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GEOTECHNICAL DESIGN REPORT
LEVENSELLER ROAD OVER
INTERSTATE 395/ROUTE 9 CONNECTOR, BRIDGE NO. 6649
MAINEDOT WIN 018915.00
EDDINGTON, MAINE

by Haley & Aldrich, Inc.
Portland, Maine

for Maine Department of Transportation
Augusta, Maine

File No. 132076-007
August 2021

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

Subject: Geotechnical Design Report
Levenseller Road over Interstate 395/Route 9 Connector, Bridge No. 6649
MaineDOT WIN 018915.00
Eddington, Maine

Ladies and Gentlemen:

We are pleased to submit herewith our report entitled, "Geotechnical Design Report, Levenseller Road over Interstate 395/Route 9 Connector, Bridge No. 6649, MaineDOT WIN 018915.00, Eddington, Maine." This Geotechnical Design Report (GDR) has been prepared in accordance with our proposal, dated 22 January 2021 and executed by your Richard J. Crawford on 5 February 2021, and the provisions of our General Consultant Agreement (GCA) with the Maine Department of Transportation (MaineDOT), No. CT20150706000000000010.

Introduction

This GDR presents the results of preliminary (Phase I) and final design (Phase II) phase subsurface investigation and laboratory testing programs and technical evaluations, and geotechnical design recommendations completed by Haley & Aldrich, Inc. (Haley & Aldrich) on behalf of MaineDOT for the proposed bridge that will carry eastbound (EB) and westbound (WB) vehicular traffic on Levenseller Road over the proposed Interstate 395/Route 9 Connector (Connector) in Eddington, Maine (see Figure 1, Project Locus).

Please note that geotechnical design recommendations and construction considerations for the Connector will be provided under separate cover.

HORIZONTAL COORDINATE SYSTEM, ELEVATION DATUM, AND BASELINE STATIONING

Plan locations of test borings are reported as northing and easting coordinates relative to the Maine State Plane Coordinate System, North American Datum of 1983 (NAD 83), Maine 2000 Central Zone. The project elevation datum and elevations referenced herein are in feet and reference the North

American Vertical Datum of 1988 (NAVD 88). Two baselines were developed by MaineDOT for the proposed horizontal alignments as summarized below:

- Levenseller Road: Sta. 4+00 to Sta. 11+00
- Interstate 395/Route 9 Connector: Sta. 234+50 to Sta. 239+50

PROJECT LOCATION AND EXISTING SITE CONDITIONS

The proposed Levenseller Road bridge will carry EB and WB vehicular traffic over the north-south oriented Connector in Eddington, Maine. The project site predominantly consists of a lightly-wooded residential area. Existing site grades along Levenseller Road are relatively flat, ranging between approximately El. 223 and El. 227 between Sta. 6+00 and Sta. 9+00. Existing grades along the proposed Connector generally slope up from approximately El. 214 at Sta. 234+50 (south) to El. 230 at Sta. 239+50 (north).

PROPOSED BRIDGE STRUCTURE

During preliminary design, MaineDOT developed and evaluated multiple bridge alternatives considering several factors including but not limited to overall project cost, maintenance of traffic, and future bridge maintenance. The bridge replacement alternative recommended by MaineDOT in the Preliminary Design Report (PDR) consists of an 88-ft long, single-span bridge that is supported on two cast-in-place (CIP) concrete, near full-height, cantilever abutments at the stations and elevations summarized below.

Substructure	Station at Centerline of Levenseller Road Alignment (ft)	Proposed Footing Bearing Elevation (ft, NAVD 88)
Abutment No. 1	Sta. 7+06	El. 200 to El. 208
Abutment No. 2	Sta. 7+94	El. 200 to El. 209

The bridge superstructure will be constructed using metalized steel plate girders (five beam lines) running parallel to the long dimension of the bridge, with a 9-in. thick CIP concrete deck. The bridge structure will be approximately 30-ft wide (shoulder-to-shoulder) and will consist of two, 11-ft wide travel lanes and two, 4-ft wide shoulders.

Based on our review of profile and cross section drawings developed by MaineDOT for the recommended bridge and Connector alternatives, we anticipate that the existing site grades along Levenseller Road will need to be lowered by approximately 1 ft to meet proposed finish grades. Construction of the Connector in the immediate vicinity of Levenseller Road will require approximately 25 ft of excavation to meet proposed finish grades.

Existing and proposed site conditions are shown on Figure 2, Site and Subsurface Exploration Location Plan.

Geologic Setting

Based on our review of the Maine Geological Survey's (MGS's) Surficial Geology Map of the Veazie Quadrangle, Maine (2011), surficial geology mapped in the vicinity of Levenseller Road consists of man-placed fill and/or naturally-deposited glacial till soils, both of which were encountered in the Phase I and Phase II subsurface explorations completed at the site.

According to MGS's Bedrock Geology Map of the Veazie Quadrangle (2011), bedrock at the site is primarily mapped as siltstone and/or claystone slate of the Brewer Formation. Mapped subordinate rock types consist of fine-grained calcareous quartz-rich meta-arenite and noncalcareous feldspathic metawacke. Thin beds of dark gray to gray-black metalimestone may also be present. The Brewer Formation is Silurian to Ordovician in age. Rock core samples collected in the Phase I and Phase II subsurface explorations completed at the site generally consisted of phyllite, slate and siltstone with low to steeply dipping beds and intermittent calcite veins.

Please refer to subsequent sections of this GDR for more specific information on the soil and bedrock conditions present at the site.

Subsurface Exploration Programs

PRELIMINARY PHASE (PHASE I) SUBSURFACE INVESTIGATION

Haley & Aldrich completed a preliminary design phase (Phase I) subsurface exploration program at the site in July 2018. The Phase I subsurface investigation consisted of two bridge test borings, designated BB-ELER-101 and BB-ELER-102, and one highway test boring, designated HB-BE-151, which were drilled in the vicinity of the proposed bridge abutments (bridge test borings) and along the Connector, south of Levenseller Road (highway test boring).

The test boring locations were laid out in the field by Haley & Aldrich using global positioning system (GPS) survey equipment prior to the start of drilling. "As-drilled" test boring locations and ground surface elevations were determined in the field by MaineDOT using GPS survey equipment upon the completion of drilling and were provided to Haley & Aldrich. The Phase I test boring locations and ground surface elevations are summarized in Table I and are shown on Figure 2.

The test borings were drilled by Northern Test Boring, Inc. (NTB) of Gorham, Maine using a Diedrich D50 track-mounted drill rig. Test borings were advanced to depths ranging from approximately 26 to 30 ft below ground surface (BGS) using cased-washed drilling methods and a combination of solid-stem augers and 4-in. (HW-size) outside diameter (OD) steel casing.

Soil samples were generally collected continuously through the existing fill soils and at standard, 5-ft intervals thereafter, by driving a 1-3/8-in. inside diameter (ID) split-spoon sampler with a 140-lb hammer dropped from a height of 30 in., as indicated on the test boring logs. The number of hammer blows required to advance the sampler through each 6-in. interval was recorded and is provided on the logs. The uncorrected standard penetration test (SPT) N-value (N-uncorrected) is defined as the total number of blows required to advance the sampler through the middle 12 in. of the 24-in. sampling interval. The drill rig was equipped with a calibrated automatic hammer per MaineDOT requirements. The energy-corrected SPT N-value (N_{60}), which is equal to the uncorrected N-value multiplied by the hammer efficiency factor (0.907; 90.7 percent theoretical hammer efficiency) divided by 0.6, is also provided on the logs.

Each test boring was advanced approximately 2 to 17 ft into bedrock using a roller bit and/or a 2.0-in. (NQ-size) ID, diamond-tipped core barrel.

Soil and bedrock samples were collected and preserved in glass jars and wooden boxes, respectively. The samples that were not submitted for laboratory testing are available for review upon request. The available soil and bedrock samples are currently being stored at the Haley & Aldrich storage facility in Portland, Maine.

One observation well was installed in completed borehole BB-ELER-101 to provide information on the static groundwater levels at the site. The observation well consisted of 2-in. ID, machine-slotted PVC pipe and solid PVC riser pipe extending to the existing ground surface (approximate). The observation well was outfitted with a steel roadway box assembly. The observation well installation and groundwater monitoring reports are provided in Appendix C.

All Phase I drilling and sampling activities were performed in accordance with MaineDOT requirements.

DESIGN PHASE (PHASE II) SUBSURFACE INVESTIGATION

Haley & Aldrich completed a design phase (Phase II) subsurface exploration program at the site in November and December 2020 and February 2021. The Phase II subsurface investigation consisted of seven bridge test borings, designated BB-ELER-201 through BB-ELER-206 (including BB-ELER-206A), and three highway test borings, designated HB-BE-235 through HB-BE-237, which were drilled at/near the ends of the abutment wingwalls (bridge test borings) and along the Connector, south and north of Levenseller Road (highway test borings).

The Phase II test borings were laid out in the field by MaineDOT using GPS survey equipment prior to the start of drilling. “As-drilled” test boring locations and ground surface elevations were determined in the field by MaineDOT using GPS survey equipment upon the completion of drilling and were provided to Haley & Aldrich. The Phase II test boring locations and ground surface elevations are summarized in Table I and are shown on Figure 2.

The Phase II test borings were drilled by New England Boring Contractors (NEBC) of Hermon, Maine using a Mobile Drill B-53 truck or track-mounted drill rig. Test borings were advanced to depths ranging from approximately 15 to 37 ft BGS using similar means and methods to those used to drill the Phase I test borings. The hammer efficiency factors for the automatic hammers used were either 0.852 or 0.867 (85.2 or 86.7 percent theoretical hammer efficiency) as noted on the test boring logs.

Test borings were advanced approximately 5 to 28 ft into bedrock using a roller bit and/or a 2.0-in. (NQ-size) ID, diamond-tipped core barrel.

Soil and bedrock samples were collected and preserved in glass jars and wooden boxes, respectively. The soil and bedrock samples that were not submitted for laboratory testing are currently being stored at the Haley & Aldrich storage facility in Portland, Maine and are available for review upon request.

All Phase II drilling and sampling activities were performed in accordance with MaineDOT requirements.

Geophysical Logging

Structural bedrock geologic data was collected in select bridge (BB) and highway (HB) test borings using downhole geophysical techniques (i.e., optical televiewer [OTV] and acoustic televiewer [ATV] logging) to locate and measure discontinuities within the bedrock mass. OTV and ATV logging was completed in the following test borings: BB-ELER-202, BB-ELER-205, BB-ELER-206A, HB-BE-235, HB-BE-236, and HB-BE-237. The borehole geophysical logging was completed by Hager-Richter Geoscience, Inc. of Salem, New Hampshire in November 2020 and March 2021.

Generalized Subsurface Conditions

The subsurface conditions present at the site generally consist of the man-placed fill soils overlying naturally-deposited glacial till and bedrock. Refer to Table II for a detailed summary of the soil units and encountered thicknesses at each test boring location. A general description of each soil/bedrock unit is provided separately, below. Detailed soil and bedrock descriptions are provided on the test boring logs included Appendix A. Refer to Figure 3, Interpretive Subsurface Profile, and Figures 4 and 5, Abutment No. 1 and Abutment No. 2 Interpretive Subsurface Cross Sections for a graphical representation of the subsurface conditions present along the proposed bridge alignment and the bridge abutments.

Geologic Unit	**Approximate Encountered Thickness (ft)**	**Generalized Description**
Bituminous Concrete	0.3 to 0.5	A surficial layer of bituminous concrete was encountered in test borings completed within the limits of Levenseller Road. *(encountered in BB-ELER-102, -202 and -205)*
Topsoil/Fill	0.2 to 5	A surficial layer of topsoil consisting of very soft to stiff SILT with variable amounts of sand, gravel and organic matter was encountered in some test borings. Fill material consisted of medium dense to very dense, fine to coarse SAND with variable amounts of silt and gravel; fine to coarse GRAVEL with variable amounts of sand. *(encountered in each test boring except BB-ELER-201, -206A and HB-BE-237*
Glacial Till	3 to 22	Stiff to hard, silty CLAY and SILT with variable amounts of clay, sand and gravel; very dense SAND with variable amounts of silt and gravel; very dense GRAVEL with variable amounts of silt and sand. Occasional cobbles and boulders were encountered within the deposit. *(encountered in each test boring)*
Bedrock	top of bedrock surface encountered at depths ranging from approximately 8 to 23 ft BGS (El. 215 to El. 193) and slopes up from south to north and from west to east *(encountered in each test boring)*	

Please note that soil descriptions provided on the test boring logs do not represent actual field conditions other than at the specific test boring locations. The actual conditions encountered between test boring locations may vary from those described herein.

BEDROCK CONDITIONS AND STRUCTURAL GEOLOGIC DATA

Bedrock Conditions

Approximately 2 to 28 ft of bedrock was cored in the Phase I and Phase II test borings. The sampled and recovered bedrock generally consisted of the following:

- Moderately hard to very hard, fresh to moderately weathered, grey, aphanitic, SILTSTONE, SLATE and PHYLLITE. Primary joints dip at low to near-vertical angles and are very close to moderately spaced, tight to open, planar to undulating, with occasional oxidation and calcite coatings on joint surfaces.

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 bedrock core run. RQD values for the sampled and recovered bedrock ranged from 0 to 98 percent (average = 36 percent), indicating variable rock quality; from very poor to excellent (average = poor).

Detailed bedrock core data and descriptions are provided on Table III and on the logs in Appendix A. In addition, photographs of the recovered bedrock core samples are provided for reference in Appendix A.

Structural Geologic Data

The structural bedrock geologic data used in the kinematic analyses, which are discussed in subsequent sections of this report, were collected during the design phase (Phase II) subsurface exploration program as discussed in previous sections of this report.

The results of the OTV and ATV logging, which includes identification and measurement of the depth, aperture (i.e., openness) and orientation (dip angle and dip direction) of planar features within the bedrock mass such as fractures (or joints), foliation or bedding planes are provided in Appendix B. Bedrock structures encountered in the boreholes were grouped into five categories, as described below.

- Foliation/Vein: Planar geologic feature with no aperture
- Fracture Rank 1: Minor fracture that may not be continuous around the borehole
- Fracture Rank 2: Intermediate fracture that is distinct and continuous around the borehole with little to no aperture
- Fracture Rank 3: Intermediate fracture that is distinct and continuous around the borehole with some apparent aperture
- Fracture Rank 4: Major fracture that is distinct with continuous apparent aperture around the borehole.

Evaluation of the data considered Fracture Ranks 1 and 2 to be "closed" joints and Fracture Ranks 3 and 4 to be "open" joints. A total of 319 joints were logged within the bedrock encountered in the test borings noted above, which represents an average of approximately 2.9 joints per vertical linear foot of bedrock (jpf). Of those joints, 25 percent were considered "open", and 75 percent were considered "closed".

In general, the joint frequency (i.e., number of joints per vertical linear foot) and aperture (openness) of the joints decreases with increasing depth below the top of bedrock surface except for the rock encountered in test boring HB-BE-237. Similarly, the RQD also tends to increase with increasing depth below the top of bedrock surface.

GROUNDWATER CONDITIONS

As discussed previously, one observation well was installed in completed borehole BB-ELER-101 to provide information on the static groundwater levels at the site. The measured water levels during the period 23 July 2018 to 12 May 2021 ranged from approximately 2 to 12 ft BGS (El. 223 to El. 213). Please note that the invert of the proposed ditches adjacent to the new Connector are planned to be constructed at approximately El. 199 and the finished Connector roadway grade is planned to be approximately El. 203.

In general, water levels may fluctuate with season, precipitation, local soil/bedrock conditions, and excavation means and methods. Therefore, water levels may vary from those summarized above, provided on the testing boring logs included in Appendix A and shown on the groundwater monitoring report included in Appendix C.

Laboratory Test Results

Phase I and Phase II laboratory testing programs were conducted by Haley & Aldrich on representative soil and rock samples collected during the preliminary and design phase subsurface exploration programs to aid in soil classification and determination of engineering soil and rock properties. Laboratory testing was performed in accordance with applicable American Society for Testing Materials (ASTM) testing procedures by GeoTesting Express, Inc. of Acton, Massachusetts. A summary of the lab testing results is provided below.

Laboratory Test	ASTM Test Designation	Geologic Unit	No. of Tests	Range in Test Results[1]
Moisture Content	ASTM D2216	Glacial Till	8	WC = 7.9 to 13.9%
Grain Size	ASTM D422		14	AASHTO Classification: A-6(3), A-4(0), A-2-4, A-1-a(0) USCS Classification: CL, ML, SM, SW-SM
Atterberg Limits	ASTM D4318		1	Liquid Limit (LL) = 25% Plastic Limit (PL) = 14% Plasticity Index (PI) = 11%
Compressive Strength and Elastic Moduli of Rock	ASTM D7012	Bedrock	8	Peak Compressive Stress: 3,590 to 27,259 psi Young's Modulus: 2,620,000 to 40,600,000 psi Poisson's Ratio 0.04 to 0.46
Sliding Friction Test of Rock	ASTM D5607		2	Peak Shear Stress: 14.3 to 29.1 psi at 15 psi normal stresses ranging from 15 to 20 psi, respectively.

[1] WC = Moisture Content; psi = pounds per square inch.

All laboratory test results are shown on the test boring logs included in Appendix A and complete results are provided in Appendix D.

Geotechnical Evaluations and Design Recommendations

Geotechnical design recommendations, as discussed and provided herein, were developed in accordance with the following documents:

- AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, Ninth Edition, 2020, referred to herein as AASHTO LRFD,
- MaineDOT Bridge Design Guide (BDG), August 2003, with Interim Revisions through June 2018, referred to herein as Bridge Design Guide.

Engineering calculations that support the design recommendations outlined in this report are provided for reference in Appendix E.

APPROACH EMBANKMENTS

Existing site grades along Levenseller Road will be lowered by approximately 1 ft to meet proposed finish grades. Because grades will be lowered and based on the subsurface conditions encountered in the Phase I and Phase II test borings drilled at the site, we anticipate that post-construction settlement of the new bridge approach roadways will be negligible.

SEISMIC SITE CLASS AND DESIGN PARAMETERS

Site class was determined in accordance with AASHTO LRFD Section 3.10.3.1 using Method C. In instances where SPT N-values were equal to 0 (i.e., weight of rod or weight of hammer), were greater than 100 blows per foot (bpf) or where bedrock was present, default values of 1 and 100 bpf were used, respectively.

Based on the nature and thickness of the overburden soils and depth to bedrock at the site, as determined from the preliminary phase test borings, we recommend the site be considered "Site Class C." Spectral accelerations were determined based on the geographic site location and the recommended "Site Class C" designation using the United States Geological Survey (USGS) software application Seismic Design Parameters v. 2.0, which is based on a seismic event having a 7 percent probability of exceedance in 75 years (approximate 1,000-year return period). The recommended values are summarized below.

Design Parameter	Design Value
Site factor for short-period range of acceleration response spectrum, F_a =	1.200
Site factor for long-period range of acceleration response spectrum, F_v =	1.700
Site factor at zero-period on acceleration response spectrum, F_{pga} =	1.200
Horizontal response spectral acceleration coeff. at 0.2-s period on rock, S_S (g) =	0.144
Horizontal response spectral acceleration coeff. at 1.0-s period on rock, S_1 (g) =	0.043
Peak seismic ground acceleration coeff. on rock, PGA (g) =	0.067
Horizontal response spectral acceleration coeff. at 0.2-s period modified by F_a, S_{DS} (g) =	0.17
Horizontal response spectral acceleration coeff. at 1.0-s period modified by F_v, S_{D1} (g) =	0.07
Peak seismic ground acceleration coefficient modified by F_{pga}, As (g) =	0.08

In accordance with AASHTO LRFD Section 3.10.6, the site falls within Seismic Zone 1 based on the calculated value of S_{D1} (i.e., $S_{D1} < 0.15$ = Seismic Zone 1 from AASHTO LRFD Table 3.10.6.1).

Based on our review of the soil conditions encountered in the test borings and the results of the laboratory testing, it is our opinion that the potential for saturated granular soils present at the site to liquefy during the design earthquake event is very low.

BRIDGE ABUTMENT AND WINGWALL FOUNDATION SUPPORT

Foundation Support Type and Preliminary Bearing Elevations

As shown on the interpretive subsurface profile (Figure 3) and the abutment interpretive subsurface cross sections (Figures 4 and 5), the subsurface conditions present at the site consist of glacial till overlying bedrock. During the project's preliminary design phase (Phase I) spread footings bearing on bedrock were selected by MaineDOT as the preferred foundation support alternative for the bridge. Because structural geologic bedrock data was not collected and kinematic analyses (used to evaluate potential for planar and wedge sliding and toppling failures to occur) were not completed during Phase I, the bottom of abutment and wingwall footing elevations were initially established by MaineDOT based on the top of bedrock elevations completed in the Phase I test borings. Please recall that only two test borings (BB-ELER-101 and BB-ELER-102) were completed in the vicinity of the proposed bridge abutments during the Phase I subsurface exploration program. The proposed bottom of abutment and wingwall footings shown by MaineDOT in the Preliminary Design Report (PDR) were El. 210 and El. 213 for Abutment No. 1 and Abutment No. 2, respectively. Based on the preliminary bottom of abutment and wingwall footing elevations (El. 210 and El. 213) established by MaineDOT as well as the elevations of the proposed ditches along the Connector roadway, approximately 11 to 14-ft high exposed rock slopes, inclined at 1H:4V, would be present below the footings.

Kinematic Analyses

As summarized in previous sections of this report, structural bedrock geologic data was collected in select bridge (BB) and highway (HB) test borings using downhole geophysical techniques (OTV/ATV) during the design phase (Phase II) subsurface exploration program. The bedrock geologic data was used, in part, to conduct kinematic analyses to evaluate the potential for planar sliding, wedge sliding and toppling failures to occur within the bedrock mass between the preliminary bottom of footing elevations and the proposed Connector roadway ditch elevation.

The measured foliation and joint pole vectors and great circle representing the orientation of the proposed Connector cut slopes were plotted on stereonets to assess the potential for planar and wedge sliding and toppling failures to occur. A stereonet is a geological engineering tool that presents three-dimensional data in a two-dimensional format. On a stereonet, a discontinuity (i.e., joint) plane can be plotted as a 'great circle' or as a line (plots as a single point) called a pole, which is measured 90 degrees from the plane and represents each plane. Therefore, if a joint plane dips to the northeast, the pole to that plane will appear as a point in the southwest quadrant of the stereonet. Poles that are close to the outer edges of the stereonet represent steeply dipping planes and poles at the center of the stereonet represent planes that are horizontal. The geophysical data collected from the above referenced test borings were plotted in polar format to simplify the data output. The results of the kinematic analyses are summarized below.

Substructure	Joint Set Data		Proposed Cut Slope Data			Kinematic Analysis	Percentage of Bedrock Joint Sets Within Failure Window
	Dip Direction (deg.)	Dip Angle (deg.)	Strike (deg.)	Dip Direction (deg.)	Dip Angle (deg.)		
Abutment No. 1	18° to 333°	31° to 78°	231	141	76	Toppling	7.3%
						Planar Sliding	42.8%
						Wedge Sliding	17.7%
Abutment No. 2			51	321	76	Toppling	41.3%
						Planar Sliding	12.0%
						Wedge Sliding	23.5%

The results of the kinematic analyses summarized above indicate that planar sliding and toppling are the dominant failure mechanisms that have a high likelihood of occurring within the exposed bedrock mass beneath the proposed Abutment No. 1 and Abutment No. 2 footings, respectively. Other types of failures are also possible but not as likely to occur as those noted above. Because of the potential for planar sliding and toppling failures to occur, it was determined that rock slope stabilization measures would be needed to prevent rock mass failures and to provide adequate bearing conditions for abutment breastwall and wingwall footings.

Rough order of magnitude (ROM) costs for rock slope stabilization measures were developed assuming that the proposed abutment and wingwall footings would remain at elevations shown in the PDR (i.e., (El. 210 at Abutment No. 1 and El. 213 at Abutment No. 2). For the purposes of the ROM cost estimate, we assumed that 1-3/8 diameter, 20-ft long galvanized steel bars spaced at either 8 ft (Abutment No. 1) or 5 ft Abutment No. 2) on-center would be required to eliminate the potential for a rock mass failure from occurring. The ROM costs for the assumed rock slope stabilization measures were approximately $35,000 to $40,000 at Abutment No. 1 and approximately $150,000 to $155,000 at Abutment No. 2 (total of $185,000 to $195,000), which were transmitted to MaineDOT via email on 26 April 2021.

This foundation support option, which includes minimal rock removal, higher abutment and wingwall footing bearing elevations, and rock slope stabilization measures, is referred to hereinafter as Alternative 1.

Alternative Abutment and Wingwall Bearing Elevations

Alternative abutment and wingwall footing bearing elevations were determined by Haley & Aldrich. Alternative 2, in comparison to Alternative 1, has lower abutment and wingwall footing bearing elevations (i.e., more rock removal) but would not include rock slope stabilization measures.

Alternative abutment and wingwall footing bearing elevations were determined by superimposing the location and elevation of the footings on Connector roadway cross sections. The zone of influence (ZOI) of the footings, which is defined as the area beneath imaginary lines that extend 2 ft beyond the bottom outer edge of the footings and down on a 1H:1V was also superimposed on the cross sections. The abutment and wingwall footing bearing elevations were incrementally lowered until the ZOI line did not daylight beyond the proposed Connector roadway rock slope (assumed at 4V:1H). Alternative abutment and wingwall footing bearing elevations that would eliminate the need for rock slope stabilization measures are summarized below.

Substructure		Preliminary Foundation Bearing Elevation (w/ rock stabilization; Alternative 1)	Alternative Foundation Bearing Elevation (w/o rock stabilization; Alternative 2)
Abutment No. 1	Left Wingwall	210.0	202.0
	Breastwall		200.5
	Right Wingwall		208.5
Abutment No. 2	Left Wingwall	213.0	206.0
	Breastwall		200.5
	Right Wingwall		209.0

Recommended Abutment and Wingwall Bearing Elevations

The results of the kinematic analyses, the ROM rock slope stabilization costs, and the alternative abutment and wingwall footing bearing elevations summarized above were discussed with MaineDOT Bridge Program staff on 28 April 2021.

Several factors contributed to the elimination of the rock slope stabilization alternative during the discussion with MaineDOT Bridge Program staff, including:

- cost (for rock removal and rock slope stabilization measures),
- an additional phase of work would be required to install the rock slope stabilization measures during bridge and Connector roadway construction,
- the long-term durability of rock slope stabilization measures located in a “splash zone” (e.g., corrosion of rock dowels and hardware),
- the need to maintain and potentially add stabilization measures in the future as time-dependent weathering of the rock slope occurs during the service life of the bridge.

The Alternative 2 abutment and wingwall footing bearing elevations, which were lowered as described above to avoid the need for rock slope stabilization measures, was the alternative that was preferred by MaineDOT. Recommended abutment and wingwall foundation bearing elevations, as determined by Haley & Aldrich and MaineDOT Bridge Program staff are presented below.

Substructure		Recommended Foundation Bearing Elevation (w/o rock stabilization)
Abutment No. 1	Left Wingwall	202.0
	Breastwall	200.0
	Right Wingwall	208.0
Abutment No. 2	Left Wingwall	206.0
	Breastwall	200.0
	Right Wingwall	209.0

Abutment and Wingwall Footing Design Recommendations

Abutment and wingwall foundation recommendations are summarized below. Please note that the design recommendations presented below assume foundation subgrade preparation is completed in accordance with the guidance provided in the Construction Considerations section of this report as well as the requirements of the Contract Documents (CDs; drawings, standard specifications and special provisions).

- Bearing Resistance:
  - For the service limit state, mass concrete footings should be designed such that footing contact pressures do not exceed 20 kips per square foot (ksf). At this pressure, it is estimated that elastic settlement of footings bearing on "fair to very good" bedrock will generally be less than ½ in. per LRFD Section 10.6.2.4.4.
  - For the strength limit state, footings should be designed for a factored bearing resistance of 31 ksf using a resistance factor of 0.45.
  - For the extreme event limit state, footings should be designed for factored bearing resistance of 55 ksf, using a resistance factor of 0.8.

- Load Distribution and Eccentricity:
  - Application of permanent and transient loads is specified in AASHTO LRFD Section 11.5.6. We recommend the stress distribution at the base of the footings be assumed to be a triangular or trapezoidal distribution over the effective footing base as shown in AASHTO LRFD Figure 11.6.3.2-2.
  - The eccentricity of loading at the Strength Limit State, based on factored loads, should not exceed 0.45 of the spread footing dimensions in either direction. The eccentricity corresponds to the resultant of reaction forces falling within the middle nine-tenths (9/10) of the base width and length.

- Sliding Resistance:
  - In accordance with AASHTO LRFD Tables C3.11.5.3-1,10.5.5.2.2-1 and 11.5.8 we recommend that sliding resistance of abutment and wingwall footings be calculated using the design parameters presented below.

Subgrade Saturation Condition During Construction	Coefficient of Friction (tan δ)	Interface Friction Angle (δ, deg)	Strength Limit State Resistance Factor for Sliding (φ_τ)	Service/Extreme Limit State Resistance Factor for Sliding (φ_τ)
Prepared in-the-dry	0.7	35	0.8	0.9

  - Lateral passive soil resistance in front of the footings, if present, should be neglected in accordance with requirements of the BDG. "Anchorage" of footings to bedrock (e.g., rock dowels) may be required to provide additional sliding resistance. If additional lateral load resistance is needed between the footings and bedrock, as determined by the bridge designer, we will provide additional geotechnical recommendations for rock dowels.

ABUTMENT AND WINGWALL DESIGN RECOMMENDATIONS

- Drainage:
  - The abutment and wingwall design should include a drainage system to intercept any groundwater and direct it to a suitable discharge point that does not adversely affect the performance of the abutment and wingwall spread footings. We recommend that drainage be provided in accordance with BDG Section 5.4.2.13.

- Lateral Earth Pressures:
  - Recommendations summarized in the table below are based on the following:
    - As stated above, the proposed bridge will be a simple span supported by full height cantilever-type abutments (not an integral structure). Because of that, passive lateral earth pressure recommendations are not needed).
    - Abutments and wingwalls are backfilled with a free-draining material (i.e., Soil Type 4, BDG Table 3-3; total unit weight = 125 pcf; internal angle of friction = 32 degrees).
    - The abutment and wingwall backwalls are vertical.
    - Adequate drainage is provided, as recommended herein and in accordance with the requirements of the BDG, to eliminate the potential for unbalanced hydrostatic pressures to develop.
    - A -0.7 degree backfill surface at Abutment No. 1 and a 0.7 degree backfill surface at Abutment 2 (based on 1.29 percent grade of proposed vertical profile of Levenseller Road).
    - A 19 degree backfill surface at Abutment No. 1 and Abutment No.2 wingwalls (maximum slope angle indicated by MaineDOT).

Substructure	**Active Lateral Earth Pressure Coefficient (K_a, dim.)**	
	Rankine	**Coulomb**
Abutment No. 1 Breastwall	0.31	0.27
Abutment No. 2 Breastwall		0.28
Abutment No. 1 and 2 Wingwalls	0.37	

  - The Coulomb active earth pressure coefficients apply to wall designs that are "gravity-shaped" or short-heeled, cantilever-types where the top of the stem wall interferes with the shear zone. For long-heeled cantilever-type walls we recommend the use of Rankine active earth pressure coefficients. In addition, alternative Rankine active earth pressure coefficients, based on a range of backfill surface inclinations, for use in designing the wingwalls are provided in the calculations in Appendix E.
  - Additional lateral earth pressures due to live load surcharge are required in accordance with BDG Section 3.6.8 for abutments if an approach slab is not included. When an approach slab is specified, reduction, not elimination of the surcharge load is permitted in accordance with AASHTO LRFD Section 3.11.6.5. We recommend that the live load surcharge be

estimated as a uniform horizontal earth pressure due to an equivalent height of soil that is related to the abutment and wingwall heights, as presented to BDG Table 3-4.

- If determined applicable by MaineDOT, the abutment breastwalls and wingwalls should be designed for a uniform lateral load to account for seismic soil loading in accordance with LRFD Section A.11.3.1 (Mononobe-Okabe Method). Based on the seismic site class (Site Class "C"), we recommend a seismic active earth pressure coefficient, K_{AE}, of 0.32 be used for design of Abutment No. 1 and 0.33 be used for design of Abutment No. 2. In addition, a seismic active earth pressure coefficient equal to 0.47, which is based on a 19 degree backfill slope inclination (maximum anticipated by MaineDOT), should be used for the design of the abutment wingwalls. Please note that the soil pressure calculated using K_{AE} includes both the static and seismic lateral earth loads.

FROST PROTECTION

The abutment and wingwall spread footings will bear directly on bedrock. It is our opinion that the potential for frost-induced heave for foundations bearing on bedrock is low and therefore, a minimum footing embedment depth requirement is not considered necessary.

Construction Considerations

The purpose of this section of the report is to provide comments and recommendations on items related to excavation, earthwork, and other geotechnical aspects of the proposed construction. Since it identifies potential construction issues related to foundations and earthwork, it will aid personnel who monitor the construction activities. Prospective Contractors for this project should evaluate construction issues based on their own knowledge and experience in the Eddington, Maine, area taking into consideration their proposed construction means, methods and procedures.

EXCAVATION

Soil

As stated above, construction of the bridge and the Connector will require a total of approximately 25 to 26 ft of excavation to meet proposed bottom of abutment breastwall bearing levels. Please note that of the 25 to 26 ft of total excavation required, approximately 13 to 14 ft will be within the overburden soils (i.e., glacial till).

We anticipate that excavation of the in-situ fill and glacial till can be accomplished using normal earth-excavating equipment (i.e., hydraulic backhoes and excavators). In our opinion, temporary cut slopes in glacial till should, typically, be stable if constructed no steeper than about 1.5H:1V. Some sloughing and raveling should be anticipated in all temporary earth slopes. All temporary excavations should be made in accordance with all OSHA and other applicable regulatory agency requirements. The Contractor should be responsible for the design, stability, and safety of all temporary excavations.

As noted on the test boring logs, the naturally-deposited glacial till soils may contain cobbles and possibly some large boulders. We recommend that the Contract Documents require the Contractor to include provisions for cobble/boulder removal in their bid.

Bedrock

Based on the elevation of the top of bedrock surface at test boring locations and the proposed footing elevations presented herein, we anticipate that up to approximately 13 ft of bedrock will need to be removed to construct the abutment footings.

It is our opinion that because of the substantial depth to which bedrock needs to be removed and our experience with similar bedrock types, the most practical method of bedrock excavation is controlled blasting. Based on the proposed cut slope angles currently shown on the plans, we anticipate that perimeter control methods such as pre-splitting (i.e., line drilling) will be needed to minimize over-break for the rock slopes adjacent to the bridge foundations. As discussed with you, we recommend that pre-split blasting methods be used to remove rock along the Connector and Abutment 1 and Abutment 2 within the following station limits:

- Left of Connector Centerline: Sta. 236+42 to Sta. 237+87 (145 linear feet)
- Right of Connector Centerline: Sta. 236+78 to Sta. 238+21 (143 linear feet)

CONSTRUCTION DEWATERING

Groundwater was measured in the observation well at depths ranging from approximately 2 to 12 ft BGS (El. 223 to El. 213) during the period 23 July 2018 to 12 May 2021. Based on the measured water levels and considering that the proposed bottom of abutment and wingwall footings vary between El. 200 and El. 209, we anticipate groundwater will be encountered in excavations during construction since the bottom of excavation will be approximately 4 to 23 ft below the measured water levels depending on the time of year that excavation is performed. We anticipate that temporary dewatering will be required and could likely be accomplished by pumping from open sumps and temporary ditches located at the base of the excavations. Sumps should be provided with filters suitable to prevent pumping of fine-grained soil particles.

The Contractor should be responsible for controlling all surface runoff, infiltration and water from other sources at all times during excavation. Rainwater or snowmelt should be directed away from exposed foundation bearing surfaces. Dewatering should be performed as required to maintain the undisturbed nature of soil surfaces and enable all final excavation, foundation construction and backfilling to be completed “in-the-dry.”

Dewatering should be performed in accordance with all applicable regulations. Dewatering effluent should be treated as required by applicable state and local regulations.

BEDROCK SUBGRADE PREPARATION

The nature, slope, and degree of fracturing in the bedrock bearing surfaces will not be evident until the foundation excavations for the abutments and wingwalls are completed. Construction activities that disturb the bedrock below the abutment footings should not be permitted. We recommend that the bedrock surface be cleared of all loose, fractured or weathered/decomposed bedrock and soil (i.e., "unsuitable material") prior to concrete placement. If localized areas of "unsuitable material" are found that extend below the bearing level of the footings, we recommend that Class S concrete be placed from the bottom of excavation up to the proposed footing bearing level, after the unsuitable material has been removed and the surface has been examined in the field by the Resident and/or project Geotechnical Engineer, as discussed below. In cases where more significant excavation of "unsuitable material" is required we recommend that Class A concrete be placed from the bottom of the excavation up to the proposed footing bearing level.

- Foundation bearing areas should be level. If bedrock is observed to slope steeper than 4H:1V at the subgrade elevation, the bedrock should be benched to create level steps or excavated to be completely level. Smooth bedrock, if present, should be roughened or serrated prior to placing concrete to enhance sliding stability.
- In-the-dry or underwater excavation of steeply sloping and/or loose, fractured bedrock may be done using conventional excavation methods. Based on the proposed bearing level of the abutment and wingwall footings and the top of bedrock surface encountered in the test borings we anticipate the need for bedrock removal using controlled blasting techniques.
- Prior to placing concrete for the sub-footings (if over-excavation is required) or abutment and wingwall footings we recommend that the exposed bedrock surface be washed with high pressure water and air to remove loose, fractured and/or decomposed rock fragments and other debris. We also recommend that the prepared bedrock surface be approved by the Resident and/or project Geotechnical Engineer prior to concrete placement.
- It is anticipated that there will be seepage of water from fractures and joints exposed in the bedrock surface. Water should be controlled by pumping from sumps so that subgrade preparation and foundation construction can be completed in-the-dry. We recommend that dewatering effluent be managed in accordance with all local, state and/or federal regulations.

Limitations

This report is prepared for the exclusive use of MaineDOT relative to the subject project. There are no intended beneficiaries other than MaineDOT. Haley & Aldrich shall owe no duty whatsoever to any other person or entity on account of the Agreement or the report. Use of this report by any person or entity other than MaineDOT for any purpose whatsoever is expressly forbidden unless such other person or entity obtains written authorization from MaineDOT and Haley & Aldrich. Use of this report by such other person or entity without the written authorization of MaineDOT and Haley & Aldrich shall be at such other person's or entities sole risk and shall be without legal exposure or liability to Haley & Aldrich.

Use of this report by any person or entity, including by MaineDOT, for a purpose other than relative to the subject project is expressly prohibited unless such person or entity obtains written authorization from Haley & Aldrich indicating that the report is adequate for such other use. Use of this report by any other person or entity for such other purpose without written authorization by Haley & Aldrich shall be at such person's or entities sole risk and shall be without legal exposure or liability to Haley & Aldrich. The information provided herein is based, in part, upon the data obtained from the referenced subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations then appear, it may be necessary to reevaluate the recommendations of this report.

It is our understanding that this report will be included as a reference document in the package that will be provided to the prospective Contractors for bidding. Please note that the recommendations included herein are superseded by the information contained in the CDs and that the information contained in the CDs takes precedence over the information provided in this report.

Please note that geotechnical design recommendations and construction considerations for the Connector will be provided under separate cover.

Closure

We appreciate the opportunity to continue to provide MaineDOT services on this project. Please do not hesitate to contact us if you have any questions or comments.

Sincerely yours,
HALEY & ALDRICH, INC.

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Senior Geotechnical Engineer

Bryan C. Steinert, P.E.
Senior Project Manager

Wayne A. Chadbourne, P.E.
Principal|Lead Quality Control Engineer

Enclosures:

- Table I – Subsurface Exploration Location Data
- Table II – Subsurface Exploration Subsurface Data
- Table III – Subsurface Exploration Bedrock Data
- Figure 1 – Project Locus
- Figure 2 – Site and Subsurface Exploration Location Plan
- Figure 3 – Interpretive Subsurface Profile
- Figure 4 – Abutment No. 1 Interpretive Subsurface Cross Section
- Figure 5 – Abutment No. 2 Interpretive Subsurface Cross Section
- Appendix A – Test Boring Logs and Rock Core Photographs
- Appendix B – Borehole Geophysical Logging Reports
- Appendix C – Observation Well Installation and Groundwater Monitoring Reports
- Appendix D – Laboratory Test Results
- Appendix E – Geotechnical Design Calculations

TABLE I
Subsurface Exploration Location Data
Levenseller Road over Interstate 395/Route 9 Connector, Bridge No. 6649
MaineDOT WIN No. 018915.00
Eddington, Maine

Haley & Aldrich, Inc. File No.: 132076-007

Test Boring No.[1]	Ground Surface Elevation (ft)[3,4]	Station[5]	Offset Distance (ft) & Direction[5,6]	Horizontal Coordinates[2]	
				Northing (Y)	Easting (X)
BB-ELER-101	225.0	237+35	45 LT	478,114	1,756,887
BB-ELER-102	225.8	237+33	40 RT	478,047	1,756,940
HB-BE-151	215.6	235+01	6 RT	477,922	1,756,743
BB-ELER-201	222.7	236+84	40 LT	478,077	1,756,851
BB-ELER-202	225.1	237+15	42 LT	478,098	1,756,873
BB-ELER-203	225.6	237+57	55 LT	478,136	1,756,898
BB-ELER-204	223.2	237+05	56 RT	478,017	1,756,929
BB-ELER-205	225.9	237+35	44 RT	478,045	1,756,944
BB-ELER-206	225.1	237+81	42 RT	478,076	1,756,977
BB-ELER-206A	224.5	237+80	53 RT	478,067	1,756,985
HB-BE-235	219.3	235+97	3 LT	477,991	1,756,809
HB-BE-236	228.5	238+14	4 LT	478,133	1,756,973
HB-BE-237	228.9	239+30	28 LT	478,225	1,757,049

Notes:
1 Test boring locations are shown on Figure 2, Site and Subsurface Exploration Location Plan.
2 As-drilled coordinates of test borings were determined by MaineDOT using GPS survey equipment, are measured in feet and reference NAD83, Maine 2000 Central Zone coordinate system.
3 Ground surface elevations at test boring locations were determined in the field by MaineDOT using GPS survey equipment, are measured in feet and reference the North American Vertical Datum of 1988 (NAVD 88).
4 Station and offset information shown are approximate and are relative to the I-395/Route 9 Connector baseline and were determined by Haley & Aldrich based on information provided by MaineDOT.
5 LT = offset distance toward left direction; RT = offset distance toward right direction; ft = feet.

	Individual	Date
Prepared By:	SSM	2/8/2021
Checked By:	BCS	6/8/2021
Reviewed By:	WAC	8/31/2021

TABLE II
Subsurface Exploration Subsurface Data
Levenseller Road over Interstate 395/Route 9 Connector, Bridge No. 6649
MaineDOT WIN No. 018915.00
Eddington, Maine

Haley & Aldrich, Inc. File No.: 132076-007

Test Boring No.[1]	Ground Surface Elevation[2] (ft)	Stratigraphy Data[2,3]									Bottom of Exploration Depth (ft)	Elevation of Bottom of Exploration[2]
		Bituminous Concrete Thickness	Topsoil/Fill			Glacial Till			Bedrock			
		(ft)	Depth to Top (ft)	Elev. of Top (ft)	Thickness (ft)	Depth to Top (ft)	Elev. of Top (ft)	Thickness (ft)	Depth to Top (ft)	Elev. of Top (ft)		
BB-ELER-101	225.0	NE	0.0	225.0	2.0	2.0	223.0	12	14	210.6	26.3	198.7
BB-ELER-102	225.8	0.3	0.3	225.5	2.0	2.3	223.5	11	13	213.0	30.2	195.6
HB-BE-151	215.6	NE	0.0	215.6	0.5	0.5	215.1	22	23	192.8	25.0	190.6
BB-ELER-201	222.7	NE	NE	NE	NE	0.0	222.7	20	20	202.6	28.5	194.2
BB-ELER-202	225.1	0.3	0.3	224.8	2.2	2.5	222.6	14	17	208.6	37.0	188.1
BB-ELER-203	225.6	NE	0.0	225.6	3.0	3.0	222.6	12	15	210.4	20.3	205.3
BB-ELER-204	223.2	NE	0.0	223.2	4.8	4.8	218.4	3	8	215.0	14.9	208.3
BB-ELER-205	225.9	0.5	0.5	225.4	2.0	2.5	223.4	12	15	211.4	35.0	190.9
BB-ELER-206	225.1	NE	0.0	225.1	0.2	0.2	224.9	10	10	214.7	16.0	209.1
BB-ELER-206A	224.5	NE	NE	NE	NE	0.0	224.5	10	10	215.0	37.0	187.5
HB-BE-235	219.3	NE	0.0	219.3	0.5	0.5	218.8	12	13	206.5	29.0	190.3
HB-BE-236	228.5	NE	0.0	228.5	2.5	2.5	226.0	11	14	215.0	34.0	194.5
HB-BE-237	228.9	NE	NE	NE	NE	0.0	228.9	8	8	220.9	29	199.9

Notes:
1 Test boring locations are shown on Figure 2, Site and Subsurface Exploration Location Plan.
2 Ground surface elevations at test boring locations were determined in the field by MaineDOT using GPS survey equipment, are measured in feet and reference the North American Vertical Datum of 1988 (NAVD 88).
3 "NE" indicates stratum was not encountered in test boring.

	Individual	Date
Prepared By:	SSM	2/8/2021
Checked By:	BCS	6/8/2021
Reviewed By:	WAC	8/31/2021

TABLE III
Subsurface Exploration Bedrock Data
Levenseller Road over Interstate 395/Route 9 Connector, Bridge No. 6649
MaineDOT WIN No. 018915.00
Eddington, Maine

Haley & Aldrich, Inc. File No.: 132076-007

Test Boring No.[1]	Ground Surface Elevation[2] (ft)	Bedrock Core Diameter (in.)	Run					Total Core		Rock Quality Designation[4,5]			Physical Rock Parameters		Lithologic, Rock Mass and Discontinuity Description
			No.	Depth Below Ground Surface (ft) Top	Bottom	Midpoint	Total Length (ft)	Recovered Length (ft)	%	Length (ft)	%	Designation	Weathering	Estimated Field Strength	
BB-ELER-101	225.0	NQ (1.875")	R1	16.4	21.3	18.9	4.9	4.6	93%	3.7	75%	Fair	Fresh	Hard	Grey, aphanitic, SILTSTONE, discontinuities dipping at low to moderate angles (5 to 55 degrees from horizontal axis), spacing very close to close (<2 in. to 12 in.), discontinuity aperatures are tight. Discontinuity surfaces oxidized with occasional calcite coatings. Frequent thin calcite veins and occasional thin quartz veins.
			R2	21.3	26.3	23.8	5.0	5.0	100%	4.3	85%	Good	Fresh	Hard	
BB-ELER-102	225.8	NQ (1.875")	R1	14.5	18.5	16.5	4.0	3.3	83%	0.6	15%	Very Poor	Fresh to Slightly	Mod. Hard to Hard	Grey, aphanitic, PHYLLITE, discontinuities dipping at moderate to steep angles (35 to 85 degrees from horizontal axis), spacing very close to close (<2 in. to 12 in.), discontinuity aperatures are tight to open. Occasional calcite veins, pitting, slightly weathered joint surfaces and fractured zones.
			R2	18.5	22.2	20.4	3.7	3.1	83%	0.5	14%	Very Poor	Fresh to Moderately	Mod. Hard to Hard	
			R3	22.2	27.2	24.7	5.0	4.5	90%	1.4	28%	Poor	Fresh to Moderately	Mod. Hard to Hard	
			R4	27.2	30.2	28.7	3.0	2.6	86%	1.2	39%	Poor	Fresh to Moderately	Mod. Hard to Hard	
BB-ELER-201	222.7	NQ (1.875")	R1	21.3	26.3	23.8	5.0	3.3	65%	2.4	48%	Poor	Slight	Mod. Hard	Grey, aphanitic, SILTSTONE, discontinuities dipping at moderate to steep angles (35 to 85 degrees from horizontal axis), spacing very close to close (<2 in. to 12 in.), discontinuity aperatures are tight to open. Discontinuity surfaces oxidized. Frequent calcite veins.
			R2	26.3	28.5	27.4	2.2	1.7	76%	0.3	15%	Very Poor	Slight	Mod. Hard	
BB-ELER-202	225.1	NQ (1.875")	R1	17.0	21.0	19.0	4.0	3.0	75%	0.3	8%	Very Poor	Slight to Moderately	Mod. Hard	Grey, aphanitic, SLATE, discontinuities dipping at low to steep angles (5 to 85 degrees from horizontal axis), spacing very close to close (<2 in. to 12 in.), discontinuity aperatures are open. Discontinuity surfaces oxidized. Common calcite veins, quartz veins and quartz intrusions up to 3-in. thick.
			R2	21.0	25.8	23.4	4.8	3.2	66%	2.2	45%	Poor	Fresh	Hard	
			R3	25.8	29.8	27.8	4.0	4.0	100%	3.1	77%	Good	Fresh	Hard	
			R4	29.8	34.8	32.3	5.0	5.0	100%	3.4	67%	Fair	Fresh	Hard	
			R5	34.8	37.0	35.9	2.2	2.1	96%	1.1	49%	Poor	Fresh	Hard	
BB-ELER-203	225.6	NQ (1.875")	R1	15.3	20.3	17.8	5.0	3.4	67%	2.4	47%	Poor	Fresh to Slightly	Hard	Grey, aphanitic, SILTSTONE, discontinuities dipping at moderate angles (35 to 55 degrees from horizontal axis), spacing close (2 in. to 12 in.), discontinuity aperatures are tight. Discontinuity surfaces iron stained. Frequent calcite veins up to 1-in. thick. Highly fractured from 15.3 to 17.0'.
BB-ELER-204	223.2	NQ (1.875")	R1	9.9	14.9	12.4	5.0	4.0	80%	1.9	38%	Poor	Fresh to Slightly	Hard	Grey, aphanitic, SILTSTONE, discontinuities dipping at moderate to vertical angles (35 to 90 degrees from horizontal axis), spacing very close to moderate (<2 in. to 36 in.), discontinuity aperatures are tight to open. Occasional to frequent calcite veins up to 1-in. thick. Highly fractured from 12.5 to 13.5'.
BB-ELER-205	225.9	NQ (1.875")	R1	15.0	18.0	16.5	3.0	2.7	89%	0.9	31%	Poor	Fresh	Mod. Hard	Grey, aphanitic, SLATE, discontinuities dipping at low to steep angles (5 to 85 degrees from horizontal axis), spacing very close to close (<2 in. to 12 in.), discontinuity aperatures are tight. Discontinuity surfaces occasionally oxidized. Few to occasional calcite veins and quartz veins up to 1.5-in. thick. Extremely fractured vertical joints from 16.0 to 16.5', 29.5 to 30.0', and 31.0 to 31.7'.
			R2	18.0	20.0	19.0	2.0	1.8	92%	0.7	33%	Poor	Fresh	Mod. Hard to Hard	
			R3	20.0	22.6	21.3	2.6	2.3	87%	0.3	13%	Very Poor	Fresh	Mod. Hard to Hard	
			R4	22.6	25.0	23.8	2.4	2.3	97%	0.7	31%	Poor	Fresh	Mod. Hard to Hard	
			R5	25.0	30.0	27.5	5.0	5.0	100%	2.9	57%	Fair	Fresh	Hard to Very Hard	
			R6	30.0	35.0	32.5	5.0	5.0	100%	2.3	45%	Poor	Fresh	Hard to Very Hard	
BB-ELER-206	225.1	NQ (1.875")	R1	11.0	13.6	12.3	2.6	2.5	96%	0.0	0%	Very Poor	Slight to Moderately	Mod. Hard to Hard	Grey, aphanitic, SILTSTONE, discontinuities dipping at moderate angles (35 to 55 degrees from horizontal axis), spacing very close to close (<2 in. to 12 in.), discontinuity aperatures are tight to open. Few surfaces slightly iron stained few calcite coatings. Frequent thin calcite veins and occasional thin quartz veins. Highly fractured zones.
			R2	13.6	16.0	14.8	2.4	2.0	83%	0.0	0%	Very Poor	Slight to Moderately	Mod. Hard to Hard	
BB-ELER-206A	224.5	NQ (1.875")	R1	10.0	15.0	12.5	5.0	4.7	93%	2.9	57%	Fair	Fresh to Slightly	Hard to Very Hard	Grey, aphanitic, SILTSTONE, discontinuities horizontal or dipping at moderate to steep angles (35 to 85 degrees from horizontal axis), spacing very close to moderately close (<2 in. to 36 in.), discontinuity aperatures are tight to open. Discontinuity surfaces slightly oxidized. Occasional calcite veins, few calcite stringers, occasional calcite-infilled joints. Intermittent highly fractured zones. Silt infilled joint at 16.0'. Dark grey/black slate bed 2.5-in. thick at 21.0'.
			R2	15.0	20.0	17.5	5.0	4.4	88%	2.7	53%	Fair	Fresh to Slightly	Hard to Very Hard	
			R3	20.0	22.0	21.0	2.0	1.1	54%	0.0	0%	Very Poor	Slight	Mod. Hard to Hard	
			R4	22.0	22.8	22.4	0.8	0.4	52%	0.0	0%	Very Poor	Fresh	Mod. Hard to Hard	
			R5	22.8	25.0	23.9	2.2	2.2	100%	0.0	0%	Very Poor	Slight	Mod. Hard to Hard	
			R6	25.0	29.0	27.0	4.0	3.2	81%	1.7	42%	Poor	Fresh to Slightly	Mod. Hard to Hard	
			R7	29.0	32.2	30.6	3.2	3.0	95%	2.4	76%	Good	Fresh to Slightly	Mod. Hard to Hard	
			R8	32.2	34.4	33.3	2.2	1.5	68%	0.0	0%	Very Poor	Fresh to Slightly	Mod. Hard to Hard	
			R9	34.4	37.0	35.7	2.6	2.1	80%	2.1	80%	Good	Fresh	Hard	

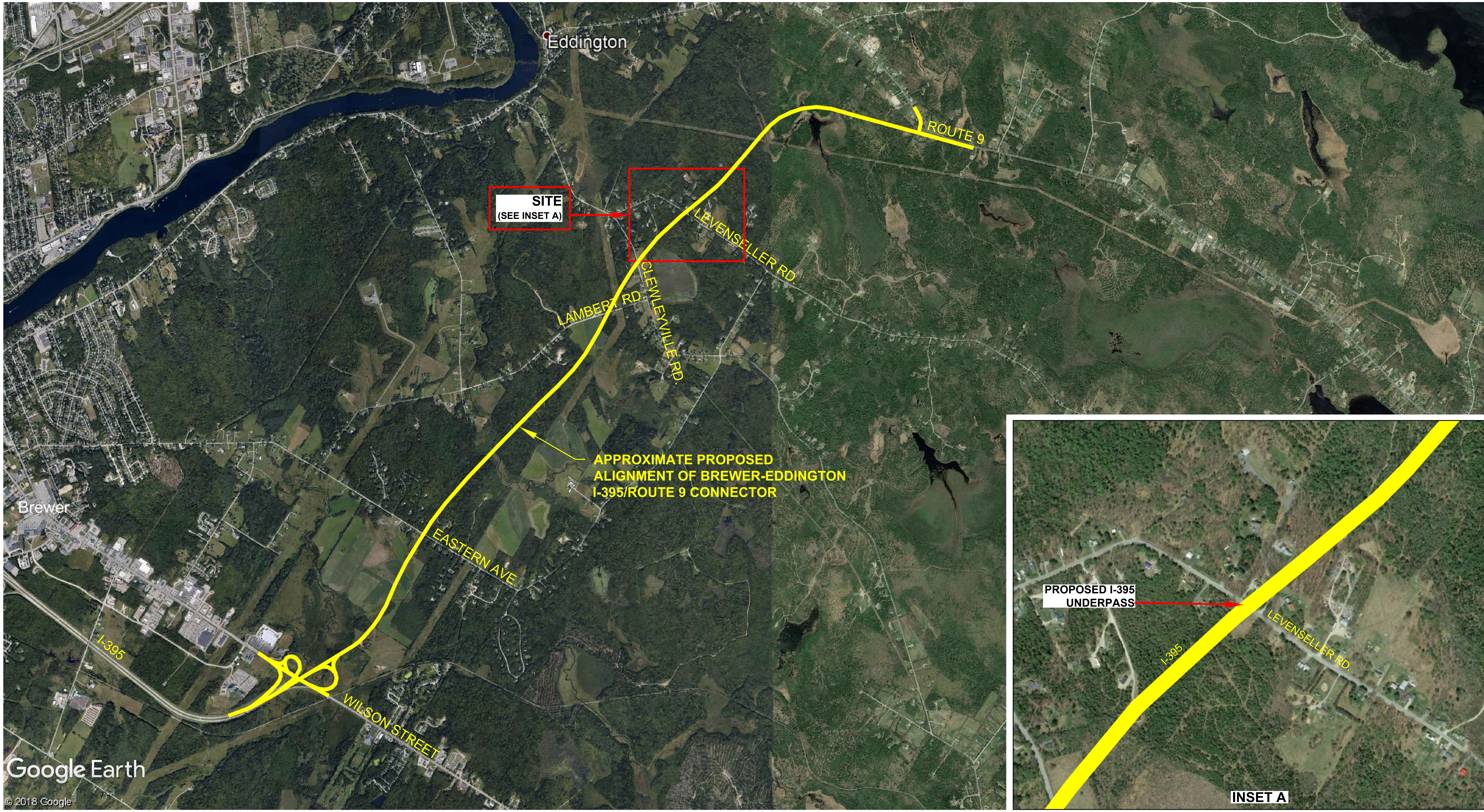
TABLE III
Subsurface Exploration Bedrock Data
Levenseller Road over Interstate 395/Route 9 Connector, Bridge No. 6649
MaineDOT WIN No. 018915.00
Eddington, Maine

Haley & Aldrich, Inc. File No.: 132076-007

Test Boring No.[1]	Ground Surface Elevation[2] (ft)	Bedrock Core Diameter (in.)	Run					Total Core		Rock Quality Designation[4,5]			Physical Rock Parameters		Lithologic, Rock Mass and Discontinuity Description
			No.	Depth Below Ground Surface (ft) Top	Bottom	Midpoint	Total Length (ft)	Recovered Length (ft)	%	Length (ft)	%	Designation	Weathering	Estimated Field Strength	
HB-BE-235	219.3	NQ (1.875")	R1	15.0	17.0	16.0	2.0	1.7	83	0.0	0%	Very Poor	Slight	Moderately Hard	Grey, aphanitic, SILTSTONE. Discontinuities dipping at moderate to steep angles (35 to 85 degrees from horizontal axis), spacing very close to close (<2 in. to 12 in.), discontinuity aperatures are smooth to rough, tight to open, planar, Calcite/quartz intrusion (1 to 2-in. thick), calcite veins (0.125-in. thick). Highly fractured zone from approximately 25.5 to 27.0 ft.
			R2	17.0	18.5	17.8	1.5	1.0	67	0.0	0%	Very Poor	Slight	Moderately Hard	
			R3	18.5	21.8	20.2	3.3	1.7	51	0.5	15%	Very Poor	Slight	Moderately Hard	
			R4	21.8	27.0	24.4	5.2	4.4	85	2.2	43%	Poor	Slight	Moderately Hard	
			R5	27.0	29.0	28.0	2.0	2.0	100	0.8	42%	Poor	Slight	Moderately Hard	
HB-BE-236	228.5	NQ (1.875")	R1	15.0	19.0	17.0	4.0	4.0	100	1.2	31%	Poor	Slight	Moderately Hard	Grey, aphanitic, SILTSTONE. Discontinuities dipping at moderate to steep angles (35 to 85 degrees from horizontal axis), spacing very close to close (<2 in. to 12 in.), discontinuity aperatures are tight to open. Highly fractured zone from approximately 19.5 to 20.0 ft.
			R2	19.0	24.0	21.5	5.0	5.0	100	2.7	53%	Fair	Slight	Moderately Hard	
			R3	24.0	29.0	26.5	5.0	5.0	100	3.4	68%	Fair	Fresh	Moderately Hard	
			R4	29.0	34.0	31.5	5.0	5.0	100	2.3	45%	Poor	Moderate	Moderately Hard	
HB-BE-237	228.9	NQ (1.875")	R1	10.0	13.5	11.8	3.5	2.8	81	0.0	0%	Very Poor	Slight	Moderately Hard	Grey, aphanitic, SILTSTONE. Discontinuities dipping at low to vertical angles (5 to 90 degrees from horizontal axis), discontinuity aperatures are rough, open to tight, planar to undulating, close, iron staining on some joint surfaces, calcite intrusions/veins. Highly fractured zone from approximately 27.3 to 29.0 ft.
			R2	13.5	17.5	15.5	4.0	2.8	71	1.3	33%	Poor	Slight	Moderately Hard	
			R3	17.5	21.5	19.5	4.0	3.9	98	3.9	98%	Excellent	Fresh to Slight	Mod. Hard to Hard	
			R4	21.5	26.4	24.0	4.9	3.8	78	3.6	73%	Fair	Fresh to Slight	Mod. Hard to Hard	
			R5	26.4	29.0	27.7	2.6	0.7	26	0.0	0%	Very Poor	Slight	Mod. Hard to Hard	

Notes:
[1] Test boring locations are shown on Figure 2, Site and Subsurface Exploration Location Plan.
[2] Ground surface elevations at test boring locations were determined in the field by MaineDOT using GPS survey equipment, are measured in feet and reference the North American Vertical Datum of 1988 (NAVD 88).
[3] TCR = total core recovery. Total core recovery is the length of core recovered divided by the length of the run.
[4] RQD = rock quality designation. RQD is the total length of intact, full-diameter core pieces recovered with a length greater than or equal to twice the core diameter (i.e., length of at least 4 in.) measured along the core axis. The percent RQD is the total length of RQD measured versus the run length. Note that vertical discontinuities are not included in determination of RQD.
[5] Designation based on RQD in accordance with MaineDOT Geotechnical Section "Key to Soil and Rock Descriptions and Terms" Field Identification Information.

	Individual	Date
Prepared By:	JAD	4/9/2021
Checked By:	BCS	6/8/2021
Reviewed By:	WAC	8/31/2021



NOTES

1. IMAGE TAKEN FROM GOOGLE EARTH IMAGES, 2018.

0 2950 5900
APPROX. SCALE IN FEET

HALEY ALDRICH

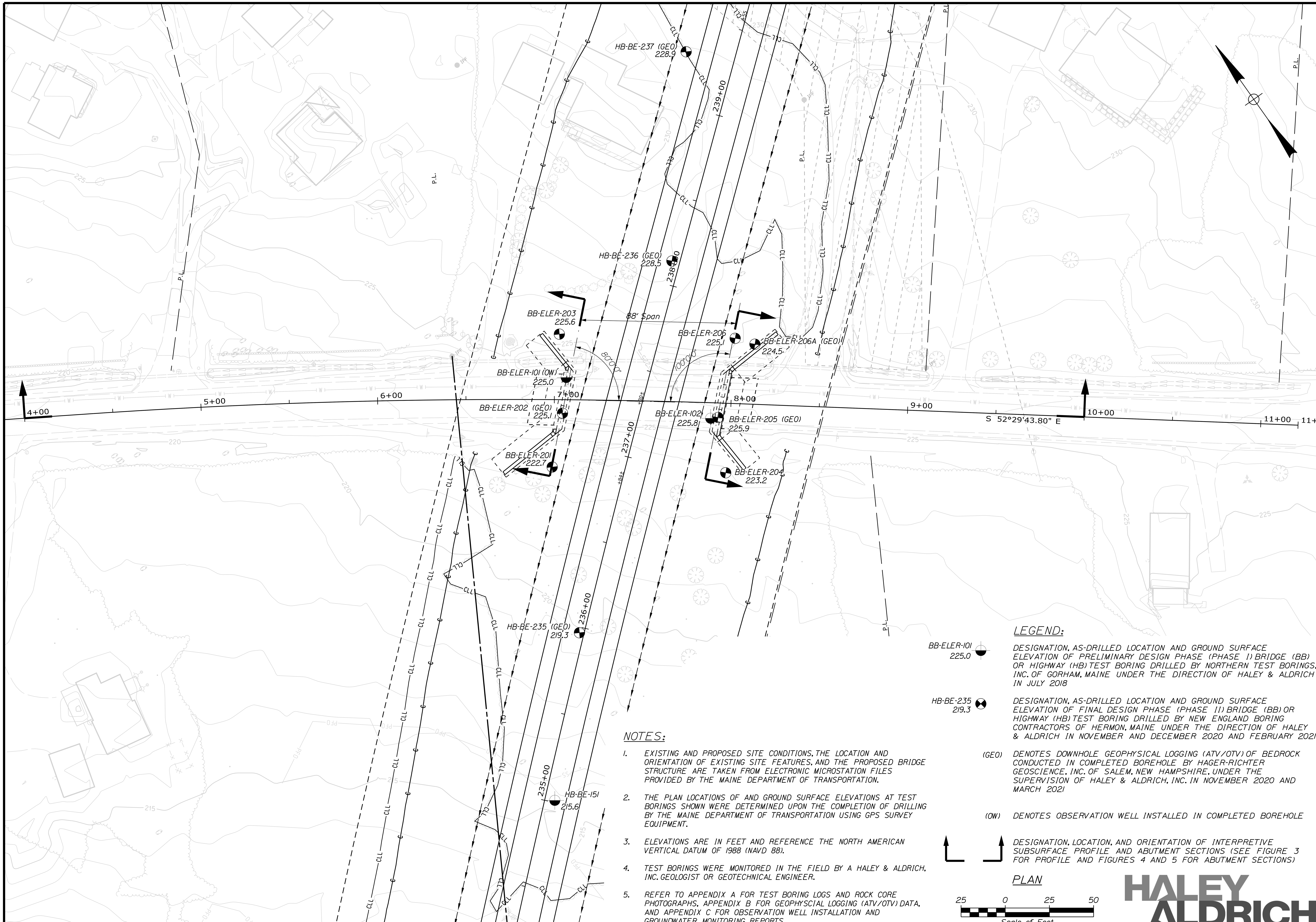
LEVENSELLER ROAD OVER INTERSTATE 395/ROUTE 9
CONNECTOR, BRIDGE NO. 6649
MAINEDOT WIN 018915.00
EDDINGTON, MAINE

PROJECT LOCUS

SCALE: AS SHOWN
AUGUST 2021

FIGURE 1

Filename: ...\048_Plan_LevensellerRoad.dgn   Division: Username: Date: 9/2/2021



LEGEND:

BB-ELER-101 225.0 — DESIGNATION, AS-DRILLED LOCATION AND GROUND SURFACE ELEVATION OF PRELIMINARY DESIGN PHASE (PHASE I) BRIDGE (BB) OR HIGHWAY (HB) TEST BORING DRILLED BY NORTHERN TEST BORINGS, INC. OF GORHAM, MAINE UNDER THE DIRECTION OF HALEY & ALDRICH IN JULY 2018

HB-BE-235 219.3 — DESIGNATION, AS-DRILLED LOCATION AND GROUND SURFACE ELEVATION OF FINAL DESIGN PHASE (PHASE II) BRIDGE (BB) OR HIGHWAY (HB) TEST BORING DRILLED BY NEW ENGLAND BORING CONTRACTORS OF HERMON, MAINE UNDER THE DIRECTION OF HALEY & ALDRICH IN NOVEMBER AND DECEMBER 2020 AND FEBRUARY 2021

(GEO) — DENOTES DOWNHOLE GEOPHYSICAL LOGGING (ATV/OTV) OF BEDROCK CONDUCTED IN COMPLETED BOREHOLE BY HAGER-RICHTER GEOSCIENCE, INC. OF SALEM, NEW HAMPSHIRE, UNDER THE SUPERVISION OF HALEY & ALDRICH, INC. IN NOVEMBER 2020 AND MARCH 2021

(OW) — DENOTES OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE

DESIGNATION, LOCATION, AND ORIENTATION OF INTERPRETIVE SUBSURFACE PROFILE AND ABUTMENT SECTIONS (SEE FIGURE 3 FOR PROFILE AND FIGURES 4 AND 5 FOR ABUTMENT SECTIONS)

PLAN

25 0 25 50
Scale of Feet

NOTES:

1. EXISTING AND PROPOSED SITE CONDITIONS, THE LOCATION AND ORIENTATION OF EXISTING SITE FEATURES, AND THE PROPOSED BRIDGE STRUCTURE ARE TAKEN FROM ELECTRONIC MICROSTATION FILES PROVIDED BY THE MAINE DEPARTMENT OF TRANSPORTATION.
2. THE PLAN LOCATIONS OF AND GROUND SURFACE ELEVATIONS AT TEST BORINGS SHOWN WERE DETERMINED UPON THE COMPLETION OF DRILLING BY THE MAINE DEPARTMENT OF TRANSPORTATION USING GPS SURVEY EQUIPMENT.
3. ELEVATIONS ARE IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
4. TEST BORINGS WERE MONITORED IN THE FIELD BY A HALEY & ALDRICH, INC. GEOLOGIST OR GEOTECHNICAL ENGINEER.
5. REFER TO APPENDIX A FOR TEST BORING LOGS AND ROCK CORE PHOTOGRAPHS, APPENDIX B FOR GEOPHYSCIAL LOGGING (ATV/OTV) DATA, AND APPENDIX C FOR OBSERVATION WELL INSTALLATION AND GROUNDWATER MONITORING REPORTS.

HALEY ALDRICH

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

STP-1891(500)

BRIDGE NO.   WIN 018915.00   BRIDGE PLANS

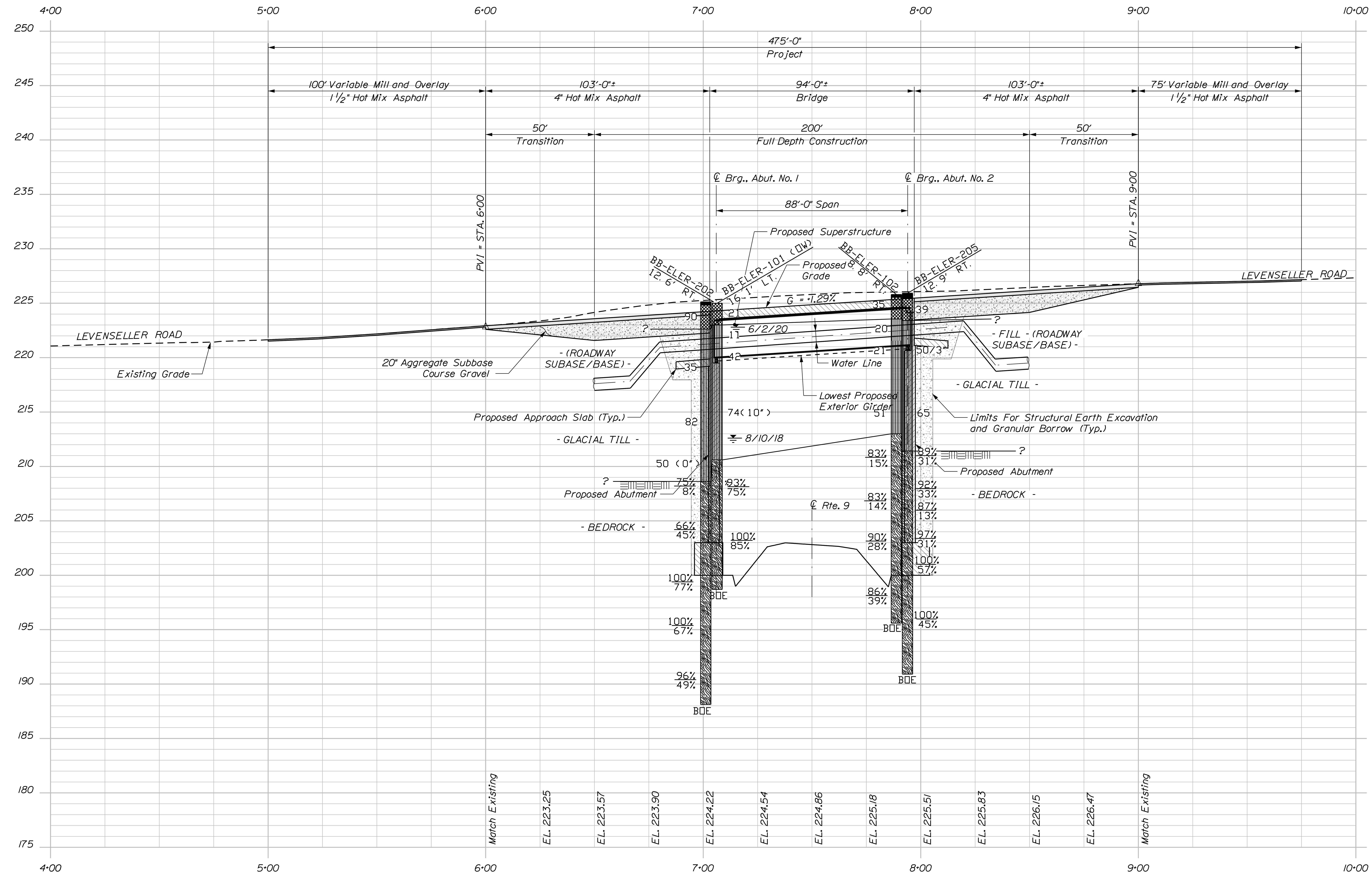
	BY	DATE
PROJ. MANAGER	M. WIGHT	
DESIGN-DETAILED	B. STEINERT	K. POST 3-31-20
CHECKED-REVIEWED	B. STEINERT	W. CHADBOURNE 8-31-21
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE
P.E. NUMBER
DATE

LEVENSELLER ROAD OVER I-395/ROUTE 9 CONNECTOR, BRIDGE NO. 6649
EDDINGTON   PENOBSCOT COUNTY

SITE AND SUBSURFACE EXPLORATION LOCATION PLAN

FIGURE 2 OF 5



LEGEND:

- Boring No. / Offset
- Pavement Thickness, if applicable
- 10 — Energy Corrected Standard Penetration Test (SPT) N60-Value (Blows Per Foot)
- Water Level Measured in Observation Well Installed in Completed Borehole
- Approximate Top of Bedrock
- 64% Percent Recovery
- 18% Percent Rock Quality Designation (RQD)
- BOE= Bottom of Exploration

NOTES:

1. BORING OFFSET BASED ON EXISTING LEVENSELLAR ROAD BASELINE.
2. THIS GENERALIZED INTERPRETIVE SUBSURFACE PROFILE IS INTENDED TO CONVEY TRENDS IN SUBSURFACE CONDITIONS. THE BOUNDARIES BETWEEN STRATA ARE APPROXIMATE AND IDEALIZED, AND HAVE BEEN DEVELOPED BY INTERPRETATIONS OF WIDELY SPACED EXPLORATIONS AND SAMPLES. ACTUAL SOIL TRANSITIONS MAY VARY AND ARE PROBABLY MORE ERRATIC. FOR MORE SPECIFIC INFORMATION REFER TO THE BORING LOGS IN APPENDIX A.
3. EXISTING AND PROPOSED SITE CONDITIONS, THE LOCATION AND ORIENTATION OF EXISTING SITE FEATURES, AND THE PROPOSED BRIDGE STRUCTURE ARE TAKEN FROM ELECTRONIC MICROSTATION FILES PROVIDED BY THE MAINE DEPARTMENT OF TRANSPORTATION.
4. ELEVATIONS ARE IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
5. REFER TO APPENDIX A FOR TEST BORING LOGS AND ROCK CORE PHOTOGRAPHS AND APPENDIX C FOR OBSERVATION WELL INSTALLATION AND GROUNDWATER MONITORING REPORTS.
6. REFER TO FIGURE 2 FOR LOCATION AND ORIENTATION OF PROFILE.

Horiz. 25 0 25 50
Vert. 5 0 5 10
Scale of Feet

HALEY ALDRICH

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

STP-1891(500)

WIN 018915.00

BRIDGE PLANS

BRIDGE NO.

		BY	DATE
PROJ. MANAGER	M. WIGHT		
DESIGN-DETAILED	E. FORCE	K. POST	4-2-20
CHECKED-REVIEWED	B. STEINERT	W. CHADBOURNE	8-31-21
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

P.E. NUMBER

DATE

LEVENSELLER ROAD OVER I-395/ROUTE 9 CONNECTOR, BRIDGE NO. 6649
EDDINGTON PENOBSCOT COUNTY

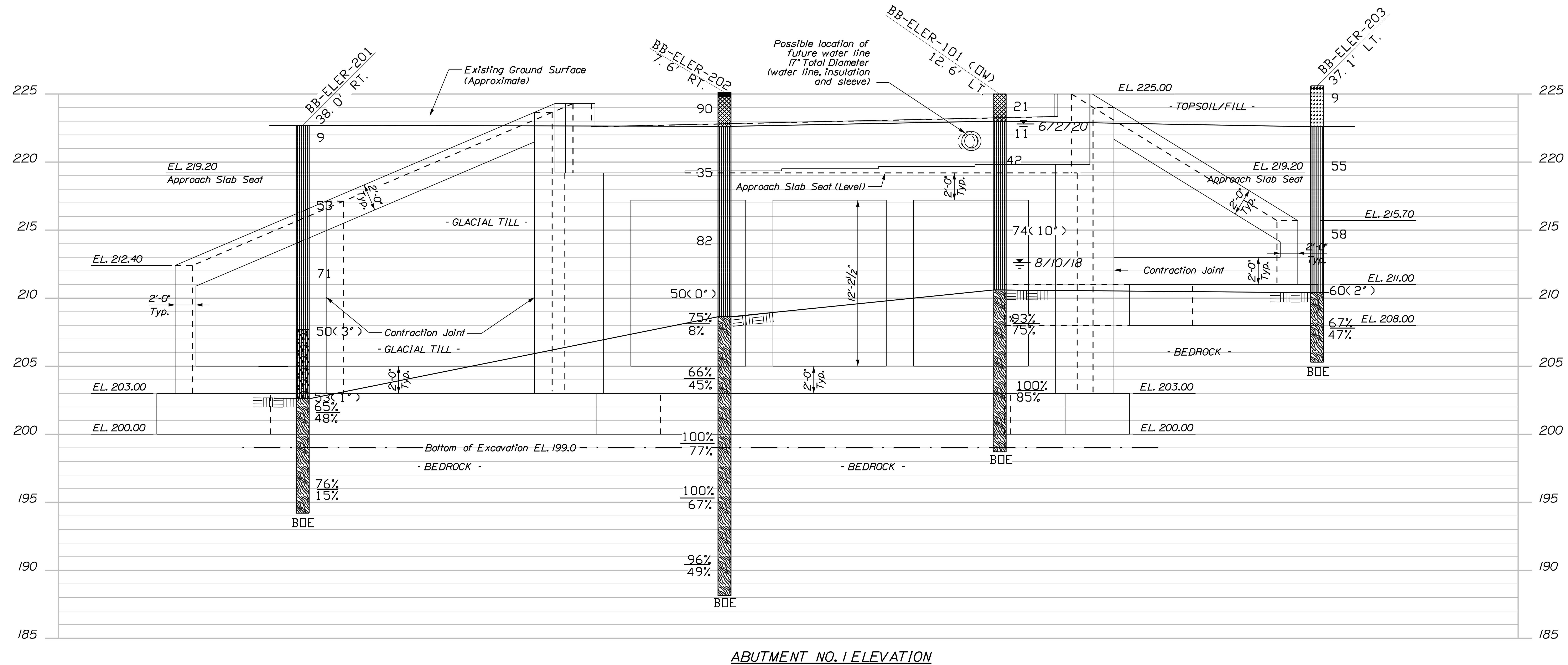
INTERPRETIVE SUBSURFACE PROFILE

SHEET NUMBER

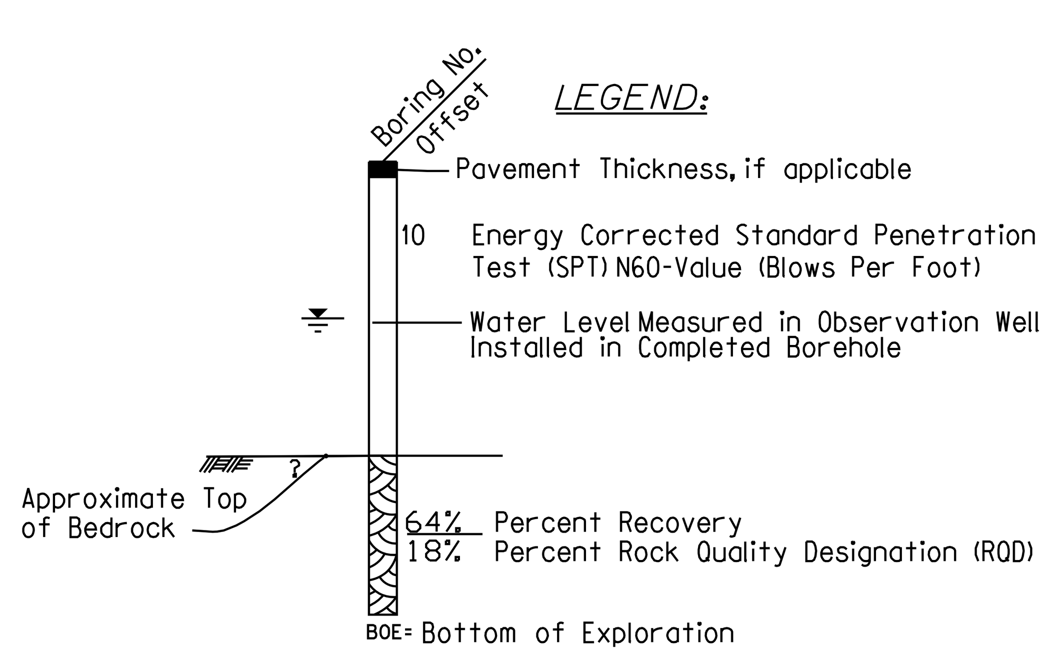
3

OF 5

Filename: ...\049_Profile_LevensellerRoad.dgn Division: Username: Date:9/2/2021



ABUTMENT NO. 1 ELEVATION



NOTES:

1. BORING OFFSET BASED ON EXISTING LEVENSELLAR ROAD BASELINE.
2. THIS GENERALIZED INTERPRETIVE SUBSURFACE CROSS SECTION IS INTENDED TO CONVEY TRENDS IN SUBSURFACE CONDITIONS. THE BOUNDARIES BETWEEN STRATA ARE APPROXIMATE AND IDEALIZED, AND HAVE BEEN DEVELOPED BY INTERPRETATIONS OF WIDELY SPACED EXPLORATIONS AND SAMPLES. ACTUAL SOIL TRANSITIONS MAY VARY AND ARE PROBABLY MORE ERRATIC. FOR MORE SPECIFIC INFORMATION REFER TO THE BORING LOGS IN APPENDIX A.
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4. ELEVATIONS ARE IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
5. REFER TO APPENDIX A FOR TEST BORING LOGS AND ROCK CORE PHOTOGRAPHS AND APPENDIX C FOR OBSERVATION WELL INSTALLATION AND GROUNDWATER MONITORING REPORTS.
6. REFER TO FIGURE 2 FOR LOCATION AND ORIENTATION OF CROSS SECTION.

Horiz. 5 0 5 10
Vert. 5 0 5 10
Scale of Feet

HALEY ALDRICH

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

STP-1891(500)

BRIDGE NO. | WIN 018915.00 | BRIDGE PLANS

		BY	DATE
PROJ. MANAGER	M. WIGHT		
DESIGN-DETAILED	E. FORCE	K. POST	4-2-20
CHECKED-REVIEWED	B. STEINERT	W. CHADBOURNE	8-31-21
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

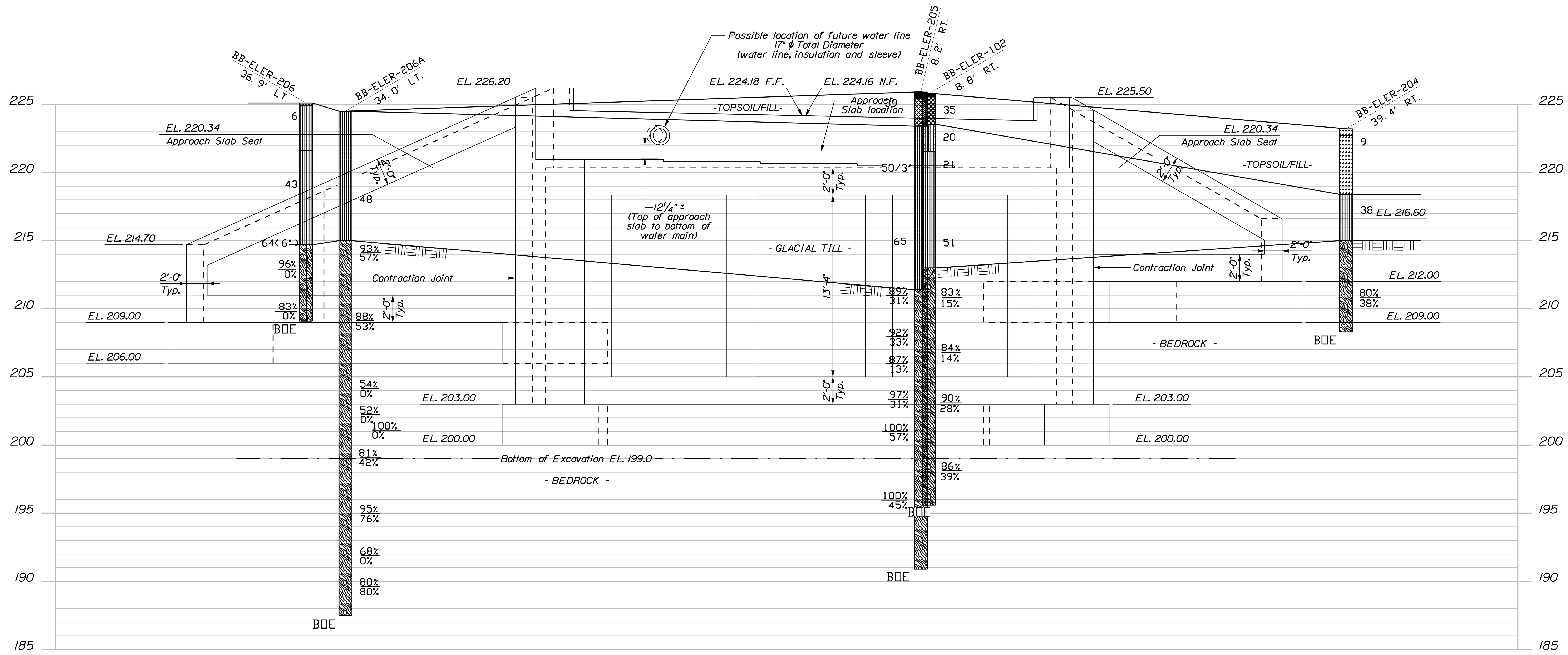
SIGNATURE | P.E. NUMBER | DATE

LEVENSELLER ROAD OVER I-395/ROUTE 9 CONNECTOR, BRIDGE NO. 6649
EDDINGTON PENOBSCOT COUNTY

ABUTMENT NO. 1 INTERPRETIVE SUBSURFACE CROSS SECTION

SHEET NUMBER
4
OF 5

Filename: ...\068_ISCS1_LevensellerRoad.dgn Division: Username: Date:9/2/2021



ABUTMENT NO. 2 ELEVATION

LEGEND

Boring No. / Offset

- Pavement Thickness, if applicable
- 10 Energy Corrected Standard Penetration Test (SPT) N60-Value (Blows Per Foot)
- Approximate Top of Bedrock
- 64% Percent Recovery
- 18% Percent Rock Quality Designation (RQD)
- BOE= Bottom of Exploration

NOTES:

1. BORING OFFSET BASED ON EXISTING LEVENSELLAR ROAD BASELINE.
2. THIS GENERALIZED INTERPRETIVE SUBSURFACE CROSS SECTION IS INTENDED TO CONVEY TRENDS IN SUBSURFACE CONDITIONS. THE BOUNDARIES BETWEEN STRATA ARE APPROXIMATE AND IDEALIZED, AND HAVE BEEN DEVELOPED BY INTERPRETATIONS OF WIDELY SPACED EXPLORATIONS AND SAMPLES. ACTUAL SOIL TRANSITIONS MAY VARY AND ARE PROBABLY MORE ERRATIC. FOR MORE SPECIFIC INFORMATION REFER TO THE BORING LOGS IN APPENDIX A.
3. EXISTING AND PROPOSED SITE CONDITIONS. THE LOCATION AND ORIENTATION OF EXISTING SITE FEATURES, AND THE PROPOSED BRIDGE STRUCTURE ARE TAKEN FROM ELECTRONIC MICROSTATION FILES PROVIDED BY THE MAINE DEPARTMENT OF TRANSPORTATION.
4. ELEVATIONS ARE IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
5. REFER TO APPENDIX A FOR TEST BORING LOGS AND ROCK CORE PHOTOGRAPHS AND APPENDIX C FOR OBSERVATION WELL INSTALLATION AND GROUNDWATER MONITORING REPORTS.
6. REFER TO FIGURE 2 FOR LOCATION AND ORIENTATION OF CROSS SECTION.

Horiz. 5 0 5 10
Vert. 5 0 5 10
Scale of Feet

HALEY ALDRICH

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

STP-1891(500)

BRIDGE NO. | WIN 018915.00 | BRIDGE PLANS

		BY	DATE
PROJ. MANAGER	M. WIGHT		
DESIGN-DETAILED	E. FORCE	K. POST	4-2-20
CHECKED-REVIEWED	B. STEINERT	W. CHADBOURNE	8-31-21
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

P.E. NUMBER

DATE

LEVENSELLER ROAD OVER I-395/ROUTE 9 CONNECTOR, BRIDGE NO. 6649
EDDINGTON PENOBSCOT COUNTY

ABUTMENT NO. 2 INTERPRETIVE SUBSURFACE CROSS SECTION

SHEET NUMBER 5 OF 5

Filename: ...\069_ISCS2_LevensellerRoad.dgn Division: Username: Date:9/2/2021

APPENDIX A

Test Boring Logs and
Rock Core Photographs

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (more than half of material is larger than No. 200 sieve size)	GRAVELS (more than half of coarse fraction is larger than No. 4 sieve size)	CLEAN GRAVELS (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel sand mixtures, little or no fines.
		GRAVEL WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (more than half of coarse fraction is smaller than No. 4 sieve size)	CLEAN SANDS (little or no fines)	SW	Well-graded sands, Gravelly sands, little or no fines
			SP	Poorly-graded sands, Gravelly sand, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (more than half of material is smaller than No. 200 sieve size)	SILTS AND CLAYS (liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, Silty or Clayey fine sands, or Clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, Gravelly clays, Sandy clays, Silty clays, lean clays.
			OL	Organic silts and organic Silty clays of low plasticity.
	SILTS AND CLAYS (liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine Sandy or Silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

Desired Soil Observations (in this order, if applicable):
Color (Munsell color chart)
Moisture (dry, damp, moist, wet)
Density/Consistency (from above right hand side)
Texture (fine, medium, coarse, etc.)
Name (Sand, Silty Sand, Clay, etc., including portions - trace, little, etc.)
Gradation (well-graded, poorly-graded, uniform, etc.)
Plasticity (non-plastic, slightly plastic, moderately plastic, highly plastic)
Structure (layering, fractures, cracks, etc.)
Bonding (well, moderately, loosely, etc.,)
Cementation (weak, moderate, or strong)
Geologic Origin (till, marine clay, alluvium, etc.)
Groundwater level

Maine Department of Transportation
Geotechnical Section
Key to Soil and Rock Descriptions and Terms
Field Identification Information

MODIFIED BURMISTER SYSTEM

Descriptive Term	Portion of Total (%)
trace	0 - 10
little	11 - 20
some	21 - 35
adjective (e.g. Sandy, Clayey)	36 - 50

TERMS DESCRIBING DENSITY/CONSISTENCY

Coarse-grained soils (more than half of material is larger than No. 200 sieve): Includes (1) clean gravels; (2) Silty or Clayey gravels; and (3) Silty, Clayey or Gravelly sands. Density is rated according to standard penetration resistance (N-value).

Density of Cohesionless Soils	Standard Penetration Resistance N-Value (blows per foot)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

Fine-grained soils (more than half of material is smaller than No. 200 sieve): Includes (1) inorganic and organic silts and clays; (2) Gravelly, Sandy or Silty clays; and (3) Clayey silts. Consistency is rated according to undrained shear strength as indicated.

Consistency of Cohesive soils	SPT N-Value (blows per foot)	Approximate Undrained Shear Strength (psf)	Field Guidelines
Very Soft	WOH, WOR, WOP, <2	0 - 250	Fist easily penetrates
Soft	2 - 4	250 - 500	Thumb easily penetrates
Medium Stiff	5 - 8	500 - 1000	Thumb penetrates with moderate effort
Stiff	9 - 15	1000 - 2000	Indented by thumb with great effort
Very Stiff	16 - 30	2000 - 4000	Indented by thumbnail
Hard	>30	over 4000	Indented by thumbnail with difficulty

Rock Quality Designation (RQD):

$$RQD\ (\%) = \frac{\text{sum of the lengths of intact pieces of core* > 4 inches}}{\text{length of core advance}}$$

*Minimum NQ rock core (1.88 in. OD of core)

Rock Quality Based on RQD

Rock Quality	RQD (%)
Very Poor	≤25
Poor	26 - 50
Fair	51 - 75
Good	76 - 90
Excellent	91 - 100

Desired Rock Observations (in this order, if applicable):
Color (Munsell color chart)
Texture (aphanitic, fine-grained, etc.)
Rock Type (granite, schist, sandstone, etc.)
Hardness (very hard, hard, mod. hard, etc.)
Weathering (fresh, very slight, slight, moderate, mod. severe, severe, etc.)
Geologic discontinuities/jointing:
-dip (horiz - 0-5 deg., low angle - 5-35 deg., mod. dipping - 35-55 deg., steep - 55-85 deg., vertical - 85-90 deg.)
-spacing (very close - <2 inch, close - 2-12 inch, mod. close - 1-3 feet, wide - 3-10 feet, very wide >10 feet)
-tightness (tight, open, or healed)
-infilling (grain size, color, etc.)
Formation (Waterville, Ellsworth, Cape Elizabeth, etc.)
RQD and correlation to rock quality (very poor, poor, etc.)
ref: ASTM D6032 and FHWA NHI-16-072 GEC 5 - Geotechnical Site Characterization, Table 4-12
Recovery (inch/inch and percentage)
Rock Core Rate (X.X ft - Y.Y ft (min:sec))

Sample Container Labeling Requirements:

WIN	Blow Counts
Bridge Name / Town	Sample Recovery
Boring Number	Date
Sample Number	Personnel Initials
Sample Depth	

January 2020

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS	**Project:** Route 9/I-395 Connector **Location:** Brewer and Eddington, Maine	**Boring No.:** BB-ELER-101 **WIN:** 18915.00

Driller:	Northern Test Borings, Inc.	**Elevation (ft.)**	225	**Auger ID/OD:**	--
Operator:	M. Nadeau	**Datum:**	NAVD 88	**Sampler:**	Split-Spoon 1.375 in. ID
Logged By:	N. Klausmeyer	**Rig Type:**	Diedrich D50 Track (Rig #377)	**Hammer Wt./Fall:**	SS-140#/30; HW-140#/20
Date Start/Finish:	07-23-18/07-23-18	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+34.7, 45.2 LT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	7.9 ft
Hammer Efficiency Factor:	0.907	**Hammer Type:**	Automatic ☒	Hydraulic ☐	Rope & Cathead ☐

Definitions:

D = Split Spoon Sample	R = Rock Core Sample	S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)	T_v = Pocket Torvane Shear Strength (psf)
MD = Unsuccessful Split Spoon Sample Attempt	SSA = Solid Stem Auger	$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)	WC = Water Content, percent
U = Thin Wall Tube Sample	HSA = Hollow Stem Auger	q_p = Unconfined Compressive Strength (ksf)	LL = Liquid Limit
MU = Unsuccessful Thin Wall Tube Sample Attempt	RC = Roller Cone	N-uncorrected = Raw Field SPT N-value	PL = Plastic Limit
V = Field Vane Shear Test, PP = Pocket Penetrometer	WOH = Weight of 140lb. Hammer	Hammer Efficiency Factor = Rig Specific Annual Calibration Value	PI = Plasticity Index
MV = Unsuccessful Field Vane Shear Test Attempt	WOR/C = Weight of Rods or Casing	N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency	G = Grain Size Analysis
	WO1P = Weight of One Person	N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected	C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/8	0.0 - 2.0	6/8/6/2	14	21	SSA			Brown, damp, medium dense, fine to coarse SAND, trace fine gravel, trace silt, well graded, reworked naturally-deposited soils -FILL-(SW-SM)	
	2D	24/16	2.0 - 4.0	3/3/4/5	7	11		223.0		2.0 Light brown, moist, stiff, SILT, little fine to coarse sand, trace fine gravel -GLACIAL TILL-(ML)	
	3D	24/24	4.0 - 6.0	12/14/14/18	28	42				Yellow-brown with occasional grey mottling, moist, hard, SILT, some fine to coarse sand, little fine to coarse gravel, well bonded -GLACIAL TILL-(ML)	G#474527 A-4(0), ML WC=12.4
5											
							47				
							49				
							37				
							68				
10	4D	16/14	10.0 - 11.3	17/24/50(4")			44			Brown, wet, hard, SILT, some fine to coarse gravel, little fine to coarse sand, well bonded -GLACIAL TILL-(ML)	
							58				
							85				
							101				
							75/4" RC	210.6		14.4 Top of Bedrock at El. 210.6	
15											
	R1	58.8/55	16.4 - 21.3	RQD = 75%			NQ CORE			R1: Grey, aphanitic SILTSTONE. Hard, fresh, joints dipping at low to moderate angles, very close to close spacing, tight, some oxidation and occasional calcite coatings on joint surfaces, frequent thin calcite veins, occasional thin quartz veins. Rock Quality=Fair Recovery=93% -BREWER FORMATION- R1 Core Times (min:sec): 16.4-17.4' (3:29); 17.4-18.4' (3:20); 18.4-19.4' (4:04); 19.4-20.4' (4:39); 20.4-21.3' (5:29)	qp=18,157 psi (16.4-16.8')
20											
	R2	60/60	21.3 - 26.3	RQD = 85%						R2: Similar to R1, except few dark gray aphanitic slatey 1 to 3-in. thick beds. Rock Quality=Good Recovery=100% -BREWER FORMATION- R2 Core Times (min:sec): 21.3-22.3' (5:27); 22.3-23.3' (6:29); 23.3-24.3' (5:50); 24.3-25.3' (5:55); 25.3-26.3' (6:10)	qp=25,061 psi (21.9-22.3')
25											

Remarks:

1. Observaton well installed in completed borehole. See observation well installation and groundwater monitoring reports for details.

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.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine

Boring No.: BB-ELER-101
WIN: 18915.00

Driller:	Northern Test Borings, Inc.	**Elevation (ft.)**	225	**Auger ID/OD:**	--
Operator:	M. Nadeau	**Datum:**	NAVD 88	**Sampler:**	Split-Spoon 1.375 in. ID
Logged By:	N. Klausmeyer	**Rig Type:**	Diedrich D50 Track (Rig #377)	**Hammer Wt./Fall:**	SS-140#/30; HW-140#/
Date Start/Finish:	07-23-18/07-23-18	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+34.7, 45.2 LT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	7.9 ft
Hammer Efficiency Factor: 0.907		**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 = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							NQ CORE				
								198.7		26.3 **Bottom of Exploration at 26.3 feet below ground surface.**	
30											
35											
40											
45											
50											

Remarks:

1. Observaton well installed in completed borehole. See observation well installation and groundwater monitoring reports for details.

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-ELER-101

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine

Boring No.: BB-ELER-102
WIN: 18915.00

Driller:	Northern Test Borings, Inc.	**Elevation (ft.)**	225.8	**Auger ID/OD:**	--
Operator:	M. Nadeau	**Datum:**	NAVD 88	**Sampler:**	Split-Spoon 1.375 in. ID
Logged By:	N. Klausmeyer	**Rig Type:**	Diedrich D50 Track (Rig #377)	**Hammer Wt./Fall:**	SS-140#/30; HW-140#/20
Date Start/Finish:	07-24-18/07-24-18	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+33.0, 39.7 RT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	5.9 ft
Hammer Efficiency Factor: 0.907		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/16	0.30 - 2.30	14/12/11/9	23	35	SSA	225.5		-BITUMINOUS CONCRETE- 0.3 Dark brown, dry, dense, Gravelly SAND, trace silt, well graded -FILL-(SW)(ROADWAY BASE/SUBBASE MATERIAL)	
	2D	24/15	2.30 - 4.30	8/7/6/10	13	20		223.5		2.3 Grey grading to yellow-brown, moist, very stiff, Sandy SILT, trace fine gravel, poorly-bonded -GLACIAL TILL-(SM)	
	3D	24/24	4.30 - 6.30	4/7/7/9	14	21		221.5		4.3 Yellow-brown, moist, very stiff, SILT, some fine to coarse sand, trace fine gravel -GLACIAL TILL-(ML)	G#474529 A-4(0), ML WC=13.9
5							39				
							33				
							41				
							45				
							49				
10	4D	24/24	10.00 - 12.00	11/15/19/21	34	51	83			Yellow-brown, wet, hard, SILT, some fine to coarse sand, little fine gravel, moderately bonded -GLACIAL TILL-(ML)	G#474530 A-4(0), ML WC=10.2
							91				
							93 RC	213.0		12.8 Top of Bedrock at El. 213.0	
	R1	48/40	14.50 - 18.50	RQD = 15%			NQ			R1: Grey, aphanitic PHYLLITE. Moderately hard to hard, fresh to slightly weathered. Primary joints dipping at moderate to steep angles, very close to close, planar, smooth to rough, tight to open, occasional calcite veins, occasional pitting, fresh to slightly weathered joint surfaces, highly fractured, slight to moderately weathered zone at approximately 17.0 to 17.7 ft. Rock Quality=Very Poor Recovery=83% -BREWER FORMATION- R1 Core Times (min:sec): 14.5-15.5' (2:59); 15.5-16.5' (2:29); 16.5-17.5' (2:11); 17.5-18.5' (2:19)	
15							CORE				
	R2	44.4/37	18.50 - 22.20	RQD = 14%						R2: Similar to R1, except high angle foliation, occasional highly fractured and moderately weathered zones. Rock Quality=Very Poor Recovery=83% -BREWER FORMATION- R2 Core Times (min:sec): 18.5-19.5' (2:07); 19.5-20.5' (1:53); 20.5-21.5' (2:20); 21.5-22.2' (2:23)	
20											
	R3	60/54	22.20 - 27.20	RQD = 28%						R3: Similar to R2, except 2-in. thick quartz vein at approximately 26 ft. Rock Quality=Poor Recovery=90%	
25											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine

Boring No.: BB-ELER-102
WIN: 18915.00

Driller:	Northern Test Borings, Inc.	**Elevation (ft.)**	225.8	**Auger ID/OD:**	--
Operator:	M. Nadeau	**Datum:**	NAVD 88	**Sampler:**	Split-Spoon 1.375 in. ID
Logged By:	N. Klausmeyer	**Rig Type:**	Diedrich D50 Track (Rig #377)	**Hammer Wt./Fall:**	SS-140#/30; HW-140#/20
Date Start/Finish:	07-24-18/07-24-18	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+33.0, 39.7 RT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	5.9 ft
Hammer Efficiency Factor:	0.907	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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WOH = Weight of 140 lb. Hammer
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WO1P = Weight of One Person
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$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_V = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							NQ CORE			-BREWER FORMATION- R3 Core Times (min:sec): 22.2-23.2' (2:14); 23.2-24.2' (2:34); 24.2-25.2' (2:13); 25.2-26.2' (3:03); 26.2-27.2' (3:42)	
	R4	36/31	27.20 - 30.20	RQD = 39%						R4: Similar to R1, except secondary low angle joints, oxidation on joint surfaces. Rock Quality=Poor Recovery=86% -BREWER FORMATION- R4 Core Times (min:sec): 27.2-28.2' (3:04); 28.2-29.2' (2:51); 29.2-30.2' (3:01)	qp=5,737 psi (27.3-27.7')
30								195.6		30.2 **Bottom of Exploration at 30.2 feet below ground surface.**	
35											
40											
45											
50											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector		**Location:** Brewer and Eddington, Maine		**Boring No.:** BB-ELER-201	**WIN:** 18915.00
Driller:	New England Boring Contractors	**Elevation (ft.)**	222.7	**Auger ID/OD:**	--
Operator:	M. Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	J. Fletcher	**Rig Type:**	Mobile B-53 Track	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/16
Date Start/Finish:	12-17-2020/12-18-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 236+83.9, 40.2 LT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	3.4 ft
Hammer Efficiency Factor:	0.852	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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MV = Unsuccessful Field 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/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/8	0.0 - 2.0	2/3/3/5	6	9	SSA			Brown, dry, stiff, SILT, little gravel, trace fine sand, loosely bonded -GLACIAL TILL-(ML)	
5	2D	24/20	5.0 - 7.0	9/17/20/23	37	53	11			Brown, dry, hard, SILT, little gravel, trace sand, moderately bonded -GLACIAL TILL-(ML)	
							9				
							15				
							15				
							11				
10	3D	24/16	10.0 - 12.0	9/26/24/20	50	71	6			Brown, wet, hard, Gravelly SILT, trace sand, moderately bonded -GLACIAL TILL-(ML)	
							11				
							9				
							12				
							19				
15	4D	3/3	15.0 - 15.3	50(3")			NW	207.7		15.0 Brown, wet, very dense, Sandy GRAVEL, little silt, well bonded -GLACIAL TILL-(GM)	
20	5D	1/0	20.0 - 20.1	53(1")			RC	202.6		No Recovery, very dense 20.1	
	R1	60/39	21.3 - 26.3	RQD = 48%			NQ CORE			Top of Bedrock El. 202.6 R1: Grey, aphanitic, SILTSTONE, moderately hard, slightly weathered. Joints dipping at moderate to steep angles, very close to close, planar to undulating, smooth to rough, tight to open, oxidation on some joint surfaces, common calcite veins. Rock Quality=Poor Recovery=65% -BREWER FORMATION- R1 Core Times (min:sec): 21.3-22.3' (1:27); 22.3-23.3' (2:41);	
25											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project:	Route 9/I-395 Connector			**Boring No.:**	BB-ELER-201
Location:	Brewer and Eddington, Maine			**WIN:**	18915.00
Driller:	New England Boring Contractors	**Elevation (ft.)**	222.7	**Auger ID/OD:**	--
Operator:	M. Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	J. Fletcher	**Rig Type:**	Mobile B-53 Track	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/
Date Start/Finish:	12-17-2020/12-18-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 236+83.9, 40.2 LT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	3.4 ft
Hammer Efficiency Factor:	0.852	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
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WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							NQ CORE			23.3-24.3' (2:34); 24.3-25.3' (2:18); 25.3-26.3' (1:52)	
	R2	26.4/20	26.3 - 28.5	RQD = 15%						R2: Similar to R1 . Rock Quality=Very Poor Recovery=76% -BREWER FORMATION- R2 Core Times (min:sec): 26.3-27.3' (2:54); 27.3-28.3' (3:45); 28.3-28.5' (0:52)	
								194.2		28.5	
										Bottom of Exploration at 28.5 feet below ground surface.	
30											
35											
40											
45											
50											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project:	Route 9/I-395 Connector	**Location:**	Brewer and Eddington, Maine	**Boring No.:**	BB-ELER-202
				WIN:	18915.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	225.1	**Auger ID/OD:**	HSA-3.25 in. ID
Operator:	J. Layfield	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	C. Toscano	**Rig Type:**	Mobile B-53 Truck	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/16
Date Start/Finish:	11-18-2020/11-18-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+14.7, 42.2 LT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	NE
Hammer Efficiency Factor:	0.867	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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	1D	24/15	0.3 - 2.3	10/11/51/4	62	90	SSA	224.8	-BITUMINOUS CONCRETE- 0.3 Brown, moist, very dense, fine to medium SAND, trace coarse sand, trace fine to coarse gravel -FILL-(ROADWAY BASE/SUBBASE MATERIAL)	
							5			
							15	222.6	2.5	
							49			
							62			
5	2D	24/22	5.0 - 7.0	6/4/20/17	24	35	15		Olive-brown, moist, hard, SILT, little fine sand, trace medium sand, trace fine to coarse gravel, well bonded -GLACIAL TILL-(ML) Note: Drill action indicated few cobbles from 7.0 to 9.0 ft. Note: Washed ahead of casing from 5.0 to 10.0 ft.	
							10			
							38			
							46			
							55			
10	3D	24/10	10.0 - 12.0	14/27/30/21	57	82	HW		Olive-brown, moist, hard, SILT, little fine sand, trace medium to coarse sand and fine gravel, well bonded, cobbles likely present -GLACIAL TILL-(ML) Note: Drill action indicated frequent cobbles from 10.0 to 14.0 ft. Rollerbit advanced rapidly from 14.0 to 15.0 ft.	G#613357 A-4, ML
15	4D	6/4	15.0 - 15.5	84/50(0.0")					Similar to 3D, except pulverized rock fragments lodged in tip of spoon. Note: Drill action indicated cobbles from 15.0 to 15.5 ft.	
							RC	208.6	Rollerbit advanced rapidly from 15.5 to 16.5 ft. 16.5	
	R1	48/36	17.0 - 21.0	RQD = 8%			NQ CORE		Top of Bedrock El. 208.6 R1: Grey, aphanitic, SLATE, moderately hard, slightly to moderately weathered. Joints low to steep, very close to close, planar to undulating, rough, open. Highly fractured, oxidized from 19 to 21 ft. Rock Quality=Very Poor Recovery=75% -BREWER FORMATION- R1 Core Times (min:sec): 17.0-18.0' (2:50); 18.0-19.0' (2:35); 19.0-20.0' (2:30); 20.0-21.0' (3:30)	
20										
	R2	57.6/38	21.0 - 25.8	RQD = 45%					R2: Similar to R1, except hard, fresh. Joints low to moderately dipping, close, silt infillings, slightly oxidized, common calcite veins. Rock Quality=Poor Recovery=66% -BREWER FORMATION- R2 Core Times (min:sec): 21.0-22.0' (3:51); 22.0-23.0' (3:40);	
25										

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project:	Route 9/I-395 Connector	**Boring No.:**	BB-ELER-202		
Location:	Brewer and Eddington, Maine	**WIN:**	18915.00		
Driller:	New England Boring Contractors	**Elevation (ft.)**	225.1	**Auger ID/OD:**	HSA-3.25 in. ID
Operator:	J. Layfield	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	C. Toscano	**Rig Type:**	Mobile B-53 Truck	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/
Date Start/Finish:	11-18-2020/11-18-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+14.7, 42.2 LT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	NE
Hammer Efficiency Factor:	0.867	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	R3	48/48	25.8 - 29.8	RQD = 77%			NQ CORE			23.0-24.0' (3:13); 24.0-25.0' (2:49); 25.0-25.8' (3:48) Note: No water return. R3: Similar to R2, except joints low to steep. Common quartz intrusions up to 3-in. thick and calcite veins, no silt infillings. Rock Quality=Good Recovery=100% -BREWER FORMATION- R3 Core Times (min:sec): 25.8-26.8' (2:40); 26.8-27.8' (3:18); 27.8-28.8' (4:15); 28.8-29.8' (4:00) Note: No water return.	qp=27,259 psi (26'-26.6') qp=21,637 psi (28.6'-29.5')
30	R4	60/60	29.8 - 34.8	RQD = 67%						R4: Similar to R3, except common quartz veins. Rock Quality=Fair Recovery=100% -BREWER FORMATION- R4 Core Times (min:sec): 29.8-30.8' (3:01); 30.8-31.8' (2:41); 31.8-32.8' (2:00); 32.8-33.8' (1:44); 33.8-34.8' (1:19) Note: No water return.	
35	R5	26/25	34.8 - 37.0	RQD = 49%				188.1		R5: Similar to R4. Rock Quality=Poor Recovery=96% -BREWER FORMATION- R5 Core Times (min:sec): 34.8-35.8' (1:36); 35.8-37.0' (1:28) 37.0 **Bottom of Exploration at 37.0 feet below ground surface.**	
40											
45											
50											

Remarks:

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

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine

Boring No.: BB-ELER-203
WIN: 18915.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	225.6	**Auger ID/OD:**	--
Operator:	J. Layfield	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	H. Hollauer	**Rig Type:**	Mobile B-53 Truck	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/16
Date Start/Finish:	12-1-2020/12-1-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+57.3, 55.2 LT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	NE
Hammer Efficiency Factor:	0.867	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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MD = Unsuccessful Split Spoon Sample Attempt
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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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	1D	24/14	0.0 - 2.0	1/3/3/3	6	9	SSA	225.4	-ROOT MAT- (0.2)	
									Grey-brown, damp, medium stiff, SILT, little fine to coarse sand, trace gravel, likely reworked naturally-deposited soil -TOPSOIL-(ML)	
								222.6	(3.0) Note: Drill action indicates strata change at 3.0 ft.	
5	2D	24/24	5.0 - 7.0	11/18/20/24	38	55	HW		Grey-brown, dry, hard, SILT, little fine sand, trace medium to coarse sand and fine to coarse gravel -GLACIAL TILL-(ML)	G#613358 A-4, ML
10	3D	24/24	10.0 - 12.0	14/18/22/28	40	58			Similar to 2D, except grey -GLACIAL TILL-(ML)	
15	4D	2/2	15.0 - 15.2	60(2")			RC	210.4	Similar to 3D, except with weathered rock fragments. (15.2)	
	R1	60/40	15.3 - 20.3	RQD = 47%			NQ CORE		Top of Bedrock El 210.4 R1: Grey, aphanitic, SILTSTONE, hard, fresh to slightly weathered. Joints dipping at moderate angles, close, tight, slight iron staining on joint surface. Highly fractured zone from approximately 15.3 to 17.0 ft. Slight pitting, frequent calcite veins up to 1 in. in thickness. Rock Quality=Poor Recovery=67% -BREWER FORMATION-	qp=16,647psi (15.9'-16.2') GTX#313322 SF-1 15.0/29.1 psi (16.7')
20								205.3	R1 Core Times (min:sec): 15.3-16.3' (2:30); 16.3-17.3' (4:00); 17.3-18.3' (3:00); 18.3-19.3' (3:00); 19.3-20.3' (3:30) Note: Bottom joint iron stained and silty. Possible open fracture encountered at bottom of core run. (20.3)	
									Bottom of Exploration at 20.3 feet below ground surface.	
25										

Remarks:

1. SF-1 denotes sliding friction test completed at depth shown. 15.0/29.1 psi represents normal and peak shear stresses, respectively.

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

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Boring No.: BB-ELER-203

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine
Boring No.: BB-ELER-204
WIN: 18915.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	223.2	**Auger ID/OD:**	--
Operator:	M. Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	J. Fletcher	**Rig Type:**	Mobile B-53 Track	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/16
Date Start/Finish:	12-15-2020/12-15-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+05.2, 55.7 RT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	1.0 ft
Hammer Efficiency Factor: 0.852		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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MV = Unsuccessful Field 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/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/6	0.0 - 2.0	1/3/3/4	6	9	SSA	222.7		-TOPSOIL- (0.5) Brown, dry, medium stiff, SILT, trace fine sand, trace gravel, organics, likely reworked naturally-deposited soil -TOPSOIL-(ML)	
										Note: Drill action indicates strata change at 4.8 ft.	
5	2D	24/22	5.0 - 7.0	31/13/14/21	27	38	50	218.4		(4.8) Brown, dry, very stiff, SILT, trace gravel, trace fine sand -GLACIAL TILL-(ML)	
							78				
							122				
							49 RC	215.0		(8.2) Top of Bedrock El. 215.0	
10	R1	60/48	9.9 - 14.9	RQD = 38%			NQ CORE			R1: Grey, aphanitic, SILTSTONE, hard, fresh to slightly weathered. Joints dipping at moderate to vertical angles, very close to moderately spaced, tight to open, planar to undulating, rough, occasional calcite veins. Highly fractured zone from approximately 12.5 to 13.5 ft. Rock Quality=Poor Recovery=80% -BREWER FORMATION- R1 Core Times (min:sec): 9.9-10.9' (3:16); 10.9-11.9 (2:44); 11.9-12.9' (2:15); 12.9-13.9' (2:26); 13.9-14.9' (2:47)	
15								208.3		(14.9) **Bottom of Exploration at 14.9 feet below ground surface.**	
20											
25											

Remarks:

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Boring No.: BB-ELER-204

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS	**Project:** Route 9/I-395 Connector **Location:** Brewer and Eddington, Maine	**Boring No.:** BB-ELER-205 **WIN:** 18915.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	225.9	**Auger ID/OD:**	--
Operator:	J. Layfield	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	C. Toscano	**Rig Type:**	Mobile B-53 Truck	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/16
Date Start/Finish:	11-18-2020/11-19-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+34.6, 43.7 RT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	NE
Hammer Efficiency Factor: 0.867		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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MV = Unsuccessful Field 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/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/18	0.5 - 2.5	12/15/12/9	27	39	SSA	225.4		-BITUMINOUS CONCRETE- (0.5) Brown, moist, dense, fine to medium SAND, little coarse sand and silt, little fine gravel, trace coarse gravel -FILL-(SP) (ROADWAY BASE/SUBBASE MATERIAL)	
								223.4		(2.5)	
5	2D	2/2	5.0 - 5.2	50/3"			HW			Olive-brown, moist, hard, SILT, little fine sand, cobbles likely present -GLACIAL TILL-(ML) Note: Drill action indicated boulder from 5.25 to 6.5 ft.	
										Note: Spun HW casing to 10.0 ft.	
10	3D	24/24	10.0 - 12.0	14/20/25/26	45	65				Olive-brown, moist, hard, SILT, little fine sand, trace medium to coarse sand and fine gravel -GLACIAL TILL-(ML)	G#613359 A-4, ML
							RC	211.4		(14.5)	
15	R1	36/32	15.0 - 18.0	RQD = 31%			NQ CORE			Top of Bedrock El. 211.4 R1: Grey, aphanitic, SLATE, moderately hard, fresh. Joints low angle to moderately dipping, very close to close, planar, smooth to rough, occasional oxidized joint surfaces, calcite and quartz veins up to 0.25-in. thick, tight joints. One vertical joint from 16.0 to 16.5 ft. Rock Quality=Poor Recovery=89% -BREWER FORMATION-	qp=8,006 psi (15'-15.9')
	R2	24/22	18.0 - 20.0	RQD = 33%						R1 Core Times (min:sec); 15.0-16.0' (4:01); 16.0-17.0' (2:45) 17.0-18.0' (2:40) Note: Little water return.	
20	R3	31.2/27	20.0 - 22.6	RQD = 13%						R2: Similar to R1, except joints hard to moderately hard, moderately dipping to steep. Rock Quality=Poor Recovery=92% -BREWER FORMATION-	qp=3,590 psi (20.3'-20.7')
	R4	28.8/28	22.6 - 25.0	RQD = 31%						R2 Core Times (min:sec): 18.0-19.0' (2:51); 19.0-20.0' (3:00) R3: Similar to R2. Rock Quality=Very Poor Recovery=87% -BREWER FORMATION-	GTX#313322 SF-2 20.0/14.3 psi (24.1')
25											

Remarks:

1. SF-2 denotes sliding friction test completed at depth shown. 20.0/14.3 psi represents normal and peak shear stresses, respectively.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project:	Route 9/I-395 Connector			**Boring No.:**	BB-ELER-205
Location:	Brewer and Eddington, Maine			**WIN:**	18915.00
Driller:	New England Boring Contractors	**Elevation (ft.)**	225.9	**Auger ID/OD:**	--
Operator:	J. Layfield	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	C. Toscano	**Rig Type:**	Mobile B-53 Truck	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/
Date Start/Finish:	11-18-2020/11-19-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+34.6, 43.7 RT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	NE
Hammer Efficiency Factor:	0.867	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	R5	60/60	25.0 - 30.0	RQD = 57%			NQ CORE			R3 Core Times (min:sec): 20.0-21.0' (3:19) 21.0-22.0' (3:04); 22.0-22.6' (1:49) R4: Grey, aphanitic, SLATE, moderately hard to hard, fresh. Joints moderately dipping to steep, very close to close, planar to undulating, smooth to rough, tight, few calcite/quartz veins. Rock Quality=Poor Recovery=97% -BREWER FORMATION- R4 Core Times (min:sec): 22.6-23.0' (1:00); 23.0-24.0' (2:56); 24.0-25.0' (2:31) R5: Similar to R4, except hard to very hard, 2-in. thick quartz vein from 25.8 to 27.0 ft. Extremely fractured vertical joints from 29.5 to 30.0 ft.	
30	R6	60/60	30.0 - 35.0	RQD = 45%						Rock Quality=Fair Recovery=100% -BREWER FORMATION- R5 Core Times (min:sec): 25.0-26.0' (2:01); 26.0-27.0' (4:22); 27.0-28.0' (2:18); 28.0-29.0' (2:19); 29.0-30.0' (2:25) R6: Similar to R5, extremely fractured vertical joints from 31.0 to 31.7 ft. Common quartz veins up to 1.5-in. thick. Rock Quality=Poor	
35								190.9		Recovery=100% -BREWER FORMATION- R6 Core Times (min:sec): 30.0-31.0' (3:29); 31.0-32.0' (4:35); 32.0-33.0' (4:58); 33.0-34.0' (3:49); 34.0-35.0' (2:28) Note: No water return from 33.0 to 35.0 ft. 35.0 **Bottom of Exploration at 35.0 feet below ground surface.**	
40											
45											
50											

Remarks:

1. SF-2 denotes sliding friction test completed at depth shown.
20.0/14.3 psi represents normal and peak shear stresses, respectively.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine

Boring No.: BB-ELER-206
WIN: 18915.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	225.1	**Auger ID/OD:**	--
Operator:	J. Layfield	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	H. Hollauer	**Rig Type:**	Mobile B-53 Truck	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/16
Date Start/Finish:	11-30-2020/11-30-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+80.6, 41.5 RT	**Casing ID/OD:**	HW-3.0 in. ID	**Water Level*:**	NE
Hammer Efficiency Factor:	0.867	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/14	0.0 - 2.0	1/2/2/2	4	6	SSA	224.9		-TOPSOIL/ROOT MAT- 0.2	
										Grey-brown, damp, soft, SILT, little fine to coarse sand, trace fine gravel, appears reworked -GLACIAL TILL-(ML)	
								221.6		3.5 Note: Drill action indicates strata change at 3.5 ft.	
5	2D	24/22	5.0 - 7.0	12/14/16/18	30	43				Grey-brown, damp, hard, SILT, little fine to coarse sand, trace fine gravel, well bonded -GLACIAL TILL-(ML)	
										Note: Drill action indicates cobbles from 7.0 to 10.0 ft.	
10	3D	6/4	10.0 - 10.5	64(6")			RC	214.7		Similar to S2, except rock in spoon tip, very dense 10.4	
	R1	31.2/30	11.0 - 13.6	RQD = 0%			NQ CORE			Top of Bedrock El. 214.7 R1: Grey, aphanitic, SILTSTONE, hard to moderately hard, slightly to moderately weathered. Joints dipping at moderate angles, very close to close, planar to undulating, rough, tight to open, slight iron staining on few joint surfaces. Calcite coating on few joint surfaces, highly fractured throughout. Rock Quality=Very Poor Recovery=96% -BREWER FORMATION- R1 Core Times (min:sec): 11.0-12.0' (3:30); 12.0-13.0' (3:00); 13.0-13.6' (1:45)	
	R2	28.8/24	13.6 - 16.0	RQD = 0%				209.1		R2: Similar to R1, except joints low angle to moderately dipping, few thin calcite veins. Central portion of recovered core has been reduced to gravel-size pieces. Rock Quality=Very Poor Recovery=83% -BREWER FORMATION- R2 Core Times (min:sec): 13.6-14.0' (1:30); 14.0-15.0' (3:30); 15.0-16.0' (3:20) 16.0	
15											
20										**Bottom of Exploration at 16.0 feet below ground surface.**	
25											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine

Boring No.: BB-ELER-206A
WIN: 18915.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	224.5	**Auger ID/OD:**	--
Operator:	M. Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	J. Fletcher	**Rig Type:**	Mobile B-53 Track	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/16
Date Start/Finish:	2-24-2021/2-25-2021	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+80.3, 53.2 RT	**Casing ID/OD:**	HW-3.0 in. ID	**Water Level*:**	2.3 ft
Hammer Efficiency Factor:	0.852	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field 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/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA				
5	1D	24/22	5.5 - 7.5	10/13/21/32	34	48	47			Brown, moist, hard, Clayey SILT, little gravel, trace fine sand, loosely bonded -GLACIAL TILL-(ML)	
							87				
							72				
							263				
							247/ RC	215.0		9.5	
10	R1	60/56	10.0 - 15.0	RQD = 57%			NQ CORE			Top of Bedrock El. 215.0 R1: Grey, aphanitic, SILTSTONE, hard to very hard, fresh to slightly weathered. Joints moderate to steeply dipping, very close to close, planar to stepped, rough, tight to open, slight oxidation. Occasional calcite infilled joints (approximately 0.125 to 0.25-in. thick). Rock Quality=Fair Recovery=93% -BREWER FORMATION- R1 Core Times (min:sec): 10.0-11.0' (2:13); 11.0-12.0' (2:01); 12.0-13.0' (1:57); 13.0-14.0' (1:58); 14.0-15.0' (2:13)	
15	R2	60/53	15.0 - 20.0	RQD = 53%						R2: Similar to R1, oxidized and silt infilled joint at approximately 16.0 ft (0.75-in. thick) within two perpendicular steeply dipping joints. Dark grey slaty layer (approximately 2-in. thick), steep foliation containing thin calcite veins (up to 0.125-in. thick). Highly fractured, platy zone from approximately 19.0 to 19.7 ft. Rock Quality=Fair Recovery=88% -BREWER FORMATION- R2 Core Times (min:sec): 15.0-16.0' (1:52); 16.0-17.0' (1:49); 17.0-18.0' (1:24); 18.0-19.0' (2:21); 19.0-20.0' (3:06)	
20	R3	24/13	20.0 - 22.0	RQD = 0%						R3: Grey, aphanitic, SILTSTONE. Hard to moderately hard, slightly weathered. Joints steeply dipping, very close to close, planar to stepped smooth to rough, tight to open. Joints fresh to slightly oxidized. Dark grey/black slate bed (apprxoimately 2.5= in. thick) at approximately 21.0 ft, parallel to steeply dipping joints. Occasional calcite veins 0.25-in. thick). Rock Quality=Very Poor Recovery=54% -BREWER FORMATION- R3 Core Times (min:sec): 20.0-21.0' (3:04); 21.0-22.0' (3:20)	
	R4	10/5	22.0 - 22.8	RQD = 0%							
	R5	26/26	22.8 - 25.0	RQD = 0%							
25										R4: Similar to R3, except fresh, joints close.	

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector				**Boring No.:**	BB-ELER-206A
Location: Brewer and Eddington, Maine				**WIN:**	18915.00
Driller:	New England Boring Contractors	**Elevation (ft.)**	224.5	**Auger ID/OD:**	--
Operator:	M. Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	J. Fletcher	**Rig Type:**	Mobile B-53 Track	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/
Date Start/Finish:	2-24-2021/2-25-2021	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 237+80.3, 53.2 RT	**Casing ID/OD:**	HW-3.0 in. ID	**Water Level*:**	2.3 ft
Hammer Efficiency Factor: 0.852		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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SSA = Solid Stem Auger
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WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	R6	48/39	25.0 - 29.0	RQD = 42%			NQ CORE				
30	R7	38.4/36	29.0 - 32.2	RQD = 76%							
	R8	26.4/18	32.2 - 34.4	RQD = 0%							
35	R9	31.2/25	34.4 - 37.0	RQD = 80%				187.5			
40											
45											
50											

Visual Description and Remarks:

Rock Quality=Very Poor
Recovery=52%
R4 Core Times (min:sec): 22.0-22.8' (2:46)
R5: Similar to R3, except dark grey/black slaty steeply dipping, foliation layer (approximately 1-in. thick) at approximately 23.5 ft, grading to slate, pyrite mineralization.
Rock Quality=Very Poor
Recovery=100%
-BREWER FORMATION-
R5 Core Times (min:sec): 22.8-23.8' (2:32); 23.8-25.0' (3:09);
R6: Grey, aphanitic, SILTSTONE, hard to moderately hard, fresh to slightly weathered. Joints steeply dipping, very close to moderately close, planar to undulating, rough, tight to open. Intermittent highly fractured zones. Calcite veins associated with steeply dipping joints (0.25 to 1-in. thick). Discontinuous silt infilling on joint surfaces at approximately 28.5 ft (0.25-in. thick).
Rock Quality=Poor
Recovery=81%
-BREWER FORMATION-
R6 Core Times (min:sec): 25.0-26.0' (2:18); 26.0-27.0' (2:31); 27.0-28.0' (2:49); 28.0-29.0' (3:01)
R7: Similar to R6, except joints moderately close. Secondary horizonta joints, close, planar to stepped, rough, tight to open. Few calcite veins (0.25-in. thick).
Rock Quality=Good
Recovery=95%
-BREWER FORMATION-
R7 Core Times (min:sec): 29.0-30.0' (1:49); 30.0-31.0' (2:13); 31.0-32.2' (2:13)
R8: Similar to R6, except no horizontal joints. Occasional 1 to 2-in. thick dark grey to black steeply dipping slate beds, planar to stepped, smooth to rough, tight to open. Calcite veins (0.25-in. thick).
Rock Quality=Very Poor
Recovery=68%
-BREWER FORMATION-
R8 Core Times (min:sec): 32.2-33.2' (3:12); 33.2-34.4' (3:32)
R9: Grey, aphanitic, SILTSTONE, hard, fresh, solid core stem (no joints). Very thin (approximately 0.25-in. thick) dark grey to black steeply dipping foliated layers from approximately 34.4 to 34.8 ft, containing calcite, few calcite stringers and veins (up to 0.25-in. thick).
Rock Quality=Good
Recovery=80%
R9 Core Times (min:sec): 34.4-35.4' (2:11); 35.4-36.4' (2:18); 36.4-37.0' (2:44)
37.0

Bottom of Exploration at 37.0 feet below ground surface.

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine

Boring No.: HB-BE-151
WIN: 18915.00

Driller:	Northern Test Borings, Inc.	**Elevation (ft.)**	215.6	**Auger ID/OD:**	--
Operator:	M. Nadeau	**Datum:**	NAVD 88	**Sampler:**	Split-Spoon 1.375 in. ID
Logged By:	N. Klausmeyer	**Rig Type:**	Diedrich D50 Track (Rig #377)	**Hammer Wt./Fall:**	SS-140#/30; HW-140#/20
Date Start/Finish:	7-24-18/7-24-18	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	--
Boring Location:	Sta. 235+01.2, 5.6 RT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	Not Measured
Hammer Efficiency Factor: 0.907		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field 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/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D/A	24/6	0.0 - 2.0	2/3/3/8	6	9	SSA	215.1		Brown, moist, stiff, SILT, organics (roots, grass, wood) -TOPSOIL-(ML) —0.5	
										Brown grading to yellow-brown, moist, stiff, SILT, little fine to coarse gravel, little fine to coarse sand, trace organics, moderately bonded -GLACIAL TILL-(ML)	
	2D	20/19	2.0 - 3.7	7/9/11/50(2")	20	30				Yellow-brown, moist, very stiff, SILT, some fine to coarse sand, trace fine gravel, moderately bonded -GLACIAL TILL-(ML)	
	3D	24/24	4.0 - 6.0	9/12/14/14	26	39				Light brown, moist, hard, SILT, some fine to coarse sand, trace fine gravel, moderately bonded -GLACIAL TILL-(ML)	G#474356 A-4(0), ML WC=13.7 G#474357 A-4(0), ML WC=13.4
5											
							39				
							47				
							62				
10	4D	11/5	10.0 - 10.9	12/50(5")			HW			Light brown, wet, hard, SILT, some fine to coarse sand, little fine gravel, moderately bonded -GLACIAL TILL-(ML)	G#474358 A-4(0), ML WC=12.4
										Note: Drill action and wash indicate granular material from approximately 11 to 15 ft.	
15	5D	14/9	15.0 - 16.2	10/12/50(2")				200.6		—15.0 Light brown, wet, hard, silty CLAY, some fine to coarse sand, little fine gravel, well bonded -GLACIAL TILL-(CL)	G#474359 A-6(3), CL LL=25 PL=14 PI=11 WC=11.3
	6D	6.84/6	17.0 - 17.6	50/50(2")				198.6		—17.0 Combined sample: Grey to light brown, wet, very dense, GRAVEL, some fine to coarse sand, little silt, well graded, well bonded -GLACIAL TILL-(SW-SM)	G#474360 A-1-a(0), SW-SM WC=7.9
	7D	20/9	19.0 - 20.7	9/11/15/20(2")	26	39					
20											
	8D	5/7	21.0 - 21.4	50(5")							
							RC	192.8		—22.8	
										Top of Probable Bedrock at El. 192.8 -PROBABLE BEDROCK-	
25											

Remarks:

1. Washed ahead of casing in approximate 5-ft intervals below 10 ft. Casing driven (advanced) after washing ahead, casing blows not recorded.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine

Boring No.: HB-BE-151
WIN: 18915.00

Driller:	Northern Test Borings, Inc.	**Elevation (ft.)**	215.6	**Auger ID/OD:**	--
Operator:	M. Nadeau	**Datum:**	NAVD 88	**Sampler:**	Split-Spoon 1.375 in. ID
Logged By:	N. Klausmeyer	**Rig Type:**	Diedrich D50 Track (Rig #377)	**Hammer Wt./Fall:**	SS-140#/30; HW-140#/20
Date Start/Finish:	7-24-18/7-24-18	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	--
Boring Location:	Sta. 235+01.2, 5.6 RT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	Not Measured
Hammer Efficiency Factor:	0.907	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25								190.6		25.0 **Bottom of Exploration at 25.0 feet below ground surface.**	
30											
35											
40											
45											
50											

Remarks:

1. Washed ahead of casing in approximate 5-ft intervals below 10 ft. Casing driven (advanced) after washing ahead, casing blows not recorded.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector		**Boring No.:**	HB-BE-235
Location: Brewer and Eddington, Maine		**WIN:**	18915.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	219.3	**Auger ID/OD:**	--
Operator:	M. Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	J. Fletcher	**Rig Type:**	Mobile B-53 Track	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/16
Date Start/Finish:	12-15-2020/12-16-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 235+96.8, 2.6 LT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	0.9 ft
Hammer Efficiency Factor: 0.852		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
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N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
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WC = Water Content, percent
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C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/8	0.0 - 2.0	WOH/3/3/5	6	9	SSA	218.8		Brown, wet, very soft, SILT, little fine to medium sand, little gravel, organics, roots -TOPSOIL-(ML) 0.5 Brown, wet, stiff, SILT, little fine to coarse sand, little gravel -GLACIAL TILL-(ML)	
5	2D	24/24	5.0 - 7.0	11/15/20/28	35	50	53			Brown, wet, hard, SILT, little fine to medium sand, trace coarse sand, trace fine gravel, moderately bonded -GLACIAL TILL-(ML)	G#613886 A-4 (0), ML
							85				
							98				
							99				
							134				
10	3D	24/22	10.0 - 12.0	51/18/24/28	42	60	HW			Brown, wet, hard, SILT, some gravel, little fine to coarse sand, moderately bonded -GLACIAL TILL-(ML)	
							RC	206.5		12.8 Top of Bedrock El. 206.5	
15	R1	24/20	15.0 - 17.0	RQD = 0%			NQ CORE			R1: Grey, aphanitic, SILTSTONE, moderately hard, slightly weathered, completely fractured throughout to rubble/gravel-sized pieces. No discernible joints. Rock Quality=Very Poor Recovery=83% -BREWER FORMATION- R1 Core Times (min:sec): 15.0-16.0' (2:57); 16.0-17.0' (3:03)	
	R2	18/12	17.0 - 18.5	RQD = 0%						R2: Similar to R1. Rock Quality=Very Poor Recovery=67% -BREWER FORMATION- R2 Core Times (min:sec): 17.0-18.0' (1:50); 18.0-18.5' (2:16)	
	R3	39.6/20	18.5 - 21.8	RQD = 15%						R3: Grey, aphanitic, SILTSTONE, moderately hard, slightly weathered. Joints dipping at steep angles (occasionally perpendicular), rough, planar, tight to open, highly fractured. Calcite/quartz intrusion (1 to 2-in. thick). Secondary low angle joints, very close to close planar, rough, open. Thin, parallel steep calcite veins (0.25 to 0.5-in. thick). Rock Quality=Very Poor Recovery=51% -BREWER FORMATION-	
20											
	R4	62.4/53	21.8 - 27.0	RQD = 43%							
25											

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine
Boring No.: HB-BE-235
WIN: 18915.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	219.3	**Auger ID/OD:**	--
Operator:	M. Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	J. Fletcher	**Rig Type:**	Mobile B-53 Track	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/
Date Start/Finish:	12-15-2020/12-16-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 235+96.8, 2.6 LT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	0.9 ft
Hammer Efficiency Factor:	0.852	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
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WC = Water Content, percent
LL = Liquid Limit
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PI = Plasticity Index
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C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							NQ CORE			R3 Core Times (min:sec): 18.5-19.5' (2:43); 19.5-20.5' (3:08); 20.5-21.8 (1:48) R4: Grey, aphanitic, SILTSTONE, moderately hard, slightly weathered. Joints dipping at moderate to steep angles, close, planar to undulating, smooth to rough, tight to open, rough. Secondary low angle joints, close to moderately close, planar, smooth to rough, open, fresh to slightly weathered, oxidized joints. Frequent calcite stringers/veins. Highly fractured zone from approximately 25.5 to 27.0 ft. Rock Quality=Poor Recovery=85% -BREWER FORMATION- R4 Core Times (min:sec): 21.8-22.8' (2:08); 22.8-23.8' (2:46); 23.8-24.8' (2:36); 24.8-25.8' (3:14); 25.8-27.0' (2:57)	
	R5	24/24	27.0 - 29.0	RQD = 42%				190.3		R5: Grey, aphanitic, SILTSTONE, moderately hard, slightly weathered. Joints dipping at steep angles, very close to close, planar, tight to open, rough, iron staining on joint surfaces, calcite veins (0.125-in. thick). Secondary low angle joints, close, planar, rough, open. Rock Quality=Poor Recovery=100% -BREWER FORMATION- R5 Core Times (min:sec): 27.0-28.0' (3:01); 28.0-29.0' (2:04) 29.0 **Bottom of Exploration at 29.0 feet below ground surface.**	
30											
35											
40											
45											
50											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector
Location: Brewer and Eddington, Maine

Boring No.: HB-BE-236
WIN: 18915.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	228.5	**Auger ID/OD:**	--
Operator:	J. Layfield	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	C. Toscano	**Rig Type:**	Mobile B-53 Truck	**Hammer Wt./Fall:**	SS-140#/30; NW-300#/16
Date Start/Finish:	11-19-2020/11-20-2020	**Drilling Method:**	NW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 238+13.6, 4.4 LT	**Casing ID/OD:**	NW-3.0 in. ID	**Water Level*:**	--
Hammer Efficiency Factor:	0.867	**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 = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field 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/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/6	0.0 - 2.0	2/4/6/8	10	14	NW	228.2		-TOPSOIL-(OL) 0.3	
										Brown, dry, medium dense, fine to coarse GRAVEL, some fine to medium sand -FILL-(GW)	
								226.0		2.5 Note: Drill action indicated common cobbles from 2.5 to 5.0 ft.	
5	2D	24/14	5.0 - 7.0	12/16/32/22	48	69				Yellow-brown, dry, hard, SILT, some fine sand, trace medium sand, trace gravel -GLACIAL TILL-(ML)	
10	3D	24/15	10.0 - 12.0	16/17/25/24	42	61		218.5		10.0 Olive-brown, moist, very dense, fine to coarse SAND, some silt, trace fine gravel -GLACIAL TILL-(SM)	G#613887 A-2-4 (0), SM
										Note: Drill action indicates top of bedrock at 13.5 ft.	
							RC	215.0		13.5 Top of Bedrock at El. 215.0 Note: Drove NW casing to refusal at 14.5 ft. Washed out borehole to 15.0 ft.	
15	R1	48/48	15.0 - 19.0	RQD = 31%			NQ CORE			R1: Grey, aphanitic, SILTSTONE, moderately hard, slightly weathered. Joints low angle, very close to close, tight to open. Occasional decomposed joints up to 1-in. thick. Frequent silt infillings, discolored. Frequent quartz and calcite veins throughout core run. Rock Quality=Poor Recovery=100% -BREWER FORMATION- R1 Core Times (min:sec): 15.0-16.0' (4:01); 16.0-17.0' (2:54); 17.0-18.0' (2:40); 18.0-19.0' (3:09)	
	R2	60/60	19.0 - 24.0	RQD = 53%						R2: Similar to R1, except no decomposed joints on discolored joint surfaces. Highly fractured zone from approximately 19.5 to 20.0 ft. Rock Quality=Fair Recovery=100% -BREWER FORMATION- R2 Core Times (min:sec): 19.0-20.0' (2:58); 20.0-21.0' (3:05); 21.0-22.0' (3:19); 22.0-23.0' (3:01); 23.0-24.0' (2:19)	
20											
25	R3	60/60	24.0 - 29.0	RQD = 68%						R3: Grey, aphanitic, SILTSTONE, moderately hard, fresh. Joints dipping at low to moderate angles, very close.	

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.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS	Project: Route 9/I-395 Connector Location: Brewer and Eddington, Maine	Boring No.: HB-BE-236 WIN: 18915.00

Driller:	New England Boring Contractors	Elevation (ft.)	228.5	Auger ID/OD:	--
Operator:	J. Layfield	Datum:	NAVD 88	Sampler:	Split Spoon 1.375 in. ID
Logged By:	C. Toscano	Rig Type:	Mobile B-53 Truck	Hammer Wt./Fall:	SS-140#/30; NW-300#/
Date Start/Finish:	11-19-2020/11-20-2020	Drilling Method:	NW Drive	Core Barrel:	NQ-2.0 in. ID
Boring Location:	Sta. 238+13.6, 4.4 LT	Casing ID/OD:	NW-3.0 in. ID	Water Level*:	--
Hammer Efficiency Factor: 0.867		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							NQ CORE			Rock Quality=Fair Recovery=100% -BREWER FORMATION- R3 Core Times (min:sec): 24.0-25.0' (2:36); 25.0-26.0' (2:19); 26.0-27.0' (2:22); 27.0-28.0' (2:05); 28.0-29.0' (2:48)	
	R4	60/60	29.0 - 34.0	RQD = 45%						R4: Similar to R3, except oxidized, moderately weathered joint from approximately 29.5 to 29.8 ft, slightly discolored joint surface and high angle fractures from approximately 31.5 to 34.0 ft. Rock Quality=Poor Recovery=100% -BREWER FORMATION- R4 Core Times (min:sec): 29.0-30.0' (3:19); 30.0-31.0' (2:21); 31.0-32.0' (2:33); 32.0-33.0' (3:01); 33.0-34.0' (2:40)	
30											
								194.5		34.0 **Bottom of Exploration at 34.0 feet below ground surface.**	
35											
40											
45											
50											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 9/I-395 Connector		**Boring No.:**	HB-BE-237
Location: Brewer and Eddington, Maine		**WIN:**	18915.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	228.9	**Auger ID/OD:**	HSA-3.25 in. ID
Operator:	M. Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon 1.375 in. ID
Logged By:	J. Fletcher	**Rig Type:**	Mobile B-53 Track	**Hammer Wt./Fall:**	SS-140#/30; HW-300#/16
Date Start/Finish:	12-21-2020/12-21-2020	**Drilling Method:**	SSA/HW Drive	**Core Barrel:**	NQ-2.0 in. ID
Boring Location:	Sta. 239+30.1, 27.6 LT	**Casing ID/OD:**	HW-4.0 in. ID	**Water Level*:**	3.7 ft
Hammer Efficiency Factor:	0.852	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
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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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/7	0.0 - 2.0	5/1/1/2	2	3	SSA			Note: 2 in. of frost. Brown, moist, soft, SILT, some gravel, trace fine sand, loosely bonded -GLACIAL TILL-(ML)	
5	2D	24/24	5.0 - 7.0	12/16/21/23	37	53	57			Brown, moist, hard, fine to medium Sandy SILT, little fine gravel, trace coarse sand, moderately bonded -GLACIAL TILL-(ML)	G#613888 A-4 (0), ML
							95				
							157			8.0	
							213	220.9		Top of Bedrock El. 220.9 Note; Advanced casing to 8.7 ft.	
							RC				
10	R1	42/34	10.0 - 13.5	RQD = 0%			NQ CORE			R1: Grey, aphanitic, SILTSTONE, moderately hard, slightly weathered. Steep to vertical joints, rough, open to tight, highly fractured. Rock Quality=Very Poor Recovery=81% -BREWER FORMATION- R1 Core Times (min:sec): 10.0-11.0' (2:37); 11.0-12.0' (2:10); 12.0-13.0' (2:14); 13.0-13.5' (2:09)	
	R2	48/34	13.5 - 17.5	RQD = 33%						R2: Grey, aphanitic, SILTSTONE, moderately hard, slightly weathered. Steeply dipping joints, rough, open to tight, highly fractured, calcite intrusions. Rock Quality=Poor Recovery=71% -BREWER FORMATION- R2 Core Times (min:sec): 13.5-14.5' (1:50); 14.5-15.5' (2:13); 15.5-16.5' (2:42); 16.5-17.5' (2:39)	
15											
	R3	48/47	17.5 - 21.5	RQD = 98%						R3: Grey, aphanitic, SILTSTONE, moderately hard to hard, fresh to slightly weathered. Joints low angle to moderately dipping, rough, planar to undulating, close to modewrately close, frequent calcite intrusions/veins. Rock Quality=Excellent Recovery=98% -BREWER FORMATION- R3 Core Times (min:sec): 17.5-18.5' (2:00); 18.5-19.5' (2:36); 19.5-20.5' (2:14); 20.5-21.5' (2:18)	
20											
	R4	58.8/46	21.5 - 26.4	RQD = 73%						R4: Grey, aphanitic, SILTSTONE, moderately hard to hard, fresh to slightly weathered. Joints moderate to steep dipping, rough, planar, close, iron staining on some joint surfaces, calcite intrusions. Rock Quality=Fair Recovery=78% -BREWER FORMATION-	
25											

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Maine Department of Transportation

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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.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							NQ CORE			R4 Core Times (min:sec): 21.5-22.5' (3:37); 22.5-23.5' (2:51); 23.5-24.5' (2:08); 24.5-25.5' (2:51); 25.5-26.4' (2:03)	
	R5	31.2/8	26.4 - 29.0	RQD = 0%						R5: Grey, aphanitic, SILTSTONE, moderately hard to hard, slightly weathered. Joints low angle to moderately dipping, planar, rough, close, open, calcite veins. Highly fractured zone from approximately 27.3 to 29.0 ft. Rock Quality=Very Poor Recovery=26% -BREWER FORMATION- R5 Core Times (min:sec): 26.4-27.4' (1:08); 27.4-28.4' (1:45); 28.4-29.0' (2:04)	
								199.9		29.0	
30										**Bottom of Exploration at 29.0 feet below ground surface.**	
35											
40											
45											
50											

Remarks:

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ROCK CORE PHOTOGRAPHS
I-395/ROUTE 9 CONNECTOR
MAINEDOT WIN 018915.00
BREWER/EDDINGTON, MAINE

Top Row: BB-ELER-101, Run No. R1 16.4 (left) to 21.3 (right)
Top Middle Row: BB-ELER-101, Run No. R2 21.3 (left) to 26.3 (right)
Bottom Middle Row: HB-BE-147, Run No. R1 10.0 (left) to 10.4, Run No. R2 10.4 to 12.2, Run No. R3 12.2 to 13.2, Run No. R4 13.2 to 15.0, Run No. R5 15.0 to 16.5 (right)
Bottom Row: BB-BE-147, Run No. R5 continued 15.0 (left) to 16.5 (middle), Run No. R6 16.5 (middle) to 18.0 (right)

ROCK CORE PHOTOGRAPHS
I-395/ROUTE 9 CONNECTOR
MAINEDOT WIN 018915.00
BREWER/EDDINGTON, MAINE

Top Row: BB-ELER-102, Run No. R1 14.5 (left) to 18.5 (middle), Run No. R2 18.5 (middle) to 22.2 (right)
Top Middle Row: BB-ELER-102 Run No. R2 continued 18.5 (left) to 22.2 (middle), Run No. R3 22.2 (middle) to 27.2 (right)
Bottom Middle Row: BB-ELER-102 Run No. R3 continued 22.2 (left) to 27.2 (middle), Run No. R4 27.2 (middle) to 30.2 (right)
Bottom Row: BB-ELER-102, Run No. R4 continued 27.2 (left) to 30.2 (right)

ROCK CORE PHOTOGRAPHS
I-395/ROUTE 9 CONNECTOR
MAINEDOT WIN 018915.00
BREWER/EDDINGTON, MAINE

Top Row: BB-ELER-202, Run No. R1 17.0 (left) to 21.0 (right)
Top Middle Row: BB-ELER-202, Run No. R2 21.0 (left) to 25.8 (middle), Run No. R3 25.8 (middle) to 29.8 (right)
Bottom Middle Row: BB-ELER-202, Run No. R3 continued 25.8 (left) to 29.8 (middle), Run No. R4 29.8 (middle) to 34.8 (right)
Bottom Row: BB-ELER-202, Run No. R4 continued 29.8 (left) to 34.8 (middle), Run No. R5 34.8 (middle) to 37.0 (right)

Top Row: BB-ELER-205, Run No. R1 15.0 (left) to 18.0 (middle), Run No. R2 18.0 (middle) to 20.0 (right)
Top Middle Row: BB-ELER-205, Run No. R3 20.0 (left) to 22.6 (middle), Run No. R4 22.6 (middle) to 25.0 (right)
Bottom Middle Row: BB-ELER-205, Run No. R5 25.0 (left) to 30.0 (right)
Bottom Row: BB-ELER-205, Run No. R6 30.0 (left) to 35.0 (right)

Top Row: BB-ELER-206A, Run No. R1 10.0 (left) to 15.0 (right)
Middle Row: BB-ELER-206A, Run No. R2 15.0 (left) to 20.0 (right)
Bottom Row: BB-ELER-206A, Run No. R3 20.0 (left) to 22.0 (middle left), Run No. R4 22.0 (middle left) to 22.8 (middle right), Run No. R5 22.8 (middle right) to 25.0 (right)

Top Row: BB-ELER-206A, Run No. R6 25.0 (left) to 29.0 (right)
Middle Row: BB-ELER-206A, Run No. R7 29.0 (left) to 32.2 (middle), Run No. R8 32.2 (middle) to 34.4 (right)
Bottom Row: BB-ELER-206A, Run No. R9 34.4 (left) to 37.0 (right)

Top Row: BB-ECR-206, Run No. R1 12.0 (left) to 14.1 (middle), Run No. R2 14.1 (middle) to 16.1 (right)
Top Middle Row: BB-ECR-203, Run No. R1 15.0 (left) to 17.5 (middle), Run No. R2 17.5 (middle) to 20.0 (right)
Bottom Middle Row: BB-ELER-206, Run No. R1 11.0 (left) to 13.6 (middle), Run No. R2 13.6 (middle) to 16.0 (right)
Bottom Row: BB-ELER-203, Run No. R1 15.3 (left) to 20.3 (right)

Top Row: BB-ECR-201, Run No. R4 continued 32.2 (page2) to 37.2 (middle), Run No. R5, 37.2 (middle) to 40.1 (right)
Top Middle Row: BB-ECR-201, Run No. R6 40.1 (left) to 42.1 (right)
Bottom Middle Row: BB-ELER-204, Run No. R1 9.9 (left) to 14.9 (right)
Bottom Row: HB-BE-235, Run No. R1 15.0 (left) to 17.0 (middle left), Run No. R2 17.0 (middle left) to 18.5 (middle right), Run No. R3 18.5 (middle right) to 21.8 (right)

Top Row: HB-BE-235, Run No. R4 21.8 (left) to 27.0 (right)
Top Middle Row: HB-BE-235, Run No. R5 27.0 (left) to 29.0 (middle); BB-ELER-201, Run No. R1 21.3 (middle) to 26.3 (right)
Bottom Middle Row: BB-ELER-201, Run No. R1 continued 21.3 (left) to 26.3 (middle-left), Run No. R2 26.3 (middle left) to 28.5 (middle-right); HB-BE-237, Run No. R1 10.0 (middle-right) to 13.5 (right)
Bottom Row: HB-BE-237, Run No. R1 continued 10.0 (left) to 13.5 (middle left), Run No. R2 13.5 (middle left) to 17.5 (right)

APPENDIX B

Borehole Geophysical Logging Reports

HAGER-RICHTER
GEOSCIENCE, INC.

GEOPHYSICS FOR THE ENGINEERING COMMUNITY
SALEM, NEW HAMPSHIRE
Tel: 603.893.9944
FORDS, NEW JERSEY
Tel: 732.661.0555

BOREHOLE GEOPHYSICAL LOGGING - DATA REPORT
BOREHOLES BB-ECR-202, BB-ECR-205, BB-ELER-202, BB-ELER-205, HB-BE-231, HB-BE-232, HB-BE-236
BREWER-EDDINGTON I-395/ROUTE 9 CONNECTOR
EDDINGTON, MAINE

Prepared for:

Haley & Aldrich, Inc.
75 Washington Avenue | Suite 1A
Portland, Maine 04101

Prepared by:

Hager-Richter Geoscience, Inc.
8 Industrial Way - D10
Salem, New Hampshire 03079

File 20RG77
January 2021

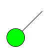
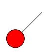
Tadpole	Structure Category (Symbol Color)	Description
	Fracture Rank 1 (Light Blue)	Minor Fracture - not distinct and may not be continuous around the borehole
	Fracture Rank 2 (Blue)	Intermediate Fracture - distinct and continuous around the borehole with little or no apparent aperture
	Fracture Rank 3 (Light Green)	Intermediate Fracture - distinct and continuous around the borehole with some apparent aperture
	Fracture Rank 4 (Red)	Major Fracture - distinct with continuous apparent aperture around the borehole
	Foliation or Vein (Orange)	Planar geologic feature interpreted as foliation or a vein

Figure 1. Key to bedrock structure categories.

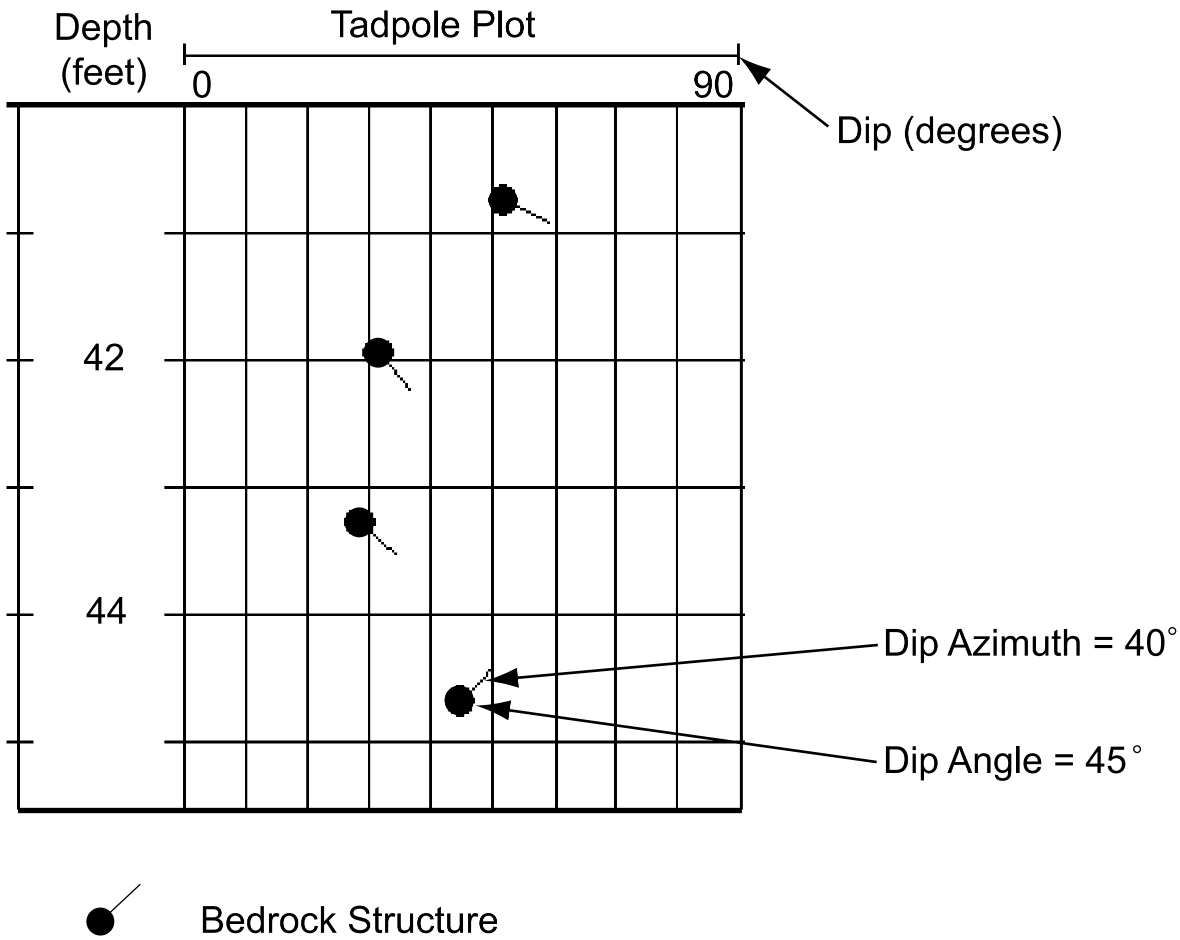


Figure 2. Tadpole plot explanation. The orientation of the bedrock structures is graphically displayed by a tadpole consisting of a circle, the head, and a line, the tail. The position of the head, left to right on the tadpole plot, gives the dip angle of the structure. The left side of the track indicates a dip angle of 0°, and the right side of the track indicates a dip angle of 90° from horizontal. The orientation of the tail gives the dip azimuth of the structure and can be read like a compass. The tail pointing directly up is 0°, north.

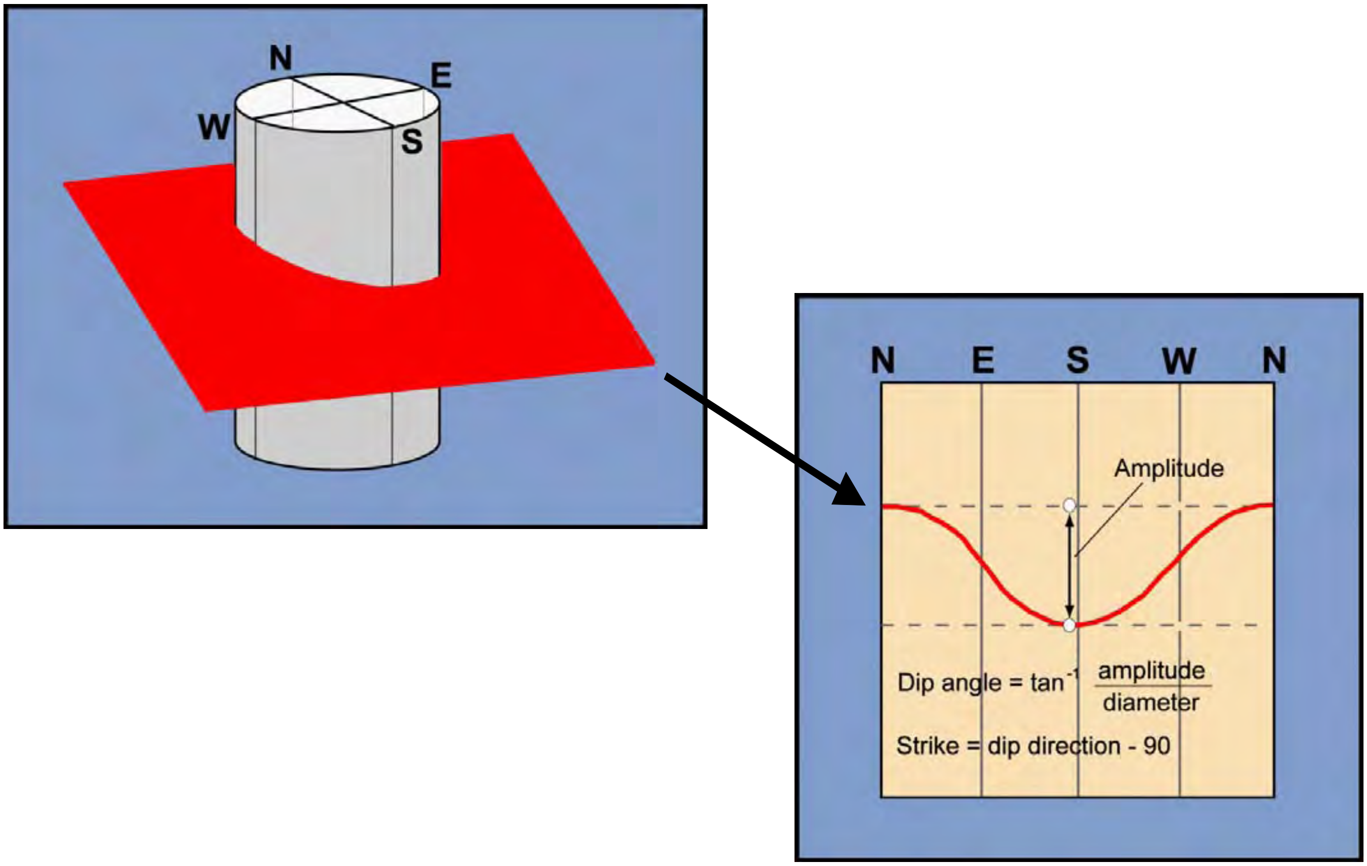


Figure 3. Televiewer Explanation Figure. The image on the left depicts a planar structure in red, such as a fracture or bedding plane, intersected by a borehole. The image on the right depicts the same structure unwrapped as it would be displayed in an optical televiewer (OTV) or acoustic televiewer (ATV) log.

Figure modified from: Garfield, R.L., Day-Lewis, F.D., Gray, M.B., Johnson, C.D., Williams, J.H. and Day-Lewis, A.D.F., 2003, Fractured-Rock Aquifer Characterization within a Regional Geologic Context: Results from the Bucknell University Hydrogeophysics Test Site, GSA Northeastern Section, 38th Annual Meeting, Paper No. 25-19.

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Tel: 603.893.9944

Fords, New Jersey
Tel: 732.661.0555

BB-ECR-202 - BOREHOLE GEOPHYSICAL LOGS

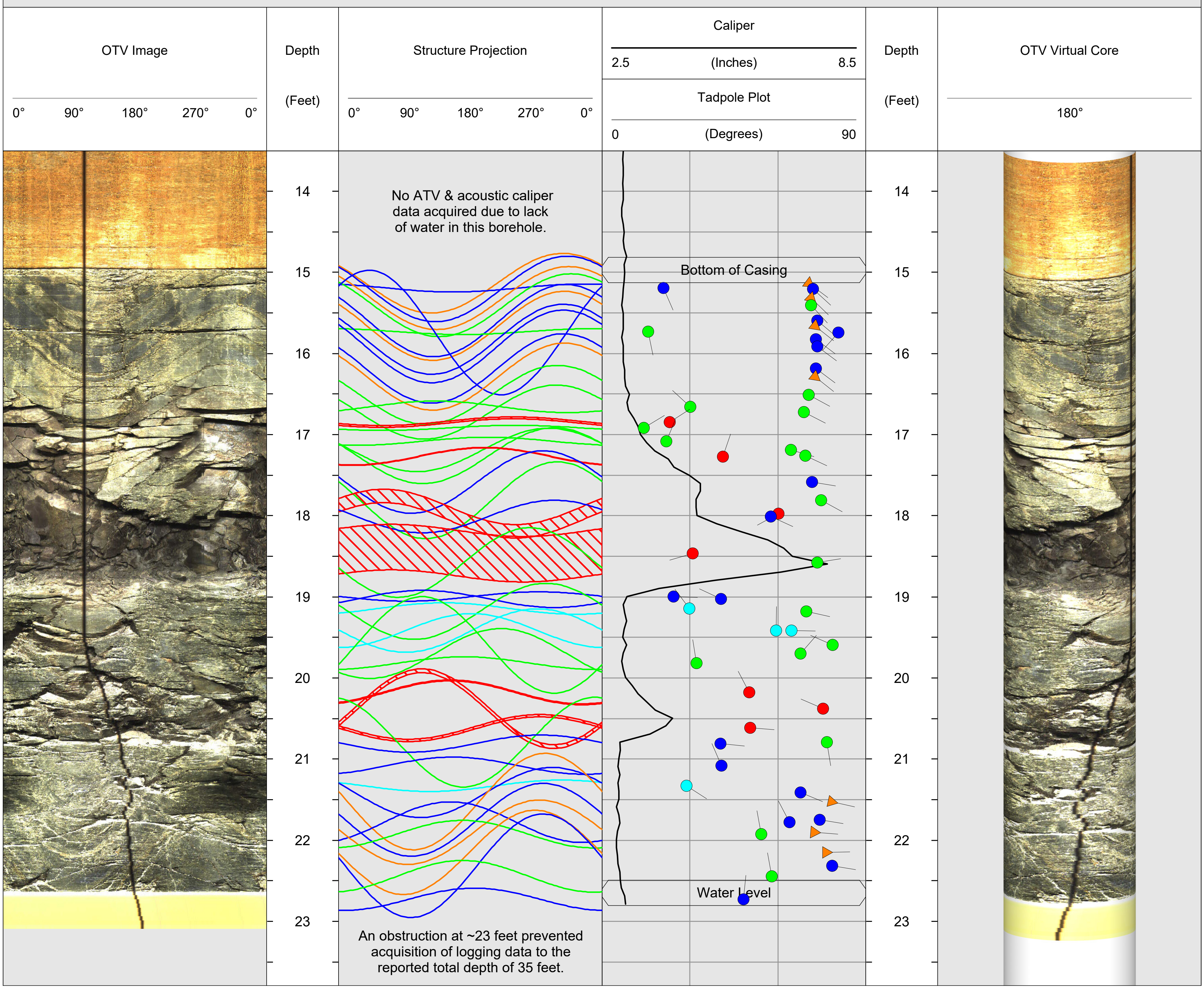
DATE(S) LOGGED: November 24, 2020

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Justin Covert	BOREHOLE DIAMETER:	3 Inches
PROJECT REP(S) ON-SITE:	Dave Dearden	LOGS PROCESSED BY:	Robert Garfield P.G. & Nick DeCristofaro

STRUCTURE LEGEND

Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

BB-ECR-202 - Borehole Geophysical Logs



HAGER-RICHTER GEOSCIENCE, INC.

Salem, New Hampshire
Tel: 603.893.9944

Fords, New Jersey
Tel: 732.661.0555

BB-ECR-205 - BOREHOLE GEOPHYSICAL LOGS

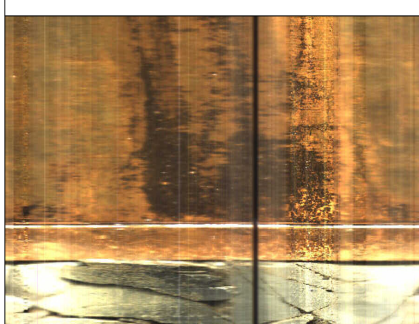
DATE(S) LOGGED: November 24, 2020

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	Data are Unoriented - See Notes Below
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Justin Covert	BOREHOLE DIAMETER:	3 Inches
PROJECT REP(S) ON-SITE:	Dave Dearden	LOGS PROCESSED BY:	Robert Garfield P.G. & Nick DeCristofaro

NOTE: The OTV data are unoriented due to magnetic interference from the steel casing throughout the unobstructed open bedrock portion of the borehole.

BB-ECR-205 - Borehole Geophysical Logs

OTV Image	Depth (Feet)	Comments	Caliper 2.5 (Inches) 7	Depth (Feet)	OTV Virtual Core



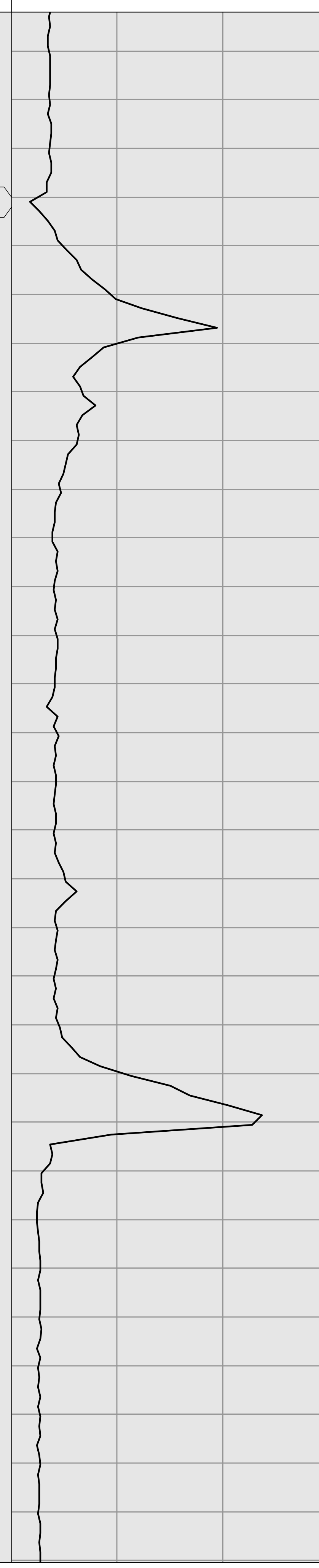
Depth (Feet): 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

Comments:

A partial obstruction at ~17 feet prevented acquisition of OTV & ATV data; only 3-arm caliper data were acquired below ~17 feet.

Bottom of Casing (16 feet)

An obstruction at ~30 feet prevented acquisition of 3-arm caliper data to the reported total depth of 35 feet.



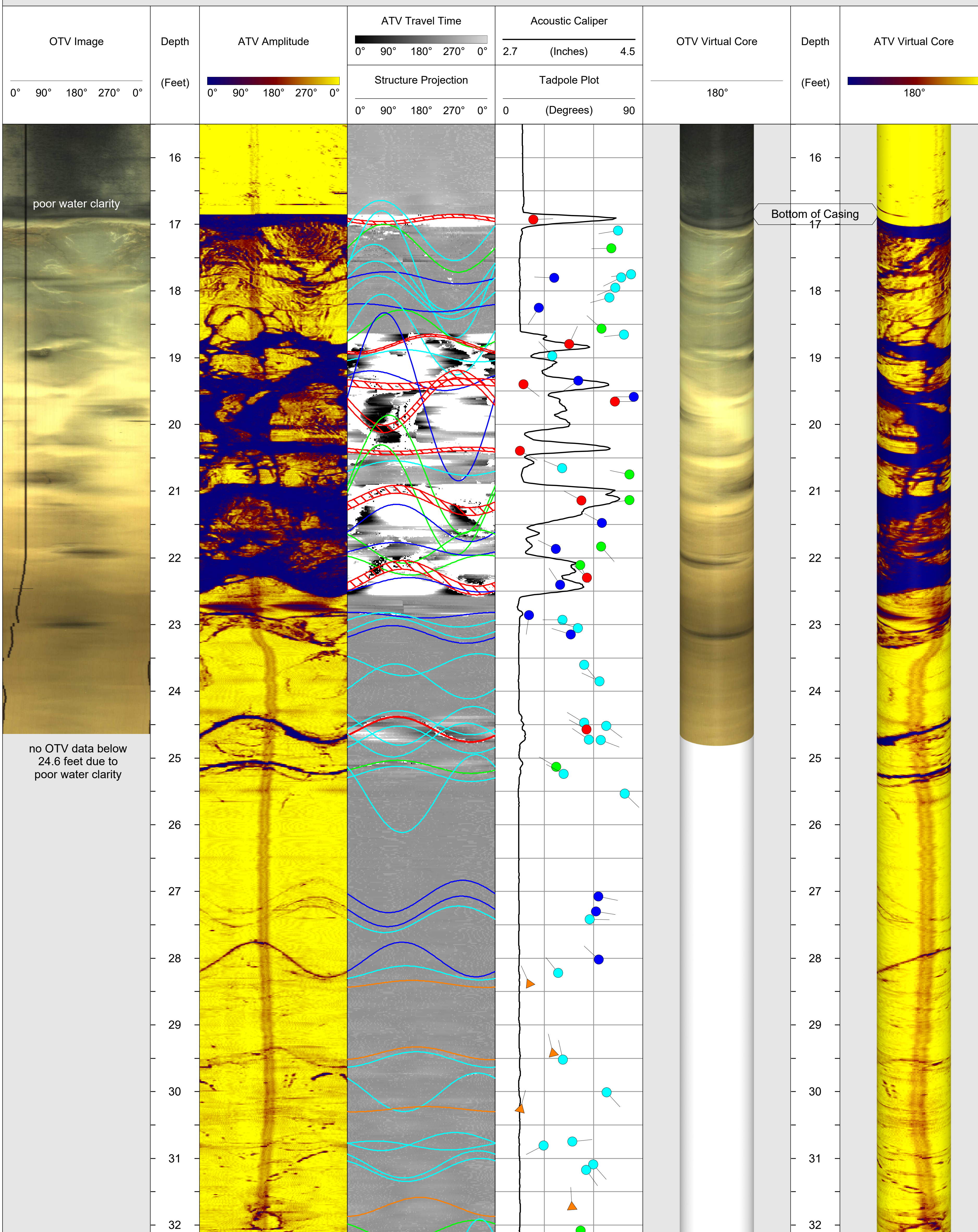
HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	BB-ELER-202 - BOREHOLE GEOPHYSICAL LOGS DATE(S) LOGGED: November 24, 2020

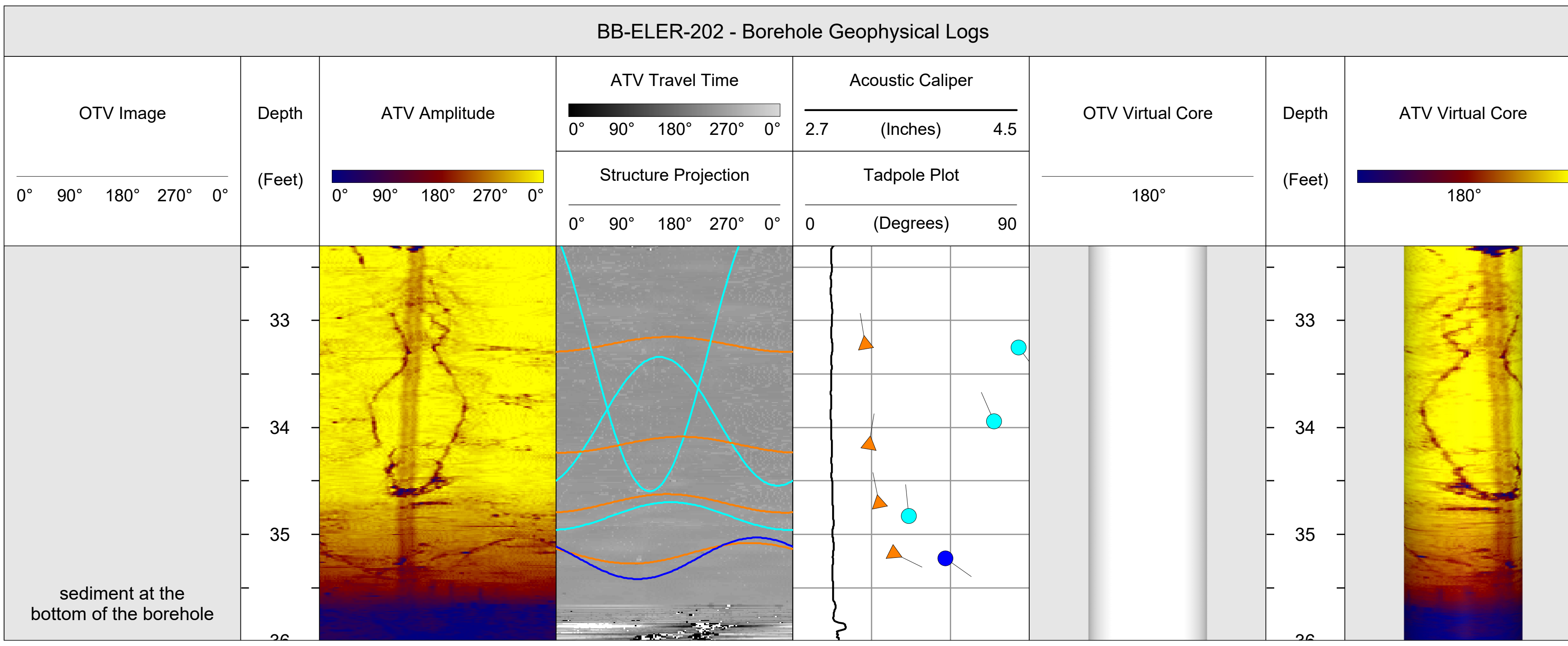
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Justin Covert	BOREHOLE DIAMETER:	3 Inches
PROJECT REP(S) ON-SITE:	Dave Dearden	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

STRUCTURE LEGEND

Fracture Rank 1   Fracture Rank 2   Fracture Rank 3   Fracture Rank 4   Foliation / Vein

BB-ELER-202 - Borehole Geophysical Logs




BB-ELER-202 - Borehole Geophysical Logs
OTV Image
0° 90° 180° 270° 0°
Depth
(Feet)
ATV Amplitude
0° 90° 180° 270° 0°
ATV Travel Time
0° 90° 180° 270° 0°
Structure Projection
0° 90° 180° 270° 0°
Acoustic Caliper
2.7 (Inches) 4.5
Tadpole Plot
0 (Degrees) 90
OTV Virtual Core
180°
Depth
(Feet)
ATV Virtual Core
180°
33
34
35
sediment at the
bottom of the borehole

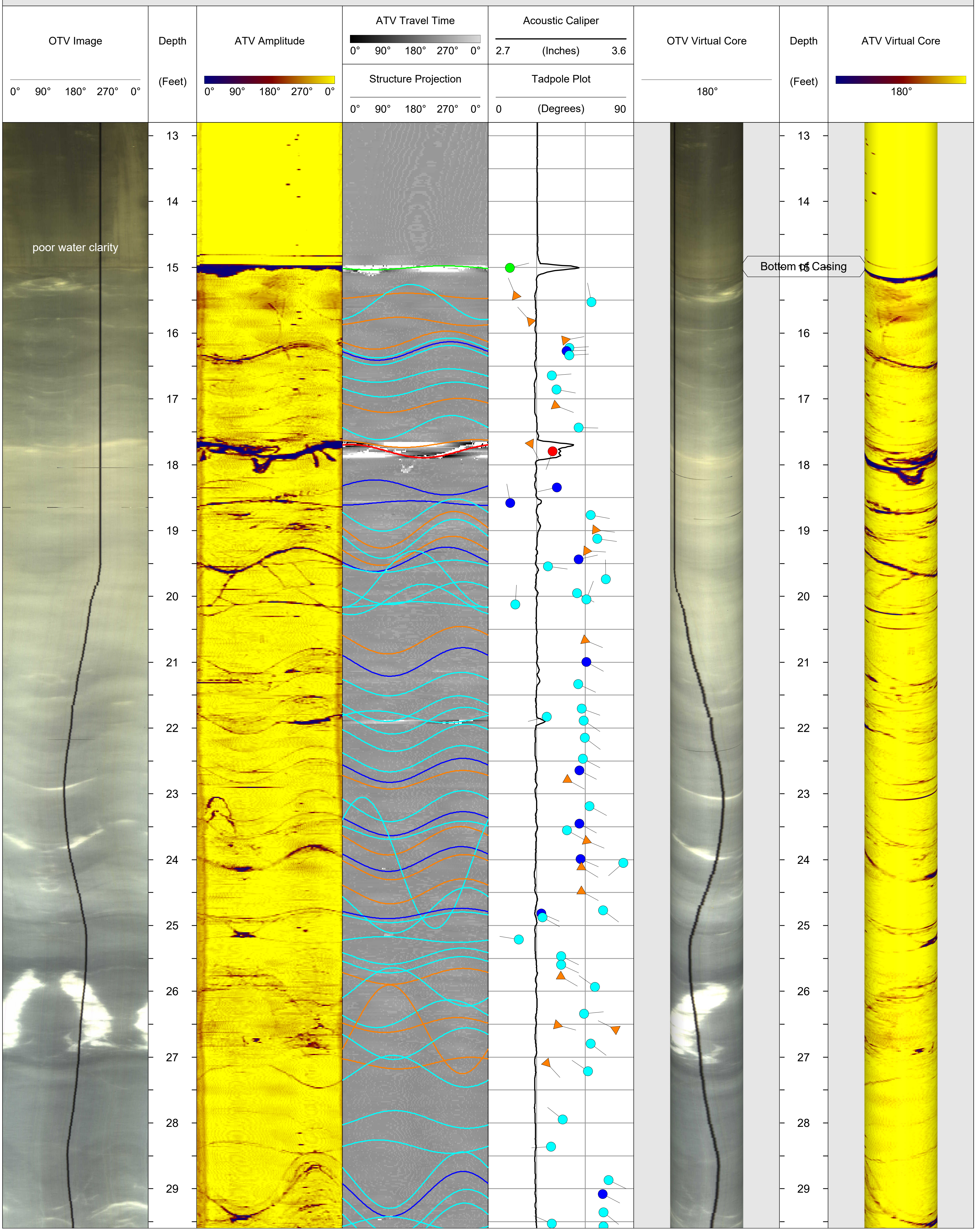
HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	BB-ELER-205 - BOREHOLE GEOPHYSICAL LOGS DATE(S) LOGGED: November 24, 2020

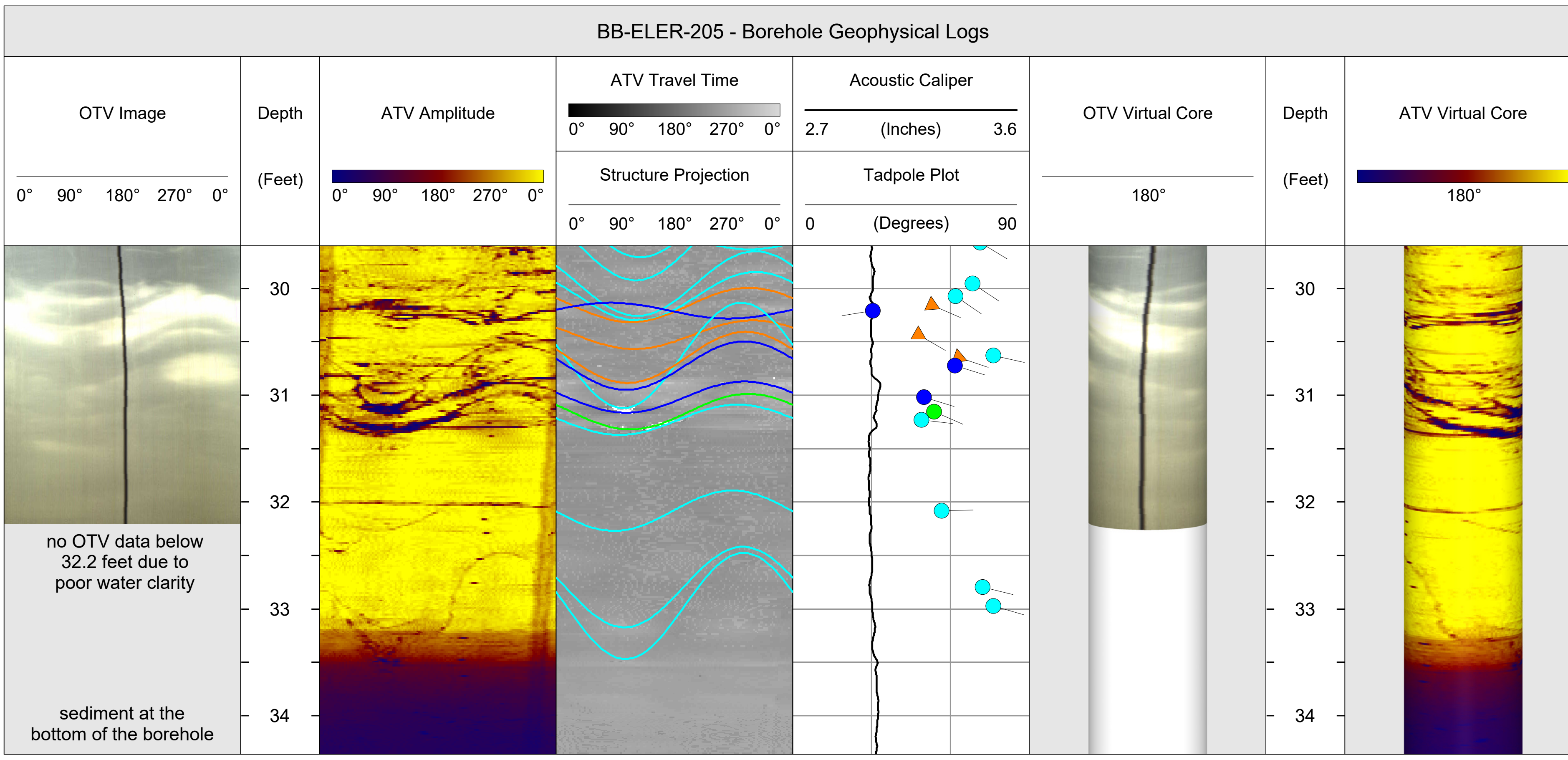
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Justin Covert	BOREHOLE DIAMETER:	3 Inches
PROJECT REP(S) ON-SITE:	Dave Dearden	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

STRUCTURE LEGEND

Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

BB-ELER-205 - Borehole Geophysical Logs




BB-ELER-205 - Borehole Geophysical Logs
OTV Image
0° 90° 180° 270° 0°
Depth
(Feet)
ATV Amplitude
0° 90° 180° 270° 0°
ATV Travel Time
0° 90° 180° 270° 0°
Structure Projection
0° 90° 180° 270° 0°
Acoustic Caliper
2.7 (Inches) 3.6
Tadpole Plot
0 (Degrees) 90
OTV Virtual Core
180°
Depth
(Feet)
ATV Virtual Core
180°
30
31
32
33
34
no OTV data below
32.2 feet due to
poor water clarity
sediment at the
bottom of the borehole

HAGER-RICHTER GEOSCIENCE, INC.

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HB-BE-231 - BOREHOLE GEOPHYSICAL LOGS

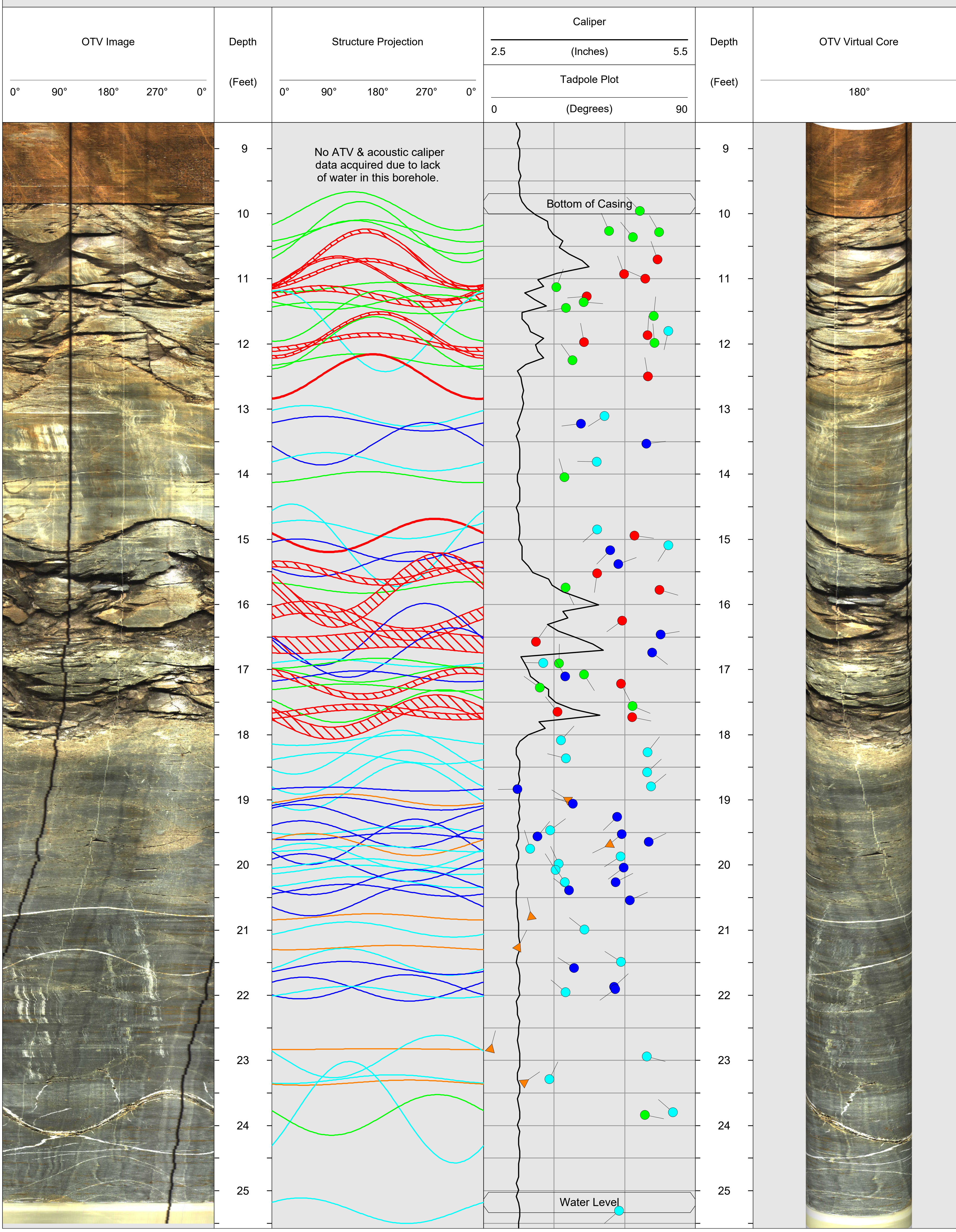
DATE(S) LOGGED: November 24, 2020

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Justin Covert	BOREHOLE DIAMETER:	3 Inches
PROJECT REP(S) ON-SITE:	Dave Dearden	LOGS PROCESSED BY:	Robert Garfield P.G. & Nick DeCristofaro

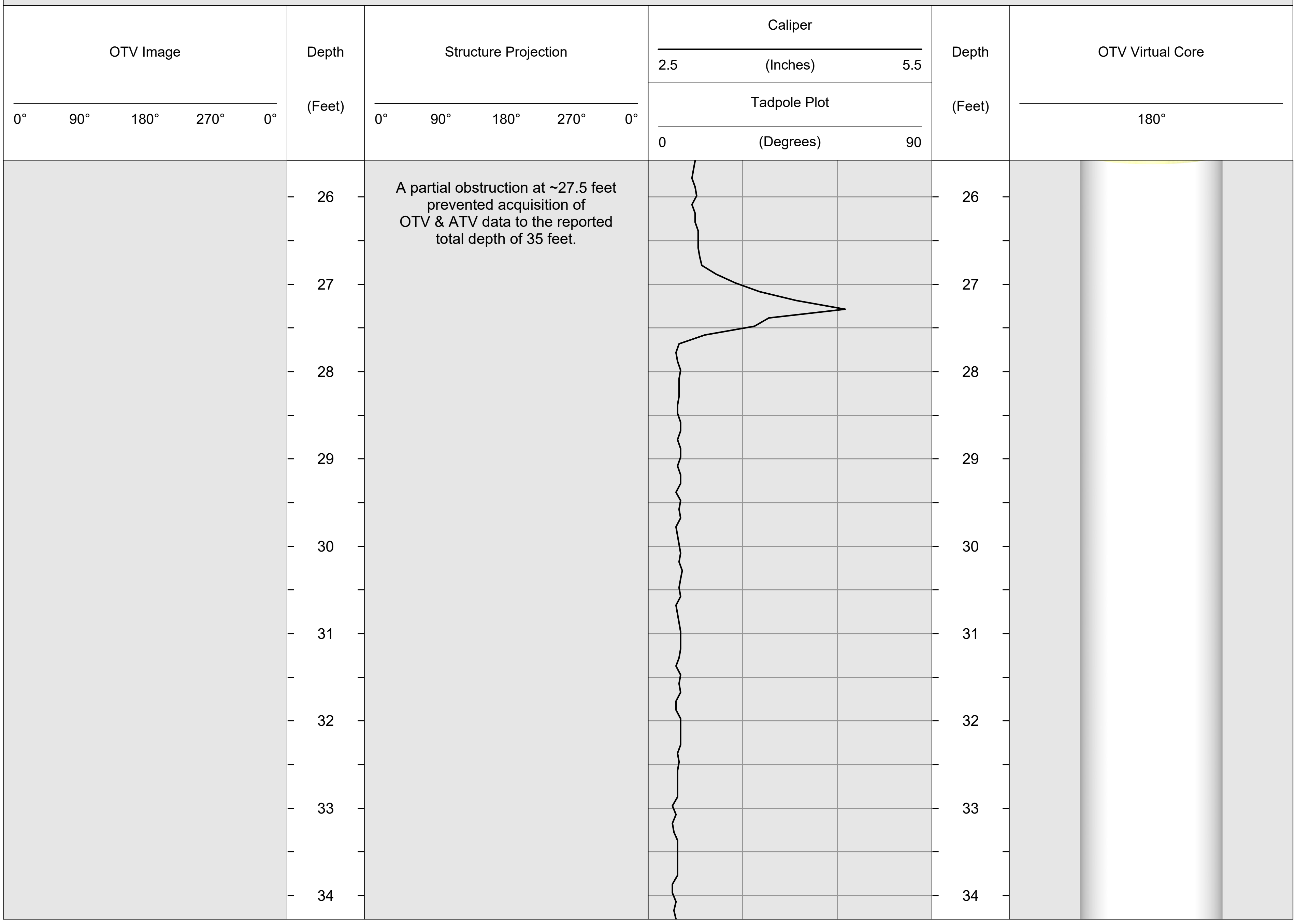
STRUCTURE LEGEND

Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

HB-BE-231 - Borehole Geophysical Logs



HB-BE-231 - Borehole Geophysical Logs



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HB-BE-232 - BOREHOLE GEOPHYSICAL LOGS

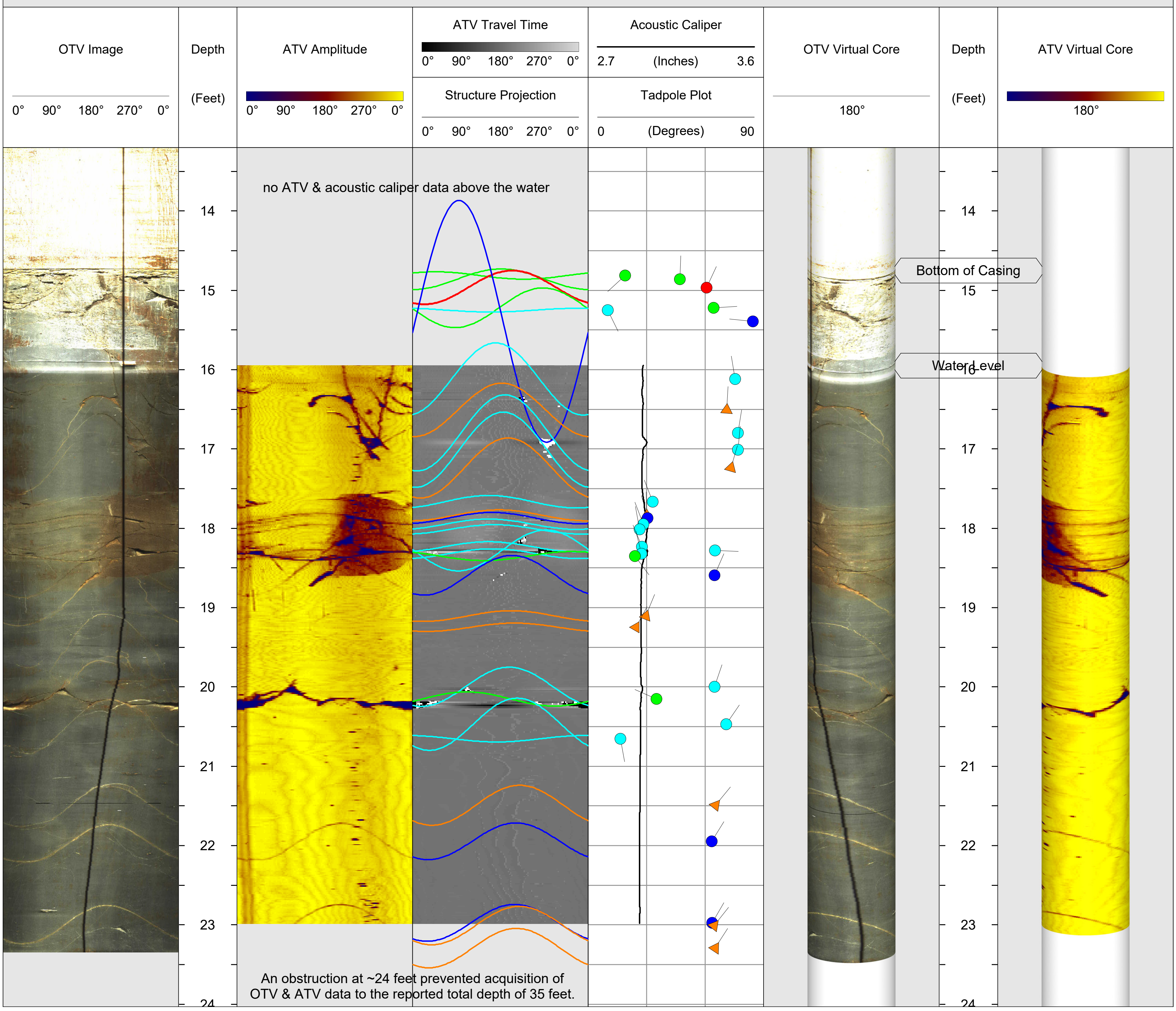
DATE(S) LOGGED: November 24, 2020

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Justin Covert	BOREHOLE DIAMETER:	3 Inches
PROJECT REP(S) ON-SITE:	Dave Dearden	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

STRUCTURE LEGEND

Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

HB-BE-232 - Borehole Geophysical Logs



HAGER-RICHTER GEOSCIENCE, INC.

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Tel: 732.661.0555

HB-BE-236 - BOREHOLE GEOPHYSICAL LOGS

DATE(S) LOGGED: November 24, 2020

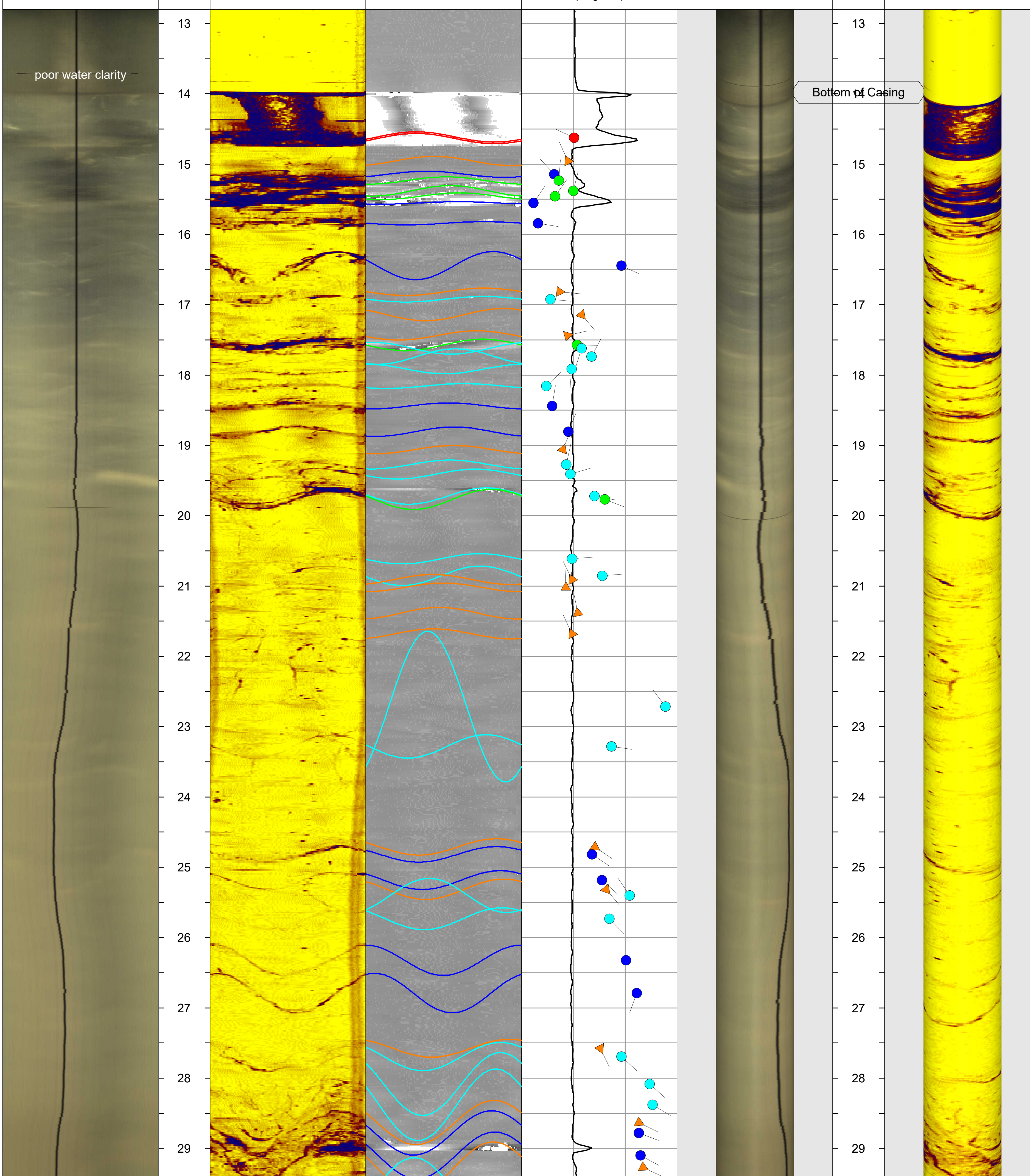
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Justin Covert	BOREHOLE DIAMETER:	3 Inches
PROJECT REP(S) ON-SITE:	Dave Dearden	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

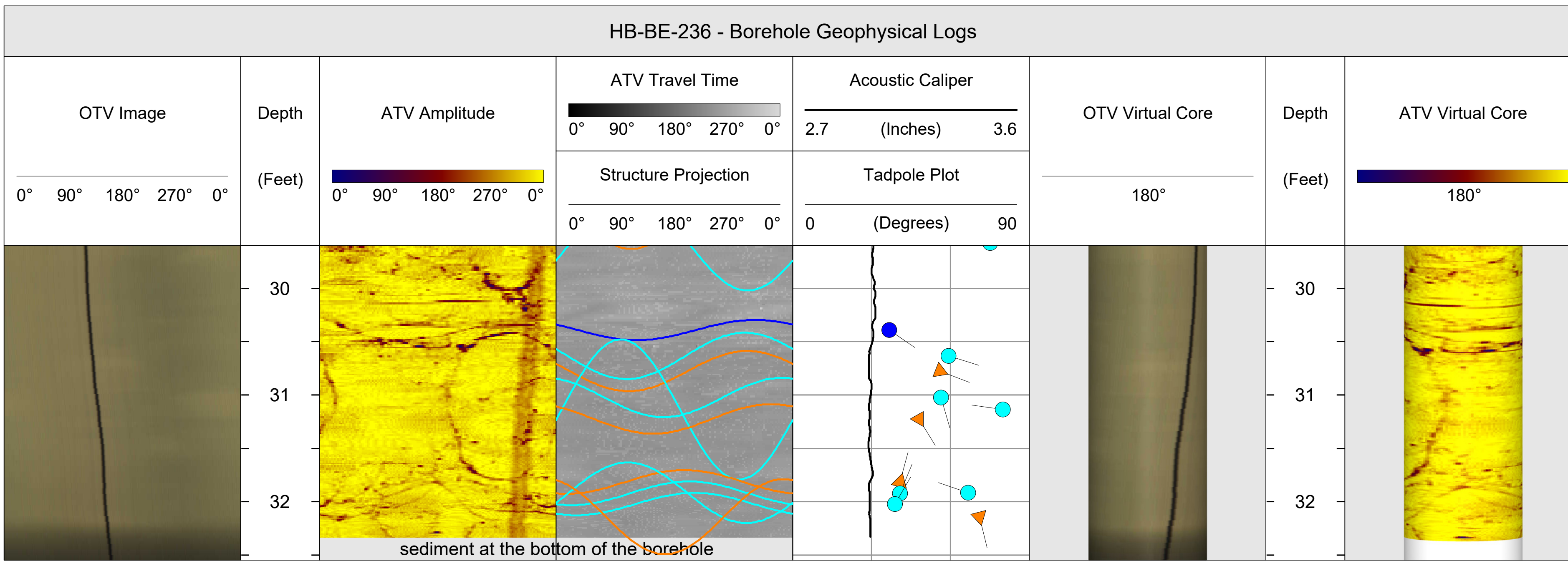
STRUCTURE LEGEND

Fracture Rank 1 — Fracture Rank 2 — Fracture Rank 3 — Fracture Rank 4 — Foliation / Vein

HB-BE-236 - Borehole Geophysical Logs

OTV Image	Depth	ATV Amplitude	ATV Travel Time / Structure Projection	Acoustic Caliper / Tadpole Plot	OTV Virtual Core	Depth	ATV Virtual Core
0° 90° 180° 270° 0°	(Feet)	0° 90° 180° 270° 0°	0° 90° 180° 270° 0° / 0° 90° 180° 270° 0°	2.7 (Inches) 3.6 / 0 (Degrees) 90	180°	(Feet)	180°




HB-BE-236 - Borehole Geophysical Logs
OTV Image
0° 90° 180° 270° 0°
Depth
(Feet)
ATV Amplitude
0° 90° 180° 270° 0°
ATV Travel Time
0° 90° 180° 270° 0°
Structure Projection
0° 90° 180° 270° 0°
Acoustic Caliper
2.7 (Inches) 3.6
Tadpole Plot
0 (Degrees) 90
OTV Virtual Core
180°
Depth
(Feet)
ATV Virtual Core
180°
30
31
32
sediment at the bottom of the borehole

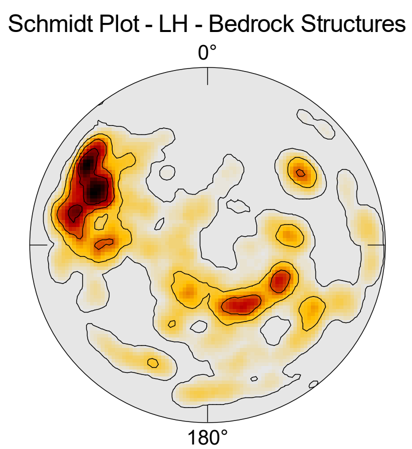
HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	ALL BOREHOLES - BEDROCK STRUCTURE STATISTICS PLOTS (BB-ECR-202, BB-ELER-202, BB-ELER-205, HB-BE-231, HB-BE-232, HB-BE-236) DATE(S) LOGGED: November 24, 2020

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

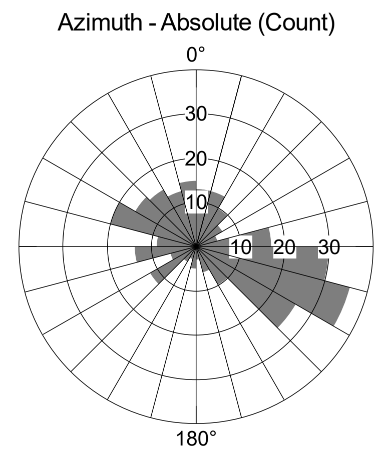
● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ◀ Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



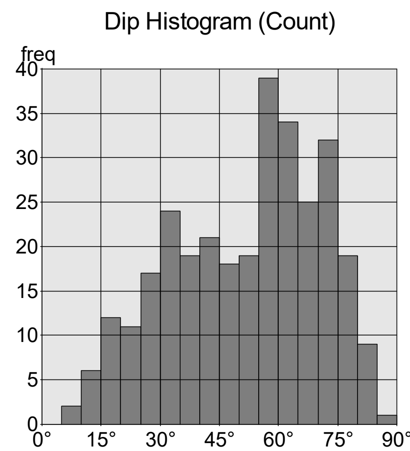
	Counts	Dip[deg]	Azi[deg]
Mean	308	51.95	59.26
● (green)	55	50.54	42.36
● (red)	33	50.12	354.36
● (cyan)	138	53.11	59.95
● (blue)	82	51.69	97.64

Dip Azimuth Rose Diagram of Bedrock Fractures



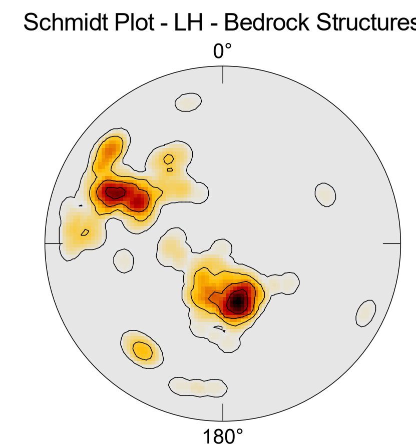
Components:	Azimuth
Counts:	308.00
Mean (2D):	59.26
Std.Dev.:	109.38
Min:	0.63
Max:	358.63

Dip Angle Histogram of Bedrock Fractures



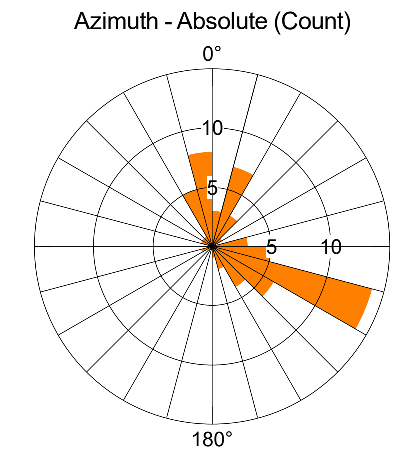
Counts:	308.00
Mean (2D):	51.95
Std.Dev.:	18.93
Min:	6.87
Max:	85.97

Stereogram - Lower Hemisphere of Foliation & Veins



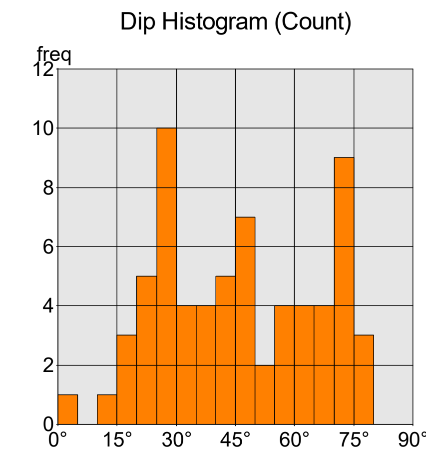
	Counts	Dip[deg]	Azi[deg]
Mean	66	45.54	69.10
▶	66	45.54	69.10

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	66.00
Mean (2D):	69.10
Std.Dev.:	71.72
Min:	3.36
Max:	358.36

Dip Angle Histogram of Foliation & Veins



Counts:	66.00
Mean (2D):	45.54
Std.Dev.:	19.65
Min:	2.88
Max:	78.75

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BB-ECR-202 - BEDROCK STRUCTURE STATISTICS PLOTS

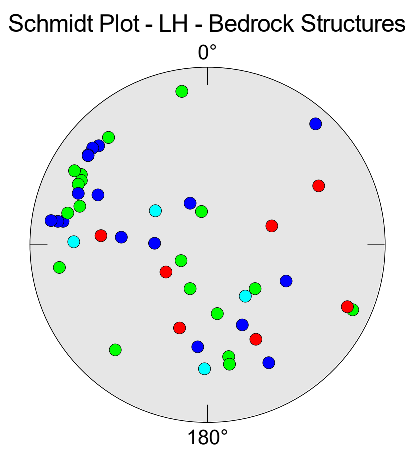
DATE(S) LOGGED: November 24, 2020

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

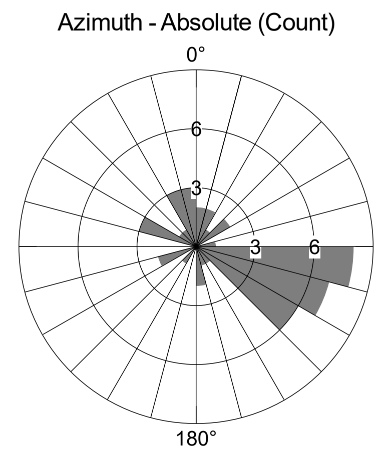
- Fracture Rank 1 (cyan)
- Fracture Rank 2 (blue)
- Fracture Rank 3 (green)
- Fracture Rank 4 (red)
- Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



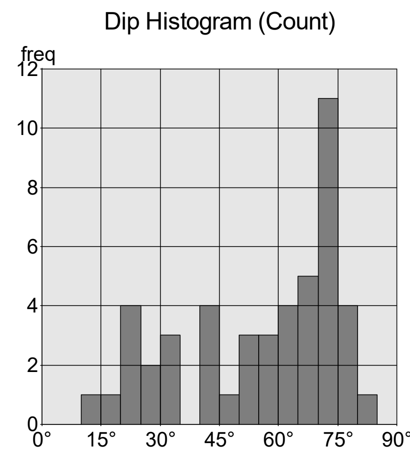
	Counts	Dip[deg]	Azi[deg]
Mean	47	55.60	84.61
Rank 2 (blue)	18	59.98	108.66
Rank 3 (green)	18	56.72	79.66
Rank 4 (red)	7	47.34	331.48
Rank 1 (cyan)	4	45.66	45.90

Dip Azimuth Rose Diagram of Bedrock Fractures



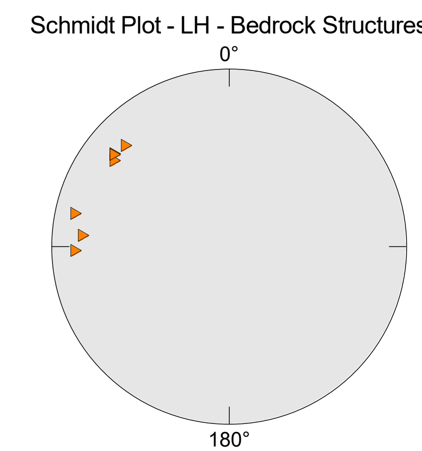
Components:	Azimuth
Counts:	47.00
Mean (2D):	84.61
Std.Dev.:	83.45
Min:	1.62
Max:	351.36

Dip Angle Histogram of Bedrock Fractures



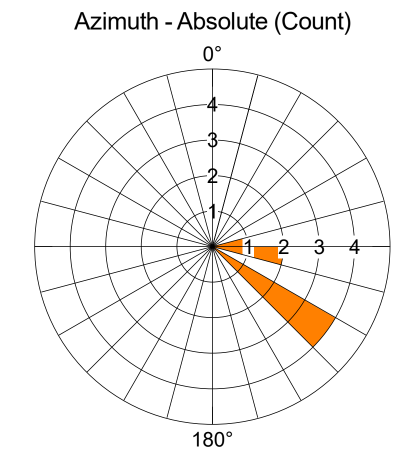
Counts:	47.00
Mean (2D):	55.60
Std.Dev.:	20.10
Min:	14.25
Max:	80.69

Stereogram - Lower Hemisphere of Foliation & Veins



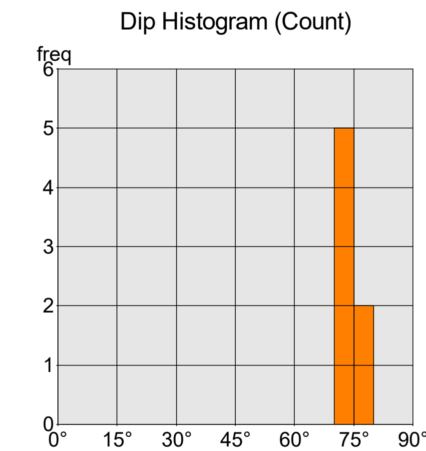
	Counts	Dip[deg]	Azi[deg]
Mean	7	73.44	114.84
Foliation / Vein	7	73.44	114.84

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	7.00
Mean (2D):	114.84
Std.Dev.:	17.71
Min:	88.42
Max:	134.16

Dip Angle Histogram of Foliation & Veins



Counts:	7.00
Mean (2D):	73.44
Std.Dev.:	2.61
Min:	70.53
Max:	78.28

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BB-ELER-202 - BEDROCK STRUCTURE STATISTICS PLOTS

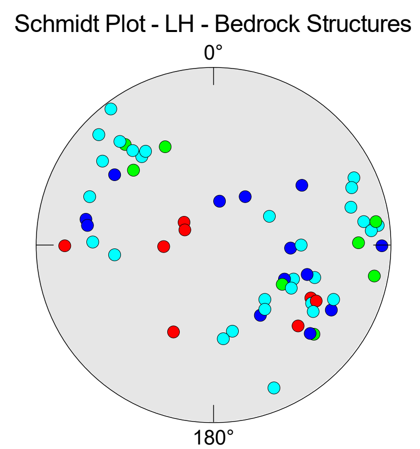
DATE(S) LOGGED: November 24, 2020

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

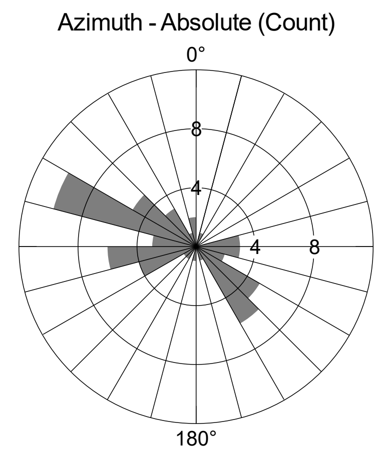
● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ◄ Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



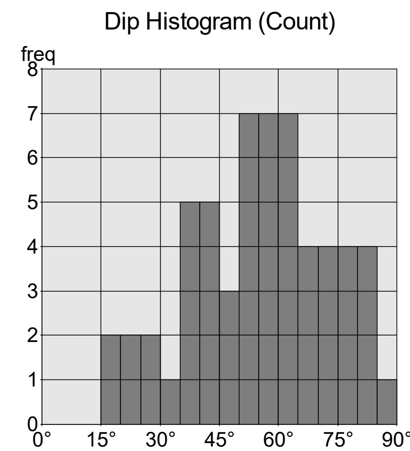
	Counts	Dip[deg]	Azi[deg]
Mean	58	55.29	267.86
●	8	42.26	46.90
●	29	58.92	267.54
●	8	63.15	247.48
●	13	50.07	263.43

Dip Azimuth Rose Diagram of Bedrock Fractures



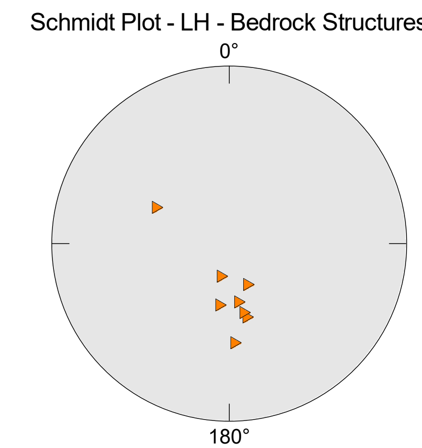
Components:	Azimuth
Counts:	58.00
Mean (2D):	267.86
Std.Dev.:	98.21
Min:	24.91
Max:	353.79

Dip Angle Histogram of Bedrock Fractures



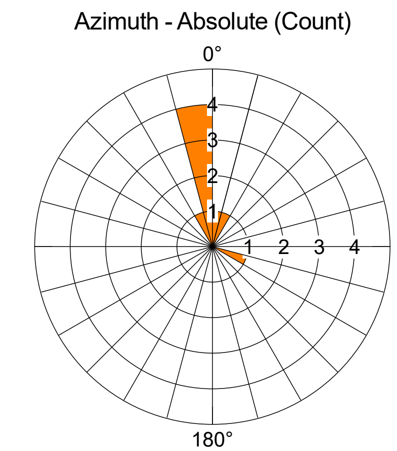
Counts:	58.00
Mean (2D):	55.29
Std.Dev.:	17.84
Min:	15.06
Max:	85.97

Stereogram - Lower Hemisphere of Foliation & Veins



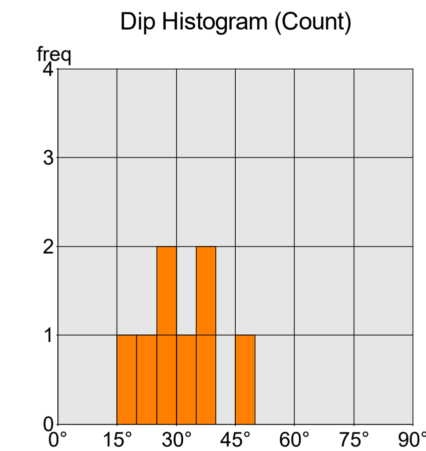
	Counts	Dip[deg]	Azi[deg]
Mean	8	30.76	2.29
►	8	30.76	2.29

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	8.00
Mean (2D):	2.29
Std.Dev.:	38.80
Min:	9.59
Max:	356.76

Dip Angle Histogram of Foliation & Veins



Counts:	8.00
Mean (2D):	30.76
Std.Dev.:	9.27
Min:	15.46
Max:	46.86

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BB-ELER-205 - BEDROCK STRUCTURE STATISTICS PLOTS

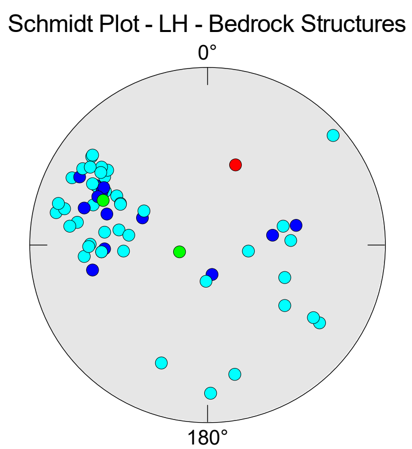
DATE(S) LOGGED: November 24, 2020

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

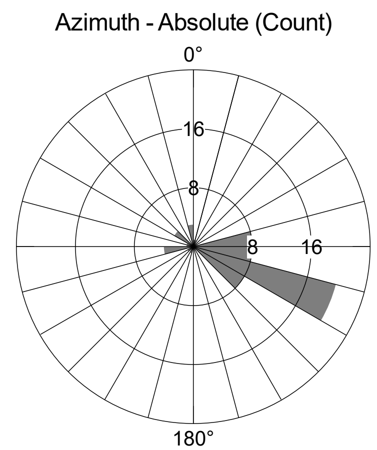
Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



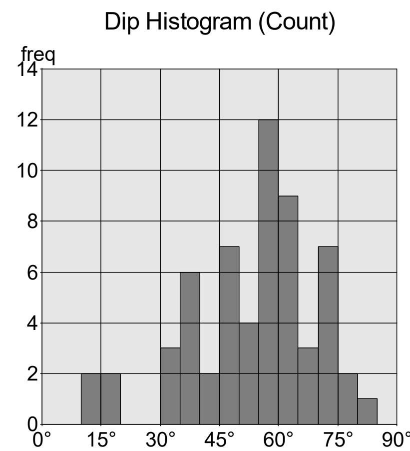
	Counts	Dip[deg]	Azi[deg]
Mean	60	53.59	105.23
(Rank 3)	2	33.59	94.75
(Rank 1)	44	56.08	102.43
(Rank 2)	13	49.16	108.81
(Rank 4)	1	39.78	199.46

Dip Azimuth Rose Diagram of Bedrock Fractures



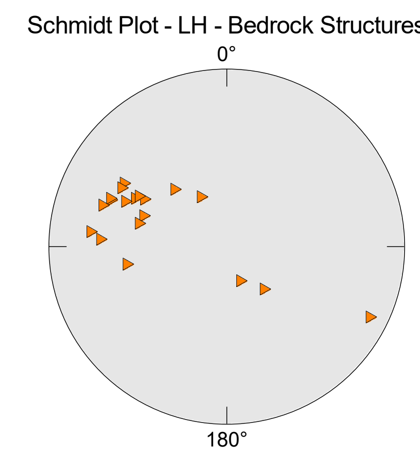
Components:	Azimuth
Counts:	60.00
Mean (2D):	105.23
Std.Dev.:	63.82
Min:	3.38
Max:	358.63

Dip Angle Histogram of Bedrock Fractures



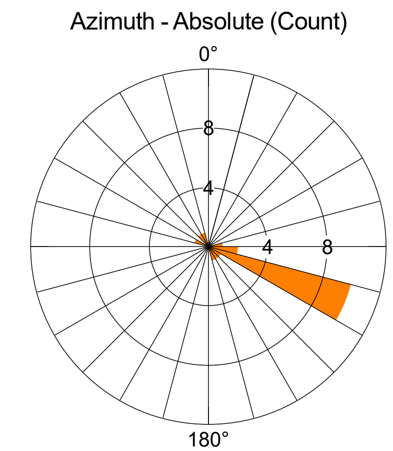
Counts:	60.00
Mean (2D):	53.59
Std.Dev.:	15.70
Min:	13.36
Max:	83.42

Stereogram - Lower Hemisphere of Foliation & Veins



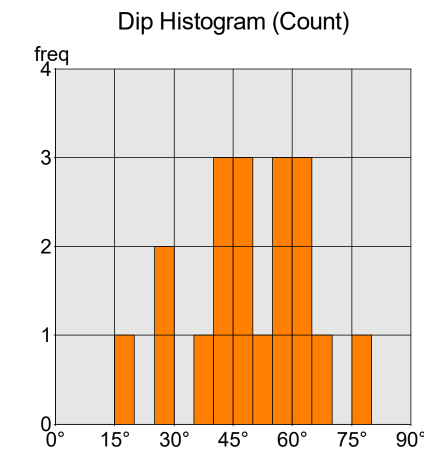
	Counts	Dip[deg]	Azi[deg]
Mean	19	49.33	108.72
(Foliation / Vein)	19	49.33	108.72

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	19.00
Mean (2D):	108.72
Std.Dev.:	51.01
Min:	79.71
Max:	337.22

Dip Angle Histogram of Foliation & Veins



Counts:	19.00
Mean (2D):	49.33
Std.Dev.:	15.03
Min:	16.94
Max:	78.75

HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	HB-BE-231 - BEDROCK STRUCTURE STATISTICS PLOTS DATE(S) LOGGED: November 24, 2020

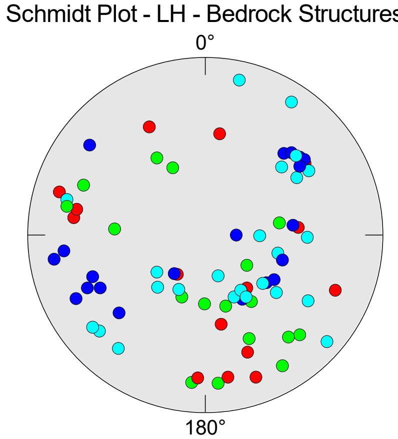
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ◄ Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures

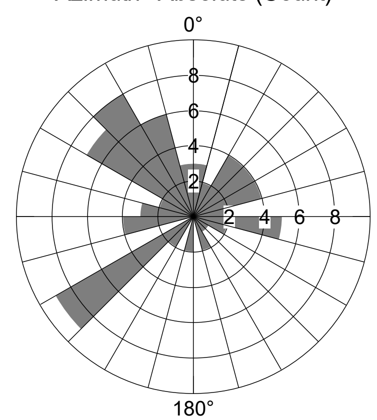
Schmidt Plot - LH - Bedrock Structures



	Counts	Dip[deg]	Azi[deg]
Mean	76	51.51	334.04
● (Rank 3)	17	49.90	354.96
● (Rank 4)	15	56.81	352.58
● (Rank 1)	24	49.24	312.02
● (Rank 2)	20	51.55	327.71

Dip Azimuth Rose Diagram of Bedrock Fractures

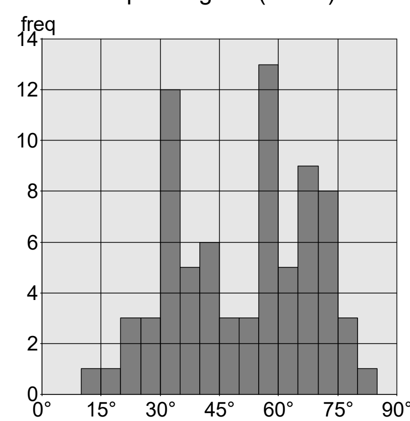
Azimuth - Absolute (Count)



Components:	Azimuth
Counts:	76.00
Mean (2D):	334.04
Std.Dev.:	92.46
Min:	0.63
Max:	354.96

Dip Angle Histogram of Bedrock Fractures

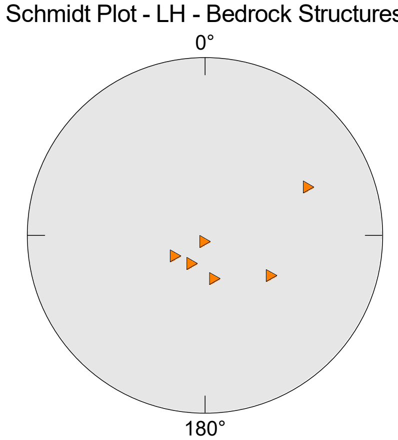
Dip Histogram (Count)



Counts:	76.00
Mean (2D):	51.51
Std.Dev.:	17.36
Min:	14.43
Max:	80.43

Stereogram - Lower Hemisphere of Foliation & Veins

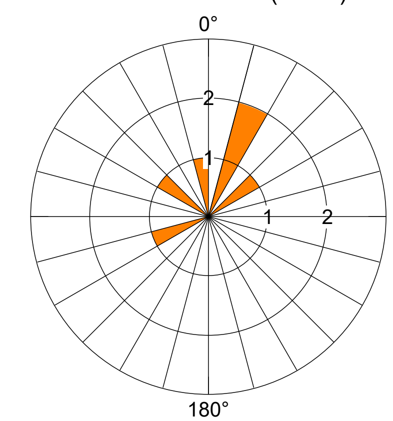
Schmidt Plot - LH - Bedrock Structures



	Counts	Dip[deg]	Azi[deg]
Mean	6	23.93	353.49
◄	6	23.93	353.49

Dip Azimuth Rose Diagram of Foliation & Veins

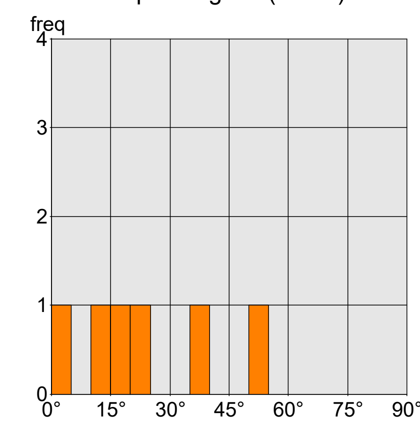
Azimuth - Absolute (Count)



Components:	Azimuth
Counts:	6.00
Mean (2D):	353.49
Std.Dev.:	59.26
Min:	15.43
Max:	348.91

Dip Angle Histogram of Foliation & Veins

Dip Histogram (Count)



Counts:	6.00
Mean (2D):	23.93
Std.Dev.:	16.46
Min:	2.88
Max:	53.74

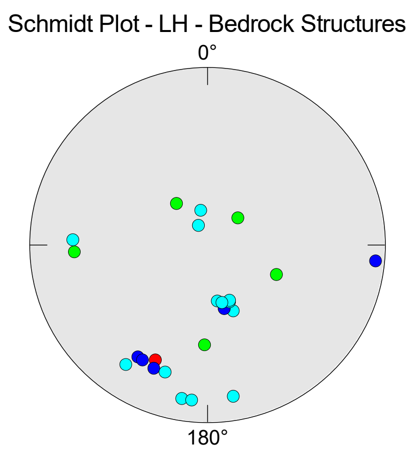
HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	HB-BE-232 - BEDROCK STRUCTURE STATISTICS PLOTS DATE(S) LOGGED: November 24, 2020

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

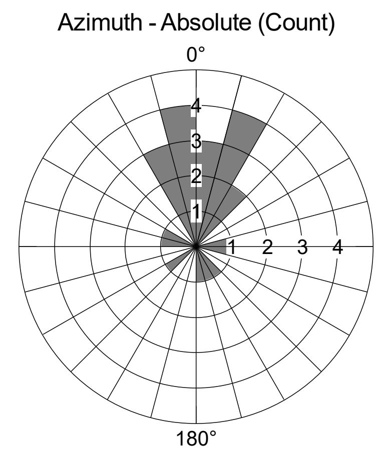
● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ◄ Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



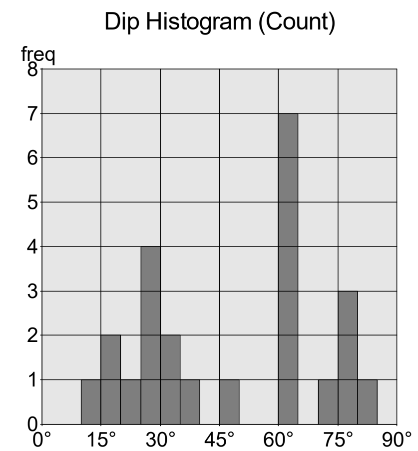
	Counts	Dip[deg]	Azi[deg]
Mean	24	48.19	7.76
● (green)	5	37.79	222.43
● (red)	1	60.78	24.58
● (cyan)	13	46.00	8.17
● (blue)	5	61.53	2.70

Dip Azimuth Rose Diagram of Bedrock Fractures



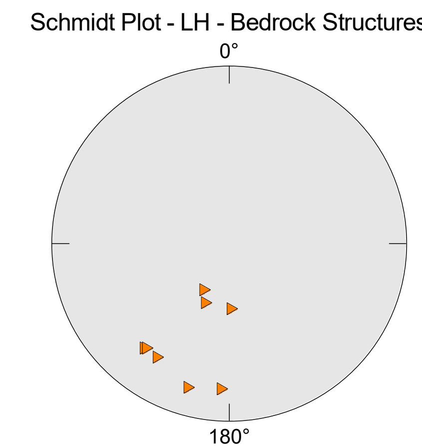
Components:	Azimuth
Counts:	24.00
Mean (2D):	7.76
Std.Dev.:	66.45
Min:	2.10
Max:	350.34

Dip Angle Histogram of Bedrock Fractures



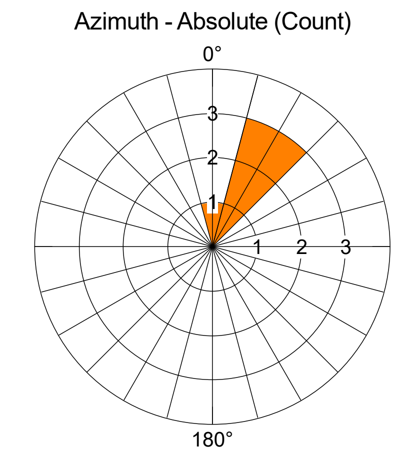
Counts:	24.00
Mean (2D):	48.19
Std.Dev.:	22.83
Min:	10.15
Max:	84.47

Stereogram - Lower Hemisphere of Foliation & Veins



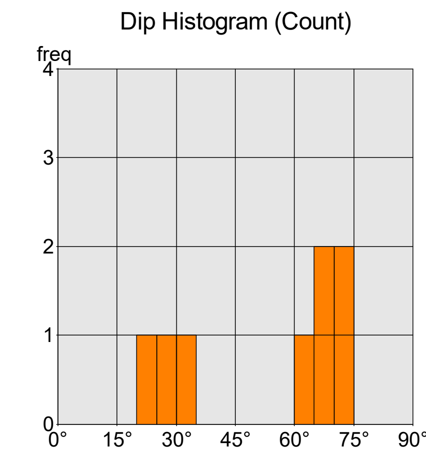
	Counts	Dip[deg]	Azi[deg]
Mean	8	53.11	22.64
►	8	53.11	22.64

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	8.00
Mean (2D):	22.64
Std.Dev.:	14.55
Min:	3.36
Max:	358.36

Dip Angle Histogram of Foliation & Veins



Counts:	8.00
Mean (2D):	53.11
Std.Dev.:	19.70
Min:	24.49
Max:	73.22

HAGER-RICHTER GEOSCIENCE, INC.

Salem, New Hampshire
Tel: 603.893.9944

Fords, New Jersey
Tel: 732.661.0555

HB-BE-236 - BEDROCK STRUCTURE STATISTICS PLOTS

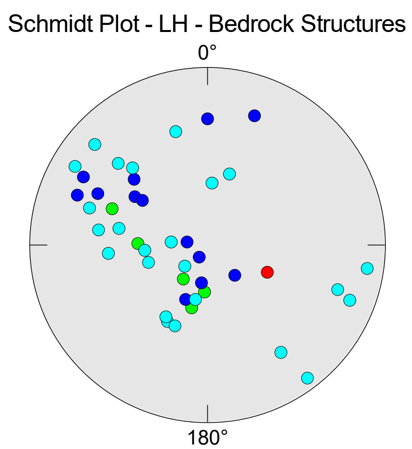
DATE(S) LOGGED: November 24, 2020

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

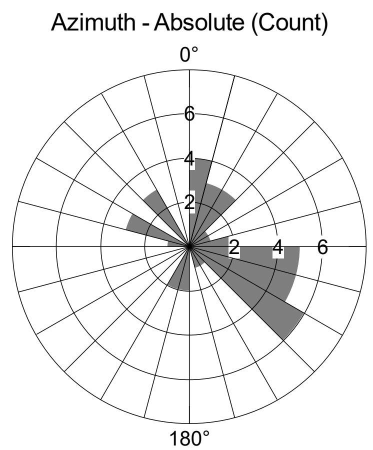
Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



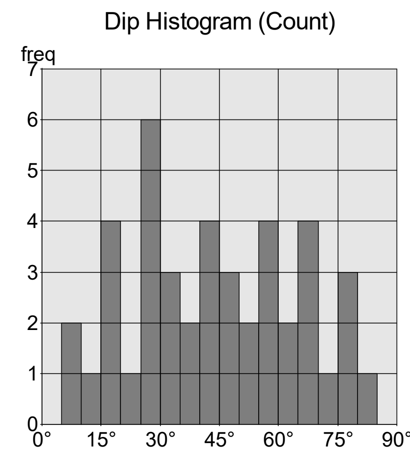
	Counts	Dip[deg]	Azi[deg]
Mean	43	43.89	82.35
Fracture Rank 4 (red)	1	30.40	294.80
Fracture Rank 2 (blue)	13	40.54	105.18
Fracture Rank 3 (green)	5	30.28	49.92
Fracture Rank 1 (cyan)	24	49.22	82.62

Dip Azimuth Rose Diagram of Bedrock Fractures



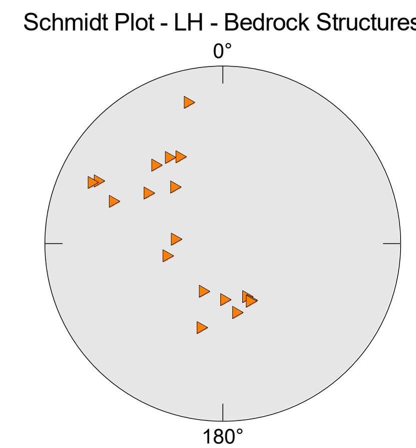
Components:	Azimuth
Counts:	43.00
Mean (2D):	82.35
Std.Dev.:	79.69
Min:	4.56
Max:	325.68

Dip Angle Histogram of Bedrock Fractures



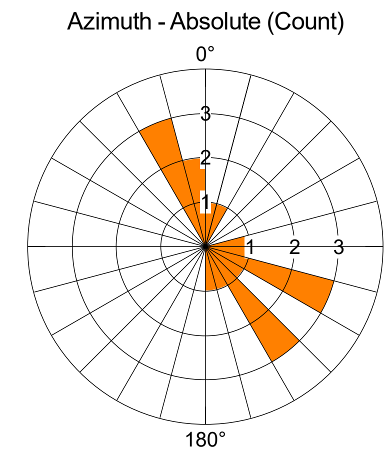
Counts:	43.00
Mean (2D):	43.89
Std.Dev.:	20.63
Min:	6.87
Max:	83.36

Stereogram - Lower Hemisphere of Foliation & Veins



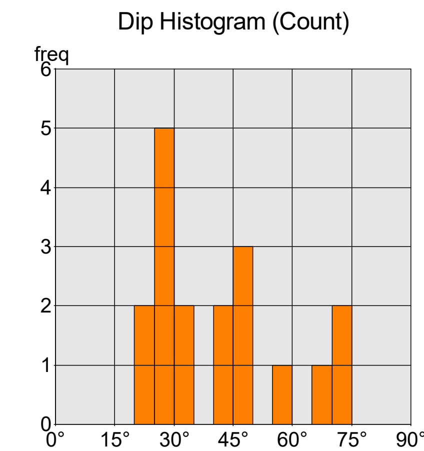
	Counts	Dip[deg]	Azi[deg]
Mean	18	41.09	84.68
Foliation / Vein	18	41.09	84.68

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	18.00
Mean (2D):	84.68
Std.Dev.:	77.57
Min:	14.63
Max:	358.19

Dip Angle Histogram of Foliation & Veins



Counts:	18.00
Mean (2D):	41.09
Std.Dev.:	15.85
Min:	22.09
Max:	70.94

HAGER-RICHTER GEOSCIENCE, INC.	
BB-ECR-202 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	November 24, 2020
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

BB-ECR-202 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
15.1	127	71	Foliation / Vein
15.2	157	21	Fracture Rank 2
15.2	132	72	Fracture Rank 2
15.3	134	71	Foliation / Vein
15.4	137	71	Fracture Rank 3
15.6	130	74	Fracture Rank 2
15.7	129	73	Foliation / Vein
15.7	169	16	Fracture Rank 3
15.7	222	81	Fracture Rank 2
15.8	127	73	Fracture Rank 2
15.9	127	73	Fracture Rank 2
16.2	127	73	Fracture Rank 2
16.3	129	73	Foliation / Vein
16.5	119	70	Fracture Rank 3
16.7	313	30	Fracture Rank 3
16.7	117	69	Fracture Rank 3
16.9	57	23	Fracture Rank 4
16.9	59	14	Fracture Rank 3
17.1	22	22	Fracture Rank 3
17.2	107	64	Fracture Rank 3
17.3	115	69	Fracture Rank 3
17.3	19	41	Fracture Rank 4
17.6	99	72	Fracture Rank 2
17.8	119	75	Fracture Rank 3
18.0	242	60	Fracture Rank 4
18.0	114	58	Fracture Rank 2
18.5	253	31	Fracture Rank 4
18.6	81	73	Fracture Rank 3
19.0	92	24	Fracture Rank 2
19.0	295	41	Fracture Rank 2
19.1	323	30	Fracture Rank 1
19.2	103	70	Fracture Rank 3
19.4	2	59	Fracture Rank 1
19.4	91	65	Fracture Rank 1
19.6	294	79	Fracture Rank 3

BB-ECR-202 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
19.7	41	68	Fracture Rank 3
19.8	351	32	Fracture Rank 3
20.2	333	50	Fracture Rank 4
20.4	294	75	Fracture Rank 4
20.6	95	51	Fracture Rank 4
20.8	170	77	Fracture Rank 3
20.8	95	40	Fracture Rank 2
21.1	336	41	Fracture Rank 2
21.3	123	29	Fracture Rank 1
21.4	112	68	Fracture Rank 2
21.5	102	78	Foliation / Vein
21.8	99	74	Fracture Rank 2
21.8	333	64	Fracture Rank 2
21.9	94	72	Foliation / Vein
21.9	349	54	Fracture Rank 3
22.2	88	76	Foliation / Vein
22.3	99	79	Fracture Rank 2
22.5	350	58	Fracture Rank 3
22.7	6	48	Fracture Rank 2

HAGER-RICHTER GEOSCIENCE, INC.	
BB-ELER-202 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	November 24, 2020
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

BB-ELER-202 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
16.9	88	23	Fracture Rank 4
17.1	261	75	Fracture Rank 1
17.4	269	71	Fracture Rank 3
17.8	263	83	Fracture Rank 1
17.8	244	77	Fracture Rank 1
17.8	272	36	Fracture Rank 2
18.0	247	73	Fracture Rank 1
18.1	255	69	Fracture Rank 1
18.3	213	27	Fracture Rank 2
18.6	312	65	Fracture Rank 3
18.7	265	79	Fracture Rank 1
18.8	25	45	Fracture Rank 4
19.0	317	35	Fracture Rank 1
19.3	236	51	Fracture Rank 2
19.4	128	17	Fracture Rank 4
19.6	270	84	Fracture Rank 2
19.7	90	73	Fracture Rank 4
20.4	118	15	Fracture Rank 4
20.7	293	41	Fracture Rank 1
20.8	281	82	Fracture Rank 3
21.1	262	82	Fracture Rank 3
21.1	299	52	Fracture Rank 4
21.5	299	65	Fracture Rank 2
21.8	139	65	Fracture Rank 3
21.9	296	37	Fracture Rank 2
22.1	154	52	Fracture Rank 3
22.3	314	56	Fracture Rank 4
22.4	326	39	Fracture Rank 2
22.9	188	21	Fracture Rank 2
22.9	270	41	Fracture Rank 1
23.1	288	50	Fracture Rank 1
23.2	288	46	Fracture Rank 2
23.6	141	54	Fracture Rank 1
23.9	295	64	Fracture Rank 1
24.5	301	54	Fracture Rank 1

BB-ELER-202 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
24.5	127	68	Fracture Rank 1
24.6	299	56	Fracture Rank 4
24.7	304	57	Fracture Rank 1
24.7	111	64	Fracture Rank 1
25.1	300	37	Fracture Rank 3
25.2	299	42	Fracture Rank 1
25.5	134	79	Fracture Rank 1
27.1	101	63	Fracture Rank 2
27.3	99	61	Fracture Rank 2
27.4	92	58	Fracture Rank 1
28.0	312	63	Fracture Rank 2
28.2	322	39	Fracture Rank 1
28.4	336	21	Foliation / Vein
29.4	347	35	Foliation / Vein
29.5	347	41	Fracture Rank 1
30.0	138	68	Fracture Rank 1
30.3	15	15	Foliation / Vein
30.8	84	47	Fracture Rank 1
30.8	243	29	Fracture Rank 1
31.1	139	60	Fracture Rank 1
31.2	144	55	Fracture Rank 1
31.7	357	47	Foliation / Vein
32.1	133	52	Fracture Rank 3
33.2	351	28	Foliation / Vein
33.3	143	86	Fracture Rank 1
33.9	337	77	Fracture Rank 1
34.2	10	29	Foliation / Vein
34.7	348	33	Foliation / Vein
34.8	354	44	Fracture Rank 1
35.2	116	38	Foliation / Vein
35.2	126	58	Fracture Rank 2

HAGER-RICHTER GEOSCIENCE, INC.	
BB-ELER-205 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	November 24, 2020
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

BB-ELER-205 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
15.0	76	13	Fracture Rank 3
15.4	337	17	Foliation / Vein
15.5	348	64	Fracture Rank 1
15.8	319	26	Foliation / Vein
16.1	80	48	Foliation / Vein
16.2	86	50	Fracture Rank 1
16.3	88	48	Fracture Rank 2
16.3	86	50	Fracture Rank 1
16.7	86	39	Fracture Rank 1
16.9	100	42	Fracture Rank 1
17.1	111	41	Foliation / Vein
17.4	91	56	Fracture Rank 1
17.7	153	26	Foliation / Vein
17.8	199	40	Fracture Rank 4
18.3	257	42	Fracture Rank 2
18.6	350	14	Fracture Rank 2
18.8	100	63	Fracture Rank 1
19.0	97	66	Foliation / Vein
19.1	98	68	Fracture Rank 1
19.3	94	61	Foliation / Vein
19.4	78	56	Fracture Rank 2
19.5	98	37	Fracture Rank 1
19.7	359	73	Fracture Rank 1
20.0	118	55	Fracture Rank 1
20.1	21	61	Fracture Rank 1
20.1	3	17	Fracture Rank 1
20.7	112	60	Foliation / Vein
21.0	118	61	Fracture Rank 2
21.3	115	56	Fracture Rank 1
21.7	110	58	Fracture Rank 1
21.8	256	36	Fracture Rank 1
21.9	123	59	Fracture Rank 1
22.2	127	60	Fracture Rank 1
22.5	118	59	Fracture Rank 1
22.6	118	56	Fracture Rank 2

BB-ELER-205 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
22.8	118	49	Foliation / Vein
23.2	118	63	Fracture Rank 1
23.5	119	56	Fracture Rank 2
23.6	118	49	Fracture Rank 1
23.7	113	61	Foliation / Vein
24.0	114	57	Fracture Rank 2
24.1	229	83	Fracture Rank 1
24.1	122	58	Foliation / Vein
24.5	119	58	Foliation / Vein
24.8	127	71	Fracture Rank 1
24.8	113	33	Fracture Rank 2
24.9	118	33	Fracture Rank 1
25.2	279	19	Fracture Rank 1
25.5	116	45	Fracture Rank 1
25.6	115	45	Fracture Rank 1
25.8	120	45	Foliation / Vein
25.9	305	66	Fracture Rank 1
26.3	84	59	Fracture Rank 1
26.5	105	43	Foliation / Vein
26.6	296	79	Foliation / Vein
26.8	127	63	Fracture Rank 1
27.1	138	36	Foliation / Vein
27.2	304	62	Fracture Rank 1
28.0	308	46	Fracture Rank 1
28.4	267	39	Fracture Rank 1
28.9	117	74	Fracture Rank 1
29.1	118	71	Fracture Rank 2
29.4	128	71	Fracture Rank 1
29.5	293	39	Fracture Rank 1
29.6	121	71	Fracture Rank 1
30.0	124	68	Fracture Rank 1
30.1	124	62	Fracture Rank 1
30.2	114	53	Foliation / Vein
30.2	261	31	Fracture Rank 2
30.4	120	48	Foliation / Vein
30.6	102	76	Fracture Rank 1
30.7	109	63	Foliation / Vein
30.7	107	62	Fracture Rank 2
31.0	107	50	Fracture Rank 2
31.2	113	54	Fracture Rank 3
31.2	97	49	Fracture Rank 1
32.1	89	57	Fracture Rank 1
32.8	104	72	Fracture Rank 1
33.0	106	76	Fracture Rank 1

HAGER-RICHTER GEOSCIENCE, INC.	
HB-BE-231 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	November 24, 2020
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

HB-BE-231 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
10.0	317	66	Fracture Rank 3
10.3	337	53	Fracture Rank 3
10.3	330	75	Fracture Rank 3
10.4	321	63	Fracture Rank 3
10.7	340	74	Fracture Rank 4
10.9	340	60	Fracture Rank 4
11.0	293	69	Fracture Rank 4
11.1	21	31	Fracture Rank 3
11.3	265	44	Fracture Rank 4
11.4	94	43	Fracture Rank 3
11.5	261	35	Fracture Rank 3
11.6	5	72	Fracture Rank 3
11.8	193	78	Fracture Rank 1
11.9	3	70	Fracture Rank 4
12.0	350	43	Fracture Rank 4
12.0	355	73	Fracture Rank 3
12.3	325	38	Fracture Rank 3
12.5	351	70	Fracture Rank 4
13.1	238	51	Fracture Rank 1
13.2	263	41	Fracture Rank 2
13.5	84	69	Fracture Rank 2
13.8	272	48	Fracture Rank 1
14.0	344	34	Fracture Rank 3
14.9	228	48	Fracture Rank 1
14.9	98	64	Fracture Rank 4
15.1	213	79	Fracture Rank 1
15.2	224	54	Fracture Rank 2
15.4	70	57	Fracture Rank 2
15.5	188	48	Fracture Rank 4
15.7	154	35	Fracture Rank 3
15.8	107	75	Fracture Rank 4
16.3	234	59	Fracture Rank 4
16.5	81	75	Fracture Rank 2
16.6	35	22	Fracture Rank 4
16.7	128	72	Fracture Rank 2

HB-BE-231 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
16.9	271	25	Fracture Rank 1
16.9	1	32	Fracture Rank 3
17.1	148	43	Fracture Rank 3
17.1	330	35	Fracture Rank 2
17.2	152	58	Fracture Rank 4
17.3	306	24	Fracture Rank 3
17.6	112	63	Fracture Rank 3
17.7	322	31	Fracture Rank 4
17.7	101	63	Fracture Rank 4
18.1	43	33	Fracture Rank 1
18.3	38	70	Fracture Rank 1
18.4	284	35	Fracture Rank 1
18.6	48	70	Fracture Rank 1
18.8	51	71	Fracture Rank 1
18.8	269	14	Fracture Rank 2
19.0	302	36	Foliation / Vein
19.1	288	38	Fracture Rank 2
19.3	226	57	Fracture Rank 2
19.5	53	28	Fracture Rank 1
19.5	230	59	Fracture Rank 2
19.6	39	23	Fracture Rank 2
19.6	64	70	Fracture Rank 2
19.7	244	54	Foliation / Vein
19.8	342	20	Fracture Rank 1
19.9	238	58	Fracture Rank 1
20.0	335	32	Fracture Rank 1
20.0	232	60	Fracture Rank 2
20.1	327	31	Fracture Rank 1
20.3	326	34	Fracture Rank 1
20.3	63	56	Fracture Rank 2
20.4	308	36	Fracture Rank 2
20.5	66	62	Fracture Rank 2
20.8	349	20	Foliation / Vein
21.0	309	43	Fracture Rank 1
21.3	27	15	Foliation / Vein
21.5	302	58	Fracture Rank 1
21.6	303	38	Fracture Rank 2
21.9	48	55	Fracture Rank 2
21.9	234	56	Fracture Rank 2
22.0	310	35	Fracture Rank 1
22.8	15	3	Foliation / Vein
22.9	105	69	Fracture Rank 1
23.3	26	28	Fracture Rank 1
23.3	56	17	Foliation / Vein
23.8	311	80	Fracture Rank 1

HB-BE-231 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
23.8	102	69	Fracture Rank 3
25.3	229	58	Fracture Rank 1

HAGER-RICHTER GEOSCIENCE, INC.	
HB-BE-232 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	November 24, 2020
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

HB-BE-232 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
14.8	228	19	Fracture Rank 3
14.9	2	47	Fracture Rank 3
15.0	25	61	Fracture Rank 4
15.2	87	64	Fracture Rank 3
15.3	154	10	Fracture Rank 1
15.4	275	84	Fracture Rank 2
16.1	350	75	Fracture Rank 1
16.5	3	71	Foliation / Vein
16.8	10	77	Fracture Rank 1
17.0	6	77	Fracture Rank 1
17.2	16	73	Foliation / Vein
17.7	338	33	Fracture Rank 1
17.8	358	30	Foliation / Vein
17.9	345	30	Fracture Rank 2
18.0	339	28	Fracture Rank 1
18.0	350	26	Fracture Rank 1
18.2	338	28	Fracture Rank 1
18.3	93	65	Fracture Rank 1
18.3	346	27	Fracture Rank 1
18.4	143	24	Fracture Rank 3
18.6	24	65	Fracture Rank 2
19.1	23	30	Foliation / Vein
19.3	29	24	Foliation / Vein
20.0	18	65	Fracture Rank 1
20.2	293	35	Fracture Rank 3
20.5	34	71	Fracture Rank 1
20.7	169	17	Fracture Rank 1
21.5	39	65	Foliation / Vein
22.0	32	63	Fracture Rank 2
23.0	30	64	Fracture Rank 2
23.0	39	65	Foliation / Vein
23.3	33	65	Foliation / Vein

HAGER-RICHTER GEOSCIENCE, INC.	
HB-BE-236 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	November 24, 2020
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

HB-BE-236 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
14.6	295	30	Fracture Rank 4
15.0	336	27	Foliation / Vein
15.1	318	19	Fracture Rank 2
15.2	5	22	Fracture Rank 3
15.4	14	30	Fracture Rank 3
15.5	36	20	Fracture Rank 3
15.6	34	7	Fracture Rank 2
15.8	99	10	Fracture Rank 2
16.5	115	58	Fracture Rank 2
16.8	96	22	Foliation / Vein
16.9	96	17	Fracture Rank 1
17.1	140	35	Foliation / Vein
17.4	78	27	Foliation / Vein
17.6	92	32	Fracture Rank 3
17.6	197	35	Fracture Rank 1
17.7	28	40	Fracture Rank 1
17.9	185	29	Fracture Rank 1
18.2	47	14	Fracture Rank 1
18.4	9	18	Fracture Rank 2
18.8	23	27	Fracture Rank 2
19.1	23	24	Foliation / Vein
19.3	13	26	Fracture Rank 1
19.4	74	28	Fracture Rank 1
19.7	101	42	Fracture Rank 1
19.8	111	48	Fracture Rank 3
20.6	85	29	Fracture Rank 1
20.9	85	47	Fracture Rank 1
20.9	334	29	Foliation / Vein
21.0	358	26	Foliation / Vein
21.4	349	33	Foliation / Vein
21.7	335	29	Foliation / Vein
22.7	323	83	Fracture Rank 1
23.3	98	52	Fracture Rank 1
24.7	124	42	Foliation / Vein
24.8	123	41	Fracture Rank 2

HB-BE-236 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
25.2	132	46	Fracture Rank 2
25.3	139	49	Foliation / Vein
25.4	326	63	Fracture Rank 1
25.7	136	51	Fracture Rank 1
26.3	180	60	Fracture Rank 2
26.8	200	67	Fracture Rank 2
27.6	154	46	Foliation / Vein
27.7	133	58	Fracture Rank 1
28.1	132	74	Fracture Rank 1
28.4	121	76	Fracture Rank 1
28.6	117	68	Foliation / Vein
28.8	111	68	Fracture Rank 2
29.1	119	69	Fracture Rank 2
29.3	115	70	Foliation / Vein
29.6	291	75	Fracture Rank 1
30.4	124	37	Fracture Rank 2
30.6	108	59	Fracture Rank 1
30.8	111	56	Foliation / Vein
31.0	164	56	Fracture Rank 1
31.1	278	80	Fracture Rank 1
31.2	148	48	Foliation / Vein
31.8	15	41	Foliation / Vein
31.9	289	67	Fracture Rank 1
31.9	22	41	Fracture Rank 1
32.0	30	39	Fracture Rank 1
32.1	166	71	Foliation / Vein

HAGER-RICHTER
GEOSCIENCE, INC.

GEOPHYSICS FOR THE ENGINEERING COMMUNITY
SALEM, NEW HAMPSHIRE
Tel: 603.893.9944
FORDS, NEW JERSEY
Tel: 732.661.0555

BOREHOLE GEOPHYSICAL LOGGING - DATA REPORT
BOREHOLES BB-ECR-201, BB-ECR-203A, BB-ECR-204A, BB-ECR-206A, BB-ELER-206A, HB-BE-235, HB-BE-237
BREWER-EDDINGTON I-395/ROUTE 9 CONNECTOR
EDDINGTON, MAINE

Prepared for:

Haley & Aldrich, Inc.
75 Washington Avenue | Suite 1A
Portland, Maine 04101

Prepared by:

Hager-Richter Geoscience, Inc.
8 Industrial Way - D10
Salem, New Hampshire 03079

File 20RG77
March 2021

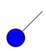
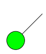
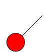
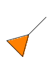
Tadpole	Structure Category (Symbol Color)	Description
	Fracture Rank 1 (Light Blue)	Minor Fracture - not distinct and may not be continuous around the borehole
	Fracture Rank 2 (Blue)	Intermediate Fracture - distinct and continuous around the borehole with little or no apparent aperture
	Fracture Rank 3 (Light Green)	Intermediate Fracture - distinct and continuous around the borehole with some apparent aperture
	Fracture Rank 4 (Red)	Major Fracture - distinct with continuous apparent aperture around the borehole
	Foliation or Vein (Orange)	Planar geologic feature interpreted as foliation or a vein

Figure 1. Key to bedrock structure categories.

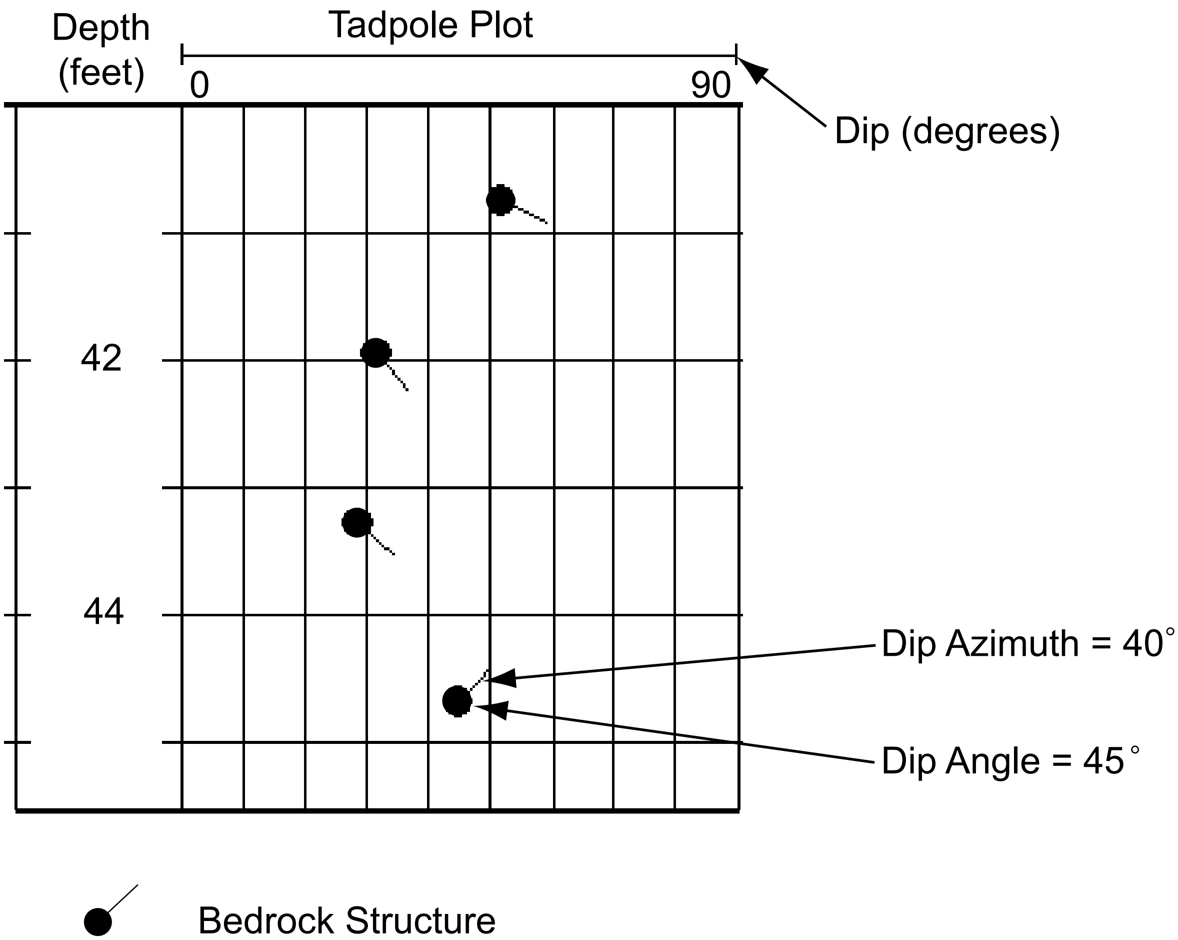


Figure 2. Tadpole plot explanation. The orientation of the bedrock structures is graphically displayed by a tadpole consisting of a circle, the head, and a line, the tail. The position of the head, left to right on the tadpole plot, gives the dip angle of the structure. The left side of the track indicates a dip angle of 0°, and the right side of the track indicates a dip angle of 90° from horizontal. The orientation of the tail gives the dip azimuth of the structure and can be read like a compass. The tail pointing directly up is 0°, north.

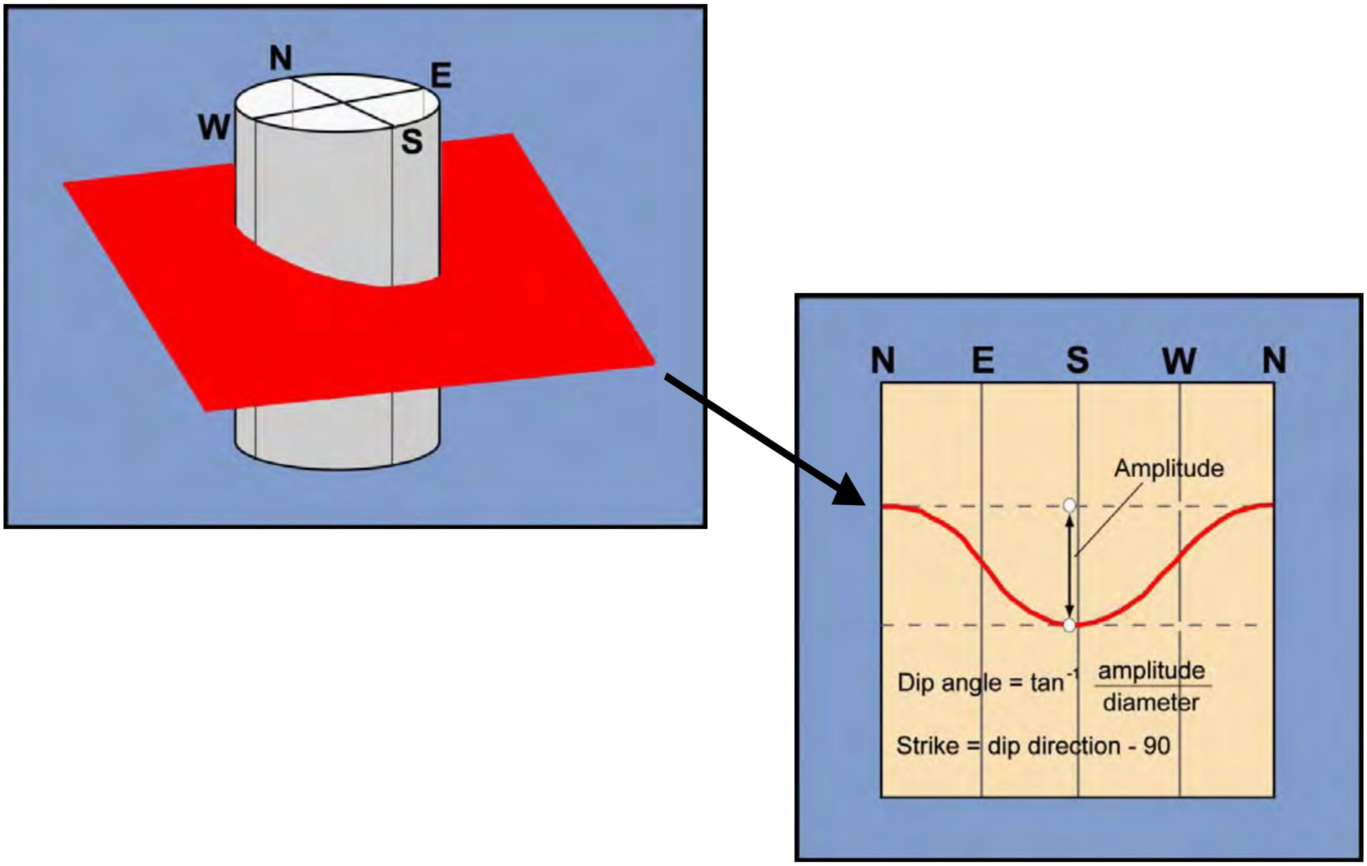


Figure 3. Televiewer Explanation Figure. The image on the left depicts a planar structure in red, such as a fracture or bedding plane, intersected by a borehole. The image on the right depicts the same structure unwrapped as it would be displayed in an optical televiewer (OTV) or acoustic televiewer (ATV) log.

Figure modified from: Garfield, R.L., Day-Lewis, F.D., Gray, M.B., Johnson, C.D., Williams, J.H. and Day-Lewis, A.D.F., 2003, Fractured-Rock Aquifer Characterization within a Regional Geologic Context: Results from the Bucknell University Hydrogeophysics Test Site, GSA Northeastern Section, 38th Annual Meeting, Paper No. 25-19.

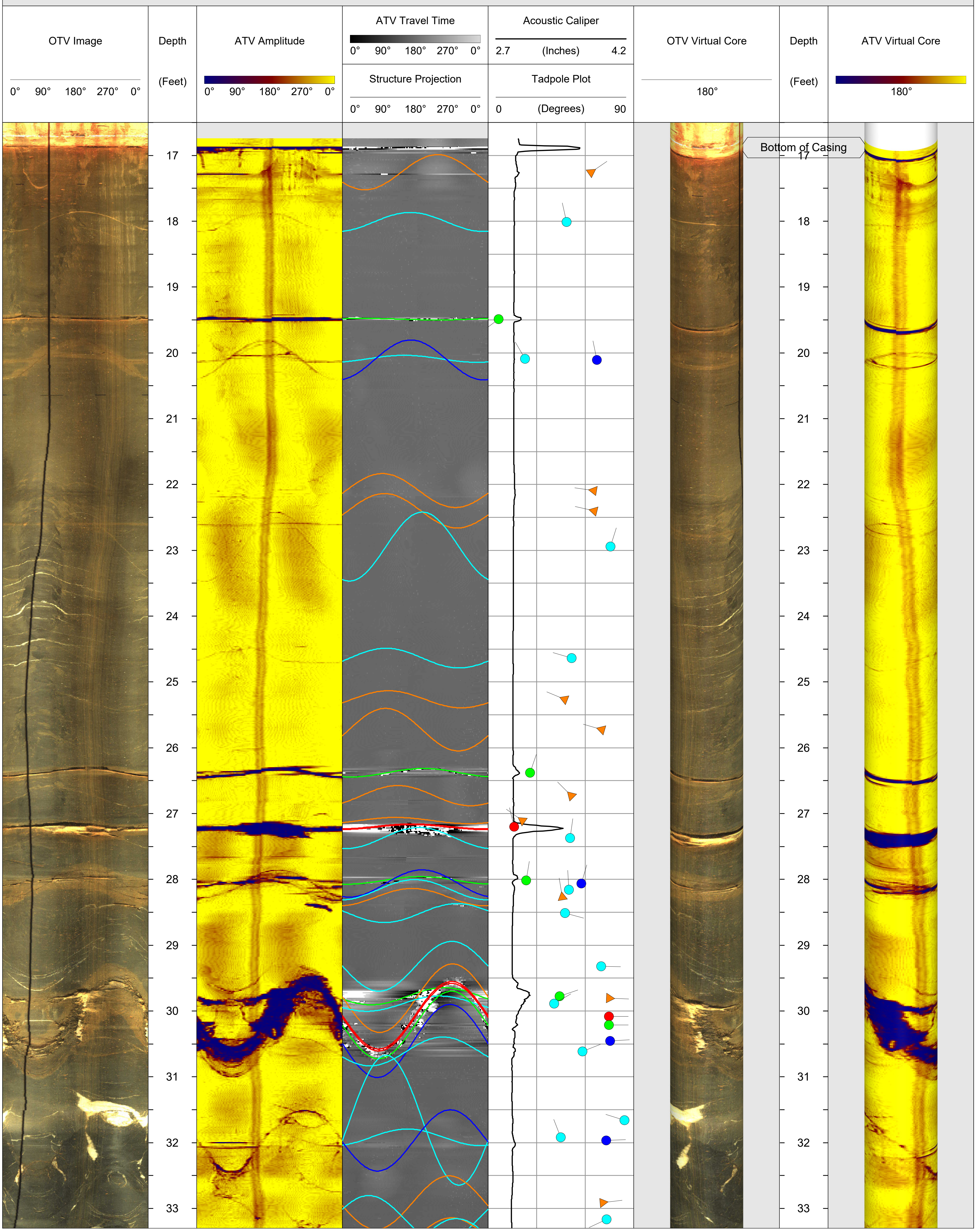
HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	BB-ECR-201 - BOREHOLE GEOPHYSICAL LOGS DATE(S) LOGGED: March 3, 2021

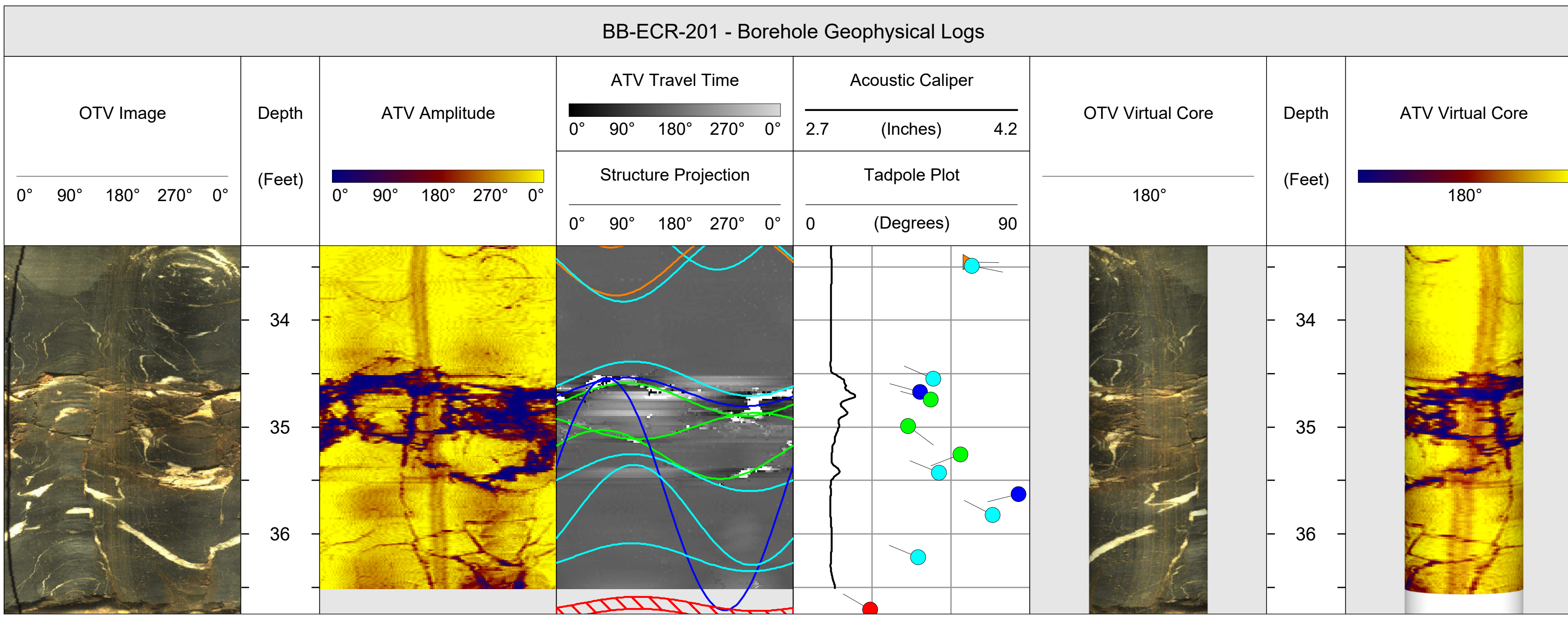
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Mark Jones	BOREHOLE DIAMETER:	3.8 Inches
PROJECT REP(S) ON-SITE:	Josh Fletcher	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

STRUCTURE LEGEND

Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

BB-ECR-201 - Borehole Geophysical Logs




BB-ECR-201 - Borehole Geophysical Logs
OTV Image
0° 90° 180° 270° 0°
Depth
(Feet)
ATV Amplitude
0° 90° 180° 270° 0°
ATV Travel Time
0° 90° 180° 270° 0°
Structure Projection
0° 90° 180° 270° 0°
Acoustic Caliper
2.7 (Inches) 4.2
Tadpole Plot
0 (Degrees) 90
OTV Virtual Core
180°
Depth
(Feet)
ATV Virtual Core
180°
34
35
36
34
35
36

HAGER-RICHTER GEOSCIENCE, INC.

Salem, New Hampshire
Tel: 603.893.9944

Fords, New Jersey
Tel: 732.661.0555

BB-ECR-203A - BOREHOLE GEOPHYSICAL LOGS

DATE(S) LOGGED: March 3, 2021

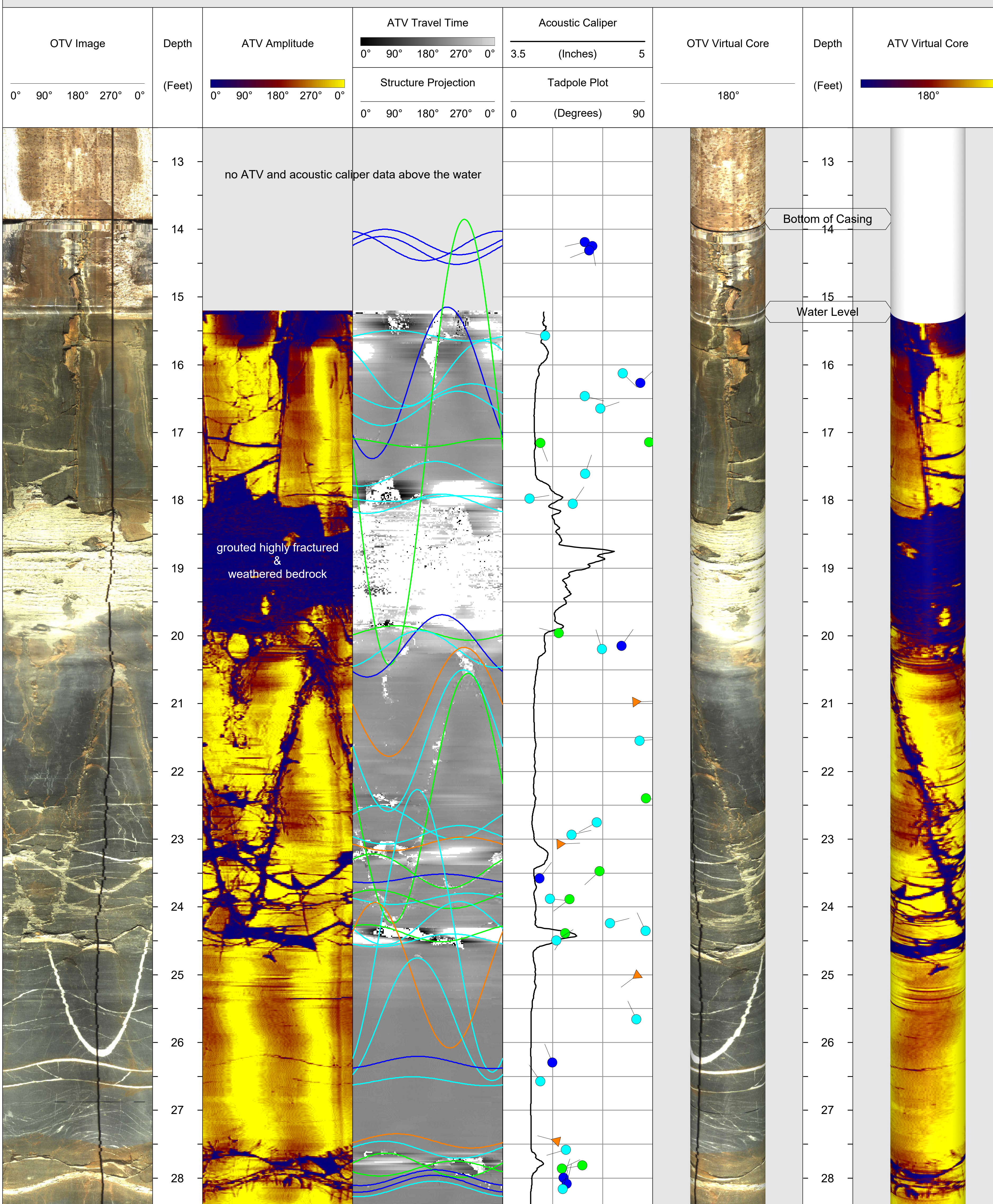
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Mark Jones	BOREHOLE DIAMETER:	3.8 Inches
PROJECT REP(S) ON-SITE:	Josh Fletcher	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

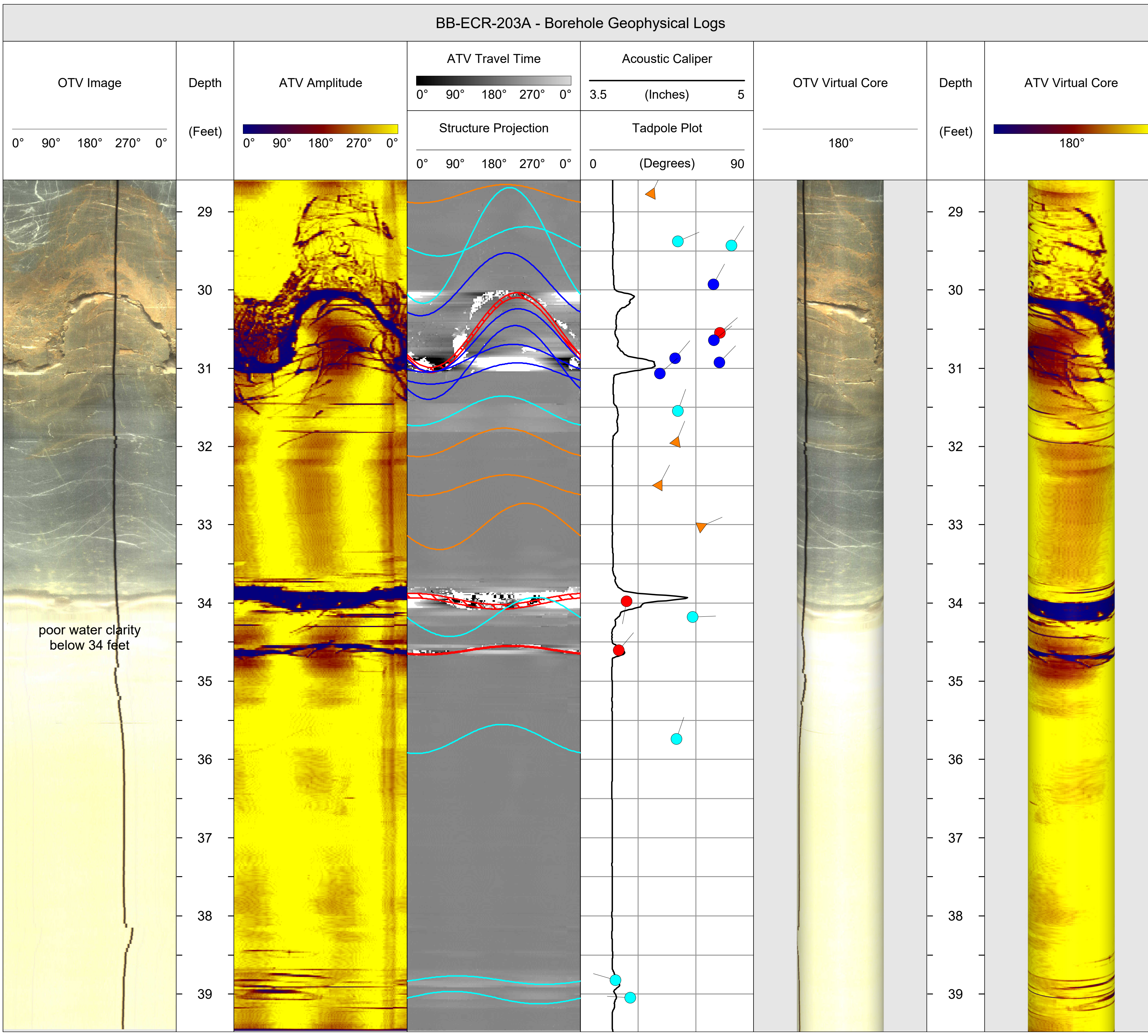
STRUCTURE LEGEND

Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

NOTES: Due to unstable, highly fractured and weathered, bedrock at ~18-20 feet in borehole BB-ECR-203A encountered during drilling, the drilling was suspended at a depth of ~25 feet to grout the bedrock. The grout stabilized bedrock was then drilled through and the drilling of the borehole was completed to total depth.

BB-ECR-203A - Borehole Geophysical Logs





BB-ECR-203A - Borehole Geophysical Logs
OTV Image
0° 90° 180° 270° 0°
Depth
(Feet)
ATV Amplitude
0° 90° 180° 270° 0°
ATV Travel Time
0° 90° 180° 270° 0°
Structure Projection
0° 90° 180° 270° 0°
Acoustic Caliper
3.5 (Inches) 5
Tadpole Plot
0 (Degrees) 90
OTV Virtual Core
180°
Depth
(Feet)
ATV Virtual Core
180°
29
30
31
32
33
34
35
36
37
38
39
poor water clarity below 34 feet

HAGER-RICHTER GEOSCIENCE, INC.

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Tel: 732.661.0555

BB-ECR-204A - BOREHOLE GEOPHYSICAL LOGS

DATE(S) LOGGED: March 3, 2021

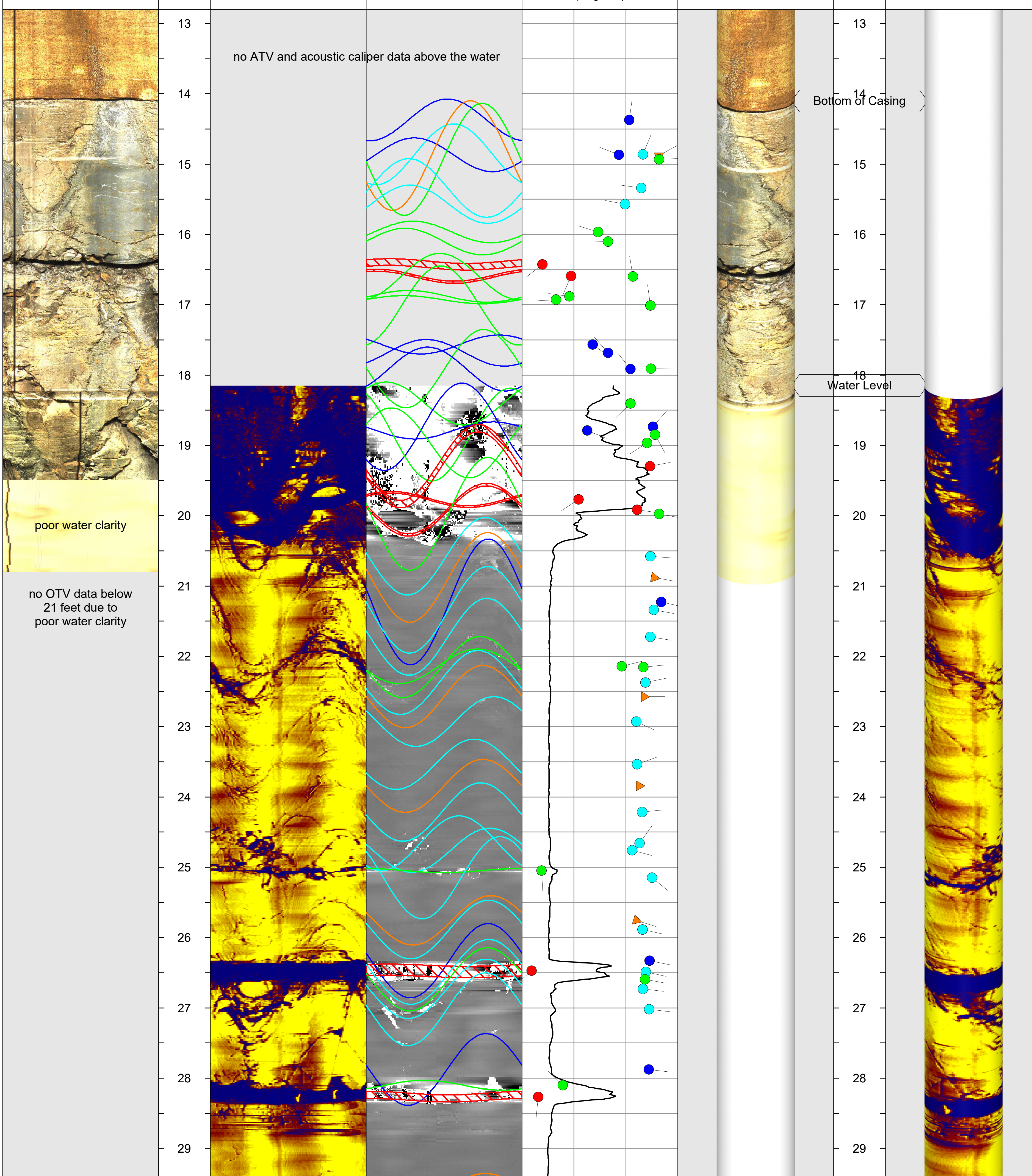
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Mark Jones	BOREHOLE DIAMETER:	3.8 Inches
PROJECT REP(S) ON-SITE:	Josh Fletcher	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

STRUCTURE LEGEND

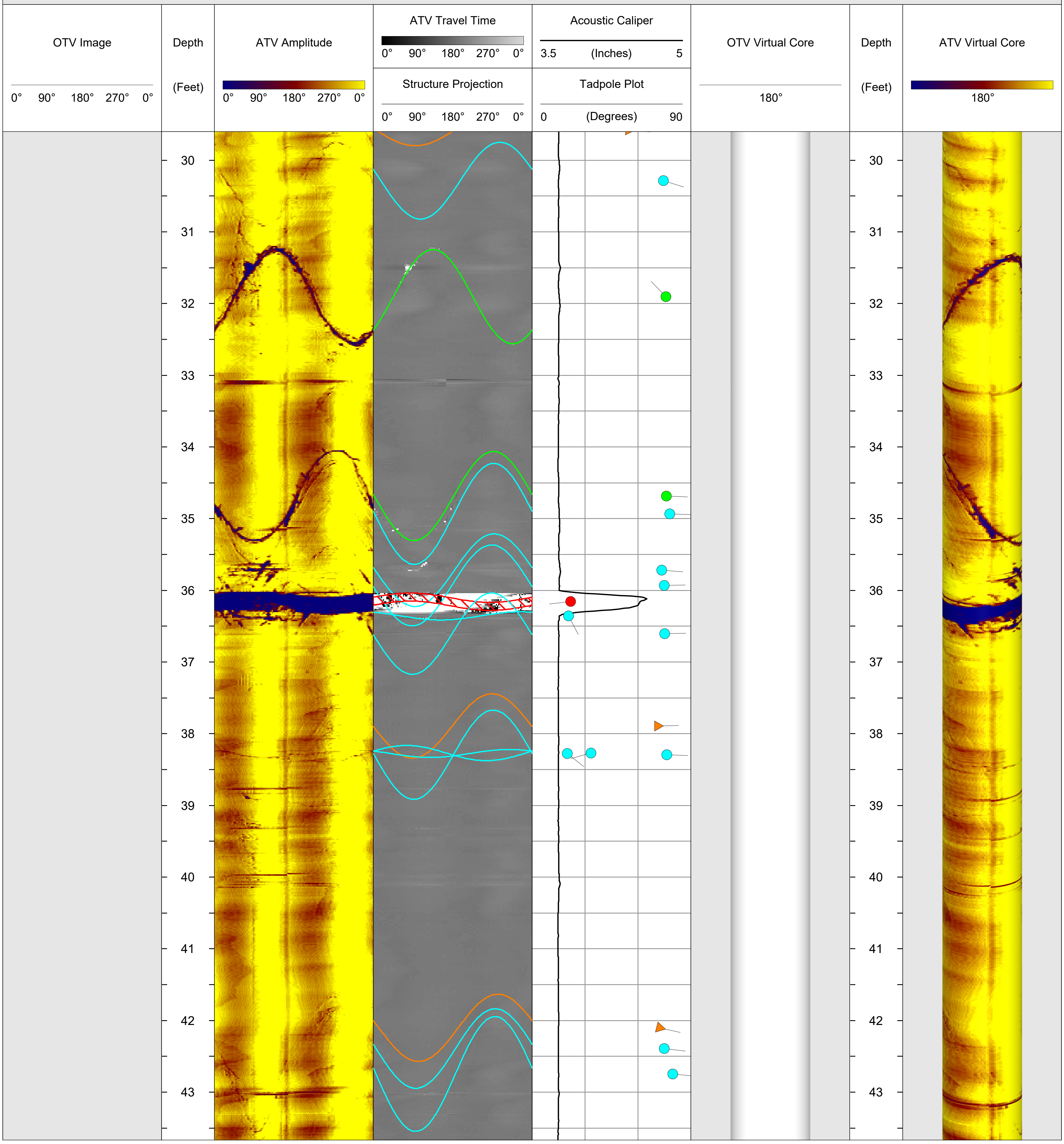
Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

BB-ECR-204A - Borehole Geophysical Logs

OTV Image	Depth	ATV Amplitude	ATV Travel Time / Structure Projection	Acoustic Caliper / Tadpole Plot	OTV Virtual Core	Depth	ATV Virtual Core
0° 90° 180° 270° 0°	(Feet)	0° 90° 180° 270° 0°	0° 90° 180° 270° 0° / 0° 90° 180° 270° 0°	3.5 (Inches) 5 / 0 (Degrees) 90	180°	(Feet)	180°



BB-ECR-204A - Borehole Geophysical Logs



HAGER-RICHTER GEOSCIENCE, INC.

Salem, New Hampshire
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Fords, New Jersey
Tel: 732.661.0555

BB-ECR-206A - BOREHOLE GEOPHYSICAL LOGS

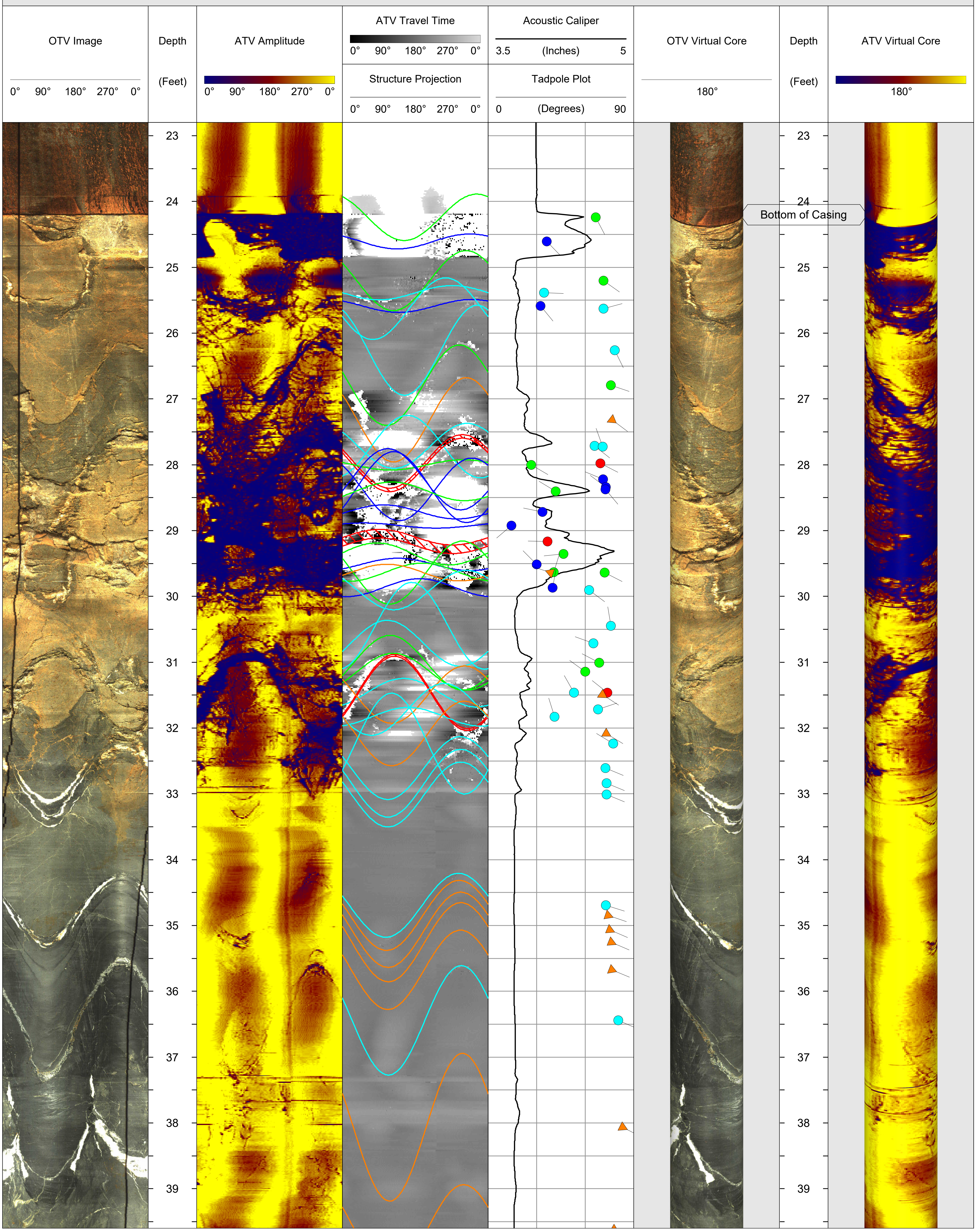
DATE(S) LOGGED: March 3, 2021

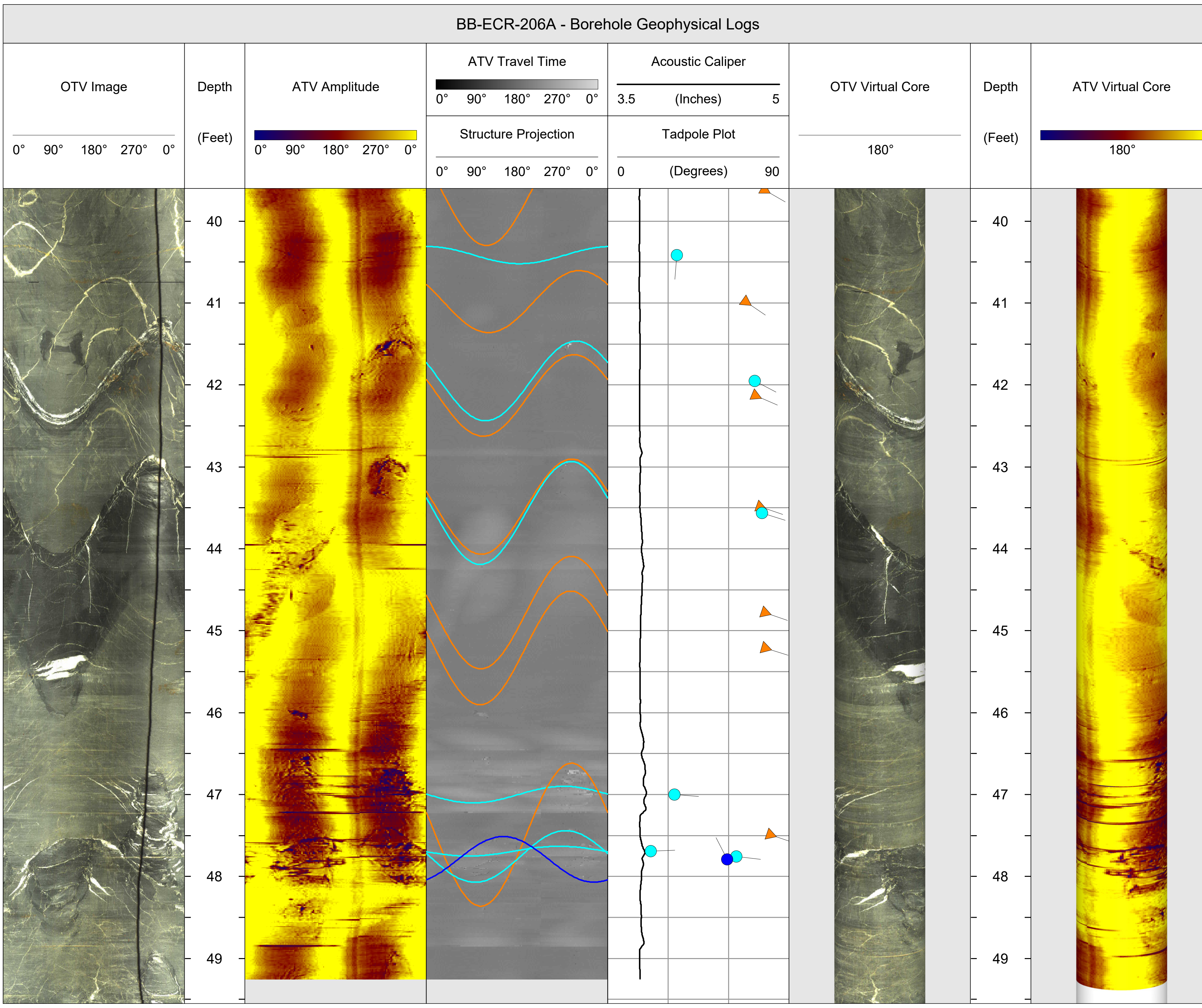
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Mark Jones	BOREHOLE DIAMETER:	3.8 Inches
PROJECT REP(S) ON-SITE:	Josh Fletcher	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

STRUCTURE LEGEND

Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

BB-ECR-206A - Borehole Geophysical Logs




BB-ECR-206A - Borehole Geophysical Logs
OTV Image
0° 90° 180° 270° 0°
Depth
(Feet)
ATV Amplitude
0° 90° 180° 270° 0°
ATV Travel Time
0° 90° 180° 270° 0°
Structure Projection
0° 90° 180° 270° 0°
Acoustic Caliper
3.5 (Inches) 5
Tadpole Plot
0 (Degrees) 90
OTV Virtual Core
180°
Depth
(Feet)
ATV Virtual Core
180°
40
41
42
43
44
45
46
47
48
49

HAGER-RICHTER GEOSCIENCE, INC.

Salem, New Hampshire
Tel: 603.893.9944

Fords, New Jersey
Tel: 732.661.0555

BB-ELER-206A - BOREHOLE GEOPHYSICAL LOGS

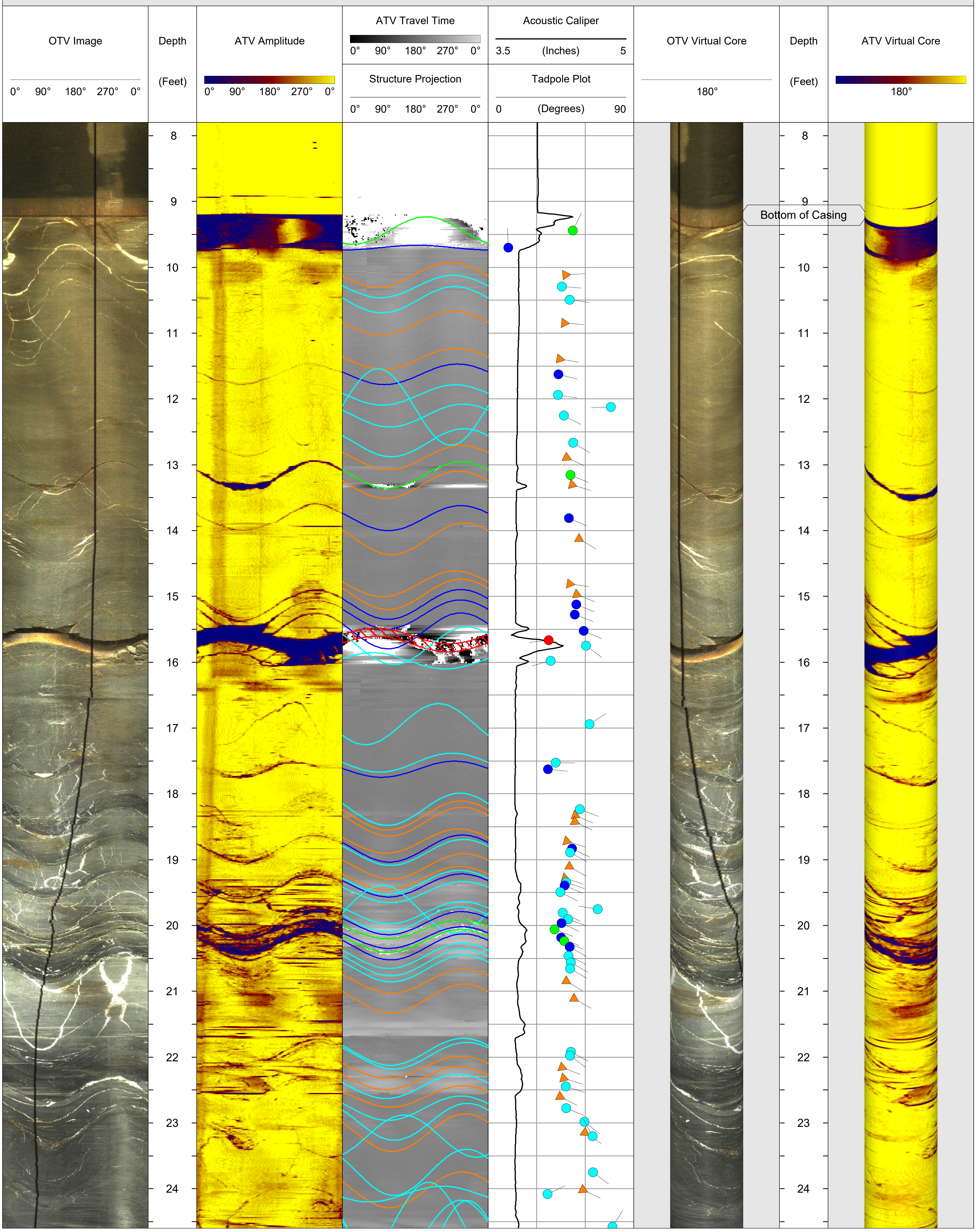
DATE(S) LOGGED: March 3, 2021

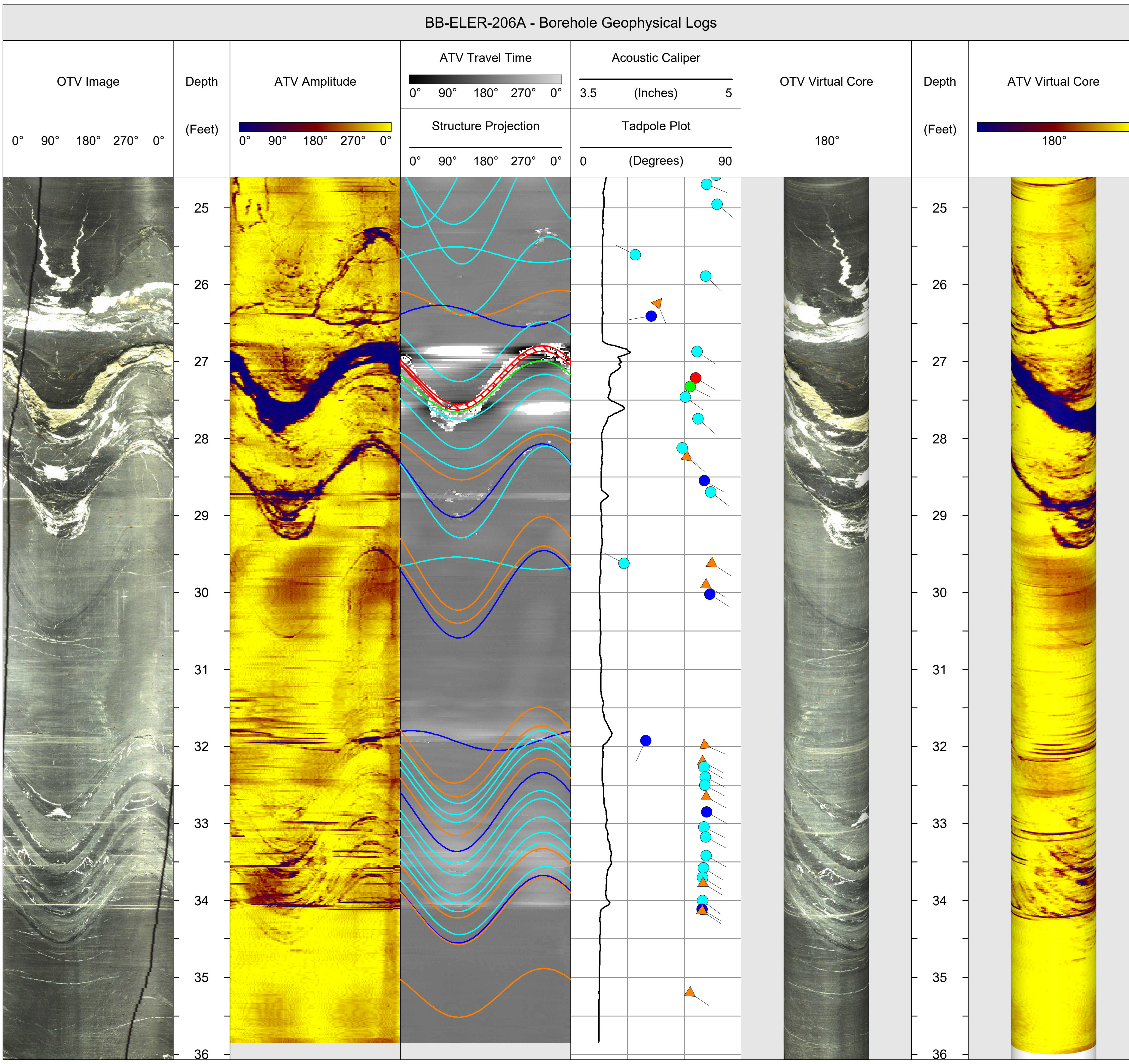
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Mark Jones	BOREHOLE DIAMETER:	3.8 Inches
PROJECT REP(S) ON-SITE:	Josh Fletcher	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

STRUCTURE LEGEND

Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

BB-ELER-206A - Borehole Geophysical Logs




BB-ELER-206A - Borehole Geophysical Logs
OTV Image
0° 90° 180° 270° 0°
Depth
(Feet)
ATV Amplitude
0° 90° 180° 270° 0°
ATV Travel Time
0° 90° 180° 270° 0°
Structure Projection
0° 90° 180° 270° 0°
Acoustic Caliper
3.5 (Inches) 5
Tadpole Plot
0 (Degrees) 90
OTV Virtual Core
180°
Depth
(Feet)
ATV Virtual Core
180°
25
26
27
28
29
30
31
32
33
34
35
36

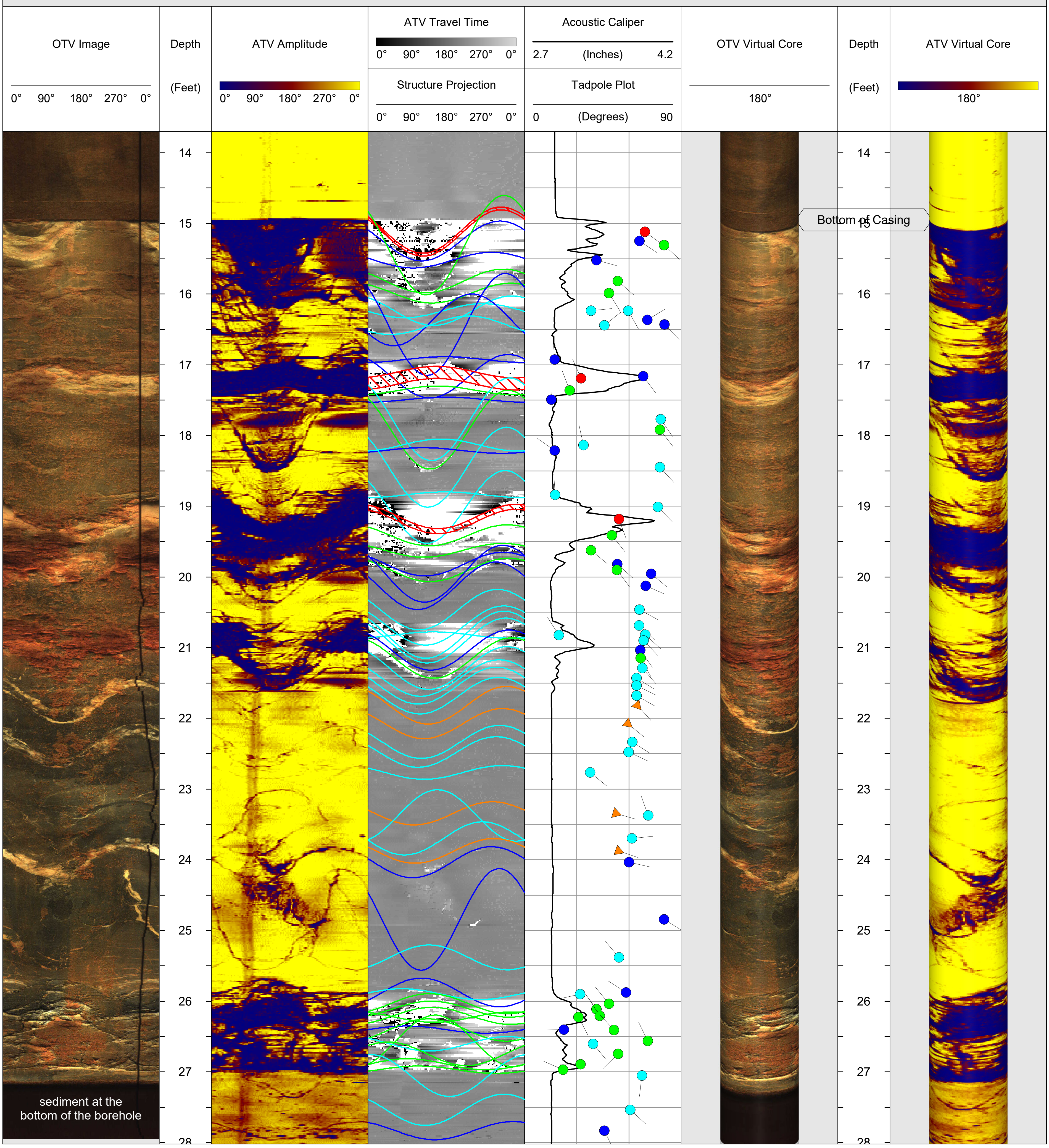
HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	HB-BE-235 - BOREHOLE GEOPHYSICAL LOGS DATE(S) LOGGED: March 3, 2021

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Mark Jones	BOREHOLE DIAMETER:	3 Inches
PROJECT REP(S) ON-SITE:	Josh Fletcher	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

STRUCTURE LEGEND

Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

HB-BE-235 - Borehole Geophysical Logs



HAGER-RICHTER GEOSCIENCE, INC.

Salem, New Hampshire
Tel: 603.893.9944

Fords, New Jersey
Tel: 732.661.0555

HB-BE-237 - BOREHOLE GEOPHYSICAL LOGS

DATE(S) LOGGED: March 3, 2021

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	LOG DATUM:	Ground Surface
LOCATION:	Eddington, Maine	ORIENTATION REFERENCE:	True North (Magnetic Declination = 15.8° West)
LOGGING GEOPHYSICIST(S):	Mikko Aarnio & Mark Jones	BOREHOLE DIAMETER:	3.8 Inches
PROJECT REP(S) ON-SITE:	Josh Fletcher	LOGS PROCESSED BY:	Robert Garfield & Nick DeCristofaro

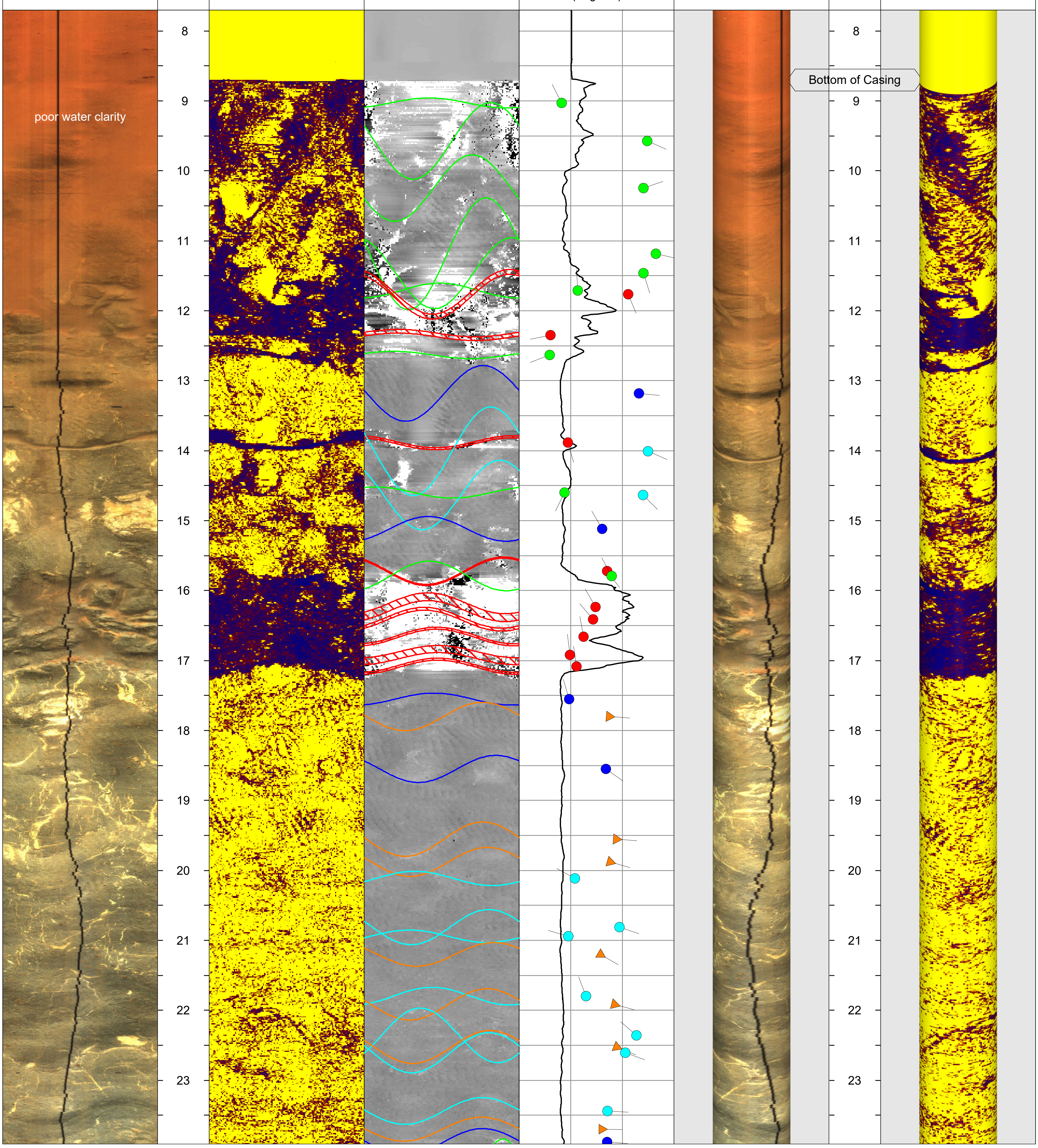
STRUCTURE LEGEND

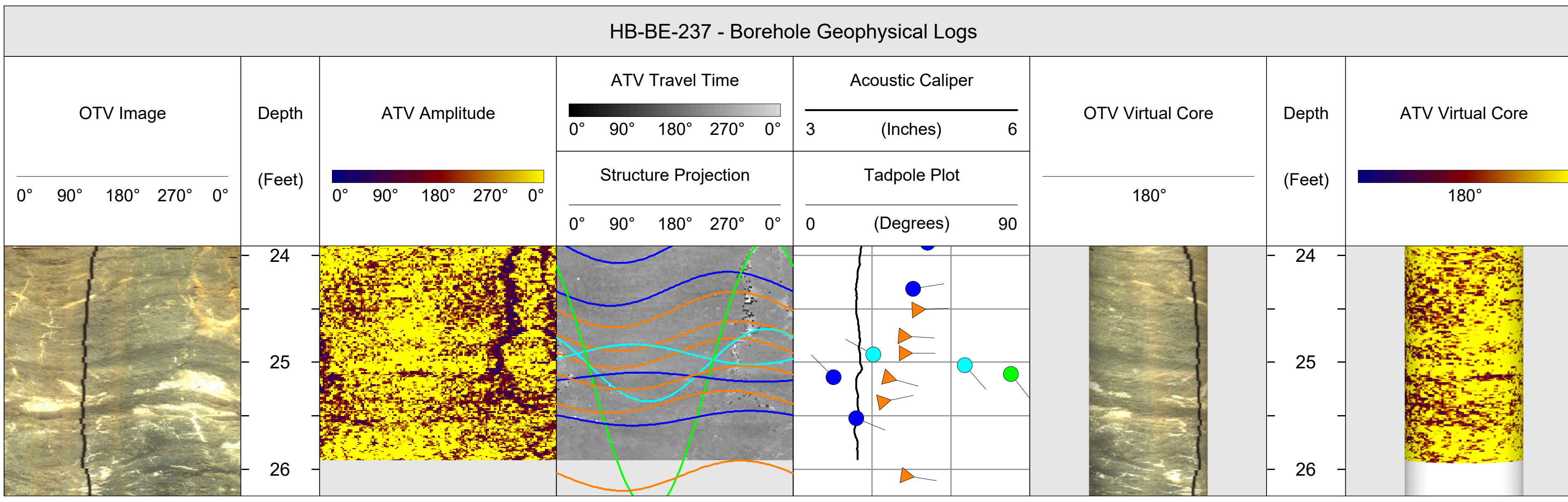
Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

NOTE: The borehole was reamed to approximately 3.8 inches after NQ coring.

HB-BE-237 - Borehole Geophysical Logs

OTV Image	Depth	ATV Amplitude	ATV Travel Time / Structure Projection	Acoustic Caliper / Tadpole Plot	OTV Virtual Core	Depth	ATV Virtual Core
0° 90° 180° 270° 0°	(Feet)	0° 90° 180° 270° 0°	0° 90° 180° 270° 0° / 0° 90° 180° 270° 0°	3 (Inches) 6 / 0 (Degrees) 90	180°	(Feet)	180°




HB-BE-237 - Borehole Geophysical Logs
OTV Image
0° 90° 180° 270° 0°
Depth
(Feet)
ATV Amplitude
0° 90° 180° 270° 0°
ATV Travel Time
0° 90° 180° 270° 0°
Structure Projection
0° 90° 180° 270° 0°
Acoustic Caliper
3 (Inches) 6
Tadpole Plot
0 (Degrees) 90
OTV Virtual Core
180°
Depth
(Feet)
ATV Virtual Core
180°
24
25
26
24
25
26

HAGER-RICHTER GEOSCIENCE, INC.

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Tel: 603.893.9944

Fords, New Jersey
Tel: 732.661.0555

ALL BOREHOLES FROM NOVEMBER 2020 & MARCH 2021 - BEDROCK STRUCTURE STATISTICS PLOTS

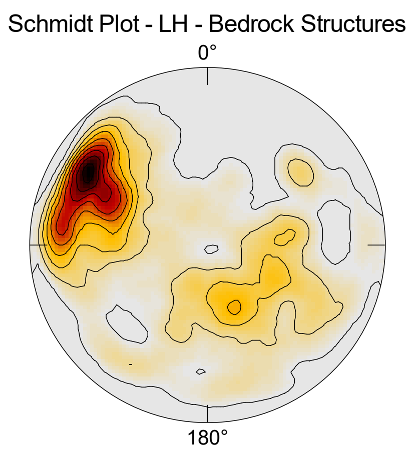
DATE(S) LOGGED: November 24, 2020 & March 3, 2021

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

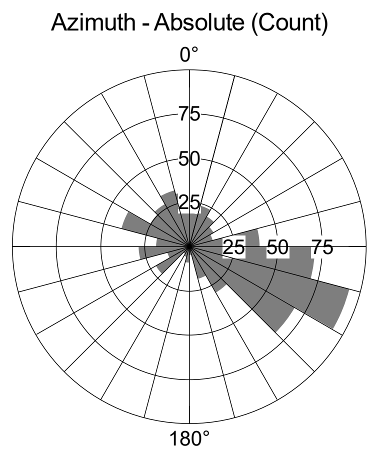
● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ◀ Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



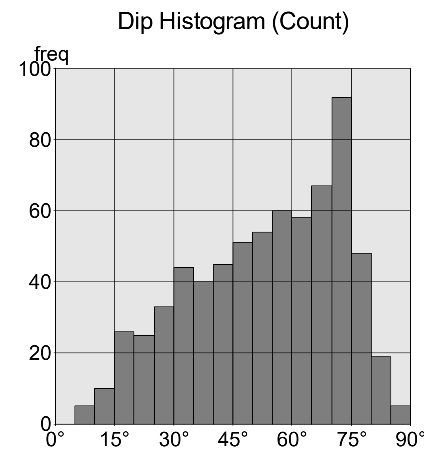
	Counts	Dip[deg]	Azi[deg]
Mean	682	53.27	83.43
● (green)	134	51.71	72.78
● (blue)	165	52.25	86.53
● (cyan)	319	55.92	87.55
● (red)	64	45.74	333.67

Dip Azimuth Rose Diagram of Bedrock Fractures



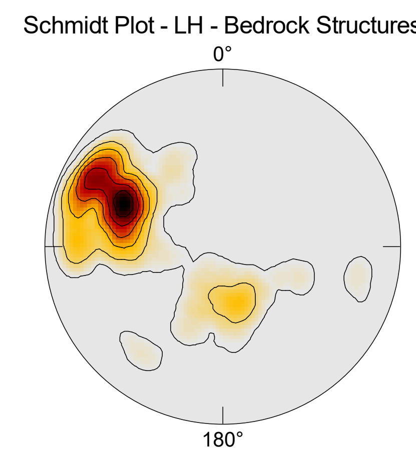
Components:	Azimuth
Counts:	682.00
Mean (2D):	83.43
Std.Dev.:	99.02
Min:	0.63
Max:	359.03

Dip Angle Histogram of Bedrock Fractures



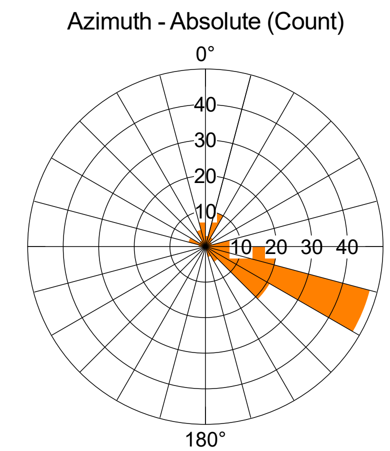
Counts:	682.00
Mean (2D):	53.27
Std.Dev.:	19.01
Min:	5.57
Max:	87.81

Stereogram - Lower Hemisphere of Foliation & Veins



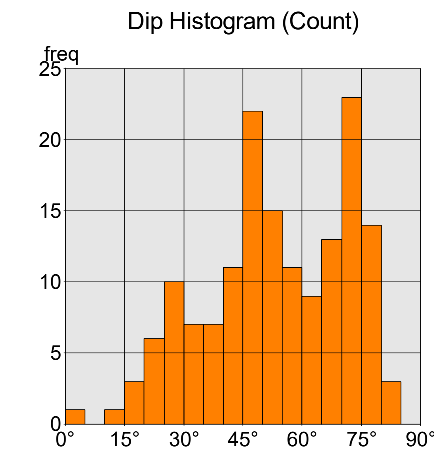
	Counts	Dip[deg]	Azi[deg]
Mean	156	53.44	93.26
▶ (orange)	156	53.44	93.26

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	156.00
Mean (2D):	93.26
Std.Dev.:	59.00
Min:	3.36
Max:	358.36

Dip Angle Histogram of Foliation & Veins



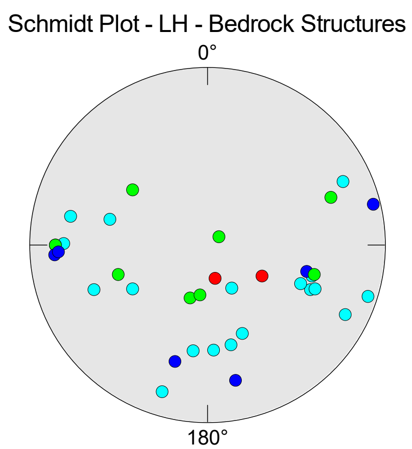
Counts:	156.00
Mean (2D):	53.44
Std.Dev.:	17.87
Min:	2.88
Max:	83.09

HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	BB-ECR-201 - BEDROCK STRUCTURE STATISTICS PLOTS	
		DATE(S) LOGGED:	March 3, 2021
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

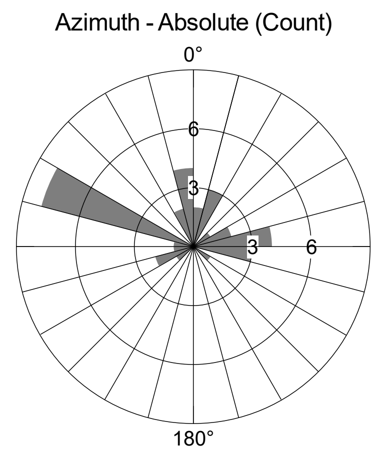
● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ◄ Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



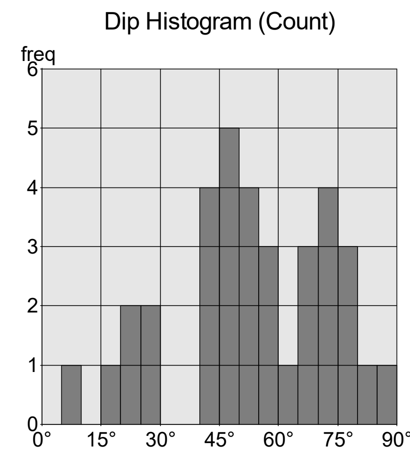
	Counts	Dip[deg]	Azi[deg]
Mean	35	53.86	351.34
●	18	56.54	342.77
●	8	41.85	28.92
●	6	67.87	3.59
●	3	39.41	355.95

Dip Azimuth Rose Diagram of Bedrock Fractures



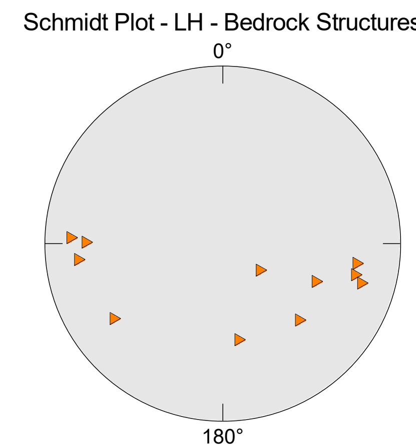
Components:	Azimuth
Counts:	35.00
Mean (2D):	351.34
Std.Dev.:	82.08
Min:	8.06
Max:	356.65

Dip Angle Histogram of Bedrock Fractures



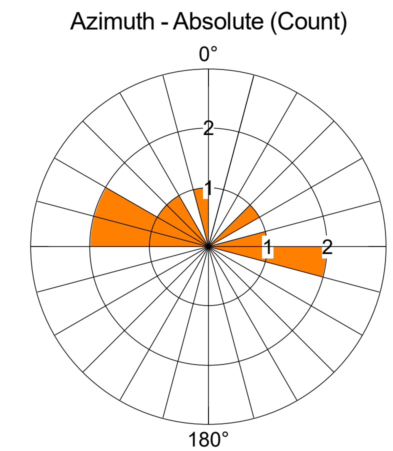
Counts:	35.00
Mean (2D):	53.86
Std.Dev.:	19.53
Min:	6.60
Max:	85.67

Stereogram - Lower Hemisphere of Foliation & Veins



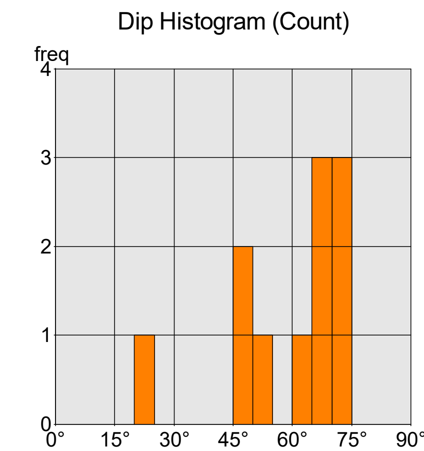
	Counts	Dip[deg]	Azi[deg]
Mean	11	58.61	336.46
►	11	58.61	336.46

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	11.00
Mean (2D):	336.46
Std.Dev.:	78.64
Min:	55.46
Max:	350.58

Dip Angle Histogram of Foliation & Veins



Counts:	11.00
Mean (2D):	58.61
Std.Dev.:	14.97
Min:	21.14
Max:	74.85

HAGER-RICHTER GEOSCIENCE, INC.

Salem, New Hampshire
Tel: 603.893.9944

Fords, New Jersey
Tel: 732.661.0555

BB-ECR-203A - BEDROCK STRUCTURE STATISTICS PLOTS

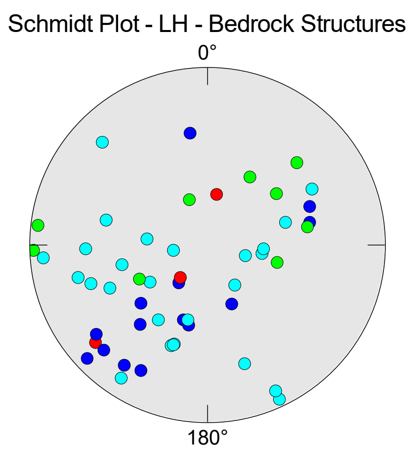
DATE(S) LOGGED: March 3, 2021

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

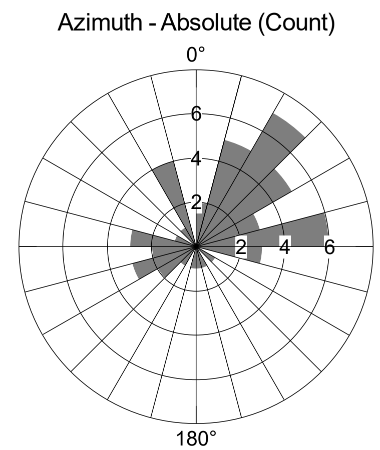
● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ◄ Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



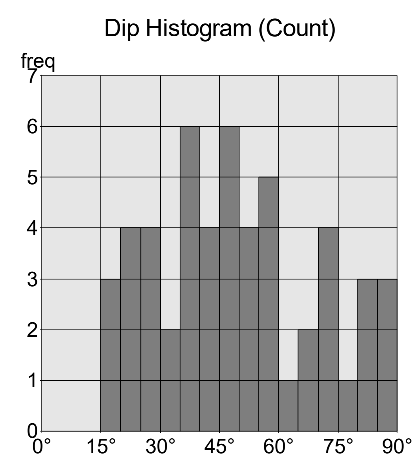
	Counts	Dip[deg]	Azi[deg]
Mean	52	49.38	34.77
●	14	52.61	26.95
●	26	48.82	32.17
●	9	49.48	196.05
●	3	38.27	70.15

Dip Azimuth Rose Diagram of Bedrock Fractures



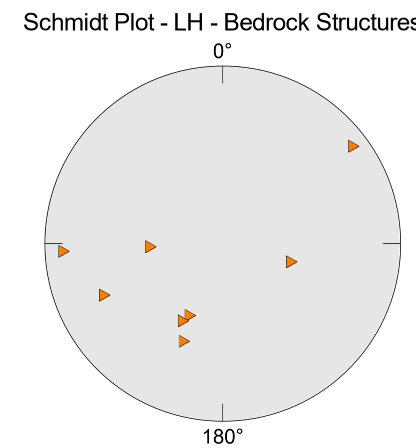
Components:	Azimuth
Counts:	52.00
Mean (2D):	34.77
Std.Dev.:	83.42
Min:	13.63
Max:	342.55

Dip Angle Histogram of Bedrock Fractures



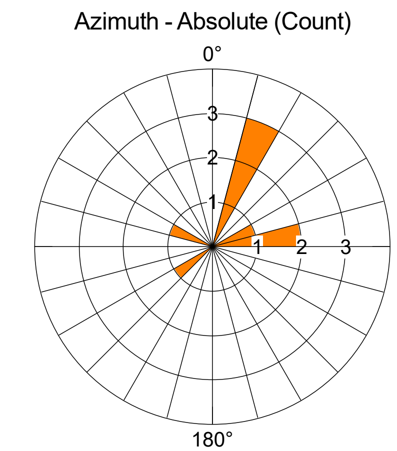
Counts:	52.00
Mean (2D):	49.38
Std.Dev.:	20.21
Min:	16.12
Max:	87.81

Stereogram - Lower Hemisphere of Foliation & Veins



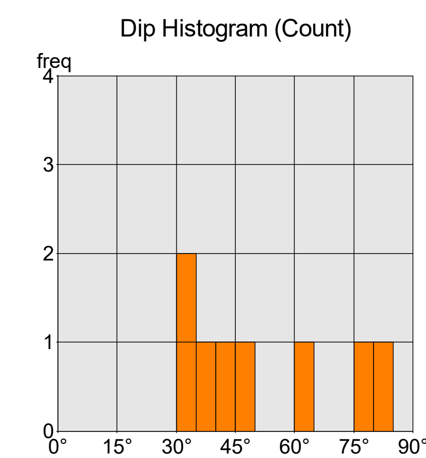
	Counts	Dip[deg]	Azi[deg]
Mean	8	51.97	40.38
►	8	51.97	40.38

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	8.00
Mean (2D):	40.38
Std.Dev.:	70.38
Min:	22.56
Max:	285.55

Dip Angle Histogram of Foliation & Veins



Counts:	8.00
Mean (2D):	51.97
Std.Dev.:	18.63
Min:	32.46
Max:	80.61

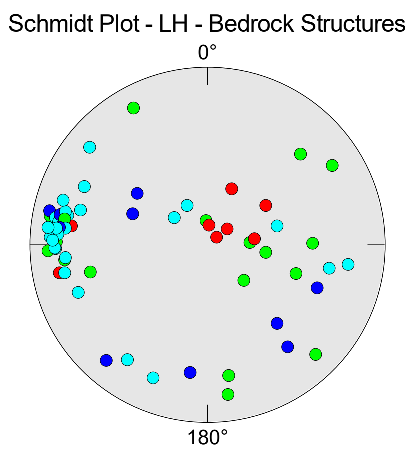
HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	BB-ECR-204A - BEDROCK STRUCTURE STATISTICS PLOTS DATE(S) LOGGED: March 3, 2021

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

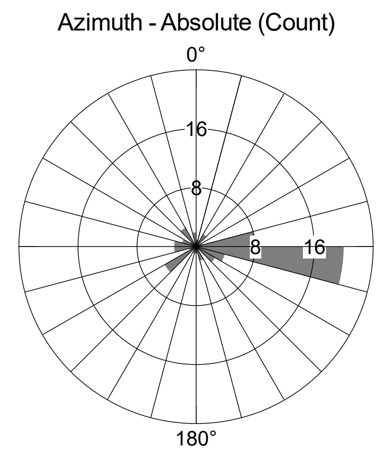
Fracture Rank 1 · Fracture Rank 2 · Fracture Rank 3 · Fracture Rank 4 · Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



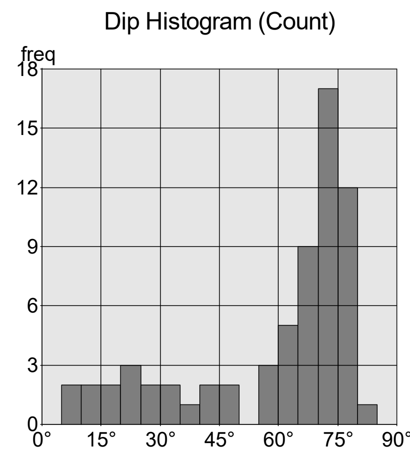
	Counts	Dip[deg]	Azi[deg]
Mean	65	59.64	98.55
● (Fracture Rank 2)	10	61.22	56.71
● (Fracture Rank 1)	28	67.10	96.12
● (Fracture Rank 3)	19	58.86	23.63
● (Fracture Rank 4)	8	30.67	205.90

Dip Azimuth Rose Diagram of Bedrock Fractures



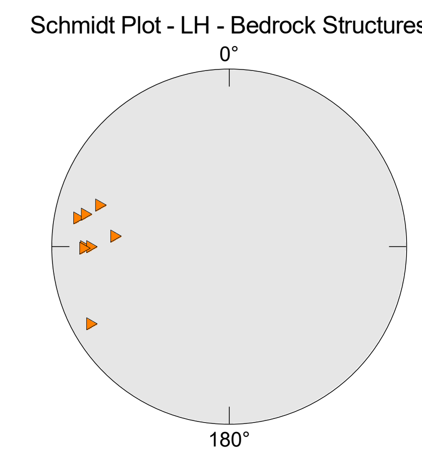
Components:	Azimuth
Counts:	65.00
Mean (2D):	98.55
Std.Dev.:	85.12
Min:	7.92
Max:	352.20

Dip Angle Histogram of Bedrock Fractures



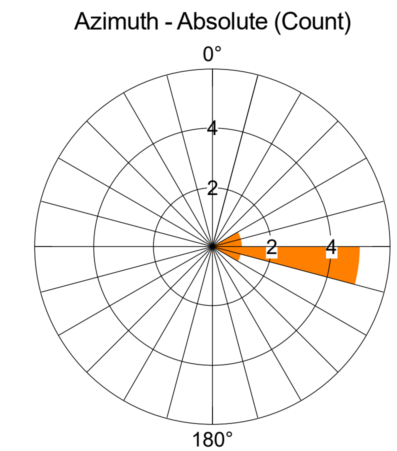
Counts:	65.00
Mean (2D):	59.64
Std.Dev.:	21.55
Min:	5.57
Max:	80.34

Stereogram - Lower Hemisphere of Foliation & Veins



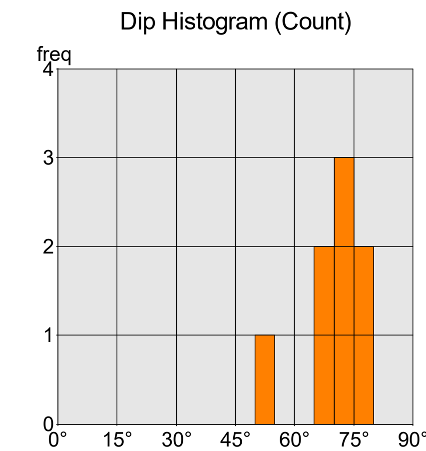
	Counts	Dip[deg]	Azi[deg]
Mean	8	69.72	92.28
► (Foliation / Vein)	8	69.72	92.28

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	8.00
Mean (2D):	92.28
Std.Dev.:	13.40
Min:	60.82
Max:	107.91

Dip Angle Histogram of Foliation & Veins



Counts:	8.00
Mean (2D):	69.72
Std.Dev.:	6.87
Min:	54.76
Max:	78.84

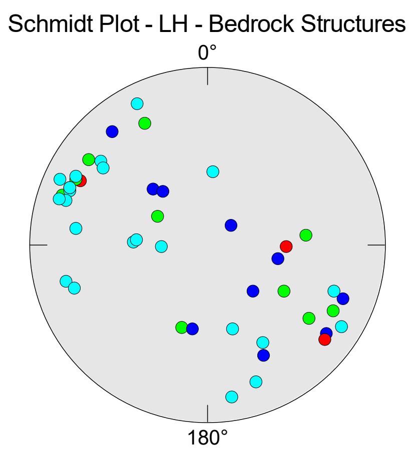
HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	BB-ECR-206A - BEDROCK STRUCTURE STATISTICS PLOTS DATE(S) LOGGED: March 3, 2021

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

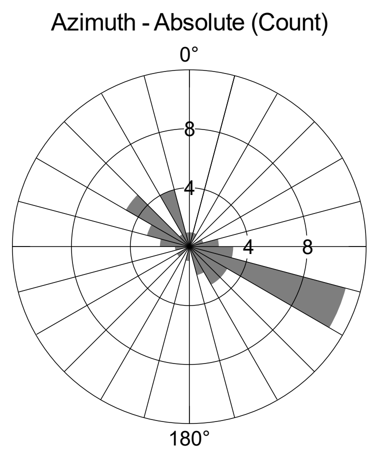
● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ◄ Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



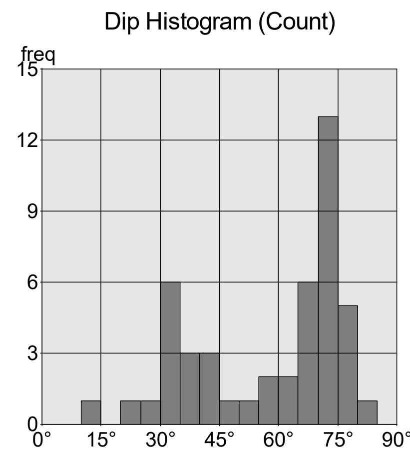
	Counts	Dip[deg]	Azi[deg]
Mean	46	57.81	90.09
● (green)	10	57.10	113.80
● (blue)	10	46.12	288.93
● (cyan)	23	62.79	93.78
● (red)	3	60.06	283.03

Dip Azimuth Rose Diagram of Bedrock Fractures



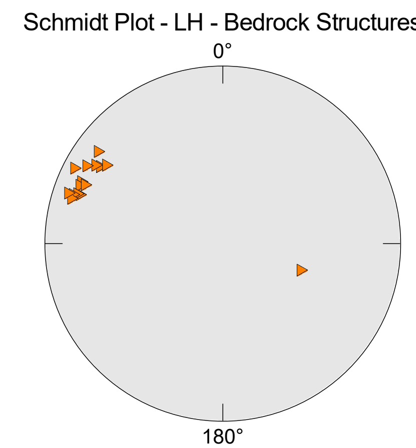
Components:	Azimuth
Counts:	46.00
Mean (2D):	90.09
Std.Dev.:	104.75
Min:	10.44
Max:	350.99

Dip Angle Histogram of Bedrock Fractures



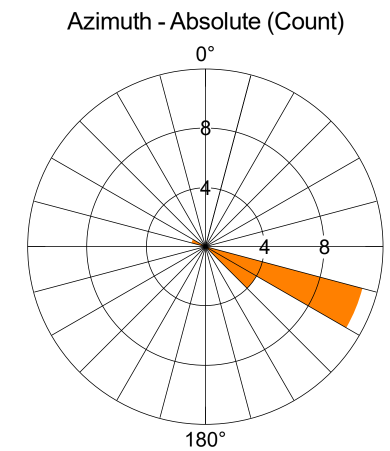
Counts:	46.00
Mean (2D):	57.81
Std.Dev.:	18.59
Min:	14.35
Max:	80.32

Stereogram - Lower Hemisphere of Foliation & Veins



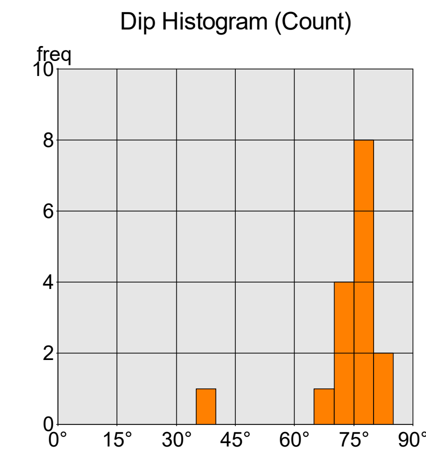
	Counts	Dip[deg]	Azi[deg]
Mean	16	73.59	115.47
►	16	73.59	115.47

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	16.00
Mean (2D):	115.47
Std.Dev.:	30.26
Min:	106.88
Max:	289.11

Dip Angle Histogram of Foliation & Veins



Counts:	16.00
Mean (2D):	73.59
Std.Dev.:	9.59
Min:	38.46
Max:	83.09

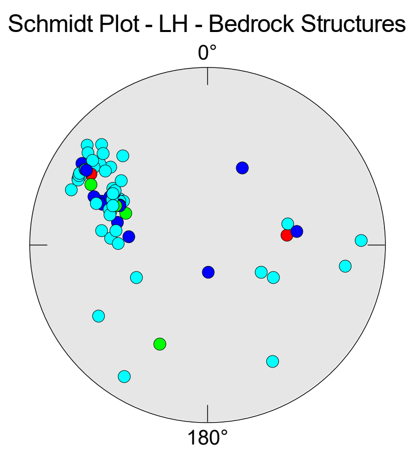
HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	BB-ELER-206A - BEDROCK STRUCTURE STATISTICS PLOTS DATE(S) LOGGED: March 3, 2021

CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

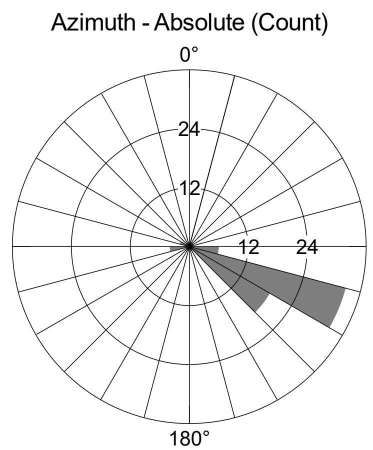
● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ◀ Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



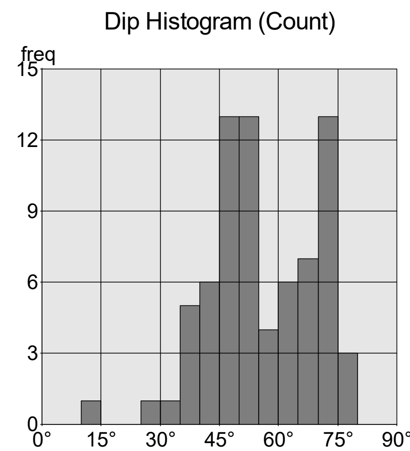
	Counts	Dip[deg]	Azi[deg]
Mean	73	55.55	115.40
● (Fracture Rank 3)	5	50.85	99.77
● (Fracture Rank 2)	18	51.04	117.02
● (Fracture Rank 1)	48	57.88	115.56
● (Fracture Rank 4)	2	51.73	192.09

Dip Azimuth Rose Diagram of Bedrock Fractures



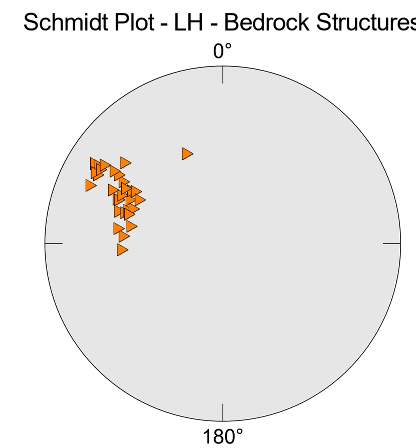
Components:	Azimuth
Counts:	73.00
Mean (2D):	115.40
Std.Dev.:	47.20
Min:	25.92
Max:	358.23

Dip Angle Histogram of Bedrock Fractures



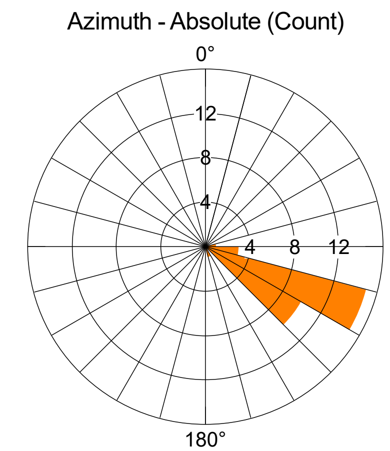
Counts:	73.00
Mean (2D):	55.55
Std.Dev.:	13.24
Min:	12.57
Max:	77.29

Stereogram - Lower Hemisphere of Foliation & Veins



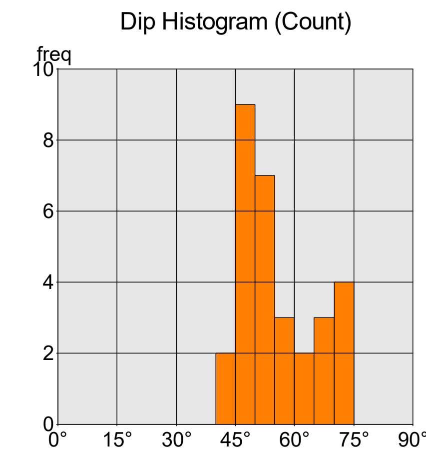
	Counts	Dip[deg]	Azi[deg]
Mean	30	55.88	115.64
◀ (Foliation / Vein)	30	55.88	115.64

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	30.00
Mean (2D):	115.64
Std.Dev.:	12.19
Min:	86.26
Max:	158.06

Dip Angle Histogram of Foliation & Veins



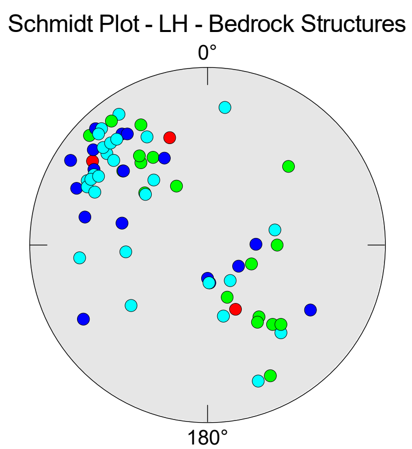
Counts:	30.00
Mean (2D):	55.88
Std.Dev.:	9.59
Min:	44.15
Max:	74.41

HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	HB-BE-235 - BEDROCK STRUCTURE STATISTICS PLOTS	
		DATE(S) LOGGED:	March 3, 2021
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

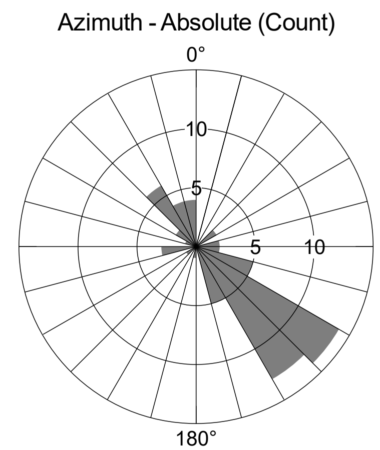
● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ◄ Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



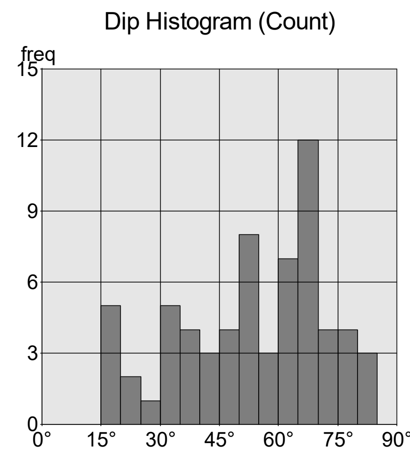
	Counts	Dip[deg]	Azi[deg]
Mean	65	53.58	122.95
● (Rank 4)	3	51.99	129.71
● (Rank 2)	17	53.62	113.91
● (Rank 3)	18	49.27	187.37
● (Rank 1)	27	56.62	118.70

Dip Azimuth Rose Diagram of Bedrock Fractures



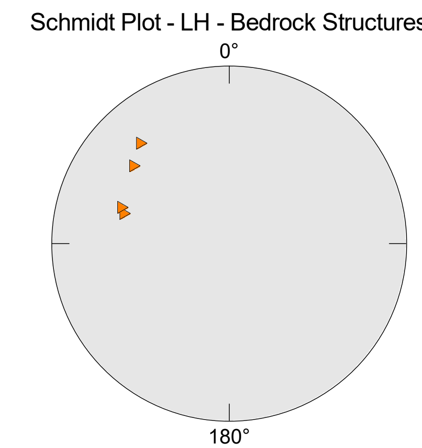
Components:	Azimuth
Counts:	65.00
Mean (2D):	122.95
Std.Dev.:	82.29
Min:	51.48
Max:	359.03

Dip Angle Histogram of Bedrock Fractures



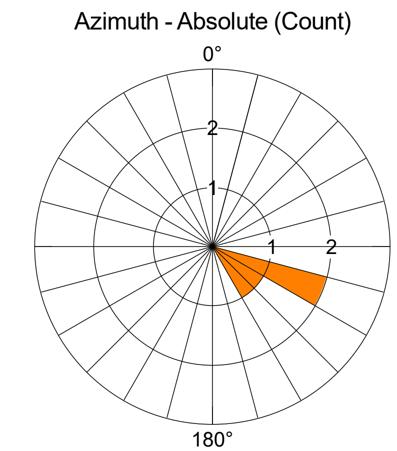
Counts:	65.00
Mean (2D):	53.58
Std.Dev.:	18.37
Min:	15.29
Max:	80.36

Stereogram - Lower Hemisphere of Foliation & Veins



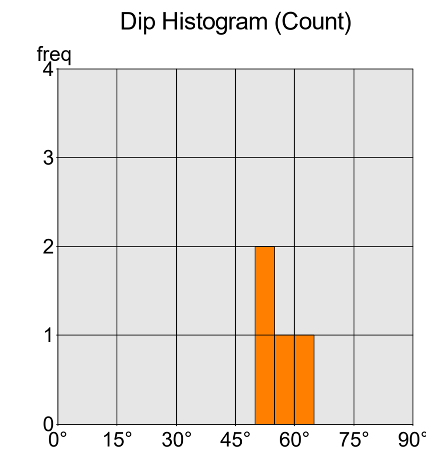
	Counts	Dip[deg]	Azi[deg]
Mean	4	57.63	120.64
► (Foliation / Vein)	4	57.63	120.64

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	4.00
Mean (2D):	120.64
Std.Dev.:	13.63
Min:	106.18
Max:	138.38

Dip Angle Histogram of Foliation & Veins



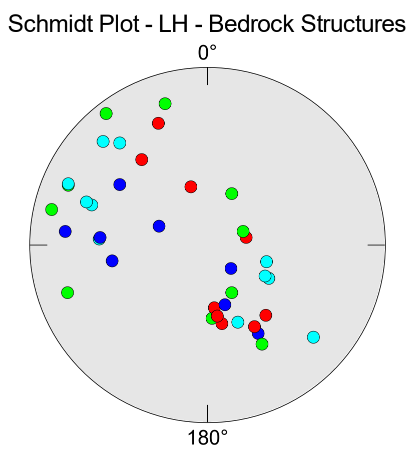
Counts:	4.00
Mean (2D):	57.63
Std.Dev.:	4.86
Min:	52.33
Max:	64.78

HAGER-RICHTER GEOSCIENCE, INC.	Salem, New Hampshire Tel: 603.893.9944 Fords, New Jersey Tel: 732.661.0555	HB-BE-237 - BEDROCK STRUCTURE STATISTICS PLOTS	
		DATE(S) LOGGED:	March 3, 2021
CLIENT:	Haley & Aldrich, Inc.	HRGS FILE:	20RG77
PROJECT:	Brewer-Eddington I-395/Route 9 Connector	ORIENTATION REFERENCE:	True North
LOCATION:	Eddington, Maine	MAGNETIC DECLINATION:	15.8° West

STRUCTURE LEGEND

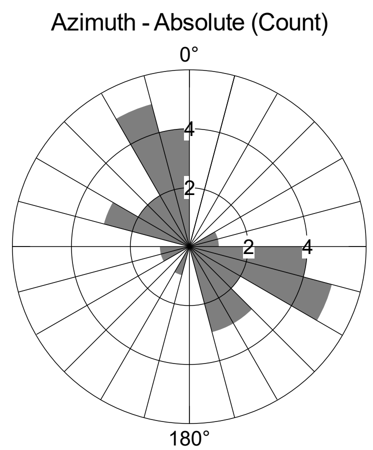
Fracture Rank 1 — Fracture Rank 2 — Fracture Rank 3 — Fracture Rank 4 — Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures



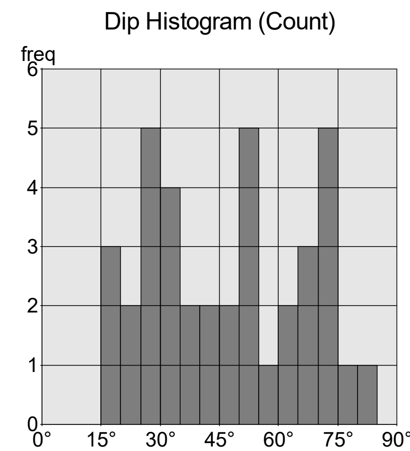
	Counts	Dip[deg]	Azi[deg]
Mean	38	47.34	57.16
● (green)	10	53.97	111.42
● (red)	9	38.68	322.81
● (blue)	8	41.64	63.94
● (cyan)	11	52.95	79.96

Dip Azimuth Rose Diagram of Bedrock Fractures



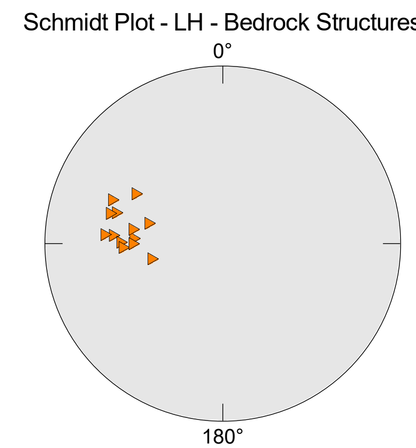
Components:	Azimuth
Counts:	38.00
Mean (2D):	57.16
Std.Dev.:	112.56
Min:	70.98
Max:	356.38

Dip Angle Histogram of Bedrock Fractures



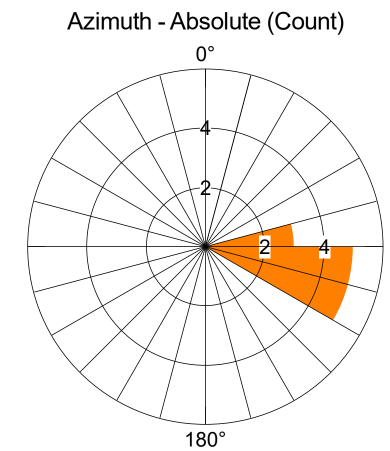
Counts:	38.00
Mean (2D):	47.34
Std.Dev.:	19.48
Min:	15.29
Max:	82.90

Stereogram - Lower Hemisphere of Foliation & Veins



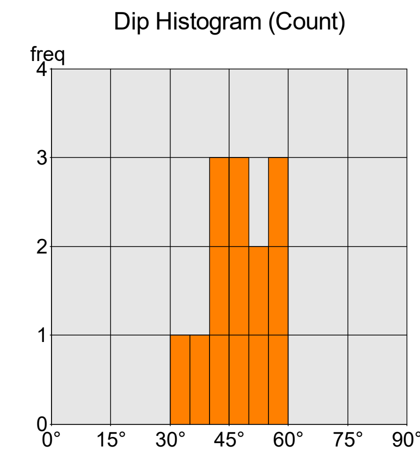
	Counts	Dip[deg]	Azi[deg]
Mean	13	47.07	98.16
▶	13	47.07	98.16

Dip Azimuth Rose Diagram of Foliation & Veins



Components:	Azimuth
Counts:	13.00
Mean (2D):	98.16
Std.Dev.:	10.82
Min:	77.95
Max:	119.88

Dip Angle Histogram of Foliation & Veins



Counts:	13.00
Mean (2D):	47.07
Std.Dev.:	7.27
Min:	33.74
Max:	56.63

HAGER-RICHTER GEOSCIENCE, INC.	
BB-ECR-201 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	March 3, 2021
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

BB-ECR-201 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
17.3	55	64	Foliation / Vein
18.0	347	48	Fracture Rank 1
19.5	233	7	Fracture Rank 3
20.1	330	23	Fracture Rank 1
20.1	348	67	Fracture Rank 2
22.1	278	65	Foliation / Vein
22.4	283	66	Foliation / Vein
22.9	17	75	Fracture Rank 1
24.6	287	52	Fracture Rank 1
25.3	292	47	Foliation / Vein
25.7	286	70	Foliation / Vein
26.4	18	26	Fracture Rank 3
26.7	315	51	Foliation / Vein
27.1	306	21	Foliation / Vein
27.2	346	16	Fracture Rank 4
27.4	8	51	Fracture Rank 1
28.0	9	23	Fracture Rank 3
28.1	16	58	Fracture Rank 2
28.2	357	50	Fracture Rank 1
28.3	351	46	Foliation / Vein
28.5	105	48	Fracture Rank 1
29.3	91	70	Fracture Rank 1
29.8	72	44	Fracture Rank 3
29.8	93	75	Foliation / Vein
29.9	60	41	Fracture Rank 1
30.1	90	75	Fracture Rank 4
30.2	90	75	Fracture Rank 3
30.5	86	75	Fracture Rank 2
30.6	68	58	Fracture Rank 1
31.7	288	84	Fracture Rank 1
31.9	338	45	Fracture Rank 1
32.0	87	73	Fracture Rank 2
32.9	84	71	Foliation / Vein
33.2	245	73	Fracture Rank 1
33.5	91	66	Foliation / Vein

BB-ECR-201 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
33.5	102	68	Fracture Rank 1
34.6	294	53	Fracture Rank 1
34.7	285	48	Fracture Rank 2
34.7	285	52	Fracture Rank 3
35.0	126	44	Fracture Rank 3
35.3	249	64	Fracture Rank 3
35.4	292	55	Fracture Rank 1
35.6	256	86	Fracture Rank 2
35.8	297	76	Fracture Rank 1
36.2	293	47	Fracture Rank 1
36.7	300	29	Fracture Rank 4

HAGER-RICHTER GEOSCIENCE, INC.	
BB-ECR-203A - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	March 3, 2021
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

BB-ECR-203A - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
14.2	257	49	Fracture Rank 2
14.3	171	54	Fracture Rank 2
14.3	249	52	Fracture Rank 2
15.6	279	25	Fracture Rank 1
16.1	134	72	Fracture Rank 1
16.3	47	83	Fracture Rank 2
16.5	104	49	Fracture Rank 1
16.7	72	59	Fracture Rank 1
17.1	88	88	Fracture Rank 3
17.2	158	23	Fracture Rank 3
17.6	19	49	Fracture Rank 1
18.0	81	16	Fracture Rank 1
18.1	33	42	Fracture Rank 1
20.0	284	34	Fracture Rank 3
20.2	35	71	Fracture Rank 2
20.2	343	59	Fracture Rank 1
21.0	87	80	Foliation / Vein
21.6	85	82	Fracture Rank 1
22.4	97	86	Fracture Rank 3
22.8	242	56	Fracture Rank 1
22.9	77	41	Fracture Rank 1
23.1	87	34	Foliation / Vein
23.5	227	58	Fracture Rank 3
23.6	37	22	Fracture Rank 2
23.9	96	28	Fracture Rank 1
23.9	233	40	Fracture Rank 3
24.2	76	64	Fracture Rank 1
24.4	335	86	Fracture Rank 1
24.4	212	38	Fracture Rank 3
24.5	57	32	Fracture Rank 1
25.0	233	81	Foliation / Vein
25.7	335	80	Fracture Rank 1
26.3	338	30	Fracture Rank 2
26.6	326	22	Fracture Rank 1
27.5	286	32	Foliation / Vein

BB-ECR-203A - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
27.6	254	38	Fracture Rank 1
27.8	260	48	Fracture Rank 3
27.9	64	36	Fracture Rank 3
28.0	18	37	Fracture Rank 2
28.1	14	38	Fracture Rank 2
28.2	15	36	Fracture Rank 1
28.8	26	37	Foliation / Vein
29.4	66	51	Fracture Rank 1
29.4	33	79	Fracture Rank 1
29.9	28	69	Fracture Rank 2
30.5	49	73	Fracture Rank 4
30.6	51	69	Fracture Rank 2
30.9	40	49	Fracture Rank 2
30.9	44	72	Fracture Rank 2
31.1	49	41	Fracture Rank 2
31.5	20	51	Fracture Rank 1
32.0	23	50	Foliation / Vein
32.5	28	41	Foliation / Vein
33.0	67	63	Foliation / Vein
34.0	191	24	Fracture Rank 4
34.2	88	58	Fracture Rank 1
34.6	40	20	Fracture Rank 4
35.7	19	50	Fracture Rank 1
38.8	286	18	Fracture Rank 1
39.0	274	26	Fracture Rank 1

HAGER-RICHTER GEOSCIENCE, INC.	
BB-ECR-204A - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	March 3, 2021
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

BB-ECR-204A - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
14.4	8	62	Fracture Rank 2
14.9	22	70	Fracture Rank 1
14.9	292	56	Fracture Rank 2
14.9	61	79	Foliation / Vein
14.9	88	79	Fracture Rank 3
15.3	278	69	Fracture Rank 1
15.6	281	59	Fracture Rank 1
16.0	288	44	Fracture Rank 3
16.1	269	50	Fracture Rank 3
16.4	231	12	Fracture Rank 4
16.6	204	28	Fracture Rank 4
16.6	351	64	Fracture Rank 3
16.9	278	27	Fracture Rank 3
16.9	266	20	Fracture Rank 3
17.0	352	74	Fracture Rank 3
17.6	126	41	Fracture Rank 2
17.7	319	50	Fracture Rank 2
17.9	91	74	Fracture Rank 3
17.9	322	63	Fracture Rank 2
18.4	226	63	Fracture Rank 3
18.7	41	76	Fracture Rank 2
18.8	112	38	Fracture Rank 2
18.9	152	77	Fracture Rank 3
19.0	238	72	Fracture Rank 3
19.3	79	74	Fracture Rank 4
19.8	236	33	Fracture Rank 4
19.9	98	66	Fracture Rank 4
20.0	100	79	Fracture Rank 3
20.6	95	74	Fracture Rank 1
20.9	101	76	Foliation / Vein
21.2	102	80	Fracture Rank 2
21.3	100	76	Fracture Rank 1
21.7	99	74	Fracture Rank 1
22.1	77	58	Fracture Rank 3
22.2	84	70	Fracture Rank 3

BB-ECR-204A - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
22.4	79	71	Fracture Rank 1
22.6	90	71	Foliation / Vein
22.9	115	66	Fracture Rank 1
23.5	70	67	Fracture Rank 1
23.8	90	68	Foliation / Vein
24.2	85	69	Fracture Rank 1
24.7	35	68	Fracture Rank 1
24.8	105	64	Fracture Rank 1
25.1	176	11	Fracture Rank 3
25.2	130	75	Fracture Rank 1
25.8	108	66	Foliation / Vein
25.9	102	70	Fracture Rank 1
26.3	102	74	Fracture Rank 2
26.5	228	6	Fracture Rank 4
26.5	103	71	Fracture Rank 1
26.6	100	71	Fracture Rank 3
26.7	97	70	Fracture Rank 1
27.0	96	73	Fracture Rank 1
27.9	97	73	Fracture Rank 2
28.1	315	24	Fracture Rank 3
28.3	185	9	Fracture Rank 4
29.6	95	55	Foliation / Vein
30.3	107	74	Fracture Rank 1
31.9	315	76	Fracture Rank 3
34.7	92	76	Fracture Rank 3
34.9	93	78	Fracture Rank 1
35.7	94	73	Fracture Rank 1
35.9	88	75	Fracture Rank 1
36.2	263	22	Fracture Rank 4
36.4	152	21	Fracture Rank 1
36.6	89	75	Fracture Rank 1
37.9	89	71	Foliation / Vein
38.3	255	33	Fracture Rank 1
38.3	129	20	Fracture Rank 1
38.3	92	76	Fracture Rank 1
42.1	103	72	Foliation / Vein
42.4	97	75	Fracture Rank 1
42.7	96	80	Fracture Rank 1

HAGER-RICHTER GEOSCIENCE, INC.	
BB-ECR-206A - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	March 3, 2021
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

BB-ECR-206A - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
24.2	153	66	Fracture Rank 3
24.6	136	36	Fracture Rank 2
25.2	126	71	Fracture Rank 3
25.4	93	35	Fracture Rank 1
25.6	140	32	Fracture Rank 2
25.6	75	71	Fracture Rank 1
26.3	154	78	Fracture Rank 1
26.8	109	76	Fracture Rank 3
27.3	127	77	Foliation / Vein
27.7	128	66	Fracture Rank 1
27.7	341	71	Fracture Rank 1
28.0	117	69	Fracture Rank 4
28.0	120	27	Fracture Rank 3
28.2	292	71	Fracture Rank 2
28.3	307	73	Fracture Rank 2
28.4	140	73	Fracture Rank 2
28.4	301	42	Fracture Rank 3
28.7	281	34	Fracture Rank 2
28.9	230	14	Fracture Rank 2
29.2	272	37	Fracture Rank 4
29.4	264	46	Fracture Rank 3
29.5	315	30	Fracture Rank 2
29.6	17	40	Fracture Rank 3
29.6	117	72	Fracture Rank 3
29.6	289	38	Foliation / Vein
29.9	10	40	Fracture Rank 2
29.9	127	62	Fracture Rank 1
30.4	351	76	Fracture Rank 1
30.7	290	65	Fracture Rank 1
31.0	298	69	Fracture Rank 3
31.1	306	60	Fracture Rank 3
31.5	331	53	Fracture Rank 1
31.5	309	74	Fracture Rank 4
31.5	122	70	Foliation / Vein
31.7	72	68	Fracture Rank 1

BB-ECR-206A - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
31.8	343	41	Fracture Rank 1
32.1	122	73	Foliation / Vein
32.2	301	77	Fracture Rank 1
32.6	112	72	Fracture Rank 1
32.8	113	73	Fracture Rank 1
33.0	113	73	Fracture Rank 1
34.7	107	73	Fracture Rank 1
34.9	109	74	Foliation / Vein
35.1	113	75	Foliation / Vein
35.3	114	76	Foliation / Vein
35.7	112	76	Foliation / Vein
36.4	114	80	Fracture Rank 1
38.1	117	83	Foliation / Vein
39.6	120	78	Foliation / Vein
40.4	184	34	Fracture Rank 1
41.0	124	68	Foliation / Vein
42.0	118	73	Fracture Rank 1
42.1	113	73	Foliation / Vein
43.5	109	76	Foliation / Vein
43.6	107	77	Fracture Rank 1
44.8	108	78	Foliation / Vein
45.2	107	78	Foliation / Vein
47.0	95	33	Fracture Rank 1
47.5	108	81	Foliation / Vein
47.7	88	21	Fracture Rank 1
47.8	97	64	Fracture Rank 1
47.8	333	59	Fracture Rank 2

HAGER-RICHTER GEOSCIENCE, INC.	
BB-ELER-206A - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	March 3, 2021
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

BB-ELER-206A - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
9.4	26	52	Fracture Rank 3
9.7	358	13	Fracture Rank 2
10.1	86	48	Foliation / Vein
10.3	94	46	Fracture Rank 1
10.5	98	50	Fracture Rank 1
10.8	95	47	Foliation / Vein
11.4	101	44	Foliation / Vein
11.6	104	44	Fracture Rank 2
11.9	99	43	Fracture Rank 1
12.1	268	76	Fracture Rank 1
12.3	118	47	Fracture Rank 1
12.7	121	52	Fracture Rank 1
12.9	115	49	Foliation / Vein
13.2	113	51	Fracture Rank 3
13.3	108	52	Foliation / Vein
13.8	113	50	Fracture Rank 2
14.1	122	56	Foliation / Vein
14.8	99	50	Foliation / Vein
15.0	113	55	Foliation / Vein
15.1	113	54	Fracture Rank 2
15.3	111	54	Fracture Rank 2
15.5	113	59	Fracture Rank 2
15.7	263	37	Fracture Rank 4
15.8	127	60	Fracture Rank 1
16.0	255	39	Fracture Rank 1
16.9	57	63	Fracture Rank 1
17.5	91	42	Fracture Rank 1
17.6	96	37	Fracture Rank 2
18.2	111	57	Fracture Rank 1
18.3	113	54	Foliation / Vein
18.4	116	54	Foliation / Vein
18.7	108	49	Foliation / Vein
18.8	117	52	Fracture Rank 2
18.9	119	51	Fracture Rank 1
19.1	120	50	Foliation / Vein

BB-ELER-206A - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
19.3	109	48	Foliation / Vein
19.3	109	48	Fracture Rank 1
19.4	114	47	Fracture Rank 2
19.5	118	45	Fracture Rank 1
19.8	279	68	Fracture Rank 1
19.8	117	46	Fracture Rank 1
19.9	110	50	Fracture Rank 1
20.0	115	45	Fracture Rank 2
20.1	111	41	Fracture Rank 3
20.2	114	45	Fracture Rank 2
20.2	113	47	Fracture Rank 3
20.3	120	50	Fracture Rank 2
20.5	116	50	Fracture Rank 1
20.6	120	51	Fracture Rank 1
20.7	121	51	Fracture Rank 1
20.9	121	48	Foliation / Vein
21.1	119	53	Foliation / Vein
21.9	119	51	Fracture Rank 1
22.0	127	51	Fracture Rank 1
22.2	111	45	Foliation / Vein
22.3	107	47	Foliation / Vein
22.5	107	48	Fracture Rank 1
22.6	118	44	Foliation / Vein
22.8	113	48	Fracture Rank 1
23.0	129	59	Fracture Rank 1
23.2	123	60	Foliation / Vein
23.2	331	64	Fracture Rank 1
23.8	127	65	Fracture Rank 1
24.0	116	59	Foliation / Vein
24.1	65	37	Fracture Rank 1
24.6	32	77	Fracture Rank 1
24.7	112	72	Fracture Rank 1
25.0	130	77	Fracture Rank 1
25.6	296	34	Fracture Rank 1
25.9	134	71	Fracture Rank 1
26.2	158	46	Foliation / Vein
26.4	261	42	Fracture Rank 2
26.9	124	67	Fracture Rank 1
27.2	121	66	Fracture Rank 4
27.3	118	63	Fracture Rank 3
27.5	126	61	Fracture Rank 1
27.7	131	67	Fracture Rank 1
28.1	136	59	Fracture Rank 1
28.2	129	61	Foliation / Vein
28.5	120	70	Fracture Rank 2

BB-ELER-206A - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
28.7	128	74	Fracture Rank 1
29.6	297	28	Fracture Rank 1
29.6	122	74	Foliation / Vein
29.9	122	71	Foliation / Vein
30.0	123	73	Fracture Rank 2
31.9	205	40	Fracture Rank 2
32.0	114	71	Foliation / Vein
32.2	119	70	Foliation / Vein
32.3	122	70	Fracture Rank 1
32.4	117	71	Fracture Rank 1
32.5	119	71	Fracture Rank 1
32.7	119	71	Foliation / Vein
32.9	120	72	Fracture Rank 2
33.1	117	70	Fracture Rank 1
33.2	119	71	Fracture Rank 1
33.4	120	72	Fracture Rank 1
33.6	122	70	Fracture Rank 1
33.7	122	70	Fracture Rank 1
33.8	121	70	Foliation / Vein
34.0	126	70	Fracture Rank 1
34.1	122	69	Fracture Rank 2
34.1	123	69	Foliation / Vein
35.2	124	63	Foliation / Vein

HAGER-RICHTER GEOSCIENCE, INC.	
HB-BE-235 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	March 3, 2021
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

HB-BE-235 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
15.1	126	69	Fracture Rank 4
15.3	124	66	Fracture Rank 2
15.3	133	80	Fracture Rank 3
15.5	105	41	Fracture Rank 2
15.8	131	53	Fracture Rank 3
16.0	148	49	Fracture Rank 3
16.2	85	38	Fracture Rank 1
16.2	151	59	Fracture Rank 1
16.4	59	71	Fracture Rank 2
16.4	136	80	Fracture Rank 2
16.4	51	46	Fracture Rank 1
16.9	356	17	Fracture Rank 2
17.2	142	68	Fracture Rank 2
17.2	336	32	Fracture Rank 4
17.4	339	26	Fracture Rank 3
17.5	359	15	Fracture Rank 2
17.8	146	78	Fracture Rank 1
17.9	142	78	Fracture Rank 3
18.1	347	34	Fracture Rank 1
18.2	305	17	Fracture Rank 2
18.5	138	78	Fracture Rank 1
18.8	357	17	Fracture Rank 1
19.0	136	77	Fracture Rank 1
19.2	160	54	Fracture Rank 4
19.4	141	50	Fracture Rank 3
19.6	130	38	Fracture Rank 3
19.8	131	53	Fracture Rank 2
19.9	143	53	Fracture Rank 3
20.0	130	73	Fracture Rank 2
20.1	114	70	Fracture Rank 2
20.5	118	66	Fracture Rank 1
20.7	132	66	Fracture Rank 1
20.8	133	69	Fracture Rank 1
20.8	327	20	Fracture Rank 1
20.9	137	68	Fracture Rank 1

HB-BE-235 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
21.0	144	66	Fracture Rank 2
21.2	151	67	Fracture Rank 3
21.3	139	68	Fracture Rank 1
21.4	122	64	Fracture Rank 1
21.5	116	64	Fracture Rank 1
21.7	120	64	Fracture Rank 1
21.8	138	65	Foliation / Vein
22.1	129	59	Foliation / Vein
22.3	123	62	Fracture Rank 1
22.5	115	60	Fracture Rank 1
22.8	129	38	Fracture Rank 1
23.3	106	52	Foliation / Vein
23.4	340	71	Fracture Rank 1
23.7	84	62	Fracture Rank 1
23.9	109	54	Foliation / Vein
24.0	103	60	Fracture Rank 2
24.9	122	80	Fracture Rank 2
25.4	320	54	Fracture Rank 1
25.9	302	58	Fracture Rank 2
25.9	257	32	Fracture Rank 1
26.0	321	48	Fracture Rank 3
26.1	324	41	Fracture Rank 3
26.2	327	43	Fracture Rank 3
26.2	152	31	Fracture Rank 3
26.4	268	23	Fracture Rank 2
26.4	317	51	Fracture Rank 3
26.6	334	71	Fracture Rank 3
26.6	140	39	Fracture Rank 1
26.8	226	54	Fracture Rank 3
26.9	270	32	Fracture Rank 3
27.0	293	22	Fracture Rank 3
27.1	187	67	Fracture Rank 1
27.5	132	61	Fracture Rank 1
27.8	153	46	Fracture Rank 2

HAGER-RICHTER GEOSCIENCE, INC.	
HB-BE-237 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Haley & Aldrich, Inc.
PROJECT	Brewer-Eddington I-395/Route 9 Connector
LOCATION	Eddington, Maine
HRGS FILE	20RG77
DATE LOGGED	March 3, 2021
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 15.8° West)
DIP ANGLE	Measured from Horizontal

HB-BE-237 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
9.0	333	25	Fracture Rank 3
9.6	113	74	Fracture Rank 3
10.2	71	72	Fracture Rank 3
11.2	103	79	Fracture Rank 3
11.5	163	72	Fracture Rank 3
11.7	356	34	Fracture Rank 3
11.8	158	63	Fracture Rank 4
12.4	258	18	Fracture Rank 4
12.6	249	18	Fracture Rank 3
13.2	96	70	Fracture Rank 2
13.9	164	28	Fracture Rank 4
14.0	114	75	Fracture Rank 1
14.6	206	26	Fracture Rank 3
14.6	135	72	Fracture Rank 1
15.1	330	48	Fracture Rank 2
15.7	143	51	Fracture Rank 4
15.8	331	54	Fracture Rank 3
16.2	330	44	Fracture Rank 4
16.4	320	43	Fracture Rank 4
16.7	350	37	Fracture Rank 4
16.9	353	29	Fracture Rank 4
17.1	352	33	Fracture Rank 4
17.6	343	29	Fracture Rank 2
17.8	94	52	Foliation / Vein
18.6	125	50	Fracture Rank 2
19.6	95	57	Foliation / Vein
19.9	106	53	Foliation / Vein
20.1	299	32	Fracture Rank 1
20.8	109	58	Fracture Rank 1
20.9	286	29	Fracture Rank 1
21.2	120	47	Foliation / Vein
21.8	339	39	Fracture Rank 1
21.9	105	55	Foliation / Vein
22.4	311	68	Fracture Rank 1
22.5	112	57	Foliation / Vein

HB-BE-237 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
22.6	110	62	Fracture Rank 1
23.4	93	51	Fracture Rank 1
23.7	91	48	Foliation / Vein
23.9	94	51	Fracture Rank 2
24.3	81	46	Fracture Rank 2
24.5	88	47	Foliation / Vein
24.8	93	42	Foliation / Vein
24.9	90	42	Foliation / Vein
24.9	298	30	Fracture Rank 1
25.0	139	65	Fracture Rank 1
25.1	142	83	Fracture Rank 3
25.1	315	15	Fracture Rank 2
25.1	105	36	Foliation / Vein
25.4	78	34	Foliation / Vein
25.5	112	24	Fracture Rank 2
26.1	99	43	Foliation / Vein

APPENDIX C

Observation Well Installation and Groundwater Monitoring Reports

HALEY ALDRICH

HALEY ALDRICH

OBSERVATION WELL INSTALLATION REPORT

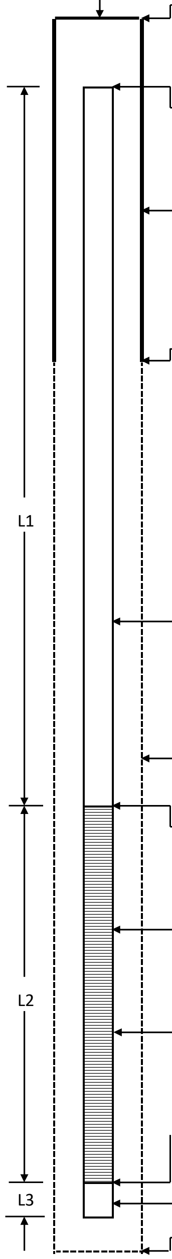
Well No.	BB-ELER-101(OW)
Boring No.	BB-ELER-101

PROJECT	Route 9/I-395 Connector	**H&A FILE NO.**	132076-002
LOCATION	Brewer, Maine/Eddington, Maine	**PROJECT MGR.**	B. Steinert
CLIENT	Maine Department of Transportation	**FIELD REP.**	N. Klausmeyer
CONTRACTOR	Northern Test Borings Inc.	**DATE INSTALLED**	7/23/2018
DRILLER	M. Nadeau	**WATER LEVEL**	7.9 ft (depth below gs)

Ground El. 225.0 ft **Location** SEE PLAN ☐ **Guard Pipe**
El. Datum NAVD 88 ☑ **Roadway Box**

SOIL/ROCK CONDITIONS	BOREHOLE BACKFILL
Granular -FILL-	-CONCRETE-
2.0 ft	2.5 ft
-GLACIAL TILL-	-BENTONITE-
	3.5 ft
	-FILTER SAND-
14.4 ft	14.4 ft
-BEDROCK-	-BENTONITE-
26.3	26.3

(Bottom of Exploration)
(Numbers refer to depth from ground surface in feet)



Type of protective cover	Steel cover, two 0.5-in. bolts	
Depth of top of roadway box below ground surface	0.0	ft
Depth of top of riser pipe below ground surface	0.2	ft
Type of protective casing:	Steel Roadway Box	
Length	0.8	ft
Inside Diameter	7.0	in
Depth of bottom of guard pipe	0.8	ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	2.5
Bentonite Seal	2.5	1.0

Type of riser pipe:	Sch. 40 PVC	
Inside diameter of riser pipe	2.0	in
Type of backfill around riser	Filter Sand	
Diameter of borehole	4.0	in
Depth to top of well screen	4.2	ft
Type of screen	Sch. 40 PVC	
Screen gauge or size of openings	0.010	in
Diameter of screen	2.0	in
Type of backfill around screen	Filter Sand	
Depth of bottom of well screen	14.2	ft
Bottom of Silt trap	14.4	ft
Depth of bottom of borehole	26.3	ft

(Not to Scale)

4.0 ft (Riser Pay Length (L1)) + 10.0 ft (Length of screen (L2)) + 0.2 ft (Length of silt trap (L3)) = 14.2 ft (Pay length)

COMMENTS:

GROUNDWATER MONITORING REPORT

OW/PZ NUMBER: BB-ELER-101

Page 1 of 1

PROJECT	Levenseller Road Bridge over I-395/Route 9 Connector	**H&A FILE NO.**	132076-007
LOCATION	Eddington, Maine	**PROJECT MGR.**	B. Steinert
CLIENT	Maine Department of Transportation	**FIELD REP.**	N. Klausmeyer
CONTRACTOR	Northern Test Borings, Inc.	**DATE**	7/23/2018

ELEVATION OF REFERENCE POINT (ft) 225.0 **REFERENCE POINT:** Ground Surface ☑ PVC ☐ Other ☐

Date	Time	Elapsed Time (days)	Depth of Water from Reference Point (ft)	Elevation of Water (ft)	Remarks	Read By
7/23/2018	2:07 PM	0	7.9	217.1	Initial Reading - 80s & Sunny	NLK
8/10/2018	12:55 PM	18	12.4	212.6	80s & Sunny	NLK
8/13/2018	11:30 PM	21	10.7	214.3	70s & Overcast	NLK
9/4/2018	1:36 PM	43	11.0	214.0	80s & Sunny	NLK
9/10/2018	12:13 PM	49	11.6	213.4	60s & Cloudy	NLK
10/5/2018	4:15 PM	74	12.3	212.7	50s & Sunny	MLS
10/16/2018	8:35 AM	85	11.1	213.9	40s & Sunny	HH
10/26/2018	2:45 PM	95	11.1	213.9	40s & Sunny	NLK
11/8/2018	7:30 AM	108	5.3	219.7	50's & Sunny; after several days of rain	HH
12/19/2018	1:40 PM	149	6.3	218.7	20s & Sunny - frozen well cap	NLK
10/30/2019	2:23 PM	464	3.4	221.6	50's and cloudy	HH
12/12/2019	2:17 PM	507	2.9	222.1	20's and sunny	JKF
4/4/2020	1:15 PM	621	2.5	222.5	50's and sunny	HH
6/2/2020	2:27 PM	680	2.2	222.8	50's and sunny	JF
12/7/2020	8:15 AM	868	3.8	221.2	20's and cloudy, no well cover	JF
3/24/2021	2:03 PM	975	4.0	221.0	40's and sunny, no well cover	JF
4/19/2021	2:22 PM	1,001	3.9	221.1	50's and sunny, well covered replaced	JF
5/12/2021	1:14 PM	1,024	4.4	220.6	50's and cloudy	JF

G:\PROJECTS\132076 - brewer eddington\002 - Exploration + Laboratory Testing Programs\Field\Ground Water Monitoring Reports

APPENDIX D

Laboratory Test Results

Client:	Haley & Aldrich, Inc.				
Project:	Rt 9/I-395 Levenseller Rd Bridge				
Location:	Brewer and Eddington, ME			Project No:	GTX-308857
Boring ID:	---	Sample Type:	---	Tested By:	jbr
Sample ID:	---	Test Date:	10/02/18	Checked By:	emm
Depth :	---	Test Id:	474534		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
BB-ELER-101	3D	4-6 ft	Moist, yellowish brown sandy clay	12.4
BB-ELER-102	3D	4.3-6.3 ft	Moist, brown sandy silt	13.9
BB-ELER-102	4D	10-12 ft	Moist, brown sandy clay with gravel	10.2

Notes: Temperature of Drying : 110º Celsius

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Client:	Haley & Aldrich, Inc.		
Project:	Rt 9/I-395 Connector		
Location:	Brewer and Eddington, ME	Project No:	GTX-308853
Boring ID: ---	Sample Type: ---	Tested By:	md
Sample ID: ---	Test Date: 10/17/18	Checked By:	emm
Depth : ---	Test Id: 474317		

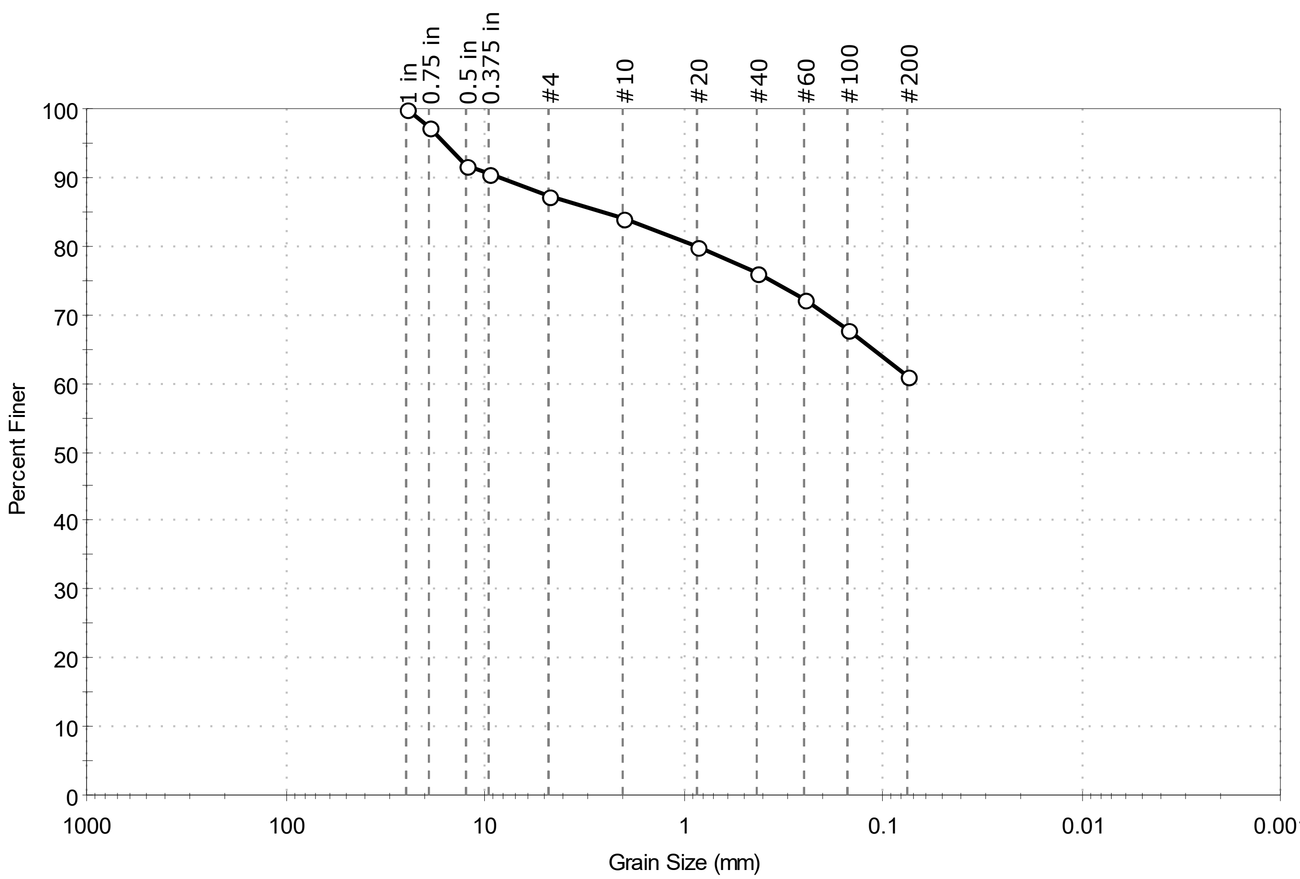
Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
HB-BE-151	2D	2-3.7 ft	Moist, olive sandy clay	13.7
HB-BE-151	3D	4-6 ft	Moist, olive sandy clay	13.4
HB-BE-151	4D	10-10.9 ft	Moist, olive gray sandy clay	12.4
HB-BE-151	5D	15-16.2 ft	Moist, olive sandy clay	11.3
HB-BE-151	6D+7D+8D	17-21.5 ft	Moist, olive brown gravel with clay and sand	7.9
HB-BFB-101	1U	5-7 ft	Moist, very dark gray clay	36.1
HB-BFB-101	2U	12-14 ft	Wet, very dark greenish gray clay	40.4
HB-BFB-101	4U	30-32 ft	Moist, dark gray clay	35.4

Notes: Temperature of Drying : 110° Celsius

Client:	Haley & Aldrich, Inc.		
Project:	Rt 9/I-395 Levenseller Rd Bridge		
Location:	Brewer and Eddington, ME	Project No:	GTX-308857
Boring ID:	BB-ELER-101	Sample Type: jar	Tested By: jbr
Sample ID:	3D	Test Date: 10/01/18	Checked By: emm
Depth :	4-6 ft	Test Id: 474527	
Test Comment:	---		
Visual Description:	Moist, yellowish brown sandy clay		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	12.6	26.4	61.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	97		
0.5 in	12.50	92		
0.375 in	9.50	91		
#4	4.75	87		
#10	2.00	84		
#20	0.85	80		
#40	0.42	76		
#60	0.25	72		
#100	0.15	68		
#200	0.075	61		

Coefficients

D_{85} =2.5324 mm	D_{30} =N/A
D_{60} =N/A	D_{15} =N/A
D_{50} =N/A	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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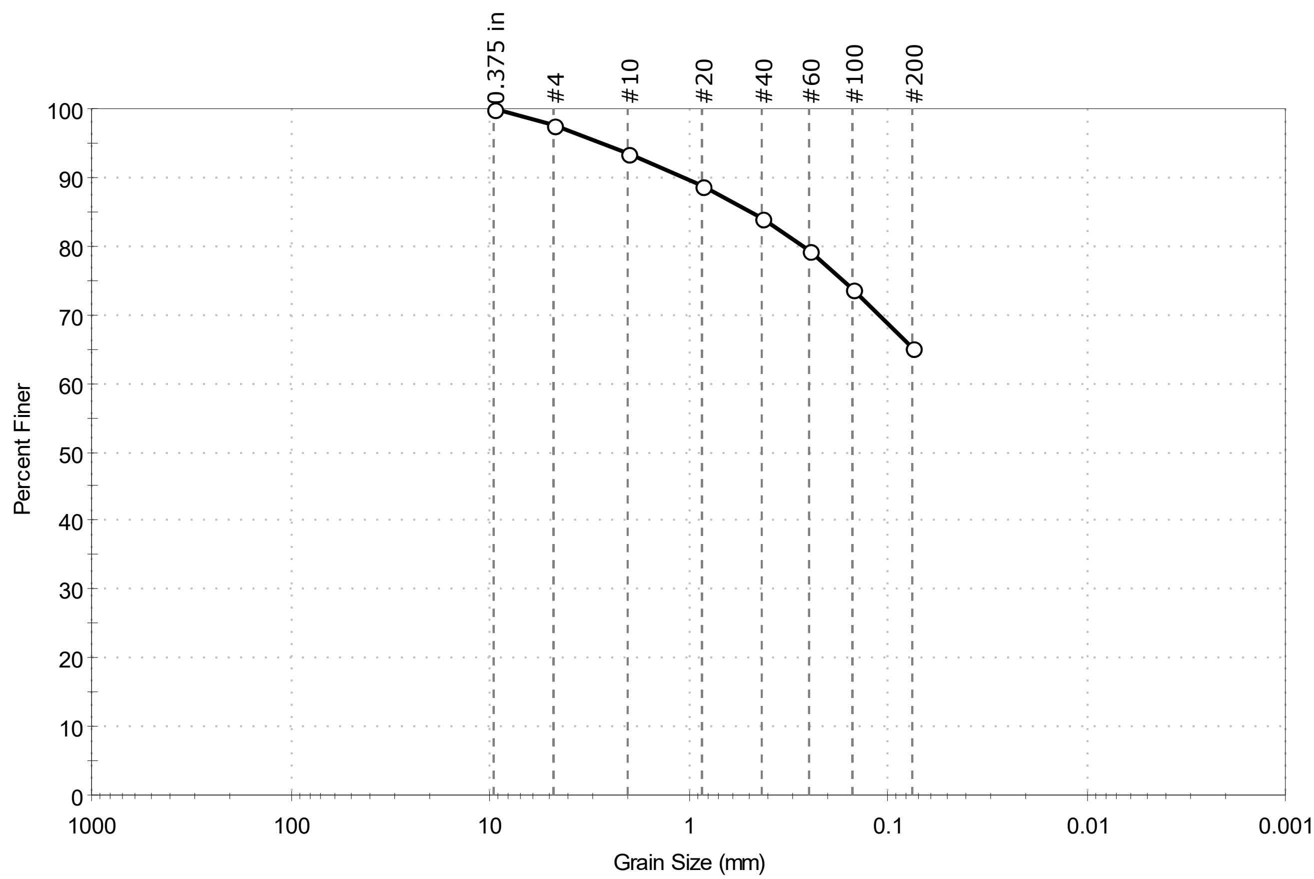
Client:	Haley & Aldrich, Inc.		
Project:	Rt 9/I-395 Levenseller Rd Bridge		
Location:	Brewer and Eddington, ME	Project No:	GTX-308857
Boring ID: BB-ELER-102	Sample Type: jar	Tested By:	jbr
Sample ID: 3D	Test Date: 10/01/18	Checked By:	emm
Depth : 4.3-6.3 ft	Test Id: 474529		
Test Comment:	---		
Visual Description:	Moist, brown sandy silt		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.3	32.4	65.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	94		
#20	0.85	89		
#40	0.42	84		
#60	0.25	79		
#100	0.15	74		
#200	0.075	65		

Coefficients

D_{85} = 0.4909 mm | D_{30} = N/A
D_{60} = N/A | D_{15} = N/A
D_{50} = N/A | D_{10} = N/A
C_u = N/A | C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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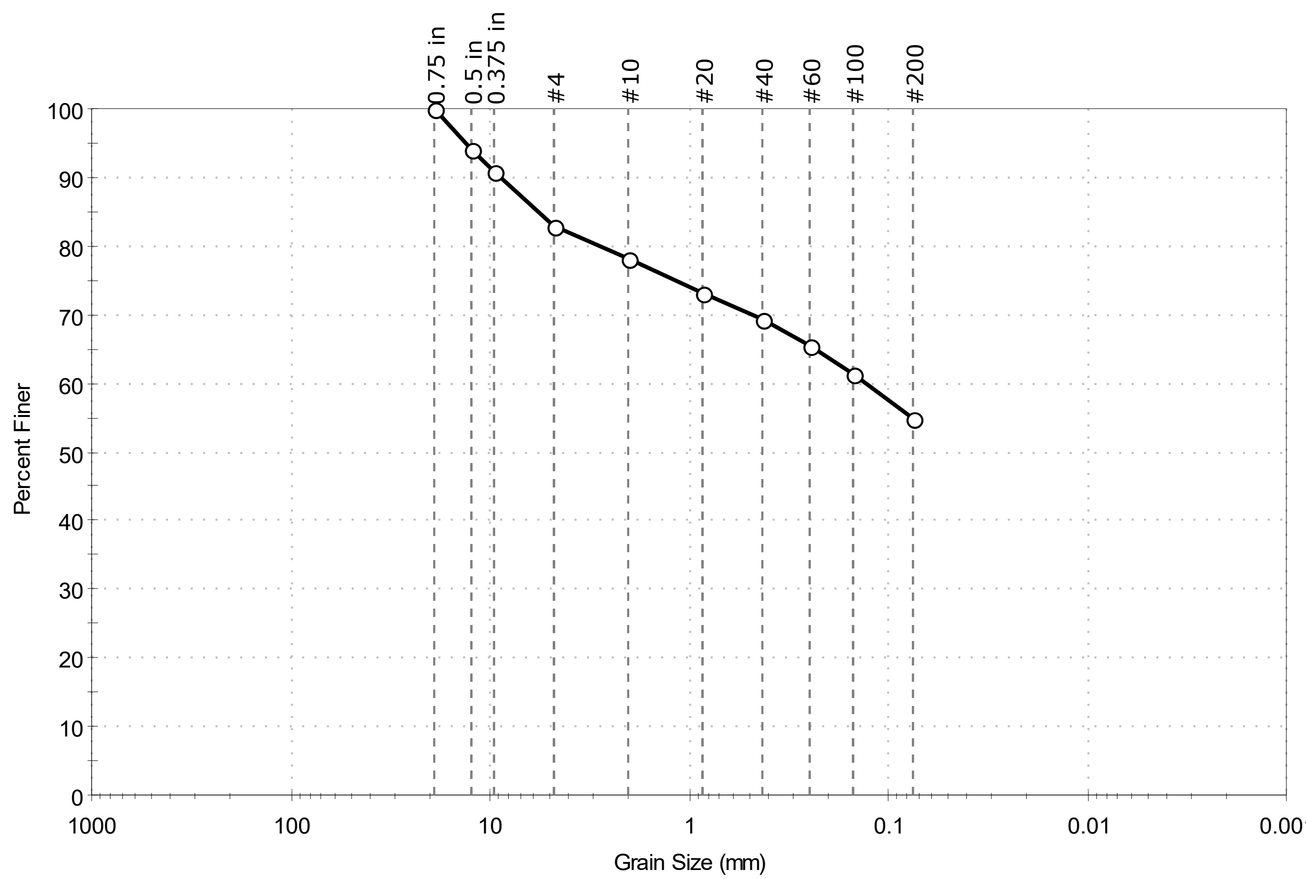
Client:	Haley & Aldrich, Inc.
Project:	Rt 9/I-395 Levenseller Rd Bridge
Location:	Brewer and Eddington, ME
Project No:	GTX-308857
Boring ID:	BB-ELER-102
Sample Type:	jar
Tested By:	jbr
Sample ID:	4D
Test Date:	10/03/18
Checked By:	emm
Depth :	10-12 ft
Test Id:	474530
Test Comment:	---
Visual Description:	Moist, brown sandy clay with gravel
Sample Comment:	---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	17.1	28.1	54.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	94		
0.375 in	9.50	91		
#4	4.75	83		
#10	2.00	78		
#20	0.85	73		
#40	0.42	69		
#60	0.25	66		
#100	0.15	61		
#200	0.075	55		

Coefficients

D_{85} =5.7232 mm D_{30} =N/A

D_{60} =0.1311 mm D_{15} =N/A

D_{50} =N/A D_{10} =N/A

C_u =N/A C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

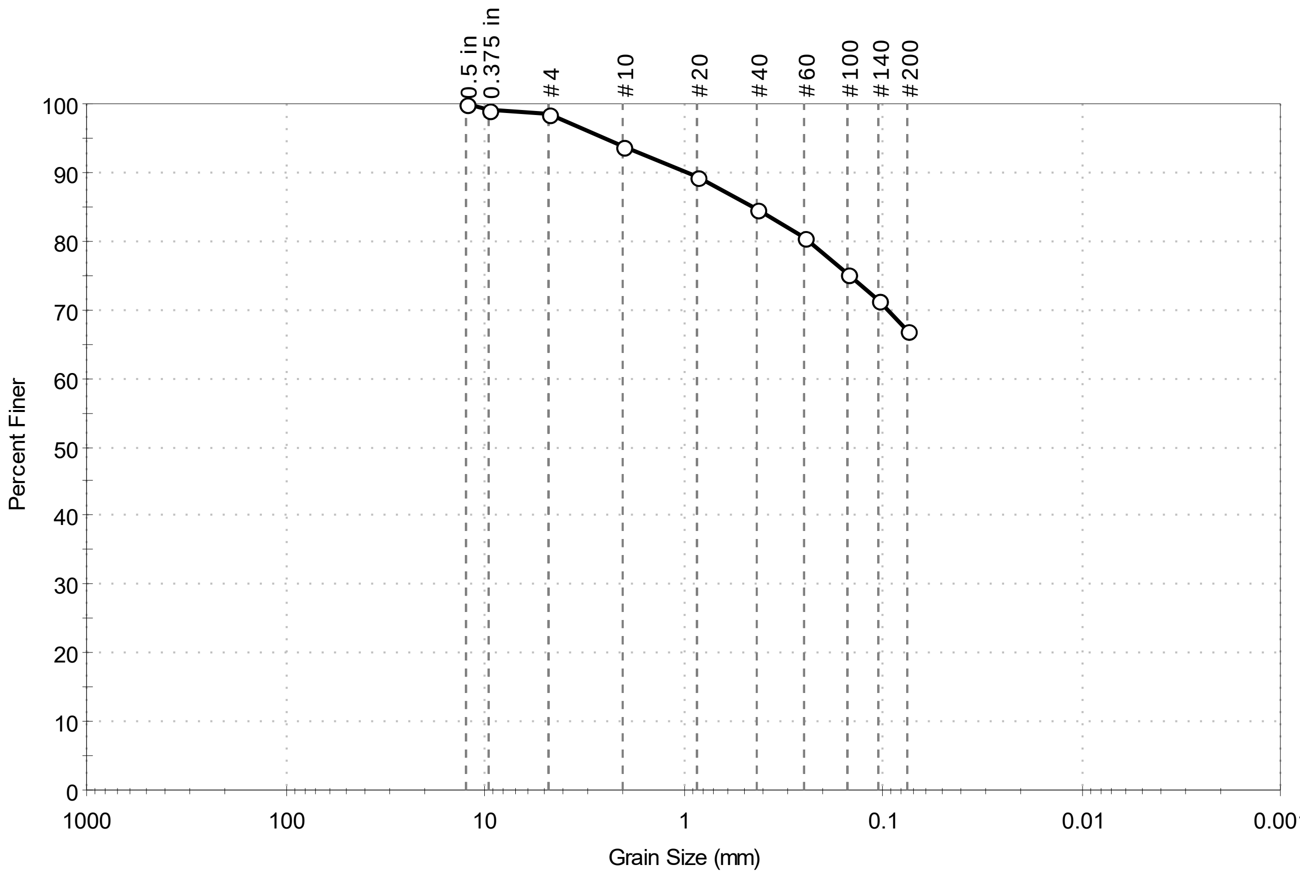
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 10/5/2018 8:10:58 AM

Client:	Haley & Aldrich, Inc.		
Project:	Rt 9/I-395 Connector		
Location:	Brewer and Eddington, ME	Project No:	GTX-308853
Boring ID: HB-BE-151	Sample Type: jar	Tested By:	GA
Sample ID: 2D	Test Date: 10/12/18	Checked By:	emm
Depth : 2-3.7 ft	Test Id: 474356		
Test Comment:	---		
Visual Description:	Moist, olive sandy clay		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.6	31.5	66.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	99		
#4	4.75	98		
#10	2.00	94		
#20	0.85	89		
#40	0.42	85		
#60	0.25	81		
#100	0.15	75		
#140	0.11	71		
#200	0.075	67		

Coefficients

D_{85} = 0.4417 mm D_{30} = N/A

D_{60} = N/A D_{15} = N/A

D_{50} = N/A D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

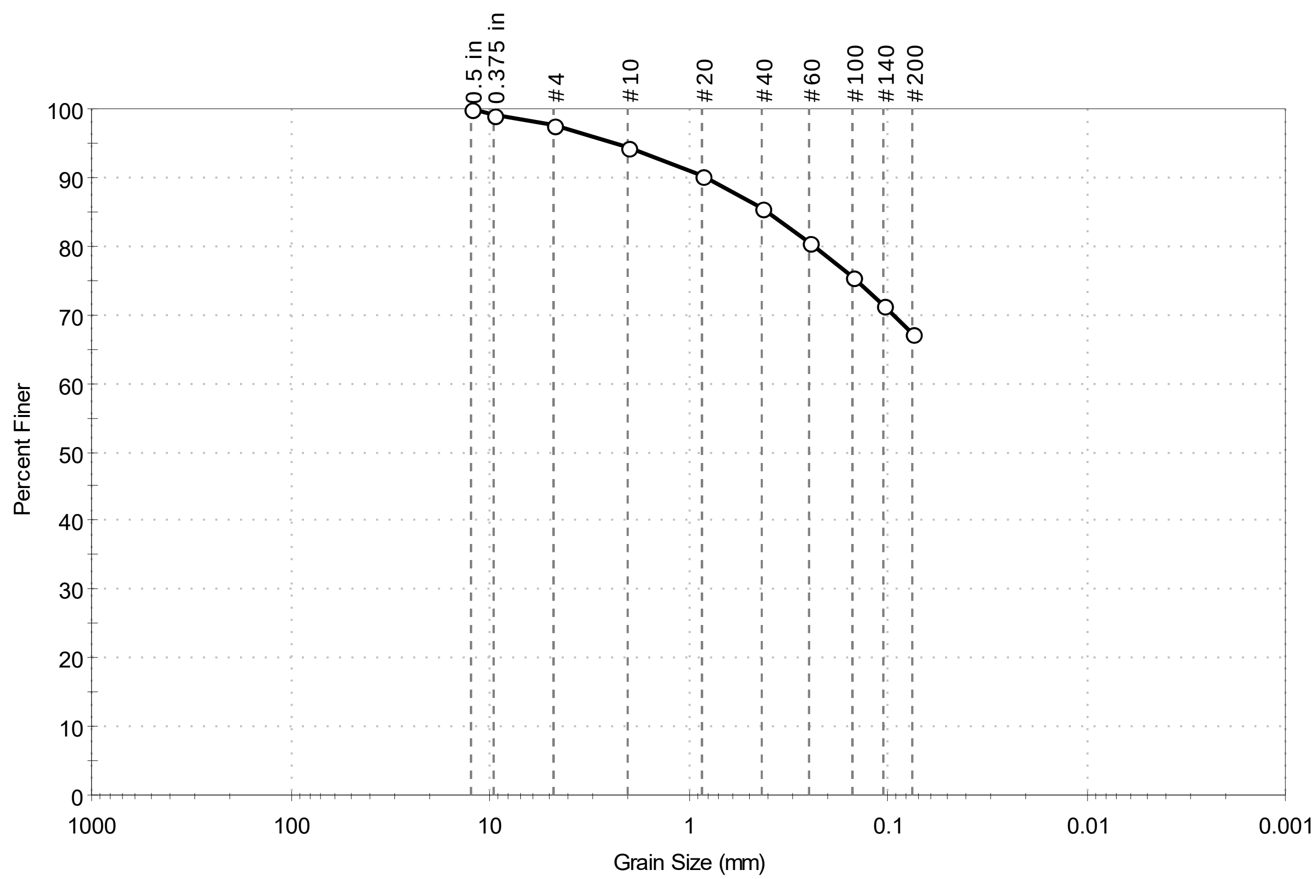
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 10/17/2018 5:38:52 PM

Client: Haley & Aldrich, Inc.			
Project: Rt 9/I-395 Connector			
Location: Brewer and Eddington, ME		Project No:	GTX-308853
Boring ID: HB-BE-151	Sample Type: jar	Tested By:	GA
Sample ID: 3D	Test Date: 10/12/18	Checked By:	emm
Depth : 4-6 ft	Test Id: 474357		
Test Comment: ---			
Visual Description: Moist, olive sandy clay			
Sample Comment: ---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.2	30.6	67.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	99		
#4	4.75	98		
#10	2.00	95		
#20	0.85	90		
#40	0.42	86		
#60	0.25	81		
#100	0.15	75		
#140	0.11	71		
#200	0.075	67		

Coefficients

D_{85} = 0.3970 mm | D_{30} = N/A

D_{60} = N/A | D_{15} = N/A

D_{50} = N/A | D_{10} = N/A

C_u = N/A | C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

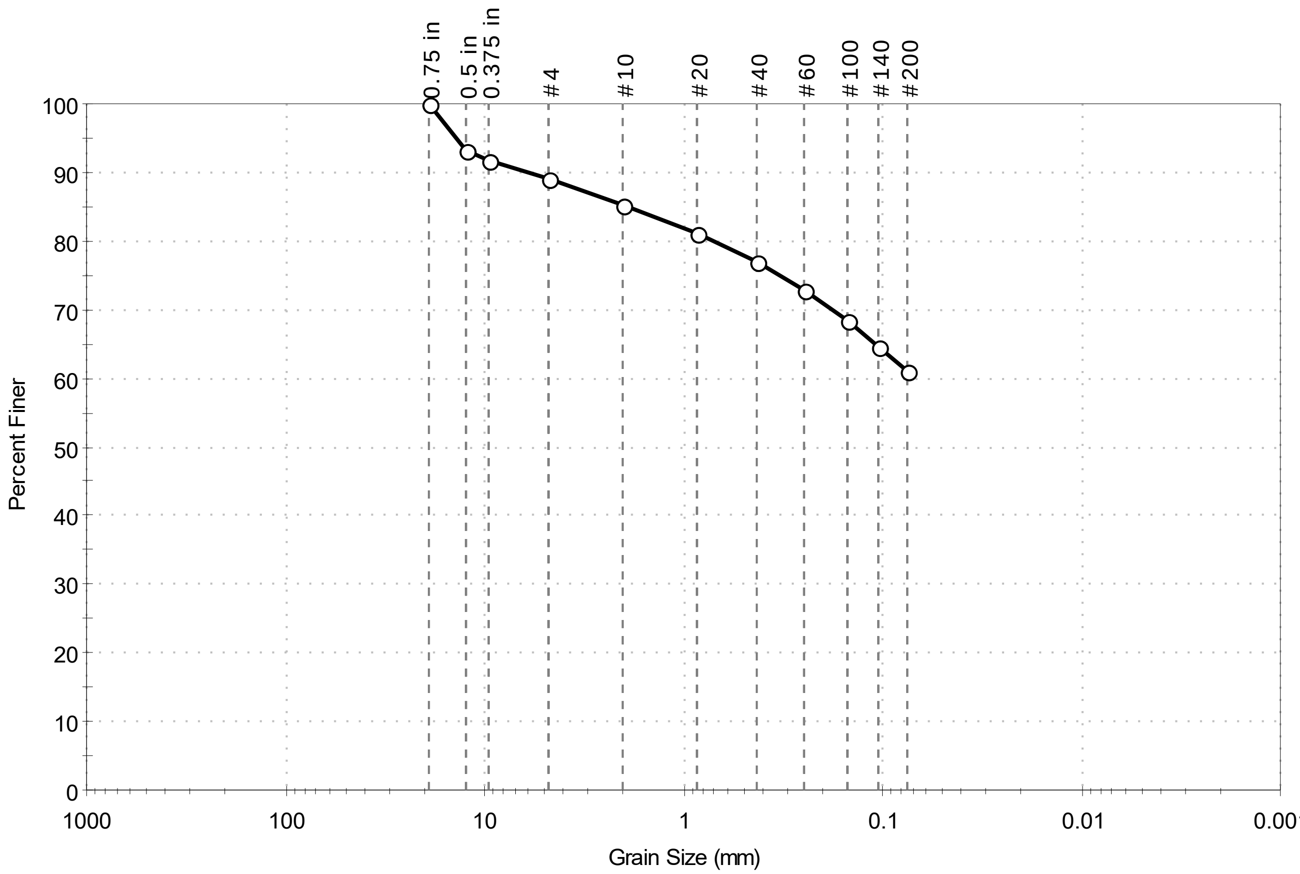
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

printed 10/17/2018 5:38:52 PM

Client:	Haley & Aldrich, Inc.			
Project:	Rt 9/I-395 Connector			
Location:	Brewer and Eddington, ME		Project No:	GTX-308853
Boring ID:	HB-BE-151	Sample Type: jar	Tested By:	GA
Sample ID:	4D	Test Date: 10/12/18	Checked By:	emm
Depth :	10-10.9 ft	Test Id: 474358		
Test Comment:	---			
Visual Description:	Moist, olive gray sandy clay			
Sample Comment:	---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	10.9	28.0	61.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	93		
0.375 in	9.50	92		
#4	4.75	89		
#10	2.00	85		
#20	0.85	81		
#40	0.42	77		
#60	0.25	73		
#100	0.15	69		
#140	0.11	65		
#200	0.075	61		

Coefficients

D_{85} = 1.9341 mm | D_{30} = N/A
D_{60} = N/A | D_{15} = N/A
D_{50} = N/A | D_{10} = N/A
C_u = N/A | C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

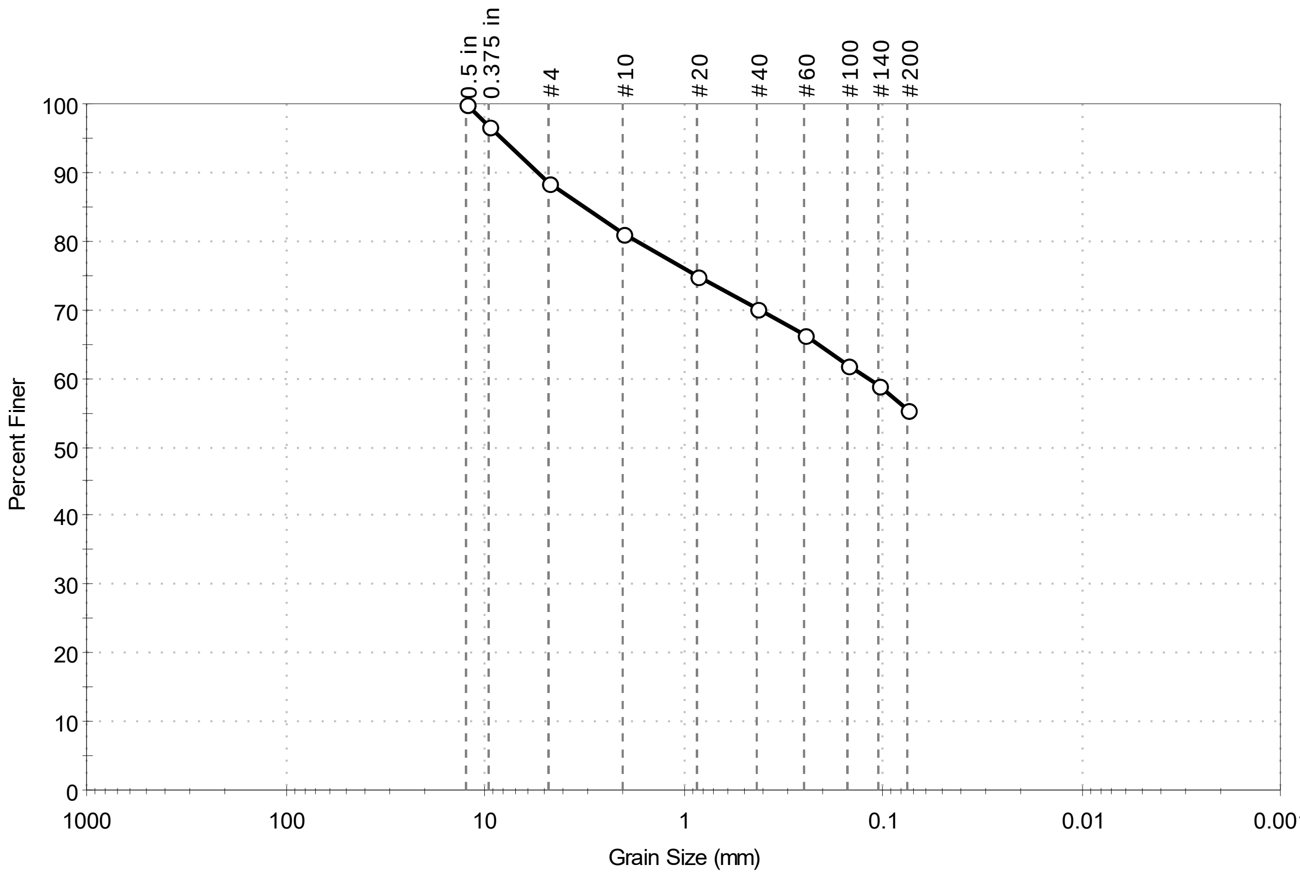
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 10/17/2018 5:38:53 PM

Client: Haley & Aldrich, Inc.				
Project: Rt 9/I-395 Connector				
Location: Brewer and Eddington, ME			Project No:	GTX-308853
Boring ID: HB-BE-151	Sample Type:	jar	Tested By:	GA
Sample ID: 5D	Test Date:	10/12/18	Checked By:	emm
Depth : 15-16.2 ft	Test Id:	474359		
Test Comment: ---				
Visual Description: Moist, olive sandy clay				
Sample Comment: ---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	11.4	33.0	55.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	97		
#4	4.75	89		
#10	2.00	81		
#20	0.85	75		
#40	0.42	70		
#60	0.25	66		
#100	0.15	62		
#140	0.11	59		
#200	0.075	56		

Coefficients

D_{85} = 3.1608 mm　　D_{30} = N/A

D_{60} = 0.1199 mm　　D_{15} = N/A

D_{50} = N/A　　D_{10} = N/A

C_u = N/A　　C_c = N/A

Classification

ASTM　Sandy Lean CLAY (CL)

AASHTO　Clayey Soils (A-6 (3))

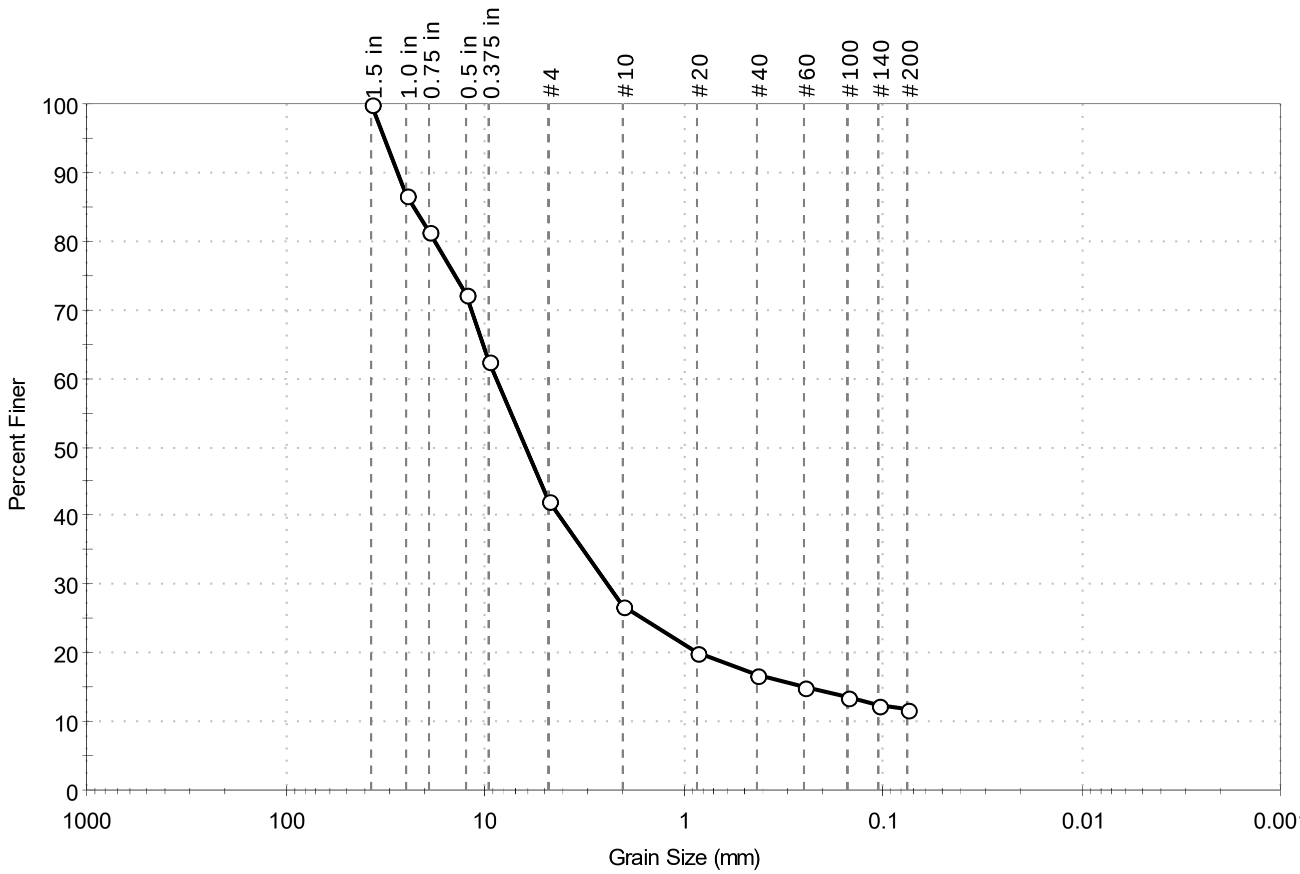
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Haley & Aldrich, Inc.				
Project:	Rt 9/I-395 Connector				
Location:	Brewer and Eddington, ME			Project No:	GTX-308853
Boring ID:	HB-BE-151	Sample Type:	jar	Tested By:	GA
Sample ID:	6D+7D+8D	Test Date:	10/12/18	Checked By:	emm
Depth :	17-21.5 ft	Test Id:	474360		
Test Comment:	---				
Visual Description:	Moist, olive brown gravel with clay and sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	57.7	30.6	11.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1.0 in	25.00	87		
0.75 in	19.00	82		
0.5 in	12.50	72		
0.375 in	9.50	63		
#4	4.75	42		
#10	2.00	27		
#20	0.85	20		
#40	0.42	17		
#60	0.25	15		
#100	0.15	14		
#140	0.11	13		
#200	0.075	12		

Coefficients

D_{85} =22.8430 mm
D_{30} =2.3793 mm
D_{60} =8.6744 mm
D_{15} =0.2570 mm
D_{50} =6.1704 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

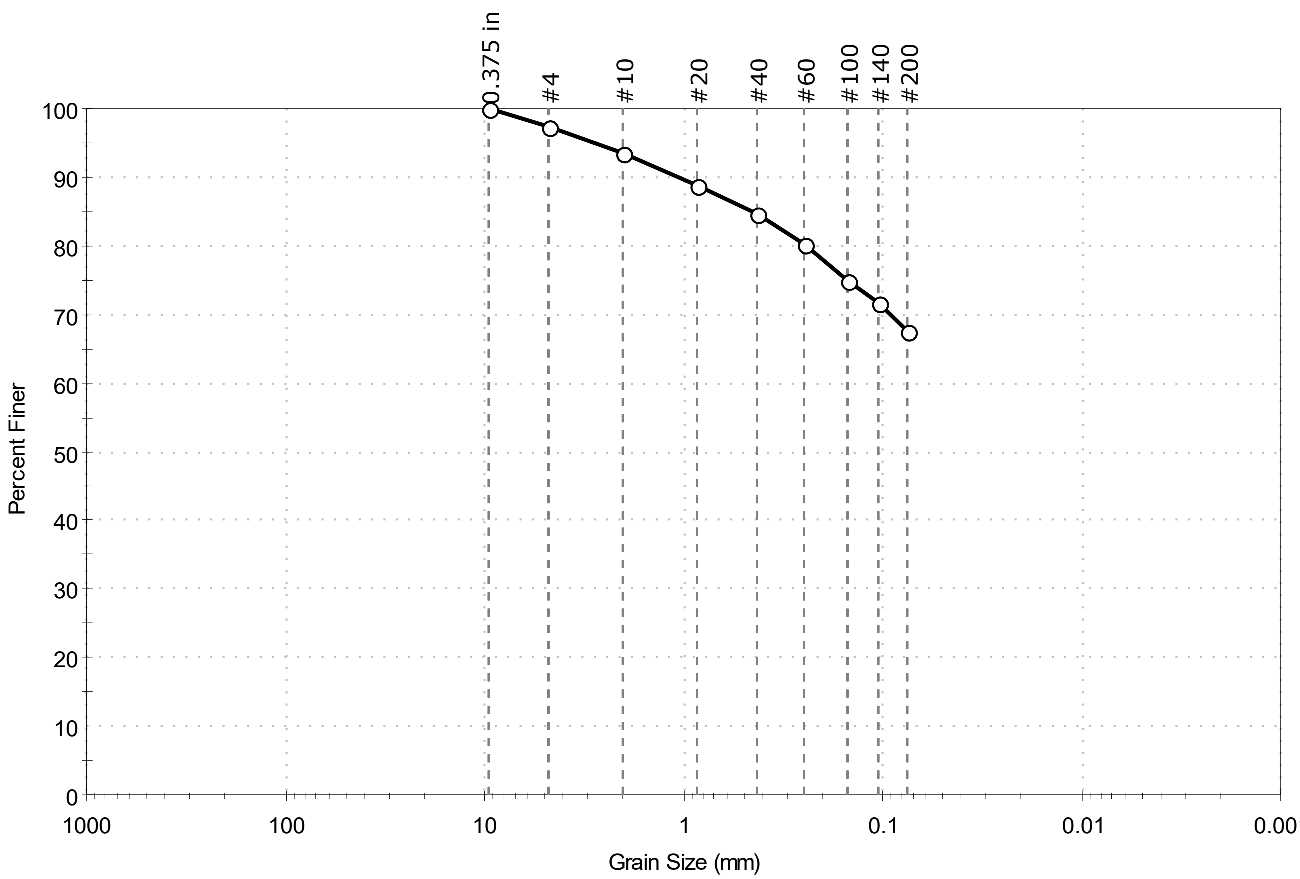
Sand/Gravel Hardness : HARD

printed 10/17/2018 5:38:54 PM

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.				
Project:	I-395/Rte 9 Connector Bridge (Levenseller Rd)				
Location:	Eddington, ME			Project No:	GTX-313322
Boring ID:	BB-ELER-202	Sample Type:	jar	Tested By:	ckg
Sample ID:	3D	Test Date:	03/19/21	Checked By:	bfs
Depth :	10-12	Test Id:	613357		
Test Comment:	---				
Visual Description:	Moist, olive brown sandy clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.7	29.8	67.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	97		
#10	2.00	93		
#20	0.85	89		
#40	0.42	85		
#60	0.25	80		
#100	0.15	75		
#140	0.11	72		
#200	0.075	68		

Coefficients

D_{85} =0.4528 mm — D_{30} =N/A

D_{60} =N/A — D_{15} =N/A

D_{50} =N/A — D_{10} =N/A

C_u =N/A — C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

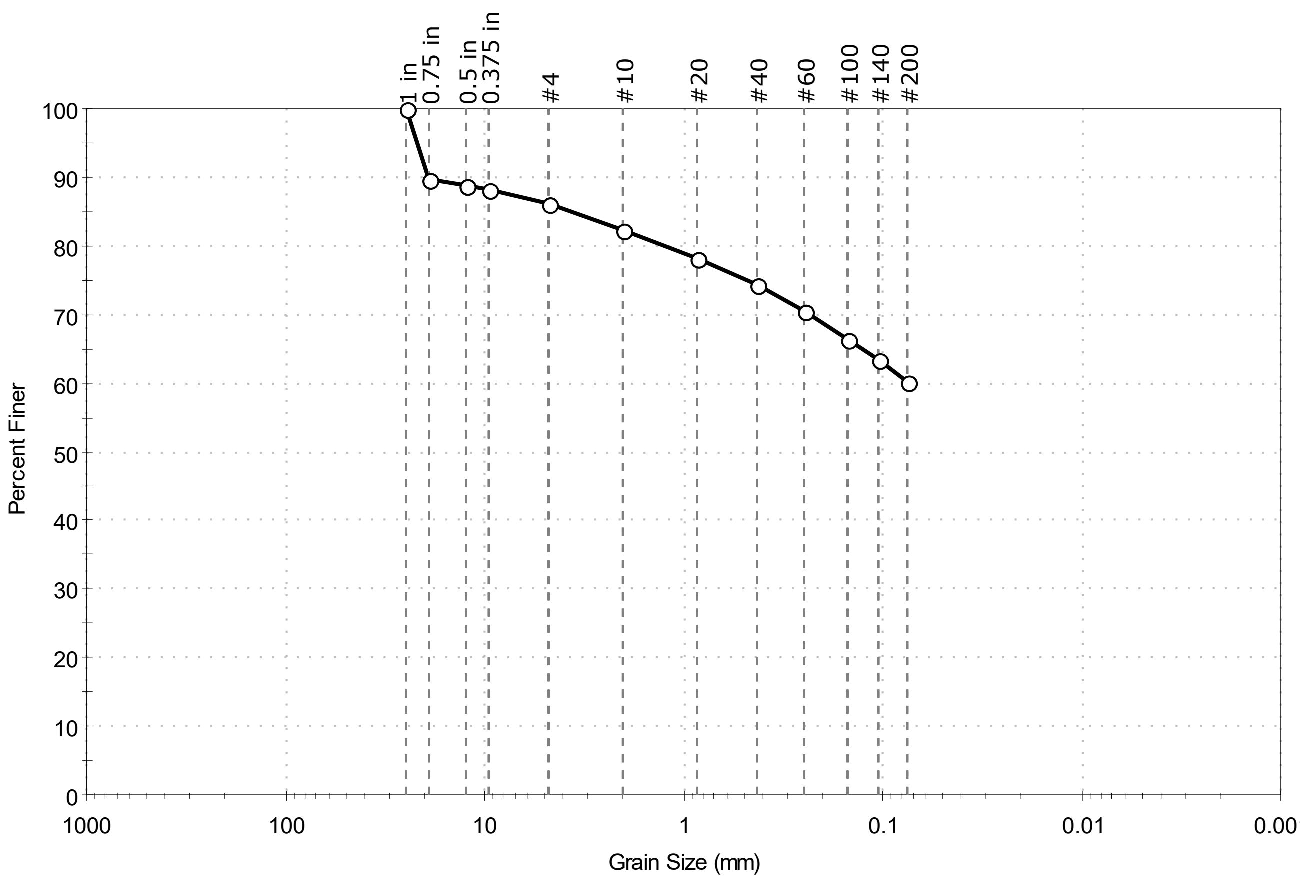
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 3/22/2021 12:43:11 PM

Client:	Haley & Aldrich, Inc.		
Project:	I-395/Rte 9 Connector Bridge (Levenseller Rd)		
Location:	Eddington, ME	Project No:	GTX-313322
Boring ID:	BB-ELER-203	Sample Type: jar	Tested By: ckg
Sample ID:	2D	Test Date: 03/22/21	Checked By: bfs
Depth :	5-7	Test Id: 613358	
Test Comment:	---		
Visual Description:	Moist, gray sandy clay		
Sample Comment:	---		

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	13.9	25.9	60.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	90		
0.5 in	12.50	89		
0.375 in	9.50	88		
#4	4.75	86		
#10	2.00	82		
#20	0.85	78		
#40	0.42	74		
#60	0.25	71		
#100	0.15	66		
#140	0.11	63		
#200	0.075	60		

Coefficients

D_{85} =3.6803 mm | D_{30} =N/A
D_{60} =N/A | D_{15} =N/A
D_{50} =N/A | D_{10} =N/A
C_u =N/A | C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

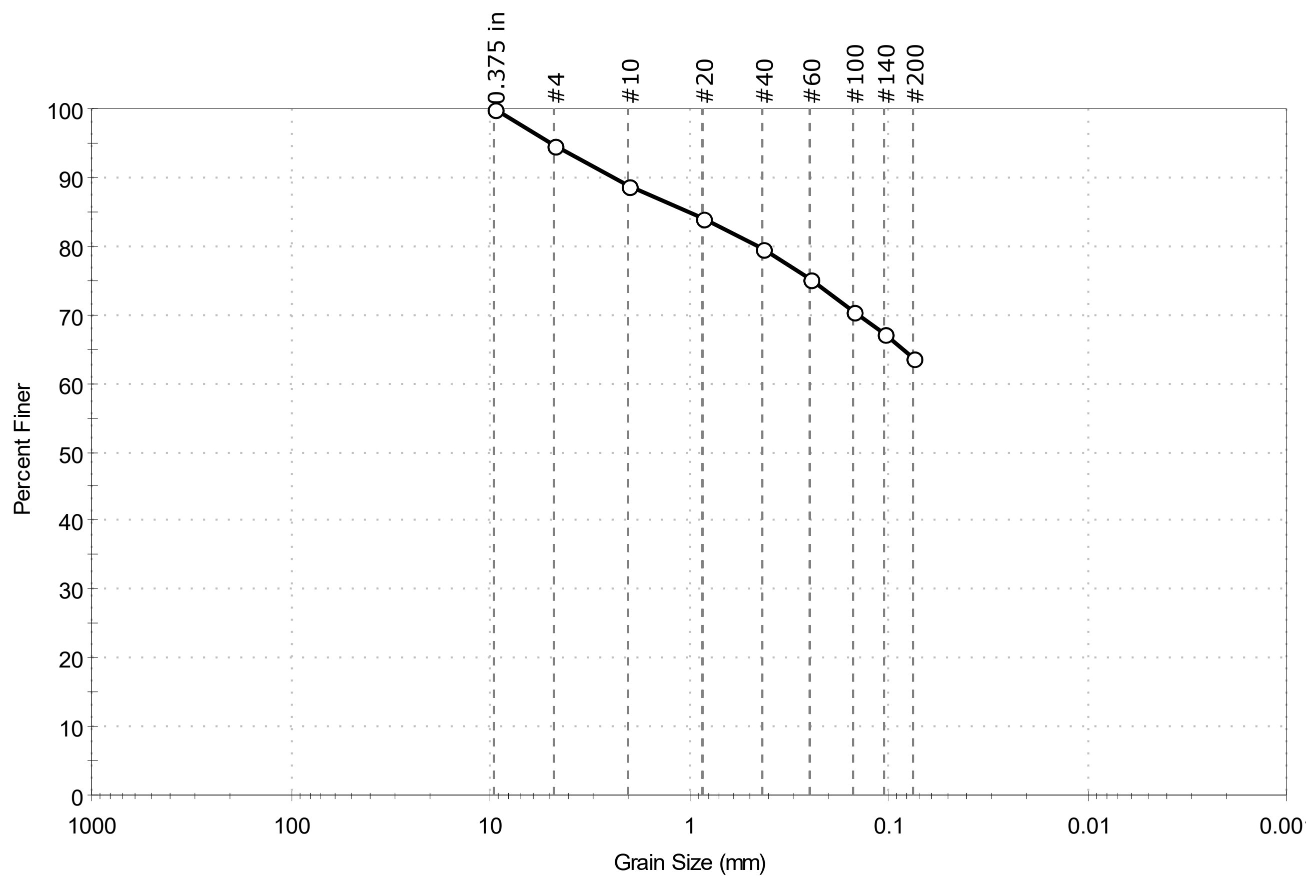
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 3/22/2021 12:43:13 PM

Client:	Haley & Aldrich, Inc.
Project:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Location:	Eddington, ME
Project No:	GTX-313322
Boring ID:	BB-ELER-205
Sample ID:	3D
Depth :	10-12
Sample Type:	jar
Test Date:	03/19/21
Test Id:	613359
Tested By:	ckg
Checked By:	bfs
Test Comment:	---
Visual Description:	Moist, gray sandy clay
Sample Comment:	---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	5.3	31.2	63.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	95		
#10	2.00	89		
#20	0.85	84		
#40	0.42	80		
#60	0.25	75		
#100	0.15	71		
#140	0.11	67		
#200	0.075	64		

Coefficients

D_{85} = 1.0065 mm D_{30} = N/A

D_{60} = N/A D_{15} = N/A

D_{50} = N/A D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

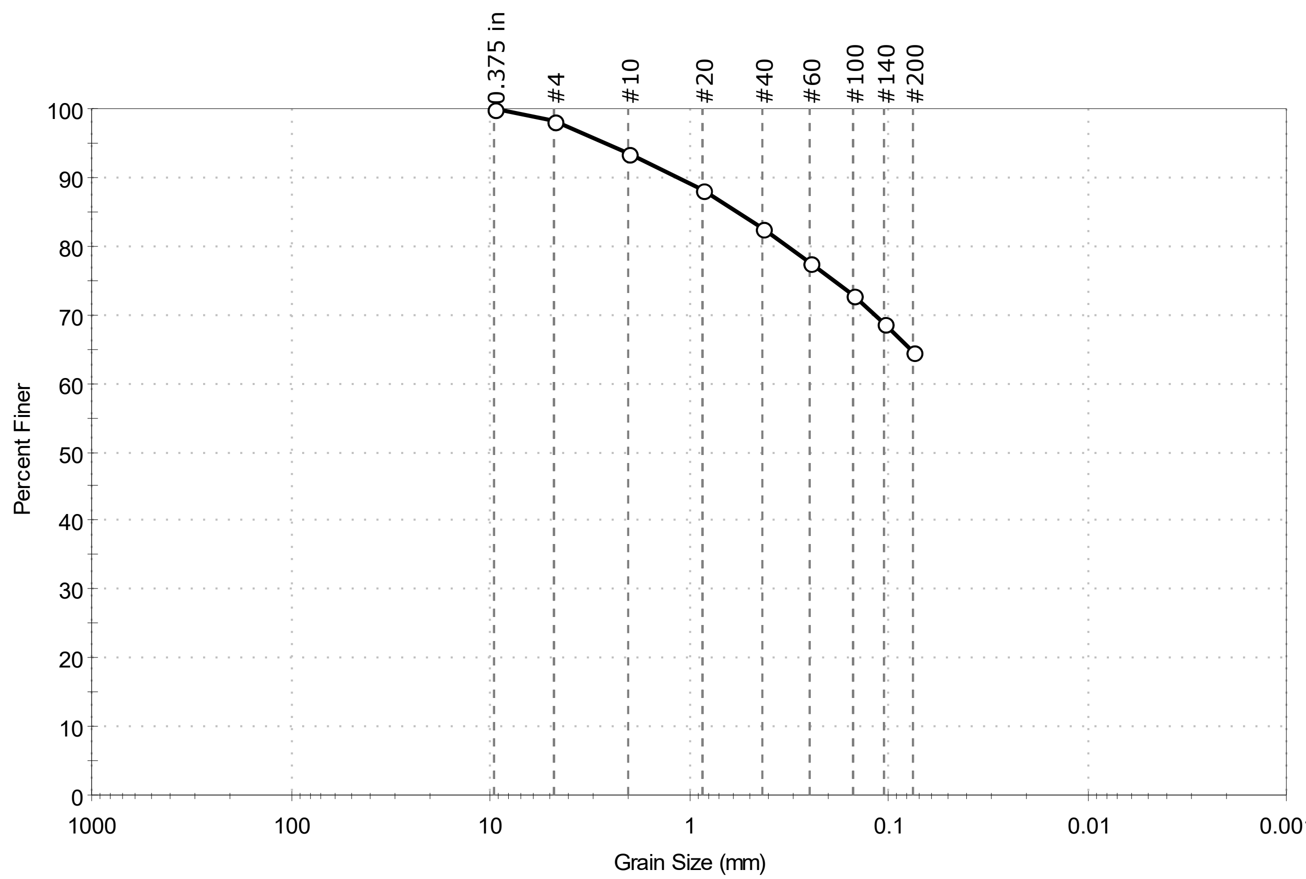
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 3/22/2021 12:43:15 PM

Client:	Haley & Aldrich, Inc.		
Project:	I-395/Rte 9 Connector Hwy, Brewer-Eddington		
Location:	Brewer, ME	Project No:	GTX-313370
Boring ID: HB-BE-235	Sample Type: jar	Tested By:	GA
Sample ID: 2D	Test Date: 03/29/21	Checked By:	emm
Depth : 5-7	Test Id: 613886		
Test Comment:	---		
Visual Description:	Moist, olive brown sandy clay		
Sample Comment:	---		

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.7	33.7	64.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	94		
#20	0.85	88		
#40	0.42	83		
#60	0.25	78		
#100	0.15	73		
#140	0.11	69		
#200	0.075	65		

Coefficients

D_{85} =0.5704 mm D_{30} =N/A
D_{60} =N/A D_{15} =N/A
D_{50} =N/A D_{10} =N/A
C_u =N/A C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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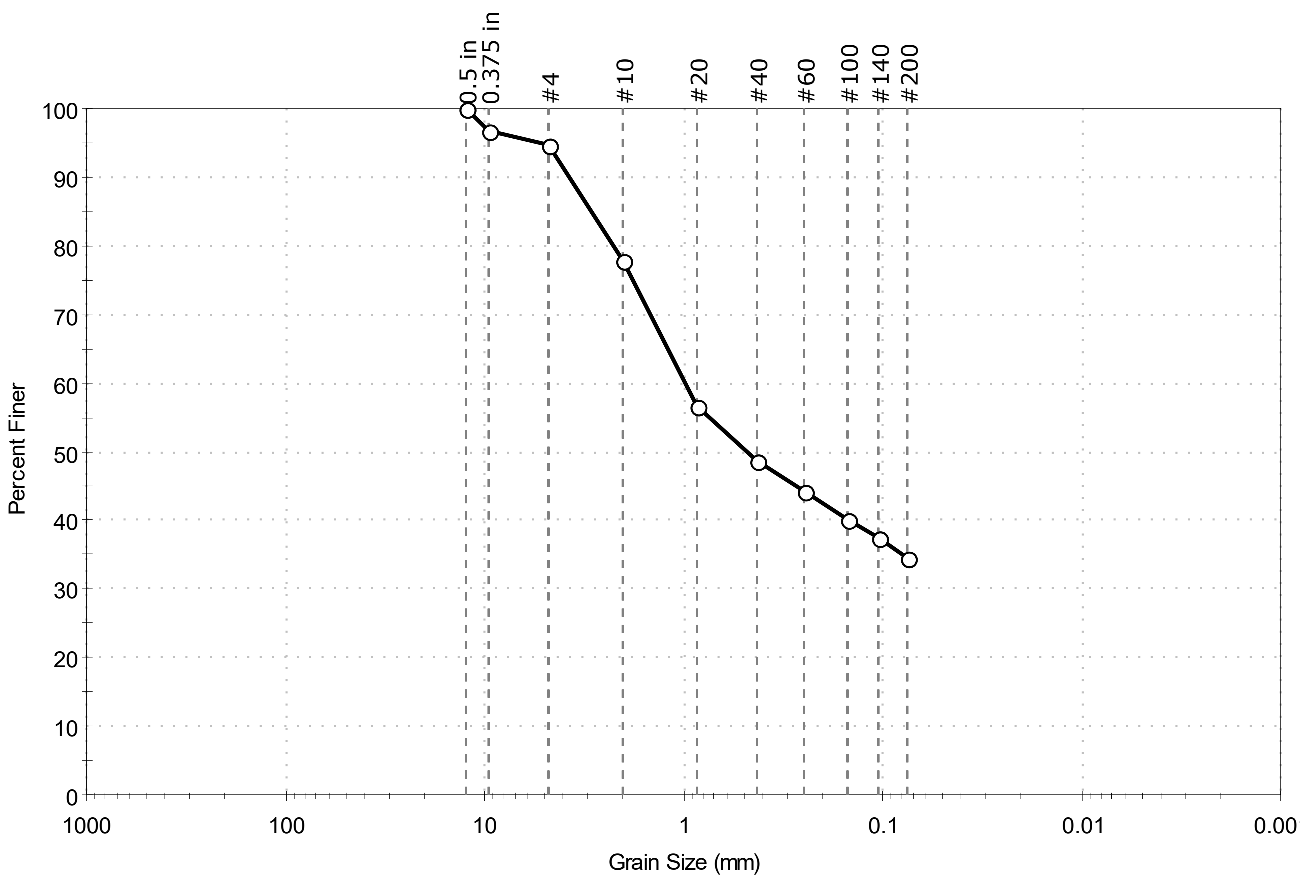
GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.		
Project:	I-395/Rte 9 Connector Hwy, Brewer-Eddington		
Location:	Brewer, ME	Project No:	GTX-313370
Boring ID: HB-BE-236	Sample Type: jar	Tested By:	GA
Sample ID: 3D	Test Date: 03/29/21	Checked By:	emm
Depth : 10-12	Test Id: 613887		
Test Comment:	---		
Visual Description:	Moist, grayish brown clayey sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	5.2	60.4	34.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	97		
#4	4.75	95		
#10	2.00	78		
#20	0.85	57		
#40	0.42	49		
#60	0.25	44		
#100	0.15	40		
#140	0.11	37		
#200	0.075	34		

Coefficients

D_{85} =2.8702 mm D_{30} =N/A
D_{60} =0.9749 mm D_{15} =N/A
D_{50} =0.4778 mm D_{10} =N/A
C_u =N/A C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

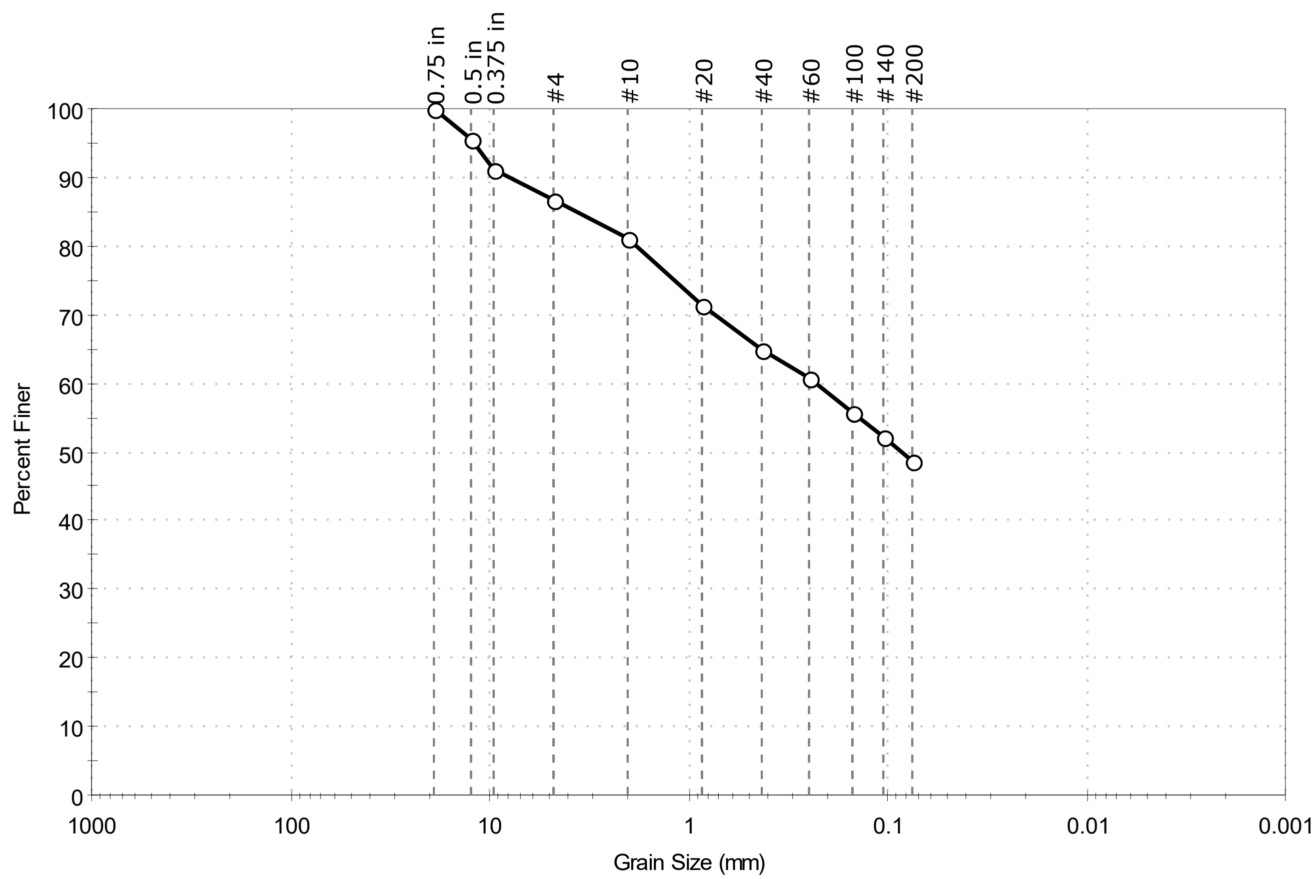
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 4/9/2021 5:12:39 PM

Client:	Haley & Aldrich, Inc.			
Project:	I-395/Rte 9 Connector Hwy, Brewer-Eddington			
Location:	Brewer, ME		Project No:	GTX-313370
Boring ID:	HB-BE-237	Sample Type: jar	Tested By:	GA
Sample ID:	2D	Test Date: 03/29/21	Checked By:	emm
Depth :	5-7	Test Id: 613888		
Test Comment:	---			
Visual Description:	Moist, grayish brown clayey sand			
Sample Comment:	---			

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	13.3	38.0	48.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	96		
0.375 in	9.50	91		
#4	4.75	87		
#10	2.00	81		
#20	0.85	71		
#40	0.42	65		
#60	0.25	61		
#100	0.15	56		
#140	0.11	52		
#200	0.075	49		

Coefficients

D_{85} =3.6512 mm D_{30} =N/A

D_{60} =0.2307 mm D_{15} =N/A

D_{50} =0.0857 mm D_{10} =N/A

C_u =N/A C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

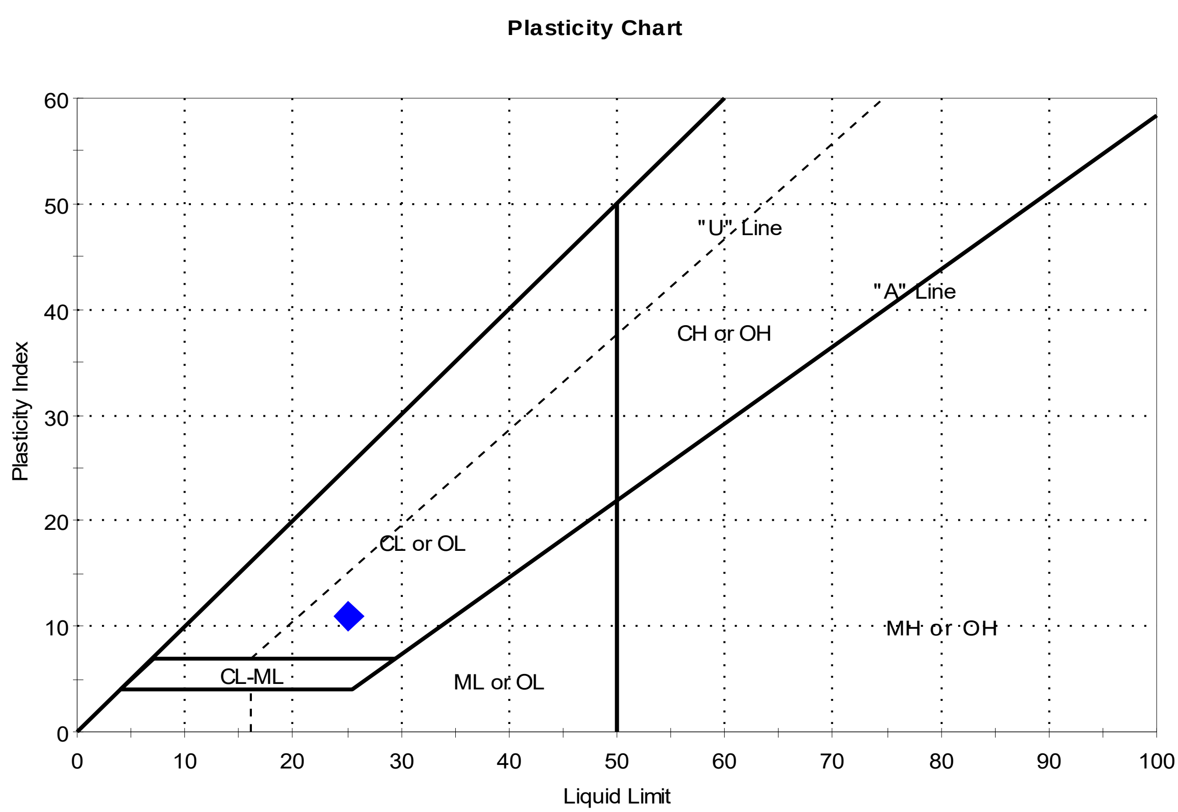
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 4/9/2021 5:12:40 PM

Client:	Haley & Aldrich, Inc.				
Project:	Rt 9/I-395 Connector				
Location:	Brewer and Eddington, ME			Project No:	GTX-308853
Boring ID:	HB-BE-151	Sample Type:	jar	Tested By:	GA
Sample ID:	5D	Test Date:	10/12/18	Checked By:	emm
Depth :	15-16.2 ft	Test Id:	474392		
Test Comment:	---				
Visual Description:	Moist, olive sandy clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	5D	HB-BE-151	15-16.2 ft	11	25	14	11	-0.2	Sandy Lean CLAY (CL)

Sample Prepared using the WET method

30% Retained on #40 Sieve

Dry Strength: HIGH

Dilatancy: NONE

Toughness: MEDIUM

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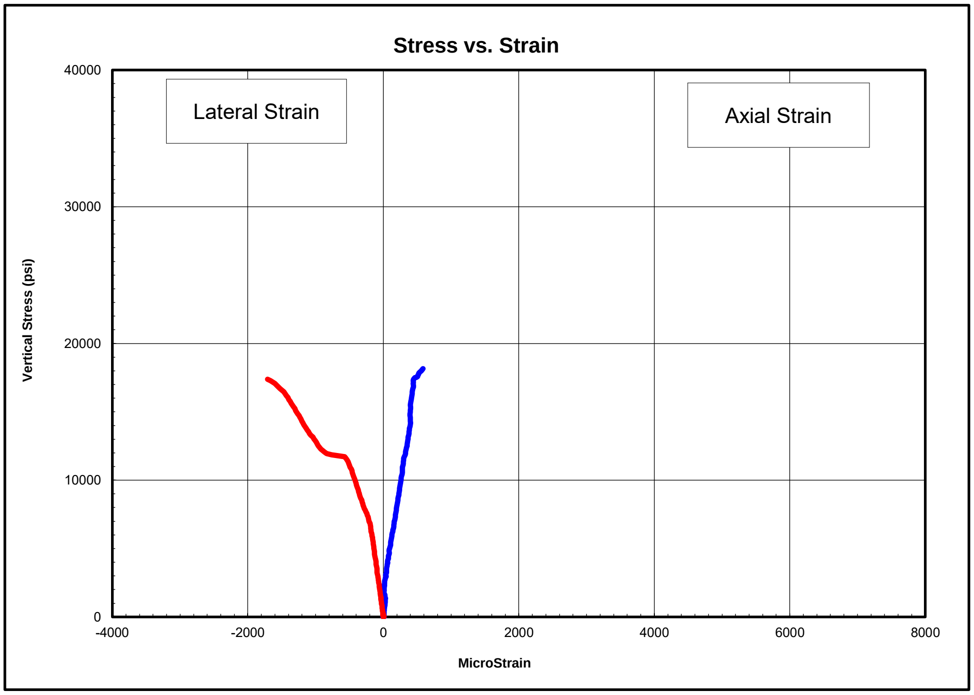
GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.
Project Name:	Rt 9/I-395 Connector
Project Location:	Brewer and Eddington, ME
GTX #:	308853
Test Date:	10/12/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	BB-ELER-101
Sample ID:	R1
Depth, ft:	16.42-16.79
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 18,157 psi

The strain values recorded for this test produce values of Poisson's Ratio that exceed maximum values found in rocks.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
1800-6700	32,700,000	---
6700-11500	32,600,000	---
11500-16300	40,600,000	---

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
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.

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.	Test Date:	10/11/2018
Project Name:	Rt 9/I-395 Connector	Tested By:	tlm
Project Location:	Brewer and Eddington, ME	Checked By:	jsc
GTX #:	308853		
Boring ID:	BB-ELER-101		
Sample ID:	R1		
Depth:	16.42-16.79 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average	
Specimen Length, in:	4.09	4.09	4.09	
Specimen Diameter, in:	1.98	1.98	1.98	
Specimen Mass, g:	553.49			
Bulk Density, lb/ft^3	167	**Minimum Diameter Tolerence Met?**		**YES**
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.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **NO**

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	-0.00010	0.00000	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	0.00000
Diameter 2, in (rotated 90°)	-0.00030	-0.00020	-0.00010	0.00000	0.00010	0.00000	0.00000	0.00000	0.00010	0.00020	0.00030	0.00040	0.00050	0.00050	0.00060

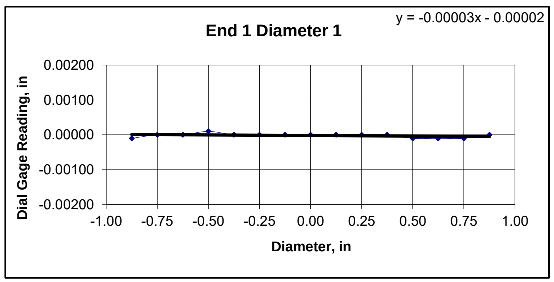
Difference between max and min readings, in:
0° = 0.00020 90° = 0.00090

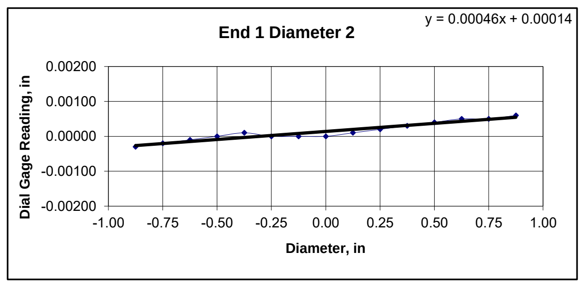
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00010	0.00000	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	0.00000
Diameter 2, in (rotated 90°)	-0.00030	-0.00020	-0.00010	0.00000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

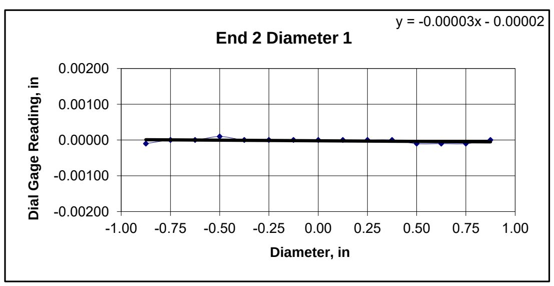
Difference between max and min readings, in:
0° = 0.0002 90° = 0.0009

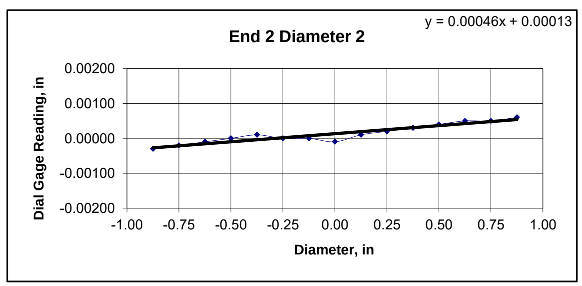
Maximum difference must be < 0.0020 in. Difference = ± 0.00045

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00003
Angle of Best Fit Line: 0.00196

End 2:
Slope of Best Fit Line 0.00003
Angle of Best Fit Line: 0.00196

Maximum Angular Difference: 0.00000

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00046
Angle of Best Fit Line: 0.02652

End 2:
Slope of Best Fit Line 0.00046
Angle of Best Fit Line: 0.02652

Maximum Angular Difference: 0.00000

Parallelism Tolerance Met? **YES**
Spherically Seated

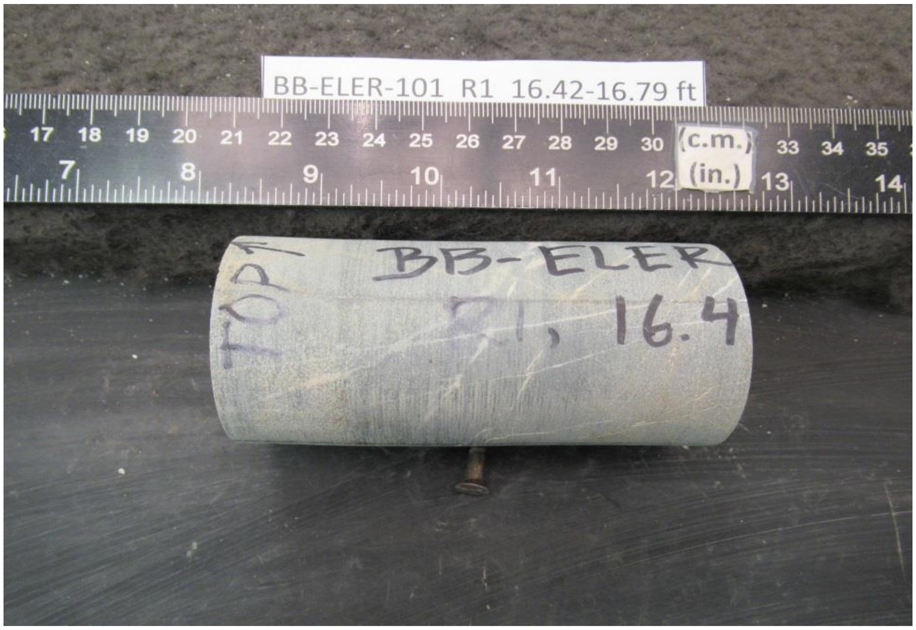
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00020	1.980	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00090	1.980	0.00045	0.026	YES
END 2					
Diameter 1, in	0.00020	1.980	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00090	1.980	0.00045	0.026	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Haley & Aldrich, Inc.
Project Name:	Rt 9/I-395 Connector
Project Location:	Brewer and Eddington, ME
GTX #:	308853
Test Date:	10/12/2018
Tested By:	cmh
Checked By:	jsc
Boring ID:	BB-ELER-101
Sample ID:	R1
Depth, ft:	16.42-16.79



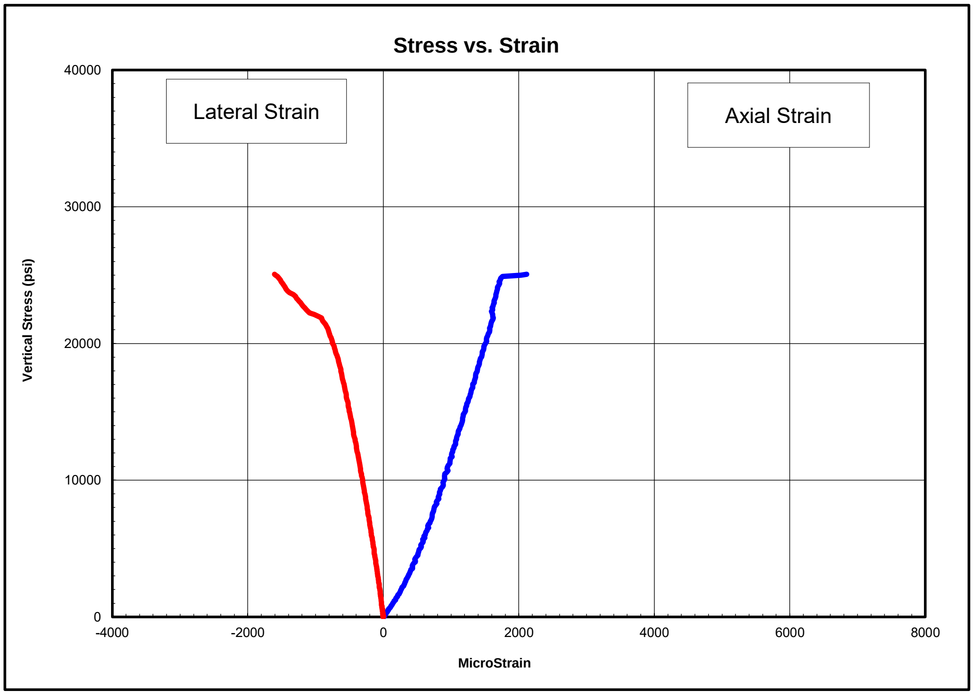
After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.
Project Name:	Rt 9/I-395 Connector
Project Location:	Brewer and Eddington, ME
GTX #:	308853
Test Date:	10/12/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	BB-ELER-101
Sample ID:	R2
Depth, ft:	21.93-22.30
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 25,061 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
2500-9200	12,800,000	0.41
9200-15900	16,200,000	---
15900-22600	17,200,000	---

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
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:	10/12/2018
Project Name:	Rt 9/I-395 Connector	Tested By:	cmh
Project Location:	Brewer and Eddington, ME	Checked By:	jsc
GTX #:	308853		
Boring ID:	BB-ELER-101		
Sample ID:	R2		
Depth:	21.93-22.30 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average	
Specimen Length, in:	4.29	4.30	4.30	
Specimen Diameter, in:	1.98	1.98	1.98	
Specimen Mass, g:	583.84			
Bulk Density, lb/ft^3	168	**Minimum Diameter Tolerence Met?**		**YES**
Length to Diameter Ratio:	2.2	**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**

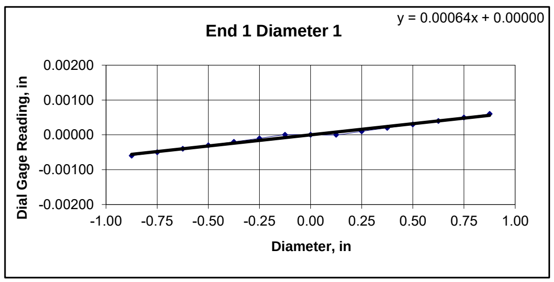
END FLATNESS AND PARALLELISM (Procedure FP1)

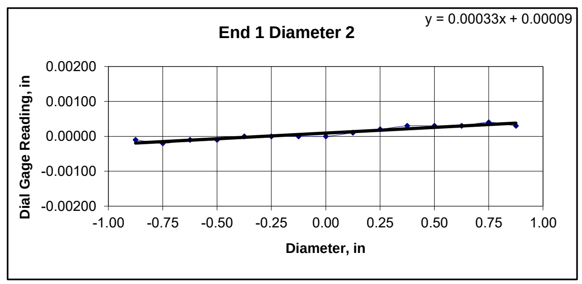
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00020	0.00030	0.00040	0.00050	0.00060
Diameter 2, in (rotated 90°)	-0.00010	-0.00020	-0.00010	-0.00010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

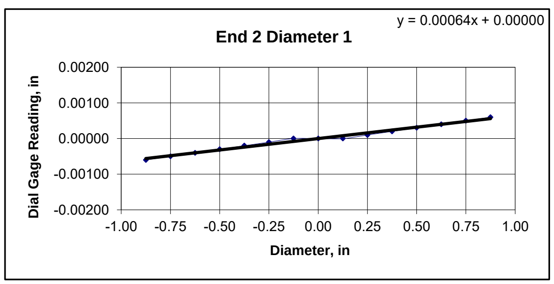
Difference between max and min readings, in:
0° = 0.00120 90° = 0.00060

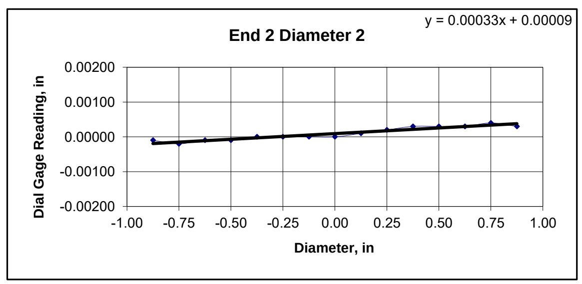
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00020	0.00030	0.00040	0.00050	0.00060
Diameter 2, in (rotated 90°)	-0.00010	-0.00020	-0.00010	-0.00010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

Difference between max and min readings, in:
0° = 0.0012 90° = 0.0006
Maximum difference must be < 0.0020 in. Difference = ± 0.00060
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00064
Angle of Best Fit Line:	0.03667

End 2:

Slope of Best Fit Line	0.00064
Angle of Best Fit Line:	0.03667

Maximum Angular Difference: 0.00000

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00033
Angle of Best Fit Line:	0.01866

End 2:

Slope of Best Fit Line	0.00033
Angle of Best Fit Line:	0.01866

Maximum Angular Difference: 0.00000

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	0.00120	1.980	0.00061	0.035	YES
Diameter 2, in (rotated 90°)	0.00060	1.980	0.00030	0.017	YES
END 2					
Diameter 1, in	0.00120	1.980	0.00061	0.035	YES
Diameter 2, in (rotated 90°)	0.00060	1.980	0.00030	0.017	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Haley & Aldrich, Inc.
Project Name:	Rt 9/I-395 Connector
Project Location:	Brewer and Eddington, ME
GTX #:	308853
Test Date:	10/12/2018
Tested By:	cmh
Checked By:	jsc
Boring ID:	BB-ELER-101
Sample ID:	R2
Depth, ft:	21.93-22.30

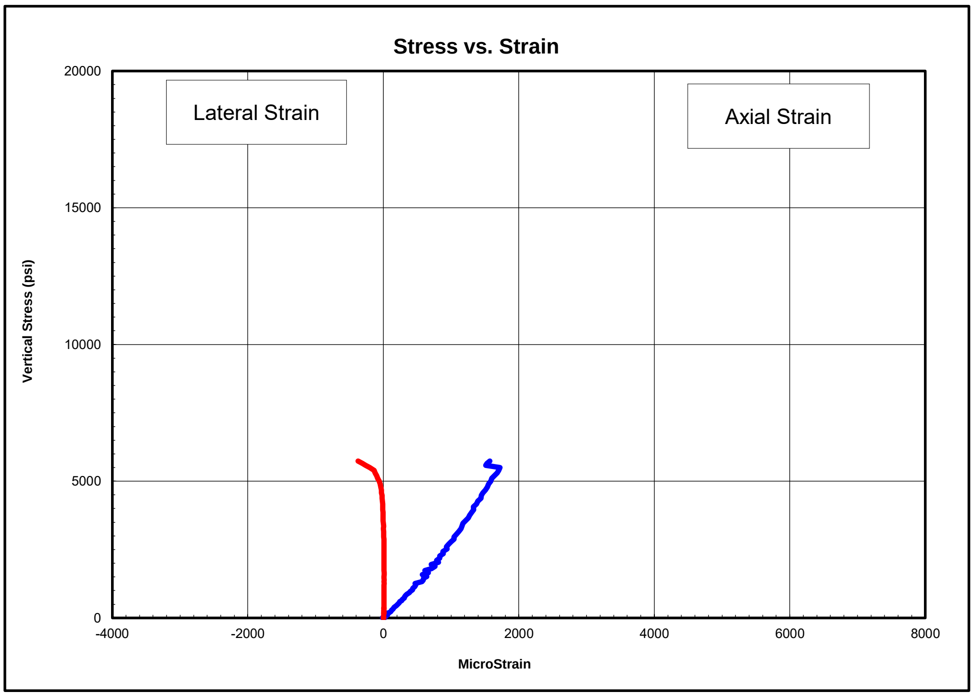
After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.
Project Name:	Rt 9/I-395 Connector
Project Location:	Brewer and Eddington, ME
GTX #:	308853
Test Date:	10/12/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	BB-ELER-102
Sample ID:	R4
Depth, ft:	27.34-27.70
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 5,737 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
600-2100	2,620,000	---
2100-3600	3,400,000	0.04
3600-5200	4,030,000	0.22

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
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.

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.	Test Date:	10/5/2018
Project Name:	Rt 9/I-395 Connector	Tested By:	tlm
Project Location:	Brewer and Eddington, ME	Checked By:	jsc
GTX #:	308853		
Boring ID:	BB-ELER-102		
Sample ID:	R4		
Depth:	27.34-27.70 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.36	4.35	4.36
Specimen Diameter, in:	1.98	1.98	1.98
Specimen Mass, g:	591.83		
Bulk Density, lb/ft^3	168	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**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.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **NO**

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	0.00060	0.00050	0.00040	0.00030	0.00020	0.00010	0.00000	0.00000	0.00010	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040
Diameter 2, in (rotated 90°)	0.00060	0.00050	0.00040	0.00030	0.00020	0.00010	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00050	-0.00050	-0.00060

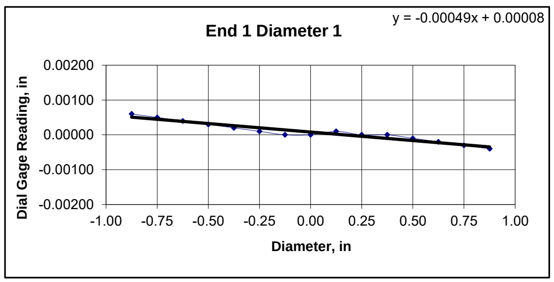
Difference between max and min readings, in:
0° = 0.00100 90° = 0.00120

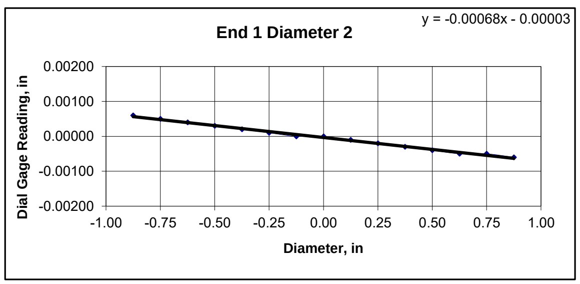
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00060	0.00050	0.00040	0.00030	0.00020	0.00010	0.00000	0.00000	0.00010	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040
Diameter 2, in (rotated 90°)	0.00060	0.00050	0.00040	0.00030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

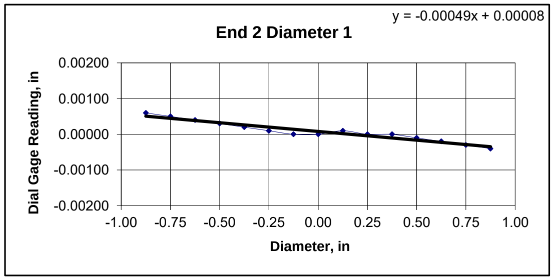
Difference between max and min readings, in:
0° = 0.001 90° = 0.0012

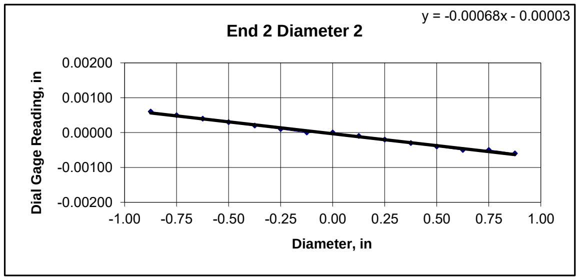
Maximum difference must be < 0.0020 in. Difference = ± 0.00060

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:	Slope of Best Fit Line	0.00049
	Angle of Best Fit Line:	0.02799
End 2:	Slope of Best Fit Line	0.00049
	Angle of Best Fit Line:	0.02799
Maximum Angular Difference:		0.00000

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:	Slope of Best Fit Line	0.00068
	Angle of Best Fit Line:	0.03912
End 2:	Slope of Best Fit Line	0.00068
	Angle of Best Fit Line:	0.03912
Maximum Angular Difference:		0.00000

Parallelism Tolerance Met? **YES**
Spherically Seated

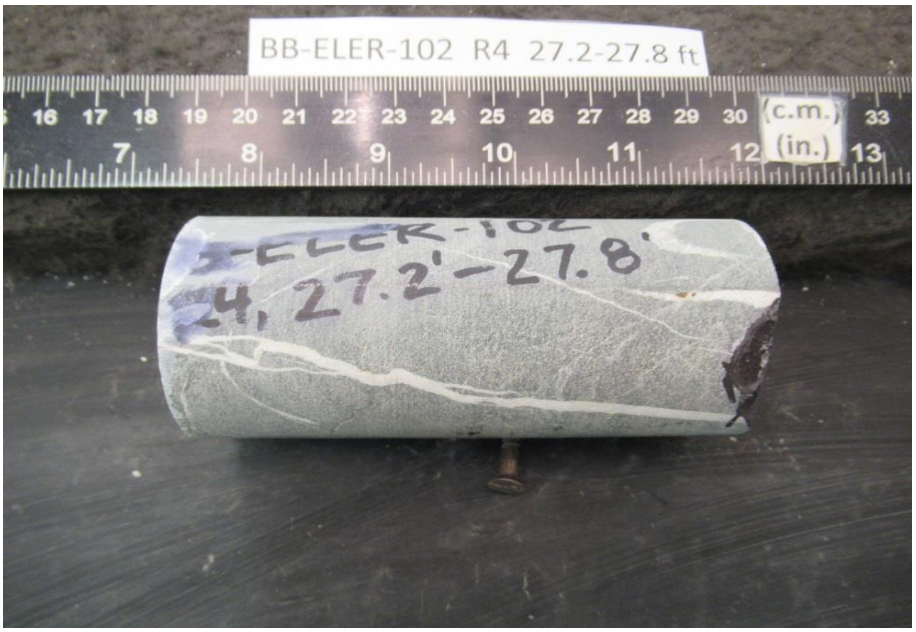
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00100	1.980	0.00051	0.029	YES
Diameter 2, in (rotated 90°)	0.00120	1.980	0.00061	0.035	YES
END 2					
Diameter 1, in	0.00100	1.980	0.00051	0.029	YES
Diameter 2, in (rotated 90°)	0.00120	1.980	0.00061	0.035	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Haley & Aldrich, Inc.
Project Name:	Rt 9/I-395 Connector
Project Location:	Brewer and Eddington, ME
GTX #:	308853
Test Date:	10/12/2018
Tested By:	cmh
Checked By:	jsc
Boring ID:	BB-ELER-102
Sample ID:	R4
Depth, ft:	27.34-27.70



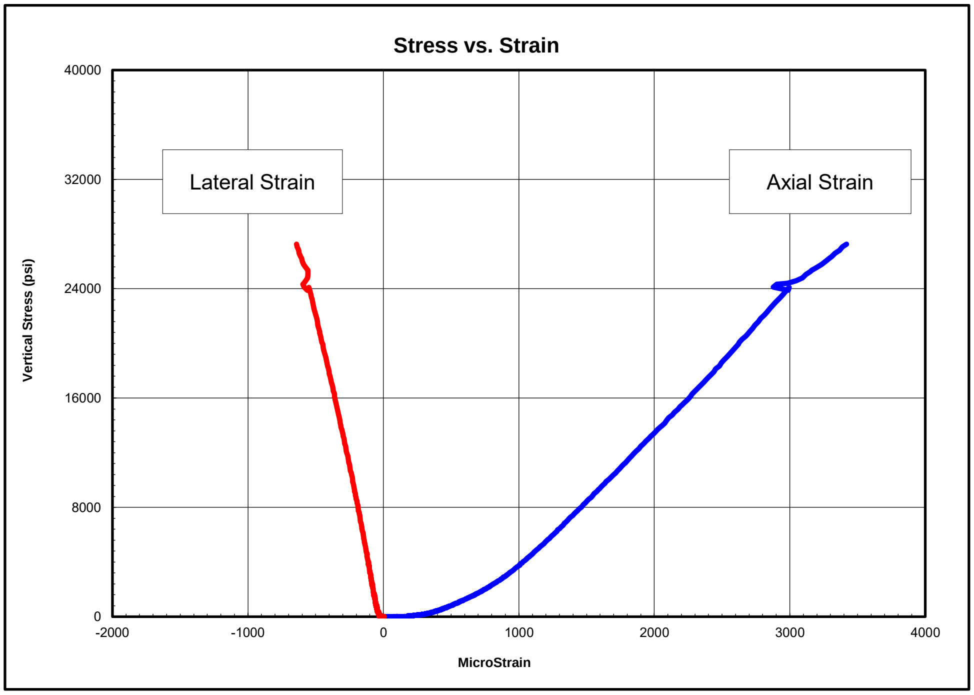
After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.
Project Name:	I-395/Rte 9 Connector Bridge(Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Test Date:	3/26/2021
Tested By:	cmh
Checked By:	jsc
Boring ID:	BB-ELER-202
Sample ID:	R3
Depth, ft:	26-26.6
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 27,259 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
2700-10000	9,200,000	0.17
10000-17300	10,100,000	0.22
17300-24500	11,500,000	0.31

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
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:	3/22/2021
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)	Tested By:	cmh
Project Location:	Eddington, ME	Checked By:	smd
GTX #:	313322		
Boring ID:	BB-ELER-205		
Sample ID:	R1		
Depth:	26-26.6 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.47	4.47	4.47
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	613.02		
Bulk Density, lb/ft^3	168	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**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	0.00030	0.00030	0.00030	0.00020	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°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010

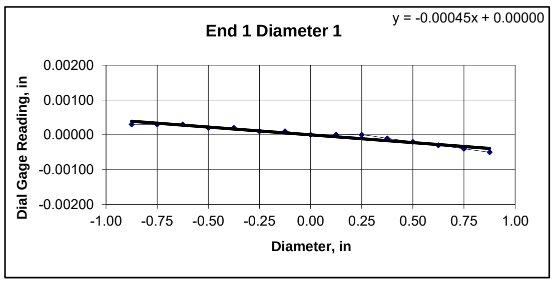
Difference between max and min readings, in:
0° = 0.00080 90° = 0.00010

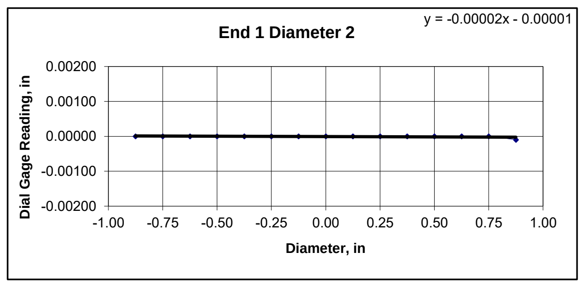
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00030	0.00030	0.00030	0.00020	0.00020	0.00010	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00050
Diameter 2, in (rotated 90°)	-0.00010	-0.00010	-0.00010	0.00000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

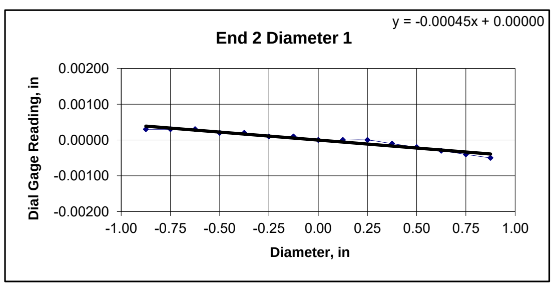
Difference between max and min readings, in:
0° = 0.0008 90° = 0.0001

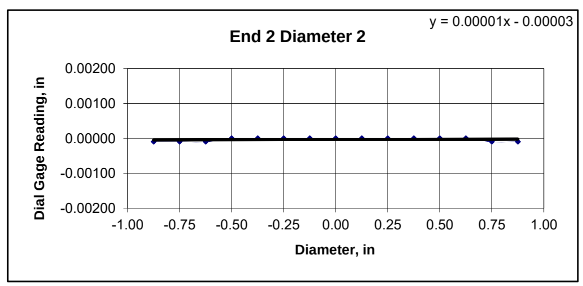
Maximum difference must be < 0.0020 in. Difference = ± 0.00040

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:	
Slope of Best Fit Line	0.00045
Angle of Best Fit Line:	0.02554
End 2:	
Slope of Best Fit Line	0.00045
Angle of Best Fit Line:	0.02554
Maximum Angular Difference:	0.00000

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:	
Slope of Best Fit Line	0.00002
Angle of Best Fit Line:	0.00115
End 2:	
Slope of Best Fit Line	0.00001
Angle of Best Fit Line:	0.00082
Maximum Angular Difference:	0.00033

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	0.00080	1.990	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00010	1.990	0.00005	0.003	YES
END 2					
Diameter 1, in	0.00080	1.990	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00010	1.990	0.00005	0.003	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

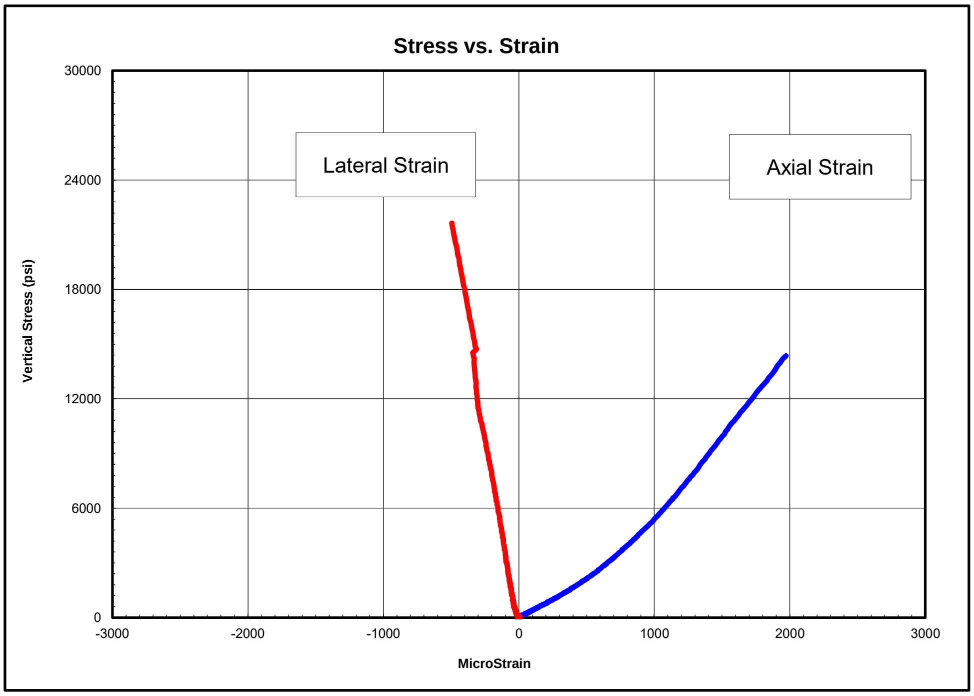
Client:	Haley & Aldrich, Inc.
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Test Date:	3/26/2021
Tested By:	cmh
Checked By:	smd
Boring ID:	BB-ELER-202
Sample ID:	R3
Depth, ft:	26-26.6

After cutting and grinding

After break

Client:	Haley & Aldrich, Inc.
Project Name:	I-395/Rte 9 Connector Bridge(Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Test Date:	3/26/2021
Tested By:	cmh
Checked By:	jsc
Boring ID:	BB-ELER-202
Sample ID:	R3
Depth, ft:	28.6-29.5
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 21,637 psi

The axial strain gauges failed before the peak value was attained. Young's Modulus and Poisson's Ratio could not be determined for the thrid stress range.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
2200-7900	7,200,000	0.16
7900-13700	9,460,000	0.23
13700-19500	---	---

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
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.

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.	Test Date:	3/22/2021
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)	Tested By:	cmh
Project Location:	Eddington, ME	Checked By:	smd
GTX #:	313322		
Boring ID:	BB-ELER-202		
Sample ID:	R3		
Depth:	28.6-29.5 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.65	4.65	4.65		
Specimen Diameter, in:	1.99	1.99	1.99		
Specimen Mass, g:	623.7				
Bulk Density, lb/ft^3	164			**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.3			**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 $\leq$ 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	0.00040	0.00040	0.00040	0.00030	0.00030	0.00020	0.00010	0.00000	0.00000	-0.00010	-0.00030	-0.00040	-0.00040	-0.00060	-0.00060
Diameter 2, in (rotated 90°)	-0.00020	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00020	0.00020	0.00020	0.00030	0.00030	0.00030	0.00030

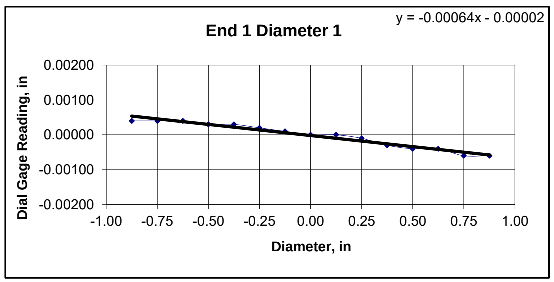
Difference between max and min readings, in:
0° = 0.00100 90° = 0.00050

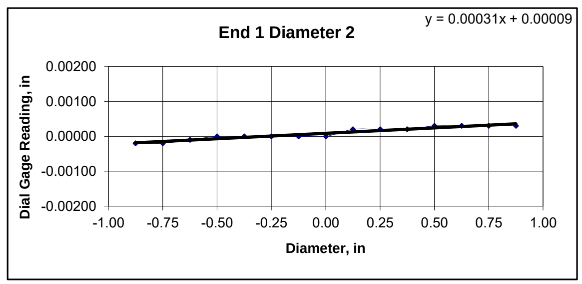
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00040	0.00040	0.00030	0.00030	0.00030	0.00020	0.00020	0.00000	0.00000	-0.00010	-0.00030	-0.00050	-0.00050	-0.00060	-0.00070
Diameter 2, in (rotated 90°)	-0.00050	-0.00040	-0.00030	-0.00030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

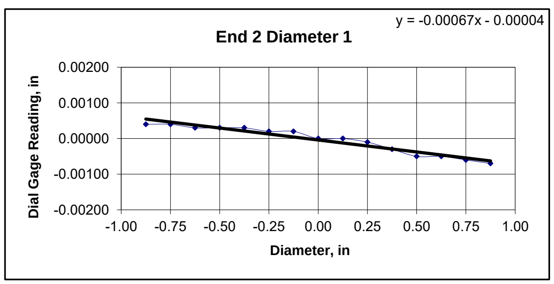
Difference between max and min readings, in:
0° = 0.0011 90° = 0.0006

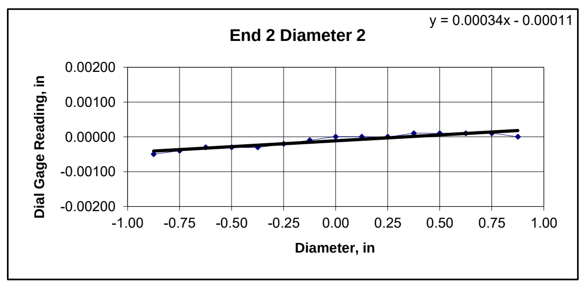
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00055

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:	
Slope of Best Fit Line	0.00064
Angle of Best Fit Line:	0.03651
End 2:	
Slope of Best Fit Line	0.00067
Angle of Best Fit Line:	0.03847
Maximum Angular Difference:	0.00196

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:	
Slope of Best Fit Line	0.00031
Angle of Best Fit Line:	0.01784
End 2:	
Slope of Best Fit Line	0.00034
Angle of Best Fit Line:	0.01932
Maximum Angular Difference:	0.00147

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	0.00100	1.990	0.00050	0.029	YES
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES
END 2					
Diameter 1, in	0.00110	1.990	0.00055	0.032	YES
Diameter 2, in (rotated 90°)	0.00060	1.990	0.00030	0.017	YES

Maximum angle of departure must be $\leq$ 0.25°

Perpendicularity Tolerance Met? **YES**

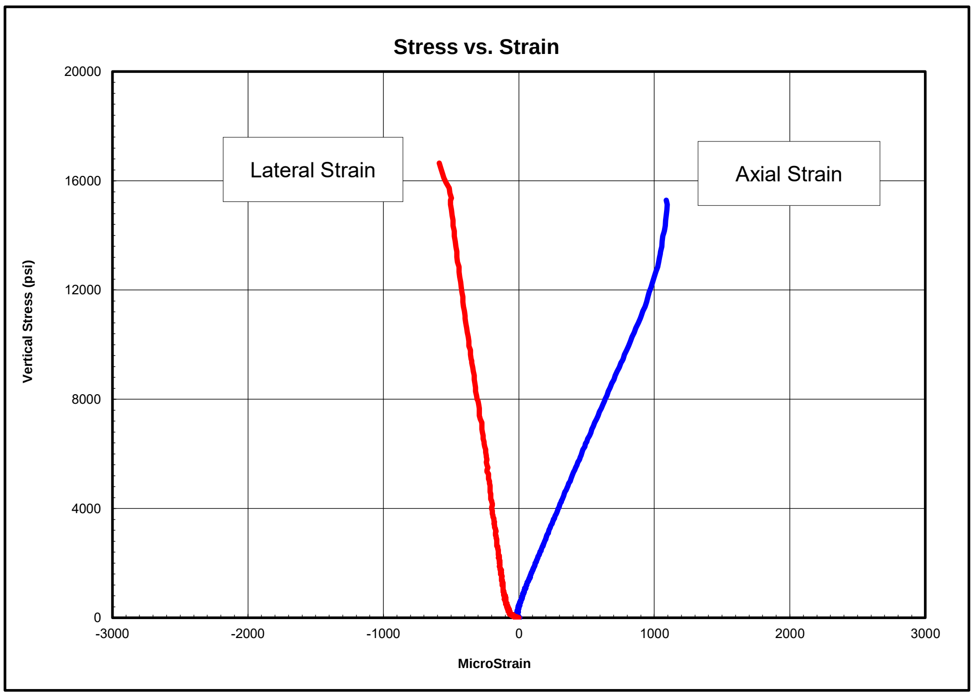
Client:	Haley & Aldrich, Inc.
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Test Date:	3/26/2021
Tested By:	cmh
Checked By:	smd
Boring ID:	BB-ELER-202
Sample ID:	R3
Depth, ft:	28.6-29.5

After cutting and grinding

After break

Client:	Haley & Aldrich, Inc.
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Test Date:	4/7/2021
Tested By:	cmh
Checked By:	jsc
Boring ID:	BB-ELER-203
Sample ID:	R1
Depth, ft:	15.85-16.23
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 16,647 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
1700-6100	11,800,000	0.31
6100-10500	11,400,000	0.35
10500-15000	17,500,000	0.46

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
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:	4/1/2021
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)		Tested By:	cmh
Project Location:	Eddington, ME		Checked By:	smd
GTX #:	313322			
Boring ID:	BB-ELER-203			
Sample ID:	R1			
Depth:	15.85-16.23	ft		
Visual Description:	See photographs			

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average	
Specimen Length, in:	4.55	4.55	4.55	
Specimen Diameter, in:	1.97	1.97	1.97	
Specimen Mass, g:	613.11			
Bulk Density, lb/ft^3	168	**Minimum Diameter Tolerence Met?**	**YES**	
Length to Diameter Ratio:	2.3	**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	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00030	-0.00030
Diameter 2, in (rotated 90°)	-0.00020	-0.00020	-0.00020	-0.00020	-0.00020	-0.00020	-0.00010	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010

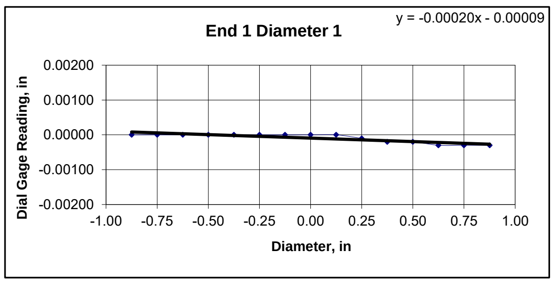
Difference between max and min readings, in:
0° = 0.00030 90° = 0.00030

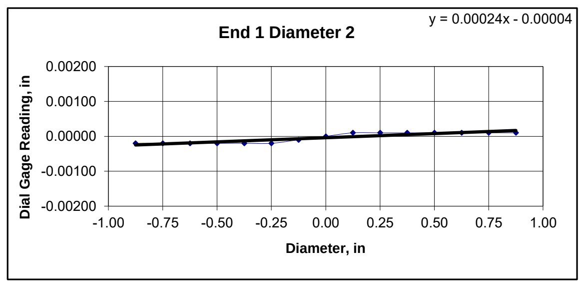
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00020	-0.00030	-0.00040
Diameter 2, in (rotated 90°)	-0.00030	-0.00030	-0.00020	-0.00020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

Difference between max and min readings, in:
0° = 0.0004 90° = 0.0004

Maximum difference must be < 0.0020 in. Difference = ± 0.00020

Flatness Tolerance Met? **YES**





DIAMETER 1

End 1:

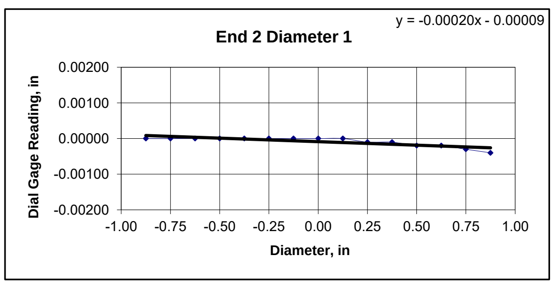
Slope of Best Fit Line	0.00020
Angle of Best Fit Line:	0.01146

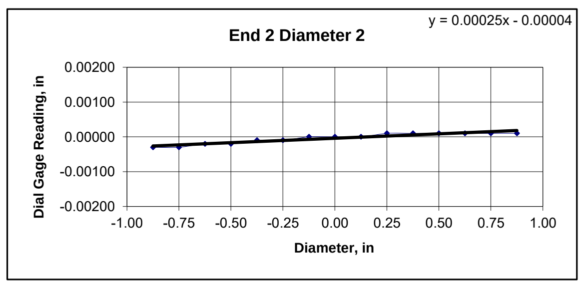
End 2:

Slope of Best Fit Line	0.00020
Angle of Best Fit Line:	0.01130

Maximum Angular Difference: 0.00016

Parallelism Tolerance Met? **YES**
Spherically Seated





DIAMETER 2

End 1:

Slope of Best Fit Line	0.00024
Angle of Best Fit Line:	0.01359

End 2:

Slope of Best Fit Line	0.00025
Angle of Best Fit Line:	0.01457

Maximum Angular Difference: 0.00098

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	0.00030	1.970	0.00015	0.009	YES
Diameter 2, in (rotated 90°)	0.00030	1.970	0.00015	0.009	YES
END 2					
Diameter 1, in	0.00040	1.970	0.00020	0.012	YES
Diameter 2, in (rotated 90°)	0.00040	1.970	0.00020	0.012	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

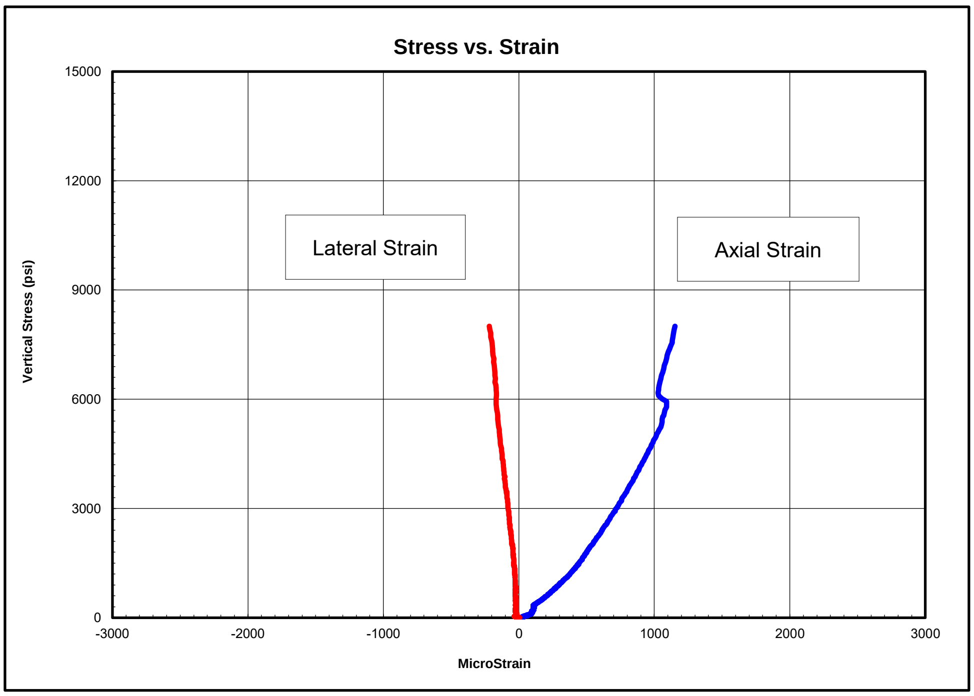
Client:	Haley & Aldrich, Inc.
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Test Date:	4/7/2021
Tested By:	cmh
Checked By:	smd
Boring ID:	BB-ELER-203
Sample ID:	R1
Depth, ft:	15.85-16.23

After cutting and grinding

After break

Client:	Haley & Aldrich, Inc.
Project Name:	I-395/Rte 9 Connector Bridge(Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Test Date:	3/26/2021
Tested By:	cmh
Checked By:	jsc
Boring ID:	BB-ELER-205
Sample ID:	R1
Depth, ft:	15.0-15.9
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 8,006 psi

The axial strain gauges picked up an initial failure within the specimen and then continued reading until total failure occured. Young's Modulus and Poisson's Ratio could not be determined for the third stress range.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
800-2900	5,400,000	0.16
2900-5100	6,680,000	0.21
5100-7200	---	---

Notes:
Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
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.

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.	Test Date:	3/22/2021
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)	Tested By:	cmh
Project Location:	Eddington, ME	Checked By:	smd
GTX #:	313322		
Boring ID:	BB-ELER-205		
Sample ID:	R1		
Depth:	15.0-15.9 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.42	4.41	4.42
Specimen Diameter, in:	1.98	1.99	1.99
Specimen Mass, g:	604.15		
Bulk Density, lb/ft^3	168	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**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 $\leq$ 0.02 in.? NO

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **NO**

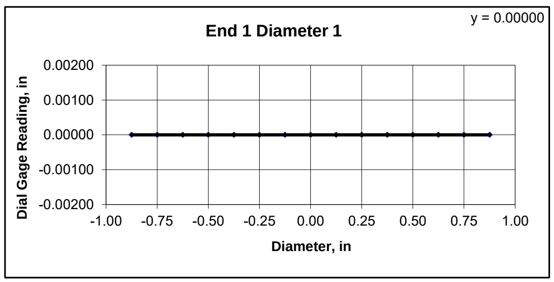
END FLATNESS AND PARALLELISM (Procedure FP1)

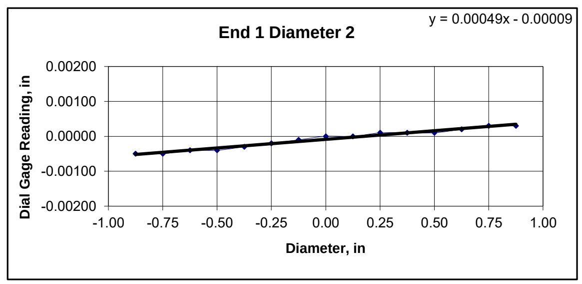
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00050	-0.00050	-0.00040	-0.00040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

Difference between max and min readings, in:
0° = 0.00000 90° = 0.00080

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	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020
Diameter 2, in (rotated 90°)	-0.00060	-0.00060	-0.00050	-0.00040	-0.00030	-0.00030	-0.00010	0.00000	0.00000	0.00010	0.00010	0.00020	0.00020	0.00020	0.00020

Difference between max and min readings, in:
0° = 0.0002 90° = 0.0008
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00040
Flatness Tolerance Met? **YES**





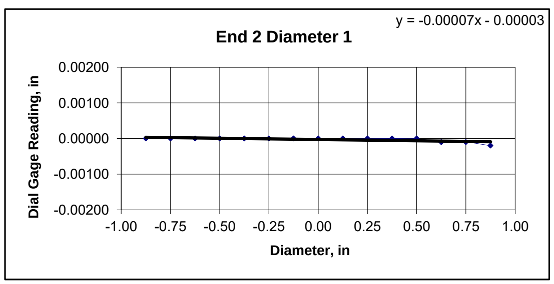
DIAMETER 1

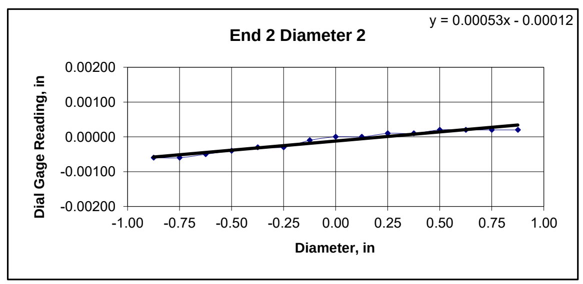
End 1:
Slope of Best Fit Line 0.00000
Angle of Best Fit Line: 0.00000

End 2:
Slope of Best Fit Line 0.00007
Angle of Best Fit Line: 0.00409

Maximum Angular Difference: 0.00409

Parallelism Tolerance Met? **YES**
Spherically Seated





DIAMETER 2

End 1:
Slope of Best Fit Line 0.00049
Angle of Best Fit Line: 0.02832

End 2:
Slope of Best Fit Line 0.00053
Angle of Best Fit Line: 0.03012

Maximum Angular Difference: 0.00180

Parallelism Tolerance Met? **YES**
Spherically Seated

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

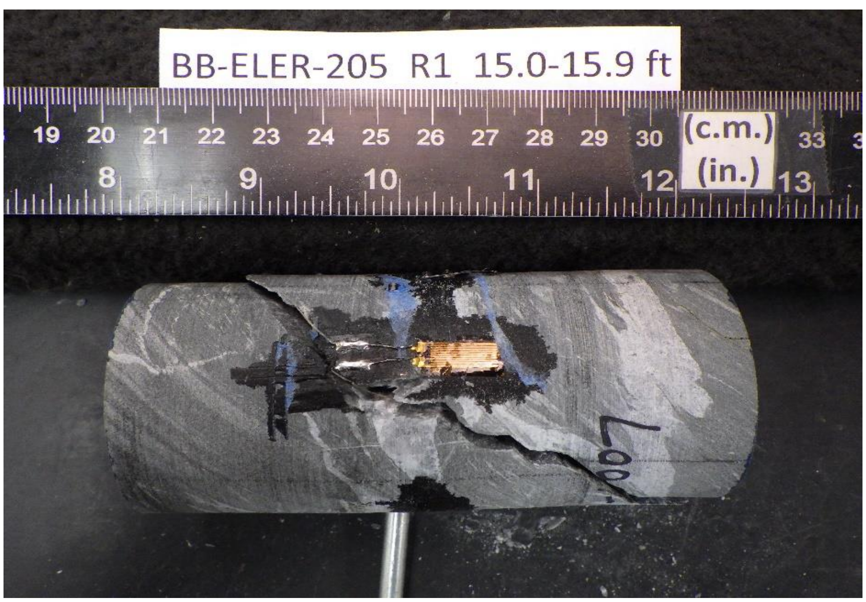
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00000	1.985	0.00000	0.000	YES
Diameter 2, in (rotated 90°)	0.00080	1.985	0.00040	0.023	YES
END 2					
Diameter 1, in	0.00020	1.985	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00080	1.985	0.00040	0.023	YES

Maximum angle of departure must be $\leq$ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Haley & Aldrich, Inc.
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Test Date:	3/26/2021
Tested By:	cmh
Checked By:	smd
Boring ID:	BB-ELER-205
Sample ID:	R1
Depth, ft:	15.0-15.9

After cutting and grinding

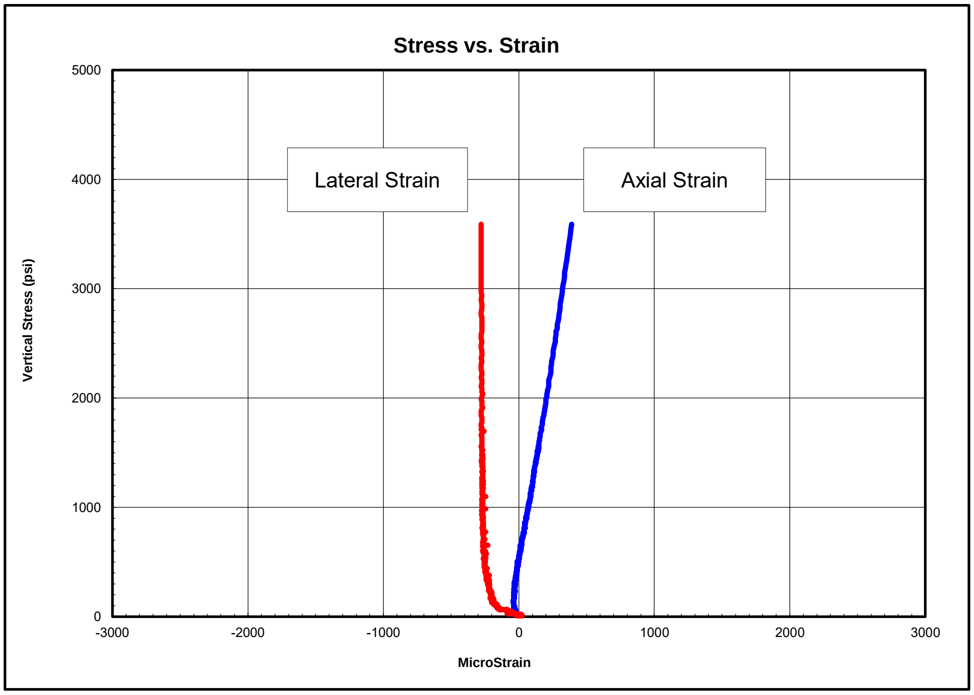


After break

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.
Project Name:	I-395/Rte 9 Connector Bridge(Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Test Date:	3/26/2021
Tested By:	cmh
Checked By:	jsc
Boring ID:	BB-ELER-205
Sample ID:	R3
Depth, ft:	20.3-20.7
Sample Type:	rock core
Sample Description:	See photographs Intact material and discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 3,590 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
400-1300	6,740,000	0.28
1300-2300	7,450,000	0.25
2300-3200	8,440,000	0.27

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
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.

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.	Test Date:	3/22/2021
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)	Tested By:	cmh
Project Location:	Eddington, ME	Checked By:	smd
GTX #:	313322		
Boring ID:	BB-ELER-205		
Sample ID:	R3		
Depth:	20.3-20.7 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.18	4.18	4.18
Specimen Diameter, in:	1.98	1.98	1.98
Specimen Mass, g:	565.65		
Bulk Density, lb/ft^3	167	**Minimum Diameter Tolerence Met?**	**YES**
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)

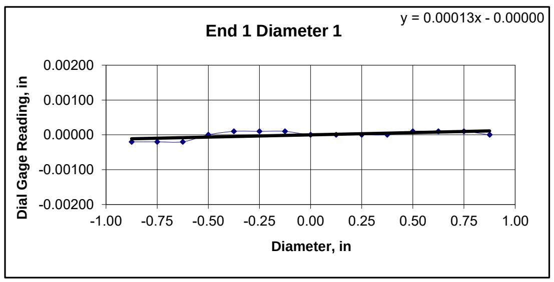
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00020	-0.00020	0.00000	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00000
Diameter 2, in (rotated 90°)	-0.00070	-0.00070	-0.00060	-0.00050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

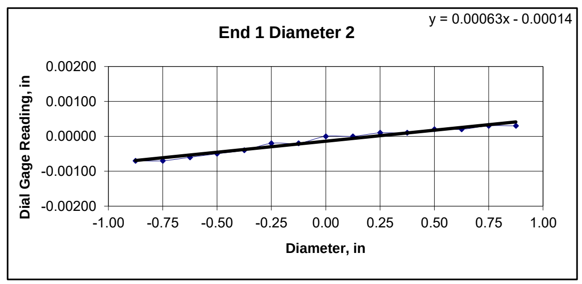
Difference between max and min readings, in:
0° = 0.00030 90° = 0.00100

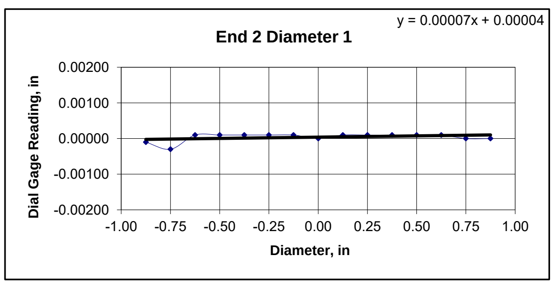
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00010	-0.00030	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00070	-0.00060	-0.00040	-0.00030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

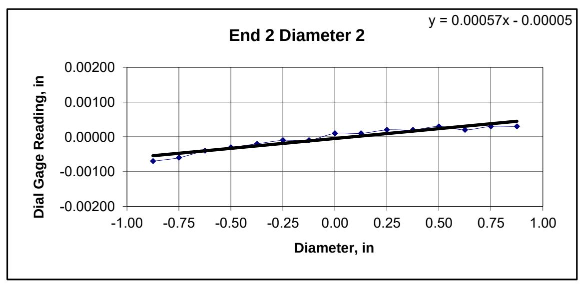
Difference between max and min readings, in:
0° = 0.0004 90° = 0.001

Maximum difference must be < 0.0020 in. Difference = ± 0.00050
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:	
Slope of Best Fit Line	0.00013
Angle of Best Fit Line:	0.00737
End 2:	
Slope of Best Fit Line	0.00007
Angle of Best Fit Line:	0.00409
Maximum Angular Difference:	0.00327

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:	
Slope of Best Fit Line	0.00063
Angle of Best Fit Line:	0.03618
End 2:	
Slope of Best Fit Line	0.00057
Angle of Best Fit Line:	0.03241
Maximum Angular Difference:	0.00377

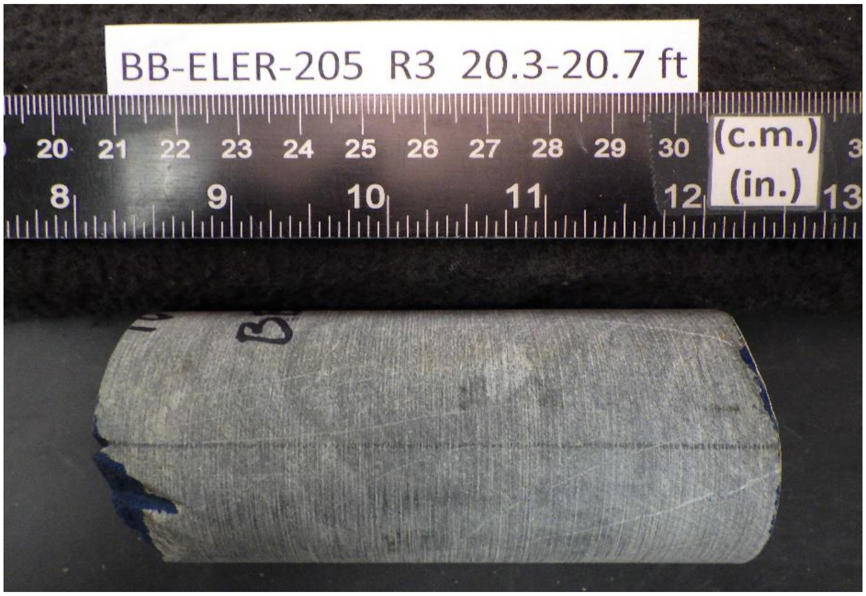
Parallelism Tolerance Met? **YES**
Spherically Seated

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

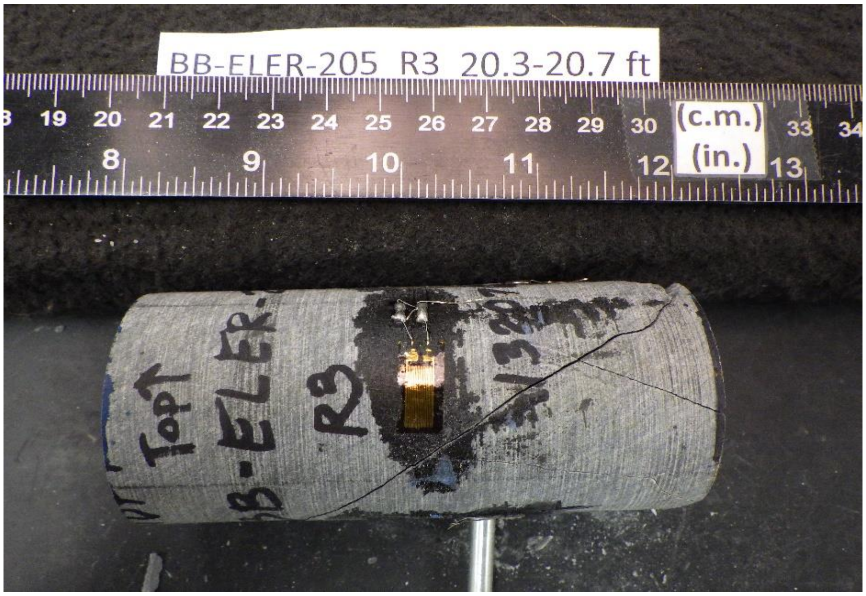
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00030	1.980	0.00015	0.009	YES
Diameter 2, in (rotated 90°)	0.00100	1.980	0.00051	0.029	YES
END 2					
Diameter 1, in	0.00040	1.980	0.00020	0.012	YES
Diameter 2, in (rotated 90°)	0.00100	1.980	0.00051	0.029	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

Client:	Haley & Aldrich, Inc.
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Test Date:	3/26/2021
Tested By:	cmh
Checked By:	smd
Boring ID:	BB-ELER-205
Sample ID:	R3
Depth, ft:	20.3-20.7



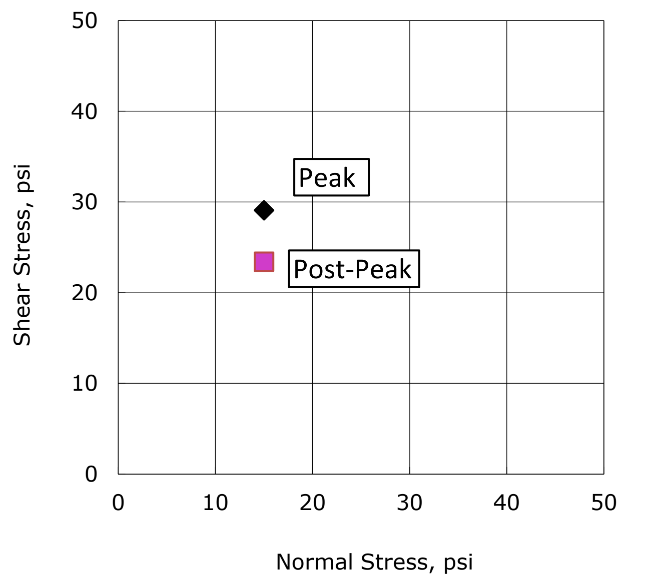
After cutting and grinding

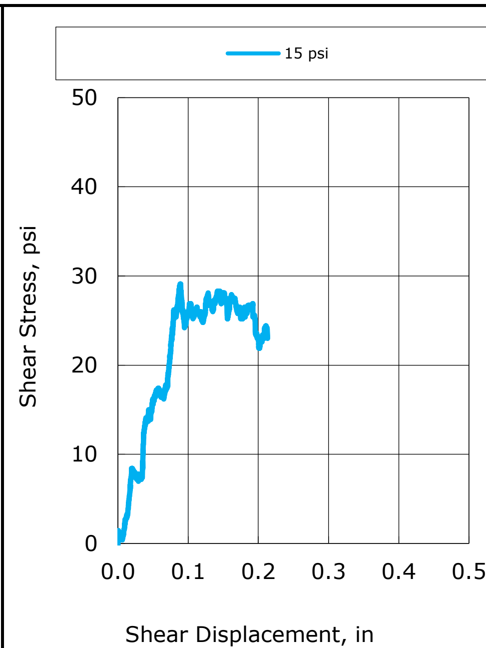


After break

Client:	Haley & Aldrich, Inc
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Start Date:	4/9/2021
End Date:	4/9/2021
Tested By:	tlm
Checked By:	jsc
Boring ID:	BB-ELER-203
Sample ID:	R1
Depth, ft:	16.7
Visual Description:	Rock Core with open joint

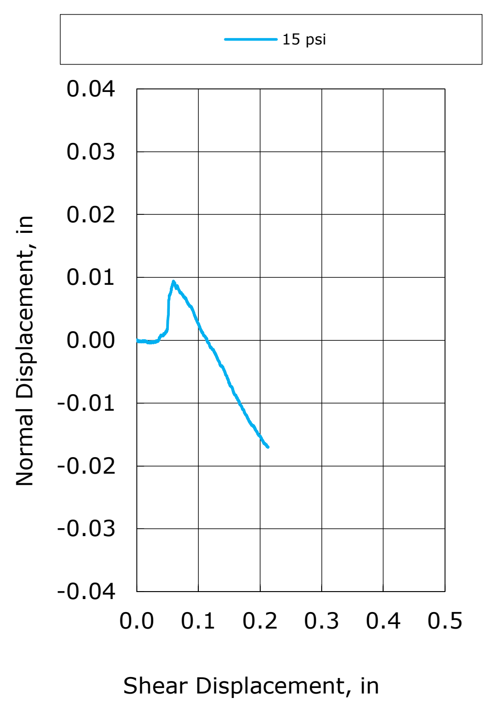
Sliding Friction Test of Rock by ASTM D5607





Test No.:	SF-1
Specimen Diameter, in:	1.97
Specimen Length, in:	2.76
Specimen Mass, grams:	376
Specimen Area, in^2:	3.06
Specimen Bulk Density, pcf	170
Shear Plane Area, in^2	3.90
Normal Stress, psi:	15.0
Peak Shear Stress, psi:	29.1
Post Peak Shear Stress, psi:	23.4
Horiz. Displacement Rate, in/min:	0.005
Peak Friction Angle:	---
Peak Cohesive Intercept, psi:	---
Post-Peak Friction Angle:	---
Post-Peak Cohesive Intercept, psi:	---
JRC Roughness	10-12

Notes: Specimen cut to length using diamond tipped saw blade.
Tested at as-received moisture content and density.
'Hydro-Stone Super X' encapsulating compound used to mount specimen in test rings.
Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.



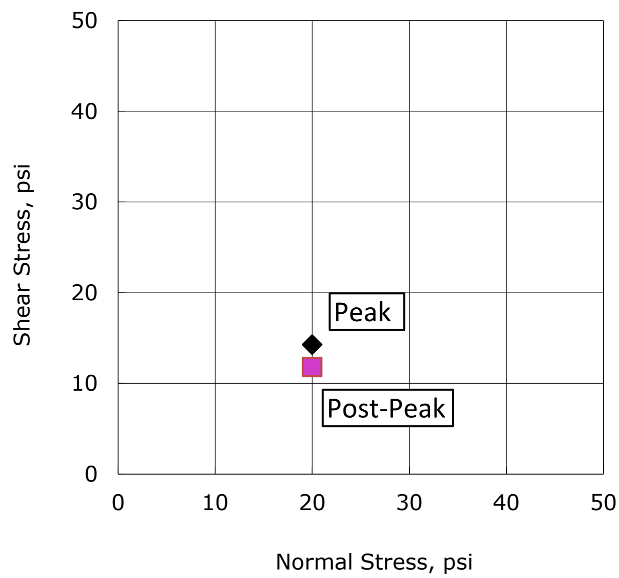
Client:	Haley & Aldrich, Inc
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Start Date:	4/9/2021
End Date:	4/9/2021
Tested By:	tlm
Checked By:	smd
Boring ID:	BB-ELER-203
Sample ID:	R1
Depth, ft:	16.7
Visual Description:	Rock Core with open joint

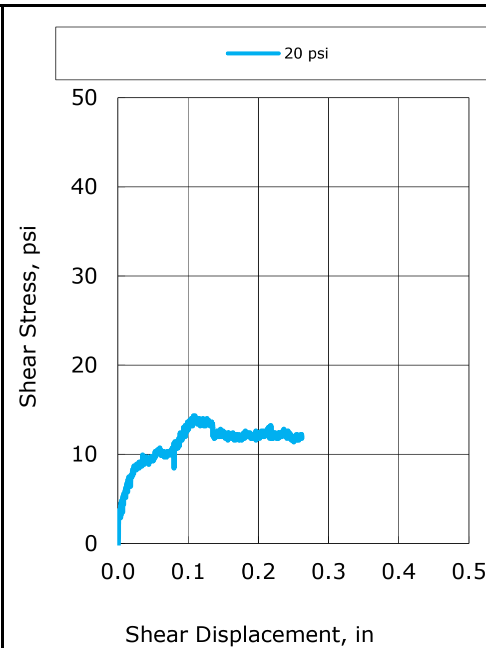
Pre-Test

Post-Test

Client:	Haley & Aldrich, Inc
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Start Date:	4/9/2021
End Date:	4/9/2021
Tested By:	tlm
Checked By:	jsc
Boring ID:	BB-ELER-205
Sample ID:	R4
Depth, ft:	24.1
Visual Description:	Rock Core with open joint

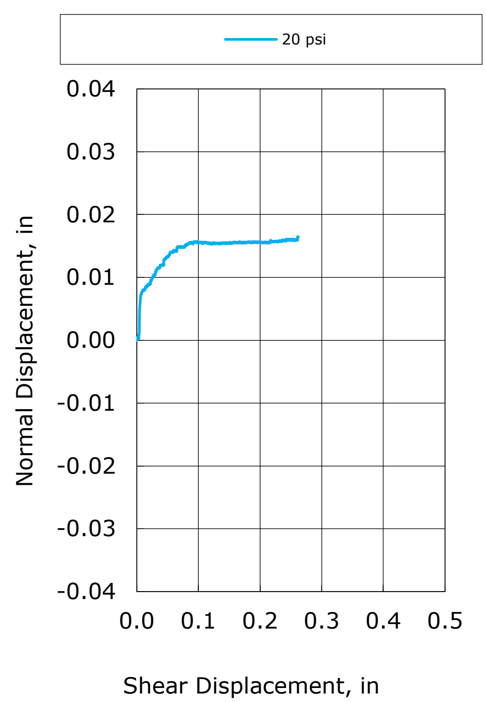
Sliding Friction Test of Rock by ASTM D5607





Test No.:	SF-2
Specimen Diameter, in:	1.97
Specimen Length, in:	2.74
Specimen Mass, grams:	319
Specimen Area, in^2:	3.03
Specimen Bulk Density, pcf	146
Shear Plane Area, in^2	3.62
Normal Stress, psi:	20.0
Peak Shear Stress, psi:	14.3
Post Peak Shear Stress, psi:	11.8
Horiz. Displacement Rate, in/min:	0.005
Peak Friction Angle:	---
Peak Cohesive Intercept, psi:	---
Post-Peak Friction Angle:	---
Post-Peak Cohesive Intercept, psi:	---
JRC Roughness	4-6

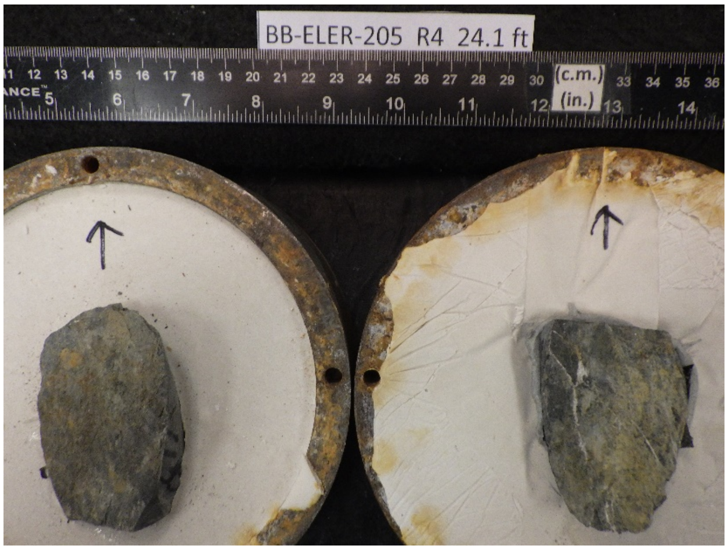
Notes: Specimen cut to length using diamond tipped saw blade.
Tested at as-received moisture content and density.
'Hydro-Stone Super X' encapsulating compound used to mount specimen in test rings.
Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.



GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc
Project Name:	I-395/Rte 9 Connector Bridge (Levenseller Rd)
Project Location:	Eddington, ME
GTX #:	313322
Start Date:	4/9/2021
End Date:	4/9/2021
Tested By:	tlm
Checked By:	smd
Boring ID:	BB-ELER-205
Sample ID:	R4
Depth, ft:	24.1
Visual Description:	Rock Core with open joint

Pre-Test



Post-Test

Appendix E

Geotechnical Design Calculations

Bearing Resistance

PROBLEM STATEMENT & OBJECTIVE

Calculate the factored bearing resistance at the service, strength and extreme limit states for the proposed abutment footings bearing on bedrock.

EXECUTIVE SUMMARY

Abutment 1 and Abutment 2

A factored bearing resistance of	31	ksf for the strength limit state is recommended.
A factored bearing resistance of	20	ksf for the service limit state for 0.5 in. settlement is recommended.
A factored bearing resistance of	55	ksf for the extreme event limit state is recommended.

AVAILABLE INFORMATION

1. Phase I (-100 series) test boring logs dated 1 and 2 August 2018 drilled by Northern Test Borings, Inc.
2. Phase II (-200 series) test boring logs dated 5 through 10 November 2021 drilled by New England Boring Contractors.
3. Bottom of abutment elevations provided by MaineDOT on 15 March 2021 (see below).
4. Phase I (preliminary design) and Phase II (final design) laboratory test results.

REFERENCES

1. AASHTO LRFD Bridge Design Specifications, 9th edition, 2020
2. NCHRP Report 651, LRFD Design and Construction of Shallow Foundations for Highway Bridge Structures, 2010.
3. The Hoek-Brown Failure Criterion, 1988.

ELEVATION DATUM

Elevations reference the North American Vertical Datum of 1988 (NAVD88).

ASSUMPTIONS

1. Bottom of footing will bear on bedrock at the following elevations:

Abutment 1 =	204.0	ft (Left WW)	200.0	ft (BW)	208.0	(Right WW)
Abutment 2 =	206.0	ft (Left WW)	200.0	ft (BW)	209.0	(Right WW)

2. The peak compressive strength of bedrock is based on laboratory test data (see page 4 for a summary of laboratory test results).

PROCEDURE FOR STRENGTH LIMIT STATE

1. See bearing resistance for footing on rock guidance from AASHTO LRFD 2017:

10.6.3.2 - Bearing Resistance of Rock

10.6.3.2.1 - General

The methods used for design of footings on rock shall consider the presence, orientation, and condition of discontinuities, weathering profile, and other similar profiles as they apply at a particular site.
For footings on competent rock, reliance on simple and direct analyses based on uniaxial compressive rock strengths and RQD may be applicable. For footings on less competent rock, more detailed investigations and analyses shall be performed to account for the effects of weathering and the presence and condition of discontinuities.

The designer shall judge the competency of a rock mass by taking into consideration both the nature of the intact rock, and the orientation and condition of the discontinuities of the overall rock mass. Where engineering judgment does not verify the presence of competent rock, the competency of the rock mass should be verified using the procedures for RMR rating.

The nominal bearing resistance of rock should be determined using empirical correlation with the Geometrics Rock Mass Rating system. Local experience shall be considered in the use of these semi-empirical procedures. The factored bearing stress of the foundation shall not be taken to be greater than the factored compressive resistance of the footing concrete.

C10.6.3.2.2

The bearing resistance of jointed or broken rock may be estimated using the semi-empirical procedure developed by Carter and Kulhawy (1988). <u>This procedure is based on the unconfined compressive strength of the intact rock core sample</u>. Depending on the rock mass quality measured in terms of RMR system, the nominal bearing resistance of a rock mass varies from small fraction to six times the unconfined compressive strength of intact rock core samples.

2. See the nominal bearing resistance equation based on Carter and Kulhawy (1988) From NCHRP Report 651:

$q_{ult} = q_u(\sqrt{s}+(m\sqrt{s} + s)^{0.5})$ Equation 82b An errata to Carter and Kulhawy 1988

3. Determine the Rock Mass Ratio (RMR) and strength parameters s and m from NCHRP Report 651 to be used in Equation 82b:

RMR from Table 15 and Table 16

m and s from Hoek-Brown Failure Criterion

4. Apply resistance factor ϕ from Table 10.5.5.2.2-1 in AASHTO LRFD 2017 for bearing resistance of footings on rock

PROCEDURE FOR SERVICE LIMIT STATE

1. See bearing resistance for footing on rock guidance from AASHTO LRFD 2017:

10.6.2.6 - Bearing Resistance at the Service Limit State

10.6.2.6.1 - Presumptive Values for Bearing Resistance

The use of presumptive values shall be based on knowledge of geological conditions at or near the structure site.

See Table C10.6.2.6.1-1 Presumptive Bearing Resistance for Spread Footing Foundations at the Service Limit State Modified after U.S. Department of the Navy (1982)

2. Use AASHTO LRFD 2017 presumptive bearing resistance for service limit state for settlement stated.

PROCEDURE FOR EXTREME EVENT LIMIT STATE

11.5.8 - Resistance Factors for Extreme Event Limit state

Unless otherwise specified, all resistance factors shall be taken as 1.0 when investigating the extreme event limit state. For overall stability of the retaining wall when earthquake loading is included, a resistance factor, ϕ, of 0.9 shall be used. For bearing resistance, a resistance factor of 0.8 shall be used for gravity and semigravity walls and 0.9 for MSE Walls.

2. Use nominal resistance calculated for the Strength Limit State and apply a resistance factor of 0.8 from AASHTO LRFD 2017 Section 11.5.8 to obtain the factored resistance.

HALEY ALDRICH	CALCULATIONS	File No.	132076-007
		Sheet	4 of 12
Client	Maine Department of Transportation	Date	9-Apr-21
Project	Levenseller Road Bridge over I-395/Route 9 Connector - WIN 18915.00	Computed by	JAD
Subject	Bearing Resistance of Bedrock for Abutment Footings	Checked by	BCS

AVAILBLE LABORATORY TEST DATA

Abutment No.	Test Boring No.	Ground Surface Elevation	Rock Core No.	Avg. Rock Specimen Depth BGS (ft)	Avg. Specimen Elevation	Depth of Specimen Below Ftg. Bearing Level (ft)	Peak Compressive Strength (psi)	Failure Type
1	BB-ELER-101	225.0	R1	16.6	208.4	-8.4	18,157	intact
			R2	22.1	202.9	-2.9	25,061	intact
	BB-ELER-202	225.1	R3	26.3	198.8	1.2	27,259	intact
				29.1	196.0	4.0	21,637	intact
	BB-ELER-203	225.6	R1	16.1	209.5	-1.5	16,647	intact
2	BB-ELER-102	225.8	R4	27.5	198.3	1.7	5,737	discontinuity
	BB-ELER-205	225.9	R1	15.5	210.4	-10.4	8,006	intact
			R4	20.5	205.4	-5.4	3,590	tact/discontinui

yellow highlighted cells represent data that is located above the proposed footing bearing level.

PARAMETERS FOR CALCULATIONS

1. Carter and Kulhawy (1988) methodology is based on the unconfined compressive strength of intact rock core samples. Because of the limited amount of intact rock core compressive strength data below the proposed footing bearing elevations, use both intact and discontinuity failure compressive strength data above and below the proposed footing bearing level at each Abutment.

Average peak compressive strengt at proposed bridge abutments:	15,762	psi
Average peak compressive strength at Abutment 1:	21,752	psi
Average peak compressive strength at Abutment 2:	5,778	psi
Use average peak compressive strength at Abutment 1:	21,752	psi
	3,132	ksf
Use average peak compressive strength at Abutment 2:	5,778	psi
	832	ksf

HALEY ALDRICH	CALCULATIONS	File No.	132076-007
		Sheet	5 of 12
Client	Maine Department of Transportation	Date	9-Apr-21
Project	Levenseller Road Bridge over I-395/Route 9 Connector - WIN 18915.00	Computed by	JAD
Subject	Bearing Resistance of Bedrock for Abutment Footings	Checked by	BCS

SUMMARY OF BEDROCK DATA AT SITE

Abutment No.	Test Boring No.	Ground Surface Elevation	Rock Core No.	Avg. Rock Core Depth (BGS)	Avg. Rock Core Elevation	Depth of Rock Core Below Ftg. Bearing Level (ft)	Rock Core Run Recovery (%)	Rock Quality Designation (RQD, %)
1	BB-ELER-101	225.0	R1	18.9	206.2	-6.2	93	75
			R2	23.8	201.2	-1.2	100	85
	BB-ELER-201	222.7	R1	23.8	198.9	1.1	65	48
			R2	27.4	195.3	4.7	76	15
	BB-ELER-202	225.1	R1	19.0	206.1	-6.1	75	8
			R2	23.4	201.7	-1.7	66	45
			R3	27.8	197.3	2.7	100	77
			R4	32.3	192.8	7.2	100	67
			R5	35.9	189.2	10.8	96	49
	BB-ELER-203	225.6	R1	17.8	207.8	0.2	67	47
2	BB-ELER-102	225.8	R1	16.5	209.3	-9.3	83	15
			R2	20.4	205.5	-5.5	83	14
			R3	24.7	201.1	-1.1	90	28
			R4	28.7	197.1	2.9	86	39
	BB-ELER-204	223.2	R1	12.4	210.8	-1.8	80	38
	BB-ELER-205	225.9	R1	16.5	209.4	-9.4	89	31
			R2	19.0	206.9	-6.9	92	33
			R3	21.3	204.6	-4.6	87	13
			R4	23.8	202.1	-2.1	97	31
			R5	27.5	198.4	1.6	100	57
			R6	32.5	193.4	6.6	100	45
	BB-ELER-206	225.1	R1	12.3	212.8	-6.8	96	0
			R2	14.8	210.3	-4.3	83	0
	BB-ELER-206A	224.5	R1	12.5	212.0	-6.0	93	57
			R2	17.5	207.0	-1.0	88	53
			R3	21.0	203.5	2.5	54	0
			R4	22.4	202.1	3.9	52	0
			R5	23.9	200.6	5.4	100	0
			R6	27.0	197.5	8.5	81	42
			R7	30.6	193.9	12.1	95	76
			R8	33.3	191.2	14.8	68	0
			R9	35.7	188.8	17.2	80	80

yellow highlighted cells represent data that is located above the proposed footing bearing level.
because sufficient data exists below the proposed footing bearing level, exclude this data.

Average RQD above and below proposed footing bearing level:

Abutment 1 = 52 %
Abutment 2 = 30 %

Average RQD below the proposed footing bearing level:

Abutment 1 = 51 %
Abutment 2 = 34 %

Use average RQD below proposed footing bearing level at each Abutment.

Strength Limit State: Abutment 1

Determine RMR

Table 15 from NCHRP Report 651:

	PARAMETER		RANGES OF VALUES						
1	Strength of intact rock material	Point load strength index	>175 ksf	85–175 ksf	45–85 ksf	20–45 ksf	For this low range, unconfined compressive test is preferred		
		Unconfined compressive strength	>4,320 ksf	2,160–4,320 ksf	1,080–2,160 ksf	520–1,080 ksf	215–520 ksf	70–215 ksf	20–70 ksf
	Relative Rating		15	12	7	4	2	1	0
2	Drill core quality RQD		90% to 100%		75% to 90%	50% to 75%	25% to 50%		<25%
	Relative Rating		20		17	13	8		3
3	Spacing of joints		>10 ft		3–10 ft	1–3 ft	2 in–1 ft		<2 in
	Relative Rating		30		25	20	10		5
4	Condition of joints		• Very rough surfaces • Not continuous • No separation • Hard joint wall rock		• Slightly rough surfaces • Separation <0.05 in • Hard joint wall rock	• Slightly rough surfaces • Separation <0.05 in • Soft joint wall rock	• Slicken-sided surfaces or • Gouge <0.2 in thick or • Joints open 0.05–0.2 in • Continuous joints		• Soft gouge >0.2 in thick or • Joints open >0.2 in • Continuous joints
	Relative Rating		25		20	12	6		0
5	Ground water conditions (use one of the three evaluation criteria as appropriate to the method of exploration)	Inflow per 30 ft tunnel length	None	<400 gal/hr		400–2,000 gal/hr		>2,000 gal/hr	
		Ratio = joint water pressure/ major principal stress	0	0.0–0.2		0.2–0.5		>0.5	
		General Conditions	Completely Dry	Moist only (interstitial water)		Water under moderate pressure		Severe water problems	
	Relative Rating		10	7		4		0	

Table 16 from NCHRP Report 651:

Strike and dip orientations of joints		Very favorable	Favorable	Fair	Unfavorable	Very unfavorable
Ratings	Tunnels	0	–2	–5	–10	–12
	Foundations	0	–2	–7	–15	–25
	Slopes	0	–5	–25	–50	–60

Total RMR Value

Parameter	Design Value	Value Based on Table 15 (shown above)	Relative Rating
Intact Rock Strength	3,132 ksf	2,160–4,320 ksf	12
RQD	51%	50% to 75%	13
Joint Spacing	2 in to 1 ft (observed in photos)	2 in–1 ft	10
Joint Condition	Slightly rough surfaces separation <0.05 in (observed in photos)	Slightly rough surfaces Separation <0.05 in Hard joint wall rock	20
Groundwater Condition	Moist only (interstitial water)	Moist only (interstitial water)	7
Joint Strike and Dip	Favorable	Favorable	-2
		Total Rating =	60

Strength Limit State: Abutment 2

Determine RMR

Table 15 from NCHRP Report 651:

	PARAMETER		RANGES OF VALUES						
1	Strength of intact rock material	Point load strength index	>175 ksf	85–175 ksf	45–85 ksf	20–45 ksf	For this low range, unconfined compressive test is preferred		
		Unconfined compressive strength	>4,320 ksf	2,160–4,320 ksf	1,080–2,160 ksf	520–1,080 ksf	215–520 ksf	70–215 ksf	20–70 ksf
	Relative Rating		15	12	7	4	2	1	0
2	Drill core quality RQD		90% to 100%	75% to 90%	50% to 75%	25% to 50%	<25%		
	Relative Rating		20	17	13	8	3		
3	Spacing of joints		>10 ft	3–10 ft	1–3 ft	2 in–1 ft	<2 in		
	Relative Rating		30	25	20	10	5		
4	Condition of joints		• Very rough surfaces • Not continuous • No separation • Hard joint wall rock	• Slightly rough surfaces • Separation <0.05 in • Hard joint wall rock	• Slightly rough surfaces • Separation <0.05 in • Soft joint wall rock	• Slicken-sided surfaces or • Gouge <0.2 in thick or • Joints open 0.05–0.2 in • Continuous joints	• Soft gouge >0.2 in thick or • Joints open >0.2 in • Continuous joints		
	Relative Rating		25	20	12	6	0		
5	Ground water conditions (use one of the three evaluation criteria as appropriate to the method of exploration)	Inflow per 30 ft tunnel length	None	<400 gal/hr	400–2,000 gal/hr	>2,000 gal/hr			
		Ratio = joint water pressure/ major principal stress	0	0.0–0.2	0.2–0.5	>0.5			
		General Conditions	Completely Dry	Moist only (interstitial water)	Water under moderate pressure	Severe water problems			
	Relative Rating		10	7	4	0			

Table 16 from NCHRP Report 651:

Strike and dip orientations of joints		Very favorable	Favorable	Fair	Unfavorable	Very unfavorable
Ratings	Tunnels	0	–2	–5	–10	–12
	Foundations	0	–2	–7	–15	–25
	Slopes	0	–5	–25	–50	–60

Total RMR Value

Parameter	Design Value	Value Based on Table 15 (shown above)	Relative Rating
Intact Rock Strength	832 ksf	520–1,080ksf	7
RQD	34%	25% to 50%	8
Joint Spacing	2 in to 1 ft (observed in photos)	2 in–1 ft	10
Joint Condition	Slightly rough surfaces separation <0.05 in (observed in photos)	Slightly rough surfaces Separation <0.05 in Hard joint wall rock	20
Groundwater Condition	Moist only (interstitial water)	Moist only (interstitial water)	7
Joint Strike and Dip	Favorable	Favorable	-2
		Total Rating =	50

Strength Limit State Continued: Abutment 1

Determine s and m
Assume the rock type B

Table 17 from NCHRP Report 651:

RMR rating	100–81	80–61	60–41	40–21	<20
Class No.	I	II	III	IV	V
Description	Very good rock	Good rock	Fair rock	Poor rock	Very poor rock

Table 19 from NCHRP Report 651:

Rock quality	**Constants**	**Rock type** A = Carbonate rocks with well developed crystal cleavage— *dolomite, limestone, and marble* B = Lithified argrillaceous rocks—*mudstone, siltstone, shale, and slate (normal to cleavage)* C = Arenaceous rocks with strong crystals and poorly developed crystal cleavage—*sandstone and quartzite* D = Fine grained polyminerallic igneous crystalline rocks— *andesite, dolerite, diabase, and rhyolite* E = Coarse-grained polymineralic igneous and metamorphic crystalline rocks—*amphibolite, gabbro, gneiss, granite, norite, quartz-diorite*				
		A	B	C	D	E
INTACT ROCK SAMPLES Laboratory size specimens free from discontinuities. CSIR rating: *RMR* = 100	m s	7.00 1.00	10.00 1.00	15.00 1.00	17.00 1.00	25.00 1.00
VERY GOOD QUALITY ROCK MASS Tightly interlocking undisturbed rock with unweathered joints at 3–10 ft. CSIR rating: *RMR* = 85	m s	2.40 0.082	3.43 0.082	5.14 0.082	5.82 0.082	8.567 0.082
GOOD QUALITY ROCK MASS Fresh to slightly weathered rock, slightly disturbed with joints at 3–10 ft. CSIR rating: *RMR* = 65	m s	0.575 0.00293	0.821 0.00293	1.231 0.00293	1.395 0.00293	2.052 0.00293
FAIR QUALITY ROCK MASS Several sets of moderately weathered joints spaced at 1–3 ft. CSIR rating: *RMR* = 44	m s	0.128 0.00009	0.183 0.00009	0.275 0.00009	0.311 0.00009	0.458 0.00009
POOR QUALITY ROCK MASS Numerous weathered joints at 2 to 12 in; some gouge. Clean compacted waste rock. CSIR rating: *RMR* = 23	m s	0.029 3×10^{-6}	0.041 3×10^{-6}	0.061 3×10^{-6}	0.069 3×10^{-6}	0.102 3×10^{-6}
VERY POOR QUALITY ROCK MASS Numerous heavily weathered joints spaced < 2 in with gouge. Waste rock with fines. CSIR rating: *RMR* = 3	m s	0.007 1×10^{-7}	0.010 1×10^{-7}	0.015 1×10^{-7}	0.017 1×10^{-7}	0.025 1×10^{-7}

Values of m and s from Hoek-Brown 1988:

$$\frac{m}{m_1} = e^{\left(\frac{RMR-100}{14}\right)} \quad \text{Equation 18}$$

m1 is the value of m for *intact* rock

$$s = e^{\left(\frac{RMR-100}{6}\right)} \quad \text{Equation 19}$$

Rock Quality	Rock Type	RMR	m_1	m	s
Fair	B	60	10.00	5.74E-01	1.27E-03

Strength Limit State Continued: Abutment 2

Determine s and m
Assume the rock type B

Table 17 from NCHRP Report 651:

RMR rating	100–81	80–61	60–41	40–21	<20
Class No.	I	II	III	IV	V
Description	Very good rock	Good rock	Fair rock	Poor rock	Very poor rock

Table 19 from NCHRP Report 651:

Rock quality	Constants	Rock type: A = Carbonate rocks with well developed crystal cleavage— *dolomite, limestone, and marble*	B = Lithified argrillaceous rocks—*mudstone, siltstone, shale, and slate (normal to cleavage)*	C = Arenaceous rocks with strong crystals and poorly developed crystal cleavage—*sandstone and quartzite*	D = Fine grained polymineralic igneous crystalline rocks— *andesite, dolerite, diabase, and rhyolite*	E = Coarse-grained polymineralic igneous and metamorphic crystalline rocks—*amphibolite, gabbro, gneiss, granite, norite, quartz-diorite*
		A	B	C	D	E
INTACT ROCK SAMPLES Laboratory size specimens free from discontinuities. CSIR rating: *RMR* = 100	m s	7.00 1.00	10.00 1.00	15.00 1.00	17.00 1.00	25.00 1.00
VERY GOOD QUALITY ROCK MASS Tightly interlocking undisturbed rock with unweathered joints at 3–10 ft. CSIR rating: *RMR* = 85	m s	2.40 0.082	3.43 0.082	5.14 0.082	5.82 0.082	8.567 0.082
GOOD QUALITY ROCK MASS Fresh to slightly weathered rock, slightly disturbed with joints at 3–10 ft. CSIR rating: *RMR* = 65	m s	0.575 0.00293	0.821 0.00293	1.231 0.00293	1.395 0.00293	2.052 0.00293
FAIR QUALITY ROCK MASS Several sets of moderately weathered joints spaced at 1–3 ft. CSIR rating: *RMR* = 44	m s	0.128 0.00009	0.183 0.00009	0.275 0.00009	0.311 0.00009	0.458 0.00009
POOR QUALITY ROCK MASS Numerous weathered joints at 2 to 12 in; some gouge. Clean compacted waste rock. CSIR rating: *RMR* = 23	m s	0.029 3×10^{-6}	0.041 3×10^{-6}	0.061 3×10^{-6}	0.069 3×10^{-6}	0.102 3×10^{-6}
VERY POOR QUALITY ROCK MASS Numerous heavily weathered joints spaced < 2 in with gouge. Waste rock with fines. CSIR rating: *RMR* = 3	m s	0.007 1×10^{-7}	0.010 1×10^{-7}	0.015 1×10^{-7}	0.017 1×10^{-7}	0.025 1×10^{-7}

Values of m and s from Hoek-Brown 1988:

$$\frac{m}{m_1} = e^{\left(\frac{RMR-100}{14}\right)}$$ Equation 18

m1 is the value of m for *intact* rock

$$s = e^{\left(\frac{RMR-100}{6}\right)}$$ Equation 19

Rock Quality	Rock Type	RMR	m_1	m	s
Poor	B	50	10.00	2.81E-01	2.40E-04

Strength Limit State Continued: Abutment 1

Semi-empirical method by Carter and Kulhawy 1988:

q_u =	21,752	psi	average of laboratory tests minus outlying highest and lowest values
m =	0.574		
s =	1.27E-03		
q_{ult} =	573.8	ksf	Equation 82b
ϕ =	0.45		from Table 10.5.5.2.2-1
q_R =	258.2	ksf	Equation 82b

Note: Value does not exceed the compressive strength of concrete 4000 psi (288 tsf).

Service Limit State

Based on Table C10.6.2.6.1-1 and engineering judgement[1] the service limit state for bearing resistance on weathered or broken rock is recommended at: 20 ksf for settlements of up to 0.5 in.

Table C10.6.2.6.1-1—Presumptive Bearing Resistance for Spread Footing Foundations at the Service Limit State Modified after U.S. Department of the Navy (1982)

Type of Bearing Material	Consistency in Place	Bearing Resistance (ksf) Ordinary Range	Bearing Resistance (ksf) Recommended Value of Use
Massive crystalline igneous and metamorphic rock: granite, diorite, basalt, gneiss, thoroughly cemented conglomerate (sound condition allows minor cracks)	Very hard, sound rock	120–200	160
Foliated metamorphic rock: slate, schist (sound condition allows minor cracks)	Hard sound rock	60–80	70
Sedimentary rock: hard cemented shales, siltstone, sandstone, limestone without cavities	Hard sound rock	30–50	40
Weathered or broken bedrock of any kind, except highly argillaceous rock (shale)	Medium hard rock	16–24	20
Compaction shale or other highly argillaceous rock in sound condition	Medium hard rock	16–24	20
Well-graded mixture of fine- and coarse-grained soil: glacial till, hardpan, boulder clay (GW-GC, GC, SC)	Very dense	16–24	20
Gravel, gravel-sand mixture, boulder-gravel mixtures (GW, GP, SW, SP)	Very dense Medium dense to dense Loose	12–20 8–14 4–12	14 10 6
Coarse to medium sand, and with little gravel (SW, SP)	Very dense Medium dense to dense Loose	8–12 4–8 2–6	8 6 3
Fine to medium sand, silty or clayey medium to coarse sand (SW, SM, SC)	Very dense Medium dense to dense Loose	6–10 4–8 2–4	6 5 3
Fine sand, silty or clayey medium to fine sand (SP, SM, SC)	Very dense Medium dense to dense Loose	6–10 4–8 2–4	6 5 3
Homogeneous inorganic clay, sandy or silty clay (CL, CH)	Very dense Medium dense to dense Loose	6–12 2–6 1–2	8 4 1
Inorganic silt, sandy or clayey silt, varved silt-clay-fine sand (ML, MH)	Very stiff to hard Medium stiff to stiff Soft	4–8 2–6 1–2	6 3 1

Extreme Event Limit State

From the Strength Limit State calculations, the nominal bearing resistance is the following:

q_{ult} = 573.8 ksf

Using a resistance factor of 0.8 from Section 11.5.8, the factored bearing resistance is the following:

q_R = 459.0 ksf

Strength Limit State Continued

Semi-empirical method by Carter and Kulhawy 1988:

q_u =	5,778	psi	average of laboratory tests minus outlying highest and lowest values
m =	0.281		
s =	2.40E-04		
q_{ult} =	69.3	ksf	Equation 82b
ϕ =	0.45		from Table 10.5.5.2.2-1
q_R =	31.2	ksf	Equation 82b

Note: Value does not exceed the compressive strength of concrete 4000 psi (288 tsf).

Service Limit State

Based on Table C10.6.2.6.1-1 and engineering judgement[1] the service limit state for bearing resistance on weathered or broken rock is recommended at: 20 ksf for settlements of up to 1.0 in.

Table C10.6.2.6.1-1—Presumptive Bearing Resistance for Spread Footing Foundations at the Service Limit State Modified after U.S. Department of the Navy (1982)

Type of Bearing Material	Consistency in Place	Bearing Resistance (ksf) Ordinary Range	Bearing Resistance (ksf) Recommended Value of Use
Massive crystalline igneous and metamorphic rock: granite, diorite, basalt, gneiss, thoroughly cemented conglomerate (sound condition allows minor cracks)	Very hard, sound rock	120–200	160
Foliated metamorphic rock: slate, schist (sound condition allows minor cracks)	Hard sound rock	60–80	70
Sedimentary rock: hard cemented shales, siltstone, sandstone, limestone without cavities	Hard sound rock	30–50	40
Weathered or broken bedrock of any kind, except highly argillaceous rock (shale)	Medium hard rock	16–24	20
Compaction shale or other highly argillaceous rock in sound condition	Medium hard rock	16–24	20
Well-graded mixture of fine- and coarse-grained soil: glacial till, hardpan, boulder clay (GW-GC, GC, SC)	Very dense	16–24	20
Gravel, gravel-sand mixture, boulder-gravel mixtures (GW, GP, SW, SP)	Very dense Medium dense to dense Loose	12–20 8–14 4–12	14 10 6
Coarse to medium sand, and with little gravel (SW, SP)	Very dense Medium dense to dense Loose	8–12 4–8 2–6	8 6 3
Fine to medium sand, silty or clayey medium to coarse sand (SW, SM, SC)	Very dense Medium dense to dense Loose	6–10 4–8 2–4	6 5 3
Fine sand, silty or clayey medium to fine sand (SP, SM, SC)	Very dense Medium dense to dense Loose	6–10 4–8 2–4	6 5 3
Homogeneous inorganic clay, sandy or silty clay (CL, CH)	Very dense Medium dense to dense Loose	6–12 2–6 1–2	8 4 1
Inorganic silt, sandy or clayey silt, varved silt-clay-fine sand (ML, MH)	Very stiff to hard Medium stiff to stiff Soft	4–8 2–6 1–2	6 3 1

[1]: Due to the highly fractured nature of the bedrock it is our judgment that the bearing resistance will behave in a manner more similar to that of gravel.

Extreme Event Limit State

From the Strength Limit State calculations, the nominal bearing resistance is the following:

q_{ult} = 69.3 ksf

Using a resistance factor of 0.8 from Section 11.5.8, the factored bearing resistance is the following:

q_R = 55.5 ksf

CONCLUSIONS AND RECOMMENDATIONS

Use calculated Abutment 2 bearing resistances for design of both Abutment 1 and Abutment 2 footings.

Strength Limit State

The recommended factored bearing resistance for the strength limit state is 31 ksf

Service Limit State

The recommended presumptive value for broken bedrock is 20 ksf for the service limit state for a settlement up to 1.0 in.

Extreme Event Limit State

The recommended factored bearing resistance for the extreme event limit state is 55 ksf

Sliding Resistance

HALEY ALDRICH	CALCULATIONS	File No.	132076-007
		Sheet	1 of 2
Client	Maine Department of Transportation	Date	9-Apr-21
Project	Levenseller Road Bridge over I-395/Route 9 Connector - Win 18915.00	Computed by	JAD
Subject	Sliding Resistance for Footing on Bedrock	Checked by	BCS

PROBLEM STATEMENT AND OBJECTIVE

Determine the coefficient of friction between the footing and bedrock, resistance factor for sliding for the Strength Limit State, and resistance factor for sliding for the Extreme Event Limit State for the footing on bedrock, assuming the bedrock surface is prepared in-the-dry

EXECUTIVE SUMMARY

The coefficient of friction between the footing and bedrock is = **0.7**
The resistance factor for sliding at the Strength Limit State is = **0.8**
The resistance factor for sliding at the Extreme Event Limit State is = **0.9**

REFERENCES

1. AASHTO LRFD Bridge Design Specifications, 9th edition, 2020
2. Maine DOT Bridge Design Guide, August 2003, with interim revisions through March 2014

AVAILABLE INFORMATION

1. Haley & Aldrich test borings BB-ELER-101 and BB-ELER-102 and BB-ELER-201 through BB-ELER-206A.

ASSUMPTIONS

1. Abutment footing will bear on intact PHYLLITEor SILTSTONE bedrock.

CALCULATIONS

Coefficient of Friction Between Concrete and Bedrock

Nominal sliding resistance between the cast-in-place concrete footing and bedrock is dependent on the coefficient of friction (tanδ) at the interface between the footing and bedrock.

Estimated footing-rock interface friction angle (δ):

35 deg., friction angle for mass concrete on clean sound rock (AASHTO LRFD Table 3.11.5.3-1)

Recommended δ = 35 deg., friction angle between footing/seal and bedrock
Recommended tanδ = 0.7 coefficient of friction

Resistance Factors

Service Limit State

AASHTO LRFD does not prescribe a sliding resistance factor for shallow foundations on bedrock.
For retaining walls, AASHTO LRFD prescribes a sliding resistance factor of = **1.0** (Section 11.5.7).

Strength Limit State

AASHTO LRFD does not prescribe a sliding resistance factor for shallow foundations on bedrock.
For cast-in-place concrete on sand, the sliding resistance factor is = **0.8** (Table 10.5.5.2.2-1)

Extreme Event Limit State

Section 10.5.5.3.3 of AASHTO LRFD prescribes a resistance factor of **0.9** for the design of foundations in the Extreme Event Limit State.

Table C3.11.5.3-1—Friction Angle for Dissimilar Materials (U.S. Department of the Navy, 1982a)

Interface Materials	Friction Angle, δ (degrees)	Coefficient of Friction, tan δ (dim.)
Mass concrete on the following foundation materials:		
• Clean sound rock	35	0.70
• Clean gravel, gravel-sand mixtures, coarse sand	29 to 31	0.55 to 0.60
• Clean fine to medium sand, silty medium to coarse sand, silty or clayey gravel	24 to 29	0.45 to 0.55
• Clean fine sand, silty or clayey fine to medium sand	19 to 24	0.34 to 0.45
• Fine sandy silt, nonplastic silt	17 to 19	0.31 to 0.34
• Very stiff and hard residual or preconsolidated clay	22 to 26	0.40 to 0.49
• Medium stiff and stiff clay and silty clay	17 to 19	0.31 to 0.34
Masonry on foundation materials has same friction factors.		
Steel sheet piles against the following soils:		
• Clean gravel, gravel-sand mixtures, well-graded rock fill with spalls	22	0.40
• Clean sand, silty sand-gravel mixture, single-size hard rock fill	17	0.31
• Silty sand, gravel or sand mixed with silt or clay	14	0.25
• Fine sandy silt, nonplastic silt	11	0.19
Formed or precast concrete or concrete sheet piling against the following soils:		
• Clean gravel, gravel-sand mixture, well-graded rock fill with spalls	22 to 26	0.40 to 0.49
• Clean sand, silty sand-gravel mixture, single-size hard rock fill	17 to 22	0.31 to 0.40
• Silty sand, gravel or sand mixed with silt or clay	17	0.31
• Fine sandy silt, nonplastic silt	14	0.25
Various structural materials:		
• Masonry on masonry, igneous and metamorphic rocks:		
○ dressed soft rock on dressed soft rock	35	0.70
○ dressed hard rock on dressed soft rock	33	0.65
○ dressed hard rock on dressed hard rock	29	0.55
• Masonry on wood in direction of cross grain	26	0.49
• Steel on steel at sheet pile interlocks	17	0.31

3.11.5.4—Passive Lateral Earth Pressure Coefficient, k_p

For noncohesive soils, values of the coefficient of passive lateral earth pressure may be taken from Figure 3.11.5.4-1 for the case of a sloping or vertical wall with a horizontal backfill or from Figure 3.11.5.4-2 for the case of a vertical wall and sloping backfill. For conditions that deviate from those described in Figures 3.11.5.4-1 and 3.11.5.4-2, the passive pressure may be calculated by using a trial procedure based on wedge theory, e.g., see Terzaghi et al. (1996). When wedge theory is used, the limiting value of the wall friction angle should not be taken larger than one-half the angle of internal friction, ϕ_f.

For cohesive soils, passive pressures may be estimated by:

C3.11.5.4

The movement required to mobilize passive pressure is approximately 10.0 times as large as the movement needed to induce earth pressure to the active values. The movement required to mobilize full passive pressure in loose sand is approximately five percent of the height of the face on which the passive pressure acts. For dense sand, the movement required to mobilize full passive pressure is smaller than five percent of the height of the face on which the passive pressure acts, and five percent represents a conservative estimate of the movement required to mobilize the full passive pressure. For poorly compacted cohesive soils, the movement required to mobilize full passive pressure is larger than five percent of the height of the face on which the pressure acts.

Lateral Earth Pressures

HALEY ALDRICH	CALCULATIONS	File No.	132076-007
		Sheet	1 of 3
Client	Maine Department of Transportation	Date	9-Apr-21
Project	Levenseller Road Bridge over I-395/Route 9 Connector - WIN 18915.00	Computed by	JAD
Subject	Lateral Earth Pressure Coefficients for Abutment No. 1 and Wingwalls	Checked by	BWC

Objective

-Calculate the active, at-rest, and passive lateral earth pressure coefficients to design the proposed Abutment No. 1 and wingwalls

Assumptions

-Due to sloping backfill conditions at the abutments, calculate different lateral earth pressure coefficients for each proposed abutment and wingwalls

-Abutments and wingwalls and their footings are backfilled with Granular Borrow based on H&A recomendations.

-Free draining retaining wall, no hydrostatic pressure.

References

1. AASHTO LRFD Bridge Design Specifications, 9th edition, 2020
2. Maine DOT Bridge Design Guide, August 2003, with interim revisions through March 2014

EARTH PRESSURE COEFFICIENTS FOR PROPOSED ABUTMENT NO. 1

Soil Properties and Geometry

designates input cell

Total Unit Weight, ϒ (pcf) =	125	pcf	Soil Type 4, BDG Table 3-3
Effective Friction Angle, ϕ' =	32	degrees	Soil Type 4, BDG Table 3-3
Backslope Angle, β =	-0.7	degrees	Preliminary bridge profile indicates -1.29% bridge grade
Backface of Wall Angle to Horizontal, ϴ =	90	degrees	
Soil and Wall Friction Angle, δ =	24	degrees	Soil Type 4, BDG Table 3-3

Static Active Lateral Earth Pressure Coefficient, K_a

$K_a = \sin^2(\Theta+\phi')/r(\sin^2\Theta\sin(\Theta-\delta))$ AASHTO LRFD Eq. 3.11.5.3-1

where $r = [1 + \sqrt{(\sin(\phi+\delta)\sin(\phi-\beta)/(\sin(\Theta-\delta)\sin(\Theta+\beta))}]^2$ AASHTO LRFD Eq. 3.11.5.3-2

K_a = 0.27

At-Rest Lateral Earth Pressure Coefficient, K_o

$K_0 = 1-\sin\phi$ AASHTO LRFD Eq. 3.11.5.2-1

K_o = 0.47

Passive Lateral Earth Pressure Coefficient, K_p

Rankine Theory

If the ratio of lateral abutment movement to **abutment height (y/H) is less than 0.005**, we recommend using Rankine theory to calculate the passive lateral earth pressure coefficient

$K_{p,Rankine} = \tan(45 + \phi'/2)^2$

$K_{p,Rankine}$ = 3.25 Das, Principles of Geotechnical Engineering, 7th Ed., Eq. 13.22

Coulomb Theory

If the ratio of lateral abutment movement to **abutment height (y/H) is greater than 0.005**, we recommend using Rankine theory to calculate the passive lateral earth pressure coefficient

$K_p = \sin^2(\Theta-\phi')/r(\sin^2\Theta\sin(\Theta+\delta))$ BDG Section 3.6.6

where $r = [1 - \sqrt{(\sin(\phi+\delta)\sin(\phi+\beta)/(\sin(\Theta+\delta)\sin(\Theta+\beta))}]^2$ BDG Section 3.6.6

$K_{p,Coulomb}$ = 8.02

HALEY ALDRICH	CALCULATIONS	File No.	132076-007
		Sheet	2 of 3
Client	Maine Department of Transportation	Date	9-Apr-21
Project	Levenseller Road Bridge over I-395/Route 9 Connector - WIN 18915.00	Computed by	JAD
Subject	Lateral Earth Pressure Coefficients for Abutment No. 2 and Wingwalls	Checked by	BWC

Objective

-Calculate the active, at-rest, and passive lateral earth pressure coefficients to design the proposed Abutment No. 2 and wingwalls

Assumptions

-Due to sloping backfill conditions at the abutments, calculate different lateral earth pressure coefficients for each proposed abutment and wingwalls

-Abutments and wingwalls and their footings are backfilled with Granular Borrow based on H&A recomendations.

-Free draining retaining wall, no hydrostatic pressure.

References

1. AASHTO LRFD Bridge Design Specifications, 9th edition, 2020
2. Maine DOT Bridge Design Guide, August 2003, with interim revisions through March 2014

EARTH PRESSURE COEFFICIENTS FOR PROPOSED ABUTMENT NO. 2

Soil Properties and Geometry

designates input cell

Total Unit Weight, ϒ (pcf) =	125	pcf	Soil Type 4, BDG Table 3-3
Effective Friction Angle, ϕ' =	32	degrees	Soil Type 4, BDG Table 3-3
Backslope Angle, β =	0.7	degrees	Preliminary bridge profile indicates 1.29% bridge grade
Backface of Wall Angle to Horizontal, ϴ =	90	degrees	
Soil and Wall Friction Angle, δ =	24	degrees	Soil Type 4, BDG Table 3-3

Static Active Lateral Earth Pressure Coefficient, K_a

$K_a = \sin^2(\theta+\phi')/r(\sin^2\theta\sin(\theta-\delta))$ AASHTO LRFD Eq. 3.11.5.3-1

where $r = [1 + \sqrt{(\sin(\phi+\delta)\sin(\phi-\beta)/(\sin(\theta-\delta)\sin(\theta+\beta))}]^2$ AASHTO LRFD Eq. 3.11.5.3-2

K_a = 0.28

At-Rest Lateral Earth Pressure Coefficient, K_o

$K_0 = 1-\sin\phi$ AASHTO LRFD Eq. 3.11.5.2-1

K_o = 0.47

Passive Lateral Earth Pressure Coefficient, K_p

Rankine Theory

If the ratio of lateral abutment movement to **abutment height (y/H) is less than 0.005**, we recommend using Rankine theory to calculate the passive lateral earth pressure coefficient

$K_{p,Rankine}$ = tan (45 + ϕ'/2)^2

$K_{p,Rankine}$ = 3.25 Das, Principles of Geotechnical Engineering, 7th Ed., Eq. 13.22

Coulomb Theory

If the ratio of lateral abutment movement to **abutment height (y/H) is greater than 0.005**, we recommend using Rankine theory to calculate the passive lateral earth pressure coefficient

$K_p = \sin^2(\theta-\phi')/r(\sin^2\theta\sin(\theta+\delta))$ BDG Section 3.6.6

where $r = [1 - \sqrt{(\sin(\phi+\delta)\sin(\phi+\beta)/(\sin(\theta+\delta)\sin(\theta+\beta))}]^2$ BDG Section 3.6.6

$K_{p,Coulomb}$ = 8.76

HALEY ALDRICH	CALCULATIONS	File No.	130732-007
		Sheet	1 of 1
Client	Maine Department of Transportation	Date	9-Apr-21
Project	Levenseller Road Bridge over I-395/Route 9 Connector - WIN 18915.00	Computed by	BWC
Subject	Rankine Active Earth Pressure Coefficient Ka	Checked by	BCS

Friction Angle= 32

Slope Behind Wall, β (deg)	K_a
0	0.307
1	0.307
2	0.308
3	0.308
4	0.309
5	0.311
6	0.312
7	0.314
8	0.316
9	0.318
10	0.321
11	0.324
12	0.328
13	0.331
14	0.336
15	0.341
16	0.346
17	0.352
18	0.358
19	0.366
20	0.374
21	0.383
22	0.393
23	0.405
24	0.418
25	0.434
26	0.451
27	0.473
28	0.498
29	0.531
30	0.574
31	0.639
32	0.848

ABUTMENT 1 AND 2 BREASTWALLS

ABUTMENT 1 AND 2 WINGWALLS

TABLE 11-3
Rankine active earth pressure coefficients K_a using Eq. (11-7a)

β	ϕ = 26	28	30	32	34	36	38	40	42
0	0.3905	0.3610	0.3333	0.3073	0.2827	0.2596	0.2379	0.2174	0.1982
5	0.3959	0.3656	0.3372	0.3105	0.2855	0.2620	0.2399	0.2192	0.1997
10	0.4134	0.3802	0.3495	0.3210	0.2944	0.2696	0.2464	0.2247	0.2044
15	0.4480	0.4086	0.3729	0.3405	0.3108	0.2834	0.2581	0.2346	0.2129
20	0.5152	0.4605	0.4142	0.3739	0.3381	0.3060	0.2769	0.2504	0.2262
25	0.6999	0.5727	0.4936	0.4336	0.3847	0.3431	0.3070	0.2750	0.2465
30	—	—	0.8660	0.5741	0.4776	0.4105	0.3582	0.3151	0.2784
35	—	—	—	—	—	0.5971	0.4677	0.3906	0.3340
40	—	—	—	—	—	—	—	0.7660	0.4668

Since $\cos\beta$ is a permanent entry it is convenient to include it with K_a' of Eq. (11-7) or K_p' of Eq. (11-8), giving, e.g.,

$$K_a = \cos\beta \frac{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}} \qquad (11\text{-}7a)$$

Seismic Site Class and
Design Parameters

PROBLEM STATEMENT & OBJECTIVE

Determine the Seismic Site Class using SPT N-values and assumed S_u values from test borings drilled approximately near the proposed substructures.

EXECUTIVE SUMMARY

Based on the subsurface conditions encountered at the ten test borings near the proposed substructures (BB-ELER-101, BB-ELER-102, BB-ELER-201 through BB-ELER-206A, HB-BE-235 and HB-BE-236), recommend a **Seismic Site Class C**.

REFERENCES

1. AASHTO LRFD Bridge Design Specifications, 9th edition, 2020
2. Maine DOT Bridge Design Guide, August 2003

AVAILABLE INFORMATION

1. Boring logs dated 23 to 24 July 2018 drilled by Northern Test Boring, Inc. (monitored by Haley & Aldrich, Inc.).
2. Boring logs dated November and December 2020 drilled by New England Boring Contractors. (monitored by Haley & Aldrich, Inc.).
3. Elevations reference the North American Vertical Datum of 1988 (NAVD 88).

ASSUMPTIONS

1. Where SPT N-value was available to depths less than 100 ft, the subsurface profile was extended to 100 ft. The SPT N-values for the extended profile were then assumed based on the available information.
2. WOH/WOR = SPT N-value of 1.

PROCEDURE

1. Check the site against the three categories of Site Class F (see attached Table 3.10.3.1-1), requiring site-specific ground motion response evaluation. If the site corresponds to any of these categories, classify the site as Site Class F and conduct a site-specific ground motion response evaluation.
2. Categorize the site using one of the following three methods (Method A, B, or C).

Method A
Average shear wave velocity for the upper 100 ft of the soil profile:

$$\overline{V_s} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{V_{si}}}$$

where

V_{si} = shear wave velocity of *i* th soil (ft/s).
d_i = thickness of *i* th soil layer (ft).
n = total number of distinctive soil layers in the upper 100 ft of the site profile.
i = any one of the layers between 1 and n.

PROCEDURE

Method B
Average standard penetration test (SPT) for the upper 100 ft of the soil profile:

$$\bar{N} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}}$$

where

N_i = standard penetration resistance as measured directly in the field, uncorrected blow count, of *i* th soil layer not to exceed 100 ft (blows/ft).
d_i = thickness of *i* th soil layer (ft).
n = total number of distinctive soil layers in the upper 100 ft of the site profile.
i = any one of the layers between 1 and n.

Method C
Average standard penetration test (SPT) for the cohesionless layers in the upper 100 ft of the soil profile:

$$\bar{N}_{ch} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

where

N_i = standard penetration resistance as measured directly in the field, uncorrected blow count, of *i* th cohesionless soil layer (blows/ft).
d_i = thickness of *i* th cohesionless soil layer (ft).
m = total number of distinctive cohesionless soil layers in the upper 100 ft of the site profile.
i = any one of the layers between 1 and m.

Average undrained shear strength for the cohesive layers in the upper 100 ft of the soil profile:

$$\bar{s}_u = \frac{\sum_{i=1}^{k} d_i}{\sum_{i=1}^{k} \frac{d_i}{s_{ui}}}$$

where

s_{ui} = undrained shear strength of *i* th cohesive soil layer (psf), not to exceed 5000 psf
d_i = thickness of *i* th cohesive soil layer (ft).
k = total number of distinctive cohesive soil layers in the upper 100 ft of the site profile.
i = any one of the layers between 1 and k.

Based on the available information, Method A/B/C will be used for the seismic Site Class evaluation.

SITE CLASS DEFINITIONS

(Table from AASHTO LRFD Bridge Design Specifications, 9th edition, 2020.

Table 3.10.3.1-1—Site Class Definitions

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s > 5{,}000$ ft/s
B	Rock with 2,500 ft/sec < $\bar{v}_s$ < 5,000 ft/s
C	Very dense soil and soil rock with 1,200 ft/sec < $\bar{v}_s$ < 2,500 ft/s, or with either $\bar{N}$ > 50 blows/ft, or $\bar{s}_u$ > 2.0 ksf
D	Stiff soil with 600 ft/s < $\bar{v}_s$ < 1,200 ft/s, or with either 15 < $\bar{N}$ < 50 blows/ft, or 1.0 < $\bar{s}_u$ < 2.0 ksf
E	Soil profile with $\bar{v}_s$ < 600 ft/s or with either $\bar{N}$ < 15 blows/ft or $\bar{s}_u$ < 1.0 ksf, or any profile with more than 10.0 ft of soft clay defined as soil with $PI > 20$, $w > 40$ percent and $\bar{s}_u$ < 0.5 ksf
F	Soils requiring site-specific evaluations, such as: • Peats or highly organic clays ($H > 10.0$ ft of peat or highly organic clay where H = thickness of soil) • Very high plasticity clays ($H > 25.0$ ft with $PI > 75$) • Very thick soft/medium stiff clays (H >120 ft)

Exceptions: Where the soil properties are not known in sufficient detail to determine the site class, a site investigation shall be undertaken sufficient to determine the site class. Site classes E or F should not be assumed unless the authority having jurisdiction determines that site classes E or F could be present at the site or in the event that site classes E or F are established by geotechnical data.

where:

$\bar{v}_s$ = average shear wave velocity for the upper 100 ft of the soil profile

$\bar{N}$ = average Standard Penetration Test (SPT) blow count (blows/ft) (ASTM D1586) for the upper 100 ft of the soil profile

$\bar{s}_u$ = average undrained shear strength in ksf (ASTM D2166 or ASTM D2850) for the upper 100 ft of the soil profile

PI = plasticity index (ASTM D4318)

w = moisture content (ASTM D2216)

HALEY ALDRICH	CALCULATIONS	File No.	132076-007
		Sheet	4 of 8
Client	Maine Department of Transportation	Date	13-Nov-18
Project	Levenseller Road Bridge over I-395/Route 9 Connector - WIN No. 18915.00	Computed by	JAD
Subject	Seismic Site Class Evaluation	Checked by	BWC

CALCULATIONS - METHOD B

Exploration ID: BB-ELER-101
Ground Surface El.: 225

Sample Number	Depth (ft)	Elevation (ft)	Description	d (ft)	SPT N (blows/ft)	d/N
1D	1.0	224	SAND (Fill)	2.0	14	0.143
2D	3.0	222	SILT (Till)	2.0	7	0.286
3D	5.0	220	SILT (Till)	4.0	28	0.143
4D	10.6	214.4	SILT (Till)	6.4	50	0.128
R1-R3	5.2	219.8	BEDROCK	94.8	100	0.948
			Totals =	109.2		1.647

N-bar (blows/ft) = 66
Site Class = C

Exploration ID: BB-ELER-102
Ground Surface El.: 225.8

Sample Number	Depth (ft)	Elevation (ft)	Description	d (ft)	SPT N (blows/ft)	d/N
1D	1.3	224.5	SAND (Fill)	2.3	23	0.100
2D	3.3	222.5	Sa SILT (Till)	2.0	13	0.154
3D	5.3	220.5	SILT (Till)	3.9	14	0.279
4D	11.0	214.8	SILT (Till)	4.6	34	0.135
R1-R3	6.6	219.2	BEDROCK	93.4	100	0.934
			Totals =	106.2		1.602

N-bar (blows/ft) = 66
Site Class = C

HALEY ALDRICH	CALCULATIONS	File No.	132076-007
		Sheet	5 of 8
Client	Maine Department of Transportation	Date	12-Feb-21
Project	Levenseller Road Bridge over I-395/Route 9 Connector - WIN No. 18915.00	Computed by	JAD
Subject	Seismic Site Class Evaluation	Checked by	BWC

CALCULATIONS - METHOD B

Exploration ID: BB-ELER-201
Ground Surface El.: 222.7

Sample Number	Depth (ft)	Elevation (ft)	Description	d (ft)	SPT N (blows/ft)	d/N
1D	0.0	222.7	SILT (Glacial Till)	5.0	6	0.833
2D	5.0	217.7	SILT (Glacial Till)	5.0	37	0.135
3D	10.0	212.7	SILT (Glacial Till)	5.0	50	0.100
4D	15.0	207.7	SILT (Glacial Till)	5.0	100	
5D	20.0	202.7	GRAVEL (Glacial Till)	0.1	100	0.001
-	20.1	202.6	BEDROCK	79.9	100	0.799
			Totals =	100.0		1.868

N-bar (blows/ft) = 54
Site Class = C

Exploration ID: BB-ELER-202
Ground Surface El.: 225.1

Sample Number	Depth (ft)	Elevation (ft)	Description	d (ft)	SPT N (blows/ft)	d/N
1D	0.0	225.1	SAND (Fill)	2.5	62	0.040
2D	5.0	220.1	SILT (Glacial Till)	7.5	24	0.313
3D	10.0	215.1	SILT (Glacial Till)	5.0	57	0.088
4D	15.0	210.1	SILT (Glacial Till)	1.5	100	0.015
-	16.5	208.6	BEDROCK	83.5	100	0.835
			Totals =	100.0		1.291

N-bar (blows/ft) = 77
Site Class = C

CALCULATIONS - METHOD B

Exploration ID: BB-ELER-203
Ground Surface El.: 225.6

Sample Number	Depth (ft)	Elevation (ft)	Description	d (ft)	SPT N (blows/ft)	d/N
1D	0.0	225.6	SILT (Till)	5.0	6	0.833
2D	5.0	220.6	SILT (Glacial Till)	5.0	38	0.132
3D	10.0	215.6	SILT (Glacial Till)	5.0	40	0.125
4D	15.0	210.6	SILT (Glacial Till)	0.2	100	0.002
-	15.2	210.4	BEDROCK	84.8	100	0.848
			Totals =	100.0		1.940

N-bar (blows/ft) = 52
Site Class = C

Exploration ID: BB-ELER-204
Ground Surface El.: 223.2

Sample Number	Depth (ft)	Elevation (ft)	Description	d (ft)	SPT N (blows/ft)	d/N
1D	0.0	223.2	?	4.8	6	0.800
2D	5.0	218.2	SILT (Glacial Till)	3.4	27	0.126
-	8.2	215	BEDROCK	91.8	100	0.918
			Totals =	100.0		1.844

N-bar (blows/ft) = 54
Site Class = C

CALCULATIONS - METHOD B

Exploration ID: BB-ELER-205
Ground Surface El.: 225.9

Sample Number	Depth (ft)	Elevation (ft)	Description	d (ft)	SPT N (blows/ft)	d/N
1D	0.0	225.9	SAND (Fill)	2.5	27	0.093
2D	5.0	220.9	SILT (Glacial Till)	7.5	100	0.075
3D	10.0	215.9	SILT (Glacial Till)	4.5	45	0.100
-	14.5	211.4	BEDROCK	85.5	100	0.855
			Totals =	100.0		1.123

N-bar (blows/ft) = 89
Site Class = C

Exploration ID: BB-ELER-206
Ground Surface El.: 225.1

Sample Number	Depth (ft)	Elevation (ft)	Description	d (ft)	SPT N (blows/ft)	d/N
1D	0.0	225.1	SILT (Glacial Till)	3.5	4	0.875
2D	5.0	220.1	SILT (Glacial Till)	6.5	30	0.217
3D	10.0	215.1	SILT (Glacial Till)	0.4	100	0.004
-	10.4	214.7	BEDROCK	89.6	100	0.896
			Totals =	100.0		1.992

N-bar (blows/ft) = 50
Site Class = C

CALCULATIONS - METHOD B

Exploration ID: HB-BE-235
Ground Surface El.: 219.3

Sample Number	Depth (ft)	Elevation (ft)	Description	d (ft)	SPT N (blows/ft)	d/N
1D	0.0	219.3	SILT (Glacial Till)	5.0	6	0.833
2D	5.0	214.3	SILT (Glacial Till)	5.0	35	0.143
3D	10.0	209.3	SILT (Glacial Till)	2.8	42	0.067
-	12.8	206.5	BEDROCK	87.2	100	0.872
			Totals =	100.0		1.915

N-bar (blows/ft) = 52
Site Class = C

Exploration ID: HB-BE-236
Ground Surface El.: 228.5

Sample Number	Depth (ft)	Elevation (ft)	Description	d (ft)	SPT N (blows/ft)	d/N
1D	0.0	228.5	GRAVEL (Fill)	2.5	10	0.250
2D	5.0	223.5	SILT (Glacial Till)	7.5	48	0.156
3D	10.0	218.5	SILT (Glacial Till)	3.5	42	0.083
-	13.5	215	BEDROCK	86.5	100	0.865
			Totals =	100.0		1.355

N-bar (blows/ft) = 74
Site Class = C

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Kinematic Analyses

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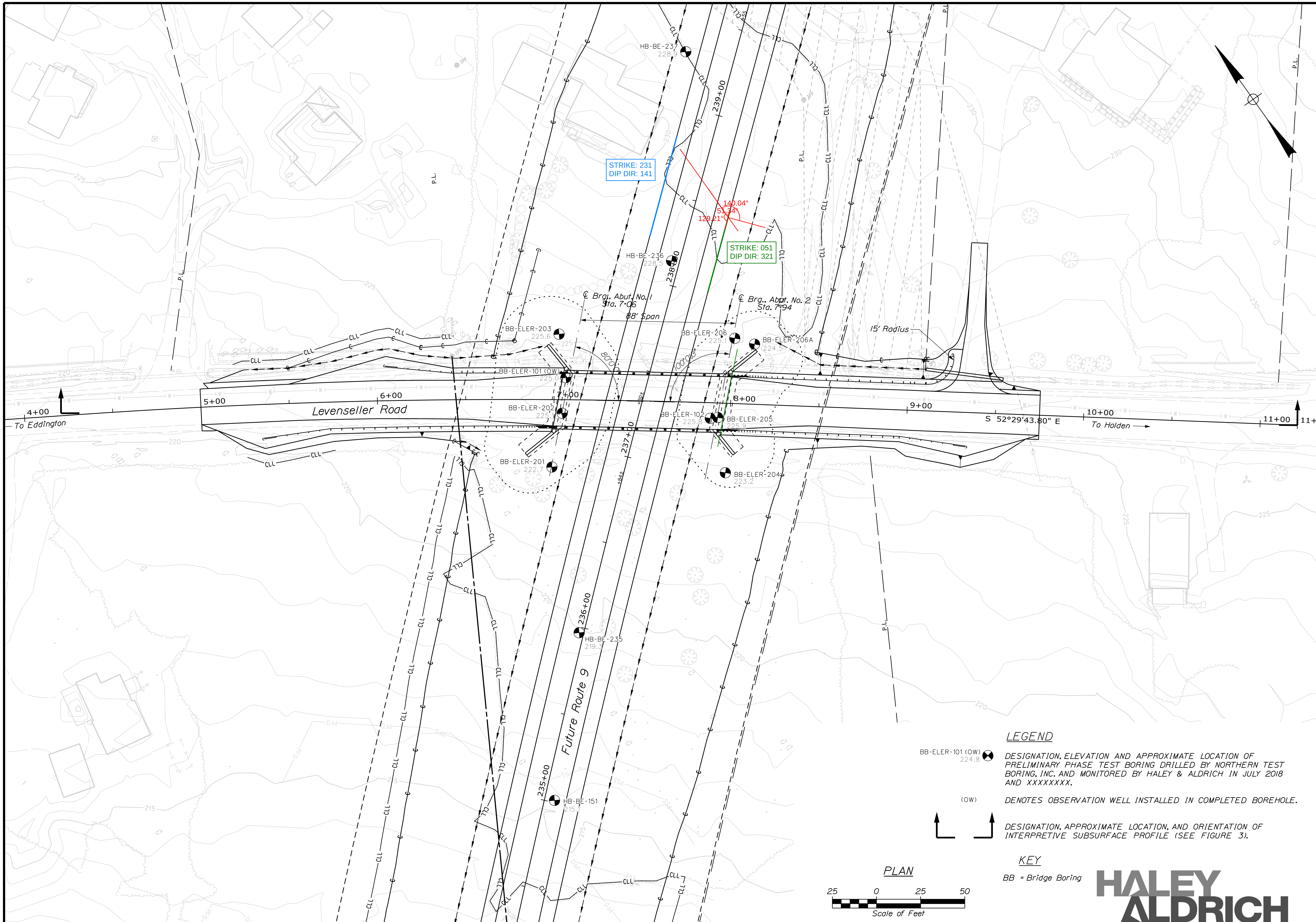
Division:

Username:

Date:3/19/2021



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

STP-1891(500)

WIN
018915.00

BRIDGE PLANS

BRIDGE NO.

SIGNATURE

P.E. NUMBER

DATE

	BY	DATE
PROJ. MANAGER	M. WIGHT	
DESIGN-DETAILED	E. FORCE	K. POST	3-31-20
CHECKED-REVIEWED	E. FORCE	W. CHAD	
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

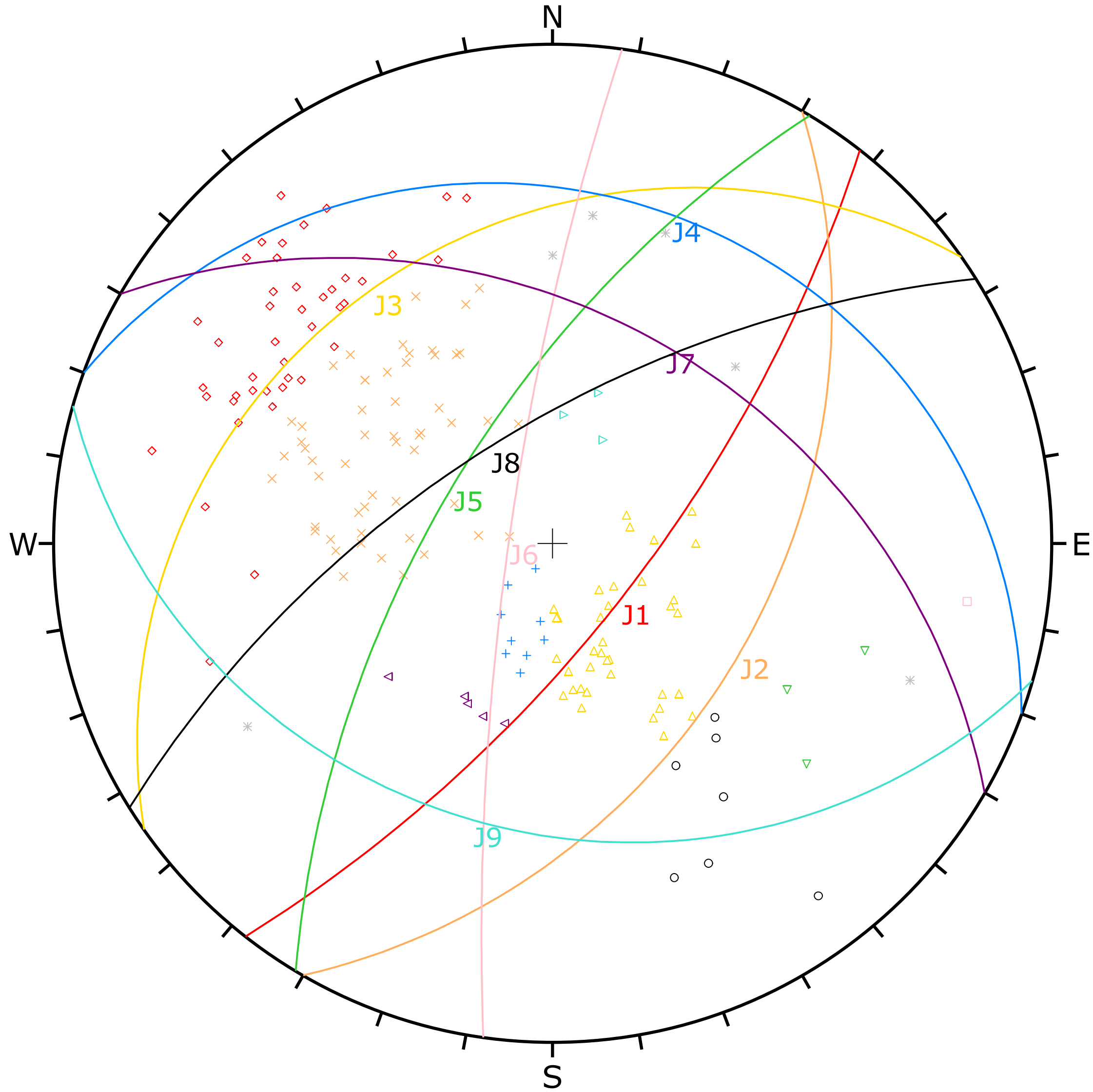
I-395 - ROUTE 9 CONNECTOR
ROUTE 9
BREWER-EDDINGTON PENOBSCOT COUNTY

SITE AND SUBSURFACE
EXPLORATION LOCATION PLAN

SHEET NUMBER

2

OF 3



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+	J4	9
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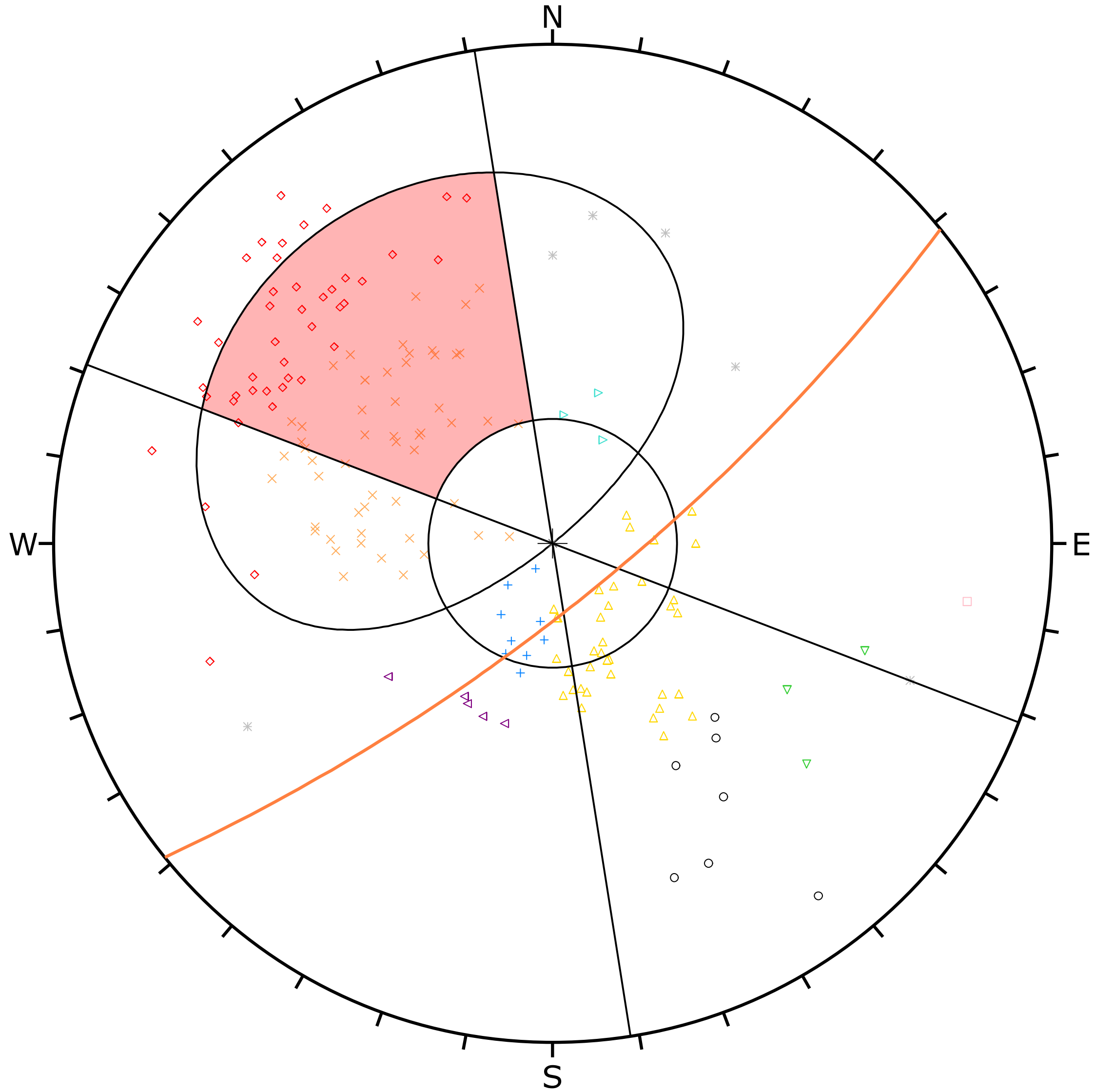
□	J6	1
◁	J7	5
○	J8	7
▷	J9	3
✳	U	6

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m	Red	70	128	J1
2m	Orange	43	120	J2
3m	Yellow	26	325	J3
4m	Blue	20	20	J4
5m	Green	64	301	J5
6m	Pink	80	278	J6
7m	Purple	41	30	J7
8m	Black	64	328	J8
9m	Turquoise	30	196	J9

Plot Mode	Pole Vectors
Vector Count	167 (167 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging (Approach Borings)		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	June 2021	*File Name*	2021-0513_Levenseller Approach borings.dips8

DIPS 8.002



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+	J4	9
▽	J5	3
□	J6	1
◁	J7	5
○	J8	7
▷	J9	3
*	U	6

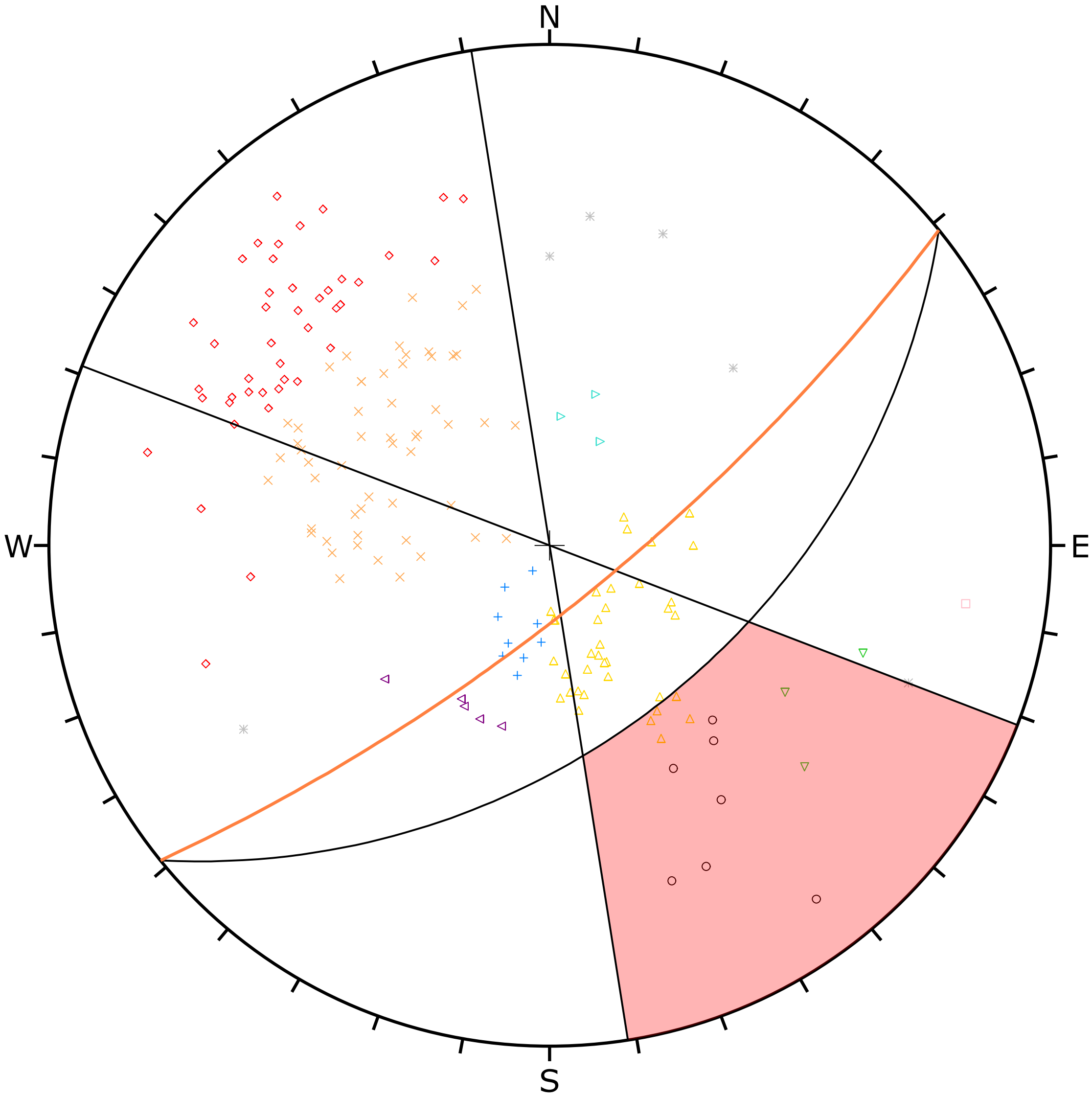
Kinematic Analysis	Planar Sliding
Slope Dip	76
Slope Dip Direction	141
Friction Angle	28°
Lateral Limits	30°

	Critical	Total	%
Planar Sliding (All)	61	167	36.53%
Planar Sliding (Set 1: J1)	29	43	67.44%
Planar Sliding (Set 2: J2)	32	54	59.26%

Plot Mode	Pole Vectors
Vector Count	167 (167 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector
Analysis Description	Levenseller Road BH Logging (Approach Borings) - Planar Sliding
Drawn By	J. Rawlins
Company	Haley & Aldrich, Inc.
Date	June 2021
File Name	2021-0513_Levenseller Approach borings.dips8

DIPS 8.002



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×	J2	54
△	J3	36
+	J4	9
▽	J5	3
□	J6	1
◁	J7	5
○	J8	7
▷	J9	3
✳	U	6

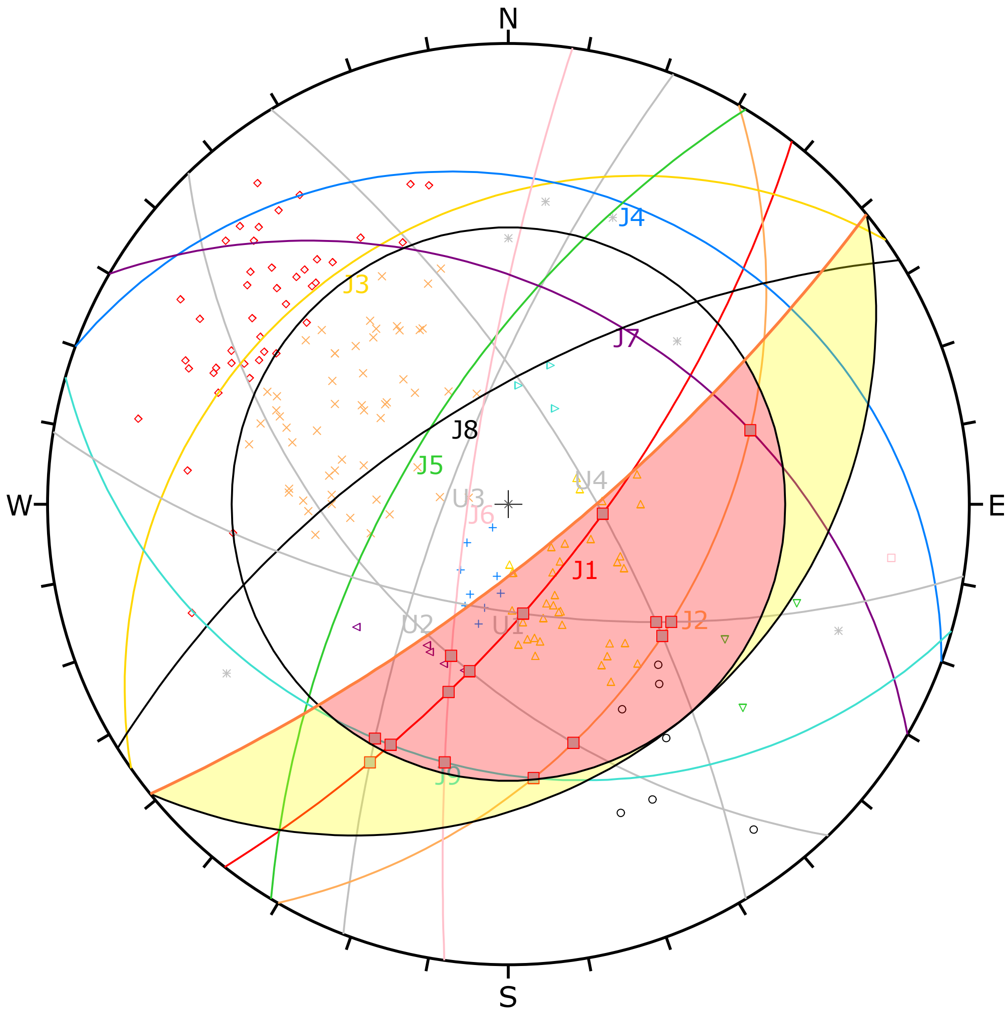
Kinematic Analysis	Flexural Toppling
Slope Dip	76
Slope Dip Direction	141
Friction Angle	28°
Lateral Limits	30°

	Critical	Total	%
Flexural Toppling (All)	15	167	8.98%
Flexural Toppling (Set 3: J3)	5	36	13.89%
Flexural Toppling (Set 5: J5)	2	3	66.67%
Flexural Toppling (Set 8: J8)	7	7	100.00%

Plot Mode	Pole Vectors
Vector Count	167 (167 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging (Approach Borings) - Toppling		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	June 2021	*File Name*	2021-0513_Levenseller Approach borings.dips8

DIPS 8.002



Symbol	FEATURE	Quantity
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×	J2	54
△	J3	36
+	J4	9
▽	J5	3
□	J6	1
◁	J7	5
○	J8	7
▷	J9	3
*	U	6
Symbol	**Feature**	
■	Critical Intersection	

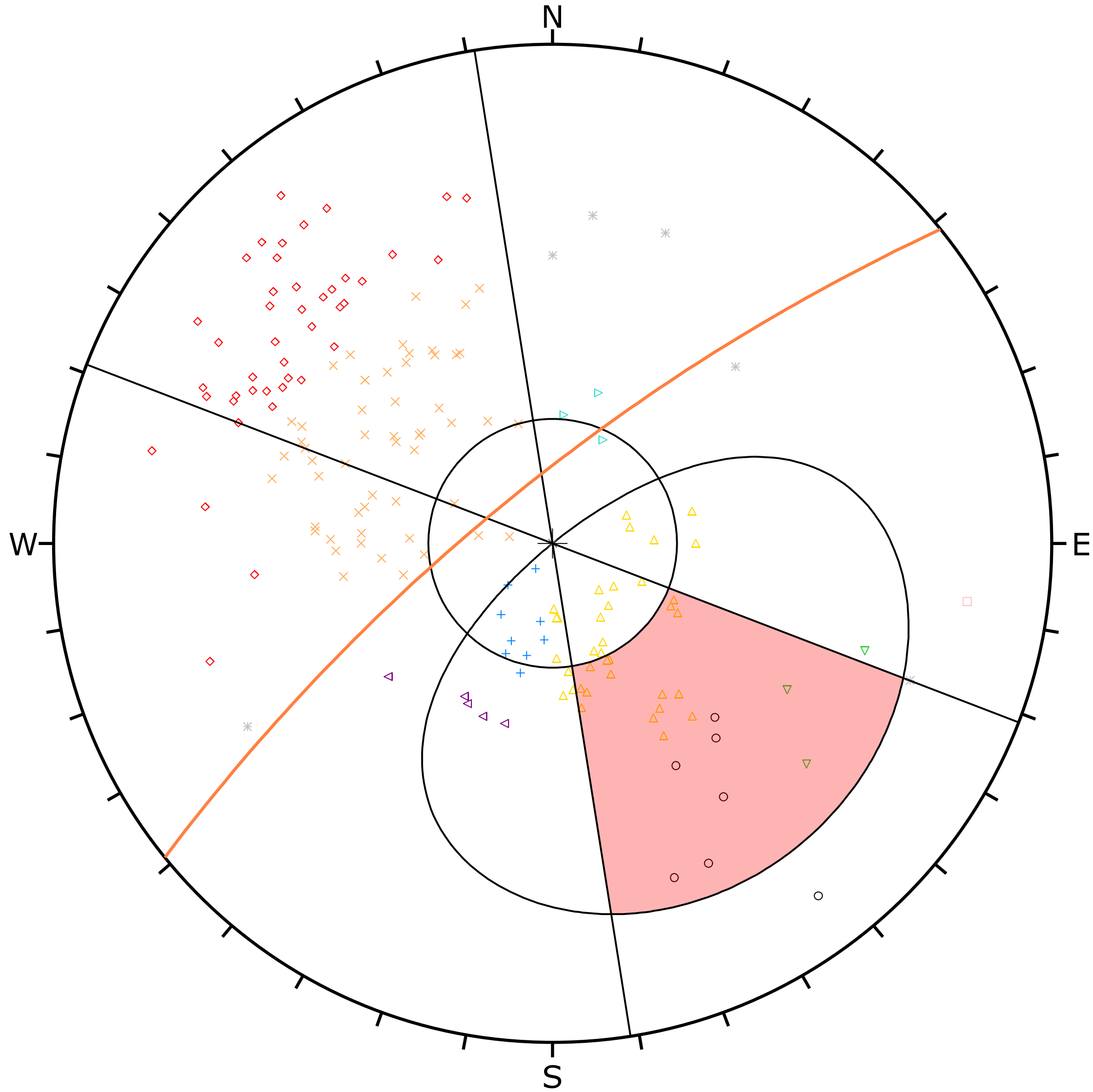
Kinematic Analysis	Wedge Sliding		
Slope Dip	76		
Slope Dip Direction	141		
Friction Angle	28°		
	Critical	Total	%
Wedge Sliding	15	78	19.23%

	Color	Dip	Dip Direction	Label
User Planes				
1	Grey	54	226	U2
2	Grey	75	291	U3
3	Grey	71	59	U4
Mean Set Planes				
1m	Red	70	128	J1
2m	Orange	43	120	J2
3m	Yellow	26	325	J3
4m	Blue	20	20	J4
5m	Green	64	301	J5
6m	Pink	80	278	J6
7m	Purple	41	30	J7
8m	Black	64	328	J8
9m	Turquoise	30	196	J9
10m	Grey	64	189	U1

Plot Mode	Pole Vectors
Vector Count	167 (167 Entries)
Intersection Mode	User and Mean Set Planes
Intersections Count	78
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector	
Analysis Description	Levenseller Road BH Logging (Approach Borings) - Wedge Sliding	
Drawn By	J. Rawlins	*Company* Haley & Aldrich, Inc.
Date	June 2021	*File Name* 2021-0517_Levenseller approach_wedge.dips8

DIPS 8.002



Symbol	FEATURE	Quantity
◇	J1	43
×	J2	54
△	J3	36
+	J4	9
▽	J5	3
□	J6	1
◁	J7	5
○	J8	7
▷	J9	3
✳	U	6

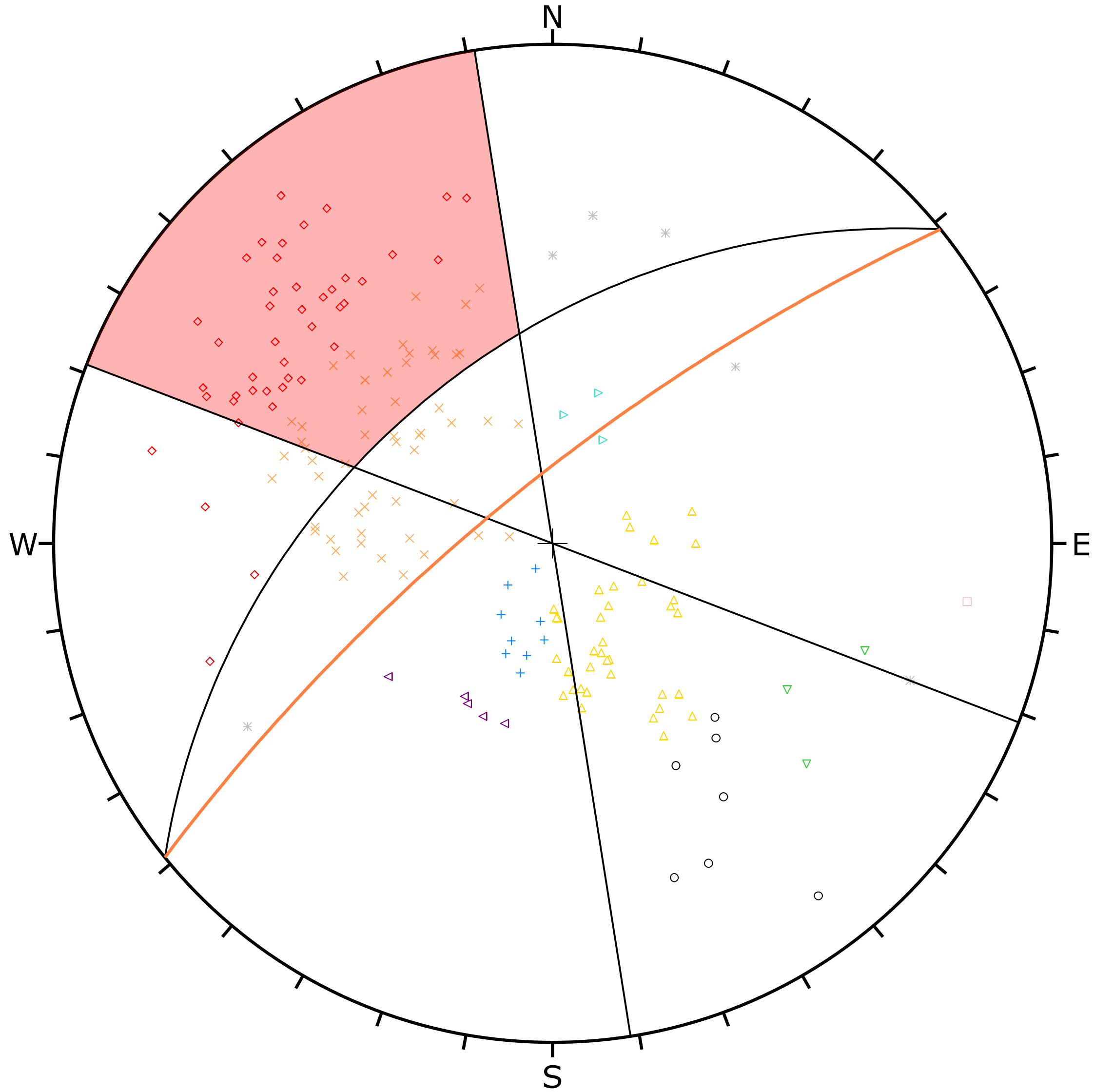
Kinematic Analysis	Planar Sliding
Slope Dip	76
Slope Dip Direction	321
Friction Angle	28°
Lateral Limits	30°

	Critical	Total	%
Planar Sliding (All)	24	167	14.37%
Planar Sliding (Set 3: J3)	16	36	44.44%
Planar Sliding (Set 5: J5)	2	3	66.67%
Planar Sliding (Set 8: J8)	6	7	85.71%

Plot Mode	Pole Vectors
Vector Count	167 (167 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector	
Analysis Description	Levenseller Road BH Logging (Approach Borings) - Planar Sliding	
Drawn By	J. Rawlins	*Company* Haley & Aldrich, Inc.
Date	June 2021	*File Name* 2021-0513_Levenseller Approach borings.dips8

DIPS 8.002



Symbol	FEATURE	Quantity
◇	J1	43
×	J2	54
△	J3	36
+	J4	9
▽	J5	3
□	J6	1
◁	J7	5
○	J8	7
▷	J9	3
✳	U	6

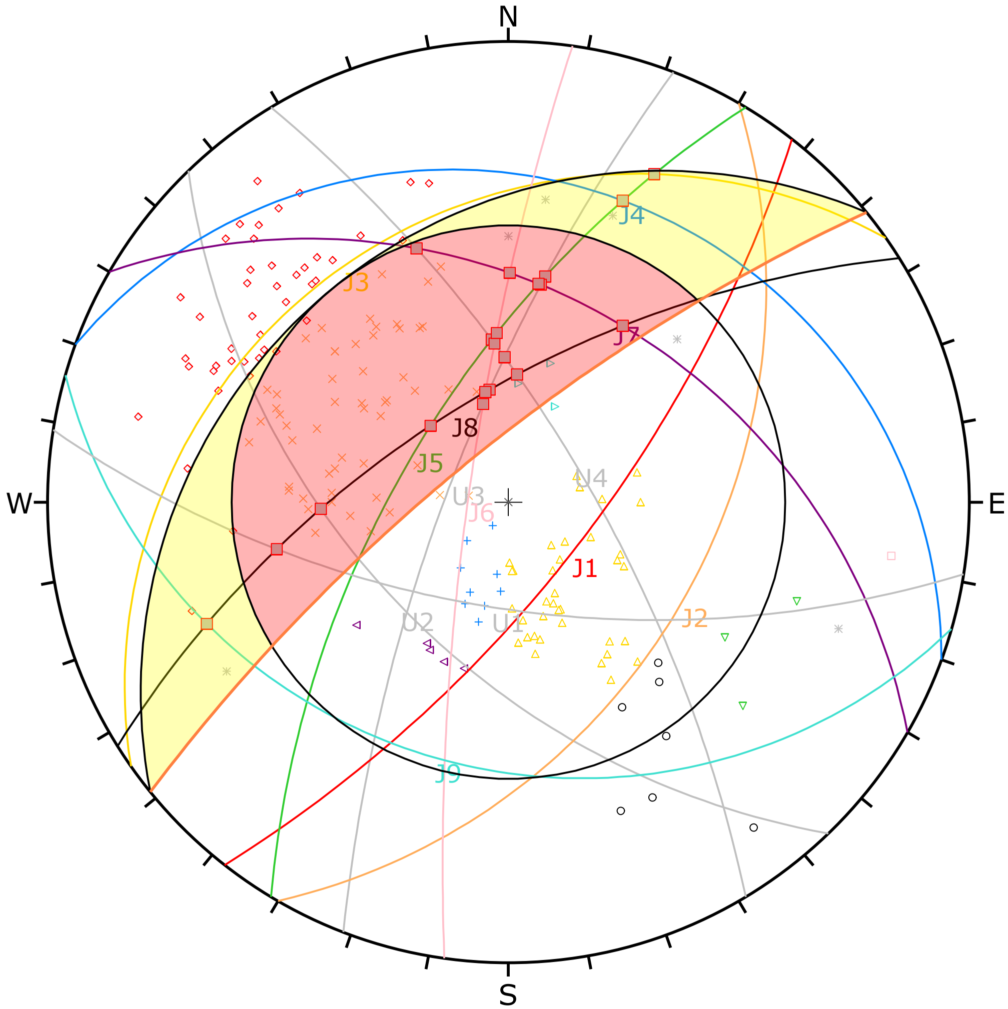
Kinematic Analysis	Flexural Toppling
Slope Dip	76
Slope Dip Direction	321
Friction Angle	28°
Lateral Limits	30°

	Critical	Total	%
Flexural Toppling (All)	62	167	37.13%
Flexural Toppling (Set 1: J1)	39	43	90.70%
Flexural Toppling (Set 2: J2)	23	54	42.59%

Plot Mode	Pole Vectors
Vector Count	167 (167 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging (Approach Borings) - Toppling		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	June 2021	*File Name*	2021-0513_Levenseller Approach borings.dips8

DIPS 8.002



Symbol	FEATURE	Quantity
◇	J1	43
×	J2	54
△	J3	36
+	J4	9
▽	J5	3
□	J6	1
◁	J7	5
○	J8	7
▷	J9	3
✳	U	6
Symbol	**Feature**	
■	Critical Intersection	

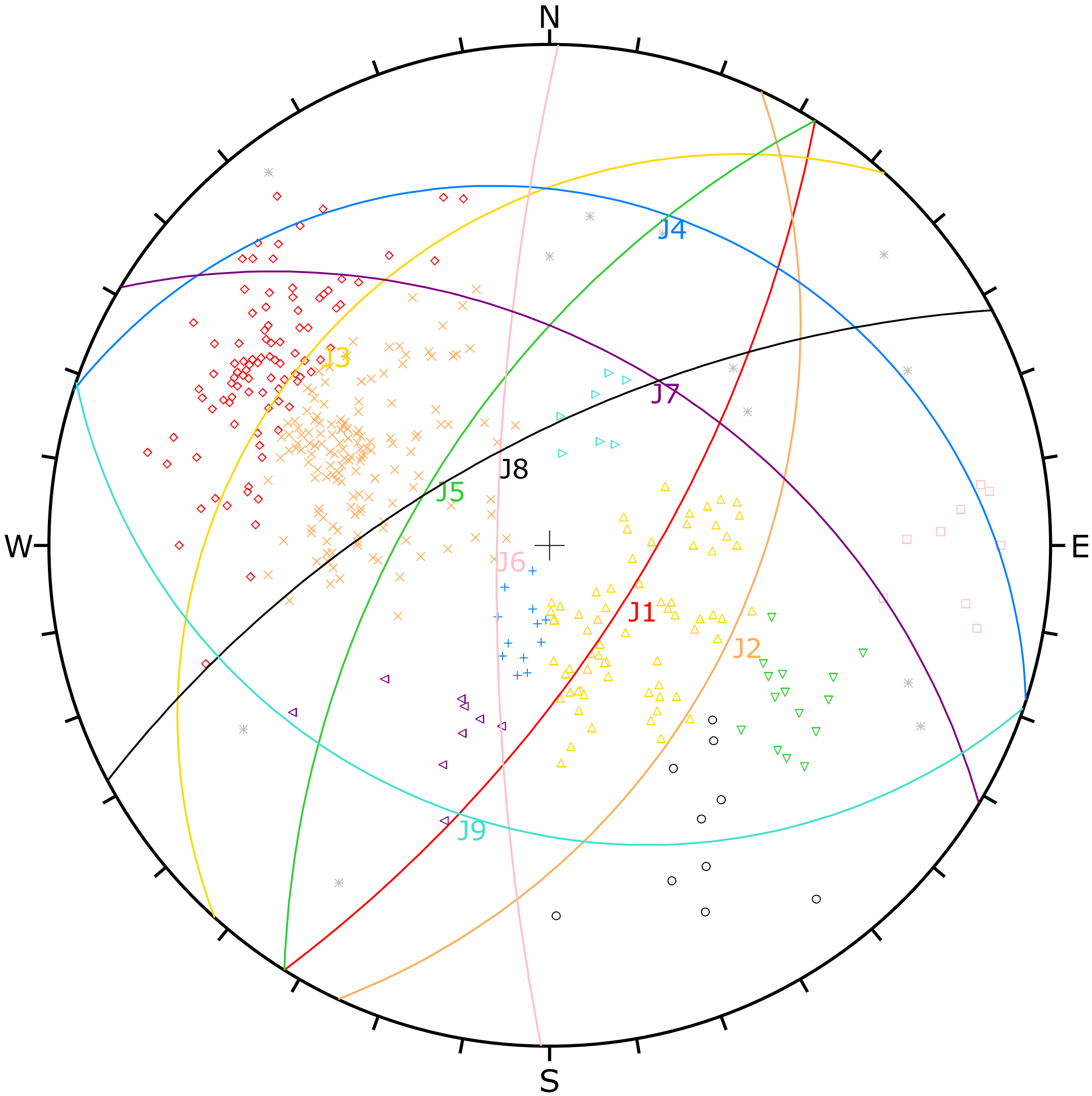
Kinematic Analysis	Wedge Sliding			
Slope Dip	76			
Slope Dip Direction	321			
Friction Angle	28°			
		Critical	**Total**	**%**
	Wedge Sliding	20	78	25.64%

	Color	Dip	Dip Direction	Label
User Planes				
1		54	226	U2
2		75	291	U3
3		71	59	U4
Mean Set Planes				
1m		70	128	J1
2m		43	120	J2
3m		26	325	J3
4m		20	20	J4
5m		64	301	J5
6m		80	278	J6
7m		41	30	J7
8m		64	328	J8
9m		30	196	J9
10m		64	189	U1

Plot Mode	Pole Vectors
Vector Count	167 (167 Entries)
Intersection Mode	User and Mean Set Planes
Intersections Count	78
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector	
Analysis Description	Levenseller Road BH Logging (Approach Borings) - Wedge Sliding	
Drawn By	J. Rawlins	*Company* Haley & Aldrich, Inc.
Date	June 2021	*File Name* 2021-0517_Levenseller approach_wedge.dips8

DIPS 8.002



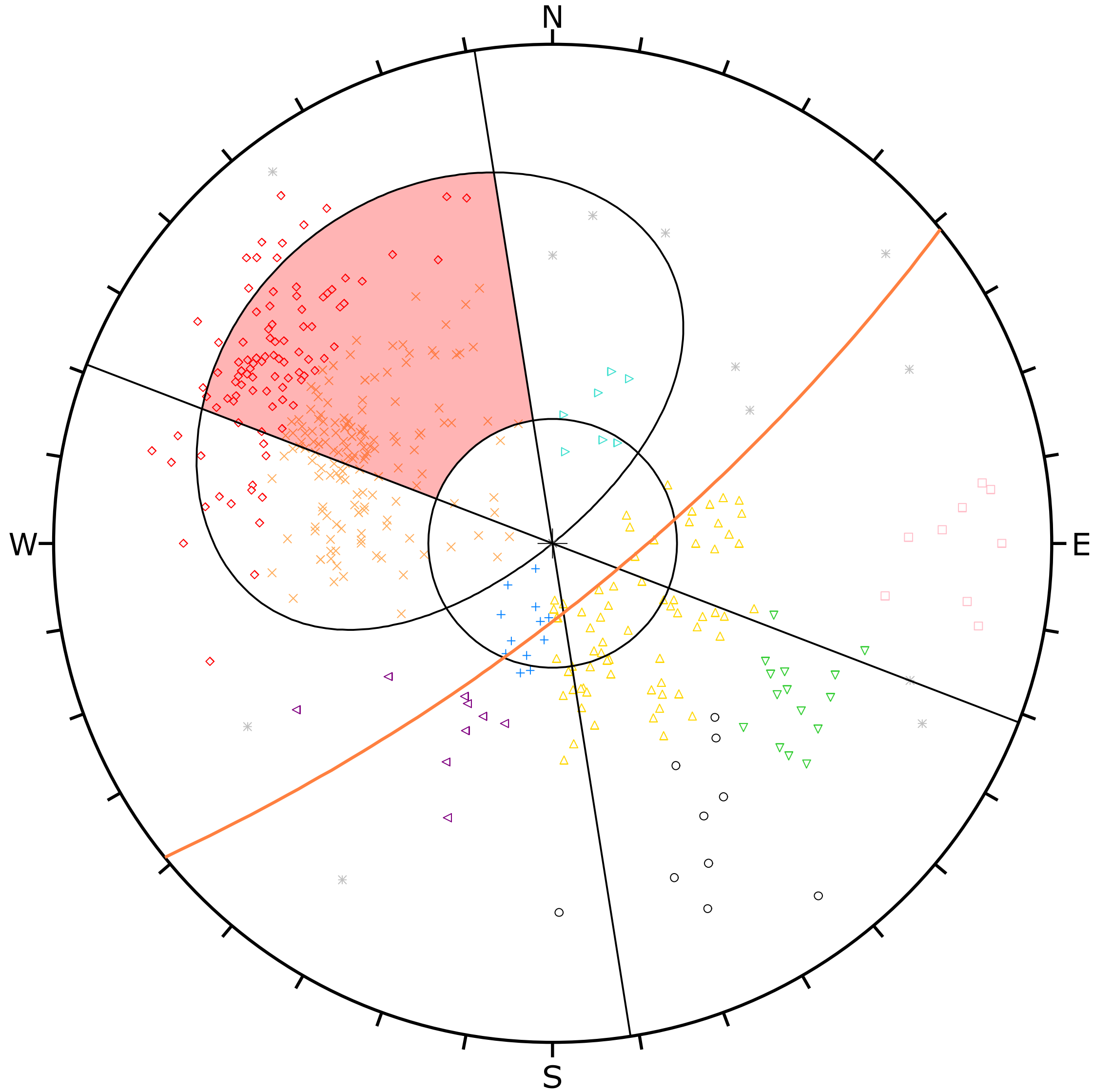
Symbol	FEATURE	Quantity
◇	J1	101
×	J2	158
△	J3	67
+	J4	12
▽	J5	15
□	J6	9
◁	J7	9
○	J8	10
▷	J9	7
✳	U	12

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m	Red	69	122	J1
2m	Orange	46	115	J2
3m	Yellow	27	312	J3
4m	Blue	20	18	J4
5m	Green	60	302	J5
6m	Pink	78	271	J6
7m	Purple	47	31	J7
8m	Black	66	332	J8
9m	Turquoise	31	199	J9

Plot Mode	Pole Vectors
Vector Count	400 (400 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector	
Analysis Description	Levenseller Road BH Logging	
Drawn By	J. Rawlins	*Company* Haley & Aldrich, Inc.
Date	June 2021	*File Name* 2021-0409_Levenseller borings.dips8

DIPS 8.002



Symbol	FEATURE	Quantity
◇	J1	101
×	J2	158
△	J3	67
+	J4	12
▽	J5	15
□	J6	9
◁	J7	9
○	J8	10
▷	J9	7
✳	U	12

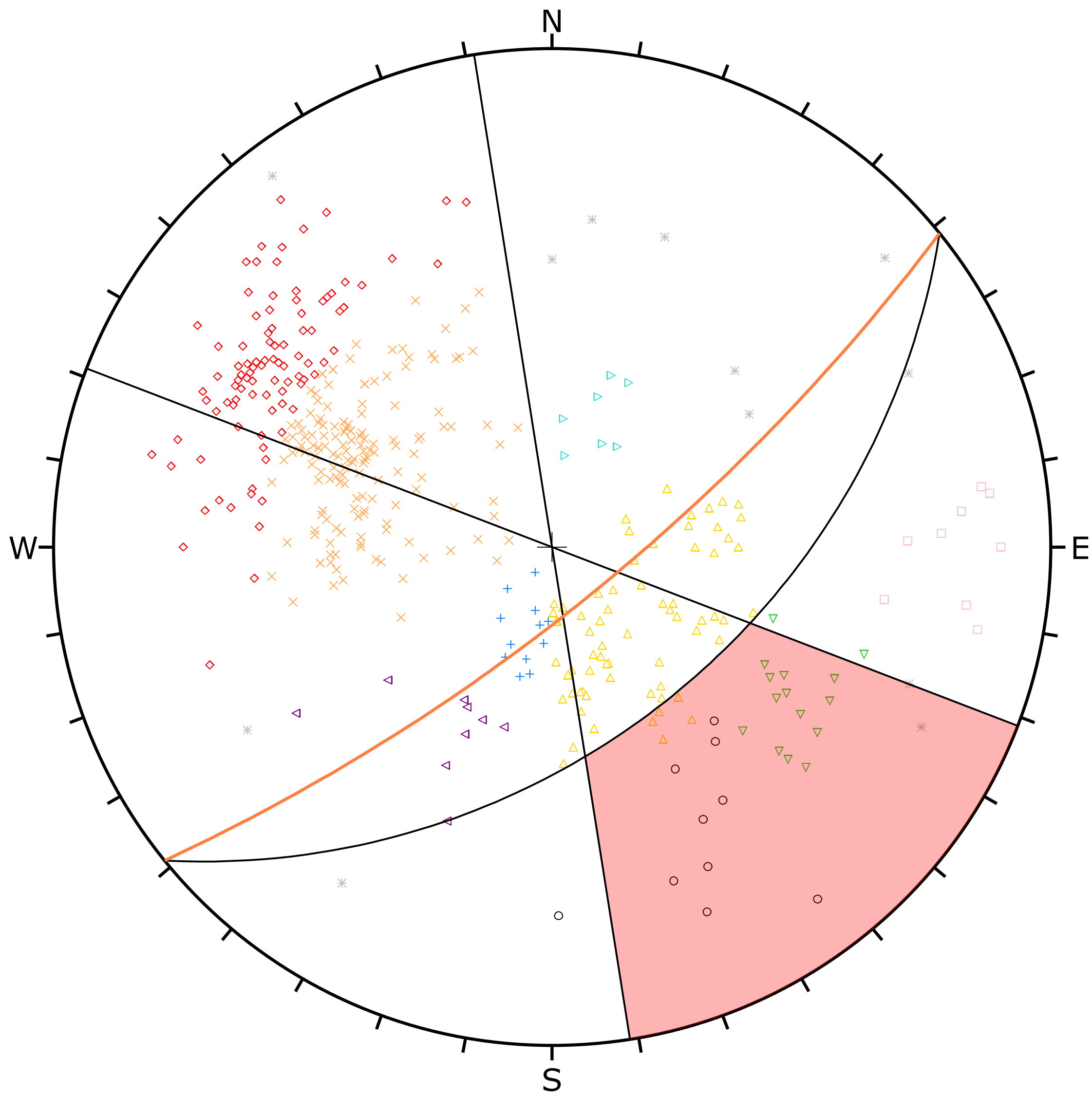
Kinematic Analysis	Planar Sliding
Slope Dip	76
Slope Dip Direction	141
Friction Angle	28°
Lateral Limits	30°

	Critical	Total	%
Planar Sliding (All)	171	400	42.75%
Planar Sliding (Set 1: J1)	73	101	72.28%
Planar Sliding (Set 2: J2)	98	158	62.03%

Plot Mode	Pole Vectors
Vector Count	400 (400 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector	
Analysis Description	Levenseller Road BH Logging - Planar Sliding	
Drawn By	J. Rawlins	*Company* Haley & Aldrich, Inc.
Date	June 2021	*File Name* 2021-0409_Levenseller borings.dips8

DIPS 8.002



Symbol	FEATURE	Quantity
◇	J1	101
×	J2	158
△	J3	67
+	J4	12
▽	J5	15
□	J6	9
◁	J7	9
○	J8	10
▷	J9	7
✳	U	12

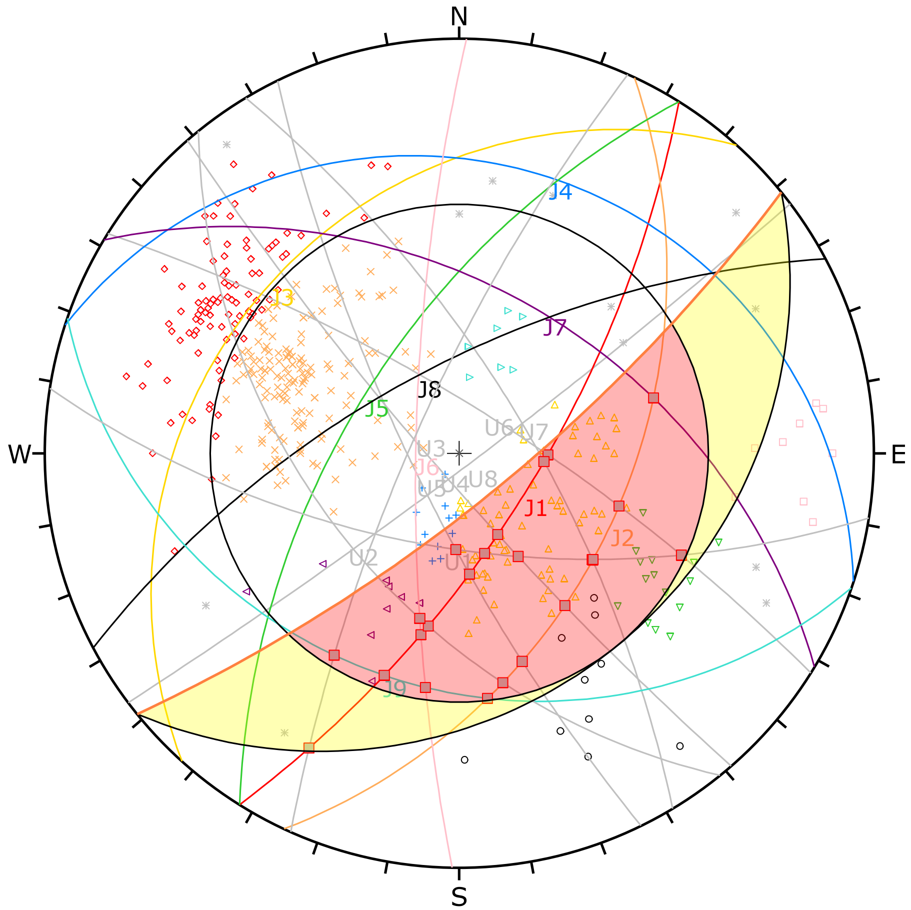
Kinematic Analysis	Flexural Toppling
Slope Dip	76
Slope Dip Direction	141
Friction Angle	28°
Lateral Limits	30°

	Critical	Total	%
Flexural Toppling (All)	29	400	7.25%
Flexural Toppling (Set 3: J3)	5	67	7.46%
Flexural Toppling (Set 5: J5)	13	15	86.67%
Flexural Toppling (Set 8: J8)	9	10	90.00%

Plot Mode	Pole Vectors
Vector Count	400 (400 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging - Toppling		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	June 2021	*File Name*	2021-0409_Levenseller borings.dips8

DIPS 8.002



Symbol	FEATURE	Quantity
◇	J1	101
×	J2	158
△	J3	67
+	J4	12
▽	J5	15
□	J6	9
◁	J7	9
○	J8	10
▷	J9	7
✳	U	12
Symbol	**Feature**	
■	Critical Intersection	

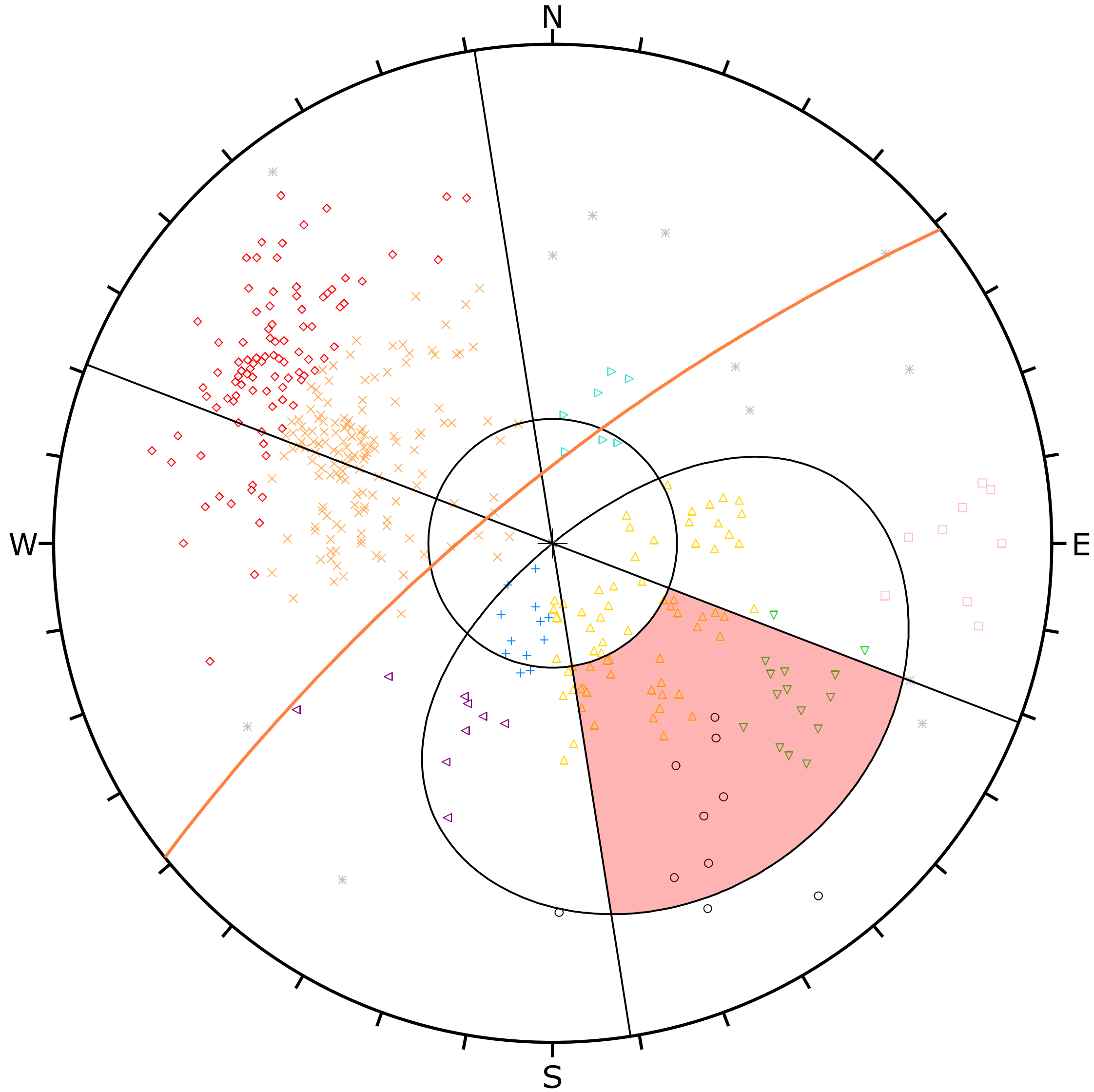
Kinematic Analysis	Wedge Sliding		
Slope Dip	76		
Slope Dip Direction	141		
Friction Angle	28°		
	Critical	Total	%
Wedge Sliding	24	136	17.65%

	Color	Dip	Dip Direction	Label
User Planes				
1	Gray	83	229	U4
2	Gray	77	244	U5
3	Gray	77	32	U6
4	Gray	71	59	U7
5	Gray	86	143	U8
Mean Set Planes				
1m	Red	69	122	J1
2m	Orange	46	115	J2
3m	Yellow	27	312	J3
4m	Blue	20	18	J4
5m	Green	60	302	J5
6m	Pink	78	271	J6
7m	Purple	47	31	J7
8m	Black	66	332	J8
9m	Turquoise	31	199	J9
10m	Gray	64	189	U1
11m	Gray	52	231	U2
12m	Gray	77	294	U3

Plot Mode	Pole Vectors
Vector Count	400 (400 Entries)
Intersection Mode	User and Mean Set Planes
Intersections Count	136
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging - Wedge Sliding		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	June 2021	*File Name*	2021-0409_Levenseller borings_wedge.dips8

DIPS 8.002



Symbol	FEATURE	Quantity
◇	J1	101
×	J2	158
△	J3	67
+	J4	12
▽	J5	15
□	J6	9
◁	J7	9
○	J8	10
▷	J9	7
⁎	U	12

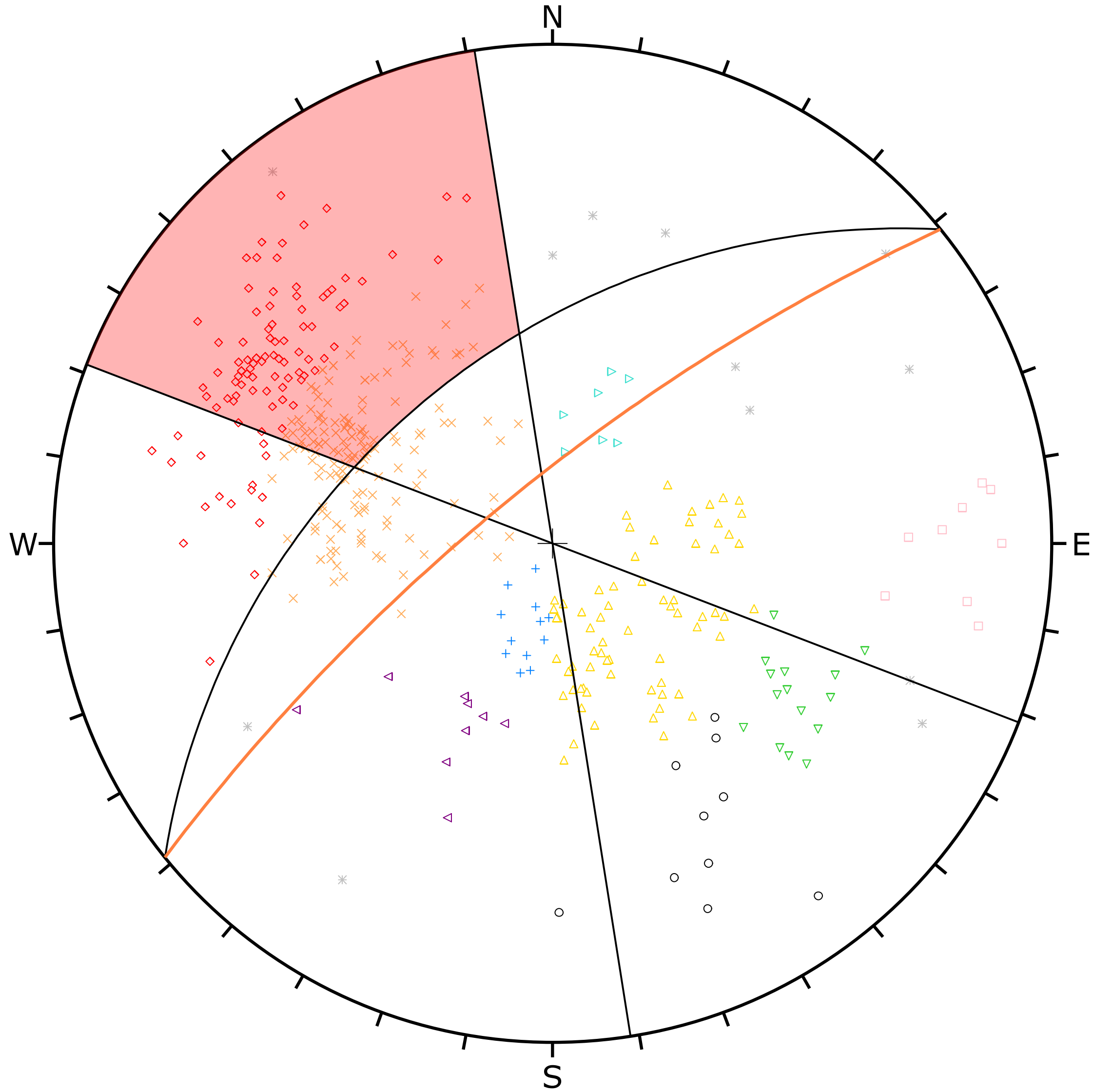
Kinematic Analysis	Planar Sliding
Slope Dip	76
Slope Dip Direction	321
Friction Angle	28°
Lateral Limits	30°

	Critical	Total	%
Planar Sliding (All)	48	400	12.00%
Planar Sliding (Set 3: J3)	28	67	41.79%
Planar Sliding (Set 5: J5)	13	15	86.67%
Planar Sliding (Set 8: J8)	7	10	70.00%

Plot Mode	Pole Vectors
Vector Count	400 (400 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging - Planar Sliding		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	June 2021	*File Name*	2021-0409_Levenseller borings.dips8

DIPS 8.002



Symbol	FEATURE	Quantity
◇	J1	101
×	J2	158
△	J3	67
+	J4	12
▽	J5	15
□	J6	9
◁	J7	9
○	J8	10
▷	J9	7
✳	U	12

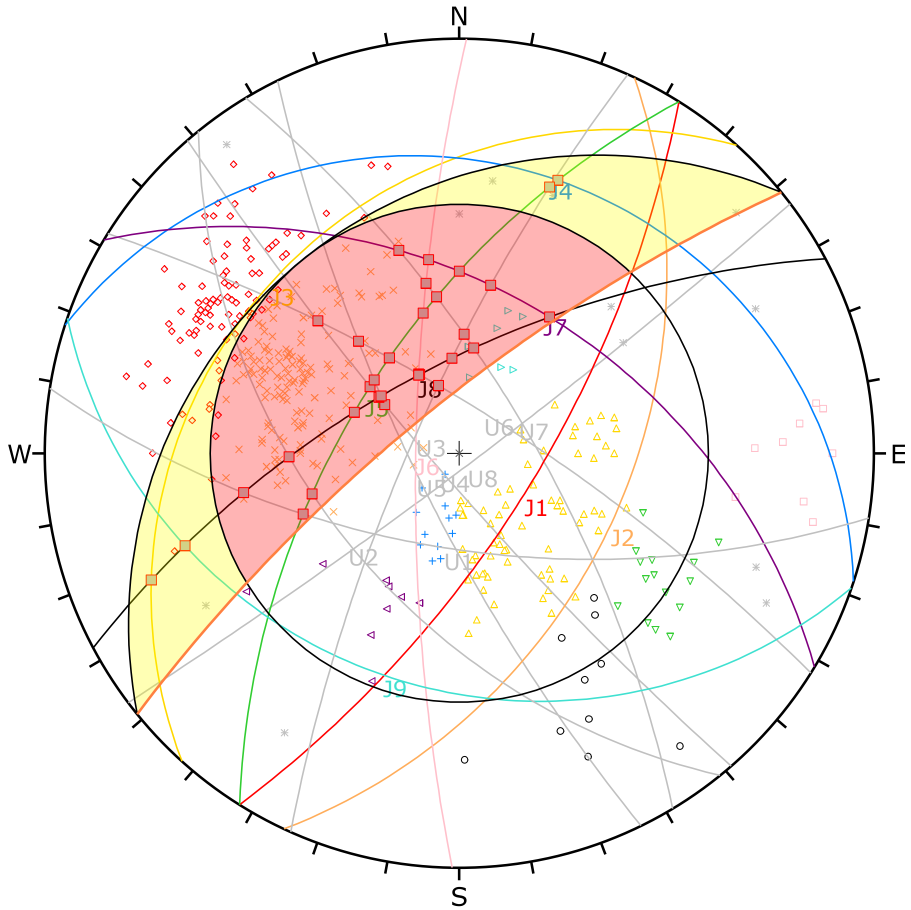
Kinematic Analysis	Flexural Toppling
Slope Dip	76
Slope Dip Direction	321
Friction Angle	28°
Lateral Limits	30°

	Critical	Total	%
Flexural Toppling (All)	165	400	41.25%
Flexural Toppling (Set 1: J1)	85	101	84.16%
Flexural Toppling (Set 2: J2)	79	158	50.00%

Plot Mode	Pole Vectors
Vector Count	400 (400 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging - Toppling		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	June 2021	*File Name*	2021-0409_Levenseller borings.dips8

DIPS 8.002



Symbol	FEATURE	Quantity
◇	J1	101
×	J2	158
△	J3	67
+	J4	12
▽	J5	15
□	J6	9
◁	J7	9
○	J8	10
▷	J9	7
*	U	12
Symbol	**Feature**	
■	Critical Intersection	

Kinematic Analysis	Wedge Sliding			
Slope Dip	76			
Slope Dip Direction	321			
Friction Angle	28°			
		Critical	**Total**	**%**
	Wedge Sliding	32	136	23.53%

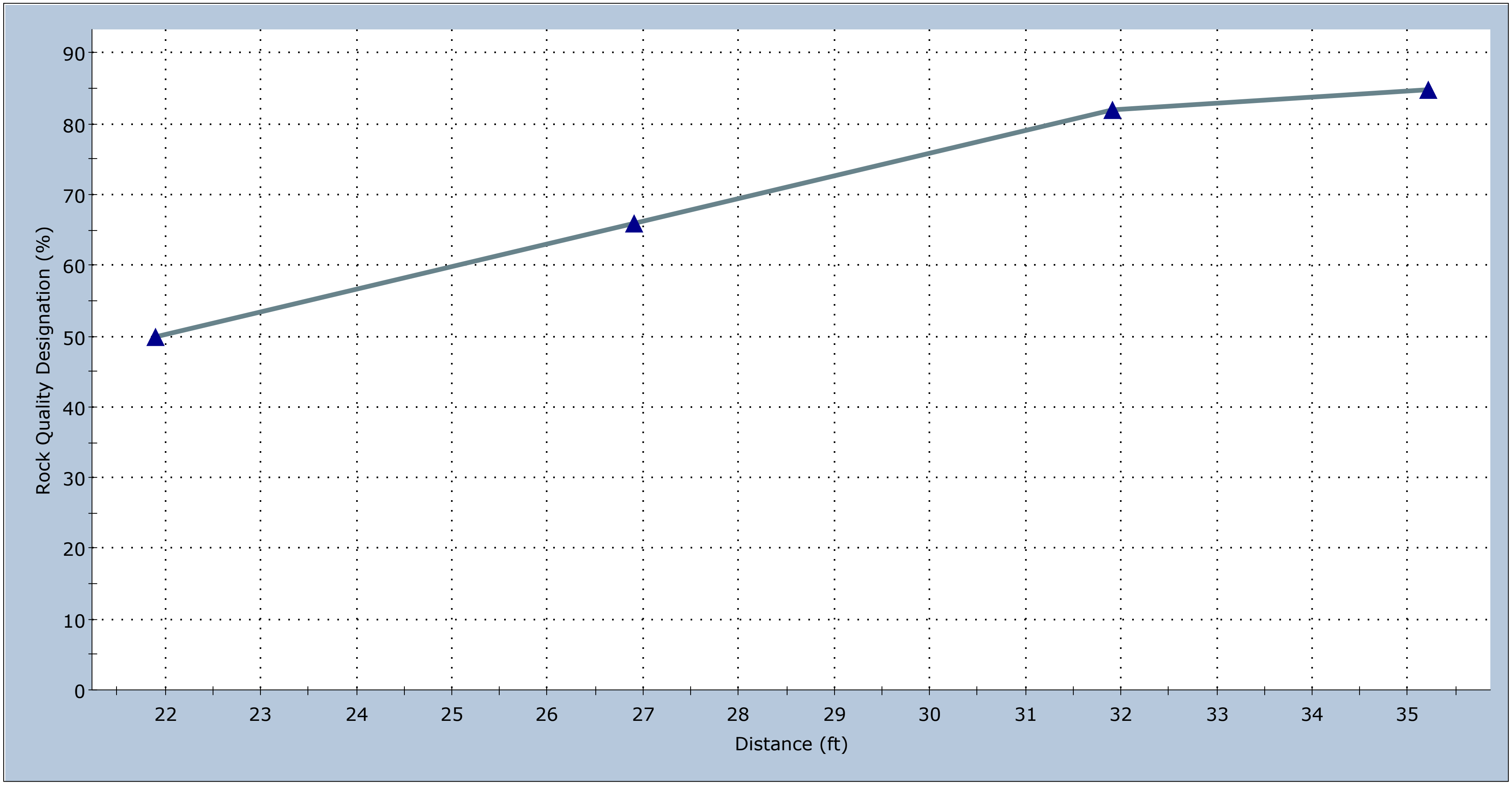
	Color	Dip	Dip Direction	Label
User Planes				
1		83	229	U4
2		77	244	U5
3		77	32	U6
4		71	59	U7
5		86	143	U8
Mean Set Planes				
1m		69	122	J1
2m		46	115	J2
3m		27	312	J3
4m		20	18	J4
5m		60	302	J5
6m		78	271	J6
7m		47	31	J7
8m		66	332	J8
9m		31	199	J9
10m		64	189	U1
11m		52	231	U2
12m		77	294	U3

Plot Mode	Pole Vectors
Vector Count	400 (400 Entries)
Intersection Mode	User and Mean Set Planes
Intersections Count	136
Hemisphere	Lower
Projection	Equal Angle

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging - Wedge Sliding		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	June 2021	*File Name*	2021-0409_Levenseller borings_wedge.dips8

DIPS 8.002

RQD Analysis
Traverse L1

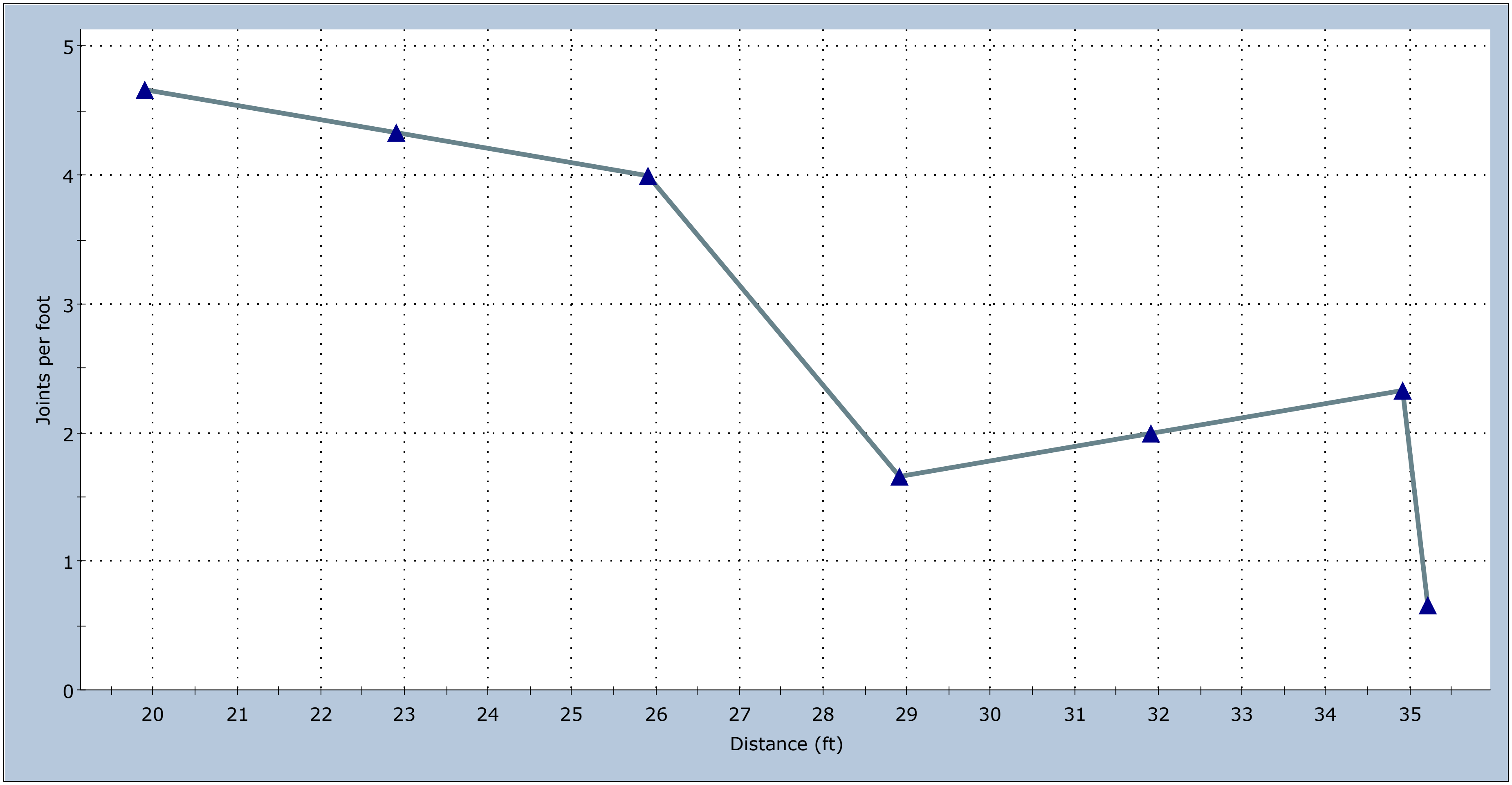


mean=70.712 s.d.=13.950 min=50.000 max=84.848

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, Planar Sliding		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-202.dips8

DIPS 8.002

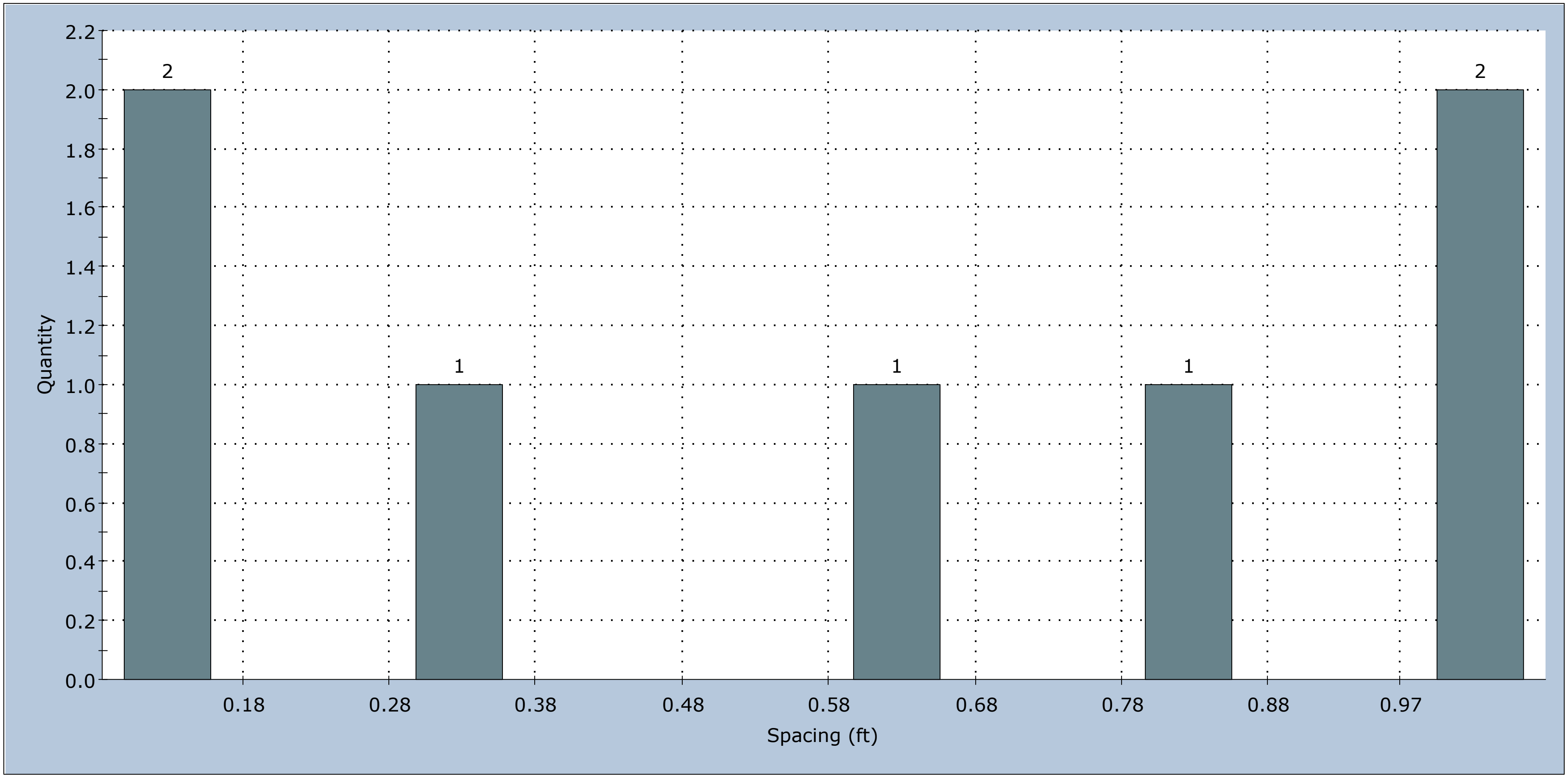
Joint Frequency Analysis
Traverse L1



mean=2.810 s.d.=1.413 min=0.667 max=4.667

DIPS 8.002	*Project* Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description Levenseller Road BH Logging, Planar Sliding		
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
	Date April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-202.dips8	

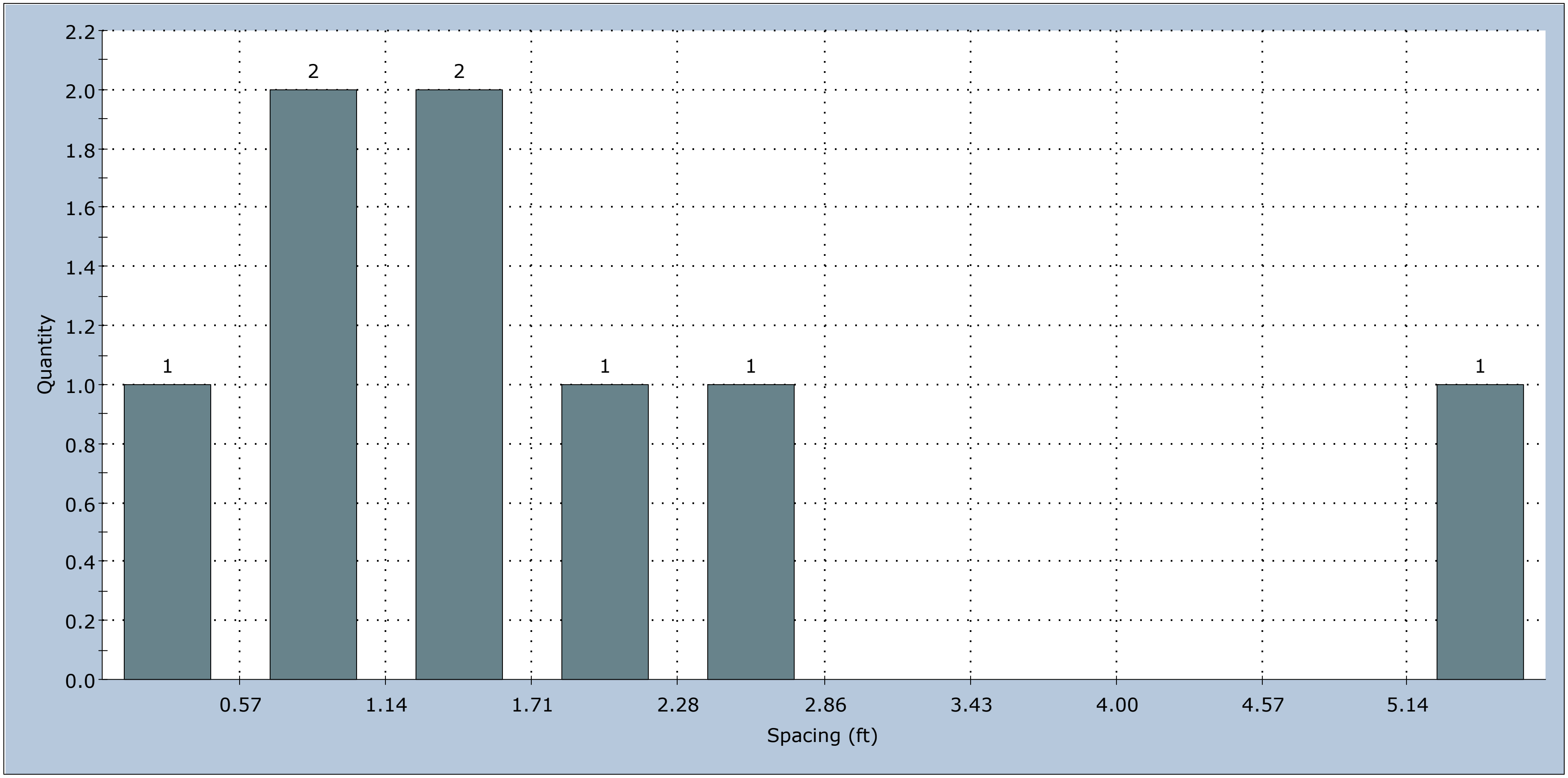
True Joint Spacing
Set 1: J1
All Traverses



mean=0.585 s.d.=0.401 min=0.080 max=1.074

DIPS 8.002	*Project*	Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description	Levenseller Road BH Logging, Planar Sliding		
	Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
	Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-202.dips8

True Joint Spacing
Set 2: J2
All Traverses

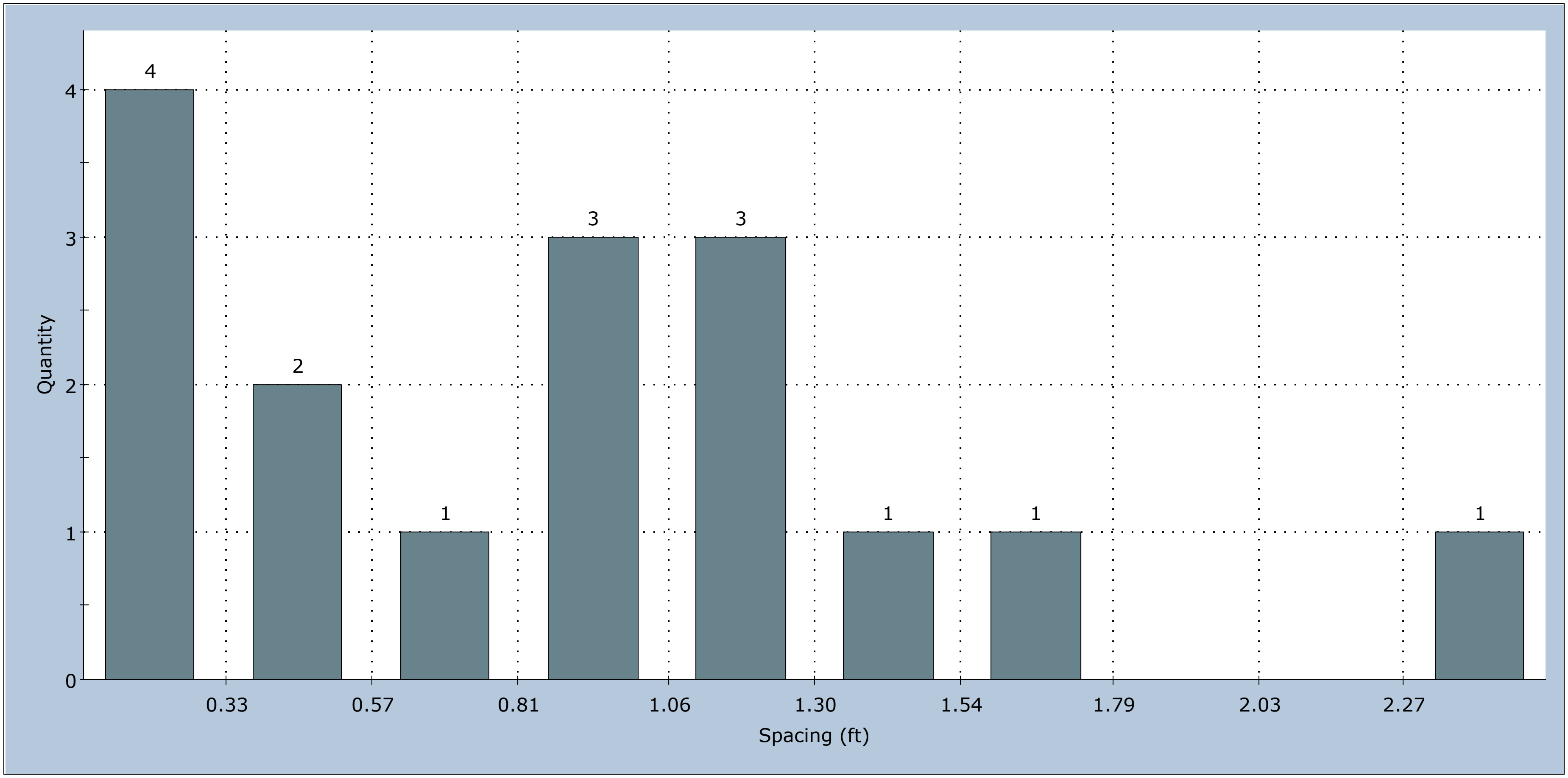


mean=1.814 s.d.=1.627 min=0.002 max=5.710

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, Planar Sliding		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-202.dips8

DIPS 8.002

True Joint Spacing
Set 3: J3
All Traverses

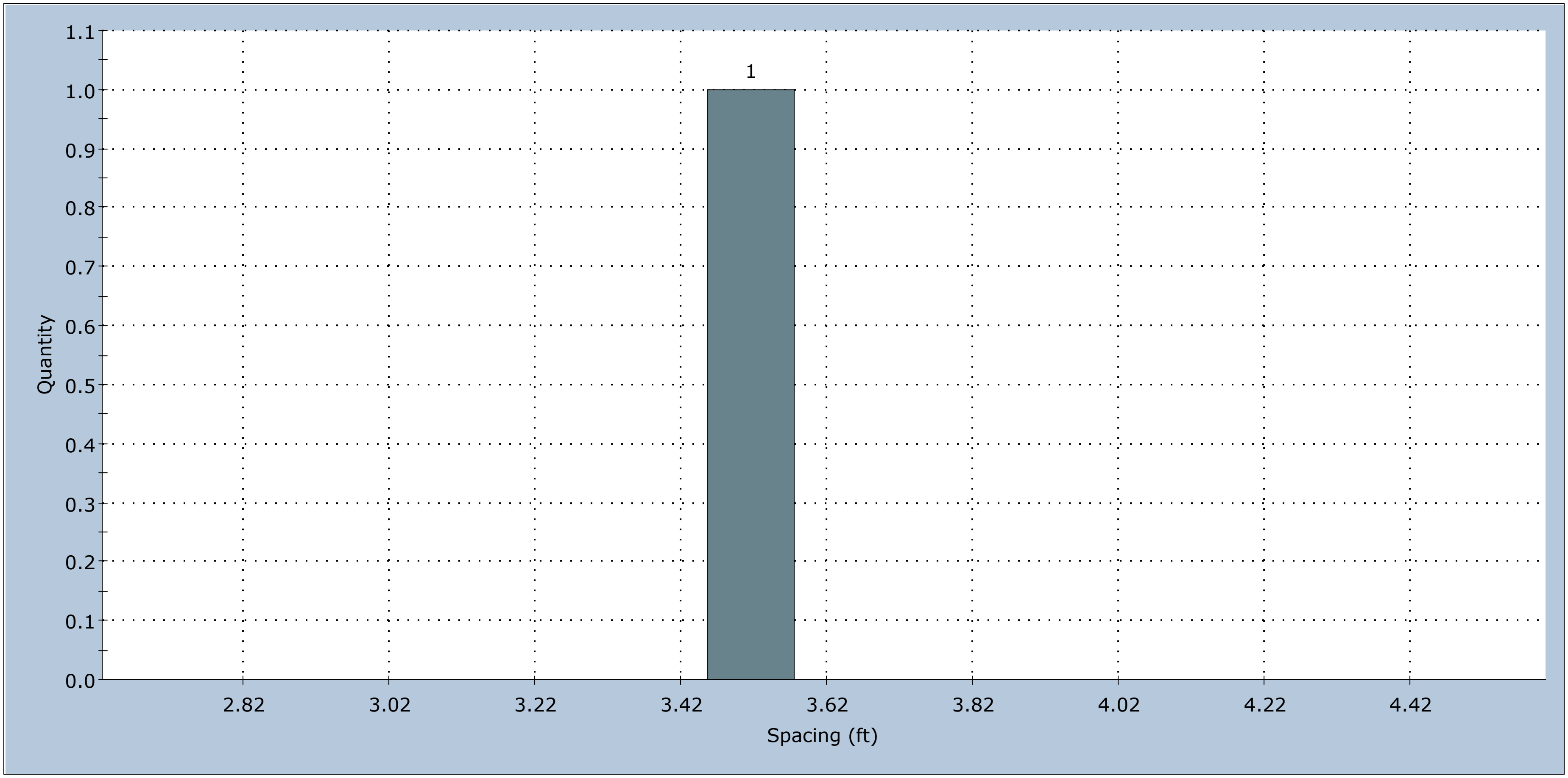


mean=0.891 s.d.=0.635 min=0.084 max=2.516

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, Planar Sliding		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-202.dips8

DIPS 8.002

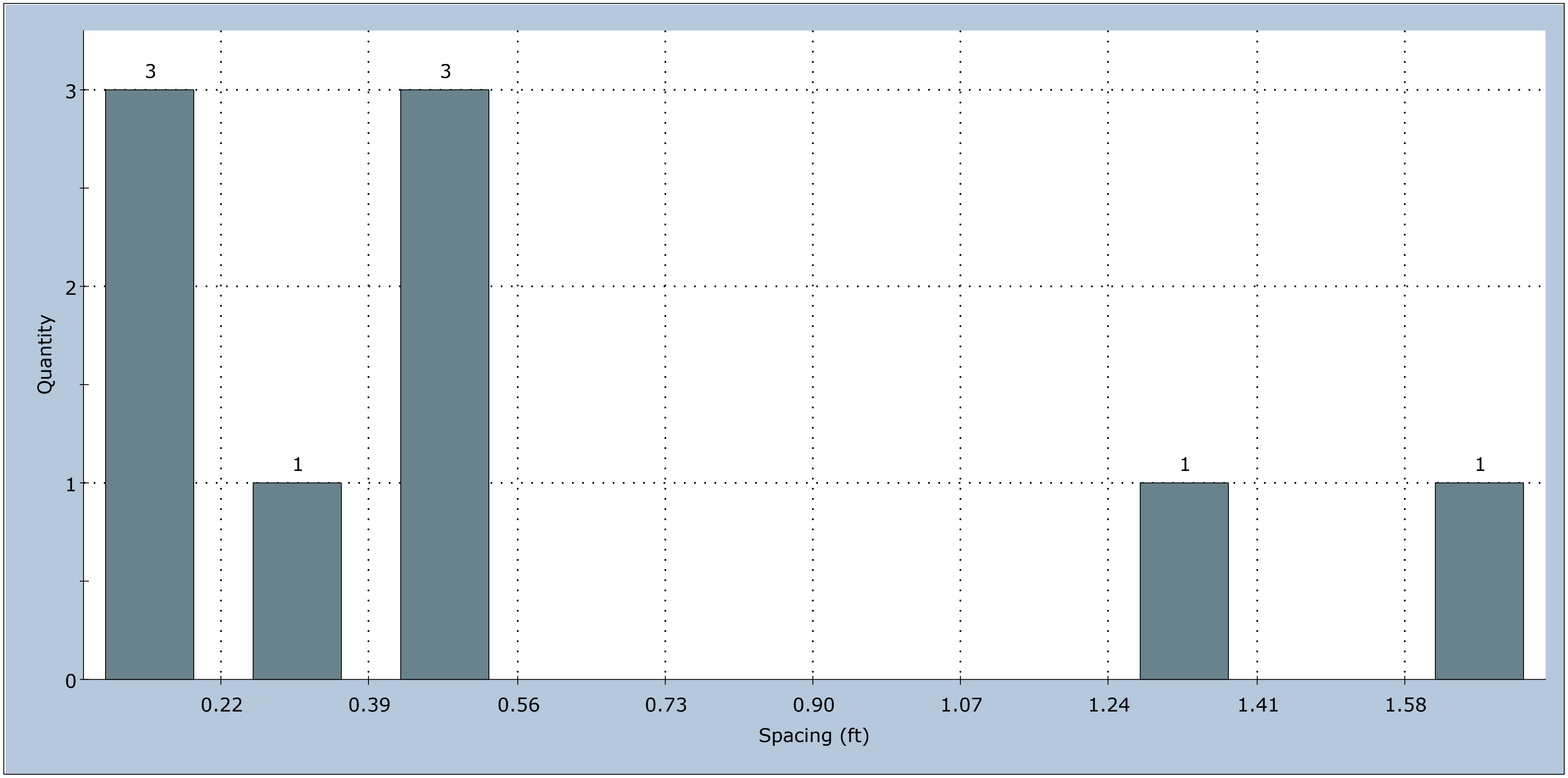
True Joint Spacing
Set 4: J4
All Traverses



mean=3.616 s.d.=0.000 min=3.616 max=3.616

	Project Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description Levenseller Road BH Logging, Planar Sliding		
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
DIPS 8.002	*Date* April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-202.dips8	

True Joint Spacing
Set 5: J5
All Traverses

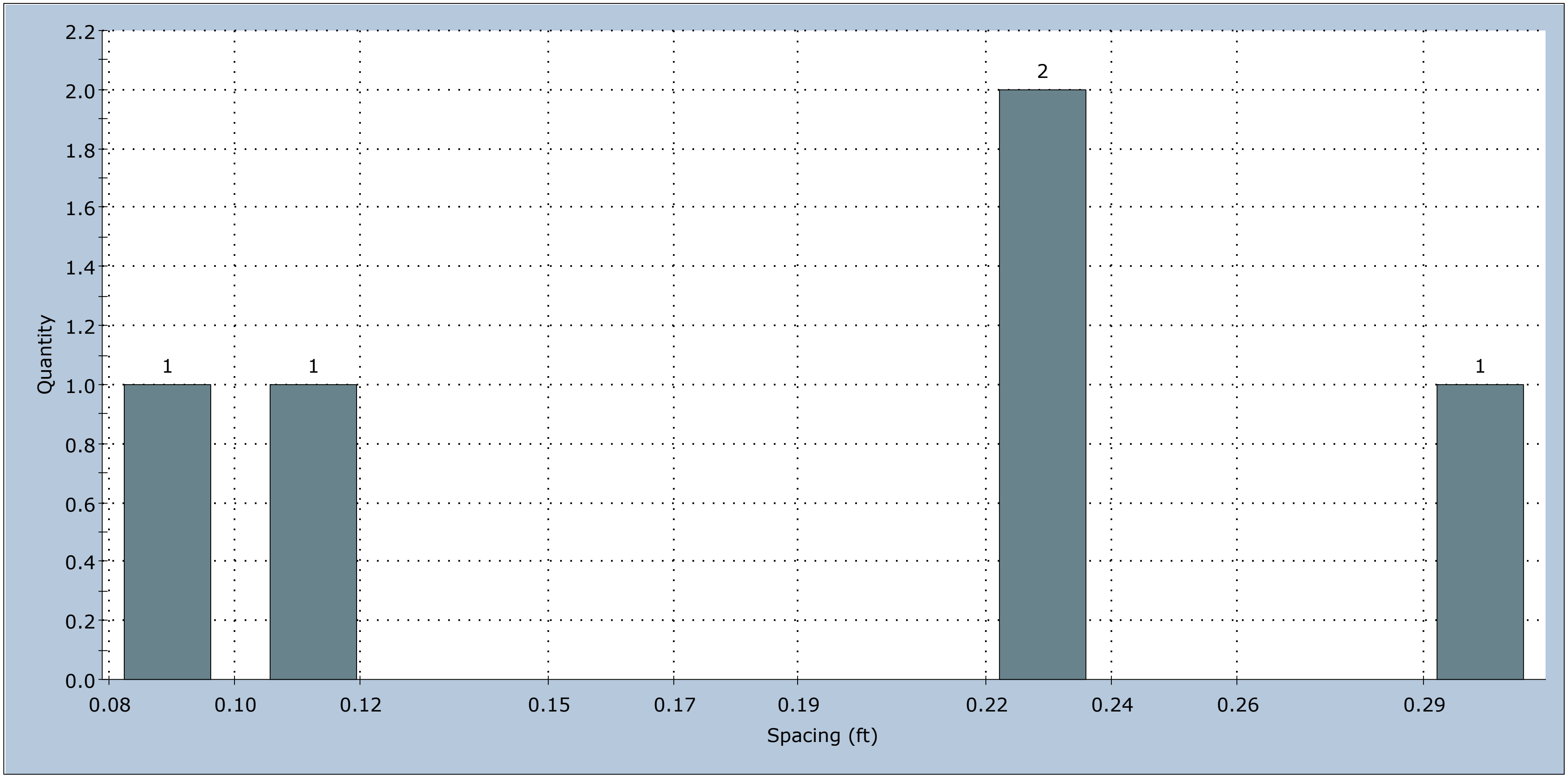


mean=0.554 s.d.=0.553 min=0.053 max=1.751

Project	Brewer-Eddington I-395/Route 9 Connector	
Analysis Description	Levenseller Road BH Logging, Planar Sliding	
Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
Date April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-202.dips8	

DIPS 8.002

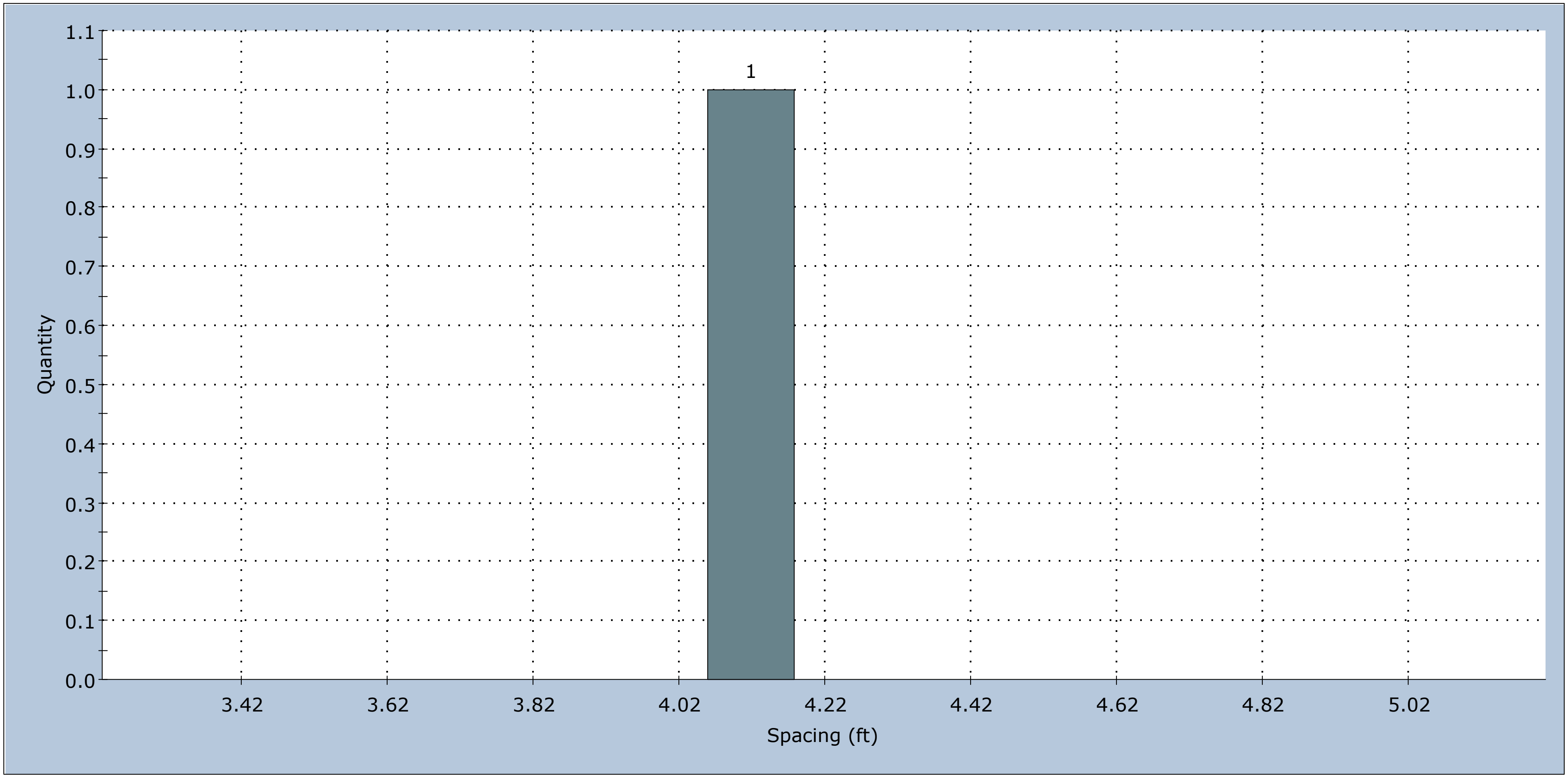
True Joint Spacing
Set 6: J6
All Traverses



mean=0.192 s.d.=0.088 min=0.078 max=0.311

DIPS 8.002	*Project*	Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description	Levenseller Road BH Logging, Planar Sliding		
	Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
	Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-202.dips8

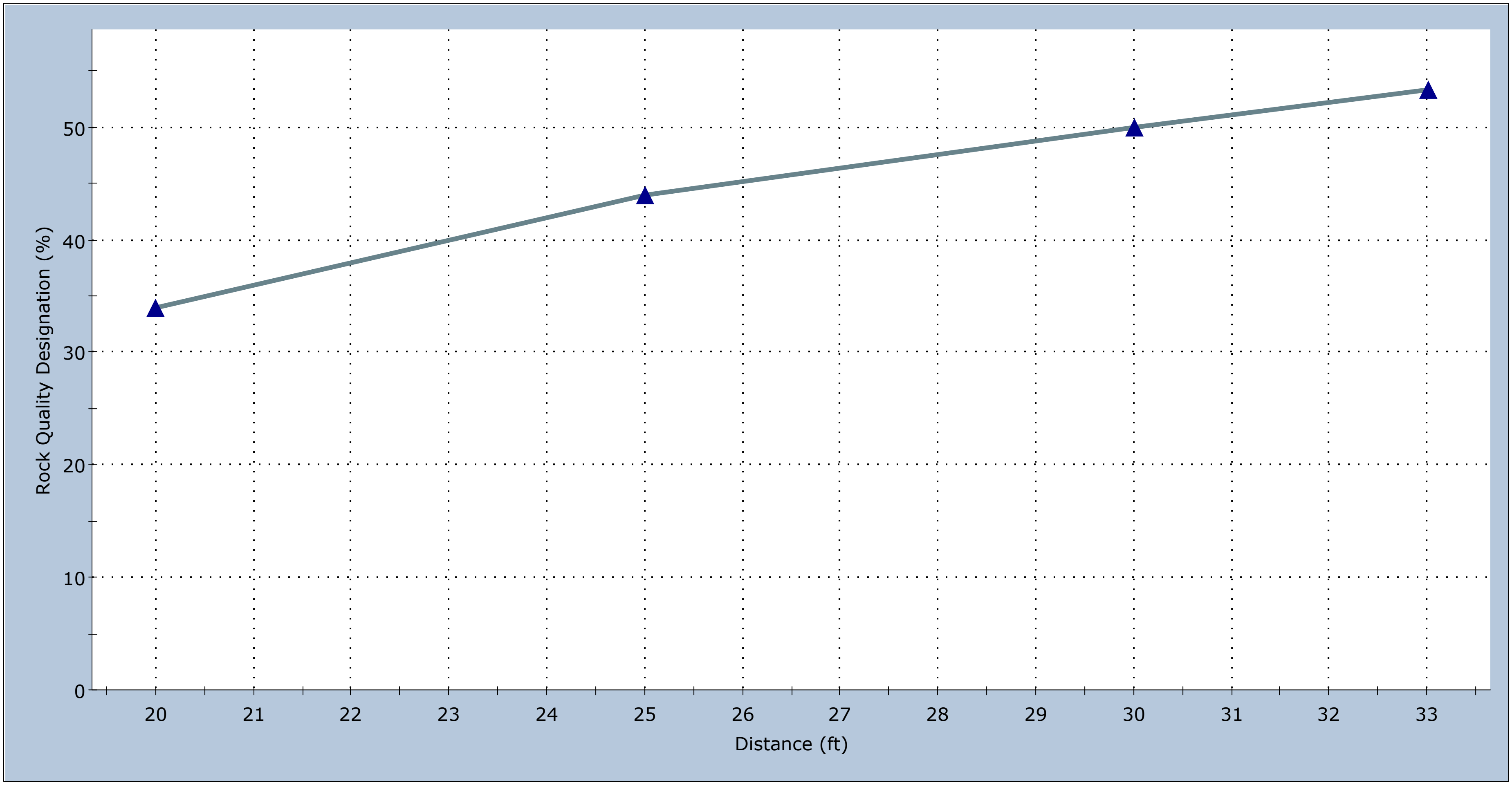
True Joint Spacing
Set 9: J9
All Traverses



mean=4.218 s.d.=0.000 min=4.218 max=4.218

	Project	Brewer-Eddington I-395/Route 9 Connector	
	Analysis Description	Levenseller Road BH Logging, Planar Sliding	
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
DIPS 8.002	*Date* April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-202.dips8	

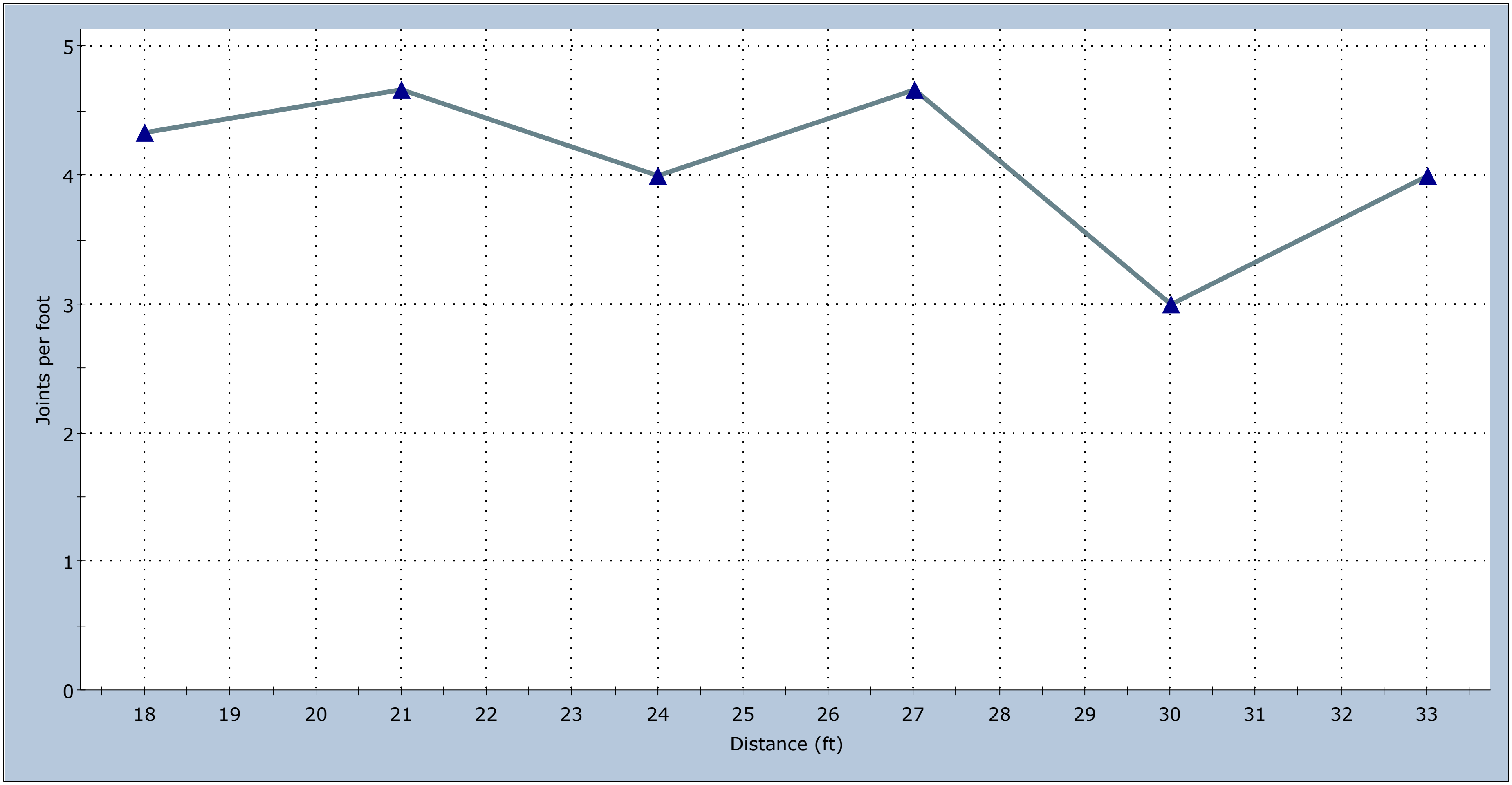
RQD Analysis
Traverse L1



mean=45.333 s.d.=7.348 min=34.000 max=53.333

DIPS 8.002	*Project*	Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description	Levenseller Road BH Logging, BB-ELER-205		
	Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
	Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-205.dips8

Joint Frequency Analysis
Traverse L1

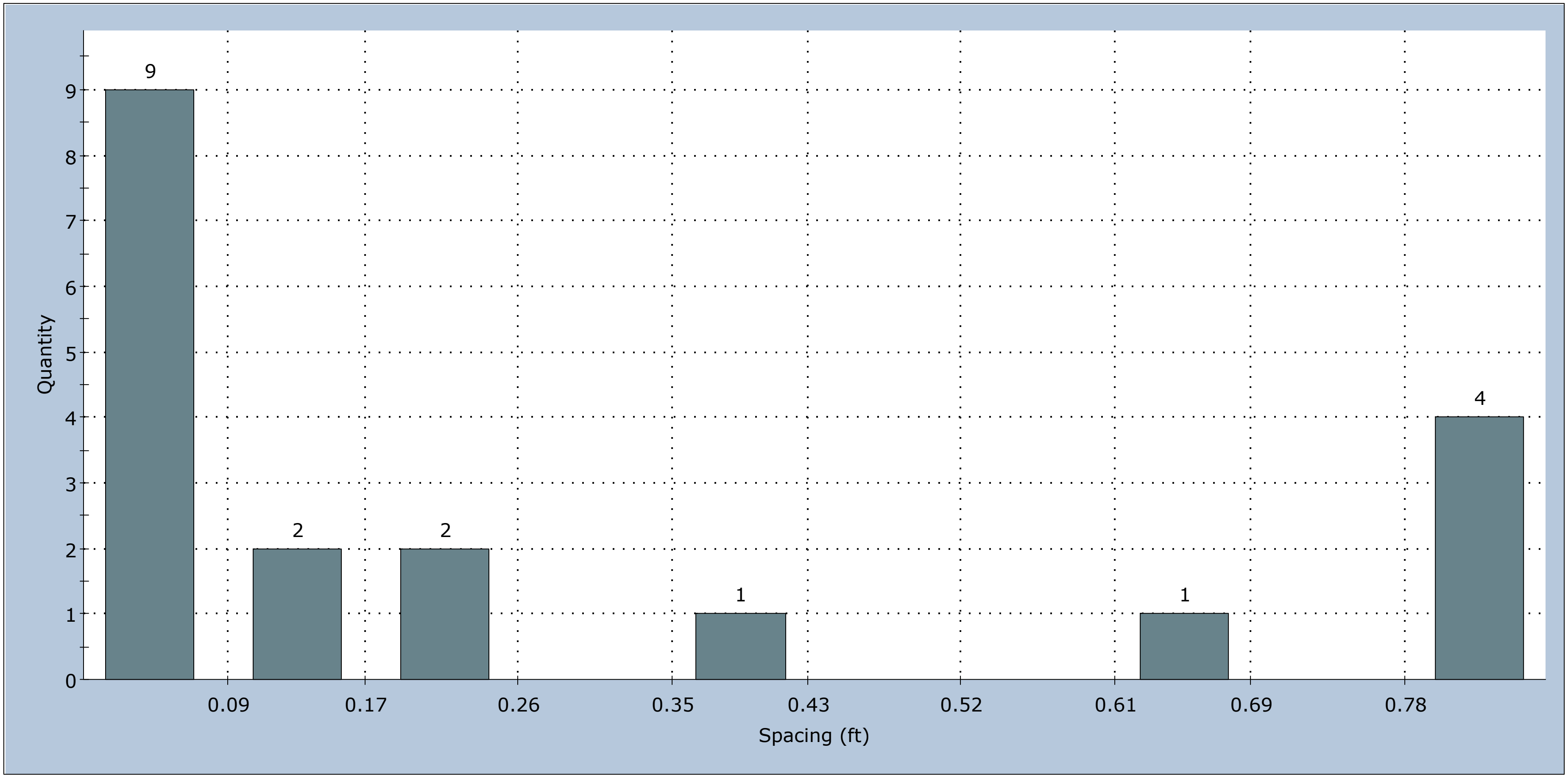


mean=4.111 s.d.=0.567 min=3.000 max=4.667

Project	Brewer-Eddington I-395/Route 9 Connector	
Analysis Description	Levenseller Road BH Logging, BB-ELER-205	
Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
Date April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-205.dips8	

DIPS 8.002

True Joint Spacing
Set 1: J1
All Traverses

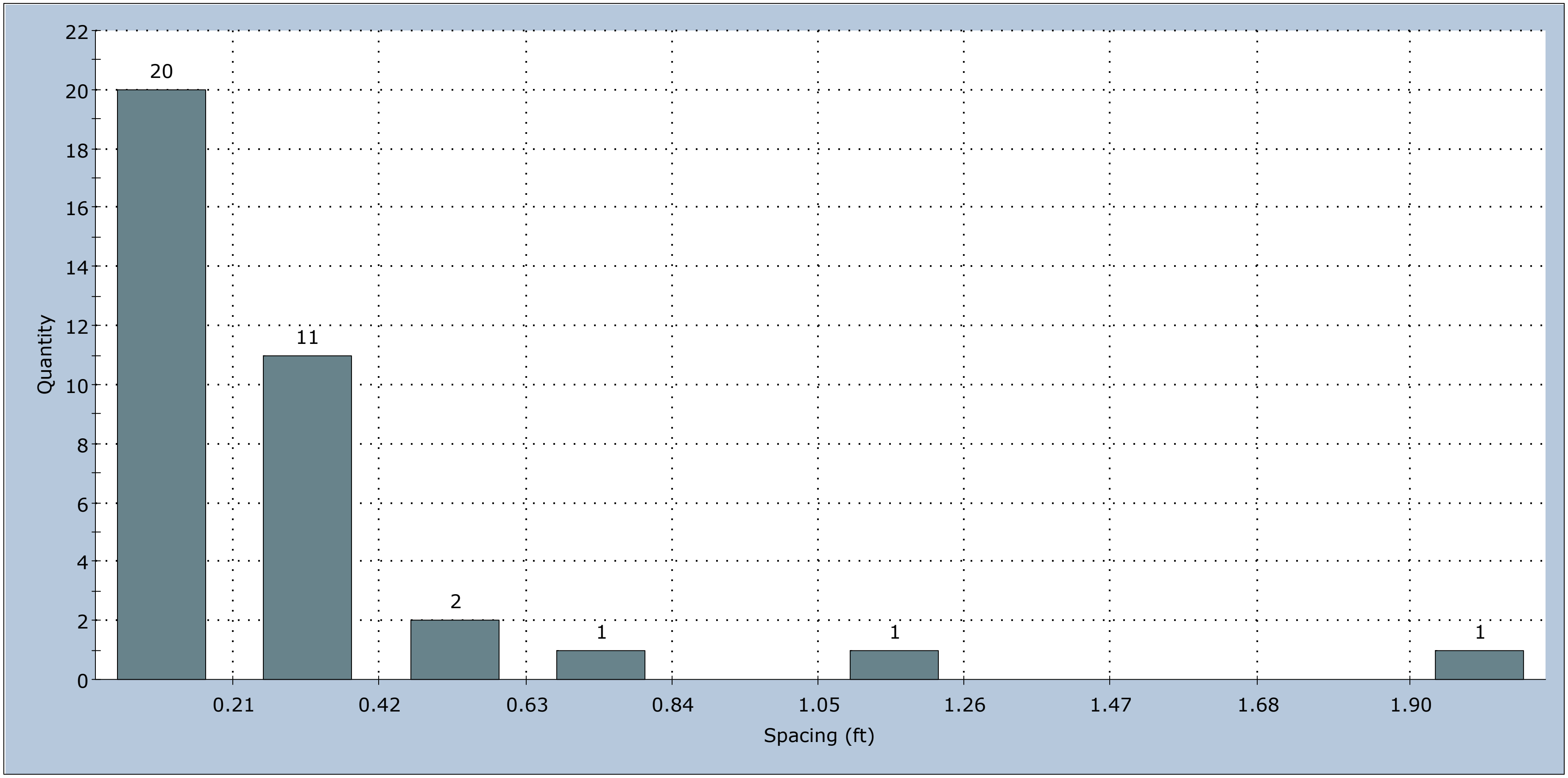


mean=0.295 s.d.=0.315 min=0.001 max=0.867

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, BB-ELER-205		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-205.dips8

DIPS 8.002

True Joint Spacing
Set 2: J2
All Traverses

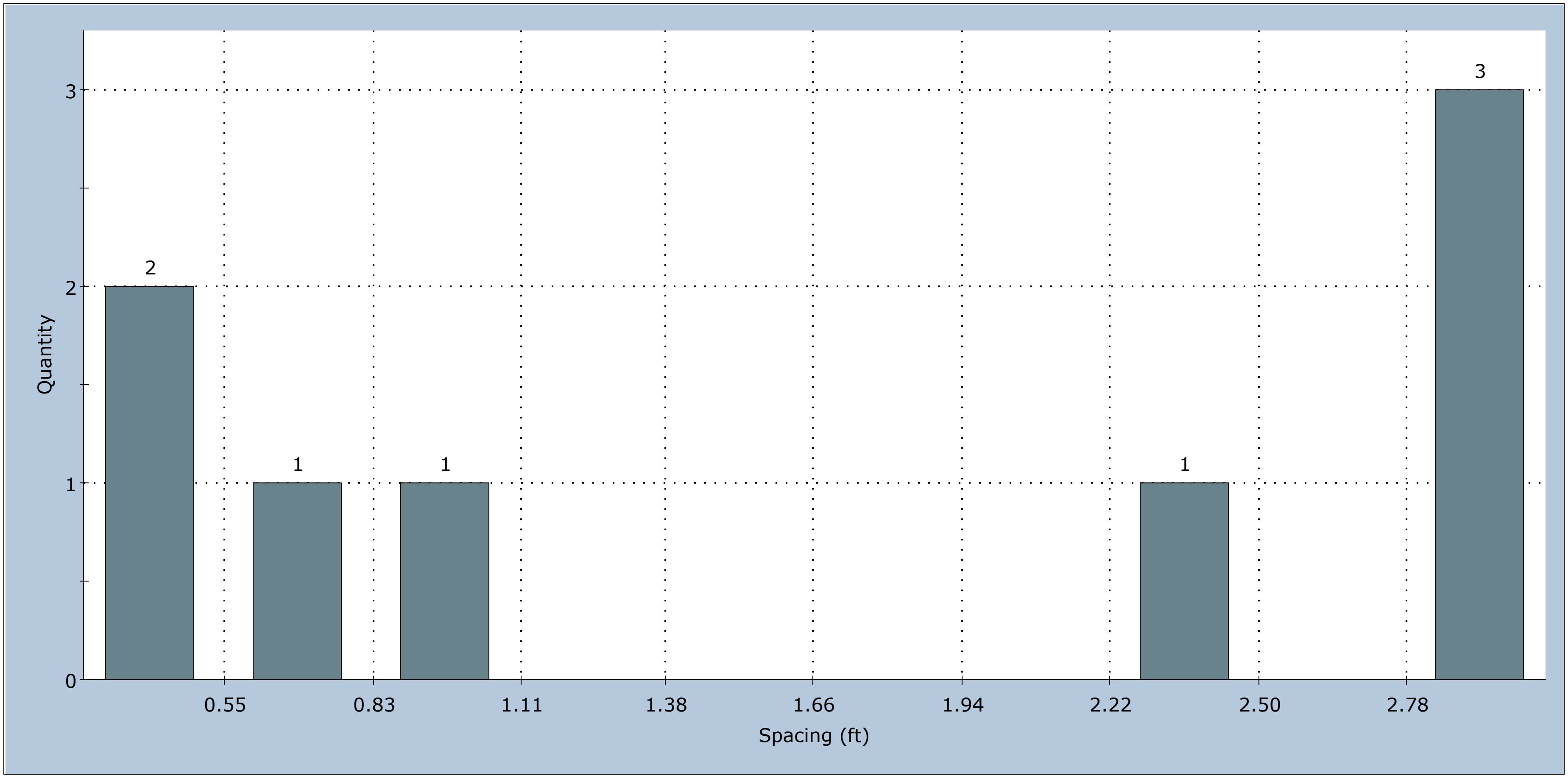


mean=0.306 s.d.=0.374 min=0.001 max=2.106

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, BB-ELER-205		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-205.dips8

DIPS 8.002

True Joint Spacing
Set 3: J3
All Traverses

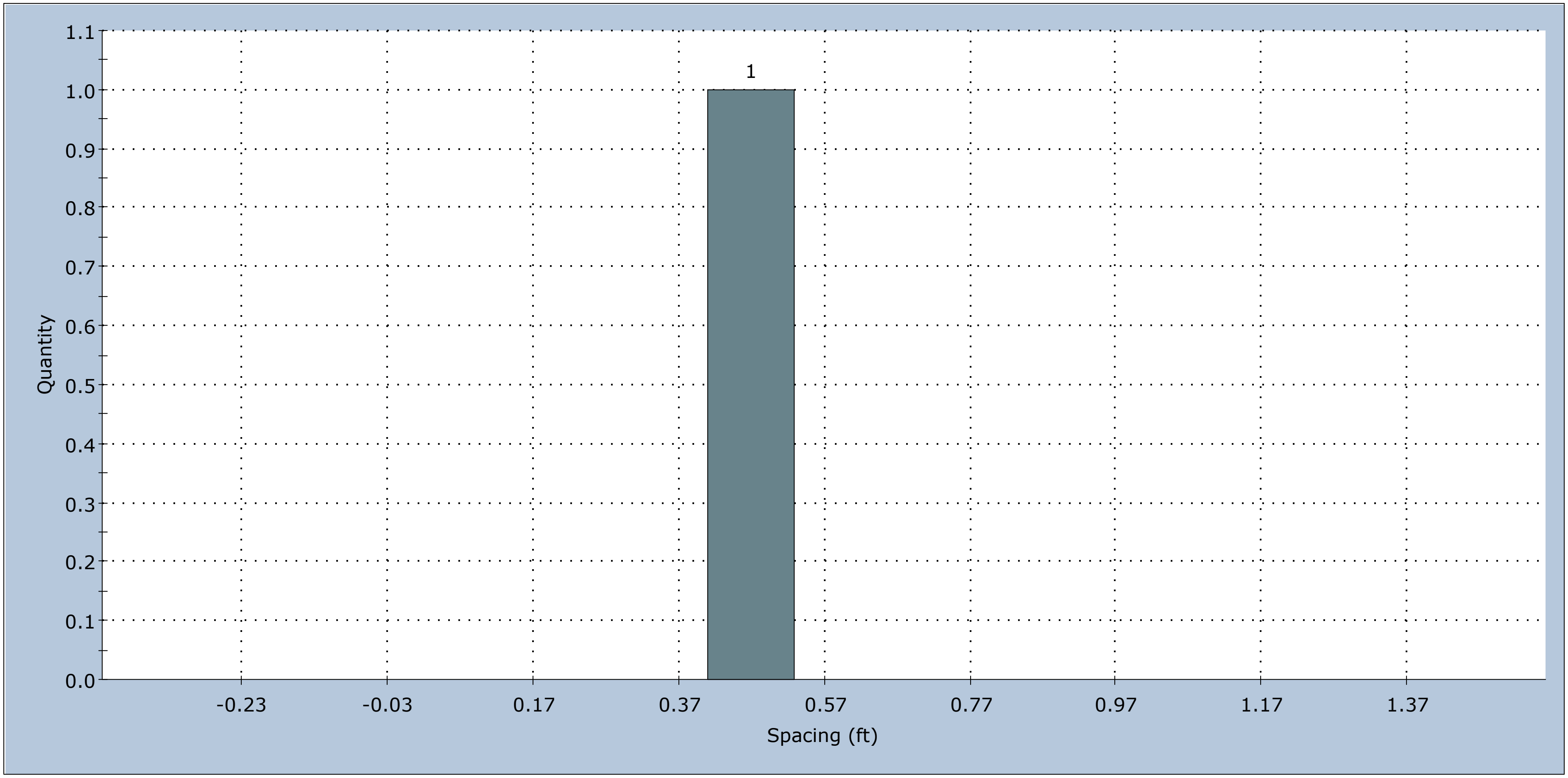


mean=1.663 s.d.=1.139 min=0.270 max=3.055

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, BB-ELER-205		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-205.dips8

DIPS 8.002

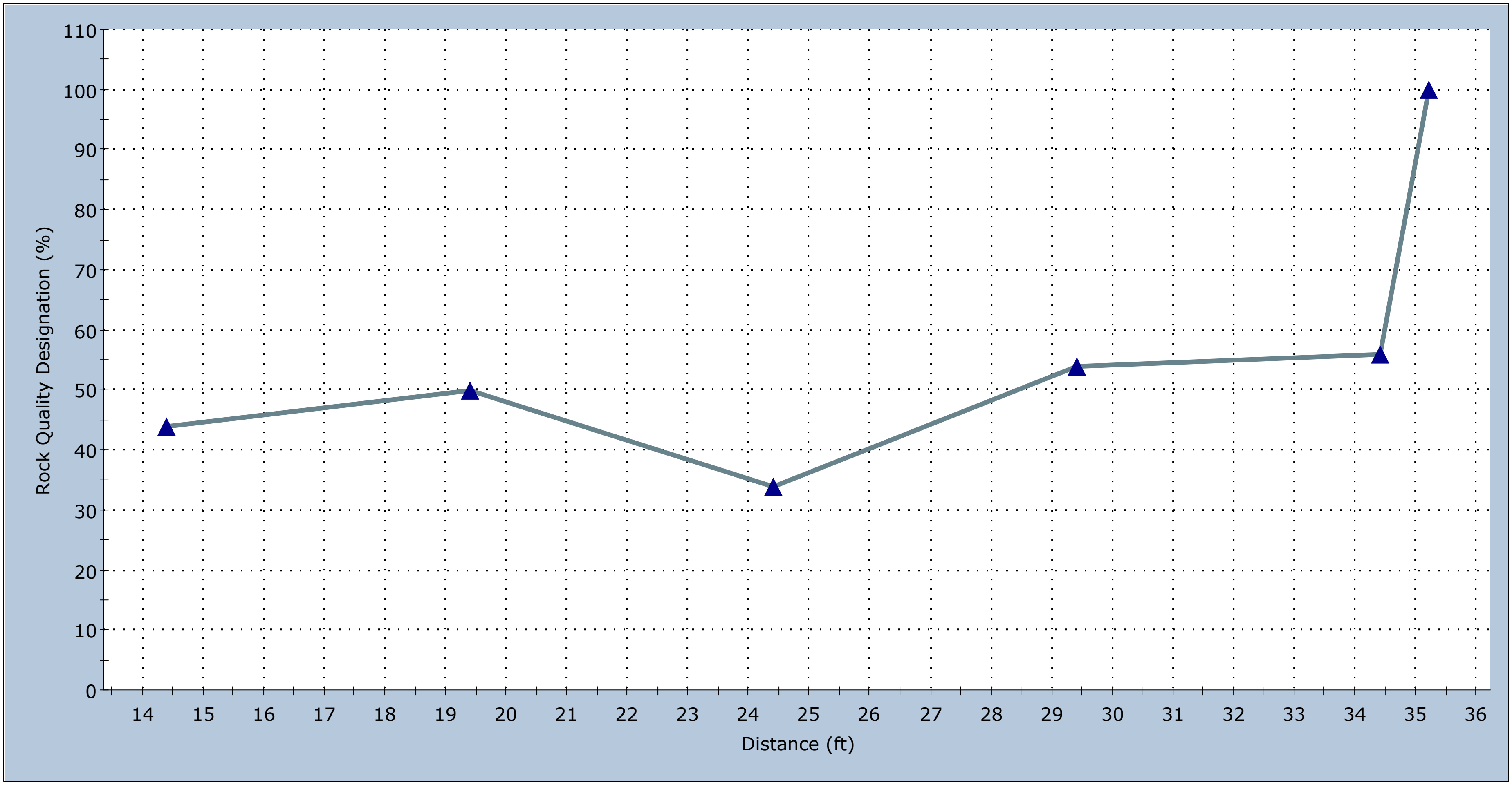
True Joint Spacing
Set 5: J5
All Traverses



mean=0.570 s.d.=0.000 min=0.570 max=0.570

DIPS 8.002	*Project*	Brewer-Eddington I-395/Route 9 Connector	
	Analysis Description	Levenseller Road BH Logging, BB-ELER-205	
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
	Date April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-205.dips8	

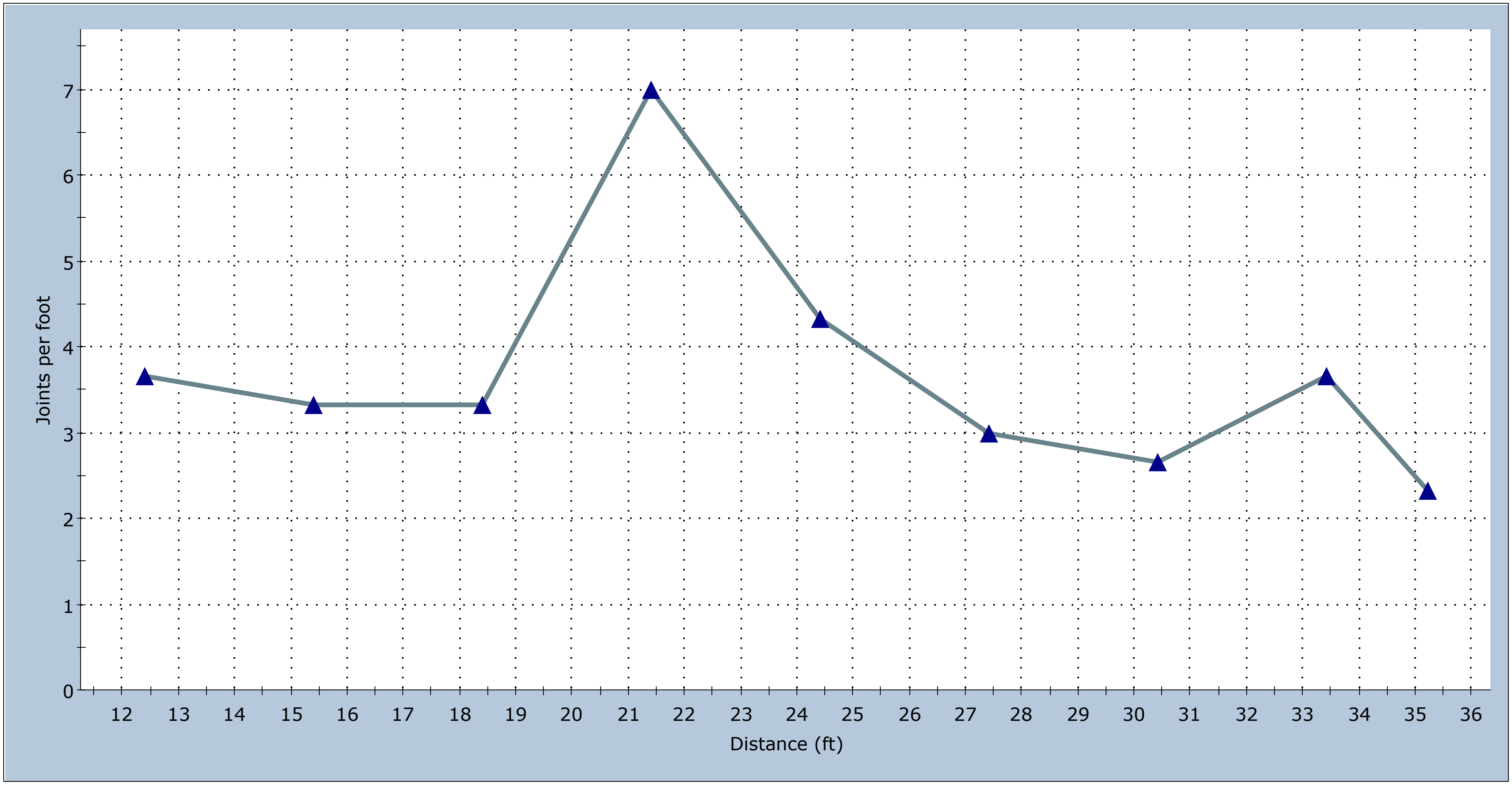
RQD Analysis
Traverse L1



mean=56.333 s.d.=20.830 min=34.000 max=100.000

DIPS 8.002	*Project*	Brewer-Eddington I-395/Route 9 Connector	
	Analysis Description	Levenseller Road BH Logging, BB-ELER-206A	
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
	Date April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-206A.dips8	

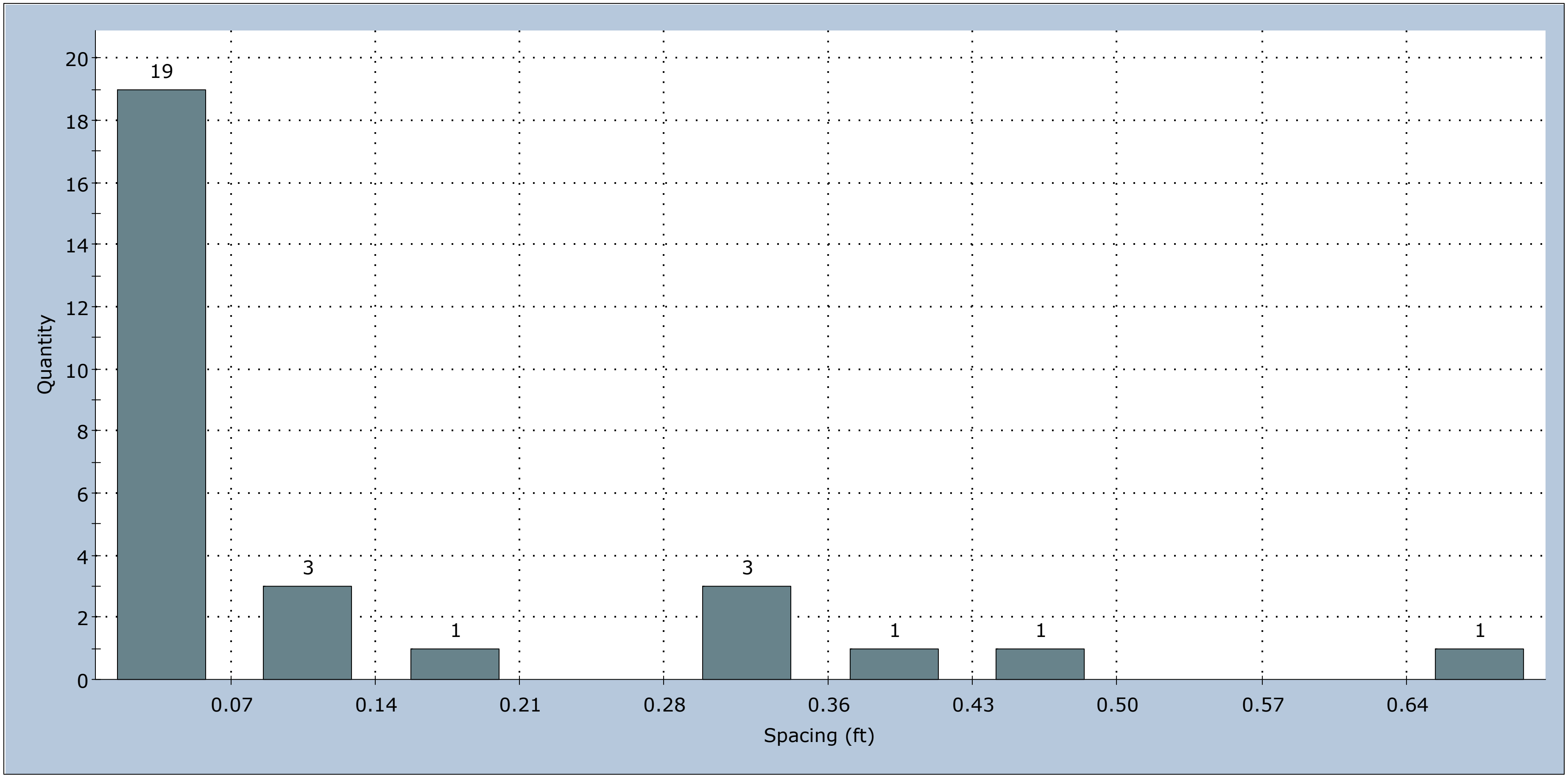
Joint Frequency Analysis
Traverse L1



mean=3.704 s.d.=1.290 min=2.333 max=7.000

	Project Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description Levenseller Road BH Logging, BB-ELER-206A		
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
DIPS 8.002	*Date* April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-206A.dips8	

True Joint Spacing
Set 1: J1
All Traverses

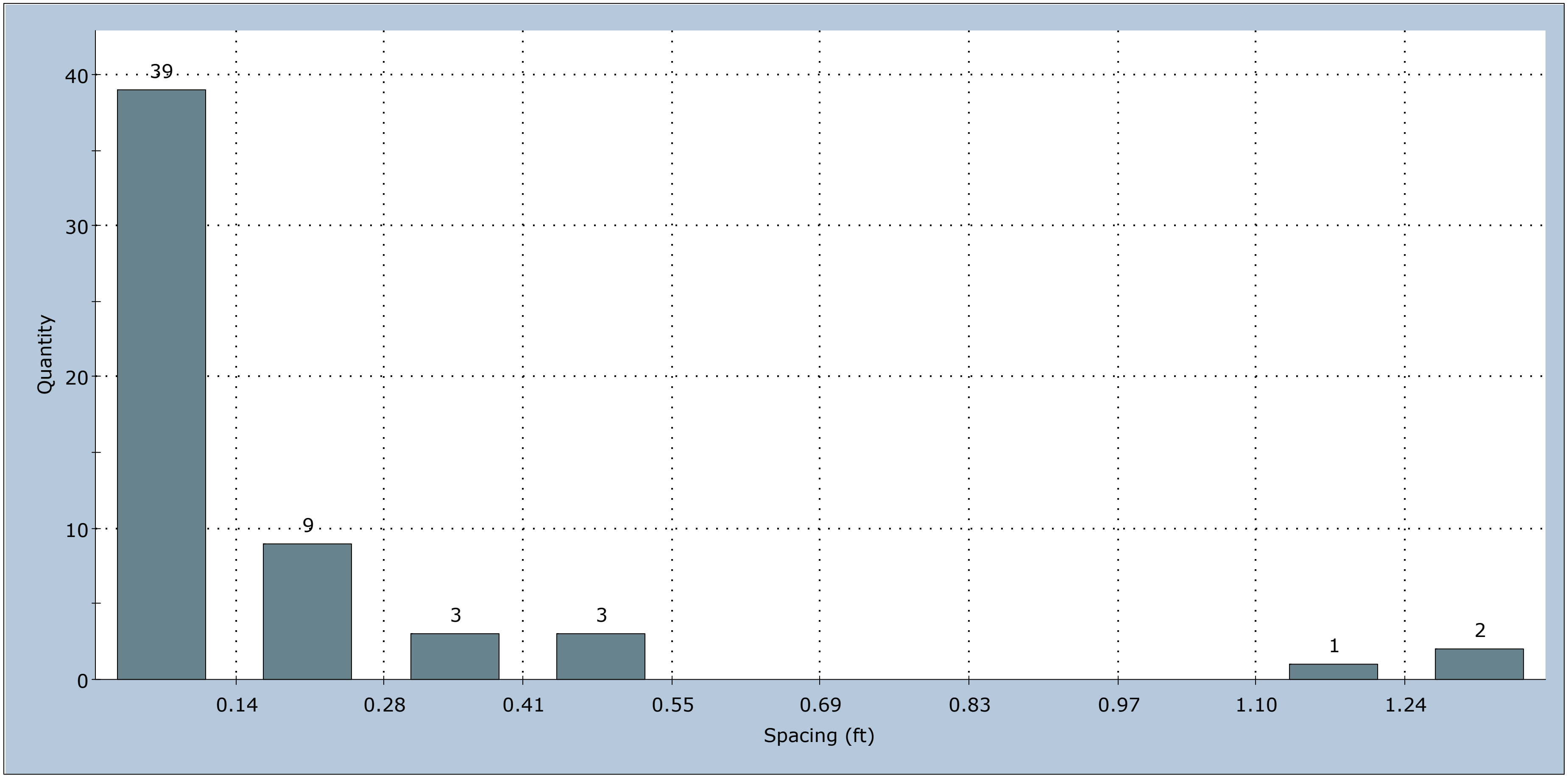


mean=0.140 s.d.=0.162 min=0.001 max=0.711

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, BB-ELER-206A		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-206A.dips8

DIPS 8.002

True Joint Spacing
Set 2: J2
All Traverses

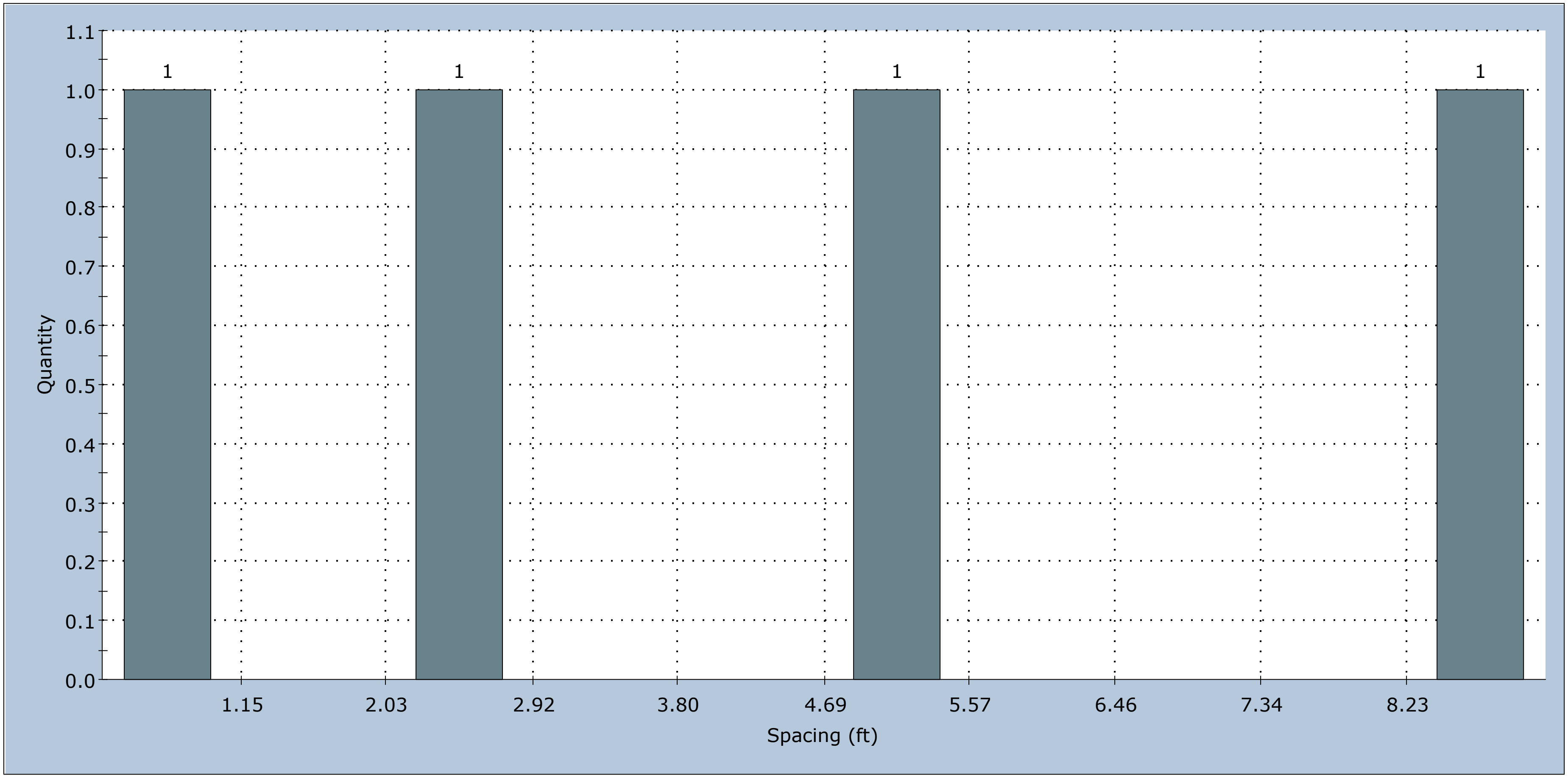


mean=0.207 s.d.=0.272 min=0.001 max=1.379

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, BB-ELER-206A		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_BB-ELER-206A.dips8

DIPS 8.002

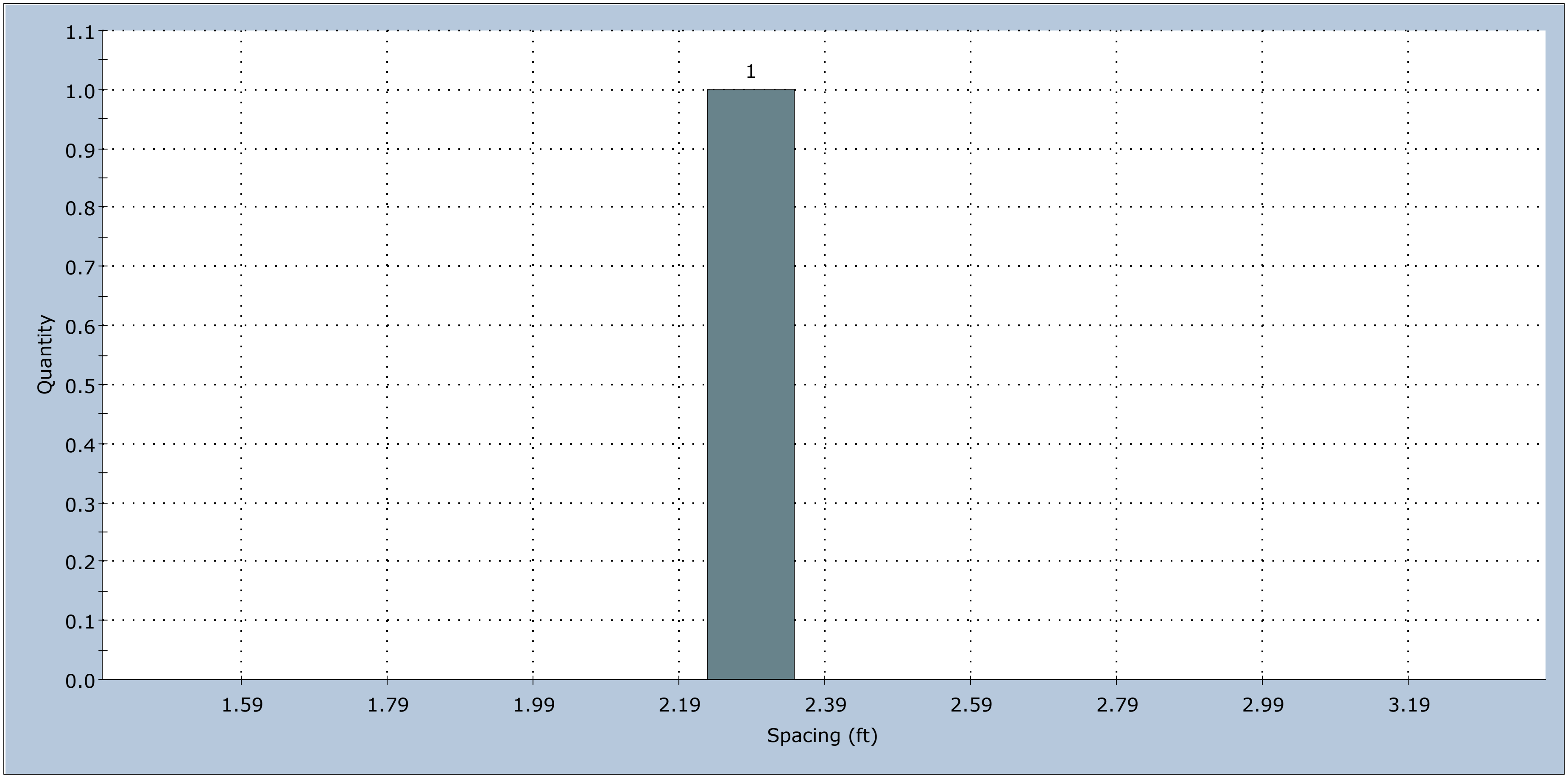
True Joint Spacing
Set 3: J3
All Traverses



mean=4.360 s.d.=3.264 min=0.263 max=9.115

DIPS 8.002	*Project* Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description Levenseller Road BH Logging, BB-ELER-206A		
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
	Date April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-206A.dips8	

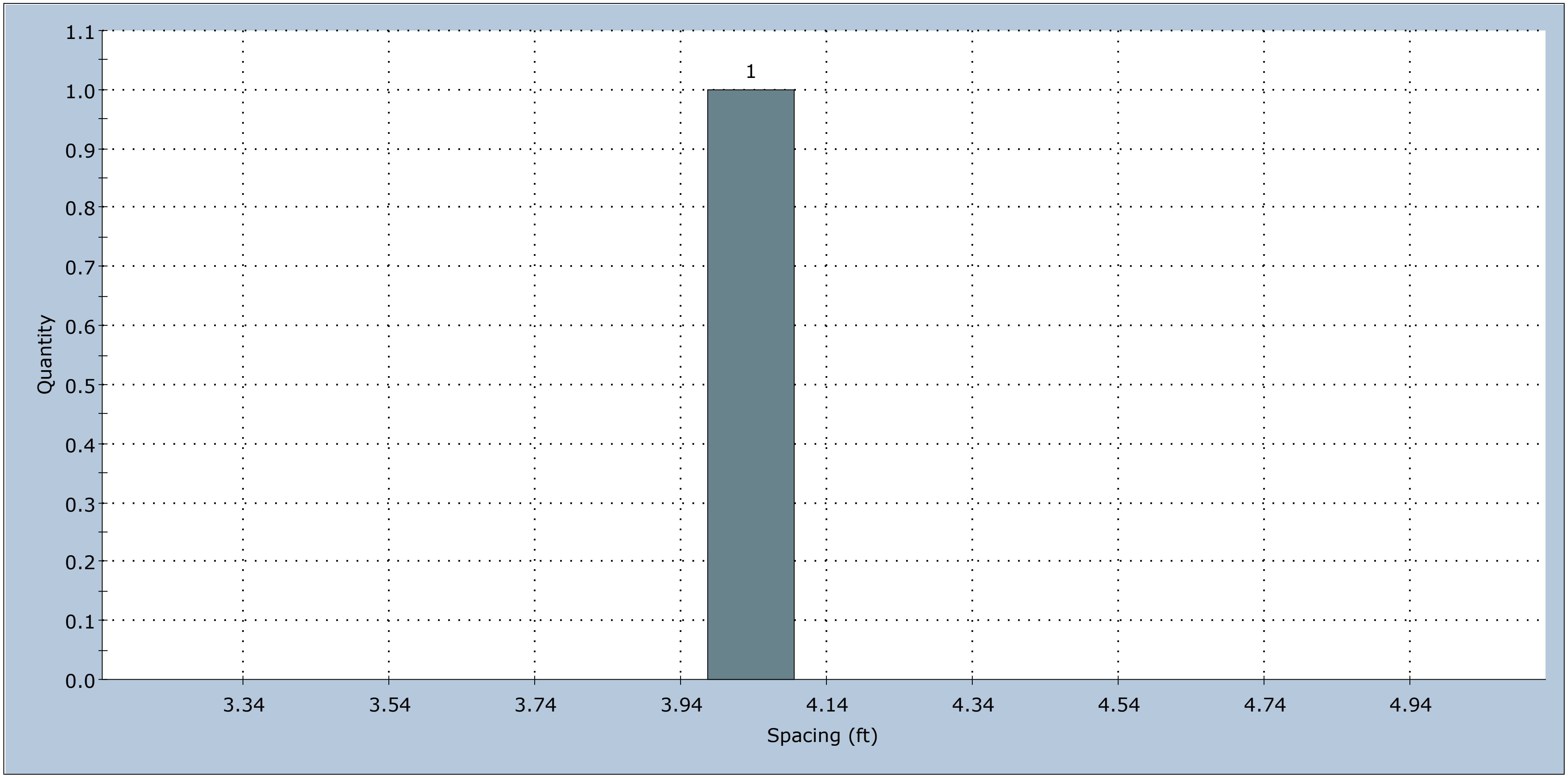
True Joint Spacing
Set 6: J6
All Traverses



mean=2.389 s.d.=0.000 min=2.389 max=2.389

DIPS 8.002	*Project* Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description Levenseller Road BH Logging, BB-ELER-206A		
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
	Date April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-206A.dips8	

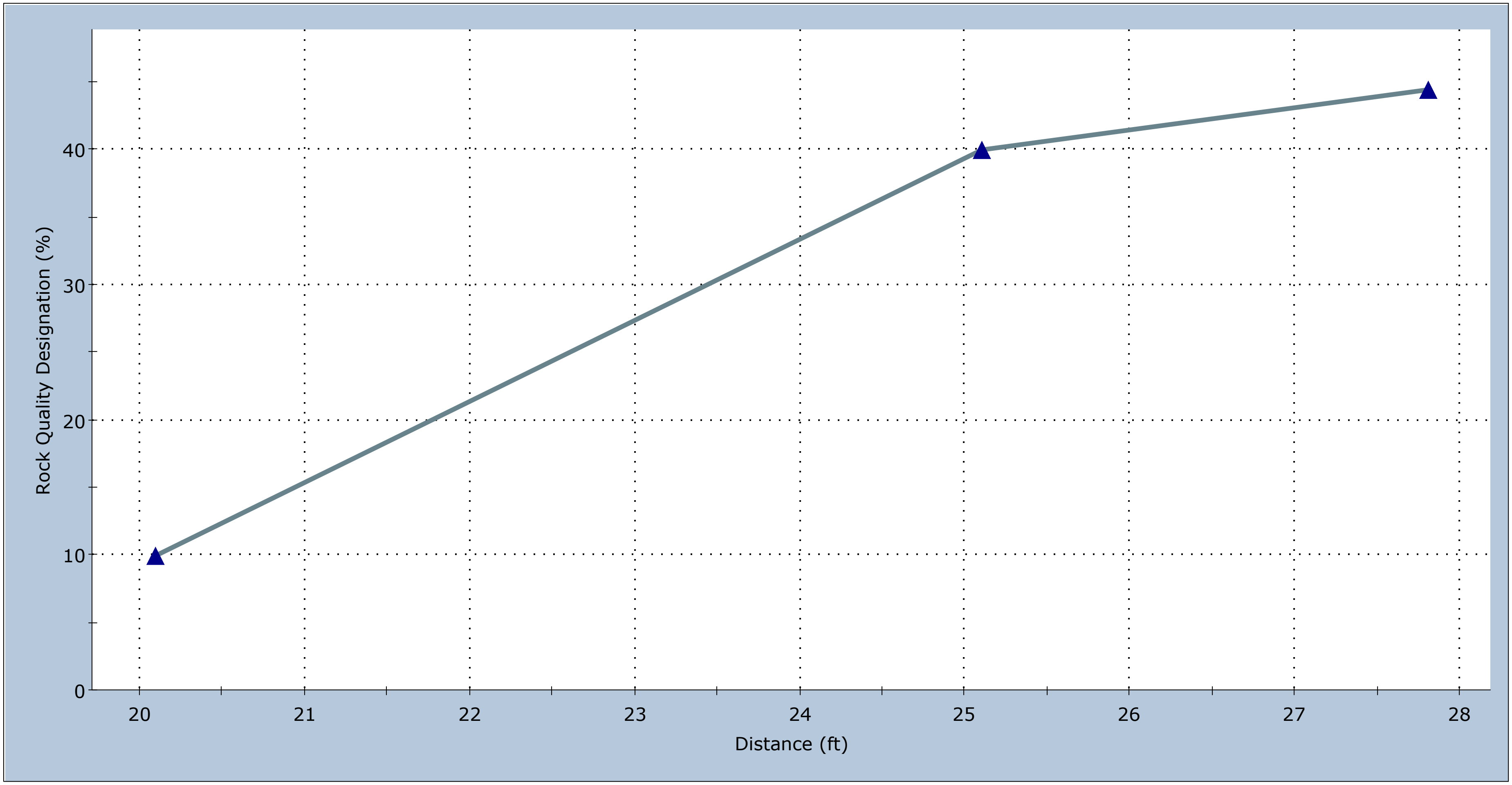
True Joint Spacing
Set 7: J7
All Traverses



mean=4.136 s.d.=0.000 min=4.136 max=4.136

DIPS 8.002	*Project* Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description Levenseller Road BH Logging, BB-ELER-206A		
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
	Date April 2021	*File Name* 2021-0414_Levenseller_BB-ELER-206A.dips8	

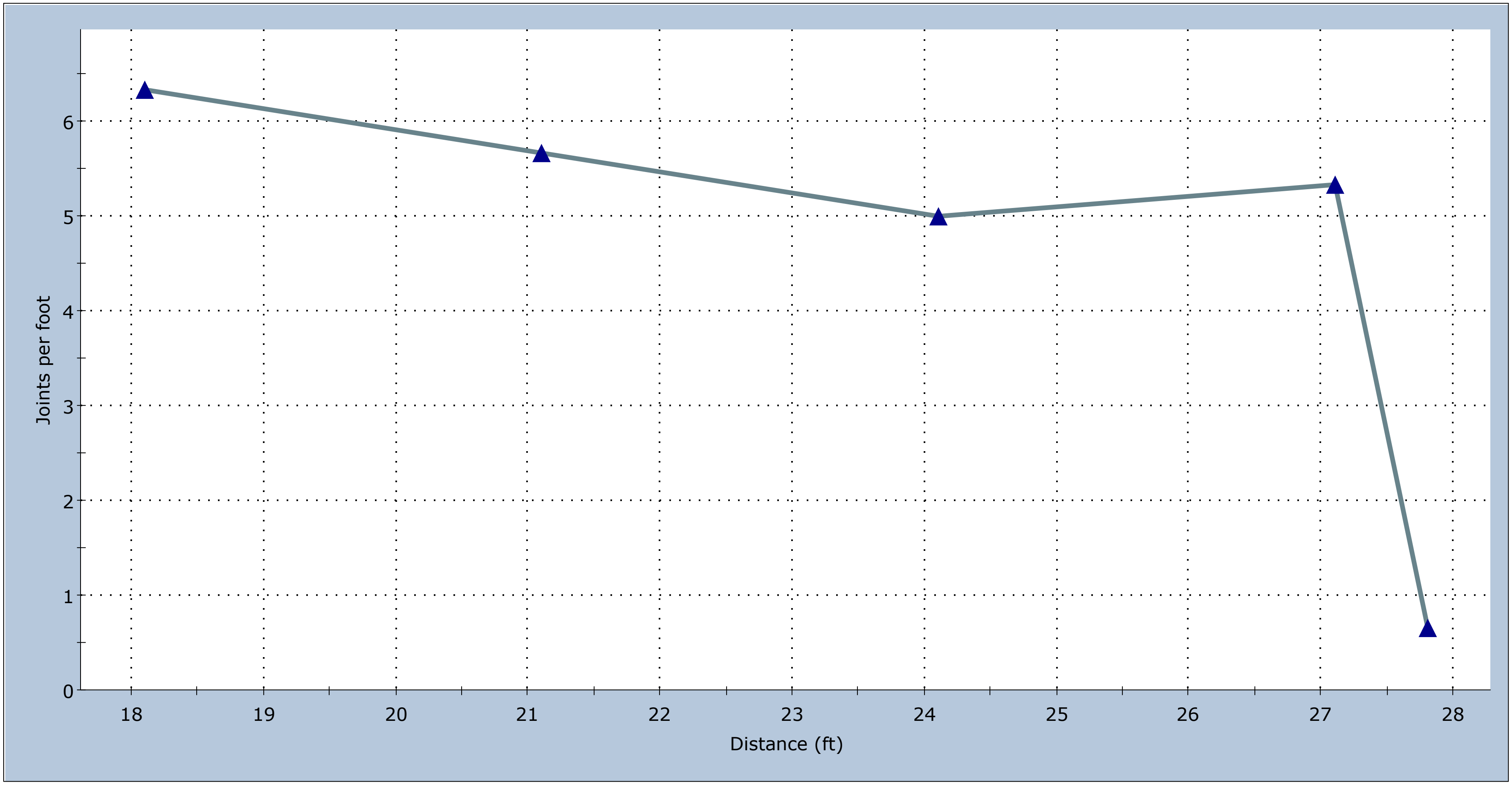
RQD Analysis
Traverse L1



mean=31.481 s.d.=15.298 min=10.000 max=44.444

	Project	Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description	Levenseller Road BH Logging, HB-BE-235		
	Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
DIPS 8.002	*Date*	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-235.dips8

Joint Frequency Analysis
Traverse L1

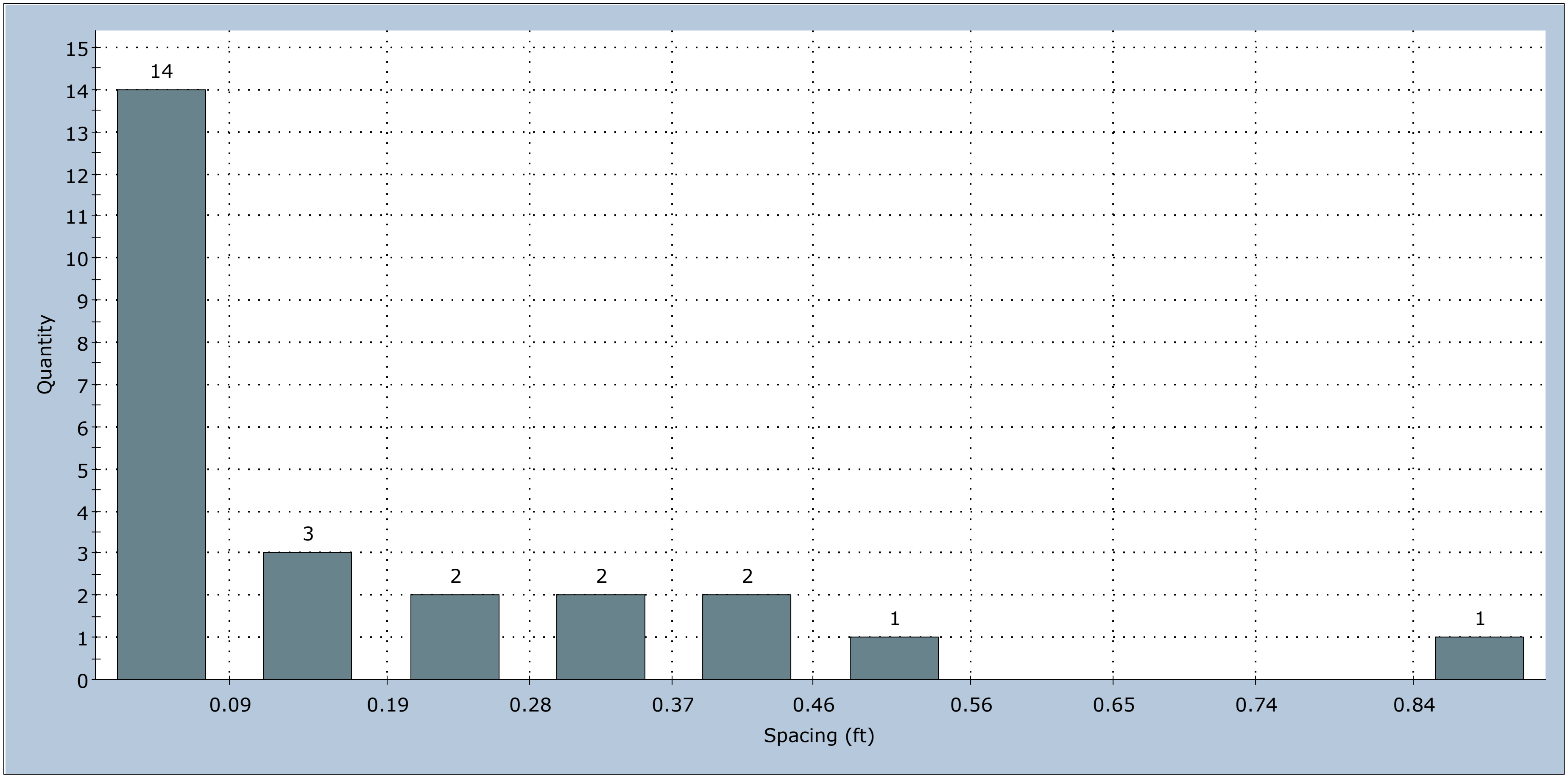


mean=4.600 s.d.=2.015 min=0.667 max=6.333

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-235		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-235.dips8

DIPS 8.002

True Joint Spacing
Set 1: J1
All Traverses

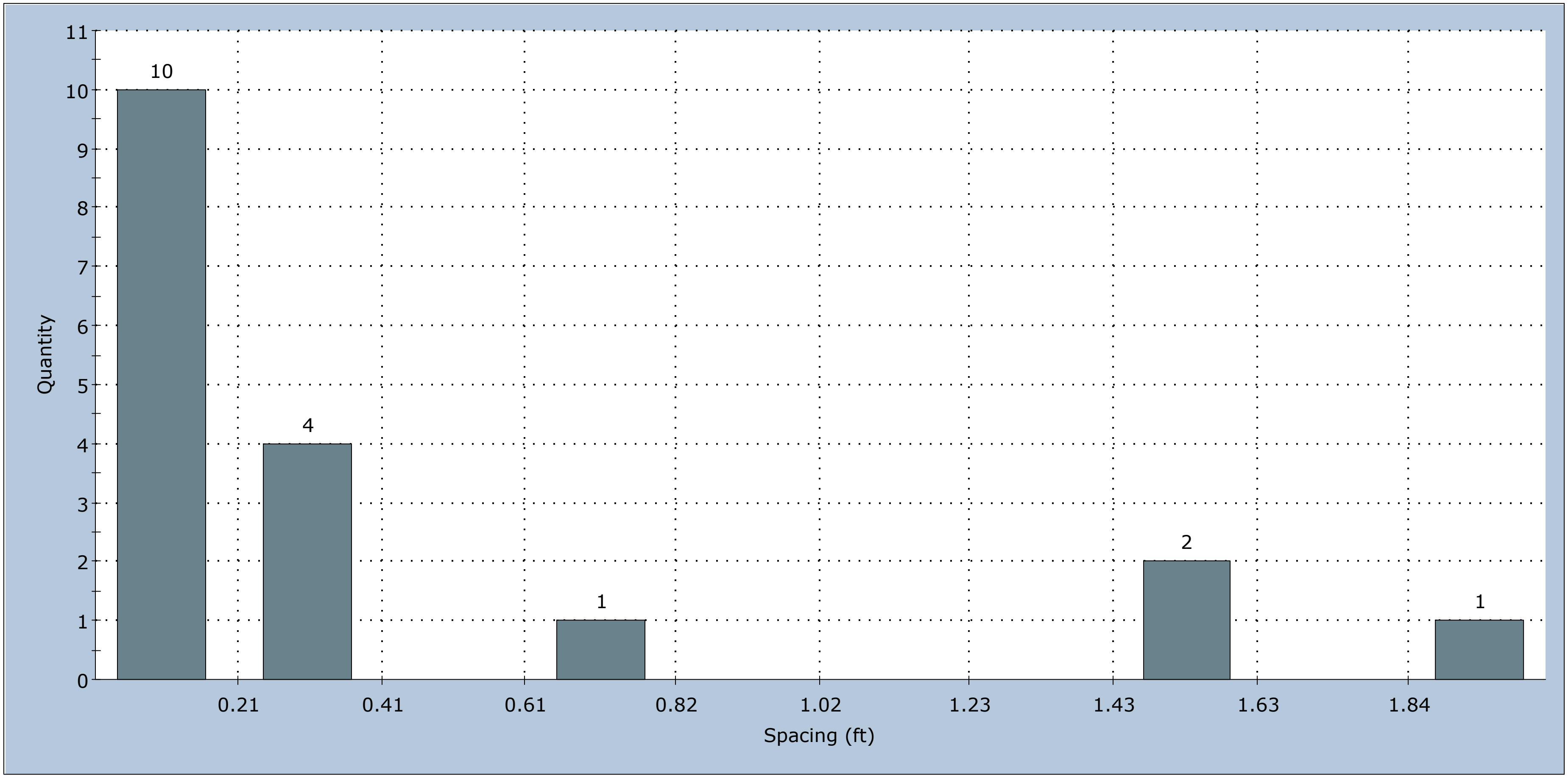


mean=0.177 s.d.=0.208 min=0.001 max=0.928

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-235		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-235.dips8

DIPS 8.002

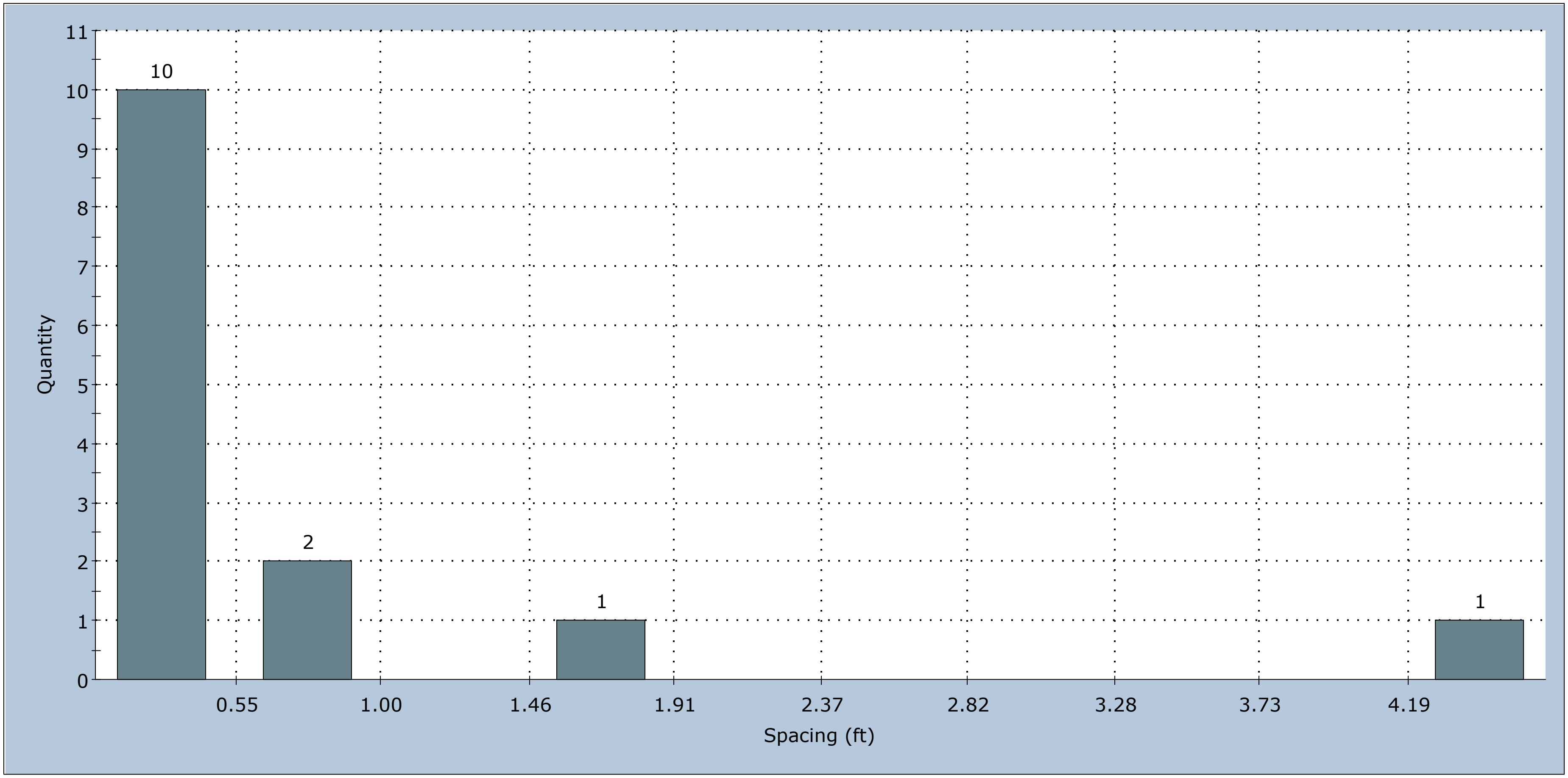
True Joint Spacing
Set 2: J2
All Traverses



mean=0.465 s.d.=0.580 min=0.001 max=2.043

	Project	Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description	Levenseller Road BH Logging, HB-BE-235		
	Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
DIPS 8.002	*Date*	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-235.dips8

True Joint Spacing
Set 3: J3
All Traverses

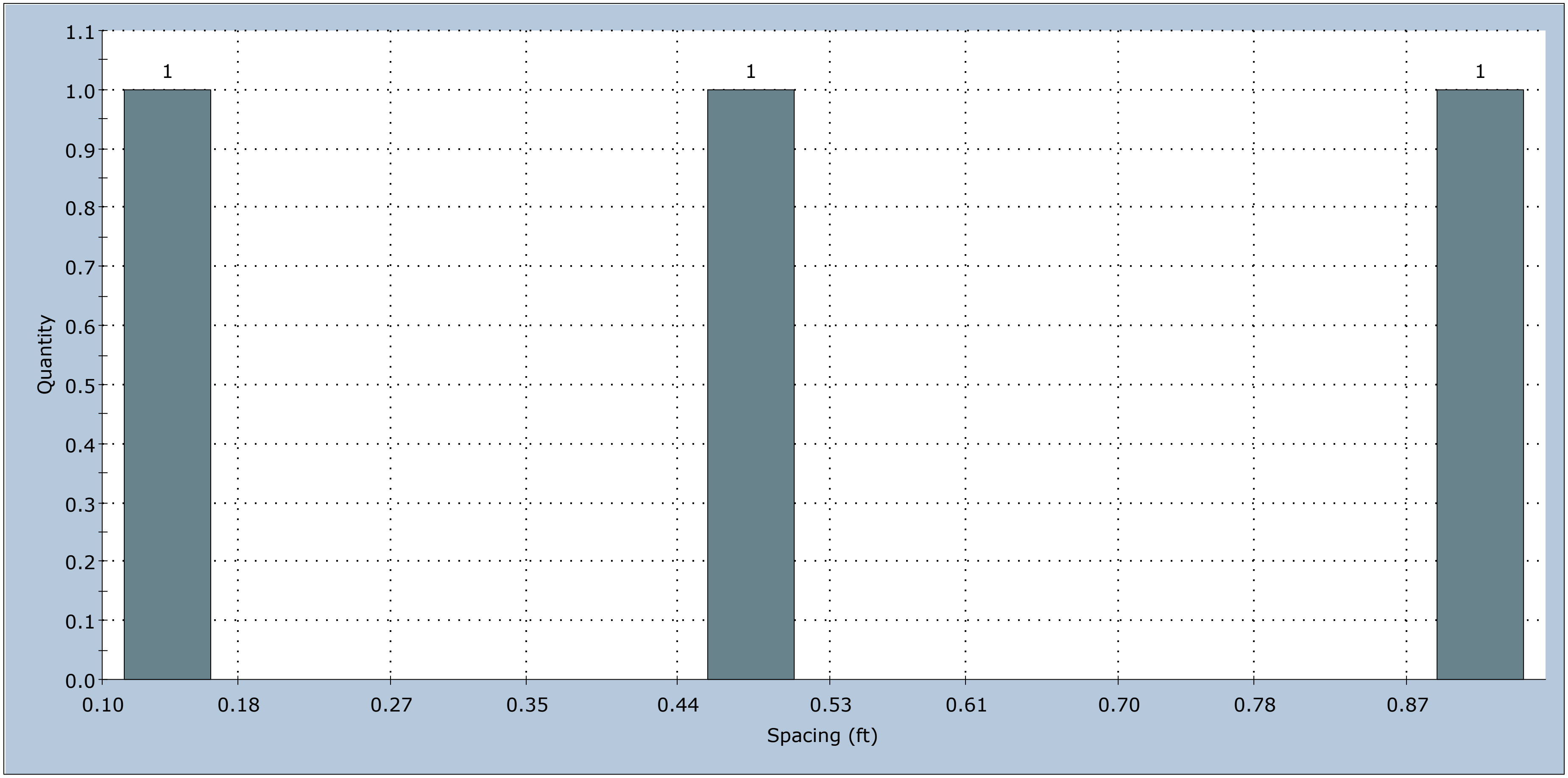


mean=0.656 s.d.=1.189 min=0.091 max=4.641

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-235		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-235.dips8

DIPS 8.002

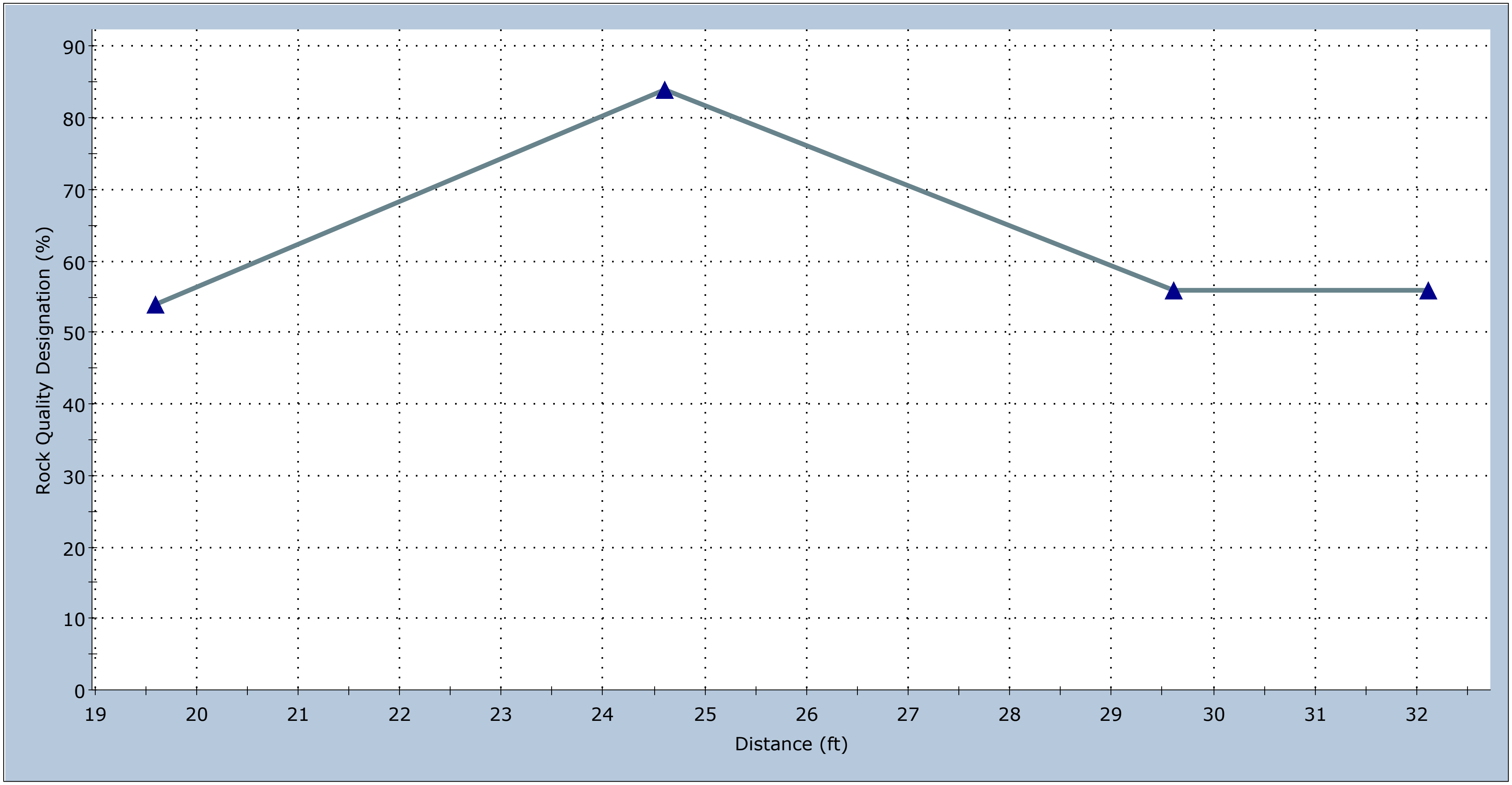
True Joint Spacing
Set 8: J8
All Traverses



mean=0.510 s.d.=0.352 min=0.096 max=0.957

DIPS 8.002	*Project*	Brewer-Eddington I-395/Route 9 Connector	
	Analysis Description	Levenseller Road BH Logging, HB-BE-235	
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
	Date April 2021	*File Name* 2021-0414_Levenseller_HB-BE-235.dips8	

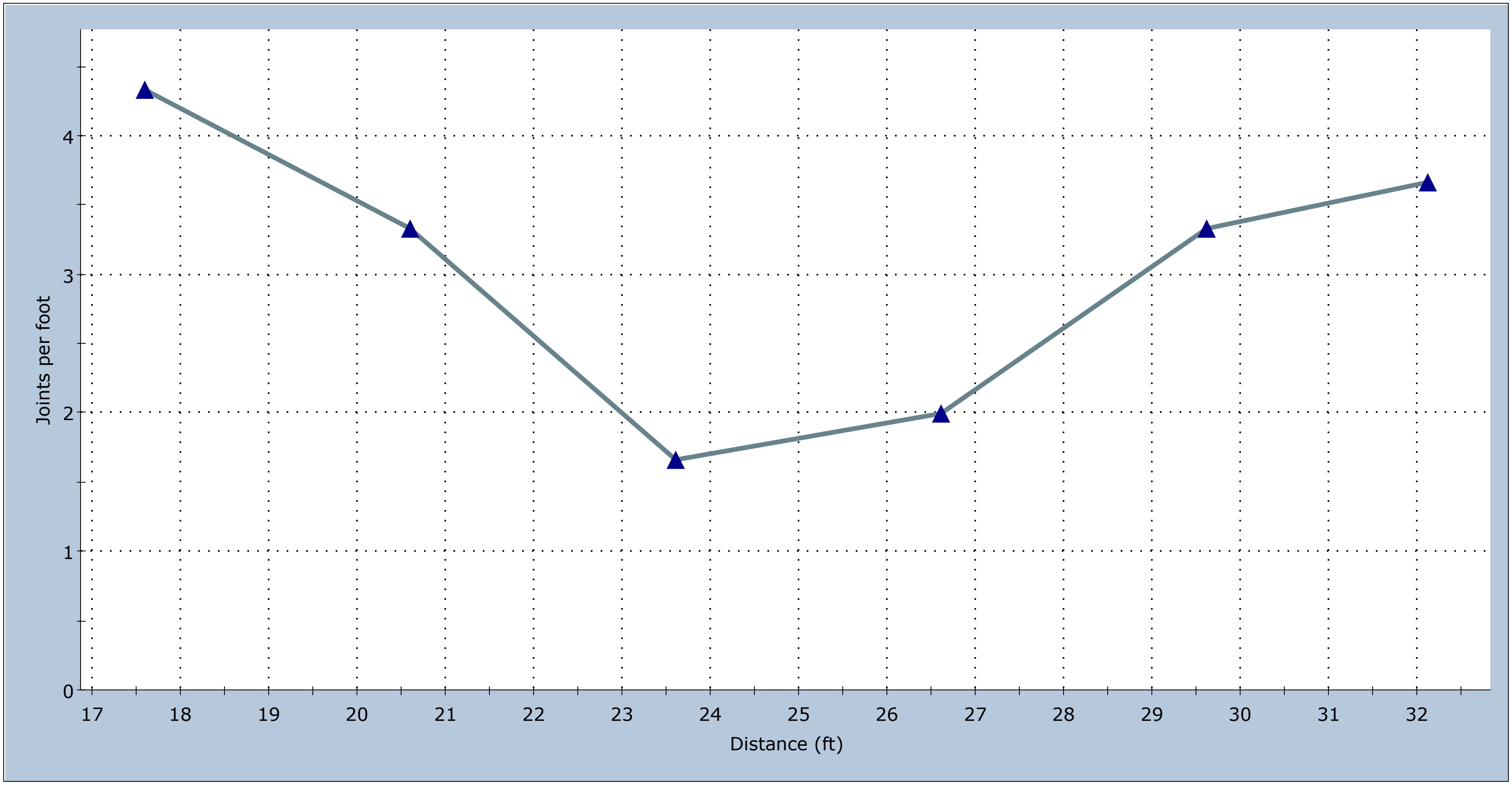
RQD Analysis
Traverse L1



mean=62.500 s.d.=12.440 min=54.000 max=84.000

	Project Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description Levenseller Road BH Logging, HB-BE-236		
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
DIPS 8.002	*Date* April 2021	*File Name* 2021-0414_Levenseller_HB-BE-236.dips8	

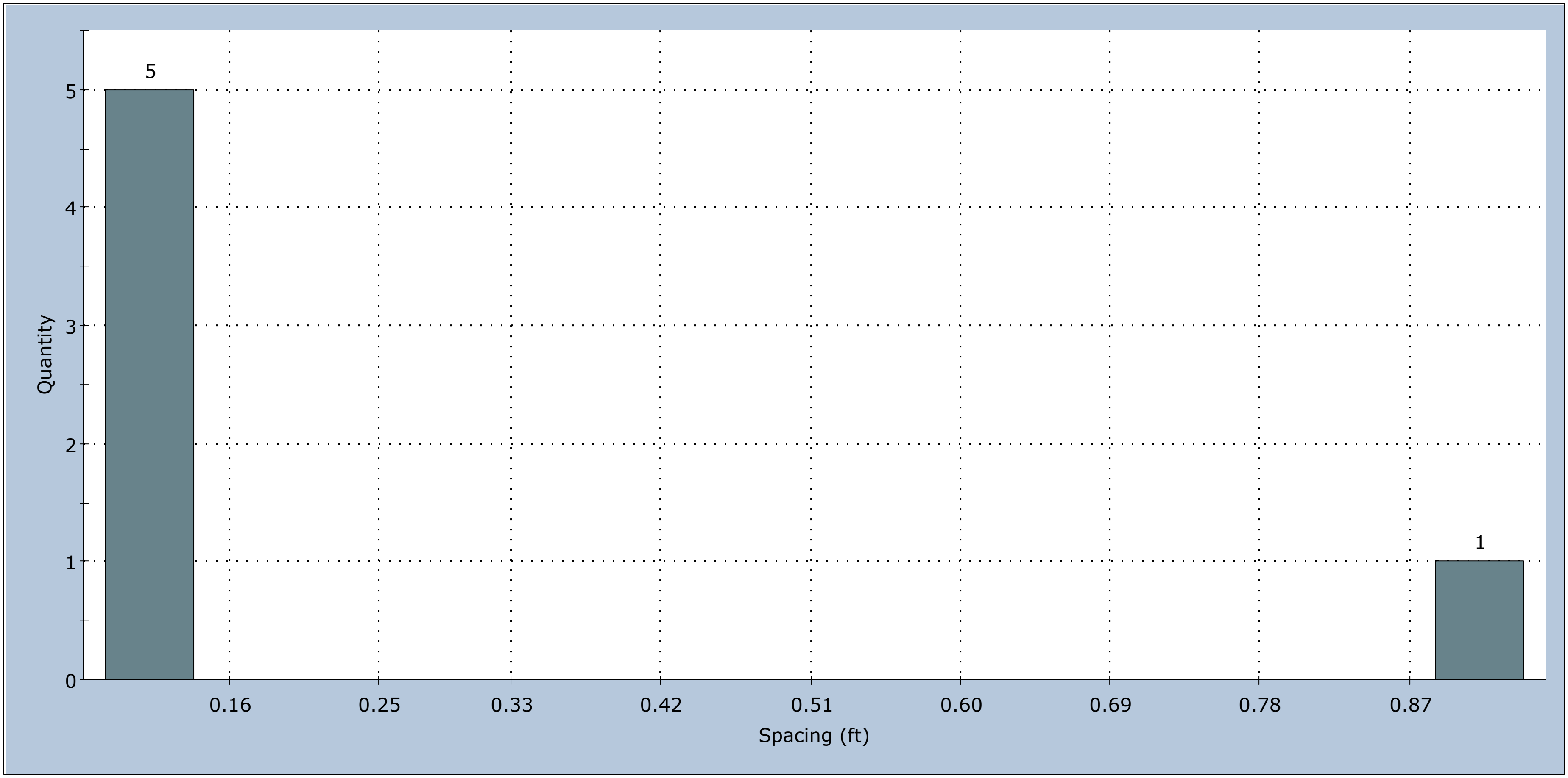
Joint Frequency Analysis
Traverse L1



mean=3.056 s.d.=0.931 min=1.667 max=4.333

	Project Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description Levenseller Road BH Logging, HB-BE-236		
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
DIPS 8.002	*Date* April 2021	*File Name* 2021-0414_Levenseller_HB-BE-236.dips8	

True Joint Spacing
Set 1: J1
All Traverses

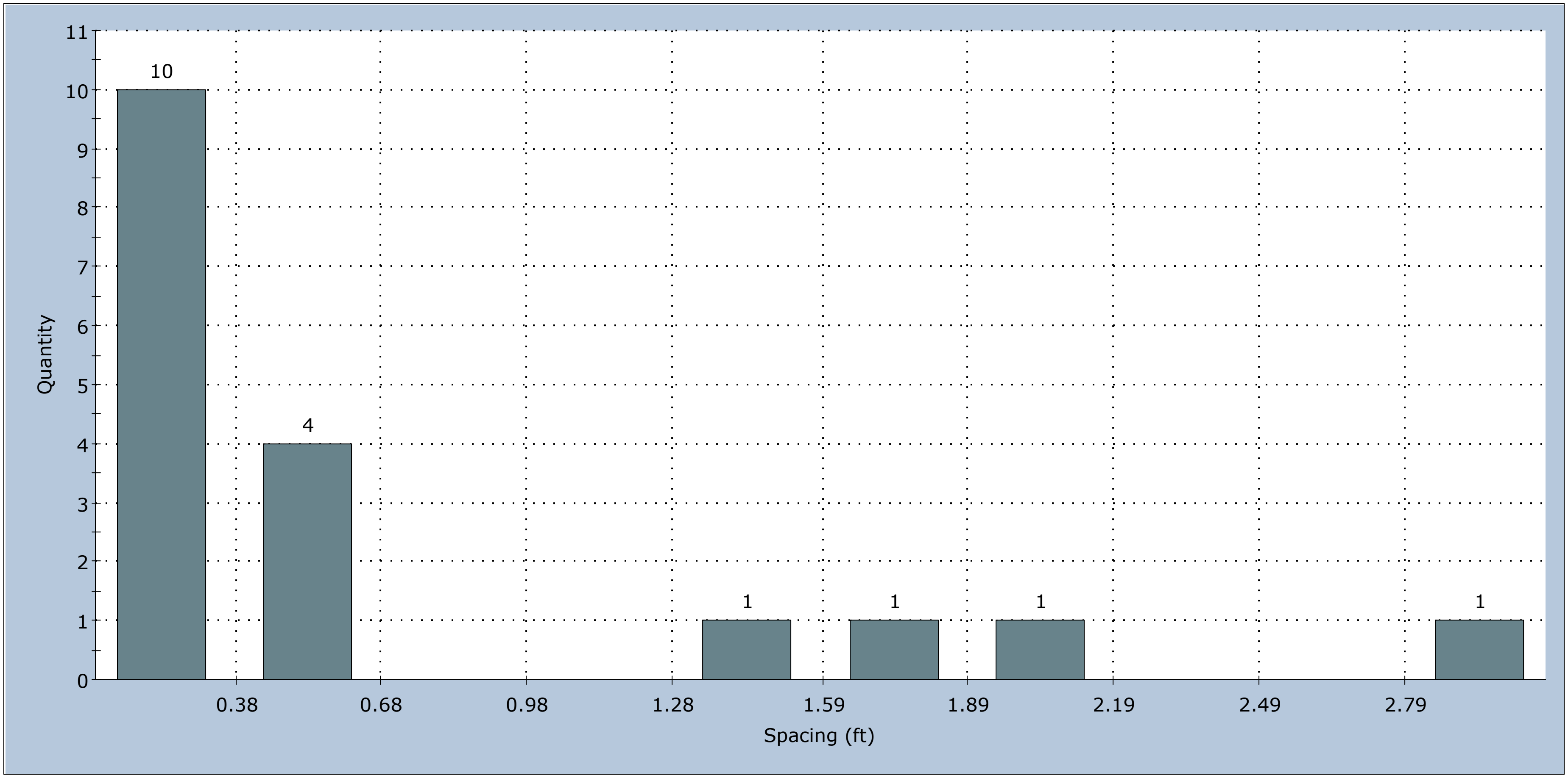


mean=0.228 s.d.=0.326 min=0.068 max=0.957

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-236		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-236.dips8

DIPS 8.002

True Joint Spacing
Set 2: J2
All Traverses

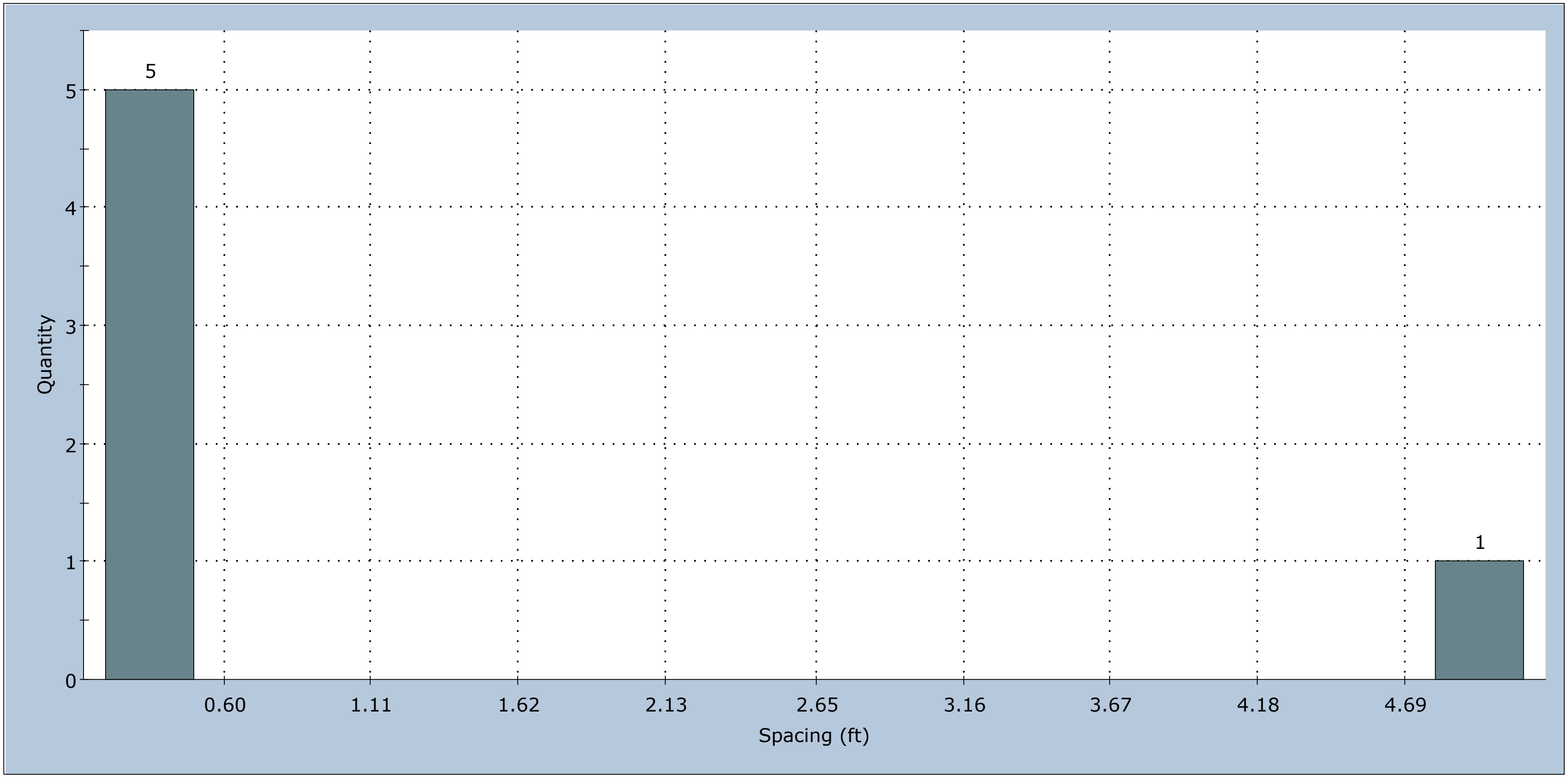


mean=0.646 s.d.=0.818 min=0.076 max=3.097

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-236		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-236.dips8

DIPS 8.002

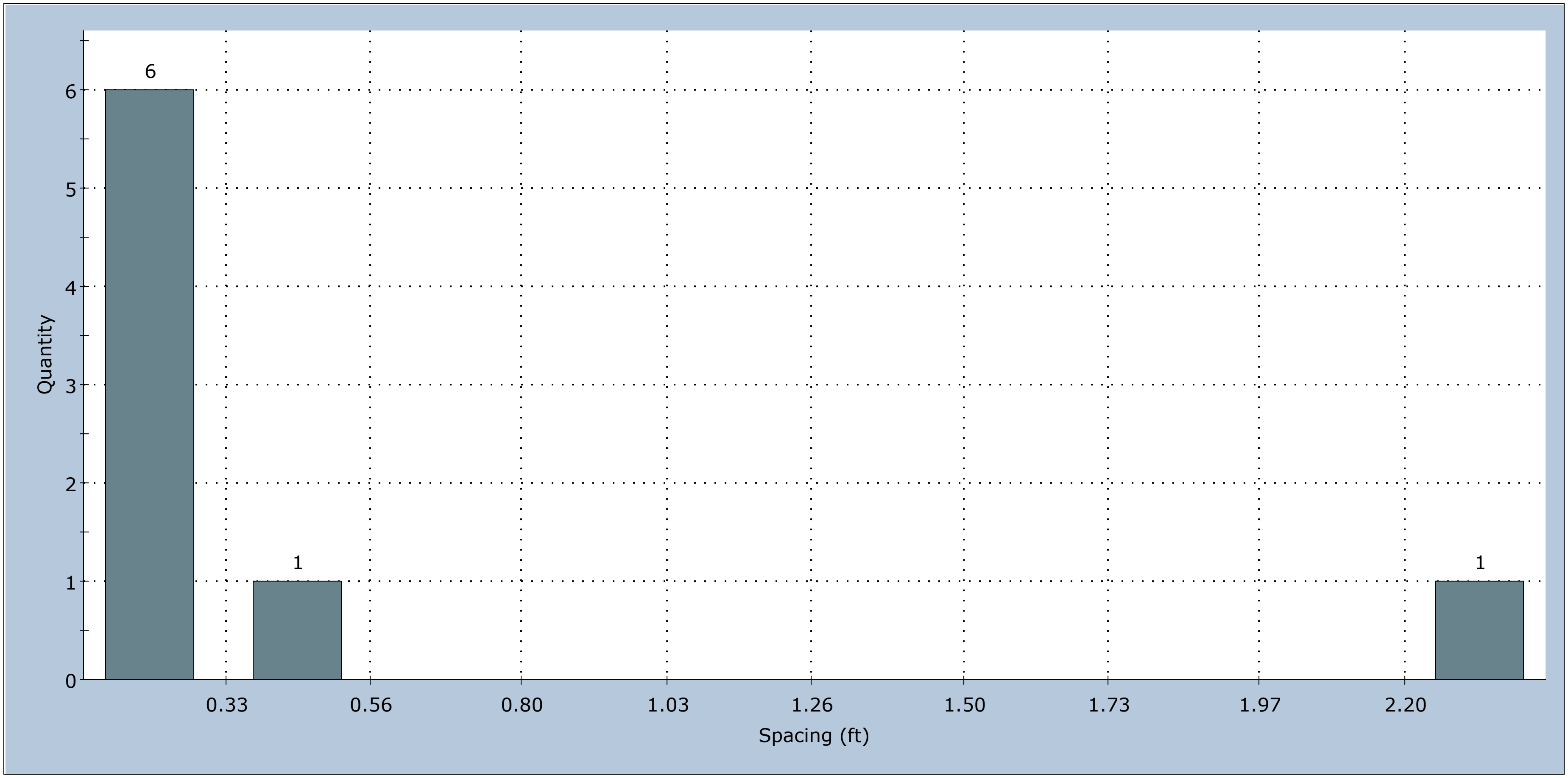
True Joint Spacing
Set 3: J3
All Traverses



mean=1.061 s.d.=1.855 min=0.090 max=5.202

	Project Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description Levenseller Road BH Logging, HB-BE-236		
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
DIPS 8.002	*Date* April 2021	*File Name* 2021-0414_Levenseller_HB-BE-236.dips8	

True Joint Spacing
Set 4: J4
All Traverses

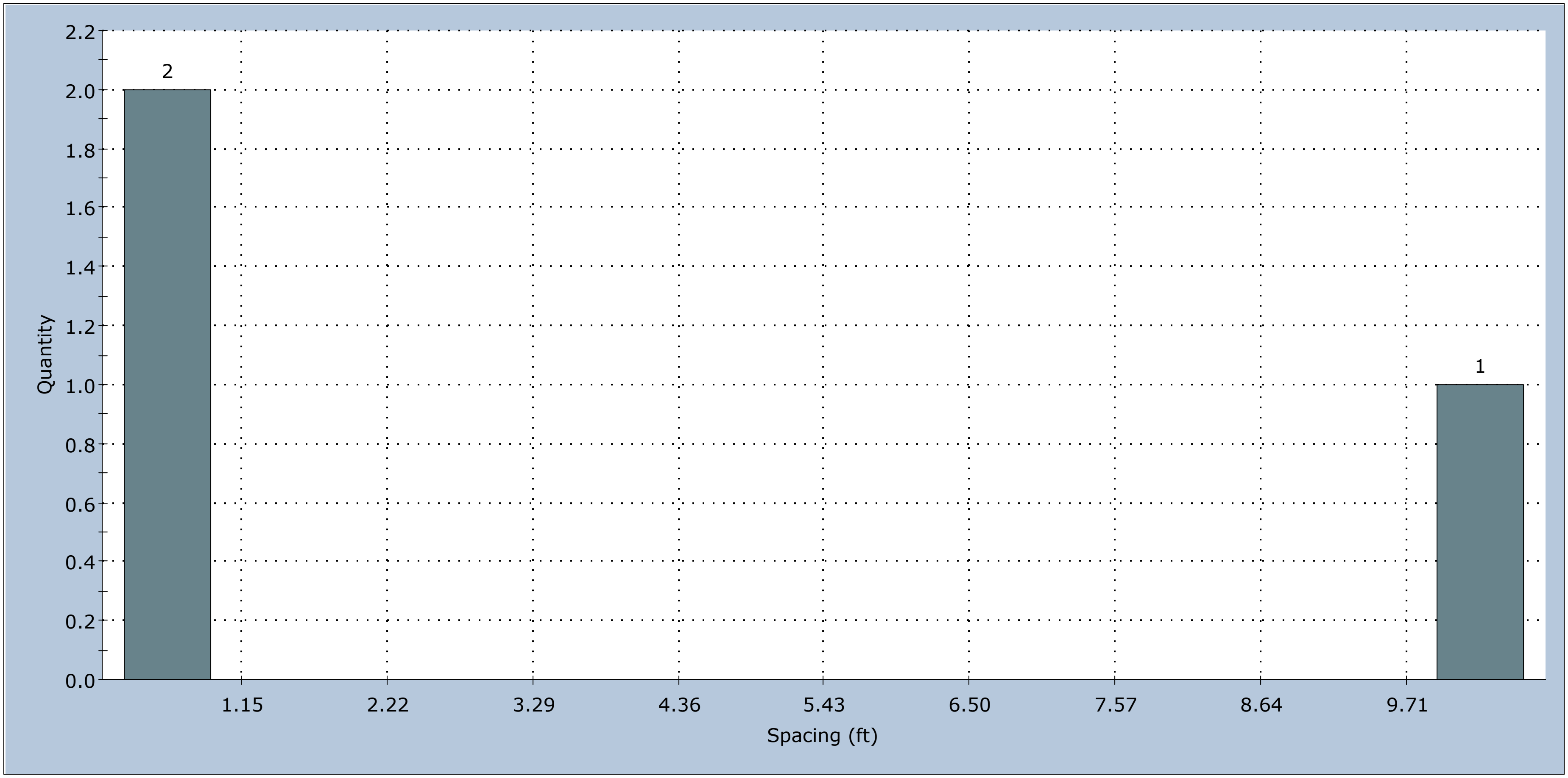


mean=0.480 s.d.=0.744 min=0.094 max=2.436

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-236		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-236.dips8

DIPS 8.002

True Joint Spacing
Set 7: J7
All Traverses

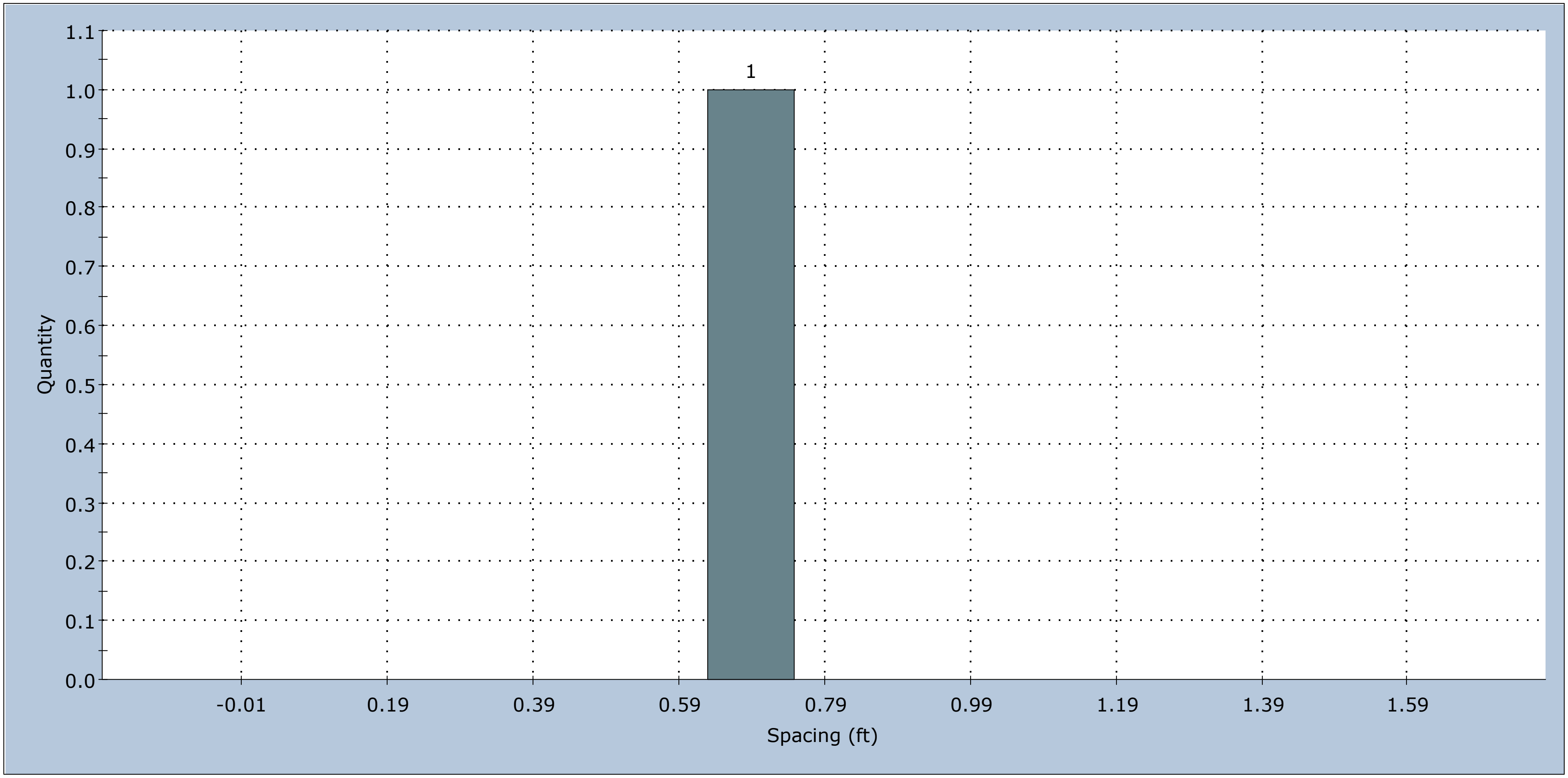


mean=3.646 s.d.=5.048 min=0.076 max=10.785

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-236		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-236.dips8

DIPS 8.002

True Joint Spacing
Set 8: J8
All Traverses

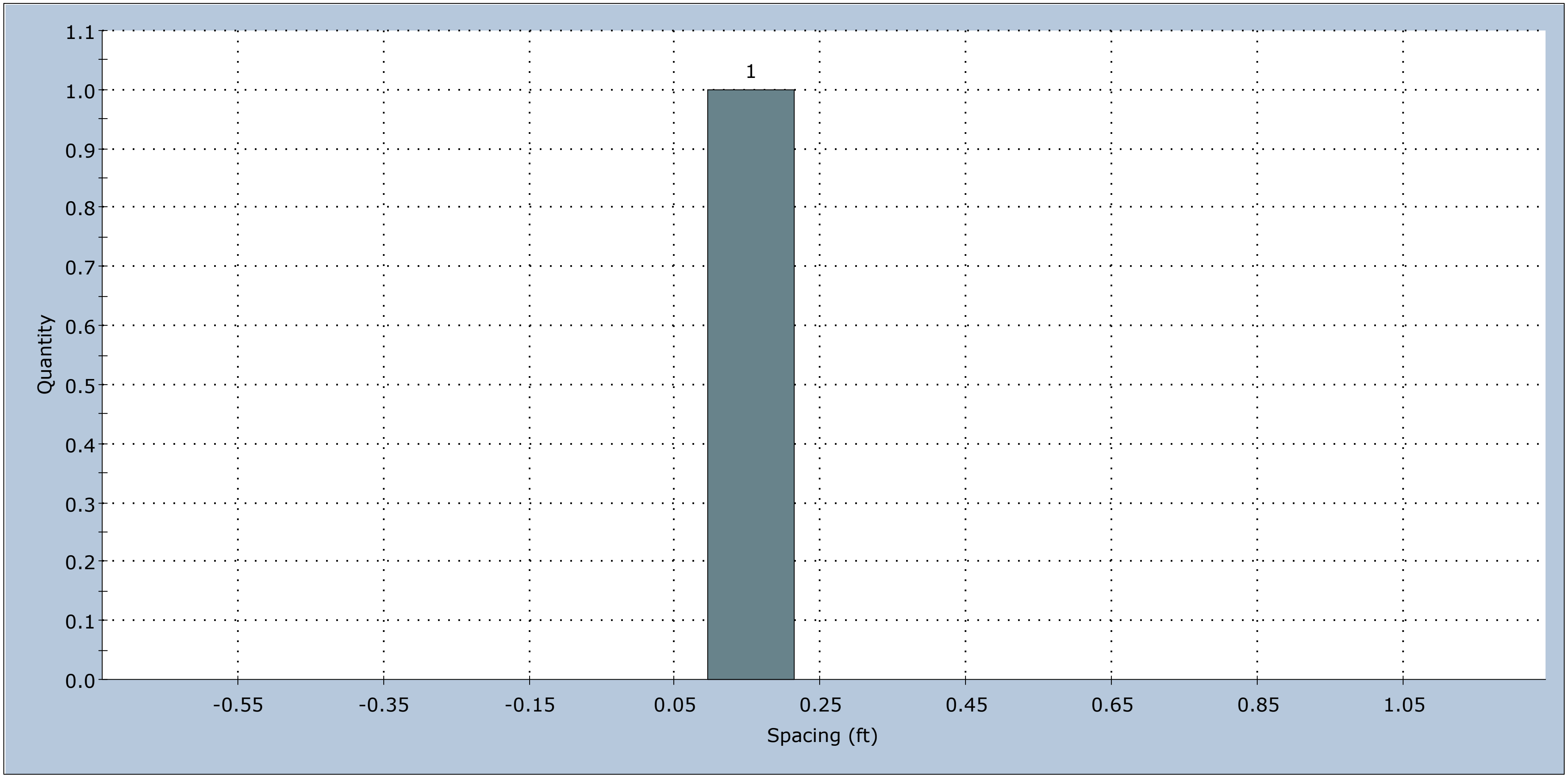


mean=0.790 s.d.=0.000 min=0.790 max=0.790

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-236		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-236.dips8

DIPS 8.002

True Joint Spacing
Set 9: J9
All Traverses

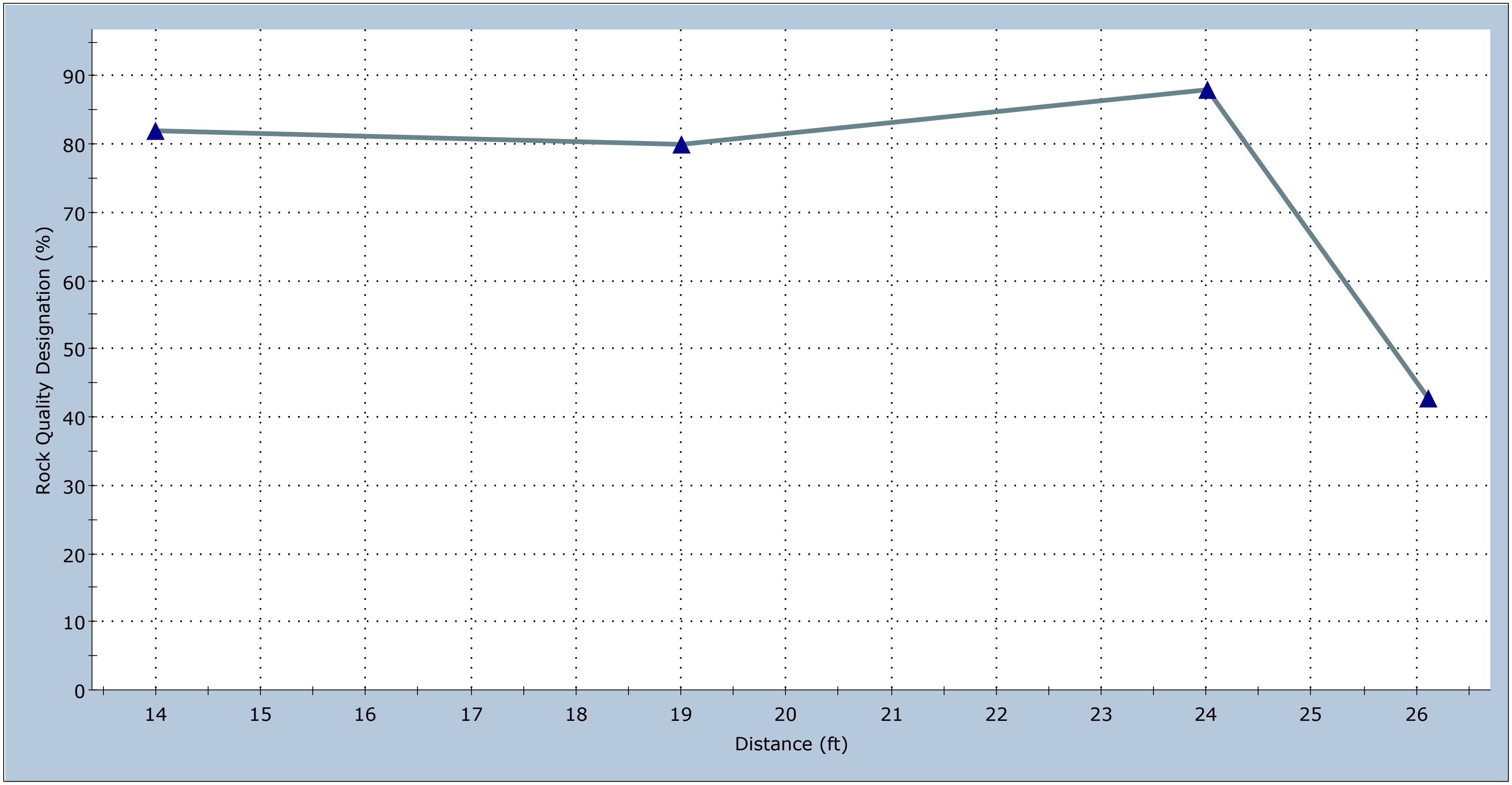


mean=0.255 s.d.=0.000 min=0.255 max=0.255

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-236		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-236.dips8

DIPS 8.002

RQD Analysis
Traverse L1

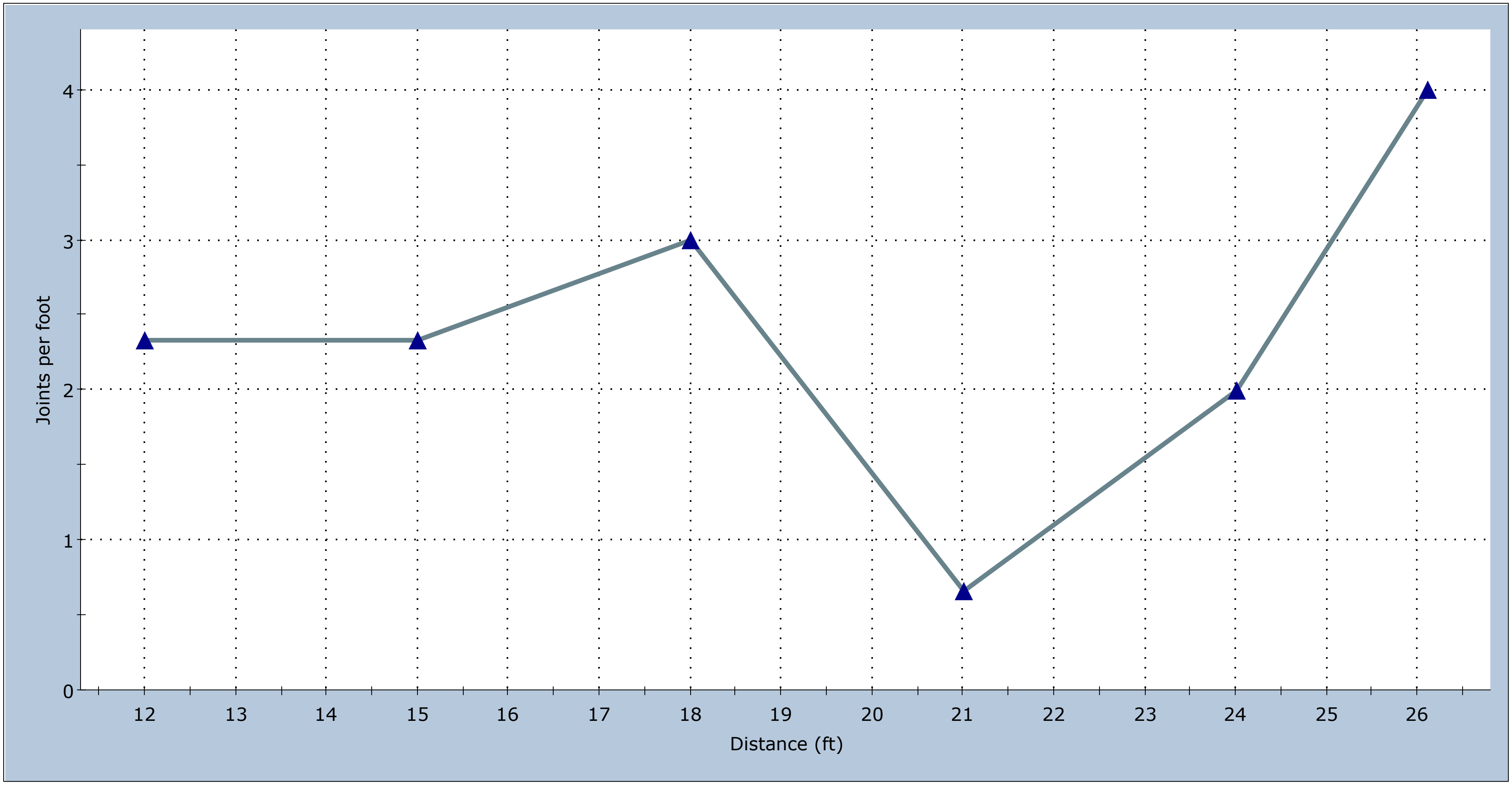


mean=73.214 s.d.=17.772 min=42.857 max=88.000

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-237		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-237.dips8

DIPS 8.002

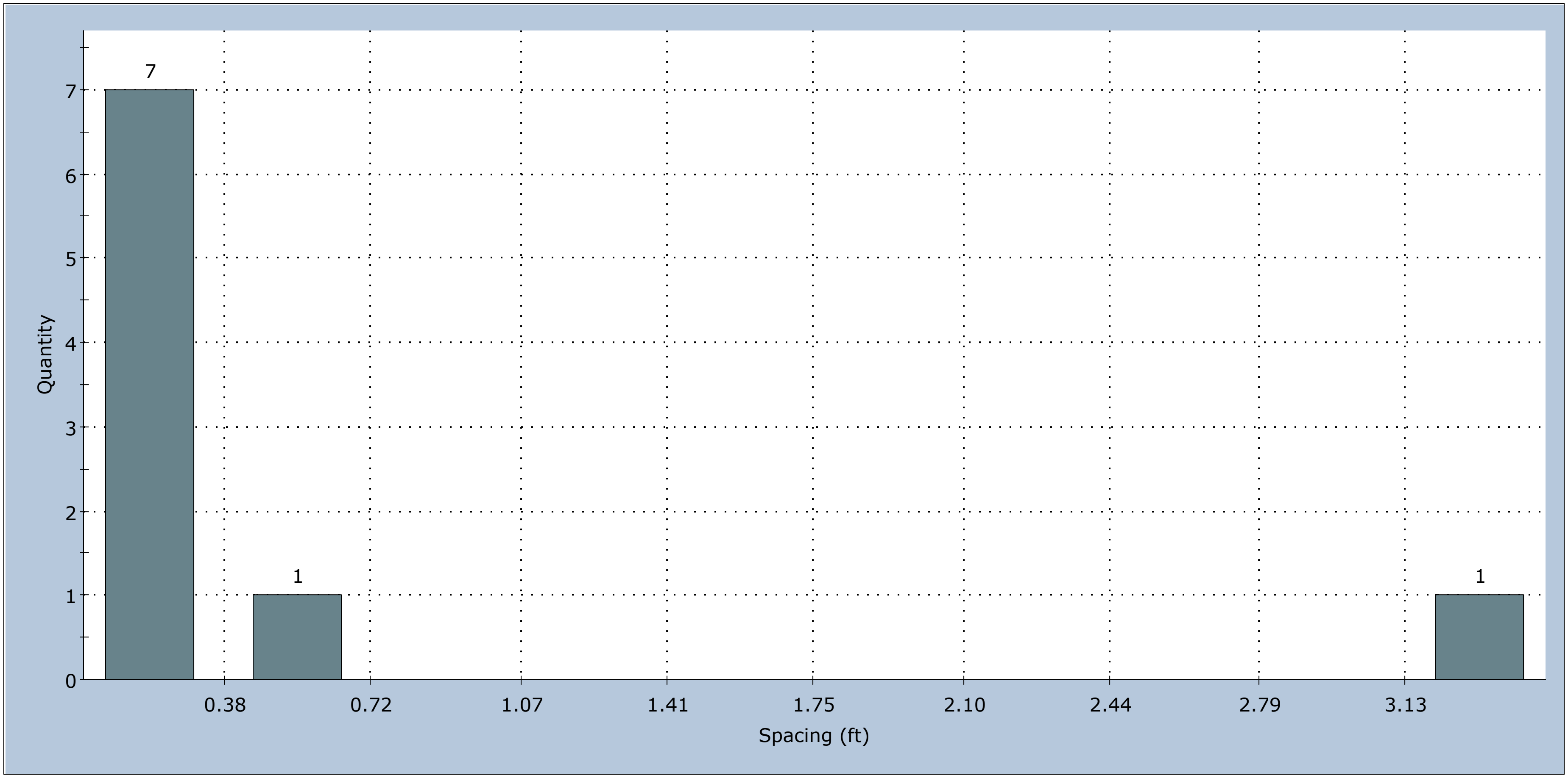
Joint Frequency Analysis
Traverse L1



mean=2.389 s.d.=1.008 min=0.667 max=4.000

	Project	Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description	Levenseller Road BH Logging, HB-BE-237		
	Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
DIPS 8.002	*Date*	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-237.dips8

True Joint Spacing
Set 1: J1
All Traverses

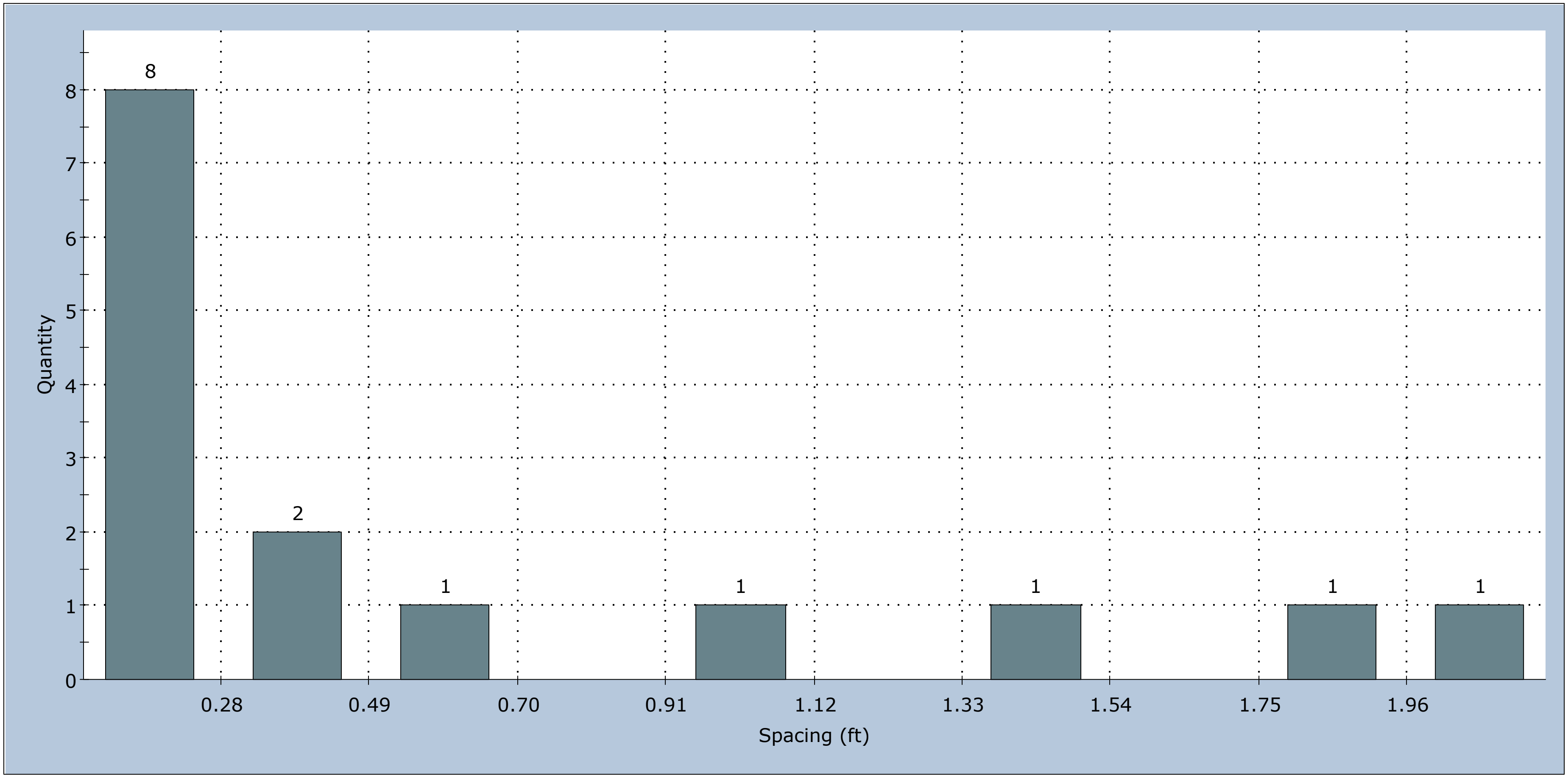


mean=0.575 s.d.=1.032 min=0.033 max=3.474

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-237		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-237.dips8

DIPS 8.002

True Joint Spacing
Set 2: J2
All Traverses

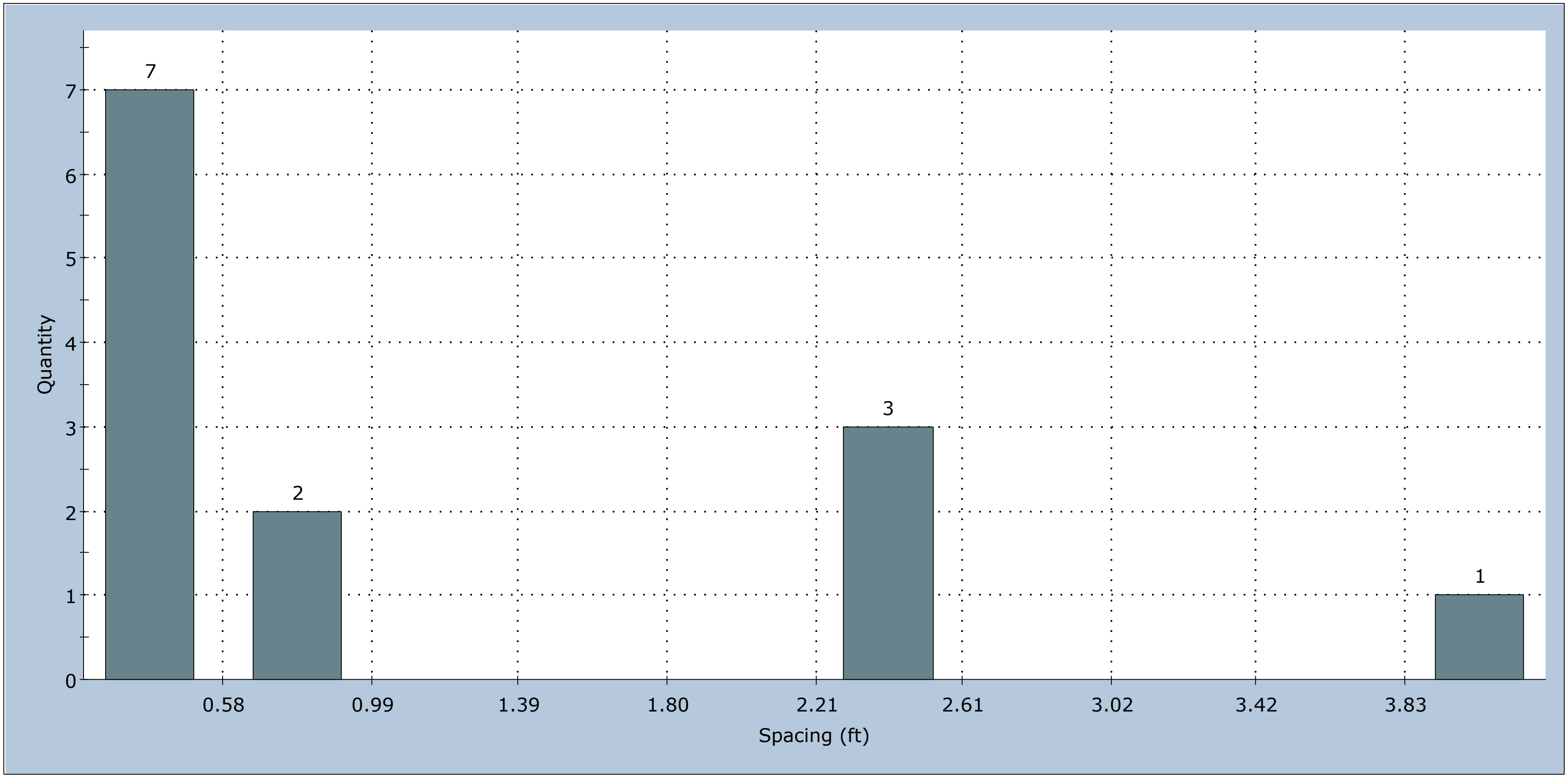


mean=0.608 s.d.=0.666 min=0.075 max=2.167

Project	Brewer-Eddington I-395/Route 9 Connector		
Analysis Description	Levenseller Road BH Logging, HB-BE-237		
Drawn By	J. Rawlins	*Company*	Haley & Aldrich, Inc.
Date	April 2021	*File Name*	2021-0414_Levenseller_HB-BE-237.dips8

DIPS 8.002

True Joint Spacing
Set 3: J3
All Traverses



mean=1.093 s.d.=1.227 min=0.176 max=4.235

	Project Brewer-Eddington I-395/Route 9 Connector		
	Analysis Description Levenseller Road BH Logging, HB-BE-237		
	Drawn By J. Rawlins	*Company* Haley & Aldrich, Inc.	
DIPS 8.002	*Date* April 2021	*File Name* 2021-0414_Levenseller_HB-BE-237.dips8	