Date: March 13, 2024

SECTION 00 90 03

BIDDING AND CONTRACT REQUIREMENTS
ADDENDUM NUMBER 3

Legat Architects, Inc.
22 E Gay St, Suite #500
Columbus, OH 43215

Distributed via:
EMAIL

To: Prospective Bidders
Re: **ADDENDUM NUMBER 3 TO THE BIDDING DOCUMENTS FOR:**

Ohio Department of Natural Resources
Mohican Visitor Center
Architect's Project Number: 223054.00

This addendum forms a part of the bidding and contract documents and modifies the original bidding documents dated February 22, 2024. Acknowledge receipt of this addendum in the space provided on Bid Form. FAILURE TO DO SO MAY SUBJECT BIDDER TO DISQUALIFICATION.

I. PART 1 – ADDENDUM TO THE PROJECT MANUAL

A. Document 00 10 00 – Solicitation:
   1. **REVISE** bid opening date to March 27 2024, at 2:00 p.m. (All other provisions of the contactcuments remain the same.)
B. **ADD** Section 07 42 13 – Metal Wall Panels to the project manual in its entirety.
C. **ADD** Section 32 33 13 – Site Bicycle Racks to the project manual in its entirety.

II. PART 2 - ADDENDUM TO THE DRAWINGS

A. None

III. PART 3 - CLARIFICATIONS

A. *Please verify the fire rating on doors 01A, 07F, 10A, and 10B.*
   These doors are not rated.
B. *The Geotechnical report references the [use] of drilled shaft foundations/helical piles or driven piles, it goes on to mention the use of rammed aggregate piers. What design are we to use?*
   See attached geotechnical report updated on Sep 21 2023. Rev 1, Page 10 of the report recommends Driven Piles and provides some criteria on them.
C. *Are we to be utilizing Glue Lam Components or Heavy Timber Framing? There seems to be missing information regarding what is Heavy Timber Framing and what is Glue Laminated…please clarify.*
   Please follow the sizing requirements as they are shown on the Construction Documents.
D. *There are paper towel dispensers shown at the men and women's restrooms but not at the family toilet. Should there be a towel dispenser here?*
   Add one paper towel dispenser to the family restroom.
E. *Please provide info on the neoprene pads shown in section 2 on S301.*
   Please use ¼" Generic Neoprene pad, 6" wide.

F. *Please provide clarity as to how are the W21x62's shown on S102 supported on their right end.*
The W21x62 is supported on the right end similar to the requirements of Section 2/S301. This is typical for all beam bearings.

G. *Are the AWI certificates for casework required for this project, or can they be waived if the subcontractors meets the standards?*
AWI Certificates are not required, provided the subcontractor meets all standards.

H. *Are the open shelves and 2 wall mounted shelves on page A-212 detail 1 and 2 within the project scope? The open shelve units are not shown on the floor plan A-101. There is no detail for the 2 wall mounted shelf with hangers.*
These shelves are not included in the scope.

IV. PART 4 – SUPPLEMENTAL INFORMATION

1. See attached Geotechnical Report (Revised September 2023). This is provided for information and reference only. Contractor to field verify actual conditions.

END OF SECTION

This addendum consists of two (2) pages.

This addendum has fifty (50) standard pages and zero (0) large drawing sheets attached as identified below:

Specification Sections:

Section 07 42 13 – Metal Wall Panels (REVISION Addendum #3 - 03.13.24)
(3 Standard Pages)
Section 32 33 13 – Site Bicycle Racks (REVISION Addendum #3 - 03.13.24)
(2 Standard Pages)

Drawings:

None

Supplemental Information:

Geotechnical Investigation Report (45 Standard Pages)

SECTION 07 42 13
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for soffit panels, with related flashings and accessory components.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wall panel substrate.

B. Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data - Soffit System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.

C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, _____, and methods of anchorage.

D. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches in size illustrating finish color, sheen, and texture.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience.

1.06 MOCK-UPS

A. Construct mock-up, 4 feet long by 8 feet wide; include panel soffit system, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, _____, and related insulation in mock-up.

B. Locate as directed by Architect.

C. Mock-up may remain as part of work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.08 FIELD CONDITIONS

A. Do not install wall panels when air temperature or relative humidity are outside manufacturer's limits.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Soffit Panels:
   1. Berridge Manufacturing Company; Flush Seam Panel: www.berridge.com/#sle.
   2. Petersen Aluminum Corporation; Flush Soffit: www.pac-clad.com/#sle.
   3. Western States Metal Roofing; T-8 PlankWall: www.westernstatesmetalroofing.com.

2.02 METAL WALL PANEL SYSTEM

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide soffit panels.
   2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
   4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
   5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
   7. Corners: Factory-fabricated in one continuous piece with minimum 2-inch returns.

B. Soffit Panels:
   1. Profile: 12" Flush, with venting not provided.
   2. Material: Precoated steel sheet, 22 gauge, 0.0299 inch minimum thickness.
   3. Color: Wood-grain finish to be selected by Architect from manufacturer's standard line..

C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

D. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

E. Anchors: Galvanized steel.

2.03 FINISHES

A. Exposed Surface Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.

B. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat metal coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss to match sample.

2.04 ACCESSORIES

A. Cladding Support Clips: Thermally-broken, thermal spacer clips for support of cladding z-girts, angles, channels, and other framing.
   1. Thermal Spacer Clip: Pultruded glass fiber and thermoset polyester resin clip; 3/16 inch thick at top, base, and web.

2. Clip Depth: As indicated on drawings.

B. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient.

C. Concealed Sealants: Non-curing butyl sealant or tape sealant, see Section 07 92 00

D. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

E. Fasteners: Manufacturer's standard type to suit application; steel, hot dip galvanized. Fastener cap same color as exterior panel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

3.02 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced at intervals indicated.

B. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

3.03 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint; allow to dry prior to wall panel installation.

C. Fasten panels to structural supports; aligned, level, and plumb.

D. Locate joints over supports.

E. Use concealed fasteners unless otherwise indicated by Architect.

F. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 TOLERANCES

A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch, maximum.

B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch, maximum.

3.05 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

3.06 PROTECTION

A. Protect metal soffit panels until completion of project.

B. Touch-up, repair, or replace damaged soffit panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 32 33 13
SITE BICYCLE RACKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior bicycle racks.

1.02 RELATED REQUIREMENTS

A. Section 32 13 13 - Concrete Paving: Mounting surface for bicycle racks.

1.03 REFERENCE STANDARDS

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Indicate size, shape, and dimensions, including clearances from adjacent walls, doors, and obstructions.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Handle racks with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Exterior Bicycle Racks:
   1. Dumore Inc.; 130-40: www.dumor.com
   2. Huntco Supply, LLC; The Rambler, 9 Bike: www.huntco.com/#sle.
   3. SiteScapes, Inc; Echo EC2-09: www.sitescapesonline.com/#sle.

2.02 BICYCLE RACKS

A. Exterior Bicycle Racks: Device allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
   1. Style: Serpentine rack formed from a continuous round pipe.
   2. Capacity: Nine bicycles.
   3. Mounting, Ground: Surface flange.
   4. Finish: Powder coat, maintenance-free and weather-resistant.
   5. Color: As selected by Architect from manufacturer's standard range.
   6. Accessories: Surface flange cover.

B. Materials:
   1. Pipe: Carbon steel, ASTM A53/A53M, Schedule 40.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive bicycle racks.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.

C. Do not begin installation until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Ensure surfaces to receive bicycle racks are clean, flat, and level.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install level, plumb, square, and correctly located as indicated on drawings.

C. Surface Flange Installation: Anchor bicycle racks securely in place with 1/2 inch by 4 inch anchor bolts through flange holes.

3.04 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

Resource International, Inc.

MOHICAN STATE PARK VISITOR CENTER
EXPERIENCE IMPROVEMENTS
PERRYSVILLE, OHIO

GEOTECHNICAL INVESTIGATION REPORT

Prepared For:
Legat Architects, Inc.
22 East Gay Street, Suite 500
Columbus, Ohio 45215

Prepared By:
Resource International, Inc.
6350 Presidential Gateway
Columbus, OH 43231

Rii Project No. W-23-083(1)

September 2023

RESOURCE INTERNATIONAL, INC.
6350 Presidential Gateway
Columbus, Ohio 43231
Ph: 614.823.4949

August 30, 2023 (Revised September 21, 2023)

Ms. Carli Sekella, AIA, NCARB
Principal/Senior Architect
Legat Architects, Inc.
22 East Gay Street, Suite 500
Columbus, Ohio 43215

Re: Geotechnical Investigation Report
Ohio Department of Natural Resources
Mohican State Park Visitor Center Experience Improvements
Perrysville, Ohio
Rii Project No. W-23-083(1) Rev. 1

Ms. Sekella:

Resource International, Inc. (Rii) is pleased to submit this revised geotechnical investigation report for the above-referenced project. Engineering logs have been prepared and are attached to this report along with field and laboratory test results. This report includes recommendations for the design and construction of the visitor's center located at Mohican State Park in Perrysville, Ohio. This revised report supersedes our previous submittal.

We sincerely appreciate the opportunity to be of service to you on this project. If you have any questions concerning the subsurface investigation or this report, do not hesitate to contact us.

Sincerely,

RESOURCE INTERNATIONAL, INC.

Daniel E. Karch, P.E.
Project Manager – Geotechnical Services

Jonathan P. Sterenberg, P.E.
Vice President – Geotechnical Services

Enclosure: Revised Geotechnical Investigation Report

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APPENDICES

1.0 INTRODUCTION

This report is a presentation of the geotechnical investigation performed for the design and construction of the proposed visitor center located at Mohican State Park in Perrysville, Ohio. A vicinity map depicting the location of the site is provided on the boring plan in Appendix I.

Based on the project information provided, it is understood that the proposed building will be approximately 5,000 square feet, and will be approximately 30 feet tall at its peak. It is understood that the finished floor elevation of the proposed building will be approximately 5 feet above existing grade. The southwest and northeast portions of the building will be raised with 5 feet of embankment on each side, and the central portion of the building will span between the two embankments with a channel to allow water to pass below the spanned section.

Additionally, it is understood that an expansion of, and improvements to, the existing parking lot are planned. The expansion is understood to include additional parking spaces and driveways, and the improvements will consist of rehabilitating or reconstructing the existing pavements.

1.1 Existing Site Conditions

Mohican State Park is located in Perrysville in the southern portion of Ashland County, Ohio. The site for the proposed visitor center is bound by State Route 3 to the southeast and State Route 97 and the Clear Fork Mohican River to the southwest. The existing parking lot and driveway is located immediately south of the proposed building area. The proposed building location is situated in a grass field currently occupied by an existing restroom building, a shelter house, two (2) playgrounds, and several trees. It is understood that the existing restroom building will be demolished as part of the proposed improvements.

Based on the provided topographic information, the existing site appears to be relatively flat with ground surface elevations ranging approximately 931 to 933 feet mean sea level (msl) in the area of the proposed building footprint. It is understood that the site located within the 100-year floodplain, and that the purpose of raising the finished floor elevation of the building is to elevate it above the flood elevation.

1.2 Site Geology

Physiographically, the site is located within the Muskingum-Pittsburgh Plateau Region of the Allegheny Plateau Section. The region is within the unglaciated area of Ohio and is generally a moderately high plateau dissected by broad river valleys that contain outwash terraces, and tributaries with lacustrine terraces. Surficial deposits include silt-loam

colluvium derived from local bedrock, including weathered material, landslides, and bedrock outcrop, as well as alluvium in valleys.

Based on the bedrock geology and topography maps obtained from the Ohio Department of Natural Resources (ODNR), the underlying bedrock directly beneath the site is Mississippian-aged, Maxville Limestone, comprised of the Rushville, Logan, and Cuyahoga Formations, undivided. The group consists of shades of gray, yellow and brown interbedded shale, siltstone, sandstone grading to massive sandstone (Black Hand Sandstone). The formation ranges from 50 to 650 feet thick. The bedrock surface in the vicinity of the site is at an approximate elevation of 895 feet. Two (2) of the soil borings performed for this investigation were extended into bedrock, which was encountered at depths ranging from 14.4 to 14.8 feet below exiting surface grades.

2.0 SUBSURFACE INVESTIGATION

On July 13, 2023, a total of four (4) borings, designated BH-1 through BH-4, were drilled at the locations illustrated on the boring plan provided in Appendix I. The borings for the building were advanced to depths ranging from 20.0 to 26.4 feet below the existing ground surface, and the boring for the proposed pavement improvements was extended to 10.0 feet below the existing ground surface.

The boring locations were determined and field located by Rii personnel. During the field reconnaissance, Rii personnel documented the existing site conditions and mapped all boring locations. Rii utilized a handheld GPS unit to obtain northing and easting coordinates at the boring locations. Approximate ground surface elevations at the boring locations were interpolated using topographic basemapping information provided by Fishbeck. A summary of the boring locations and ground surface elevations is illustrated in Table 1.

Table 1. Boring Reference

Boring	Northing	Easting	Ground Elevation (feet) [1]	Boring Depth (feet)
BH-1	342940.489	2035219.438	933.0	20.0
BH-2	342968.737	2035158.276	932.8	26.4
BH-3	342877.278	2035152.42	932.4	26.3
BH-4	342811.062	2034919.647	933.1	10.0

1. *Ground surface elevations at the boring locations were interpolated using topographic basemapping provided by Fishbeck.*

The borings were drilled with an all-terrain vehicle (ATV) mounted CME 750X rotary drill rig, utilizing a 3.25-inch inside diameter hollow stem augers to advance the holes. Standard penetration test (SPT) and split spoon sampling was performed at 2.5-foot increments to a depth of 10.0 feet and at 5.0-foot increments thereafter to the boring termination depth. The SPT, per the American Society for Testing and Materials (ASTM) designation D1586, is conducted using a 140-pound hammer free falling 30 inches to drive a 2.0-inch outside diameter split spoon (SS) sampler 18 inches. Rii utilized a calibrated automatic drop hammer to generate consistent energy transfer to the sampler. Driving resistance is recorded on the boring logs in terms of blows per 6.0-inch interval of the driving distance. The second and third intervals are added to obtain the number of blows per foot (N). SPT blow counts aid in estimating soil characteristics used to calculate bearing capacities and settlement potential. Measured blow count (N_m) values are corrected to an equivalent (60 percent) energy ratio, N_{60}, by the following equation. Both values are represented on boring logs presented in Appendix III.

$$N_{60} = N_m*(ER/60)$$

Where:

N_m = measured N value

ER = drill rod energy ratio, expressed as a percent, for the system used

The hammer for the CME 750X ATV-mounted drill rig used for this project was calibrated on March 21, 2022 and has a drill rod energy ratio of 84.2 percent.

Hand penetrometer readings, which provide a rough estimate of the unconfined compressive strength of the soil, were reported on the boring logs in units of tons per square foot (tsf) and were utilized to classify the consistency of the cohesive soil in each layer. An indirect estimate of the unconfined compressive strength of the cohesive split spoon samples can be made from a correlation with the blow counts (N_{60}). Please note that split spoon samples are considered to be disturbed and the laboratory determination of their shear strengths may vary from undisturbed conditions.

For instances of no recovery from standard SS interval, a 2.5-inch outside diameter split spoon was driven the full length of the standard SS interval plus an additional 6.0 inches to obtain a representative sample. Only the final 6.0 inches of sample is retained. Blow counts from 2S sampling are not correlated with N_{60} values.

The depth to bedrock was determined by split spoon sampler refusal and increased resistance in the auger advancement. Two (2) borings were extended into the bedrock using an NQ-2 double-tube diamond bit core barrel (utilizing wire line equipment) to core the bedrock. The rock cores obtained from the boring were logged in the field and visually classified in the laboratory. The retrieved core was analyzed to identify the type of rock, color, mineral content, bedding planes and other geological and mechanical features of interest in this project. The rock quality designation (RQD) for each rock core run was calculated according to the following equation:

$$RQD = \frac{\sum \text{segments equal to or longer than 4.0 inches}}{\text{core run length}} \text{ x } 100$$

Upon completion of drilling, the borings were backfilled with a mixture of bentonite chips and soil cuttings generated during drilling process. The pavement at the surface of boring BH-4 was patched with an equivalent thickness of cold patch asphalt.

During drilling, field personnel prepared field logs showing the encountered subsurface conditions. Soil samples obtained from the drilling operation were preserved in sealed glass jars and delivered to the soil laboratory. In the laboratory, the soil samples were visually classified and select soil samples were tested as noted in Table 2.

Table 2. Laboratory Test Schedule

Laboratory Test	Test Designation	Number of Tests Performed
Natural Moisture Content	ASTM D2216	13
Plastic and Liquid Limits	ASTM D4318	3
Gradation – Hydrometer	ASTM D422	7
Organic Content – Loss on Ignition	ASTM D2974	2

These tests are necessary to classify the soil based on the Unified Soil Classification System (USCS) in accordance with ASTM D2487. The results are also used to estimate engineering properties needed to provide foundation and pavement design recommendations and soil related construction considerations. Results of the laboratory testing are presented in Appendix IV and, in part, on the boring logs in Appendix III. A description of the soil terms used throughout this report is presented in Appendix II.

3.0 SUBSURFACE PROFILE

Interpreted engineering logs have been prepared based on the field logs, visual classification of samples and laboratory test results. Classification of the borings follows the current USCS specifications. The following is a summary of what was found in the test borings and what is represented on the boring logs.

3.1 Surface Materials

Borings BH-1 through BH-3 encountered approximately 3.0 to 6.0 inches of topsoil at the ground surface, as identified by the presence of vegetation and organic matter. Boring BH-4 encountered 8.0 inches of asphalt pavement overlying 7.0 inches of aggregate base at the ground surface.

3.2 Subsurface Soils

Below the surficial materials, natural soils were encountered consisting of predominantly cohesive material overlying granular soils. The natural cohesive soils were generally described as sandy silt, lean clay with sand, and silty clay with sand (USCS ML, CL, CL-ML). The natural granular soils were generally described as well graded gravel with silt and sand, silty sand with gravel, and poorly graded sand with gravel (USCS GW-GM, SM, SP).

The shear strength and consistency of the cohesive soils are primarily derived from the hand penetrometer values (HP). The cohesive soils encountered ranged from soft ($0.25 < HP \leq 0.5$ tsf) to hard ($HP \geq 4.0$ tsf). The unconfined compressive strength of the cohesive soil samples tested, as estimated from the hand penetrometer, ranged from 0.5 to over 4.5 tsf (limit of the instrument). The relative density of granular soils is primarily derived from SPT blow count (N_{60}). Based on the SPT blow counts obtained, the granular soils encountered ranged from very loose ($0 \leq N_{60} \leq 4$ blows per foot [bpf]) to medium dense ($11 \leq N_{60} \leq 30$ bpf). The SPT blow counts within the granular soils ranged from 4 to 25 bpf.

Natural moisture contents of the cohesive soil samples tested ranged from 16 to 25 percent. The natural moisture contents of the soil samples tested for plasticity index ranged from 3 to 4 percent above their corresponding plastic limits. In general, the soils exhibited natural moisture contents estimated to be significantly above optimum moisture levels.

3.3 Bedrock

Top of bedrock was encountered in borings BH-2 and BH-3 at depths of 14.4 and 14.8 feet below the existing grade, respectively. Bedrock coring was performed upon the encounter of split spoon refusal on bedrock. The recovered cored bedrock samples were described as brown to gray, moderately strong, moderately to slightly weathered and thin bedded sandstone bedrock.

The recovered rock core samples exhibited core recovery values ranging from 56 to 100 percent and rock quality designation (RQD) values ranging from 0 of 85 percent. The uniaxial compressive strength and point load strength testing performed on selected core samples exhibited unconfined compressive strength (Qu) values ranging from 1,676 to 2,352 psi. Detailed information of rock core along with rock core photographs are provided in Appendix III and a summary of rock core information is provided below in Table 3.

Table 3. Rock Core Summary

Boring Number	Core No.	Depth (feet)	Ground Elevation (feet msl)	Recovery (%)	RQD (%)	Qu (psi)
BH-2	RC-1	14.4 - 16.4	917.4 – 915.4	58	0	---
	RC-2	16.4 - 21.4	915.4 – 910.4	98	38	---
	RC-3	21.4 - 26.4	910.4 – 905.4	100	78	2,352
BH-3	RC-1	14.8 - 16.3	917.6 – 916.1	56	0	---
	RC-2	16.3 - 21.3	916.1 – 911.1	100	18	---
	RC-3	21.3 - 26.3	911.1 – 906.1	97	85	1,676

3.4 Groundwater

Seepage was encountered in boring BH-1 during drilling at a depth of 6.0 feet below the existing ground surface. Borings BH-1 through BH-4 initially encountered groundwater at depths ranging from 6.0 to 8.5 feet below existing grades. Groundwater was encountered upon completion of drilling activities in borings BH-1, BH-2, and BH-4 at depths ranging from 4.0 to 5.0 feet below existing grades.

Please note that short-term water level readings are not necessarily an accurate indication of the actual groundwater level. In addition, groundwater levels or the presence of groundwater are considered to be dependent seasonal fluctuations in precipitation. A more comprehensive description of the subsurface conditions encountered during the drilling program can be found on the boring logs in Appendix III.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine foundation support capabilities and the settlement potential for the soil encountered at the site. These parameters have been used to provide guidelines for the design of the structure foundation and pavement support systems, as well as the construction specifications related to the placement of foundation and pavement systems and general earthwork recommendations, which are discussed in the following paragraphs. Allowable bearing capacity considers the gross loading, which includes the weight of foundation concrete for elements placed below the existing ground and the loading from the superstructures. Structural loading information, however, was not available at the time of preparation of this report.

Based on the project information provided, it is understood that the proposed building will consist of a slab-on-grade structure with no below grade stories or basements. Specific structural loading and site grading information was not available at the time of this report. It is understood that the finished floor elevation of the proposed building will be approximately 5 feet above existing grade. The southwest and northeast portions of the building will be raised with 5 feet of embankment on each side, and the central portion of the building will span between the two embankments with a channel to allow water to pass below the spanned section.

4.1 Settlement Due to Embankment Fill

Rii performed settlement analysis utilizing the estimated surcharge load from the proposed fill embankment, the general soil profile obtained from the field exploration, and the results of the laboratory tests. Based on the grading plan provided, existing grades within the site range from approximately 931 to 933 feet msl. Approximately 5 feet of fill and no cuts will be required to bring the site to proposed grade. The deepest fills will be located on the eastern and western exteriors of the building.

Total settlement of the subsurface soils due to the fill placement will vary across the site depending on the underlying soil conditions and the height of the fill. For the proposed building, it is estimated that the placement of the embankment fill will result in a maximum total settlement of approximately **1.75 and 2.0 inches** on the western and eastern sides of the proposed building, respectively, with differential settlements on the order of **0.5 inches**.

4.2 Foundation Recommendations

Based upon an evaluation of the subsurface conditions encountered on the site, it is anticipated that the bearing soils for the proposed structure would consist of natural cohesive and granular soils or newly placed engineered fill. These bearing soils are not suitable to support the proposed structure using conventional shallow spread foundation systems. Therefore, Rii recommends one of two options for foundations for this project:

1. Deep foundations extending into bedrock per Sections 4.2.1 and 4.2.2 of this report.

2. Ground improvement per Section 4.2.2 of this report.

4.2.1 Drilled Shafts

It is recommended that drilled shaft foundations be installed for the proposed structure, extended to bear on the sandstone bedrock at or below elevation 912 feet msl in the areas of borings BH-2 and BH-3, approximately 20.0 feet below the existing ground surface. Bedrock was not encountered in BH-1 within a depth of 20.0 feet below the existing ground surface. It is estimated that the top of bedrock is within 35.0 feet of the existing ground surface at this location. Drilled shafts in the area should be extended a minimum of 1.5B into competent bedrock, where B is the diameter of the drilled shaft. Drilled shafts bearing at these depths should be designed using a maximum allowable end bearing capacity of 100.0 ksf.

Drilled shaft capacities were analyzed utilizing a factor of safety of 5.0. Drilled shaft lengths should measure a minimum of three (3) times the diameter. The maximum total settlement is estimated to be 0.5 inches or less for shafts extended to bedrock.

Drilled shafts should be designed in strict accordance with the current Ohio Building Code (OBC). Per the OBC the structural capacity of the shafts must be in compliance with the following guideline:

- Design load stresses in the concrete must not exceed 0.33 f'c.

4.2.1.1 *Drilled Shaft Considerations*

The minimum requirements for proper inspection of drilled shaft construction are as follows:

- A qualified inspector should record the material types being removed from the hole as excavation proceeds.
- When the bearing material has been encountered and identified and/or the designated tip elevation has been reached, the shaft walls and base should be observed for anomalies, unexpected soft soil conditions, obstructions or caving.
- The bottom of drilled shaft excavation should be clean and free of loose material. Any loose material observed should be removed using a clean-out bucket (muck bucket).
- Due to the presence of seams of granular materials and relatively high groundwater levels, Rii recommends full length of casing and slurry drilling mud be required for drilled shaft excavation.
- Based on relatively shallow groundwater encountered in the borings, groundwater is anticipated during drilled shaft excavation. However, with full length of casing installed trying to seal incoming groundwater from the bottom of excavation, the

standing water inside the casing may be completely removed prior to setting steel cage and concrete placement. The bottom of drilled shaft excavation should be cleaned and free of loose material. Any excessive water (more than 2 inches) or loose material observed should be removed using a clean-out bucket (muck bucket).

- Concrete placed freefall should not be allowed to hit the sidewalls of the excavation or the rebar cage and should not pass through any water.

- Structural stability of the rebar cage should be maintained during the concrete pour to prevent buckling.

- The volume of concrete should be checked to ensure voids did not result during extraction of the casing.

- The placement of all concrete for the drilled shafts shall follow the American Concrete Institute's Design and Construction of Drilled Piers (ACI 336.3R-93).

- If incoming groundwater cannot be sealed during drilled shaft excavation, then concrete must be placed with tremie method, it must be done so with a rigid tremie pipe under adequate head pressure to displace water or slurry from the bottom of drilled shafts (all tremie procedures shall follow applicable ACI specifications).

- If concrete is placed by tremie method, it must be done so with a rigid tremie pipe under adequate head pressure to displace water or slurry if groundwater has entered the shaft excavation (all tremie procedures shall follow applicable ACI specifications).

- Pulling casing with insufficient concrete inside should be restricted.

The use of casing for drilled shafts is recommended under any of the following conditions:

- Caving material is encountered at any time during the drilling of the shaft.

- Groundwater is encountered at any time during the drilling of the shaft, or groundwater seepage occurs in the drilled shaft.

- Down hole inspection is planned (casing is required for this instance).

Groundwater should be anticipated during the installation of drilled shafts, and temporary casing or a drilling fluid (slurry) will be required to maintain an open excavation below the groundwater table/seepage depth. If casing is used, it is recommended to be pulled immediately after the concrete is placed, allowing for re-use of the casing.

4.2.2 Driven Piles

As an alternative to drilled shafts socketed into bedrock, a driven pile foundation system could be utilized for foundation support. Based on the depth of bedrock encountered at the site, it is recommended that steel H-piles driven to refusal on the underlying sandstone bedrock be employed for foundation support. Refusal is met during driving when the pile penetration is an inch or less after receiving at least 20 blows from the pile hammer. **For HP 10x42 or HP 12x53 steel H-piles driven to refusal on the underlying sandstone bedrock, an allowable pile capacity of 310 and 380 kips per pile, respectively, may be utilized for design.**

Please note that it is anticipated that the piles will be able to be driven a short distance into the surficial bedrock before satisfying the driving conditions that meet the refusal criterion. It is estimated that refusal will be meet within the upper 1.0-foot of the surficial bedrock. Settlement is estimated to be less than 0.5 inches for H-piles driven to refusal on sandstone bedrock.

4.2.3 Lateral Design

If lateral load or moments are expected to be applied on the foundation elements, the shafts should be analyzed to verify the shaft has enough lateral and bending resistance against these loads. Lateral soils parameters for selected representative borings are provided in Table 4.

Table 4. Lateral Design Parameters

Building/ Reference Borings	Elevation (feet msl)	Strata	Effective [1] Unit Weight (pcf)	Strength Parameter	k (soil) [2] k_m (rock)	ε_{50} (soil) ε_r (rock)
Visitors Center (BH-1 to BH-3)	932.9 to 927.4	3	115 psf	Su = 1,000 psf	235 pci	0.0090
	927.4 to 920.9	4	120 psf	φ = 28°	15 pci	-
	920.9 to 912.9	2	120 psf	Su = 2,000 psf	665 pci	0.0063
	GWT @ 6.0 feet					

1. When below groundwater table, use effective unit weight, γ' = γ - 62.4 pcf.
2. k value is the recommended initial value when utilizing COM624 and/or LPILE analysis.

In order to evaluate the lateral capacity, it is recommended that a derivation of COM624, such as LPILE, be utilized to determine the proper embedment depth and cross section to resists the lateral load for given end condition and deflection. Table 4 may be utilized for design. Note that the table was prepared with a design groundwater elevation as indicated at each of the borings, measured below existing grade. The following table, Table 5, lists the different soil types internal to the LPILE program. These strata were utilized in Table 4, above, in evaluating the soil layers.

Table 5. Soil Strata Description

Strata	Description
1	Soft Clay
2	Stiff Clay with Water
3	Stiff Clay without Free Water
4	Sand (Reese)
5	User Defined
6	Vuggy Limestone (Strong Rock)
7	Silt (with cohesion and internal friction angle)
8	API Sand
9	Weak Rock
10	Liquefiable Sand (Rollins)
11	Stiff Clay without free water with a specified initial K (Brown)

4.2.4 Ground Improvement

As an alternative to a conventional deep foundation system, consideration may be given to supporting the proposed structure on shallow foundations in conjunction with ground improvement techniques, such as the installation of stone columns, rammed aggregate piers, vibro concrete columns, wick drains, soil mixing or other techniques. Such ground improvement systems are design/build solutions which can provide an economic advantage, increasing the bearing capacity of the foundation soils and reducing settlement of conventional shallow spread foundations. Ground improvement installation may occur either prior to embankment fill placement to support both the embankment and foundation system or after embankment construction to support only the footings themselves.

The ground improvement system is typically designed such that the spacing and size of the stabilizing elements results in an improvement to the soil matrix and confining pressure within the depth of the installation, thus increasing the shear strength and reducing the compressibility of the soil. The selected system should be designed to meet the bearing capacity and settlement requirements for the structure. **The evaluation of such ground improvement techniques is proprietary and beyond the scope of this investigation; a qualified contractor specializing in these methods will need to be employed to provide a design of the ground improvement system.** Based on our experience on similar projects, the implementation of ground improvement could increase the allowable bearing capacity to approximately 4.0 to 6.0 ksf while keeping the differential settlements to within ½ inch.

4.3 Seismic Site Classification

Based on the soil conditions at the site, as indicated by the test borings and estimated from local geological references, the seismic analysis and design procedures for the proposed structure should be based on **Site Class D** (stiff/dense soil profile) per the current Ohio Building Code.

4.4 Pavement Subgrade and Thickness Recommendations

It is understood that as part of the construction of the new visitor's center, an expansion of, and improvements to, the existing parking lot are planned. The expansion is understood to include additional parking spaces and driveways, and the improvements will consist of rehabilitating or reconstructing the existing pavements.

4.4.1 Pavement Subgrade Recommendations

The subgrade soils in the proximity of the proposed pavements are anticipated to consist of predominantly cohesive. The cohesive soil comprised of hard lean clay with sand, (USCS CL). Based on the soil conditions encountered, it is estimated that the subgrade soils within the upper portions of the anticipated pavement subgrade will require some level of stabilization per the ODOT GDM. Stabilization methods are included in Section 4.5 of this report. It should be noted that at the time of this report, no profile information has been provided to Rii. Therefore, the Subgrade Analysis was performed based on the consideration that the pavement subgrade will be at approximately 1.0 foot below existing ground surface.

The subgrade soil should be thoroughly proofrolled in accordance with the recommendations presented in Section 4.5 to identify any soft, wet or weak zones prior to placement of aggregate subbase stone or pavement materials. At a minimum, the soils will likely require moisture conditioning. However, if the soils continue to present evidence of deformation during the proofrolling, then it is recommended that the soils be stabilized via a 1.0-foot undercut and replacement with granular engineered fill.

Based on the conditions encountered in the borings, **it is recommended that pavement design be based on a CBR value of 6** with a corresponding resilient modulus, M_R, of 7,200 psi. Correlation charts indicate a modulus of subgrade reaction (K) of 150 pci and a soil support value (SSV) of 4.8.

4.4.2 Pavement Thickness Evaluation

At the time of this report no specific traffic data was available; therefore, the recommendations included in this report are based upon a review of Rii's past pavement design projects similar in size and complexity.

Rii has included a summary of the assumed vehicle types, axle load configurations, and the estimated number of passes for each vehicle to determine the equivalent single axle loads (ESALs) for the proposed pavement sections.

Table 6. Vehicle Types, Axle Loads and Estimated Passes

Vehicle Type	Axle Loads (kips)			Estimated No. of Passes[1]	
	Single Front Axle	Single Rear Axle	Tandem Rear Axle	Frequency	Per Year
Passenger Vehicles	2	2	-	50 per Day	18,250
Trash Truck	12	-	34	1 per Week	52
School Bus	12	20	-	5 per Week	260

1. *Estimated number of passes per type of vehicle. Each time a vehicle access and leaves the premises is counted as two (2) passes.*

The procedures outlined in the 2022 ODOT Pavement Design Manual (PDM) were utilized to determine the equivalent single axle loads (ESALs) for the proposed pavement sections. Based on the anticipated traffic loading summarized in the preceding tables, and the parameters provided in the PDM, total ESALs for a 20-year design life were calculated. The calculated ESAL values are summarized below.

Table 7. Calculated ESAL Values for Flexible and Rigid Pavements

Pavement Section	20-year Design Life ESALs
Flexible Pavement	10,517
Rigid Pavement	11,261

Considering the subgrade conditions encountered in the borings, the recommendations provided in the pavement subgrade recommendations noted in Section 4.4.1 and the estimated traffic loading, Rii recommends the following minimum required pavement buildups for flexible and rigid pavement sections:

Table 8. Recommended Minimum Thickness for Standard Duty Flexible Pavement Section

Pavement Layer	Thickness
ODOT Item 441 - Asphalt Concrete Surface Course, Type 1 (PG70-22)	1.25 inches
ODOT Item 441 - Asphalt Concrete Intermediate Course, Type 2	1.75 inches
ODOT Item 302 Asphalt Concrete Base Course	4.0 inches
ODOT Item 304 Aggregate Base Course	6.0 inches
Prepared Subgrade	-

Table 9. Recommended Minimum Thickness for Rigid Pavement Section

Pavement Layer	Thickness
ODOT Item 452 Non-Reinforced Concrete Pavement	6.0 inches
ODOT Item 304 Aggregate Base	6.0 Inches
Prepared Subgrade	-

Table 10. Recommended Minimum Thickness Light Duty Flexible Pavement Section (Automobiles Only)

Pavement Layer	Thickness
ODOT Item 441 - Asphalt Concrete Surface Course, Type 1	1.5 inches
ODOT Item 441 - Asphalt Concrete Intermediate Course, Type 2	2.5 inches
ODOT Item 304 - Aggregate Base Course	6.0 inches
Prepared Subgrade	-

If it is anticipated that any semi-trucks or other heavily loaded vehicles (delivery trucks, dump trucks, etc.) will be parked on the pavement for long durations, it is recommended that a rigid pavement section be utilized to minimize the potential for distressing the pavement due to the static loading from the vehicles. Additionally, if a flexible pavement section is utilized, it is recommended that the surface and intermediate courses utilize a polymer modified binder mix (PG70-22).

Pavement design is dependent on the inclusion of adequate surface and subsurface drainage in order to maintain the compacted subgrade near optimum moisture conditions throughout the lifetime of the pavement. Lack of proper drainage is considered to be the cause(s) of many distresses that may develop in the pavement during its service life and

result in premature failures. This parameter was included in the evaluation of pavement by assuming that adequate drainage will be provided to all pavements built for this project.

Materials utilized for pavement construction should meet material and procedural details as outlined by the Ohio Department of Transportation (ODOT), the Asphalt Institute and/or the American Concrete Institute, as applicable.

Sources of borrow material, if required, should be designated in advance of construction. The material should be tested in the laboratory to verify the soil exhibits a minimum design CBR value of 6. The fill soil should be placed and compacted in accordance with the recommendations presented in Section 4.5.

The pavement sections recommendation herein has been based upon the abovementioned subgrade condition and assumed traffic (vehicles type, axle load configuration and vehicles frequency). If different traffic loads (from those assumed in this report) are expected or different subgrade conditions are encountered during construction, it should be brought to the attention of the pavement design engineer to determine whether any changes in the recommended sections are necessary.

4.5 Construction Considerations

The site work shall conform to the local specifications. If local specifications are not available, the latest ODOT CMS should be implemented. Site preparation should begin with general clearing, including the complete removal of all topsoil, vegetation, debris, existing pavement sections, unsuitable existing fill materials (as determined by a geotechnical engineer or an experienced soil technician), or any otherwise unsuitable materials from within the footprint of the proposed structure and pavement areas.

Prior to placing engineered filland/or pavement materials, the proposed subgrade surfaces should be thoroughly proofrolled with sufficient proofrolling apparatus (preferably a fully loaded tandem axle dump truck). A geotechnical engineer or an experienced soil technician should be present during proofrolling. Deflection, cracking or rutting of the subgrade surface during a proofroll indicates inadequate subgrade stability.

Areas of excess yielding should be stabilized using one of the following options: 1) scarifying, drying and recompacting, 2) mixing wet soil with dry soil, 3) undercutting unsuitable surficial soil and replacing it with controlled engineered fill, 4) modifying the soil by adding a chemical such as lime, cement or lime kiln dust, or 5) using a geogrid subgrade reinforcement system in conjunction with granular fill. Other methods of subgrade stabilization are available and certainly may be effective (both physically and economically) in stabilizing the soil. The adequacy of any stabilization method should be verified through the construction of a test section. All proposed subgrade surfaces should be shaped to promote positive drainage, with a minimum slope of 2 percent or 0.25 inches per foot. Adequate drainage is necessary for maintaining the stability of the subgrade.

Care should be taken during final grading so that no areas of potential ponding or standing water remain at the subgrade surface.

After materials are excavated to design grade, proper control of subgrade and new fill compaction should be performed by the geotechnical engineer and/or his/her representative. Generally, materials utilized for engineered fill should free of waste construction debris and other deleterious materials and meet the following requirements:

- Maximum Dry Density per ASTM D698 > 110 pcf
- Liquid Limit < 40
- Plasticity Index < 15
- Organic Matter < 3 percent
- Maximum Particle Size < 3 inches
- Silt Content (between 0.075 and 0.005 mm) < 45 percent

Compacted granular fill shall meet the above specification and additionally shall have a maximum 35 percent passing the No. 200 sieve.

The majority of the site's natural soils (excluding sod, topsoil, and/or organic containing materials) are generally considered suitable for reuse as structural fill when compacted at its optimum moisture content. Fill soil placed for foundation support should be placed in loose lifts not to exceed 8.0 inches. Fill soil placed under structures shall be compacted to not less than 100 percent of maximum dry density obtained by a Standard Proctor Test (ASTM D698). Compaction of fill material beneath any paved section should be performed to no less than 98 percent of Standard Proctor. Fill soil containing excess moisture shall be required to dry prior to or during compaction to a moisture content not greater than 3.0 percent above or below optimum moisture levels. However, for material which displays pronounced elasticity or deformation under the action of loaded rubber tire construction equipment, the moisture content shall be reduced to optimum if necessary to secure stability. Drying of wet soil shall be expedited by the use of plows, discs, or by other approved methods when so ordered by the site geotechnical engineer. Fill soil should not be placed in a frozen condition, and fill soil should not be placed on a frozen subgrade.

Underground utilities should be bedded in crushed granular stone, such as No. 57 or No. 8 stone, extending from 4.0 inches below the pipe to the springline of the pipe or 12.0 inches above the pipe for concrete and PVC pipe, respectively. The stone will serve as a leveling course and will provide a stable working platform. Compaction of backfill material within trench excavations located beneath any structure or pavement areas should be performed at no less than 98 percent of Standard Proctor using granular backfill placed in lifts no thicker than 8.0 inches.

4.5.1 Excavation Considerations

All trenching and excavation procedures should follow applicable Occupational Safety and Health Administration (OSHA) standards, including adequate safety precautions conforming to OSHA standards for the personnel installing underground lines. During excavation, if slopes cannot be laid back to OSHA Standards due to adjacent structures or other obstructions, trench boxes or temporary sheeting or shoring may be required. The following table should be utilized as a general guide for implementing OSHA guidelines when estimating excavation back slopes at the various boring locations. Actual excavation back slopes must be field verified by qualified personnel at the time of excavation in strict accordance with OSHA guidelines.

Table 11. Excavation Back Slopes

Soil	Maximum Back Slope	Notes
Soft to Medium Stiff Cohesive	1.5 : 1.0	Above Ground Water Table and No Seepage
Stiff Cohesive	1.0 : 1.0	Above Ground Water Table and No Seepage
Very Stiff to Hard Cohesive	0.75 : 1.0	Above Ground Water Table and No Seepage
All Granular & Cohesive Soil Below Ground Water Table or with Seepage	1.5 : 1.0	None

For the soil types encountered in the borings, the in-situ unit weight (γ), cohesion (c), effective angle of friction (φ'), and lateral earth pressure coefficients for at-rest conditions (k_o), active conditions (k_a), and passive conditions (k_p) have been estimated and are provided in Table 12 and Table 13.

Table 12. Estimated Undrained (Short-term) Soil Parameters for Design

Soil Type	γ [1] (pcf)	c (psf)	φ	k_a	k_o	k_p
Soft to Medium Stiff Cohesive Soils	110	500	0°	N/A	N/A	N/A
Very Stiff to Hard Cohesive Soils	125	2,000	0°	N/A	N/A	N/A
Very Loose to Loose Granular Soils	120	0	30°	0.33	0.50	3.00
Medium Dense Granular Soils	125	0	32°	0.31	0.47	3.25
Dense to Very Dense Granular Soil	130	0	34°	0.28	0.44	3.54
Compacted Cohesive Engineered Fill	125	2,000	0°	N/A	N/A	N/A
Compacted Granular Engineered Fill	125	0	33°	0.30	0.46	3.39

1. *When below groundwater table, use effective unit weight, γ' = γ - 62.4 pcf and add hydrostatic water pressure.*

Table 13. Estimated Drained (Long-term) Soil Parameters for Design

Soil Type	γ [1] (pcf)	c' (psf)	φ'	k_a	k_o	k_p
Soft to Medium Stiff Cohesive Soils	110	0	22°	0.45	0.63	2.20
Very Stiff to Hard Cohesive Soils	125	0	26°	0.39	0.56	2.56
Very Loose to Loose Granular Soils	120	0	30°	0.33	0.50	3.00
Medium Dense Granular Soils	125	0	32°	0.31	0.47	3.25
Dense to Very Dense Granular Soils	130	0	34°	0.28	0.44	3.54
Compacted Cohesive Engineered Fill	125	0	28°	0.36	0.53	2.77
Compacted Granular Engineered Fill	125	0	33°	0.29	0.46	3.39

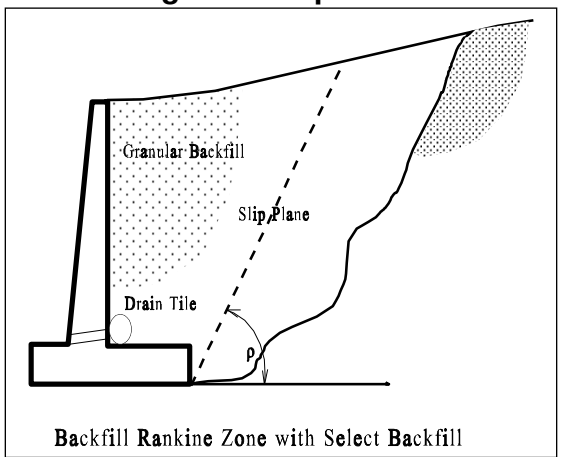
1. *When below the groundwater level, use effective unit weight, γ' = γ - 62.4 pcf and add hydrostatic water pressure.*

These parameters are considered appropriate for the design of all subsurface structures and any excavation support systems. Subsurface structures (where the top of the structure is restrained from movement) should be designed based on at-rest (k_o) conditions. For proposed temporary retaining structures (where the top of the structure is allowed to move), earth pressure distributions should be based on active (k_a) and passive (k_p) conditions. The values in this table have been estimated from correlation charts based on minimum standards specified for compacted engineered fill materials. These recommendations do not take into consideration the effect of any surcharge loading or a sloped ground surface (a flat surface is assumed). Earth pressures on excavation support systems will be dependent on the type of sheeting and method of bracing or anchorage.

Temporary retaining structures should be designed using the undrained soil parameters provided in Table 12, and the design should follow all applicable guidelines for the type of retaining structure utilized. Permanent retaining structures should be designed using the drained soil parameters provided in Table 13. Regardless of whether the retaining structure is temporary or permanent, the effective unit weight (γ' = γ - 62.4 pcf) plus the hydrostatic water pressure ($\gamma_w * h_w$, where h_w is the height of water behind the wall above the base of the wall) should be utilized below the design groundwater level. The lateral earth pressure coefficients should only be applied to the horizontal pressure resulting from the effective overburden pressure, and should not be applied to the hydrostatic water pressure.

The 2.0 feet of free draining material placed behind the wall prevents the formation of hydrostatic pressures as noted above. However, unless the free draining granular backfill is placed beyond the slip plane (see Figure 1), it has no influence on the equivalent fluid weight of the soil. If free draining granular fill (meeting the requirements listed above) is to be placed beyond the slip plane (ρ=45° for at-rest conditions; ρ=45°+φ/2 for active conditions), the values presented for the compacted granular engineered fill can be employed, consequently lowering the pressures on the wall.

Figure 1. Slip Plane



4.5.2 Groundwater Considerations

Groundwater is not anticipated to be encountered in excavations. However, for cases were over excavation is necessary, groundwater may be encountered. In such cases, proper groundwater control should be employed and maintained to prevent disturbance to excavation bottoms consisting of cohesive soil, and to prevent the possible development of a quick or boiling conditions where soft silts and/or fine sands are encountered. It is preferable that the groundwater level, if encountered, be maintained at least 36.0 inches below the deepest excavation. Groundwater flow encountered within granular layers at this site will likely be significant, therefore a robust groundwater control system beyond conventional temporary sumps would likely be required. However, it is the responsibility of the contractor to properly control the groundwater during construction.

5.0 LIMITATIONS OF STUDY

The above recommendations are predicated upon construction inspection by a qualified soil technician under the direct supervision of a professional geotechnical engineer. Adequate testing and inspection during construction are considered necessary to assure adequate construction of the structure foundations and pavement subgrade.

Our recommendations for this project were developed utilizing soil information obtained from the test borings that were made at the proposed site. At this time we would like to point out that soil borings only depict the soil conditions at the specific locations and time at which they were made. The conditions at other locations on the site may differ from those occurring at the boring locations.

The conclusions and recommendations herein have been based upon the available soil information and the preliminary design details furnished by a representative of the owner of the proposed project. Any revision in the plans for the proposed construction from those anticipated in this report should be brought to the attention of the geotechnical engineer to determine whether any changes in the foundation or earthwork recommendations are

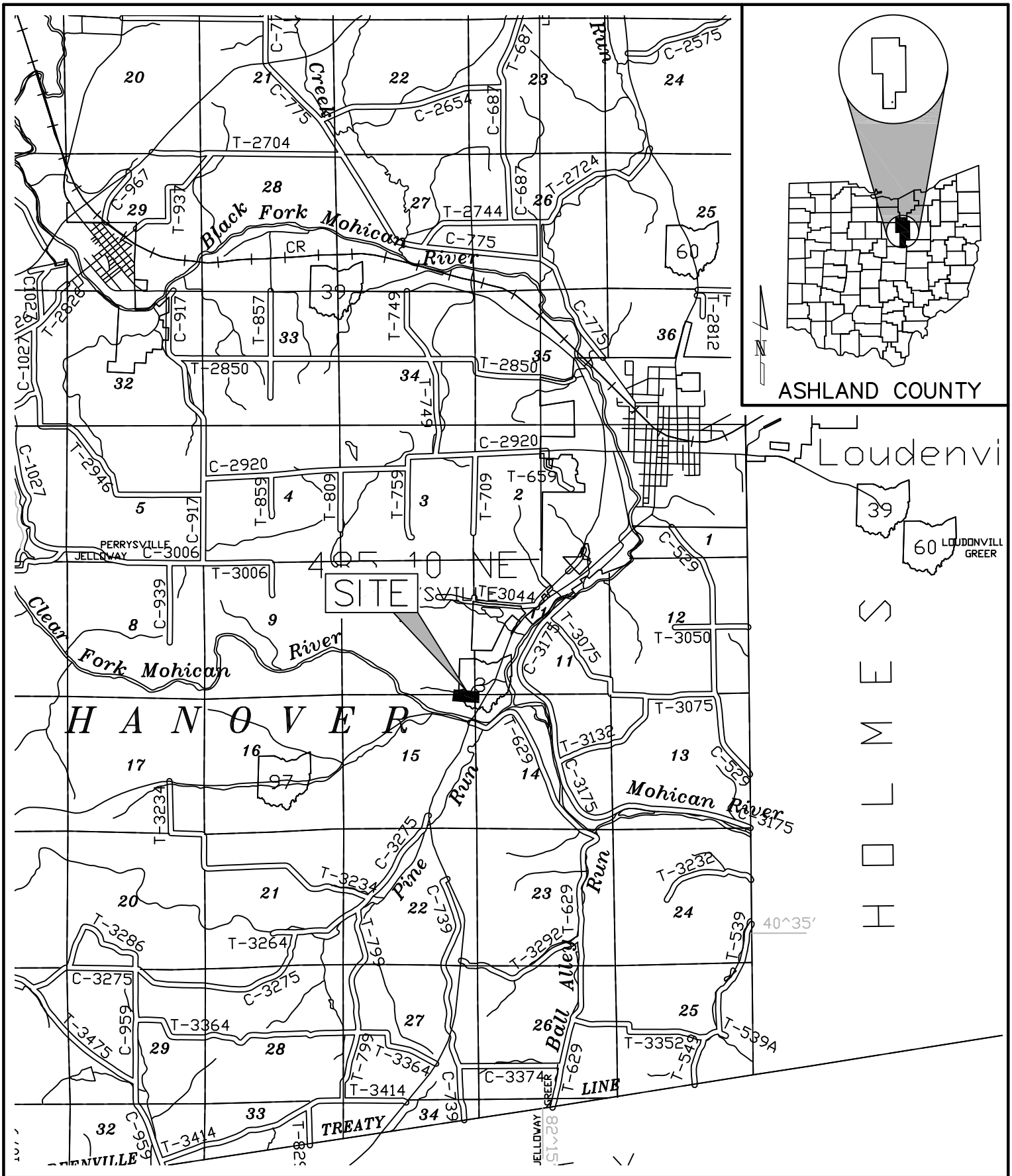
necessary. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of the geotechnical engineer.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report or on the test boring logs regarding odors, gases, staining of soils or other unusual conditions observed are strictly for the information of our client.

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. Resource International is not responsible for the conclusions, opinions or recommendations made by others based upon the data included.

APPENDIX I

VICINITY MAP AND BORING PLAN



VICINITY MAP

MOHICAN STATE PARK
VISITORS CENTER
ASHLAND COUNTY, OHIO

RII PROJECT NO.
W-23-083

SCALE: 1"=5000'
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DRAWN
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REVIEWED
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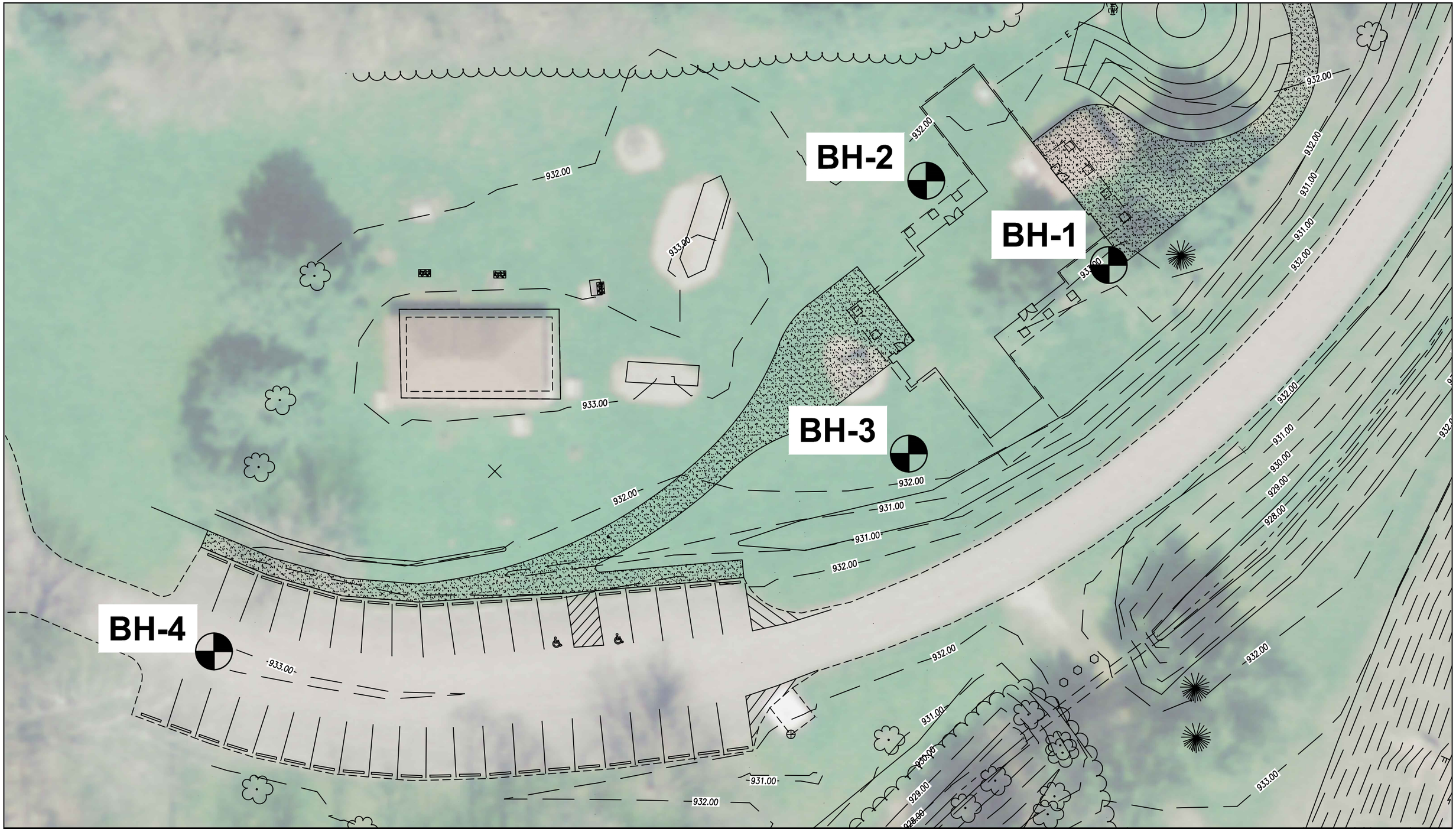
DATE
7/31/2023

RESOURCE INTERNATIONAL
Rii



BORING PLAN
MOHICAN STATE PARK VISITORS CENTER
ASHLAND COUNTY, OHIO

RII PROJECT NO.
W-23-083

SCALE: 1"=30'
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7/31/2023

RESOURCE INTERNATIONAL
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APPENDIX II

DESCRIPTION OF SOIL TERMS

DESCRIPTION OF SOIL TERMS

The following terminology was used to describe soils throughout this report and is generally adapted from ASTM 2487/2488.

Granular Soils – USCS GW, GP, GM, GC, SW, SP, SM, SC, ML (non-plastic)
The relative compactness of granular soils is described as:

Description	Blows per foot – SPT (N_{60})		
Very Loose	Below		5
Loose	5	-	10
Medium Dense	11	-	30
Dense	31	-	50
Very Dense	Over		50

Cohesive Soils – USCS ML, CL, OL, MH, CH, OH, PT
The relative consistency of cohesive soils is described as:

Description	Unconfined Compression (tsf)		
Very Soft	Less than		0.25
Soft	0.25	-	0.5
Medium Stiff	0.5	-	1.0
Stiff	1.0	-	2.0
Very Stiff	2.0	-	4.0
Hard	Over		4.0

Gradation - The following size-related denominations are used to describe soils:

Soil Fraction		Size
Boulders		Larger than 12”
Cobbles		12” to 3”
Gravel	coarse	3” to ¾”
	fine	¾” to 4.75 mm (¾” to #4 Sieve)
Sand	coarse	4.75 mm to 2.0 mm (#4 to #10 Sieve)
	medium	2.0 mm to 0.42 mm (#10 to #40 Sieve)
	fine	0.42 mm to 0.074 mm (#40 to #200 Sieve)
Silt		0.074 mm to 0.005 mm (#200 to 0.005 mm)
Clay		Smaller than 0.005 mm

Modifiers of Components – The following modifiers indicate the range of percentages of the minor soil components:

Term	Range		
Trace	0%	-	10%
Little	10%	-	20%
Some	20%	-	35%
And	35%	-	50%

Moisture Table - The following moisture-related denominations are used to describe cohesive soils:

Term	Range
Dry	0% to 10%
Damp	>2% below Plastic Limit
Moist	2% below to 2% above Plastic Limit
Very Moist	>2% above Plastic Limit
Wet	≥ Liquid Limit

Organic Content – The following terms are used to describe organic soils:

Term	Organic Content (%)
Slightly organic	2-4
Moderately organic	4-10
Highly organic	>10

Bedrock – The following terms are used to describe bedrock hardness:

Term	Parameter
Very Weak	Can be carved with knife and scratched by fingernail.
Weak	Can be grooved or gouged with knife readily.
Slightly Strong	Can be grooved or gouged 0.05 in deep with knife.
Moderately Strong	Can be scratched with knife or pick.
Strong	Can be scratched with knife or pick with difficulty.
Very Strong	Cannot be scratched by knife or pick. Hard repeated blows of hammer to detach specimen.
Extremely Strong	Cannot be scratched by knife or pick. Hard repeated blows of hammer to chip hand specimen.

DESCRIPTION OF ROCK TERMS

The following terminology was used to describe the rock throughout this report and is generally adapted from ASTM D5878.

Weathering – Describes the degree of weathering of the rock mass:

Description	Field Parameter
Unweathered	No evidence of any chemical or mechanical alteration of the rock mass. Mineral crystals have a right appearance with no discoloration. Fractures show little or not staining on surfaces.
Slightly Weathered	Slight discoloration of the rock surface with minor alterations along discontinuities. Less than 10% of the rock volume presents alteration.
Moderately Weathered	Portions of the rock mass are discolored as evident by a dull appearance. Surfaces may have a pitted appearance with weathering "halos" evident. Isolated zones of varying rock strengths due to alteration may be present. 10 to 15% of the rock volume presents alterations.
Highly Weathered	Entire rock mass appears discolored and dull. Some pockets of slightly to moderately weathered rock may be present and some areas of severely weathered materials may be present.
Severely Weathered	Majority of the rock mass reduced to a soil-like state with relic rock structure discernable. Zones of more resistant rock may be present but the material can generally be molded and crumbled by hand pressures.

Strength of Bedrock – The following terms are used to describe the relative strength of bedrock:

Description	Field Parameter
Very Weak	Can be carved with knife and scratched by fingernail. Pieces 1 in. thick can be broken by finger pressure.
Weak	Can be grooved or gouged with knife readily. Small, thin pieces can be broken by finger pressure.
Slightly Strong	Can be grooved or gouged 0.05 in deep with knife. 1 in. size pieces from hard blows of geologist hammer.
Moderately Strong	Can be scratched with knife or pick. 1/4 in. size grooves or gouges from blows of geologist hammer.
Strong	Can be scratched with knife or pick with difficulty. Hard hammer blows to detach hand specimen.
Very Strong	Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to detach hand specimen.
Extremely Strong	Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to chip hand specimen.

Bedding Thickness – Description of bedding thickness as the average perpendicular distances between bedding surfaces:

Description	Thickness
Very Thick	Greater than 36 inches
Thick	18 to 36 inches
Medium	10 to 18 inches
Thin	2 to 10 inches
Very Thin	0.4 to 2 inches
Laminated	0.1 to 0.4 inches
Thinly Laminated	Less than 0.1 inches

Fracturing – Describes the degree and condition of fracturing (fault, joint, or shear):

Degree of Fracturing

Description	Spacing
Unfractured	Greater than 10 feet
Intact	3 to 10 feet
Slightly Fractured	1 to 3 feet
Moderately Fractured	Less than 1 foot

Aperture Width

Description	Width
Open	Greater than 0.2 inches
Narrow	0.05 to 0.2 inches
Tight	Less than 0.05 inches

Surface Roughness

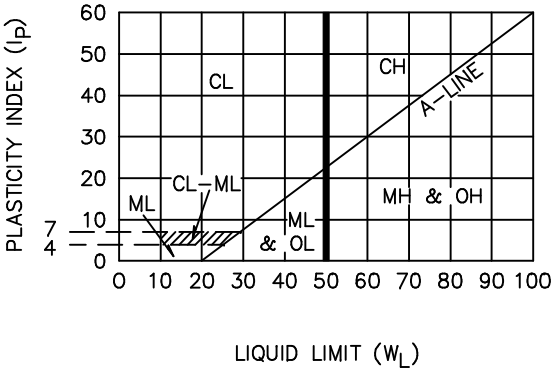
Description	Criteria
Very Rough	Near vertical steps and ridges occur on surface
Slightly Rough	Asperities on the surfaces distinguishable
Slickensided	Surface has smooth, glassy finish, evidence of Striations

RQD – Rock Quality Designation:

RQD %	Rock Index Property Classification
0 – 25%	Very Poor
26 – 50%	Poor
51 – 70%	Fair
71 – 85%	Good
86 – 100%	Very Good

UNIFIED SOIL CLASSIFICATION SYSTEM
(ASTM D 2487)

MAJOR DIVISION			GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS MORE THAN 50% RETAINED ON 75μm (NO. 200) SIEVE	GRAVELS 50% OR MORE OF COARSE FRACTION RETAINED ON 4.75 mm (NO. 4) SIEVE	CLEAN GRAVELS	GW	WELL-GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	CLASSIFICATION ON BASIS PERCENTAGE OF FINES LESS THAN 5% PASS 75 μm SIEVE GW, GP, SW, SP MORE THAN 12% PASS 75 μm SIEVE GM, GC, SM, SC 5% TO 12% PASS 75 μm SIEVE BORDERLINE CLASSIFICATION REQUIRING USE OF DUAL SYMBOLS	$C_U = D_{60}/D_{10}$ GREATER THAN 4 $C_Z = \frac{(D_{30})^2}{D_{10} * D_{60}}$ BETWEEN 1 AND 3
			GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES		NOT MEETING BOTH CRITERIA FOR GW
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES		ATTERBERG LIMITS PLOT BELOW "A" LINE OR PLASTICITY INDEX LESS THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS PLOT ABOVE "A" LINE AND PLASTICITY INDEX GREATER THAN 7
	SANDS MORE THAN 50% OF COARSE FRACTION PASSES 4.75 mm (NO. 4) SIEVE	CLEAN SANDS	SW	WELL-GRADED SAND AND GRAVELLY SANDS, LITTLE OR NO FINES		$C_U = D_{60}/D_{10}$ GREATER THAN 6 $C_Z = \frac{(D_{30})^2}{D_{10} * D_{60}}$ BETWEEN 1 AND 3
			SP	POORLY GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES		NOT MEETING BOTH CRITERIA FOR SW
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES		ATTERBERG LIMITS PLOT BELOW "A" LINE OR PLASTICITY INDEX LESS THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS PLOT ABOVE "A" LINE AND PLASTICITY INDEX GREATER THAN 7

MAJOR DIVISION		GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA
FINE-GRAINED SOILS 50% OR MORE PASSES 75 μm (NO. 200) SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS	ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	 PLASTICITY CHART FOR THE CLASSIFICATION OF FINE-GRAINED SOILS
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
HIGHLY ORGANIC SOILS		PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS	FIBROUS ORGANIC MATTER; WILL CHAR, BURN, OR GLOW

APPENDIX III

BORING LOGS

BH-1 to BH-4

BORING LOGS

Definitions of Abbreviations

AS = Auger sample

HP = Unconfined compressive strength as determined by a hand penetrometer (tons per square foot)

LOI = Percent organic content (by weight) as determined by ASTM D2974 (loss on ignition test)

PID = Photo-ionization detector reading (parts per million)

QR = Unconfined compressive strength of intact rock core sample as determined by ASTM D2938 (pounds per square inch)

QU = Unconfined compressive strength of soil sample as determined by ASTM D2166 (pounds per square foot)

RC = Rock core sample

REC = Ratio of total length of recovered soil or rock to the total sample length, expressed as a percentage

RQD = Rock quality designation – estimate of the degree of jointing or fracture in a rock mass, expressed as a percentage:

$$\frac{\sum \text{segments equal to or longer than 4.0 inches}}{\text{core run length}} \times 100$$

S = Sulfate content (parts per million)

SPT = Standard penetration test blow counts, per ASTM D1586. Driving resistance recorded in terms of blows per 6-inch interval while letting a 140-pound hammer free fall 30 inches to drive a 2-inch outer diameter (O.D.) split spoon sampler a total of 18 inches. The second and third intervals are added to obtain the number of blows per foot (N_m).

N_{60} = Measured blow counts corrected to an equivalent (60 percent) energy ratio (ER) by the following equation: $N_{60} = N_m*(ER/60)$

SS = Split spoon sample

2S = For instances of no recovery from standard SS interval, a 2.5 inch O.D. split spoon is driven the full length of the standard SS interval plus an additional 6.0 inches to obtain a representative sample. Only the final 6.0 inches of sample is retained. Blow counts from 2S sampling are not correlated with N_{60} values.

3S = Same as 2S, but using a 3.0 inch O.D. split spoon sampler.

TR = Top of rock

USCS = Unified Soil Classification System per ASTM D2487

W = Seepage encountered during drilling

▽ = Initial water level measured during drilling

▼ = Water level measured at completion of drilling

Classification Test Data

Gradation (as defined on Description of Soil Terms):

GR = % Gravel
SA = % Sand
SI = % Silt
CL = % Clay

Atterberg Limits:

LL = Liquid limit
PL = Plastic limit
PI = Plasticity Index
WC = Water content (%)

RESOURCE INTERNATIONAL, INC.

PROJECT: W-23-083 (1)	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	NORTHING 342958.322	**EXPLORATION ID**
NAME: ODNR Mohican Visitors Center	SAMPLING FIRM / LOGGER: RII / PF	HAMMER: Automatic	EASTING: 2035325.269	**BH-1**
CLIENT: Legat Architects	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/21/22	ELEVATION: 932.9 ft.	PAGE
START: 7-13-23 END: 7-13-23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	COMPLETION DEPTH: 20.0 ft.	1 OF 1

ELEV. 932.9	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	*MATERIAL DESCRIPTION AND NOTES*	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
932.4							0.5' - Topsoil (6.0")										
	1–5	SS-1	1 5 3	11	33		Loose to medium dense, dark brown **SANDY SILT**, damp.	0.2	41.5	41.8	16.5	NP	NP	NP	12	ML	
							-Root fibers in SS-1 -SS-1: LOI = 2.7%										
	4–5	SS-2	2 2 2	6	33											ML (V)	
927.4																	
	6–7	SS-3	1 1 2	4	33		Very loose to loose, brownish gray **WELL GRADED GRAVEL WITH SILT AND SAND**, wet.	49.0	39.5	11.6		NP	NP	NP	16	GW-GM	
	8–9	SS-4	3 2 4	8	33											GW-GM (V)	
920.9																	
	12–13						Very stiff, brownish gray **LEAN CLAY WITH SAND**, moist to very moist.										
	14–15	SS-5	8 7 10	24	56	4.0									16	CL (V)	
	19–20	SS-6	3 4 5	13	89	2.5		0.3	16.5	53.7	29.5	27	17	10	20	CL	
912.9	EOB																

NOTES: Seepage @ 6.0'; Groundwater encountered initially @ 8.5' and at completion @ 5.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 50 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-23-083 (1)	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	NORTHING 342986.571	**EXPLORATION ID**
NAME: ODNR Mohican Visitors Center	SAMPLING FIRM / LOGGER: RII / PF	HAMMER: Automatic	EASTING: 2035264.104	**BH-2**
CLIENT: Legat Architects	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/21/22	ELEVATION: 932.8 ft.	PAGE
START: 7-13-23 END: 7-13-23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	COMPLETION DEPTH: 26.4 ft.	1 OF 1

ELEV. 932.8	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
932.5							0.3' - Topsoil (3.0")										
	1–2	SS-1	2 1 1	3	67	0.5	Soft, dark brown **LEAN CLAY WITH SAND**, moist.								22	CL (V)	
929.8	3																
	4–5	SS-2	3 3 4	10	39		Loose to medium dense, brown **SILTY SAND WITH GRAVEL**, damp.	28.9	58.3	8.6	4.1	NP	NP	NP	9	SM	
	6–7	SS-3	3 3 11	20	33											SM (V)	
	8–9	SS-4	7 9 9	25	0											SM (V)	
	10	2S-4A	12		100										18	SM (V)	
920.8	11–12																
	13						Very dense, brownish gray **SANDY SILT**, moist.										
918.4	14	SS-5	16 50/4"	-	100											ML (V)	
	15–16	RC-1	0		58		**SANDSTONE** : brown to gray, moderately weathered, slightly to moderately strong, medium grained, thin bedded, fossiliferous, fractured to moderately fractured, narrow apertures, very rough, very blocky, fair surface condition.									CORE	
	17–21	RC-2	38		98											CORE	
	22–24	RC-3	78		100		-Qu @ 21.7' = 2,352 psi									CORE	
906.4	26 EOB																

NOTES: Groundwater encountered initially @ 6.0' and at completion @ 4.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 100 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-23-083 (1)	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	NORTHING 342895.108	**EXPLORATION ID**
NAME: ODNR Mohican Visitors Center	SAMPLING FIRM / LOGGER: RII / PF	HAMMER: Automatic	EASTING: 2035258.248	**BH-3**
CLIENT: Legat Architects	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/21/22	ELEVATION: 932.4 ft.	PAGE
START: 7-13-23 END: 7-13-23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	COMPLETION DEPTH: 26.3 ft.	1 OF 1

ELEV. 932.4	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
931.9							0.5' - Topsoil (6.0")										
	1–2	SS-1	1 1 1	3	67	2.5	Stiff, dark brown **LEAN CLAY WITH SAND**, very moist. -SS-1: LOI = 3.7%	0.0	24.7	54.9	20.4	34	22	12	25	CL	
929.4	3																
	4–5	SS-2	1 1 1	3	89		Very loose to medium dense, brown **SANDY SILT**, very moist.	0.0	46.5	39.2	14.3	NP	NP	NP	23	ML	
	6–7	SS-3	1 2 3	7	100										23	ML (V)	
	8 ▽																
	9–10	SS-4	4 3 5	11	56										23	ML (V)	
920.4	11–12																
	13–14	SS-5	34 45 50/2"	-	100	4.5+	Hard, gray **SILTY CLAY WITH SAND**, damp.									CL-ML (V)	
917.6	15–16	RC-1	0		56		**SANDSTONE** : gray, moderately to slightly weathered,, moderately strong, medium grained, thin bedded, fractured to moderately fractured, narrow apertures, slightly rough to very rough, blocky, good surface condition.									CORE	
	17–19	RC-2	18		100											CORE	
	21–22						-Gray limestone seam @ 20.8'-21.3'										
	23–24	RC-3	85		97		-Qu @ 22.1' = 1,676 psi									CORE	
906.1	26 EOB																

NOTES: Groundwater encountered initially @ 8.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 50 lbs bentonite chips and soil cuttings.

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-23-083 (1)	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	NORTHING 342828.888	**EXPLORATION ID**
NAME: ODNR Mohican Visitors Center	SAMPLING FIRM / LOGGER: RII / PF	HAMMER: Automatic	EASTING: 2035025.463	**BH-4**
CLIENT: Legat Architects	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/21/22	ELEVATION: 933.1 ft.	PAGE
START: 7-13-23 END: 7-13-23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	COMPLETION DEPTH: 10.0 ft.	1 OF 1

ELEV. 933.1	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	*MATERIAL DESCRIPTION AND NOTES*	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
932.5							0.7' - Asphalt (8.0")										
931.9							0.6' - Aggregate Base (7.0")										
	1–3	SS-1	5 2 2	6	72	4.5+	Hard, dark brown to brown **LEAN CLAY WITH SAND**, very moist.	0.0	29.9	53.0	17.1	30	21	9	25	CL	
	4–5	SS-2	1 2 2	6	100										25	CL (V)	
927.6																	
	6–7	SS-3	5 5 3	11	78		Medium dense, brown **POORLY GRADED SAND WITH GRAVEL**, moist to very moist.									SP (V)	
	8–9	SS-4	4 5 4	13	72											SP (V)	
923.1	EOB 10																

NOTES: Groundwater encountered initially @ 6.0' and at completion @ 4.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 25 lbs bentonite chips and soil cuttings. Pavement patched with cold patch asphalt

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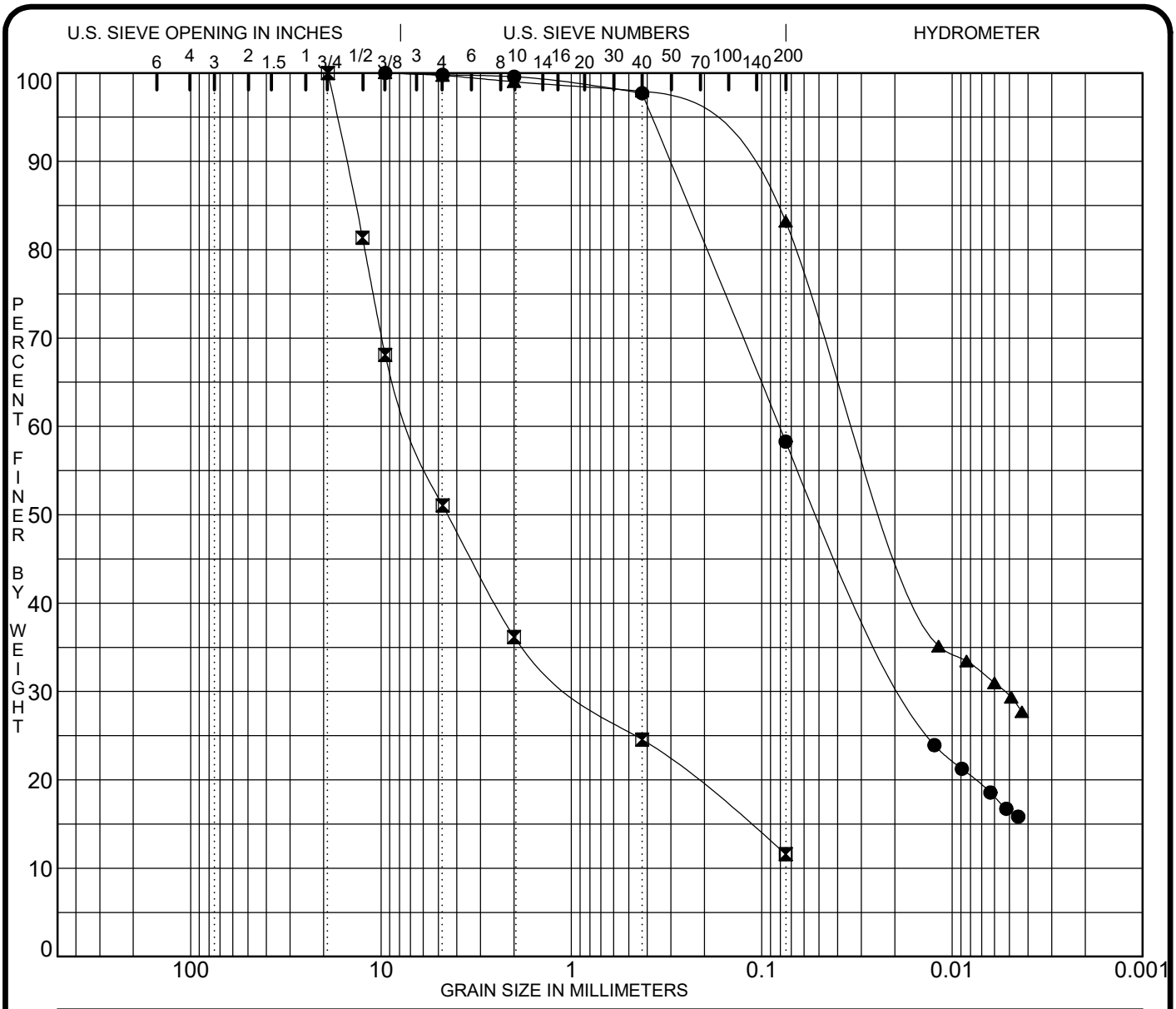
APPENDIX IV

LABORATORY TEST RESULTS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

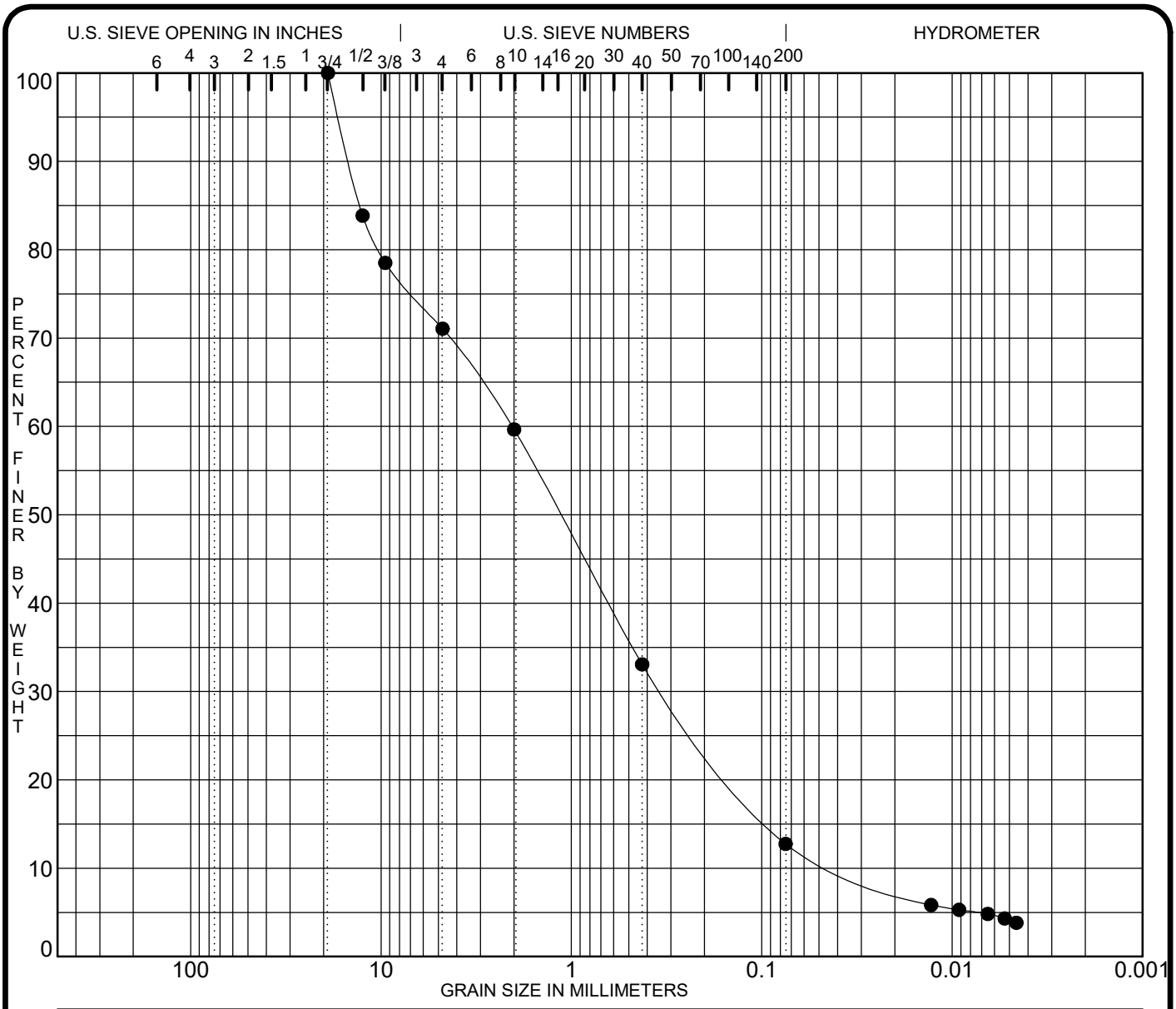
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH-1**	**1.0**	**SANDY SILT ML**	**12**	**NP**	**NP**	**NP**		
⊠	**BH-1**	**6.0**		**16**				**1.86**	**112.8**
▲	**BH-1**	**18.5**	**LEAN CLAY with SAND CL**	**20**	**27**	**17**	**10**		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**BH-1**	**1.0**	**9.50**	**0.08**	**0.017**		**0.0**	**0.2**	**0.2**	**1.9**	**39.4**	**41.8**	**16.5**
⊠	**BH-1**	**6.0**	**19.00**	**6.84**	**0.879**		**0.0**	**49.0**	**14.9**	**11.6**	**13.0**	**11.6**	
▲	**BH-1**	**18.5**	**9.50**	**0.03**	**0.005**		**0.0**	**0.3**	**0.7**	**1.1**	**14.7**	**53.7**	**29.5**

PROJECT **ODNR Mohican Visitors Center** PROJECT NO. **W-23-083 (1)**

GRADATION CURVES

Resource International, Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

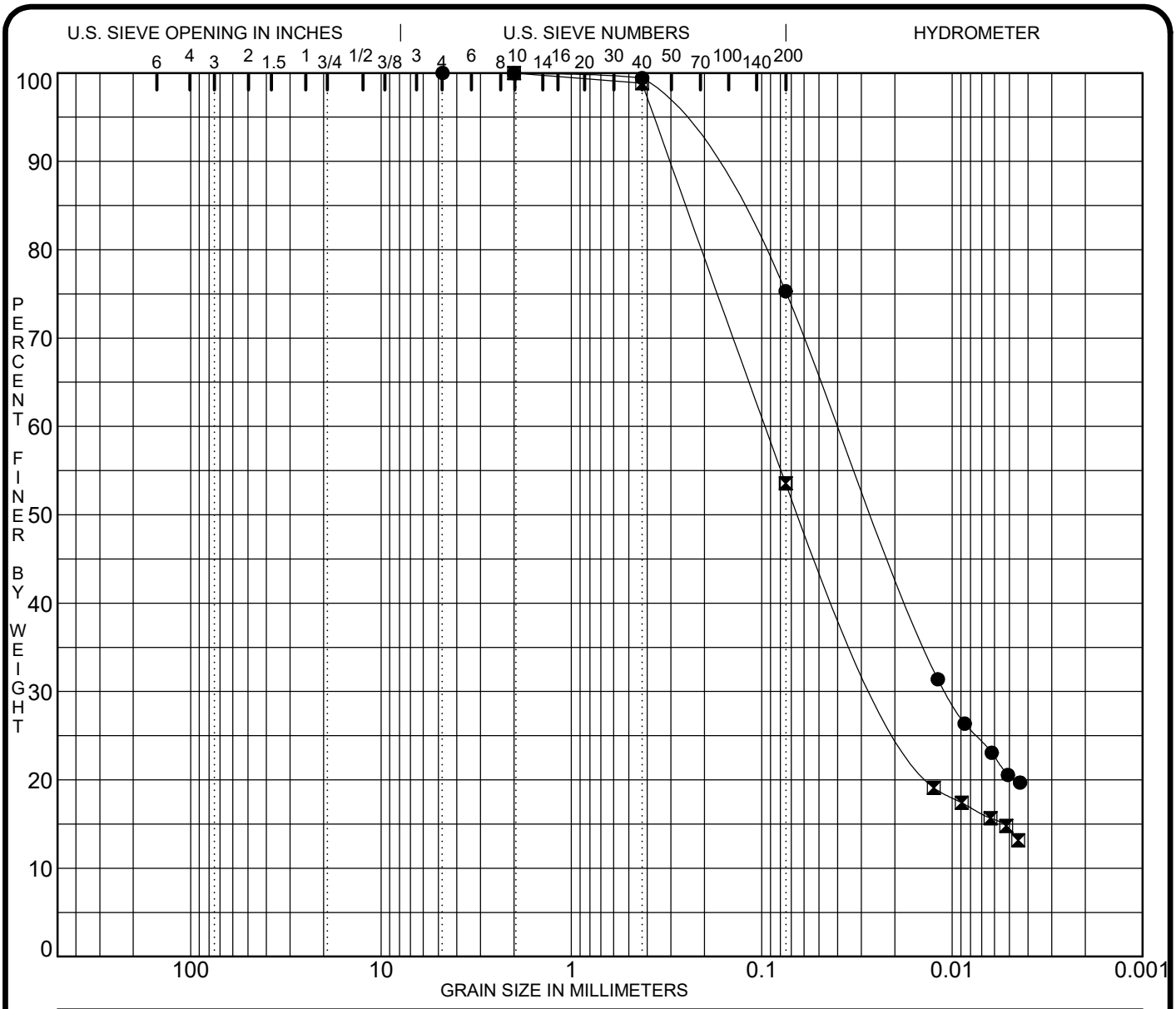
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH-2**	**3.5**	**SILTY SAND with GRAVEL SM**	**9**	**NP**	**NP**	**NP**	**1.40**	**55.2**

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**BH-2**	**3.5**	**19.00**	**2.05**	**0.327**	**0.0372**	**0.0**	**28.9**	**11.4**	**26.6**	**20.3**	**8.6**	**4.1**

PROJECT **ODNR Mohican Visitors Center** PROJECT NO. **W-23-083 (1)**

GRADATION CURVES

Resource International, Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

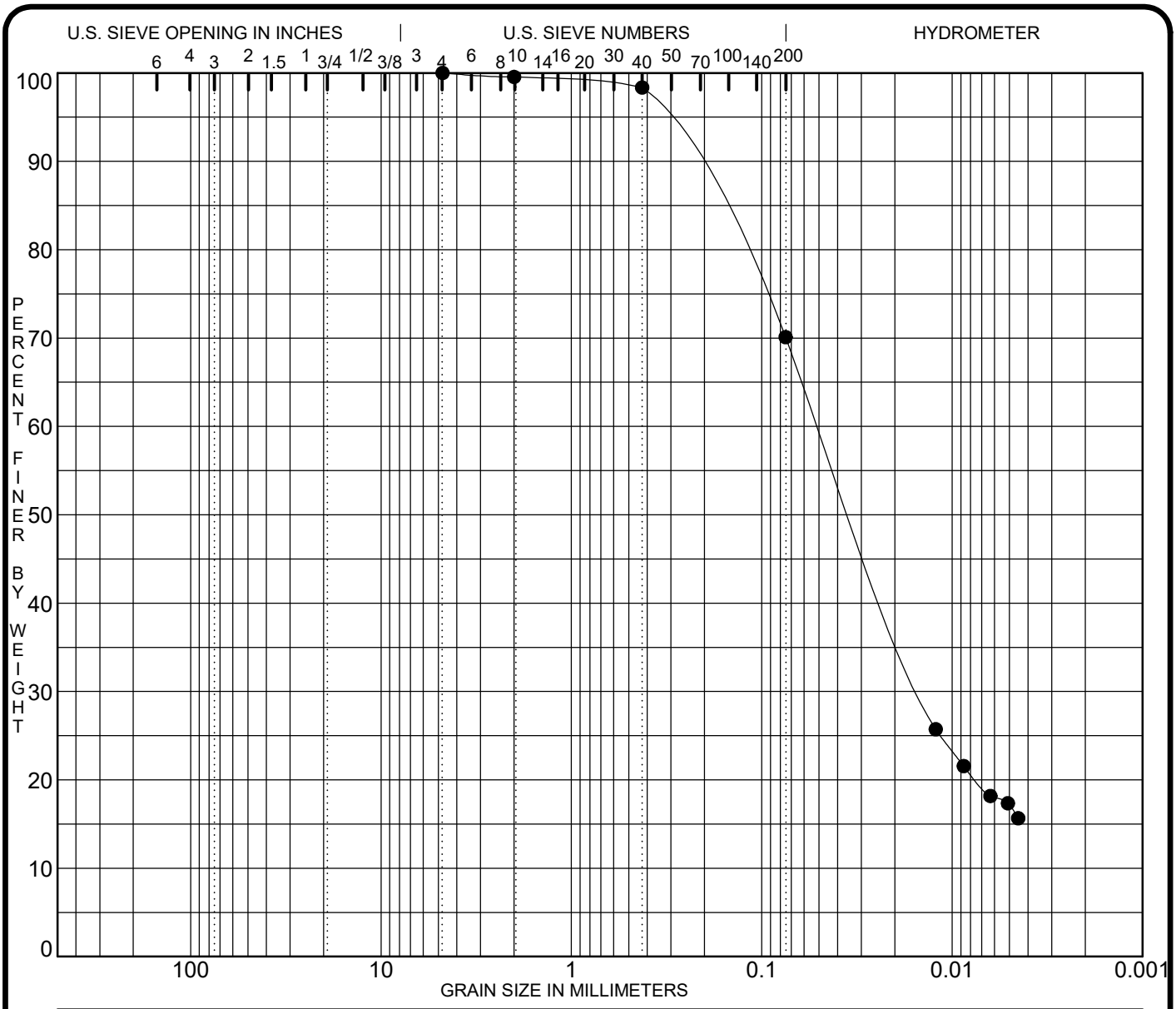
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH-3**	**1.0**	**LEAN CLAY with SAND CL**	**25**	**34**	**22**	**12**		
⊠	**BH-3**	**3.5**	**SANDY SILT ML**	**23**	**NP**	**NP**	**NP**		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**BH-3**	**1.0**	**4.75**	**0.04**	**0.011**		**0.0**	**0.0**	**0.0**	**0.5**	**24.1**	**54.9**	**20.4**
⊠	**BH-3**	**3.5**	**2.00**	**0.10**	**0.022**		**0.0**	**0.0**	**0.0**	**1.1**	**45.3**	**39.2**	**14.3**

PROJECT **ODNR Mohican Visitors Center** PROJECT NO. **W-23-083 (1)**

GRADATION CURVES

Resource International, Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH-4**	**1.5**	**LEAN CLAY with SAND CL**	**25**	**30**	**21**	**9**		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**BH-4**	**1.5**	**4.75**	**0.05**	**0.015**		**0.0**	**0.0**	**0.4**	**1.2**	**28.3**	**53.0**	**17.1**

PROJECT **ODNR Mohican Visitors Center** PROJECT NO. **W-23-083 (1)**

GRADATION CURVES

Resource International, Inc.

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Engineering Consultants

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4480 Lake Forest Drive
Cincinnati, Ohio 45242
Phone (513) 769-6998

Unconfined Compressive Strength of Intact Rock Core Specimens

(ASTM D 7012-14)

Project: ODNR Mohican Visitors Center
Project No.: W-23-083
Date of Testing: 7/28/2023
Test Performed by: KL/EM

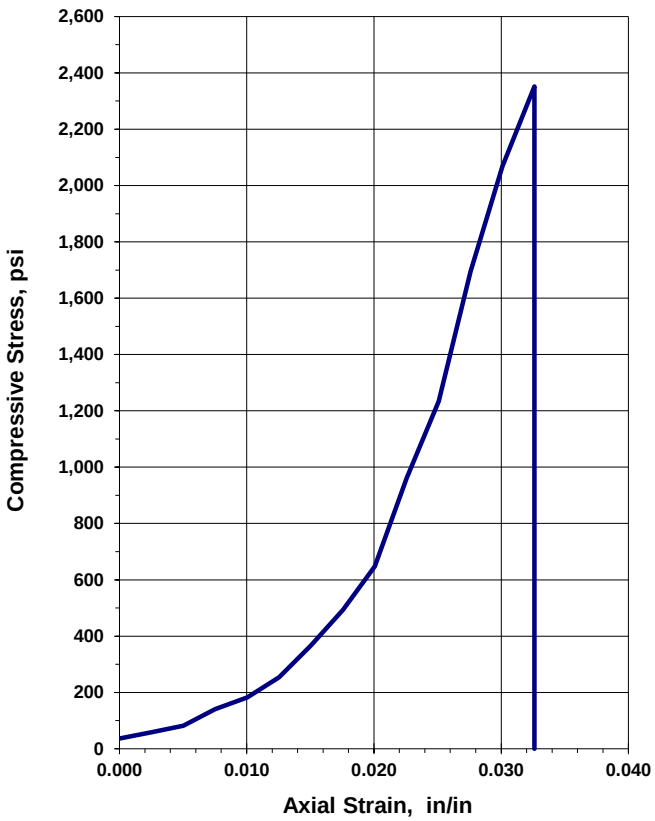
Rock Description: Gray Sandstone
Rock Formation:

Boring No.:	BH-2		Average Length:	3.986	in
Sample No:	RC-2		Average Diameter:	1.993	in
Depth (ft):	21.70	feet	Length to diameter ratio:	2.000	
Moisture condition:	As received		Cross Sectional Area:	3.120	in^2
Sample Mass:	498.56	grams	Volume:	0.0072	ft^3
Testing Temperature:	23	^oC	Unit Weight (sample specimen)*:	152.74	lbs/ft3
Rate of Loading:	31.0	lbs/sec	Failure Load:	7,337	lbs
Testing Time:	237	sec	Axial Strain at Failure:	0.0326	in/in
(Rate 2-15 mir			Compressive Strength:	2,352	psi

Sample Preparation: Per ASTM D4543

**Actual test sample used for unit weight prior to testing.*

Unconfined Compression Test



Before Testing

After Failure

REMARKS:

RESOURCE INTERNATIONAL, INC.
Engineering Consultants

6350 Presidential Gatew.
Columbus, OH 43231
Phone (614) 823-4949

9885 Rockside Road
Cleveland, OH 44125
Phone (216) 573-0955

4480 Lake Forest Drive
Cincinnati, Ohio 45242
Phone (513) 769-6998

Unconfined Compressive Strength of Intact Rock Core Specimens

(ASTM D 7012-14)

Project: ODNR Mohican Visitors Center
Project No.: W-23-083
Date of Testing: 7/28/2023
Test Performed by: KL/EM

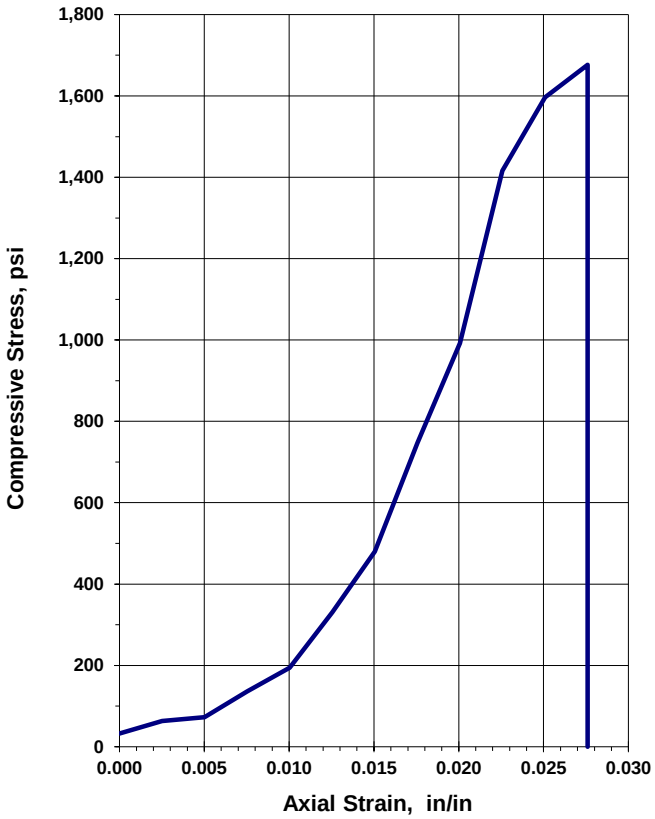
Rock Description: Gray Sandstone
Rock Formation:

Boring No.:	BH-3		Average Length:	3.986	in
Sample No:	RC-3		Average Diameter:	1.993	in
Depth (ft):	21.30	feet	Length to diameter ratio:	2.000	
Moisture condition:	As received		Cross Sectional Area:	3.120	in^2
Sample Mass:	511.09	grams	Volume:	0.0072	ft^3
Testing Temperature:	23	^oC	Unit Weight (sample specimen)*:	156.58	lbs/ft3
Rate of Loading:	22.1	lbs/sec	Failure Load:	5,230	lbs
Testing Time:	237	sec	Axial Strain at Failure:	0.0276	in/in
(Rate 2-15 mir			Compressive Strength:	1,676	psi

Sample Preparation: Per ASTM D4543

**Actual test sample used for unit weight prior to testing.*

Unconfined Compression Test



Before Testing

After Failure

REMARKS:

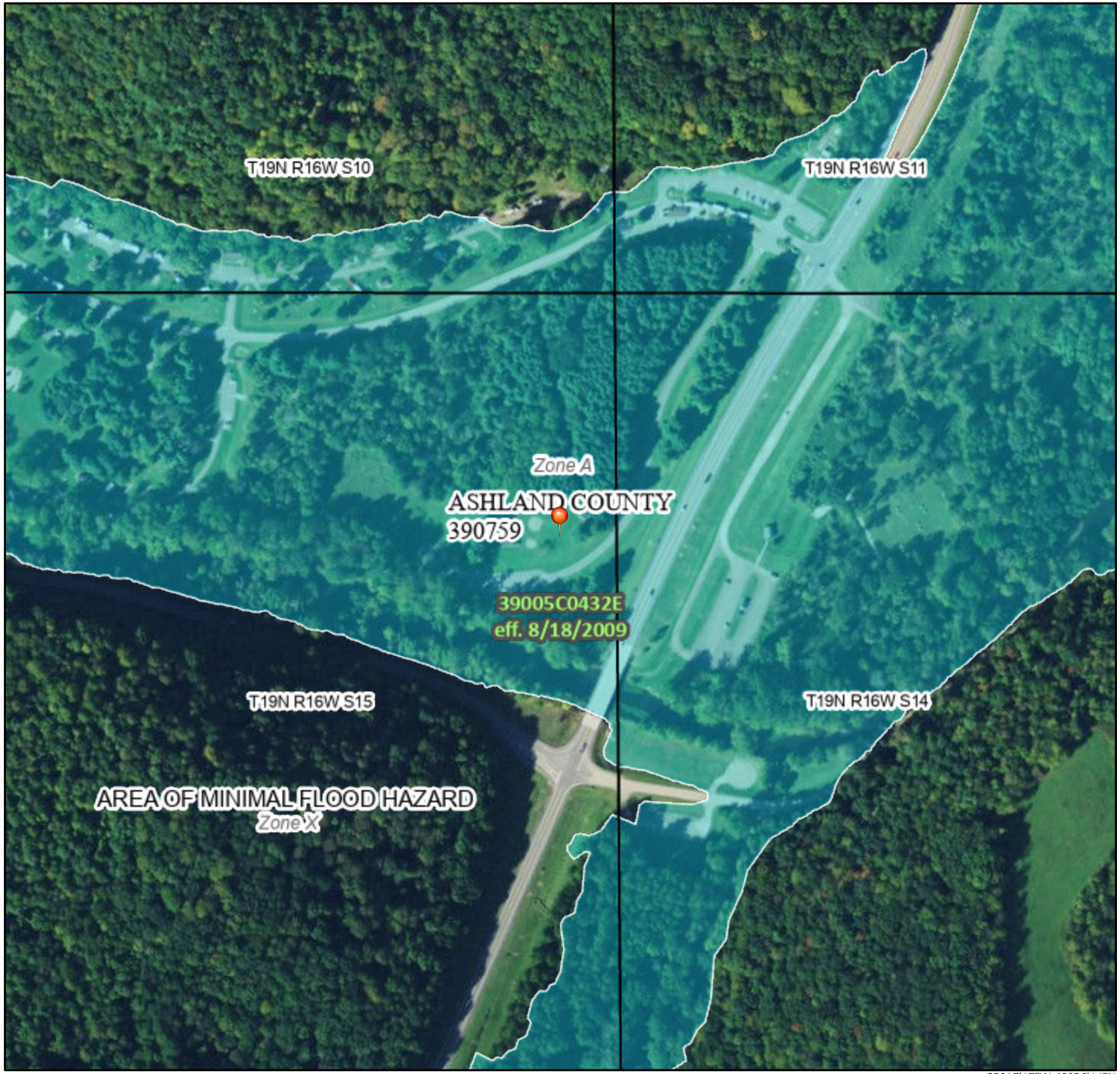
APPENDIX V

FEMA FLOOD INSURANCE RATE MAP

National Flood Hazard Layer FIRMette

FEMA

82°15'55"W 40°36'41"N



82°15'17"W 40°36'14"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/21/2023 at 11:53 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.