to be employed. Stabilization measures may include placement of aggregate base and multi-axial geogrid. Use of lime or cement could also be considered as a stabilization technique. Laboratory evaluation is recommended to determine the effect of chemical stabilization on subgrade soils prior to construction.

We recommend that the earthwork portion of this project be completed during extended periods of dry weather if possible. If earthwork is completed during the wet season (typically November through April) it may be necessary to take extra precautionary measures to protect subgrade soils. Wet season earthwork operations may require additional mitigative measures beyond that which would be expected during the drier summer and fall months. This could include diversion of surface runoff around exposed soils and draining of ponded water on the site. Once subgrades are established, it may be necessary to protect the exposed subgrade soils from construction traffic.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

## Construction Observation and Testing

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests, footing inspections and observations during subgrade preparation, proof-rolling, placement and compaction of controlled compacted fills, backfilling of excavations to the completed subgrade.

The exposed subgrade and each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. One density and water content test should be performed for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

## SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

### Design Parameters – Compressive Loads

| Item | Description |
|---|---|
| **Maximum Net Allowable Bearing pressure** [1, 2] | 3,000 psf |
| **Required Bearing Stratum** [3] | Moist (greater than 3% above optimum moisture content) undisturbed, firm native soils or non-expansive engineered fill. |
| **Minimum Foundation Dimensions** | Columns: 30 inches<br>Continuous: 18 inches |
| **Maximum Foundation Dimensions** | Columns: 96 inches<br>Continuous: 48 inches |
| **Ultimate Passive Resistance** [4] **(equivalent fluid pressures)** | 350 pcf |
| **Ultimate Coefficient of Sliding Friction** [5] | 0.30 |
| **Minimum Embedment below Finished Grade** [6] | 18 inches |
| **Estimated Total Settlement from Structural Loads** [2] | Less than about 1 inch |
| **Estimated Differential Settlement** [2, 7] | About 1/2 of total settlement |

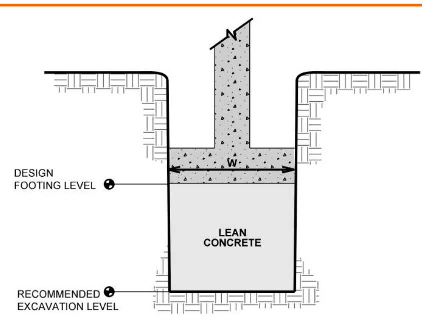
| Item | Description |
| --- | --- |

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**.
3. Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the **Earthwork**.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements are as measured over a span of 50 feet.

## Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.




LEAN CONCRETE BACKFILL

**NOTE:** EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

To ensure foundations have adequate support, special care should be taken when footings are located adjacent to trenches. The bottom of such footings should be at least 1 foot below an imaginary plane with an inclination of 1.5 horizontal to 1.0 vertical extending upward from the nearest edge of the adjacent trench.

## FLOOR SLABS

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

### Floor Slab Design Parameters

| Item | Description |
|---|---|
| **Floor Slab Support** | For conditioned spaces or slabs with floor coverings, use a minimum 4 inches of ¾ inch crushed free-draining gravel (less than 6% passing the U.S. No. 200 sieve) crushed aggregate [1, 2]<br>For warehouse areas, use a minimum of 4 inches of Class 2 aggregate base.<br>At least 12 inches of compacted non expansive engineered fill. |
| **Estimated Modulus of Subgrade Reaction** [1] | 150 pounds per square inch per inch (psi/in) for point loads |

1. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
2. Free-draining granular material should have less than 5% fines (material passing the No. 200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

### Floor Slab Construction Considerations

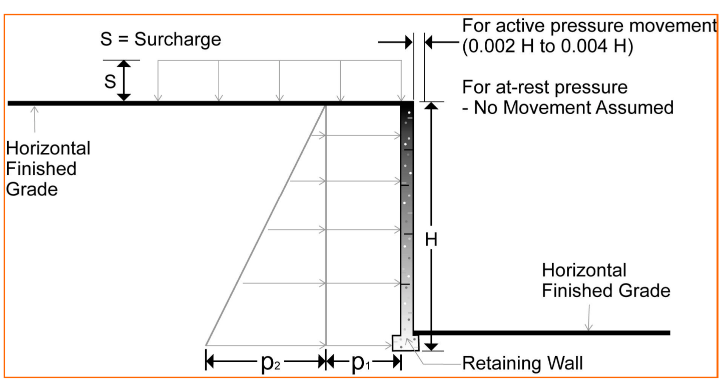
Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

## LATERAL EARTH PRESSURES

### Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The “at-rest” condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



| Lateral Earth Pressure Design Parameters | | | |
|---|---|---|---|
| **Earth Pressure Condition** [1] | **Coefficient for Backfill Type**[2] | **Surcharge Pressure** [3, 4, 5] **$p_1$ (psf)** | **Unsaturated Effective Fluid Pressure** [2, 4, 5, 6] **$p_2$ (psf)** |
| Active (Ka) | Engineered Fill - 0.31<br>Native Soils - 0.41 | (0.31)S<br>(0.41)S | (40)H<br>(50)H |
| At-Rest (Ko) | Engineered Fill - 0.47<br>Native Soils - 0.58 | 0.47)S<br>(0.58)S | (55)H<br>(70)H |
| Passive (Kp) | Engineered Fill - 3.25<br>Native Soils - 2.46 | ---<br>--- | (390)H<br>(295)H |

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.
2. Uniform, horizontal backfill, compacted to at least 90% of the ASTM D 1557 maximum dry density, rendering a maximum unit weight of 120 pcf.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No safety factor is included in these values.
6. To achieve “Unsaturated” conditions, follow guidelines in **Subsurface Drainage for Below-Grade Walls** below.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively.

## PAVEMENTS

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Design of Asphaltic Concrete (AC) pavements are based on the procedures in the Caltrans Highway Design Manual, 2012 edition. Design of Portland Cement Concrete (PCC) pavements are based upon American Concrete Institute (ACI) 330R-01; Guide for Design and Construction of Concrete Parking Lots.

One sample of the near surface soils was obtained from boring B-14 and classified at our laboratory by an engineer. The sample was tested to determine its Resistance Value (R-value). The test produced an R-value of 22, therefore, a design value of 22 was used for the AC and PCC pavement designs. We have provided pavement sections for traffic indices (TI) of 4.5, 5.5, 6.5 and 9.0.

## Pavement Section Thicknesses

The following table provides options for AC and PCC Sections:

| Typical Pavement Section (inches) | | | | | |
|---|---|---|---|---|---|
| **Traffic Area** | **Alternative** | **Asphalt Concrete (AC) Surface Course** | **Portland Cement Concrete (PCC) [1]** | **Aggregate Base (AB) Course** | **Total Thickness** |
| Auto/Light Truck Parking<br>Assumed Traffic Index (TI) = 4.5 | PCC | -- | 5.0 | 4.0 | 9.0 |
| | AC | 2.5 | -- | 7.0 | 9.0 |
| Auto/Light Truck Traffic<br>Assumed Traffic Index (TI) = 5.5 | PCC | -- | 5.5 | 4.0 | 9.5 |
| | AC | 3.0 | -- | 9.0 | 12.0 |
| Tractor-Trailer Parking<br>Assumed Traffic Index (TI) = 6.5 | PCC | -- | 6.0 | 4.0 | 10.0 |
| | AC | 3.5 | -- | 11.0 | 14.5 |
| Moderate 5-Axle Truck Traffic<br>Assumed Traffic Index (TI) = 9.0 | PCC | -- | 7.0 | 5.0 | 12.0 |
| | AC | 5.5 | -- | 15.0 | 20.5 |

1. Minimum compressive strength of 4,000 psi at 28 days, minimum modulus of rupture of 500 psi/in., 6-sack min. mix. PCC pavements are recommended for trash container pads and in any other areas subjected to heavy wheel loads and/or turning traffic.

The estimated pavement sections provided in this report are minimums for the assumed design criteria, and as such, periodic maintenance should be expected. Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles. A maintenance program including surface sealing, joint cleaning and sealing, and timely repair of cracks and deteriorated areas will increase the pavement's service life. As an option, thicker sections could be constructed to decrease future maintenance.

Concrete for rigid pavements should have a minimum 28-day compressive strength of 4,000 psi, a modulus of rupture of 500 psi, and be placed with a maximum slump of 4 inches. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Pavement design methods are intended to provide structural sections with adequate thickness over a subgrade such that wheel loads are reduced to a level the subgrade can support.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. This is especially applicable for islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils. The civil design for the pavements with these conditions should include features to restrict or to collect and discharge excess water from the islands. Examples of features are edge drains connected to the storm water collection system, longitudinal subdrains, or other suitable outlet and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Dishing in parking lots surfaced with AC is usually observed in frequently-used parking stalls (such as near the front of buildings), and occurs under the wheel footprint in these stalls. The use of higher-grade asphaltic cement, or surfacing these areas with PCC, should be considered. The dishing is exacerbated by factors such as irrigated islands or planter areas, sheet surface drainage to the front of structures, and placing the ACC directly on a compacted clay subgrade.

Rigid PCC pavements will perform better than AC in areas where short-radii turning and braking are expected (i.e. entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to large or sustained loads. An adequate number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI and/or AASHTO requirements. Expansion (isolation) joints must be full depth and should only be used to isolate fixed objects abutting or within the paved area.

PCC pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with American Concrete Institute (ACI 330R-01 and ACI 325R.9-91). PCC pavements should be provided with mechanically reinforced joints (doweled or keyed) in accordance with ACI 330R-01.

### Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

The pavement surfacing and adjacent sidewalks should be sloped to provide rapid drainage of surface water. Water should not be allowed to pond on or adjacent to slabs, since it could saturate the subgrade and contribute to premature pavement or slab deterioration.

### Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

1. Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
2. Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
3. Install below pavement drainage systems surrounding areas anticipated for frequent wetting.
4. Install joint sealant and seal cracks immediately.
5. Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
6. Place compacted, low permeability backfill against the exterior side of curb and gutter.
7. Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

## SEISMIC CONSIDERATIONS

The 2019 California Building Code (CBC) Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool. This web-based software application calculates seismic design parameters in accordance with ASCE 7-16 and 2019 CBC. The 2019 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped $S_1$ value greater than or equal 0.2.

However, Section 11.4.8 of ASCE 7-16 includes an exception from such analysis for specific structures on Site Class D sites. The commentary for Section 11 of ASCE 7-16 (Page 534 of Section C11 of ASCE 7-16) states that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." Based on our understanding of the proposed structures, it is our assumption that the exception in Section 11.8.4 applies to the proposed structures. However, the structural engineer should verify the applicability of this exception.

Based on this exception, the spectral response accelerations presented below were calculated using the site coefficients ($F_a$ and $F_v$) from Tables 1613.2.3(1) and 16132.3(2) presented in Section 16.4.4 of the 2019 CBC.

| Description | Value |
|---|---|
| **2019 California Building Code Site Soil Classification**[1] | D[2] |
| **Site Latitude** | 38.5356°N |
| **Site Longitude** | 121.3936°W |
| **$S_s$ – Spectral Acceleration Parameter for a Short Period**[4] | 0.516 |
| **$S_1$ – Spectral Acceleration Parameter for a 1-Second Period**[4] | 0.239 |
| **$F_a$ – Site Amplification Factor for a Short Period** | 1.387 |
| **$F_v$ – Site Amplification Factor for a 1-Second Period** | 2.122 |
| **$S_{MS}$ – MCE[3] Spectral Acceleration Parameter for a Short Period** | 0.716 |
| **$S_{M1}$ – MCE[3] Spectral Acceleration Parameter for a 1-Second Period** | 0.507 |
| **$S_{DS}$ – Design Spectral Acceleration for a Short Period** | 0.477 |
| **$S_{D1}$ – Design Spectral Acceleration for a 1-Second Period** | 0.338 |

1. Seismic site soil classification in general accordance with the *2019 California Building Code*, which refers to ASCE 7-16.
2. The 2019 California Building Code (CBC) uses a site profile extending to a depth of 100 feet for seismic site soil classification. The borings for this report extended to the maximum depth of approximately 26½ feet and this seismic site class assignment considers that similar soils continue below the maximum depth of the

subsurface exploration. Additional exploration to greater depths could be considered to confirm the conditions below the current depth of exploration. Alternatively, a geophysical exploration could be utilized in order to attempt to justify a more favorable seismic site class.

3. MCE refers to Maximum Considered Earthquake.
4. These values were obtained using online seismic design maps and tools provided by SEAOC and OSHPD (https://seismicmaps.org/).

Typically, a site-specific ground motion study will generate less conservative coefficients and acceleration values which may reduce construction costs. We recommend consulting with the project structural engineer to evaluate the need for such a study and its potential impact on construction costs. Terracon should be contacted if a site-specific ground motion study is desired.

### Faulting and Estimated Ground Motions

The site is located in North Central California, which is a seismically active area. The type and magnitude of seismic hazards affecting the site are dependent on the distance to causative faults, the intensity, and the magnitude of the seismic event. Based on the OSHPD Seismic Design Maps Report, using the American Society of Civil Engineers (ASCE 7-16) standard, the peak ground acceleration ($PGA_M$) at the project site is expected to be 0.300g. Based on the USGS Unified Hazard Tool, the project site has a mean earthquake magnitude of 6.53. Furthermore, the site is not located within an Alquist-Priolo Earthquake Fault Zone based on our review of the State Fault Hazard Maps.[3]

## LIQUEFACTION

Liquefaction is a mode of ground failure that results from the generation of high pore water pressures during earthquake ground shaking, causing loss of shear strength. Liquefaction is typically a hazard where loose sandy soils or non-plastic fine-grained soils exist below groundwater. The California Geologic Survey (CGS) has designated certain areas within California as potential liquefaction hazard zones. These are areas considered at a risk of liquefaction-related ground failure during a seismic event, based upon mapped surficial deposits and the presence of a relatively shallow water table. The project site is not located within a liquefaction hazard zone mapped by the CGS.

A liquefaction analysis was not part of our scope of services, however, based on the Pleistocene age of the geologic formation and the relative depth to groundwater at this site, we conclude that the potential for liquefaction at this site is low. Therefore, other seismically induced hazards, such as lateral spreading, should also be considered low.

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[3] California Department of Conservation Division of Mines and Geology (CDMG), *"Digital Images of Official Maps of Alquist-Priolo Earthquake Fault Zones of California, Southern Region"*, CDMG Compact Disc 2000-003, 2000.

## CORROSIVITY

The table below lists the results of laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

| Corrosivity Test Results Summary | | | | | | |
|---|---|---|---|---|---|---|
| Boring | Sample Depth (feet) | Soil Description | Soluble Sulfate (%) | Soluble Chloride (%) | Electrical Resistivity (Ω-cm) | pH |
| B-6 | 2½ | Lean Clay with Sand | 0.01 | 0.01 | 1,116 | 8.01 |
| B-13 | 3½ | Lean Clay with Sand | <0.01 | <0.01 | 2,425 | 7.71 |

These test results are provided to assist in determining the type and degree of corrosion protection that may be required for the project. We recommend that a certified corrosion engineer determine the need for corrosion protection and design appropriate protective measures.

### Resistivity

The resistivity values indicate the samples tested exhibit high corrosive potential to buried metal pipes. Evaluation of the test results is based upon the guidelines of J.F. Palmer, "Soil Resistivity Measurements and Analysis", Materials Performance, Volume 13, January 1974. The following table outlines the guidelines for soil resistivity for corrosion potential.

| Corrosion Potential of Soil on Steel | |
|---|---|
| Soil Resistivity (ohm-cm) | Corrosion Potential |
| 0 to 1,000 | Very High |
| 1,000 to 2,000 | High |
| 2,000 to 5,000 | Moderate |
| > 5,000 | Mild |

### Sulfates

The sulfate test results indicate that the soil from boring B-6 and B-13 classify as Class S0 according to Table 19.3.1.1 of ACI 318-14. This indicates that the sulfate severity is negligible when considering corrosion to concrete. ACI 318-14, Section 19.3 does not provided restrictions to the type of concrete used for Sulfate Class S0. For further information, see ACI 318-14, Section 19.3.

### Laboratory pH

Data suggests the soil pH should not be the dominant soil variable affecting soil corrosion if the soil has a pH in the 5 to 8 range. The pH of the sample generally tested within the recommended range and therefore should not be considered when determining soil corrosion potential.

## COMPACTION TESTING

As requested by the project civil engineer Ware Malcomb, three (3) in-place density and water content tests were performed at each testing location for a total of nine (9) test performed. In-place testing was completed at the existing ground surface to depths of approximately 6 inches. Testing was performed in general accordance with ASTM D6938 (Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods). The three tests taken at each location were then averaged to determine a representative in-place soil density and water content.

After in-place density and water content testing was performed, one bulk soil sample from each testing location was obtained and taken to our laboratory to determine maximum dry density and optimum moisture contents in accordance with a Modified Proctor (ASTM D1557). Samples were taken at each test location from the ground surface to depths of approximately 6 inches bgs. The following table compares in-place density and moisture content testing to the laboratory determined maximum dry density and optimum moisture content.

| Testing Location | Average In-Place Dry Density (pcf) | Maximum Dry Density (pcf) | Percent Compaction (%) | Average In-Place Moisture Content (%) | Optimum moisture Content (%) | Percent Within Optimum Moisture Content (%) |
|---|---|---|---|---|---|---|
| CI-1 | 107.0 | 122.5 | 87.3 | 6.4 | 10.8 | - 4.4 |
| CI-2 | 112.3[1] | 115.7 | 97.1 | 2.0 | 13.2 | - 11.2 |
| CI-3 | 97.6 | 119.3 | 81.8 | 5.8 | 11.9 | - 6.1 |

1. Value contains a 15 percent rock correction

## PRELIMINARY INFILTRATION TESTING

Three (3) double-ring infiltrometer tests were also completed at each test location defined in the **Exploration Plan**. Testing was performed in general accordance with ASTM D3385 test method.

The tests were performed at the ground surface and the infiltrometer rings were seated with a Case 480 backhoe excavator bucket.

The infiltration testing results are provided in the table below:

| Sample Location | Test Depth | Field Infiltration Rate (in/hr) |
|---|---|---|
| **CI-1** | Ground Surface | 0.25 |
| **CI-2** | Ground Surface | 0.29 |
| **CI-3** | Ground Surface | 0.25 |

The field test results are not intended to be design rates. They represent the result of our tests, at the depths and locations indicated, as described above. The infiltration tests were performed with clear water, whereas the storm water will likely not be clear, but may contain organics, fines, and grease/oil. The presence of these deleterious materials will tend to decrease the rate that water percolates from the infiltration systems. Based on the soils encountered, we expect the infiltration rates of the soils could be different than measured in the field due to variations in fines content. The actual infiltration rate may vary from the values provided here.

## PERCOLATION TESTING

Five (5) in-situ percolation tests were performed to approximate depths of 5 feet bgs. A 2-inch thick layer of gravel was placed in the bottom of each 4-inch diameter borehole after the borings were drilled to investigate the soil profile. A 2-inch diameter perforated pipe was installed on top of the gravel layer in each boring. Gravel was used to backfill the annular space. The borings were then filled with water for a pre-soak period of 24 hours. Testing began after the pre-soak period. At the beginning of the test, the pipes were refilled with water and readings were taken at standardized time intervals. Percolation rates are provided in the following table:

| Percolation Test Results | | | | |
|---|---|---|---|---|
| **Test Location (depth, feet bgs)** | **Soil Classification** | **Slowest Measured Percolation Rate (in/hr.)** | **Correlated Infiltration Rate[1,2] (in/hr.)** | **Water Head (in)** |
| P-1 (5) | Lean Clay with Sand | 3.36 | 0.10 | 32 |
| P-2 (5) | Lean Clay with Sand | 1.44 | 0.04 | 35 |
| P-3 (5) | Lean Clay with Sand | 2.88 | 0.08 | 35 |
| P-4 (5) | Lean Clay with Sand | 3.84 | 0.20 | 19 |

| Percolation Test Results | | | | |
|---|---|---|---|---|
| **Test Location (depth, feet bgs)** | **Soil Classification** | **Slowest Measured Percolation Rate (in/hr.)** | **Correlated Infiltration Rate[1,2] (in/hr.)** | **Water Head (in)** |
| P-5 (5) | Lean Clay with Sand | 8.64 | 0.31 | 27 |

1. If the proposed infiltration system will mainly on vertical downward seepage, the correlated infiltration rates should be used.
2. The Porchet Formula (aka Inverse Borehole Formula) was used to calculate the test infiltration rates which takes into account sidewall area of the borehole.

The field test results are not intended to be design rates. They represent the result of our tests, at the depths and locations indicated, as described above. The design rate should be determined by the designer by applying an appropriate factor of safety. The designer should take into consideration the variability of the native soils when selecting appropriate design rates. With time, the bottoms of infiltration systems tend to plug with organics, sediments, and other debris. Long term maintenance and design implemented elements will likely be required to remove these deleterious materials to help reduce decreases in actual percolation rates.

The percolation test was performed with clear water, whereas the storm water will likely not be clear, but may contain organics, fines, and grease/oil. The presence of these deleterious materials will tend to decrease the rate that water percolates from the infiltration systems. Design of the storm water infiltration systems should account for the presence of these materials and should incorporate structures/devices to remove these deleterious materials.

Based on the soils encountered in our borings, we expect the percolation rates of the soils could be different than measured in the field due to variations in fines content. The design elevation and size of the proposed infiltration system should account for this expected variability in infiltration rates.

Infiltration testing using double ring infiltrometer testing should be performed after construction of the infiltration system to verify the design infiltration rates. It should be noted that siltation and vegetation growth along with other factors may affect the infiltration rates of the infiltration areas. The actual infiltration rate may vary from the values reported here. Infiltration systems should be located a minimum of 10 feet from any existing or proposed foundation system.

## GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction.

Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

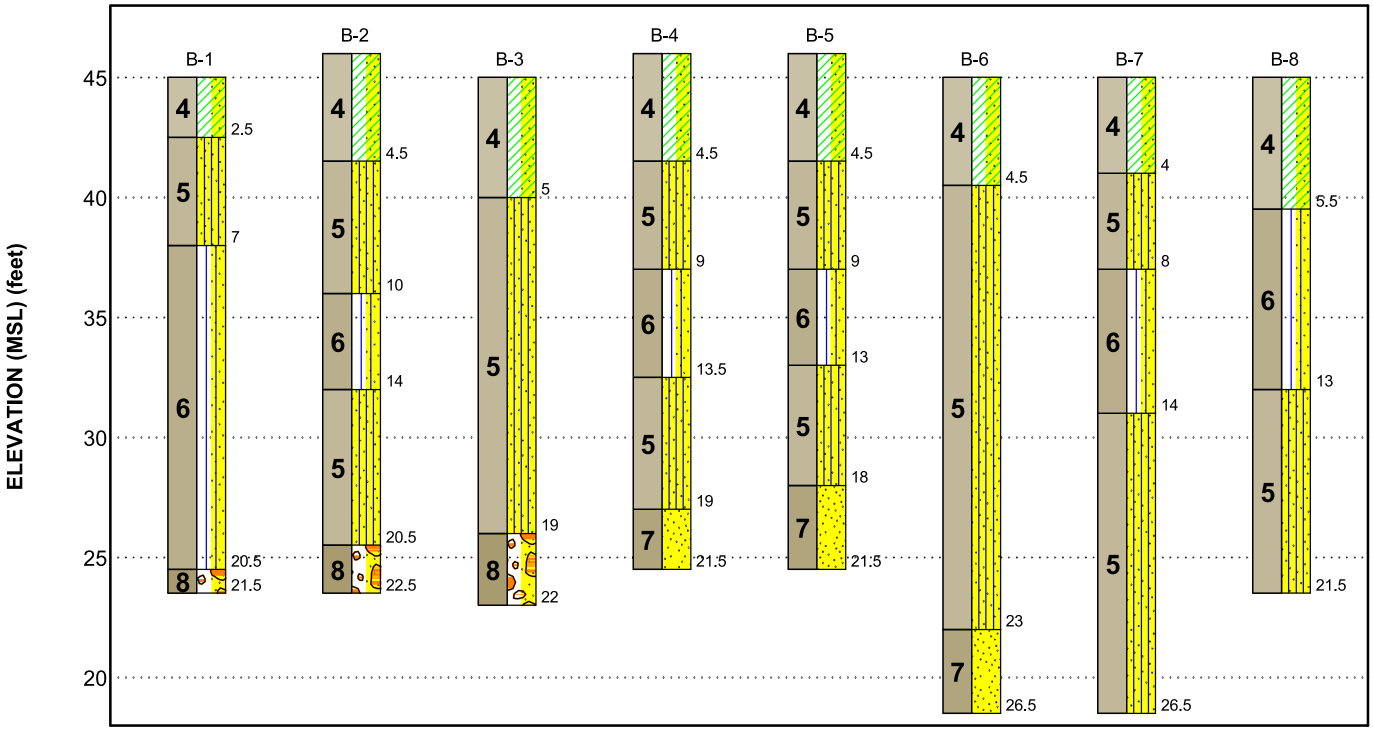
Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

# FIGURES

**Contents:**

## GEOMODEL - East Expansion

**Grocery Outlet Warehouse ■ Sacramento, CA**
**Terracon Project No. NB205060**




This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

### LEGEND

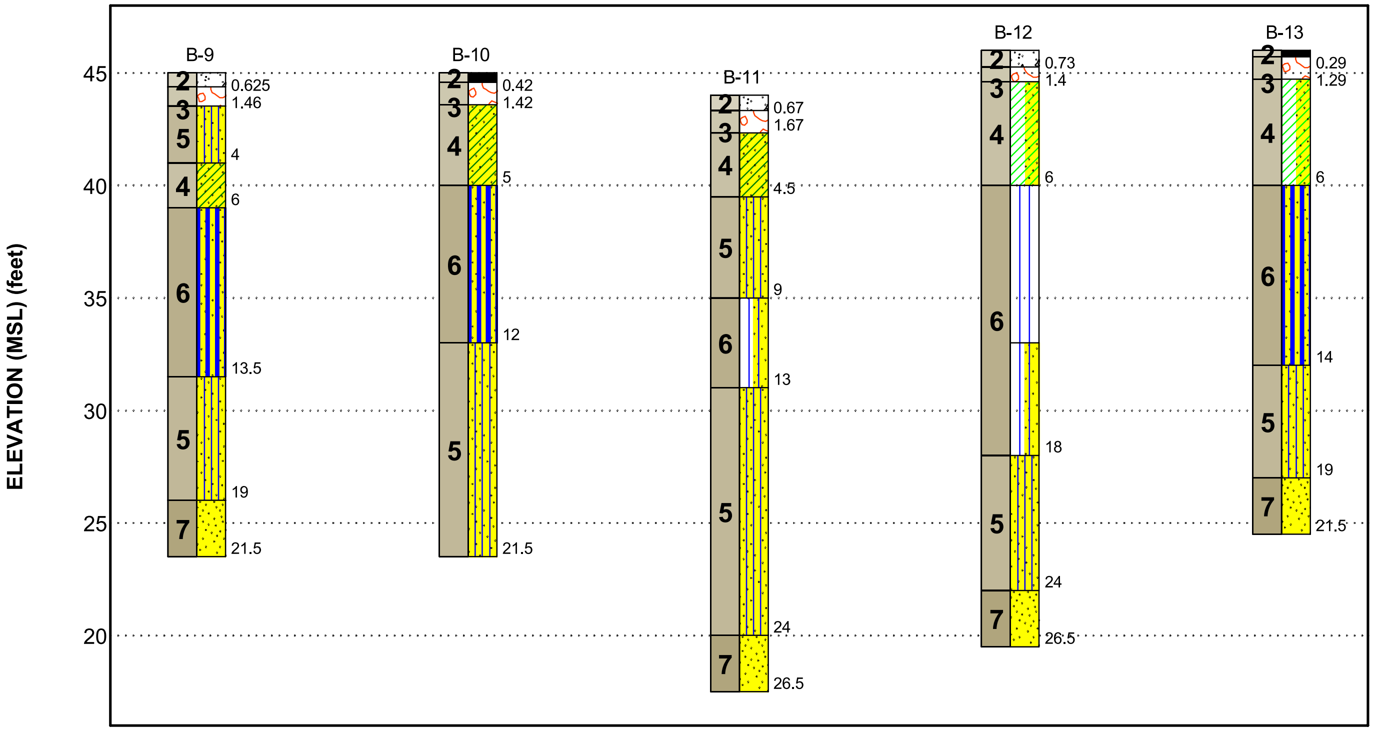
Lean Clay with Sand
Silty Sand
Silt with Sand
Poorly-graded Gravel with Sand
Poorly-graded Sand

| Model Layer | Layer Name | General Description |
|---|---|---|
| 1 | Topsoil | Approximately 8 inches in thickness |
| 2 | Surface Course | Asphalt and concrete pavements 3½ to 8½ inches in thickness |
| 3 | Base Course | Aggregate base course 6 to 18 inches in thickness |
| 4 | Lean Clay with Sand | Very stiff to hard, low to medium plasticity, varying sand content, varying cementation |
| 5 | Silty Sand | Medium dense to very dense, fine to medium grained, varying fines content |
| 6 | Silt with Sand | Very stiff to hard, low plasticity, varying sand content, varying cementation |
| 7 | Poorly Graded Sand | Medium dense to dense, fine to coarse grained |
| 8 | Poorly Graded Gravel | Very dense, fine to coarse grained, subrounded |

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.

## GEOMODEL - South Expansion

**Grocery Outlet Warehouse ■ Sacramento, CA**
**Terracon Project No. NB205060**




This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

| Model Layer | Layer Name | General Description |
|---|---|---|
| 1 | Topsoil | Approximately 8 inches in thickness |
| 2 | Surface Course | Asphalt and concrete pavements 3½ to 8½ inches in thickness |
| 3 | Base Course | Aggregate base course 6 to 18 inches in thickness |
| 4 | Lean Clay with Sand | Very stiff to hard, low to medium plasticity, varying sand content, varying cementation |
| 5 | Silty Sand | Medium dense to very dense, fine to medium grained, varying fines content |
| 6 | Silt with Sand | Very stiff to hard, low plasticity, varying sand content, varying cementation |
| 7 | Poorly Graded Sand | Medium dense to dense, fine to coarse grained |
| 8 | Poorly Graded Gravel | Very dense, fine to coarse grained, subrounded |

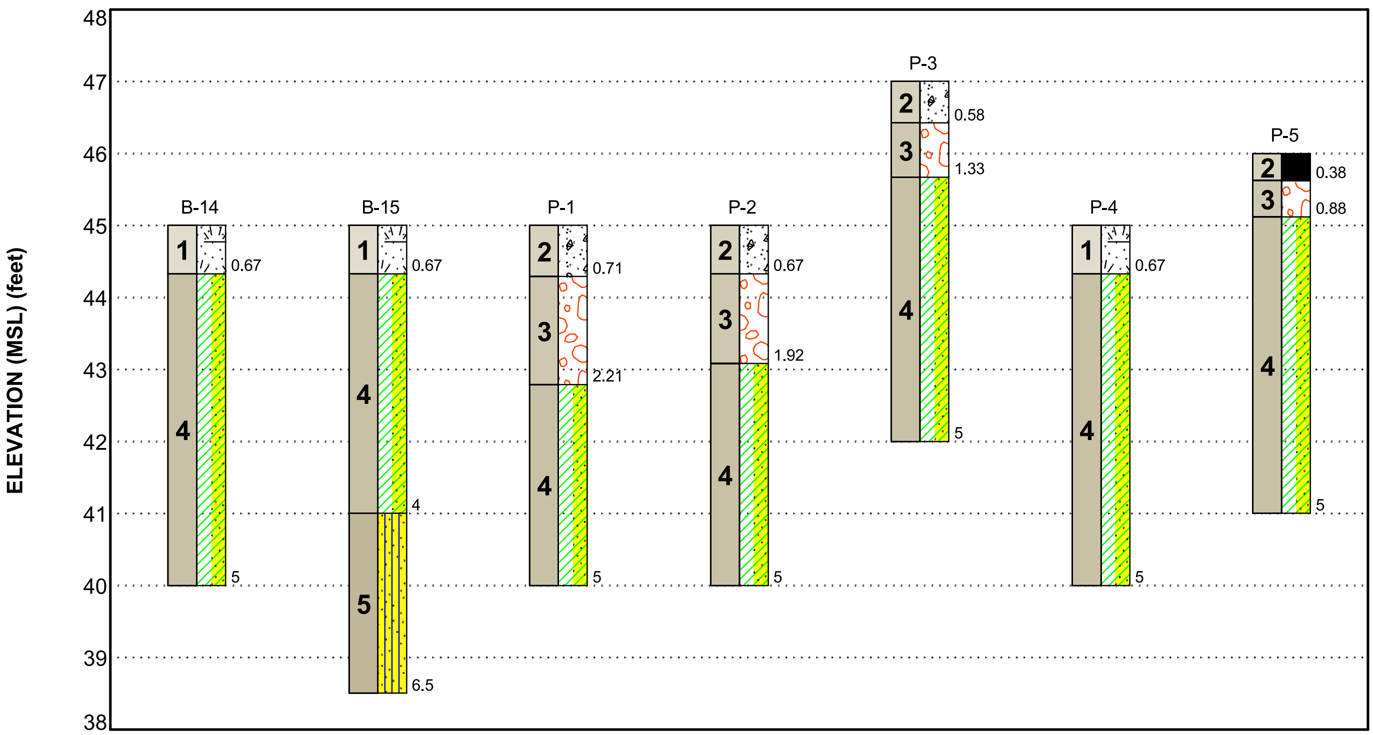
### LEGEND

Concrete
Aggregate Base Course
Silty Sand
Sandy Lean Clay
Sandy Silt
Poorly-graded Sand
Asphalt
Silt with Sand
Lean Clay with Sand
Silt

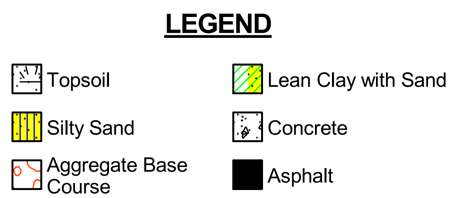
NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.

## GEOMODEL - Stormwater and Pavements

**Grocery Outlet Warehouse ■ Sacramento, CA**
**Terracon Project No. NB205060**




This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.




| Model Layer | Layer Name | General Description |
|---|---|---|
| 1 | Topsoil | Approximately 8 inches in thickness |
| 2 | Surface Course | Asphalt and concrete pavements 3½ to 8½ inches in thickness |
| 3 | Base Course | Aggregate base course 6 to 18 inches in thickness |
| 4 | Lean Clay with Sand | Very stiff to hard, low to medium plasticity, varying sand content, varying cementation |
| 5 | Silty Sand | Medium dense to very dense, fine to medium grained, varying fines content |
| 6 | Silt with Sand | Very stiff to hard, low plasticity, varying sand content, varying cementation |
| 7 | Poorly Graded Sand | Medium dense to dense, fine to coarse grained |
| 8 | Poorly Graded Gravel | Very dense, fine to coarse grained, subrounded |

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.

# ATTACHMENTS

# EXPLORATION AND TESTING PROCEDURES

## Field Exploration

| Number of Borings | Boring Depth (feet) | Planned Location |
|---|---|---|
| 8 | 21½ to 26½ | East warehouse expansion |
| 5 | 21½ to 26½ | South warehouse expansion |
| 7 | 5 to 6½ | Stormwater and pavement areas |

**Boring Layout and Elevations:** Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet) and approximate elevations were obtained from Google Earth. If elevations and a more precise boring layout are desired, we recommend borings be surveyed following completion of fieldwork.

**Subsurface Exploration Procedures:** We advanced the borings with a truck-mounted rotary drill rig using continuous flight augers. Two to three samples were obtained from borings that were advanced to depths of less than feet. Four samples were obtained in the upper 10 feet and at intervals of 5 feet thereafter for borings that extended to depths greater than 10 feet. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. split-barrel sampling spoon with 2.5-inch I.D. ring lined sampler was also used for sampling. Ring-lined, split-barrel sampling procedures are similar to standard split spoon sampling procedure; however, blow counts are typically recorded for 6-inch intervals for a total of 12 inches of penetration. For safety purposes, all borings were backfilled with auger cuttings after their completion. Pavements were patched with cold-mix asphalt and/or pre-mixed concrete, as appropriate.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by an Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

**Stormwater Infiltration Testing:** We seated our infiltrometer rings using a Case 480 backhoe with a 7½ -foot end loader bucket. One sample was obtained at each testing location. Soil sampling was performed using grab sampling procedures. In the grab sampling procedure, disturbed samples were collected directly from the surface. This sampling technique provided disturbed samples which were used to classify the soil.

## Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D1140 Standard Test Method for Determining the Amount of Material Finer than No. 200 Sieve by Soil Washing
- ASTM D2435/D2435M Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading
- ASTM D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

# SITE LOCATION AND EXPLORATION PLANS

**Contents:**



Note: All attachments are one page unless noted above.

## SITE LOCATION

Grocery Outlet Warehouse ■ Sacramento, Sacramento County, California
November 11, 2020 ■ Terracon Project No. NB205060

Terracon GeoReport

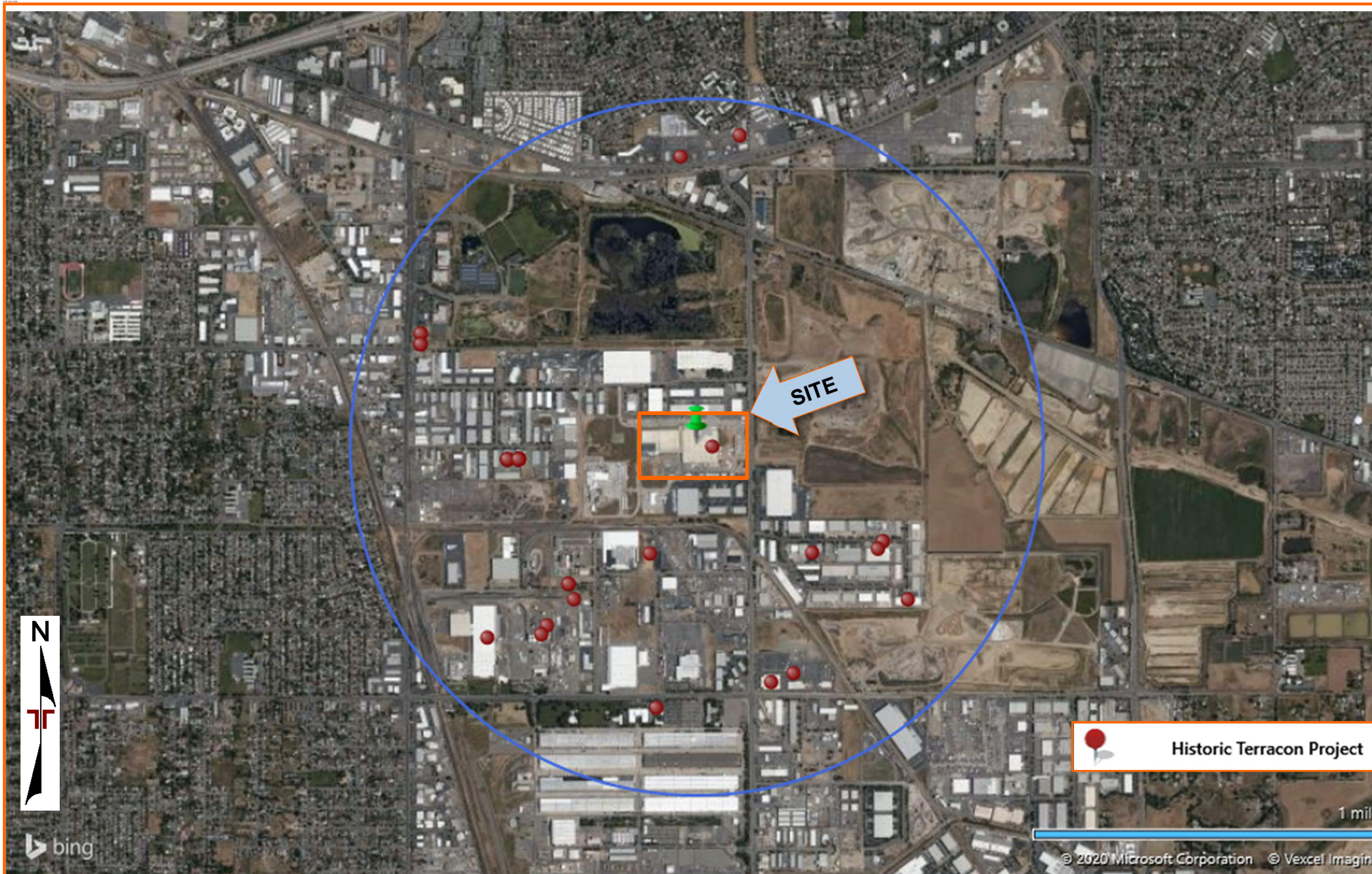



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

## EXPLORATION PLAN

Grocery Outlet Warehouse ■ Sacramento, Sacramento County, California
November 11, 2020 ■ Terracon Project No. NB205060

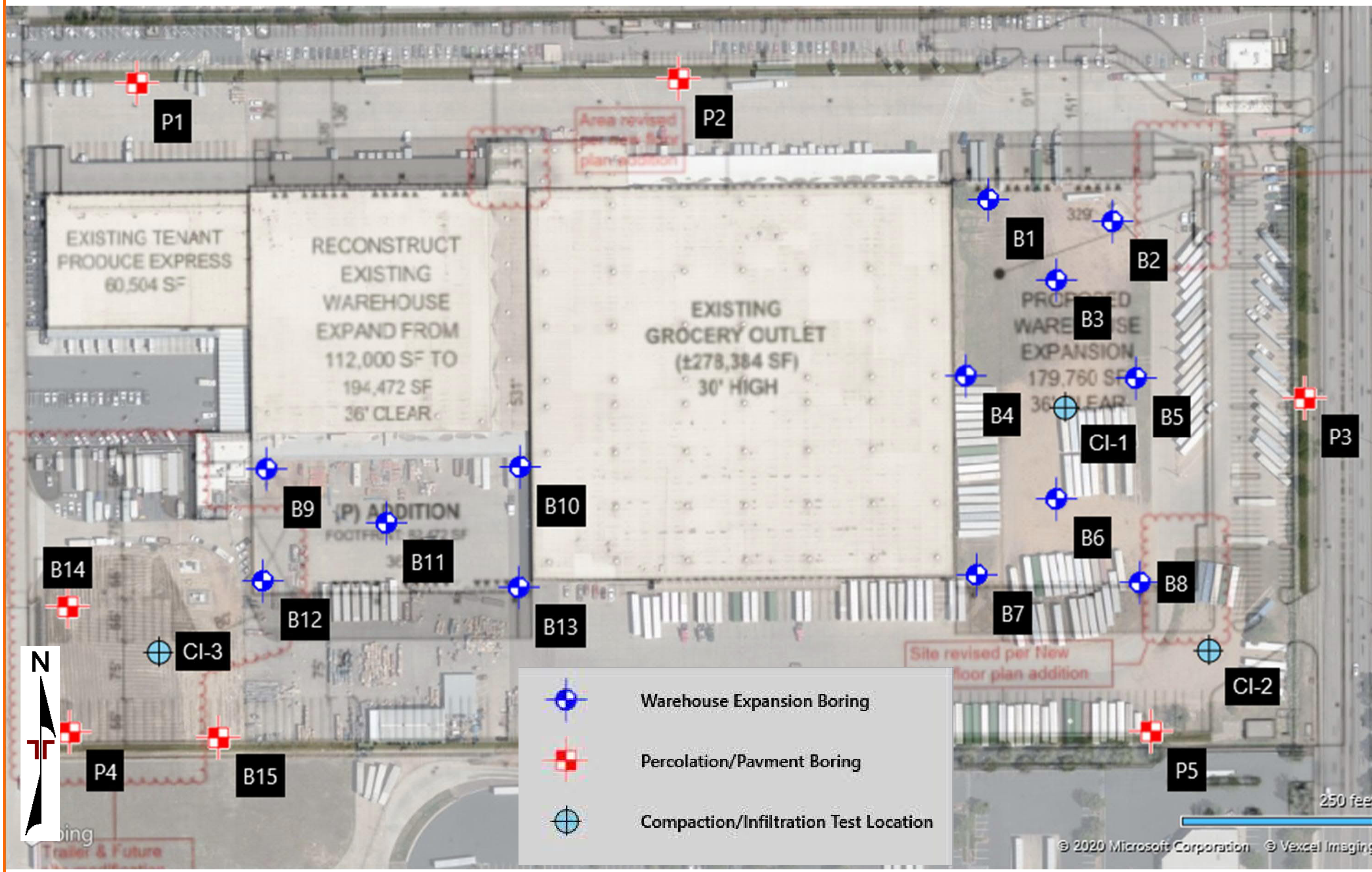



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

# EXPLORATION RESULTS

**Contents:**



Note: All attachments are one page unless noted above.

# BORING LOG NO. B-1



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5362° Longitude: -121.3924°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | 2.5 | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, light brown, hard, moderate cementation | 42.5+/- | | | | | | | | | |
| 5 | | 7.0 | **SILTY SAND (SM)**, fine grained, light brown, medium dense | 38+/- | | | | 50 | | 13.2 | | | |
| | | | | | 5 | | | 12-12-17 | | | | | |
| 6 | | 20.5 | **SILT WITH SAND (ML)**, fine grained, low plasticity, light brown, very stiff to hard, weak cementation | 24.5+/- | | | | 12-16-20 | 4.5+ (HP) | 20.4 | 103 | | |
| | | | | | 10 | | | 12-16-25 | 4.5+ (HP) | 21.6 | 104 | | |
| | | | | | 15 | | | 8-12-17 | 3.75 (HP) | 23.8 | 98 | | 70 |
| 8 | | 21.5 | **POORLY GRADED GRAVEL WITH SAND (GP)**, fine to coarse grained, subrounded, brown, very dense, gravel approximately 1.5" in dimension | 23.5+/- | 20 | | | 20-13-50/5" | | 4.7 | | | |

***Boring Terminated at 21.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-2



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5362° Longitude: -121.3919°

Approximate Surface Elev.: 46 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, light brown, hard, moderate cementation | | | | X | 27-50/2" | | 13.7 | 123 | | |
| | | 4.5 | | 41.5+/- | | | | | | | | | |
| 5 | | | **SILTY SAND (SM)**, fine grained, orangish brown, very dense | | 5 | | X | 27-50 | | 20.3 | 99 | | |
| | | | | | | | X | 15-32-45 | | 22.9 | 97 | | |
| | | 10.0 | | 36+/- | 10 | | | | | | | | |
| 6 | | | **SILT WITH SAND (ML)**, fine grained, low plasticity, orangish brown, hard, weak cementation | | | | X | 15-50 | | 30.4 | 89 | | |
| | | 14.0 | | 32+/- | | | | | | | | | |
| 5 | | | **SILTY SAND (SM)**, fine to medium grained, brown, medium dense | | 15 | | X | 12-13-16 | | 10.4 | 95 | | |
| | | 20.5 | | 25.5+/- | 20 | | X | 50 | | 7.5 | | | |
| 8 | | | **POORLY GRADED GRAVEL WITH SAND (GP)**, fine to coarse grained, subrounded, brown, very dense, gravel approximately 1.5" in dimension, auger chatter noted | | | | X | 50 | | 2.3 | | | |
| | | 22.5 | *Auger Refusal at 22.5 Feet* | 23.5+/- | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-3



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5359° Longitude: -121.3921°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH / DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | | | | | 15-23-30 N=53 | 4.5+ (HP) | 14.2 | | 37-19-18 | 83 |
| | | 5.0 | 40+/- | 5 | | | | | | | | |
| 5 | | **SILTY SAND (SM)**, fine grained, orangish brown, medium dense | | | | | 15-22-30 | | 20.1 | 105 | | |
| | | | | | | | 10-17-30 | | 24.3 | 99 | | |
| | | | | 10 | | | 10-15-20 | | 15.0 | 90 | | 48 |
| | | | | | | | 50 | | | | | |
| | | | | 15 | | | 10-13-15 | | 22.7 | 101 | | |
| | | 19.0 | 26+/- | | | | | | | | | |
| 8 | | **POORLY GRADED GRAVEL WITH SAND (GP)**, fine to coarse grained, subrounded, brown, very dense, gravel approximately 1.5" in dimension, auger chatter noted | | 20 | | | 15-30-30 | | 10.7<br>3.6 | 120 | | |
| | | 22.0 | 23+/- | | | | | | | | | |
| | | ***Auger Refusal at 22 Feet*** | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-4

**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5358° Longitude: -121.3924°

Approximate Surface Elev.: 46 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | | | | | 50 | | 11.7 | | | |
| | | 4.5 | 41.5+/- | 5 | | | 20-50/5" | | 17.3 | | | |
| 5 | | **SILTY SAND (SM)**, fine grained, orangish brown, very dense | | | | | 15-30-50/3" | | 15.4 | 104 | | |
| | | 9.0 | 37+/- | 10 | | | | | | | | |
| 6 | | **SILT WITH SAND (ML)**, fine grained, low plasticity, orangish brown, hard, weak cementation | | | | | 18-50 | 4.25 (HP) | 19.0 | 91 | | |
| | | 13.5 | 32.5+/- | 15 | | | | | | | | |
| 5 | | **SILTY SAND (SM)**, fine grained, orangish brown, dense | | | | | 15-22-40 | | 17.7 | 102 | | |
| | | 19.0 | 27+/- | 20 | | | | | | | | |
| 7 | | **POORLY GRADED SAND (SP)**, fine to medium grained, brown, medium dense | | | | | 13-12-13 N=25 | | 10.7 | | | |
| | | 21.5 | 24.5+/- | | | | | | | | | |
| | | ***Boring Terminated at 21.5 Feet*** | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-5

**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5357° Longitude: -121.3917°

Approximate Surface Elev.: 46 (Ft.) +/-

| MODEL LAYER | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 4.5 | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, light brown, hard, moderate cementation | 41.5+/- | | | | 50/3" | | 15.5 | | | |
| 5 | 9.0 | **SILTY SAND (SM)**, fine grained, orangish brown, medium dense | 37+/- | 5 | | | 10-12-15 N=27 | | 21.1 | | | |
| | | | | | | | 9-12-17 | | | | | |
| 6 | 13.0 | **SILT WITH SAND (ML)**, fine grained, low plasticity, brown, hard, weak cementation | 33+/- | 10 | | | 14-30-25 | | 18.0 | 98 | | |
| 5 | 18.0 | **SILTY SAND (SM)**, fine grained, brown, dense | 28+/- | 15 | | | 12-16-21 | | 10.0 | 102 | | |
| 7 | 21.5 | **POORLY GRADED SAND (SP)**, fine to medium grained, brown, medium dense to dense | 24.5+/- | 20 | | | 11-20-21 | | 10.0 | 108 | | |

***Boring Terminated at 21.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-09-2020 | Boring Completed: 10-09-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-6



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5353° Longitude: -121.392°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | | | | | 8-9-50/1" | 4.5+ (HP) | | | | |
| | 4.5 | | 40.5+/- | | | | | | | | | |
| 5 | | **SILTY SAND (SM)**, fine grained, light brown, medium dense | | 5 | | | 22-25-16 N=41 | | 16.8 | | NP | 27 |
| | | | | | | | 12-16-20 | | 13.2 | 104 | | |
| | | | | 10 | | | 10-16-25 | | 13.2 | 96 | | |
| | | | | 15 | | | 10-13-20 | | 16.0 | 104 | | |
| | | | | 20 | | | 10-10-15 N=25 | | 13.4 | | | |
| | 23.0 | | 22+/- | | | | | | | | | |
| 7 | | **POORLY GRADED SAND (SP)**, fine to medium grained, brown, medium dense | | 25 | | | 8-10-10 N=20 | | 7.6 | | | |
| | 26.5 | | 18.5+/- | | | | | | | | | |
| | | ***Boring Terminated at 26.5 Feet*** | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-7

**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5349° Longitude: -121.3924°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | DEPTH | DESCRIPTION | ELEVATION (Ft.) |
|---|---|---|---|
| 4 | 4.0 | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | 41+/- |
| 5 | 8.0 | **SILTY SAND (SM)**, fine grained, orangish brown, medium dense | 37+/- |
| 6 | 14.0 | **SILT WITH SAND (ML)**, fine grained, low plasticity, orangish brown, hard, weak cementation | 31+/- |
| 5 | 26.5 | **SILTY SAND (SM)**, fine grained, light brown, medium dense to dense | 18.5+/- |
| | | ***Boring Terminated at 26.5 Feet*** | |

| DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|
| | | | 50 | | 13.7 | | | |
| 5 | | | 10-15-21 | | 17.3 | | | |
| 10 | | | 10-15-18 | 4.5 (HP) | 22.6 | 91 | | |
| 15 | | | 10-20-23 | | 12.8 | 95 | | |
| 20 | | | 6-7-9 N=16 | | 20.2 | 99 | | 45 |
| 25 | | | 5-9-9 N=18 | | 21.1 | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-09-2020 | Boring Completed: 10-09-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-8



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5348° Longitude: -121.3917°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | | | | | 21-50 | | 15.2 | | | |
| | 5.5 | | 39.5+/- | 5 | | | 13-14-18 N=32 | | 17.0 | 87 | | |
| 6 | | **SILT WITH SAND (ML)**, fine grained, low plasticity, orangish brown, hard | | | | | 9-19-25 | 4.5 (HP) | | | | |
| | | | | 10 | | | 10-15-21 | 4.5 (HP) | 19.3 | 97 | | |
| | 13.0 | | 32+/- | | | | | | | | | |
| 5 | | **SILTY SAND (SM)**, fine grained, brown, medium dense to dense | | 15 | | | 13-17-26 | | 13.6 | 100 | | |
| | | | | 20 | | | 10-15-20 | | 15.5 | | | |
| | 21.5 | | 23.5+/- | | | | | | | | | |

***Boring Terminated at 21.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

Boring Started: 10-09-2020

Boring Completed: 10-09-2020

Drill Rig: CME 75

Driller: H1 Drilling

Project No.: NB205060

# BORING LOG NO. B-9



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5352° Longitude: -121.3956°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0.6 | **CONCRETE**, ~7.5" | 44.5+/- | | | | | | | | | |
| 3 | 1.5 | **AGGREGATE BASE COURSE**, ~10" | 43.5+/- | | | | | | | | | |
| 5 | 4.0 | **SILTY SAND (SM)**, fine grained, orangish brown, dense | 41+/- | | | | 21-26-27 N=53 | 3.75 (HP) | 18.1 | | NP | 22 |
| 4 | 6.0 | **SANDY LEAN CLAY (CL)**, fine grained, low plasticity, orangish brown, very stiff to hard, weak cementation | 39+/- | 5 | | | 50/5" | 4.5+ (HP) | 17.6 | 95 | | |
| 6 | 13.5 | **SANDY SILT (ML)**, fine grained, low plasticity, brown, very stiff to hard, weak cementation | 31.5+/- | | | | 12-16-30 | 4.5+ (HP) | 25.7 | 94 | | |
| | | | | 10 | | | 12-15-21 | | 19.7 | 95 | | |
| 5 | 19.0 | **SILTY SAND (SM)**, fine grained, brown, dense | 26+/- | 15 | | | 16-30-30 | 4.5 (HP) | 19.4 | 104 | | |
| 7 | 21.5 | **POORLY GRADED SAND (SP)**, fine to medium grained, brown, medium dense | 23.5+/- | 20 | | | 8-10-12 N=22 | | 13.2 | | | |

***Boring Terminated at 21.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

Boring Started: 10-09-2020

Boring Completed: 10-09-2020

Drill Rig: CME 75

Driller: H1 Drilling

Project No.: NB205060

# BORING LOG NO. B-10



**PROJECT:** Grocery Outlet Warehouse

**CLIENT:** Read Investments LLC
Berkeley, CA

**SITE:** 4400 Florin Perkins
Sacramento, CA

LOCATION See Exploration Plan

Latitude: 38.5352° Longitude: -121.3945°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | 0.4 | **ASPHALT**, ~5" | 44.5+/- | | | | | | | | | |
| 3 | | 1.4 | **AGGREGATE BASE COURSE**, ~12" | 43.5+/- | | | | | | | | | |
| 4 | | 5.0 | **SANDY LEAN CLAY (CL)**, fine grained, low plasticity, orangish brown, very stiff to hard, weak cementation | 40+/- | | | | 17-21-22 N=43 | | 16.2 | | | |
| 6 | | 12.0 | **SANDY SILT (ML)**, fine grained, low plasticity, orangish brown, very stiff to hard, weak cementation | 33+/- | 5 | | | 17-20-25 N=45 | 3.5 (HP) | 22.0 | | | |
| | | | | | | | | 9-16-15 | 4.5+ (HP) | | | | |
| | | | | | 10 | | | 11-21-30 | 4.5 (HP) | 17.8 | 93 | | |
| 5 | | 21.5 | **SILTY SAND (SM)**, fine to medium grained, brown, medium dense | 23.5+/- | 15 | | | 8-10-12 N=22 | | 26.6 | | | |
| | | | | | 20 | | | 4-6-14 N=20 | | 25.4 | | | |
| | | | ***Boring Terminated at 21.5 Feet*** | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-09-2020 | Boring Completed: 10-09-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-11



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5352° Longitude: -121.3951°

Approximate Surface Elev.: 44 (Ft.) +/-

| MODEL LAYER | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0.7 | **CONCRETE**, ~8" | 43.5+/- | | | | | | | | | |
| 3 | 1.7 | **AGGREGATE BASE COURSE**, ~12" | 42.5+/- | | | | | | | | | |
| 4 | 4.5 | **SANDY LEAN CLAY (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, weak cementation | 39.5+/- | | | | 50 | 4.5+ (HP) | 16.2 | 97 | | |
| 5 | 9.0 | **SILTY SAND (SM)**, fine to medium grained, orangish brown, medium dense | 35+/- | 5 | | | 6-9-5 N=14 | | 24.5 | | | |
| | | | | | | | 7-11-20 | | 23.5 | 95 | | |
| 6 | 13.0 | **SILT WITH SAND (ML)**, fine grained, low plasticity, orangish brown, hard, weak cementation | 31+/- | 10 | | | 13-14-17 N=31 | | 20.1 | | | |
| 5 | 24.0 | **SILTY SAND (SM)**, fine to medium grained, orangish brown, medium dense | 20+/- | 15 | | | 8-12-16 N=28 | | 14.6 | | | 47 |
| | | | | 20 | | | 8-8-15 N=23 | | 15.2 | | | |
| 7 | 26.5 | **POORLY GRADED SAND (SP)**, fine to coarse grained, black and brown, medium dense | 17.5+/- | 25 | | | 8-9-14 N=23 | | 5.9 | | | |

***Boring Terminated at 26.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

Boring Started: 10-09-2020 | Boring Completed: 10-09-2020
Drill Rig: CME 75 | Driller: H1 Drilling
Project No.: NB205060

# BORING LOG NO. B-12

**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5349° Longitude: -121.3956°

Approximate Surface Elev.: 46 (Ft.) +/-

| MODEL LAYER | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0.7 | **CONCRETE**, ~8.75" | 45.5+/- | | | | | | | | | |
| 3 | 1.4 | **AGGREGATE BASE COURSE**, ~8" | 44.5+/- | | | | | | | | | |
| 4 | | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | | | | | 50/5" | | 14.7 | 91 | | |
| | | | | 5 | | | 50/3" | | 15.9 | 106 | | |
| | 6.0 | | 40+/- | | | | | | | | | |
| 6 | | **SILT (ML)**, brown, very stiff to hard, weak cementation | | | | | 8-10-13 N=23 | | 23.0 | | | |
| | | | | 10 | | | 8-13-20 | 4.5+ (HP) | 28.3 | 89 | NP | 88 |
| | 13.0 | | 33+/- | | | | | | | | | |
| | | **SILT WITH SAND (ML)**, fine grained, low plasticity, brown, hard | | 15 | | | 18-50 | 4.5+ (HP) | 23.7 | 100 | | |
| | 18.0 | | 28+/- | | | | | | | | | |
| 5 | | **SILTY SAND (SM)**, fine to medium grained, brown, dense | | 20 | | | 15-15-15 N=30 | | 10.4 | | | |
| | 24.0 | | 22+/- | | | | | | | | | |
| 7 | | **POORLY GRADED SAND (SP)**, fine to coarse grained, black and brown, dense | | 25 | | | 8-12-20 N=32 | | 7.0 | | | |
| | 26.5 | | 19.5+/- | | | | | | | | | |

***Boring Terminated at 26.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-09-2020 | Boring Completed: 10-09-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-13



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5349° Longitude: -121.3945°

Approximate Surface Elev.: 46 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | 0.3 | **ASPHALT**, ~3.5" | 45.5+/- | | | | | | | | | |
| 3 | | 1.3 | **AGGREGATE BASE COURSE**, ~12" | 44.5+/- | | | | | | | | | |
| 4 | | | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | | | | | 50/5" | | | | | |
| | | | | | 5 | | | 20-26-30 N=56 | | 22.7 | | | |
| | | 6.0 | | 40+/- | | | | | | | | | |
| 6 | | | **SANDY SILT (ML)**, fine grained, low plasticity, orangish brown, hard, weak cementation | | | | | 9-11-17 | 4.5 (HP) | 24.4 | 92 | | |
| | | | | | 10 | | | 9-15-20 | 4.5 (HP) | 23.0 | 95 | | |
| | | 14.0 | | 32+/- | | | | | | | | | |
| 5 | | | **SILTY SAND (SM)**, fine grained, brown, medium dense to dense | | 15 | | | 11-17-25 | | 13.7 | 104 | | |
| | | 19.0 | | 27+/- | | | | | | | | | |
| 7 | | | **POORLY GRADED SAND (SP)**, fine to medium grained, black and brown, medium dense | | 20 | | | 11-15-25 | | 13.0 | 107 | | |
| | | 21.5 | | 24.5+/- | | | | | | | | | |
| | | | ***Boring Terminated at 21.5 Feet*** | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-09-2020 | Boring Completed: 10-09-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-14



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5348° Longitude: -121.3966°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.7 **TOPSOIL**, ~8" | 44.5+/- | | | | | | | | | |
| 4 | | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, light reddish brown, very stiff to hard, weak cementation | | | | | 10-15-18 | | 8.3 | | | |
| | | | | | | | 50/3" | | 11.8 | 109 | | |
| | | 5.0 | 40+/- | 5 | | | | | | | | |

***Boring Terminated at 5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon

50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. B-15



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5343° Longitude: -121.3958°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | MATERIAL DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.7 | **TOPSOIL**, ~8" | 44.5+/- | | | | | | | | | |
| 4 | | 4.0 | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | 41+/- | | | X | 22-50/4" | | 15.8 | 105 | | |
| 5 | | 6.5 | **SILTY SAND (SM)**, fine to coarse grained, orangish brown, medium dense | 38.5+/- | 5 | | X | 8-10-15 N=25 | | 30.2 | | | |

***Boring Terminated at 6.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. P-1

**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5366° Longitude: -121.3962°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | 0.7 | **CONCRETE**, ~8.5" | 44.5+/- | | | | | | | | | |
| 3 | | 2.2 | **AGGREGATE BASE COURSE**, ~18 inches | 43+/- | | | | | | | | | |
| 4 | | 5.0 | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | 40+/- | 5 | | | 50 | 4.5+ (HP) | 16.1 | 104 | | |
| | | | ***Boring Terminated at 5 Feet*** | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. P-2



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5366° Longitude: -121.3938°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | 0.7 | **CONCRETE**, ~8.0" | 44.5+/- | | | | | | | | | |
| 3 | | 1.9 | **AGGREGATE BASE COURSE**, ~15 inches | 43+/- | | | X | 30-30-16 N=46 | | 18.2 | | | |
| 4 | | 5.0 | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, stiff | 40+/- | 5 | | X | 3-4-5 N=9 | | 30.9 | | | 82 |
| | | | ***Boring Terminated at 5 Feet*** | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. P-3



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5355° Longitude: -121.3911°

Approximate Surface Elev.: 47 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | 0.6 **CONCRETE**, ~7.0" | 46.5+/- | | | | | | | | | |
| 3 | | 1.3 **AGGREGATE BASE COURSE**, ~9.0 inches | 45.5+/- | | | | | | | | | |
| 4 | | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | | | | X | 15-30-50/3" | | 11.8 | 110 | | |
| | | 5.0 | 42+/- | 5 | | | | | | | | |
| | | ***Boring Terminated at 5 Feet*** | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. P-4



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5342° Longitude: -121.3965°

Approximate Surface Elev.: 45 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.7 **TOPSOIL**, ~8.0" | 44.5+/- | | | | | | | | | |
| 4 | | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | | | | | 15-25-30 N=55 | | 15.6 | | | |
| | | | | | | | 50 | 4.5+ (HP) | 17.1 | 103 | | |
| | | 5.0 | 40+/- | 5 | | | | | | | | |

***Boring Terminated at 5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# BORING LOG NO. P-5



**PROJECT: Grocery Outlet Warehouse**

**CLIENT: Read Investments LLC**
**Berkeley, CA**

**SITE: 4400 Florin Perkins**
**Sacramento, CA**

LOCATION See Exploration Plan

Latitude: 38.5344° Longitude: -121.3917°

Approximate Surface Elev.: 46 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | LABORATORY HP (tsf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | 0.4 | **ASPHALT**, ~4.5" | 45.5+/- | | | | | | | | | |
| 3 | | 0.9 | **AGGREGATE BASE COURSE**, ~6.0" | 45+/- | | | | | | | | | |
| 4 | | 5.0 | **LEAN CLAY WITH SAND (CL)**, fine to coarse grained, low to medium plasticity, orangish brown, hard, moderate cementation | 41+/- | 5 | | | 20-50 | 4.5+ (HP) | 16.0 | 101 | | |
| | | | ***Boring Terminated at 5 Feet*** | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" Solid Stem Auger

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

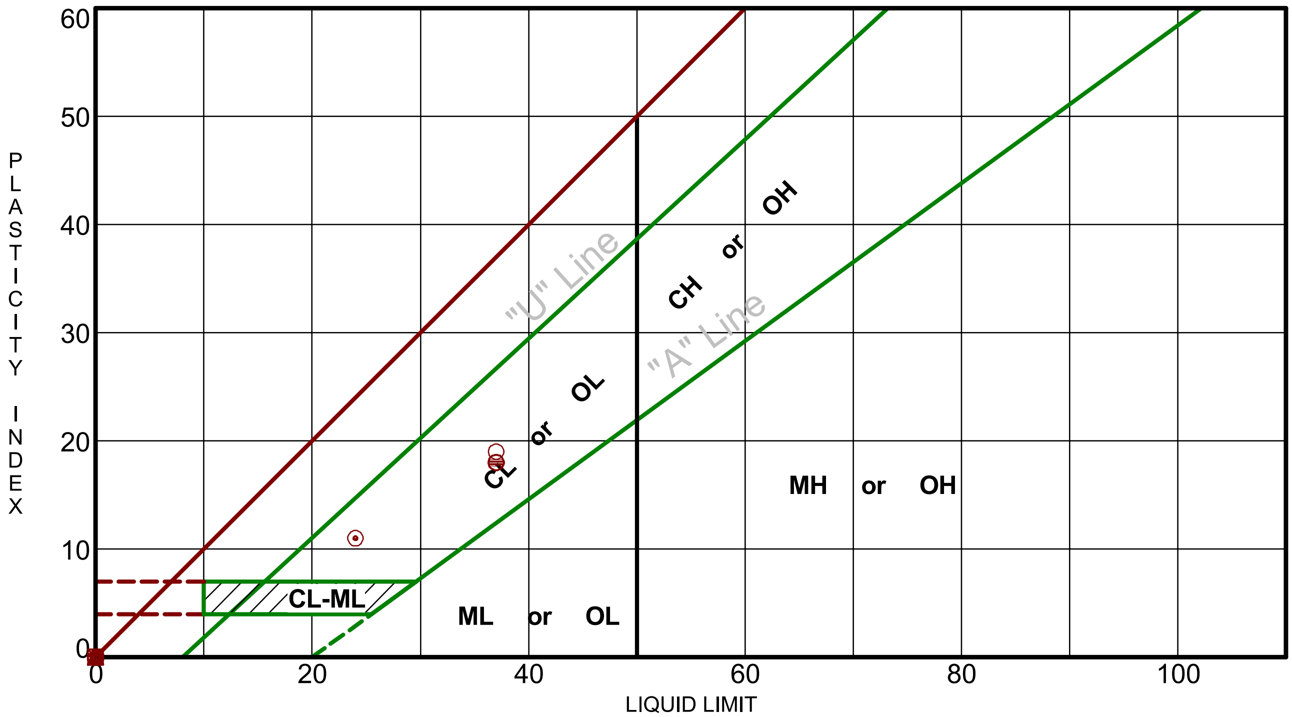
*Groundwater not encountered*

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

| | |
|---|---|
| Boring Started: 10-08-2020 | Boring Completed: 10-08-2020 |
| Drill Rig: CME 75 | Driller: H1 Drilling |
| Project No.: NB205060 | |

# ATTERBERG LIMITS RESULTS

ASTM D4318




| Boring ID | | Depth | LL | PL | PI | Fines | USCS | Description |
|---|---|---|---|---|---|---|---|---|
| ⊖ | B-3 | 2.5 - 4 | 37 | 19 | 18 | 83.0 | CL | LEAN CLAY with SAND |
| ⊠ | B-6 | 5 - 6.5 | NP | NP | NP | 27.0 | SM | SILTY SAND |
| △ | B-9 | 2.5 - 4 | NP | NP | NP | 22.0 | SM | SILTY SAND |
| ☆ | B-12 | 10 - 11.5 | NP | NP | NP | 88.0 | ML | SILT |
| ⊙ | CI-1 | 0 - 0.5 | 24 | 13 | 11 | 58.0 | CL | Sandy Lean Clay with Gravel |
| ✪ | CI-2 | 0 - 0.5 | NP | NP | NP | 44.0 | SM | Silty Sand |
| ○ | CI-3 | 0 - 1 | 37 | 18 | 19 | 89.0 | CL | Lean Clay |

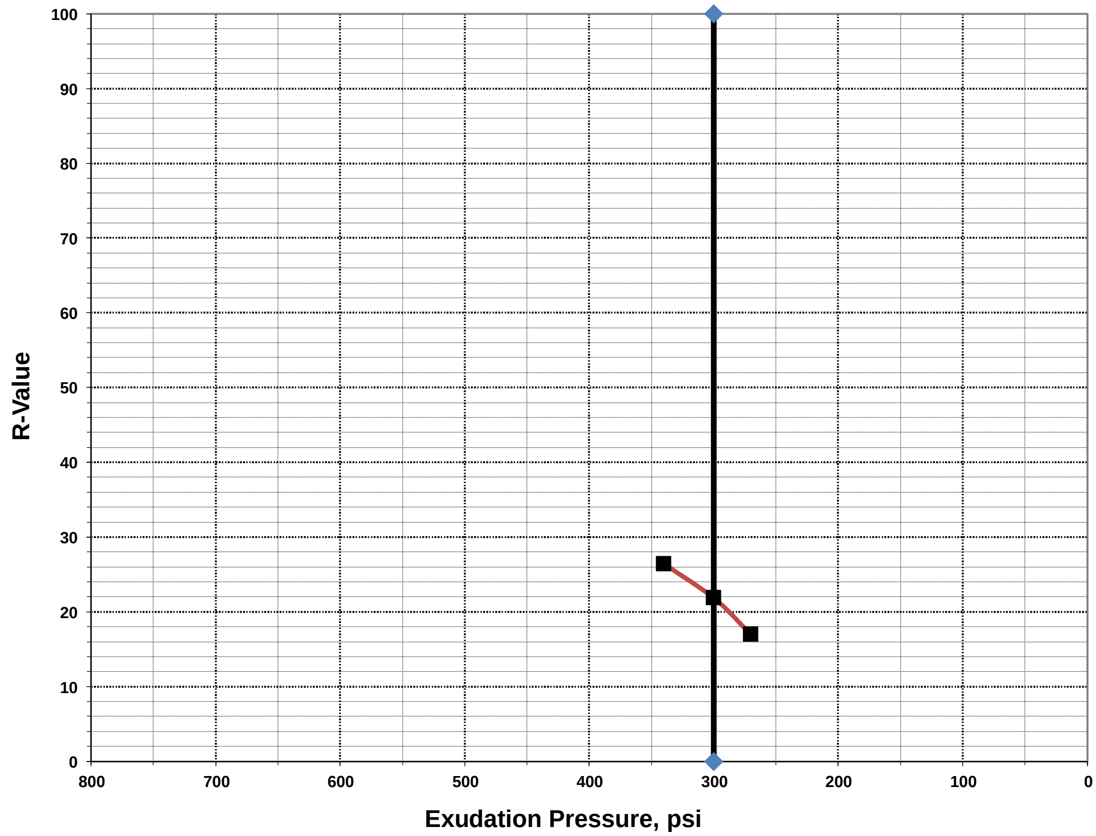
PROJECT: Grocery Outlet Warehouse

SITE: 4400 Florin Perkins
Sacramento, CA

Terracon
50 Golden Land Ct Ste 100
Sacramento, CA

PROJECT NUMBER: NB205060

CLIENT: Read Investments LLC
Berkeley, CA




| Specimen Identification | Compaction Pressure (psi) | R-Value at 300 psi |
|---|---|---|
| **B14** | **143.3** | **22** |

## R-Value Test

**Client:** Read Investments, LLC
**Project:** Grocery Outlet Warehouse
**Site:** 4400 Florin Perking Road, Sacramento, CA
**Project No.:** NB205060

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Terracon GeoReport

**Client**

Read Investments LLC

**Project**

Grocery Outlet Warehouse

**Sample Submitted By:** Terracon (NB) **Date Received:** 10/13/2020 **Lab No.: 20-1103**

## Results of Corrosion Analysis

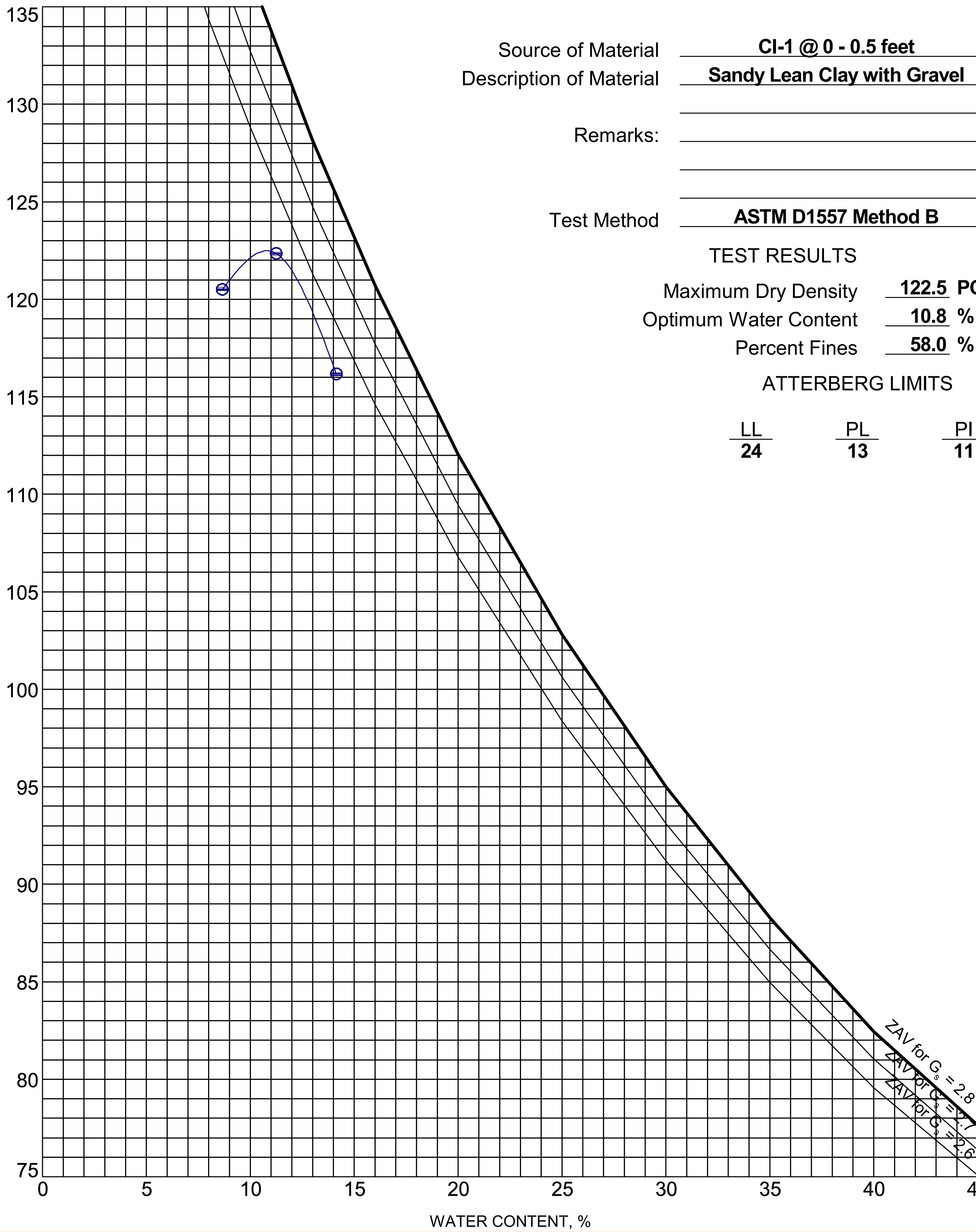
| | | |
|---|---|---|
| **Sample Number** | B6-1 | B13-1 |
| **Sample Location** | B6 | B13 |
| **Sample Depth (ft.)** | 2.5 | 3.5 |
| pH Analysis, ASTM G 51 | 8.01 | 7.71 |
| Water Soluble Sulfate (SO4), ASTM C 1580 (percent %) | 0.01 | <0.01 |
| Chlorides, ASTM D 512, (percent %) | 0.01 | <0.01 |
| Resistivity, ASTM G 57, (ohm-cm) | 1116 | 2425 |

**Analyzed By:** Trisha Campo

Trisha Campo
Chemist

# MOISTURE-DENSITY RELATIONSHIP

**ASTM D698/D1557**




Source of Material **CI-1 @ 0 - 0.5 feet**

Description of Material **Sandy Lean Clay with Gravel**

Remarks:

Test Method **ASTM D1557 Method B**

TEST RESULTS

Maximum Dry Density **122.5 PCF**

Optimum Water Content **10.8 %**

Percent Fines **58.0 %**

ATTERBERG LIMITS

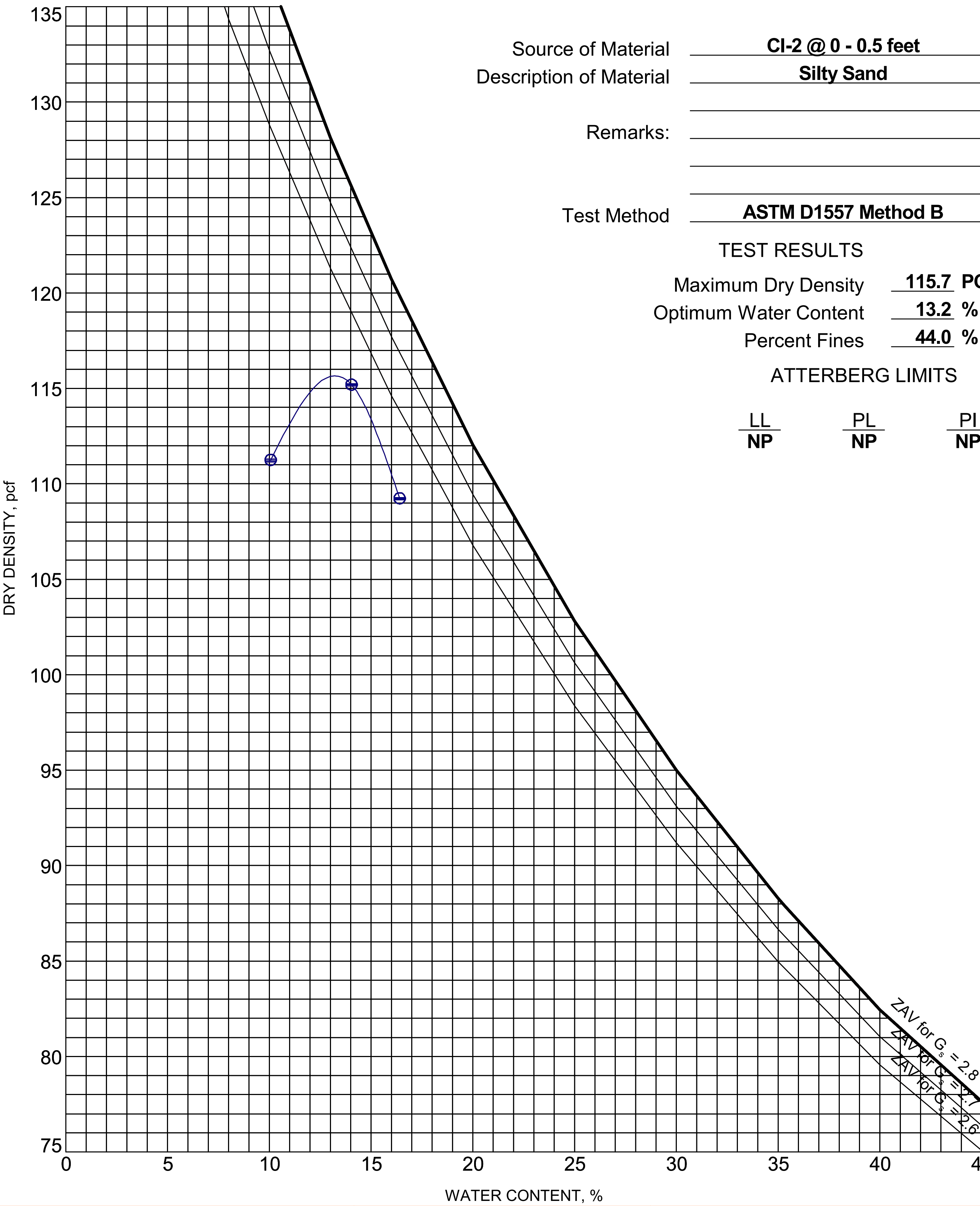
| LL | PL | PI |
|---|---|---|
| **24** | **13** | **11** |



| | | |
|---|---|---|
| PROJECT: Grocery Outlet Warehouse | Terracon<br>50 Golden Land Ct Ste 100<br>Sacramento, CA | PROJECT NUMBER: NB205060 |
| SITE: 4400 Florin Perkins<br>Sacramento, CA | | CLIENT: Read Investments LLC<br>Berkeley, CA |

# MOISTURE-DENSITY RELATIONSHIP

**ASTM D698/D1557**




| | |
|---|---|
| Source of Material | **CI-2 @ 0 - 0.5 feet** |
| Description of Material | **Silty Sand** |
| Remarks: | |
| Test Method | **ASTM D1557 Method B** |

TEST RESULTS

| | | |
|---|---|---|
| Maximum Dry Density | **115.7** | **PCF** |
| Optimum Water Content | **13.2** | **%** |
| Percent Fines | **44.0** | **%** |

ATTERBERG LIMITS

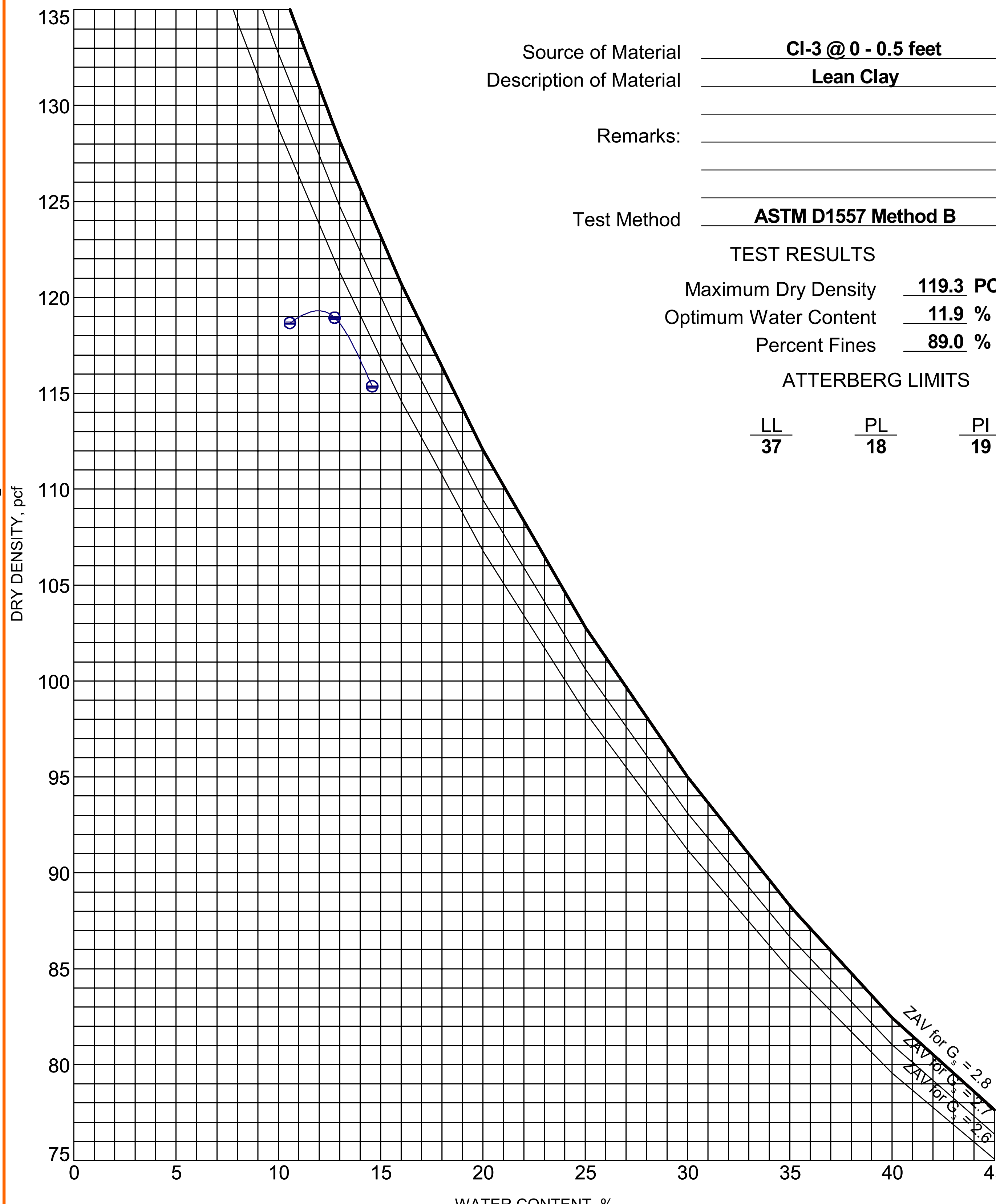
| LL | PL | PI |
|---|---|---|
| **NP** | **NP** | **NP** |

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 NB205060 GROCERY OUTLET WA.GPJ TERRACON_DATATEMPLATE.GDT 9/30/20

| | | |
|---|---|---|
| PROJECT: Grocery Outlet Warehouse | Terracon<br>50 Golden Land Ct Ste 100<br>Sacramento, CA | PROJECT NUMBER: NB205060 |
| SITE: 4400 Florin Perkins<br>Sacramento, CA | | CLIENT: Read Investments LLC<br>Berkeley, CA |

# MOISTURE-DENSITY RELATIONSHIP

**ASTM D698/D1557**




| | |
|---|---|
| Source of Material | **CI-3 @ 0 - 0.5 feet** |
| Description of Material | **Lean Clay** |
| Remarks: | |
| Test Method | **ASTM D1557 Method B** |

TEST RESULTS

| | |
|---|---|
| Maximum Dry Density | **119.3 PCF** |
| Optimum Water Content | **11.9 %** |
| Percent Fines | **89.0 %** |

ATTERBERG LIMITS

| LL | PL | PI |
|---|---|---|
| **37** | **18** | **19** |

| | | |
|---|---|---|
| PROJECT: Grocery Outlet Warehouse | Terracon<br>50 Golden Land Ct Ste 100<br>Sacramento, CA | PROJECT NUMBER: NB205060 |
| SITE: 4400 Florin Perkins<br>Sacramento, CA | | CLIENT: Read Investments LLC<br>Berkeley, CA |

# SUPPORTING INFORMATION

**Contents:**



Note: All attachments are one page unless noted above.

# GENERAL NOTES

**DESCRIPTION OF SYMBOLS AND ABBREVIATIONS**

**Grocery Outlet Warehouse ■ Sacramento, CA**

**Terracon Project No. NB205060**

Terracon GeoReport

## SAMPLING

Modified California Ring Sampler

Grab Sample

Standard Penetration Test

## WATER LEVEL

**Water Initially Encountered**

**Water Level After a Specified Period of Time**

**Water Level After a Specified Period of Time**

**Cave In Encountered**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

## FIELD TESTS

| | |
|---|---|
| **N** | **Standard Penetration Test Resistance (Blows/Ft.)** |
| **(HP)** | **Hand Penetrometer** |
| **(T)** | **Torvane** |
| **(DCP)** | **Dynamic Cone Penetrometer** |
| **UC** | **Unconfined Compressive Strength** |
| **(PID)** | **Photo-Ionization Detector** |
| **(OVA)** | **Organic Vapor Analyzer** |

## DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

## LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

## Strength Terms

| Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve) Density determined by Standard Penetration Resistance | | | Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve) Consistency determined by laboratory shear strength testing, field visual0manual procedures or standard penetration resistance | | | |
|---|---|---|---|---|---|---|
| Descriptive Term (Density) | Standard Penetration or N-Value Blows/Ft. | 2.5-inch California Modified Sampler Blows/Ft. | Descriptive Term (Consistency) | Unconfined Compressive Strength Qu, (tsf) | Standard Penetration or N-Value Blows/Ft. | 2.5-inch California Modified Sampler Blows/Ft. |
| Very Loose | 0 to 3 | 0 to 5 | Very Soft | less than 0.25 | < 2 | < 3 |
| Loose | 4 to 10 | 5 to 12 | Soft | 0.25 to 0.50 | 2 to 4 | 3 to 5 |
| Medium Dense | 10 to 30 | 19 to 58 | Medium Stiff | 0.50 to 1.00 | 5 to 8 | 6 to 11 |
| Dense | 31 to 50 | 36 to 60 | Stiff | 1.00 to 2.00 | 9 to 15 | 12 to 21 |
| Very Dense | > 50 | > 60 | Very Stiff | 2.00 to 4.00 | 16 to 30 | 22 to 42 |
| | | | Hard | > 4.00 | > 30 | > 42 |

## RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

Terracon GeoReport

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A] | | | | | Soil Classification | |
|---|---|---|---|---|---|---|
| | | | | | Group Symbol | Group Name [B] |
| **Coarse-Grained Soils:** More than 50% retained on No. 200 sieve | **Gravels:** More than 50% of coarse fraction retained on No. 4 sieve | **Clean Gravels:** Less than 5% fines [C] | $Cu \geq 4$ and $1 \leq Cc \leq 3$ [E] | | GW | Well-graded gravel [F] |
| | | | $Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E] | | GP | Poorly graded gravel [F] |
| | | **Gravels with Fines:** More than 12% fines [C] | Fines classify as ML or MH | | GM | Silty gravel [F, G, H] |
| | | | Fines classify as CL or CH | | GC | Clayey gravel [F, G, H] |
| | **Sands:** 50% or more of coarse fraction passes No. 4 sieve | **Clean Sands:** Less than 5% fines [D] | $Cu \geq 6$ and $1 \leq Cc \leq 3$ [E] | | SW | Well-graded sand [I] |
| | | | $Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E] | | SP | Poorly graded sand [I] |
| | | **Sands with Fines:** More than 12% fines [D] | Fines classify as ML or MH | | SM | Silty sand [G, H, I] |
| | | | Fines classify as CL or CH | | SC | Clayey sand [G, H, I] |
| **Fine-Grained Soils:** 50% or more passes the No. 200 sieve | **Silts and Clays:** Liquid limit less than 50 | **Inorganic:** | $PI > 7$ and plots on or above "A" line [J] | | CL | Lean clay [K, L, M] |
| | | | $PI < 4$ or plots below "A" line [J] | | ML | Silt [K, L, M] |
| | | **Organic:** | Liquid limit - oven dried | $< 0.75$ | OL | Organic clay [K, L, M, N] |
| | | | Liquid limit - not dried | | | Organic silt [K, L, M, O] |
| | **Silts and Clays:** Liquid limit 50 or more | **Inorganic:** | PI plots on or above "A" line | | CH | Fat clay [K, L, M] |
| | | | PI plots below "A" line | | MH | Elastic Silt [K, L, M] |
| | | **Organic:** | Liquid limit - oven dried | $< 0.75$ | OH | Organic clay [K, L, M, P] |
| | | | Liquid limit - not dried | | | Organic silt [K, L, M, Q] |
| **Highly organic soils:** | Primarily organic matter, dark in color, and organic odor | | | | PT | Peat |

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] $PI \geq 4$ and plots on or above "A" line.

[O] $PI < 4$ or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.