# Geotechnical Engineering Report

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## Albertsons – Safeway Store #1522 Expansion
## Arlington, Snohomish County, Washington

April 19, 2022
Terracon Project No. 81225052

**Prepared for:**
Albertsons Companies, Inc.
Boise, ID

**Prepared by:**
Terracon Consultants, Inc.
Mountlake Terrace, Washington

April 19, 2022

Albertsons Companies, Inc.
250 E Parkcenter Blvd
Boise, ID 83706

Attn: Mark Palmer – Sr. Development Manager
P: (208) 395-3864
E: mark.palmer@albertsons.com

Re: Geotechnical Engineering Report
Albertsons – Safeway Store #1522 Expansion
20500 Olympic Place
Arlington, Snohomish County, Washington
Terracon Project No. 81225052

Dear Mr. Palmer:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P81225052 dated March 17, 2022. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork, the design and construction of building foundations, floor slabs, stormwater management, and pavements for the proposed project.

Based on our analyses, we estimate up to about 4½ inches of total post-liquefaction settlement following a major, strong-motion earthquake. If the structural engineer determines that the estimated settlement is tolerable, then shallow foundations bearing on native soils is acceptable; otherwise, we recommend ground improvement via aggregate piers. Should ground improvement prove necessary, we recommend consultation with a ground improvement specialty contractor to develop a design that meets the project needs.

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.**

Zac Koehn

ZACHARY L. KOEHN
4/19/2022

Xiaoyi Tan
for

Zachary L. Koehn, P.E.
Project Engineer

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Environmental ■ Facilities ■ Geotechnical ■ Materials

## REPORT TOPICS

## ATTACHMENTS

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

# REPORT SUMMARY

| Topic [1] | Overview Statement [2] |
|---|---|
| **Project Description** | The proposed improvements shown on the preliminary site plan include a building expansion of about 10,000 square feet which is located on the east side of the existing Safeway building. As included in the expansion are revisions to the nearby parking lot and drive aisles.<br>Expected loads:<br>■ Interior columns footings: about 100 to 150 kips<br>■ Continuous perimeter footings: average 4 kips per linear foot (klf)<br>■ Slab-on-grade: 150 pounds per square foot (assumed)<br>Expected traffic for pavement areas:<br>■ Parking lots: EDLA of 10 (73,000 ESALs)<br>■ Driveway: EDLA of 30 (219,000 ESALs) |
| **Geotechnical Characterization** | About 2 inches asphalt over 6 inches base course within paved area.<br>About 5 inches topsoil within landscape area.<br>Existing fill was observed at B-01 only to about 1½ feet below ground surface (bgs).<br>Loose to medium dense, dark brown, fine-grained sand with silt and gravel up to about 7 feet bgs was observed at all exploration locations. Organics and cobbles were observed in this unit.<br>Loose to dense, brown, medium to coarse grained sand and gravel with variable silt content up to about 18½ feet bgs. Cobbles were observed in this unit.<br>Medium dense to very dense, brown, medium-grained poorly graded sand with silt were observed to at least 51½ feet below.<br>Cobbles may be abundant in the near-surface soils.<br>Groundwater was encountered between 10 to 13½ feet bgs. |
| **Earthwork** | Remove topsoil and existing fill where encountered.<br>On-site granular soils can be reused for structural fill with some handling.<br>At the foundation level, the soils in their native state would be marginal for directly supporting shallow foundations, namely continuous and spread footings. Therefore, support of building bearing on at least two feet of compacted structural fill over native soil is recommended.<br>Restore grades with compacted structural fill if overexcavation performed for foundation, floor slab, and pavements.<br>Near-surface, fine-grained soils can be considered moisture sensitive and may become unstable when exposed to excessive moisture. |
| **Shallow Foundations** | Shallow foundations will be sufficient for the anticipated loading.<br>Allowable bearing pressure on structural fill over native soils and improved ground scenarios are presented in **Shallow Foundation** section.<br>Expected settlements: < 1-inch total, < 2/3-inch differential<br>Detect and remove zones of fill as noted in **Earthwork** |
| **Ground Improvement** | A total seismic-induced settlement of 2 to 4½ inches, and differential settlement of about 3 inches are estimated. Ground improvement can be used to mitigate the effects of the liquefaction hazard. Consultation with a ground improvement specialty contractor should occur prior to final design. If the estimated post-liquefaction induced settlement is deemed tolerable by the structural engineer, then ground improvement will not be required. |
| **Stormwater Management** | We understand that an infiltration trench is being considered for the management of stormwater runoff at the east side of the future expansion. Per email communication with the Civil Engineer, the base of the infiltration trench is about 6 feet below the existing ground surface. |

| | |
|---|---|
| **Pavements** | With subgrade prepared as noted in **Earthwork**<br>Concrete:<br>■ 5½ inches Portland Cement Concrete (PCC) over 4 inches crushed aggregate base<br>Asphalt:<br>■ 3 inches Asphaltic Concrete (AC) over 8 inches granular base in parking lots<br>■ 4 inches AC over 8 inches granular base in driveways |
| **General Comments** | This section contains important information about the limitations of this geotechnical engineering report. |

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

# Geotechnical Engineering Report

**Albertsons – Safeway Store #1522 Expansion**
**20500 Olympic Place**
**Arlington, Snohomish County, Washington**
**Terracon Project No. 81225052**
**April 19, 2022**

## INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the existing Safeway store expansion to be located at 20500 Olympic Place in Arlington, Snohomish County, Washington. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Seismic considerations and liquefaction
- Ground improvement
- Foundation design and construction
- Floor slab design and construction
- Stormwater management
- Pavement design and construction
- Corrosivity and resistivity

The geotechnical engineering Scope of Services for this project included the advancement of five (5) soil borings to depths ranging from approximately 15 to 51½ feet below existing site grades.

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 as 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 20500 Olympic Place in Arlington, Snohomish County, Washington. The site coordinates are:<br>Latitude: 48.1825 Longitude: -122.1280 See **Site Location** |

| Item | Description |
|---|---|
| **Existing Improvements** | An existing Safeway grocery store (#1522) with about 42,728 square feet footprint at the northern portion of the site, a Safeway fuel station at the southeastern portion of the site, parking and drive aisles, a few scattered landscape islands within the parking area to the south of the existing building, and relatively large landscape area along the eastern side of the site. |
| **Current Ground Cover** | Primarily asphalt and concrete pavement with landscape areas. |
| **Existing Topography** (from Civil Site Plan) | Within the proposed development area, the site is relatively level with elevations ranging between 128 and 129 feet. |
| **Geology** | The subsurface conditions consist of the Marysville sand member, which locally at the site is a thicker, recessional glacial outwash unit comprised primarily of loose to dense sand and gravel deposits with variable silt content.<br>Groundwater is observed between 10 to 13½ feet below ground surface. |

## 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:

| Item | Description |
|---|---|
| **Information Provided** | ■ Email request for proposal prepared by Albertsons dated March 09, 2022.<br>■ Preliminary site plan dated November 11, 2021<br>■ Geotechnical Engineer Services proposal prepared by ZipperGeo dated January 6, 2021.<br>■ Civil Plan prepared by TerraForma dated March 01, 2022<br>■ Email communication with the Civil Engineer dated March 17, 2022 |
| **Project Description** | The proposed improvement shown on the preliminary site plan include a building expansion located on the east side of the existing Safeway building with associated nearby parking lot and drive aisles.<br>An infiltration trench is being considered for the management of stormwater runoff at the east side of the future expansion. |
| **Proposed Structure** | The grocery store expansion will be located at the east side of the existing building. |
| **Building Construction** | The grocery store expansion is expected to be a single-story with a footprint of about 10,000 square feet. The store consists of concrete masonry block exterior walls, a concrete slab-on-grade interior floor, with steel interior columns supporting a streel truss roof. |
| **Finished Floor Elevation** | The finish floor elevation for the proposed grocery store expansion is anticipated to be consistent with the existing Safeway. |

| Item | Description |
|---|---|
| **Maximum Loads** | ■ Interior columns footings: about 100 to 150 kips<br>■ Continuous perimeter footings: average 4 kips per linear foot (klf)<br>■ Slabs: 150 pounds per square foot (assumed)<br>These loads do not include snow loads, which may be required in some locations. |
| **Grading/Slopes** | We assume grading will be minimal for site leveling and clearing/grubbing. |
| **Pavements** | Associated paved driveway and parking to the building expansion will be constructed on about 6,300 square feet of parcel.<br>We assume both rigid (concrete) and flexible (asphalt) pavement sections should be considered, and the pavement design period is assumed to be 20 years. Traffic loads are as follow (20-year ESALs in parentheses):<br>■ Parking lots: EDLA of 10 (73,000 ESALs)<br>■ Driveway: EDLA of 30 (219,000 ESALs) |
| **Applicable Building Code and Minimum Design Load Standard** | 2018 International Building Code (2018 IBC)<br>2016 ASCE Standard ASCE/SEI 7-16 (ASCE 7-16) |

## 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 **Exploration Results** section of this report. As noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

| Soil Layer[1] | Layer Name | USCS | General Description |
|---|---|---|---|
| Surface | Topsoil/Pavement | -- | About 2 inches asphalt over 6 inches base course within the paved area.<br>About 5 inches topsoil within the landscape area.<br>Existing fill consisting of silty sand with gravel was observed at B-01 only to about 1½ feet below ground surface (bgs). |
| 1[2] | **Sand with silt and gravel** | SP-SM | Poorly graded sand with silt with variable gravel content was encountered at all soil borings. This unit is loose to medium dense, fine grained, dark brown, with organics. Organic content within this layer was tested to be ranged between 2 and 4%. Cobbles was observed in this unit. The depth to the bottom of this unit ranged from 4 ½ to 7 feet bgs. |

| | | | |
|---|---|---|---|
| 2[3] | **Sand and Gravel** | GW-GM, GW, GP, SP-SM | Brown Sand and Gravel with variable silt content was encountered at all soil borings. This unit generally underlays Soil Layer 1 and the depth to the bottom of this unit ranged from 13 to 18 ½ feet bgs. Composition of the soils varied:<br>■ Well Graded gravel with sand and variable silt content, sub-rounded to subangular, medium dense to dense<br>■ Poorly graded gravel with sand, trace silt, sub-rounded to subangular, medium dense to dense<br>■ Poorly graded sand with silt and gravel, loose to dense, fine to coarse grained |
| 3[4] | **Sand with silt** | SP-SM | This unit generally underlays Soil Layer 2 and consists of medium to very dense poorly graded sand with silt, trace gravel, fine to coarse grained, brown. The depth to the bottom of this unit was observed as deep as 51½ feet bgs. |

1. This summary is based on Terracon field exploration and is for convenience only. It should be used in conjunction with the entire report for design purposes.
2. This unit was encountered at all soil borings.
3. B-05 was terminated in this unit.
4. This unit was encountered at all soil borings except B-05, these borings were terminated in this unit.

## Groundwater Conditions

The boreholes were observed while drilling and at completion for the presence and level of groundwater. The water levels observed in the boreholes can be found on the boring logs in **Exploration Results**, and are summarized below.

| Boring Number | Approximate Depth to Groundwater (feet) [1] |
|---|---|
| B-01[2,3] | 13½ |
| B-02[5] | 13 |
| B-03[6] | 10.7 |
| B-04[6] | 10 |
| B-05[6] | 11.8 |

1. Below ground surface
2. Inferred from change in sample moisture or from evidence of free water on drilling equipment while drilling.
3. Water level measurement not attempted due to drilling method of boring advancement.
4. Measured using a water level indicator.
5. Measured while drilling.
6. Measured at the completion of the drilling.

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 the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

## GEOTECHNICAL OVERVIEW

The site is underlain primarily by cohesionless, granular soils that appear to have been deposited erratically as glacial outwash. This mode of deposition results in the variable soil density observed. The combination of the variable density and relatively shallow groundwater renders the site susceptible to liquefaction during a design-level seismic event. The free-field estimate of total liquefaction-induced settlement is about 2 to 4½ inches. We estimate the differential settlement will be on the order of 3 inches. Should the structural engineer determine that this magnitude of settlement is tolerable, then the structures can be founded on shallow foundations bearing on native soils and/or structural fill. Otherwise, we recommend ground improvement via aggregate piers beneath the foundation elements. Further discussion of liquefaction is provided in the **Liquefaction** and **Ground Improvement** section.

About 1½ feet of existing, undocumented fill was encountered at B-01 only. Per current site plan, the building footprint appears to be within the area where existing fill was observed. Support of footings, floor slabs, or pavement on or above existing fill soils, is not recommended. There is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill. Due to the relatively thin thickness of the existing fill, we recommended that all existing fill, if encountered, be removed beneath the proposed building and pavement areas.

In addition, per current site plan, Soil Layer 1 will be the bearing soils at the foundation level. However, organics and cobbles were observed in this unit. Organic content within this layer was is estimated to range from about 2 and 4%. Terracon should observe the subgrades following grading to aid the contractor in identifying the presence of existing fill and deleterious materials. If existing fill and deleterious materials are observed, or areas are observed to be deflecting excessively, perform overexcavation per Terracon's field recommendations at the time of construction. Compacted structural fill or suitable existing on-site materials can be used to restore the grade.

Based on our interpretation of the exploration results, we suspect that the presence of gravels and cobbles within the Soil Layers 1 and 2 influenced the penetration testing results and that the soils are more consistent with a loose to medium dense state rather than dense to very dense, as the raw blow-counts would suggest. The soils in their native state would be marginal for directly supporting shallow foundations, namely continuous and spread footings. Therefore, support of building bearing on at least two feet of compacted structural fill over native soil is recommended.

Additionally, cobble-sized particles present at the subgrade surface could present a localized hard spot that could lead to cracking of foundations or floor slabs. The presence of cobble-sized particles immediately beneath the slab or footing may lead to a non-uniform subgrade behavior. Recommendations presented in the **Earthwork** section are intended to reduce the risks associated with the presence of cobbles.

The near-surface fine-grained sand (Soil Layer 1) that are exposed after stripping of the topsoil, existing fill, and deleterious/unsuitable material are likely to be moisture sensitive (about 8% passing the #200 sieve) and could become unstable when exposed to excessive moisture and/or disturbance with typical earthwork and construction traffic. Effective drainage should be completed early in the construction sequence and maintained after construction to avoid potential issues. If possible, the grading should be performed during the warmer and drier times of the year. If grading is performed during the winter months, fill placement and compaction will be difficult and an increased risk for possible undercutting and replacement of unstable subgrade with persist. Additional site preparation recommendations, including subgrade improvement and fill placement are provided in **Earthwork** section.

The **Shallow Foundations** section addresses options for support of the building bearing on structural fill over loose to medium dense native soil (Soil Layer 1) and improved ground. The **Floor Slabs** section addresses slab-on-grade support on medium dense native soil and the above two scenarios as well.

Recommendations for flexible and rigid pavement systems are provided in the **Pavements** section.

Specific conclusions and recommendations regarding these geotechnical considerations, as well as other geotechnical aspects of design and construction of foundation systems and other earthwork related phases of the project are outlined in the following sections. The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and our current understanding of the proposed project. ASTM and Washington State Department of Transportation (WSDOT) specification codes cited herein respectively refer to the current manual published by the American Society for Testing & Materials and the current edition of the *Standard Specifications for Road, Bridge, and Municipal Construction, (M41-12)*.

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

# SEISMIC CONSIDERATIONS

| Description[1] | Value |
|---|---|
| **2018 International Building Code (IBC) Site Classification** | F[3] |
| **Site Latitude** | 48.1825 |
| **Site Longitude** | -122.1280 |
| **$S_S$ – Short Period Spectral Acceleration**[2] | 1.038 g |
| **$S_1$ – 1-Second Period Spectral Acceleration**[2] | 0.371 g |
| **PGA - ASCE 7, Peak Ground Acceleration** | 0.441 g |

1. The IBC requires a site profile extending to a depth of 100 feet for seismic site classification. Borings were extended to a maximum depth of 51½ feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area.
2. These values were obtained using online seismic design maps and tools provided by OSHPD (https://seismicmaps.org/).
3. If the fundamental period of vibration for the building is equal to or less than 0.5 seconds, Site Class D may be used to determine the values of $F_a$ and $F_v$ per ASCE 7-16 Section 20.3.1.

## Surface-Fault Rupture

The hazard of damage from onsite fault rupture appears to be low based on review of the USGS Earthquake Hazards Program Quaternary Faults and Folds Database available online (https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf) accessed on March 25, 2021. The closest mapped fault is the Darrington-Devils Mountain fault, which lies approximately 11 miles to the northeast.

# LIQUEFACTION

Liquefaction is the phenomenon where saturated soils develop high pore water pressures during seismic shaking and lose their strength characteristics. This phenomenon generally occurs in areas of high seismicity, where groundwater is shallow and loose granular soils or relatively non-plastic fine-grained soils are present.

The site geology and subsurface groundwater conditions is relatively consistent with some nearby, previously performed soil borings (approximately 700 feet to the southwest). Based on the results of our previous findings and soil boring B-01, the hazard of liquefaction of the site soils is moderate for this site during a design level earthquake and is most likely to trigger between 10 and 30 feet below the ground surface. Due to the absence of a sloping ground, the risk of lateral spreading is low while the risk of flow sliding is negligible.

Liquefaction potential was evaluated using LiqSVs (v.2.2.1.8) developed by Geoogismiki Software. A mean-moment magnitude of 6.9 was assumed along with a peak site-modified ground acceleration (PGA) of 0.53g. Based on these assumed seismic parameters, we evaluated soil borings within our site, and the nearby historical soil boring to estimate a free-field, seismic-induced total settlement of about 2 and 4½ inches. We estimate that this magnitude of settlement will result in approximately 3 inches of differential settlement for the site, and lateral spreading displacements are estimated to be less than ¼-foot.

Per ASCE 7-16, Table 12.13-3 for a 40-foot span and risk category II, a differential settlement threshold of about 4½ inches is allowable for "*other multi-story structures.*" The differential settlement estimated for the area of the addition appears to be below the threshold allowed by the code. Although the addition is not a multi-story structure, it is a relatively tall single-story building and we assume it is more analogous to a multi-story structure than a single-story. The Structural Engineer should review this assumption as well as the magnitudes of seismic-induced settlements presented herein and assess if mitigation of liquefaction hazard is necessary.

Vertical settlements deemed excessive by the structural engineer can be reduced using ground improvement. Ground improvement via aggregate piers are installed with the intent to densify the ground, increase soil stiffness, and embed in denser material that is not expected to liquefy. However, the ground located outside the aggregate pier improvements will be subject to liquefaction-induced settlement. Therefore, we recommend any utilities connected to the proposed structures be designed with flexible connections to reduce damage during a seismic event. Foundation recommendations are provided in the **Shallow Foundations** section. Discussion of aggregate piers is provided in the **Ground Improvement** section.

## GROUND IMPROVEMENT

Mitigation of excessive settlement from static loading and/or seismic-induced ground motions (e.g., seismic-induced settlement) can generally be accomplished through ground improvement. Though many options for ground improvement exist, in our option, aggregate piers are likely to be the most cost efficient.

We estimate that the thickness of liquefiable soil is about 20 feet and results in a post-liquefaction differential settlement on the order of 3 inches. Should the structural engineer determine the life safety objective cannot be achieved, or if it is desired to reduce the post-liquefaction settlement and potential building damage, then ground improvement via aggregate piers is recommended. The aggregate pier field should extend outside the building footprint by 5 feet or at least 10 percent of the building footprint, whichever is greater. Assuming damage to the floor slab is acceptable, ground improvement beneath the foundation elements rather than under the entire building footprint could be considered to help reduce costs.

It is recommended that a ground improvement contractor be consulted for design of the ground improvement system and the structural engineer consulted to provide the tolerable post-liquefaction displacements. Recommendations for spread footings with seismic ties are provided in the **Shallow Foundations** section.

# EARTHWORK

Earthwork is anticipated to include clearing and grubbing, overexcavation, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

## Existing Fill and Deleterious/Unsuitable Materials

As noted in **Geotechnical Characterization**, existing fill to about 1½ feet bgs was encountered at B-01 only, which is within the proposed building expansion area per the current site plan. Although existing fill was not encountered at any of the other locations, the previous construction activities for the existing development suggest other areas of existing fill may be present. Support of footings, floor slabs, and pavement on or above existing fill soils, is not recommended. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill. We recommend that all existing fill, if encountered, be removed beneath the proposed building and pavement area.

In addition, as mentioned in **Geotechnical Overview** section, Soil Layer 1 includes cobbles and about 2 to 4% of organics, which is considered for foundation subgrades. Exposed subgrades should be reviewed by the Geotechnical Engineer for appropriate control of organic content.

Terracon should observe the subgrades following grading to aid the contractor in identifying the presence of existing fill and deleterious materials. If existing fill and deleterious materials are observed, or areas are observed to be deflecting excessively, perform overexcavation per Terracon’s field recommendations at the time of construction. Compacted structural fill or suitable existing on-site materials can be used to restore the grade.

## Site Preparation

Prior to placing fill, existing vegetation and root mat, overexcavation of unsuitable soil should be removed. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas. Cobble and boulder-sized particles exposed at subgrade surfaces should be removed prior to placing fill.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck. The proofrolling should be performed under the observation of the Geotechnical Engineer. Areas excessively deflecting under the proofroll should be delineated and subsequent recommendations provided by the Geotechnical Engineer. Excessively wet or dry material should either be removed or moisture conditioned and recompacted or replaced with compacted fill as recommended herein.

## Fill Material Types

Fill required to achieve design grade should be classified as structural fill and common fill. Structural fill is material used below, or within 10 feet of structures and apertures, pavements, and constructed slopes. Common fill is material used to achieve grade outside of these areas. Earthen materials used for structural and common fill should meet the following material property requirements:

| Fill Type | Recommended Materials | Acceptable Location for Placement |
|---|---|---|
| Structural Fill | 9-03.9(1) *Ballast*[1]<br>9-03.9(3) *Crushed Surfacing Base Course* [1]<br>9-03.12(1)A *Gravel Backfill for Foundations Class A*[1]<br>9-03.14(1) *Gravel Borrow*[1]<br>On-site Soils (i.e. Soil Layers 2 and 3)[2,3] | Beneath and adjacent to structural slabs, foundations, building appurtenances, and pavement subgrades |
| Common Fill | Section 9-03.14(3) *Common Borrow*[1]<br>On-site Soils (i.e. Soil layers 1 with some handling, 2, and 3)[2,3] | Grade filling, utility trench backfill outside the building foundation and appurtenances |
| Free-Draining Granular Fill | Structural Fill [4]<br>9-03.9(2) *Permeable Ballast*[1]<br>9-03.12(2) *Gravel Backfill for Walls*[1]<br>9-03.12(4) *Gravel Backfill for Drains*[1] | Backfilling in wet weather, drainage layers for walls, sump drains, footing drains[5] |

1. WSDOT Standard Specifications
2. Structural and common fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
3. May contain local areas of higher fines content that could make this material moisture sensitive. Particles with a nominal diameter greater than about 3 in. should be removed.
4. Material provided must be specified to be less than 5-percent passing the #200 sieve for the portion of material passing the #4 sieve.
5. Minimum particle size must be greater than drain pipe perforations.

Other earthen materials may be suitable for use in addition to the options presented in the table above. All materials should be approved by the Geotechnical Engineer prior to use.

## Fill Compaction Requirements

Structural and common fill should meet the following compaction requirements.

| Item | Structural and Free-Draining Fill | Common Fill |
|---|---|---|
| **Maximum Lift Thickness** | 8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used<br>4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used | Same as Structural fill |
| **Minimum Compaction Requirements** [1] | 95% of max. below foundations and floor slabs and within 2 foot of finished pavement subgrade<br>92% of max. above foundations and more than 2 feet below finished pavement subgrade | 92% of maximum dry density |
| **Water Content Range** [1] | Typically within 2% of optimum | As required to achieve min. compaction requirements |

1. Maximum density and optimum water content as determined by the modified Proctor test (ASTM D 1557).

## Utility Trench Backfill

All trenches should be wide enough to allow for compaction around the haunches of the pipe. If water is encountered in the excavations, it should be removed prior to fill placement. The presence of cobbles may present challenges with respect to trench stability. Nested cobbles in trench side walls may become loosened during trench that could influence trench stability. The utility contractor should be prepared to contend with the likely presence of cobbles in utility trench alignments.

Placement and compaction of recommended materials for utility trench backfill should be in accordance with the recommendations presented herein for **Earthwork**. In our opinion, the initial lift thickness should not exceed one foot unless recommended by the manufacturer to protect utilities from damage by compacting equipment. Light, hand-operated compaction equipment in conjunction with thinner fill lift thicknesses may be utilized on backfill placed above utilities if damage resulting from heavier compaction equipment is of concern.

Flexible connections for utilities that pass through building foundations are recommended to reduce potential stress associated with differential settlement that may occur between the building foundation and the improvements located outside of the building footprint.

## Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. Gutters and downspouts should be routed into tightline pipes that discharge either directly into a municipal storm drain or to an alternative drainage facility. Splash-blocks should also be considered below hose bibs and water spigots.

Site grades should be established such that surface water is directed away from foundation and pavement subgrades to prevent an increase in the water content of the soils. Adequate positive drainage diverting water from structures, open cuts, and slopes should be established to prevent erosion, ground loss, and instability. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping, final grades should be verified to document effective drainage has been achieved. Where paving or flatwork abuts the structure a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

## Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over, or adjacent to, construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted, prior to floor slab construction.

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 earthwork efforts should be monitored under the observation of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proof-rolling and mitigation of areas delineated by the proof-roll to require mitigation.

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.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. In the event that unanticipated conditions are encountered, the Geotechnical Engineer should recommend mitigation options.

Where ground improvement has been implemented, footing subgrades should be observed by the Geotechnical Engineer for the presence of the aggregate piers to confirm installation has occurred per plan. Any improperly located aggregate piers should be reinstalled or the footing widened such that the footings bear firm on the aggregate piers or leveling pad. In the event that unanticipated conditions are encountered, the Geotechnical Engineer should recommend 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.

### Wet Weather Earthwork

The near-surface soils have variable fines content based on our visual observations and lab testing and are considered moisture sensitive. The soils will exhibit low to moderate erosion potential and may be transported by running water. Silt fences and other best-management practices will be necessary to control erosion and sediment transport during construction.

The suitability of soils used for structural fill depends primarily on their grain-size distribution and moisture content when they are placed. As the fines content (the soil fraction passing the U.S. No. 200 Sieve) increases, soils become more sensitive to small changes in moisture content. Soils containing more than about 5 percent fines (by weight) cannot be consistently compacted to a firm, unyielding condition when the moisture content is more than 2 percentage points above or below optimum. Optimum moisture content is the moisture content at which the maximum dry density for the material is achieved in the laboratory by the ASTM D1557 test procedure.

If inclement weather or in situ soil moisture content prevents the use of on-site material as structural fill, we recommend use of materials specified in **Fill Material Types** for free-draining granular fill.

Stockpiled soils should be protected with polyethylene sheeting anchored to withstand local wind conditions and preservation of the soil's moisture content.

## 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

| Description | Spread Footing | Wall Footing |
|---|---|---|
| **Net Allowable Bearing Pressure** [1,2] | | |
| *Footing Widths less Than 5 feet:* | | |
| ■ **2-ft of compacted structural fill over native soil** | 3,000 psf | 2,500 psf |
| ■ **Ground improvement (preliminary)** | 4,000 to 6,000 psf | 4,000 to 6,000 psf |
| *Footing Widths 5 to 10 feet* [3]*:* | | |
| ■ **2-ft of compacted structural fill over native soil** | 2,500 psf | 1,500 psf |
| ■ **Ground improvement (preliminary)** | 4,000 to 6,000 psf | 4,000 to 6,000 psf |
| **Minimum Dimensions** | 24 inches | 18 inches |
| **Minimum Embedment Below Finished Grade** [4] | 18 inches | 18 inches |
| **Approximate Static Total Settlement From Foundation Loads For Condition Specified** [5] | <1 inch | <1 inch |
| **Estimated Static Differential Settlement From Foundation Loads** [5] | About 2/3 of total settlement | |
| **Ultimate Passive Pressure** [6,7] | | |
| ■ Compacted Structural Fill | 400 pcf (equivalent fluid unit weight) | |
| **Ultimate Coefficient of Sliding Friction** [8] | 0.40 | |

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. These bearing pressures can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. Assumes that exterior grades are relatively level adjacent to the structure.
2. Values provided are for maximum loads noted in **Project Description**. Assumes the foundation elevation remains 6 feet above the groundwater table year-round. Values for ground improvement should be verified by a ground improvement specialty contractor prior to final design.
3. Bearing capacity analyses for footings width greater than 10 feet were not performed, contact Terracon for additional recommendations if footings widths greater than this size are considered.
4. For frost protection and to reduce the effects of seasonal moisture variations in the subgrade soils. For perimeter footing and footings beneath unheated areas. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
5. Differential settlements are as measured over a span of 50 feet. We should review the settlement estimates after the foundation plan has been prepared by the structural engineer.
6. 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.
7. Passive resistance in the upper 2 feet of the soil profile should be neglected.
8. 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.

## Construction Adjacent to Existing Building

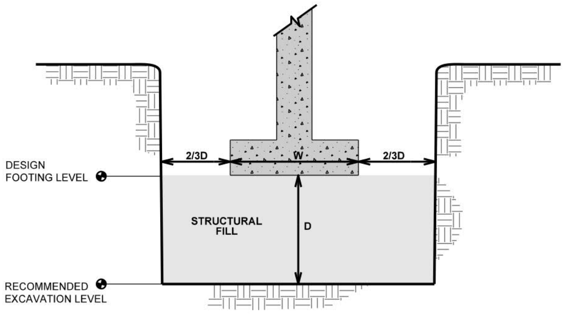
Differential settlement between the additions and the existing building is expected to approach the magnitude of the total settlement of the addition. Expansion joints should be provided between the existing building and the proposed addition to accommodate differential movements between the two structures. Underground piping between the two structures should be designed with flexible couplings and utility knockouts in foundation walls should be oversized, so minor deflections in alignment do not result in breakage or distress. Care should be taken during excavation adjacent to existing foundations, to avoid disturbing existing foundation bearing soils.

New footings should bear at or near the bearing elevation of immediately adjacent existing foundations. Depending upon their locations and current loads on the existing footings, footings for the new addition could cause settlement of adjacent walls. To reduce this concern and risk, clear distances at least equal to the new footing widths should be maintained between the addition's footings and footings supporting the existing building.

## 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.

Footing locations should be overexcavated at least 2 feet and backfill with compacted structural fill. If unsuitable/deleterious bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils and backfilled with structural fill as recommended in the **Earthwork** section. This is illustrated on the sketch below:

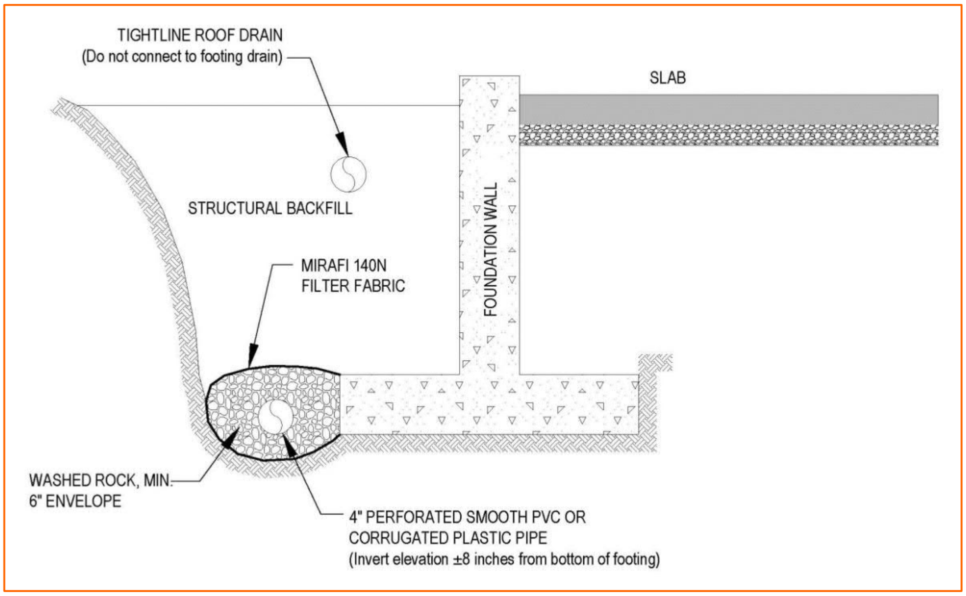


OVER-EXCAVATION / BACKFILL ZONE

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

## Foundation Drains

We recommend the building be **encircled with a perimeter foundation** drain to collect exterior seepage water. This drain should consist of a 4-inch diameter perforated pipe within an envelope of washed rock, extending at least 6 inches on all sides of the pipe. The washed rock should conform to WSDOT Section 9-03.12(4), Gravel Backfill for Drains or 9-03.12(5), Gravel Backfill for Drywells. The washed rock envelope should be wrapped with filter fabric (such as Mirafi 140N, or equal) to reduce the migration of fines from the surrounding soil. Ideally, the drain invert would be installed no more than 8 inches above or below the base of the perimeter footings. The perimeter foundation drain should **not** be connected to roof downspout drains and should be constructed to discharge into the site storm water system or other appropriate outlet. These recommendations are summarized in the figure below.



# FLOOR SLABS

Depending upon the finished floor elevation, unsuitable soils (e.g., existing fill, loose native soils) may be encountered at the floor slab subgrade level. These soils should be replaced with structural fill, so the floor slab is supported on at least 2 feet of compacted suitable natural soils or structural fill.

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** [1] | Minimum 6 inches of free-draining of either of the following:<br>▪ washed drain rock<br>▪ 9-03.12(1)A *Gravel Backfill for Foundations Class A* (compacted to at least 95% of ASTM D 1557) [3,4] |

| Item | Description |
|---|---|
| **Estimated Modulus of Subgrade Reaction** [2] | Medium Dense Native Soil:<br>■ 120 pounds per square inch per inch (psi/in) for point loads<br>■ 80 psi/in for distributed loads<br>2 feet Structural Fill:<br>■ 270 pounds per square inch per inch (psi/in) for point loads<br>■ 150 psi/in for distributed loads<br>Ground improvement:<br>■ 380 pounds per square inch per inch (psi/in) for point loads<br>■ 190 psi/in for distributed loads |

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Values of modulus of subgrade reaction are estimated for subgrade conditions where non-yielding, medium dense native soils are present, at least 2 feet of compacted structural fill over native soil, or ground improvement has been performed.
3. Free-draining granular material should have less than 5% fines (material passing the No. 200 sieve).
4. WSDOT Standard Specifications

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.

## STORMWATER MANAGEMENT

We understand that an infiltration trench is being considered for the management of stormwater runoff. Based on communication with the Civil Engineer, the stormwater management design will be completed the 2019 Washington Department of Ecology Stormwater Management Manual for Manual for Western Washington (SWMMWW). Per SWMMWW, for a site with soils not consolidated by glacial advance, an infiltration rate can be determined using a correlation to grain size distribution of representative soil samples. The analysis method performed is based on the methodology proposed by Massman (2003) as presented in the SWMMWW. The subsurface conditions consist of a geologic unit known locally as the Marysville Sand Member, which to our understanding, has not been consolidated by glacial advance. Therefore, an estimation of the design infiltration rate using a grain size analysis method is suitable.

Based on email communication with the Civil Engineer, the base of the infiltration trench is proposed to be about 6 feet bgs. Based on the subsurface conditions observed at soil boring B-5, the soil unit at this depth consisted primarily of medium to coarse-grained, poorly graded sand with silt and gravel. This unit is identified as an infiltrating unit.

The subsurface conditions at the proposed infiltration trench location were relatively consistent with other soil borings. As a result, to assess the feasibility of potential stormwater management via infiltration, an infiltration rate was estimated via sieve analysis results of soil samples recovered between 6 and 7½ feet bgs within the proposed infiltration trench area. Based on the analysis presented in the SWMMWW, a design infiltration rate of 15 inches per hour is estimated. This value is adjusted per the SWMMWW which applies correction factors for methodology, siltation/biofouling, and site variability of 0.4, 0.9, and 1.0, respectively.

To demonstrate that the hydraulic properties of the deeper and shallower portion of the sand and gravel unit are comparable, two additional sieve analysis were performed on sample collected from 7½ to 9, and 9 to 10½ feet bgs. The design infiltration rates are estimated to be much higher, 57 and 37 inches per hour, respectively. Though these values are not recommended as design values, the results suggest that the deeper portion is not as hydraulically restrictive as shallower portion of the unit which is where the base of the infiltration trench is proposed. Therefore, the infiltration rate estimated obtained for the shallower portion is appropriate for all depths above the water table.

Based on the results from the analysis methodology presented in the SWMMWW, and observations of subsurface conditions via soil borings, we recommend the following:

- Infiltration facility depth no shallower than 6 feet bgs if the proposed depth is shallower, the trench can be overexcavated to 6 feet bgs and backfill with using free-draining material such as washed drain rock.
- Design infiltration rate of 15 inches per hour.
- The Geotechnical Engineer should observe the soils at the base of the infiltration facility and compare with the soils observed at the exploration location (i.e. B-05).
- Where soil units with lower permeability are present (e.g., interbedded silt layers), perform overexcavation as needed to hydraulically connect the base of the infiltration system with the clean sand infiltrating unit.
- In areas where overexcavation is necessary, backfilling should be performed using free-draining material such as washed drain rock.

In general, and based on the subsurface information collected to date, management of surface water through stormwater infiltration appears suitable in the general vicinity of where infiltration testing was performed. We recommend retaining Terracon during construction to aid the contractor in identifying the infiltrating unit.

# PAVEMENTS

## General Pavement Comments

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.

The standard equivalent single-axle load (ESAL) was estimated using 1993 Guideline for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO-1993). The assumed traffic loading for flexible and rigid pavement areas on the traffic loads as follows:

- Parking lots: EDLA of 10 (73,000 ESALs)
- Driveway: EDLA of 30 (219,000 ESALs)

A 20-year design life is assumed. If traffic volumes will exceed the assumed values, Terracon should be notified in order to provide pavement sections designed for higher levels of traffic. For design purposes, we have assumed a CBR value of 10. Any imported or borrow source fill placed below the proposed pavements should have a CBR value of at least 10. A modulus of subgrade reaction of 190 lbs per cubic inch (pci) was assumed for compacted subgrade for concrete pavement design.

## Pavement Design

Design of Asphaltic Concrete (AC) pavements are based on the 1993 AASHTO guidelines. Minimum recommended pavement section thicknesses are presented below:

**Minimum AC Pavement Section (inches)**

| Layer | Thickness (inches) | | Compaction/Material Specification |
|---|---|---|---|
| | Parking Lots | Driveway | |
| Compacted Subgrade [1] | 12 | | 95% of Modified Proctor Maximum Dry Density;<br>-2 to +2% Optimum Moisture Content |
| Crushed Aggregate Base | 8 | | WSDOT: 9-03.9(3) Base Course |
| Asphalt Thickness [2] | 3 | 4 | WSDOT: 9-03.8(2) ½-inch HMA<br>PG58H-22 asphalt binder |

1. May vary based on observations following proof-rolling.
2. Asphalt surface course only

We recommend that Portland cement concrete (PCC, rigid) pavement be used where rigid pavements are appropriate. These areas include but are not limited to entrance and exit sections, dumpster pads, or any areas where extensive wheel maneuvering or repeated loading are expected. The rigid pavement pads should be large enough to support the wheels of the truck which will bearing the haul load. The minimum thickness of PCC pavement should be 5½ inches and underlain by a minimum of 4 inches of crushed aggregate base course (use WSDOT 9.03.9(3)). Adequate reinforcement and number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI requirements. Although not required for structural support, the base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, subgrade "pumping" through joints, and provide a workable surface. These thicknesses assume the subgrade is properly prepared and compacted as noted above. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. All joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

The minimum pavement sections outlined above were determined based on post-construction traffic loading conditions. These pavement sections do not account for heavy construction traffic during development. A partially constructed structural section that is subjected to heavy construction traffic can result in pavement deterioration and premature distress or failure. Our experience indicates that this pavement construction practice can result in pavements that will not perform as intended. Considering this information, several alternatives are available to mitigate the impact of heavy construction traffic prior to pavement construction. These include using thicker sections to account for the construction traffic after paving; using some method of soil stabilization to improve the support characteristics of the pavement subgrade; routing heavy construction traffic around paved areas; or delaying paving operations until as near the end of construction as is feasible.

## 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.

We recommend drainage be included at the bottom of crushed aggregate base (when used) at the storm structures to aid in removing water that may enter this layer. Drainage could consist of small diameter weep holes excavated around the perimeter of the storm structures. The weep holes should be excavated at the elevation of the crushed aggregate base and soil interface. The excavation should be covered with crushed aggregate encompassed in Mirafi 140NL, or an approved equivalent, which will aid in reducing the amount of fines that enter the storm system.

## 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:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install joint sealant and seal cracks immediately.

- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.

## 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.

| Analyte Tested | Test Method | Test Results for Shallow Utilities | | |
|---|---|---|---|---|
| | | C-01 (B-01, 0 to 5 ft) | C-02 (B-02, 0 to 5 ft) | C-03 (B-04, 0 to 5 ft) |
| **pH** | AWWA 4500H | 7.17 | 8.30 | 8.32 |
| **Water Soluble Sulfates** (mg/kg) | ASTM C1580 | 112 | 2,738 | 176 |
| **Sulfides** (mg/kg) | AWWA 4500-S D | Nil | Nil | Nil |
| **Chlorides** (mg/kg) | ASTM D512 | 97 | 127 | 50 |
| **Red-Ox** [1] (mV) | AWWA 2580 | +723 | +721 | +735 |
| **Total Salts** (mg/kg) | AWWA 2540 | 889 | 1,074 | 105 |
| **Resistivity** (ohm-cm) | ASTM G57 | 2,716 | 2,037 | 12,610 |

AWWA = American Water Works Association
ASTM = American Society for Testing and Materials
1. Reduction-Oxidation potential (positive values indicates an oxidizing environment)

Results of soluble sulfate testing indicate samples of the on-site soils tested possess negligible sulfate concentrations when classified in accordance with Table 4.3.1 of the ACI Design Manual. Concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

## FIELD RESISTIVITY

In the table below is a summary of the filed resistivity testing results. The method used is 4-point Wenner method (ASTM G57).

| Electrode Spacing a (ft) | Electrode Depth b (in) | NE-SW | | NW-SE | |
|---|---|---|---|---|---|
| | | Apparent Resistance R (Ω) | Apparent Resistivity ρ (Ω-m) | Apparent Resistance R (Ω) | Apparent Resistivity ρ (Ω-m) |
| 1 | 6 | 415.0 | 79,481 | 460.0 | 88,099 |
| 2 | 6 | 185.0 | 70,860 | 180.0 | 68,945 |
| 3 | 6 | 106.5 | 61,188 | 108.5 | 62,337 |
| 5 | 6 | 59.0 | 56,496 | 58.5 | 56,017 |
| 7.5 | 6 | 41.5 | 59,608 | 42.5 | 61,044 |
| 10 | 6 | 34.5 | 66,071 | 29.5 | 56,496 |
| 15 | 6 | 26.5 | 76,126 | 25.5 | 73,253 |
| 20 | 6 | 19.0 | 72,774 | 19.5 | 74,689 |
| 30 | 6 | 11.0 | 63,199 | 11.5 | 66,071 |
| 40 | 6 | 4.6 | 35,238 | 5.8 | 44,431 |
| 50 | 6 | 1.9 | 18,194 | 1.2 | 11,491 |

1. Performed on April 1, 2022 within the landscape area to the east of the existing Safeway grocery store.

The above results should be provided to the electrical engineer to assess in the influence of the soil conductivity on below ground utilities and groundings.

## 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.

# ATTACHMENTS

# EXPLORATION AND TESTING PROCEDURES

## Field Exploration

| Number of Explorations | Type of Exploration | Exploration Depth (feet) [1] | Planned Location [2] |
|---|---|---|---|
| 1 | Soil Boring | 51½ | Planned building area |
| 1 | Soil Boring | 26½ | Planned building area |
| 2 | Soil Borings | 21½ | Planned Parking/driveway area |
| 1 | Soil Boring | 15 | Planned Infiltration trench |

1. Below ground surface.
2. The approximate locations of the proposed explorations are shown on the attached Exploration Site Plan.

**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 by interpolation from the Google Earth. If elevations and a more precise boring layout are desired, we recommend borings be surveyed following completion of fieldwork.

**Soil Boring Procedures:** We advanced soil borings with a truck-mounted drill rig using hollow stem augers. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter within the planned building and parking/driveway area. Soil sampling is typically performed using split-barrel sampling procedures. In the split barrel sampling procedure, a standard 2-inch outer diameter split barrel sampling spoon is 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. Continuous sampling was performed at planned infiltration trench area. Soil sampling is performed using split-barrel sampling procedures with 3-inch outer diameter split barrel sampling spoon (Modified California sampler). We observed and recorded groundwater levels during drilling and sampling. Per Washington State law, all borings were backfilled with granular bentonite after their completion.

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 a Geotechnical Engineer. Our exploration team prepared field boring logs and the test pits logs as part of standard operations. These field logs included visual classifications of the materials encountered during the exploration and our interpretation of the subsurface conditions between samples. Final logs were prepared from the field logs. The final logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

**Field Electrical Resistivity Testing:** We characterized electrical resistivity for design of electrical grounding system by performing electrical resistivity testing in the field using the Wenner 4-pin method along two transects (NE-SW and NW-SE). This is a non-displacement test method and resulted in little to no property disturbance.

## 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 D6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- ASTM D422 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- ASTM D1140 Standard Test Method for determining the Amount of Material Finer than 75-µm (No.200) Sieve in Soils by Washing
- ASTM D2974 Standard Test Method for Moisture, Ash and Organic Matter of Peat and Other Organic Soils
- Corrosivity testing for pH, water soluble sulfates, sulfides, chlorides, reduction-oxidation total salts, and resistivity (ASTM and AWWA testing standards)

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.

- 10 – ASTM D2216 (Water Content)
- 2 – ASTM D6913 (Grain Size Distribution)
- 3 – ASTM D422 (Grain Size Distribution with Hydrometer)
- 3 – ASTM D1140 (No. 200)
- 2 – ASTM D2974 (Organic Content)
- 3 – Corrosivity Suites

# SITE LOCATION AND EXPLORATION PLANS

**Contents:**

# SITE LOCATION PLAN

Albertsons – Safeway Store #1522 Expansion ■ Arlington, Snohomish County, Washington
April 19, 2022 ■ Terracon Project No. 81225052

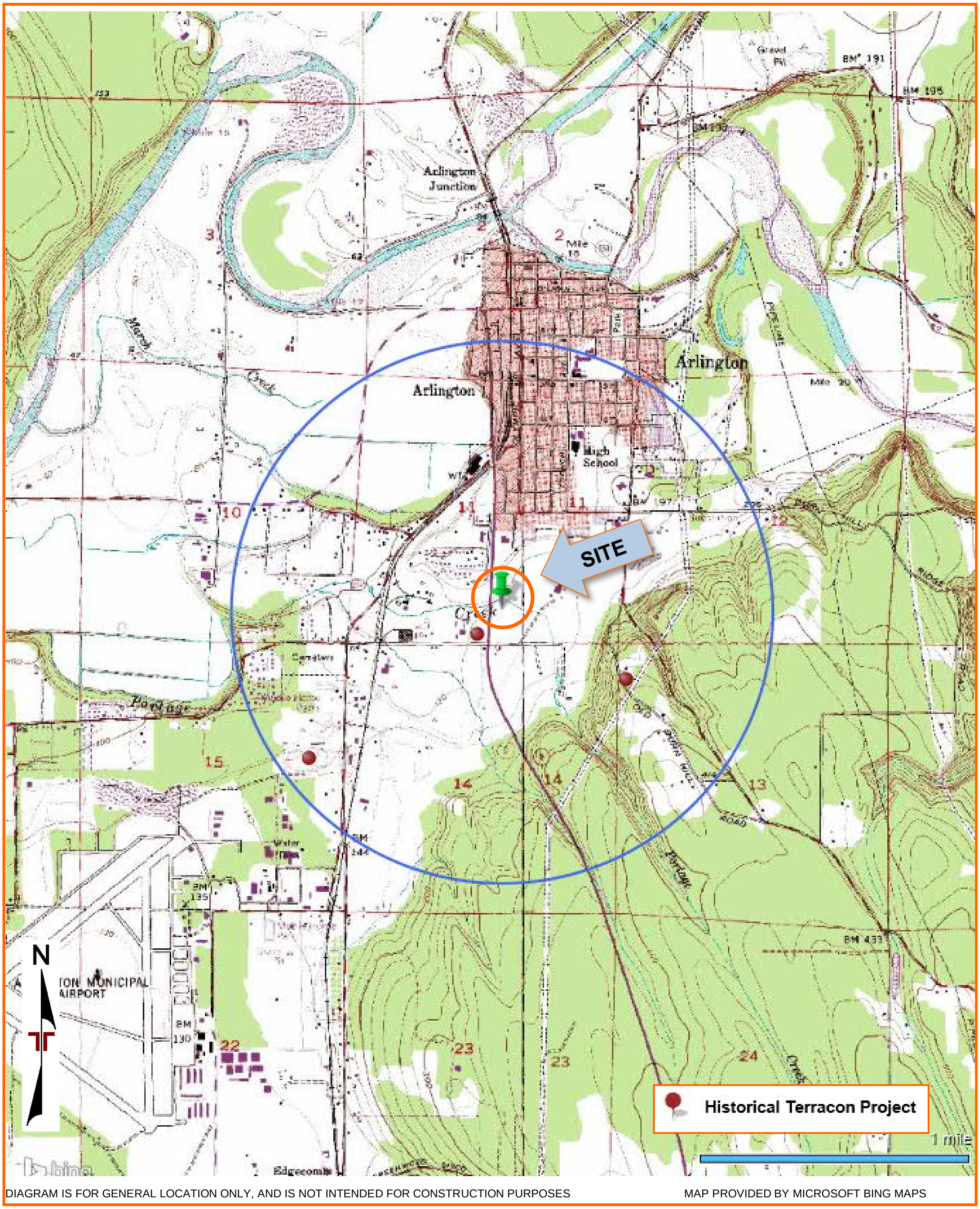


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

# EXPLORATION PLAN

Albertsons – Safeway Store #1522 Expansion ■ Arlington, Snohomish County, Washington
April 19, 2022 ■ Terracon Project No. 81225052

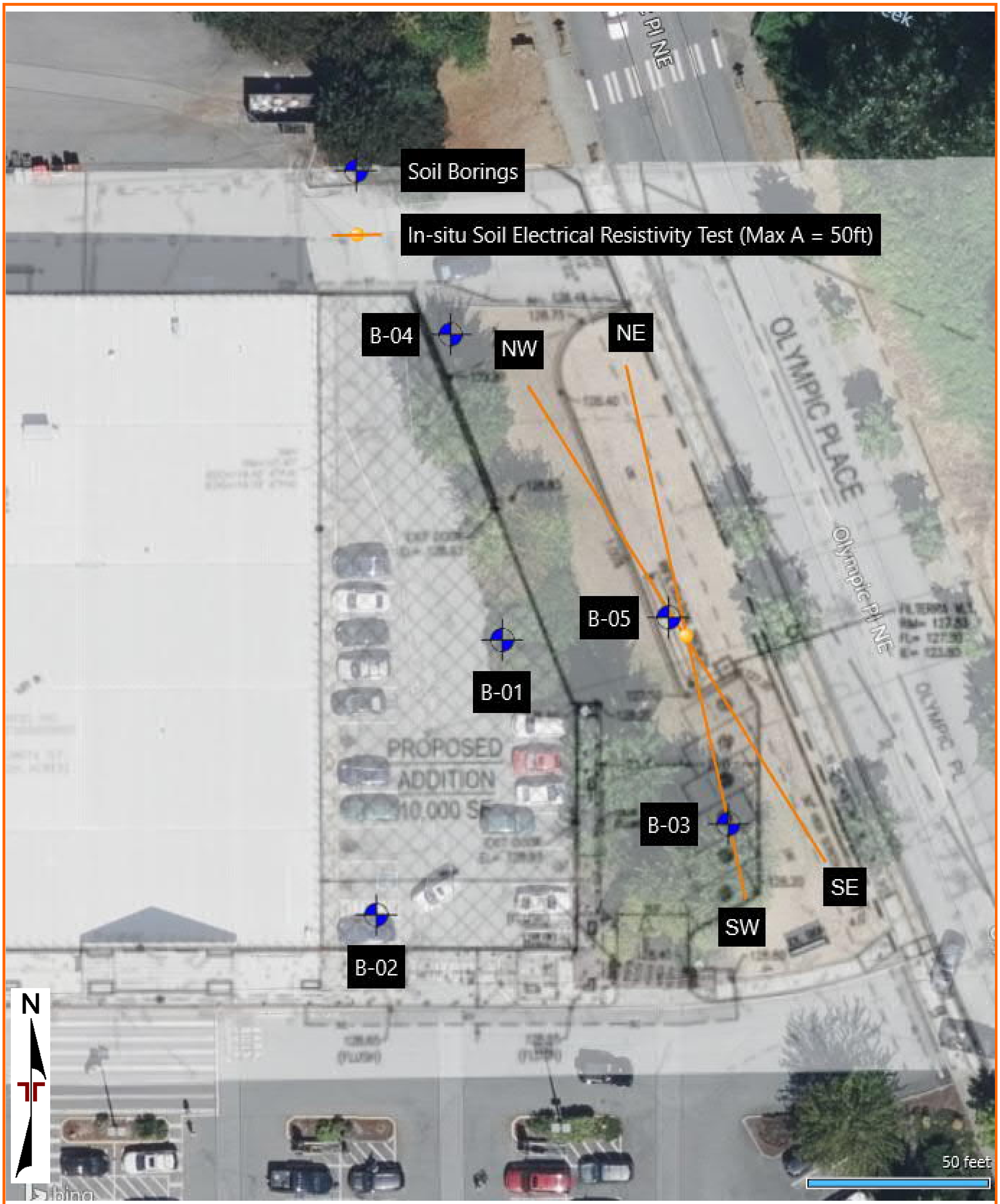


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

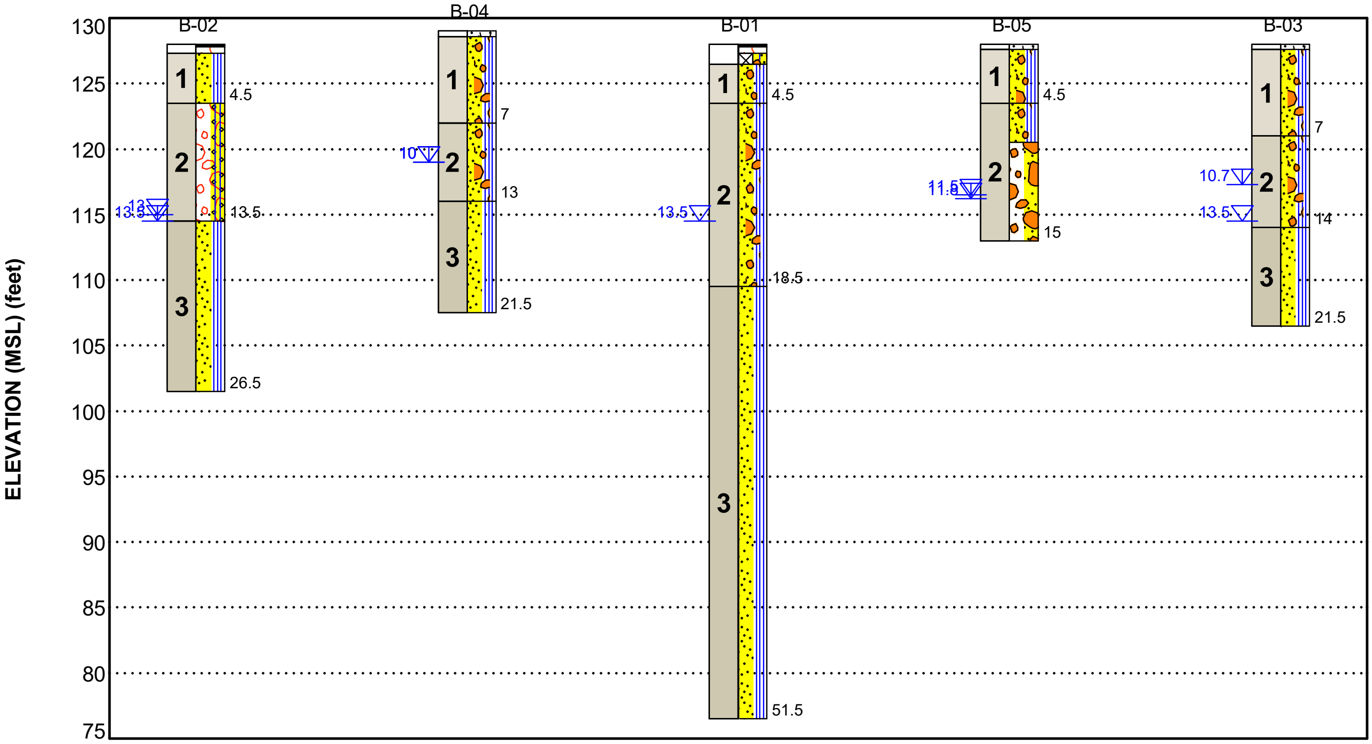
MAP PROVIDED BY MICROSOFT BING MAPS

# EXPLORATION RESULTS

**Contents:**

## GEOMODEL

**Albertsons - Safeway Store #1522 Expansion ■ Arlington, WA**
**Terracon Project No. 81225052**



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 | Sand with silt and gravel | Sand with silt and gravel, with organics, dark brown, fine grained, loose to medium dense |
| 2 | Sand and Gravel | Sand and gravel with variable silt content, brown, loose to very dense |
| 3 | Sand with silt | Sand with silt, trace gravel, brown, medium dense to very dense |

## LEGEND

- ■ Asphalt
- ▨ Aggregate Base Course
- ▨ Silty Sand with Gravel
- ▨ Poorly-graded Sand with Silt and Gravel
- ▨ Poorly-graded Sand with Silt
- ▨ Well-graded Gravel with silt and sand
- ▨ Topsoil
- ▨ Poorly-graded Gravel with Sand

▽ First Water Observation
▽ Second Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

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.
Numbers adjacent to soil column indicate depth below ground surface.

# BORING LOG NO. B-01

**PROJECT:** Albertsons - Safeway Store #1522 Expansion

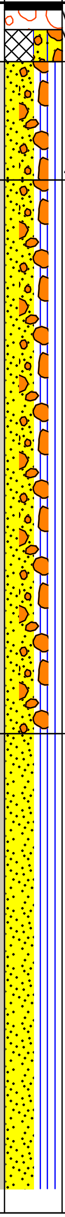
**CLIENT:** Albertsons Companies, Inc.
Boise, ID

**SITE:** 20500 Olympic Place
Arlington, WA

LOCATION See Exploration Plan

Latitude: 48.1825° Longitude: -122.1273°

Approximate Surface Elev.: 128 (Ft.) +/-



| MODEL LAYER | DEPTH | DESCRIPTION | ELEVATION (Ft.) |
|---|---|---|---|
| | 0.2 | **ASPHALT**, about 2" | 128+/- |
| | 0.7 | **AGGREGATE BASE COURSE**, about 6" | 127.5+/- |
| | 1.5 | **FILL - SILTY SAND WITH GRAVEL (SM)**, grayish brown | 126.5+/- |
| 1 | 4.5 | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, fine grained, dark brown, damp, medium dense, with organics and fine to medium size roots<br>@ S-1: O.C.=3.8% | 123.5+/- |
| 2 | 18.5 | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, medium to coarse grained, brown, damp, medium dense to dense<br>@S-3: trace organics<br>moist<br>wet | 109.5+/- |
| 3 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine to medium grained, brown, wet, medium dense to very dense<br>decrease in gravel content<br>water added to mitigate heave<br>silt content and grain size decreasing with depth<br>color change to grayish brown | |

| SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE ID | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|
| ☒ | 9 | 11-5-6<br>N=11 | S-1 | 13.8 | |
| ☒ | 6 | 11-16-21<br>N=37 | S-2 | | |
| ☒ | 12 | 9-12-14<br>N=26 | S-3 | | |
| ☒ | 11 | 13-16-14<br>N=30 | S-4 | | |
| ☒ | 13 | 13-26-25<br>N=51 | S-5 | 12.5 | 8 |
| ☒ | 9 | 9-23-25<br>N=48 | S-6 | | |
| ☒ | 14 | 17-28-45<br>N=73 | S-7 | | |

DEPTH (Ft.): 5, 10, 15, 20, 25, 30

WATER LEVEL OBSERVATIONS: ▽

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

Hammer Type: Automatic (ETR=78.9%)

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite
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.

Elevations were interpolated from the Civil Plan.

Notes:

@ S-1, S-2, S-3, S-4, S-5 : rock fragments present, blow counts may be overstated.

**WATER LEVEL OBSERVATIONS**

▽ *Inferred from change in sample moisture*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

| | |
|---|---|
| Boring Started: 03-21-2022 | Boring Completed: 03-21-2022 |
| Drill Rig: Truck-mounted 02-54610 | Driller: Cascade Drilling |
| Project No.: 81225052 | |

# BORING LOG NO. B-01

**PROJECT:** **Albertsons - Safeway Store #1522 Expansion**

**CLIENT:** **Albertsons Companies, Inc.**
**Boise, ID**

**SITE:** **20500 Olympic Place**
**Arlington, WA**

| MODEL LAYER | GRAPHIC LOG | LOCATION See Exploration Plan<br>Latitude: 48.1825° Longitude: -122.1273°<br>Approximate Surface Elev.: 128 (Ft.) +/-<br>DEPTH ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE ID | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine to medium grained, brown, wet, medium dense to very dense *(continued)*<br>transitions to SAND (SP) | | | ☒ | 14 | 14-27-30<br>N=57 | S-8 | | |
| | | | 35 | | ☒ | 16 | 17-29-30<br>N=59 | S-9 | | |
| | | | 40 | | ☒ | 8 | 14-50/6"<br>N=50/6" | S-10 | | |
| | | | 45 | | ☒ | 12 | 10-14-21<br>N=35 | S-11 | | |
| | | 51.5 76.5+/- | 50 | | ☒ | 16 | 7-9-18<br>N=27 | S-12 | 24.2 | 5 |
| | | ***Boring Terminated at 51.5 Feet*** | | | | | | | | |

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

Hammer Type: Automatic (ETR=78.9%)

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite
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.

Elevations were interpolated from the Civil Plan.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *Inferred from change in sample moisture*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

| | |
|---|---|
| Boring Started: 03-21-2022 | Boring Completed: 03-21-2022 |
| Drill Rig: Truck-mounted 02-54610 | Driller: Cascade Drilling |
| Project No.: 81225052 | |

# BORING LOG NO. B-02

Page 1 of 1

**PROJECT: Albertsons - Safeway Store #1522 Expansion**

**SITE: 20500 Olympic Place**
**Arlington, WA**

**CLIENT: Albertsons Companies, Inc.**
**Boise, ID**

LOCATION See Exploration Plan

Latitude: 48.1822° Longitude: -122.1274°

Approximate Surface Elev.: 128 (Ft.) +/-

| MODEL LAYER | DEPTH | DESCRIPTION | ELEVATION (Ft.) |
|---|---|---|---|
| | 0.2 | **ASPHALT**, about 2" | 128+/- |
| | 0.7 | **AGGREGATE BASE COURSE**, about 6" | 127.5+/- |
| 1 | 4.5 | **POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine grained, dark brown, moist, loose, trace organics and cobbles | 123.5+/- |
| 2 | 13.5 | **WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM)**, subrounded to subangular, brown, damp, medium dense to dense<br>silt content decreasing with depth | 114.5+/- |
| 3 | 26.5 | **POORLY GRADED SAND WITH SILT (SP-SM)**, medium to coarse grained, brown, wet, medium dense<br>silt content decreasing with depth | 101.5+/- |

***Boring Terminated at 26.5 Feet***

| SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE ID | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|
| ☒ | 1 | 4-3-5<br>N=8 | S-1 | | |
| ☒ | 9 | 10-26-13<br>N=39 | S-2 | 5.9 | 8 |
| ☒ | 7 | 11-16-19<br>N=35 | S-3 | | |
| ☒ | 10 | 14-16-12<br>N=28 | S-4 | | |
| ☒ | 18 | 6-8-10<br>N=18 | S-5 | | |
| ☒ | 15 | 11-7-13<br>N=20 | S-6 | | |
| ☒ | 14 | 6-9-11<br>N=20 | S-7 | | |

DEPTH (Ft.): 5, 10, 15, 20, 25

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

Hammer Type: Automatic (ETR=78.9%)

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite
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.

Elevations were interpolated from the Civil Plan.

Notes:

@ S-2, S-3, S-4 : rock fragments present, blow counts may be overstated.

**WATER LEVEL OBSERVATIONS**

▽ *Inferred from change in sample moisture*

▽ *Measured while drilling*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

| | |
|---|---|
| Boring Started: 03-21-2022 | Boring Completed: 03-21-2022 |
| Drill Rig: Truck-mounted 02-54610 | Driller: Cascade Drilling |
| Project No.: 81225052 | |

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81225052 ALBERTSONS - SAFE.GPJ TERRACON_DATATEMPLATE.GDT 4/14/22

# BORING LOG NO. B-03

Page 1 of 1

**PROJECT:** Albertsons - Safeway Store #1522 Expansion

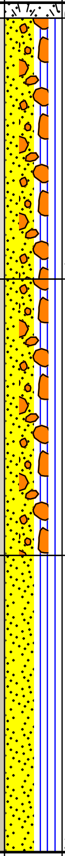
**CLIENT:** Albertsons Companies, Inc.
Boise, ID

**SITE:** 20500 Olympic Place
Arlington, WA

LOCATION See Exploration Plan

Latitude: 48.1823° Longitude: -122.1270°

Approximate Surface Elev.: 128 (Ft.) +/-



| MODEL LAYER | DEPTH | DESCRIPTION | ELEVATION (Ft.) |
|---|---|---|---|
|  | 0.4 | **SANDY SILT (ML)**, dark brown, moist, with abundant fine roots and organics | 127.5+/- |
| 1 | 7.0 | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, trace organics, fine grained, dark brown, moist, medium dense | 121+/- |
| 2 | 14.0 | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, with cobbles, fine to coarse grained, grayish brown to brown, moist, dense<br>wet | 114+/- |
| 3 | 21.5 | **POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, brown, wet, medium dense | 106.5+/- |
|  |  | ***Boring Terminated at 21.5 Feet*** |  |

| DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE ID | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|---|---|
|  |  | ☒ | 9 | 5-6-7<br>N=13 | S-1 | 10.5 | 10 |
| 5 |  | ☒ | 1 | 10-26-31<br>N=57 | S-2 |  |  |
|  |  | ☒ | 14 | 4-18-28<br>N=46 | S-3 |  |  |
| 10 | ▽ | ☒ | 0 | 16-19-18<br>N=37 | S-4 |  |  |
|  |  | ⧗ | 10 | 13-23-25 | S-5 |  |  |
|  | ▽ |  |  |  |  |  |  |
| 15 |  | ☒ | 4 | 9-11-12<br>N=23 | S-6 |  |  |
| 20 |  | ☒ | 13 | 4-6-12<br>N=18 | S-7 |  |  |

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

Hammer Type: Automatic (ETR=78.9%)

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips 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.

Elevations were interpolated from the Civil Plan.

Notes:

@ S-2 and S-4: rock fragments present, blow counts may be overstated.
S-5 was sampled by 3-inch diameter sampler

**WATER LEVEL OBSERVATIONS**

▽ *Inferred from change in sample moisture*

▽ *Measured at completion of drilling*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

| | |
|---|---|
| Boring Started: 03-22-2022 | Boring Completed: 03-22-2022 |
| Drill Rig: Truck-mounted 02-54610 | Driller: Cascade Drilling |
| Project No.: 81225052 | |

# BORING LOG NO. B-04

Page 1 of 1

**PROJECT:** **Albertsons - Safeway Store #1522 Expansion**

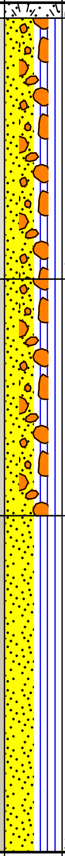
**CLIENT:** **Albertsons Companies, Inc.**
**Boise, ID**

**SITE:** **20500 Olympic Place**
**Arlington, WA**

LOCATION See Exploration Plan

Latitude: 48.1827° Longitude: -122.1274°

Approximate Surface Elev.: 129 (Ft.) +/-



| MODEL LAYER | DEPTH | | ELEVATION (Ft.) |
|---|---|---|---|
| | 0.4 | **SANDY SILT (ML)**, dark brown, moist, with abundant fine roots and organics | 128.5+/- |
| 1 | 7.0 | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, with organics, fine grained, dark brown, moist, medium dense<br>fine to medium size roots to about 1 foot below ground surface<br>silt content increasing with depth<br>@ S-1: O.C.=1.9% | 122+/- |
| 2 | 13.0 | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, with cobbles, fine to coarse grained, brown, moist, loose to medium dense, change in layer inferred due to lack of sample recovery<br>wet | 116+/- |
| 3 | 21.5 | **POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, brown, wet, medium dense to very dense | 107.5+/- |

***Boring Terminated at 21.5 Feet***

| DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE ID | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|---|---|
| | | ☒ | 13 | 3-12-13<br>N=25 | S-1 | 11.3 | |
| 5 | | ☒ | 12 | 4-7-4<br>N=11 | S-2 | 12.5 | 10 |
| | | ☒ | 0 | 3-3-5<br>N=8 | S-3 | | |
| 10 | ▽ | ☒ | 0 | 4-3-9<br>N=12 | S-4 | | |
| 15 | | ☒ | 10 | 2-6-11<br>N=17 | S-5 | | |
| 20 | | ☒ | 14 | 12-18-27<br>N=45 | S-6 | | |

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

Hammer Type: Automatic (ETR=78.9%)

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips 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.

Elevations were interpolated from the Civil Plan.

Notes:

@ S-2: rock fragments present, blow counts may be overstated.

**WATER LEVEL OBSERVATIONS**

▽ *Inferred from change in sample moisture*

▽ *Measured at completion of drilling*

21905 64th Ave W, Ste 100
Mountlake Terrace, WA

| | |
|---|---|
| Boring Started: 03-22-2022 | Boring Completed: 03-22-2022 |
| Drill Rig: Truck-mounted 02-54610 | Driller: Cascade Drilling |
| Project No.: 81225052 | |

# BORING LOG NO. B-05

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**PROJECT: Albertsons - Safeway Store #1522 Expansion**

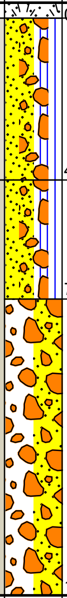
**CLIENT: Albertsons Companies, Inc.**
**Boise, ID**

**SITE: 20500 Olympic Place**
**Arlington, WA**

LOCATION See Exploration Plan

Latitude: 48.1825° Longitude: -122.1271°

Approximate Surface Elev.: 128 (Ft.) +/-



| MODEL LAYER | DEPTH | | ELEVATION (Ft.) |
|---|---|---|---|
| 1 | 0.4 | **SANDY SILT (ML)**, dark brown, moist, with abundant fine roots and organics | 127.5+/- |
| | 4.5 | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, trace organics, fine to coarse grained, dark brown, moist, (medium dense) | 123.5+/- |
| 2 | 7.5 | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, with cobbles, medium to coarse grained, brown, damp to moist, (loose to medium dense) | 120.5+/- |
| | 15.0 | **POORLY GRADED GRAVEL WITH SAND (GP)**, subangular to subrounded, brown, wet, (medium dense to dense)<br>transitions well graded gravel with sand (GW) | 113+/- |

***Boring Terminated at 15 Feet***

| DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE ID | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|---|---|
| | | ⧗ | 10 | 32-12-14 | S-1 | | |
| 5 | | ⧗ | 7 | 7-8-8 | S-2 | | |
| | | ⧗ | 10 | 16-20-17 | S-3 | 3.9 | 7 |
| | | ⧗ | 6 | 16-31-29 | S-4 | 3.7 | 3 |
| 10 | | ⧗ | 10 | 21-23-26 | S-5 | 5.7 | 4 |
| | ▽ | ⧗ | 8 | 22-33-41 | S-6 | | |
| | | ⧗ | 8 | 8-27-27 | S-7 | | |
| | | ⧗ | 10 | 17-19-22 | S-8 | | |
| 15 | | | | | | | |

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

Hammer Type: Automatic (ETR=78.9%)

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips 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.

Elevations were interpolated from the Civil Plan.

Notes:

Samples were sampled by three inches diameter sampler
sampling was performed using a 3-inch outside diameter sampler
sampling was performed using a 3-inch outside diameter sampler

**WATER LEVEL OBSERVATIONS**

▽ *Inferred from change in sample moisture*

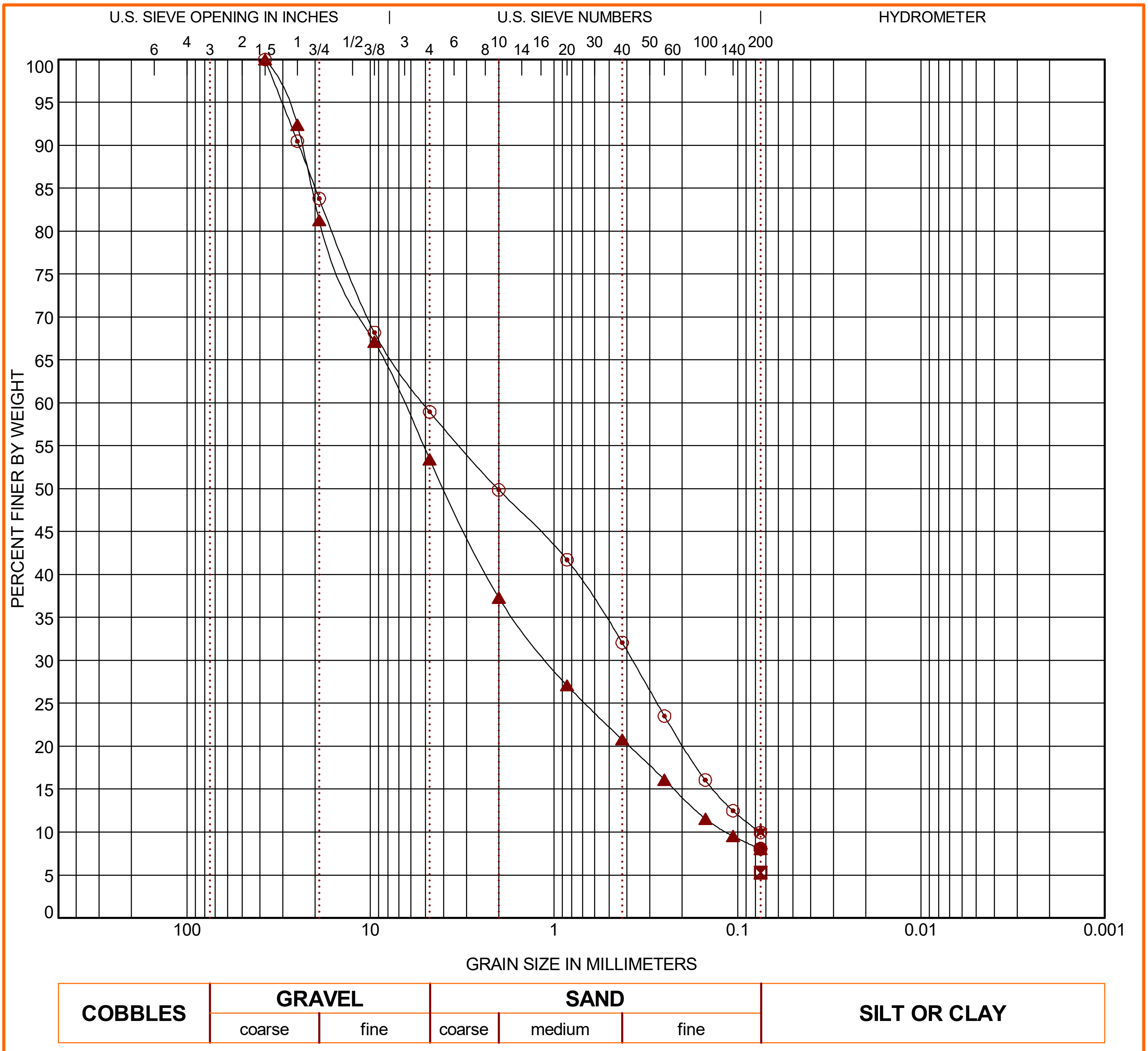
▽ *Measured at completion of drilling*

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

| | |
|---|---|
| Boring Started: 03-22-2022 | Boring Completed: 03-22-2022 |
| Drill Rig: Truck-mounted 02-54610 | Driller: Cascade Drilling |
| Project No.: 81225052 | |

# GRAIN SIZE DISTRIBUTION

## ASTM D422 / ASTM C136



| Boring ID | Depth (Ft) | USCS Classification | WC (%) | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● B-01 | 15 - 16.5 | POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) | 12.5 | | | | | |
| ☒ B-01 | 50 - 51.5 | POORLY GRADED SAND WITH SILT (SP-SM) | 24.2 | | | | | |
| ▲ B-02 | 5 - 6.5 | WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM) | 5.9 | | | | 1.55 | 57.67 |
| ★ B-03 | 2.5 - 4 | POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) | 10.5 | | | | | |
| ⊙ B-04 | 5 - 6.5 | POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) | 12.5 | | | | 0.36 | 68.02 |

| Boring ID | Depth (Ft) | $D_{100}$ | $D_{60}$ | $D_{30}$ | $D_{10}$ | %Cobbles | %Gravel | %Sand | %Silt | %Fines | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● B-01 | 15 - 16.5 | 0.075 | | | | | | | | 8.1 | |
| ☒ B-01 | 50 - 51.5 | 0.075 | | | | | | | | 5.3 | |
| ▲ B-02 | 5 - 6.5 | 37.5 | 6.625 | 1.084 | 0.115 | 0.0 | 46.6 | 45.4 | | 8.0 | |
| ★ B-03 | 2.5 - 4 | 0.075 | | | | | | | | 10.2 | |
| ⊙ B-04 | 5 - 6.5 | 37.5 | 5.138 | 0.374 | 0.076 | 0.0 | 41.0 | 49.0 | | 9.9 | |

PROJECT: Albertsons - Safeway Store #1522
Expansion

PROJECT NUMBER: 81225052

SITE: 20500 Olympic Place
Arlington, WA

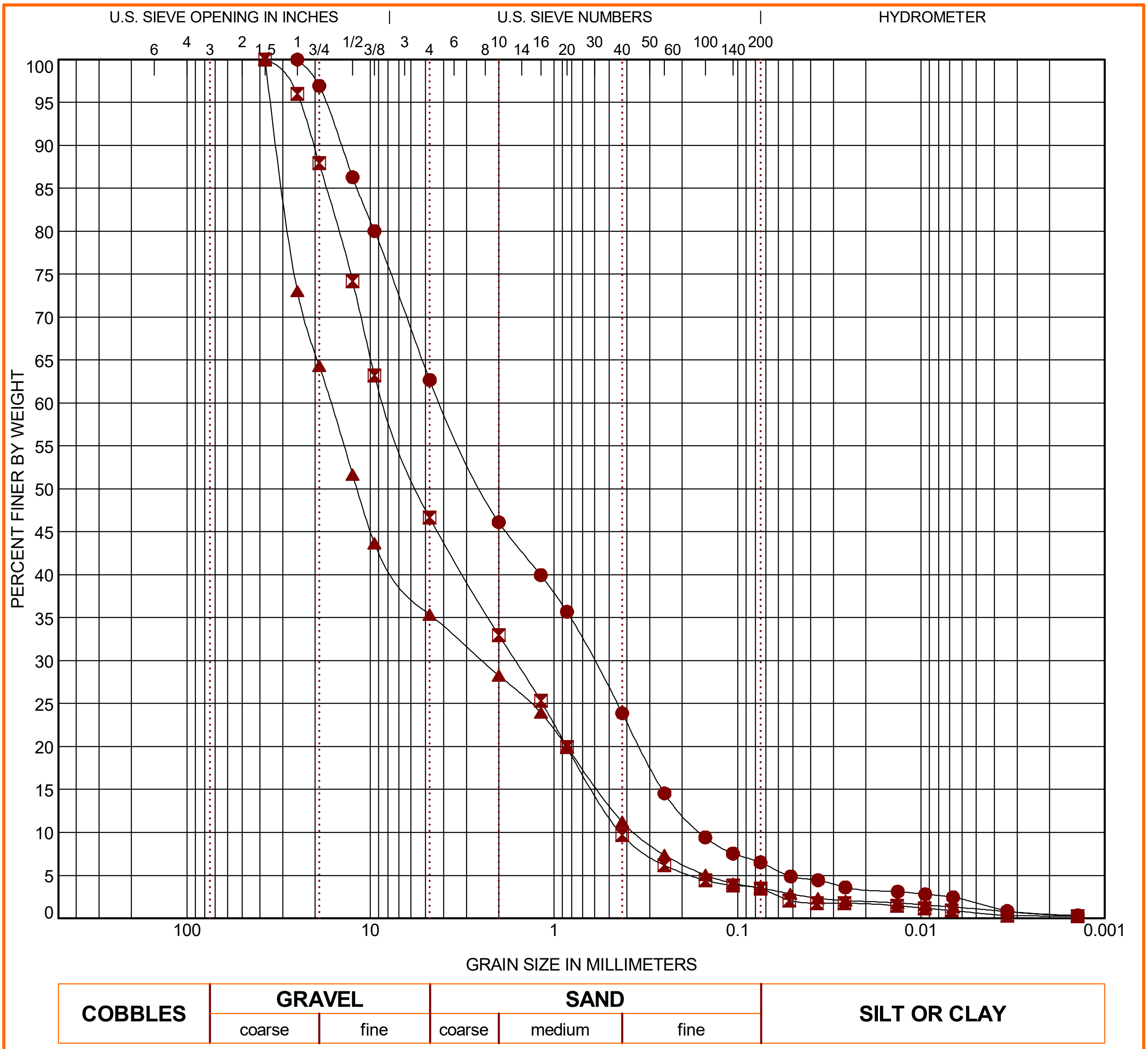
Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

CLIENT: Albertsons Companies, Inc.
Boise, ID

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 81225052 ALBERTSONS - SAFE.GPJ TERRACON_DATATEMPLATE.GDT 4/5/22

# GRAIN SIZE DISTRIBUTION

## ASTM D422 / ASTM C136



| Boring ID | | Depth (Ft) | USCS Classification | WC (%) | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|
| ● | B-05 | 6 - 7.5 | POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) | 3.9 | | | | 0.56 | 25.97 |
| ☒ | B-05 | 7.5 - 9 | POORLY GRADED GRAVEL WITH SAND (GP) | 3.7 | | | | 0.74 | 19.13 |
| ▲ | B-05 | 9 - 10.5 | WELL GRADED GRAVEL WITH SAND (GW) | 5.7 | | | | 1.03 | 45.86 |
| | | | | | | | | | |
| | | | | | | | | | |

| Boring ID | | Depth (Ft) | $D_{100}$ | $D_{60}$ | $D_{30}$ | $D_{10}$ | %Cobbles | %Gravel | %Sand | %Silt | %Fines | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-05 | 6 - 7.5 | 25 | 4.128 | 0.609 | 0.159 | 0.0 | 37.3 | 56.2 | 4.8 | | 1.8 |
| ☒ | B-05 | 7.5 - 9 | 37.5 | 8.299 | 1.631 | 0.434 | 0.0 | 53.4 | 43.2 | 2.8 | | 0.6 |
| ▲ | B-05 | 9 - 10.5 | 37.5 | 16.458 | 2.471 | 0.359 | 0.0 | 64.6 | 31.8 | 2.4 | | 1.1 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

PROJECT: Albertsons - Safeway Store #1522
Expansion

SITE: 20500 Olympic Place
Arlington, WA

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

PROJECT NUMBER: 81225052

CLIENT: Albertsons Companies, Inc.
Boise, ID

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 81225052 ALBERTSONS - SAFE.GPJ TERRACON_DATATEMPLATE.GDT 4/5/22

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

Terracon GeoReport

**Client**

Albertsons Companies, Inc.

**Project**

Albertsons - Safeway Store #1522 Expansion

**Sample Submitted By:** Terracon (81) **Date Received:** 3/25/2022 **Lab No.: 22-0276**

## Results of Corrosion Analysis

| **Sample Number** | C-01 | C-02 | C-03 |
|---|---|---|---|
| **Sample Location** | B-01 | B-02 | B-04 |
| **Sample Depth (ft.)** | 0.0-5.0 | 0.0-5.0 | 0.0-5.0 |
| pH Analysis, ASTM G 51 | 7.17 | 8.30 | 8.32 |
| Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg) | 112 | 2738 | 176 |
| Sulfides, AWWA 4500-S D, (mg/kg) | Nil | Nil | Nil |
| Chlorides, ASTM D 512, (mg/kg) | 97 | 127 | 50 |
| Red-Ox, ASTM G 200, (mV) | +723 | +721 | +735 |
| Total Salts, AWWA 2520 B, (mg/kg) | 889 | 1074 | 105 |
| Saturated Minimum Resistivity, ASTM G 57, (ohm-cm) | 2716 | 2037 | 12610 |

N. Campo

**Analyzed By:** Nathan Campo
Engineering Technician II

## FIELD ELECTRICAL RESISTIVITY TEST DATA

Albertsons - Safeway Store #1522 Expansion ■ Arlington, Sonohomish County, WA
April 19, 2022 ■ Terracon Project No. 81225052

**Array Loc.** In-Situ Electrical Resistivity Test

**Instrument** Nilsson 400 Soil Resistivity Meter

**Weather** Cloudy

**Serial #** S/N 4-9489

**Ground Cond.** Relatively flat, Landscape area, Sod

**Cal. Check** Feburary 17, 2022

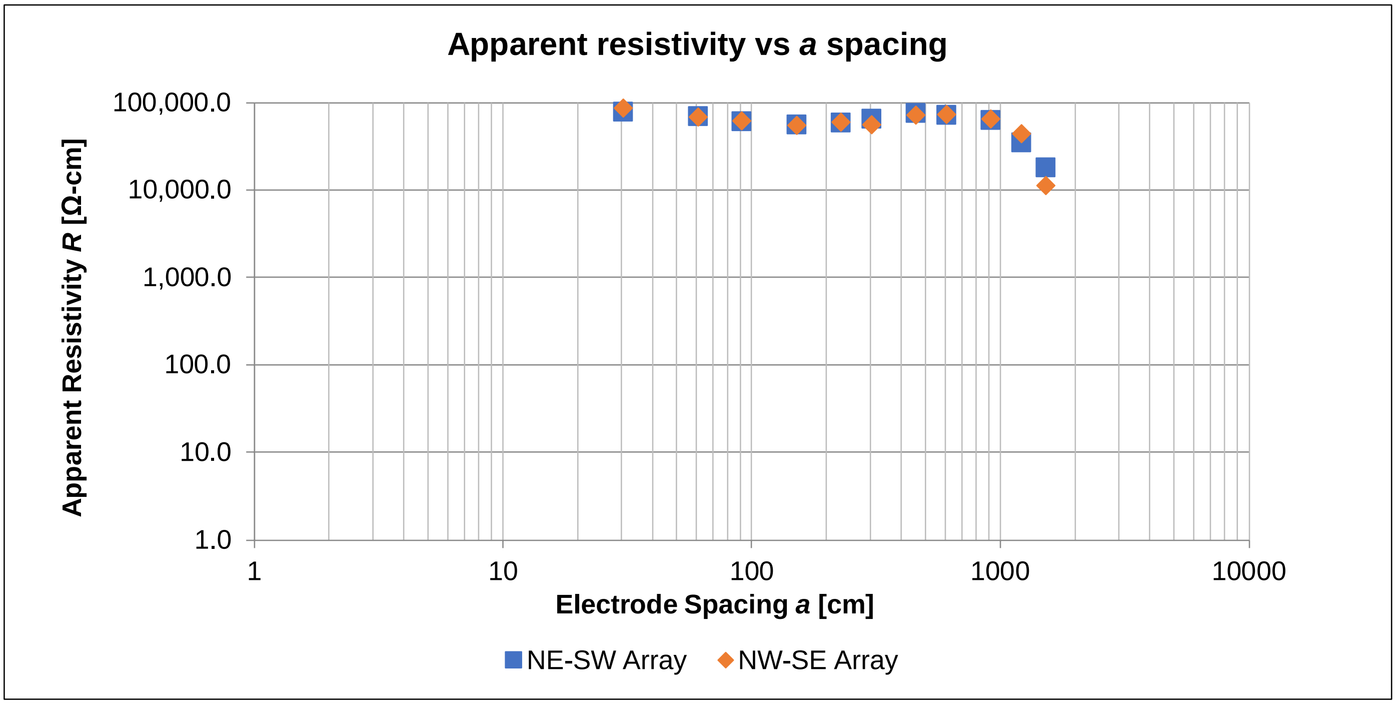
**Tested By** Xiaoyi Tan

**Test Date** April 1, 2022

**Method** Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012

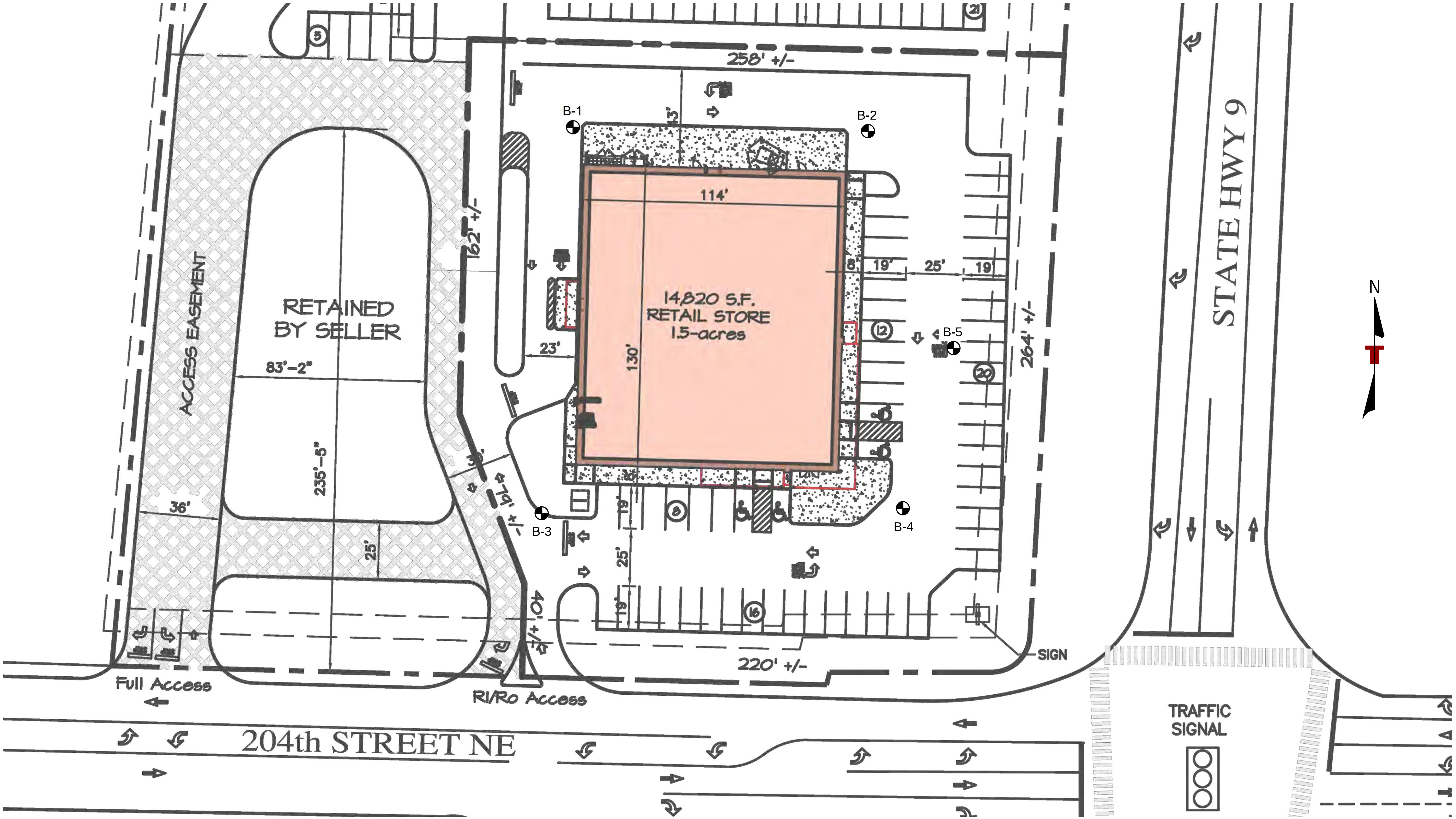
**Notes & Conflicts** Moist grass, sod

| **Electrode Spacing *a*** | | **Electrode Depth *b*** | | **NE-SW Test** | | **NW-SE Test** | |
|---|---|---|---|---|---|---|---|
| [feet] | [centimeters] | [inches] | [centimeters] | Measured Resistance *R* | Apparent Resistivity *ρ* | Measured Resistance *R* | Apparent Resistivity *ρ* |
| | | | | Ω | [Ω-cm] | Ω | [Ω-cm] |
| 1 | 30 | 6 | 15 | 415.0 | 79481 | 460.0 | 88099 |
| 2 | 61 | 6 | 15 | 185.0 | 70860 | 180.0 | 68945 |
| 3 | 91 | 6 | 15 | 106.5 | 61188 | 108.5 | 62337 |
| 5 | 152 | 6 | 15 | 59.0 | 56496 | 58.5 | 56017 |
| 7.5 | 229 | 6 | 15 | 41.5 | 59608 | 42.5 | 61044 |
| 10 | 305 | 6 | 15 | 34.5 | 66071 | 29.5 | 56496 |
| 15 | 457 | 6 | 15 | 26.5 | 76126 | 25.5 | 73253 |
| 20 | 610 | 6 | 15 | 19.0 | 72774 | 19.5 | 74689 |
| 30 | 914 | 6 | 15 | 11.0 | 63199 | 11.5 | 66071 |
| 40 | 1219 | 6 | 15 | 4.6 | 35238 | 5.8 | 44431 |
| 50 | 1524 | 6 | 15 | 1.9 | 18194 | 1.2 | 11491 |



# HISTORICAL EXPLORATION RESULTS

**Contents:**



Basemap PDF file provided by CAP Arlington LLC and modified by Terracon.

**LEGEND:**

**B-1** BORING NUMBER AND APPROXIMATE LOCATION

40 0 10 20 40
SCALE IN FEET

Project Mngr: RMS
Drawn By: RMS
Checked By: RMS
Approved By: JMB

Project No. 81135070
Scale: AS SHOWN
File No. Exhibit A-1.dwg
Date: October 2013

Terracon
Consulting Engineers and Scientists
21905 64th Avenue W, Ste 100 Mountlake Terrace, WA 98043
PH. (425) 771-3304 FAX. (425) 771-3549

## SITE AND EXPLORATION PLAN

Proposed Walgreens
204th Street NE and Highway 9
Arlington, Snohomish County, Washington

EXHIBIT
A-1

# BORING LOG NO. B-1

Page 1 of 1

**PROJECT:** Arlington Walgreens

**CLIENT:** CAP Arlington, LLC
Greenville, South Carolina

**SITE:** 204th Street NE & Highway 9
Arlington, Washington

LOCATION See Exhibit A-1

Surface Elev.: 98.5 (Ft.)

| DEPTH | DESCRIPTION | ELEVATION (Ft.) |
|---|---|---|
| 11.0 | **GRAVELLY SAND (SP-SM)**, with silt, brown, medium dense to dense, moist to wet | 87.5 |
| 21.5 | **SAND (SP)**, trace silt and gravel, brown-yellow, medium dense, wet to saturated | 77 |

***Boring Terminated at 21.5 Feet***

| DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE NUMBER | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|---|---|
|  |  | ☒ | 12 | 9-12-16<br>N=28 | S-1 | 4 | 6 |
| 5 |  | ☒ | 12 | 9-14-26<br>N=40 | S-2 | 4 |  |
| 10 |  | ☒ | 6 | 5-6-7<br>N=13 | S-3 |  |  |
|  | ▽ |  |  |  |  |  |  |
| 15 |  | ☒ | 14 | 5-6-8<br>N=14 | S-4 |  |  |
| 20 |  | ☒ | 14 | 7-9-16<br>N=25 | S-5 |  |  |

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

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-2 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *14' While Drilling*

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

| | |
|---|---|
| Boring Started: 9/27/2013 | Boring Completed: 9/27/2013 |
| Drill Rig: B-61 TRUCK | Driller: Environmental Drilling , Inc. |
| Project No.: 81135070 | Exhibit: A-3 |

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT.

# BORING LOG NO. B-2

Page 1 of 2

**PROJECT:** Arlington Walgreens

**CLIENT:** CAP Arlington, LLC
Greenville, South Carolina

**SITE:** 204th Street NE & Highway 9
Arlington, Washington

LOCATION See Exhibit A-1

Surface Elev.: 98.5 (Ft.)

| GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE NUMBER | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|
| | **GRAVELLY SAND (SP-SM)**, with silt, brown, medium dense, moist to wet | | | | | | | | | |
| | | | | | ☒ | 12 | 9-12-17<br>N=29 | S-1 | | |
| | | | 5 | | ☒ | 12 | 10-11-14<br>N=25 | S-2 | 4 | |
| | 10.0 | 88.5 | | | | | | | | |
| | **SAND (SP)**, with silt and trace gravel, brown-yellow, medium dense, wet | | 10 | | ☒ | 14 | 5-4-6<br>N=10 | S-3 | 9 | |
| | | | 15 | | ☒ | 18 | 5-8-10<br>N=18 | S-4 | 10 | 4 |
| | grades to saturated | | | ▽ | | | | | | |
| | | | 20 | | ☒ | 18 | 4-5-16<br>N=21 | S-5 | | |
| | | | 25 | | ☒ | 18 | 5-7-11<br>N=18 | S-6 | | |
| | | | 30 | | | | | | | |

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

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-2 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *18' While Drilling*

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

| | |
|---|---|
| Boring Started: 9/27/2013 | Boring Completed: 9/27/2013 |
| Drill Rig: B-61 TRUCK | Driller: Environmental Drilling , Inc. |
| Project No.: 81135070 | Exhibit: A-4 |

# BORING LOG NO. B-2

**PROJECT:** Arlington Walgreens

**CLIENT:** CAP Arlington, LLC
Greenville, South Carolina

**SITE:** 204th Street NE & Highway 9
Arlington, Washington

LOCATION See Exhibit A-1

Surface Elev.: 98.5 (Ft.)

| GRAPHIC LOG | DEPTH / ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE NUMBER | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| ▨ | **SAND (SP)**, with silt and trace gravel, brown-yellow, medium dense, wet *(continued)* | | | ☒ | 12 | 7-8-7<br>N=15 | S-7 | 26 | 8 |
| ▨ | | 35 | | ☒ | 14 | 4-7-11<br>N=18 | S-8 | | |
| ▨ | | 40 | | ☒ | 18 | 9-10-10<br>N=20 | S-9 | | |
| ▨ | grades dense to very dense | 45 | | ☒ | 12 | 10-12-50<br>N=62 | S-10 | | |
| ▨ | 51.5 / 47 | 50 | | ☒ | 14 | 12-12-37<br>N=49 | S-11 | | |

***Boring Terminated at 51.5 Feet***

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

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-2 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *18' While Drilling*

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

| | |
|---|---|
| Boring Started: 9/27/2013 | Boring Completed: 9/27/2013 |
| Drill Rig: B-61 TRUCK | Driller: Environmental Drilling , Inc. |
| Project No.: 81135070 | Exhibit: A-4 |

# BORING LOG NO. B-3

Page 1 of 1

**PROJECT:** **Arlington Walgreens**

**CLIENT:** **CAP Arlington, LLC**
**Greenville, South Carolina**

**SITE:** **204th Street NE & Highway 9**
**Arlington, Washington**

LOCATION See Exhibit A-1

Surface Elev.: 99 (Ft.)

| DEPTH / DESCRIPTION | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE NUMBER | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| **GRAVELLY SAND (SW-SM)**, with silt, brown, medium dense to dense, moist to wet | | | | | | | | | |
| | | | | ☒ | 5 | 7-10-9<br>N=19 | S-1 | | |
| (overstated blowcount on rock) | | 5 | | ☒ | 12 | 22-25-28<br>N=53 | S-2 | 6 | 7 |
| | | 10 | | ☒ | 12 | 9-14-16<br>N=30 | S-3 | | |
| 14.0 | 85 | | | | | | | | |
| **SAND (SP)**, trace silt and gravel, brown-yellow, medium dense, wet | | | | | | | | | |
| | | 15 | | ☒ | 14 | 6-6-6<br>N=12 | S-4 | | |
| | | 20 | | ☒ | 14 | 3-4-6<br>N=10 | S-5 | | |
| 21.5 | 77.5 | | | | | | | | |
| ***Boring Terminated at 21.5 Feet*** | | | | | | | | | |

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

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-2 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Not Encountered*

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

| | |
|---|---|
| Boring Started: 9/27/2013 | Boring Completed: 9/27/2013 |
| Drill Rig: B-61 TRUCK | Driller: Environmental Drilling , Inc. |
| Project No.: 81135070 | Exhibit: A-5 |

# BORING LOG NO. B-4

Page 1 of 1

**PROJECT: Arlington Walgreens**

**CLIENT: CAP Arlington, LLC**
**Greenville, South Carolina**

**SITE: 204th Street NE & Highway 9**
**Arlington, Washington**

| GRAPHIC LOG | LOCATION See Exhibit A-1<br>Surface Elev.: 100 (Ft.)<br>DEPTH — ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE NUMBER | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | **SILT (ML)**, with clay, trace sand, dark brown, soft, moist | | | | | | | | |
| | | | | ☒ | 12 | 1-1-2<br>N=3 | S-1 | | |
| | 5.5 — 94.5 | 5 | | | | | | | |
| | **GRAVELLY SAND (SP-SM)**, trace silt, brownish-gray, dense, moist | | | ☒ | 14 | 29-29-20<br>N=49 | S-2 | 8 | |
| | | 10 | | ☒ | 8 | 16-20-21<br>N=41 | S-3 | | |
| | 15.0 — 85 | 15 | | | | | | | |
| | **SAND (SP)**, trace silt and gravel, brown-yellow, medium dense, wet | | | ☒ | 16 | 5-5-6<br>N=11 | S-4 | | |
| | | 20 | ▽ | ☒ | 10 | 6-4-7<br>N=11 | S-5 | | |
| | grades to saturated<br>21.5 — 78.5 | | | | | | | | |
| | ***Boring Terminated at 21.5 Feet*** | | | | | | | | |

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

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-2 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *20.5' While Drilling*

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

| | |
|---|---|
| Boring Started: 9/27/2013 | Boring Completed: 9/27/2013 |
| Drill Rig: B-61 TRUCK | Driller: Environmental Drilling , Inc. |
| Project No.: 81135070 | Exhibit: A-6 |

# BORING LOG NO. B-5

Page 1 of 1

**PROJECT: Arlington Walgreens**

**CLIENT: CAP Arlington, LLC**
**Greenville, South Carolina**

**SITE: 204th Street NE & Highway 9**
**Arlington, Washington**

| GRAPHIC LOG | LOCATION See Exhibit A-1<br>Surface Elev.: 100 (Ft.)<br>DEPTH / ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | SAMPLE NUMBER | WATER CONTENT (%) | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | **TOPSOIL** | | | ☒ | 6 | 8-4-3<br>N=7 | S-1 | 4 | 4 |
| | 1.5 / 98.5 | | | | | | | | |
| | **GRAVELLY SAND (SP-SM)**, with organics, trace silt, brownish-gray, medium dense, moist | | | | | | | | |
| | (overstated blowcount on rock) | 5 | | ☒ | 12 | 17-29-18<br>N=47 | S-2 | | |
| | | 10 | | ☒ | 14 | 10-12-15<br>N=27 | S-3 | | |
| | 10.5 / 89.5 | | | | | | | | |
| | ***Boring Terminated at 10.5 Feet*** | | | | | | | | |

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

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-2 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Not Encountered*

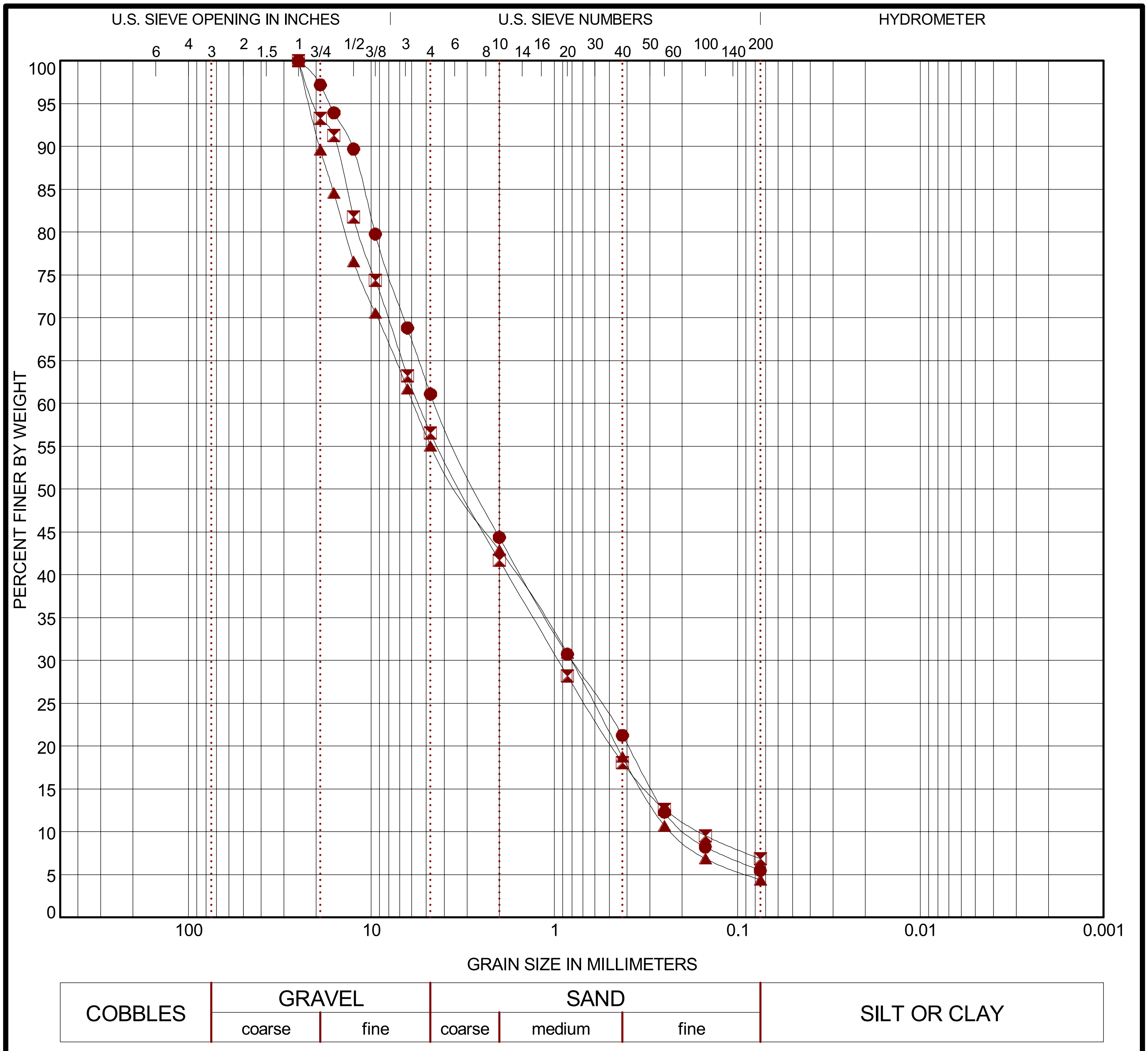
Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

| | |
|---|---|
| Boring Started: 9/27/2013 | Boring Completed: 9/27/2013 |
| Drill Rig: B-61 TRUCK | Driller: Environmental Drilling , Inc. |
| Project No.: 81135070 | Exhibit: A-7 |

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT.

# GRAIN SIZE DISTRIBUTION

## ASTM D422



| | Boring ID | Depth | USCS Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | B-1 | 2.5 | GRAVELLY SAND (SP-SM), with silt | | | | 0.77 | 23.99 |
| ⧗ | B-3 | 5.0 | GRAVELLY SAND (SW-SM), with silt | | | | 1.02 | 34.22 |
| ▲ | B-5 | 0.5 | GRAVELLY SAND (SP-SM), with silt | | | | 0.49 | 25.91 |
| | | | | | | | | |
| | | | | | | | | |

| | Boring ID | Depth | $D_{100}$ | $D_{60}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-1 | 2.5 | 25 | 4.485 | 0.805 | 0.187 | 38.9 | 55.6 | 5.5 | |
| ⧗ | B-3 | 5.0 | 25 | 5.512 | 0.951 | 0.161 | 43.4 | 49.7 | 6.9 | |
| ▲ | B-5 | 0.5 | 25 | 5.889 | 0.808 | 0.227 | 44.9 | 50.6 | 4.4 | |
| | | | | | | | | | | |
| | | | | | | | | | | |

PROJECT: Proposed Walgreens

SITE: 204th Street NE & Highway 9
Arlington, Washington

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

PROJECT NUMBER: 81135070

CLIENT: CAP Arlington, LLC
Greenville, South Carolina

EXHIBIT: B-2

Terracon
Consulting Engineers & Scientists

**Project Name:** Arlington Walgreens **Date:** 10/2/2013

**Project Number:** 81135070

**Client:** CAP

# Report of Determination

## Organic Content ASTM D2974/ D2216

| | |
|---|---|
| **Sample:** | S-2 |
| **Location:** | B-5 |
| **Depth:** | 4' |
| **Organic Content, percent:** | 9.63% |
| **Moisture Content:** | 31.2% |

**Tested by:** NT
**Reviewed by:** JW

Respectfully submitted,

By Jeff Ward

# SUPPORTING INFORMATION

**Contents:**

# GENERAL NOTES

## DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

**Albertsons - Safeway Store #1522 Expansion ■ Arlington, WA**
**Terracon Project No. 81225052**

## SAMPLING

⧗ Modified Dames & Moore Ring Sampler

☒ 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**<br>(More than 50% retained on No. 200 sieve.)<br>Density determined by Standard Penetration Resistance | | **CONSISTENCY OF FINE-GRAINED SOILS**<br>(50% or more passing the No. 200 sieve.)<br>Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance | | |
|---|---|---|---|---|
| **Descriptive Term (Density)** | **Standard Penetration or N-Value Blows/Ft.** | **Descriptive Term (Consistency)** | **Unconfined Compressive Strength Qu, (tsf)** | **Standard Penetration or N-Value Blows/Ft.** |
| Very Loose | 0 - 3 | Very Soft | less than 0.25 | 0 - 1 |
| Loose | 4 - 9 | Soft | 0.25 to 0.50 | 2 - 4 |
| Medium Dense | 10 - 29 | Medium Stiff | 0.50 to 1.00 | 4 - 8 |
| Dense | 30 - 50 | Stiff | 1.00 to 2.00 | 8 - 15 |
| Very Dense | > 50 | Very Stiff | 2.00 to 4.00 | 15 - 30 |
| | | Hard | > 4.00 | > 30 |

## 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.

# UNIFIED SOIL CLASSIFICATION SYSTEM

| 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” | | 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 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] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \text{ x } D_{60}}$

[F] If soil contains ≥ 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 ≥ 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 ≥ 30% plus No. 200 predominantly sand, add “sandy” to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] PI ≥ 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.