DANE COUNTY DEPT. OF PUBLIC WORKS, HIGHWAY & TRANSPORTATION

1919 Alliant Energy Center Way
Madison, Wisconsin 53713
Office: 608/266-4018 ◊ Fax: 608/267-1533
Public Works Engineering Division
Public Works Solid Waste Division

ADDENDUM 2

NOVEMBER 26, 2018

ATTENTION ALL REQUEST FOR BID (RFB) HOLDERS

RFB NO. 318008 (REBID) - ADDENDUM NO. 2

ALBION SALT STORAGE BUILDING

BIDS DUE: TUESDAY, DECEMBER 4, 2018, 2:00 PM. DUE DATE AND TIME ARE NOT CHANGED BY THIS ADDENDUM.

This Addendum is issued to modify, explain or clarify the original Request for Bid (RFB) and is hereby made a part of the RFB. Please attach this Addendum to the RFB.

PLEASE MAKE THE FOLLOWING CHANGES:

1. **Section 32 12 16**
   Delete Specification Section 32 12 16 Asphalt Paving and replace with Specification Section 32 12 16 Asphalt Paving included with this addendum. The specification has been modified to eliminate discrepancies.

2. **Sheet A101 – Site Plan**
   Delete "New Detention Pond" from drawing. Stormwater controls are as shown on the "Grading and Erosion Control Plans, Sheet C-1"

If any additional information about this Addendum is needed, please call Ryan Shore at 608/266-4475, shore@countyofdane.com.

Sincerely,

Ryan Shore

Project Manager

Enclosures:
Section 32 12 16 – Asphalt Paving
Geotechnical Exploration Report - Informational only

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Asphalt materials.
   2. Aggregate materials.
   3. Pavement-marking paint.

B. Related Sections:
   1. Section 01 00 00 - Basic Requirements
   2. Section 01 74 19 - Recycling
   3. Section 32 11 23 – Dense Graded Base

1.2 MEASUREMENT AND PAYMENT

A. Basis of Payment. HMA Pavement mixture of this type or types, accepted as stated above, shall be measured by lump sum of mixed aggregate and asphaltic material laid and compacted in place and shall include all work necessary to provide quality management programs in accordance with Section 460 of State of Wisconsin, Department of Transportation Standard Specifications for Highway and Structure standard: Sections: 455 and 460 for HMA Type 3 MT 58-28S and 4 MT 58-28H.

B. Method of Payment. Payment will be made only for supplied material accompanied by ticket containing this information:
   1. Ticket number, date, and time
   2. Type of material
   3. Gross and net weights

C. Copy of tickets will be given to County inspector on job site.

1.3 REFERENCES

A. State of Wisconsin, Department of Transportation Standard Specifications for Highway and Structure standard.

1.4 SUBMITTALS

A. Product Data:
   1. Submit product information for asphalt and aggregate materials.
   2. Submit mix design with laboratory test results supporting design.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Mixing Plant: Conform to State of Wisconsin, Department of Transportation Highway and Structure standard.

B. Perform Work in accordance with State of Wisconsin, Department of Transportation Standard Specifications for Highway and Structure standard.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum three (3) years experience.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if these conditions are not met:
   1. Tack Coat: Minimum surface temperature of 60 degrees F (15.6 degrees C).
   2. Asphalt Base Course: Minimum surface temperature of 40 degrees F (4.4 degrees C) and rising at time of placement.
   3. Asphalt Surface Course: Minimum surface temperature of 60 degrees F (15.6 degrees C) at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at minimum ambient or surface temperature of 40 degrees F (4.4 degrees C) for oil-based materials or 55 degrees F (12.8 degrees C) for water-based materials, and not exceeding 95 degrees F (35 degrees C).

PART 2 PRODUCTS

2.1 HMA PAVEMENT - 3 MT 58-28S & 4 MT 58-28H

Description: Materials covered under this provision shall conform to State of Wisconsin, Department of Transportation's specifications for each “Type” mix. The asphaltic pavement shall be 6” inside the salt storage building, installed in a 4” binder lift and a 2”surface layer. The asphaltic pavement shall be 5” outside the salt storage building, installed in a 3” binder lift and a 2”surface layer. The said pavement mix shall be 3 MT 58-28S in the binder layer and 4 MT 58-28 H in the surface layer in conformance with WisDOT Standard Spec Section 460. The binder lift nominal maximum gradation shall be 19.0 millimeters. The surface lift nominal maximum gradation shall be 12.5 millimeters. All surface pavement lateral pavement seams shall be offset a minimum of 6” from binder pavement lateral seams and be compacted with a hot roller. Trucks transporting the asphaltic material shall be covered with a tarp at all times until paving operations begin for that load. The material shall have a temperature of 270°F -300°F at time of paving and loads of asphalt that are less than 250°F or more than 350°F shall be rejected.

A. Contractor will be responsible for providing mix design(s) and for testing required to insure uniformity of mix and adequacy of compaction. Mix design must be submitted to

County for approval within 30 days after execution of contract. In no case will paving be allowed to begin until County is in receipt of said mix design(s).

B. Mix designs must be prepared by approved materials engineering consultant. Designs from previous years will not be allowed unless certification is included as to proposed aggregate and asphalt source, quality and consistency being equal to previous years. Separate mix design must be submitted for both upper and lower courses, if both are required. Separate mix designs shall be provided for each different source of aggregate.

2.2 ASPHALT MATERIALS

A. Asphalt Binder and Surface Course shall be in accordance with State of Wisconsin, Department of Transportation Standard Specifications for Highway and Structure standard:

2.3 AGGREGATE MATERIALS

A. All Aggregate shall be in accordance with State of Wisconsin, Department of Transportation Standard Specifications for Highway and Structure standard.

2.4 AUXILIARY MATERIALS

A. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.

B. Color: Yellow Conventional, 4 inch width.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner.

B. Allow paving to age for 24 hours minimum before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide minimum wet film thickness of 15 mils (0.4 mm).

3.3 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.4 PROTECTION OF FINISHED WORK

A. Immediately after placement, protect paving from mechanical injury for 48 hours or until surface temperature is less than 140 degrees F (60 degrees C).

END OF SECTION

August 4, 2017

Geotechnical Report for WisDOT review.

This report addressed Strand's comments provided to PSI on July 26, 2017.

Additional Strand comments for WisDOT consideration are indicated within this report.

Strand Associates, Inc.
910 West Wingra Drive
Madison, WI 53715

Attn: Mr. Brett Oftedahl, P.E.

Re: Geotechnical Exploration Report
Project ID 1007-11-01
IH 39
Illinois State Line – Madison
USH 51 Intch Area/CTH A Salt Shed
Dane County
PSI Report No: 00521771R1

Dear Mr. Oftedahl:

Professional Service Industries, Inc. (PSI) is pleased to submit our Geotechnical Exploration Report for the Proposed CTH A Salt Shed Project located in Dane County, Wisconsin. This report includes the results of field and laboratory testing, recommendations for foundations, floor slabs, pavements, and a stormwater management device, as well as general site development recommendations.

PSI appreciates the opportunity to perform this geotechnical study and we look forward to continued participation during the design and construction phases of this project. If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC

WISCONSIN TED A. CERA 34991-006 WAUKESHA, WI PROFESSIONAL ENGINEER

Benjamin J. Kroeger, E.I.T.
Staff Engineer
Geotechnical Services

Ted A. Cera, P.E.
Department Manager
Geotechnical Services

The above Professional Engineering Seal and signature is an electronic reproduction of the original seal and signature. Original hard copies can be provided if requested. This electronic reproduction shall not be construed as an original or certified document.

Intertek psi

GEOTECHNICAL ENGINEERING SERVICES REPORT

For the

Proposed CTH A Salt Shed
Project ID 1007-11-01
IH 39
Illinois State Line – Madison
USH 51 Intch Area/CTH A Salt Shed
Dane County
Town of Albion, Wisconsin

Prepared for:
Strand Associates, Inc.
910 West Wingra Drive
Madison, WI 53715

Prepared by:

Professional Service Industries, Inc.
821 Corporate Court
Waukesha, WI 53189
(262) 521-2125
Fax (262) 521-2471

PSI Report Number: 00521771R1

August 4, 2017

Benjamin J. Kroeger, E.I.T.
Staff Engineer
Geotechnical Services

Ted A. Cera, P.E.
Department Manager
Geotechnical Services

Information To Build On

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PROJECT INFORMATION

Project Authorization

PSI proceeded with the services based on authorization from the signed Task Order for Geotechnical Services (Task Order Number 16-02).

Project Description

It is PSI's understanding that the proposed project includes construction of a new salt storage shed and a stormwater management basin in Albion, Wisconsin. The following Table lists the material and information provided for this project:

DESCRIPTION OF MATERIAL	PROVIDER/SOURCE	DATE
Site Plan with Proposed Building and Pond Locations	Joe Bunker / Email	4/27/2017
Preliminary Traffic Loading and Building Elevations	Brett Oftedahl / Email	6/21/2017

PSI understands that the project may include the demolition and removal of up to 3 of the existing buildings in addition to the construction of a new 13,529 square foot salt shed along with, possibly, a stormwater management basin. Based on discussions with Strand Associates it is understood that one of the existing buildings may remain on the site for use as a cold storage facility (denoted as Existing Building #2). In addition, the existing structure that may remain will be surrounded by asphalt pavement and the planned salt shed is to be partially surrounded by asphalt pavement. This proposal is based on the proposed new salt storage structure being a single story high-bay structure with a finished floor elevation being at or near existing grade.

Based on discussions with Strand, WisDOT is considering raising the site grades around existing building #2 on the site to accommodate the use of that building. The finish floor elevation of building #2 is approximately 4 feet above the surrounding site grades. Strand has indicated that the site design concept around existing building #2 has not yet been established. Based on preliminary site grading information, the finished floor elevation of the salt shed will be an elevation of approximately EL. 902 if existing building #2 remains and the site is raised in elevation. However, if existing building #2 is removed, the finished floor elevation of the salt shed will be approximately EL. 899. It is also understood that the incorporation of a stormwater management basin is uncertain at the time of this report.

It is understood that the building is planned to be a contractor-designed structure. However, based on the information provided by Strand, wall loads are anticipated to be in the range of 2 to 3 kips per linear foot. The anticipated structure type for the planned salt shed is to consist of wood side walls with columns and bracing at 8 feet on center around the building. The wall loads from the building will be transferred to individual spread footings at approximately 8 feet on center. It is understood that a continuous strip footing around the building perimeter is not anticipated for this type of structure. In addition, it is also unknown if lateral bracing anchors are planned to be incorporated into the design of the salt shed.

The anticipated floor loading for the salt shed is as follows. The stored salt pile within the shed may be as high as 30 feet above the floor at the center of the pile, and will reduce to about 12 feet at the side walls. It is understood that the unit weight of the salt to be used for design of the floor slab is 100 pounds per cubic foot (pcf). Multiplying this load by the anticipated height of the pile will result in a loading intensity on the floor slab of approximately 1,200 pounds per square foot (psf) at/near the side walls and a maximum loading of approximately 3,000 psf at the very center of the pile. The anticipated floor for the salt shed will consist of asphalt.

Based on the preliminary information, a large front-end loader will be used on site, it is anticipated that it will take about 4 buckets to fill the dump trucks. It is also anticipated that the large front-end loader is to be used for snow removal of the site. In addition, it is understood the site will be used by fully loaded tractor trailers (WB-65) and large dump trucks. The exact frequency of trucks on this site is unknown, however, Strand estimated the shed to be filled once per year, requiring approximately 400 loads (from the WB-65 trucks) of salt to fill the shed. It is also anticipated that during a winter storm 50 salt trucks (large dump trucks) will be loaded per storm. It was also estimated for frequency of traffic loading that one storm will occur per week, over a 3-month period from December through March.

For purposes of this report, it is estimated that the large dump trucks would consist of quad-axle dump trucks with a gross weight of 69,000 pounds. The fully loaded tractor trailers (WB-65) are estimated to have a gross weight of 80,000 pounds. The large front-end loader was estimated to have gross weight of 42,000 pounds. The axle weights for the respective trucks were assigned based on the maximum axle loading weights specified by WisDOT.

Traffic loading information with regards to access to the site by passenger vehicles was not provided at the time of this report. However, for purposes of this report the anticipated traffic loading/frequency for any standard-duty pavements is estimated to result in a total of 30,000 ESAL’s based on a service life of 20 years. Based on the traffic loading information provided by Strand, along with the aforementioned assumptions, it is estimated that traffic loading/frequency for the asphalt or concrete heavy-duty pavements will result in approximately 222,197 and 283,788 ESALs, respectively, based on a service life of 20 years. In addition, based on the estimated traffic loading/frequency for the asphalt or concrete heavy-duty pavements located within and around the salt shed, it is anticipated that the pavement will be subject to approximately 1,281,062 and 1,335,761 ESALs, respectively, based on a service life of 20 years.

The following Table lists the structural loads and site features that are required for or are the design basis for the conclusions contained in this report:

STRUCTURAL LOAD/PROPERTY	REQUIREMENT/DESIGN BASIS	
SALT SHED		
Finish Floor Elevation	EL. 902± to EL. 899±	R
Maximum Wall Loads	4 kips per lineal foot (klf)	B
Maximum Floor Loads and Size	3,000 pounds per square foot (psf)	B
Settlement Tolerances	1-inch total; ¾-inch differential between adjacent columns	B
PAVEMENTS		
Pavement 18-kip ESAL (cycle & duration) With a life expectancy of 20 years	Standard Duty – 30,000 ESALs (flexible) Heavy Duty – 222,197 ESALs (flexible) / 283,788 ESALs (rigid) Salt Shed Area – 1,281,062 ESALs (flexible) / 1,335,761 ESALs (rigid)	B

B = Report has been prepared based on this parameter or loading in the absence of information at the time of this report
R = Information supplied by Strand Associates, Inc.

The geotechnical recommendations presented in this report are based on the available project information, building location, and the subsurface materials described in this report. If the noted information is incorrect, please inform PSI in writing so that we may amend the recommendations presented in this report if appropriate and if desired by Strand Associates. PSI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

Purpose and Scope of Services

The purpose of this study was to explore the subsurface conditions at the site and develop geotechnical design criteria regarding foundations, floor slabs, pavements and stormwater basin for the planned project. In addition, PSI was also requested to provide recommended thicknesses for the pavements. Subgrade preparation recommendations and construction considerations are also provided. PSI's scope of services included drilling a total of seven soil borings, select laboratory testing, and preparation of this geotechnical report.

With respect to the proposed 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 possible stormwater management area was beyond PSI's scope of services for this project.

PSI's scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

PSI did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminates in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence of the amplification of the same.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The project site is generally located within the area bounded to the east by Interstate Highway 39, bounded to the west by County Trunk Highway A, bounded to the north by U.S. Highway 51, and bounded to the south by Maple Grove Road. The site, which was formerly owned by Marling Lumber, is currently owned by the Wisconsin Department of Transportation. The site consists of 4 buildings surrounded by a gravel drive. The current site grades have not been provided at the time of this report, however based on aerial imagery, in addition to the elevation of the performed soil borings, the site appears to be relatively flat.

Site Pedology

The U.S. Department of Agriculture *Soil Survey of Dane County, Wisconsin* was reviewed with regard to the pedological classification of the soils in the project area. The soil survey indicates that the soils generally consist of Dodge silt loam and St. Charles silt loam. These soils are described as well drained, and they exhibit variable water table depths of about 40 to 80 inches. These soils are typically classified as silty clay (CL-ML) and sandy lean clay (CL) using the USCS classification system; and as A-4/A-6 using the AASHTO Soil Classification system. The soil survey indicates that the above soil series generally exhibit moderate to poor subgrade support characteristics, with low to high shrink-swell potential, and can exhibit low bearing when wet. These soils are generally assigned Design Group indexes of 13 to 15; a frost index of F-3; and subgrade modulus values of 125 pci.

Subsurface Conditions

The subsurface conditions were explored with seven soil test borings (B-1 to B-7). The following Table indicates the general locations, approximate elevations and depths to which the borings were completed.

BORING NUMBER	GENERAL LOCATION	APPROXIMATE ELEVATION (FEET)	COMPLETION DEPTH (FEET)
B-1	Proposed Salt Shed – SW Corner	898	25
B-2	Proposed Salt Shed – NW Corner	897	25
B-3	Proposed Salt Shed – SE Corner	898	25
B-4	Proposed Salt Shed – NE Corner	898	25
B-5	Proposed Stormwater Basin	898	20
B-6	Proposed Stormwater Basin	898	20
B-7	Proposed Asphalt Drive	899	10

The borings were located in the field by the drill crew utilizing conventional taping procedures referenced to existing site features. In addition, the elevations of the borings were measured in the field by the drill crew utilizing conventional leveling techniques. The boring elevations were referenced to the finish floor elevation of existing building #2, with a known elevation of EL. 903. The locations of the borings are considered to be accurate within a few feet. The elevations are considered to be accurate to within about a foot. The approximate boring locations can be found within the appendix of this report. The borings were advanced utilizing hollow-stem auger drilling methods and soil samples were routinely obtained during the drilling process. Drilling and sampling techniques were accomplished generally in accordance with ASTM procedures. Representative soil samples were obtained from the soil borings and were returned to PSI's laboratory where they were visually classified using the Unified Soil Classification System (USCS) as a guideline. Further, PSI conducted limited laboratory testing on select soil samples to aid in identifying and describing the physical characteristics of the soils and to aid in defining the site soil stratigraphy. The results of the field exploration and laboratory tests were used in PSI's engineering analysis and in the formulation of our engineering recommendations.

USCS Classification (B-1 to B-7)

The surface materials encountered at borings B-2, B-4, and B-6 consisted of about 3 to 6 inches of topsoil. Surficial materials encountered at boring B-7 consisted of about 5 inches of aggregate base.

Surficial materials encountered at borings B-1, B-3, B-5 consisted of about 12 inches of fill material generally consisting of sand and gravel, which was found to be in moist condition. In addition, trace root matter was observed within boring B-5.

Below the above described surficial materials, fill soils were observed in borings B-1 to B-6 extending to depths ranging from about 5½ to 8 feet below the ground surface (EL. 892½± to EL. 889±). Typically, the existing fill materials were observed to consist of lean clay and silty sand with gravel with considerable amounts of concrete and asphalt rubble. In addition, varying amounts of intermixed topsoil was observed within boring B-1. The moisture contents of the fill material were observed to be in the range of 11% to

15%, indicating a moist condition. The granular fill materials were found to be very dense with "N-Values" obtained from Standard Penetration Tests (SPT) of about 50+ blows per foot (bpf). However, these N-values are considered to be artificially elevated due to the presence of considerable amounts of rubble within the fill. The cohesive fill soils were medium stiff with estimated unconfined compressive strengths of 2 to 2.25 tons per square foot (tsf).

Below the above described surficial and/or fill materials, native soils were observed extending to the boring termination depths (EL. 899± to EL. 872±). Typically, the native soils were observed to consist of brown lean clay, light brown silty fine sand, as well as some sandy silt, clayey sand and sandy clay. The moisture contents of the native lean clay soils were observed to be in the range of about 15% to 26%, indicating a moist to wet condition. The native lean clay soils were stiff to very stiff in consistency with estimated unconfined compressive strengths of 1 to 3 tons per square foot (tsf), but most typically near 2 tsf. The moisture contents of the native granular soils were found to be in the range of about 7% to 15%, but more typically in the range of about 8% to 9%, indicating a moist condition. The granular native soils were found to be loose to very dense in consistency with "N-Values" in the range of about 8 to 55 bpf, but more typically in the range of about 15 to 31 bpf.

USDA Soil Classification – Proposed Stormwater Pond Borings B-5 and B-6

Borings B-5 and B-6, located in the area of the proposed stormwater pond, were additionally classified in accordance with the USDA Textural Soil Classification System for infiltration and stormwater design purposes. The surficial soils encountered at the location of boring B-6 consisted of about 3 inches of topsoil. Surficial soils encountered at the location of boring B-5 consisted of about 12 inches of fill material comprising of a dark yellowish brown gravelly loamy sand.

Below the above described surficial materials fill soils consisting of a light yellowish brown to brown gravely loamy sand were observed extending to depths of about 5½ to 8 feet below the ground surface (EL. 892½± to EL. 890±). Below the above described fill soils were native cohesive soils generally consisting of dark yellowish-brown clay, clay loam and sandy clay loam to depths of about 10½ to 15½ feet (EL. 882½± to EL. 887½±). Below the cohesive soils was a yellowish brown gravely sandy loam, extending to the boring termination depths (EL. 878±).

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the appendix should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, penetration resistances, locations of the samples and laboratory test data. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on these boring logs. The samples that were not discarded during classification or altered by laboratory testing will be retained for 60 days from the date of this report and then will be discarded.

Groundwater Information

Groundwater observations were made during the drilling operations, and in the open boreholes at completion. No groundwater was encountered during auger advancement in any of the borings performed. Upon completion and removal of the augers, groundwater was not present in any of the borings above the caved soils. However, it should be noted that a zone of wet soils was encountered within boring B-2 from 11.5 to 16.5 feet below the ground surface (EL. 886½± to EL. 880½±). These wet soils appear to be indicative of a perched or trapped condition at boring B-2.

The groundwater level at the site will fluctuate based on variations in rainfall, snowmelt, evaporation, surface run-off and other related hydrogeologic factors. The water level measurements presented in this report are the levels that were measured at the time of PSI's field activities.

EVALUATION AND RECOMMENDATIONS

Geotechnical Discussion

There are five primary geotechnical related concerns at this site. The following summarizes these concerns:

1) ***Existing fill material was encountered within the borings performed within the proposed salt storage structure footprint (borings B-1 to B-4) extending to depths of approximately 5½ to 8± feet below existing ground surface (EL. 892½± to EL. 889±). In addition, intermixed topsoil was encountered within the fill boring B-1 at a depth of about 3 to 5½ feet below the existing ground surface (EL. 895± to 892½±). These fill soils are not recommended for foundation support within the proposed building area. It should be anticipated that the depth and consistency of the unsuitable existing fill materials may change vary between and beyond boring locations, and between sampling intervals.***

Based on the borings, the fill material encountered within borings B-1 through B-4 appears to contain considerable amounts of asphalt and concrete rubble. Typically, fill soils such as these are indicative of uncontrolled fills. Large pieces of asphalt and concrete rubble can artificially elevate N-values, and can result in voids in the deposit. As such, these existing fill materials are not considered suitable for foundation support due to their potential for excessive overall and/or differential settlement, and resulting distress to the overlying foundation elements. **PSI does not recommend that new foundations be supported upon the existing undocumented fill, or newly placed**

structural fill placed upon these materials. Within foundation subgrade excavations, full removal of any existing fill soils and any buried organics to expose the underlying suitable natural soils, is therefore recommended. Shallow foundation systems supported on suitable natural soils, compacted engineered fill, or lean mix concrete founded upon suitable underlying natural cohesive soils, may be used for building support provided the site is prepared as outlined below and the recommendations contained herein are followed. The footing observation program discussed in this report will be critical in terms of foundation performance.

It is anticipated that for the most part, the existing fill within the proposed salt shed area, provided it has been observed and tested by a qualified geotechnical engineer during construction, will be suitable for subgrade support within the floor area as well as for the site pavement portions of the project. Therefore, complete removal of the existing fill is generally not considered to be required in these areas provided the owner can accept the inherent risk of some possible differential settlement and reduced service life of the pavement by relying upon existing fill soils for structural support.

The adherence to the initial site preparation recommendations is considered critical to verify a suitable subgrade exists, prior to the placement of new fills required to obtain project grades. Depending upon the moisture conditions at the time of construction, some surficial instability may be encountered across the site due to the moisture sensitive nature of the soils. The project geotechnical engineer must be available throughout construction to provide guidance where necessary.

2) ***When excavations extend into the existing fill material, sloughing/caving of the sidewalls can occur. Significantly widened excavations may result, or be required for stability.***

Fill materials containing apparent considerable amounts of concrete and asphalt rubble were observed within borings B-1 through B-4, performed within the proposed building footprint. These soils have the potential for instability when excavations extend through them due to the variable nature of the fill materials.

3) ***It should be anticipated that the near surface silty and clayey soils at this site may be in a very moist to wet condition in areas once exposed below the surface materials, which will result in these materials being unstable.***

Higher moisture contents, if encountered during construction, will cause the silty and clayey soils to be unstable, especially when subjected to construction traffic. Where observed during construction, very moist or wet, unstable clay soils may either be scarified, dried, and recompacted according to WisDOT Standard Specifications section 207.3.6.3 for Special Compaction, or excavated below subgrade (EBS), and replaced with a select granular material such as those specified in Sections 209, 305, or 312 of the WisDOT Standard Specifications. Special Compaction, rather than Standard Compaction, is specifically recommended due to the presence of existing, undocumented fill soils, and fine-grained soils which were in a very moist condition during the exploration. In areas of EBS, excavation below subgrade to a depth of about

Does WisDOT have a preference for the materials that are being recommended by PSI? Does WisDOT agree with the recommendation for special compaction that is provided throughout the report?

1 to 2 feet and the placement of select granular fill, along with the placement of a geogrid such as BX1200, if necessary, can generally be used to improve the stability of the subgrade. Additionally, in order to lessen the “bath tub” effect, the bottom of over-excavations in pavement areas should be sloped to drain to a 4-inch draintile that is in turn sloped to drain (minimum slope of 1 percent) to the nearest catch basin, or daylighted to an appropriate area of the site.

It must be recognized that soil stability can be dependent on such factors as soil type and moisture content, weather conditions at the time of construction, and also construction disturbance. Thus, the need to perform EBS, or not, generally must be determined based upon field observations made during subgrade preparation. However, clayey soils are very sensitive to moisture and disturbance. As such, at least some EBS of these soils should be expected to be necessary during subgrade preparation.

4) ***Perched water conditions were apparent within boring B-2. Excavations required to extend below the depth of perched water will require temporary dewatering methods such as the use of sump pits and pumps.***

The methods for dewatering the excavation must ultimately be determined by the contractor so as to prevent standing water in the trench during construction activities. Based upon PSI’s past experience, the apparent perched conditions encountered should generally be able to be managed through the use of properly placed and sized sump pits and pumps.

5) ***Due to the predominance of low permeability clay soils encountered within the pavement subgrade, adequate drainage of the aggregate base will be imperative for maintaining as dry of a subgrade condition as possible to maximize subgrade support and reduce the effects of freeze-thaw cycles. Minimum drain tile placement, as described in the Pavement Recommendation section, should be provided below the entire length of the roadway replacement in order to improve drainage of the aggregate base materials.***

In order to provide adequate drainage for the aggregate base, minimum drain tile placement, as described in the Pavement Recommendations section, should be used in the pavement design to help provide a drained condition within the aggregate base below the asphalt pavement. A drained condition will help reduce heaving and softening of the subgrade soils.

The following geotechnical related recommendations have been developed on the basis of the subsurface conditions encountered and PSI’s understanding of the proposed development. Should changes in the project criteria occur, a review must be made by PSI to determine if modifications to our recommendations will be required.

Site Preparation

Prior to the placement of new fill or preparation of the construction area subgrade, PSI recommends that any surficial topsoil materials, vegetation, or other unsuitable soils be removed from within and to a minimum distance of 10 feet beyond proposed structural areas (buildings and pavements).

Old building foundations, building remnants, associated underground utilities not intended for reuse, or unsuitable backfill materials, should be completely removed from within and a minimum of 10 feet beyond new building areas. The resulting excavations should then be backfilled with select granular materials such as those described in WisDOT Standard Specifications Sections 209, 305, or 312, which are compacted by Special Compaction as specified in WisDOT Standard Specifications 207.3.6.3. In order to utilize backfill soils for support of the new structure and pavements, the backfill materials must be placed in a controlled manner, to the specified level, which is monitored by the project geotechnical engineer. Complete removal of foundations, foundation walls or concrete floor slabs need not be completely removed from within pavement and landscape areas; however, PSI recommends they be removed to a minimum depth of 2 feet below planned subgrade elevation (bottom of aggregate base course elevation) to provide a more uniform subgrade condition.

Higher moisture content soils may be exposed during the above operations. These soils will be sensitive to moisture and disturbance when the confining weight of the overburden materials is removed. These soils may require some form of stabilization and must be prepared according to WisDOT Standard Specifications section 211. Accordingly, any unstable subgrade areas should be over-excavated and subsequently backfilled as directed by the project geotechnical engineer.

Prior to placement of new fills, and subsequent to cutting high areas of the site to planned grades, the subgrades within the building and pavement areas should be proof compacted and proof rolled. Proof compaction should be performed with a heavy (minimum 10-ton static weight) compactor. A fully-loaded tandem axle dump truck, or rubber tired vehicle of similar size and weight, typically 9 tons/axle, should then be used for the proof roll. Soils that are observed to rut or deflect excessively under the moving load (typically greater than about 1 inch), should be undercut and replaced with properly compacted fill. The proof rolling is important to identify soft or loose zones under buildings and pavements. The proof rolling and undercutting activities should be documented by a representative of a qualified geotechnical engineer and should be performed during a period of dry weather. The subgrade soils should be scarified and compacted according to Special Compaction due to the presence of existing undocumented fill soils, and very moist fine-grained soils, which will likely require at least some moisture conditioning to achieve the required density and a stable condition. The depth of scarification should not be less than six inches below the surface. Drying or wetting of the subgrade soils, typically to within 3% of the optimum moisture content, may be advised to facilitate compaction.

New structural fill materials should include select granular materials such as those specified in WisDOT Standard Specifications sections 209, 305, or 312. As stated, the select granular materials should be placed in maximum lifts of eight inches of loose material and should be compacted within 3% of the optimum moisture and to a minimum of 95 percent of the maximum dry density as determined by the standard Proctor test (ASTM D 698/AASHTO T99), as specified for Special Compaction. If water is to be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying. Each lift of compacted select granular materials should be observed and tested by the project geotechnical engineer prior to placement of subsequent lifts. The lateral extent of the over-excavation of poor soil and subsequent placement and compaction of the select granular materials should be equal to or greater than the depth of over-excavation below finished floor elevation. As for the pavement areas, the newly placed compacted select granular materials should extend laterally a distance at least equal to the necessary thickness of fill required to reach planned development grades.

When excavations encroach upon or extend below the groundwater or perched zones, and into sandy or silty soils, subgrade instability and sloughing/caving of sidewalls can occur. Some over-excavation of softened or loosened soils, in conjunction with the use of a crushed stone working mat, may be necessary. Additionally, significantly widened excavations may result, or be required for stability. Dewatering, such as with the use of sump pits and pumps, will be required.

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.

The adherence to the initial site preparation recommendations are considered critical to verify a suitable subgrade exists, prior to the placement of any new fills required to obtain project grades. Some surficial instability should be anticipated across the site due to the moisture sensitive nature of the clay and silt soils and the presence of variable fill. During earthwork operations, a representative of the geotechnical engineer should be present on-site on a full-time basis to verify the subgrade conditions and placement and compaction of new fills.

Foundation Recommendations

Based on borings B-1 through B-4 performed within the proposed footprint of the Salt Shed, the proposed structure may be supported by individual concrete spread footings, or conventional continuous wall and/or column footings, which bear upon suitable native soils, or upon newly placed and compacted fill or lean concrete placed upon suitable native soils. However, based the borings and the estimated finish floor elevation (EL. 902 and EL. 899 for the two different options, respectively), the soils at the approximate footing bearing elevations (EL. 898± or EL. 895±) are estimated to consist mainly of fill with variable amounts of concrete and asphalt rubble. These fill soils are not considered to be suitable for foundation support. All footings must therefore be extended through any existing fill to bear upon suitable bearing underlying natural soils. Fill soils were present within borings B-1 to B-4 extending to depths of about 5½ to 8±

feet below existing ground surface (EL. 892½± to EL. 889±). Over-excavation depths below frost footing grade of about 5½ to 9 feet or 2½ to 6 feet will generally be required, depending upon the finished floor elevation chosen.

Based on the foundations bearing upon suitable native soils, or newly compacted engineered fill or lean concrete placed upon suitable bearing native soils that have been observed and tested, PSI recommends that footings be designed for a maximum net allowable soil bearing pressure of **3,000 pounds per square feet (psf)** for column footings and wall footings based on dead load plus design live load. Minimum dimensions of 20 inches for continuous footings and 30 inches for any column footings should be used in foundation design to minimize the possibility of a local bearing capacity failure, even if the allowable bearing pressure recommended herein is not fully utilized.

Where unsuitable bearing soils are encountered in a footing excavation, the excavation should be deepened to competent bearing soil, and the footing could be lowered or an over-excavation and backfill procedure could be performed. An over-excavation and backfill treatment would require widening the deepened excavation in all directions at least 6 inches beyond the edge of the footing for each 12 inches of over-excavation depth. The over-excavation should then be backfilled with select granular materials such as those described in WisDOT Standard Specifications sections 209, 305, or 312 which are compacted according to Special Compaction. In order to utilize backfill soils for support of the foundation, the backfill materials must be placed in a controlled manner, to the specified level, which is monitored by the project geotechnical engineer.

As an alternative to supporting the footings at deeper elevations or on structural backfill properly placed with Special Compaction methods, footings may also be designed to bear upon a lean concrete founded upon suitable bearing natural soils. If this option is chosen, the footing excavation should extend a minimum of 6 inches beyond each face of the footing.

A method for evaluating the acceptability of the natural soils under the footing would involve hand auger and static cone or dynamic cone penetrometer testing below the footing bearing level. Based on the recommended net allowable bearing pressure of 3,000 psf for the proposed salt shed, suitable bearing natural clay soils should be at least medium in consistency with minimum penetrometer values of 1.5 tons per square foot (tsf); and suitable bearing granular soils must have dynamic cone penetrometer values commensurate with a Standard Penetration Test N-value of at least about 10 bpf.

Exterior footings and footings in unheated areas should be located at a depth of at least 48 inches below the final exterior grade to provide adequate frost protection. If the building is to be constructed during the winter months or if footings will likely be subjected to freezing temperatures after foundation construction, then the footings and concrete should be adequately protected from freezing.

Where perched water is encountered, the need for some dewatering should be anticipated. The methods for dewatering the excavation must ultimately be determined by the contractor so as to prevent standing water in the trench during construction activities.

Dewatering is generally recommended to be performed to a depth of at least 2 feet below the lowest anticipated depth of excavation.

After opening, PSI recommends that the soils at foundation bearing elevation in the footing excavations be observed and tested by a representative of a qualified geotechnical engineer prior to concrete placement, to evaluate the suitability and uniformity of the bearing materials for support of the design foundation loads. Once the support soils are observed and tested, the concrete should be placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. If it is required that footing excavations be left open for more than one day, they should be protected to reduce evaporation or entry of moisture.

Lateral Bracing Anchor Recommendations

The incorporation of lateral bracing anchors for the proposed salt shed walls was unknown at the time of the report. However, where their use is considered, the following recommendations should be followed.

The lateral bracing forces may be resisted by conventional, reinforced cast-in-place concrete piers or deadmen, or a continuous wall or strip footing foundation. Vertical uplift forces may be resisted by the weight of the concrete and overlying backfill soil, if applicable. Horizontal forces may be resisted by the passive pressure developed by the adjacent supporting soil. Proper placement and/or compaction of the backfill soils above and adjacent to the anchor foundations will be essential for the development of uplift and lateral resistance. The soil mass for resisting uplift forces may be estimated by a line extending from the top outer edge of the horizontal projection of the footing to the ground surface, rotated outward from the footing 30˚ from the vertical. If the anchor footing does not have a horizontal projection then this contribution would not apply. A well-graded granular material, such as those recommended in WisDOT Standard Specifications sections 209, 305, or 312, is recommended for use as backfill above and alongside the lateral bracing foundations. The backfill must be placed in lifts not exceeding 8 inches in thickness, at moisture contents near optimum, and be compacted according to Special Compaction in order to develop the required lateral support and uplift.

For the recommended well-graded granular soils, a soil moist unit weight of 125 pounds per cubic foot, an internal friction angle of 32˚, passive pressure coefficient (K_p) of 3.2, and an at-rest pressure coefficient (K_o) of 0.47, may be used for design of the anchors. For these values to be applicable, the backfill must extend around the foundations for a lateral distance of at least equal to the height of the foundation or 4 feet, whichever is less. Surface soils that are subject to strength loss due to freeze/thaw cycles within the upper 4 feet may not provide sufficient passive earth pressure resistance. Therefore, consideration must be made in this regard for design calculations. An appropriate safety factor must be applied to all design values. Additionally, is must be recognized that significant foundation movement will likely be required in order to develop full passive resistance, and should be considered in the design. Proper tensioning of the lateral bracing to develop lateral resistance will also be necessary.

Exterior/Unheated Area Slabs

Entry slabs, sidewalks, aprons, and other slabs in exterior or unheated areas will likely bear upon clay soils. Such materials are frost susceptible and poorly drained. Slabs placed directly upon such soils 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). Where encountered in exterior/unheated area slabs, it is recommended that consideration be given to limited undercutting of the frost susceptible materials to a depth of 1 to 2 feet below the slabs, and replacement with select materials similar to materials specified in WisDOT Standard Specifications sections 209, 305, or 312, which are compacted by Special Compaction methods. A properly designed underdrain system connected to the municipal sewer (if permissible) or directed to on-site storm water management devices should also be incorporated to reduce the potential effects of freeze/thaw cycles.

Seismic Site Class

The 2009 International Building Code requires a site class for the calculation of earthquake design forces. This class is a function of soils type (i.e. depth of soil and strata types). Based on the estimated density of the soils observed within the boring locations, **Site Class "D"** is recommended.

Pavement Recommendations

It is anticipated that the existing fill within the proposed salt shed area, provided it has been observed and tested by a qualified geotechnical engineer during construction, will generally be suitable for subgrade support within the floor area as well as for the site pavement portions of the project. Therefore, complete removal of the existing fill is generally not considered to be required in these areas provided the owner can accept the inherent risk of some possible differential settlement and reduced service life of the pavement by relying upon existing fill soils for structural support.

PSI understands that new asphalt paved access roads and parking areas are planned for the project. Additionally, it is understood that the interior salt shed floor will be constructed as an asphalt pavement section to alleviate concerns with potential corrosivity of salt to a concrete floor slab option. Based on the borings, PSI anticipates the subgrade soils within the pavement areas will consist of areas of native lean clay, areas of existing fill, as well as areas with newly placed and compacted select granular materials, or a combination thereof. PSI recommends that the subgrade soils for the pavements be prepared in accordance with the Site Preparation section of this report. The following subgrade parameters are recommended for the pavement design based on the predominance of cohesive subgrade soils, when the subgrade is prepared as discussed in the site preparation section of this report.

AASHTO Soil Classification	Material	SSV	DGI	Subgrade Reaction Modulus, k (pci)	Resilient Modulus, M_R (psi)	CBR	Frost Index
A-6	Il-Poorly Sorted	4.0	14	125	2,800	3	F-3

Note: The above parameters were estimated based upon the soil classification, boring information and were not measured in the laboratory.

The CBR value given above has been estimated. For a less conservative CBR value, PSI recommends that actual CBR tests be performed on each type of material, including the proposed base course material. Preparation of the existing ground surface and construction of the new subgrade and pavements should be in accordance with the Wisconsin Department of Transportation Standard Specifications (Standard Specifications).

Based upon the soil survey review and engineering judgement, PSI estimated the additional soil parameter values shown in the following table based on the predominance of cohesive subgrade soils that were observed beneath the surficial materials in the majority of the soil borings. PSI understands that these parameters are required for pavement design using AASHTOware software. PSI was only requested to provide the following parameters and not perform any AASHTOware analysis.

LABORATORY TEST		ESTIMATED VALUES FOR LEAN CLAY SOIL SUBGRADE
Maximum Dry Density-AASHTO T99 (pcf)		125±
Optimum Moisture Content (%)		15±
Specific Gravity		2.69±
Atterberg Limits	Liquid Limit	<45
	Plasticity Index	>11
Grain Size Distribution (Percent Passing)	#4 Sieve	100-95±
	#10 Sieve	100-90±
	#40 Sieve	95-85±
	#200 Sieve	95-65±
Depth to Bedrock		>25

PSI was additionally requested to provide recommended pavement thickness for the pavements on the site. The anticipated floor loading for the salt shed is as follows. The stored salt pile within the shed may be as high as 30 feet above the floor at the center of the pile, and will reduce to about 12 feet at the side walls. Strand indicated that the unit weight of the salt to be used for design of the floor slab is 100 pounds per cubic foot (pcf). Multiplying this load by the anticipated height of the pile will result in a loading intensity on the floor slab of approximately 1,200 pounds per square foot (psf) at/near the side walls and a maximum loading of approximately 3,000 psf at the very center of the pile. It is understood that the floor for the salt shed will consist of asphalt.

Based on the preliminary information provided, a large front-end loader will be used on-site to load and handle the salt. It is also anticipated that the large front-end loader is to be used for snow removal of the site. In addition, it is understood that the site will be used by fully loaded tractor trailers (WB-65) and large dump trucks. The exact frequency of trucks on this site is unknown, however, Strand has estimated the shed will be filled once per year, requiring approximately 400 loads (from the WB-65 trucks) of salt to fill the shed. It is also anticipated that during a winter storm that 50 salt trucks (large dump trucks) will be loaded per storm. It is also estimated that one storm will occur per week over a 5-month period from December through March.

For purposes of this report, it is estimated that the large dump trucks would consist of quad-axle dump trucks with a gross weight of 69,000 pounds. The fully loaded tractor trailers (WB-65) are estimated to have a gross weight of 80,000 pounds. The large front-end loaders are estimated to have gross weight of 42,000 pounds. The axle weights for the respective trucks were assigned based on the maximum axle loading weights specified by WisDOT.

Traffic loading information with regards to access to the site by passenger vehicles was not provided at the time of this report. However, for purposes of this report the anticipated traffic loading/frequency for any standard-duty pavements is estimated to result in a total of 30,000 ESAL's based on a service life of 20 years. Based on the traffic loading information provided, along with the aforementioned assumptions, it is estimated that traffic loading/frequency for the asphalt or concrete heavy-duty pavements will result in approximately 222,197 and 283,788 ESAL's, respectively, based on a service life of 20 years. In addition, based on the estimated traffic loading/frequency for the asphalt or concrete heavy-duty pavements located within and around the salt shed, it is anticipated that the pavement will be subject to approximately 1,281,062 and 1,335,761 ESAL's, respectively, based on a service life of 20 years.

If these traffic loads are not indicative of the actual loads, PSI must be contacted immediately to review this data. The existing native clay soils encountered below the surficial topsoil and fill materials are considered medium subgrade materials, having a minimum CBR value of 3 according to the Wisconsin Asphalt Pavement Association Design Guide. Select granular materials used to raise existing grades within parking and drive areas should meet or exceed this CBR value. The following design factors were used in developing the recommended pavement sections:

DESIGN FACTOR	ASPHALT	CONCRETE
Design Life	20 years	20 years
Reliability	0.85	0.85
Overall Deviation	0.45	0.35
Modulus of Rupture	-	600 (4,000 psi concrete)
Modulus of Elasticity	-	4,000,000 psi
Load Transfer Coefficient	-	3.2
Drainage Coefficient	1	1
Modulus of Subgrade Reaction	125 pci	125 pci
CBR/Resilient Modulus	3 / 2,800 psi	3 / 2,800 psi
Initial Serviceability	4.2	4.5
Terminal Serviceability	2.0	2.0
Design Traffic (Standard Duty)	30,000 ESALs	-
Design Traffic (Heavy Duty)	222,197 ESALs	283,788 ESALs
Design Traffic (Heavy Duty – Salt Shed Area)	1,281,062 ESALs	1,335,761 ESALs
Assumes large front-end loader used for snow plowing		

If during the final design phase these values are determined to be incorrect, PSI must be contacted to provide revised pavement recommendations. Based upon the soil borings, laboratory data and provided the subgrade soils are prepared as outlined in this report, the following flexible pavement sections are recommended for areas used by passenger vehicles (Standard-Duty), and drive lanes for the trucks (Heavy-Duty). In addition, a preliminary Heavy-Duty pavement section for the asphalt floor of the Salt Storage Facility, as well as the immediate area around the facility, has also been provided. It is assumed that this area will be heavily traveled by the front-end loader. This must be verified after the final loading conditions on the floor have been determined.

Recommended Asphalt Pavement Section Thickness

PAVEMENT COMPONENTS	STANDARD DUTY* AREAS	HEAVY DUTY AREAS	SALT SHED AREA	STRUCTURAL COEFFICIENTS
Hot Mix Asphalt Surface Course	1½"	2"	3	WisDOT FDM 14-10, Attach. 5.1 (a=0.44)
Hot Mix Asphalt Binder Course	2"	2½"	3½	WisDOT FDM 14-10, Attach. 5.1 (a=0.44)
Aggregate Base Course (Upper)	8"	4"	4"	WisDOT FDM 14-10, Attach. 5.1 1.25" Crushed Stone (a=0.14)
Aggregate Base Course (Lower)	-	8"	10"	WisDOT FDM 14-10, Attach. 5.1 3" Crushed Stone (a=0.14)

***If a front-end loader is used to clear snow in this area, PSI recommends placing a BX1200 geogrid below the base course or adding 2 inches of base course to the section.**

The granular base course should consist of well-graded crushed stone meeting the requirements from sections 209, 305, or 312 of the WisDOT Standard Specifications, and should be compacted according to Special Compaction. Special Compaction, rather than Standard Compaction, is recommended due to the heavy loads anticipated at this site. The upper and lower layers of stone should consist of 1¼ inch and 3-inch sized aggregate, respectively. If a material other than crushed stone is used, such as crushed gravel or crushed concrete, the structural coefficients in the table above must be revised. A representative of a qualified geotechnical engineer must test the base course material prior to, and during, placement.

In addition, it is recommended that a geotextile fabric be used to prevent migration of the aggregate base course into the subgrade over time for the heavy duty and salt shed pavements. A subgrade-aggregate-separation (SAS) type fabric, specified under section 645.2.2.2 of the State of Wisconsin Standard Specifications for Highway and Structure Construction, is recommended.

Asphaltic binder and surface courses should meet the requirements from Section 460 of the State of Wisconsin Standard Specifications for Construction. Asphaltic courses should be placed and compacted to the minimum required density contained within section 460 of the Standard Specifications. An adequate number of in-place density tests should be performed during construction to document the placement compaction. The pavements should be sloped to provide positive surface drainage. Water should not be allowed to pond on or adjacent to the pavement as this could saturate the subgrade and cause premature pavement deterioration. The granular base course should be protected from water inflow along drainage paths. Additionally, the granular base course should extend beyond the edges of the pavement in low areas to allow any water that enters the base course stone a path for exit.

It may be advantageous to utilize rigid Portland Cement Concrete pavement at dumpster pad areas and at entrance and exit aprons. It is recommended that a minimum of 7 inches of 4,000 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 305 (for concrete and base course, respectively) of the WisDOT Standard Specification.

The paved areas are recommended to be constructed with attention to final grades to facilitate drainage. Otherwise, a storm sewer system may be appropriate to carry away storm run-off water. Construction of the subgrade and pavements should be in accordance with the project specifications.

PSI recommends that subsurface drains be installed. If placed properly, subsurface drains will greatly reduce the amount of trapped water under the pavement surfaces. Trapped water leads to subgrade degradation and increases pavement heave during winter months. It is recommended that underdrains be placed within the subgrade, just below the granular base. Minimally, these drains should be placed in low spots in the pavement, at the toe of slopes that are draining toward pavement surfaces, undercuts that have been filled with select granular fill, and as finger drains. At a minimum, finger drains should consist of installing 3 to 4 drain tiles extending radially outward, 20 feet from each interior catch basin. In addition, drain tiles should extend along curb lines, 20 feet up the slope from curb inlets. The drain tile details should follow the Facilities Development Manual Chapter 13, Section 40.

Periodic pavement maintenance is required to keep a pavement, under normal traffic and environmental conditions, as near as possible to its constructed 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. Unrepaired areas will generally lead to more severe and widespread distress, and eventually, pavement disintegration. Therefore, periodic maintenance consisting of crack sealing, seal coating every 3 to 5 years, and other necessary repairs at least annually, will be required to obtain the design service life.

Infiltration Characteristics of Subgrade Soils

Borings B-5 and B-6 were performed within the proposed stormwater management basin to the south of the proposed Salt Shed. Field infiltration testing was not requested at the time of field exploration. However, for design purposes the following table provides estimates of design infiltration rates for different soil textures and is based on Table 2 of the Site Evaluation for Stormwater Infiltration (1002) document, which is published by the Wisconsin Department of Natural Resources Conservation Practice Standards.

SOIL TEXTURE	DNR 1002 TABLE 2, DESIGN INFILTRATION RATE WITHOUT MEASUREMENT (IN/HOUR)
Coarse sand or coarser (COS)	3.60
Loamy coarse sand (LCOS)	3.60
Sand (S)	3.60
Loamy sand (LS)	**1.63**
Sandy loam (SL)	**0.50**
Loam (L)	0.24
Silt loam (SIL)	0.13
Sandy clay loam (SCL)	**0.11**
Clay loam (CL)	**0.03**
Silty Clay loam (SICL)	0.04
Sandy clay (SC)	0.04
Silty clay (SIC)	0.07
Clay (C)	**0.07**

NR-151 guidelines indicate infiltration rates shall be based on the least permeable soil horizon within 5 feet of the bottom elevation of the proposed infiltration system. The bottom elevation of the proposed stormwater management basin has not been provided to PSI at the time of this report.

The fill material at borings B-5 and B-6, located within the proposed stormwater management basin, were classified as a gravely loamy sand (LS) with a design infiltration rate of 1.63 inches per hour based on Table 2 above, making them non-exempt from infiltration according to Wisconsin Administrative Code NR 151. However, it must be recognized that the actual infiltration rates of the in-place fill soils can vary significantly from the estimated table values depending on the uniformity and in-place density. This is especially true of fill soils containing varying amounts of asphalt and concrete rubble.

The Clay (C), Clay Loam (CL), Sandy Clay Loam (SCL) soils observed below the fill material at borings B-5 and B-6, have design infiltration rates of 0.11 to 0.03 inches per hour based on Table 2 above. These infiltration rates are less than 0.6 inches per hour, and this soil is therefore exempt from the infiltration requirements of NR151.12(5)(c) under NR151.12(5)(c)6a**.**

The Gravelly Sandy Loam (SL) soils encountered have an estimated infiltration rate of 0.5 inches per hour, based on Table 2 above. This infiltration rate is less than 0.6 inches per hour. However, field verification testing of the actual in-situ infiltration rate for these materials is required under Step C5 of the Site Evaluation for Stormwater Infiltration document, to confirm they are exempt from the infiltration requirements of NR151.12(5)(c) under NR151.12(5)(c)6a.

If the basin is designed as a wet pond, the clay soil encountered are generally considered to be of low permeability, and may be suitable for such purpose. However, zones of more permeable granular soils may be present within upper portions of the basin sidewalls, or along the bottom in areas beyond borings B-5 and B-6. It may therefore be necessary to install a properly designed clay liner along at least portions of the basin side walls and bottom. This must be of adequate thickness and low permeability. Natural or clay liner materials along the bottom and sidewalls of the basin are generally recommended to have a hydraulic conductivity of $1X10^{-7}$ cm/sec or less. Past experience has shown that soils which have a grain size distribution of at least 50 to 75 percent passing the No. 200 sieve, a clay content of 25 to 50 percent, a liquid limit of 25 or more, and a plasticity index of 12 or more, have the potential to exhibit a hydraulic conductivity of $1X10^{-7}$ cm/sec when properly compacted. However, the above properties are general guidelines. The permeability of the liner material can vary significantly depending upon its consistency, density, compaction level, as well as other factors. It is recommended that the liner design be performed by an experienced engineer, in accordance with applicable regulations and guide lines. It is also recommended that proper testing of the clay soils be performed during construction to verify estimated properties.

The liner and natural soils used for the basin perimeter must be sufficient to resist lateral earth and water pressure, as well as outward migration that may occur, possibly through tension or shrinkage type cracks. Where it is necessary to raise grades around the basin, the fill soils must consist of clay soils that have relatively low permeabilities when properly placed and compacted. The on-site non-organic clay, silty clay, clay loam and sandy clay loam soils are expected to be suitable for liner and embankment construction purposes when properly placed and compacted to at least 95% of the maximum dry density as determined by Standard Proctor Method. However, additional confirmation testing is recommended.

The preceding infiltration rate estimates are intended only for use in preliminary planning. In-situ testing, such as with a double ring infiltrometer, along with test pits in other areas of the basins are recommended to allow more detailed evaluation of subsurface conditions, including groundwater levels, and to provide more representative infiltration rates to be used in the final basin design. It is recommended that the bottom of the stormwater management area be observed by qualified geotechnical personnel at the time of construction to verify the soil types. The type of basin and intended use, such as being “wet” or “dry”, must be carefully considered when evaluating infiltration rates.

It must be recognized that actual infiltration rates will be somewhat variable depending upon the uniformity, in-place density, and/or grading of the subsoils below the individual basin or trench footprint. It should also be recognized that the performance of the basin could be affected by other factors such as densification by construction equipment and sedimentation. A maintenance program must be developed to address the removal of sedimentation and or organic materials should they develop. Additionally, it is recommended that the basin design be performed by an experienced civil engineering firm, and that thorough review of applicable codes (especially NR151) and regulations be performed. Proper design and construction of sidewalls and berms will also be essential for proper basin performance.

CONSTRUCTION CONSIDERATIONS

The project geotechnical engineer must be available throughout construction. PSI will not accept any responsibility for any conditions that deviated from those described in this report, nor for the performance of the foundation or pavement if we are not engaged to also provide construction observation and testing for this project.

Moisture Sensitive Soils/Weather-Related Concerns

The soils encountered at this site are expected to be sensitive to disturbances caused by construction traffic and changes in moisture content. Increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather.

Water should not be allowed to collect in the foundation excavation, on floor slab or pavement areas, or on prepared subgrades during or after construction. Areas should be sloped to facilitate removal of collected rainwater, groundwater, or surface runoff.

Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of buildings, beneath floor slabs, and within pavement areas. The grades should be sloped away from buildings and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

Drainage and Groundwater Concerns

Perched water conditions were apparent within boring B-2. Excavations required to extend below the depth of perched water are anticipated to require temporary dewatering methods such as the use of sump pits and pumps.

The methods for dewatering the excavation must ultimately be determined by the contractor so as to prevent standing water in the trench during construction activities. If excavations extend only a few inches or so below groundwater or perched zones, it is expected that filtered sump pumps or other conventional means should suffice to control the groundwater. However, for deeper excavations, or for substantial perched zones, prolonged dewatering with a series of sumps or well points and high capacity sump pumps, or other more comprehensive means may be necessary to facilitate construction. Dewatering is typically recommended to be performed to a depth of at least 2 feet below anticipated excavation depths.

Fluctuations in the groundwater level should be anticipated throughout the year depending on variations in climatological conditions and other factors not apparent at the time the borings were performed. The possibility of groundwater level fluctuation should be considered when developing the design and construction plans for the project.

Excavations

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.

GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations presented in the preceding section constitutes PSI's professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and PSI's experience in working with these conditions.

REPORT LIMITATIONS

PSI's recommendations are based on the available subsurface information obtained by PSI and design details furnished by others. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI must be notified immediately to determine if changes in the recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the project.

PSI warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are complete, PSI must be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At this time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use by Strand Associates for the Proposed WisDOT CTH A Salt Shed to be located in Albion, Wisconsin.