

Structural Geotechnical Report

IDOT PTB 198-003
FAI-80 (I-80) over Des Plaines River Bridge
Proposed I-80 Eastbound and Westbound Bridges
over the Des Plaines River
SN: 099-8325, EB
SN: 099-8309, WB
Will County, Illinois

Prepared for



Illinois Department of Transportation
Contract Number: D-91-204-19

Project Design Engineer Team
WSP USA

Geotechnical Consultant
GSG Consultants, Inc.



April 19, 2023
Revised December 29, 2025



735 Remington Road
Schaumburg, IL 60173
Tel: 630.994.2600
www.gsg-consultants.com

December 29, 2025

David Skaleski, P.E.
Project Manager
WSP USA
30 N. LaSalle Street, Suite 4200
Chicago, Illinois 60602

Structural Geotechnical Report
PTB 198-003
FAI-80 (I-80) Eastbound and Westbound Bridges
over the Des Plaines River
Will County, IL

Dear Mr. Skaleski:

Attached is a copy of the Structural Geotechnical Report for the above-referenced project. The report provides a description of the site investigation, site conditions, and recommendations for the foundation types and construction. The site investigation at this stage for the proposed bridge construction included advancing forty-four (44) soil borings to depths ranging from 1 to 48.5 feet, including bedrock cores.

Should you have any questions or require additional information, please call us at 630-994-2600.

Sincerely,

A handwritten signature in black ink, appearing to read "Rachel Miller".

Rachel Miller, P.E.
Sr. Project Engineer

A handwritten signature in blue ink, appearing to read "Ala E Sassila".

Ala E Sassila, Ph.D., P.E.
Principal

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	Existing Bridge Information	1
1.2	Proposed Bridge Information	4
2.0	SITE SUBSURFACE CONDITIONS	6
2.1	Subsurface Exploration.....	6
2.2	Laboratory Testing Program	10
2.3	Subsurface Soil Conditions	10
2.4	Groundwater Conditions	16
3.0	GEOTECHNICAL ANALYSES	18
3.1	Scour	18
3.2	Embankment Settlement.....	19
3.3	Roadway Fill Settlement Treatment and Recommendations.....	20
3.3.1	Staged Embankment Construction.....	20
3.3.2	Maintenance	21
3.4	Seismic Parameters	21
4.0	GEOTECHNICAL BRIDGE DESIGN RECOMMENDATIONS	22
4.1	Bridge Foundation Recommendations.....	23
4.2	Shallow Foundations Recommendations	24
4.2.1	Shallow Foundations Bearing Resistance	24
4.2.2	Shallow Foundation Lateral Resistance.....	25
4.3	Drilled Shaft Foundation Design Recommendation.....	25
4.4	Driven Pile Foundation Design Recommendation	28
4.4.1	Pile Design with No Downdrag	28
4.4.2	Pile Design with Downdrag.....	31
4.5	Lateral Load Resistance	35
5.0	GEOTECHNICAL RETAINING WALL DESIGN RECOMMENDATIONS.....	37
5.1	Retaining Wall Type Recommendations.....	37
5.2	Retaining Wall Design Recommendations.....	38
5.3	Bearing Resistance	40
5.4	Sliding and Overturning Stability	44
5.5	Wall Settlement	44
5.6	Overall Stability.....	45
5.7	Slope Stability Results	46
6.0	CONSTRUCTION CONSIDERATIONS	48
6.1	Existing Utilities and Structures and Site Preparation	48
6.2	Site Excavation	48
6.3	Groundwater Management	49
6.4	Drilled Shafts Construction	50
6.5	Pile Installation	51
6.6	Temporary Earth Structures	51
6.7	Cofferdam Recommendations	52
7.0	LIMITATIONS	53



Exhibits

Exhibit 1	Project Location Map
Exhibit 2	Existing Site Conditions at Existing and Proposed Bridge Location
Exhibit 3	Structural Fill Placement Below MSE Wall

Tables

Table 1	Summary of Subsurface Exploration Borings Completed
Table 2	Rock Quality Designation Summary
Table 3	Rock Core Summary and Classification
Table 4	Design Scour Data for Des Plaines River Bridge
Table 5	Anticipated Abutment Fill Settlement –Calculations
Table 6	Seismic Parameters
Table 7a, 7b	Foundation Loads
Table 8	Drilled Shaft End Bearing Parameters
Table 9a-9b	Pile Design Parameters – No Downdrag
Table 10a-10d	Pile Design Parameters – With Downdrag
Table 11	LRFD Load Factors for Retaining Wall Analyses
Table 12a, 12b	Equivalent Height of Soil for Vehicular Loading on Abutments, Retaining Walls
Table 13	Recommended Bearing Resistance
Table 14	Recommended Undercuts
Table 15	MSE Retaining Wall Description
Table 16	Stability Analyses Results

Appendices

Appendix A	General Plan & Elevation dated 6/30/2025 MSE Wall Preliminary Drawings
Appendix B	Soil Boring Location Plan and Subsurface Profiles
Appendix C	Soil Boring Logs
Appendix D	Laboratory Test Results
Appendix E	Seismic Site Class Determination
Appendix F	Soil and Rock Parameters
Appendix G	Slope Stability Analysis Exhibits



Structural Geotechnical Report
PTB 198-003
FAI-80 (I-80) Eastbound and Westbound Bridges
over the Des Plaines River, Will County, IL
SN: 099-8325(EB) & SN: 099-8309(WB)

1.0 INTRODUCTION

GSG Consultants, Inc. (GSG) completed a geotechnical investigation for the proposed I-80 mainline bridge replacement project over the Des Plaines River. The proposed structures will carry I-80 eastbound (EB) and westbound (WB) lanes over the Des Plaines River in the City of Joliet in Will County, Illinois. The purpose of the investigation was to explore the subsurface conditions, to determine engineering properties of the subsurface soil, and to develop design and construction recommendations for the proposed bridge. **Exhibit 1** shows the general project location.

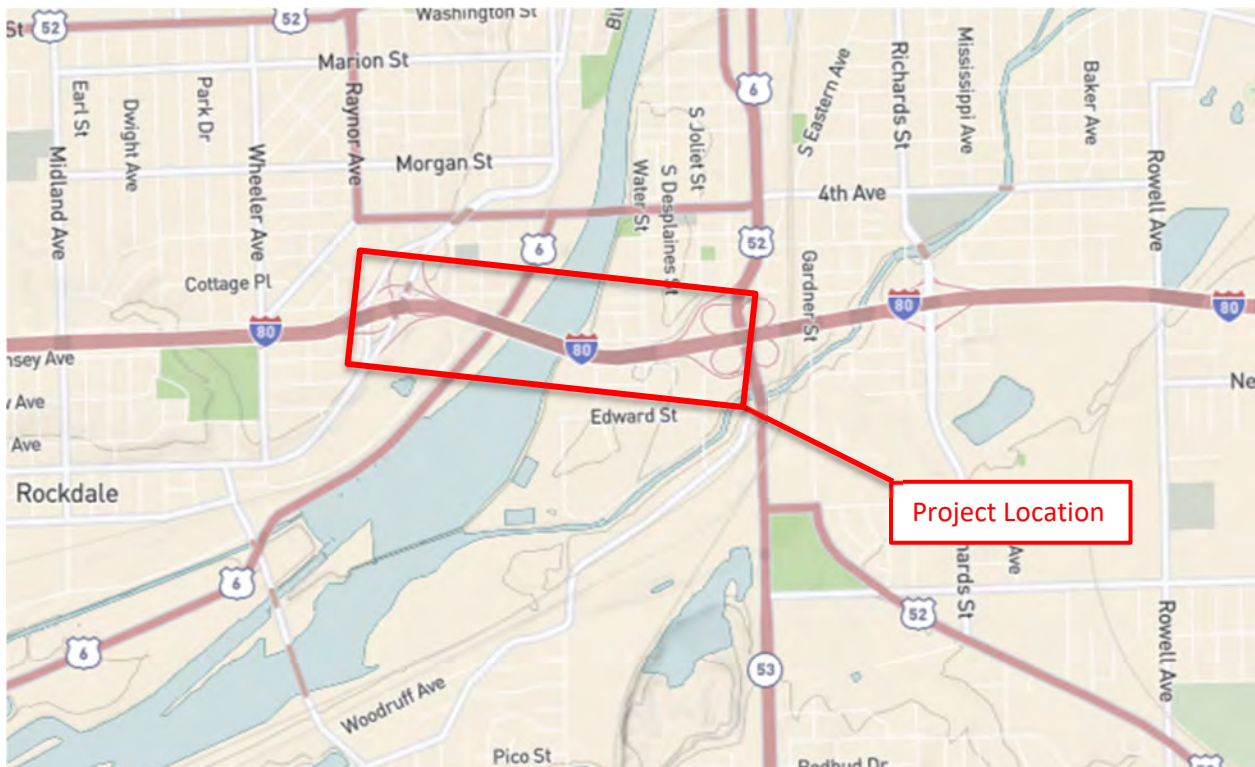


Exhibit 1 – Project Location Map
(Source: USGS Topographic Maps, usgs.gov)

1.1 Existing Bridge Information

The existing bridge structures are twin bridges, SN 099-0056 (EB) and SN 099-0057 (WB), carrying I-80 EB and WB over Des Plaines River in Joliet, respectively. They were first constructed in 1964 and reconstructed in 1998. The bridges have 27 spans and a total length of approximately 2,300

feet. The bridge structures are truss style bridges. Each bridge has 2 abutments, 2 piers within the river, 6 piers on the western shore and 18 piers on the eastern shore. The existing abutments are supported on piles and the piers are supported on spread footings. The twin bridges have a total of six (6) lanes, with three (3) traffic lanes on each bridge and minimal shoulders. Below each abutment, the side slopes from the Des Plaines River to the abutments are at an approximate 2.0H:1V slope.

On the west shoreline, the existing bridges span over US-6 and a CSX rail line that will remain. There are also significant utilities on both shorelines, including gas mains, water lines, electric lines, telephone lines, sewers, and fiber optic cables, that will remain in place along the US-6 right of way, and along Water Street in the vicinity of the proposed eastern abutment.

Exhibits 2a through 2e show the existing conditions of the bridge to be replaced. It is understood that the new bridge will be constructed on the north side/upstream of the existing bridges.



Exhibit 2a – Aerial View of Existing Bridge, Looking Northwest



Exhibit 2b – Existing Bridge, Looking Northwest on Top of Bridge Deck



Exhibit 2c – Existing Bridge, Piers in the River, Looking Southwest



Exhibit 2d – Existing Bridge, Piers on West Shore, Looking Southwest



Exhibit 2e – Existing Bridge, Piers on East Shore, Looking Southeast

1.2 Proposed Bridge Information

Based on the General Plan & Elevation (GPE) (**Appendix A**) dated June 30 2025, provided by WSP, two new bridges, SN 099-8325 (EB) and SN 099-8309 (WB), will be constructed for I-80 eastbound and westbound over the Des Plaines River to replace the existing bridges. The twin bridges are to be built on a new alignment which is offset to the north/upstream from the existing bridges. The proposed bridges will be continuous, multi-girder, steel structures for the main unit and steel multi-girder or PPC I-beams for the approach units. It is expected that traffic will continue to use the existing bridges while the new structures are being built. Traffic will be open on the proposed

WB structure once construction is completed in order to complete construction of the EB structure.

Based on the GPE, each of the new bridges will have 10 spans with a total length of 2,173 feet for EB and 2,147 feet for WB. The out-to-out width will range from 75 to 112 feet for EB and from 75 to 93 feet for WB. The longest span is 414 feet between piers 3 and 4 over the navigation channel. Piers 3 and 4 will be constructed in the river, and the remaining seven (7) piers (Pier 1, 2, and 5 through 9) on land. The bridges will have a 66°30'0" skew.

Based on the GPE, the embankments will be constructed with side slopes. The east and west abutments will be supported on steel H-piles and will be retained by an MSE wall with a 1V:2H concrete slope wall. Piers 2, and 6 through 9, for the piers on land, will be supported on spread footings bearing on bedrock. The river piers (3 and 4) will be supported on a group of drilled shafts socketed into bedrock. Pier 1 and Pier 5 will be supported on drilled shafts socketed into bedrock due to utility conflicts at the proposed pier locations.

2.0 SITE SUBSURFACE CONDITIONS

This section describes the subsurface exploration program and laboratory testing program completed as part of this project. The proposed locations and depths of the soil borings were selected in accordance with IDOT requirements and reviewed with WSP. The borings were completed in the field based on field conditions and accessibility.

2.1 Subsurface Exploration

The first phase of site subsurface exploration for the proposed bridges was conducted between October 18 and November 9, 2022. The investigation included advancing twenty-seven (27) borings to depths between 1 and 41.5 feet, including up to 40-foot rock cores at several locations. The borings included eleven (11) borings for the piers on the land, eight (8) borings for the river piers, and eight (8) interim borings to provide preliminary information in areas where the other land borings had not been drilled due to limited accessibility.

The second phase of the site exploration was conducted between March 14 and July 3, 2025. The investigation included advancing fifteen (15) borings to depths ranging from 6 to 48.5 feet, including up to 15-foot rock cores at multiple locations. The borings will be used for the design of the abutments and piers on land. Two (2) additional soil borings were drilled within the existing Ozinga building on November 20, 2025. The locations of the soil borings were coordinated with WSP and IDOT and adjusted in the field as necessary based on utilities and accessibility. Elevations and as-drilled locations for the borings were gathered by GSG's field crew using GPS surveying equipment. The approximate as-drilled locations of the soil borings are shown on the Soil Boring Location Plan & Subsurface Profiles (**Appendix B**). **Table 1** presents a summary of the borings used for the proposed bridge analyses.

Table 1 – Summary of Subsurface Exploration Borings Completed

Structure & Substructure		Boring ID	Station ¹	Offset (ft)/ Direction	Ground Surface Elevation (ft)	Boring Depth (ft)	Top of Bedrock Elevation ⁵ (ft)
I-80 Eastbound (EB) over Des Plaines River	West Abutment	BSB-01	37+88.08	95.13 RT	578.21	48.5 ²	544.7
		BSB-02 ³	38+43.37	1.19 LT	548.00	7.0	541.0
	Pier 1	BSB-04	39+81.30	77.89 RT	540.36	4.0	536.4
		BSB-05 ³	40+15.20	2.76 RT	541.00	22.0 ²	536.0
	Pier 2	BSB-07	41+30.61	83.27 RT	536.14	1.08	535.1
		BSB-10	41+76.00	40.02 LT	539.00	6.5	532.5
		BSB-109 ⁴	42+54.10	46.71 RT	533.95	13.5 ²	525.5
	Pier 3	BSB-205	44+78.72	25.27 RT	519.32	40.0 ²	509.3
		BSB-206	44+70.35	70.35 RT	519.72	41.0 ²	508.7
	Pier 4	BSB-207	48+91.48	23.20 RT	512.61	32.0 ²	511.1
		BSB-208	48+80.07	79.99 RT	512.89	33.5 ²	509.4
	Pier 5	BSB-13	51+85.54	7.08 RT	517.66	6.0	511.7
		BSB-14	51+81.12	81.00 RT	518.40	35.0 ²	498.4
		BSB-106 ⁴	52+48.70	160.41 RT	518.95	16.5 ²	513.0
	Pier 6	BSB-18	53+55.25	80.51 RT	521.26	23.0 ²	513.3
		BSB-107 ⁴	53+68.86	129.06 RT	518.40	8.5	509.9
	Pier 7	BSB-21	55+19.39	5.44 RT	522.20	6.5	515.7
		BSB-22	54+86.60	94.82 RT	519.88	29.0 ²	505.9
	Pier 8	BSB-25	56+27.19	68.00 RT	520.95	14.0	507.0
	Pier 9	BSB-27	58+33.46	19.51 RT	521.77	33.5 ²	503.3
		BSB-28	58+38.17	102.13 RT	522.97	25.5 ²	512.5
	East Abutment	BSB-30 ³	59+55.89	1.59 RT	521.62	8.5	513.3
		BSB-31	59+46.62	90.81 RT	523.33	27.0 ²	513.3
I-80 Westbound (WB) over Des Plaines River	West Abutment	BSB-02 ³	38+43.37	1.19 LT	548.00	7.0	541.0
		BSB-03	38+71.43	75.28 LT	548.48	20.0 ²	543.5
	Pier 1	BSB-05 ³	40+15.20	2.76 RT	541.00	22.0 ²	536.0
		BSB-06	40+53.51	84.05 LT	541.53	6.0	535.5

Structure & Substructure		Boring ID	Station ¹	Offset (ft)/ Direction	Ground Surface Elevation (ft)	Boring Depth (ft)	Top of Bedrock Elevation ⁵ (ft)
	Pier 2	BSB-08	41+65.07	77.12 LT	539.00	21.5 ²	533.5
		BSB-09	41+60.73	12.64 LT	539.00	26.0 ²	528.0
		BSB-110 ⁴	43+00.92	52.51 LT	534.96	8.75	526.2
	Pier 3	BSB-201	45+2.33	70.72 LT	516.76	39.0 ²	507.8
		BSB-202	45+2.82	15.90 LT	516.91	36.75 ²	510.2
	Pier 4	BSB-203	49+21.08	73.79 LT	511.82	41.5 ²	510.3
		BSB-204	49+12.14	17.82 LT	512.54	31.5 ²	511.0
	Pier 5	BSB-12	51+7.08	110.23 LT	517.78	6.5	511.3
		BSB-103 ⁴	52+75.49	185.28 LT	522.12	9.0	513.1
	Pier 6	BSB-15	53+58.44	96.41 LT	519.63	18.0 ²	516.6
		BSB-16	53+63.41	9.32 LT	519.87	8.0	511.9
		BSB-104 ⁴	54+91.69	246.82 LT	520.03	26.5 ²	501.5
	Pier 7	BSB-19	55+46.73	83.23 LT	519.66	25.5 ²	509.2
		BSB-20	55+28.91	11.36 LT	522.43	24.0 ²	513.4
	Pier 8	BSB-23	56+50.39	82.55 LT	520.15	19.5 ²	515.7
		BSB-105 ⁴	56+54.33	281.66 LT	519.62	8.5	511.1
	Pier 9	BSB-26	58+21.42	88.12 LT	521.90	25.0 ²	511.9
		BSB-27 ³	58+33.46	19.51 RT	521.77	33.5 ²	503.3
		BSB-108 ⁴	58+63.22	98.95 LT	521.87	10.0	511.9
	East Abutment	BSB-29	59+68.11	100.33 LT	521.6	20.5 ²	516.1
		BSB-30 ⁴	59+55.89	1.59 RT	521.62	8.5	513.3

- Notes:
1. Based on proposed I-80 centerline stationing
 2. Includes a 5-foot to 40-foot deep rock core
 3. Borings to be used for the EB and WB bridges
 4. Interim Soil Borings
 5. Top of Bedrock is where auger refusal is encountered

The soil borings were drilled using truck mounted Diedrich D-50 (hammer efficiency 95.5%, 97.7%, and 99.5%), B-57 Mobile (hammer efficiency 89% to 92.1%), Geoprobe (hammer efficiency 99%), CME-75 (hammer efficiency 78.8% to 79.8%), and Diedrich D-70 ATV (hammer efficiency 93%) drill rigs, each equipped with 3¼-inch I.D. hollow stem augers and an automatic

hammer. Soil sampling was performed according to AASHTO T 206, "Penetration Test and Split Barrel Sampling of Soils." Soil samples were obtained at 2.5-foot intervals to the boring termination depths encountering auger refusal on apparent bedrock. For the borings completed on land, water level measurements were made in each boring when evidence of free groundwater was detected on the drill rods or in the samples. The boreholes were also checked for free water immediately after auger removal, and before filling the open boreholes with soil cuttings and surface patching with concrete and asphalt where necessary to match the existing pavement, where applicable. Copies of the Soil Boring Logs are provided in **Appendix C**.

GSG's field representative inspected, visually classified, and logged the soil samples during the subsurface exploration activities and performed unconfined compressive strength tests on cohesive soil samples using a calibrated Rimac compression tester and a calibrated hand penetrometer in accordance with IDOT procedures and requirements. Representative soil samples were collected from each sample interval, placed in jars, and returned to the laboratory for further testing and evaluation.

GSG collected rock core runs from twenty-eight (28) of the soil boring locations with the use of a ten-foot and/or a five-foot diamond bit, NX-5 split core barrel during the investigation. The bedrock cores were evaluated in the field for texture, physical condition, recovery percentage, and Rock Quality Designation (RQD). The extracted samples were visually inspected and classified. The Rock Quality Designation (RQD) was determined according to ASTM D 6032, "Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core" by totaling all sections with a length in excess of four (4) inches and dividing it by the total length of the core run. The RQD is given a classification based upon the numeric value as indicated in **Table 2**.

Table 2 – Rock Quality Designation Summary

Rock Quality Designation	Descriptions
< 25%	Very Poor
25 – 50%	Poor
51 – 75%	Fair
76 – 90%	Good
91 – 100%	Excellent

2.2 Laboratory Testing Program

All samples were inspected in the laboratory to verify the field classifications. A laboratory testing program was undertaken to characterize and determine the engineering properties of the subsurface soils encountered for the proposed bridges. The following laboratory tests were performed on representative soil and rock samples:

- Moisture content ASTM D2216 / AASHTO T-265
- Unconfined Compression Strength on Rock – ASTM D2938

The laboratory tests were performed in accordance with test procedures outlined in the most current IDOT Geotechnical Manual, and per ASTM and AASHTO requirements. Based on the laboratory test results, the soils encountered were classified according to the AASHTO and the Illinois Division of Highways (IDH) classification systems. The results of the laboratory testing program are included in the Laboratory Test Results (**Appendix D**) and are also shown along with the field test results in the Soil Boring Logs (**Appendix C**).

2.3 Subsurface Soil Conditions

This section provides a brief description of the soils encountered in the borings performed in the vicinity of the proposed bridges. Variations in the general subsurface soil profile were noted during the drilling activities. Detailed descriptions of the subsurface soils are provided in the soil boring logs and are shown graphically in the Boring Location Plan & Subsurface Profiles. Subsurface profiles are included for the borings completed within Des Plaines River and along each shore.

The soil boring logs provide specific conditions encountered at each boring location and include soil descriptions, stratifications, penetration resistance, elevations, location of the samples, and laboratory test data. Unless otherwise noted, soil descriptions indicated on boring logs are visual identifications. The stratifications shown on the boring logs represent the conditions only at the actual boring locations and represent the approximate boundary between subsurface materials; however, the actual transition may be gradual.

2.3.1 East Shore

For the proposed foundations on the east shore, eighteen (18) borings were drilled at the proposed pier and abutment locations (see **Table 1**). Six (6) interim borings, BSB-103 through

BSB-108, were drilled in the vicinity of the proposed pier locations to obtain general bedrock information where the proposed final boring locations were not originally accessible. The surface elevations of the borings ranged between 517.7 and 523.3 feet. Thirteen (13) borings (BSB-106, BSB-12 through BSB-16, BSB-18, BSB-20, BSB-21, BSB-23, BSB-28, BSB-30, and BSB-31) were drilled in the landscape area off the road and residential areas and noted 1 to 12 inches of topsoil. Two borings (BSB-26 and BSB-29) noted 1 inch of surficial gravel. The remaining nine (9) borings were drilled on the street and noted 3 to 5 inches of asphalt followed by 7 to 8 inches of aggregate base.

Below the pavement section, gravel, or topsoil, borings BSB-26, BSB-29, BSB-31, BSB-104, and BSB-108 encountered silty clay fill to depths ranging between 2.5 and 6.0 feet (El. 520.4 to 516.5 feet). Several borings encountered sand fill and gravel fill to depths ranging between 2.5 and 7.5 feet (El. 519.5 to 512.4 ft). Under the fill layer, medium dense to extremely dense sand with gravel and/or weathered limestone was typically encountered before reaching auger refusal on bedrock. BSB-105 encountered bedrock under the fill. At boring locations BSB-12, BSB-13, BSB-18, and BSB-20, alternating layers of native silty clay, sand, and gravel were observed to auger refusal at depths of 6.0 to 9.0 feet (El. 513.4 to 511.3 ft). BSB-14, BSB-16, and BSB-21 encountered native sand, gravel, and cobbles to auger refusal at depths of 6.5 to 20.0 feet (El. 515.7 to 498.4 ft).

The native sand has SPT-N values ranging between 11 and 100 blows per foot (bpf). The gravel has SPT-N values ranging between 7 bpf and 50 blows per 2 inches. The native silty clay exhibits unconfined compressive strengths of 0.8 to 2.5 tsf. It is understood that a sanitary sewer is trenched up to approximately 10 feet below the top-of-rock in some areas along Duncan Street. The presence of fractured rock and lower top-of-rock elevations observed in borings BSB-14, BSB-22, BSB-25, BSB-27, and BSB-106 may be indicative of the presence of this trench.

Rock cores were collected at borings BSB-14, BSB-15, BSB-18, BSB-19, BSB-20, BSB-22, BSB-23, BSB-27, BSB-28, BSB-29, BSB-31, BSB-104, and BSB-106 after auger refusal was encountered at EL. 498.4 to 516.6 feet. The bedrock cores generally consisted of gray limestone, with slight to heavy weathering and fracturing. Cobbles and sand seams were noted within the severely weathered rock zone in boring BSB-106. Some vugs, small to medium sized cavities within rock, were observed. Unconfined compressive strength tests were completed on representative

samples of the rock cores. **Table 3** provides the RQD values and unconfined compression strength values of the rock cores extracted during the site investigation. Photographs of the cores are included with each boring log in **Appendix C**. The RQD classifications ranged from very poor to excellent.

2.3.2 West Shore

For the proposed foundations on the west shore, ten (10) borings were drilled at the proposed pier and abutment locations (see **Table 1**) and two (2) interim borings, BSB-109 and BSB-110, were drilled in the vicinity of the proposed pier locations to obtain bedrock information where the final boring locations were previously inaccessible (Ozinga property). The surface elevations of the borings ranged between 548.5 and 539.0 feet. Borings BSB-02 and BSB-03 were completed on an open lot and noted 3 inches of topsoil (BSB-02) and no surficial materials (BSB-03), respectively.

Borings BSB-04 through BSB-06 were completed along US-6 and noted 3 to 5 inches of asphalt followed by 7 to 8 inches of concrete. Boring BSB-01 was drilled along the shoulder of I-80 and noted 18 inches of asphalt. Borings BSB-07, BSB-08, BSB-109, and BSB-110 were completed on the Ozinga property and noted 4 to 9 inches of concrete followed by 6 inches of aggregate base. Two soil borings, BSB-09 and BSB-10, were drilled in the building interior on the Ozinga property and noted 5 inches of concrete slab over 8 inches of sand and gravel subbase.

Below the pavement, BSB-01 encountered silty clay fill underlain by native silty clay and silty clay loam to auger refusal on bedrock at 33.5 feet (Elev. 544.5 feet). Below the topsoil, boring BSB-02 encountered alternating strata of silty clay and sand to auger refusal on bedrock at El. 541 feet. At the ground surface, BSB-03 encountered sand fill underlain by native gravel, which extended to auger refusal on rock at El. 543.5 feet. Below the pavement section, borings BSB-04 through BSB-06 encountered 4 feet of silty clay fill and sand fill before encountering auger refusal on bedrock at El. 536 to 537 feet. On the north side of the Ozinga property, BSB-07 encountered auger refusal at an elevation of 535 feet under the pavement section, and BSB-08 noted 5 feet of sand and loam before auger refusal at an elevation of 533.5 feet on bedrock. On the south side of the Ozinga property, BSB-109 and 110 noted 8.5 feet of silty clay fill, sand and gravel, and highly weathered limestone before encountering auger refusal at elevations 525 to 526 feet on bedrock. Within the Ozinga building, BSB-09 and 10 noted 6.5 to 11 feet of sand fill, gravel, and

heavily weathered limestone before encountering auger refusal at El. 532.5 to 528 feet on bedrock.

The silty clay fill layers noted are 0.5 to 4.0 feet thick with unconfined compressive strengths ranging from 0.5 to 2.3 tons per square foot (tsf). The sand fill has SPT blow counts ranging from 13 to 100 bpf, and the native sand and gravel have SPT blow counts ranging from 10 bpf to 50 blows per 2 inches. The native silty clay/silty clay loam exhibited unconfined compressive strengths of 0.5 to 4.2 tsf.

Rock cores were collected at borings BSB-01, BSB-03, BSB-05, BSB-08, BSB-09, and BSB-109 after encountering auger refusal at elevations ranging from 525.5 to 544.5 feet. The bedrock cores generally consisted of gray limestone, with slight to heavy weathering and slight to heavy levels of fracturing. Some vugs were observed. Unconfined compressive strength tests were completed on representative samples of the rock cores. **Table 3** provides the RQD values and unconfined compression strength values of the rock cores extracted during the site investigation. Photographs of the cores are included with each boring log in **Appendix C**. The RQD classifications ranged from very poor to excellent.

2.3.3 Des Plaines River Borings

Soil Borings BSB-201 to BSB-208 were completed in the Des Plaines River using a temporary barge. Borings BSB-201, 202, 205 and 206 were drilled for Pier 3 on west side of the river and BSB-203, 204, 207 and 208 for Pier 4 on east side of the navigation channel. The streambed elevations ranged between 516.9 and 519.7 feet on the west side and between 511.8 and 512.9 feet on the east side.

At the streambed surface, all of the river borings encountered very soft to medium stiff dark gray silty clay soils at the base of the river, before encountering highly weathered bedrock and auger refusal on moderately weathered bedrock at elevations between 511.1 and 509.2 feet, with the exception of BSB-205 and 206, which noted a loose to very dense gravel layer between the clay and the bedrock. The silty clay had unconfined compressive strengths ranging from 0.0 to 0.8 tsf. The gravel had SPT-N values ranging between 6 and 50 blows per foot (bpf).

At each of the borings completed within the Des Plaines River, thirty to forty-foot rock cores were collected. The bedrock cores generally consisted of light gray limestone, with slight to moderate weathering and slight to heavy levels of fracturing. Some vugs were observed in several of the cores. Unconfined compressive strength tests were completed on representative samples of the rock cores. **Table 3** provides the RQD values and unconfined compression strength values of the rock cores extracted during the site investigation. Photographs of the cores are included with each boring log in **Appendix C**. The RQD classification of most of the rock cores are fair to good, with some cores at BSB-201 through 203 classified as poor.

Table 3 – Rock Core Summary and Classification

Boring Number	Core Run / Length (ft)	Core Depth (feet)	Type of Rock	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)
West Shore Borings						
BSB-01	1 / 5	33.5-38.5	Limestone	45.8	Poor	38.0 / 7,440
	2 / 10	38.5-48.5	Limestone	90.2	Good	44.0 / 12,266
BSB-03	1 / 10	5.0-15.0	Limestone	55.6	Fair	9.0 / 15,953
	2 / 5	15.0-20.0	Limestone	92.5	Excellent	18.0 / 17,948
BSB-05	1 / 10	5.0-15.0	Limestone	70.8	Fair	7.0 / 17,099
	2 / 7	15.0-22.0	Limestone	92.5	Excellent	N/A
BSB-08	1 / 7	5.5-12.5	Limestone	0.0	Very Poor	N/A
	2/9	12.5-21.5	Limestone	84.7	Good	16.5 / 11,381
BSB-09	1 / 10	11.0-21.0	Limestone	72.9	Fair	11.5 / 11,453
	2 / 5	21.0-26.0	Limestone	71.7	Fair	21.5 / 5,135
BSB-109	1 / 5	8.5-13.5	Limestone	31.7	Poor	9.0 / 7,041
East Shore Borings						
BSB-14	1 / 7	20.0-27.0	Limestone	0.0	Very Poor	N/A
	2 / 8	27.0-35.0	Limestone	4.7	Very Poor	N/A
BSB-15	1 / 10	3.0-13.0	Limestone	64.6	Fair	6.0 / 8,529
	2 / 5	13.0-18.0	Limestone	60.0	Fair	14.0 / 11,523
BSB-18	1 / 10	8.0-18.0	Limestone	46.3	Poor	N/A
	2 / 5	18.0-23.0	Limestone	80.8	Good	22.0 / 10,265
BSB-19	1 / 9	10.5-19.5	Limestone	72.2	Good	13.5/17,233
	2 / 6	19.5-25.5	Limestone	70.1	Good	N/A
BSB-20	1 / 5	9.0-14.0	Limestone	45.8	Poor	9.0 / 16,387
	2 / 4	14.0-18.0	Limestone	8.3	Very Poor	N/A
	3 / 6	18.0-24.0	Limestone	35.8	Poor	21.0 / 6,367
BSB-22	1 / 5	14.0-19.0	Limestone	6.0	Very Poor	N/A
	2 / 10	19.0-29.0	Limestone	41.7	Poor	23.5 / 12,246
BSB-23	1 / 10	4.5-14.5	Limestone	47.3	Poor	13.5 / 5,989
	2 / 5	14.5-19.5	Limestone	87.5	Good	17.5 / 13,846
BSB-26	1 / 10	10.0-20.0	Limestone	69.2	Fair	13.0 / 14,031
	2 / 5	20.0-25.0	Limestone	95.0	Excellent	23.0 / 17,753
BSB-27	1 / 9	18.5-27.5	Limestone	70.8	Fair	25.0/ 13,002
	2 / 6	27.5-33.5	Limestone	56.6	Fair	N/A
BSB-28	1 / 5	10.5-15.5	Limestone	69.2	Fair	13.0 / 19,236
	2 / 10	15.5-25.5	Limestone	86.3	Good	18.0 / 8,703
BSB-29	1 / 10	5.5-15.5	Limestone	57.5	Fair	10.0 / 4,316
	2 / 5	15.5-20.5	Limestone	95.8	Excellent	15.5 / 20,408
BSB-31	1 / 10	10.0-20.0	Limestone	93.0	Excellent	13.0 / 18,637

Boring Number	Core Run / Length (ft)	Core Depth (feet)	Type of Rock	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)
	2 / 7	20.0-27.0	Limestone	93.0	Excellent	N/A
BSB-104	1 / 8	18.5-26.5	Limestone	70.0	Fair	21.5 / 14,275
BSB-106	1 / 5	6.0-11.0	Limestone	15	Very Poor	9.0 / 9,467
	2 / 6	19.5-25.5	Limestone	0	Very Poor	N/A
Des Plaines River Borings (to be used for Eastbound and Westbound structures)						
BSB-201	1 / 10	9.0-19.0	Limestone	70.8	Fair	13.0 / 15,615
	2 / 10	19.0-29.0	Limestone	76.6	Good	25.0 / 14,996
	3 / 10	29.0-39.0	Limestone	65.0	Fair	35.0 / 13,903
BSB-202	1 / 10	6.75-16.75	Limestone	65.0	Fair	9.5 / 9,053
	2 / 10	16.75-26.75	Limestone	50.8	Fair	25.75 / 14,160
	3 / 10	26.75-36.75	Limestone	76.3	Good	32.75 / 16,491
BSB-203	1 / 10	1.5-11.5	Limestone	72.0	Fair	7.5 / 11,786
	2 / 10	11.5-21.5	Limestone	65.4	Fair	13.0 / 9,645
	3 / 10	21.5-31.5	Limestone	37.5	Poor	25.5 / 10,188
	4 / 10	31.5-41.5	Limestone	63.3	Fair	35.5 / 12,737
BSB-204	1 / 5	1.5-6.5	Limestone	90.0	Excellent	5.0 / 15,002
	2 / 5	6.5-11.5	Limestone	73.0	Fair	7.0 / 15,716
	3 / 10	11.5-21.5	Limestone	79.0	Good	12.0 / 9,866
	4 / 10	21.5-31.5	Limestone	67.5	Fair	28.0 / 9,400
BSB-205	1 / 10	10.0-20.0	Limestone	75.0	Fair	15.0 / 13,376
	2 / 10	20.0-30.0	Limestone	89.1	Good	24.0 / 14,166
	3 / 10	30.0-40.0	Limestone	85.4	Good	39.0 / 11,557
BSB-206	1 / 10	11.0-21.0	Limestone	72.0	Fair	17.0 / 7,281
	2 / 10	21.0-31.0	Limestone	74.5	Fair	27.5 / 8,370
	3 / 10	31.0-41.0	Limestone	82.0	Good	39.0 / 6,839
BSB-207	1 / 10	2.0-12.0	Limestone	88.0	Good	8.0 / 15,016
	2 / 10	12.0-22.0	Limestone	87.5	Good	14.0 / 12,675
	3 / 10	22.0-32.0	Limestone	81.0	Good	28.0 / 7,611
BSB-208	1 / 10	3.5-13.5	Limestone	82.5	Good	12.5 / 15,621
	2 / 10	13.5-23.5	Limestone	87.5	Good	19.5 / 12,216
	3 / 10	23.5-33.5	Limestone	84.0	Good	30.5 / 13,666

2.4 Groundwater Conditions

Water levels were checked in each boring completed onshore to determine the general groundwater conditions present at the site, and were measured both while drilling and after each boring was completed. Groundwater was observed during drilling at boring location BSB-01 at

8.5 feet (El. 569.7 feet) and at BSB-22 at a depth of 13 feet (El. 506.9 feet). Groundwater was not encountered during or immediately after drilling at the remaining soil boring locations on the land. None of the borings were left open after completing the drilling activities.

Based on the observed water levels and the water level of the Des Plaines River (about El. 539 feet), it is anticipated that the long-term groundwater level is near the top of bedrock at elevations of 525.5 to 543.5 feet at the west shore area and 501.5 to 516.6 feet at the east shore area. Perched water may also be present within the fill materials observed in the borings. Water level readings were taken in the boreholes at the times and under the conditions specified in the boring logs and stated in this report. However, it should be noted that fluctuations in groundwater level may occur due to variations in the rainfall, the river water level, other climatic conditions, or other factors not evident at the time measurements were made and reported herein.

3.0 GEOTECHNICAL ANALYSES

This section presents GSG's geotechnical analysis and recommendations for the proposed bridge design, based on the results of field exploration, laboratory testing, and geotechnical analysis. Subsurface conditions between borings may vary from those encountered at the boring locations. If structure locations, loadings, or elevations are changed, we request that GSG be contacted so that we may re-evaluate our recommendations.

3.1 Scour

The proposed bridge structures will carry I-80 over the Des Plaines River. Scour is anticipated to be a concern for the proposed Piers 3 and 4 in the river. According to the IDOT Bridge Manual (2023), it is understood that for bridge abutments set back from the edge of a waterway, scour typically results from multiple flood events over time. The proposed I-80 abutments and Piers 1, 2, and 5 through 9 will be constructed on the land and are protected by a floodwall; therefore, scour is not a concern for those locations.

Table 4 presents the bottom elevations for scour events as provided in the GPE (**Appendix A**). The scour elevations correspond to the top of bedrock or fall within the weathered limestone encountered over competent bedrock. Based on the granular weathered limestone and bedrock encountered along the river bottom at the scour elevations, scour reductions due to cohesive materials are not anticipated.

Table 4 – Design Scour Data for Des Plaines River Bridge

Event/Limit State	Design Scour Elevations (ft)				Item 113
	Pier 3WB	Pier 3EB	Pier 4WB	Pier 4EB	
Q100	510.7	509.2	510.8	509.4	5
Q200	510.7	509.2	510.8	509.4	
Design	510.7	509.2	510.8	509.4	
Check	510.7	509.2	510.8	509.4	

It is recommended that scour countermeasures be implemented as specified in the IDOT Bridge Manual and IDOT Drainage Manual, and as recommended in the final hydraulic report for this project.

3.2 Embankment Settlement

It is understood that the twin bridges will be built on a new alignment, which is offset north/upstream from the existing bridges. Based on the observed site grades and proposed final bridge and abutment elevations, it is assumed that between approximately 47 and 49 feet of new engineered fill will be necessary for construction of the MSE walls below the east abutment and to create the new east and west embankments, respectively, along the new alignment.

An analysis was performed to evaluate the anticipated total settlement of the underlying fill and native soils due to the new wall and embankment construction for the alignment. Immediate settlement for cohesionless soils can typically occur during filling operations, whereas consolidation settlement for cohesive soils generally occurs over a longer period. The maximum estimated total settlements within the existing fill soils and native soils below the new embankments were calculated as shown in **Table 5**, where 90% of the total settlement is estimated to be completed within 12 months. The settlement values provided in **Table 5** do not include any potential settlement of the newly constructed embankment materials as it is assumed the new embankment will be compacted and constructed per the IDOT Construction Manual (2021). Settlement estimates of the existing soils were calculated for the soil boring locations that were completed near the east and west bridge abutments.

Table 5 – Anticipated Abutment Fill Settlement –Calculations

Location	Nearest Borings	Fill Area		Assumed New Fill Height (feet)	Anticipated Total Settlement (inches)
		Assumed Width (feet)	Assumed Length (feet)		
East Abutment, WB	BSB-29, BSB-30	150	250	46.8 to 47.0	1.0
East Abutment, EB	BSB-30, BSB-31	150	250	45.2 to 46.8	1.2
West Abutment, WB	BSB-02, BSB-03	150	250	47.9 to 48.4	2.2
West Abutment, EB	BSB-01, BSB-02	150	250	17.7 ¹ to 47.9	3.0

Notes: 1. Within the area of the existing embankment

Based on the general nature of the lower-strength silty clay soils, underlain by sand and gravel, encountered in the area of soil borings BSB-01, BSB-02, BSB-04 through BSB-06, BSB-20, and BSB-31, the estimated settlement of the existing soils from the new embankment fill could be approximately 1.0 to 3.0 inches. Settlement of less than about 0.1 to 0.2 inches is anticipated in the area of borings BSB-03 and BSB-30, where granular fill and sand over shallow bedrock were encountered. Accordingly, downdrag should be anticipated to be an issue in areas where pile foundations are constructed within the east and west embankments. It is recommended that pile sleeves be included for the abutment piles to mitigate downdrag, where necessary. Alternatively, ground improvements may be installed below the MSE walls and new embankments to mitigate the anticipated settlement.

3.3 Roadway Fill Settlement Treatment and Recommendations

If the anticipated settlement is excessive for the proposed improvements, special design recommendations may be considered to mitigate the impact on bridge construction. Some areas of the subgrade soils beneath the new roadway fill may require in-situ ground improvement to mitigate the anticipated settlement after the filling operations. The recommended ground improvement techniques and their impact on the estimated settlement rate are discussed below. The selected treatment alternative must also consider the proposed bridge foundation construction schedule.

3.3.1 Staged Embankment Construction

For the construction of the embankments, the proposed alignments of I-80 Eastbound and I-80 Westbound may be partially constructed, allowing for consolidation settlement of the newly constructed embankment materials to occur and dissipate the excess pore water pressure before completion of the full fill placement. For the initial construction, allowing the partially filled embankment to remain in place for varying amounts of time before the final stage of construction will result in different amounts of settlement after construction. The longer the initial stage of construction remains in place as a surcharge over the underlying soils, the less settlement is anticipated to occur after construction.

Proper instrumentation, as outlined in IDOT Geotechnical Manual in Section 6.4.4.6-Instrumentation and Control of Embankment Construction, will be required to monitor the state

of stress in the soil during the loading period, to ensure that loading does not proceed so rapidly as to cause a shear failure.

3.3.2 Maintenance

A maintenance program will likely be necessary throughout the construction stage to account for the settlement of the new fill. This will require additional quantities of new fill materials to be placed during construction, which should be accounted for when estimating earthwork quantities.

3.4 Seismic Parameters

The seismic hazard for the site was evaluated in accordance with the IDOT Geotechnical Manual, IDOT Bridge Design Manual, and AASHTO LRFD Bridge Design Specifications. The Seismic Soil Site Class was determined per the requirements of All Geotechnical Manual Users (AGMU) Memo 9.1, Design Guide for Seismic Site Class Determination, and the “Seismic Site Class Determination” Excel spreadsheet provided by IDOT. A global Site Class Definition was determined for this project, and was found to be Soil Site Class D. The site class calculation sheet is presented in **Appendix E**. For structures with span lengths greater than 200 feet the global Site Class Definition typically reflects the softest (weakest) individual Site Class Definition determined. The Seismic Performance Zone (SPZ) was determined using Figure 2.3.10-2 in the IDOT Bridge Manual and was found to be Seismic Performance Zone 1. It is understood that the twin bridges will be classified as “Critical” bridges, per AASHTO LRFD Section 3.10.5.

The AASHTO Seismic Design Parameters program was used to determine the peak ground acceleration coefficient (PGA), and the short (S_{DS}) and long (S_{D1}) period design spectral acceleration coefficients for the proposed structure. For this section of the project, the S_{DS} and the S_{D1} were determined using the 2020 AASHTO Guide Specifications, as shown in **Table 6**. Given the site location and materials encountered, the liquefaction potential is minimal.

Table 6 – Seismic Parameters

Building Code Reference	PGA	S_{DS}	S_{D1}
2020 AASHTO Guide for LRFD Seismic Bridge Design	0.049g	0.167g	0.095g

4.0 GEOTECHNICAL BRIDGE DESIGN RECOMMENDATIONS

The foundations for the proposed bridges must provide sufficient support to resist the dead and live loads, as well as seismic loading. The foundation design recommendations presented in this section were developed in accordance with the AASHTO LRFD 9th Edition (2020). Based on the bridge study and design, GSG understands that the bridges will be supported on several types of foundation systems, including driven piles, drilled shafts, and shallow foundations. Several foundation types are proposed for individual piers. The bridge loads provided by WSP for each foundation type are shown in **Tables 7a and 7b**.

Table 7a –Vertical Foundation Loads

Substructure	Pile Group - Factored Loads per Pile (kips)	Drilled Shafts - Factored Load per Shaft (kips)	Spread Footings – Factored Load (klf)
West Abutments	165.0	n/a	n/a
Pier 1	405.0	2,485	140.0
Pier 2	n/a	n/a	125.0
Pier 3	n/a	see Table 7b	n/a
Pier 4	n/a	see Table 7b	n/a
Pier 5	n/a	2,260	130.0
Pier 6	n/a	n/a	120.0
Pier 7	n/a	n/a	120.0
Pier 8	n/a	n/a	120.0
Pier 9	n/a	n/a	120.0
East Abutment	200.0	n/a	n/a

Table 7b –Foundation Loads – River Bridge Piers

Load Type	Strength I	Extreme II Longitudinal	Extreme II Trans.
Pier 3			
Factored Axial Load (kips)	3,180	3,135	2,390
Factored Lateral (kips)	91	607	551
Factored Overturning (k-ft)	1,024	8,987	7,535
Pier 4			
Factored Axial Load (kips)	2,960	2,850	2,375
Factored Lateral (kips)	70	585	556
Factored Overturning (k-ft)	797	7,952	7,612

4.1 Bridge Foundation Recommendations

GSG completed foundation evaluations and developed foundation recommendations based on the results of the subsurface investigation and included driven piles, drilled shafts and shallow foundations. The results of the evaluation for each of these foundation types are presented below.

4.1.1 Shallow Foundations

Based on the fill soils encountered in the existing embankments, the new span length and the anticipated loads, excessive settlement is anticipated for shallow foundations at the bridge abutments. Therefore, shallow foundations are not anticipated to be a feasible option for the proposed bridge abutments.

Due to the presence of shallow bedrock, onshore bridge piers 2, 6, 7, 8, and 9 will be supported on spread footings bearing on the shallow bedrock. Design recommendations for bridge pier shallow foundations are provided in *Section 4.2* of this report.

4.1.2 Drilled Shaft Foundations

Drilled shafts are considered a viable option for each of the bridge piers. It is understood that the bridge piers within the Des Plaines River, Piers 3 and 4, will be supported on drilled shafts socketed into bedrock. Piers 1 (EB and WB) and 5 (EB and WB), on either shore, will also be supported on drilled shafts socketed into bedrock, due to the proximity of the existing CSX

railroad and existing utilities that will remain in place below the new bridges. Design recommendations for drilled shafts are provided in *Section 4.3* of this report.

4.1.3 Driven Pile Foundations

It is understood that driven H-piles are being considered to support the bridge abutments. Concrete piles are not recommended for this site because the pile lengths cannot be readily adjusted to accommodate variability in soil conditions. Metal shell piles are not recommended for structures supported upon the bedrock, and they will not be further evaluated. H-piles are a viable option for constructing the abutments for the proposed bridge structures.

Driving shoes for the piles, in accordance with Section 1006.05 (e) of the IDOT Standard Specifications for Road and Bridge Construction (SSRBC), should be considered to guard against the very dense granular soils and relatively shallow bedrock. Design recommendations for driven piles are provided in *Section 4.4* of this report.

4.2 Shallow Foundations Recommendations

Based on the available design information and the site's soil conditions, it is anticipated that Piers 2, 6, 7, 8, and 9 of the bridge will be supported on shallow spread footings that bear on the underlying bedrock. The results of the evaluation are presented below.

4.2.1 Shallow Foundations Bearing Resistance

Bearing resistance for the pier spread footings shall be evaluated at the strength limit state using load factors and factored bearing resistance. The bearing resistance factor, ϕ_b , for shallow bedrock is 0.45 per AASHTO Table 10.5.5.2.2-1. Bearing on the underlying bedrock, the spread footings could be designed using a nominal bearing resistance of 130 kips per square foot (ksf) and factored resistance of 58 ksf. The nominal bearing resistance of the footings should not be greater than the compressive resistance of the footing concrete. The shallow footings should be designed such that the eccentricity of loading at the strength limit state should not exceed 0.45 of the footing width or length per AASHTO 10.6.3.3, Eccentric Load Limitations. No differential settlement is anticipated for footings bearing on bedrock. The footing should be supported upon competent bedrock, which is estimated to be present approximately 3 feet below the top of bedrock. Based on the most recent GP&E and new Ozinga borings BSB-09 and 10, the bearing elevation for Pier 2 will be between El. 529.5 and 525 feet on the west side of the river; Piers 6,

7, 8, and 9 are anticipated to bear at elevations between El. 513 and El. 506 feet on the east side of the river.

4.2.2 Shallow Foundation Lateral Resistance

The shallow foundations should be designed to resist both sliding and overturning due to lateral and/or eccentric bridge loading. Resistance to lateral loads can be developed by sliding friction between the bearing bedrock and the bottom of the footings. A nominal coefficient of sliding friction of 0.83 may be assumed between the bottom of the concrete footing and the bedrock, and a nominal coefficient of sliding friction of 0.57 may be assumed between the concrete footing and the new gravel fill. A resistance factor of 0.80 is recommended based on AASHTO Table 10.5.5.2.2-1. Sliding resistance due to passive pressure in front of the footing can be applied, given that the lower portion of the footing is keyed into bedrock. If the footing sliding resistance requires embedment in rock, the bottom of the footing elevation should be adjusted to ensure the necessary minimum embedment. The top 2 feet of the rock should be neglected from passive resistance due to disturbance during construction. A nominal passive resistance equivalent fluid pressure of 420 pounds per cubic foot (pcf) acting against the embedded portion of the footing may be used with a resistance factor of 0.50.

4.3 Drilled Shaft Foundation Design Recommendation

Drilled shafts are considered a feasible foundation option for the proposed bridge piers. Rock core data indicate limestone with variable joint conditions. Joints are typically spaced at intervals greater than 1 foot and are weathered to varying degrees. Occasionally, open joints filled with clay were encountered in some of the rock cores. Specific joint conditions are considered at each pier for the foundation evaluation.

The construction of the channel piers will require pile caps, cofferdams, and/or coffer cells; GSG understands that coffer cells are being considered for the design. Drilled shafts bearing on bedrock should have a straight shaft, with no bell, and should be placed on top of solid bedrock or socketed into bedrock. Based on the limestone strength and jointing conditions, base resistance was assumed to be the primary mode of axial resistance in rock. The IDOT design guide, Axial Capacity of Drilled Shafts in Rock (2016) was used to evaluate the rock socketed caisson tip resistance which is based on AASHTO 10.8.3.5.4 and the Geological Strength Index (GSI), RQD, and rock unconfined compressive strength. Factors such as the presence of clay

seams are incorporated in the RQD value and Joint Type within the IDOT spreadsheet and shown in the tables in **Appendix F**.

Rock core parameters are required for a depth of twice the socket diameter below the bottom of the shaft. For piers where there are insufficient lengths of rock core, the data was extended assuming the extended core has the same properties as the bottom core parameters. Based on the rock joint data, the range of GSI values were estimated. The lower bound of the GSI value was used in the nominal base resistance. All materials above rock are ignored in determining the geotechnical resistance, and no axial group effect was considered in rock. Side resistance within a rock socket will only be evaluated if the base resistance is insufficient to support the required loading. At some locations, the limestone strength is higher than the concrete compressive strength and the maximum nominal side resistance will be controlled by the concrete strength. The nominal side resistance for 4,000 psi and 5,000 psi compressive strength in concrete is 34.9 and 39.0 ksf, respectively (AASHTO 10.8.3.5.4b).

As per AASHTO Table 10.5.5.2.4.1, geotechnical resistance factors of 0.55 for side resistance and 0.50 base resistance were used in our analyses. The resistance factor may be increased to 0.7 if load testing is conducted at the location with the poorest quality rock. The end bearing drill shafts should be supported upon the competent bedrock beneath the top weathered surface materials. Therefore, a minimum 3-foot-long rock socket will be required; however, the final socket length should be determined based on the actual loading condition and the lateral resistance required. The socket diameter should be 6 inches less than the shaft diameter above bedrock. **Table 8** provides a summary of the drilled shaft side and tip resistances of the bedrock at each pier location.

Table 8 – Drilled Shaft Side and End Bearing Parameters

Substructure	Top of Bedrock Elevation (feet)	Nominal Side Resistance (ksf)	Factored Side Resistance (ksf)	Nominal Unit Tip Resistance (ksf)	Factored Unit Tip Resistance (ksf)
Pier 1	536.0	87*	48*	368	184
Pier 3	510.0	31	17	413	206
Pier 4	510.0	87*	48*	411	205
Pier 5	512.0**	19	10	229	114

*Nominal side resistance at Piers 1 and 4 will be limited by the nominal concrete strength: 34.9 ksf for 4,000 psi concrete and 39.0 ksf for 5,000 psi concrete, respectively (AASHTO 10.8.3.5.4b).

** Deeper top of bedrock encountered at boring BSB-14 at elevation 498.4 ft.

No skin friction should be considered within the scour depth of drilled piers. If no protective casing is used, and new fill will be placed in the area of the drilled shafts, downdrag (negative skin friction) should be included in the drilled pier's resistance calculation. If new fill is not anticipated in the area of the drilled shafts, downdrag will not occur.

Based on the structural drawings, it is anticipated that the minimum rock socket shaft diameter of the piers on land will be 60 inches (5 feet) and the piers within the Des Plaines River will have rock sockets of 78 inches (6.5 feet) in diameter. Drilled shafts should be installed with a minimum center-to-center spacing of at least 4 shaft diameters (4D) for the vertical loads and 5D for the lateral load analyses, as drilling the shafts at close spacing can reduce the total capacity of the drilled shafts and the group effect must then be considered. Based on the FHWA's "Drilled Shafts: Construction Procedures and LRFD Design Methods" document, Chapter 14, if constructed poorly, closely spaced drilled shafts may cause soil loosening around previously installed shafts, reducing the shaft's lateral resistance. This effect on constructability is less significant in rock-socketed caissons. Based on the aforementioned FHWA standard, Section 14.4.3, the strength of bedrock is generally greater than the strength of the drilled shaft/rock interface; group effects within rock are usually insignificant and do not control the foundation design.

As it can be expected that the shafts will penetrate through very dense granular soils or bedrock, the contractor should be prepared for hard drilling and have techniques in place to properly clean the bottom of the shaft before any concrete is placed.

4.4 Driven Pile Foundation Design Recommendation

Depending on the construction sequence, driven piles for the abutments and approach bents, within the newly constructed embankments, may be subjected to downdrag effects. If the new I-80 Eastbound and Westbound embankments are constructed and preloaded to allow settlement to occur before the pile installations, there will be no downward movement of the soil relative to piles, and downdrag influence is eliminated. Pile design recommendations with no downdrag are provided in *Section 4.4.1*. If the piles are installed before the filling operations, downdrag effects should be considered in the pile design or should be mitigated. Pile design recommendations including the effect of downdrag are provided in *Section 4.4.2*. Once final grading plans are determined, GSG can review and revise these recommendations as necessary.

4.4.1 Pile Design with No Downdrag

The Modified IDOT static method Excel spreadsheet was used to estimate pile lengths at various axial geotechnical resistances for driven piles, as per IDOT AGMU Memo 10.2. The factored resistance includes a reduction of 0.55 for the geotechnical resistance for the pile installation. No geotechnical losses due to scour or liquefaction were included in the axial pile resistance calculations; it is anticipated that slope walls will be used to protect the abutment piles from scour.

Tables 9a and 9b summarize the estimated maximum pile lengths for representative pile sections along with the factored resistance available for several H-pile types driven to bedrock.

Due to the MSE wall construction below the exterior corners of the east abutments, the top of the pile foundations for the abutments would extend through new embankment materials, which will require the installation of corrugated steel pipes or pile sleeves within the wall's select backfill. The steel pipes may be filled to full depth with clean sand after the piles are driven. The ground elevation at the beginning of pile driving used in the east abutment pile analysis is assumed to be the bottom of the MSE wall levelling pad. The western abutment pile foundations will be installed after the embankment is constructed and are anticipated to include downdrag forces; further discussion is included in *Section 4.4.2*. The estimated pile lengths shown in **Tables 9a and 9b** include the length of pile within this pipe, as necessary.

The estimated pile lengths shown in **Tables 9a and 9b** are based on the pile cut-off estimated elevations and noted below each table. The actual pile length and resistance should be evaluated based on test piles installed in accordance with the specifications provided in Section 512.15 of IDOT Standard Specifications for Road and Bridge Construction. Per section 3.10.1.11 of the IDOT Bridge Manual, the minimum pile spacing should be 3 pile diameters.

Table 9a – I-80 Eastbound, East Abutment Pile Design (BSB-30, BSB-31)
No Downdrag

Pile Section	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (FT)*
HP8x36 (Max. R_N = 286 Kips)	286	157	42.6
HP10x42 (Max. R_N = 335 Kips)	335	184	42.1
HP10x57 (Max. R_N = 454 Kips)	454	250	43.1
HP12x53 (Max. R_N = 418 Kips)	418	230	42.6
HP12x63 (Max. R_N = 497 Kips)	497	273	43.1
HP12x74 (Max. R_N = 589 Kips)	589	324	43.6
HP12x84 (Max. R_N = 664 Kips)	664	365	44.1
HP14x73 (Max. R_N = 578 Kips)	578	318	42.6
HP14x89 (Max. R_N = 705 Kips)	705	388	43.6
HP14x102 (Max. R_N = 810 Kips)	810	445	44.1
HP14x117 (Max. R_N = 929 Kips)	929	511	44.6

* Estimated pile length is based on assuming the pile cut off elevation: 553.36 ft., and ground elevation at the beginning of pile driving: 539.9 ft.

Table 9b – I-80 Westbound, East Abutment Pile Design (BSB-29, BSB-30)
No Downdrag

Pile Section	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (FT)*
HP8x36 (Max. R_N = 286 Kips)	286	157	42.6
HP10x42 (Max. R_N = 335 Kips)	335	184	42.1
HP10x57 (Max. R_N = 454 Kips)	454	250	43.1
HP12x53 (Max. R_N = 418 Kips)	418	230	42.1
HP12x63 (Max. R_N = 497 Kips)	497	273	42.6
HP12x74 (Max. R_N = 589 Kips)	589	324	43.6
HP12x84 (Max. R_N = 664 Kips)	664	365	43.6
HP14x73 (Max. R_N = 578 Kips)	578	318	42.6
HP14x89 (Max. R_N = 705 Kips)	705	388	43.6
HP14x102 (Max. R_N = 810 Kips)	810	445	44.1
HP14x117 (Max. R_N = 929 Kips)	929	511	44.6

* Estimated pile length is based on assuming the pile cut off elevation: 553.36 ft., and ground elevation at the beginning of pile driving: 539.9 ft.

4.4.2 Pile Design with Downdrag

This section presents pile design recommendations, including the effect of downdrag induced due to the downward movement of the soil relative to the piles for the abutment foundations. According to AASHTO Section 3.11.8-Downdrag, the pile should be designed to resist the downdrag if the ground settlement is 0.4 inches or greater. Based on *Section 3.2 Settlement*, 1.0 to 3.0 inches of ground settlement could be anticipated in the area of the east and west abutments; therefore, downdrag needs to be considered if no mitigation of the existing soil is completed. The nominal geotechnical resistance available to resist the structure load plus the downdrag load is estimated by considering only the positive side resistance and tip resistance below the lowest layer contributing to the downdrag.

Tables 10a through 10d summarize the estimated maximum pile lengths for representative pile sections along with the factored resistance available for several H-pile types driven to bedrock.

Due to the MSE wall construction below the exterior corners of the abutments, the top of the pile foundations for the abutments would extend through new embankment materials, which will require the installation of corrugated steel pipes/pile sleeves within the wall select backfill. The steel pipes may be filled to full depth with clean sand after the piles are driven. The ground elevation at the beginning of pile driving for the eastern abutment is assumed to be the top of the MSE wall levelling pad. The ground elevation for pile driving for the west abutment is assumed to be the bottom of the abutment cap, after construction of the embankment. The estimated pile lengths shown in **Tables 10a through 10d** include the length of pile within this pipe, as necessary.

The estimated pile lengths shown in **Table 10a through 10d** are based on the estimated pile cut off elevations noted below the table. The actual pile length and resistance should be evaluated based on test piles installed in accordance with the specifications provided in Section 512.15 of IDOT Standard Specifications for Road and Bridge Construction. Per section 3.10.1.11 of the IDOT Bridge Manual, the minimum pile spacing should be 3 pile diameters.

Table 10a – I-80 Eastbound, East Abutment Pile Design (BSB-30, BSB-31)
With Downdrag

Pile Section	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (FT)*
HP8x36 (Max. R_N = 286 Kips)	286	120	45.4
HP10x42 (Max. R_N = 335 Kips)	335	138	44.9
HP10x57 (Max. R_N = 454 Kips)	454	202	45.9
HP12x53 (Max. R_N = 418 Kips)	418	174	45.4
HP12x63 (Max. R_N = 497 Kips)	497	217	45.9
HP12x74 (Max. R_N = 589 Kips)	589	267	46.4
HP12x84 (Max. R_N = 664 Kips)	664	308	46.9
HP14x73 (Max. R_N = 578 Kips)	578	252	45.4
HP14x89 (Max. R_N = 705 Kips)	705	321	46.4
HP14x102 (Max. R_N = 810 Kips)	810	378	46.9
HP14x117 (Max. R_N = 929 Kips)	929	443	47.4

* Estimated pile length is based on assuming the pile cut off elevation: 556.19 ft., and ground elevation at the beginning of pile driving: 539.9 ft. Bottom of downdrag elevation 518 ft.

Table 10b – I-80 Westbound, East Abutment Pile Design (BSB-29, BSB-30)
With Downdrag

Pile Section	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (FT)*
HP8x36 (Max. R_N = 286 Kips)	286	121	42.6
HP10x42 (Max. R_N = 335 Kips)	335	140	42.1
HP10x57 (Max. R_N = 454 Kips)	454	204	43.1
HP12x53 (Max. R_N = 418 Kips)	418	177	42.1
HP12x63 (Max. R_N = 497 Kips)	497	219	42.6
HP12x74 (Max. R_N = 589 Kips)	589	269	43.6
HP12x84 (Max. R_N = 664 Kips)	664	310	43.6
HP14x73 (Max. R_N = 578 Kips)	578	254	42.6
HP14x89 (Max. R_N = 705 Kips)	705	324	43.6
HP14x102 (Max. R_N = 810 Kips)	810	381	44.1
HP14x117 (Max. R_N = 929 Kips)	929	445	44.6

* Estimated pile length is based on assuming the pile cut off elevation: 553.36 ft., and ground elevation at the beginning of pile driving: 539.9 ft. Bottom of downdrag elevation 518 ft.

Table 10c –I-80 Eastbound, West Abutment Pile Design (BSB-01, BSB-02)
With Downdrag**

Pile Section	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (FT)*
HP12x63 (Max. R_N = 497 Kips)	424	138	44.0
HP12x74 (Max. R_N = 589 Kips)	579	222	45.0
HP12x84 (Max. R_N = 664 Kips)	661	266	45.5
HP14x73 (Max. R_N = 578 Kips)	502	164	44.0
HP14x89 (Max. R_N = 705 Kips)	689	266	45.0
HP14x102 (Max. R_N = 810 Kips)	786	318	45.5
HP14x117 (Max. R_N = 929 Kips)	929	395	46.5

* Estimated pile length is based on assuming the pile cut off elevation: 583.0 ft., and ground elevation at the beginning of pile driving: 582.0 ft. Bottom of downdrag elevation 542 ft.

**Assuming existing soils will be replaced by granular engineered fill to elevation 545.2 ft.

Table 10d –I-80 Westbound, West Abutment Pile Design (BSB-02, BSB-03)
With Downdrag

Pile Section	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (FT)*
HP8x36 (Max. R_N = 286 Kips)	280	87	45.8
HP10x42 (Max. R_N = 335 Kips)	288	76	45.3
HP10x57 (Max. R_N = 454 Kips)	454	166	46.8
HP12x53 (Max. R_N = 418 Kips)	417	131	45.8
HP12x63 (Max. R_N = 497 Kips)	427	136	45.8
HP12x74 (Max. R_N = 589 Kips)	589	223	47.3
HP12x84 (Max. R_N = 664 Kips)	664	264	47.8
HP14x73 (Max. R_N = 578 Kips)	506	162	45.8
HP14x89 (Max. R_N = 705 Kips)	705	270	47.3
HP14x102 (Max. R_N = 810 Kips)	810	326	47.8
HP14x117 (Max. R_N = 929 Kips)	929	391	48.3

* Estimated pile length is based on assuming the pile cut off elevation: 584.8 ft., and ground elevation at the beginning of pile driving: 583.8 ft. Bottom of downdrag elevation 542 ft.

**Assuming existing soils will be replaced by granular engineered fill to elevation 545.5 ft.

4.5 Lateral Load Resistance

Lateral loadings applied to deep foundations are typically resisted by the soil/structure interaction, pile flexure, or a combination of these factors. Section 3.10.1.10 of the 2012 IDOT Bridge Manual requires performing detailed structure interaction analysis if the factored lateral loading per pile exceeds 3 kips. The analysis shall determine the actual pile moment and deflection to determine the selected pile adequacy for the existing loadings. Generalized soil parameters for the entire site, including recommended lateral soil modulus and soil strain

parameters that can be used for deep foundation analysis via the p-y curve method based on the encountered subsurface conditions, are included in **Appendix F**.

5.0 GEOTECHNICAL RETAINING WALL DESIGN RECOMMENDATIONS

This section will provide retaining wall design parameters for MSE walls below the east bridge abutment. Final recommendations for design and construction of the MSE walls will be included in a later version of this report, pending the completion of additional soil borings at those locations.

5.1 Retaining Wall Type Recommendations

It is anticipated that where the proposed alignment encroaches upon the existing embankment, this area will either be removed and replaced with the new embankment or the existing embankment will require ground improvements to support the new wall. New embankments will also be constructed for the eastern abutments. There are various types of retaining walls that could be utilized for retaining earth embankments in fill areas. This section discusses several earth retaining structures that could be used for the proposed project. Several typical wall types are described in the section below.

5.1.1 CIP Concrete Cantilever Walls

CIP concrete cantilever retaining walls are typically used in fill areas. They are constructed with a footing that extends laterally both in front of and behind the wall. They can be designed to resist horizontal loading with or without tiebacks by adjusting the foundation's geometry. The footing can also be supported on a deep foundation to minimize the settlement and resist horizontal loading. This type of wall typically requires that the area behind the wall be excavated to facilitate construction or be constructed where new fill embankments are necessary.

The advantages of a CIP wall include that it is a conventional system with well-established design procedures and performance characteristics; it is durable; and it has the ability to easily be formed, textured, or colored to meet aesthetic requirements. Disadvantages include a relatively long construction period due to undercutting, excavation, deep foundation construction, form work, steel placement, and curing of the concrete. This wall system is also sensitive to total and differential settlements.

5.1.2 Mechanically Stabilized Earth Walls

An MSE wall is typically associated with fill wall construction and consists of facing such as segmental precast units, dry block concrete, or CIP concrete facing units connected to horizontal

steel strips, bars, or geosynthetic to create a reinforced soil mass. The reinforcement is typically placed in horizontal layers between successive layers of granular backfill or light weight cellular concrete as backfill to reduce the wall loads. MSE walls can be used in cut situations as well. The additional cost of the excavations for an MSE wall is usually offset by the savings in construction costs and schedule as compared to a CIP wall on spread footings.

Advantages of the MSE wall include a relatively rapid construction schedule that does not require specialized labor or equipment, provided excavation for the reinforcement is not extensive. This type of retaining wall can accommodate relatively large total and differential settlements without significant distress to the wall system, and the reinforcement materials are light and easy to handle. Settlement of any anchor slabs, pavements or structures constructed at the top of the wall should also be considered. Facing panels can be designed for various architectural finishes.

The design of MSE walls for internal stability is the Contractor's responsibility and will need to be designed by a licensed Structural Engineer in the State of Illinois. The length of the reinforced soil mass from the outside face should be a minimum of 8 feet, but not less than 70% of the wall height. The length should be determined to satisfy eccentricity and sliding criteria and provide adequate length to prevent structural failure with respect to pullout and rupture of reinforcement. The MSE wall could be designed using a unit weight of 120 pcf and a friction angle of 34 degrees for the reinforced granular backfill soil.

5.1.3 Recommended Wall Type

Based on the existing site conditions, GSG concurs with WSP's design selection of an MSE wall for this project.

5.2 Retaining Wall Design Recommendations

The engineering analyses performed for evaluating the retaining wall options followed the current AASHTO Load and Resistance Factor Design (LRFD) Methodology, as required by IDOT. The LRFD methodology incorporates the use of load factors and resistance factors to account for uncertainty in both the applied loads and the load resistance of structural elements separately. The AASHTO LRFD Bridge Design Specifications outline load factors and combinations for various strength, extreme event, service, and fatigue limit states. Section 11, which outlines geotechnical criteria for retaining walls, of the AASHTO Specifications requires the evaluation of bearing

resistance failure, lateral sliding, and overturning at the strength limit state and excessive vertical displacement, excessive lateral displacement, and overall stability at the service limit state. The selected wall should also be evaluated with respect to the collision load. **Table 11** outlines the load factors used in evaluation of the retaining wall in accordance with AASHTO Specification Tables 3.4.1-1 and 3.4.1-2.

Table 11 - LRFD Load Factors for Retaining Wall Analyses

	Type of Load	Sliding and Eccentricity Strength	Bearing Resistance Strength I	Sliding and Eccentricity Extreme II	Bearing Resistance Extreme II	Settlement Service I
Load Factors for Vertical Loads	Dead Load of Structural Components (DC)	0.90	1.25	1.00	1.00	1.00
	Vertical Earth Pressure Load (EV)	1.00	1.35	1.00	1.00	1.00
	Earth Surcharge Load (ES)		1.50			
	Live Load Surcharge (LS)		1.75		0.50	1.00
Load Factors for Horizontal Loads	Horizontal Earth Pressure Load (EH) Active	1.50		1.00	1.00	1.00
	At-Rest		1.50			
	AEP for anchored walls		1.35			
			1.35			
	Earth Surcharge (ES)	1.50	1.50			
	Live Load Surcharge (LS)	1.75	1.75	0.50	0.50	1.00
Load Factor for Vehicular Collision				1.00	1.00	

5.2.1 Lateral Earth Pressures and Loading

The walls should be designed to withstand the effects of earth and live lateral earth pressures. The lateral earth pressures on MSE walls should be determined in accordance with AASHTO 3.11.5.8. The earth loads of retained soils behind the MSE walls can be calculated using an active earth pressure coefficient, K_a , which is determined using the Rankine Theory. **Appendix F** presents soil design properties that may be used for designing the retaining walls at the abutment for the anticipated soil type at this site. Once the final borings are completed at the locations of the MSE walls, the soil design properties will be updated.

Traffic and other surcharge loads should be included in the retaining wall design as applicable. A live load surcharge shall be applied where vehicular load is expected to act on the surface of the

backfill within a distance equal to one-half the wall height behind the back face of the wall in accordance with AASHTO 3.11.6.4. The live load surcharge may be estimated as a uniform horizontal earth pressure due to an equivalent height (H_{eq}) of soil. **Tables 12a and 12b** provide the equivalent heights of soil for vehicular loadings on retaining walls.

Table 12a - Equivalent Height of Soil for Vehicular Loading on Abutments Perpendicular to Traffic

Abutment Height (feet)	H_{eq} (feet)
5	4.0
10	3.0
≥ 20	2.0

Reference: AASHTO LRFD Table 3.11.6.4-1

Table 12b – Equivalent Height of Soil for Vehicular Loading on Retaining Walls Parallel to Traffic

Retaining Wall Height (ft)	H_{eq} Distance from Wall Back face to Edge of Traffic	
	0 feet	1.0 feet or Further
5	5.0 feet	2.0 feet
10	3.5 feet	2.0 feet
≥ 20	2.0 feet	2.0 feet

Reference: AASHTO LRFD Table 3.11.6.4-2

The retaining wall design should include drainage to allow movement of any water behind the wall and prevent the development of hydrostatic (seepage) pressures in the active soil wedge behind the wall. It is assumed that the soil behind the wall will be free-flowing.

Heavy compaction equipment should not be allowed to be positioned closer than five (5) feet to the retaining wall to prevent inducing high lateral earth pressures and causing wall yielding and/or other damage. The passive lateral earth pressure coefficient (K_p) from the upper 3.5 feet of level backfill at the toe of the wall should be neglected, unless the soil is confined or protected by a concrete slab or well drained pavement. The passive lateral earth pressure coefficient from the upper 3.5 feet of soil for a descending slope at the wall toe should also be neglected, regardless of any surface protection.

5.3 Bearing Resistance

Bearing resistance for the retaining walls founded on a granular fill leveling slab shall be evaluated at the strength limit state using load factors (see **Table 11**), and factored bearing resistances. The

bearing resistance factor, ϕ_b , for an MSE wall is 0.65 per AASHTO Table 11.5.7-1. The bearing resistance shall be checked for the extreme event limit state with a resistance factor of 1.0.

Tables 13a and 13b present the proposed bearing elevations and recommended bearing resistances of suitable materials to support the wall systems.

Table 13a – Recommended Bearing Resistance East Abutment Wall

Soil Borings	Approx. Station Limits	Approximate Bearing Elevation (feet)	Nominal Resistance (ksf)	Factored Bearing Resistance (ksf)	Bearing Resistance for 1-inch Settlement Service Limit (ksf)	Bearing Resistance for 2-inch Settlement Service Limit (ksf)	Anticipated Bearing Soil
BSB-29	59+64.7 to 59+65.4	548.9 to 544.5	46.1	30.0	5.1	9.1	Granular Engineered Fill over Native Very Dense Gravel
BSB-30	59+65.4 to 59+92.7	539.9	40.8	26.5	8.5	15.5	Granular Engineered Fill over Native Very Dense Sand
BSB-31	59+92.7 to 60+19.4	551.5 to 539.9			8.2	14.9	Granular Engineered Fill over Native Extremely Dense Gravel

Table 13b – Recommended Bearing Resistance West Abutment Wall

Soil Borings	Approx. Station Limits	Approximate Bearing Elevation (feet)	Nominal Resistance (ksf)	Factored Bearing Resistance (ksf)	Bearing Resistance for 1-inch Settlement Service Limit (ksf)	Bearing Resistance for 2-inch Settlement Service Limit (ksf)	Anticipated Bearing Soil
BSB-01	37+51.0 to 37+89.1	576.8 to 566.5	41.4	26.9	4.8	8.5	Granular Engineered Fill over Weathered Limestone
BSB-02	37+89.1 to 38+41.4	566.5			8.2	14.8	Granular Engineered Fill over Very Dense Sand
BSB-03	38+41.4 to 38+55.5	579.8 to 566.5			4.2	7.4	Granular Engineered Fill over Very Dense Gravel

The minimum depth of the leveling pad should be 3.5 feet below the final exterior grade to alleviate the effects of frost. A MSE reinforcement width of 1.1H (34 feet) and 1.2H (36 feet) was used for the west and east abutment bearing and settlement calculations, respectively, based on the results of the slope stability analysis discussed in **Section 4.5**.

5.3.1 Subgrade Undercut Areas

The subgrade soils at bearing grade should be evaluated in accordance with the guidelines provided in Section 8.9 of the IDOT Geotechnical Manual (2020) for suitability/workability before placing any portion of the proposed structures. According to Section 540 of the IDOT SSRBC (2022), a minimum of 6 inches of porous granular material should be provided as bedding material, serving as a working platform.

GSG recommends undercutting any existing silty clay fill soils along the wall alignment, as well as low-strength native clay and low-density granular soils. With the exception of the area of BSB-01, which was drilled at a higher elevation, undercuts to depths of up to 6.0 feet below existing site grades may be anticipated to reach the medium dense to extremely dense native sand and gravel. The undercut depth should be verified in the field during construction and backfilled with compacted granular engineered fill to support the proposed retaining wall. Anticipated undercut depths are presented in **Tables 14a and 14b**.

Table 14a – Recommended Undercuts East Abutment Wall

Soil Borings	Station Limits	Undercut Depth Below <u>Existing</u> <u>Grade</u> (Elevation, feet)	Approximate Bearing Elevation (feet)*	Comments
BSB-29	59+64.7 to 59+65.4	4.0 (517.6)	548.9 to 544.5	Existing unsuitable silty clay fill
BSB-30	59+65.4 to 59+92.7	3.5 (518.3)	539.9	Existing unsuitable fill Trace organics
BSB-31	59+92.7 to 60+19.4	6.0 (517.3)	551.5 to 539.9	Existing unsuitable fill Low strength 1.5 tsf

* Assumed bearing elevation at about El. 551.5 to El. 539.9 feet based on the GPE drawings

Table 14b – Recommended Undercuts West Abutment Wall

Soil Borings	Station Limits	Undercut Depth Below <u>Existing</u> <u>Grade</u> (Elevation, feet)	Approximate Bearing Elevation (feet)*	Comments
BSB-01	37+51.0 to 37+89.1	21.3** (545.2)	576.8 to 566.5	Existing unsuitable silty clay fill and native silty clay Low strength <1.5 tsf at several depths
BSB-02	37+89.1 to 38+41.4	5.5 (542.5)	566.5	Existing low-strength silty clay <1.5 tsf, loose sand
BSB-03	38+41.4 to 38+55.5	3.0 (545.5)	579.8 to 566.5	Existing low density sand fill

* Assumed bearing elevation at about El. 579.8 to El. 566.5 feet based on the GPE drawings

**BSB-01 was drilled atop the existing bridge. It is assumed that much of this earthwork/soil removal will be part of the bridge demolition.

Settlement generally depends on the foundation size and bearing resistance, as well as the strength and compressibility characteristics of the underlying bearing soil.

Undercut areas should be replaced with structural fill in accordance with IDOT Standard Specifications for Road and Bridge Construction. The lateral limit of the structural fill should extend a minimum of 1 foot beyond the edge of the MSE wall leveling pad, then an additional 1 foot laterally for every 2 feet of structural fill depth, as depicted in **Exhibit 3**. The structural fill should be placed and compacted to a minimum of 95% of the maximum dry density, as determined by AASHTO T-180: Standard Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures (ASTM D1557) in accordance with IDOT standard construction requirements.

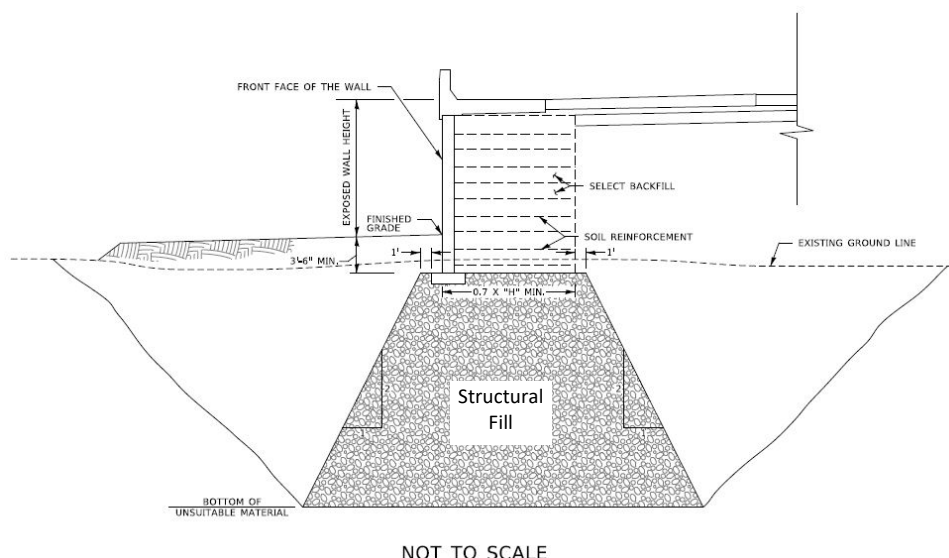


Exhibit 3 - Structural Fill Placement below MSE Wall

5.4 Sliding and Overturning Stability

The wall base width should be sufficient to resist sliding. The frictional resistance shall include the friction between granular backfill for the wall and supportive cohesive or granular soils, and the friction between the wall foundation and bearing soils.

The factored resistance against sliding should be calculated using equation 10.6.3.4-1 in the AASHTO LRFD manual. A sliding resistance factor, ϕ , of 1.0 (Table 11.5.7-1) shall be applied to the nominal sliding resistance of soil on soil beneath the MSE walls. A maximum nominal frictional coefficient of 0.53 ($\tan 28$ degrees) could be used for determining the sliding resistance for the soil-to-soil infill interfaces. The width of the MSE wall (length of reinforcing) must be wide enough to resist overturning forces. The location of the resultant of the forces shall be within the middle two-thirds of the MSE base width.

5.5 Wall Settlement

Settlement of the MSE walls depends on the wall widths and bearing pressures, as well as the strength and compressibility characteristics of the underlying bearing soils. Assuming the embankments have been constructed as recommended in *Section 3.3.1*, settlement of the MSE walls could be on the order of 2 to 4 inches, based on the anticipated settlement of the proposed embankment. Differential settlement between two points 100 feet apart along the length of the

walls could be 1 to 2 inches due to the nonuniform soil conditions and the varied embankment height. AASHTO 11.10.4.1 provides guidelines regarding the maximum total and differential tolerable settlements for various facing of MSE walls. The allowable settlement of MSE walls shall be established based on the longitudinal deformability of the facing. It is recommended to provide vertical, full-height slip joints if large differential settlements are anticipated over short horizontal distances.

If these estimated settlements are considered to be too large to accommodate in design, the MSE walls may have to be constructed in stages so as to preload the embankment area, or the subgrade will need to be improved.

5.6 Overall Stability

The retaining walls should be designed to ensure both external stability of the wall system and internal stability behind the wall facing. The following parameters were used to evaluate the overall stability of the walls. Based on the design of the embankments, it is anticipated that large rock will be used as fill immediately below the MSE walls; a concrete slope wall will be constructed on the final slopes below the wall.

Table 15a – MSE Retaining Wall Description East Abutment

Maximum height of the retaining wall (H*)	29.3 feet
Assumed length of reinforcement 0.7xH	21 feet
Recommended length of reinforcement to reach FoS of 1.5	1.2H = 36 feet
Unit weight of the retained soil (embankment)	125 pcf
Unit weight of MSE wall backfill	120 pcf
Assumed elevation of new rock fill below MSE wall	El. 522 feet
Slope below MSE wall	1V:2H concrete slopewall

*H extends from top of the leveling pad to bridge deck

Table 15b – MSE Retaining Wall Description West Abutment

Maximum height of the retaining wall (H*)	30.8 feet
Assumed length of reinforcement 0.7xH	22 feet
Recommended length of reinforcement to reach FoS of 1.5	1.1H = 34 feet
Unit weight of the retained soil (embankment)	125 pcf
Unit weight of MSE wall backfill	120 pcf
Assumed elevation of new rock fill below MSE wall	El. 555 feet
Slope below MSE wall	1V:2H concrete slopewall

*H extends from top of the leveling pad to bridge deck

The actual wall width and total height of the walls should be based on structural analysis performed by a Licensed Structural Engineer in the State of Illinois.

5.7 Slope Stability Results

The Slide2 program was used to evaluate the global slope stability of the proposed east and west abutment MSE walls based on the limit equilibrium method. The proposed wall systems were analyzed based on the MSE wall drawings and the soils encountered at the site. Circular failure analyses were evaluated using the simplified Bishop analysis method for the proposed wall and slope geometries.

Circular failure analyses were evaluated for both short-term (undrained) and long-term (drained) conditions based on the proposed geometry for the retaining wall. The analyses were performed at the sections of the assumed maximum wall heights for each proposed abutment. The results of the analyses are shown in **Table 16**.

Table 16 – Stability Analyses Results

Cross Section	Soil Profile	Failure Type	Factor of Safety	Required Minimum Factor of Safety
East Abutment 0.7H	Borings BSB-29, BSB-30, BSB-31	Circular – Short Term	1.3	1.5
		Circular – Long Term	1.2	1.5
East Abutment 1.2H		Circular – Short Term	1.6	1.5
		Circular – Long Term	1.5	1.5
West Abutment 0.7H	Borings BSB-01, BSB-02, BSB-03	Circular – Short Term	1.3	1.5
		Circular – Long Term	1.3	1.5
West Abutment 1.1H		Circular – Short Term	1.5	1.5
		Circular – Long Term	1.5	1.5

Based on the analyses performed, the proposed retaining walls do not meet the minimum factor of safety of 1.5 using a reinforcement length of 0.7H. The west abutment wall meets the factor of safety of 1.5 using a minimum reinforcement length of 1.1H. The east abutment wall meets the factor of safety of 1.5 using a minimum reinforcement length of 1.2H. Copies of the Slope Stability analyses exhibits are included in **Appendix G**.

6.0 CONSTRUCTION CONSIDERATIONS

All work performed for the proposed project should conform to the requirements in the IDOT Standard Specifications for Road and Bridge Construction (2022). Any deviation from the requirements in the manuals above should be approved by the design engineer.

6.1 Existing Utilities and Structures and Site Preparation

Based on the existing site conditions, significant utilities are known to exist along the project corridor and within the vicinity of several of the proposed foundations. Before proceeding with construction, all existing underground utility lines or structures that will interfere with construction should be completely relocated from the proposed construction areas. Where possible, existing utility lines that are to be abandoned in place should be removed and/or plugged with a minimum of 2 feet of cement grout.

There are also significant commercial structures and residences in the vicinity of the proposed new bridge foundations. These structures should be demolished, and all foundations/slabs/utilities removed where they will interfere with new construction.

All excavations resulting from underground utilities or structure removal activities should be cleaned of loose and disturbed materials, including all previously placed backfill, and backfilled with suitable fill materials in accordance with the requirements of this section. During clearing and stripping operations, positive surface drainage should be maintained to prevent water accumulation.

There are significant amounts of trees and heavy vegetation along the shorelines of the Des Plaines River and within the existing residential neighborhood. The trees and vegetation should be removed, and their root systems should be grubbed where they may interfere with new construction along the alignment.

6.2 Site Excavation

If borrow material is to be used for onsite construction, it should conform to Section 204 "Borrow and Furnished Excavation" of the IDOT Construction Manual (2021). The fill material should be free of organic matter and debris. Earth-moving operations should be avoided during excessively

cold or wet weather to avoid freezing or softening subgrade soils.

Structural fill shall consist of crushed limestone or recycled concrete consistent with IDOT CA-6 gradation or medium plasticity silty clays. Structural fill should be placed in lifts not to exceed 8 inches in loose thickness and compacted to a minimum of 95% of the material's standard proctor maximum dry density obtained according to the ASTM D698/AASHTO T 99 method. Once the additional borings are completed within the existing embankments for the abutments, the existing soils can be evaluated for potential reuse or removal.

Materials unsatisfactory for use as structural fill include soils classified as silt or organic silt (ML, MH, PT, OL, and OH) in the Unified Classification System (ASTM D2487). Soils with these classifications may be used for general purpose landscaping and in areas where uncontrolled settlement is acceptable.

Should fill be placed during cool, wet seasons, the use of granular fill may be necessary since weather conditions will make compaction of cohesive soils more difficult. If water seepage occurs during excavating and backfilling procedures, or when wet conditions are encountered that prevent the removal of water with conventional sump and pump procedures, GSG recommends placing open-grade stone, similar to IDOT CA-7, to stabilize the bottom of the excavation. The CA-7 stone should be placed 12 inches above the water level in 12-inch lifts and compacted using a heavy, smooth drum roller or a heavy vibratory plate compactor until it is stable. The remaining portion of the excavation should be backfilled using approved engineered fill.

GSG recommends that foundation excavations, subgrade preparation, and structural fill placement and compaction be inspected by a GSG geotechnical engineer to verify the type and strength of soil materials present at the site and their conformance with the geotechnical recommendations in this report.

6.3 Groundwater Management

The Des Plaines River elevation is anticipated to be influenced by seasonal rainfall or melting snow. A 10-year storm is anticipated to result in a river rise of about 6 inches. GSG anticipates that groundwater and river elevations will be an issue during construction activities due to the

extent of the proposed improvements and the anticipated timeframe for excavation construction. It is understood that float-in coffer cells, sealed to the drilled shafts, will be used for the construction of the piers within the Des Plaines River.

Based on the observed groundwater levels and water level of Des Plaines River (about El. 539 feet), it is anticipated that the long-term groundwater level is near the top of bedrock at elevations of 525.5 to 543.5 feet at the west shore area and 501.5 to 516.6 feet at the east shore area. Perched water is also likely to be present within the existing fill materials. If rainwater runoff or groundwater accumulates at the base of excavations, the contractor should remove the accumulated water using conventional sump pit and pump procedures and maintain a dry and stable excavation. The location of the sump should be determined by the contractor based on field conditions. During earthmoving activities at the site, grading should be performed to ensure that drainage is maintained throughout the construction period. Water should not be allowed to accumulate in the foundation area either during or after construction. Undercut and excavated areas should be sloped toward one corner to facilitate the removal of any collected rainwater or surface run-off. Grades should be sloped away from the excavations to minimize runoff from entering.

If water seepage occurs during excavations or where wet conditions are encountered such that the water cannot be removed with conventional sumping, we recommend placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation below the water table. The CA-7 stone should be placed 12 inches above the water table, in 12-inch lifts, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable. The remaining portion of the excavation beneath the footings should be backfilled using approved structural fill.

6.4 Drilled Shafts Construction

Any drilled shaft construction should be completed in accordance with Section 516, Drilled Shafts, in the IDOT SSRBC (2022). One concern for caisson construction is that the very soft to medium-stiff clay and silty clay fill with high water content could squeeze into the caisson shafts. This material was encountered at depths ranging from 0 to 6.5 feet below existing grade (El. 538 to 509.4 feet) at Pier locations 1, 3, 4, and 5. If necessary, installing a temporary steel casing with a permanent corrugated liner casing will help to maintain the sides of the caisson excavations

through the very soft to medium stiff silty clay observed above the bedrock. It is anticipated that a permanent steel casing will be used for Piers 3 and 4. The bottom of the casing should be set at a minimum of 2 feet into the underlying sand and gravel. The outer space between the permanent and temporary casing should be grouted using lean cement grout. The casing will prevent caving of the granular fill materials and the squeezing of the soft clay soils into the caissons and help to control water infiltration.

6.5 Pile Installation

Based on the variance in top-of-rock elevations, particularly on each side of the river (between approximately 544.7 feet and 498.4 feet), it is recommended that test piles be used at the site. The test piles are installed based on the preliminary driving criteria in order to evaluate site conditions and are inspected in accordance with the IDOT Standard for Road and Bridge Construction. All test pile installation should be completed by the IDOT SSRBC Section 512.15.

6.6 Temporary Earth Structures

During construction of the abutments and associated MSE walls, fill may need to be removed and replaced. It is anticipated that a soil retention system may then be necessary before construction of the new embankments and east and west abutments. It is also expected that a TSRS system will be required for the excavation and construction of a new crash wall at Pier 1.

Based on the soil profile and the Temporary Sheet Pile Design Chart, a temporary sheet pile system is not feasible for the east and west abutments due to the presence of very dense granular soils and shallow bedrock, and a temporary soil retention system (TSRS) will be required. Temporary MSE walls may also be considered for temporary soil retention in areas with large fills near embankments and abutments.

The Temporary Soil Retention System shall be designed by an Illinois-licensed structural engineer in accordance with the IDOT Bridge Design Manual. The design of the Temporary Soil Retention System is the responsibility of the contractor. The contractor should submit the TSRS plans to the structural design team for review before commencing construction of the TSRS.

6.7 Cofferdam Recommendations

The GPE plan indicates the EWSE of the Des Plaines River is 538.22 feet. The IDOT Bridge Manual indicates that a cofferdam Type 1 is typically required where there is 6 feet or less between the Estimated Water Surface Elevation (EWSE) and the bottom of the excavation; Type 2 is required when the EWSE is greater than 6 feet from the bottom of the excavation. Cofferdam cells may also be considered for constructing the bridge piers. The EWSE should be adjusted for April, typically a high month for water surface levels. Pier 3 and Pier 4 are preliminarily anticipated to have rock-socketed drilled shafts that extend to about 20 feet below top-of-rock. In this scenario, the bottoms of the drilled shafts are expected to be about El. 491.1 to 487.8 feet. For the construction of Piers 3 and 4, Type 2 cofferdams may be utilized based on the pier locations and assumed bearing elevations. The type of cofferdam should be specified in the plans. This system may be constructed with the use of sheet piles or other systems as approved by the Bureau of Bridges and Structures and should be designed by a Structural Engineer licensed in the State of Illinois.

7.0 LIMITATIONS

This report has been prepared for the exclusive use of the Illinois Department of Transportation (IDOT) and its Design Section Engineer consultant. The recommendations provided in the report are specific to the project described herein and are based on the information obtained at the soil boring locations within the proposed bridge area. The geotechnical analyses have been performed, and the recommendations provided in this report are based on subsurface conditions determined at the location of the borings. This report may not reflect all variations that may occur between boring locations or at some other time, the nature and extent of which may not become evident until the time of construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and review the recommendations presented herein.

APPENDIX A
GENERAL PLAN & ELEVATION

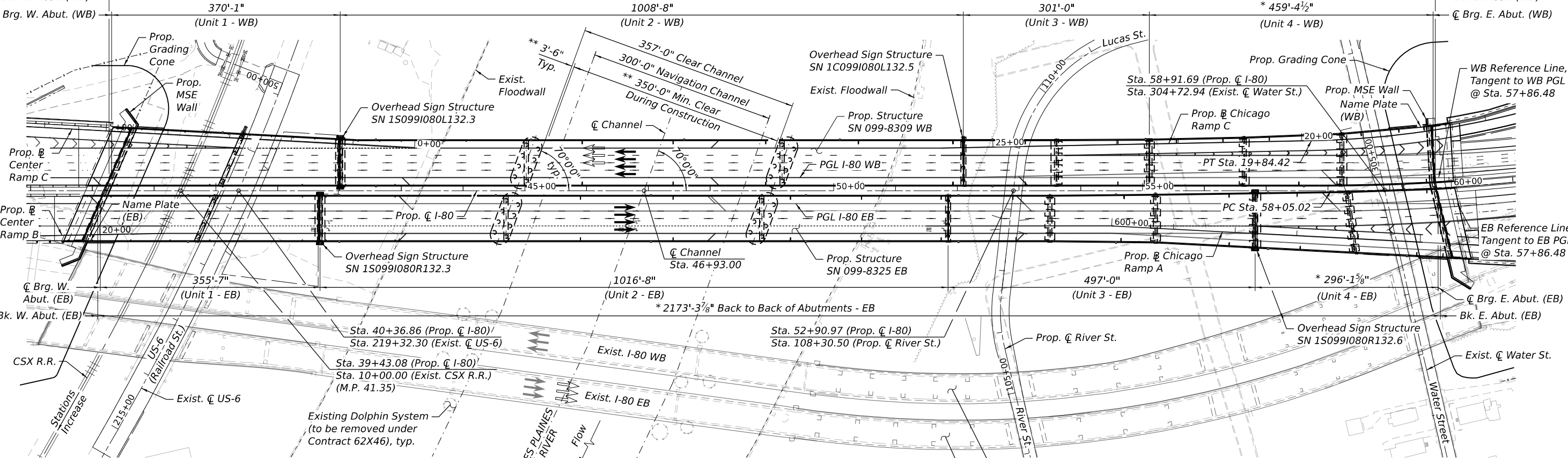
Benchmark: Magnetic nail in pavement, C/I-80 Sta. 38+10.02, Offset 504.24' Rt., Elev. 538.845.

Existing Structure: S.N. 099-0056 (EB) and S.N. 099-0057 (WB) were built in 1964 under Federal Aid Interstate Route 80 Project I-80-4(13)133 Section 99-3B, I-80-4(56)133 Section 99-3 F&E, I-UI-80-4(57)133 Section 99-3P, and I-UI-80-4(57)133 Section 99-3D. The existing 27-span structures have total lengths of approximately 2,362'-6" (EB) and 2,300'-0" (WB). S.N. 099 0056 (EB) has an out to out width varying from 60'-0" to 48'-0" from the west abutment to span 6, and varying from 46'-7½" to 49'-6" from the truss span to the east abutment. S.N. 099-0057 (WB) has an out to out width varying from 74'-0" to 48'-0" from the west abutment to span 6, and varying from 46'-7½" to 65'-6" from the truss to the east abutment. The existing superstructures consist of a 3-span continuous, cantilever through truss over the Des Plaines River (Spans 7 through 9) and simple and continuous approach spans with steel beams and variable thickness deck (6 1/4" min.) and concrete overlay. The existing substructures consists of concrete abutments and multi-column or two column piers. Existing abutments are supported on steel piles and the piers are supported on spread footings. The existing structure is to be partially demolished where in conflict with the proposed structure in this contract and the remainder in a separate contract.

Traffic Control: The proposed dual structures will be built while traffic remains open on the existing structures. Shift WB Stage II traffic onto the proposed WB structure in order to complete the proposed EB structure.

No salvage. Existing bridge to be removed under separate contract, except for portions shown along the east and west spans.

Bk. W. Abut. (WB) * 2146'-8½" Back to Back of Abutments - WB



WATERWAY INFORMATION

Drainage Area = 1397.0 Sq. Mi. Existing Overtopping Elev. = 589.57 @ Sta. 676+39 Prop. Overtopping Elev. = 595.33 @ Sta. 50+82.59									
Flood	Freq. Yr.	Q C.F.S.	Opening Ft²		Nat. H.W.E.	Head - Ft.		Headwater El.	
			Exist.	Prop.		Exist.	Prop.	Exist.	Prop.
10	9600	11867	12423	538.71	0.01	0.01	538.72	538.72	538.72
Design	50	15600	12369	12922	539.53	0.01	0.01	539.54	539.54
Base	100	31100	12978	13527	540.50	0.05	0.02	540.55	540.52
Overtopping	>500								
Max. Calc.	500	35500	13001	13551	540.53	0.06	0.02	540.59	540.55

10-Yr. velocity through existing structure = 0.8 fps
10-Yr. velocity through proposed structure = 0.7 fps
All time H.W.E. & Date = 542 ft HA 89

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.)				Item 113
	Pier 3WB	Pier 3EB	Pier 4WB	Pier 4EB	
Q100	510.7	509.2	510.8	509.4	5
Q200	510.7	509.2	510.8	509.4	
Design	510.7	509.2	510.8	509.4	
Check	510.7	509.2	510.8	509.4	

The scour elevations shown in this table correspond to estimated top of rock elevation.

PLAN

DESIGN STRESSES

FIELD UNITS

f' = 3,500 psi
f'c = 4,000 psi (Superstructure)
f'c = 5,000 psi (Pier 3 & 4 Drilled Shaft)
f'c = 60,000 psi (Reinforcement)
f' = 50,000 psi (M270 Grade 50, Units 3 & 4)
f' = 50,000 psi (M270 Grade 50W, Units 1 & 2)
f' = 70,000 psi (M270 Grade HPS 70W, Unit 2 Flanges Over Piers 3 & 4 only)

PRECAST PRESTRESSED UNITS

f'c = 8,500 psi
f'ci = 6,500 psi
fpu = 270,000 psi (0.6"Ø Low Relaxation Strands)
fpbt = 202,500 psi (0.6"Ø Low Relaxation Strands)

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

SEISMIC DATA

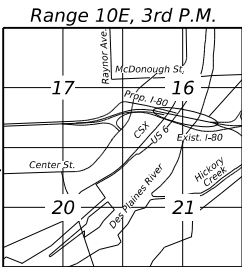
Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.095g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.167g
Soil Site Class = D
Operational Classification = Critical

LEGEND:

- Stage I Traffic: Proposed WB Construction and Partial EB Construction
- Stage II Traffic: Completion of Proposed EB Construction
- Proposed Traffic
- * Dimension Measured Along Local Reference Line in Unit 4.
- ** Subject to USCG Approval.

NOTES:

- See sheet S-2 & S-3 for General Plan & Elevations.
- See sheet S-4 for Index of Sheets.



LOCATION SKETCH

KEY PLAN

I-80 OVER CSX, US-6 (RAILROAD ST.),

DES PLAINES RIVER (PUBLIC WATER),

RIVER ST. & WATER ST.

F.A.I. RTE. 80 - FAI 80 21 STRUCTURE 2

WILL COUNTY

STA. 46+93.00

STRUCTURE NO. 099-8309 WB

STRUCTURE NO. 099-8325 EB

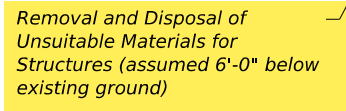
XX/XX/2025

Patrick J. Laux, P.E., S.E.
State of Illinois Lic. No. 081-007655
License Expires 11-30-2026.
This stamp applies to sheets S-1 thru S-333

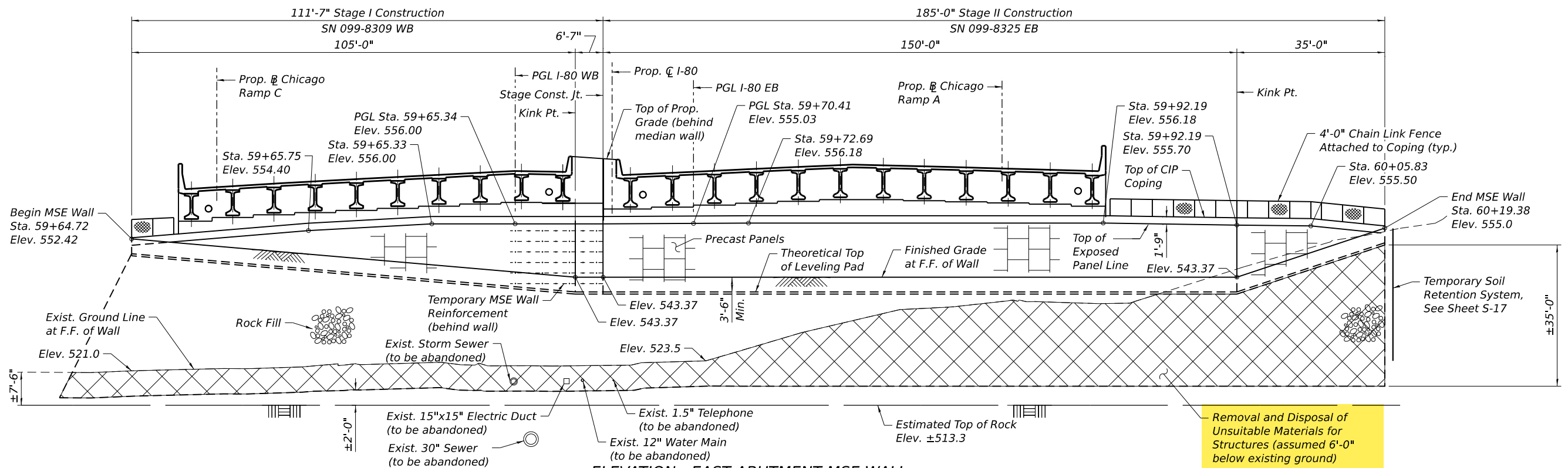
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET S-1 OF S-333 SHEETS

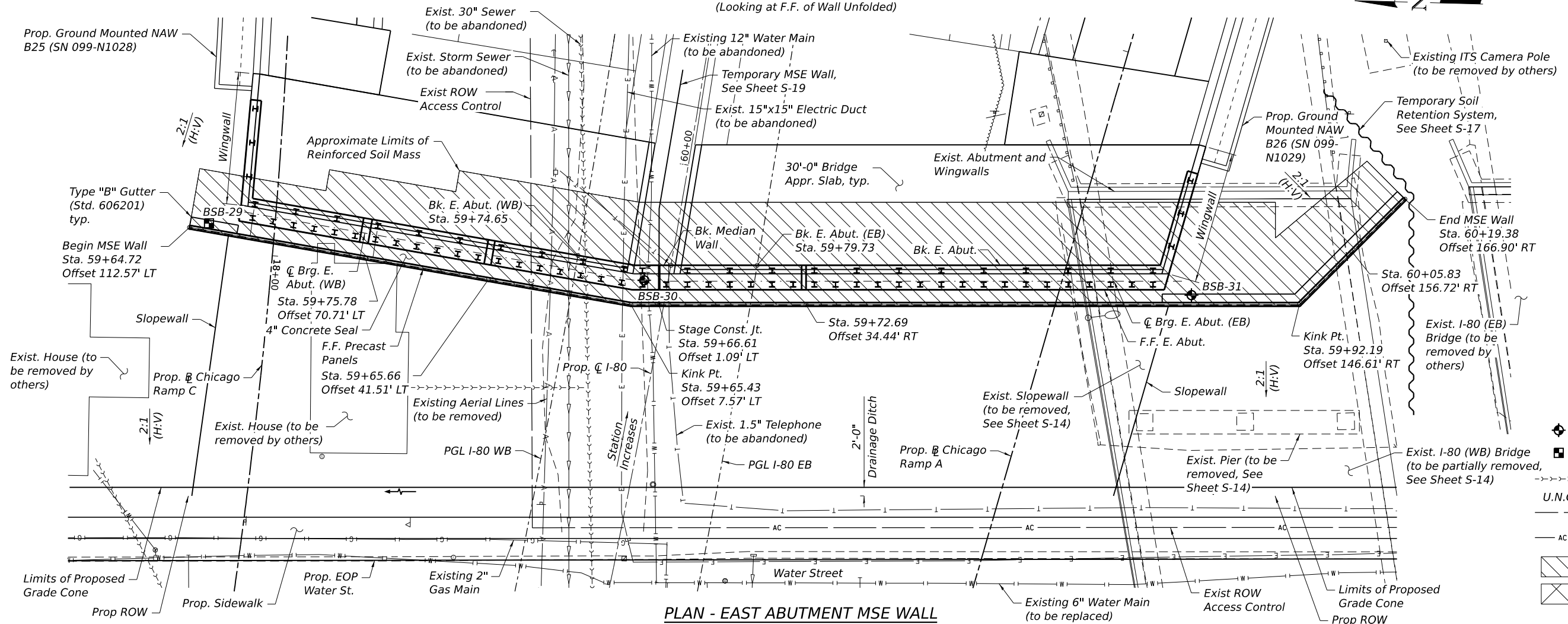
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
I-80	FAI 80 21 STRUCTURE 2	WILL	1077	1
CONTRACT NO. 62R23				
ILLINOIS FED. AID PROJECT				



- | | |
|---|---|
|  | <i>Indicates Boring Location</i> |
|  | <i>Indicates Future Boring Location</i> |
|  | <i>Existing Sewer</i> |
| <i>U.N.O.</i> | <i>Unless Noted Otherwise</i> |
|  | <i>Existing ROW</i> |
|  | <i>Existing ROW for Access Control</i> |
|  | <i>Approximate Limits of Reinforced Soil Mass</i> |
|  | <i>Approximate Limits of Exist. Fill Removal</i> |



ELEVATION - EAST ABUTMENT MSE WALL
(Looking at F.F. of Wall Unfolded)



PLAN - EAST ABUTMENT MSE WALL

LEGEND

- Indicates Boring Location
- Indicates Future Boring Location
- Existing Sewer
- Unless Noted Otherwise
- Existing ROW
- Existing ROW for Access Control
- Approximate Limits of Reinforced Soil Mass
- Approximate Limits of Exist. Fill Removal

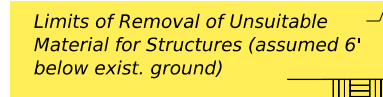
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

EAST ABUTMENT MSE WALL PLAN AND ELEVATION
STRUCTURE NUMBER 099-8309 WB AND 099-8325 EB

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
I-80	FAI 80 21 STRUCTURE 2	WILL	1077	312
CONTRACT NO. 62R23				
ILLINOIS FED. AID PROJECT				

SHEET S-312 OF S-333 SHEETS

USER NAME = USSJ696614	DESIGNED - PSK	REVISED -
CHECKED - PSK	REVISED -	
PLOT SCALE = 26.667' / in.	DRAWN - PP	REVISED -
PLOT DATE = 6/30/2025	CHECKED - PJL	REVISED -



Eye Bolt, See Abutment for details

2'-0" Min.

2%

1" P.J.F.

CIP Coping

USER NAME = USJ696614	DESIGNED - PP	REVISED -
	CHECKED - PJL	REVISED -
PLOT SCALE = 8,000" = 1 in.	DRAWN - PP	REVISED -
PLOT DATE = 6/30/2025	CHECKED - PJL	REVISED -



Item	Unit	Quantity
Removal and Disposal of Unsuitable Material for Structures	Cu Yd	390
Mechanically Stabilized Earth Retaining Wall	Sq Ft	1,170
Chain Link Fence, 4' Attached to Structure	Foot	10
Rock Fill	Cu Yd	3,443

Item	Unit	Quantity
Removal and Disposal of Unsuitable Material for Structures	Cu Yd	3,387
Mechanically Stabilized Earth Retaining Wall	Sq Ft	2,867
Chain Link Fence, 4' Attached to Structure	Foot	70
Rock Fill	Cu Yd	4,581

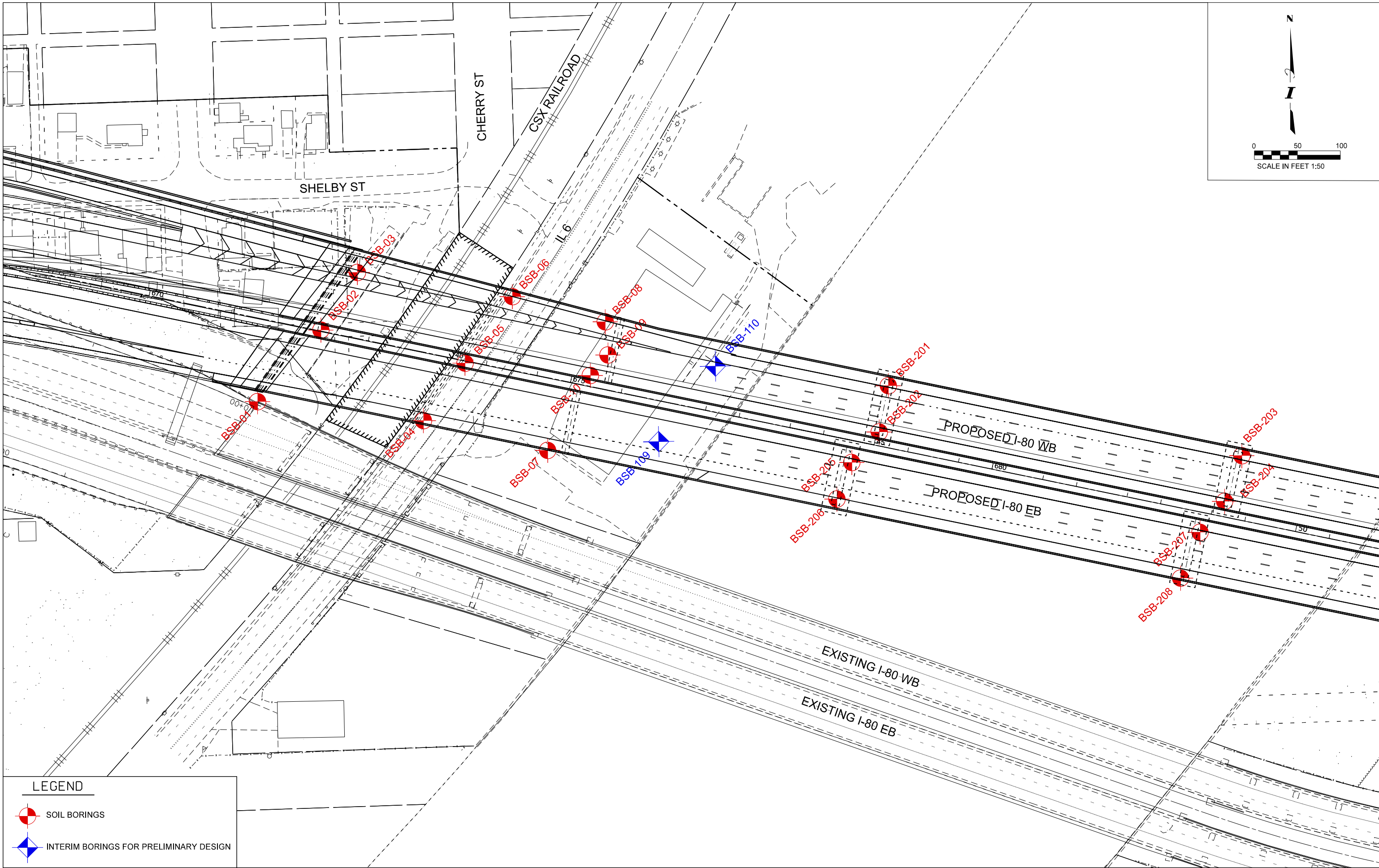
NOTES:

1. *Bottom of abutment cap shall be poured against the top of plywood cap. Cut opening to match pile cap perimeter within 1/8". Support with bars tack welded to webs rated for 500 lbs. Seal gaps to keep concrete out.*
2. *The M.S.E. wall supplier shall design the abutment soil reinforcement to resist a horizontal forces of 7.62 kips/ft. of abutment.*
3. *Reinforcing for Cast in Place Coping shown for information only, cost included with Mechanically Stabilized Earth Retaining Wall.*

APPENDIX B

SOIL BORING LOCATION PLAN AND SUBSURFACE PROFILES

FILE NAME: Z:\Projects\Illinois DOT\WSP-198-003\Geotechnical\Bridges\Des Plaines River\WB&EB-Bridge - PL-01.dgn
PEN TABLE: Z:\cadd\clients\dot\CONNECT\Configuration\Organization\Civil\DOT_Standards\Pen Tables\GSG-Color-IL Tollway.tbl
TUP DATE: 12/9/2025
SHEET SIZE: 17x11 (in.)
PLOT SCALE: 100.0000' / in.
USER NAME: \$USER\$



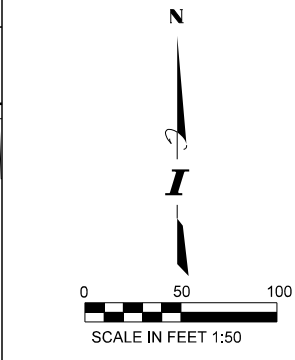
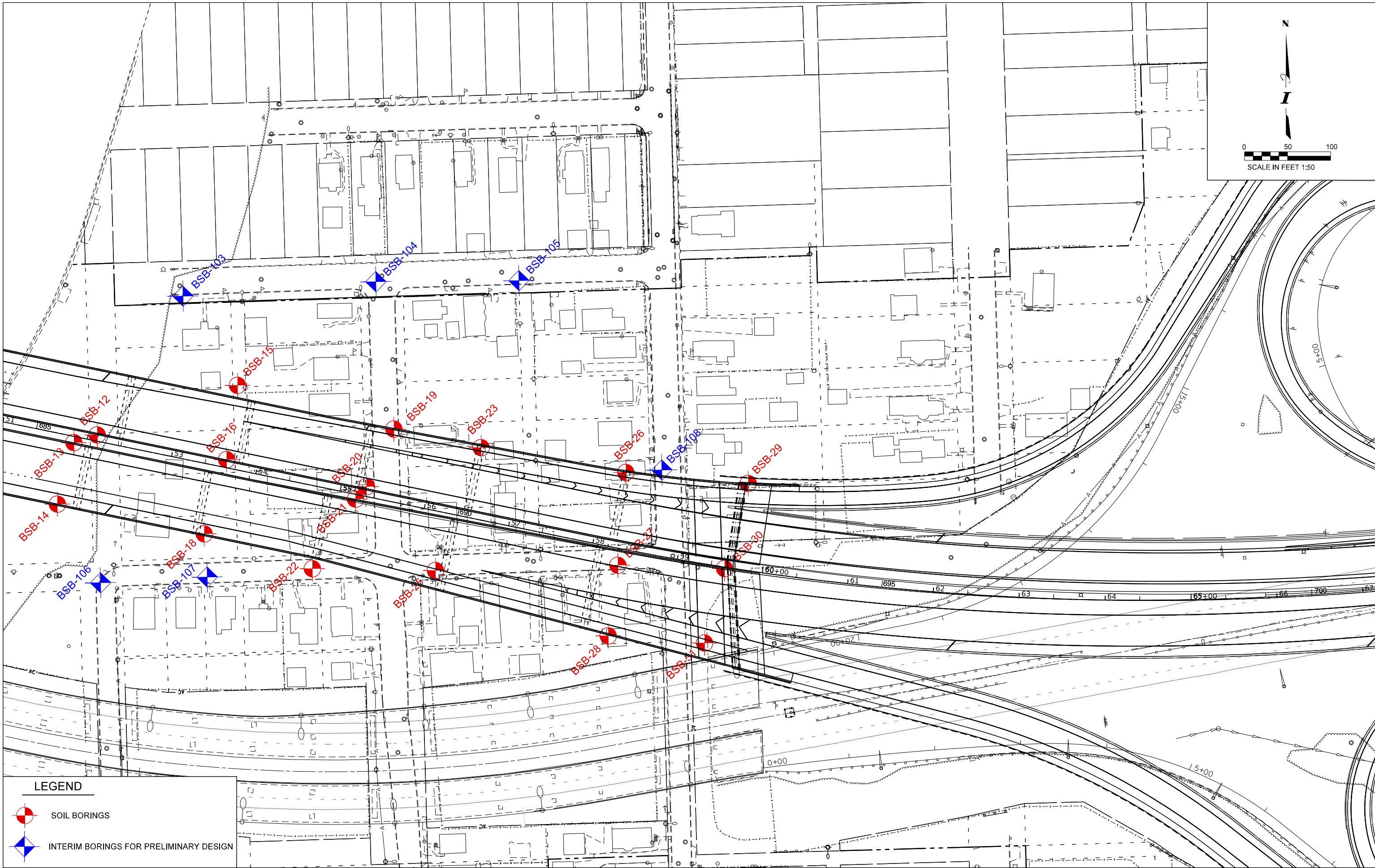
LEGEND

SOIL BORINGS

INTERIM BORINGS FOR PRELIMINARY DESIGN

 GSG CONSULTANTS, INC. 735 E. REMINGTON RD. SCHAUMBURG, IL 60173 TEL: +1630.994.2600 WWW.GSG-CONSULTANTS.COM	USER NAME = \$USER\$	DESIGNED - RM	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION										DES PLAINES RIVER BRIDGE		F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
	SHEET SIZE = 17x11 (in.)	DRAWN - NN											SOIL BORING LOCATION PLAN				WILL	9	1
	PLOT SCALE = 100.0000' / in.	CHECKED - DE	JOLIET, ILLINOIS		CONTRACT NO. PTB 198-003														
	PLOT DATE = 12/9/2025	DATE - 03/15/2023	SCALE: 1:50		SHEET 1	OF 2 SHEETS	STA.	TO STA.	ILLINOIS FED. AID PROJECT										

FILE NAME: Z:\Projects\Illinois DOT\NSP-198-003\Geotechnical\Bridges\Des Plaines River\MB&EB\Kibrits\ODNs\Des Plaines River\MB&EB - Bridge - PL-02.dgn
PEN TABLE: Z:\cadd\clients\dot\CONNECT\Configuration\Organization\Civil\DOT_Standards\Pen Tables\GSG-Color-IL Tollway.tbl
PLOT DATE: 12/8/2025
SHEET SIZE: 17x11 (in.)
PLOT SCALE: 100.0000' / 1 in.
USER NAME: JUSER\$



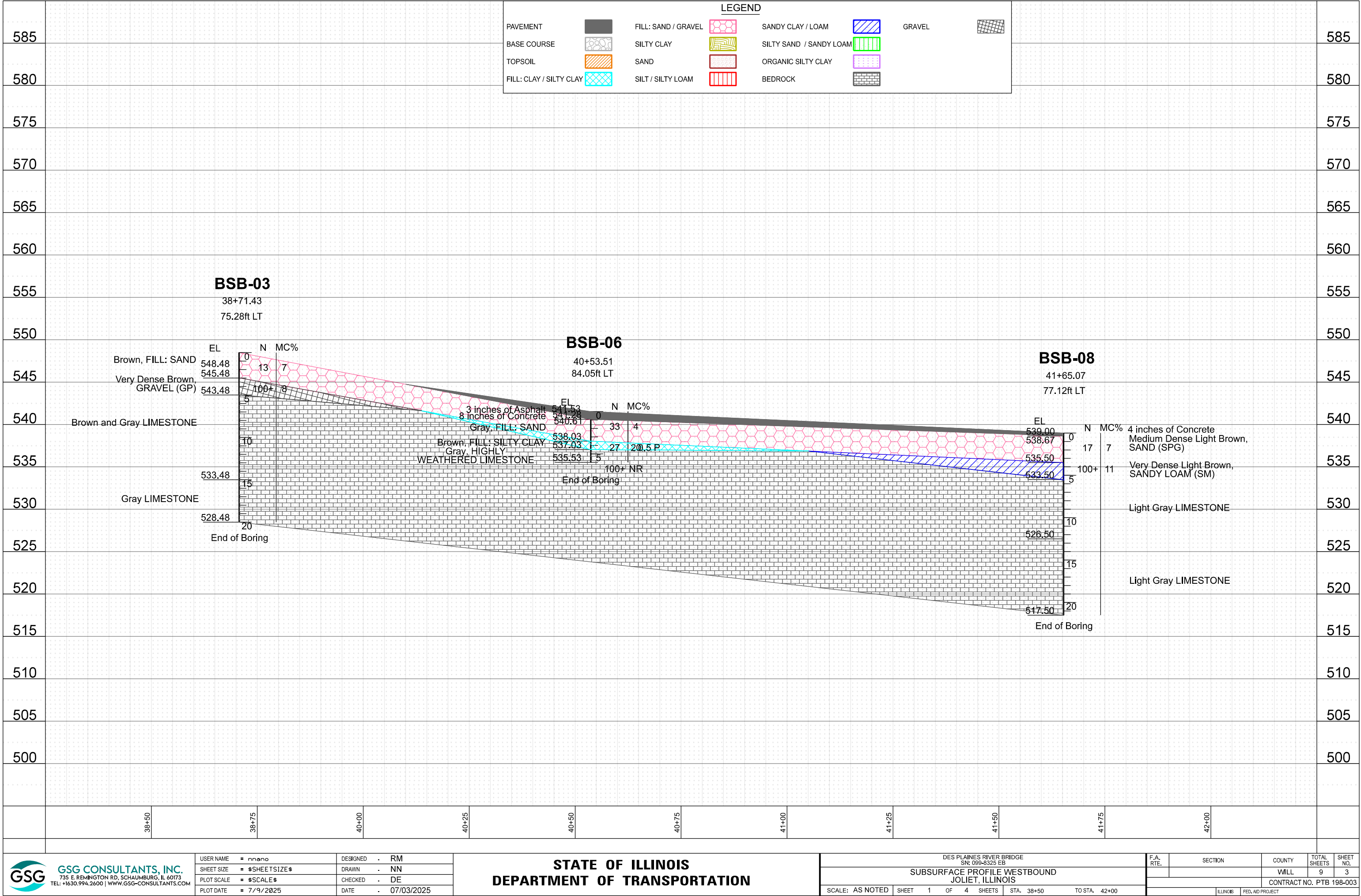
LEGEND

 SOIL BORINGS

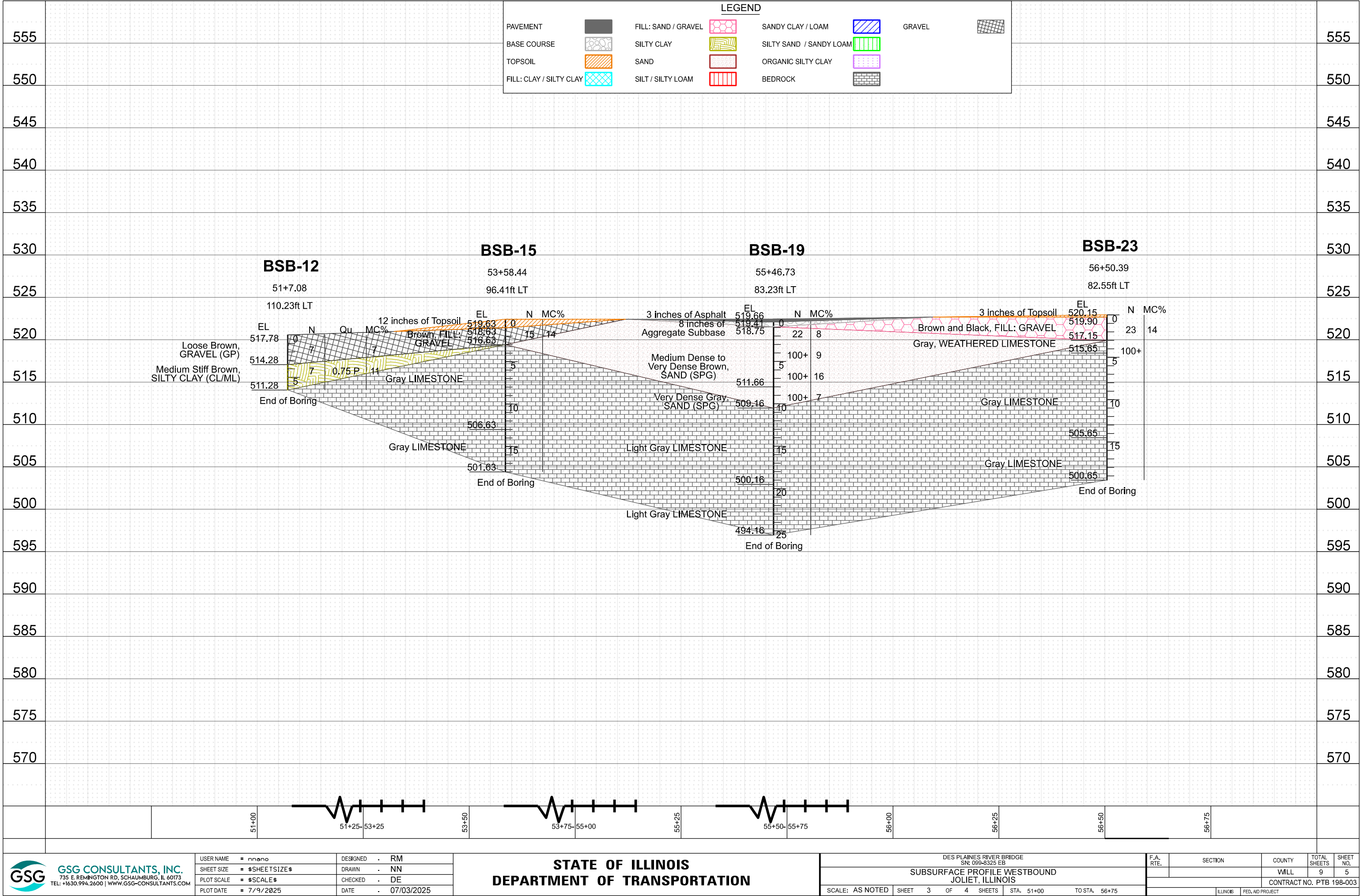
 INTERIM BORINGS FOR PRELIMINARY DESIGN

 GSG CONSULTANTS, INC. 735 E. REMINGTON RD. SCHAUMBURG, IL 60173 TEL: +1630.994.2600 WWW.GSG-CONSULTANTS.COM	USER NAME = \$USER\$	DESIGNED . RM	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION										DES PLAINES RIVER BRIDGE				F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
	SHEET SIZE = 17x11 (in.)	DRAWN . NN											SOIL BORING LOCATION PLAN						WILL	9	2
	PLOT SCALE = 100.0000 ' / in.	CHECKED . DE											JOLIET, ILLINOIS				CONTRACT NO. PTB 198-003				
	PLOT DATE = 12/8/2025	DATE . 07/03/2025																			
	SCALE: 1:50 SHEET 2 OF 2 SHEETS STA. TO STA.												ILLINOIS FED. AID PROJECT								

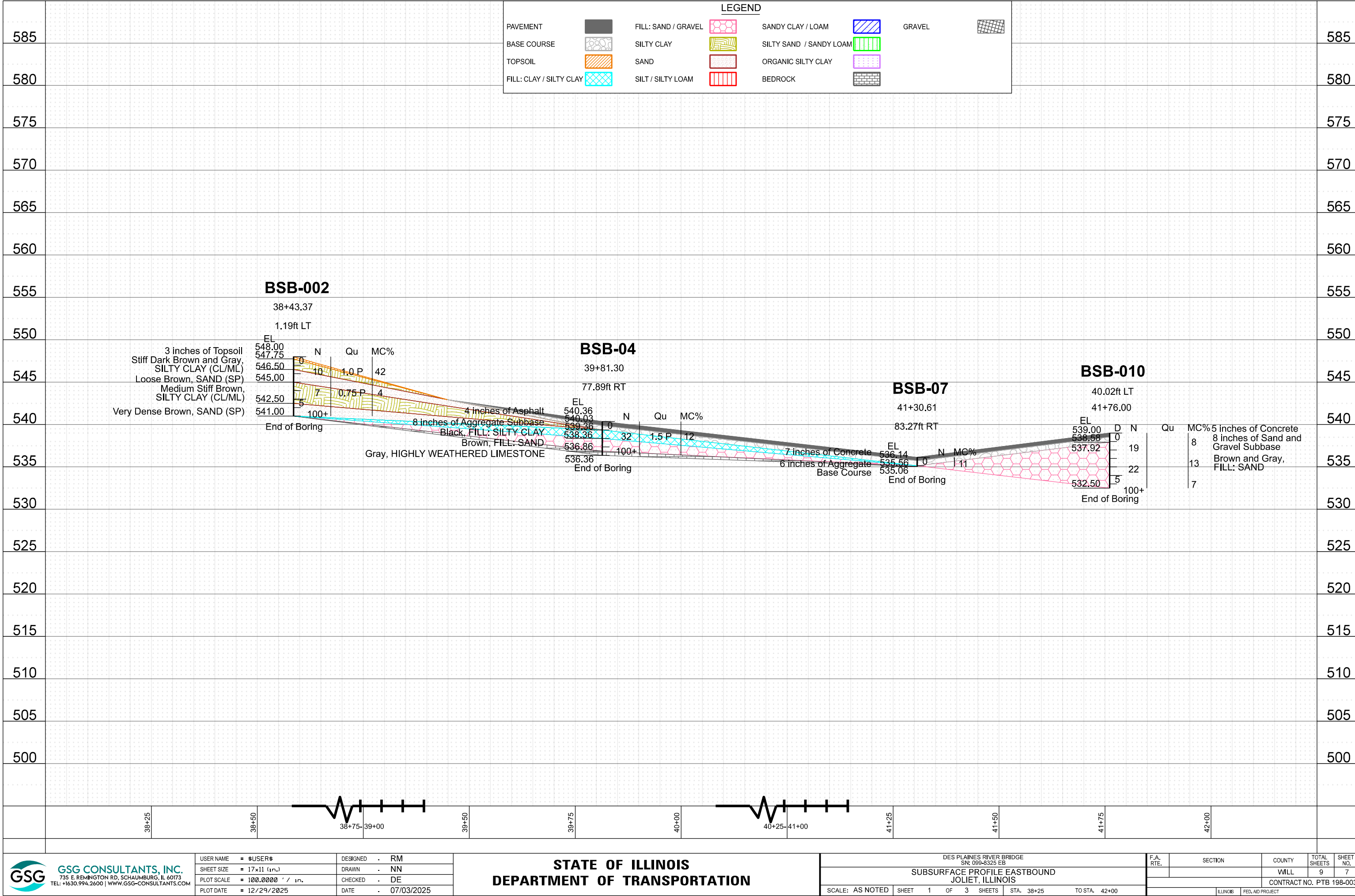
FILE NAME : Z:\P-projects\Illinois DOT\NSP-198-003\Geotechnical\Bridges\Des Plaines River-WB&EB\chibits\CDNA\Des Plaines River-WB-PR-B1.dgn
PEN TABLE : #PENTBL\$
PLOT DATE : 7/9/2025
SHEET SIZE : #SHEETSIZE\$
PLOT SCALE: #SCALE\$
USER NAME : rmano



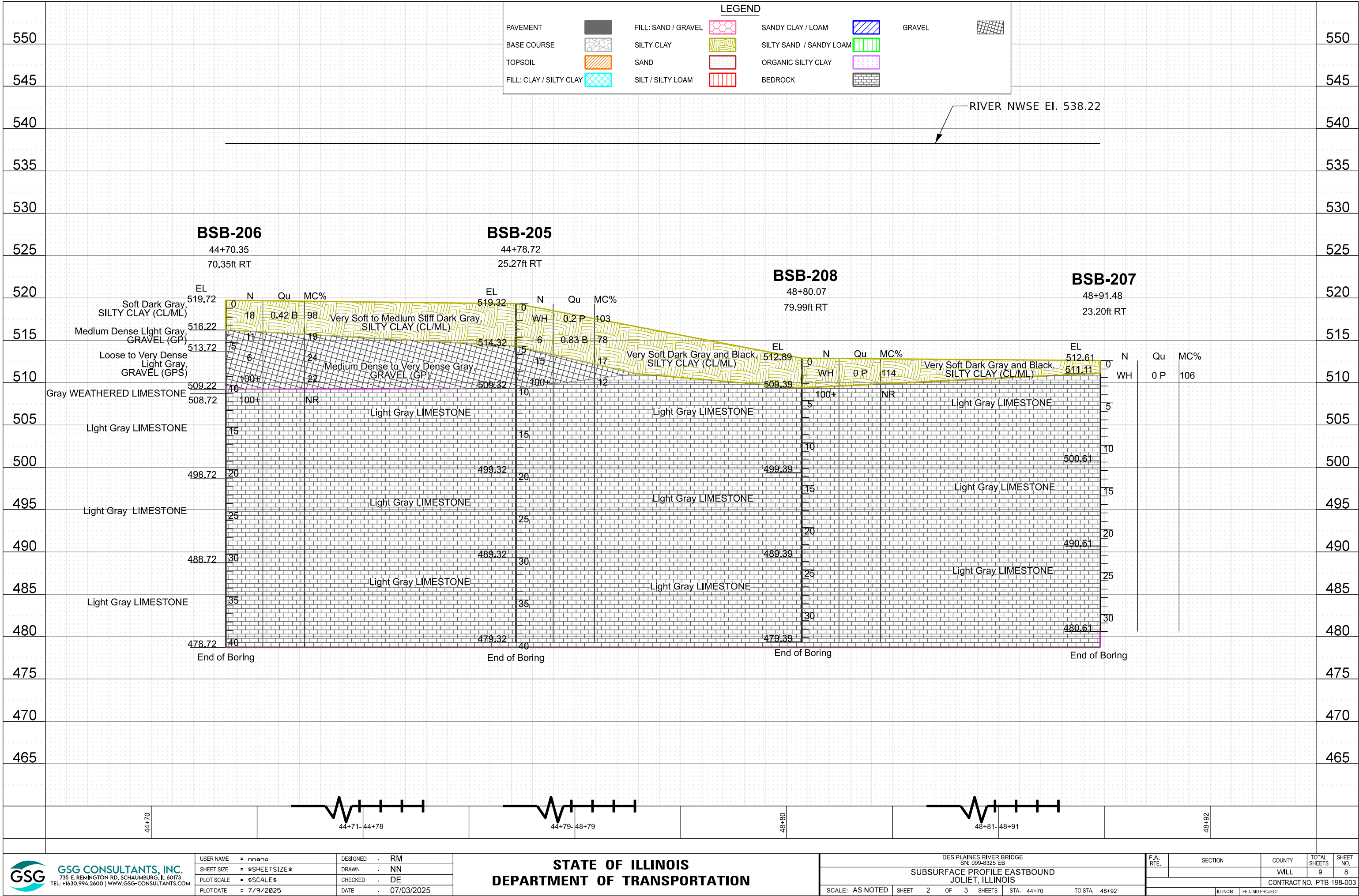
FILE NAME : Z:\P-projects\Illinois DOT\NSP-198-003\Geotechnical\Bridges\Des Plaines River-WB&EB\chibits\CDNA\Des Plaines River-WB-PR-03.dgn
PEN TABLE : #PENTBL\$
PLOT DATE : 7/9/2025 AM
SHEET SIZE : #SHEETSIZE\$
PLOT SCALE: #SCALE\$
USER NAME : rmano



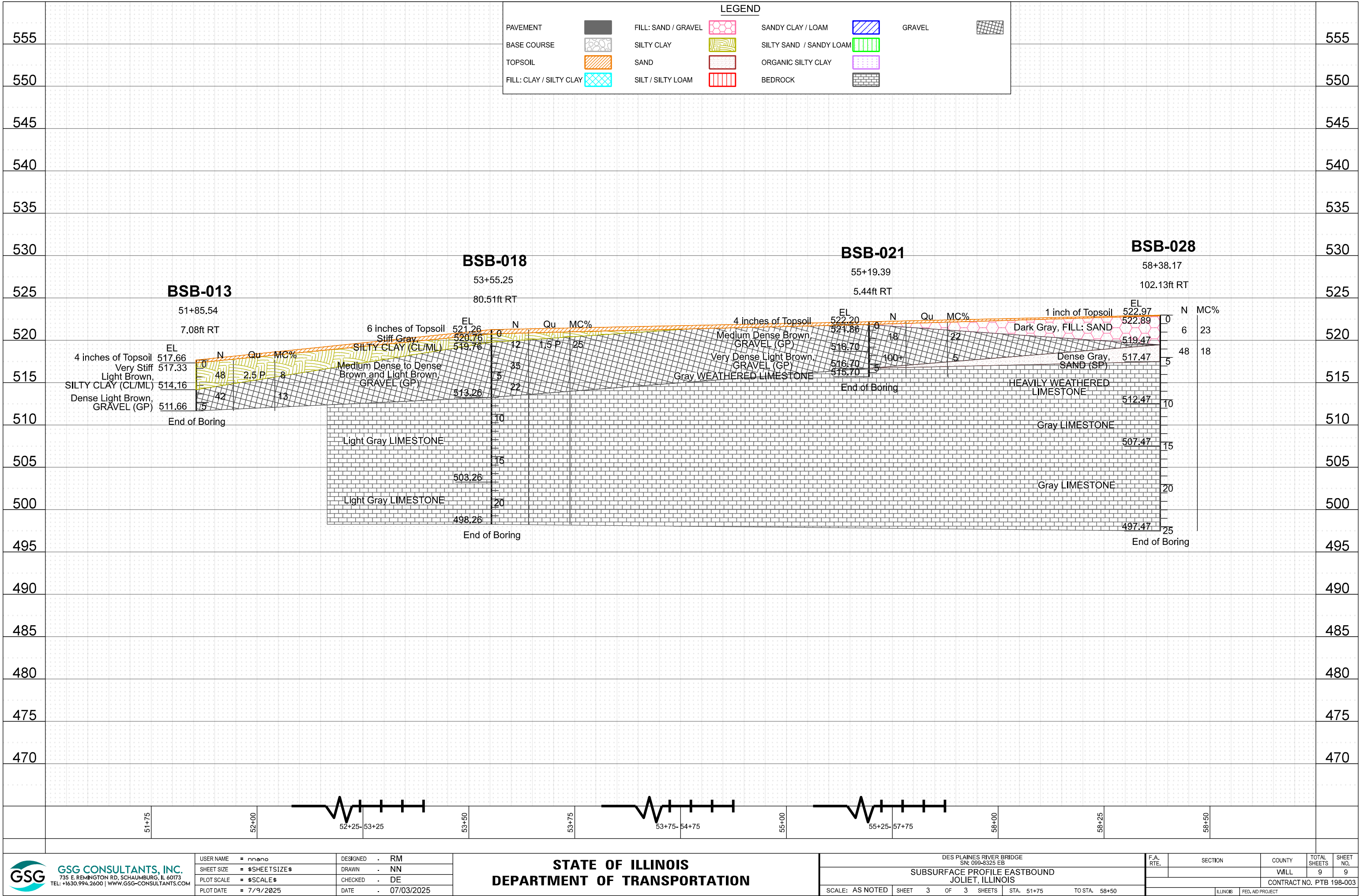
FILE NAME = Z:\Projects\Illinois DOT\NSP-198-003\Geotechnical\Bridges\Des Plaines River- WB&EB\Exhibits\CDNs\Des Plaines River- EB- PR-01.dgn
PEN TABLE = Z:\cadd\Clients\Ildot\CONNECT\Configuration\Organization\Civil\DOT_Standards\Pen Tables\GSG-Color-IL\Tolway.tbl
PLOT DATE = 12/29/2025
PLOT SCALE = 100.0000' / 1in.
SHEET SIZE = 17x11 (in.)
USER NAME = JUSER8



FILE NAME: Z:\P-projects\Illinois DOT\NSP-189-003\Geotechnical\Bridges\Des Plaines River-WB&EB\Subsites\CDNA\Des Plaines River-EB-PR-02.dgn
PEN TABLE: #PENTBL\$
PLOT DATE: 7/9/2025
SHEET SIZE: #SHEETSIZE\$
PLOT SCALE: #SCALE\$
USER NAME: rmano



FILE NAME : Z:\P-projects\Illinois DOT\NSP-198-003\Geotechnical\Bridges\Des Plaines River-WB&EB\chibits\CDNA\Des Plaines River-EB- PR-03.dgn
PEN TABLE : #PENTBL\$
PLOT DATE : 7/9/2025 AM
SHEET SIZE : #SHEETSIZE\$
PLOT SCALE: #SCALE\$
USER NAME : rmano



APPENDIX C
SOIL BORING LOGS



Illinois Department of Transportation

Division of Highways
GSG Consultants

SOIL BORING LOG

Page 1 of 2

Date 7/3/25

ROUTE I-80 DESCRIPTION I-80 EB over Des Plaines River (CSX) LOGGED BY MP

SECTION C-91-109-22 LOCATION SEC. 16, TWP. 35 N, RNG. 10 E,

COUNTY Will DRILLING RIG Mobile B-57 HAMMER TYPE Auto
DRILLING METHOD HSA HAMMER EFF (%) 92.1

STRUCT. NO. 099-8325
Station _____

BORING NO. BSB-001
Station 37+88.08
Offset 95.13ft RT
Ground Surface Elev. 578.21 ft

D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
-------------------------------	--------------------------------	----------------------------	------------------------------

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	569.7	ft ▼
Upon Completion	N/A	ft
After _____ Hrs.	N/A	ft

D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
-------------------------------	--------------------------------	----------------------------	------------------------------

18 inches of Asphalt				Stiff to Very Stiff			
576.71	5			Brown, Gray, and Black, Moist		0	
Brown, Moist	5	0.8		SILTY CLAY, trace sand, trace		2	1.5
FILL: SILTY CLAY, with gravel	3	P		gravel (CL/ML) (continued)		4	B
	3					2	
	3	2.3				5	2.1
-5	2	P				7	B
572.71							
Medium Stiff to Stiff	2					2	
Brown and Gray, Moist	1	0.5				4	1.5
SILTY CLAY, trace sand, trace	1	P				8	B
gravel (CL/ML)							
	1			Hard		4	
▼	1	0.6		Dark Gray, Moist		50/6"	4.2
-10	2	B		SILTY CLAY LOAM, some gravel			B
				(ML/CL)			
				Cobbles at 29 to 31.5 feet			
	1			Medium Stiff		20	
	3	1.7		Dark Brown and Gray, Moist		13	0.8
	4	B		SILTY CLAY, trace sand, trace		8	B
				gravel (CL/ML)			
	2						
	4	1.5		Gray, Moist			
-15	4	B		WEATHERED LIMESTONE			
				Auger refusal at 33.5 feet			
				Gray			
				LIMESTONE, slightly moderately			
				weathered, moderately to heavily			
				fractured, trace clay at 34.5', trace			
				chert			
562.71	2						
Stiff to Very Stiff	2	1.5		Run 1: 33.5' - 38.5'			
Brown, Gray, and Black, Moist	3	B		Recovery: 96.7%			
SILTY CLAY, trace sand, trace				RQD: 45.8% (Poor)			
gravel (CL/ML)							
	2						
	2	1.0					
-20	2	B					

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)



Illinois Department of Transportation

Division of Highways
GSG Consultants

SOIL BORING LOG

Page 2 of 2

Date 7/3/25

ROUTE I-80 DESCRIPTION I-80 EB over Des Plaines River (CSX) LOGGED BY MP

SECTION C-91-109-22 LOCATION SEC. 16, TWP. 35 N, RNG. 10 E,

COUNTY Will DRILLING RIG Mobile B-57 HAMMER TYPE Auto
DRILLING METHOD HSA HAMMER EFF (%) 92.1

STRUCT. NO. 099-8325
Station

BORING NO. BSB-001
Station 37+88.08
Offset 95.13ft RT
Ground Surface Elev. 578.21 ft

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Surface Water Elev.	<u>N/A</u>	ft
Stream Bed Elev.	<u>N/A</u>	ft
Groundwater Elev.:		
First Encounter	<u>569.7</u>	ft ▼
Upon Completion	<u>N/A</u>	ft
After <u> </u> Hrs.	<u>N/A</u>	ft

Gray
LIMESTONE, slightly weathered,
slightly to moderately fractured,
trace chert

Run 2: 38.5' - 48.5'
Recovery: 99.4%
RQD: 90.2% (Good) (continued)

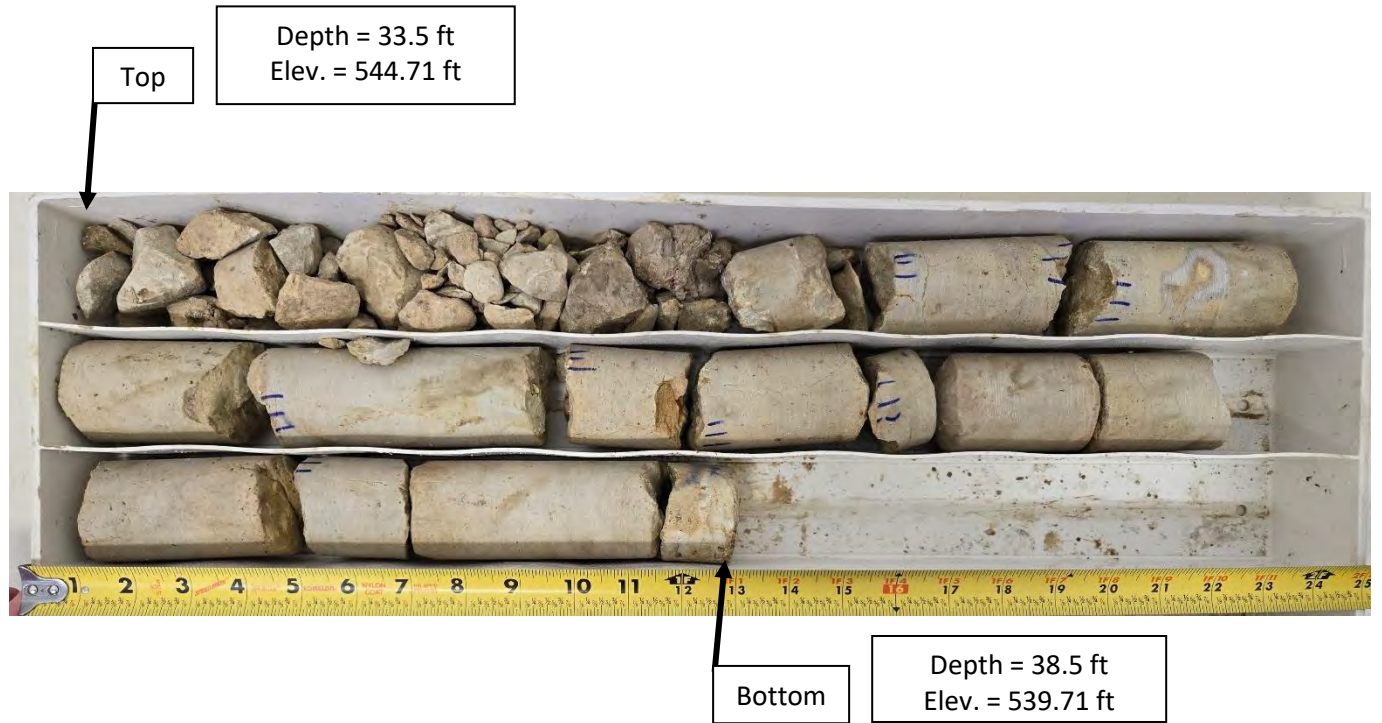
529.71

End of Boring

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
 Boring Number: BSB-01
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-01	1	33.5'- 38.5'	96.7	45.8	Poor	38/7,440	Gray Limestone Slightly to Moderately Weathered, Moderately to Heavily Fractured, Trace Clay at 34.5', Trace Chert

I-80 EB over Des Plaines River

Boring Number: BSB-01

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-01	2	38.5' – 48.5'	99.4	90.2	Good	44/12,266	Gray Limestone Slightly Weathered, Slightly to Moderately Fractured, Trace Chert

ROUTE	<u>I-80</u>	DESCRIPTION	<u>I-80 EB over Des Plaines River (CSX)</u>	LOGGED BY	<u>EH</u>
--------------	-------------	--------------------	---	------------------	-----------

SECTION C-91-109-22 **LOCATION** , SEC. 16, TWP. 35 N, RNG. 10 E,

COUNTY	Will	DRILLING RIG	CME-75	HAMMER TYPE	Auto
		DRILLING METHOD	HSA	HAMMER EFF (%)	78.8

STRUCT. NO. 099-8325
Station

BORING NO.	BSB-002
Station	38+43.37
Offset	1.19ft LT
Ground Surface Elev.	548.00

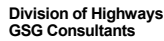
D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After Hrs.	N/A	ft

[illegible]

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)



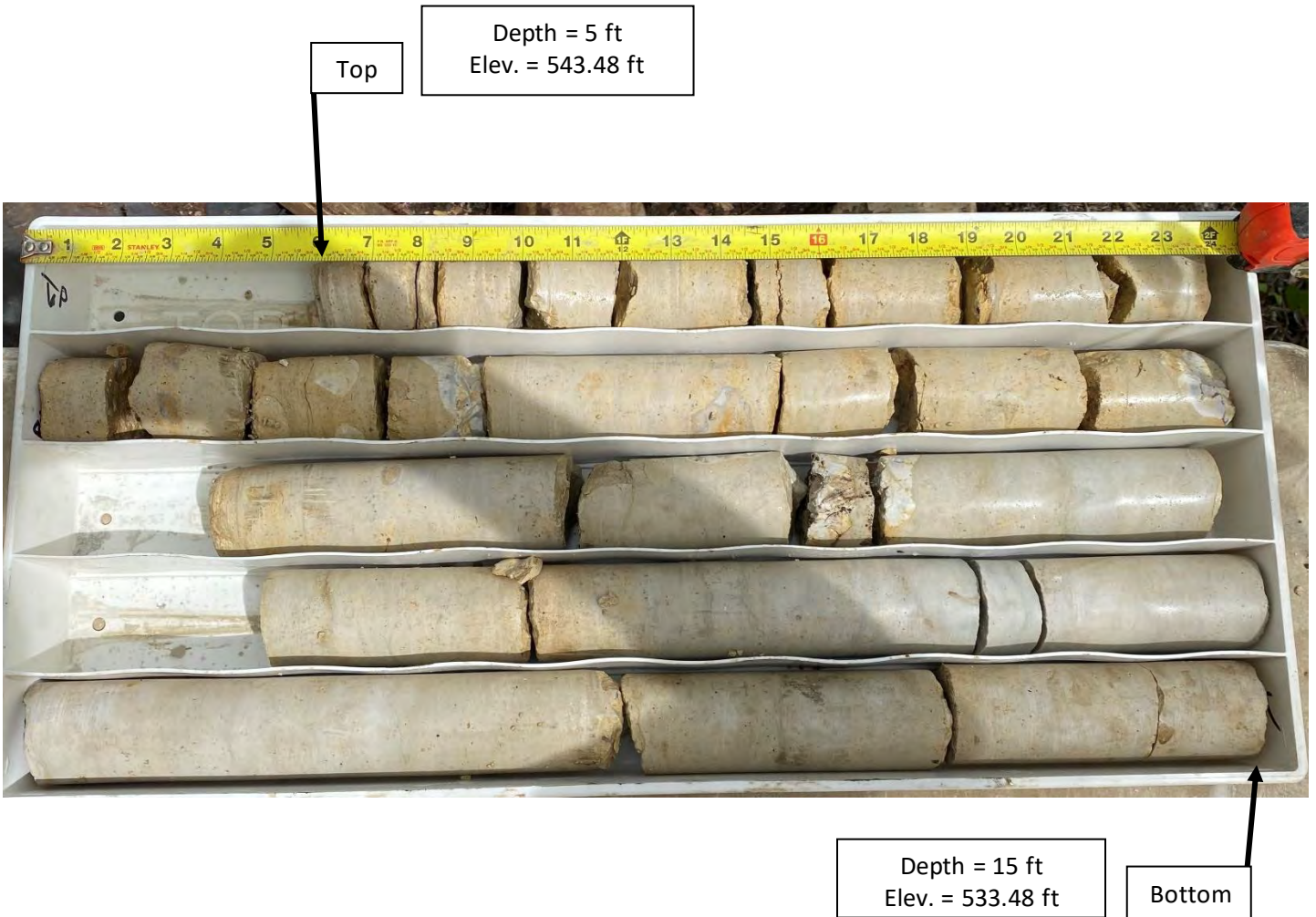
Date 4/29/25

BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River

Boring Number: BSB-03

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-03	1	5'-15'	88.8	55.6	Fair	9/15,953	Brown and Gray Limestone Slightly Weathered, Moderately Fractured

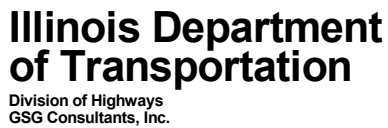
I-80 WB over Des Plaines River

Boring Number: BSB-03

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-03	2	15' – 20'	100	92.5	Excellent	18/17,948	Gray Limestone Slightly Weathered, Slightly Fractured, Trace Shale

Page 1 of 1

Date 10/20/22

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After _____ Hrs.	N/A	ft

[illegible]

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

ROUTE	<u>I-80</u>	DESCRIPTION	<u>I-80 EB over Des Plaines River (CSX)</u>	LOGGED BY	<u>EH</u>
--------------	-------------	--------------------	---	------------------	-----------

SECTION C-91-109-22 **LOCATION** , SEC. 16, TWP. 35 N, RNG. 10 E,

COUNTY	Will	DRILLING RIG DRILLING METHOD	Latitude 41.5127292, Longitude -88.09342765	
			Diedrich D-50	HAMMER TYPE
			HSA	Auto
			HAMMER EFF (%)	99.5

STRUCT. NO. 099-8325
Station

BORING NO.	BSB-05
Station	40+15.20
Offset	2.76ft RT
Ground Surface Elev.	541.00

DEPTH	BLOW COUNTS	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After Hrs.	N/A	ft

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

[illegible]

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

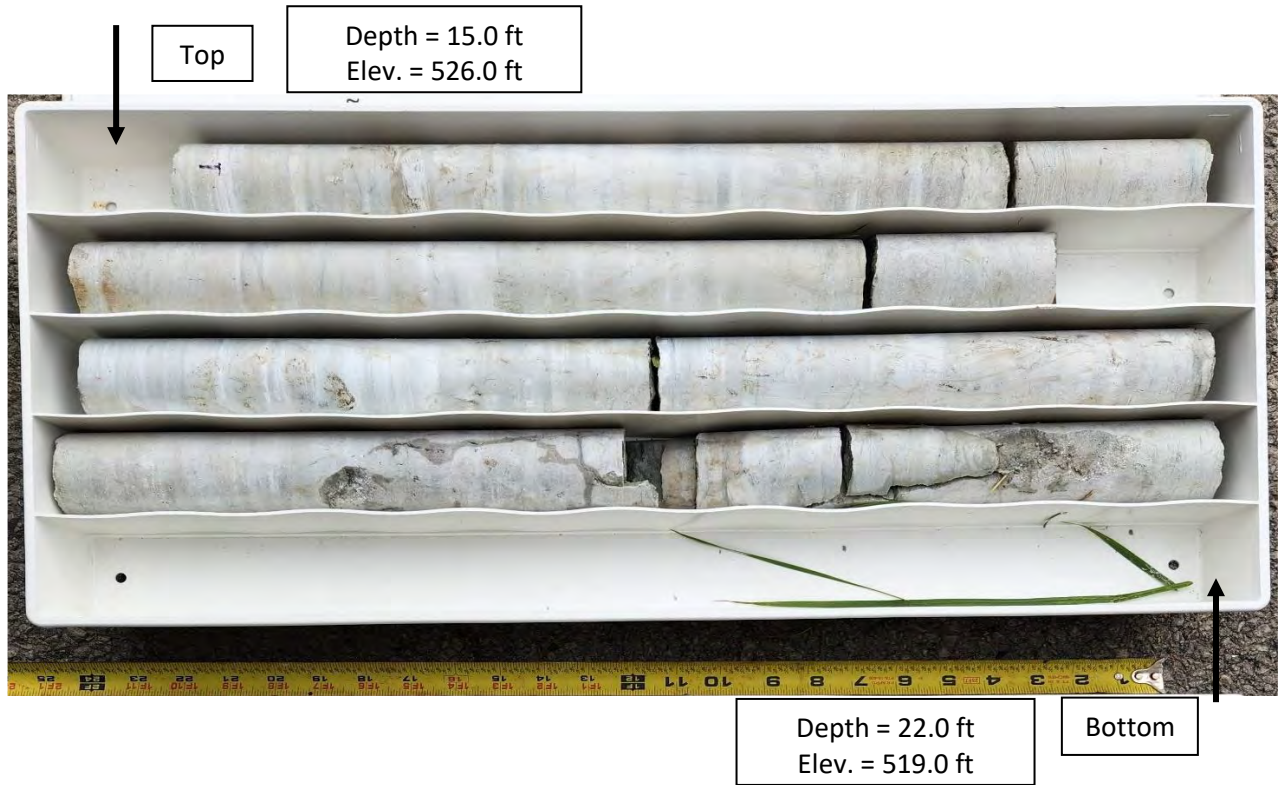
BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
Boring Number: BSB-05
Will County, IL

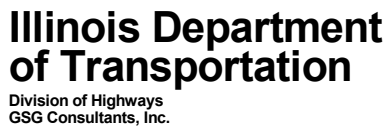


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-5	1	5.0' – 15.0'	91.7	70.8	Fair	7.0 / 17,099	Light Gray Limestone Moderately Weathered, Moderately Fractured, Some Vugs

I-80 EB over Des Plaines River
Boring Number: BSB-05
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-5	2	15.0' – 22.0'	100.0	92.5	Excellent	Light Gray Limestone Moderately Weathered, Slightly Fractured, Some Vugs

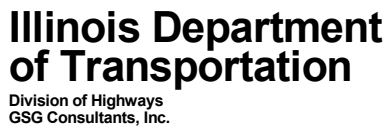
Page 1 of 1

Date 10/20/22

BBS, form 137 (Rev. 8-99)

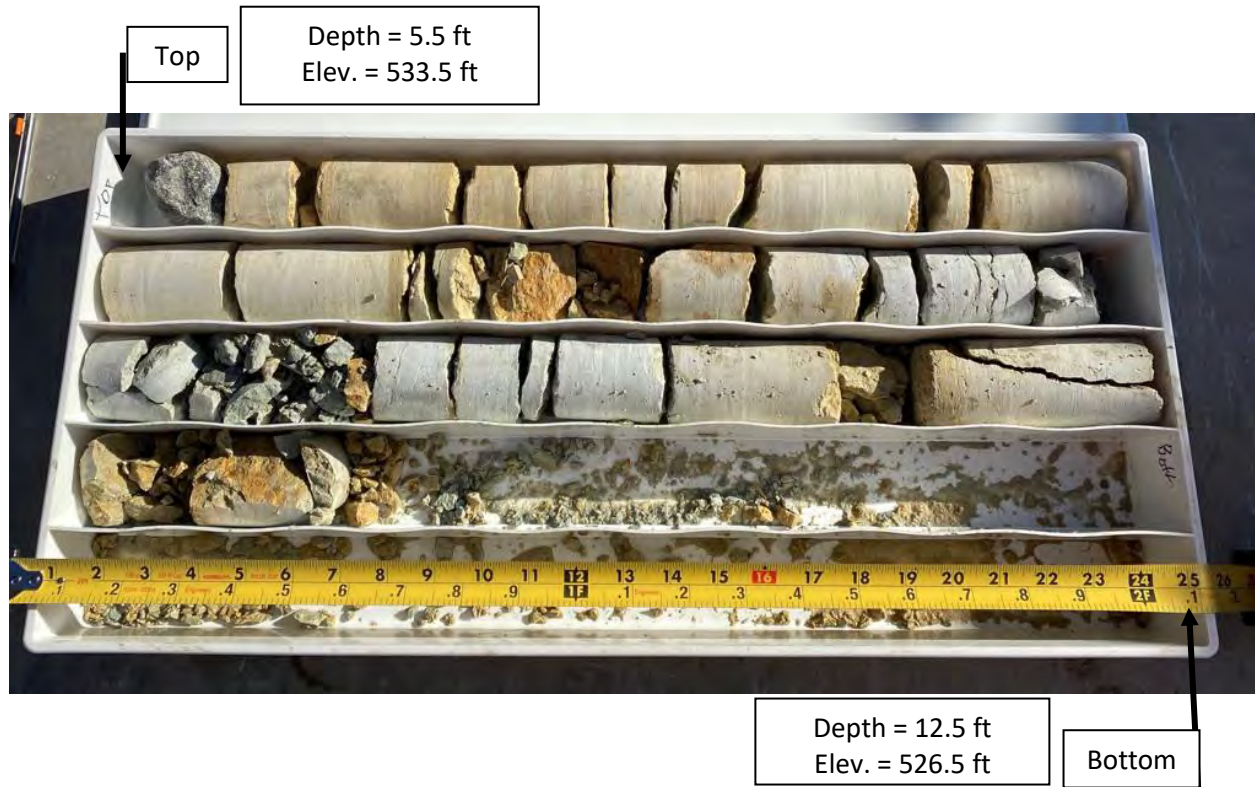


Date 11/9/22

Page 1 of 1Date 11/11/22[illegible]

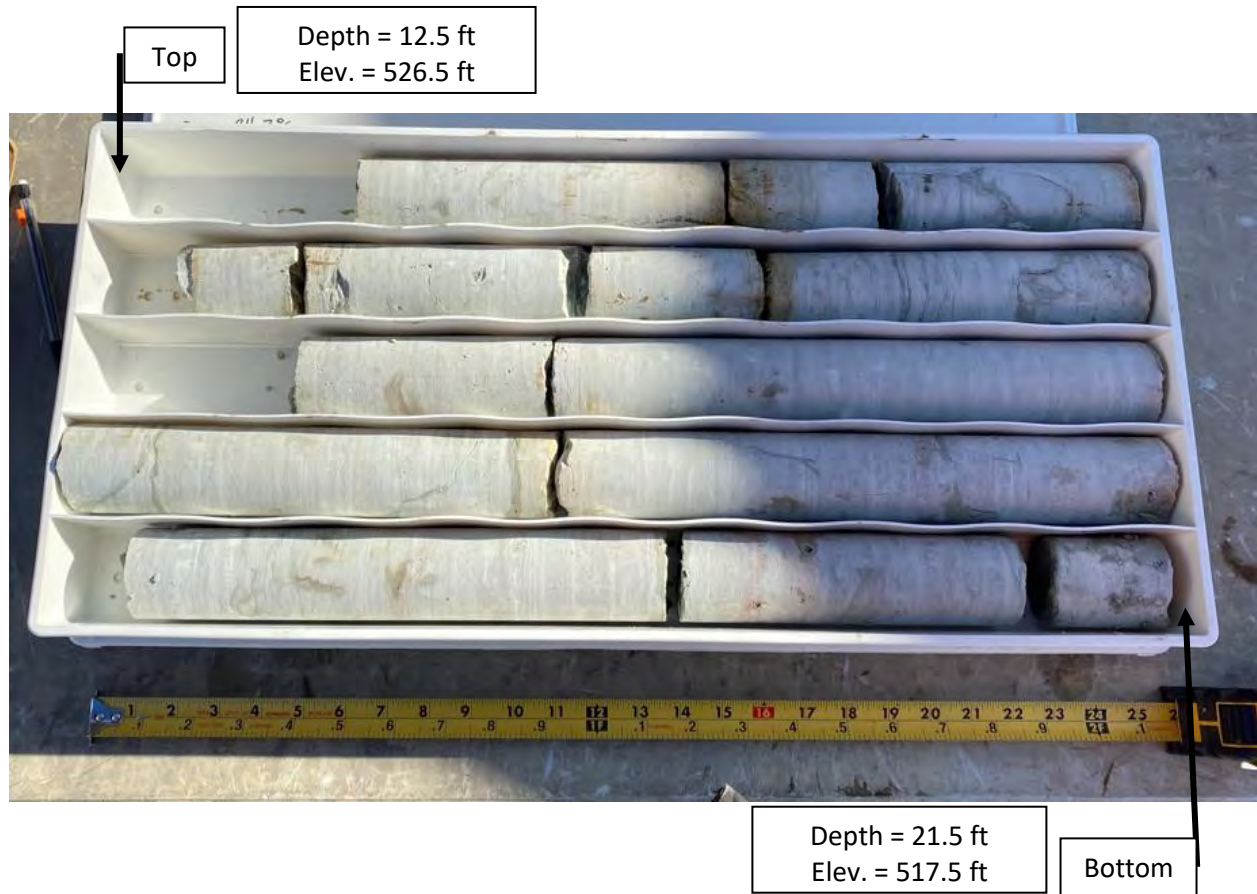
BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
 Boring Number: BSB-08
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-08	1	5.5'-12.5'	92.9	0	Very Poor	Gray Limestone Moderately Weathered, Heavily Fractured, Some Vertical Fractures

I-80 EB over Des Plaines River
 Boring Number: BSB-08
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) / Compressive Strength (psi)	Description
BSB-08	2	12.5' – 21.5'	97.2	84.7	Good	16.5 / 11,381	Gray Limestone Moderately Weathered, Lightly Fractured

Page 1 of 1

Date 11/20/25

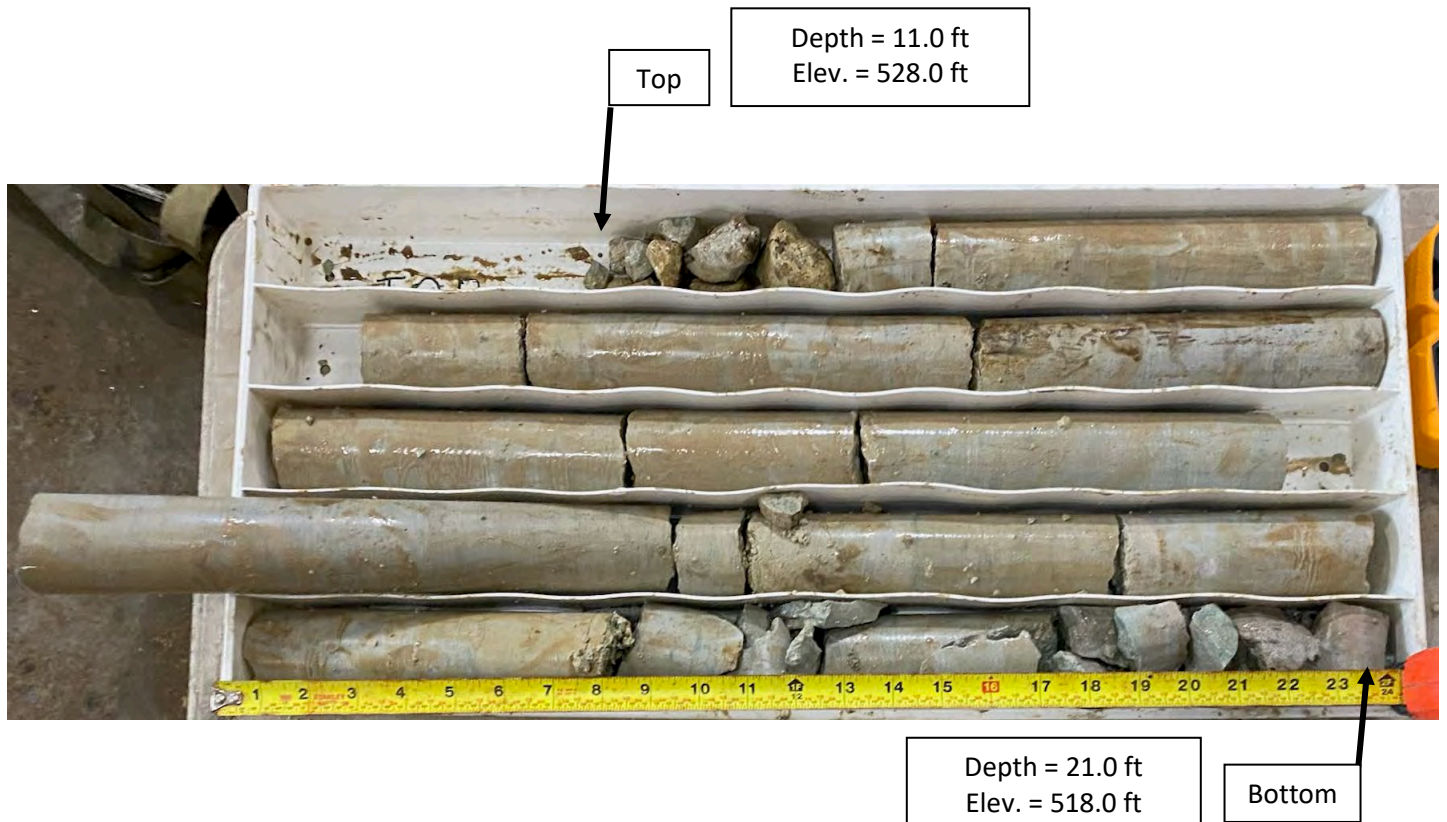
[illegible]

BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River

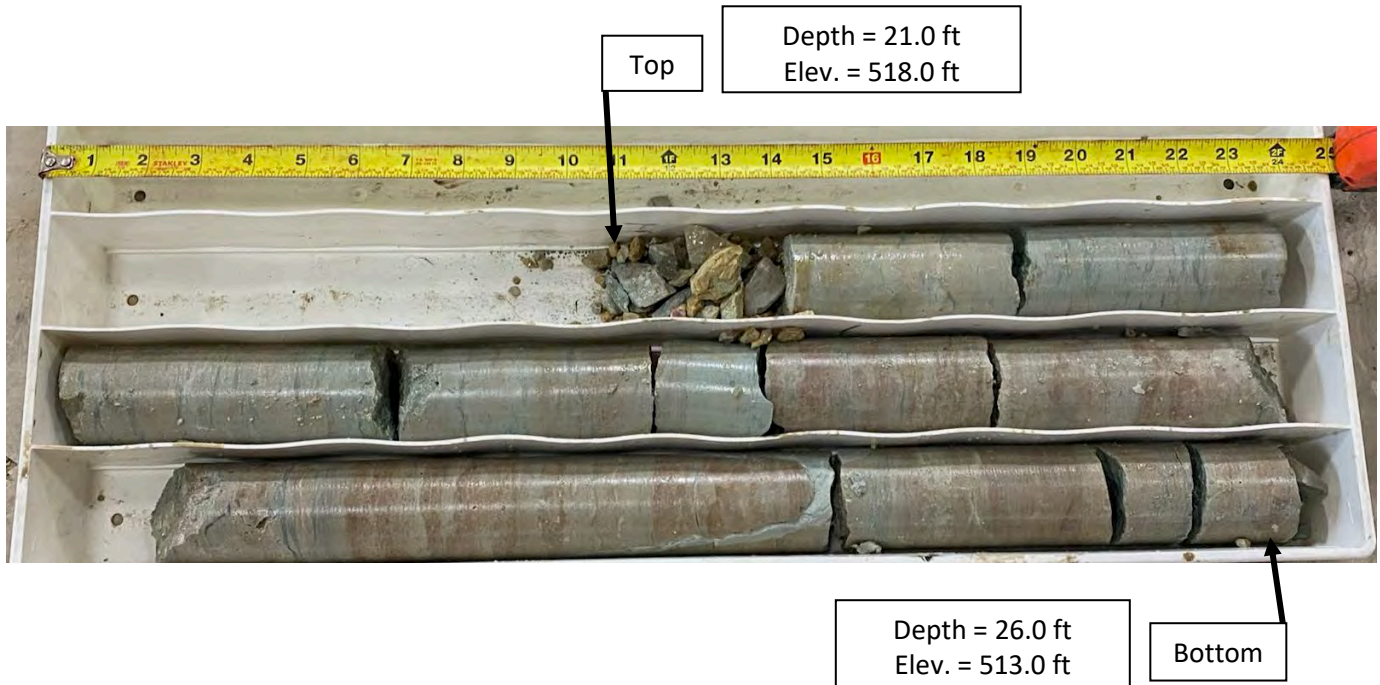
Boring Number: BSB-09

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-09	1	11'-21'	92.9	72.9	Fair	11.5/11,453	Gray Limestone Slightly to Moderately Weathered, Slightly to Heavily Fractured, Trace Sand, Trace Silt

I-80 WB over Des Plaines River
 Boring Number: BSB-09
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-09	2	21' – 26'	98.3	71.7	Fair	21.5/5,135	Gray Limestone Slightly Weathered, Slightly to Moderately Fractured, Trace Shale

Page 1 of 1

Date 11/20/25

BBS, form 137 (Rev. 8-99)

Page 1 of 1

Date 4/30/25

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After _____ Hrs.	N/A	ft

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Page 1 of 1

Date 4/22/25

BBS, form 137 (Rev. 8-99)

Page 1 of 1

Date 4/23/25

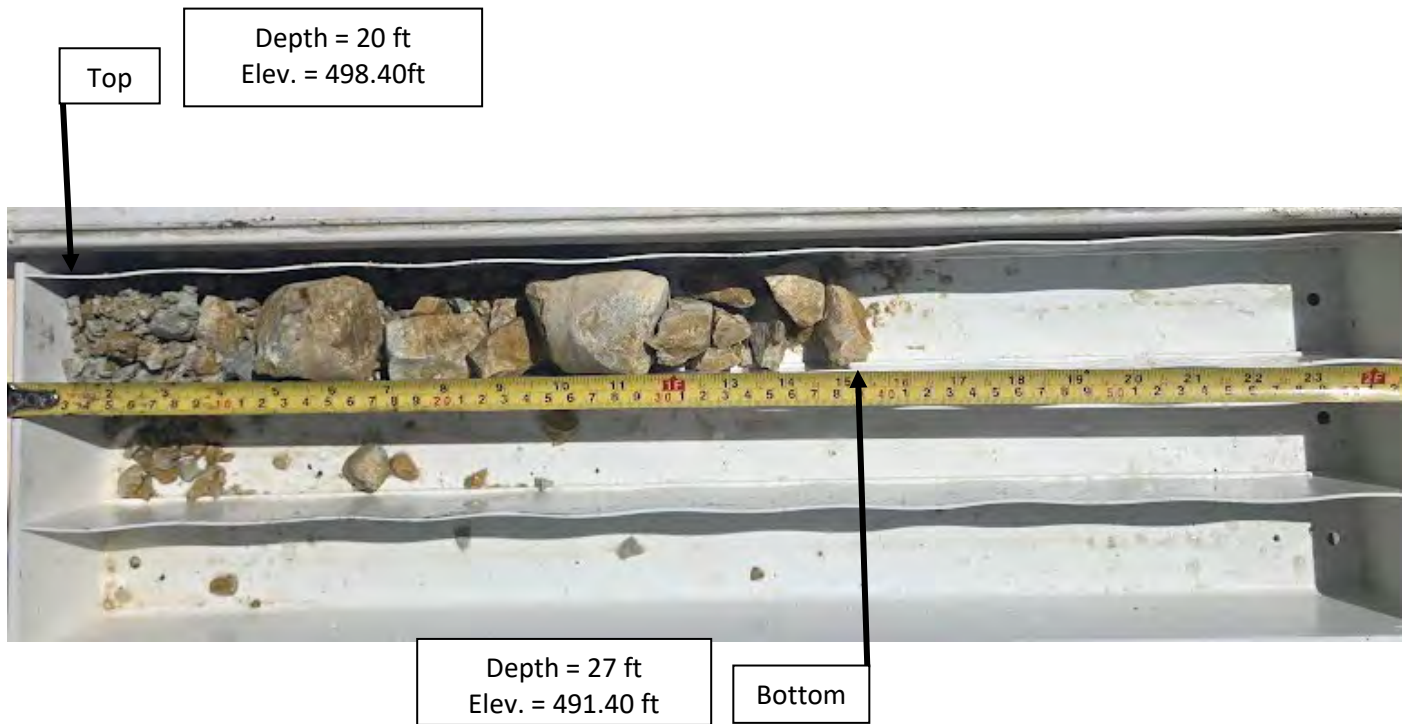
[illegible]

BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River

Boring Number: BSB-14

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-14	1	20'-27'	14.3	0	Very Poor	Gray Limestone Heavily Weathered, Heavily Fractured

I-80 EB over Des Plaines River

Boring Number: BSB-14

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-14	2	27' – 35'	25.0	4.7	Very Poor	Gray Limestone Heavily Weathered, Heavily Fractured

Page 1 of 1

Date 4/7/25

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After Hrs.	N/A	ft

12 inches of Topsoil				
518.63				
Brown, Moist FILL: GRAVEL, with sand, trace asphalt		6		
		7		14
		8		
516.63				
Auger refusal at 3 feet				
Gray LIMESTONE, slightly weathered, moderately to heavily fractured				
	-5			
Run 1: 3' - 13'				
Recovery: 82.5%				
RQD: 64.6% (Fair)				
	-10			
506.63				
Gray LIMESTONE, slightly weathered, moderately fractured, trace shale				
Run 2: 13' - 18'	-15			
Recovery: 100%				
RQD: 60.0% (Fair)				
501.63				
End of Boring				
	-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River

Boring Number: BSB-15

Will County, IL

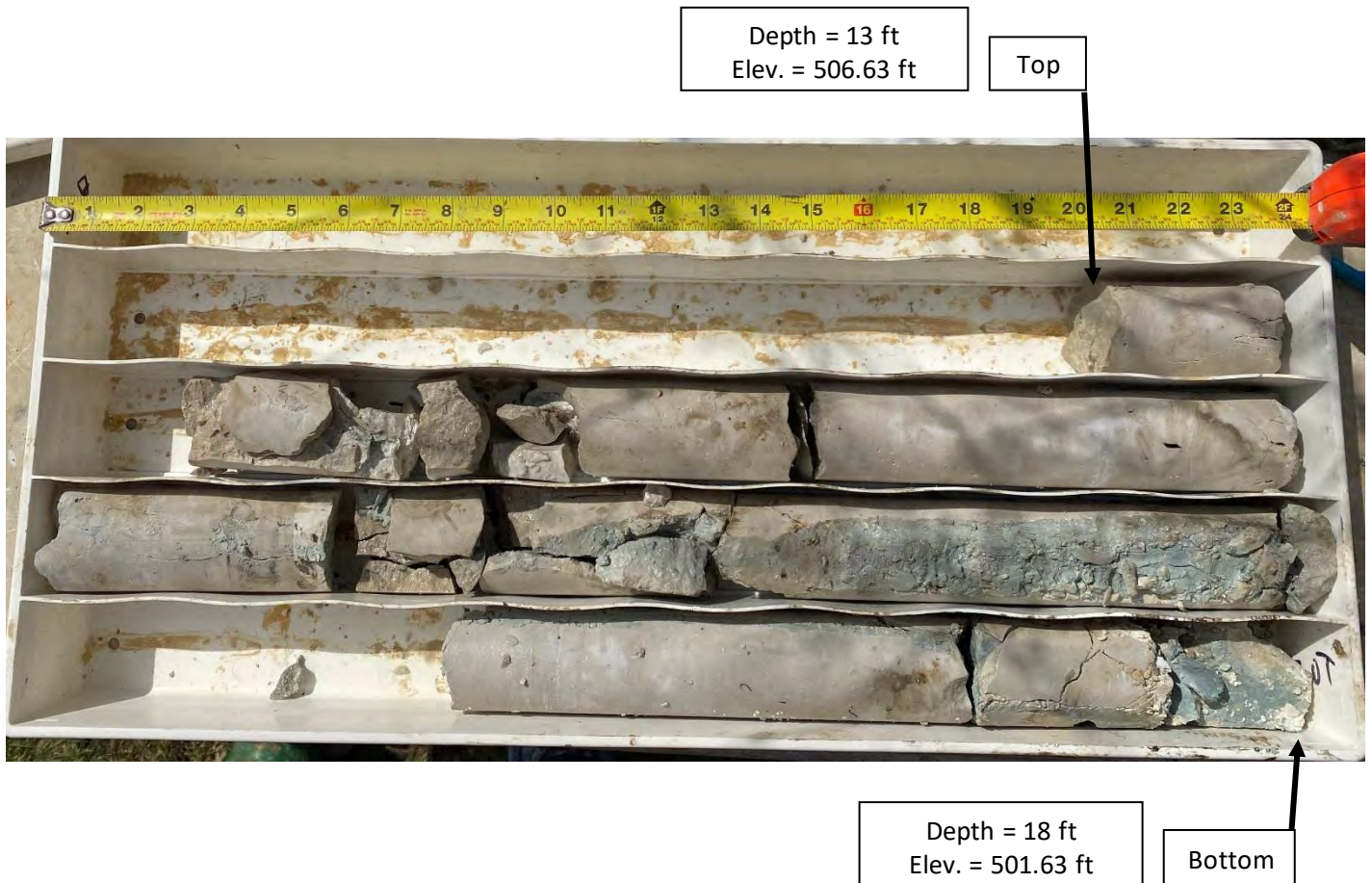


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-15	1	3'-13'	82.5	64.6	Fair	6/8,529	Brown and Gray Limestone Slightly Weathered, Moderately to Heavily Fractured

I-80 WB over Des Plaines River

Boring Number: BSB-15

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-15	2	13' – 18'	100	60.0	Fair	14/11,523	Gray Limestone Slightly Weathered, Moderately Fractured, Trace Shale

Page 1 of 1

Date 3/18/25

Surface Water Elev.	<u>N/A</u>	ft
Stream Bed Elev.	<u>N/A</u>	ft
Groundwater Elev.:		
First Encounter	<u>Dry</u>	ft
Upon Completion	<u>N/A</u>	ft
After _____ Hrs.	<u>N/A</u>	ft

[illegible]

BBS, form 137 (Rev. 8-99)

Page 1 of 1

Date 3/18/25

BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
Boring Number: BSB-18
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-18	1	8'-18'	100	46.3	Poor	Light Gray Limestone Slightly to Moderately Weathered, Moderately to Heavily Fractured, Trace Chert

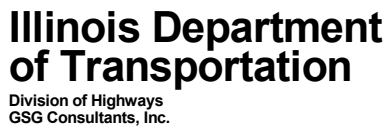
I-80 EB over Des Plaines River

Boring Number: BSB-18

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-18	2	18' – 23'	100	80.8	Good	22/10,265	Light Gray Limestone Slightly Weathered, Moderately Fractured, Trace Chert

Page 1 of 1

Date 10/24/22

-40

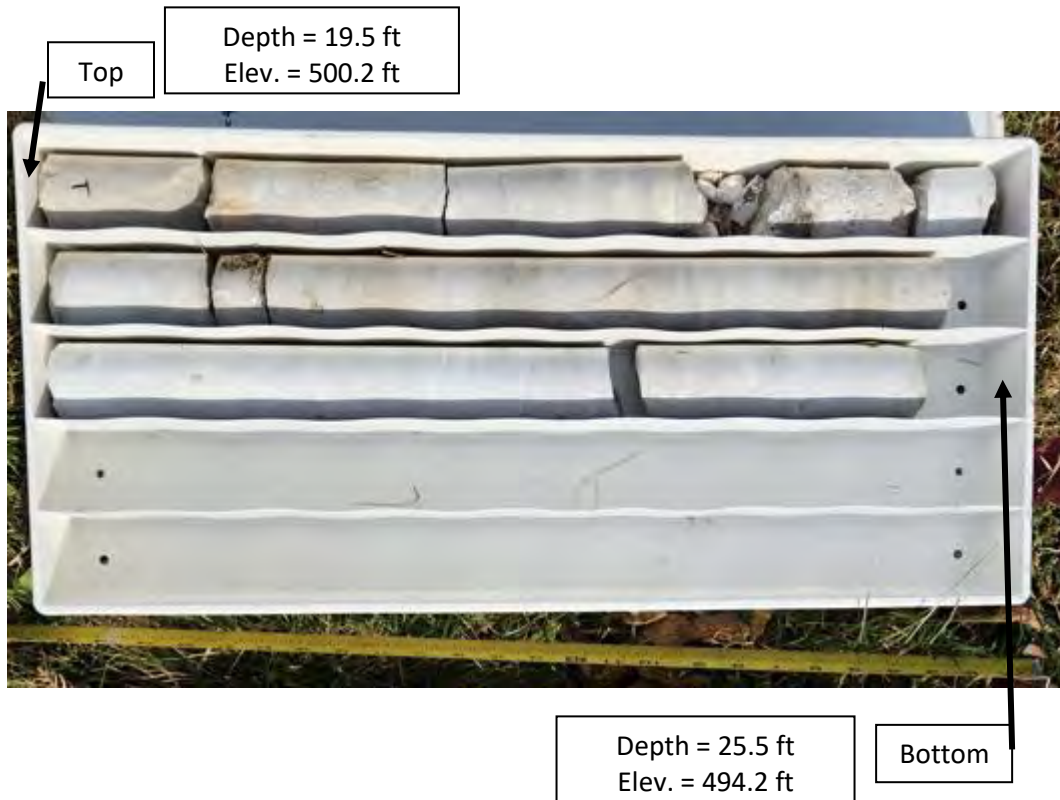
BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River
 Boring Number: BSB-19
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) / Compressive Strength (psi)	Description
BSB-19	1	10.5' – 19.5'	99.1	72.2	Good	13.5 / 17,233	Light Gray Limestone Moderately Weathered, Moderately Fractured, Some Chert, Trace Shale Seams

I-80 WB over Des Plaines River
 Boring Number: BSB-19
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-19	2	19.5' – 25.5'	91.7	70.1	Good	Light Gray Limestone Moderately Weathered, Moderately Fractured

Page 1 of 1

Date 3/14/25

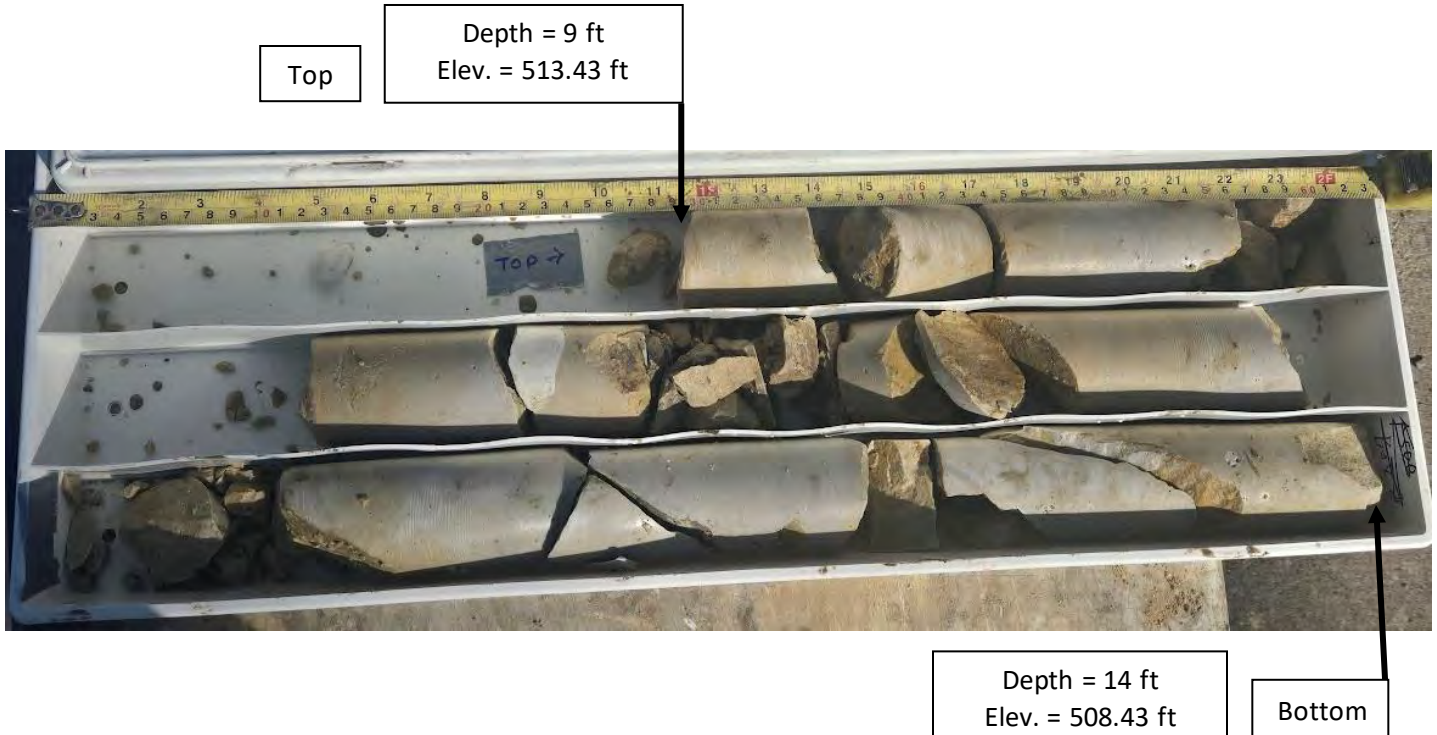
[illegible]

BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River

Boring Number: BSB-20

Will County, IL

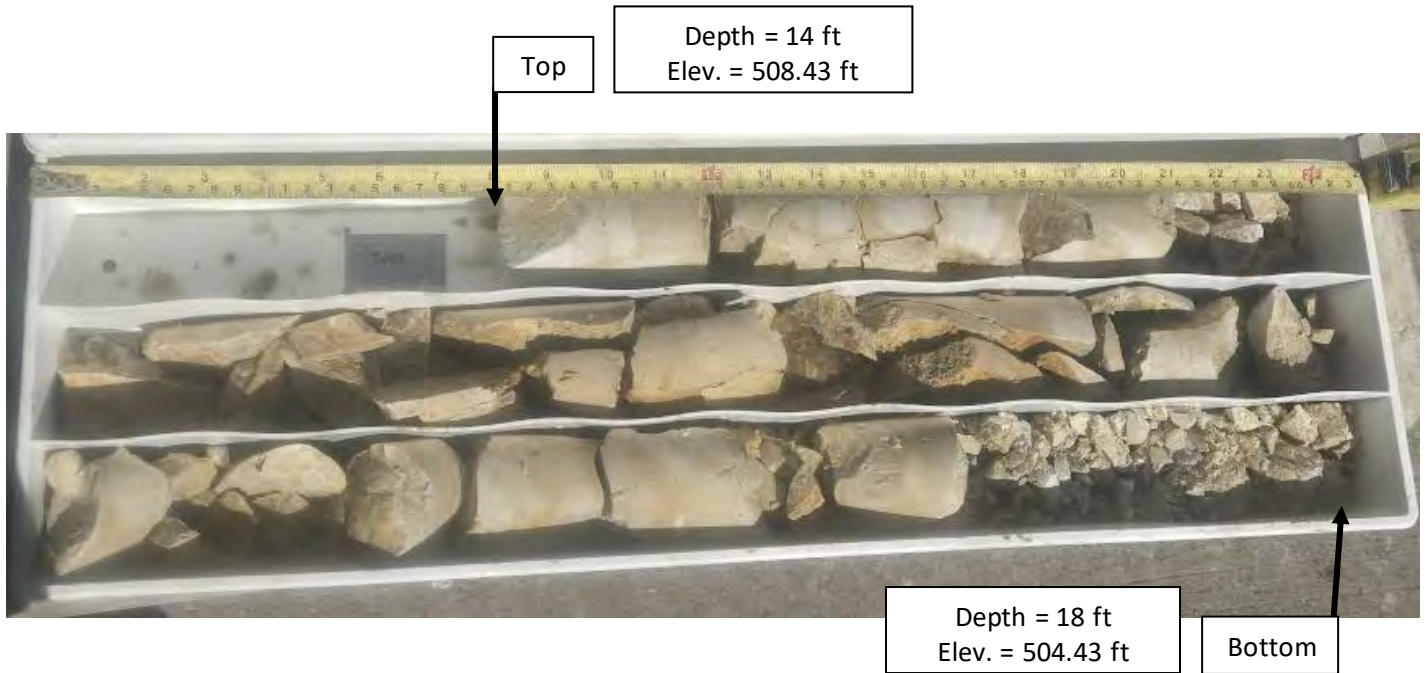


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-20	1	9'-14'	91.7	45.8	Poor	9/16,387	Gray Limestone Slightly Weathered, Heavily Fractured, Trace Vugs

I-80 WB over Des Plaines River

Boring Number: BSB-20

Will County, IL

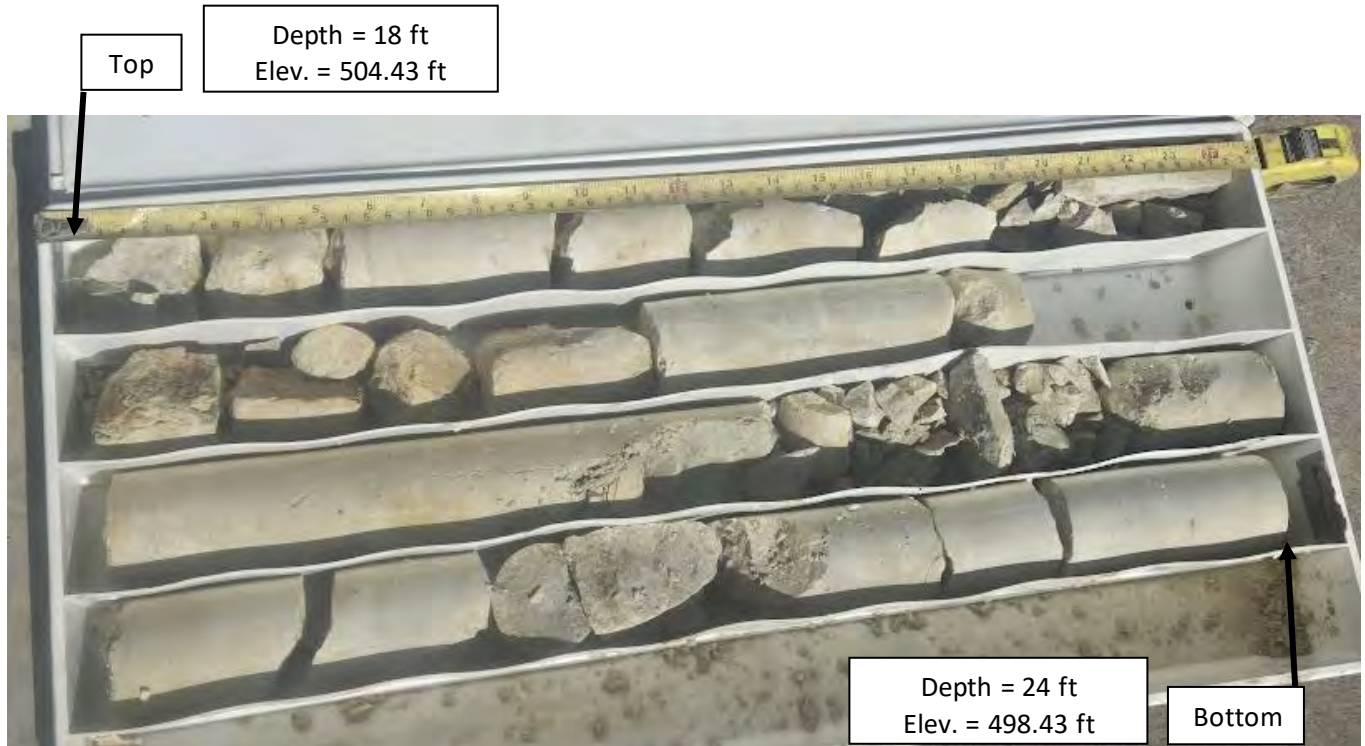


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-20	2	14' – 18'	100	8.3	Very Poor	21/6,367	Gray and Brown Limestone Moderately to Heavily Weathered, Heavily Fractured

I-80 WB over Des Plaines River

Boring Number: BSB-20

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-20	3	18' – 24'	92.0	35.8	Poor	Gray Limestone Moderately Weathered, Moderately to Heavily Fractured

Page 1 of 1

Date 3/14/25

BBS, form 137 (Rev. 8-99)



Illinois Department of Transportation

Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Page 1 of 1

Date 10/18/22

ROUTE I-80 DESCRIPTION I-80 EB over Des Plaines River (CSX) LOGGED BY KA

SECTION C-91-109-22 LOCATION SEC. 16, TWP. 35 N, RNG. 10 E,

Latitude 41.51165701, Longitude -88.08823718

COUNTY Will DRILLING RIG CME-75 DRILLING METHOD HSA HAMMER TYPE Auto HAMMER EFF (%) 79.8

STRUCT. NO. 099-8325
Station

BORING NO. BSB-22
Station 54+86.60
Offset 94.82ft RT
Ground Surface Elev. 519.88 ft

D E P T H (ft)	B L O W S (/6")	U C S (tsf)	M O I S T (%)
-----------------------------------	------------------------------------	--------------------------	----------------------------------

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	506.9	ft ▼
Upon Completion	N/A	ft
After _____ Hrs.	N/A	ft

D E P T H (ft)	B L O W S (/6")	U C S (tsf)	M O I S T (%)
-----------------------------------	------------------------------------	--------------------------	----------------------------------

4 inches of Asphalt 519.55

Brown, Black and Gray, Moist
FILL: SAND AND GRAVEL, trace
clay

11

9

5

3

1

1

-5

7

19

29

512.38

Very Dense
Light Brown and Gray, Dry to
Moist
SAND, with gravel (SPG)

34

50/3"

-10

50/3"

5

507.38

Very Dense
Brown, Moist
GRAVEL, with sand (GPS)

50/5"

505.88

Auger refusal at 14 feet

12

Light Gray
LIMESTONE, moderately
weathered, highly fractured, some
vugs

-15

-35

Run 1: 14' - 19'
Recovery: 100%
RQD: 6.6% (Very Poor)

500.88

-20

Light Gray
LIMESTONE, moderately
weathered, moderately fractured,
some vugs

Run 2: 19' - 29'
Recovery: 85.8%
RQD: 41.7% (Poor) (continued)

End of Boring

490.88

-30

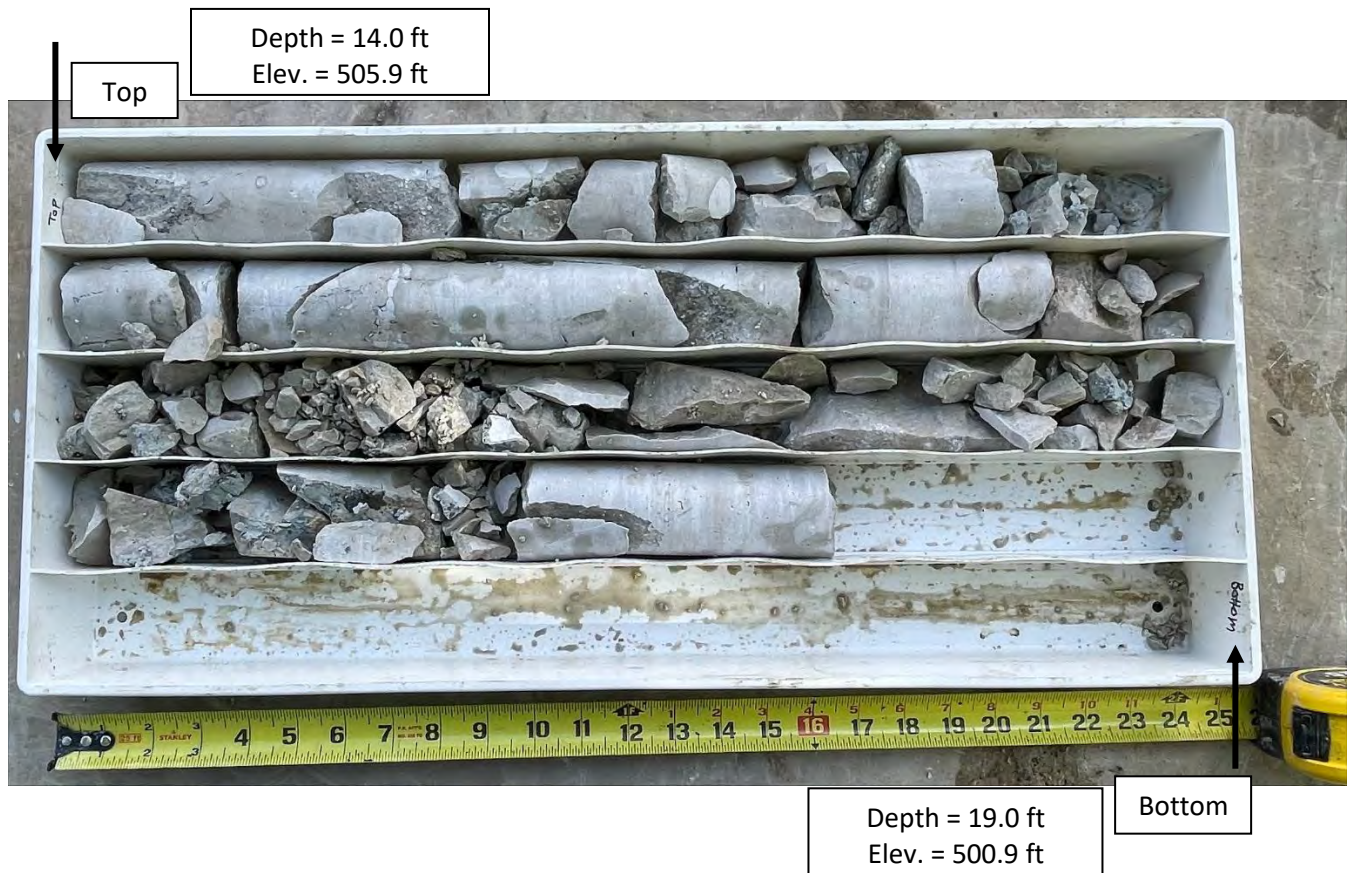
-35

-40

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
Boring Number: BSB-22
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-22	1	14.0' – 19.0'	100.0	6.6	Very Poor	Light Gray Limestone Moderately Weathered, Highly Fractured, Some Vugs

I-80 EB over Des Plaines River
 Boring Number: BSB-22
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) / Compressive Strength (psi)	Description
BSB-22	2	19.0' – 29.0'	85.8	41.7	Poor	23.5 / 12,246	Light Gray Limestone Moderately Weathered, Moderately Fractured, Some Vugs



Illinois Department of Transportation

Division of Highways
GSG Consultants

SOIL BORING LOG

Page 1 of 1

Date 6/3/25

ROUTE I-80 DESCRIPTION I-80 WB over Des Plaines River (CSX) LOGGED BY SB

SECTION C-91-109-22 LOCATION SEC. 16, TWP. 35N, RNG. 10E,

COUNTY Will DRILLING RIG CME-75 DRILLING METHOD HSA HAMMER TYPE Auto
HAMMER EFF (%) 78.8

STRUCT. NO. 099-8309
Station

BORING NO. BSB-023
Station 56+50.39
Offset 82.55ft LT
Ground Surface Elev. 520.15 ft

D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
-------------------------------	--------------------------------	----------------------------	------------------------------

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft
Groundwater Elev.:
First Encounter Dry ft
Upon Completion N/A ft
After Hrs. N/A ft

3 inches of Topsoil 519.90
Brown and Black, Moist
FILL: GRAVEL, trace brick, trace
clay

6			
9			14
14			

517.15
Gray, Moist
WEATHERED LIMESTONE

50/6"			
-------	--	--	--

515.65
Gray
LIMESTONE, slightly to
moderately weathered,
moderately to heavily fractured,
some vertical fractures, trace
chert

Run 1: 4.5' - 14.5'
Recovery: 73.5%
RQD: 47.3% (Poor)

-10

505.65
Gray
LIMESTONE, slightly weathered,
slightly fractured, some vertical
fractures, trace chert

-15

Run 2: 14.5' - 19.5'
Recovery: 100%
RQD: 87.5% (Good)

500.65

End of Boring

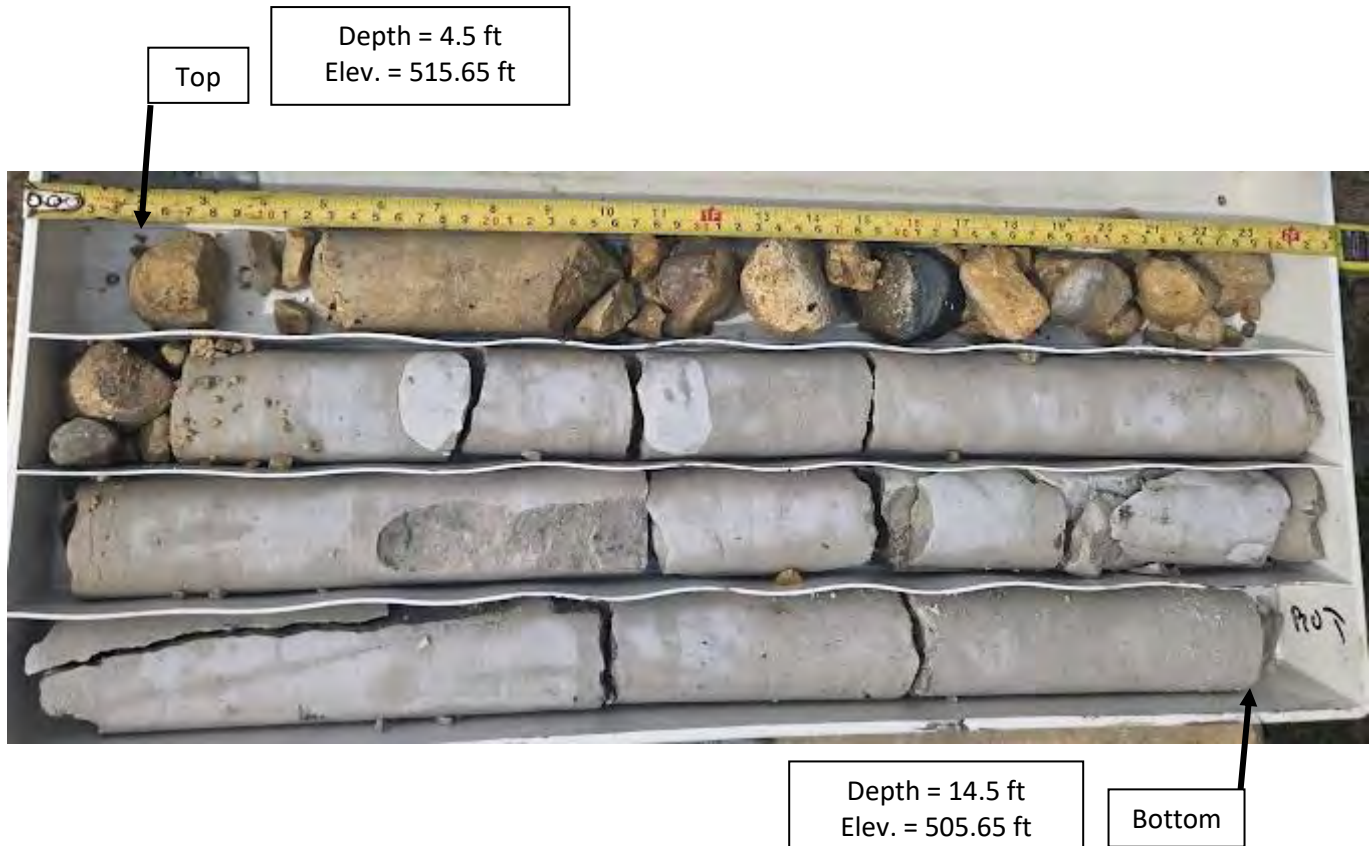
-20

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

I-80 WB over Des Plaines River

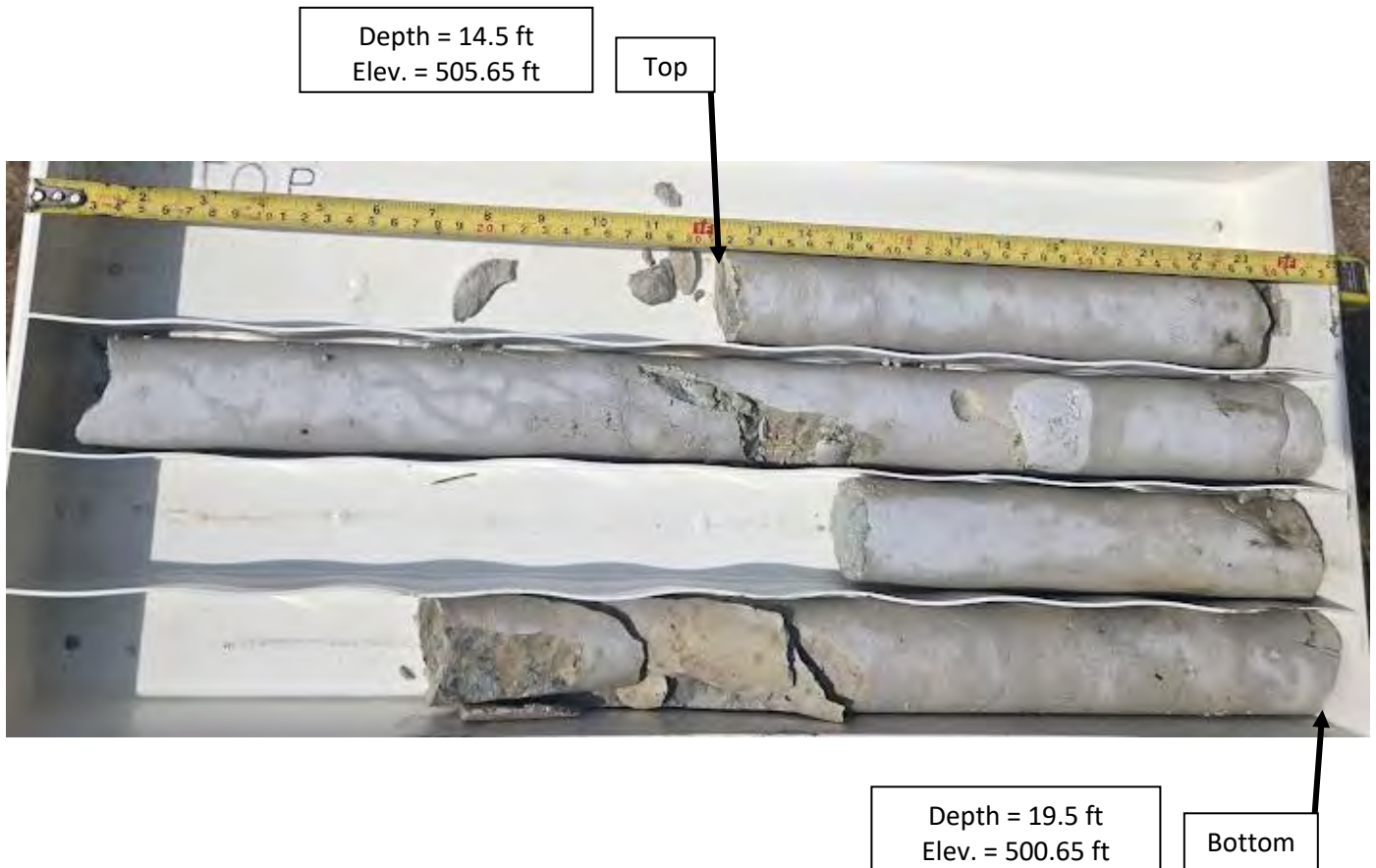
Boring Number: BSB-23

Will County, IL

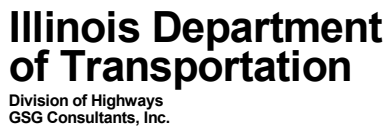


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-23	1	4.5'- 14.5'	73.5	47.3	Poor	13.5/5,989	Gray Limestone Slightly to Moderately Weathered, Moderately to Heavily Fractured, Some Vertical Fractures, Trace Chert

I-80 WB over Des Plaines River
 Boring Number: BSB-23
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-23	2	14.5' – 19.5'	100	87.5	Good	17.5/13,846	Gray Limestone Slightly Weathered, Slightly Fractured, Some Vertical Fractures, Trace Chert

Page 1 of 1

Date 10/17/22

BBS, form 137 (Rev. 8-99)

Page 1 of 1

Date 4/9/25

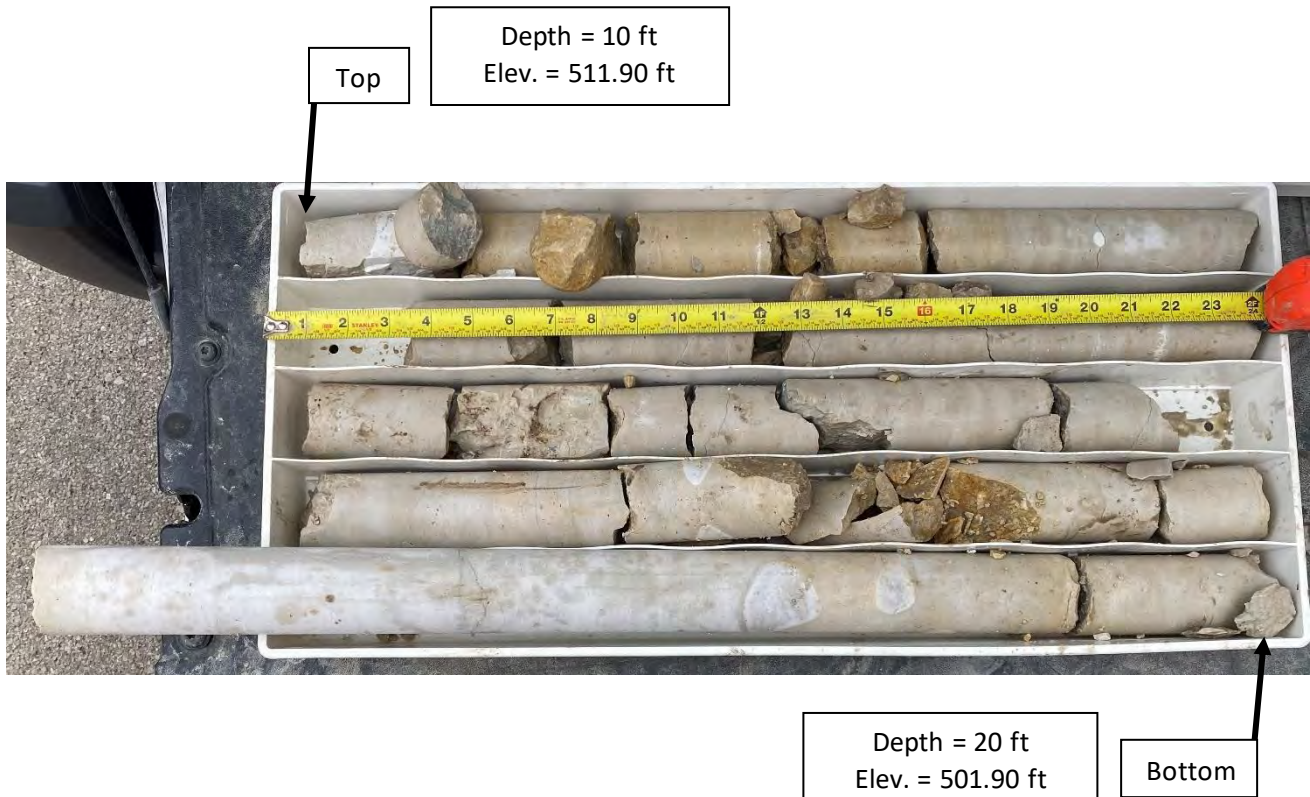
[illegible]

BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River

Boring Number: BSB-26

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-26	1	10'-20'	100	69.2	Fair	13/14,031	Gray Limestone Slightly Weathered, Slightly to Moderately Fractured, Trace Chert

I-80 WB over Des Plaines River

Boring Number: BSB-26

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-26	2	20' – 25'	95.0	95.0	Excellent	23/17,753	Gray Limestone Slightly Weathered, Slightly Fractured, Trace Chert



Illinois Department of Transportation

Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Page 1 of 1

Date 10/18/22

ROUTE I-80 DESCRIPTION I-80 EB over Des Plaines River (CSX) LOGGED BY EH

SECTION C-91-109-22 LOCATION SEC. 16, TWP. 35 N, RNG. 10 E,

COUNTY Will DRILLING RIG Diedrich D-50 Latitude 41.51166508, Longitude -88.08694055
DRILLING METHOD HSA HAMMER TYPE Auto
HAMMER EFF (%) 99.5

STRUCT. NO. 099-8325
Station _____

BORING NO. BSB-27
Station 58+33.46
Offset 19.51ft RT
Ground Surface Elev. 521.77 ft

D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
-------------------------------	--------------------------------	----------------------------	------------------------------

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After _____ Hrs.	N/A	ft

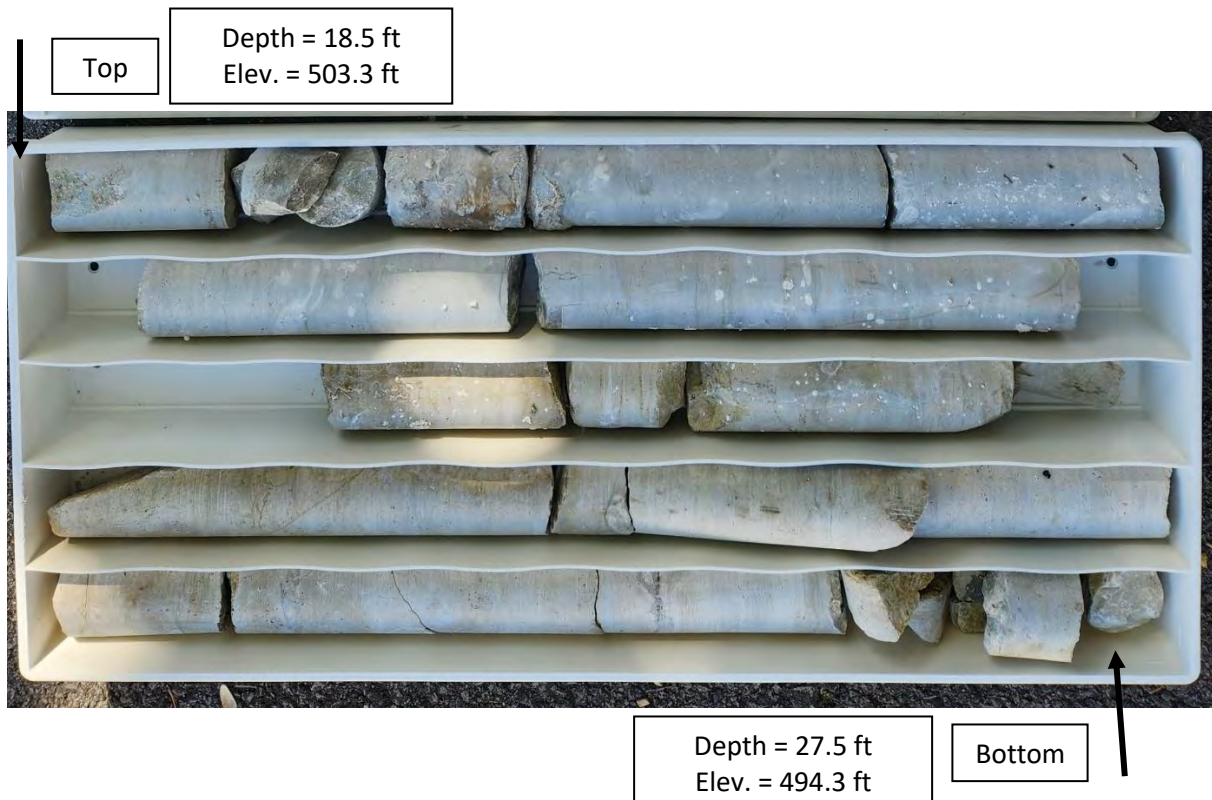
D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
-------------------------------	--------------------------------	----------------------------	------------------------------

3 inches of Asphalt	521.52				Light Gray				
Light Gray, Moist	520.77				LIMESTONE, slightly weathered,				
FILL: SAND AND GRAVEL		9			moderately fractured, some vugs				
Brown, Moist		11		12					
FILL: SANDY CLAY LOAM, with		7			Run 1: 18.5' - 27.5'				
gravel					Recovery: 99.1%				
	518.27				RQD: 70.8% (Fair) (continued)				
Loose to Extremely Dense		2							
Brown and Light Brown, Dry to		5		6					
Wet		3							
SAND, with gravel (SPG)		-5							
		2							
		9		4					
		7							
						494.27			
					Light Gray				
		7			LIMESTONE, moderately				
		5		19	weathered, moderately fractured,				
		7			some vugs				
	-10				Run 2: 27.5' - 33.5'				
					Recovery: 82.6%				
		10			RQD: 56.9% (Fair)				
		30		5					
		50/3"							
		24				488.27			
		37		3	End of Boring				
	-15	50/4"							
		50/2"							
				NR					
Auger refusal at 18.5 feet	503.27								
		50/1"							
				NR					
	-20								

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

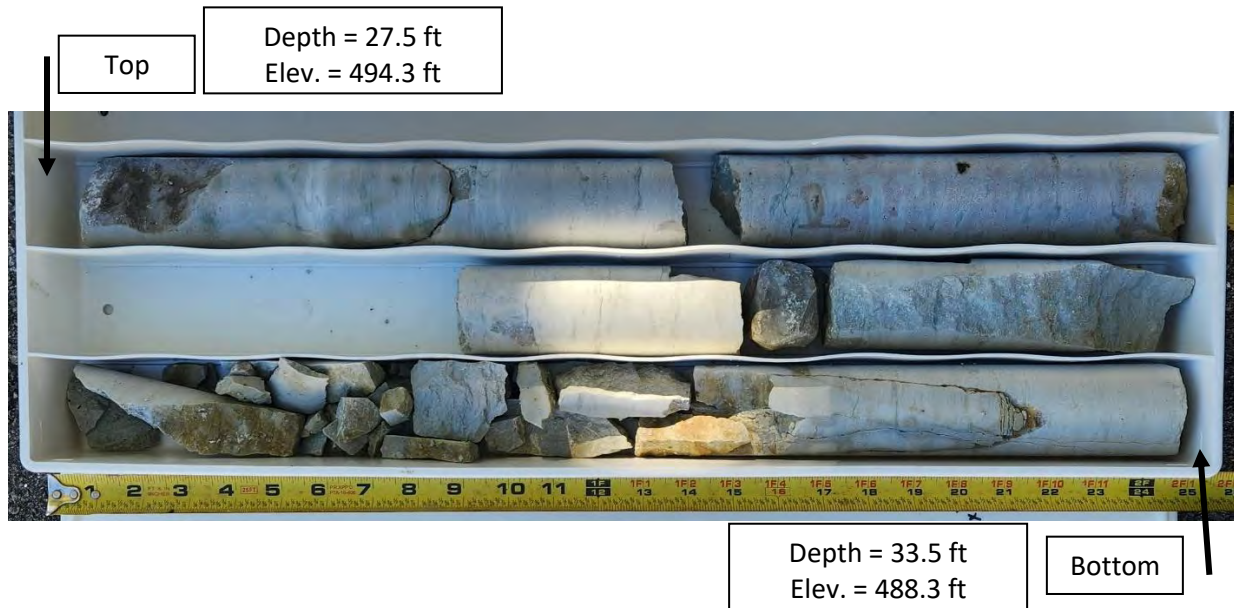
BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
 Boring Number: BSB-27
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) / Compressive Strength (psi)	Description
BSB-27	1	18.5' – 27.5'	99.1	70.8	Fair	25.0 / 13,002	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs

I-80 EB over Des Plaines River
 Boring Number: BSB-27
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-27	2	27.5' – 33.5	82.6	56.6	Fair	Light Gray Limestone Moderately Weathered, Moderately Fractured, Some Vugs

Page 1 of 1

Date 4/9/25

I-80 EB over Des Plaines River
 Boring Number: BSB-28
 Will County, IL

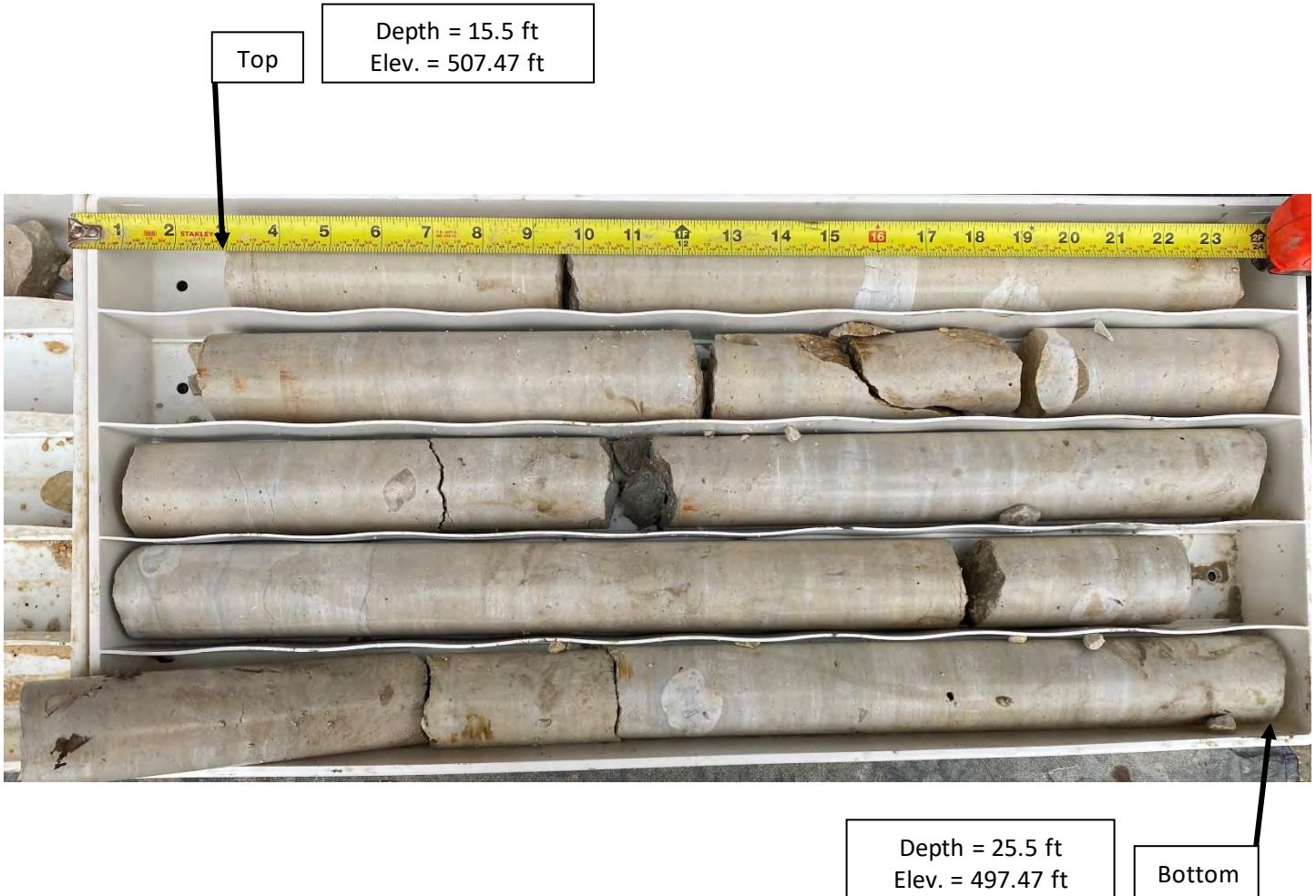


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-28	1	10.5'- 15.5'	94.2	69.2	Fair	13/19,236	Gray Limestone Slightly Weathered, Slightly to Moderately Fractured

I-80 EB over Des Plaines River

Boring Number: BSB-28

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-28	2	15.5' – 25.5'	95.4	86.3	Good	18/8,703	Gray Limestone Slightly Weathered, Slightly Fractured

Page 1 of 1

Date 4/9/25

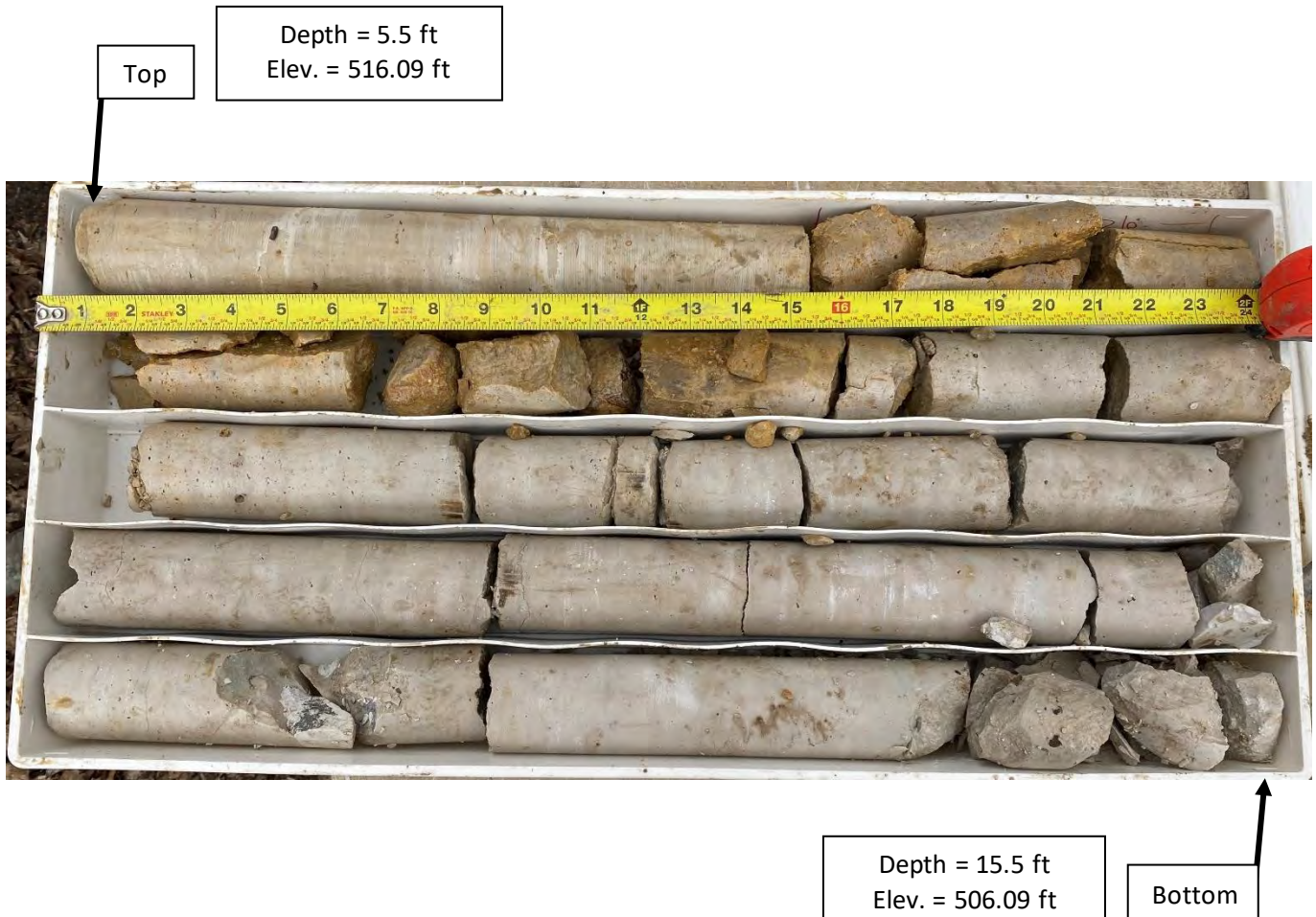
1 inch of Gravel	521.51				
Dark Gray and Brown, Moist to Very Moist		3			
FILL: SILTY CLAY, with gravel		6		26	
		7			
	517.59	6			
Very Dense Brown, Moist GRAVEL, with sand (GP)		50/3"		12	
	-5				-25
Auger refusal at 5.5 feet	516.09				
Gray LIMESTONE, slightly to moderately weathered, moderately fractured					
Run 1: 5.5' - 15.5'					
Recovery: 100%					
RQD: 57.5% (Fair)					
	-10				-30
	-15				-35
	506.09				
Gray LIMESTONE, slightly weathered, slightly fractured, trace chert					
Run 2: 15.5' - 20.5'					
Recovery: 95.8%					
RQD: 95.8% (Excellent)					
	-20				-40

BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River

Boring Number: BSB-29

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-29	1	5.5'- 15.5'	100	57.5	Fair	10/4,316	Gray Limestone Slightly to Moderately Weathered, Moderately Fractured

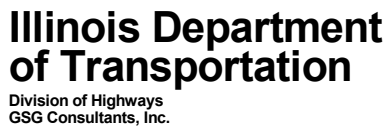
I-80 WB over Des Plaines River

Boring Number: BSB-29

Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-29	2	15.5' – 20.5'	95.8	95.8	Excellent	15.5/20,408	Gray Limestone Slightly Weathered, Slightly Fractured, Trace Chert

Page 1 of 1

Date 10/18/22

BBS, form 137 (Rev. 8-99)

ROUTE	<u>I-80</u>	DESCRIPTION	<u>I-80 EB over Des Plaines River (CSX)</u>	LOGGED BY	<u>EH</u>
--------------	-------------	--------------------	---	------------------	-----------

SECTION C-91-109-22 **LOCATION** , SEC. 16, TWP. 35 N, RNG. 10 E,

COUNTY	Will	DRILLING RIG DRILLING METHOD	Latitude 41.51141626, Longitude -88.08657338	
			Diedrich D-50	HAMMER TYPE
			HSA	Auto
			HAMMER EFF (%)	99.5

STRUCT. NO. 099-8325
Station

BORING NO.	BSB-31
Station	59+46.62
Offset	90.81ft RT
Ground Surface Elev.	523.33

DEPTH	BLOW COUNTS	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After Hrs.	N/A	ft

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

[illegible]

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
 Boring Number: BSB-31
 Will County, IL

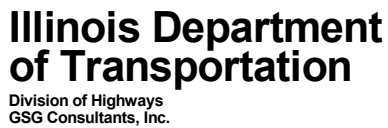


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) / Compressive Strength (psi)	Description
BSB-31	1	10.0' – 20.0'	100.0	93.0	Excellent	13.0 / 18,637	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs

I-80 EB over Des Plaines River
 Boring Number: BSB-31
 Will County, IL

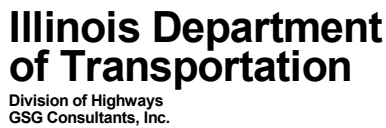


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-31	2	20.0' – 27.0'	100.0	93.0	Excellent	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs

Page 1 of 1

Date 10/19/22

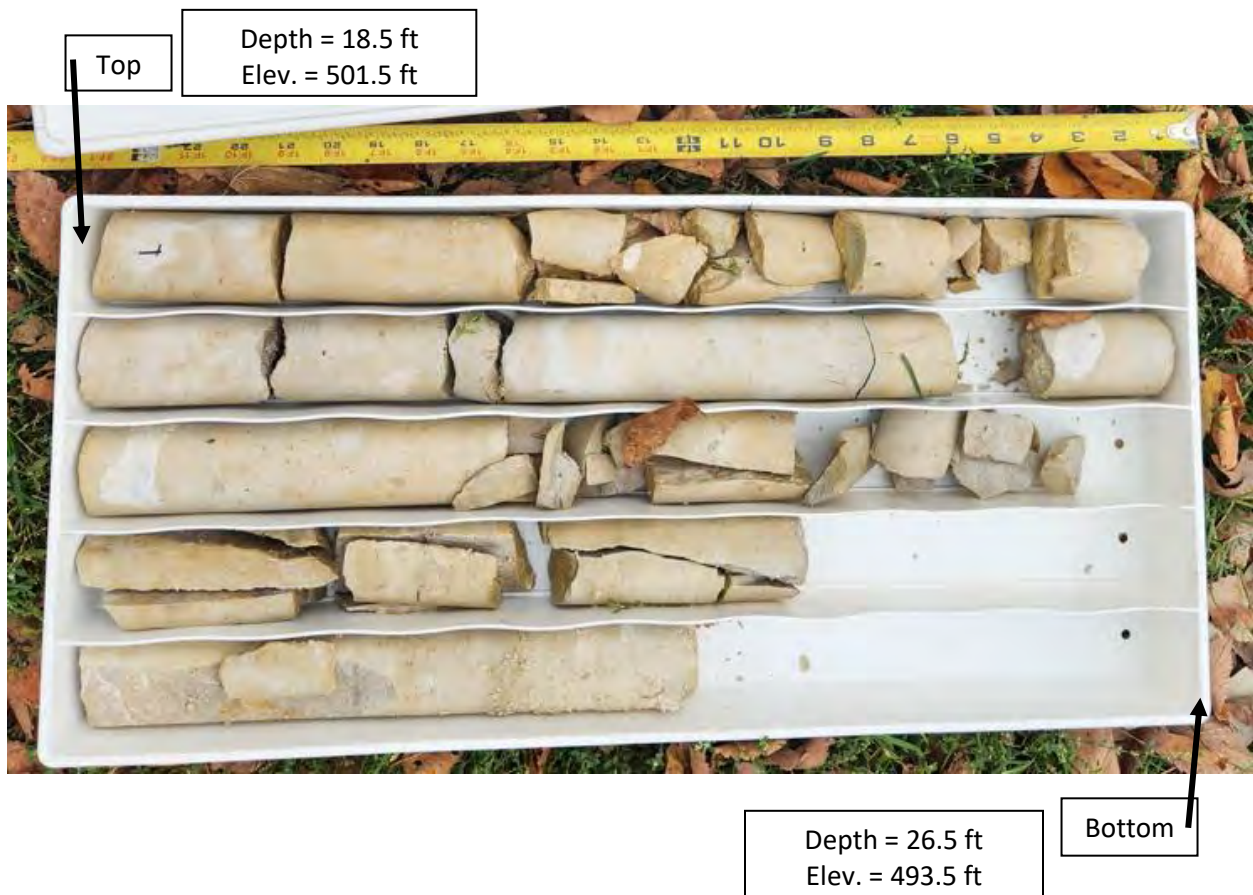
BBS, form 137 (Rev. 8-99)

Page 1 of 1

Date 10/24/22

BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River
Boring Number: BSB-104
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) / Compressive Strength (psi)	Description
BSB-104	1	18.5' – 26.5'	100.0	70	Fair	21.5 / 14,275	Light Gray Limestone Moderately Weathered, Heavily Fractured, Some Vugs

ROUTE	DESCRIPTION	LOGGED BY
I-80	I-80 WB over Des Plaines River (CSX)	AA

SECTION C-91-109-22 **LOCATION** , SEC. 16, TWP. 35 N, RNG. 10 E,

Latitude 41.51257437, **Longitude** -88.08735683

COUNTY	Will	DRILLING RIG	Diedrich D-50	HAMMER TYPE	Auto
		DRILLING METHOD	HSA	HAMMER EFF (%)	95.5

STRUCT. NO. 099-8309
Station

BORING NO.	BSB-105
Station	56+54.33
Offset	281.66ft LT
Ground Surface Elev.	519.62

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After Hrs.	N/A	ft

[illegible]

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

ROUTE	<u>I-80</u>	DESCRIPTION	<u>I-80 EB over Des Plaines River (CSX)</u>	LOGGED BY	<u>KA</u>
--------------	-------------	--------------------	---	------------------	-----------

SECTION C-91-109-22 **LOCATION** , SEC. 16, TWP. 35 N, RNG. 10 E,

Latitude 41.51161417, **Longitude** -88.08913642

COUNTY	Will	DRILLING RIG	CME-75	HAMMER TYPE	Auto
		DRILLING METHOD	HSA	HAMMER EFF (%)	79.8

STRUCT. NO. 099-8325
Station

BORING NO.	BSB-106
Station	52+48.70
Offset	160.41ft RT
Ground Surface Elev.	518.95

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

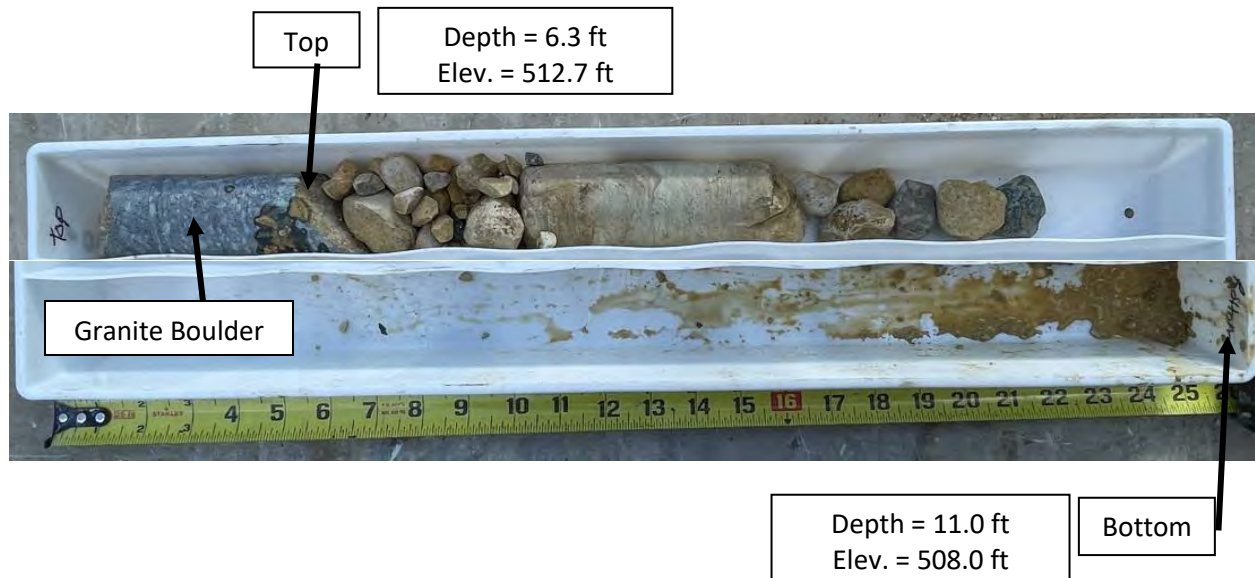
Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After Hrs.	N/A	ft

3 inches of Topsoil	518.70			
Dark Brown, Moist		10		
FILL: SAND, with gravel, trace clay		15		11
	516.45	18		
Medium Dense				
Light Brown and Brown, Dry to Moist		8		
SAND, with gravel (SPG)		10		5
	-5	19		
	512.95			
Boulders and Cobbles	512.65	50/5"		
Light Gray				5
LIMESTONE, heavily weathered, heavily fractured, some cobbles				
Run 1: 6' - 11'				
Recovery: 30%				
RQD: 15% (Very Poor)				
	-10			
	507.95			
Sand and gravel seam from 11 to 13 feet				
	505.95			
Light Gray				
LIMESTONE, heavily weathered, heavily fractured, with cobbles				
Run 2: 13' - 16.5'	-15			
Recovery: 14%				
RQD: 0% (Very Poor)				
	502.45			
End of Boring				
	-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

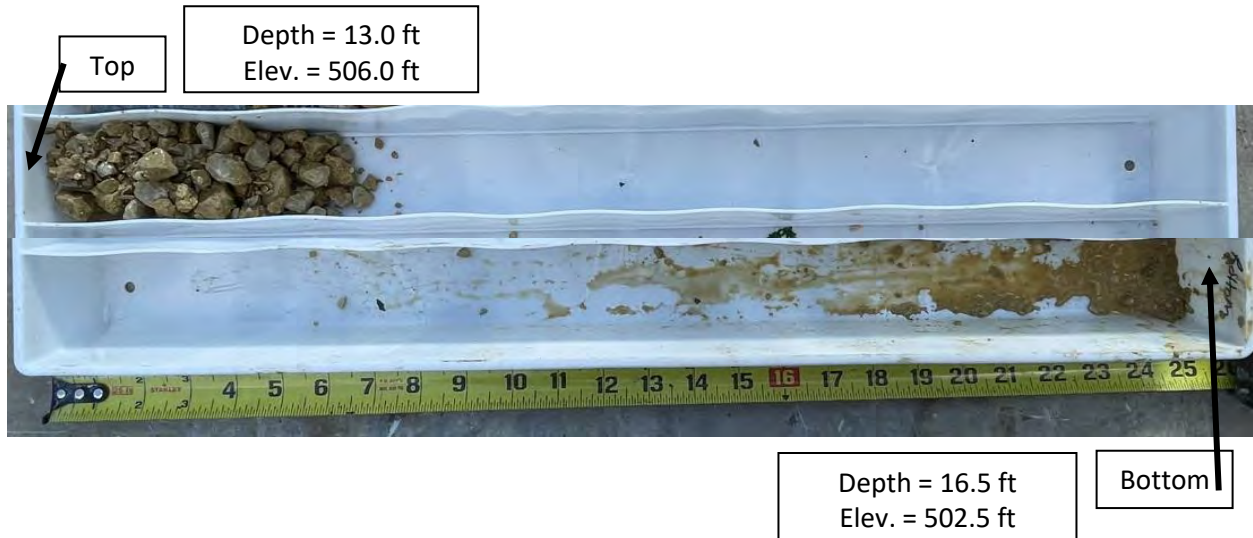
BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River
Boring Number: BSB-106
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) / Compressive Strength (psi)	Description
BSB-106	1	6.3' – 11.0'	25	9	Very Poor	9.0 / 9,467	Light Gray Limestone Heavily Weathered, Heavily Fractured, Some Cobbles

I-80 WB over Des Plaines River
Boring Number: BSB-106
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-106	2	13.0' – 16.5'	14	0	Very Poor	Light Gray Limestone Heavily Weathered, Heavily Fractured, With Cobbles



Illinois Department of Transportation

Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Page 1 of 1

Date 10/20/22

ROUTE I-80 DESCRIPTION I-80 EB over Des Plaines River (CSX) LOGGED BY AA

SECTION C-91-109-22 LOCATION SEC. 16, TWP. 35 N, RNG. 10 E,

COUNTY Will DRILLING RIG Diedrich D-50 Latitude 41.51163115, Longitude -88.08868351
DRILLING METHOD HSA HAMMER TYPE Auto
HAMMER EFF (%) 95.5

STRUCT. NO. 099-8325
Station _____

BORING NO. BSB-107
Station 53+68.86
Offset 129.06ft RT
Ground Surface Elev. 518.40 ft

D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
-------------------------------	--------------------------------	----------------------------	------------------------------

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft
Groundwater Elev.:
First Encounter Dry ft
Upon Completion N/A ft
After _____ Hrs. N/A ft

4 inches of Asphalt 518.07
8 inches of Aggregate Subbase 517.40

Brown, Moist
FILL: SAND, with gravel
Clay seam at 1 foot
514.90

Loose
Brown, Dry
GRAVEL, with cobbles
-5

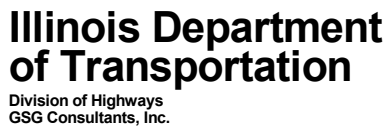
7
5
6
NR

Auger refusal at 8.5 feet 509.90
End of Boring

10			
15			10
10			
10			
4			2
5			
7			
5			NR
6			
-10			
-15			
-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

Page 1 of 1

Date 10/19/22

[illegible]

BBS, form 137 (Rev. 8-99)

ROUTE	I-80	DESCRIPTION	I-80 WB over Des Plaines River (CSX)	LOGGED BY	DD
-------	------	-------------	--------------------------------------	-----------	----

SECTION C-91-109-22 **LOCATION** , SEC. 16, TWP. 35 N, RNG. 10 E,

COUNTY	Will	DRILLING RIG	B-57 Mobile	Latitude 41.5124772, Longitude -88.0926067	HAMMER TYPE	Auto
		DRILLING METHOD	HSA		HAMMER EFF (%)	89

STRUCT. NO. 099-8309
Station

BORING NO.	BSB-109
Station	42+54.10
Offset	46.71ft RT
Ground Surface Elev.	533.95

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

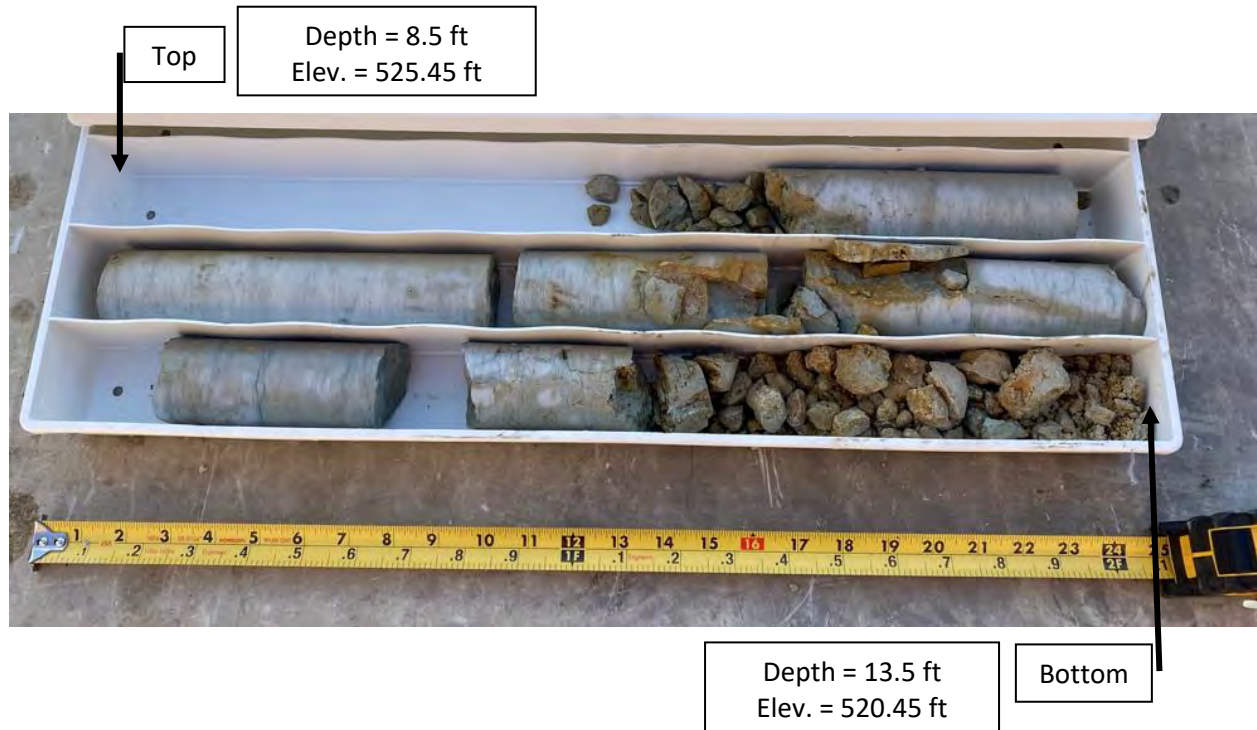
Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After Hrs.	N/A	ft

7 inches of Concrete	533.37			
Dark Brown and Gray, Moist		9		
FILL: GRAVEL, with sand		12		8
		7		
	530.45			
Dark Brown and Gray, Very Moist		2		
FILL: SILTY CLAY, with sand and		3	1.0	35
gravel		6	P	
Cobbles at 3.5 feet	528.95	-5		
Very Dense				
Brown, Moist		50/4"		
SAND, with gravel (SPG)				9
	525.45			
Auger refusal at 8.5 feet		50/3"		
Light Gray				6
LIMESTONE, heavily weathered,				
heavily fractured, some vertical	-10			
fractures, some vugs				
Run 1: 8.5' - 13.5'				
Recovery: 100%				
RQD: 31.7% (Poor)				
	520.45			
End of Boring				
	-15			
	-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
Boring Number: BSB-109
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) /Compressive Strength (psi)	Description
BSB-109	1	8.5'-13.5'	100	31.7	Poor	9.0 / 7,041	Light Gray Limestone Heavily Weathered, Heavily Fractured, Some Vertical Fractures, Some Vugs

SOIL BORING LOG

Date 11/9/22

ROUTE	I-80	DESCRIPTION	I-80 EB over Des Plaines River (CSX)	LOGGED BY	DF
-------	------	-------------	--------------------------------------	-----------	----

SECTION C-91-109-22 **LOCATION** , SEC. 16, TWP. 35 N, RNG. 10 E,

Latitude 41.5127175, **Longitude** -88.0923652
CME-75 **HAMMER TYPE**

COUNTY	Will	DRILLING RIG	CME-75	HAMMER TYPE	Auto
		DRILLING METHOD	HSA	HAMMER EFF (%)	79.8

STRUCT. NO. 099-8325
Station

BORING NO.	BSB-110
Station	43+00.92
Offset	52.51ft LT
Ground Surface Elev.	534.96

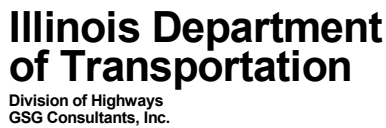
D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Surface Water Elev.	N/A	ft
Stream Bed Elev.	N/A	ft
Groundwater Elev.:		
First Encounter	Dry	ft
Upon Completion	N/A	ft
After Hrs.	N/A	ft

[illegible]

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

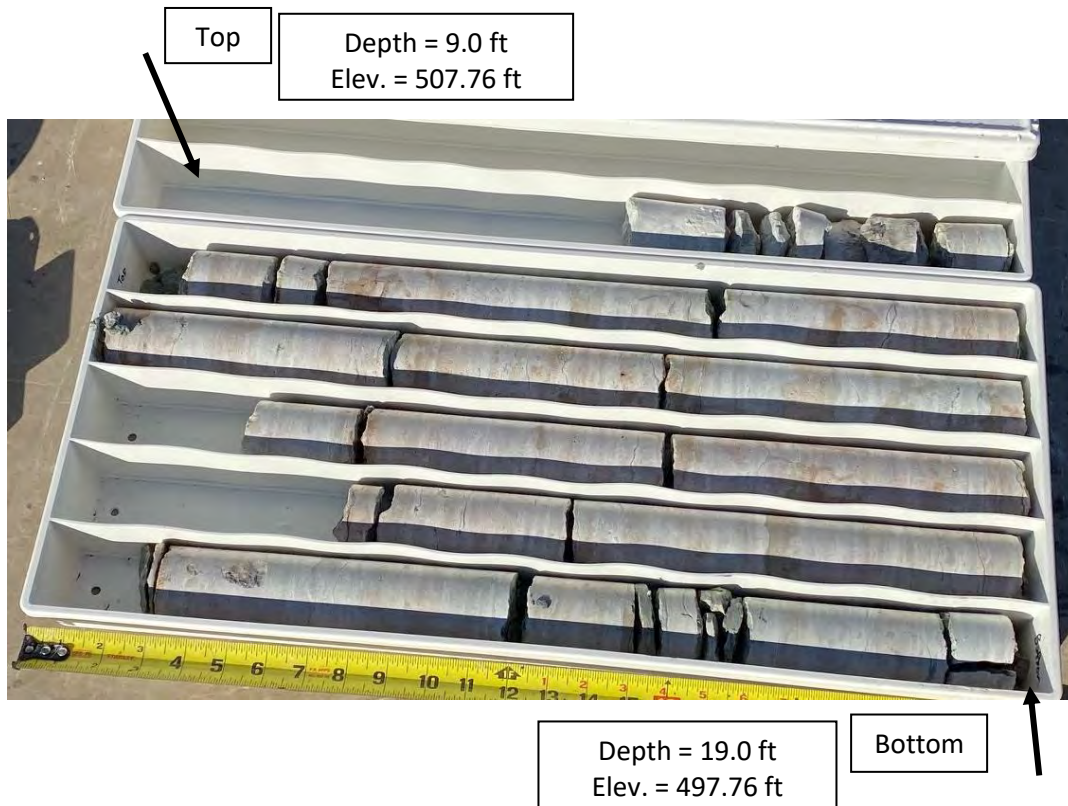
Page 1 of 1

Date 10/26/22

[illegible]

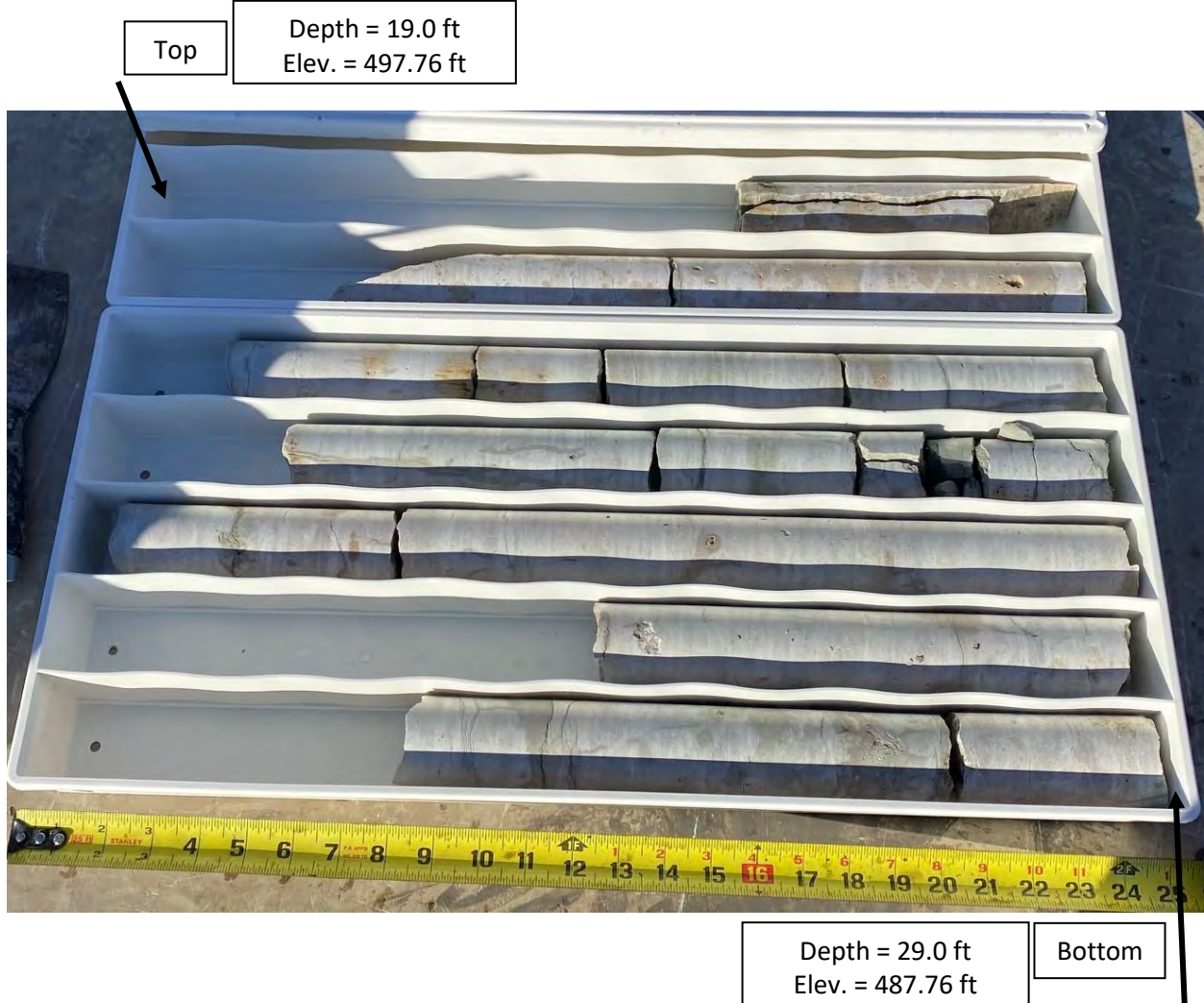
BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River
 Boring Number: BSB-201
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) /Compressive Strength (psi)	Description
BSB-201	1	9' – 19'	100	70.8	Fair	13.0/15,615	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 WB over Des Plaines River
Boring Number: BSB-201
Will County, IL

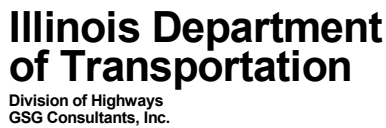


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) /Compressive Strength (psi)	Description
BSB-201	2	19' – 29'	100	76.6	Good	25.0/14,996	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 WB over Des Plaines River
Boring Number: BSB-201
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) /Compressive Strength (psi)	Description
BSB-201	3	29' – 39'	100	65.0	Fair	35.0/13,903	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs

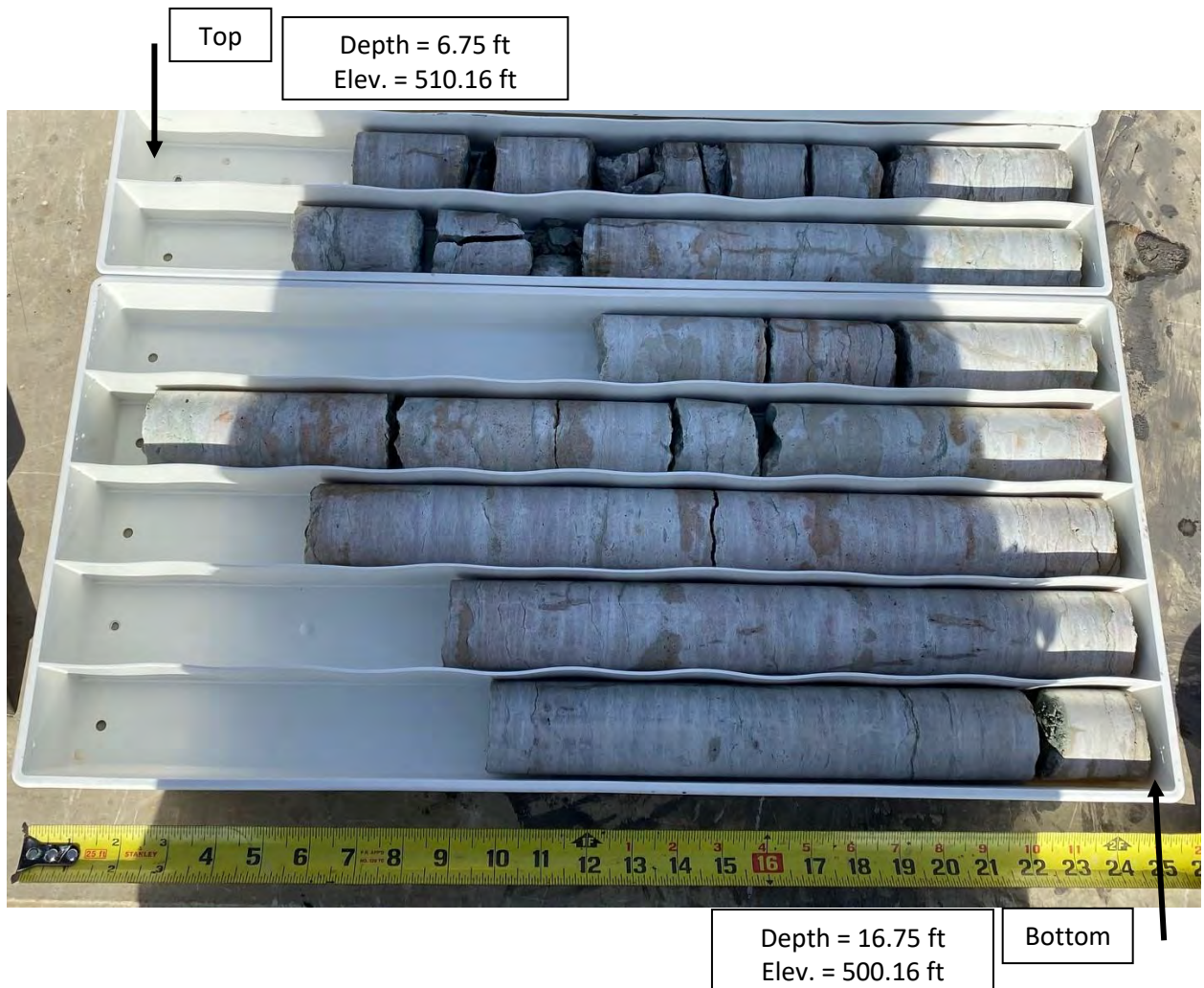
Page 1 of 1

Date 10/27/22

[illegible]

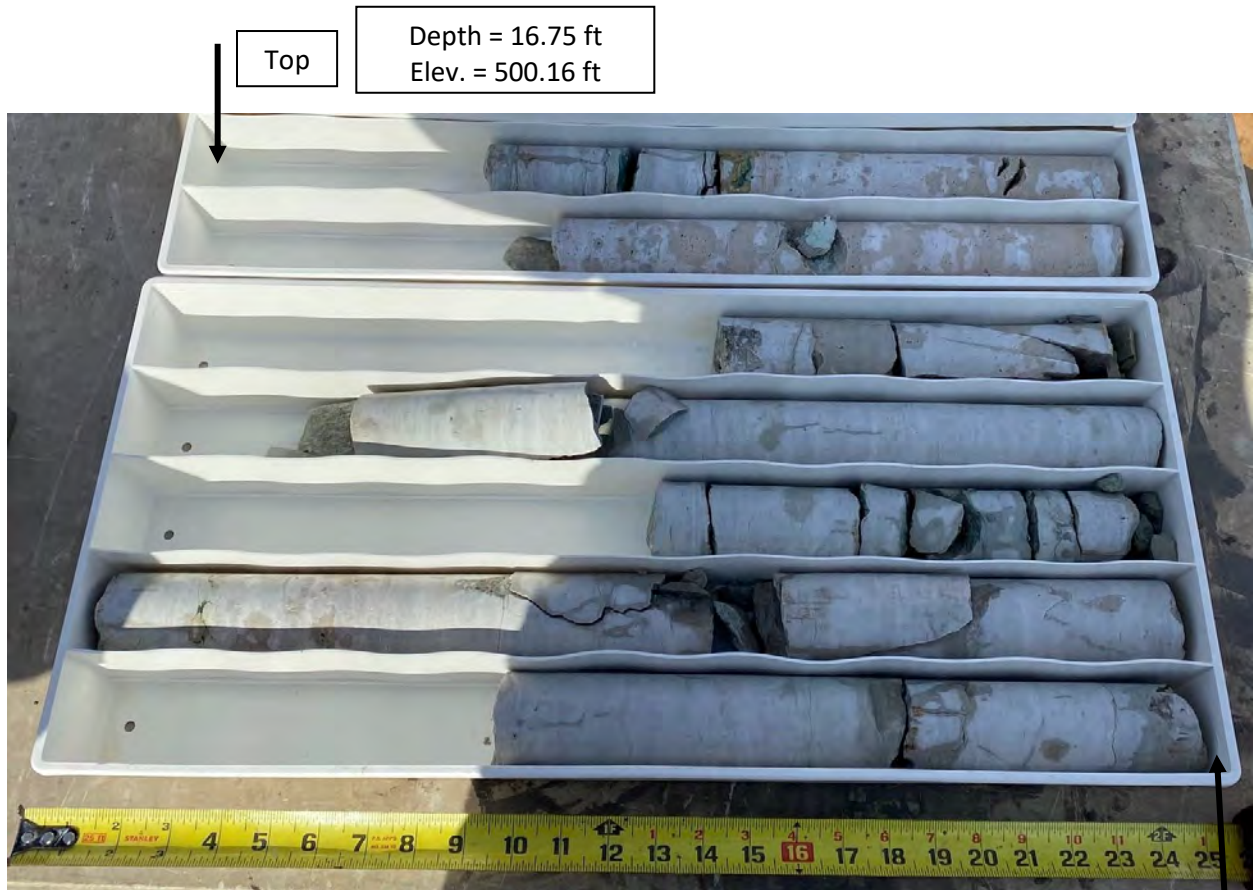
BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River
Boring Number: BSB-202
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) /Compressive Strength (psi)	Description
BSB-202	1	6.75' – 16.75'	100.0	65.0	Fair	9.5/9,053	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs

I-80 WB over Des Plaines River
 Boring Number: BSB-202
 Will County, IL



Depth = 26.75 ft
 Elev. = 490.16 ft

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) /Compressive Strength (psi)	Description
BSB-202	2	16.75'–26.75'	95.8	50.8	Fair	25.75/14,160	Light Gray Limestone Moderately Weathered, Moderately Fractured, Some Vugs

I-80 WB over Des Plaines River
 Boring Number: BSB-202
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) /Compressive Strength (psi)	Description
BSB-202	3	26.75'–36.75'	100.0	76.3	Good	32.75/16,491	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs



Illinois Department of Transportation

Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Page 1 of 2

Date 11/1/22

ROUTE I-80 DESCRIPTION I-80 WB over Des Plaines River (CSX) LOGGED BY KA

SECTION C-91-109-22 LOCATION SEC. 16, TWP. 35 N, RNG. 10 E,

Latitude 41.51242703, Longitude -88.09013271
CME-75

COUNTY Will DRILLING RIG CME-75 DRILLING METHOD HSA HAMMER TYPE Auto HAMMER EFF (%) 79.8

STRUCT. NO. 099-8309
Station

BORING NO. BSB-203
Station 49+21.08
Offset 73.79ft LT
Ground Surface Elev. 511.82 ft

D E P T H (ft)	B L O W S (/6")	U C S (tsf)	M O I S T (%)
-----------------------------------	------------------------------------	--------------------------	----------------------------------

Surface Water Elev.	538.82	ft
Stream Bed Elev.	511.82	ft
Groundwater Elev.:		
First Encounter	N/A	ft
Upon Completion	N/A	ft
After <u> </u> Hrs.	N/A	ft

D E P T H (ft)	B L O W S (/6")	U C S (tsf)	M O I S T (%)
-----------------------------------	------------------------------------	--------------------------	----------------------------------

Dark Gray and Black, Very Moist
SILTY CLAY, trace gravel
(CL/ML)

510.82
510.32

50/2"

490.32

Gray, Wet
WEATHERED LIMESTONE
Auger refusal at 1.5 feet

84

Light Gray
LIMESTONE, moderately
weathered, heavily fractured,
some vugs

Light Gray
LIMESTONE, slightly weathered,
slightly fractured, some vugs

Run 1: 1.5' - 11.5'
Recovery: 100%
RQD: 72% (Fair)

-5

Run 3: 21.5' - 31.5'
Recovery: 100%
RQD: 37.5% (Poor)

-25

-10

-30

500.32

480.32

Light Gray
LIMESTONE, moderately
weathered, heavily fractured,
some vugs

Run 2: 11.5' - 21.5'
Recovery: 100%
RQD: 65.4% (Fair)

-15

Run 4: 31.5' - 41.5'
Recovery: 100%
RQD: 63.3% (Fair)

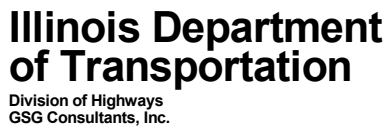
-35

-20

-40

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

Page 2 of 2

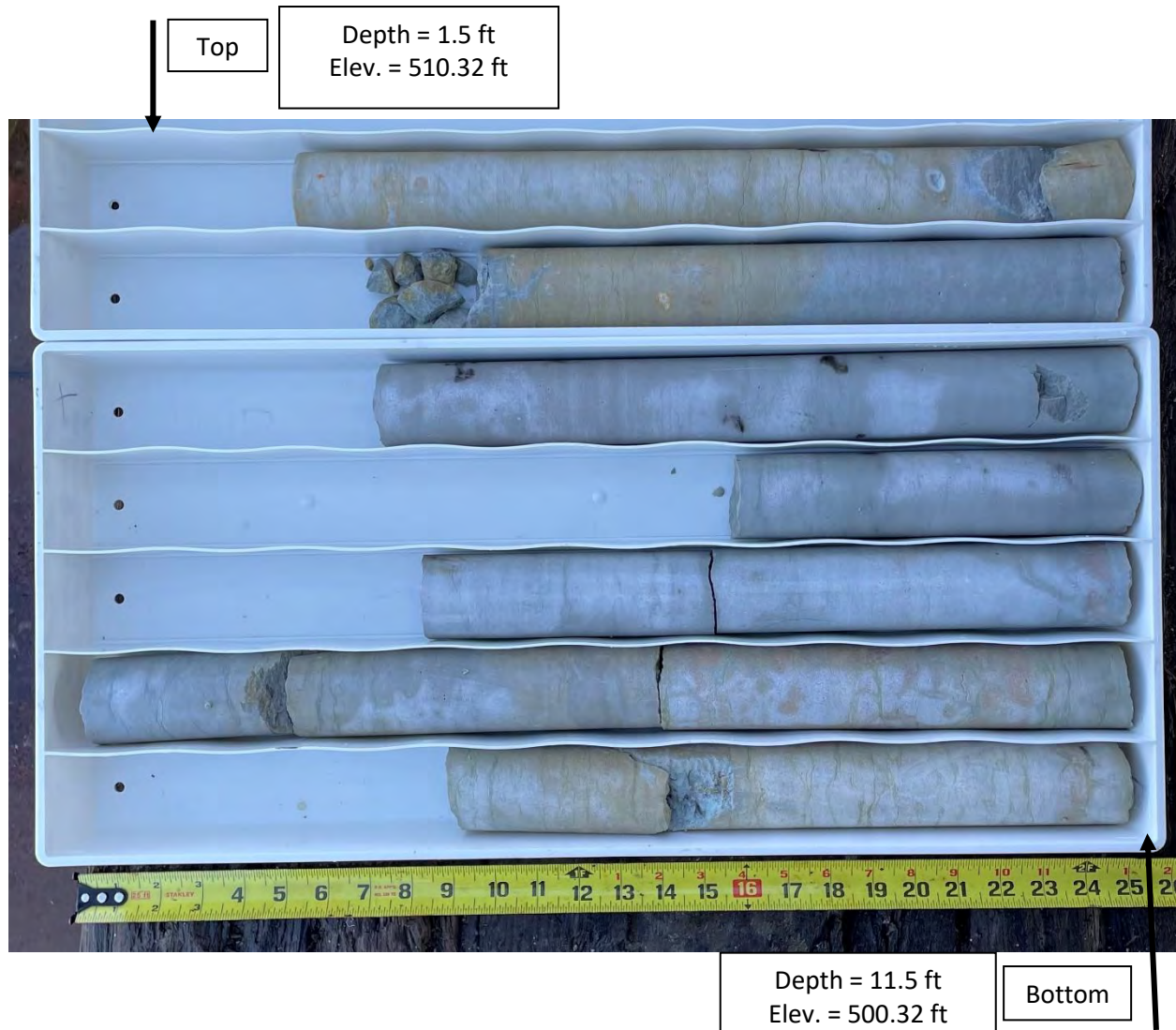
Date 11/1/22

Surface Water Elev.	<u>538.82</u>	ft
Stream Bed Elev.	<u>511.82</u>	ft
Groundwater Elev.:		
First Encounter	<u>N/A</u>	ft
Upon Completion	<u>N/A</u>	ft
After _____ Hrs.	<u>N/A</u>	ft

—

BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River
 Boring Number: BSB-203
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-203	1	1.5' – 11.5'	100.0	72.0	Fair	7.5/11,786	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 WB over Des Plaines River
 Boring Number: BSB-203
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-203	2	11.5'– 21.5'	100.0	65.4	Fair	13.0/9,645	Light Gray Limestone Moderately Weathered, Heavily Fractured, Some Vugs

I-80 WB over Des Plaines River
 Boring Number: BSB-203
 Will County, IL



Depth = 31.5 ft
 Elev. = 480.32 ft

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-203	3	21.5'–31.5'	100.0	37.5	Poor	25.5/10,188	Light Gray Limestone Moderately Weathered, Heavily Fractured, Some Vugs

I-80 WB over Des Plaines River

Boring Number: BSB-203

Will County, IL



Top

Depth = 31.5 ft
Elev. = 480.32 ft

Bottom

Depth = 41.5 ft
Elev. = 470.32 ft

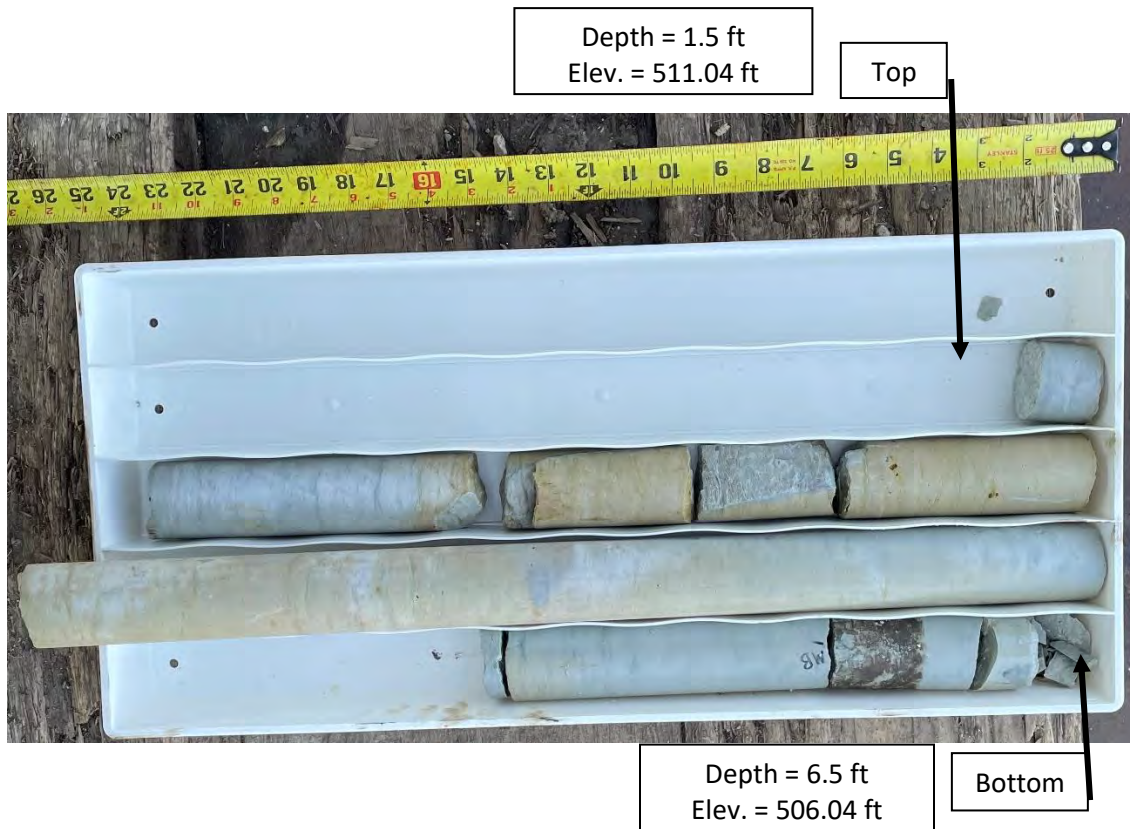
Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-203	4	31.5'-41.5'	100.0	63.3	Fair	35.5/12,737	Light Gray Limestone Moderately Weathered, Heavily Fractured, Some Vugs

Page 1 of 1

Date 11/3/22

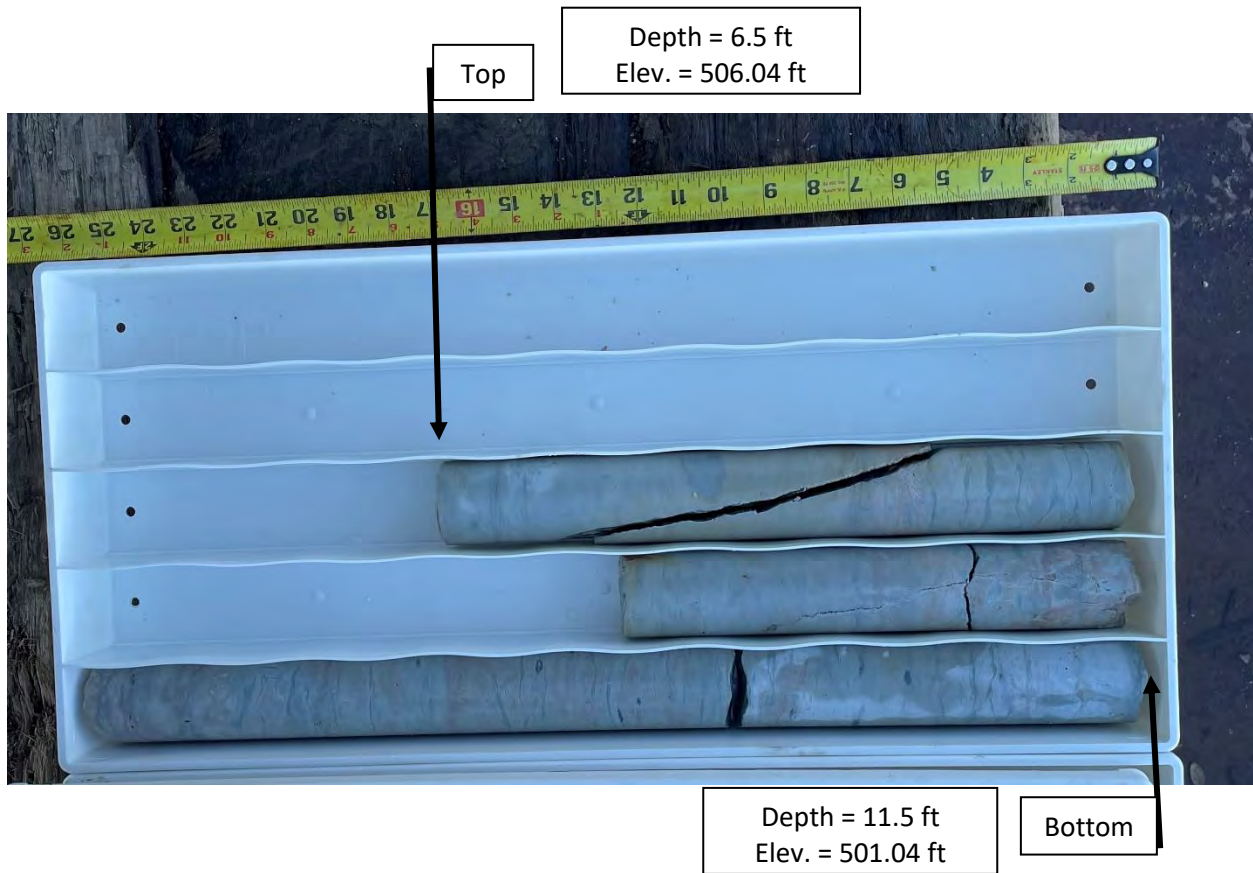
BBS, form 137 (Rev. 8-99)

I-80 WB over Des Plaines River
 Boring Number: BSB-204
 Will County, IL



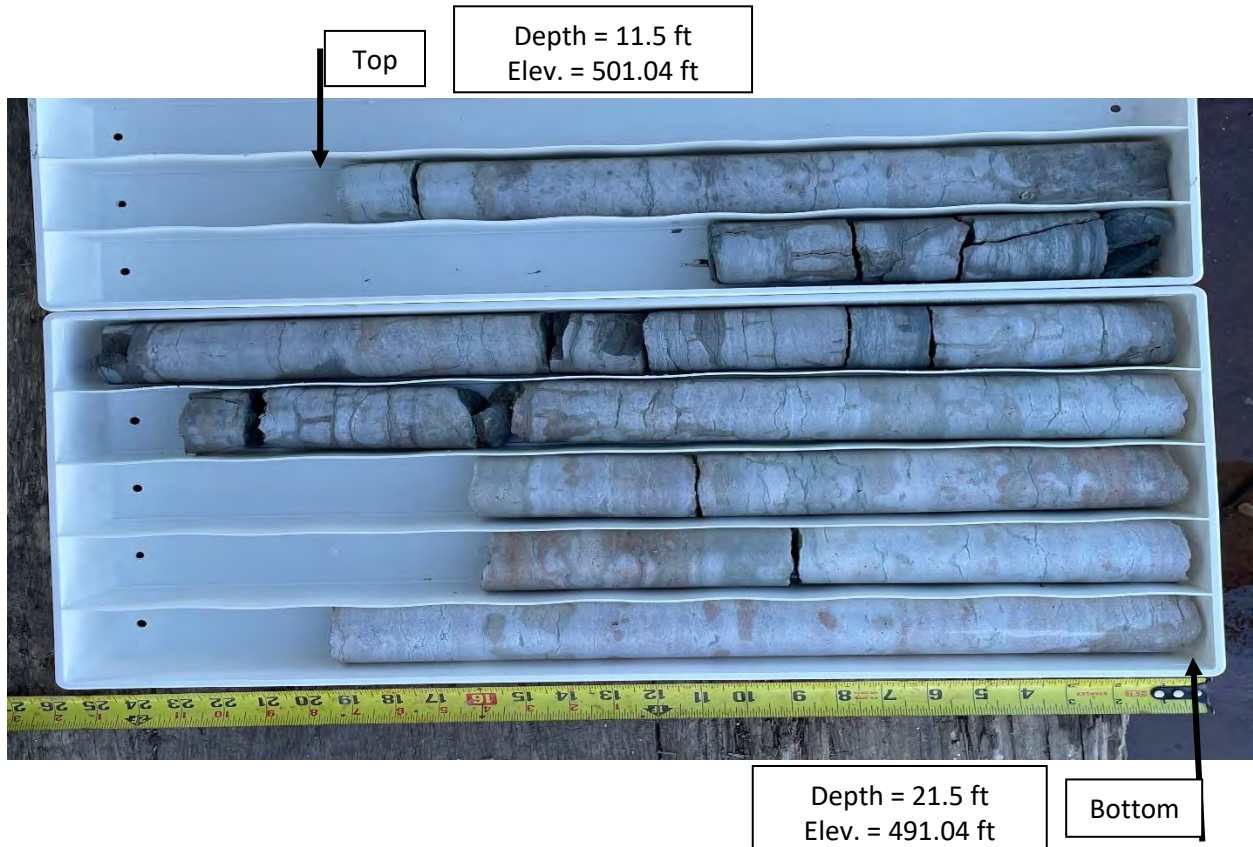
Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) /Compressive Strength (psi)	Description
BSB-204	1	1.5' – 6.5'	100.0	90.0	Excellent	5.0/15,002	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 WB over Des Plaines River
Boring Number: BSB-204
Will County, IL



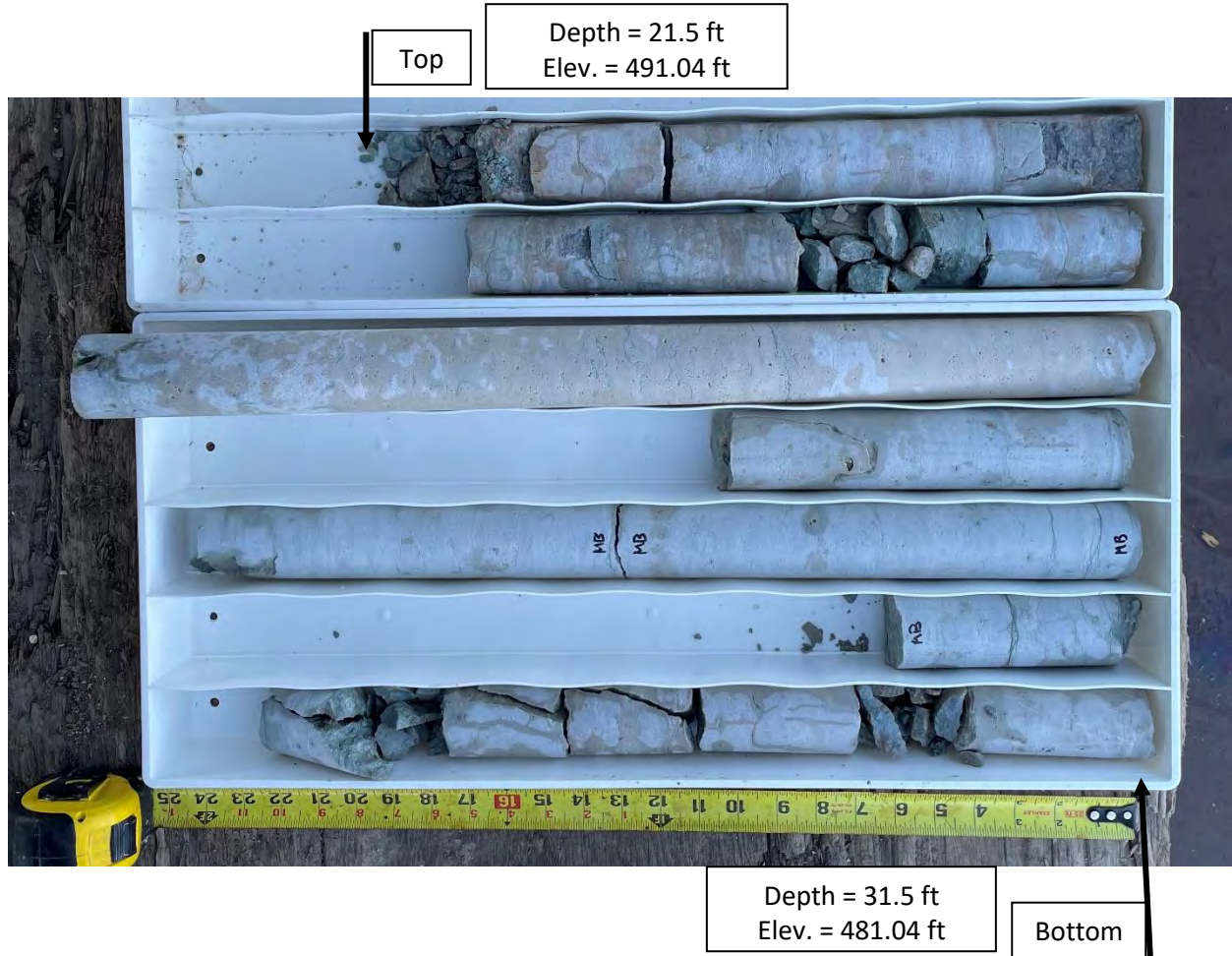
Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) /Compressive Strength (psi)	Description
BSB-204	2	6.5'-11.5'	85.0	73.0	Fair	7.0/15,716	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 WB over Des Plaines River
 Boring Number: BSB-204
 Will County, IL

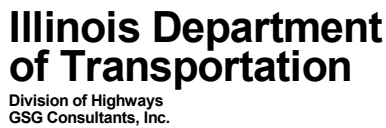


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft) /Compressive Strength (psi)	Description
BSB-204	3	11.5'–21.5'	100.0	79.0	Good	12.0/9,866	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 WB over Des Plaines River
 Boring Number: BSB-204
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-204	4	21.5'-31.5'	100.0	67.5	Fair	28.0/9,400	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs

Page 1 of 1

Date 10/28/22

Latitude 41.51240888, **Longitude** -88.09178768
CME-75 **HAMMER TYPE**

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Very Soft to Medium Stiff Dark Gray, Very Moist SILTY CLAY (CL/ML)					Light Gray LIMESTONE, slightly weathered, slightly fractured, some vugs Run 2: 20' - 30' Recovery: 100% RQD: 89.1% (Good)	
		WH				
		WH	0.2	103		
		WH	P			
		WH				
	2	0.8	78			
514.32	-5	4	B		-25	
Medium Dense to Very Dense Gray, Moist to Wet GRAVEL, trace clay seams (GP)						
		4				
		10		17		
		5				
		29				
	50/5"		12			
509.32	-10				489.32	-30
Auger refusal at 10 feet						
Light Gray LIMESTONE, slightly weathered, moderately fractured, some vugs Run 1: 10' - 20' Recovery: 100% RQD: 75.0% (Fair)					Light Gray LIMESTONE, slightly weathered, slightly fractured, some vugs Run 3: 30' - 40' Recovery: 100% RQD: 85.4% (Good)	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

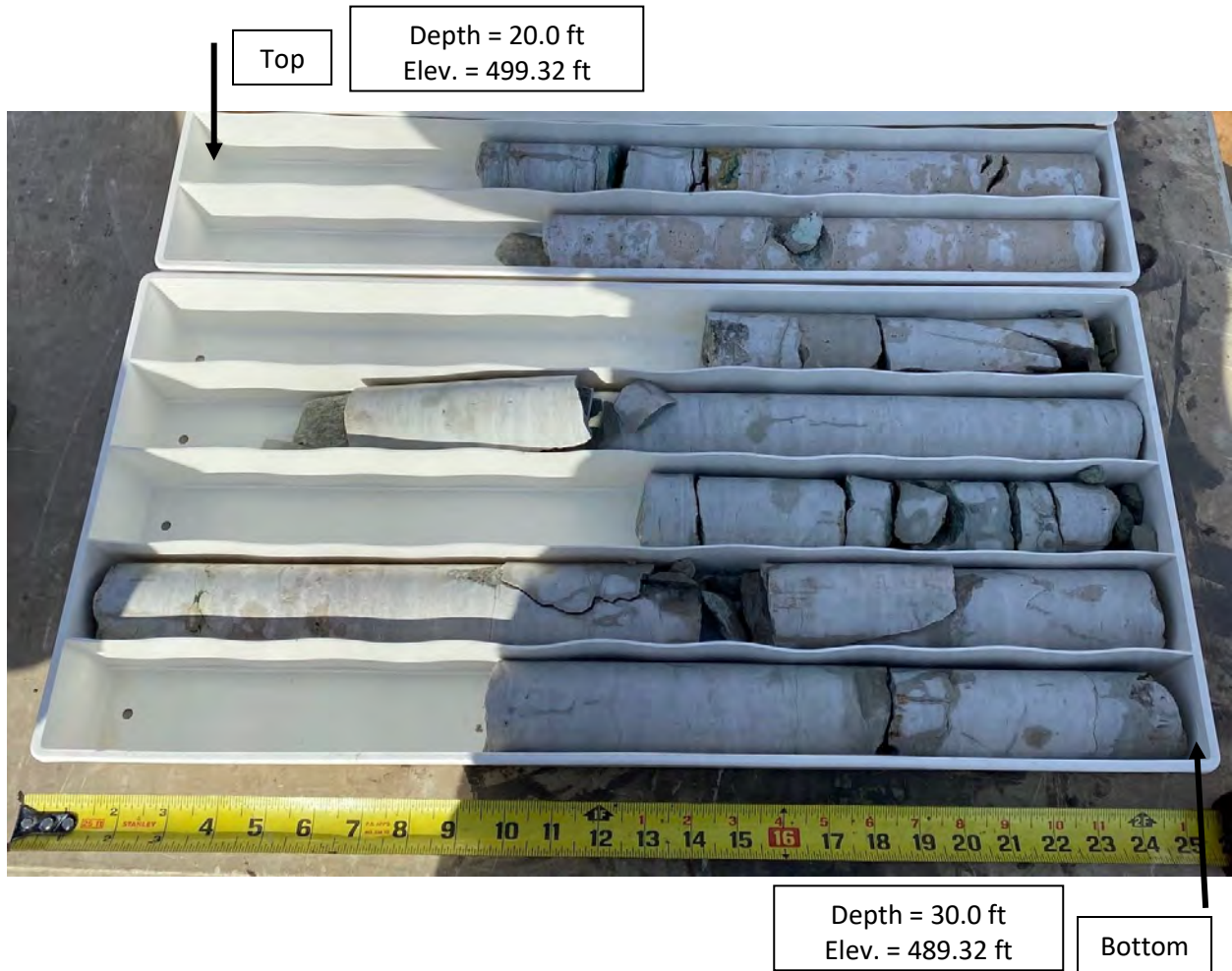
BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
 Boring Number: BSB-205
 Will County, IL



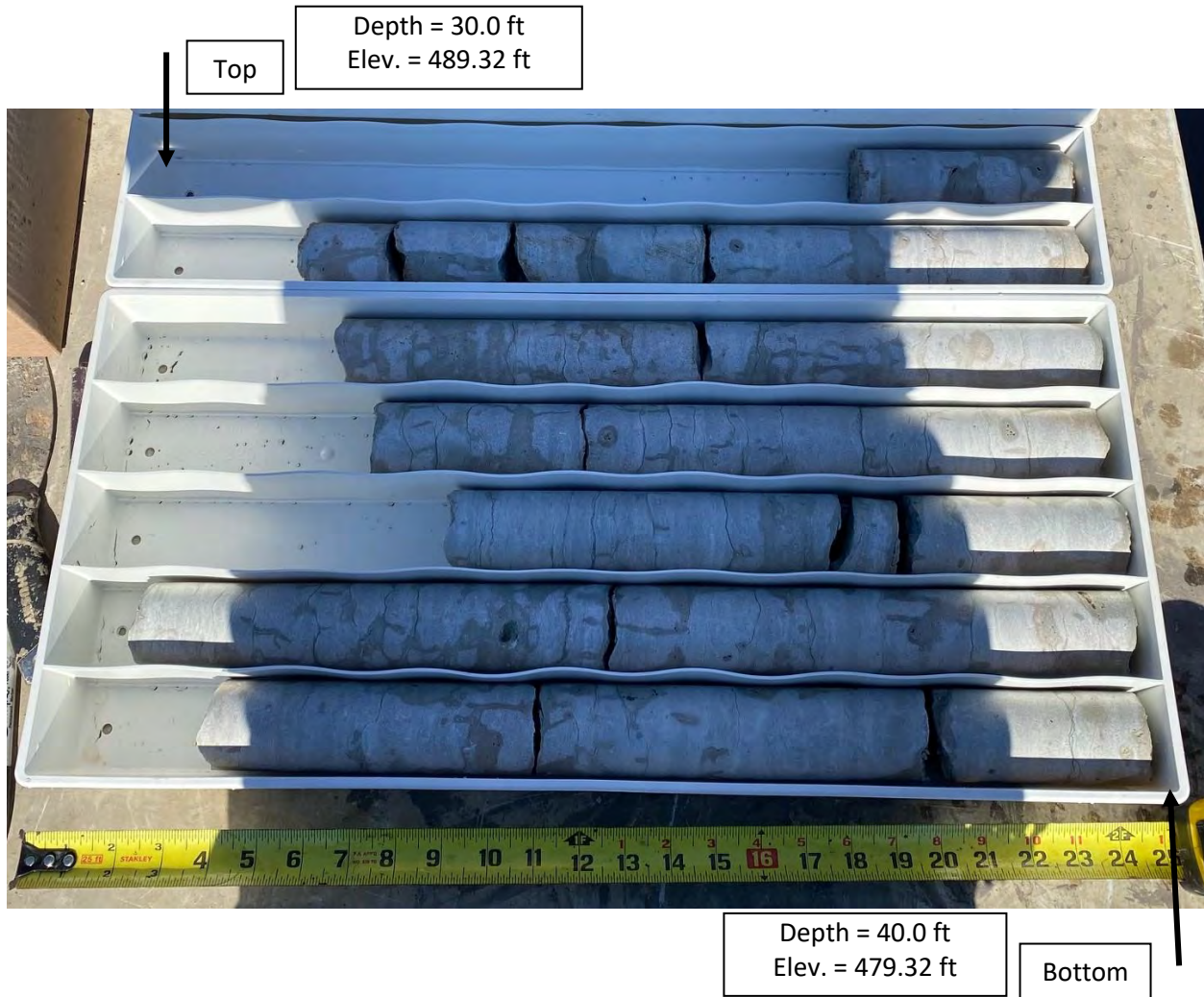
Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-205	1	10.0' – 20.0'	100.0	75.0	Fair	15.0/13,376	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs

I-80 EB over Des Plaines River
Boring Number: BSB-205
Will County, IL

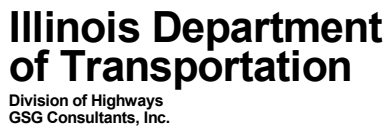


Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-205	2	20.0'-30.0'	100.0	89.1	Good	24.0/14,166	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 EB over Des Plaines River
 Boring Number: BSB-205
 Will County, IL



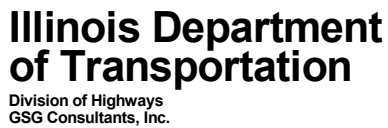
Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)	Description
BSB-205	3	30.0'-40.0'	100.0	85.4	Good	39.0/11,557	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

Page 1 of 2

Date 10/31/22

[illegible]

BBS, form 137 (Rev. 8-99)

Page 2 of 2

Date 10/31/22

Surface Water Elev.	<u>538.22</u>	ft
Stream Bed Elev.	<u>519.72</u>	ft
Groundwater Elev.:		
First Encounter	<u>N/A</u>	ft
Upon Completion	<u>N/A</u>	ft
After _____ Hrs.	<u>N/A</u>	ft

BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
Boring Number: BSB-206
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-206	1	11.0' – 21.0'	100.0	72.0	Fair	17/7,281	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs

I-80 EB over Des Plaines River
 Boring Number: BSB-206
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-206	2	21.0'-31.0'	100.0	74.5	Fair	27.5/8,370	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 EB over Des Plaines River
Boring Number: BSB-206
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-206	3	31.0'-41.0'	100.0	82.0	Good	39/6,839	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

SOIL BORING LOG

Date 11/4/22

ROUTE	DESCRIPTION	LOGGED BY
I-80	I-80 EB over Des Plaines River (CSX)	KA

SECTION C-91-109-22 **LOCATION** , SEC. 16, TWP. 35 N, RNG. 10 E,

Latitude 41.51218307, **Longitude** -88.09031085

COUNTY	Will	DRILLING RIG	CME-75	HAMMER TYPE	Auto
		DRILLING METHOD	HSA	HAMMER EFF (%)	79.8

STRUCT. NO. 099-8325
Station

BORING NO. BSB-207

Station	<u>48+91.48</u>
----------------	-----------------

Offset	23.20ft RT
---------------	------------

Ground Surface Elev.	512.61	ft
-----------------------------	---------------	-----------

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Surface Water Elev. 539.11 ft

Stream Bed Elev.	512.61	ft
------------------	--------	----

Groundwater Elev.:

First Encounter	N/A	ft
-----------------	-----	----

Upon Completion	N/A	ft
-----------------	-----	----

After	Hrs.	N/A	ft
-------	------	-----	----

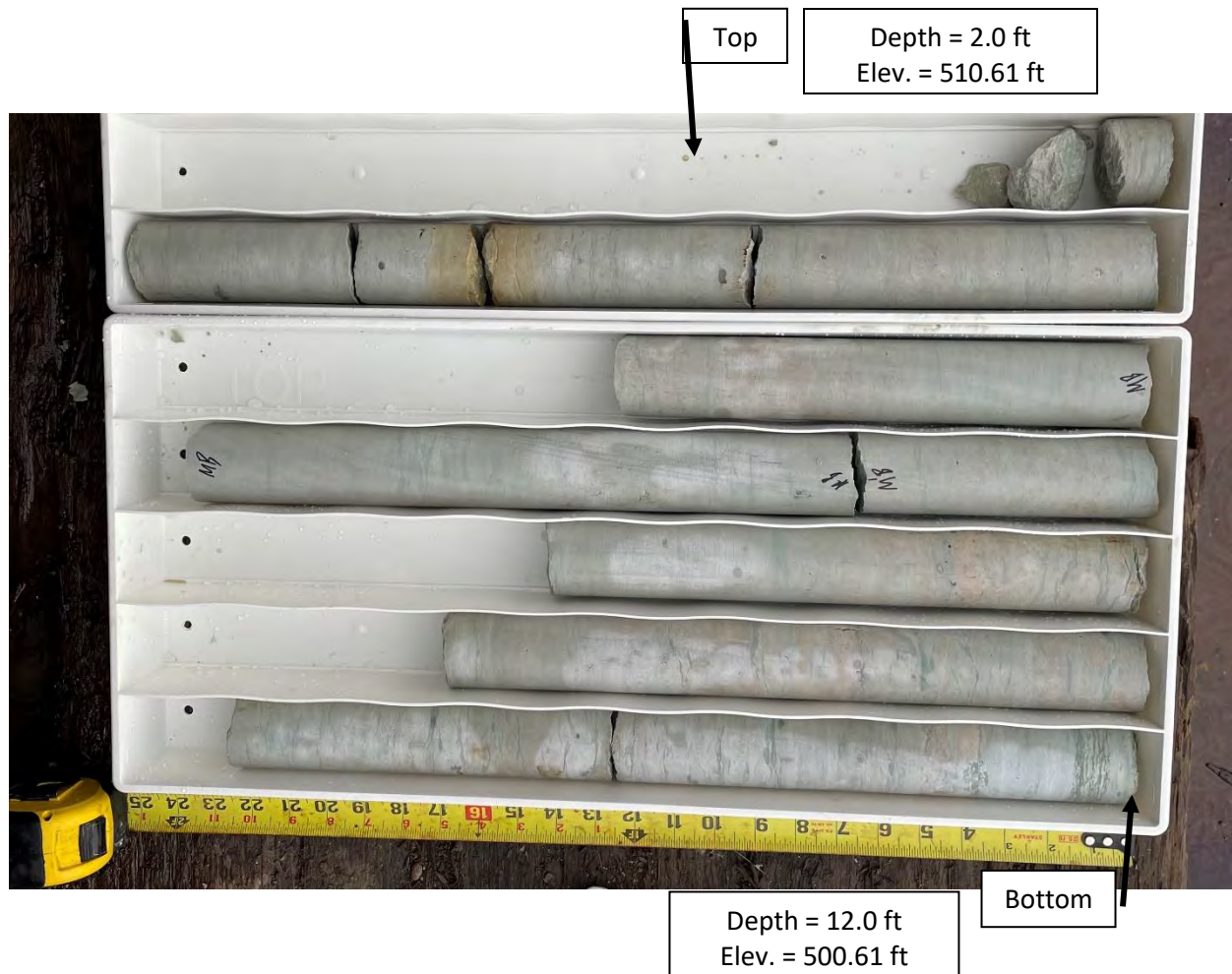
D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

[illegible]

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
 Boring Number: BSB-207
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-207	1	2.0'-12.0'	96.0	88.0	Good	8/15,016	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 EB over Des Plaines River
 Boring Number: BSB-207
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-207	2	12.0'-22.0'	100.0	87.5	Good	14/12,675	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs

I-80 EB over Des Plaines River
 Boring Number: BSB-207
 Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-207	3	22.0'-32.0'	100.0	81.0	Good	28/7,611	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs



Illinois Department of Transportation

Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Page 1 of 1

Date 11/2/22

ROUTE I-80 DESCRIPTION I-80 EB over Des Plaines River (CSX) LOGGED BY KA

SECTION C-91-109-22 LOCATION SEC. 16, TWP. 35 N, RNG. 10 E,

Latitude 41.5120369, Longitude -88.09039398

COUNTY Will DRILLING RIG CME-75 DRILLING METHOD HSA HAMMER TYPE Auto HAMMER EFF (%) 79.8

STRUCT. NO. 099-8325
Station

BORING NO. BSB-208
Station 48+80.07
Offset 79.99ft RT
Ground Surface Elev. 512.89 ft

D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
-------------------------------	--------------------------------	----------------------------	------------------------------

Surface Water Elev.	538.89	ft
Stream Bed Elev.	512.89	ft
Groundwater Elev.:		
First Encounter	N/A	ft
Upon Completion	N/A	ft
After _____ Hrs.	N/A	ft

D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
-------------------------------	--------------------------------	----------------------------	------------------------------

Very Soft
Dark Gray and Black, Very Moist
SILTY CLAY, trace organics
(CL/ML)

WH		
WH	0.0	114
WH	P	

Light Gray
LIMESTONE, slightly weathered,
slightly fractured, some vugs

Run 2: 13.5' - 23.5'
Recovery: 100%
RQD: 87.5% (Good) (continued)

Auger refusal at 3.5 feet

509.39

50/1"

Light Gray
LIMESTONE, slightly weathered,
slightly fractured, some vugs

NR		
----	--	--

Light Gray
LIMESTONE, slightly weathered,
slightly fractured, some vugs

Run 3: 23.5' - 33.5'
Recovery: 100%
RQD: 84% (Good)

Run 1: 3.5' - 13.5'
Recovery: 97.5%
RQD: 82.5% (Good)

-10

499.39

Light Gray
LIMESTONE, slightly weathered,
slightly fractured, some vugs

-15

Run 2: 13.5' - 23.5'
Recovery: 100%
RQD: 87.5% (Good)

End of Boring

479.39

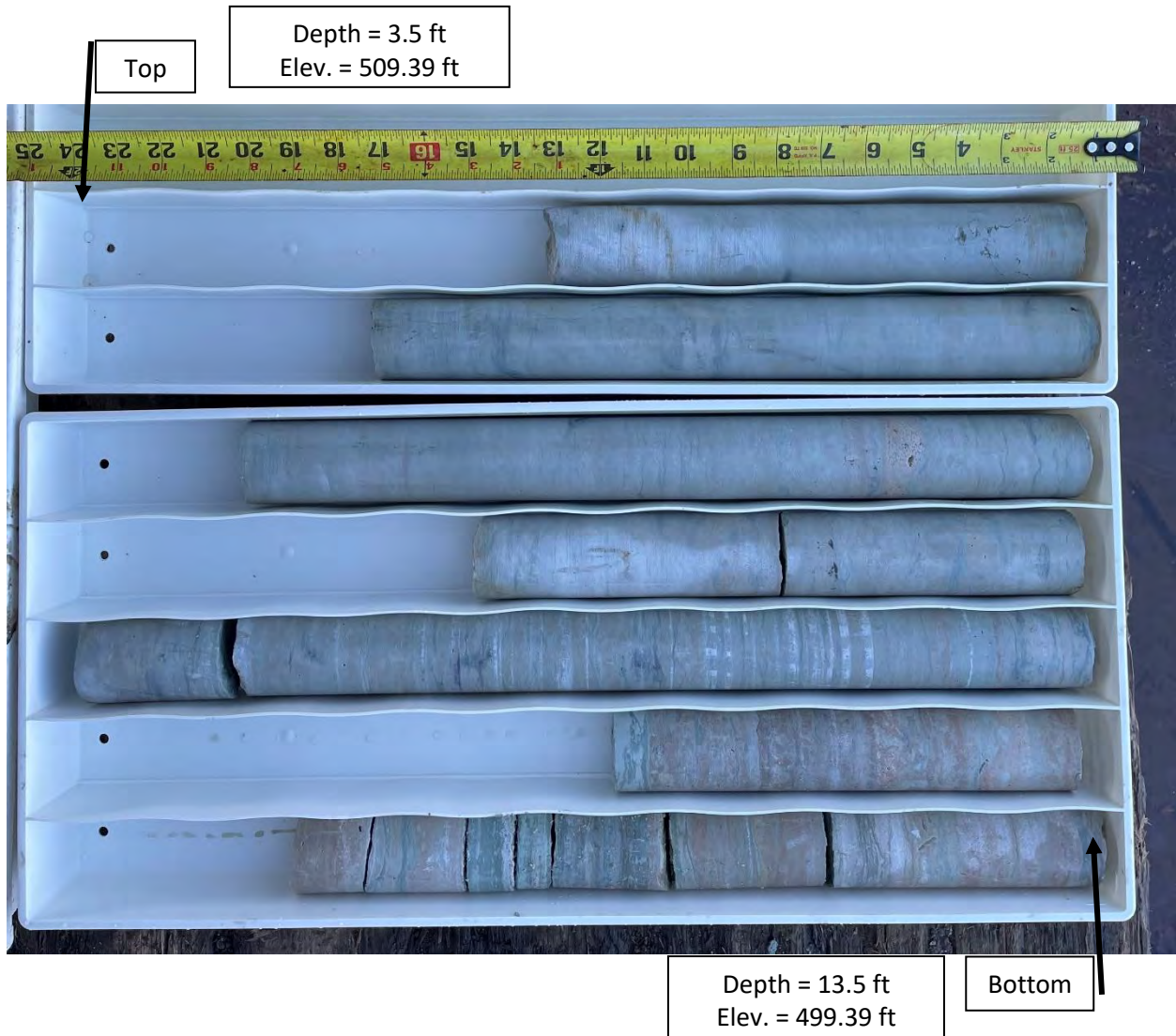
-20

-40

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

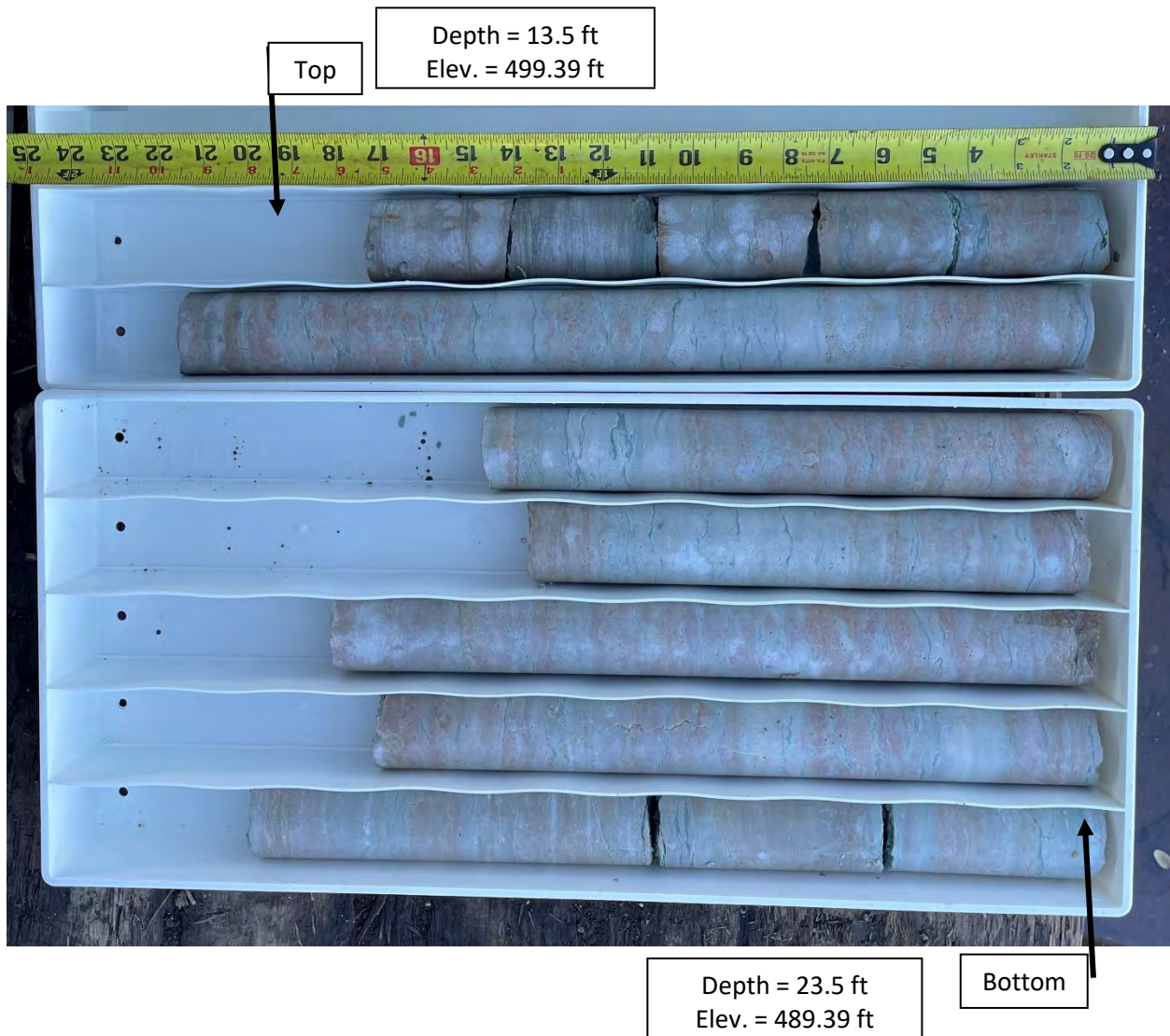
BBS, form 137 (Rev. 8-99)

I-80 EB over Des Plaines River
 Boring Number: BSB-208
 Will County, IL



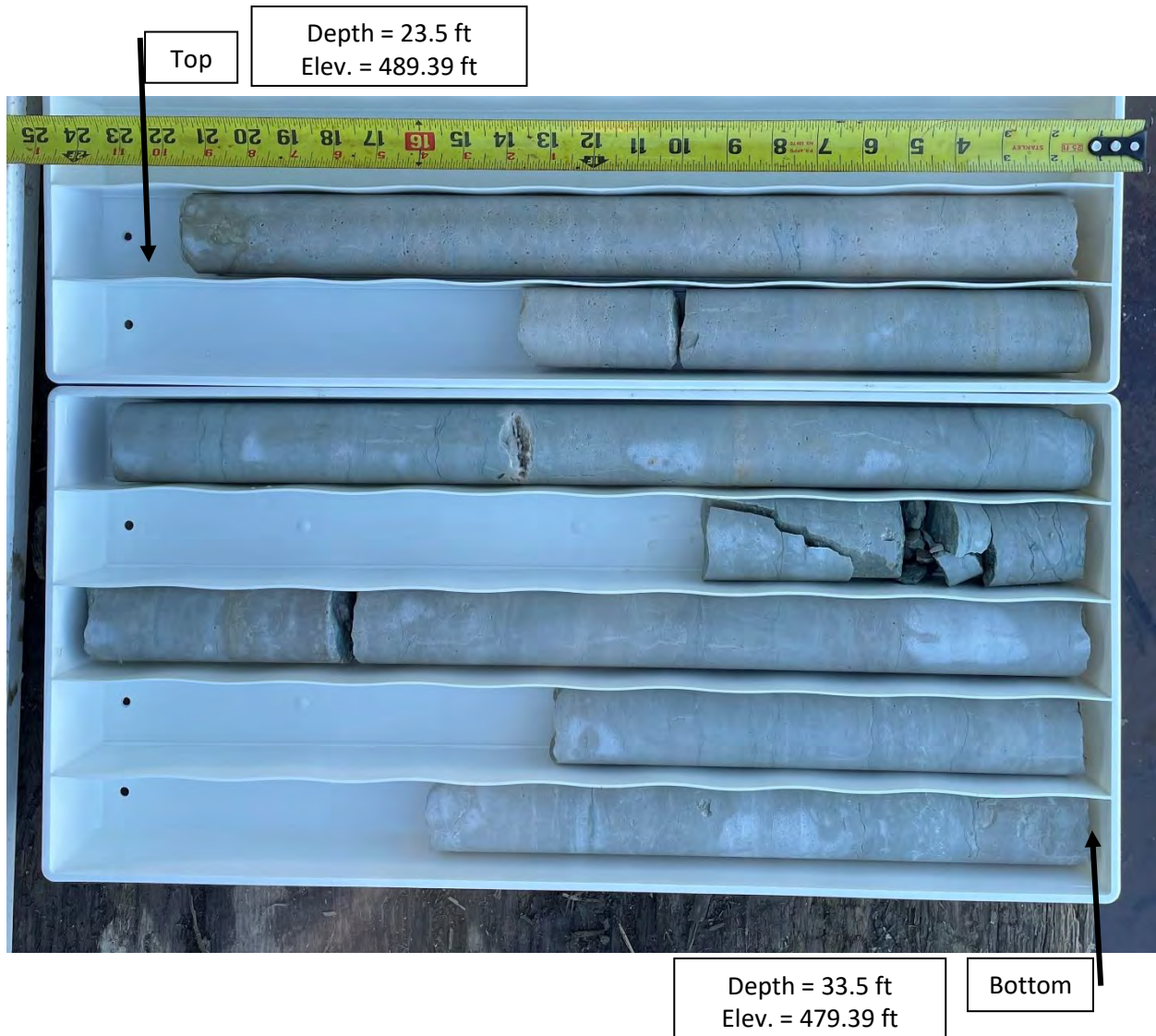
Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-208	1	3.5'-13.5'	97.5	82.5	Good	12.5/15,621	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 EB over Des Plaines River
Boring Number: BSB-208
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-208	2	13.5'-23.5'	100.0	87.5	Good	19.5/12,216	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

I-80 EB over Des Plaines River
Boring Number: BSB-208
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-208	3	23.5'-33.5'	100.0	84.0	Good	30.5/13,666	Light Gray Limestone Slightly Weathered, Slightly Fractured, Some Vugs

APPENDIX D
LABORATORY TEST RESULTS

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80

Project No: 21-2007

Boring ID: BSB-1

<u>Bulk/Prep</u>	<u>MC/CS</u>
------------------	--------------

Sample Depth (ft): 38

Tester: TH ID 2473

Lithological Description: Limestone

Date: 07/08/25 Date: 07/08/25

Formation Name: _____ Load Direction: _____

Vertical Angle Drilled: Vertical

Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, <i>in.</i>	3.4825	3.4680	3.4775	3.4760
Diameter, <i>in.</i>	1.9915	1.9990	1.9950	1.9952
Specimen Mass, <i>g</i>	481.4			Ratio (2.0-2.5)
Bulk Density, <i>pcf</i>	168.8			1.74

Moisture Condition - D2216

container, g	519.4
container + wet rock, g	994.7
container + dry soil, g	986.9
moisture content, $w\%$	1.7

Preparation Check

Preparation Check	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

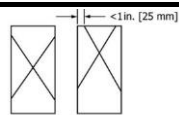
Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	1 min 5 sec	
Load @ Failure, <i>lbf</i>	23,262	
Uniaxial Compressive Strength, <i>psi</i>	7,440	

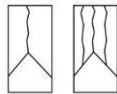
After Preparation



After Break (check applicable appearance)



Type 1
Reasonably well-formed
cones on both ends, less
than 1 in. [25 mm] of
cracking through caps



Type 2
Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end



Type 3
Columnar vertical cracking
through both ends, no well-
formed cones



Type 4
Diagonal fracture with no
cracking through ends;
tap with hammer to
distinguish from Type 1



Type 5
Side fractures at top or bottom (occur commonly with unbonded caps)



Type 6
Similar to Type 5 but end
of cylinder is pointed

Sketch if Other:



Form ID	TF-RCS	Reviewed By	Sam
Revision Date	8/25/2024	Review Date	10/29/24

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-1
Sample Depth (ft): 44'
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: TH ID 2473
Date: 07/08/25 Date: 07/08/25
Vertical Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.6960	4.6760	4.6860	4.6860
Diameter, in.	2.0010	2.0045	2.0095	2.0050
Specimen Mass, g	648.8		Ratio (2.0-2.5)	
Bulk Density, pcf	167.1		2.34	

Moisture Condition - D2216

container, g	465.5
container + wet rock, g	1095.5
container + dry soil, g	1081.5
moisture content, w%	2.3

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	1 min 49 sec	
Load @ Failure, lbf	38,727	
Uniaxial Compressive Strength, psi	12,266	

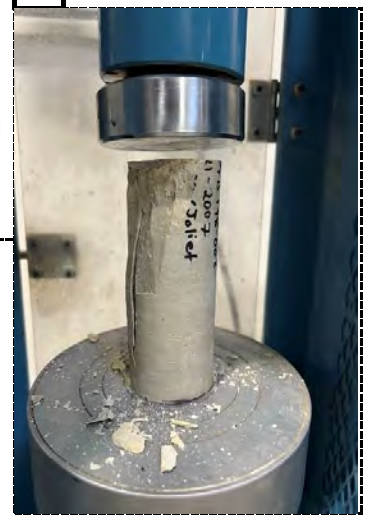
After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☒

Sketch if Other:



Form ID	TF-RCS	Reviewed By	Sam
Revision Date	8/25/2024	Review Date	10/29/24

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-03 Bulk/Prep MC/CS
Sample Depth (ft): 9-10ft Tester: AR ID
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	4.5730	4.5740	4.5760	4.574
Diameter, in.	1.7470	1.7590	1.7455	1.751
Specimen Mass, g	648.6		Ratio (2.0-2.5)	
Bulk Density, pcf	224.5		2.61	

Moisture Condition - D2216

container, g	468.5
container + wet rock, g	1036.5
container + dry soil, g	1035.5
moisture content, w%	0.2

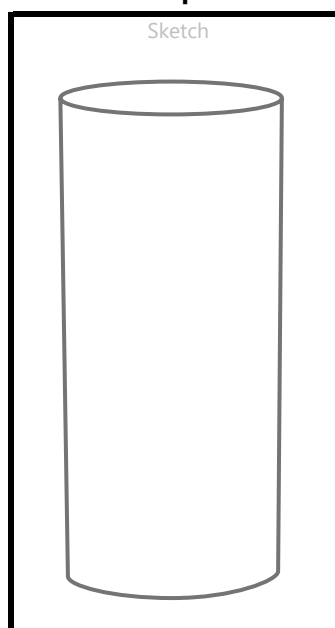
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

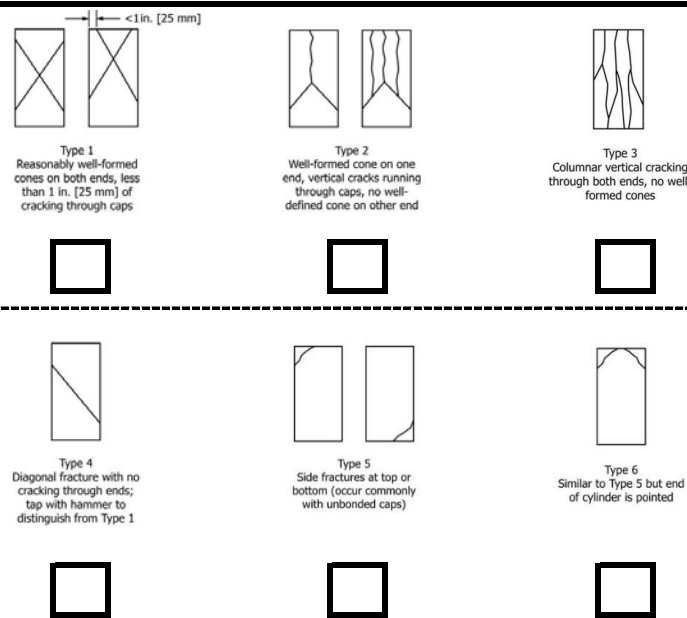
Axial Loading

		Remarks
Seating Load (≤ 1000 psi)		Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)		
Time to Failure (2-15 min)	2 min 17 sec	
Load @ Failure, lbf	38,393	
Uniaxial Compressive Strength, psi	15,953	

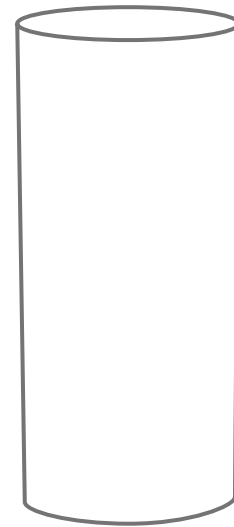
After Preparation



After Break (check applicable appearance)



Sketch if Other:



Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-03 Bulk/Prep MC/CS
Sample Depth (ft): 18-19 Tester: AR ID
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	4.2740	4.2690	4.2550	4.266
Diameter, in.	1.7360	1.7340	1.7540	1.741
Specimen Mass, g	622.8		Ratio (2.0-2.5)	
Bulk Density, pcf	233.6		2.45	

Moisture Condition - D2216

container, g	158.6
container + wet rock, g	492.3
container + dry soil, g	491.3
moisture content, w%	0.3

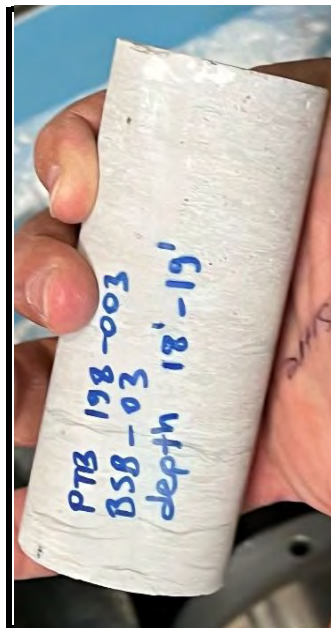
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)		Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)		
Time to Failure (2-15 min)	2 min 41 sec	
Load @ Failure, lbf	42,744	
Uniaxial Compressive Strength, psi	17,948	

After Preparation



After Break (check applicable appearance)

Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	Type 6 Similar to Type 5 but end of cylinder is pointed ☐



Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP 198-003 I-80
Boring ID: BSB-5
Sample Depth (ft): 7-7.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 10/25/22 Date: 10/25/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.6285	4.6400	4.6235	4.6307
Diameter, in.	1.9825	1.9760	1.9815	1.9800
Specimen Mass, g	633.0			Ratio (2.0-2.5)
Bulk Density, pcf	169.2			2.34

Moisture Condition - D2216

Container ID	SWEET
container, g	226.3
container + wet rock, g	684.1
container + dry soil, g	677.2
moisture content, w%	1.5

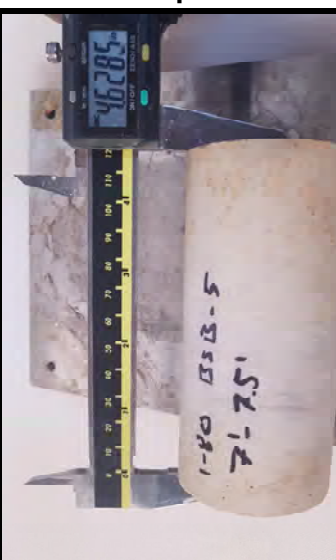
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?		X	Side Surface isn't Straight
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

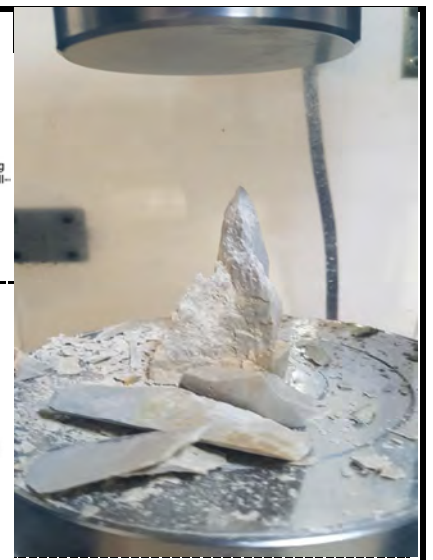
		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	3 min 43 sec	
Load @ Failure, lbf	52,650	
Uniaxial Compressive Strength, psi	17,099	

After Preparation



After Break (check applicable appearance)

Type 1	Type 2	Type 3
Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps	Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end	Columnar vertical cracking through both ends, no well-formed cones
☐	☐	☒
Type 4	Type 5	Type 6
Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1	Side fractures at top or bottom (occur commonly with unbonded caps)	Similar to Type 5 but end of cylinder is pointed
☐	☐	☐



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	10/31/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-08
Sample Depth (ft): 16.5-17.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 11/14/22 Date: 11/14/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.8595	4.8490	4.8475	4.8520
Diameter, in.	1.9870	1.9855	1.9845	1.9857
Specimen Mass, g	674.9			Ratio (2.0-2.5)
Bulk Density, pcf	171.1			2.44

Moisture Condition - D2216

Container ID	NERDS
container, g	226.2
container + wet rock, g	802.3
container + dry soil, g	793.7
moisture content, w%	1.5

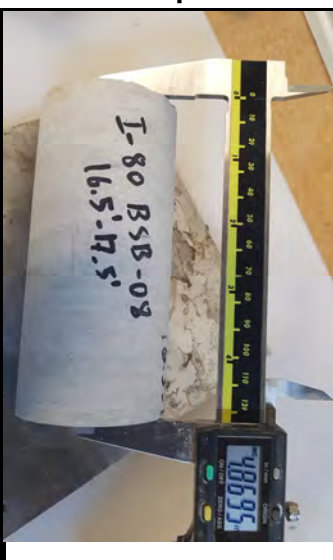
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 28 sec	
Load @ Failure, lbf	35,245	
Uniaxial Compressive Strength, psi	11,381	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	
Revision Date	10/21/2021	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80
Boring ID: BSB-09
Sample Depth (ft): 11.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AM ID 2736
Date: 12/01/25 Date: 12/01/25
Vertical Angle Drilled: Vertical
Cracks

Bulk Density Determination

	1	2	3	Average
Height, in.	5.0740	5.0710	5.0730	5.0727
Diameter, in.	1.9550	1.9590	1.9680	1.9607
Specimen Mass, g	682.1		Ratio (2.0-2.5)	
Bulk Density, pcf	169.7		2.59	

Moisture Condition - D2216

container, g	226.2
container + wet rock, g	545.2
container + dry soil, g	541.3
moisture content, w%	1.2

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	10000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	85	
Time to Failure (2-15 min)	2 min 33 sec	
Load @ Failure, lbf	34,578	
Uniaxial Compressive Strength, psi	11,453	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☒

Sketch if Other:



Form ID	TF-RCS	Reviewed By	Sam
Revision Date	8/25/2024	Review Date	10/29/24

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80
Boring ID: BSB-09
Sample Depth (ft): 21.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AM ID 2736
Date: 12/01/25 Date: 12/01/25
Vertical Angle Drilled: Vertical
Cracks

Bulk Density Determination

	1	2	3	Average
Height, in.	4.2270	4.2290	4.2410	4.2323
Diameter, in.	1.9730	1.9765	1.9855	1.9783
Specimen Mass, g	574.7			Ratio (2.0-2.5)
Bulk Density, pcf	168.3			2.14

Moisture Condition - D2216

container, g	226.6
container + wet rock, g	760.8
container + dry soil, g	753.7
moisture content, w%	1.3

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	10000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	85	
Time to Failure (2-15 min)	0 min 40 sec	
Load @ Failure, lbf	15,785	
Uniaxial Compressive Strength, psi	5,135	

After Preparation



After Break (check applicable appearance)

Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
Type 4 Diagonal fracture with caps cracking through ends; tap with hammer to distinguish from Type 1 ☐	Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	Type 6 Similar to Type 5 but end of cylinder is pointed ☒

Sketch if Other:



Form ID	TF-RCS	Reviewed By	Sam
Revision Date	8/25/2024	Review Date	10/29/24

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 24-2019
Boring ID: BSB-15 Bulk/Prep MC/CS
Sample Depth (ft): 6-7ft Tester: AR ID
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	4.4300	4.4200	4.4300	4.427
Diameter, in.	1.7200	1.1210	1.7215	1.521
Specimen Mass, g	628.6		Ratio (2.0-2.5)	
Bulk Density, pcf	297.8		2.91	

Moisture Condition - D2216

container, g	513.1
container + wet rock, g	1137.7
container + dry soil, g	1136.5
moisture content, w%	0.2

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

Seating Load (≤ 1000 psi)		Remarks Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	42	
Time to Failure (2-15 min)	1 min 39 sec	
Load @ Failure, lbf	15,493	
Uniaxial Compressive Strength, psi	8,529	

After Preparation

After Break (check applicable appearance)

Sketch

Type 1	Type 2	Type 3
Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps	Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end	Columnar vertical cracking through both ends, no well-formed cones
☐	☐	☒

Type 4	Type 5	Type 6
Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1	Side fractures at top or bottom (occur commonly with unbonded caps)	Similar to Type 5 but end of cylinder is pointed
☐	☐	☐

Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007

Boring ID: BSB-15 Bulk/Prep: MC/CS

Sample Depth (ft): 14-15 Tester: AR ID:

Lithological Description: Limestone Date: 05/05/25 Date:

Formation Name: Load Direction: Vertical Angle Drilled: Vertical

Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	4.5230	4.4900	4.5300	4.514
Diameter, in.	1.7500	1.7220	1.7230	1.732
Specimen Mass, g	645.8			Ratio (2.0-2.5)
Bulk Density, pcf	231.4			2.61

Moisture Condition - D2216

container, g	513.6
container + wet rock, g	1131.7
container + dry soil, g	1131.0
moisture content, w%	0.1

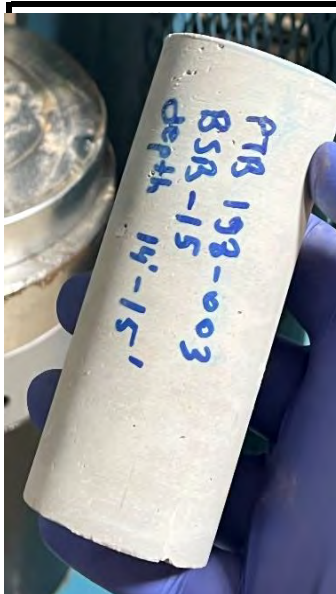
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

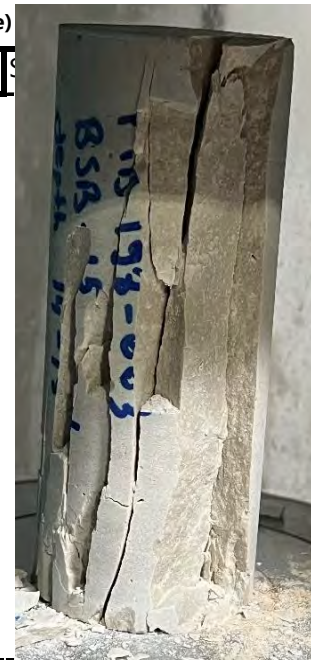
		Remarks
Seating Load (≤ 1000 psi)		Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)		
Time to Failure (2-15 min)	1 min 24 sec	
Load @ Failure, lbf	27,138	
Uniaxial Compressive Strength, psi	11,523	

After Preparation



After Break (check applicable appearance)

Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	Type 6 Similar to Type 5 but end of cylinder is pointed ☐



Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-18 Bulk/Prep MC/CS
Sample Depth (ft): 22-23 Tester: AR ID
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	5.5210	5.5210	5.5310	5.524
Diameter, in.	1.7260	1.7270	1.7560	1.736
Specimen Mass, g	760.8		Ratio (2.0-2.5)	
Bulk Density, pcf	221.6		3.18	

Moisture Condition - D2216

container, g	515.0
container + wet rock, g	1243.0
container + dry soil, g	1241.2
moisture content, w%	0.2

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

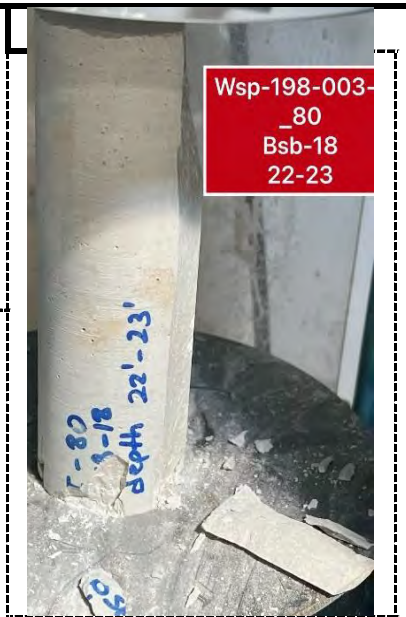
		Remarks
Seating Load (≤ 1000 psi)		Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	90	
Time to Failure (2-15 min)	1 min 15 sec	
Load @ Failure, lbf	24,305	
Uniaxial Compressive Strength, psi	10,265	

After Preparation



After Break (check applicable appearance)

 ☐	 ☒	 ☐
 ☐	 ☐	 ☐



Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP 198-003 I-80
Boring ID: BSB-19
Sample Depth (ft): 13.5-14.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 10/25/22 Date: 10/25/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.9150	4.9165	4.9140	4.9152
Diameter, in.	1.9765	1.9795	1.9775	1.9778
Specimen Mass, g	678.4			Ratio (2.0-2.5)
Bulk Density, pcf	171.2			2.49

Moisture Condition - D2216

Container ID	M&M
container, g	225.9
container + wet rock, g	639.1
container + dry soil, g	633.9
moisture content, w%	1.3

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

	Remarks
Seating Load (≤ 1000 psi)	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	
Time to Failure (2-15 min)	
Load @ Failure, lbf	
Uniaxial Compressive Strength, psi	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	10/31/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-20 Bulk/Prep MC/CS
Sample Depth (ft): 9-10ft Tester: AR ID
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	4.5290	4.5370	4.5260	4.531
Diameter, in.	1.7240	1.7260	1.7260	1.725
Specimen Mass, g	633.6		Ratio (2.0-2.5)	
Bulk Density, pcf	227.9		2.63	

Moisture Condition - D2216

container, g	470.2
container + wet rock, g	858.2
container + dry soil, g	857.7
moisture content, w%	0.1

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)		Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	86	
Time to Failure (2-15 min)	2 min 20 sec	
Load @ Failure, lbf	38,313	
Uniaxial Compressive Strength, psi	16,387	

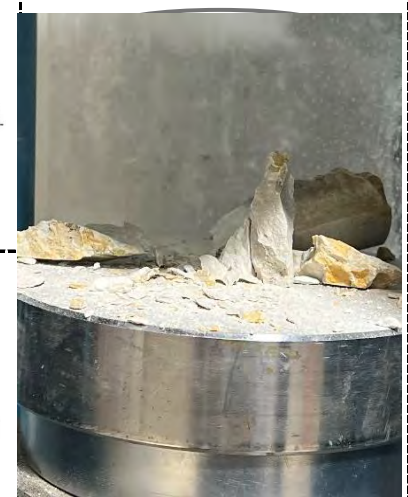
After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-20 Bulk/Prep: MC/CS
Sample Depth (ft): 21-22 Tester: AR ID:
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	3.1230	3.1320	3.1660	3.140
Diameter, in.	1.7270	1.7310	1.7350	1.731
Specimen Mass, g	468.6		Ratio (2.0-2.5)	
Bulk Density, pcf	241.6		1.81	

Moisture Condition - D2216

container, g	469.5
container + wet rock, g	1095.0
container + dry soil, g	1093.1
moisture content, w%	0.3

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

Seating Load (≤ 1000 psi)		Remarks Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	90	
Time to Failure (2-15 min)	0 min 29 sec	
Load @ Failure, lbf	14,984	
Uniaxial Compressive Strength, psi	6,367	

After Preparation

After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80 Project No: 21-2007
Boring ID: BSB-22 Bulk/Prep: MC/CS
Sample Depth (ft): 23.5-24 Tester: Tester:
Lithological Description: Limestone Date: 10/19/22 Date: 10/19/2022
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling): cracks

Bulk Density Determination

	1	2	3	Average
Height, in.	4.7280	4.7245	4.7290	4.7272
Diameter, in.	1.9890	1.9875	1.9865	1.9877
Specimen Mass, g	653.2			Ratio (2.0-2.5)
Bulk Density, pcf	169.7			2.38

Moisture Condition - D2216

Container ID	TAFFY
container, g	226.7
container + wet rock, g	715.8
container + dry soil, g	708.3
moisture content, w%	1.6

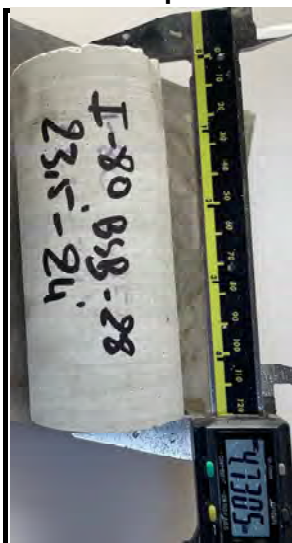
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 42 sec	
Load @ Failure, lbf	38,000	
Uniaxial Compressive Strength, psi	12,246	

After Preparation



After Break (check applicable appearance)

 Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	 Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	 Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
 Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	 Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	 Type 6 Similar to Type 5 but end of cylinder is pointed ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	10/31/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-23
Sample Depth (ft): 13.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: TH ID: 2466
Date: 07/01/25 Date: 07/01/25
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.1460	4.1480	4.1475	4.1472
Diameter, in.	2.0020	2.0025	1.9965	2.0003
Specimen Mass, g	575.0			Ratio (2.0-2.5)
Bulk Density, pcf	168.1			2.07

Moisture Condition - D2216

container, g	513.0
container + wet rock, g	1078.3
container + dry soil, g	1074.9
moisture content, w%	0.6

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	min 30 sec	
Load @ Failure, lbf	18,820	
Uniaxial Compressive Strength, psi	5,989	

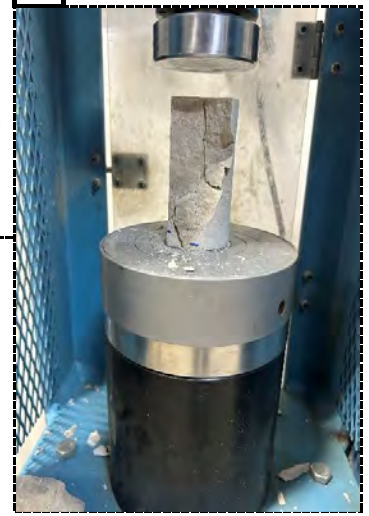
After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☒

Sketch if Other:



Form ID	TF-RCS	Reviewed By	Sam
Revision Date	8/25/2024	Review Date	10/29/24

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-23
Sample Depth (ft): 17.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: TH ID: 2466
Date: 07/01/25 Date: 07/01/25
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.9290	4.9325	4.9505	4.9373
Diameter, in.	1.9975	2.0035	2.0020	2.0010
Specimen Mass, g	693.9		Ratio (2.0-2.5)	
Bulk Density, pcf	170.3		2.47	

Moisture Condition - D2216

container, g	467.4
container + wet rock, g	1108.2
container + dry soil, g	1105.1
moisture content, w%	0.5

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

Seating Load (≤ 1000 psi)	1000	Remarks Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 1 sec	
Load @ Failure, lbf	43,542	
Uniaxial Compressive Strength, psi	13,846	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☒

Sketch if Other:



Form ID	TF-RCS	Reviewed By	Sam
Revision Date	8/25/2024	Review Date	10/29/24

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-26 Bulk/Prep MC/CS
Sample Depth (ft): 13-14 Tester: AR ID
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	4.1310	4.1340	4.1340	4.133
Diameter, in.	1.7340	1.7350	1.7340	1.734
Specimen Mass, g	589.4		Ratio (2.0-2.5)	
Bulk Density, pcf	230.0		2.38	

Moisture Condition - D2216

container, g	470.4
container + wet rock, g	985.7
container + dry soil, g	985.2
moisture content, w%	0.1

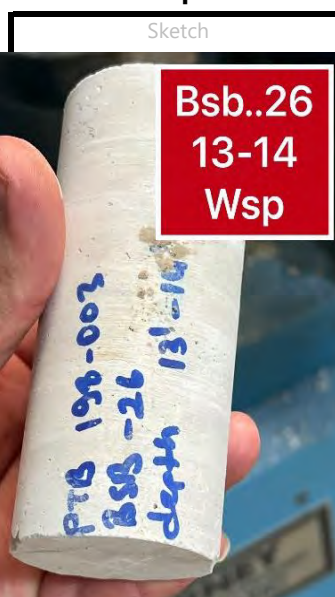
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)		Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)		
Time to Failure (2-15 min)	1 min 55 sec	
Load @ Failure, lbf	33,146	
Uniaxial Compressive Strength, psi	14,031	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐



Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-26 Bulk/Prep MC/CS
Sample Depth (ft): 23-24 Tester: AR ID
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	5.1715	5.1781	5.2055	5.185
Diameter, in.	1.7500	1.7500	1.7390	1.746
Specimen Mass, g	731.2		Ratio (2.0-2.5)	
Bulk Density, pcf	224.3		2.97	

Moisture Condition - D2216

container, g	226.5
container + wet rock, g	954.5
container + dry soil, g	953.5
moisture content, w%	0.1

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

	Remarks
Seating Load (≤ 1000 psi)	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	
Time to Failure (2-15 min)	
Load @ Failure, lbf	
Uniaxial Compressive Strength, psi	

After Preparation

After Break (check applicable appearance)

Type 1	Type 2	Type 3
Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps	Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end	Columnar vertical cracking through both ends, no well-formed cones
☐	☐	☒

Type 4	Type 5	Type 6
Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1	Side fractures at top or bottom (occur commonly with unbonded caps)	Similar to Type 5 but end of cylinder is pointed
☐	☐	☐

Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-27
Sample Depth (ft): 25-25.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 10/19/22 Date: 10/19/2022
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.7965	4.7960	4.7940	4.7955
Diameter, in.	1.9745	1.9735	1.9774	1.9751
Specimen Mass, g	668.4			Ratio (2.0-2.5)
Bulk Density, pcf	173.3			2.43

Moisture Condition - D2216

Container ID	MENTOS
container, g	226.7
container + wet rock, g	832.1
container + dry soil, g	820.4
moisture content, w%	2.0

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 47 sec	
Load @ Failure, lbf	39,838	
Uniaxial Compressive Strength, psi	13,002	

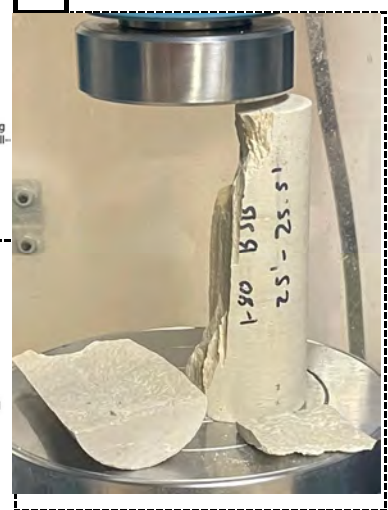
After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	10/31/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-28 Bulk/Prep MC/CS
Sample Depth (ft): 13-14 Tester: AR ID
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	5.0720	5.0600	5.0900	5.074
Diameter, in.	1.7130	1.7700	1.7400	1.741
Specimen Mass, g	720.2		Ratio (2.0-2.5)	
Bulk Density, pcf	227.2		2.91	

Moisture Condition - D2216

container, g	467.2
container + wet rock, g	1011.4
container + dry soil, g	1010.5
moisture content, w%	0.2

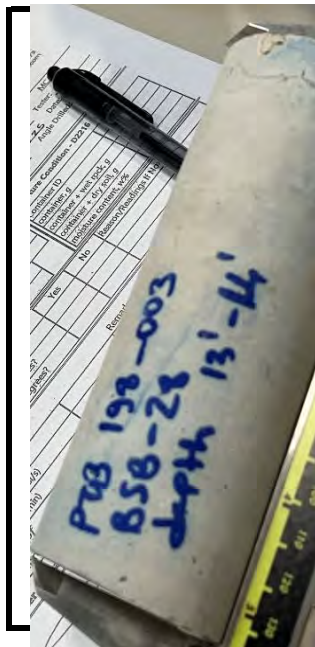
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)		Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)		
Time to Failure (2-15 min)	3 min 11 sec	
Load @ Failure, lbf	45,793	
Uniaxial Compressive Strength, psi	19,236	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☐
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-28 Bulk/Prep MC/CS
Sample Depth (ft): 18-19 Tester: AR ID
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	5.4240	5.4210	5.4250	5.423
Diameter, in.	1.7500	1.7300	1.7470	1.742
Specimen Mass, g	763.6		Ratio (2.0-2.5)	
Bulk Density, pcf	225.0		3.11	

Moisture Condition - D2216

container, g	470.0
container + wet rock, g	1274.0
container + dry soil, g	1273.2
moisture content, w%	0.1

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)		Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)		
Time to Failure (2-15 min)	1 min 10 sec	
Load @ Failure, lbf	20,751	
Uniaxial Compressive Strength, psi	8,703	

After Preparation



After Break (check applicable appearance)

Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	Type 3 Columnar vertical cracking through both ends, no well-formed cones ☐
Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	Type 6 Similar to Type 5 but end of cylinder is pointed ☐



Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-29 Bulk/Prep MC/CS
Sample Depth (ft): 10-11ft Tester: AR ID
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	4.6160	4.6510	4.7590	4.675
Diameter, in.	1.7690	1.7460	1.7370	1.751
Specimen Mass, g	650.8		Ratio (2.0-2.5)	
Bulk Density, pcf	220.3		2.67	

Moisture Condition - D2216

container, g	226.7
container + wet rock, g	787.2
container + dry soil, g	786.1
moisture content, w%	0.2

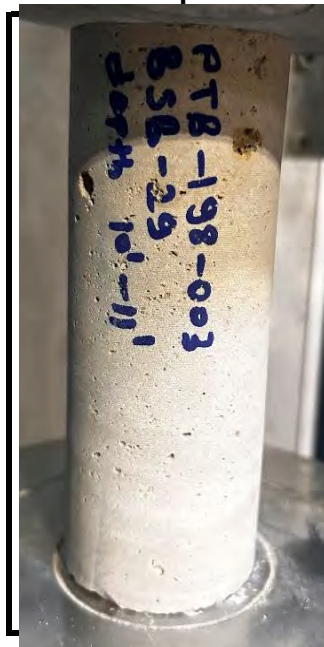
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

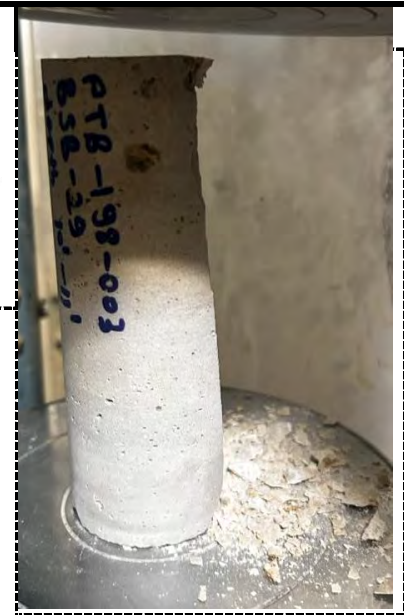
		Remarks
Seating Load (≤ 1000 psi)		Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)		
Time to Failure (2-15 min)	0 min 42 sec	
Load @ Failure, lbf	10,388	
Uniaxial Compressive Strength, psi	4,316	

After Preparation



After Break (check applicable appearance)

 Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	 Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☒	 Type 3 Columnar vertical cracking through both ends, no well-formed cones ☐
 Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	 Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	 Type 6 Similar to Type 5 but end of cylinder is pointed ☐



Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP-198-003 I-80 Project No: 21-2007
Boring ID: BSB-29 Bulk/Prep: MC/CS
Sample Depth (ft): 15.5-16.5 Tester: AR ID:
Lithological Description: Limestone Date: 05/05/25 Date:
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	5.6200	5.5960	5.6800	5.632
Diameter, in.	1.7140	1.7200	1.7200	1.718
Specimen Mass, g	797.3		Ratio (2.0-2.5)	
Bulk Density, pcf	232.7		3.28	

Moisture Condition - D2216

container, g	463.0
container + wet rock, g	872.4
container + dry soil, g	871.3
moisture content, w%	0.3

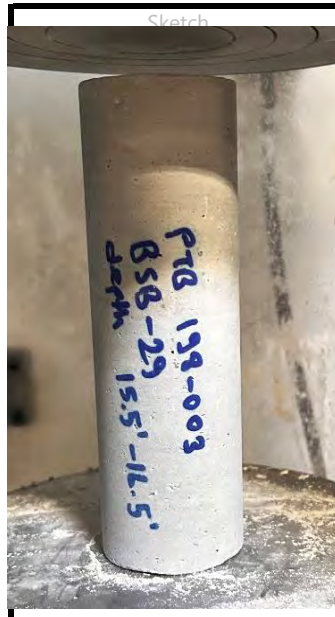
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?		X	
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)		Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)		
Time to Failure (2-15 min)	3 min 1 sec	
Load @ Failure, lbf	47,308	
Uniaxial Compressive Strength, psi	20,408	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	
Revision Date	8/25/2024	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-31
Sample Depth (ft): 13-14
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 10/20/22 Date: 10/20/22
Vertical Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.0480	4.0560	4.0535	4.0525
Diameter, in.	1.9770	1.9805	1.9770	1.9782
Specimen Mass, g	553.5			Ratio (2.0-2.5)
Bulk Density, pcf	169.3			2.05

Moisture Condition - D2216

Container ID	
container, g	
container + wet rock, g	
container + dry soil, g	
moisture content, w%	

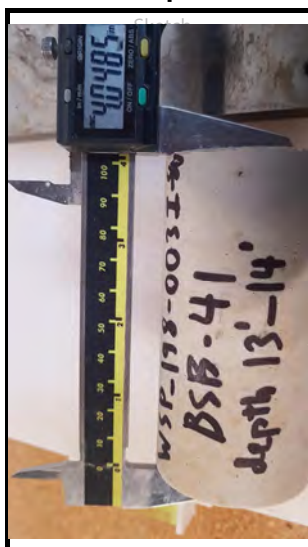
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	4 min 5 sec	
Load @ Failure, lbf	57,277	
Uniaxial Compressive Strength, psi	18,637	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	10/31/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP 198-003 I-80
Boring ID: BSB-104
Sample Depth (ft): 21.5-22
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 10/25/22 Date: 10/25/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.9080	4.9105	4.9190	4.9125
Diameter, in.	1.9820	1.9780	1.9750	1.9783
Specimen Mass, g	664.5			Ratio (2.0-2.5)
Bulk Density, pcf	167.7			2.48

Moisture Condition - D2216

Container ID	AIRHEAD
container, g	226.5
container + wet rock, g	862.3
container + dry soil, g	847.8
moisture content, w%	2.3

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?		X	Side surface isn't straight
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	3 min 6 sec	
Load @ Failure, lbf	43,881	
Uniaxial Compressive Strength, psi	14,275	

After Preparation



After Break (check applicable appearance)

Sketch if Other:

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	10/31/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-106
Sample Depth (ft): 9-9.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 10/19/22 Date: 10/19/2022
Vertical Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.1335	4.1345	4.1300	4.1327
Diameter, in.	1.9815	1.9845	1.9820	1.9827
Specimen Mass, g	545.0			Ratio (2.0-2.5)
Bulk Density, pcf	162.8			2.08

Moisture Condition - D2216

Container ID	KITKAT
container, g	226.7
container + wet rock, g	765.7
container + dry soil, g	746.4
moisture content, w%	3.7

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 1 sec	
Load @ Failure, lbf	29,229	
Uniaxial Compressive Strength, psi	9,467	

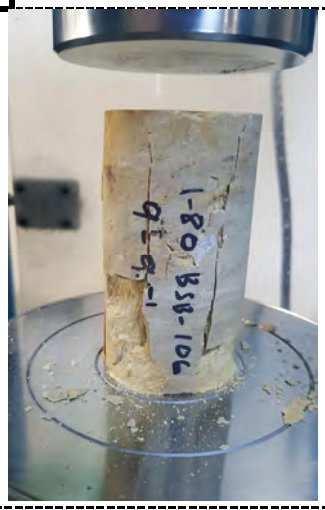
After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	10/31/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80 Project No: 21-2007
Boring ID: BSB-109 Bulk/Prep: MC/CS
Sample Depth (ft): 9-10 Tester: SM Tester: SM/AJ
Lithological Description: Limestone Date: 11/14/22 Date: 11/14/22
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, in.	4.7575	4.7560	4.7630	4.7588
Diameter, in.	1.9840	1.9845	1.9820	1.9835
Specimen Mass, g	654.9			Ratio (2.0-2.5)
Bulk Density, pcf	169.7			2.40

Moisture Condition - D2216

Container ID	TAFFY
container, g	226.6
container + wet rock, g	863.0
container + dry soil, g	851.2
moisture content, w%	1.9

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

	Remarks
Seating Load (≤ 1000 psi)	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	
Time to Failure (2-15 min)	
Load @ Failure, lbf	
Uniaxial Compressive Strength, psi	

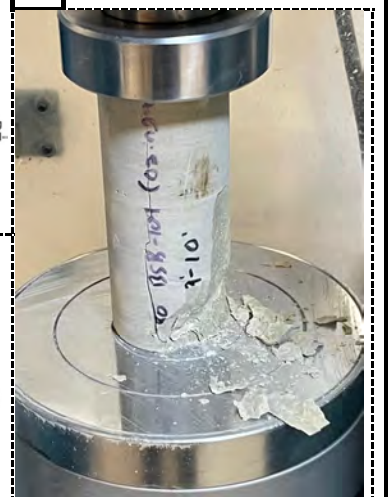
After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	
Revision Date	10/21/2021	Review Date	

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP 198-003 I-80
Boring ID: BSB-201
Sample Depth (ft): 13-13.5
Lithological Description: Lime Stone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 10/27/22 Date: 10/27/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.5210	4.5215	4.5225	4.5217
Diameter, in.	1.9890	1.9880	1.9975	1.9915
Specimen Mass, g	638.8			Ratio (2.0-2.5)
Bulk Density, pcf	172.8			2.27

Moisture Condition - D2216

Container ID	
container, g	226.2
container + wet rock, g	803.5
container + dry soil, g	799.8
moisture content, w%	0.6

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	3 min 15 sec	
Load @ Failure, lbf	48,640	
Uniaxial Compressive Strength, psi	15,615	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/01/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP 198-003 I-80
Boring ID: BSB-201
Sample Depth (ft): 25-26
Lithological Description: LimeStone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): cracks

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 10/27/22 Date: 10/27/22
Angle Drilled: vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.8155	4.8160	4.8155	4.8157
Diameter, in.	1.9900	1.9910	1.9920	1.9910
Specimen Mass, g	671.4			Ratio (2.0-2.5)
Bulk Density, pcf	170.6			2.42

Moisture Condition - D2216

Container ID	NERDS
container, g	226.3
container + wet rock, g	824.1
container + dry soil, g	816.1
moisture content, w%	1.4

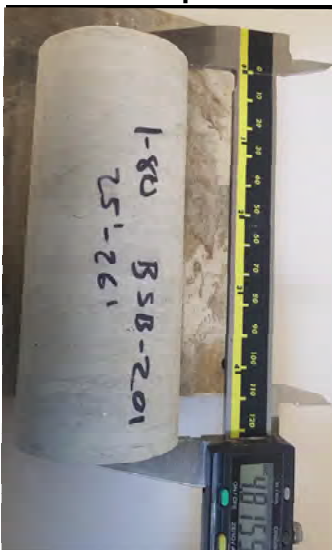
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	3 min 8 sec	
Load @ Failure, lbf	46,688	
Uniaxial Compressive Strength, psi	14,996	

After Preparation



After Break (check applicable appearance)

 Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	 Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	 Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
 Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	 Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	 Type 6 Similar to Type 5 but end of cylinder is pointed ☐



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/01/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-201
Sample Depth (ft): 35
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): cracks

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 01/05/23 Date: 01/05/23
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.3985	4.3985	4.3965	4.3978
Diameter, in.	1.9875	1.9880	1.9870	1.9875
Specimen Mass, g	616.6			Ratio (2.0-2.5)
Bulk Density, pcf	172.2			2.21

Moisture Condition - D2216

Container ID	MENTOS
container, g	226.7
container + wet rock, g	756.3
container + dry soil, g	754.2
moisture content, w%	0.4

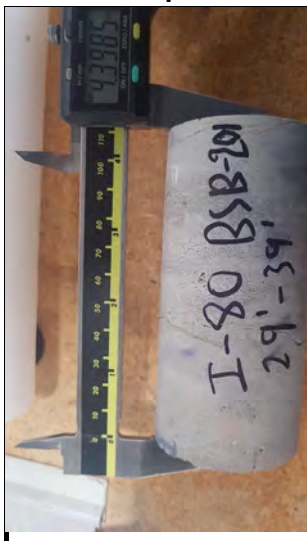
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?		X	Side surface isn't straight
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	3 1 sec	
Load @ Failure, lbf	43,134	
Uniaxial Compressive Strength, psi	13,903	

After Preparation



After Break (check applicable appearance)

Type 1	Type 2	Type 3
Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps	Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end	Columnar vertical cracking through both ends, no well-formed cones
☐	☐	☒
Type 4	Type 5	Type 6
Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1	Side fractures at top or bottom (occur commonly with unbonded caps)	Similar to Type 5 but end of cylinder is pointed
☐	☐	☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	01/06/23

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-202
Sample Depth (ft): 9.5-10
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 11/02/22 Date: 11/02/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.5375	4.5400	4.5390	4.5388
Diameter, in.	1.9900	1.9870	1.9880	1.9883
Specimen Mass, g	620.4			Ratio (2.0-2.5)
Bulk Density, <i>pcf</i>	167.7			2.28

Moisture Condition - D2216

Container ID	SWEET
container, g	226.4
container + wet rock, g	844.8
container + dry soil, g	831.7
moisture content, w%	2.2

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	1 min 50 sec	
Load @ Failure, <i>lbf</i>	28,111	
Uniaxial Compressive Strength, <i>psi</i>	9,053	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/12/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-202
Sample Depth (ft): 25.75
Lithological Description: Lime Stone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 01/05/23 Date: 01/05/23
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.5230	4.5010	4.5210	4.5150
Diameter, in.	1.9925	1.9915	1.9915	1.9918
Specimen Mass, g	600.0			Ratio (2.0-2.5)
Bulk Density, pcf	162.5			2.27

Moisture Condition - D2216

Container ID	Khadijah
container, g	226.6
container + wet rock, g	824.9
container + dry soil, g	820.9
moisture content, w%	0.7

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

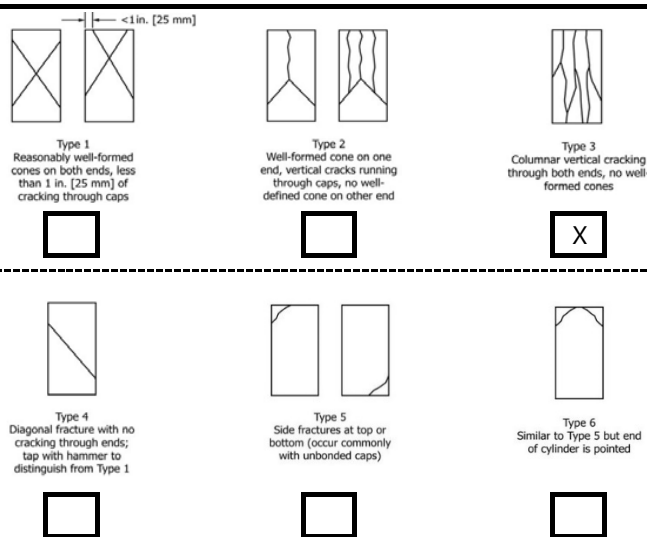
Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 59 sec	
Load @ Failure, lbf	44,122	
Uniaxial Compressive Strength, psi	14,160	

After Preparation



After Break (check applicable appearance)



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	01/06/23

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-202
Sample Depth (ft): 32.75
Lithological Description: Lime Stone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 01/05/23 Date: 01/05/23
Vertical Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.5275	4.5340	4.5210	4.5275
Diameter, in.	1.9935	1.9920	1.9915	1.9923
Specimen Mass, g	628.4			Ratio (2.0-2.5)
Bulk Density, pcf	169.6			2.27

Moisture Condition - D2216

Container ID	Milk Dud
container, g	226.5
container + wet rock, g	752.8
container + dry soil, g	750.5
moisture content, w%	0.4

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

	Remarks
Seating Load (≤ 1000 psi)	1000
Rate of Loading (73-145 psi/s)	75
Time to Failure (2-15 min)	3 min 31 sec
Load @ Failure, lbf	51,411
Uniaxial Compressive Strength, psi	16,491

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	01/06/23

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-203
Sample Depth (ft): 7.5-8
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 11/02/22 Date: 11/02/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.3770	4.3730	4.3710	4.3737
Diameter, in.	1.9885	1.9890	1.9885	1.9887
Specimen Mass, g	606.7			Ratio (2.0-2.5)
Bulk Density, pcf	170.2			2.20

Moisture Condition - D2216

Container ID	Pez
container, g	226.7
container + wet rock, g	787.2
container + dry soil, g	780.8
moisture content, w%	1.2

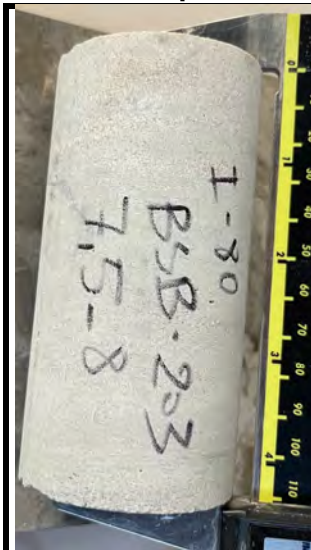
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 32 sec	
Load @ Failure, lbf	36,607	
Uniaxial Compressive Strength, psi	11,786	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/15/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-203
Sample Depth (ft): 13'
Lithological Description: Lime Stone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 01/05/23 Date: 01/05/23
Vertical Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.7850	4.7850	4.7860	4.7853
Diameter, in.	1.9920	1.9935	1.9945	1.9933
Specimen Mass, g	665.0			Ratio (2.0-2.5)
Bulk Density, pcf	169.7			2.40

Moisture Condition - D2216

Container ID	Peepls
container, g	226.8
container + wet rock, g	838.9
container + dry soil, g	837.0
moisture content, w%	0.3

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

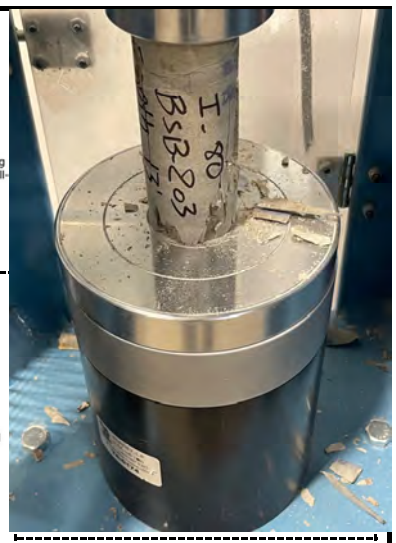
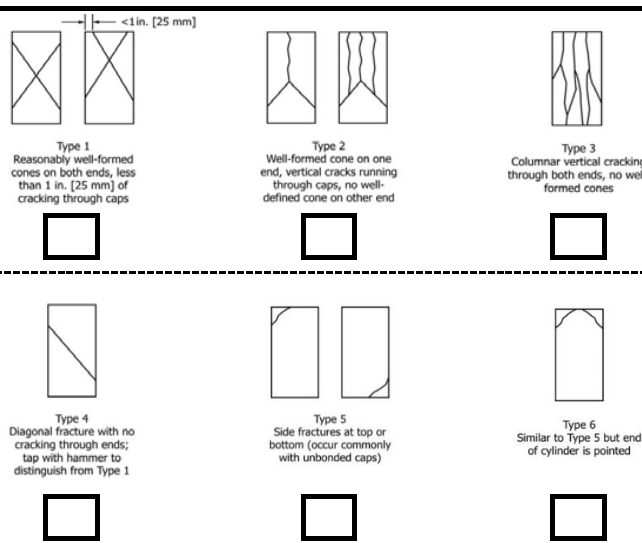
Axial Loading

	Remarks
Seating Load (≤ 1000 psi)	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	
Time to Failure (2-15 min)	
Load @ Failure, lbf	
Uniaxial Compressive Strength, psi	

After Preparation



After Break (check applicable appearance)



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	01/06/23

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-203
Sample Depth (ft): 25.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 01/05/23 Date: 01/05/23
Vertical Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.8640	4.8565	4.8580	4.8595
Diameter, in.	1.9835	1.9840	1.9845	1.9840
Specimen Mass, g	665.9			Ratio (2.0-2.5)
Bulk Density, pcf	168.9			2.45

Moisture Condition - D2216

Container ID	16
container, g	470.3
container + wet rock, g	1108.9
container + dry soil, g	1104.2
moisture content, w%	0.7

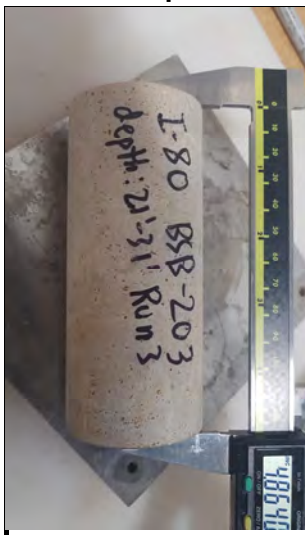
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

Seating Load (≤ 1000 psi)	1000	Remarks Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 2 sec	
Load @ Failure, lbf	31,497	
Uniaxial Compressive Strength, psi	10,188	

After Preparation



After Break (check applicable appearance)

Type 1	Type 2	Type 3
Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps	Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end	Columnar vertical cracking through both ends, no well-formed cones
☐	☐	☒
Type 4	Type 5	Type 6
Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1	Side fractures at top or bottom (occur commonly with unbonded caps)	Similar to Type 5 but end of cylinder is pointed
☐	☐	☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	01/06/23

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80 Project No: 21-2007
Boring ID: BSB-203 Bulk/Prep: MC/CS
Sample Depth (ft): 35.5 Tester: AJ Tester: AJ
Lithological Description: Limestone Date: 01/05/23 Date: 01/05/23
Formation Name: Load Direction: Vertical Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling): cracks

Bulk Density Determination

	1	2	3	Average
Height, in.	4.7005	4.6990	4.6890	4.6962
Diameter, in.	1.9840	1.9845	1.9885	1.9857
Specimen Mass, g	655.5			Ratio (2.0-2.5)
Bulk Density, pcf	171.7			2.37

Moisture Condition - D2216

Container ID	Φ5
container, g	518.6
container + wet rock, g	1043.0
container + dry soil, g	1042.0
moisture content, w%	0.2

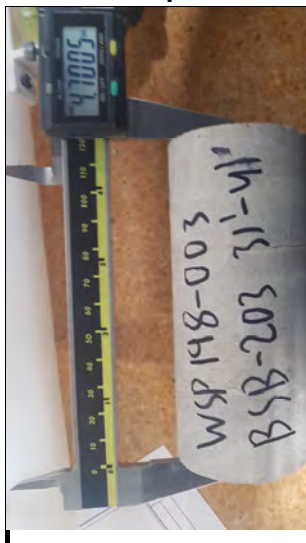
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

	Remarks
Seating Load (≤1000 psi)	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	
Time to Failure (2-15 min)	
Load @ Failure, lbf	
Uniaxial Compressive Strength, psi	

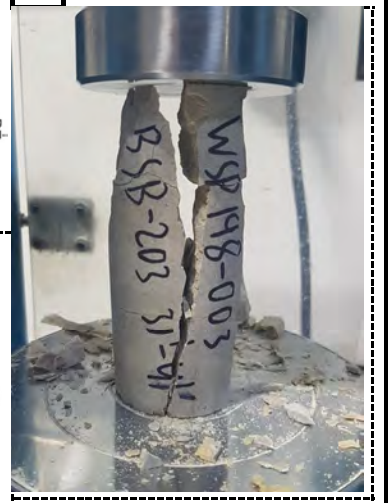
After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	01/06/23

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-204
Sample Depth (ft): 5-6
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 11/04/22 Date: 11/04/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.5805	4.5900	4.5785	4.5830
Diameter, in.	1.9860	1.9855	1.9865	1.9860
Specimen Mass, g	635.0			Ratio (2.0-2.5)
Bulk Density, pcf	170.4			2.31

Moisture Condition - D2216

Container ID	AUDREY
container, g	226.2
container + wet rock, g	817.4
container + dry soil, g	806.6
moisture content, w%	1.9

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	3 min 14 sec	
Load @ Failure, lbf	46,472	
Uniaxial Compressive Strength, psi	15,002	

After Preparation



After Break (check applicable appearance)

Type 1	Type 2	Type 3
Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps	Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end	Columnar vertical cracking through both ends, no well-formed cones
☐	☐	☒
Type 4	Type 5	Type 6
Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1	Side fractures at top or bottom (occur commonly with unbonded caps)	Similar to Type 5 but end of cylinder is pointed
☐	☐	☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/23/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-204
Sample Depth (ft): 7
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 01/05/23 Date: 01/05/23
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.8505	4.8490	4.8525	4.8507
Diameter, in.	1.9875	1.9875	1.9880	1.9877
Specimen Mass, g	666.0			Ratio (2.0-2.5)
Bulk Density, pcf	168.6			2.44

Moisture Condition - D2216

Container ID	21
container, g	470.6
container + wet rock, g	987.5
container + dry soil, g	986.6
moisture content, w%	0.2

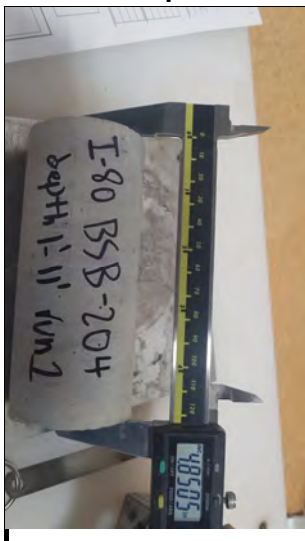
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	4 min 15 sec	
Load @ Failure, lbf	48,765	
Uniaxial Compressive Strength, psi	15,716	

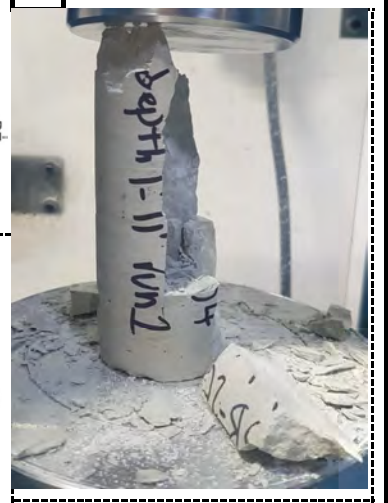
After Preparation



After Break (check applicable appearance)

Type 1 Reasonably well-formed cones on both ends, less than 1 in. (25 mm) of cracking through caps	Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end	Type 3 Columnar vertical cracking through both ends, no well-formed cones
☐	☐	☒
Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1	Type 5 Side fractures at top or bottom (occur commonly with unbonded caps)	Type 6 Similar to Type 5 but end of cylinder is pointed
☐	☐	☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	01/06/23

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-204
Sample Depth (ft): 12- (11-12) Run 2
Lithological Description: Lime Stone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 01/05/23 Date: 01/05/23
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.9155	4.9080	4.9128	4.9121
Diameter, in.	1.9935	1.9940	1.9920	1.9932
Specimen Mass, g	681.5			Ratio (2.0-2.5)
Bulk Density, pcf	169.4			2.46

Moisture Condition - D2216

Container ID	6
container, g	517.8
container + wet rock, g	1182.4
container + dry soil, g	1181.3
moisture content, w%	0.2

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 785 sec	
Load @ Failure, lbf	30,785	
Uniaxial Compressive Strength, psi	9,866	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	01/06/23

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-204
Sample Depth (ft): 28-29
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): cracks

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 11/04/22 Date: 11/04/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.6870	4.6985	4.6875	4.6910
Diameter, in.	1.9870	1.9895	1.9885	1.9883
Specimen Mass, g	657.5			Ratio (2.0-2.5)
Bulk Density, pcf	172.0			2.36

Moisture Condition - D2216

Container ID	GUSHERS
container, g	226.4
container + wet rock, g	870.8
container + dry soil, g	862.1
moisture content, w%	1.4

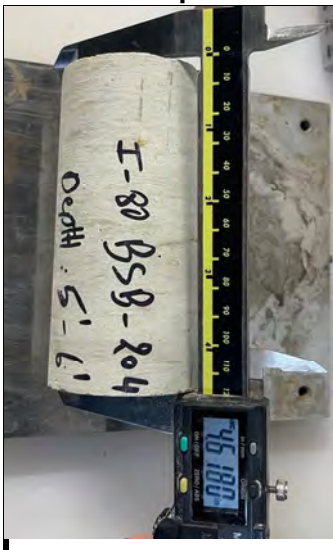
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	1 min 57 sec	
Load @ Failure, lbf	29,188	
Uniaxial Compressive Strength, psi	9,400	

After Preparation



After Break (check applicable appearance)

Type 1	Type 2	Type 3
Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps	Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end	Columnar vertical cracking through both ends, no well-formed cones
☐	☐	☒
Type 4	Type 5	Type 6
Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1	Side fractures at top or bottom (occur commonly with unbonded caps)	Similar to Type 5 but end of cylinder is pointed
☐	☐	☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/23/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-205
Sample Depth (ft): 15
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): cracks

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 01/05/23 Date: 01/05/23
Vertical Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.8815	4.8790	4.8750	4.8785
Diameter, in.	1.9880	1.9885	1.9880	1.9882
Specimen Mass, g	682.9			Ratio (2.0-2.5)
Bulk Density, pcf	171.8			2.45

Moisture Condition - D2216

Container ID	Φ8
container, g	516.6
container + wet rock, g	1199.3
container + dry soil, g	1197.2
moisture content, w%	0.3

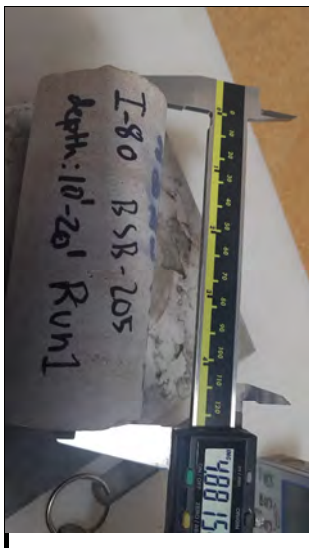
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 55 sec	
Load @ Failure, lbf	41,527	
Uniaxial Compressive Strength, psi	13,376	

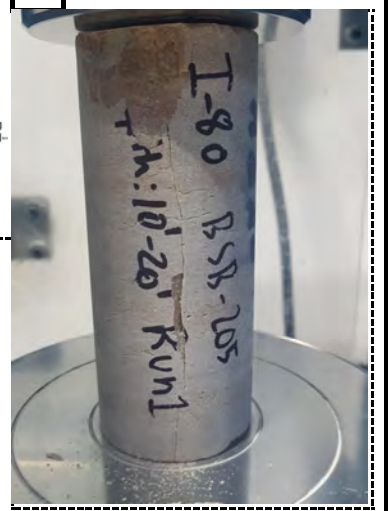
After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	01/06/23

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-205
Sample Depth (ft): 24-25
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 11/02/22 Date: 11/02/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.7995	4.8125	4.7920	4.8013
Diameter, in.	1.9870	1.9875	1.9875	1.9873
Specimen Mass, g	670.5			Ratio (2.0-2.5)
Bulk Density, pcf	171.5			2.42

Moisture Condition - D2216

Container ID	Φ1
container, g	515.2
container + wet rock, g	1094.4
container + dry soil, g	1087.8
moisture content, w%	1.2

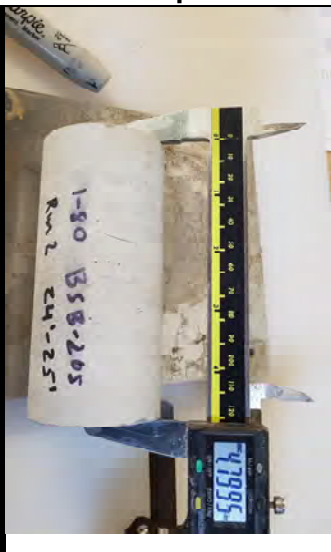
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	3 min 3 sec	
Load @ Failure, lbf	43,941	
Uniaxial Compressive Strength, psi	14,166	

After Preparation



After Break (check applicable appearance)

 Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	 Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	 Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
 Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	 Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	 Type 6 Similar to Type 5 but end of cylinder is pointed ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/12/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-205
Sample Depth (ft): 39-40
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): cracks

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 11/02/22 Date: 11/02/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.4225	4.4320	4.4320	4.4288
Diameter, in.	1.9870	1.9885	1.9890	1.9882
Specimen Mass, g	620.4			Ratio (2.0-2.5)
Bulk Density, pcf	171.9			2.23

Moisture Condition - D2216

Container ID	20
container, g	462.8
container + wet rock, g	1010.4
container + dry soil, g	1005.1
moisture content, w%	1.0

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 29 sec	
Load @ Failure, lbf	35,880	
Uniaxial Compressive Strength, psi	11,557	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/14/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-206
Sample Depth (ft): 17-18
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): cracks

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 11/02/22 Date: 11/02/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.6740	4.6750	4.6770	4.6753
Diameter, in.	1.9945	1.9935	1.9925	1.9935
Specimen Mass, g	Ratio (2.0-2.5)			
Bulk Density, pcf	2.35			

Moisture Condition - D2216

Container ID	13
container, g	468.1
container + wet rock, g	1110.6
container + dry soil, g	1106.5
moisture content, w%	0.6

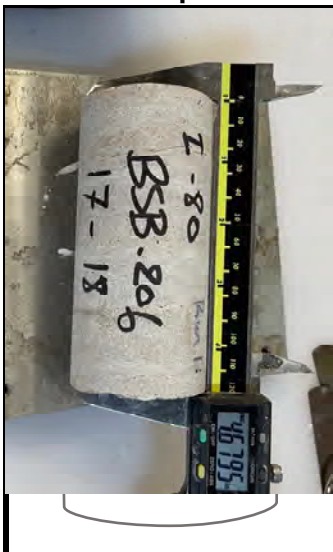
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	1 min 34 sec	
Load @ Failure, lbf	22,725	
Uniaxial Compressive Strength, psi	7,281	

After Preparation



After Break (check applicable appearance)

 Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	 Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	 Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
 Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	 Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	 Type 6 Similar to Type 5 but end of cylinder is pointed ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/15/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-206
Sample Depth (ft): 27.5-28.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): cracks

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 11/02/22 Date: 11/02/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.8055	4.8035	4.8060	4.8050
Diameter, in.	1.9885	1.9885	1.9885	1.9885
Specimen Mass, g	668.7			Ratio (2.0-2.5)
Bulk Density, pcf	170.7			2.42

Moisture Condition - D2216

Container ID	16
container, g	470.4
container + wet rock, g	1049.3
container + dry soil, g	1041.9
moisture content, w%	1.3

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	1 min 44 sec	
Load @ Failure, lbf	25,994	
Uniaxial Compressive Strength, psi	8,370	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/15/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-206
Sample Depth (ft): 39-40
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): cracks

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 11/02/22 Date: 11/02/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.3275	4.3290	4.3260	4.3275
Diameter, in.	1.9920	1.9930	1.9935	1.9928
Specimen Mass, g	606.0			Ratio (2.0-2.5)
Bulk Density, pcf	171.1			2.17

Moisture Condition - D2216

Container ID	17
container, g	465.7
container + wet rock, g	1068.9
container + dry soil, g	1062.5
moisture content, w%	1.1

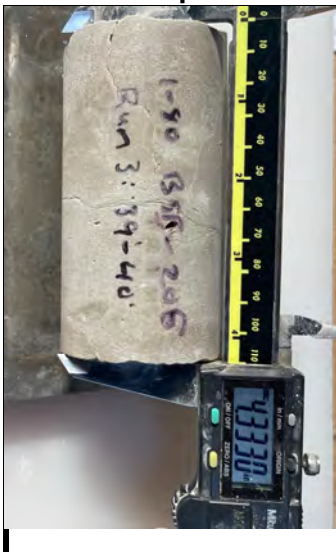
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	1 min 27 sec	
Load @ Failure, lbf	21,333	
Uniaxial Compressive Strength, psi	6,839	

After Preparation



After Break (check applicable appearance)

 Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	 Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	 Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
 Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	 Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	 Type 6 Similar to Type 5 but end of cylinder is pointed ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/14/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-207
Sample Depth (ft): 8-9
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 11/07/22 Date: 11/07/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.9090	4.9130	4.9125	4.9115
Diameter, in.	1.9870	1.9875	1.9875	1.9873
Specimen Mass, g	686.0			Ratio (2.0-2.5)
Bulk Density, pcf	171.6			2.47

Moisture Condition - D2216

Container ID	15
container, g	469.9
container + wet rock, g	1098.1
container + dry soil, g	1089.8
moisture content, w%	1.3

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	3 min 42 sec	
Load @ Failure, lbf	46,578	
Uniaxial Compressive Strength, psi	15,016	

After Preparation



After Break (check applicable appearance)

 Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	 Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	 Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
 Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	 Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	 Type 6 Similar to Type 5 but end of cylinder is pointed ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/23/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-207
Sample Depth (ft): 14-15
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): cracks

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 11/07/22 Date: 11/07/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.9035	4.8980	4.9055	4.9023
Diameter, in.	1.9870	1.9860	1.9880	1.9870
Specimen Mass, g	694.8			Ratio (2.0-2.5)
Bulk Density, pcf	174.2			2.47

Moisture Condition - D2216

Container ID	TWIX
container, g	226.5
container + wet rock, g	825.4
container + dry soil, g	820.9
moisture content, w%	0.8

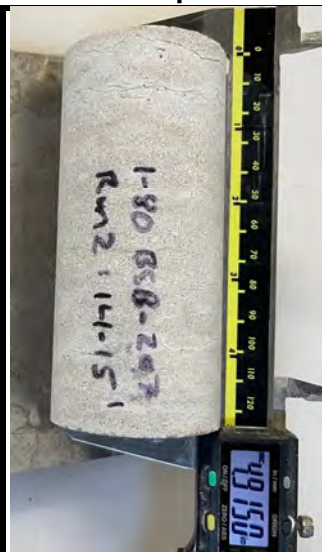
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 35 sec	
Load @ Failure, lbf	39,304	
Uniaxial Compressive Strength, psi	12,675	

After Preparation



After Break (check applicable appearance)

 Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	 Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	 Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
 Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	 Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	 Type 6 Similar to Type 5 but end of cylinder is pointed ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/23/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-207
Sample Depth (ft): 28-29
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 11/07/22 Date: 11/07/22
Angle Drilled: Vertical
cracks, holes

Bulk Density Determination

	1	2	3	Average	
Height, <i>in.</i>	4.9130	4.9125	4.9145	4.9133	
Diameter, <i>in.</i>	1.9870	1.9875	1.9885	1.9877	
Specimen Mass, <i>g</i>	684.3			Ratio (2.0-2.5)	
Bulk Density, <i>pcf</i>	171.0			2.47	

Moisture Condition - D2216

Container ID	MILK DUD
container, g	226.5
container + wet rock, g	901.1
container + dry soil, g	891.8
moisture content, w%	1.4

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	1 min 37 sec	
Load @ Failure, lbf	23,618	
Uniaxial Compressive Strength, psi	7,611	

After Preparation



After Break (check applicable appearance)

 Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps	 Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end	 Type 3 Columnar vertical cracking through both ends, no well-formed cones
☐	☐	☒
 Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1	 Type 5 Side fractures at top or bottom (occur commonly with unbonded caps)	 Type 6 Similar to Type 5 but end of cylinder is pointed
☐	☐	☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/23/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-208
Sample Depth (ft): 12.5-13.5
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 11/03/22 Date: 11/03/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.3820	4.3805	4.3860	4.3828
Diameter, in.	1.9890	1.9900	1.9900	1.9897
Specimen Mass, g	608.3			Ratio (2.0-2.5)
Bulk Density, pcf	170.1			2.20

Moisture Condition - D2216

Container ID	KITKAT
container, g	226.7
container + wet rock, g	821.6
container + dry soil, g	811.9
moisture content, w%	1.7

Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	3 min 36 sec	
Load @ Failure, lbf	48,569	
Uniaxial Compressive Strength, psi	15,621	

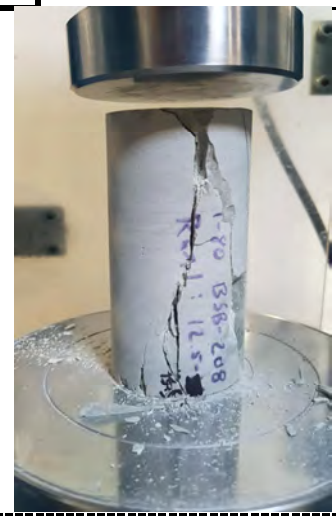
After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/14/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-208
Sample Depth (ft): 19.5-20
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): cracks

Project No: 21-2007
Bulk/Prep MC/CS
Tester: AJ Tester: AJ
Date: 11/03/22 Date: 11/03/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.8930	4.9075	4.8935	4.8980
Diameter, in.	1.9935	1.9905	1.9905	1.9915
Specimen Mass, g	684.5			Ratio (2.0-2.5)
Bulk Density, pcf	170.9			2.46

Moisture Condition - D2216

Container ID	M&M
container, g	226.0
container + wet rock, g	794.5
container + dry soil, g	786.5
moisture content, w%	1.4

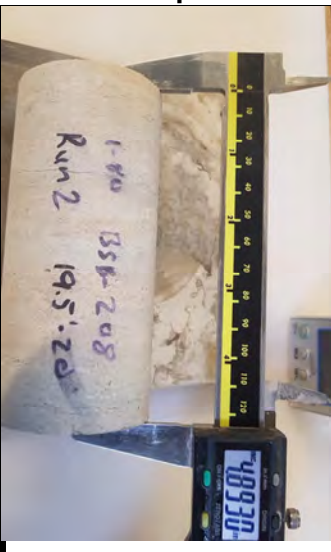
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?		X	Side surface isn't straight
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 44 sec	
Load @ Failure, lbf	38,053	
Uniaxial Compressive Strength, psi	12,216	

After Preparation



After Break (check applicable appearance)

 ☐	 ☐	 ☒
 ☐	 ☐	 ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/14/22

Compressive Strength of Rock by ASTM D7012 - Method C



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name: WSP_198-003 I-80
Boring ID: BSB-208
Sample Depth (ft): 30.5-31
Lithological Description: Limestone
Formation Name: _____ Load Direction: _____
Appearance (e.g. cracks, shearing, spalling): _____

Project No: 21-2007
Bulk/Prep MC/CS
Tester: SM Tester: SM
Date: 11/03/22 Date: 11/03/22
Angle Drilled: Vertical

Bulk Density Determination

	1	2	3	Average
Height, in.	4.5940	4.6045	4.5840	4.5942
Diameter, in.	1.9890	1.9875	1.9895	1.9887
Specimen Mass, g	641.4			Ratio (2.0-2.5)
Bulk Density, pcf	171.3			2.31

Moisture Condition - D2216

Container ID	MENTOS
container, g	226.7
container + wet rock, g	810.4
container + dry soil, g	803.0
moisture content, w%	1.3

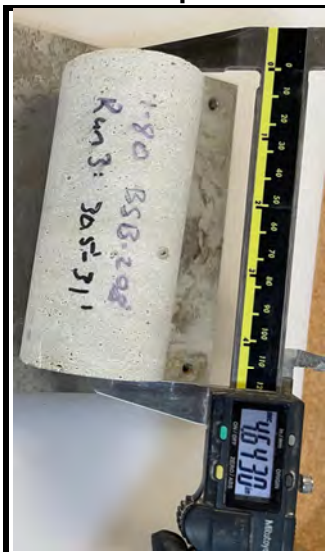
Preparation Check

	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

		Remarks
Seating Load (≤ 1000 psi)	1000	Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.
Rate of Loading (73-145 psi/s)	75	
Time to Failure (2-15 min)	2 min 56 sec	
Load @ Failure, lbf	42,448	
Uniaxial Compressive Strength, psi	13,666	

After Preparation



After Break (check applicable appearance)

 Type 1 Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps ☐	 Type 2 Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end ☐	 Type 3 Columnar vertical cracking through both ends, no well-formed cones ☒
 Type 4 Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1 ☐	 Type 5 Side fractures at top or bottom (occur commonly with unbonded caps) ☐	 Type 6 Similar to Type 5 but end of cylinder is pointed ☐

Sketch if Other:



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	11/14/22

APPENDIX E
SEISMIC SITE CLASS DETERMINATION

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified on 12/10/10

Substructure 1

Individual Site Class Definition:

Seismic	Bot. Of	Layer			
Soil Column	Sample	Sample	Description		
Depth	Elevation	Thick.	N	Qu	Boundary
(ft)		(ft.)	(tsf)		
1.0	519.3	2.50	18		
	516.8	2.50	8		B
	514.3	2.50	16		
	511.8	2.50	12		
	509.3	2.50	80		B
100.0	415.3	94.00	50	5.00	R

Individual Site Class Definition:

Seismic	Bot. Of	Layer		
Soil Column	Sample	Description		
Depth	Elevation	Thick.	N	Qu
(ft)		(ft.)	(tsf)	
	518.5	2.50	38	B
1.5	516.0	2.50	18	
4.0	513.5	2.50		
6.5	511.0	2.50	50	
9.0	508.5	2.50	50	
11.5	506.0	2.50	50	R

Individual Site Class Definition:

Seismic Soil Column	Bot. Of Sample	Layer Description		
Depth	Elevation	Sample Thick.	N	Qu Boundary
(ft)		(ft.)	(tsf)	
	517.5	2.50	54	
1.5	515.0	2.50	18	B
4.0	512.5	2.50	13	
6.5	510.0	2.50	50	
9.0	507.5	2.50	17	
11.5	505.0	2.50	34	

Individual Site Class Definition:

Seismic Soil Column Depth	Bot. Of Sample Elevation	Sample Thick.	N	Qu	Layer Description Boundary
(ft)		(ft.)	(tsf)		
1.5	510.4	2.50	0		B
	507.9	2.50	50		R

N (bar): 41 (Blows/ft.) Soil Site Class D
 N_{ch} (bar): 45 (Blows/ft.) Soil Site Class D <---Controls
 s_u (bar): _____ (ksf) NA, H < 0.1*H (Total)

APPENDIX F
SOIL AND ROCK PARAMETERS

Table F-1 –Soil and Rock Parameters Table - West Abutment (BSB-01, 02, 03)

(B-SA) for Slope Stability Analysis and LPile Analysis - Soil

Elevation (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained		Parameters for p-y Curve Method		
			Cohesion c (psf)	Friction Angle ϕ (°)	Cohesion c (psf)	Friction Angle ϕ (°)	p-y Curve Type in LPile	Coefficient of Subgrade Modulus (k_{py} , pci)	Horizontal Strain Factor ϵ_{50}
596.1*-557	New Engineered Granular Fill	125	0	30	0	30	Sand	90	NA
557-547	Medium Stiff to Very Stiff Silty Clay	133	1,200	0	120	28	Stiff Clay w/o Free water	750	0.007
547-545	Loose to Medium Dense Sand/Sand Fill	134	0	30	0	30	Sand	20	NA
545-543	Medium Stiff Silty Clay	127	800	0	80	27	Soft Clay	100	0.01
543-542	Very Dense Sand/Gravel with Sand	149	0	45	0	45	Sand	225	NA

*This is the average surface elevation at the EB and WB west abutments based on GPE dated 2/7/2024.

(B-SA) for LPile Analysis – Rock, P-y Curve Massive Rock

Elevation (feet)	Selected Rock Type	Effective Unit Weight (pcf)	Uniaxial Compressive Strength (psi)	Hoek-Brown material index*, m_i	Poisson's Ratio	GSI	Intact Rock Modulus (psi)
542-537	(Sedimentary) Dolomites	165	11,700	9	0.17	35 - 50	4,690x10 ³
537-528			15,100				

* Hoek-Brown material index, m_i , is a dimensionless number depends on the type of rock used by LPile program.

Table F-2 –Soil and Rock Parameters Table - East Abutment (BSB-29, 30, 31)

(B-NA) for Slope Stability Analysis and LPile Analysis - Soil

Elevation (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained		Parameters for p-y Curve Method		
			Cohesion c (psf)	Friction Angle ϕ (°)	Cohesion c (psf)	Friction Angle ϕ (°)	p-y Curve Type in LPile	Coefficient of Subgrade Modulus (k_{py} , pci)	Horizontal Strain Factor ϵ_{50}
568.6*- 523.5	New Engineered Granular Fill	125	0	30	0	30	Sand	90	NA
568.6*- 523.5	New Engineered Cohesive Fill	125	1,000	0	50	25	Stiff Clay w/o Free water	500	0.01
523.5-517.5	Stiff Silty Clay/Silty Clay Fill	120	1,500	0	150	28	Stiff Clay w/o Free water	750	0.007
517.5-514.5	Very Dense Sand and Gravel	130	0	45	0	45	Sand	225	NA

*This is the average surface elevation at the EB and WB abutments based on GPE dated 2/7/2024.

(B-NA) for LPile Analysis – Rock, P-y Curve Massive Rock

Elevation (feet)	Selected Rock Type	Effective Unit Weight (pcf)	Uniaxial Compressive Strength (psi)	Hoek-Brown material index*, m_i	Poisson's Ratio	GSI	Intact Rock Modulus (psi)
514.5-511.5	(Sedimentary) Dolomites	<u>165</u>	4,300	9	0.17	40 - 45	5,052x10 ³
511.5-508			18,600				
508-498.5			20,400				

* Hoek-Brown material index, m_i , is a dimensionless number depends on the type of rock used by LPile program.

Table F-3 - Soil and Rock Parameters Table - Pier 1 (BSB-04, 05, 06)

(B-P1) for LPile Analysis - Soil

Elevation (feet)	Soil Description	Effective Unit Weight γ' (pcf)	Cohesion c (psf)	Friction Angle ϕ (°)	Parameters for p-y Curve Method		
					P-y Curve Type in LPile	Coefficient of Subgrade Modulus (k_{py} , pci)	Horizontal Strain Factor ϵ_{50}
540.5*-537.5	Soft to Stiff Silty Clay	72.6	1,500	0	Soft Clay	750	0.007
537.5-536	Very Dense Sand	87.6	0	45	Sand	225	NA

*This is the surface elevation at the pier based on GPE dated 6/30/2025

(B-P1) for LPile Analysis – Rock, P-y Curve Massive Rock

Elevation (feet)	Selected Rock Type	Effective Unit Weight (pcf)	Uniaxial Compressive Strength (psi)	Hoek-Brown material index*, m_i	Poisson's Ratio	GSI	Intact Rock Modulus (psi)
536-526	(Sedimentary) Dolomites	165	17,000	9	0.17	30	$5,950 \times 10^3$
526-519							

* Hoek-Brown material index, m_i , is a dimensionless number depends on the type of rock used by LPile program.

Bedrock Properties used for Drilled shaft Calculation Using IDOT Spreadsheet

Top of Bedrock Elevation (feet)	GSI	Rock Condition	Joint Type	Rock Intact
536	30 - 35	Normal	Closed	Yes

Notes: The unconfined compressive strength (q_u) and RQD value in the rock core log are used in the calculation.

Joint Type based on review of rock core samples; representative of the average condition observed along the rock core.

Table F-4 Soil and Rock Parameters Table- Pier 3 (BSB-201, 202, 205, 206)

(B-P2) for LPile Analysis - Soil

	Elevation (feet)	Soil Description	Effective Unit Weight γ' (pcf)	Cohesion c (psf)	Friction Angle ϕ (°)	Parameters for p-y Curve Method		
						P-y Curve Type in LPile	Coefficient of Subgrade Modulus (k_{py} , pci)	Horizontal Strain Factor ϵ_{50}
WB	516.5*-510.5	Soft to Stiff Silty Clay	58.6	500	0	Soft Clay	100	0.01
EB	519.5-514.5	Soft to Stiff Silty Clay	58.6	500	0	Soft Clay	100	0.01
EB	514.5-509	Medium Dense Gravel	52.6	0	33	Sand	20	NA

*This is the bottom of river elevation at the Pier 3

(B-P2) for LPile Analysis – Rock, P-y Curve Massive Rock

Elevation (feet)	Selected Rock Type	Effective Unit Weight (pcf)	Uniaxial Compressive Strength (psi)	Hoek-Brown material index*, m_i	Poisson's Ratio	GSI	Intact Rock Modulus (psi)
510-500	(Sedimentary) Dolomites	165	11,300	9	0.17	40	4,247x10 ³
500-490			12,900				
490-480			12,200				

* Hoek-Brown material index, m_i , is a dimensionless number depends on the type of rock used by LPile program.

Bedrock Properties used for Drilled shaft Calculation Using IDOT Spreadsheet

Top of Bedrock Elevation (feet)	GSI	Rock Condition	Joint Type	Rock Intact
510	40 - 45	Normal	Closed	Yes

Notes: the unconfined compressive strength (q_u) and RQD values in the rock core log are used in the calculation.
Joint Type based on review of rock core samples; representative of the average condition observed along the rock core.

Table F-5 Soil and Rock Parameters Table - Pier 4 (BSB-203, 204, 207, 208)

(B-P2) for LPile Analysis - Soil

Elevation (feet)	Soil Description	Effective Unit Weight γ' (pcf)	Cohesion c (psf)	Friction Angle ϕ (°)	Parameters for p-y Curve Method		
					P-y Curve Type in LPile	Coefficient of Subgrade Modulus (k_{py} , pci)	Horizontal Strain Factor ϵ_{50}
512*-510	Soft to Stiff Silty Clay	58.6	500	0	Soft Clay	100	0.01

*This is the bottom of river elevation at the Pier 4

(B-P2) for LPile Analysis – Rock, P-y Curve Massive Rock

Elevation (feet)	Selected Rock Type	Effective Unit Weight (pcf)	Uniaxial Compressive Strength (psi)	Hoek-Brown material index*, m_i	Poisson's Ratio	GSI	Intact Rock Modulus (psi)
510-500	(Sedimentary) Dolomites	165	14,600	9	0.17	40	4,252x10 ³
500-490			11,100				
490-480			10,200				
480-470			12,700				

* Hoek-Brown material index, m_i , is a dimensionless number depends on the type of rock used by LPile program.

Bedrock Properties used for Drilled shaft Calculation Using IDOT Spreadsheet

Top of Bedrock Elevation (feet)	GSI	Rock Condition	Joint Type	Rock Intact
510	40 - 45	Fractured	Open	No

Notes: the unconfined compressive strength (q_u) and RQD values in the rock core log are used in the calculation.
Joint Type based on review of rock core samples; representative of the average condition observed along the rock core.

Table F-6 Soil and Rock Parameters Table - Pier 5 (BSB-11 to 14) (BSB-103, 106)

(B-P3) for LPile Analysis - Soil

	Elevation (feet)	Soil Description	Effective Unit Weight γ' (pcf)	Cohesion c (psf)	Friction Angle ϕ (°)	Parameters for p-y Curve Method		
						P-y Curve Type in LPile	Coefficient of Subgrade Modulus (k_{py} , pci)	Horizontal Strain Factor ϵ_{50}
WB	520-515	Loose to Medium Dense Sand/Gravel	52.6	0	30	Sand	20	NA
WB	515-511.5	Medium Stiff Silty Clay	58.6	500	0	Soft Clay	100	0.01
EB	518.5-512	Medium Dense to Dense Sand/Gravel	62.6	0	36	Sand	60	NA

(B-P3) for LPile Analysis – Rock, P-y Curve Massive Rock

Elevation (feet)	Selected Rock Type	Effective Unit Weight (pcf)	Uniaxial Compressive Strength (psi)	Hoek-Brown material index*, m_i	Poisson's Ratio	GSI	Intact Rock Modulus (psi)
512-508	(Sedimentary) Dolomites	165	9,500	9	0.17	30	$3,325 \times 10^3$
508-483.5							

* Hoek-Brown material index, m_i , is a dimensionless number depends on the type of rock used by LPile program.

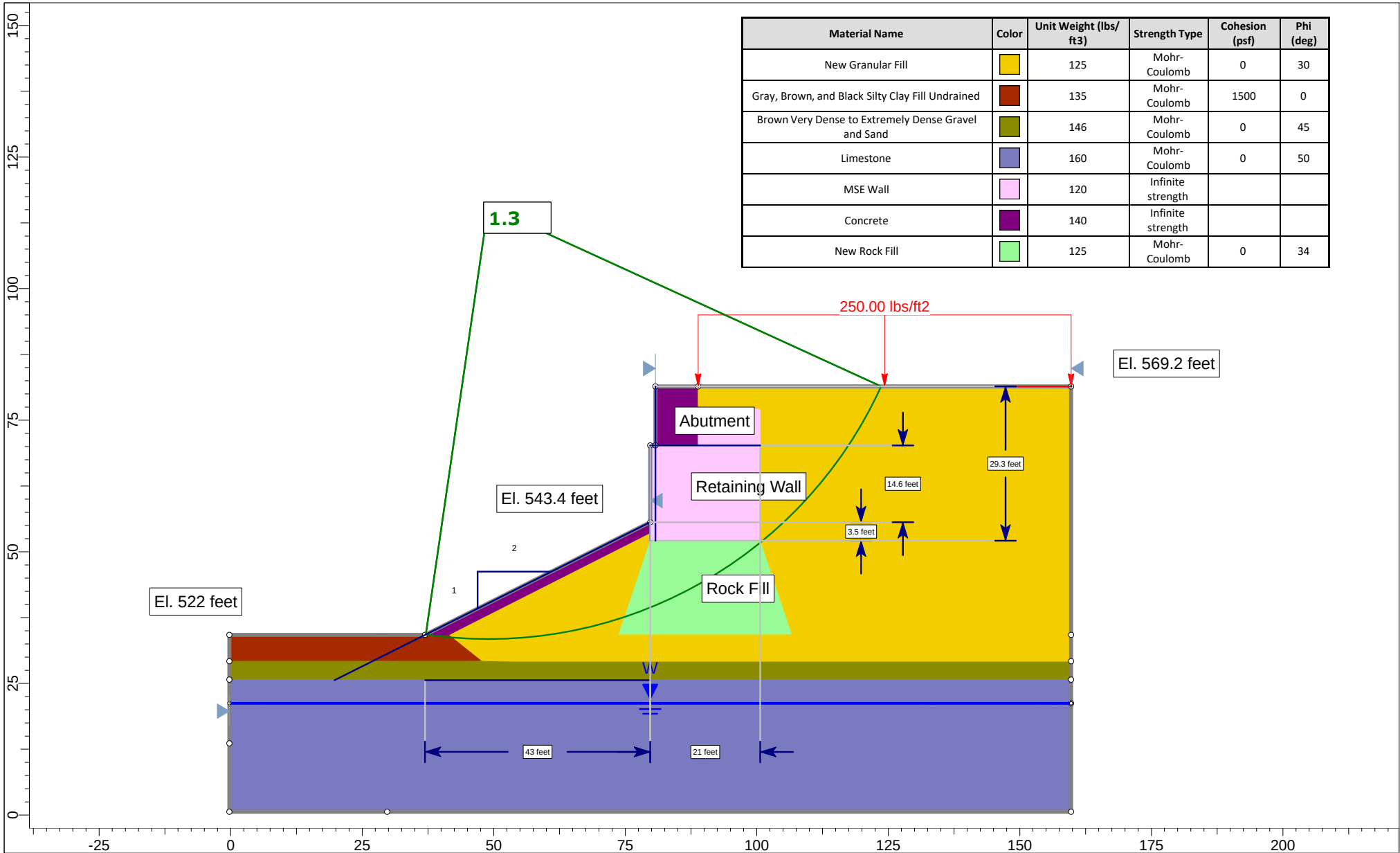
Bedrock Properties used for Drilled shaft Calculation Using IDOT Spreadsheet

Top of Bedrock Elevation (feet)	GSI	Rock Condition	Joint Type	Rock Intact
512	30	Fractured	Open	No

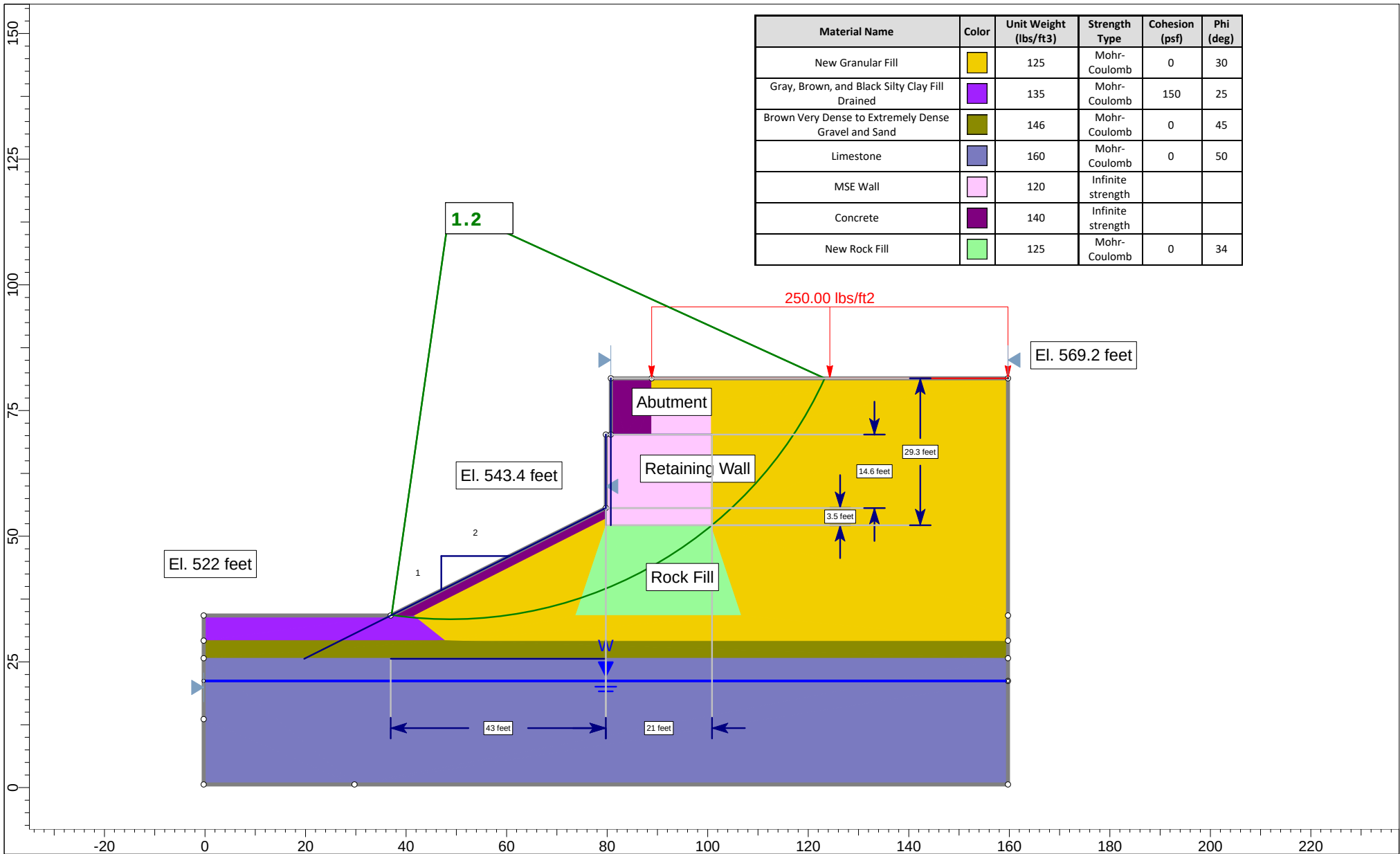
Notes: the unconfined compressive strength (q_u) and RQD values in the rock core log are used in the calculation.

Joint Type based on review of rock core samples; representative of the average condition observed along the rock core.

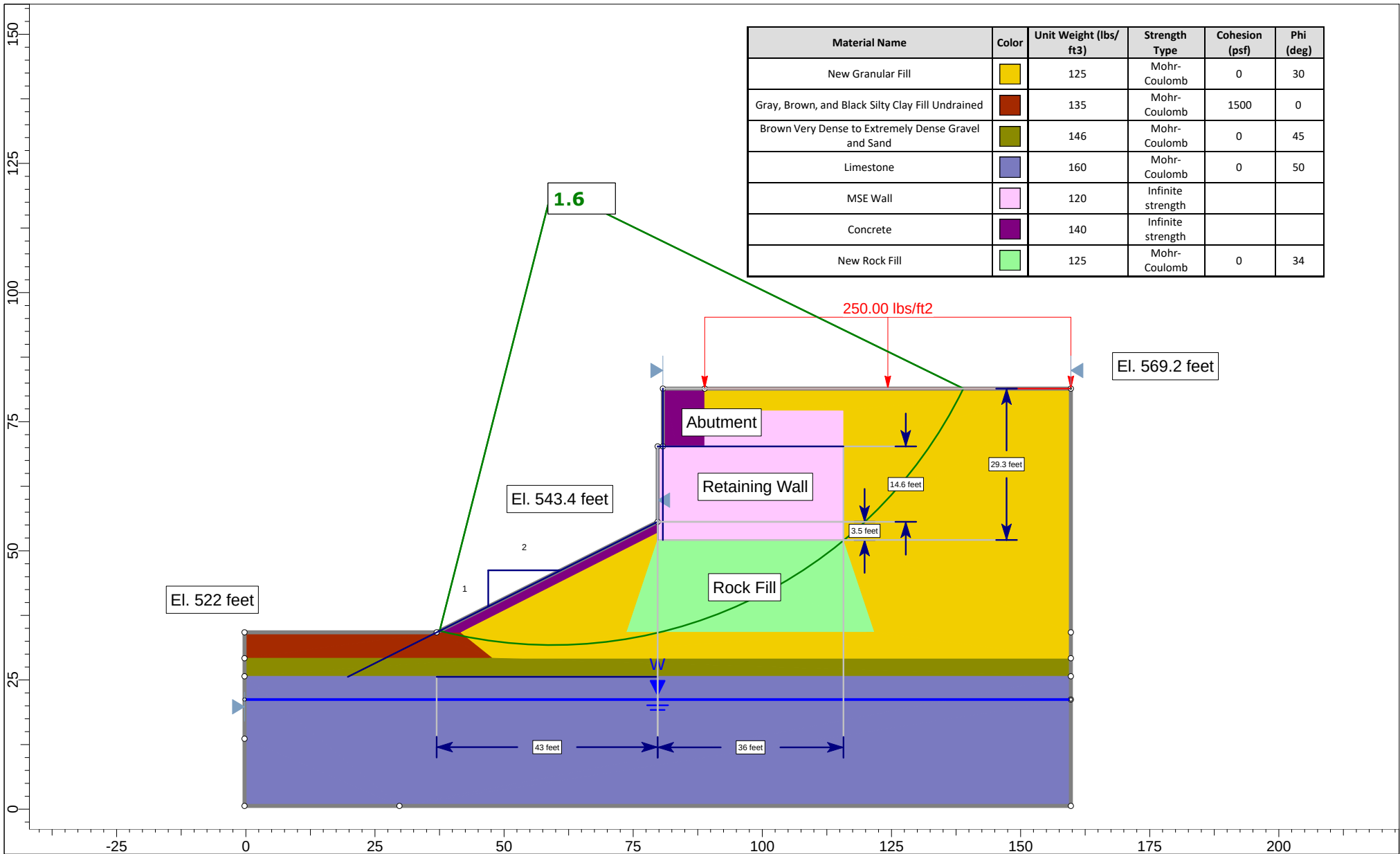
APPENDIX G
SLOPE STABILITY ANALYSIS EXHIBITS

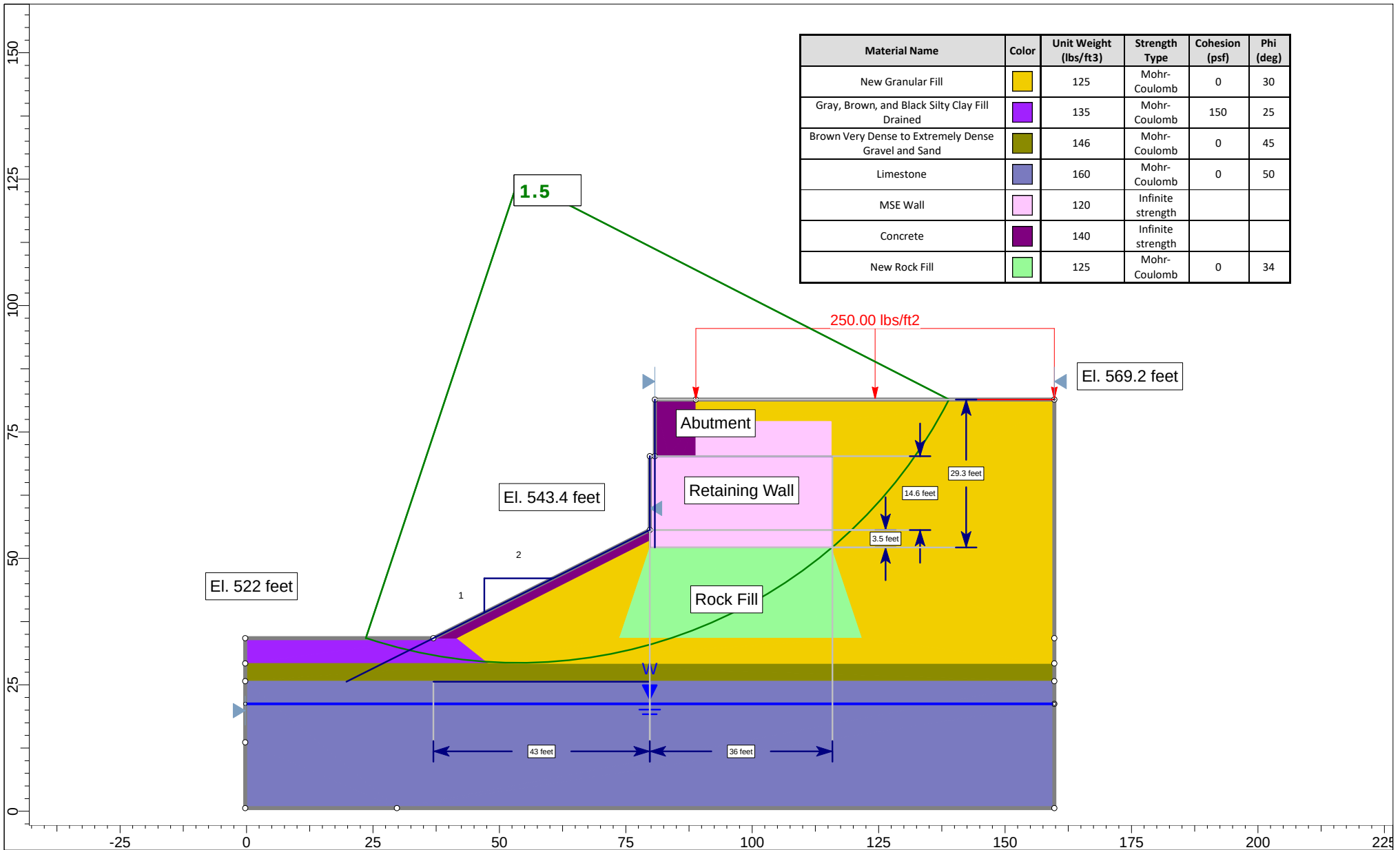


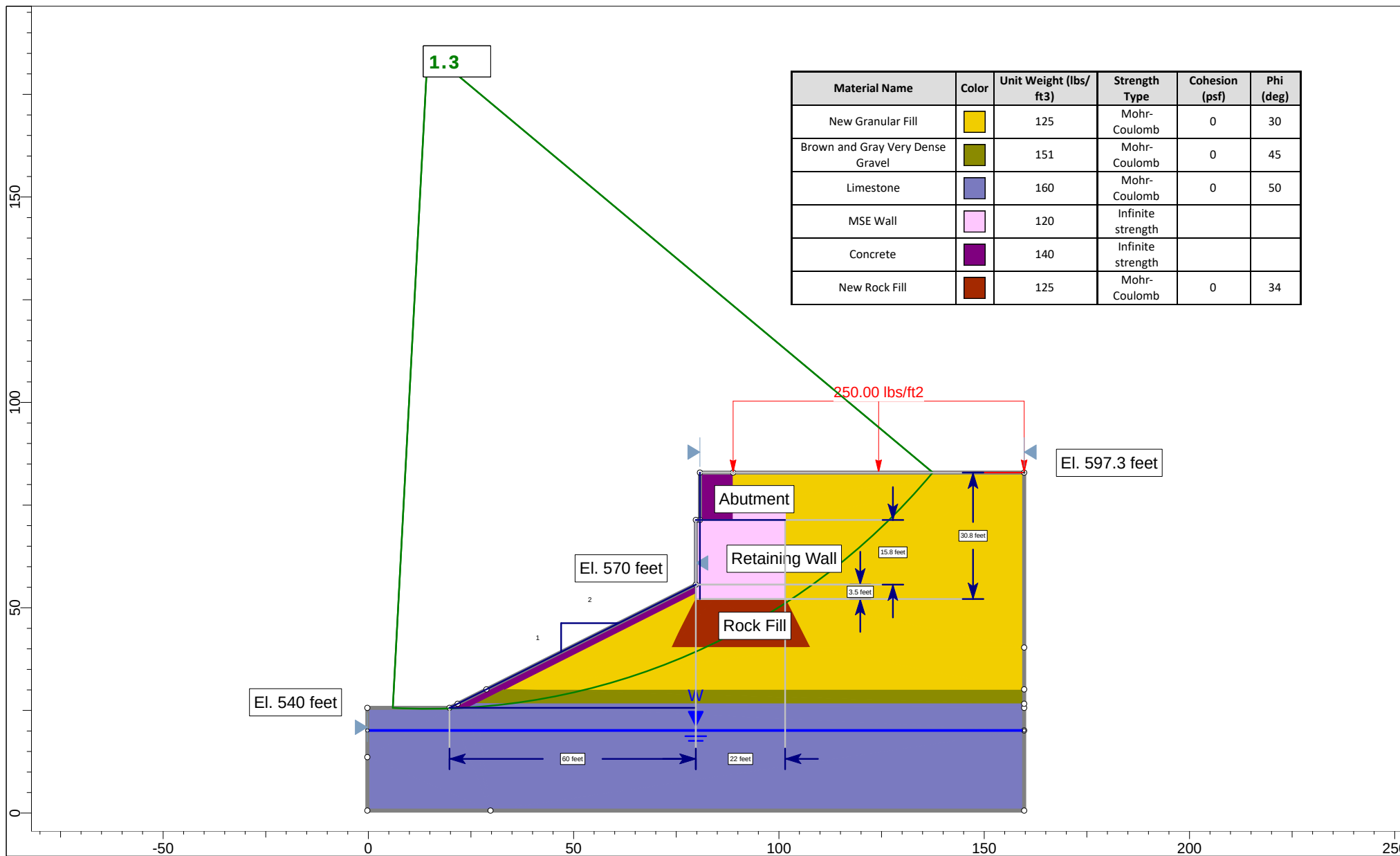
 GSG CONSULTANTS, INC. 735 Remington Road, Schaumburg, IL 60173 Tel: 630.994.2600, www.gsg-consultants.com	Project		I-80 over Des Plaines River - East Abutment	
	Group	0.7H	Scenario	Short Term Stability - Water El. 509 feet
	Drawn By	RM	Company	GSG Consultants, Inc.
	Date	7/15/2021, 12:22:18 PM	File Name	east BSB-29, 30, 31 with MSE wall.slmd



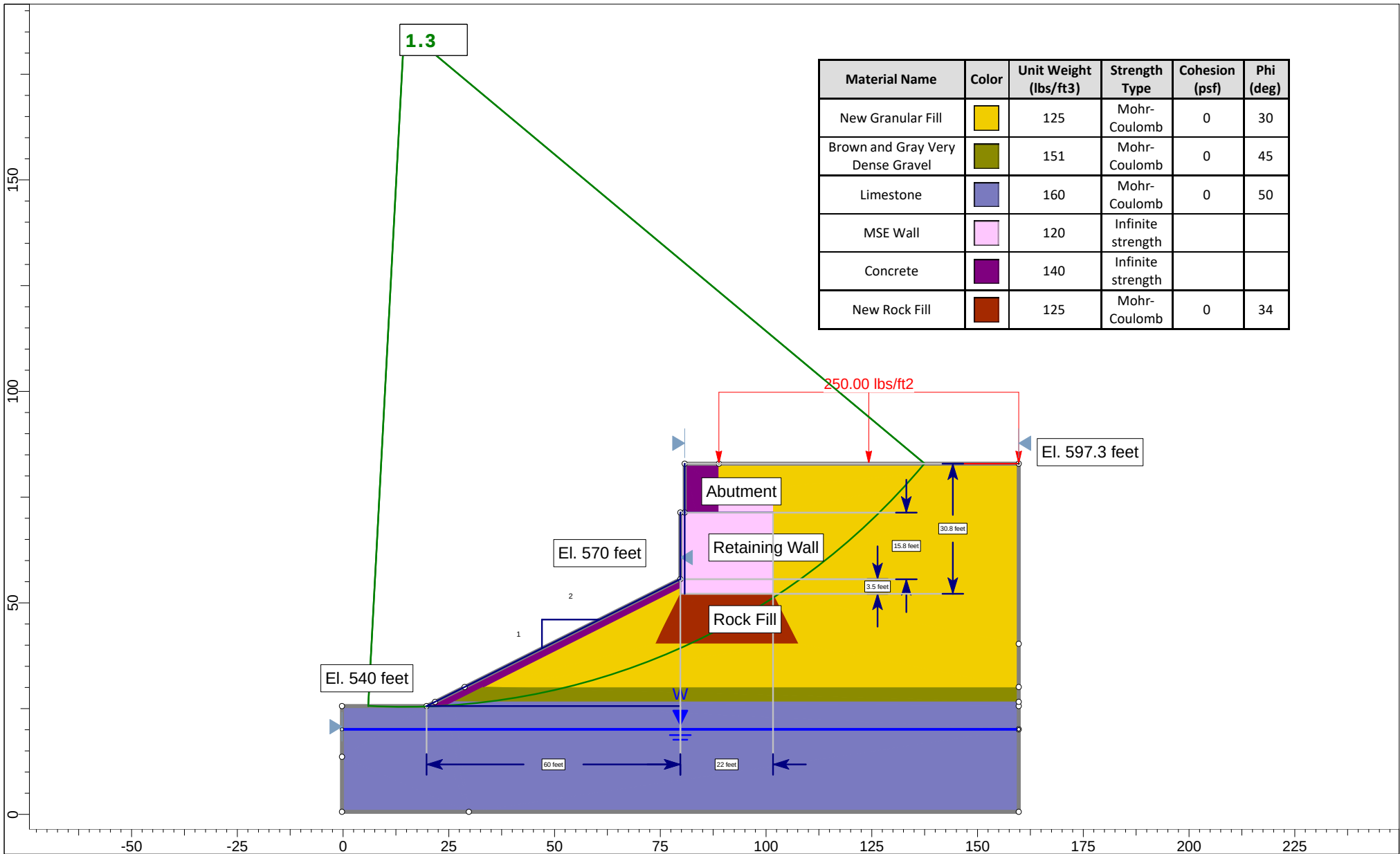
Project		I-80 over Des Plaines River - East Abutment	
Group	0.7H	Scenario	Long Term Stability - Water El. 509 feet
Drawn By	RM	Company	GSG Consultants, Inc.
Date	7/15/2021, 12:22:18 PM	File Name	east BSB-29, 30, 31 with MSE wall.slmd



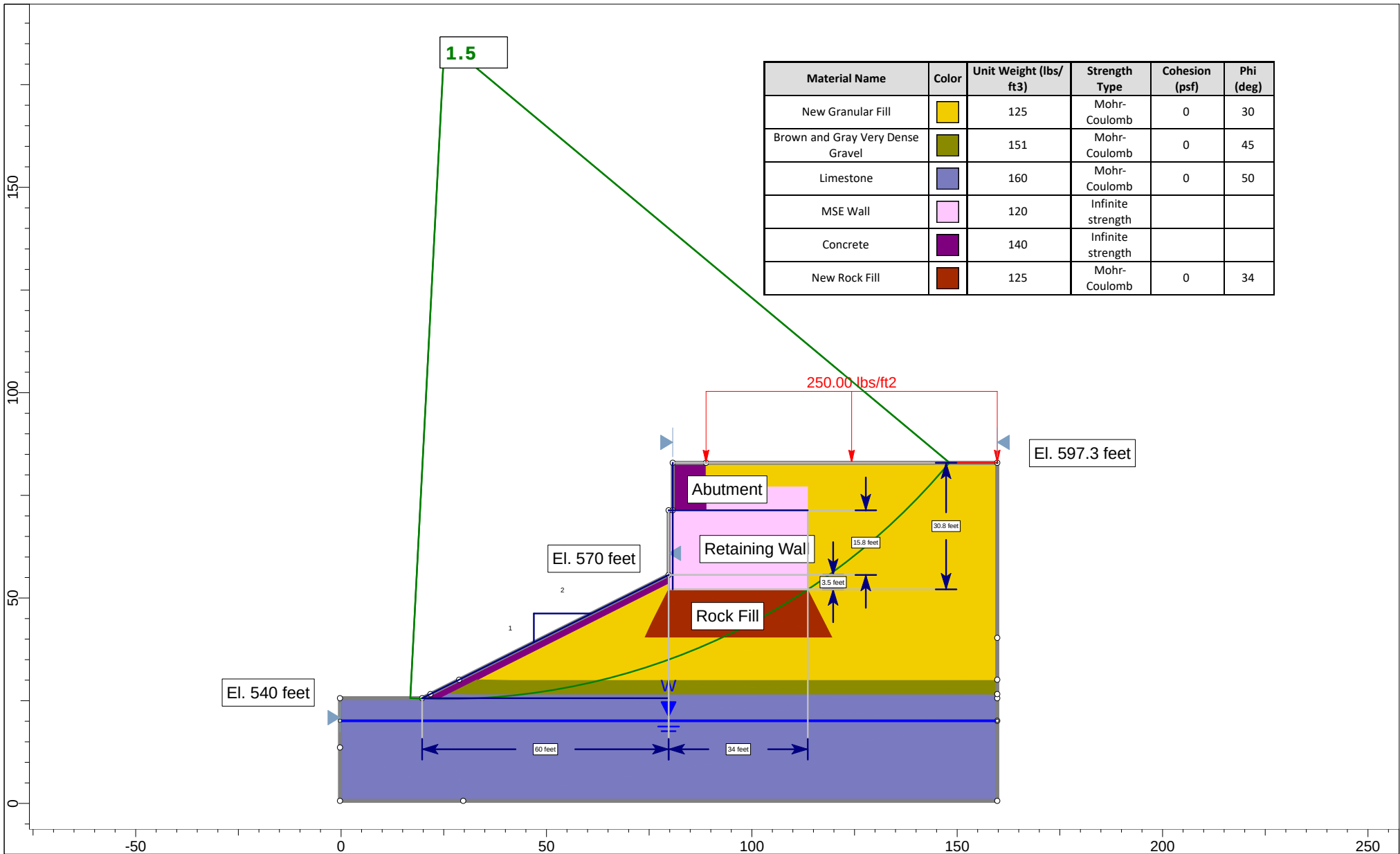




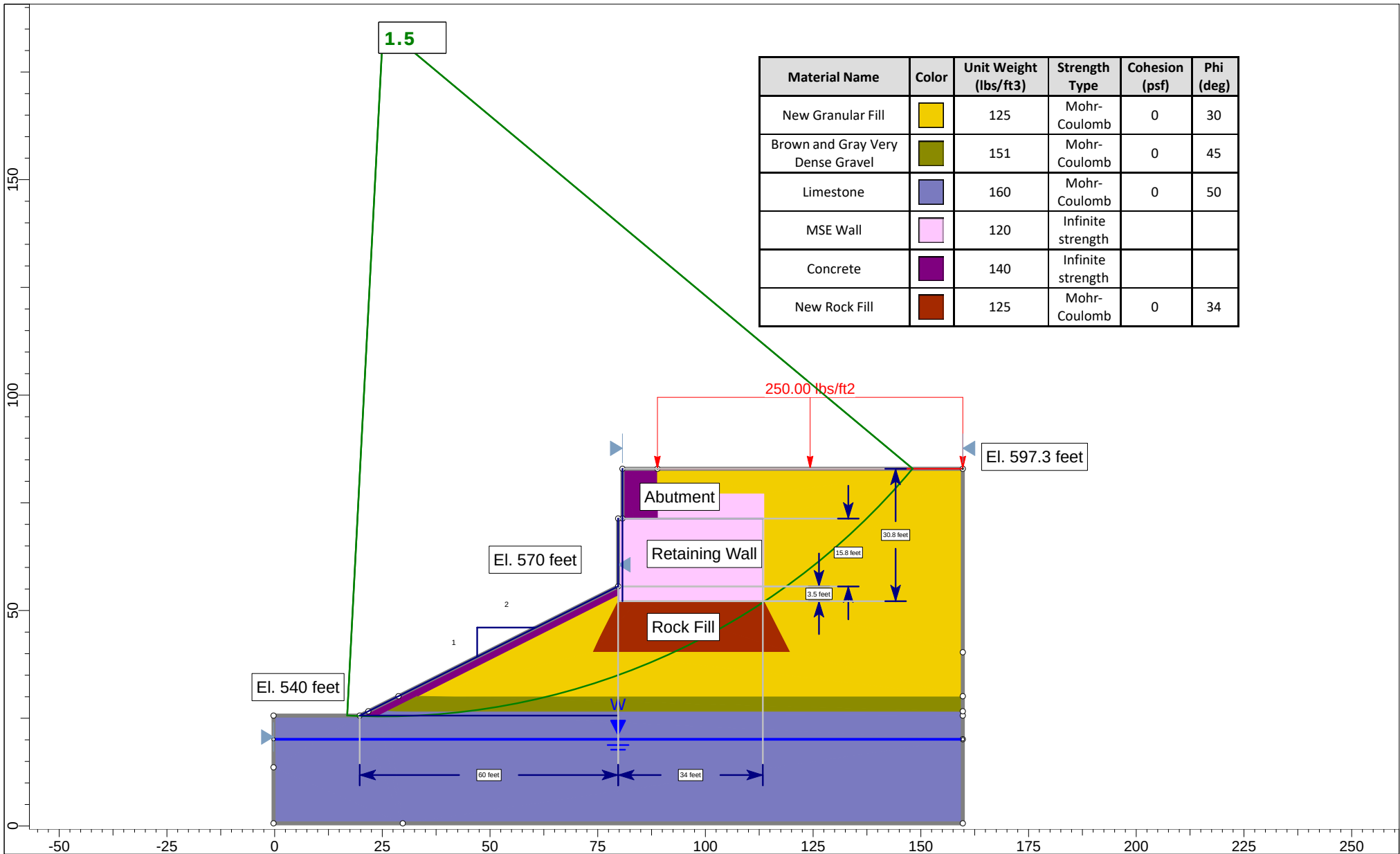
Project			I-80 over Des Plaines River - West Abutment		
Group		0.7H		Scenario	
Drawn By		RM		Company	
Date		7/15/2021, 12:22:18 PM		File Name	
				Short Term Stability - Water El. 534.5 feet	
				GSG Consultants, Inc.	
				west BSB-1, 2, 3 with MSE wall.slmd	



Project			I-80 over Des Plaines River - West Abutment		
Group		0.7H	Scenario		
Drawn By		RM	Company		
Date		7/15/2021, 12:22:18 PM	GSG Consultants, Inc.		
			File Name		
			west BSB-1, 2, 3 with MSE wall.slmd		



 GSG CONSULTANTS, INC. 735 Remington Road, Schaumburg, IL 60173 Tel: 630.994.2600; www.gsg-consultants.com	Project		I-80 over Des Plaines River - West Abutment	
	Group	1.1H	Scenario	Short Term Stability - Water El. 534.5 feet
	Drawn By	RM	Company	GSG Consultants, Inc.
	Date	7/15/2021, 12:22:18 PM	File Name	west BSB-1, 2, 3 with MSE wall.slmd
	SLIDEINTERPRET 9.025			



Material Name	Color	Unit Weight (lbs/ft ³)	Strength Type	Cohesion (psf)	Phi (deg)
New Granular Fill		125	Mohr-Coulomb	0	30
Brown and Gray Very Dense Gravel		151	Mohr-Coulomb	0	45
Limestone		160	Mohr-Coulomb	0	50
MSE Wall		120	Infinite strength		
Concrete		140	Infinite strength		
New Rock Fill		125	Mohr-Coulomb	0	34