GREEN

Draft Geotechnical Engineering Report

Proposed Chick-fil-A Restaurant #04481
Spokane, Washington
May 21, 2019
Terracon Project No. 81195058

Prepared for:
Chick-fil-A, Inc.
Atlanta, Georgia

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

May 21, 2019

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Re: Draft Geotechnical Engineering Report
Proposed Chick-fil-A Restaurant #04481
9340 North Newport Highway
Spokane, Washington
Terracon Project No. 81195058

Dear Mr. Ikeler:

Terracon Consultants, Inc. (Terracon) has completed the Draft Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Master Services Task Order dated March 31, 2005. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and pavement for the proposed project.

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

Sincerely,
Terracon Consultants, Inc.
Certificate of Authorization No. 8830

Kristen McFarland, EIT
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REPORT SUMMARY

Topic [1]	Overview Statement [2]
Project Description	Approximately 4,800 square foot structure Max. Column loads: 50 kips, Max. Wall loads: 2 kips per lineal foot Excavations to include demolition of old building and new foundation construction Expected traffic for pavement areas: ■ 300 auto/light trucks per day ■ Up to 5 medium-duty delivery/trash trucks per week ■ 1 tractor-trailer per week
Geotechnical Characterization	Poorly graded sand with variable amounts of silt, ranging from loose to dense to the maximum depths explored Groundwater not encountered at the time of exploration
Earthwork	Options for foundations and floor slab subgrade preparation & risk of post-construction movement. ■ Low risk (**Terracon recommendation**): Remove & replace loose sand in the top 5 to 7 feet of existing soil under building area. Remove and replace top 3 feet of existing soil under paved areas. ■ Low risk (**Terracon recommendation**): Remove & replace loose sand in the top 5 feet of existing soil under building area. Remove and replace top 2 feet of existing soil under paved areas. Site soils encountered may be suitable for use as fill due to the low fines content, however the narrow range of particle sizes may prove difficult to achieve the target density during construction operations. Any material proposed to be used for engineered fill should be tested and approved
Shallow Foundations	Shallow foundations will be sufficient following completion of recommendations noted in **Earthwork** Allowable bearing pressure = 2,500 lbs/sq ft Expected settlements: 1 inch total, $^{3}/_{4}$ inch differential Detect and remove zones of unsuitable soils as noted in **Earthwork**
Pavements	For subgrade prepared as noted in **Earthwork**, we have provided CFA's standard pavement sections as well as locally recommended pavement sections and general construction recommendations.
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.

Draft Geotechnical Engineering Report

Proposed Chick-fil-A Restaurant #04481
9340 North Newport Highway
Spokane, Washington
Terracon Project No. 81195058
May 21, 2019

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Chick-fil-A restaurant #04481 to be located at 9340 North Newport Highway in Spokane, 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
- Demolition considerations
- Excavation considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC
- Lateral earth pressures
- Pavement design and construction

The subsurface exploration for this project conducted on April 15th, 2019 included the advancement of eight geotechnical borings to depths ranging from approximately 6½ to 19 feet below the existing ground surface.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the field exploration are included on the boring logs in the **Exploration Results** section of this report.

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 9340 North Newport Highway in Spokane, Washington. Lot Size: Approximately 1.6 acres Latitude: 47.742561° N, Longitude: 117.408030° W (See **Site Location**)
Existing Improvements	Existing asphalt parking lot, existing used car dealership and renovated barn structure for commercial use, existing signpost near the SW corner of the parcel
Current Ground Cover	Asphalt paved parking lot, gravel, grass
Existing Topography	The site is relatively flat. Based on information from Google Earth Pro, the elevation is about 1,944 feet (SW corner of site) to 1,947 feet (E side of site), mean sea level
Site History	We reviewed historic aerial photographs and found the site was undeveloped in 1972 and the existing parking lot and barn structure were visible in 1995. The site has remained relatively unchanged since then.
Geology	According to map reviewed, the site is underlain by Holocene age dune sand (Qd). Dune sands are characterized by well-sorted, fine to medium sand and silt in active and stabilized dunes; locally it includes volcanic ash.

PROJECT DESCRIPTION

Our understanding of the project conditions is as follows:

Item	Description
Site Layout	Refer to the Site Vicinity Map and Site and Exploration Plan
Proposed Structures	A one-story 4,833 square-foot Chick-fil-A restaurant with associated parking and drive through improvements
Building Construction	Details not provided, but assumed to be steel and-or wood framing with concrete foundations
Finished Floor Elevation	Assumed to be at or near existing site grades
Maximum Loads	Building: Details not provided, but assumed to be: ■ Column Load – 50 kips ■ Load-Bearing Wall Loads – 2 kips per lineal foot ■ Maximum Uniform Floor Slab Load – 125 psf
Grading/Slopes/Below grade structures	None anticipated

Item	Description
Pavements	Parking to accommodate up to 100 vehicles is planned in addition to paved driveways No specific traffic information has been provided to us. Without this information, we plan to use the following traffic volumes for design of the pavement: ■ Autos/Light Trucks: 300 vehicles per day ■ Medium duty trucks and Trash Collection Vehicles: 5 vehicles per week ■ Tractor-trailer trucks: 1 vehicle per week. The pavement design period is 20 years.

GEOTECHNICAL CHARACTERIZATION

Geology

The Spokane area is generally underlain by glacial drift and related deposits from glaciers north of Spokane, and flood deposits consisting of coarse-grained sediments from catastrophic floods caused by glacial-ice dam failure and rapid draining of glacial lakes. The following geologic map was reviewed as part of our study:

"*Washington Geologic Information Portal*", Washington Geological Survey, Washington Department of Natural Resources.

Based on the above referenced geologic map, the site is underlain by Holocene dune sand (Qd). Dune sands are characterized by well-sorted, fine to medium sand and silt in active and stabilized dunes; locally it includes volcanic ash.

Subsurface Profile

We developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction. The following table provides our geotechnical characterization.

The geotechnical characterization forms the basis of our geotechnical calculations and evaluation of site preparation, foundation options and pavement options. As noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
1	Up to 7 feet	Poorly graded sand, fine grained, reddish brown, moist	Loose to medium dense
2	7 feet to 19 feet	Poorly graded sand, fine grained, grayish brown, moist	Medium dense to dense

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

Groundwater Conditions

Groundwater was not observed in the borings while drilling, nor for the short duration that the borings remained open.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, agricultural and construction activities, as well as other factors. In addition, perched groundwater can develop above low permeability soil. Therefore, groundwater may be encountered, or groundwater levels may fluctuate during construction or at future times. While the possibility of groundwater fluctuations should be considered when developing the design and construction plans for the project, we do not anticipate the presence of groundwater to adversely affect the proposed design and construction.

GEOTECHNICAL OVERVIEW

Based on our field exploration program and subsequent characterization of the subsurface conditions at the proposed project site, it is our opinion that the proposed development is feasible from a geotechnical standpoint contingent on proper design and construction practices. Primary geotechnical considerations that may affect aspects of design and construction are listed below.

- Foundation support of the proposed structure utilizing conventional spread footings is feasible provided that the footing loads are transmitted by means of properly placed structural fill extending at least five to seven feet below existing surface grades or to medium dense native deposits. The **Shallow Foundations** section addresses support of the building bearing on native medium dense to dense sand with silt or engineered fill.
- Existing native soils should be removed to five feet below existing surface grades or to medium dense native material and replaced and compacted to compaction standards provided in **Fill Compaction Requirements** to mitigate potential settlement.

- Seasonal high groundwater fluctuations should be considered in the civil engineering design for the site grading, utility construction, and pavements. Based on the results of our subsurface investigation, we do not anticipate high groundwater levels to adversely impact the design or construction of the proposed improvements.
- A flexible pavement system and a rigid pavement system are recommended for this site. The **Pavements** section addresses the design of pavement systems.
- The **Floor Slabs** section addresses slab-on-grade support of the building.
- The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

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

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

Site Preparation

We anticipate construction will be initiated by demolition of existing buildings and removal of existing asphalt surfacing. Removed asphalt and debris should be transported off site. Existing asphalt thicknesses measured approximately 3 inches in the parking area. The existing building structure appears to be constructed partially below grade.

We recommend retaining walls, foundations, slabs and utilities be demolished and removed from the site. Where underground utilities are not completely removed, they should be abandoned in place using lean cement or controlled density fill. Upon removal of the existing building, the resulting excavation should be backfilled to the proposed finished grades as noted herein. Backfill placed where below grade structures have been removed should be benched into the native soil in accordance with the Hillside Terraces section of WSDOT 2-03.3(14) Embankment Construction. The backfill should be compacted to standards provided in **Fill Compaction Requirements**.

We recommend over excavation of the loose sand on the project site and replacement with compacted, structural fill as discussed in **Fill Compaction Requirements**. The depth of removal should extend to five to seven feet below existing surface grade and may be greater at some locations within 10 feet of the building plan area and three feet below paved areas. Prior to placing

fill, existing vegetation and root mats should be removed. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas.

The subgrade should be proof-rolled with an appropriate loaded vehicle. The proof-rolling should be performed under the observation of the Geotechnical Engineer. Areas excessively deflecting under the proof-roll should be delineated and subsequently reworked until the resulting subgrade is a firm unyielding surface. Unstable materials located should be stabilized as recommended by the engineer based on conditions observed during construction. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 10 feet of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas.

The project specifications should include options for reusing the onsite soils, although compacting clean, fine grained, poorly graded sand to the recommended density can be challenging. Another option is to use imported, clean, granular fill. As a generic structural fill material, we recommend using a well-graded sand and gravel such as “Ballast” or “Gravel Borrow” meeting the requirements of the 2018 WSDOT Standard Specifications (hereafter referred to as WSDOT) Section 9-03.9(1) and 9-03.14, respectively. For combined structural fill and drainage purposes, a relatively clean and uniformly graded angular material such as “Crushed Surfacing Base Course” per WSDOT 9-03.9(3) is preferable. Engineered fill should consist of approved materials, free of organic material, debris, and particles larger than about 4 inches. The maximum particle size criteria may be relaxed by the Geotechnical Engineer depending on construction techniques, material gradation, allowable lift thickness and observations during fill placement.

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 at which the maximum dry density for the material is achieved in the laboratory following ASTM procedures.

In general, the existing soils on-site consist of poorly graded sand with variable amounts of silt. These soils are generally considered acceptable for re-use as structural fill from a compositional perspective; however, soils with a greater fraction of silt content will be more sensitive to changes in moisture and may not be practical for re-use as structural fill if the moisture content deviates

more than a few percent from optimum. Also, as noted above, clean, poorly graded, fine sand can be difficult to compact to the required density.

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill
Minimum Compaction Requirements [1]	95 percent of the material's maximum modified Proctor dry density (ASTM D1557).
Moisture Content [2]	Within ±2 percent of optimum moisture content as determined by the Modified Proctor test, at the time of placement and compaction.
Minimum Testing Frequency	One field density test per 20,000 square feet or fraction thereof per 1-foot lift.

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

Utility Trench Backfill

The contractor is responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including all applicable federal, state, and local regulations, such as OSHA and WISHA, for open excavations.

All trenches should be wide enough to allow for compaction around the haunches of the pipe, or material such as pea gravel (provided this is allowed by the pipe manufacturer) should be used below the spring line of the pipes to eliminate the need for mechanical compaction in this portion of the trenches. We recommend that utility trench excavations be completed using a smooth excavation bucket (without teeth) to reduce the potential for subgrade disturbance. If water is encountered in the excavations, it should be removed prior to fill placement.

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.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction. Final surrounding grades should be sloped away from the structure on all sides to prevent ponding of water. Gutters, downspouts, or other appropriate methods that direct water a minimum of 10 feet beyond the footprint of the proposed structures are recommended.

Exposed ground should be sloped and maintained at a minimum 5 percent away from the building for at least 10 feet beyond the perimeter of the building. 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. Grades around the structure should also be periodically inspected and adjusted as necessary as part of the structure's maintenance program. 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

It is anticipated that excavations for the proposed construction can be accomplished with conventional, earthmoving equipment. The earthwork contractor should anticipate encountering soils that are highly sensitive to changes in moisture and disturbance, potentially resulting in unstable or inadequate working pad and/or foundation subgrade conditions. In addition, construction debris may be encountered.

Construction dewatering is the responsibility of the contractor, who should maintain the excavation and foundation subgrades in a dry condition. Although no groundwater was observed during our exploration program, perched groundwater seepage may be encountered during construction.

If earthwork takes place during freezing conditions, we recommend that the exposed subgrade be allowed to thaw and be re-compacted prior to placing subsequent lifts of structural fill. Alternatively, the frozen soil could be scraped off and wasted to expose unfrozen soil.

After initial proof-rolling and compaction, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and re-compacted prior to floor slab and pavement construction.

Trees or other vegetation whose root systems could remove excessive moisture from the subgrade and foundation soils should not be planted next to the structure. Trees and shrubbery should be kept away from the exterior edges of the foundation element a distance at least equal to 1.5 times their expected mature height.

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 top soil, 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 at a frequency stated in **Earthwork**.

In areas of foundation excavations, the bearing subgrade should be evaluated under the observation of the Geotechnical Engineer. In the event unanticipated conditions are encountered, the Geotechnical Engineer should be consulted to 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.

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

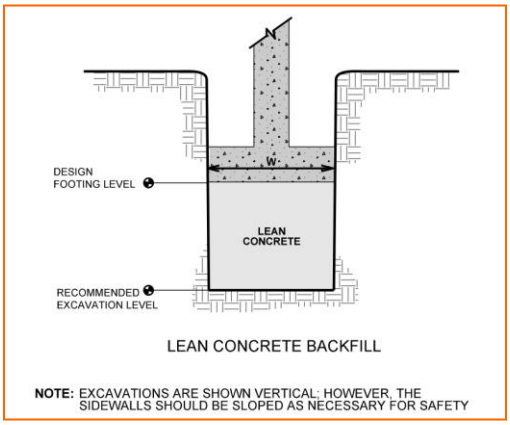
DESCRIPTION	Column	Wall
Net allowable bearing pressure [1]	2,500 psf	2,500 psf
Minimum width	24 inches	18 inches
Minimum embedment below finished grade [2]	24 inches	24 inches
Approximate total settlement [3]	1 inch	1 inch
Estimated differential settlement [3]	½ inch between columns	½ inch over 40 feet
Ultimate coefficient of sliding friction	0.60	

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable fill or soft/organic soils, if encountered, will be undercut and replaced with structural fill.
2. To reduce the effects of seasonal moisture variations in the subgrade soils. For perimeter footing and footings beneath unheated areas.
3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. Once loading conditions and footing dimensions are known, Terracon should be provided the opportunity to confirm the estimated settlement values.

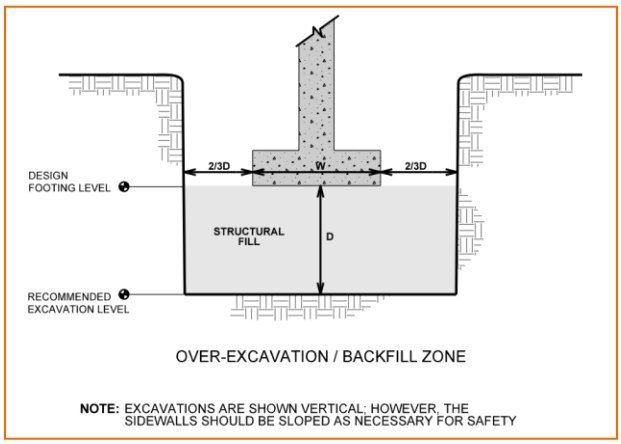
Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the observation 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.

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



Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation as recommended in the **Earthwork** section.



SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on the Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Chapter 20 of ASCE 7.

Description	Value
2015 International Building Code (IBC) Site Classification[1,2]	D[3]
Site Latitude	47.742570
Site Longitude	-117.408128
S_S – Short Period Spectral Acceleration, Site Class B[4]	0.335 g
S_1 – 1-Second Period Spectral Acceleration, Site Class B[4]	0.115 g
F_a – Short Period Site Coefficient [4]	1.532
F_v –1-Second Period Site Coefficient[4]	2.338
PGA - ASCE 7-10, Peak Ground Acceleration	0.145 g
F_{PGA} – Peak Ground Acceleration Site Coefficient	1.51

1. Seismic site classification in general accordance with the 2015 IBC, which refers to ASCE 7-10.
2. 2015 IBC requires a site profile extending to a depth of 100 feet for seismic site classification. Borings were extended to a maximum depth of 19 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.
3. Site Class D applies to any profile having (1) soils having an average shear wave velocity of 600 to 1,200 feet per sec, (2) an average N value of 15 to 50 blows/foot, (3) an undrained shear strength of 1,000 to 2,000 psf.
4. These values were obtained using online seismic design maps and tools provided by OSHPD (https://seismicmaps.org/).

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 May 8th, 2019. There are no mapped faults within a 50 mile radius of the project site.

LIQUEFACTION

Liquefaction is a 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 to medium dense granular soils or relatively non-plastic fine-grained soils are present. Based on the site geology and subsurface groundwater conditions, the risk of liquefaction of the site soils is low for this site during a design level earthquake.

FLOOR SLABS

We recommend over-excavation of the material located within ten feet of the building footprint and replacement with compacted, structural fill as discussed in this report. The depth of removal should extend to 5 feet below existing surface grades. The following design parameters for floor slabs assume the requirements for **Earthwork** have been followed.

Floor Slab Design Parameters

Item	Description
Floor slab support [1]	Aggregate base (see below) underlain by at least 5 feet of low-plasticity structural fill prepared according to **Site Preparation** in **Earthwork.**
Modulus of subgrade reaction [2]	100 pounds per square inch per in (psi/in) for point loading conditions
Aggregate base course/capillary break [3]	4 inches of free draining granular material

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. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
3. The floor slab design should include a capillary break, comprised of compacted, granular material, as described in subsection **Fill Material Types**.

A subgrade prepared and tested as recommended in this report should provide adequate support for lightly loaded floor slabs.

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 have thickened edges 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.

Mitigation measures as noted in **Site Preparation** within **Earthwork** are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams and/or post-tensioned elements.

Floor Slab Construction Considerations

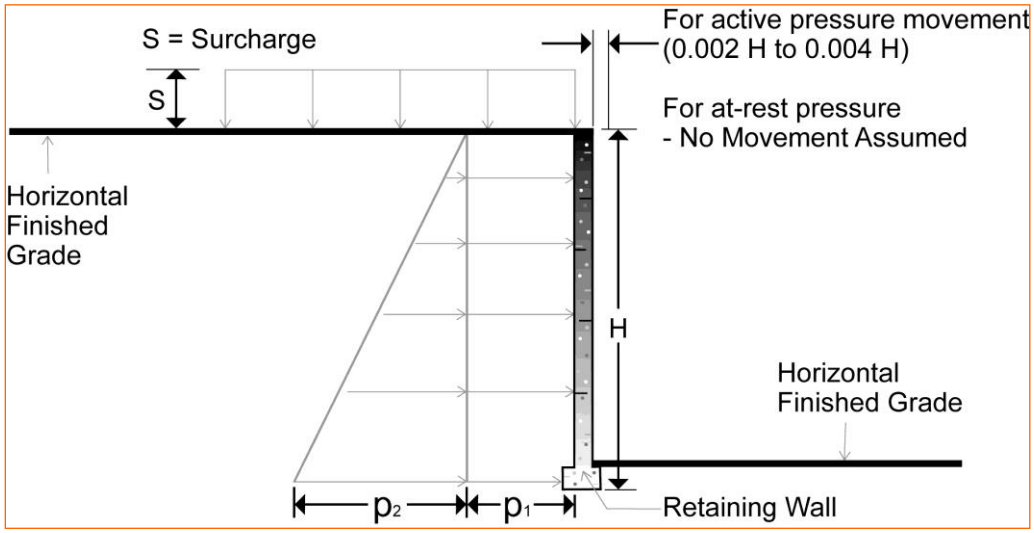
Finished subgrade within and for at least 10 feet beyond the floor slab should be protected from traffic, rutting, or other disturbances and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor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

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

LATERAL EARTH PRESSURES

Design Parameters

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



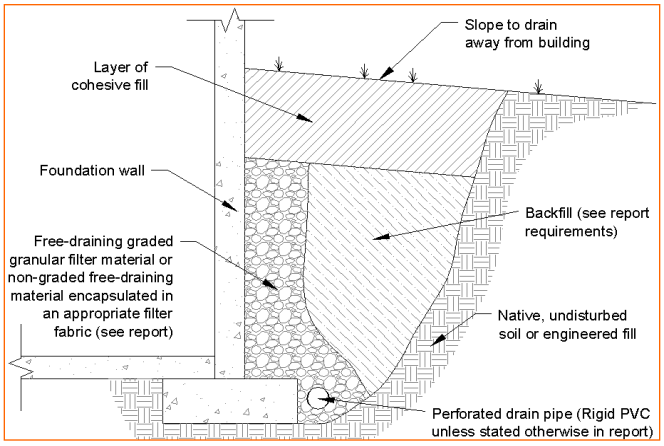
Lateral Earth Pressure Design Parameters[1]			
Earth Pressure Condition [2]	**Coefficient for Backfill Type[3]**	**Surcharge Pressure [4, 5, 6] p_1 (psf)**	**Effective Fluid Pressures (psf) [3, 5, 6]**
Active (Ka)	0.31	(0.31)S	(36)H
At-Rest (Ko)	0.47	(0.47)S	(54)H
Passive (Kp)	3.26	---	(375)H
Seismic (Kae)	0.46	(6)H[7]	---

1. Retaining walls must include drainage system or be designed for full hydrostatic pressure per IBC Section 1610.1
2. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.
3. Uniform, granular, horizontal backfill, compacted to at least 95 percent of the ASTM D1557 maximum dry density.
4. Uniform surcharge, where S is surcharge pressure.
5. Loading from heavy equipment should be added as a surcharge where applicable.
6. No safety factor is included in these values.
7. Seismic lateral load. Use rectangular distribution.

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

Subsurface Drainage for Below Grade Walls

Section 1610.1 of the 2015 IBC requires retaining walls to support the weight of the full hydrostatic pressure unless a drainage system is installed. Terracon recommends a perforated rigid plastic drain line installed behind the base of walls and extending below adjacent grade to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to an appropriate capture system. The drain line should be surrounded by clean, free-draining granular material having less than 5 percent passing the No. 200 sieve. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with relatively impermeable material to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a pre-fabricated drainage structure may be used. A pre-fabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion and is fastened to the wall prior to placing backfill.

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 current asphalt pavement parking lot consists of about 3 inches of asphalt. Based on the site plan and orientation of the proposed building, we recommend that the existing pavement be removed and replaced with fresh pavement sections consistent with the designs outlined below.

Pavement Design Parameters

Traffic patterns and anticipated loading conditions were not available at the time that this report was prepared. However, we anticipate that traffic loads will be produced primarily by automobile traffic and occasional delivery and trash removal trucks. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.

Pavement thickness can be determined using AASHTO, Asphalt Institute and/or other methods if specific wheel loads, axle configurations, frequencies, and desired pavement life are provided. Terracon can provide thickness recommendations for pavements subjected to loads other than personal vehicle and occasional delivery and trash removal truck traffic if this information is provided.

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 parking lots and drives should slope down from pavement edges at a minimum 2%;
- The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote proper surface drainage;
- Install pavement drainage surrounding areas anticipated for frequent wetting (e.g., landscaping areas, etc.);
- Install joint sealant and seal cracks immediately;
- Seal all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils, and;
- Place compacted, low permeability backfill against the exterior side of curb and gutter

Pavement Section Thicknesses

As a minimum, we recommend the following typical pavement section be considered for car only areas.

Material	Thickness (inches)	Preparation.
Subgrade	Minimum 12 inches of compacted subgrade	95% of Modified Proctor MDD, -±2% Optimum Moisture Content
Aggregate Base[1]	6	Minimum CFA recommended base course thickness
Asphalt	4	Minimum CFA recommended binder course (2.5 inches) and surface course (1.5 inches)
Total Pavement Section	10	---

1. A material similar to WSDOT: 9-03.9(3) Base Course, or approved alternate. Terracon can review proposed materials during construction

As a minimum, we suggest the following typical pavement section be considered for combined car and delivery truck traffic.

Material	Thickness (inches)	Preparation
Subgrade	Minimum 12 inches of compacted subgrade	95% of Modified Proctor MDD, -±2% Optimum Moisture Content
Aggregate Base	8	Increased recommended base course thickness
Asphalt	4	Minimum CFA recommended binder course (2.5 inches) and surface course (1.5 inches)
Total Pavement Section	12	---

1. A material similar to WSDOT: 9-03.9(3) Base Course, or approved alternate. Terracon can review proposed materials during construction

The graded aggregate base should be compacted to a minimum of 95 percent of the material's modified Proctor (ASTM D1557, Method C) maximum dry density. Where base course thickness exceeds 8 inches, the material should be placed and compacted in two or more lifts of equal thickness. Asphalt concrete aggregates and base course materials should conform to the 2018 WSDOT Standard Specifications.

The listed pavement component thicknesses should be used as a guide for pavement systems at the site for the traffic classifications stated herein. These recommendations assume a 20-year pavement design life. If pavement frequencies or loads will be different than that specified Terracon should be contacted and allowed to review these pavement sections.

We recommend a Portland cement concrete (PCC) pavement be utilized in entrance and exit sections, dumpster pads, loading dock areas, or other areas where extensive wheel maneuvering or repeated loading are expected. The dumpster pad should be large enough to support the wheels of the truck which will bear the load of the dumpster. We recommend a minimum of 6½ inches of PCC underlain by 4 inches of crushed aggregate base. Although not required for

structural support, the base course layer is recommended to help reduce potentials for slab curl, shrinkage cracking, and subgrade "pumping" through joints. 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.

Portland cement concrete should be designed with proper air-entrainment and have a minimum 28 day compressive strength of 4,000 psi. Adequate reinforcement and number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI requirements. The joints should be sealed as soon as possible (in accordance with sealant manufacturer's instructions) to minimize infiltration of water into the soil.

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.

We recommend drainage be included at the bottom of the crushed aggregate base layer 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 rock which is encompassed in Mirafi 140N or approved equivalent which will aid in reducing fines from entering 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 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 recommendations noted in **Pavement Design Parameters**.

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 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

As requested, our field exploration work included the drilling and sampling of exploratory soil borings consistent with the following schedule.

Boring	Boring Depth (feet)	Elevation (feet)	Location
B-1	16½	1945	Building
B-2	16½	1946	Building
B-3	19	1945	Building
B-4	16½	1946	Building
B-5	6½	1947	Parking / Drive Areas
B-6	6½	1946	Parking / Drive Areas
B-7	6½	1947	Parking / Drive Areas
B-8	6½	1948	Parking / Drive Areas

1. Below existing ground surface
2. See **Exploration Plan**

Boring Layout and Elevations: Coordinates and elevations were obtained with a handheld GPS unit to locate borings with an estimated horizontal accuracy of ±10 feet and an estimated vertical accuracy of ±10 feet.

Subsurface Exploration Procedures: We advanced the borings with a trailer-mounted G-2400 drill rig using continuous flight augers (hollow stem). Four samples were obtained in the upper 10 feet of boring and at intervals of 5 feet thereafter. In borings B-5, B-6, B-7 and B-8 samples were collected at 2½feet below ground surface (bgs) and 5 feet bgs. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound 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. We did not observe groundwater during drilling and sampling. All borings were backfilled with bentonite chips after their completion. Pavements were patched with cold-mix asphalt.

The sampling depths, penetration distances, and other sampling information were 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 as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between

samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

SITE LOCATION

Proposed Chick-fil-A Restaurant #04481 ■ Spokane, Washington
May 21, 2019 ■ Terracon Project No. 81195058

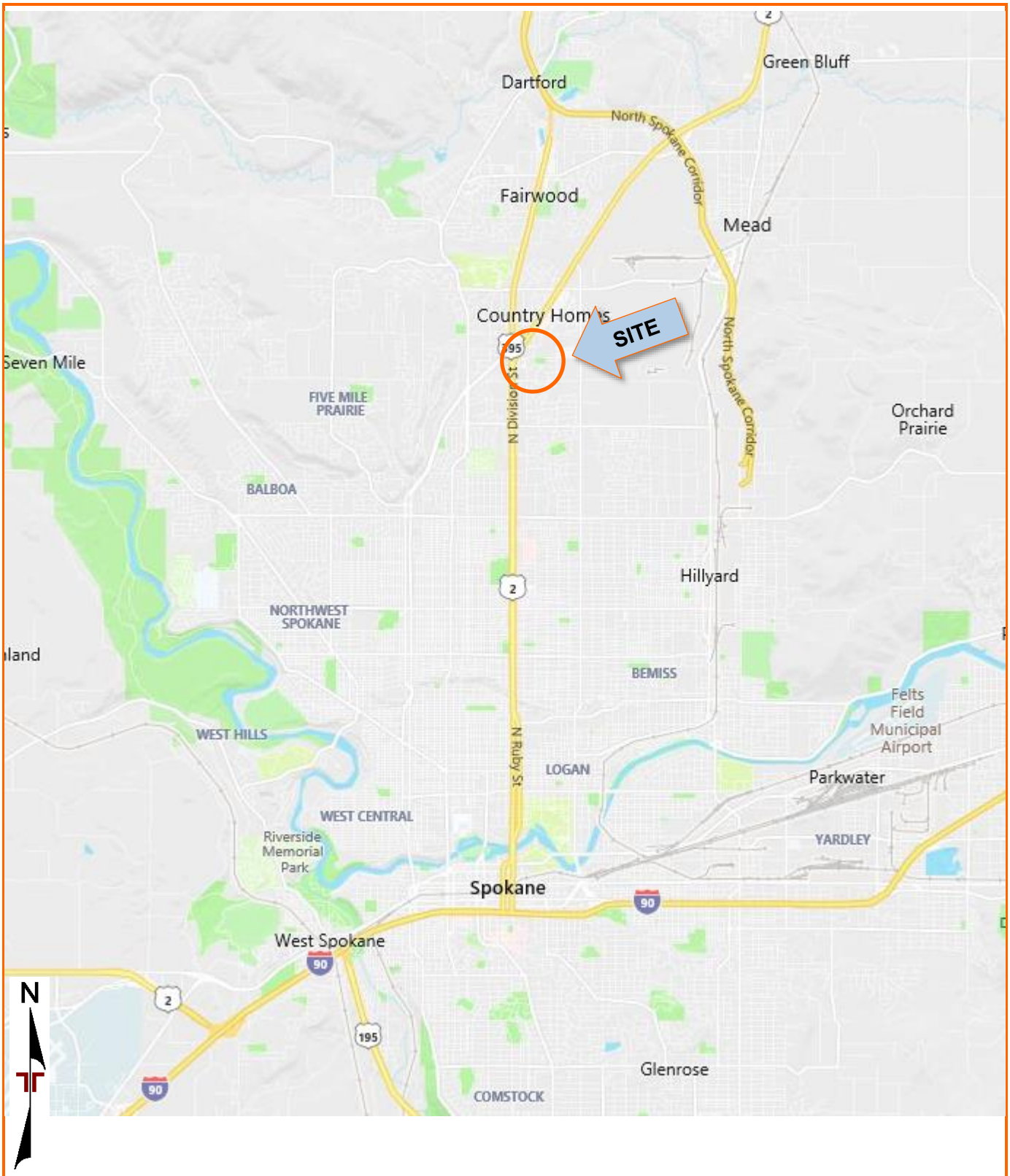


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Proposed Chick-fil-A Restaurant #04481 ■ Spokane, Washington

May 21, 2019 ■ Terracon Project No. 81195058

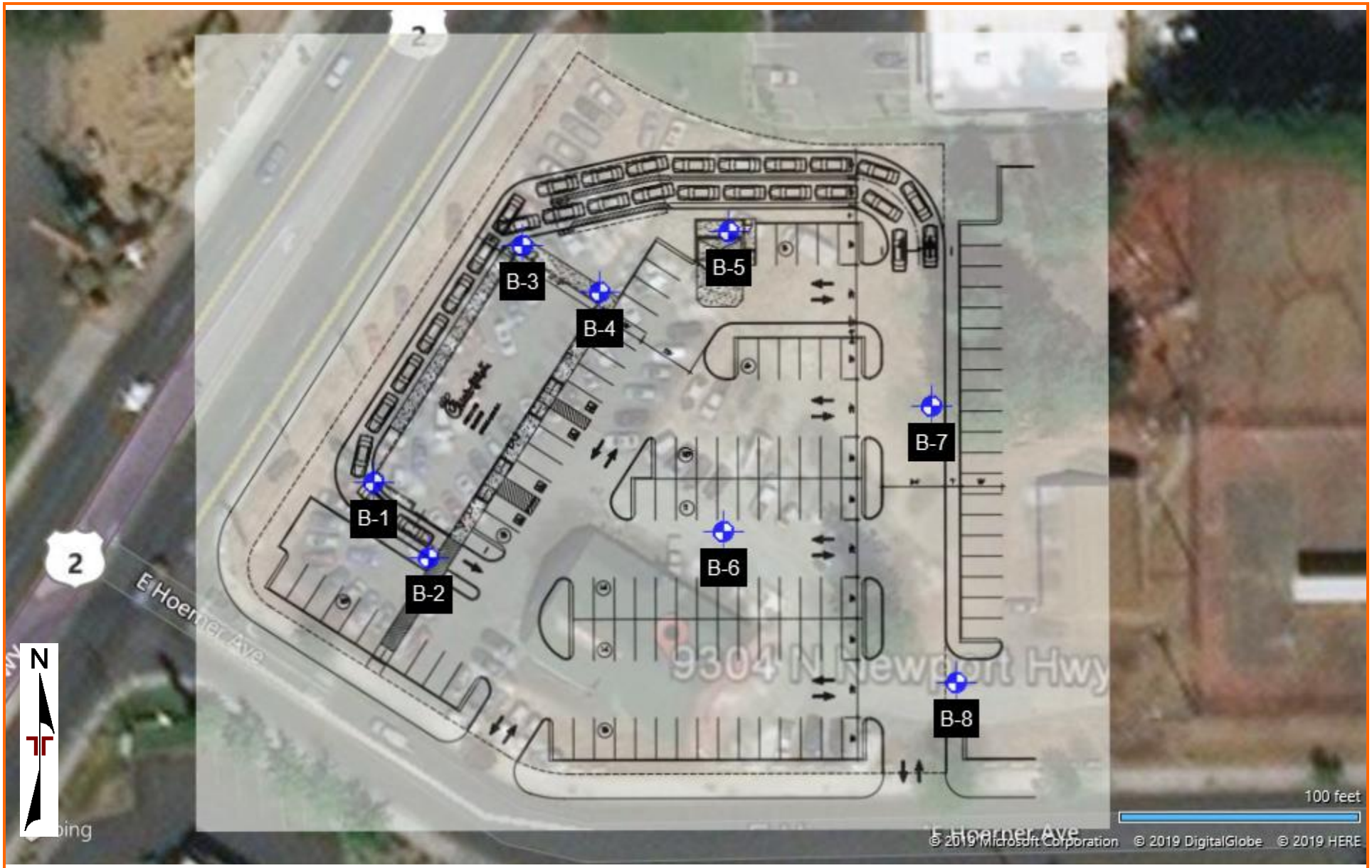


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Boring Logs (B-1 through B-8)

Note: All attachments are one page unless noted above.

BORING LOG NO. B-1

PROJECT: CFA #04481 - Spokane

CLIENT: Chick-fil-A, Inc.
Atlanta, GA

SITE: 9304 N Newport Highway
Spokane, WA

LOCATION See Exploration Plan

Latitude: 47.7425° Longitude: -117.4083°

Surface Elev.: 1945 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Sample Number
0.3 3" ASPHALT	1944.5					
POORLY GRADED SAND(SP), fine grained, reddish brown, moist, loose						
				X	3-2-4 N=6	S-1
grayish brown, medium dense		5		X	7-11-12 N=23	S-2
				X	7-13-15 N=28	S-3
		10		X	10-13-14 N=27	S-4
dense		15		X	12-17-18 N=35	S-5
16.5	1928.5					
Boring Terminated at 16.5 Feet						

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

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with Bentonite

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 measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

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

Boring Started: 04-15-2019
Boring Completed: 04-15-2019
Drill Rig: G-2400
Driller: Geologic Drill
Project No.: 81195058

BORING LOG NO. B-2

PROJECT: CFA #04481 - Spokane

CLIENT: Chick-fil-A, Inc.
Atlanta, GA

SITE: 9304 N Newport Highway
Spokane, WA

LOCATION See Exploration Plan

Latitude: 47.7425° Longitude: -117.4082°

Surface Elev.: 1946 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Sample Number
0.3 3" ASPHALT	1945.5					
POORLY GRADED SAND(SP), fine grained, reddish brown, moist, loose						
				X	2-3-2 N=5	S-1
medium dense		5		X	4-10-12 N=22	S-2
grayish brown				X	10-14-15 N=29	S-3
		10		X	10-12-12 N=24	S-4
dense		15		X	12-24-24 N=48	S-5
16.5	1929.5					
Boring Terminated at 16.5 Feet						

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

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with Bentonite

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 measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

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

Boring Started: 04-15-2019 | Boring Completed: 04-15-2019

Drill Rig: G-2400 | Driller: Geologic Drill

Project No.: 81195058

BORING LOG NO. B-3

PROJECT: CFA #04481 - Spokane

CLIENT: Chick-fil-A, Inc.
Atlanta, GA

SITE: 9304 N Newport Highway
Spokane, WA

LOCATION See Exploration Plan

Latitude: 47.7428° Longitude: -117.4081°

Surface Elev.: 1945 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Sample Number
0.3	1944.5	3" ASPHALT					
		POORLY GRADED SAND(SP), fine grained, reddish brown, moist, loose					
					X	2-2-2 N=4	S-1
		medium dense	5		X	5-8-9 N=17	S-2
6.0	1939						
		SILTY SAND(SM), fine grained, reddish brown, moist, medium dense					
8.0	1937						
		POORLY GRADED SAND(SP), fine grained, grayish brown, moist, medium dense			X	5-10-13 N=23	S-3
			10		X	8-11-13 N=24	S-4
		no recovery, gravel in shoe, blow count likely overstated due to coarse gravel	15		X	29-50/6" N=50/6"	S-5
					X	8-13-15 N=28	S-6
19.0	1926						
		Boring Terminated at 19 Feet					

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

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with Bentonite

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 measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

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

Boring Started: 04-15-2019
Boring Completed: 04-15-2019
Drill Rig: G-2400
Driller: Geologic Drill
Project No.: 81195058

BORING LOG NO. B-4

PROJECT: CFA #04481 - Spokane

CLIENT: Chick-fil-A, Inc.
Atlanta, GA

SITE: 9304 N Newport Highway
Spokane, WA

LOCATION See Exploration Plan

Latitude: 47.7428° Longitude: -117.408°

Surface Elev.: 1946 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Sample Number
	0.3 3" ASPHALT	1945.5					
	POORLY GRADED SAND(SP), fine grained, reddish brown, moist, loose						
					X	4-4-3 N=7	S-1
			5		X	3-4-5 N=9	S-2
	grayish brown, medium dense				X	7-10-12 N=22	S-3
			10		X	9-13-14 N=27	S-4
	dense		15		X	9-13-19 N=32	S-5
	16.5	1929.5					
	Boring Terminated at 16.5 Feet						

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

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with Bentonite

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 measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

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

Boring Started: 04-15-2019 | Boring Completed: 04-15-2019

Drill Rig: G-2400 | Driller: Geologic Drill

Project No.: 81195058

BORING LOG NO. B-5

PROJECT: CFA #04481 - Spokane

CLIENT: Chick-fil-A, Inc.
Atlanta, GA

SITE: 9304 N Newport Highway
Spokane, WA

LOCATION See Exploration Plan

Latitude: 47.7428° Longitude: -117.4077°

Surface Elev.: 1947 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Sample Number
0.5	1946.5					
SILT, trace organics, brown, moist, loose, grass, roots found						
POORLY GRADED SAND WITH SILT (SP-SM), fine grained, orangish brown, moist, loose				X	2-2-3 N=5	S-1
5.5	1941.5	5				
POORLY GRADED SAND (SP), trace organics, fine grained, grayish brown, moist, loose, roots found				X	2-3-2 N=5	S-2
6.5	1940.5					
Boring Terminated at 6.5 Feet						

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

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with Bentonite

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 measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

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

Boring Started: 04-15-2019 | Boring Completed: 04-15-2019

Drill Rig: G-2400 | Driller: Geologic Drill

Project No.: 81195058

BORING LOG NO. B-6

PROJECT: CFA #04481 - Spokane

CLIENT: Chick-fil-A, Inc.
Atlanta, GA

SITE: 9304 N Newport Highway
Spokane, WA

LOCATION See Exploration Plan

Latitude: 47.7425° Longitude: -117.4077°

Surface Elev.: 1946 (Ft.)

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Sample Number
	0.5	**FILL - FILL**, gravel, silt	1945.5					
		POORLY GRADED SAND(SP), fine grained, reddish brown, moist, medium dense				X	2-9-11 N=20	S-1
				5				
		interbedded with silt				X	6-10-10 N=20	S-2
	6.5		1939.5					
		Boring Terminated at 6.5 Feet						

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

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with Bentonite

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 measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

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

Boring Started: 04-15-2019 | Boring Completed: 04-15-2019

Drill Rig: G-2400 | Driller: Geologic Drill

Project No.: 81195058

BORING LOG NO. B-7

PROJECT: CFA #04481 - Spokane

CLIENT: Chick-fil-A, Inc.
Atlanta, GA

SITE: 9304 N Newport Highway
Spokane, WA

LOCATION See Exploration Plan

Latitude: 47.7426° Longitude: -117.4074°

Surface Elev.: 1947 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Sample Number
	0.5 **FILL - FILL**, gravel, silt	1946.5					
	POORLY GRADED SAND(SP), fine to medium grained, reddish brown, moist, loose						
					X	5-3-2 N=5	S-1
			5				
	trace organics				X	1-2-3 N=5	S-2
	6.5	1940.5					
	Boring Terminated at 6.5 Feet						

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

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with Bentonite

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 measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

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

Boring Started: 04-15-2019 | Boring Completed: 04-15-2019

Drill Rig: G-2400 | Driller: Geologic Drill

Project No.: 81195058

BORING LOG NO. B-8

PROJECT: CFA #04481 - Spokane

CLIENT: Chick-fil-A, Inc.
Atlanta, GA

SITE: 9304 N Newport Highway
Spokane, WA

LOCATION See Exploration Plan

Latitude: 47.7423° Longitude: -117.4074°

Surface Elev.: 1948 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Sample Number
	0.5 **FILL - FILL**, gravel, silt	1947.5					
	POORLY GRADED SAND(SP), fine grained, grayish brown, moist, loose						
					X	3-4-5 N=9	S-1
	medium dense		5		X	5-10-10 N=20	S-2
	6.5	1941.5					
	Boring Terminated at 6.5 Feet						

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

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with Bentonite

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 measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

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

Boring Started: 04-15-2019 | Boring Completed: 04-15-2019

Drill Rig: G-2400 | Driller: Geologic Drill

Project No.: 81195058

SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

CFA #04481 - Spokane ■ Spokane, WA

May 21, 2019 ■ Terracon Project No. 81195058

SAMPLING	WATER LEVEL	FIELD TESTS
☒ Standard Penetration Test	▽ **Water Initially Encountered** ▽ **Water Level After a Specified Period of Time** ▼ **Water Level After a Specified Period of Time** 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.	**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 is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field 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

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12

GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

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 ≥ 4 and 1 ≤ Cc ≤ 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 ≥ 6 and 1 ≤ Cc ≤ 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 organic odor				PT	Peat

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

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

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

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

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

[F] If soil contains ≥ 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.