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April 30, 2025

Mr. Joe Zellmer
Outagamie County Highway Department
1313 Holland Road
Appleton, Wisconsin

SUBJECT: Geotechnical Exploration and Evaluation
Outagamie County Highway Department - Hortonia
CTH-JJ / STH-15
Hortonia, Wisconsin
PSI Project No. 00942598

Dear Mr. Zellmer,

The geotechnical exploration and evaluation for the referenced project has been completed. An electronic copy of the report is being provided via email. Paper copies can be issued upon request. After you have had the opportunity of reading the report, please call at any time with any questions or comments you may have. Professional Service Industries, Inc. (PSI) appreciates the opportunity to be of service on this project, and looks forward to continuing as your geotechnical consultant during the design and construction phases, as well as your upcoming projects.

Sincerely,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Andrew Olson
Staff Geologist

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GEOTECHNICAL EXPLORATION AND EVALUATION

Outagamie County Highway Department - Hortonia

Hortonia, Wisconsin

Prepared For:

Outagamie County Highway Department

1313 Holland Road

Appleton, Wisconsin 54911

PSI Project No. 00942598

April 30, 2025

TABLE OF CONTENTS

Appendix (in order of appearance)
Figure 1 – Boring Location Plan
Soil Boring Logs
Laboratory Data Sheets
Storm Forms
General Notes

1 INTRODUCTION

1.1 GENERAL

This report presents the results of the geotechnical exploration and evaluation for the proposed Outagamie County Highway Department project in Hortonia, Wisconsin. The work was performed for the Outagamie County Highway Department, at the request of Mr. Joe Zellmer.

1.2 PURPOSE

The purpose of this study was to evaluate the subsurface conditions at specific boring locations on the site, and to establish parameters for use by the design engineers and architects in preparing the foundation, floor slab, pavement, and stormwater management area designs for the proposed project.

1.3 SCOPE

The scope of services included a site reconnaissance, the subsurface exploration, a determination of soil characteristics by field and laboratory testing, and an evaluation of the data obtained. The scope of the field work, including the number, depth, and locations of the borings was determined by the client's consultant, McMahon Associates, Inc. A settlement evaluation, and any necessary related field and laboratory testing, was not requested or performed. Any settlement tolerances were not provided to PSI.

1.4 AUTHORIZATION

The description of services and authorization to perform this subsurface exploration and evaluation were in the form of a signed acceptance copy of PSI Proposal No. 0094-447233-R-2, dated March 31, 2025. The general conditions for the performance of the work were referenced in the proposal. This report has been prepared on behalf of, and exclusively for the use of the Outagamie County Highway Department. The information contained in this report may not be relied upon by any other parties without the express written consent of PSI, and acceptance by such parties of PSI's General Conditions.

2 SITE AND PROJECT DESCRIPTION

2.1 SITE FEATURES

The project site is located just southeast of the intersection of CTH-JJ and STH-15 in Hortonia, Wisconsin. The project area is a wedge-shaped parcel that is bound by STH-15 to the north; Fox Valley and Lake Superior Railway to the east; Givens Road to the south; and CTH-JJ to the west. At the time of the exploration, the site and area of the proposed buildings were vacant and covered with field grass and shrubs. An unpaved parking and equipment storage area (associated with the Outagamie County Highway Department) was present just to the southeast of the project site. The surrounding parcels consisted of vacant agricultural fields

and residential properties. A review of historical aerial photography available from Google Earth of various years between 1992 and 2024 indicates that at the time of the photo taken in 1992, the majority of the project site was a vacant farm field. As an exception, the western portion of the site was occupied by a farmstead with associated home, at least five (5) outbuildings, silos, and unpaved drive lanes. At the time of the 2013 photo, the structures in the western portion of the site were no longer present. In the 2021 photo, some stripping and grading had occurred in the northern portion of the site associated with the construction of STH-15. In the 2023 photo, stripping and grading (possibly including cutting and filling) was occurring over much of the western portion of the site as part of continuing road construction. At the time of the photo taken in 2024, construction of STH-15 was completed, and the unpaved parking and equipment storage area located just to the southeast of the project site was present. The subject site is depicted on the enclosed Boring Location Plan (Figure 1).

The topography of the subject site is gently rolling, with an elevation difference of approximately 17 feet between the boring locations. The site generally slopes down towards the east. The surface elevations of the boring locations ranged between about EL. 810.0 and EL. 793.0. At the time of the exploration, the surface of the site was relatively soft; therefore, an ATV mounted drill rig was utilized to access the boring locations.

2.2 PROJECT DESCRIPTION

Based on the information provided by the client's consultant, it is understood that the proposed project will consist of the construction of five (5) separate structures for the Outagamie County Highway Department. Additional details for each structure are provided below.

Main Building (B-1 through B-4)

The Main Building will consist of an approximately 33,600 square foot, single-story, high bay structure, without a basement or any below grade levels. The structure is planned to be supported by a conventional spread foundation. Structural loading details were not provided at the time of report preparation. For the purpose of this report, it is estimated that maximum column and wall loads will not exceed 100 kips and 10 kips per lineal foot, respectively. When structural loads are determined, PSI must be informed in order to determine if revisions to this report are necessary.

The finished floor elevation was not known at the time of the report preparation. Based on the existing grade at the boring locations, a finished floor elevation of EL. 806.0, was estimated for use in the evaluation. The existing elevation at borings B-1 through B-4 ranged between about EL. 809.0 and EL. 802.0. Therefore, on the basis of the estimated first floor elevation, cuts of up to about 3 feet and fills of up to about 4 feet are estimated to be necessary. However, this will also be dependent on the subgrade preparation criteria, to be discussed in a later section.

Fuel Station / Tanks (B-5)

The Fuel Station will consist of an approximately 900 square foot, single-story, open-air canopy structure. No below grade levels or underground storage tanks are planned. It is understood

that two (2) above ground Fuel Tanks are planned just to the east of the proposed Fuel Station. The size and capacity of the tanks was not known. The Fuel Station is planned to be supported by conventional frost depth footings. The tanks are planned to be supported by an approximately 600 square foot mat foundation bearing at a depth of about 2 feet, and will be enclosed by concrete walls supported by frost depth footings. The mat is estimated to be approximately 2 feet thick. Structural loading details were not provided at the time of report preparation. For the purpose of this report, it is estimated that maximum column loads will not exceed 100 kips. When structural loads are determined, PSI must be informed in order to determine if revisions to this report are necessary.

The finished grade in the area of the proposed Fuel Station and Fuel Tanks was not known at the time of the report preparation. Based on the elevation at boring B-5, it is estimated that the finished grade of the project site in this area will be about EL. 810.0. Therefore, conventional spread footings and the tank mat are estimated to bear at about EL. 806.0 and EL. 808.0, respectively. Nominal surface cuts and fills may be necessary. However, this will also be dependent on the subgrade preparation criteria, to be discussed in a later section.

Storage Area Building (B-6)

The Storage Area Building will consist of an approximately 5,000 square foot, single-story, high bay structure, without a basement or any below grade levels. The structure is planned to be supported by a conventional spread foundation. Structural loading details were not provided at the time of report preparation. For the purpose of this report, it is estimated that maximum column and wall loads will not exceed 100 kips and 10 kips per lineal foot, respectively. When structural loads are determined, PSI must be informed in order to determine if revisions to this report are necessary.

The finished grade and floor elevation were not known at the time of the report preparation. Based on the existing grade at boring B-6, a finished floor elevation of EL. 804.0, was estimated for use in the evaluation. Nominal surface cuts and fills may be necessary. However, this will also be dependent on the subgrade preparation criteria, to be discussed in a later section.

Brine Shed (B-7)

The Brine Shed will consist of an approximately 2,400 square foot, single-story, high bay structure, without a basement or any below grade levels. The structure is planned to be supported by a mat foundation bearing at a depth of about 2 feet. The mat is estimated to be approximately 2 feet thick. Structural loading details were not provided at the time of report preparation. When structural loads are determined, PSI must be informed in order to determine if revisions to this report are necessary.

The finished grade and top of mat elevation were not known at the time of the report preparation. Based on the elevation at boring B-7, it is estimated that the finished grade of the project site in this area will be about EL. 802.0. Therefore, the mat is estimated to bear at about

EL. 800.0. Nominal surface cuts and fills may be necessary. However, this will also be dependent on the subgrade preparation criteria, to be discussed in a later section.

County Salt Shed (B-8)

The County Salt Shed will consist of an approximately 6,375 square foot, single-story, high bay structure, without a basement or any below grade levels. The overall height and amount of salt that will be stored was not provided. The structure is planned to be supported by a mat foundation bearing at a depth of about 2 feet. The mat is estimated to be approximately 2 feet thick. Structural loading details were not provided at the time of report preparation. When structural loads are determined, PSI must be informed in order to determine if revisions to this report are necessary.

The finished grade and top of mat elevation were not known at the time of the report preparation. Based on the elevation at boring B-8, it is estimated that the finished grade of the project site in this area will be about EL. 798.0. Therefore, the mat is estimated to bear at about EL. 796.0. Nominal surface cuts and fills may be necessary. However, this will also be dependent on the subgrade preparation criteria, to be discussed in a later section.

Paved asphalt parking and drive lanes are generally planned for the development. It is estimated the pavements will be subjected to relatively light passenger vehicle and occasional truck traffic. A daily average loading of 5-18 kip ESALs/day was estimated for standard duty pavements, and a daily average loading 15-18 kip ESALS/day was estimated for heavy duty pavements subjected to heavier truck traffic and loads. When final traffic loading details are known, they must be provided to PSI to determine if a re-evaluation of the pavement recommendations provided herein is necessary.

It is understood that a stormwater management area will be located in the eastern portion of the site. The size, type, bottom elevation and other design details were not provided at the time of report preparation.

When additional information regarding the project becomes available, and/or if any of the information discussed herein differs from current plans or changes as design progresses, PSI must be informed so that any necessary revisions to this report can be made.

3 EXPLORATION AND LABORATORY PROCEDURES

3.1 SCOPE SUMMARY

The field and laboratory data utilized in the evaluation and analysis of the subsurface materials was obtained by drilling exploratory test borings, securing soil samples by the split-spoon sampling method, and subjecting the samples to laboratory testing.

With respect to the stormwater management area, the field and laboratory work for classification of the subgrade soils was performed to provide information for use by the basin

design personnel when considering requirements of Chapter NR151 of the Wisconsin Administrative Code, and of WDNR Technical Standard 1002, “Site Evaluation for Stormwater Infiltration” guidelines. The design of the proposed stormwater management area was beyond the scope of services for this project.

3.2 FIELD EXPLORATION

A total of twelve (12) soil test borings were planned to be performed to depths ranging from about 15 to 20 feet below the existing ground surface. However, auger refusal on possible cobbles, boulders, or bedrock was encountered at borings B-1 through B-12 at depths ranging from about 7 to 14 feet (EL. 800.0 to EL. 782.0) below existing grade. Coring of the refusal materials was not requested or performed. Borings B-1 through B-8 were performed to depths ranging from about 7.5 to 14 feet within the area of the proposed building and tanks; B-9 and B-10 were performed to a depth of about 8 and 7 feet within the area of proposed pavement, respectively; and B-11 and B-12 were performed to a depth of about 12 feet and 10 feet, respectively, within the proposed stormwater management area. The number, depths, and locations of the borings were determined by the client’s consultant. The borings were located in the field by PSI utilizing a handheld GPS device. They are estimated to be accurate to within several feet. The surface elevations shown on the logs were estimated by interpolation of a 1-foot contour map of the property, provided by the client’s consultant. The elevations are estimated to be accurate to within about 1 foot.

The soil test borings were performed with an ATV mounted rotary drilling rig utilizing continuous flight hollow stem augers to advance the holes. Representative samples were obtained by the Standard Penetration Test (SPT) method using split-spoon sampling procedures in general accordance with ASTM D-1586 procedures. Samples were collected at 2.5-foot intervals to 10 feet, and then at 5-foot intervals thereafter to the end of the borings. As an exception, samples were obtained at 2-foot intervals at the borings performed within the proposed stormwater management areas. The standard penetration value (N) is defined as the number of blows of a 140-pound hammer, falling thirty (30) inches, required to advance the split-spoon sampler one (1) foot into the soil. The sampler is lowered to the bottom of the drill hole and the number of blows recorded for each of the three (3) successive increments of six (6) inches of penetration. The “N” value is obtained by adding the second and third incremental numbers. The SPT provides a means of estimating the relative density of granular soils and comparative consistency of cohesive soils, thereby providing a method of evaluating the relative strength and compressibility characteristics of the subsoils.

The SPT soil samples were transferred into clean glass jars immediately after retrieval and returned to the laboratory upon completion of the field operations. Samples will be discarded unless other instructions are received. All soil samples were visually classified in general accordance with the Unified Soil Classification System (ASTM D-2488-75). The samples collected within the stormwater management areas were visually classified by a certified soil tester in general accordance with USDA National Resources Conservation Service textural soil classification procedures. A description of the subsurface conditions encountered at each boring location is shown on the enclosed Soil Boring Logs. After completion of the borings the auger holes were backfilled to the ground surface with bentonite chips.

A copy of the Soil Boring Logs and Boring Location Plan (Figure 1) are enclosed in the Appendix. The soil stratification shown on the logs represents the approximate soil conditions in the actual boring locations at the time of the exploration. The terms and symbols used on the logs are described in the General Notes found in the Appendix.

3.3 LABORATORY PHYSICAL TESTING

Soil samples obtained from the exploration were visually classified in the laboratory, and subjected to testing, which included moisture content determinations, and grain size analysis by mechanical method. Selected cohesive soil samples were tested in unconfined compression with an uncontrolled strain loading rate and/or with a calibrated hand penetrometer to aid in evaluating the soil strength characteristics. The values of strength tests performed on soil samples obtained by the Standard Penetration Test Method (SPT) are considered approximate, recognizing that the SPT method provides a representative but somewhat disturbed soil sample.

The laboratory testing was performed in general accordance with the respective ASTM methods, as applicable, and the results are shown on the boring logs and Laboratory Data Sheets in the Appendix.

4 DESCRIPTION OF SUBSURFACE CONDITIONS

4.1 GENERAL

A description of the subsurface conditions encountered at the test boring locations is shown on the Soil Boring Logs. The lines of demarcation shown on the logs represent approximate boundaries between the various soil classifications. It must be recognized that the soil descriptions are considered representative for the specific test boring location, but that variations may occur between and beyond the sampling intervals and boring locations. Soil depths, topsoil and layer thicknesses, and demarcation lines utilized for preconstruction planning should not be expected to yield exact and final quantities. A summary of the major soil profile components is described in the following paragraphs.

4.2 SUBSURFACE CONDITIONS

The surface of the site at borings B-1 through B-10 consisted of about 4 to 23 inches of topsoil, generally comprised of dark brown to reddish brown fine sand with silt, and trace clay and root matter; and brown to very dark brown clay with silt, and variable amounts of sand, gravel and root matter. The underlying natural soils generally consisted predominantly of brown fine to medium sand with varying gravel and silt content. As exceptions, reddish brown clay was encountered below the topsoil to a depth of about 5 feet (EL. 805.0 and EL. 801.5) at B-5 and B-9.

The natural cohesive soils encountered in the borings were generally very stiff to hard in

comparative consistency, with Standard Penetration Resistances (N-values) ranging from about 28 to 68 blows per foot (bpf). The natural granular soils encountered in the borings were generally dense to very dense in relative density, with N-values ranging from about 17 bpf to 50 blows per 1-inch of initial sampling.

The natural soils in stormwater borings B-11 and B-12 generally consisted of black to very dark gray and dark reddish brown fine to very fine sandy loam; dark reddish brown silty clay loam; dark reddish brown sandy clay loam; and reddish brown clay loam to the maximum depths explored by the borings.

Auger refusal on possible cobbles, boulders, or bedrock was encountered at borings B-1 through B-12 at depths ranging from about 7 to 14 feet (EL. 800.0 to EL. 782.0) below existing grade. Refusal depths are outlined in Table 1:

Table 1. Approximate Boring Refusal Depths

Boring No.	Approximate Refusal Depth (Feet)	Approximate Refusal Elevation (Feet)
B-1	14	795.0
B-2	8	796.0
B-3	7	794.5
B-4	9	798.0
B-5	10	800.0
B-6	8	796.0
B-7	8	794.0
B-8	12	786.0
B-9	8	798.5
B-10	7	791.0
B-11	12	782.0
B-12	10	783.0

Mechanical grain-size analyses were performed on two (2) bulk soil samples obtained from B-6 and B-8 at depths of about 0 to 2 feet and about 5 to 7 feet below existing grade, respectively. The test results indicate the samples to be classified as SM by the USCS method and as A-2-4 and A-4 by the AASHTO method. The mechanical grain-size testing results can be found in the laboratory data sheets provided in the Appendix.

The foregoing discussion of soil conditions on this site represents a generalized soil profile as determined at the test boring locations. A more detailed description and supporting data for each test location can be found on the individual Soil Boring Logs.

4.3 GROUNDWATER OBSERVATIONS

Groundwater observations were made during the drilling operations and in the open boreholes upon completion. Groundwater was encountered during auger advancement in borings B-8, B-

11, and B-12 at depths ranging from about 1.5 to 5 feet (EL. 793.0 to EL. 790.0) below the ground surface. No groundwater was encountered upon completion and removal of the augers in the borings.

The groundwater observations reported herein are considered approximate. It must be recognized that groundwater levels fluctuate with time due to variations in seasonal precipitation, lateral drainage conditions, and soil permeability characteristics. Longer term monitoring would be required to further evaluate groundwater levels on this site.

5 CONSIDERATIONS AND RECOMMENDATIONS

5.1 GENERAL DEVELOPMENTAL CONSIDERATIONS

In view of the subsurface conditions encountered in the test borings, together with the structural loading criteria and development grades anticipated, conventional spread and mat foundations can be used for support of the proposed structures and tanks. Undercutting of soft, loose, wet, or otherwise unsuitable natural soils may be necessary, at least on an isolated basis.

Some difficulty with groundwater and/or softening of subgrade soils may occur, especially where excavations encroach upon or extend below the groundwater level or perched zones (such as were encountered in the area of the proposed County Salt Shed). An adequate dewatering effort, possibly in conjunction with the overexcavation of unstable zones, and the use of a crushed stone working mat (or “mud mat”), may be required. In addition, excavation instability may occur, especially during any undercutting or for utility installation.

Auger refusal on possible cobbles, boulders, or bedrock was encountered at borings B-1 through B-12 at depths ranging from about 7 to 14 feet (EL. 800.0 to EL. 782.0) below existing grade. In addition, extremely dense granular and very stiff to hard cohesive soils were encountered. Substantial difficulty digging and longer excavation times, and refusal or near refusal conditions may be experienced. It is recommended that test pits be performed as part of design and construction planning to further evaluate the type, depth, and excavatability of the refusal materials.

The existing natural soils can generally be utilized for support of the floor slabs and pavements after proper subgrade preparation. However, some overexcavation of unsuitable soils may be necessary. A discussion of the building foundation and pavement design parameters, as well as the support conditions for the floor slab and pavement are included in later sections.

5.2 SITE PREPARATION

The presence of organic topsoil and vegetation within the subgrade can adversely affect the serviceability of structural fills, foundations, floor slabs, pavements, and other structures placed upon them. The surface at the borings was covered with about 4 to 23 inches of topsoil. However, some variation should be expected, especially within former agricultural fields, where tilling and other related operations can result in thicker pockets of topsoil, or topsoil having

become intermixed within underlying soils. All topsoil, vegetation, trees, roots, organic matter, and other unsuitable materials encountered on the surface at the time of construction, must be removed from the areas of floor slabs, footings, pavements, and other structural areas.

Site preparation will require removal of any remnants of former buildings, including foundations and underground utilities, must be removed. Extensive areas of loose backfill material may be encountered within utility trenches, adjacent to the existing structures, and in former building and basement areas. These will also require removal. The areas, including basements, must then be properly backfilled with compacted structural fill. Prior to the backfilling, the areas must be observed by a PSI representative to evaluate the suitability of the subgrade for subsequent support of the new building, utilities, or other structures.

The majority of the property was a farm field at some time in the past. If any remnant drain tiles are encountered during construction, it is generally recommended that they be tied into new drainage structures or otherwise be properly drained to a suitable area (in accordance with any applicable regulatory requirements or restrictions), since they may still actively drain areas of the subject site or adjacent properties.

After stripping the topsoil and cutting high areas of the site to the planned finished grade, and prior to the placement of new fill which may be placed to raise grades, the exposed subgrade must be thoroughly proofrolled to detect unstable, yielding soils. This should consist of overlapping passes in a perpendicular grid pattern, with a fully-loaded tandem-axle dump truck, or other equipment of similar size and weight suitable for the surface conditions. Proofrolling should be performed in consultation with the geotechnical engineer at the time of construction. Some difficulty with subgrade preparation may be experienced, especially in wet or cold weather, or during thawing conditions. Additionally, instability can become more severe in silty and clayey materials, which are considered to be moderately to highly moisture sensitive. It is generally recommended that earthwork be carried out during relatively warm, dry weather. Any soft, wet, or otherwise unstable zones which cannot be improved by scarification and aeration, must be removed and replaced with compacted structural fill, such as clean crushed stone, possibly in conjunction with the use of a geotextile fabric. Long delays and substantial difficulty with subgrade stabilization may be experienced if the soils are wet or are otherwise at high moisture contents during construction.

Every effort must be made to keep excavations dry. If construction proceeds during wet weather, some additional overexcavation may be necessary. If weather permits, the soil could be dried and recompacted. A crushed stone working mat, possibly in conjunction with a geotextile fabric may also be feasible to help stabilize subgrades. Site grading runoff should be directed to catch basins, or other appropriate areas of the site, so that the potential for the softening of the foundation and pavement subgrade soils is reduced.

If site grades are raised in excess of 2 feet, the first lift of new fill must be placed so as to extend a minimum lateral distance of 5 feet beyond the planned top building pad dimension (for fills less than 5 feet in thickness), or for a distance equal to at least 1 foot laterally beyond the top pad dimension for every foot of fill thickness (for fills greater than 5 feet in depth). Subsequent

lifts can then be placed on an approximate 1H:1V slope back up to the planned top perimeter dimension of the pad. Similarly, where undercutting of unsuitable soils is performed beneath foundations, floor slabs, or other structural areas, it is recommended that the removal extend laterally beyond the perimeter of the structure at least 1 foot for every foot of removal below the planned bearing depth. Proper moisture control is essential to reduce the amount of compactive effort necessary to achieve the desired densities.

When a firm and stable subgrade is established, low areas may be raised to planned grades with properly compacted structural fill. Any new fill should be a clean granular soil, such as those materials meeting the gradations outlined in Section 209 or 305 of the State of Wisconsin Standard Specification for Highway and Structure Construction. If fine-grained soils, such as those with high silt or clay content are used, they should generally be placed over large open areas, where conditions are more favorable for the proper placement and compaction of such materials. It must be recognized that high silt or clay content materials are extremely difficult to compact when placed at moisture contents beyond a few percent of the optimum moisture content. In addition, the near surface soils in at least some areas are considered to be highly moisture sensitive; therefore, some difficulty with subgrade preparation should be expected, especially if they become wet during construction. Fill must be placed in layers of not more than nine (9) inches in thickness, at moisture contents at or near optimum, and be compacted to a minimum density of 95 percent of the maximum dry density as determined by ASTM designation D-698 (Standard Proctor). At least portions of the on-site soils can be used as new fill to raise grades, generally over large, open areas. However, some sorting or moisture conditioning will likely be required. Silt, clay, and wet granular soils are not suitable for reuse as fill in trenches, or adjacent to foundation stem walls or retaining walls. Some importing of suitable granular backfill soils is likely to be necessary.

Proper moisture control is essential to reduce the amount of compactive effort necessary to achieve the desired densities. This is especially true of clayey soils, where scarification and aeration may be required to achieve near - optimum moisture levels prior to compaction. A sheepsfoot roller is generally required for compaction of clayey soils, whereas a vibratory smooth drum roller is preferred for granular material. Small hand-operated compactors should be used in confined areas; granular fills are generally more readily compacted to the required densities in such applications.

It is recommended that well-graded granular soils be utilized as backfill in new utility trenches and along side below grade walls to reduce the potential for consolidation and settlement of the fill. All fill soils must be placed and compacted under engineering controlled conditions, to provide suitable support for overlaying structures and roadways. Additional guidance can be provided at the time of construction in the selection process for grade-raising fill and trench backfill.

The selection of fill materials for various applications should be done in consultation with the soils engineer. Similarly, the evaluation of the subgrade and placement and compaction of fill for structural applications should be monitored and tested by a qualified representative of the soils engineer.

5.3 FOUNDATION EVALUATION

Main Building (B-1 through B-4)

The proposed structure may be supported by a conventional spread foundation system. Based upon the estimated finished floor elevation (EL. 806.0), interior and exterior footings will bear at about EL. 804.5 and EL. 802.0, respectively. Generally extremely dense sand soils were encountered at these approximate elevations at the boring locations. Conventional spread footings bearing upon suitable natural soils, or upon compacted structural fill (or lean concrete mix), may be designed for a net allowable soil pressure of 4,000 psf. Undercutting of soft, loose, wet, or otherwise unsuitable natural soils may be necessary, at least on an isolated basis.

Fuel Station / Tanks (B-5)

The proposed Fuel Station and associated above ground Fuel Tanks may be supported by conventional spread and mat foundations, respectively. Based upon the estimated finished grade elevation (EL. 810.0), conventional frost depth footings will bear at about EL. 806.0. The mat for the tanks is estimated to bear at about EL. 808.0. Generally very stiff clay soils were encountered at these approximate elevations at B-5. Frost depth footings and a mat foundation bearing upon suitable natural soils, or upon compacted structural fill (or lean concrete mix), may be designed for a net allowable soil pressure of 3,000 psf. Undercutting of soft loose, wet, or otherwise unsuitable natural soils may be necessary, at least on an isolated basis.

Storage Area Building (B-6)

The proposed structure may be supported by a conventional spread foundation system. Based upon the estimated finished floor elevation (EL. 804.0), interior and exterior footings will bear at about EL. 802.5 and EL. 800.0, respectively. Generally extremely dense sand soils were encountered at these approximate elevations at B-6. Conventional spread footings bearing upon suitable natural soils, or upon compacted structural fill (or lean concrete mix), may be designed for a net allowable soil pressure of 4,000 psf. Undercutting of soft, loose, wet, or otherwise unsuitable natural soils may be necessary, at least on an isolated basis.

Brine Shed (B-7)

The proposed structure may be supported by a mat foundation bearing at a depth of about 2 feet. Based upon the estimated finished grade elevation (EL. 802.0), the mat is estimated to bear at about EL. 800.0. Generally extremely dense sand soils were encountered at this approximate elevation at B-7. A mat foundation bearing upon suitable natural soils, or upon compacted structural fill (or lean concrete mix), may be designed for a net allowable soil pressure of 3,000 psf. Undercutting of soft, loose, wet, or otherwise unsuitable natural soils may be necessary, at least on an isolated basis.

County Salt Shed (B-8)

The proposed structure may be supported by a mat foundation bearing at a depth of about 2 feet. Based upon the estimated finished grade elevation (EL. 798.0), the mat is estimated to bear at about EL. 796.0. Generally very dense sand soils were encountered at this approximate elevation at B-7. A mat foundation bearing upon suitable natural soils, or upon compacted structural fill (or lean concrete mix), may be designed for a net allowable soil pressure of 3,000 psf. Undercutting of soft, loose, wet, or otherwise unsuitable natural soils may be necessary, at least on an isolated basis.

Wet soils, and groundwater or perched zones may be encountered within foundation excavations (at least in the area of B-8), and a substantial loss in strength, along with an extremely soft, loose, unstable or otherwise unsuitable subgrade may develop when the confining effect of the overburden is removed. This may require undercutting and the use of a crushed stone working mat or a “mud mat” to establish a stable bearing grade. Substantial sloughing and caving may also occur. Dewatering may be required.

The suitability of the existing soils for support of the proposed foundation must be determined by testing by a qualified geotechnical engineer during construction, utilizing static cone penetrometer tests or dynamic cone penetrometer tests for cohesive and granular soils, respectively. Soft, loose, wet, or otherwise unsuitable materials not disclosed by the borings, may be encountered in the foundation excavations at the bearing elevation. If unsuitable existing soil is present, it must be removed throughout a zone extending one foot laterally for each foot removed below the foundation, on either side of the planned footing. The over-excavated area must be backfilled with structural compacted fill. As an alternate, the excavation could extend 4 inches beyond the plan footing width to suitable bearing soil and then backfilled with lean (500 to 1000 psi) concrete mix to planned footing grade to reduce lateral over-excavation.

All foundations must be placed at a depth of 4 feet (or deeper if in accordance with local requirements or customary practice) below the finish grade for frost protection. Due to periodic severity of winters in this area, it is recommended that footings in poorly heated or unheated areas of the building also be placed at least 4 feet below the adjacent exterior grade. Interior footings not subject to frost action may be placed at a shallow depth of 18 inches below the floor slab, provided they bear on suitable natural soils or engineered fills. All foundations must be protected from the effects of frost if construction is carried out during winter months.

Where foundations (such as mats) are placed above the typical frost depth, they must be provided with sufficient insulation, extending downward along the sides and then outward from the outside edge portion, to prevent frost heave. If foundations are not adequately insulated, some movement may occur. This may have detrimental effects on the structure. Selection of the insulation material type and thickness must be completed by the structural engineer in accordance with appropriate published design manuals (such as the Design Guide for Frost-Protected Shallow Foundations prepared for the Department of Housing and Urban

Development); and in accordance with applicable building codes, and local and state requirements.

With regard to the Fuel Station canopy, it should be noted that although use of the net allowable soil pressure may be sufficient to resist a bearing capacity failure, other factors will influence the final design of the proposed structure, including lateral and eccentric loads, uplift, and overturning moments. The foundations must be of adequate size and be placed at a sufficient depth to resist such loads, forces and moments. The significance and impact of these factors as they pertain to the structural behavior of the proposed foundation system must be carefully considered and evaluated. Additionally, the bearing pressure outlined above must not be exceeded (including eccentric, cyclic, or other loads). Proper placement and compaction of backfill soils above and alongside the foundation must be performed.

It is recommended that the footings supporting individual columns have a minimum dimension of 24 inches, and continuous footings have a minimum width of 18 inches, even if the maximum recommended allowable bearing pressure is not fully utilized. In order to minimize the effects of any slight differential movement that may occur due to variations in the character of the supporting soils and any variations in seasonal moisture contents, it is recommended that all foundations be suitably reinforced to make them as rigid as needed.

In general, the performance of the foundation system on this site is dependent on the various factors discussed herein. The excavation, preparation, and concreting of foundations should be monitored and tested by a representative of the soils engineer.

5.4 FLOOR SLAB AND PAVEMENT SUBGRADES

Prior to constructing the floor slabs or pavements, and prior to the placement of any fill used to raise grades, the exposed subgrade must be prepared utilizing the proofrolling procedures described previously. In areas that exhibit soft, yielding or unstable soil conditions, the following remedial measures are recommended to provide a stable subgrade. It must be recognized that the high silt and clay content soils are highly sensitive to increases in moisture and construction disturbance. It will therefore be necessary to maintain these materials in a relatively dry condition to allow for proper subgrade preparation. It is recommended that the proofrolling operations be monitored by a representative of the geotechnical engineer so that a firm, suitable subgrade is present prior to placement of new fills, or to construction of floor slabs and pavements.

Localized wet, soft or unstable areas should be undercut to such depths determined necessary in the field to reach stable material. The overexcavations should then be backfilled with imported crushed stone, such as a 1¼-inch dense graded base specified in Section 305 of the WisDOT Standard Specifications, placed and compacted as recommended in the Site Preparation section of this report. If relatively thick zones or areas of extensive yielding (such as in fill zones or encroaching upon wetland areas) are observed that cannot be stabilized by normal discing, aeration and recompaction procedures, undercutting and replacement with crushed stone and geotextile fabric (if needed) may also be required in these areas.

The floor slab(s) may be designed utilizing an estimated modulus of subgrade reaction of 200 pci based on the presence of a suitable and stable sand/gravel subgrade, prepared as discussed in this report. However, this is based on common range values obtained from 1 ft. x 1 ft. plate load tests on specific soil types. Depending on how the slab load is applied, the value may need to be modified for larger areas using the following:

Modulus of Subgrade Reaction $k_s = (\frac{k}{B})$ for cohesive soil

$k_s = k\,(\frac{B+1}{2B})^2$ for cohesionless soil

where: k_s = coefficient of vertical subgrade reaction for loaded area
k = coefficient of vertical subgrade reaction for a 1x1 foot square area
B = width of area loaded, in feet

The final design and detailing should be performed by a qualified structural engineer based on the intended slab use, loading conditions and anticipated subgrade conditions.

A granular mat, which can be designed as a drainage layer, should be provided below the floor slab. This must be a minimum of six (6) inches in thickness and properly compacted. In moisture sensitive areas, a vapor barrier may be placed beneath the floor slab or base course; however, it is recommended that the architect be consulted in this regard. The proper use of a vapor barrier may not completely prevent moisture beneath or on top of slabs. If the base course contains sharp particles, a cushion layer of sand approximately 2 inches in thickness may be required to provide protection from puncture.

The floor slabs must be suitably reinforced to make them as rigid as necessary and proper joints provided at the junction of slabs and the foundation system so that a small amount of independent movement can occur without causing damage. Large floor areas must be provided with joints at frequent intervals (maximum spacing of 30 times the slab thickness, per ACI) to compensate for concrete volume changes (shrinkage). Where the slab will be supporting live loads, such as from moving vehicles, joints must be keyed or dowelled to permit proper load transfer. It is recommended that appropriate construction methods and curing procedures be used to minimize shrinkage and curling of the floor slabs.

5.5 EXTERIOR/UNHEATED AREA SLABS

Based on the borings, entry slabs, sidewalks, aprons, and other slabs in exterior or unheated areas will bear upon predominantly sandy soils. Such materials are not considered to be highly frost susceptible. However, it must be noted that slabs placed directly upon more frost susceptible soils, such as those with high silt or clay content, are subject to heaving and subsequent settlement due to freeze/thaw cycles. This can result in cracking, misalignment, and other related effects (especially at joints). If more fine grained soils are encountered in areas beyond the borings, or are used to raise grades, it is recommended that consideration be given to limited undercutting of frost susceptible materials, where encountered, to a depth of 1 to 2 feet below the slab, and replacement with well graded, properly placed and compacted granular soils. A properly designed underdrain system connected to the municipal sewer (if

permissible) or directed to on-site stormwater management areas should also be incorporated to reduce the potential effects of freeze/thaw cycles.

5.6 UTILITY CONSTRUCTION

In general, the on-site soils can be used for support of utility lines. However, some undercutting of soft, loose, or otherwise unsuitable soils, in conjunction with the placement of crushed stone or other suitable granular backfill may be necessary to establish a stable working mat and/or bearing subgrade. Some difficulty with the stability of utility trenches may be experienced due to the presence of granular soils across the site. The use of shoring, bracing, or trench boxes will be required. Additionally, excavations encroaching upon or extending below the groundwater or perched zones within granular or soft clay soils can become substantially unstable when the confining effect of the overburden is removed. An adequate dewatering effort and bracing of sidewalls may be required. Utility construction should be performed in accordance with “The Standard Specifications for Sewer and Water Line Construction” for the State of Wisconsin.

It is recommended that well graded granular soils such as those specified in Tables 37 and 39 of the Standard Specification for Sewer and Water Construction be utilized as backfill in utility trenches to reduce the potential for consolidation and settlement of the backfill. All fill soils must be properly placed and compacted under engineering controlled conditions to provide suitable support for overlaying structures and roadways. Silty and clayey soils, organic soils, and wet granular materials are not recommended for use as backfill within utility trenches due to the substantial difficulty of obtaining proper compaction in confined areas. Some importing of suitable fill will likely be required.

As with all excavation work, all open cut trenches must be properly shored and braced as required by applicable federal and state OSHA codes, and as necessary to protect life and property.

6 CONSTRUCTION CONSIDERATIONS

6.1 GROUNDWATER CONTROL

Groundwater was encountered during auger advancement in borings B-8, B-11, and B-12 at depths ranging from about 1.5 to 5 feet (EL. 793.0 to EL. 790.0) below the ground surface. No groundwater was encountered upon completion and removal of the augers in the borings. On the basis of the observations, some difficulty with groundwater or perched zones may be experienced during excavation work in some areas on this site. For low volume perched zones, a filtered sump pump may suffice for control. However, for excavations encroaching upon or extending below the groundwater, for larger volume perched zones, prolonged dewatering with a series of sump pumps may be necessary to facilitate construction.

Since the foundation materials are subject to softening when exposed to free moisture, every effort should be made to keep excavations dry. Discharge water from roof drains should be

directed away from the building, and the site grading direct runoff to catch basins or other appropriate areas of the site, so that the potential for the softening of the foundation and pavement subgrade soils is reduced.

The groundwater observations reported herein are considered approximate. It must be recognized that groundwater levels fluctuate with time due to variations in seasonal precipitation, lateral drainage conditions, and soil permeability characteristics.

6.2 EXCAVATIONS AND SITE DRAINAGE

Sloping, shoring or bracing of the excavation sidewalls will be necessary to facilitate construction and to protect life and property. Substantial sloughing and caving, and subgrade instability may occur within unprotected excavations. The degree of excavation instability problems is dependent upon the depth and length of time that excavations remain open, excavation bank slopes, water levels and the effectiveness of any dewatering systems. All excavation work must be performed in accordance with OSHA and local building code requirements.

Where excavations encroach upon or extend below the groundwater or perched zones and into granular, organic, or soft clay soils, a substantially unstable subgrade may develop when the confining effect of the overburden is removed. Significant sloughing or caving of sidewalls may also occur. Some overexcavation of softened or loosened soils, in conjunction with the use of a crushed stone working mat, may be necessary to establish a stable bearing subgrade. Additionally, significantly widened excavations may result, or be required to maintain or achieve sidewall stability.

All excavations must be performed with caution and utilize methods which will prevent undermining or destabilization of buildings, utilities, pavements, sidewalks or other structures. The use of a properly designed shoring and bracing, sheet piling, or underpinning system must be utilized as necessary to adequately protect buildings, utilities, pavements, and other structures. This must be performed by an experienced specialty contractor. Additionally, extreme care must be used during the installation of any bracing system, especially those using driven or vibratory methods, in order to avoid damaging existing buildings, utilities, and other structures. Consideration should be given to the performance of video and/or photographic documentation of the condition of nearby buildings, utilities, and other structures prior to installation.

Auger refusal on possible cobbles, boulders, or bedrock was encountered at borings B-1 through B-12 at depths ranging from about 7 to 14 feet (EL. 800.0 to EL. 782.0) below existing grade. In addition, extremely dense granular and very stiff to hard cohesive soils were encountered with increasing depth. Substantial difficulty digging and longer excavations times for conventional excavating, and substantial difficulty with the installation of bracing systems may be experienced. Refusal or near refusal conditions may also occur. Additional subsurface exploration with backhoe test pits is recommended as part of design and construction planning to further evaluate the type and excavatability of the materials. Special removal techniques,

such as ripping and/or blasting, may be required to established the planned elevations for the proposed structure or to establish the invert elevations for utilities.

Since the subgrade soils are generally sensitive to moisture, every effort should be made to provide adequate drainage across the site during construction, and to prevent ponding of runoff on the subgrade. These soils are also subject to erosion caused by runoff, and erosion control measures should be implemented where needed or required by local ordinances.

It is mandated that excavations, whether they be for utility trenches, basement excavations or footing excavations, be constructed in accordance with current Occupational Safety and Health Administration (OSHA) guidelines to protect workers and others during construction. PSI recommends that these regulations be strictly enforced; otherwise, workers could be in danger and the owner(s) and the contractor(s) could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

PSI is providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

6.3 SEISMIC DESIGN CONSIDERATIONS

The soils encountered in the borings are considered to meet the criteria for Site Class D in accordance with 1613.2.5.2 of the International Building Code-2018 (which directs to the simplified design procedure outlined in ASCE 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures).

7 STORMWATER MANAGEMENT CONSIDERATIONS

As requested by the client, borings B-11 and B-12 were performed in the proposed stormwater management area. Additional design details for the stormwater management area were not provided to PSI for inclusion in this report

The soils encountered in B-11 and B-12 have been visually classified in general accordance with the USDA textural soil classification system. The natural soils in stormwater borings B-11 and B-12 generally consisted of black to very dark gray and dark reddish brown fine to very fine sandy loam; dark reddish brown silty clay loam; dark reddish brown sandy clay loam; and reddish brown clay loam to the maximum depths explored by the borings. No groundwater was encountered during auger advancement or upon completion and removal of the augers. Auger

refusal on possible cobbles, boulders, or bedrock was encountered at B-11 and B-12 at a depth of about 12 and 10 feet (EL. 782.0 and EL. 783.0) below existing grade, respectively.

With regard to the above soil and groundwater conditions encountered at the borings, NR 151.124(4)(c)1 and 2 – *Infiltration rate exemptions* indicates that infiltration practices located in an area where the infiltration rate of the soil measured at the proposed bottom of the infiltration system is less than 0.6 inches per hour using a scientifically credible field test method; or where the least permeable soil horizon to 5 feet below the proposed bottom of the infiltration system using the USDA method of soils analysis consists of sandy clay loam, clay loam, sandy clay, silty clay or clay may be credited toward meeting the requirements, but the decision to infiltrate under these conditions is optional. In addition, NR 151.124(4)(b)1 – *Separation distances* indicates that infiltration practices shall be located so that the characteristics of the soil and the separation distance between the bottom of the infiltration system and the elevation of seasonal high groundwater or the top of bedrock are in accordance with the following Table (reproduced from NR 151.124):

Table 3. Separation Distances and Soil Characteristics

Source Area	Separation Distance	Soil Characteristics
Industrial, Commercial, Institutional Parking Lots and Roads	5 feet or more	Filtering Layer*
Residential Arterial Roads	5 feet or more	Filtering Layer*
Roofs Draining to Surface Infiltration Practices	1 foot or more	Native or Engineered Soil with Particles Finer than Coarse Sand
Roofs Draining to Surface Infiltration Practices	Not Applicable	
All Other Impervious Source Areas	3 feet or more	Filtering Layer*

*Defined in NR 151.002(14r) as a "soil that has at least a 3-foot deep layer with at least 20 percent fines; or at least a 5-foot deep layer with at least 10 percent fines; or an engineered soil with an equivalent level of protection as determined by the regulatory authority for the site."

The information presented above is provided as general guidance for considering stormwater management in conjunction with the encountered subsurface conditions. However, Chapter NR151 of the Wisconsin Administrative Code; the Site Evaluation for Stormwater Infiltration (1002) document; the Wisconsin Department of Natural Resources Conservation Practice Standard for Wet Detention Ponds (1001), including additional specifications in Appendix D; or other applicable references must be consulted for appropriate site-specific stormwater design guidance and requirements.

Stormwater management basins are not recommended to be placed in close proximity to basements or other below grade structures. Proper and careful consideration of soils and subsurface conditions must be given during site and design planning, and extreme care must be exercised during construction. Lateral migration of water may result in substantially

increased sump pump activity and can quickly overcome the ability of such pumps to maintain a desirable water level, resulting in significant flooding. The potential for such conditions to occur can greatly increase when basement floors are below the elevation of basin bottoms and/or when basins are placed in close proximity to structures (strongly not recommended). In addition, the presence of granular or other generally permeable soils, which is typically necessary in the areas of structures, especially within utility backfill, alongside basement walls, or within other development excavations, can act as extensive migration channels to rapidly carry large volumes of water from basins and into nearby basements. Building codes or municipal regulations may require that basement floor elevations be a specified distance above the water level of nearby basins. It is therefore recommended that the design engineer (or other appropriate representative) review applicable municipal requirements, and verify the design normal and design high water elevations of stormwater basins with respect to planned basement slab elevations.

8 PAVEMENT DESIGN RECOMMENDATIONS

Paved asphalt parking and drive lanes are generally planned for the development. It is estimated the pavements will be subjected to relatively light passenger vehicle and occasional truck traffic. A daily average loading of 5-18 kip ESALs/day was estimated for standard duty pavements, and a daily average loading 15-18 kip ESALS/day was estimated for heavy duty pavements subjected to heavier truck traffic and loads. When final traffic loading details are known, they must be provided to PSI to determine if a re-evaluation of the pavement recommendations provided herein is necessary.

The near surface subgrade soils encountered in the borings consisted predominantly of sand and clay. Based on grain size analysis and visual observation, the predominantly sand soils have been assigned an estimated visual classification of A-2-4 by the AASHTO soil classification system. They are generally rated as fair to good for pavement subgrade support based on their fair drainage, low to moderate shrink-swell potential, low to moderate frost susceptibility, and their relatively low potential to soften when exposed to moisture. They have a frost index of F-3, a design group index of 10, a soil support value (SSV) of 4.5, and a subgrade modulus of 200 pci. In order to use these values, all new fill used to raise low areas must have pavement support characteristics that are equal to or better than the existing soils.

During construction, the surficial subgrade soils can become wet, softened and disturbed from rainfall and construction equipment. Therefore, prior to placing the pavement base materials, the subgrade must be recompacted and proofrolled. Particular attention should be given to high traffic areas that have become rutted and areas of backfilled trenches. Localized wet, soft, or unstable areas can be undercut to such depths determined necessary in the field to reach stable materials, and the area backfilled with crushed stone, such as 1 ¼ or 1 ½ inch traffic bond (Section 305 of the State of Wisconsin Standard Specification for Highway and Structure Construction). If relatively large or thick zones of extensive yielding are observed, and normal discing and recompaction procedures cannot stabilize them, undercutting and replacement with crushed stone and geotextile fabric and/or grid (if needed) may also be required in these areas.

Preparation of the pavement subgrade must be performed as outlined in the *Site Preparation* section of this report.

The following recommendations for the proposed pavements are based upon the pavement subgrade being properly prepared as indicated in the Site Preparation section. The following design factors were used in developing the recommended pavement sections.

DESIGN FACTOR	ASPHALT
Design Life	20 years
Reliability	0.85
Overall Deviation	0.45
Drainage Coefficient	1
Modulus of Subgrade Reaction	200 pci
CBR/Resilient Modulus	7/3,600
Initial Serviceability	4.2
Terminal Serviceability	2.0

If the actual values differ from those above, PSI must be contacted to provide revised pavement recommendations. Based upon the estimation that sand soils will comprise the subgrade for the proposed pavements, and provided the subgrade soils are properly prepared as outlined in this report, the following flexible pavement sections are recommended.

Recommended Asphalt Pavement Section Thickness

PAVEMENT COMPONENTS	STANDARD DUTY AREAS	HEAVY DUTY AREAS	WISCONSIN DOT STRUCTURAL COEFFICIENTS
Hot Mix Asphalt*	3.5”	3.5”	Section 460 (a=0.44)
Aggregate Base Course	7”	12”	Section 305, 1¼” Crushed Stone (a=0.14)

*Surface and binder course thickness, and other details by pavement designer

The asphaltic base and surface course should be placed and provided in accordance with Section 455/460 of the State of Wisconsin Standard Specification for Highway and Structure Construction. The crushed aggregate base course should be provided and placed in accordance with Section 301/305 of the Standard Specification.

It may be advantageous to utilize rigid Portland Cement Concrete pavement at entrance and exit aprons. It is recommended that a minimum of 6 inches of 4000 psi, air-entrained concrete (5 to 7 percent) be utilized along with a 6 inch thickness of aggregate base for a rigid pavement section. The construction materials and procedures should be in accordance with Section 415 and Section 304 (for concrete and base course, respectively) of the WDOT Standard Specification.

The thickness designs shown above are based on the estimated traffic loading; the assumption that all subgrade materials, natural or fill, have minimum strength characteristics equal to or greater than the expected natural clay soils; the subgrade being properly prepared; and the pavement being properly drained to prevent softening and erosion of the subgrade. Actual service life will be dependent upon deterioration caused by weather conditions and pavement use. All pavement materials and construction must be in accordance with the guidelines of the State of Wisconsin Standard Specification for Highway and Structure construction. If design traffic loading is found to be different from that discussed above; or if the soils encountered at planned subgrade vary from the anticipated natural clay soils; a new pavement section design may be necessary.

It should be recognized that all pavements require regular maintenance and occasional repairs to keep the pavements in a serviceable condition. Maintenance is necessary to reduce the effects of pavement stress caused by changes in temperature and moisture, repetitive traffic loadings, and movement of the subgrade soils. As pavement distress is observed, it should be repaired as quickly as possible. Timely sealing of joints and cracks is essential to help reduce the potential for water to enter the pavement section and cause rapid deterioration of the pavement during freeze-thaw cycles. Unrepaired areas will generally lead to more severe and widespread distress, and eventually, pavement disintegration. Therefore, annual maintenance should include sealing of cracks and joints, and maintenance of proper surface drainage to avoid ponding water on or near the pavements. Periodic pavement condition surveys of the pavement can also be implemented to evaluate the need for other surface maintenance, and treatments or repairs that may be needed to obtain the design service life.

The subject site is located in an area that experiences annual freezing cycles and the subgrade soils encountered have been classified as moderately susceptible to frost action when free water is present. In order to reduce the potential for frost action, it will be necessary to control surface runoff and water seepage, because complete removal and replacement of the frost susceptible subgrade soils is not considered economically feasible. It is recommended that underdrains be placed within the subgrade, just below the granular base, to help reduce the potential for trapping water within the aggregate base layer. Sufficient drain tiles extending radially outward an adequate distance from each interior catch basin must be installed. In addition, drain tiles should extend along curb lines, up the slope from curb inlets. The drain tile should be directly connected to the storm sewer manholes or catch basins (if permissible by local municipal or other applicable code). The drain tile should consist of perforated PVC pipe of adequate diameter placed beneath the base layer, extending a sufficient distance into the subgrade. The pipe should be surrounded by appropriately sized clean stone, with the pipe and stone being wrapped with a geotextile filter fabric to reduce the potential for soils to migrating into and obstruct the pipe. It is also recommended that roof drains be connected to the stormwater collection system to minimize the potential for this water to enter the base and subgrade.

9 GENERAL COMMENTS

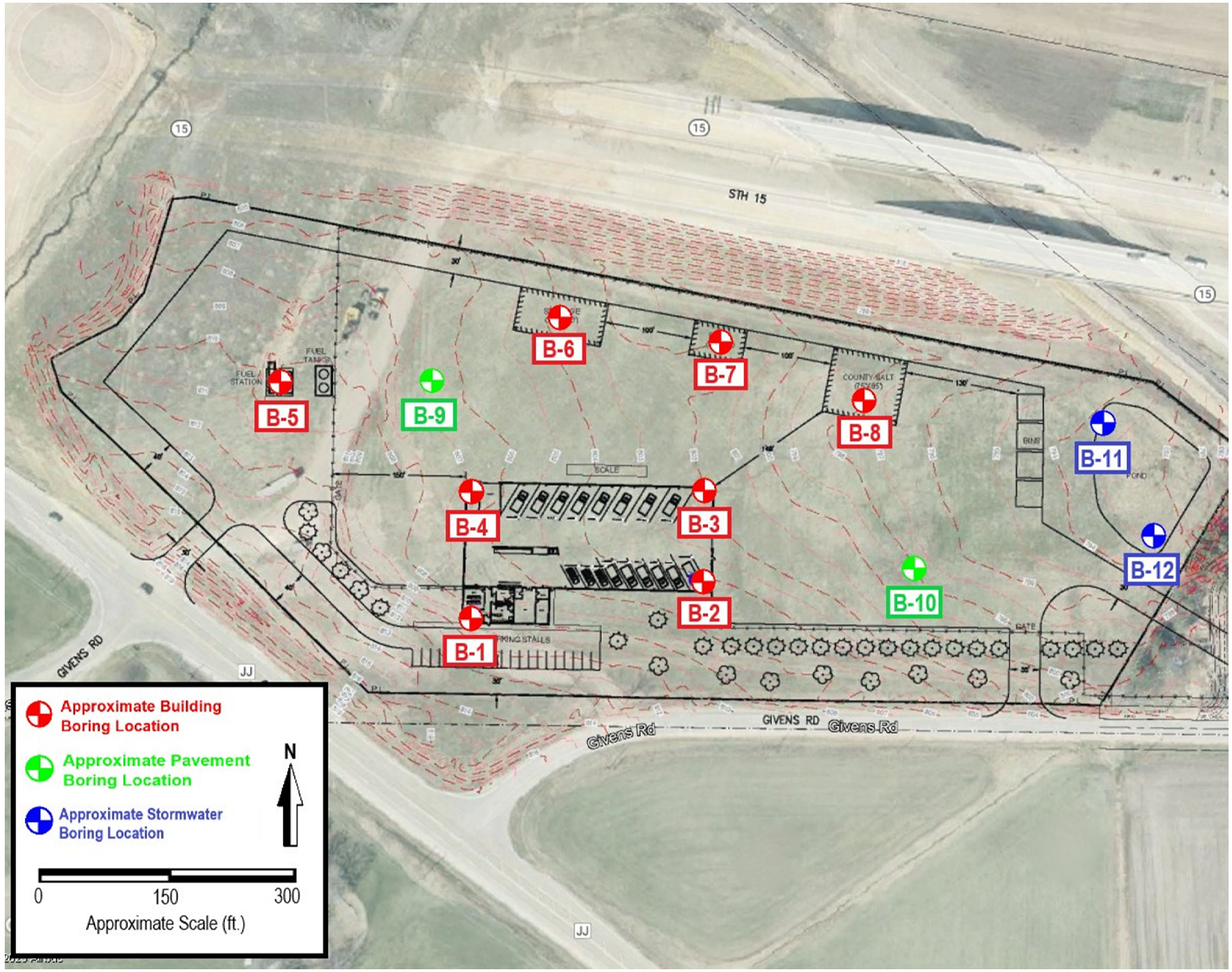
This geotechnical exploration and foundation evaluation has been prepared to aid in the evaluation of the foundation conditions on this site. The recommendations presented herein are based on the available soil information and the design information provided. Any changes in the design information or building locations should be brought to the attention of the soils engineer to determine if modifications in the recommendations are required. The final design plans and specifications should also be reviewed by the soils engineer to determine that the recommendations presented herein have been interpreted and implemented as intended.

This geotechnical study has been conducted in a manner consistent with that level of care ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. The findings, recommendations and opinions contained herein have been promulgated in accordance with generally accepted practice in the fields of foundation engineering, soils mechanics, and engineering geology. No other representations, expressed or implied, and no warranty or guarantee is included or intended in this report.

It is recommended that the earthwork and foundation operations be monitored by the soils engineer, to test and evaluate the bearing capacities, and the selection, placement and compaction of controlled fills.

APPENDIX

Figure 1 – Boring Location Plan
Soil Boring Logs
Laboratory Data Sheets
Storm Forms
General Notes



SCALE: SHOWN ABOVE

PROJECT NO: 00942598

PAGE 1 OF 1

4/30/2025

Outagamie County Hwy Department - Hortonia
CTH-JJ / STH-15
Hortonia, Wisconsin

FIGURE 1: Boring Location Plan

intertek psi

SOIL BORING LOG: B - 1

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin
Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 809.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 / 808.0	0-4": Dark brown to reddish brown Fine SAND, with silt, and trace clay and root matter, moist (TOPSOIL) Reddish brown Fine SAND, with silt and trace gravel, moist	1-AU	-	-	-	9	
2 / 807.0							
3 / 806.0		2-SS	17	-	-	11	
4 / 805.0							
5 / 804.0							▽
6 / 803.0	Light brown Fine to Medium SAND, with gravel and trace silt, moist	3-SS*	50/S1"	-	-	-	
7 / 802.0							
8 / 801.0		4-SS*	50/S1"	-	-	-	
9 / 800.0							
10 / 799.0							
11 / 798.0		5-SS*	50/S1"	-	-	-	
12 / 797.0							
13 / 796.0							
14 / 795.0							
15 / 794.0	**AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 14± FEET** **END OF BORING @ 14± FEET**						

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: 5± feet below ground surface (EL. 804.0±) ▽
Water Level $_{\text{upon completion}}$: Not Present ▼
Caved at $_{\text{upon completion}}$: N/A ⊥
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A ¥
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** Poor sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 2

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin

Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 804.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 / 803.0	0-16": Dark brown Fine SAND, with silt, and trace clay and root matter, moist (TOPSOIL)	1-AU	-	-	-	16	
2 / 802.0	Dark brown Fine SAND, with silt and trace gravel, moist						
3 / 801.0		2-SS	57/7"	-	-	16	
4 / 800.0							
5 / 799.0							
6 / 798.0	Light brown Fine to Medium SAND, with gravel and trace silt, moist	3-SS*	50/S8"	-	-	-	
7 / 797.0							
8 / 796.0		4-SS*	50/S4"	-	-	-	
9 / 795.0	**AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 8± FEET** **END OF BORING @ 8± FEET**						
10 / 794.0							
11 / 793.0							
12 / 792.0							
13 / 791.0							
14 / 790.0							
15 / 789.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered
Water Level $_{\text{upon completion}}$: Not Present
Caved at $_{\text{upon completion}}$: N/A
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** Poor sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 3

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin

Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 802.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
	0-9": Dark brown to reddish brown Fine SAND, with silt, clay, and trace root matter, moist (TOPSOIL)						
1 / 801.0	Light brown Fine to Medium SAND, with gravel and trace silt, moist	1-AU	-	-	-		
2 / 800.0							
3 / 799.0		2-SS*	50/S10"	-	-		
4 / 798.0							
5 / 797.0							
6 / 796.0		3-SS**	50/S1"	-	-		
7 / 795.0							
8 / 794.0	**AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 7.5± FEET** **END OF BORING @ 7.5± FEET**						
9 / 793.0							
10 / 792.0							
11 / 791.0							
12 / 790.0							
13 / 789.0							
14 / 788.0							
15 / 787.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered
Water Level $_{\text{upon completion}}$: Not Present
Caved at $_{\text{upon completion}}$: N/A
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** Poor sample recovery**
**** No sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 4

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin

Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 807.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
0	0-10": Dark brown to light brown Fine SAND, with silt, and trace clay and root matter, moist (TOPSOIL)						
1 / 806.0	Light brown Fine to Medium SAND, with gravel and trace silt, moist	1-AU	-	-	-	13	
2 / 805.0							
3 / 804.0		2-SS*	50/S8"	-	-	5	
4 / 803.0							
5 / 802.0							
6 / 801.0		3-SS*	50/S4"	-	-	4	
7 / 800.0							
8 / 799.0		4-SS**	50/S1"	-	-	-	
9 / 798.0	**AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 9± FEET** **END OF BORING @ 9± FEET**						
10 / 797.0							
11 / 796.0							
12 / 795.0							
13 / 794.0							
14 / 793.0							
15 / 792.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered
Water Level $_{\text{upon completion}}$: Not Present
Caved at $_{\text{upon completion}}$: N/A
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** Poor sample recovery**
**** No sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 5

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin
Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 810.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
	0-6": Brown to very dark brown CLAY, with silt, and trace sand and root matter, moist (TOPSOIL)						
1 / 809.0	Reddish brown CLAY, with silt, sand, and trace gravel, moist	1-AU	-	-	-	20	
2 / 808.0							
3 / 807.0		2-SS	28	-	-	19	
4 / 806.0							
5 / 805.0							
6 / 804.0	Light brown Fine to Medium SAND, with gravel and trace silt, moist	3-SS*	50/S7"	-	-	-	
7 / 803.0							
8 / 802.0		4-SS*	50/S3"	-	-	-	
9 / 801.0							
10 / 800.0							
11 / 799.0	**AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 10± FEET** **END OF BORING @ 10± FEET**						
12 / 798.0							
13 / 797.0							
14 / 796.0							
15 / 795.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered
Water Level $_{\text{upon completion}}$: Not Present
Caved at $_{\text{upon completion}}$: N/A
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** Poor sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 6

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin

Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 804.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 / 803.0	0-12": Brown to very dark brown CLAY, with silt, and tace sand, gravel, and root matter, moist (TOPSOIL)	1-AU	-	-	-	15	
2 / 802.0	Light brown Fine SAND, with silt, and trace clay and gravel, moist						
3 / 801.0		2-SS*	50/S2"	-	-	4	
4 / 800.0							
5 / 799.0							
6 / 798.0		3-SS*	50/S3"	-	-	3	
7 / 797.0							
8 / 796.0		4-SS**	50/S1"	-	-	-	
9 / 795.0	**AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 8± FEET** **END OF BORING @ 8± FEET**						
10 / 794.0							
11 / 793.0							
12 / 792.0							
13 / 791.0							
14 / 790.0							
15 / 789.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered
Water Level $_{\text{upon completion}}$: Not Present
Caved at $_{\text{upon completion}}$: N/A
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** Poor sample recovery**
**** No sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 7

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin

Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 802.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 / 801.0	0-7": Dark brown to light brown Fine SAND, with silt, and trace clay and root matter, moist (TOPSOIL)						
	Light brown Fine to Medium SAND, with gravel and trace silt, moist	1-AU	-	-	-	14	
2 / 800.0							
3 / 799.0		2-SS*	50/S5"	-	-	2	
4 / 798.0							
5 / 797.0							
6 / 796.0		3-SS*	50/S5"	-	-	2	
7 / 795.0							
8 / 794.0		4-SS**	50/S1"	-	-	-	
9 / 793.0	**AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 8± FEET** **END OF BORING @ 8± FEET**						
10 / 792.0							
11 / 791.0							
12 / 790.0							
13 / 789.0							
14 / 788.0							
15 / 787.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered
Water Level $_{\text{upon completion}}$: Not Present
Caved at $_{\text{upon completion}}$: N/A
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** Poor sample recovery**
**** No sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 8

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin
Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 798.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 / 797.0	0-23": Dark brown CLAY, with sand, silt, and trace root matter, moist (TOPSOIL)	1-AU	-	-	-	15	
2 / 796.0	Reddish brown Fine to Medium SAND, with silt, and trace clay and gravel, moist to very moist						
3 / 795.0		2-SS	65	-	-	9	
4 / 794.0							
5 / 793.0							▽
6 / 792.0	Light brown Silty Fine to Medium SAND, with trace gravel, moist to very moist	3-SS*	50/S7"	-	-	11	
7 / 791.0							
8 / 790.0		4-SS*	50/S3"	-	-	11	
9 / 789.0							
10 / 788.0							
11 / 787.0		5-SS**	50/S1"	-	-	-	
12 / 786.0							
	AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 12± FEET **END OF BORING @ 12± FEET**						
13 / 785.0							
14 / 784.0							
15 / 783.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: 5± feet below ground surface (EL. 793.0±) ▽
Water Level $_{\text{upon completion}}$: Not Present ▼
Caved at $_{\text{upon completion}}$: N/A ⊥
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A ¥
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** Poor sample recovery**
**** No sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 9

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin

Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 806.5	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
	0-7": Dark brown to reddish brown CLAY, with silt, sand, and trace root matter, moist (TOPSOIL)						
1 / 805.5	Reddish brown CLAY, with silt, and trace sand and gravel, moist	1-AU	-	-	-	17	
2 / 804.5							
3 / 803.5		2-SS	68	1.0	-	15	
4 / 802.5							
5 / 801.5							
	Light brown Fine to Medium SAND, with trace gravel and silt, moist						
6 / 800.5		3-SS*	50/S4"	-	-	-	
7 / 799.5							
8 / 798.5		4-SS*	50/S4"	-	-	-	
	AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 8± FEET **END OF BORING @ 8± FEET**						
9 / 797.5							
10 / 796.5							
11 / 795.5							
12 / 794.5							
13 / 793.5							
14 / 792.5							
15 / 791.5							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered
Water Level $_{\text{upon completion}}$: Not Present
Caved at $_{\text{upon completion}}$: N/A
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** Poor sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 10

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin

Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 798.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 / 797.0	0-15": Dark brown Fine SAND, with silt, and trace clay and root matter, moist (TOPSOIL)	1-AU	-	-	-	21	
2 / 796.0	Light brown Fine to Medium SAND, with gravel and trace silt, moist						
3 / 795.0		2-SS*	50/S3"	-	-	-	
4 / 794.0							
5 / 793.0							
6 / 792.0		3-SS**	50/S1"	-	-	-	
7 / 791.0							
8 / 790.0	**AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 7± FEET** **END OF BORING @ 7± FEET**						
9 / 789.0							
10 / 788.0							
11 / 787.0							
12 / 786.0							
13 / 785.0							
14 / 784.0							
15 / 783.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered
Water Level $_{\text{upon completion}}$: Not Present
Caved at $_{\text{upon completion}}$: N/A
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** Poor sample recovery**
**** No sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 11

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin
Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 794.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 793.0	5YR 2.5/1 Black VERY FINE SANDY LOAM,0,m,mfi	1-AU	-	-	-	32	⊻
2 792.0							
3 791.0	5YR 3/3 Dark reddish brown SILTY CLAY LOAM,1,f,sbk,mfi	2-SS	14	2.5	2.0	19	
4 790.0							
5 789.0		3-SS	17	1.75	1.8	20	
6 788.0							
7 787.0	5YR 3/3 Dark reddish brown SANDY CLAY LOAM,1,f,sbk,mfi	4-SS	50/S5"	1.75	-	20	
8 786.0							
9 785.0		5-SS*	50/S1"	-	-	-	
10 784.0							
11 783.0		6-SS*	50/S1"	-	-	-	
12 782.0							
13 781.0	**AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 12± FEET** **END OF BORING @ 12± FEET**						
14 780.0							
15 779.0							
16 778.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: 1.5± feet below existing grade (EL. 792.5±) ⊻
Water Level $_{\text{upon completion}}$: Not Present ▼
Caved at $_{\text{upon completion}}$: N/A ⊥
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A ¥
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** No sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 12

Project: Outagamie County Highway Department - Hortonia
Project No.: 00942598

Location: CTH-JJ / STH-15
Hortonia, Wisconsin

Drill Date: April 8, 2025
Drilled By: GDC, LLC

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 793.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 792.0	5YR 3/1 Very dark gray FINE SANDY LOAM,0,m,mfr	1-AU	-	-	-	16	
2 791.0							
3 790.0	5YR 3/3 Dark reddish brown FINE SANDY LOAM,1,thin pl,mfr	2-SS	19	-	-	16	⊻
4 789.0							
5 788.0	5YR 4/3 Reddish brown CLAY LOAM,1,f,sbk,mfi	3-SS	80/7"	1.0	-	19	
6 787.0							
7 786.0		4-SS*	50/S1"	-	-	-	
8 785.0							
9 784.0		5-SS*	50/S1"	-	-	-	
10 783.0							
11 782.0	**AUGER REFUSAL ON POSSIBLE COBBLES, BOULDERS, OR BEDROCK @ 10± FEET** **END OF BORING @ 10± FEET**						
12 781.0							
13 780.0							
14 779.0							
15 778.0							
16 777.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: 3± feet below existing grade (EL. 790.0±) ⊻
Water Level $_{\text{upon completion}}$: Not Present ▼
Caved at $_{\text{upon completion}}$: N/A ⊥
Delay Time: N/A
Water Level $_{\text{delayed}}$: N/A ¥
Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

*** No sample recovery**

Note: Lines of stratification represent an approximate boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

Professional Service Industries, Inc.
3009 Vandenbroek Road
Kaukauna, WI 54130

Phone: (920) 735-1200
Fax: (920) 735-1840

Report No: MAT:00942598-1-S1
Issue No: 1

Material Test Report

Client: OUTAGAMIE COUNTY HIGHWAY DEPT
1313 HOLLAND ROAD
APPLETON, WI 54911

CC:

Project: OUTAGAMIE COUNTY - HORTONVILLE
HORTONVILLE, WI

Approved Signatory: Andrew Olson (Staff Geologist)
Date of Issue: 4/28/2025

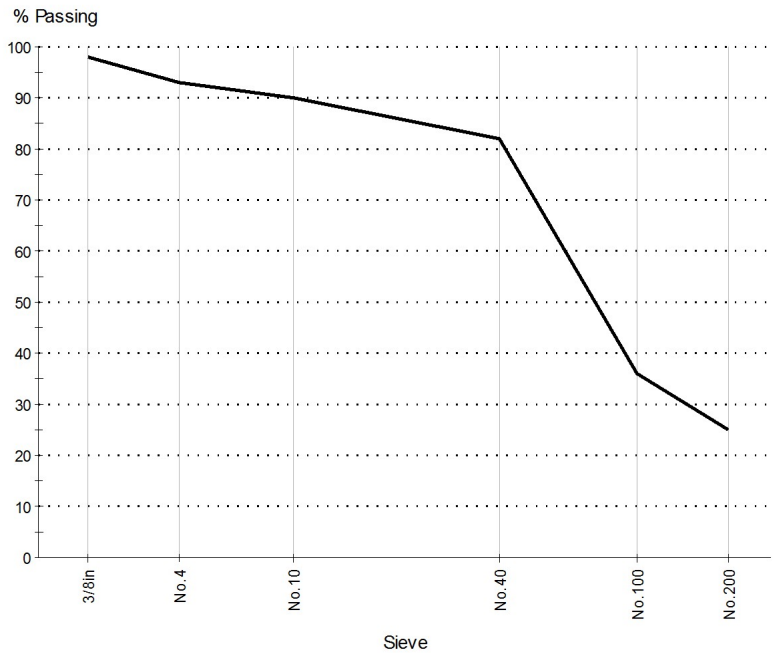
Sample Details

Sample ID:	00942598-1-S1
Client Sample ID:	
Date Sampled:	04/08/25
Sampled By:	Andrew Olson
Specification:	Standard Sieve
Supplier:	On-Site Material
Source:	Soil Boring
Material:	Brown to very dark brown Fine SAND, with silt, and trace gravel and clay (SM, A-2-4)
Sampling Method:	Bulk Sample
Soil Description:	Brown to very dark brown Fine SAND, with silt, and trace gravel and clay (SM, A-2-4)
General Location:	B-6
Location:	0ft to 2ft

Sample Description:

Brown to very dark brown Fine SAND, with silt, and trace gravel and clay (SM, A-2-4)

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES (24.7%)	
(0.0%)	Coarse (0.0%)	Fine (6.6%)	Coarse (3.1%)	Medium (8.3%)	Fine (57.2%)	Silt	Clay

Grading: ASTM C 136, ASTM C 117

Date Tested: 4/28/2025
Tested By: Andrew Olson

Sieve Size	% Passing	Limits
3/8in (9.5mm)	98	
No.4 (4.75mm)	93	
No.10 (2.0mm)	90	
No.40 (425µm)	82	
No.100 (150µm)	36	
No.200 (75µm)	25	

D85: 0.7597 **D60:** 0.2583 **D50:** 0.2059
D30: 0.1028 **D15:** N/A **D10:** N/A

Professional Service Industries, Inc.
3009 Vandenbroek Road
Kaukauna, WI 54130

Phone: (920) 735-1200
Fax: (920) 735-1840

Report No: MAT:00942598-1-S2
Issue No: 1

Material Test Report

Client: OUTAGAMIE COUNTY HIGHWAY DEPT
1313 HOLLAND ROAD
APPLETON, WI 54911

CC:

Project: OUTAGAMIE COUNTY - HORTONVILLE
HORTONVILLE, WI

Approved Signatory: Andrew Olson (Staff Geologist)
Date of Issue: 4/28/2025

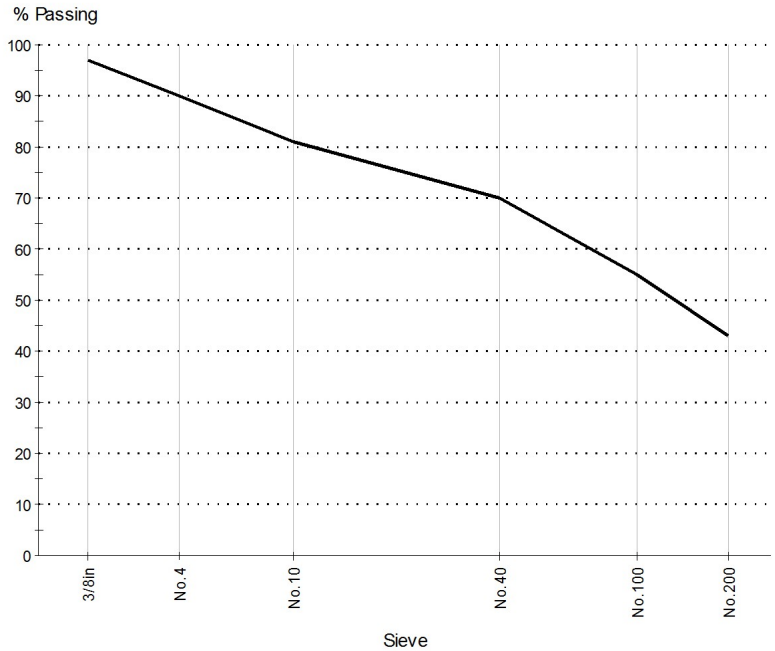
Sample Details

Sample ID:	00942598-1-S2
Client Sample ID:	
Date Sampled:	04/08/25
Sampled By:	Andrew Olson
Specification:	Standard Sieve
Supplier:	On-Site Material
Source:	Soil Boring
Material:	Brown Silty Fine to Medium SAND, with trace gravel (SM, A-4)
Sampling Method:	Bulk Sample
Soil Description:	Brown Silty Fine to Medium SAND, with trace gravel (SM, A-4)
General Location:	B-8
Location:	5ft to 7ft

Sample Description:

Brown Silty Fine to Medium SAND, with trace gravel (SM, A-4)

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES (43.4%)	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(0.0%)	(9.5%)	(9.8%)	(11.1%)	(26.2%)		

Grading: ASTM C 136, ASTM C 117

Date Tested: 4/28/2025
Tested By: Andrew Olson

Sieve Size	% Passing	Limits
3/8in (9.5mm)	97	
No.4 (4.75mm)	90	
No.10 (2.0mm)	81	
No.40 (425µm)	70	
No.100 (150µm)	55	
No.200 (75µm)	43	

D85: 2.9376 **D60:** 0.2123 **D50:** 0.1124
D30: N/A **D15:** N/A **D10:** N/A

Wis. Dept. of Safety and Professional Services
Division of Industry Services

SOIL EVALUATION - STORM

In accordance with SPS 382.365 & 385, Wis. Adm. Code and WDNR Standard 1002

Attach complete site plan on paper not less that 8 1/2 x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent slope, scale or dimensions, north arrow, and BM referenced to nearest road.

Please print all information.

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04 (1) (m)].

County: Outagamie

Parcel I.D.:

Reviewed by:

Date:

Property Owner:

Property Location: Hortonia, WI

Govt. Lot:

Property Owner's Mailing Address:

Lot #:

Block #:

Subd. Name or CSM#:

City | State | Zip Code | Phone Number

☐ City ☐ Village ☒ Town

Hortonia

Nearest Road:

Drainage area _____ ☐ sq. ft. ☐ acres

Optional:

Test Site Suitable for (check all that apply)

☐ Irrigation ☐ Bioretention trench ☐ Trench(es)

☐ Rain Garden ☐ Grassed swale ☐ Reuse

☐ Infiltration trench ☐ SDS (> 15' wide) ☐ Other _____

Hydraulic Application Test Method:

☒ Morphological Evaluation

☐ Double Ring Infiltrometer

☐ Other (specify)

Soil Moisture

Date of Test Pits: April 7, 2025

USDA-NRCS WETS Value: 14

☐ **Dry =1;**

☒ **Normal = 2;**

☐ **Wet = 3.**

1 Obs. # ☒ Boring ☐ Pit B-11

Ground surface elevation ± Elevation of limiting factor: 8'±

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	% Fines	Hydraulic App. Rate Inches/Hr.
1	0-24	5YR 2.5/1		vfsl	0 m	mfi		<15		0.5
2	24-72	5YR 3/3		sicl	1 f sbk	mfi		<15		0.04
3	72-96	5YR 3/3		scl	1 f sbk	mfi		<15		0.11

Comment: possible bedrock at about 8 feet

2 Obs. # ☒ Boring ☐ Pit B-12

Ground surface elevation ± Elevation of limiting factor: 3'±

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	% Fines	Hydraulic App. Rate Inches/Hr.
1	0-24	5YR 3/1		fsl	0 m	mfr		<15		0.5
2	24-48	5YR 3/3		fsl	1 thin pl	mfr		<15		0.5
3	48-96	5YR 4/3		cl	1 f sbk	mfi		<15		0.03

Comment: wet soils at about 3 feet; possible bedrock at about 8 feet

CST/PSS Name (Please Print)	Signature	CST/PSS/Geologist Number
Patrick J. Patterson		G-229
Address	**Date Evaluation Conducted**	**Telephone Number**
821 Corporate Court, Waukesha, WI 53189	4/11/2025	262 521 2125

GENERAL NOTES

SAMPLE IDENTIFICATION

1. Information on each log is a compilation of subsurface conditions, based on visual soil classifications of soil samples obtained from the field as assigned by a soils engineer, as well as from laboratory testing of samples, if performed. The strata lines on the logs may be approximate or the transition between the strata may be gradual rather than distinct. Water level measurements refer only to those observed at the times and locations indicated, and may vary with time, geologic condition and construction activity.
2. Unified Soil Classification System (USCS) designations are based on visual soil classification estimates on the basis of textural and particle size categorization and various soil behavior characteristics. If laboratory tests were performed to classify the soil, the USCS designation is shown in parenthesis.

USCS SOIL PARTICLE SIZE CLASSES

U.S. Std. Sieve			#200	#40	#10	#4	¾"	3"	12"	
Soil Type	Clay	Silt	Sand			Gravel		Cobbles	Boulders	
			Fine	Medium	Coarse	Fine	Coarse			
Millimeters	0.002	0.074	0.42	2	4.8	19	76	300		

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487-00)

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 w/ < 5% fines [E]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [C]	GW	Well-graded gravel [D]
			Cu < 4 and/or1 > Cc > 3 [C]	GP	Poorly graded gravel [D]
		Gravels w/ > 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 (More than 50% of coarse fraction passes the No. 4 sieve)	Clean sands w/ < 5% fines [I]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [C]	SW	Well-graded sand [H]
			Cu < 6 and/or 1 > Cc > 3 [C]	SP	Poorly graded sand [H]
		Sands w/ > 12% fines [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 (More than 50% passes the No. 200 sieve)	Silts and clays w/ liquid limit (LL) < 50	Inorganic	PI > 7 and plots on or above "A" line [J]	CL	Lean clay [K,L,M]
			PI < 4 and plots below "A" line [J]	ML	Silt [K,L,M]
		Organic	LL (Oven dried) / LL (Not dried) < 0.75	OL	Organic clay [K,L,M,N]
				OL	Organic silt [K,L,M,O]
	Silts and clays w/ liquid limit (LL) ≥ 50	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	LL (Oven dried) / LL (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-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] $Cu = D_{60}/D_{10}$; $Cc = (D_{30})^2 / D_{10} \times D_{60}$
[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 - 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 15 - 29% plus No. 200, add "with sand" or "with gravel"
[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 below "A" line

RELATIVE SOIL COMPOSITION

Trace - 0 - 15% of sample
With - 15 - 35% of sample
Soil modifier - > 35% of sample (i.e. sandy, silty, clayey, gravelly)

DRILLING & SAMPLING SYMBOLS

AU - Auger sample from cuttings
BS - Bag sample
HA - Hand auger sample
SS - Split spoon sample (2" O.D. by 1⅜" I.D.)
ST - Shelby Tube sample (2" or 3" O.D.)
WS - Wash sample from wash water return

SOIL PROPERTY SYMBOLS

N - N-value (blow count) is the standard penetration resistance based on the total number of blows required to advance a split spoon sampler one (1) foot, using a 140 lb. hammer with a 30 inch free fall. To avoid damage to sampling tools, driving is typically limited to 50 blows during any 6 inch interval. Additional description is provided below:

N-value (bpf)	Description
HW	Sampler penetrated soil under weight of hammer and rods; no driving required
25	25 blows to advance sampler 12 inches after initial 6 inches of seating
75/10"	75 blows to advance sampler 10 inches after initial 6 inches of seating
50/S3"	50 blows to advance sampler 3 inches during initial 6 inch seating interval

MC - Moisture content, %
Qu - Unconfined compressive strength, tons per square foot (tsf)
Qp - Calibrated hand penetrometer resistance, tsf
γd - Dry density, pounds per cubic foot (pcf)
LL - Liquid limit, % (ASTM D4318)
PL - Plastic limit, % (ASTM D4318)
PI - Plasticity index, % (ASTM D4318)
%P200 - Percent of sample passing the No. 200 sieve
RQD - Rock quality designation of NX-size core sample
RMR - Rock mass rating, as developed by Z.T. Bieniawski
PID - Photoionization detector (Hnu meter) volatile vapor level, ppm

SOIL RELATIVE DENSITY & CONSISTENCY CLASSIFICATION

NON-COHESIVE SOILS		COHESIVE SOILS		
Density	N-Value Range	Consistency	Qu Range (tsf)	Approximate N-value Range
Very loose	0 - 3	Very soft	0 - 0.25	0 - 2
Loose	3 - 7	Soft	0.25 - 0.5	2 - 5
Medium dense	7 - 15	Medium stiff	0.5 - 1.0	5 - 10
Dense	15 - 38	Stiff	1.0 - 2.0	10 - 14
Very dense	38+	Very Stiff	2.0 - 4.0	14 - 32
		Hard	4.0+	32+

SOIL STRUCTURE TERMINOLOGY

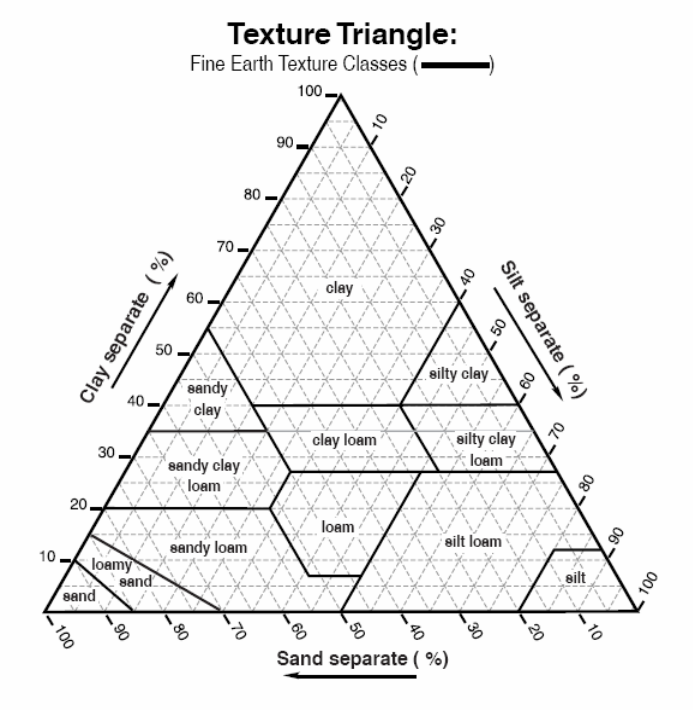
Interlayered - Alternating layers of different soil types
Layer - Inclusion greater than 3 inches thick
Seam - Inclusion ⅛ to 3 inches thick
Laminated - Alternating seams of different soil type
Intermixed - Pockets of different soil types, no layering
Pocket - Inclusion of material of different texture
Varved - Alternating layers or seams of sand, silt, and/or clay

GROUNDWATER & MOISTURE CONDITIONS

v - Approximate groundwater level as noted during drilling and sampling
▼ - Groundwater level as noted within the open borehole upon removal of the augers
¥ - Delayed groundwater level within open borehole
Dry - Absence of moisture, dry to the touch
Moist - Damp, but no visible water
Wet - Visible free water, saturated, usually below water table

NOTE: General Notes have been adapted from and incorporate portions of ASTM D2487 "Classification of Soils for Engineering Purposes (Unified Soil Classification System)" and ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)."

USDA SOIL CLASSIFICATION SYSTEM*



NOTE: **Soil Texture** encompasses only the fine earth fraction (≤ 2 mm). **Particle Size Distribution** (PSD) encompasses the whole soil, including both the fine earth fraction (≤ 2 mm; weight %) and rock fragments (> 2 mm; volume %).

TEXTURE CLASS

Texture Class or Subclass	Code	
	Conv.	NASIS
Coarse Sand	cos	COS
Sand	s	S
Fine Sand	fs	FS
Very Fine Sand	vfs	VFS
Loamy Coarse Sand	lcos	LCOS
Loamy Sand	ls	LS
Loamy Fine Sand	lfs	LFS
Loamy Very Fine Sand	lvfs	LVFS
Coarse Sandy Loam	cosl	COSL
Sandy Loam	sl	SL
Fine Sandy Loam	fsl	FSL
Very Fine Sandy Loam	vfsl	VFSL
Loam	l	L
Silt Loam	sil	SIL
Silt	si	SI
Sandy Clay Loam	scl	SCL
Clay Loam	cl	CL
Silty Clay Loam	sicl	SICL
Sandy Clay	sc	SC
Silty Clay	sic	SIC
Clay	c	C

TEXTURE MODIFIERS - Conventions for using "Rock Fragment Texture Modifiers" and for using textural adjectives that convey the "% volume" ranges for **Rock Fragments - Size and Quantity**.

Fragment Content % By Volume	Rock Fragment Modifier Usage
< 15	No texture adjective is used (noun only; e.g., *loam*).
15 to < 35	Use adjective for appropriate size; e.g., *gravelly*.
35 to < 60	Use "very" with the appropriate size adjective; e.g., *very gravelly*.
60 to < 90	Use "extremely" with the appropriate size adjective; e.g., *extremely gravelly*.
≥ 90	No adjective or modifier. If ≤ 10% fine earth, use the appropriate noun for the dominant size class; e.g., *gravel*. Use **Terms in Lieu of Texture**.

TEXTURE MODIFIERS - *(adjectives)*

ROCK FRAGMENTS: Size & Quantity [1]	Code		Criteria: Percent (By Volume) of Total Rock Fragments and Dominated By (*name size*): [1]
	Conv.	PDP/ NASIS	
ROCK FRAGMENTS (> 2 mm; ≥ Strongly Cemented)			
Gravelly	GR	GR	≥ 15% but < 35% gravel
Fine Gravelly	FGR	GRF	≥15% but < 35% fine gravel
Medium Gravelly	MGR	GRM	≥15% but < 35% med. gravel
Coarse Gravelly	CGR	GRC	≥ 15% but < 35% coarse gravel
Very Gravelly	VGR	GRV	≥ 35% but < 60% gravel
Extremely Gravelly	XGR	GRX	≥ 60% but < 90% gravel
Cobbly	CB	CB	≥ 15% but < 35% cobbles
Very Cobbly	VCB	CBV	≥ 35% but < 60% cobbles
Extremely Cobbly	XCB	CBX	≥ 60% but < 90% cobbles
Stony	ST	ST	≥ 15% but < 35% stones
Very Stony	VST	STV	≥ 35% but < 60% stones
Extremely Stony	XST	STX	≥ 60% but < 90% stones
Bouldery	BY	BY	≥ 15% but < 35% boulders
Very Bouldery	VBY	BYV	≥ 35% but < 60% boulders
Extremely Bouldery	XBY	BYX	≥ 60% but < 90% boulders
Channery	CN	CN	≥ 15% but < 35% channers
Very Channery	VCN	CNV	≥ 35% but < 60% channers
Extremely Channery	XCN	CNX	≥ 60% but < 90% channers
Flaggy	FL	FL	≥ 15% but < 35% flagstones
Very Flaggy	VFL	FLV	≥ 35% but < 60% flagstones
Extremely Flaggy	XFL	FLX	≥ 60% but < 90% flagstones

* As outlined in the NRCS Field Book for Describing and Sampling Soils, Version 2.0 (2002).