



ECS Southeast, LLC

Geotechnical Engineering Report
Express Oil Change - Sevierville

Winfield Dunn Parkway
Sevierville, Tennessee

ECS Project No. 26:6578

February 16, 2024





ECS SOUTHEAST, LLC

Geotechnical • Construction Materials • Environmental • Facilities

February 16, 2024

Mr. Justin Duck
Express Oil Change, LLC
1880 Southpark Drive
Birmingham, AL 35244

ECS Project No. 26:6578

Reference: Geotechnical Engineering Report
Express Oil Change - Sevierville
Winfield Dunn Parkway
Sevierville, Tennessee

Dear Mr. Duck:

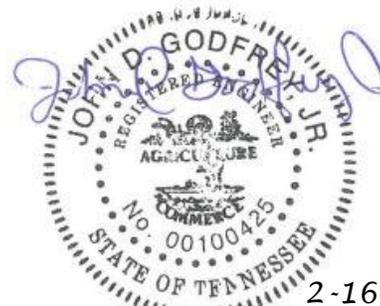
ECS Southeast, LLC (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Express Oil Change, LLC during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Southeast, LLC

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2-16-2024

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"ONE FIRM. ONE MISSION."

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EXECUTIVE SUMMARY

ECS Southeast, LLC (ECS) has completed the subsurface exploration for the proposed Express Oil Change with associated parking/drive lanes at Winfield Dunn Parkway in Sevierville, Tennessee. The project information summarized below is based exclusively on the information made available to us by the client at the time of this report and the results of our subsurface exploration. Our findings, conclusions, and recommendations are summarized below.

PROJECT INFORMATION:

- Site Location: Winfield Dunn Parkway, Sevierville, Tennessee
- Building Scope: Commercial
- Assumed Loads: Max. column loads = 25 kips, Max. wall loads = 2.5 klf
- Earthwork: Unknown at this time; +/- 3 feet cut/fill assumed
- Sitework: Parking lot, drive lanes, SWM facility and underground utilities

SUBSURFACE CONDITIONS:

- Field Exploration: 6 SPT borings in the proposed construction area
- Surface Material: Not encountered in our boring locations.
- Existing Fill: LEAN CLAY (CL) with varying amounts of gravel and sand
- Native Material: LEAN CLAY (CL) with varying amounts of gravel and sand
- Refusal Materials: Not encountered in our boring locations.
- Groundwater: Not encountered in our boring locations.

GEOTECHNICAL CONCERNS:

- Presence of undocumented fill

DESIGN & CONSTRUCTION RECOMMENDATIONS:

- Foundations: 2,500 psf on approved undocumented fill/native soils
- Slabs-on-Grade: Modulus of Subgrade Reaction, $k = 110$ pci/in
- Seismic Design: Seismic Site Class "D-Default"

This Executive Summary is intended as a very brief overview of the primary geotechnical conditions that are expected to affect design and construction. Information gleaned from this Executive Summary should not be utilized in lieu of reading the entire geotechnical report. Details of our conclusions and recommendations are discussed in the report text.

1.0 INTRODUCTION

Our services were provided in accordance with our Proposal No. 26:11854, dated December 21, 2023, as authorized by Express Oil Change, LLC on January 3, 2024, which includes our Terms and Conditions of Service.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- Observations from our site reconnaissance including current site conditions, surface drainage features, and surface topographic conditions.
- A subsurface characterization and a description of the field exploration and laboratory tests were performed. Groundwater concerns relative to the planned construction are summarized. Expected geological or seismic hazards are also addressed.
- Final logs of the soil borings and records of the field exploration prepared in accordance with the standard practice for geotechnical engineering. A boring location plan is included, and the results of the laboratory tests were plotted on the final boring logs and included on a separate test report sheet. Existing approximate elevation were recorded for each top of boring, based on interpolation of approximate locations and contour information.
- Recommendations for allowable bearing pressures for conventional shallow foundation systems and estimates of predicted total and differential foundation settlement.
- Recommendations for floor slab construction, including recommendations for subgrade modulus and subgrade improvements.
- Recommendations for lateral earth pressures likely to develop on below-grade walls, as well as perimeter and underdrainage systems for below-grade walls.
- Evaluation of the on-site soil characteristics encountered in the soil borings. Specifically, we discuss the on-site materials for re-use as engineered fill to support slabs and pavements. We also included compaction requirements and material guidelines.
- Recommended seismic site class in accordance with the International Building Code (IBC 2018) and our knowledge of the site geology.
- Recommended flexible asphalt and rigid concrete pavement sections (light duty and heavy duty) based on assumed loading conditions and assumed California Bearing Ratio (CBR) values.
- Recommendations for additional testing and/or consultation that might be required to complete the geotechnical assessment and related engineering for this project.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE

The project site is located at Winfield Dunn Parkway in Sevierville, Tennessee. The site is currently a vacant lot bounded to the Old Douglas Dam Road to the north, an empty lot to the east, a commercial building to the west and North Winfield Dunn Parkway to the south. Based on elevations obtained from Google Earth, the site appears to undergo approximately 12 feet of topographic relief from +901 to +913 feet MSL. Based on the historical aerial map obtained from Google Earth, it appears that the site was occupied by two buildings to the north and south corner. The buildings occupied the site back to 1992 and demolished between 2015 and 2016. It also appears that the site has been mass-graded recently.



Figure 2.1.1. Site Location Shown

2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the planned development including proposed buildings and related infrastructure.

Table 2.2.1 Design Information

| SUBJECT | DESIGN INFORMATION / ASSUMPTIONS |
|-------------------------------|--|
| Development Footprint | Approximately 6,500 square feet in plan view |
| # of Stories | One-story |
| Usage | Commercial |
| Assumed Column Loads | 25 kips (Full Dead and Factored Live) |
| Assumed Wall Loads | 2.5 kips per linear foot (klf) maximum |
| Lowest Finish Floor Elevation | Unknown at this time |

3.0 FIELD EXPLORATION

The field exploration was planned with the objective of characterizing the project site in general geotechnical and geological terms to assist in developing geotechnical recommendations for the project.

3.1.1 Test Borings

The subsurface conditions were explored by drilling six (6) soil test borings within the proposed construction area. A truck-mounted drill rig was utilized to drill the soil test borings. Borings were advanced to a total depth of approximately 10 to 20 feet below the ground surface (the approximate boring termination depth).

Boring locations were identified in the field by drilling personnel at the time of the mobilization of our drilling equipment. The approximate as-drilled boring locations are shown on the Boring Location Diagram in Appendix A. Ground surface elevations noted on our boring logs were obtained from Google Earth and should be considered approximate.

Standard penetration tests (SPT's) were conducted in the borings at regular intervals in general accordance with ASTM D 1586. Small representative samples were obtained during these tests and were used to classify the soils encountered. The standard penetration resistances obtained provide a general indication of soil shear strength and compressibility.

3.1.2 Laboratory Testing Program

A geotechnical engineer classified each SPT soil sample on the basis of texture and plasticity in general accordance with the Unified Soil Classification System (USCS, ASTM D 2487). The group symbols for each soil type are indicated in parentheses following the soil descriptions on each boring log. The engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between materials on the exploration records should be considered approximate; in situ, the transitions may be gradual.

Representative soil samples were selected and tested in our laboratory to check field classifications and to determine pertinent index properties. The laboratory testing program included:

- Natural moisture content determinations (ASTM D 2216)
- Atterberg Limits tests (ASTM D 4318)
- Percent Passing #200 Sieve (ASTM D 1140)

The soil samples will be retained in our laboratory for a period of 60 days, after which, they will be discarded unless other instructions are received as to their disposition.

3.2 REGIONAL/SITE GEOLOGY

The USGS Geologic Map of the Great Smokey Mountains Quadrangle (1964) indicates this particular site is underlain by Undifferentiated Quaternary Alluvial Deposits. The material comprising of coarse alluvium of present valleys; terrace deposits on benches above present drainage; bouldery alluvium of piedmont coves; block fields on mountain slopes.

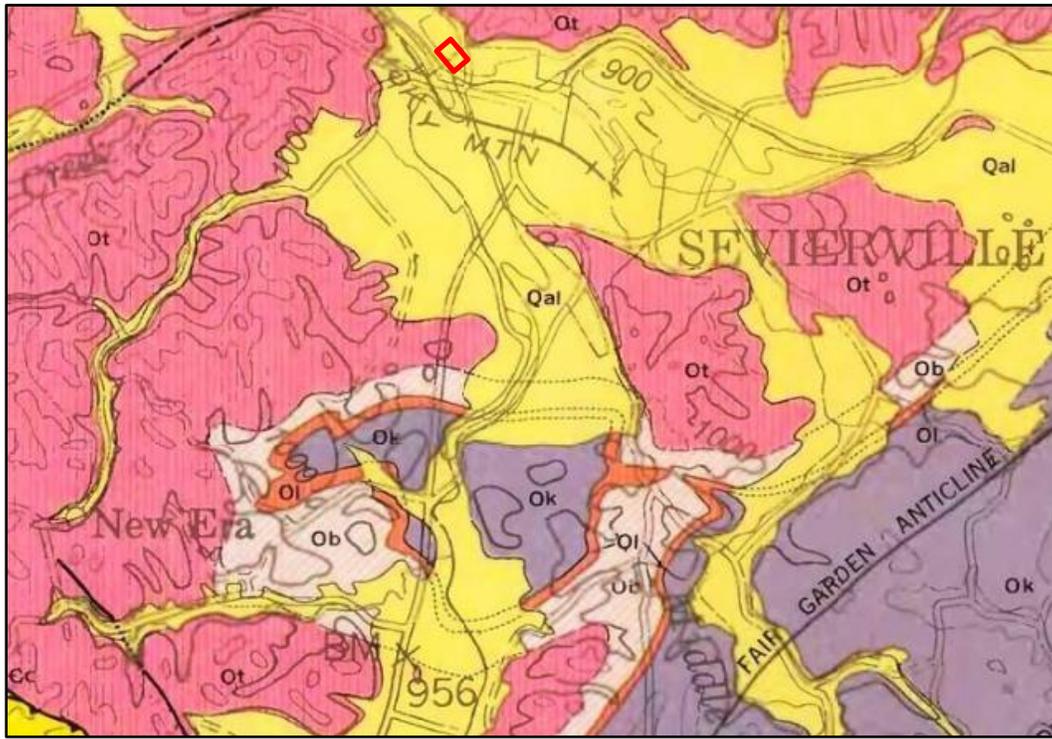


Figure 3.1.1 - USGS Geologic Map of the central Great Smoky Mountain (approximate site location outlined in red)

3.3 SUBSURFACE CHARACTERIZATION

The site subsurface conditions were evaluated with six (6) SPT borings at the approximate locations shown on the Boring Location Diagram in the Appendix. The quantity of borings, boring locations, and drilling depths were discussed with the project team prior to completing this subsurface exploration.

The following tables provides generalized characterizations of the soil and rock strata encountered during our subsurface exploration.

Table 3.3.1 - Summary of Subsurface Conditions

| Boring No. | Undocumented Fill | | Native Material | | End of Boring Depth (ft) |
|------------|-------------------|----------------|-----------------|----------------|--------------------------|
| | Depth (ft) | N-Values (bpf) | Depth (ft) | N-Values (bpf) | |
| B-01 | 0 – 3 | 10 | 3 – 10 | 9 – 18 | 10 |
| B-02 | 0 – 3 | 14 | 3 – 10 | 10 – 18 | 10 |
| B-03 | - | - | 0 – 15 | 11 – 16 | 15 |
| B-04 | 0 – 3 | 9 | 3 – 20 | 12 – 34 | 20 |
| B-05 | - | - | 0 – 10 | 12 – 18 | 10 |
| B-06 | 0 – 3 | 11 | 3 – 10 | 12 – 18 | 10 |

NOTE: bpf – blows per foot

The subsurface conditions presented in Tables 3.3.1 and shown on the Boring Logs should be considered approximate, based on interpretation of the exploration data using normally accepted geotechnical engineering judgments. It should be noted that transitions between different soil strata are typically less distinct than that shown on the exploration records. Subsurface conditions between the actual boring locations will vary. In addition, surficial material depths may also vary significantly across the site from those we encountered.

3.4 LABORATORY TEST RESULTS

Laboratory index test results indicate the in-situ moisture contents of the tested samples ranged from approximately 8 to 31 percent.

Atterberg Limits tests performed on a select soil sample from Borings B-03 and B-04 indicated low plasticity LEAN CLAY (CL) with Liquid Limits of 31 and 44, and Plasticity Indices of 14 and 22, respectively.

These results have been included on the boring logs, separate report sheets, and Laboratory Testing Summary in the Appendix.

3.5 GROUNDWATER OBSERVATIONS

During drilling operations, groundwater was not encountered. A 48-hour reading of groundwater was conducted at Boring B-04 after drilling and less than approximately 3 inches of water was encountered in the borehole. However, it is highly possible that surface water due to wet weather conditions on the days of fieldwork as the result of heavy rain and snow infiltrates the borehole. It should be noted that it is possible for perched water to exist within the depths explored for the rest of the borings during other times of the year depending upon climatic and rainfall conditions. Additionally, discontinuous zones of perched water may exist within the native material.

Variations in the location of the long-term water table may occur as a result of change in precipitation, evaporation, surface water runoff, and other factors not immediately apparent at the time of this exploration.

4.0 DESIGN RECOMMENDATIONS

4.1 GENERAL

The primary purpose of this geotechnical exploration was to help identify and evaluate the general subsurface conditions relative to the proposed construction. Our recommendations have been developed on the basis of the previously described project information and subsurface conditions identified during this study. The following is a brief discussion of the potential geotechnical hazards encountered during our subsurface exploration.

4.1.1. Presence of Existing Fill Material: Existing undocumented fill materials were encountered during our exploration at our boring locations. The samples obtained appeared relatively free of deleterious material. However, information pertaining to the age, placement and compaction of the fill was not available, although we do believe the fill was placed as part of the development for the previous structure that has been demolished and it appeared that some compaction effort has been performed. As is the case with fill placed without technical observations, the possibility exists that the fill may contain concentrated amounts of deleterious material and soft compressible zones not disclosed by our borings.

Accordingly, there are certain risks associated with construction on these types of fills. The risk primarily consists of excessive and/or non-uniform settlement caused by extensive zones or pockets of soft, loose, or uncompacted material. The risk could be reduced with documentation supporting acceptable fill placement methods and compaction. Based on the SPT N-values taken within the fill material stratum, it does appear that some compactive effort was performed upon the soils as part of the existing development. The undocumented fill materials should be handled in accordance with the recommendations in this report as discussed in Section 4.3.2.

4.1.2 Construction Monitoring: ECS should be on-site full-time during earthwork and foundation construction activities to document that our recommendations are followed and to provide recommendations for remedial activities, where necessary.

4.2 SUBGRADE PREPARATION

The following sections describe our general recommendations for preparing the site subgrade prior to fill placement operations.

4.2.1 Stripping and Grubbing

Surface material was not encountered at our boring locations. The subgrade preparation should consist of stripping the vegetation, rootmat, topsoil, and soft or poor-quality materials from the 10-foot expanded building and 5-foot expanded pavement limits, and 5 feet beyond the toe of structural fills. ECS should be retained to verify that surficial materials have been removed prior to the placement of structural fill or construction of structures.

The site was previously occupied with a structure that has been demolished between 2015 and 2016. The buried (below grade) components associated with previous structures (e.g., foundations, utilities, grease traps, buried basements etc.) can cause new construction to behave poorly for many reasons, including stress concentrations resulting from point loading and poor support caused by old backfill. These components are required to be removed and addressed properly. Also, Cosmetic, and structural damage to the overlying construction can result if the demolished building components are not removed and

properly addressed during construction. It is important that subgrades are carefully evaluated during construction for poorly compacted backfill associated with buried or removed building components and improved as recommended by ECS during construction.

4.2.2 Existing Man-Placed Fill

Fill Content: Based on the visual assessment of soil samples collected during drilling, apparent fill was observed in the boring locations to depths of approximately 3 feet below the ground surface. Based on our review of historical satellite imagery, the fill appears to have been placed during construction of the previous structure that occupied the site. The information pertaining to the age, placement and compaction of the fill was not available. As is the case with fill placed without technical observations, the possibility exists that the fill may contain concentrated amounts of deleterious material and soft compressible zones not disclosed by our borings.

Accordingly, there are certain risks associated with construction on these types of fill. The risk primarily consists of excessive and/or non-uniform settlement caused by extensive zones or pockets of soft, loose, or uncompacted material. The risk could be reduced with documentation supporting acceptable fill placement methods and compaction. Based on the SPT N-values taken within the fill material stratum, it does appear that some compactive effort was performed upon the soils as part of the existing development.

Foundations: Where the existing fill materials are encountered at the foundation bearing levels, ECS recommends Dynamic Cone Penetrometer (DCP) testing be performed to further evaluate the existing fill soils.

Slab-on-Grade Areas: It is recommended that the existing fill should be proofrolled and/or tested using a DCP. The fill materials that are found to yield or rut when proofrolled should be removed and replaced with structural fill soils.

Pavement Areas: For the parking/drive lanes, existing fill may be left as-is if it can pass a proofroll as detailed in Section 4.3.5 of this report.

Re-Use of Fill: Based on the results of the laboratory testing indicating the soils are a low plasticity clay, it appears that the majority of this fill may be re-used as engineered fill at the site in structural fill areas.

Test Pits: In regard to the undocumented fill material, it is possible for deleterious materials to exist in areas where we did not explore. Furthermore, ECS recommends that test pits are completed at the site to further evaluate the existing undocumented fill. The test pits can be completed during the site stripping phase.

4.2.3 Excavation Considerations

The soil encountered within the borings should generally be excavatable with conventional earth moving equipment such as pans/scrapers, loaders, bulldozers, rubber-tired backhoes, etc. However, large boulders which may be present within the existing fill will require large tack-hoes or dozers and/or hoe-ramming for excavation.

Areas of mass excavation, trenches and pits should meet the requirements of the most current Occupational Safety and Health Administration (OSHA) 29 CFR Part 1926, "Occupational Safety and Health Standards-Excavations". Site excavation safety should be solely the responsibility of the contractor and his subcontractors.

4.2.4 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by an ECS field technician. The exposed subgrade should be thoroughly proofrolled with construction equipment having a minimum axle load of 10 tons [e.g. fully loaded tandem-axle dump truck]. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of an ECS technician. This procedure is intended to assist in identifying localized yielding materials. If the existing cut subgrade materials consist of bedrock, proofrolling will not be required.

Where proofrolling identifies areas that are yielding or “pumping” subgrade those areas should be repaired prior to the placement of subsequent structural fill or other construction materials. Undercut areas may be backfilled with compacted shotrock fill, engineered fill, compacted dense-grade aggregate base, or flowable fill once adequate subgrade soils have been encountered. If soft or yielding subgrade soils are not encountered after the initial 3 to 4 feet of undercut in pavement or slab-on-grade areas, the backfill recommendations in Table 4.2.4.1 may be utilized.

Table 4.2.4.1 – Maximum Undercut Remediation Recommendations

| Maximum Undercut Depth | Backfill Requirements |
|------------------------|---|
| No Undercut | Cement treat upper 12 inches of subgrade |
| 3 feet | Layer of Tensar TX 140 grid or equivalent and 3 feet of granular stone or shotrock fill |
| 4 feet | 4 feet of granular material or shotrock fill |

4.3 EARTHWORK OPERATIONS

4.3.1 Structural Fill

Prior to placement of structural fill, representative bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which will typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications. The fill should exhibit a maximum dry density of at least 90 pounds per cubic foot, as determined by a Standard Proctor compaction test (ASTM D 698). Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

Structural Fill Materials: Materials for use as structural fill should consist of inorganic soils with the following engineering properties and compaction requirements.

Table 4.3.1.1 – Structural Fill Recommendations

| Material Type | Subject | Property |
|---------------|--|------------------|
| Soil Fill | Building and Pavement Areas | LL < 45, PI<25 |
| | Building and Pavement Areas Below upper 2 feet | LL < 60, PI<35 |
| | Max. Particle Size | 4 inches |
| | Max. organic content | 5% by dry weight |
| Shotrock Fill | Max. Amount of Fines (Pass No. 4 sieve) | 20% by weight |
| | Max. Particle Size | 18 inch |

Table 4.3.1.2 – Structural Fill Compaction Recommendations

| Subject | Requirement |
|---------------------|---|
| Compaction Standard | Standard Proctor, ASTM D698 |
| Required Compaction | 95% of Max. Dry Density |
| Moisture Content | -2 to +3 % points of the soil's optimum value |
| Loose Thickness | 8 inches prior to compaction |

Fill Compaction Control: The expanded limits of the proposed construction areas should be well defined, including the limits of the fill zones for buildings, pavements, and slopes, etc., at the time of fill placement. Grade controls should be maintained throughout the filling operations. Filling operations should be observed on a full-time basis by ECS to document that the minimum compaction requirements are being achieved. Field density testing of fills should be performed at the frequencies shown in Table 4.3.1.3, but not less than 2 tests per lift.

Table 4.3.1.3 Frequency of Compaction Tests in Fill Areas

| Location | Frequency of Tests |
|--------------------------|------------------------------------|
| Expanded Building Limits | 1 test per 2,500 sq. ft. per lift |
| Pavement Areas | 1 test per 10,000 sq. ft. per lift |
| Utility Trenches | 1 test per 200 linear ft. per lift |

Fill Placement: Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen materials at the time of placement, and frozen or frost-heaved soils should be removed prior to placement of structural fill or other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned.

At the end of each work day, fill areas should be graded to facilitate drainage of precipitation and the surface should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the Contractor may need to scarify existing subgrades to a depth on the order of 4 inches so that a weak plane will not be formed between the new fill and the existing subgrade soils.

Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, earthwork should be performed during the warmer, drier times of the year, if practical. Proper drainage

should be maintained during the earthwork phases of construction to reduce the likelihood ponding of water which has a tendency to degrade subgrade soils.

Where fill materials will be placed to widen existing embankment fills, or placed up against sloping ground, the soil subgrade should be scarified and the new fill benched or keyed into the existing material. Fill material should be placed in horizontal lifts. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 inches to 4 inches may be required to achieve specified degrees of compaction.

We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. We do not anticipate significant problems in controlling moisture within the fill during dry weather, but moisture control may be difficult during winter months or extended periods of rain. The control of moisture content of higher plasticity soils is difficult when these soils become wet. Further, such soils are easily degraded by construction traffic when the moisture content is elevated.

4.4 FOUNDATION DESIGN

Provided subgrades and structural fills are prepared as discussed herein, the proposed structure can be supported by conventional shallow foundations consisting of individual column footings and continuous wall footings. The design of the foundation should utilize the following parameters:

Table 4.4.1 Foundation Design

| Design Parameter | Column Footing | Wall Footing |
|---|---|---|
| Foundation Type | Shallow Footings | Shallow Footings |
| Net Allowable Bearing Pressure ⁽¹⁾ | 2,500 psf – Approved Existing Fill, Structural Fill, or Native Material | 2,500 psf – Approved Existing Fill, Structural Fill, or Native Material |
| Minimum Width | 24 inches | 18 inches |
| Minimum Exterior Frost Depth (below final exterior grade) | 18 inches | 18 inches |
| Sliding Friction Coefficient | 0.3 | 0.3 |
| Passive Soil Resistance | 295 psf | 295 psf |
| Estimated Total Settlement ⁽²⁾ | Less than 1-inch | Less than 1-inch |
| Estimated Differential Settlement ⁽³⁾ | Less than ½ inches between columns | Less than ½ inches along 50 feet |

Notes:

- (1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
- (2) Based on assumed structural loads. If final loads are different, ECS must be contacted to confirm foundation recommendations and settlement calculations.
- (3) Based on assumed or provided column/wall loads and variability in the borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation

bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick “mud mat” of “lean” concrete should be placed on the bearing soils before the placement of reinforcing steel.

Footing Subgrade Observations: Most of the soils at the foundation bearing elevation are anticipated to be adequate for support of the proposed structure. It will be important to have the geotechnical engineer of record observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are capable of supporting the design bearing pressures. If soft or poor-quality soils are observed at the footing bearing elevations, these soils should be undercut and removed. Undercuts should be backfilled with lean concrete ($f'_c \geq 1,000$ psi at 28 days) or dense graded aggregate fill up to the original design bottom of footing elevation; the original footing should be constructed on top of the hardened lean concrete or aggregate fill.

4.5 SLABS ON GRADE

Assuming the undocumented fill in the building areas can pass a proofroll as discussed in section 4.2.4, the soil appears to be adequate to support a typical slab on grade construction. The following graphic depicts our supported slab recommendations:

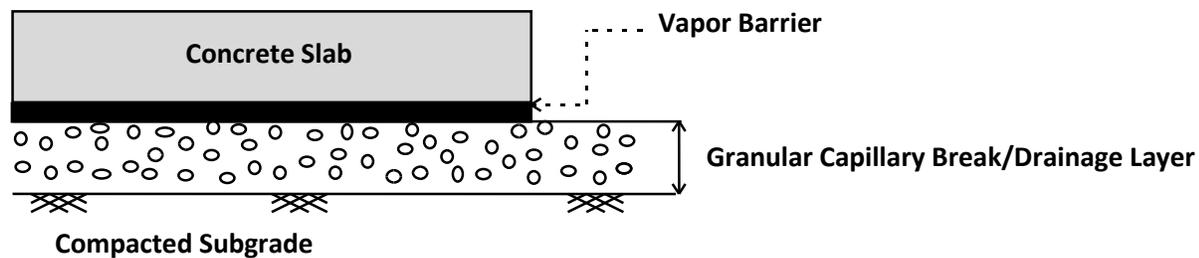


Figure 4.5.1

1. Drainage Layer Thickness: 4 inches
2. Drainage Layer Material: GRAVEL (GP, GW), SAND (SP, SW)

Slab Subgrade Verification: Prior to placement of a drainage layer, the subgrade should be observed through proofrolling as discussed in Section 4.2.4.

Subgrade Modulus: Provided the slab will bear on approved soils, the slab may be designed assuming a modulus of subgrade reaction, k_1 of 110 pci (lbs./cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

Vapor Barrier: Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture penetration through the floor slab. When a vapor barrier is used, special attention should be given to surface curing of the slab to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.

Slab Isolation: Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration does not allow

the use of a free-floating slab such as in a drop-down footing/monolithic slab configuration, the slab should be designed with adequate reinforcement and load transfer devices to avoid overstressing of the slab.

4.6 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The Chapter 16 of the International Building Codes (IBC) 2018 is utilized by structural engineers to calculate the acceleration response spectra from earthquake motions in the design of the lateral force resistant members of structures.

At least two methods are utilized in classifying sites, namely the shear wave velocity (v_s) method and the Standard Penetration Resistance (N-value) method. The second method (N-Value) was used in classifying this site.

The seismic site class definitions based on the average N-value in the upper 100 feet of the subsurface profile are presented in Table 1613.5.2 of the Code and are summarized below.

Table 4.6.1. Seismic Site Classification

| Site Class | Soil Profile Name | Shear Wave Velocity, V_s , (ft./s) | N value (bpf) |
|------------|-------------------------------|--------------------------------------|---------------|
| A | Hard Rock | $V_s > 5,000$ fps | N/A |
| B | Rock | $2,500 < V_s \leq 5,000$ fps | N/A |
| C | Very dense soil and soft rock | $1,200 < V_s \leq 2,500$ fps | >50 |
| D | Stiff Soil Profile | $600 \leq V_s \leq 1,200$ fps | 15 to 60 |
| E | Soft Soil Profile | $V_s < 600$ fps | <15 |

Based upon our interpretation of the subsurface conditions, the appropriate Seismic Site Classification is “D” as shown in the preceding table.

Ground Motion Parameters: In addition to the seismic site classification, ECS has determined the design spectral response acceleration parameters following the IBC methodology. The Mapped Responses were estimated from the USGS website <https://earthquake.usgs.gov/ws/designmaps/>. The design responses for the short (0.2 sec, S_{DS}) and 1-second period (S_{D1}) are noted in bold at the far-right end of the following table.

Table 4.6.2. Ground Motion Parameters “Class D” (IBC 2018 Method)

| Period (sec) | Mapped Spectral Response Accelerations (g) | | Values of Site Coefficient for Site Class | | Maximum Spectral Response Acceleration Adjusted for Site Class (g) | | Design Spectral Response Acceleration (g) | |
|--------------|--|-------|---|-------|--|-------|---|--------------|
| Reference | Figures 1613.3.1 (1) & (2) | | Tables 1613.3.3 (1) & (2) | | Eqs. 16-37 & 16-38 | | Eqs. 16-39 & 16-40 | |
| 0.2 | S_s | 0.511 | F_a | 1.391 | $S_{MS}=F_a S_s$ | 0.711 | $S_{DS}=2/3 S_{MS}$ | 0.474 |
| 1.0 | S_1 | 0.122 | F_v | 2.356 | $S_{M1}=F_v S_1$ | 0.288 | $S_{D1}=2/3 S_{M1}$ | 0.192 |

The Site Class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses. If a higher site classification is beneficial to the project, we can provide additional testing methods that may yield more favorable results.

4.7 PAVEMENTS

The final grading plan was not provided at the time of this report. Based on the results of our borings and our expected final grades, it appears that the pavement subgrades will consist mainly of approved existing fill material, native LEAN CLAY (CL), or a structural fill material. CBR testing was not performed as part of this study. Therefore, we have assumed a CBR value of 3 for preliminary design purposes.

We were not provided traffic loading information, so we have assumed loadings typical of this type of project in the following table assuming a 20-year design life and 90% reliability:

Table 4.7.1. Pavement Loading Assumptions

| Vehicle Description | Light Duty (15,000 ESAL) | | Heavy Duty (50,000 ESAL) | |
|------------------------|--------------------------|---------------|--------------------------|---------------|
| | Number of Trips per Day | Days Per Week | Number of Trips | Days Per Week |
| Passenger Car | 250 | 7 | 250 | 7 |
| Package Delivery Truck | 2 | 7 | 2 | 7 |
| Garbage Truck | 1 | 2 | 1 | 2 |
| Semi-tractor trailer | - | - | 1 | 7 |

The preliminary pavement sections below are guidelines that may or may not comply with local jurisdictional minimums.

Table 4.7.2. Proposed Pavement Sections

| MATERIAL | FLEXIBLE PAVEMENT | | RIGID PAVEMENT | |
|---|-------------------|------------|----------------|------------|
| | Light Duty | Heavy Duty | Light Duty | Heavy Duty |
| Portland Cement Concrete ($f'_c = 4000$ psi) | - | - | 5 in. | 6 in. |
| Asphaltic Surface Course | 1 in. | 1 in. | - | - |
| Asphaltic Binder Course | 2 in. | 2 ½ in. | - | - |
| Crushed Stone Base ¹ | 6 in. | 8 in. | 5 in. | 5 in. |

In general, heavy-duty sections are areas that will be subjected to trucks, buses, or other similar vehicles including main drive lanes of the development. Light duty sections are appropriate for vehicular traffic and parking areas.

Large, front loading trash dumpsters frequently impose concentrated front wheel loads on pavements during loading. This type of loading typically results in rutting of asphalt pavement and ultimately pavement failures. For preliminary design purposes, we recommend that the pavement in trash pickup areas consist of a 6-inch thick, 4,000 psi, reinforced concrete slab over 6-inches of dense graded aggregate. When traffic loading becomes available ECS or the Civil Engineer can design the pavements.

Pavement Maintenance: Regular maintenance and occasional repairs should be implemented to keep pavements in a serviceable condition. In addition, to help reduce water infiltration to the pavement section and within the base course layer resulting in softening of the subgrade and deterioration of the

pavement, we recommend the timely sealing of joints and cracks using proper sealants. We recommend exterior pavements be reviewed for distress/cracks twice a year, once in the spring and once in the fall.

Sound maintenance programs should help maintain and enhance the performance of pavements and attain the design service life. A preventative maintenance program should be implemented early in the pavement life to be effective. The “standard in the industry” supported by research indicates that preventative maintenance should begin within 2 to 5 years of the pavement construction. Failure to perform preventative maintenance will reduce the service life of the pavement and increase the costs for both corrective maintenance and full pavement rehabilitation.

4.8 BELOW GRADE WALLS

We recommend that permanent below grade walls be designed to withstand lateral earth pressures and surcharge loads from soil, adjacent building foundations, or streets. We recommend that walls that are restrained from movement at the top be designed for a linearly increasing lateral earth pressure.

The following Figure depicts the suggested lateral earth pressure condition for an “undrained condition” with restrained wall tops:

This diagram is not applicable for the design of Support of Excavation or temporary shoring systems.

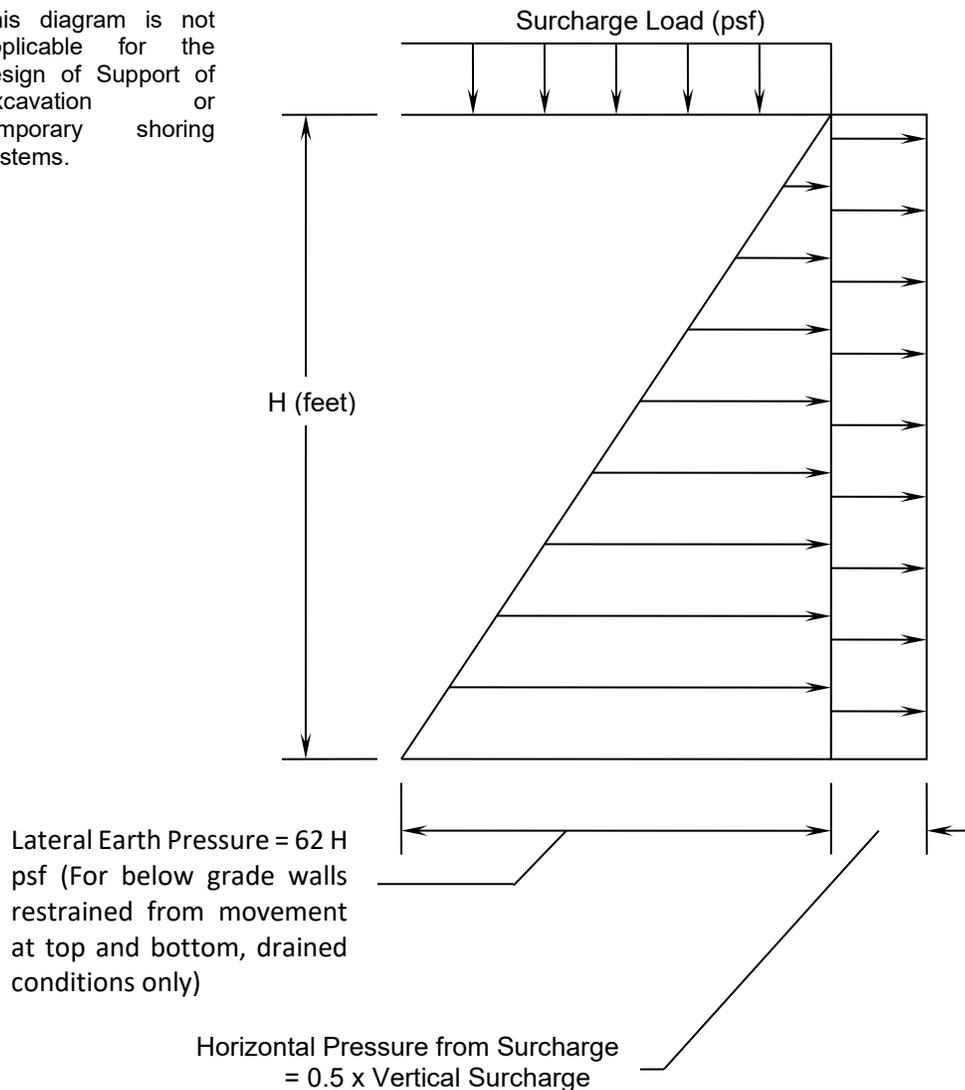


Figure 4.8.1

Surcharge loads imposed within a 45-degree slope of the base of the wall should be considered in the below grade wall design. The influence of these surcharge loads on the below grade walls should be based on an at-rest pressure coefficient, k_0 , of 0.5 in the case of restrained walls.

Lateral Earth Pressures: Below grade walls should be designed to withstand the lateral earth pressures exerted by the backfill. The pressure diagram is triangular. For design of below grade retaining wall structures, the following soil parameters can be utilized. These parameters assume that “drained” granular soils meeting the requirements recommended herein for retaining wall backfill will comprise the backfill in the critical zone. The critical zone is defined as the area between the back of the retaining wall structure and an imaginary line projected upward and rearward from the bottom back edge of the wall footing at a 45-degree angle.

Table 4.8.1. Retaining Wall Backfill in the Critical Zone

| Soil Parameter | Estimated value Select Granular Fill | Estimated value 57 or 67 Stone |
|---|--|-----------------------------------|
| Coefficient of Earth Pressure at Rest (K_o) | 0.47 | 0.35 |
| Coefficient of Active Earth Pressure (K_a) | 0.31 | 0.22 |
| Coefficient of Passive Earth Pressure (K_p) | 3.25 | 4.6 |
| Retained Soil Moist Unit Weight (γ) | 130 pcf | 105 pcf |
| Cohesion (C) | 0 psf | 0 psf |
| Angle of Internal Friction (ϕ) | 32° | 40° |
| Friction Coefficient (μ) | 0.50 | 0.50 |
| At-rest Equivalent Fluid Pressure | 62H (psf) | 38H (psf) |
| Active Equivalent Fluid Pressure | 40H (psf) | 23H (psf) |
| Passive Equivalent Fluid Pressure | 425H (psf) | 485H (psf) |

Retaining Wall Backfill: Backfill of below-grade walls may consist of well-graded granular materials (SC, SM, SW, GC, GM or GW) may be used. Select granular backfill should consist of clean sands or gravel. ECS’s geotechnical engineer should review the laboratory data for the proposed backfill material, prior to backfill placement, to determine whether the material is consistent with the recommended lateral earth pressures. The first layer of fill should be placed in a relatively uniform horizontal lift and be adequately keyed into the stripped and scarified subgrade soils. The backfill materials should be placed in 8-inch thick loose layers and compacted to at least 95 percent of the Standard Proctor maximum dry density. We recommend that backfill directly behind the walls be compacted with hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within 5 to 10 feet of the wall during backfilling to avoid developing excessive temporary lateral soil pressures.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally adequate for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Loose or poor-quality materials encountered should be removed and replaced with adequately compacted structural fill, or pipe stone bedding material.

Utility Backfilling: The granular bedding material (often #57 stone) should be at least 4 inches thick, but not less than that specified by the civil engineer's project drawings and specifications. We recommend that the bedding materials be placed up to the springline of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for structural fill and fill placement.

5.2 GENERAL CONSTRUCTION CONSIDERATIONS

Moisture Conditioning: During the cooler and wetter periods of the year, delays and additional costs should be anticipated. At these times, reduction of soil moisture may need to be accomplished by a combination of mechanical manipulation and the use of chemical additives, such as lime or cement, in order to lower moisture contents to levels appropriate for compaction. Alternatively, during the drier times of the year, such as the summer months, moisture may need to be added to the soil to provide adequate moisture for successful compaction according to the project requirements.

Subgrade Protection: Measures should also be taken to limit site disturbance, especially from rubber-tired heavy construction equipment, and to control and remove surface water from development areas, including structural and pavement areas. It would be advisable to designate a haul road and construction staging area to limit the areas of disturbance and to reduce construction traffic from excessively degrading sensitive subgrade soils and existing pavement areas. Haul roads and construction staging areas could be covered with excess depths of aggregate to protect those subgrades. The aggregate can later be removed and used in pavement areas.

Surface Drainage: Surface drainage conditions should be properly maintained. Surface water should be directed away from the construction area, and the work area should be sloped away from the construction area at a gradient of 1 percent or greater to reduce the potential of ponding water and the subsequent saturation of the surface soils. At the end of each work day, the subgrade soils should be sealed by rolling the surface with a smooth drum roller to reduce the likelihood of the infiltration of surface water.

Excavation Safety: Cuts or excavations associated with utility excavations may require forming or bracing, slope flattening, or other physical measures to control sloughing and/or reduce the potential for slope failures. Contractors should be familiar with applicable OSHA codes to ensure that adequate protection of the excavations and trench walls is provided.

Erosion Control: The surface soils may be erodible. Therefore, the Contractor should provide and maintain good site drainage during earthwork operations to maintain the integrity of the surface soils. Erosion and sedimentation controls should be in accordance with sound engineering practices and local requirements.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by Express Oil Change. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

Appendix A - Drawings and Reports

Boring Location Diagram(s)

Subsurface Cross-Section(s)



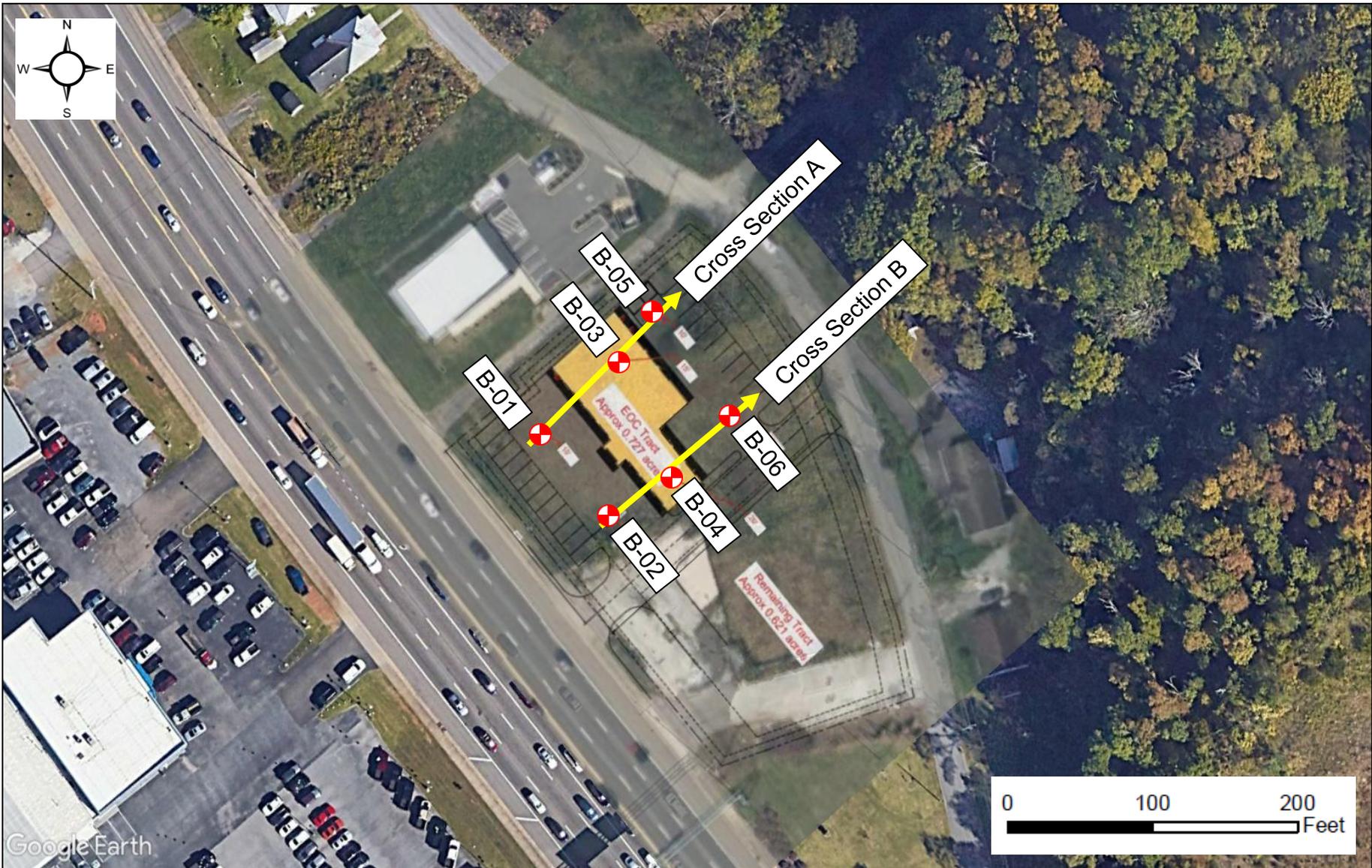
Express Oil Change – Sevierville

Winfield Dunn Parkway
Sevierville, Tennessee
ECS Project No. 26:6578



Site Location Diagram

(approximate site location outlined in red)



Express Oil Change – Sevierville

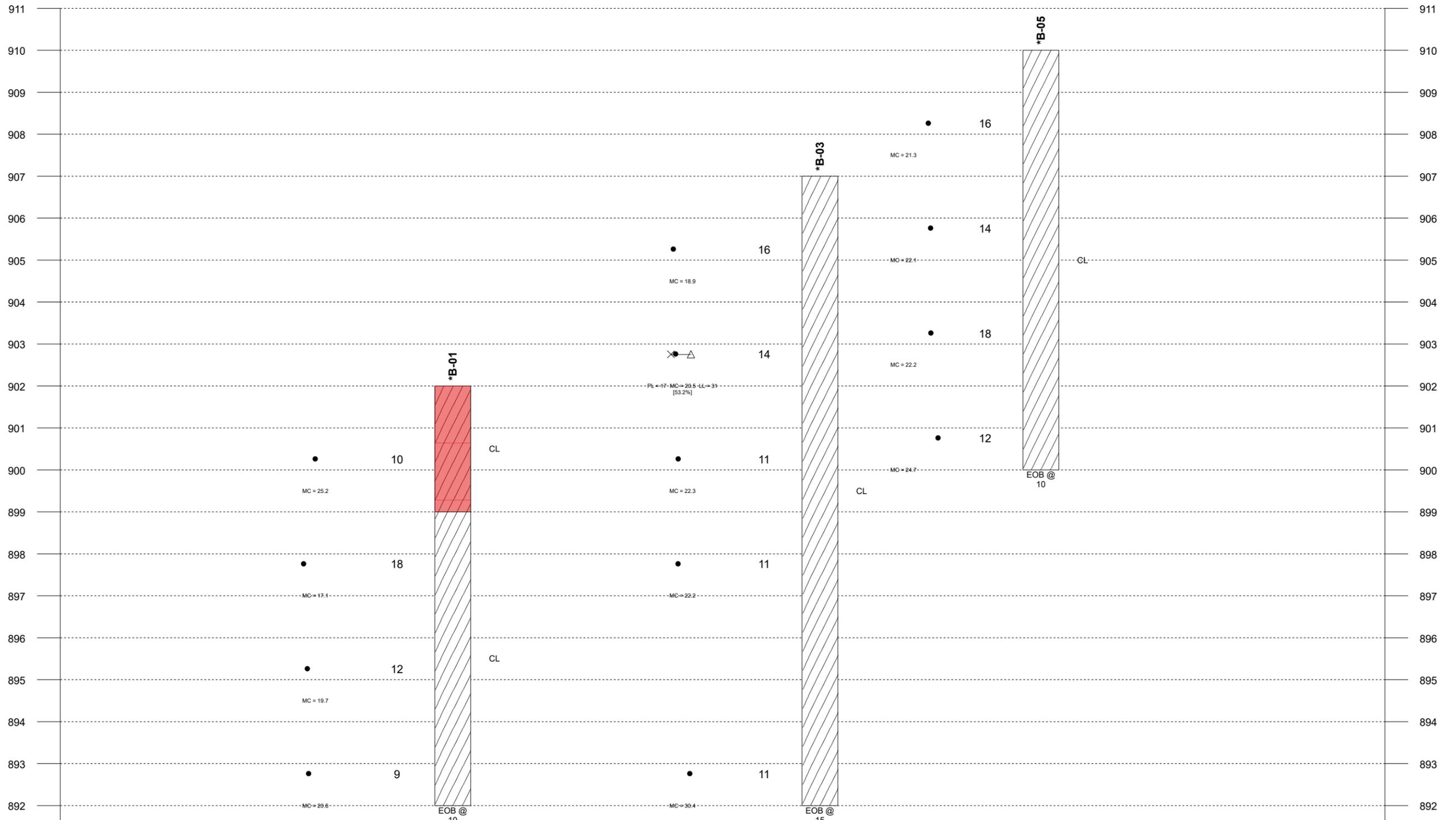
Winfield Dunn Parkway
Sevierville, Tennessee
ECS Project No. 26:6578



Boring Location Diagram



Approximate Boring Location



Legend Key
 Lean CLAY

| | | | | |
|------|-------|-------|--------|--------|
| 0.00 | 27.51 | 95.91 | 137.08 | 166.38 |
|------|-------|-------|--------|--------|

Notes:
 1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
 2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
 3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
 4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

| | | | | |
|---------------------------|---------------|--------------|--------------------------------------|-----------------|
| Plastic Limit | Water Content | Liquid Limit | ▽ WL (First Encountered) | ■ Fill |
| X | ● | △ | ▼ WL (Completion) | ■ Possible Fill |
| [FINES CONTENT %] | | | ▽ WL (Estimated Seasonal High Water) | ■ Probable Fill |
| ▬ BOTTOM OF CASING | | | ▽ WL (Stabilized) | ■ Rock |
| ⊗ LOSS OF CIRCULATION | | | | |
| ○ CALIBRATED PENETROMETER | | | | |



GENERALIZED SUBSURFACE SOIL PROFILE

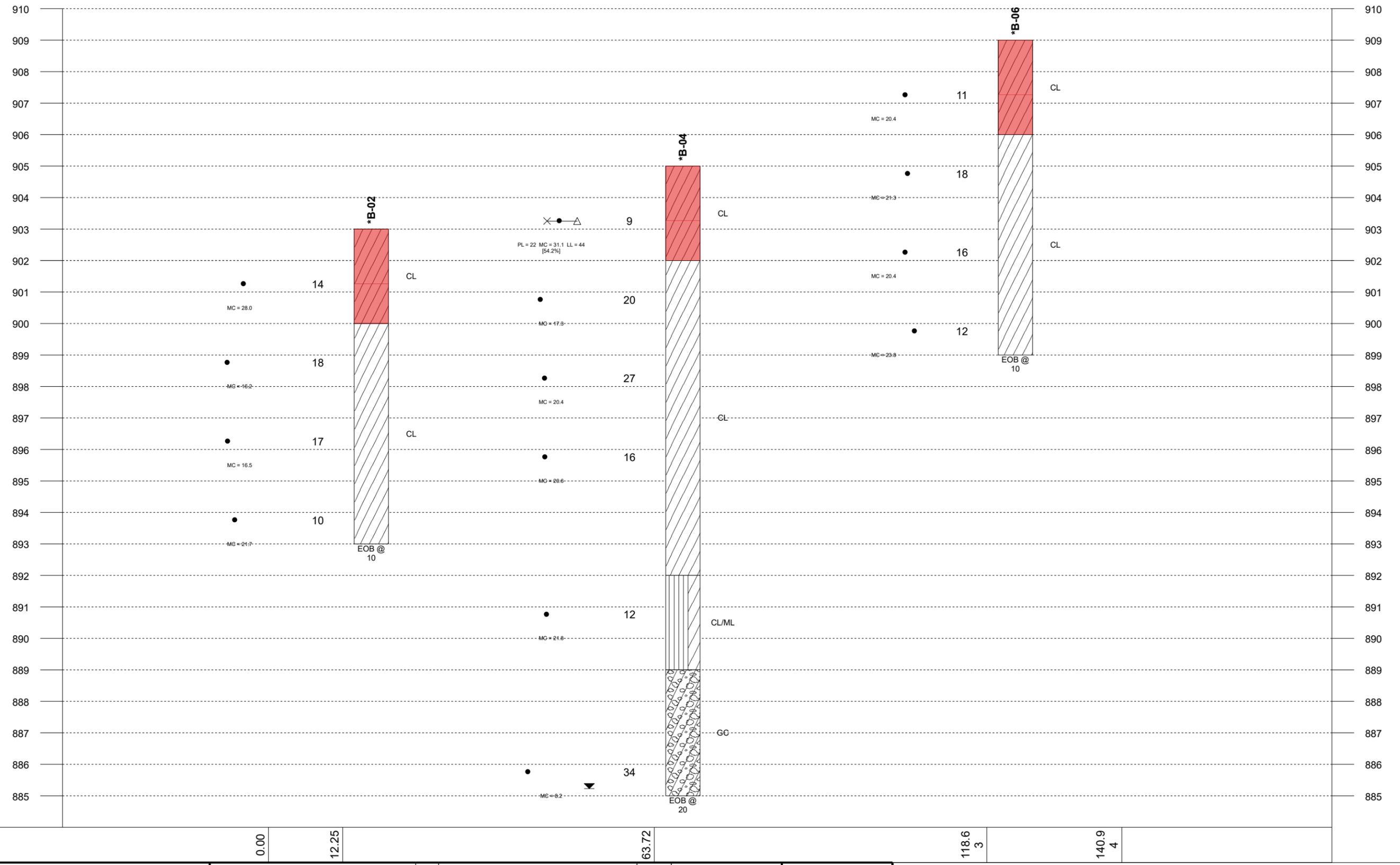
Section line A

Express Oil Change- Sevierville

Express Oil Change, LLC

332 Old Douglas Dam Road, Sevierville, Tennessee, 37876

Project No: 26:6578 Date: 02/14/2024



Legend Key

-  Lean CLAY
-  SILTY CLAY
-  CLAYEY GRAVEL

Notes:
 1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
 2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
 3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
 4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

| | |
|----------|-------------------------|
| ○ | CALIBRATED PENETROMETER |
| ▽ | LOSS OF CIRCULATION |
| ■ | BOTTOM OF CASING |
| [Symbol] | [FINES CONTENT %] |
| X | Plastic Limit |
| ● | Water Content |
| △ | Liquid Limit |

| | |
|---|------------------------------------|
| ▽ | WL (First Encountered) |
| ▽ | WL (Completion) |
| ▽ | WL (Estimated Seasonal High Water) |
| ▽ | WL (Stabilized) |

| | |
|---|---------------|
|  | Fill |
|  | Possible Fill |
|  | Probable Fill |
|  | Rock |



GENERALIZED SUBSURFACE SOIL PROFILE

Section line B

Express Oil Change- Sevierville

Express Oil Change, LLC

332 Old Douglas Dam Road, Sevierville, Tennessee, 37876

Project No: 26:6578 Date: 02/14/2024

Appendix B – Field Operations

Reference Notes

Boring Logs

REFERENCE NOTES FOR BORING LOGS

| MATERIAL ^{1,2} | |
|-------------------------|--|
| | ASPHALT |
| | CONCRETE |
| | GRAVEL |
| | TOPSOIL |
| | VOID |
| | BRICK |
| | AGGREGATE BASE COURSE |
| | GW WELL-GRADED GRAVEL gravel-sand mixtures, little or no fines |
| | GP POORLY-GRADED GRAVEL gravel-sand mixtures, little or no fines |
| | GM SILTY GRAVEL gravel-sand-silt mixtures |
| | GC CLAYEY GRAVEL gravel-sand-clay mixtures |
| | SW WELL-GRADED SAND gravelly sand, little or no fines |
| | SP POORLY-GRADED SAND gravelly sand, little or no fines |
| | SM SILTY SAND sand-silt mixtures |
| | SC CLAYEY SAND sand-clay mixtures |
| | ML SILT non-plastic to medium plasticity |
| | MH ELASTIC SILT high plasticity |
| | CL LEAN CLAY low to medium plasticity |
| | CH FAT CLAY high plasticity |
| | OL ORGANIC SILT or CLAY non-plastic to low plasticity |
| | OH ORGANIC SILT or CLAY high plasticity |
| | PT PEAT highly organic soils |

| DRILLING SAMPLING SYMBOLS & ABBREVIATIONS | | | |
|---|-------------------------|-----|----------------------------|
| SS | Split Spoon Sampler | PM | Pressuremeter Test |
| ST | Shelby Tube Sampler | RD | Rock Bit Drilling |
| WS | Wash Sample | RC | Rock Core, NX, BX, AX |
| BS | Bulk Sample of Cuttings | REC | Rock Sample Recovery % |
| PA | Power Auger (no sample) | RQD | Rock Quality Designation % |
| HSA | Hollow Stem Auger | | |

| PARTICLE SIZE IDENTIFICATION | |
|------------------------------|--|
| DESIGNATION | PARTICLE SIZES |
| Boulders | 12 inches (300 mm) or larger |
| Cobbles | 3 inches to 12 inches (75 mm to 300 mm) |
| Gravel: Coarse | ¾ inch to 3 inches (19 mm to 75 mm) |
| Gravel: Fine | 4.75 mm to 19 mm (No. 4 sieve to ¾ inch) |
| Sand: Coarse | 2.00 mm to 4.75 mm (No. 10 to No. 4 sieve) |
| Sand: Medium | 0.425 mm to 2.00 mm (No. 40 to No. 10 sieve) |
| Sand: Fine | 0.074 mm to 0.425 mm (No. 200 to No. 40 sieve) |
| Silt & Clay ("Fines") | <0.074 mm (smaller than a No. 200 sieve) |

| COHESIVE SILTS & CLAYS | | |
|--|------------------------|-------------------------------------|
| UNCONFINED COMPRESSIVE STRENGTH, QP ⁴ | SPT ⁵ (BPF) | CONSISTENCY ⁷ (COHESIVE) |
| <0.25 | <2 | Very Soft |
| 0.25 - <0.50 | 2 - 4 | Soft |
| 0.50 - <1.00 | 5 - 8 | Firm |
| 1.00 - <2.00 | 9 - 15 | Stiff |
| 2.00 - <4.00 | 16 - 30 | Very Stiff |
| 4.00 - 8.00 | 31 - 50 | Hard |
| >8.00 | >50 | Very Hard |

| RELATIVE AMOUNT ⁷ | COARSE GRAINED (%) ⁸ | FINE GRAINED (%) ⁸ |
|------------------------------|---------------------------------|-------------------------------|
| Trace | ≤5 | ≤5 |
| With | 10 - 20 | 10 - 25 |
| Adjective (ex: "Silty") | 25 - 45 | 30 - 45 |

| GRAVELS, SANDS & NON-COHESIVE SILTS | |
|-------------------------------------|--------------|
| SPT ⁵ | DENSITY |
| <5 | Very Loose |
| 5 - 10 | Loose |
| 11 - 30 | Medium Dense |
| 31 - 50 | Dense |
| >50 | Very Dense |

| WATER LEVELS ⁶ | |
|---------------------------|--------------------------|
| | WL (First Encountered) |
| | WL (Completion) |
| | WL (Seasonal High Water) |
| | WL (Stabilized) |

| FILL AND ROCK | | | |
|---------------|----------------------|--|----------------------|
| | FILL | | POSSIBLE FILL |
| | PROBABLE FILL | | ROCK |

¹Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

²To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

³Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

⁴Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

⁵Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

⁶The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

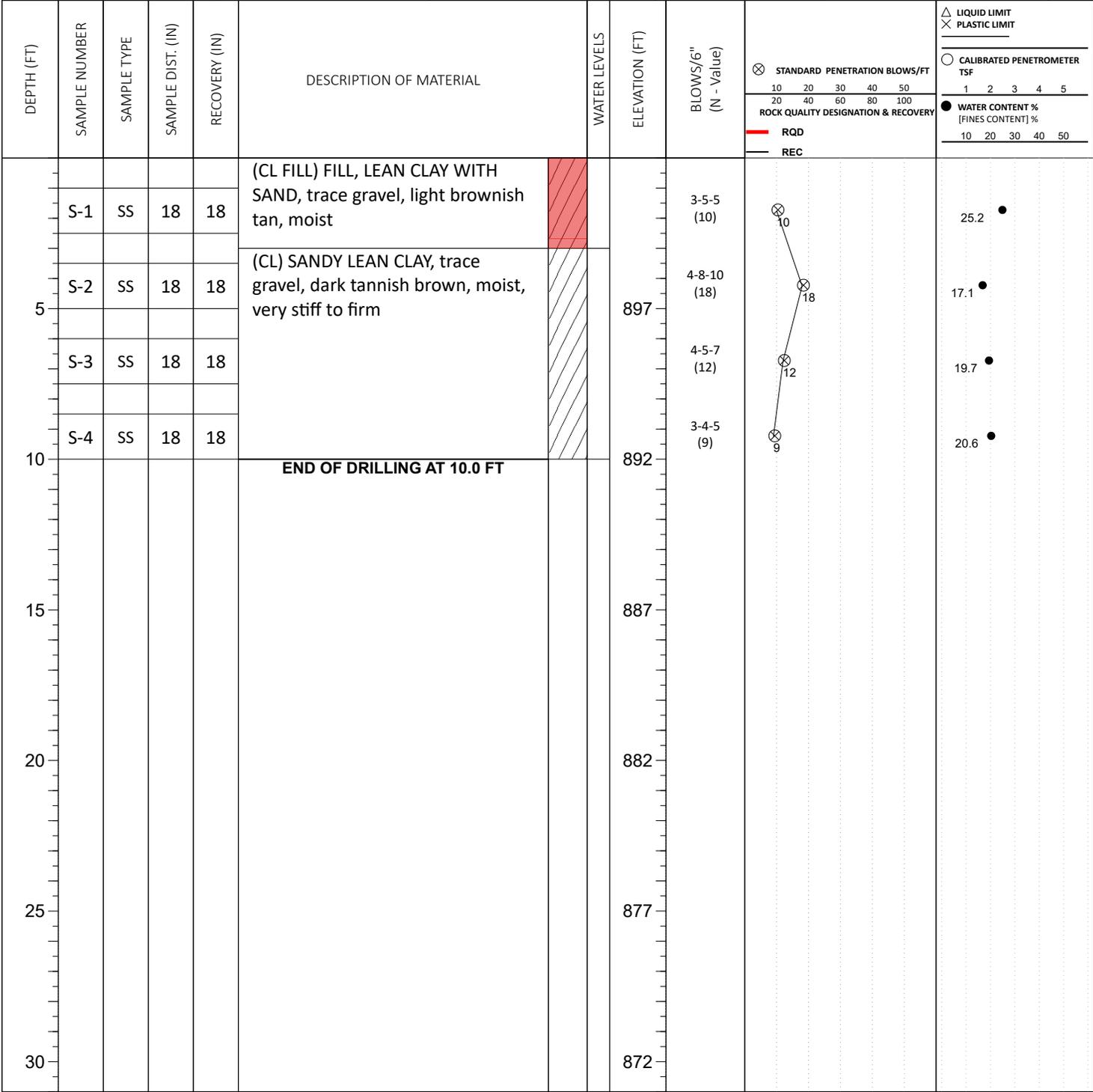
⁷Minor deviation from ASTM D 2488-17 Note 14.

⁸Percentages are estimated to the nearest 5% per ASTM D 2488-17.

| | | | | |
|---|---|----------------------------|-------------------------|--|
| CLIENT: Express Oil Change, LLC | PROJECT NO.: 26:6578 | BORING NO.: B-01 | SHEET: 1 of 1 | |
| PROJECT NAME: Express Oil Change- Sevierville | DRILLER/CONTRACTOR: Master Drillers, Inc. | | | |

| | | |
|--|---------------------|--|
| SITE LOCATION: 332 Old Douglas Dam Road, Sevierville, Tennessee, 37876 | LOSS OF CIRCULATION | |
|--|---------------------|--|

| | | | | |
|-------------------------------|---------------------------------|----------|------------------------------------|------------------|
| LATITUDE: 35.873795 | LONGITUDE: -83.569244 | STATION: | SURFACE ELEVATION: 902.0 | BOTTOM OF CASING |
|-------------------------------|---------------------------------|----------|------------------------------------|------------------|

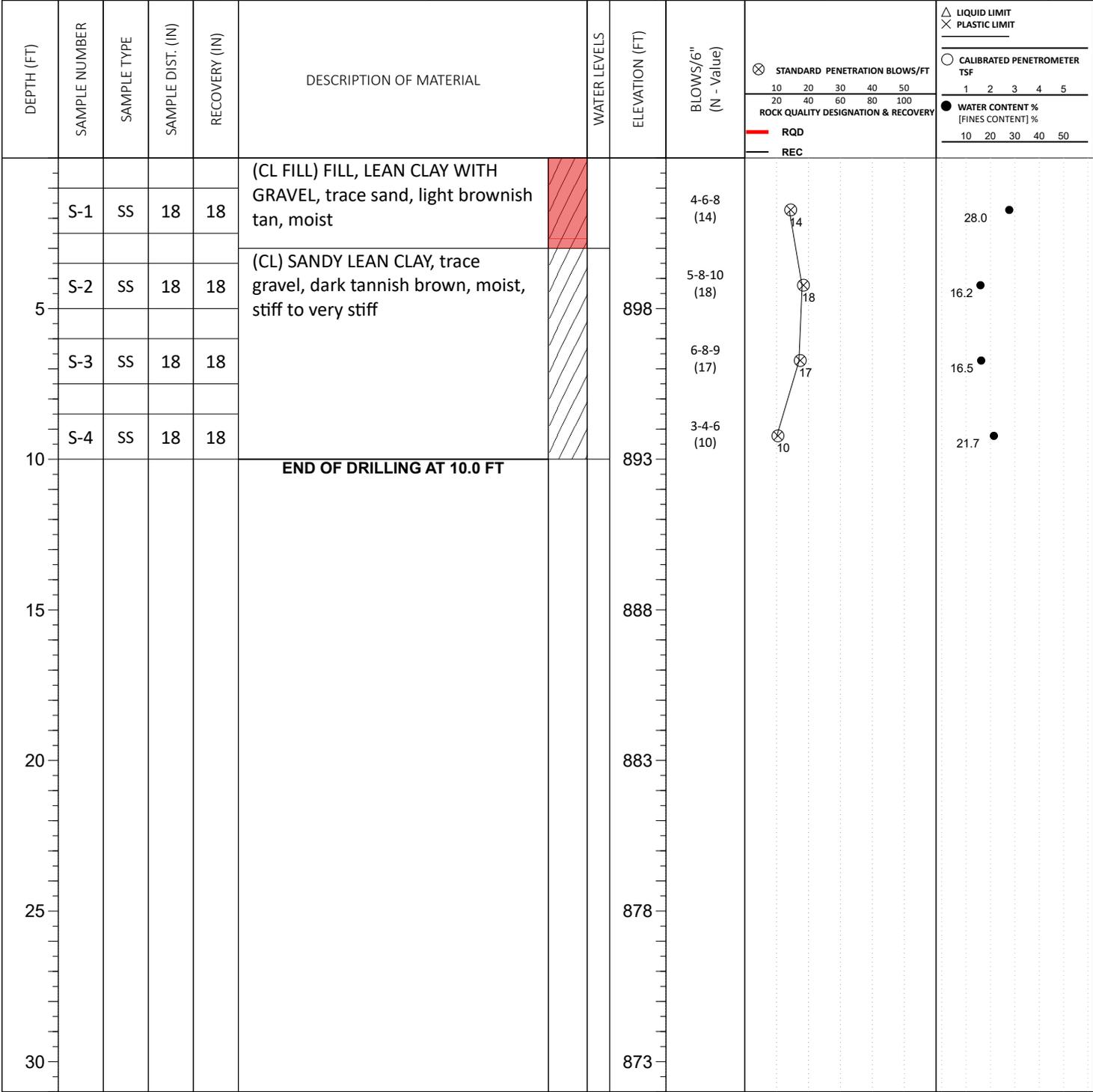


| | | | |
|---|-------------------|-------------|--------------------------|
| THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL | | | |
| <input checked="" type="checkbox"/> WL (First Encountered) Dry | BORING STARTED: | Jan 24 2024 | CAVE IN DEPTH: |
| <input checked="" type="checkbox"/> WL (Completion) | BORING COMPLETED: | Jan 24 2024 | HAMMER TYPE: Auto |
| <input checked="" type="checkbox"/> WL (Seasonal High Water) | EQUIPMENT: | Track | LOGGED BY: |
| <input checked="" type="checkbox"/> WL (Stabilized) | | | EM9 |
| DRILLING METHOD: HSA/SPT | | | |

GEOTECHNICAL BOREHOLE LOG

| | | | | |
|---|---|----------------------------|-------------------------|--|
| CLIENT: Express Oil Change, LLC | PROJECT NO.: 26:6578 | BORING NO.: B-02 | SHEET: 1 of 1 | |
| PROJECT NAME: Express Oil Change- Sevierville | DRILLER/CONTRACTOR: Master Drillers, Inc. | | | |

| | | | | |
|--|---------------------------------|----------|------------------------------------|----------------------|
| SITE LOCATION: 332 Old Douglas Dam Road, Sevierville, Tennessee, 37876 | | | LOSS OF CIRCULATION | |
| LATITUDE: 35.873639 | LONGITUDE: -83.569091 | STATION: | SURFACE ELEVATION: 903.0 | BOTTOM OF CASING |



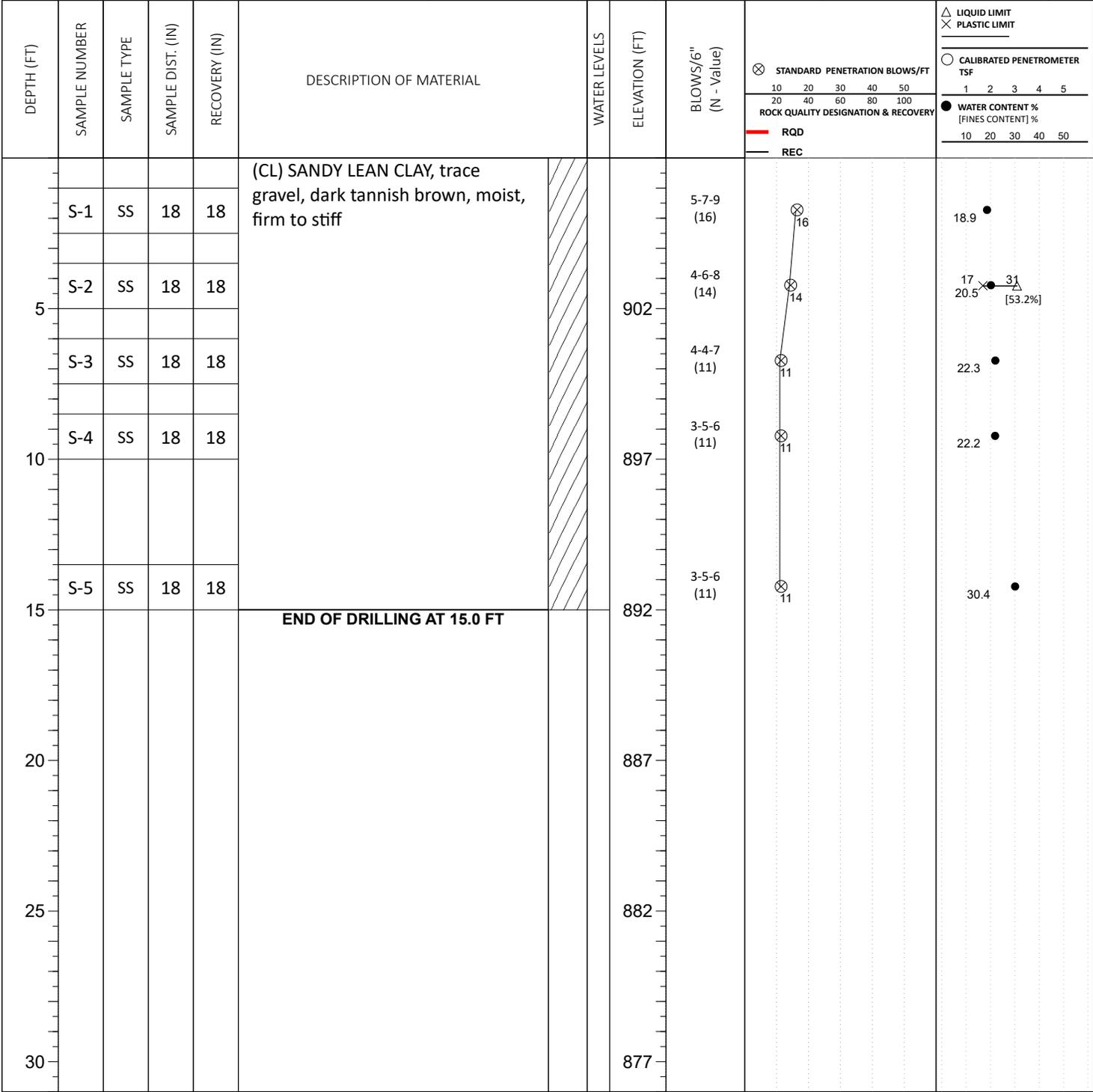
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|--|------------|--------------------------------------|---------------------------------|
| <input checked="" type="checkbox"/> WL (First Encountered) | Dry | BORING STARTED: Jan 24 2024 | CAVE IN DEPTH: |
| <input checked="" type="checkbox"/> WL (Completion) | | BORING COMPLETED: Jan 24 2024 | HAMMER TYPE: Auto |
| <input checked="" type="checkbox"/> WL (Seasonal High Water) | | EQUIPMENT: Track | DRILLING METHOD: HSA/SPT |
| <input checked="" type="checkbox"/> WL (Stabilized) | | LOGGED BY: EM9 | |

GEOTECHNICAL BOREHOLE LOG

| | | | | |
|---|---|----------------------------|-------------------------|--|
| CLIENT: Express Oil Change, LLC | PROJECT NO.: 26:6578 | BORING NO.: B-03 | SHEET: 1 of 1 | |
| PROJECT NAME: Express Oil Change- Sevierville | DRILLER/CONTRACTOR: Master Drillers, Inc. | | | |

| | | | | |
|--|---------------------------------|----------|------------------------------------|----------------------|
| SITE LOCATION: 332 Old Douglas Dam Road, Sevierville, Tennessee, 37876 | | | LOSS OF CIRCULATION | |
| LATITUDE: 35.873911 | LONGITUDE: -83.569062 | STATION: | SURFACE ELEVATION: 907.0 | BOTTOM OF CASING |



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

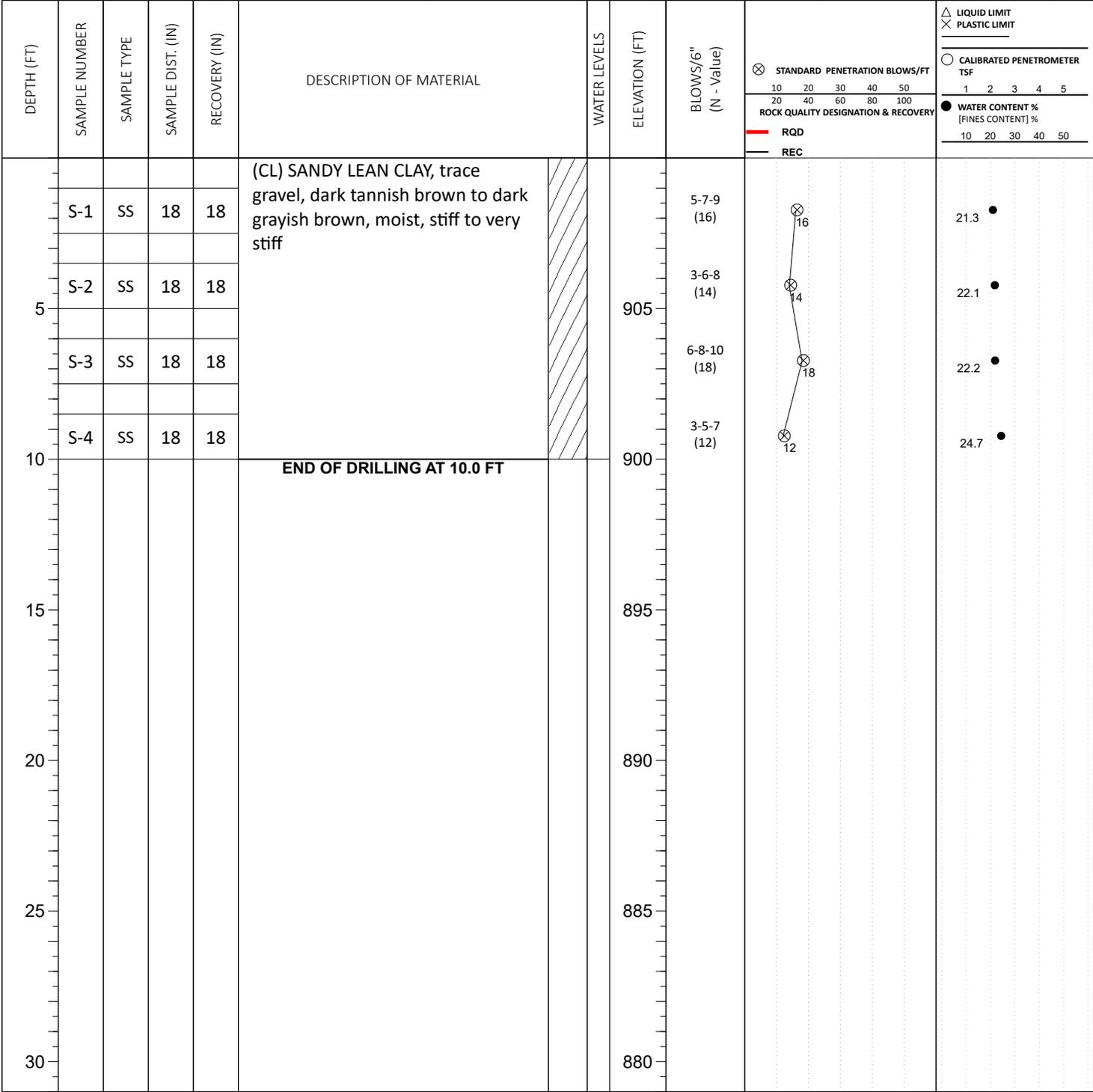
| | | |
|--|--------------------------------------|---------------------------------|
| <input checked="" type="checkbox"/> WL (First Encountered) Dry | BORING STARTED: Jan 24 2024 | CAVE IN DEPTH: |
| <input checked="" type="checkbox"/> WL (Completion) | BORING COMPLETED: Jan 24 2024 | HAMMER TYPE: Auto |
| <input checked="" type="checkbox"/> WL (Seasonal High Water) | EQUIPMENT: Track | LOGGED BY: EM9 |
| <input checked="" type="checkbox"/> WL (Stabilized) | | DRILLING METHOD: HSA/SPT |

GEOTECHNICAL BOREHOLE LOG

| | | | | |
|---|---|----------------------------|-------------------------|--|
| CLIENT: Express Oil Change, LLC | PROJECT NO.: 26:6578 | BORING NO.: B-05 | SHEET: 1 of 1 | |
| PROJECT NAME: Express Oil Change- Sevierville | DRILLER/CONTRACTOR: Master Drillers, Inc. | | | |

| | | |
|--|---------------------|--|
| SITE LOCATION: 332 Old Douglas Dam Road, Sevierville, Tennessee, 37876 | LOSS OF CIRCULATION | |
|--|---------------------|--|

| | | | | |
|-------------------------------|---------------------------------|----------|------------------------------------|------------------|
| LATITUDE: 35.874001 | LONGITUDE: -83.568974 | STATION: | SURFACE ELEVATION: 910.0 | BOTTOM OF CASING |
|-------------------------------|---------------------------------|----------|------------------------------------|------------------|



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | |
|---|--------------------------------------|---------------------------------|
| <input checked="" type="checkbox"/> WL (First Encountered) Dry | BORING STARTED: Jan 24 2024 | CAVE IN DEPTH: |
| <input checked="" type="checkbox"/> WL (Completion) | BORING COMPLETED: Jan 24 2024 | HAMMER TYPE: Auto |
| <input checked="" type="checkbox"/> WL (Seasonal High Water) | EQUIPMENT: Track | LOGGED BY: EM9 |
| <input checked="" type="checkbox"/> WL (Stabilized) | | DRILLING METHOD: HSA/SPT |

GEOTECHNICAL BOREHOLE LOG

SITE LOCATION:
332 Old Douglas Dam Road, Sevierville, Tennessee, 37876

| | | | | |
|-------------------------------|---------------------------------|----------|------------------------------------|---------------------|
| LATITUDE: 35.873817 | LONGITUDE: -83.568806 | STATION: | SURFACE ELEVATION: 909.0 | LOSS OF CIRCULATION |
| | | | | BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" (N - Value) | STANDARD PENETRATION BLOWS/FT | | ROCK QUALITY DESIGNATION & RECOVERY | | WATER CONTENT % [FINES CONTENT] % | |
|------------|---------------|-------------|-------------------|---------------|--|--------------|----------------|----------------------|-------------------------------|----|-------------------------------------|----|-----------------------------------|------|
| | | | | | | | | | 10 | 20 | 30 | 40 | 50 | 10 |
| 5 | S-1 | SS | 18 | 18 | (CL FILL) FILL, LEAN CLAY WITH SAND, trace gravel, light brownish tan, moist | | 904 | 4-5-6 (11) | ⊗ | 11 | | | | 20.4 |
| | S-2 | SS | 18 | 18 | (CL) SANDY LEAN CLAY, trace gravel, dark tannish brown to dark grayish brown, moist, stiff to very stiff | | 904 | 4-8-10 (18) | ⊗ | 18 | | | | 21.3 |
| | S-3 | SS | 18 | 18 | | | | 6-7-9 (16) | ⊗ | 16 | | | | 20.4 |
| 10 | S-4 | SS | 18 | 18 | | | | 4-5-7 (12) | ⊗ | 12 | | | | 23.8 |
| | | | | | END OF DRILLING AT 10.0 FT | | | 899 | | | | | | |
| 15 | | | | | | | 894 | | | | | | | |
| 20 | | | | | | | 889 | | | | | | | |
| 25 | | | | | | | 884 | | | | | | | |
| 30 | | | | | | | 879 | | | | | | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | |
|---|--------------------------------------|---------------------------------|
| <input checked="" type="checkbox"/> WL (First Encountered) Dry | BORING STARTED: Jan 24 2024 | CAVE IN DEPTH: |
| <input checked="" type="checkbox"/> WL (Completion) | BORING COMPLETED: Jan 24 2024 | HAMMER TYPE: Auto |
| <input checked="" type="checkbox"/> WL (Seasonal High Water) | EQUIPMENT: Track | DRILLING METHOD: HSA/SPT |
| <input checked="" type="checkbox"/> WL (Stabilized) | LOGGED BY: EM9 | |

GEOTECHNICAL BOREHOLE LOG

Appendix C – Laboratory Testing

Laboratory Testing Summary

Plasticity Chart(s)

Laboratory Testing Summary

| Sample Location | Sample Number | Depth (ft) | ^MC (%) | Soil Type | Atterberg Limits | | | **Percent Passing No. 200 Sieve | Moisture - Density | | CBR (%) | | #Organic Content (%) |
|-----------------|---------------|------------|---------|-----------|------------------|----|----|---------------------------------|------------------------|-----------------------|---------|---------|----------------------|
| | | | | | LL | PL | PI | | <Maximum Density (pcf) | <Optimum Moisture (%) | 0.1 in. | 0.2 in. | |
| B-01 | S-1 | 1.0-2.5 | 25.2 | | | | | | | | | | |
| B-02 | S-1 | 1.0-2.5 | 28.0 | | | | | | | | | | |
| B-03 | S-1 | 1.0-2.5 | 18.9 | | | | | | | | | | |
| B-04 | S-1 | 1.0-2.5 | 31.1 | *CL | 44 | 22 | 22 | 54.2 | | | | | |
| B-05 | S-1 | 1.0-2.5 | 21.3 | | | | | | | | | | |
| B-06 | S-1 | 1.0-2.5 | 20.4 | | | | | | | | | | |
| B-01 | S-2 | 3.5-5.0 | 17.1 | | | | | | | | | | |
| B-02 | S-2 | 3.5-5.0 | 16.2 | | | | | | | | | | |
| B-03 | S-2 | 3.5-5.0 | 20.5 | *CL | 31 | 17 | 14 | 53.2 | | | | | |
| B-04 | S-2 | 3.5-5.0 | 17.3 | | | | | | | | | | |

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

Project: Express Oil Change- Sevierville
Client:

Project No.: 26:6578
Date Reported: 2/2/2024



Office / Lab
ECS Southeast LLC - Knoxville

Address
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| | | | |
|-----------|------------|-------------|---------------|
| Tested by | Checked by | Approved by | Date Received |
| adusheck | adusheck | adusheck | 1/25/2024 |

Laboratory Testing Summary

| Sample Location | Sample Number | Depth (ft) | ^MC (%) | Soil Type | Atterberg Limits | | | **Percent Passing No. 200 Sieve | Moisture - Density | | CBR (%) | | #Organic Content (%) |
|-----------------|---------------|------------|---------|-----------|------------------|----|----|---------------------------------|------------------------|-----------------------|---------|---------|----------------------|
| | | | | | LL | PL | PI | | <Maximum Density (pcf) | <Optimum Moisture (%) | 0.1 in. | 0.2 in. | |
| B-05 | S-2 | 3.5-5.0 | 22.1 | | | | | | | | | | |
| B-06 | S-2 | 3.5-5.0 | 21.3 | | | | | | | | | | |
| B-01 | S-3 | 6.0-7.5 | 19.7 | | | | | | | | | | |
| B-02 | S-3 | 6.0-7.5 | 16.5 | | | | | | | | | | |
| B-03 | S-3 | 6.0-7.5 | 22.3 | | | | | | | | | | |
| B-04 | S-3 | 6.0-7.5 | 20.4 | | | | | | | | | | |
| B-05 | S-3 | 6.0-7.5 | 22.2 | | | | | | | | | | |
| B-06 | S-3 | 6.0-7.5 | 20.4 | | | | | | | | | | |
| B-01 | S-4 | 8.5-10.0 | 20.6 | | | | | | | | | | |
| B-02 | S-4 | 8.5-10.0 | 21.7 | | | | | | | | | | |

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

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| Tested by | Checked by | Approved by | Date Received |
| adusheck | adusheck | adusheck | 1/25/2024 |

Laboratory Testing Summary

| Sample Location | Sample Number | Depth (ft) | ^MC (%) | Soil Type | Atterberg Limits | | | **Percent Passing No. 200 Sieve | Moisture - Density | | CBR (%) | | #Organic Content (%) |
|-----------------|---------------|------------|---------|-----------|------------------|----|----|---------------------------------|------------------------|-----------------------|---------|---------|----------------------|
| | | | | | LL | PL | PI | | <Maximum Density (pcf) | <Optimum Moisture (%) | 0.1 in. | 0.2 in. | |
| B-03 | S-4 | 8.5-10.0 | 22.2 | | | | | | | | | | |
| B-04 | S-4 | 8.5-10.0 | 20.6 | | | | | | | | | | |
| B-05 | S-4 | 8.5-10.0 | 24.7 | | | | | | | | | | |
| B-06 | S-4 | 8.5-10.0 | 23.8 | | | | | | | | | | |
| B-03 | S-5 | 13.5-15.0 | 30.4 | | | | | | | | | | |
| B-04 | S-5 | 13.5-15.0 | 21.8 | | | | | | | | | | |
| B-04 | S-6 | 18.5-20.0 | 8.2 | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

Project: Express Oil Change- Sevierville
Client:

Project No.: 26:6578
Date Reported: 2/2/2024



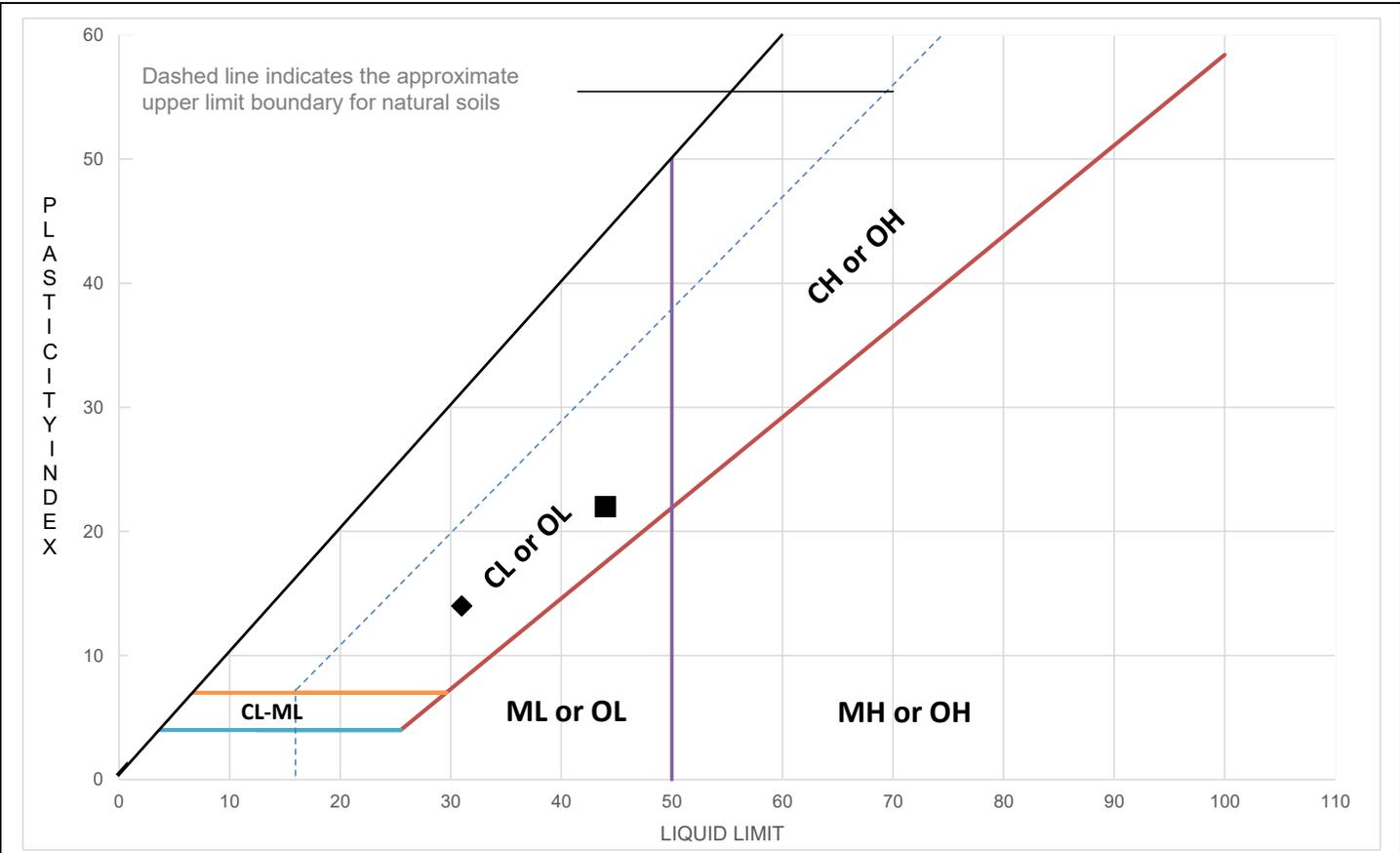
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| | | | |
|-----------|------------|-------------|---------------|
| Tested by | Checked by | Approved by | Date Received |
| adusheck | adusheck | adusheck | 1/25/2024 |

LIQUID AND PLASTIC LIMITS TEST REPORT



TEST RESULTS (ASTM D4318-10 (MULTIPOINT TEST))

| | Sample Location | Sample Number | Sample Depth (ft) | LL | PL | PI | %<#40 | %<#200 | AASHTO | USCS | Material Description |
|---|-----------------|---------------|-------------------|----|----|----|-------|--------|--------|------|---|
| ■ | B-04 | S-1 | 1.00-2.50 | 44 | 22 | 22 | | 54.2 | | | (CL) Light Brownish Tan Sandy lean Clay |
| ◆ | B-03 | S-2 | 3.50-5.00 | 31 | 17 | 14 | | 53.2 | | | (CL) Dark Tannish Brown Sandy Lean Clay |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
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Project: Express Oil Change- Sevierville
Client:

Project No.: 26:6578
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(865)281-1840

| | | | |
|-----------------------|------------------------|-------------------------|----------------------------|
| Tested by adusheck | Checked by adusheck | Approved by adusheck | Date Received 1/25/2024 |
|-----------------------|------------------------|-------------------------|----------------------------|

Appendix D – Supplemental Documents

Other Supplemental Documents

 This is a beta release of the new ATC Hazards by Location website. Please [contact us](#) with feedback.

 The ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

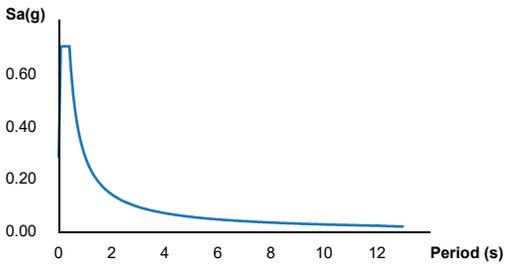
ATC Hazards by Location

Search Information

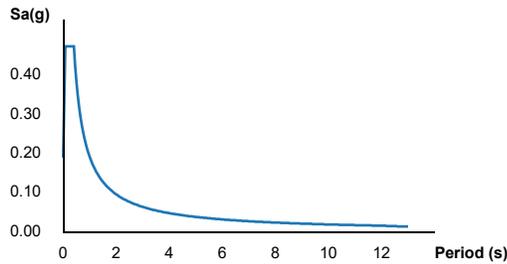
Coordinates: 35.87336208952716, -83.56862305026245
Elevation: 907 ft
Timestamp: 2024-02-05T15:14:08.445Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: II
Site Class: D-default



MCE_R Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

| Name | Value | Description |
|-----------------|-------|--|
| S _S | 0.511 | MCE _R ground motion (period=0.2s) |
| S ₁ | 0.122 | MCE _R ground motion (period=1.0s) |
| S _{MS} | 0.711 | Site-modified spectral acceleration value |
| S _{M1} | 0.288 | Site-modified spectral acceleration value |
| S _{DS} | 0.474 | Numeric seismic design value at 0.2s SA |
| S _{D1} | 0.192 | Numeric seismic design value at 1.0s SA |

Additional Information

| Name | Value | Description |
|------------------|-------|--|
| SDC | C | Seismic design category |
| F _a | 1.391 | Site amplification factor at 0.2s |
| F _v | 2.356 | Site amplification factor at 1.0s |
| CR _S | 0.913 | Coefficient of risk (0.2s) |
| CR ₁ | 0.93 | Coefficient of risk (1.0s) |
| PGA | 0.333 | MCE _G peak ground acceleration |
| F _{PGA} | 1.267 | Site amplification factor at PGA |
| PGA _M | 0.422 | Site modified peak ground acceleration |
| T _L | 12 | Long-period transition period (s) |
| SsRT | 0.511 | Probabilistic risk-targeted ground motion (0.2s) |
| SsUH | 0.56 | Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years) |
| SsD | 1.5 | Factored deterministic acceleration value (0.2s) |
| S1RT | 0.122 | Probabilistic risk-targeted ground motion (1.0s) |
| S1UH | 0.131 | Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years) |
| S1D | 0.6 | Factored deterministic acceleration value (1.0s) |

| | | |
|------|-----|---|
| PGAd | 0.5 | Factored deterministic acceleration value (PGA) |
|------|-----|---|

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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Appendix E – Other Information

GBA - Geotechnical Engineering Report Information Sheet

Important Information about This

Geotechnical-Engineering Report

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

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

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

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer

will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

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

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

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the “Findings” Related in This Report Are Professional Opinions

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

This Report’s Recommendations Are Confirmation-Dependent

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

This Report Could Be Misinterpreted

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

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals’ plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

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

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note*

conspicuously that you’ve included the material for information purposes only. To avoid misunderstanding, you may also want to note that “informational purposes” means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled “limitations,” many of these provisions indicate where geotechnical engineers’ responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a “phase-one” or “phase-two” environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer’s services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer’s recommendations will not of itself be sufficient to prevent moisture infiltration.* **Confront the risk of moisture infiltration** by including building-envelope or mold specialists on the design team. **Geotechnical engineers are not building-envelope or mold specialists.**



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