FINAL REPORT
STRUCTURE FOUNDATION EXPLORATION
BRIDGE REPLACEMENT OF SR-104 OVER NO NAME CREEK
PIK-104-06.27
PIKE COUNTY, OHIO
PID#: 100889

Prepared For:

BG Engineering Group
5910 Wilcox Place, Suite C
Dublin, Ohio 43016

Prepared by:

NATIONAL ENGINEERING AND ARCHITECTURAL SERVICES INC.
2800 Corporate Exchange Drive, Suite 240
Columbus, Ohio 43231

NEAS PROJECT 21-0056

August 1, 2022

EXECUTIVE SUMMARY

The Ohio Department of Transportation (ODOT) has proposed a bridge replacement project (PIK-104-06.27, PID 100889) in Pike County, Ohio. ODOT intends to replace the existing bridge carrying State Route 104 (SR-104) over No Name Creek located about 0.4 mile south of Jasper Township, Pike County, Ohio.

NEAS presents our Summary Report for the bridge replacement project (PIK-104-06.27, PID 100889). This report presents a summary of the estimated soil properties and our recommendations for foundation design and construction in accordance with AASHTO's Publication LRFD Bridge Design Specifications, 9th Edition with 2020 interim revisions, and ODOT's 2021 LRFD Bridge Design Manual. The scope of work performed by NEAS as part of the referenced project included: a review of published geotechnical information; performing four (4) structure borings and two (2) deck cores at each pier boring; performing geotechnical engineering analysis to assess foundation design and construction considerations; and development of this summary report.

The subsurface profile at the bridge site consists of surficial materials comprised of existing pavement section (asphalt and granular base) ranging from 13.0 to 14.5 inches in thickness which is generally underlain by embankment fill materials (A-6a) over interbedded cohesive and non-cohesive natural overburden soils (A-3a, A-4a, A-4b, A-6a, A-6b, A-2-4, A-2-6, and A-1-b). Bedrock was encountered within depths of all the structure borings performed. Bedrock elevations range from 485.9 ft to 504.7 ft amsl, putting bedrock at a depth of 39.3 to 68.0 ft below ground surface (bgs).

Subgrade analyses were performed for the referenced project site to evaluate the soil characteristics for use in pavement design. Unstable subgrade conditions that may require some form of subgrade stabilization within the subgrade per GB1 guidelines were encountered within the project site. The subgrade conditions encountered along SR-104 alignment include areas of weak soils and high moisture content soils. Therefore, we recommend global stabilization in the form of Excavate and Replace (Item 204 with Geotextile, top 12 inches of the subgrade) be performed for the entire project limits.

Deep foundations will be used to support the abutments of the referenced bridge. HP-piles are recommended to support the proposed bridge abutments since bedrock was encountered in both abutment structural borings at a depth of 39.3 to 68.0 ft bgs (Elev. 48.3 ft to 499.7 ft amsl). The resistance of HP 10x42 piles will be dictated by structural considerations and the maximum factored structural resistances. Since the embankment fill above the abutment footings will be carried by the abutments, the surcharge loads will then be transferred from the abutments to the piles; therefore, it is our opinion that the piles will not be subjected to downdrag loads. The "Estimated Length" and "Order Length" of pile are estimated in the following report.

According to BG Engineering Group, the maximum estimated scour depth at the design flood is about 8.3 ft below the bottom of footing (elevations 532.5 ft and 530.5 at the rear and the forward abutment location, respectively). It is NEAS's opinion that when the scour extends below the abutment footing, the retained embankment soils behind the proposed abutments will be compromised and eroded away. Therefore, the piles will not subject to any lateral load induced by the retained embankment soils. The p-y analysis on the pile is unnecessary.

Global stability was performed for the proposed bridge abutments for long-term (Effective Stress) and short-term (Total Stress) slope stability. Based on our slope stability analyses for the referenced bridge, the minimum slope stability safety factor for short-term (Total Stress) and long-term (Effective Stress) conditions exceeded the desired value of 1.54. It should be noted that NEAS evaluated the global stability of both abutments with the inclusion of the proposed steel piles, with minimum shear strength of 106630 lbs (assumed HP 10x42 pile with yield strength of 50 kips). Based on the results of the analyses, it is our opinion that the subsurface conditions encountered at this location are generally satisfactory and the site can be considered to be stable at short-term and long-term condition.

Behind the planned bridge abutments, there will be about maximum 8 feet of new fills. Based on our settlement analyses, the ground surface at the proposed rear abutment is estimated to experience at most about 0.96 inches of immediate settlement and 3.96 inches of long term (consolidation) settlement from the induced embankment fill loads. The ground surface at the proposed forward abutment is estimated to experience at most about 0.72 inches of immediate settlement and 4.32 inches of long term (consolidation) settlement from the induced embankment fill loads. The maximum differential settlement across the length of each abutment is estimated to be less than the allowable differential settlement of 1% per ODOT's BDM. The elastic (immediate) settlement will take place during construction prior to traffic loading and is not expected to be a concern. Due to the weak and thick soil layers underlying the proposed bridge abutments, the long term (consolidation) settlement will take months to settle. Based on our analyses, the 90% consolidation settlement will take 93 days and 91 days for the rear and forward abutments, respectively. It is recommended that a settlement monitoring program be designed and implemented to verify that the settlements have dissipated to a level acceptable by the Geotechnical Engineer (i.e., 90% consolidation settlement has taken place, or 3 weekly consecutive readings of 1/8-inch or less) and determine the time period at which Stage 2 construction and the permanent structure/final grading/pavement construction may begin.

TABLE OF CONTENTS

1. INTRODUCTION 5
1.1. GENERAL 5
1.2. PROPOSED CONSTRUCTION 5
2. GEOLOGY AND OBSERVATIONS OF THE PROJECT 5
2.1. GEOLOGY AND PHYSIOGRAPHY 5
2.1. HYDROLOGY/HYDROGEOLOGY 6
2.2. MINING AND OIL/GAS PRODUCTION 6
2.3. HISTORICAL RECORDS AND PREVIOUS PHASES OF PROJECT EXPLORATION 6
2.4. SITE RECONNAISSANCE 7
3. GEOTECHNICAL EXPLORATION 11
3.1. FIELD EXPLORATION PROGRAM 11
3.2. LABORATORY TESTING PROGRAM 12
3.2.1. Classification Testing 12
3.2.2. Standard Penetration Test Results 13
3.2.3. Unconfined Compressive Strength of Rock Core Results 13
3.2.4. Scour Design Parameters 13
4. GEOTECHNICAL FINDINGS 14
4.1. SUBSURFACE CONDITIONS 14
4.1.1. Overburden Soil 14
4.1.2. Bedrock 15
4.1.3. Groundwater 15
5. ANALYSIS AND RECOMMENDATIONS 16
5.1. GENERALIZED SOIL PROFILE FOR ANALYSIS 16
5.2. PAVEMENT DESIGN AND RECOMMENDATIONS 18
5.2.1. Pavement Design Recommendations 19
5.2.2. Unsuitable/Unstable Subgrade 19
5.2.2.1. Rock 19
5.2.2.2. Prohibited Soils 19
5.2.2.3. Weak Soils 19
5.2.2.4. High Moisture Content Soils 20
5.2.3. Stabilization Recommendations 20
5.2.3.1. Summary of Stabilization 20
5.3. BRIDGE FOUNDATION ANALYSIS 21
5.3.1. Deep Foundation Analysis 21
5.3.2. Global Stability 22
5.3.3. Settlement 23
6. SEISMIC DESIGN PARAMETERS 23
7. QUALIFICATIONS 24

LIST OF TABLES

TABLE 1: PROJECT BORING SUMMARY 12
TABLE 2: UNCONFINED COMPRESSIVE STRENGTH TEST RESULTS 13
TABLE 3: SCOUR DESIGN PARAMETERS 13
TABLE 4: BEDROCK SUMMARY 15
TABLE 5: SOIL PROFILE AND ESTIMATED ENGINEERING PROPERTIES – B-001-0-21 17
TABLE 6: SOIL PROFILE AND ESTIMATED ENGINEERING PROPERTIES – B-002-0-21 17
TABLE 7: SOIL PROFILE AND ESTIMATED ENGINEERING PROPERTIES – B-003-0-21 18
TABLE 8: SOIL PROFILE AND ESTIMATED ENGINEERING PROPERTIES – B-004-0-21 18
TABLE 9: PAVEMENT DESIGN VALUES 19
TABLE 10: WEAK SOIL LOCATIONS FOR SR-104 20
TABLE 11: HIGH MOISTURE CONTENT SOIL LOCATIONS FOR SR-104 20
TABLE 12: SUMMARY OF STABILIZATION 21
TABLE 13: ESTIMATED PILE LENGTHS 21
TABLE 14: SUMMARY OF GLOBAL STABILITY OF ABUTMENTS 22
TABLE 15: SEISMIC DESIGN PARAMETERS 24

LIST OF APPENDICES

APPENDIX A: BORING PLAN
APPENDIX B: SOIL BORING LOGS AND LAB TESTS
APPENDIX C: GB 1 SPREADSHEET
APPENDIX D: DRIVEN ANALYSIS
APPENDIX E: GLOBAL STABILITY ANALYSIS
APPENDIX F: SETTLEMENT ANALYSIS
APPENDIX G: SEISMIC ANALYSES

1. INTRODUCTION

1.1. General

NEAS presents our Structure Foundation Exploration Report for the proposed replacement of the bridge carrying SR-104 over No Name Creek as part of the proposed project (PIK-104-06.27, PID 100889) located about 0.4 mile south of Jasper Township, Pike County, Ohio. This report presents a summary of the surficial and subsurface conditions and our recommendations for bridge foundation design and construction in accordance with AASHTO's Publication LRFD Bridge Design Specifications, 9th Edition with 2020 interim revisions (BDS) (AASHTO, 2020), and ODOT's 2021 LRFD Bridge Design Manual (BDM) (ODOT, 2020).

The exploration was conducted in general accordance with Barr Engineering, Inc.'s DBA NEAS, Inc. proposal to BG Engineering Group, dated July 30, 2021, and with the provisions of ODOT's Specifications for Geotechnical Explorations (SGE) (ODOT, 2021). The scope of work performed by NEAS as part of the referenced project included: a review of published geotechnical information; performing four (4) structure borings and two (2) deck cores at each pier boring; performing geotechnical engineering analysis to assess foundation design and construction considerations; and development of this summary report.

1.2. Proposed Construction

NEAS understands that BG Engineering Group is working with the Ohio Department of Transportation (ODOT) to develop construction plans for the proposed PIK-104-06.27 project in Pike County, Ohio. It is our understanding that ODOT intends to replace the existing bridge carrying SR-104 over No Name Creek. The existing Bridge PIK-104-06.27 is a 3-span continuous rolled steel beam structure with reinforced concrete deck on stub abutments supported on spread footings and cap and column piers supported on HP-pile.

It is our understanding that the proposed structure is a single span prestressed concrete beam bridge with composite reinforced concrete deck on semi-integral abutments supported on HP-piles in accordance with the email sent by BG Engineering Group on January 6, 2022.

2. GEOLOGY AND OBSERVATIONS OF THE PROJECT

2.1. Geology and Physiography

The project site is located within the Shawnee-Mississippian Plateau physiographic region part of the Allegheny Plateaus. This area is characterized as a highly dissected plateau of coarse- and fine-grained rock sequences of high-relief (400 to 800 ft) with extensive remnants of ancient lacustrine clay-filled Teays drainage systems present in lowlands and absent in uplands. The geology in this region is characterized as Pleistocene-age sandy outwash in the Scioto River, Teays-age Minford Clay, as well as silt-loam and channery colluvium all atop Devonian- and Mississippian-age shales, siltstones, and locally thick sandstones (ODGS, 1998).

The geology at the project site of the bridge carrying SR-104 over No Name Creek is mapped as an average of 10 ft of Holocene-age alluvium underlain by an average of 60 ft of Wisconsinan-age sand and

gravel, all underlain by Devonian-age shale bedrock (ODGS, 2005). The alluvium is described as including a wide variety of textures from silt and clay to boulders, commonly includes organic material and generally not compact. The sand and gravel is described intermixed and interbedded commonly containing thin, discontinuous layers of silt, clay, and till. Grains are well to moderately sorted, moderately to well rounded; finely stratified to massive and may locally contain organics. Sand and gravel in deep buried valleys are noted as potentially being older than Wisconsinan.

Based on the Bedrock Geologic Units Map of Ohio (USGS & ODGS, 2006), bedrock within the project area consists of shale, of the Ohio Shale Formation. This unit is comprised of Devonian-age shale and mudstone. The shale in this formation is described as brownish black to greenish gray and weathers to brown in color, carbonaceous to clayey, laminated to thin bedded, fissile parting and contains a petroliferous odor. The bedrock is does not appear to follow the natural topography of the site. While the topography of the site is relatively flat, bedrock rises from east to west (ODGS, 2003). Based on the ODNR bedrock topography map of Ohio, bedrock elevations at the project site can be expected to be between about 475 and 500 ft amsl, putting bedrock at a depth ranging from about 55 ft below ground surface (bgs) to about 80 ft below ground surface (bgs).

The soils at the project site have been mapped (Web Soil Survey) by the Natural Resources Conservation Service (USDA, 2015) as primarily Genesee silt loam. Soils in the Genesee series are characterized as very deep, well drained soils formed in loamy alluvium on flood plains. The Genesee series is comprised of primarily fine-grained soils and classifies as cohesive A-4, and A-6 type soils according to the AASHTO method of soil classification.

2.1. Hydrology/Hydrogeology

Groundwater can be expected at an elevation consistent with that of the no name creek local surface water bodies. The water level ranges between 532 ft to 542 ft amsl.

Local variations in the groundwater table may exist for one of two reasons. First, if there has been extensive groundwater abstraction, water levels may be depressed by tens of feet over significantly large areas. Second, the presence of discontinuous bodies of glacial till provides the opportunity for localized pockets of perched groundwater to form.

According to available mapping by the Federal Emergency Management Agency's (FEMA) National Flood Hazard mapping program (FEMA, 2019), the existing bridge is located within a 1% Annual Chance Flood Hazard area.

2.2. Mining and Oil/Gas Production

No abandoned mines are noted on ODNR’s Abandoned Underground Mine Locator within the immediate vicinity of the project's boundaries (ODNR [1], 2019).

No oil or gas wells are noted on ODNR’s Ohio Oil & Gas Locator within the immediate vicinity of the project's boundaries (ODNR [2], 2019).

2.3. Historical Records and Previous Phases of Project Exploration

A historic record search was performed through ODOT's Transportation Information Management System (TIMS). The historic site plan prepared in 1954 are available on the ODOT TIMS Database, which can be referenced to:

- Structure Sheets, Project Boring Logs and Structure Foundation Investigation Sheets for PIK-104-0630 prepared by the Bureau of Bridges Dept. of Highways State of Ohio, dated between December 8, 1954, and August 17, 1954.

2.4. Site Reconnaissance

A field reconnaissance visit for the Bridge PIK-104-06.27 replacement was conducted on September 17, 2021, along SR-104 at the No Name creek crossing in Pike County, Ohio. During our field reconnaissance, site conditions were noted and photographed. Land use at the project site can be described as a combination of woodland and agricultural.

The existing bridge carrying SR-104 over No Name creek is a three-span, multi-beam bridge which carries one lane of traffic in each direction on a reinforced concrete slab bridge deck with an asphalt wearing course. The bridge sits atop concrete stub type abutments and cap and column type piers. The remains of the original bridge piers could be seen to the west of the current bridge (Photograph 1). The roadway side slopes at the site, generally appeared to be stable with no signs of instability observed during our site visit. Existing roadway side slopes appeared to be at grades ranging between 2 Horizontal to 1 Vertical (2H:1V) and 1.5H:1V. The spill through slopes showed significant signs of erosion and did not appear to have slope protection (Photograph 2). The southern spill through slope was observed to be heavily eroded near the southwestern side of the southern bridge abutment (Photograph 3). The northern spill through slope also showed signs of erosion and the slope near the northeastern side of the northern bridge abutment was observed to be very steep (Photograph 4). Overall, the bridge appeared to be in fair condition with some structural wear observed on the underside of the bridge deck. Reinforcement bars were exposed at various location and corrosion of the bridge beams and concrete was noted to be worse along the edges of the deck and near the abutments near the expansion joints (Photograph 5). The northwestern wingwall was observed to be heavily deteriorated (Photograph 6) and exposed reinforcing steel was observed in the northern pier at the water level of the creek (Photograph 7). However, no apparent signs of structural distress due to geotechnical concerns were observed during our field reconnaissance visit.

In general, the existing bridge structure appeared to be well drained with signs of significant erosion and issues confined to the spill through slopes. Overall, the pavement at the site was observed to be in fair condition with moderate severity map cracking observed near the abutment expansion joints as well as longitudinal and transverse cracking along with crack sealing deficiencies observed in the pavement as a whole (Photograph 8). The pavement appeared to be well drained with water directed to drainage ditches on either side of the roadway as well as directly off the shoulders of the bridge.

Photograph 1: Original Bridge Pier Remains West of Current Bridge

Photograph 2: Spill Through Slopes

Photograph 3: Western End of Southern Spill Through Slope

Photograph 4: Eastern End of Northern Spill Through Slope

Photograph 5: Corrosion of Beams and Exposed Reinforcing Steel of Bridge Deck

Photograph 6: Observed Deterioration of Northwestern Wingwall

Photograph 7: Exposed Reinforcing Steel at Northern Pier

Photograph 8: Overall Pavement Condition

3. GEOTECHNICAL EXPLORATION

3.1. Field Exploration Program

The exploration for the proposed bridge was conducted by NEAS between September 28, 2021 and September 30, 2021 and included 4 borings drilled to depths between 49.3 and 80.8 ft bgs. The boring locations were selected by NEAS in general accordance with the guidelines contained in the SGE with the intent to evaluate subsurface soil and groundwater conditions. Borings were typically located near the

substructure of the proposed bridge in locations that were not restricted by maintenance of traffic, underground utilities or dictated by terrain (i.e., steep embankment slopes). Each as-drilled project boring location and corresponding ground surface elevation was surveyed in the field by NEAS (project surveyor) before driling. Each individual project boring log (included within Appendix B) includes the recorded boring latitude and longitude location (based on the surveyed Ohio State Plane North, NAD83, location) and the corresponding ground surface elevation. Elevations of the borings are shown on Table 1 below.

Table 1: Project Boring Summary

Boring Number	Alignment	Location (Sta/Offset)	Latitude	Longitude	Elevation (NAVD 88) (ft)	Depth (ft)
B-001-0-21	SR-104	330+71, 10' LT.	39.043123	-83.052773	554.6	66.0
B-002-0-21	SR-104	331+18, 7' RT.	39.043245	-83.052687	533.0	49.3
B-003-0-21	SR-104	331+92, 8' LT.	39.043453	-83.052696	539.2	61.0
B-004-0-21	SR-104	332+40, 12' RT.	39.043570	-83.052593	553.9	80.8

Notes:
1. *As-drilled boring location and corresponding ground surface elevation was surveyed in the field.*
2. *As-drilled boring Location (Sta/Offset) based on SR-104 alignment provided by BG Engineering Group .*

Borings were drilled using a CME 55X CS truck mounted drilling rig utilizing 3.25-inch diameter hollow stem augers. In general, soil samples were recovered at intervals of 2.5-ft to a depth of 25 ft bgs or top of bedrock and at 5.0-ft intervals thereafter using a split spoon sampler (AASHTO T-206 “Standard Method for Penetration Test and Split Barrel Sampling of Soils.”). Borings drilled as roadway subgrade characterization and scour analysis purposes obtained samples continuously within depths of the borings corresponding to the subgrade elevation of the proposed roadway grades and the river surface elevation, respectively. The soil samples obtained from the exploration program were visually observed in the field by the NEAS field representative and preserved for review by a Geologist and possible laboratory testing. Standard penetration tests (SPT) were conducted using a CME auto hammer that has been calibrated to be between 90% efficient as indicated on the boring logs on December 3, 2019.

Field boring logs were prepared by drilling personnel, and included lithological description, SPT results recorded as blows per 6-inch increment of penetration and estimated unconfined shear strength values on specimens exhibiting cohesion (using a hand-penetrometer). Groundwater level observations were recorded both during and after the completion of drilling. These groundwater level observations are included on the individual boring logs. After completing the borings, the boreholes were backfilled with either auger cuttings, bentonite chips, or a combination of these materials.

3.2. Laboratory Testing Program

The laboratory testing program consisted of classification testing and moisture content determinations. Data from the laboratory-testing program were incorporated onto the boring logs (Appendix B). Untested portions of samples are retained through completion and ODOT approval of Stage 2 plans, after which time they will be discarded.

3.2.1. Classification Testing

Representative soil samples were selected for index properties (Atterberg Limits) and gradation testing for classification purposes on approximately 41% of the samples. At each boring location, samples were selected for testing with the intent of identification and classification of all significant soil units. Soils not selected for testing were compared to laboratory tested samples/strata and classified visually. Moisture

content testing was conducted on all samples. The laboratory testing was performed in general accordance with applicable AASHTO specifications.

A final classification of the soil strata was made in accordance with AASHTO M-145 "Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes," as modified by ODOT "Classification of Soils" once laboratory test results became available. The results of the soil classification are presented on the boring logs provided in Appendix B.

3.2.2. Standard Penetration Test Results

Standard Penetration Tests (SPT) and split-barrel (commonly known as split-spoon) sampling of soils were performed at varying intervals (i.e., 2.5-ft or 5.0-ft intervals) in the project borings performed. To account for the high efficiency (automatic) hammers used during SPT sampling, field SPT N-values were converted based on the calibrated efficiency (energy ratio) of the specific drill rig's hammer. Field N-values were converted to an equivalent rod energy of 60% (N_{60}) for use in analysis or for correlation purposes. The resulting N_{60} values are presented on the boring logs provided in Appendix B.

3.2.3. Unconfined Compressive Strength of Rock Core Results

Unconfined Compressive Strength of Rock Core Testing was conducted in accordance with ASTM D7012 "Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying Sates of Stress and Temperatures" on two rock core samples obtained during the exploration program. The Unconfined Compressive Strength Test results are shown in Table 2 below and provided in Appendix B.

Table 2: Unconfined Compressive Strength Test Results

Boring ID	Depth (ft)	Elevation (ft)	Unconfined Compressive Strength (psi)	Stain at Failure (%)
B-002-0-21	45.8 - 46.2	507.9 - 508.3	1,252	1.6
B-004-0-21	77.3 - 77.6	476.3 - 476.6	1,014	2.5

3.2.4. Scour Design Parameters

The scour design parameters are shown in Table 3 and provided in Appendix B.

Table 3: Scour Design Parameters

Boring Number	Specimen Elevation (ft)	ODOT (Modified AASHTO) ~ USCS Classification	D50 (mm)	Scour Critical Shear Stress, τ_C (psf)	Erosion Category (EC)
B-002-0-21	533.0' - 531.5'	A-6a ~ LEAN CLAY with SAND(CL)	0.020	0.091	3.255
	531.5' - 530.0'	A-4b ~ SANDY LEAN CLAY(CL)	0.035	0.046	2.868
	530.0' - 528.5'	A-6a ~ LEAN CLAY with SAND(CL)	0.018	0.000	3.255
	528.5' - 527.0'	A-6a ~ LEAN CLAY(CL)	0.010	0.085	3.413
	527.0' - 525.5'	A-4b ~ SILT with SAND(ML)	0.025	0.000	1.500
B-003-0-21	539.2' - 537.7'	A-6a ~ LEAN CLAY with SAND(CL)	0.006	0.331	3.075
	537.7' - 536.2'	A-6a ~ LEAN CLAY with SAND(CL)	0.012	0.187	3.168
	536.2' - 534.7'	A-6a ~ LEAN CLAY with SAND(CL)	0.009	0.240	3.255
	534.7' - 533.2'	A-6a ~ LEAN CLAY(CL)	0.017	0.189	3.075
	533.2' - 531.7'	A-4b ~ LEAN CLAY with SAND(CL)	0.022	0.094	2.868
	531.7' - 530.2'	A-6a ~ LEAN CLAY with SAND(CL)	0.022	0.111	3.168

4. GEOTECHNICAL FINDINGS

The subsurface conditions encountered during NEAS's explorations are described in the following subsections and on each boring log presented in Appendix B. The boring logs represent NEAS's interpretation of the subsurface conditions encountered at each boring location based on our site observations, field logs, visual review of the soil samples by NEAS's geologist, and laboratory test results. The lines designating the interfaces between various soil strata on the boring logs represent the approximate interface location; the actual transition between strata may be gradual and indistinct. The subsurface soil and groundwater characterizations included herein, including summary test data, are based on the subsurface findings from the geotechnical explorations performed by NEAS as part of the referenced project, and consideration of the geological history of the site.

4.1. Subsurface Conditions

The subsurface profile at the bridge site consists of surficial materials comprised of existing pavement section (asphalt and granular base) ranging from 13.0 to 14.5 inches in thickness which is generally underlain by embankment fill materials (A-6a) over interbedded cohesive and non-cohesive natural overburden soils (A-3a, A-4a, A-4b, A-6a, A-6b, A-2-4, A-2-6, and A-1-b). Bedrock was encountered within depths of all the structure borings performed. Bedrock elevations range from 485.9 ft to 504.7 ft amsl, putting bedrock at a depth of 39.3 to 68.0 ft below ground surface (bgs).

4.1.1. Overburden Soil

At the bridge site, the embankment fill materials were encountered immediately below the pavement materials. The thickness of the embankment fill materials is approximately 6 ft and varies across the abutments since the current bridge was built on the side embankment of the original roadway alignment. Below the embankment fill materials, cohesive and non-cohesive glacial tills were interbedded. These materials and the general profile are further described below.

The first stratum encountered below the embankment fill materials is cohesive glacial tills and extended to depths ranging from 6.0 to 33.3 ft bgs (approximate elevations 520.6 to 545.6 ft amsl). In general, the deeper top cohesive soil stratum thicknesses of approximately 14.5 ft and 26.3 ft were encountered at the abutment locations within borings B-001-0-21 and the B-004-0-21, respectively. At the current pier locations (B-002-0-21 and B-003-0-21) the top cohesive soil stratum ranges approximately from6.0 ft to 13.0 ft of. Based on laboratory testing results and a visual review of the soil samples obtained in the referenced boring, the top cohesive soil stratum at the site consisted of Silt and Clay (A-6a), Silty Clay (A-6b), Silt (A-4b) and sandy silt (A-4a). The exception being a 0.8 ft thick layer of granular material, Gravel with Sand (A-1-b), encountered in B-004-0-21. With respects to the soil strength, the top cohesive soils can be described having a soft to hard consistency correlating to converted SPT-N values (N60) values between 0 and 32 blows per foot (bpf) and an unconfined compressive strength (estimated by means of hand penetrometer) ranging from 0.20 tons per square foot (tsf) to 4.5 tsf. Natural moisture contents of the cohesive soils ranged from 15 to 35 percent. Based on Atterberg Limits test performed on representative samples of the cohesive soils, the liquid and plastic limits ranged from 28 to 39 percent and from 17 to 24 percent, respectively.

The stratum encountered beneath the top cohesive soil stratum consisted of a non-cohesive till layer. This granular layer ranged from 17.0 ft to 35.3 ft in thickness and consisted of Gravel with Sand (A-1-b), Gravel with Sand and Silt (A-2-4), Stone fragments with Sand, Silt and Clay (A-2-6), Coarse and Fine Sand (A-3a), and Sandy Silt (A-4a). The exception being a 5.0 ft thick layer of cohesive material, Silt (A-

4b), was encountered in B-004-0-21. With respects to the soil strength, the non-cohesive till soils can be described having a relative density of very loose to very dense correlating to N60 values between 0 bpf and refusal. Natural moisture contents of the till ranged from 9 to 27 percent.

The last stratum encountered on top of bedrock is cohesive glacial tills and ranged from 7.1 to 15.0 ft bgs. The exceptions are no bottom cohesive layer was encountered in B-004-0-21 and a 5.0 ft thick layer of granular material, Gravel with Sand (A-1-b), encountered in B-002-0-21. Based on laboratory testing results and a visual review of the soil samples obtained in the referenced boring, the bottom cohesive soil stratum at the site consisted of Silt and Clay (A-6a), Silty Clay (A-6b), and sandy silt (A-4a). With respects to the soil strength, the bottom cohesive soils can be described having a soft to hard consistency correlating to converted SPT-N values (N60) values between 24 bpf and refusal and an unconfined compressive strength (estimated by means of hand penetrometer) ranging from 0.5 tons per square foot (tsf) to 4.25 tsf. Natural moisture contents of the cohesive soils ranged from 14 to 26 percent. Based on Atterberg Limits test performed on representative samples of the cohesive soils, the liquid and plastic limits ranged from 26 to 36 percent and from 19 to 20 percent, respectively.

4.1.2. Bedrock

Bedrock was encountered in all the project borings performed. Bedrock elevations range from 485.9 ft to 504.7 ft amsl, putting bedrock at a depth of 39.3 to 68.0 ft below ground surface (bgs). The bedrock type and depths are summarized in Table 4.

Table 4: Bedrock Summary

Boring ID	Bedrock Type	Bedrock Depth (ft)	Bedrock Elevation (ft)	Bedrock Recovery Avg (%)	Bedrock RQD Avg (%)
B-001-0-21	Shale	49.9 - 55.0	499.7 - 504.8	-	-
	Shale	55.0 - 66.0	488.7 - 499.7	89	46
B-002-0-21	Shale	39.3 - 49.3	483.8 - 493.8	37	97
B-003-0-19	Shale	46.8 - 51.0	488.5 - 491.7	-	-
	Shale	51.0 - 61.0	478.5 - 488.5	49	97
B-004-0-19	Shale	68.0 - 70.8	483.1 - 485.9	-	-
	Shale	70.8 - 80.8	473.1 - 483.1	51	93

4.1.3. Groundwater

Groundwater measurements were taken during the boring drilling procedures and immediately following the completion of each borehole. Groundwater was encountered in three out of four borings during drilling, except boring B-001-0-21. Groundwater was encountered at 7.5 ft to 35.5 ft below ground surface and at the approximate elevation of 518.4 ft to 526.5 ft amsl.

It should be noted that groundwater is affected by many hydrologic characteristics in the area and may vary from those measured at the time of the exploration.

5. ANALYSIS AND RECOMMENDATIONS

The proposed project consists of the replacement of the bridge PIK-104-06.27 carrying SR-104 over No Name Creek located about 0.4 mile south of Jasper Township, Pike County, Ohio. It is our understanding that the proposed structure a single span prestressed concrete beam bridge with composite reinforced concrete deck on semi-integral abutments supported on HP-piles

Based on the above information in addition to: 1) the soil characteristics gathered during the subsurface exploration (i.e., SPT results, laboratory test results, etc.); 2) the developed generalized soil profile and estimated engineering properties and other design assumptions presented in subsequent sections of this report; and, 3) the site plan provided by BG Engineering Group via email on January 6, 2022, Geotechnical design elements for the proposed project will include:

- Pavement Design
- Foundation Analyses
- Global Stability Analyses
- Settlement Analyses

The geotechnical engineering analyses were performed in accordance with ODOT's BDM (ODOT BDM, 2021) and AASHTO's LRFD BDS (AASHTO LRFD, 2020). Design recommendations are provided in the following sections.

5.1. Generalized Soil Profile for Analysis

For analysis purposes, each substructure location (boring log) was reviewed and a generalized material profile was developed for analysis. Utilizing the generalized soil profile, engineering properties for each soil strata were estimated based on the field (i.e., SPT N_{60} Values, hand penetrometer values, etc.) and laboratory (i.e., Atterberg Limits, grain size, etc.) test results using correlations provided in published engineering manuals, research reports and guidance documents. The developed preliminary soil profile and estimated soil engineering properties for use in analysis (with cited correlation/reference material) are summarized in Tables 5 through 8. The project borings are presented in Appendix B.

Table 5: Soil Profile and Estimated Engineering Properties – B-001-0-21

SR-104 Bridge Over No Name Creek: Rear Abutment, B-001-0-21						
Soil Description	**Unit Weight[1] (pcf)**	**Moist Unit Weight[1] (pcf)**	**Saturated Unit Weight[1] (pcf)**	**Undrained Shear Strength[2] (psf)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**
Silt and Clay Elevation (554.6 ft - 548.6 ft)	110	110	120	2,200	115	24
Sandy Silt Elevation (548.6 ft - 544.1 ft)	108	108	118	1,000	100	22
Silt and Clay Elevation (544.1 ft - 534.1 ft)	105	105	115	750	75	21
Gravel with Sand Elevation (534.1 ft - 531.6 ft)	112	112	122	-	-	29
Sandy Silt Elevation (531.6 ft - 530.1 ft)	110	110	120	2,250	115	24
Coarse and Fine Sand Elevation (530.1 ft - 527.3 ft)	115	115	125	-	-	31
Gravel with Sand and Silt Elevation (527.3 ft - 517.3 ft)	130	130	140	-	-	37
Gravel with Sand, Silt and Clay Elevation (517.3 ft - 512.8 ft)	118	118	128	-	-	32
Silt and Clay Elevation (512.8 ft - 507.8 ft)	112	112	122	3,000	150	25
Silt and Clay Elevation (507.8 ft - 504.7 ft)	130	130	140	6,950	250	28

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2.*

Table 6: Soil Profile and Estimated Engineering Properties – B-002-0-21

SR-104 Bridge Over No Name Creek: Rear Pier, B-002-0-21						
Soil Description	**Unit Weight[1] (pcf)**	**Moist Unit Weight[1] (pcf)**	**Saturated Unit Weight[1] (pcf)**	**Undrained Shear Strength[2] (psf)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**
Silt and Clay Elevation (533 ft - 531.5 ft)	105	105	115	750	75	21
Silt Elevation (531.5 ft - 530 ft)	105	105	115	600	75	21
Silt and Clay Elevation (530 ft - 527 ft)	95	95	105	150	12	16
Silt Elevation (527 ft - 524.5 ft)	105	105	115	-	-	25
Gravel with Sand Elevation (524.5 ft - 517.5 ft)	122	112	122	-	-	30
Gravel with Sand Elevation (517.5 ft - 512.5 ft)	135	125	135	-	-	37
Gravel with Sand and Silt Elevation (512.5 ft - 510 ft)	130	120	130	-	-	35
Sandy Silt Elevation (510 ft - 507.5 ft)	125	115	125	-	-	32
Silty Clay Elevation (507.5 ft - 501.2 ft)	128	118	128	4,000	200	26
Gravel with Sand Elevation (501.2 ft - 496.2 ft)	140	130	140	-	-	37
Silty Clay Elevation (496.2 ft - 493.7 ft)	140	130	140	6850	250	28

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2.*

Table 7: Soil Profile and Estimated Engineering Properties – B-003-0-21

SR-104 Bridge Over No Name Creek: Forward Pier, B-003-0-21						
Soil Description	**Unit Weight[1] (pcf)**	**Moist Unit Weight[1] (pcf)**	**Saturated Unit Weight[1] (pcf)**	**Undrained Shear Strength[2] (psf)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**
Silt and Clay Elevation (539.2 ft - 533.2 ft)	112	112	122	2,500	150	25
Silt Elevation (533.2 ft - 531.7 ft)	105	105	115	750	75	21
Silt and Clay Elevation (531.7 ft - 526.2 ft)	102	102	112	500	50	20
Coarse and Fine Sand Elevation (526.2 ft - 521.2 ft)	115	105	115	-	-	27
Gravel with Sand Elevation (521.2 ft - 514.2 ft)	122	112	122	-	-	31
Gravel with Sand Elevation (514.2 ft - 507.4 ft)	140	130	140	-	-	37
Silt and Clay Elevation (507.4 ft - 502.4 ft)	130	120	130	4,500	225	27
Sandy Silt Elevation (502.4 ft - 497.4 ft)	125	115	125	3,250	180	25
Sandy Silt Elevation (497.4 ft - 492.4 ft)	122	112	122	3,000	150	25

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2.*

Table 8: Soil Profile and Estimated Engineering Properties – B-004-0-21

SR-104 Bridge Over No Name Creek: Forward Abutment, B-004-0-21						
Soil Description	**Unit Weight[1] (pcf)**	**Moist Unit Weight[1] (pcf)**	**Saturated Unit Weight[1] (pcf)**	**Undrained Shear Strength[2] (psf)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**
Gravel with Sand Elevation (553.9 ft - 551.9 ft)	115	115	125	-	-	34
Silt and Clay Elevation (551.9 ft - 544.4 ft)	110	110	120	1,500	115	23
Silty Clay Elevation (544.4 ft - 536.9 ft)	108	108	118	1,300	100	23
Silt and Clay Elevation (536.9 ft - 520.6 ft)	105	105	115	600	75	21
Gravel with Sand Elevation (520.6 ft - 500.6 ft)	125	115	125	-	-	31
Silt Elevation (500.6 ft - 495.6 ft)	140	130	140	7,100	250	28
Gravel with Sand and Silt Elevation (495.6 ft - 485.9 ft)	140	130	140	-	-	35

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2.*

5.2. Pavement Design and Recommendations

The subgrade analysis was performed in accordance with ODOT's GB1 criteria utilizing the ODOT provided *GB1: Subgrade Analysis Spreadsheet* (GB1_SubgradeAnalysis.xls, Version 14.5 dated January 18, 2019). Input information for the spreadsheet was based on the soil characteristics gathered during NEAS's subgrade exploration (i.e., SPT results, laboratory test results, etc.), and our geotechnical experience. For analysis purposes, final roadway elevations were determined based on the proposed profiles shown in the basemap provided by BG Engineering Group via email on January 11, 2022.

A GB1 analysis was performed to identify the method, location, and dimensions (including depth) of recommended subgrade stabilization in the referenced project plan. Appropriate stabilization of the subgrade will ensure a constructible pavement buildup, enhance pavement performance over its life, and

help reduce costly extra work change orders (ODOT SGE, 2020). In addition to identifying stabilization recommendations, pavement design parameters are also determined to aid in pavement section design. The subsections below present the results of our GB1 analysis including pavement design parameters and unsuitable subgrade conditions if any identified within the project limits. GB1 analysis spreadsheet for the referenced roadway segment is provided in Appendix C.

5.2.1. Pavement Design Recommendations

It is our understanding that pavement analyses and design are to be performed to determine the proposed pavement section of SR-104. GB1 analyses were performed using the subgrade soil data obtained for the referenced roadway segment to evaluate the soil characteristics for use in pavement design. The subgrade analysis parameters recommended for use in pavement design for the referenced roadway segment are presented in Table 9. Provided in the table are average Plasticity Index (PI) values, ranges of maximum, minimum and average N_{60L} values for the indicated segments as well as the design CBR value recommended for use in pavement design.

Table 9: Pavement Design Values

Segment	Maximum N_{60L}	Minimum N_{60L}	Average N_{60L}	Average PI Values	Design CBR
SR-104	11	11	11	13	7

5.2.2. Unsuitable/Unstable Subgrade

Per ODOT's GB1, the presence of select subgrade conditions may require some form of subgrade stabilization within the subgrade zone for new pavement construction. These unsuitable and unstable subgrade conditions generally include the presence of rock, specific soil types, weak soil conditions, and overly moist soil conditions. With respect to the planned roadways, these subgrade conditions are further discussed in the following subsections.

5.2.2.1. Rock

Rock was not encountered within top 2 ft of the proposed grade in all borings performed; therefore, no specialized remediation efforts are required.

5.2.2.2. Prohibited Soils

Prohibited soil types, per the GB1, include A-4b, A-2-5, A-5, A-7-5, A-8a, A-8b, and soils with liquid limits greater than 65. No prohibited soils were encountered within the subgrade of the referenced project roadway.

5.2.2.3. Weak Soils

Soils for which the lowest N_{60} (N_{60L}) at the referenced boring location is less than or equal to 12 bpf and in some cases less than 15 bpf (i.e., where moisture content is greater than optimum plus 3 percent) subgrade stabilization depths are recommended per *Figure B - Subgrade Stabilization* within the GB1. Based on N_{60L} values, our GB1 analysis suggests the need for either chemical treatment or excavate and replace at select locations. It should be noted that for the purposes of this report the term "weak soils" has been assumed to represent subgrade soils of these conditions. A summary of the boring locations where weak soils was encountered and the associated GB1 recommended remediation depths are shown in Table 10.

Table 10: Weak Soil Locations for SR-104

Boring ID	N_{60L}	Subgrade Depth (ft)
B-001-0-21	11	4.0 -5.5
B-004-0-21	11	1.7 - 4.7

It should be noted that *Figure B - Subgrade Stabilization* does not apply to soil types A-1-a, A-1-b, A-3, or A-3a, nor to soils with N_{60L} values of 15 or more. Per GB1 guidance *these soils should be reworked to stabilize the subgrade.*

5.2.2.4. High Moisture Content Soils

High moisture content soils are defined by the GB1 as soils that exceed the estimated optimum moisture content (per *Figure A - Optimum Moisture Content* within the GB1) for a given classification by 3 percent or more. Per the GB1, soils determined to be above the identified moisture content levels are a likely indication of the presence of an unstable subgrade and may require some form of subgrade stabilization. Summaries of the boring locations where high moisture content conditions were encountered within the limits of each proposed alignment are shown in Table 11.

Table 11: High Moisture Content Soil Locations for SR-104

Boring ID	Soil Type	Moisture Content (%)	Optimum Moisture Content (%)	Depth Below Subgrade (ft)
B-001-0-21	A-6a	19	14	(-)0.5- 1.0
		20	15	1.0 - 2.5
		18	14	2.5 - 4.0
	A-4a	15	10	4.0 - 5.5
B-004-0-21	A-4a	11	6	0.2 - 0.7
	A-6a	17	14	0.7 - 1.7
		18	14	1.7 - 3.2
		23	14	3.2 - 4.7

5.2.3. Stabilization Recommendations

5.2.3.1. Summary of Stabilization

Unstable subgrade conditions that may require some form of subgrade stabilization within the subgrade per GB1 guidelines were encountered within the project site. The subgrade conditions encountered along SR-104 alignment within project limits include areas of weak soils and high moisture content soils, as previously indicated in Section 5.2.2. of this report. Therefore, we recommend stabilization in the form of Excavate and Replace (Item 204 with Geotextile) be performed for SR-104 within the project limits.

Based on: 1) the results of our GB1 analysis; 2) the review of the unstable subgrade conditions as described in Section 5.2.2. of this report; and, 3) the subsequent conclusions regarding recommended stabilization, Table 12 presents our recommendations for subgrade stabilization depths for SR-104 within the project limits.

Table 12: Summary of Stabilization

Segment	Average N_{60L}	Remediation Depth (inches)
		Excavate and Replace (Item 204 w/ Geotextile)
Begin to End of Project	11	12

Excavations are estimated to extend to the depths indicated within Table 12 with the excavated material being replaced with material in accordance with Section F "Excavate and Replace (Item 204)" of the ODOT GB1. Stabilization limits should extend 18 inches beyond the edge of the proposed paved roadway, shoulder or median.

5.3. Bridge Foundation Analysis

5.3.1. Deep Foundation Analysis

Deep foundations will be used to support the abutments of the referenced bridge. Since bedrock was encountered in all structural borings at depths of 39.3 to 68.0 ft bgs (Elev. from 485.9 ft to 504.7 ft amsl), HP-piles, which are usually used as end-bearing piles bearing on bedrock and can provide high axial working capacity, are recommended to support the proposed bridge abutments. According to the bridge site plan provided by BG Engineering Group, the abutment piles will be supported from the elevations of 540.75 ft and 538.75 ft for the rear and forward abutments, respectively.

Based on our estimated engineering soil properties, a pile analysis was performed using the computer program Driven at each substructure location. For the purposes of this report and our analysis the term 'geotechnical pile length' has been assumed to represent the length of pile from bottom of footing (pile cap bearing elevation) to the depth at which the bedrock is encountered. The "Estimated Length" and "Order Length" definitions and formulas are presented in Section 303.4.2 "Pile Foundations" of the BDM. The calculated 'estimated' length assumes penetration through one foot of broken rock, one-foot embedment in the pile cap, and rounding up to the nearest 5 ft. The "Order Length" is the calculated "Estimated Length" plus 5 ft. Pile lengths are expected to be as shown in Table 13 based on the rock elevations (worst case if there are more than one boring logs at the location) shown on the boring logs and pile cap elevations provided by the designers. The maximum factored structural resistance shown in Table 13 can be found in ODOT's 2020 BDM Section 305.3.3 (ODOT, 2020). Factored structural resistance information provided in Table 13 for HP-Piles can be used for determining the minimum number of deep foundation elements that would be required to support the Strength I Limit State axial design loads for the abutments. The driven analysis results can be found in Appendix D.

Table 13: Estimated Pile Lengths

Substructure	Pile Size	Maximum Factored Structural Resistance (kips)	Pile Cap Elevation (ft)	Estimated Top of Bedrock (ft)	Geotechnical Design Length (ft)	Estimated Length (ft)	Order Length (ft)
Rear Abutment	HP 10X42	310	540.8	496.5	45.0	50	55
Forward Abutment	HP 10X42	310	538.8	486.7	53.0	60	65

Since the embankment fill above the abutment footings will be carried by the abutments, the surcharge loads will then be transferred from the abutments to the piles; therefore, it is our opinion that the piles will not be subjected to downdrag loads.

According to BG Engineering Group, the bottom of scour at the design flood and check flood is about 8.4 ft below the bottom of footing (elevations 532.4 ft and 530.4 at the rear and the forward abutment location, respectively). It is NEAS's opinion that when the scour extends below the abutment footing, the retained embankment soils behind the proposed abutments will be compromised and eroded away. Therefore, the piles will not subject to any lateral load induced by the retained embankment soils. The p-y analysis on the pile is unnecessary.

5.3.2. Global Stability

For purposes of evaluating the stability of the abutments, NEAS reviewed the cross-section and project boring logs to determine the subsurface soil conditions that posed the greatest potential for slope instability. Based on our review, NEAS developed a representative cross-sectional model at each abutment to use as the basis for global stability analyses. The models were developed from NEAS's interpretation of the available information which included: 1) the proposed bridge site plan provided by BG Engineering Group through email on January 11, 2022; and, 2) test borings and laboratory data developed as part of this report. With respect to the soil's engineering properties, the provided Soil Profile Estimated Engineering Properties presented in Section 5.1 of this report were used in our analyses.

The above referenced slope stability models were analyzed for long-term (Effective Stress) and short-term (Total Stress) slope stability utilizing the software entitled Slide 7.0 by Rocscience, Inc. Specifically, the Bishop Simplified, Corrected Janbu, GLE and Spencer analysis method were used to calculate a factor of safety (FOS) for circular type slope failures. The FOS is the ratio of the resisting forces and the driving forces, with the desired safety factor being more than about 1.54 which equates to an AASHTO resistance factor less than 0.65 (per AASHTO, 2020 - the specified resistance factors are essentially the inverse of the FOS that should be targeted in slope stability programs). For this analysis, a resistance factor of 0.65 or lower is targeted as the slope contains or supports a structural element. It should be noted that scour was not a consideration in the performance of global stability analysis.

Based on our slope stability analyses for the referenced bridge abutments, the minimum slope stability safety factor for short-term (Total Stress) and long-term (Effective Stress) conditions exceeded the desired value of 1.54. It should be noted that NEAS evaluated the global stability of both abutments with the inclusion of the proposed steel piles, with minimum shear strength of 106,630 lbs (assumed HP 10x42 pile with yield strength of Fy=50 kips). The results of the analyses are summarized in Table 14. The graphical output of the slope stability program (cross-sectional model, calculated safety factor, and critical failure plane) is presented in Appendix E.

Table 14: Summary of Global Stability of Abutments

Location	Boring No.	Water level Condition	Description	Minimum Factor of Safety	Equivalent Resistance Factor	Status (OK/NG)
Rear Abutment	B-001-0-21 & B-002-0-21	Normal Water	Short Term	2.77	0.36	OK
			Long Term	1.85	0.54	OK
		100-Year H.W.	Short Term	3.26	0.31	OK
			Long Term	2.12	0.47	OK
Forward Abutment	B-003-0-21 & B-004-0-21	Normal Water	Short Term	2.30	0.43	OK
			Long Term	2.05	0.49	OK
		100-Year H.W.	Short Term	2.73	0.37	OK
			Long Term	2.64	0.38	OK

5.3.3. Settlement

Since the proposed bridge alignment will be shifted approximately 15 ft east of the current location, there will be about maximum 8 feet of new fills at the east end abutments and the east side wingwalls. In order to estimate the maximum total and differential settlement that could result within the subsurface soils, NEAS reviewed: 1) the proposed bridge site plan prepared by BG Engineering Group; 2) cross sections along SR-104 provided by BG Engineering Group on January 13, 2022; and, 3) test borings and laboratory data. Utilizing this information and the software entitled FoSSA 2.0 by ADAMA Engineering, Inc., two settlement models were developed and analyzed for both elastic (immediate) and consolidation (long term) settlement. The selected settlement models are located at the rear abutment (STA 330+94.45) and the forward abutment (STA 332+06.12).

Based on our analyses, the ground surface at the proposed rear abutment is estimated to experience at most about 0.96 inches of immediate settlement and 3.96 inches of long term (consolidation) settlement from the induced embankment fill loads. The ground surface at the proposed forward abutment is estimated to experience at most about 0.72 inches of immediate settlement and 4.32 inches of long term (consolidation) settlement from the induced embankment fill loads. The maximum differential settlement across the length of each abutment is estimated to be at the threshold of the allowable differential settlement of 1% per ODOT's BDM (ODOT, 2021). The elastic (immediate) settlement will take place during construction prior to traffic loading and is not expected to be a concern. Due to the weak and thick soil layers underlying the proposed bridge abutments, the long term (consolidation) settlement will take months to settle. Based on our analyses, the 90% consolidation settlement will take 93 days and 91 days for the rear abutment and the forward abutment, respectively. However, it should be noted, that it is NEAS's experience that current settlement estimate methodology typically provides conservative (increased) values and settlement is generally observed to be less in construction. The settlement analysis results are presented in Appendix F.

It is recommended that a settlement monitoring program be designed and implemented to verify that the settlements have dissipated to a level acceptable by the Geotechnical Engineer (i.e., 90% consolidation settlement has taken place, or 3 weekly consecutive readings of 1/8-inch or less) and determine the time period at which Stage 2 construction and the permanent structure/final grading/pavement construction may begin. With respect to the settlement monitoring plan, it is recommended that settlement platforms per Item 7 of ODOT's "Geotechnical Bulletin #4, Guidelines for the use of Geotechnical Instrumentation", dated May 30, 2008 (GB4) be installed. The elevation of each settlement platforms shall be recorded at once every week for during construction and during waiting periods. Written documentation of the settlement monitoring, including the settlement measurements plotted on a semi-log plot, shall be provided to the Geotechnical Engineer at the conclusion of each monitoring period. It is estimated that condition for settlement monitoring completion (i.e., 90% consolidation settlement has taken place, or 3 consecutive readings of 1/8-inch or less) will be obtained after about three months after completing new fills.

6. SEISMIC DESIGN PARAMETERS

Based on the results of the subsurface exploration, laboratory test data, and the AASHTO Site Class Definitions indicated in Table 3.10.3.1-1 Method B of the *LRFD Bridge Design Specifications, 9th Edition* (AASHTO LRFD, 2020), the average Standard Penetration Test blow count $\bar{N}$ for the project site is 12 blows/ft. Therefore, the project site is classified as Site Class of E – Soft Clay Soil, with $\bar{N}$ <15 blows/ft.

Following seismic site classification, seismic design parameters for the site were developed using the web-based ATC Hazards by Location (ATC, 2019) which references the 2016 AASHTO Guide Specifications for LRFD Seismic Bridge Design. The ATC Hazards by Location Maps generated LRFD Seismic Design parameters as presented in Table 15. The ATC Hazards by Location Maps detailed report can be found in Appendix G.

Table 15: Seismic Design Parameters

Variable	Symbol (AASHTO 3.10)	Design Values
Latitude		39.043078
Longitude		-83.053044
Site Class		E
Peak Ground Acceleration	PGA	0.069g
Short Period Acceleration	S_s	0.137g
Long Period Acceleration	S_1	0.067g
Site Factor (zero period)	F_{PGA}	2.4
Site Factor (short period)	F_a	2.4
Site Factor (long period)	F_v	4.2
Zero period response seismic coefficient	$A_s = F_{PGA} * PGA$	0.1656g
Short period response seismic coefficient (0.2 seconds)	$S_{DS} = F_a * S_s$	0.219g
Long period response seismic coefficient (1.0 second)	$S_{D1} = F_v * S_1$	0.188g
Seismic Design Category	SDC	C

7. QUALIFICATIONS

This investigation was performed in accordance with accepted geotechnical engineering practices for the purpose of characterizing the subsurface conditions at the site of Bridge PIK-104-06.27 carrying SR-104 over No Name Creek in Pike County, Ohio. This report has been prepared for BG Engineering Group, ODOT and their design consultants to be used solely in evaluating the soils underlying the bridge site and presenting geotechnical engineering recommendations specific to this project. The assessment of general site environmental conditions and the presence of pollutants in the soil, rock and groundwater of the site are beyond the scope of this geotechnical exploration. Our recommendations are based on the results of our field exploration, laboratory test results from representative soil samples, and geotechnical engineering analyses. The results of the field exploration and laboratory tests, which form the basis of our recommendations, are presented in the appendices as noted. This report does not reflect any variations that may occur between the borings or elsewhere on the site, or variations whose nature and extent may not become evident until a later stage of construction. In the event that any changes in the nature, design or location of the proposed bridge project are made, the conclusions and recommendations contained in this preliminary report should not be considered valid until they are reviewed and have been modified or verified in writing by a geotechnical engineer.

It has been a pleasure to be of service to BG Engineering Group in performing this geotechnical exploration for the PIK-104-06.27 project. Please call if there are any questions, or if we can be of further service.

Respectfully Submitted,

National Engineering and Architectural Services Inc.

Zhao Mankoci, Ph.D., P.E.
Geotechnical Engineer

Chunmei He, Ph.D., P.E.
Geotechnical Engineer/Project Manager

REFERENCES

AASHTO. (2002). *Standard Specifications for Highway Bridges, 7th Edition.* Washington, D.C.: American Association of State Highway and Transporation Officials.

AASHTO. (2020). *Standard Specifications for Highway Bridges, 9th Edition.* Washington, D.C.: American Association of State Highway and Transporation Officials.

AASHTO LRFD. (2020). *LRFD Bridge Design Specifications, 8th Edition.* The American Association of State Highway and Transportations Officials.

ATC. (2019, January). ATC Hazards by Location. Retrieved from https://earthquake.usgs.gov/designmaps/us/application.php

Bienawski, Z. (1989). *Engineering Rock Mass Classifications: A CompleteManual for Engineers and Geologists in Mining, Civil and Petroleum Engineering.* New York: John Wiley & Sons.

FEMA. (2019). *National Flood Hazard Layer kmz v3.0.* Federal Emergency Management Agency.

FEMA. (2019). *National Flood Hazard Layer kmz v3.2.* Federal Emergency Management Agency.

ODGS. (1998). Physiographic regions of Ohio: Ohio Department of Natural Resources, Division of Geological Survey. page-size map with text, 2p., scale 1:2,100,00.

ODGS. (2002). Shaded elevation map of Ohio—earth-tone version: Ohio Departmentof Natural Resources, Division of Geological Survey Map MG-1. generalized page-size version with text, 2 p., scale 1:2,000,000.

ODGS. (2002). Surficial geology of the Cleveland South 30 x 60-minute quadrangle: Ohio Division of Geological Survey Map SG-1 Cleveland South. scale 1:100,000.

ODGS. (2003). Bedrock-topography data for Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map BG-3, 1 CD-ROM, GIS file formats. Revised January 9, 2004.

ODGS. (2005). Surficial geology of the western portion of the Lancaster 30 x 60-minute quadrangle: Ohio Division of Geological Survey Map SG-2 Lancaster. scale 1:100,000.

ODNR [1]. (2016). Ohio Abandoned Mine Locator Interactive Map. *Mines of Ohio*. Ohio Department of Natural Resources, Division of Geological Survey & Division of Mineral Resources. Retrieved from https://gis.ohiodnr.gov/MapViewer/?config= OhioMines

ODNR [1]. (2019). Ohio Abandoned Mine Locator Interactive Map. *Mines of Ohio*. Ohio Department of Natural Resources, Division of Geological Survey & Division of Mineral Resources. Retrieved from https://gis.ohiodnr.gov/MapViewer/?config= OhioMines

ODNR [2]. (2019). Ohio Oil & Gas Locator Interactive Map. *Ohio Oil & Gas Wells*. Ohio Department of Natural Resources, Division of Oil and Gas. Retrieved from https://gis.ohiodnr.gov/MapViewer/?config= oilgaswells

ODOT. (2015). *Specifications for Geotechnical Explorations.* Ohio Department of Transportation: Office of Geotechnical Engineering.

ODOT. (2016). *FALCON Geotechnical Document Management System (GDMS).* Ohio Department of Transportation: Office of Geotechnical Engineering. Retrieved from http://falcon.odotgeoms.org/FalconWebV3/default.aspx

ODOT. (2016). *Location and Design Manual - Volume Two Drainage Design.* Columbus, OH: Ohio Department of Transportation: Office of Hydraulic Engineering. Retrieved from https://www.dot.state.oh.us/Divisions/Engineering/Hydraulics/Location and Design Volume 2/LD Volume 2 Archive 12013/ODOT-Location and Design Manual Volume II.pdf

ODOT. (2016). *Specifications for Geotechnical Explorations.* Ohio Department of Transportation: Office of Geotechnical Engineering.

ODOT. (2020). *2019 Bridge Design Manual.* Columbus, OH: Ohio Department of Transportation: Office of Structural Engineering. Retrieved from http://www.dot.state.oh.us/Divisions/Engineering/Structures/standard/Bridges/Pages/BDM2004.aspx

ODOT. (2021). *Bridge Design Manual.* Columbus, OH: Ohio Department of Transportation: Office of Structural Engineering. Retrieved from http://www.dot.state.oh.us/Divisions/Engineering/Structures/standard/Bridges/Pages/BDM2004.aspx

ODOT BDM. (2021). *ODOT Bridge Design Manual 2019 Edition.* Columbus, OH: Ohio Department of Transportation: Office of Structural Engineering. Retrieved from http://www.dot.state.oh.us/Divisions/Engineering/Structures/standard/Bridges/Pages/BDM2004.aspx

ODOT SGE. (2020). *Specifications for Geotechnical Explorations.* Ohio Department of Transportation: Office of Geotechnical Engineering.

Pavey, R. R., Goldthwait, R. P., Brockman, C. S., Hull, D. N., Swinford, E. M., & Van Horn, R. G. (1999). Quarternary geology of Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map M-2. 1:500,000-scale map and 1:250,000-scale GIS files.

USDA. (2015, September). Web Soil Survey. Retrieved from http://websoilsurvey.nrcs.usda.gov

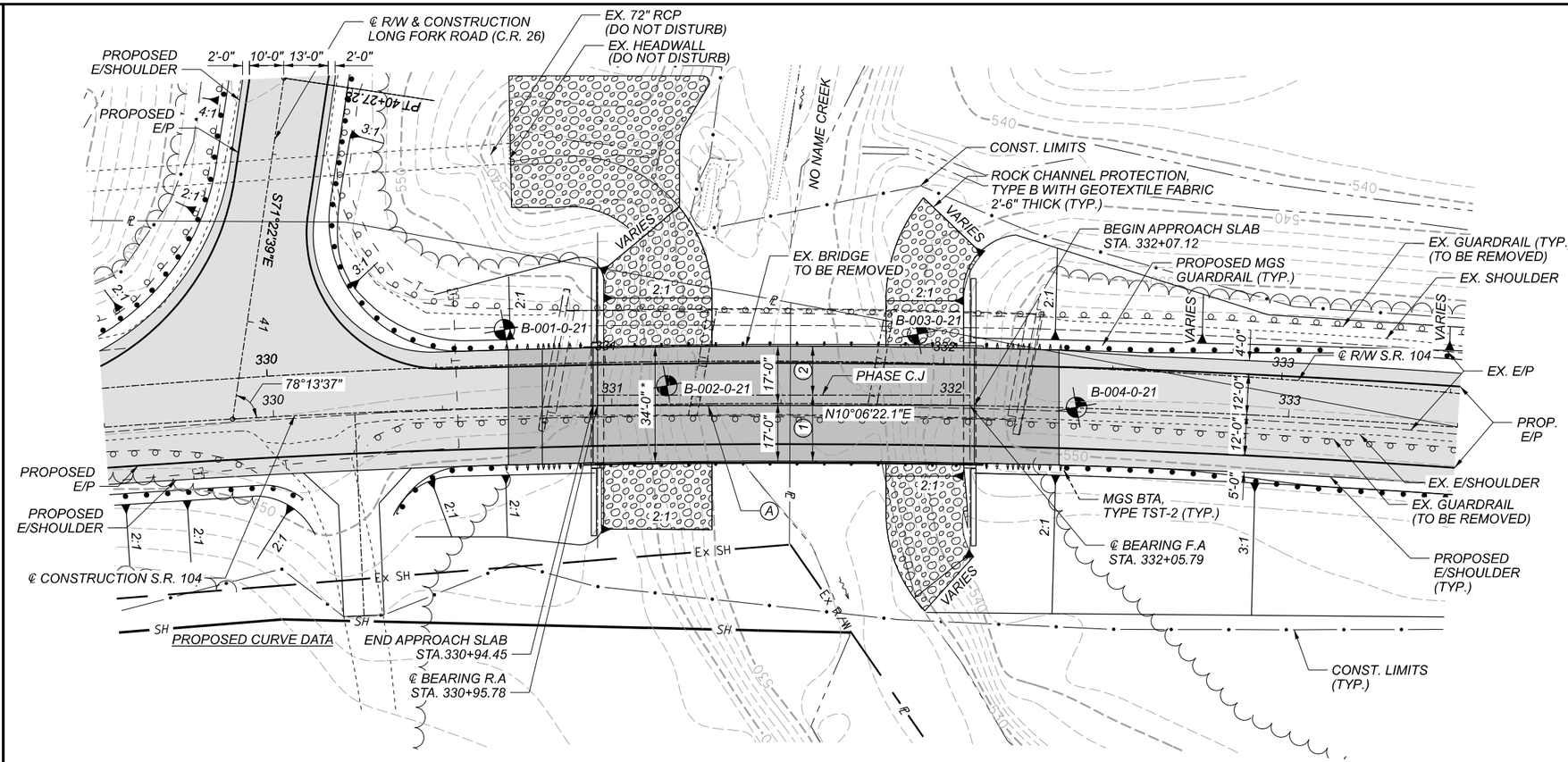
USGS & ODGS. (2005, June). Geologic Units of Ohio. *ohgeol.kmz*. United States Geologic Survey.

USGS & ODGS. (2006, June). Geologic Units of Ohio. *ohgeol.kmz*. United States Geologic Survey.

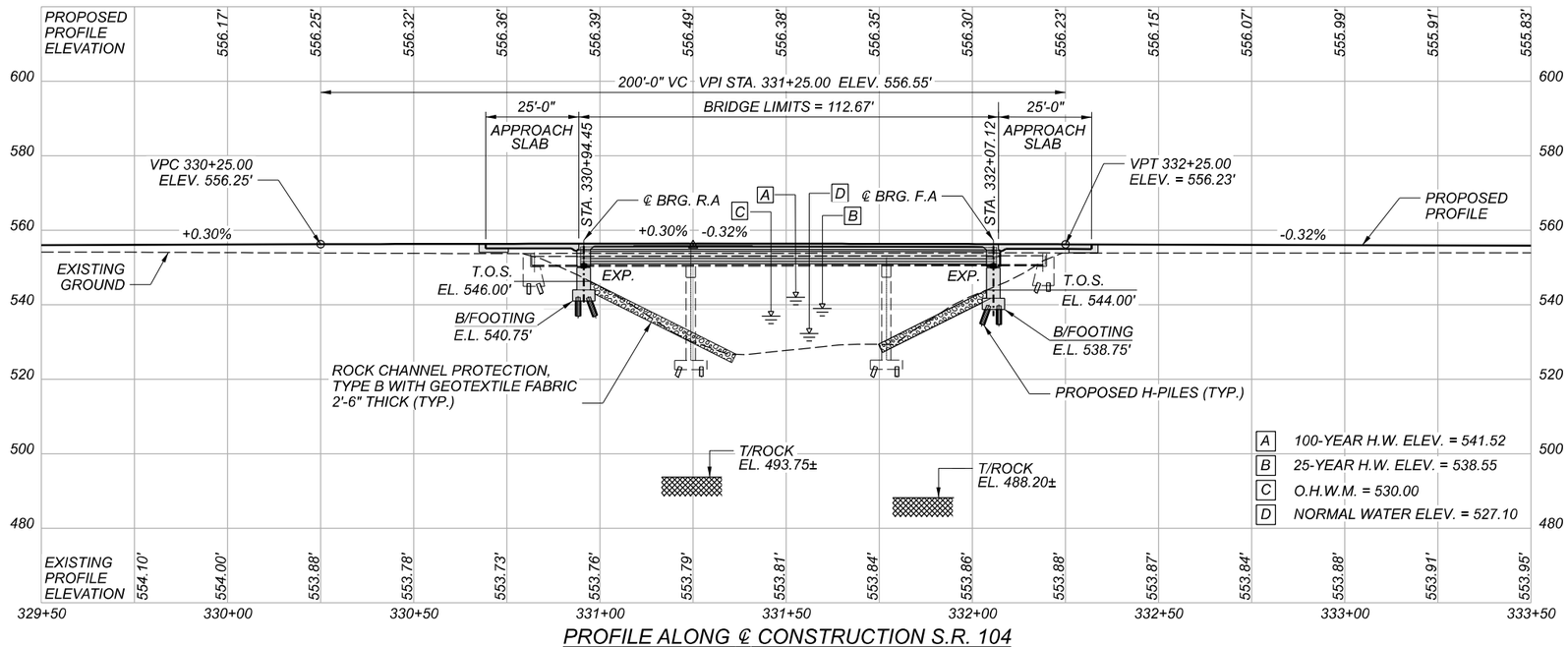
Walker, A. (1986). *Ground water resources of Clermont County, Ohio.* Ohio Department of Natural Resources, Division of Water.

APPENDIX A

BORING PLAN



PLAN



PROFILE ALONG ℄ CONSTRUCTION S.R. 104

BENCHMARK DATA

BM #1 STA. 330+29.66	ELEV. 553.75	OFFSET 52.13' LT
BM #2 STA. 333+54.35	ELEV. 552.66	OFFSET 9.36' RT

FOR ADDITIONAL BENCHMARK INFORMATION. SEE ROADWAY PLAN SHEET 19

NOTES

EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

DESIGN TRAFFIC:

2025 ADT =	3100	2025 ADTT =	403
2045 ADT =	3500	2045 ADTT =	455

DIRECTIONAL DISTRIBUTION = 0.51

LEGEND

- BORING LOCATION
- (1) = VARIES FROM 20'-0" TO 19'-5¾"(-) PHASE-I CONSTRUCTION
- (2) = VARIES FROM 14'-0" TO 14'-6¼ "(+) PHASE-II CONSTRUCTION
- * F/F BRIDGE RAILING
- (A) PROPOSED BRIDGE REFERENCE CHORD

HYDRAULIC DATA

DRAINAGE AREA = 16.20 SQ. MILES

Q (25) =	3310 CFS	V (25) =	5.38 FT/S
Q (100) =	4860 CFS	V (100) =	5.61 FT/S

STRUCTURE CLEARS THE 25 YEAR DESIGN HW BY 11.72 FEET.

EXISTING STRUCTURE

TYPE: CONTINUOUS ROLLED STEEL BEAM WITH REINFORCED CONCRETE DECK ON STUB ABUTMENTS WITH SPREAD FOOTINGS AND CAP-AND-COLUMN PIERS WITH H-PILES

SPANS: 42'-0"± - 52'-6"± - 42'-0"±

ROADWAY: 32'-0"± F/F GUARDRAILS

LOADING: CF-30(51)

SKEW: 10° 00' 00" L.F

WEARING SURFACE: BITUMINOUS

APPROACH SLABS: 15'-0" LONG

ALIGNMENT: 2° 30' CURVE RIGHT

CROWN: SUPERELEVATION 0.041

STRUCTURAL FILE NUMBER: 6600999

DATE BUILT: 1956 REHABILITATION: 07/01/1956

DISPOSITION: TO BE REPLACED

PROPOSED STRUCTURE

TYPE: SINGLE SPAN PRESTRESSED CONCRETE BEAM BRIDGE WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENT WITH H-PILES

SPAN: 110'-0" C/C BEARING ALONG REFERENCE CHORD

ROADWAY: 34'-0" F/F GUARDRAIL

LOADING: HL93 AND FUTURE WEARING SURFACE 60 PSF

SKEW: 00°00'00"

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: 25' LONG (AS-1-15, AS-2-15)

ALIGNMENT: 2° 00' 00" CURVE RIGHT

CROWN: SUPERELEVATION 0.045 FT/FT

DECK AREA: 3740.00 SF

COORDINATES: LATITUDE: 39° 02' 35.39" N

LONGITUDE: 83° 03' 10.81" W

HORIZONTAL SCALE IN FEET
0 10 20 40

SITE PLAN
BRIDGE NO. PIK-00104-06.270
S.R. 104 OVER NO NAME CREEK

SFN 6601000

DESIGN AGENCY
BG
www.bgeng group.com
6910 WILCOX PLACE, SUITE C
DUBLIN, OHIO 43016

DESIGNER	CHECKER
RG	CCJ

REVIEWER GTB XX-XX-22

PROJECT ID 100889

SUBSET	TOTAL
1	25

SHEET	TOTAL
44	76

PIK-104-6.14

MODEL: Plan [Sheet] PAPERSIZE: 17x11 (in.) DATE: 7/21/2022 TIME: 10:09:11 AM USER: JPerchinske
P:\Transportation\WorkSets\100889_PIK-104-06274400-Engineering\Structures\SFN_6600999\Sheets\100889_SFN6600999_SP001.dgn

APPENDIX B

SOIL BORING LOGS & LABORATORY TEST RESULTS

PROJECT: PIK-104-6.27	DRILLING FIRM / OPERATOR: CENTRAL STAR / MJ	DRILL RIG: CME 55X CS	STATION / OFFSET: 330+71, 10' LT.	EXPLORATION ID B-001-0-21
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / ASHBAUGH	HAMMER: CME AUTOMATIC	ALIGNMENT: SR-104	
PID: 100889 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 12/3/19	ELEVATION: 554.6 (MSL) EOB: 66.0 ft.	PAGE 1 OF 3
START: 9/28/21 END: 9/29/21	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 90*	LAT / LONG: 39.043123, -83.052773	

MATERIAL DESCRIPTION AND NOTES	ELEV. 554.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
6.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	553.5	1																
VERY STIFF, BROWN MOTTLED WITH ORANGISH BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, CONTAINS IRON STAINING, DAMP		2	6 5 6	17	89	SS-1	3.50	5	10	7	42	36	30	19	11	19	A-6a (8)	
		3 4	3 7 7	21	89	SS-2	2.50	5	10	7	44	34	34	20	14	20	A-6a (10)	
	548.6	5 6	6 6 4	15	78	SS-3	3.50	-	-	-	-	-	-	-	-	18	A-6a (V)	
STIFF TO VERY STIFF, BROWNISH GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP		6 7	4 3 4	11	67	SS-4	2.00	-	-	-	-	-	-	-	-	15	A-4a (V)	
	544.1	8 9																
STIFF, BROWNISH GRAY AND BROWN, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST		10	2 1 2	5	100	SS-5	2.00	6	9	23	44	18	28	19	9	18	A-4a (5)	
		11 12	1 2 1	5	83	SS-6	1.25	-	-	-	-	-	-	-	-	25	A-6a (V)	
		13 14	2 2 2	6	89	SS-7	1.25	17	7	11	42	23	36	22	14	21	A-6a (8)	
		15 16	2 2 3	8	89	SS-8	1.50	-	-	-	-	-	-	-	-	26	A-6a (V)	
		17 18	2 2 2	6	100	SS-9	1.25	-	-	-	-	-	-	-	-	25	A-6a (V)	
	534.1	19 20																
LOOSE, ORANGISH BROWN, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, LITTLE CLAY, CONTAINS IRON STAINING, MOIST		21 22	5 2 4	9	33	SS-10	-	-	-	-	-	-	-	-	-	18	A-1-b (V)	
	531.6	23																
MEDIUM STIFF, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, SLIGHTLY ORGANIC, WET	530.1	24	3 7 5	18	89	SS-11A	0.75	-	-	-	-	-	-	-	-	28	A-4a (V)	
MEDIUM DENSE, GRAY, **COARSE AND FINE SAND**, TRACE SILT, TRACE GRAVEL, TRACE CLAY, MOIST		25 26				SS-11B	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
	527.3	27 28																
VERY DENSE, BROWN AND GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, WET		29	5 13 50	95	50	SS-12	-	-	-	-	-	-	-	-	-	15	A-2-4 (V)	

PID: 100889	SFN:	PROJECT: PIK-104-6.27	STATION / OFFSET: 330+71, 10' LT.	START: 9/28/21	END: 9/29/21	PG 2 OF 3	B-001-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY DENSE, BROWN AND GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, WET *(continued)*	524.6	31 32 33 34 35 36 37	30 50/5"	-	91	SS-13	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	
MEDIUM DENSE, ORANGISH BROWN AND GRAY, **STONE FRAGMENTS WITH SAND, SILT, AND CLAY**, CONTAINS IRON STAINING, WET	517.3	38 39 40 41	4 9 11	30	78	SS-14	-	-	-	-	-	-	-	-	-	18	A-2-6 (V)	
SOFT TO MEDIUM STIFF, ORANGISH BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, CONTAINS IRON STAINING, MOIST	512.8	42 43 44 45	5 8 8	24	67	SS-15	0.50	5	16	14	34	31	34	20	14	24	A-6a (8)	
VERY STIFF, DARK GRAY, **SILT AND CLAY**, SOME SAND, LITTLE STONE FRAGMENTS, RELIC SHALE ROCK STRUCTURE, MOIST	507.8	46 47 48 49	5 9 50/4"	-	63	SS-16	2.50	-	-	-	-	-	-	-	-	26	A-6a (V)	
SHALE, DARK GRAY AND GRAY, SEVERELY WEATHERED, VERY WEAK, FISSILE.	504.7	TR 50 51 52 53 54	50/5"	-	80	SS-17	-	-	-	-	-	-	-	-	-	15	Rock (V)	
SHALE, DARK GRAY AND GRAY, SLIGHTLY TO MODERATELY WEATHERED, WEAK TO SLIGHTLY STRONG, LAMINATED, FISSILE, BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 61.0'-61.7', HIGHLY FRACTURED TO MODERATELY FRACTURED, NARROW TO TIGHT, SLIGHTLY ROUGH, LAMINATED, FAIR TO POOR SURFACE CONDITION; RQD 46%, REC 89%.	499.6	55 56 57 58 59 60 61	48		77	NQ2-1											CORE	
			68		96	NQ2-2											CORE	

PID: 100889	SFN:	PROJECT: PIK-104-6.27	STATION / OFFSET: 330+71, 10' LT.	START: 9/28/21	END: 9/29/21	PG 3 OF 3	B-001-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
	492.5	63	22		85	NQ2-3											CORE	
	488.6	EOB 64 65 66																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. ADDED WATER AS CIRCULATING FLUID AT 18.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 120 GAL. BENTONITE GROUT

PROJECT: PIK-104-6.27	DRILLING FIRM / OPERATOR: CENTRAL STAR / MJ	DRILL RIG: CME 55X CS	STATION / OFFSET: 331+18, 7' RT.	EXPLORATION ID B-002-0-21
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / ASHBAUGH	HAMMER: CME AUTOMATIC	ALIGNMENT: SR-104	
PID: 100889 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 12/3/19	ELEVATION: 533.0 (MSL) EOB: 49.3 ft.	PAGE 1 OF 2
START: 9/29/21 END: 9/29/21	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 90*	LAT / LONG: 39.043245, -83.052687	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
LOWERED AUGERS 21.0' THROUGH BRIDGE DECK TO GROUND SURFACE	533.0																	
VERY SOFT, BROWNISH GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, CONTAINS TRACE BLACK ORGANICS, SLIGHTLY ORGANIC, MOIST	531.5	1	2 2 2	6	67	SS-1	0.20	5	5	13	52	25	34	21	13	29	A-6a (9)	
SOFT, BROWNISH GRAY, **SILT**, SOME SAND, LITTLE CLAY, TRACE GRAVEL, CONTAINS TRACE BLACK ORGANICS, SLIGHTLY ORGANIC, MOIST	530.0	2	0 1 2	5	78	SS-2	0.25	0	3	27	53	17	29	20	9	28	A-4b (7)	
SOFT, BROWNISH GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, WET		3	0 0 0	0	100	SS-3	0.25	0	2	17	55	26	35	22	13	34	A-6a (9)	
	527.0	4																
VERY LOOSE, BROWNISH GRAY, **SILT**, SOME CLAY, LITTLE SAND, LITTLE GRAVEL, WET		5	0 0 2	3	56	SS-4	0.40	0	0	6	60	34	37	22	15	35	A-6a (10)	
		6	0 0 1	2	100	SS-5	-	12	4	9	53	22	NP	NP	NP	33	A-4b (8)	
W 525.5		7																
	524.5	8	1 1 1	3	100	SS-6A	-	-	-	-	-	-	-	-	-	33	A-4b (V)	
MEDIUM DENSE TO VERY DENSE, BROWNISH GRAY, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, MOIST TO WET		9				SS-6B	-	-	-	-	-	-	-	-	-	20	A-1-b (V)	
		10																
		11	2 4 4	12	56	SS-7	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
		12																
		13																
		14	2 5 7	18	44	SS-8	-	-	-	-	-	-	-	-	-	16	A-1-b (V)	
		15																
		16																
		17	5 15 20	53	100	SS-9	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	
		18																
		19	32 50	-	100	SS-10	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
	512.5	20																
DENSE, BROWN, **STONE FRAGMENTS WITH SAND AND SILT**, LITTLE CLAY, WET		21																
		22	13 11 12	35	89	SS-11	-	-	-	-	-	-	-	-	-	19	A-2-4 (V)	
	510.0	23																
MEDIUM DENSE, ORANGISH BROWN BECOMING BROWNISH GRAY, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, CONTAINS IRON STAINING, WET		24	7 7 9	24	89	SS-12	-	23	12	10	40	15	NP	NP	NP	18	A-4a (4)	
	507.5	25																
STIFF, BROWNISH GRAY, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, MOIST		26																
		27																
		28																
		29	7 10 11	32	100	SS-13	1.50	12	17	15	28	28	36	20	16	23	A-6b (7)	

PID: 100889	SFN:	PROJECT: PIK-104-6.27	STATION / OFFSET: 331+18, 7' RT.	START: 9/29/21	END: 9/29/21	PG 2 OF 2	B-002-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF, BROWNISH GRAY, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, MOIST *(continued)*	503.0																	
VERY DENSE, GRAY, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, WET	501.2	31 32 33																
		34	36 20 27	71	100	SS-14	-	-	-	-	-	-	-	-	-	19	A-1-b (V)	
	496.2	35 36 37 38																
HARD, DARK GRAY, **SILTY CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, RELIC SHALE ROCK STRUCTURE, DAMP	493.7	TR 39	30 50/3"	-	100	SS-15	4.25	-	-	-	-	-	-	-	-	14	A-6b (V)	
SHALE, DARK GRAY AND GRAY, SLIGHTLY TO MODERATELY WEATHERED, WEAK TO SLIGHTLY STRONG, LAMINATED, FISSILE, CONTAINS A 1.0" LIMESTONE SEAM AT 48.8', BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 40.0'-40.3', 43.0'-43.1', AND 44.7'-44.8', HIGHLY FRACTURED TO MODERATELY FRACTURED, NARROW TO TIGHT, SLIGHTLY ROUGH, LAMINATED, GOOD TO FAIR SURFACE CONDITION; RQD 37%, REC 97%.		40 41	18		91	NQ2-1												CORE	
@45.8' TO 46.2'; Qu = 1252 PSI @ 1.6%		42 43 44 45 46	22		100	NQ2-2											CORE	
		47 48	76		96	NQ2-3											CORE	
	483.7	EOB 49																

NOTES: GROUNDWATER ENCOUNTERED AT 7.5' DURING DRILLING. HOLE DID NOT CAVE. ADDED WATER AS CIRCULATING FLUID AT 13.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 80 GAL. BENTONITE GROUT; POURED 2 BAGS HOLE PLUG

PROJECT: PIK-104-6.27	DRILLING FIRM / OPERATOR: CENTRAL STAR / MJ	DRILL RIG: CME 55X CS	STATION / OFFSET: 331+92, 8' LT.	EXPLORATION ID B-003-0-21
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / ASHBAUGH	HAMMER: CME AUTOMATIC	ALIGNMENT: SR-104	
PID: 100889 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 12/3/19	ELEVATION: 539.2 (MSL) EOB: 61.0 ft.	PAGE 1 OF 2
START: 9/30/21 END: 9/30/21	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 90*	LAT / LONG: 39.043453, -83.052696	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
LOWERED AUGERS 15.5' THROUGH BRIDGE DECK TO GROUND SURFACE VERY STIFF TO HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE TO LITTLE GRAVEL, CONTAINS TRACE ROOTS AND WOOD FRAGMENTS, SLIGHTLY ORGANIC, DAMP TO MOIST	539.2	1	3 3 4	11	83	SS-1	4.50	2	4	9	38	47	35	24	11	17	A-6a (8)	
		2	5 8 13	32	44	SS-2	3.25	12	7	10	34	37	34	22	12	20	A-6a (8)	
		3	5 11 4	23	56	SS-3	2.50	3	4	9	46	38	36	23	13	22	A-6a (9)	
		4	3 4 6	15	89	SS-4	2.75	0	2	11	58	29	33	22	11	23	A-6a (8)	
	533.2	5																
STIFF, BROWN, **SILT**, SOME CLAY, LITTLE SAND, TRACE GRAVEL, MOIST	531.7	6	2 2 2	6	100	SS-5	1.25	0	0	18	54	28	31	22	9	27	A-4b (8)	
SOFT TO STIFF, BROWN AND GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, TRACE TO LITTLE GRAVEL, MOIST		7	1 1 2	5	100	SS-6	1.25	16	1	9	46	28	34	22	12	27	A-6a (9)	
		8	0 1 2	5	100	SS-7	0.50	-	-	-	-	-	-	-	-	29	A-6a (V)	
		9																
		10																
		11	0 0 2	3	67	SS-8	0.75	0	0	14	51	35	35	22	13	30	A-6a (9)	
	526.2	12																
VERY LOOSE, GRAY, **COARSE AND FINE SAND**, LITTLE TO SOME SILT, TRACE CLAY, TRACE GRAVEL, CONTAINS TRACE WOOD FRAGMENTS, WET	W 526.2	13																
		14	2 1 1	3	100	SS-9	-	-	-	-	-	-	-	-	-	31	A-3a (V)	
		15																
		16																
		17	0 0 0	0	100	SS-10	-	-	-	-	-	-	-	-	-	35	A-3a (V)	
	521.2	18																
LOOSE TO MEDIUM DENSE, BROWN AND GRAY, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, MOIST TO WET		19	3 2 3	8	56	SS-11	-	-	-	-	-	-	-	-	-	16	A-1-b (V)	
		20																
		21																
		22	3 2 3	8	67	SS-12	-	-	-	-	-	-	-	-	-	15	A-1-b (V)	
		23																
		24	7 7 10	26	67	SS-13	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
		25																
		26																
		27																
		28																
@28.5'; SS-14 BECOMES VERY DENSE		29	26 11 50	92	100	SS-14	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/14/22 15:28 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\PIK-104-6.27\GINT FILES\PIK-104-6.27.GPJ

PID: 100889	SFN:	PROJECT: PIK-104-6.27	STATION / OFFSET: 331+92, 8' LT.	START: 9/30/21	END: 9/30/21	PG 2 OF 2	B-003-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
LOOSE TO MEDIUM DENSE, BROWN AND GRAY, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, MOIST TO WET *(continued)*	509.2																	
VERY STIFF, GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	507.4		6 9 15	36	100	SS-15	2.75	14	15	8	27	36	33	19	14	17	A-6a (7)	
VERY STIFF, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, RELIC SHALE ROCK STRUCTURE, WET	502.4		5 9 8	26	100	SS-16	3.00	0	12	26	38	24	26	19	7	24	A-4a (5)	
VERY STIFF, DARK GRAY AND GRAY, **SANDY SILT**, SOME CLAY, LITTLE STONE FRAGMENTS, RELIC SHALE ROCK STRUCTURE, MOIST	497.4		9 7 9	24	100	SS-17	3.50	11	19	16	31	23	28	19	9	21	A-4a (4)	
SHALE, DARK GRAY, SEVERELY WEATHERED, VERY WEAK, FISSILE.	492.4	TR	50	-	67	SS-18	-	-	-	-	-	-	-	-	-	11	Rock (V)	
SHALE, DARK GRAY AND GRAY, SLIGHTLY WEATHERED, WEAK TO SLIGHTLY STRONG, LAMINATED, FISSILE, HIGHLY WEATHERED FROM 54.0'-54.4', CONTAINS A 1.0" LIMESTONE SEAM AT 54.4', BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 59.8'-60.3', HIGHLY FRACTURED TO MODERATELY FRACTURED, SLIGHTLY FRACTURED FROM 55.2'-57.2', NARROW TO TIGHT, SLIGHTLY ROUGH, LAMINATED, GOOD TO FAIR SURFACE CONDITION; RQD 49%, REC 97%.	488.2		60		88	NQ2-1											CORE	
			59		100	NQ2-2											CORE	
			31		96	NQ2-3											CORE	
	478.2	EOB																

NOTES: GROUNDWATER ENCOUNTERED AT 13.0' DURING DRILLING. HOLE DID NOT CAVE. ADDED WATER AS CIRCULATING FLUID AT 18.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 100 GAL. BENTONITE GROUT; POURED 2 BAGS HOLE PLUG

PROJECT: PIK-104-6.27	DRILLING FIRM / OPERATOR: CENTRAL STAR / MJ	DRILL RIG: CME 55X CS	STATION / OFFSET: 332+40, 12' RT.	EXPLORATION ID B-004-0-21
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / ASHBAUGH	HAMMER: CME AUTOMATIC	ALIGNMENT: SR-104	
PID: 100889 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 12/3/19	ELEVATION: 553.9 (MSL) EOB: 80.8 ft.	PAGE 1 OF 3
START: 9/28/21 END: 9/28/21	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 90*	LAT / LONG: 39.043570, -83.052593	

MATERIAL DESCRIPTION AND NOTES	ELEV. 553.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
8.5" ASPHALT AND 6.0" BASE (DRILLERS DESCRIPTION)	552.7	1																
MEDIUM DENSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, DAMP	551.9	2	4 3 8	17	56	SS-1A	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
						SS-1B	2.75	12	9	13	34	32	32	19	13	17	A-6a (7)	
VERY STIFF TO HARD, BROWNISH GRAY BECOMING ORANGISH BROWN, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST		3 4	8 4 4	12	67	SS-2	2.75	7	12	13	36	32	30	18	12	18	A-6a (7)	
		5	3 3 4	11	89	SS-3	3.75	-	-	-	-	-	-	-	-	23	A-6a (V)	
@6.0' TO 9.0'; CONTAINS IRON STAINING		6 7	2 3 3	9	100	SS-4	4.00	6	9	7	40	38	35	21	14	21	A-6a (10)	
		8	5 6 5	17	78	SS-5	4.25	-	-	-	-	-	-	-	-	21	A-6a (V)	
	544.4	9																
STIFF TO VERY STIFF, ORANGISH BROWN AND GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, CONTAINS IRON STAINING, MOIST		10 11	4 4 4	12	83	SS-6	2.75	-	-	-	-	-	-	-	-	28	A-6b (V)	
		12 13	3 4 4	12	94	SS-7	2.50	-	-	-	-	-	-	-	-	28	A-6b (V)	
		14 15	2 2 3	8	100	SS-8	1.50	7	7	8	39	39	39	23	16	27	A-6b (10)	
	536.9	16 17																
SOFT TO STIFF, BROWNISH GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST TO WET		18 19	1 1 2	5	100	SS-9	1.00	0	1	7	56	36	37	24	13	31	A-6a (9)	
		20 21	1 1 2	5	100	SS-10	0.50	-	-	-	-	-	-	-	-	31	A-6a (V)	
		22 23	1 1 2	5	100	SS-11	0.75	-	-	-	-	-	-	-	-	32	A-6a (V)	
		24 25	2 1 2	5	100	SS-12	0.50	0	0	17	58	25	30	17	13	29	A-6a (9)	
		26 27 28 29																

PID: 100889	SFN:	PROJECT: PIK-104-6.27	STATION / OFFSET: 332+40, 12' RT.	START: 9/28/21	END: 9/28/21	PG 2 OF 3	B-004-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
SOFT TO STIFF, BROWNISH GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST TO WET *(continued)*	523.9	31	1 1 2	5	100	SS-13	1.00	-	-	-	-	-	-	-	-	34	A-6a (V)	
	520.6	32																
MEDIUM DENSE, GRAY, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, MOIST TO WET		33																
		34																
W 518.4		35	1 6 7	20	94	SS-14	-	-	-	-	-	-	-	-	-	19	A-1-b (V)	
		36																
		37																
		38																
		39																
		40	4 4 5	14	89	SS-15	-	-	-	-	-	-	-	-	-	16	A-1-b (V)	
		41																
		42																
		43																
		44																
		45	4 9 8	26	78	SS-16	-	-	-	-	-	-	-	-	-	20	A-1-b (V)	
		46																
		47																
		48																
		49																
		50	5 9 10	29	56	SS-17	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
	500.6	51																
VERY STIFF, LIGHT GRAYISH BROWN, **SILT**, SOME SAND, LITTLE CLAY, TRACE GRAVEL, MOIST		52																
		53																
		54																
		55	19 50/4"	-	80	SS-18	2.25	4	9	14	55	18	26	19	7	20	A-4b (8)	
	495.6	56																
VERY DENSE, GRAY, **STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, MOIST		57																
		58																
		59																
		60	13 39 18	86	100	SS-19	-	-	-	-	-	-	-	-	-	15	A-2-4 (V)	
		61																

PID: 100889	SFN:	PROJECT: PIK-104-6.27	STATION / OFFSET: 332+40, 12' RT.	START: 9/28/21	END: 9/28/21	PG 3 OF 3	B-004-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY DENSE, GRAY, **STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, MOIST *(continued)*	491.8	63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80	18 15 20	53	78	SS-20	-	-	-	-	-	-	-	-	-	18	A-2-4 (V)	
	485.9	TR																
SHALE, DARK GRAY, SEVERELY WEATHERED, VERY WEAK, FISSILE.	483.1		31 50/2"	-	75	SS-21	-	-	-	-	-	-	-	-	-	12	Rock (V)	
SHALE, DARK GRAY, SLIGHTLY TO MODERATELY WEATHERED, WEAK TO SLIGHTLY STRONG, LAMINATED, FISSILE, BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 71.9'-72.2', HIGHLY FRACTURED TO MODERATELY FRACTURED, NARROW TO TIGHT, SLIGHTLY ROUGH, LAMINATED, GOOD TO FAIR SURFACE CONDITION; RQD 51%, REC 93%. @77.3' TO 77.6'; Qu = 1014 PSI @ 2.5%			51		93	NQ2-1											CORE	
	473.1	EOB																

NOTES: GROUNDWATER ENCOUNTERED AT 35.5' DURING DRILLING. HOLE DID NOT CAVE. ADDED WATER AS CIRCULATING FLUID AT 40.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; PUMPED 110 GAL. BENTONITE GROUT; POURED 1 BAG HOLE PLUG

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-001-0-21

Run #:	Depth		Recovery		RQD	
NQ2-1	55.0’	56.4’	13”/17”	77%	8”/17”	48%
NQ2-2	56.4’	61.4’	57.5”/60”	96%	40.5”/60”	68%
NQ2-3	61.4’	66.0’	47”/55”	85%	12”/55”	22%
PIK-104-6.27						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-002-0-21

Run #:	Depth		Recovery		RQD	
NQ2-1	39.3’	41.4’	23”/25.2”	91%	4.5”/25.2”	18%
NQ2-2	41.4’	46.4’	60”/60”	100%	13”/60”	22%
NQ2-3	46.4’	49.3’	33.5”/34.8”	96%	26.5”/34.8”	76%
PIK-104-6.27						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-003-0-21

Run #:	Depth		Recovery		RQD	
NQ2-1	51.0'	52.4'	14.75"/16.8"	88%	10"/16.8"	60%
NQ2-2	52.4'	57.4'	60"/60"	100%	35.25"/60"	59%
NQ2-3	57.4'	61.0'	41.5"/43.2"	96%	13.5"/43.2"	31%
PIK-104-6.27						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-004-0-21

Run #:	Depth		Recovery		RQD	
NQ2-1	70.8'	80.8'	111.25"/120"	93%	61"/120"	51%
PIK-104-6.27						

National Engineering & Architectural Services Inc.
5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

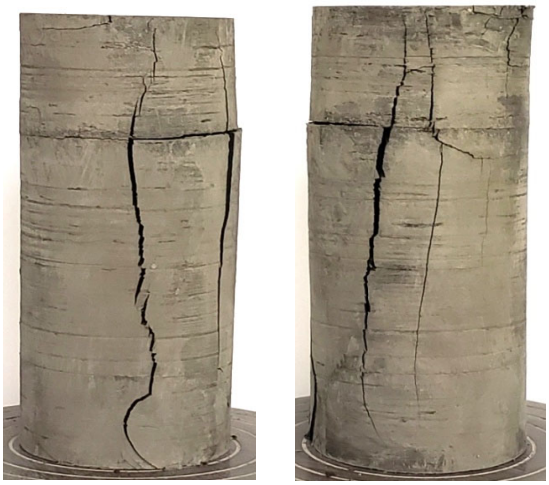
(Project: PIK-104-6.27, Boring Location: B-002-0-21, NQ2-2, Depth: 45.8 - 46.2ft)

Tested Date: 12/1/2021

Specimen Properties

Average Dia., D_{avg} (in):	1.96
Average Height, H_{avg} (in):	4.32
Length to Diameter Ratio:	2.20
Area, A (in^2):	3.03
Volume, V (in^3):	13.09
Wet Mass of Specimen (lb):	1.1
Moisture Content (%):	4.3
Dry Mass of Specimen (lb):	1.1
Wet Unit Weight, γ (lb/ft^3):	149.5
Dry Unit Weight, γ_d (lb/ft^3):	143.3

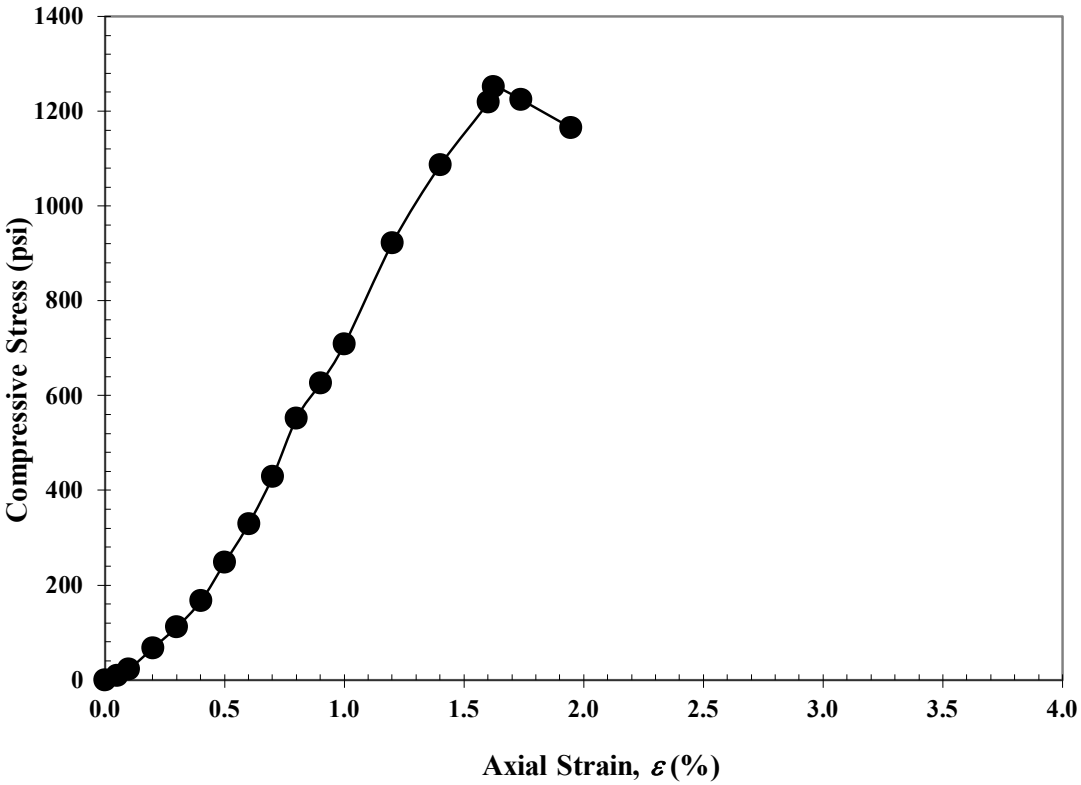
Final Specimen Figure



Results

Unconfined Compressive Strength (psi): **1252** **9** (MPa)

Strain (%): **1.6**



Notes: Shale, dark gray, slightly weathered, weak, fissile.

Sample trimming procedure does not conform to ASTM D4543 and the results reported may differ from the results obtained from a test specimen that meets the requirements of Practice D4543.

National Engineering & Architectural Services Inc.
5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: PIK-104-6.27, Boring Location: B-004-0-21, NQ2-1, Depth: 77.3 - 77.6ft)

Tested Date: 12/1/2021

Specimen Properties

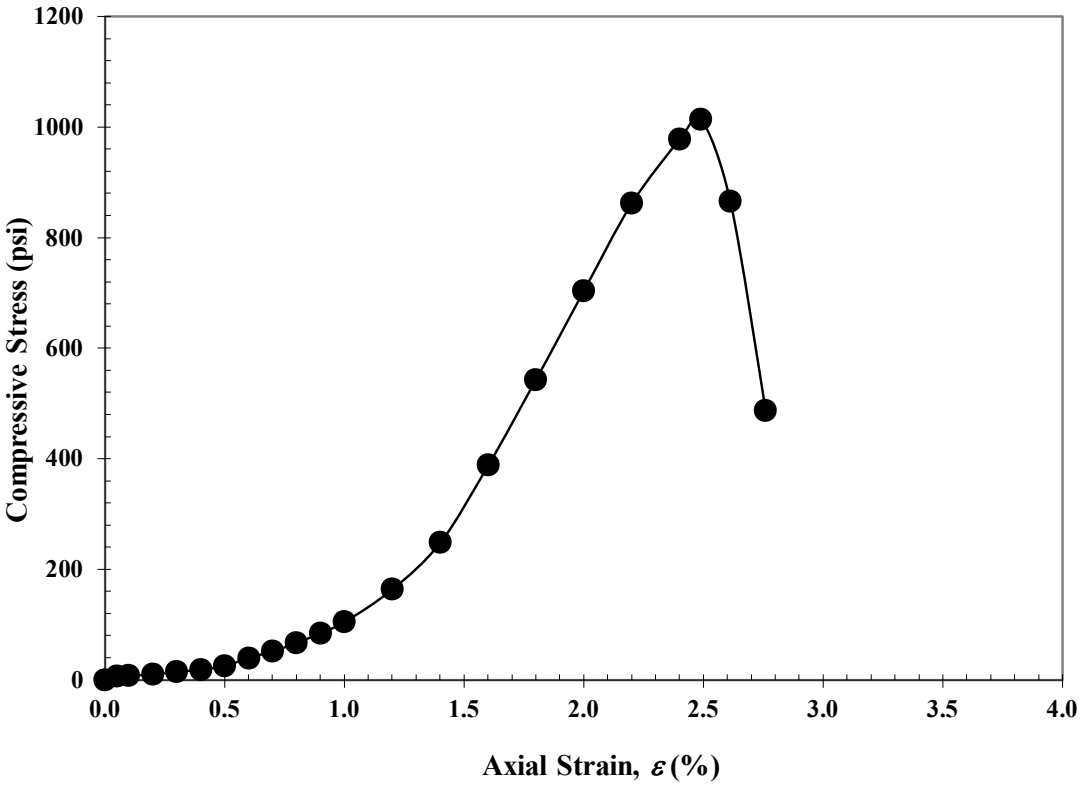
Average Dia., D_{avg} (in):	1.98
Average Height, H_{avg} (in):	4.10
Length to Diameter Ratio:	2.07
Area, A (in^2):	3.07
Volume, V (in^3):	12.59
Wet Mass of Specimen (lb):	1.1
Moisture Content (%):	4.4
Dry Mass of Specimen (lb):	1.0
Wet Unit Weight, γ (lb/ft^3):	150.0
Dry Unit Weight, γ_d (lb/ft^3):	143.7

Final Specimen Figure

Results

Unconfined Compressive Strength (psi): **1014** **7** (MPa)

Strain (%): **2.5**



Notes: Shale, dark gray, moderately weathered, weak, fissile.

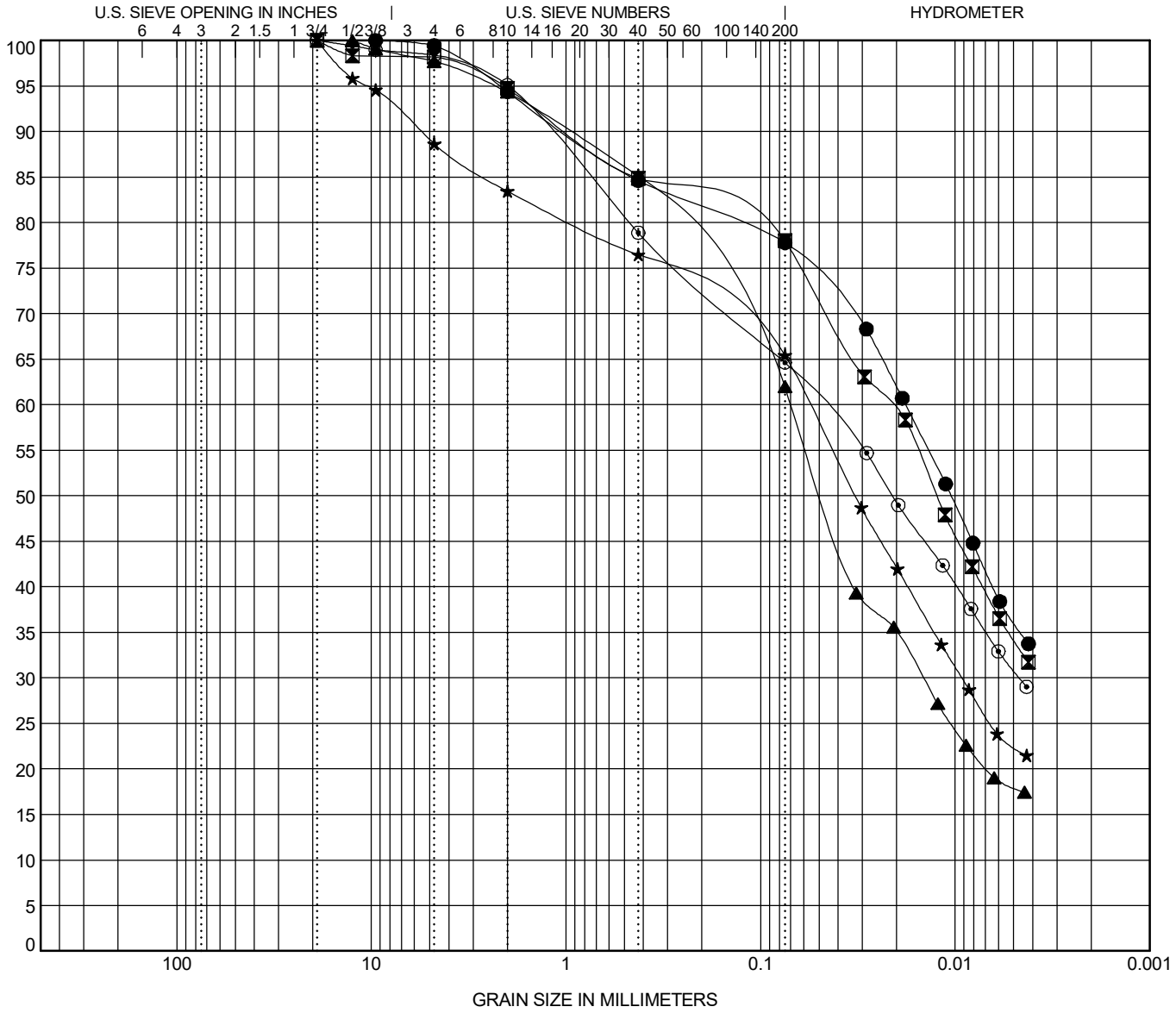
Sample trimming procedure does not conform to ASTM D4543 and the results reported may differ from the results obtained from a test specimen that meets the requirements of Practice D4543.

GRAIN SIZE DISTRIBUTION

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT PIK-104-6.27 **PID**

OGE NUMBER 0 **PROJECT TYPE**



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification			ODOT (Modified AASHTO) ~ USCS Classification	LL	PL	PI
●	B-001-0-21	1.5	**A-6a ~ LEAN CLAY with SAND(CL)**	**30**	**19**	**11**
⊠	B-001-0-21	3.0	**A-6a ~ LEAN CLAY with SAND(CL)**	**34**	**20**	**14**
▲	B-001-0-21	8.5	**A-4a ~ SANDY LEAN CLAY(CL)**	**28**	**19**	**9**
★	B-001-0-21	13.5	**A-6a ~ SANDY LEAN CLAY(CL)**	**36**	**22**	**14**
⊙	B-001-0-21	43.5	**A-6a ~ SANDY LEAN CLAY(CL)**	**34**	**20**	**14**

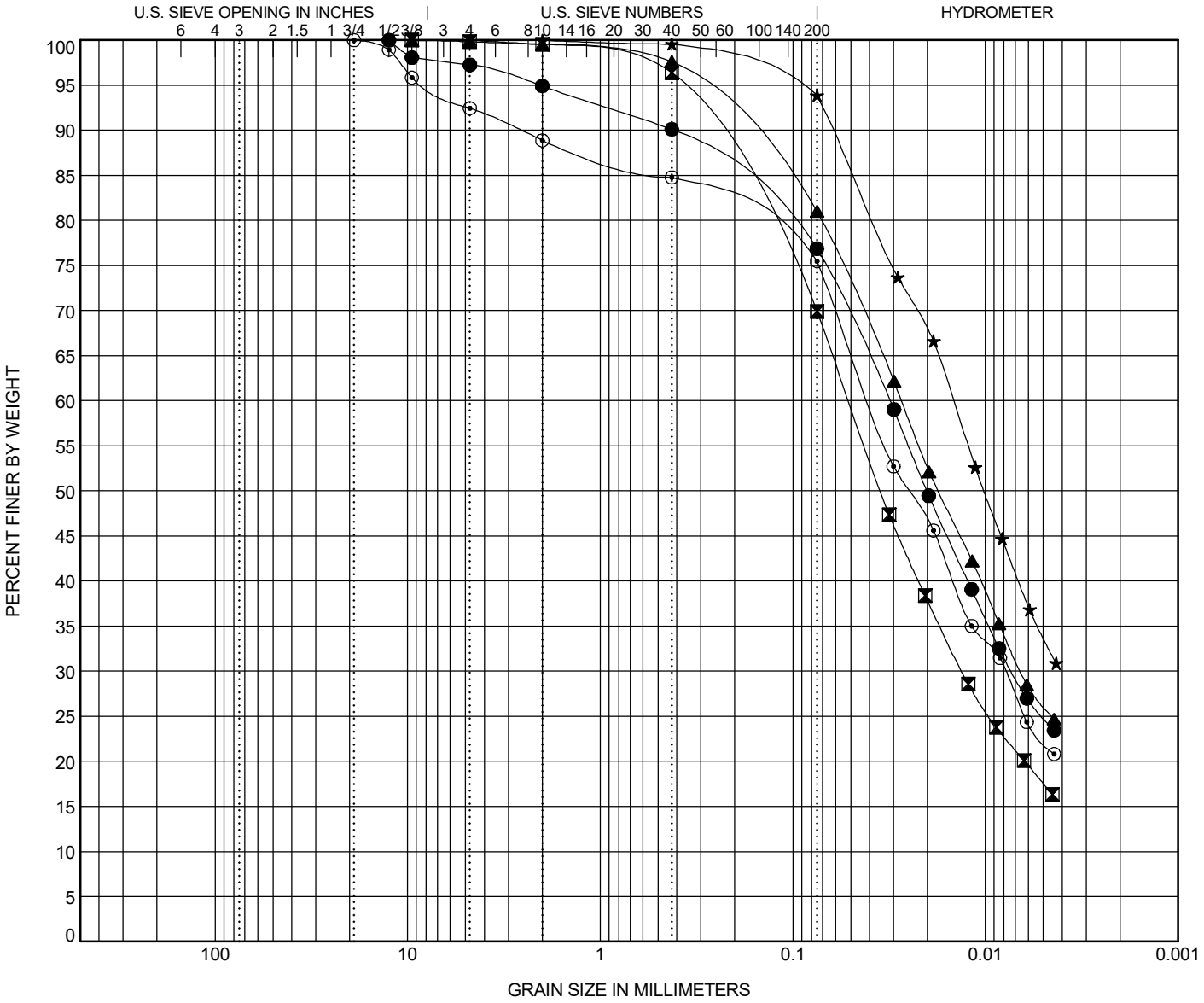
Specimen Identification			D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	B-001-0-21	1.5	**0.996**	**0.01**			**5**	**10**	**7**	**42**	**36**		
⊠	B-001-0-21	3.0	**0.947**	**0.012**			**5**	**10**	**7**	**44**	**34**		
▲	B-001-0-21	8.5	**0.965**	**0.048**	**0.015**		**6**	**9**	**23**	**44**	**18**		
★	B-001-0-21	13.5	**5.549**	**0.033**	**0.009**		**17**	**7**	**11**	**42**	**23**		
⊙	B-001-0-21	43.5	**1.228**	**0.021**	**0.005**		**5**	**16**	**14**	**34**	**31**		

GRAIN SIZE DISTRIBUTION

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT PIK-104-6.27 **PID**

OGE NUMBER 0 **PROJECT TYPE**



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification			ODOT (Modified AASHTO) ~ USCS Classification	LL	PL	PI
●	B-002-0-21	0.0	**A-6a ~ LEAN CLAY with SAND(CL)**	**34**	**21**	**13**
⊠	B-002-0-21	1.5	**A-4b ~ SANDY LEAN CLAY(CL)**	**29**	**20**	**9**
▲	B-002-0-21	3.0	**A-6a ~ LEAN CLAY with SAND(CL)**	**35**	**22**	**13**
★	B-002-0-21	4.5	**A-6a ~ LEAN CLAY(CL)**	**37**	**22**	**15**
⊙	B-002-0-21	6.0	**A-4b ~ SILT with SAND(ML)**	**NP**	**NP**	**NP**

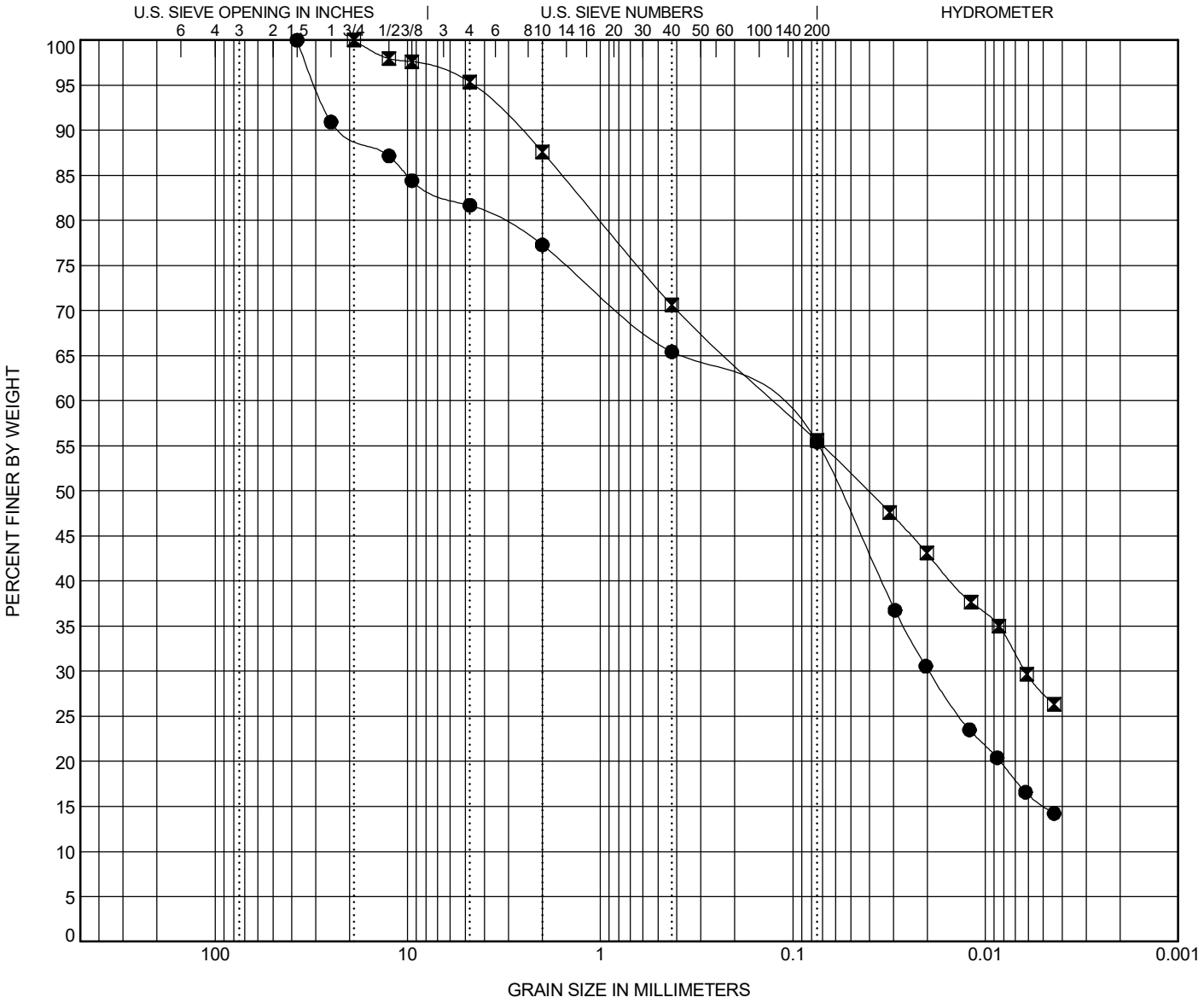
Specimen Identification			D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	B-002-0-21	0.0	**0.419**	**0.02**	**0.007**		**5**	**5**	**13**	**52**	**25**		
⊠	B-002-0-21	1.5	**0.279**	**0.035**	**0.013**		**0**	**3**	**27**	**53**	**17**		
▲	B-002-0-21	3.0	**0.192**	**0.018**	**0.007**		**0**	**2**	**17**	**55**	**26**		
★	B-002-0-21	4.5	**0.062**	**0.01**			**0**	**0**	**6**	**60**	**34**		
⊙	B-002-0-21	6.0	**2.62**	**0.025**	**0.008**		**12**	**4**	**9**	**53**	**22**		

GRAIN SIZE DISTRIBUTION

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT PIK-104-6.27 **PID**

OGE NUMBER 0 **PROJECT TYPE**



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		ODOT (Modified AASHTO) ~ USCS Classification	LL	PL	PI
●	**B-002-0-21**	**23.5**	**A-4a ~ SANDY SILT with GRAVEL(ML)**	**NP**	**NP**	**NP**
⊠	**B-002-0-21**	**28.5**	**A-6b ~ SANDY LEAN CLAY(CL)**	**36**	**20**	**16**

	Specimen Identification		D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	**B-002-0-21**	**23.5**	**21.08**	**0.057**	**0.02**		**23**	**12**	**10**	**40**	**15**		
⊠	**B-002-0-21**	**28.5**	**2.606**	**0.041**	**0.006**		**12**	**17**	**15**	**28**	**28**		

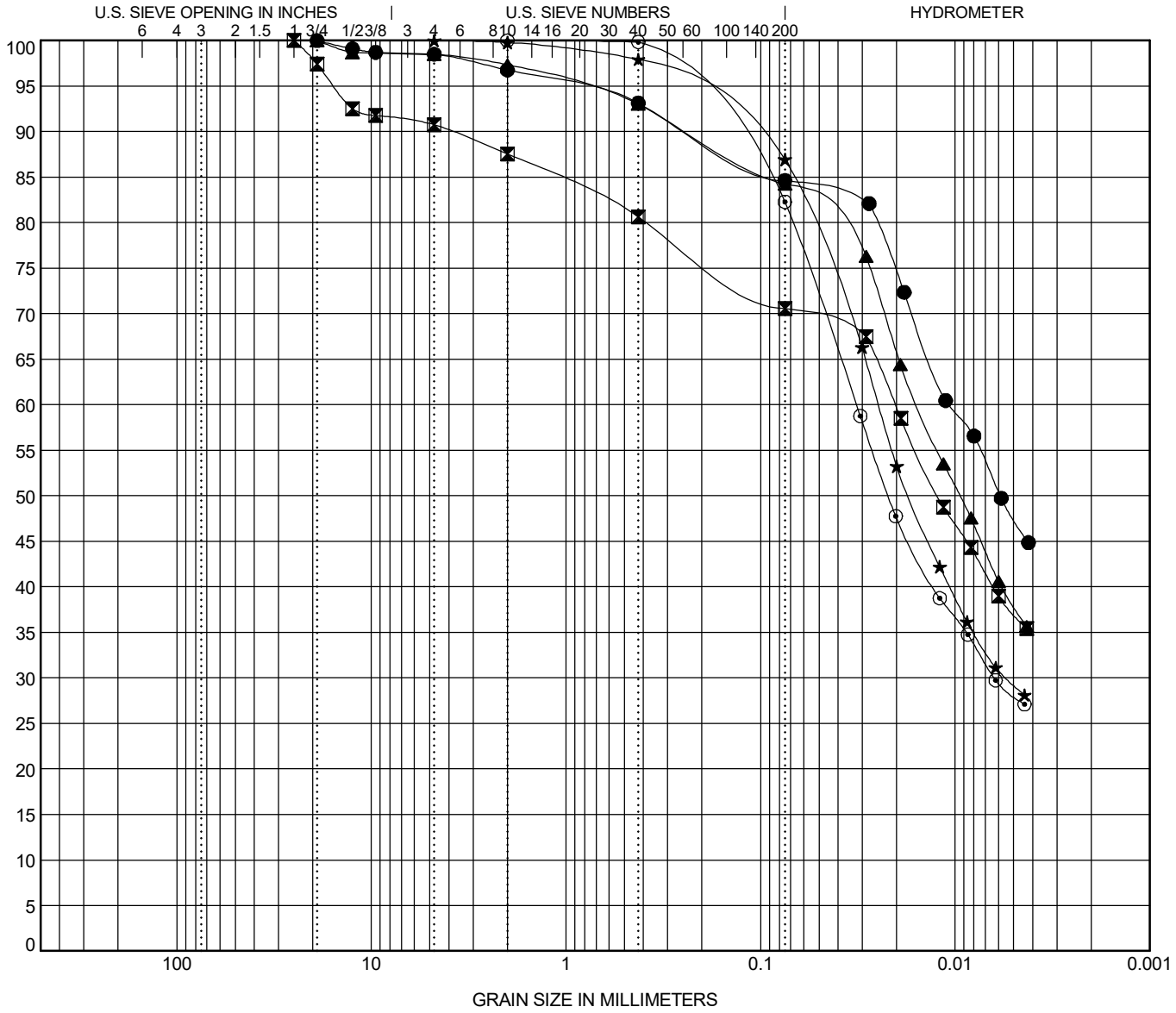
GRAIN SIZE - OH DOT.GDT - 1/6/22 13:48 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\PIK-104-6.27\GINT FILES\PIK-104-6.27.GPJ

GRAIN SIZE DISTRIBUTION

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT PIK-104-6.27 **PID**

OGE NUMBER 0 **PROJECT TYPE**



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification			ODOT (Modified AASHTO) ~ USCS Classification	LL	PL	PI
●	B-003-0-21	0.0	**A-6a ~ LEAN CLAY with SAND(CL)**	**35**	**24**	**11**
⊠	B-003-0-21	1.5	**A-6a ~ LEAN CLAY with SAND(CL)**	**34**	**22**	**12**
▲	B-003-0-21	3.0	**A-6a ~ LEAN CLAY with SAND(CL)**	**36**	**23**	**13**
★	B-003-0-21	4.5	**A-6a ~ LEAN CLAY(CL)**	**33**	**22**	**11**
⊙	B-003-0-21	6.0	**A-4b ~ LEAN CLAY with SAND(CL)**	**31**	**22**	**9**

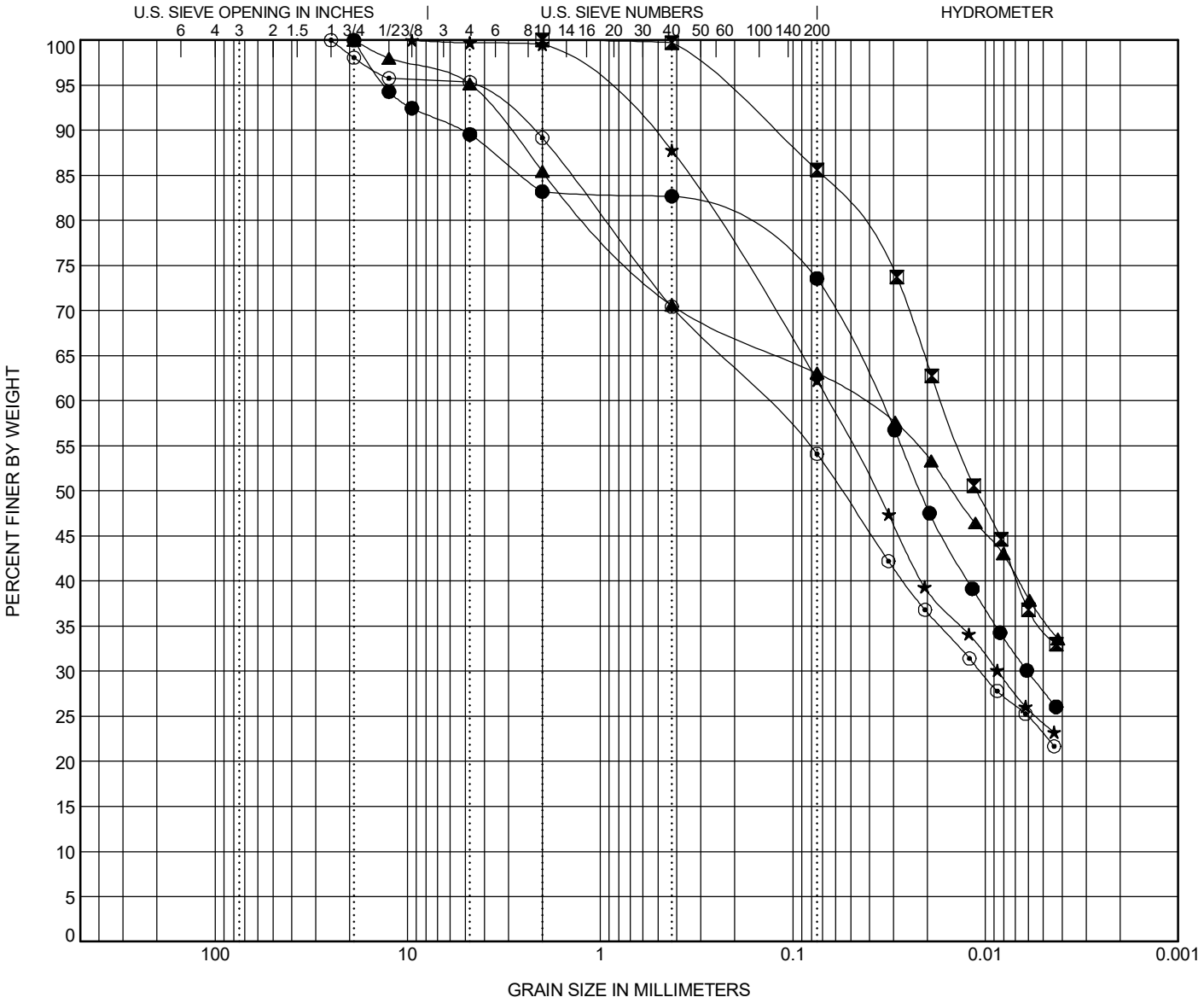
Specimen Identification			D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	B-003-0-21	0.0	**0.224**	**0.006**			**2**	**4**	**9**	**38**	**47**		
⊠	B-003-0-21	1.5	**3.869**	**0.012**			**12**	**7**	**10**	**34**	**37**		
▲	B-003-0-21	3.0	**0.234**	**0.009**			**3**	**4**	**9**	**46**	**38**		
★	B-003-0-21	4.5	**0.121**	**0.017**	**0.005**		**0**	**2**	**11**	**58**	**29**		
⊙	B-003-0-21	6.0	**0.161**	**0.022**	**0.006**		**0**	**0**	**18**	**54**	**28**		

GRAIN SIZE DISTRIBUTION

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT PIK-104-6.27 **PID**

OGE NUMBER 0 **PROJECT TYPE**



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification			ODOT (Modified AASHTO) ~ USCS Classification	LL	PL	PI
●	B-003-0-21	7.5	**A-6a ~ LEAN CLAY with SAND(CL)**	**34**	**22**	**12**
⊠	B-003-0-21	11.0	**A-6a ~ LEAN CLAY(CL)**	**35**	**22**	**13**
▲	B-003-0-21	33.5	**A-6a ~ SANDY LEAN CLAY(CL)**	**33**	**19**	**14**
★	B-003-0-21	38.5	**A-4a ~ SANDY SILTY CLAY(CL-ML)**	**26**	**19**	**7**
⊙	B-003-0-21	43.5	**A-4a ~ SANDY LEAN CLAY(CL)**	**28**	**19**	**9**

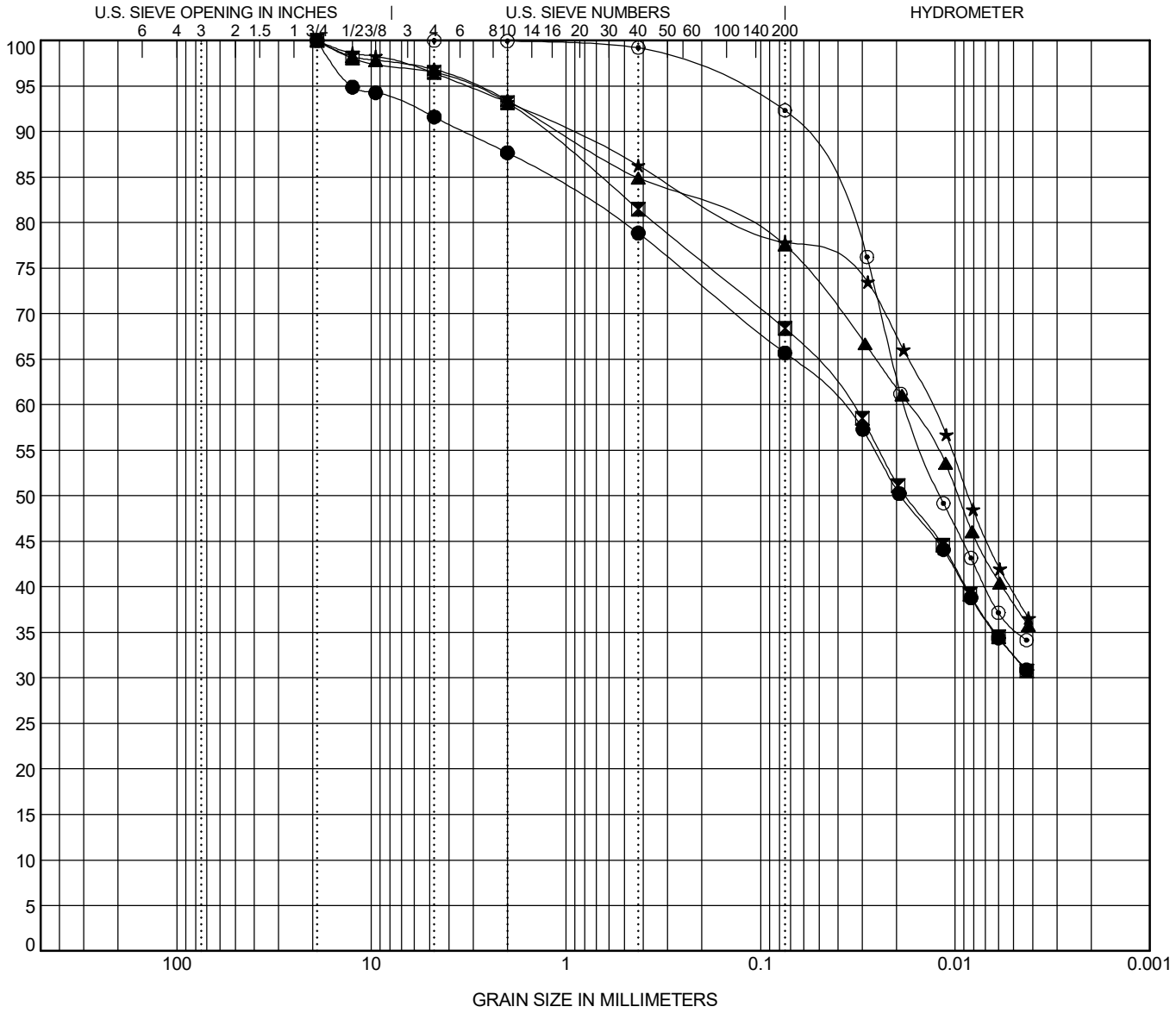
Specimen Identification			D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	B-003-0-21	7.5	**5.278**	**0.022**	**0.006**		**16**	**1**	**9**	**46**	**28**		
⊠	B-003-0-21	11.0	**0.129**	**0.011**			**0**	**0**	**14**	**51**	**35**		
▲	B-003-0-21	33.5	**3.001**	**0.015**			**14**	**15**	**8**	**27**	**36**		
★	B-003-0-21	38.5	**0.567**	**0.037**	**0.009**		**0**	**12**	**26**	**38**	**24**		
⊙	B-003-0-21	43.5	**2.248**	**0.056**	**0.011**		**11**	**19**	**16**	**31**	**23**		

GRAIN SIZE DISTRIBUTION

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT PIK-104-6.27 **PID**

OGE NUMBER 0 **PROJECT TYPE**



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification			ODOT (Modified AASHTO) ~ USCS Classification	LL	PL	PI
●	B-004-0-21	2.0	A-6a ~ SANDY LEAN CLAY(CL)	32	19	13
⊠	B-004-0-21	3.0	A-6a ~ SANDY LEAN CLAY(CL)	30	18	12
▲	B-004-0-21	6.0	A-6a ~ LEAN CLAY with SAND(CL)	35	21	14
★	B-004-0-21	15.0	A-6b ~ LEAN CLAY with SAND(CL)	39	23	16
⊙	B-004-0-21	17.5	A-6a ~ LEAN CLAY(CL)	37	24	13

Specimen Identification			D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	B-004-0-21	2.0	3.329	0.019			12	9	13	34	32		
⊠	B-004-0-21	3.0	1.309	0.018			7	12	13	36	32		
▲	B-004-0-21	6.0	1.068	0.01			6	9	7	40	38		
★	B-004-0-21	15.0	0.973	0.009			7	7	8	39	39		
⊙	B-004-0-21	17.5	0.065	0.012			0	1	7	56	36		

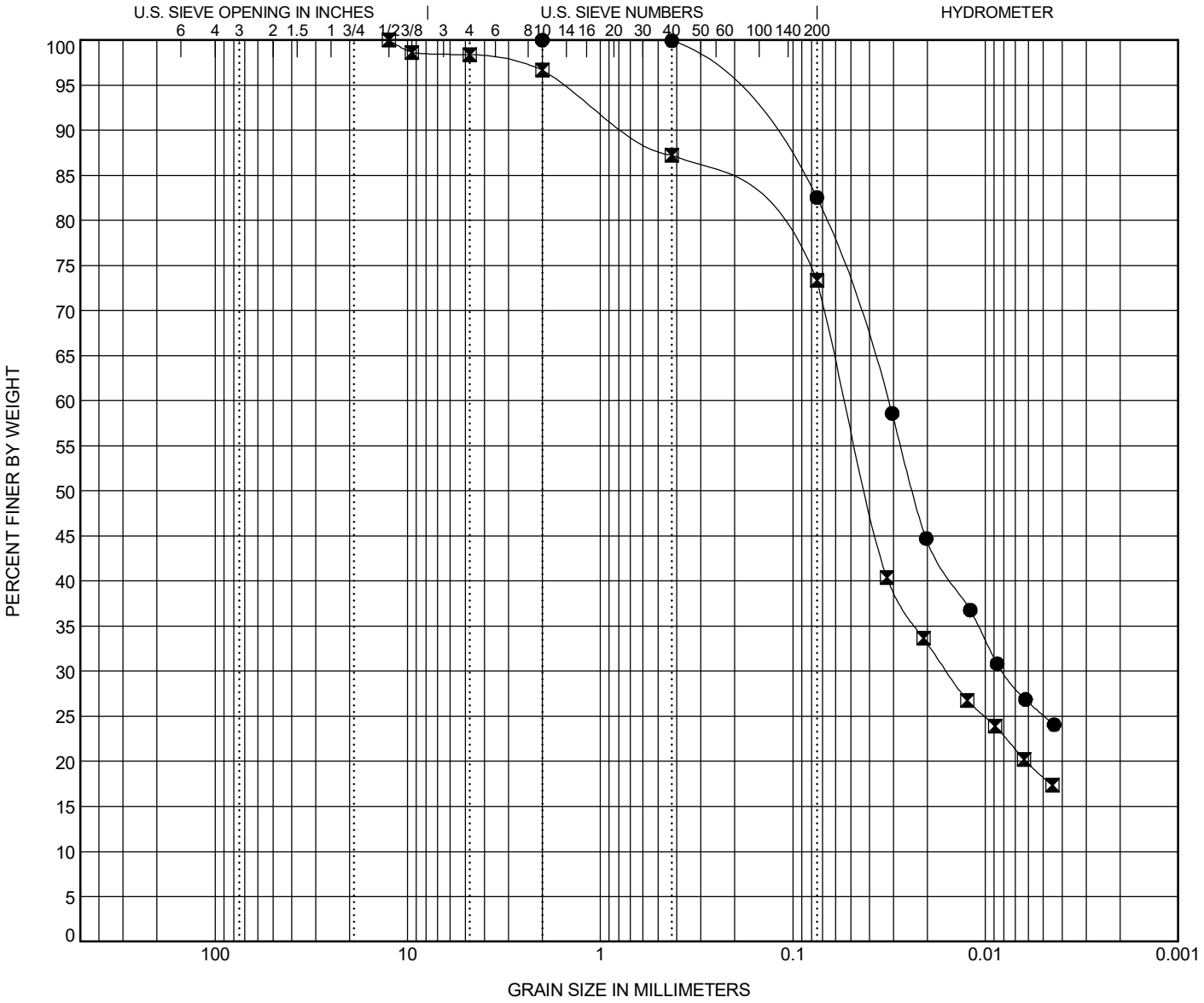
GRAIN SIZE - OH DOT.GDT - 1/6/22 13:49 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\PIK-104-6.27\GINT FILES\PIK-104-6.27.GPJ

GRAIN SIZE DISTRIBUTION

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT PIK-104-6.27 **PID**

OGE NUMBER 0 **PROJECT TYPE**



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		ODOT (Modified AASHTO) ~ USCS Classification	LL	PL	PI
●	**B-004-0-21**	**25.0**	**A-6a ~ LEAN CLAY with SAND(CL)**	**30**	**17**	**13**
⊠	**B-004-0-21**	**55.0**	**A-4b ~ SILTY CLAY with SAND(CL-ML)**	**26**	**19**	**7**

	Specimen Identification		D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	**B-004-0-21**	**25.0**	**0.158**	**0.024**	**0.008**		**0**	**0**	**17**	**58**	**25**		
⊠	**B-004-0-21**	**55.0**	**0.667**	**0.041**	**0.016**		**4**	**9**	**14**	**55**	**18**		

GRAIN SIZE - OH DOT.GDT - 1/6/22 13:49 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\PIK-104-6.27\GINT FILES\PIK-104-6.27.GPJ

APPENDIX C

GEOTECHNICAL BULLETIN 1 (GB1)
SUBGRADE ANALYSIS

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

PIK-104-06.27

Replacement of the bridge carrying SR-104 over No Name Creek in Pike County, Ohio

NEAS, INC.

Prepared By: ZM
Date prepared: Tuesday, January 11, 2022

Chunmei (Melinda) He, Ph.D, P.E.
2800 Corporate Exchange Drive
Suite 240
Columbus, OH, 43231
614-714-0299
che@neasinc.com

NO. OF BORINGS: 2

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-21	SR-104	330+71	10	LT	CME 55X CS	90	554.6	552.6	2.0 C
2	B-004-0-21	SR-104	332+40	12	RT	CME 55X CS	90	553.9	552.6	1.3 C

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	1.5	3.0	-0.5	1.0	17		3.5	30	19	11	42	36	78	19	14	A-6a	8			Mc			
	001-0	SS-2	3.0	4.5	1.0	2.5	21		2.5	34	20	14	44	34	78	20	15	A-6a	10			Mc			
	21	SS-3	4.5	6.0	2.5	4.0	15		3.5							18	14	A-6a	10						
		SS-4	6.0	7.5	4.0	5.5	11	11	2							15	10	A-4a	8						
2	B	SS-1A	1.5	2.0	0.2	0.7	17									11	6	A-1-b	0						
	004-0	SS-1B	2.0	3.0	0.7	1.7	17		2.75	32	19	13	34	32	66	17	14	A-6a	7			Mc			
	21	SS-2	3.0	4.5	1.7	3.2	12		2.75	30	18	12	36	32	68	18	14	A-6a	7			N_{60} & Mc			
		SS-3	4.5	6.0	3.2	4.7	11	11	3.75							23	14	A-6a	10						

PID:

County-Route-Section: PIK-104-06.27
No. of Borings: 2

Geotechnical Consultant: NEAS, INC.
Prepared By: ZM
Date prepared: 1/11/2022

Chemical Stabilization Options		
320	Rubblize & Roll	No
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	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	25%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	13%	1 < HP ≤ 2	13%
$N_{60} \geq 20$	13%	HP > 2	75%
M+	50%		
Rock	0%		
Unsuitable	0%		

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

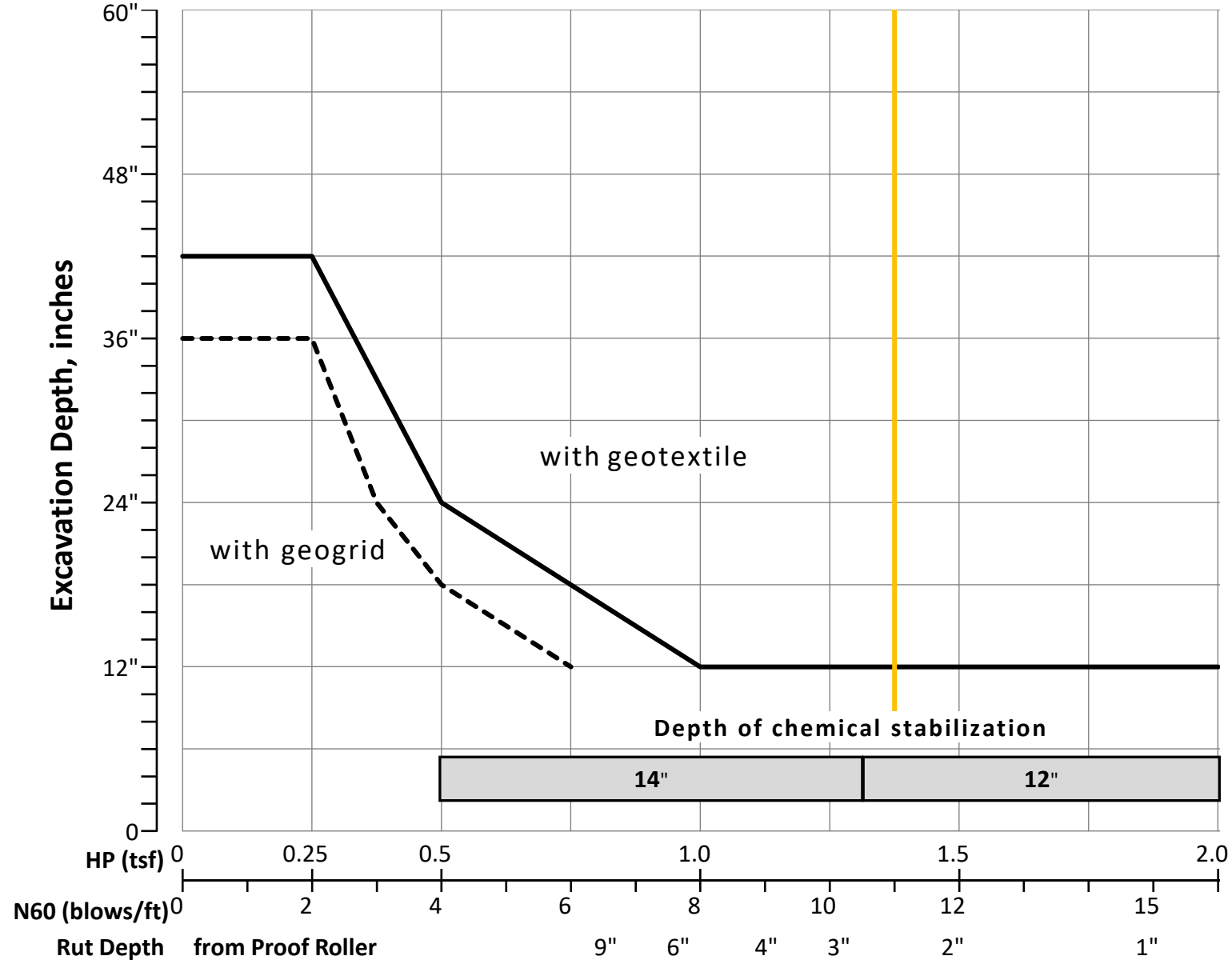
% Proposed Subgrade Surface	
Unstable & Unsuitable	67%
Unstable	67%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	15	11	2.96	32	19	13	39	34	73	18	13	8
Maximum	21	11	3.75	34	20	14	44	36	78	23	15	10
Minimum	11	11	2.00	30	18	11	34	32	66	11	6	0

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	0	0	1	0	0	0	0	0	0	1	0	0	6	0	0	0	0	0	8
Percent	0%	0%	13%	0%	0%	0%	0%	0%	0%	13%	0%	0%	75%	0%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	0%	25%									75%								100%
Surface Class Count	0	0	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	6
Surface Class Percent	0%	0%	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	83%	0%	0%	0%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
2.96	0.50	☐ HP
11.00	6.00	☐ N60L

Average HP
Average N_{60L}

APPENDIX D

DRIVEN ANALYSES

REAR ABUTMENT

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\PIK-104\RB02.DVN
Project Name: PIK-104-06.27 Project Date: 01/14/2022
Project Client: BG Engineering Group
Computed By: ZM
Project Manager: CH

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	9.15 ft	33.00%	105.00 pcf	750.00 psf	T-80 Same
2	Cohesive	1.50 ft	33.00%	105.00 pcf	600.00 psf	T-80 Same
3	Cohesive	3.00 ft	33.00%	95.00 pcf	150.00 psf	T-80 Same
4	Cohesionless	2.50 ft	33.00%	105.00 pcf	25.0/25.0	Nordlund
5	Cohesionless	7.00 ft	0.00%	122.00 pcf	30.0/30.0	Nordlund
6	Cohesionless	5.00 ft	0.00%	135.00 pcf	37.0/37.0	Nordlund
7	Cohesionless	2.50 ft	17.00%	130.00 pcf	35.0/35.0	Nordlund
8	Cohesionless	2.50 ft	17.00%	125.00 pcf	32.0/32.0	Nordlund
9	Cohesive	6.30 ft	43.00%	128.00 pcf	4000.00 psf	T-80 Same
10	Cohesionless	5.00 ft	0.00%	140.00 pcf	37.0/37.0	Nordlund
11	Cohesive	2.50 ft	43.00%	140.00 pcf	6850.00 psf	T-80 Same

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	715.25 psf	0.02 Kips
9.01 ft	Cohesive	N/A	N/A	716.10 psf	21.26 Kips
9.14 ft	Cohesive	N/A	N/A	716.28 psf	21.58 Kips
9.16 ft	Cohesive	N/A	N/A	582.11 psf	21.62 Kips
10.64 ft	Cohesive	N/A	N/A	582.11 psf	24.46 Kips
10.66 ft	Cohesive	N/A	N/A	147.60 psf	24.48 Kips
13.64 ft	Cohesive	N/A	N/A	147.60 psf	25.93 Kips
13.66 ft	Cohesionless	551.70 psf	18.33	N/A	25.94 Kips
16.14 ft	Cohesionless	604.53 psf	18.33	N/A	26.95 Kips
16.16 ft	Cohesionless	658.29 psf	21.99	N/A	26.96 Kips
23.14 ft	Cohesionless	866.29 psf	21.99	N/A	32.67 Kips
23.16 ft	Cohesionless	1075.55 psf	27.13	N/A	32.70 Kips
28.14 ft	Cohesionless	1256.33 psf	27.13	N/A	43.61 Kips
28.16 ft	Cohesionless	1438.53 psf	25.66	N/A	43.66 Kips
30.64 ft	Cohesionless	1522.35 psf	25.66	N/A	49.00 Kips
30.66 ft	Cohesionless	1607.50 psf	23.46	N/A	49.04 Kips
33.14 ft	Cohesionless	1685.13 psf	23.46	N/A	53.75 Kips
33.16 ft	Cohesive	N/A	N/A	952.00 psf	53.80 Kips
39.44 ft	Cohesive	N/A	N/A	952.00 psf	73.51 Kips
39.46 ft	Cohesionless	2177.36 psf	27.13	N/A	73.58 Kips
44.44 ft	Cohesionless	2370.58 psf	27.13	N/A	94.17 Kips
44.46 ft	Cohesive	N/A	N/A	1630.30 psf	94.27 Kips
46.94 ft	Cohesive	N/A	N/A	1630.30 psf	107.60 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
9.14 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
9.16 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
10.64 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
10.66 ft	Cohesive	N/A	N/A	N/A	0.12 Kips
13.64 ft	Cohesive	N/A	N/A	N/A	0.12 Kips
13.66 ft	Cohesionless	551.92 psf	15.00	1.15 Kips	0.34 Kips
16.14 ft	Cohesionless	657.56 psf	15.00	1.15 Kips	0.40 Kips
16.16 ft	Cohesionless	658.59 psf	30.00	1.15 Kips	0.99 Kips
23.14 ft	Cohesionless	1074.59 psf	30.00	1.15 Kips	1.15 Kips
23.16 ft	Cohesionless	1075.92 psf	91.20	17.74 Kips	5.98 Kips
28.14 ft	Cohesionless	1437.46 psf	91.20	17.74 Kips	7.99 Kips
28.16 ft	Cohesionless	1438.87 psf	64.00	9.27 Kips	5.29 Kips
30.64 ft	Cohesionless	1606.51 psf	64.00	9.27 Kips	5.89 Kips
30.66 ft	Cohesionless	1607.82 psf	40.40	2.84 Kips	2.84 Kips
33.14 ft	Cohesionless	1763.06 psf	40.40	2.84 Kips	2.84 Kips
33.16 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.44 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.46 ft	Cohesionless	2177.75 psf	91.20	17.74 Kips	12.10 Kips
44.44 ft	Cohesionless	2564.19 psf	91.20	17.74 Kips	14.25 Kips
44.46 ft	Cohesive	N/A	N/A	N/A	5.31 Kips
46.94 ft	Cohesive	N/A	N/A	N/A	5.31 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	0.58 Kips	0.60 Kips
9.01 ft	21.26 Kips	0.58 Kips	21.85 Kips
9.14 ft	21.58 Kips	0.58 Kips	22.16 Kips
9.16 ft	21.62 Kips	0.46 Kips	22.09 Kips
10.64 ft	24.46 Kips	0.46 Kips	24.92 Kips
10.66 ft	24.48 Kips	0.12 Kips	24.60 Kips
13.64 ft	25.93 Kips	0.12 Kips	26.05 Kips
13.66 ft	25.94 Kips	0.34 Kips	26.28 Kips
16.14 ft	26.95 Kips	0.40 Kips	27.35 Kips
16.16 ft	26.96 Kips	0.99 Kips	27.94 Kips
23.14 ft	32.67 Kips	1.15 Kips	33.81 Kips
23.16 ft	32.70 Kips	5.98 Kips	38.67 Kips
28.14 ft	43.61 Kips	7.99 Kips	51.60 Kips
28.16 ft	43.66 Kips	5.29 Kips	48.95 Kips
30.64 ft	49.00 Kips	5.89 Kips	54.90 Kips
30.66 ft	49.04 Kips	2.84 Kips	51.89 Kips
33.14 ft	53.75 Kips	2.84 Kips	56.59 Kips
33.16 ft	53.80 Kips	3.10 Kips	56.90 Kips
39.44 ft	73.51 Kips	3.10 Kips	76.61 Kips
39.46 ft	73.58 Kips	12.10 Kips	85.68 Kips
44.44 ft	94.17 Kips	14.25 Kips	108.42 Kips
44.46 ft	94.27 Kips	5.31 Kips	99.58 Kips
46.94 ft	107.60 Kips	5.31 Kips	112.90 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	715.25 psf	0.02 Kips
9.01 ft	Cohesive	N/A	N/A	716.10 psf	14.25 Kips
9.14 ft	Cohesive	N/A	N/A	716.28 psf	14.46 Kips
9.16 ft	Cohesive	N/A	N/A	582.11 psf	14.49 Kips
10.64 ft	Cohesive	N/A	N/A	582.11 psf	16.39 Kips
10.66 ft	Cohesive	N/A	N/A	147.60 psf	16.40 Kips
13.64 ft	Cohesive	N/A	N/A	147.60 psf	17.38 Kips
13.66 ft	Cohesionless	551.70 psf	18.33	N/A	17.38 Kips
16.14 ft	Cohesionless	604.53 psf	18.33	N/A	18.05 Kips
16.16 ft	Cohesionless	658.29 psf	21.99	N/A	18.06 Kips
23.14 ft	Cohesionless	866.29 psf	21.99	N/A	23.78 Kips
23.16 ft	Cohesionless	1075.55 psf	27.13	N/A	23.80 Kips
28.14 ft	Cohesionless	1256.33 psf	27.13	N/A	34.72 Kips
28.16 ft	Cohesionless	1438.53 psf	25.66	N/A	34.76 Kips
30.64 ft	Cohesionless	1522.35 psf	25.66	N/A	39.19 Kips
30.66 ft	Cohesionless	1607.50 psf	23.46	N/A	39.23 Kips
33.14 ft	Cohesionless	1685.13 psf	23.46	N/A	43.14 Kips
33.16 ft	Cohesive	N/A	N/A	952.00 psf	43.16 Kips
39.44 ft	Cohesive	N/A	N/A	952.00 psf	54.40 Kips
39.46 ft	Cohesionless	2177.36 psf	27.13	N/A	54.47 Kips
44.44 ft	Cohesionless	2370.58 psf	27.13	N/A	75.06 Kips
44.46 ft	Cohesive	N/A	N/A	1630.30 psf	75.12 Kips
46.94 ft	Cohesive	N/A	N/A	1630.30 psf	82.71 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
9.14 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
9.16 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
10.64 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
10.66 ft	Cohesive	N/A	N/A	N/A	0.12 Kips
13.64 ft	Cohesive	N/A	N/A	N/A	0.12 Kips
13.66 ft	Cohesionless	551.92 psf	15.00	1.15 Kips	0.34 Kips
16.14 ft	Cohesionless	657.56 psf	15.00	1.15 Kips	0.40 Kips
16.16 ft	Cohesionless	658.59 psf	30.00	1.15 Kips	0.99 Kips
23.14 ft	Cohesionless	1074.59 psf	30.00	1.15 Kips	1.15 Kips
23.16 ft	Cohesionless	1075.92 psf	91.20	17.74 Kips	5.98 Kips
28.14 ft	Cohesionless	1437.46 psf	91.20	17.74 Kips	7.99 Kips
28.16 ft	Cohesionless	1438.87 psf	64.00	9.27 Kips	5.29 Kips
30.64 ft	Cohesionless	1606.51 psf	64.00	9.27 Kips	5.89 Kips
30.66 ft	Cohesionless	1607.82 psf	40.40	2.84 Kips	2.84 Kips
33.14 ft	Cohesionless	1763.06 psf	40.40	2.84 Kips	2.84 Kips
33.16 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.44 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.46 ft	Cohesionless	2177.75 psf	91.20	17.74 Kips	12.10 Kips
44.44 ft	Cohesionless	2564.19 psf	91.20	17.74 Kips	14.25 Kips
44.46 ft	Cohesive	N/A	N/A	N/A	5.31 Kips
46.94 ft	Cohesive	N/A	N/A	N/A	5.31 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	0.58 Kips	0.60 Kips
9.01 ft	14.25 Kips	0.58 Kips	14.83 Kips
9.14 ft	14.46 Kips	0.58 Kips	15.04 Kips
9.16 ft	14.49 Kips	0.46 Kips	14.95 Kips
10.64 ft	16.39 Kips	0.46 Kips	16.85 Kips
10.66 ft	16.40 Kips	0.12 Kips	16.52 Kips
13.64 ft	17.38 Kips	0.12 Kips	17.49 Kips
13.66 ft	17.38 Kips	0.34 Kips	17.72 Kips
16.14 ft	18.05 Kips	0.40 Kips	18.45 Kips
16.16 ft	18.06 Kips	0.99 Kips	19.05 Kips
23.14 ft	23.78 Kips	1.15 Kips	24.92 Kips
23.16 ft	23.80 Kips	5.98 Kips	29.78 Kips
28.14 ft	34.72 Kips	7.99 Kips	42.71 Kips
28.16 ft	34.76 Kips	5.29 Kips	40.05 Kips
30.64 ft	39.19 Kips	5.89 Kips	45.09 Kips
30.66 ft	39.23 Kips	2.84 Kips	42.07 Kips
33.14 ft	43.14 Kips	2.84 Kips	45.98 Kips
33.16 ft	43.16 Kips	3.10 Kips	46.26 Kips
39.44 ft	54.40 Kips	3.10 Kips	57.50 Kips
39.46 ft	54.47 Kips	12.10 Kips	66.57 Kips
44.44 ft	75.06 Kips	14.25 Kips	89.31 Kips
44.46 ft	75.12 Kips	5.31 Kips	80.43 Kips
46.94 ft	82.71 Kips	5.31 Kips	88.02 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	715.25 psf	0.02 Kips
9.01 ft	Cohesive	N/A	N/A	716.10 psf	21.26 Kips
9.14 ft	Cohesive	N/A	N/A	716.28 psf	21.58 Kips
9.16 ft	Cohesive	N/A	N/A	582.11 psf	21.62 Kips
10.64 ft	Cohesive	N/A	N/A	582.11 psf	24.46 Kips
10.66 ft	Cohesive	N/A	N/A	147.60 psf	24.48 Kips
13.64 ft	Cohesive	N/A	N/A	147.60 psf	25.93 Kips
13.66 ft	Cohesionless	551.70 psf	18.33	N/A	25.94 Kips
16.14 ft	Cohesionless	604.53 psf	18.33	N/A	26.95 Kips
16.16 ft	Cohesionless	658.29 psf	21.99	N/A	26.96 Kips
23.14 ft	Cohesionless	866.29 psf	21.99	N/A	32.67 Kips
23.16 ft	Cohesionless	1075.55 psf	27.13	N/A	32.70 Kips
28.14 ft	Cohesionless	1256.33 psf	27.13	N/A	43.61 Kips
28.16 ft	Cohesionless	1438.53 psf	25.66	N/A	43.66 Kips
30.64 ft	Cohesionless	1522.35 psf	25.66	N/A	49.00 Kips
30.66 ft	Cohesionless	1607.50 psf	23.46	N/A	49.04 Kips
33.14 ft	Cohesionless	1685.13 psf	23.46	N/A	53.75 Kips
33.16 ft	Cohesive	N/A	N/A	952.00 psf	53.80 Kips
39.44 ft	Cohesive	N/A	N/A	952.00 psf	73.51 Kips
39.46 ft	Cohesionless	2177.36 psf	27.13	N/A	73.58 Kips
44.44 ft	Cohesionless	2370.58 psf	27.13	N/A	94.17 Kips
44.46 ft	Cohesive	N/A	N/A	1630.30 psf	94.27 Kips
46.94 ft	Cohesive	N/A	N/A	1630.30 psf	107.60 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
9.14 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
9.16 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
10.64 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
10.66 ft	Cohesive	N/A	N/A	N/A	0.12 Kips
13.64 ft	Cohesive	N/A	N/A	N/A	0.12 Kips
13.66 ft	Cohesionless	551.92 psf	15.00	1.15 Kips	0.34 Kips
16.14 ft	Cohesionless	657.56 psf	15.00	1.15 Kips	0.40 Kips
16.16 ft	Cohesionless	658.59 psf	30.00	1.15 Kips	0.99 Kips
23.14 ft	Cohesionless	1074.59 psf	30.00	1.15 Kips	1.15 Kips
23.16 ft	Cohesionless	1075.92 psf	91.20	17.74 Kips	5.98 Kips
28.14 ft	Cohesionless	1437.46 psf	91.20	17.74 Kips	7.99 Kips
28.16 ft	Cohesionless	1438.87 psf	64.00	9.27 Kips	5.29 Kips
30.64 ft	Cohesionless	1606.51 psf	64.00	9.27 Kips	5.89 Kips
30.66 ft	Cohesionless	1607.82 psf	40.40	2.84 Kips	2.84 Kips
33.14 ft	Cohesionless	1763.06 psf	40.40	2.84 Kips	2.84 Kips
33.16 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.44 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.46 ft	Cohesionless	2177.75 psf	91.20	17.74 Kips	12.10 Kips
44.44 ft	Cohesionless	2564.19 psf	91.20	17.74 Kips	14.25 Kips
44.46 ft	Cohesive	N/A	N/A	N/A	5.31 Kips
46.94 ft	Cohesive	N/A	N/A	N/A	5.31 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	0.58 Kips	0.60 Kips
9.01 ft	21.26 Kips	0.58 Kips	21.85 Kips
9.14 ft	21.58 Kips	0.58 Kips	22.16 Kips
9.16 ft	21.62 Kips	0.46 Kips	22.09 Kips
10.64 ft	24.46 Kips	0.46 Kips	24.92 Kips
10.66 ft	24.48 Kips	0.12 Kips	24.60 Kips
13.64 ft	25.93 Kips	0.12 Kips	26.05 Kips
13.66 ft	25.94 Kips	0.34 Kips	26.28 Kips
16.14 ft	26.95 Kips	0.40 Kips	27.35 Kips
16.16 ft	26.96 Kips	0.99 Kips	27.94 Kips
23.14 ft	32.67 Kips	1.15 Kips	33.81 Kips
23.16 ft	32.70 Kips	5.98 Kips	38.67 Kips
28.14 ft	43.61 Kips	7.99 Kips	51.60 Kips
28.16 ft	43.66 Kips	5.29 Kips	48.95 Kips
30.64 ft	49.00 Kips	5.89 Kips	54.90 Kips
30.66 ft	49.04 Kips	2.84 Kips	51.89 Kips
33.14 ft	53.75 Kips	2.84 Kips	56.59 Kips
33.16 ft	53.80 Kips	3.10 Kips	56.90 Kips
39.44 ft	73.51 Kips	3.10 Kips	76.61 Kips
39.46 ft	73.58 Kips	12.10 Kips	85.68 Kips
44.44 ft	94.17 Kips	14.25 Kips	108.42 Kips
44.46 ft	94.27 Kips	5.31 Kips	99.58 Kips
46.94 ft	107.60 Kips	5.31 Kips	112.90 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\PIK-104\RB02.DVN
Project Name: PIK-104-06.27 Project Date: 01/14/2022
Project Client: BG Engineering Group
Computed By: ZM
Project Manager: CH

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	9.15 ft	33.00%	105.00 pcf	750.00 psf	T-80 Same
2	Cohesive	1.50 ft	33.00%	105.00 pcf	600.00 psf	T-80 Same
3	Cohesive	3.00 ft	33.00%	95.00 pcf	150.00 psf	T-80 Same
4	Cohesionless	2.50 ft	33.00%	105.00 pcf	25.0/25.0	Nordlund
5	Cohesionless	7.00 ft	0.00%	122.00 pcf	30.0/30.0	Nordlund
6	Cohesionless	5.00 ft	0.00%	135.00 pcf	37.0/37.0	Nordlund
7	Cohesionless	2.50 ft	17.00%	130.00 pcf	35.0/35.0	Nordlund
8	Cohesionless	2.50 ft	17.00%	125.00 pcf	32.0/32.0	Nordlund
9	Cohesive	6.30 ft	43.00%	128.00 pcf	4000.00 psf	T-80 Same
10	Cohesionless	5.00 ft	0.00%	140.00 pcf	37.0/37.0	Nordlund
11	Cohesive	2.50 ft	43.00%	140.00 pcf	6850.00 psf	T-80 Same

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	715.25 psf	0.03 Kips
9.01 ft	Cohesive	N/A	N/A	715.25 psf	25.59 Kips
9.14 ft	Cohesive	N/A	N/A	715.25 psf	25.96 Kips
9.16 ft	Cohesive	N/A	N/A	582.11 psf	26.01 Kips
10.64 ft	Cohesive	N/A	N/A	582.11 psf	29.43 Kips
10.66 ft	Cohesive	N/A	N/A	147.60 psf	29.46 Kips
13.64 ft	Cohesive	N/A	N/A	147.60 psf	31.21 Kips
13.66 ft	Cohesionless	551.70 psf	18.83	N/A	31.22 Kips
16.14 ft	Cohesionless	604.53 psf	18.83	N/A	32.48 Kips
16.16 ft	Cohesionless	658.29 psf	22.59	N/A	32.49 Kips
23.14 ft	Cohesionless	866.29 psf	22.59	N/A	39.73 Kips
23.16 ft	Cohesionless	1075.55 psf	27.87	N/A	39.76 Kips
28.14 ft	Cohesionless	1256.33 psf	27.87	N/A	53.80 Kips
28.16 ft	Cohesionless	1438.53 psf	26.36	N/A	53.86 Kips
30.64 ft	Cohesionless	1522.35 psf	26.36	N/A	60.70 Kips
30.66 ft	Cohesionless	1607.50 psf	24.10	N/A	60.75 Kips
33.14 ft	Cohesionless	1685.13 psf	24.10	N/A	66.74 Kips
33.16 ft	Cohesive	N/A	N/A	952.00 psf	66.80 Kips
39.44 ft	Cohesive	N/A	N/A	952.00 psf	90.54 Kips
39.46 ft	Cohesionless	2177.36 psf	27.87	N/A	90.63 Kips
44.44 ft	Cohesionless	2370.58 psf	27.87	N/A	117.12 Kips
44.46 ft	Cohesive	N/A	N/A	1630.30 psf	117.24 Kips
46.94 ft	Cohesive	N/A	N/A	1630.30 psf	133.29 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
9.14 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
9.16 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
10.64 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
10.66 ft	Cohesive	N/A	N/A	N/A	0.15 Kips
13.64 ft	Cohesive	N/A	N/A	N/A	0.15 Kips
13.66 ft	Cohesionless	551.92 psf	15.00	1.43 Kips	0.42 Kips
16.14 ft	Cohesionless	657.56 psf	15.00	1.43 Kips	0.50 Kips
16.16 ft	Cohesionless	658.59 psf	30.00	1.43 Kips	1.23 Kips
23.14 ft	Cohesionless	1074.59 psf	30.00	1.43 Kips	1.43 Kips
23.16 ft	Cohesionless	1075.92 psf	91.20	22.18 Kips	7.47 Kips
28.14 ft	Cohesionless	1437.46 psf	91.20	22.18 Kips	9.98 Kips
28.16 ft	Cohesionless	1438.87 psf	64.00	11.58 Kips	6.66 Kips
30.64 ft	Cohesionless	1606.51 psf	64.00	11.58 Kips	7.41 Kips
30.66 ft	Cohesionless	1607.82 psf	40.40	3.55 Kips	3.55 Kips
33.14 ft	Cohesionless	1763.06 psf	40.40	3.55 Kips	3.55 Kips
33.16 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.44 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.46 ft	Cohesionless	2177.75 psf	91.20	22.18 Kips	15.13 Kips
44.44 ft	Cohesionless	2564.19 psf	91.20	22.18 Kips	17.81 Kips
44.46 ft	Cohesive	N/A	N/A	N/A	6.64 Kips
46.94 ft	Cohesive	N/A	N/A	N/A	6.64 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	0.73 Kips	0.75 Kips
9.01 ft	25.59 Kips	0.73 Kips	26.32 Kips
9.14 ft	25.96 Kips	0.73 Kips	26.69 Kips
9.16 ft	26.01 Kips	0.58 Kips	26.59 Kips
10.64 ft	29.43 Kips	0.58 Kips	30.01 Kips
10.66 ft	29.46 Kips	0.15 Kips	29.61 Kips
13.64 ft	31.21 Kips	0.15 Kips	31.35 Kips
13.66 ft	31.22 Kips	0.42 Kips	31.64 Kips
16.14 ft	32.48 Kips	0.50 Kips	32.98 Kips
16.16 ft	32.49 Kips	1.23 Kips	33.73 Kips
23.14 ft	39.73 Kips	1.43 Kips	41.16 Kips
23.16 ft	39.76 Kips	7.47 Kips	47.24 Kips
28.14 ft	53.80 Kips	9.98 Kips	63.79 Kips
28.16 ft	53.86 Kips	6.66 Kips	60.52 Kips
30.64 ft	60.70 Kips	7.41 Kips	68.11 Kips
30.66 ft	60.75 Kips	3.55 Kips	64.30 Kips
33.14 ft	66.74 Kips	3.55 Kips	70.29 Kips
33.16 ft	66.80 Kips	3.88 Kips	70.67 Kips
39.44 ft	90.54 Kips	3.88 Kips	94.41 Kips
39.46 ft	90.63 Kips	15.13 Kips	105.75 Kips
44.44 ft	117.12 Kips	17.81 Kips	134.92 Kips
44.46 ft	117.24 Kips	6.64 Kips	123.87 Kips
46.94 ft	133.29 Kips	6.64 Kips	139.93 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	715.25 psf	0.02 Kips
9.01 ft	Cohesive	N/A	N/A	715.25 psf	17.15 Kips
9.14 ft	Cohesive	N/A	N/A	715.25 psf	17.39 Kips
9.16 ft	Cohesive	N/A	N/A	582.11 psf	17.43 Kips
10.64 ft	Cohesive	N/A	N/A	582.11 psf	19.72 Kips
10.66 ft	Cohesive	N/A	N/A	147.60 psf	19.74 Kips
13.64 ft	Cohesive	N/A	N/A	147.60 psf	20.91 Kips
13.66 ft	Cohesionless	551.70 psf	18.83	N/A	20.92 Kips
16.14 ft	Cohesionless	604.53 psf	18.83	N/A	21.76 Kips
16.16 ft	Cohesionless	658.29 psf	22.59	N/A	21.78 Kips
23.14 ft	Cohesionless	866.29 psf	22.59	N/A	29.01 Kips
23.16 ft	Cohesionless	1075.55 psf	27.87	N/A	29.05 Kips
28.14 ft	Cohesionless	1256.33 psf	27.87	N/A	43.09 Kips
28.16 ft	Cohesionless	1438.53 psf	26.36	N/A	43.13 Kips
30.64 ft	Cohesionless	1522.35 psf	26.36	N/A	48.81 Kips
30.66 ft	Cohesionless	1607.50 psf	24.10	N/A	48.85 Kips
33.14 ft	Cohesionless	1685.13 psf	24.10	N/A	53.82 Kips
33.16 ft	Cohesive	N/A	N/A	952.00 psf	53.86 Kips
39.44 ft	Cohesive	N/A	N/A	952.00 psf	67.39 Kips
39.46 ft	Cohesionless	2177.36 psf	27.87	N/A	67.47 Kips
44.44 ft	Cohesionless	2370.58 psf	27.87	N/A	93.96 Kips
44.46 ft	Cohesive	N/A	N/A	1630.30 psf	94.03 Kips
46.94 ft	Cohesive	N/A	N/A	1630.30 psf	103.18 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
9.14 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
9.16 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
10.64 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
10.66 ft	Cohesive	N/A	N/A	N/A	0.15 Kips
13.64 ft	Cohesive	N/A	N/A	N/A	0.15 Kips
13.66 ft	Cohesionless	551.92 psf	15.00	1.43 Kips	0.42 Kips
16.14 ft	Cohesionless	657.56 psf	15.00	1.43 Kips	0.50 Kips
16.16 ft	Cohesionless	658.59 psf	30.00	1.43 Kips	1.23 Kips
23.14 ft	Cohesionless	1074.59 psf	30.00	1.43 Kips	1.43 Kips
23.16 ft	Cohesionless	1075.92 psf	91.20	22.18 Kips	7.47 Kips
28.14 ft	Cohesionless	1437.46 psf	91.20	22.18 Kips	9.98 Kips
28.16 ft	Cohesionless	1438.87 psf	64.00	11.58 Kips	6.66 Kips
30.64 ft	Cohesionless	1606.51 psf	64.00	11.58 Kips	7.41 Kips
30.66 ft	Cohesionless	1607.82 psf	40.40	3.55 Kips	3.55 Kips
33.14 ft	Cohesionless	1763.06 psf	40.40	3.55 Kips	3.55 Kips
33.16 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.44 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.46 ft	Cohesionless	2177.75 psf	91.20	22.18 Kips	15.13 Kips
44.44 ft	Cohesionless	2564.19 psf	91.20	22.18 Kips	17.81 Kips
44.46 ft	Cohesive	N/A	N/A	N/A	6.64 Kips
46.94 ft	Cohesive	N/A	N/A	N/A	6.64 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	0.73 Kips	0.75 Kips
9.01 ft	17.15 Kips	0.73 Kips	17.87 Kips
9.14 ft	17.39 Kips	0.73 Kips	18.12 Kips
9.16 ft	17.43 Kips	0.58 Kips	18.01 Kips
10.64 ft	19.72 Kips	0.58 Kips	20.30 Kips
10.66 ft	19.74 Kips	0.15 Kips	19.88 Kips
13.64 ft	20.91 Kips	0.15 Kips	21.05 Kips
13.66 ft	20.92 Kips	0.42 Kips	21.33 Kips
16.14 ft	21.76 Kips	0.50 Kips	22.26 Kips
16.16 ft	21.78 Kips	1.23 Kips	23.01 Kips
23.14 ft	29.01 Kips	1.43 Kips	30.44 Kips
23.16 ft	29.05 Kips	7.47 Kips	36.52 Kips
28.14 ft	43.09 Kips	9.98 Kips	53.07 Kips
28.16 ft	43.13 Kips	6.66 Kips	49.79 Kips
30.64 ft	48.81 Kips	7.41 Kips	56.22 Kips
30.66 ft	48.85 Kips	3.55 Kips	52.40 Kips
33.14 ft	53.82 Kips	3.55 Kips	57.37 Kips
33.16 ft	53.86 Kips	3.88 Kips	57.73 Kips
39.44 ft	67.39 Kips	3.88 Kips	71.26 Kips
39.46 ft	67.47 Kips	15.13 Kips	82.60 Kips
44.44 ft	93.96 Kips	17.81 Kips	111.77 Kips
44.46 ft	94.03 Kips	6.64 Kips	100.67 Kips
46.94 ft	103.18 Kips	6.64 Kips	109.82 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	715.25 psf	0.03 Kips
9.01 ft	Cohesive	N/A	N/A	715.25 psf	25.59 Kips
9.14 ft	Cohesive	N/A	N/A	715.25 psf	25.96 Kips
9.16 ft	Cohesive	N/A	N/A	582.11 psf	26.01 Kips
10.64 ft	Cohesive	N/A	N/A	582.11 psf	29.43 Kips
10.66 ft	Cohesive	N/A	N/A	147.60 psf	29.46 Kips
13.64 ft	Cohesive	N/A	N/A	147.60 psf	31.21 Kips
13.66 ft	Cohesionless	551.70 psf	18.83	N/A	31.22 Kips
16.14 ft	Cohesionless	604.53 psf	18.83	N/A	32.48 Kips
16.16 ft	Cohesionless	658.29 psf	22.59	N/A	32.49 Kips
23.14 ft	Cohesionless	866.29 psf	22.59	N/A	39.73 Kips
23.16 ft	Cohesionless	1075.55 psf	27.87	N/A	39.76 Kips
28.14 ft	Cohesionless	1256.33 psf	27.87	N/A	53.80 Kips
28.16 ft	Cohesionless	1438.53 psf	26.36	N/A	53.86 Kips
30.64 ft	Cohesionless	1522.35 psf	26.36	N/A	60.70 Kips
30.66 ft	Cohesionless	1607.50 psf	24.10	N/A	60.75 Kips
33.14 ft	Cohesionless	1685.13 psf	24.10	N/A	66.74 Kips
33.16 ft	Cohesive	N/A	N/A	952.00 psf	66.80 Kips
39.44 ft	Cohesive	N/A	N/A	952.00 psf	90.54 Kips
39.46 ft	Cohesionless	2177.36 psf	27.87	N/A	90.63 Kips
44.44 ft	Cohesionless	2370.58 psf	27.87	N/A	117.12 Kips
44.46 ft	Cohesive	N/A	N/A	1630.30 psf	117.24 Kips
46.94 ft	Cohesive	N/A	N/A	1630.30 psf	133.29 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
9.14 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
9.16 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
10.64 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
10.66 ft	Cohesive	N/A	N/A	N/A	0.15 Kips
13.64 ft	Cohesive	N/A	N/A	N/A	0.15 Kips
13.66 ft	Cohesionless	551.92 psf	15.00	1.43 Kips	0.42 Kips
16.14 ft	Cohesionless	657.56 psf	15.00	1.43 Kips	0.50 Kips
16.16 ft	Cohesionless	658.59 psf	30.00	1.43 Kips	1.23 Kips
23.14 ft	Cohesionless	1074.59 psf	30.00	1.43 Kips	1.43 Kips
23.16 ft	Cohesionless	1075.92 psf	91.20	22.18 Kips	7.47 Kips
28.14 ft	Cohesionless	1437.46 psf	91.20	22.18 Kips	9.98 Kips
28.16 ft	Cohesionless	1438.87 psf	64.00	11.58 Kips	6.66 Kips
30.64 ft	Cohesionless	1606.51 psf	64.00	11.58 Kips	7.41 Kips
30.66 ft	Cohesionless	1607.82 psf	40.40	3.55 Kips	3.55 Kips
33.14 ft	Cohesionless	1763.06 psf	40.40	3.55 Kips	3.55 Kips
33.16 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.44 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.46 ft	Cohesionless	2177.75 psf	91.20	22.18 Kips	15.13 Kips
44.44 ft	Cohesionless	2564.19 psf	91.20	22.18 Kips	17.81 Kips
44.46 ft	Cohesive	N/A	N/A	N/A	6.64 Kips
46.94 ft	Cohesive	N/A	N/A	N/A	6.64 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	0.73 Kips	0.75 Kips
9.01 ft	25.59 Kips	0.73 Kips	26.32 Kips
9.14 ft	25.96 Kips	0.73 Kips	26.69 Kips
9.16 ft	26.01 Kips	0.58 Kips	26.59 Kips
10.64 ft	29.43 Kips	0.58 Kips	30.01 Kips
10.66 ft	29.46 Kips	0.15 Kips	29.61 Kips
13.64 ft	31.21 Kips	0.15 Kips	31.35 Kips
13.66 ft	31.22 Kips	0.42 Kips	31.64 Kips
16.14 ft	32.48 Kips	0.50 Kips	32.98 Kips
16.16 ft	32.49 Kips	1.23 Kips	33.73 Kips
23.14 ft	39.73 Kips	1.43 Kips	41.16 Kips
23.16 ft	39.76 Kips	7.47 Kips	47.24 Kips
28.14 ft	53.80 Kips	9.98 Kips	63.79 Kips
28.16 ft	53.86 Kips	6.66 Kips	60.52 Kips
30.64 ft	60.70 Kips	7.41 Kips	68.11 Kips
30.66 ft	60.75 Kips	3.55 Kips	64.30 Kips
33.14 ft	66.74 Kips	3.55 Kips	70.29 Kips
33.16 ft	66.80 Kips	3.88 Kips	70.67 Kips
39.44 ft	90.54 Kips	3.88 Kips	94.41 Kips
39.46 ft	90.63 Kips	15.13 Kips	105.75 Kips
44.44 ft	117.12 Kips	17.81 Kips	134.92 Kips
44.46 ft	117.24 Kips	6.64 Kips	123.87 Kips
46.94 ft	133.29 Kips	6.64 Kips	139.93 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\PIK-104\RB02.DVN
Project Name: PIK-104-06.27 Project Date: 01/14/2022
Project Client: BG Engineering Group
Computed By: ZM
Project Manager: CH

PILE INFORMATION

Pile Type: H Pile - HP14X73
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	9.15 ft	33.00%	105.00 pcf	750.00 psf	T-80 Same
2	Cohesive	1.50 ft	33.00%	105.00 pcf	600.00 psf	T-80 Same
3	Cohesive	3.00 ft	33.00%	95.00 pcf	150.00 psf	T-80 Same
4	Cohesionless	2.50 ft	33.00%	105.00 pcf	25.0/25.0	Nordlund
5	Cohesionless	7.00 ft	0.00%	122.00 pcf	30.0/30.0	Nordlund
6	Cohesionless	5.00 ft	0.00%	135.00 pcf	37.0/37.0	Nordlund
7	Cohesionless	2.50 ft	17.00%	130.00 pcf	35.0/35.0	Nordlund
8	Cohesionless	2.50 ft	17.00%	125.00 pcf	32.0/32.0	Nordlund
9	Cohesive	6.30 ft	43.00%	128.00 pcf	4000.00 psf	T-80 Same
10	Cohesionless	5.00 ft	0.00%	140.00 pcf	37.0/37.0	Nordlund
11	Cohesive	2.50 ft	43.00%	140.00 pcf	6850.00 psf	T-80 Same

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	715.25 psf	0.03 Kips
9.01 ft	Cohesive	N/A	N/A	715.25 psf	30.28 Kips
9.14 ft	Cohesive	N/A	N/A	715.25 psf	30.72 Kips
9.16 ft	Cohesive	N/A	N/A	582.11 psf	30.78 Kips
10.64 ft	Cohesive	N/A	N/A	582.11 psf	34.83 Kips
10.66 ft	Cohesive	N/A	N/A	147.60 psf	34.86 Kips
13.64 ft	Cohesive	N/A	N/A	147.60 psf	36.93 Kips
13.66 ft	Cohesionless	551.70 psf	19.65	N/A	36.94 Kips
16.14 ft	Cohesionless	604.53 psf	19.65	N/A	38.57 Kips
16.16 ft	Cohesionless	658.29 psf	23.58	N/A	38.59 Kips
23.14 ft	Cohesionless	866.29 psf	23.58	N/A	48.14 Kips
23.16 ft	Cohesionless	1075.55 psf	29.08	N/A	48.19 Kips
28.14 ft	Cohesionless	1256.33 psf	29.08	N/A	67.61 Kips
28.16 ft	Cohesionless	1438.53 psf	27.51	N/A	67.69 Kips
30.64 ft	Cohesionless	1522.35 psf	27.51	N/A	76.97 Kips
30.66 ft	Cohesionless	1607.50 psf	25.15	N/A	77.04 Kips
33.14 ft	Cohesionless	1685.13 psf	25.15	N/A	85.05 Kips
33.16 ft	Cohesive	N/A	N/A	952.00 psf	85.13 Kips
39.44 ft	Cohesive	N/A	N/A	952.00 psf	113.22 Kips
39.46 ft	Cohesionless	2177.36 psf	29.08	N/A	113.33 Kips
44.44 ft	Cohesionless	2370.58 psf	29.08	N/A	149.96 Kips
44.46 ft	Cohesive	N/A	N/A	1630.30 psf	150.12 Kips
46.94 ft	Cohesive	N/A	N/A	1630.30 psf	169.12 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
9.14 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
9.16 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
10.64 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
10.66 ft	Cohesive	N/A	N/A	N/A	0.20 Kips
13.64 ft	Cohesive	N/A	N/A	N/A	0.20 Kips
13.66 ft	Cohesionless	551.92 psf	15.00	1.98 Kips	0.58 Kips
16.14 ft	Cohesionless	657.56 psf	15.00	1.98 Kips	0.69 Kips
16.16 ft	Cohesionless	658.59 psf	30.00	1.98 Kips	1.70 Kips
23.14 ft	Cohesionless	1074.59 psf	30.00	1.98 Kips	1.98 Kips
23.16 ft	Cohesionless	1075.92 psf	91.20	30.62 Kips	10.32 Kips
28.14 ft	Cohesionless	1437.46 psf	91.20	30.62 Kips	13.78 Kips
28.16 ft	Cohesionless	1438.87 psf	64.00	15.99 Kips	9.26 Kips
30.64 ft	Cohesionless	1606.51 psf	64.00	15.99 Kips	10.31 Kips
30.66 ft	Cohesionless	1607.82 psf	40.40	4.90 Kips	4.90 Kips
33.14 ft	Cohesionless	1763.06 psf	40.40	4.90 Kips	4.90 Kips
33.16 ft	Cohesive	N/A	N/A	N/A	5.35 Kips
39.44 ft	Cohesive	N/A	N/A	N/A	5.35 Kips
39.46 ft	Cohesionless	2177.75 psf	91.20	30.62 Kips	20.88 Kips
44.44 ft	Cohesionless	2564.19 psf	91.20	30.62 Kips	24.59 Kips
44.46 ft	Cohesive	N/A	N/A	N/A	9.16 Kips
46.94 ft	Cohesive	N/A	N/A	N/A	9.16 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	1.00 Kips	1.04 Kips
9.01 ft	30.28 Kips	1.00 Kips	31.29 Kips
9.14 ft	30.72 Kips	1.00 Kips	31.72 Kips
9.16 ft	30.78 Kips	0.80 Kips	31.58 Kips
10.64 ft	34.83 Kips	0.80 Kips	35.63 Kips
10.66 ft	34.86 Kips	0.20 Kips	35.06 Kips
13.64 ft	36.93 Kips	0.20 Kips	37.13 Kips
13.66 ft	36.94 Kips	0.58 Kips	37.52 Kips
16.14 ft	38.57 Kips	0.69 Kips	39.26 Kips
16.16 ft	38.59 Kips	1.70 Kips	40.30 Kips
23.14 ft	48.14 Kips	1.98 Kips	50.12 Kips
23.16 ft	48.19 Kips	10.32 Kips	58.51 Kips
28.14 ft	67.61 Kips	13.78 Kips	81.39 Kips
28.16 ft	67.69 Kips	9.26 Kips	76.95 Kips
30.64 ft	76.97 Kips	10.31 Kips	87.28 Kips
30.66 ft	77.04 Kips	4.90 Kips	81.94 Kips
33.14 ft	85.05 Kips	4.90 Kips	89.95 Kips
33.16 ft	85.13 Kips	5.35 Kips	90.48 Kips
39.44 ft	113.22 Kips	5.35 Kips	118.57 Kips
39.46 ft	113.33 Kips	20.88 Kips	134.22 Kips
44.44 ft	149.96 Kips	24.59 Kips	174.55 Kips
44.46 ft	150.12 Kips	9.16 Kips	159.28 Kips
46.94 ft	169.12 Kips	9.16 Kips	178.28 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	715.25 psf	0.02 Kips
9.01 ft	Cohesive	N/A	N/A	715.25 psf	20.29 Kips
9.14 ft	Cohesive	N/A	N/A	715.25 psf	20.58 Kips
9.16 ft	Cohesive	N/A	N/A	582.11 psf	20.62 Kips
10.64 ft	Cohesive	N/A	N/A	582.11 psf	23.34 Kips
10.66 ft	Cohesive	N/A	N/A	147.60 psf	23.36 Kips
13.64 ft	Cohesive	N/A	N/A	147.60 psf	24.74 Kips
13.66 ft	Cohesionless	551.70 psf	19.65	N/A	24.75 Kips
16.14 ft	Cohesionless	604.53 psf	19.65	N/A	25.85 Kips
16.16 ft	Cohesionless	658.29 psf	23.58	N/A	25.86 Kips
23.14 ft	Cohesionless	866.29 psf	23.58	N/A	35.41 Kips
23.16 ft	Cohesionless	1075.55 psf	29.08	N/A	35.46 Kips
28.14 ft	Cohesionless	1256.33 psf	29.08	N/A	54.88 Kips
28.16 ft	Cohesionless	1438.53 psf	27.51	N/A	54.94 Kips
30.64 ft	Cohesionless	1522.35 psf	27.51	N/A	62.65 Kips
30.66 ft	Cohesionless	1607.50 psf	25.15	N/A	62.71 Kips
33.14 ft	Cohesionless	1685.13 psf	25.15	N/A	69.35 Kips
33.16 ft	Cohesive	N/A	N/A	952.00 psf	69.40 Kips
39.44 ft	Cohesive	N/A	N/A	952.00 psf	85.41 Kips
39.46 ft	Cohesionless	2177.36 psf	29.08	N/A	85.52 Kips
44.44 ft	Cohesionless	2370.58 psf	29.08	N/A	122.15 Kips
44.46 ft	Cohesive	N/A	N/A	1630.30 psf	122.24 Kips
46.94 ft	Cohesive	N/A	N/A	1630.30 psf	133.07 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
9.14 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
9.16 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
10.64 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
10.66 ft	Cohesive	N/A	N/A	N/A	0.20 Kips
13.64 ft	Cohesive	N/A	N/A	N/A	0.20 Kips
13.66 ft	Cohesionless	551.92 psf	15.00	1.98 Kips	0.58 Kips
16.14 ft	Cohesionless	657.56 psf	15.00	1.98 Kips	0.69 Kips
16.16 ft	Cohesionless	658.59 psf	30.00	1.98 Kips	1.70 Kips
23.14 ft	Cohesionless	1074.59 psf	30.00	1.98 Kips	1.98 Kips
23.16 ft	Cohesionless	1075.92 psf	91.20	30.62 Kips	10.32 Kips
28.14 ft	Cohesionless	1437.46 psf	91.20	30.62 Kips	13.78 Kips
28.16 ft	Cohesionless	1438.87 psf	64.00	15.99 Kips	9.26 Kips
30.64 ft	Cohesionless	1606.51 psf	64.00	15.99 Kips	10.31 Kips
30.66 ft	Cohesionless	1607.82 psf	40.40	4.90 Kips	4.90 Kips
33.14 ft	Cohesionless	1763.06 psf	40.40	4.90 Kips	4.90 Kips
33.16 ft	Cohesive	N/A	N/A	N/A	5.35 Kips
39.44 ft	Cohesive	N/A	N/A	N/A	5.35 Kips
39.46 ft	Cohesionless	2177.75 psf	91.20	30.62 Kips	20.88 Kips
44.44 ft	Cohesionless	2564.19 psf	91.20	30.62 Kips	24.59 Kips
44.46 ft	Cohesive	N/A	N/A	N/A	9.16 Kips
46.94 ft	Cohesive	N/A	N/A	N/A	9.16 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	1.00 Kips	1.03 Kips
9.01 ft	20.29 Kips	1.00 Kips	21.29 Kips
9.14 ft	20.58 Kips	1.00 Kips	21.59 Kips
9.16 ft	20.62 Kips	0.80 Kips	21.43 Kips
10.64 ft	23.34 Kips	0.80 Kips	24.14 Kips
10.66 ft	23.36 Kips	0.20 Kips	23.56 Kips
13.64 ft	24.74 Kips	0.20 Kips	24.94 Kips
13.66 ft	24.75 Kips	0.58 Kips	25.33 Kips
16.14 ft	25.85 Kips	0.69 Kips	26.53 Kips
16.16 ft	25.86 Kips	1.70 Kips	27.57 Kips
23.14 ft	35.41 Kips	1.98 Kips	37.39 Kips
23.16 ft	35.46 Kips	10.32 Kips	45.78 Kips
28.14 ft	54.88 Kips	13.78 Kips	68.66 Kips
28.16 ft	54.94 Kips	9.26 Kips	64.21 Kips
30.64 ft	62.65 Kips	10.31 Kips	72.96 Kips
30.66 ft	62.71 Kips	4.90 Kips	67.61 Kips
33.14 ft	69.35 Kips	4.90 Kips	74.26 Kips
33.16 ft	69.40 Kips	5.35 Kips	74.75 Kips
39.44 ft	85.41 Kips	5.35 Kips	90.76 Kips
39.46 ft	85.52 Kips	20.88 Kips	106.41 Kips
44.44 ft	122.15 Kips	24.59 Kips	146.74 Kips
44.46 ft	122.24 Kips	9.16 Kips	131.40 Kips
46.94 ft	133.07 Kips	9.16 Kips	142.23 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	715.25 psf	0.03 Kips
9.01 ft	Cohesive	N/A	N/A	715.25 psf	30.28 Kips
9.14 ft	Cohesive	N/A	N/A	715.25 psf	30.72 Kips
9.16 ft	Cohesive	N/A	N/A	582.11 psf	30.78 Kips
10.64 ft	Cohesive	N/A	N/A	582.11 psf	34.83 Kips
10.66 ft	Cohesive	N/A	N/A	147.60 psf	34.86 Kips
13.64 ft	Cohesive	N/A	N/A	147.60 psf	36.93 Kips
13.66 ft	Cohesionless	551.70 psf	19.65	N/A	36.94 Kips
16.14 ft	Cohesionless	604.53 psf	19.65	N/A	38.57 Kips
16.16 ft	Cohesionless	658.29 psf	23.58	N/A	38.59 Kips
23.14 ft	Cohesionless	866.29 psf	23.58	N/A	48.14 Kips
23.16 ft	Cohesionless	1075.55 psf	29.08	N/A	48.19 Kips
28.14 ft	Cohesionless	1256.33 psf	29.08	N/A	67.61 Kips
28.16 ft	Cohesionless	1438.53 psf	27.51	N/A	67.69 Kips
30.64 ft	Cohesionless	1522.35 psf	27.51	N/A	76.97 Kips
30.66 ft	Cohesionless	1607.50 psf	25.15	N/A	77.04 Kips
33.14 ft	Cohesionless	1685.13 psf	25.15	N/A	85.05 Kips
33.16 ft	Cohesive	N/A	N/A	952.00 psf	85.13 Kips
39.44 ft	Cohesive	N/A	N/A	952.00 psf	113.22 Kips
39.46 ft	Cohesionless	2177.36 psf	29.08	N/A	113.33 Kips
44.44 ft	Cohesionless	2370.58 psf	29.08	N/A	149.96 Kips
44.46 ft	Cohesive	N/A	N/A	1630.30 psf	150.12 Kips
46.94 ft	Cohesive	N/A	N/A	1630.30 psf	169.12 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
9.14 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
9.16 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
10.64 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
10.66 ft	Cohesive	N/A	N/A	N/A	0.20 Kips
13.64 ft	Cohesive	N/A	N/A	N/A	0.20 Kips
13.66 ft	Cohesionless	551.92 psf	15.00	1.98 Kips	0.58 Kips
16.14 ft	Cohesionless	657.56 psf	15.00	1.98 Kips	0.69 Kips
16.16 ft	Cohesionless	658.59 psf	30.00	1.98 Kips	1.70 Kips
23.14 ft	Cohesionless	1074.59 psf	30.00	1.98 Kips	1.98 Kips
23.16 ft	Cohesionless	1075.92 psf	91.20	30.62 Kips	10.32 Kips
28.14 ft	Cohesionless	1437.46 psf	91.20	30.62 Kips	13.78 Kips
28.16 ft	Cohesionless	1438.87 psf	64.00	15.99 Kips	9.26 Kips
30.64 ft	Cohesionless	1606.51 psf	64.00	15.99 Kips	10.31 Kips
30.66 ft	Cohesionless	1607.82 psf	40.40	4.90 Kips	4.90 Kips
33.14 ft	Cohesionless	1763.06 psf	40.40	4.90 Kips	4.90 Kips
33.16 ft	Cohesive	N/A	N/A	N/A	5.35 Kips
39.44 ft	Cohesive	N/A	N/A	N/A	5.35 Kips
39.46 ft	Cohesionless	2177.75 psf	91.20	30.62 Kips	20.88 Kips
44.44 ft	Cohesionless	2564.19 psf	91.20	30.62 Kips	24.59 Kips
44.46 ft	Cohesive	N/A	N/A	N/A	9.16 Kips
46.94 ft	Cohesive	N/A	N/A	N/A	9.16 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	1.00 Kips	1.04 Kips
9.01 ft	30.28 Kips	1.00 Kips	31.29 Kips
9.14 ft	30.72 Kips	1.00 Kips	31.72 Kips
9.16 ft	30.78 Kips	0.80 Kips	31.58 Kips
10.64 ft	34.83 Kips	0.80 Kips	35.63 Kips
10.66 ft	34.86 Kips	0.20 Kips	35.06 Kips
13.64 ft	36.93 Kips	0.20 Kips	37.13 Kips
13.66 ft	36.94 Kips	0.58 Kips	37.52 Kips
16.14 ft	38.57 Kips	0.69 Kips	39.26 Kips
16.16 ft	38.59 Kips	1.70 Kips	40.30 Kips
23.14 ft	48.14 Kips	1.98 Kips	50.12 Kips
23.16 ft	48.19 Kips	10.32 Kips	58.51 Kips
28.14 ft	67.61 Kips	13.78 Kips	81.39 Kips
28.16 ft	67.69 Kips	9.26 Kips	76.95 Kips
30.64 ft	76.97 Kips	10.31 Kips	87.28 Kips
30.66 ft	77.04 Kips	4.90 Kips	81.94 Kips
33.14 ft	85.05 Kips	4.90 Kips	89.95 Kips
33.16 ft	85.13 Kips	5.35 Kips	90.48 Kips
39.44 ft	113.22 Kips	5.35 Kips	118.57 Kips
39.46 ft	113.33 Kips	20.88 Kips	134.22 Kips
44.44 ft	149.96 Kips	24.59 Kips	174.55 Kips
44.46 ft	150.12 Kips	9.16 Kips	159.28 Kips
46.94 ft	169.12 Kips	9.16 Kips	178.28 Kips

FORWARD ABUTMENT

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\PIK-104\FB03.DVN
Project Name: PIK-104-06.27 Project Date: 01/14/2022
Project Client: BG Engineering Group
Computed By: ZM
Project Manager: CH

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	5.55 ft	33.00%	105.00 pcf	600.00 psf	T-80 Same
2	Cohesive	1.50 ft	33.00%	105.00 pcf	750.00 psf	T-80 Same
3	Cohesive	5.50 ft	33.00%	102.00 pcf	500.00 psf	T-80 Same
4	Cohesionless	5.00 ft	0.00%	115.00 pcf	27.0/27.0	Nordlund
5	Cohesionless	7.00 ft	0.00%	122.00 pcf	31.0/31.0	Nordlund
6	Cohesionless	7.00 ft	0.00%	140.00 pcf	37.0/37.0	Nordlund
7	Cohesive	4.80 ft	33.00%	130.00 pcf	4500.00 psf	T-80 Same
8	Cohesive	5.00 ft	33.00%	125.00 pcf	3250.00 psf	T-80 Same
9	Cohesive	5.00 ft	33.00%	122.00 pcf	3000.00 psf	T-80 Same

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	582.11 psf	0.02 Kips
5.54 ft	Cohesive	N/A	N/A	582.11 psf	10.63 Kips
5.56 ft	Cohesive	N/A	N/A	715.25 psf	10.67 Kips
7.04 ft	Cohesive	N/A	N/A	715.25 psf	14.16 Kips
7.06 ft	Cohesive	N/A	N/A	491.09 psf	14.20 Kips
12.54 ft	Cohesive	N/A	N/A	491.09 psf	23.07 Kips
12.56 ft	Cohesionless	518.39 psf	19.79	N/A	23.09 Kips
17.54 ft	Cohesionless	649.37 psf	19.79	N/A	25.59 Kips
17.56 ft	Cohesionless	781.43 psf	22.73	N/A	25.61 Kips
24.54 ft	Cohesionless	989.43 psf	22.73	N/A	32.75 Kips
24.56 ft	Cohesionless	1198.72 psf	27.13	N/A	32.78 Kips
31.54 ft	Cohesionless	1469.54 psf	27.13	N/A	50.68 Kips
31.56 ft	Cohesive	N/A	N/A	1071.00 psf	50.75 Kips
36.34 ft	Cohesive	N/A	N/A	1071.00 psf	67.62 Kips
36.36 ft	Cohesive	N/A	N/A	859.57 psf	67.68 Kips
41.34 ft	Cohesive	N/A	N/A	859.57 psf	81.79 Kips
41.36 ft	Cohesive	N/A	N/A	907.69 psf	81.85 Kips
46.34 ft	Cohesive	N/A	N/A	907.69 psf	96.75 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
5.54 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
5.56 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
7.04 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
7.06 ft	Cohesive	N/A	N/A	N/A	0.39 Kips
12.54 ft	Cohesive	N/A	N/A	N/A	0.39 Kips
12.56 ft	Cohesionless	518.66 psf	19.80	1.15 Kips	0.45 Kips
17.54 ft	Cohesionless	780.60 psf	19.80	1.15 Kips	0.68 Kips
17.56 ft	Cohesionless	781.73 psf	35.20	1.78 Kips	1.42 Kips
24.54 ft	Cohesionless	1197.73 psf	35.20	1.78 Kips	1.78 Kips
24.56 ft	Cohesionless	1199.11 psf	91.20	17.74 Kips	6.66 Kips
31.54 ft	Cohesionless	1740.75 psf	91.20	17.74 Kips	9.67 Kips
31.56 ft	Cohesive	N/A	N/A	N/A	3.49 Kips
36.34 ft	Cohesive	N/A	N/A	N/A	3.49 Kips
36.36 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
41.34 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
41.36 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
46.34 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	0.46 Kips	0.48 Kips
5.54 ft	10.63 Kips	0.46 Kips	11.09 Kips
5.56 ft	10.67 Kips	0.58 Kips	11.25 Kips
7.04 ft	14.16 Kips	0.58 Kips	14.74 Kips
7.06 ft	14.20 Kips	0.39 Kips	14.59 Kips
12.54 ft	23.07 Kips	0.39 Kips	23.46 Kips
12.56 ft	23.09 Kips	0.45 Kips	23.54 Kips
17.54 ft	25.59 Kips	0.68 Kips	26.27 Kips
17.56 ft	25.61 Kips	1.42 Kips	27.03 Kips
24.54 ft	32.75 Kips	1.78 Kips	34.53 Kips
24.56 ft	32.78 Kips	6.66 Kips	39.45 Kips
31.54 ft	50.68 Kips	9.67 Kips	60.35 Kips
31.56 ft	50.75 Kips	3.49 Kips	54.23 Kips
36.34 ft	67.62 Kips	3.49 Kips	71.11 Kips
36.36 ft	67.68 Kips	2.52 Kips	70.20 Kips
41.34 ft	81.79 Kips	2.52 Kips	84.31 Kips
41.36 ft	81.85 Kips	2.32 Kips	84.17 Kips
46.34 ft	96.75 Kips	2.32 Kips	99.07 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	582.11 psf	0.01 Kips
5.54 ft	Cohesive	N/A	N/A	582.11 psf	7.12 Kips
5.56 ft	Cohesive	N/A	N/A	715.25 psf	7.15 Kips
7.04 ft	Cohesive	N/A	N/A	715.25 psf	9.49 Kips
7.06 ft	Cohesive	N/A	N/A	491.09 psf	9.51 Kips
12.54 ft	Cohesive	N/A	N/A	491.09 psf	15.46 Kips
12.56 ft	Cohesionless	518.39 psf	19.79	N/A	15.48 Kips
17.54 ft	Cohesionless	649.37 psf	19.79	N/A	17.98 Kips
17.56 ft	Cohesionless	781.43 psf	22.73	N/A	17.99 Kips
24.54 ft	Cohesionless	989.43 psf	22.73	N/A	25.14 Kips
24.56 ft	Cohesionless	1198.72 psf	27.13	N/A	25.17 Kips
31.54 ft	Cohesionless	1469.54 psf	27.13	N/A	43.07 Kips
31.56 ft	Cohesive	N/A	N/A	1071.00 psf	43.11 Kips
36.34 ft	Cohesive	N/A	N/A	1071.00 psf	54.42 Kips
36.36 ft	Cohesive	N/A	N/A	859.57 psf	54.46 Kips
41.34 ft	Cohesive	N/A	N/A	859.57 psf	63.91 Kips
41.36 ft	Cohesive	N/A	N/A	907.69 psf	63.95 Kips
46.34 ft	Cohesive	N/A	N/A	907.69 psf	73.93 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
5.54 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
5.56 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
7.04 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
7.06 ft	Cohesive	N/A	N/A	N/A	0.39 Kips
12.54 ft	Cohesive	N/A	N/A	N/A	0.39 Kips
12.56 ft	Cohesionless	518.66 psf	19.80	1.15 Kips	0.45 Kips
17.54 ft	Cohesionless	780.60 psf	19.80	1.15 Kips	0.68 Kips
17.56 ft	Cohesionless	781.73 psf	35.20	1.78 Kips	1.42 Kips
24.54 ft	Cohesionless	1197.73 psf	35.20	1.78 Kips	1.78 Kips
24.56 ft	Cohesionless	1199.11 psf	91.20	17.74 Kips	6.66 Kips
31.54 ft	Cohesionless	1740.75 psf	91.20	17.74 Kips	9.67 Kips
31.56 ft	Cohesive	N/A	N/A	N/A	3.49 Kips
36.34 ft	Cohesive	N/A	N/A	N/A	3.49 Kips
36.36 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
41.34 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
41.36 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
46.34 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.01 Kips	0.46 Kips	0.48 Kips
5.54 ft	7.12 Kips	0.46 Kips	7.59 Kips
5.56 ft	7.15 Kips	0.58 Kips	7.73 Kips
7.04 ft	9.49 Kips	0.58 Kips	10.07 Kips
7.06 ft	9.51 Kips	0.39 Kips	9.90 Kips
12.54 ft	15.46 Kips	0.39 Kips	15.84 Kips
12.56 ft	15.48 Kips	0.45 Kips	15.93 Kips
17.54 ft	17.98 Kips	0.68 Kips	18.66 Kips
17.56 ft	17.99 Kips	1.42 Kips	19.41 Kips
24.54 ft	25.14 Kips	1.78 Kips	26.92 Kips
24.56 ft	25.17 Kips	6.66 Kips	31.83 Kips
31.54 ft	43.07 Kips	9.67 Kips	52.74 Kips
31.56 ft	43.11 Kips	3.49 Kips	46.60 Kips
36.34 ft	54.42 Kips	3.49 Kips	57.90 Kips
36.36 ft	54.46 Kips	2.52 Kips	56.98 Kips
41.34 ft	63.91 Kips	2.52 Kips	66.43 Kips
41.36 ft	63.95 Kips	2.32 Kips	66.28 Kips
46.34 ft	73.93 Kips	2.32 Kips	76.26 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	582.11 psf	0.02 Kips
5.54 ft	Cohesive	N/A	N/A	582.11 psf	10.63 Kips
5.56 ft	Cohesive	N/A	N/A	715.25 psf	10.67 Kips
7.04 ft	Cohesive	N/A	N/A	715.25 psf	14.16 Kips
7.06 ft	Cohesive	N/A	N/A	491.09 psf	14.20 Kips
12.54 ft	Cohesive	N/A	N/A	491.09 psf	23.07 Kips
12.56 ft	Cohesionless	518.39 psf	19.79	N/A	23.09 Kips
17.54 ft	Cohesionless	649.37 psf	19.79	N/A	25.59 Kips
17.56 ft	Cohesionless	781.43 psf	22.73	N/A	25.61 Kips
24.54 ft	Cohesionless	989.43 psf	22.73	N/A	32.75 Kips
24.56 ft	Cohesionless	1198.72 psf	27.13	N/A	32.78 Kips
31.54 ft	Cohesionless	1469.54 psf	27.13	N/A	50.68 Kips
31.56 ft	Cohesive	N/A	N/A	1071.00 psf	50.75 Kips
36.34 ft	Cohesive	N/A	N/A	1071.00 psf	67.62 Kips
36.36 ft	Cohesive	N/A	N/A	859.57 psf	67.68 Kips
41.34 ft	Cohesive	N/A	N/A	859.57 psf	81.79 Kips
41.36 ft	Cohesive	N/A	N/A	907.69 psf	81.85 Kips
46.34 ft	Cohesive	N/A	N/A	907.69 psf	96.75 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
5.54 ft	Cohesive	N/A	N/A	N/A	0.46 Kips
5.56 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
7.04 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
7.06 ft	Cohesive	N/A	N/A	N/A	0.39 Kips
12.54 ft	Cohesive	N/A	N/A	N/A	0.39 Kips
12.56 ft	Cohesionless	518.66 psf	19.80	1.15 Kips	0.45 Kips
17.54 ft	Cohesionless	780.60 psf	19.80	1.15 Kips	0.68 Kips
17.56 ft	Cohesionless	781.73 psf	35.20	1.78 Kips	1.42 Kips
24.54 ft	Cohesionless	1197.73 psf	35.20	1.78 Kips	1.78 Kips
24.56 ft	Cohesionless	1199.11 psf	91.20	17.74 Kips	6.66 Kips
31.54 ft	Cohesionless	1740.75 psf	91.20	17.74 Kips	9.67 Kips
31.56 ft	Cohesive	N/A	N/A	N/A	3.49 Kips
36.34 ft	Cohesive	N/A	N/A	N/A	3.49 Kips
36.36 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
41.34 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
41.36 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
46.34 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	0.46 Kips	0.48 Kips
5.54 ft	10.63 Kips	0.46 Kips	11.09 Kips
5.56 ft	10.67 Kips	0.58 Kips	11.25 Kips
7.04 ft	14.16 Kips	0.58 Kips	14.74 Kips
7.06 ft	14.20 Kips	0.39 Kips	14.59 Kips
12.54 ft	23.07 Kips	0.39 Kips	23.46 Kips
12.56 ft	23.09 Kips	0.45 Kips	23.54 Kips
17.54 ft	25.59 Kips	0.68 Kips	26.27 Kips
17.56 ft	25.61 Kips	1.42 Kips	27.03 Kips
24.54 ft	32.75 Kips	1.78 Kips	34.53 Kips
24.56 ft	32.78 Kips	6.66 Kips	39.45 Kips
31.54 ft	50.68 Kips	9.67 Kips	60.35 Kips
31.56 ft	50.75 Kips	3.49 Kips	54.23 Kips
36.34 ft	67.62 Kips	3.49 Kips	71.11 Kips
36.36 ft	67.68 Kips	2.52 Kips	70.20 Kips
41.34 ft	81.79 Kips	2.52 Kips	84.31 Kips
41.36 ft	81.85 Kips	2.32 Kips	84.17 Kips
46.34 ft	96.75 Kips	2.32 Kips	99.07 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\PIK-104\FB03.DVN
Project Name: PIK-104-06.27 Project Date: 01/14/2022
Project Client: BG Engineering Group
Computed By: ZM
Project Manager: CH

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	5.55 ft	33.00%	105.00 pcf	600.00 psf	T-80 Same
2	Cohesive	1.50 ft	33.00%	105.00 pcf	750.00 psf	T-80 Same
3	Cohesive	5.50 ft	33.00%	102.00 pcf	500.00 psf	T-80 Same
4	Cohesionless	5.00 ft	0.00%	115.00 pcf	27.0/27.0	Nordlund
5	Cohesionless	7.00 ft	0.00%	122.00 pcf	31.0/31.0	Nordlund
6	Cohesionless	7.00 ft	0.00%	140.00 pcf	37.0/37.0	Nordlund
7	Cohesive	4.80 ft	33.00%	130.00 pcf	4500.00 psf	T-80 Same
8	Cohesive	5.00 ft	33.00%	125.00 pcf	3250.00 psf	T-80 Same
9	Cohesive	5.00 ft	33.00%	122.00 pcf	3000.00 psf	T-80 Same

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	582.11 psf	0.02 Kips
5.54 ft	Cohesive	N/A	N/A	582.11 psf	12.81 Kips
5.56 ft	Cohesive	N/A	N/A	715.25 psf	12.86 Kips
7.04 ft	Cohesive	N/A	N/A	715.25 psf	17.06 Kips
7.06 ft	Cohesive	N/A	N/A	491.09 psf	17.11 Kips
12.54 ft	Cohesive	N/A	N/A	491.09 psf	27.79 Kips
12.56 ft	Cohesionless	518.39 psf	20.33	N/A	27.82 Kips
17.54 ft	Cohesionless	649.37 psf	20.33	N/A	30.98 Kips
17.56 ft	Cohesionless	781.43 psf	23.35	N/A	31.00 Kips
24.54 ft	Cohesionless	989.43 psf	23.35	N/A	40.06 Kips
24.56 ft	Cohesionless	1198.72 psf	27.87	N/A	40.11 Kips
31.54 ft	Cohesionless	1469.54 psf	27.87	N/A	63.12 Kips
31.56 ft	Cohesive	N/A	N/A	1071.00 psf	63.20 Kips
36.34 ft	Cohesive	N/A	N/A	1071.00 psf	83.53 Kips
36.36 ft	Cohesive	N/A	N/A	859.57 psf	83.61 Kips
41.34 ft	Cohesive	N/A	N/A	859.57 psf	100.61 Kips
41.36 ft	Cohesive	N/A	N/A	907.69 psf	100.68 Kips
46.34 ft	Cohesive	N/A	N/A	907.69 psf	118.63 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
5.54 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
5.56 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
7.04 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
7.06 ft	Cohesive	N/A	N/A	N/A	0.48 Kips
12.54 ft	Cohesive	N/A	N/A	N/A	0.48 Kips
12.56 ft	Cohesionless	518.66 psf	19.80	1.43 Kips	0.57 Kips
17.54 ft	Cohesionless	780.60 psf	19.80	1.43 Kips	0.86 Kips
17.56 ft	Cohesionless	781.73 psf	35.20	2.22 Kips	1.79 Kips
24.54 ft	Cohesionless	1197.73 psf	35.20	2.22 Kips	2.22 Kips
24.56 ft	Cohesionless	1199.11 psf	91.20	22.18 Kips	8.33 Kips
31.54 ft	Cohesionless	1740.75 psf	91.20	22.18 Kips	12.09 Kips
31.56 ft	Cohesive	N/A	N/A	N/A	4.36 Kips
36.34 ft	Cohesive	N/A	N/A	N/A	4.36 Kips
36.36 ft	Cohesive	N/A	N/A	N/A	3.15 Kips
41.34 ft	Cohesive	N/A	N/A	N/A	3.15 Kips
41.36 ft	Cohesive	N/A	N/A	N/A	2.91 Kips
46.34 ft	Cohesive	N/A	N/A	N/A	2.91 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	0.58 Kips	0.60 Kips
5.54 ft	12.81 Kips	0.58 Kips	13.39 Kips
5.56 ft	12.86 Kips	0.73 Kips	13.58 Kips
7.04 ft	17.06 Kips	0.73 Kips	17.79 Kips
7.06 ft	17.11 Kips	0.48 Kips	17.59 Kips
12.54 ft	27.79 Kips	0.48 Kips	28.28 Kips
12.56 ft	27.82 Kips	0.57 Kips	28.39 Kips
17.54 ft	30.98 Kips	0.86 Kips	31.83 Kips
17.56 ft	31.00 Kips	1.79 Kips	32.78 Kips
24.54 ft	40.06 Kips	2.22 Kips	42.29 Kips
24.56 ft	40.11 Kips	8.33 Kips	48.43 Kips
31.54 ft	63.12 Kips	12.09 Kips	75.21 Kips
31.56 ft	63.20 Kips	4.36 Kips	67.56 Kips
36.34 ft	83.53 Kips	4.36 Kips	87.89 Kips
36.36 ft	83.61 Kips	3.15 Kips	86.76 Kips
41.34 ft	100.61 Kips	3.15 Kips	103.76 Kips
41.36 ft	100.68 Kips	2.91 Kips	103.58 Kips
46.34 ft	118.63 Kips	2.91 Kips	121.53 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	582.11 psf	0.02 Kips
5.54 ft	Cohesive	N/A	N/A	582.11 psf	8.58 Kips
5.56 ft	Cohesive	N/A	N/A	715.25 psf	8.61 Kips
7.04 ft	Cohesive	N/A	N/A	715.25 psf	11.43 Kips
7.06 ft	Cohesive	N/A	N/A	491.09 psf	11.46 Kips
12.54 ft	Cohesive	N/A	N/A	491.09 psf	18.62 Kips
12.56 ft	Cohesionless	518.39 psf	20.33	N/A	18.65 Kips
17.54 ft	Cohesionless	649.37 psf	20.33	N/A	21.81 Kips
17.56 ft	Cohesionless	781.43 psf	23.35	N/A	21.82 Kips
24.54 ft	Cohesionless	989.43 psf	23.35	N/A	30.89 Kips
24.56 ft	Cohesionless	1198.72 psf	27.87	N/A	30.93 Kips
31.54 ft	Cohesionless	1469.54 psf	27.87	N/A	53.95 Kips
31.56 ft	Cohesive	N/A	N/A	1071.00 psf	54.01 Kips
36.34 ft	Cohesive	N/A	N/A	1071.00 psf	67.63 Kips
36.36 ft	Cohesive	N/A	N/A	859.57 psf	67.68 Kips
41.34 ft	Cohesive	N/A	N/A	859.57 psf	79.06 Kips
41.36 ft	Cohesive	N/A	N/A	907.69 psf	79.11 Kips
46.34 ft	Cohesive	N/A	N/A	907.69 psf	91.14 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
5.54 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
5.56 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
7.04 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
7.06 ft	Cohesive	N/A	N/A	N/A	0.48 Kips
12.54 ft	Cohesive	N/A	N/A	N/A	0.48 Kips
12.56 ft	Cohesionless	518.66 psf	19.80	1.43 Kips	0.57 Kips
17.54 ft	Cohesionless	780.60 psf	19.80	1.43 Kips	0.86 Kips
17.56 ft	Cohesionless	781.73 psf	35.20	2.22 Kips	1.79 Kips
24.54 ft	Cohesionless	1197.73 psf	35.20	2.22 Kips	2.22 Kips
24.56 ft	Cohesionless	1199.11 psf	91.20	22.18 Kips	8.33 Kips
31.54 ft	Cohesionless	1740.75 psf	91.20	22.18 Kips	12.09 Kips
31.56 ft	Cohesive	N/A	N/A	N/A	4.36 Kips
36.34 ft	Cohesive	N/A	N/A	N/A	4.36 Kips
36.36 ft	Cohesive	N/A	N/A	N/A	3.15 Kips
41.34 ft	Cohesive	N/A	N/A	N/A	3.15 Kips
41.36 ft	Cohesive	N/A	N/A	N/A	2.91 Kips
46.34 ft	Cohesive	N/A	N/A	N/A	2.91 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	0.58 Kips	0.60 Kips
5.54 ft	8.58 Kips	0.58 Kips	9.16 Kips
5.56 ft	8.61 Kips	0.73 Kips	9.34 Kips
7.04 ft	11.43 Kips	0.73 Kips	12.16 Kips
7.06 ft	11.46 Kips	0.48 Kips	11.95 Kips
12.54 ft	18.62 Kips	0.48 Kips	19.11 Kips
12.56 ft	18.65 Kips	0.57 Kips	19.22 Kips
17.54 ft	21.81 Kips	0.86 Kips	22.66 Kips
17.56 ft	21.82 Kips	1.79 Kips	23.61 Kips
24.54 ft	30.89 Kips	2.22 Kips	33.11 Kips
24.56 ft	30.93 Kips	8.33 Kips	39.26 Kips
31.54 ft	53.95 Kips	12.09 Kips	66.04 Kips
31.56 ft	54.01 Kips	4.36 Kips	58.36 Kips
36.34 ft	67.63 Kips	4.36 Kips	71.98 Kips
36.36 ft	67.68 Kips	3.15 Kips	70.82 Kips
41.34 ft	79.06 Kips	3.15 Kips	82.21 Kips
41.36 ft	79.11 Kips	2.91 Kips	82.02 Kips
46.34 ft	91.14 Kips	2.91 Kips	94.04 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	582.11 psf	0.02 Kips
5.54 ft	Cohesive	N/A	N/A	582.11 psf	12.81 Kips
5.56 ft	Cohesive	N/A	N/A	715.25 psf	12.86 Kips
7.04 ft	Cohesive	N/A	N/A	715.25 psf	17.06 Kips
7.06 ft	Cohesive	N/A	N/A	491.09 psf	17.11 Kips
12.54 ft	Cohesive	N/A	N/A	491.09 psf	27.79 Kips
12.56 ft	Cohesionless	518.39 psf	20.33	N/A	27.82 Kips
17.54 ft	Cohesionless	649.37 psf	20.33	N/A	30.98 Kips
17.56 ft	Cohesionless	781.43 psf	23.35	N/A	31.00 Kips
24.54 ft	Cohesionless	989.43 psf	23.35	N/A	40.06 Kips
24.56 ft	Cohesionless	1198.72 psf	27.87	N/A	40.11 Kips
31.54 ft	Cohesionless	1469.54 psf	27.87	N/A	63.12 Kips
31.56 ft	Cohesive	N/A	N/A	1071.00 psf	63.20 Kips
36.34 ft	Cohesive	N/A	N/A	1071.00 psf	83.53 Kips
36.36 ft	Cohesive	N/A	N/A	859.57 psf	83.61 Kips
41.34 ft	Cohesive	N/A	N/A	859.57 psf	100.61 Kips
41.36 ft	Cohesive	N/A	N/A	907.69 psf	100.68 Kips
46.34 ft	Cohesive	N/A	N/A	907.69 psf	118.63 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
5.54 ft	Cohesive	N/A	N/A	N/A	0.58 Kips
5.56 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
7.04 ft	Cohesive	N/A	N/A	N/A	0.73 Kips
7.06 ft	Cohesive	N/A	N/A	N/A	0.48 Kips
12.54 ft	Cohesive	N/A	N/A	N/A	0.48 Kips
12.56 ft	Cohesionless	518.66 psf	19.80	1.43 Kips	0.57 Kips
17.54 ft	Cohesionless	780.60 psf	19.80	1.43 Kips	0.86 Kips
17.56 ft	Cohesionless	781.73 psf	35.20	2.22 Kips	1.79 Kips
24.54 ft	Cohesionless	1197.73 psf	35.20	2.22 Kips	2.22 Kips
24.56 ft	Cohesionless	1199.11 psf	91.20	22.18 Kips	8.33 Kips
31.54 ft	Cohesionless	1740.75 psf	91.20	22.18 Kips	12.09 Kips
31.56 ft	Cohesive	N/A	N/A	N/A	4.36 Kips
36.34 ft	Cohesive	N/A	N/A	N/A	4.36 Kips
36.36 ft	Cohesive	N/A	N/A	N/A	3.15 Kips
41.34 ft	Cohesive	N/A	N/A	N/A	3.15 Kips
41.36 ft	Cohesive	N/A	N/A	N/A	2.91 Kips
46.34 ft	Cohesive	N/A	N/A	N/A	2.91 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	0.58 Kips	0.60 Kips
5.54 ft	12.81 Kips	0.58 Kips	13.39 Kips
5.56 ft	12.86 Kips	0.73 Kips	13.58 Kips
7.04 ft	17.06 Kips	0.73 Kips	17.79 Kips
7.06 ft	17.11 Kips	0.48 Kips	17.59 Kips
12.54 ft	27.79 Kips	0.48 Kips	28.28 Kips
12.56 ft	27.82 Kips	0.57 Kips	28.39 Kips
17.54 ft	30.98 Kips	0.86 Kips	31.83 Kips
17.56 ft	31.00 Kips	1.79 Kips	32.78 Kips
24.54 ft	40.06 Kips	2.22 Kips	42.29 Kips
24.56 ft	40.11 Kips	8.33 Kips	48.43 Kips
31.54 ft	63.12 Kips	12.09 Kips	75.21 Kips
31.56 ft	63.20 Kips	4.36 Kips	67.56 Kips
36.34 ft	83.53 Kips	4.36 Kips	87.89 Kips
36.36 ft	83.61 Kips	3.15 Kips	86.76 Kips
41.34 ft	100.61 Kips	3.15 Kips	103.76 Kips
41.36 ft	100.68 Kips	2.91 Kips	103.58 Kips
46.34 ft	118.63 Kips	2.91 Kips	121.53 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\PIK-104\FB03.DVN
Project Name: PIK-104-06.27 Project Date: 01/14/2022
Project Client: BG Engineering Group
Computed By: ZM
Project Manager: CH

PILE INFORMATION

Pile Type: H Pile - HP14X73
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	5.55 ft	33.00%	105.00 pcf	600.00 psf	T-80 Same
2	Cohesive	1.50 ft	33.00%	105.00 pcf	750.00 psf	T-80 Same
3	Cohesive	5.50 ft	33.00%	102.00 pcf	500.00 psf	T-80 Same
4	Cohesionless	5.00 ft	0.00%	115.00 pcf	27.0/27.0	Nordlund
5	Cohesionless	7.00 ft	0.00%	122.00 pcf	31.0/31.0	Nordlund
6	Cohesionless	7.00 ft	0.00%	140.00 pcf	37.0/37.0	Nordlund
7	Cohesive	4.80 ft	33.00%	130.00 pcf	4500.00 psf	T-80 Same
8	Cohesive	5.00 ft	33.00%	125.00 pcf	3250.00 psf	T-80 Same
9	Cohesive	5.00 ft	33.00%	122.00 pcf	3000.00 psf	T-80 Same

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	582.11 psf	0.03 Kips
5.54 ft	Cohesive	N/A	N/A	582.11 psf	15.15 Kips
5.56 ft	Cohesive	N/A	N/A	715.25 psf	15.22 Kips
7.04 ft	Cohesive	N/A	N/A	715.25 psf	20.19 Kips
7.06 ft	Cohesive	N/A	N/A	491.09 psf	20.25 Kips
12.54 ft	Cohesive	N/A	N/A	491.09 psf	32.89 Kips
12.56 ft	Cohesionless	518.39 psf	21.22	N/A	32.92 Kips
17.54 ft	Cohesionless	649.37 psf	21.22	N/A	37.04 Kips
17.56 ft	Cohesionless	781.43 psf	24.36	N/A	37.06 Kips
24.54 ft	Cohesionless	989.43 psf	24.36	N/A	49.12 Kips
24.56 ft	Cohesionless	1198.72 psf	29.08	N/A	49.17 Kips
31.54 ft	Cohesionless	1469.54 psf	29.08	N/A	81.00 Kips
31.56 ft	Cohesive	N/A	N/A	1071.00 psf	81.11 Kips
36.34 ft	Cohesive	N/A	N/A	1071.00 psf	105.16 Kips
36.36 ft	Cohesive	N/A	N/A	859.57 psf	105.26 Kips
41.34 ft	Cohesive	N/A	N/A	859.57 psf	125.37 Kips
41.36 ft	Cohesive	N/A	N/A	907.69 psf	125.45 Kips
46.34 ft	Cohesive	N/A	N/A	907.69 psf	146.70 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
5.54 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
5.56 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
7.04 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
7.06 ft	Cohesive	N/A	N/A	N/A	0.67 Kips
12.54 ft	Cohesive	N/A	N/A	N/A	0.67 Kips
12.56 ft	Cohesionless	518.66 psf	19.80	1.98 Kips	0.78 Kips
17.54 ft	Cohesionless	780.60 psf	19.80	1.98 Kips	1.18 Kips
17.56 ft	Cohesionless	781.73 psf	35.20	3.07 Kips	2.47 Kips
24.54 ft	Cohesionless	1197.73 psf	35.20	3.07 Kips	3.07 Kips
24.56 ft	Cohesionless	1199.11 psf	91.20	30.62 Kips	11.50 Kips
31.54 ft	Cohesionless	1740.75 psf	91.20	30.62 Kips	16.69 Kips
31.56 ft	Cohesive	N/A	N/A	N/A	6.02 Kips
36.34 ft	Cohesive	N/A	N/A	N/A	6.02 Kips
36.36 ft	Cohesive	N/A	N/A	N/A	4.35 Kips
41.34 ft	Cohesive	N/A	N/A	N/A	4.35 Kips
41.36 ft	Cohesive	N/A	N/A	N/A	4.01 Kips
46.34 ft	Cohesive	N/A	N/A	N/A	4.01 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	0.80 Kips	0.83 Kips
5.54 ft	15.15 Kips	0.80 Kips	15.96 Kips
5.56 ft	15.22 Kips	1.00 Kips	16.22 Kips
7.04 ft	20.19 Kips	1.00 Kips	21.19 Kips
7.06 ft	20.25 Kips	0.67 Kips	20.92 Kips
12.54 ft	32.89 Kips	0.67 Kips	33.56 Kips
12.56 ft	32.92 Kips	0.78 Kips	33.71 Kips
17.54 ft	37.04 Kips	1.18 Kips	38.22 Kips
17.56 ft	37.06 Kips	2.47 Kips	39.53 Kips
24.54 ft	49.12 Kips	3.07 Kips	52.19 Kips
24.56 ft	49.17 Kips	11.50 Kips	60.67 Kips
31.54 ft	81.00 Kips	16.69 Kips	97.70 Kips
31.56 ft	81.11 Kips	6.02 Kips	87.13 Kips
36.34 ft	105.16 Kips	6.02 Kips	111.18 Kips
36.36 ft	105.26 Kips	4.35 Kips	109.60 Kips
41.34 ft	125.37 Kips	4.35 Kips	129.72 Kips
41.36 ft	125.45 Kips	4.01 Kips	129.47 Kips
46.34 ft	146.70 Kips	4.01 Kips	150.71 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	582.11 psf	0.02 Kips
5.54 ft	Cohesive	N/A	N/A	582.11 psf	10.15 Kips
5.56 ft	Cohesive	N/A	N/A	715.25 psf	10.19 Kips
7.04 ft	Cohesive	N/A	N/A	715.25 psf	13.53 Kips
7.06 ft	Cohesive	N/A	N/A	491.09 psf	13.57 Kips
12.54 ft	Cohesive	N/A	N/A	491.09 psf	22.04 Kips
12.56 ft	Cohesionless	518.39 psf	21.22	N/A	22.07 Kips
17.54 ft	Cohesionless	649.37 psf	21.22	N/A	26.19 Kips
17.56 ft	Cohesionless	781.43 psf	24.36	N/A	26.21 Kips
24.54 ft	Cohesionless	989.43 psf	24.36	N/A	38.26 Kips
24.56 ft	Cohesionless	1198.72 psf	29.08	N/A	38.32 Kips
31.54 ft	Cohesionless	1469.54 psf	29.08	N/A	70.15 Kips
31.56 ft	Cohesive	N/A	N/A	1071.00 psf	70.22 Kips
36.34 ft	Cohesive	N/A	N/A	1071.00 psf	86.34 Kips
36.36 ft	Cohesive	N/A	N/A	859.57 psf	86.40 Kips
41.34 ft	Cohesive	N/A	N/A	859.57 psf	99.87 Kips
41.36 ft	Cohesive	N/A	N/A	907.69 psf	99.93 Kips
46.34 ft	Cohesive	N/A	N/A	907.69 psf	114.16 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
5.54 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
5.56 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
7.04 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
7.06 ft	Cohesive	N/A	N/A	N/A	0.67 Kips
12.54 ft	Cohesive	N/A	N/A	N/A	0.67 Kips
12.56 ft	Cohesionless	518.66 psf	19.80	1.98 Kips	0.78 Kips
17.54 ft	Cohesionless	780.60 psf	19.80	1.98 Kips	1.18 Kips
17.56 ft	Cohesionless	781.73 psf	35.20	3.07 Kips	2.47 Kips
24.54 ft	Cohesionless	1197.73 psf	35.20	3.07 Kips	3.07 Kips
24.56 ft	Cohesionless	1199.11 psf	91.20	30.62 Kips	11.50 Kips
31.54 ft	Cohesionless	1740.75 psf	91.20	30.62 Kips	16.69 Kips
31.56 ft	Cohesive	N/A	N/A	N/A	6.02 Kips
36.34 ft	Cohesive	N/A	N/A	N/A	6.02 Kips
36.36 ft	Cohesive	N/A	N/A	N/A	4.35 Kips
41.34 ft	Cohesive	N/A	N/A	N/A	4.35 Kips
41.36 ft	Cohesive	N/A	N/A	N/A	4.01 Kips
46.34 ft	Cohesive	N/A	N/A	N/A	4.01 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 Kips	0.80 Kips	0.82 Kips
5.54 ft	10.15 Kips	0.80 Kips	10.96 Kips
5.56 ft	10.19 Kips	1.00 Kips	11.20 Kips
7.04 ft	13.53 Kips	1.00 Kips	14.53 Kips
7.06 ft	13.57 Kips	0.67 Kips	14.23 Kips
12.54 ft	22.04 Kips	0.67 Kips	22.71 Kips
12.56 ft	22.07 Kips	0.78 Kips	22.85 Kips
17.54 ft	26.19 Kips	1.18 Kips	27.37 Kips
17.56 ft	26.21 Kips	2.47 Kips	28.67 Kips
24.54 ft	38.26 Kips	3.07 Kips	41.33 Kips
24.56 ft	38.32 Kips	11.50 Kips	49.82 Kips
31.54 ft	70.15 Kips	16.69 Kips	86.84 Kips
31.56 ft	70.22 Kips	6.02 Kips	76.24 Kips
36.34 ft	86.34 Kips	6.02 Kips	92.36 Kips
36.36 ft	86.40 Kips	4.35 Kips	90.74 Kips
41.34 ft	99.87 Kips	4.35 Kips	104.22 Kips
41.36 ft	99.93 Kips	4.01 Kips	103.94 Kips
46.34 ft	114.16 Kips	4.01 Kips	118.18 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	582.11 psf	0.03 Kips
5.54 ft	Cohesive	N/A	N/A	582.11 psf	15.15 Kips
5.56 ft	Cohesive	N/A	N/A	715.25 psf	15.22 Kips
7.04 ft	Cohesive	N/A	N/A	715.25 psf	20.19 Kips
7.06 ft	Cohesive	N/A	N/A	491.09 psf	20.25 Kips
12.54 ft	Cohesive	N/A	N/A	491.09 psf	32.89 Kips
12.56 ft	Cohesionless	518.39 psf	21.22	N/A	32.92 Kips
17.54 ft	Cohesionless	649.37 psf	21.22	N/A	37.04 Kips
17.56 ft	Cohesionless	781.43 psf	24.36	N/A	37.06 Kips
24.54 ft	Cohesionless	989.43 psf	24.36	N/A	49.12 Kips
24.56 ft	Cohesionless	1198.72 psf	29.08	N/A	49.17 Kips
31.54 ft	Cohesionless	1469.54 psf	29.08	N/A	81.00 Kips
31.56 ft	Cohesive	N/A	N/A	1071.00 psf	81.11 Kips
36.34 ft	Cohesive	N/A	N/A	1071.00 psf	105.16 Kips
36.36 ft	Cohesive	N/A	N/A	859.57 psf	105.26 Kips
41.34 ft	Cohesive	N/A	N/A	859.57 psf	125.37 Kips
41.36 ft	Cohesive	N/A	N/A	907.69 psf	125.45 Kips
46.34 ft	Cohesive	N/A	N/A	907.69 psf	146.70 Kips

ULTIMATE - END BEARING

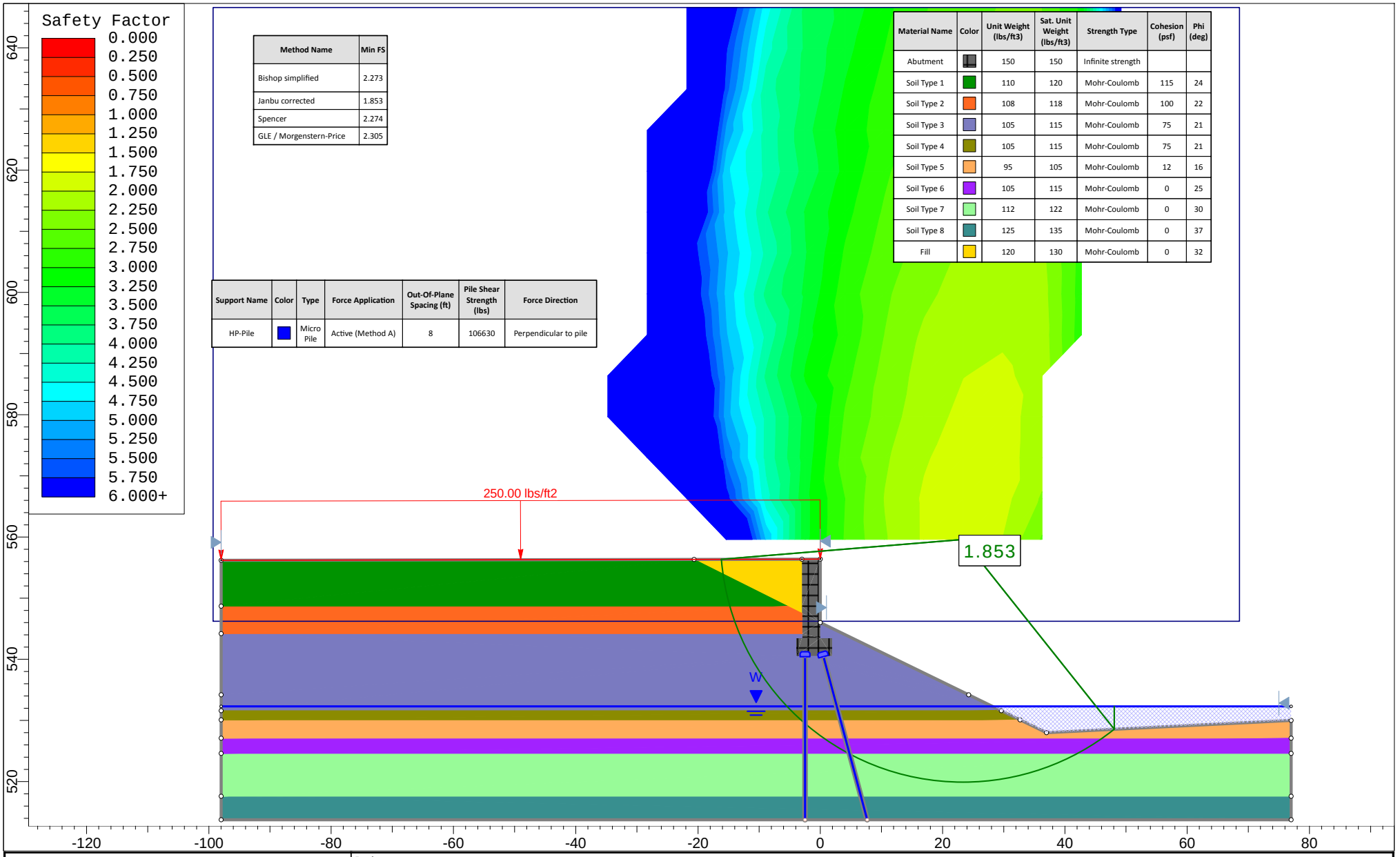
Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
5.54 ft	Cohesive	N/A	N/A	N/A	0.80 Kips
5.56 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
7.04 ft	Cohesive	N/A	N/A	N/A	1.00 Kips
7.06 ft	Cohesive	N/A	N/A	N/A	0.67 Kips
12.54 ft	Cohesive	N/A	N/A	N/A	0.67 Kips
12.56 ft	Cohesionless	518.66 psf	19.80	1.98 Kips	0.78 Kips
17.54 ft	Cohesionless	780.60 psf	19.80	1.98 Kips	1.18 Kips
17.56 ft	Cohesionless	781.73 psf	35.20	3.07 Kips	2.47 Kips
24.54 ft	Cohesionless	1197.73 psf	35.20	3.07 Kips	3.07 Kips
24.56 ft	Cohesionless	1199.11 psf	91.20	30.62 Kips	11.50 Kips
31.54 ft	Cohesionless	1740.75 psf	91.20	30.62 Kips	16.69 Kips
31.56 ft	Cohesive	N/A	N/A	N/A	6.02 Kips
36.34 ft	Cohesive	N/A	N/A	N/A	6.02 Kips
36.36 ft	Cohesive	N/A	N/A	N/A	4.35 Kips
41.34 ft	Cohesive	N/A	N/A	N/A	4.35 Kips
41.36 ft	Cohesive	N/A	N/A	N/A	4.01 Kips
46.34 ft	Cohesive	N/A	N/A	N/A	4.01 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	0.80 Kips	0.83 Kips
5.54 ft	15.15 Kips	0.80 Kips	15.96 Kips
5.56 ft	15.22 Kips	1.00 Kips	16.22 Kips
7.04 ft	20.19 Kips	1.00 Kips	21.19 Kips
7.06 ft	20.25 Kips	0.67 Kips	20.92 Kips
12.54 ft	32.89 Kips	0.67 Kips	33.56 Kips
12.56 ft	32.92 Kips	0.78 Kips	33.71 Kips
17.54 ft	37.04 Kips	1.18 Kips	38.22 Kips
17.56 ft	37.06 Kips	2.47 Kips	39.53 Kips
24.54 ft	49.12 Kips	3.07 Kips	52.19 Kips
24.56 ft	49.17 Kips	11.50 Kips	60.67 Kips
31.54 ft	81.00 Kips	16.69 Kips	97.70 Kips
31.56 ft	81.11 Kips	6.02 Kips	87.13 Kips
36.34 ft	105.16 Kips	6.02 Kips	111.18 Kips
36.36 ft	105.26 Kips	4.35 Kips	109.60 Kips
41.34 ft	125.37 Kips	4.35 Kips	129.72 Kips
41.36 ft	125.45 Kips	4.01 Kips	129.47 Kips
46.34 ft	146.70 Kips	4.01 Kips	150.71 Kips

APPENDIX E

GLOBAL STABILITY ANALYSES



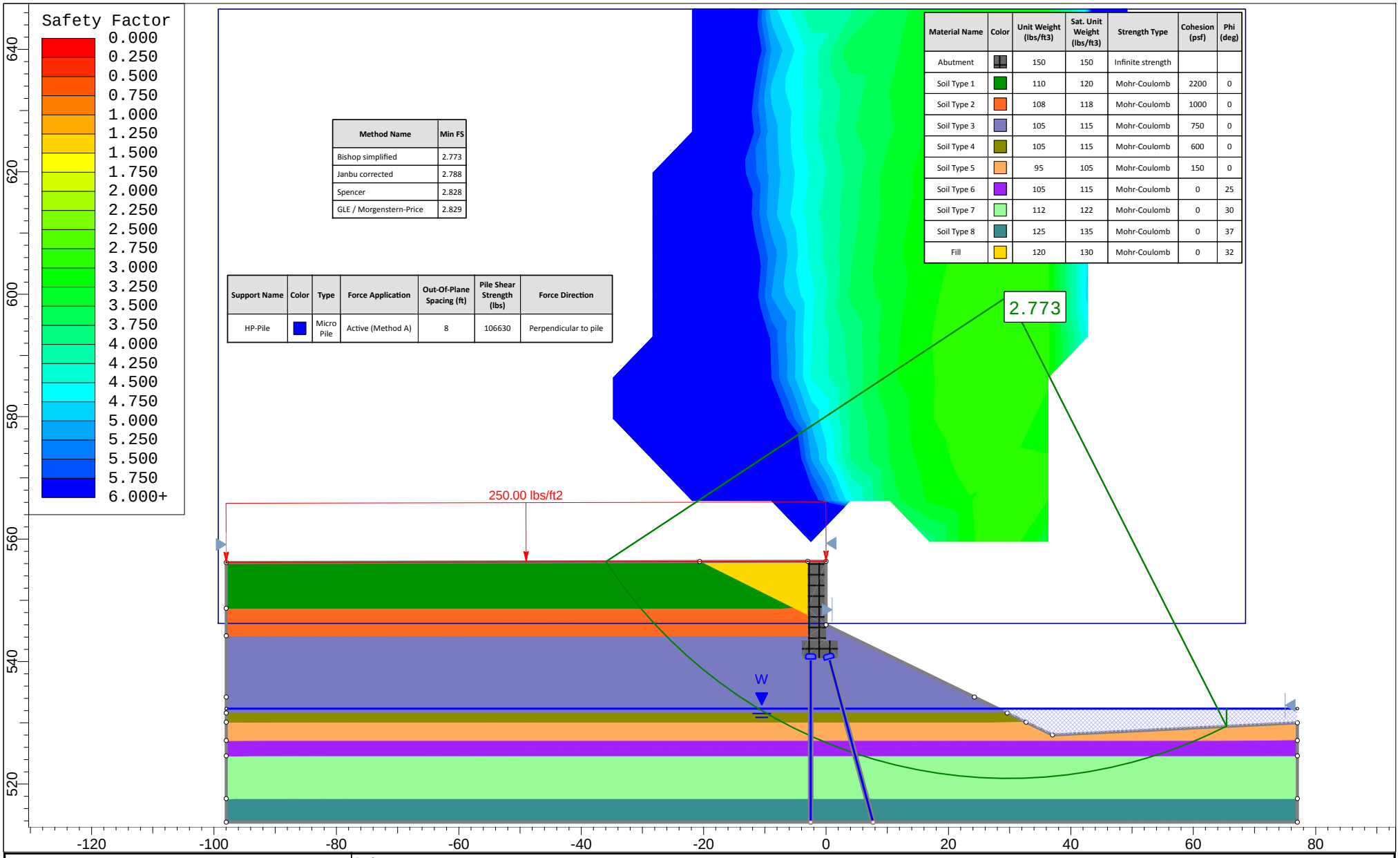
Method Name	Min FS
Bishop simplified	2.273
Janbu corrected	1.853
Spencer	2.274
GLE / Morgenstern-Price	2.305

Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Abutment		150	150	Infinite strength		
Soil Type 1		110	120	Mohr-Coulomb	115	24
Soil Type 2		108	118	Mohr-Coulomb	100	22
Soil Type 3		105	115	Mohr-Coulomb	75	21
Soil Type 4		105	115	Mohr-Coulomb	75	21
Soil Type 5		95	105	Mohr-Coulomb	12	16
Soil Type 6		105	115	Mohr-Coulomb	0	25
Soil Type 7		112	122	Mohr-Coulomb	0	30
Soil Type 8		125	135	Mohr-Coulomb	0	37
Fill		120	130	Mohr-Coulomb	0	32

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)	Force Direction
HP-Pile		Micro Pile	Active (Method A)	8	106630	Perpendicular to pile

Project	PIK-104-06.27 Bridge		
Analysis Description	Rear Abutment		
Drawn By	ZM	Scale	1:260
Company	NEAS, Inc.		
Date	01/06/2022	File Name	PIK-104-06.27_RearAbut_Effective_Normal Water_B-01&02 - With HP10X42 slim

SLIDEINTERPRET 7.038



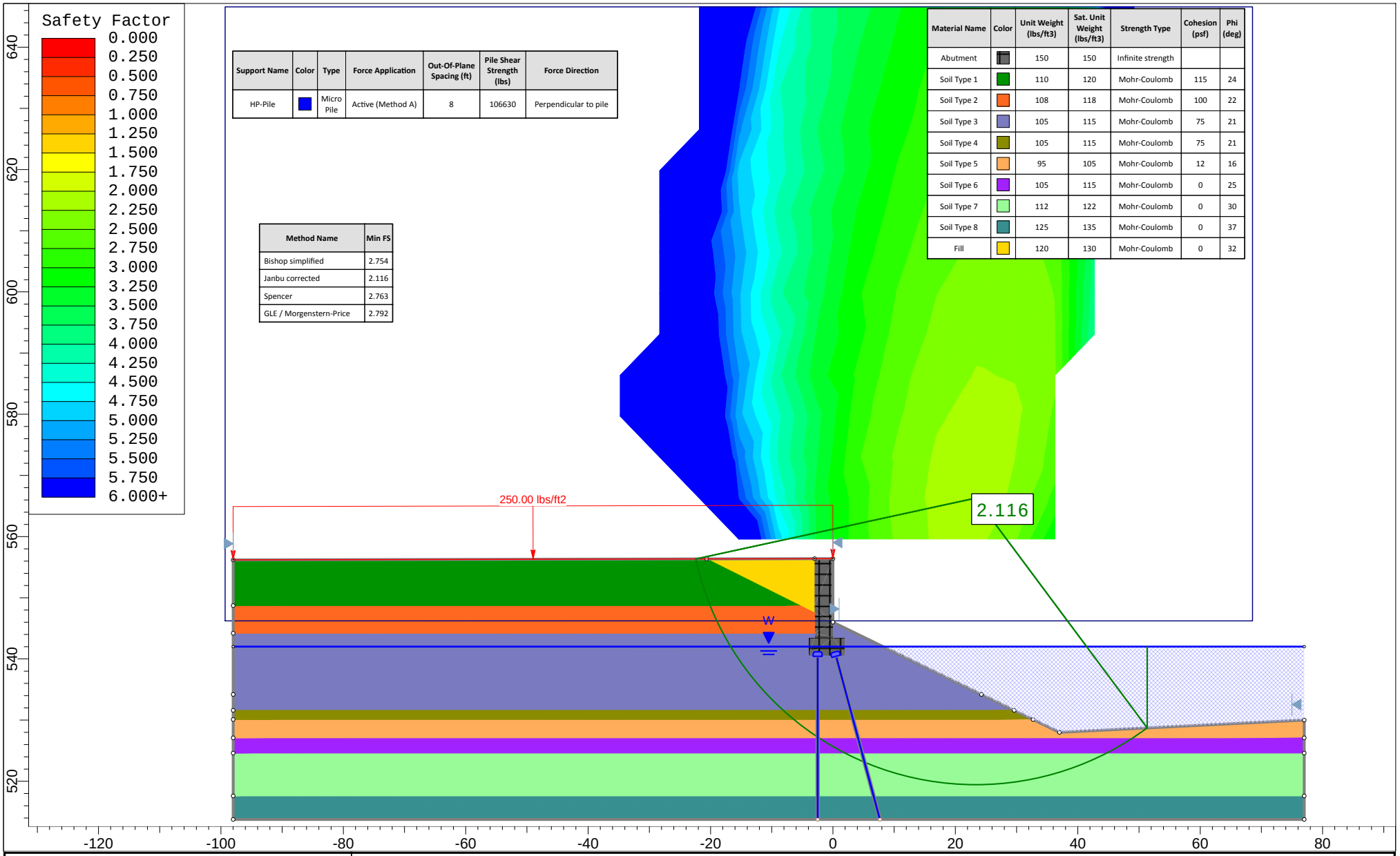
Method Name	Min FS
Bishop simplified	2.773
Janbu corrected	2.788
Spencer	2.828
GLE / Morgenstern-Price	2.829

Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Abutment		150	150	Infinite strength		
Soil Type 1		110	120	Mohr-Coulomb	2200	0
Soil Type 2		108	118	Mohr-Coulomb	1000	0
Soil Type 3		105	115	Mohr-Coulomb	750	0
Soil Type 4		105	115	Mohr-Coulomb	600	0
Soil Type 5		95	105	Mohr-Coulomb	150	0
Soil Type 6		105	115	Mohr-Coulomb	0	25
Soil Type 7		112	122	Mohr-Coulomb	0	30
Soil Type 8		125	135	Mohr-Coulomb	0	37
Fill		120	130	Mohr-Coulomb	0	32

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)	Force Direction
HP-Pile		Micro Pile	Active (Method A)	8	106630	Perpendicular to pile

Project	PIK-104-06.27 Bridge		
Analysis Description	Rear Abutment		
Drawn By	ZM	Scale	1:260
Company	NEAS, Inc.		
Date	01/06/2022	File Name	PIK-104-06.27_RearAbut_Total_Normal Water_B-01&02 - With HP10X42 slim

SLIDEINTERPRET 7.038



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)	Force Direction
HP-Pile		Micro Pile	Active (Method A)	8	106630	Perpendicular to pile

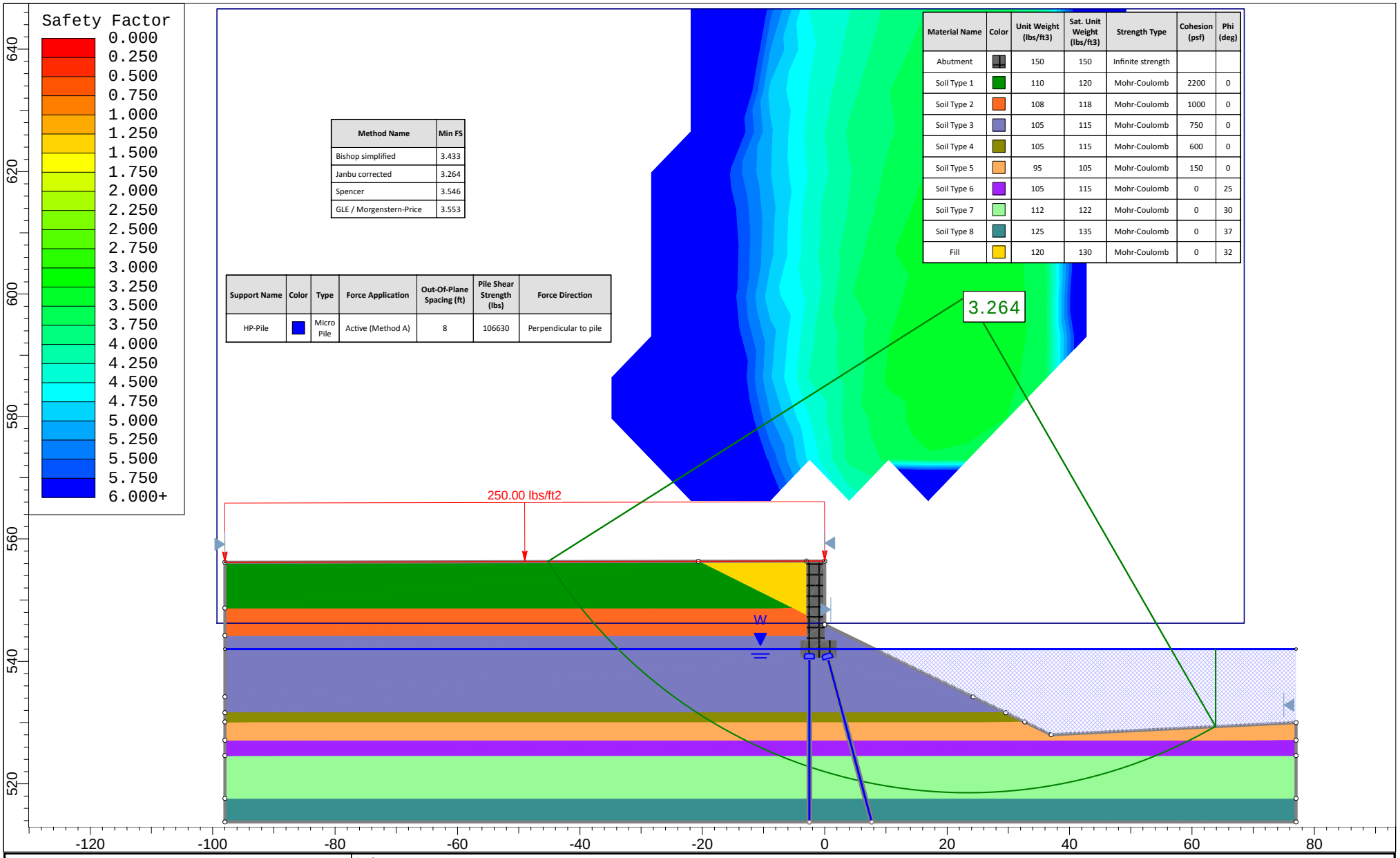
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Abutment		150	150	Infinite strength		
Soil Type 1		110	120	Mohr-Coulomb	115	24
Soil Type 2		108	118	Mohr-Coulomb	100	22
Soil Type 3		105	115	Mohr-Coulomb	75	21
Soil Type 4		105	115	Mohr-Coulomb	75	21
Soil Type 5		95	105	Mohr-Coulomb	12	16
Soil Type 6		105	115	Mohr-Coulomb	0	25
Soil Type 7		112	122	Mohr-Coulomb	0	30
Soil Type 8		125	135	Mohr-Coulomb	0	37
Fill		120	130	Mohr-Coulomb	0	32

Method Name	Min FS
Bishop simplified	2.754
Janbu corrected	2.116
Spencer	2.763
GLE / Morgenstern-Price	2.792

rocscience

SLIDEINTERPRET 7.038

Project	PIK-104-06.27 Bridge		
Analysis Description	Rear Abutment		
Drawn By	ZM	*Scale*	1:260
Company	NEAS, Inc.		
Date	01/06/2022	*File Name*	PIK-104-06.27_RearAbut_Effective_100-Year Flood_B-01&02 - With HP10X42 slim



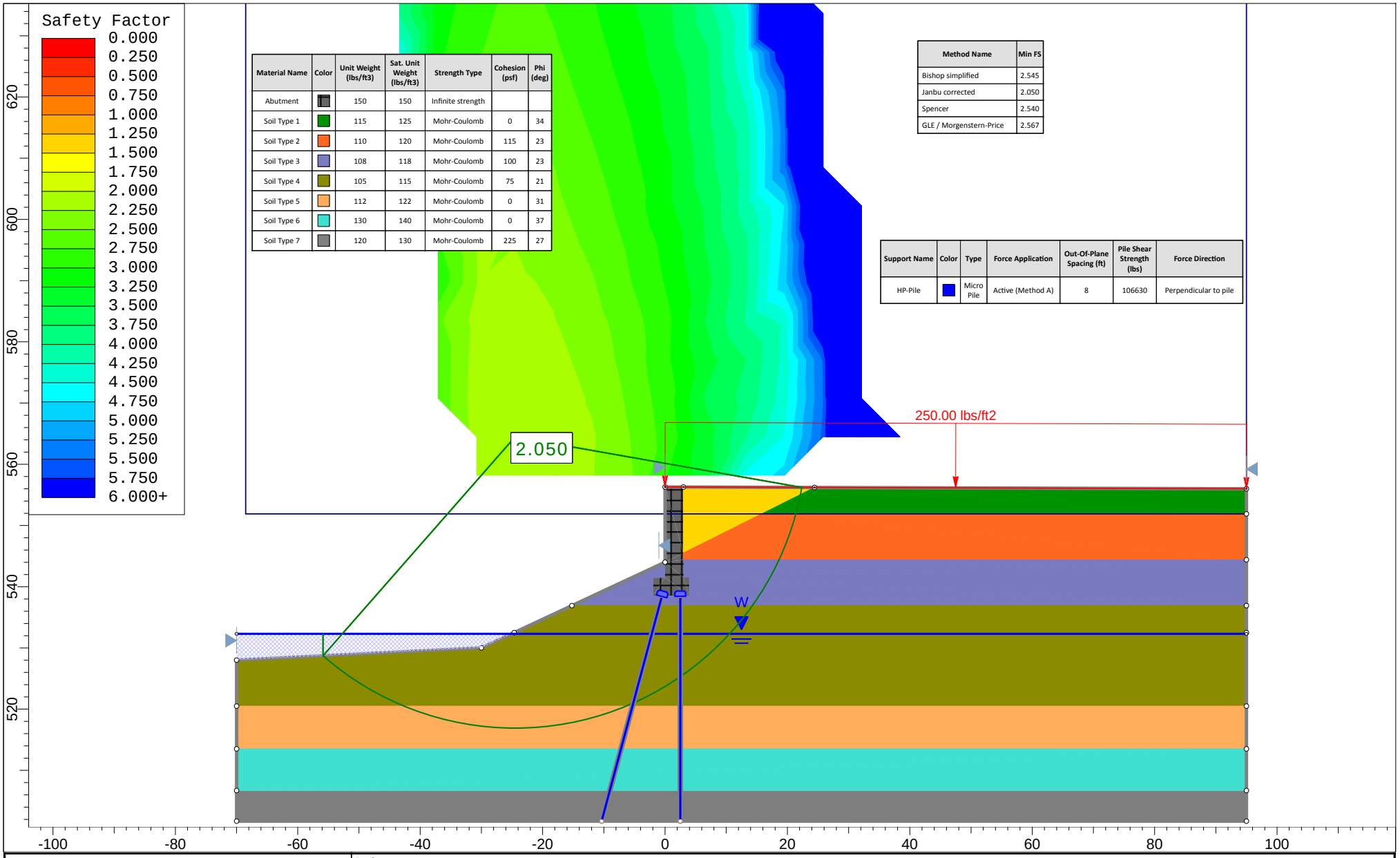
Method Name	Min FS
Bishop simplified	3.433
Janbu corrected	3.264
Spencer	3.546
GLE / Morgenstern-Price	3.553

Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Abutment		150	150	Infinite strength		
Soil Type 1		110	120	Mohr-Coulomb	2200	0
Soil Type 2		108	118	Mohr-Coulomb	1000	0
Soil Type 3		105	115	Mohr-Coulomb	750	0
Soil Type 4		105	115	Mohr-Coulomb	600	0
Soil Type 5		95	105	Mohr-Coulomb	150	0
Soil Type 6		105	115	Mohr-Coulomb	0	25
Soil Type 7		112	122	Mohr-Coulomb	0	30
Soil Type 8		125	135	Mohr-Coulomb	0	37
Fill		120	130	Mohr-Coulomb	0	32

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)	Force Direction
HP-Pile		Micro Pile	Active (Method A)	8	106630	Perpendicular to pile

Project	PIK-104-06.27 Bridge		
Analysis Description	Rear Abutment		
Drawn By	ZM	Scale	1:260
Company	NEAS, Inc.		
Date	01/06/2022	File Name	PIK-104-06.27_RearAbut_Total_100-Year Flood_B-01&02 - With HP10X42 slim

SLIDEINTERPRET 7.038



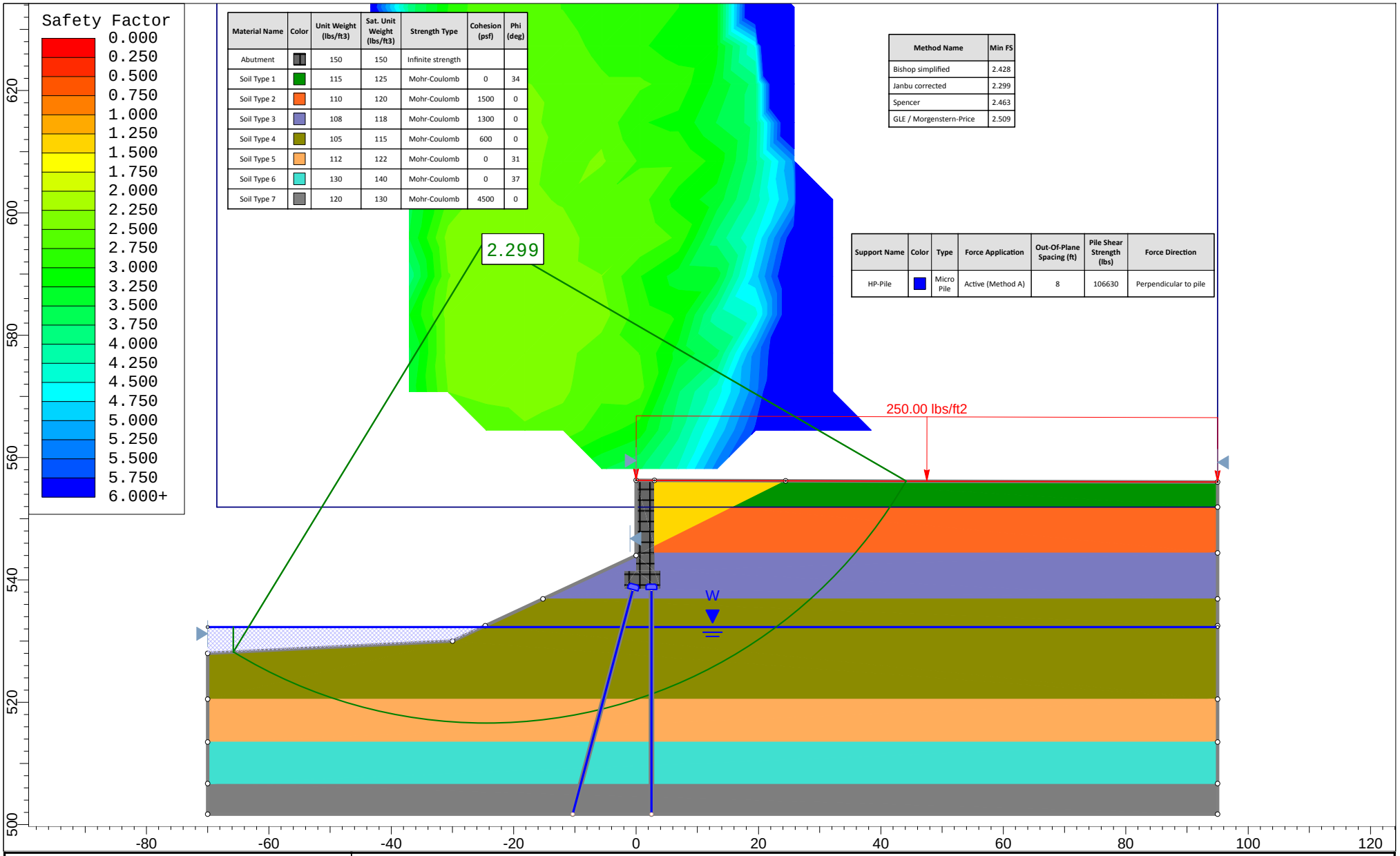
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Abutment		150	150	Infinite strength		
Soil Type 1		115	125	Mohr-Coulomb	0	34
Soil Type 2		110	120	Mohr-Coulomb	115	23
Soil Type 3		108	118	Mohr-Coulomb	100	23
Soil Type 4		105	115	Mohr-Coulomb	75	21
Soil Type 5		112	122	Mohr-Coulomb	0	31
Soil Type 6		130	140	Mohr-Coulomb	0	37
Soil Type 7		120	130	Mohr-Coulomb	225	27

Method Name	Min FS
Bishop simplified	2.545
Janbu corrected	2.050
Spencer	2.540
GLE / Morgenstern-Price	2.567

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)	Force Direction
HP-Pile		Micro Pile	Active (Method A)	8	106630	Perpendicular to pile

Project	PIK-104-06.27 Bridge		
Analysis Description	Forward Abutment		
Drawn By	ZM	*Scale*	1:260
Company	NEAS, Inc.		
Date	01/06/2022	*File Name*	PIK-104-06.27_ForwAbut_Effective_Normal Water_B-03&04 - With HP 10X42 slim

SLIDEINTERPRET 7.038



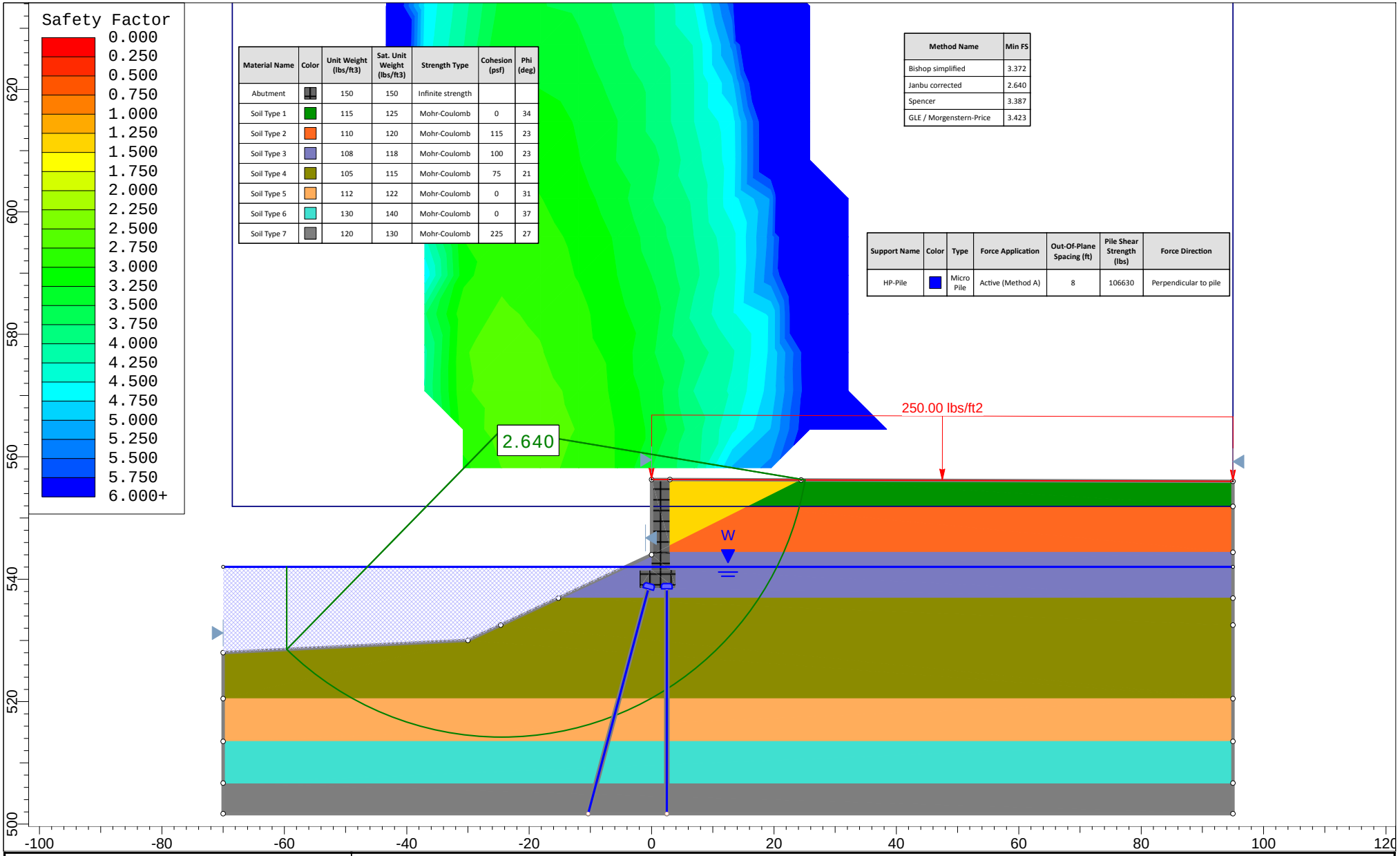
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Abutment		150	150	Infinite strength		
Soil Type 1		115	125	Mohr-Coulomb	0	34
Soil Type 2		110	120	Mohr-Coulomb	1500	0
Soil Type 3		108	118	Mohr-Coulomb	1300	0
Soil Type 4		105	115	Mohr-Coulomb	600	0
Soil Type 5		112	122	Mohr-Coulomb	0	31
Soil Type 6		130	140	Mohr-Coulomb	0	37
Soil Type 7		120	130	Mohr-Coulomb	4500	0

Method Name	Min FS
Bishop simplified	2.428
Janbu corrected	2.299
Spencer	2.463
GLE / Morgenstern-Price	2.509

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)	Force Direction
HP-Pile		Micro Pile	Active (Method A)	8	106630	Perpendicular to pile

Project	PIK-104-06.27 Bridge		
Analysis Description	Forward Abutment		
Drawn By	ZM	Scale	1:260
Company	NEAS, Inc.		
Date	01/06/2022	File Name	PIK-104-06.27_ForwAbut_Total_Normal Water_B-03&04 - With HP 10X42 slim

SLIDEINTERPRET 7.038



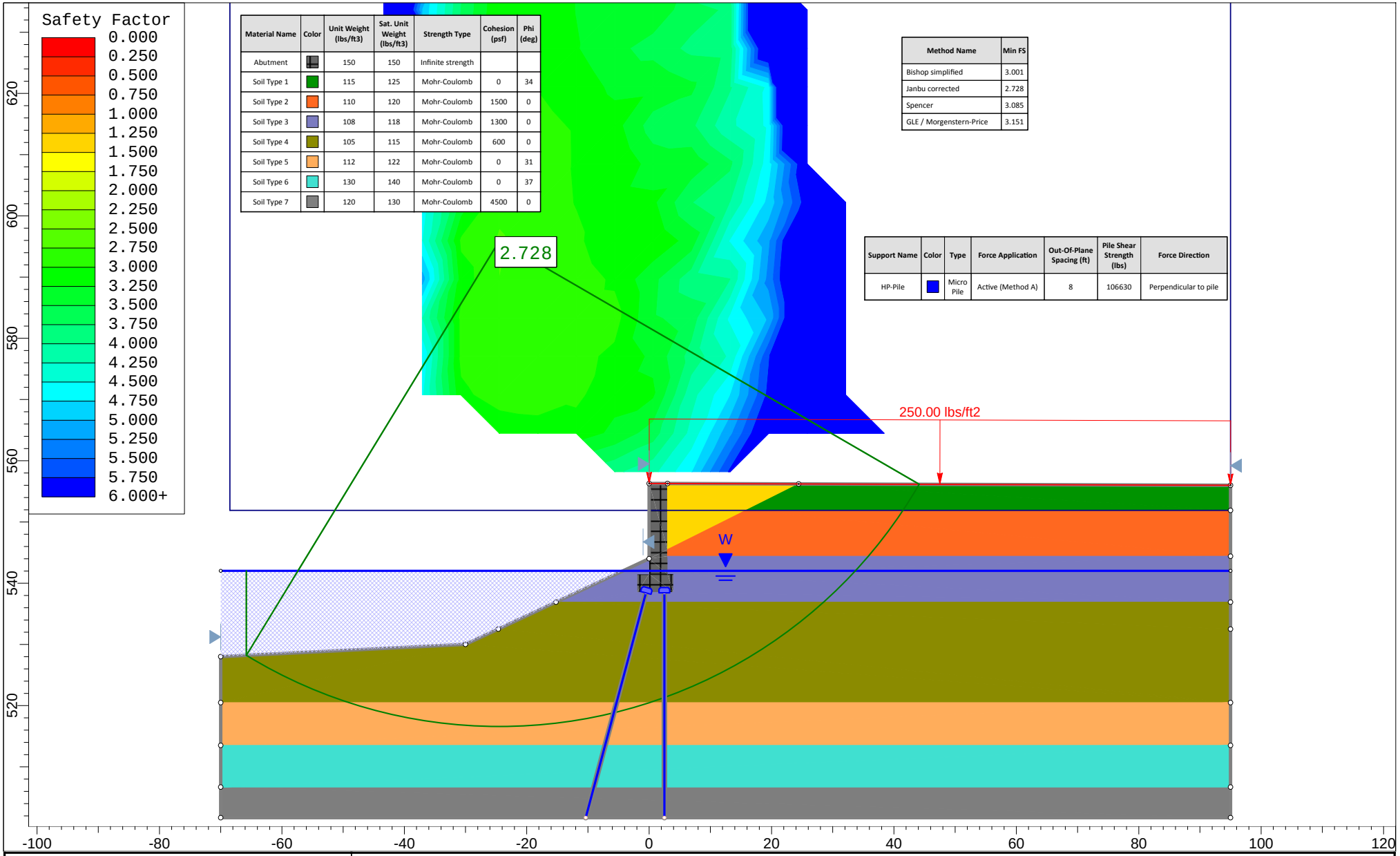
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Abutment		150	150	Infinite strength		
Soil Type 1		115	125	Mohr-Coulomb	0	34
Soil Type 2		110	120	Mohr-Coulomb	115	23
Soil Type 3		108	118	Mohr-Coulomb	100	23
Soil Type 4		105	115	Mohr-Coulomb	75	21
Soil Type 5		112	122	Mohr-Coulomb	0	31
Soil Type 6		130	140	Mohr-Coulomb	0	37
Soil Type 7		120	130	Mohr-Coulomb	225	27

Method Name	Min FS
Bishop simplified	3.372
Janbu corrected	2.640
Spencer	3.387
GLE / Morgenstern-Price	3.423

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)	Force Direction
HP-Pile		Micro Pile	Active (Method A)	8	106630	Perpendicular to pile

Project	PIK-104-06.27 Bridge		
Analysis Description	Forward Abutment		
Drawn By	ZM	Scale	1:260
Company	NEAS, Inc.		
Date	01/06/2022	File Name	PIK-104-06.27_ForwAbut_Effective_100-Year Flood_B-03&04 - With HP 10X42 slim

SLIDEINTERPRET 7.038



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Abutment		150	150	Infinite strength		
Soil Type 1		115	125	Mohr-Coulomb	0	34
Soil Type 2		110	120	Mohr-Coulomb	1500	0
Soil Type 3		108	118	Mohr-Coulomb	1300	0
Soil Type 4		105	115	Mohr-Coulomb	600	0
Soil Type 5		112	122	Mohr-Coulomb	0	31
Soil Type 6		130	140	Mohr-Coulomb	0	37
Soil Type 7		120	130	Mohr-Coulomb	4500	0

Method Name	Min FS
Bishop simplified	3.001
Janbu corrected	2.728
Spencer	3.085
GLE / Morgenstern-Price	3.151

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)	Force Direction
HP-Pile		Micro Pile	Active (Method A)	8	106630	Perpendicular to pile

Project	PIK-104-06.27 Bridge		
Analysis Description	Forward Abutment		
Drawn By	ZM	*Scale*	1:260
Company	NEAS, Inc.		
Date	01/06/2022	*File Name*	PIK-104-06.27_ForwAbut_Total_100-Year Flood_B-03&04 - With HP 10X42 slim

SLIDEINTERPRET 7.038

APPENDIX F

SETTLEMENT ANALYSES

PIK-104-06.27 Rear Abutment

PROJECT IDENTIFICATION

Title: PIK-104-06.27 Rear Abutment
Project Number: -
Client: BG Engineering Group
Designer: ZM
Station Number: STA. 330+94.45

Description:

Company's information:

Name: NEAS, Inc.
Street:
,
Telephone #:
Fax #:
E-Mail:

Original file path and name: C:\Users\s ..... OneDrive\Desktop\PIK-104\PIK-104-RearAbut_B-01.2ST
Original date and time of creating this file: 1/13/2022

GEOMETRY: Analysis of a 3D-Approximate geometry

INPUT DATA – FOUNDATION LAYERS – 10 layers

	Wet Unit Weight, γ [lb/ft³]	Poisson's Ratio μ	Description of Soil
1	108.00	0.35	A-4a
2	105.00	0.35	A-6a
3	112.00	0.30	A-1-b
4	110.00	0.30	A-4a
5	115.00	0.30	A-3a
6	130.00	0.30	A-2-4
7	118.00	0.30	A-2-6
8	112.00	0.35	A-6a
9	130.00	0.35	A-6a
10	140.00	0.30	Rock

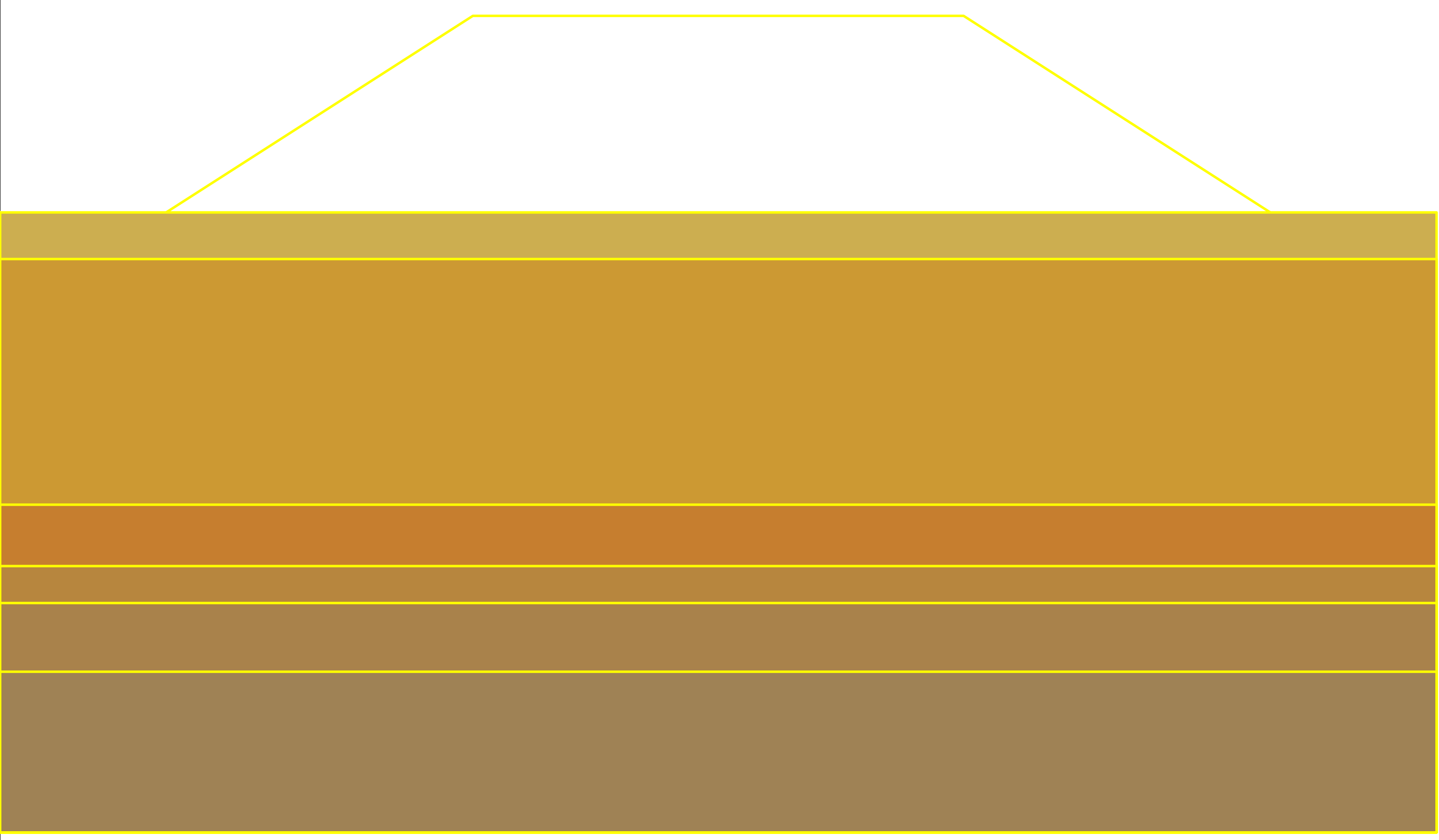
INPUT DATA – EMBANKMENT LAYERS – 1 layers

	Wet Unit Weight, γ [lb/ft³]	Description of Soil
1	120.00	

INPUT DATA OF WATER

Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]
1	0.00	532.30
2	20.00	532.30
3	25.00	532.30
4	40.00	532.30

DRAWING OF SPECIFIED GEOMETRY



INPUT DATA FOR CONSOLIDATION –– $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :	Shear Strength Data S	m	CREEP Ca/Cc
1	Yes	2.50	0.126	0.009	0.800	0.2153	Top & Bot.	0.250	0.800	0.0500
2	Yes	1.50	0.182	0.018	0.900	0.2153	Top & Bot.	0.250	0.800	0.0500
3	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	Yes	2.00	0.168	0.018	0.840	0.2153	Top & Bot.	0.250	0.800	0.0500
9	Yes	4.00	0.138	0.018	0.610	0.2153	Top & Bot.	0.250	0.800	0.0500
10	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Secondary Comprassion (Creep) : Settlement is calculated at t2/t1 = 10.0

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	0.00	0.00	1	200000	0.3500	-0.0000	546.00	546.00	0.00
			2	200000	0.3500	-0.0019			
			3	200000	0.3000	0.0002			
			4	150000	0.3000	0.0003			
			5	200000	0.3000	0.0008			
			6	900000	0.3000	0.0011			
			7	400000	0.3000	0.0016			
			8	800000	0.3500	0.0009			
			9	900000	0.3500	0.0005			
			10	99999999	0.3000	0.0000			
2	6.00	0.00	1	200000	0.3500	-0.0002	546.00	545.99	0.01
			2	200000	0.3500	-0.0006			
			3	200000	0.3000	0.0013			
			4	150000	0.3000	0.0014			
			5	200000	0.3000	0.0022			
			6	900000	0.3000	0.0022			
			7	400000	0.3000	0.0024			
			8	800000	0.3500	0.0013			
			9	900000	0.3500	0.0007			
			10	99999999	0.3000	0.0000			
3	12.00	0.00	1	200000	0.3500	0.0016	546.00	545.97	0.03
			2	200000	0.3500	0.0096			
			3	200000	0.3000	0.0037			
			4	150000	0.3000	0.0032			
			5	200000	0.3000	0.0045			
			6	900000	0.3000	0.0035			
			7	400000	0.3000	0.0034			
			8	800000	0.3500	0.0018			
			9	900000	0.3500	0.0009			
			10	99999999	0.3000	0.0000			
4	18.00	0.00	1	200000	0.3500	0.0039	546.00	545.94	0.06
			2	200000	0.3500	0.0234			
			3	200000	0.3000	0.0065			
			4	150000	0.3000	0.0054			
			5	200000	0.3000	0.0071			
			6	900000	0.3000	0.0050			
			7	400000	0.3000	0.0044			
			8	800000	0.3500	0.0022			
			9	900000	0.3500	0.0011			
			10	99999999	0.3000	0.0000			
5	24.00	0.00	1	200000	0.3500	0.0045	546.00	545.93	0.07
			2	200000	0.3500	0.0294			
			3	200000	0.3000	0.0084			
			4	150000	0.3000	0.0068			
			5	200000	0.3000	0.0089			
			6	900000	0.3000	0.0060			
			7	400000	0.3000	0.0051			
			8	800000	0.3500	0.0025			
			9	900000	0.3500	0.0013			
			10	99999999	0.3000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
6	30.00	0.00	1	200000	0.3500	0.0045	546.00	545.92	0.08
			2	200000	0.3500	0.0300			
			3	200000	0.3000	0.0089			
			4	150000	0.3000	0.0073			
			5	200000	0.3000	0.0095			
			6	900000	0.3000	0.0064			
			7	400000	0.3000	0.0054			
			8	800000	0.3500	0.0027			
			9	900000	0.3500	0.0013			
			10	99999999	0.3000	0.0000			
7	36.00	0.00	1	200000	0.3500	0.0045	546.00	545.93	0.07
			2	200000	0.3500	0.0294			
			3	200000	0.3000	0.0084			
			4	150000	0.3000	0.0068			
			5	200000	0.3000	0.0089			
			6	900000	0.3000	0.0060			
			7	400000	0.3000	0.0051			
			8	800000	0.3500	0.0025			
			9	900000	0.3500	0.0013			
			10	99999999	0.3000	0.0000			
8	42.00	0.00	1	200000	0.3500	0.0039	546.00	545.94	0.06
			2	200000	0.3500	0.0234			
			3	200000	0.3000	0.0065			
			4	150000	0.3000	0.0054			
			5	200000	0.3000	0.0071			
			6	900000	0.3000	0.0050			
			7	400000	0.3000	0.0044			
			8	800000	0.3500	0.0022			
			9	900000	0.3500	0.0011			
			10	99999999	0.3000	0.0000			
9	48.00	0.00	1	200000	0.3500	0.0016	546.00	545.97	0.03
			2	200000	0.3500	0.0096			
			3	200000	0.3000	0.0037			
			4	150000	0.3000	0.0032			
			5	200000	0.3000	0.0045			
			6	900000	0.3000	0.0035			
			7	400000	0.3000	0.0034			
			8	800000	0.3500	0.0018			
			9	900000	0.3500	0.0009			
			10	99999999	0.3000	0.0000			
10	54.00	0.00	1	200000	0.3500	-0.0002	546.00	545.99	0.01
			2	200000	0.3500	-0.0006			
			3	200000	0.3000	0.0013			
			4	150000	0.3000	0.0014			
			5	200000	0.3000	0.0022			
			6	900000	0.3000	0.0022			
			7	400000	0.3000	0.0024			
			8	800000	0.3500	0.0013			
			9	900000	0.3500	0.0007			
			10	99999999	0.3000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, µ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
11	60.00	0.00	1	200000	0.3500	-0.0000	546.00	546.00	0.00
			2	200000	0.3500	-0.0019			
			3	200000	0.3000	0.0002			
			4	150000	0.3000	0.0003			
			5	200000	0.3000	0.0008			
			6	900000	0.3000	0.0011			
			7	400000	0.3000	0.0016			
			8	800000	0.3500	0.0009			
			9	900000	0.3500	0.0005			
			10	99999999	0.3000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	0.00	0.00	546.00	0.00	546.00
2	6.00	0.00	546.00	0.01	545.99
3	12.00	0.00	546.00	0.11	545.89
4	18.00	0.00	546.00	0.26	545.74
5	24.00	0.00	546.00	0.32	545.68
6	30.00	0.00	546.00	0.33	545.67
7	36.00	0.00	546.00	0.32	545.68
8	42.00	0.00	546.00	0.26	545.74
9	48.00	0.00	546.00	0.11	545.89
10	54.00	0.00	546.00	0.01	545.99
11	60.00	0.00	546.00	0.00	546.00

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	30.00	546.00	A-4a
2	1	30.00	544.10	A-6a
3	1	30.00	534.10	A-1-b
4	1	30.00	531.60	A-4a
5	1	30.00	530.10	A-3a
6	1	30.00	527.30	A-2-4
7	1	30.00	517.30	A-2-6
8	1	30.00	512.80	A-6a
9	1	30.00	507.80	A-6a
10	1	30.00	504.70	Rock

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

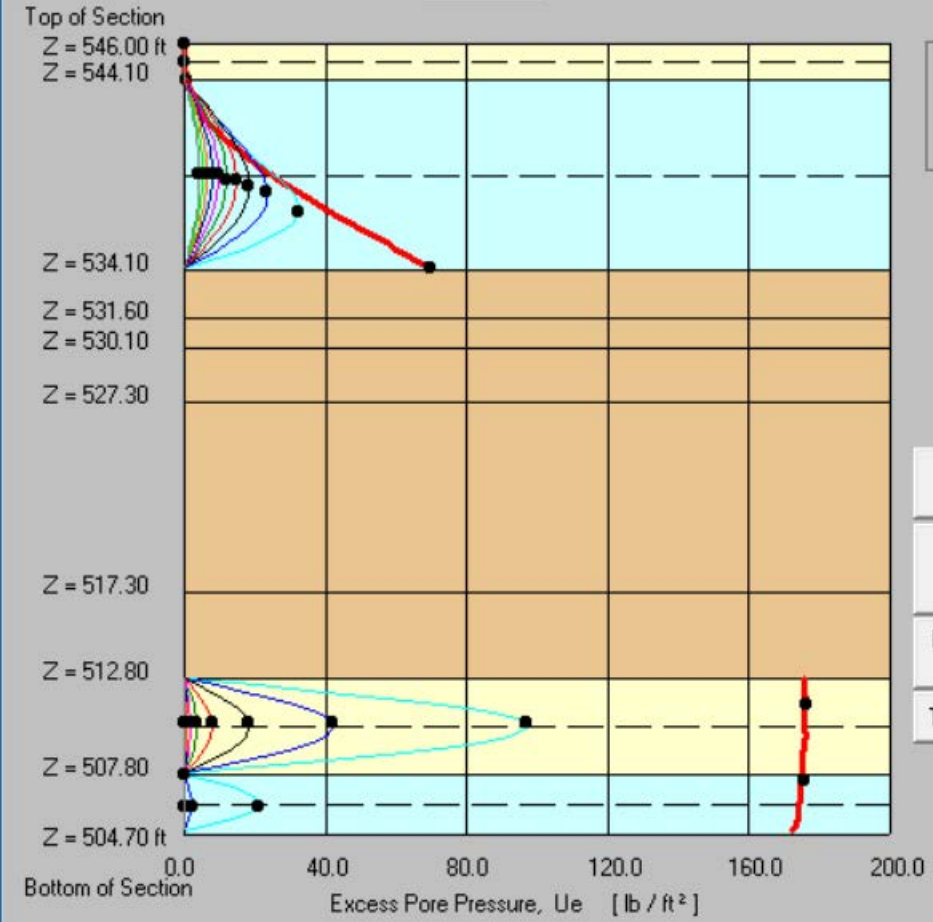
Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	X1 = 7.50 [ft]	1	20.00	554.00	
	X2 = 52.50 [ft]	2	40.00	554.00	

Time Rate Calculations

Assess consolidation 1 days after loading OR when the average degree of consolidation, U, reaches 90 %, whichever happens LAST

NOTE: FoSSA calculates U of each consolidating layer. If U controls the final time step, its value in all layers will equal or exceed the prescribed value.

Initial excess porewater pressure is :
- (•) Calculated by FoSSA (i.e., $u_{e_o}=\Delta\sigma$)
- ( ) User Input — Modify Input



Place mouse on line for details

Excess Ue = 104.6 lb/ft²
Z = 544.44 ft.

Secondary (creep) settlement

Undrained Shear Strength Results

Display/Print Sc/U vs. Time

Time Rate Equation

Calculate

Tabulated Results for approximately 93 days

Results displayed for FoSSA calculated Ue

PRINT SCREEN

RETURN

Cancel

PIK-104-06.27 Forward Abutment

PROJECT IDENTIFICATION

Title: PIK-104-06.27 Forward Abutment
Project Number: -
Client: BG Engineering Group
Designer: ZM
Station Number: STA. 332+06.21

Description:
B-004-0-21

Company's information:

Name: NEAS, Inc.
Street:
,
Telephone #:
Fax #:
E-Mail:

Original file path and name: C:\Users\s ..... Drive\Desktop\PIK-104\PIK-104-ForwardAbut_B-04.2ST
Original date and time of creating this file: 1/13/2022

GEOMETRY: Analysis of a 3D-Approximate geometry

INPUT DATA – FOUNDATION LAYERS – 6 layers

	Wet Unit Weight, γ [lb/ft³]	Poisson's Ratio μ	Description of Soil
1	108.00	0.35	A-6b
2	105.00	0.35	A-6a
3	125.00	0.30	A-1-b
4	140.00	0.30	A-4b
5	140.00	0.30	A-2-4
6	140.00	0.30	Rock

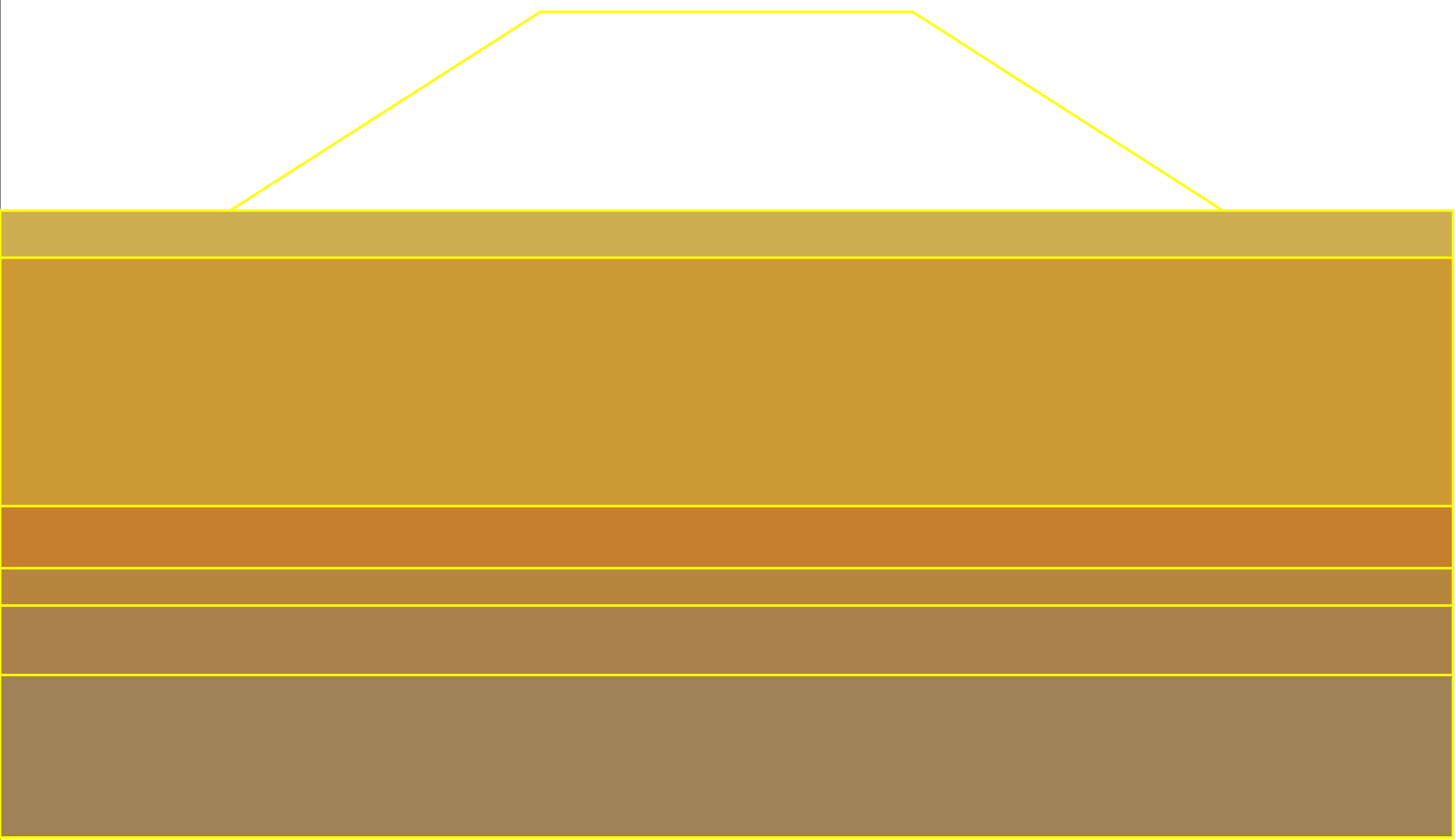
INPUT DATA – EMBANKMENT LAYERS – 1 layers

	Wet Unit Weight, γ [lb/ft³]	Description of Soil
1	120.00	Fills

INPUT DATA OF WATER

Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]
1	0.00	532.30
2	20.00	532.30
3	25.00	532.30
4	40.00	532.30

DRAWING OF SPECIFIED GEOMETRY



INPUT DATA FOR CONSOLIDATION –– $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :	Shear Strength Data S	m	CREEP Ca/Cc
1	Yes	2.50	0.203	0.022	0.800	0.2153	Top & Bot.	0.250	0.800	0.0500
2	Yes	1.50	0.165	0.016	0.900	0.2153	Top & Bot.	0.250	0.800	0.0500
3	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	Yes	4.00	0.090	0.005	0.430	0.2153	Top & Bot.	0.250	0.800	0.0500
5	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Secondary Comprassion (Creep) : Settlement is calculated at t2/t1 = 10.0

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	-10.00	0.00	1	350000	0.3500	-0.0000	546.00	546.00	0.00
			2	200000	0.3500	-0.0013			
			3	400000	0.3000	-0.0001			
			4	500000	0.3000	-0.0000			
			5	800000	0.3000	0.0000			
			6	900000	0.3000	0.0042			
2	-4.00	0.00	1	350000	0.3500	-0.0000	546.00	546.00	0.00
			2	200000	0.3500	-0.0017			
			3	400000	0.3000	0.0000			
			4	500000	0.3000	0.0001			
			5	800000	0.3000	0.0001			
			6	900000	0.3000	0.0061			
3	2.00	0.00	1	350000	0.3500	-0.0001	546.00	545.99	0.01
			2	200000	0.3500	-0.0012			
			3	400000	0.3000	0.0005			
			4	500000	0.3000	0.0003			
			5	800000	0.3000	0.0004			
			6	900000	0.3000	0.0086			
4	8.00	0.00	1	350000	0.3500	0.0006	546.00	545.98	0.02
			2	200000	0.3500	0.0065			
			3	400000	0.3000	0.0015			
			4	500000	0.3000	0.0008			
			5	800000	0.3000	0.0010			
			6	900000	0.3000	0.0116			
5	14.00	0.00	1	350000	0.3500	0.0019	546.00	545.96	0.04
			2	200000	0.3500	0.0205			
			3	400000	0.3000	0.0030			
			4	500000	0.3000	0.0015			
			5	800000	0.3000	0.0016			
			6	900000	0.3000	0.0146			
6	20.00	0.00	1	350000	0.3500	0.0026	546.00	545.94	0.06
			2	200000	0.3500	0.0293			
			3	400000	0.3000	0.0040			
			4	500000	0.3000	0.0019			
			5	800000	0.3000	0.0021			
			6	900000	0.3000	0.0166			
7	26.00	0.00	1	350000	0.3500	0.0026	546.00	545.94	0.06
			2	200000	0.3500	0.0303			
			3	400000	0.3000	0.0043			
			4	500000	0.3000	0.0021			
			5	800000	0.3000	0.0022			
			6	900000	0.3000	0.0172			
8	32.00	0.00	1	350000	0.3500	0.0027	546.00	545.95	0.05
			2	200000	0.3500	0.0277			
			3	400000	0.3000	0.0037			
			4	500000	0.3000	0.0018			
			5	800000	0.3000	0.0020			
			6	900000	0.3000	0.0161			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
9	38.00	0.00	1	350000	0.3500	0.0014	546.00	545.96	0.04
			2	200000	0.3500	0.0158			
			3	400000	0.3000	0.0025			
			4	500000	0.3000	0.0013			
			5	800000	0.3000	0.0014			
			6	900000	0.3000	0.0137			
10	44.00	0.00	1	350000	0.3500	0.0001	546.00	545.98	0.02
			2	200000	0.3500	0.0026			
			3	400000	0.3000	0.0011			
			4	500000	0.3000	0.0006			
			5	800000	0.3000	0.0008			
			6	900000	0.3000	0.0106			
11	50.00	0.00	1	350000	0.3500	-0.0000	546.00	545.99	0.01
			2	200000	0.3500	-0.0016			
			3	400000	0.3000	0.0003			
			4	500000	0.3000	0.0002			
			5	800000	0.3000	0.0003			
			6	900000	0.3000	0.0077			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	-10.00	0.00	546.00	0.00	546.00
2	-4.00	0.00	546.00	0.00	546.00
3	2.00	0.00	546.00	0.00	546.00
4	8.00	0.00	546.00	0.08	545.92
5	14.00	0.00	546.00	0.27	545.73
6	20.00	0.00	546.00	0.36	545.64
7	26.00	0.00	546.00	0.36	545.64
8	32.00	0.00	546.00	0.34	545.66
9	38.00	0.00	546.00	0.21	545.79
10	44.00	0.00	546.00	0.03	545.97
11	50.00	0.00	546.00	0.00	546.00

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	25.00	546.00	A-6b
2	1	30.00	544.10	A-6a
3	1	30.00	534.10	A-1-b
4	1	30.00	531.60	A-4b
5	1	30.00	530.10	A-2-4
6	1	30.00	527.30	Rock

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

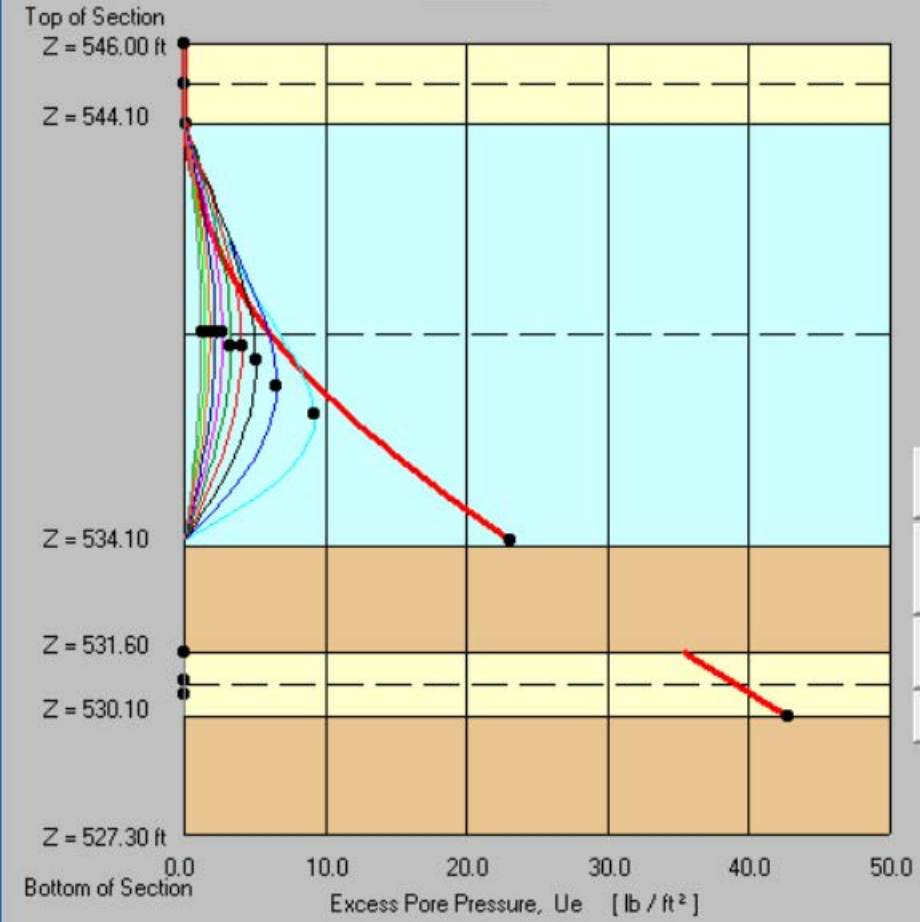
Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	X1 = 5.00 [ft]	1	17.50	554.00	Fills
	X2 = 45.00 [ft]	2	32.50	554.00	

Time Rate Calculations

Assess consolidation 1 days after loading OR when the average degree of consolidation, U, reaches 90 %, whichever happens LAST

NOTE: FoSSA calculates U of each consolidating layer. If U controls the final time step, its value in all layers will equal or exceed the prescribed value.

Initial excess porewater pressure is :
- (•) Calculated by FoSSA (i.e., $u_{e_o}=\Delta\sigma$)
- ( ) User Input — Modify Input



Place mouse on line for details

Excess Ue = 41.9 lb/ft²
Z = 545.72 ft.

Secondary (creep) settlement

Undrained Shear Strength Results

Display/Print Sc/U vs. Time

Time Rate Equation

Calculate

Tabulated Results for approximately 91 days

Results displayed for FoSSA calculated Ue

PRINT SCREEN

RETURN

Cancel

APPENDIX G

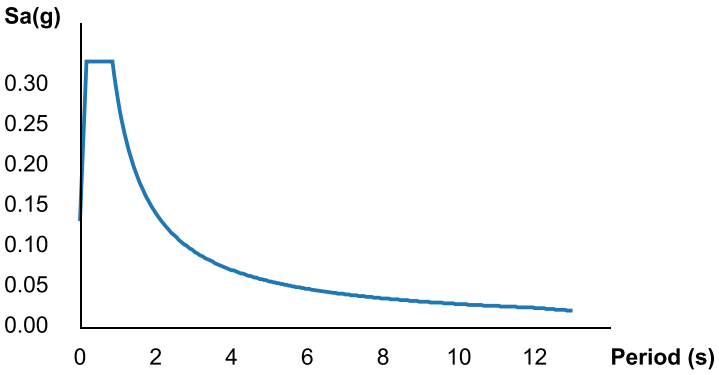
ATC HAZARDS BY LOCATION MAPS

Hazards by Location

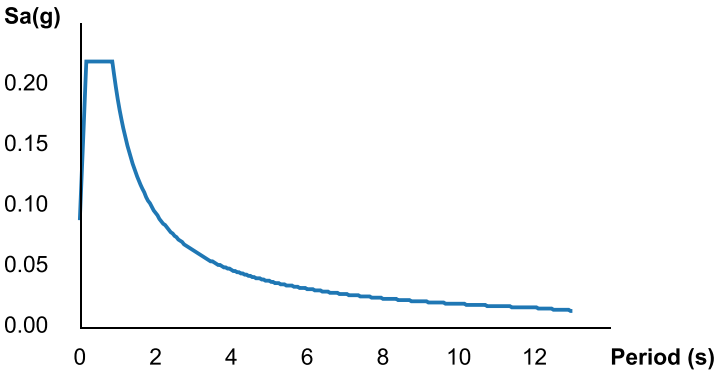
Search Information

Address:	39.0430782 -83.05304378
Coordinates:	39.0430782, -83.05304378
Elevation:	554 ft
Timestamp:	2021-10-11T20:28:12.553Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	E

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.137	MCE_R ground motion (period=0.2s)
S_1	0.067	MCE_R ground motion (period=1.0s)
S_{MS}	0.329	Site-modified spectral acceleration value
S_{M1}	0.282	Site-modified spectral acceleration value
S_{DS}	0.219	Numeric seismic design value at 0.2s SA
S_{D1}	0.188	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	C	Seismic design category
F_a	2.4	Site amplification factor at 0.2s
F_v	4.2	Site amplification factor at 1.0s

CR_S	0.95	Coefficient of risk (0.2s)
CR_1	0.903	Coefficient of risk (1.0s)
PGA	0.069	MCE_G peak ground acceleration
F_{PGA}	2.4	Site amplification factor at PGA
PGA_M	0.166	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
SsRT	0.137	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.144	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.067	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.074	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.