SECTION 02 32 00
GEOTECHNICAL INVESTIGATION
BASED ON DFD MASTER SPECIFICATION DATED 11/21/13

PART 1 - GENERAL

SCOPE

This section provides information resulting from subsurface investigations completed at the site as part of this project. This section may contain information applicable to ALL sitework, and other technical specification sections, as well. All Contractors are expected to review this information as part of their duties to familiarize themselves with the site.

Results of the geotechnical investigation apply only to the locations at which data was collected, at the specific time it was collected. Geotechnical conditions may differ elsewhere on the site.

Prior to making additional investigations of his own using test pits, borings, or other methods; Bidder shall first gain permission from property owner and DFD Project Manager. Geotechnical investigations completed by Bidder shall comply with all applicable requirements of Division 01 through Division 33 of this project.

RELATED WORK

Applicable provisions of Division 01 govern work under this Section.

PART 2 - MATERIALS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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Kilo Engineering, LLC
Marine on St. Croix, Minnesota
763-412-1965
www.kiloengineering.com

May 17, 2024

Mr. Nick Peterson
Quest Civil Engineering, LLC
320 West Grand Avenue, Suite 302
Wisconsin Rapids, Wisconsin 54495

Re: Geotechnical Engineering Services Report
Proposed Garage Building
473 Griffith Avenue
Wisconsin Rapids, Wisconsin
Kilo Project No.: 24-1595

Dear Mr. Peterson:

Kilo Engineering, LLC (Kilo) is pleased to transmit this Geotechnical Engineering Services Report for the proposed garage building to be located at approximately 473 Griffith Avenue in Wisconsin Rapids, Wisconsin. This report includes the results of field and laboratory testing, recommendations for foundations, pavement section design, and general site development.

Kilo appreciates the opportunity to perform this Geotechnical Study and looks forward to continuing our participation during the design phases of this project. If you have questions pertaining to this report, or if Kilo may be of further service, please contact us.

Respectfully submitted,
KILO ENGINEERING

Reed Kaeppe, P.E.
Project Manager
Wisconsin PE #E-100092

Kaitlyn Field
Engineering Intern

LICENSEE STATEMENT	
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly licensed Professional Engineer under the laws of the state of Wisconsin.	
Signature:	
Name: Reed Kaeppe, P.E.	
WI P.E. # E-100092	Date: May 17, 2024

WISCONSIN
REED
KAEPPE
E-100092
MINNEAPOLIS
MN
PROFESSIONAL ENGINEER

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EXECUTIVE SUMMARY

Kilo Engineering, LLC (Kilo) completed a geotechnical exploration for the proposed garage structure in Wisconsin Rapids, Wisconsin. Based on the findings of the field and laboratory work, the following geotechnical hazards will likely impact the design and construction of the project.

Surficial Organic Soils

A deposit of surficial organic soil was encountered within the building and pavement areas extending to depths of ½± foot below existing site grades. Organic soil depths and consistencies should be anticipated to vary across the site. This material has likely been disturbed by previous agriculture activity on site. The term "surficial organic soil" is used here in lieu of the word "topsoil" since the material was not tested for suitability for landscaping or agricultural purposes. The surficial organic soil generally consisted of silty sand soils with roots and organic material. The surficial organic soil is not suitable for support of foundations or foundation supporting fill in its current condition due to the presence of roots and organics. The organic-containing soils should be used in green areas or disposed of offsite. The depth and extent required for unsuitable soil removal should be determined by a representative of a qualified special inspections firm at the time of construction.

Loose to Medium Dense Sand Soils

Loose to medium dense sand soils were encountered at each of the borings at the proposed foundation elevation. These soils will be easily disturbed by construction traffic and the loss of confining pressure. The soils in a loose condition will require moisture conditioning and recompaction in order to achieve desirable strength and deformation characteristics. These soils should be compacted in place using a smooth-drum roller or other heavy compaction equipment prior to the placement of engineered fill soils or the placement of concrete. Any rutting or deformations of the surface should be repaired prior to the placement of additional fill or concrete.

Kilo has provided this executive summary for the convenience of the client, and this information should not be relied upon in lieu a full review of the contents of this report. Should variance in recommendations be present, the recommendations in the body of this report shall govern over those in this executive summary.

PROJECT INFORMATION

Project Authorization and Provided Documentation

The following Table summarizes, in chronological order, the Project Authorization History for the services performed and represented in this report by Kilo Engineering, LLC.

Document and Reference Number	Date	Representative & Company
Email Request for Proposal	3/13/2024	Mr. Nick Peterson Quest Civil Engineering, LLC
Kilo Proposal 24e-1502	3/20/2024	Mr. Joseph Rozmiarek Kilo Engineering, LLC
Notice to Proceed	3/25/2024	Ms. Kimberly Kronstedt, PE Quest Civil Engineering, LLC

The following documents were provided by the client for this project.

Description of Material	Provider/Source	Date
Site Survey	Mr. Nick Peterson Capital Growth Buchalter	1/31/2024

Project Description

Kilo understands that the project includes the design and construction of a new garage building to store trucks and work equipment. The site is located at approximately 473 Griffith Avenue in Wisconsin Rapids, Wisconsin. The site is part of the Department of Natural Resources Fire Control Station, located approximately 250 feet northwest of the intersection of Griffith Avenue and Lincoln Street. The proposed garage building has a footprint of 12,000 square feet with one planned above-grade level and no below-grade levels.

The proposed finished floor elevation for the new building has not been provided to Kilo at the time of this report. The boring elevations during the field exploration ranged from 1016± to 1017± feet relative to the Mean Sea Level (MSL) based on the site survey provided by the client. This report is based on the finished floor of the new building being set at 1017± feet MSL, based on the highest elevations located on the footprint of the proposed building. **Should these elevations be incorrect, Kilo should be contacted to amend this report with proper elevations and modified recommendations, as appropriate.**

The elevation differences between the borings completed for the project are on the order of 1± foot within the building footprint. Based upon these elevations, cuts on the order of ½± feet to remove the existing surficial organic soils, and fills on the order of 1± to 2± feet will be required to reach final grades in the proposed building pad. New pavements on site are anticipated to closely match existing site grades, with nominal amounts of cut and fill required to establish site grades in pavement areas.

The table below provides information regarding the proposed development.

Proposed Development		
Property	**Description**	**Source**
Structures		
Number of Buildings	One, West of Site	Site Plan
Stories Above Grade	1	RFP
Stories Below Grade	0	RFP
Construction Type	Light-Gauge Steel Framing	NP
Maximum Wall Load	5.0 kips per lineal foot (klf)	NP
Maximum Column Load	100 kips	NP
Maximum Floor Slab Load	125 pounds per square foot (psf)	NP
Load Source		NP
Proposed FFE	1017± feet MSL	NP
Pavements and Stormwater Management		
Pavement Types	Light-Duty Automobile Parking Heavy-Duty Auto and Truck Drive Lanes	NP
Pavement Traffic Loads	Light-Duty – 30,000 ESALs Heavy-Duty – 60,000 ESALs	NP
Pavement Locations	Existing Pavements East of Site	Site Plan
Pavement Access	Griffith Avenue, South of Site	Site Plan
Stormwater Features	None	Site Plan
Stormwater Location	-	Site Plan
Proposed Grade Changes		
Unsuitable Soil Depth	½± feet of surficial organic soils	Boring Logs
Grade Changes – Borings	1± feet in building	Field Survey
Grade Changes – Plan		NP

NP – Information not provided to Kilo. This report is based on Kilo's experience with similar developments in lieu of client-provided information. This information should be verified by the client.
RFP – Information provided by the client in the project Request for Proposal

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 Kilo in writing so that we may amend the recommendations presented in this report as appropriate and if desired by the client. Kilo 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, and construction recommendations for the proposed project. Kilo's scope of services included drilling a total of four (4) soil test borings completed by Quest

Civil Engineering, evaluation of the laboratory testing conducted by Quest Civil Engineering, and preparation of this Geotechnical Report.

The 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. Kilo is not nor does it advertise to be an environmental professional firm. In the event that the geotechnical recommendations in this report and environmental recommendations by others vary, the more stringent recommendation should be followed or the relevant design professionals contacted for clarification.

SITE AND SUBSURFACE CONDITIONS

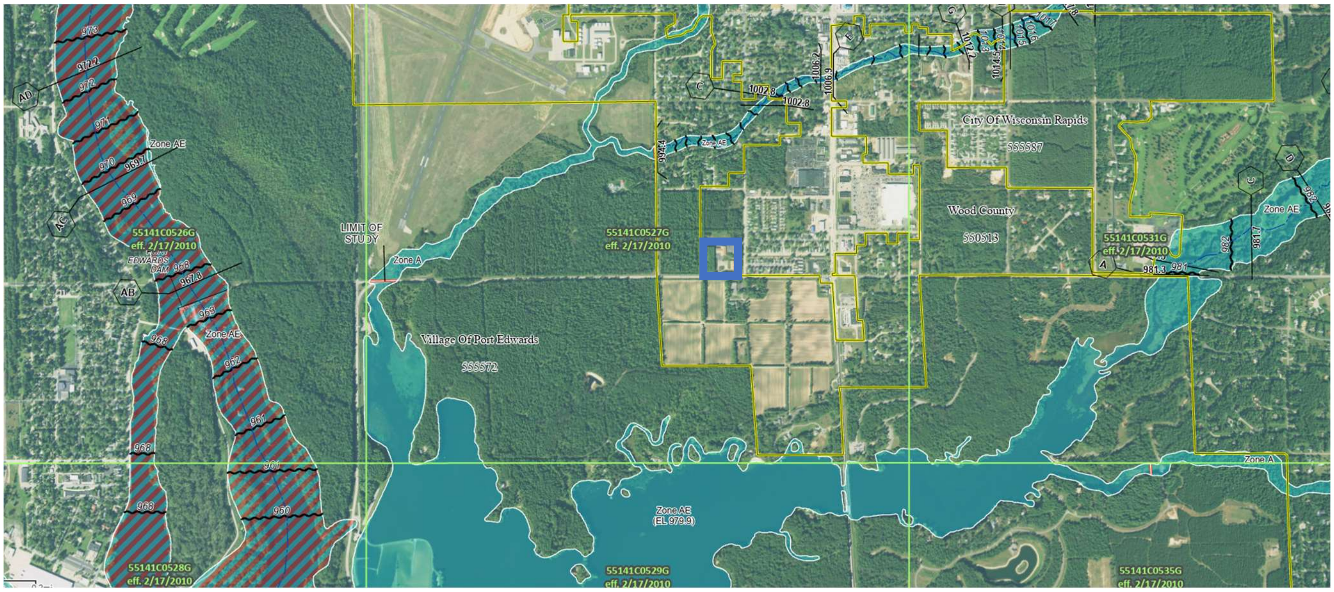
Site Location and Description

The site is located at approximately 473 Griffith Avenue in Wisconsin Rapids, Wisconsin. The site is located approximately 250 feet northwest of the intersection between Griffith Avenue and Lincoln Street. The site is bounded to the north by undeveloped woodland with Brianwood Avenue beyond; to the east by Lincoln Street with residential properties beyond; to the south by Griffith Avenue with a commercial property beyond; and to the west by undeveloped woodland with Sampson Street beyond. The site is currently developed with the Department of Natural Resources Fire Control Station.

Publicly available historical aerial photographs were used to explore the site history. Historical aerial photos were observed dating to 1985 in Google Earth. The aerial photographs show the site relatively unchanged since at least 1985, appearing in each aerial photograph as developed with the existing Department of Natural Resources Fire Control Station and associated pavements. The site Latitude and Longitude coordinates are approximately 44.3522°N and 89.8238°W, respectively. The site topography is relatively flat, with elevation differences of 1± feet between the borings.

Potential Flood Impacts

As part of the due diligence for the site, Kilo reviewed the publicly available flood zone maps produced by the Federal Emergency Management Agency (FEMA), which includes several designations related to flood potential. For areas without designated levee protection, Zones A or AE designate an area within the 100-year floodplain, Zone B (Zone X - shaded) is the area between the 100-year and 500-year floodplain, and Zone C (Zone X - unshaded) is the area beyond the 500-year floodplain. Areas that have not been mapped for flood potential are noted as Zone D. An image pulled from the relevant FEMA flood map is shown in the figure below.



Based on the data in the site map below, the site is in Zone X and is outside the 100-year and 500-year floodplain. The nearest areas of Zone A and Zone AE areas are approximately one-quarter mile north of the site and one-half mile south of the site. These Zone A and Zone AE areas generally follow the floodplains of the Twomile Creek to the north, Nepco Lake to the south, and Wisconsin River to the west. The normal water elevations of these Zone A and Zone AE regions range from 960± to 1017± feet MSL, respectively. Elevations on site range from approximately 1016± to 1017± MSL based on client provided survey data. Given the grade changes, the distance to the nearest Zone A and Zone AE regions, and the Zone X designation, the risk of large-scale flood potential is considered to be low to moderate.

Field Exploration Summary

The following locations were sampled with soil borings to explore the subsurface conditions at the site:

Boring	Boring Type	Location	Surface Elevation (ft MSL)	Depth of Boring (ft)
B-1	Proposed Building	Northwest Corner	1016±	21.5
B-2	Proposed Building	Northeast Corner	1017±	21.5
B-3	Proposed Building	Southwest Corner	1016±	21.5
B-4	Proposed Building	Southeast Corner	1016±	21.5

The borings were located in the field utilizing conventional taping techniques and estimating right angles from existing site features. The horizontal accuracy of the borings is estimated to be 10± feet. The surface elevation at each boring location was obtained using the client provided survey of the site, and no elevations data was collected by the drilling crew in the field. The vertical accuracy of the boring locations is estimated to be 1± foot, consistent with the contour lines of the underlying dataset.

Soil borings for the site were completed by the client, Quest Civil Engineering, LLC on March 20, 2024. Hollow-stem augers were used to advance the borings. Samples were taken at half-flight intervals to a depth of 12 feet below existing site grades, and every 5 feet thereafter. Samples were recovered using split-spoon sampling techniques in general accordance with ASTM D1586. Field data, including boring number, sample depth, soil classification, and SPT N-value was recorded in the field and a representative soil sample was placed in a glass jar to minimize moisture loss.

The client evaluated the soil samples with a limited number of engineering property tests, Kilo received the laboratory results on May 2, 2024. These tests included:

- USCS Soil Classification (ASTM D2487 and D2488)
- Moisture Content (ASTM D2216)
- Percent Passing the #200 Sieve (ASTM D1140)

The soil stratigraphy encountered in the field exploration is generalized in the table below:

SOIL (USCS)	SOIL DESCRIPTION	SOIL COLOR	DEPTH RANGE (FT)	MOISTURE CONTENT RANGE (%)	SPT N-VALUE RANGE (BPF)*
OL	Surficial Organic Soil	Black	0 to ½± feet	-	-
SP	Sand, Sand with trace Gravel	Brown, Light Brown	½± to 21.5± feet (Termination Depth)	-	5 to 18

*BPF – blows per foot

The shallow site soils encountered in the field exploration were compared to the mapped Web Soil Survey prepared by the Natural Resources Conservation Service. This service has mapped soil properties for 95% of the United States. At this location, the mapped soils on site consist of the Plainfield sand. This stratum consists of approximately 95% sand-sized particles in the upper soil profile, remaining generally consistent with depth. These soils are generally consistent with the materials encountered within the upper soil profile but have been disturbed prior to this field exploration. The NRCS soil descriptions consider these soils "not limited" for supporting small commercial buildings and "poor" materials for construction reclamation. It should be noted that the soil sampling for this database was originally intended for agricultural purposes and only covers the upper 80 inches of the soil profile.

Soils are not homogenous and may change both vertically and laterally between the boring locations. Clear separation between strata may not be observed in the field, with gradual transitions between soil types encountered. The general soil description above is generalized for convenience. Full details regarding the soils encountered during this exploration are included in the boring logs in the appendix of this report, including soil descriptions, penetration resistances, moisture contents, and completed laboratory testing to define soil engineering properties. Water level observations are only valid for the time and locations sampled and may vary substantially with time. The samples not altered by laboratory testing have been retained by Quest Civil Engineering, LLC, and may be available upon request.

Groundwater Observations

Groundwater was not encountered during or at the completion of drilling activities in any of the completed borings on site. Based on the observed moisture contents, changes in colorization, and the soil types encountered, the static groundwater level is likely below the planned zone of construction. If groundwater seepage is encountered during construction, it is anticipated that it can be controlled using conventional sumping techniques. If larger or uncontrollable amounts of seepage are encountered, Kilo should be contacted for additional recommendations. Kilo recommends that the contractor determine the actual groundwater level on site at the time of construction if seepage is encountered.

The groundwater observations noted on the boring logs represent the groundwater conditions at the test boring locations at the time of sampling. It should be expected that the groundwater levels will fluctuate at least several feet seasonally and depending on climatic conditions and precipitation. The possibility of groundwater level fluctuation should be considered when developing the design and construction plans for the project. Short-term dewatering may be required to facilitate foundation construction, depending on climatic conditions at the time of construction.

GEOTECHNICAL HAZARDS RECOMMENDATIONS

Geotechnical Hazard Identification

The following table summarizes the potential geotechnical hazards observed on site with a limited description of the potential remedial actions included. Full descriptions of the remedial actions are included below the table.

Geotechnical Hazard	Present?	Remediation Method
Surficial Organic Soil	Yes	½± feet of cut to remove surficial organic soils
Organic Soils at Depth	No	
Undocumented Fill	No	
Previous Site Disturbance	Yes	Surficial materials likely disturbed during construction of the existing municipal structures
Previous Site Structures	Yes	Site is currently developed with several existing municipal structures
Loose Granular Soils	Yes	Moisture condition and recompact
Soft Cohesive Soils	No	
Moisture-Sensitive Soils	No	
Limited Reuse of Site Soils	No	
Mass Grading	Yes	Raise site grades to FFE
Shallow Bedrock	No	
Shallow Groundwater	No	
Perched Groundwater	No	
Flood Risk	No	

GEOTECHNICAL HAZARD	PRESENT?	REMEDIATION METHOD
Unsuitable Soils at Foundation Level	No	
Wet Soils at Foundation Level	No	
Building Additions	No	
Buried Obstructions	No	
Deep Foundations Recommended	No	
High Settlement Potential	No	
Swell, Shrinkage, or Collapse	No	
Karst or Subsidence	No	
Pavement Drainage Concerns	No	
Infiltration Limitations	No	
Seismic Concerns	No	
Liquefaction Concerns	No	
Earth Retention Concerns	No	
Slope Stability Concerns	No	

Geotechnical Hazard Remediation

A deposit of surficial organic soil was encountered within the building areas extending to depths of ½± feet below existing site grades. Organic soil depths and consistencies should be anticipated to vary across the site. This material has likely been disturbed by previous agriculture activity on site. The term “surficial organic soil” is used here in lieu of the word “topsoil” since the material was not tested for suitability for landscaping or agricultural purposes. The surficial organic soil is not suitable for support of foundations or foundation supporting fill in its current condition due to the presence of roots and organics. The organic-containing soils should be used in green areas or disposed of offsite. The depth and extent required for unsuitable soil removal should be determined by a representative of a qualified special inspections firm at the time of construction.

Some of the near-surface soils have been disturbed as part of the existing municipal development of the site, including areas that have been previously graded, near existing site utilities, and under the existing pavements. Existing utilities that are not planned to be part of the proposed development should be properly sealed and removed from the site. “Undocumented Fills” are soils that have been previously disturbed by man-made activities and have an unknown or undocumented history of compaction as part of the previous site disturbance. These materials can be highly variable in material composition and compaction quality. Due to this unknown condition, these soils should be either removed and replaced with engineered fill as described in the “Subgrade Preparation” section of this report or may be stabilized in place under proposed pavement areas, depending on the condition of the materials at the time of construction. Undocumented fill soils below foundation elements should be removed and replaced by engineered fill prior to foundation construction. The materials should be evaluated by a qualified special inspections firm at the time of construction.

Loose to medium dense sand soils were encountered at each of the borings at the proposed foundation elevation. These soils will be easily disturbed by construction traffic and the loss of confining pressure. The soils in a loose condition will require moisture conditioning and recompaction in order to achieve desirable strength and deformation characteristics. These soils should be compacted in place using a smooth-drum roller or other heavy compaction equipment prior to the placement of engineered fill soils or the placement of concrete. Any rutting or deformations of the surface should be repaired prior to the placement of additional fill or concrete.

Kilo has not been provided a proposed grading plan for the site. This report is based on the cuts of ½± feet to remove the surficial organic soils, and new fills on the order of 1± to 2± feet in the building area to achieve a design finished floor elevation of 1017± feet MSL. New pavements on site are anticipated to closely match existing site grades, with nominal amounts of cut and fill required to establish site grades in pavement areas. Due to the presence of organics and deleterious material, the existing surficial organic and fill materials on site may not be reusable as engineered fill.

Boring	Building Location	Surface Elevation	Depth of Soil to Remove (ft)	Bottom of Cut Elevation	Fill Required to 1017± FFE (ft)
B-1	Northwest Corner	1016±	½±	1015±	2±
B-2	Northeast Corner	1016±	½±	1015±	2±
B-3	Southwest Corner	1017±	½±	1016±	1±
B-4	Southeast Corner	1016±	½±	1015±	2±

The site hydrology will be modified by the development of the site. Precipitation that previously would infiltrate into the soil will instead generate runoff when an impervious surface, such as a building, slab, or pavement, is encountered. This additional peak runoff may require temporary site storage and treatment, depending on local regulations. Moisture should not be allowed to collect near the building foundations, and the site should be sloped to drain. It may be possible to grade the site to drain to stormwater features directly, or a private storm sewer system with catchments and pipelines to the stormwater feature may be necessary.

The following geotechnical related recommendations have been developed in order to minimize the risk of the hazards identified above and to accommodate the proposed construction as described in this report. These recommendations are based on the owner and their design team incorporating these recommendations into the project plans and specifications and that appropriate construction quality control is utilized and verified with independent construction material testing under the direction of a licensed professional engineer in the state of Wisconsin. If changes in the planned construction occur, Kilo should review the scope and magnitude of the proposed changes with revised recommendations as appropriate.

CONSTRUCTION RECOMMENDATIONS

Subgrade Preparation

Preparation of the subgrade is an important prerequisite to foundation, slab, and pavement performance. The subgrade preparation generally consists of four major components as described below:

- Removal of unsuitable soils

- Scarification, moisture-conditioning, and compaction of the final cut subgrade
- Placement, compaction, and testing of new engineered fill to achieve site grades
- Protection of the subgrade from moisture, ruts, and loosening prior to final surface cover

Prior to the placement of new fill or preparation of the construction area subgrade, Kilo recommends that surficial organic soils, vegetation, trees including root bulbs (where encountered), debris larger than three inches in diameter, undocumented fill materials (where encountered), and frozen soils (if present during construction) be removed from within and a minimum of 10 feet beyond the proposed building and pavement areas. Soils containing organic material will be unsuitable for reuse on site due to their deleterious nature and unfavorable settlement characteristics. Soils containing organics should be disposed of offsite or used in landscaped areas. Unsuitable soils that do not contain organics, such as wet, soft, or loose mineral soils encountered should be selectively undercut and/or stabilized in place. A representative of a qualified special inspections firm working under the direction of a qualified geotechnical engineer should determine the need for and means of stabilization at the time of construction.

After stripping and excavating the unsuitable soils described above, the subgrade should be compacted to a minimum of 95% relative compaction (to the standard proctor, ASTM D698) or to more stringent requirements as described in the table below. The compaction of the exposed subgrade should be tested prior to the placement of engineered fill, foundations, or final surface cover. One means of testing large areas such as the slab on grade and pavement areas is a proofroll test. Proofrolling should be performed with a steel drummed vibratory roller where granular soils are present at subgrade elevations, or a fully loaded tandem axle dump truck or rubber-tired vehicle with a minimum axle load of 18 kips where cohesive soils are encountered. Soils that are observed to rut in excess of one inch under the moving load or have elastic deformations in excess of one-half inch should be remediated prior to placement of engineered fill. Remediation may consist of either moisture conditioning, scarification and recompaction, or placement of new engineered fill. Cut material generated by these operations may be moisture conditioned and compacted as a source of engineered fill, used in landscape areas, or disposed of offsite.

The compaction, proofrolling, and undercutting activities should be witnessed by a representative of the special inspections firm under the direction of a qualified geotechnical engineer licensed in the state of Wisconsin. Kilo does not provide construction observation or special inspections services. Proofrolling should be performed following a warm and dry period, which may limit the need for surface repairs to localized areas. If subgrade preparation, compaction, or fill placement activities occur during wet periods or during cool weather, additional remedial actions to repair the proofrolled surface should be anticipated.

Newly placed engineered fill required to establish site grades should consist of mineral soils and should be free of organics, frozen soils, ice, debris in excess of three inches, and other deleterious materials. The existing onsite surficial organic soils are not suitable for this purpose due to the presence of organics. Predominantly silt soils are not recommended for use as engineered fill due to concerns with moisture control and material workability. Due to the underlying sand soils, predominantly clay soils are not recommended for fill due to the risk of ponding water in the fill above the higher permeability sand soils below. Imported fill should consist of sand soils with a maximum of 12% of the material passing the #200 sieve. A qualified special inspections firm or accredited soil engineering laboratory should test the proposed import soils for gradation or plasticity characteristics as appropriate prior to import. Approved soil imports should be tested for optimum moisture content and maximum laboratory dry density in accordance with the Standard Proctor, ASTM D698. Depending on the proposed use of the newly placed engineered fill, the soils should be compacted to the relative densities noted in the table below.

Material Tested	Min % Dry Density (D698)	Moisture Content Range	Frequency of Testing
Pavement Subgrade - Top 3 feet	100%	-2 to +2%	1 per 200 cy of fill placed or 1 per 5,000 square feet minimum of three tests per lift
Fill under Foundation Elements Lateral Oversize under Foundation Elements	98%	-2 to +2%	1 per 200 cy of fill placed or 1 per 2,500 square feet minimum of three tests per lift
Mass Grading Fill not covered above Utility Trench Backfill Below-Grade Wall Backfill Floor Slab Subgrade Pavement Subgrade Deeper than 3’	95%	-3 to +3 %	1 per 200 cy of fill placed or 1 per 5,000 square feet minimum of three tests per lift
Random Fill (non-load bearing/Green Space)	92%	-3 to +3 %	1 per 3,000 cy of fill placed or 1 per 10,000 square feet minimum 1 test per lift

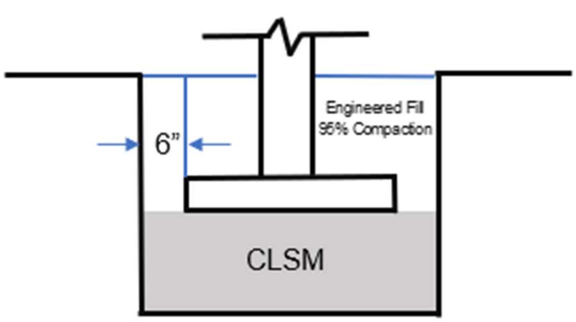
To achieve the design relative compaction values noted in the table above, the compaction equipment should be matched to the proposed material and proposed use. Granular soils subject to full-size, smooth-drum compaction equipment (minimum ten tons) may be placed in 12-inch loose lifts prior to compaction. Cohesive soils subject to full-size, sheepsfoot compaction equipment (minimum ten tons) should be placed in 8-inch loose lifts prior to compaction. Material subject to lightweight compaction equipment, including walk-behind compactors, jumping jacks, or plate compactors should be placed in 6-inch loose lifts prior to compaction. All newly placed engineered fill should be placed and compacted in horizontal lifts, not parallel to existing slopes. Moisture control should be exercised during material placement to maintain moisture contents within the ranges of the optimum moisture content noted above. If soils are not within the recommended moisture contents, these soils should be spread thinly and allowed to dry, or water should be added uniformly through the material by disking or scarifying. Compaction tests should be performed by a qualified special inspections firm on every lift of new engineered fill at the frequencies noted in the table above. Newly placed engineered fill should extend a minimum of 10 feet beyond the edges of proposed building areas and a minimum of 5 feet beyond the edges of pavement areas.

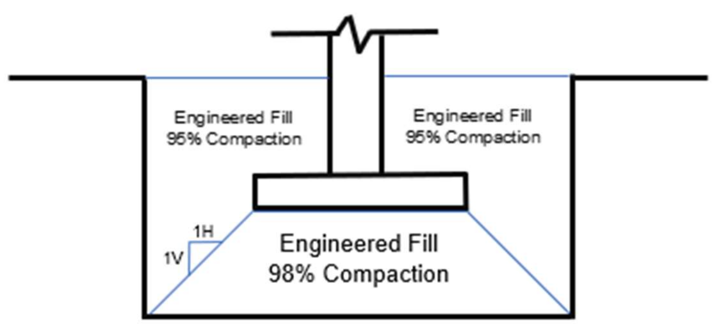
<u>Conventional Shallow Foundation Recommendations</u>

Kilo has based this report on the proposed finished floor elevation of 1017± feet relative to mean sea level, a proposed grade change on the order of up to 1± feet from existing site grades. If the proposed building elevation varies from this elevation, Kilo should be contacted in writing to verify the validity of the recommendations provided in this report. Based on this proposed finished floor elevation, the associated bottom of footing elevations accounting for local frost depth requirements are estimated to be 1013± feet relative to the temporary benchmark. The soils at this elevation are anticipated to consist of newly placed engineered fill after the removal of existing unsuitable soils as noted in this report.

Based on the reported structural loads, the soils observed in the field exploration, and the engineering properties noted in the laboratory testing, the proposed building can be supported by conventional continuous shallow foundations at the proposed walls and columns. Kilo recommends foundations be designed to bear upon either the existing native sand soils or newly placed engineered fill that has been placed and compacted as recommended in this report. Prior to any new engineered fill placement, the soils at the base of excavations should be observed and tested by a qualified special inspections firm prior to engineered fill placement. Soils suitable for bearing after remediation were observed at depths of ½± feet below existing site grades but may vary between boring locations. Moisture conditioning and compaction to achieve desirable strength and settlement potential characteristics should be anticipated for the site.

If unsuitable soils are encountered at a foundation excavation, a soil correction will be required. This excavation should be extended to competent soils that meet field strength testing requirements. The resulting overexcavation can be backfilled with controlled low-strength material (CLSM), sometimes referred to as lean fill, that extends six inches beyond the face of the proposed foundation element in each direction. Alternatively, the overexcavation can be backfilled with engineered fill as defined in this report extending at a minimum one horizontal to one horizontal (1H:1V) ratio beyond the face of the foundation element. This new engineered fill should be compacted to a minimum of 98% relative compaction as noted in the "Subgrade Preparation" section of this report. This will require widening and deepening the area to be corrected with engineered fill from conventional foundation excavations. Alternatively, foundations can bear at the bottom of excavation with additional structural materials (foundation walls or column bearing piers) to proposed surface grades.





The proposed building can be supported on conventional shallow foundations with allowable bearing pressures as noted in the table below. These bearing capacities are based on the soil materials at proposed bearing elevations above with appropriate testing of the subgrade, newly placed engineered fill, and overexcavations as noted. Excavations should extend to the depths noted for adequate frost protection in accordance with local frost depths. The minimum foundation size for column foundations of 30 inches square and wall foundations of 18 inches wide should be followed to minimize the risk of punching shear failures. This minimum foundation size should be utilized even if narrower foundations would be allowable given the allowable bearing pressures noted below.

Foundation Type	Depth Below Adjacent Grades (in)	Proposed Load	Maximum Allowable Bearing Capacity (PSF)
Interior Column Foundations	24	100 kips	2,000
Exterior Column Foundations	48	100 kips	2,500
Continuous Wall Foundations	48	5.0 kips/foot	2,500

The depth of code-required frost penetration design is dependent on whether the structure is designed to be heated or unheated. Exterior footings in heated areas, such as permanently climate-controlled buildings, should be located at a depth of at least 48 inches below the final exterior grades. Isolated unheated foundations for unheated structures, signage, canopies, and exposed vestibules should be located at least 60 inches below the final exterior grades. If the foundation soils will be exposed to freezing temperatures during or after foundation construction, then the footings and concrete should be adequately protected from freezing. Soils should be allowed to thaw prior to the placement of additional foundations or slabs. Otherwise, interior footings can be located on the native soils or newly placed engineered fill at shallower depths below the floor slab, compatible with architectural and structural considerations.

Foundation excavations should be tested prior to concrete placement to verify the field conditions are consistent with those recommended in this report. One means of testing native, undisturbed soils is the use of the dynamic cone penetrometer in accordance with ASTM Special Technical Publication (STP) 399, "Dynamic Cone for Shallow Penetration Testing" by George F. Sowers. This test method correlates the results of a specific dynamic cone penetrometer testing apparatus to SPT N-values and associated allowable bearing capacities. Testing should be completed at spacing no greater than every 25 feet along continuous foundations and a minimum of one test per every isolated column foundation. Based on the allowable bearing pressures noted in the table above, the penetrometer values should be consistent with a SPT N-value of 6 or 8 blows per foot or greater, respectively, at each test location.

During excavations, soils should be protected from changes in moisture content. The addition of water into soil subgrades can negatively impact the shear strength of the soil and material workability. Subgrade soils should be protected from site runoff by maintaining proper site drainage from prepared site subgrades to non-structural areas of the site. Wet soils should be properly moisture conditioned prior to the placement of new engineered fill soils. Foundation, slab, and pavement concrete should be placed as quickly as possible to minimize degradation of the subgrade surface due to wetting and drying. Wicking of moisture from the shallow groundwater table may increase the need for moisture conditioning at the surface or require the use of static compaction techniques for the near-surface subgrade soils and newly placed engineered fill.

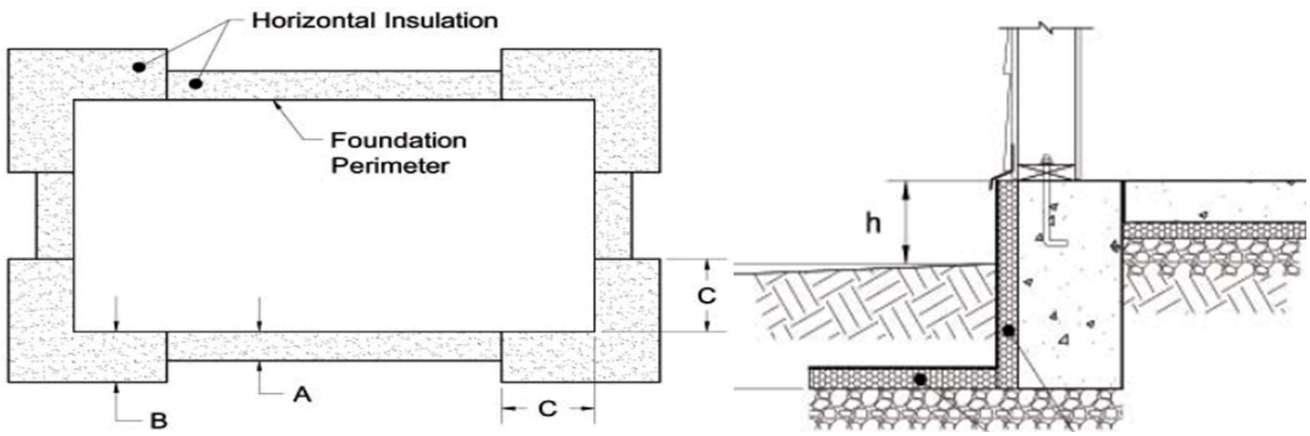
The proposed foundation system has been evaluated for settlement potential based on the soil properties described in this report. Kilo estimates that total foundation settlement for the foundation system is one inch. Differential settlement between adjacent column foundations or between 30-foot spans of continuous is estimated to be one-half inch. This settlement estimate is based on the subgrade materials being prepared as noted in the "Subgrade Preparation" of this report. Generally, this level of differential settlement is tolerable but should be verified by the structural engineer of record.

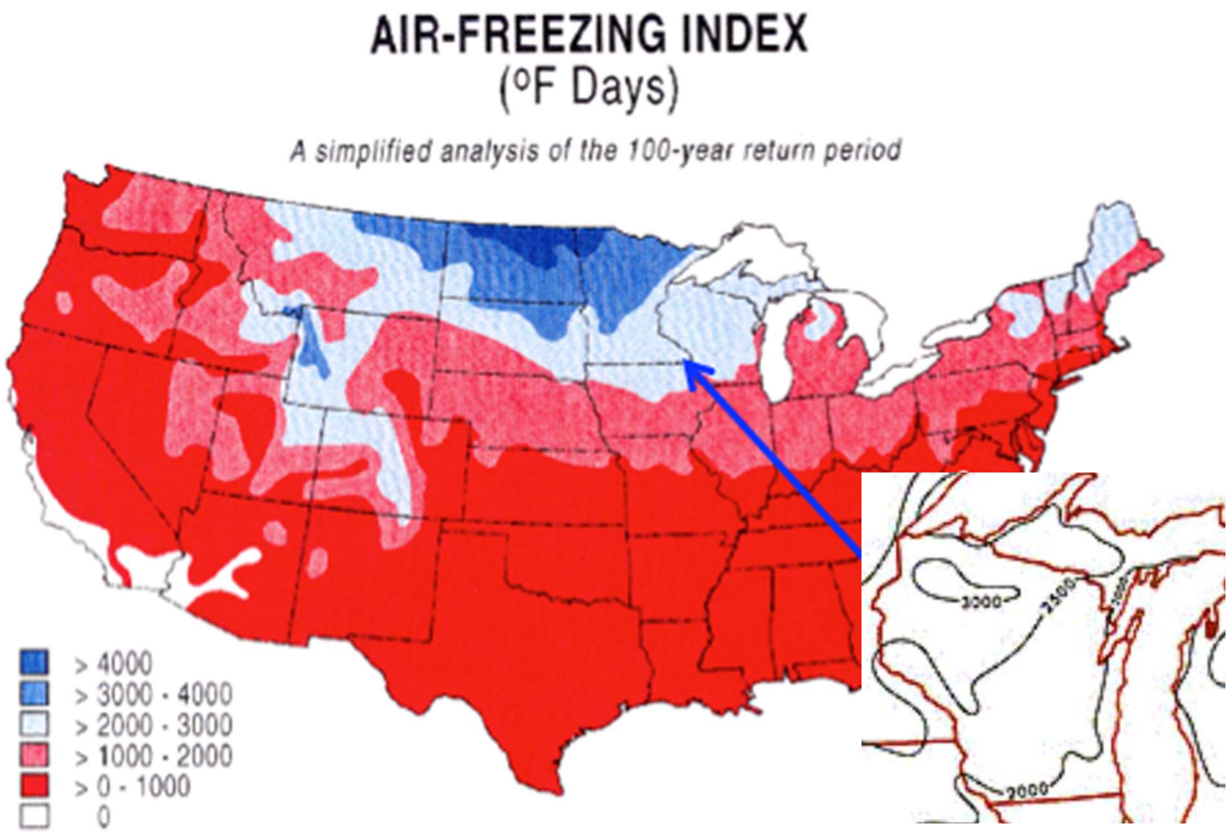
Sensitive materials such as masonry walls should be designed to minimize cosmetic damage from differential settlement with properly placed control joints.

Frost-Protected Shallow Foundation Recommendations

As an alternative to conventional shallow foundations, Kilo understands that the lightly-loaded structures are frequently designed as frost-protected shallow foundations (FPSF) utilizing a thickened slab at the perimeter of the building to support the wall loads, with the majority of the structure bearing on column foundations at both interior and exterior locations. Based on the soil conditions observed in this exploration, this structural system may be utilized given the parameters noted below.

The site is located in central Wisconsin, with an estimated air-freezing index of 2,500°F-days based on the map below. This air-freezing index dictates the required insulation R-value, depth of thickened slab bearing, and dimensions of the installed insulation for the FPSF system.



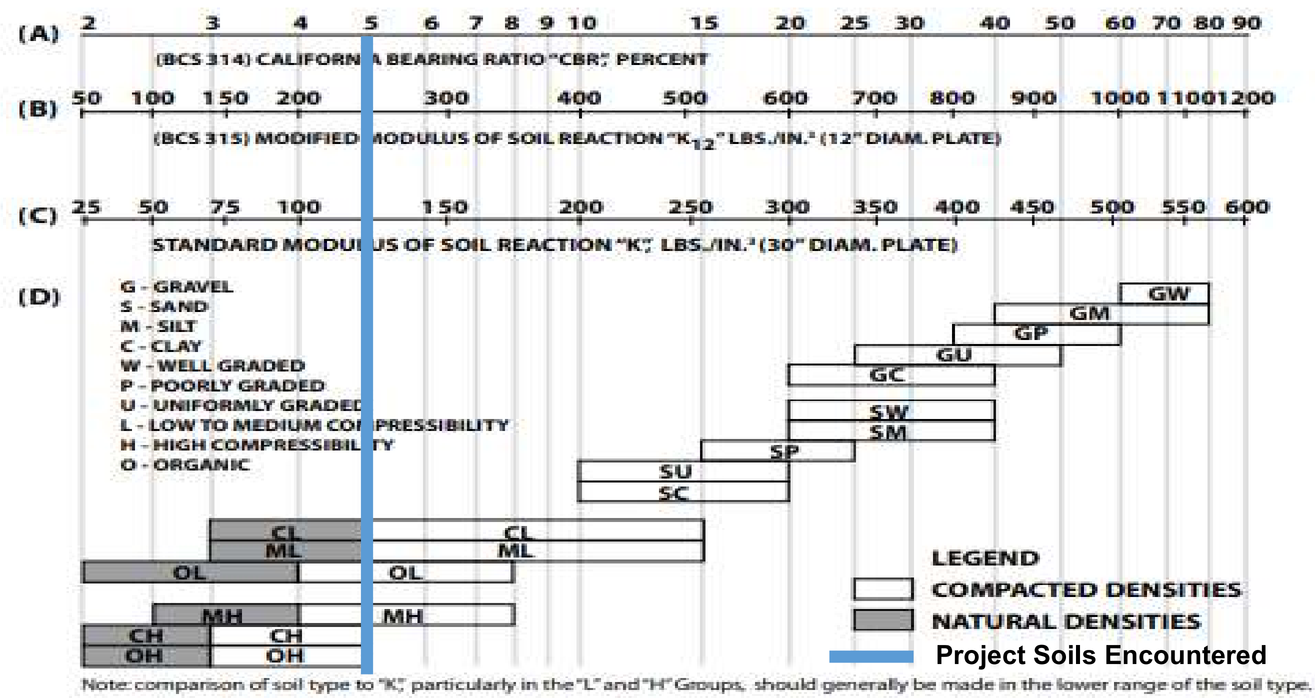


The values recommended below are based on ASCE 32-01, "Design and Construction of Frost-Protected Shallow Foundations". The insulation should be placed on properly compacted, unfrozen ground, and protected during installation from damage. Backfill should be placed using light equipment above the horizontal insulation. The values listed in the table below are minimum values for design. The area should be graded for proper drainage away from the foundation. The foundation should be embedded a minimum of 18 inches below the exterior grades, and the horizontal insulation should have a minimum cover depth of 12 inches below exterior grades. No more than 12 inches of vertical insulation should be exposed above exterior grades. Exposed insulation should be adequately adhered to the foundation and protected from environmental damage.

Design Parameter	Value	Unit
Minimum Vertical Insulation R-Value	6.7	UL
Minimum Horizontal Insulation R-Value Along Walls	1.7	UL
Minimum Horizontal Insulation R-Value at Corners	4.9	UL
Horizontal Dimension A	12	Inches
Horizontal Dimension B	24	Inches
Horizontal Dimension C	40	Inches
Minimum Foundation Depth	16	Inches
Allowable Bearing Pressure	2,500	Psf

Floor Slab Recommendations

The building floor slab is anticipated to be supported upon either properly compacted native soils or newly placed engineered fill. Both the subgrade and fill soils should be tested as noted in the "Construction Recommendations" section of this report. The chart below is an excerpt from "Slab Thickness Design for Industrial Concrete Floors on Grade" by Robert G. Packard (1976) with the Portland Cement Association, a commonly referenced chart in the Civil Engineering Body of Knowledge that correlates soil types to a range of subgrade modulus and California Bearing Ratio (CBR) values.



Utilizing this chart, Kilo recommends the following values be used for floor slab design.

Design Parameter	Value	Unit
Subgrade Modulus k_{12}, 12-inch square plate load test	250	lb/in^3
Subgrade Modulus k_{30}, 30-inch circular plate load test	125	lb/in^3
California Bearing Ratio (CBR)	5	Percent
Select Granular Fill Minimum Thickness Below Slab	4	Inches
On-site soils suitable for reuse as Select Granular Fill	No	

Kilo recommends that select granular fill be placed below the floor slab with the minimum thickness noted in the table above. Select granular fill should be a free-draining material with a maximum of 5% of the material retained on the #200 sieve and a minimum of 50% of the material retained on the #40 sieve by mass. Floor slabs should have a vapor retarder in accordance with ACI 302 "Guide to Concrete Floor and Slab Construction". This guidance document recommends polyethylene sheeting placed directly under the floor slab to minimize moisture penetration from the soil subgrade below if sensitive floor finishes are present and that the vapor retarder is below the select granular fill if slab curling or deformation is a concern. Properly spaced control joints should be utilized to minimize random cracking of the slab due to shrinkage, curing, and curling forces.

Seismic Design Recommendations

Although the site is in a region with low seismicity, the site is in a municipality that employs the 2018 International Building Code (IBC). The 2018 International Building Code (IBC) requires that a site class be determined based on soil type for the calculation of earthquake design forces in structures. Based on the estimated depth to rock and the estimated shear strength of the soil at the boring locations, Site Class "D" is recommended. If shallower rock or stiffer soils are encountered deeper than the depth of the borings, Kilo should be notified in writing in order to make appropriate modifications to the seismic design recommendations contained in this report. The USGS-NEHRP probabilistic ground motion values interpolated between the nearest four grid points from latitude 44.3522ºN and longitude 89.8238ºW are as follows:

Period (S)	2% Probability of Event in 50 Years	Site Coefficient	Maximum Spectral Design Acceleration	Spectral Design Acceleration Parameters	
0.2 (S_s)	5.0	$F_a = 1.6$	$S_{ms} = 8.1$	$S_{Ds} = 5.4$	$T_0 = 0.22$
1.0 (S_1)	3.7	$F_v = 2.4$	$S_{m1} = 8.8$	$S_{D1} = 5.9$	$T_s = 1.09$

$Sms = FaSs$ $SDs = \frac{2}{3}*Sms$ $T0 = 0.2*SD1/SDs$
$Sm1 = FvS1$ $SD1 = \frac{2}{3}*Sm1$ $Ts = SD1/SDs$

The seismic parameters for this report were accessed via SeismicMaps.org, which is based on USGS seismic data for the contiguous United States. The site coefficients, maximum spectral accelerations, and design parameters are based solely on this source and the underlying USGS data. The risk category utilized is based on occupied, non-essential structures but should be verified with the architect, structural engineer, or building official as appropriate. This determination is beyond Kilo's scope of services.

Pavement Recommendations

Kilo has provided recommendations for pavement construction based on the existing unsuitable soils being removed from the surface, properly compacted subgrades, and properly compacted engineered fill to achieve design site grades. If the existing site soils are not prepared in this manner, undesirable performance of the pavements may result. Any observed soft or loose locations should be selectively subcut and replaced with suitable engineered fill, or stabilized in place using engineered fill, aggregate base, or open-graded clean crushed stone.

Kilo has based the pavement sections in the table below on the traffic loadings noted in this report and the soil conditions noted in this report. If traffic loadings vary from those stated, modifications to the pavement sections may be required. The site soils are anticipated to be fair to poor materials with a minimum CBR value of 5. If higher quality materials are used for engineered fill that exceeds this value, Kilo should be contacted to value-engineer the pavement sections if appropriate. These pavements have been designed only for the anticipated garbage and delivery truck service. The following pavement sections have been recommended based on AASHTO 1993 methodologies and the following design parameters:

- Design Life - 20 years
- Initial Serviceability - 4.2
- Terminal Serviceability - 2.0
- Reliability - 85%
- Standard Deviation - 0.45
- Drainage Factor – 0.9

If during the final design phase these values are determined to be incorrect, Kilo 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 and rigid pavement section thicknesses are recommended for parking lot and drive areas in general accordance with AASHTO 1993 methodologies.

PAVEMENT TYPE	WEAR COURSE THICKNESS (IN)	BASE COURSE THICKNESS (IN)	AGGREGATE BASE THICKNESS (IN)
Light-Duty Asphalt (30,000 ESALs)	1-1/2	1-1/2	8
Heavy-Duty Asphalt (60,000 ESALs)	1-1/2	1-1/2	10
Concrete (60,000 ESALs)	5		4

The pavement sections noted above are based on the traffic loadings noted in this report, which account for typical parking lot traffic from light-duty automobiles, retail deliveries, and garbage surface. Sites in northern climates can see significant truck traffic from snowplowing activities depending on the types of equipment used. If pickup-mounted snowplows are used, the effect may be minor, but heavy-duty trucks or front-end loaders used for snow clearing activities would increase the traffic loads on the pavements. If heavy-duty trucks or front-end loaders are planned for snow clearing activities, it may be advisable to add an additional half-inch of wear-course asphalt to the design section.

The granular base course should consist of well-graded crushed stone meeting the requirements from Section 305 of the State of Wisconsin DOT Standard Specifications for Construction. The granular base course material should be placed and compacted to a minimum of 100% of maximum density as determined by the standard Proctor (ASTM D698). Also, a representative of a qualified geotechnical engineer should test and document the base course material for gradation prior to and during placement.

Asphaltic binder and surface courses should meet the gradation requirements from Section 460 the State of Wisconsin DOT Standard Specifications for Construction. Asphaltic courses should be placed and compacted to the minimum required density contained within Section 460 of the State of Wisconsin DOT Standard Specifications for Construction. An adequate number of in-place density tests should be performed during construction to document the placement compaction as recommended in the Standard Specifications for Construction.

The pavements should be sloped to provide positive surface drainage. Otherwise, a storm sewer system may be appropriate to carry away storm run-off water. 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. Construction of the subgrade and pavements should be in accordance with the project specifications and the recommendations of this report.

A flexible pavement system is not recommended in dumpster pad areas and areas where heavy trucks will turn frequently or will be parked due to concerns about plastic deformations of the surface course. Based upon the anticipated traffic volumes, Kilo recommends a concrete pavement section consisting of 6 inches of crushed aggregate base course and 5 inches of Portland cement concrete as a rigid pavement replacement. The concrete should have a minimum compressive strength of 4,000 psi at 28 days and should be properly air entrained. The concrete must be properly reinforced and must have appropriately spaced control joints.

RISK MANAGEMENT CONSIDERATIONS

Special Inspections During Construction

A qualified special inspections firm under the supervision of a professional engineer licensed in the state of Wisconsin should be retained to provide observation and testing of construction activities involved in the foundation, earthwork, and related activities of this project. Kilo does not provide these services but can advise the client regarding firms who can perform these services. Kilo will not accept responsibility for conditions that deviated from those described in this report, nor for the performance of the foundation or pavement if a qualified special inspections firm is not engaged to also provide construction observation and testing for this project in accordance with the recommended testing frequencies in this report.

Moisture Sensitive Soils/Weather Related Concerns

Protection of the subgrade from changes in moisture content will be necessary for the subgrade to perform as designed. Increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. To minimize this risk, the exposed surface should be compacted prior to anticipated precipitation events and should be sloped to drain away from building and pavement areas until final surface wear courses (pavements and floor slab) are in place. Failure to maintain surface drainage may slow the progress of earthwork activities. Water should not be allowed to pond in excavations or upon prepared soil surfaces. Wet soils should be scarified, allowed to dry, and recompacted, or should be replaced by properly placed engineered fill. It will be advantageous to perform earthwork during dry weather to minimize moisture-related impacts on soil subgrades and associated strength loss.

Excavation Safety

This report was written to address the technical hazards anticipated for the site and the proposed project conditions. During the execution of the work, excavation work involving utility trenches, foundation excavations, and other below-grade penetrations. It is mandated that excavations be constructed in accordance with current Occupational Safety and Health Administration (OSHA) guidelines to protect workers and others during construction. Kilo 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. Kilo is providing this information solely as a service to our client. Kilo 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.

Given that Kilo is not involved with the means and methods of construction, the contractor is solely responsible for designing and constructing stable, temporary excavations for the protection of workers and the general public. These responsibilities may include shoring, sloping, or benching the sides of the excavations as required to maintain stability of both the excavation sides and bottom. All soils should be considered "Type C" soils requiring the maximum protection requirements unless dictated otherwise by the contractor's "Competent Person" as defined in OSHA regulations for excavation safety. The contractor's "Competent Person" 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.

Utilities Trenching

Backfill for utility trenches is as important as the original subgrade preparation or engineered fill placed to support either a foundation or slab. Utility trench excavations have the potential to degrade the properties of the adjacent fill materials. Utility trench walls that are allowed to move laterally can lead to reduced bearing capacity and increased settlement of adjacent structural elements and overlying slabs and pavements. Therefore, it is imperative that the backfill for utility trenches be placed to meet the project specifications for the engineered fill of this project. Due to the narrow nature of utility trenches, larger compaction equipment cannot typically used. Unless otherwise specified, the backfill for the utility trenches should be placed in 4 to 6 inch loose lifts and compacted to a minimum of 95 percent of the maximum dry density and within 2 percent of the optimum moisture content achieved by the standard Proctor test (ASTM D698). It may be advisable to utilize granular fill in utility trenches to allow for compaction with the lighter equipment typically utilized. Up to 4 inches of bedding material placed directly under the pipes or conduits placed in the utility trench can be compacted to 90 percent relative compaction with respect to the standard Proctor. Compaction testing should be completed at the minimum rates noted in the "Subgrade Preparation" section of this report, including testing each lift placed.

REPORT LIMITATIONS

The concept of risk is an important aspect of the geotechnical evaluation. Soils are non-homogenous and material properties may change across the project site and between locations sampled in the field exploration. Geotechnical engineers use a variety of analyses that include theoretical, mathematical, and empirical models to estimate the performance of a given set of soils under a given set of loads. Given the nature of the materials, these analyses do not always comprise an exact science. The analyses must be combined with engineering judgment and experience when developing recommendations. Due to potential variations in material properties on site at and away from Kilo's field exploration, this geotechnical evaluation should not be considered risk-free. The interaction between the soils and the proposed structure may not perform as planned. The engineering recommendations presented in this report constitute Kilo'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 Kilo's experience in working with similar conditions.

The recommendations submitted are based on the project information provided by the client, the subsurface information acquired during the field exploration, and Kilo's engineering experience with similar projects. If project details were to change, including the type of construction, building loads, or location of features, Kilo should be contacted to verify the validity of their recommendations. If changes do not occur without Kilo having the opportunity to review the changes and revise their recommendations accordingly, Kilo accepts no responsibility for the impact of the changes on the project.

The geotechnical engineer has endeavored to adhere to generally accepted professional geotechnical engineering practices in the local area with the findings, recommendations, specifications, or professional advice contained in this report. No other warranties are implied or expressed. This report is based on the recommendations contained herein being incorporated into the project plans and specifications, adequate construction quality control measures are utilized, and that third-party special inspections or construction material testing is completed as noted in this report and as required by section 1705 of the International Building Code (IBC).

This report may be used only by the client, their design team, and only for the purposes stated, within three years from its issuance. Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kilo of such intended use. Based on the intended use of the report, Kilo may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kilo from any liability resulting from the use of this report by any unauthorized party.

LIST OF APPENDICES

Site Vicinity Plan
Boring Location Plan
Boring Logs
Geotechnical General Notes

Kilo ENGINEERING

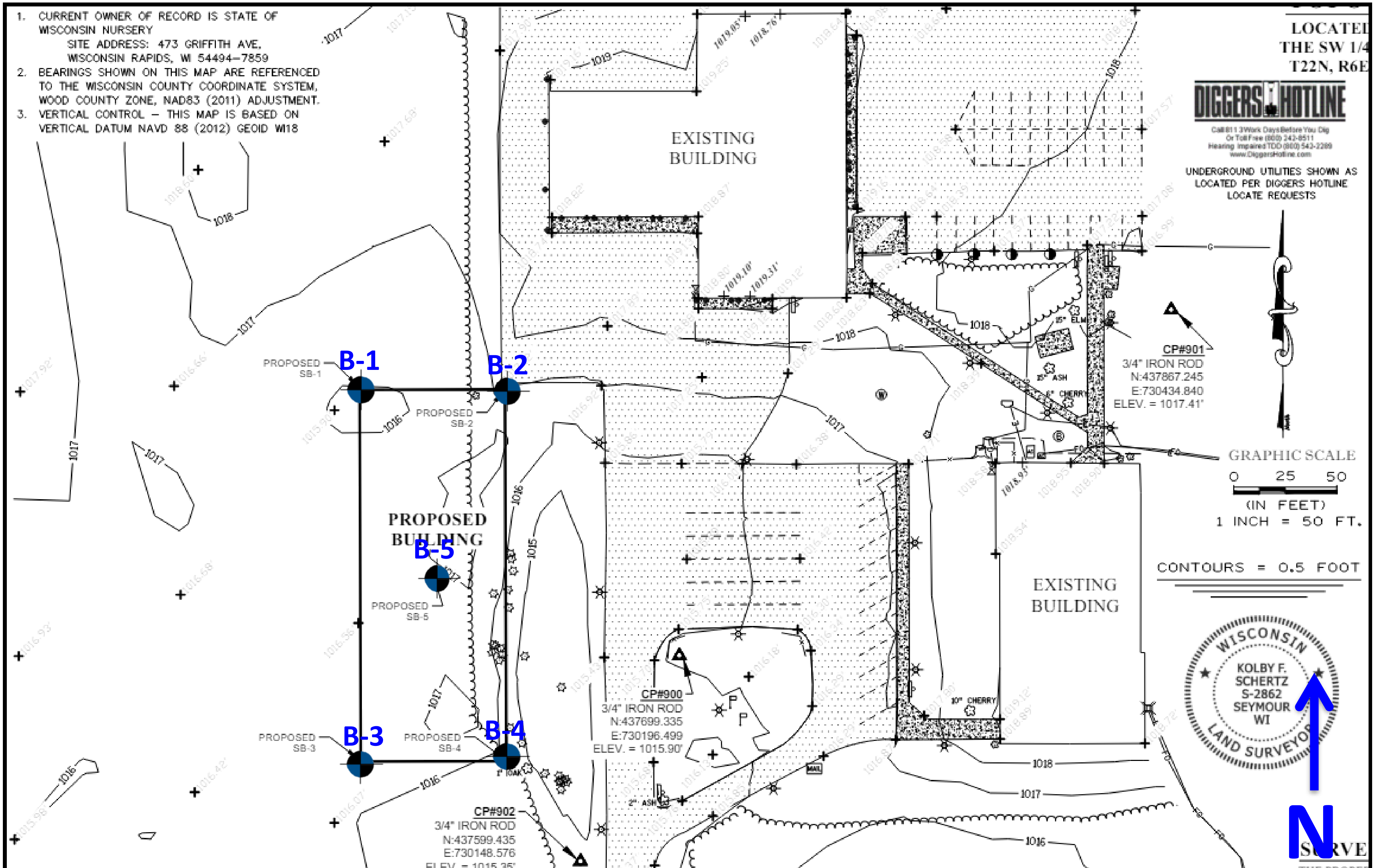
Project Name:	WI DNR Garage
Project Address:	473 Griffith Avenue
City, State:	Wisconsin Rapids, WI
Project Number:	24-1595

Proposed Site Vicinity Plan

KILO ENGINEERING

Project Name:	WI DNR Garage
Project Address:	473 Griffith Avenue
City, State:	Wisconsin Rapids, WI
Project Number:	24-1595

Proposed Boring Location Plan



Kilo ENGINEERING

Project Name:	WI DNR Garage
Project Address:	473 Griffith Avenue
City, State:	Wisconsin Rapids, WI
Project Number:	24-1595

Proposed Boring Location Plan

Kilo Engineering
Marine on Saint Croix, MN

Boring B-1

Drilling Crew:	Quest	Boring Depth:	21.5 ft	Project Name:	WI DNR Garage Building
Drilling Rig:	Rig #1	Elevation:	1030 ft MSL	Project Address:	473 Griffith Avenue
Drilling Date:	3/20/2024	GW During Drilling:	Not Observed	City, State:	Wisconsin Rapids, WI
Drilling Method:	H.A.S	GW At Completion:	Not Observed	Project Number:	24-1595
Sampling Type:	Split Spoon	GW At Delay:	--		
Drilling Foreman:	-	Latitude:	44.352215°N	Boring Location:	Proposed Building
Logged By:	K.Field	Longitude:	89.82405°W		Northwest Corner

Depth	Sample	Soil Profile	Recovery (in)	Symbol	Soil or Rock Description:	N-value	MC	PL	LL	PI	P200
0	SS		17	OL	Surficial Organic Soil (5" thick)	3-3-5 N=8					
1					SAND, Fine Grained, Brown, Moist, Loose						
2–3	SS		16	SP		3-5-4 N=9					
4											
5	SS		14	SP	SAND, Fine Grained, Light Brown, Moist, Medium Dense	5-6-6 N=12					
6											
7–8	SS		15	SP	SAND, Fine Grained, trace Gravel, Light Brown, Moist, Loose	2-4-3 N=7					
9											
10	SS		15	SP	SAND, Fine Grained, Light Brown, Moist, Loose	3-3-3 N=6					
11											
12			15	SP	SAND, Fine Grained, Light Brown, Moist, Loose	8-4-5 N=6					
13											
14											
15	SS		15	SP	SAND, Fine Grained, Light Brown, Moist, Medium Dense	4-5-6 N=11					
16											
17											
18											
19											
20	SS		16	SP	SAND, Fine Grained, Light Brown, Moist, Loose	3-4-3 N=7					

End of Boring at 21.5 feet - Boring backfilled with auger cuttings

Kilo Engineering
Marine on Saint Croix, MN

Boring B-2

Drilling Crew:	Quest	Boring Depth:	21.5 ft	Project Name:	WI DNR Garage Building
Drilling Rig:	Rig #1	Elevation:	1029 ft MSL	Project Address:	473 Griffith Avenue
Drilling Date:	3/20/2024	GW During Drilling:	Not Observed	City, State:	Wisconsin Rapids, WI
Drilling Method:	H.A.S	GW At Completion:	Not Observed	Project Number:	24-1595
Sampling Type:	Split Spoon	GW At Delay:	--		
Drilling Foreman:	-	Latitude:	44.35222°N	Boring Location:	Proposed Building
Logged By:	K.Field	Longitude:	89.82377°W		Northeast Corner

Depth	Sample	Soil Profile	Recovery (in)	Symbol	Soil or Rock Description:	N-value	MC	PL	LL	PI	P200
0	SS		6	OL	Surficial Organic Soil (3" thick)	2-3-3 N=6					
1					SAND, Fine Grained, trace Gravel, Brown, Moist, Loose						
2–3	SS		14	SP		2-4-5 N=9					
4											
5	SS		15	SP	SAND, Fine Grained, trace Gravel, Brown, Moist, Medium Dense	2-4-6 N=10					
6											
7–8	SS		15	SP	SAND, Fine Grained, trace Gravel, Brown, Moist, Medium Dense	5-6-7 N=13					
9											
10	SS		15	SP	SAND, Fine Grained, trace Gravel, Brown, Moist, Loose	3-3-5 N=8					
11											
12			15	SP	SAND, Fine Grained, Light Brown, Moist, Medium Dense						
13											
14											
15	SS		15	SP	SAND, Fine Grained, Light Brown, Moist, Medium Dense	3-5-5 N=10					
16											
17											
18											
19											
20	SS		16	SP	SAND, Fine Grained, Light Brown, Moist, Loose	6-4-5 N=9					

End of Boring at 21.5 feet - Boring backfilled with auger cuttings

Kilo Engineering
Marine on Saint Croix, MN

Boring B-3

Drilling Crew:	Quest	Boring Depth:	21.5 ft	Project Name:	WI DNR Garage Building
Drilling Rig:	Rig #1	Elevation:	1031 ft MSL	Project Address:	473 Griffith Avenue
Drilling Date:	3/20/2024	GW During Drilling:	Not Observed	City, State:	Wisconsin Rapids, WI
Drilling Method:	H.A.S	GW At Completion:	Not Observed	Project Number:	24-1595
Sampling Type:	Split Spoon	GW At Delay:	--		
Drilling Foreman:	-	Latitude:	44.35173°N	Boring Location:	Proposed Building
Logged By:	K.Field	Longitude:	89.82405°W		Southwest Corner

Depth	Sample	Soil Profile	Recovery (in)	Symbol	Soil or Rock Description:	N-value	MC	PL	LL	PI	P200
0	SS		2	OL	Surficial Organic Soil (5" thick)	1-2-5 N=7					
1					SAND, Fine Grained, Light Brown, Moist, Loose						
2–3	SS		15	SP		2-3-5 N=8					
4–5	SS		15	SP	SAND, Fine Grained, Light Brown, Moist, Loose	1-2-4 N=6					
6–8	SS		15	SP	SAND, Fine Grained, Light Brown, Moist, Medium Dense	2-5-6 N=11					
9–10	SS		15	SP	SAND, Fine Grained, Light Brown, Moist, Medium Dense	3-5-5 N=10					
11–13			14	SP	SAND, Fine Grained, Light Brown, Moist, Loose						
14–19	SS		16	SP	SAND, Fine Grained, Light Brown, Moist, Medium Dense	4-6-6 N=12					
20	SS		14	SP	SAND, Fine Grained, Light Brown, Moist, Medium Dense	1-5-8 N=13					

End of Boring at 21.5 feet - Boring backfilled with auger cuttings

Kilo Engineering
Marine on Saint Croix, MN

Boring B-4

Drilling Crew:	Quest	Boring Depth:	21.5 ft	Project Name:	WI DNR Garage Building
Drilling Rig:	Rig #1	Elevation:	1027 ft MSL	Project Address:	473 Griffith Avenue
Drilling Date:	3/20/2024	GW During Drilling:	Not Observed	City, State:	Wisconsin Rapids, WI
Drilling Method:	H.A.S	GW At Completion:	Not Observed	Project Number:	24-1595
Sampling Type:	Split Spoon	GW At Delay:	--		
Drilling Foreman:	-	Latitude:	44.35173°N	Boring Location:	Proposed Building
Logged By:	K.Field	Longitude:	89.82377°W		Southeast Corner

Depth	Sample	Soil Profile	Recovery (in)	Symbol	Soil or Rock Description:	N-value	MC	PL	LL	PI	P200
0–1	SS		16	OL	Surficial Organic Soil (7" thick) / Sandy SILT, Fine Grained, Brown, Moist, Loose	1-4-3 N=7					
2–3	SS		13	ML		3-4-5 N=9					
5	SS		14	SP	SAND, Fine Grained, trace Gravel, Light Brown, Moist, Medium Dense	3-4-7 N=11					
7–8	SS		15	SP	SAND, Fine Grained, trace Gravel, Light Brown, Moist, Medium Dense	3-5-5 N=10					
10	SS		15	SP	SAND, Fine Grained, trace Gravel, Light Brown, Moist, Loose	2-3-2 N=5					
12			15	SP	SAND, Fine Grained, trace Gravel, Light Brown, Moist, vs						
15	SS		16	SP	SAND, Fine Grained, trace Gravel, Light Brown, Moist, Medium Dense	7-11-6 N=17					
20	SS		18	SP	SAND, Fine Grained, Light Brown, Moist, Medium Dense	7-8-6 N=14					

End of Boring at 21.5 feet - Boring backfilled with auger cuttings

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-$^3/_8$" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	BCR:	Before Casing Removal
WCI:	Wet Cave in	WD:	While Drilling	ACR:	After Casing Removal
DCI:	Dry Cave in	AB:	After Boring	N/E:	Not Encountered

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 - 1	Very Soft
500 – 1,000	2 - 4	Soft
1,000 – 2,000	4 - 8	Medium Stiff
2,000 – 4,000	8 - 15	Stiff
4,000 – 8,000	15 - 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3[E]		GW	Well-graded gravel[F]
			Cu < 4 and/or 1 > Cc > 3[E]		GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel[F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3[E]		SW	Well-graded sand[I]
			Cu < 6 and/or 1 > Cc > 3[E]		SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]		ML	Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay[K,L,M,N]
						Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay[K,L,M]
			PI plots below "A" line		MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay[K,L,M,P]
						Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

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

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

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

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

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

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

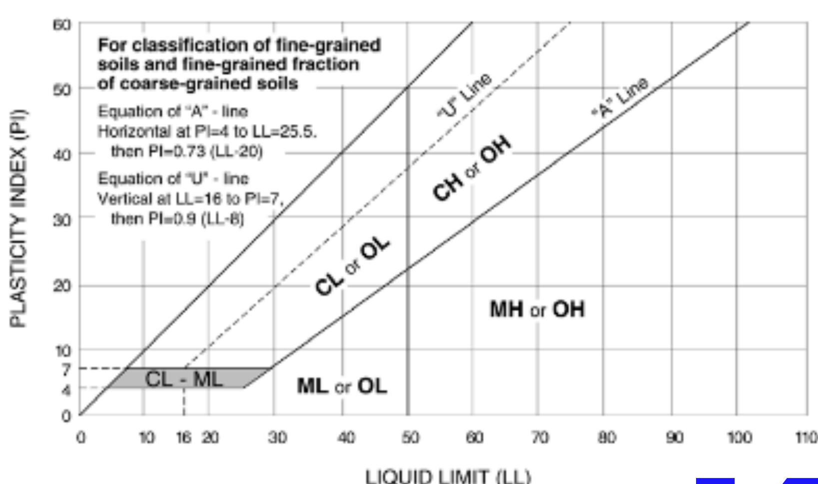
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Kilo Engineering, LLC
Marine on St. Croix, Minnesota
763-412-1965
www.kiloengineering.com

July 3, 2024

Mr. Nick Peterson
Quest Civil Engineering, LLC
320 West Grand Avenue, Suite 320
Wisconsin Rapids, Wisconsin 54495

RE: Addendum One to the Geotechnical Engineering Services Report
Proposed DNR Garage
473 Griffith Avenue
Wisconsin Rapids, Wisconsin
Kilo Project No.: 24-1703 – Addendum One

Dear Mr. Peterson:

Kilo Engineering, LLC (Kilo) is pleased to transmit this Geotechnical Engineering Services Report for the proposed Garage Building to be located at 473 Griffith Avenue in Wisconsin Rapids, Wisconsin. This report includes the results of field and laboratory testing, recommendations for foundations, pavement section design, and general site development. This addendum (addendum 1) includes boring log observation information and the additional stormwater management recommendations requested by the client.

This addendum is under the same terms and conditions as the original report, Kilo Report 24-1595 dated May 17, 2024, which was authorized by the execution of Kilo's proposal 24e-1502 dated March 25, 2024, by the signature of Ms. Kimberly Kronstedt. The information in the original report is to be utilized unless explicitly modified in this addendum. Kilo appreciates the opportunity to perform this Geotechnical Study and looks forward to continuing our participation during the design phases of this project. If you have questions pertaining to this report, or if Kilo may be of further service, please contact us at your convenience.

Respectfully submitted,
KILO ENGINEERING

Reed Kaeppe, P.E.
Project Manager

Zack Pilz, E.I.T.
Staff Engineer

LICENSEE STATEMENT
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly licensed Professional Engineer under the laws of the state of Wisconsin.
Signature:
Name: Reed Kaeppe, P.E.
WI P.E. # E-100092 Date: July 3, 2024

WISCONSIN REED KAEPPE E-100092 MINNEAPOLIS MN PROFESSIONAL ENGINEER

PROJECT INFORMATION

Project Authorization and Provided Documentation

The following Table summarizes, in chronological order, the Project Authorization History for the services performed and represented in this report by Kilo Engineering, LLC.

DOCUMENT AND REFERENCE NUMBER	DATE	REPRESENTATIVE & COMPANY
Request for Proposal	3/13/2024	Mr. Nick Peterson Quest Civil Engineering, LLC
Kilo Proposal 24e-1502	3/20/2024	Mr. Joseph Rozmiarek Kilo Engineering, LLC
Notice to Proceed	3/25/2024	Ms. Kimberly Kronstedt, PE Quest Civil Engineering, LLC
Request for Additional Services	6/10/2024	Mr. Nick Peterson Quest Civil Engineering, LLC
Change Order One	6/10/2024	Mr. Joseph Rozmiarek Kilo Engineering, LLC
Notice to Proceed	6/10/2024	Ms. Kimberly Kronstedt, PE Quest Civil Engineering, LLC

Field Exploration Summary

One soil boring was planned to the south of the proposed Garage Building within the envelope of a proposed detention feature. Elevation data on the completed boring was not recorded in the field. The location of the boring was provided within an additional site plan provided by Quest Civil Engineering, LLC prior to the writing of this report. The horizontal accuracy of the boring location is 10± feet.

Kilo engaged Quest Civil Engineering, LLC of Wisconsin Rapids, Wisconsin as drilling subcontractor on this project. The soil boring for the site was completed on June 10, 2024. Hollow-stem augers were used to advance the borings. Samples were taken at half flight intervals to a depth of 20 feet below existing grades. Samples were recovered using split-spoon techniques in general accordance with ASTM D1586. Field data, including boring number, sample depth, and SPT N-value was recorded in the field and a representative soil sample was placed in a glass jar to minimize moisture loss.

The following locations were sampled with soil borings to explore the subsurface conditions at the site:

BORING	TEST PIT TYPE	LOCATION	GENERAL SOIL TYPE (USCS)	DEPTH OF TEST PIT (FT)
TP-1	Stormwater	South of Proposed Building	Sand	21±

The soil samples were delivered to Kilo's soil engineering laboratory for a limited number of engineering property tests. These tests included:

- USCS Soil Classification (ASTM D2487 and D2488)
- Moisture Content (ASTM D2216)
- Percent Passing the #200 Sieve (ASTM D1140)

Material thicknesses were measured to the nearest half-foot in the field. The soil stratigraphy encountered in the field exploration, based on visual-manual classification only, is generalized in the tables below:

Soil (USCS)	Soil Description	Soil Color	Depth Range (ft)
OL	Surficial Organic Soil, (Sandy Clay with Organics)	Black	0 to 1-½± feet
SP	Sand, Sand w/t Trace Clay	Dark Brown, Light Brown	1-½± to 21± feet (termination depth)

The soils noted in the summary above are intended to provide a general description of the soils encountered on site. The test pit logs in the appendix of this report should be consulted for specific information on soil type and observed depths in the test pits. Laboratory testing of samples recovered in this exploration will be reported in the full geotechnical exploration report.

Stormwater Management Recommendations

As sites are developed, the construction of man-made impervious features such as pavements and building roofs reduce the capacity of a site to infiltrate stormwater into the subgrade and increases the peak runoff generated by a given land area in a given storm. As a result of the increase in impervious areas, more of the stormwater volume becomes runoff instead of infiltrating into the ground. With this increase in impervious area, contaminants such as salts, sediment, and debris can be carried by the runoff and eventually pollute lakes, streams, and rivers.

In order to reduce the risks of this problem, the Wisconsin Department of Natural Resources requires on-site storage, infiltration, and treatment of stormwater as part of the Stormwater Permit prior to discharge off-site. This is typically through the use of stormwater management ponds, below-grade storage, or as part of a capture and beneficial reuse process. The soil types present on site affect the available options for stormwater management, and must be evaluated using Wisconsin Stormwater Form 1002 by a certified soils scientist or licensed professional engineer. One planned stormwater management area was noted on the provided site plan, to the south of the proposed building. The site plan with pond locations and test locations is shown in the appendix of this report. This report is based on the soil types in the proposed feature location, and additional testing may be required if the location of the stormwater feature were to change.

The feature types, bottom of feature elevations, and maximum allowable depths are provided in the Wisconsin Stormwater Manual. This manual notes a maximum depth of feature to allow for drainage within 72 hours of the design storm event, and requires a minimum separation of five feet from the bottom of feature elevation to the seasonal high groundwater level or bedrock elevation. Infiltration features that allow infiltrating water to recharge the groundwater require pretreatment prior to discharge as noted in the stormwater manual. A minimum infiltration rate of 0.5 inches per hour is required for an infiltration feature.

The Wisconsin stormwater design manual has a recommended infiltration rate of 0.50 to 1.63 inches per hour based on the sand soil types present on site below the surficial organic soils. No double-ring infiltration test was completed as part of the project. The soil boring completed on June 10, 2024 indicate the presence of sand below the depths tested in the addendum exploration. Based on the tabular values from the Wisconsin DNR manual, Kilo recommends that infiltration features be utilized for stormwater management.

In order to construct an infiltration stormwater feature, any soils that would be classified as organics, cobbles, boulders, silty sand, clayey sand, or sandy clay should be removed from the proposed stormwater feature area and used in other locations on site or disposed of offsite. Then, the upper 12 inches of the poorly graded sand subgrade should be scarified and left in an uncompacted state. The area should be protected from construction traffic after scarification. The site should be graded to direct stormwater runoff to the at-grade feature or a storm sewer collection system as is appropriate. The feature should be protected to minimize erosion upstream of the feature and sediment deposition in the feature, which will negatively impact infiltration rates. This protection can be accomplished using velocity dissipators, rip-rap linings, or other means. Kilo understands the majority of the site will include stormwater discharging into the proposed stormwater system directly. Periodic maintenance to remove accumulated fines material from the base of the feature should be anticipated during the lifetime of the infiltration feature.

Regarding allowable slopes, slopes with a ratio of three horizontal to one vertical (3H:1V) are generally stable but may be difficult to construct and maintain. For this reason, maximum slopes of 4H:1V are recommended to allow for mowing and other maintenance equipment to operate on the side slopes. This reduced slope also reduces the runoff velocity and scour potential near the stormwater feature.

The stormwater areas will require sizing and locating based on-site constraints. The storage volume of the feature will be dependent on the design storm calculations, new building and impervious areas, and the lateral extents of the feature. Determining this storage volume was beyond the authorized scope of this report. It should be noted that the authorized scope of work did not include infiltration testing to determine infiltration rates. The scope of services did not include HydroCAD modeling of the site to determine runoff volumes. This should be completed by others after the proposed site plan has been completed for impervious area calculations.

REPORT LIMITATIONS

The geotechnical engineer has endeavored to adhere to generally accepted professional geotechnical engineering practices in the local area with the findings, recommendations, specifications, or professional advice contained in this report. No other warranties are implied or expressed. This report is based on the recommendations contained herein being incorporated into the project plans and specifications, adequate construction quality control measures are utilized, and that third-party special inspections or construction material testing is completed as noted in this report and as required by section 1705 of the

International Building Code (IBC).

This report may be used only by the client, their design team, and only for the purposes stated, within three years from its issuance. Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kilo of such intended use. Based on the intended use of the report, Kilo may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kilo from any liability resulting from the use of this report by any unauthorized party.

LIST OF APPENDICES

Site Vicinity Plan
Boring Location Plan
Test Pit Logs
Wisconsin Stormwater Form 1002

KILO ENGINEERING

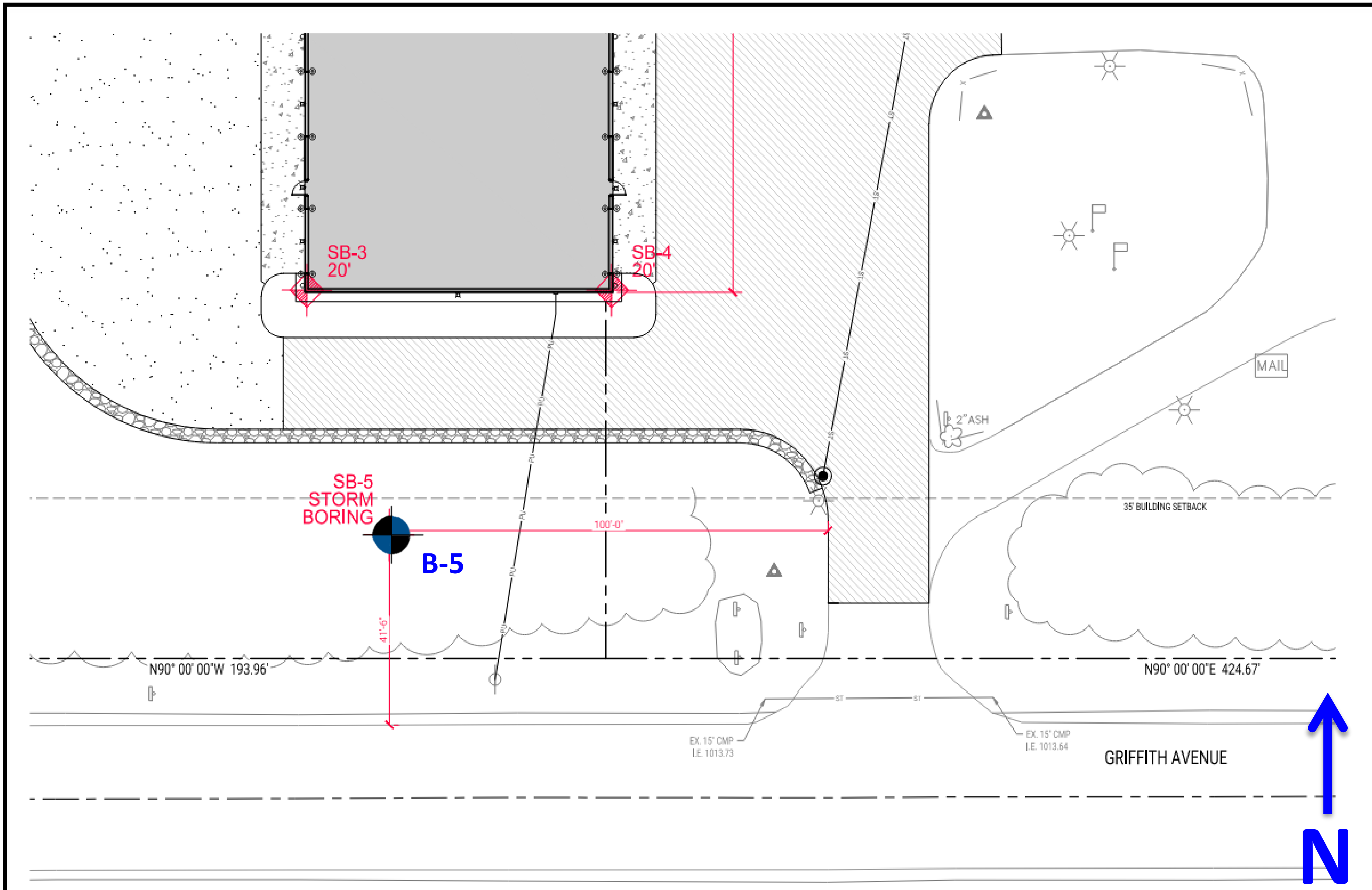
Project Name:	WI DNR Garage
Project Address:	473 Griffith Avenue
City, State:	Wisconsin Rapids, Wisconsin
Project Number:	24-1703

Proposed Site Vicinity Plan

ENGINEERING

Project Name:	WI DNR Garage
Project Address:	473 Griffith Avenue
City, State:	Wisconsin Rapids, Wisconsin
Project Number:	24-1703

Proposed Boring Location Plan



Kilo ENGINEERING

Project Name:	WI DNR Garage
Project Address:	473 Griffith Avenue
City, State:	Wisconsin Rapids, Wisconsin
Project Number:	24-1703

Proposed Boring Location Plan

Kilo Engineering
Marine on Saint Croix, MN

Boring B-5

Drilling Crew:	Quest	Boring Depth:	21 ft	Project Name:	Proposed DNR Garage
Drilling Rig:	CME-75	Elevation:	--	Project Address:	473 Griffith Avenue
Drilling Date:	6/10/2024	GW During Drilling:	Not Observed	City, State:	Wisconsin Rapids, WI
Drilling Method:	H.S.A.	GW At Completion:	Not Observed	Project Number:	24-1703
Sampling Type:	Split Spoon	GW At Delay:	--		
Drilling Foreman:	--	Latitude:	44.351624°N	Boring Location:	Proposed BMP
Logged By:	B. Ficenec	Longitude:	89.823936°W		Stormwater BMP

Depth	Sample	Soil Profile	Recovery (in)	Symbol	Soil or Rock Description:	N-value	MC	PL	LL	PI	P200
0	SS			CL	Sandy LEAN CLAY with Organics, Black, Moist, Very Soft		22				
2	SS		14	SP	SAND, Medium Grained, trace Clay, Dark Brown, Moist, Loose	2-3-4 N=7	7				
5	SS		14	SP	SAND, Medium Grained, Light Brown, Moist, Loose	1-4-4 N=8	4				
7	SS		15	SP	SAND, Medium Grained, Light Brown, Moist, Medium Dense	2-6-7 N=13	5				
10	SS		17	SP	SAND, Medium Grained, Light Brown, Moist, Medium Dense	4-6-6 N=12	5				
12			17	SP		4-5-5 N=10	4				
15	SS		17	SP	SAND, Medium Grained, Light Brown, Moist, Medium Dense	3-5-5 N=10	5				
20	SS		18	SP	SAND, Medium Grained, Light Brown, Moist, Medium Dense	6-6-5 N=11	4				

End of Boring at 21 feet - Boring backfilled with auger cuttings

1002-CPS-23
Division of Industry Services
P. O. Box 2658
Madison, Wisconsin 53701
Scott Walker, Governor
Laura Gutierrez, Secretary

Attachment 2:

SOIL AND SITE EVALUATION – STORM

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

Attach a complete site plan on paper not less than 8 ½ x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent of 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: Wood
Parcel I.D.: 3414095
Reviewed by: J. Rozwinsle
Date: 7/1/2024

Property Owner: Wisconsin DNR Nursery
Property Owner' Mail Address: ~~Griffith Avenue~~ 711 Nepco Road
City / State / Zip Code / Phone Number: Wisconsin Rapids WI 54494

Property Location: Govt. Lot SW ¼ SW ¼ 29 S 22 T N(N) R 6 (E)(or) W
Lot # / Block # / Subd. Name or CSM #
☒ City ☐ Village ☐ Town — Wisconsin Rapids
Nearest Road: Griffith Avenue

Drainage area 17.88 ☐ sq .ft ☒ acres

Test site suitable for (check all that apply): ☐ Site not suitable;
☐ Bioretention; ☐ Subsurface Dispersal System;
☐ Reuse; ☐ Irrigation; ☐ Other ____________

Hydraulic Application Test Method:
☒ Morphological Evaluation
☐ Double Ring Infiltrometer
☐ Other: (specify) ____________

Soil Moisture
Date of soil borings: 6/14/24
USDA-NRCS WETS Value:
☐ Dry =1;
☒ Normal = 2;
☐ Wet = 3.

☒ #OBS. B-5 ☐ Pit ☒ Boring Ground surface elevation. 1029 ft. Elevation of limiting factor 1004 ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr
A	0-12	7.5YR 2.5/2	None	S	FG	–	–	–	25	0.50
B	12-24	7.5YR 6/4	None	S	FG	–	–	–	10	0.50
C	24-240	10YR 8/2	None	S	FG	–	–	–	3	1.63

Comments:

☐ #OBS. ☐ Pit ☐ Boring Ground surface elevation. ________ ft. Elevation of limiting factor ________ ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr

Comments:

Name (Please Print): Joseph Rozwinsle
Signature: [signature]
Credential Number: PE-44797
Address: 10600 116th St N, Marine on St Croix MN
Date Evaluation Conducted: 7/1/24
Telephone Number: 763-412-1965

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-$^{3}/_{8}$" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	BCR:	Before Casing Removal
WCI:	Wet Cave in	WD:	While Drilling	ACR:	After Casing Removal
DCI:	Dry Cave in	AB:	After Boring	N/E:	Not Encountered

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

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Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
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500 – 1,000	2 - 4	Soft
1,000 – 2,000	4 - 8	Medium Stiff
2,000 – 4,000	8 - 15	Stiff
4,000 – 8,000	15 - 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
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UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines Classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay[K,L,M,N]
					Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic Silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay[K,L,M,P]
					Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

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

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

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

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

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

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

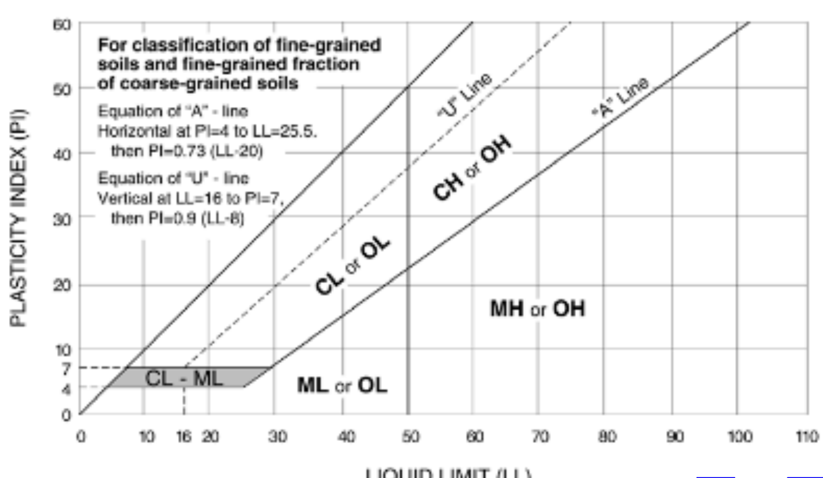
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



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