PRELIMINARY GEOTECHNICAL DESIGN REPORT
WESTERN AVENUE OVER MESSALONSKEE STREAM
MAINEDOT WIN 18234.00
WATERVILLE, MAINE

by

Haley & Aldrich, Inc.
Portland, Maine

for

Maine Department of Transportation
Augusta, Maine

File No. 38751-020
30 November 2012

HALEY & ALDRICH

Haley & Aldrich, Inc.
75 Washington Avenue
Suite 203
Portland, ME 04101

Tel: 207.482.4600
Fax: 207.775.7666
HaleyAldrich.com

30 November 2012
File No. 38751-020

Maine Department of Transportation
16 State House Station
Augusta, Maine 04333-0016

Attention: Laura Krusinski, P.E.
Senior Geotechnical Engineer

Subject: Preliminary Geotechnical Design Report
Western Avenue over Messalonskee Stream
MaineDOT WIN 18234.00
Waterville, Maine

Ladies and Gentlemen:

This preliminary geotechnical design report (PGDR) presents the results of subsurface investigations and geotechnical laboratory testing programs, and also provides preliminary geotechnical design recommendations and geotechnical factors that will likely affect the bridge reconstruction/replacement. This PGDR has been prepared in support of Erdman Anthony's (EA) Preliminary Design Report (PDR) submission to the Maine Department of Transportation (MaineDOT).

This work has been completed based on our mutually agreed upon work scope and in accordance with the provisions of our GCA Agreement with MaineDOT, No. CT20110614000000006492, and with our project-specific assignment letter dated 8 June 2012.

ELEVATION DATUM

Elevations referenced herein are in feet and reference the North American Vertical Datum of 1988 (NAVD 88).

PROJECT UNDERSTANDING

The existing bridge carries Western Avenue over Messalonskee Stream (stream) between Cool Street and South Street in Waterville, Maine as shown on Figure 1, Project Locus.

Based on our review of historic bridge plans provided by you, we understand that the existing bridge was originally constructed in 1947 and consists of a 56-ft long, 37-ft wide, single-span bridge supported on two abutments. The cast-in-place concrete (CIP) abutments are supported on either granite blocks bearing directly on bedrock (Abutment No. 1, west of the stream) or directly on bedrock (Abutment No. 1, east of stream). Historic bridge plans are provided for reference in Appendix D.

Based on discussions with you, we understand that EA has been retained by MaineDOT to evaluate bridge rehabilitation and replacement alternatives and submit the results of their study in a PDR. We also understand the alternatives may consist of, but may not be limited to, the following:

- Rehabilitation of the existing superstructure and substructures such that the remaining design life for both components is approximately equal. This is considered a "short-term" fix.
- Replacement of the superstructure and rehabilitation of the existing substructure.
- Replacement of both superstructure and substructure.

We understand that the existing horizontal and vertical alignments will not be altered for any of the alternatives summarized above. Depending on the preferred alternative, we understand that detouring traffic around the site may be allowed during construction.

SUBSURFACE EXPLORATION PROGRAM

Haley & Aldrich conducted a subsurface investigation at the site to provide general subsurface information along the existing bridge alignment. Two test borings, designated BB-WMS-101 and BB-WMS-102, were drilled behind each of the existing bridge abutments. The location of each test boring was determined in the field by taping/pacing distances from existing site features as shown on the attached Figure 2, Boring Location Plan.

Test borings were drilled by MaineDOT on 18 July 2012 using a truck-mounted CME 45 drill rig. Test borings were drilled using "cased-wash" methods to depths ranging from approximately 17 to 23 ft below ground surface (BGS) using 3.0-in. (NW-size) inside diameter (ID) steel casing. Soil samples were collected continuously by driving a 1-3/8-in. ID split-spoon sampler with a 140-lb hammer dropped from a height of 30 in., using a calibrated automatic hammer.

The number of hammer blows required to advance the sampler through each 6-in. interval was recorded and is provided on the test boring logs. The uncorrected SPT N-value is defined as the total number of blows required to advance the sampler through the middle 12 in. of the 24-in. sampling interval (blows per foot, bpf). The energy-corrected SPT N-value (N_{60}) is equal to the uncorrected N-value multiplied by the hammer efficiency factor divided by 0.84 (i.e., 84 percent theoretical hammer efficiency).

Both test borings were advanced approximately 10 ft into bedrock using a 2.0-in. (NQ-size) ID diamond-tipped core barrel.

Test borings were backfilled with soil cuttings and filter sand upon the completion of drilling and were sealed at the roadway surface with cold patch.

All soil and bedrock samples were preserved in glass jars and wooden boxes. The samples that were not submitted for laboratory testing are available for review upon request. The soil and bedrock samples are being stored at the Haley & Aldrich laboratory facility in Portland, Maine. Logs of each test boring are provided in Appendix A.

BEDROCK MAPPING

Haley & Aldrich collected rock mass data and photographed the exposed bedrock faces beneath the existing bridge abutments and within the limits of the stream on 5 October 2012. While onsite, data on structural geologic properties (e.g., discontinuity dip and dip direction, infilling, visible seepage, persistence, aperture) and general rock mass properties (e.g. weathering/alteration, intact rock compressive strength) were collected. As an integral part of our field evaluations, Haley & Aldrich utilized industry-accepted technical guidance criteria produced by the International Society for Rock Mechanics (ISRM). The rock mass data that was collected was used to support our preliminary technical evaluations and develop the subsequent conclusions and preliminary design recommendations included herein. The rock mass data that was collected is summarized in subsequent sections of this report and is also provided for reference in Appendix C.

GENERALIZED SUBSURFACE CONDITIONS

Soil and Bedrock Conditions

A. Bituminous Concrete/Man-Placed Fill

An approximate 5-in. thick layer of bituminous concrete was encountered at each test boring location at the ground surface. The bituminous concrete was overlying an approximate 5 to 11-ft thick layer of man-placed fill (fill). A greater thickness of fill was encountered on the west side of Messalonskee Stream behind Abutment No. 1.

In general, the material consisted of fine to coarse SAND with varying percentages of silt and gravel. The fill was very loose to dense with SPT N_{60} values ranging from 3 to 34 bpf (average of 17 bpf). In addition, SPT N_{60} values generally decreased with increasing depth BGS.

B. Alluvial Deposit

A thin layer of alluvial soil was encountered directly beneath the fill in both test borings. The layer ranged in thickness from 0.8 ft at the west abutment (BB-WMS-101) to 1.5 ft at the east abutment (BB-WMS-102). In general, the deposit consisted of silty fine to coarse SAND and/or sandy SILT with varying percentages of gravel, black organic-like soil and wood fragments.

The alluvial soil was typically very loose to loose with SPT N_{60} values ranging from 4 to 6 bpf.

C. Bedrock

Bedrock was encountered directly below the alluvial deposit at both boring locations. As described above, bedrock was encountered and sampled in each test boring. The depth to the top of the bedrock surface varied from approximately 7 ft BGS at the east abutment (BB-WMS-102) to 13 ft BGS at the west abutment (BB-WMS-101). The top of rock was fairly flat across the site and varied from approximately El. 96.5 at the west abutment to El. 99 at the east abutment. Bedrock encountered at the site consists of moderately hard to hard, slightly weathered SCHIST. Primary joints were oriented at

steep to vertical angles, parallel to the foliation, and joint surfaces were slightly discolored. A thin layer (< 1 ft) of weathered bedrock was encountered at the bedrock surface in test boring BB-WMS-101. Photographs of the bedrock core are provided for reference in Appendix C.

Rock quality designation (RQD) is a common parameter that is used to help assess the competency of sampled bedrock. RQD is defined as the sum of pieces of recovered bedrock greater than 4 in. in length divided by the total length of the core run. RQD values for bedrock encountered at the site ranged from 0 to 80 percent. Please note that the RQD values estimated from recovered bedrock core were highly influenced by joint orientation (near vertical).

Disclosed joint sets observed at the site generally trended in a northeast orientation with the strike varying from approximately N54°E to N83°E. Beneath existing Abutment No. 1 on the west bank of the stream the dip of the rock mass varied between 80° and 90° to the northwest (dip direction varied between 324 ° and 353 °). The dip of the exposed rock mass between approximately 50 ft and 150 ft upstream on the west and east sides of the stream varied between 80° and 90° to the southeast (dip direction varied between 155 ° and 166 °). In general, the mapping indicates that most joints dip marginally away from or into the exposed face. We do not anticipate that large blocks would tend to slide out of the slope. However, several large "sheets" of rock were observed beneath both bridge abutments, which had become unstable and dislodged from the rock face. It is likely that this phenomenon is a result of the dip angle, the thinly bedded nature of the rock mass and seasonal impacts (i.e., freezing of water in the bedding planes).

Groundwater Conditions

Water levels were measured in test boring BB-WMS-101 upon the completion of drilling as noted on the test boring log. The measured water level was 9.6 ft BGS. The water depth measured in test boring BB-WMS-101 may not be representative of groundwater and could have been influenced by drilling means/methods. In general, groundwater levels can be expected to fluctuate, subject to seasonal variation, water level in Messalonskee Stream, local soil conditions, topography and precipitation. Water levels encountered during construction may differ from those summarized above.

LABORATORY TESTING PROGRAM

A geotechnical laboratory testing program was undertaken on representative soil and bedrock samples collected during the field investigations to assist in soil classification and determine engineering soil/bedrock properties needed for final design. In general, laboratory testing was performed on disturbed soil samples collected during SPT sampling and bedrock coring. Laboratory testing was performed in accordance with applicable American Society for Testing Materials (ASTM) testing procedures. All geotechnical laboratory testing was performed by GeoTesting Express of Acton, Massachusetts (bedrock) and the MaineDOT Materials Testing and Exploration Central Laboratory in Bangor, Maine (soil).

The soil testing program included ten grain size analyses, ten natural water content tests and two Atterberg Limits tests. A summary of laboratory test results on these samples is provided below.

- Natural Water Content:
  - Man-Placed Fill: 3.8% to 21.7%
  - Alluvial Deposit: 16.2% to 47.4%
- Atterberg Limits: samples tested determined to be non-plastic (NP)
- Soil Classification:
  - Man-Placed Fill: SC-SM
  - Alluvial Deposit: ML, SC-SM

The laboratory testing program also included two unconfined compressive strength tests on samples of bedrock core. The results of these laboratory tests are summarized below.

Test Boring No.	Sample No.	Top Depth (ft, BGS)	Bottom Depth (ft, BGS)	Peak Compressive Stress (psi)	Bulk Density (pcf)
BB-WMS-101	R2	19.1	19.5	5,120	174
		21.2	21.5	8,977	173

Results of individual laboratory tests on soil and rock are provided for reference in Appendix B.

PRELIMINARY GEOTECHNICAL EVALUATIONS

Preliminary geotechnical design recommendations for the subject project, as discussed and provided herein, were developed in accordance with the following documents:

- AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, Sixth Edition, 2012 with Errata dated June 2012.
- MaineDOT Bridge Design Guide (BDG), August 2003 with Interim Revisions through August 2008.

Furthermore, the preliminary design recommendations are based, in part, on the subsurface conditions encountered in the recently completed test borings. It should be noted that only one test boring was drilled at each bridge abutment location. Variations in subsurface conditions, particularly the thickness of man-placed fill and depth to top of bedrock BGS are likely to exist across the width of each abutment. Our evaluations are based on the assumption that subsurface conditions are somewhat uniform in these areas and similar to those encountered in the test borings.

Frost Penetration

Three basic requirements must be met simultaneously in order for frost-induced movements (heave) to occur: 1) the soil must meet certain grain size requirements in order to be frost susceptible, 2) freezing temperatures must penetrate into the ground and 3) a source of water must be present (e.g., groundwater, surface water infiltration, capillary rise). A summary of the subsurface conditions at the site as they relate to these requirements is provided below.

- **Soil Type** – Laboratory grain size analyses were conducted on soil samples recovered during the subsurface exploration programs in part to assess the frost susceptibility of the soil. Based

on the laboratory test results, a frost susceptibility classification was assigned to each of the soil types anticipated to be present at the design subgrade level. Frost susceptibility classifications were determined based on MaineDOT frost susceptibility criteria that were developed, in part, based on the Corps of Engineers method. Frost ratings range from 0 (non-frost susceptible) to IV (highly frost susceptible). Frost susceptibility classifications for each soil sample tested ranged from III to IV indicating that the soil types present at the site are moderately to highly frost susceptible.

- **Temperature** – Based on weather data obtained from the computer program ModBerg v. 99.2, the design freezing index for the Waterville, Maine area is approximately 1,400 freezing degree days (°F-days). Freezing temperatures must penetrate the pavement section and subgrade soil down to the capillary zone (zone where water is present) because the phase change from water to ice is largely responsible for drawing additional water from the surrounding soil toward the growing ice mass.

- **Water** – An uninterrupted source of water must be available to the zone of freezing. Typically, the source will be the underlying groundwater table, a perched water source, infiltration through overlying layers and/or by capillary rise. The static water level was measured in test boring BB-WMS-101 at a depth of 9.6 ft BGS. In addition, natural water content laboratory tests indicate that there is between approximately 4 and 47 percent (by weight) water present in the soil, which generally increases with depth BGS.

Based on the information summarized above, we evaluated the maximum depth of seasonal frost penetration into the ground. Our evaluations were conducted using the computer program ModBerg v. 99.2. The program calculates the maximum depth of frost penetration for a given geographic location using input from its built-in, long-term weather database and pavement/soil layer information provided by the user. ModBerg's primary algorithm is based on the Modified Berggren Equation. Multiple iterations were completed modeling the subsurface conditions encountered in each test boring. The results of the evaluations are summarized below.

Test Boring No.	Maximum Depth of Frost Penetration (in.)
BB-WMS-101	55.7
BB-WMS-102	57.9
Average	56.8

Based on the results summarized above, we recommend that a maximum depth of frost penetration equal to approximately 5 ft be considered for pavement design. Since the proposed bridge abutments will likely bear on bedrock, there is no minimum embedment required for frost protection.

Seismic Design Considerations

The existing, rehabilitated or proposed abutments will be supported on continuous spread footings bearing on bedrock. As a result, the Site Class was determined using Method A as described in

AASHTO LRFD Table C3.10.3.1-1. Based on our review of "typical" values of shear wave velocity for SCHIST bedrock encountered at the site, it is our opinion that the shear wave velocity for this material likely exceeds 5,000 ft/sec. Therefore, in accordance with AASHTO LRFD Table 3.10.3.1-1 we recommend the site be considered "Site Class A".

Based on the geographic site location and the assignment of seismic "Site Class A", the United States Geological Survey (USGS) software application Seismic Design Parameters v. 2.0 provided the recommended AASHTO response spectra for a 7 percent probability of exceedance in 75 years. The values are summarized below.

Design Parameter	Design Value
Site factor for short-period range of acceleration response spectrum, F_a =	0.80
Site factor for long-period range of acceleration response spectrum, F_v =	0.80
Horizontal response spectral acceleration coeff. at 0.2-s period on rock, S_S =	0.159
Horizontal response spectral acceleration coeff. at 1.0-s period on rock, S_1 =	0.046
Peak seismic ground acceleration coeff. on rock, PGA =	0.076
Site factor at zero-period on acceleration response spectrum, F_{pga} =	0.80
Horizontal response spectral acceleration coeff. at 0.2-s period modified by F_a, S_{DS} =	0.128
Horizontal response spectral acceleration coeff. at 1.0-s period modified by F_v, SD_1 =	0.037

In accordance with AASHTO LRFD Table 3.10.6-1, the bridge should be designed in accordance with the requirements of Seismic Zone 1 based on the calculated value of SD_1 (i.e., $0.037 < 0.150$).

Bearing Resistance

As discussed previously, the existing, rehabilitated or proposed abutments will be supported on continuous spread footings bearing on bedrock. We recommend that the footings designed to bear on intact bedrock be designed for a nominal bearing resistance equal to 40 kips per square foot (ksf). In addition, the footings should be designed at the strength limit state based on a factored bearing resistance equal to 18 ksf ($\phi=0.45$). Please note that resistance factors for service and extreme event limit state bearing resistance are equal to 1.0. Therefore, the factored bearing resistance at these limits states is equal to the recommended nominal bearing resistance (40 ksf).

Please note that the methodology outlined in AASHTO LRFD for determining bearing resistance of footings on bedrock is partially dependent on grading assigned to the recovered bedrock core in accordance with the Rock Mass Rating (RMR) System. The collected rock mass data was used to adjust the RMR to account for strike and dip orientations relative to the existing foundations.

External Stability

We recommend that the existing, rehabilitated or proposed abutments be evaluated for sliding and eccentricity during final design in accordance with AASHTO LRFD Sections 10.6.3.4 and 11.6.3.3, respectively. In addition, we recommend that the load and resistance factors provided in AASHTO LRFD Tables 3.4.1-1, 3.4.1-2, and 10.5.5.2.2-1 be used when evaluating external stability.

GEOTECHNICAL FACTORS EFFECTING BRIDGE CONSTRUCTION

A subsurface investigation and laboratory testing program was conducted in July and August 2012, as discussed herein, in order to identify general subsurface conditions along the bridge alignment. Based on the subsurface conditions encountered in the subsurface explorations and our understanding of the proposed bridge rehabilitation/reconstruction, we offer the following general geotechnical "observations" regarding planned bridge rehabilitation/reconstruction:

- Two test borings were drilled at discrete locations; at the south end of existing Abutment Nos. 1 and 2. Variations in the bedrock surface within the limits of each substructure and the need for bedrock removal are unknown at this time.

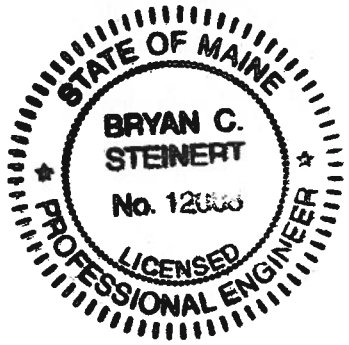
- Based on the depth of the bedrock surface encountered in each test boring it is likely that temporary earth support will be required if detouring traffic around the site is not feasible. If detouring traffic around the site is feasible, the majority of excavation could be open-cut.

- If the existing bridge abutments are demolished and new abutments constructed, consideration should be given to the impact that jack-hammering or hoe-ramming may have on the stability of the near vertical rock face in front of the abutments.

- Based on our evaluation of the rock mass condition in front of the existing bridge abutments, it is our opinion that there is future potential for relatively thin sheets of rock to become unstable in a similar fashion to those shown in the photographs included in Appendix C. Although not an immediate concern, we recommend that this potential be further evaluated during final design to determine whether remedial measures are necessary to stabilize the rock face. In addition, we recommend that MaineDOT maintenance crews periodically inspect the rock to see if the vertical face is encroaching on the existing bridge abutments.

We appreciate the opportunity to provide geotechnical engineering services on this project. Please do not hesitate to call if you have any questions or comments.

Sincerely yours,
HALEY & ALDRICH, INC.



Bryan C. Steinert, P.E.
Senior Geotechnical Engineer

Wayne A. Chadbourne, P.E.
Lead Geotechnical Engineer/Vice President

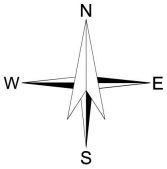
Enclosures:

Figure 1 -	Project Locus
Figure 2 -	Boring Location Plan
Appendix A -	Test Boring Logs
Appendix B -	Laboratory Test Results
Appendix C -	Rock Mass Data and Rock Core Photographs
Appendix D -	Historic Bridge Plans

G:\PROJECTS\38751 - MaineDOT Multi-PIN Support\020 - Western Ave over Messalonskee Stream\Preliminary Design Report\2012_1130_HAI_18234 Prelim GT Report_f1.docx

Printed on 30% post-consumer recycled paper

SITE COORDINATES:44°32'54"N 69°38'33"W



U.S.G.S. QUADRANGLE: WATERVILLE, ME

HALEY & ALDRICH

WESTERN AVENUE OVER MESSALONSKEE STREAM
MAINEDOT WIN 18234.00
WATERVILLE, MAINE

PROJECT LOCUS

SCALE: 1:24,000
OCTOBER 2012

FIGURE 1

38751-020 1.PDF

PROJ. MANAGER		BY	DATE
DESIGN-DETAILED			
CHECKED-REVIEWED			
DESIGN2-DETAILED2	L.KRUSINSKI	T.WHITE	AUG 2012
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

P.E. NUMBER

DATE

WESTERN AVENUE BRIDGE
MESSALONSKEE STREAM
WATERVILLE KENNEBEC COUNTY

BORING LOCATION PLAN & INTERPRETIVE SUBSURFACE PROFILE

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BH-1823(400)X

BRIDGE NO. 3836 WIN 18234.00 BRIDGE PLANS

SHEET NUMBER 2 OF 3

APPENDIX A

Test Boring Logs

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Western Avenue over Messalonskee Stream
Location: Waterville, Maine

Boring No.: BB-WMS-101
PIN: 18234.00

Driller:	MaineDOT	**Elevation (ft.)**	109.5 (Approx.)	**Auger ID/OD:**	--
Operator:	E. Giguere	**Datum:**	NAVD 88	**Sampler:**	Split spoon - 1.375 in. ID
Logged By:	B. Babcock	**Rig Type:**	CME 45 Skid on Truck	**Hammer Wt./Fall:**	NW-S 140#/30 in.
Date Start/Finish:	07-18-2012/07-18-2012	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ - 2.0 in. ID
Boring Location:	See Plan	**Casing ID/OD:**	NW - 3.0 in. ID	**Water Level*:**	9.6
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							HSA	109.1	-BITUMINOUS CONCRETE- 0.4	
	1D	24/18	1.0 - 3.0	11/9/7/6	16	22			Brown, dry, medium dense, silty fine to medium SAND, trace coarse sand, trace fine to coarse gravel, trace asphalt -FILL-(SC-SM)	G#244214 A-4, SC-SM WC=3.9%
	2D	24/14	3.0 - 5.0	4/4/5/5	9	13			Brown, dry, loose, silty fine to medium SAND, little fine to coarse gravel, trace coarse sand -FILL-(SC-SM)	G#244215 A-4, SC-SM WC=3.8%
5	3D	24/12	5.0 - 7.0	4/4/4/4	8	11	5		Brown, dry, loose, fine to medium SAND, some silt, trace fine to coarse gravel -FILL-(SC-SM)	G#244216 A-2-4, SC-SM WC=5.0%
							16			
	4D	24/5	7.0 - 9.0	8/4/1/1	5	7	13		Brown, wet, loose, fine to coarse SAND, some silt, some fine gravel, trace cinders -FILL-(SC-SM)	G#244217 A-2-4, SC-SM WC=14.6%
							6			
	5D	24/6	9.0 - 11.0	2/1/1/1	2	3	5	100.5	9.0 Brown, wet, very loose, silty fine to coarse SAND, little fine to coarse gravel, trace wood and plant fibers -FILL-(SC-SM)	G#244218 A-4, SC-SM WC=21.7 PI=NP
10							4			
	6D	10/5	11.0 - 11.8	4/100(3.0")			4	98.5	11.0 Light brown, saturated, very loose, fine to medium SAND, some silt, trace fine to coarse gravel, trace wood -ALLUVIAL DEPOSIT-(SC-SM)	G#244219 A-2-4, SC-SM WC=16.2%
	R1	60/60	12.9 - 17.9	RQD = 0%			6	97.7		
							16	96.6	11.8 -PROBABLE WEATHERED BEDROCK- 12.9	
15									Top of Bedrock at El.-12.9 ft Gray, aphanitic to fine grained SCHIST. Hard, very slightly weathered. Primary joints dipping at steep to vertical angles, close, smooth, planar to stepped, discolored, open. Rock Mass Quality=Very Poor -WATERVILLE FORMATION- R1 Core Times (min:sec): 12.9-13.9' (2:10); 13.9-14.9' (2:08); 14.9-15.9' (1:55); 15.9-16.9' (2:22); 16.9-17.9' (3:28)	
	R2	60/60	17.9 - 22.9	RQD = 80%					Gray, aphanitic to fine grained SCHIST. Hard, very slightly weathered. Primary joints dipping at steep to vertical angles, moderately close, smooth, planar, discolored, open. Rock Mass Quality=Good -WATERVILLE FORMATION- R2 Core Times (min:sec): 17.9-18.9' (1:22); 18.9-19.9' (2:01); 19.9-20.9' (2:08); 20.9-21.9' (2:43); 21.9-22.9' (2:18)	GTX#12141 qp=5,120 psi
20										GTX#12141 qp=8,977 psi
								86.6	22.9 **Bottom of Exploration at 22.9 feet below ground surface.**	
25										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Boring No.: BB-WMS-101

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Western Avenue over Messalonskee Stream
Location: Waterville, Maine

Boring No.: BB-WMS-102
PIN: 18234.00

Driller:	MaineDOT	**Elevation (ft.)**	106.0 (Approx.)	**Auger ID/OD:**	--
Operator:	E. Giguere	**Datum:**	NAVD 88	**Sampler:**	Split spoon - 1.375 in. ID
Logged By:	B. Babcock	**Rig Type:**	CME 45 Skid on Truck	**Hammer Wt./Fall:**	NW-S 140#/30 in.
Date Start/Finish:	07-18-2012/07-18-2012	**Drilling Method:**	Cased Wash BoringW	**Core Barrel:**	NQ - 2.0 in. ID
Boring Location:	See Plan	**Casing ID/OD:**	NW - 3.0 in. ID	**Water Level*:**	Not Measured
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							HSA	105.6	-BITUMINOUS CONCRETE- 0.4	
	1D	24/16	1.0 - 3.0	6/10/12/11	22	31			Brown, dry, medium dense, fine to coarse SAND, some fine gravel, some silt, trace brick -FILL-(SC-SM)	G#244220 A-2-4, SC-SM WC=7.1%
	2D	24/6	3.0 - 5.0	9/11/13/14	24	34			Brown, dry, medium dense, fine to coarse SAND, some fine gravel, some silt -FILL-(SC-SM)	G#244221 A-2-4, SC-SM WC=5.1%
5	3D	18/18	5.0 - 6.5	3/3/45/100(0.0")	48	67	7	101.0	5.0 Gray-brown, moist, dense, sandy SILT, trace fine gravel, frequent thin pockets of brown and black organic soil, stratified -ALLUVIAL DEPOSIT-(ML)	G#244222 A-4, ML WC=17.7% PI=NP
							24	100.0 99.5	6.0 Gray-brown, moist, dense, SILT, little fine sand, trace medium and coarse sand, trace fine gravel, interbedded with brown and black organic-like soil, stratified, weathered bedrock in tip of spoon -ALLUVIAL DEPOSIT-(ML)	G#244223 A-4, ML WC=47.4%
	R1	60/57	7.0 - 12.0	RQD = 0%					6.5 Top of Bedrock at El.-6.5 ft. Gray, aphanitic to fine grained SCHIST. Hard to moderately hard, slightly weathered. Primary joints dipping at steep to vertical angles, very close to close, smooth, undulating to planar, discolored, open. Rock Mass Quality=Very Poor -WATERVILLE FORMATION- R1 Core Times (min:sec): 7.0-8.0' (2:08); 8.0-9.0' (1:42); 9.0-10.0' (1:35); 10.0-11.0' (1:44); 11.0-12.0' (1:55)	
10										
	R2	60/60	12.0 - 17.0	RQD = 0%					Gray, aphanitic to fine grained SCHIST. Hard to moderately hard, slightly weathered. Primary joints dipping at steep to vertical angles, very close, smooth, undulating to planar, discolored, open. Rock Mass Quality=Very Poor -WATERVILLE FORMATION- R2 Core Times (min:sec): 12.0-13.0' (2:15); 13.0-14.0' (2:29); 14.0-15.0' (2:13); 15.0-16.0' (1:50); 16.0-17.0' (1:56)	
15										
								89.0	17.0 **Bottom of Exploration at 17.0 feet below ground surface.**	
20										
25										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

APPENDIX B

Laboratory Test Results

State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Town(s): Waterville Work Number: 18234.00

Boring & Sample Identification Number	Station (Feet)	Offset (Feet)	Depth (Feet)	Reference Number	G.S.D.C. Sheet	W.C. %	L.L.	P.I.	Classification		
									Unified	AASHTO	Frost
BB-WMS-101, 1D			1.0-3.0	244214	1	3.9			SC-SM	A-4	III
BB-WMS-101, 2D			3.0-5.0	244215	1	3.8			SC-SM	A-4	III
BB-WMS-101, 3D			5.0-7.0	244216	1	5.0			SC-SM	A-2-4	III
BB-WMS-101, 4D			7.0-9.0	244217	1	14.6			SC-SM	A-2-4	III
BB-WMS-101, 5D			9.0-11.0	244218	1	21.7	-N	P-	SC-SM	A-4	III
BB-WMS-101, 6D			11.0-11.8	244219	1	16.2			SC-SM	A-2-4	III
BB-WMS-102, 1D			1.0-3.0	244220	2	7.1			SC-SM	A-2-4	III
BB-WMS-102, 2D			3.0-5.0	244221	2	5.1			SC-SM	A-2-4	III
BB-WMS-102, 3D			5.0-6.0	244222	2	17.7	-N	P-	ML	A-4	IV
BB-WMS-102, 3D/A			6.0-6.5	244223	2	47.4			ML	A-4	IV

Classification of these soil samples is in accordance with AASHTO Classification System M-145-40. This classification is followed by the "Frost Susceptibility Rating" from zero (non-frost susceptible) to Class IV (highly frost susceptible). The "Frost Susceptibility Rating" is based upon the MaineDOT and Corps of Engineers Classification Systems.

GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

WC = water content as determined by AASHTO T 265-93 and/or ASTM D 2216-98

LL = Liquid limit as determined by AASHTO T 89-96 and/or ASTM D 4318-98 NP = Non Plastic

PI = Plasticity Index as determined by AASHTO 90-96 and/or ASTM D4318-98

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
244214	**BB-WMS-101/1D**	**GEOTECHNICAL (DISTURBED)**	**7/18/2012**	**8/20/2012**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: Offset, ft: Dbfg, ft: **1.0-3.0**

WIN/Town **018234.00 - WATERVILLE** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	**100.0**
¾ in. [19.0 mm]	**94.9**
½ in. [12.5 mm]	**92.9**
⅜ in. [9.5 mm]	**91.1**
¼ in. [6.3 mm]	**90.0**
No. 4 [4.75 mm]	**86.5**
No. 10 [2.00 mm]	**85.4**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**65.8**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**49.7**
[0.0309 mm]	**43.6**
[0.0200 mm]	**39.3**
[0.0120 mm]	**32.7**
[0.0086 mm]	**28.4**
[0.0063 mm]	**24.0**
[0.0032 mm]	**17.4**
[0.0013 mm]	**13.1**

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

Plastic Limit (T 90), %

Plasticity Index (T 90), %

Specific Gravity, Corrected to 20°C (T 100): **2.65**

Loss on Ignition (T 267)

Loss, %	H2O, %

Water Content (T 265), %: **3.9**

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft²	Remold tons/ft²	U. Shear tons/ft²	Remold tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **8/28/2012**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
244215	**BB-WMS-101/2D**	**GEOTECHNICAL (DISTURBED)**	**7/18/2012**	**8/20/2012**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: Offset, ft: Dbfg, ft: **3.0-5.0**

WIN/Town **018234.00 - WATERVILLE** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	**100.0**
1 in. [25.0 mm]	**94.4**
¾ in. [19.0 mm]	**91.1**
½ in. [12.5 mm]	**88.3**
⅜ in. [9.5 mm]	**86.6**
¼ in. [6.3 mm]	**82.9**
No. 4 [4.75 mm]	**79.0**
No. 10 [2.00 mm]	**74.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**56.3**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**43.5**
[0.0284 mm]	**38.5**
[0.0185 mm]	**35.5**
[0.0113 mm]	**29.6**
[0.0083 mm]	**23.7**
[0.0061 mm]	**20.7**
[0.0030 mm]	**17.8**
[0.0013 mm]	**11.8**

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

Plastic Limit (T 90), %

Plasticity Index (T 90), %

Specific Gravity, Corrected to 20°C (T 100): **2.65**

Loss on Ignition (T 267)

Loss, %	H2O, %

Water Content (T 265), %: **3.8**

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft²	Remold tons/ft²	U. Shear tons/ft²	Remold tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **8/28/2012**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
244216	**BB-WMS-101/3D**	**GEOTECHNICAL (DISTURBED)**	**7/18/2012**	**8/20/2012**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: Offset, ft: Dbfg, ft: **5.0-7.0**

WIN/Town **018234.00 - WATERVILLE** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	**100.0**
1 in. [25.0 mm]	**89.2**
¾ in. [19.0 mm]	**89.2**
½ in. [12.5 mm]	**89.2**
⅜ in. [9.5 mm]	**86.5**
¼ in. [6.3 mm]	**82.8**
No. 4 [4.75 mm]	**79.8**
No. 10 [2.00 mm]	**71.3**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**44.4**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**26.0**
[0.0325 mm]	**25.5**
[0.0208 mm]	**23.5**
[0.0125 mm]	**15.7**
[0.0089 mm]	**13.7**
[0.0064 mm]	**11.8**
[0.0032 mm]	**7.8**
[0.0013 mm]	**5.8**

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

Plastic Limit (T 90), %

Plasticity Index (T 90), %

Specific Gravity, Corrected to 20°C (T 100): **2.73**

Loss on Ignition (T 267)

Loss, %	H2O, %

Water Content (T 265), %: **5.0**

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft²	Remold tons/ft²	U. Shear tons/ft²	Remold tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **8/28/2012**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
244217	**BB-WMS-101/4D**	**GEOTECHNICAL (DISTURBED)**	**7/18/2012**	**8/20/2012**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: Offset, ft: Dbfg, ft: **7.0-9.0**

WIN/Town **018234.00 - WATERVILLE** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	**100.0**
½ in. [12.5 mm]	**93.3**
⅜ in. [9.5 mm]	**85.8**
¼ in. [6.3 mm]	**81.2**
No. 4 [4.75 mm]	**77.3**
No. 10 [2.00 mm]	**65.5**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**47.8**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**32.9**
[0.0309 mm]	**28.8**
[0.0200 mm]	**25.9**
[0.0118 mm]	**23.1**
[0.0086 mm]	**18.7**
[0.0062 mm]	**17.3**
[0.0031 mm]	**14.4**
[0.0013 mm]	**8.6**

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

Plastic Limit (T 90), %

Plasticity Index (T 90), %

Specific Gravity, Corrected to 20°C (T 100): **2.66**

Loss on Ignition (T 267)

Loss, %	H2O, %

Water Content (T 265), %: **14.6**

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft²	Remold tons/ft²	U. Shear tons/ft²	Remold tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **8/28/2012**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
244218	**BB-WMS-101/5D**	**GEOTECHNICAL (DISTURBED)**	**7/18/2012**	**8/20/2012**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: Offset, ft: Dbfg, ft: **9.0-11.0**

WIN/Town **018234.00 - WATERVILLE** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	**100.0**
¾ in. [19.0 mm]	**88.2**
½ in. [12.5 mm]	**82.6**
⅜ in. [9.5 mm]	**78.1**
¼ in. [6.3 mm]	**72.8**
No. 4 [4.75 mm]	**71.0**
No. 10 [2.00 mm]	**64.2**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**47.7**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**38.4**
[0.0317 mm]	**37.6**
[0.0208 mm]	**31.6**
[0.0123 mm]	**27.7**
[0.0088 mm]	**25.7**
[0.0063 mm]	**23.7**
[0.0031 mm]	**17.8**
[0.0014 mm]	**11.9**

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

Plastic Limit (T 90), %

Plasticity Index (T 90), %

NP

Specific Gravity, Corrected to 20°C (T 100)

2.56

Loss on Ignition (T 267)

Loss, %	H2O, %

Water Content (T 265), %

21.7

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft²	Remold tons/ft²	U. Shear tons/ft²	Remold tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **8/28/2012**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
244219	**BB-WMS-101/6D**	**GEOTECHNICAL (DISTURBED)**	**7/17/2012**	**8/20/2012**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: Offset, ft: Dbfg, ft: **11.0-11.8**

WIN/Town **018234.00 - WATERVILLE** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	**100.0**
¼ in. [6.3 mm]	**91.8**
No. 4 [4.75 mm]	**89.4**
No. 10 [2.00 mm]	**83.4**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**53.7**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**31.7**
[0.0355 mm]	**26.5**
[0.0229 mm]	**21.7**
[0.0134 mm]	**19.3**
[0.0096 mm]	**14.4**
[0.0068 mm]	**12.1**
[0.0034 mm]	**9.7**
[0.0014 mm]	**4.8**

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

Plastic Limit (T 90), %

Plasticity Index (T 90), %

Specific Gravity, Corrected to 20°C (T 100): **2.69**

Loss on Ignition (T 267)

Loss, %	H2O, %

Water Content (T 265), %: **16.2**

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft²	Remold tons/ft²	U. Shear tons/ft²	Remold tons/ft²		

Comments:

Insufficient material to run Atterberg Limits.

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **8/28/2012**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
244220	**BB-WMS-102/1D**	**GEOTECHNICAL (DISTURBED)**	**7/18/2012**	**8/20/2012**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: Offset, ft: Dbfg, ft: **1.0-3.0**

WIN/Town **018234.00 - WATERVILLE** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	**100.0**
½ in. [12.5 mm]	**96.1**
⅜ in. [9.5 mm]	**92.3**
¼ in. [6.3 mm]	**81.8**
No. 4 [4.75 mm]	**77.2**
No. 10 [2.00 mm]	**64.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**42.9**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**26.2**
[0.0316 mm]	**23.4**
[0.0210 mm]	**18.2**
[0.0124 mm]	**15.6**
[0.0089 mm]	**13.0**
[0.0064 mm]	**10.4**
[0.0032 mm]	**7.8**
[0.0014 mm]	**5.2**

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

Plastic Limit (T 90), %

Plasticity Index (T 90), %

Specific Gravity, Corrected to 20°C (T 100): **2.67**

Loss on Ignition (T 267)

Loss, %	H2O, %

Water Content (T 265), %: **7.1**

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft²	Remold tons/ft²	U. Shear tons/ft²	Remold tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **8/28/2012**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
244221	**BB-WMS-102/2D**	**GEOTECHNICAL (DISTURBED)**	**7/18/2012**	**8/20/2012**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: Offset, ft: Dbfg, ft: **3.0-5.0**

WIN/Town **018234.00 - WATERVILLE** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	**100.0**
½ in. [12.5 mm]	**86.9**
⅜ in. [9.5 mm]	**81.6**
¼ in. [6.3 mm]	**77.2**
No. 4 [4.75 mm]	**73.5**
No. 10 [2.00 mm]	**63.8**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**44.8**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**31.3**
[0.0335 mm]	**30.5**
[0.0219 mm]	**24.8**
[0.0131 mm]	**19.0**
[0.0094 mm]	**15.2**
[0.0068 mm]	**11.4**
[0.0034 mm]	**9.5**
[0.0014 mm]	**7.6**

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

Plastic Limit (T 90), %

Plasticity Index (T 90), %

Specific Gravity, Corrected to 20°C (T 100): **2.69**

Loss on Ignition (T 267)

Loss, %	H2O, %

Water Content (T 265), %: **5.1**

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft²	Remold tons/ft²	U. Shear tons/ft²	Remold tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **8/28/2012**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
244222	**BB-WMS-102/3D**	**GEOTECHNICAL (DISTURBED)**	**7/18/2012**	**8/20/2012**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: Offset, ft: Dbfg, ft: **5.0-6.0**

WIN/Town **018234.00 - WATERVILLE** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	**100.0**
¼ in. [6.3 mm]	**99.3**
No. 4 [4.75 mm]	**97.9**
No. 10 [2.00 mm]	**94.1**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**80.7**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**59.4**
[0.0321 mm]	**38.4**
[0.0208 mm]	**34.1**
[0.0123 mm]	**29.8**
[0.0089 mm]	**25.6**
[0.0064 mm]	**21.3**
[0.0033 mm]	**12.8**
[0.0014 mm]	**8.6**

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

Plastic Limit (T 90), %

Plasticity Index (T 90), %: **NP**

Specific Gravity, Corrected to 20°C (T 100): **2.62**

Loss on Ignition (T 267)

Loss, %	H2O, %

Water Content (T 265), %: **17.7**

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft²	Remold tons/ft²	U. Shear tons/ft²	Remold tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **8/28/2012**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
244223	**BB-WMS-102/3DA**	**GEOTECHNICAL (DISTURBED)**	**7/18/2012**	**8/20/2012**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: Offset, ft: Dbfg, ft: **6.0-6.5**

WIN/Town **018234.00 - WATERVILLE** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	**100.0**
¼ in. [6.3 mm]	**99.0**
No. 4 [4.75 mm]	**98.6**
No. 10 [2.00 mm]	**97.2**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**89.9**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**74.9**
[0.0317 mm]	**61.4**
[0.0208 mm]	**51.7**
[0.0124 mm]	**42.1**
[0.0090 mm]	**32.4**
[0.0065 mm]	**25.9**
[0.0033 mm]	**16.1**
[0.0014 mm]	**9.7**

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

Plastic Limit (T 90), %

Plasticity Index (T 90), %

Specific Gravity, Corrected to 20°C (T 100): **2.56**

Loss on Ignition (T 267)

Loss, %	H2O, %

Water Content (T 265), %: **47.4**

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft²	Remold tons/ft²	U. Shear tons/ft²	Remold tons/ft²		

Comments:

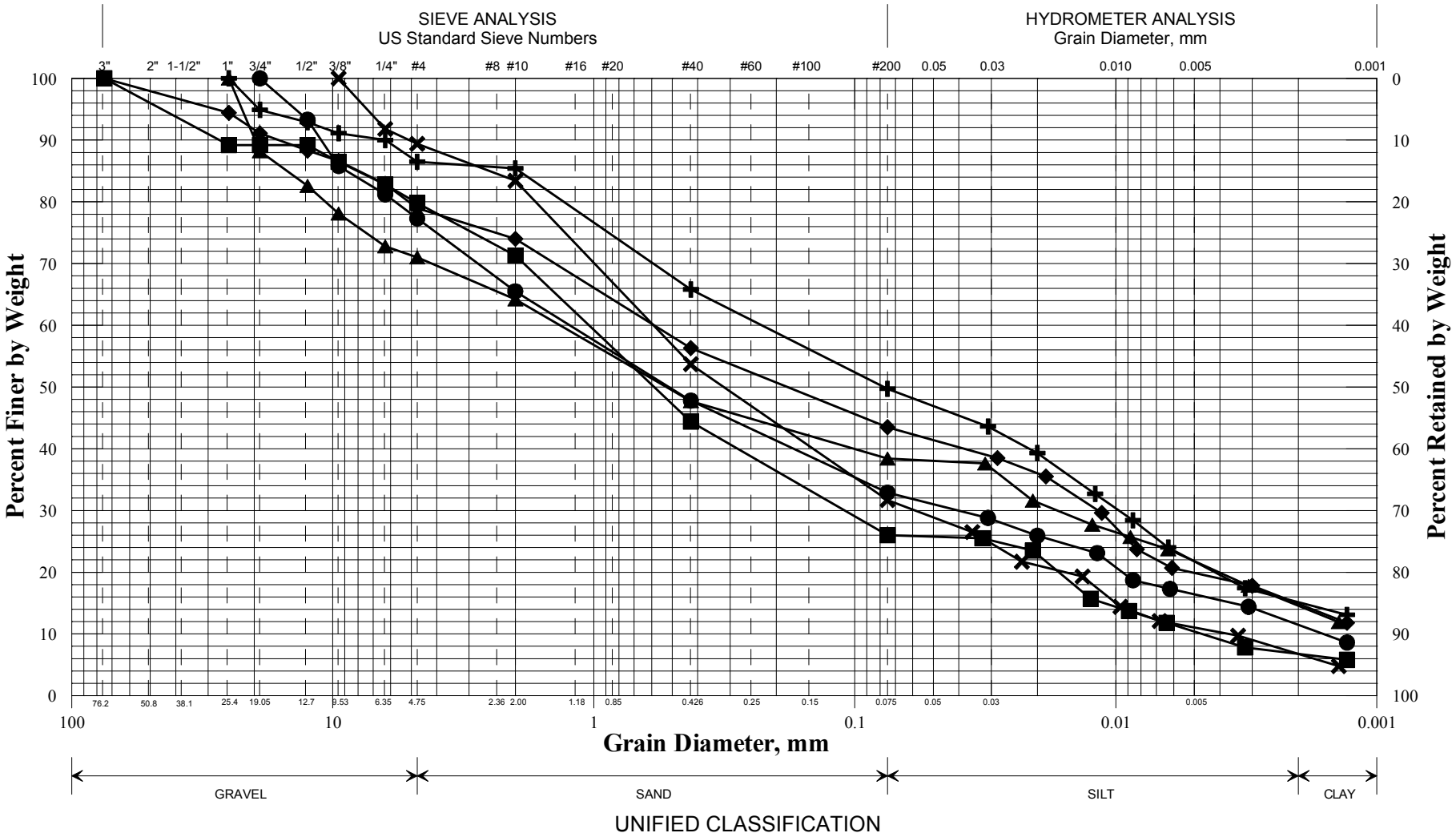
insufficient material to run Atterberg Limits

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **8/28/2012**

Paper Copy: Lab File; Project File; Geotech File

State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



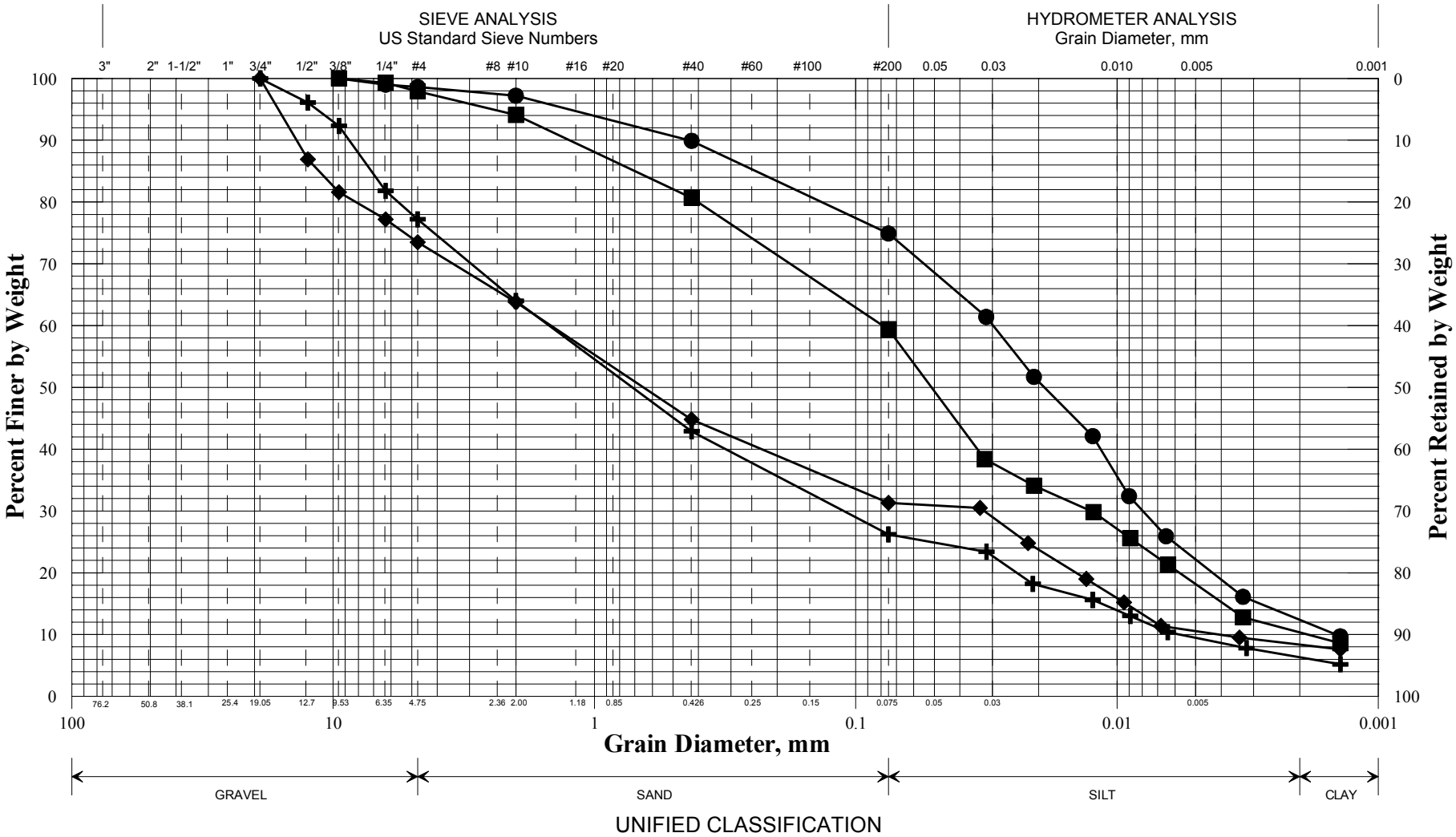
UNIFIED CLASSIFICATION

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-WMS-101/1D			1.0-3.0	SAND, some silt, little clay, little gravel.	3.9			
◆	BB-WMS-101/2D			3.0-5.0	SAND, some silt, some gravel, little clay.	3.8			
■	BB-WMS-101/3D			5.0-7.0	SAND, some gravel, little silt, trace clay.	5.0			
●	BB-WMS-101/4D			7.0-9.0	SAND, some gravel, some silt, little clay.	14.6			
▲	BB-WMS-101/5D			9.0-11.0	SAND, some gravel, some silt, little clay.	21.7			NP
✖	BB-WMS-101/6D			11.0-11.8	SAND, some silt, little gravel, trace clay.	16.2			

WIN
018234.00
Town
Waterville
Reported by/Date
WHITE, TERRY A 8/28/2012

SHEET 1

State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



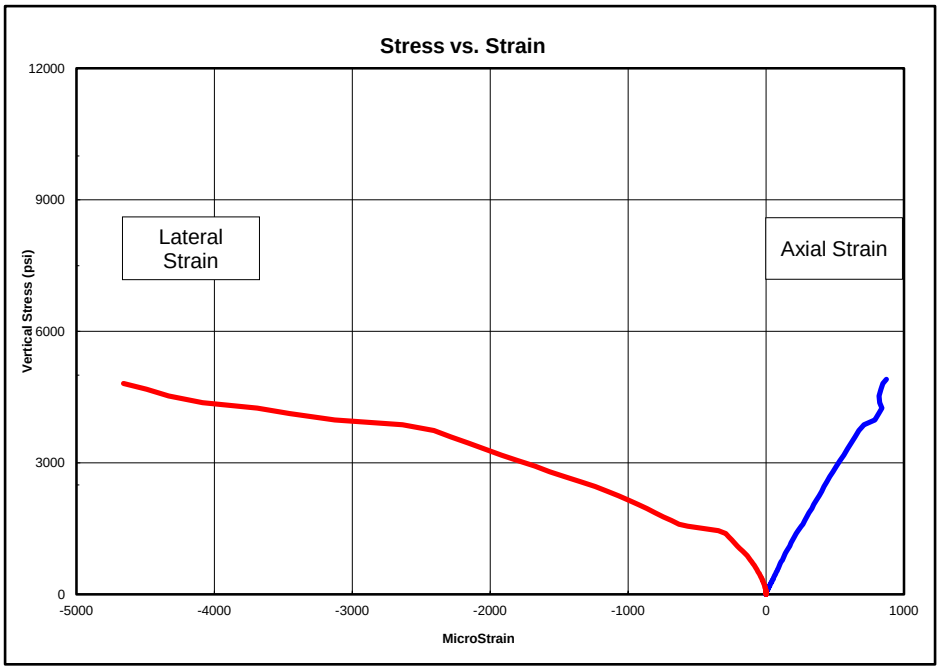
UNIFIED CLASSIFICATION

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-WMS-102/1D			1.0-3.0	SAND, some gravel, little silt, trace clay.	7.1			
◆	BB-WMS-102/2D			3.0-5.0	SAND, some gravel, some silt, trace clay.	5.1			
■	BB-WMS-102/3D			5.0-6.0	Sandy SILT, trace clay, trace gravel.	17.7			NP
●	BB-WMS-102/3DA			6.0-6.5	SILT, some sand, little clay, trace gravel.	47.4			
▲									
✖									

WIN
018234.00
Town
Waterville
Reported by/Date
WHITE, TERRY A 8/28/2012

Client:	Haley & Aldrich, Inc.
Project Name:	Western Avenue over Messalonskee Stream
Project Location:	Waterville, ME
GTX #:	12141
Test Date:	8/26/2012
Tested By:	daa
Checked By:	mpd
Boring ID:	BB-WMS-101
Sample ID:	R2
Depth, ft:	19.12-19.47
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D 7012 - Method D



Peak Compressive Stress: 5,120 psi

The graph above does not include all data up to the peak stress value. The strain gauges failed before the peak stress value was recorded.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
500-1900	5,710,000	---
1900-3200	5,270,000	---
3200-4600	3,980,000	---

Notes: Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed. Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Haley & Aldrich, Inc.	Test Date:	8/22/2012
Project Name:	Western Avenue over Messalonskee Stream	Tested By:	daa
Project Location:	Waterville, ME	Checked By:	mpd
GTX #:	12141		
Boring ID:	BB-WMS-101		
Sample ID:	R2		
Depth:	19.12-19.47 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.15	4.15	4.15
Specimen Diameter, in:	1.98	1.99	1.99
Specimen Mass, g:	588.49		
Bulk Density, lb/ft^3	174		
Length to Diameter Ratio:	2.1	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00050	-0.00040	-0.00030	-0.00020	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00030	0.00030	0.00040	0.00040
Diameter 2, in (rotated 90°)	-0.00080	-0.00060	-0.00050	-0.00040	-0.00040	-0.00020	-0.00010	0.00000	0.00010	0.00020	0.00030	0.00040	0.00060	0.00070	0.00090

Difference between max and min readings, in:

0° = 0.00090 90° = 0.00170

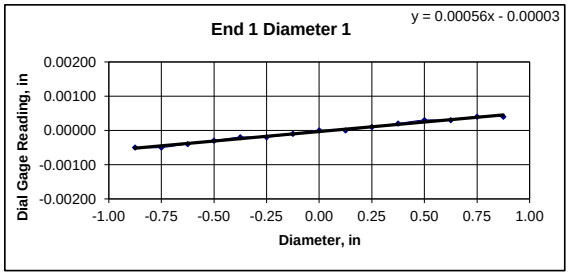
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00020	0.00030	0.00040	0.00050
Diameter 2, in (rotated 90°)	-0.00080	-0.00070	-0.00050	-0.00040	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00010	0.00030	0.00040	0.00050	0.00070	0.00090

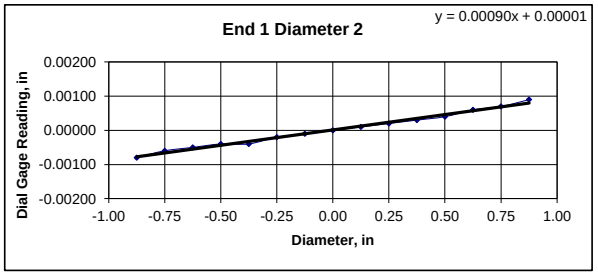
Difference between max and min readings, in:

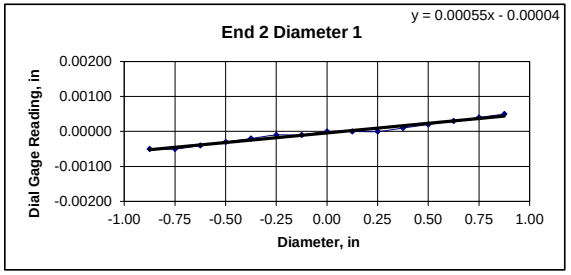
0° = 0.001 90° = 0.0017

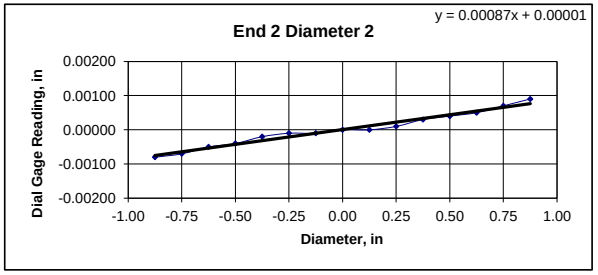
Maximum difference must be < 0.0020 in. Difference = ± 0.00085

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00056
Angle of Best Fit Line:	0.03209

End 2:

Slope of Best Fit Line	0.00055
Angle of Best Fit Line:	0.03151

Maximum Angular Difference: 0.00057

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00090
Angle of Best Fit Line:	0.05157

End 2:

Slope of Best Fit Line	0.00087
Angle of Best Fit Line:	0.04985

Maximum Angular Difference: 0.00172

Parallelism Tolerance Met? **YES**

Spherically Seated

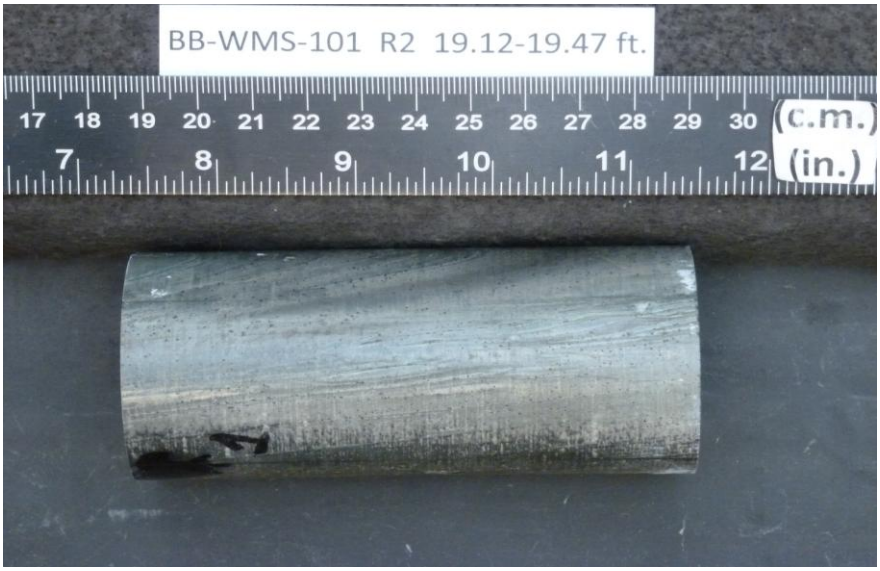
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00090	1.985	0.00045	0.026	YES
Diameter 2, in (rotated 90°)	0.00170	1.985	0.00086	0.049	YES
END 2					
Diameter 1, in	0.00100	1.985	0.00050	0.029	YES
Diameter 2, in (rotated 90°)	0.00170	1.985	0.00086	0.049	YES

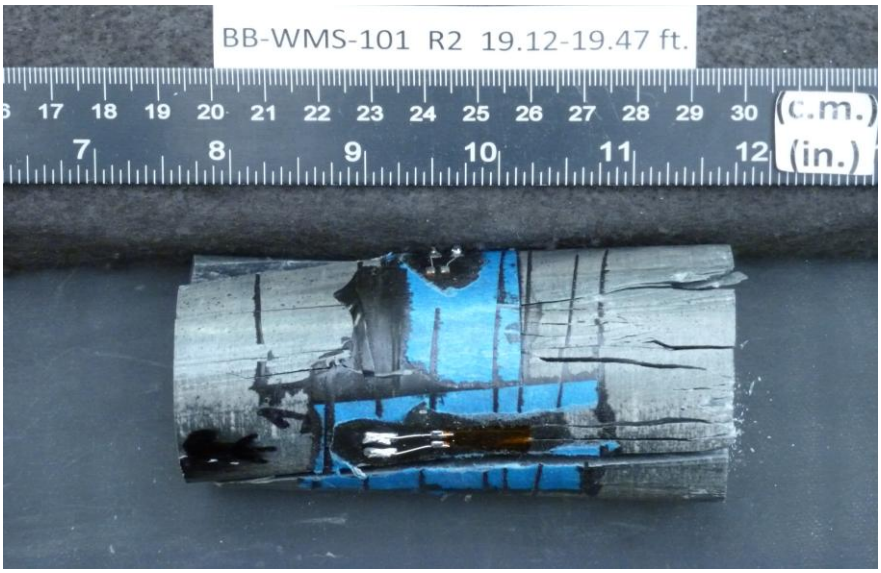
Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Haley & Aldrich, Inc.
Project Name:	Western Avenue over Messalonskee Stream
Project Location:	Waterville, ME
GTX #:	12141
Test Date:	8/26/2012
Tested By:	daa
Checked By:	mpd
Boring ID:	BB-WMS-101
Sample ID:	R2
Depth, ft:	19.12-19.47



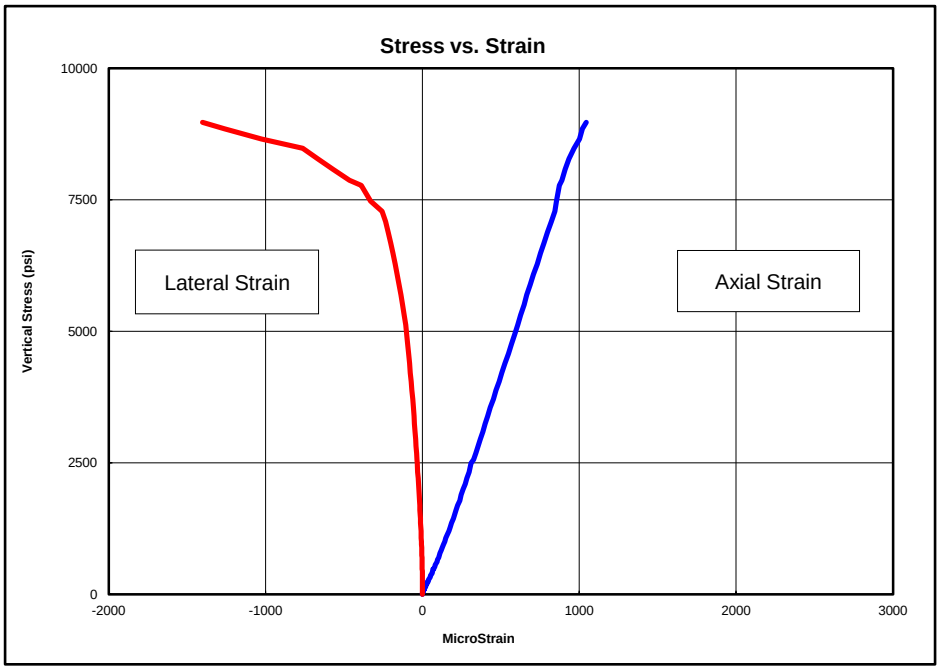
After cutting and grinding



After break

Client:	Haley & Aldrich, Inc.
Project Name:	Western Avenue over Messalonskee Stream
Project Location:	Waterville, ME
GTX #:	12141
Test Date:	8/26/2012
Tested By:	daa
Checked By:	mpd
Boring ID:	BB-WMS-101
Sample ID:	R2
Depth, ft:	21.15-21.51
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D 7012 - Method D



Peak Compressive Stress: 8,977 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
900-3300	8,650,000	0.17
3300-5700	9,130,000	0.32
5700-8100	9,870,000	---

Notes: Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed. Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Haley & Aldrich, Inc.	Test Date:	8/22/2012
Project Name:	Western Avenue over Messalonskee Stream	Tested By:	daa
Project Location:	Waterville, ME	Checked By:	mpd
GTX #:	12141		
Boring ID:	BB-WMS-101		
Sample ID:	R2		
Depth:	21.15-21.51 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.24	4.24	4.24
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	599.64		
Bulk Density, lb/ft^3	173		
Length to Diameter Ratio:	2.1	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00080	0.00080	0.00060	0.00050	0.00040	0.00030	0.00020	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00050	-0.00060	-0.00060
Diameter 2, in (rotated 90°)	0.00050	0.00040	0.00030	0.00030	0.00020	0.00010	0.00010	0.00000	-0.00010	-0.00020	-0.00030	-0.00030	-0.00040	-0.00050	-0.00060

Difference between max and min readings, in:

0° = 0.00140 90° = 0.00110

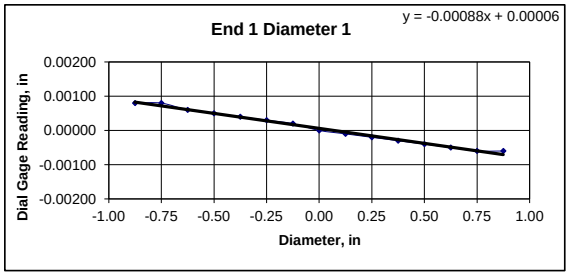
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00080	0.00070	0.00060	0.00050	0.00050	0.00030	0.00010	0.00000	0.00000	-0.00020	-0.00030	-0.00040	-0.00040	-0.00050	-0.00070
Diameter 2, in (rotated 90°)	0.00050	0.00050	0.00050	0.00040	0.00030	0.00020	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00040	-0.00040

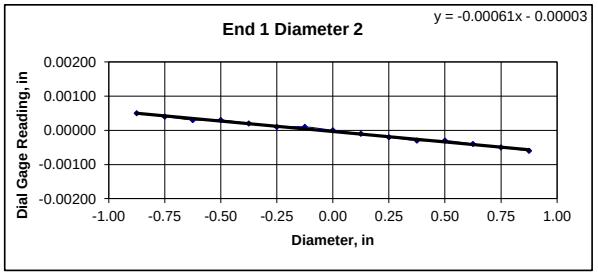
Difference between max and min readings, in:

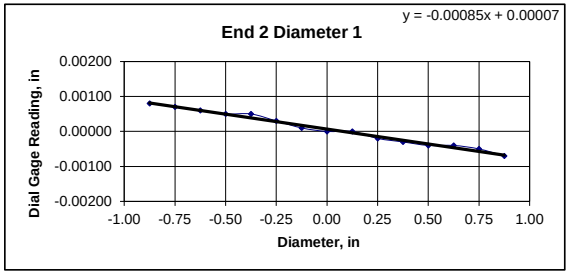
0° = 0.0015 90° = 0.0009

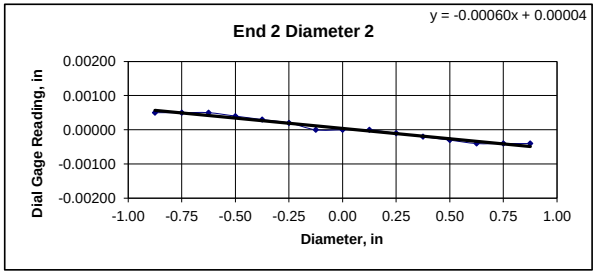
Maximum difference must be < 0.0020 in. Difference = ± 0.00075

Flatness Tolerance Met? YES









DIAMETER 1

End 1:

Slope of Best Fit Line -0.00088

Angle of Best Fit Line: -0.05042

End 2:

Slope of Best Fit Line -0.00085

Angle of Best Fit Line: -0.04870

Maximum Angular Difference: 0.00172

Parallelism Tolerance Met? YES

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line -0.00061

Angle of Best Fit Line: -0.03495

End 2:

Slope of Best Fit Line -0.00060

Angle of Best Fit Line: -0.03438

Maximum Angular Difference: 0.00057

Parallelism Tolerance Met? YES

Spherically Seated

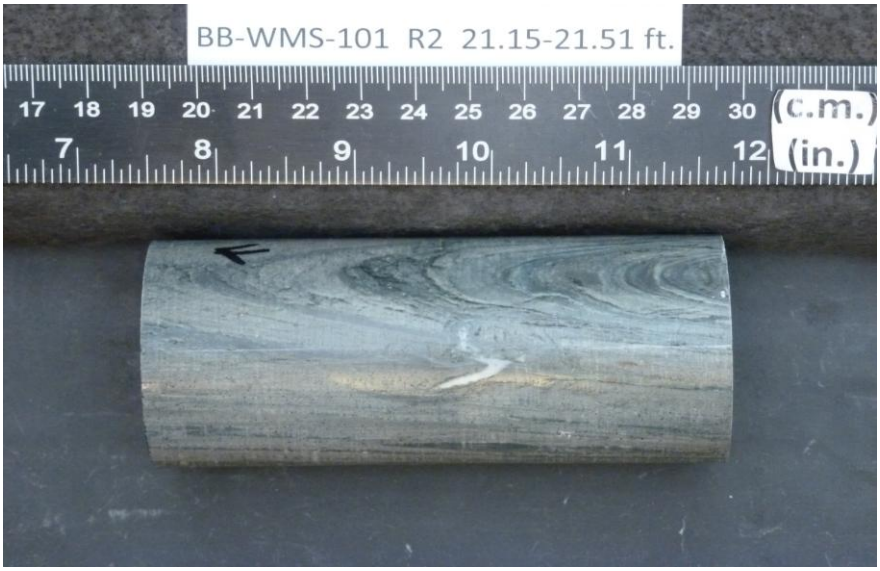
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00140	1.990	0.00070	0.040	YES
Diameter 2, in (rotated 90°)	0.00110	1.990	0.00055	0.032	YES
END 2					
Diameter 1, in	0.00150	1.990	0.00075	0.043	YES
Diameter 2, in (rotated 90°)	0.00090	1.990	0.00045	0.026	YES

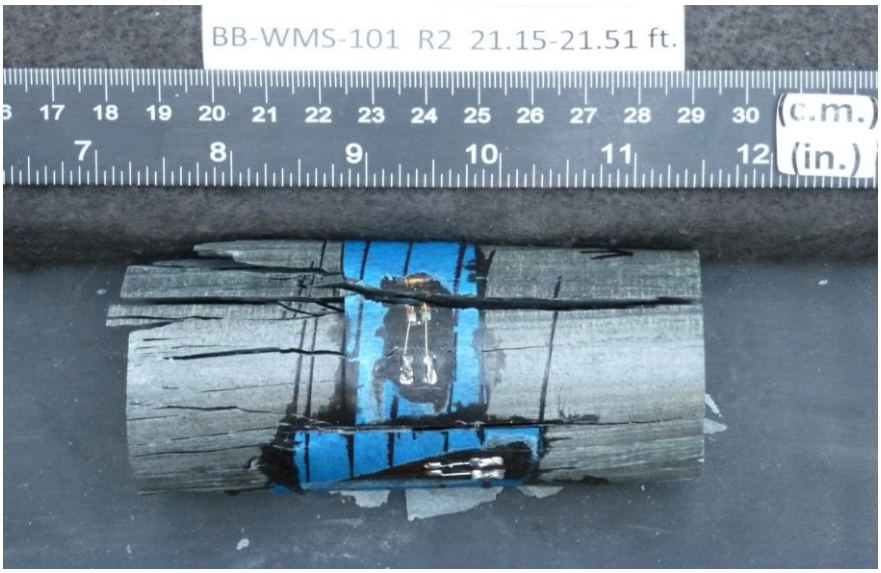
Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Haley & Aldrich, Inc.
Project Name:	Western Avenue over Messalonskee Stream
Project Location:	Waterville, ME
GTX #:	12141
Test Date:	8/26/2012
Tested By:	daa
Checked By:	mpd
Boring ID:	BB-WMS-101
Sample ID:	R2
Depth, ft:	21.15-21.51



After cutting and grinding



After break

APPENDIX C

Rock Mass Data and
Rock Core Photographs

Summary of Bedrock Samples: (see test boring logs for additional information)

Test Boring No.	Rock Core Sample No.	Top Depth (ft, BGS)	Bottom Depth (ft, BGS)	Length of Core Run (ft)	Recovery		RQD	
					in.	%	in.	%
BB-WMS-102	R1	7.0	12.0	5.0	57	95%	0	0%
BB-WMS-102	R2	12.0	17.0	5.0	60	100%	0	0%
BB-WMS-101	R1	12.9	17.9	5.0	60	100%	0	0%
BB-WMS-101	R2	17.9	22.9	5.0	60	100%	48	80%

Bedrock Description: (see test boring logs for a more detailed bedrock sample descriptions)

moderately hard to hard, very slightly to slightly weathered,aphanitic to fine-grained SCHIST. Primary joints dipping at steep to vertical angles, very close to moderately spaced, smooth, undulating to planar, discolored, open joint surfaces.

Summary of Laboratory Bedrock Test Results:

Test Boring No.	Rock Core Sample No.	Top Depth (ft, BGS)	Bottom Depth (ft, BGS)	Peak Compressive Strees (psi)
BB-WMS-101	R2	19.1	19.5	5,120
BB-WMS-101	R2	21.2	21.5	8,977
			Average =	7,049

HALEY & ALDRICH

WESTERN AVEUNE OVER MESSALONSKEE STREAM
MAINEDOT WIN 18234.00
WATERVILLE, MAINE

ROCK CORE DATA AND PHOTOGRAPHS

NOVEMBER 2012

G:\PROJECTS\38751 - MaineDOT Multi-PIN Support\020 - Western Ave over Messalonskee Stream\Preliminary Design Report\Appendix C - Rock Mass Data\(2012_0928_HA_Rock Core Summary and Photos.xls]BB-FPR-101,102 Chart

Discontinuity Survey Data Sheet

General Information

Location: Waterville, Maine

Slope Height: ~10 in.

Slope Length: East ~150'/West 50' (Banks)

Slope Dip Direction: SE + NW

Domain: _____ of _____

GPS Coord: Lat./Long. 44.5483°N 69.6423°W

Compass Declination: Set at 16° (direct readings below)

Associated Rock Mass Sheet: --

HALEY & ALDRICH

Project Name: Western Avenue over Messalonskee Stream

Project Number: 38751-020

Date: 10 (Month) 5 (Day) 2012 (Year)

Inspector(s): M. Snow

1 page of 1 page

Nature and Orientation of Discontinuity

Reference: FHWA-HI-99-007

Location	Strike	Type	Dip	Dip Direction	Persistence	Apperture Width	Nature of Filling	Strength of Filling	Surface Roughness	Surface Shape	JRC	Water Flow	Spacing	Remarks
East Upstream Side 50-150 ft from Bridge	N70°E	1	90°	160°	10'	1-2	none	--	R	P to U	8-10	none	1	Bedrock description:
	N65°E	1	90°	155°	3'	1-2	none	--	S to R	P to U	8-10	none	3-4	
	N75°E	1	90°	166°	3'	1-2	none	--	R	P to U	8-10	none	3-4	Dark gray, aphanitic, moderately hard to soft, fresh to
	N65°E	1	90°	155°	2'	1-2	none	--	S to R	P to St.	8-10	none	3-4	slightly weathered PHYLLITE. Joints vertical, extremely
West Side Upstream 50 ft from Bridge	N66°E	1	90°	156°	1.5-5'	1-2	none	--	S	P to St.	4-6	none	3-4	close to moderately spaced, tight, thinly foliated bedding,
	N72°E	1	90°	162°	4'	1-2	none	--	S	P to St.	4-6	none	3	platy texture
	N72°E	1	89°	162°	4'	1-2	none	--	S to R	P to St.	8-10	none	3	
Under Bridge - West Side	N83°E	1	80°	353°	1.5'	1-2	none	--	S to R	P to St.	8-10	none	2	
	N79°E	1	88°	349°	2'	1-2	none	--	S to R	P to St.	8-10	none	2	
	N54°E	1	87°	324°	2'	1-2	none	--	S	P to St.	8-10	none	1-2	
	N82°E	1	89°	352°	1.5'	1-2	none	--	S	P to St.	8-10	none	3	
	N77°E	1	84°	347°	2'	1-2	none	--	S	P to St.	8-10	none	3	
	N66°E	1	90°	336°	2.5'	1-2	none	--	S to R	P to U	8-10	none	3	

Type
1. Bedding
2. Small Joint
3. Large Joint
4. Sealed Joints
5. Foliations
6. Faults
7. Not defined

Aperture Width
1. Very Tight (<0.1 mm)
2. Tight (0.1-0.25 mm)
3. Partly open (0.25-0.5 mm)
4. Open (0.5-2.5 mm)
5. Moderately wide (2.5-10mm)
6. Wide (> 10 mm)
7. Very wide (1-10 cm)
8. Extremely wide (10-100 cm)
9. Cavernous (> 1 m)

Persistence

1. Very low persistence	< 1 m	< 3.3 ft
2. Low persistence	1 - 3 m	3.3 - 10 ft
3. Medium persistence	3 - 10 m	10 ft - 33 ft
4. High persistense	10 - 20 m	33 - 66 ft
5. Very high persistence	> 20 m	> 66 ft

Surface roughness
1. Rough
2. Smooth
3. Polished
4. Slickensided

Surface shape
1. Stepped
2. Undulating
3. Planar

Nature of Infilling
1. Clean
2. Surface Staining
3. Non-cohesive
4. Inactive clay or clay matrix
5. Swelling clay or clay matrix
6. Cemented
7. Chloride, talc, or gypsum
8. Calcite

Termination
0. Neither end visible
1. One end visible
2. Both ends visible

Spacing

1. Extremely close spacing	< 20 mm	< 0.8 in
2. Very close spacing	20 - 60 mm	0.8 - 2.4 in
3. Close spacing	60 - 200 mm	2.4 - 8.0 in
4. Moderate spacing	200 - 600 mm	8.0 in - 2.0 ft
5. Wide spacing	600 - 2,000 mm	2.0 - 6.6 ft
6. Very wide spacing	2,000 - 6,000 mm	6.6 - 20.0 ft
7. Extremely wide spacing	> 6,000 mm	> 20.0 ft

Compressive Strength of Infilling

	Mpa	Psf
S1 Very soft clay	< 0.025	500 psf
S2 Soft Clay	0.025-0.05	500-1,000 psf
S3 Firm clay	0.05-0.10	1,000-2,000 psf
S4 Stiff clay	0.10-0.25	2,000-5,000 psf
S5 Very stiff clay	0.25-0.50	5,000-10,000 psf
S6 Hard clay	>0.50	>10,000 psf
R0 Extremely weak rock	0.25-1.0	36 - 145 psi
R1 Very weak rock	1.0-5.0	145 - 725 psi
R2 Weak rock	5.0-25	725 - 3,625 psi
R3 Medium strong rock	25-50	3,625 - 7,250 psi
R4 Strong rock	50-100	7,250 - 14,500 psi
R5 Very strong rock	100-250	14,500 - 36,250 psi
R6 Extremely strong rock	>250	> 36,250 psi

Water Flow (open)
0. The discontinuity is very tight and dry: water flow along it does not appear possible.
1. The discontinuity is dry with no evidence of water flow.
2. The discontinuity is dry but shows evidence of water flow. i.e. rust staining.
3. The discontinuity is damp but no free water is present.
4. The discontinuity shows seepage, occasional drops of water, but no continuous flow.
5. The discontinuity shows a continuous flow of water. (Estimate l/min and describe pressure i.e. low medium, high)

Water Flow (filled)
6. The filling materials are heavily consolidated and dry: significant flow appears unlikely
7. The filling materials are damp, but no free water is present.
8. The filling materials are wet, occasional drops of water.
9. The filling materials show signs of outwash, continuous flow of water (estimate l/,im).
10. The filling materials are washed out locally; considerable water flow along out-wash channels (estimate l/min and describe pressure, i.e.low, medium, high).

VIEW OF EXISTING ABUTMENT 2, LOOKING SOUTHEAST.

VIEW OF EXISTING ABUTMENT 1, LOOKING NORTH WITH INTERFACE BETWEEN CAST-IN-PLACE CONCRETE, GRANITE BLOCKS AND BEDROCK VISIBLE.

VIEW OF EXISTING ABUTMENT 2, LOOKING NORTHEAST WITH EXFOLIATED SHEETS OF ROCK VISIBLE NEAR MID-SLOPE.

VIEW OF EXPOSED ROCK FACE ALONG WESTERN BANK OF MESSALONSKEE STREAM, LOOKING SOUTHWEST (DOWNSTREAM), WITH EXISTING ABUTMENT 1 VISIBLE. NOTICE STRIKE OF THE ROCK FACE AND DIP AND DIP DIRECTION OF JOINTS (NEAR VERTICAL TO VERTICAL).

CLOSEUP VIEW OF EXPOSED ROCK FACE ALONG WESTERN BANK OF MESSALONSKEE STREAM, LOOKING SOUTHWEST (DOWNSTREAM). NOTICE STRIKE OF THE ROCK FACE AND DIP AND DIP DIRECTION OF JOINTS (NEAR VERTICAL TO VERTICAL).

HALEY & ALDRICH

WESTERN AVENUE OVER MESSALONSKEE STREAM
MAINEDOT WIN 18234.00
WATERVILLE, MAINE

PHOTOGRAPHS OF ROCK FACE AT EXISTING BRIDGE ABUTMENT LOCATIONS

NOVEMBER 2012

G:\PROJECTS\38751 - MaineDOT Multi-PIN Support\020 - Western Ave over Messalonskee Stream\Preliminary Design Report\Appendix C - Rock Mass Data\[2012_1114_HAI_Rock Photos.xls]General Site Photographs

APPENDIX D

Historic Bridge Plans

NOTES.

EXISTING SUPERST. Steel Pony Truss for Road. Steel thru. truss for sidewalk. Steel badly rusted. Wood floor on roadway very poor condition

EXISTING SUBST. Granite Abuts. fairly laid in mortar. Good condition. Sidewalk bridge has concrete abuts. Fair condition.

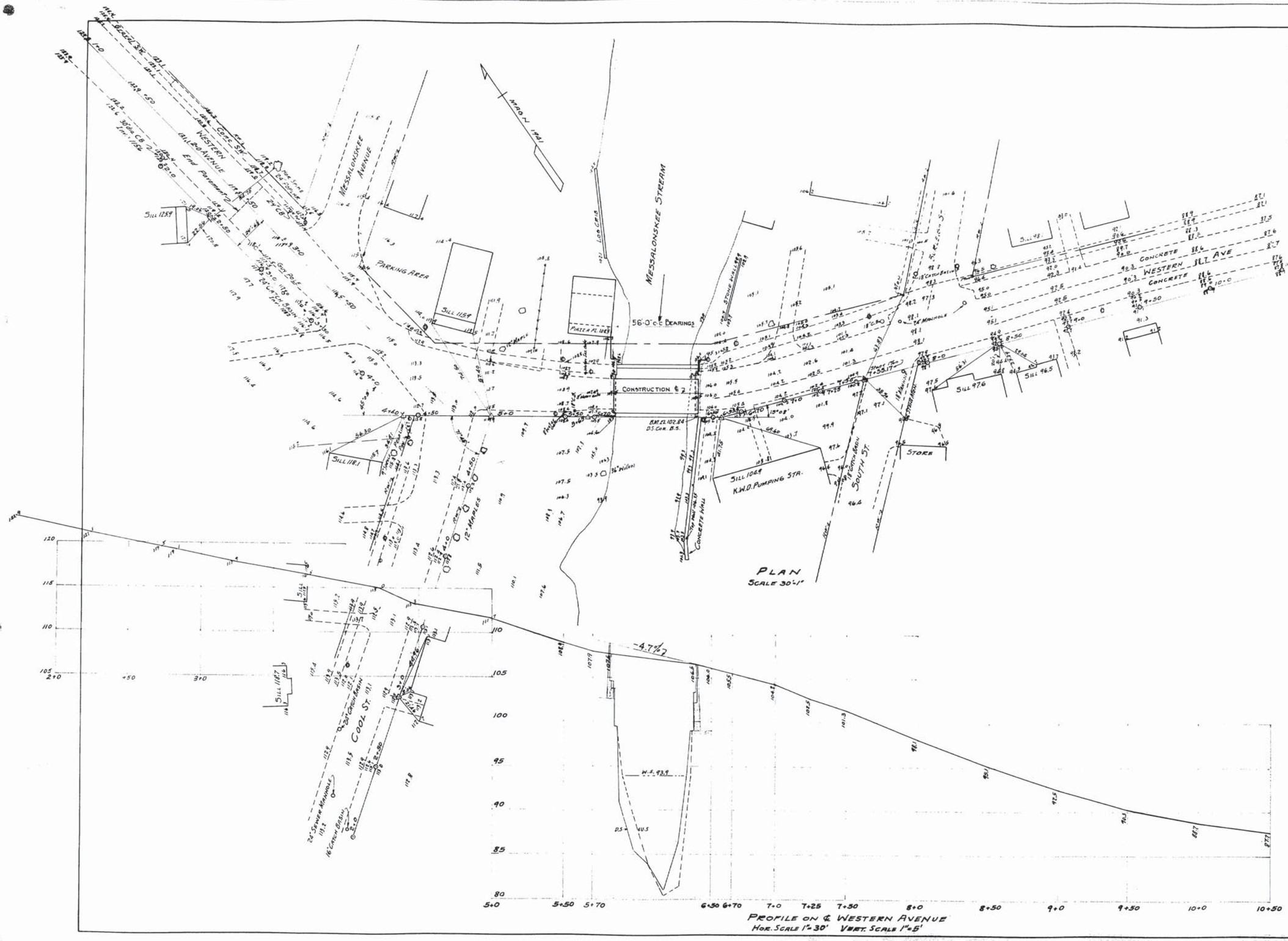
STREAM. Bridge in flowage of Central Maine Power Co. Dam about 800' below bridge. Water well controlled. Extreme high water at El. 98.0 ordinary water at present stage 93.9

FOUNDATION. All ledge. Stream in ledge gorge.

12" water pipe supported by 2-24" I Beams on their own Footings.

4" Gas pipe on downstream side of bridge.

B.M. downstream corner of bridge seat Abut. #2 El. 102.84 (from Kennebec Water District. U.S.G.S. Elevation.



SURVEY	BLAKE	TOWN	06-25
PLOT	B.T.W.	BRIDGE	3836

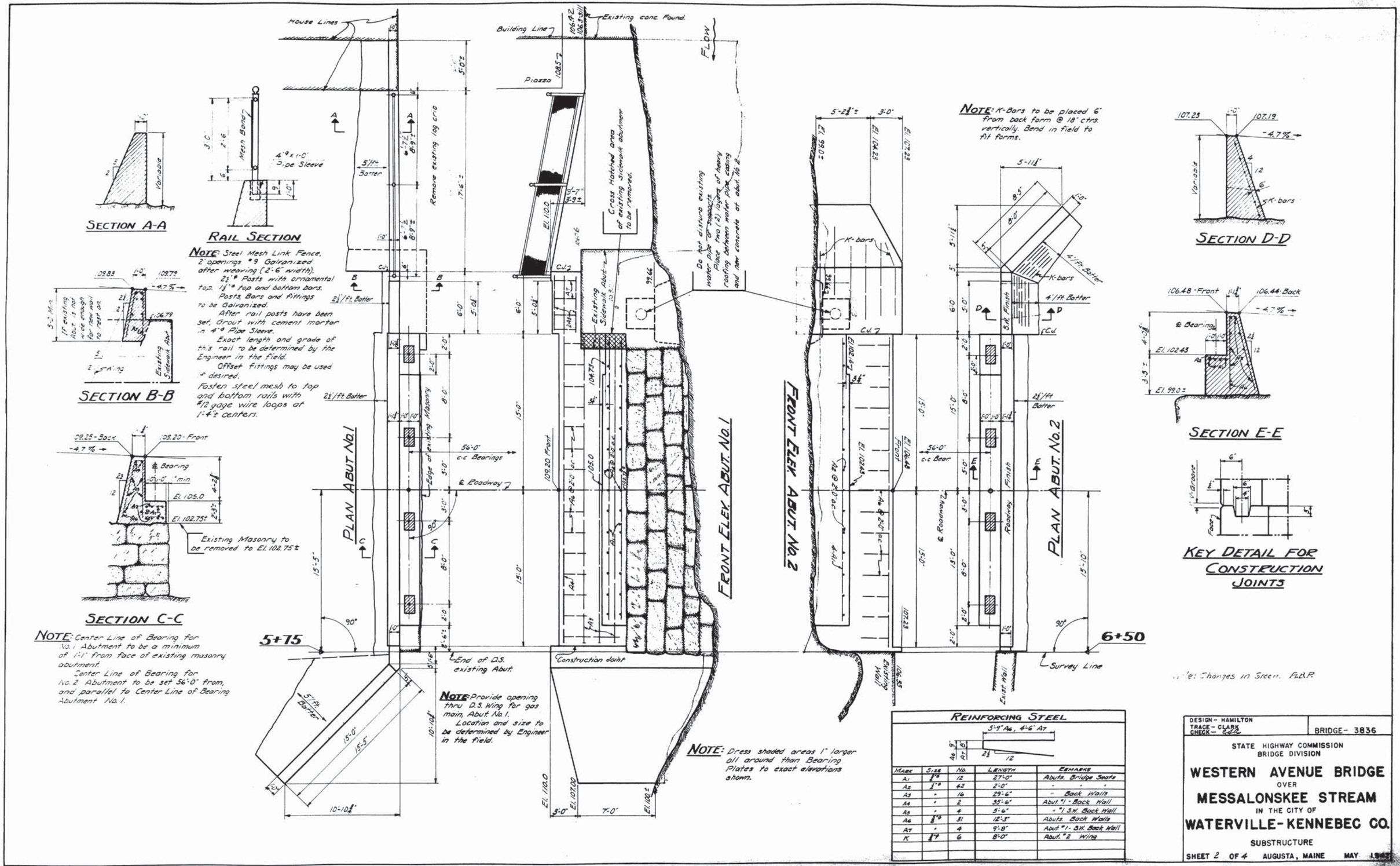
STATE HIGHWAY COMMISSION
BRIDGE DIVISION

WESTERN AVENUE BRIDGE OVER MESSALONSKEE STREAM IN THE CITY OF WATERVILLE-KENNEBEC CO.

SURVEY PLAN

SHEET 1 OF 4. AUGUSTA ME DEC. 1941

44-187



REINFORCING STEEL

5'-9" A6, 4'-6" A7

Mark	Size	No.	Length	Remarks
A1	1"ø	12	27'-0"	Abuts. Bridge Seats
A2	1"ø	42	2'-0"	" " "
A3	"	16	29'-6"	" Back Walls
A4	"	2	35'-6"	Abut. #1 - Back Wall
A5	"	4	5'-6"	" #1 S.W. Back Wall
A6	⅝"ø	31	12'-3"	Abuts. Back Walls
A7	"	4	9'-8"	Abut. #1 - S.W. Back Wall
K	½"ø	6	8'-0"	Abut. #2 Wing

DESIGN - HAMILTON
TRACE - CLARK
CHECK - [illegible]

BRIDGE - 3836

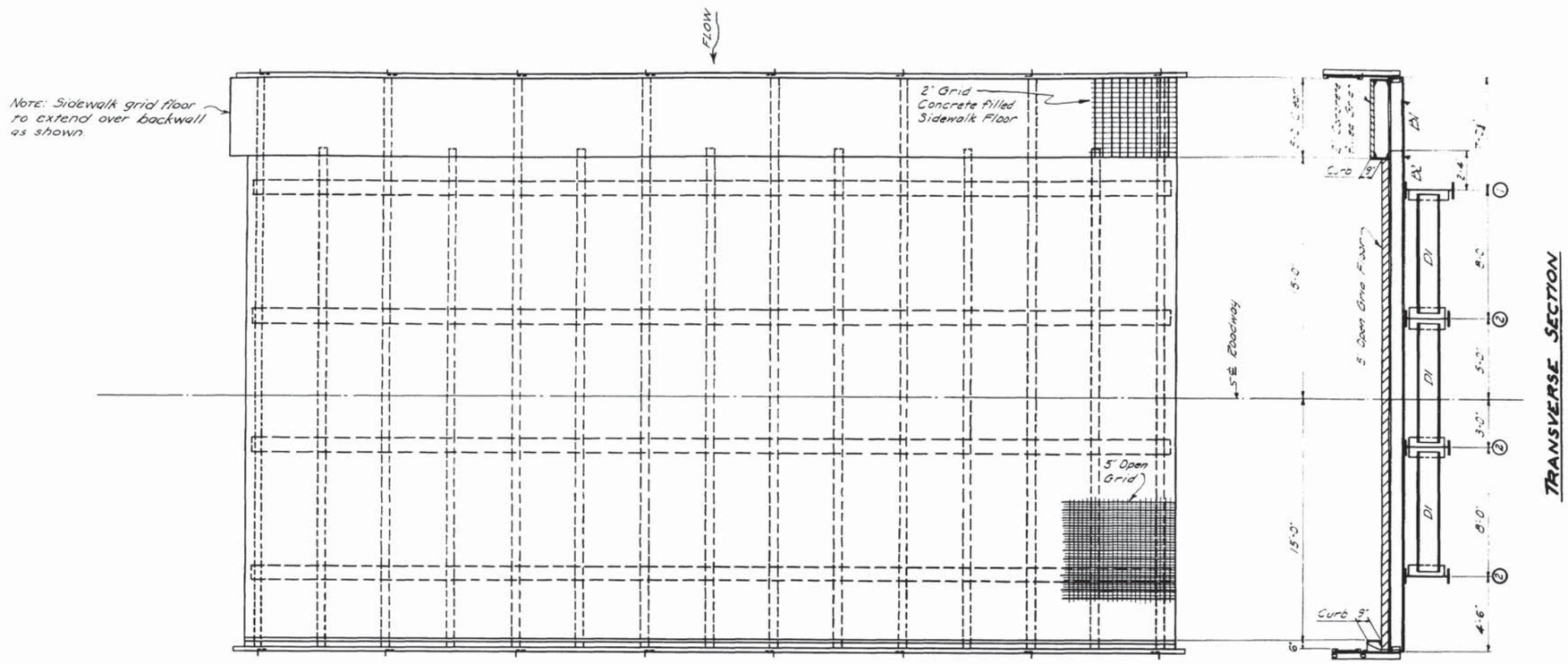
STATE HIGHWAY COMMISSION
BRIDGE DIVISION

WESTERN AVENUE BRIDGE
OVER
MESSALONSKEE STREAM
IN THE CITY OF
WATERVILLE - KENNEBEC CO.

SUBSTRUCTURE

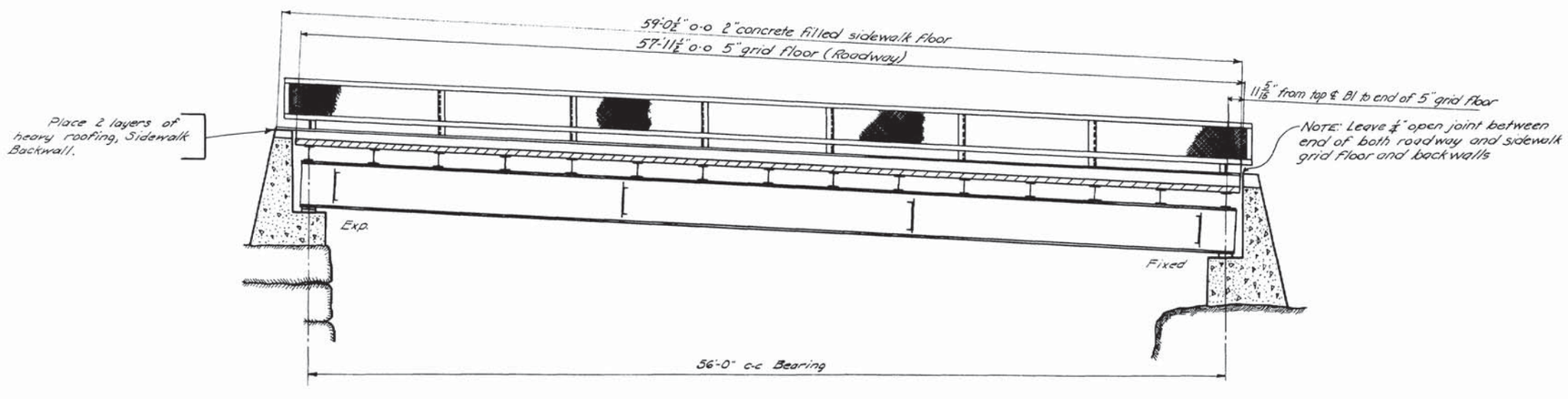
SHEET 2 OF 4 AUGUSTA, MAINE MAY 1963

44-189



PLAN

TRANSVERSE SECTION



ABUT. No. 1

ABUT. No. 2

LONGITUDINAL SECTION

ROADWAY FLOOR 5" open grid
30'-6" Width
57'-11½" Length

SIDEWALK FLOOR 2" Concrete filled grid
5'-0" Width
59'-0½" Length

Loading - H 20-44

DESIGN - HAMILTON
TRACE - CLARK
CHECK - CDS

BRIDGE - 3836

STATE HIGHWAY COMMISSION
BRIDGE DIVISION

WESTERN AVENUE BRIDGE
OVER
MESSALONSKEE STREAM
IN THE CITY OF
WATERVILLE - KENNEBEC CO.

SUPERSTRUCTURE

SHEET 3 OF 4 AUGUSTA, MAINE MAY 1947

44-189