BRAUN INTERTEC
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February 13, 2020 Project B1909583

Mr. David Young
United Properties Residential, LLC
651 Nicollet Mall, Suite 450
Minneapolis, MN 55402

Re: Addendum 1 to Geotechnical Evaluation
Cherrywood Pointe
5501 American Boulevard West
Bloomington, Minnesota

Dear Mr. Young:

This letter serves as Addendum 1 to our Geotechnical Evaluation Report for this project, dated June 21, 2019. This Addendum addresses stormwater management design.

Background

Our Geotechnical Evaluation Report did not include site specific testing for infiltration capacities. Since the issuance of our report, we have been authorized to complete Double Ring Infiltrometer testing to measure the infiltration rate of soils on the site. This addendum is intended to address the results of the testing and how that applies to the stormwater management design.

Site Review

Prior to conducting the infiltration testing, we reviewed all 22 borings taken across the Cherrywood Pointe site as well as the adjacent The Pointe site. The purpose of the review was to evaluate the soil conditions at and below the typical invert depths of infiltration tanks or infiltration basins. For this site, the typical invert elevation required to facilitate installation of an infiltration tank or basin would be about 816 to 819.

In our review we found that the borings are notably consistent, and all borings encountered Glacial Till deposits. The exception was two distinct areas where pockets of Glacial Outwash sand was encountered. One such area is located on the Cherrywood Pointe site at Infiltration Basin 2B. The other area is located on The Pointe site to the south of the west wing of the building where we took soil borings ST-1, ST-14, and ST-101. On the Cherrywood Pointe site, the top of the Glacial Outwash sand pocket was encountered at approximate elevation 814. On The Pointe site, the top of the Glacial Outwash sand pocket ranged from elevation 811 to 819.

The Glacial Till is predominantly texturally classified as silty sand. Results of 200 washes we have conducted on the Glacial Till in this area range from 27 to 38 percent fines, with an average of 34 percent. N values of the Glacial Till typically ranged from 15 to 30 blows per foot at the invert depths, indicating the material is medium dense.

The Glacial Outwash is predominately texturally classified as Poorly Graded Sand with Silt. N values of the Glacial Outwash typically ranged from 11 to 25 blows per foot, indicating the material is medium dense.

Results

We conducted Double Ring Infiltrometer tests according to ASTM D 3385 in the Glacial Till soils on the south end of Underground Stormwater System 2A and north side of Infiltration Basin 2B. The results of the tests indicated an infiltration rate ranging from 0.11 to 0.32 inches per hour (in/hr).

Recommendations

A slightly higher infiltration rate was measured in Infiltration Basin 2B, which is anticipated to be influenced by the nearby presence of Glacial Outwash soils. As the Glacial Outwash soils were only encountered as pockets of material, it is anticipated that these pockets would fill with water in a rain event and then drain away at the rate at which the Glacial Till will drain. For this reason we recommend the design infiltration rate for this site be considered 0.11 in/hr. We recommend the soil be loosened to a depth of at least 3 feet below the invert elevation by tilling or ripping.

Remarks

This Addendum should be attached to and considered a part of our original Geotechnical Evaluation Report. With the exception of any results or recommendations changed by this Addendum, the information contained in our Geotechnical Evaluation Report remains unchanged.

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.

If you have any questions about this Addendum, please contact Nate McKinney at 952.995.2228.

Sincerely,

BRAUN INTERTEC CORPORATION

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.

Nathan L. McKinney, PE
Vice President, Principal Engineer
License Number: 45791
February 13, 2020

NATHAN LYLE McKINNEY LICENSED PROFESSIONAL ENGINEER 45791 STATE OF MINNESOTA

Ray A. Huber, PE
Vice President, Principal Engineer

Attachments:
Results of Double Ring Infiltrometer Testing

c: Mr. David Knaeble, Civil Site Group Inc.
Mr. Griffin Jameson, Kaas Wilson Architects

Results of Double Ring Infiltrometer Testing (ASTM D 3385)- Mariotte Tube Method

BRAUN INTERTEC

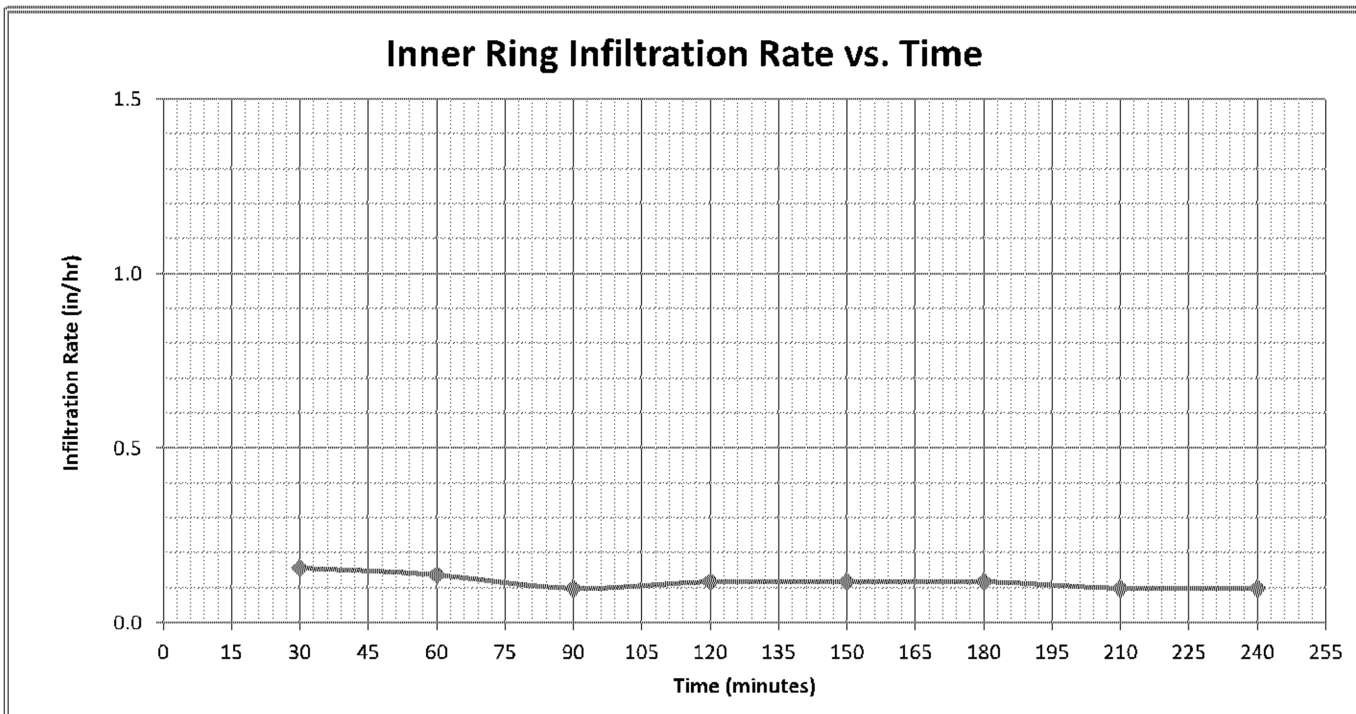
Test Number:	DRI-2
Project Description:	Cherrywood Pointe - BL
Project Number:	B1909583
Date:	January 31, 2020
Liquid used:	Potable water
Inner Ring Area:	113 square inches
Outer Ring Area:	452 square inches
Water depth Inner Ring (in):	6
Water depth annular Ring (in):	6
Weather:	28°/Snow

Test Location:	South end of underground stormwater system 2A
Test Elevation:	Approximately 816 feet MSL
Ground Temperature F°:	38
Water Temperature F°:	37
Test performed by:	Ryan Braun
Moisture Content of soil at test depth before test:	10%
Percent Fines passing a 200 sieve on soil at test depth:	29%

Time	Infiltration Rate (in/hr)
30	0.2
60	0.1
90	0.1
120	0.1
150	0.1
180	0.1
210	0.1
240	0.1

Depth below bottom of test	Soil Profile
0-36 inches	SM, Fine- to Medium-Grained, with gravel, Brown, Moist
Groundwater depth	Not Encountered

Average Infiltration Rate of Inner Ring Over Entire Test (in/hr)	**0.12**
Steady State Infiltration Rate of Inner Ring Over Last 4 intervals (in/hr)	**0.11**



Test performed by Braun Intertec personnel in general accordance with test method ASTM D 3385.

Results of Double Ring Infiltrometer Testing (ASTM D 3385)- Mariotte Tube Method

BRAUN INTERTEC

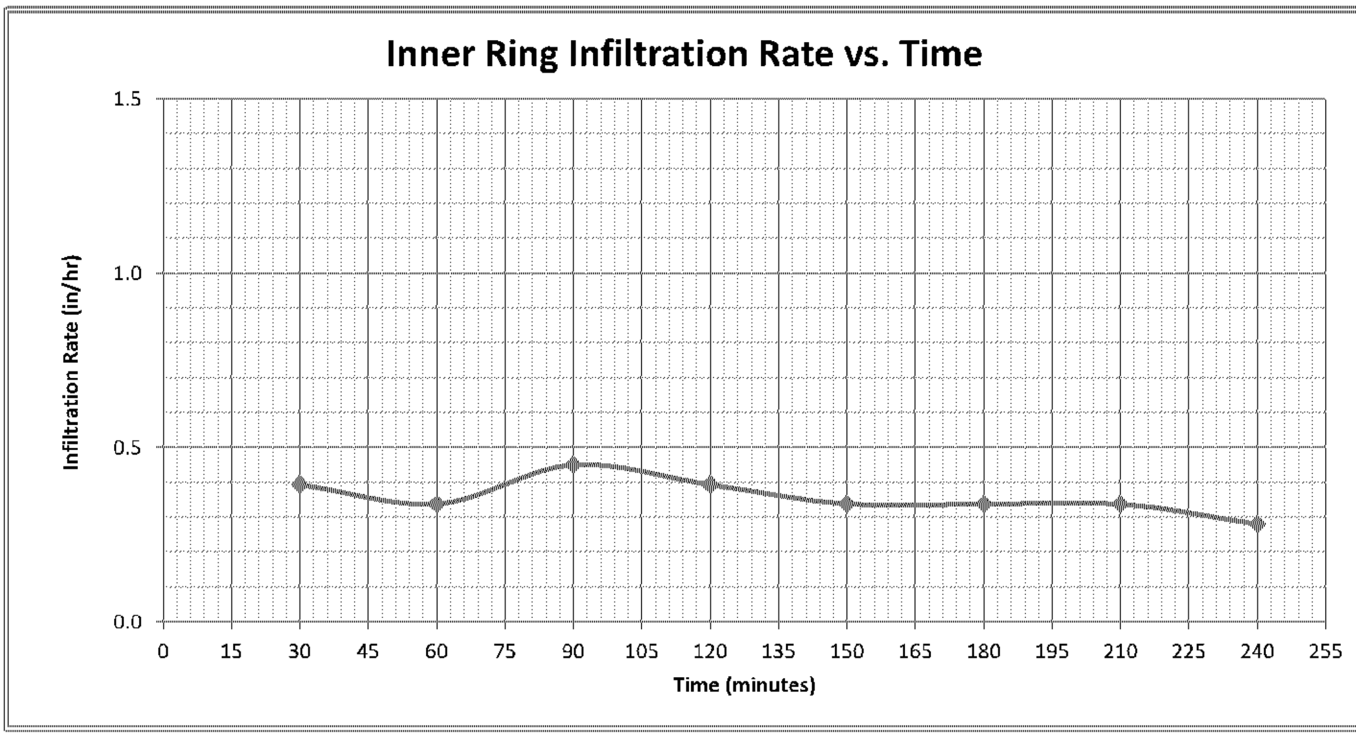
Test Number:	DRI-3
Project Description:	Cherrywood Pointe - BL
Project Number:	B1909583
Date:	January 31, 2020
Liquid used:	Potable water
Inner Ring Area:	113 square inches
Outer Ring Area:	452 square inches
Water depth Inner Ring (in):	6
Water depth annular Ring (in):	6
Weather:	28°/snow

Test Location:	North end of Infilitration Basin 2B
Test Elevation:	Approximately 814 ft MSL
Ground Temperature F°:	38
Water Temperature F°:	37
Test performed by:	Ryan Braun
Moisture Content of soil at test depth before test:	10%
Percent Fines passing a 200 sieve on soil at test depth:	31%

Time	Infiltration Rate (in/hr)
30	0.4
60	0.3
90	0.5
120	0.4
150	0.3
180	0.3
210	0.3
240	0.3

Depth below bottom of test	Soil Profile
0-36 inches	SM, Fine- to Medium-Grained, with gravel, brown, moist; grading to significantly less fines at termination of hand auger.
Groundwater depth	Not Encountered

Average Infiltration Rate of Inner Ring Over Entire Test (in/hr)	**0.36**
Steady State Infiltration Rate of Inner Ring Over Last 4 intervals (in/hr)	**0.32**



Test performed by Braun Intertec personnel in general accordance with test method ASTM D 3385.

PL201900139

Geotechnical Evaluation Report

Cherrywood Pointe
5601 and 5501 American Boulevard West
Bloomington, Minnesota

Prepared for

United Properties Residential, 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.

Nathan L. McKinney, PE
Principal – Senior Engineer
License Number: 45791
June 21, 2019

NATHAN LYLE McKINNEY
LICENSED PROFESSIONAL ENGINEER
45791
STATE OF MINNESOTA

Project B1906473

Braun Intertec Corporation

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June 21, 2019

Project B1906473

Mr. David Young
United Properties Residential, LLC
651 Nicollet Mall, Suite 450
Minneapolis, MN 55402

Re: Geotechnical Evaluation
Cherrywood Pointe
5601 and 5501 American Boulevard West
Bloomington, Minnesota

Dear Mr. Young:

We have completed the geotechnical evaluation for the proposed Cherrywood Pointe in Bloomington, Minnesota. Please refer to the attached report for a detailed summary of our results and recommendations.

We appreciate the opportunity to be of service to you on this project. If we can provide additional assistance or observation and testing services during construction, please call Nate McKinney at 952.995.2228 or Ray Huber at 952.995.2260.

Sincerely,

BRAUN INTERTEC CORPORATION

Nathan L. McKinney, PE
Principal – Senior Engineer

Ray A. Huber, PE
Vice President – Principal Engineer

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Description **Page**

A. Introduction

A.1. Project

United Properties is proposing to construct a Cherrywood Pointe on the property located along the south side of American Boulevard West between Normandale Lake Boulevard and Norman Center Drive. The proposed construction is a senior assisted living building, along with utilities, paved areas, and infiltration/detention basins. The boring location sketch in the Appendix illustrates the proposed development.

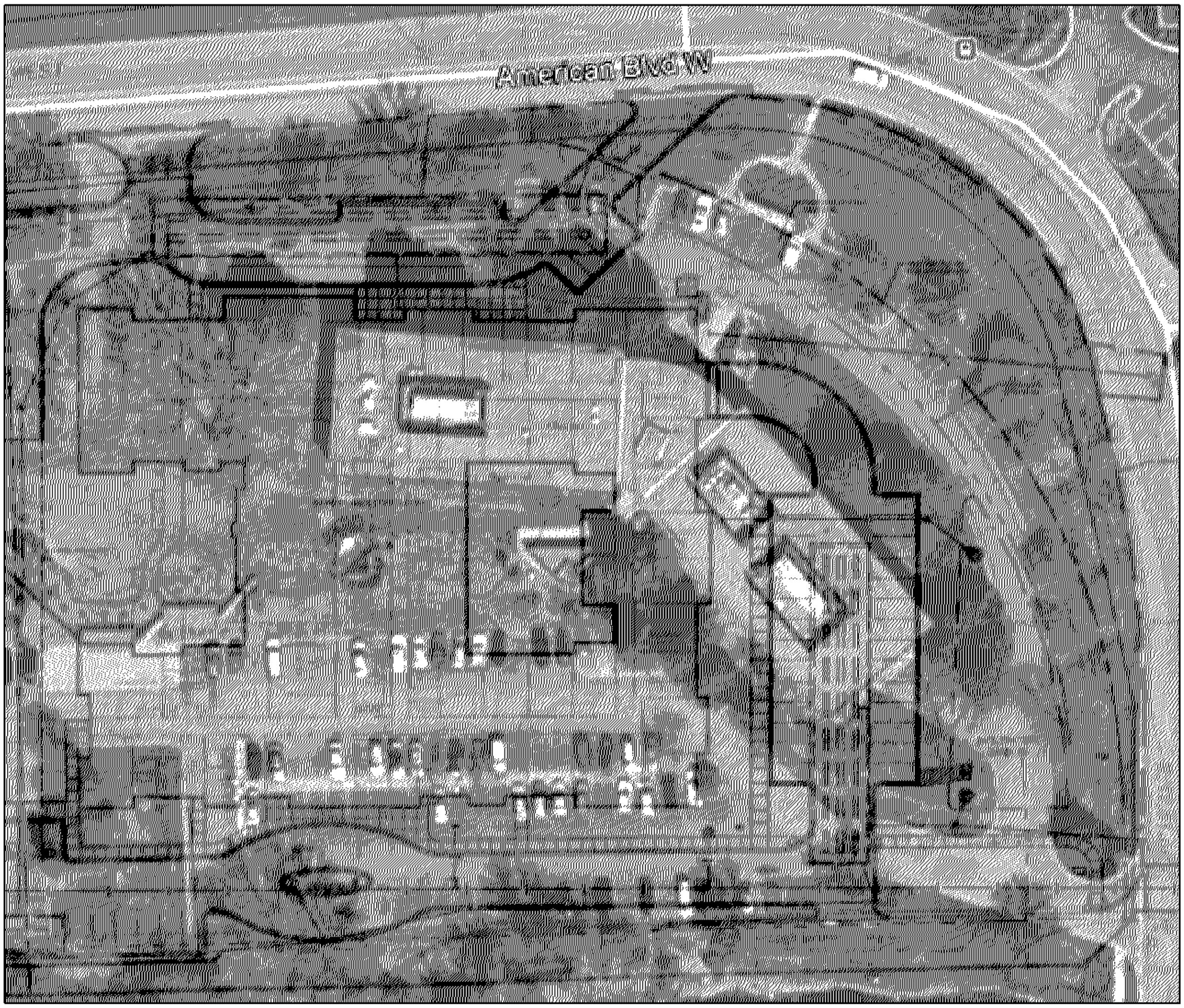
A.2. Purpose

The purpose of the geotechnical evaluation was to assist United Properties and their design team in gathering available geotechnical information about the site and to develop recommendations for design of the foundation system for support of the proposed senior assisted living housing. We also provided recommendations for design of utilities and paved areas.

A.3. Background

A building occupied by Jostens once resided on this site until it was removed in 2008/2009. The site was also used for construction staging while the building across the street to the north was constructed in 2017. Currently the building site is relatively flat with a gentle slope downwards towards the east from about elevation 830 to 827. The figure below represents an aerial image from Google Earth that shows the former Jostens building overlain by the approximate location of the proposed Cherrywood Pointe development.

Figure 1. Historic Aerial overlain with Proposed Development



A.4. Documents Provided

As part of our evaluation, we were provided with the civil plans that were prepared by Civil Site Group dated December 15, 2018. The plans show the approximate location of the various structures and other surface features and grades.

Braun Intertec completed seven soil borings on or adjacent to this site for the 8100 Tower (Borings ST-101 through ST-107) in 2015 under project B1503964. Braun Intertec also completed 15 borings (ST-1 through ST-15) in 2008 and 2009 on or adjacent to this site under project BL-08-01612 and

BL-08-01612A. The available borings were used as a basis for this report. Since the borings were taken, demolition and excavations have occurred. You should expect the near surface conditions in some borings has changed.

A.5. Boring Locations and Elevations

The boring locations and surface elevations at the boring locations were acquired with GPS technology, through the use of the State of Minnesota's permanent GPS base station network. We also recorded the elevation of several known features so that the GPS elevations could be crosschecked if needed. Attached with this report is a site map showing the approximate location of each of the borings conducted and the proposed structures.

B. Results

B.1. Logs

Log of Boring sheets indicating the depths and identifications of the various soil strata, penetration resistances, laboratory test data, and groundwater observations are attached. The strata changes were inferred from the changes in the penetration test samples and auger cuttings. The depths shown as changes between the strata are only approximate. The changes are likely transitions and the depths of the changes vary between the borings.

Geologic origins presented for each stratum on the Log of Boring sheets are based on the soil types, blows per foot, and available common knowledge of the depositional history of the site. Because of the complex glacial and post-glacial depositional environments, geologic origins can be difficult to ascertain. A detailed investigation of the geologic history of the site was not conducted for this evaluation.

B.2. Soils

B.2.a. Fill

Several of the borings encountered fill and/or possible fill. This is remnants of the previous development that was on the site. Note that some grading has occurred at the site since our borings were completed and the borings may not be indicative of conditions near the ground surface as it sits today.

The borings encountered fill and/or possible fill extending to depths ranging from 1 to 12 feet. The fill soils consisted of silty sand, silty clayey sand, sandy lean clay, and silty clay.

B.2.b. Glacially Deposited Soils

The majority of the borings encountered glacially deposited sands. These soils consisted of poorly graded sand, poorly graded sand with silt, silty sand and silty clayey sand. Penetration resistances recorded in the sands ranged from 4 blows per foot (BPF) to 50 blows for 3 inches, indicating that the sands were in a loose to very dense condition. A majority of the sands were primarily medium dense, with the higher blow counts generally attributed to the presence of gravel.

Several of the borings encountered glacially-deposited clays at depth. These soils consisted of lean or sandy lean clay and clayey sand. Penetration resistances recorded in the clayey soils ranged from 5 to 66 BPF, indicating the clays were rather soft to hard.

Some of the borings encountered a thin layer of glacially deposited silt at depth, along with some seams and layers of clay and sand. Penetration resistances recorded in the silt ranged from 8 to 26 BPF, indicating the silt was loose to medium dense.

B.3. Groundwater

Groundwater was encountered while drilling at most of the boring locations at depths ranging from 10 to 60 feet below existing grade. Following removal of the auger, groundwater was encountered at depths ranging from 6 to 39 feet below existing grade. Due to the presence of glacial clay till at depth, it was difficult to estimate the groundwater elevation based on the relatively short duration it took to complete the soil borings. A majority of the borings that encountered groundwater indicated that the groundwater elevation is generally within the range of 800 to 810. For design purposes, we estimate that groundwater is roughly at elevation 805.

Groundwater levels are affected by a variety of climatic conditions, thus seasonal and annual fluctuations should be anticipated.

B.4. Laboratory Tests

We conducted 200 washes to determine the percent of particles passing the number 200 sieve on selected soil samples. Moisture and organic content tests were also conducted on selected soil samples. The results of the 200 washes, moisture content and organic content tests are shown in the Notes column on the Log of Boring sheets. These tests were conducted to develop a better understanding of the engineering properties of the soils.

B.5. Pressuremeter Tests

To evaluate the load bearing and settlement characteristics of the granular soils at depth, a series of pressuremeter tests were completed. Pressuremeter tests (PMT) were done at the depths shown in Table 1 below, in general accordance with ASTM D-4719, "Standard Method for Pressuremeter Testing in Soils." The PMT was performed on May 19, 2015.

Several values are considered to be important when the pressuremeter results are evaluated. The calculated deformation modulus (Ep) is the value that is used to estimate the soils potential for further densification when subjected to the foundation loads. The limit pressure (P_L) is the load in which the soil around the probe has deformed to a point where failure is assumed. This value is used to evaluate the ultimate load-bearing capacity of the soil. The ratio of the two values is used as an indicator of the soil type in which the test is being run. In compact sands and gravels, values in the range of 6 to 12 are considered typical.

Table 1. Pressuremeter Test Results

Location	Surface Elevation (ft)	Approximate Test Depth (ft)	Test Elevation (ft)	Soil Type	Limit Pressure, P_l (tsf)	Pressuremeter Modulus, E_p (tsf)	E_p/P_l
ST-4	832.4	10	822	SM	25.6	172	6.7
ST-4	832.4	15	817	SC	28.4	194	6.8
ST-106	826.9	6	820	SM	20.7	160	7.7
ST-106	826.9	20	805	ML	13.6	65	4.7

C. Analysis and Recommendations

C.1. Proposed Construction

A senior assisted living building is currently proposed for construction as part of the project. The building will have a basement near elevation 819 1/2 with the first floor at 830. The first floor will be precast planks supported by masonry or poured concrete basement walls. The above grade will be 4-story wood framing.

If the proposed loads exceed these values, if the proposed grades differ by more than 1 foot from the assumed values, or if the design or location of the proposed building changes, we should be informed. Additional analyses and revised recommendations may be necessary.

Table 2. Building Description

Aspect	Description
Below Grade Parking Level (MSL)	819 1/2 (Provided)
First Floor Level - Finished Floor Elevation	830 (Provided)
Maximum Column Loads (kips)	300 (Assumed)
Maximum Wall Loads (kips/lineal foot)	6 - 8 (Assumed)
Assumed Pavement Loads	Light-duty: 50,000 ESALs* Heavy-duty: 100,000 ESALs*

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

C.2. Building Pad Preparation

C.2.a. Excavation

Based on the soil borings, it is our opinion the building can be supported by spread footings with limited soil correction required below footings. For preparation of the building pad, we recommend that the existing topsoil, fill and soft soils be removed from within the footprint of the building and any oversizing area. The soil borings indicate that when the excavation reaches basement grade, topsoil and fill should largely be removed to underlying glacial soils. The exception is Boring ST-7 where some fill may be in place below the basement floor and will require additional soil correction work. Table 3 summarizes the recommended excavation depths at each of the boring locations to remove the unsuitable soils.

Table 3. Anticipated Depth of Excavation

Boring	Surface Elevation	Estimated Depth of Excavation (feet)**	Estimated Excavation Bottom Elevation
ST-4	832.4	1	831 1/2*
ST-5	836.3	1 – 4	835 1/2 – 832 1/2*
ST-6	827.3	1	826 1/2*
ST-7	824.0	9 – 12	815 – 812
ST-8	827.6	7	820 1/2*
ST-10	835.0	1/2	834 1/2*
ST-11	825.8	0	N/A*
ST-12	835.2	3	832*
ST-13	827.0	2	825*
ST-102	827.4	0	N/A*
ST-104	829.2	0	N/A*
ST-105	827.1	0	N/A*
ST-106	826.9	0	N/A*
ST-107	825.3	1/2	825*

*Soil boring indicates a cut to grade, with the anticipated soils at anticipated footing grade judged adequate for building support.
**As previously noted, excavation depths are expected to vary since site work has occurred since borings were taken.

The excavation depths indicated in the above table are at the boring locations at the time they were taken only, and will likely vary away from each location. The actual depth of excavation and the actual lateral extent of the required corrections will need to be determined in the field. A contingency should be provided in the project budget to account for variable excavation depths.

The bottom of the excavations should be observed by a geotechnical engineer to evaluate the completeness of the removal and the suitability of the soils at the base of the excavation. This should be done prior to the placement of engineered fill and footings.

C.2.b. Footing Excavation Oversizing

Where excavations extend below footings we recommend excavation bottoms be extended laterally beyond the edges of the proposed footings at an oversize of 1 foot for each foot of engineered fill placed below footings. This oversizing is necessary for the lateral distribution of the footing loads through the compacted fill zone.

C.2.c. Surface Compaction

After vegetation, topsoil, fill and soft soils are stripped, and the excavations have reached bottom of slab or footing grade, we recommend surface compaction of the excavation bottoms. Once the recommended bottom of the excavation has been reached (or bottom of planned building excavation, whichever is deeper) and the exposed soils have been evaluated, we recommend the excavation bottom be surface compacted with a large-drummed (minimum 4-foot diameter), self-propelled vibratory sheepsfoot compactor to further densify the soils and provide for a more uniform subgrade. We recommend a minimum of five passes be made over any given area of the excavation bottom to densify the granular soils.

C.2.d. Fill and Backfill

Below footings, fill should be placed in 8-inch lifts and be compacted to a minimum of 100 percent of the maximum dry densities based on the standard Proctor test (ASTM D 698). We recommend soil placed as fill and backfill be placed at a moisture content within 3 percentage points of its optimum moisture content. All fill placed below footings should be granular in nature with less than 20 percent passing the number 200 sieve and a plasticity index less than 4.

Above footings, fill should be placed in 1-foot lifts and be compacted to a minimum of 95 percent of the maximum dry densities based on the standard Proctor test (ASTM D 698) for floor slab support. We recommend soil placed as fill and backfill be placed at a moisture content within 3 percentage points of its optimum moisture content. It is our opinion the native granular soils encountered on the site in the soil borings should be suitable for reuse as engineered fill for floor slab support, but moisture conditioning may be required. The on-site soils re-used as engineered fill should be debris-free and not contain organic material. If imported sands are required for floor support, we would recommend it consist of a granular soil that meets the requirements of a MNDOT granular borrow so the imported fill is similar to the on-site soils.

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.3. Spread Footings

C.3.a. Depth

For frost protection, we recommend embedding perimeter footings at least 42 inches below the lowest exterior grade. Interior footings may be placed directly below floor slabs. We recommend embedding building footings not heated during winter construction, and other unheated footings associated with canopies, stoops or sidewalks at least 60 inches below the lowest exterior grade.

C.3.b. Subgrades

At the recommended foundation depths, we anticipate that the footings will bear on either native glacial till soils or compacted granular engineered material.

C.3.c. Bearing Pressure

Based on our settlement and bearing capacity analysis, we recommend the senior assisted living building be supported by typical spread footings. We recommend the bearing pressure for the footings be designed for a bearing pressure of 8,000 psf. It should be noted that all bearing wall footings should be at least 2 feet wide and column pads at least 4 feet x 4 feet to reduce the potential for punching shear failure.

C.3.d. Settlement

With some limited subgrade improvements completed, it is our opinion the subgrade soils will be suitable for support of typical spread footings. Based on the pressuremeter results and assuming the subgrade is modified as recommended, we estimate that total settlement under the provided loadings will be less than 1 inch and the differential settlement will be less than 1/2 inch.

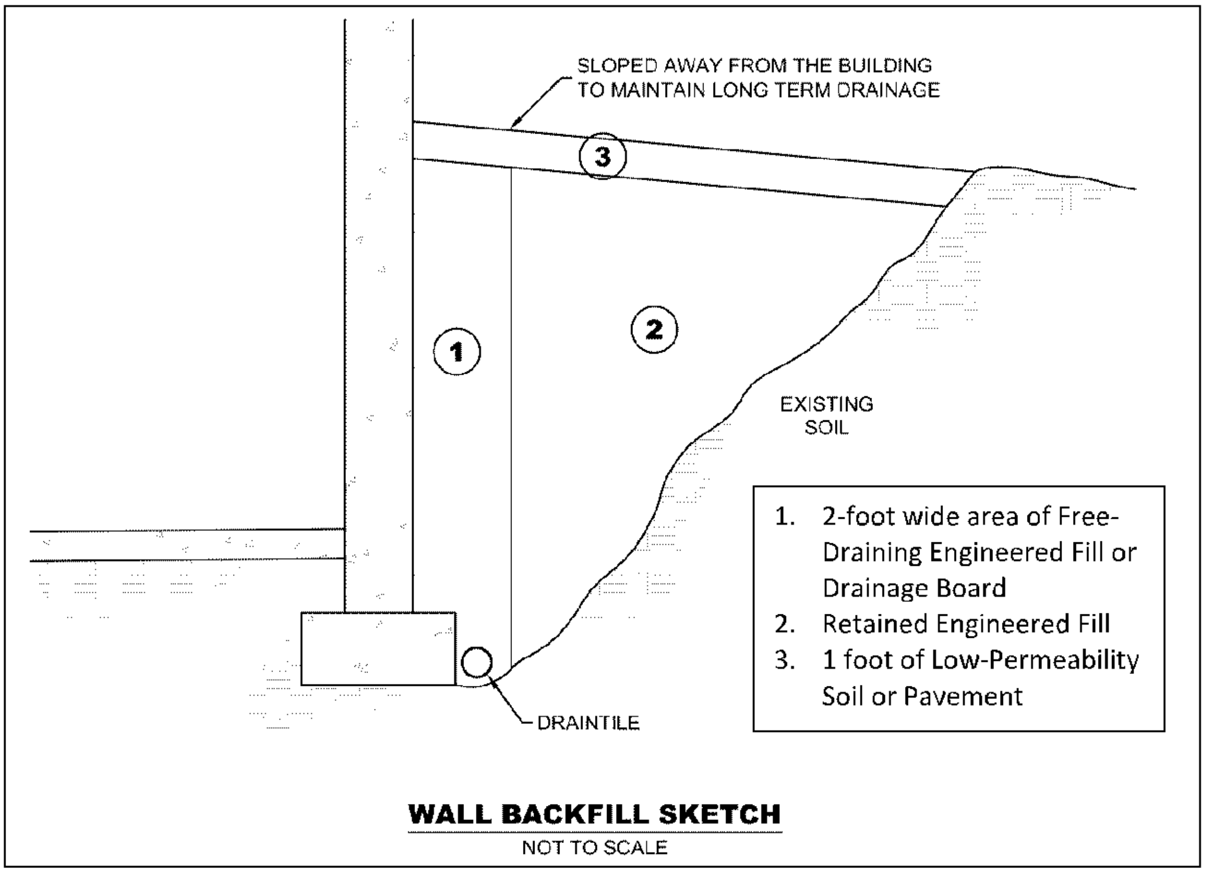
C.4. Below-Grade Walls

C.4.a. Drainage Control

We recommend installing drain tile to remove water behind the below-grade walls, at the location shown in Figure 2. 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 2. Generalized Illustration of Wall Engineered Fill



Free draining fill should have less than 50 percent of the material passing a number 40 sieve and less than 5 percent passing a number 200 sieve. Retained fill in Zone 2 should have less than 20 percent passing a number 200 sieve. 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.

C.4.b. 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 4 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 4. Recommended Below-Grade Wall Design Parameters – Drained Conditions

Retained Soil	Wet Unit Weight (pcf)	Friction Angle (degrees)	Active Equivalent Fluid Pressure (pcf)	At-Rest Equivalent Fluid Pressure (pcf)	Passive Equivalent Fluid Pressure* (pcf)
Retained Fill	120	30	40	60	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 0.5 between the concrete and soil.

The values presented in this section are un-factored.

C.5. Interior Slabs

C.5.a. Subgrade

After the building pad preparation has been completed, we anticipate the floor subgrade will be engineered fill or native granular soils. Backfill in footing and mechanical trenches should be compacted to a minimum of 95 percent of the standard Proctor maximum dry density and be placed within 3 percentage points of its optimum moisture content. We recommend the slabs be designed based on a modulus of subgrade reaction, k, of 150 pounds per square inch per inch of deflection. It may be advantageous to provide a 4- to 6-inch layer of crushed aggregate base over the granular soils to provide for a more stable, less ruttable subgrade for placement of the concrete slab.

C.5.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.6. Exterior Slabs

C.6.a. Subgrades

We recommend vegetation and topsoil, be removed from beneath any proposed exterior slabs. Existing fill can remain in place if the area can pass a proofroll. Additional excavation may be required to facilitate frost protection measures. Fill and backfill should be compacted to a minimum of 95 percent of the standard Proctor density.

C.6.b. Frost Protection

Based on the soil borings, the predominant subgrade soils will likely be silty and clayey sand soils. These soils are considered to be frost-susceptible and not recommended for direct exterior slab support. If these soils become saturated and freeze, 2 to 4 inches of heave may occur.

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.

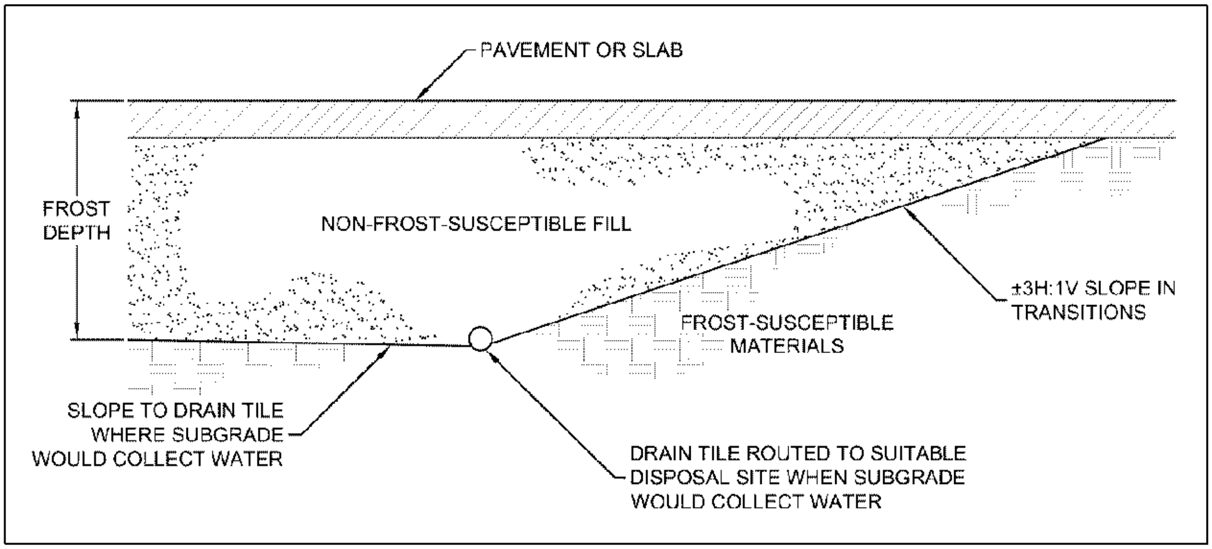
Even small amounts of frost-related differential movement at walkway joints or cracks can create tripping hazards. Project planning can explore several subgrade improvement options to address this condition.

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 5 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 3 shows an illustration summarizing some of the recommendations.

Figure 3. 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.7. Pavement Areas

C.7.a. Subgrade Preparation

After stripping the vegetation and topsoil, we recommend the subgrade soils be surface compacted with a large self-propelled vibratory sheepsfoot compactor. If areas are encountered that are unable to be compacted, the unstable material should be subcut and replaced with engineered fill. Where fill is required, we recommend that it be placed in 12-inch lifts and be compacted to a minimum of 100 percent of its standard Proctor density. For fills more than 3 feet below final subgrades, 95 percent compaction should be sufficient. Fill placed in pavement areas should have 100 percent of the material passing a number 200 sieve and a plasticity index less than 20 percent.

C.7.b. Anticipated Subgrade

After the site has been graded, we anticipate the subgrade soils will be fill, engineered fill or native granular tills.

C.7.c. Proofrolls

Prior to the placement of the aggregate base, we recommend the subgrade soils be proofrolled with a loaded tandem-axle truck with this operation observed by a geotechnical engineer. This will assist in identifying any soft or weak areas that will require additional soil correction work.

C.7.d. Design Sections

Based on the anticipated subgrade, we recommend an R-value of 25 be used in the design of pavements. For light-duty pavement sections (i.e. no trucks), we recommend a minimum of 3 inches of bituminous surface over 7 inches of aggregate base. For heavy-duty pavement sections (i.e. drive lanes), we recommend a minimum of 4 inches of bituminous surface over 12 inches of aggregate base.

C.7.e. Subgrade Drainage

We recommend installing perforated drainpipes throughout pavement areas at low points and about catch basins. The drainpipes should be placed 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.7.f. Performance and Maintenance

We based the above pavement designs on a 20-year performance life for pavements. 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.8. Utility Support

C.8.a. Excavation

Earthwork activities associated with utility installations located inside the building area should adhere to the recommendations in Section C.2. For exterior utilities the soils generally appear suitable for pipe support. If some unstable soils are encountered at pipe invert elevations, they should be subcut and replaced with engineered backfill. Project design and construction should not place utilities within the 1H:1V oversizing of foundations.

C.8.b. Backfill

We recommend that the utility trench backfill be compacted to a minimum of 95 percent of its standard Proctor density, except in the upper 3 feet of pavement areas, where the compaction level should be increased to a minimum of 100 percent of the standard Proctor density. Material selection should follow the recommendations for the structure(s) that will be placed over the backfill (i.e. pavements, building, etc.).

C.9. Stormwater Management

Sheet C4.2 Utility Plan – East notes 3 separate stormwater management systems labelled as 1B to the north of the building, and 2A and 2B to the east of the building. System 1B and 2A are noted as infiltration/detention systems with an invert elevation of stone at 818 (1B) and 816.5 (2A) that is to be excavated down to free-draining native soils for installation. System 2B is noted as an infiltration basin with pipe invert elevations at 819.5.

The soils encountered at the invert depths of the infiltration areas are typically glacial till consisting of silty sand to clayey sand with N-values of 20 to 34. Based on these soils, we estimate an infiltration rate of 0.2 inches per hour for design purposes based on empirical correlations (i.e. no site testing was a part of this scope), which is consistent with the Minnesota Stormwater Manual design recommendations. It should be noted that these soils are not considered "free-draining" so we recommend the current stormwater design be evaluated based on these conditions.

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.10. Site Grading and Drainage

We recommend the site be graded to provide a positive runoff away from the proposed structure. We recommend landscaped areas be sloped a minimum of 6 inches within 10 feet of the building and slabs be sloped a minimum of 2 inches.

C.11. 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. Qualifications

D.1. Variations in Subsurface Conditions

D.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 or since recent excavations have occurred 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.

D.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.

D.2. Continuity of Professional Responsibility

D.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.

D.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.

D.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.

D.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

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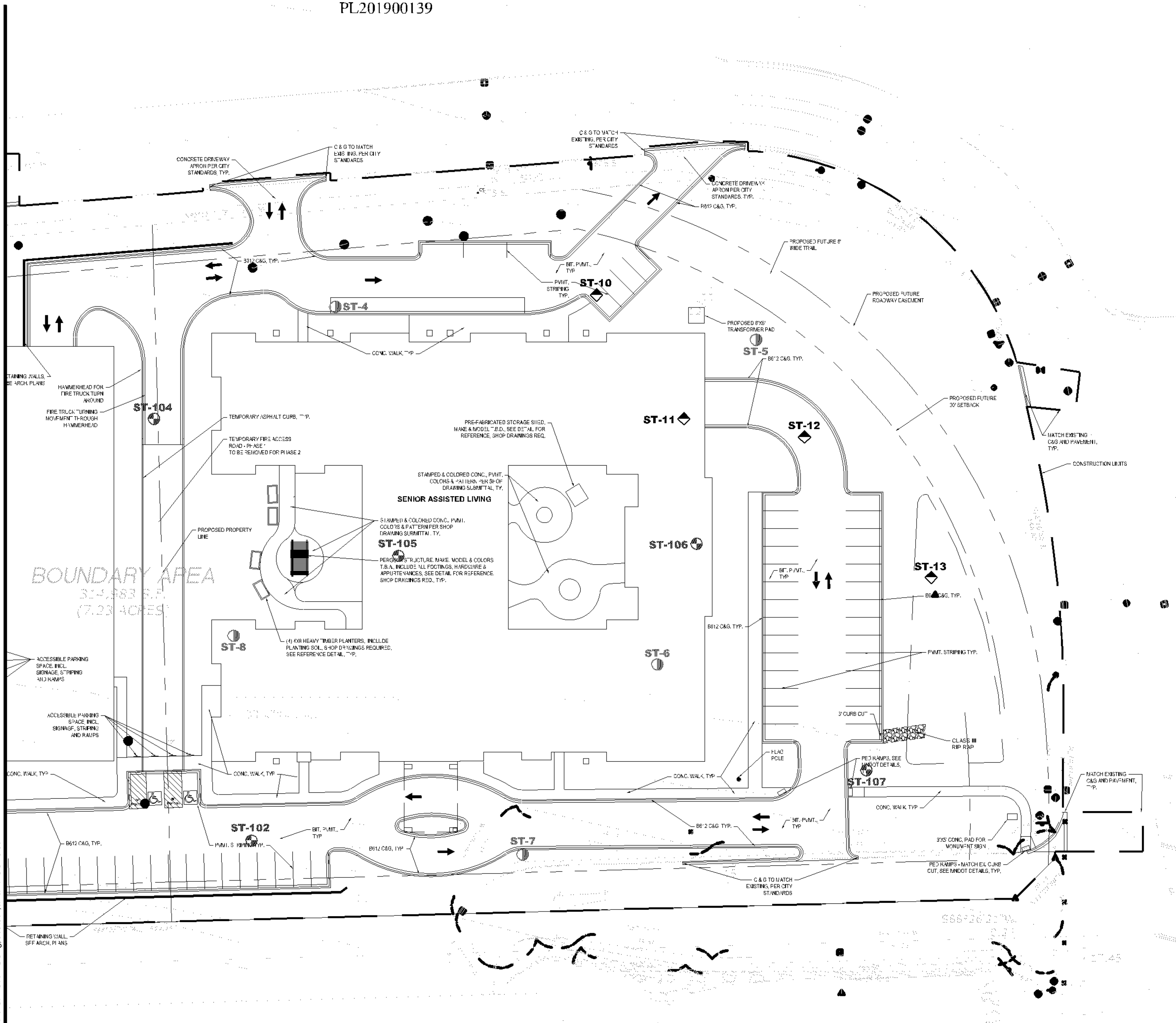

DENOTES APPROXIMATE LOCATION OF PREVIOUS BRAUN SOIL BORING (2015)

DENOTES APPROXIMATE LOCATION OF PREVIOUS BRAUN SOIL BORING (2009)

DENOTES APPROXIMATE LOCATION OF PREVIOUS BRAUN SOIL BORING (2008)

25' 0 50'

SCALE: 1"= 50'

BRAUN INTERTEC

The Science You Build On.

11001 Hampshire Avenue S
Minneapolis, MN 55438
952.995.2000
braunintertec.com

Drawing Information

Project No: B1906473

Drawing No: B1906473

Drawn By: JAG
Date Drawn: 6/19/19
Checked By: NLM
Last Modified: 6/20/19

Project Information

Cherrywood Pointe Bloomington Senior Assisted Living

5601 and 5501 American Boulevard W.

Bloomington, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

Braun Project BL-08-01612
PRELIMINARY GEOTECHNICAL EVALUATION
8100 Tower and Hotel
Normandale Lake Boulevard & American Boulevard
Bloomington, Minnesota

BORING: **ST-4**

LOCATION: See attached sketch.

DRILLER: B. Oldenberg | METHOD: 3 1/4" HSA, Autohammer | DATE: **4/29/08** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 832.4	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
831.6	0.8	FILL	FILL: 4 inches of Bituminous over 5 1/2 inches of Sand with Gravel.			
		SC	CLAYEY SAND, brown, moist, medium to rather stiff. (Glacial Till)	6		
825.4	7.0			10		
823.4	9.0	CL	SANDY LEAN CLAY, with Sand seams and a trace of Gravel, brown, moist, very stiff. (Glacial Till)	21		
820.4	12.0	SM	SILTY SAND, fine- to medium-grained, with a trace of Gravel, reddish brown, moist, dense. (Glacial Till)	34		
		SC	CLAYEY SAND, with a trace of Gravel, reddish brown, moist, very stiff. (Glacial Till)	24		
814.4	18.0			25		
		ML	SILT, with Sand layers, gray, moist, medium dense. (Glaciofluvium)	26		
806.4	26.0			16		
		CL	SANDY LEAN CLAY, with a trace of Gravel, gray, wet, medium to very stiff. (Glacial Till)	8		

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BRAUN℠ INTERTEC

LOG OF BORING

Braun Project BL-08-01612 PRELIMINARY GEOTECHNICAL EVALUATION 8100 Tower and Hotel Normandale Lake Boulevard & American Boulevard Bloomington, Minnesota	BORING: **ST-4 (cont.)** LOCATION: See attached sketch.

DRILLER: B. Oldenberg	METHOD: 3 1/4" HSA, Autohammer	DATE: **4/29/08**	SCALE: **1" = 4'**

Elev. feet 800.4	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
796.4	36.0		SANDY LEAN CLAY, with a trace of Gravel, gray, wet, medium to very stiff. (Glacial Till) *(continued)*	27		
			END OF BORING. Water not observed during drilling. Water not observed to cave-in depth of 25 1/2 feet immediately after withdrawal of the auger. Boring immediately backfilled with Grout.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project BL-08-01612 PRELIMINARY GEOTECHNICAL EVALUATION 8100 Tower and Hotel Normandale Lake Boulevard & American Boulevard Bloomington, Minnesota	BORING: ST-5 LOCATION: See attached sketch.

DRILLER: B. Oldenberg	METHOD: 3 1/4" HSA, Autohammer	DATE: 4/25/08	SCALE: 1" = 4'

Elev. feet 836.3	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
835.7	0.6	FILL	FILL: 2 1/2 inches of Bituminous over 4 1/2 inches of Sand with Gravel.			
832.3	4.0	SC-SM	SILTY CLAYEY SAND, fine- to medium-grained, with a trace of Gravel, grayish brown, moist. (Possible Fill)	12		
829.3	7.0	SM	SILTY SAND, fine- to medium-grained, with Roots, brown, moist, loose. (Glacial Till)	9		
818.3	18.0	SM	SILTY SAND, fine- to medium-grained, with Gravel, reddish brown, moist, medium dense to very dense. (Glacial Till)	27 50/6" 21 23		
814.3	22.0	CL	SANDY LEAN CLAY, with a trace of Gravel, reddish brown, wet, very stiff. (Glacial Till)	26		
		SM	SILTY SAND, fine- to medium-grained, with Gravel, gray to brown, moist, medium dense. (Glacial Till)	29 29		

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project BL-08-01612 **PRELIMINARY GEOTECHNICAL EVALUATION** **8100 Tower and Hotel** **Normandale Lake Boulevard & American Boulevard** **Bloomington, Minnesota**	BORING: **ST-5 (cont.)** LOCATION: See attached sketch.

DRILLER: B. Oldenberg	METHOD: 3 1/4" HSA, Autohammer	DATE: **4/25/08**	SCALE: **1" = 4'**

Elev. feet 804.3	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
			SILTY SAND, fine- to medium-grained, with Gravel, gray to brown, moist, medium dense. (Glacial Till) *(continued)*			
801.3	35.0	ML	SILT with Sand, gray, wet, loose. (Glacial Till)	9		
800.3	36.0		END OF BORING. Water not observed during drilling. Water not observed to cave-in depth of 26 feet immediately after withdrawal of the auger. Boring immediately backfilled with Grout.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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(See Descriptive Terminology sheet for explanation of abbreviations)

Braun Project BL-08-01612 PRELIMINARY GEOTECHNICAL EVALUATION 8100 Tower and Hotel Normandale Lake Boulevard & American Boulevard Bloomington, Minnesota	BORING: ST-6 LOCATION: See attached sketch.
DRILLER: B. Oldenberg / METHOD: 3 1/4" HSA, Autohammer	DATE: 4/29/08 / SCALE: 1" = 4'

Elev. feet 827.3	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
826.4	0.9	FILL	FILL: 4 1/2 inches of Bituminous over 5 1/2 inches of Sand with Gravel.			
823.3	4.0	CL	SANDY LEAN CLAY, with a trace of Gravel, reddish brown, wet, rather stiff. (Glacial Till)	9		
820.3	7.0	SM	SILTY SAND, fine- to medium-grained, with a trace of Gravel, reddish brown, moist, medium dense. (Glacial Till)	17		
804.3	23.0	SC	CLAYEY SAND, with Gravel and Sand seams, reddish brown, moist, stiff to hard. (Glacial Till)	29 17 24 37 16		
796.3	31.0	CL	SANDY LEAN CLAY, with a trace of Gravel, gray, moist, very stiff to hard. (Glacial Till)	28 66		*Water not observed during drilling. Water not observed to cave-in depth of 23 feet immediately after withdrawal of the auger. Boring immediately backfilled with Grout.
			END OF BORING.*			

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Braun Project BL-08-01612 PRELIMINARY GEOTECHNICAL EVALUATION 8100 Tower and Hotel Normandale Lake Boulevard & American Boulevard Bloomington, Minnesota	BORING: ST-7 LOCATION: See attached sketch.

DRILLER: B. Oldenberg	METHOD: 3 1/4" HSA, Autohammer	DATE: 4/25/08	SCALE: 1" = 4'

Elev. feet 824.0	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
823.1	0.9	FILL	FILL: 2 inches of Bituminous over 9 inches of Sand with Gravel.			
815.0	9.0	SM	SILTY SAND, fine- to medium-grained, with Roots, gray and black, moist. (Possible Fill)	8 12 12		
812.0	12.0	CL	SANDY LEAN CLAY, brown, wet. (Possible Fill)	7		
805.0	19.0	SP-SM	POORLY-GRADED SAND with SILT, fine-grained, brown, moist to 16 feet then waterbearing, loose. (Glacial Outwash)	7 7	∇	
798.0	26.0	SM	SILTY SAND, fine- to medium-grained, with a trace of Gravel, reddish brown, moist, loose to medium dense. (Glacial Till)	25 11		
			END OF BORING. Water not observed during drilling. Water observed at 19 feet with a cave-in depth of 19 1/2. Boring immediately backfilled with Grout.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project BL-08-01612
PRELIMINARY GEOTECHNICAL EVALUATION
8100 Tower and Hotel
Normandale Lake Boulevard & American Boulevard
Bloomington, Minnesota

BORING: **ST-8**

LOCATION: See attached sketch.

DRILLER: B. Oldenberg | METHOD: 3 1/4" HSA, Autohammer | DATE: **4/28/08** | SCALE: **1" = 4'**

Elev. feet 827.6	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
826.7	0.9	FILL	FILL: 4 inches of Bituminous over 6 inches of Sand with Gravel.			
823.6	4.0	FILL	FILL: Silty Clay, with Sand, slightly Organic, black, wet, rather stiff.	5		
820.6	7.0	CL	SANDY LEAN CLAY, with a trace of Gravel, reddish Brown, wet, rather soft. (Glacial Till)	5		
815.6	12.0	SM	SILTY SAND, fine- to medium-grained, with a trace of Gravel, reddish brown, moist, medium dense. (Glacial Till)	15 12		
810.6	17.0	ML	SILT, with a trace of Gravel, light gray with rust staining, moist, medium dense. (Glaciofluvium)	19 13		
		SM	SILTY SAND, fine- to medium-grained, with Gravel, reddish brown to 37 feet, then gray, moist, medium dense to dense. (Glacial Till)	37 22 20		

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project BL-08-01612
PRELIMINARY GEOTECHNICAL EVALUATION
8100 Tower and Hotel
Normandale Lake Boulevard & American Boulevard
Bloomington, Minnesota

BORING: **ST-8 (cont.)**

LOCATION: See attached sketch.

DRILLER: B. Oldenberg	METHOD: 3 1/4" HSA, Autohammer	DATE: **4/28/08**	SCALE: **1" = 4'**

Elev. feet 795.6	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
			SILTY SAND, fine- to medium-grained, with Gravel, reddish brown to 37 feet, then gray, moist, medium dense to dense. (Glacial Till) *(continued)*	24	∇	
786.6	41.0			15		
			END OF BORING. Water observed at 36 feet with 39 1/2 feet of hollow-stem auger in the ground. Water observed at 31 1/2 feet with cave-in depth of 34 feet. Boring immediately backfilled with Grout.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project BL-08-01612A **GEOTECHNICAL EVALUATION** **Hampton Inn & Suites** **5501 American Blvd W** **Bloomington, Minnesota**	BORING: **ST-10** LOCATION: See attached sketch.

DRILLER: M. Takada	METHOD: 3 1/4" HSA, Autohammer	DATE: **3/23/09**	SCALE: **1" = 4'**

Elev. feet 835.0	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
834.5	0.5	PAV	4 inches of bituminous over 2 inches of aggregate base.			Benchmark: Elevations were obtained using GPS and the State of Minnesota's permanent base station network.
		SM	SILTY SAND, fine- to medium-grained, with a trace of Gravel, reddish brown, moist, medium dense to dense. (Glacial Till)	13		
				21		
				17		///////////// FFE
				20		
				17		
				24		
				31		
811.0	24.0	CL	SANDY LEAN CLAY, with a trace of Gravel, gray, wet, rather stiff. (Glacial Till)	10		
807.0	28.0	SM	SILTY SAND, fine- to medium-grained, with Gravel and Poorly Graded Sand layers, gray, moist, medium dense. (Glacial Till)	12		

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project BL-08-01612A
GEOTECHNICAL EVALUATION
Hampton Inn & Suites
5501 American Blvd W
Bloomington, Minnesota

BORING: **ST-10 (cont.)**

LOCATION: See attached sketch.

DRILLER: M. Takada | METHOD: 3 1/4" HSA, Autohammer | DATE: **3/23/09** | SCALE: **1" = 4'**

Elev. feet 803.0	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
			SILTY SAND, fine- to medium-grained, with Gravel and Poorly Graded Sand layers, gray, moist, medium dense. (Glacial Till) *(continued)*	15		
799.0	36.0		END OF BORING. Water not observed while drilling. Water not observed to cave-in depth of 23 feet immediately after withdrawal of auger. Boring then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project BL-08-01612A **GEOTECHNICAL EVALUATION** **Hampton Inn & Suites** **5501 American Blvd W** **Bloomington, Minnesota**	BORING: **ST-11** LOCATION: See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohammer	DATE: **4/1/09**	SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 825.8	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
		SM	SILTY SAND, fine- to medium-grained, with a trace of Gravel, reddish brown, moist, medium dense. (Glacial Till)	15		
				23		
818.8	7.0	SC	CLAYEY SAND, with a trace of Gravel, brown, moist, very stiff to hard. (Glacial Till)	20		
				20		
				50/3"		
811.8	14.0	ML	CLAYEY SILT, gray, wet, stiff. (Glacial Till)	14		
808.8	17.0	SP	POORLY GRADED SAND, fine- to coarse-grained, light gray, moist to 29 feet then waterbearing, medium dense to loose. (Glacial Outwash)	19		
				10		
					▽	An open triangle in the water level (WL) column indicates the depth at which groundwater was observed while drilling. Groundwater levels fluctuate.
				8		

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LOG OF BORING

Braun Project BL-08-01612A **GEOTECHNICAL EVALUATION** **Hampton Inn & Suites** **5501 American Blvd W** **Bloomington, Minnesota**	BORING: **ST-11 (cont.)** LOCATION: See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohammer	DATE: **4/1/09**	SCALE: **1" = 4'**

Elev. feet 793.8	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
789.8	36.0		POORLY GRADED SAND, fine- to coarse-grained, light gray, moist to 29 feet then waterbearing, medium dense to loose. (Glacial Outwash) *(continued)*	6		
			END OF BORING. Water observed at 29 feet with 29 feet of hollow-stem auger in the ground. Water observed at a depth of 28 feet immediately after withdrawal of auger. Boring then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project BL-08-01612A
GEOTECHNICAL EVALUATION
Hampton Inn & Suites
5501 American Blvd W
Bloomington, Minnesota

BORING: **ST-12**

LOCATION: See attached sketch.

DRILLER: K. Keck | METHOD: 3 1/4" HSA, Autohammer | DATE: **4/1/09** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 835.2	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
834.2	1.0	FILL	FILL: Organic Clay, black, wet.			
833.2	2.0	FILL	FILL: Silty Sand, fine- to medium-grained, brown, moist.			
832.2	3.0	FILL	FILL: Aggregate base.	29		
826.2	9.0	SM	SILTY SAND, fine- to medium-grained, with a trace of Gravel, reddish brown, moist, medium dense. (Glacial Till)	19 34		////////////// FFE No recovery.
823.2	12.0	CL	SANDY LEAN CLAY, with a trace of Gravel, brown, wet, very stiff. (Glacial Till)	19		
816.2	19.0	SC	CLAYEY SAND, with Gravel and Cobbles, brown, moist, hard. (Glacial Till)	45 53		
806.2	29.0	SM	SILTY SAND, fine- to medium-grained, with Sand layers, brown, moist, medium dense to dense. (Glacial Till)	34 13		
		SP	POORLY GRADED SAND, fine-grained, light gray, moist, medium dense to dense. (Glacial Outwash)	47		

LOG OF BORING N:\GINT\PROJECTS\MINNEAPOLIS\2008\01612A.GPJ BRAUN_V8_CURRENT.GDT 6/1/15 11:50

BRAUN℠ INTERTEC

LOG OF BORING

Braun Project BL-08-01612A **GEOTECHNICAL EVALUATION** **Hampton Inn & Suites** **5501 American Blvd W** **Bloomington, Minnesota**	BORING: **ST-12 (cont.)** LOCATION: See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohammer	DATE: **4/1/09**	SCALE: **1" = 4'**

Elev. feet 803.2	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
799.2	36.0		POORLY GRADED SAND, fine-grained, light gray, moist, medium dense to dense. (Glacial Outwash) *(continued)*	17		
			END OF BORING. Water not observed while drilling. Water not observed to cave-in depth of 29 feet immediately after withdrawal of auger. Boring then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-08-01612A GEOTECHNICAL EVALUATION Hampton Inn & Suites 5501 American Blvd W Bloomington, Minnesota	BORING: ST-13 LOCATION: See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohammer	DATE: 4/1/09	SCALE: 1" = 4'

Elev. feet 827.0	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
825.0	2.0	FILL	FILL: Silty Sand, fine- to coarse-grained, with Gravel, dark brown, wet.			
821.0	6.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with Clayey Sand layers at 3 feet, light brown, moist, loose. (Glacial Outwash)	7 10		
815.0	12.0	SM	SILTY SAND, fine- to medium-grained, with a trace of Gravel, reddish brown, moist, medium dense. (Glacial Till)	22 20		
814.0	13.0	CL	SANDY LEAN CLAY, with a trace of Gravel, brown, wet, very stiff. (Glacial Till)	24		
809.0	18.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with a trace of Gravel, light brown, moist, medium dense. (Glacial Outwash)	24		
798.0	29.0	CL	SANDY LEAN CLAY, with a trace of Gravel, gray, wet, stiff to very stiff. (Glacial Till)	16 19	▽	
795.0	32.0	ML	CLAYEY SILT, gray, wet, medium. (Glacial Till)	8		

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project BL-08-01612A
GEOTECHNICAL EVALUATION
Hampton Inn & Suites
5501 American Blvd W
Bloomington, Minnesota

BORING: **ST-13 (cont.)**

LOCATION: See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohammer	DATE: 4/1/09	SCALE: 1" = 4'

Elev. feet 795.0	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
791.0	36.0	SP	POORLY GRADED SAND, fine- to coarse-grained, gray, waterbearing, loose. (Glacial Outwash)	7		
			END OF BORING. Water observed at 29 feet while drilling. Water observed at a depth of 29 feet immediately after withdrawal of auger. Boring then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN℠ INTERTEC

LOG OF BORING

Braun Project B1503964 **GEOTECHNICAL EVALUATION** **8100 Tower** **8100 American Boulevard** **Bloomington, Minnesota**	BORING: **ST-102** LOCATION: See attached sketch.

DRILLER: S. McLean	METHOD: 3 1/4" HSA, Autohammer	DATE: **5/15/15**	SCALE: **1" = 4'**

Elev. feet 827.4	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
825.4	2.0	SC-SM	SILTY CLAYEY SAND, fine- to medium-grained, trace Gravel, brown, moist. (Glacial Till)			
808.4	19.0	SM	SILTY SAND, fine- to medium-grained, with Gravel, brown, moist, medium dense. (Glacial Till)	24 22 20 16 23 15		
798.4	29.0	SC-SM	SILTY CLAYEY SAND, fine- to medium-grained, with layers of Clayey Sand, brown, moist to wet, medium dense. (Glacial Till)	13 14		
		SC	CLAYEY SAND, fine- to medium-grained, brown, wet, stiff. (Glacial Till)	13		

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project B1503964 GEOTECHNICAL EVALUATION 8100 Tower 8100 American Boulevard Bloomington, Minnesota	BORING: **ST-102 (cont.)** LOCATION: See attached sketch.

DRILLER: S. McLean	METHOD: 3 1/4" HSA, Autohammer	DATE: **5/15/15**	SCALE: **1" = 4'**

Elev. feet 795.4	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
			CLAYEY SAND, fine- to medium-grained, brown, wet, stiff. (Glacial Till) *(continued)*	13		
791.4	36.0		END OF BORING. Water not observed with 35 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project B1503964
GEOTECHNICAL EVALUATION
8100 Tower
8100 American Boulevard
Bloomington, Minnesota

BORING: **ST-104**
LOCATION: See attached sketch.

DRILLER: S. McLean | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/14/15** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 829.2	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	P200 %	Tests or Notes
		SM	SILTY SAND, fine- to medium-grained, trace Gravel, brown to reddish brown, moist, medium dense to dense. (Glacial Till)					
				18				
				19				
				24		8	35	
				34				
				21				
815.2	14.0	SM	SILTY SAND, fine- to medium-grained, with layers of Clayey Sand, brown, moist, medium dense. (Glacial Till)					
				22				
810.2	19.0	ML	SANDY SILT, brown, moist, medium dense. (Glacial Till)					
				18		19	90	
805.2	24.0	SC-SM	SILTY CLAYEY SAND, fine- to medium-grained, trace Gravel, grayish brown, moist to wet, medium dense. (Glacial Till)					
				17				
800.2	29.0	SM	SILTY SAND, fine- to medium-grained, trace Gravel, grayish brown, wet, medium dense. (Glacial Till)					
				17				

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1503964
GEOTECHNICAL EVALUATION
8100 Tower
8100 American Boulevard
Bloomington, Minnesota

BORING: **ST-104 (cont.)**

LOCATION: See attached sketch.

DRILLER: S. McLean	METHOD: 3 1/4" HSA, Autohammer	DATE: **5/14/15**	SCALE: **1" = 4'**

Elev. feet 797.2	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	P200 %	Tests or Notes
795.2	34.0		SILTY SAND, fine- to medium-grained, trace Gravel, grayish brown, wet, medium dense. (Glacial Till) *(continued)*					
793.2	36.0	SM	SILTY SAND, fine- to medium-grained, with layers of Sandy Silt, brown, wet, medium dense. (Glacial Till)	20				
			END OF BORING. Water not observed with 35 feet of hollow-stem auger in the ground. Boring then grouted.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project B1503964 GEOTECHNICAL EVALUATION 8100 Tower 8100 American Boulevard Bloomington, Minnesota	BORING: ST-105 LOCATION: See attached sketch.

DRILLER: M. Takada	METHOD: 3 1/4" HSA, Autohammer	DATE: 5/19/15	SCALE: 1" = 4'

Elev. feet 827.1	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
		SM	SILTY SAND, fine- to medium-grained, trace Gravel, brown, moist to 19 feet then wet, medium dense to dense. (Glacial Till)			
				12		
				18		
				23		
				13		
				20		
				15		
				30		
					▽	An open triangle in the water level (WL) column indicates the depth at which groundwater was observed while drilling. Groundwater levels fluctuate.
				29		
				12		

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project B1503964 GEOTECHNICAL EVALUATION 8100 Tower 8100 American Boulevard Bloomington, Minnesota	BORING: **ST-105 (cont.)** LOCATION: See attached sketch.

DRILLER: M. Takada	METHOD: 3 1/4" HSA, Autohammer	DATE: **5/19/15**	SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 795.1	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
			SILTY SAND, fine- to medium-grained, trace Gravel, brown, moist to 19 feet then wet, medium dense to dense. (Glacial Till) *(continued)*			
792.1	35.0	SM	SILTY SAND, fine- to medium-grained, with Sand and Silt layers, gray, wet, loose. (Glacial Till)	9		
787.1	40.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, trace Gravel, brown, waterbearing, loose to medium dense. (Glacial Outwash)	9		
				10		
				13		
				14		
				19		

BRAUN INTERTEC

LOG OF BORING

Braun Project B1503964 GEOTECHNICAL EVALUATION 8100 Tower 8100 American Boulevard Bloomington, Minnesota	BORING: ST-105 (cont.) LOCATION: See attached sketch.

DRILLER: M. Takada	METHOD: 3 1/4" HSA, Autohammer	DATE: 5/19/15	SCALE: 1" = 4'

Elev. feet 763.1	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
			POORLY GRADED SAND with SILT, fine- to medium-grained, trace Gravel, brown, waterbearing, loose to medium dense. (Glacial Outwash) *(continued)*			
				25		
				30		
				20		

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1503964
GEOTECHNICAL EVALUATION
8100 Tower
8100 American Boulevard
Bloomington, Minnesota

BORING: **ST-105 (cont.)**

LOCATION: See attached sketch.

DRILLER: M. Takada | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/19/15** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 731.1	Depth feet 96.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
729.1	98.0					
726.1	101.0	SC	CLAYEY SAND, trace Gravel, gray, wet, rather stiff. (Glacial Till)	11		
			END OF BORING. Water observed at 22 feet with 100 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 18 feet immediately after withdrawal of auger. Boring then grouted.			

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1503964
GEOTECHNICAL EVALUATION
8100 Tower
8100 American Boulevard
Bloomington, Minnesota

BORING: **ST-106**

LOCATION: See attached sketch.

DRILLER: S. McLean | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/15/15** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 826.9	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	Tests or Notes
		SM	SILTY SAND, fine- to medium-grained, with Gravel and Sand layers, reddish brown, moist, medium dense. (Glacial Till)	17			
				13		16	
				15			
				23			
814.9	12.0	CL	LEAN CLAY, with Sand lenses, gray, wet, rather stiff. (Glaciofluvium)	12		19	LL=26; PL=17; PI=9
812.9	14.0	SC	CLAYEY SAND, with Gravel, gray, wet, stiff. (Glacial Till)	14			
807.9	19.0	ML	CLAYEY SILT, with Sand seams, gray, wet, rather stiff. (Glaciofluvium)	9			
803.9	23.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, wet. (Glacial Outwash)				
802.9	24.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, trace Gravel, gray, wet, medium dense. (Glacial Outwash)	13			
798.9	28.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, with layers of Clayey Sand, brown, waterbearing, very loose to loose. (Glacial Outwash)	6			

BRAUN INTERTEC

LOG OF BORING

Braun Project B1503964
GEOTECHNICAL EVALUATION
8100 Tower
8100 American Boulevard
Bloomington, Minnesota

BORING: **ST-106 (cont.)**

LOCATION: See attached sketch.

DRILLER: S. McLean	METHOD: 3 1/4" HSA, Autohammer	DATE: **5/15/15**	SCALE: **1" = 4'**

Elev. feet 794.9	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	Tests or Notes
			POORLY GRADED SAND with SILT, fine- to medium-grained, with layers of Clayey Sand, brown, waterbearing, very loose to loose. (Glacial Outwash) *(continued)*				
				4			
					∇		An open triangle in the water level (WL) column indicates the depth at which groundwater was observed in the auger at its termination depth. Groundwater levels fluctuate.
				7			
780.9	46.0			9			
			END OF BORING. Water observed at 39 feet with 45 feet of hollow-stem auger in the ground. Boring then grouted.				

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN[SM]
INTERTEC

LOG OF BORING

Braun Project B1503964 **GEOTECHNICAL EVALUATION** **8100 Tower** **8100 American Boulevard** **Bloomington, Minnesota**	BORING: **ST-107** LOCATION: See attached sketch.

DRILLER: M. Takada | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/19/15** | SCALE: **1" = 4'**

Elev. feet 825.3	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
825.0	0.3	SM	SILTY SAND, fine-grained, dark brown, moist. (Topsoil)			
		SM	SILTY SAND, fine-grained, brown, moist, loose to medium dense. (Glacial Till)	8		
				15		
				19		
815.3	10.0	ML	SANDY SILT, brown, moist, medium dense. (Glaciofluvium)	21		
813.3	12.0	SM	SILTY SAND, fine- to medium-grained, trace Gravel, brown, moist to 24 feet then wet, medium dense to very dense. (Glacial Till)	20		
				18		
				50		
				11	▽	
				14		

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1503964 GEOTECHNICAL EVALUATION 8100 Tower 8100 American Boulevard Bloomington, Minnesota	BORING: ST-107 (cont.) LOCATION: See attached sketch.

DRILLER: M. Takada	METHOD: 3 1/4" HSA, Autohammer	DATE: 5/19/15	SCALE: 1" = 4'

Elev. feet 793.3	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
791.3	34.0					
		SC-SM	SILTY CLAYEY SAND, fine- to medium-grained, trace Gravel, grayish brown, wet, medium dense. (Glacial Till)	16		
786.3	39.0					
		SM	SILTY SAND, fine- to medium-grained, trace Gravel, grayish brown, wet, medium dense. (Glacial Till)	24		
				21		
776.3	49.0					
		CL	LEAN CLAY, trace Gravel, gray, wet, very stiff. (Glaciofluvium)	17		
				18		
766.3	59.0					
		SM	SILTY SAND, fine- to medium-grained, trace Gravel, gray, wet, medium dense. (Glacial Till)	21		

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1503964 GEOTECHNICAL EVALUATION 8100 Tower 8100 American Boulevard Bloomington, Minnesota	BORING: **ST-107 (cont.)** LOCATION: See attached sketch.

DRILLER: M. Takada	METHOD: 3 1/4" HSA, Autohammer	DATE: **5/19/15**	SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 761.3	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
757.3	68.0		SILTY SAND, fine- to medium-grained, trace Gravel, gray, wet, medium dense. (Glacial Till) *(continued)*			
746.3	79.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, trace Gravel, gray, waterbearing, medium dense. (Glacial Outwash)	16		
736.3	89.0	SM	SILTY SAND, fine-grained, trace Gravel, gray, waterbearing, medium dense. (Glacial Till)	21		
		CL	LEAN CLAY, gray, wet, hard. (Glacial Till)	49		

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INTERTEC

LOG OF BORING

Braun Project B1503964 GEOTECHNICAL EVALUATION 8100 Tower 8100 American Boulevard Bloomington, Minnesota	BORING: **ST-107 (cont.)** LOCATION: See attached sketch.

DRILLER: M. Takada	METHOD: 3 1/4" HSA, Autohammer	DATE: 5/19/15	SCALE: 1" = 4'

Elev. feet 729.3	Depth feet 96.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
727.3	98.0		LEAN CLAY, gray, wet, hard. (Glacial Till) *(continued)*			
724.3	101.0	SC	CLAYEY SAND, trace Gravel, gray, wet, stiff. (Glacial Till)	13		
			END OF BORING. Water observed at 25 feet with 25 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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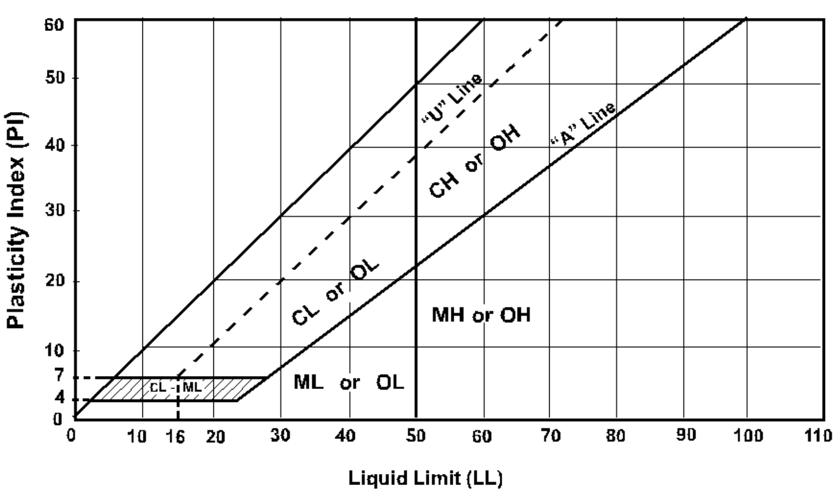
BRAUN INTERTEC

ptive Terminology of Soil

Standard D 2487 - 00
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soils Classification: Group Symbol	Soils Classification: 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 5% or less fines [e]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [c]	GW	Well-graded gravel [d]
			$C_u < 4$ and/or $1 > C_c > 3$ [c]	GP	Poorly graded gravel [d]
		Gravels with Fines More than 12% fines [e]	Fines classify as ML or MH	GM	Silty gravel [d f g]
			Fines classify as CL or CH	GC	Clayey gravel [d f g]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines [i]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [c]	SW	Well-graded sand [h]
			$C_u < 6$ and/or $1 > C_c > 3$ [c]	SP	Poorly graded sand [h]
		Sands with Fines More than 12% [i]	Fines classify as ML or MH	SM	Silty sand [f g h]
			Fines classify as CL or CH	SC	Clayey sand [f g h]
Fine-grained Soils 50% or more passed 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	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay [k l m n]
				OL	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	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay [k l m p]
				OH	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-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60} / D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. 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
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. If soil contains ≥ 15% gravel, add "with gravel" to group name.
i. 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
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	**OC**	Organic content, %
WD	Wet density, pcf	**S**	Percent of saturation, %
MC	Natural moisture content, %	**SG**	Specific gravity
LL	Liquid limit, %	**C**	Cohesion, psf
PL	Plastic limit, %	∅	Angle of internal friction
PI	Plasticity index, %	**qu**	Unconfined compressive strength, psf
P200	% passing 200 sieve	**qp**	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders .... over 12"
Cobbles .... 3" to 12"
Gravel
  Coarse .... 3/4" to 3"
  Fine .... No. 4 to 3/4"
Sand
  Coarse .... No. 4 to No. 10
  Medium .... No. 10 to No. 40
  Fine .... No. 40 to No. 200
Silt .... < No. 200, PI < 4 or below "A" line
Clay .... < No. 200, PI ≥ 4 and on or above "A" line

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

Very soft .... 0 to 1 BPF
Soft .... 2 to 3 BPF
Rather soft .... 4 to 5 BPF
Medium .... 6 to 8 BPF
Rather stiff .... 9 to 12 BPF
Stiff .... 13 to 16 BPF
Very stiff .... 17 to 30 BPF
Hard .... over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise, Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

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

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

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.