ECS Midwest, LLC

Geotechnical Engineering Report

Proposed Sauna Guard Development

11250 West Laraway Road
Frankfort, Illinois

ECS Project No. 16:14878

May 31, 2023

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May 31, 2023

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ECS Project No. 16:14878

Reference: Geotechnical Engineering Report
Proposed Sauna Guard Development
11250 West Laraway Road
Frankfort, Illinois

Dear Mr. Gorecki:

ECS Midwest, LLC (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Unlimited Masonry & Construction, Inc. during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS MIDWEST, LLC

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APPENDICES

EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal foundation recommendations are summarized. Information gleaned from the Executive Summary should not be utilized in lieu of reading the entire geotechnical report.

- The project is planned to consist of a sauna guard office and the associated site amenities.
- A shallow foundation system bearing in competent native soils or bearing on engineered fill or lean concrete overlying competent native soils may be designed for a maximum net allowable bearing pressure of **3,000 psf.** Limited undercuts (up to about 1 foot deep) at isolated locations may be required based on the subsurface conditions encountered at the time of construction**.**
- The building floor slab thicknesses may be determined based on an assumed modulus of subgrade reaction of **100 pounds per cubic inch (pci),** provided the subgrade soils proofroll satisfactorily, or **150 pounds per cubic inch (pci),** provided the existing fill is completely removed and replaced with engineered fill. Please refer to the corresponding section for more important information.
- For pavement design purposes, an **estimated Illinois Bearing Ratio of 3** (for flexible pavements) or an assumed modulus of subgrade reaction of **100 pounds per cubic inch (pci)** (for rigid pavements) should be utilized for compacted natural soil or new engineered fill. Please refer to the corresponding section for more important information.

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design of shallow foundations, slabs-on-grade, drive lanes and parking lots for the proposed sauna guard development in Frankfort, Illinois. The recommendations developed for this report are based on project information supplied by Mr. David Gorecki with Unlimited Masonry & Construction, Inc.

Our services were provided in accordance with our Proposal No. 16:23033-GP dated May 4, 2023 as authorized by the execution of our proposal by Mr. Brandon Caldwell with Unlimited Masonry & Construction, Inc. on May 4, 2023, which includes the Terms and Conditions of Service within.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

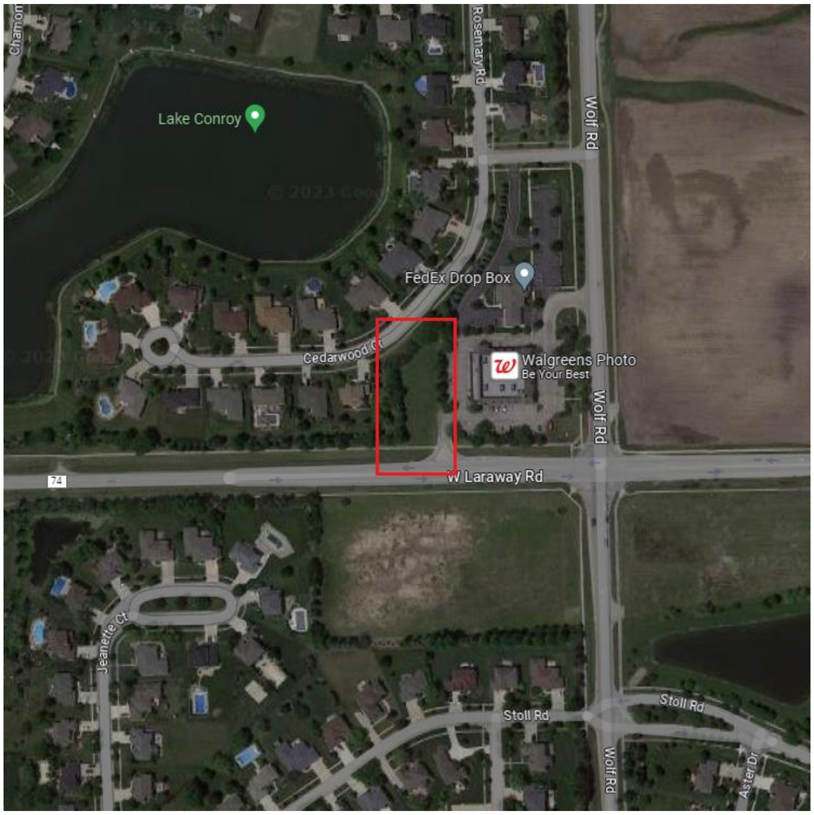
The report includes the following items.

- A brief review and description of our field and laboratory test procedures and the results of testing conducted.
- A review of surface topographical features and site conditions.
- A review of subsurface soil stratigraphy with pertinent physical properties.
- Final soil exploration/test boring logs.
- Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills and identification of potentially unsuitable soils and/or soils exhibiting excessive moisture at the time of sampling.
- Recommended foundation type(s).
- Recommendations for the design and construction of soil-supported slabs.
- General recommendations for new pavement design, including a recommended design CBR.
- Evaluation and recommendations relative to groundwater control, including recommendations for pavement underdrains.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The project site is a vacant lot located between 11200 and 11267 West Laraway Road in Frankfort, Illinois and is bounded to the north by Cedarwood Court, to the east by a pharmacy development and the associated site amenities, to the south by West Laraway Road and to the west by a single-family home and the associated site amenities. The site location is shown below, and in wider scope on the Site Location Diagram in Appendix A:



Site Location Map

The project site is currently an undeveloped, grassed lot and forested in the north and west portions of the site. At the time this report was written, a site-specific topographic survey was not available. Based on our review of available online resources (i.e., Will County GIS, Illinois website), the existing site grades generally range from about EL. 759 feet to EL. 768 feet above MSL (±). The project site is generally flat in the eastern two thirds of the project stie (area where the proposed project will be constructed), and slopes downhill in the southeast-to-northwest and east-to-west directions.

2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the planned development including proposed buildings and related infrastructure:

STRUCTURAL DESIGN	
SUBJECT	**DESIGN INFORMATION**
Building Footprint	4,750 square feet
# of Stories	Single-story above grade, Slab-on-grade (no basement)
Usage	Retail
Framing	Concrete foundation, steel frame
Column Loads	Up to 75 kips or less
Wall Loads	1½ to 2½ kip per linear foot (klf) or less
Lowest Finished Floor Elevation	EL. 768 feet above MSL (approximately matching the average site grades in the area of the proposed structure)

The settlement tolerance was not provided. Based on our experience with similar structure, we have assumed a settlement tolerance of 1 inch total and ¾ inch differential.

Pavement: The design traffic was not provided to us. Therefore, it was necessary for us to use arbitrarily selected design traffic volumes. The information below summarizes our understanding and estimations of the traffic:

TRAFFIC VOLUME INFORMATION	
Vehicle Type	**Daily Traffic Counts**
Personal Vehicles	250
Delivery Vans	6
Garbage Disposal	2

In addition, a traffic growth factor of 2% per year and a design period of 20 years are included in the preliminary pavement sections detailed below.

Grading: Based on our review of the available contour information, grading operations consisting of up to about 2 feet of cut and/ or fill operations will be required to develop the proposed finished site grades.

If ECS' understanding of the project is not correct, especially if the structural loads or elevations are different, please contact ECS so that we may review these changes and revise our recommendations, as appropriate.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our exploration procedures are explained in greater detail in Appendix B including the insert entitled *'Subsurface Exploration Procedures: SPT'*. Our scope of work included drilling five (5) borings. Our borings were located with a handheld GPS unit and their approximate locations are shown on the Boring Location Diagram in Appendix A.

3.1 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following Sections of this text provide generalized characterizations of the soil strata. Please refer to the boring logs in Appendix B.

Approximate Depth Increment (feet)	Stratum No.	Material Description	Calibrated Penetrometer Resistance (tsf)	Natural Moisture Content (%)	SPT(1) N-values (bpf)
Near-Surface Cover	N/A	**Topsoil:** approximately 7 to 8 inches	N/A	N/A	N/A
¾-6½	I(2)	**Fill: (CL/ML) Silty Clay,** dark brown and black, moist, very stiff to hard	2¼-5	14-29	5-13(2)
4½-25	II	**(CL/ML) Silty Clay,** brown to gray, moist, stiff to hard	1¼-5	13-29	5-23

Notes:

(1) Standard Penetration Testing
(2) SPT N-Values in fill or possible fill soils may not be representative of actual in-situ conditions.

The soil stratification shown on the boring logs represents the interpreted soil conditions at the actual boring locations. Variations in the stratification can occur between sample intervals and boring locations. The subsurface conditions at other times and locations on the site may differ from those found at the boring locations. If different site conditions are encountered during construction, ECS should be contacted to review our recommendations relative to the new information.

3.2 GROUNDWATER OBSERVATIONS

In conventional auger drilling, water or drilling fluid is not injected during drilling. As such, free-flowing water can be observed during drilling and/or after auger removal. Water levels were measured in our boring logs in Appendix B. Free-flowing groundwater was not encountered during drilling activities at the boring locations. Soils in the Midwest frequently oxidize from gray to brown above the level where the soil remains saturated. The ground water table is frequently interpreted to be located near this zone of change, which may be an indication of the static long-term water level. Based on the results of the subsurface exploration and our experience in sites with similar geological setting, we anticipate the long-term groundwater table is located at about EL. 752 feet above MSL (corresponding to about 16 feet below current site grades) and follows the existing site topography.

Perched water conditions may develop or exist seasonally especially in areas where lower permeability silty clay soils are present beneath the pavements. Variations in the long-term water table elevation may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

3.3 LABORATORY TESTING

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples. These tests included:

- Natural Moisture Content (ASTM D2216)
- Calibrated Penetrometer Resistance

Each sample was visually classified on the basis of texture and plasticity in accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and including USCS classification symbols. After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

The soil samples will be retained in our laboratory for a period of 60 days, after which, they will be discarded, unless other instructions are received as to their disposal.

4.0 DESIGN RECOMMENDATIONS

4.1 SHALLOW FOUNDATIONS

Provided subgrades and engineered fills are prepared as recommended in this report, the proposed structure can be supported by shallow foundations including column footings and continuous wall footings. We recommend the foundation design use the following parameters:

FOUNDATION DESIGN CHARACTERISTICS

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure (1)	3,000 psf	3,000 psf
Acceptable Bearing Soil Material	Stratum II Engineered fill or lean concrete overlying Stratum II	Stratum II Engineered fill or lean concrete overlying Stratum II
Minimum Width	30 inches	18 inches
Minimum Footing Embedment Depth (below slab or finished grade) (2)	24 inches	24 inches
Minimum Exterior Frost Depth (below final exterior grade)	42 inches	42 inches
Estimated Total Settlement	Less than 1- inch	Less than 1- inch
Estimated Differential Settlement	Less than ¾ inch between columns	Less than ¾ inch

Notes:

(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.

(2) Based on estimated structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.

(3) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

Suitable Bearing Materials: Footing pads are recommended to be entirely supported by at least 2 feet of select engineered fill or lean concrete overlying competent natural soils. Soils suitable as the subgrade for engineered fill and indirect foundation support should have parameters as noted in the following Table or greater, unless otherwise approved by the geotechnical engineer:

SUITABLE BEARING SOIL CHARACTERISTICS

Maximum Net Allowable Bearing Capacity (psf)	Cohesive Soil (Clays)		
	Consistency	Unconfined Compressive Strength	SPT-N Value
3,000	Stiff	1¼ tsf or higher	8 or higher

Potential Undercuts: Based on the results of the present subsurface exploration, undocumented miscellaneous fill soils were not generally encountered within the soil borings at the project site. Based on the results at the boring locations, a finished floor elevation of EL. 768 feet above MSL and a bearing elevation of 3½ feet below finished floor elevation (in accordance with the previous Section), the anticipated undercuts required to reach suitable soils are indicated in the Table below:

ANTICIPATED UNDERCUTS (BELOW FOOTINGS ONLY) AT THE BORING LOCATIONS

Boring Location	Depth to Suitable Soils^1	Anticipated Undercuts Depths
B-01	4½ feet	About 2 feet
B-02	Less than 1 foot^3	About 2½ feet

1. Includes the thickness of the observed surficial materials. If encountered, thickness of undocumented fill could be deeper in unexplored areas of the project site.
2. Assumes a FFE of EL. 768 feet and a bearing elevation of EL. 764½ feet (3½ feet below FFE)

Please note, the anticipated undercuts indicated in the Table above are approximate and should be validated once the topographic survey is made available. The anticipated undercuts should be confirmed at the time of construction by an experienced Geotechnical technician. Please note the anticipated undercuts refer only to the proposed foundation locations. Undercuts should be backfilled with engineered fill or lean concrete ($f'_c \geq 1,000$ psi at 28 days) up to the original design bottom of footing elevation; the original footing shall be constructed on top of the new engineered fill or hardened lean concrete.

Coefficient of Friction: ECS anticipates the primary component of lateral resistance will be developed by friction along the horizontal interface between the footing concrete and underlying soil. For cast-in place concrete, based on the data obtained from this exploration and in accordance with recommendations presented in *Chapter 3 of NAVFAC DM 7.2, Table I,* the friction coefficients (f) for cohesive and granular materials are provided below.

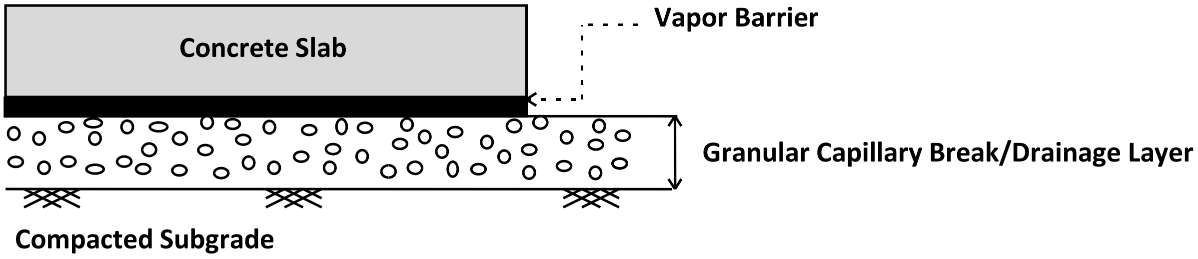
COEFFICIENT OF FRICTION RECOMMENDATIONS

Condition	Recommended Coefficient of Friction
Concrete Over Cohesive Material (Clay/Silt)	0.35

*These Values Do Not Reflect a Factor of Safety

4.2 SLABS ON GRADE

The on-site natural soils are considered suitable for support of the lowest floor slabs. Based on a lowest finished floor elevation of EL. 768 feet MSL, it appears that the slabs will bear on Stratum I or engineered fill used to backfill excavations or establish site grades. The following graphic depicts our soil-supported slab recommendations:



1. Drainage Layer Thickness: 6 inches

Subgrade Modulus: Provided the Engineered Fill and Granular Drainage Layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction, k_1 of 100 pci (lbs./cu. inch**)** provided the exposed subgrade proofrolls satisfactorily, or 150 pci if the existing fill is completely removed and the resulting excavations backfilled with engineered fill**.** The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

Vapor Barrier: Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture penetration through the floor slab. When a vapor barrier is used, special attention should be given to surface curing of the slab to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.

Slab Isolation: Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration prevents the use of a free-floating slab such as in a drop down footing/monolithic slab configuration, the slab should be designed with suitable reinforcement and load transfer devices to preclude overstressing of the slab.

4.4 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The International Building Code (IBC) 2018 requires site classification for seismic design based on the upper 100 feet of a soil profile. At least two methods are utilized in classifying sites, namely the shear wave velocity (v_s) method and the Standard Penetration Resistance (N-value) method. The second method (N-value) was used in classifying this site.

SEISMIC SITE CLASSIFICATION			
Site Class	Soil Profile Name	Shear Wave Velocity, Vs, (ft./s)	N value (bpf)
A	Hard Rock	Vs > 5,000 fps	N/A
B	Rock	2,500 < Vs ≤ 5,000 fps	N/A
C	Very dense soil and soft rock	1,200 < Vs ≤ 2,500 fps	>50
D	Stiff Soil Profile	600 ≤ Vs ≤ 1,200 fps	15 to 60
E	Soft Soil Profile	Vs < 600 fps	<15

The maximum explored depth in the present subsurface exploration was 25 feet below current site grades. As such, based upon our interpretation of the subsurface conditions and our experience with similar geological settings, the appropriate Seismic Site Classification is "D" as shown in the preceding Table.

Ground Motion Parameters: In addition to the seismic site classification, ECS has determined the design spectral response acceleration parameters following the IBC methodology. The Mapped Reponses were estimated from the *'ATC Hazards by Location'* website (https://hazards.atcouncil.org/) for the address of the project. The design responses for the short (0.2 sec, S_{DS}) and 1-second period (S_{D1}) are noted in bold at the far-right end of the following table.

GROUND MOTION PARAMETERS								
Period (sec)	Mapped Spectral Response Accelerations (g)		Values of Site Coefficient for Site Class		Maximum Spectral Response Acceleration Adjusted for Site Class (g)		Design Spectral Response Acceleration (g)	
0.2	S_S	0.152	F_a	1.6	$S_{MS}=F_aS_s$	0.243	**$S_{DS}=2/3\ S_{MS}$**	**0.162**
1.0	S_1	0.069	F_v	2.4	$S_{M1}=F_vS_1$	0.165	**$S_{D1}=2/3\ S_{M1}$**	**0.110**

The Site Class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses. If a higher site classification is beneficial to the project, we can provide additional testing methods that may yield more favorable results.

4.5 PAVEMENTS

Subgrade Characteristics: Based on the results of our borings, it appears that the pavement subgrades in cuts will consist mainly of Silty CLAY (CL/ML) FILL. Illinois Bearing Ratio (IBR) testing or other means to characterize the response of the exposed subgrade materials was not included in our scope or performed in our lab. As such, based on the results of the exploration and the anticipated pavement subgrade materials, we recommend using an estimated IBR value of 3 for design purposes of flexible pavements and a modulus of subgrade reaction, k_v, value of 100 pci for rigid pavements.

The design traffic was not provided to us. Therefore, it was necessary for us to use arbitrarily selected design traffic volumes. The information below summarizes our understanding and estimations of the traffic:

TRAFFIC VOLUME INFORMATION	
Vehicle Type	**Daily Traffic Counts**
Personal Vehicles	250
Delivery Vans	6
Garbage Disposal	2

In addition, a traffic growth factor of 2% per year and a design period of 20 years are included in the preliminary pavement sections detailed below.

The preliminary pavement sections below are guidelines that may or may not comply with local jurisdictional minimums. Please note, the sections below were developed assuming trailers will traverse the heavy-duty pavement sections only:

PROPOSED PAVEMENT SECTIONS (IBR = 3; K_V = 100 PCI)				
	FLEXIBLE PAVEMENT		RIGID PAVEMENT	
MATERIAL	Heavy Duty	Light Duty	Heavy Duty	Light Duty
Portland Cement Concrete (f'_c = 4000 psi)	-	-	6 in.	5 in.
Bituminous Surface Course (SM-9.5)	1½ in	1¼ in	-	-
Bituminous Binder Course (BM-25.0)	3 in	2¼ in	-	-
Graded Aggregate Base Course (AASHTO #21A/21B)	10 in	8 in	6 in	6 in
Total	14½ in	11½ in	12 in	11 in

In frequent and higher stress traffic areas, such as where trucks frequently turn, drive through lanes, delivery areas, loading dock aprons, trash enclosure pads, and points of ingress or egress, the heavy duty rigid pavement is recommended to be used.

Pavement materials and construction should be in accordance with the AASHTO Guide for Design of Pavement Structures, and the IDOT Standard Specifications for Specifications for Road and Bridge Construction.

If the pavements will be constructed early during site development to accommodate construction traffic, consideration should be given to the construction of designated haul roads, where thickened pavement sections are provided to accommodate the construction traffic, as well as the future in-service traffic.

Rigid Pavements: We recommend an air-entrained concrete mix (compressive strength of at least 4,000 pounds per square inch at 28 days) for rigid pavement. Provide adequate construction joints, contraction joints and isolation joints in the areas of rigid pavement to reduce the impacts of cracking and shrinkage. Please refer to ACI 330R-92 Guide for Design of Concrete Parking Lots. The ACI Guide recommends an appropriate spacing strategy for the anticipated loads and pavement thickness. It has been our experience that joint spacing closer to the recommended values in ACI results in a pavement with less cracks outside the joints and better long-term performance. Control joint spacing should be determined in accordance with the current ACI code. Provide expansion joints where the pavement abuts fixed objects, such as the buildings and light poles.

Drainage: An important consideration with the design and construction of pavements is surface and subsurface drainage. Based on our estimated groundwater level, we consider surface water infiltration to be the main source of water to be considered for pavement design on this project.

Shape or crown the final pavement surface to properly direct surface water to suitable on or off-site stormwater drainage infrastructure. Properly slope the pavement subgrade to avoid dips or pockets where water may become trapped. Dips in the subgrade can result in a “bathtub” effect, which may trap water and potentially soften the subgrade. The subgrade in areas requiring undercut and backfill with granular soils are recommended to be graded to drain toward a drain tile. The drain tile should be sloped a minimum of ½ to 1 percent to discharge to nearby storm sewers, drainage ditches or other appropriate drainage facilities. Install edge drains where site grades slope toward the pavement edge to reduce the potential for water to enter the base course layer. Slope edge drains to the nearest appropriate drainage facility. Water that ponds on the subgrade surface can lead to deterioration of the subgrade soils, reduction of the base course support characteristics, and result in pavement heave during freezing conditions. Good drainage should help reduce the possibility of the subgrade materials being wet over a long period of time.

To reduce the potential for shallow perched water to develop in areas of the site, install “stub” or “finger” drains around catch basins and in other low-lying areas of the parking lot to reduce the accumulation of water above and within the subgrade soils and aggregate base. As an alternative to the use of stub or finger drains, perforate existing manholes and storm sewer inlets with 1-inch diameter holes at 2-foot centers, cover the holes with a wire mesh and wrap the manhole/inlet with a non-woven geotextile to reduce migration of material into the manhole/inlet. The holes could be placed at 90 degree intervals around the perimeter of the manhole, and the excavation around the manhole backfilled with free draining granular materials. Consider installation of pavement edge drains or trench drains to reduce the accumulation of water within the base course and on the subgrade soils.

Sheet drainage across large pavement areas allows more water to enter the pavement through openings, cracks, and weak points over time which can adversely affect the base course and subgrade. This can increase the potential risk of premature pavement deterioration, distress, and long-term pavement maintenance issues. Intermediate drains should be installed at adequate intervals to reduce the length of sheet flow across the pavement surface.

Maintenance: A sound maintenance program should be implemented to help maintain and enhance the performance of pavements and help attain the design service life. A preventative maintenance program should be started early in the pavement life to be effective. The “standard of the industry” supported by research indicates that preventative maintenance should typically begin within 2 to 5 years of the placement of pavement. However, maintenance of pavement on undocumented fill sites may require more maintenance and sooner. Failure to perform preventative maintenance will reduce the service life of the pavement and increase the costs for corrective maintenance and full pavement rehabilitation. Seal joints and cracks with elastomeric caulk in a timely manner to help reduce water infiltration thru the pavement section into the base course layer, which may result in softening of the subgrade and deterioration of the pavement. Observe pavements for distresses, such as cracks, depressions, and poor drainage, at least twice a year, typically once in the spring and once in the fall.

Shrinkage cracking is common with asphalt and occurs with age. Development of cracks should be expected with normal exposure to weather, wear and age. These cracks may become larger when exposed to such things as weather and vegetation growth and should be treated promptly.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

5.1.1 Stripping and Grubbing

The subgrade preparation should consist of stripping all vegetation, rootmat, topsoil, pavements (including gravel base) and any soft or unsuitable materials from the 10-foot expanded building, 5-foot expanded pavement limits, and 5 feet beyond the toe of Engineered Fills. ECS should be retained to verify that unsuitable surficial materials have been removed prior to the placement of Engineered Fill or construction of structures.

5.1.2 Proofrolling

After removing all unsuitable surface materials, cutting to the proposed grade, and prior to the placement of any engineered fill or other construction materials, the exposed subgrade should be observed by ECS. The exposed subgrade should be thoroughly proofrolled with previously approved construction equipment having a minimum axle load of 10 tons (e.g., fully loaded tandem-axle dump truck). The areas subject to proofrolling should be traversed by the equipment in two perpendicular (orthogonal) directions with overlapping passes of the vehicle under the observation of ECS. This procedure is intended to assist identification of yielding materials. In the event that unstable or "pumping" subgrade is identified during the proofroll, those areas should be marked for repair prior to the placement of any subsequent engineered fill or other construction materials. Methods of repair of unstable subgrade, such as undercutting, moisture conditioning and recompaction, or chemical stabilization, should be discussed with ECS to determine the appropriate procedure with regard to the existing conditions causing the instability. Test pits may be excavated to explore the shallow subsurface materials in the area of the instability to help determine the appropriate remedial action to stabilize the subgrade.

If construction will occur during wet times of the year (such as during the spring or fall months) or immediately following extended periods of rain, then seasonal reduction of the near surface soil strength will occur. This may cause additional unstable or pumping subgrade areas for constructability concerns. The high moisture content clayey and silty materials, present near surface at several of the boring locations, may not pass a proofroll, and may need to be undercut or repaired. Some undercutting or repair of unstable subgrade soils should be anticipated during slab and pavement subgrade preparation. The actual quantity of the subgrade undercut, or stabilization should be determined at the time of construction.

Undercut or repair of unstable subgrades to establish a suitable support condition may be needed. The improvement method chosen may be influenced by several factors such as weather and schedule, as well as the area, depth and nature of the unstable subgrade soils. Depending on the aforementioned and other factors, subgrade repair methods may include:

Scarification and Compaction: Soils can be scarified, moisture conditioned (i.e., dried or wetted) to within a narrow range of the material's optimum moisture content and compacted. Scarification and compaction is generally most applicable where very shallow unstable conditions are encountered and at times when the soil can be properly dried or wetted to within a narrow range of the materials optimum moisture content.

Undercut and Replacement: We recommend soft or yielding soils be evaluated in approximately 6 to 12-inch intervals to help limit the volume of undercuts. If soft or yielding soils are identified, the contractor should remove only 6 to 12 inches of material at a time in the subject area and then proofroll/evaluate the undercut subgrade to determine if additional undercut is needed. This may take more time but could potentially reduce the removal of more soil than necessary.

Chemical Modification: Alternatively, if these soils cannot be stabilized by conventional methods, chemical modification of the subgrade soils, such as cement, cement kiln dust, or other materials, may be utilized to reduce the moisture content and/or provide additional stabilization. An experienced pre-qualified contractor that has successfully chemically modified similar-sized projects with similar soil conditions is recommended to be used. The soil modification procedure, such as determination of the type and quantity of additive, and mixing and curing procedures, should be evaluated before implementation. This evaluation may include testing the soil for pH, resistivity, sulfates, and chloride to check if an adverse chemical reaction could occur. The contractor should be required to minimize dusting or implement dust control measures. For preliminary estimating purposes, the approximate incorporation rate (based on dry weight of soil) is typically in the range of 5 to 7 percent for Portland cement and at least a depth of 18 inches must be stabilized. Typically, the percentage needed is less for hydrated lime than other lime byproducts because the available calcium oxide content of lime byproducts tends to be lower. Alteration of the pavement section to include additional drainage may be needed if a chemically stabilized subgrade is used.

5.1.3 Site Temporary Dewatering

Limited Excavation Dewatering: Based upon our subsurface exploration at this site, as well as significant experience on sites in nearby areas of similar geologic setting, we believe construction dewatering at this site will be mainly limited to removing accumulated rainwater or perched water if it becomes an issue. It appears that the permanent static groundwater for this site is well below the planned deepest excavation, at an elevation of about EL. 752 feet above MSL (or about 16 feet below current site grades). The project team should consider contingencies during construction to deal with perched water during the construction of the proposed foundations, in case it is encountered in unexplored areas of the project site.

5.2 EARTHWORK OPERATIONS

5.2.2 Engineered Fill

Prior to placement of Engineered Fill, representative bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which will typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications. Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

Satisfactory Engineered Fill Materials: Materials satisfactory for use as Engineered Fill should consist of inorganic soils with the following engineering properties and compaction requirements.

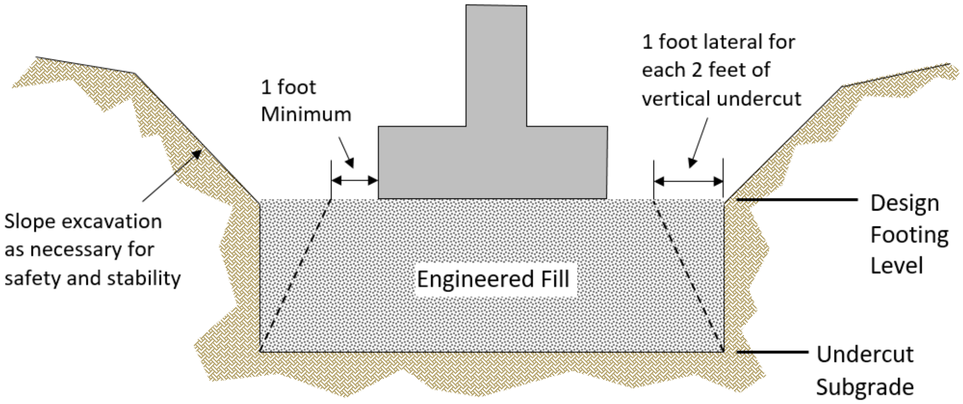
ENGINEERED FILL INDEX PROPERTIES	
Subject	**Property**
Building and Pavement Areas	LL < 40, PI<20
Max. Particle Size	3 inches
Max. Organic Content	5% by dry weight

ENGINEERED FILL COMPACTION REQUIREMENTS	
Subject	**Requirement**
Compaction Standard	Modified Proctor, ASTM D1557
Required Compaction	95% of Max. Dry Density
Moisture Content	-1, +3 % points of the soil's optimum value
Loose Thickness	8 inches prior to compaction

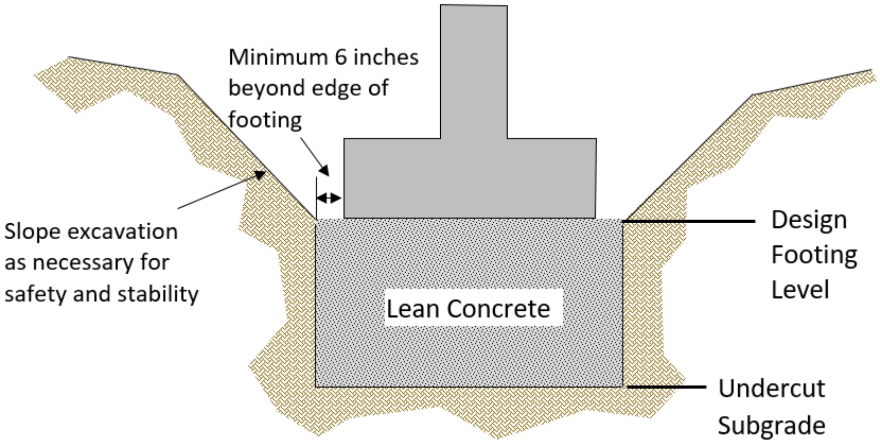
On-Site Borrow Suitability: The on-site soil may be feasible to use as engineered fill but should be further evaluated by ECS prior to its use. On-site soil used as engineered fill must not contain more than 5 percent organic matter as determined by ASTM D2974, and must be free of frozen matter, deleterious materials, over-sized material (maximum 3-inch particle diameter), or chemicals that may result in the material being classified as "contaminated." Some conditions at the time of construction, such as wet or freezing weather, may preclude the use of on-site soil, and use of an imported less moisture sensitive or less frost susceptible granular material may be needed. The soils must be compacted within a narrow range of the material's optimum moisture content, preferably at or above the optimum moisture content. The soil should not be compacted too dry as it may lose its apparent stability if it later becomes wet. Soil chemical modification may be helpful to reduce moisture contents of subgrade soils and fills. The suitability of engineered fill materials is recommended to be checked by ECS prior to placement. Silt soils are difficult to work with, properly compact and can get easily disturbed, especially when wet. In addition, silt soils are frost susceptible and should not be utilized within 3 feet beneath exposed slabs and pavements.

Compaction Equipment: Compaction equipment suitable to the soil type being compacted should be used to compact the subgrades and fill materials. Sheepsfoot compaction equipment should be suitable for the fine-grained soils (clays). A vibratory steel drum roller should be used for compaction of coarse-grained soils (sands and gravels) as well as to help seal compacted surfaces. Vibratory compaction methods should be done with caution near the water table because an unstable subgrade condition could develop. Static compaction and thinner lifts may be needed near the water table.

Engineered Fill Below Foundations: Recompact unsuitable bearing soils encountered at the proposed foundation bearing grade or within the foundation influence zone, if feasible, or removed to a suitable bearing subgrade and to a lateral extent, as conceptually shown in the following Figure. The zone of the engineered fill placed below the foundations is recommended to extend 1 foot beyond the outside edges of the footings and from that point, outward laterally 1 foot for every 2 feet of fill thickness below the footing.



Alternatively, backfill undercuts with lean concrete ($f'_c \geq 1,000$ psi at 28 days) up to the original design bottom of footing elevation. The original footing is recommended to be constructed on top of the hardened lean concrete. If lean concrete is utilized the excavation is recommended to be 1 foot wider than the footing (6 inches on each side), as conceptually shown in the Figure below, and the lean concrete should be allowed to sufficiently harden prior to placement of the foundation concrete.



Fill Placement Considerations: Do not place fill materials on frozen soils, on frost-heaved soils, on excessively wet soils, or soils that are otherwise unstable. Borrow fill materials should not contain frozen materials at the time of placement, and all frozen or frost-heaved soils should be removed prior to placement of engineered fill or other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned.

Grade fill areas at the end of each workday to help facilitate drainage of precipitation and seal the surface by use of a smooth-drum roller to reduce infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the contractor may need to scarify existing subgrades to an approximate depth of 4 inches to reduce the potential for a weak plane to form between the new fill and the existing subgrade soils.

Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, earthwork should be performed during the warmer, drier times of the year, if practical. Proper drainage should be maintained during the earthwork phases of construction to prevent ponding of water which tends to degrade subgrade soils. Alternatively, if these soils cannot be stabilized by conventional methods as previously discussed, modification of the subgrade soils, such as with lime, Portland cement, or other materials may be utilized to adjust the moisture content.

Have equipment readily available during earthwork for both drying and wetting of fill soils. We do not anticipate significant problems in controlling moisture within the fill during dry weather, but moisture control may be difficult during winter months or extended periods of rain. The control of moisture content of clayey and silty soils can be difficult. Further, these soils are easily degraded by construction traffic when the moisture content is elevated.

5.3 FOUNDATION AND SLAB OBSERVATIONS

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick “mud mat” of “lean” concrete should be placed on the bearing soils before the placement of reinforcing steel.

Footing Subgrade Observations: Most of the soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structure. It is important to have ECS observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are what was anticipated.

Slab Subgrade Verification: Prior to placement of a drainage layer, the subgrade should be prepared in accordance with the recommendations found in **Section 5.1.2 Proofrolling**.

5.4 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally suitable for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Any loose or unsuitable materials encountered should be removed and replaced with suitable compacted Engineered Fill, or pipe stone bedding material.

Utility Backfilling: The granular bedding material (AASHTO No. 57 stone) should be at least 4 inches thick, but not less than that specified by the civil engineer’s project drawings and specifications. We recommend that the bedding materials be placed up to the spring line of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for Engineered Fill and Fill Placement.

Excavation Safety: All excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining stable temporary excavations and slopes. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by the Client. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

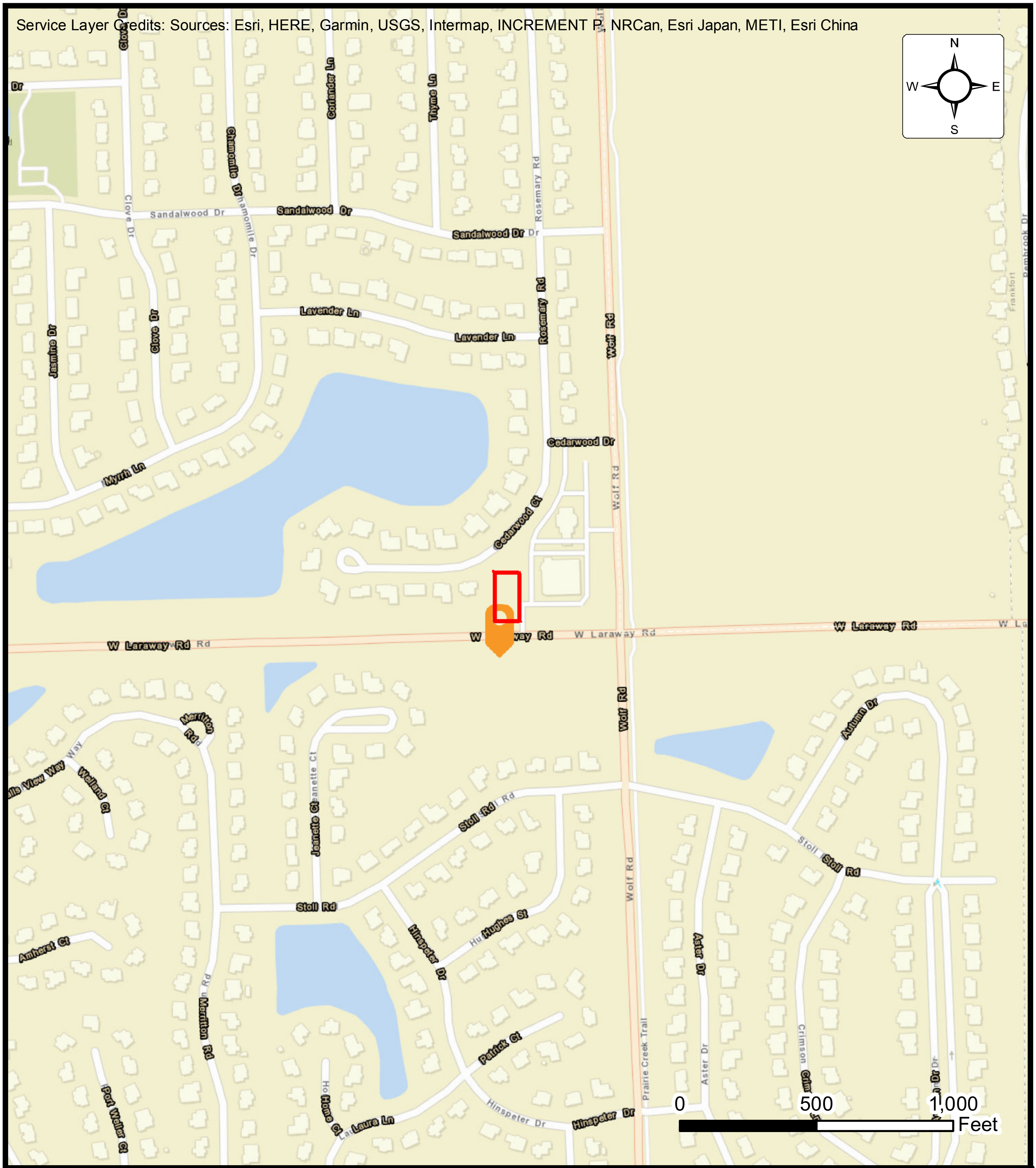
We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

Appendix A - Drawings and Reports

Site Location Diagram
Boring Location Diagram(s)
Subsurface Cross-Section(s)

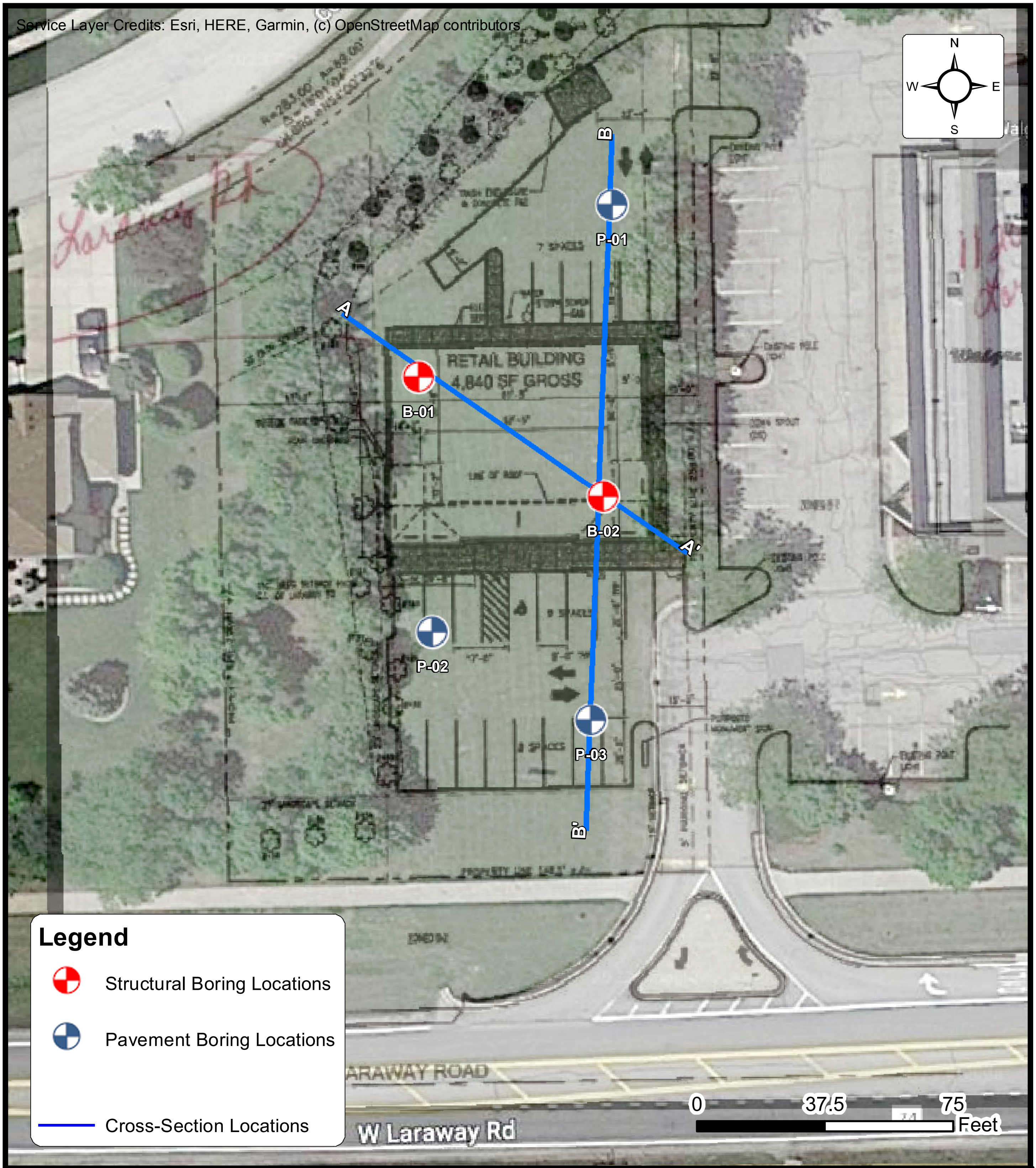

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China

SITE LOCATION DIAGRAM
PROPOSED SAUNA GUARD

11240 W LARAWAY RD, FRANKFORT, IL

UNLIMITED MASONRY & CONSTRUCTION, INC.

ENGINEER	BMT
SCALE	AS NOTED
PROJECT NO.	16:14878
FIGURE	1 OF 1
DATE	5/8/2023

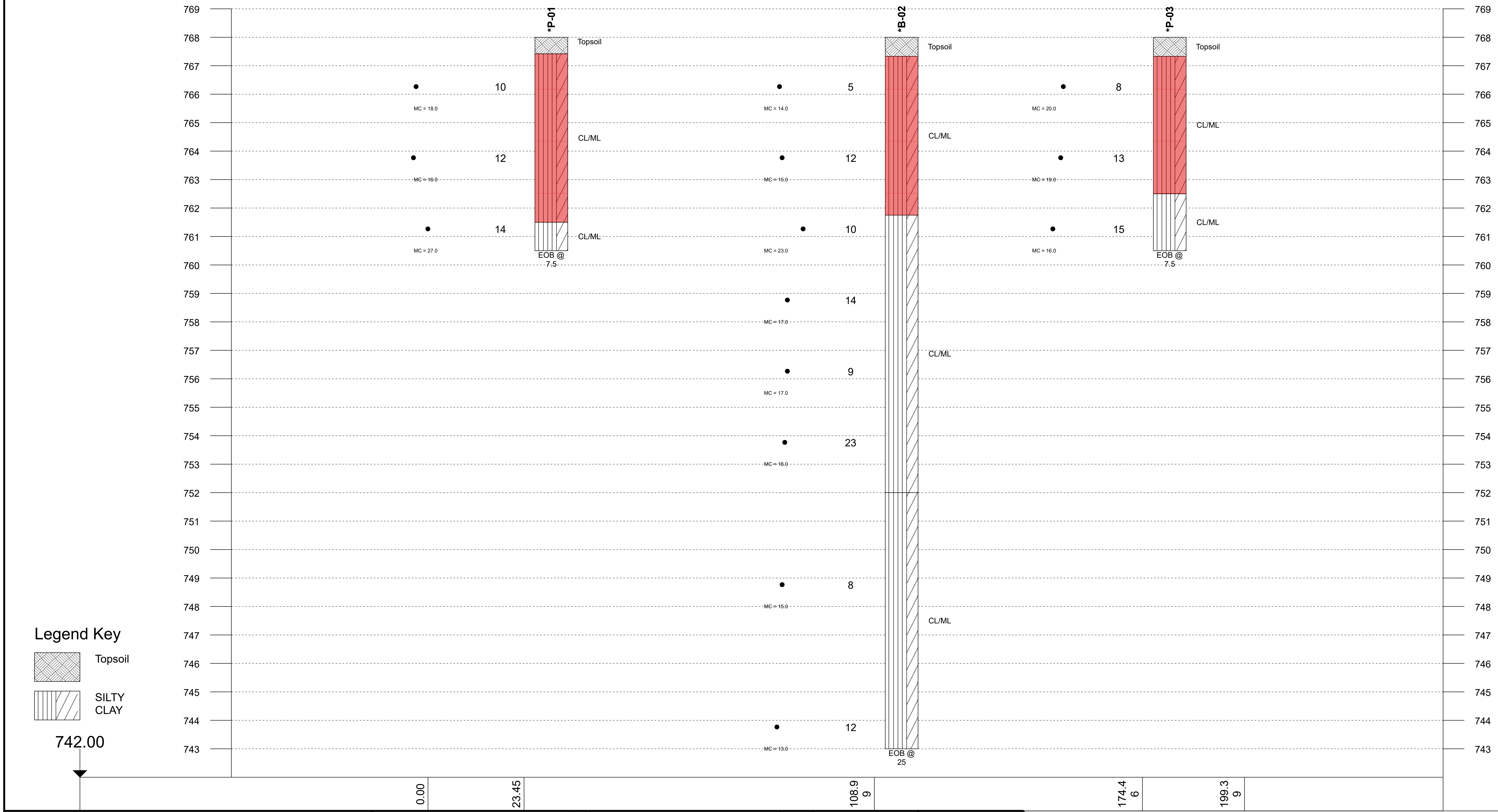


BORING LOCATION DIAGRAM
PROPOSED SAUNA GUARD

11240 W LARAWAY RD, FRANKFORT, IL

UNLIMITED MASONRY & CONSTRUCTION, INC.

ENGINEER	BMT
SCALE	AS NOTED
PROJECT NO.	16:14878
FIGURE	1 OF 1
DATE	5/24/2023



Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

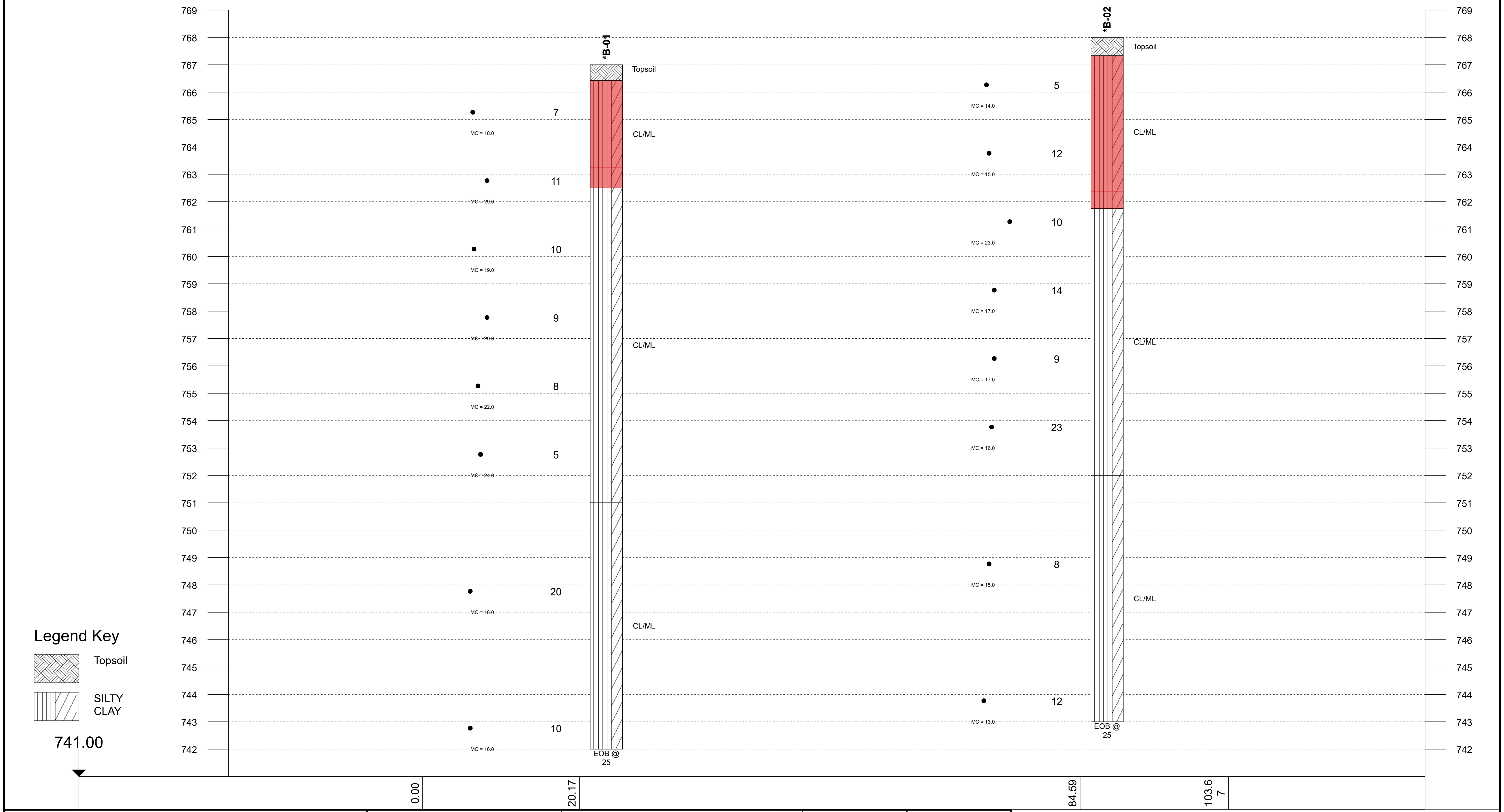
Plastic Limit Water Content Liquid Limit
X——●——△
[FINES CONTENT %]
BOTTOM OF CASING
LOSS OF CIRCULATION
○ CALIBRATED PENETROMETER

▽ WL (First Encountered)
▼ WL (Completion)
WL (Estimated Seasonal High Water)
WL (Stabilized)

🟥 Fill
🟪 Possible Fill
◻ Probable Fill
🟩 Rock

GENERALIZED SUBSURFACE SOIL PROFILE
B
Proposed Sauna Guard Development - Frankfort, IL
Unlimited Masonry & Construction, Inc.
11240 West Laraway Road, Frankfort, Illinois, 60423

Project No: 16:14878
Date: 05/26/2023



Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit X——●——△	▽ WL (First Encountered)	🟥	Fill
[FINES CONTENT %]	▼ WL (Completion)	🟪	Possible Fill
➤ BOTTOM OF CASING	▽ WL (Estimated Seasonal High Water)	🟥	Probable Fill
➤ LOSS OF CIRCULATION	▽ WL (Stabilized)	🟩	Rock
○ CALIBRATED PENETROMETER			

ECS

GENERALIZED SUBSURFACE SOIL PROFILE

A

Proposed Sauna Guard Development - Frankfort, IL
Unlimited Masonry & Construction, Inc.
11240 West Laraway Road, Frankfort, Illinois, 60423

Project No:	16:14878	Date:	05/26/2023

Appendix B – Field Operations

Reference Notes
Exploration Procedures
Boring Logs

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]

■		**ASPHALT**
⁘		**CONCRETE**
⁘		**GRAVEL**
▨		**TOPSOIL**
□		**VOID**
▦		**BRICK**
⁘		**AGGREGATE BASE COURSE**
▨	**GW**	**WELL-GRADED GRAVEL** **gravel-sand mixtures, little or no fines**
▨	**GP**	**POORLY-GRADED GRAVEL** **gravel-sand mixtures, little or no fines**
▨	**GM**	**SILTY GRAVEL** **gravel-sand-silt mixtures**
▨	**GC**	**CLAYEY GRAVEL** **gravel-sand-clay mixtures**
▨	**SW**	**WELL-GRADED SAND** **gravelly sand, little or no fines**
▨	**SP**	**POORLY-GRADED SAND** **gravelly sand, little or no fines**
▨	**SM**	**SILTY SAND** **sand-silt mixtures**
▨	**SC**	**CLAYEY SAND** **sand-clay mixtures**
▥	**ML**	**SILT** **non-plastic to medium plasticity**
▥	**MH**	**ELASTIC SILT** **high plasticity**
▨	**CL**	**LEAN CLAY** **low to medium plasticity**
▨	**CH**	**FAT CLAY** **high plasticity**
▨	**OL**	**ORGANIC SILT or CLAY** **non-plastic to low plasticity**
▨	**OH**	**ORGANIC SILT or CLAY** **high plasticity**
▨	**PT**	**PEAT** **highly organic soils**

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, QP[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective *(ex: "Silty")*	25 - 45	30 - 45

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

WATER LEVELS[6]

▽	WL (First Encountered)
▼	WL (Completion)
▼	WL (Seasonal High Water)
▽	WL (Stabilized)

FILL AND ROCK

🟥	🟪	🟥	🟩
FILL	**POSSIBLE FILL**	**PROBABLE FILL**	**ROCK**

---

[1] Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2] To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

[3] Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

[4] Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5] Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6] The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7] Minor deviation from ASTM D 2488-17 Note 14.

[8] Percentages are estimated to the nearest 5% per ASTM D 2488-17.

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SUBSURFACE EXPLORATION PROCEDURE: STANDARD PENETRATION TESTING (SPT)
ASTM D 1586
Split-Barrel Sampling

Standard Penetration Testing, or **SPT**, is the most frequently used subsurface exploration test performed worldwide. This test provides samples for identification purposes, as well as a measure of penetration resistance, or N-value. The N-Value, or blow counts, when corrected and correlated, can approximate engineering properties of soils used for geotechnical design and engineering purposes.

SPT Procedure:

- Involves driving a hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30-inches at desired depth
- Recording the number of hammer blows required to drive split-spoon a distance of 18-24 inches (in 3 or 4 Increments of 6 inches each)
- Auger is advanced* and an additional SPT is performed
- One SPT typically performed for every two to five feet. An approximate 1.5 inch diameter soil sample is recovered.

**Drilling Methods May Vary*— The predominant drilling methods used for SPT are open hole fluid rotary drilling and hollow-stem auger drilling.

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Unlimited Masonry & Construction, Inc.	**16:14878**	**B-01**	**1 of 1**

PROJECT NAME: **Proposed Sauna Guard Development - Frankfort, IL**

DRILLER/CONTRACTOR: **ECS59 - Crew 1**

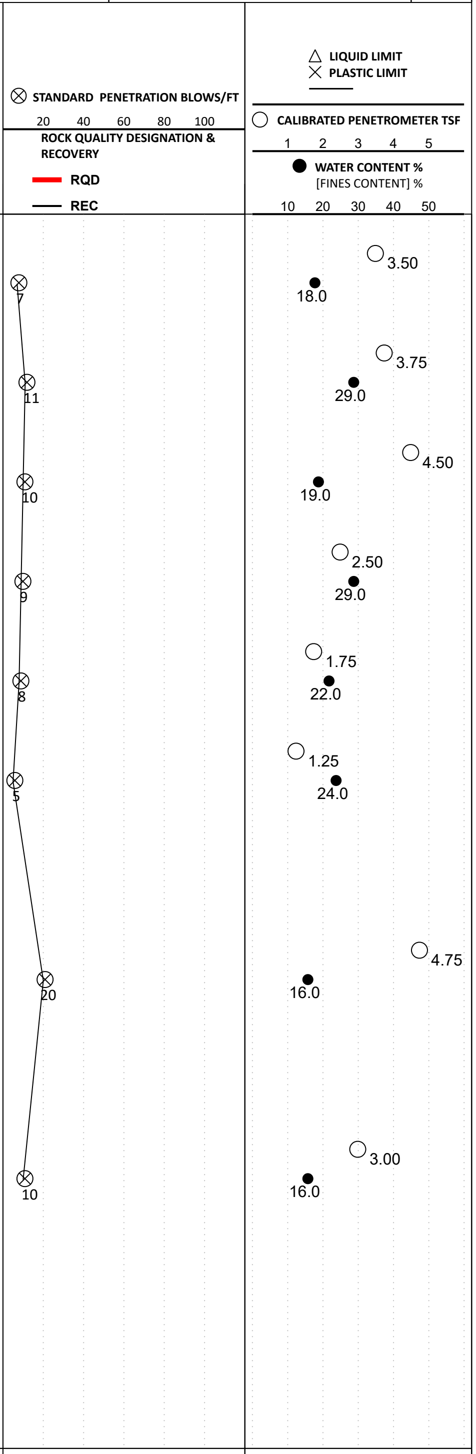
SITE LOCATION: **11240 West Laraway Road, Frankfort, Illinois, 60423**

LOSS OF CIRCULATION ⟩100%⟩

BOTTOM OF CASING ➤

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
1762935.7	**2920563.5**		**767.00**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil [7"] (+/-)			
					(CL/ML FILL) FILL, SILTY CLAY, trace gravel, dark brown and black, moist, hard			
	S-1	SS	18	10				2-4-3 (7)
	S-2	SS	18	12				3-4-7 (11)
					(CL/ML) SILTY CLAY, trace gravel, trace sand, brown and gray, moist, stiff to hard			
5							762	
	S-3	SS	18	14				3-4-6 (10)
	S-4	SS	18	14				4-4-5 (9)
10							757	
	S-5	SS	18	18				3-4-4 (8)
	S-6	SS	18	18				2-2-3 (5)
15							752	
					(CL/ML) SILTY CLAY, trace gravel, gray, moist, very stiff to hard			
	S-7	SS	18	18				6-9-11 (20)
20							747	
	S-8	SS	18	18				3-4-6 (10)
25					**END OF BORING AT 25 FT**		742	
30							737	



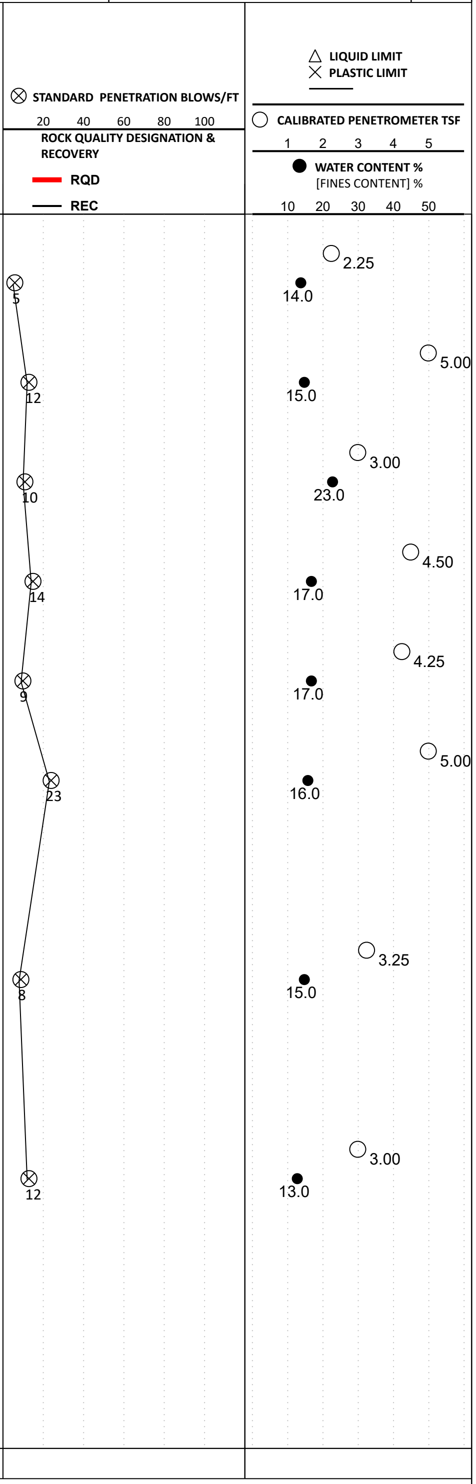
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **Dry**	BORING STARTED: **May 19 2023**		CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **May 19 2023**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **Truck**	LOGGED BY: **BM08**	DRILLING METHOD: **HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Unlimited Masonry & Construction, Inc.**	PROJECT NO.: **16:14878**	BORING NO.: **B-02**	SHEET: **1 of 1**
PROJECT NAME: **Proposed Sauna Guard Development - Frankfort, IL**	DRILLER/CONTRACTOR: **ECS59 - Crew 1**		
SITE LOCATION: **11240 West Laraway Road, Frankfort, Illinois, 60423**		LOSS OF CIRCULATION	
NORTHING: **1762901.7**	EASTING: **2920618.3**	STATION:	SURFACE ELEVATION: **768.00**
		BOTTOM OF CASING	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil [8"] (+/-)			
	S-1	SS	18	8	(CL/ML FILL) FILL, SILTY CLAY, trace gravel, trace sand, dark brown and black, moist, hard to very stiff			2-2-3 (5)
	S-2	SS	18	12				4-5-7 (12)
5							763	
	S-3	SS	18	18	(CL/ML) SILTY CLAY, trace gravel, trace sand, brown and gray, moist, very stiff to hard			3-5-5 (10)
	S-4	SS	18	16				4-7-7 (14)
10							758	
	S-5	SS	18	18				2-4-5 (9)
	S-6	SS	18	18				6-11-12 (23)
15							753	
					(CL/ML) SILTY CLAY, gray, moist, very stiff			
	S-7	SS	18	18				3-3-5 (8)
20							748	
	S-8	SS	18	18				4-6-6 (12)
25					**END OF BORING AT 25 FT**		743	
30							738	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered) **Dry**	BORING STARTED: **May 19 2023**		CAVE IN DEPTH:
WL (Completion) **Dry**	BORING COMPLETED: **May 19 2023**		HAMMER TYPE: **Auto**
WL (Seasonal High Water)	EQUIPMENT: **Truck**	LOGGED BY: **BM08**	DRILLING METHOD: **HSA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:
Unlimited Masonry & Construction, Inc.

PROJECT NO.:
16:14878

BORING NO.:
P-01

SHEET:
1 of 1

PROJECT NAME:
Proposed Sauna Guard Development - Frankfort, IL

DRILLER/CONTRACTOR:
ECS59 - Crew 1

SITE LOCATION:
11240 West Laraway Road, Frankfort, Illinois, 60423

LOSS OF CIRCULATION ⟩100%⟩

NORTHING:
1762987.3

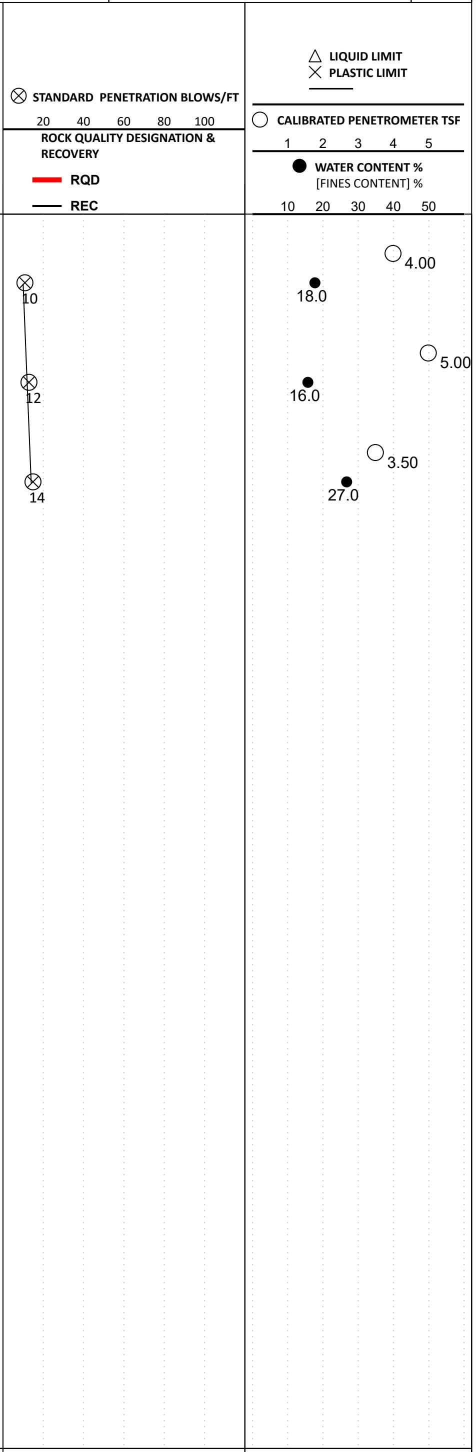
EASTING:
2920618.9

STATION:

SURFACE ELEVATION:
768.00

BOTTOM OF CASING ➤

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil [7"] (+/-)			
	S-1	SS	18	8	(CL/ML FILL) FILL, SILTY CLAY, trace gravel, trace sand, dark brown and black, moist, hard			3-4-6 (10)
5	S-2	SS	18	12			763	4-6-6 (12)
	S-3	SS	18	14	(CL/ML) SILTY CLAY, trace gravel, trace sand, brown and gray, moist, hard			3-6-8 (14)
					END OF BORING AT 7.5 FT			
10							758	
15							753	
20							748	
25							743	
30							738	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**
▼ WL (Completion)	**Dry**
▼ WL (Seasonal High Water)	
▽ WL (Stabilized)	

BORING STARTED: **May 19 2023**

CAVE IN DEPTH:

BORING COMPLETED: **May 19 2023**

HAMMER TYPE: **Auto**

EQUIPMENT: **Truck**

LOGGED BY: **BM08**

DRILLING METHOD: **HSA**

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Unlimited Masonry & Construction, Inc.	**16:14878**	**P-02**	**1 of 1**

PROJECT NAME: **Proposed Sauna Guard Development - Frankfort, IL**

DRILLER/CONTRACTOR: **ECS59 - Crew 1**

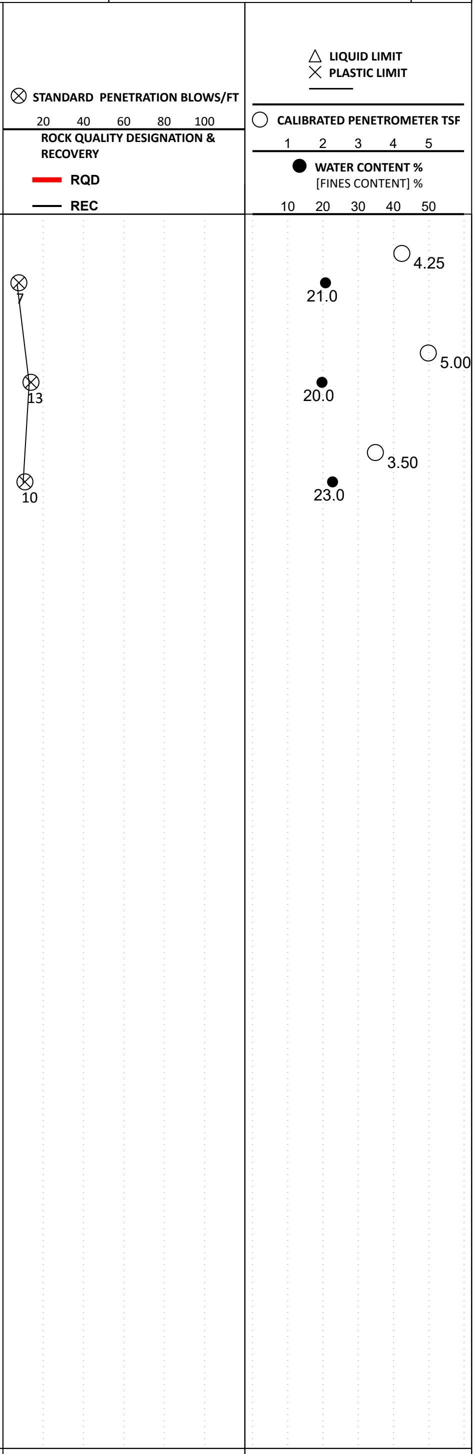
SITE LOCATION: **11240 West Laraway Road, Frankfort, Illinois, 60423**

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
1762861.1	**2920569.0**		**767.00**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil [8"] (+/-)			
	S-1	SS	18	11	(CL/ML FILL) FILL, SILTY CLAY, trace gravel, trace sand, dark brown and black, moist, hard			3-3-4 (7)
5	S-2	SS	18	10			762	3-6-7 (13)
					(CL/ML) SILTY CLAY, trace gravel, trace sand, brown and gray, moist, hard			
	S-3	SS	18	16				3-4-6 (10)
					END OF BORING AT 7.5 FT			
10							757	
15							752	
20							747	
25							742	
30							737	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **Dry**

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **May 19 2023**

BORING COMPLETED: **May 19 2023**

EQUIPMENT: **Truck**

LOGGED BY: **BM08**

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

DRILLING METHOD: **HSA**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Unlimited Masonry & Construction, Inc.**

PROJECT NO.: **16:14878**

BORING NO.: **P-03**

SHEET: **1 of 1**

PROJECT NAME: **Proposed Sauna Guard Development - Frankfort, IL**

DRILLER/CONTRACTOR: **ECS59 - Crew 1**

SITE LOCATION: **11240 West Laraway Road, Frankfort, Illinois, 60423**

LOSS OF CIRCULATION

BOTTOM OF CASING

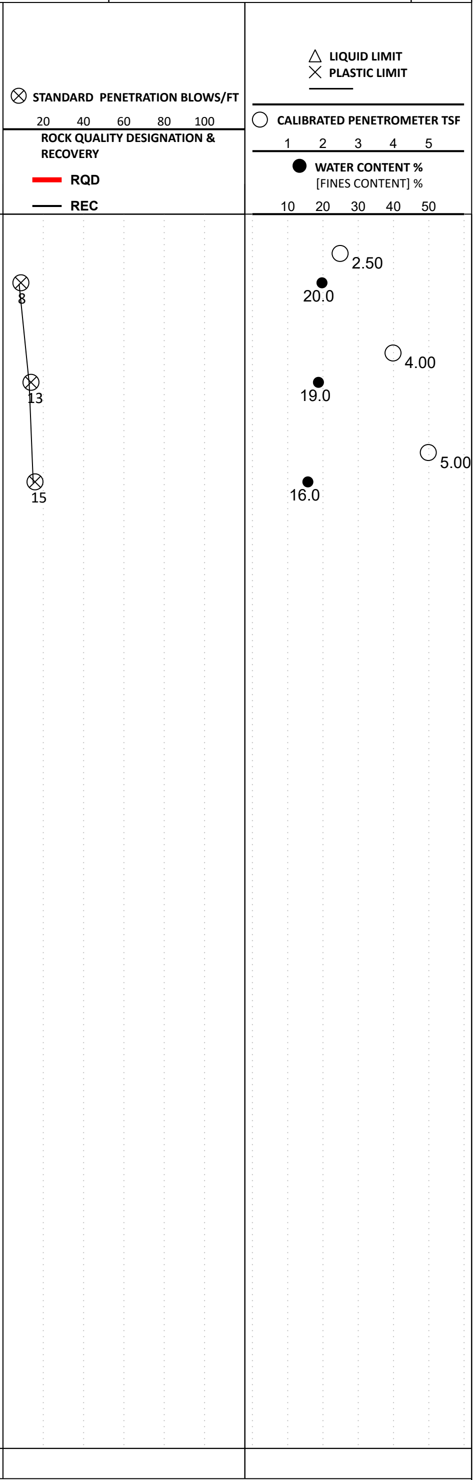
NORTHING: **1762836.3**

EASTING: **2920616.0**

STATION:

SURFACE ELEVATION: **768.00**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil [8"] (+/-)			
	S-1	SS	18	10	(CL/ML FILL) FILL, SILTY CLAY, trace gravel, trace sand, dark brown and black, moist, very stiff to hard			2-3-5 (8)
	S-2	SS	18	16				5-5-8 (13)
5							763	
	S-3	SS	18	18	(CL/ML) SILTY CLAY, trace gravel, trace sand, brown and gray, moist, hard			5-8-7 (15)
					END OF BORING AT 7.5 FT			
10							758	
15							753	
20							748	
25							743	
30							738	



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LOGGED BY: **BM08**

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

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GEOTECHNICAL BOREHOLE LOG

Appendix C – Other Information

Important Information About This Geotechnical Engineering Report

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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