ARKANSAS DEPARTMENT OF TRANSPORTATION

ARDOT
ARKANSAS DEPARTMENT
OF TRANSPORTATION

SUBSURFACE INVESTIGATION

STATE JOB NO. 050423

FEDERAL AID PROJECT NO. BFP-0033(28)

PINEY CREEK STR. & APPRS. (S)

STATE HIGHWAY 56 **SECTION** 1

IN IZARD **COUNTY**

The information contained herein was obtained by the Department for design and estimating purposes only. It is being furnished with the express understanding that said information does not constitute a part of the Proposal or Contract and represents only the best knowledge of the Department as to the location, character and depth of the materials encountered. The information is only included and made available so that bidders may have access to subsurface information obtained by the Department and is not intended to be a substitute for personal investigation, interpretation and judgment of the bidder. The bidder should be cognizant of the possibility that conditions affecting the cost and/or quantities of work to be performed may differ from those indicated herein.

ARKANSAS DEPARTMENT OF TRANSPORTATION
ArDOT.gov | IDriveArkansas.com | Lorie H. Tudor, P.E., Director
MATERIALS DIVISION
11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

October 12, 2020

TO: Mr. Trinity Smith, Engineer of Roadway Design

SUBJECT: Job No. 050423
Piney Creek Str. & Apprs. (S)
Route 56 Section 1
Izard County

Based on soil information from projects in the surrounding area, an estimated R-Value of 10 is appropriate for pavement design.

Listed below is the additional information requested for use in developing the plans:

Asphalt Concrete Hot Mix

Type	Asphalt Cement %	Mineral Aggregate %
Surface Course	5.3	94.7
Binder Course	4.4	95.6
Base Course	4.4	95.6

Jonathan A. Annable
Materials Engineer

JAA:pt:bjj
Attachment
cc: State Constr. Eng. – Master File Copy
District 5 Engineer
System Information and Research Div.
G. C. File

ARKANSAS DEPARTMENT OF TRANSPORTATION
ARDOT.gov | IDriveArkansas.com | Lorie H. Tudor, P.E., Director
MATERIALS DIVISION
11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

July 25, 2022

TO: Mr. Rick Ellis, Bridge Engineer

SUBJECT: Job No. 050423
Piney Creek Str. & Apprs. (S)
Izard County
Route 56, Section 01

Introduction

Submitted herein are foundation recommendations for the proposed replacement bridge planned on Arkansas Highway 56 in Izard County. Results of slope stability analyses and recommendations for the abutment slopes are also provided in this report. This project consists of replacing the existing 26.7-foot-wide, 302-foot-long bridge (Bridge No. 02308) over Piney Creek with a new 362-foot-long, 42.5-foot-wide (out-to-out width) structure. The new bridge will be a three (3)-span, continuous composite W-beam unit to be constructed at an offset location north (upstream) of the existing bridge. 2-Horizontal to 1-vertical (2H:1V) configuration is planned for the end slopes while 3H:1V configuration is designed for the side slopes. The west abutment (Bent 1) is formed by cutting back into the existing slope. The cut slope is about 12 feet tall. The east abutment is formed by placing 27 feet of fill.

Field Investigation

Request for Subsurface Investigation made by Bridge Division was received on June 8, 2021, to develop recommendations for bridge foundations and to verify suitability of bridge abutment slope configurations. A total of five (5) borings were requested and six (6) borings were drilled, including three (3) borings performed at the west bridge end (Bent 1). The approximate locations of the borings are presented in the Plan of Borings included in Attachment A.

One (1) boring (Boring 3) was originally planned to investigate the subsurface conditions at the west bridge end. However, rock encountered in this boring is considerably deeper than expected based on field observations and local geology. Consequently, two (2) borings (Borings 1 and 2) were added for verification purpose. A geophysical study was later performed by a geotechnical consultant (Terracon) to verify boring results and to investigate this anomaly in subsurface conditions. The geophysical study is comprised of a combination of Multi-channel Analysis of Surface Waves (MASW) and Electrical Resistivity Tomography (ERT). The results of the geophysical study performed by Terracon are included as Attachment B.

The borings were advanced with a track-mounted Acker Renegade rotary drill rig using a combination of hollow-stem auger and diamond core method. The boring logs, showing the subsurface conditions encountered in the borings and the results of field and laboratory tests, are also included in Attachment A, immediately following the Plan of Borings. A Legend is attached after the boring logs to interpret / explain the symbols, terms, and conventions used on logs. Standard Penetration Tests (SPT) were conducted in accordance with ASTM D1586 for field testing and soil sampling. Liners were not used inside the standard split-barrel samplers.

The number of blows required to drive the standard split-barrel sampler for each 6-inch penetration of the total 18-inch drive were counted and shown on the logs. SPT N-values are defined as the number of blows required to advance the split barrel the final 12 inches. The SPT N-values indicated on the logs are raw (uncorrected) blow count measured in field.

Core samples of bedrock were retrieved by using NQ3-size triple-tube core barrels (rock core diameter of 1-3/4 in. and hole diameter of 3 in.). For each core run, Rock Quality Designation (RQD) was determined in field by logger and further evaluated by licensed Professional Geologist (PG). RQD, expressed in percent, is defined as the sum of the intact core pieces that are longer than 4 inches divided by the total length of the core run. The RQD of each core run is indicated on corresponding log. Core pictures are also included in Attachment A, following the boring logs and Legend.

Groundwater was also observed during the drilling and excavating process. Groundwater observations were noted on the logs.

Lab Investigation

All samples were brought to the Materials laboratory for further evaluation and testing. Rock cores were first examined by licensed Professional Geologists to verify RQD measured in the field and to determine Geological Strength Index (GSI) and Rock Mass Rating (RMR). Compressive strength of rock cores was then determined by uniaxial compressive test on intact rock cores in accordance with ASTM D7012, Method C. The results of uniaxial compressive tests on intact rock cores are presented in Attachment C. GSI and RMR, as evaluated by licensed Professional Geologists, are also included in Attachment C.

Site Conditions

This job consists of replacing the Piney Creek bridge with a new bridge north of the existing alignment. The existing bridge (No 02308) is a 26.7 feet wide, 302 feet long, 6 span bridge with concrete decking resting on 50 foot steel beams supported by reinforced concrete abutments and concrete single column bents with spread footings. Piney Creek flows from the northeast to the southwest. At the project site, there is a wooded bluff on the west side of the river channel and a sand bar on the east side of the channel. There is a dirt road leading to private property on the northeast end of the bridge that passes under bridge span five. Overhead power lines and a buried waterline parallel the south side of the existing bridge. Selected pictures are included in Attachment D.

D_{50} for Scour Analysis

The particle size through which 50% of particles by weight passing, D_{50}, is summarized below in Table 1. Detailed particle size distribution curves used for D_{50} determination are included in Attachment E.

Table 1: Summary of D_{50} for Scour Analysis

Creek Name	Station	Sample Type	Location	D_{50}, mm
Piney Creek	118+08, 60 Rt.	Bulk	Creek Bank	0.28

Site Geology

The project alignment is located close to, or directly over, the contact between the Powell Formation (map symbol Op) and the Everton Formation (map symbol Oe). The Everton Formation shows considerable differences in lithologic character. It is composed of various mixtures of dolostone, sandstone, and limestone. The formation also has traces of conglomerate, shale, and chert in limited areas. The limestones are light-gray to brownish-gray and are generally more or less dolomitic and sandy. The dolostones are light- to dark-gray and generally more or less limy and sandy. The thickness of the Everton Formation varies from about 300 feet to as much as 650 feet. The lower contact is unconformable and other disconformities occur within the Everton. The Everton overlies the Powell Formation (map symbol Op). The contact between these two (2) formations is mapped as being approximately half a mile upstream to the north of the existing bridge.

The Powell Formation is generally a fine-grained, light-gray to greenish-gray, limy, argillaceous dolostone with thin beds of shale, sandstone, sandy dolostone, and occasionally chert. The formation's thickness may be as much as over 200 feet, but is often much thinner. At the project site, the Powel Formation can be observed in the channel on the south side of the existing bridge.

Generalized Subsurface Conditions

Generalized Subsurface Profiles are included in Attachment F to aid in visualizing subsurface conditions and stratigraphy. In light of the natural variations in stratigraphy and subsurface conditions, particularly varying nature of the dolostone, deviation from those illustrated on the profiles must be anticipated.

The overburden soils are comprised of medium dense to very dense reddish brown clayey sand, soft to hard reddish brown sandy clay, and loose to medium dense brown sand. These overburden soils contain variable amounts of gravel and cobbles (sandstone fragments) and represent completely weathered sandstone. The overburden soils extend to depths of 13 to 42 feet below existing ground surface (Elev. 435 to Elev. 420).

Highly weathered to slightly weathered sandstone (see Boring 3) and weathered dolostone (see Borings 5 and 6) are locally below the overburden soils. Thickness of the weathered rock ranges from 0 to 8 feet. **A possible cavity was encountered in Boring between 34.5 and 39 feet**.

Competent moderately hard light gray to gray, slightly weathered to unweathered dolostone with locally interbedded sandstone was encountered in the borings at 14 to 42 feet (Elev. 432 to 420). The estimated elevation of the competent rock (defined as slightly weathered to unweathered rock), as revealed by the borings, are summarized below in Table 2.

Table 2: Estimated Elevation of Competent Rock

Boring No.	Boring Location	Ground Surf. Elev.@ Boring Location, ft.	Depth to Competent Rock, ft.	Estimated Elev. of Competent Rock, ft.
1	Sta. 115+84, C.L.	479.3	Rock not encountered	
2	Sta. 116+40, C.L.	474.4	42	432.4
3	Sta. 116+60, C.L.	466.6	40	426.6
4	Sta. 118+40, 56 Rt.	437.6	18	419.6
5	Sta. 119+05, 62 Rt.	435.9	16	419.9
6	Sta. 119+80, C.L.	437.4	14	423.4
Average		455.2	28	427

Seismic Conditions

In light of the average subsurface conditions as revealed by the borings, a **Seismic Site Class C (Very Dense Soil and Soft Rock Profile)** is calculated for the project site. Utilizing the Seismic Site Class C and the approximate GPS coordinates of the project site, the following design peak ground acceleration coefficient (A_S), design short-period spectral acceleration coefficient (S_{DS}), as well as design long-period spectral acceleration coefficient (S_{D1}), are determined. These seismic coefficients are summarized in Table 3. Design Response Spectrum is presented in Attachment G.

Table 3: Summary of Design Ground Motion Acceleration Response Coefficients

Acceleration Coefficient	Value (g)
A_S (Site PGA)	0.174
S_{DS} (0.2 sec)	0.386
S_{D1} (1 sec)	0.170

For the design long-period spectral acceleration coefficient (S_{D1}) of 0.170, a **Seismic Performance Zone 2** is considered applicable to the project site.

Embankment and Cut Slope Configuration

General. As noted, 2H:1V end slopes are planned for both bridge abutments while 3H:1V configuration is designed for the side slopes. The west bridge end will be formed by cutting back into the existing ground. The cut slope at the west bridge end will be 12 feet tall. The east abutment will be an embankment to be constructed by placing 27 feet of fill. Stability analyses have been performed to evaluate the 2H:1V design cut slope and embankment configurations of both abutments. The 3H:1V side slopes are not evaluated due to the flatter configuration and expected less critical slope stability.

The slope stability analyses were performed utilizing a commercial computer program Slide2 (Version 2021) developed by RocScience. Simplified Bishop method was chosen in the analyses. Three (3) general loading conditions were analyzed with respect to slope stability: Short Term / End of Construction Condition, Long Term Condition, and Seismic / Pseudo-Static condition. A horizontal acceleration coefficient (k_h) of 0.087 (0.5 A_{max}/g), was utilized for analysis of the Seismic / Pseudo-Static Condition. A surcharge of 250 psf is included to model the live load. The results of these analyses are summarized below in Table 4a and Table 4b for the west abutment and east abutment, respectively. These results are presented graphically in Attachment H and Attachment I, respectively.

Table 4a: Slope Stability of Cut Slope – West Abutment (Bent 1)

Slope	Loading Condition	Calculated Min. F.S.	Recommended Min. F.S.
2H:1V End Slope – Cut Slope (12 feet Tall)	Short Term	5.1	1.3
	Long Term	1.6	1.4
	Seismic (k_h = 0.087)	1.3	1.1

Table 4b: Slope Stability of Embankment – East Abutment (Bent 4)

Slope	Loading Condition	Calculated Min. F.S.	Recommended Min. F.S.
2H:1V End Slope – Embankment (27 Feet Tall)	Short Term	2.3	1.3
	Long Term	1.4	1.4
	Seismic (k_h = 0.087)	1.2	1.1

The results of stability analyses indicate the plan slope configurations at both bridge abutments are suitable.

Foundation Recommendations

Steel H-Piling – Bents 1 through 4. Based on the results of the borings, it is recommended steel H-piling be utilized to support the foundation loads at the bridge end bents (Bents 1 and 4). A foundation system of steel H piles capped with a footing (pile footing) is also suitable to support the foundation loads at the intermediate bents (Bents 2 and 3).

Final pile size has not been determined. Steel H-piles should be driven to practical refusal and should penetrate through embankment fill in the abutment areas, the overburden soils and highly weathered rock (if any), to bear in the resistant (defined as rock that refusal is expected at) weathered dolostone, slightly weathered dolostone, or unweathered dolostone with interbedded sandstone. Preboring will be required at all the bent locations for penetrating through the overburden soils that contain gravel and cobbles. **At Bent 1 where cavities are possible, prebore will also be required to penetrate through the capping rock above the cavities**.

Practical refusal is defined as a maximum penetration of 1.0 inch for 20 blows by a pile hammer. For the purpose of estimating pile length, a pile embedment of 6 inches into the moderately hard weathered dolostone / slightly weathered dolostone / unweathered dolostone with interbedded sandstone is assumed. This estimated penetration is based on the results of the borings and our experience with similar foundation rock. **At Bent 1, it is recommended prebore extend through the capping rock above the cavities, the soil-filled capacities, the highly weathered sandstone, and at least 3 feet into the competent slightly weathered dolostone.**

The results of the borings indicate moderate to severe driving conditions are expected to be experienced. Consequently, rock points are recommended for all the h-piles driven to refusal.

A minimum pile penetration of 10 feet, measured below natural ground surface, is recommended. Greater pile length / penetration may be warranted by lateral resistance demand. Based on the results of the borings and the above assumed penetration into the resistant rock, the estimated shallowest pile tip elevation is summarized below in Table 5.

Table 5: Summary of Estimated Shallowest Pile Tip Elevation

Bent No.	Boring No.	Estimated Shallowest Pile Tip Elevation, ft.	Comments
1	3	423.5	Prebore to penetrate through civilities and to socket piles at least 3 feet into competent slightly weathered dolostone
2	4 and 5	419	Prebore to penetrate overburden soils containing cobbles and boulders
3	4, 5, and 6	422.5	
4	6	424	

The estimated shallowest pile tip elevation summarized in the table above is based on our evaluation of the rock cores retrieved from the borings. Actual subsurface conditions can vary from those encountered in the borings. As-constructed pile tip elevation can vary and must be field verified.

Nominal axial resistance of steel H piles driven to refusal in competent rock is governed by the structural capacity of the piles. Therefore, the nominal resistance should be determined by the Structural Engineer utilizing applicable AASHTO LRFD design procedures. The Geotechnical Section is available to provide geotechnical inputs for structural evaluation of the nominal axial pile resistance. In light of the expected moderate to severe driving conditions, a resistance factor (φ_c) of 0.50 is recommended for calculating factored structural bearing resistance of h-piles. For steel piling driven to refusal in competent rock, long-term, post-construction settlement is expected to be negligible.

Drilled Shaft Alternative – Bents 2 and 3. As an alternative to pile footings, drilled shafts are also suitable to support the foundation loads at the intermediate bents (Bents 2 and 3). Drilled shafts should be founded a minimum of two (2) shaft diameters into the competent moderately hard slightly weathered to unweathered shale. It is understood that diameter of the drilled shafts will be 5 feet.

A maximum nominal bearing capacity (q_p) of 160 ksf is recommended for drilled shafts founded as recommended above. Shaft side resistance should be neglected from design consideration. Applying the resistance factor to the nominal tip resistance results in a maximum factored tip resistance (q_R) of 80 ksf.

Utilizing the results of the borings and the design shaft diameter of 5 feet, we recommend the drilled shafts be designed with the following shallowest tip elevations.

Table 6: Summary of Estimated Shallowest Drilled Shaft Tip Elevation

Bent No.	Boring No.	Estimated Shallowest Shaft Tip Elevation, ft.	Comments
2	4 and 5	409.5	
3	4, 5, and 6	410	

This recommended tip elevation utilizes the results of borings and two (2) shaft diameters (10 feet) of penetration into the competent moderately hard slightly weathered to unweathered dolostone / sandstone. Deeper rock socket or larger shaft diameter may be required by bearing and / or lateral resistance demand. If rock socket and shaft diameter other than these assumed parameters are to be utilized, shaft tip elevation should be adjusted accordingly. Actual competent rockline elevation at the drilled shaft locations can vary and must be field verified. Depending on specific rock quality, deepening or shortening of shaft length can be warranted. Settlement of properly constructed drilled shafts founded into the competent rock should be negligible.

In light of the varying nature of the dolostone, we recommend one test boring be drilled at each shaft location prior to drilled shaft excavation. Test borings should be 1-1/2 inches or larger and should extend to a minimum depth of 1.5 times of the shaft diameter below planned tip elevation.

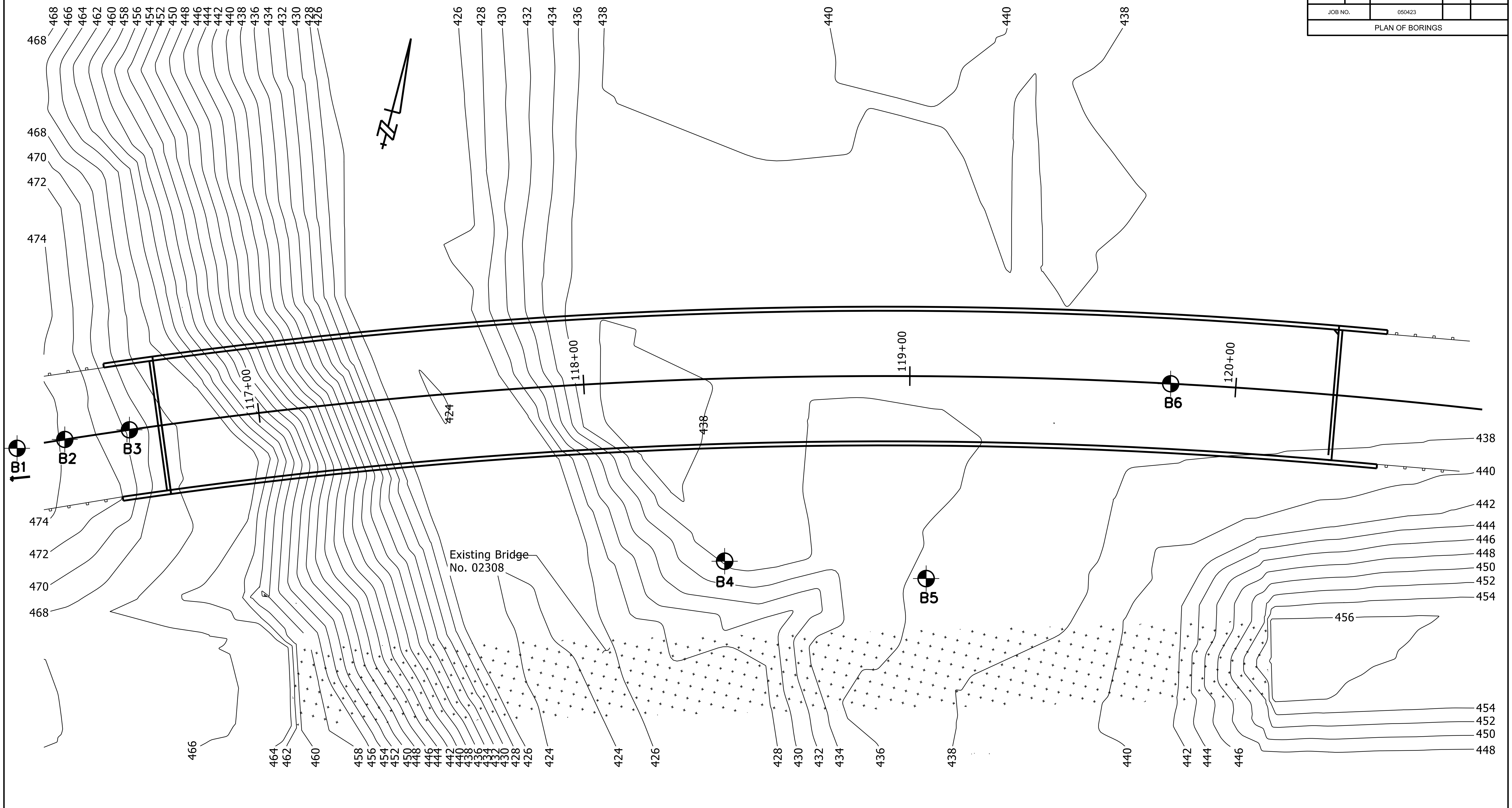
Paul Tinsley

Paul Tinsley
Materials Engineer

PT:yz:mlg:pjt:pwc
cc: State Construction Engineer
District 5 Engineer
G. C. File

Attachment A

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
6	AR			
JOB NO.		050423		
PLAN OF BORINGS				



BORING	STATION	OFFSET
B1	115+84	CL
B2	116+40	CL
B3	116+60	CL
B4	118+40	56' RT CL
B5	119+05	62' RT CL
B6	119+80	CL

PLAN OF BORINGS

PINEY CREEK STR. & APPRS. (S)
ROUTE 56, SECTION 01
IZARD COUNTY
FED. AID PROJECT

JOB NO. 050423
SHEET 1/1

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 1 OF 2

JOB NO. 050423 Izard County
JOB NAME: Piney Creek Str. & Apprs. (S)
Route 56, Section 1
STATION: 115+84
LOCATION: Construction Centerline
LOGGED BY: Coty Campbell and Don McCollum

DATE: December 14, 2021
TYPE OF DRILLING: Hollow Stem Auger
EQUIPMENT: Acker 2
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 40.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 479.3	SOIL GROUP	MOISTURE CONTENT (%) ● PL ├──┤ LL 10 20 30 40 50 60 70	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
5			Reddish Brown Sandy Clay						
10			Reddish Brown Clayey Sand						
15 20			Reddish Brown Clayey Sand with Gravel and Cobbles						
25 30 35			Moist, Reddish Brown Clayey Sand						

REMARKS: This boring was for rock sounding only and no samples were collected.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 2 OF 2

JOB NO. 050423 Izard County
JOB NAME: Piney Creek Str. & Apprs. (S)
Route 56, Section 1
STATION: 115+84
LOCATION: Construction Centerline
LOGGED BY: Coty Campbell and Don McCollum

DATE: December 14, 2021
TYPE OF DRILLING: Hollow Stem Auger
EQUIPMENT: Acker 2
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 40.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 479.3	SOIL GROUP	MOISTURE CONTENT (%) ● PL ├──┤ LL 10 20 30 40 50 60 70	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
40	▨								
			Boring Terminated						
45									
50									
55									
60									
65									
70									

REMARKS: This boring was for rock sounding only and no samples were collected.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
PAGE 1 OF 2

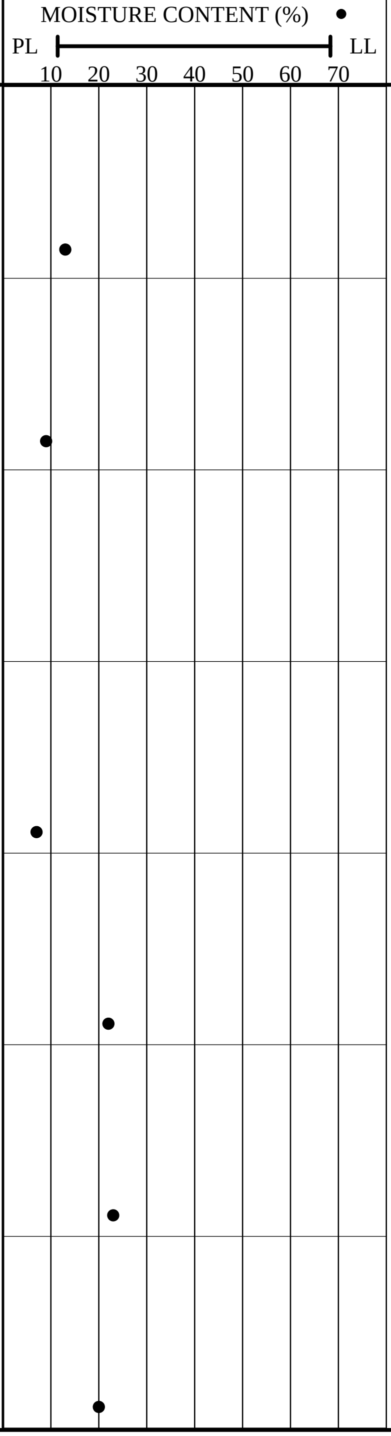
JOB NO. 050423 Izard County
JOB NAME: Piney Creek Str. & Apprs. (S)
Route 56, Section 1
STATION: 116+40
LOCATION: Construction Centerline
LOGGED BY: Coty Campbell and Don McCollum

DATE: December 8, 2021
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 2
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 57.1

SURFACE ELEVATION: 474.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%)	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
5		☒	Moist, Hard, Reddish Brown Sandy Clay				9 16-18		
10		☒	Moist, Very Dense, Reddish Brown Clayey Sand				40 60 (4")		
15		☒	Moist, Very Dense, Reddish Brown Clayey Sand with Gravel				19 34-25		
20		☒	Moist, Medium Dense, Reddish Brown Clayey Sand				3 15-13		
25		☒	Moist, Stiff, Reddish Brown Sandy Clay with Gravel (Sandstone Fragments)				4 7-7		
30		☒	Moist, Stiff, Reddish Brown Sandy Clay				5 6-8		
35		☒					6 3-3		



REMARKS: *Vertical fracture encountered at 47.0 to 48.1 feet below ground level (BGL). Total water loss at approximately 42.1 feet (BGL).

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BORING NO. 2
PAGE 2 OF 2

JOB NO. 050423 Izard County
JOB NAME: Piney Creek Str. & Apprs. (S)
Route 56, Section 1
STATION: 116+40
LOCATION: Construction Centerline
LOGGED BY: Coty Campbell and Don McCollum

DATE: December 8, 2021
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 2
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 57.1

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 474.4	SOIL GROUP	MOISTURE CONTENT (%) ● PL ├──┤ LL 10 20 30 40 50 60 70	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Moist, Medium Stiff, Reddish Brown Sandy Clay						
40			Wet, Soft, Reddish Brown Sandy Clay				0 2-1		
			DOLOSTONE - Slightly Weathered, Moderately Hard, Occasional Fractures, Light Gray*						
45			SANDSTONE - Slightly Weathered, Cemented, Calcareous, Light Gray					100	92
50			DOLOSTONE - Slightly Weathered, Moderately Hard, Occasional Fractures, Light Gray*					100	84
55								100	82
			Boring Terminated						
60									
65									
70									

REMARKS: *Vertical fracture encountered at 47.0 to 48.1 feet below ground level (BGL). Total water loss at approximately 42.1 feet (BGL).

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

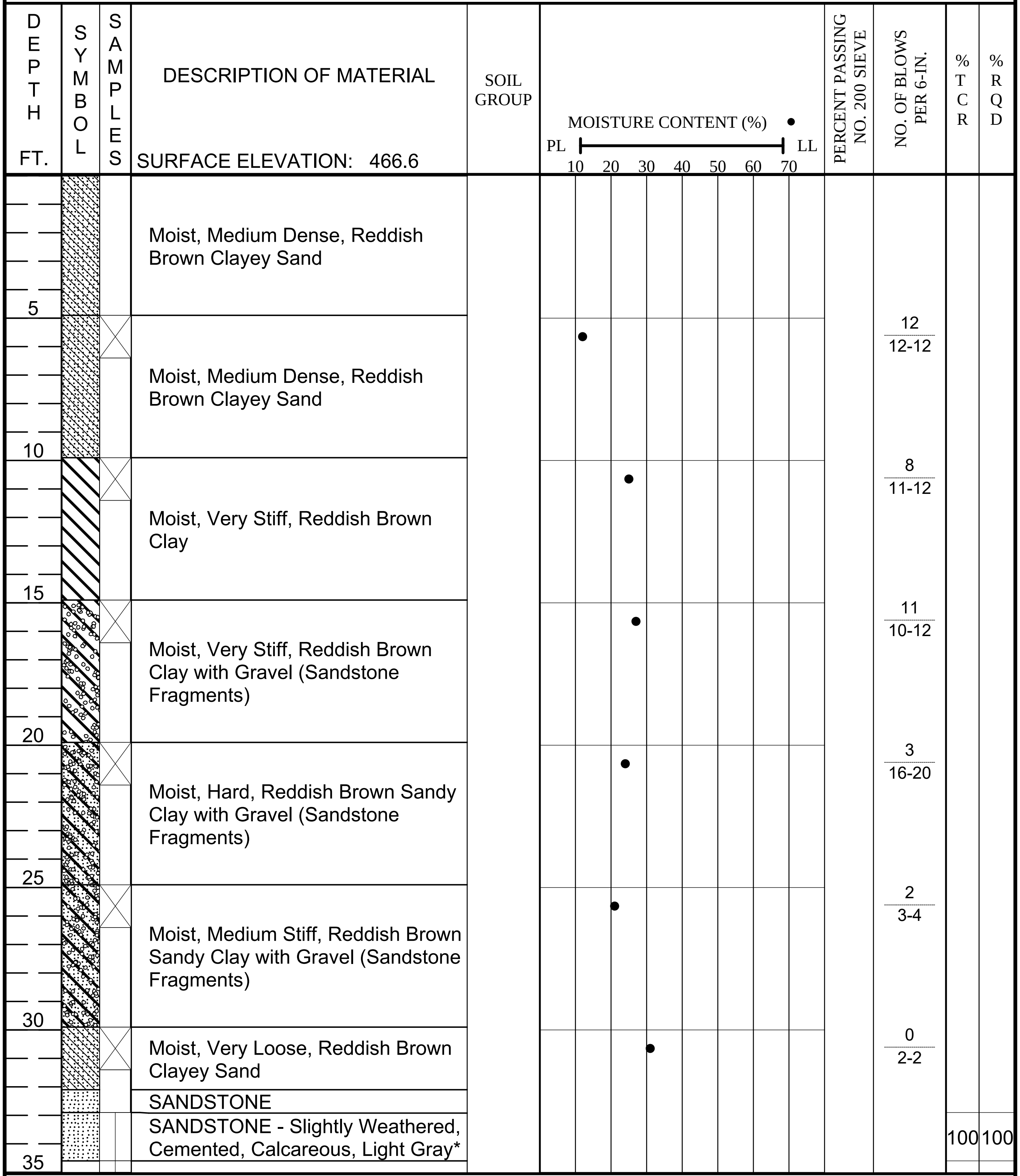
BORING NO. 3
PAGE 1 OF 2

JOB NO. 050423 Izard County
JOB NAME: Piney Creek Str. & Apprs. (S)
Route 56, Section 1
STATION: 116+60
LOCATION: Construction Centerline
LOGGED BY: Coty Campbell

DATE: December 7, 2021
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 2
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 54.6

SURFACE ELEVATION: 466.6



DEPTH FT.	DESCRIPTION OF MATERIAL	SOIL GROUP	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
0-5	Moist, Medium Dense, Reddish Brown Clayey Sand					
5-10	Moist, Medium Dense, Reddish Brown Clayey Sand			12 12-12		
10-15	Moist, Very Stiff, Reddish Brown Clay			8 11-12		
15-20	Moist, Very Stiff, Reddish Brown Clay with Gravel (Sandstone Fragments)			11 10-12		
20-25	Moist, Hard, Reddish Brown Sandy Clay with Gravel (Sandstone Fragments)			3 16-20		
25-30	Moist, Medium Stiff, Reddish Brown Sandy Clay with Gravel (Sandstone Fragments)			2 3-4		
30	Moist, Very Loose, Reddish Brown Clayey Sand			0 2-2		
	SANDSTONE					
35	SANDSTONE - Slightly Weathered, Cemented, Calcareous, Light Gray*				100	100

REMARKS: *Cavity encountered at approximately 34.6 to 38.9 feet below ground level.

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BORING NO. 3
PAGE 2 OF 2

JOB NO. 050423 Izard County
JOB NAME: Piney Creek Str. & Apprs. (S)
Route 56, Section 1
STATION: 116+60
LOCATION: Construction Centerline
LOGGED BY: Coty Campbell

DATE: December 7, 2021
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 2
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 54.6

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 466.6	SOIL GROUP	MOISTURE CONTENT (%) ● PL ├──┤ LL 10 20 30 40 50 60 70	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Cavity					0	0
40			SANDSTONE - Highly Weathered, Cemented, Gray and Reddish Brown						
			DOLOSTONE - Slightly Weathered, Moderately Hard, Light Gray					92	100
45			DOLOSTONE - Slightly Weathered, Moderately Hard, Frequent Healed Fractures and Dolomite Crystals, Light Gray					100	100
50			DOLOSTONE - Slightly Weathered, Moderately Hard, Light Gray					100	100
55			Boring Terminated						
60									
65									
70									

REMARKS: *Cavity encountered at approximately 34.6 to 38.9 feet below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
PAGE 1 OF 1

JOB NO. 050423 Izard County
JOB NAME: Piney Creek Str. & Apprs. (S)
Route 56, Section 1
STATION: 118+40
LOCATION: 56' Right of Construction Centerline
LOGGED BY: Coty Campbell and Don McCollum

DATE: January 4, 2022
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 2
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 31.7

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 437.6	SOIL GROUP	MOISTURE CONTENT (%) ● PL ├─┤ LL 10 20 30 40 50 60 70	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
5		☒	Moist, Loose, Brown Sand				3 4-5		
10		☒					1 1-4		
			Wet, Loose, Brown Sand with Some Gravel						
15		☒	Wet, Dense, Brown Sand with Gravel				6 12-24		
			Gravel and Cobbles						
20								100	75
			DOLOSTONE - Unweathered, Moderately Hard, Frequent Dolomite Crystals, Gray						
25								100	100
30			DOLOSTONE - Unweathered, Moderately Hard, Gray					100	100
			Boring Terminated						
35									

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 5
PAGE 1 OF 1

JOB NO. 050423 Izard County
JOB NAME: Piney Creek Str. & Apprs. (S)
Route 56, Section 1
STATION: 119+05
LOCATION: 62' Right of Construction Centerline
LOGGED BY: Coty Campbell and Don McCollum

DATE: January 4, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 2
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 27.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 435.9	SOIL GROUP	MOISTURE CONTENT (%) ● PL ⊢—⊣ LL 10 20 30 40 50 60 70	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Sand with Gravel						
5		☒	Wet, Medium Dense, Brown Sand with Gravel				5 7-6		
10		☒					7 7-6		
			DOLOSTONE						
15			DOLOSTONE - Weathered, Moderately Hard, Occasional Fractures and Dolomite Crystals, Gray				10 (0")	85	52
20			DOLOSTONE - Unweathered, Moderately Hard, Occasional Fractures and Dolomite Crystals, Gray					100	80
25								100	90
30			Boring Terminated						
35									

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 6
PAGE 1 OF 1

JOB NO. 050423 Izard County
JOB NAME: Piney Creek Str. & Apprs. (S)
Route 56, Section 1
STATION: 119+80
LOCATION: Construction Centerline
LOGGED BY: Coty Campbell/ Don McColllum

DATE: December 15, 2021
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 2
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 28

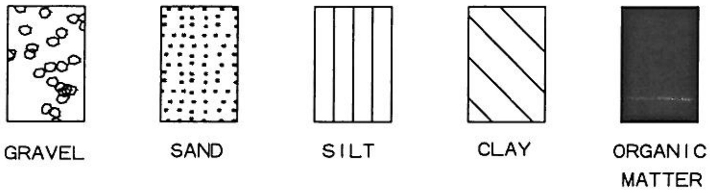
DEPTH FT.	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 437.4	SOIL GROUP	MOISTURE CONTENT (%) ● PL ├──┤ LL 10 20 30 40 50 60 70	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
5	Moist, Medium Dense, Brown Sand				5 7-8		
10	Wet, Loose, Brown Gravel with Sand				4 3-3		
	DOLOSTONE						
15						100	100
20	DOLOSTONE - Unweathered, Moderately Hard, Frequent Dolomite Crystals, Gray					100	100
25						100	100
	Boring Terminated						
30							
35							

REMARKS:

LEGEND

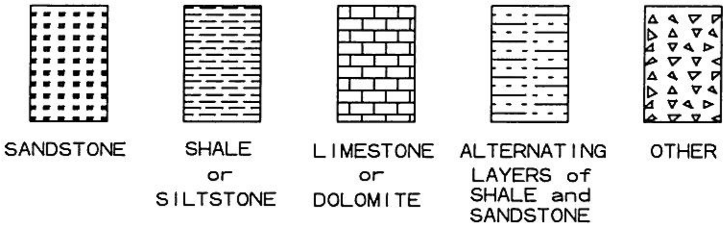
SOIL TYPES

(SHOWN IN SYMBOL COLUMN)
(PREDOMINANT TYPE SHOWN HEAVY)



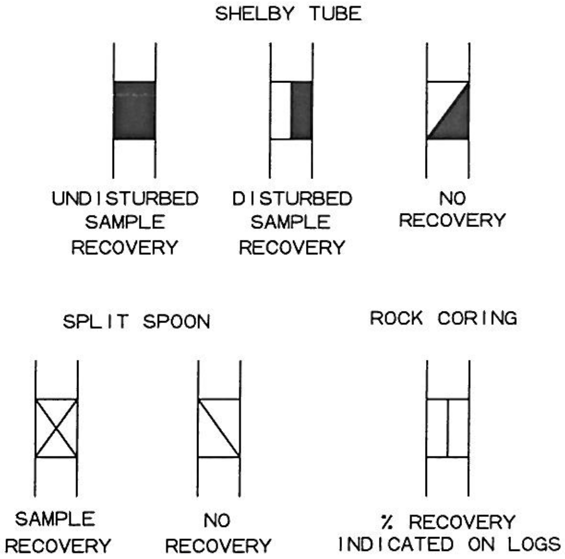
ROCK TYPES

(SHOWN IN SYMBOL COLUMN)



SAMPLER TYPES

(SHOWN IN SAMPLE COLUMN)



TERMS DESCRIBING CONSISTENCY OR CONDITION

GRANULAR SOIL		CLAY		CLAY-SHALE		SHALE	
'N' Value	Density	'N' Value	Consistency	'N' Value	Consistency	'N' Value	Consistency
0-4	Very Loose	0-1	Very Soft	0-1	Very Soft		
5-10	Loose	2-4	Soft	2-4	Soft	31-60	Soft
11-30	Medium Dense	5-8	Medium Stiff	5-8	Medium Stiff	Over 60	
31-50	Dense	9-15	Stiff	9-15	Stiff	More than 2'	
Over 50	Very Dense	16-30	Very Stiff	16-30	Very Stiff	Penetration	
		31-60	Hard	31-60	Hard	in 60 Blows:	Medium Hard
		Over 60	Very Hard	Over 60	Very Hard	Less than 2'	
						Penetration	
						in 60 Blows:	Hard

1. Ground water elevations indicated on boring logs represent ground water elevations at date or time shown on boring log. Absence of water surface implies that no ground water data is available but does not necessarily mean that ground water will not be encountered at locations or within the vertical reaches of these borings.
2. Borings represent subsurface conditions at their respective locations for their respective depths. Variations in conditions between or adjacent to boring locations may be encountered.
3. Terms used for describing soils according to their texture or grain size distribution are in accordance with the Unified Soil Classification System.

Standard Penetration Test – Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and performing the test are recorded for each 6 inches of penetration on the drill log. The field "N" Value (N_f) can be obtained by adding the bottom two numbers for example: $\frac{6}{8-9} \Rightarrow 8+9=17 blows/ft$. The "N" Value corrected to 60% efficiency (N_{60}) can be obtained by multiplying N_f by the hammer correction factor published on the boring log.

ARDOT

ROCK CORE PHOTO

Job No.: 050423
Job Name: Piney Creek Str. & Apprs. (S).

Station and Offset, ft: Sta. 116+40, CL Const.
Depth, ft: 42.1 – 52.1

ROCK CORE PHOTO

Job No.: 050423
Job Name: Piney Creek Str. & Apprs. (S).

Station and Offset, ft: Sta. 116+40, CL Const.
Depth, ft: 52.1 – 57.1

ROCK CORE PHOTO

Job No.: 050423
Job Name: Piney Creek Str. & Apprs. (S).

Station and Offset, ft: Sta. 116+60, CL Const.
Depth, ft: 32.9 – 44.6

ROCK CORE PHOTO

Job No.: 050423
Job Name: Piney Creek Str. & Apprs. (S).

Station and Offset, ft: Sta. 116+60, CL Const.
Depth, ft: 44.6 – 54.6

ROCK CORE PHOTO

Job No.: 050423
Job Name: Piney Creek Str. & Apprs. (S).

Station and Offset, ft: Sta. 118+40, 56' Rt.
Depth, ft: 17.7 – 26.7

ROCK CORE PHOTO

Job No.: 050423
Job Name: Piney Creek Str. & Apprs. (S).

Station and Offset, ft: Sta. 118+40, 56' Rt.
Depth, ft: 26.7 – 31.7

ARDOT

ROCK CORE PHOTO

Job No.: 050423
Job Name: Piney Creek Str. & Apprs. (S).

Station and Offset, ft: Sta. 119+05, 62' Rt.
Depth, ft: 13.5 – 22.5

ROCK CORE PHOTO

Job No.: 050423
Job Name: Piney Creek Str. & Apprs. (S).

Station and Offset, ft: Sta. 119+05, 62' Rt.
Depth, ft: 22.5 – 27.5

ROCK CORE PHOTO

Job No.: 050423
Job Name: Piney Creek Str. & Apprs. (S).

Station and Offset, ft: Sta. 119+80, CL Const.
Depth, ft: 14.0 – 23.0

ROCK CORE PHOTO

Job No.: 050423
Job Name: Piney Creek Str. & Apprs. (S).

Station and Offset, ft: Sta. 119+80, CL Const.
Depth, ft: 23.0 – 28.0

Attachment B

113 Dixieland
Rogers, AR 72758
P (479) 621-0196
Terracon.com

May 17, 2022

Arkansas Department of Transportation
P.O. Box 2261
Little Rock, AR 72203

Attn: Paul Tinsley
O: 501.569.2496
E: Paul.Tinsley@ardot.gov

Re: Geophysical Investigation Report
Job No. 050423 Piney Creek Structure and Approaches
Route 56
Pineville, Arkansas
Terracon Report No. KB225007

Dear Mr. Tinsley:

On April 20th, 2022 Terracon Consultants, Inc. (Terracon) performed geophysical exploration services at the above referenced site. These services were performed in general accordance with ArDOT Task order G022. This report discusses our test methods and findings.

PROJECT DESCRIPTION

The purpose of the exploration was to use geophysical methods to further characterize the shallow geology and supplement the geotechnical investigation performed by ArDOT at the site referenced above. The project site is on the west side of Piney Creek just north of Route 56 where a proposed new bridge structure is planned.

EXPLORATION METHODS

Our methods of investigation included use of an Electrical Resistivity Tomography (ERT) system consisting of an Advanced Geosciences Inc. (AGI) SuperSting R8 control unit with up to 56 electrodes and a Geometrics Geode seismograph with a linear array of 24 geophones. Each test method was used along three survey lines located along the proposed north right of way, bridge centerline and south right of (Exhibit 1).

Electrical Resistivity Tomography (ERT)

This method uses an array of potential and current electrodes that function independently of one another to measure the potential field. A transmitting current dipole is followed by a series of potential dipoles which measure the resulting voltage gradient at each station. As the transmitting dipole is advanced along the electrodes, the resulting gradient measurements were collected as a 2D section below the survey array. After field collection, the resistivity data was processed using

EarthImager 2D (engineered by AGI), an inversion and modeling software package. Changes in the earth resistivity can indicate changes in lithology, saturation, and amount of fracturing.

Multichannel Analysis of Surface Waves (MASW)

The seismograph and a linear array of twenty-four (24) 4.5Hz receivers (geophones) was used to collect MASW data. The geophones were set with 10 foot spacing and surface waves generated using a 16 lb sledgehammer striking on an aluminum ground plate at each geophone then 12 geophones were relocated to extend the line for a total of 36 geophone locations.

MASW data is then processed using dispersion analysis software (SurfSeis), engineered by the Kansas Geological Survey, which extracts the fundamental-mode dispersion curve(s) for each shot location. The curves are inverted and modeled to yield a one-dimensional (1D) shear-wave velocity profile along the array for a corresponding depth and surface location. 1D profiles are created for each surface location interval and then combined to yield a two-dimensional profile (2D). These 2D profiles are then examined for shear-wave velocity (Vs) variations to provide information on the soil/bedrock stratigraphy of the surveyed area.

FINDINGS AND CONCLUSIONS

In general, the interpreted stratigraphy, based on the available boring logs and collected geophysical data, includes clayey sand at the surface to approximately 30 to 40 feet foot below ground surface (BGS). This zone includes an area of clayey sand with gravel and cobbles about 10 to 20 foot BGS. A calcareous sandstone transitioning to dolostone appears to underlie the above soils. The attached exhibits provide our collected profiles and interpretations.

High Resistivity areas (green to red) are interpreted as very sandy clays with sandstone, gravels and/or cobbles, or sandstone/dolostone deeper in the section. Low resistivity areas (blue) could indicate moist clays or possible areas of concern for small cavities as seen in boring B-3.

The MASW data can indicate weathered rock when interpreted in conjunction with the ERT. Some areas indicated as sandstone/dolostone by ERT showed lower shear wave velocities than typically expected, which could indicate weathering or fracturing.

LIMITATIONS

It should be noted that, as with any geophysical testing method, the process relies on instrument signals to indicate physical conditions in the field. Signal information can be affected by on-site conditions beyond the control of the operator. Interpretation of those signals is based on a combination of known factors combined with the experience of the operator and geophysical scientist evaluating the results. Utilizing conventional observation, sampling and testing (“truthing”) of select areas is recommended to confirm the results. As with all geophysical methods, the results provide a level of confidence, but should not be considered absolute. We cannot be responsible for the misinterpretation of unverified results by others.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geophysical practices. No warranties, either express or implied, are intended or made.

The results presented in this report are based upon the data obtained from the geophysical surveys and from other information discussed in this report. This report does not reflect variations that may occur in areas inaccessible to the geophysical equipment, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction.

We appreciate the opportunity to be of service to you on this project. If you have any questions regarding our findings, please contact us.

Sincerely,
Terracon Consultants, Inc.
Cert. of Auth. #CA-223, Exp. 6/30/23

John W. Adamson	Michael H. Homan, P.E.
Senior Staff Geophysicist	Senior Principal

Copies to: Addressee (1)
Attachments: Exhibits 1 to 4

Location Diagram

— MASW Line

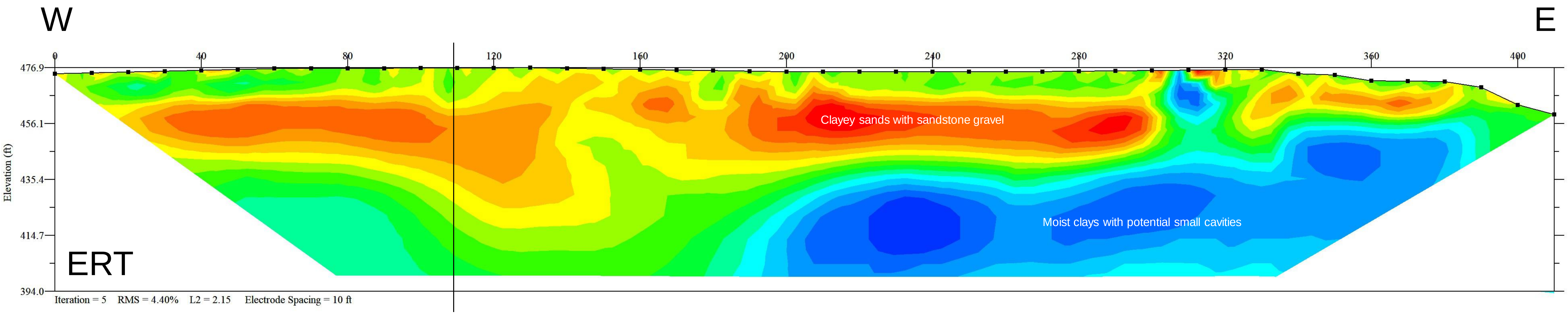
— ERT Line

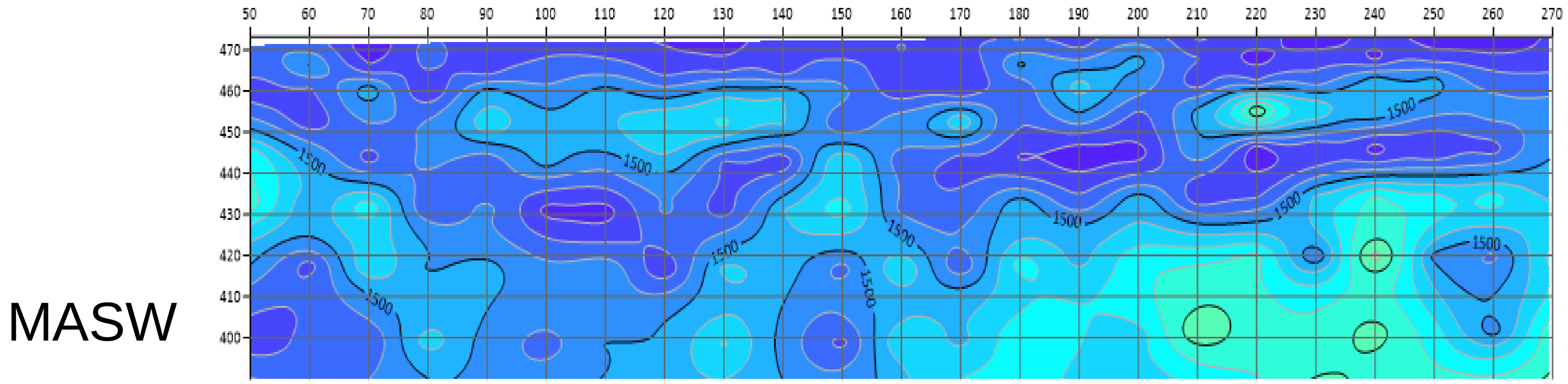
● Borings completed by previously by ARDOT.

Exhibit 1

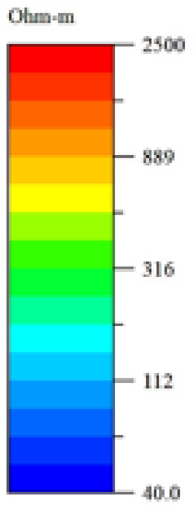
North Line Geophysical Results

Terracon





Resistivity (ERT) (top)

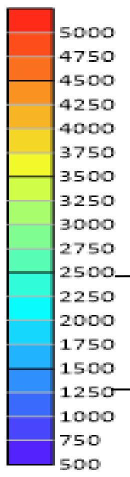


Sandstone/Dolostone
Gravel and Sand

Sandy clay
Weathered rock

Shales/Moist clay

MASW (bottom)
Vs (ft/s)



Competent Rock

Stiff soils/Weathered Rock

Soils

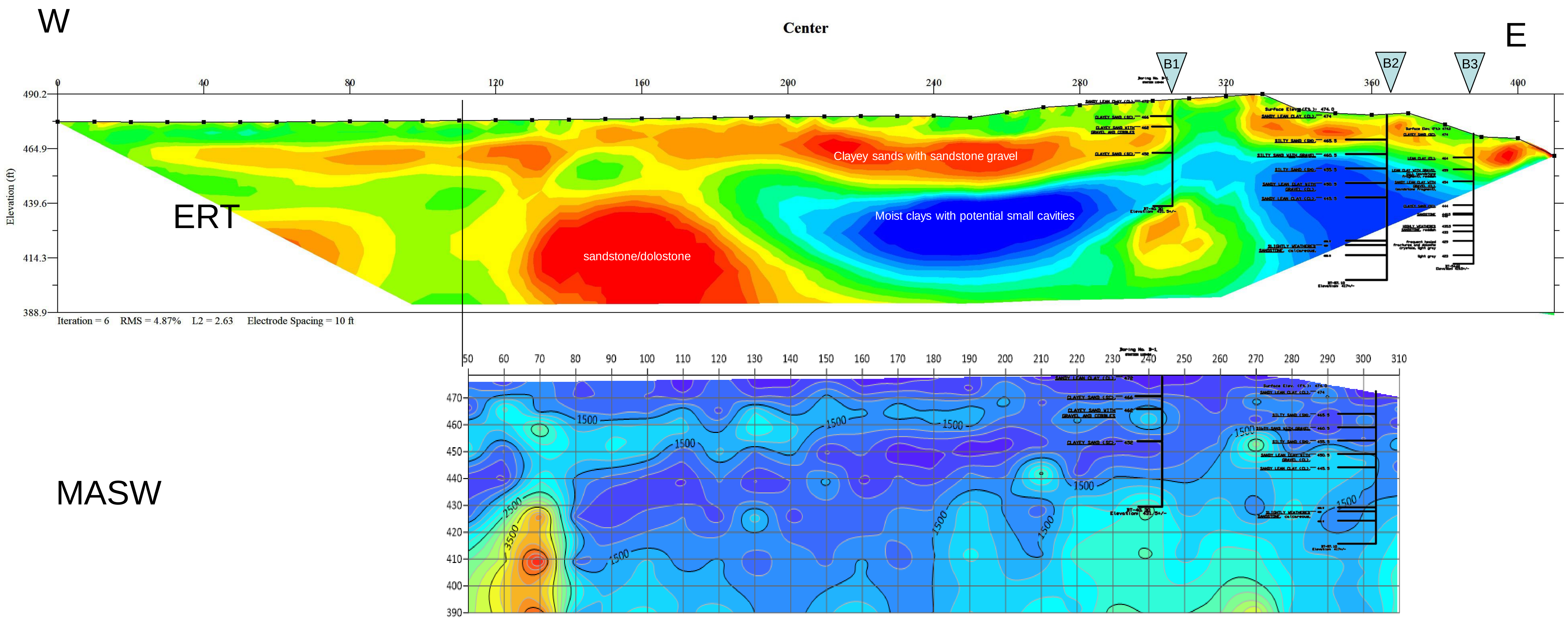
High Resistivity areas (green to red) are interpreted as sandy clays, gravels, and/or cobbles in the top portion of the profile with sandstone/dolostone deeper.

Low resistivity areas (dark blue) could indicate small cavities as seen in boring B-3 or moist clays.

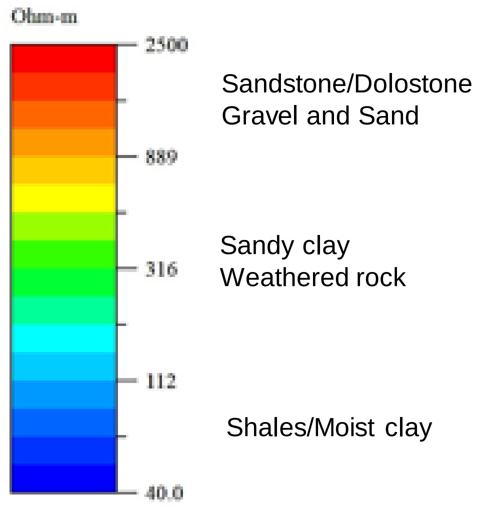
Some areas indicated as sandstone/dolostone with ERT exhibit lower shear wave velocities than typically expected, which could indicate weathering or fracturing in those rocks in the MASW profile.

Exhibit 2

Center Line Geophysical Results



Resistivity (ERT) (top)

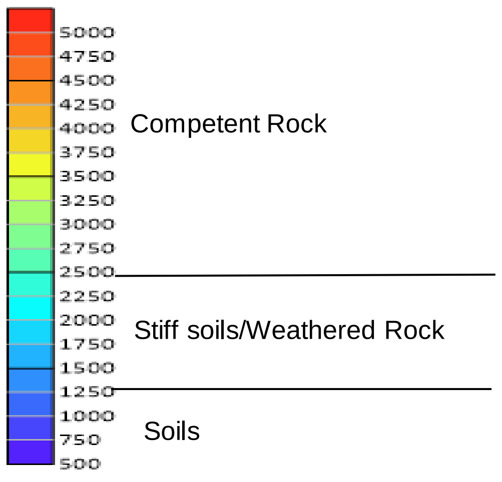


Sandstone/Dolostone
Gravel and Sand

Sandy clay
Weathered rock

Shales/Moist clay

MASW (bottom)
Vs (ft/s)



Competent Rock

Stiff soils/Weathered Rock

Soils

High Resistivity areas (green to red) are interpreted as sandy clays, gravels, and/or cobbles in the top portion of the profile with sandstone/dolostone deeper.

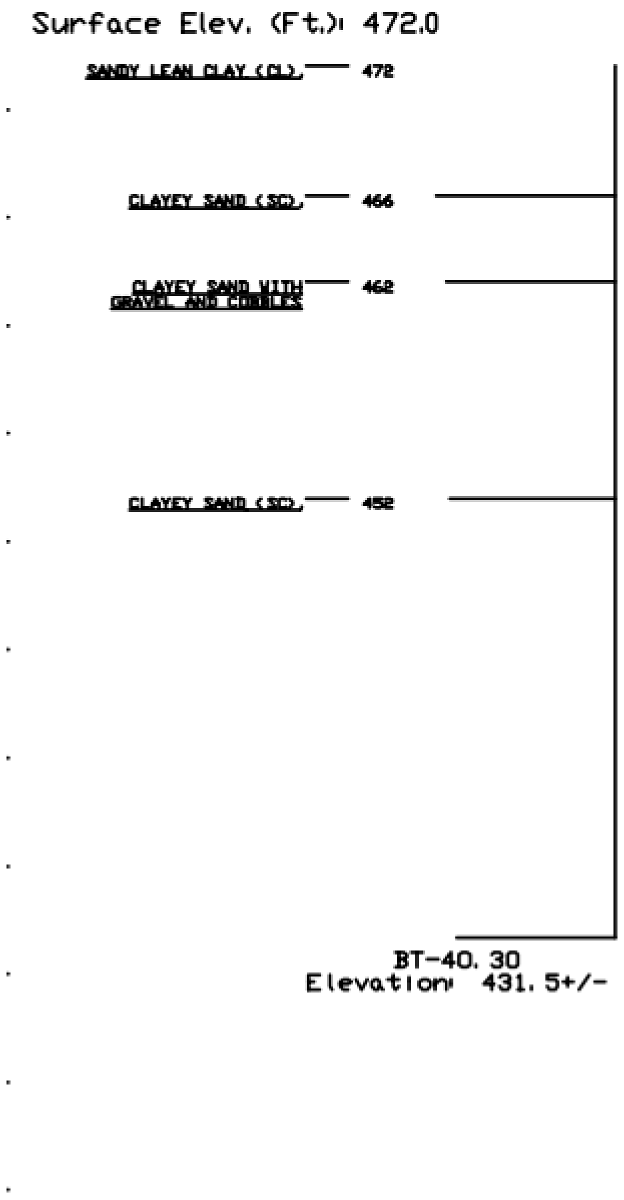
Low resistivity areas (dark blue) could indicate small cavities as seen in boring B-3 or moist clays.

Some areas indicated as sandstone/dolostone with ERT exhibit lower shear wave velocities than typically expected, which could indicate weathering or fracturing in those rocks in the MASW profile.

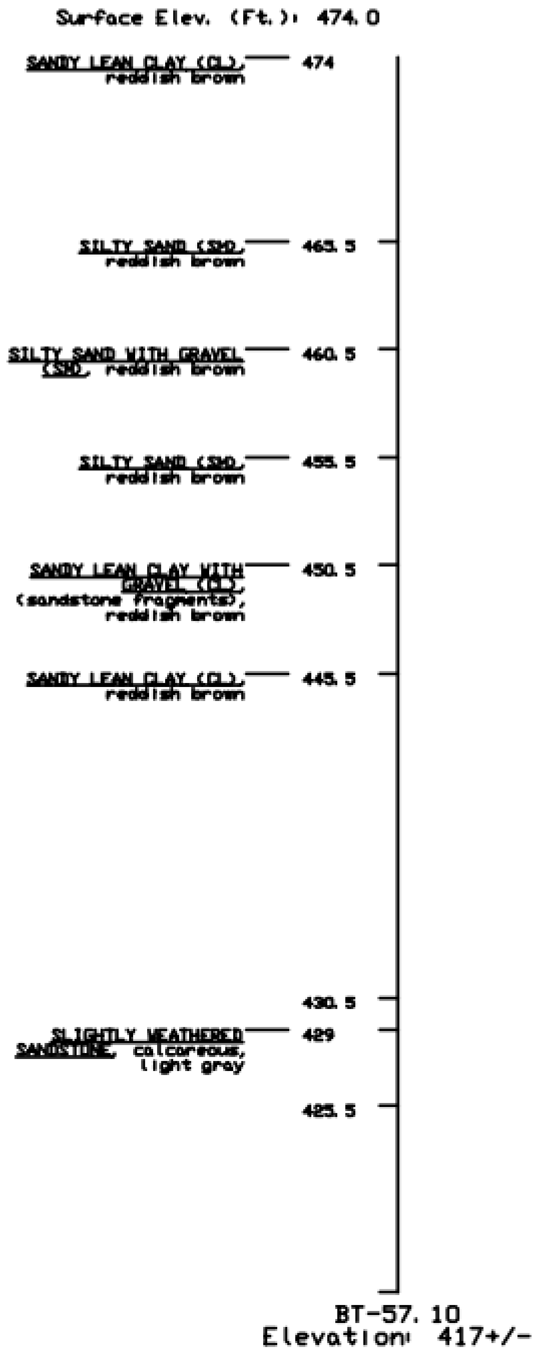
Exhibit 3

Boring Logs

Boring No. B-1
STATION 115+84



Boring No. B-2



Boring No. B-3

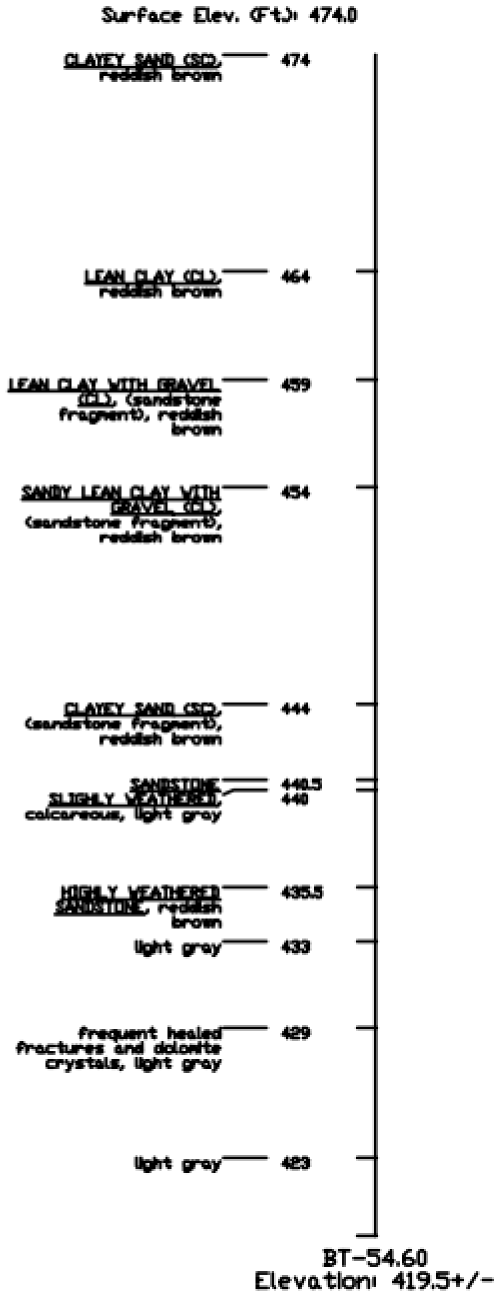
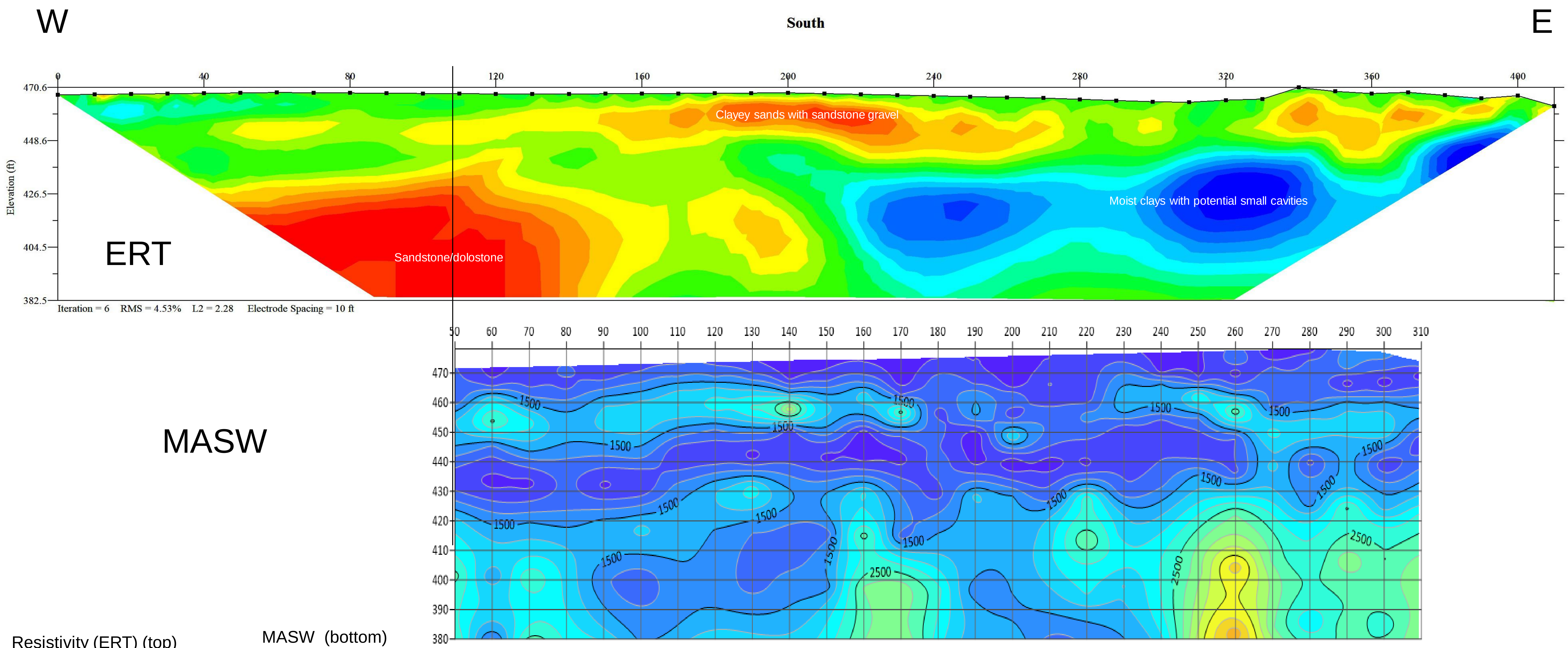


Exhibit 4

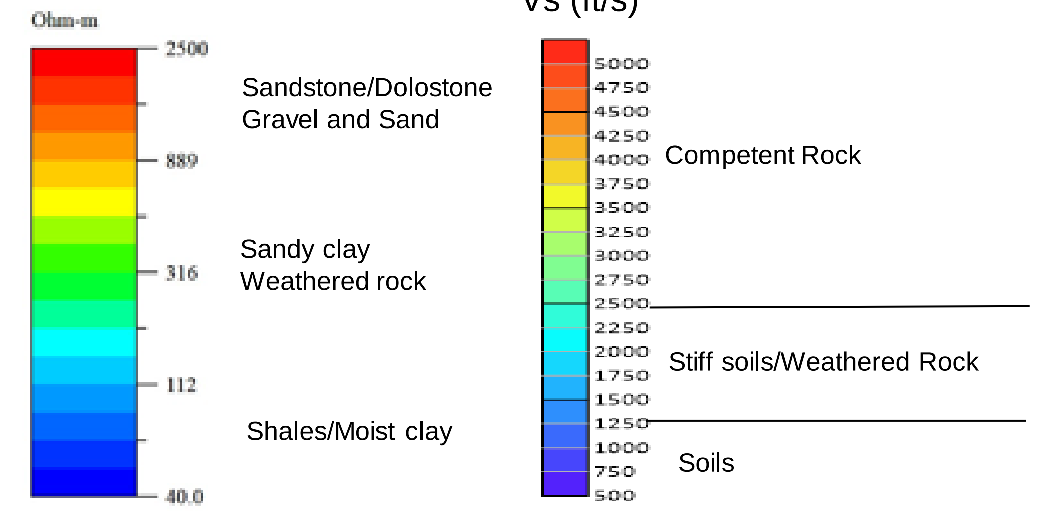
South Line Geophysical Results

Terracon



Resistivity (ERT) (top)

MASW (bottom)
Vs (ft/s)



High Resistivity areas (green to red) are interpreted as sandy clays, gravels, and/or cobbles in the top portion of the profile with sandstone/dolostone deeper.

Low resistivity areas (dark blue) could indicate small cavities as seen in boring B-3 or moist clays.

Some areas indicated as sandstone/dolostone with ERT exhibit lower shear wave velocities than typically expected, which could indicate weathering or fracturing in those rocks in the MASW profile.

Exhibit 5

Attachment C

Rock Core Unconfined Compression Test Summary

Project Number: 050423
Project Name: Piney Creek
Date Tested: 3/28/2022

Station	Location	Sample No.	Depth (ft.)	Diameter (in)	Height (in)	Total Load (lbs.)	Correction Factor	Stress (psi)	Remarks
116+40	CL	1	43.2	1.76	3.52	16,490		6,778	
116+40	CL	2	50.3	1.76	3.46	27,070		11,126	
116+40	CL	3	52.4	1.76	3.53	-	-	-	Broke
116+60	CL	4	33.8	1.75	3.52	29,070		12,086	
116+60	CL	5	40.7	1.76	3.49	-	-	-	Broke
116+60	CL	6	43.4	1.76	3.50	43,650		17,942	
116+60	CL	7	48.3	1.76	3.47	9,010		3,703	
118+40	56' RT	8	19.7	1.76	3.43	47,730		19,619	
118+40	56' RT	9	23.0	1.76	3.51	48,320		19,862	
118+40	56' RT	10	26.3	1.76	3.47	13,650		5,611	
118+40	56' RT	11	30.4	1.76	3.49	20,250		8,323	
119+05	62' RT	12	18.1	1.76	3.57	12,070		4,961	
119+05	62' RT	13	21.2	1.76	3.48	16,980		6,979	
119+05	62' RT	14	22.8	1.76	3.55	29,380		12,076	
119+80	CL	15	15.8	1.76	3.53	41,030		16,865	
119+80	CL	16	18.2	1.76	3.51	32,480		13,351	
119+80	CL	17	21.6	1.76	3.56	30,140		12,388	

* Please note any broken samples, fractures or other characteristics of sample in Remarks.

ROCK MASS RATING SUMMARY

JOB # 050423 **GSI: 65**

SAMPLE #1

Station/Location	116+40, CL
Depth (ft)	43.2
	Relative Rating
Uniaxial Compressive Strength	4
RQD	17
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	*68*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #2

Station/Location	116+40, CL
Depth (ft)	50.3
	Relative Rating
Uniaxial Compressive Strength	7
RQD	17
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	*71*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #3

Station/Location	116+40, CL
Depth (ft)	52.4
	Relative Rating
Uniaxial Compressive Strength	Broke in saw
RQD	17
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	*64*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #4

Station/Location	116+60, CL
Depth (ft)	33.8
	Relative Rating
Uniaxial Compressive Strength	7
RQD	20
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	*74*
Class Number	**II**
Description	**GOOD ROCK**

4.3 feet thick cavity below this sample

SAMPLE #5

Station/Location	116+60, CL
Depth (ft)	40.7
	Relative Rating
Uniaxial Compressive Strength	Broke in saw
RQD	20
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	*67*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #6

Station/Location	116+60, CL
Depth (ft)	43.4
	Relative Rating
Uniaxial Compressive Strength	12
RQD	20
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	*79*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #7

Station/Location	116+60, CL
Depth (ft)	48.3
	Relative Rating
Uniaxial Compressive Strength	2
RQD	20
Spacing of Joints	20
Condition of Joints	12
Groundwater Conditions	7
Sum	*61*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #8

Station/Location	118+40, 56' RT
Depth (ft)	19.7
	Relative Rating
Uniaxial Compressive Strength	12
RQD	17
Spacing of Joints	10
Condition of Joints	20
Groundwater Conditions	7
Sum	*66*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #9

Station/Location	118+40, 56' RT
Depth (ft)	23
	Relative Rating
Uniaxial Compressive Strength	12
RQD	20
Spacing of Joints	10
Condition of Joints	20
Groundwater Conditions	7
Sum	*69*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #10

Station/Location	118+40, 56' RT
Depth (ft)	26.3
	Relative Rating
Uniaxial Compressive Strength	4
RQD	20
Spacing of Joints	10
Condition of Joints	20
Groundwater Conditions	7
Sum	*61*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #11

Station/Location	118+40, 56' RT
Depth (ft)	30.4
	Relative Rating
Uniaxial Compressive Strength	7
RQD	20
Spacing of Joints	30
Condition of Joints	25
Groundwater Conditions	7
Sum	*89*
Class Number	**I**
Description	**VERY GOOD ROCK**

SAMPLE #12

Station/Location	119+05, 62' RT
Depth (ft)	18.1
	Relative Rating
Uniaxial Compressive Strength	4
RQD	17
Spacing of Joints	10
Condition of Joints	12
Groundwater Conditions	7
Sum	*50*
Class Number	**III**
Description	**FAIR ROCK**

SAMPLE #13

Station/Location	119+05, 62' RT
Depth (ft)	21.2
	Relative Rating
Uniaxial Compressive Strength	4
RQD	17
Spacing of Joints	10
Condition of Joints	12
Groundwater Conditions	7
Sum	*50*
Class Number	**III**
Description	**FAIR ROCK**

SAMPLE #14

Station/Location	119+05, 62' RT
Depth (ft)	22.8
	Relative Rating
Uniaxial Compressive Strength	7
RQD	17
Spacing of Joints	20
Condition of Joints	25
Groundwater Conditions	7
Sum	*76*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #15

Station/Location	119+80, CL
Depth (ft)	15.8
	Relative Rating
Uniaxial Compressive Strength	12
RQD	20
Spacing of Joints	20
Condition of Joints	25
Groundwater Conditions	7
Sum	*84*
Class Number	**I**
Description	**VERY GOOD ROCK**

SAMPLE #16

Station/Location	119+80, CL
Depth (ft)	18.2
	Relative Rating
Uniaxial Compressive Strength	4
RQD	20
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	*71*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #17

Station/Location	119+80, CL
Depth (ft)	21.6
	Relative Rating
Uniaxial Compressive Strength	7
RQD	20
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	*74*
Class Number	**II**
Description	**GOOD ROCK**

SAMPLE #18

Station/Location	
Depth (ft)	
	Relative Rating
Uniaxial Compressive Strength	
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	7
Sum	*7*
Class Number	**V**
Description	**VERY POOR ROCK**

Attachment D

SITE PICTURES

Job No.: 050423
Job Name: Hwy. 56 – Piney Creek Str. & Apprs. (S)

Overall View of Existing Bridge - Looking East (March 2022)

Rock Exposed at the Southwest End of Existing Bridge (March 2022)

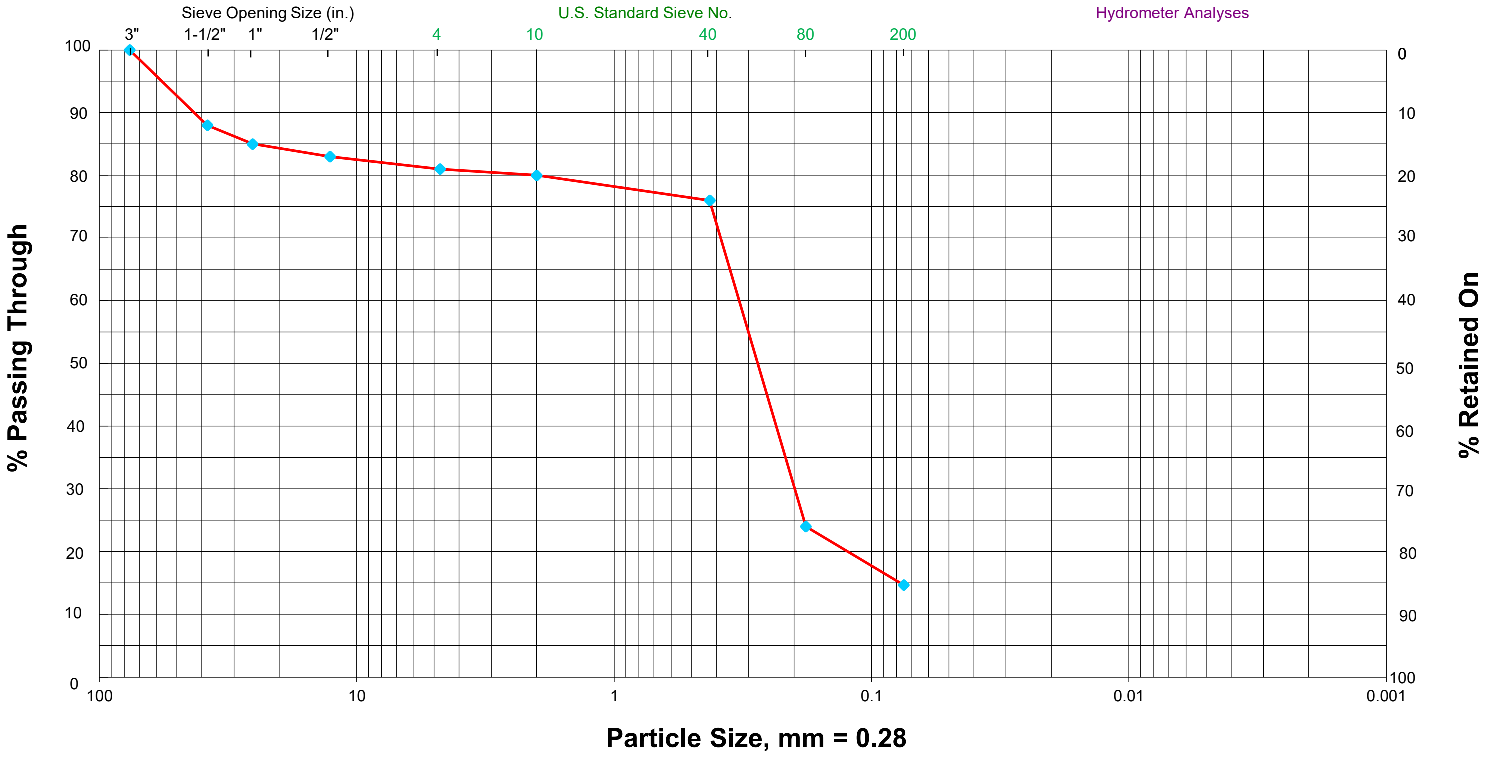
Rock Exposed under West End of Existing Bridge (March 2022)

East End of Existing Bridge (March 2022)

Looking North of the Bridge Upstream (March 2022)

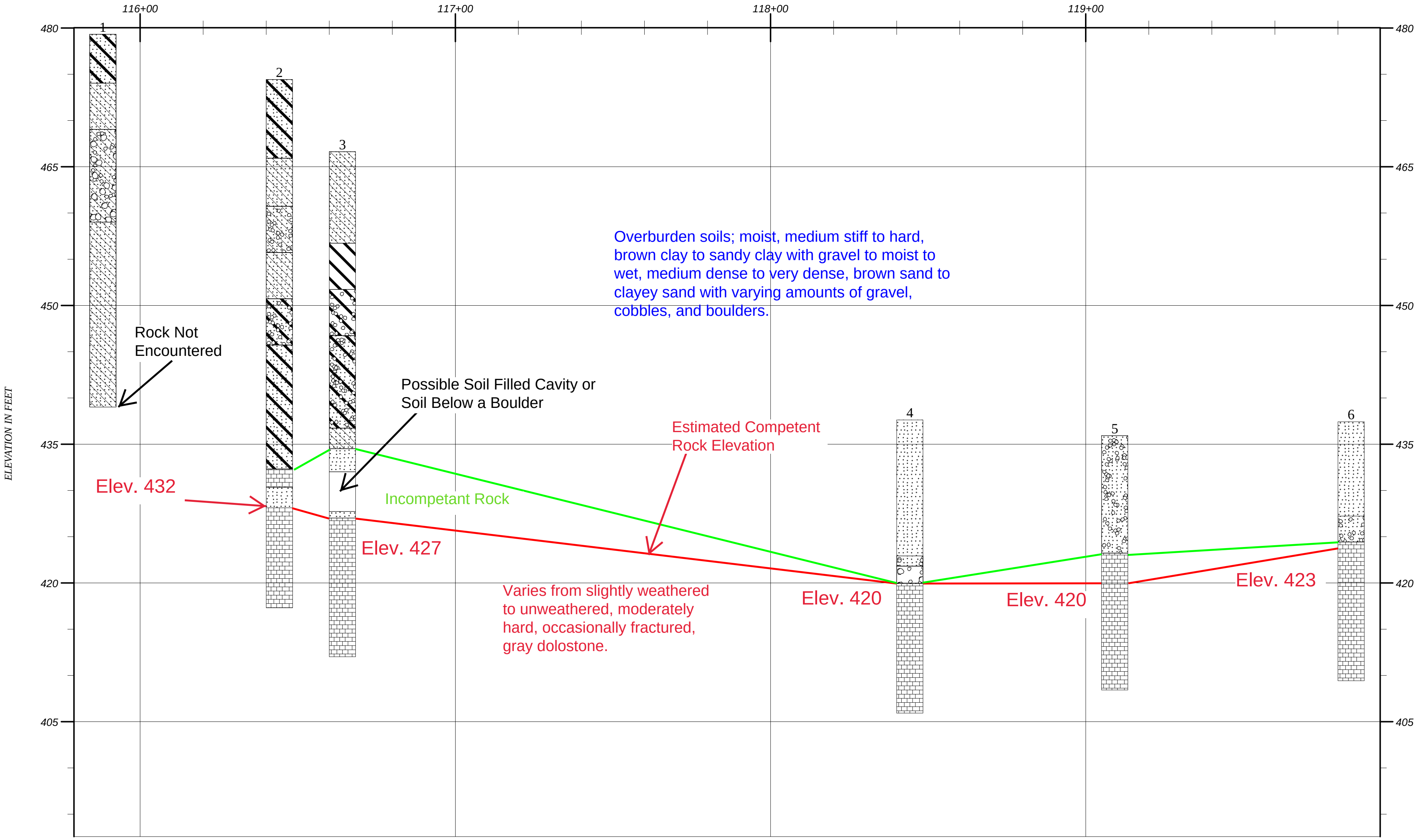
Looking South of the Bridge Downstream (March 2022)

Attachment E



118+08, 60' RT (Creek Side)
Particle Size Distribution Curve

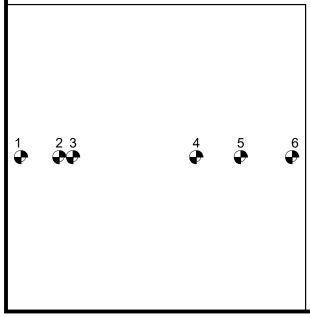
Attachment F



Overburden soils; moist, medium stiff to hard, brown clay to sandy clay with gravel to moist to wet, medium dense to very dense, brown sand to clayey sand with varying amounts of gravel, cobbles, and boulders.

Varies from slightly weathered to unweathered, moderately hard, occasionally fractured, gray dolostone.

Plan View



Strata symbols

- ▨ sandy clay
- ▨ clayey sand
- ▨ clayey sand, gravel and cobbles
- ▨ clayey sand and gravel
- ▨ sandy clay with gravel
- ▦ limestone/dolomite
- ▨ sand
- ▨ clay
- ▨ clay with gravel
- ☐ cavity
- ▨ sand and gravel
- ▨ gravel and cobbles

ARDOT
GENERALIZED SUBSURFACE PROFILE

HORIZONTAL SCALE: NTS	DRAWN BY/APPROVED BY	DATE DRAWN
VERTICAL SCALE: NTS		4/12/2022

Piney Creek Str. & Apprs. (S)

PROJECT NO: 050423
IZARD COUNTY

FIGURE NUMBER

Attachment G

Title: 050423

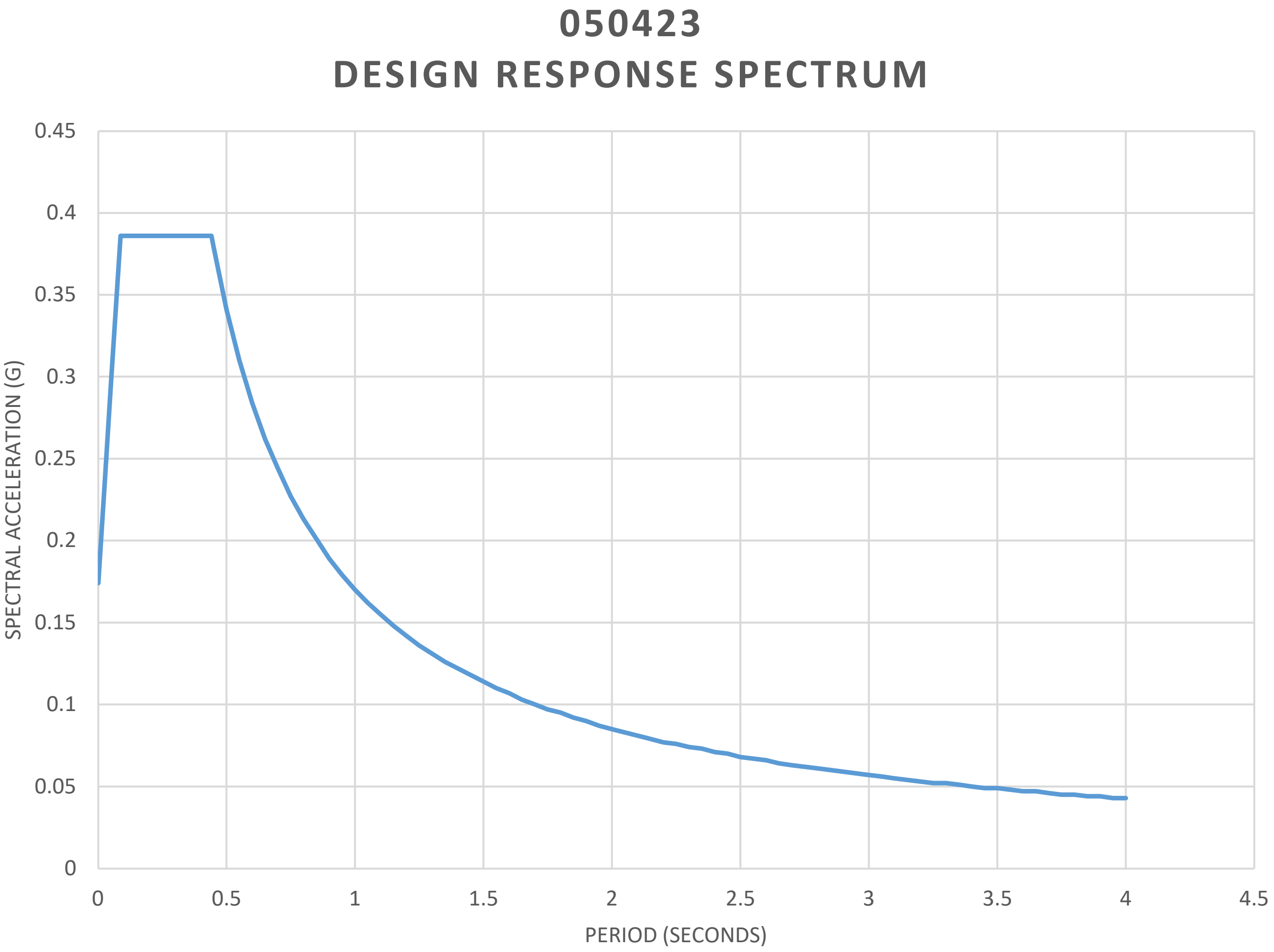
Latitude: 36.14698

Longitude: -92.07121

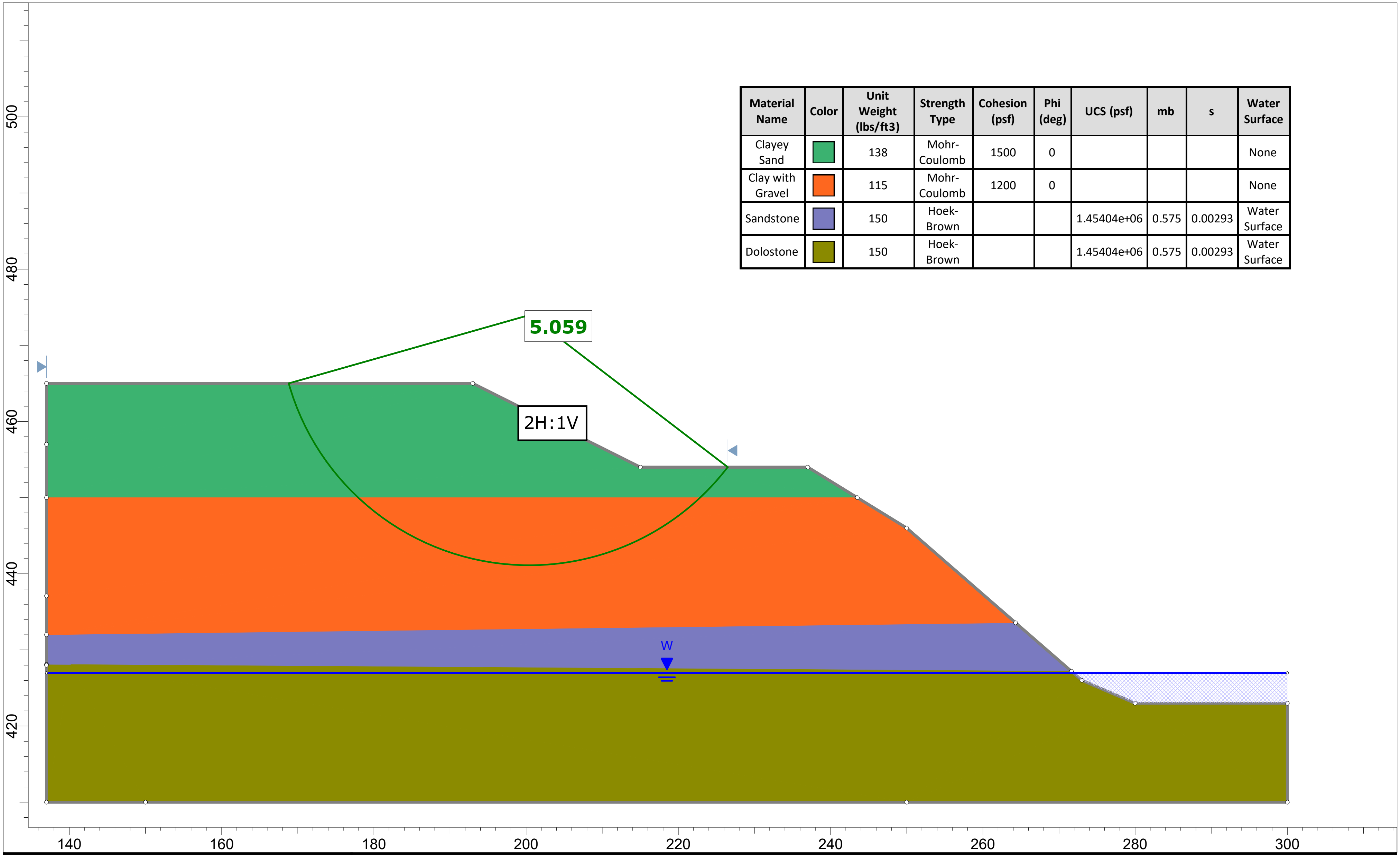
Site Class C

Get USGS Data

PGA:	0.145
F_{PGA}:	1.2
A_S:	0.174
S_S:	0.322
F_A:	1.2
S_{DS}:	0.386
S_1:	0.1
F_V:	1.7
S_{D1}:	0.17
S_{Dc}:	B
T_S:	0.441
T_0:	0.088



Attachment H



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	mb	s	Water Surface
Clayey Sand	🟩	138	Mohr-Coulomb	1500	0				None
Clay with Gravel	🟧	115	Mohr-Coulomb	1200	0				None
Sandstone	🟪	150	Hoek-Brown			1.45404e+06	0.575	0.00293	Water Surface
Dolostone	🟫	150	Hoek-Brown			1.45404e+06	0.575	0.00293	Water Surface

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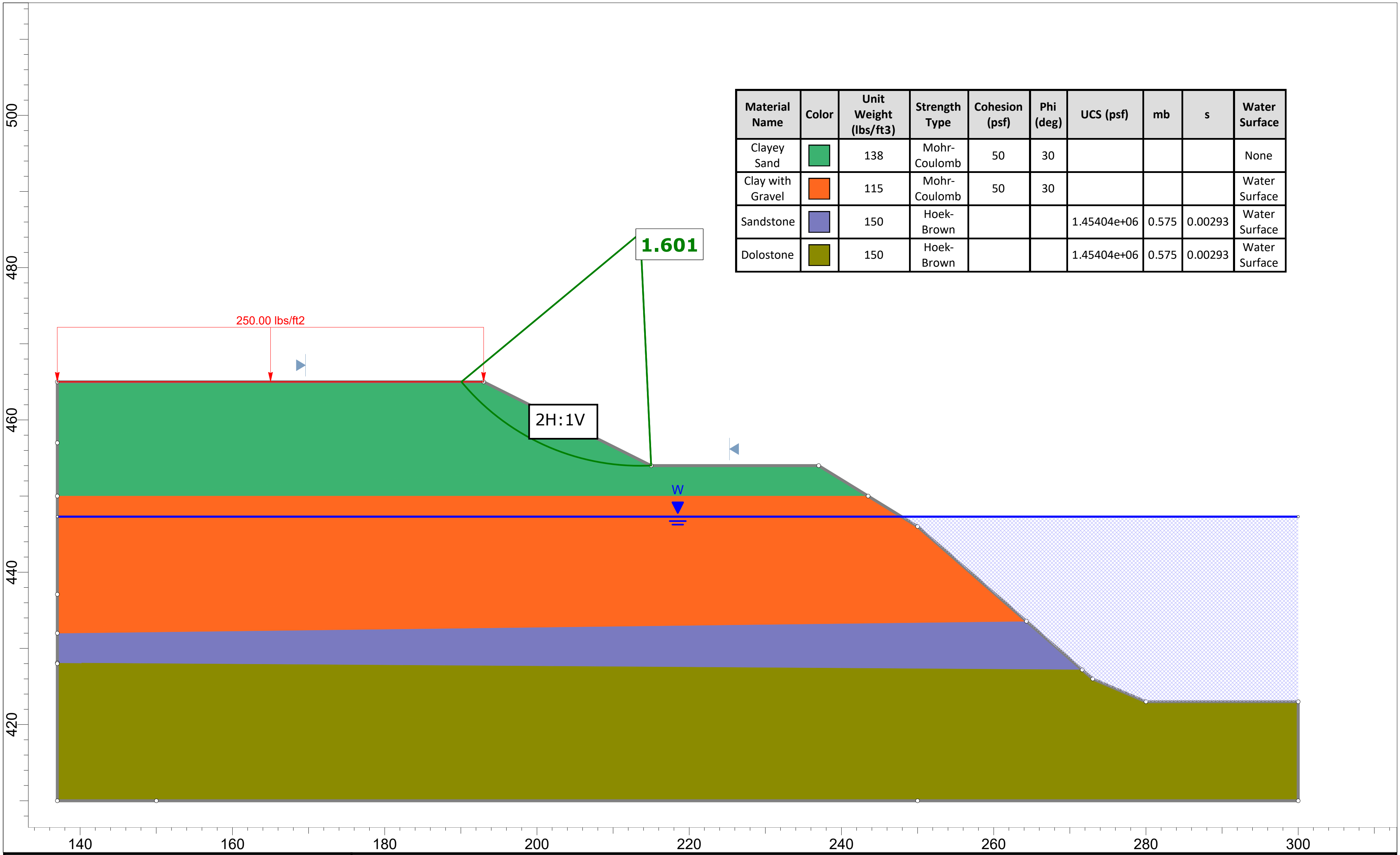
SLIDEINTERPRET 9.020

Project	050423 - U.S. Hwy. 56 over Piney Creek		
Company	ARDOT	Analysis Type	Short-Term/End of Construction
Drawn By	PJT	Configuration	West Bridge End Cut Slope - 2H:1V End Slope
Date	4/13/2022		

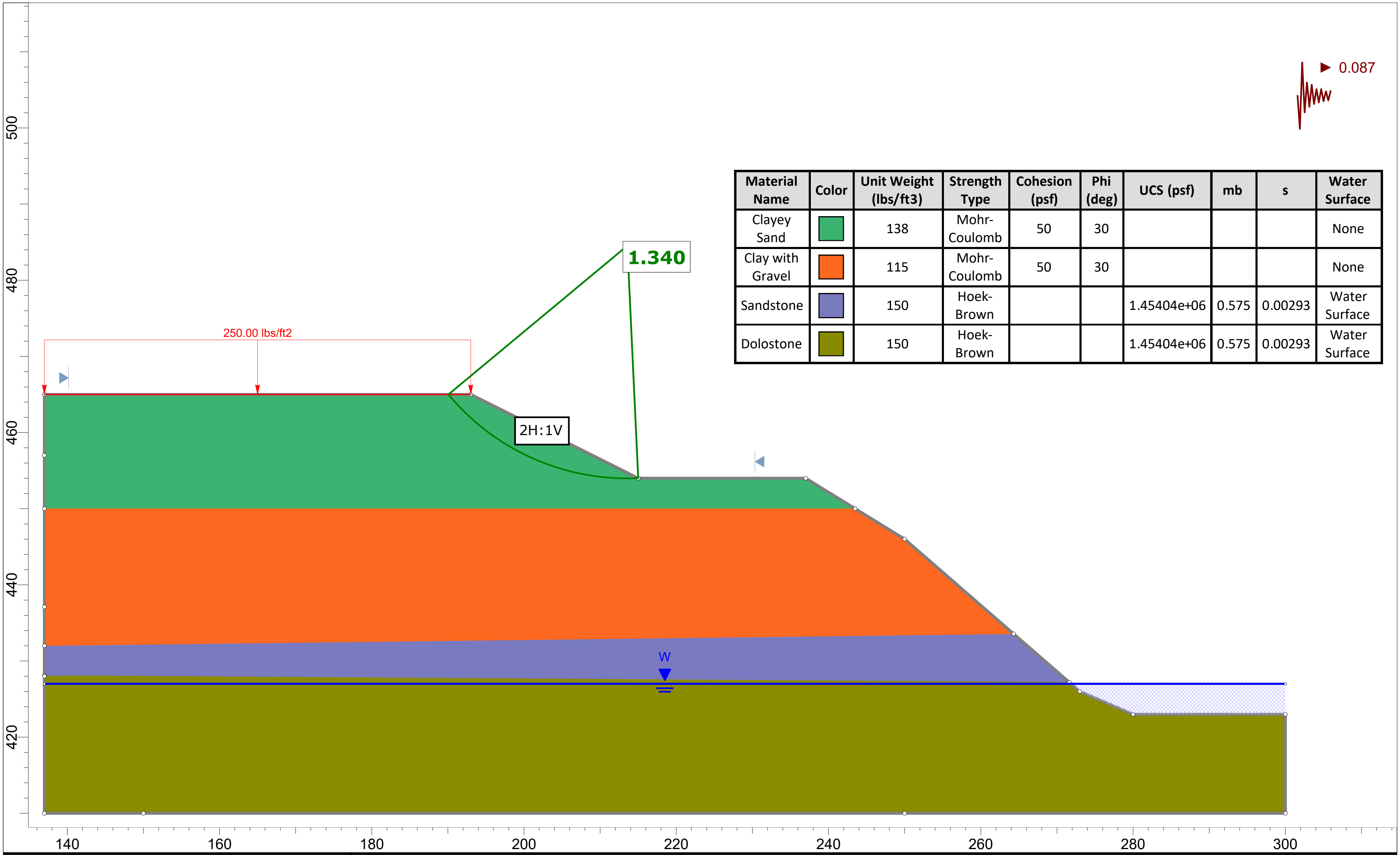


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	mb	s	Water Surface
Clayey Sand	🟩	138	Mohr-Coulomb	50	30				None
Clay with Gravel	🟧	115	Mohr-Coulomb	50	30				Water Surface
Sandstone	🟪	150	Hoek-Brown			1.45404e+06	0.575	0.00293	Water Surface
Dolostone	🟫	150	Hoek-Brown			1.45404e+06	0.575	0.00293	Water Surface

rocscience

SLIDEINTERPRET 9.020

Project 050423 - U.S. Hwy. 56 over Piney Creek
Company ARDOT
Drawn By PJT
Date 4/13/2022
Analysis Type Long-Term
Configuration West Bridge End Cut Slope - 2H:1V End Slope



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	mb	s	Water Surface
Clayey Sand	🟩	138	Mohr-Coulomb	50	30				None
Clay with Gravel	🟧	115	Mohr-Coulomb	50	30				None
Sandstone	🟪	150	Hoek-Brown			1.45404e+06	0.575	0.00293	Water Surface
Dolostone	🟫	150	Hoek-Brown			1.45404e+06	0.575	0.00293	Water Surface

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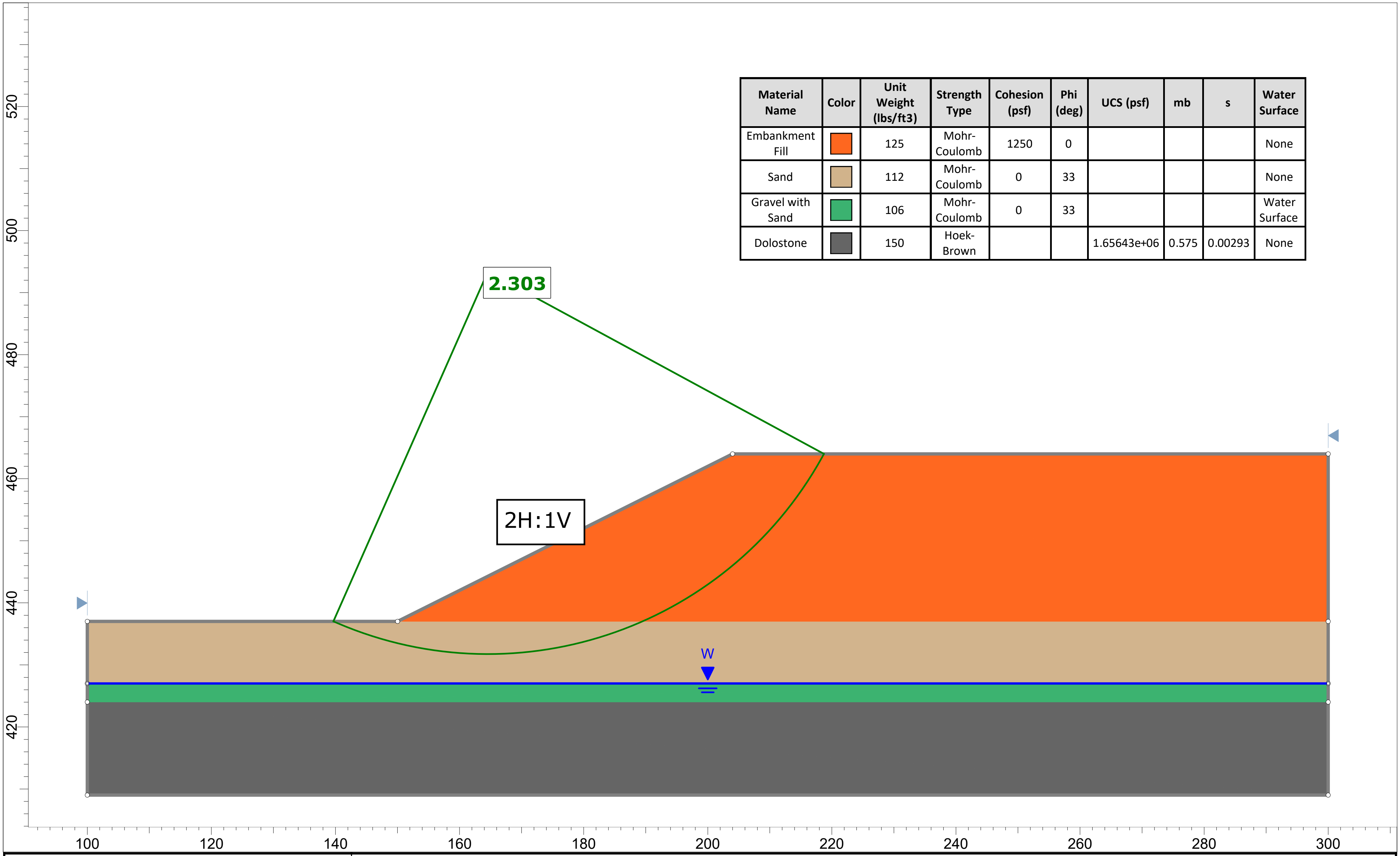
SLIDEINTERPRET 9.020

Project	050423 - U.S. Hwy. 56 over Piney Creek
Company	ARDOT
Drawn By	PJT
Date	4/13/2022
Analysis Type	Seismic
Configuration	West Bridge End Cut Slope - 2H:1V End Slope

Attachment I



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	mb	s	Water Surface
Embankment Fill	🟧	125	Mohr-Coulomb	1250	0				None
Sand	🟫	112	Mohr-Coulomb	0	33				None
Gravel with Sand	🟩	106	Mohr-Coulomb	0	33				Water Surface
Dolostone	⬛	150	Hoek-Brown			1.65643e+06	0.575	0.00293	None

Project 050423 - U.S. Hwy. 56 over Piney Creek

Company ARDOT

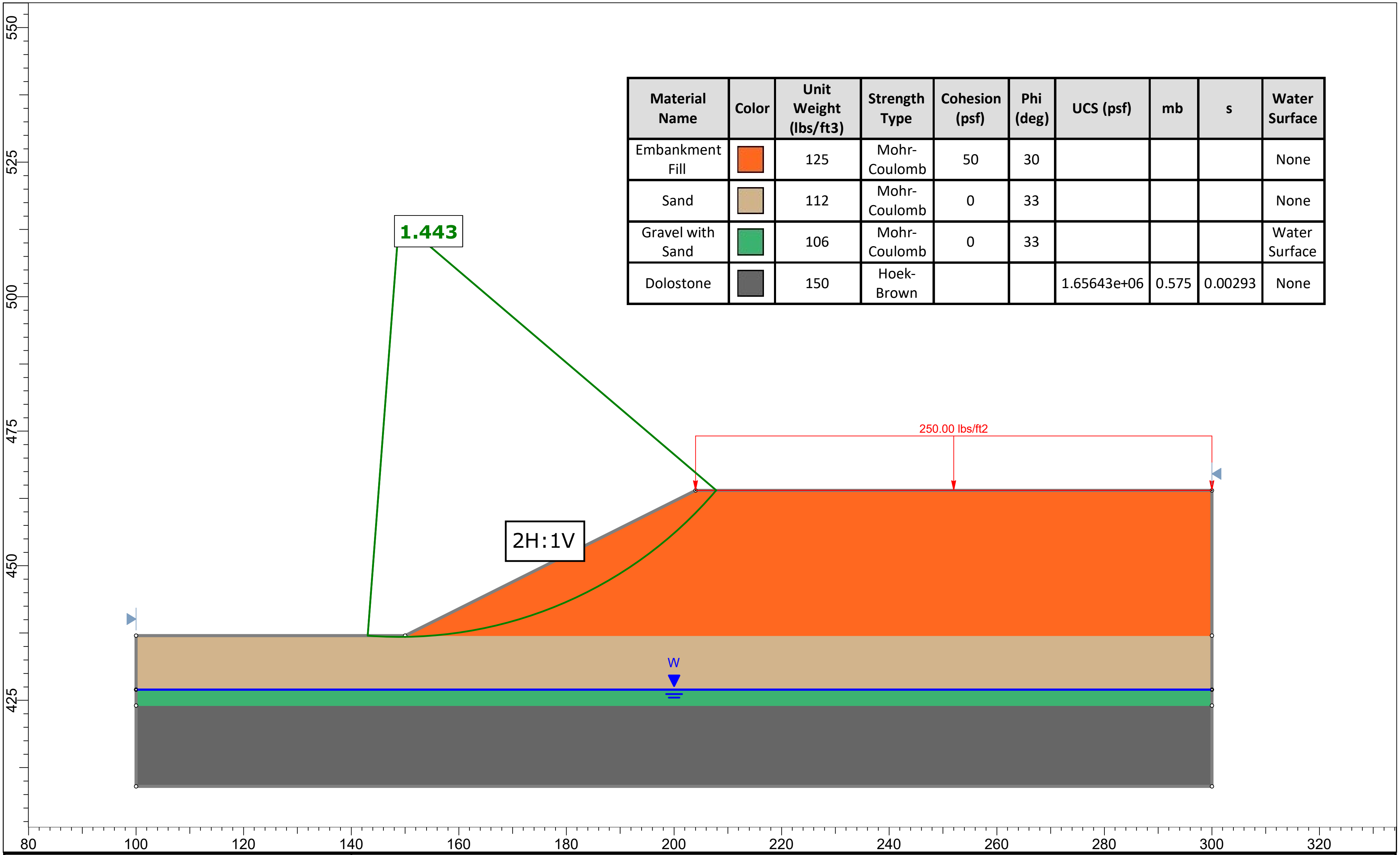
Analysis Type Short-Term/End of Construction

Drawn By PJT

Configuration East Bridge Embankment - 2H:1V End Slope

Date 4/11/2022

SLIDEINTERPRET 9.020



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	mb	s	Water Surface
Embankment Fill	🟧	125	Mohr-Coulomb	50	30				None
Sand	🟫	112	Mohr-Coulomb	0	33				None
Gravel with Sand	🟩	106	Mohr-Coulomb	0	33				Water Surface
Dolostone	⬛	150	Hoek-Brown			1.65643e+06	0.575	0.00293	None

SLIDEINTERPRET 9.020

Project 050423 - U.S. Hwy. 56 over Piney Creek

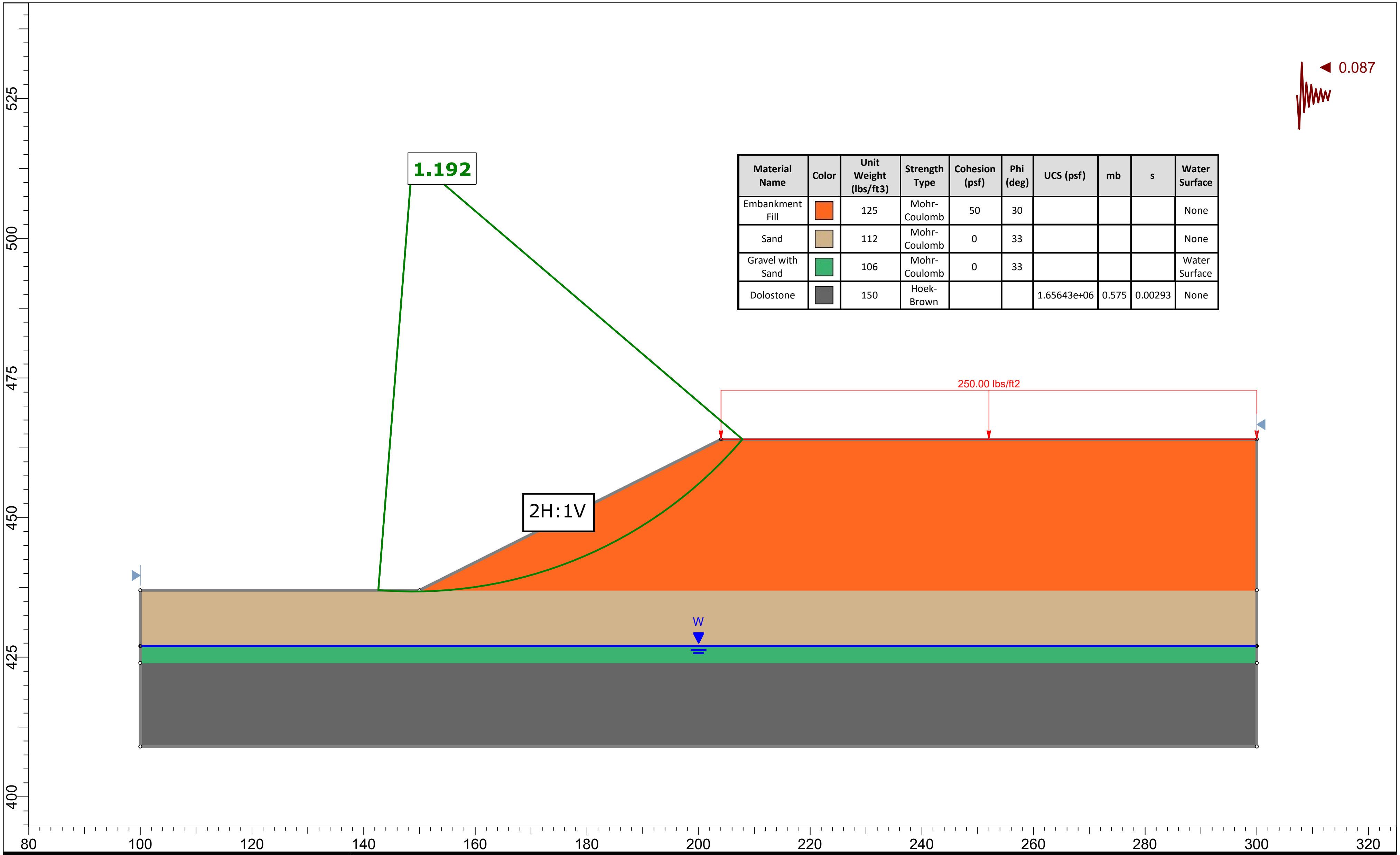
Company ARDOT

Drawn By PJT

Date 4/11/2022

Analysis Type Long-Term

Configuration East Bridge Embankment - 2H:1V End Slope



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	mb	s	Water Surface
Embankment Fill	🟧	125	Mohr-Coulomb	50	30				None
Sand	🟫	112	Mohr-Coulomb	0	33				None
Gravel with Sand	🟩	106	Mohr-Coulomb	0	33				Water Surface
Dolostone	⬛	150	Hoek-Brown			1.65643e+06	0.575	0.00293	None

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SLIDEINTERPRET 9.020

Project 050423 - U.S. Hwy. 56 over Piney Creek

Company ARDOT

Drawn By PJT

Date 4/11/2022

Analysis Type Seismic

Configuration East Bridge Embankment - 2H:1V End Slope