Resource International, Inc.

PIK-C.R. 36-4.35
PEE PEE TOWNSHIP, PIKE COUNTY, OHIO
PID No. 117094

FINAL GEOTECHNICAL EXPLORATION REPORT

Prepared For:
Carpenter Marty Transportation
6612 Singletree Drive
Columbus, Ohio 43229

Prepared By:
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Rii Project No. W-22-126

December 2023

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December 28, 2023

Mr. Tony Grieshop, P.E., P.S.
Roadway Department Manager
Carpenter Marty Transportation
6612 Singletree Drive
Columbus, Ohio 43229

Re: Final Geotechnical Exploration Report
PIK-C.R. 36-4.35
Pike County, Ohio
PID No. 117094
Rii Project No. W-22-126

Mr. Grieshop:

Resource International, Inc. (Rii) is pleased to submit this final geotechnical exploration report for the above referenced project. Engineering logs have been prepared and are attached to this report along with the results of laboratory testing. This final report includes recommendations for the proposed improvements to C.R. 36 in Pee Pee Township, Pike County, Ohio.

We sincerely appreciate the opportunity to be of service to you on this project. If you have any questions regarding the Geotechnical Exploration or this report, please contact us.

Sincerely,

RESOURCE INTERNATIONAL, INC.

Ashok Gaire, P.E.
Project Engineer

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

Enclosure: Final Geotechnical Exploration Report

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APPENDICES

EXECUTIVE SUMMARY

Resource International, Inc. (Rii) has completed the geotechnical exploration for the proposed improvement to the existing Pleasant Hill Road (C.R. 36) by realignment and profile adjustment at a location immediately north of the intersection of C.R. 36 with S.R. 220 in Pee Pee Township, Pike County, Ohio. Based on the available plans, it is understood that the total length of project is 809.26 linear feet (Station 329+75 to Station 337+84.26). It is also understood that a maximum fill depth of approximately 12.0 feet (Station 335+50) and a cut depth of less than 1 foot (Station 330+00) will be required to achieve the proposed roadway grade.

Exploration and Findings

On August 30, 2022, a total of four (4) roadway borings, designated as B 001-0-22 through B-004-0-22, were advanced for this project along the proposed alignment of C.R. 36. The borings were advanced to depths ranging from 5.6 to 9.8 feet below the existing ground/pavement surface (bgs).

Borings B-001-0-22, B-002-0-22 and B-004-0-22 were performed through the existing pavement and encountered 6 to 7 inches of hot mix asphalt (HMA) pavement over 3.0 to 5.0 inches of aggregate base materials. Boring B-003-0-22 encountered 4.0 inches of the topsoil at the ground surface.

Beneath the surficial materials, borings B-001-0-22 and B-002-0-22 encountered natural cohesive soils to depths ranging from 4.9 to 5.5 feet bgs underlain by granular soils to boring termination depths. Boring B-004-0-22 encountered natural cohesive soils to boring termination depth. Below the surficial materials, boring B-003-0-22 encountered natural granular soils to a depth of 3.0 feet bgs underlain by cohesive soils to the top of bedrock surface encountered at a depth of 5.5 feet bgs. The natural cohesive soils were described as brown and reddish-brown sandy silt, silt and clay as well as clay soils (ODOT A-4a, A-6a, A-7-6) and, natural granular soils were described as brown and various shades of gray gravel with sand as well as gravel with sand and silt and clay (ODOT A-1-b, A-2-6).

Bedrock was encountered in boring B-003-0-22 at a depth of 5.5 feet below existing grade.

Groundwater was not encountered during or upon completion of drilling in any of the borings performed for this investigation.

Analysis and Recommendations

The subgrade soils along proposed CR 36, within the project limits, consisted of medium stiff to hard cohesive soils (ODOT A-4a, A-6a) and medium dense granular soils (ODOT A-2-6). These subgrade soils exhibited natural moisture content values significantly above their estimated optimum moisture content values and are predicted to be in an unstable condition during proof rolling, in accordance with ODOT Geotechnical Bulletin GB-1. Therefore, ODOT GB-1 recommends stabilization of these soils.

Average Site Parameters

Alignment	Average N_{60L}	Average PI	Average Moisture	Average Optimum Moisture	Average Group Index	Average CBR
Proposed C.R. 36	14	14	22	13	9	6

Based on the conditions encountered across the subject site, **it is recommended that pavement design be based on a** California Bearing Ratio (**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 4.4.

Applying the averages values from above table and based on the results of the subgrade analysis, the following global stabilization option is recommended within the project limits:

Stone stabilize from Station 329+75 to Station 330+50 via a 12-inch undercut and replacement to proposed subgrade with ODOT Item 703.16C granular material, Type B, C or D installed over ODOT Item 712.09 Geotextile Fabric, Type D as detailed in accordance with ODOT Item 204.

Please note that this executive summary does not contain all the information presented in the report. The unabridged Subgrade exploration report should be read in its entirety to obtain a more complete understanding of the information presented.

1.0 INTRODUCTION

This report is a presentation of the geotechnical exploration performed for the proposed improvement to the existing Pleasant Hill Road (C.R. 36) by realignment and profile adjustment at a location immediately north of the intersection of C.R. 36 with S.R. 220 in Pee Pee Township, Pike County, Ohio.

Based on the available plans, it is understood that the total length of project is 809.26 linear feet (Station 329+75 to Station 337+84.26). It is also understood that a maximum fill depth of approximately 12.0 feet (Station 335+50) and a cut depth of less than 1 foot (Station 330+00) will be required to achieve the proposed roadway grade. Available plans indicate that the side slopes of the proposed roadway embankment will be 3H:1V (Horizontal: Vertical) or flatter.

2.0 GEOLOGY AND OBSERVATIONS OF THE PROJECT

2.1 Site Geology

Both the Illinoian and Wisconsinan glaciers advanced over two-thirds of the State of Ohio, leaving behind glacial features such as moraines, kame deposits, lacustrine deposits and outwash terraces. The glacial and non-glacial regions comprise five physiographic sections, grouped by age, depositional process and geomorphic occurrence. Physiographically, the site lies within the unglaciated section of Ohio, within the Shawnee-Mississippian Plateau Region of the Allegheny Plateaus Section. This region is characterized by highly dissected coarse and fine-grained rock plateaus of high relief and lacustrine clay-filled Teays Valley remnants. The plateaus are covered with a thin to non-existent layer of colluvium. Colluvium is the weathered rock, weathered debris, and scattered residuum that forms due primarily to gravity. The Teays Valley is an ancient river valley, comparable in size to the Ohio River, which once drained much of the east-central U.S, including nearly two- thirds of Ohio. The Teays Valley and its tributaries are associated with the modern-day Scioto River and Walnut Creek river valleys. The valley contains laminated silt and clay from pre-Illinoian ice-damned lakes. The overall topography of this region exhibits steep valleys deeply cut with large streams or filled with outwash material, alternating with broad floodplains.

Based on bedrock geology and topography maps obtained from the Ohio Department of Natural Resources (ODNR), the bedrock underlying the glacial deposits consists of the Mississippian-aged Logan and Cuyahoga Formations undivided. The Logan Formation consists of gray, yellow and brown sandstone and siltstone. The sandstone layers contain lenses and beds of coarse sand grains to fine-pebble conglomerate and the siltstone contains shale interbeds and partings and is locally fossiliferous. The Cuyahoga Formation consists of gray, olive, brown and yellow sandstone, siltstone and shale. The sandstone is silty to conglomeratic and becomes massively bedded which is the Black Hand Sandstone member. The siltstone and shale in the unit are locally fossiliferous and intertongue and intergrade. The undivided formation ranges between 250 to 1050 feet thick. According to bedrock topography mapping, the bedrock surface is shallow and

roughly follows the ground surface. The bedrock surface is likely to be highly weathered and soft, which can result in a variable surface delineation.

2.2 Existing Site Conditions

The project site is located north of the intersection of C.R. 36 with S.R. 220 in Pee Pee Township, Pike County, Ohio. At the time of this report, Pleasant Hill Road (C.R. 36), within the project limits, is a two-lane asphalt paved roadway. The area surrounding the Pleasant Hill Road is field with brush and trees and residential property. Overhead electric lines and cable lines were noted along Pleasant Hill Road. Drainage ditches are located along the majority of the roadway or the adjacent berm's ground surface slopes downward in elevation below the roadway elevation. The ground surface elevations of the existing roadway within the project limits generally slopes down from south to north.

3.0 EXPLORATION

On August 30, 2022, a total of four (4) roadway borings, designated as B-001-0-22 through B-004-0-22, were advanced for this project along the proposed alignment of C.R. 36. The borings were advanced to depths ranging from 5.6 to 9.8 feet below the existing ground/pavement surface (bgs). Additionally, three (3) pavement cores, designated as X-001-0-22, X-002-0-22 and X-004-0-22, were obtained from the location of B-001-0-22, B-002-0-22 and B-004-0-22, respectively. The borings locations are illustrated on the boring plan presented in Appendix I of this report and summarized in Table 1.

Table 1. Soil Boring Summary

Boring Number	Reference Alignment	Northing [1]	Easting [1]	Station [2]	Offset	Ground Elevation (feet msl) [2]	Boring Depth (feet)
B-001-0-22	Proposed C.R. 36	412997.094	1821494.588	329+99.44	2.1' RT	742.2	5.6
B-002-0-22		412764.505	1821655.806	332+85.52	1.1' RT	740.0	5.8
B-003-0-22		412592.518	1821858.711	335+49.65	7.6' RT	744.8	8.7
B-004-0-22		412417.290	1821925.026	337+52.45	9.4' RT	762.9	9.8

1. *Coordinates were determined from handheld GPS used by Rii during site reconnaissance.*
2. *Stationing and ground surface elevations were interpolated from topographic basemaps provided by Carpenter Marty Transportation.*

The locations of the soil borings were determined in the field by using Google Earth computer software, a handheld GPS unit, and the available site plans provided to Rii. The ground surface elevations at the soil boring locations were interpolated from basemaps (CAD file) provided to Rii by Carpenter Marty Transportation.

The borings were drilled and sampled with Diedrich D-50 all-terrain vehicle (ATV) rig utilizing 4.5-inch continuous flight augers or 3.25-inch inside diameter hollow stem augers to advance the holes. Standard penetration test (SPT) and split spoon sampling were

performed continuously in borings B-001-0-22, B-002-0-22 and B-004-0-22 and at 2.5 foot intervals in boring B-003-0-22. The SPT, per the American Society for Testing and Materials (ASTM) designation D1586, was conducted using a 140 pound hammer free falling 30 inches to drive a 2.0-inch outside diameter (O.D.) split spoon sampler for 18.0 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 were added to obtain the number of blows per foot (N). SPT blow counts aid in estimating soil characteristics used to calculate bearing/subgrade capacities and settlement potential. Measured blow count (N_m) values are corrected to an equivalent (60%) 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_{60} = energy corrected number of blows required to drive split spoon sampler final 12 inches in 1.5-foot sampling intervals
N_m = measured N value
ER = drill rod energy ratio, expressed as a percent, for the system used

The hammer utilized in Diedrich D-50 was calibrated on March 21, 2022 and had an energy ratio of 86.4 percent. Upon completion of drilling, the borings were backfilled with a mixture of soil cuttings and bentonite chips. Where borings penetrated the existing pavement, the pavement surface was patched with an equivalent thickness of asphalt cold patch.

During drilling, Rii personnel prepared field logs showing the encountered subsurface conditions. Soil samples obtained from the drilling operation were preserved and sealed in glass jars and delivered to the soil laboratory. In the laboratory, the soil samples were visually classified and select 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 D 2216	19
Plastic and Liquid Limits	AASHTO T89, T90	7
Gradation – Sieve/Hydrometer	AASHTO T88	8
Sulfate Content – Colorimetric Method	ODOT S1122	3

The tests performed are necessary to classify existing soil according to the Ohio Department of Transportation (ODOT) classification system and to estimate engineering properties of importance for pavement design and construction recommendations.

Results of the laboratory testing are presented on the boring logs in Appendix III. A description of the soil terms used throughout this report is presented in Appendix II.

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 also 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.

4.0 FINDINGS

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

4.1 Surface Materials

Borings B-001-0-22, B-002-0-22 and B-004-0-22 were performed through the existing pavement and encountered 6.0 to 7.0 inches of hot mix asphalt (HMA) pavement over 3.0 to 5.0 inches of aggregate base materials. Boring B-003-0-22 encountered 4.0 inches of the topsoil at the ground surface.

4.2 Subsurface Soils

Beneath the surficial materials, borings B-001-0-22 and B-002-0-22 encountered natural cohesive soils to depths ranging from 4.9 to 5.5 feet bgs underlain by granular soils to boring termination depths. Boring B-004-0-22 encountered natural cohesive soils to boring termination depth. Below the surficial materials, boring B-003-0-22 encountered natural granular soils to a depth of 3.0 feet bgs underlain by cohesive soils to the top of bedrock surface encountered at a depth of 5.5 feet bgs.

The natural cohesive soils were described as brown and reddish-brown sandy silt, silt and clay, as well as clay soils (ODOT A-4a, A-6a, A-7-6) with varying amount of sand and gravel. The SPT-N_{60} values determined within these soils ranged from 9 blows per foot (bpf) to 53 bpf. The consistency of the encountered cohesive soils ranged from medium stiff ($0.5 \leq HP \leq 1.0$ tsf) to hard ($HP > 4.0$ tsf). The unconfined compressive strength of the cohesive soil samples tested, obtained from the hand penetrometer, ranged from 1.0 tsf to over 4.5 tsf (limit of instrument).

The natural granular soils were described as brown and various shades of gray gravel with sand as well as gravel with sand and silt and clay (ODOT A-1-b, A-2-6). Based on

the SPT blow counts obtained within the granular soils, the relative density ranged from medium dense (10< N_{60} < 30 bpf) to very dense (>50 bpf). The SPT-N_{60} values determined within these granular soils ranged from 17 bpf to split spoon refusal (50 blows for less than 6 inches of penetration).

Moisture contents of the cohesive soil samples tested ranged from 15 to 27 percent, while the moisture contents of the granular soil samples tested ranged from 12 to 17 percent. The natural moisture contents of the cohesive soil samples tested for plasticity index ranged from 7 percent below to 7 percent above their corresponding plastic limits. In general, the cohesive soils exhibited natural moisture contents estimated to be slightly below to significantly above the estimated optimum moisture levels.

Sulfate testing was performed in the upper soil samples obtained from three (3) borings in accordance with the ODOT S1122 Colorimetric Method along the proposed alignments, as outlined in the current ODOT SGE and ODOT Geotechnical Bulletin GB-1. Based on the results of the testing, the sulfate contents of the subgrade soils ranged from 140 to 220 parts per million (ppm or mg/kg of material). Results of the sulfate testing at each boring location tested are provided on the respective boring log in Appendix III.

4.3 Bedrock

Weathered bedrock was encountered in Boring B-003-0-22 at a depth of 5.5 feet bgs. The determination of weathered bedrock surface was based on refusal in SPT sampling, increased resistance to the advancement of the drilling equipment, and recovered samples. The recovery of the split spoon samples within the weathered bedrock was limited but appeared to consist of highly weathered shale. It should be noted that split spoon refusals were encountered in borings B-001-0-22 and B-002-0-22 at depths 5.6 and 5.8 feet bgs, respectively, possibly indicating the bedrock surface.

4.4 Groundwater

Groundwater was not encountered during or upon completion of drilling in any of the borings performed for this investigation.

Please note that short-term water level readings, especially in cohesive soils, 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 on seasonal fluctuations in precipitation.

A more comprehensive description of what was encountered during the drilling process may be found on the boring logs in Appendix III.

5.0 ANALYSES AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine pavement foundation and support capabilities for the soils encountered at the site. These parameters have been used to provide guidelines for the design of the pavement foundation systems, as well as the construction specifications related to the placement of the pavement and general earthwork recommendations, which are discussed in the following paragraphs. This report, and the recommendations contained herein, has been written under the consideration that the construction will be performed in accordance with the latest version of the ODOT Construction and Materials Specifications (CMS).

5.1 Pavement Subgrade Recommendations

Based on the available plans, a maximum fill depth of approximately 12.0 feet (Station 335+50) and a cut depth of less than 1 foot (Station 330+00) will be required to achieve the proposed grade. A summary of cut and fill depths required along the proposed alignment at the boring locations are summarized below in Table 3.

Table 3. Summary of Proposed Cut/Fill Depths

Boring No.	Station	Offset	Existing Ground Surface Elevation, feet	Proposed Subgrade Elevation, feet [1]	Cut (C), Fill (F) Depth, feet
B-001-0-22	329+99	2.1' RT	742.2	740.8	1.4 C
B-002-0-22	332+86	1.1' RT	740.0	740.2	0.2 F
B-003-0-22	335+50	7.6' RT	744.8	754.9	10.1 F
B-004-0-22	337+52	9.4' RT	762.9	765.6	2.7 F

1. *Determined from proposed roadway grade elevation and 13-inches of pavement materials (asphalt and granular base). Pavement thickness was determined from available plans.*

The subgrade soils along the proposed alignment of CR 36, within the project limits, consisted of medium stiff to hard cohesive soils (ODOT A-4a, A-6a) and medium dense granular soils (ODOT A-2-6). These subgrade soils exhibited natural moisture content values significantly above their estimated optimum moisture content values and are predicted to be in an unstable condition during proof rolling, in accordance with ODOT Geotechnical Bulletin GB-1. Therefore, ODOT GB-1 recommends stabilization of these soils.

5.1.1 Subgrade Stabilization

Based on the ODOT GB1 guidelines, when approximately 30 percent or more of the subgrade area requires stabilization, consideration should be given to utilizing a global stabilization option. For this project, 80 percent of the subgrade area along the project

alignment is anticipated to require stabilization based on the soil borings performed. Per ODOT GB1, global stabilization recommendations are based upon the overall average site parameters, as noted in Table 4.

Table 4. Average Site Parameters

Alignment	Average N_{60L}	Average PI	Average Moisture	Average Optimum Moisture	Average Group Index	Average CBR
Proposed C.R. 36	14	14	22	13	9	6

Applying the averages from Table 4, and based on the results of the subgrade analysis, the following global stabilization option is recommended within the project limits:

Stone stabilize from Station 329+75 to Station 330+50 via a 12-inch undercut and replacement to proposed subgrade with ODOT Item 703.16C granular material, Type B, C or D installed over ODOT Item 712.09 Geotextile Fabric, Type D as detailed in accordance with ODOT Item 204.

Per ODOT GB1 requirements the entire subgrade should be stabilized using one of the global stabilization options provided above. Upon completion of the stabilization, the entire subgrade should be proof rolled to verify that stability has been achieved.

5.1.2 Subgrade Design Considerations

Based on the conditions encountered across the subject site, **it is recommended that pavement design be based on a** California Bearing Ratio (**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 4.4.

Per ODOT Geotechnical Design Manual, soils with sulfate content in excess of 5,000 ppm cannot be chemically stabilized due to the potential for sulfate heave in the soil. Based on the results of the testing, the sulfate contents of the subgrade soils range from 140 to 220 ppm. Therefore, soils with sulfate content greater than 5,000 ppm was not encountered in any boring.

Please note that the recommended CBR values assume that the materials utilized for the subgrade in fill areas are equivalent to, or better than materials at the existing subgrade elevation. Sources of borrow material 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.

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. Based on the elevated natural moisture contents compared to the optimum values, as shown in the boring logs and GB-1 analysis, it is recommended that underdrains be considered for the proposed improvements. Under drained should be installed in accordance with the specifications in Item 204 of the ODOT CMS.

5.2 Embankment Settlement

Based on the available plans, a maximum fill depth of approximately 12.5 feet (Station 335+50) and a cut depth of less than 1 foot (Station 330+00) will be required to achieve the proposed roadway grades. Available plans indicate that the side slopes of the proposed roadway embankment will be 3H:1V (Horizontal: Vertical) or flatter.

Rii performed settlement analysis utilizing the estimated surcharge load from the proposed fill embankment, general soil profile obtained from the field exploration, and results of the laboratory tests. Total settlement due to the fill placement will vary across the proposed roadway alignment depending on underlying soil condition, height of the fill, and depth to the bedrock surface. However, it is estimated that the maximum total settlement will be within ¾ inches.

5.3 Construction Considerations

All site work shall conform to local codes and to the latest ODOT CMS, including that all excavation and embankment preparation and construction should follow ODOT Item 200 (Earthwork).

5.3.1 Excavation Considerations

All excavations should be shored / braced or laid back at a safe angle in accordance to Occupational Safety and Health Administration (OSHA) guidelines. During excavation, if slopes cannot be laid back to OSHA Standards due to adjacent structures or other obstructions, temporary 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 5. Excavation Back Slopes

Soil	Maximum Back Slope (H:V)	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

5.4 Groundwater Considerations

Groundwater was not encountered at any time during our subsurface exploration. However, based on our experience with the geology at this site, groundwater conditions affecting construction may be encountered within the trapped/perched zones. These trapped/perched zones are generally the layer(s) of granular soils that are isolated within fine-grained soil layers and may not have been encountered in the borings. If excavations encounter such layers, temporary dewatering may be accomplished by placing localized sumps and pumps within and beyond the excavation. Seepage rates from these layers are difficult to predict and flow rate could be significant. Additionally, trapped water should also be expected at the interface of bedrock and overburden soils.

Groundwater, if encountered, proper groundwater control measures should be implemented to prevent disturbance to excavation bottoms consisting of cohesive soil, and to prevent the possible development of a quick or “boiling” condition if soft/loose silts and/or fine sands are encountered. It is preferable that the groundwater level, if encountered, be maintained at least 24.0 inches below the deepest excavation. Note that determining and maintaining actual groundwater levels during construction is the responsibility of the contractor.

6.0 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 an adequate foundation system and are part of these recommendations.

The recommendations for this project were developed utilizing soil and bedrock information obtained from the test borings that were made at the proposed site for the current investigation. Resource International is not responsible for the data, conclusions, opinions or recommendations made by others during previous investigations at this site. At this time we would like to point out that soil borings only depict the soil and bedrock

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.

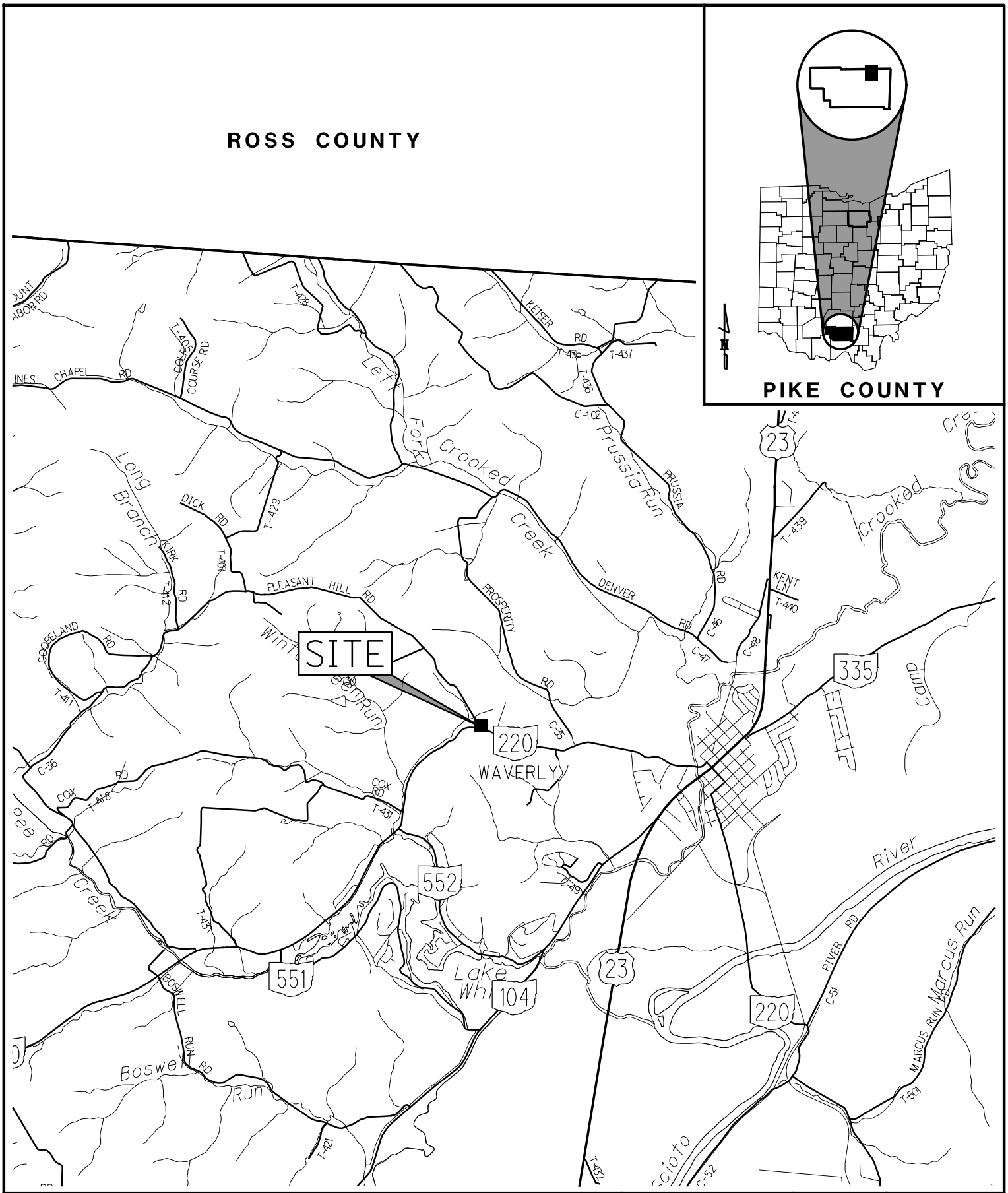
The conclusions and recommendations herein have been based upon the available soil and bedrock information and the design details furnished by a representative of the owner of the proposed project. Any revision in the plans for the proposed construction from those anticipated in this report should be 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, 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 Subgrade 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



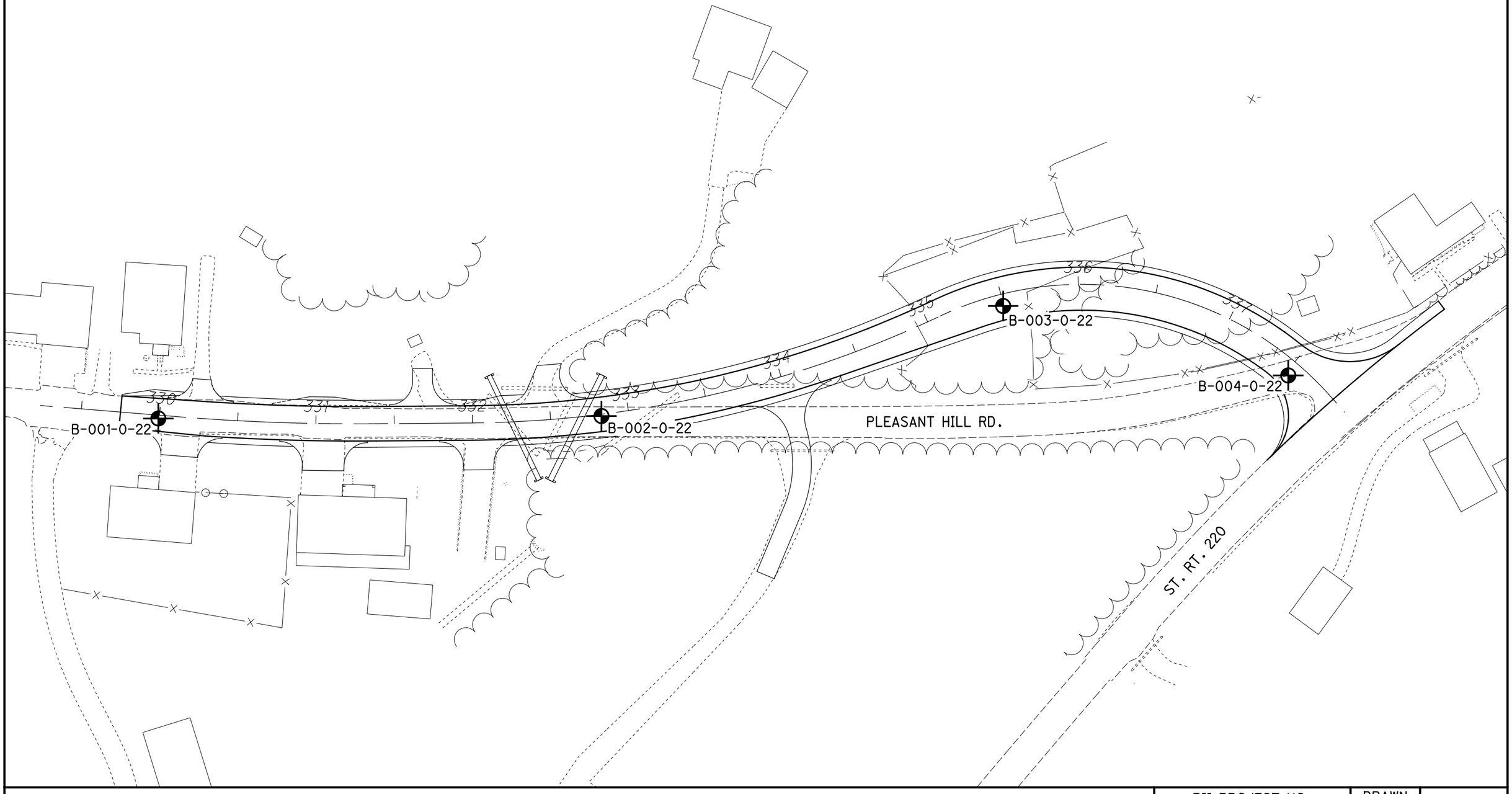
VICINITY MAP

PIK-CR 36-4.35

PIKE COUNTY, OHIO

RII PROJECT NO. W-22-126	DRAWN RRM
	REVIEWED AG
SCALE: 1"=5000' (0, 2500, 5000)	DATE 10/3/22

RESOURCE INTERNATIONAL Rii



BORING PLAN

PIK-CR 36-4.35

PIKE COUNTY, OHIO

RII PROJECT NO. W-22-126	DRAWN RRM
SCALE: 1"=60' (0 30 60)	REVIEWED AG
	DATE 10/3/22

RESOURCE INTERNATIONAL Rii

APPENDIX II

DESCRIPTION OF SOIL TERMS

CLASSIFICATION OF SOILS

Ohio Department of Transportation

(The classification of a soil is found by proceeding from top to bottom of the chart.
The first classification that the test data fits is the correct classification.)

SYMBOL	DESCRIPTION	Classifcation		LL_O/LL x 100*	% Pass #40	% Pass #200	Liquid Limit (LL)	Plastic Index (PI)	Group Index Max.	REMARKS
		AASHTO	OHIO							
	Gravel and/or Stone Fragments	A-1-a			30 Max.	15 Max.		6 Max.	0	Min. of 50% combined gravel, cobble and boulder sizes
	Gravel and/or Stone Fragments with Sand	A-1-b			50 Max.	25 Max.		6 Max.	0	
	Fine Sand	A-3			51 Min.	10 Max.	NON-PLASTIC		0	
	Coarse and Fine Sand	--	A-3a			35 Max.		6 Max.	0	Min. of 50% combined coarse and fine sand sizes
	Gravel and/or Stone Fragments with Sand and Silt	A-2-4				35 Max.	40 Max.	10 Max.	0	
		A-2-5					41 Min.			
	Gravel and/or Stone Fragments with Sand, Silt and Clay	A-2-6				35 Max.	40 Max.	11 Min.	4	
		A-2-7					41 Min.			
	Sandy Silt	A-4	A-4a	76 Min.		36 Min.	40 Max.	10 Max.	8	Less than 50% silt sizes
	Silt	A-4	A-4b	76 Min.		50 Min.	40 Max.	10 Max.	8	50% or more silt sizes
	Elastic Silt and Clay	A-5		76 Min.		36 Min.	41 Min.	10 Max.	12	
	Silt and Clay	A-6	A-6a	76 Min.		36 Min.	40 Max.	11 - 15	10	
	Silty Clay	A-6	A-6b	76 Min.		36 Min.	40 Max.	16 Min.	16	
	Elastic Clay	A-7-5		76 Min.		36 Min.	41 Min.	$\leq$LL-30	20	
	Clay	A-7-6		76 Min.		36 Min.	41 Min.	>LL-30	20	
	Organic Silt	A-8	A-8a	75 Max.		36 Min.				W/o organics would classify as A-4a or A-4b
	Organic Clay	A-8	A-8b	75 Max.		36 Min.				W/o organics would classify as A-5, A-6a, A-6b, A-7-5 or A-7-6

MATERIAL CLASSIFIED BY VISUAL INSPECTION

 Sod and Topsoil

 Pavement or Base

 Uncontrolled Fill (Describe)

 Bouldery Zone

Peat

* Only perform the oven-dried liquid limit test and this calculation if organic material is present in the sample.

DESCRIPTION OF SOIL TERMS

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

Granular Soils - The relative compactness of granular soils is described as:
ODOT A-1, A-2, A-3, A-4 (non-plastic) or USCS GW, GP, GM, GC, SW, SP, SM, SC, ML (non-plastic)

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 - The relative consistency of cohesive soils is described as:
ODOT A-4, A-5, A-6, A-7, A-8 or USCS ML, CL, OL, MH, CH, OH, PT

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

Modifiers of Components - Modifiers of components are as follows:

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 - USCS	Range - ODOT
Dry	0% to 10%	Well below Plastic Limit
Damp	>2% below Plastic Limit	Below Plastic Limit
Moist	2% below to 2% above Plastic Limit	Above PL to 3% below LL
Very Moist	>2% above Plastic Limit	
Wet	≥ Liquid Limit	3% below LL to above LL

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 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.

DESCRIPTION OF ROCK TERMS

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

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	

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 (calculation shown in report) and Rock Quality (ODOT, GB 3, January 13, 2006):

RQD %	Rock Index Property Classification (based on RQD, not slake durability index)
0 – 25%	Very Poor
26 – 50%	Poor
51 – 70%	Fair
71 – 85%	Good
86 – 100%	Very Good

APPENDIX III

BORING LOGS:

B-001-0-22 through B-004-0-22

BORING LOGS

Definitions of Abbreviations

AS = Auger sample

GI = Group index as determined from the Ohio Department of Transportation classification system

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

LL_o = Oven-dried liquid limit as determined by ASTM D4318. Per ASTM D2487, if LL_o/LL is less than 75 percent, soil is classified as "organic".

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

W = 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: PIK-C.R. 36-4.35	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 329+99.44 / 2.1' Rt	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: PRPOSED C.R. 36	**B-001-0-22**	
PID: 117094 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 742.2 (MSL) EOB: 5.6 ft.	PAGE	
START: 8/30/22 END: 8/30/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.4	LAT / LONG: 39.132678, -83.018799	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 742.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - ASPHALT (7.0")	741.6																		
0.4' - AGGREGATE BASE (5.0")	741.2																		
VERY STIFF TO HARD, BROWN **SILT AND CLAY**, LITTLE COARSE AND FINE SAND, LITTLE FINE GRAVEL, MOIST.		1	10 5 8	19	67	SS-1	3.00	11	15	4	40	30	35	20	15	20	A-6a (9)	160	
		2																	
		3	13 14 19	48	100	SS-2	4.5+	14	9	5	38	34	34	19	15	20	A-6a (9)	-	
	737.3	4	6 12 50/2"	-	100	SS-3A	4.5+	-	-	-	-	-	-	-	-	27	A-6a (V)	-	
VERY DENSE, REDDISH GRAY TO LIGHT GRAY **GRAVEL WITH SAND**, TRACE SILT, MOIST. -SANDSTONE FRAGMENTS IN SS-3B	736.6	5 EOB	50/1"	-	100	SS-3B SS-4	-	-	-	-	-	-	-	-	-	14 12	A-1-b (V) A-1-b (V)	- -	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: PIK-C.R. 36-4.35	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 332+85.52 / 1.1' Rt	**EXPLORATION ID B-002-0-22**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: PRPOSED C.R. 36		
PID: 117094 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 740.0 (MSL) EOB: 5.8 ft.		PAGE 1 OF 1
START: 8/30/22 END: 8/30/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.4	LAT / LONG: 39.132042, -83.018226		

MATERIAL DESCRIPTION AND NOTES	ELEV. 740.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - ASPHALT (7.0")	739.4																		
0.4' - AGGREGATE BASE (5.0")	739.0																		
STIFF, BROWN **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, MOIST.	737.5	1	8 4 5	13	44	SS-1	1.50	29	22	6	31	12	NP	NP	NP	22	A-4a (2)	220	
MEDIUM STIFF TO HARD, REDDISH BROWN **SILT AND CLAY**, TRACE FINE TO COARSE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.	734.5	2 3 4	2 2 4	9	83	SS-2	1.00	10	5	2	52	31	34	20	14	27	A-6a (10)	-	
		5	6 9 18	39	94	SS-3	4.5+	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
VERY DENSE, RED AND GRAY **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST. -SANDSTONE FRAGMENTS IN SS-4	734.2	EOB	50/4"	-	100	SS-4	-	-	-	-	-	-	-	-	-	14	A-2-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: PIK-C.R. 36-4.35	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 335+49.65 / 7.6' Rt	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: PRPOSED C.R. 36	**B-003-0-22**	
PID: 117094 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/21/22	ELEVATION: 744.8 (MSL) EOB: 8.7 ft.	PAGE	
START: 8/30/22 END: 8/30/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.4	LAT / LONG: 39.131573, -83.017507	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 744.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.3' - TOPSOIL (4.0")	744.5																		
MEDIUM DENSE, BROWN **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST.		1	1 4 8	17	72	SS-1	-	59	16	3	13	9	34	21	13	17	A-2-6 (0)	-	
	741.8	2																	
VERY STIFF, BROWN **SILT AND CLAY**, "AND" FINE GRAVEL, LITTLE FINE TO COARSE SAND, DAMP.		3	5 8 11	27	100	SS-2	3.50	50	9	3	23	15	37	25	12	18	A-6a (1)	-	
	739.3	4																	
SHALE : DARK GRAY, VERY WEAK.		5																	
		6	50/4"	-	100	SS-3	-	-	-	-	-	-	-	-	-	7	Rock (V)	-	
		7																	
	736.1	8																	
		EOB	50/2"	-	100	SS-4	-	-	-	-	-	-	-	-	-	5	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: PIK-C.R. 36-4.35	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 337+52.45 / 9.4' RT	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: PRPOSED C.R. 36	**B-004-0-22**	
PID: 117094 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/21/22	ELEVATION: 762.9 (MSL) EOB: 9.8 ft.	PAGE	
START: 8/30/22 END: 8/30/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.4	LAT / LONG: 39.131093, -83.017270	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 762.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.5' - ASPHALT (6.0")	762.4																		
0.3' - AGGREGATE BASE (3.0")	762.1																		
VERY STIFF TO HARD, BROWN **SILT AND CLAY**, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST. -TRACE ROOT FIBERS IN SS-1		1	5 4 5	13	72	SS-1	3.50	10	7	4	54	25	34	21	13	23	A-6a (9)	140	
		2																	
		3	5 4 5	13	92	SS-2	3.00	5	1	2	66	26	34	20	14	25	A-6a (10)	-	
		4																	
		5	4 7 12	27	100	SS-3	4.5+	-	-	-	-	-	-	-	-	20	A-6a (V)	-	
	756.1	6																	
HARD, LIGHT BROWN **CLAY**, LITTLE SILT, TRACE COARSE TO FINE SAND, MOIST.			13 18 19	53	83	SS-4	4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		7	9 14 18	46	78	SS-5	4.5+	-	-	-	-	-	-	-	-	15	A-7-6 (V)	-	
		8																	
	753.1	9	7 11 14	36	94	SS-6	4.5+	-	-	-	-	-	-	-	-	17	A-7-6 (V)	-	
		EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

APPENDIX IV

Pavement Core Data Sheet

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT	PIK-CR 36-4.35
LOCATION	Pike County, Ohio
JOB No.	W-22-126
BORING/CORE No.	B-001-0-22
DATE CORE OBTAINED	8/30/2022
CORE OBTAINED BY	TG & MJ

Core Composition

Core Number	Layer Thickness (in.)	Pavement Layer Number	Asphalt: Surface Binder	Asphalt: Intermediate Binder	Asphalt: Base Binder	Concrete	Aggregate/Granular Base	Other		
B-001-0-22	0.50	5	✓							
	1.00	4	✓							
	1.50	3	✓							
	1.50	2		✓						
	2.50	1		✓						
	5.00						✓			

Comments/Remarks

- Layer 4 has a trace of voids.
- Layer 3 has some voids.
- Layer 2 has voids.
- Layer 1 has a trace of voids.
- Aggregate Base:

Total Pavement Thickness =	7.00 in.	Total Asphalt Thickness =	7.00 in.	Total Concrete Thickness =	0.00 in.	Total Base Thickness =	5.00 in.

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT	PIK-CR 36-4.35
LOCATION	Pike County, Ohio
JOB No.	W-22-126
BORING/CORE No.	B-002-0-22
DATE CORE OBTAINED	8/30/2022
CORE OBTAINED BY	TG & MJ

Core Composition

Core Number	Layer Thickness (in.)	Pavement Layer Number	Asphalt: Surface Binder	Asphalt: Intermediate Binder	Asphalt: Base Binder	Concrete	Aggregate/Granular Base	Other		
B-002-0-22	0.50	6	✓							
	0.75	5	✓							
	0.75	4	✓							
	1.75	3	✓							
	1.50	2		✓						
	1.75	1		✓						
	5.00						✓			

Comments/Remarks

- The core is separating between layers 5 & 6.
- Layers 3 & 4 have a trace of voids.
- Layer 2 has voids.
- Layer 1 has a trace of voids.
- Aggregate Base:

Total Pavement Thickness =	7.00	in.	Total Asphalt Thickness =	7.00	in.	Total Concrete Thickness =	0.00	in.	Total Base Thickness =	5.00	in.

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT	PIK-CR 36-4.35
LOCATION	Pike County, Ohio
JOB No.	W-22-126
BORING/CORE No.	B-004-0-22
DATE CORE OBTAINED	8/30/2022
CORE OBTAINED BY	TG & MJ

Core Composition

Core Number	Layer Thickness (in.)	Pavement Layer Number	Asphalt: Surface Binder	Asphalt: Intermediate Binder	Asphalt: Base Binder	Concrete	Aggregate/Granular Base	Other		
B-004-0-22	0.50	4	✓							
	1.25	3	✓							
	2.25	2		✓						
	2.00	1		✓						
	3.00						✓			

Comments/Remarks

- The core is separating between layers 3 & 4.
- Layers 1, 2 & 3 have a trace of voids.
- Aggregate Base:

Total Pavement Thickness =	6.00	in.	Total Asphalt Thickness =	6.00	in.	Total Concrete Thickness =	0.00	in.	Total Base Thickness =	3.00	in.

APPENDIX V

Subgrade Stabilization Summary

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

PIK-CR 36-4.35
117094

Improvement of 809.26 feet of Pleasant Hill Road (C.R. 36) by realignment from Station 329+75 to Station 337+84.26 in Pee Pee Township, Pike County, Ohio.

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Tuesday, October 11, 2022

Daniel E. Karch, P.E.
6350 Presidential Gateway
Columbus, Ohio 43231

(614) 823-4949
danielk@resourceinternational.com

NO. OF BORINGS: 4

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-22	CL PROPOSED C.R. 36	329+99	2.1'	RT	DIEDRICH D-50 ATV	86	742.2	740.8	1.4 C
2	B-002-0-22	CL PROPOSED C.R. 36	332+86	1.1'	RT	DIEDRICH D-50 ATV	86	740.0	740.2	0.2 F
3	B-003-0-22	CL PROPOSED C.R. 36	335+50	7.6'	RT	DIEDRICH D-50 ATV	86	744.8	754.9	10.1 F
4	B-004-0-22	CL PROPOSED C.R. 36	337+52	9.4'	RT	DIEDRICH D-50 ATV	86	762.9	765.6	2.7 F

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.0	2.5	-0.4	1.1	19		3	35	20	15	40	30	70	20	15	A-6a	9	160		Mc			206 Cement or 204 Geotextile
	001-0	SS-2	2.5	4.0	1.1	2.6	48		4.5	34	19	15	38	34	72	20	14	A-6a	9			Mc			
	22	SS-3	4.0	4.9	2.6	3.5	50		4.5							27	14	A-6a	10			Mc			
								19																	
2	B	SS-1	1.0	2.5	1.2	2.7	13		1.5	NP	NP	NP	31	12	43	22	11	A-4a	2	220		HP & Mc			206 Cement or 204 Geotextile
	002-0	SS-2	2.5	4.0	2.7	4.2	9		1	34	20	14	52	31	83	27	15	A-6a	10						
	22	SS-3	4.0	5.5	4.2	5.7	39		4.5							17	14	A-6a	10						
								9																	
3	B	SS-1	1.0	2.5	11.1	12.6	17			34	21	13	13	9	22	17	10	A-2-6							
	003-0	SS-2	3.5	5.0	13.6	15.1	27		3.5	37	25	12	23	15	38	18	20	A-6a							
	22	SS-3	6.0	6.3	16.1	16.4	50										0	Rock							
4	B	SS-1	0.8	2.3	3.5	5.0	13		3.5	34	21	13	54	25	79	23	16	A-6a	9	140					
	004-0	SS-2	2.3	3.8	5.0	6.5	13		3	34	20	14	66	26	92	25	15	A-6a	10						
	22	SS-3	3.8	5.3	6.5	8.0	27		4.5								14	A-6a							
		SS-4	5.3	6.8	8.0	9.5	53	13	4.5								14	A-6a							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 117094

County-Route-Section: PIK-CR 36-4.35
No. of Borings: 4

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel E. Karch, P.E.
Date prepared: 10/11/2022

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	12"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	13%	0.5 < HP ≤ 1	13%
$12 \leq N_{60} < 15$	38%	1 < HP ≤ 2	13%
$N_{60} \geq 20$	38%	HP > 2	75%
M+	50%		
Rock	0%		
Unsuitable	8%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

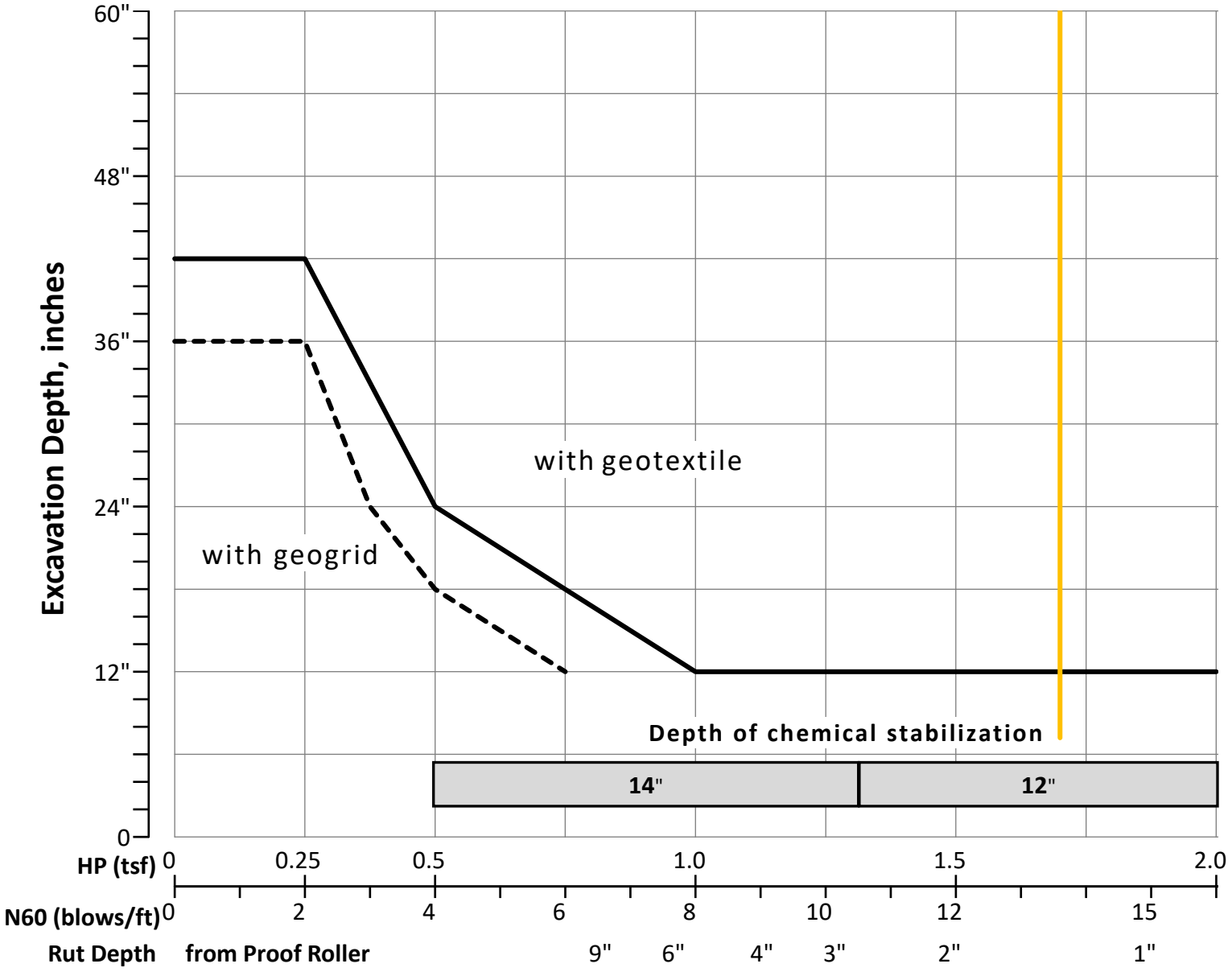
% Proposed Subgrade Surface	
Unstable & Unsuitable	80%
Unstable	80%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	29	14	3.45	35	21	14	40	23	62	22	13	9
Maximum	53	19	4.50	37	25	15	66	34	92	27	20	10
Minimum	9	9	1.00	34	19	12	13	9	22	17	0	2

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	1	0	0	0	0	1	0	0	0	1	0	0	10	0	0	0	0	0	13
Percent	8%	0%	0%	0%	0%	8%	0%	0%	0%	8%	0%	0%	77%	0%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	8%	15%									77%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	1	0	0	4	0	0	0	0	0	5
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	80%	0%	0%	0%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.45	0.50	☐ HP
13.67	6.00	☐ N60L

Average HP
Average N_{60L}