Known for excellence.
Built on trust.

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

5 Commerce Park North
Suite 201
Bedford, NH 03110
T: 603.623.3600
F: 603.624.9463
www.gza.com



Via Email

June 19, 2025
File No. 04.0191154.26

Mr. Stephen Madden
Vermont Agency of Transportation
Construction and Materials Bureau, Geotechnical Engineering Services
2178 Airport Road, Unit B
Berlin, Vermont 05641

RE: Geotechnical Engineering Data Report
Chester ER P23-1(319) (Project Pin 23d794)
Chester, Vermont

Dear Mr. Madden:

This data report presents GZA GeoEnvironmental, Inc.'s (GZA's) geotechnical subsurface investigation for the proposed replacement of Bridge No. 15, a culvert carrying Vermont Route 103 (VT 103) over an unnamed tributary in Chester, Vermont. This study has been conducted in accordance with our Standard Contract for Services, Geotechnical Engineering Services 2020 to the Vermont Agency of Transportation (VTrans) and our proposal dated February 21, 2025. The contents of this report are subject to the *Limitations* set forth in **Appendix A**.

GZA's understanding of the project is based on discussions with VTrans and the VTrans Work Order Request (WOR) for Geotechnical Engineering Services dated February 10, 2025.

BACKGROUND AND EXISTING CONDITIONS

The existing culvert is located on VT 103 in Chester, Vermont, at mile marker 9.154, approximately 1.43 miles north of the intersection of VT 103 and VT Route 10, as shown in **Figure 1, Locus Plan.** It is GZA's understanding the project involves the removal of the existing corrugated metal pipe culvert and the construction of a new precast concrete box culvert with associated headwalls.

OBJECTIVES AND SCOPE OF SERVICES

The objectives of our work were to perform subsurface explorations to evaluate the subsurface conditions with respect to the proposed construction, conduct geotechnical laboratory testing, perform geotechnical engineering analyses, and provide VTrans with this geotechnical data report. To meet these objectives, GZA completed the following Scope of Services:

- Conducted a site visit to pre-mark locations for utility clearance and observe surficial conditions, traffic, and boring access;
- Coordinated and observed a subsurface exploration program consisting of two test borings to evaluate subsurface conditions;
- Conducted a laboratory testing program consisting of two soil gradation analyses on select soil samples and one representative rock core sample to evaluate the engineering properties of the soil and bedrock encountered in the test borings;
- Completed geotechnical engineering evaluations and developed recommendations for engineering properties of the soils encountered for use in design and construction; and
- Prepared this report summarizing our findings and recommendations.

SUBSURFACE EXPLORATIONS

GZA completed the requested subsurface exploration program consisting of two test borings (designated B-101 and B102). The two test borings were drilled within the right-of-way (ROW) on either side of the existing culvert. The test borings were located by GZA personnel using the coordinates provided by VTrans in the WOR and a handheld GPS unit with an accuracy of +/- 5 feet, and are shown on **Figure 2, Subsurface Exploration Location Plan**. Existing ground surface elevations at each boring location were also provided by VTrans.

Test borings B-101 and B-102 were drilled to depths of 25.1 and 16.5 feet below ground surface (bgs), respectfully. Borings were drilled using a truck-mounted drill rig and 4-inch-diameter flush-jointed casing and drive-and-wash drilling techniques. Standard penetration testing (SPT) and split-spoon sampling were generally performed at 5-foot intervals in each boring. Approximately 10 feet of bedrock core was obtained at test boring B-101 using an NX core barrel (2.0-inch-diameter). At test boring B-102 the roller bit was advanced into bedrock from approximately 15.2 to 16.5 feet bgs. The borings were backfilled with drill cuttings and clean sand, then finished with an asphalt cold patch of approximately the same thickness as the existing pavement.

New England Boring Contractors (NEBC) of Derry, New Hampshire coordinated Dig Safe® utility clearance and provided drilling services and traffic control. The drilling was completed on April 15 and April 16, 2025. GZA personnel observed the drilling and prepared logs of each boring. Soil samples were visually classified according to the Modified Burmister classification system with the AASHTO classification indicated in parentheses. Test boring logs prepared by GZA are included in **Appendix B**.

LABORATORY TESTING

GZA conducted a geotechnical laboratory testing program consisting of two soil gradation analyses on representative soil samples recovered from the subsurface explorations. The tests were used to confirm visual-manual field classifications and for use in our engineering analyses. Unconfined compressive strength testing was conducted on one representative bedrock core sample recovered from test boring B-101. The laboratory testing was performed by Thielsch Engineering of Cranston, Rhode Island. The results of the geotechnical laboratory testing are included in **Appendix C**.

SUBSURFACE CONDITIONS

SURFICIAL AND BEDROCK GEOLOGY

From a review of available literature, including the USGS 1970 Surficial Geologic Map of Vermont, the surficial geologic unit identified in the vicinity of the site consists of glacial till underlain by bedrock.

According to the USGS 2011 Bedrock Geologic Map of Vermont, bedrock in the vicinity of the site is part of a widespread, heterogeneous unit of well-layered, predominately biotite-quartz plagioclase gneisses containing variable amounts of magnetite, hornblende, and garnet.

SUBSURFACE PROFILE

One soil unit was encountered in the test borings: Sand and Gravel. Approximately seven inches of asphalt pavement was encountered at the ground surface in each test boring. The approximate thickness and a generalized description of the subsurface unit encountered is presented below. Detailed descriptions of the materials encountered at specific locations are provided in the boring logs in **Appendix B**.

GENERALIZED SUBSURFACE CONDITIONS		
Subsurface Unit	**Approx. Thickness (ft)**	**Generalized Description**
Sand and Gravel	14.4	Medium dense to very dense, brown, fine to coarse SAND, and to some Gravel, little to trace Silt. (A-1-a, A-1-b) Encountered in test borings B-101 and B-102.

BEDROCK

Approximately 10 feet of bedrock core was obtained from test boring B-101. The top of bedrock was encountered at approximately 15.0 feet bgs in each test boring. GZA evaluated the depth to top of bedrock based on split spoon refusals, casing refusals, drilling conditions, and confirmatory rock coring.

Bedrock recovered from the cores was generally described as hard, fresh to slightly weathered, fine to medium grained, light gray to gray with black, GNEISS, consistent with the bedrock mapped in the vicinity of the site. Joints were generally close to moderately spaced, horizontal to moderately dipping, undulating, rough to smooth, fresh, and tight to partially open. The Rock Quality Designation (RQD) for the bedrock cores obtained ranged from 72 to 88 percent, with an average RQD of 80 percent, indicating good rock mass quality.

One laboratory unconfined compressive strength test was conducted on representative bedrock core sample taken from B-101 (16.8 to 17.9 feet). The testing yielded unconfined compressive strength of 6.8 kips per square inch (ksi).

GROUNDWATER

The drive-and-wash cased drilling method used introduces large quantities of water during drilling. Therefore, groundwater levels observed in the test borings may not represent stabilized groundwater levels. Groundwater

was observed at the completion of drilling at depths ranging from 7.0 to 7.9 feet bgs with stabilization times of approximately 15 minutes.

Groundwater observations were made at the times and under the conditions stated on the boring logs. Fluctuations in groundwater levels will occur due to variations in season, precipitation, stream level and other factors. Consequently, water levels during and after construction are likely to vary from those encountered in the borings at the time the observations were made.

GENERAL GEOTECHNICAL DESIGN RECOMMENATIONS

Recommended geotechnical design parameters for foundation design are provided the following sections.

GEOTECHNICAL ENGINEERING EVALUATIONS AND RECOMMENDATIONS

GZA conducted our geotechnical engineering evaluations in general accordance with the 2020 American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LFRD) Bridge Design Specifications, 9th Edition.

SEISMIC CONSIDERATIONS

Evaluation of the seismic site class for the project site was based on the N-bar approach in accordance with AASHTO Table C3.10.3.1-1. N-bar is defined as the average, corrected SPT value for the upper 100 feet of the soil profile. For the Chester ER P23-1(319) culvert replacement site, N-bar was greater than 50 blows per foot; therefore, the site should be assigned to Site Class C.

Based on the site location, the recommended AASHTO Response Spectrum (Site Class C) for a 7 percent probability of exceedance in 75 years are summarized as follows:

SITE CLASS C SEISMIC DESIGN PARAMETERS	
Parameter	**Design Value**
PGA	0.07 g
S_s	0.15 g
S_1	0.045 g
F_{pga}	1.2
F_a	1.2
F_v	1.7
A_s (Period = 0.0 sec)	0.08 g
S_{DS} (Period = 0.2 sec)	0.18 g
S_{D1} (Period = 1.0 sec)	0.08 g

The site was also evaluated for liquefaction potential during an earthquake. The term "liquefaction" describes a phenomenon in which cohesionless soil experiences a substantial reduction in effective stress during an earthquake and acquires a degree of temporary mobility sufficient to permit substantial settlement and/or loss of bearing capacity. Based on the relative density of the soils and their gradation, it is GZA's opinion that site soils are not liquefiable.

INTERPRETATION OF SOIL ENGINEERING PROPERTIES

Based on the laboratory and in-situ testing results and our experience with similar deposits in the area, GZA has provided the following soil properties for the encountered strata at the replacement culvert site, as outlined in the following tables.

ESTIMATED ENGINEERING PROPERTIES OF SOIL				
	Total Unit Weight, φ (pcf)	Effective Submerged Unit Weight, φ' (pcf)	Friction Angle, ϕ (deg.)	Undrained Shear Strength Cohesion, s_u (psf)
Sand and Gravel	120	58	32	-

ESTIMATED ENGINEERING PROPERTIES OF BEDROCK				
	Total Unit Weight, φ (pcf)	Effective Submerged Unit Weight, φ' (pcf)	Unconfined Uniaxial Compressive Strength, q_u (psi)	RQD %
Bedrock	165	103	6,800	80

CLOSING

We appreciate the opportunity to work with you on this project, and we would be pleased to work with you through design and construction. In the meantime, if you have any questions regarding the recommendations contained in this report or require additional information, please contact us.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Jennifer R. Baron
Senior Project Manager

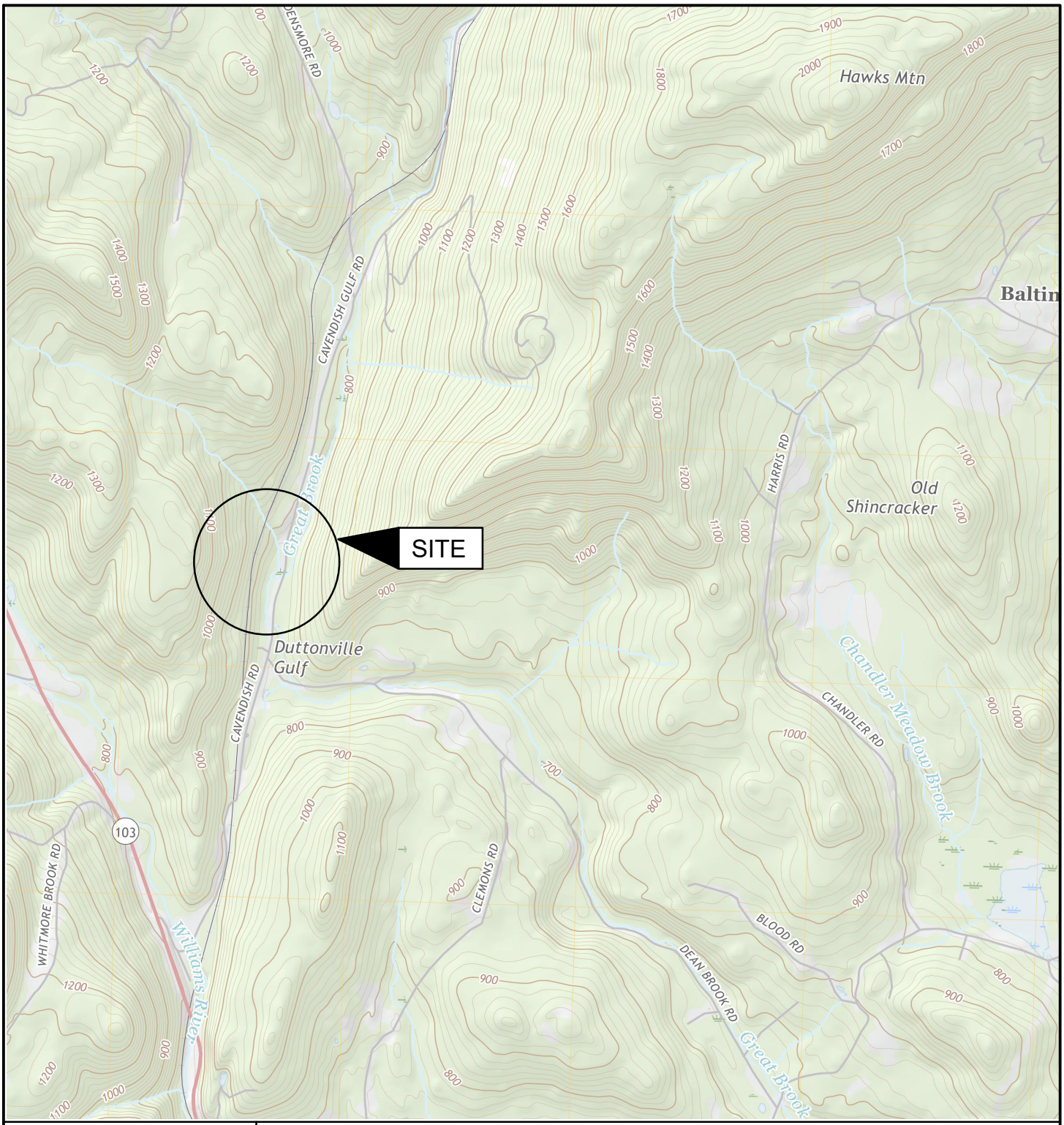
Dave G. Lamothe, P.E.
Associate Principal

Jay L. Hodkinson, P.E.
Consultant/Reviewer

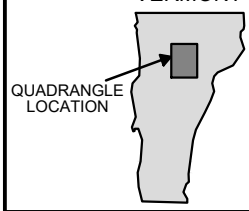
JRB/DGL/JLH:jrb
p:\04jobs\0191100s\04.0191154.00-vtrans ps08451\04.0191154.26 - chester er p23-1(319)\report\final 191154.26 chester er p23-1(319) geotech report 061925.docx

Attachments: Figure 1 – Locus Plan
Figure 2 – Subsurface Exploration Location Plan
Appendix A – Limitations
Appendix B – Test Boring Logs
Appendix C – Laboratory Test Results

Figures



VERMONT



SOURCE: DIGITAL TOPOGRAPHIC MAPS PROVIDED BY USGSSTORE.GOV.
CONTOUR ELEVATIONS REFERENCE NAVD88, CONTOURS ARE SHOWN IN FEET AT 10' INTERVALS

USGS QUADRANGLE MAPS: CHESTER, VERMONT (2018)

0 1000' 2000' 4000'

SCALE IN FEET

N W E S

UNLESS SPECIFICALLY STATED BY WRITTEN AGGREEMENT, THIS DRAWING IS THE SOLE PROPERTY OF GZA GEOENVIRONMENTAL, INC. (GZA). THE INFORMATION SHOWN ON THE DRAWING IS SOLELY FOR USE BY GZA'S CLIENT OR THE CLIENT'S DESIGNATED REPRESENTATIVE FOR THE SPECIFIC PROJECT AND LOCATION IDENTIFIED ON THE DRAWING. THE DRAWING SHALL NOT BE TRANSFERRED, REUSED, COPIED, OR ALTERED IN ANY MANNER FOR USE AT ANY OTHER LOCATION OR FOR ANY OTHER PURPOSE WITHOUT THE PRIOR WRITTEN CONSENT OF GZA. ANY TRANSFER, REUSE, OR MODIFICATION TO THE DRAWING BY THE CLIENT OR OTHERS, WITHOUT THE PRIOR WRITTEN EXPRESS CONSENT OF GZA, WILL BE AT THE USER'S SOLE RISK AND WITHOUT ANY RISK OR LIABILITY TO GZA.

PREPARED BY:	GZA GeoEnvironmental, Inc. www.gza.com	
PREPARED FOR:	VTRANS (VERMONT AGENCY OF TRANSPORTATION)	
PROJ MGR: JRB	REVIEWED BY: DGL	
DESIGNED BY: -	DRAWN BY: KMB	

CHESTER ER P23-1 (319)
VT ROUTE 103, BRIDGE NO. 15
CHESTER, VERMONT

LOCUS PLAN

DATE: JUNE 2025

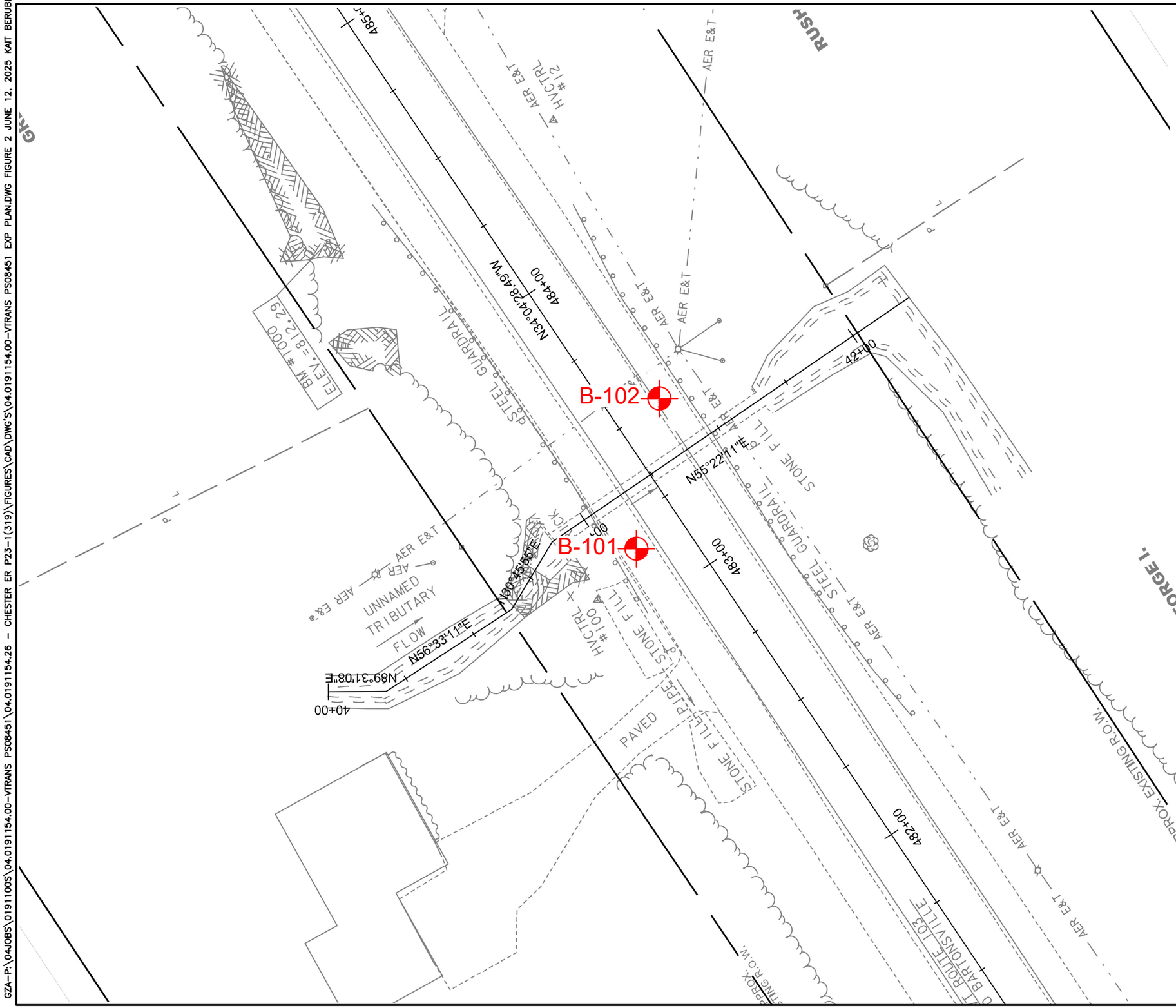
PROJECT NO. 04.0191154.26

FIGURE 1

SHEET NO. 1 OF 2

© 2022 – GZA GeoEnvironmental, Inc.
GZA–P:\04JOBS\0191100S\04.0191154.00–VTRANS PS08451\04.0191154.26 – CHESTER ER P23–1(319)\FIGURES\CAD\DWG'S\04.0191154.00–VTRANS PS08451 LOCUS.DWG FIG–1 LOCUS June 12, 2025 KAIT BERUBE

©2021 – GZA GeoEnvironmental, Inc.
GZA–P:\04JOBS\0191100S\04.0191154.00–VTRANS PS08451\04.0191154.26 – CHESTER ER P23–1(319)\FIGURES\CAD\DWG'S\04.0191154.00–VTRANS PS08451 EXP PLAN.DWG FIGURE 2 JUNE 12, 2025 KAIT BERUBE



NOTES:

1. BASE PLAN DEVELOPED FROM A PDF PLAN ENTITLED "Z23D794BOR. DGN. PDF" PREPARED BY GIA AND RECEIVED BY GZA IN MAY 2025.
2. TEST BORINGS WERE DRILLED BY NEW ENGLAND BORING COMPANY OF NEW HAMPSHIRE, FROM APRIL 15 TO 16 , 2025, AND OBSERVED BY GZA PERSONNEL
3. LOCATIONS DETERMINED BY HANDHELD GPS UNIT.

LEGEND:

B-102 — APPROXIMATE AS-DRILLED LOCATION OF BORING

N
W E
S

0 15' 30' 60'

SCALE IN FEET 1" = 30'

NO.	ISSUE/DESCRIPTION	BY	DATE

UNLESS SPECIFICALLY STATED BY WRITTEN AGREEMENT, THIS DRAWING IS THE SOLE PROPERTY OF GZA GEOENVIRONMENTAL, INC. (GZA). THE INFORMATION SHOWN ON THE DRAWING IS SOLELY FOR USE BY GZA'S CLIENT OR THE CLIENT'S DESIGNATED REPRESENTATIVE FOR THE SPECIFIC PROJECT AND LOCATION IDENTIFIED ON THE DRAWING. THE DRAWING SHALL NOT BE TRANSFERRED, REUSED, COPIED, OR ALTERED IN ANY MANNER FOR USE AT ANY OTHER LOCATION OR FOR ANY OTHER PURPOSE WITHOUT THE PRIOR WRITTEN CONSENT OF GZA. ANY TRANSFER, REUSE, OR MODIFICATION TO THE DRAWING BY THE CLIENT OR OTHERS, WITHOUT THE PRIOR WRITTEN EXPRESS CONSENT OF GZA, WILL BE AT THE USER'S SOLE RISK AND WITHOUT ANY RISK OR LIABILITY TO GZA.

CHESTER P23-1 (319)
VT ROUTE 103, BRIDGE NO. 15
CHESTER, VERMONT

SUBSURFACE EXPLORATION LOCATION PLAN

PREPARED BY: GZA GeoEnvironmental, Inc. www.gza.com		PREPARED FOR: VTRANS (VERMONT AGENCY OF TRANSPORTATION)	
PROJ MGR: JRB	REVIEWED BY: DGL	CHECKED BY: JLH	FIGURE 2
DESIGNED BY: -	DRAWN BY: KMB	SCALE: AS NOTED	
DATE: JUNE, 2025	PROJECT NO. 04.0191154.26	REVISION NO. -	SHEET NO. 2 OF 2

Appendix A – Limitations

GEOTECHNICAL LIMITATIONS

Use of Report

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

Standard of Care

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in GZA's Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report, as appropriate, to reflect the unanticipated changed conditions.

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

Subsurface Conditions

4. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs.

5. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

6. Water level readings have been made in test holes (as described in the Report) at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the Report.

7. GZA's services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

8. Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

Compliance with Codes and Regulations

9. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

Cost Estimates

10. Unless otherwise stated, our cost estimates are only for comparative and general planning purposes. These estimates may involve approximate quantity evaluations. Note that these quantity estimates are not intended to be sufficiently accurate to develop construction bids, or to predict the actual cost of work addressed in this Report. Further, since we have no control over either when the work will take place or the labor and material costs required to plan and execute the anticipated work, our cost estimates were made by relying on our experience, the experience of others, and other sources of readily available information. Actual costs may vary over time and could be significantly more, or less, than stated in the Report.

Additional Services

11. GZA recommends that we be retained to provide services during any future: site observations, design, implementation activities, construction and/or property development/redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

Appendix B – Test Boring Logs

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

BORING LOG

Chester ER P23-1(319)
VT 103, Br. 15
Chester, VT

Boring No.: **B-101**
Page No.: 1 of 1
Pin No.: 23d794
Checked By: J. Baron

Boring Crew: M. Materazzo (NEBC), I. Colcord (GZA)
Date Started: 4/15/25 Date Finished: 4/15/25
VTSPG NAD83: N 306795.80 ft E 1608380.20 ft
Station: 483+17.00 Offset: 15 LT
Ground Elevation: 807.0 ft

	Casing	Sampler
Type:	WASH BORE	SS
I.D.:	4 in	2 in
Hammer Wt:	140 lb.	140 lb
Hammer Fall:	30 in.	30 in
Hammer/Rod Type:	Auto/AWJ	
Rig:	GtechDrill GT-8	C_E = 1.3

Groundwater Observations

Date	Depth (ft)	Notes
04/15/25	7.9	15 Min.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		0.0 ft - 0.6 ft, ASPHALT								
		Visual Description, (Modified Burmister), S-1 (0.6 ft - 2.6 ft): Medium dense, brown, fine to coarse SAND, some Gravel, trace Silt (A-1-a), Rec. = 0.8 ft, SAND AND GRAVEL				12-12-17-20 (29)				
		2.6 ft - 5.0 ft, SAND AND GRAVEL								
5		Visual Description, (Modified Burmister), S-2 (5.0 ft - 5.6 ft): Very dense, brown, fine to coarse SAND, some Gravel, little Silt (A-1-b), Rec. = 0.3 ft, SAND AND GRAVEL				40-25/1"				
		5.6 ft - 10.0 ft, SAND AND GRAVEL								
10		Lab Classification, S-3 (10.0 ft - 12.0 ft): Very dense, brown, fine to coarse SAND and Gravel, little Silt (A-1-b), Rec. = 0.4 ft, 10.0 ft - 12.0 ft, SAND AND GRAVEL				25-25-19-21 (44)		52.0	35.2	12.8
		12.0 ft - 15.0 ft, SAND AND GRAVEL								
15		S-4 (15.0 ft - 15.1 ft): Refusal, Rec. = 0.1 ft, 15.0 ft - 15.1 ft, BEDROCK	C-1	100 (72)	1.5	50/Top of Bedrock @ 15.0 ft				
		15.1 ft - 20.1 ft, C-1: Hard, fresh to slightly weathered, fine to medium grained, light gray to gray with black, GNEISS. Joints are closely to moderately spaced, moderately dipping to horizontal, undulating, rough to smooth, fresh, and tight to partially open.			1.5					
					2					
					1.5					
20					2					
		20.1 ft - 25.1 ft, C-2: Hard, fresh to slightly weathered, fine to medium grained, light gray to gray with black, GNEISS. Joints are closely to moderately spaced, moderately dipping to horizontal, undulating, rough to smooth, fresh, and tight to partially open.	C-2	100 (88)	1.5					
					1.5					
					2					
					2					
25					2					
		Hole stopped @ 25.1 ft								

Notes:
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_E is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.

2010 COPY 04.0191154.26 - CHESTER, VT - VTRANS CULVERT 319.GPJ VERMONT AOT.GDT 7/18/25

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

BORING LOG

Chester ER P23-1(319)
VT 103, Br. 15
Chester, VT

Boring No.: **B-102**
Page No.: 1 of 1
Pin No.: 23d794
Checked By: J. Baron

Boring Crew: M. Materazzo (NEBC), I. Colcord (GZA)
Date Started: 4/16/25 Date Finished: 4/16/25
VTSPG NAD83: N 306842.00 ft E 1608387.20 ft
Station: 483+51.00 Offset: 15 RT
Ground Elevation: 807.0 ft

	Casing	Sampler
Type:	WASH BORE	SS
I.D.:	4 in	2 in
Hammer Wt:	140 lb.	140 lb
Hammer Fall:	30 in.	30 in
Hammer/Rod Type:	Auto/AWJ	
Rig:	GtechDrill GT-8	C_E = 1.3

Groundwater Observations

Date	Depth (ft)	Notes
04/16/25	7.0	15 Min.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		0.0 ft - 0.6 ft, ASPHALT					
		Visual Description, (Modified Burmister), S-1 (0.6 ft to 2.6 ft): Dense, brown, fine to coarse SAND, some Gravel, trace Silt (A-1-a), Rec. = 1.0 ft, SAND AND GRAVEL	15-15-16-17 (31)				
		2.6 ft - 5.0 ft, SAND AND GRAVEL					
5		Lab Classification, S-2 (5.0 ft - 7.0 ft): Dense, brown, GRAVEL and fine to coarse Sand, little Silt (A-1-a), Rec. = 1.4 ft, 5.0 ft - 7.0 ft, SAND AND GRAVEL	10-17-11-8 (28)		57.4	31.2	11.4
		7.0 ft - 10.0 ft, SAND AND GRAVEL					
10		Visual Description, (Modified Burmister), S-3 (10.0 ft - 12.0 ft): Dense, gray to brown, fine to coarse SAND, some Gravel, little Silt (A-1-b), Rec. = 0.7 ft, SAND AND GRAVEL	33-36-25-35 (61)				
		12.0 ft - 15.0 ft, SAND AND GRAVEL					
15		S-4 (15.0 ft - 15.2 ft): Refusal, Rec. = 0.0 ft, 15.0 ft - 15.2 ft, BEDROCK	25/Top of Bedrock @ 15.0 ft				
		15.2 ft - 16.5 ft, BEDROCK					
		Hole stopped @ 16.5 ft					
20		Remarks: 1. Advanced roller bit into probable bedrock from approximately 15.2 ft bgs to 16.5 ft bgs to confirm top of bedrock.					
25							

Notes:
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_E is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.

2010 COPY 04.0191154.26 - CHESTER, VT - VTRANS CULVERT 319.GPJ VERMONT AOT.GDT 7/18/25

Appendix C - Laboratory Test Results

Thielsch
DIVISION OF THE RISE GROUP

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
cts.thielsch.com
Let's Build a Solid Foundation

Client Information:		Project Information:	
GZA GeoEnvironmental		**Chester, VT Culvert (319)**	
Bedford, NH		**Chester, VT**	
603-623-3600		Project Number:	04.0191154.26
Project Contact:	Jennifer Baron	Summary Page:	1 of 1
Collected By:	Isaac Colcord	Report Date:	4/25/2025

LABORATORY TESTING DATA SHEET, Report No.: 7425-D-239

Boring No.	Sample ID	Depth (ft)	Laboratory No.	Identification Tests									Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Rcvd Moisture Content %	LL %	PL %	OD LL	Gravel %	Sand %	Fines %	Org. %	pH	g_d MAX (pcf) W_{opt} (%)	g_d MAX (pcf) W_{opt} (%) (Corr.)	Dry unit wt. (pcf)	Test Moisture Content %	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318			D6913			D2974	D4792	D1557								
B-101	S-3	10-12	25-S-1377					42.4	44.8	12.8											Brown f-c SAND and GRAVEL, little Silt
B-102	S-2	5-7	25-S-1378					45.2	43.4	11.4											Brown GRAVEL and f-c SAND, little Silt

Date Received: **4/21/2025** Reviewed By: Date Reviewed: **4/25/2025**

This report only relates to items inspect and/or tested. No warranty, expressed or implied, is made.
This report shall not be reproduced, except in full, without prior written approval from the Agency, as defined in ASTM E329.

These results are for the exclusive use of the client for whom they were obtained. This report only relates to items inspect and/or tested. No warranty, expressed or implied, is made.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.7	26.7	9.6	16.0	19.2	12.8	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/2"	100.0		
1"	90.2		
3/4"	84.3		
1/2"	69.9		
3/8"	65.6		
#4	57.6		
#10	48.0		
#20	38.2		
#40	32.0		
#60	26.3		
#100	20.1		
#200	12.8		

* (no specification provided)

Soil Description

Brown f-c SAND and GRAVEL, little Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 25.2095 D_{85}= 19.5253 D_{60}= 5.8965
D_{50}= 2.3851 D_{30}= 0.3491 D_{15}= 0.0924
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Source of Sample: Boring Depth: 10-12'
Sample Number: B-101, S-3

Date: 04/25/25

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Chester, VT Culvert
Chester, VT
Project No: 04.0191154.26

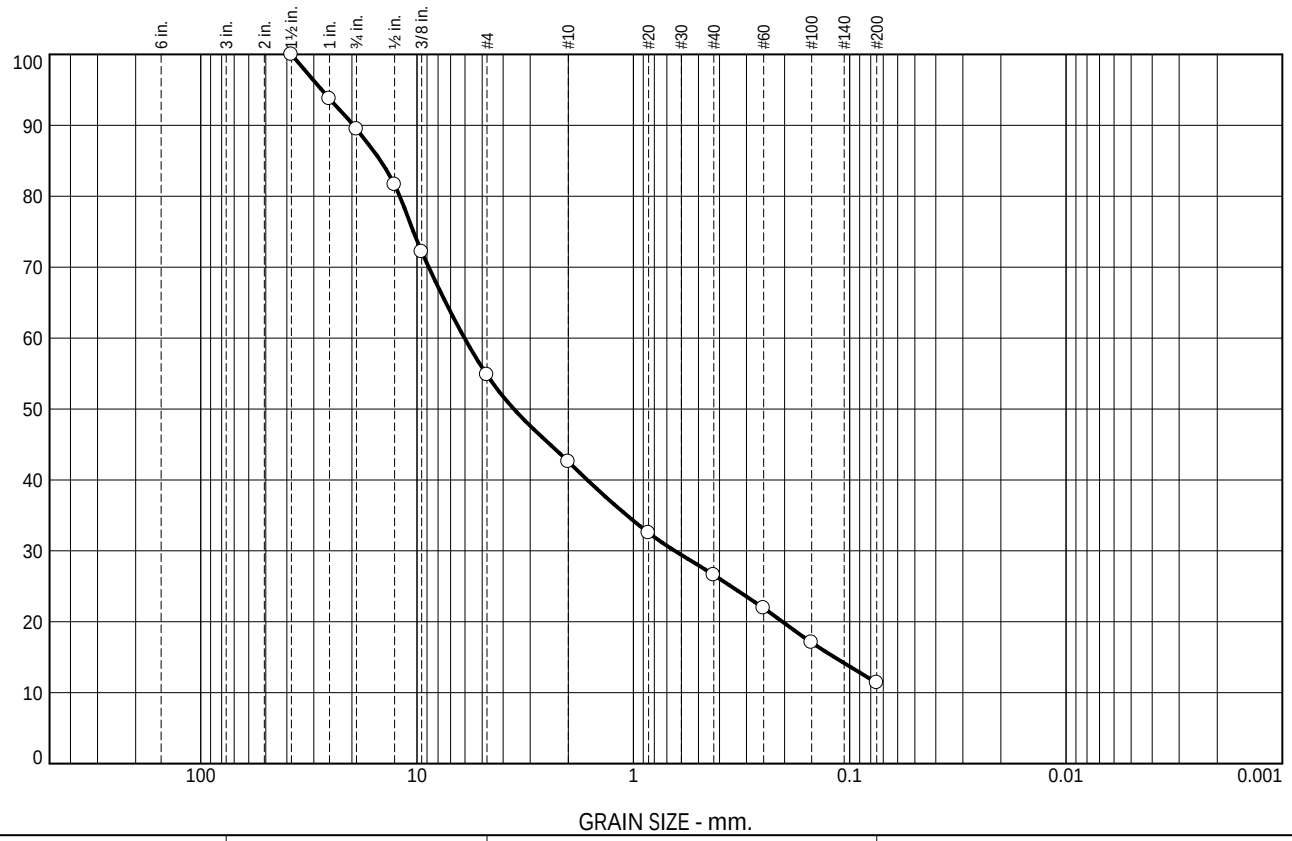
Fig. 25-S-1377

Tested By: RB / TG

Checked By: Kris Roland

These results are for the exclusive use of the client for whom they were obtained. This report only relates to items inspect and/or tested. No warranty, expressed or implied, is made.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.5	34.7	12.2	16.0	15.2	11.4	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/2"	100.0		
1"	93.8		
3/4"	89.5		
1/2"	81.6		
3/8"	72.2		
#4	54.8		
#10	42.6		
#20	32.5		
#40	26.6		
#60	21.9		
#100	17.1		
#200	11.4		

* (no specification provided)

Soil Description

Brown GRAVEL and f-c SAND, little Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 19.6681 D_{85}= 14.7350 D_{60}= 6.0334
D_{50}= 3.5687 D_{30}= 0.6433 D_{15}= 0.1175
D_{10}= C_u= C_c=

Classification

USCS= AASHTO= A-1-a

Remarks

Source of Sample: Boring Depth: 5-7'
Sample Number: B-102, S-2

Date: 04/25/25

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Chester, VT Culvert
Chester, VT
Project No: 04.0191154.26

Fig. 25-S-1378

Tested By: RB/TG Checked By: Becca Blake

Thielsch
DIVISION OF THE RISE GROUP

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:	Project Information:
GZA Geo Environmental	**Chester< VT Culvert (319)**
Bedford, NH	**4877 VT-103, Chester, VT 05143**
(603) 623-3600	Project Number: 04.0191154.26
Project Contact: Jennifer Baron	Summary Page: 1 of 1
Collected By: Isaac Colcord	Report Date: 5/1/2025

LABORATORY TESTING DATA SHEET, Report No.: 7424-K-237

Boring No.	Sample No.	Depth (ft)	Laboratory No.	Specimen Data						Compressive Strength Tests								Rock Formation or Description or Remarks
				Mohs Hard-ness	Diameter (in)	Length (in)	(1) Unit Weight (PCF)	(2) Wet Density (PCF)	Bulk G_s	(3) Other Tests	(4) Strength PSI	(5) Strain %	(6) E sec PSI EE+06	(7) Poisson's Ratio	st PSI	Is_{50} PSI	(8) s_c PSI	
B-101	C-1:S-1	16.8-17.9	25-S-1367		1.995	4.488	164.4			U	6822							Light Grey Gneiss
Fresh break along foliation																		

	Notes		Notes	
(1) Volume Determined By Measuring Dimensions		(3) PLD=Point Load (diametrical),		(5) Strain at Peak Deviator Stress
(2) Determined by Measuring Dimensions and Weight of Saturated Sample		PLA= Point Load (Axial) ST= Splitting Tensile U= Unconfined Compressive Strength		(6) Represents Secant Modulus at 50% of Total Failure Stress
		(4) Taken at Peak Deviator Stress		(7) Represents Secant Poisson's Ratio at 50% of Total Failure Stress
				(8) Estimated UCS from Table 1 of ASTM D5731 for NX cores (Is x 24)

Date Received: **4/21/2025** Reviewed By: Date Review **5/1/2025**

This report only relates to items inspect and/or tested. No warranty, expressed or implied, is made.
This report shall not be reproduced, except in full, without prior written approval from the Agency, as defined in ASTM E329.

Thielsch
DIVISION OF THE RISE GROUP

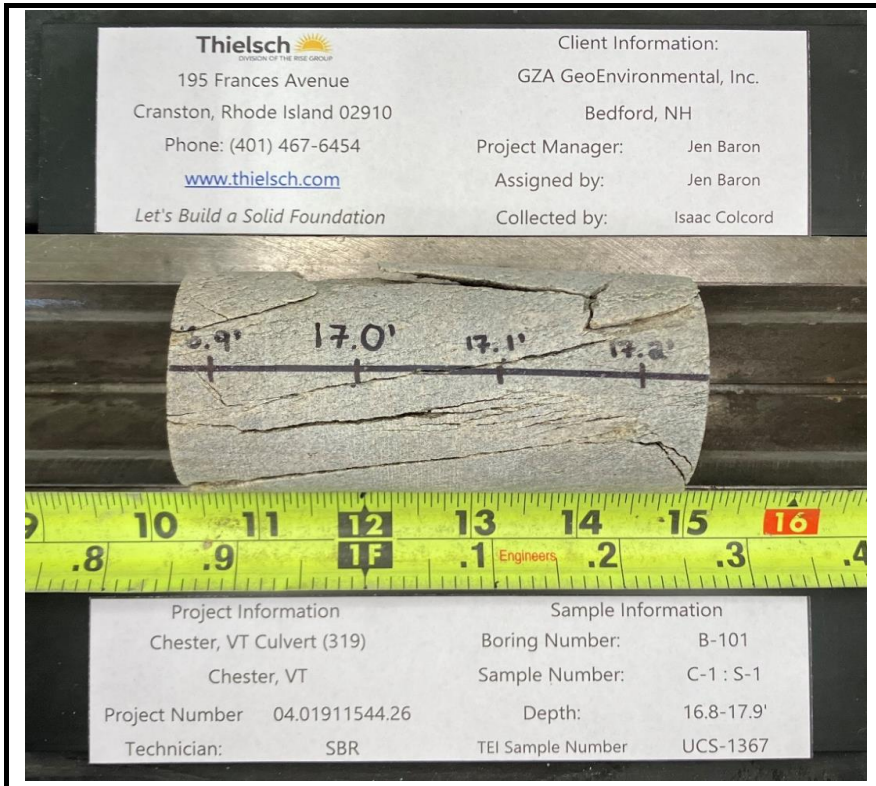
195 Frances Avenue
Cranston, Rhode Island 02910
Phone: (401) 467-6454
Fax: (401) 467-2398
www.thielsch.com
Let's Build a Solid Foundation

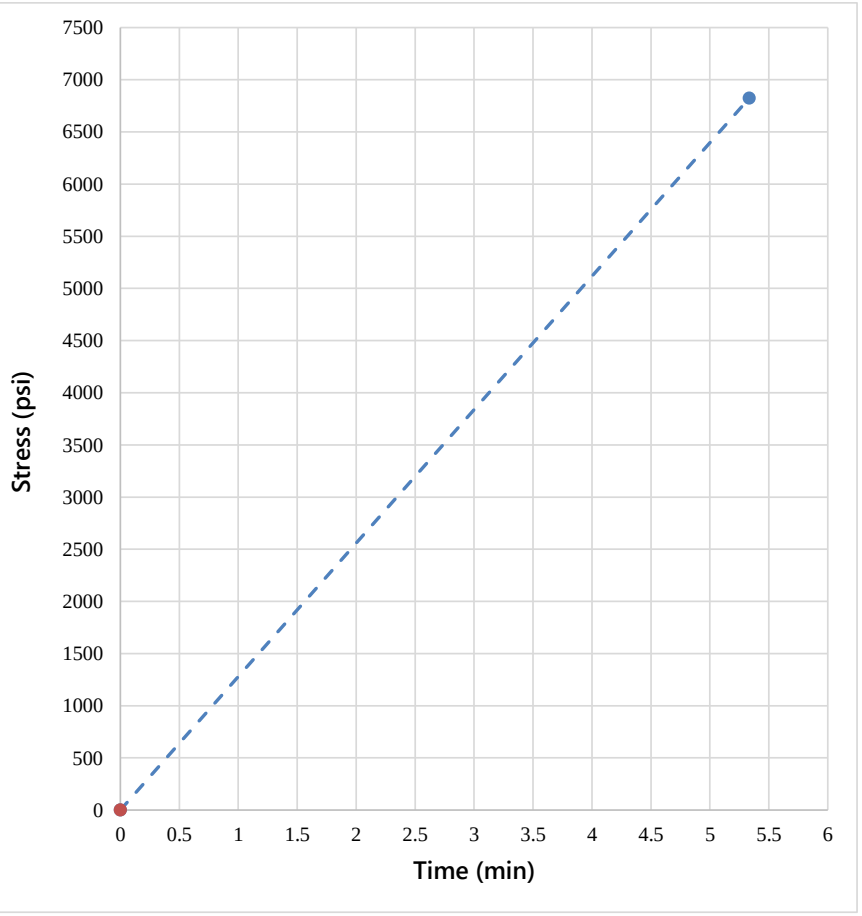
Client Information:	
GZA GeoEnvironmental, Inc.	
Bedford, NH	
Project Manager:	Jen Baron
Assigned by:	Jen Baron
Collected by:	Isaac Colcord

Project Information:	
Chester, VT Culvert (319)	
Chester, VT	
Project Number:	04.01911544.26
Technician:	SBR
Report Date:	5/1/2025

ASTM D7012 Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Sample Information		Compressive Test Information		Test Specimen Information		Elastic Moduli Test Information	
Boring ID:	B-101	**Unit Weight (pcf):**	164.4	**Diameter, D (in):**	1.995	**Poisson's Ratio @ 50%:**	NA
Sample No.:	C-1 : S-1	**Failure Stress (psi):**	6,822	**Length, L (in):**	4.488	**Strain %:**	NA
Depth (ft):	16.8-17.9	**Failure Mode:**	Fresh	**L:D Ratio:**	2.25	**E sec PSI @ 50%:**	NA
Tested Depth (ft):	16.87-17.25	**Time to Failure (min):**	5.33				
Rock Type:	Light Grey Schist						
Features:	Broke along foliation						





Testing Notes: