

**STRUCTURE GEOTECHNICAL REPORT  
VARIOUS BOX CULVERTS  
ROUTE FAP 336A (IL 31)  
FROM AMES ROAD TO CHARES MILLER ROAD (BULL VALLEY ROAD)  
CONTRACT 80C85  
MCHENRY COUNTY, ILLINOIS**

01/30/2026

**Prepared for:**

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**1.0 INTRODUCTION**

Interra, Inc. (INTERRA) was tasked by Patrick Engineering, Inc. based in Lisle, Illinois to conduct subsurface soil investigation and prepare the Structural Geotechnical Report (SGR) for the culvert structures located under IL 31 from Ames Road to Charles Miller Road (Bull Valley Road).

**2.0 PROJECT SCOPE**

INTERRA's scope of work included drilling a total of fifteen (15) structure geotechnical borings; performing associated laboratory tests on collected soil samples; preparation of Structure Geotechnical Report in accordance with IDOT Geotechnical Manual 2020. Number of borings and the location and details of the culverts are provided as Table 1 below.

**Table 1 – Project Scope**

<b>Structure</b>	<b>Detail</b>	<b>Station</b>	<b>Number of Borings</b>
Box Culvert No. 8	Triple Precast Concrete Box Culverts 12' x 2' upstream Invert: 832.35, downstream Invert: 831.9	IL 31 Stn. 273+35	3
Box Culvert No. 9	SN 056-0322. Precast Concrete Box Culverts 8' x 5' upstream Invert: 821.49, downstream Invert: 821.21	IL 31 Stn. 287+95	3
Box Culvert No. 10	Precast Concrete Box Culverts 12' x 2' upstream Invert: 819.42, downstream Invert: 819.32	IL 31 Stn. 304+81	3
Box Culvert No. 11	Precast Concrete Box Culverts 6' x 3' upstream Invert: 819.45, downstream Invert: 818.75	IL 31 Stn. 320+00	3
Box Culvert No. 12	Precast Concrete Box Culverts 7' x 3' upstream Invert: 814.5, downstream Invert: 814.25	IL 31 Stn. 350+00	3



### **3.0 SITE DESCRIPTION**

The project site is located between Ames Road and Charles Miller Road in McHenry County, IL. The site is within Nunda Township, defined as T44N R8E of the Third Principal Meridian. The approximate coordinates at the north end of the project are 42.3210N and 88.2745W and the south end are 42.2812N and 88.2868W. The ground surface elevation varies approximately from 813 feet to 863 feet at borehole locations. Approximate elevation at the north end of the project (IL 31 & Charles Miller Road) is 830 feet and at the south end of the project (IL 31 Ames Road) is 864 feet.

#### *2.1 Mining Activity*

From the Illinois State Geological Survey (ISGS, 2021), McHenry County is not identified as coal producing area. Therefore, no past coal mining activities may have taken place at the project site.

#### *2.2 Seismic Considerations*

USGS National Seismic Hazard Maps (AASHTO LRFD, Figure 3.10.2.1-1) indicate a Peak Ground Acceleration (PGA) of 4% of gravity, with a 7% probability of exceedance in 75 years. The project area has no active, major faults (Kolata, 2005).

### **4.0 FIELD INVESTIGATION**

The locations of the borings are presented in the Borehole Location Plan in Appendix A. The Boreholes are as marked in the field by INTERRA and surveying subcontractor ORION Engineers, Inc. The location of the borings was adjusted as needed due to utility conflicts or accessibility issues. Any offset from marked location is given in parenthesis of location in the boring logs.

Prior to drilling, the drilling sub-contractor Geocon Professional Services (GEOCON) contacted the local one-call utility clearance service (JULIE) to clear underground utilities. The borings were drilled with a truck mounted and ATV mounted drill rigs. INTERRA's personnel were present during the drilling to collect and log the soil samples. The borings were drilled, and samples were collected in general accordance with the guidelines in the



IDOT Geotechnical Manual. Soil sampling was performed per AASHTO T-206, "Penetration Test and Split Barrel Sampling of Soils". Soil sampling was performed at 2.5-foot intervals up to a depth of 30 feet, followed by 5-foot intervals. The soil samples were taken in conjunction with the Standard Penetration Test where a driving resistance to a standard 2" split-spoon samples indicate relative density of granular materials and consistency of cohesive soils. Soil specimens from the borings were visually identified in accordance with the AASHTO and IDOT textural classification systems. Also, unconfined compressive strength tests were performed on cohesive samples using an Illinois modified RIMAC tester. Cohesive samples that could not be tested with a RIMAC tester were tested with a pocket penetrometer to estimate the unconfined compressive strength. Shelby tube samples were also collected at selected boring locations for performing laboratory tests. Water level readings were taken during drilling and immediately after completion of drilling. Delayed water level readings were also taken in selected borings when feasible.

## **5.0 LABORATORY TESTING**

All laboratory testing was performed in accordance with IDOT and/or AASHTO standard methods for testing. Moisture content tests (AASHTO T 265) were performed for all soil samples. Selected Shelby Tube samples were tested for Unconfined Compressive Strength (ASTM D 2166). Laboratory test reports are presented in Appendix B.

Soil boring logs indicating the blow counts, moisture content and soil description have been prepared and included in Appendix A of this report.

## **6.0 SUBSURFACE CONDITIONS**

Summary of subsurface conditions are given in Table 2 below. Based on the soils encountered while boring, soil type expected at the invert level of the culvert is shown in bold letters in Table 2. For detailed stratification, please refer to boring logs presented as Appendix A.



**Table 2 –Summary of Subsurface Conditions**

Boring No.	Surface Elevation (feet)	Depth (feet)	Groundwater During Drilling (feet)	Major Stratum Encountered from Top to Bottom
<b>Box Culvert No. 8</b> (Stn. 273+35. upstream invert level: 832.35 feet; downstream invert level: 831.9 feet)				
CUL08-01	833.2	15	3.5	Topsoil, <b>medium stiff clay</b> , loose sand, loose sandy loam, loose silty loam, hard to very stiff silty clay loam
CUL08-02	834.3	10	6.0	Asphalt, concrete, loose sandy loam fill, <b>very stiff clay loam</b> , loose sand
CUL08-03	835.3	20	8.5	Asphalt, crushed aggregate, stiff sandy clay loam, <b>stiff to soft clay</b> , fine sand, soft sandy clay loam, medium dense sandy loam, stiff sandy clay loam
<b>Box Culvert No. 9</b> (Stn. 287+95. upstream invert level: 821.49 feet; downstream invert level: 821.21 feet)				
CUL09-01	823.6	25	25.0	Topsoil, stiff clay loam, <b>loose to medium dense silty loam</b> , dense silt, medium dense to dense sandy loam
CUL09-02	823.1	20	13.0	Asphalt, asphalt grindings, medium dense sandy loam fill, <b>loose silty loam</b> , medium dense to loose silt, medium dense sandy loam, medium dense silty loam
CUL09-03	825.6	25	8.5	Crushed aggregate, loose sandy loam and gravel, stiff clay, <b>silty loam</b> , medium stiff to soft sandy clay loam, loose sandy loam, very stiff sandy clay loam, medium dense sand, medium dense sand and gravel
<b>Box Culvert No. 10</b> (Stn. 304+81. upstream invert level: 819.42 feet; downstream invert level: 819.32 feet)				
CUL10-01	820.1	15	11.0	Topsoil, <b>very loose fine sandy loam</b> , loose sandy loam, medium dense silty loam, very stiff clay, medium dense sand, medium dense silty loam
CUL10-02	821.4	10	8.5	Asphalt, concrete, <b>very stiff clay loam fill</b> , hard clay loam fill, loose silty clay loam, loose silt
CUL10-03	821.8	15	7.5	Topsoil, <b>very soft clay loam</b> , loose to medium dense sandy loam, medium dense to dense sand
<b>Box Culvert No. 11</b> (Stn. 320+00. upstream invert level: 819.45 feet; downstream invert level: 818.75 feet)				
CUL11-01	819.3	20	15.0	Topsoil, <b>stiff clay loam</b> , very loose to medium dense sandy loam, dense silty loam, medium dense sand
CUL11-02	820.7	15	Dry	Asphalt, <b>medium dense sand</b> , loose sandy clay loam, medium dense to dense sandy loam, dense sand



CUL11-03	821.8	20	14.0	Topsoil, stiff silty clay, <b>loose sandy loam</b> , very stiff silty clay loam, medium dense sandy loam, medium dense silty loam, very soft sandy clay and gravel
<b>Box Culvert No. 12</b> (Stn. 350+00. upstream invert level: 814.5 feet; downstream invert level: 814.25 feet)				
CUL12-01	815.4	15	11.0	Topsoil, <b>medium stiff clay</b> , soft to very soft sandy clay loam, medium dense sandy loam, very stiff sandy clay loam, very stiff clay loam
CUL12-02	816.6	25	Dry	<b>Loose sand and gravel</b> , stiff clay, very stiff clay loam, fine sand, medium dense silty loam, loose sandy loam, very loose to loose sand
CUL12-03	818.1	20	18.0	Topsoil, very stiff clay loam, <b>soft sandy clay</b> , medium stiff sandy clay loam, medium dense fine sand, very stiff sandy clay loam, medium dense sand, medium dense sandy loam, very stiff clay loam, medium dense sandy loam

Groundwater Information

Groundwater elevations were recorded during drilling and immediately after completion of drilling at all boring locations. The recorded depths are provided in the Soil Boring Logs. The boreholes were backfilled with auger cuttings and bentonite chips immediately after completion of drilling. Since the boreholes were backfilled immediately after drilling, the water levels reported may not represent the long-term groundwater levels. Changes in water levels should be expected due to seasonal variations and precipitation.

**7.0 ANALYSIS AND RECOMMENDATIONS**

The following recommendations are developed based on the field investigation and laboratory testing, project information provided to INTERRA, IDOT Culvert Manual and Standard specifications and the AASHTO LRFD Bridge Design Specifications, 10<sup>th</sup> Edition, 2024.

Bearing Capacity and Settlement

Several existing culverts underneath IL 31 are proposed to be replaced with new culverts including extensions to accommodate roadway widening. Number of borings and their depth were scoped in accordance with the IDOT Geotechnical Manual. Table 2 lists the soils conditions at those borings that were performed. Table 3 summarizes the required



undercuts, if any; recommended factored bearing resistance (inclusive of an LRFD resistance factor of 0.45), and an estimate of settlement.

Per IDOT Standard Specifications, for precast culverts a 6-in layer of porous granular material (CA7, CA11 or CA18) at least 6 inch in thickness shall be placed below the elevation of the bottom of the entire culvert. The porous granular material shall extend at least 2 feet beyond each side of the box. Any undercuts should be extended beyond the culvert in the lateral direction at least two feet in accordance with IDOT specifications. Any undercuts should be backfilled with Rockfill capped with 6 inches of CA-7 in accordance with the IDOT Culvert Manual. Geotextile fabric should be used below the undercut area (IDOT Section 1080.02).

In addition to the undercuts in the table, it is recommended that a quantity of Removal and Disposal of Unsuitable Material for Structures (CU YD) be included in the Schedule of Quantities (SOQ) in the design plans. The recommended quantity should be equal to 25% of the proposed bearing footprint of the structure assuming a depth of 1 foot. This pay item can be used to remove any unstable or unsuitable material that is encountered in the field during construction, in accordance with Article 502.13.

If the foundation soils become unstable due to construction equipment loadings during excavation or construction, a working platform may be needed. The need for such platform is dependent on the type, thickness and strength of the soils encountered, the method of water diversion selected by the Contractor, precipitation, construction sequence, and the time of the year the box culvert is constructed. The Engineer should make the determination that a working platform is required during excavation based on the field conditions.

### Wingwalls

If possible, IDOT culvert manual recommends a horizontal cantilever wingwall as it is the most economical and preferred type. Based on the site conditions it appears that horizontal cantilever wingwalls are suitable for the culverts with precast middle sections



and cast-in-place end sections. IDOT culvert manual limits the length of the horizontal cantilever wingwall to 16 feet. If either of these dimensions are exceeded, L-Type vertical cantilever wingwalls may be used. Sheet pile walls will allow installation through open water and at locations where bearing capacity may not be adequate for other wall types.

At-rest lateral earth pressures are assumed on horizontal, L-Type and sheet piling wingwalls and can be determined from Table 4.1.1.2-1 of IDOT Culvert Manual for various slopes of backfill.

### Channel Protection

Channel protection at culvert outlets can be achieved by providing a riprapped transition or apron from the culvert outlet to the natural channel. The riprap should have bedding and/or filter fabric under it and should be of sufficient size and depth for the anticipated flow. A length of protection of three times the anticipated velocity in feet per second is commonly used as a rule of thumb.

### Scour

As per All Bridge Designers Memo 14.2, design scour elevations for box culverts are no longer needed.

### Stability Analyses

Global slope stability analyses were conducted for CUL08-01 assuming wall height of 5.5 feet and a 3H:1V backfill. Slope stability analyses were conducted using SLIDE V7.0. Analyses indicated that the global slope factors under short term conditions and long-term conditions exceed the minimum required value of 1.5 for SPT data in fill areas. Appendix C contains the results of the slope stability analyses.

**Table 3 – Foundation Recommendations**

<b>Boring No.</b>	<b>Ground Treatment (Note 1)</b>	<b>Factored Bering Resistance (psf)</b>	<b>Anticipated Settlement, After Ground Treatment if Any (inches)</b>
<b>Box Culvert No. 8</b> (Stn. 273+35. upstream invert level: 832.35 feet; downstream invert level: 831.9 feet)			
CUL08-01 CUL08-02 CUL08-03	Undercut to elevation 830.5	3000	<1
<b>Box Culvert No. 9</b> (Stn. 287+95. upstream invert level: 821.49 feet; downstream invert level: 821.21 feet)			
CUL09-01 CUL09-02 CUL09-03	Contractor Designed Ground Improvement (Note 2)	3000	<1
<b>Box Culvert No. 10</b> (Stn. 304+81. upstream invert level: 819.42 feet; downstream invert level: 819.32 feet)			
CUL10-01 CUL10-02 CUL10-03	Undercut to elevation 818.5	3000	<1
<b>Box Culvert No. 11</b> (Stn. 320+00. upstream invert level: 819.45 feet; downstream invert level: 818.75 feet)			
CUL11-01 CUL11-02 CUL11-03	Undercut to elevation 815.0 (Note 3)	3000	<1
<b>Box Culvert No. 12</b> (Stn. 350+00. upstream invert level: 814.5 feet; downstream invert level: 814.25 feet)			
CUL12-01 CUL12-02 CUL12-03	Undercut to elevation 807.5	3000	<1

Note 1: Undercuts are recommended based on the soils encountered at the boring locations. Actual need and depth should be determined during construction based on field observations and testing.

Note 2: Based on the proposed profile and the soil types encountered in the subgrade borings, contractor designed ground improvement is recommended. Recommended ground improvement methods are discussed in the section below.

Note 3: Based on the proposed profile and the soil types encountered in the subgrade borings, undercut to elevation 815.0 feet is recommended for the roadway between stations 318+00 to 321+00. Undercut to elevation 815.0 feet is recommended for Box Culvert 11 also.



### Recommended Ground Improvement Methods

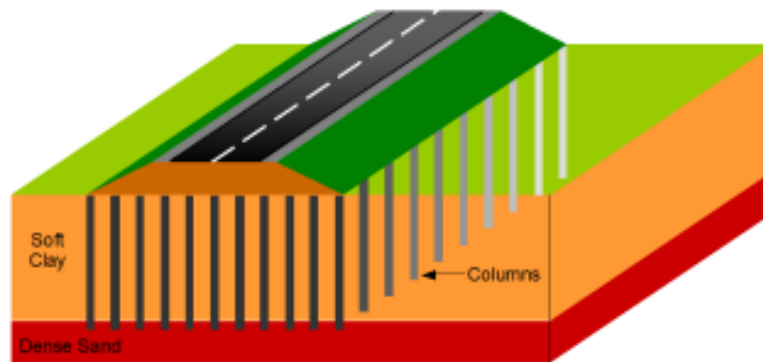
Boring SGB-44 did not encounter suitable material prior to termination of the boring at 10.0 feet. It is anticipated that ground improvement will be needed between station 281+00 and 292+00 for the proposed embankment width. Box Culvert 9 is located within this station range; therefore, Box Culvert 9 is also recommended to be supported on the ground improvement system. Borehole log for SGB-44 is included in Appendix A3 for reference.

The ground improvement methods considered were Aggregate Columns (AC) and Controlled Stiffness Columns (CSC). Ground improvement using aggregate columns is not considered viable in the very soft or organic soils with high moisture contents encountered at the project site. Under these conditions, the aggregate columns are susceptible to excessive bulging and lateral displacement, resulting in the loss of stone into the surrounding soils. As a result, the columns would be unable to develop the stiffness necessary to perform as intended. Controlled Stiffness Columns (CSCs), also referred to as Controlled Modulus Columns or Rigid Inclusions, are considered suitable for these conditions and are expected to perform effectively in such soils. CSCs consists of stiff vertical columns that are designed to transfer the load of the embankment through the soft compressible soil layer to a firm foundation. Cement based columns use Portland cement binder with aggregate for column construction and are more rigid than an aggregate column. CSC is a category of cement-based columns that are traditionally used for ground improvement in transportation projects. CSCs require a Load Transfer Platform (LTP) to distribute embankment loads to the columns. The embankment loads are transferred through the LTP, which consists of select granular structural fill and may be constructed with one or more layers of geosynthetic reinforcement or without reinforcement. This prevents unacceptable differential deformations between columns that may appear at the embankment surface. LTPs are typically on the order of two feet thick; however, the required thickness depends on factors such as the applied load, column spacing, and underlying soil strength, and is optimized by the contractor during the design phase. When time constraints are critical to the success of the project, CSCs



present an innovative solution. In the last 30 years, this technology has been used successfully by over a dozen state DOTs including IDOT.

CSCs provide a technical and potentially economical alternative to more conventional construction techniques (i.e., surcharge loading and PVDs, staged construction with or without geosynthetic reinforcement). The key advantage to CSCs is that construction may proceed rapidly in one stage. There is no waiting time for dissipation of pore water pressure in the soft foundation soil. CSCs are also more economical than the removal and replacement of deep deposits of soft soils, particularly on larger sites where the groundwater is close to the surface.



**Figure: Typical Layout of a Column Supported Embankment (FHWA)**

## 8.0 CONSTRUCTION CONSIDERATIONS

The contractor can consider temporary ditches, sumps, granular drainage blankets and other methods to control surface water infiltration and ground water and provide a dry condition for construction.

All excavations must be performed in accordance with local and federal regulations. The proposed construction will be in stages and Temporary Soil Retention System (TSRS) may be required. A temporary 2H:1V excavation for construction clearance has an adequate factor of safety. Steeper slopes should not be used. Temporary shoring, if required during the stage construction is feasible using simple cantilevered temporary



sheet piling due to hard clays present. A temporary soil retention system will be needed for a near vertical excavation along the centerline of the pavement. In such a case, a contractor-designed temporary soil retention system can be considered to accommodate stage construction. All Temporary Soil Retention Systems (TSRS) should consider surcharge loads from construction equipment, excavated material and trucks. The soil retention system should be designed by an Illinois Licensed Structural Engineer in accordance with IDOT standard specifications 522.07. Table 4 lists suggested lateral earth pressure and soil resistance parameters.

**Table 4 - Recommended Soil Parameters for Temporary Soil Retention Systems**

Geotechnical Parameter	Granular Soils			Clays				
	Loose	Medium Dense	Dense	Soft	Medium	Stiff	Very Stiff	Hard
SPT Value	<10	10-30	31-50	-	-	-	-	-
Unconfined Compressive Strength, Qu, tsf	-	-	-	0.25-0.50	0.5-1.0	1.0-2.0	2.0-4.0	>4.0
Saturated Unit Weight, (pcf)	115	125	140	120	120	120	125	130
Undrained Shear Strength, c, psf	-	-	-	300	750	1500	3000	4000
Angle of internal friction, $\phi$ , deg	28	30	34	-	-	-	-	-
Soil modulus, k, pci, Above WT	25	90	225	30	100	500	1000	2000
Soil modulus, k, pci, Below WT	20	60	125	-	-	-	-	-
Soil Strain Parameter, E50	-	-	-	0.020	0.010	0.007	0.005	0.004



## 9.0 CLOSURE

The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the Borehole Location Plan, project information provided to INTERRA and from any other information discussed in this report. This report does not reflect any variations that may occur between these boreholes. In performing subsurface explorations, specific information is obtained at specific locations at specific times. It is a well-known fact that variations in soil and rock conditions exist on most sites between borehole locations. Also, groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction. If project characteristics change or if variations in the subsurface conditions appear evident, it will be necessary for a re-evaluation of the recommendations of this report.

We appreciate the opportunity to be of service to you. Should you need additional information or clarifications, please call us at (630) 754-8700.

Yours truly,

**INTERRA, INC.**



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Reshma Chirakkara, Ph.D.  
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Sanjeev Bandi, Ph.D., PE  
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Sudhakar "Rao" Doppalapudi, PE  
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## REFERENCES

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**Appendix A**

Site Location Map

Borehole Location Plan and Profiles

Soil Boring Logs



**Project Limits**  
 Illinois Route 31  
 Charles J Miller Rd.  
 to Ames Rd.

**Legend**

 Project Limits

**SITE LOCATION MAP**

Illinois Route 31 Phase II Study  
 Illinois Route 176 to Illinois Route 120  
 McHenry County



# BORING LOCATION PLANS AND SOIL PROFILES

IL 31  
FROM IL 176 TO IL 120  
MCHENRY COUNTY, ILLINOIS

PREPARED FOR:

PATRICK ENGINEERING, INC  
4970 VARSITY DRIVE  
LISLE, IL 60532

PREPARED BY:

INTERRA, INC.  
600 TERRITORIAL DRIVE, SUITE G  
BOLINGBROOK, IL 60440

MAY 10, 2024  
INTERRA PROJECT 9012

## LEGEND:



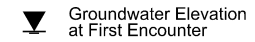
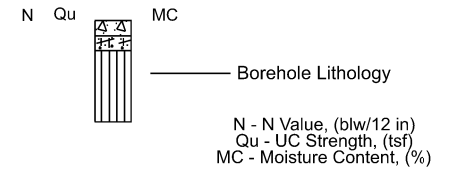
Soil Boring



Approximate Area  
of Ground Improvement

### Borehole Data

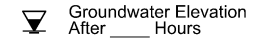
SGB-01                      Borehole Number  
886.95 ft                      Elevation  
124+58, 43ft RT              Station, Offset



Groundwater Elevation  
at First Encounter



Groundwater Elevation  
Upon Completion



Groundwater Elevation  
After \_\_\_ Hours

### Lithology Graphics

	Topsoil		Organic silt or clay
	Pavement		Clay
	Concrete		Silty Clay, Silty Clay Loam
	Fill (made ground)		Clay Loam
	Crushed stone		Loam
	Sand, Sandy Loam		Silt, Silty Loam
	Coarse Sand		Peat
	Gravelly Sand, Sandy Gravel		No Recovery
	Gravel, Rock Aggregate		Rock Core

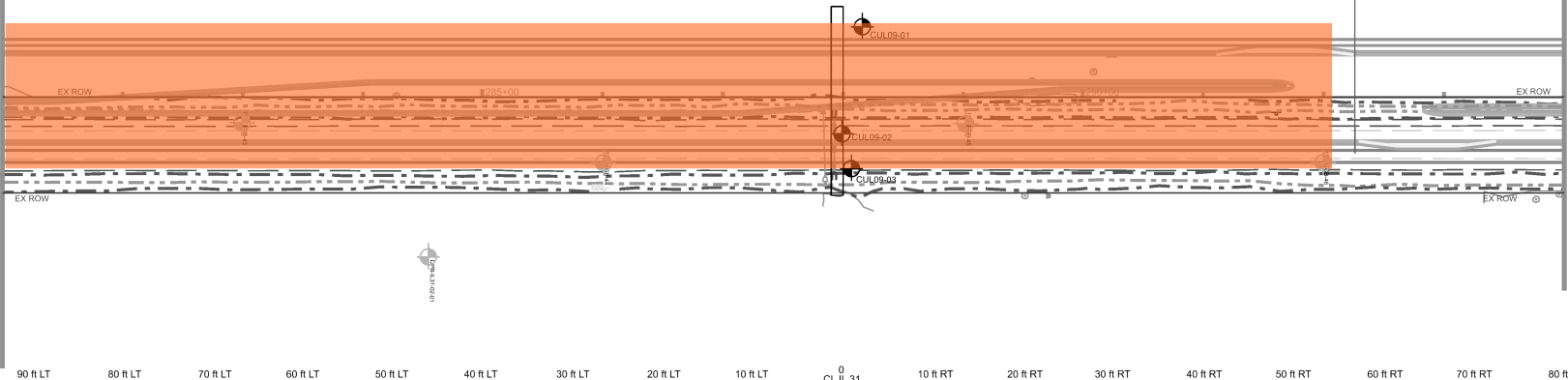




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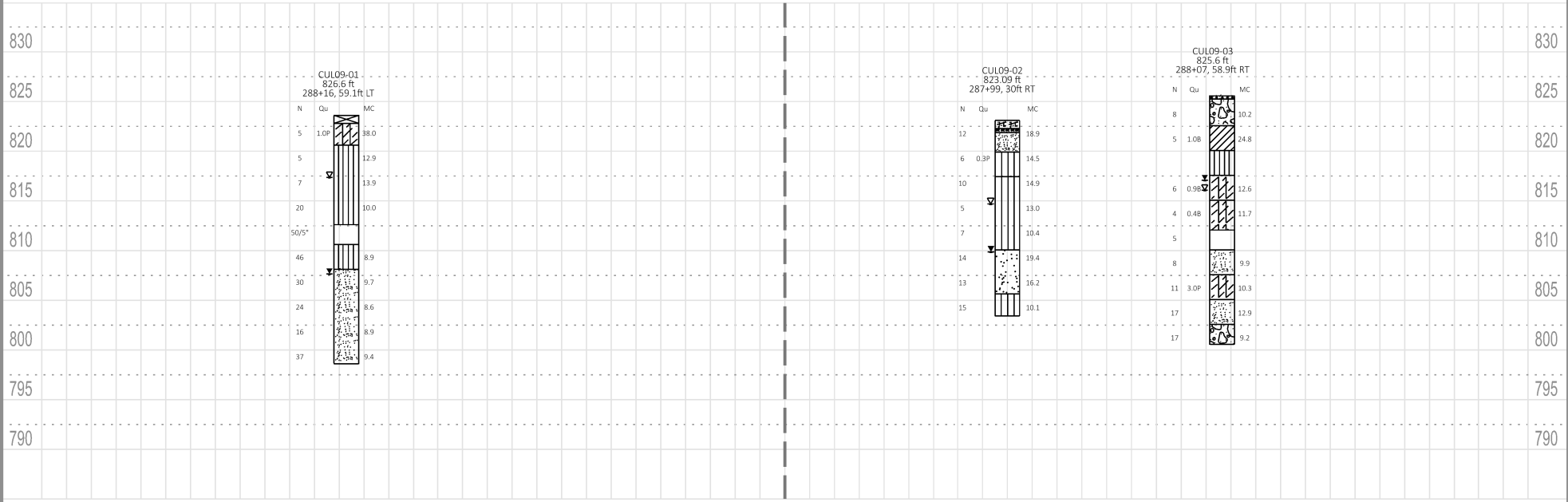
MATCHLINE STATION 281+00

MATCHLINE STATION 294+00



90 ft RT 80 ft RT 70 ft RT 60 ft RT 50 ft RT 40 ft RT 30 ft RT 20 ft RT 10 ft RT 0 CL IL 31 10 ft RT 20 ft RT 30 ft RT 40 ft RT 50 ft RT 60 ft RT 70 ft RT 80 ft RT

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NO.	



MOD. 11/20/2011

USER NAME	SUSERS	DESIGNED	-	REVISOR	-
DRAWN	-	CHECKED	-	DATE	-
DATE	-	CHKDATE	-		

STATE OF ILLINOIS  
DEPARTMENT OF TRANSPORTATION

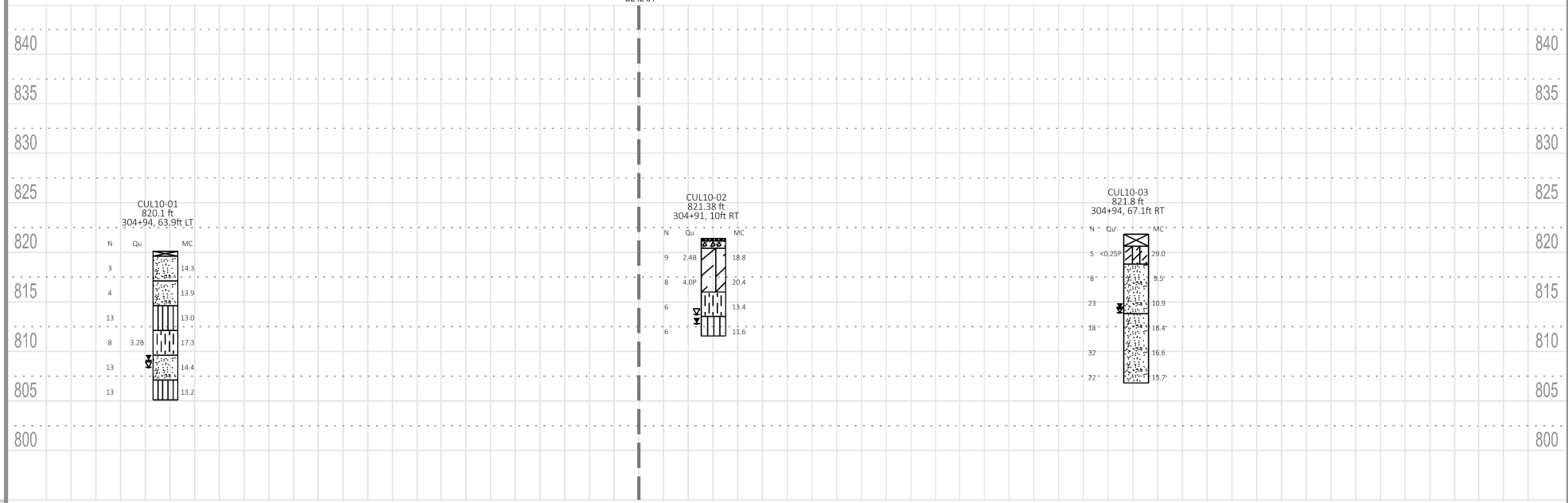
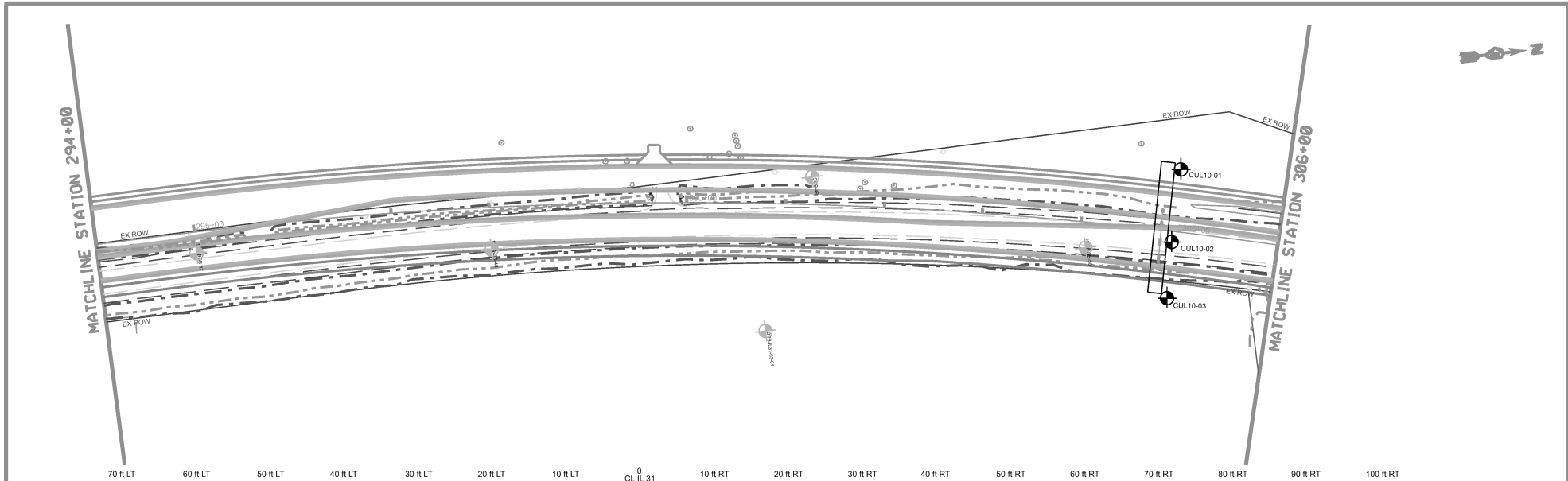
ILLINOIS ROUTE 31 PLAN AND PROFILE

SCALE: SHEET OF SHEETS STA. TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
CONTRACT NO.				
ILLINOIS FED. AID PROJECT				

DATE	
BY	
PROJECT NO.	
PROJECT NAME	
DATE OF PRELIMINARY DESIGN	
DATE OF FINAL DESIGN	
NO.	

DATE	
BY	
PROJECT NO.	
PROJECT NAME	
DATE OF PRELIMINARY DESIGN	
DATE OF FINAL DESIGN	
NO.	



STATE OF ILLINOIS  
DEPARTMENT OF TRANSPORTATION

ILLINOIS ROUTE 31 PLAN AND PROFILE

USER NAME	SUSERS	DESIGNED	-	REVISED	-
DRAWN	-	CHECKED	-	REVISED	-
DATE	CHKDATE	REVISED	-	REVISED	-

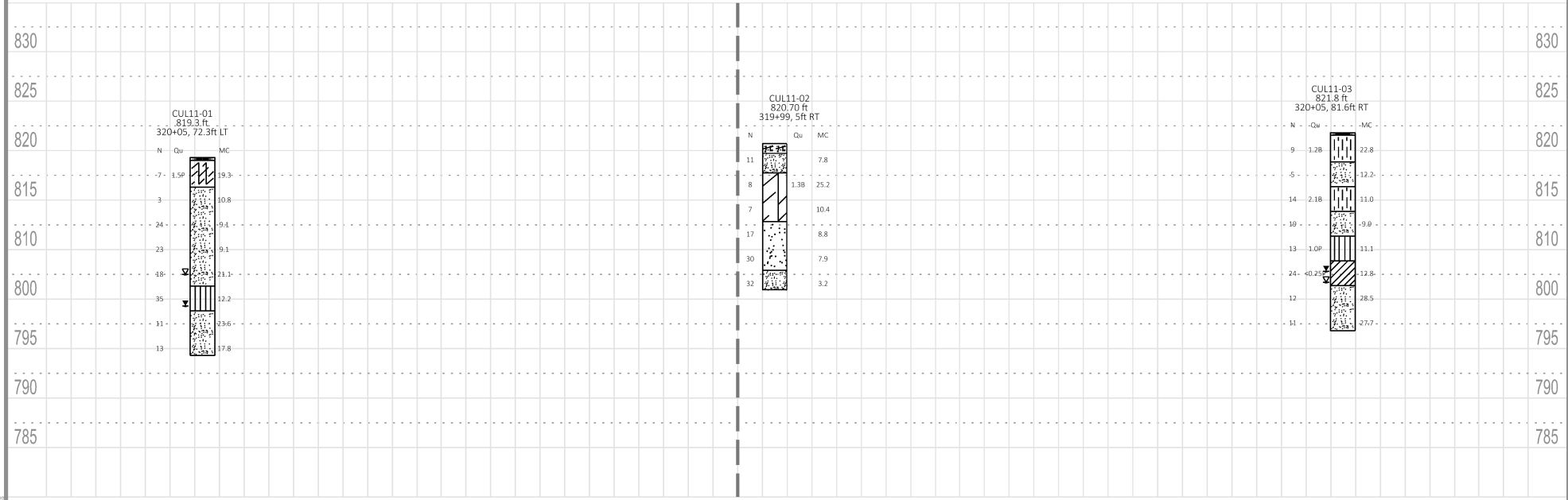
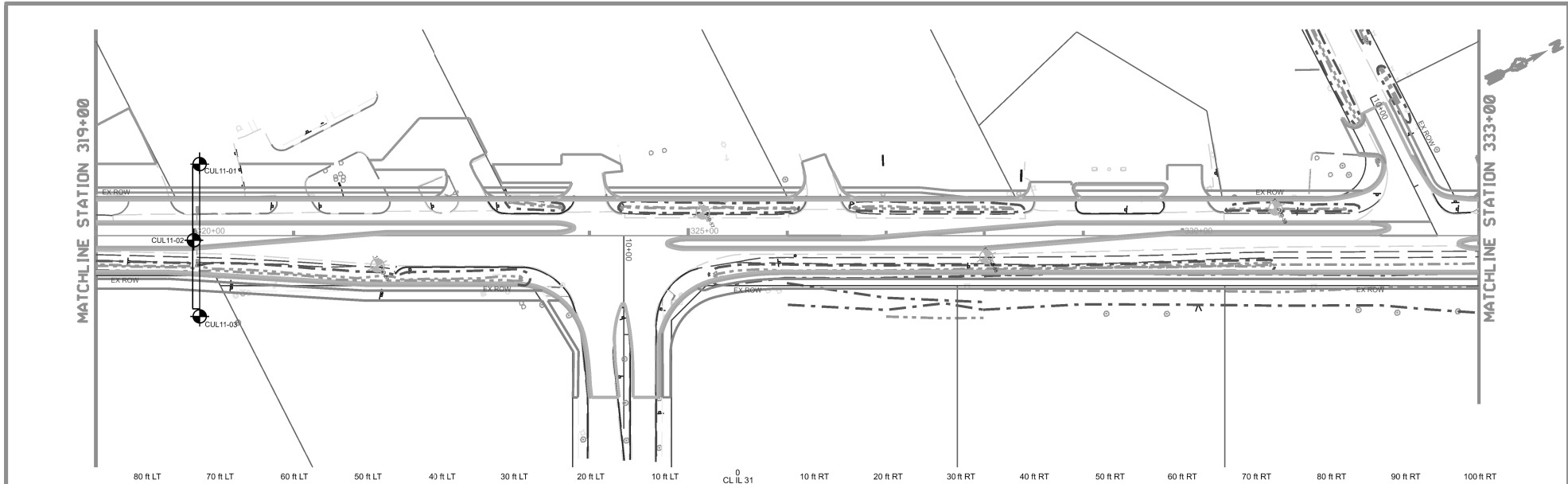
SCALE:	SHEET	OF	SHEETS	STA.	TO STA.
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F.A. RTEL	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
			CONTRACT NO.	
ILLINOIS FED. AID PROJECT				

MODEL: SPOORLUMMES  
SCALE: 1"=40'

DATE	
BY	
PROJECT	
NO. OF SHEETS	
NO. OF THIS SHEET	
NO.	

DATE	
BY	
PROJECT	
NO. OF SHEETS	
NO. OF THIS SHEET	
NO.	



MODULE: SPOCALMAME

USER NAME	+ SUSERS	DESIGNED	-	REVISED	-
PLOT SCALE	+ SSSALES	DRAWN	-	REVISED	-
PLOT DATE	+ S0ATES	CHECKED	-	REVISED	-
		DATE	-	CHKDATE	-

STATE OF ILLINOIS  
DEPARTMENT OF TRANSPORTATION

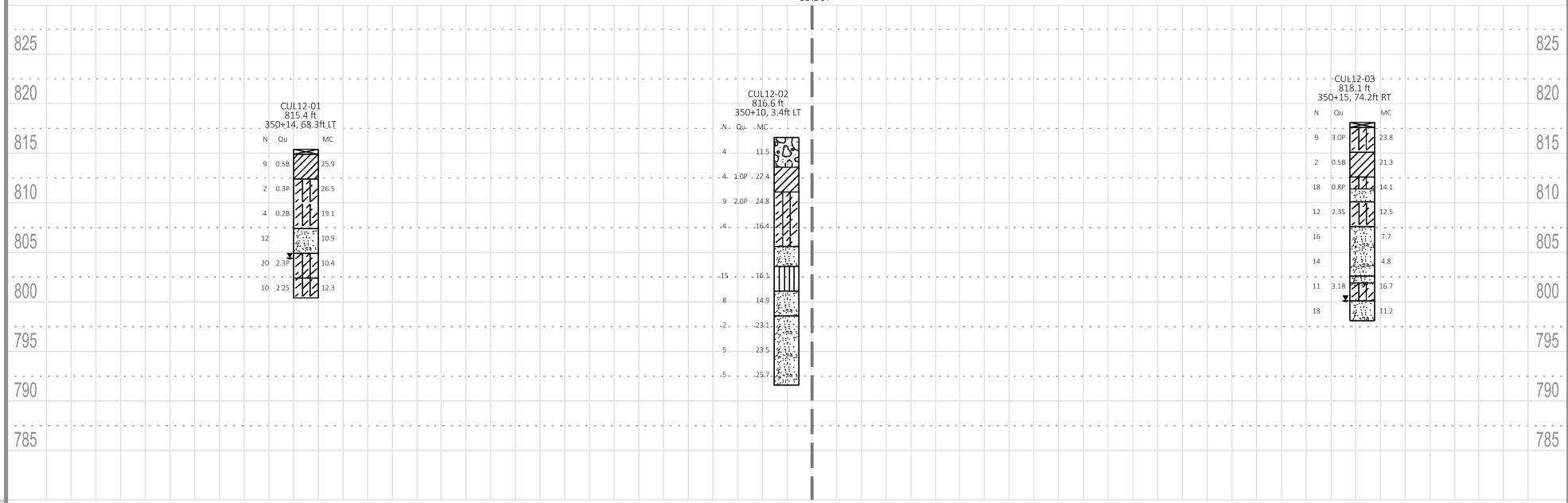
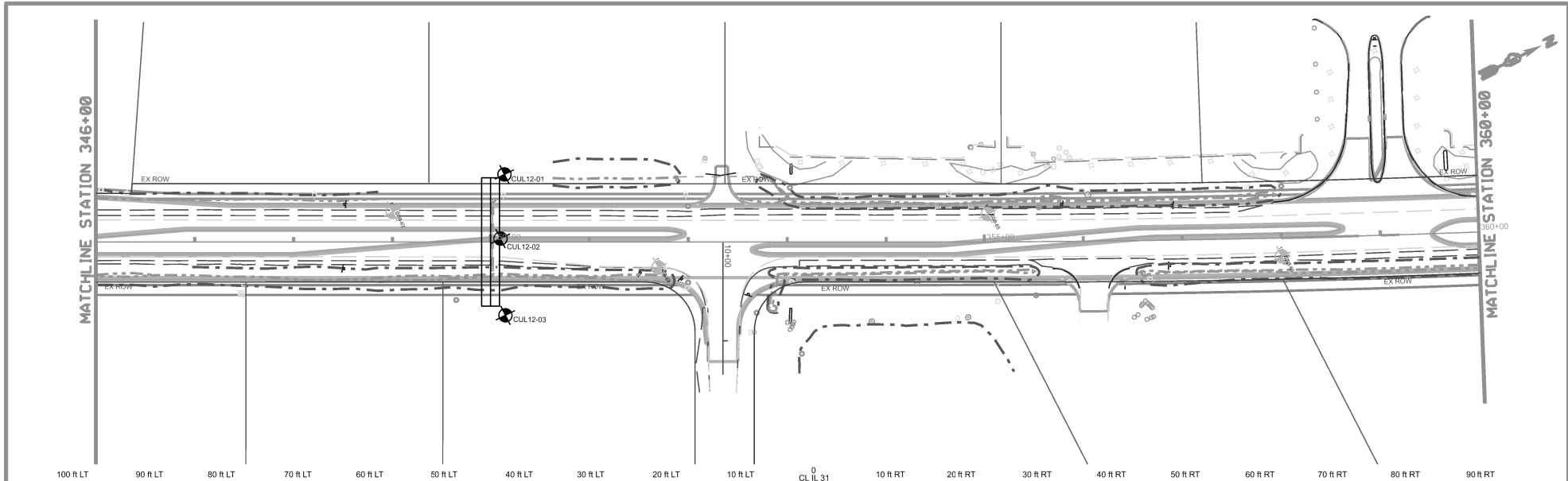
ILLINOIS ROUTE 31 PLAN AND PROFILE

SCALE: SHEET OF SHEETS STA. TO STA.

F.A. SITE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
CONTRACT NO.				
ILLINOIS FED. AID PROJECT				

DATE	
BY	
PROJECT	
PLAN	
DATE	
BY	
PROJECT	
NOTE BOOK	
NO.	

DATE	
BY	
PROJECT	
PROFILE	
DATE	
BY	
PROJECT	
NOTE BOOK	
NO.	



MODEL: SPOORLUMMES

USER NAME	+ SUSERS	DESIGNED	-	REVISED	-
PLLOT SCALE	+ SSSCALES	DRAWN	-	REVISED	-
PLLOT DATE	+ SDATE	CHECKED	-	REVISED	-
		DATE	-	CHKDATE	-

STATE OF ILLINOIS  
DEPARTMENT OF TRANSPORTATION

ILLINOIS ROUTE 31 BORING PLAN AND PROFILE

SCALE:	SHEET	OF	SHEETS	STA.	TO STA.
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F.A. RTEL	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
CONTRACT NO.				
ILLINOIS FED. AID PROJECT				







# SOIL BORING LOG

Date 4/8/24

ROUTE IL 31 DESCRIPTION Box Culvert No. 8 LOGGED BY Boland

SECTION IL 120 to IL 176 PTB 195-015 LOCATION E: 996821.0; N: 2048474.2

COUNTY McHenry DRILLING METHOD Hollow Stem Auger HAMMER TYPED50 Auto (98.2% efficiency)

STRUCT. NO. Box Culvert No. 8  
Station

BORING NO. CUL08-03  
Station 273+55  
Offset 62.30ft RT  
Ground Surface Elev. 835.30 ft

DEPTH (ft)	BLOW S (ft/6")	UCS Qu (tsf)	MOIST (%)	Surface Water Elev. NA ft	Stream Bed Elev. NA ft	DEPTH (ft)	BLOW S (ft/6")	UCS Qu (tsf)	MOIST (%)
834.97									
834.63									
	3		12.2						
832.30		1.8 P							
	3		29.0						
	2								
829.80		1.0 P							
	2		28.9						
	1								
	2	0.4 B							
826.80		P							
		U	6.2						
		S							
824.80		H							
	2		11.5						
	3	0.4 B							
822.30									
	4		10.8						
	5								
	6								
819.80									
	3		11.9						
	5	2.0 P							
	2								
	3		11.4						
815.30		2.0							
	4								

End of boring at 20'  
Borehole backfilled with cuttings,  
bentonite, and concrete.

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)



# SOIL BORING LOG

Date 4/10/24

ROUTE IL 31 DESCRIPTION Box Culvert No. 9 LOGGED BY Sponaugle

SECTION IL 120 to IL 176 PTB 195-015 LOCATION E: 996682.8; N: 2049932.9

COUNTY McHenry DRILLING METHOD Hollow Stem Auger HAMMER TYPED 50 Auto (95.6% efficiency)

STRUCT. NO.	Station	DEPTH (ft)	BLOW (ft)	UCS (tsf)	MOIST (%)	Surface Water Elev. (ft)	Stream Bed Elev. (ft)	Groundwater Elev.:	First Encounter	Upon Completion	After Hrs.	DEPTH (ft)	BLOW (ft)	UCS (tsf)	MOIST (%)
Box Culvert No. 9						NA	NA								
BORING NO.	CUL09-01														
Station	288+16														
Offset	59.10ft LT														
Ground Surface Elev.	823.60	ft													
TOPSOIL (9")	822.80														
Stiff, Black (10YR 2/1) CLAY LOAM, medium plasticity, moist			3										12		
			2		38.0								8		8.9
			3	1.0 P									8		
	820.60														
Loose, light brownish Gray (10YR 6/2) SILTY LOAM, low plasticity, moist			2										11		
			3		12.9								20		9.4
			-5										17		
			2												
			3		13.9										
			4												
Medium dense			6												
			8		10.0										
			-10										-30		
No recovery	812.60			50/5"											
Dense, light Gray (10YR 7/1) SILT, trace gravel, moist	810.60														
			16												
			30		8.9										
			-15										-35		
Medium dense, light Gray (10YR 7/1) coarse to fine SANDY LOAM, trace gravel, wet	808.10														
Free water at 16'															
			10												
			14		9.7										
			16												
			11												
			11		8.6										
			-20										-40		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)



Interra, Inc.  
600 Territorial Drive, Suite G  
Bolingbrook, IL 60440  
www.interraservices.com

# SOIL BORING LOG

Date 12/7/21

ROUTE IL 31 DESCRIPTION Box Culvert No. 9 SN 056-0322 LOGGED BY Abde Sellah

SECTION IL 120 to IL 176 PTB 195-015 LOCATION 2049917.466,996765.498

COUNTY McHenry DRILLING METHOD Hollow Stem Auger HAMMER TYPE D50 Auto (93% efficiency)

Box Culvert No. 9 <b>STRUCT. NO.</b> SN 056-0322 <b>Station</b> IL 31 Stn. 287+89	<b>D</b> <b>E</b> <b>P</b> <b>T</b> <b>H</b> <b>(ft)</b>	<b>B</b> <b>L</b> <b>O</b> <b>W</b> <b>S</b> <b>(/6")</b>	<b>U</b> <b>C</b> <b>S</b> <b>Qu</b> <b>(tsf)</b>	<b>M</b> <b>O</b> <b>I</b> <b>S</b> <b>T</b> <b>(%)</b>	<b>Surface Water Elev.</b> _____ <b>ft</b>
<b>BORING NO.</b> CUL09-02 <b>Station</b> 287+99 <b>Offset</b> 30.00ft RT <b>Ground Surface Elev.</b> 823.09 <b>ft</b>					<b>Stream Bed Elev.</b> _____ <b>ft</b>
					<b>Groundwater Elev.:</b> <b>First Encounter</b> 810.1 <b>ft</b> ▼ <b>Upon Completion</b> 814.6 <b>ft</b> ▽ <b>After</b> _____ <b>Hrs.</b> Filled <b>ft</b>

ASPHALT (10")	822.26				
ASPHALT GRINDINGS (5")	821.84	7			
Medium dense, brown SANDY LOAM FILL. Moist		5		18.9	
		7			
	820.09				
Loose, brown SILTY LOAM. Moist		4			
		3		14.5	
		-5			
	817.59				
Medium dense, brown and gray SILT, little gravel. Moist		9			
		7		14.9	
		3			
	815.09				
Loose, redish brown and gray SILT, little gravel. Moist	▽	2			
		2		13.0	
		-10			
	812.59				
Loose, gray and yellowish brown SILT, little gravel. Moist		3			
		3		10.4	
		4			
	810.09 ▼				
Medium dense, yellowish brown SANDY LOAM, trace of gravel. Wet.		15			
		8		19.4	
		-15			
		13			
		8		16.2	
		5			
	805.09				
Medium dense, gray SILTY LOAM, little gravel and cobbles. Moist		3			
		7		10.1	
End of boring at 20'.	803.09 -20	8			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)



# SOIL BORING LOG

ROUTE IL 31 DESCRIPTION Box Culvert No. 9 LOGGED BY Boland

SECTION IL 120 to IL 176 PTB 195-015 LOCATION E: 996800.9; N: 2049925.4

COUNTY McHenry DRILLING METHOD Hollow Stem Auger HAMMER TYPED50 Auto (98.2% efficiency)

STRUCT. NO.	Station	DEPTH (ft)	BLOW (ft)	UCS (tsf)	MOIST (%)	Surface Water Elev. NA ft	Stream Bed Elev. NA ft	GROUNDWATER ELEV.:	DEPTH (ft)	BLOW (ft)	UCS (tsf)	MOIST (%)
Box Culvert No. 9												
BORING NO.	CUL09-03											
Station	288+07											
Offset	58.90ft RT											
Ground Surface Elev.	825.60											
CRUSHED AGGREGATE (4")	825.27								805.10		P	
Loose, very dark Brown (10YR 2/2) SANDY LOAM and GRAVEL, moist			5		10.2					3		
			5							7		12.9
			3							10		
	822.60								802.60			
Stiff, olive Gray (5Y 5/2) CLAY, trace gravel, medium plasticity, moist			2		24.8					5		
			2							5		9.2
		-5	3	1.0					800.60	-25	12	
	820.10											
Gray (10YR 6/1) SILTY LOAM, dry, low recovery Shelby Tube 6-8'			P									
			U									
			S									
			H									
	817.60											
Medium stiff, dark yellowish Brown (10YR 4/6) SANDY CLAY LOAM, trace gravel, low plasticity, wet			3		12.6							
Free water at 8.5'			3	0.9								
		-10	3							-30		
	815.10											
Soft, dark grayish Brown (10YR 4/2) SANDY CLAY LOAM, trace gravel, low plasticity, wet			2		11.7							
			2	0.4								
			2									
	812.10											
No Recovery			5									
			3									
		-15	2							-35		
	810.10											
Loose, dark grayish Brown (10YR 4/2) SANDY LOAM, trace gravel, moist			2		9.9							
			4									
			4									
	807.60											
Very stiff, dark grayish Brown (10YR 4/2) SANDY CLAY LOAM, little gravel, low plasticity, moist			5		10.3							
			5									
		-20	6	3.0						-40		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)









# SOIL BORING LOG

ROUTE IL 31 DESCRIPTION Box Culvert No. 11 LOGGED BY Sponaugle

SECTION IL 120 to IL 176 PTB 195-015 LOCATION E: 997359.0; N: 2053028.5

COUNTY McHenry DRILLING METHOD Hollow Stem Auger HAMMER TYPED 50 Auto (95.6% efficiency)

STRUCT. NO. Box Culvert No. 11  
Station \_\_\_\_\_

BORING NO. CUL11-01  
Station 320+05  
Offset 72.30ft LT  
Ground Surface Elev. 819.30 ft

DEPTH (ft)	BLOWS (/6")	UCS (tsf)	MOIST (%)
------------	-------------	-----------	-----------

Surface Water Elev. NA ft  
Stream Bed Elev. NA ft  
Groundwater Elev.:  
First Encounter 804.3 ft ▼  
Upon Completion 807.5 ft ▼  
After      Hrs. Filled ft

TOPSOIL (4")	819.00				
Stiff, very dark Gray (10YR 3/1) CLAY LOAM, trace organics, medium plasticity, moist		2			
		3		19.3	
		4	1.5 P		
	816.30				
Very loose, brownish Yellow (10YR 6/8) fine SANDY LOAM, moist		1			
		1		10.8	
		-5			
		4			
Medium dense, trace gravel		9		9.1	
		15			
		5			
		10		9.1	
		-10			
		6			
		7		21.1	
		11			
	806.30				
Dense, light yellowish Brown (10YR 6/4) SILTY LOAM, trace gravel, moist		12			
		15		12.2	
		20			
Free water at 15'	803.80				
Medium dense, brownish Yellow (10YR 6/8) fine SAND, wet		5			
		5		23.6	
		6			
		4			
End of boring at 20'		5		17.8	
Borehole backfilled with cuttings and bentonite.	799.30	-20	8		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)





# SOIL BORING LOG

Date 4/10/24

ROUTE IL 31 DESCRIPTION Box Culvert No. 11 LOGGED BY Sponaugle  
 SECTION IL 120 to IL 176 PTB 195-015 LOCATION E: 997496.7; N: 2052959.6  
 COUNTY McHenry DRILLING METHOD Hollow Stem Auger HAMMER TYPED 50 Auto (95.6% efficiency)

STRUCT. NO.	Station	DEPTH (ft)	BLOW COUNT (blows/6")	UCS (tsf)	MOISTURE (%)	Surface Water Elev.	Stream Bed Elev.	Groundwater Elev.:	First Encounter	Upon Completion	After
Box Culvert No. 11						NA	NA		807.8 ft	806.7 ft	Filled ft
BORING NO.	CUL11-03										
Station	320+05										
Offset	81.60ft RT										
Ground Surface Elev.	821.80	ft									
TOPSOIL (3")	821.50										
Stiff, very dark grayish Brown (10YR 3/2) SILTY CLAY, medium plasticity, moist			3								
			4		22.8						
			5	1.2							
	818.80			B							
Loose, brownish Yellow (10YR 6/6) SANDY LOAM, trace gravel, moist			2								
			2		12.2						
			-5	3							
	816.30										
Very stiff, brownish Yellow (10YR 6/6) SILTY CLAY LOAM, trace gravel, medium plasticity, moist			4								
			6		11.0						
			8	2.1							
	813.80			B							
Medium dense, light yellowish Brown (10YR 6/4) fine SANDY LOAM, trace gravel, moist			10								
			11		9.9						
			-10	8							
	811.30										
Medium dense, brownish Yellow (10YR 6/6) SILTY LOAM, low plasticity, moist			4								
			4		11.1						
			9	1.0							
	808.80			P							
Very soft, brownish Yellow (10YR 6/6) SANDY CLAY and GRAVEL, low plasticity, wet			9								
Free water at 14'			10		12.8						
			14	<0.25							
	806.30			P							
Medium dense, yellowish Brown (10YR 5/6) fine SAND, wet			3								
			5		28.5						
			7								
End of boring at 20'			4								
Borehole backfilled with cuttings and bentonite.			6		27.7						
	801.80	-20	5								

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)





# SOIL BORING LOG

ROUTE IL 31 DESCRIPTION Box Culvert No. 12 LOGGED BY Geocon

SECTION IL 120 to IL 176 PTB 195-015 LOCATION E: 998761.1; N: 2055687.2

COUNTY McHenry DRILLING METHOD Hollow Stem Auger HAMMER TYPED50 Auto (95.6% efficiency)

STRUCT. NO.	Station	DEPTH (ft)	BLOW (ft)	UCS (tsf)	MOIST (%)	Surface Water Elev. (ft)	Stream Bed Elev. (ft)	Groundwater Elev.:	First Encounter (ft)	Upon Completion (ft)	After (Hrs.)	DEPTH (ft)	BLOW (ft)	UCS (tsf)	MOIST (%)
Box Culvert No. 12						NA	NA								
BORING NO.	CUL12-02														
Station	350+10														
Offset	3.40ft LT														
Ground Surface Elev.	816.60														
Loose, dark Brown (10YR 3/3) SAND and GRAVEL (fill), dry		4											3		
		2			11.5								2		23.5
		2											3		
	813.60														
Stiff, Black (10YR 2/1) CLAY (fill), medium plasticity, moist		2											3		
		2			27.4								2		25.7
		-5	2	1.0									3		
	811.10							791.60				-25			
Very stiff, dark yellowish brown (10YR 3/4) CLAY LOAM, trace gravel, medium plasticity, moist		2													
		4			24.8										
		5	2.0												
		2													
		2			16.4										
		-10	2												
	805.60														
Advanced Shelby tube 11-13' Dark yellowish Brown (10YR 4/4) fine SAND, moist															
					12.2										
	803.60														
Medium dense, dark yellowish Brown (10YR 4/6) SILTY LOAM, moist		3													
		6			16.1										
		-15	9												
	801.10														
Loose, dark yellowish Brown (10YR 4/4) SANDY LOAM, some gravel, moist		4													
		5			14.9										
		3													
	798.60														
Very loose, dark yellowish Brown (10YR 4/6) fine SAND, moist		2													
		1			23.1										
		-20	1												

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)



# SOIL BORING LOG

Date 4/9/24

ROUTE IL 31 DESCRIPTION Box Culvert No. 12 LOGGED BY Boland

SECTION IL 120 to IL 176 PTB 195-015 LOCATION E: 998832.7; N: 2055656.9

COUNTY McHenry DRILLING METHOD Hollow Stem Auger HAMMER TYPED50 Auto (95.6% efficiency)

STRUCT. NO.	Station	DEPTH (ft)	BLOW (ft)	UCS (tsf)	MOIST (%)	Surface Water Elev. (ft)	Stream Bed Elev. (ft)	GROUNDWATER ELEV. (ft)	DEPTH (ft)	BLOW (ft)	UCS (tsf)	MOIST (%)
Box Culvert No. 12						NA	NA					
BORING NO.	CUL12-03											
Station	350+15											
Offset	74.20ft RT											
Ground Surface Elev.	818.10											
TOPSOIL (6")	817.60											
Very stiff, very dark Brown (10YR 2/2) CLAY LOAM, medium plasticity, moist			4		23.8							
			4									
			5	3.0								
	815.10											
Soft, dark Brown (10YR 3/3) SANDY CLAY, medium plasticity, moist			1		21.3							
			1									
		-5	1	0.5					-25			
	812.60											
Medium stiff, dark yellowish Brown (10YR 4/4) SANDY CLAY LOAM, trace gravel, medium plasticity, moist	811.40		5		14.1							
			7									
			11	0.8								
Medium dense, dark yellowish Brown (10YR 4/4) fine SAND, trace gravel, moist	810.10											
Very stiff, dark yellowish Brown (10YR 4/4) SANDY CLAY LOAM, moist			6		12.5							
			5									
		-10	7	2.3					-30			
	807.60											
Medium dense, medium to fine SAND, moist			6		7.7							
			8									
			8									
			5									
Some gravel			7		4.8							
		-15	7						-35			
	802.60											
Medium dense, dark yellowish Brown (10YR 4/4) medium to fine SANDY LOAM, moist	801.90		7		16.7							
			6									
Very stiff, dark yellowish Brown (10YR 4/3) CLAY LOAM, medium plasticity, moist	800.10		5	3.1								
Medium dense, dark yellowish Brown (10YR 4/6) medium to fine SANDY LOAM, moist			5		11.2							
			8									
			10									
	798.10	-20							-40			

End of boring at 20'  
Borehole backfilled with cuttings and bentonite.

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)



**Appendix B**  
Laboratory Test Reports



**Moisture Content**  
AASHTO T265

<b>Project</b>	IL 31 from IL 120 to IL 176 PTB 195-005 Geotechnical Investigation						
<b>Client</b>	Patrick Engineering, Inc., 4970 Varsity Drive, Lisle, IL 60532						
<b>File No.</b>	9012	<b>Sample #</b>	CUL08 03-ST-04	<b>Date Tested</b>	5/2/2024	<b>Tested By</b>	DG
						<b>Qc By</b>	AB

<b>Date Sample Received</b>	4/8/2024
<b>Sample Location</b>	8.5-10.5'
<b>Sample Description</b>	Yellowish brown (10YR 5/4) brown sand
<p>Can Number : 87-A</p> <p>Can Weight : 30.50 gm</p> <p>Can + Wet Sample Weight : 83.13 gm</p> <p>Can + Dry Sample Weight : 80.06 gm</p> <p>Moisture Content : <b>6.19</b> %</p>	

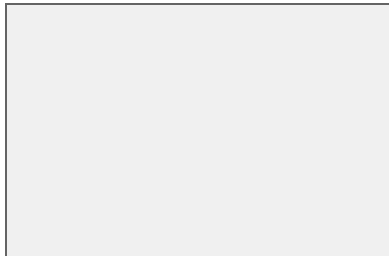
<b>Remarks</b>	
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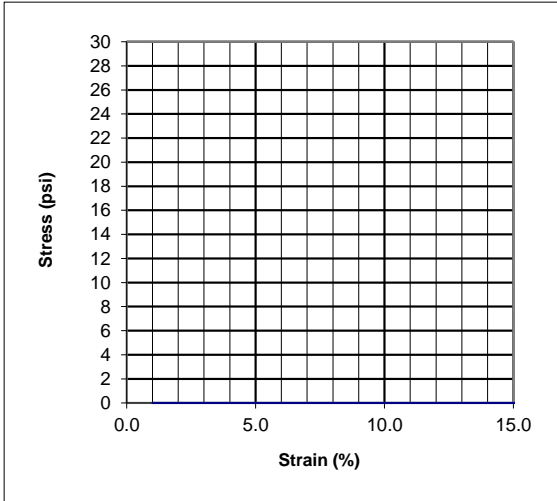
**UNCONFINED COMPRESSIVE STRENGTH (ASTM D 2166)**

<b>Project</b>	IL 31 from IL 120 to IL 176 PTB 195-005 Geotechnical Investigation						
<b>Client</b>	Patrick Engineering, Inc., 4970 Varsity Drive, Lisle, IL 60532						
<b>File No.</b>	9012	<b>Sample No.</b>	CUL09 03-ST-03	<b>Date Tested</b>	5/2/24	<b>Tested By</b>	DG
						<b>QC By</b>	AB

<b>Date Sample Received</b>	4/8/24	
<b>Description of Soil</b>	Gray (10YR 6/1) silty loam	
<b>Location</b>	6-7.5'	
Type of Sample		
Average Height =		cm
Average Diameter =		cm
Height/Diameter Ratio =		
Wet Sample Weight=		g
Wet Density =		g/cc
Moisture Content =		%
Dry Density =		g/cc
Strain Rate =		%/min
<b>Unconfined Compressive Strength =</b>	0.00 psi <b>0.00 tsf</b>	
<b>Shear Strength =</b>	0.00 psi 0.00 tsf	
<b>Strain at Failure =</b>		%



Failure Image



**Remarks:**  
Not enough sample to run test. Top = 4.5+ tsf, Bottom = 4.5+ tsf



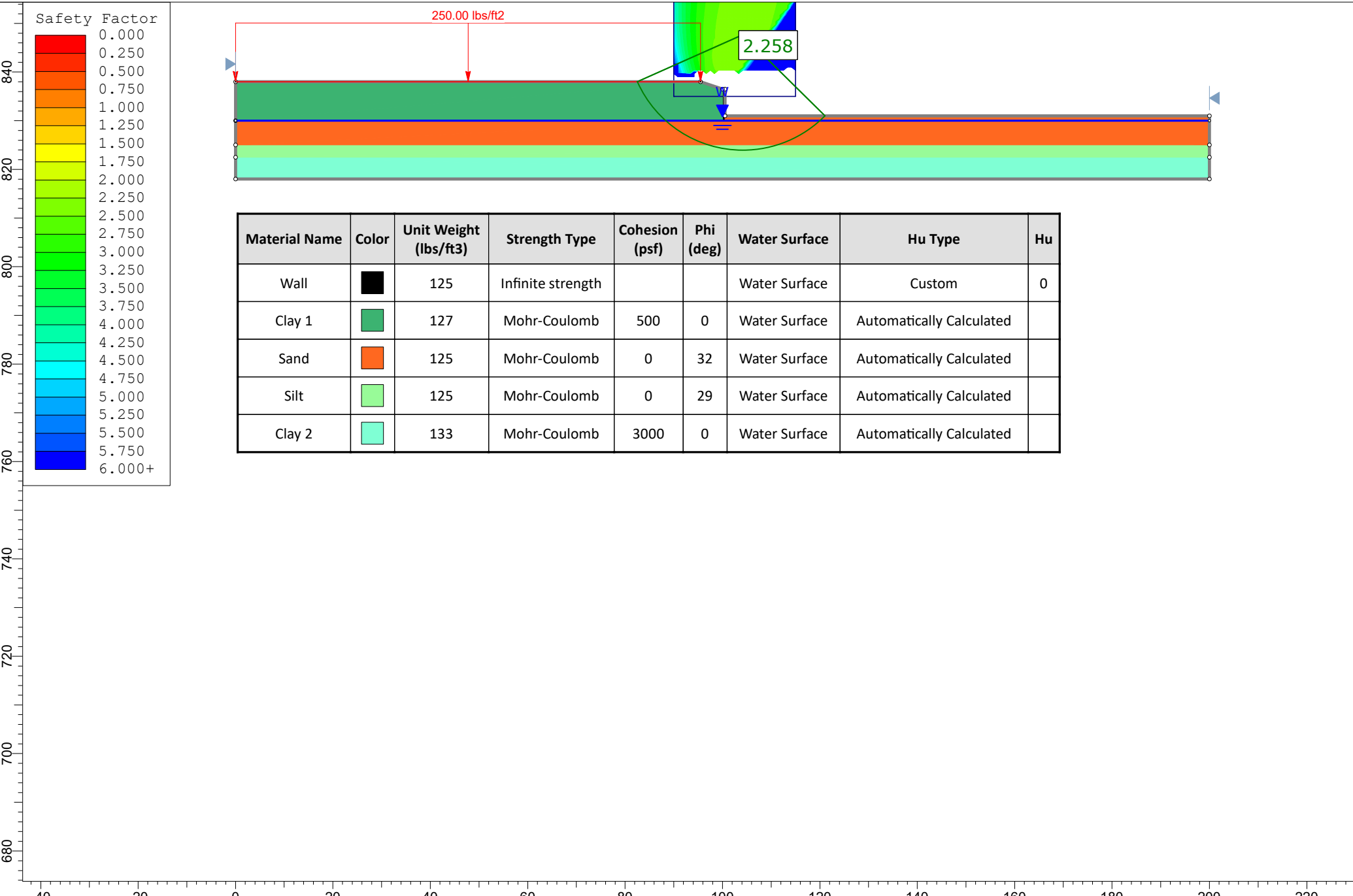
**Moisture Content**  
AASHTO T265

<b>Project</b>	IL 31 from IL 120 to IL 176 PTB 195-005 Geotechnical Investigation						
<b>Client</b>	Patrick Engineering, Inc., 4970 Varsity Drive, Lisle, IL 60532						
<b>File No.</b>	9012	<b>Sample #</b>	CUL12 02-ST-05	<b>Date Tested</b>	5/1/2024	<b>Tested By</b>	DG
						<b>Qc By</b>	AB

<b>Date Sample Received</b>	4/9/2024
<b>Sample Location</b>	10.5-12.5'
<b>Sample Description</b>	Dark yellowish brown (10YR 4/4) fine sand
<p>Can Number : 58-A</p> <p>Can Weight : 30.80 gm</p> <p>Can + Wet Sample Weight : 180.31 gm</p> <p>Can + Dry Sample Weight : 164.09 gm</p> <p>Moisture Content : <b>12.17</b> %</p>	

<b>Remarks</b>	
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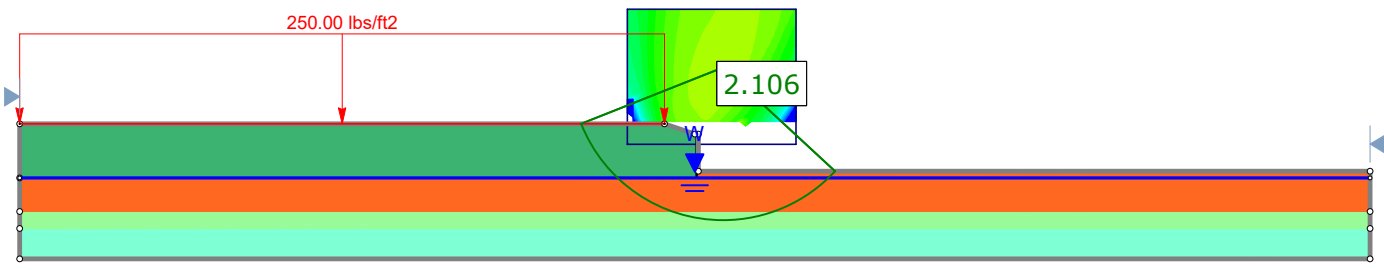
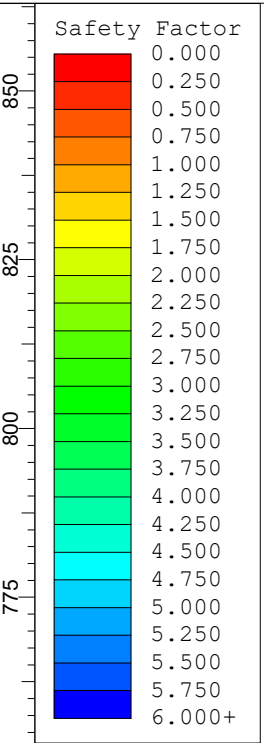
**Appendix C**  
Slope Stability Analysis



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Wall	Black	125	Infinite strength			Water Surface	Custom	0
Clay 1	Green	127	Mohr-Coulomb	500	0	Water Surface	Automatically Calculated	
Sand	Orange	125	Mohr-Coulomb	0	32	Water Surface	Automatically Calculated	
Silt	Light Green	125	Mohr-Coulomb	0	29	Water Surface	Automatically Calculated	
Clay 2	Cyan	133	Mohr-Coulomb	3000	0	Water Surface	Automatically Calculated	



<i>Project</i>		IL 31 Box Culvert 8 Boring CUL08-01	
<i>Analysis Description</i>		Global Stability Analysis-Short Term	
<i>Analyzed By</i>	RC	<i>Scale</i>	1:309
<i>Date</i>	01/20/26	<i>Checked By</i>	SB



Material Name	Color	Unit Weight (lbs/ft <sup>3</sup> )	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Wall	■	125	Infinite strength			Water Surface	Custom	0
Clay 1	■	127	Mohr-Coulomb	100	26	Water Surface	Automatically Calculated	
Sand	■	125	Mohr-Coulomb	0	32	Water Surface	Automatically Calculated	
Silt	■	125	Mohr-Coulomb	0	29	Water Surface	Automatically Calculated	
Clay 2	■	133	Mohr-Coulomb	100	28	Water Surface	Automatically Calculated	



<i>Project</i>		IL 31 Box Culvert 8 Boring CUL08-01	
<i>Analysis Description</i>		Global Stability Analysis-Long Term	
<i>Analyzed By</i>	RC	<i>Scale</i>	1:341
<i>Date</i>	01/20/26	<i>Checked By</i>	SB