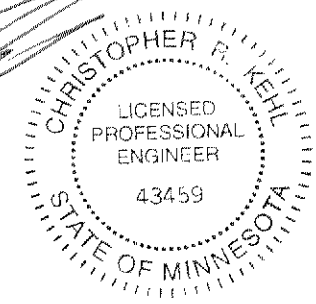
Geotechnical Evaluation Report

Crown Plaza Site
3601 American Blvd E
Bloomington, Minnesota

Prepared for

Bloomington QOZ, LLC

Professional Certification:
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Christopher R. Kehl, PE
Vice President, Principal Engineer
License Number: 43459
March 2, 2020

Project B1909819

Braun Intertec Corporation

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March 2, 2020

Project B1909819

Mr. Michael Roebuck
Bloomington QOZ, LLC
7500 W 78th Street
Edina, MN 55439

Re: Geotechnical Evaluation
Crown Plaza Site
3601 American Blvd E
Bloomington, Minnesota

Dear Mr. Roebuck:

We are pleased to present this Geotechnical Evaluation Report for the proposed development located at the Crown Plaza Site in Bloomington, Minnesota.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Chris Kehl at 952.995.2386 (ckehl@braunintertec.com) or Ryan Braun at 651.304.7074 (rbraun@braunintertec.com).

Sincerely,

BRAUN INTERTEC CORPORATION

Ryan M. Braun, EIT
Staff Engineer

Christopher R. Kehl, PE
Vice President, Principal Engineer

c: Dave Nash, PE, Alliant Engineering, Inc.
John Madden, PE, Ericksen Roed & Associates

Table of Contents

Description **Page**

Table of Contents (continued)

Description **Page**

Table of Contents (continued)

Description **Page**

A. Introduction

A.1. Project Description

This Geotechnical Evaluation Report addresses the proposed design and construction of the proposed redevelopment of the surface parking lot and vacant lot, located adjacent to the Crown Plaza in Bloomington, Minnesota. The project will include the construction of a new market rate apartment building and a new workforce apartment building. The existing six-story parking ramp will remain on the site in its current state. First, the market rate apartments over basement parking will be constructed over the eastern portion of the site; second, the workforce apartments over basement parking will be constructed to the south of the existing parking ramp. The parking lot directly north of the workforce parking lot will be filled with approximately 20 feet of soil fill, and separated for the existing parking ramp by a wall. Tables 1 and 2 provide project details.

Table 1. Building Description

Aspect	Description	
Type of building	Workforce Apartment	Market Rate Apartment
Below grade levels	2 (Provided)	2 (Provided)
Above grade levels	5 (Provided)	4 (Assumed)
Lowest level floor elevation (feet Mean Sea Level)	776 (Provided)	782 (Provided)
Column loads (kips)	Up to 1,000 (Assumed)	Up to 650 (Assumed)
Wall loads (kips per linear foot)	Up to 30 (Assumed)	Up to 20 (Assumed)
Nature of construction	Precast with wood framing above (Assumed)	Concrete foundation walls with wood framing above grade (Assumed)

Table 2. Site Aspects and Grading Description

Aspect	Description
Additional site aspects	Limited surface parking
Stormwater management	Reuse existing pond
Grade changes	Overall site grades remain similar West building near existing elevations East building cut to grade for basement
Pavement type(s)	Flexible (bituminous)
Assumed pavement loads	Light-duty: 50,000 ESALs* Car traffic only
	Heavy-duty: 100,000 ESALs* Occasional deliveries and garbage pickup

*Equivalent 18,000-lb single axle loads based on 20-year design.

The figure below shows an illustration of the proposed site layout.

Figure 1. Proposed Site Layout

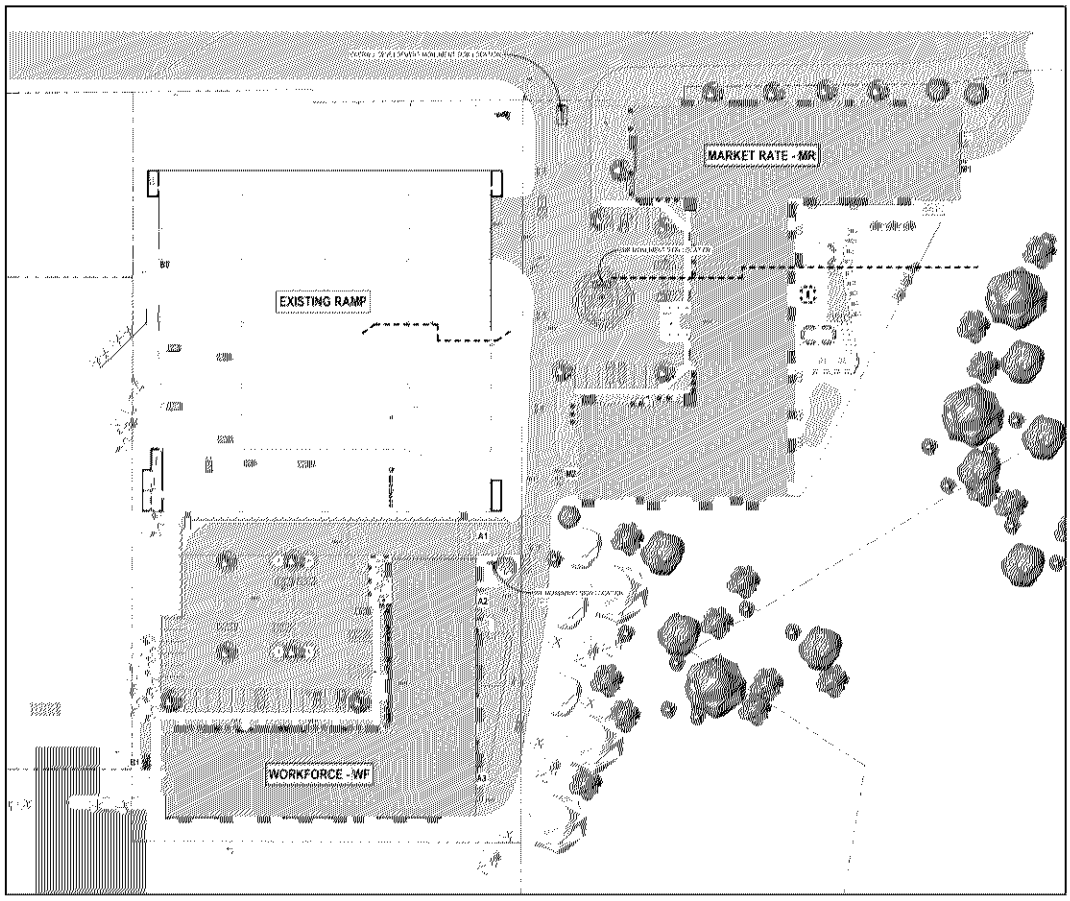


Figure provided by Millennium Design Group.

A.2. Site Conditions and History

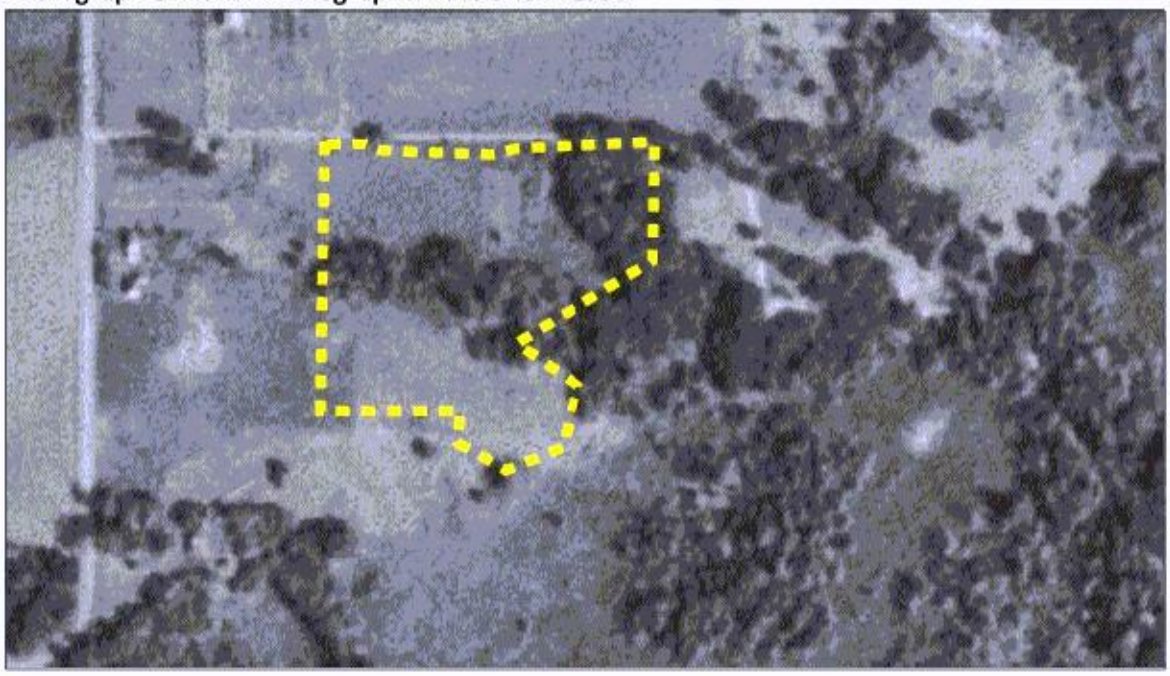
Currently, the site exists as four separate parcels as shown in Photograph 1 below. The parcels on the west half of the site currently contains a six-story parking garage with a surface parking lot to the south of the ramp. The east parcel exists as a surface parking lot. The site has a notable topography with current grades ranging from 774 to 811 feet Mean Sea Level (MSL). Generally, the site is sloping, from the northwest corner of the site to the southeast corner of the site, with the low area of the site being in the southeast corner around the existing pond.

Photograph 1. Site Extents

Photograph from Hennepin County GIS

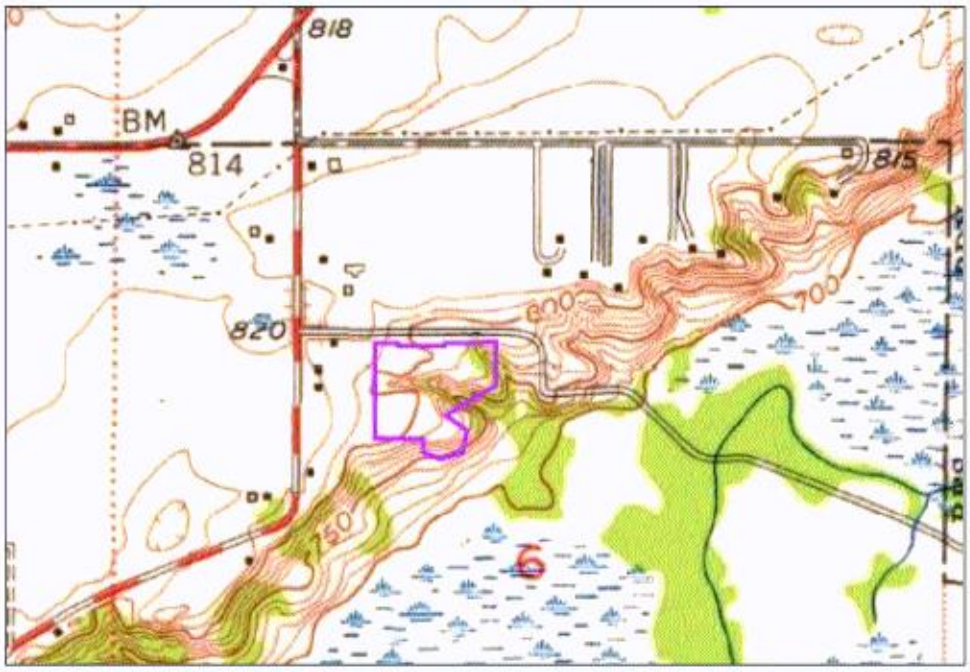
Historically, it appears the site was used for agricultural purposes until the 1950s. As shown in Photograph 2 below, you will note the site has a row of trees down the middle. Based on the photograph and topographic map in Figure 2, it appears to be a ravine that bisects the site.

Photograph 2. Aerial Photograph of the Site in 1953



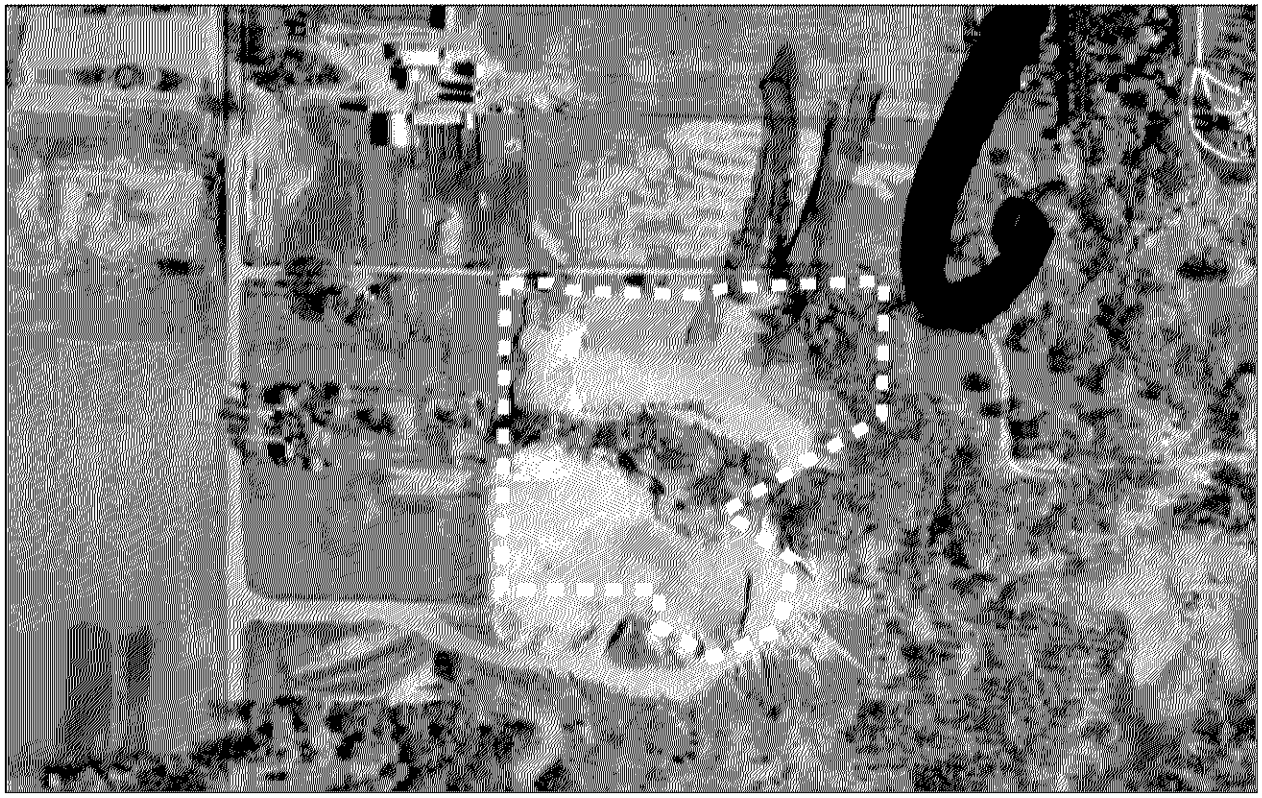
Photograph provided by Environmental Risk Information Services (ERIS).

Figure 2. Predevelopment Topography from 1957 USGS Quadrangle



The 1960 aerial photograph and several of the topographic maps of roughly the same time frame indicate a gravel pit on the site. The typical process for gravel to remove soil is to extract the gravel by screening and placing the waste sand back in the excavation. Some of this waste sand may also have been placed in the ravine. Frequently in pit operations, other unsuitable soils are accepted and sand is hauled back to the originating site.

Photograph 3. Aerial Photograph of the Site in 1960



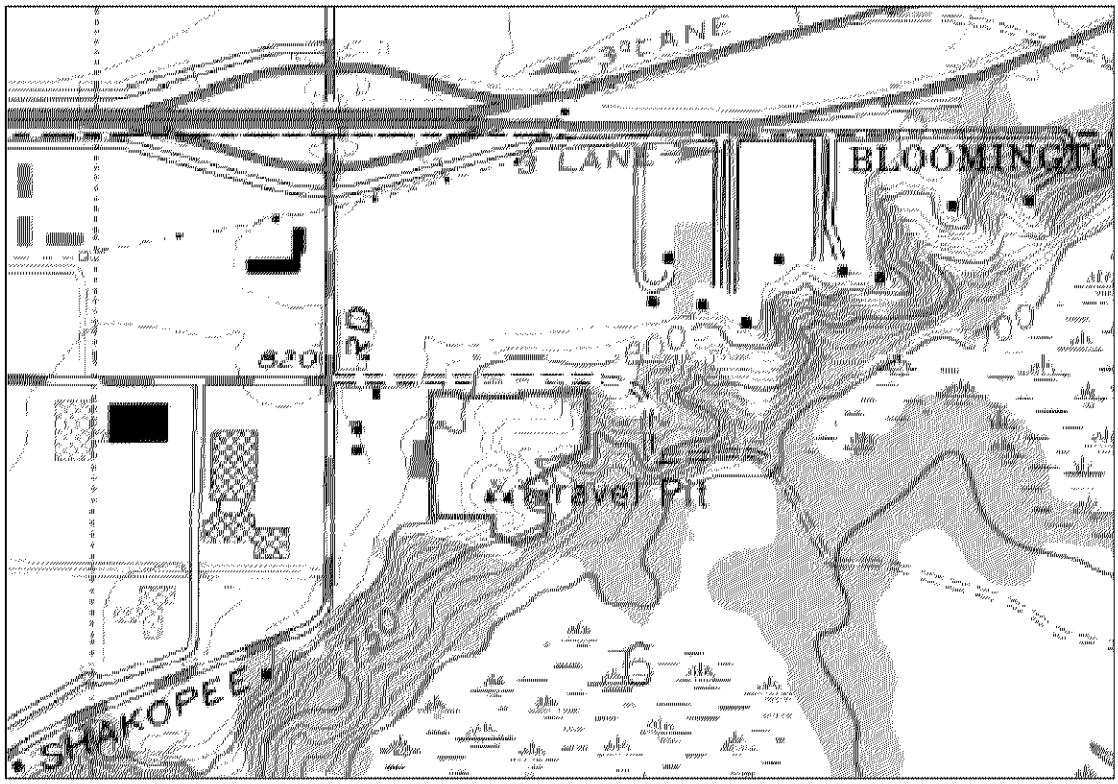
Photograph 4 below shows the site which appears to be in construction process for the buildings and parking ramps. Prior to the parking ramp structure, no structures were documented on the property. Hennepin County lists the construction date of the office tower and parking ramp as 1973. The Crown Plaza Hotel was constructed in 1980.

Photograph 4. Aerial Photograph of the Site in 1972

Photograph provided by Environmental Risk Information Services (ERIS).

Figure 3 is shown after grading and construction has occurred. It still indicates a gravel pit at the site but the ravine is less defined as compared to Figure 2.

Figure 3. Topography from 1980 USGS Quadrangle



Photograph 5 below illustrates the site in more or less the same condition as it is now, along with the existing topography overlaid. Generally speaking, the topography of the site appears to be relatively the same as the post-mining operation topography. As described above, the existing six-story parking garage is shown as well as the two surface parking lots.

Photograph 5. Aerial Photograph of the Site in 2018

Photograph provided by MnTOPO.

A.3. Purpose

The purpose of the geotechnical evaluation is to characterize subsurface geologic conditions at selected exploration locations and evaluate their impact on the design and construction of the Crown Plaza Site.

A.4. Background Information and Reference Documents

We reviewed the following information:

- Existing topographic map from MnTOPO.
- Previous geotechnical reports prepared by Braun Intertec under project numbers 84-033 dated February 6, 1984 and BABX-97-728 dated December 12, 1997.
- Communications with Alliant Engineering, Inc., Ericksen Roed and Ron Clark Construction regarding site layout and design aspects.
- Phase I Environmental Site Assessment prepared by Braun Intertec as part of this project.

In addition to the provided sources, we have used several publicly available sources of information, including Geologic Atlas of Hennepin County, Minnesota – Surficial Geology maps.

We have described our understanding of the proposed construction and site to the extent others reported it to us. Depending on the extent of available information, we may have made assumptions based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, the project team should notify us. New or changed information could require additional evaluation, analyses and/or recommendations.

A.5. Scope of Services

We performed our scope of services for the project in accordance with our Proposal QTB107161 to Ron Clark Construction, Inc., dated September 5, 2019 as well as the services in accordance with the Change Order to Ron Clark Construction, Inc., dated October 31, 2019. The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Reviewing the background information and reference documents previously cited.

- Staking and clearing the exploration location of underground utilities. We selected and staked the new exploration locations. We acquired the surface elevations and locations with GPS technology using the State of Minnesota's permanent GPS base station network. The Soil Boring Location Sketch included in the Appendix shows the approximate locations of the borings.

- Performing 21 standard penetration test (SPT) borings, denoted as ST-101 to ST-121, to nominal depths of 25 to 45 feet below grade across the site. After drilling, we were also asked to perform several hand augers in the stormwater ponds and install several temporary water level evaluating pipes.

- Installing two temporary water level evaluating pipes in the south parking lot and lower level of the parking garage.

- Performing test pit observations to further evaluate the amount of debris in the existing fill.

- Performing a slope stability analysis of the stormwater management pond that was previously constructed by others.

- Performing laboratory testing on select samples to aid in soil classification and engineering analysis.

- Performing ground penetrating radar (GPR) on existing footing and walls of the parking ramp to help evaluate reinforcing and thickness of the walls and footing.

- Preparing this report containing a boring location sketch, logs of soil borings, a summary of the soils encountered, results of laboratory tests, and recommendations for structure and pavement subgrade preparation and the design of foundations, floor slabs, exterior slabs, utilities, stormwater improvements and pavements.

Our authorized scope of services for the project also included a Phase I Environmental Site Assessment (ESA) and a Pre-Demolition Hazardous Building Materials Inspection (HazMat). The work for these are underway and will be submitted as separate reports.

B. Results

B.1. Geologic Overview

We based the geologic origins used in this report on the soil types, in-situ and laboratory testing, and available common knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

B.2. Previous Geotechnical Information

Although we have performed soil borings and prepared a geotechnical evaluation for portions of this property, Appletree Condominiums and Appletree Square Condominiums Groundwater Monitoring, none of the previous borings were performed within the proposed building pad areas. One boring, ST-2, was performed near the storm runoff area.

However, as presented below in Section B.3, the soil conditions for the proposed buildings are generally consistent with what was encountered for the nearby developments discussed above. Soils may have changed in particular from the 1984 soil borings, as they were performed prior to construction. They are useful as they also observed deep fill consistent with what we have observed.

Groundwater measurements should also be reviewed but may change with time.

B.3. Boring Results

Table 3 provides a summary of the soil boring results, in the general order we encountered the strata. Please refer to the Log of Boring sheets in the Appendix for additional details. The Descriptive Terminology sheet in the Appendix includes definitions of abbreviations used in Table 3.

Table 3. Subsurface Profile Summary*

Strata	Soil Type - ASTM Classification	Range of Penetration Resistances	Commentary and Details
Pavement section	---	---	▪ Overall thickness ranges from 8 to 14 inches. ▪ Bituminous thickness 3 to 6 inches, typically 5 inches. ▪ Aggregate base is 3 to 10 inches.
Topsoil fill	SM, SC	---	▪ Dark brown to black. ▪ Variable thickness, present only at ST-101, ST-102, ST-106, ST-118 and ST-121. ▪ Thicknesses at boring locations varied from 4 to 15 inches. ▪ Moisture condition generally moist.
Fill	SP-SM, SM, SC, CL	2 to 61 Blows per Foot (BPF)	▪ Moisture condition generally moist. ▪ Thicknesses at boring locations varied from 9 to 26 feet. ▪ Highly variable, soils intermixed. ▪ Occasional layers of slightly organic to organic soils throughout. ▪ Existing fill contained variable amounts of debris, including concrete and bituminous.
Alluvial	SP, SP-SM, SM, ML, SC	2 to 49 BPF	▪ Moisture condition generally moist to wet. ▪ Variable amounts of gravel.

*Abbreviations defined in the attached Descriptive Terminology sheet.

For simplicity in this report, we define existing fill to mean existing, uncontrolled or undocumented fill.

B.4. Test Pit Results

We performed four test pits to better evaluate the amount of debris in the existing fill and to expose the footing for the west parking ramp wall.

- Test pit TP-1 was dug to expose the existing footing and contained 1 foot of pavement over 6 feet of fill down to the top of the footing. The fill consisted of silty sand and poorly graded sand with silt and contained no debris. The footing extended from the wall approximately 15 feet and we had not found the edge yet. The footing was estimated to be over 24 inches thick as we were not able to view the base when scanned with ground penetrating radar.

Photograph 6. TP-1

- Test pit TP-2 was dug in the south parking lot in the southeast corner. This test pit encountered 1 foot of pavement over 3 1/2 feet of fill consisting of poorly graded sand with silt underlain by native poorly graded sand.

Photograph 7. TP-2

- Test pits TP-3 and TP-4 were dug in the east surface parking lot. These two test pits encountered similar soils. The two test pits encountered fill to termination depths of 26 feet. The fill consisted of a silty sand, clayey sand and poorly graded sand with silt with varying amounts of bituminous debris. The bituminous debris was encountered from 16 feet to 26 feet in both test pits along with a bituminous layer at 5 feet in the test pit to the east.

Photograph 8. TP-3

Photograph 9. TP-4

B.5. Groundwater

Table 4 summarizes the depths where we observed groundwater; the attached Log of Boring sheets in the Appendix also include this information and additional details.

Table 4. Groundwater Summary

Location	Surface Elevation	Measured or Estimated Depth to Groundwater (ft)	Corresponding Groundwater Elevation (ft)
ST- 13	810.7	41.9 Measured overnight	768.8
ST-14	812.8	Not encountered to 872	
ST-101	810.6	40	770 1/2
ST-102	805.2	40	765
ST-103	799.4	Not observed to elevation 768	
ST-104	799.3	Not observed to elevation 768	
ST-105	793.6	Not observed to elevation 767	
ST-106	796.2	Not observed to elevation 765	
ST-107	778.5	5	773 1/2
ST-108	778.2	20	758
ST-109	776.4	15	761
ST-110	776.7	20	756 1/2
ST-111	775.5	5	770 1/2
ST-112	773.9	20	753 1/2
ST-113	778.3	7	771
ST-114	777.2	3	774
ST-115	775.7	4	771 1/2
ST-116	774.6	17	757 1/2
ST-117	798.3	Not observed to elevation 767	
ST-118	798.0	Not observed to elevation 757	
ST-119	797.5	Not observed to elevation 751 1/2	
ST-120	789.2	28	761
ST-121	792.4	Not observed to elevation 761	
ST-1 (1984)	784.5	Not observed to elevation 754	
ST-2 (1984)	794.4	Not observed to elevation 763 1/2	
ST-2 (1997)	771	24	
ST-3 (1997)	793	Not observed to elevation 791 1/2	

In addition, we performed some probes at the existing pond to evaluate the water level in the pond. There was standing water in the pond at the times we visited the pond. Locations are shown in Figure 4 below and are to be recorded with GPS at a later date. A summary of our observations is shown in the table below.

Figure 4. Probes at Stormwater Pond

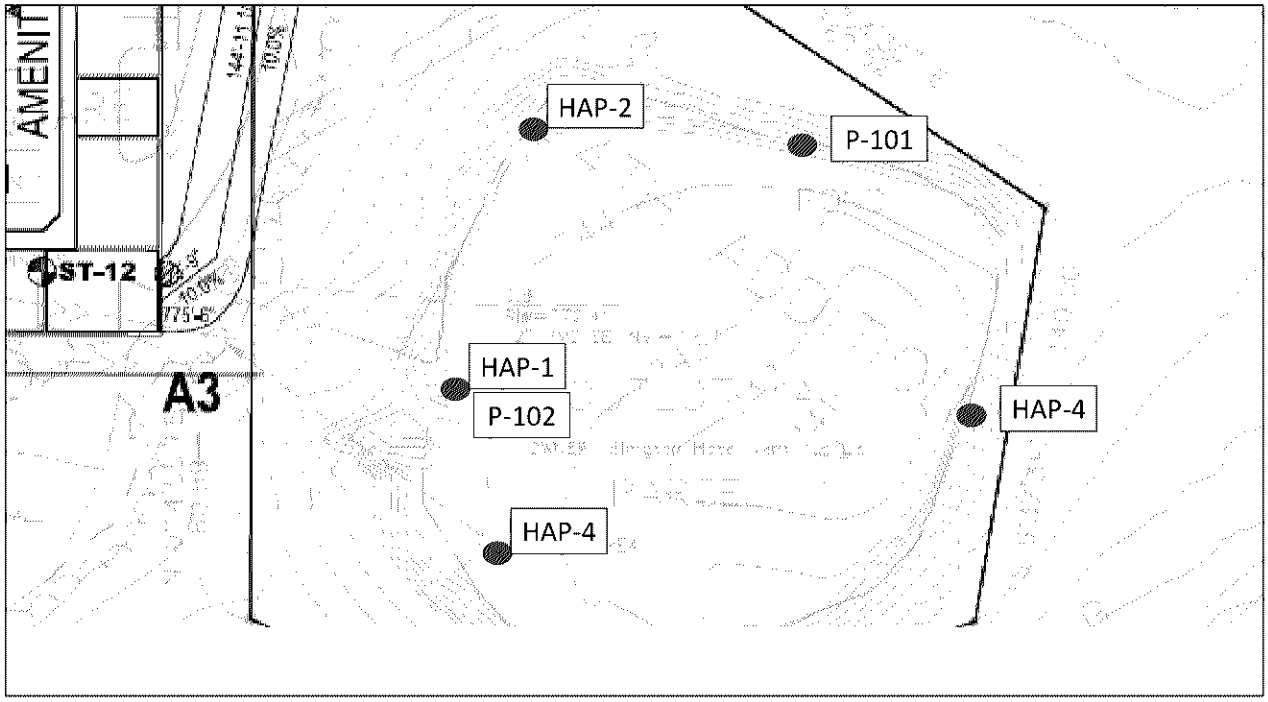


Table 5. Pond Water levels

Location	Surface Elevation	Water Level Depth from Surface (feet)	Water Level Depth from Surface (feet)	Water Level Depth from Surface (feet)	Water Level Depth from Surface (feet)	Water Level Depth from Surface (feet)
Date		**Oct. 8, 2019**	**Oct. 10, 2019**	**Oct. 25, 2019**	**Nov. 20, 2019**	**Dec. 9, 2019**
P-101	750.2	0.9	0.8	1.6	2.8	3.0
P-102	738.5	3.4	1.4	0.8	1.1	2.0

Table 6. Soil Profile at Pond

Hand Auger Probe	Soil Profile	Groundwater Depth
HAP-1	0-2 feet - very loose, fine grained, silty sand, brown 2-4 feet - loose, fine grained, silty sand, brown	1 foot
HAP-2	0-1/2 feet - loose, fine grained, silty sand, brown 1/2-4 feet - loose, fine to medium grained, poorly graded sand, light brown	3 feet
HAP -3 (Off survey pt 117)	0-1/2 feet - very loose, fine grained, clayey sand, brown 1/2-3 feet - medium, sandy lean clay, brown	Not Encountered
HAP-4	0-2 feet - very loose, fine grained, silty sand, brown 2-3 feet - loose, fine grained, silty sand, dark brown 3-4 feet - medium, sandy lean clay, dark gray	Surface

In addition to noting groundwater while drilling, we installed two piezometers in the south parking lot and the lower level of the parking garage. Table 7 below summarizes the groundwater measurements taken from the two piezometers.

Table 7. South Parking Lot Water Levels

Location	Surface Elevation	Water Level Depth from Surface (feet)	Water Level Depth from Surface (feet)	Water Level Depth from Surface (feet)
Date		**Nov 26, 2019**	**Dec 4, 2019**	**Dec 9, 2019**
P-01	Approximately 793	---	Not Encountered to 5 feet	Not Encountered to 5 feet
P-02	778.2	4.4	4.2	4.2

The groundwater table varies across the site by about 20 feet. Based on our boring results, it appears as the groundwater table is dropping in relation to the surface elevation. In general, groundwater was encountered at higher elevations in the north side of the site and generally was dropping as it headed to the south side of the site, with groundwater encountered at lower elevations in the southeast corner of the site. This change in groundwater table is likely associated with an old ravine that ran through the site along with the dropping surface elevation across the site. Project planning should expect groundwater would fluctuate seasonally and annually. Existing storm utilities and drain tile around the ramp may also be acting as a conduit to drain groundwater on the site.

B.6. Laboratory Test Results

The boring logs show the results of the laboratory testing we performed, next to the tested sample depth. The Appendix contains the results of these tests.

The moisture content (ASTM D 2216) of the selected fill varied from approximately 5 to 31 percent, indicating that the material was near or above of its probable optimum moisture content.

Our mechanical analyses (ASTM C 117) indicated that the selected samples contained 4 to 18 percent silt and clay by weight.

B.7. Ground Penetrating Radar Results

Braun Intertec performed our evaluation using a 350 MHz Ground Penetrating Radar (GPR) antenna on November 21, 2019. A GPR system operates by transmitting electromagnetic pulses into the subsurface and recording subsequent reflections from features of varying electric properties. The system was observed in real time and interpretation of results was performed in the field. The GPR has a limiting range of recording thicknesses up to 24 inches; if thicknesses are more than 24 inches, the GPR will not register it.

In our evaluation, we scanned one spot of the existing west parking ramp wall footing as well as three spots of the west parking ramp wall on different levels. We were unable to expose the side of the footing so we performed a scan on the side of the footing; we were not able to determine the thickness indicating that the footing is likely more than 24 inches thick. The scan indicated two reinforcing mats in the footing, one at the top of the footing and one toward the bottom of the footing. The reinforcing for the footing was spaced at approximately 12 inches on center in both directions for both the top and bottom mat. We scanned the west parking ramp wall at the base of the wall where the wall meets the footing, the 2nd level of the parking ramp and the 4th floor of the parking ramp. The three scans of the wall indicated similar readings. All three spots had an approximate thickness of 12 inches with a double mat of reinforcing, inside and outside face with reinforcing spaced at approximately 12 inches on center horizontally and vertically.

C. Recommendations

C.1. Design and Construction Discussion

Existing fill was encountered in most of the soil borings that was likely related to the gravel mining operations, ravine filling, and grading related to site development. Some of the fill encountered in the soil borings such as ST-107, ST-108 and ST-112 appear to be suitable material and have penetration resistance (blow counts) indicating it was compacted. Others soil borings such as ST-103, ST-104, ST-105 contains debris, little or variable compaction and unsuitable soil. Due to the inherent variability of soil placed by man, without documentation and testing the existing fill material is assumed to be unsuitable for building support. The east building pad appears to have "worse" fill than the west side. However, soil borings sample only a small portion of the site and conditions may exist that will not be understood until test pits or mass excavation of the site begins. Additional field evaluation through either test pits and/or very dense soil borings would be needed to further define the condition of the fill.

C.1.a. East Market Rate Apartment Building

The fill observed will require soil corrections to prepare the building pad. In several of the locations the basement excavations would extend almost entirely through the fill, limiting the volume that needs to be corrected. Given the site geometry, we anticipate that an open cut and soil correction would be performed. However, on the south end of the building the fill gets deeper such that ground improvement could also be considered. Logistics of this correction need to consider the following:

- Cost and extents of soil corrections and oversizing for building support.
- Cost and risk associated with environmentally impacted soils.

Consideration could be given to using permanent steel sheet pile to not only retain the soils during construction but also act as the permanent foundation wall.

C.1.b. Workforce Apartments

Some relatively shallow groundwater was encountered in the soil borings in the south parking lot. The water table drops off so it may be encountered at different elevations throughout the site. It is to be expected that groundwater may be encountered during excavations for footings or soil corrections, especially in deep excavations around the ramp. Water table separation below the interior slab should be maintained to provide 4 feet of separation from the groundwater table. We would again note that the existing ramp may have features such as drain tile that are currently limiting groundwater tables, so they should be maintained or improved upon to relieve any groundwater.

C.1.c. Building Subgrade Preparation

We believe there are multiple viable subgrade preparation procedures for this site. Two of the most likely are summarized below.

C.1.c.1. Option A – Standard Soil Correction

Based on the results of our subsurface exploration and evaluation, spread footing foundations bearing on the native soils or engineered fill can support the proposed structure, after performing subgrade preparation. Subgrade preparation includes removing existing fill, topsoil or organic soils, structures and any very loose sands and silts or soft to medium clays directly below the footings.

Some of these soil corrections may extend below the water table. Given the soils are on site are generally granular, some dewatering would be required and well points would be needed.

If the soil corrections are needed and extend more than 10 feet from finished grade, select sand with less than 12 percent fines should be placed until 10 feet from finished grade.

C.1.c.2. Option B – Ground Improvement

Based on the excavation depths required for a soil correction and the costs associated with it, we believe that ground improvement such as aggregate piers/stone columns are another viable option for subgrade preparation that may be more cost effective than a standard soil correction. Ground improvement would not be needed below slabs, only below foundations and their oversize zones. Extensive debris, if encountered, can be a challenge for this technique. Groundwater can be more challenging with this approach but can be addressed through alternate techniques.

Following ground improvement, the proposed buildings can be supported upon conventional spread footings, usually with bearing pressures of 4,000 to 5,000 psf.

Another option is Densipact system by Geopier; this approach can densify loose sand fill. This approach requires sand fill relatively free of fines (ideally 12 percent or less but may be effective with up to 20 percent fines, and no debris or organic soils). With this approach, bearing pressures of 10,000 psf are achievable without having to remove soils. However, soils containing silt and clay, such as at ST-115, would still need to be improved by conventional methods. This approach may be helpful in the parking ramp area, where fill appears to be more consistently granular to improve the existing deep fill or native sands to improve consistency.

C.2. Site Grading and Subgrade Preparation

C.2.a. Building Subgrade Excavations

We recommend removing unsuitable materials from within the building pad and oversizing areas. We define unsuitable materials as existing fill, frozen materials, organic soils, existing structures, existing utilities and associated backfill, vegetation and soft/very loose soils. As an alternate, consideration could be given to leaving in place existing fill below the floor slab where the ground level is used for parking. In parking areas performance expectations are generally lower, and with additional steps such as observing the subgrade, focused corrections of unstable materials and surface compaction the fill could be left in place.

Table 8 shows the anticipated excavation depths and bottom elevations for each of the borings for the west structure in relation to the proposed low floor elevation (LFE) of 776 feet Mean Sea Level (MSL). Table 9 shows the anticipates excavation depths and bottom elevations for each of the borings for the east structure in relation to the proposed low floor elevation (LFE) of 782 feet Mean Sea Level (MSL).

Table 8. West Workforce Building Excavation Depths

Location	Approximate Surface Elevation (ft)	Anticipated Excavation Depth (ft)	Anticipated Bottom Elevation (ft)	Anticipated Depth Below LFE 776 (ft MSL)
ST-107	778.5	9	769 1/2*	6 1/2
ST-108	778.2	19	759	17
ST-109	776.4	9	767 1/2	8 1/2
ST-110	776.7	19	757 1/2	18 1/2
ST-111	775.5	12	763 1/2*	12 1/2
ST-112	773.9	19	755	21
ST-113	778.3	9	769*	7
ST-114	777.2	7	770*	6
ST-115	775.7	7	768 1/2*	7 1/2
ST-116	774.6	19	755 1/2*	20 1/2

*Below observed water table.

Table 9. East Market Rate Building Excavation Depths

Location	Approximate Surface Elevation (ft)	Anticipated Excavation Depth (ft)	Anticipated Bottom Elevation (ft)	Anticipated Depth Below LFE 782 (ft MSL)
ST-103	799.4	14	785 1/2	Cut to grade
ST-104*	799.3	14	785	Cut to grade
ST-105	793.6	24	769 1/2	12 1/2
ST-106	796.2	12	784	Cut to grade
ST-117	798.3	28	770	12
ST-118	798.0	38	760	22
ST-119*	797.5	39	758 1/2	23 1/2
ST-120	789.2	19	770	12
ST-121*	792.4	24	768	14

*Additional subcuts of the silt may be needed to provide a stable working platform.

Upon completion the surface should be compacted with three perpendicular passes with a large vibratory roller.

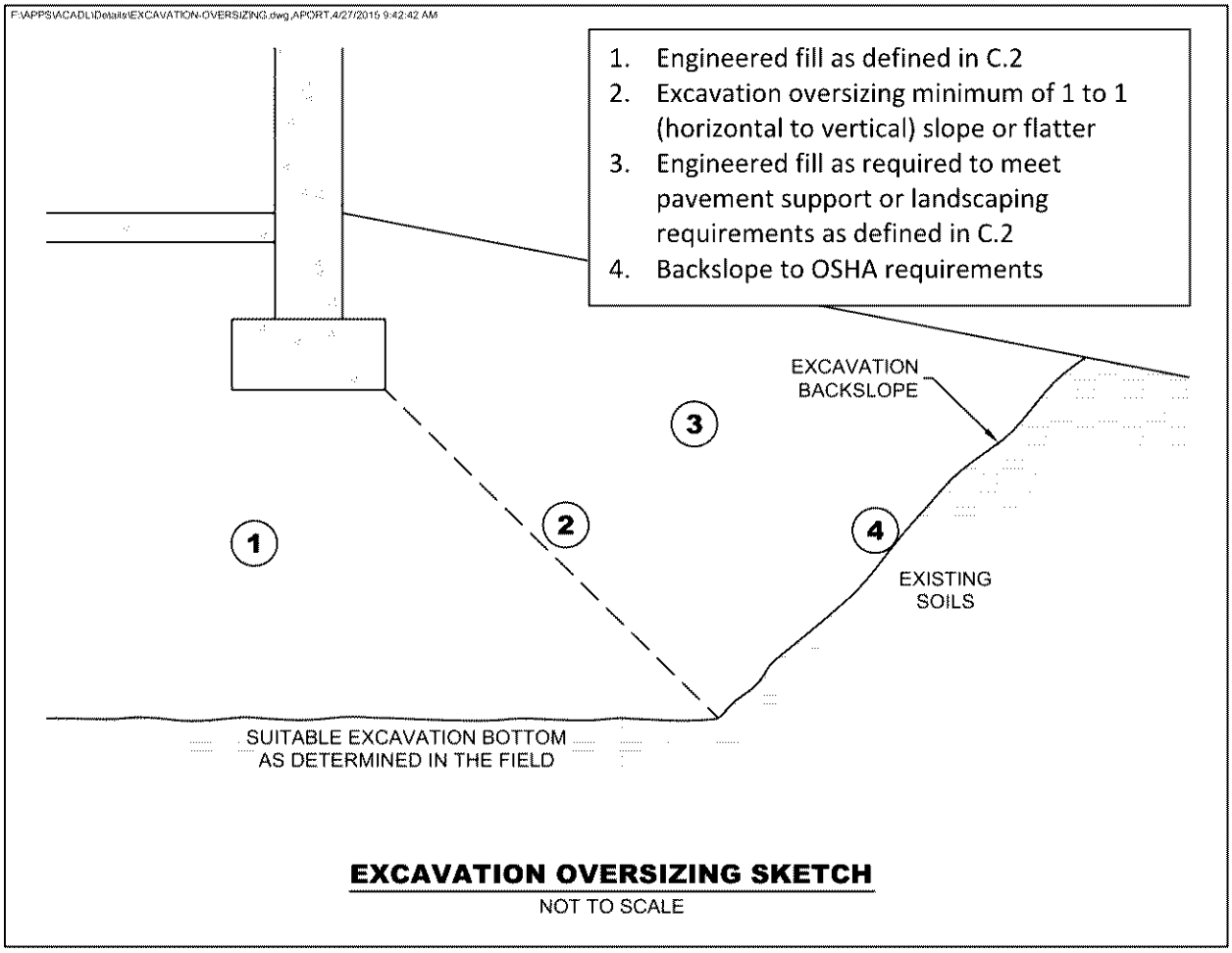
Excavation depths will vary between the borings. Portions of the excavations may also extend deeper than indicated by the borings. A geotechnical representative should observe the excavations to make the necessary field judgments regarding the suitability of the exposed soils.

The contractor should use equipment and techniques to minimize soil disturbance. If soils become disturbed or are wet, we recommend excavation and replacement of silty soils or surface compaction of sandy soils.

C.2.b. Excavation Oversizing

When removing unsuitable materials below structures or pavements, we recommend the excavation extend outward and downward at a slope of 1H:1V (horizontal:vertical) or flatter. See Figure 5 for an illustration of excavation oversizing.

Figure 5. Generalized Illustration of Oversizing



C.2.c. Excavated Slopes

Based on the borings, we anticipate on-site soils in excavations will consist of predominately sandy and silty soils. These soils are typically considered Type C Soil under OSHA (Occupational Safety and Health Administration) guidelines. OSHA guidelines indicate unsupported excavations in Type C soils should have a gradient no steeper than 1 1/2H:1V. If groundwater is encountered, the excavation slopes may need to be considerably flatter. Slopes constructed in this manner may still exhibit surface sloughing. OSHA requires an engineer to evaluate slopes or excavations over 20 feet in depth.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches." This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

C.2.d. Excavation Dewatering

We recommend removing groundwater from the excavations. Dewatering of high-permeability soils (e.g., sands) more than 1 foot from the groundwater surface from within the excavation with conventional pumps has the potential to loosen the soils, due to upward flow. A well contractor should develop a dewatering plan; the design team should review this plan. Where this water can be pumped for disposal and the associated permitting should be considered.

C.2.e. Pavement and Exterior Slab Subgrade Preparation

We recommend the following steps for pavement and exterior slab subgrade preparation. Note that project planning may need to require additional subcuts to limit frost heave.

1. Strip unsuitable soils consisting of topsoil, organic soils, vegetation, existing structures and pavements from the area, within 3 feet of the surface of the proposed pavement grade.

2. Have a geotechnical representative observe the excavated subgrade to evaluate if additional subgrade improvements are necessary.

3. Slope subgrade soils to areas of sand or drain tile to allow the removal of accumulating water.

4. Surface compact the subgrade with several passes of a large self-propelled drum roller.

5. Place pavement engineered fill to grade and compact in accordance with Section C.2.g to bottom of pavement and exterior slab section. See Section C.8 for additional considerations related to frost heave.

6. Proofroll the pavement or exterior slab subgrade as described in Section C.2.f.

C.2.f. Pavement Subgrade Proofroll

After preparing the subgrade as described above and prior to the placement of the aggregate base, we recommend proofrolling the subgrade soils with a fully loaded tandem-axle truck. We also recommend having a geotechnical representative observe the proofroll. Areas that fail the proofroll likely indicate soft or weak areas that will require additional soil correction work to support pavements.

The contractor should correct areas that display excessive yielding or rutting during the proofroll, as determined by the geotechnical representative. We recommend performing a second proofroll after the aggregate base material is in place, and prior to placing bituminous or concrete pavement.

C.2.g. Engineered Fill Materials and Compaction

Table 10 below contains our recommendations for engineered fill materials.

Table 10. Engineered Fill Materials*

Locations To Be Used	Engineered Fill Classification	Possible Soil Type Descriptions	Gradation	Additional Requirements
▪ Below foundations ▪ Below interior slabs	Structural fill	SP, SP-SM, SM	100% passing 2-inch sieve < 20% passing #200 sieve	< 2% Organic Content (OC)
Deep fill areas over 10 feet	Select structural fill	SP, SP-SM	100% passing 2-inch sieve < 12% passing #200 sieve	< 2% OC
▪ Drainage layer ▪ Non-frost-susceptible ▪ In standing water or very soft subgrades	▪ Free-draining ▪ Non-frost-susceptible fill	GP, GW, SP, SW	100% passing 1-inch sieve < 50% passing #40 sieve < 5% passing #200 sieve	< 2% OC
Behind below-grade walls, beyond drainage layer	Retained fill	SP, SP-SM, SM	100% passing 3-inch sieve < 20% passing #200 sieve	< 2% OC Plasticity Index (PI) < 4%
Pavements	Pavement fill	SP, SM, SC	100% passing 3-inch sieve < 50% passing #200 sieve	< 2% OC PI < 15%
Below landscaped surfaces, where subsidence is not a concern	Non-structural fill	---	100% passing 6-inch sieve	< 10% OC

* Engineered fill materials should satisfy the approved Response Action Plan (RAP), or applicable environmental requirements.

* More select soils comprised of coarse sands with < 5% passing #200 sieve may be needed to accommodate work occurring in periods of wet or freezing weather.

We recommend spreading engineered fill in loose lifts of approximately 12 inches thick. We recommend compacting engineered fill in accordance with the criteria presented below in Table 11. The project documents should specify relative compaction of engineered fill, based on the structure located above the engineered fill, and vertical proximity to that structure.

Table 11. Compaction Recommendations Summary

Reference	Relative Compaction, percent (ASTM D698 – Standard Proctor)	Moisture Content Variance from Optimum, percentage points	
		< 12% Passing #200 Sieve (typically SP, SP-SM)	> 12% Passing #200 Sieve (typically CL, SC, ML, SM)
Below building pads and oversizing zones	100	±3	-1 to +3
Within 3 feet of pavement subgrade	100	±3	-1 to +3
More than 3 feet below pavement subgrade	95	±3	±3
Below landscaped surfaces	90	±5	±4
Adjacent to below-grade wall	95*	±3	-1 to +3

*Increase compaction requirement to meet compaction required for structure supported by this engineered fill.

The project documents should not allow the contractor to use frozen material as engineered fill or to place engineered fill on frozen material. Frost should not penetrate under foundations during construction.

We recommend performing density tests in engineered fill to evaluate if the contractors are effectively compacting the soil and meeting project requirements.

C.2.h. Reuse of On-Site Soils

The existing, non-organic, debris-free, fill and native soils are suitable for reuse as engineered fill below the proposed building pad with the exception of the on-site silt. The on-site silt is highly susceptible to disturbance which makes it very difficult to achieve proper compaction. Relatively significant amounts of the existing fill may contain debris or organic material, likely more than revealed by the borings. We do not recommend reusing existing fill that contains debris or organic material as structural fill. The project team should reuse any on-site soils in accordance with the approved environmental response action plan (RAP) for the project.

Note that the existing fill contained variable amounts of debris. It is likely additional debris is present within the existing fill that the borings did not encounter or sample. We recommend performing test pits to determine the extent of debris in the existing fill.

C.2.i. Construction Disturbance

The contractor should note some of the on-site soils, most notably the silt soils, are highly susceptible to disturbance, due to repeated construction traffic. Disturbance of these soils may cause areas that were previously prepared, or that were suitable for pavement or structure support, to become unstable and require moisture conditioning and compaction. In some cases, especially silts and fine-grained silty sand, leaving these soils alone for several days will allow the excess pore water pressures to dissipate and the material will behave like a dense soil again. Subcutting and replacing the disturbed material with crushed, coarse gravel, free of fines is also an alternative. The contractor should use means and methods to limit disturbance of the soils.

C.2.j. Special Inspections of Soils

We recommend including the site grading and placement of engineered fill within the building pad under the requirements of Special Inspections, as provided in Chapter 17 of the International Building Code, which is part of the Minnesota State Building Code. Special Inspection requires observation of soil conditions below engineered fill or footings, evaluations to determine if excavations extend to the anticipated soils, and if engineered fill materials meet requirements for type of engineered fill and compaction condition of engineered fill. A licensed geotechnical engineer should direct the Special Inspections of site grading and engineered fill placement. The purpose of these Special Inspections is to evaluate whether the work is in accordance with the approved Geotechnical Report for the project. Special Inspections should include evaluation of the subgrade, observing preparation of the subgrade (surface compaction or dewatering, excavation oversizing, placement procedures and materials used for engineered fill, etc.) and compaction testing of the engineered fill.

C.3. Spread Footings

Table 12 below contains our recommended parameters for foundation design. Note that further evaluation on the site may result in us revising these values.

Table 12. Recommended Spread Footing Design Parameters

Item	Description
Maximum net allowable bearing pressure (psf)	5,000
Minimum factor of safety for bearing capacity failure	3.0
Minimum embedment below final exterior grade for heated structures (inches)	42
Minimum embedment below final exterior grade for unheated structures or for footings not protected from freezing temperatures during construction (inches)	60
Total estimated settlement (inches)	Less than 1 inch
Differential settlement	Typically about 2/3 of total settlement*

* Actual differential settlement amounts will depend on final loads and foundation layout. When tying into the existing buildings, the total settlement of this new building will be differential to the existing building. We can evaluate differential settlement based on final foundation plans and loadings.

C.4. Aggregate Piers or Stone Columns

Based on the anticipated depth of excavations (up to 27 1/2 feet below grade), removing the unsuitable soils and replacing with suitable fill could have some challenges including excavations extending below the water table. One approach to addressing deep corrections would be by using ground improvements with aggregate piers or stone columns, commonly known by trade names such as: Geopier, Vibro Piers, Vibro Stone Columns, etc.

A subgrade improved with aggregate piers or stone columns will reduce the potential for detrimental settlement associated with the existing fill to occur, provide adequate bearing capacity, eliminate the need for deep excavations, reduce impacts to adjacent site features, and reduce the volume of subgrade soils disturbed at this site.

Different contractors use varying techniques to construct aggregate piers but generally consist of excavating soil from a hole with an auger or vibrating a probe into the ground, and then building a column of clean, open-graded aggregate. The contractor constructs the pier by placing the aggregate in lifts from the bottom of the pier and compacting each lift before placing aggregate for the subsequent lift. The vibratory energy, and sometimes ramming action, causes the aggregate to interlock, forming a stiff pier that provides soil reinforcement and increases shear resistance. Due to the many variations in techniques, we recommend using performance-based specifications with design-build contracting. We recommend requiring the contractor to have at least five years of experience in performing this work,

and to demonstrate performing the proposed protection system(s) on at least three previous projects of similar size and scope. The specifications should require the design engineer be licensed in the project state. We can assist you with developing a list of pre-qualified contractors prior to bidding or with reviewing contractor experience as part of the bidding process.

Aggregate piers are a Special Inspection item in accordance with Chapter 17 of the IBC. The observations should include installed length, consistency of soil profile with the geotechnical evaluation confirmation of the materials, and confirmation of installation techniques.

We recommend installing aggregate piers under both foundations for the building, but are not needed below the floor slab. The aggregate piers should extend through the existing fill to bear on the underlying native soils.

C.4.a. Net Allowable Bearing Pressure

The aggregate pier designer will determine the allowable soil bearing capacity of footings bearing upon rammed aggregate piers. However, aggregate piers are typically able to support net allowable bearing pressures of 3,000 to 5,000 pounds per square foot (PSF). This value includes a safety factor of at least 3.0 with regard to bearing capacity failure.

C.4.b. Settlement

The aggregate pier designer will determine the settlement of footings bearing upon rammed aggregate piers. However, aggregate piers typically limit total and differential settlement of spread footing foundations to less than 1 inch and 1/2 inch, respectively.

C.5. Construction Adjacent to Existing Structures

C.5.a. Excavations

Excavations for soil corrections or new footings may extend near or below existing footing grades. To reduce the risk of undermining the existing foundations, we recommend excavations do not extend into a zone extending 10 feet away horizontally, and extending down at 1.5H:1V down and away from the existing footing. After reaching the design depth, a geotechnical representative should observe the excavation bottom to evaluate the suitability of the soils near the existing foundation for support of the new floor slab and foundation. We recommend contacting us if excavations need to extend beyond the limits described above, as this may warrant additional construction such as ground improvement, retention or solidification may be required. We can aid you in this review.

C.5.b. Footing Depth

New building foundations constructed adjacent to the foundations of the existing building may exert additional stresses on existing foundations. In general, we recommend constructing new foundations to bear at the same elevation as the existing foundations. We also recommend lowering or offsetting foundations so a foundation or its oversize zone does not exert a load on adjacent structures. We can review this effect as loads and foundation loads are established.

C.5.c. Settlement

Due to the existing walls not likely settling with the proposed new building, differential settlement could occur between the existing building and the new building. The amount of differential settlement should be considered to be as much as the total estimated settlement for the new footing. We recommend installing expansion joints between the existing building and the new building or designing the structure to accommodate differential movement.

C.6. Soil Retention System

We understand that in order to construct the workforce apartments to the south of the existing ramp that a significant grade raise, on the order of 20 feet, is required. In order to raise grade, a permanent retention system will need to be constructed parallel to the south end of the existing ramp and along the west retaining wall. The design team has looked at three possible options for the retention system; a cast-in-place concrete retaining wall, modular block wall and a sheet pile wall. The cast-in-place concrete retaining wall has been ruled out due to the cost to construct the wall. The two options still being evaluated are laid out in further detail below.

C.6.a. Option A - Modular Block Wall

Modular block walls are a system comprised of individual retaining wall blocks that typically have a stone base that they bear on. The individual blocks come in all shapes, sizes and colors which gives flexibility during the design of the wall. Modular block walls typically include a system of Geogrid that is placed in the retained soil to reinforce wall.

The main advantage for a modular block wall is the ease and relative low expense of construction. Another advantage is that the wall could be constructed as the grade change is happening and would not have to be installed prior to the grade change.

One major disadvantage to a modular block wall is that it would add more stress on the soil supporting existing footings of the ramp and further evaluation would be needed to determine the exact magnitude of additional deflection. Understanding the ramp already has had some distress, any additional

movement is not desired. To use this approach, micropile should be installed to support these foundations. We have performed preliminary evaluation of this approach and it appears to be a viable option to support the wall footing and three column footings.

C.6.b. Option B - Sheet Pile Wall

Sheet pile walls are sections of sheet materials with interlocking edges that are driven into the ground to provide earth retention and excavation support.

Generally, the steel sheets are installed using a vibratory hammer. With the close proximity of this wall to the existing ramp, the vibration could cause consolidation of the soils below the existing ramp footings causing detrimental settlement. We recommend that if a vibratory hammer is to be used to install the sheet that micropiles be installed under the wall footing and three column footings. Based on discussions with the design team, we understand that a method that uses a hydraulic ram to push the sheets into the ground is being evaluated. This would help limit the vibration, but we note that the equipment and contractors that have used this method are limited locally.

A sheet pile wall would be beneficial in that the grade raise would not significantly stress the existing ramp footings as the wall would provide separation to soil interaction so that stresses form the load increase would not overlap onto the existing footings.

Note that that the weight of the soils behind the wall will cause deflection of the wall and any additional excavation at the base of the wall would be limited unless tiebacks are used. These could either be conventional helical or grouted anchors as is often used for tiebacks, or as this wall will be erected and then backfilled, "dead men" could be built behind the wall as means of restraining wall displacement.

C.7. Below-Grade Walls

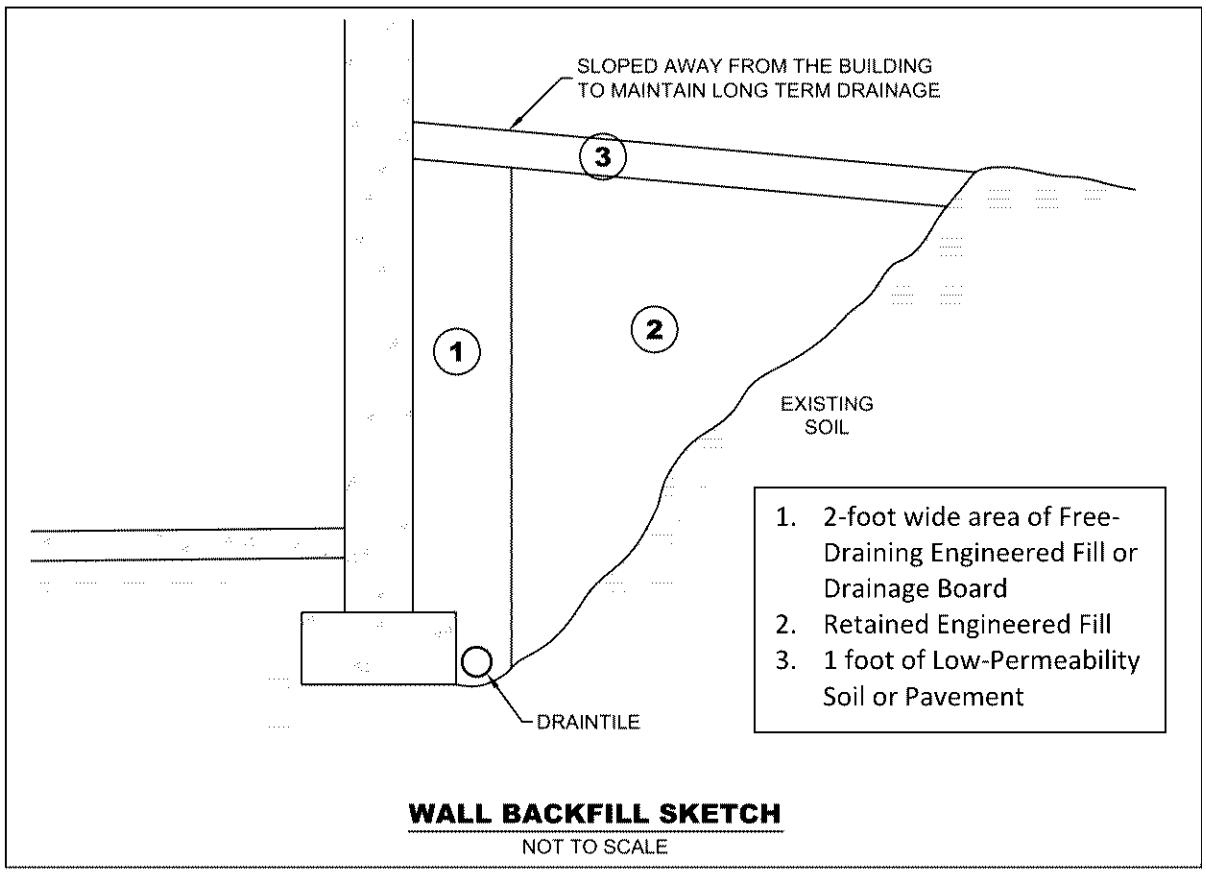
The proposed buildings are anticipated to have up to three levels below grade with a floor elevation up to 25 feet below exterior surface grade. The project documents should indicate if walls need bracing prior to filling and allowable unbalanced fill heights.

C.7.a. Drainage Control

We recommend installing drain tile to remove water behind the below-grade walls, at the location shown in Figure 6. The below-grade wall drainage system should also incorporate free-draining, engineered fill or a drainage board placed against the wall and connected to the drain tile.

Even with the use of free-draining, engineered fill, we recommend general waterproofing of below-grade walls that surround occupied or potentially occupied areas because of the potential cost impacts related to seepage after construction is complete.

Figure 6. Generalized Illustration of Wall Engineered Fill



The materials listed in the sketch should meet the definitions in Section C.2. Low-permeability material is capable of directing water away from the wall, like clay, topsoil or pavement. The project documents should indicate if the contractor should brace the walls prior to filling and allowable unbalanced fill heights.

As shown in Figure 6, we recommend Zone 2 consist of retained, engineered fill, and this material will control lateral pressures on the wall. However, we are also providing design parameters for using other engineered fill material. If final design uses non-sand material for engineered fill, project planning should account for the following items:

- Other engineered fill material may result in higher lateral pressure on the wall.
- Other engineered fill material may be more difficult to compact.
- Post-construction consolidation of other engineered fill material may result in settlement-related damage to the structures or slabs supported on the engineered fill. Post-construction settlement of other engineered fill material may also cause drainage towards the structure. The magnitude of consolidation could be up to about 3 percent of the wall fill thickness.

C.7.b. Selection, Placement and Compaction of Backfill

After any sand required for drainage has been placed, we recommend remaining backfill to be placed against exterior perimeter walls consist of sand.

We recommend a walk-behind compactor be used to compact the backfill placed within about 5 feet of the walls. Further away, a self-propelled compactor can be used. The project documents should indicate if walls need bracing prior to filling and allowable unbalanced fill heights. To the extent possible, the walls should be backfilled evenly on both sides of the wall.

C.7.c. Configuring and Resisting Lateral Loads

Below-grade wall design can use active earth pressure conditions, if the walls can rotate slightly. If the wall design cannot tolerate rotation, then design should use at-rest earth pressure conditions. Rotation up to 0.002 times the wall height is generally required for walls supporting sand.

Table 13 presents our recommended lateral coefficients and equivalent fluid pressures for wall design of active, at-rest and passive earth pressure conditions. The table also provides recommended wet unit weights and internal friction angles. Designs should also consider the slope of any engineered fill and dead or live loads placed behind the walls within a horizontal distance that is equal to the height of the walls. Our recommended values assume the wall design provides drainage so water cannot accumulate behind the walls. The construction documents should clearly identify what soils the contractor should use for engineered fill of walls.

Table 13. Recommended Below-Grade Wall Design Parameters – Drained Conditions

Retained Soil	Wet Unit Weight, pcf	Friction Angle, degrees	Active Lateral Equivalent Fluid Pressure* (pcf)	At-Rest Lateral Equivalent Fluid Pressure* (pcf)	Passive Lateral Equivalent Fluid Pressure* (pcf)
Sand (up to 12% fines)	115	35	31	49	424
On-site fills (up to 50% fines)	130	28	47	69	360

* Based on Rankine model for soils in a region behind the wall extending at least 2 horizontal feet beyond the bottom outer edges of the wall footings and then rising up and away from the wall at an angle no steeper than 60 degrees from horizontal.

Sliding resistance between the bottom of the footing and the soil can also resist lateral pressures. We recommend assuming a sliding coefficient equal to 0.45 between the concrete and soil.

The values presented in this section are un-factored.

C.8. Interior Slabs

C.8.a. Subgrade Modulus

The anticipated floor subgrade is native sand or non-organic debris free fill needed to reach subgrade elevations. We recommend using a modulus of subgrade reaction, k, of 200 pounds per square inch per inch of deflection (pci) to design the slabs. If the slab design requires placing 6 inches of compacted crushed aggregate base immediately below the slab, the slab design may increase the k-value by 50 pci. We recommend that the aggregate base materials be free of bituminous. In addition to improving the modulus of subgrade reaction, an aggregate base facilitates construction activities and is less weather sensitive.

C.8.b. Moisture Vapor Protection

Excess transmission of water vapor could cause floor dampness, certain types of floor bonding agents to separate, or mold to form under floor coverings. If project planning includes using floor coverings or coatings, we recommend placing a vapor retarder or vapor barrier immediately beneath the slab. We also recommend consulting with floor covering manufacturers regarding the appropriate type, use and installation of the vapor retarder or barrier to preserve warranty assurances.

C.8.c. Water Table Separation

With the lowest floor elevation at 775 feet MSL, we recommend maintaining a 4-foot separation from anticipated long-term water levels. This separation will reduce the risk of seepage, buoyant forces and other water related issues.

Based on the groundwater encountered in the borings, areas of the building footprint will have groundwater within 3 feet of the lowest floor elevation; we recommend making provisions to remove the groundwater. The provisions that project planning should consider include installing drainage and a waterproofing system below the slab. The removal of this water and the logistics of disposal, maintenance and regulatory requirements are beyond the scope of this geotechnical evaluation but also require consideration by the owner, design team and contractors.

With both approaches, we recommend placing free-draining material a minimum of 6 inches below the slab.

C.9. Slope Stability

C.9.a. Scope of Services

We visited the site on November 20, 2019 to observe the condition of the slopes around the stormwater management pond on the southeast portion of the site. The purpose of our site visit was to look for evidence of deep seated and surface instability as well as evidence of historic or recent seepage and slope movement. We viewed the slopes uphill from the pond to the north and west and also the slopes downhill from the pond to the south and east. We also reviewed historic aerial images and USGS Quadrangle maps of the site, as shown in Section A.

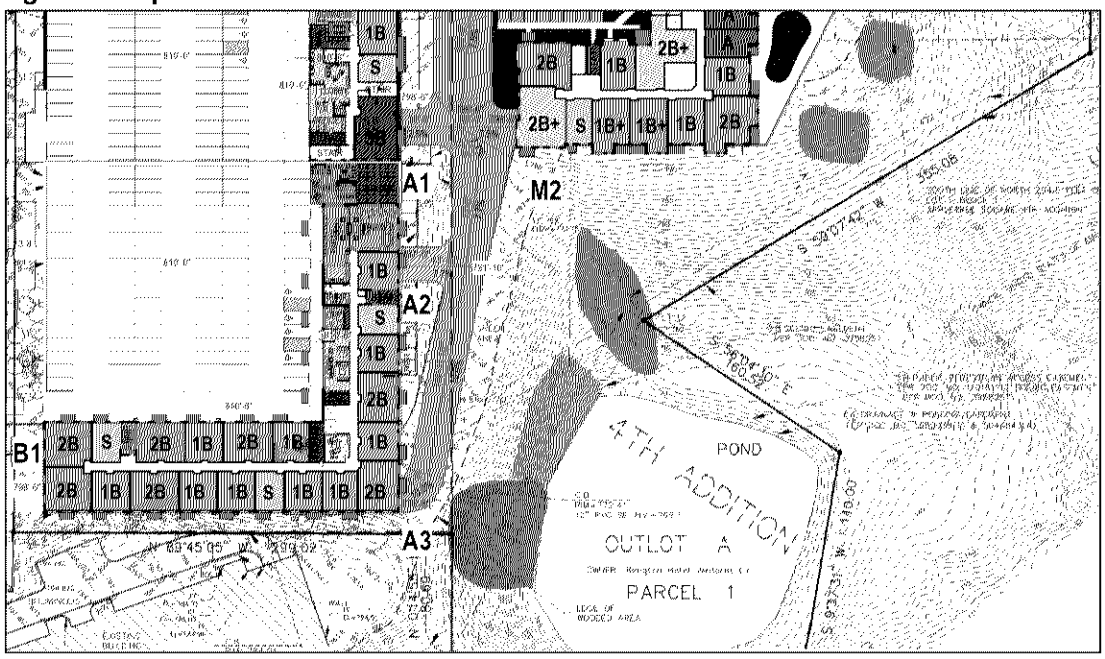
C.9.b. Results

In our review of historic aerial images and USGS Quadrangle maps, we noted that a gravel pit was operated on the site. The images suggest the east and south slopes of what is now the pond were likely filled in the late 1950s, possibly as part of the mining operation. The pond itself first shows up in an aerial image from 1984, and based on county records we assume it was constructed either when the office tower and parking ramp were built in 1973 or when the Crown Plaza Hotel was built in 1980, about 40 years ago.

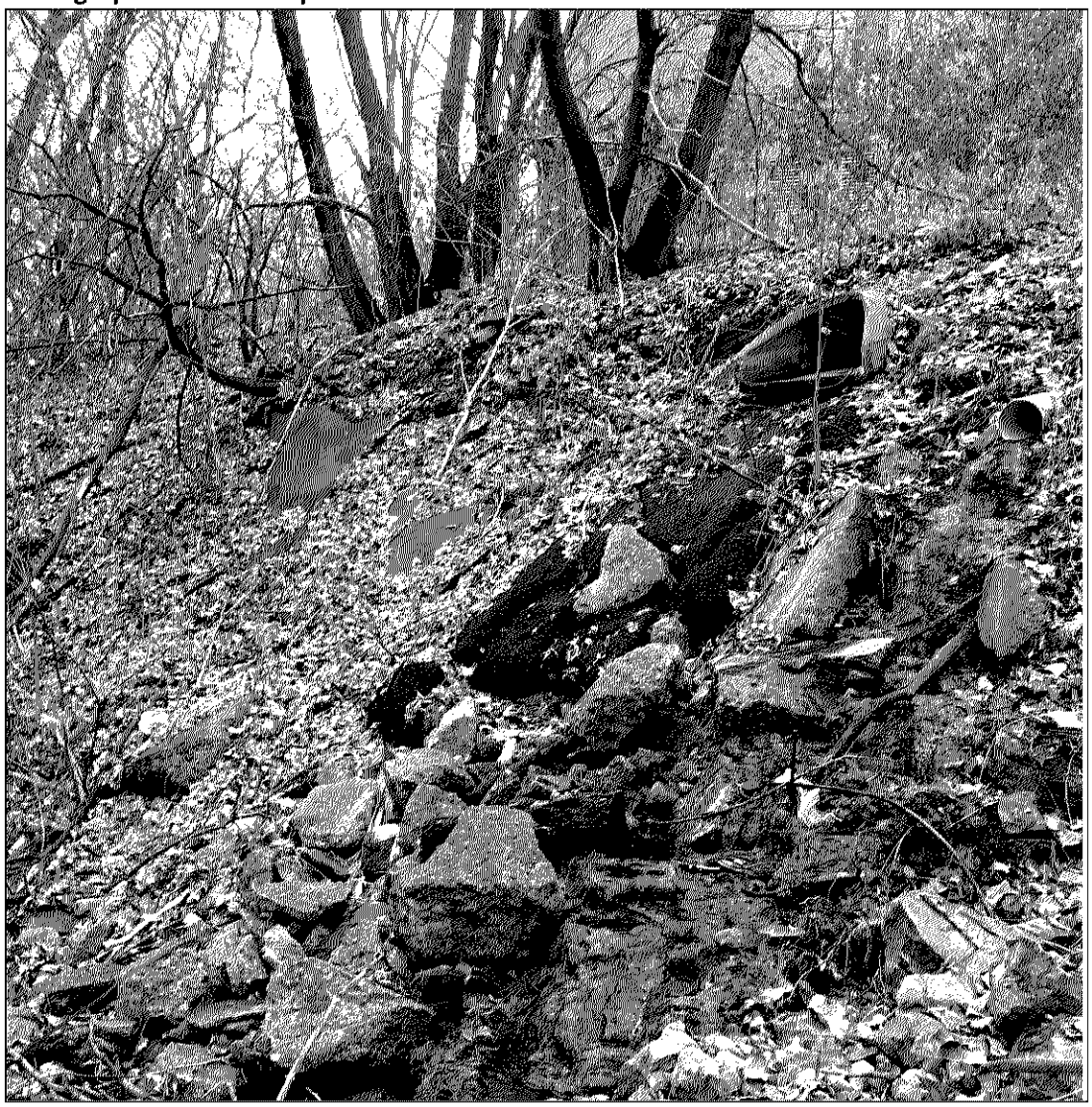
During our site visit we did not observe evidence of deep seated or surface instability on the downhill slopes of the pond to the south and east. The information previously mentioned suggests that these slopes are about 60 years old, and the type and size of vegetation on the slopes corroborates that assumption. We found two seeps within the hillside, one about 250 feet NNE from the pond and one about 100 feet SSE from the pond. Topographic maps of the site indicate these seeps are near elevation 730 or lower, which is generally consistent with the downward gradient of regional groundwater across the site towards the river valley.

On the slopes uphill from the pond to the north and west we noted shallow, slope instability in various locations. In Figure 7, the three areas shaded in green approximate the location of erosional cuts downhill from areas where stormwater drainage is concentrated. The area shaded in blue represents a section of the slope where some minor surface erosion has steepened the base of a slope. The area shaded in red represents a location where erosion from concentrated water flow has occurred and has led to movement of the slope. The slope movement generally appears to be shallow and within a few feet of the surface. Within the red area there are three pipes, two near the top of the slope and one at the base of the slope. Drainage of water was observed from these pipes during our visits to the site in October and November, during periods of wet and dry weather. Photograph 10 further illustrates this location. Note the exposed fabric to the left of the pipe, presumably placed either as a base for slope protection (rip rap) or to aid in growth of vegetation.

Figure 7. Slope Conditions



Photograph 10. West Slope of Pond



C.9.c. Opinions and Recommendations

Based on the information noted in our site visit and historical document review, it is our professional opinion there is little risk to instability of the slopes downhill from the stormwater management pond provided that the grades within and downhill from the pond are not altered, and the pond is operated at the same conditions as its current operation.

For the slopes directly adjacent the proposed development, uphill to the north and west of the pond, we recommend that we be engaged to review the stability of the slope if structures will be placed within a horizontal distance from the top edge of the slope equal to the height of the slope. Depending on the location and depth of proposed structures, a review of the slope stability may reveal that some modifications may be needed to the existing slopes. Potential modifications could include flattening the slopes, incorporating some form of slope reinforcement, or providing surface protection to the slope face. Furthermore, we recommend that no structures (including pavements) be planned for location within the current slopes, unless a detailed slope stability assessment is conducted as part of the design. Areas currently undergoing erosion from concentrated flows should be stabilized with rip rap, structures to dissipate the water energy be installed or pipes be extended to discharge water at the base of the slope.

C.10. Frost Protection and Exterior Slabs

C.10.a. General

In general, on-site silty sand will underlie all or some of the exterior slabs, as well as pavements. We consider the on-site silty sand moderately to highly frost susceptible. Soils of this type can retain moisture and heave upon freezing. In general, this characteristic is not an issue unless these soils become saturated, due to surface runoff or infiltration, or are excessively wet in situ. Once frozen, unfavorable amounts of general and isolated heaving of the soils and the surface structures supported on them could develop. This type of heaving could affect design drainage patterns and the performance of exterior slabs and pavements, as well as any isolated exterior footings and piers.

Note that general runoff and infiltration from precipitation are not the only sources of water that can saturate subgrade soils and contribute to frost heave. Roof drainage and irrigation of landscaped areas in close proximity to exterior slabs, pavements, and isolated footings and piers, contribute as well.

C.10.b. Frost Heave Mitigation

To address most of the heave related issues, we recommend setting general site grades and grades for exterior surface features to direct surface drainage away from buildings, across large paved areas and away from walkways. Such grading will limit the potential for saturation of the subgrade and subsequent heaving. General grades should also have enough "slope" to tolerate potential larger areas of heave, which may not fully settle after thawing.

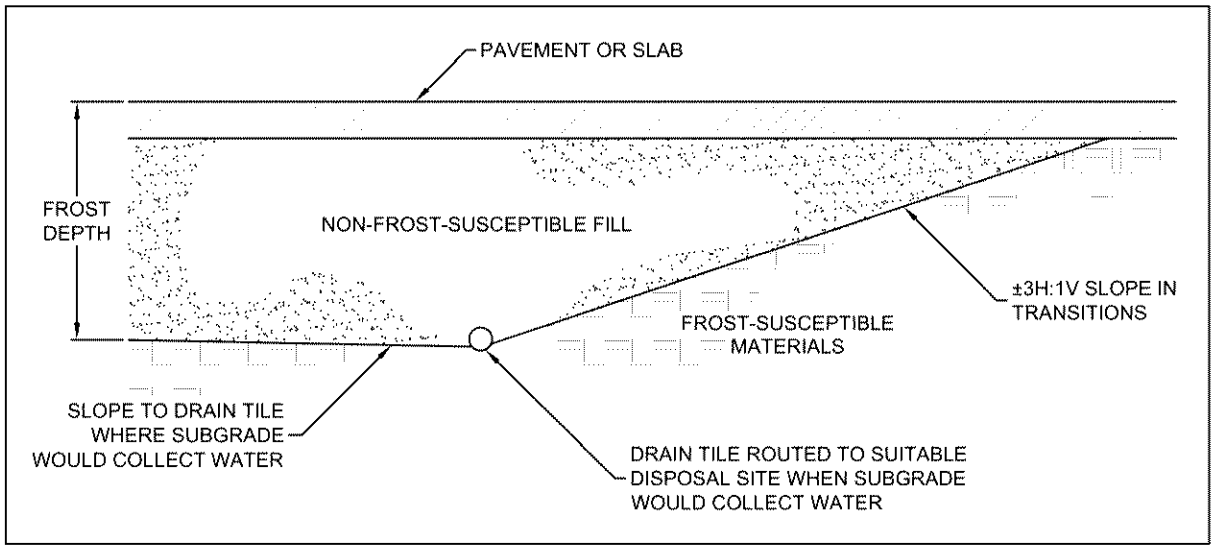
Even small amounts of frost-related differential movement at walkway joints or cracks can create tripping hazards. Project planning can explore several subgrade improvement options to address this condition.

One of the more conservative subgrade improvement options to mitigate potential heave is removing any frost-susceptible soils present below the exterior slab areas down to a minimum depth of 3 feet below subgrade elevations. We recommend filling the resulting excavation with non-frost-susceptible fill. We also recommend sloping the bottom of the excavation toward one or more collection points to remove any water entering the engineered fill. This approach will not be effective in controlling frost heave without removing the water.

An important geometric aspect of the excavation and replacement approach described above is sloping the banks of the excavations to create a more gradual transition between the unexcavated soils considered frost susceptible and the engineered fill in the excavated area, which is not frost susceptible. The slope allows attenuation of differential movement that may occur along the excavation boundary. We recommend slopes that are 3H:1V, or flatter, along transitions between frost-susceptible and non-frost-susceptible soils.

Figure 8 shows an illustration summarizing some of the recommendations.

Figure 8. Frost Protection Geometry Illustration



Another option is to limit frost heave in critical areas, such as doorways and entrances, via frost-depth footings or localized excavations with sloped transitions between frost-susceptible and non-frost-susceptible soils, as described above.

Over the life of slabs and pavements, cracks will develop and joints will open up, which will expose the subgrade and allow water to enter from the surface and either saturate or perch atop the subgrade soils. This water intrusion increases the potential for frost heave or moisture-related distress near the crack or joint. Therefore, we recommend implementing a detailed maintenance program to seal and/or fill any cracks and joints. The maintenance program should give special attention to areas where dissimilar materials abut one another, where construction joints occur and where shrinkage cracks develop.

C.11. Pavements

C.11.a. Design Sections

Our scope of services for this project did not include laboratory tests on subgrade soils to determine an R-value for pavement design. Based on our experience with soils similar to the mixed fill, comprised of clayey sand and silty sand soils anticipated at the pavement subgrade elevation, we recommend pavement design assume an R-value of 20. Note the contractor may need to perform limited removal of unsuitable or less suitable soils to achieve this value. Tables 14 and 15 provide recommended pavement sections, based on the soils support and traffic loads.

Table 14. Recommended Bituminous and Concrete Pavement Sections

Use	Light Duty	Medium Duty
Type of loading	Mainly car traffic	Multi-family residential with occasional truck traffic
Estimated ESALs	50,000	200,000
Minimum asphalt thickness (inches)	3 1/2	4 1/2
Minimum aggregate base thickness (inches)	8	10
Minimum concrete thickness (inches)	4	6
Minimum aggregate base thickness (inches)	4	4

Table 15. Recommended Bituminous Pavement Thickness Design

Layer	Duty	Thickness (in.)	MnDOT Specification/Designation
Wear Course	Light	1 1/2	SPWEB240B*
Base Course	Light	2	SPNWB230B**
Wear Course	Medium	2	SPWEB240B*
Base Course	Medium	2 1/2	SPNWB230B**

* Alternatively, use SPWEB240C to help reduce potential thermal cracking.
** Substitute base course with a second layer of wear course as an alternative to using two different base and wear courses.

C.11.b. Concrete Pavements

We assumed the concrete pavement sections in Table 14 will have edge support. We recommend placing an aggregate base below the pavement to provide a suitable subgrade for concrete placement, reduce faulting and help dissipate loads. Appropriate mix designs, panel sizing, jointing, doweling and edge reinforcement are critical to performance of rigid pavements. We recommend you contact your civil engineer to determine the final design or consult with us for guidance on these items.

C.11.c. Bituminous Pavement Materials

Appropriate mix designs are critical to the performance of flexible pavements. We recommend specifying pavement materials as recommended in Tables 14 and 15.

C.11.d. Subgrade Drainage

We recommend installing perforated drainpipes throughout pavement areas at low points, around catch basins, and behind curb in landscaped areas. We also recommend installing drainpipes along pavement and exterior slab edges where exterior grades promote drainage toward those edge areas. The contractor should place drainpipes in small trenches, extended at least 8 inches below the granular subbase layer, or below the aggregate base material where no subbase is present.

C.11.e. Performance and Maintenance

We based the above pavement designs on a 20-year performance life for bituminous and a 35-year life for concrete. This is the amount of time before we anticipate the pavement will require reconstruction. This performance life assumes routine maintenance, such as seal coating and crack sealing. The actual pavement life will vary depending on variations in weather, traffic conditions and maintenance.

It is common to place the non-wear course of bituminous and then delay placement of wear course. For this situation, we recommend evaluating if the reduced pavement section will have sufficient structure to support construction traffic.

Many conditions affect the overall performance of the exterior slabs and pavements. Some of these conditions include the environment, loading conditions and the level of ongoing maintenance. With regard to bituminous pavements in particular, it is common to have thermal cracking develop within the first few years of placement, and continue throughout the life of the pavement. We recommend developing a regular maintenance plan for filling cracks in exterior slabs and pavements to lessen the potential impacts for cold weather distress due to frost heave or warm weather distress due to wetting and softening of the subgrade.

C.12. Utilities

C.12.a. Subgrade Stabilization

Earthwork activities associated with utility installations located inside the building area should adhere to the recommendations in Section C.2.g.

For exterior utilities, we anticipate the soils at typical invert elevations will be suitable for utility support. However, if construction encounters unfavorable conditions such as soft clay, organic soils or perched water at invert grades, the unsuitable soils may require some additional subcutting and replacement with sand or crushed rock to prepare a proper subgrade for pipe support. Project design and construction should not place utilities within the 1H:1V oversizing of foundations.

C.12.b. Corrosion Potential

A majority of the soil borings indicated the site predominantly consists of sandy soils. We consider these soils non- to slightly corrosive to metallic conduits. If utilities extend through clay soils, we recommend bedding the utilities in sandy soil free of any clay lumps or constructing the utilities with non-corrosive materials.

C.13. Stormwater

We understand that the existing pond in the southeast corner of the site will continue to be used as the main stormwater management system. The pond has standing water in it that has been observed the few times we have been to the site this fall. In addition, the stormwater pipes leading into the pond have been observed to be draining water during these visits. Likely, this water may be in part coming from groundwater. Given the steady inflow of water, without any observed outflow it is logical that the pond must be infiltrating this water.

If any new stormwater management system is to be constructed, we estimate infiltration rates for some of the soils we encountered in our soil borings, as listed in Table 16. These infiltration rates represent the long-term infiltration capacity of a practice and not the capacity of the soils in their natural state. Field testing, such as with a double-ring infiltrometer (ASTM D3385), may justify the use of higher infiltration rates. However, we recommend adjusting field test rates by the appropriate correction factor, as provided for in the Minnesota Stormwater Manual or as allowed by the local watershed. We recommend consulting the Minnesota Stormwater Manual for stormwater design.

Table 16. Estimated Design Infiltration Rates Based on Soil Classification

Soil Type	Infiltration Rate * (inches/hour)
Sands with less than 12% fines, poorly graded or well graded sands	0.8
Silty sands, silty gravelly sands	0.45
Silts, very fine sands, silty or clayey fine sands	0.2

* From Minnesota Stormwater Manual. Rates may differ at individual sites.

Fine-grained soils (silts and clays), topsoil or organic matter that mixes into or washes onto the soil will lower the permeability. The contractor should maintain and protect infiltration areas during construction. Furthermore, organic matter and silt washed into the system after construction can fill the soil pores and reduce permeability over time. Proper maintenance is important for long-term performance of infiltration systems.

This geotechnical evaluation does not constitute a review of site suitability for stormwater infiltration or evaluate the potential impacts, if any, from infiltration of large amounts of stormwater.

C.14. Equipment Support

The recommendations included in the report may not be applicable to equipment used for the construction and maintenance of this project. We recommend evaluating subgrade conditions in areas of shoring, scaffolding, cranes, pumps, lifts and other construction equipment prior to mobilization to determine if the exposed materials are suitable for equipment support, or require some form of subgrade improvement. We also recommend project planning consider the effect that loads applied by such equipment may have on structures they bear on or surcharge – including pavements, buried utilities, below-grade walls, etc. We can assist you in this evaluation.

D. Procedures

D.1. Penetration Test Borings

We drilled the penetration test borings with a truck-mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at 2 1/2- or 5-foot intervals in general accordance to ASTM D1586. The boring logs show the actual sample intervals and corresponding depths. We also collected bulk samples of auger cuttings at selected locations for laboratory testing.

We sealed penetration test boreholes meeting the Minnesota Department of Health (MDH) Environmental Borehole criteria with an MDH-approved grout. We will forward sealing records for those boreholes to the Minnesota Department of Health Well Management Section.

D.2. Exploration Logs

D.2.a. Log of Boring Sheets

The Appendix includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials, and present the results of penetration resistance and other in-situ tests performed. The logs also present the results of laboratory tests performed on penetration test samples, and groundwater measurements. The Appendix also includes a Fence Diagram intended to provide a summarized cross-sectional view of the soil profile across the site.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

D.2.b. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance and other in-situ testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

D.3. Material Classification and Testing

D.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

D.3.b. Laboratory Testing

The exploration logs in the Appendix note the results of the laboratory tests performed on geologic material samples. We performed the tests in general accordance with ASTM or AASHTO procedures.

D.4. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes or allowed them to remain open for an extended period of observation, as noted on the boring logs.

E. Qualifications

E.1. Variations in Subsurface Conditions

E.1.a. Material Strata

We developed our evaluation, analyses and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work, or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

E.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

E.2. Continuity of Professional Responsibility

E.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

E.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

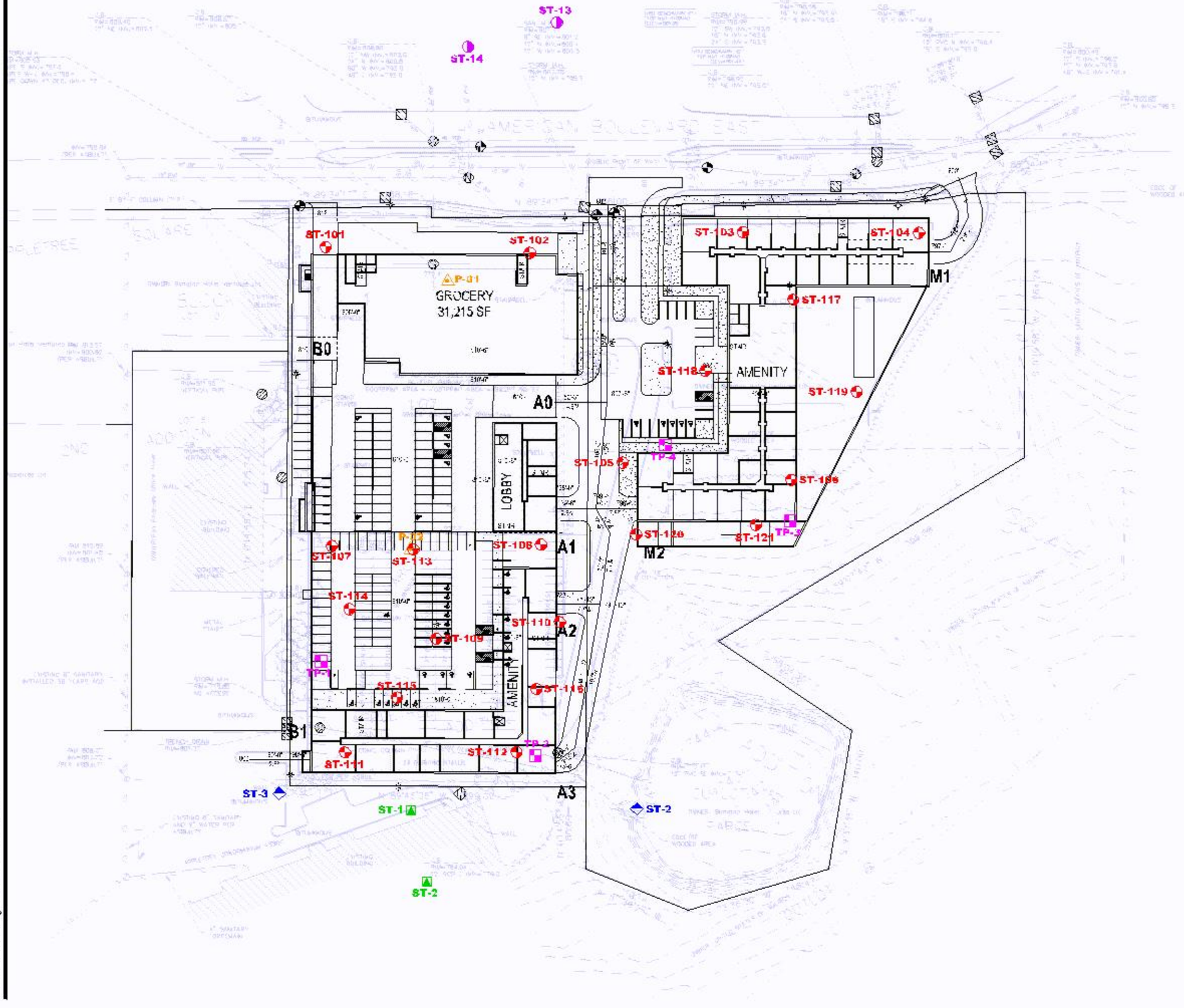
E.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

E.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix



DENOTES APPROXIMATE LOCATION OF TEST PIT

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

DENOTES APPROXIMATE LOCATION OF WATER LEVEL READING

DENOTES APPROXIMATE LOCATION OF PREVIOUS SOIL BORING (B1907929.00)

DENOTES APPROXIMATE LOCATION OF PREVIOUS SOIL BORING (BABX-97-728)

DENOTES APPROXIMATE LOCATION OF PREVIOUS SOIL BORING (84-033)

50' 0 100'

SCALE: 1" = 100'

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The Science You Build On.
11001 Hampshire Avenue S.
Minneapolis, MN 55438
952.995.2000
braunintertec.com

Drawing Information

Project No: B1903819

Drawing No: B1903819

Drawn By:	LAD
Date Drawn:	9/18/19
Checked By:	KS
Last Modified:	12/5/19

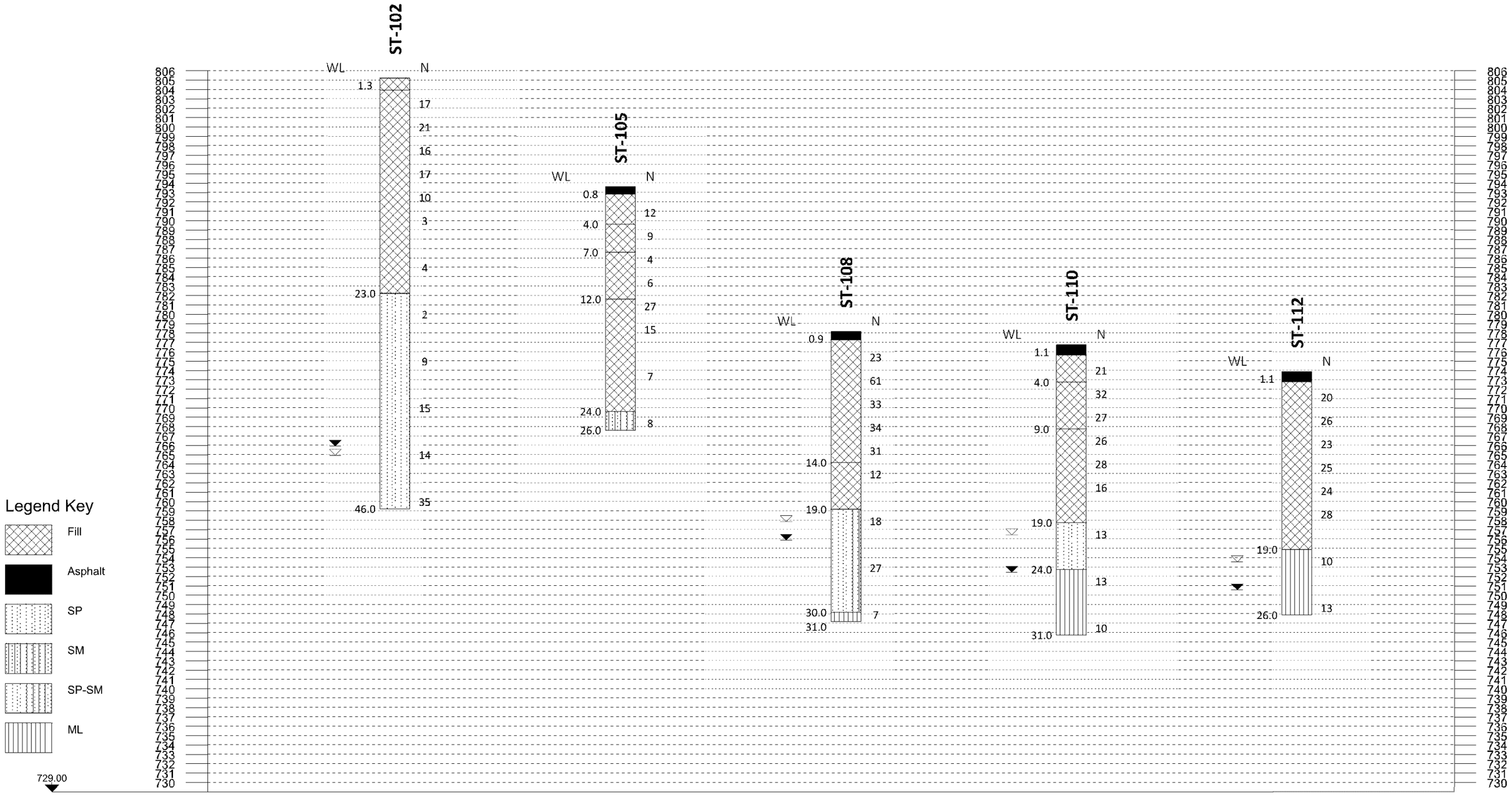
Project Information

Growing Plaza Site

3661 American Boulevard E.

Bloomington, Minnesota

Soil Boring Location Sketch



SECTION LINE 1

Fence Diagram
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

Project ID:	B1909819
Vert. Scale:	1"= 10'
Hor. Scale:	NTS
Date:	10-10-2019

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-101**

LOCATION: See attached sketch. Benchmark: Elevations were obtained using GPS and the State of Minnesota's permanent base station network.

NORTHING: 124597	EASTING: 542076		
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE: 09/27/19	END DATE: 09/27/19
SURFACE ELEVATION: 810.6 ft	RIG: 7514	METHOD: 3 1/4" HSA	SURFACING: Grass	WEATHER: Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
809.8		CLAYEY SAND (SC), black, moist (TOPSOIL FILL)					
0.8		FILL: SILTY SAND (SM), fine to medium-grained Sand, brown, moist		3-4-3 (7) 12"		9	P200=18%
			5	1-2-2 (4) 12"		14	
				1-1-2 (3) 10"		11	
801.6							
9.0		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, brown, moist	10	1-1-1 (2) 10"		10	P200=11%
				1-1-2 (3) 12"			
			15	2-2-2 (4) 12"			
			20	2-1-3 (4) 14"			
		Sandy Silt layer at 25 feet	25	2-3-2 (5) 14"			
784.6							
26.0		POORLY GRADED SAND (SP), fine to medium-grained Sand, brown, moist, loose (ALLUVIUM)					

Continued on next page

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See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-101**

LOCATION: See attached sketch. Benchmark: Elevations were obtained using GPS and the State of Minnesota's permanent base station network.

NORTHING:	124597	EASTING:	542076
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE: 09/27/19	END DATE: 09/27/19
SURFACE ELEVATION: 810.6 ft	RIG: 7514	METHOD: 3 1/4" HSA	SURFACING: Grass	WEATHER: Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine to medium-grained Sand, brown, moist, loose (ALLUVIUM)	30	2-2-3 (5) 12"			
776.6 34.0		SILTY SAND (SM), brown, moist, medium dense (ALLUVIUM)	35	5-11-10 (21) 15"			////////////////////////////////// Slab on grade elevation approx. 775
771.6 39.0	▽	POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, trace Gravel, brown to gray, wet, loose to medium dense (ALLUVIUM)	40	1-3-5 (8) 16"			
			45	2-5-6 (11) 18"			
764.6 46.0		END OF BORING Boring immediately grouted					Water observed at 40.0 feet with 40.0 feet of tooling in the ground while drilling. Water observed at 37.0 feet with 45.0 feet of tooling in the ground at end of drilling. Water not observed to cave-in depth of 25.0 feet immediately after withdrawal of auger.
			50				
			55				

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See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-102**
LOCATION: See attached sketch
NORTHING: 124597 EASTING: 542280
START DATE: 09/27/19 END DATE: 09/27/19
SURFACE ELEVATION: 805.2 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Grass WEATHER: Cloudy
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
803.9		SILTY SAND (SM), fine-grained Sand, black, moist (TOPSOIL FILL)					
1.3		FILL: SILTY SAND (SM), fine to medium-grained Sand, trace Gravel, brown, moist		5-8-9 (17) 14"		6	
			5	10-11-10 (21) 14"		8	P200=14%
				6-7-9 (16) 12"		8	
			10	4-7-10 (17) 14"			
				5-6-4 (10) 3"			
			15	2-2-1 (3) 10"			
			20	2-2-2 (4) 12"			
782.2							
23.0		POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, brown, moist to wet, loose to dense (ALLUVIUM)	25	1-1-1 (2) 10"			

Continued on next page

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See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-102**

LOCATION: See attached sketch

NORTHING: 124597	EASTING: 542280		
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE: 09/27/19	END DATE: 09/27/19
SURFACE ELEVATION: 805.2 ft	RIG: 7514	METHOD: 3 1/4" HSA	SURFACING: Grass	WEATHER: Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, brown, moist to wet, loose to dense (ALLUVIUM)	30	5-5-4 (9) 14"			Slab on grade elevation approx. 775
			35	4-8-7 (15) 12"			
	▼	*Wet at 40 feet*	40	4-6-8 (14) 18"			
			45	10-15-20 (35) 18"			
759.2 46.0		END OF BORING Boring immediately grouted	50				Water observed at 40.0 feet with 40.0 feet of tooling in the ground while drilling. Water observed at 39.0 feet with 45.0 feet of tooling in the ground at end of drilling. Water not observed to cave-in depth of 24.0 feet immediately after withdrawal of auger.
			55				

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See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-103**

LOCATION: See attached sketch

NORTHING: 124623 EASTING: 542492

DRILLER: C. McClain | LOGGED BY: R. Braun | START DATE: 09/26/19 | END DATE: 09/26/19

SURFACE ELEVATION: 799.4 ft | RIG: 7514 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER: Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
798.3		PAVEMENT, 3 inches of bituminous over 10 inches of aggregate base					
1.1		FILL: CLAYEY SAND (SC), brown, moist		2-2-5 (7) 10"		13	
			5	2-5-8 (13) 16"		12	
792.4							
7.0		FILL: SILTY SAND (SM), fine to medium-grained Sand, with bituminous, concrete, and fabric debris, black, moist		30-20-23 (43) 4"			Petroleum-like odor from 7 to 14 feet
			10	9-6-7 (13) 4"			
				7-4-5 (9) 2"			
785.4							//////////////////////////////////
14.0		POORLY GRADED SAND (SP), fine-grained Sand, brown, moist, loose to medium dense (ALLUVIUM)	15	6-4-5 (9) 10"			Slab on grade elevation approx. 786
			20	5-4-5 (9) 10"			
			25	3-2-5 (7) 12"			

Continued on next page

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See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-103**

LOCATION: See attached sketch

NORTHING:	124623	EASTING:	542492		
DRILLER:	C. McClain	LOGGED BY:	R. Braun	START DATE:	09/26/19
END DATE:	09/26/19	SURFACE ELEVATION:	799.4 ft	RIG:	7514
METHOD:	3 1/4" HSA	SURFACING:	Bituminous	WEATHER:	Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine-grained Sand, brown, moist, loose to medium dense (ALLUVIUM)	30	3-4-7 (11) 13"			
768.4							
31.0		END OF BORING					Water not observed while drilling.
		Boring immediately grouted					Water not observed at end of drilling.
							Water not observed to cave-in depth of 15.0 feet immediately after withdrawal of auger.
			35				
			40				
			45				
			50				
			55				

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See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-104**
LOCATION: See attached sketch
NORTHING: 124623 EASTING: 542268
START DATE: 09/26/19 END DATE: 09/26/19
DRILLER: C. McClain LOGGED BY: R. Braun
SURFACE ELEVATION: 799.3 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
798.5		PAVEMENT, 4 inches of bituminous over 5 inches of aggregate base					
0.8		FILL: SILTY SAND (SM), fine-grained Sand, brown, moist		3-5-5 (10) 11"		14	
			5	4-4-3 (7) 14"		9	
790.3				2-2-2 (4) 12"			
9.0		FILL: LEAN CLAY (CL), slightly organic, gray, moist	10	2-3-4 (7) 11"			
787.3							
12.0		FILL: SILTY SAND (SM), trace organic, brown, moist		3-4-4 (8) 13"			
785.3							////////////////////////////////// Slab on grade elevation approx. 786
14.0		SILT (ML), brown to gray, moist, loose (ALLUVIUM)	15	2-2-5 (7) 11"			
780.3							
19.0		POORLY GRADED SAND (SP), fine-grained Sand, brown, moist, loose (ALLUVIUM)	20	2-3-5 (8) 13"			
			25	1-4-4 (8) 12"			

Continued on next page

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See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-104**

LOCATION: See attached sketch

NORTHING:	124623	EASTING:	542268		
DRILLER:	C. McClain	LOGGED BY:	R. Braun	START DATE:	09/26/19
END DATE:	09/26/19	SURFACE ELEVATION:	799.3 ft	RIG:	7514
METHOD:	3 1/4" HSA	SURFACING:	Bituminous	WEATHER:	Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine-grained Sand, brown, moist, loose (ALLUVIUM)					
768.3			30	2-3-4 (7) 14"			
31.0		END OF BORING					Water not observed while drilling.
		Boring immediately grouted					Water not observed at end of drilling.
							Water not observed to cave-in depth of 15.0 feet immediately after withdrawal of auger.
			35				
			40				
			45				
			50				
			55				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-105**
LOCATION: See attached sketch
NORTHING: 124394 EASTING: 542372
START DATE: 09/26/19 END DATE: 09/26/19
SURFACING: Bituminous WEATHER: Clear

DRILLER: C. McClain LOGGED BY: R. Braun
SURFACE ELEVATION: 793.6 ft RIG: 7514 METHOD: 3 1/4" HSA

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
792.8		PAVEMENT, 6 inches of bituminous over 3 inches of aggregate base					
0.8		FILL: CLAYEY SAND (SC), brown, moist		1-5-7 (12) 16"		10	
789.6							
4.0		FILL: SANDY LEAN CLAY (CL), brown, moist	5	5-6-3 (9) 12"		14	
786.6							
7.0		FILL: CLAYEY SAND (SC), brown, moist		2-2-2 (4) 14"			Slab on grade elevation approx. 786
			10	2-3-3 (6) 4"			
781.6							
12.0		FILL: SILTY SAND (SM), black, moist		15-15-12 (27) 12"			Petroleum-like odor from 12 to 24 feet
		Concrete debris at 15 feet	15	4-4-11 (15) 14"			
		Concrete debris at 20 feet	20	6-4-3 (7) 6"			
769.6							
24.0		SILTY SAND (SM), fine-grained Sand, gray, moist, loose (ALLUVIUM)	25	3-3-5 (8) 14"			
767.6							
26.0		END OF BORING					Water not observed while drilling.
		Boring immediately grouted					Water not observed at end
		Continued on next page					

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-105**

LOCATION: See attached sketch

NORTHING:	124394	EASTING:	542372
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE: 09/26/19	END DATE: 09/26/19
SURFACE ELEVATION: 793.6 ft	RIG: 7514	METHOD: 3 1/4" HSA	SURFACING: Bituminous	WEATHER: Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
							of drilling. Water not observed to cave-in depth of 13.0 feet immediately after withdrawal of auger.
30							
35							
40							
45							
50							
55							

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-106**
LOCATION: See attached sketch
NORTHING: 124377 EASTING: 542540
START DATE: 09/26/19 END DATE: 09/26/19
SURFACE ELEVATION: 796.2 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
795.6		CLAYEY SAND (SC), dark brown, moist (TOPSOIL FILL)					
0.6		FILL: SILTY SAND (SM), fine-grained Sand, brown, moist		1-4-6 (10) 10"		10	
792.2							
4.0		FILL: SILT (ML), brown, moist	5	2-1-3 (4) 12"		31	
				2-4-4 (8) 14"			
			10	1-1-4 (5) 14"			//////////////////////////////// Slab on grade elevation approx. 786
784.2							
12.0		CLAYEY SAND (SC), gray, moist, loose (ALLUVIUM)		1-4-4 (8) 12"			
			15	2-4-5 (9) 12"			
777.2							
19.0		SILTY SAND (SM), gray, moist, loose to medium dense (ALLUVIUM)	20	5-10-15 (25) 8"			
			25	1-2-4 (6) 8"			

Continued on next page

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-106**

LOCATION: See attached sketch

NORTHING:	124377	EASTING:	542540
DRILLER:	C. McClain	LOGGED BY:	R. Braun
START DATE:	09/26/19	END DATE:	09/26/19
SURFACE ELEVATION:	796.2 ft	RIG:	7514
METHOD:	3 1/4" HSA	SURFACING:	Bituminous
WEATHER:	Clear		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		SILTY SAND (SM), gray, moist, loose to medium dense (ALLUVIUM)					
765.2			30	1-2-4 (6) 11"			
31.0		END OF BORING					Water not observed while drilling.
		Boring immediately grouted					Water not observed at end of drilling.
							Water not observed to cave-in depth of 14.0 feet immediately after withdrawal of auger.
			35				
			40				
			45				
			50				
			55				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-107**
LOCATION: See attached sketch
NORTHING: 124311 EASTING: 542083
START DATE: 09/25/19 END DATE: 09/25/19
SURFACE ELEVATION: 778.5 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
777.4		PAVEMENT, 5 inches of bituminous over 8 inches of aggregate base					
1.1		FILL: SILTY SAND (SM), fine-grained Sand, brown, moist		1-3-4 (7) 6"		10	
774.5	▼						////////////////////////////////// Slab on grade elevation approx. 775
4.0	▽	FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, trace Gravel, brown, wet	5	4-5-6 (11) 12"		18	P200=5%
	▼			1-6-6 (12) 16"		19	
769.5							
9.0		POORLY GRADED SAND (SP), fine to coarse-grained Sand, trace Gravel, brown to gray, wet, loose to medium dense (ALLUVIUM)	10	2-4-6 (10) 18"			
				5-10-12 (22) 18"			
			15	2-7-10 (17) 18"			
			20	1-5-9 (14) 10"			
			25	9-12-11 (23) 10"			
750.5							
28.0							

Continued on next page

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-107**

LOCATION: See attached sketch

NORTHING:	124311	EASTING:	542083
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE:	09/25/19
END DATE:	09/25/19		
SURFACE ELEVATION: 778.5 ft	RIG: 7514	METHOD: 3 1/4" HSA	
SURFACING: Bituminous	WEATHER: Clear		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		SILT (ML), brown, wet, loose (ALLUVIUM)					
747.5			30	1-4-6 (10) 12"			
31.0		END OF BORING					Water observed at 5.0 feet with 5.0 feet of tooling in the ground while drilling.
		Boring immediately grouted					Water observed at 6.0 feet with 30.0 feet of tooling in the ground at end of drilling.
			35				Water observed at 4.0 feet immediately after withdrawal of auger.
			40				
			45				
			50				
			55				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-108**
LOCATION: See attached sketch
NORTHING: 124312 EASTING: 542291
START DATE: 09/26/19 END DATE: 09/26/19
SURFACE ELEVATION: 778.2 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
777.3		PAVEMENT, 5 inches of bituminous over 6 inches of aggregate base					
0.9		FILL: SILTY SAND (SM), fine to medium-grained Sand, trace Gravel, brown, moist		5-10-13 (23) 10"		7	////////////////////////////// Slab on grade elevation approx. 775
			5	11-30-31 (61) 14"		5	
				8-15-18 (33) 14"			
			10	5-12-22 (34) 16"			
				9-16-15 (31) 3"			
764.2							
14.0		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, trace Gravel, dark brown, wet	15	5-6-6 (12) 11"			
759.2							
19.0	▽	POORLY GRADED SAND with SILT (SP-SM), fine to coarse-grained Sand, trace Gravel, brown, wet, medium dense (ALLUVIUM)	20	7-5-13 (18) 8"			
	▼						
			25	9-9-18 (27) 18"			

Continued on next page

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-108**

LOCATION: See attached sketch

NORTHING:	124312	EASTING:	542291
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE:	09/26/19
END DATE:	09/26/19		
SURFACE ELEVATION: 778.2 ft	RIG: 7514	METHOD: 3 1/4" HSA	
SURFACING: Bituminous	WEATHER: Clear		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
748.2		POORLY GRADED SAND with SILT (SP-SM), fine to coarse-grained Sand, trace Gravel, brown, wet, medium dense (ALLUVIUM)					
30.0		SILT (ML), brown, wet, loose (ALLUVIUM)		1-3-4 (7) 18"			
747.2							
31.0		END OF BORING					Water observed at 20.0 feet with 20.0 feet of tooling in the ground while drilling.
		Boring immediately grouted					Water observed at 22.0 feet with 30.0 feet of tooling in the ground at end of drilling.
							Water not observed to cave-in depth of 14.0 feet immediately after withdrawal of auger.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-109**
LOCATION: See attached sketch
NORTHING: 124218 EASTING: 542186
START DATE: 09/25/19 END DATE: 09/25/19
SURFACE ELEVATION: 776.4 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
775.4		PAVEMENT, 5 inches of bituminous over 7 inches of aggregate base					
1.0		FILL: SILTY SAND (SM), fine-grained Sand, brown, moist		6-10-14 (24) 10"		7	////////////////////////////////// Slab on grade elevation approx. 775
			5	8-10-14 (24) 14"		9	
767.4				7-10-13 (23)			
9.0		SILTY SAND (SM), fine-grained Sand, gray to brown, moist, medium dense to dense (ALLUVIUM)	10	6-7-10 (17) 12"			
762.4				18-36-13 (49) 3"			
14.0	▽	POORLY GRADED SAND (SP), fine to medium-grained Sand, with Gravel, dark gray, wet, medium dense (ALLUVIUM)	15	3-13-8 (21) 13"			
757.4							
19.0		SILT (ML), brown, wet to moist, medium dense (ALLUVIUM)	20	6-6-10 (16) 14"			
	▼		25	3-5-6 (11) 14"			

Continued on next page

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-109**

LOCATION: See attached sketch

NORTHING:	124218	EASTING:	542186
DRILLER:	C. McClain	LOGGED BY:	R. Braun
START DATE:	09/25/19	END DATE:	09/25/19
SURFACE ELEVATION:	776.4 ft	RIG:	7514
METHOD:	3 1/4" HSA	SURFACING:	Bituminous
WEATHER:	Clear		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		SILT (ML), brown, wet to moist, medium dense (ALLUVIUM)					
745.4			30	4-5-7 (12) 18"			
31.0		END OF BORING					Water observed at 15.0 feet with 15.0 feet of tooling in the ground while drilling.
		Boring immediately grouted					Water observed at 26.0 feet with 30.0 feet of tooling in the ground at end of drilling.
			35				Water not observed to cave-in depth of 11.0 feet immediately after withdrawal of auger.
			40				
			45				
			50				
			55				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-110**
LOCATION: See attached sketch
NORTHING: 124235 EASTING: 542310
START DATE: 09/25/19 END DATE: 09/25/19
SURFACE ELEVATION: 776.7 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
775.6		PAVEMENT, 5 inches of bituminous over 8 inches of aggregate base					
1.1		FILL: SILTY SAND (SM), fine to medium-grained Sand, trace Gravel, dark brown, moist		3-10-11 (21) 15"		8	////////////////////////////////// Slab on grade elevation approx. 775
772.7							
4.0		FILL: POORLY GRADED SAND with SILT (SP-SM), fine-grained Sand, brown, moist	5	8-15-17 (32) 12"		5	P200=11%
		Clay seams at 7 1/2 feet		10-10-17 (27) 14"		12	
767.7							
9.0		FILL: SILTY SAND (SM), fine-grained Sand, gray, moist	10	10-10-16 (26) 15"			
				8-12-16 (28) 16"			
		Slightly organic at 15 feet	15	8-8-8 (16) 15"			
757.7							
19.0	▽	POORLY GRADED SAND (SP), fine to coarse-grained Sand, trace Gravel, brown, wet, medium dense (ALLUVIUM)	20	9-8-5 (13) 14"			
752.7	▼						
24.0		SILT (ML), brown, moist to wet, loose to medium dense (ALLUVIUM)	25	3-5-8 (13) 18"			

Continued on next page

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-110**

LOCATION: See attached sketch

NORTHING:	124235	EASTING:	542310
DRILLER:	C. McClain	LOGGED BY:	R. Braun
START DATE:	09/25/19	END DATE:	09/25/19
SURFACE ELEVATION:	776.7 ft	RIG:	7514
METHOD:	3 1/4" HSA	SURFACING:	Bituminous
WEATHER:	Clear		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		SILT (ML), brown, moist to wet, loose to medium dense (ALLUVIUM)					
745.7			30	3-4-6 (10) 18"			
31.0		END OF BORING					Water observed at 20.0 feet with 20.0 feet of tooling in the ground while drilling.
		Boring immediately grouted					Water observed at 24.0 feet with 30.0 feet of tooling in the ground at end of drilling.
			35				Water not observed to cave-in depth of 10.0 feet immediately after withdrawal of auger.
			40				
			45				
			50				
			55				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-111**
LOCATION: See attached sketch
NORTHING: 124105 EASTING: 542096
START DATE: 09/25/19 END DATE: 09/25/19
SURFACE ELEVATION: 775.5 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
774.3		PAVEMENT, 5 inches of bituminous over 9 inches of aggregate base					////////////////////////////////// Slab on grade elevation approx. 775
1.2		FILL: SILTY SAND (SM), fine-grained Sand, trace Gravel, brown, moist		2-5-9 (14) 12"		10	
771.5							
4.0	▽	FILL: POORLY GRADED SAND with SILT (SP-SM), fine to coarse-grained Sand, with Gravel, brown, wet *Concrete debris at 5 feet*	5	4-4-5 (9) 12"			
				5-9-14 (23) 8"		17	
			10	2-2-3 (5) 14"			
763.5							
12.0		POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, gray, wet, medium dense (ALLUVIUM)		5-6-5 (11) 14"			
760.5							
15.0		SILT (ML), gray, wet, medium dense (ALLUVIUM)	15	4-6-7 (13) 16"			
			20	4-6-10 (16) 18"			
			25	4-5-8 (13) 18"			
749.5							
26.0		END OF BORING					Water observed at 5.0 feet with 5.0 feet of tooling in the ground while drilling.
		Boring immediately grouted					

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-112**

LOCATION: See attached sketch

NORTHING: 124105 EASTING: 542266

DRILLER: C. McClain | LOGGED BY: R. Braun | START DATE: 09/26/19 | END DATE: 09/25/19

SURFACE ELEVATION: 773.9 ft | RIG: 7514 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER: Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
772.8		PAVEMENT, 5 inches of bituminous over 8 inches of aggregate base					////////////////////////////////// Slab on grade elevation approx. 775
1.1		FILL: SILTY SAND (SM), fine to medium-grained Sand, brown, moist		4-6-14 (20) 10"		6	
			5	8-4-22 (26) 12"		8	P200=31%
				5-8-15 (23) 14"		14	
			10	6-12-13 (25) 13"			
				6-12-12 (24) 14"			
			15	7-12-16 (28) 11"			
754.9							
19.0	▽	SANDY SILT (ML), with Sand lenses, brown, wet, loose to medium dense (ALLUVIUM)	20	1-5-5 (10) 16"			
	▼						
			25	4-5-8 (13) 18"			
747.9							
26.0		END OF BORING					Water observed at 20.0 feet with 20.0 feet of tooling in the ground while drilling.
		Boring immediately grouted					
		Continued on next page					

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-112**

LOCATION: See attached sketch

NORTHING: 124105	EASTING: 542266		
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE: 09/26/19	END DATE: 09/25/19
SURFACE ELEVATION: 773.9 ft	RIG: 7514	METHOD: 3 1/4" HSA	SURFACING: Bituminous	WEATHER: Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
							Water observed at 23.0 feet with 25.0 feet of tooling in the ground at end of drilling. Water not observed to cave-in depth of 13.0 feet immediately after withdrawal of auger.

30
35
40
45
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BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-113**

LOCATION: See attached sketch

NORTHING: 124308 EASTING: 542164

DRILLER: C. McClain | LOGGED BY: R. Braun | START DATE: 11/25/19 | END DATE: 11/25/19

SURFACE ELEVATION: 778.3 ft | RIG: 7514 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER: Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
777.4		PAVEMENT, 5 inches of bituminous over 6 inches of aggregate base					
0.9		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, brown, moist to wet		3-7-6 (13) 11"	0.0	5	Soil sample ST-113 (2-3') @ 08:25 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
			5	3-7-7 (14) 6"	0.0	22	
	▼			2-2-2 (4) 6"	0.0	18	P200=7%
769.3							
9.0		POORLY GRADED SAND with SILT (SP-SM), fine to coarse-grained Sand, trace Gravel, brown, wet, loose to medium dense (ALLUVIUM)	10	1-1-2 (3) 8"	0.0		Installed piezometer at 10 feet. Screen set from 6.5 to 11.5 feet. Water measured at 6 feet in piezometer. Water sample GW-113 @ 08:40 collected for VOCs, GRO, DRO, SVOCs and dissolved RCRA metals.
				5-9-11 (20) 10"	0.0		
			15	1-12-12 (24) 5"	0.1		
			20	5-7-8 (15) 12"	0.0		
			25	5-7-9 (16) 8"	0.1		

Continued on next page

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-113**

LOCATION: See attached sketch

NORTHING:	124308	EASTING:	542164
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE: 11/25/19	END DATE: 11/25/19
SURFACE ELEVATION: 778.3 ft	RIG: 7514	METHOD: 3 1/4" HSA	SURFACING: Bituminous	WEATHER: Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
749.3 29.0		POORLY GRADED SAND with SILT (SP-SM), fine to coarse-grained Sand, trace Gravel, brown, wet, loose to medium dense (ALLUVIUM)		1-4-6 (10) 6"	0.0		
747.3 31.0		SANDY SILT (ML), brown, wet, loose (ALLUVIUM)					
		END OF BORING Boring immediately grouted					Water observed at 7.0 feet with 7.0 feet of tooling in the ground while drilling. Water observed at 7.0 feet with 30.0 feet of tooling in the ground at end of drilling.

30 35 40 45 50 55

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-114**
LOCATION: See attached sketch
NORTHING: 124248 EASTING: 542100
START DATE: 11/22/19 END DATE: 11/22/19
SURFACE ELEVATION: 777.2 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
776.2		PAVEMENT, 5 inches of bituminous over 7 inches of aggregate base					
1.0		FILL: POORLY GRADED SAND (SP), fine to medium-grained Sand, brown, wet		4-5-5 (10) 9"	0.1	17	P200=4% Soil sample ST-114 (2-3.5') @ 08:20 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
			5	3-3-7 (10) 8"	0.2	19	
770.2							
7.0		POORLY GRADED SAND with SILT (SP-SM), fine to coarse-grained Sand, trace Gravel, brown, wet, loose to medium dense (ALLUVIUM)		2-5-5 (10) 9"	0.2		
			10	2-14-8 (22) 18"	0.0		
				4-7-9 (16) 18"	0.0		
			15	3-8-8 (16) 18"	0.3		
			20	6-5-8 (13) 6"	0.5		
			25	1-4-6 (10) 10"	0.4		
751.2							
26.0		SANDY SILT (ML), brown, moist, medium dense (ALLUVIUM)					

Continued on next page

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-114**

LOCATION: See attached sketch

NORTHING:	124248	EASTING:	542100
DRILLER:	C. McClain	LOGGED BY:	R. Braun
START DATE:	11/22/19	END DATE:	11/22/19
SURFACE ELEVATION:	777.2 ft	RIG:	7514
METHOD:	3 1/4" HSA	SURFACING:	Bituminous
WEATHER:	Clear		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		SANDY SILT (ML), brown, moist, medium dense (ALLUVIUM)					
746.2			30	1-3-8 (11) 6"	0.4		
31.0		END OF BORING					Water observed at 5.0 feet with 5.0 feet of tooling in the ground while drilling.
		Boring immediately grouted					Water observed at 10.0 feet with 30.0 feet of tooling in the ground at end of drilling.
			35				Water observed at 3.0 feet with a cave-in depth of 3.0 feet immediately after withdrawal of auger.
			40				
			45				
			50				
			55				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-115**
LOCATION: See attached sketch
NORTHING: 124160 EASTING: 542147
START DATE: 11/25/19 END DATE: 11/25/19
SURFACE ELEVATION: 775.7 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
774.9		PAVEMENT, 5 inches of bituminous over 4 inches of aggregate base					
0.8		FILL: SILTY SAND (SM), fine to medium-grained Sand, brown, moist		4-7-8 (15) 12"	0.0	11	
771.7	▼						
4.0		FILL: SANDY LEAN CLAY (CL), brown, moist	5	7-8-5 (13) 10"	0.0	29	Soil sample ST-115 (4.5-5.5') @ 10:25 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
768.7							
7.0		POORLY GRADED SAND with SILT (SP-SM), fine to coarse-grained Sand, trace Gravel, brown, wet, loose to medium dense (ALLUVIUM)		7-6-5 (11) 12"	0.0		
			10	3-5-5 (10) 14"	0.0		
763.7							
12.0		POORLY GRADED SAND (SP), fine to coarse-grained Sand, trace Gravel, brown, wet, loose to medium dense (ALLUVIUM)		3-4-6 (10) 6"	0.0		
			15	2-5-13 (18) 12"	0.0		
756.7							
19.0		SANDY SILT (ML), brown, wet, very loose to medium dense (ALLUVIUM)	20	1-1-3 (4) 6"	0.0		
			25	3-3-5 (8) 14"	0.0		

Continued on next page

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-115**

LOCATION: See attached sketch

NORTHING:	124160	EASTING:	542147
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE:	11/25/19
SURFACE ELEVATION: 775.7 ft	RIG: 7514	METHOD: 3 1/4" HSA	SURFACING: Bituminous
END DATE:	11/25/19	WEATHER:	Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		SANDY SILT (ML), brown, wet, very loose to medium dense (ALLUVIUM)					
744.7			30	5-7-8 (15) 18"	0.0		
31.0		END OF BORING					Water observed at 7.0 feet with 7.0 feet of tooling in the ground while drilling.
		Boring immediately grouted					Water observed at 4.0 feet with 30.0 feet of tooling in the ground at end of drilling.
			35				Water observed at 4.0 feet with a cave-in depth of 5.0 feet immediately after withdrawal of auger.
			40				
			45				
			50				
			55				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-116**

LOCATION: See attached sketch

NORTHING: 124168 EASTING: 542286

DRILLER: C. McClain | LOGGED BY: R. Braun | START DATE: 11/22/19 | END DATE: 11/22/19

SURFACE ELEVATION: 774.6 ft | RIG: 7514 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER: Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
773.9		PAVEMENT, 5 inches of bituminous over 3 inches of aggregate base					
0.7		FILL: SILTY SAND (SM), fine to medium-grained Sand, brown, moist		4-10-11 (21) 12"	0.3	5	
			5	8-13-13 (26) 12"	0.5	5	P200=13% Soil sample ST-116 (4.5-6') @ 10:00 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
				6-10-15 (25) 14"	0.7	7	
			10	5-8-14 (22) 16"	0.3		
				5-9-12 (21) 14"	0.4		
			15	8-12-14 (26) 16"	0.5		
755.6							
19.0		SANDY SILT (ML), brown, wet, loose to medium dense (ALLUVIUM)	20	1-4-11 (15) 12"	0.7		
			25	2-3-3 (6) 14"	0.9		

Continued on next page

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-116**

LOCATION: See attached sketch

NORTHING:	124168	EASTING:	542286
DRILLER:	C. McClain	LOGGED BY:	R. Braun
START DATE:	11/22/19	END DATE:	11/22/19
SURFACE ELEVATION:	774.6 ft	RIG:	7514
METHOD:	3 1/4" HSA	SURFACING:	Bituminous
WEATHER:	Clear		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		SANDY SILT (ML), brown, wet, loose to medium dense (ALLUVIUM)					
743.6			30	2-5-6 (11) 18"	0.2		
31.0		END OF BORING					Water not observed while drilling.
		Boring immediately grouted					Water observed at 17.0 feet with 30.0 feet of tooling in the ground at end of drilling.
			35				Water not observed to cave-in depth of 7.0 feet immediately after withdrawal of auger.
			40				
			45				
			50				
			55				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-117**
LOCATION: See attached sketch
NORTHING: 124556 EASTING: 542542
START DATE: 11/25/19 END DATE: 11/25/19
SURFACE ELEVATION: 798.3 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
797.5		PAVEMENT, 3 inches of bituminous over 7 inches of aggregate base					
0.8		FILL: SILTY SAND (SM), fine to medium-grained Sand, trace Gravel, brown, moist		1-3-3 (6) 8"	0.0	7	P200=16%
			5	5-4-6 (10) 14"	0.0	12	Soil sample ST-117 (5-6') @ 14:00 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
				5-9-9 (18) 6"	0.1		
789.3							
9.0		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, gray, moist	10	5-7-12 (19) 10"	0.2		
786.3							
12.0		FILL: SILTY SAND (SM), fine to medium-grained Sand, black to gray, moist		3-3-4 (7) 6"	0.4		
		Slight petroleum-like odor from 12 to 23 feet	15	1-9-15 (24) 12"	5.9		
		Bituminous debris at 20 feet	20	8-10-17 (27) 8"	28.2		Soil sample ST-117 (20-21') @ 14:15 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
			25	1-1-2 (3) 13"	0.6		
770.3							
28.0		Continued on next page					

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The Science You Build On

LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-117**

LOCATION: See attached sketch

NORTHING:	124556	EASTING:	542542		
DRILLER:	C. McClain	LOGGED BY:	R. Braun	START DATE:	11/25/19
END DATE:	11/25/19				
SURFACE ELEVATION:	798.3 ft	RIG:	7514	METHOD:	3 1/4" HSA
SURFACING:	Bituminous	WEATHER:	Clear		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, brown, moist, loose (ALLUVIUM)					
767.3			30	1-2-5 (7) 8"	0.0		
31.0		END OF BORING					Water not observed while drilling.
		Boring immediately grouted					Water not observed at end of drilling.
							Water not observed to cave-in depth of 14.0 feet immediately after withdrawal of auger.
			35				
			40				
			45				
			50				
			55				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-118**
LOCATION: See attached sketch
NORTHING: 124485 EASTING: 542455
START DATE: 11/25/19 END DATE: 11/25/19
SURFACE ELEVATION: 798.0 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
~~797.7~~ 0.3		SILTY SAND (SM), fine to medium-grained Sand, brown, moist (TOPSOIL FILL)					
		FILL: CLAYEY SAND (SC), trace Gravel, brown, moist		3-5-5 (10) 8"	0.0	13	
794.0 4.0		FILL: SILTY SAND (SM), fine to medium-grained Sand, black, moist	5	3-3-5 (8) 14"	0.0		
		Bituminous debris from 7 to 12 feet *Slight petroleum-like odor from 7 to 19 feet*		6-8-9 (17) 6"	3.6		Soil sample ST-118 (7-8') @ 12:20 collected for VOCs, GRO, DRO, PAHs, PCBs and 8 RCRA metals
			10	5-4-2 (6) 5"	1.7		
				5-9-7 (16) 8"	0.9		
			15	1-2-2 (4) 5"	0.6		
		Bituminous debris at 20 feet	20	3-6-12 (18) 12"	2.0		Soil sample ST-118 (20-21') @ 13:00 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
		Slight petroleum-like odor at 25 feet	25	8-6-5 (11) 10"	1.3		

Continued on next page

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-118**

LOCATION: See attached sketch

NORTHING:	124485	EASTING:	542455
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE: 11/25/19	END DATE: 11/25/19
SURFACE ELEVATION: 798.0 ft	RIG: 7514	METHOD: 3 1/4" HSA	SURFACING: Bituminous	WEATHER: Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		FILL: SILTY SAND (SM), fine to medium-grained Sand, black, moist	30	1-2-4 (6)	0.5		
			35	1-6-10 (16) 18"	0.2		
760.0 38.0		POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, trace Gravel, gray, moist, medium dense (ALLUVIUM)	40	1-12-16 (28) 10"	0.0		
757.0 41.0		END OF BORING Boring immediately grouted	45				Water not observed while drilling. Water not observed at end of drilling. Water not observed to cave-in depth of 19.0 feet immediately after withdrawal of auger.
			50				
			55				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-119**
LOCATION: See attached sketch
NORTHING: 124464 EASTING: 542605
START DATE: 11/22/19 END DATE: 11/22/19
SURFACE ELEVATION: 797.5 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: R. Braun

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
796.7		PAVEMENT, 3 inches of bituminous over 6 inches of aggregate base					
0.8		FILL: SILTY SAND (SM), fine to medium-grained Sand, dark brown, moist		4-9-8 (17) 12"	0.8		Soil sample ST-119 (2-3.5') @ 11:35 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
793.5							
4.0		FILL: CLAYEY SAND (SC), trace Gravel, brown to dark brown, moist	5	8-11-10 (21) 16"	0.9	16	
				3-5-5 (10) 18"	0.3	13	
			10	4-2-7 (9) 14"	0.1		
785.5							
12.0		FILL: SILTY SAND (SM), fine to medium-grained Sand, dark brown, moist		2-3-6 (9) 14"	0.9		
		Slight chemical-like odor at 15 feet	15	2-4-4 (8) 14"	8.9		
778.5							
19.0		FILL: CLAYEY SAND (SC), with concrete and bituminous debris, black, moist *Faint petroleum-like odor*	20	7-21-8 (29) 18"	4.0		
773.5							
24.0		FILL: SILTY SAND (SM), fine to medium-grained Sand, with bituminous debris, black, moist *Faint petroleum-like odor*	25	4-9-11 (20) 14"	2.3		

Continued on next page

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-119**

LOCATION: See attached sketch

NORTHING: 124464 EASTING: 542605

DRILLER: C. McClain | LOGGED BY: R. Braun | START DATE: 11/22/19 | END DATE: 11/22/19

SURFACE ELEVATION: 797.5 ft | RIG: 7514 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER: Clear

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		FILL: SILTY SAND (SM), fine to medium-grained Sand, with bituminous debris, black, moist	30	1-4-5 (9) 13"	2.3		
		Slight chemical-like odor at 35 feet	35	1-6-6 (12) 12"	1.6		
758.5							
39.0		SANDY SILT (ML), gray, moist, loose (ALLUVIUM)	40	1-3-3 (6) 13"	0.9		
754.5							
43.0		POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, brown, moist, medium dense (ALLUVIUM)	45	1-6-8 (14) 9"	0.6		
751.5							
46.0		END OF BORING					Water not observed while drilling.
		Boring immediately grouted					Water not observed at end of drilling.
			50				Water not observed to cave-in depth of 19.0 feet immediately after withdrawal of auger.
			55				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-120**
LOCATION: See attached sketch
NORTHING: 124322 EASTING: 542385
START DATE: 11/26/19 END DATE: 11/26/19
DRILLER: C. McClain LOGGED BY: R. Braun
SURFACE ELEVATION: 789.2 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
788.1		PAVEMENT, 5 inches of bituminous over 8 inches of aggregate base					
1.1		FILL: CLAYEY SAND (SC), brown, moist		1-3-6 (9) 15"	0.0	15	Soil sample ST-120 (2-3') @ 10:15 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
			5	3-3-6 (9) 9"	0.0		
				2-3-3 (6) 15"	0.0	12	
780.2							
9.0		FILL: SILTY SAND (SM), fine to medium-grained Sand, dark brown to black, moist *Bituminous debris at 10 feet*	10	12-25-19 (44) 18"	0.0 0.6		
		Faint petroleum-like odor from 12 to 19 feet		3-3-3 (6) 13"	0.3		Soil sample ST-120 (11-12') @ 10:25 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
			15	1-2-2 (4) 12"	0.0		
770.2							
19.0		POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, brown, moist to wet, loose to medium dense (ALLUVIUM)	20	1-2-4 (6) 10"	0.0		
			25	3-5-5 (10) 13"	0.0		

Continued on next page

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-120**

LOCATION: See attached sketch

NORTHING:	124322	EASTING:	542385
DRILLER: C. McClain	LOGGED BY: R. Braun	START DATE:	11/26/19
END DATE:	11/26/19		
SURFACE ELEVATION: 789.2 ft	RIG: 7514	METHOD: 3 1/4" HSA	
SURFACING: Bituminous	WEATHER: Cloudy		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
758.2	▽	POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, brown, moist to wet, loose to medium dense (ALLUVIUM)		2-7-12 (19) 14"	0.0		
31.0		END OF BORING Boring immediately grouted					Water observed at 30.0 feet with 30.0 feet of tooling in the ground while drilling. Water observed at 28.0 feet with 30.0 feet of tooling in the ground at end of drilling. Water not observed to cave-in depth of 13.0 feet immediately after withdrawal of auger.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-121**
LOCATION: See attached sketch
NORTHING: 124332 EASTING: 542505
START DATE: 11/26/19 END DATE: 11/26/19
DRILLER: C. McClain LOGGED BY: R. Braun
SURFACE ELEVATION: 792.4 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Grass WEATHER: Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
791.1		SILTY SAND (SM), fine to medium-grained Sand, black, moist (TOPSOIL FILL)					
1.3		FILL: CLAYEY SAND (SC), fine to medium-grained Sand, brown, moist		2-5-7 (12) 14"	0.1	12	
788.4							
4.0		FILL: SILTY SAND (SM), fine-grained Sand, brown, moist	5	3-3-2 (5) 12"	0.0	17	
785.4							
7.0		FILL: SANDY LEAN CLAY (CL), brown, moist *Bituminous debris at 7 1/2 feet*		12-4-3 (7) 11"	0.2 0.0		Soil sample ST-121 (8-8.5') @ 09:00 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
783.4							
9.0		FILL: SILTY SAND (SM), fine-grained Sand, brown, moist	10	3-4-13 (17) 10"	0.0		
780.4							
12.0		FILL: POORLY GRADED SAND (SP), fine to medium-grained Sand, brown, moist *Bituminous debris at 12 1/2 feet*		3-3-2 (5) 7"	0.0		
778.4							
14.0		FILL: SILTY SAND (SM), fine to medium-grained Sand, dark brown, moist *Bituminous debris from 15 to 20 feet*	15	3-10-12 (22) 14"	0.0 0.2		
		Slight petroleum-like odor at 20 feet	20	7-8-12 (20) 16"	0.9		Soil sample ST-121 (20-21') @ 09:20 collected for VOCs, GRO, DRO, PAHs, PCBs and 8 RCRA metals
768.4							
24.0		SILTY SAND (SM), fine-grained Sand, gray, moist, loose (ALLUVIUM)	25	1-2-3 (5) 10"	0.1		

Continued on next page

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **ST-121**

LOCATION: See attached sketch

NORTHING:	124332	EASTING:	542505		
DRILLER:	C. McClain	LOGGED BY:	R. Braun	START DATE:	11/26/19
END DATE:	11/26/19	SURFACE ELEVATION:	792.4 ft	RIG:	7514
METHOD:	3 1/4" HSA	SURFACING:	Grass	WEATHER:	Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
		SILTY SAND (SM), fine-grained Sand, gray, moist, loose (ALLUVIUM)					
761.4			30	1-2-4 (6) 14"	0.0		
31.0		END OF BORING					Water not observed while drilling.
		Boring immediately grouted					Water not observed at end of drilling.
							Water not observed to cave-in depth of 14.0 feet immediately after withdrawal of auger.
			35				
			40				
			45				
			50				
			55				

BRAUN INTERTEC
The Science You Build On

LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907929.00
Geotechnical Evaluation
Park N Fly Property
3700 American Boulevard East
Bloomington, Minnesota

BORING: **ST-13**
LOCATION: See attached sketch
NORTHING: 124833 EASTING: 542307
START DATE: 10/09/19 END DATE: 10/09/19
SURFACE ELEVATION: 810.7 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: B. Tanko

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
810.0		PAVEMENT, 5 inches of bituminous over 3 inches of aggregate base					
0.7		POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, light brown, moist, loose to medium dense (ALLUVIUM)		2-7-6 (13) 10"			
			5	4-4-5 (9) 12"			
				3-3-4 (7) 14"		3	P200=2%
			10	2-3-3 (6) 13"			
				2-4-5 (9) 10"		2	
			15	3-4-5 (9) 13"			
			20	3-4-5 (9) 13"			
			25	3-7-8 (15) 13"			
			30	2-4-7 (11) 13"			

Continued on next page

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907929.00
Geotechnical Evaluation
Park N Fly Property
3700 American Boulevard East
Bloomington, Minnesota

BORING: **ST-13**
LOCATION: See attached sketch
NORTHING: 124833 EASTING: 542307
START DATE: 10/09/19 END DATE: 10/09/19
SURFACE ELEVATION: 810.7 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clear
DRILLER: C. McClain LOGGED BY: B. Tanko

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, light brown, moist, loose to medium dense (ALLUVIUM)	35	1-6-8 (14) 14"			
772.7 38.0		POORLY GRADED SAND (SP), fine to coarse-grained Sand, with Gravel, brown, moist (ALLUVIUM)	40	11-8-11 (19) 9"			
	▼	*Wet at 42 feet*					
764.7 46.0		END OF BORING Boring then grouted	45	5-9-10 (19) 11"			Water observed at 42.0 feet when rechecked 24 hours after drilling. Installed temporary PVC standpipe overnight, then removed on 10/10/19.
			50				
			55				
			60				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907929.00
Geotechnical Evaluation
Park N Fly Property
3700 American Boulevard East
Bloomington, Minnesota

BORING: **ST-14**
LOCATION: See attached sketch
NORTHING: 124808 EASTING: 542218
START DATE: 10/10/19 END DATE: 10/10/19
SURFACE ELEVATION: 812.8 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clouds
DRILLER: C. McClain LOGGED BY: B. Tanko

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
812.0		PAVEMENT, 5 inches of bituminous over 4 inches of aggregate base					
0.8		POORLY GRADED SAND (SP), fine to medium-grained Sand, light brown, moist, medium dense to loose (ALLUVIUM)		4-12-15 (27) 13"			
			5	3-8-9 (17) 13"			
				3-4-5 (9) 13"		5	
			10	3-4-5 (9) 14"			
				2-3-4 (7) 13"		4	
			15	2-4-4 (8) 12"			
			20	2-6-8 (14) 14"			
			25	1-4-5 (9) 15"			
784.8							
28.0		POORLY GRADED SAND (SP), fine to medium-grained Sand, little Gravel, brown, moist, medium dense (ALLUVIUM)	30	3-7-11 (18) 14"			

Continued on next page

BRAUN INTERTEC
The Science You Build On

LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907929.00
Geotechnical Evaluation
Park N Fly Property
3700 American Boulevard East
Bloomington, Minnesota

BORING: **ST-14**
LOCATION: See attached sketch
NORTHING: 124808 EASTING: 542218
START DATE: 10/10/19 END DATE: 10/10/19
SURFACE ELEVATION: 812.8 ft RIG: 7514 METHOD: 3 1/4" HSA
SURFACING: Bituminous WEATHER: Clouds
DRILLER: C. McClain LOGGED BY: B. Tanko

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine to medium-grained Sand, little Gravel, brown, moist, medium dense (ALLUVIUM)					
			35	4-6-9 (15) 6"			
			40	5-9-13 (22) 13"			
771.8							
41.0		END OF BORING					Water not observed while drilling.
		Boring then grouted					
			45				
			50				
			55				
			60				

LOG OF BORING

BRAUN ENGINEERING TESTING

PROJECT: 84-033 FOUNDATION INVESTIGATION Appletree Condominiums 34th Avenue & 80th Street Bloomington, MN	BORING: ST-1 LOCATION: See Attached Sketch DATE: 2-8-84 SCALE: 1"=4'

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
784.5	0	SC-SM	SILTY CLAYEY SAND, fine to medium-grained, moist, loose. (Fill)	10		Benchmark: Top of SW corner of retaining wall north of proposed building elevation= 805.8.
779.0	5.5			14		
		SM	SILTY SAND, fine to medium-grained, with a trace of fine to medium Gravel, with layers of fine-grained SILTY SAND with occasional layers of SILTY SAND Topsoil, cobbles encountered between 8 and 10.5', brown, moist, medium dense. (Fill)	16		
772.5	12			18		
		SP to SP-SM	SAND to SLIGHTLY SILTY SAND, fine-grained, light brown, moist, medium dense. (Coarse Alluvium)	25		
				24		
				22		
				20		*moist, medium dense. (Fine Alluvium)
755.5	29					
754.0	30.5	SP-SM	SLIGHTLY SILTY SAND, fine-grained, with layers of CLAYEY SAND, *	20		Water level not encountered to cave-in depth of 20' immediately after withdrawal of auger.
			Water level not encountered with 30' of hollow-stem auger in the ground.			

LOG OF BORING

BRAUN ENGINEERING TESTING

PROJECT: 84-033 FOUNDATION INVESTIGATION
Appletree Condominiums
34th Avenue & 80th Street
Bloomington, MN

BORING: ST-2
LOCATION:
See Attached Sketch

DATE: 2-8-84 SCALE: 1"=4'

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
794.4	0	SM	SILTY SAND, fine-grained, with a trace of fine Gravel, brown, moist, medium dense. (Fill)	11		
789.9	5.5			8		
787.4	7	SC-SM to CL	SILTY CLAYEY SAND to SILTY SANDY CLAY, very fine-grained, brown,*			*moist, loose. (Fill)
785.4	9	SC-SM	SILTY CLAYEY SAND, fine to very fine-grained, brown, moist, medium dense. (Fill)	15		
782.2	12	SM	SILTY SAND, fine-grained, boulders encountered between 10 and 13', brown, moist, medium dense. (Fill)	12		
780.4	14	SC-SM	SILTY CLAYEY SAND, fine-grained, brown, wet, medium dense. (Fill)	14		
777.4	17	SM	SILTY SAND, fine-grained, black, moist, medium dense. (Possible Original Topsoil)	23		
776.4	18	SC-SM to SM	SILTY CLAYEY SAND to SILTY SAND, very fine-grained, with layers**	20		**of topsoil and a trace of roots, gray and black, moist, medium dense. (Possible Fill)
		SP	SAND, fine to medium-grained, with some fine Gravel, brown, moist, medium dense. (Coarse Alluvium)	25		
			Cobbles encountered at 27'.	18		Water level not encountered to cave-in depth of 20' immediately after withdrawal of auger.
763.9	30.5			17		
			Water level not encountered with 30' of hollow-stem auger in the ground.			

BRAUN INTERTEC

LOG OF BORING

PROJECT: **BABX-97-728**
GEOTECHNICAL EVALUATION
Driveway Elvaluation
Appletree Square Condominiums
Bloomington, Minnesota

BORING: **ST-2**

LOCATION:
See attached sketch.

CREW CHIEF: P. Petschl | METHOD: 3 1/4" HSA Autohmr | DATE: 11/4/97 | SCALE: 1" = 4'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
69.0	0.0					Elevation 100' (assumed)= 802' MSL
67.0	2.0	SM	SILTY SAND, fine- to medium-grained, with trace of roots, dark brown, wet.			
		SM	SILTY SAND, fine-grained, with layers of Clayey Sand, brown, moist, medium dense (Glacial Outwash)	11		
63.0	6.0			11		
		SP-SM	POORLY GRADED SAND, fine-grained, with SILT, with a trace of Gravel, with layers of Silty Sand, brown, moist, medium dense. (Glacial Outwash)	19		
58.0	11.0			15		
		SM	SILTY SAND, fine-grained, with layers of Silt, brown, moist, medium dense. (Glacial Outwash)	20		
53.0	16.0			11		
		SP	POORLY GRADED SAND, fine-grained, light brown, moist, medium dense. (Glacial Outwash)	23		
50.0	19.0					
		SP-SM	POORLY GRADED SAND, fine-grained, with SILT, moist, loose. (Glacial Outwash)	8		
48.0	21.0					
		ML	SILT, reddish brown, wet, loose. (Glacial Outwash)		▽	
43.5	25.5			8		
			END OF BORING.			The triangle in the WL column indicates the highest level at which groundwater was observed while drilling. Groundwater levels fluctuate. Please refer to the discussions in Sections B.5 and F.2 of our report.
			Water down 24 feet of hollow-stem auger in the ground.			
			Water not observed to cave-in depth of 17 1/2 feet immediately after withdrawal of the auger.			
			Boring then backfilled.			

BRAUN INTERTEC

LOG OF BORING

PROJECT: **BABX-97-728** **GEOTECHNICAL EVALUATION** **Driveway Elvaluation** **Appletree Square Condominiums** **Bloomington, Minnesota**	BORING: **ST-3** LOCATION: **100' E and 46' N of NW Building Corner**
CREW CHIEF: P. Petschl	METHOD: 3 1/4" HSA Autohmr.
DATE: 11/4/97	SCALE: 1" = 4'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
91.0	0.0					
90.6	0.4	BIT	2 inches Bituminous with 2 1/2 inch Granular Base.			
		FILL	FILL: Silty Sand, fine- to medium-grained, slightly organic, dark brown, moist.	15		Elevation 100' (assumed)= 802' MSL
				12		
87.0	4.0	FILL	FILL: Silty Sand, fine- to medium-grained, with trace of Gravel, dark brown, moist.	5		
84.5	6.5	FILL	FILL: Clayey Sand, fine- to medium-grained, possible 8 feet of Fill, dark brown, moist.	5		
82.5	8.5	SP	POORLY GRADED SAND, fine- to medium-grained, light brown, moist, loose. (Glacial Outwash)	7		
80.5	10.5		END OF BORING. Water not observed with 9 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 5 1/2 feet immediately after withdrawal of the auger. Boring then backfilled and patched.			

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LOG OF TEST PIT

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **TP-1**

LOCATION: See attached sketch

NORTHING: | EASTING:

DRILLER:	Bolander	LOGGED BY:	R. Braun	START DATE:	11/21/19	END DATE:	11/21/19
SURFACE ELEVATION:		RIG:	Excavator	METHOD:		SURFACING:	Asphalt	WEATHER:	Snow

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
1.0		PAVEMENT, 6 inches of bituminous over 6 inches of aggregate base			0.0		Nearest Boring: ST-107
		FILL: SILTY SAND (SM), brown, wet					
4.0					0.0		Soil sample TP-1 (2-4') @ 08:15 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, trace Gravel, brown, wet					
6.0					0.0		
		END OF BORING					
		Test pit then backfilled with spoils					

BRAUN INTERTEC
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LOG OF TEST PIT

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **TP-2**

LOCATION: See attached sketch

NORTHING: | EASTING:

DRILLER:	Bolander	LOGGED BY:	R. Braun	START DATE:	11/21/19	END DATE:	11/21/19
SURFACE ELEVATION:		RIG:	Excavator	METHOD:		SURFACING:	Asphalt	WEATHER:	Snow

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
1.0		PAVEMENT, 6 inches of bituminous over 6 inches of aggregate base			0.0		Nearest Boring: ST-112
		FILL: POORLY GRADED SAND (SP-SM), fine to medium-grained Sand, trace Gravel, brown, moist					Soil sample TP-2 (0.5-2') @ 09:40 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
3.5					0.0		
		POORLY GRADED SAND (SP), fine to medium-grained Sand, light brown, moist (ALLUVIUM)					
5					0.0		
10.0					0.0		
10		END OF BORING					
		Test pit then backfilled with spoils					
15							
20							
25							

BRAUN INTERTEC
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LOG OF TEST PIT

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **TP-3**
LOCATION: See attached sketch
NORTHING: EASTING:

DRILLER:	Bolander	LOGGED BY:	R. Braun	START DATE:	11/21/19	END DATE:	11/21/19
SURFACE ELEVATION:		RIG:	Excavator	METHOD:		SURFACING:	Tall grass	WEATHER:	Snow

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
0.5		SILTY SAND (SM), fine to medium-grained Sand, black, moist (TOPSOIL FILL)			0.0		Nearest Boring: ST-106
		FILL: SILTY SAND (SM), fine to medium-grained Sand, trace Gravel, brown, moist			0.0		
		Bituminous layer from 5-7 feet	5				Soil sample TP-3 (5-7') @ 10:50 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
6.0		FILL: CLAYEY SAND (SC), trace Gravel, reddish brown, moist			0.0		
					0.0		
			10				
					0.0		
15.0			15				
		FILL: SILTY SAND (SM), fine to medium-grained Sand, trace Gravel, brown, moist			0.0		
17.0		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, trace Gravel, gray, moist					Soil sample TP-3 (17-26') @ 11:10 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
		With bituminous debris	20				
					0.0		
			25				
26.0		END OF BORING					
		Test pit then backfilled with spoils					

BRAUN INTERTEC
The Science You Build On

LOG OF TEST PIT

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1909819
Geotechnical & Environmental Evaluation
Crown Plaza Site
3601 American Boulevard E
Bloomington, Minnesota

BORING: **TP-4**

LOCATION: See attached sketch

NORTHING: | EASTING:

DRILLER:	Bolander	LOGGED BY:	R. Braun	START DATE:	11/21/19	END DATE:	11/21/19
SURFACE ELEVATION:		RIG:	Excavator	METHOD:		SURFACING:	Tall grass	WEATHER:	Snow

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	PID ppm	MC %	Tests or Remarks
0.5		CLAYEY SAND (SC), trace Gravel, dark brown, moist (TOPSOIL FILL)					Nearest Boring: ST-105
		FILL: SILTY SAND (SM), fine to medium-grained Sand, brown, moist			0.2		Soil sample TP-4 (4-6') @ 12:45 collected for VOCs, GRO, DRO, PAHs and 8 RCRA metals
6.0		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, trace Gravel, gray to reddish brown, moist			0.1		
13.0		FILL: CLAYEY SAND (SC), trace Gravel, black, moist			0.4		
16.0		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, trace Gravel, black to dark brown, moist *With bituminous debris*			1.2		
26.0		END OF BORING Test pit then backfilled with spoils					

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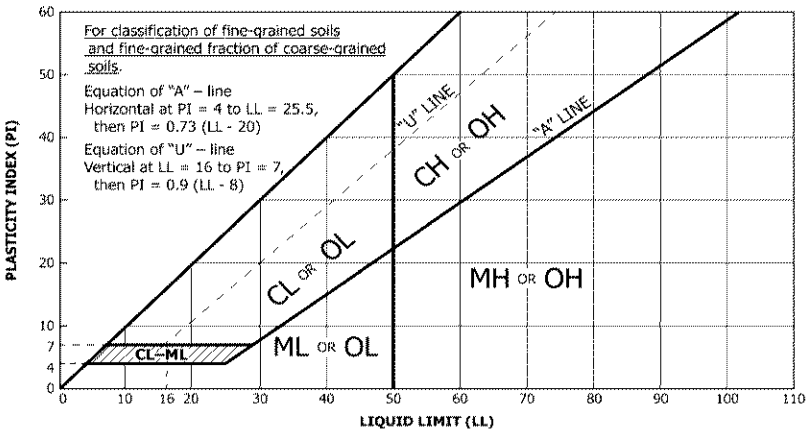
Descriptive Terminology of Soil

Based on Standards ASTM D2487/2488
(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])	$C_u \geq 4$ and $1 \leq C_c \leq 3$[J]	GW	Well-graded gravel[F]
			$C_u < 4$ and/or $(C_c < 1$ or $C_c > 3)$[D]	GP	Poorly graded gravel[E]
		Gravels with Fines (More than 12% fines[C])	Fines classify as ML or MH	GM	Silty gravel[E,F,G]
			Fines Classify as CL or CH	GC	Clayey gravel[E,F,G]
	Sands (50% or more coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines[H])	$C_u \geq 6$ and $1 \leq C_c \leq 3$[J]	SW	Well-graded sand[I]
			$C_u < 6$ and/or $(C_c < 1$ or $C_c > 3)$[D]	SP	Poorly graded sand[I]
		Sands with Fines (More than 12% fines[H])	Fines classify as ML or MH	SM	Silty sand[I,G,I]
			Fines classify as CL or CH	SC	Clayey sand[F,G,I]
Fine-grained Soils (50% or more passes the No. 200 sieve)	Silts and Clays (Liquid limit less than 50)	Inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		Organic	Liquid Limit – oven dried / Liquid Limit – not dried < 0.75	OL	Organic clay[K,L,M,N] / 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 / Liquid Limit – not dried < 0.75	OH	Organic clay[K,L,M,P] / 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. $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
E. If soil contains ≥ 15% sand, add "with sand" to group name.
F. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
G. If fines are organic, add "with organic fines" to group name.
H. 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
I. If soil contains ≥ 15% gravel, add "with gravel" to group name.
J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
K. If soil contains 15 to < 30% 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.



Particle Size Identification

Boulders..... over 12"
Cobbles..... 3" to 12"
Gravel
  Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
  Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand
  Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
  Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
  Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt..... No. 200 (0.075 mm) to .005 mm
Clay..... < .005 mm

Relative Proportions[L,M]

trace..... 0 to 5%
little..... 6 to 14%
with..... ≥ 15%

Inclusion Thicknesses

lens..... 0 to 1/8"
seam..... 1/8" to 1"
layer..... over 1"

Apparent Relative Density of Cohesionless Soils

Very loose ..... 0 to 4 BPF
Loose ..... 5 to 10 BPF
Medium dense..... 11 to 30 BPF
Dense..... 31 to 50 BPF
Very dense..... over 50 BPF

Consistency of Cohesive Soils	Blows Per Foot	Approximate Unconfined Compressive Strength
Very soft	0 to 1 BPF	< 0.25 tsf
Soft	2 to 4 BPF	0.25 to 0.5 tsf
Medium	5 to 8 BPF	0.5 to 1 tsf
Stiff	9 to 15 BPF	1 to 2 tsf
Very Stiff	16 to 30 BPF	2 to 4 tsf
Hard	over 30 BPF	> 4 tsf

Moisture Content:

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

Drilling Notes:

Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

Water Level: Indicates the water level measured by the drillers either while drilling (▽), at the end of drilling (▼), or at some time after drilling (▼).

Laboratory Tests

DD	Dry density, pcf	**OC**	Organic content, %	**LL**	Liquid limit
WD	Wet density, pcf	**q_p**	Pocket penetrometer strength, tsf	**PL**	Plastic limit
P200	% Passing #200 sieve	**MC**	Moisture content, %	**PI**	Plasticity index
		q_U	Unconfined compression test, tsf		

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