

**To:** Robert Young, P.E., Structures Project Manager  
AJA CEE

**From:** August Arles, Geotechnical Engineer, via, Callie Ewald, Geotechnical Engineering Manager

**Date:** April 5<sup>th</sup>, 2023

**Subject:** Jericho BF 0209(10) Geotechnical Data Report

**1.0 INTRODUCTION**

As requested, we have completed our subsurface investigation of the proposed bridge replacement and retaining wall as part of the Jericho BF 0209(10) project. The subject project consists of replacement of Bridge 15 on FAS Route 209 (Browns Trace Rd) over Mill Brook in the town of Jericho. Contained herein are the results of our field sampling and testing, laboratory analysis of soil samples, and design parameter recommendations for use in the design of the proposed replacement structure, as determined using the 2020 AASHTO LRFD Bridge Design Specifications.

**2.0 FIELD INVESTIGATION**

Two phases of field investigations were conducted as part of this project this far. An initial subsurface investigation was conducted between July 7<sup>th</sup> and July 17<sup>th</sup>, 2021, during the scoping phase of the project. This subsurface investigation included advancing two standard penetration (SPT) borings (B-101 and B-102) at opposite corners of the existing structure. A brief summary of the investigation was included in a Preliminary Geotechnical Report to Scoping Engineer Laura Stone on August 20<sup>th</sup>, 2021, to assist in the evaluation of foundation alternatives.

A second investigation was conducted between February 15<sup>th</sup> and March 2<sup>nd</sup>, 2023. This subsurface investigation included the advancement of one SPT boring (B-105) in the location of the proposed retaining wall. A summary of the final location of each boring and corresponding ground surface elevation can be found in Table 2.1. The values for Northings and Easting are based on the Vermont State Plan Grid Coordinate System NAD 83 and were located by the Geotechnical Engineering Section’s Trimble Geoexplorer 600 handheld GPS with a decimeter accuracy. Elevations for the borings are based on the North American Vertical Datum, NAVD88. The locations and elevations for the borings should be considered accurate only to the degree implied by the method used to determine them.

**Table 2.1 Boring Locations and Elevations**

Boring No.	Station	Offset (ft)	Northing (ft)	Easting (ft)	Approximate Ground Surface Elevation (ft)
B-101	91+73	8.1 LT	709462.6	1516277.0	589.7
B-102	91+38	14.1 RT	709425.3	1516294.2	589.6
B-105	92+56	21.9 RT	709541.1	1516318.1	590.7

The borings were performed in general accordance with AASHTO T206, *Standard Method of Test for Penetration Test and Split-Barrel Sampling of Soils*. During drilling operations for boring B-101 and B-102, split spoon samples and standard penetration tests (SPT) were taken at a 5-foot interval until a depth of 50 feet (ft) below ground surface (bgs), and then at a 10 ft interval until encountering presumed bedrock. For boring B-105, samples were taken continuously until a depth of 30 ft bgs, and then at 5 ft intervals until a depth of 40 ft, the boring was then progressed without sampling to bedrock. When bedrock was encountered, two 5 ft bedrock cores totaling 10 ft, were taken to confirm the presence of bedrock. The depth that bedrock was encountered in borings B-101, B-102, and B-105 was approximately 110.1 ft, 120.0 ft, and 137.0 ft bgs, respectively.

Soil samples were visually identified in the field and SPT blow counts were recorded on the boring logs when applicable. Soil samples were preserved and returned to the VTrans Construction and Materials Bureau Laboratory for testing and further evaluation. Upon completion of the laboratory testing, the borings logs were revised to reflect the results of the laboratory classification analysis. The attached boring logs display the types of soil strata encountered and include the laboratory test data, SPT data, and any pertinent observations made by the boring crew.

Details of the bedrock coring were recorded on the boring logs when applicable. Cores were then placed in core boxes and returned to the VTrans Construction and Materials Bureau Laboratory for further evaluation and testing, where applicable. The boring logs were revised to reflect the classification and description of the bedrock cores. It should be noted that while presumed bedrock was encountered for holes B-101 and B-102, the cores were not made available for the Geology Section to classify the rock per standard procedures and are no longer available to do so. In addition, the first run of B-105 yielded no recovery, the head driller noted this may have been due to the use of an incorrect drill bit for the type of rock present. The second core was recovered and brought back to the VTrans Construction and Materials Bureau Laboratory for further evaluation, the results of this evaluation can be found in Section 4.4.

### **3.0 FIELD AND LABORATORY TESTING**

The standard penetration resistance of the in-situ soil is determined by the number of blows required to drive a 2-inch outside diameter (OD) split-barrel sampler into the soil with a 140-pound hammer dropped from a height of 30 inches, in accordance with procedures specified in AASHTO T206. The number of blows required to drive the sampler each 6-inch increment is recorded, and the Standard Penetration Resistance (N-Value) is calculated as the sum of the blows over the second and third 6-inch intervals. The SPT N-value is commonly used with established correlations to estimate several soil parameters, particularly the shear strength and density of cohesionless soils. The N-values provided on the boring logs are raw values and have not been corrected for energy, borehole diameter, rod length, or overburden pressure.

The VT Agency of Transportation has determined a hammer correction value,  $C_E$ , to account for the efficiency of the SPT hammers on its drill rigs. A CME 55 Track rig was used for all borings, with a hammer energy correction factor of 1.52. These values, included on the boring logs, should be used in calculations to estimate soil parameters.

Geotechnical laboratory tests were performed on select representative samples to assist with soil classification and evaluate engineering properties of the soil. Grain size analyses were performed

on select soil samples in accordance with AASHTO T 88, *Standard Method of Test for Particle Size Analysis of Soils*. Results from this testing can be found on the attached boring logs.

A detailed description of the recovered rock cores is presented on the boring logs including run length, drill times, recovery, and Rock Quality Designation (RQD). Recovery is defined as the length of core obtained expressed as a percentage of the total length cored. In accordance with ASTM D6032, RQD is the total length of core pieces, 4 inches or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams, jointing and bending planes. The Rock Mass Rating (RMR) is also included on the logs. RMR is AASHTO’s (LRFD Bridge Design Specification) recommended method of classifying rock and is based on five different parameters that all have relative ratings which combine to form the RMR. These parameters include rock strength, RQD, joint spacing, joint condition, and groundwater (AASHTO Section 10.4.6.4).

**4.0 SOIL PROFILE**

Review of the laboratory data, field testing, and boring logs revealed the following information pertaining to the soil strata. It should be noted that groundwater elevations are subject to change given the fact that boreholes were generally left open for a short period of time. Because groundwater elevations can fluctuate seasonally and are affected by temperature and precipitation, groundwater may be encountered during construction when not previously noted on the logs.

**4.1 Boring B-101 (Abutment No. 2)**

The ground surface elevation at B-101 was approximately 589.7 ft. Groundwater was measured before drilling on July 12<sup>th</sup>, 2021, at a depth of 0.4 ft, corresponding to an approximate elevation of 589.3 ft. Presumed bedrock was encountered at a depth of 110.1 ft bgs, corresponding to an approximate elevation of 479.6 ft.

Approximate Elevation (ft)	Soil Profile
590 – 578 ft	Loose to Medium Dense Gravelly Silty Sand
578 – 480 ft	Dense to Very Dense Silt
< 480 ft	Bedrock

**4.2 Boring B-102 (Abutment No. 1)**

The ground surface elevation at B-102 was approximately 589.6 ft. Groundwater was measured before drilling on July 14<sup>th</sup>, 2021, at a depth of 1.0 ft bgs, corresponding to an approximate groundwater elevation of 588.6 ft. Presumed bedrock was encountered at a depth of 120.0 ft bgs, corresponding to an approximate elevation of 469.6 ft.

Approximate Elevation (ft)	Soil Profile
590 – 578 ft	Loose to Medium Dense Gravelly Sand
568 – 470 ft	Dense to Very Dense Silt
< 470 ft	Bedrock

**4.3 Boring B-105**

The ground surface elevation at B-105 was approximately 590.7 ft. Groundwater was measured before and after drilling on February 16<sup>th</sup>, 2023, at a depth of 5.0 ft and 0.0 ft bgs, corresponding to an approximate ground elevation of 585.7 ft and 590.7 ft, respectively. An artesian water condition was noted during drilling on February 27<sup>th</sup> and March 2<sup>nd</sup>, 2023. Water was noted flowing out of the top of the casing extending 3 ft above the ground surface. Bedrock was encountered at a depth of 137.0 ft bgs, corresponding to an approximate elevation of 453.7 ft.

Approximate Elevation (ft)	Soil Profile
591 – 582 ft	Loose to Medium Dense Gravelly Silty Sand
582 – 454 ft	Dense to Very Dense Silt
< 454 ft	Bedrock

**4.4 Design Parameters**

A summary of the rock core findings are listed in Table 4.4.1 as well as available in the attached boring logs. Information from the cores indicated SCHIST to be the main rock type in the recovered sample. The bedrock had a rock mass rating (RMR) of 61, indicating fair rock. Engineering properties assigned to the in-situ materials are shown in Table 4.4.2. These values should be used when designing the substructure units. It is recommended that values of  $K_o$  be used for calculating earth pressures where the structure is not allowed to deflect longitudinally, away from or into the retained soil mass. Values for  $K_a$  should be utilized for an active earth pressure condition where the structure is moving away from the soil mass and  $K_p$  where the structure is moving toward the soil mass. The design earth pressure coefficients are based on horizontal surfaces (non-sloping backfill) and a vertical wall face.

**Table 4.4.1 Rock Core Sample Results – B-105**

Run Number	Core Size	Depth (ft)	Recovery (%)	RQD (%)	Dip (deg)	Lithologic Description	RMR
R-2	NX	142-147	100	63	65	Dark Gray-Blue-Green, Quartz-Chlorite-Biotite, SCHIST. Fine-grained. Slightly discolored, rust colored. Close to moderate joint spacing and rough condition. Very hard. Very slight weathering.	61

**Table 4.4.1: Engineering Properties of In-Situ Materials**

Soil Description	M. Dense SiGrSa	M. Dense to Dense Si
Unit Weight, $\gamma$ (lbs/ft <sup>3</sup> ):	130	135
Internal Friction Angle, $\phi$ (degrees):	36	38
Coefficient of Friction, f		
- mass concrete cast against soil:	0.55	0.34
- soil against precast/formed concrete:	0.40	0.25
Active Earth Pressure Coef., $K_a$ :	0.26	0.24
Passive Earth Pressure Coef., $K_p$ :	3.85	4.20
At-Rest Earth Pressure Coefficient, $K_0$ :	0.41	0.38

**5.0 RECOMMENDATIONS**

Based on the soils present at the site we believe that abutments supported on piles are a feasible option for the proposed bridge foundations. Dense material, occasional broken rock and refusal conditions were encountered in all three borings. While conventional pile driving to bedrock may prove difficult at this location, it is our opinion that the materials are finer grained and dense, rather than cobbles and boulders, allowing for an H-pile to be driven to a sufficient embedment by an appropriately sized hammer. Additionally, predrilling or the use of micropiles are suitable alternatives.

**7.0 CONCLUSION**

We are happy to provide design recommendations once information is available to do so. If you have any questions or would like to discuss this report, please contact the Geotechnical Engineering Section via email. Computer generated boring logs are attached and available in the [M:\Projects\12j634\MaterialsResearch](#) folder.

Reviewed by: Eric Denardo, Geotechnical Engineer *END*

Attachments: Boring Layout (1 Page)  
 Boring Logs (11 Pages)

cc: Electronic Read File/MG  
 Project File/CEE  
 AJA

**SOIL CLASSIFICATION**

**AASHTO**

A1	Gravel and Sand
A3	Fine Sand
A2	Silty or Clayey Gravel and Sand
A4	Silty Soil - Low Compressibility
A5	Silty Soil - Highly Compressible
A6	Clayey Soil - Low Compressibility
A7	Clayey Soil - Highly Compressible

**ROCK QUALITY DESIGNATION**

R.O.D. (Z)	ROCK DESCRIPTION
<25	Very Poor
25 to 50	Poor
51 to 75	Fair
76 to 90	Good
>90	Excellent

**SHEAR STRENGTH**

UNDRAINED SHEAR STRENGTH IN P.S.F.	CONSISTENCY
<250	Very Soft
250-500	Soft
500-1000	Med. Stiff
1000-2000	Stiff
2000-4000	Very Stiff
>4000	Hard

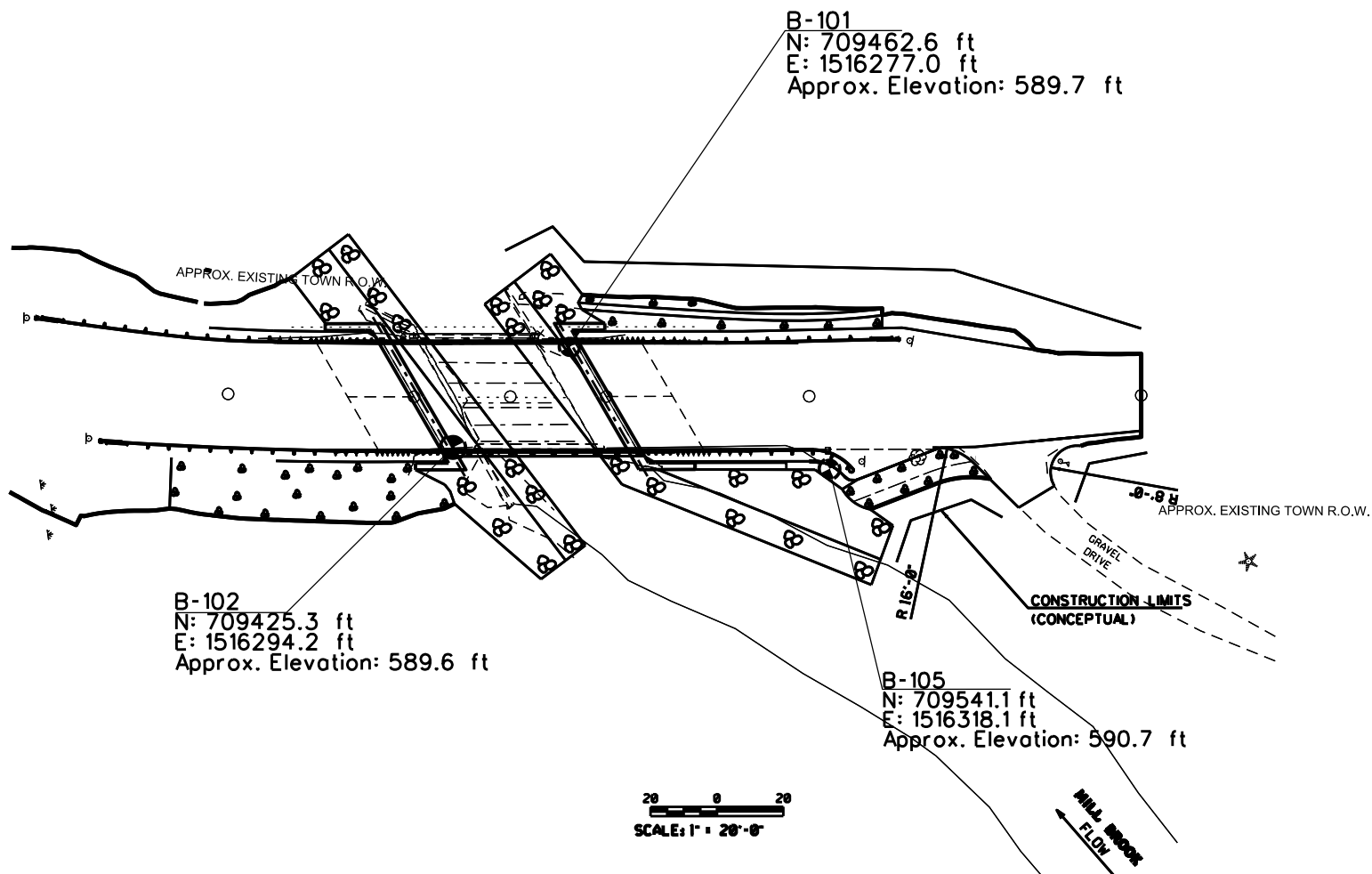
**CORRELATION GUIDE OF "N" TO DENSITY/CONSISTENCY**

DENSITY (GRANULAR SOILS)		CONSISTENCY (COHESIVE SOILS)	
N	DESCRIPTIVE TERM	N	DESCRIPTIVE TERM
<5	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-24	Med. Dense	5-8	Med. Stiff
25-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		31-60	Hard
		>60	Very Hard

**COMMONLY USED SYMBOLS**

Y	Water Elevation
⊙	Standard Penetration Boring
⊗	Auger Boring
⊖	Rod Sounding
S	Sample
N	Standard Penetration Test
	Blow Count Per Foot For:
	2" O. D. Sampler
	1 3/8" I. D. Sampler
	Hammer Weight Of 140 Lbs.
	Hammer Fall Of 30"
VS	Field Vane Shear Test
US	Undisturbed Soil Sample
B	Blast
DC	Diamond Core
MD	Mud Drill
WA	Wash Ahead
HSA	Hollow Stem Auger
AX	Core Size 1 1/2"
BX	Core Size 1 3/4"
NX	Core Size 2 1/4"
M	Double Tube Core Barrel Used
LL	Liquid Limit
PL	Plastic Limit
PI	Plasticity Index
NP	Non Plastic
w	Moisture Content (Dry Wgt. Basis)
D	Dry
M	Moist
MTW	Moist To Wet
W	Wet
Sat	Saturated
Bo	Boulder
Gr	Gravel
Sa	Sand
Si	Silt
Cl	Clay
HP	Hardpan
Le	Ledge
NLTD	No Ledge To Depth
CNPF	Can Not Penetrate Further
TLOB	Top of Ledge Or Boulder
NR	No Recovery
Rec.	Recovery
%Rec.	Percent Recovery
ROD	Rock Quality Designation
CBR	California Bearing Ratio
<	Less Than
>	Greater Than
R	Refusal (N > 100)
VTSPG	NA083 - See Note 7

COLOR			
bk	Black	pu	Pink
bl	Blue	rd	Purple
brn	Brown	rd	Red
dk	Dark	tn	Tan
gr	Gray	wh	White
gn	Green	yel	Yellow
ll	Light	mlc	Multicolored
or	Orange		



**DEFINITIONS (AASHTO)**

<b>BEDROCK (LEDGE)</b> - Rock in its native location of indefinite thickness.	<b>VARVED</b> - Alternate layers of silt and clay.
<b>BOULDER</b> - A rock fragment with an average dimension > 12 inches.	<b>HARDPAN</b> - Extremely dense soil, cemented layer, not softened when wet.
<b>COBBLE</b> - Rock fragments with an average dimension between 3 and 12 inches.	<b>MUCK</b> - Soft organic soil (containing > 10% organic material).
<b>GRAVEL</b> - Rounded particles of rock < 3" and > 0.075" (#10 sieve).	<b>MOISTURE CONTENT</b> - Weight of water divided by dry weight of soil.
<b>SAND</b> - Particles of rock < 0.075" (#10 sieve) and > 0.0029" (#200 sieve).	<b>FLOWING SAND</b> - Granular soil so saturated (loose) that it flows into drill casing during extraction of wash rod.
<b>SILT</b> - Soil < 0.0029" (#200 sieve), non or slightly plastic and exhibits no strength when air-dried.	<b>STRIKE</b> - Angle from magnetic north to line of intersection of bed with a horizontal plane.
<b>CLAY</b> - Fine grained soil, exhibits plasticity when moist and considerable strength when air-dried.	<b>DIP</b> - Inclination of bed with a horizontal plane.

**GENERAL NOTES**

- The subsurface explorations shown herein were made between 7/07/2021 and 7/17/2021 and between 2/15/2023 and 3/02/2023 by the Agency.
- Soil and rock classifications, properties and descriptions are based on engineering interpretation from available subsurface information by the Agency and may not necessarily reflect actual variations in subsurface conditions that may be encountered between individual boring or sample locations.
- Observed water levels and/or conditions indicated are as recorded at the time of exploration and may vary according to the prevailing rainfall, methods of exploration and other factors.
- Engineering judgment was exercised in preparing the subsurface information presented herein. Analysis and interpretation of subsurface data was performed and interpreted for Agency design and estimating purposes. Presentation of the information in the Contract is intended to provide the Contractor access to the same data available to the Agency. The subsurface information is presented in good faith and is not intended as a substitute for personal investigation, independent interpretation, independent analysis or judgment by the Contractor.
- Pictorial structure details shown on the boring plan layout or soils profile are for illustrative purposes only and may not accurately portray final contract details.
- Terminology used on boring logs to describe the hardness, degree of weathering, and spacing of fractures, joints and other discontinuities in the bedrock is defined in the AASHTO Manual on Subsurface Investigations, 1988.
- Northing and Easting coordinates are shown in Vermont State Plane Grid North American Datum 1983 in meters and survey feet.

PROJECT NAME: JERICHO  
 PROJECT NUMBER: BF 0209(10)  
 FILE NAME: s12j634bor.dgn  
 PROJECT LEADER: R. YOUNG  
 DESIGNED BY: A. MANN  
 BORING INFORMATION SHEET

PLOT DATE: \$\$\$DATE\$\$\$  
 DRAWN BY: A. MANN  
 CHECKED BY: F. BARROWS  
 SHEET 55-S OF 51-S



STATE OF VERMONT  
AGENCY OF TRANSPORTATION  
CONSTRUCTION AND  
MATERIALS BUREAU  
CENTRAL LABORATORY

BORING LOG

Jericho  
BF 0209(10)  
FAS 209 Bridge No. 15

Boring No.: B-101  
Page No.: 1 of 3  
Pin No.: 12j634  
Checked By: AJA

Boring Crew: Judkins, Emerson, Arles  
Date Started: 7/07/21 Date Finished: 7/13/21  
VTSPG NAD83: N 709462.64 ft E 1516276.99 ft  
Station: 91+73 Offset: 8.1 LT  
Ground Elevation: 589.67 ft

Casing: WB Sampler: SS  
Type: WB I.D.: 4 in 1.5 in  
Hammer Wt: N.A. 140 lb.  
Hammer Fall: N.A. 30 in.  
Hammer/Rod Type: Auto/AWJ  
Rig: CME 55 TRACK  $C_F = 1.52$

Groundwater Observations		
Date	Depth (ft)	Notes
07/07/21	1.8	WT After Drilling
07/12/21	0.4	WT Before Drilling
07/13/21	6.4	WT After Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. (% RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		Visual Description:., Asphalt 0.0'-0.95'								
		Visual Description:., GrSa, brn, Moist, Rec. = 1.1 ft, Field Note: NXDC Cleanout 4.0'-5.0'				9-10-9-8 (19)				
5		Field Note, No Recovery. Gravel in end of sampler, Rollercone Cleanout 9.1'-10.0'				6-4-4-6 (8)				
10		Visual Description:., SiSa w/ gravel, gry, Moist, Rec. = 0.3 ft, Field Note: Refusal @ 11.3' 50 blows/6". NXDC Cleanout 13.3'-15.0'				4-9-R@4" (R)				
15		Visual Description:., Si, gry, Moist, Rec. = 1.1 ft, Field Note: Rollercone Cleanout 19.7'-20.0'				8-8-12-16 (20)				
20		Visual Description:., Si, Lt/brn, Moist, Rec. = 1.5 ft, Field Note: NXDC Cleanout 24.7'-25.0'				11-19-20-23 (39)				
25		Visual Description:., Si, gry, Moist, Rec. = 1.5 ft, Field Note: Apparent Boulder 27.0'-29.0'. NXDC Cleanout 28.8'-30.0'				5-21-34-38 (55)				
30		A-4, Si, gry, Moist, Rec. = 1.7 ft, Field Note: Rollercone Cleanout 33.5'-35.0'				15-18-30-31 (48)	24.7	0.1	2.5	97.4
35		Visual Description:., ClSi, gry, Moist, Rec. = 1.4 ft, Field Note: Refusal @ 36.8' 100 blows. Rollercone Cleanout 39.3'-40.0'				13-25-39-R@4" (64)				
40		A-4, Si, Lt/brn, Moist, Rec. = 1.5 ft, Field Note: Refusal @ 41.8' 100 blows.				12-23-32-R@4" (55)	23.7	1.0	17.5	81.5
45		Visual Description:., Si, brn, Moist, Rec. = 1.2 ft, Field Note: Refusal @ 46.8' 100 blows				10-20-48-R@4" (68)				

BORING LOG JERICHO BF 0209(10).GPJ VERMONT AOT.GDT 11/9/22

Notes:  
 1. Stratification lines represent approximate boundary between material types. Transition may be gradual.  
 2. N Values have not been corrected for hammer energy.  $C_F$  is the hammer energy correction factor.  
 3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.  
 4. "bgs" is used as the shorthand stand in for "Below Ground Surface".



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**Jericho**  
**BF 0209(10)**  
**FAS 209 Bridge No. 15**

Boring No.: **B-101**  
Page No.: **2 of 3**  
Pin No.: **12j634**  
Checked By: **AJA**

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55		Visual Description: SaSi, gry, Moist, Rec. = 0.2 ft, Field Note: Refusal @ 50.2 10 blows no movement. NXDC Cleanout 59.3'-60.0'				R@2" (R)				
60		A-4, Si, gry, Moist, Rec. = 0.3 ft, Field Note: Refusal @ 61.3' 100 blows. NXDC Cleanout 69.0'-70.0'				25-42-R@3" (R)	24.5	1.9	10.5	87.6
70		Visual Description: Si, gry, Moist, Rec. = 0.8 ft, Field Note: Refusal @ 70.8' 50 blows per 6". NXDC Cleanout 77.7'-80.0'				26-R@4" (R)				
80		A-4, SaSi, Lt/brn, Moist, Rec. = 1.4 ft, Field Note: Refusal @ 81.8' 100 blows. NXDC Cleanout 88.8'-90.0'				19-26-36-R@4" (42)	17.9	19.3	27.5	53.2
90		A-4, SaSi, Lt/brn, Moist, Rec. = 1.5 ft, Field Note: NXDC Cleanout 98.0'-100.0'				11-21-27-32 (48)	27.2	3.3	37.9	58.8

Notes: 1. Stratification lines represent approximate boundary between material types. Transition may be gradual.  
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BORING LOG JERICHO BF 0209(10).GPJ VERMONT AOT.GDT 11/9/22





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BORING LOG

Jericho  
BF 0209(10)  
FAS 209 Bridge No. 15

Boring No.: B-101  
Page No.: 3 of 3  
Pin No.: 12j634  
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105		Visual Description: Si, Lt/brn, Moist, Rec. = 1.4 ft, Field Note: Refusal @ 101.7' 100 blows. NXDC Cleanout 108.5'-110.0'				10-22-35-R@2" (57)				
110		Visual Description: Si Broken Rock, Lt/brn, Moist, Rec. = 0.1 ft, Field Note: Refusal @ 110.1' 10 blows no movement	R-1	0	3	R@1" (R)				
115		110.1 ft - 115.0 ft, NXMDC 110'-115'. No Recovery. NXMDC			3					
120		115.0 ft - 120.0 ft, NXMDC 115'-120'. No Recovery. NXMDC	R-2	0	5					
125		Visual Description: Si Broken Rock, Lt/brn, Moist, Rec. = 0.3 ft, Field Note: Refusal @ 120' no movement			5	R@4" (R)				
130		Hole stopped @ 120.1 ft			4					
135		Remarks: Hole Collapsed @ 32.9'			4					

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BORING LOG

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Checked By: AJA

Boring Crew: Judkins, Brochu, Emerson  
Date Started: 7/13/21 Date Finished: 7/17/21  
VTSPG NAD83: N 709425.26 ft E 1516294.19 ft  
Station: 91+38 Offset: 14.1 RT  
Ground Elevation: 589.64 ft

Casing: WB Sampler: SS  
Type: WB I.D.: 4 in 1.5 in  
Hammer Wt: N.A. 140 lb.  
Hammer Fall: N.A. 30 in.  
Hammer/Rod Type: Auto/AWJ  
Rig: CME 55 TRACK  $C_F = 1.52$

Groundwater Observations		
Date	Depth (ft)	Notes
07/13/21	1.5	WT After Drilling
07/14/21	1.0	WT Before Drilling
07/17/21	4.8	WT After Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
0.0 - 1.1		0.0 ft - 1.1 ft, Field Note: Asphalt 0.0'-1.1' Visual Description: SaGr, brn, Moist, Rec. = 0.7 ft, Field Note: 1'-2' Asphalt grindings. Rollercone Cleanout 3.9'-5.0'				15-18-12-10 (30)				
5		Visual Description: GrSa, brn, Moist, Rec. = 1.0 ft, Field Note: Rollercone Cleanout 8.1'-10.0'				5-7-8-6 (15)				
10		Visual Description: SaGr, brn, Moist, Rec. = 0.6 ft, Field Note: NXDC Cleanout 11.7'-15.0'. Apparent Concrete 14.0'-18.0'				15-17-13-8 (30)				
20		A-4, Si, brn, Moist, Rec. = 1.3 ft				8-12-14-17 (26)	20.4	1.5		98.5
25		A-2-4, SiSa, brn, Moist, Rec. = 1.7 ft, Field Note: Refusal @ 26.8' 100 blows. NXDC Cleanout 29.0'-30.0'				14-24-30-R@4" (54)	20.8	4.1	66.9	29.0
30		A-4, SaSi, brn, Moist, Rec. = 1.3 ft, Field Note: Refusal @ 31.6' 100 blows. Rollercone Cleanout 34.3'-35.0'				19-30-45-R@1" (75)	16.6	15.0	36.7	48.3
35		A-4, Si, brn, Moist, Rec. = 1.1 ft, Field Note: Refusal @ 36.2' 10 blows no movement. Rollercone Cleanout 36.5'-40.0'				10-30-R@2" (R)	24.3	1.7	12.9	85.4
40		Visual Description: Si, brn, Moist, Rec. = 0.9 ft, Field Note: Refusal @ 40.9' 50 blows per 6". NXDC Cleanout 48.8'-50.0'				25-R@5" (R)				
45										

BORING LOG JERICHO BF 0209(10).GPJ VERMONT AOT.GDT 11/9/22

Notes:  
 1. Stratification lines represent approximate boundary between material types. Transition may be gradual.  
 2. N Values have not been corrected for hammer energy.  $C_F$  is the hammer energy correction factor.  
 3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.  
 4. "bgs" is used as the shorthand stand in for "Below Ground Surface".



STATE OF VERMONT  
AGENCY OF TRANSPORTATION  
CONSTRUCTION AND  
MATERIALS BUREAU  
CENTRAL LABORATORY

BORING LOG

Jericho  
BF 0209(10)  
FAS 209 Bridge No. 15

Boring No.: B-102  
Page No.: 2 of 3  
Pin No.: 12j634  
Checked By: AJA

Boring Crew: Judkins, Brochu, Emerson  
Date Started: 7/13/21 Date Finished: 7/17/21  
VTSPG NAD83: N 709425.26 ft E 1516294.19 ft  
Station: 91+38 Offset: 14.1 RT  
Ground Elevation: 589.64 ft

Casing: WB Sampler: SS  
Type: WB I.D.: 4 in 1.5 in  
Hammer Wt: N.A. 140 lb.  
Hammer Fall: N.A. 30 in.  
Hammer/Rod Type: Auto/AWJ  
Rig: CME 55 TRACK  $C_F = 1.52$

Groundwater Observations		
Date	Depth (ft)	Notes
07/13/21	1.5	WT After Drilling
07/14/21	1.0	WT Before Drilling
07/17/21	4.8	WT After Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
55		Visual Description: GrSa, brn, Moist, Rec. = 0.7 ft, Field Note: Refusal @ 50.7' 50 blows per 6". NXDC Cleanout 59.2-60.0'				41-R@5" (R)				
60		A-4, Si, brn, Moist, Rec. = 0.8 ft, Field Note: Refusal @ 60.8' 50 blows per 6". NXDC Cleanout 67.2'-70.0'				32-R@4" (R)	23.6	1.3	17.5	81.2
70		Visual Description: Si, brn, Moist, Rec. = 1.2 ft, Field Note: Refusal @ 71.2'. Rollercone Cleanout 78.2'-80.0'				30-35-R@2" (R)				
80		Visual Description: Si, Lt/brn, Moist, Rec. = 1.0 ft, Field Note: Refusal @ 81.7' 100 blows. Rollercone Cleanout 88.5'-90.0'				14-29-36-R@3" (35)				
90		A-4, GrSaSi, Lt/brn, Moist, Rec. = 1.0 ft, Field Note: Refusal @ 91.3' 100 blows. Field Note, Drilling was advanced from 91.3 to top of bedrock without sampling.				31-40-R@3" (R)	16.3	26.5	37.7	35.8

BORING LOG JERICHO BF 0209(10).GPJ VERMONT AOT.GDT 11/9/22

Notes:  
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 2. N Values have not been corrected for hammer energy.  $C_F$  is the hammer energy correction factor.  
 3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.  
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STATE OF VERMONT  
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 CONSTRUCTION AND  
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 CENTRAL LABORATORY

**BORING LOG**

**Jericho**  
**BF 0209(10)**  
**FAS 209 Bridge No. 15**

Boring No.: **B-102**  
 Page No.: **3 of 3**  
 Pin No.: **12j634**  
 Checked By: **AJA**

Boring Crew: Judkins, Brochu, Emerson  
 Date Started: 7/13/21 Date Finished: 7/17/21  
 VTSPG NAD83: N 709425.26 ft E 1516294.19 ft  
 Station: 91+38 Offset: 14.1 RT  
 Ground Elevation: 589.64 ft

Casing: WB Sampler: SS  
 Type: WB I.D.: 4 in 1.5 in  
 Hammer Wt: N.A. 140 lb.  
 Hammer Fall: N.A. 30 in.  
 Hammer/Rod Type: Auto/AWJ  
 Rig: CME 55 TRACK  $C_e = 1.52$

Groundwater Observations		
Date	Depth (ft)	Notes
07/13/21	1.5	WT After Drilling
07/14/21	1.0	WT Before Drilling
07/17/21	4.8	WT After Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
105										
110										
115										
120		120.0 ft - 125.0 ft, NXMDC 120'-125'. Recovered rock was not examined for description. Based on quality of sample recovered, the rock is extremely weathered.. NXMDC	R-1	20	1 1 2 6 9					
125		125.0 ft - 130.0 ft, NXMDC 125'-130'. Recovered rock was not examined for description. Based on quality of sample recovered, the rock is extremely weathered.. NXMDC	R-2	20	7 9 9 7 6					
130		Hole stopped @ 130.0 ft								
135		Remarks: Hole Collapsed @ 4.8'								
140										
145										

BORING LOG JERICHO BF 0209(10).GPJ VERMONT AOT.GDT 11/9/22

Notes:  
 1. Stratification lines represent approximate boundary between material types. Transition may be gradual.  
 2. N Values have not been corrected for hammer energy.  $C_e$  is the hammer energy correction factor.  
 3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.  
 4. "bgs" is used as the shorthand stand in for "Below Ground Surface".



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CENTRAL LABORATORY

BORING LOG

Jericho  
BF 0209(10)  
FAS 209 Bridge No. 15

Boring No.: B-105  
Page No.: 1 of 5  
Pin No.: 12j634  
Checked By: AJA

Boring Crew: McGinley, Monette, Arles, Zottola  
Date Started: 2/15/23 Date Finished: 3/02/23  
VTSPG NAD83: N 709541.10 ft E 1516318.10 ft  
Station: 92+56 Offset: 21.9 RT  
Ground Elevation: 590.7 ft

Casing: WB Sampler: SS  
Type: WB I.D.: 4 in 1.5 in  
Hammer Wt: N.A. 140 lb.  
Hammer Fall: N.A. 30 in.  
Hammer/Rod Type: Auto/AWJ  
Rig: CME 55 TRACK C<sub>F</sub> = 1.52

Groundwater Observations		
Date	Depth (ft)	Notes
02/16/23	0.0	WT After Drilling
02/16/23	5.0	WT Before Drilling
02/27/23		See Remarks

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. (% RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		Field Note, brn, Moist, Rec. = 0.3 ft, Field Description: SAND, some silt, trace gravel, trace organics				4-2-1-2 (3)				
		Field Note, brn, MTW, Rec. = 1.0 ft, Field Description: SILT and SILT, littel gravel. Refusal @ 3.8', 10 blows no movement. NXDC core through cobble 4.5-5.0'				3-3-1-R@3" (4)				
5		A-2-4, brn, MTW, Rec. = 0.8 ft, Lab Classification: SAND, some gravel				11-7-8-11 (15)	12.5	28.6	52.6	18.8
		Field Note, Lt brn, MTW, Rec. = 1.1 ft, NXDC cleanout 7.8'-9.0'				20-9-10-15 (19)				
10		Field Note, Lt brn, Moist, Rec. = 1.0 ft, Field Description: SILT and SAND, trace gravel. Refusal @ 10.6', 100 blows				15-32-46-R@1" (58)				
		A-4, Lt brn, MTW, Rec. = 1.2 ft, Lab Classification: SILT, some gravel. Refusal @ 12.5', 100 blows				27-33-R@0" (R)	14.6	31.3	16.5	52.2
		Field Note, Lt brn, Moist, Rec. = 0.9 ft, Field Description: SILT and broken rock. Refusal @ 13.9', 50 blows per 0.5'				28-R@5" (R)				
15		A-4, gry, Moist, Rec. = 1.2 ft, Lab Classification: SILT, some gravel, some sand. Refusal @ 16.6', 100 blows				21-28-39-R@1" (67)	15.9	32.2	23.9	43.9
		A-4, gry, Moist, Rec. = 1.3 ft, Lab Classification: SILT and SAND. Refusal @ 18.6', 100 blows				23-31-40-R@1" (71)	15.9	12.5	41.3	46.2
20		Field Note, Rec. = 0.0 ft, No Recovery. Refusal @ 19.0', 10 blows, no movement				R@0" (R)				
		Field Note, gry, Moist, Rec. = 0.2 ft, Field Description: Weatherd/broken rock, some sand. Refusal @ 21.2', 50 blows per 0.5'. BXDC Cleanout from 21.2'-23.0', recovered 1.3' of core, and several inches of broken rock				R@2" (R)				
		Field Note, Rec. = 0.0 ft, No Recovery. Refusal @ 23.0', 10 blows, no movement. BXDC Cleanout 23.0'-25.0', barrel began to advance quickly at 24.0'				R@0" (R)				
25		A-4, Lt brn, Moist, Rec. = 1.3 ft, Lab Classification: SILT some sand. Refusal @ 26.6', 100 blows				25-30-29-R@1" (59)	17.2	15.7	29.7	54.6
		A-4, Lt brn, Moist, Rec. = 1.5 ft, Lab Classification: SILT, some gravel. Refusal @ 28.8', 100 blows				15-26-36-R@4" (42)	21.4	25.2	7.7	67.1
30		A-4, Lt brn, Moist, Rec. = 1.3 ft, Lab Classification: SILT. Refusal @ 30.6', 100 blows				16-28-39-R@1" (47)	22.0	17.9	4.8	77.3

BORING LOG JERICHO BF 0209(10).GPJ VERMONT AOT.GDT 4/5/23

Notes: 1. Stratification lines represent approximate boundary between material types. Transition may be gradual.  
2. N Values have not been corrected for hammer energy. C<sub>F</sub> is the hammer energy correction factor.  
3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.  
4. "bgs" is used as the shorthand stand in for "Below Ground Surface".



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 CENTRAL LABORATORY

**BORING LOG**

**Jericho**  
**BF 0209(10)**  
**FAS 209 Bridge No. 15**

Boring No.: **B-105**  
 Page No.: **2 of 5**  
 Pin No.: **12j634**  
 Checked By: **AJA**

Boring Crew: McGinley, Monette, Arles, Zottola  
 Date Started: 2/15/23 Date Finished: 3/02/23  
 VTSPG NAD83: N 709541.10 ft E 1516318.10 ft  
 Station: 92+56 Offset: 21.9 RT  
 Ground Elevation: 590.7 ft

Casing Type: WB Sampler: SS  
 I.D.: 4 in 1.5 in  
 Hammer Wt: N.A. 140 lb.  
 Hammer Fall: N.A. 30 in.  
 Hammer/Rod Type: Auto/AWJ  
 Rig: CME 55 TRACK  $C_e = 1.52$

Groundwater Observations		
Date	Depth (ft)	Notes
02/16/23	0.0	WT After Drilling
02/16/23	5.0	WT Before Drilling
02/27/23		See Remarks

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. (% RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		A-4, Lt brn, Moist, Rec. = 1.7 ft, Lab Classification: SILT, some sand. Refusal @ 36.7', 100 blows				23-22-35-R@2" (57)	21.2	12.5	23.2	64.3
40		A-4, Lt brn, Moist, Rec. = 1.3 ft, Lab Classification: SILT, and SAND. Refusal @ 41.3', 100 blows				28-44-R@4" (R)	18.7	1.3	45.7	53.0
		Field Note, Casing was advanced to bedrock without any sampling.								
45										
50										
55										
		Field Note, Cobble/Boulder from 56.0'-57.0'								
60										
65										

BORING LOG JERICHO BF 0209(10).GPJ VERMONT AOT.GDT 4/5/23

Notes:  
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**BORING LOG**

**Jericho**  
**BF 0209(10)**  
**FAS 209 Bridge No. 15**

Boring No.: **B-105**  
 Page No.: 3 of 5  
 Pin No.: 12j634  
 Checked By: AJA

Boring Crew: McGinley, Monette, Arles, Zottola  
 Date Started: 2/15/23 Date Finished: 3/02/23  
 VTSPG NAD83: N 709541.10 ft E 1516318.10 ft  
 Station: 92+56 Offset: 21.9 RT  
 Ground Elevation: 590.7 ft

Casing Sampler  
 Type: WB SS  
 I.D.: 4 in 1.5 in  
 Hammer Wt: N.A. 140 lb.  
 Hammer Fall: N.A. 30 in.  
 Hammer/Rod Type: Auto/AWJ  
 Rig: CME 55 TRACK C<sub>E</sub> = 1.52

Groundwater Observations		
Date	Depth (ft)	Notes
02/16/23	0.0	WT After Drilling
02/16/23	5.0	WT Before Drilling
02/27/23		See Remarks

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. (% RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
75		Field Note, Casing was advanced to bedrock without any sampling.								
80										
85										
90										
95										
100										

BORING LOG JERICHO BF 0209(10).GPJ VERMONT AOT.GDT 4/5/23

Notes:  
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**BORING LOG**

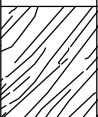
**Jericho**  
**BF 0209(10)**  
**FAS 209 Bridge No. 15**

Boring No.: **B-105**  
 Page No.: 4 of 5  
 Pin No.: 12j634  
 Checked By: AJA

Boring Crew: McGinley, Monette, Arles, Zottola  
 Date Started: 2/15/23 Date Finished: 3/02/23  
 VTSPG NAD83: N 709541.10 ft E 1516318.10 ft  
 Station: 92+56 Offset: 21.9 RT  
 Ground Elevation: 590.7 ft

Casing: WB Sampler: SS  
 Type: WB I.D.: 4 in 1.5 in  
 Hammer Wt: N.A. 140 lb.  
 Hammer Fall: N.A. 30 in.  
 Hammer/Rod Type: Auto/AWJ  
 Rig: CME 55 TRACK  $C_e = 1.52$

Groundwater Observations		
Date	Depth (ft)	Notes
02/16/23	0.0	WT After Drilling
02/16/23	5.0	WT Before Drilling
02/27/23		See Remarks

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. (% RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		Field Note, Casing was advanced to bedrock without any sampling.								
110										
115										
120										
125										
130										
135										
		137.0 ft - 142.0 ft, NX, No Recovery. Driller notes indicate incorrect drill bit. Rock is assumed to be SCHIST based on description below.	R-1 (0)	0 (0)	10 14 14					Top of Bedrock @ 137.0 ft

BORING LOG JERICHO BF 0209(10).GPJ VERMONT AOT.GDT 4/5/23

Notes:  
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**BORING LOG**

**Jericho**  
**BF 0209(10)**  
**FAS 209 Bridge No. 15**

Boring No.: **B-105**  
 Page No.: **5 of 5**  
 Pin No.: **12j634**  
 Checked By: **AJA**

Boring Crew: McGinley, Monette, Arles, Zottola  
 Date Started: 2/15/23 Date Finished: 3/02/23  
 VTSPG NAD83: N 709541.10 ft E 1516318.10 ft  
 Station: 92+56 Offset: 21.9 RT  
 Ground Elevation: 590.7 ft

Casing WB Sampler SS  
 Type: WB SS  
 I.D.: 4 in 1.5 in  
 Hammer Wt: N.A. 140 lb.  
 Hammer Fall: N.A. 30 in.  
 Hammer/Rod Type: Auto/AWJ  
 Rig: CME 55 TRACK C<sub>E</sub> = 1.52

Groundwater Observations		
Date	Depth (ft)	Notes
02/16/23	0.0	WT After Drilling
02/16/23	5.0	WT Before Drilling
02/27/23		See Remarks

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. (% RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %	
145		142.0 ft - 147.0 ft, Dark Gray-Blue-Green, Quartz-Chlorite-Biotite, SCHIST. Fine-grained. Slightly discolored, rust-colored. Close to moderate joint spacing and rough condition. Very hard, Very slightly weathered, Good rock, NX, RMR = 61	R-2 (65)	100 (63)	8						
Hole stopped @ 147.0 ft											
150		Remarks: Hole Collapsed @ 31.0' Artesian conditions encountered during drilling of the boring. Water was observed flowing out of the casing 3.0' above ground surface on 2/27/2023 and 3/2/2023.									
155											
160											
165											
170											

BORING LOG JERICHO BF 0209(10).GPJ VERMONT AOT.GDT 4/5/23

Notes:  
 1. Stratification lines represent approximate boundary between material types. Transition may be gradual.  
 2. N Values have not been corrected for hammer energy. C<sub>e</sub> is the hammer energy correction factor.  
 3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.  
 4. "bgs" is used as the shorthand stand in for "Below Ground Surface".