

To: Chris Williams, P.E., Structures Project Manager
MLM CEE

From: Marcy Meyers, Geotechnical Engineer via Callie Ewald, P.E., Senior Geotechnical Engineer

Date: May 29th, 2014

Subject: Weathersfield STP 0146(16) – Preliminary Subsurface Investigation

1.0 INTRODUCTION

We have completed our preliminary geological and geotechnical subsurface investigation for the proposed replacement of Bridge No. 15 located on VT Route 131 over the Mill Brook in Weathersfield, Vermont. The proposed project includes the replacement of the existing bridge with a new structure. Contained herein are the results of field sampling and testing, laboratory analyses of soil and rock samples, as well as boring logs.

2.0 FIELD INVESTIGATION

The field investigation was conducted between May 21st, 2014 and May 22nd, 2014. Two standard penetration borings were drilled to determine the existing subsurface stratum. A summary of the location of each boring and corresponding ground surface elevation can be found in Table 1. The values for the Northings and Eastings are based on the Vermont State Plane Grid Coordinate System NAD 83, and were located by a handheld GPS. Elevations, stations, and offsets were then taken off a provided survey file.

Table 1: Boring Locations and Elevations

Boring Number	Easting (ft)	Northing (ft)	Station (ft)	Offset (ft)	Ground Elevation (ft)	Top of Bedrock Elevation (ft)
B – 101	1652145.06	332786.72	41+64	-13.0	803.9	768.8
B – 102	1652097.56	332782.31	41+24	12.8	807.3	776.6

During the boring operations, split spoon samples and standard penetration tests (SPT) were taken continuously to twenty feet and every five feet thereafter until bedrock. When bedrock was encountered, NX rock cores were taken 10 feet into bedrock to collect five foot core sample runs. The notation ‘NXDC’ found on the boring logs signifies that the core barrel was used to core ahead through a boulder, cobble, or very dense material. For each boring, soil samples were visually identified and SPT blow counts were recorded on the boring logs.

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 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. During the standard penetration test (SPT), the sampler is driven for a total length of 2 feet, while counting the blows for each 6 inch

increment. The SPT N-value, which is defined as the sum of the number of blows required to drive the sampler through the second and third increments, is commonly used with established correlations to estimate a number of 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 hammer on the drill rig. For this project, a CME 45C Skid Rig was used, with a hammer energy correction factor of 1.33. This value, included on the boring logs, should be used in calculations to determine soil parameters. Laboratory tests were conducted on all samples to evaluate grain size, moisture content, and percent finer than No. 200 sieve. Results from this testing can be found on the attached boring logs.

A detailed description of the rock cores is presented on the logs in addition to Recovery and Rock Quality Designation (RQD). The percent recovery is defined as the length of core obtained expressed as a percentage of the total length cored. 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 bedding planes.

4.0 FOUNDATION RECOMMENDATIONS

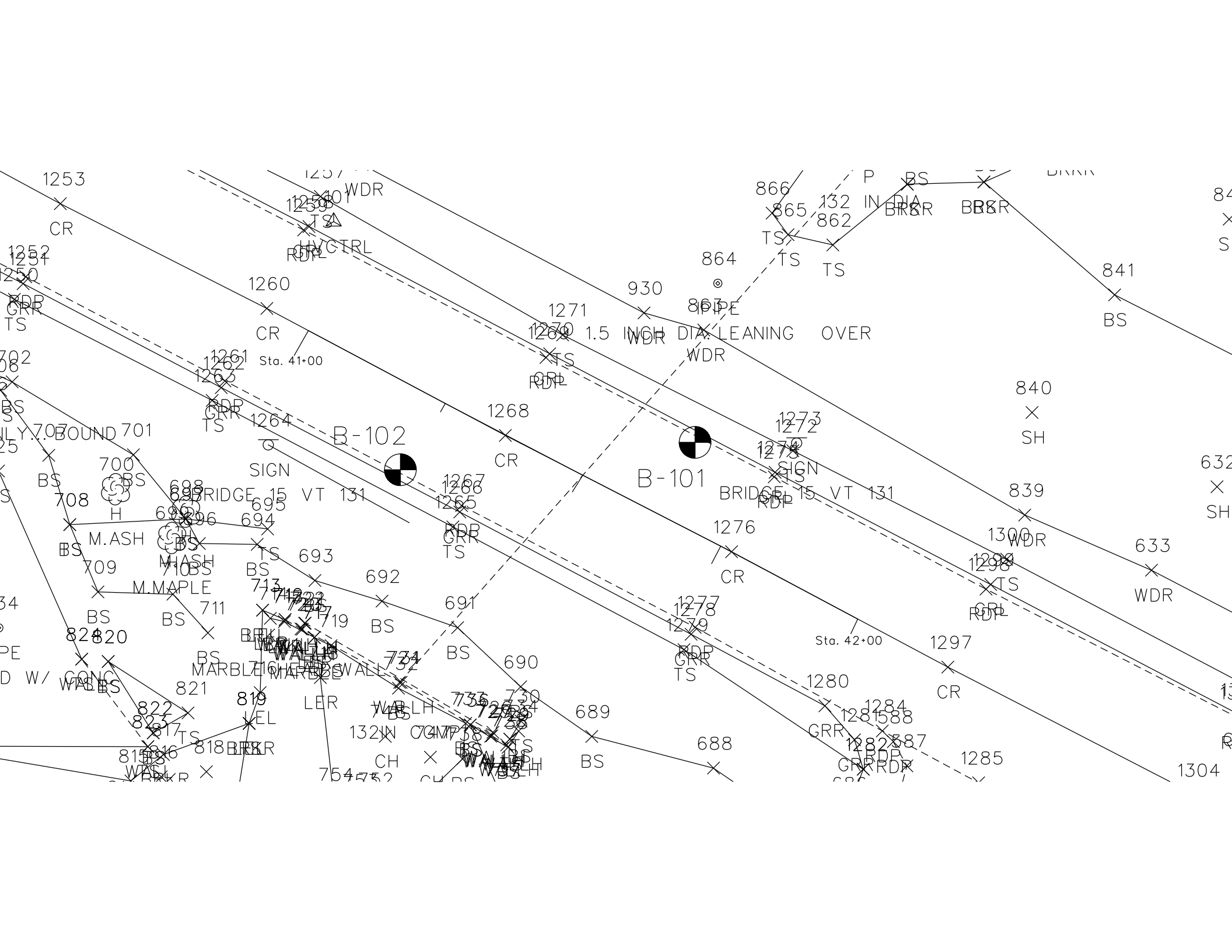
Based on a preliminary look at the subsurface investigation results and the presence of bedrock at depths close to the current bottom of culvert location, a precast arch bridge supported on spread footings or a reinforced concrete box culvert with new headwalls and wingwalls are considered feasible options. The dense granular overburden material as well as the moderately hard and unweathered bedrock appear to be suitable for spread footings on soil or rock.

5.0 CONCLUSION

Once further information becomes available, we would be happy to assist in the analysis and design of components of the substructure. If you have any questions, or you would like to discuss this report, please contact us at (802) 828-2561. The boring logs are attached as available in the M:Projects\00C266\MaterialsResearch folder.

Enclosures: Boring Location Plan – 1 page
Boring Logs – 2 pages

cc: Electronic Read File/WEA
Project File/CEE
MLM



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STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

WEATHERSFIELD
STP 0146(16)
VT-131 BR-15

Boring No.: B-101
Page No.: 1 of 2
Pin No.: 00C266
Checked By: MLM

Boring Crew: DAIGNEAULT, NIETO, HOOK
Date Started: 5/21/14 Date Finished: 5/21/14
VTSPG NAD83: N 332786.72 ft E 1652145.06 ft
Station: 41+64 Offset: -13.00
Ground Elevation: 803.9 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 45C SKID $C_F = 1.33$

Groundwater Observations		
Date	Depth (ft)	Notes
05/21/14	7.1	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 - 1.24		Asphalt Pavement, 0.0 ft - 1.24 ft								
2.5		Field Note:., No Recovery, Roller coned and cleaned out casing.				11-12-9-13 (21)				
5.0		A-2-4, SiSaGr, Lt/brn, Moist, Rec. = 0.6 ft, Roller coned and cleaned out casing.				10-9-33-R@2.5" (42)	11.4	41.5	32.5	26.0
5.0		A-1-b, SiSaGr, Dk/brn, Moist, Rec. = 0.6 ft, Lab Note: Broken Rock was within sample.				22-34-33-R@5.0" (67)	11.9	51.2	27.6	21.2
7.5		Field Note:., Roller coned and cleaned out casing.								
7.5		Field Note:., No Recovery				R@5.0" (R)				
7.5		Field Note:., NXDC								
10.0		A-2-4, GrSiSa, Dk/brn-gry, Moist, Rec. = 1.0 ft, NXDC and cleaned out casing.				14-16-23-31 (39)	12.8	28.3	36.3	35.4
12.5		A-2-4, SiSaGr, gry-Dk/brn, Moist, Rec. = 1.0 ft, NXDC and cleaned out casing. Lab Note: Broken Rock was within sample.				32-28-25-R@1.0" (53)	11.8	38.1	33.5	28.4
15.0		A-2-4, SiSaGr, gry, Moist, Rec. = 1.4 ft, NXDC and cleaned out casing. Lab Note: Broken Rock was within sample.				15-13-19-14 (32)	14.9	37.1	31.8	31.1
15.0		A-4, GrSaSi, gry, Moist, Rec. = 1.2 ft, NXDC and cleaned out casing. Lab Note: Broken Rock was within sample.				13-8-7-6 (15)	14.5	26.6	36.4	37.0
17.5		A-2-4, SiGrSa, gry, Moist, Rec. = 0.8 ft, NXDC and cleaned out casing. Lab Note: Broken Rock was within sample.				3-3-4-10 (7)	14.6	34.6	36.3	29.1
20.0		A-4, GrSiSa, gry-tan, Moist, Rec. = 0.8 ft				8-24-17-8 (41)	16.9	25.0	39.1	35.9
22.5		Field Note:., NXDC								

BORING LOG 2 WEATHERSFIELD STP 0146(16).GPJ VERMONT AOT.GDT 5/29/14

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.



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Pin No.: 00C266
Checked By: MLM

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Date Started: 5/21/14 Date Finished: 5/21/14
VTSPG NAD83: N 332786.72 ft E 1652145.06 ft
Station: 41+64 Offset: -13.00
Ground Elevation: 803.9 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 45C SKID $C_F = 1.33$

Groundwater Observations

Date	Depth (ft)	Notes
05/21/14	7.1	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 %
27.5		A-1-b, GrSa, Lt/brn, Moist, Rec. = 0.7 ft, Lab Note: Broken Rock was within sample. Visual Description: Mostly Broken Rock with silty sand, Dk/gry, Moist, Rec. = 0.2 ft Field Note: NXDC				9-7-41-28 (48)	10.8	36.1	50.9	13.0
30.0		A-1-b, SiGrSa, gry, Moist, Rec. = 0.5 ft, Lab Note: Broken Rock was within sample. Field Note: NXDC				28-R@3.5" (R)	13.9	35.4	42.7	21.9
35.0		A-1-b, SiGrSa, gry, Moist, Rec. = 0.1 ft				R@1.0" (R)	13.1	37.6	40.6	21.8
35.1 - 40.1		35.1 ft - 40.1 ft, Dark-to light-gray, lustrous, carbonaceous chlorite-biotite-muscovite-quartz Phyllite, with thin beds of quartzite. Moderately hard, Unweathered, Fair rock, NXMDC, RMR = 56	1 (40)	94 (66)	5, 8, 8, 7, 6					
40.1 - 45.1		40.1 ft - 45.1 ft, Dark-to light-gray, lustrous, carbonaceous chlorite-biotite-muscovite-quartz Phyllite, with thin beds of quartzite. Moderately hard, Unweathered, Good rock, NXMDC, RMR = 63	2 (40)	94 (90)	5, 7, 7, 9, 7					
45.0		Hole stopped @ 45.1 ft								
47.5		Remarks: Hole collapsed at 16.7 ft.								

BORING LOG 2 WEATHERSFIELD STP 0146(16).GPJ VERMONT AOT.GDT 5/29/14

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BORING LOG

WEATHERSFIELD
STP 0146(16)
VT-131 BR-15

Boring No.: **B-102**
Page No.: **1 of 2**
Pin No.: **00C266**
Checked By: **MLM**

Boring Crew: DAIGNEAULT, JUDKINS
Date Started: 5/22/14 Date Finished: 5/22/14
VTSPG NAD83: N 332782.31 ft E 1652097.56 ft
Station: 41+24 Offset: 12.80
Ground Elevation: 807.3 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 45C SKID $C_F = 1.33$

Groundwater Observations		
Date	Depth (ft)	Notes
		Not recorded.

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 %
		Asphalt Pavement, 0.0 ft - 1.21 ft								
2.5		Visual Description: GrSa with Asphalt Pavement, Dk/brn, Moist, Rec. = 0.9 ft				13-12-12-15 (24)	11.3			
		A-1-b, GrSa, brn, Moist, Rec. = 1.1 ft				7-14-9-6 (23)	11.4	34.5	48.7	16.8
5.0		Visual Description: SaSi with Asphalt Pavement, brn, Moist, Rec. = 0.9 ft				9-8-48-27 (56)	13.8			
7.5		A-4, SaGrSi, brn, Moist, Rec. = 0.4 ft, NXDC. Lab Note: Broken Rock was within sample.				8-4-5-8 (9)	14.0	34.7	27.4	37.9
10.0		A-4, SaSi, Lt/brn, MTW, Rec. = 0.5 ft, NXDC and Cleaned out casing.				6-2-2-2 (4)	18.9	17.3	33.7	49.0
12.5		A-2-4, GrSiSa, Lt/brn, MTW, Rec. = 0.2 ft, NXDC and Cleaned out casing.				4-3-2-4 (5)	17.2	24.2	43.5	32.3
15.0		A-1-b, SaGr, brn, MTW, Rec. = 0.4 ft, NXDC. Lab Note: Broken Rock was within sample.				9-3-3-5 (6)	14.4	54.7	28.0	17.3
17.5		A-2-4, SiSaGr, brn, MTW, Rec. = 0.9 ft, NXDC. Lab Note: Broken Rock was within sample.				6-5-6-6 (11)	16.6	37.3	33.7	29.0
		A-2-4, SiSaGr, brn-gry, MTW, Rec. = 0.6 ft, NXDC. Lab Note: Broken Rock was within sample.				5-11-7-7 (18)	19.7	44.0	30.2	25.8
20.0		Visual Description: SaGr, brn-gry, MTW, Rec. = 0.1 ft, Insufficient sample for testing.				5-3-8-4 (11)	30.5			
22.5		Field Note: NXDC and Cleaned out casing.								

BORING LOG 2 WEATHERSFIELD STP 0146(16).GPJ VERMONT AOT.GDT 5/29/14

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Checked By: MLM

Boring Crew: DAIGNEAULT, JUDKINS
Date Started: 5/22/14 Date Finished: 5/22/14
VTSPG NAD83: N 332782.31 ft E 1652097.56 ft
Station: 41+24 Offset: 12.80
Ground Elevation: 807.3 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 45C SKID C_F = 1.33

Groundwater Observations		
Date	Depth (ft)	Notes
		Not recorded.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	R _{un} (Dip deg.)	C _{ore Rec.} % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
27.5		Field Note:., No Recovery, Appears to be silty sand in water return.				4-1-2-1 (3)				
30.0		Field Note:., NXDC and Cleaned out casing.								
30.0		Lab Note, Sample was mostly fractured rock pieces, Dk/gry, Wet, Rec. = 0.5 ft				35-R@2.5" (R)	46.0	42.7	38.9	18.4
30.7		30.7 ft - 35.7 ft, Dark-to light-gray, lustrous, carbonaceous chlorite-biotite-muscovite-quartz Phyllite, with thin beds of quartzite. Moderately hard, Unweathered, Fair rock, NXMDC, RMR = 51	1 (40)	94 (38)	4	Top of Bedrock @ 30.7 ft				
32.5					5					
35.0					4					
35.0					6					
35.0					12					
37.5		35.7 ft - 40.7 ft, Dark-to light-gray, lustrous, carbonaceous chlorite-biotite-muscovite-quartz Phyllite, with thin beds of quartzite. Moderately hard, Unweathered, Fair rock, NXMDC, RMR = 51	2 (40)	100 (34)	4					
37.5					6					
37.5					5					
37.5					6					
40.0					8					
40.0		Hole stopped @ 40.7 ft								
42.5		Remarks: Hole collapsed at 7.2 ft.								
45.0										
47.5										

BORING LOG 2 WEATHERSFIELD STP 0146(16).GPJ VERMONT AOT.GDT 5/29/14

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