STATE OF VERMONT
AGENCY OF TRANSPORTATION

Scoping Report

FOR

Buel's Gore BF 0200(11)

VT Route 17, Bridge 29 over Beaver Meadow Brook

February 25, 2022

I. Table of Contents

I. Site Information

Bridge 29 is a State-owned bridge located on VT Route 17 over Beaver Meadow Brook. The bridge is approximately 7.2 miles west of the intersection of VT Route 100 and US Route 17. The bridge is at a skew to the roadway and is located on a sharp curve under an average of 7 feet of fill. The existing conditions were gathered from a combination of a Site Visit, the Inspection Report, the Route Log and the existing Survey. See correspondence in the Appendix for more detailed information.

Roadway Classification	Major Collector
Bridge Type	Asphalt Coated Corrugated Galvanized Metal Plate Pipe (ACCGMPP)
Culvert Span	6 feet
Culvert Length	72 feet
Year Built	1957
Ownership	State of Vermont

Need

Bridge 29 carries VT Route 17 across Beaver Meadow Brook. The following is a list of deficiencies of Bridge 29 and VT Route 17 in this location:

1. The culvert is in poor condition. The structure has scattered perforations throughout, a large hole near the outlet, and is rusted. The barrel has deflection and distortion and there is a separation along the last collar at the outlet end due to the collar rusting through.

2. The existing culvert does meet the minimum hydraulic standard but does not meet the state stream equilibrium standards for bankfull width.

3. VT Route 17 through the project area has a substandard radius for the posted speed limit.

Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2025 and 2045.

TRAFFIC DATA	2025	2045
AADT	810	900
DHV	210	220
ADTT	65	100
%T	7.7	11.0
%D	54	54

Design Criteria

The design standards for this bridge project are the Vermont State Standards, dated October 22, 1997. Minimum standards are based on an ADT of 900, a DHV of 220, and a design speed of 40 mph for a Major Collector.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 5.3	11'/4' (30')	9'/2' (22')	
Bridge Lane and Shoulder Widths	VSS Section 5.7	11'4' (30')	9'/3' (24')	
Clear Zone Distance	VSS Table 4.4	No issues noted	12' fill / 10' cut (1:3) 10' cut (1:4)	
Banking	VSS Section 4.12	e = 2%	8% (max)	
Speed		40 mph	40 mph (Design)	Series of curves posted (warning plaques) for 25 MPH.
Horizontal Alignment	AASHTO Green Book Table 3-10b	R = 155'	R_{min} = 3,970' @ e = 2%	Substandard
Vertical Grade	VSS Table 4.5	11.66%	10% (max) for mountainous terrain	Substandard
K Values for Vertical Curves	VSS Table 4.1	K_{crest} = 60	60 crest / 60 sag	
Vertical Clearance	VSS Section 4.8	No Issues Noted	14'-3" (min)	
Stopping Sight Distance	VSS Table 4.1	378'	275'	
Bicycle/Pedestrian Criteria	VSS Table 4.7	3' shoulder	3' Shoulder	
Bridge Railing	Structures Design Manual Section 13	N/A	TL-2	
Hydraulics	VTrans Hydraulics Section	• $HW/D_{(2\% AEP)} = 0.86$ • Clear span: 5.1 feet	• $HW/D_{(2\% AEP)} < 1.2$ • BFW: 8 feet	Substandard BFW
Structural Capacity	SM, Ch. 3.4.1	Structurally Deficient	Design Live Load: HL-93	Substandard

Inspection Report Summary

Culvert Rating 4 Poor
Channel Rating 6 Satisfactory

10/26/2020 – Structure is in poor condition with scattered perforation throughout and larger hole outlet end and separation at last collar which rust out. Pipe will have to be replaced most likely due to inadequate hydraulics. ~MJK

11/20/2019 – Culvert remains in poor condition with holes through out invert along with heavy rust scaling and pitting. Last section of pipe is starting to separate causing undermining under pipe and loss of material in bank above. Structure should be replaced. ~ABC/JAS

11/1/2018 – Culvert is in poor condition with holes through out invert along with heavy rust scaling and pitting. Last section of pipe is starting to separate causing undermining under pipe. Structure should be replaced. ~ABC/JAS

12/11//2017 – Structure is in poor condition having large perforations, heavy rust scaling and pitting present. Barrel has severe deformation occurring. Last section of pipe on outlet end has separated a little and has started to undermine a little Structure should be considered for a replacement. ~SMP/MAC

11/7/2016 – This structure has squashing nearly throughout with 1'+/- of drop in the top of the pipe and sides bow out equally. Large perforations mostly at the outlet end has allowed for piping and there is 6" of undermining. This structure needs to be replaced in the near future. ~JW/TB/AC

11/30/2015 – Pipe is in poor condition and has been for years, repairs or replacement needed. Debris at inlet end needs removing. ~MJK/SP

11/20/2014 – Most of the culvert has squashed downwards as much as 5" +/- forcing the sides out. The invert at the outlet half has small and large perforations throughout, mainly along the water line. These perforations have caused the undermining of the downstream end of the pipe. This structure should be replaced in the near future. ~JWW/JDM

12/4/2013 – Poor condition due to perforation, deflection, distortion at ends & piping. ~MJK/SP

10/26/2011 – Poor condition, pipe continues to deteriorate at a study pace and needs to be evaluated for repairs or replacement soon. ~MJK/ JM

4/13/2010 – Pipe is in need of repair or full replacement due to deterioration & deflection along top of pipe. Tree debris at inlet should be removed. ~MK/RF

Hydraulics

The existing structure meets the current hydraulic standards of the VTrans hydraulic manual. However, it does not meet the state stream equilibrium standards for bankfull width (span length). The structure constricts the channel width, resulting in an increased potential for debris blockage. This structure is within the mapped FEMA flood insurance study floodplain.

The VTrans Hydraulics Unit has provided several recommendations for a replacement structure. Any new structure should have a minimum clearspan of 8-feet and clear height of 4-feet.

See the Preliminary Hydraulics Report in Appendix D for additional information.

Utilities

The existing utilities are shown on the Existing Conditions Layout Sheet, and are as follows:

<u>Municipal Utilities</u>

- Buel's Gore does not have any water or sewer mains anywhere near this area.

<u>Public Utilities</u>

<u>Underground:</u>

- Waitsfield Champlain Valley Telecom has a buried communication line running along the Northerly side of the road. This line is approximately 30 in deep and in a 1.5-inch conduit.

<u>Aerial:</u>

- There are no aerial utilities in the project area.

Right-Of-Way

The existing Right-of-Way is plotted on the Existing Conditions Layout Sheet. There is a 3-rod Right-of-Way centered on VT Route 17. The inlet and outlet of the existing pipe is located outside the State-owned Right-Of-Way, and as such, it is anticipated that Right-Of-Way will be required for all alternatives.

Environmental and Cultural Resources

The environmental resources present at this project are shown on the Existing Conditions Layout Sheet, and are as follows:

Biological:
Additional information about biological resources can be found in Appendix G.

<u>Wetlands/Floodplains</u>
There are no wetlands within the study area. A small emergent marsh wetland was identified to the north of the study area.

Beaver Meadow Brook, a tributary of the Huntington River, which is a perennial stream, flows through the project area.

Wetlands and the watercourse within the project area are regulated by the US COE and the ANR. Alternatives must avoid and minimize impacts to these resources to the maximum extent practical.

<u>Rare, Threatened, and Endangered Species</u>
An inventory for RTE and uncommon plant species was undertaken in the study area on June 11, 2021. A small population of the S1-ranked Laurentian fragile fern (*Cystopteris laurentiana*) was discovered in the study area. The plants are located on a cliff-face and at the base of the cliff above Beaver Meadow Brook.

The Northern Long Eared Bat (*Myotis septentrionalis*, MYSE) became a federally listed endangered species in May of 2015. The State of Vermont has determined that project clearing greater than 1% of the total forested area within a 1 square mile radius of a project triggers greater review for habitat loss for this endangered species. Although the specific details of the proposed project at this location are unknown, it is located in a forested environment with approximately 1,950 acres of forest within a 1 mile radius. The Project would require more than 19 acres of clearing before reaching the 1% threshold triggering MYSE related restrictions or further review.

<u>Wildlife Habitat</u>
Aquatic organism passage should be incorporated into any design at this location. This would allow passage of small terrestrial mammals that may use the riparian zone as movement from habitat blocks. The stream is a direct tributary to the Huntington River.

<u>Agricultural Soils</u>
Soils mapped in the project area are Lyman-Marlow very rocky loams, and Peru fine sandy loam.

Hazardous Materials:

According to the Vermont Agency of Natural Resources (VANR) Vermont Hazardous Sites List, there are no hazardous waste sites located in the project area.

Historic:

Bridge 29 is not historic and there are no historic resources in the project area. Camel's Hump State Park is located in the project area and it is considered a 4(f) resource.

Archeological:

There are no archaeologically sensitive areas within the project limits.

Stormwater:

There are no stormwater concerns for this project.

II. Alternatives Discussion

No Action

This alternative is not recommended. The culvert is in poor condition and will continue to deteriorate if no action is taken. Something will have to be done to improve this culvert in the near future. Although the culvert does not appear to be in imminent danger of collapse, it will eventually be posted for lower traffic loads. In the interest of safety to the traveling public, the No Action alternative is not recommended. No cost estimate has been provided for this alternative since there are no immediate costs.

Rehabilitation

This alternative involves the rehabilitation of the existing corrugated metal plate pipe. The culvert is rated in poor condition with deflection and distortion. Additionally, the culvert span is undersized, resulting in a large scour pool at the outlet. A rehabilitation would further reduce the waterway area. As such, a rehabilitation is not recommended.

Culvert Replacement – New Buried Structure

This option involves removing the existing corrugated galvanized metal plate pipe and replacing it with a new buried structure having a waterway opening of at least 8 feet wide and 4 feet high.

Culvert replacement using an open cut is considered a more cost-effective solution then trenchless methods when there is a shallow amount of fill over the culvert. Since there is an average of 7 feet of fill above the existing culvert, there would not have to be a large amount of earthwork, making this a good candidate for open-cut construction. Any new structure should have flared wingwalls and headwalls extending down at least four feet or to ledge, at the inlet and outlet to make a smooth transition between the channel and the culvert. The various considerations under this option include: the roadway width, structure type, culvert length and skew, and roadway alignment.

a. Roadway Width

The existing roadway currently has 11-foot-wide lanes and 4-foot-wide shoulders, which exceeds the minimum standard of 24-feet as set forth in the Vermont State Standards. Since a new 50+ to 75+ year structure is being proposed, the roadway geometry should meet the minimum standards and match the existing conditions. A 30-foot width roadway will be proposed through the project area to match to existing conditions.

b. Structure Type

The most common structure types for the recommended hydraulic opening are a 4-sided concrete box culvert, a 3-sided open bottom concrete structure, or a metal arch. Due to the presence of ledge upstream and downstream of the existing structure, a 3-sided open bottom structure or arch founded on a footing poured to ledge may be preferred.

It is preferred that the structure be a precast 4-sided concrete box culvert. This type of structure would provide protection against scour and undermining and would require less excavation than an open bottomed structure. Additionally, it would have a shorter construction duration compared to an opened bottom structure, since footings would not have to be placed six feet below the stream bed. Based on available information from nearby wells, shallow ledge may be encountered. As such, a precast box may not be feasible without blasting. Borings should be requested early on in design process to determine the most appropriate structure type.

If an arch or frame is used, it should be founded either on bedrock or a minimum of 6-feet below the channel bottom. Additionally, full-depth headwalls should be installed.

A 3-sided or 4-sided concrete structure would have a design life of 75 years. While a metal arch would be less expensive than a concrete structure, it would have a reduced design life of 50-years. A metal arch would not need as heavy equipment as a precast concrete structure, which may be preferred due to the inaccessibility of the site for large trucks.

c. Culvert Size, Length and Skew

The existing culvert has a clearspan of 5.1 feet, which constricts the natural channel width and does not provide adequate hydraulic capacity. Hydraulics has recommended a buried structure with a minimum 8 foot wide and 4-foot-high inside opening. The 8-foot bank full width should be confirmed by ANR early on in the design process. The culvert will have a skew of 30 degrees to the roadway to match the existing skew of the channel. In order to accommodate a 30-foot-wide roadway with that culvert skew, the proposed barrel length will be approximately 70 feet long.

d. Roadway Alignment

The existing culvert is located under an extremely sharp curve in the roadway. This horizontal alignment does not meet the minimum standard as set forth in the AASHTO Green Book. The existing alignment follows the contours of the mountainous area to provide the most gradual slope. As is, the vertical grade is substandard for mountainous terrain, and choosing a steeper slope is not recommended. As such, both the horizontal and vertical alignment will remain unchanged.

e. Maintenance of Traffic

Either an off-site detour, phased construction, or a downstream temporary bridge would be appropriate measures for traffic control at this site.

Advantages: This alternative would address the structural deficiencies of the existing bridge, with a brand-new culvert with a 50 to 75-year design life. This option would meet the minimum hydraulic standards and provide adequate AOP.

Disadvantages: This option has the highest upfront costs and impacts to traffic during construction.

III. Maintenance of Traffic

The Vermont Agency of Transportation reviews each new project to determine suitability for the Accelerated Bridge Program, which focuses on expedited delivery of plans and specifications, permitting, and Right-of-Way, as well as accelerated construction of projects in the field. One practice that helps this endeavor is closing bridges for portions of the construction period, rather than providing temporary bridges thereby reducing project impacts. In addition to saving money, the intention is to minimize the closure period with faster construction techniques and incentives to contractors to complete projects sooner. The Agency will consider the closure option on most projects where rapid reconstruction or rehabilitation is feasible. The use of prefabricated elements in new bridges also expedites construction schedules. This applies to bridge decks, superstructures, and substructures. Accelerated Bridge Construction also provide enhanced safety for the workers and the travelling public while maintaining project quality. The following options have been considered:

Option 1: Off-Site Detour

This option would close the road and reroute traffic onto a regional detour. There are limited options for detour routes available at this site. The shortest regional detour has an end-to-end distance of 67.1 miles and adds approximately 26.5 miles to travel distance. The available regional detour route is as follows:

> Regional Detour Route: VT Route 17, to VT Route 100, VT Route 125, and VT Route 116 back to VT Route 17. (67.1 miles end-to-end)

There are several local bypass routes that may see an increase in traffic from local passenger cars. Local bypass routes are not signed detours but may experience higher traffic volumes if VT Route 17 is closed during construction. The most likely local bypass route is as follows:

> Local Bypass Route: VT Route 100, to Lincoln Gap Road (closed mid-October through mid-May), E. River Road, W River Road, Lincoln Road, VT Route 116 and back to VT Route 17 (35.2 mi end-to-end)

A map of the detour route and possible local bypass route, which could see an increase in traffic, can be found in Appendix O.

Advantages: This option would eliminate the need for a temporary bridge or phased construction, which would significantly decrease cost and time of construction. Additionally, this option would have the least impacts to environmental and cultural resources.

Disadvantages: Traffic flow would not be maintained through the project corridor during construction.

Option 2: Phased Construction

Phased construction is the maintenance of one-way alternating traffic on the existing bridge while building one lane at a time of the proposed structure. This allows the road to be kept open during construction. There is an average of 7 feet of fill over the existing culvert. As such, it would not require large amounts of fill to be retained during construction.

Based on the traffic volumes, it is reasonable to close one lane of traffic, and maintain one lane of alternating one-way traffic with a traffic signal.

The phasing for this site could be accomplished in 2 phases. The layout of this phasing sequence can be found in Appendix P. The following is a description of the phases:

- Phase 1: A single lane open to traffic on the upstream side of the road, over the existing culvert. During this phase, the downstream portion of the existing culvert would be removed and replaced with new culvert sections on the downstream side of the road.

- Phase 2: A single lane open to traffic on the downstream side of the road, over the new culvert sections that were placed in Phase 1. During this phase, the remaining portion of the existing culvert would be removed and replaced with new culvert sections installed on the upstream side of the road. The channel flow would be established in the new culvert at this time.

Advantages: Traffic flow would be maintained through the project corridor during construction. Also, this option would have minimal impacts to adjacent properties, threatened species, surrounding wetlands, and cultural resources.

Disadvantages: Phased construction generally involves higher costs and complexity of construction. Costs are usually higher and construction duration is longer since many construction activities must be performed multiple times. Additionally, since cars are traveling near construction activity, there is decreased safety. There would be some delays and disruption to traffic, since the road would be reduced to one-way alternating traffic.

Option 3: Temporary Bridge

From a constructability standpoint, a temporary bridge could only be placed on the downstream side of the existing culvert. There is a steep grade change with cascades located just upstream of the culvert, which would make placement of a temporary bridge difficult and expensive. A downstream temporary bridge would need to span a large scour hole and would require significant tree clearing. Additionally, the temporary roadway would be constructed along a steep slope.

A one-way temporary bridge with traffic signals would be required based on the substandard sight distance. See the Temporary Bridge Layout Sheets in Appendix P.

Advantages: Traffic flow can be maintained through the project corridor during construction.

Disadvantages: This option would require additional Right-of-Way acquisition for placement of the temporary bridge. This option would have adverse impacts to adjacent land, threatened species, and other environmental and cultural resources. There would be decreased safety to the workers and to vehicular traffic, because of cars driving near the construction site, and construction vehicles entering and exiting the construction site.

IV. Alternatives Summary

Based on the existing site conditions, bridge condition, and recommendations from hydraulics, there are several viable alternatives:

Alternative 1a: New Precast Box or 3-Sided Frame with Traffic Maintained on Offsite Detour
Alternative 1b: New Precast Box or 3-Sided Frame with Traffic Maintained with Phased Construction
Alternative 1c: New Precast Box or 3-Sided Frame with Traffic Maintained on a Temporary Bridge
Alternative 2a: New Pipe Arch with Traffic Maintained on Offsite Detour
Alternative 2b: New Pipe Arch with Traffic Maintained with Phased Construction
Alternative 2c: New Pipe Arch with Traffic Maintained on a Temporary Bridge

V. Cost Matrix[1]

Buel's Gore BF 0200(11)		Do Nothing	Alternative 1			Alternative 2		
			Alternative 1: New Concrete Box or 3-Sided Frame			New Metal Pipe (Round or Squash Pipe)		
			a. Offsite Detour	b. Phased Construction	c. Temporary Bridge	a. Offsite Detour	b. Phased Construction	c. Temporary Bridge
COST	Bridge Cost	$0	387,200	513,800	484,000	177,600	235,600	221,900
	Removal of Structure	$0	70,200	81,000	70,200	70,200	81,000	70,200
	Roadway	$0	256,200	425,000	320,300	232,000	370,100	279,000
	Maintenance of Traffic	$0	116,090	255,580	473,330	116,090	255,580	473,330
	Construction Costs	$0	829,690	1,275,380	1,347,830	595,890	942,280	1,044,430
	Construction Engineering & Contingencies	$0	248,907	318,845	336,958	178,767	282,684	261,108
	Accelerated Premium	$0	33,200	0	0	23,900	0	0
	Total Construction Costs w CEC	$0	1,111,797	1,594,225	1,684,788	798,557	1,224,964	1,305,538
	Preliminary Engineering[2]	$0	290,400	318,900	487,000	208,600	329,800	411,200
	Right of Way	$0	10,000	10,000	40,000	10,000	10,000	40,000
	Total Project Costs	$0	1,412,197	1,923,125	2,211,788	1,017,157	1,564,764	1,756,738
	Annualized Costs	$0	18,900	25,700	29,500	20,343	31,295	35,135
SCHEDULEING	Project Development Duration[3]	N/A	2 Years	2 Years	2 Years	2 Years	2 Years	2 Years
	Construction Duration	N/A	4 months	6 months	9 months	4 months	6 months	9 months
	Closure Duration (If Applicable)	N/A	7 Days	N/A	N/A	3 Days	N/A	N/A
ENGINEERING	Typical Section - Roadway (feet)	30	30	30	30	30	30	30
	Typical Section - Bridge (feet)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Geometric Design Criteria	Substandard Horizontal and Vertical Alignments	Substandard Horizontal and Vertical Alignments			Substandard Horizontal and Vertical Alignments		
	Traffic Safety	Poor Condition Culvert	Improved	Improved	Improved	Improved	Improved	Improved
	Alignment Change	N/A	No Change	No Change	No Change	No Change	No Change	No Change
	Bicycle Access	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard
	Pedestrian Access	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard
	Hydraulics	Substandard Bankfull Width	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard
	Utilities	N/A	No Change	No Change	No Change	No Change	No Change	No Change
OTHER	ROW Acquisition	N/A	Yes	Yes	Yes	Yes	Yes	Yes
	Road Closure	N/A	Yes	No	No	Yes	No	No
	Design Life (years)	<10 years	75	75	75	50	50	50

[1] Costs are estimates only, used for comparison purposes.
[2] Preliminary Engineering costs are estimated starting from the end of the Project Definition Phase.
[3] Project Development Durations are starting from the end of the Project Definition Phase.

VI. Conclusion

Alternative 2a is recommended; to replace the existing culvert with a new metal pipe while maintaining traffic on an offsite detour.

Structure:
The existing culvert is in poor condition and needs replacement. The current culvert does not meet the minimum hydraulic standard for capacity or bank full width. As such, a culvert replacement with a larger structure is recommended.

The new culvert will be an at-grade 8-foot pipe with the invert buried as much as possible given the shallow ledge. While the invert of the new pipe does not need to be buried, it should be buried as much as possible based on the ledge profile in order to mitigate potential abrasion issues.

The new culvert should have cutoff walls that extend four feet below the channel bottom, or to ledge, at the inlet and the outlet to prevent undermining. This structure will have no roadway overtopping below the Q_{50} storm event.

Traffic Control:
The recommended method of traffic control is to close the culvert for 3 days and maintain traffic on an offsite detour. The available regional detour for this project location would add approximately 27 miles to the through route and has an end-to-end distance of 67 miles. The option to close the road is the least expensive and the safest option. By closing the road, there will be less impacts to Right-of-Way, threatened species, cultural and environmental resources, and the project can be delivered sooner.

While phased construction avoids impacts to environmental resources and Right-of-Way, it is not recommended for a number of reasons. The skew of the culvert would be very difficult to construct between phases. Additionally, the 12-foot minimum lane width through the project area along with the very tight radius might make it difficult for trucks to pass through the construction zone. Shallow ledge would also make it difficult to drive sheet piles for phased construction.

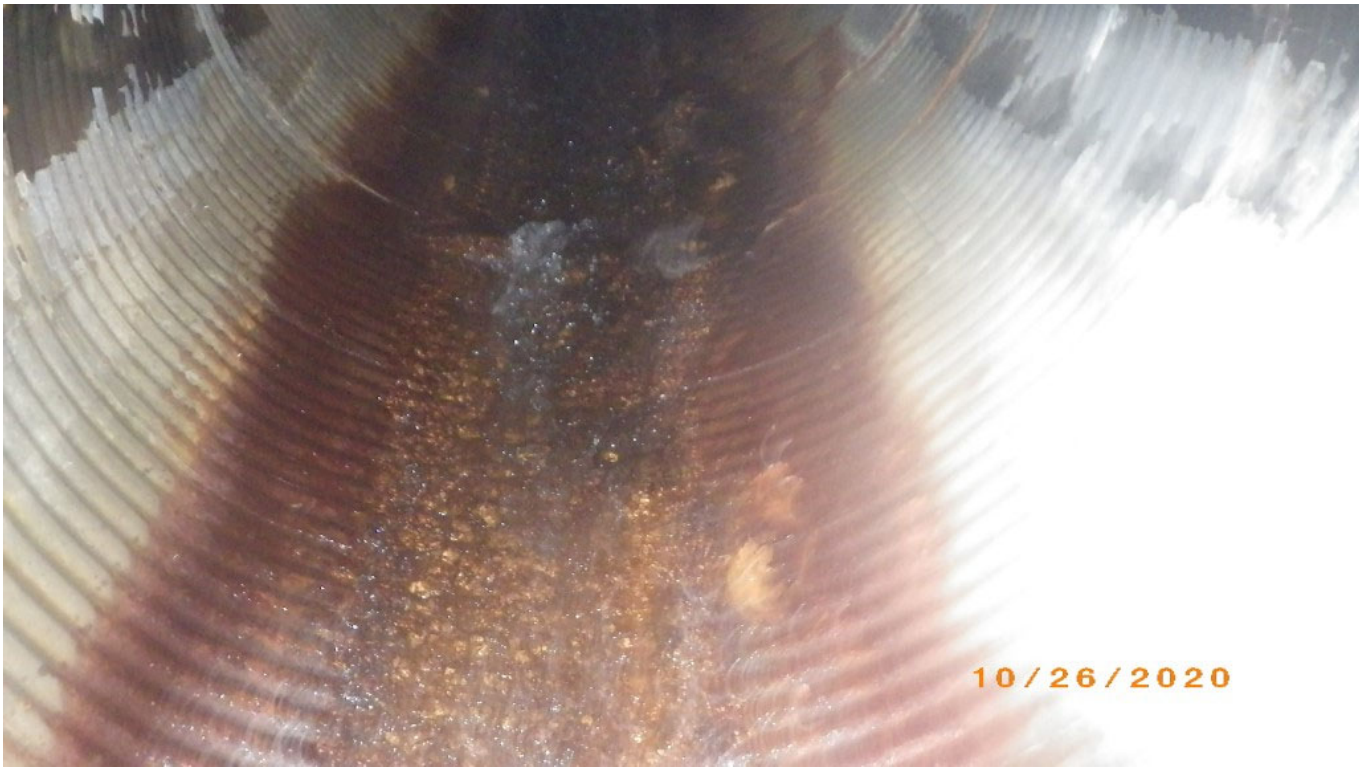
VII. Appendices

- Appendix A: Site Pictures
- Appendix B: Town Map
- Appendix C: Bridge Inspection Report
- Appendix D: Hydraulics Memo
- Appendix E: Preliminary Geotechnical Information
- Appendix F: Resource ID Completion Memo
- Appendix G: Natural Resources Memo
- Appendix H: Archeology Memo
- Appendix I: Historic Memo
- Appendix J: Stormwater Memo
- Appendix K: Local Input – No Response Received
- Appendix L: VTrans Operations Input
- Appendix M: Crash Data
- Appendix N: Hazardous Sites Map
- Appendix O: Detour and Local Bypass Maps
- Appendix P: Plans

Appendix A: Site Pictures

Picture 1: Looking west over Bridge 29

Picture 2: Looking east over Bridge 29



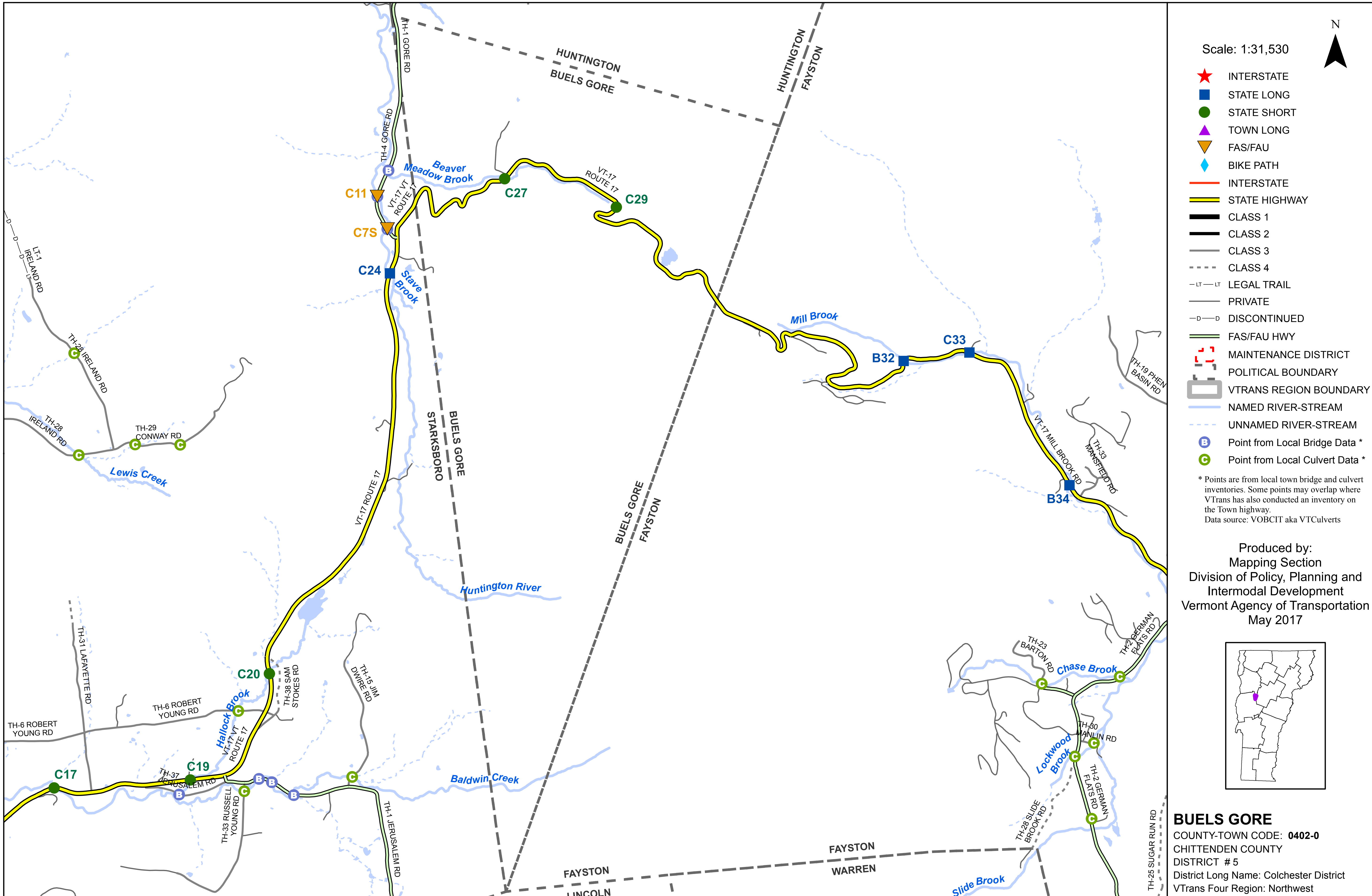
Picture 3: Culvert Barrel

Picture 4: Deteriorated Invert

Picture 5: Cascades just upstream of Bridge 29

Picture 6: Scour pool downstream of Bridge 29

Appendix B: Town Map



This map was funded in part through grants from the Federal Highway Administration, U.S. Department of Transportation. The representation of the authors expressed herein do not necessarily state or reflect those of the U. S. Department of Transportation.

Appendix C: Bridge Inspection Report

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

Vermont Agency of Transportation ~ Structures Section ~ Bridge Management and Inspection Unit

Inspection Report for : BUEL'S GORE | Bridge No.: 0029 | District: 5

Located on: VT17 over BROOK | approximately 7.2 MI W JCT VT 100 | Maintained By: STATE-OWNED

CONDITION

Deck Rating: N NOT APPLICABLE

Superstructure Rating: N NOT APPLICABLE

Substructure Rating: N NOT APPLICABLE

Channel Rating: 5 FAIR

Culvert Rating: 4 POOR

Federal Str. Number: 300200002904021

AGE and SERVICE

Year Built: 1957 Year Reconstructed: ____

Type of Service On: 1 HIGHWAY

Type of Service Under: 5 WATERWAY

Lanes On the Structure: 02

Lanes Under the Structure: 00

Bypass, Detour Length (miles): 36

ADT: 750 Year of ADT: 1996

GEOMETRIC DATA

Length of Maximum Span (ft): 6

Structure Length (ft): 6

Lt Curb/Sidewalk Width (ft): 0

Rt Curb/Sidewalk Width (ft): 0

Bridge Rdwy Width Curb-to-Curb (ft): 0

Deck Width Out-to-Out (ft): 0

Appr. Roadway Width (ft): 31

Skew: 25

Bridge Median: 0 NO MEDIAN

Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD

Min Vertical Underclr (ft): 06 FT 00 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: ACCGMPP

Number of Main Spans: 1

Kind of Material and/or Design: 3 STEEL

Deck Structure Type: N NOT APPLICABLE

Type of Wearing Surface: N NOT APPLICABLE

Type of Membrane: N NOT APPLICABLE

Deck Protection: N NOT APPLICABLE

CULVERT GEOMETRIC DATA and INDICATORS

Culvert Barrel Length (ft): 72

Average Cover Over Culvert (ft): 07

Waterway Area Through Culvert (sq.ft.): 19

Wingwall/Headwall Rating: N NOT APPLICABLE

APPRAISAL

Appr. Rdwy. Alignment: 4 MEETS MINIMUM TOLERABLE CRITERIA

INSPECTION

Inspection Date: 102020 Inspection Frequency (months): 12

INSPECTION SUMMARY and NEEDS

10/26/2020 Structure is in poor condition with scattered perforation throughout and larger hole outlet end and separation at last collar which rust out. Pipe will have to be replaced most likely due to inadequate hydraulics. MJK

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12/4/13 Poor condition due to perforation, deflection, distortion at ends & piping. MJK SP

10/26/11 Poor condition, pipe continues to deteriorate at a study pace and needs to be evaluated for repairs or replacement soon. MJK & JM

4/13/2010 Pipe is in need of repair or full replacement due to deterioration & deflection along top of pipe. Tree debris at inlet should be removed. ~MK/RF

04/24/2009 Culvert will need replacement in the near future. ~FRE~

Appendix D: Hydraulics Memo

VERMONT

State of Vermont
Structures and Hydraulics Section
One National Life Drive
Montpelier, Vermont 05633-5001
vtrans.vermont.gov

[phone] 802-371-7326
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[ttd] 800-253-0191

Agency of Transportation

TO: Laura Stone, Structures, Scoping Engineer

CC: Nick Wark, Hydraulics Engineer

FROM: Christian Boisvert, Hydraulics Project Engineer

DATE: August 19, 2021

SUBJECT: Buel's Gore BF 0200(11) pin#21B412
Buel's Gore, VT-17 Br 29, over Beaver Meadow Brook
Site location: 7.2 miles west of VT-100
Coordinates: 44.216165, -72.940351

We have completed our hydraulic study for the above referenced site, and offer the following for your use:

In an email on 7/21/21, Jaron Borg indicated that a structure with an 8 ft span would be appropriate for this site.

VT-17 is a Major Collector. Design Storm Flow is 2% AEP (Q50).

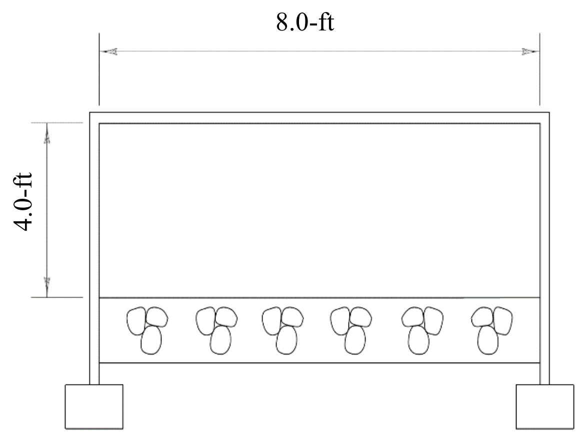
The following was analyzed:

Existing Conditions: CGMPP with a measured 5.1-ft span and a 6.1-ft clear height at the inlet.

- Provides a Headwater to Depth ratio (HW/D) of 0.77 and 0.86 during the design and check storm event, respectively.
- The existing culvert does meet the current hydraulic standards, but does not meet the state stream equilibrium standards for bankfull width (span length).

Option 1: Open Bottom Concrete Box (3-sided) with a minimum 8.0-ft span and 4-ft clear height

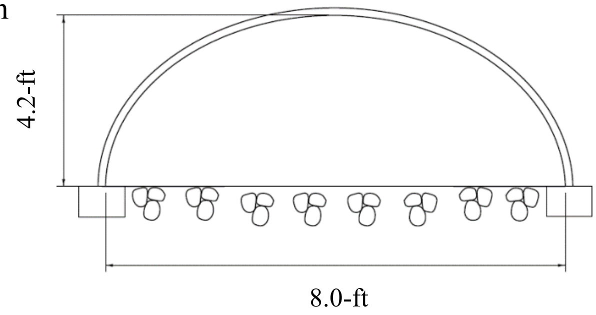
- There is approximately 1.4- and 1.0-feet of freeboard at the 2% and 1% AEP respectively.
- Provides a minimum waterway area of 32 sq. ft.
- E-Stone, Type IV will need to be used to build the channel through this structure.
- Stone Fill, Type IV shall be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet.
- Assumes no changes to the existing structures alignment/skew.



Option 1: Typical Section

Option 2: Open Bottom Metal Pipe Arch with a minimum 8.0-ft span and 4.2-ft clear height

- There is approximately 1.3- and 0.8-feet of freeboard at the 2% and 1% AEP respectively.
- Provides a minimum waterway area of 26 sq. ft.
- E-Stone, Type IV will need to be used to build the channel through this structure.
- Stone Fill, Type IV shall be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet.
- Assumes no changes to the existing structures alignment/skew.



Option 2: Typical Section

Ledge is visible in the main channel upstream and downstream of the existing structure. For this reason, a preliminary scour analysis was not performed. For both options, the bottom of abutment footings should be at least 6 feet below the channel bottom, or to ledge. An updated/detailed scour analysis will be performed during the final hydraulics phase.

Other similar sized structures could be considered for this site. If another alternative is considered, coordinate with the Hydraulics Unit to perform additionally analyses.

Please contact us with any questions, or to check substructure configuration scenarios.

Appendix E: Preliminary Geotechnical Information

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Laura Stone, P.E., Scoping Project Manager

EJT CEE

From: Ethan Thomas, AOT Geologist, via Callie Ewald, P.E., Geotechnical Engineering Manager

Date: April 30th, 2021

Subject: Buel's Gore BF 0200(11) Preliminary Geotechnical Information

1.0 INTRODUCTION

As requested, we have conducted our preliminary geotechnical investigation of Bridge No. 29 on Vermont Route 17 over an unnamed brook in Buel's Gore, VT. The subject project consists of replacing the existing culvert. This review included the examination of as-built record plans, water well logs as well as published surficial and bedrock geologic maps. A site visit was not conducted by Geotechnical Section staff however photos from bridge inspection reports and available satellite imagery were reviewed as part of this preliminary investigation.

2.0 SUBSURFACE INFORMATION

2.1 Published Geologic Data

Mapping conducted in 1970 for the Surficial Geologic Map of Vermont shows that the project area consists of till deposits overlying bedrock and exposed bedrock outcrops. (Doll, 1970).

According to the 2011 Bedrock Map of Vermont, published by the USGS and State of Vermont, the bedrock at the project site consists of the Fayston Formation which is composed of Silvery-green to grayish-green, medium-grained albite-chlorite-muscovite-quartz Schist with white albite porphyroblasts and garnet and magnetite. (Ratliffe, et. al, 2011).

The Geotechnical Engineering Section maintains a GIS based historical record of subsurface investigations, which contains electronic records for the majority borings completed in the past 10 years. An exploration of this database revealed no nearby projects within a 1-mile radius of the project site.

2.2 Water Well Logs

The Vermont ANR documents and publishes all water wells that are drilled for residential or commercial purposes. Published online, these logs may provide general characteristics of the soil strata and depth to bedrock in the area. The closest recorded water well is within 0.5 miles to the northwest of the project site and is identified as TAG 52704. Bedrock was reported at a depth of 25 feet.

2.3 Hazardous Materials and Underground Storage Tanks

The ANR Natural Resources Atlas also maps the location and information of known hazardous waste sites and underground tanks. The project site location is not listed on the Hazardous Site List.

2.4 Record Plans

Record plans show that construction of the culvert at the project location was completed by July 30th, 1957. Record plans show that the foundation for the culvert was laid on excavated bedrock.

3.0 FIELD OBSERVATIONS

Photos from bridge inspection reports and satellite imagery were reviewed to evaluate feasibility of boring operations and assess general site conditions as they relate to the proposed project.

Bedrock outcrops were observed in the vicinity of the existing bridge as well as loose blocks of rock within the stream channel, as shown in Figure 3.1 and 3.2. Both banks are moderately vegetated with shrubs and trees visible throughout.

Overhead utilities are not present at the project site location. A guardrail is present at both sides of the roadway. Figure 3.3 shows the grade of the slopes to the base of the culvert and Figure 3.4 shows the general condition of the discharging end of the culvert.

Figure 3.1 *Looking upstream from within the culvert at the stream. Note presence of bedrock outcrops and loose blocks.*

Figure 3.2 *Looking downstream from culvert. Note the presence of bedrock in left side of photo.*

Figure 3.3 *Bridge marker and view of the discharging end of culvert. Note the relatively steep grade of the embankments leading down to the culvert.*

Figure 3.4 *Discharging end of culvert. Note probable bedrock around base of culvert.*

4.0 RECOMMENDATIONS

4.1 Preliminary Foundation Alternatives

Based on the preliminary information, possible foundation options for the culvert replacement include the following:

- Precast or steel arch with spread footings founded on rock.
- Reinforced concrete box culvert with new headwalls and wingwalls

4.2 Proposed Subsurface Investigation

We recommend a subsurface investigation including two borings and two probes at this location to better assess the subsurface soils, groundwater conditions, and the depth to bedrock across the site. Based on the steep grades of the slopes and shallow bedrock, the borings and bedrock probes would be performed in the roadway to determine the variability in bedrock elevation across the site. Hand steel and/or geophysical investigation may be necessary closer to the inlet and outlet locations to supplement the data collected from the roadway. The bedrock should be cored and evaluated by a geologist to determine the competency.

5.0 CLOSING

When a structure type and alignment has been chosen, the Geotechnical Engineering Section can assist in developing a subsurface investigation that efficiently gathers adequate information for the replacement of the culvert.

If you have any questions or would like to discuss this report, please contact us by phone at (802) 595-6752.

6.0 REFERENCES

Doll, C. G., 1970, Surficial Geologic Map of Vermont, Vermont Geological Survey, Montpelier, VT.

Ratcliffe, N. M., Stanley, R. S., Gale, M. H., Thompson, P. J., Walsh, G. J., 2011, Bedrock Geologic Map of Vermont, Vermont Geological Survey, Montpelier, VT.

Vermont Agency of Natural Resources Department of Environmental Conservation, Natural Resources Atlas, www.anr.vermont.gov/maps/nr-atlas%20, accessed 04/27/2021.

cc: Laura Stone, P.E., P.I.I.T. Project Manager
Electronic Read File
Project File/CEE
EJT

Appendix F: Resource ID Completion Memo

OFFICE MEMORANDUM

AOT - PDB - ENVIRONMENTAL SECTION

RESOURCE IDENTIFICATION COMPLETION MEMO

TO: Laura Stone, Project Manager
FROM: Julie Ann Held, Environmental Specialist
DATE: July 12, 2021
Project: Buel's Gore BF 0200(11)

ENVIRONMENTAL RESOURCES:

Resource	Yes	No	Comments
Archaeological Resources:		X	See Archaeological Resource ID Memo
Historic Resources:		X	See Historic Resource ID Memo: "However, Camel's Hump State Park is located in the project area and it is considered a 4(f) resource."
Wetlands:	X		See Natural Resource ID Memo
Aquatic Organism Passage:	X		See Natural Resource ID Memo
Agricultural Soils:	X		See Natural Resource ID Memo
Wildlife Habitat:	X		See Natural Resource ID Memo
Endangered Species:	X		See Natural Resource ID Memo
Stormwater Considerations:		X	See Stormwater Resource ID Memo: "However, construction of a detour or realignment of the roadway could possibly push the area of disturbance above 1 acre, which would trigger the need for a construction SW permit and also require the project to follow the TS4 "Gap" procedure and incorporate feasible post construction treatment measures."
6(f) Properties:		X	
Hazardous Waste:		X	
Urban Background Area:		X	
Wild Scenic Rivers:		X	
Act 250 Permits:		X	
FEMA Floodplains:		X	
Flood Hazard Area:		X	
River Corridor:	X		This project is located along Beaver Meadow Brook. Any work in the stream or along with banks will require a RME coordination.
US Coast Guard:		X	
Lakes and Ponds:		X	
Other:		X	

cc:
Project File

Appendix G: Natural Resources Memo

Natural Resources Assessment Report for
Vermont Agency of Transportation
Buels Gore BF 0200 (11) BR 29

Prepared by:

Arrowwood Environmental, LLC

June 16, 2021

ARROWWOOD ENVIRONMENTAL
950 BERT WHITE ROAD
HUNTINGTON, VT 05462
(802 434-7276 FAX: (802) 329-2253

Natural Resources Assessment Report for

Vermont Agency of Transportation

Buels Gore BF 0200 (11) BR 29

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Natural Resources Assessment Report for
Vermont Agency of Transportation
Buels Gore BF 0200 (11) BR29

I. Introduction and Project Description

Arrowwood Environmental, LLC (AE) was retained by the Vermont Agency of Transportation to perform a natural resources assessment for a proposed culvert replacement along Route 17 in Buels Gore, Vermont. The study area for the assessment is shown on the Natural Resource Map in Appendix 2.

The assessment consisted of a remote landscape analysis of the study area as well as a field assessment. The field assessment was conducted on May 4 and June 11, 2021. This Natural Resource Assessment Report summarizes the results of the remote analysis and field assessment.

II. Site Characterization

Ecologically the site is within the Northern Green Mountains biophysical region of the state (Zaino, Thompson and Sorenson, 2019). The study area is located at approximately 1850 feet above mean sea level according to U.S. Geologic Survey ("USGS") topographic data and is generally mountainous and steep. The mapped bedrock that is underlying the site is carbonaceous schist and quartzite from the Fayston Formation. (Ratcliffe et al. 2011). The soils are mapped as Lyman-Marlow very rocky loams (NRCS Soil Survey). The surrounding landscape is dominated by forest land.

The study area consists of disturbed road shoulder and a mixed Red Spruce-Northern Hardwood Forest. Dominant canopy trees include sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), red spruce (*Picea rubens*) and hemlock (*Tsuga canadensis*). Understory vegetation consists of hobblebush (*Viburnum lantanoides*), wild sarsaparilla (*Aralia nudicaulis*) and Canada lily (*Maianthemum canadense*).

III. Wetlands

The wetland assessment involved both a remote review of available maps (including Vermont Significant Wetland Inventory Maps and the NRCS Soil Survey) and a field inventory component conducted on May 4, 2021. The protocols put forth in the USACE's *Corp of Engineers Wetlands Delineation Manual* (2009 Regional Supplement for the Northcentral and Northeast Region) were employed for delineating wetlands as is the standard practice in Vermont. There are no wetlands within the study area. A small emergent marsh wetland (Wetland A) was identified to the north of the study area, location provided for reference.

IV. Rare, Threatened and Endangered Species

The RTE species review involved both a remote review of available digital maps for the study area as well as a field survey. AE reviewed digital orthophotography, the NRCS Soil Survey, the 2011 Bedrock Geologic Map of Vermont and the Wildlife Natural Heritage Inventory (NHI) Rare, Threatened and Endangered Species digital database.

In reviewing the NHI digital database, there is one record of a State endangered S1 plant (*Crepidomanes intricatum*) within the study area.

Plant Species

An inventory for RTE and uncommon plant species was undertaken in the study area on June 11, 2021. Appropriate habitat for *Crepidomanes intricatum* in the study area was thoroughly searched. This species was not documented in the study area. A small population of the S1-ranked Laurentian fragile fern (*Cystopteris laurentiana*) was discovered in the study area. The plants are located on a cliff-face and at the base of the cliff above Beaver Meadow Brook.

A Rare Plant Reporting Form for this population is included in Appendix 3. A list of all plant species documented during the inventory is included in Appendix 4. No plants that are considered invasive species were documented during the plant inventory.

Animal Species

The Northern Long Eared Bat (*Myotis septentrionalis*, MYSE) became a federally listed endangered species in May of 2015. The State of Vermont has determined that project clearing greater than 1% of the total forested area within a 1 square mile radius of a project triggers greater review for habitat loss for this endangered species. Although the specific details of the proposed project at this location are unknown, it is located in a forested environment with approximately 1,950 acres of forest within a 1 mile radius. The Project would require more than 19 acres of clearing before reaching the 1% threshold triggering MYSE related restrictions or further review.

No other RTE animal species are documented nearby or are expected to be impacted by the proposed project.

V. Streams

The stream assessment involved both a remote review of the USGS topographic map, Vermont Hydrography Dataset (streams, rivers, and waterbodies), LiDAR derived elevation data, and field investigation on May 4, 2021. Three streams were mapped in the study area and are summarized below. Stream data summary forms are provided in Appendix 7.

<u>Stream S1:</u> Structure BF 0200 (11) BR29 is located on Beaver Meadow Brook. Beaver Meadow Brook is a perennial stream with an approximate bankfull channel width of 25' and a bedrock substrate in a cascade, semi-gorge, morphology. The existing metal corrugated culvert is perched above the streambed at its outlet and has created a significant scour pool at this location which then drops into a waterfall/cascade as the steep-gradient stream continues. There is significant erosion coming off the roadway over top of the culvert, exposing guardrail posts.

<u>Stream S2</u>: Stream 2 flows along and parallel to Rte 17 in a northeasterly direction to its confluence with S1 right at the BF 0200 (11) BR29 culvert inlet. S2 appears to be a perennial stream with an approximate 6' channel width. The bed is predominantly coarse gravel within the study area in a step-pool morphology.

<u>Stream S3</u>: S2 flows along Rte 17 in a north/south direction crossing Rte 17 north of Structure BF 0200 (11) BR 29 through an 18" corrugated metal culvert. This stream is intermittent with an approximate 6' channel width and bedrock substrate in a cascade morphology. The outlet of this structure is perched above the stream bed, which descends steeply downhill to join S1 approximately 120' downstream from the outlet of BF 0200 (11) BR 29.

VI. Wildlife Habitat and Habitat Connectivity

The wildlife habitat assessment involved both a remote review of available digital maps for the study area and a field inventory component. A remote review of available digital databases was conducted to identify and map necessary wildlife habitat (including Vt. Fish and Wildlife's Deer Winter Area data layer) within the study area and within the vicinity of the study area.

There are no mapped Vt. Fish and Wildlife deer winter habitats in the study area. Field investigation confirmed the absence of deer wintering areas within the study area. The field assessment did reveal moose and deer activity in the vicinity of the study area. Numerous tracks were present in open seepy areas associated with Wetland A.

Vt. Fish and Wildlife's Vt Conservation Design identifies the study area as a Highest Priority for riparian wildlife connectivity, and the entire surrounding area is Highest Priority interior forest block. The forest surrounding the study area is unfragmented with varying habitat types and considerable structural diversity. The roadway cuts tightly through the surrounding forest with only minor elevation changes between road edge and forest and no significant barriers to habitat connectivity.

The landscape conditions coupled with the presence of wildlife activity in the study area, particularly on the eastern roadside suggests there may be an increased likelihood of an active wildlife corridor in the area. Beaver Meadow Pond, just ~1/3 of a mile upstream from the study area is known anecdotally for its moose viewing opportunities. While large megafauna like moose are important on the Vermont landscape, particularly in this region, their proximity to traveled roads can cause conflicts resulting in risk to the traveling public and moose alike. The highest quality large animal movement opportunities appear to be located uphill from the proposed project at the edge of the study area- near Wetland A where slopes are more moderate, and it does not appear that this project will interfere with moose movement through the area. The area of the proposed project is a steep, ledgy gorge, generally inappropriate as a moose or other large mammal travel corridor so additional enhancements are not recommended at the project site to accommodate these species.

Concentrated amphibian crossing areas occur when different amphibian habitat features are separated from each other by roads. Beaver Meadow Brook offers appropriate habitat for stream salamanders and all three species of this group were documented during the field assessment: spring salamanders (*Gyrinophilus porphyriticus*), northern dusky salamanders (*Desmognathus fuscus*) and northern two-lined salamanders (*Eurycea bislineata*). Only limited movement of these species occurs outside of the stream corridor and concentrated amphibian movement does not occur. Since these species rarely cross roads, they do not pose a management concern as concentrated amphibian crossing areas. Small mammals, fish, and amphibians likely migrate through the area utilizing the stream channel and its immediate surroundings. Maintaining standard aquatic organism passage standards in structure sizing and installation methods will help assure connectivity for these species.

Appendix 1: Photo Log

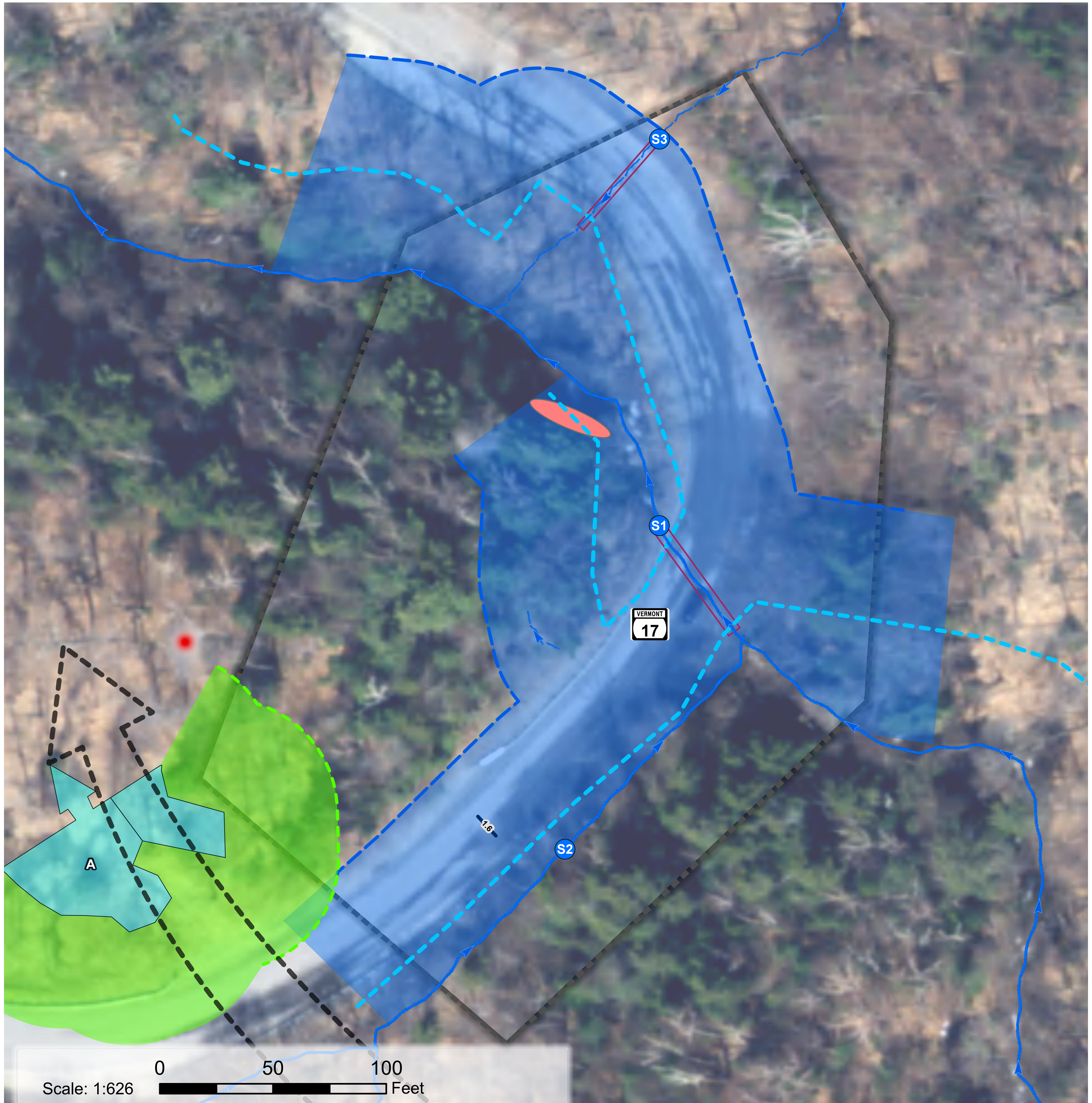
Wetland A (with moose tracks)

May 4, 2021

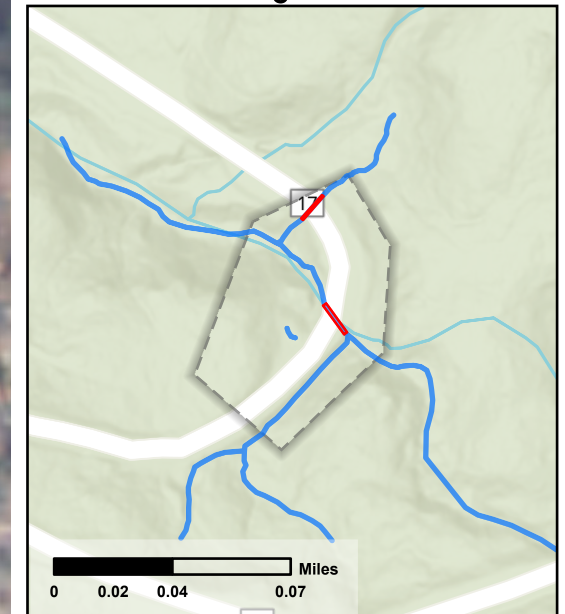
Cystopteris laurentiana

June 11, 2021

Appendix 2: Resource Map



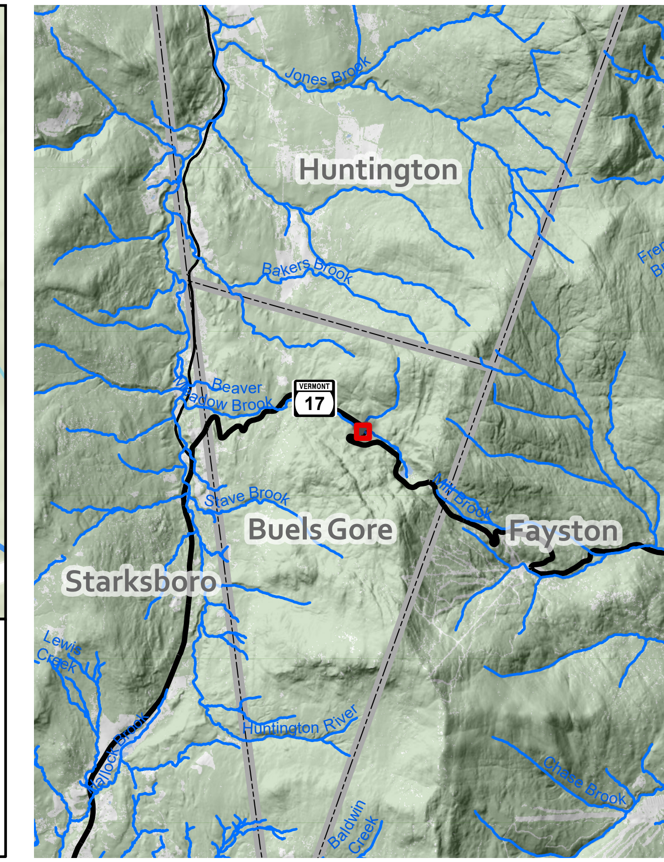
NNIS & Prime Ag. Soils



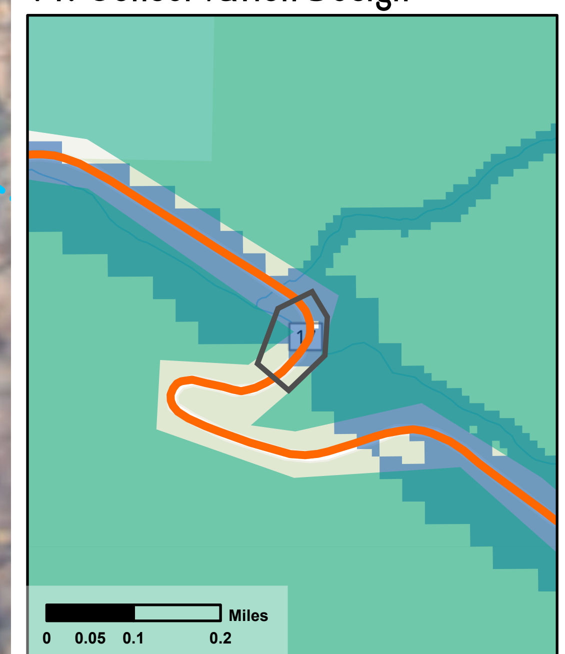
Non-native Invasive Species (NNIS)
Prime Ag Soils
Statewide Ag Soils

NNIS- None found
Prime Ag Soils- None present

Locus



Vt. Conservation Design



Vt. Conservation Design Elements
- Highest Priority Interior Forest Blocks
- Highest Priority Surface Water & Riparian Areas
- Highest Priority Terrestrial Crossings
- Highest Priority Riparian Crossings

Combined Linkage Ratings
◀not impt. — more impt.▶

- Study Area
- Intermittant Stream
- Perennial Stream/River
- Top of bank/slope
- Riparian zone
- RTE: Cystopteris laurentiana (S1)
- Wetland
- 50' Wetland Buffer
- Wildlife- Moose Sign
- Potential Corridor/Crossing

Notes: Information provided based on remote and field assessment by Arrowwood Environmental, 2021. Wetlands field delineated,flagged and flags located with sub-meter grade GPS by Arrowwood Environmental. Streams, top-of bank, plant populations, wildlife features, and structure locations from sub meter grade GPS, fieldnotes, and analysis of aerial imagery and high-resolution LiDAR topographic data.

Other data from VCGI, Vt Agency of Natural Resources. Contour interval 1' derived from LiDAR-based elevation models provided by VCGI. Background imagery- VCGI 2017.

Vt. Agency of Transportation: Buels Gore BF 0200 (11). Statewide Natural Resource Services 2019

Monday, June 14, 2021 File: VtransBuelsGoreBR29 Prepared By: A Worthley, Arrowwood Environmental Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400 Feet

ARROWWOOD ENVIRONMENTAL
950 BERT WHITE ROAD
HUNTINGTON, VT 05462
(802 434-7276 FAX: (802) 329-2259

Appendix 3: Rare Plant Reporting Form

rev. Apr. 2009

VERMONT RARE PLANT FORM
Nongame and Natural Heritage Program
Vermont Fish & Wildlife Department

Latin Name: Cystopteris laurentiana EO# (if known): ______ New: X Update: ______

Surveyor(s): Michael Lew-Smith
Mailing address (phone, email): 950 Bert White Road Huntington Vermont 05462

Survey Date(s): 6/11/2021 Report Date: 6/14/2021

Survey Site: Buels Gore Stream Crossing **Town**(s): Buels Gore

Directions to location(s) of plants:
Plants are located on a rock outcrop above Meadow Brook where it crosses Route 17. The crossing is 0.4 miles below the beaver pond just below the hairpin turn in the road. The rock outctop is located approximately 40 feet northwest of the culvert.

Are plants in same location(s) as previously observed? ______

LANDOWNER(S) / CONTACT(S) (**Name**, **Telephone**, **Address**, **Email**—if not in a Site Summary Form) Permission?
Camel's Hump State Forest ☐
☐

BIOLOGY

Approximate #		**Population Area**(s)	Phenology (% or #)	
______	ramets	(e.g. 30x10ft; 1m²; 0.5 acre, 1ha)	______	in leaf
(Stems originating separately from ground)		400 sq ft	100	in bud
				in flower
140- see comments below	genets			immature fruit
(Presumed genetic individuals, e.g. clumps, patches, stems)				mature fruit
				dormant

Verbal synopsis of above biological data and evidence of reproduction (if not found, discuss search effort):
Too early in season for full evidence of reprodution, but sporangia seemed to be developing on most fronds.

SURVEY SITE & HABITAT INFORMATION (if not provided in a Site Summary Form or previous form)

Survey site description:
The site consists of a steep rock face and habitat at the base of the rock face. The rock face is north-facing and plants are growing in cracks, fissures and small ledges of the rock. The habitat at the base of the rock face consists of very shallow soil over rock.

Substrate: rock and shallow soil over rock Topographic position: rock face and base

Aspect: North Slope: vertical Elevation (in feet): minimum 1880 maximum 1880

Light: shaded Moisture: xeric

Associated plant species observed (immediate vicinity):
No other species present on the rock face. At base, ferns are largely shaded by yellow birch, red-berried elder and white ash.

IDENTIFICATION Are there any ID questions? If so, describe. Photos taken: ☐

Both parents of C. laurentiana appear to be present. Plants vary considerably in the amount of gland-tipped hairs that are present and morphology. A few plants on the rock face are hairless and presumably represent C. fragilis. Other plants, especially those at the base of the cliff, have much more gland-tipped pubescence and a morphology generally resembling C. bulbifera. It is difficult to give a good estimation of the number of C. laurentiana plants present because of the wide gradation that is present. There are approximately 100 plants growing on the cliff, and a small number (20%) are likely C. fragilis and the rest C. laurentiana. There are approximately 300 plants growing at the base of the cliff and most of these (?80%) appear to be C. bulbifera (or hybrids resembling C. bulbifera more than C. laurentiana and C. fragilis).

Specimen collected? ☒ Collection #: 3394-96 Collector (s): Michael Lew-Smith Repository: will be submitted to Pringle

(A permit is required to collect Threatened & Endangered species)

QUALITY OF THIS OCCURRENCE (optional): Likelihood of persisting for next 25 years in present condition or better based on present population size, condition, defensibility, and ongoing threats. Future potential threats should not be considered; ranking is *not comparative* with other populations. A range of ranks may be used (e.g. AC).

A: ☐ B: ☒ C: ☐ D: ☐ Explain:

CONSERVATION SUMMARY (if not provided in a Site Summary Form)

Is the habitat likely to persist? Yes

Explain any threats: None known

Conservation, management, and inventory needs:

A further assessment later in the season may help to tease out the hybrid status of the plants at this site and give better account of number of C. laurentiana plants present.

Full extent of population known? Amount/ percent of habitat searched:

The survey was generally in the vicinity of the road and the entire area was searched. Cliff face can be readily seen from the base, Within this area, all plants present have likely been documented.

Comments that do not fit in another field:

All appropriate habitat for Trichomanes intricatum in the study area was also thoroughly searched. This species was not documented here.

MAPPING (required if not provided in a Site Summary)

Attach a copy of the USGS Map or Aerial Image showing the rare plant location(s): ☐

(Keep in mind that if an area occupied is longer or wider than 12.5 meters, we prefer to map a polygon or line)

Optional: Attach shapefile (must be *NAD83 State Plane*) ☐; GPS point printout ☐; and/or write out GPS coordinates below:

GPS Points: Datum (required; NAD83 preferred): NAD83

Accuracy (if known): +/- meters☐/feet☐

Optional: At the bottom of this printed form, or as an attachment, provide the following sketches with rare plant location(s), direction, and scale: 1) Cross-section of local topography. 2) Diagram of the site with survey route.

Please send completed forms to Bob Popp: Bob.Popp [at] vermont.gov / Natural Heritage Inventory, Vermont Fish & Wildlife Department, 5 Perry St., Suite 40, Barre, VT 05641 / (802)-476-0127

Appendix 4: Plant Species List

ARROWWOOD ENVIRONMENTAL

Rare, Threatened and Endangered Plant Inventory

Report Date: 6/14/2021

Project Name Vtrans Buels Gore BF 0200 (11)

Botanist Michael Lew-Smith

Survey Date 6/11/2021

Description Project area consists of disturbed road shoulder and Red Spruce-Northern Hardwood Forest

Plant List

note: plants with no listed S-Ranks are considered common in Vermont.

Plant Name	Common Name	S-Rank*	T/E	Plant Family
Maianthemum canadense	Canada mayflower			Amaryllidaceae
Maianthemum racemosum	false Solomon's-seal			Amaryllidaceae
Daucus carota	Queen Anne's lace			Apiaceae
Pastinaca sativa	parsnip			Apiaceae
Asclepias syriaca	common milkweed			Apocynaceae
Vinca minor	periwinkle			Apocynaceae
Arisaema triphyllum	Jack-in-the-pulpit			Araceae
Aralia nudicaulis	wild sarsaparilla			Araliaceae
Ambrosia artemisiifolia	common ragweed			Asteraceae
Leucanthemum vulgare	common daisy			Asteraceae
Nabalus cf albus	white lettuce			Asteraceae
Pilosella aurantiaca	orange hawkweed			Asteraceae
Pilosella caespitosa	yellow king devil			Asteraceae
Solidago flexicaulis	zig-zag goldenrod			Asteraceae
Solidago gigantea	large goldenrod			Asteraceae
Solidago rugosa	rough-leaved goldenrod			Asteraceae
Sonchus arvensis	sow thistle			Asteraceae
Symphyotrichum puniceum	red-stemmed aster			Asteraceae
Taraxacum officinale	common dandelion			Asteraceae
Tussilago farfara	colt's-foot			Asteraceae
Athyrium filix-femina	lady fern			Athyriaceae
Impatiens capensis	common jewelweed			Balsaminaceae
Betula alleghaniensis	yellow birch			Betulaceae
Betula papyrifera	paper birch			Betulaceae
Myosotis scorpioides	common forget-me-not			Boraginaceae
Cardamine diphylla	common toothwort			Brassicaceae
Silene vulgaris	common bladder campion			Caryophyllaceae
Cornus sericea	red-osier dogwood			Cornaceae
Carex debilis	weak sedge			Cyperaceae
Carex leptonervia	northern woodland sedge			Cyperaceae

Rare, Threatened and Endangered Plant Inventory

Report Date: 6/14/2021

	Plant Name	Common Name	S-Rank*	T/E	Plant Family
	Carex pensylvanica	Pennsylvania sedge			Cyperaceae
	Carex sparganioides	bur-reed sedge			Cyperaceae
	Cystopteris bulbifera	bulblet bladder fern			Cystopteridaceae
	Cystopteris fragilis	fragile fern			Cystopteridaceae
!	*Cystopteris laurentiana*	Laurentian bladder fern	S1		Cystopteridaceae
	Gymnocarpium dryopteris	oak fern			Cystopteridaceae
	Dennstaedtia punctilobula	hay-scented fern			Dennstaedtiaceae
	Dryopteris intermedia	intermediate woodfern			Dryopteridaceae
	Polystichum acrostichoides	Christmas fern			Dryopteridaceae
	Equisetum arvense	field horsetail			Equisetaceae
	Lotus corniculatus	bird's-foot trefoil			Fabaceae
	Melilotus albus	white sweet clover			Fabaceae
	Vicia cracca	cow vetch			Fabaceae
	Fagus grandifolia	American beech			Fagaceae
	Hypericum punctatum	spotted St. John's-wort			Hypericaceae
	Clintonia borealis	bluebead lily			Liliaceae
	Streptopus lanceolatus	rosy twisted-stalk			Liliaceae
	Huperzia lucidula	shining firmoss			Lycopodiaceae
	Trillium erectum	red trillium			Melanthiaceae
	Trillium undulatum	painted trillium			Melanthiaceae
	Veratrum viride	Indian poke			Melanthiaceae
	Fraxinus americana	white ash			Oleaceae
	Onoclea sensibilis	sensitive fern			Onocleaceae
	Osmunda claytoniana	interrupted fern			Osmundaceae
	Oxalis montana	wood-sorrel			Oxalidaceae
	Abies balsamea	balsam fir			Pinaceae
	Picea rubens	red spruce			Pinaceae
	Tsuga canadensis	eastern hemlock			Pinaceae
	Chelone glabra	turtlehead			Plantaginaceae
	Plantago major	plantain			Plantaginaceae
	Dactylis glomerata	orchard grass			Poaceae
	Festuca sp.	fescue			Poaceae
	Panicum cf dichotomiflorum	smooth witch grass			Poaceae
	Poa annua	annual bluegrass			Poaceae
	Poa compressa	Canada bluegrass			Poaceae
	Schedonorus pratensis	meadow fescue			Poaceae
	Polypodium appalachianum	Appalachian polypody			Polypodiaceae

Rare, Threatened and Endangered Plant Inventory

Report Date: 6/14/2021

Plant Name	Common Name	S-Rank*	T/E	Plant Family
Lysimachia borealis	starflower			Primulaceae
Ranunculus abortivus	kidney-leaved crowfoot			Ranunculaceae
Thalictrum dioicum	early meadow-rue			Ranunculaceae
Amelanchier sp.	shadbush			Rosaceae
Fragaria vesca	wood strawberry			Rosaceae
Rubus allegheniensis	common highbush blackberry			Rosaceae
Rubus idaeus	red raspberry			Rosaceae
Rubus odoratus	flowering raspberry			Rosaceae
Rubus pubescens	dwarf raspberry			Rosaceae
Galium mollugo	common bedstraw			Rubiaceae
Populus grandidentata	large-toothed aspen			Salicaceae
Salix discolor	pussy willow			Salicaceae
Acer pensylvanicum	striped maple			Sapindaceae
Acer saccharum	sugar maple			Sapindaceae
Acer spicatum	mountain maple			Sapindaceae
Tiarella cordifolia	foam flower			Saxifragaceae
Parathelypteris noveboracensis	New York fern			Thelypteridaceae
Phegopteris connectilis	long beech fern			Thelypteridaceae
Sambucus racemosa	red-berried elder			Viburnaceae
Viburnum lantanoides	hobble-bush			Viburnaceae
Parthenocissus quinquefolia	woodbine			Vitaceae

Appendix 5: Stream Existing Condition Summary Forms

ARROWWOOD ENVIRONMENTAL
950 BERT WHITE ROAD
HUNTINGTON, VT 05462
(802 434-7276 FAX: (802) 329-2259

Streams: Existing Condition Summary

June 14, 2021

Project: Buels Gore BF 0200 (11)

Stream ID:	S1 Beaver Meadow Brook					
Date(s) Observed:	5/4/2021					
Survey Type:	Rapid					
Field Observations						
Observation Location:	LAT	44.2160945°N	LONG	72.9402594°W		
Stream Type (typical):	Cascade☒ Step-Pool☐ Riffle-pool☐ Plane Bed☐ Ripple-dune☐ Braided☐					
Dominant Sediment Size:	Bedrock☒ Boulder☐ Cobble☐ C-Gravel☐ F-Gravel☐ Silt/Sand☐					
Average Bankfull Width:	Estimated☒ Measured☐	25’				
Flow Conditions:	Flowing☒ Pools☐ Damp☐ Dry☐	Prelim*	Perennial☒ Intermittent☐			
Slope/Confinement:	Steep/confined gorge					
Field Comments:	Steep bedrock waterfall Culvert is metal corrugated 6’height					
Other Data						
Watershed Size:	179.7 acres					
Approx. Elevation:	1890					

**preliminary assessment of flow regime based on field observations and professional judgement*

Photos	
	
Photo Date: 5/4/2021	Photo Date:5/4/2021

Stream ID:	S2
Date(s) Observed:	5/4/2021
Survey Type:	Rapid
Field Observations	
Observation Location:	LAT 44.2157301°N LONG 72.9408395°W
Stream Type (typical):	Cascade☐ Step-Pool☒ Riffle-pool☐ Plane Bed☐ Ripple-dune☐ Braided☐
Dominant Sediment Size:	Bedrock☐ Boulder☐ Cobble☐ C-Gravel☒ F-Gravel☐ Silt/Sand☐
Average Bankfull Width:	Estimated☒ Measured☐ 6’
Flow Conditions:	Flowing☒ Pools☐ Damp☐ Dry☐ Prelim* Perennial☒ Intermittent☐
Slope/Confinement:	
Field Comments:	
Other Data	
Watershed Size:	132.6 acres
Approx. Elevation:	1870

Photos	
	
Photo Date: 5/4/2021	Photo Date:5/4/2021

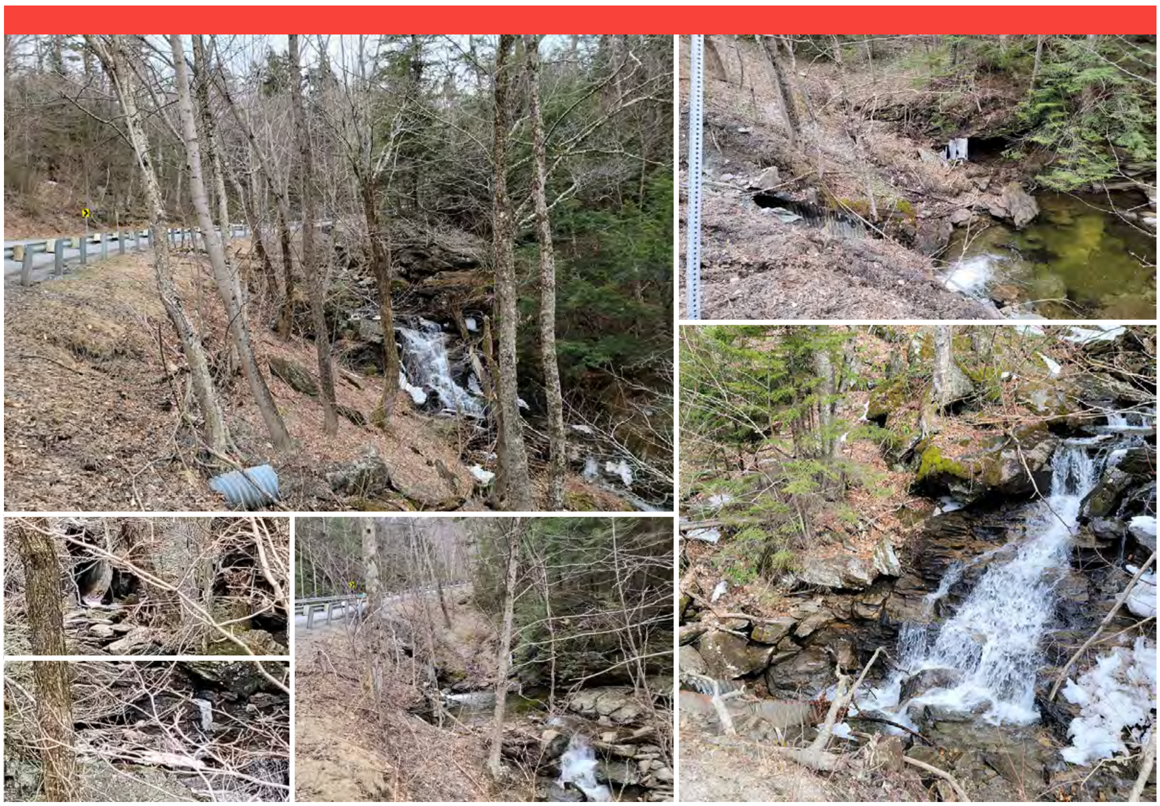
Stream ID:	S3			
Date(s) Observed:	5/4/2021			
Survey Type:	Rapid			
Field Observations				
Observation Location:	LAT	44.2167129°N	LONG	72.9404100°W
Stream Type (typical):	Cascade☒ Step-Pool☐ Riffle-pool☐ Plane Bed☐ Ripple-dune☐ Braided☐			
Dominant Sediment Size:	Bedrock☒ Boulder☐ Cobble☐ C-Gravel☐ F-Gravel☐ Silt/Sand☐			
Average Bankfull Width:	Estimated☒ Measured☐	6’		
Flow Conditions:	Flowing☒ Pools☐ Damp☐ Dry☐	Prelim*	Perennial☐	Intermittent☒
Slope/Confinement:				
Field Comments:				
Other Data				
Watershed Size:	132.6 acres			
Approx. Elevation:	1870			

Photos	
	
Photo Date: 5/4/2021	Photo Date:5/4/2021

Appendix H: Archeology Memo

Archaeological Resource Assessment Buels Gore Culvert No. 29, VT Route 17 BF-0200(11)

Buels Gore, Chittenden County, Vermont



Prepared for:

Vermont Agency of Transportation
219 North Main Street
Barre, Vermont 05641

Prepared by:

WSP USA Inc.
433 River Street, 7th Floor
Troy, New York 12180

June 18, 2021

Archaeological Resource Assessment
Buels Gore Culvert No. 29, VT Route 17
BF-0200(11)

Buels Gore, Chittenden County, Vermont

Prepared for:

Vermont Agency of Transportation
219 North Main Street
Barre, Vermont 05641

Prepared by:

Jessica Vavrasek and Marlis Muschal

WSP USA Inc.
433 River Street, 7th Floor
Troy, New York 12180

June 18, 2021

Abstract

On behalf of the Vermont Agency of Transportation (VTrans), WSP USA Inc. (WSP) of Troy, New York, completed an archaeological resource assessment (ARA) for the proposed Buels Gore Culvert No. 29, VT Route 17, Chittenden County. The scope for the project has yet to be defined; WSP therefore conducted this survey and resource assessment to consider the potential effects of site access, approach work, staging, culvert installation, and other potential project activities associated with improvements at the site of the culvert. The archaeological area of potential effect (APE) extends 30.5 meters (100 feet) from either end of the culvert to include all four quadrants of the culvert approaches.

The goal of the ARA was to survey the entire APE to determine if any archaeologically sensitive areas are present. The ARA consisted of background research as well as field inspection, which was conducted on April 8, 2021. The ARA determined the project APE's sensitivity for archaeological resources based on the potential for intact subsurface soils, the APE's relationship to nearby known archaeological sites and historic structures, and other criteria, including soils, topography, and proximity to water. WSP used the Vermont Division for Historic Preservation's *Environmental Predictive Model for Locating Precontact Archaeological Sites* and the Vermont Online Resource Center to inform its assessment.

Background research identified no potentially archaeologically sensitive areas in the current APE, and no previously recorded precontact or historic archaeological sites located within 1.6 kilometers (1 mile) of the APE. No precontact or historic sites were identified during the ARA. Given the lack of positive environmental factors combined with evidence of disturbance documented throughout the surrounding area, the APE is not sensitive for archaeological resources. Any subsurface disruption in the assumed APE has little potential for disturbing buried cultural deposits.

It is WSP's opinion that any future development carried out within the APE will have no impacts on any significant archaeological resources and would not have an adverse effect on archaeological sites that are eligible for or listed in the National Register of Historic Places. Additional archaeological investigation of the APE is not necessary; however, should project activities be expanded and the APE changed, further investigation may be warranted.

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I. Introduction

A. Project Description

On behalf of the Vermont Agency of Transportation (VTrans), WSP USA Inc. (WSP) of Troy, New York, completed an archaeological resource assessment (ARA) for the proposed Buels Gore Culvert No. 29, VT 17, Chittenden County (Figure 1). The scope for the project has yet to be defined; WSP therefore conducted this survey and resource assessment to consider the potential effects of site access, approach work, staging, culvert installation, and other potential project activities associated with improvements at the site of the culvert. The archaeological area of potential effect (APE) extends 30.5 meters (100 feet) from either end of the culvert to include all four quadrants of the culvert approaches (Figure 2).

B. Scope of Services

The goal of the ARA was to survey the entire APE to determine if any archaeological sensitive areas are present. This will allow VTrans maximum flexibility in avoiding sites that are eligible for the National Register of Historic Places (NRHP). For the ARA, WSP conducted background research and a field inspection, and evaluated the location using the Vermont Department of Historic Preservation (VDHP) *Environmental Predictive Model for Locating Precontact Archaeological Sites* (VDHP 2015) (see Appendix A), the Vermont Online Resource Center (ORC) map tool (VDHP 2021), historical maps, and local histories (see Chapter IV.A).

All archaeological investigations were conducted in accordance with guidelines established by VTrans and the Programmatic Agreement (PA) among VTrans, the Federal Highway Administration, the VDHP, and the Advisory Council on Historic Preservation, which guides the administration and review process of archaeological projects. That PA and the accompanying *Manual of Standards and Guidelines* (VTrans 2000) provide the framework for the conduct of archaeological investigations for VTrans projects.

All cultural resource services were performed using the professional guidelines and standards in *Procedures for the Protection of Historic and Cultural Properties* (36 CFR 800) and *Procedures for Determining Site Eligibility for the National Register of Historic Places* (36 CFR 60 and 63). This investigation also conformed to the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 *Federal Register* 44716) (United States Department of the Interior 1983), and *Guidelines for Conducting Archaeology in Vermont* (VDHP 2002). The cultural resource specialists who performed this work satisfy the Secretary of the Interior's Professional Qualifications standards as specified in 36 CFR 66.3(6)(2).

This report has been organized into six chapters. After the introduction in Chapter I, Chapter II describes the environmental setting of the APE. Chapter III discusses the cultural context for the APE, briefly outlining the 11,000-year history of the region and summarizing previous archaeological investigations in the vicinity. Chapter IV presents the methods and results of the ARA, and Chapter V contains the conclusions. Chapter VI lists the references cited. The Environmental Predictive Model Checklists are provided in Appendix A.

This investigation was conducted under the direction and supervision of WSP Senior Vice President Hope Luhman, PhD (Register of Professional Archaeologists [RPA 10505]). WSP Historic Preservation Manager Camilla McDonald served as the project manager. Archaeologist Jessica Vavrasek, PhD (RPA 989768) conducted the field inspection, and completed the background research and wrote the report with assistance from WSP Archaeologist Marlis Muschal (RPA 34344474). Principal Draftsperson Jacqueline L. Horsford prepared the graphics. Principal Editor Anne Moiseev supervised the editing and production of the report.

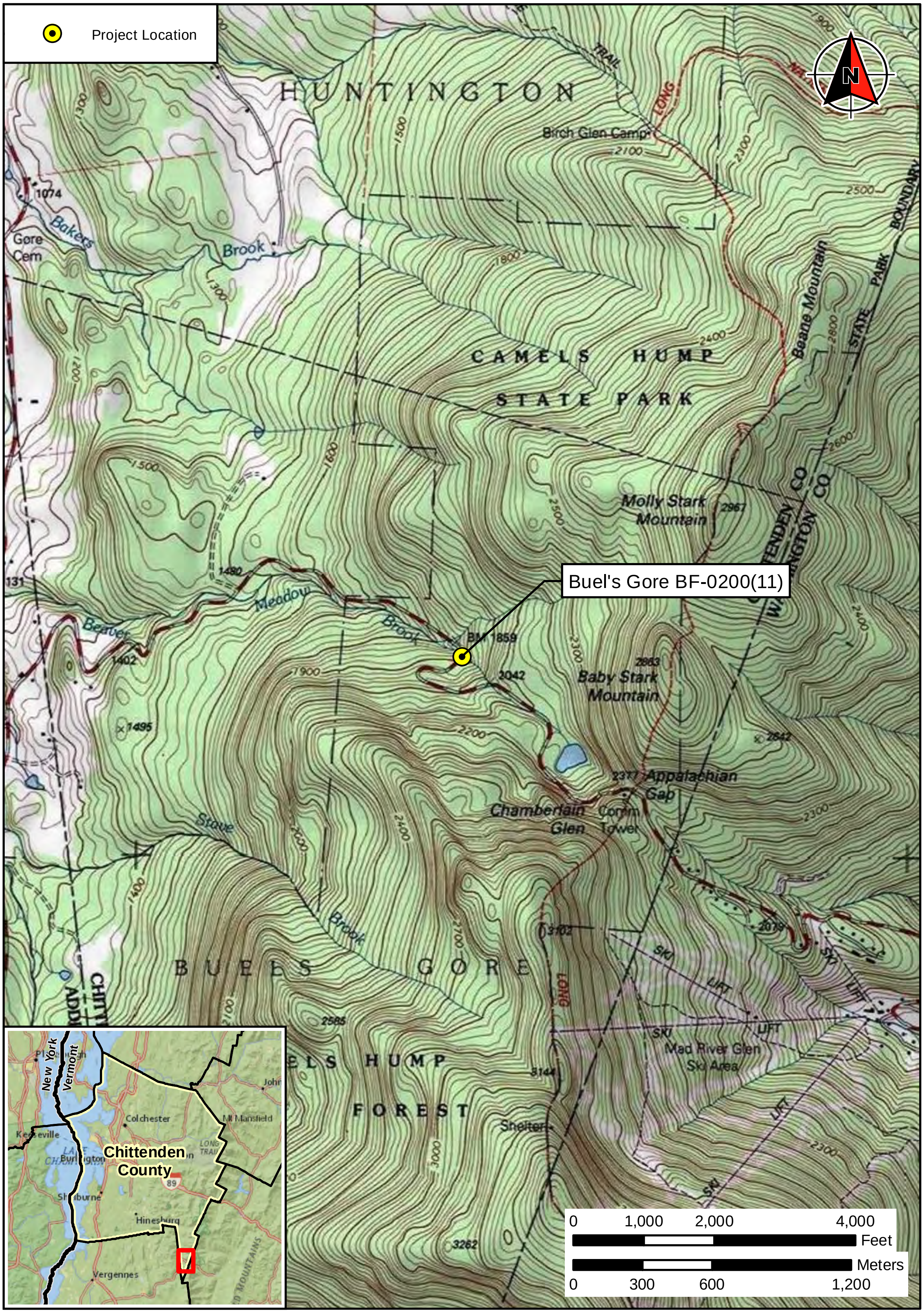

FIGURE 1: Location of Project BF 0200(11) (ESRI USA Topo Maps 2019)

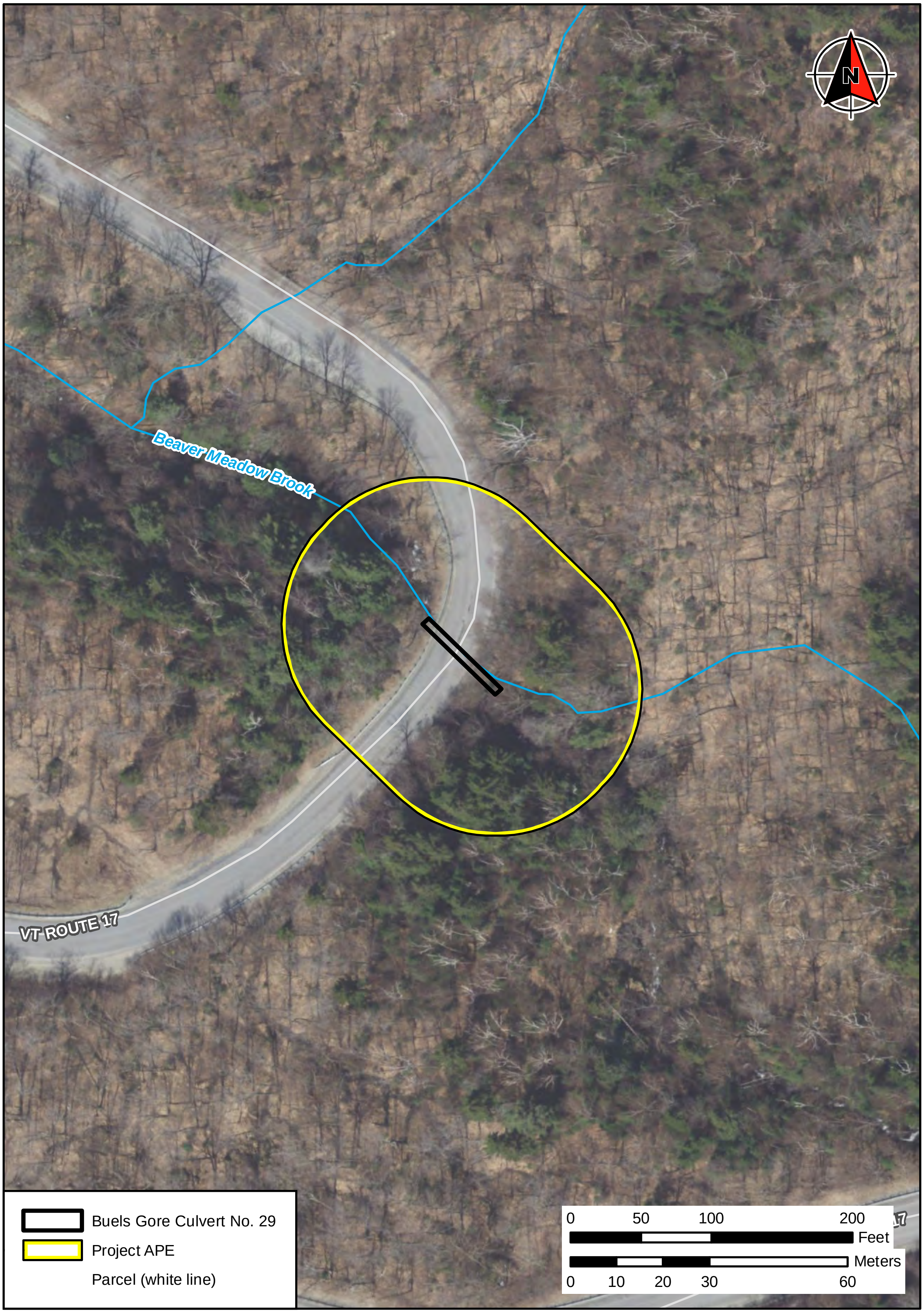

FIGURE 2: Project Area of Potential Effect (APE) (VCGI 2017)

II. Environmental Setting

A. General Setting

The APE is located where VT 17/McCullough Turnpike crosses over Beaver Meadow Brook, approximately 5.23 kilometers (3.25 miles) west of the Town of Fayston, Vermont (see Figure 2). The APE is in the Green Mountains physiographic region, which runs north-south through Vermont. The north part of the Green Mountain physiographic region is characterized as an assortment of mountain peaks with deeply incised valleys carved by both the Winooski and Lamoille rivers. The mountains are 400 million years old. The glaciated terrain once reached elevations of as much as (2,438 meters) 8,000 feet, well above the state's current highest elevation of 1,340 meters (4,395 feet) (Mount Mansfield). The landscape is not well suited for agriculture, and farmland is more often used as pasture. The area also receives a high amount of precipitation, partly because of its location relative to Lake Champlain (Doolan 1996; Vermont Fish & Wildlife Department 2018).

The dominant water source in the region is Lake Champlain. The major rivers of western Vermont drain the region, including Otter Creek and the Winooski, Lamoille, and Missisquoi rivers. The APE is in the Winooski River watershed (United States Geological Survey [USGS] 2018). Limestones, dolomites, and shales are found throughout the region, with sedimentary rocks in several places metamorphosed to quartzites, marbles, and slates. Rocks of Lower Cambrian and Lower Ordovician age lie throughout the Lowlands, which are part of a trough, or downfold, located between the Champlain and Hinesburg Thrusts (Ratcliffe et al. 2011).

The landscape in the APE includes steep, forested land and a portion of Beaver Meadow Brook. Baby Stark Mountain is located to the east, and Molly Stark Mountain is located to the northeast.

B. Soils in the APE

The APE contains two general soil types. Lyman soils are shallow, somewhat excessively drained, and formed in loamy supraglacial till on glaciated uplands. Marlowe soils, found on drumlins and mountain sideslopes, are well-drained soils formed in loamy glacial till (United States Department of Agriculture-Natural Resources Conservation Service [USDA-NRCS] 2020) (Figure 3; Table 1).

TABLE 1: SOILS IN PROJECT APE

SERIES NAME	SOIL HORIZON	DEPTH	COLOR	TEXTURE, INCLUSIONS	SLOPE	DRAINAGE	LANDFORM
Lyman-Marlow complex (LyE)	Oe A E Bhs Bs1 Bs2 R	0-3 cm (0-1 in) 3-8 cm (1-3 in) 8-13 cm (3-5 in) 13-18 cm (5-7 in) 18-28 cm (7-11 in) 28-46 cm (11-18 in) +46 cm (+18 in)	Blk Rd Gr Vr Dusky Rd Dk Rd Brn Dk Gr	Plant material Lo Fi Sa Lo Lo Lo Ch Lo Schist bedrock	LyE (30-60%)	Somewhat Excessively Drained	Glacial Uplands

KEY: Shade: Lt – Light, Dk – Dark, V – Very, St – Strong
Color: *Brn – Brown, Blk – Black, Gry – Gray, GBrn – Grayish Brown, StrBrn – Strong Brown, RBrn – Reddish* Brown, YBrn – Yellowish Brown, OlBrn – Olive Brown, Wh – White, Ol – Olive, PlBrn-Pale Brown, Brn Yl-Brownish Yellow, YRd-Yellowish Red
Soils: Cl – Clay, Lo – Loam, Si – Silt, Sa – Sand
Other: / - Mottled, Grl – Gravel, Cbs – Cobbles, Pbs – Pebbles, Rts – Roots, C – Coarse, Ch - Channery, F – Fine, V-Very, E- Extremely, Dec OM – Decomposed organic matter, S- Stratified
USDA-NRCS 2020

FIGURE 3: Soils in Project APE (USDA-NRCS 2020; VCGI 2017)

C. Environmental History of Vermont

Paleoecologists have constructed the environmental history of Vermont from a variety of sources, including pollen cores, sedimentation histories, and faunal collections. The ruggedness of Vermont and the pronounced differences in elevation across its landscape have resulted in regional contrasts in vegetation, creating a “patchy” landscape. Today it is possible to find tundra at a few thousand feet on the highest peaks of the Green Mountains in contrast to the deciduous and coniferous vegetation in lowlands to the east and west (Thomas 1991).

Before 13,500 years before present (BP), most of present-day Vermont was covered with glacial ice. Within a thousand years the glaciers had moved north of the St. Lawrence lowland, and in their wake grew a landscape of moss, lichens, and stunted shrubs. A frigid arctic climate prevailed, leaving the ground frozen for most of year. By about 12,000 BP most of Vermont was within an herb-to-spruce zone, with higher elevations following suit about 500 to 1,000 years later. Fauna during that period likely included wooly mammoth, mastodon, moose, elk, caribou, and musk ox, as well as smaller arctic animals such as ptarmigan, arctic shrews, and lemmings. By 11,000 BP a subarctic climate dominated the region. Before the end of the eleventh millennium BP, the Champlain Sea had drained. This sea once covered an area about twice the size of present-day Vermont and may have provided Vermont’s earliest human settlers with many resources.

With the close of the Pleistocene, an open park-like woodland of largely spruce, fir, and birch moved into Vermont’s lowlands, and into the mountains by the following millennium. Evidence exists of larch and alder in wet lowlands and beech, oak, ash, and maple in the better drained bottomland and low hills of the Champlain and Connecticut valleys. These changes led to growth in the populations of many animals that today live in Vermont, including moose, beaver, lynx, porcupine, snowshoe rabbit, spruce grouse, mice, voles, and other animals that likely came in from the south.

Pollen cores indicate a sharp increase by 9000 BP in the amount of white pine, hemlock, oak, poplar, elm, ash, sweet gale, and ferns throughout Vermont. Pine pollen takes up 50 percent of pollen diagrams for that period. The presence of pine-dominated forests indicates a warming trend, and thin alluvial beds on floodplains from the period suggest low precipitation (Thomas and Dillon 1983). Pollen cores illustrate a drop in the rates of various pine pollen and a rise in the amount of oak, beech, birch, sugar maple, elm, and ash pollen within a thousand years, indicating the beginning of a Temperate Oak Forest (Thomas 1991:2-4).

Different strands of evidence from the Upper Midwest and the Northeast reveal that between 7500 and 5300 BP, precipitation was higher than today, and the climate was fairly warm. Evidence of rapid sedimentation and increased channel migration along the Missisquoi River between 6500 and 5400 BP indicates a higher level of rainfall. Other evidence of a wetter environment includes high rates of hemlock and beech pollen deposition, as well as beech, cedar, maple, and hemlock logs found along the Missisquoi floodplain and dating to that time period (Brakenridge 1988; COHMAP Members 1988; Thomas and Dillon 1983).

After 6500 BP the mixed deciduous-coniferous forest in the lowlands of eastern and western Vermont provided good habitat for deer, bear, wolf, raccoon, otter, fox, gray squirrel, wild turkey, and passenger pigeon. In the higher, mountainous elevations of central Vermont, spruce-fir-northern hardwood forests were home to moose, elk, and possibly small herds of woodland caribou (Thomas 1991:2-10).

After 5000 BP hemlock steeply declined and oak and hickory increased (Whitehead and Bentley 1963), possibly indicating the onset of drier conditions. Other evidence of drier conditions includes the entrenchment and infrequent river flooding in the upper Midwest (Thompson and Bettis 1982), a lack of substantial alluvial deposits along floodplains of the Missisquoi River (Brakenridge 1988; Thomas and Dillon 1983), and an apparent drop in the water table of Shelburne Pond in the Champlain Lowlands of Vermont (Carr et al. 1977). The climate was probably between 2 and 4 degrees centigrade warmer than today (Dincauze 1989). Chestnut appeared after about 2000 BP. Oak continues to dominate in Vermont's forests today.

Temperatures likely became cooler after about 2800 BP, and precipitation increased until about AD 270. These changes led to greater quantities of spruce and fir at higher elevations and a general increase in pine in the lowlands (Bernabo and Webb 1977; Whitehead and Bentley 1963). Warmer temperatures then returned during the first millennium AD, with a rise in precipitation after about AD 750 (Swain 1978). After AD 1050 drought conditions and higher temperatures prevailed. Evidence of lower water tables, a decrease in stream flow and frequency, and the duration of flooding demonstrate that the period between AD 1000 and 1200 may have been the warmest in Vermont in over 2,000 years. After AD 1550 cooler and moister conditions came with the beginning of the so-called "Little Ice Age" (Thomas 1991:2-9), extending into the mid-nineteenth century.

III. Cultural Context

A. Precontact Background

1. Paleoindian Period (11,000 to 10,000 BP)

The earliest known archaeological remains in Vermont date to the Paleoindian period. These sites were created by small groups of hunter-gatherers who colonized the recently deglaciated sections of the state and the surrounding region sometime before the eleventh millennium BP. Data on the specific nature of Paleoindian adaptations in Vermont remain limited. Although sites of this time period have been found in the state (Loring 1980; Ritchie 1953), none have been subject to excavation. Nevertheless, some aspects of Paleoindian adaptations can be inferred by reference to investigated Paleoindian sites in the neighboring areas of New York State, New England, and the Canadian Maritimes (e.g., Deller and Ellis 1992; Ellis and Deller 2000; Ellis and Lothrop 1989; Lothrop 1989; Meltzer 1984; Stork 1997, 2004).

Assemblages from these sites indicate three consistent attributes of Paleoindian technology that were probably also true for groups in Vermont. First, in addition to fluted points, the stone technologies of these groups consisted of a flake-based toolkit with general categories of wide- and narrow-bit unifacial tools, unifacial gravers, utilized flakes, bipolar artifacts, and large bifaces. Second, people during the Paleoindian period in the Northeast probably preferred bedrock lithic sources as opposed to secondary cobble, and lithic procurement strategy may have been driven, in part, by the design requirements of their transported stone toolkits. Finally, locations of raw material sources for Paleoindian stone toolkits are often many kilometers distant from the sites where these tools are recovered. These distances indicate that people in the Northeast traveled far to collect stone for toolmaking, either during their seasonal movements or as part of trips made specifically to gather new supplies of lithic materials (Seeman 1994).

Disagreement exists over whether people at the end of the Pleistocene in the Northeast were specialists following herds of caribou, or generalists living off a diverse environment, collecting and hunting a wide range of resources (Dincauze and Curran 1983; Pelletier and Robinson 2005). More than likely, the reality varied over time and across space, and was a question not of specialist versus generalist but rather of degree and scale (Thomas 1991:3-7). As specialists, people likely gathered in larger, multifamily settlements at key times of year along strategic intercept points to hunt caribou. These larger aggregations then split up into smaller groups and moved widely across the landscape. As generalists, the people of the Paleoindian period may have moved in small family-sized groups, mapping their movements to the availability of resources.

Archaeologists know of substantial Paleoindian sites south of the present APE in the Connecticut River Valley, including the Whipple Site just off the Ashuelot River in New Hampshire (Curran 1984), the DEDIC Site on the Connecticut River in Deerfield, Massachusetts (Chilton et al. 2005), and the Turner’s Falls Site on the Connecticut River in Turner’s Falls, Massachusetts (Binzen 2005). In northwestern Vermont Loring (1980) documented the recovery of fluted points on and below Champlain Sea beach deposits from adjacent interior lowlands and from higher-elevation settings in the western foothills of the Green Mountains. Several sites in northwestern Vermont with evidence of Paleoindian occupations have been found in the Champlain Basin (Robinson et al. 2017).

2. Archaic Period (10,000 to 3000 BP)

Archaeologists call the period beginning 10,000 years ago following the end of the Pleistocene and the beginning of the Holocene, the Archaic period. They further subdivide the Archaic into at least three subperiods, the Early (10,000 to 7500 BP), Middle (7500 to 6000 BP), and Late Archaic (6000 to 3000 BP). These subperiods are largely demarcated by changes in projectile point styles.

Earlier archaeologists generalized the environment of the early Holocene (Early and Middle Archaic) in the Northeast as closed woodlands dominated by conifers (Dincauze and Mulholland 1977; Fitting 1968; Ritchie 1980). Since a low carrying capacity characterizes such an environment, they hypothesized that there was a low population until about 6,000 years ago, which resulted in low site density for the period. More recently, archaeologists have questioned this understanding. Nicholas (1991a, 1991b, 1998) cites evidence that the landscape in the early Holocene was far more diverse, supporting a broader resource base than that characterized by a closed conifer forest environment. According to Nicholas's "glacial lake basin mosaic model" (Nicholas 1991a, 1991b, 1998), people took advantage of a highly productive ecosystem that contained a complex system of lakes, ponds, and wetlands. Robinson and Petersen (1993) cite the problems encountered with trying to attach changing demographics to known frequencies of temporally diagnostic projectile points. Since earlier archaeologists did not find many sites with temporally diagnostic points in early Holocene contexts, they assumed that the region was fairly uninhabited. Robinson and Petersen (1993), however, write that the lithic technology recovered from known early Holocene components is typically very expedient, resulting in the production of few temporally diagnostic formal artifacts such as projectile points. Rather, assemblages from these sites consist mostly of flake assemblages, and therefore many of the components dating to this time period have likely gone unrecognized. Furthermore, it is possible that many sites from the Early and Middle Archaic now lie deep beneath river floodplains (Thomas 1991:5-1).

In southern Vermont the transition to the Early Archaic was contemporaneous with the continued warming trend in the early Holocene and the replacement of spruce and fir by pine as the dominant tree species (Carr et al. 1977) (see Chapter II.C). The combination of environmental and technological changes during the transition to the Early Archaic may indicate an increase in the importance of plant foods and shifts in the exploitation of certain terrestrial fauna, such as the hunting of deer rather than caribou. As opposed to Paleoindian use of high-quality cherts brought long distances before discard, evidence from early Holocene sites indicates a switch to the use of local chert, quartzite, and quartz during the Early Archaic. The change is likely the result of people living in far more restricted areas than their Paleoindian ancestors as well as a lack of widespread external contacts (Thomas 1991:5-6). Archaeologists have long thought that people remained within these territories, spending portions of the year in larger base camps and then moving to smaller, more task-specific camps in the surrounding area (Snow 1980:171).

The number of known sites and diagnostic artifact types and projectile points dating to the Late Archaic (6000 to 3000 BP) is far greater throughout the Northeast and Vermont than for any of the preceding periods. There is also evidence of the development of mortuary ceremonialism. Archaeologists have traditionally characterized the Late Archaic in the Northeast and Vermont into three basic traditions based on these numerous changing artifact types. The Laurentian tradition is thought to date to between about 5600 and 4400 BP and is known from sites in western Vermont as well as elsewhere throughout the Northeast, including New York, southern Ontario, southern Quebec, and northern New England. The Narrow Point tradition follows the Laurentian and dates roughly between 4400 and 3600 BP. Archaeologists have found artifacts associated with this tradition up and down the East Coast from as far south as North Carolina and as far north as the Upper St. Lawrence River. The Susquehanna tradition is later, dating to between about 3800 and 1800 BP. Traits associated with this tradition are thought to have moved north from the Southeastern Piedmont to as far north as Maine and the Upper St. Lawrence.

These traditions differ from each other based largely on changing artifact traits; however, Dean Snow (1980) and others (e.g., Braun and Braun 1994) geographically split the Northeast during the Late Archaic into three very general sections. They base these divisions on broad generalizations about adaptations to major regional environments. The Maritime Archaic lay in the coastal regions of northern New England

and the Canadian Maritimes and is defined as an adaptation based on the resources of the ocean. The Lake Forest Archaic stretched from the Eastern Great Lakes across northern New England. Snow (1980) believes the people of the Lake Forest Archaic lived around the many lakes and rivers found in the region. The Mast Forest Archaic ran from the coastal plains of southern New England into the oak forests of the interior. Here people are thought to have made use of the abundant nut-bearing deciduous trees in the region. Although these models are useful in a very general sense, they are also problematic because they are so general and mask much of the potential for variation across the Northeast.

Our understanding of the lives people led in the Northeast is largely shaped by where the vast majority of archaeologists have worked along the great rivers of the region, including the Connecticut, the Hudson, and the Merrimack. Thousands of years ago people migrated to these rivers each spring to take advantage of the abundant annual migrations of anadromous fish. Each spring around April these fish swam far up the rivers and their tributaries to spawn until stopped by falls. They created a plentiful food resource for people at the leanest time of year when the winter stocks were empty. These large groups likely stayed together throughout much of the warm-weather months, splintering off periodically to hunt, gather different food, and collect other needed resources. There is ample archaeological evidence along the floodplains of large rivers in much of the Northeast of these large gatherings at so-called "base camps." With the onset of the cold weather, people are thought to have splintered into smaller groups, likely extended families, and moved inland away from the rivers. This pattern of small groups of hunter-gatherers aggregating during the spring and then splintering in the fall has been defined as the "central-based wandering pattern" (Ritchie and Funk 1973:340). There is ample archaeological evidence along the floodplains of large rivers in much of the Northeast of large gatherings at so-called "base camps." These large groups likely stayed together throughout much of the warm-weather months, splintering off periodically to hunt, gather different food, and collect other needed resources. With the onset of the cold weather, people are thought to have splintered into smaller groups, likely extended families, and moved inland away from the rivers. This pattern of small groups of hunter-gatherers aggregating during the spring and then splintering in the fall has been defined as the "central-based wandering pattern" (Ritchie and Funk 1973:340).

The problem with applying these interpretations elsewhere in Vermont is the lack of anadromous fish coming up the Connecticut River beyond Bellows Falls. Ohl (1994:55) comments on the lack of known sites dating to the Middle Archaic north of the falls, although sites dating to this period are known south of the falls up the West River and Ashuelot River in New Hampshire. Site VT-WD-0003 lies just south of the confluence of the West and Connecticut rivers and may have been the location of a large, warm-weather group aggregation. Elsewhere in Vermont, however, since the major impetus for large gatherings appears to have been absent north of Bellows Falls, the lives people lived in this region were likely very different from elsewhere in the Northeast.

3. Woodland Period (3000 BP to AD 1600)

The Woodland period is marked by the introduction of ceramic technology about 3,000 years ago. This new technology allowed the production of containers that could withstand cooking with direct heat. This new capability likely affected nutrition and therefore population dynamics. Ceramics also enhanced the capability to store food, which by offsetting seasonal changes in the availability of different foods made it possible for people to become more sedentary. Despite the possibilities presented by this new technology, there is little evidence of any profound changes in life across Vermont. In addition, the elaborate ceremonialism represented by the rich grave-good assemblages found at Early Woodland (3000 to 2000 BP) and Middle Woodland (2000 to 1000 BP) sites, such as Swanton, Boucher, East Creek, and Bennett (Loring 1985; Thomas 1991:9-9), indicate continuity with the burial ceremonialism of the Late Archaic.

There is little archaeological evidence of the Early Woodland in Vermont, and much of what we know about the Early to Middle Woodland comes from sites located in the Connecticut Valley. Two notable sites are the Canaan Site (VT-ES-2) in Canaan, Vermont, and the Skitchewaug Site (VT-WN-41) in southeastern Vermont (Bolian and Gengras 1994; Heckenberger et al. 1992). Middle Woodland sites in western Vermont, such as the Winooski (Power et al. 1980) and McNeil Generating Station sites (Thomas 1980), illustrate the use of areas along the lower reaches of rivers flowing into Lake Champlain. These sites indicate the presence of large gatherings of people who fished, harvested nuts, and hunted.

At Middle Woodland sites like Winooski and McNeil, lithic artifacts are mostly made of non-local cherts. By the Late Woodland (AD 1000 to 1600), however, people were using local cherts, perhaps suggesting changes in and an end to the long-distance trade and political relationships that had existed during the Middle and perhaps Early Woodland periods (Haviland and Power 1982:132-133; Thomas 1991:9-9). The ceramics at Winooski are “related to ceramics from the Lake Forest Middle Woodland ‘cultural complex’ of the Great Lakes-St. Lawrence drainage” (Petersen and Power 1983:142), whereas later ceramic assemblages “seem more clearly related to other local assemblages within the Lake Champlain drainage basin” (Petersen and Power 1983:143). Ceramics recovered from the Canaan and Skitchewaug sites are consistent with contemporaneous types found elsewhere in Vermont.

Throughout the Northeast the Late Woodland period is associated with the introduction of horticulture, particularly the importation of domesticated maize; however, it is more than likely that maize did not appear in New England until after about AD 1300 (Chilton 2006), several centuries after the Iroquois to the west had adopted it. In New York maize became a key component in the development of large permanent villages. Although maize was adopted throughout New England, there is little evidence of the development of large sedentary villages based on maize horticulture (c.f., Petersen and Cowie 2002). Rather, archaeological evidence indicates that people remained mobile hunter-gatherers who only used maize as a dietary supplement. These people therefore become what Elizabeth Chilton (2002) has called mobile farmers because although they planted, they did not become sedentary farmers like the Iroquois.

4. Contact Period (ca. AD 1600 to 1750)

At the time of European contact in the seventeenth century, the descendants of Late Woodland groups inhabiting the Connecticut Valley of Vermont included the Western Abenaki. By that time sedentary village life was a major aspect of their adaptation. The Western Abenaki were organized into several major bands or organizations, each occupying its own village site. Subsistence strategies alternated between the village setting, where crops were grown and surplus foodstuffs stored, and periodic dispersion into smaller groups that traveled to other locations, primarily to hunt (Haviland and Power 1982).

The coming of Europeans to New England in the seventeenth century brought immense and catastrophic changes to the Native peoples of the region—changes that we are only beginning to understand today. The Native inhabitants of Vermont, the Abenaki, experienced severe population loss to European diseases. Their traditional lifeways were forever changed by Europeans who took their lands, refugee populations of American Indians who moved in from elsewhere in New England, and involvement in European wars and European demand for trade goods, such as beaver pelts. The Abenaki, who call their homeland Ndakinna, meaning “our land,” received tribal recognition from the State of Vermont in 2006. They are still seeking federal recognition and are referred to as the St. Francis/Sokoki Band of the Abenaki Nation of Missisquoi (Abenaki Nation 2010). Today, the St. Francis/Sokoki Band of the Abenaki Nation of Missisquoi live in northwestern Vermont (Abenaki Nation 2010).

B. Historical Overview

1. Historic Context for Northern Vermont

The first Euro-Americans to venture into the region that would become Vermont were trappers and hunters in the eighteenth century. Access to much of this area was impeded by mountains, and colonization was slow because the political situation was unsettled. Recurring hostilities between the British and French authorities initially inhibited settlers from making Vermont their home; however, even before the final surrender of the French to the British at Quebec in 1760, applications for land grants were being made by many parties.

The colony of Connecticut made the first land grants within what is now Vermont in the early eighteenth century, after Massachusetts, which had erroneously granted its own citizens 436 square kilometers (172 square miles) within the borders of Connecticut, transferred these land grants (the “equivalent lands”) to Connecticut. Connecticut immediately sold these lands to people from both Connecticut and Massachusetts, who in turn sold the land to prospective settlers at a profit. After the final resolution of the Massachusetts-New Hampshire territorial disputes in 1740, these lands became New Hampshire territory. Nevertheless, most of the region’s settlers continued to come from Connecticut and Massachusetts (Tosi 1948:48-49). European settlement was slow in all parts of today’s Vermont until 1761, when Benning Wentworth, governor of New Hampshire, claimed the lands for New Hampshire and began establishing illegal land grants. These territories became the State of Vermont in 1791.

Prior to 1830, subsistence farming was the dominant economic activity. The earliest economic activity outside the household was the sale of potash and lumber obtained from land clearing. Potash, owing to its high market value and use in the production of glass, became the only inspected product in Vermont at that time (Elliott 1977:18). Small manufacturers, including gristmills and sawmills, sprang up throughout the region to process locally grown materials. Distilleries (using rye and corn) and starch factories (using potatoes) also developed. Taverns and general stores opened to cater to the local populace in nearly every town. By 1830 the region’s agricultural economy was concentrated on the cultivation of potatoes and grains, some of which was shipped to Eastern and Southern markets. Wheat was initially an important crop, so much so that it was used as money by the earliest settlers. As transportation increased to wider markets, farmers focused more on a smaller number of specialized products.

Apple growing in particular became an important part of the Vermont economy. John McIntosh, born in 1776, eventually began selling his apple seedlings to settlers, and the McIntosh apple became the dominant apple in Vermont because of its acclimation to cool nights and warm, sunny days. In 1899 Vermont boasted 1,675,131 apple trees and produced 1,176,822 bushels of apples. Commercial apple production in Vermont continued into the twentieth century but declined owing to the lack of modernized facilities. The introduction of the automobile boosted apple production again; in 1955 Vermont produced over 1,100,000 bushels, and in the 1980s roughly 79 commercial growers on 3,500 bearing acres of land produced roughly 1.25 million bushels annually (VDHP 1990).

By the late eighteenth century some industry had begun to develop in Vermont. Lumbering in the oak forests brought much-needed money into the state and also cleared land for farming (Stratton 1980:250). Large fallen trees were ideal for making masts for ships and were usually shipped to Quebec. Production of hats was also an early trade, which used local wool and beaver hides from trappers. Other early businesses included blacksmithing, brick making, and dyeing.

The developing livestock industry rapidly took over in Vermont as both cattle and horses thrived on the local grasslands and climate (Bearse 1968; Tosi 1948:58-59; VDHP 1990). During the early nineteenth century the Spanish Merino sheep, an outstanding wool producer easily adapted to rugged terrain and climate, arrived in Vermont. The self-sufficiency of the Vermont farmers diminished considerably as many turned to sheep farming for an alternative source of income almost to the complete exclusion of other agricultural products. The improved machinery and larger wool mills that were introduced around 1830 permitted Vermont farmers to produce more wool, and 33 wool factories were built in Vermont during that period. In addition to wool, raw cotton was imported into Vermont mills for processing (Meeks 1986; Tosi 1948:62).

Although some textile production occurred in fulling and cleansing mills, and later also carding mills, the production of textiles remained a household activity until about 1820. After about 1820 factories took over the production of textiles, and the number of fulling and carding mills increased by 200 percent (from 136 to 273) and 275 percent (from 87 to 234), respectively. By 1830 the home manufacture of textiles was almost non-existent. Since a typical textile mill required the labor of about nine or so workers, the mills typically sprang up where the workers lived. In many cases the wool factories were an outgrowth of earlier textile mills as the mills became suppliers for developing wool factories (Meeks 1986; Steponaitis 1975:43-50).

The breeding of wool sheep reached its peak in Vermont in the early 1840s, but by the end of the decade, the industry had begun to decline, partly the result of lower protective tariffs on imported wool and partly the result of competition from the West with its larger pastures, less costly grain, and better transportation following the opening of the Ohio and Pennsylvania canal systems (Tosi 1948:59-60; VDHP 1989b). The number of wool factories in Vermont decreased from 97 in the mid-1840s to 89 a decade later. In addition, the number of textile concerns in Vermont began to drop as the industry consolidated into fewer, larger firms using more efficient machinery and located along more traveled transportation routes. The number of mills fell from a peak of over 400 in the 1820s to only 75 in the early 1850s. The sheep industry revived briefly in the 1860s and immediately afterward, as the Civil War prompted a greater demand and higher prices for wool products because of the low availability of Southern cotton as well as the imposition of higher tariffs (Steponaitis 1975:60-67).

With the initial decline of the sheep and wool industry in the late 1840s, many farmers returned to breeding cattle, although not before mutton sheep slowly infiltrated many farms formerly devoted to wool-bearing sheep (VDHP 1989a:2). Dairy farming in Vermont and elsewhere in New England had been introduced by the 1840s (Barron 1980; Russell 1982). Dairying proved to be a protection against the fluctuating price of wool and allowed farmers to take advantage of expanding urban markets to the south. The introduction of dairy breeds to replace beef cattle was a slow and intermittent process. Barron (1980) believes that one reason farmers in Vermont were slow to switch from wool to dairy was problems with labor. The young of Vermont were moving out West and to the big cities, depopulating the countryside during the second half of the nineteenth century (discussed further below). Because sheep farming was far less labor-intensive, it remained a more efficient use of resources during this period even as prices for wool dropped. Dairy farming, on the other hand, was becoming more labor-intensive, and Barron (1980:333) estimates that because of technological changes, the labor demand for cows grew by 68 percent per cow between 1850 and 1910. As a result, since the available pool of labor was declining after the mid-nineteenth century, farmers were hesitant to make the switch from wool to dairy even though the wool market was unstable. It was not until the market for wool completely collapsed at the end of the century that the switch from sheep to cows became complete.

Up until the 1850s, only private dairying took place. As the industry became more widespread, cheese factories, and later creameries, were built to service entire dairying communities. The three staple crops for the mid-nineteenth century Vermont farmer became wool, butter, and maple sugar, and dairy farming dominated the agriculture of eastern Vermont after the Civil War (Bremer 1929:587; Tosi 1948:63). Butter and cheese were manufactured in centrally located factories, although up until 1900 almost 40 percent of manufactured dairy products were produced privately in the home for sale to a private clientele. The number of dairy cows in some Vermont counties reached a peak in 1900. By the close of the nineteenth century, however, the Vermont dairy farmer faced direct competition from the dairy industries of Ohio and Wisconsin, for whom the transport of perishable goods did not pose as great an obstacle after development of the railroads connected these states with the East. Dairying declined slowly until 1920, then rose sharply until 1930 (Tosi 1948:62-64). By the end of the twentieth century, however, the need for expensive equipment had put many small hill-country farmers out of business (VDHP 1989a).

The wool industry in Vermont changed in the late nineteenth century with the emergence of large town-based manufacturing firms (those employing more than 100 employees) in places such as Bennington, Winooski, Rutland, Johnson, and Fair Haven. Vermont still enjoyed prominence in the manufacture of wool and knit goods during the 1880s; however, the state's industry declined steadily through the first half of the twentieth century despite a brief rise during the World War II years (Steponaitis 1975:118; VDHP 1991:10-11). Mills gradually closed after the end of the nineteenth century as they became unable to compete with mills and factories in the South (Barron 1980:326).

The population decline during the second half of the nineteenth century produced one of the greatest historical effects on the landscape. As the United States expanded, new opportunities arose and young people moved to the West. Many of the Vermont's rural youth left for jobs in the growing big cities, although Barron (1980) describes contemporary writing of abandoned farms as "hyperbole," writing that agriculture in New England did not collapse after the Civil War but only experienced stagnation. He points out that throughout Vermont two-thirds of male household heads remained farmers/farm laborers throughout the second half of the nineteenth century, 90 percent of farms were family-owned, and two-thirds of the land remained agricultural land. In short, the number, size, and location of farms throughout Vermont remained stable. In addition, the output of wool, butter, and maple sugar from these farms remained constant into the late 1890s. The number of tradesmen also remained constant, although a number of mills and factories were replaced because they could not compete with those in the South (Barron 1980:326). Vermont farmers may have been able to survive the slow attrition of labor throughout the second half of the nineteenth century, but the lack of available labor ultimately prevented them from adapting to more economically advantageous forms of farming.

2. Historic Context for Chittenden County

a. County Formation

The French, the first Europeans to settle in the Champlain Valley, came to present-day Vermont in the seventeenth century. It was not until the end of the French and Indian War (1756-1763), almost 150 years later, that people of English descent began to settle along the western reaches of the Winooski River in present-day Burlington, South Burlington, Williston, and Essex under grants issued by the English governor of New Hampshire. The first proprietors met to establish a new township in 1774, when the Onion River Land Company was formed in Connecticut with members including Ethan Allen, Ira Allen, Remember Baker, and Tom Chittenden. Many of these early settlers left the Winooski Valley with the outbreak of the American Revolution, fearing an attack from the British, and moved south (Rann 1886).

Tom Chittenden settled with his family along the banks of the Winooski in Williston and went on to become the first Governor of the New Republic of Vermont in 1778, serving until his death in 1797. Others also soon settled along the Winooski, taking advantage of the fertile farmland and building farms along the river, near the Winooski Falls (Hemenway 1867; Rann 1886; Swift 1996). Ira Allen began milling grain and sawing lumber in 1772 at the Falls, and he and Remember Baker built Fort Frederick nearby for protection from the Abenaki. The small community that developed around the falls, the mills, and the fort became known as Allen's Settlement.

Since the earliest settlers placed their first farms on the arable land they found along the Winooski River and its tributaries, these lowland areas have the oldest place names. The more upland and mountainous sections of the valley were settled later and have more descriptive names (Swift 1996:159). Apparently, the name Winooski has its roots in the Abenaki words for "the wild onion place"; *Winooskitook* means "the wild onion river." The French took the name and spelled it Ouinoustick and Ouinouski. It is possible that the Allens and other early settlers of English descent changed the name to the Onion River (subsequently forming the Onion River Company to settle the land) to remove any trace of French or Abenaki claims to what is today Williston, Burlington, and South Burlington (Swift 1996:159).

b. Town of Buels Gore

Buels Gore is located in the far southern tip of Chittenden County. A gore is an unincorporated portion of a Vermont county that is not a part of any town and has limited government. Gores are often uninhabited. The total area of Buels Gore is 5 square miles with only one road, VT 17, running east to west across the north end of the gore. Buels Gore was chartered on November 4, 1780, by the Vermont General Assembly. It is named for Maj. Elias Buel, who with family members and a group of proprietors petitioned the Vermont legislature for the land grant. At the time of the petition, very little land was available. Several small gores, unconnected pieces of land left over from the land surveying process, were offered to the petitioners.

The Walling (1857) map shows no development in Buels Gore (Figure 4). The Beers (1869) map shows Buels Gore as separate from the Town of Huntington and labeled merely as "Gore" (Figure 5). VT 17 had not been constructed yet, and only four dwellings and a small cemetery are shown in the far northwest corner of the gore (Beers 1869).

There are no official historical accounts of Buels Gore. The gore had a population of only 18 people in 1840 but had 35,000 sheep (Bushnell 2017).

Originally called the McCullough Turnpike, the route now designated VT 17 was first authorized as a private toll turnpike by legislative act No. 168 of the Acts of 1933, and the rights to the McCullough Turnpike were sold to Vermont in 1935. Early construction efforts along the turnpike include the construction of a 1.27-mile standard gravel highway completed by the Civilian Conservation Corps and later improvements to access the Mad River ski development. An additional graveled one-way stretch of 1.4 miles with turnouts, which extended to the divide at the Appalachian Gap, was completed by 1954 (Figure 6). At that time only a 1.7-mile connection from the Appalachian Gap down the west side of the Green Mountain range was left unconstructed (Vermont State Highway Board 1952-1954:24). This section had an elevation change of 900 feet and traversed through very rugged terrain in state forest lands. Completion of the connecting road came before the legislature and passed on May 6, 1955, with the requirement that the road be completed by November 1, 1956 (*Burlington Free Press* 1955:2). Completion of the road was stalled because of funding issues, and the legislation set aside lumber sales from the state park to fund the road, which covered only a fraction of the total cost. This last section of road had wood post and wire fencing along the 20-foot-wide roadway (see Figure 6). That same year the existing access road to the Mad River ski development was hard-surfaced with gravel (Vermont State Highway Board 1954-1956:11). The route was open to traffic by October 1956, but the entire route was not paved until the summer of 1957 (*Burlington Daily News* 1956). Along with providing access to the ski resort, the completed route provided a passage through the Appalachian Gap (*Burlington Free Press* 1957:10) (Louis Berger 2018).

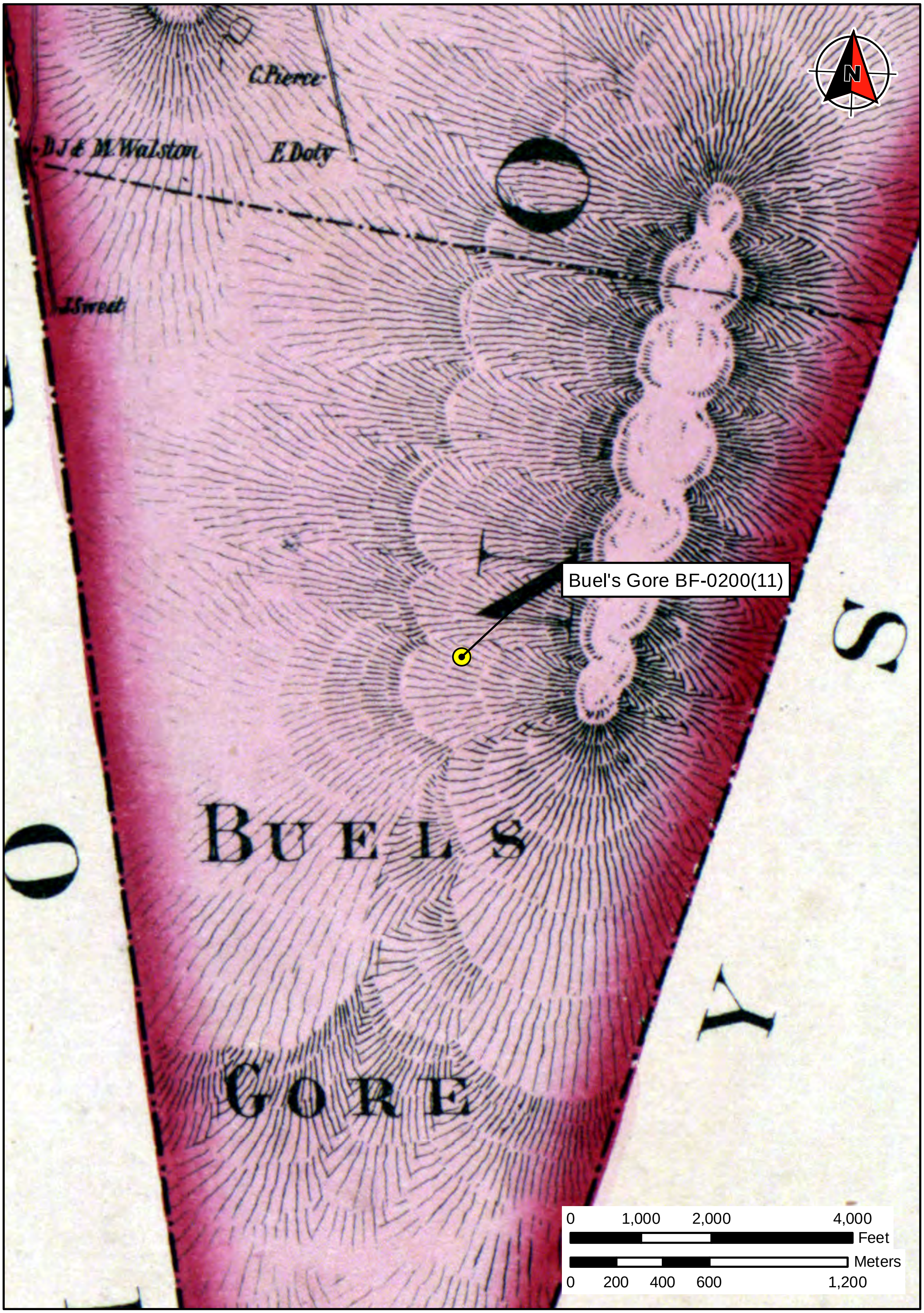

FIGURE 4: Project APE in 1857 (Walling 1857)

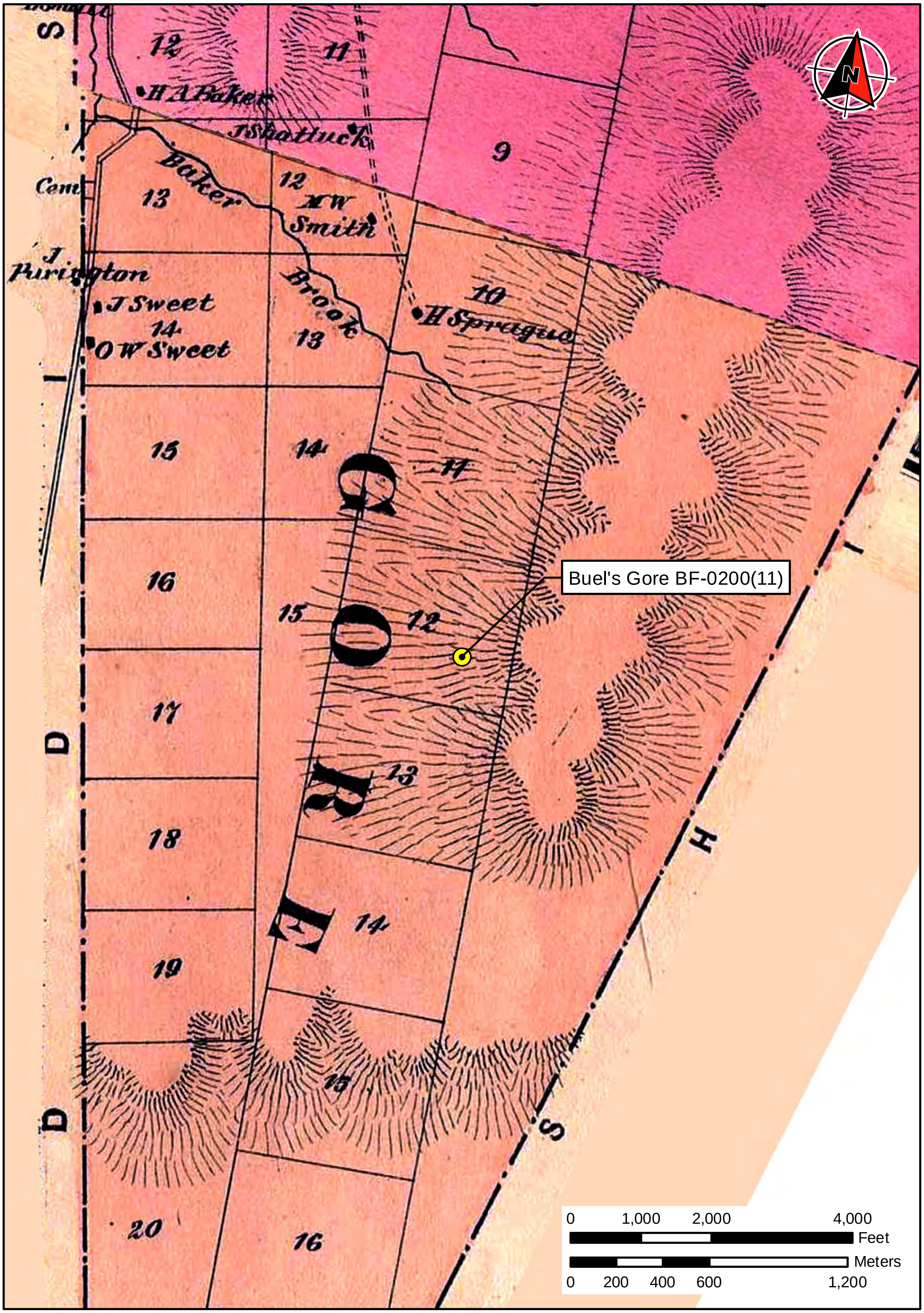

FIGURE 5: Project APE in 1869 (Beers 1869)


FIGURE 6: Completed McCullough Turnpike Connector(Vermont State Highway Board 1954-1956)

C. Historical Map Review

The earliest map of Chittenden County dates to 1857 (Walling 1857). No development is shown in Buels Gore at that time (see Figure 4). Buels Gore is not shown in detail on the Beers (1869) county atlas of Chittenden (see Figure 5). No development of the APE vicinity is evident from topographic maps throughout the late nineteenth and twentieth centuries (Burgett 1876; Nationwide Environmental Title Research [NETR] 2021).

D. Previous Cultural Resource Management Projects and Known Sites

1. Previous Cultural Resource Management Studies in Vicinity of APE

WSP's background research included examination of the VDHP's ORC files to identify known sites and the results of previously conducted cultural resource management surveys in the vicinity. No cultural resource surveys have been conducted within 1.6 kilometers (1 mile) of the APE.

2. Precontact Archaeological Sites in Vicinity of APE

No precontact archaeological sites have been previously recorded within 1.6 kilometers (1 mile) of the APE. The closest precontact site, VT-WA-0169, is located 10.1 kilometers (6.3 miles) to the east and consists of a subsurface lithic scatter.

3. Historic Archaeological Sites in Vicinity of APE

No historic archaeological sites have been previously recorded within 1.6 kilometers (1 mile) of the APE. The closest historic site, VT-AD-1717, is located 5.6 kilometers (3.5 miles) to the northwest and consists of the remains of a nineteenth-century residence.

IV. Archaeological Assessment

A. Methods

WSP's goal for the ARA was to assess and survey the entire APE to identify archaeologically sensitive areas. This will allow VTrans maximum flexibility in avoiding sites that are eligible for the NRHP. To derive this assessment, WSP conducted background research, field inspection, and analysis of the APE using the *Environmental Predictive Model for Locating Precontact Archaeological Sites* (VDHP 2015)

1. Background Research

The background research included use of the Vermont ORC map tool (VDHP 2021), a review of site files from sites located within 1.6 kilometers (1 mile) of the APE, reports from projects conducted within the Town of Bloomfield, historical maps, and local histories.

2. Determination of Archaeologically Sensitive Areas

WSP's archaeological assessment followed several stages. WSP first reviewed the APE using the VDHP ORC online map tool (2021) and *Environmental Predictive Model for Locating Precontact Archaeological Sites* (VDHP 2015; see Appendix A) to identify the distribution of key environmental criteria possibly affecting the location of precontact archaeological sites. The environmental criteria listed in these two predictive tools are summarized below.

Proximity to a:
- Permanent Stream/River
- Waterbody
- Wetlands
- Stream/Waterbody Confluence
- Head of Drainage
- Stream Confluence
- Waterfalls

The presence of:
- Glacial Lake Shore Line
- Glacial Outwash and Kame Terrace
- Floodplain Soils
- Level Terrain
- Significantly Sloped Terrain

For the seven criteria defined by proximity, the radius of proximity defined as significant is typically 180 meters (590 feet). The value attached to proximity was refined according to the Environmental Predictive Model, with a higher significance and greater score given to areas within 90 meters (295 feet) of a particular environmental criterion, versus a lower significance and half the score given to locations between 90 and 180 meters (295 and 590 feet) of the same criterion. The other five criteria are based on presence/absence (i.e., presence on level terrain versus presence on significantly sloped terrain) and not on varying levels of proximity. The Environmental Predictive Model attaches scores to each of these criteria as well as other criteria, including the presence of burials and known archaeological sites.

WSP determined sensitivity for the possibility of historic archaeological sites through an analysis of historical maps (see Figures 4-6) of the APE as well as regional histories. These historical maps are useful sources of information about old roads as well as the location of historic-era structures and other features. WSP also researched the VDHP site and report files available through the ORC as well as in-house resources to identify known sites and the results of previously conducted cultural resource management surveys surrounding the project, as described in Chapter III. Familiarity with known sites is useful both for understanding where sites might be located and for interpreting what is found and assessing its potential significance.

WSP also consulted the Historic Front Yards study (Louis Berger 2005) to provide a context for identification of archaeological sensitivity in areas of historic building-road space. The study provides a guideline for assessing archaeological sensitivity and making recommendations for additional work. This includes identification of historic building-road spaces, eliminating historic building road spaces that have been obviously and significantly disturbed, evaluating the archaeological sensitivity of each historic building-road space, and determining the setting and context of the space. The space and context setting variables are summarized below.

- Space Setting
  - Age of adjoining road compared to the adjoining historic building.
  - Historical function of the building or building complex adjoining space and type of associated below-grade infrastructure to support the functions of the associated building.
  - Overall general historical setting of the space.
  - Distance of the historic building from the road and evidence of changing distance since the building was originally erected.
  - Known previous buildings erected nearby or in the location of the historic building.
  - Historical orientation of the historic building relative to the space.
  - Historical functions of the historic building-road space.
  - Evidence of archaeological features or deposits.

- Context Setting
  - Ability to pose research issues that might be investigated on the property where the historic building-road space is located, based on documentary research and field reconnaissance.
  - Presence of pertinent historical themes or associations that the property might illustrate.
  - The potential for the historic building-road space to contribute substantively to the possible overall significance of the property.

B. Results

1. Field Inspections

The results from the field inspection, in combination with the background research, indicates that the APE contains no areas of archaeological concern. The area immediately surrounding the culvert is highly sloped with areas of exposed rockface (Plates 1 and 2). The culvert is also deeply buried under the road, indicating that the soil above and to the sides of it are fill from the original installation of the culvert. Removing these soils to install a new one will pose minimal impact to possible intact cultural soils.

Next to the west end of the culvert are some exposed beams (Plate 3). These beams are firmly embedded in the soil surrounding the culvert. The beams' purpose is not known, but it likely has something to do with the original installation of the culvert. The age of the beams is also unknown. No metal hardware remains

PLATE 1: View of West Side of Culvert, View East

PLATE 2: View of East Side of Culvert, View West

PLATE 3: Closeup of Beam Protruding from West Side of West Culvert Exit, View East

despite indications in the wood that it was once there. Because of the beams’ fragmentary nature and their location within the fill, it is unlikely that they are of any historical significance.

2. Analysis

The VDHP (2015) predictive model for precontact archaeological sites relies mainly on ecological variables, including distance to water, particular types of landforms, and slope, as well as possible archival or oral traditions and the known presence of sites and burials. Scoring according to this model is not meant to be taken rigidly, but rather as a guide to review possible environmental variables. The primary environmental variable related to precontact sites that applies to the APE is water sources. Elevated landforms are located too far from water sources to yield cumulative scores of 32 on the predictive model. The previous culvert and road construction operations have also resulted in surface and limited subsurface disturbances, that when combined with a lack of suitable intact landforms such as alluvial or outwash deposits, results in a negative score. Given the lack of positive environmental factors, the existing disturbance, and the generally low-density distribution of precontact sites in the vicinity, the APE is considered to have a low to very low sensitivity for precontact archaeological resources. Based on the predictive model, no portion of the APE scored 32 or higher, with a minimum score of 32 required to indicate archaeological sensitivity.

Application of criteria in Louis Berger’s (2005) Historic Front Yards study showed that there is a low historic archaeological sensitivity within then APE. While historic maps of the area depicted some historical activities in the general area of the APE, there were none that fell within the APE of the culvert itself. In addition, the roadway leading up to the culvert shows evidence of having been repaved several times since its instillation, causing changes to the historic road space of the APE.

V. Conclusions

On behalf of VTrans, WSP completed an ARA for the improvements to Buels Gore Culvert No. 29, VT 17, Chittenden County, Vermont. The scope for the project has yet to be defined; WSP therefore conducted this survey and resource assessment to consider the potential effects of site access approach work, staging, culvert installation, and other potential project activities associated with improvements at the site of the culvert. The APE extends 30.5 meters (100 feet) from either end of the culvert to include all four quadrants of the culvert approaches. The survey included background research, field inspection conducted on April 7, 2021, and application of the predictive model.

No previously recorded precontact or historic archaeological sites lie within the APE, and no precontact or historic archaeological sites have been recorded within 1.6 kilometers (1 mile) of the APE. No other archaeological sites were identified during the ARA. Given the lack of positive environmental factors combined with evidence of disturbance documented throughout the surrounding area, It is WSP's opinion that the APE is not sensitive for archaeological resources. Any subsurface disruption in the assumed APE has little potential for disturbing buried cultural deposits.

It is WSP's opinion that any future development carried out in the APE will have no impacts on any significant archaeological resources and would not have an adverse effect on archaeological sites that are eligible for or listed in the NRHP. WSP's opinion is that additional archaeological investigation of the APE is not necessary; however, should project activities be expanded and the APE changed, further investigation may be warranted.

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APPENDIX A: Environmental Predictive Model Checklist

VERMONT DIVISION FOR HISTORIC PRESERVATION

Environmental Predictive Model for Locating Pre-contact Archaeological Sites

Project Name **County** **Town**
DHP No. **Map No.** **Staff Init.** **Date**

Additional Information

Environmental Variable	Proximity	Value	Assigned Score
A. RIVERS and STREAMS (EXISTING or RELICT):			
1) Distance to River or Permanent Stream (measured from top of bank)	0- 90 m	12	
	90- 180 m	6	
2) Distance to Intermittent Stream	0- 90 m	8	
	90-180 m	4	
3) Confluence of River/River or River/Stream	0-90 m	12	
	90 –180 m	6	
4) Confluence of Intermittent Streams	0 – 90 m	8	
	90 – 180 m	4	
5) Falls or Rapids	0 – 90 m	8	
	90 – 180 m	4	
6) Head of Draw	0 – 90 m	8	
	90 – 180 m	4	
7) Major Floodplain/Alluvial Terrace		32	
8) Knoll or swamp island		32	
9) Stable Riverine Island		32	
B. LAKES and PONDS (EXISTING or RELICT):			
10) Distance to Pond or Lake	0- 90 m	12	
	90 -180 m	6	
11) Confluence of River or Stream	0-90 m	12	
	90 –180 m	6	
12) Lake Cove/Peninsula/Head of Bay		12	
C. WETLANDS:			
13) Distance to Wetland (wetland > one acre in size)	0- 90 m	12	
	90 -180 m	6	
14) Knoll or swamp island		32	
D. VALLEY EDGE and GLACIAL LAND FORMS:			
15) High elevated landform such as Knoll Top/Ridge Crest/ Promontory		12	
16) Valley edge features such as Kame/Outwash Terrace**		12	

17) Marine/Lake Delta Complex** 18) Champlain Sea or Glacial Lake Shore Line**		12 32	
E. OTHER ENVIRONMENTAL FACTORS: 19) Caves /Rockshelters		32	
20) [ ] Natural Travel Corridor [ ] Sole or important access to another drainage [ ] Drainage divide		12	
21) Existing or Relict Spring	0 – 90 m 90 – 180 m	8 4	
22) Potential or Apparent Prehistoric Quarry for stone procurement	0 – 180 m	32	
23)) Special Environmental or Natural Area, such as Milton acquifer, mountain top, etc. (these may be historic or prehistoric sacred or traditional site locations and prehistoric site types as well)		32	
F. OTHER HIGH SENSITIVITY FACTORS: 24) High Likelihood of Burials		32	
25) High Recorded Site Density		32	
26) High likelihood of containing significant site based on recorded or archival data or oral tradition		32	
G. NEGATIVE FACTORS: 27) Excessive Slope (>15%) or Steep Erosional Slope (>20)		- 32	
28) Previously disturbed land as evaluated by a qualified archeological professional or engineer based on coring, earlier as-built plans, or obvious surface evidence (such as a gravel pit)		- 32	

** **refer to 1970 Surficial Geological Map of Vermont**

Total Score:

Other Comments :

0- 31 = Archeologically Non- Sensitive
32+ = Archeologically Sensitive

Appendix I: Historic Memo

VERMONT

Vermont Agency of Transportation
Project Delivery Bureau - Environmental Section
219 North Main Street
Barre, VT 05641

To: JulieAnn Held, Environmental Specialist

From: Judith Williams Ehrlich, VTrans Historic Preservation Officer

Date: July 8, 2021

Subject: Historic Resource Identification for Buels Gore BF 0200(11)

I have completed a resource identification (ID) for Buels Gore BF 0200(11). At this time, the project is expected to include replacement of the existing culvert, but the full scope of the project has not been determined.

This Resource Identification effort is being undertaken to provide information to the VTrans designers working on a proposed improvement project. Toward that end, VTrans Cultural Resources staff have identified potential resources within a broad preliminary Area of Potential Effect to ensure the designers are aware of all cultural resources that could possibly be affected by a project. Once the project is defined at the Conceptual Design phase, Cultural Resources staff will be able to determine a formal Area of Potential Effect for purposes of Section 106 and 22 VSA § 14.

I requested WSP USA Inc. complete a Resource Identification of Culvert No. 29 on Vermont Route 17 in Buels Gore. The consultant recommended that the culvert is not historic, and I concur with this recommendation. No other historic resources are located in the project area. However, Camel's Hump State Park is located in the project area and it is considered a 4(f) resource.

Please see the report titled, "Architectural Resource Identification Survey Buels Gore Cuvlert No. 29, VT 17, BF 0200(11)" and dated June 11, 2021.

Architectural Resource Identification Survey
Buels Gore Culvert No. 29, VT 17
BF 0200(11)

Buels Gore, Chittenden County, Vermont

Prepared for:

Vermont Agency of Transportation
219 North Main Street
Barre, Vermont 05641

Prepared by:

WSP USA Inc.
433 River Street, 7th Floor
Troy, New York 12180

June 11, 2021

Architectural Resource Identification Survey
Buels Gore Culvert No. 29, VT 17
BF 0200(11)

Buels Gore, Chittenden County, Vermont

Prepared for:

Vermont Agency of Transportation
219 North Main Street
Barre, Vermont 05641

Prepared by:

Camilla McDonald

WSP USA Inc.
433 River Street, 7th Floor
Troy, New York 12180

June 11, 2021

Abstract

On behalf of the Vermont Agency of Transportation (VTrans), Montpelier, WSP USA Inc. (WSP), of Troy, New York, completed a historic architectural resource identification survey and effects assessment for the proposed improvements to Buels Gore Culvert No. 29, VT 17, Chittenden County. The scope for the project has yet to be defined; WSP therefore conducted this survey and resource assessment to take into account the potential effects of site access, temporary bridge construction, approach work, staging, and other potential project activities associated with improvements at the site of the bridge. The area of potential effect (APE) for the architectural survey and effects assessment extends 30.5 meters (100 feet) from either end of the bridge to include all four quadrants of the bridge approaches.

The goal of the survey was to identify (1) historic architectural resources (properties) in the APE previously listed in the Vermont State Register of Historic Places/National Register of Historic Places (SRHP/NRHP) (the criteria for both are identical), and (2) previously unsurveyed historic architectural resources in the APE that may be eligible for listing in the SRHP/NRHP. The survey also evaluated the potential effects of the project on viewsheds associated with any properties listed in or eligible for the SRHP/NRHP. As the project is still in the planning stages and may take several years to be implemented, WSP identified properties that meet the 45-year age mark for NRHP evaluation. The investigation included background research and fieldwork. Fieldwork took place in April 2021. The historic architectural investigations were undertaken in accordance with Act 250 (Title 10 of Vermont Statutes Annotated [VSA], Chapter 151); and Title 30, VSA Chapter 5, Section 248 (Public Service Board's Certificate of Public Good).

WSP identified one resource in the APE, which is older than 45 years and previously unsurveyed, the subject property, Buels Gore Culvert No. 29. It is WSP's opinion that the bridge is not eligible for the SRHP/NRHP. No other architectural resources were located in the APE. The Camel's Hump State Park, which is a Section 4(f) property, is located in the APE.

It is WSP's opinion is that there are no SRHP/NRHP-eligible properties in the project APE and that no intensive survey is required at this time. Should project activities expand beyond the current project APE, a supplemental survey may be warranted to identify and fully evaluate adjacent resources with respect to NRHP Criteria, identify all issues that may arise, and establish mitigation efforts that can be put in place to ensure the protection of the resources. This will allow VTrans to consider historic resources in planning the improvements to Buels Gore Culvert No. 29.

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I. Introduction

A. Project Description

On behalf of the Vermont Agency of Transportation (VTrans), Montpelier, WSP USA Inc. (WSP), of Troy, New York, completed a historic architectural resource identification survey and effects assessment for the proposed improvements to Buels Gore Culvert No. 29, VT 17, Chittenden County. The scope for the project has yet to be defined; WSP therefore conducted this survey and resource assessment to take into account the potential effects of site access, temporary bridge construction, approach work, staging, and other potential project activities associated with improvements at the site of the culvert.

The project is located along U.S. Route 2 in Buels Gore, Chittenden County (Figure 1). The area of potential effect (APE) for the architectural survey and effects assessment extends 30.5 meters (100 feet) from either end of the bridge to include all four quadrants of the bridge approaches (Figure 2).

B. Objectives

The goal of the survey was to identify (1) historic architectural resources (properties) in the APE previously listed in the Vermont State Register of Historic Places/National Register of Historic Places (SRHP/NRHP) (the criteria for both are identical), and (2) previously unsurveyed historic architectural resources in the APE that may be eligible for listing in the SRHP/NRHP. The survey also evaluated the potential effects of the project on viewsheds associated with any historic resources listed in or eligible for the SRHP/NRHP. The investigation included background research and fieldwork. Fieldwork took place in April 2021.

Determinations of eligibility for the NRHP followed the guidelines and criteria established by the National Park Service (36 CFR 60.4). In 2001 the Vermont Division for Historic Preservation (VDHP) changed the Vermont SRHP criteria to be identical to the NRHP Criteria, and all resources then listed in the Vermont SRHP were deemed eligible for the NRHP, creating a single class of historic properties and thereby streamlining the historic preservation permitting process in Vermont. As the project is still in the planning stages and may take several years to be implemented, WSP identified properties that meet the 45-year age mark for evaluation for the NRHP. The historic architectural investigations were undertaken in accordance with Act 250 (Title 10 of Vermont Statutes Annotated [VSA], Chapter 151); and Title 30 VSA Chapter 5, Section 248 (Public Service Board's Certificate of Public Good), and followed VTrans (2000) guidelines.

This report contains six chapters. Following the introduction in Chapter I, Chapter II describes the survey's methodology. Chapter III provides the historic context for the project vicinity. Chapter IV describes the survey results, and the conclusions appear in Chapter V. Chapter VI contains the references cited.

This investigation was conducted under the direction and supervision of WSP Senior Vice President Hope Luhman, PhD. Director of Historic Preservation Steven Bedford, PhD supervised the QA/QC process. WSP Historic Preservation Manager Camilla McDonald conducted research and wrote the report, and Archaeologist Jessica Vavrasek conducted the fieldwork. Principal Draftsperson Jacqueline L. Horsford prepared the graphics. Principal Editor Anne Moiseev edited the report.

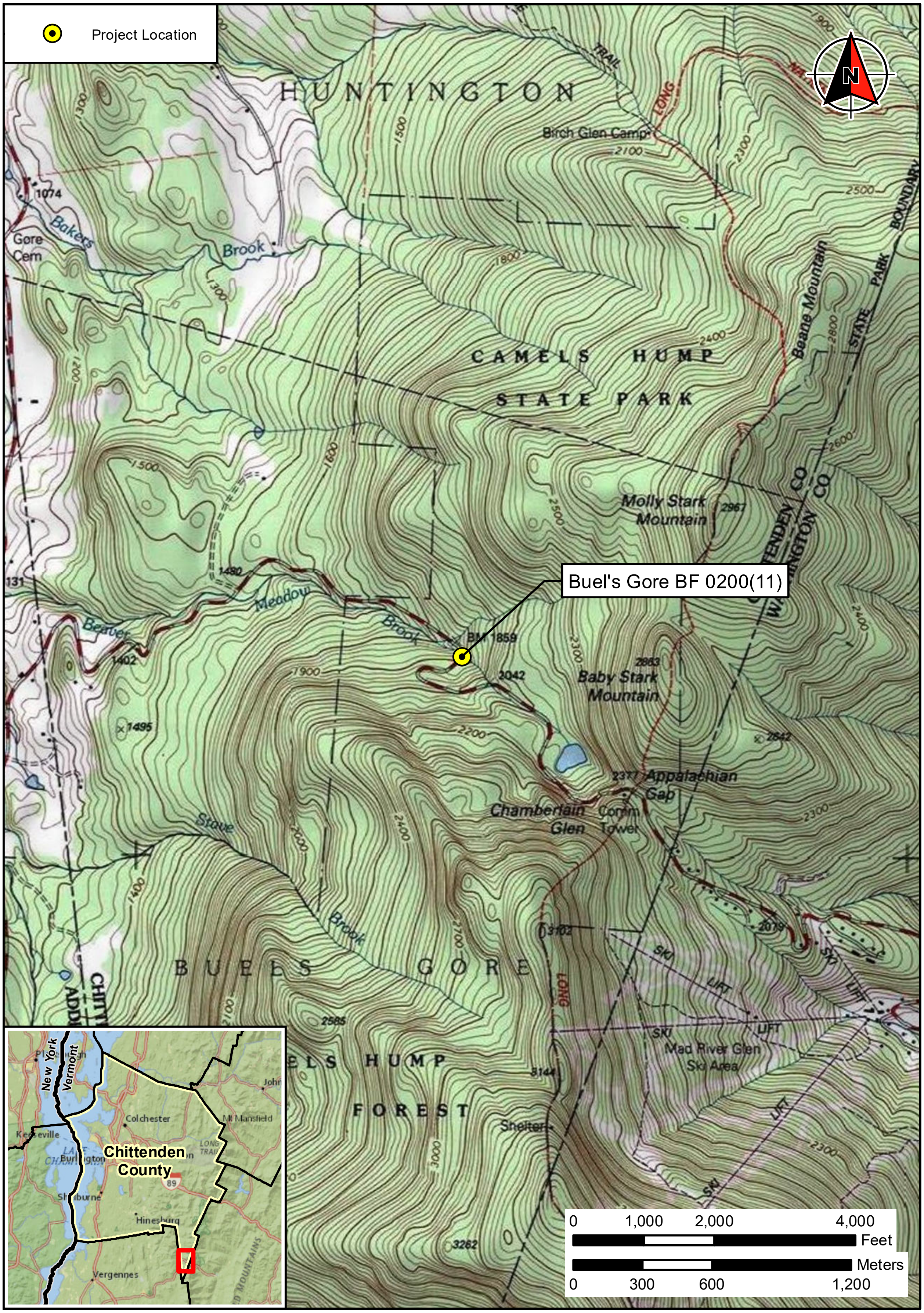

FIGURE 1: Location of Project BF 0200(11) (ESRI USA Topo Maps 2019)

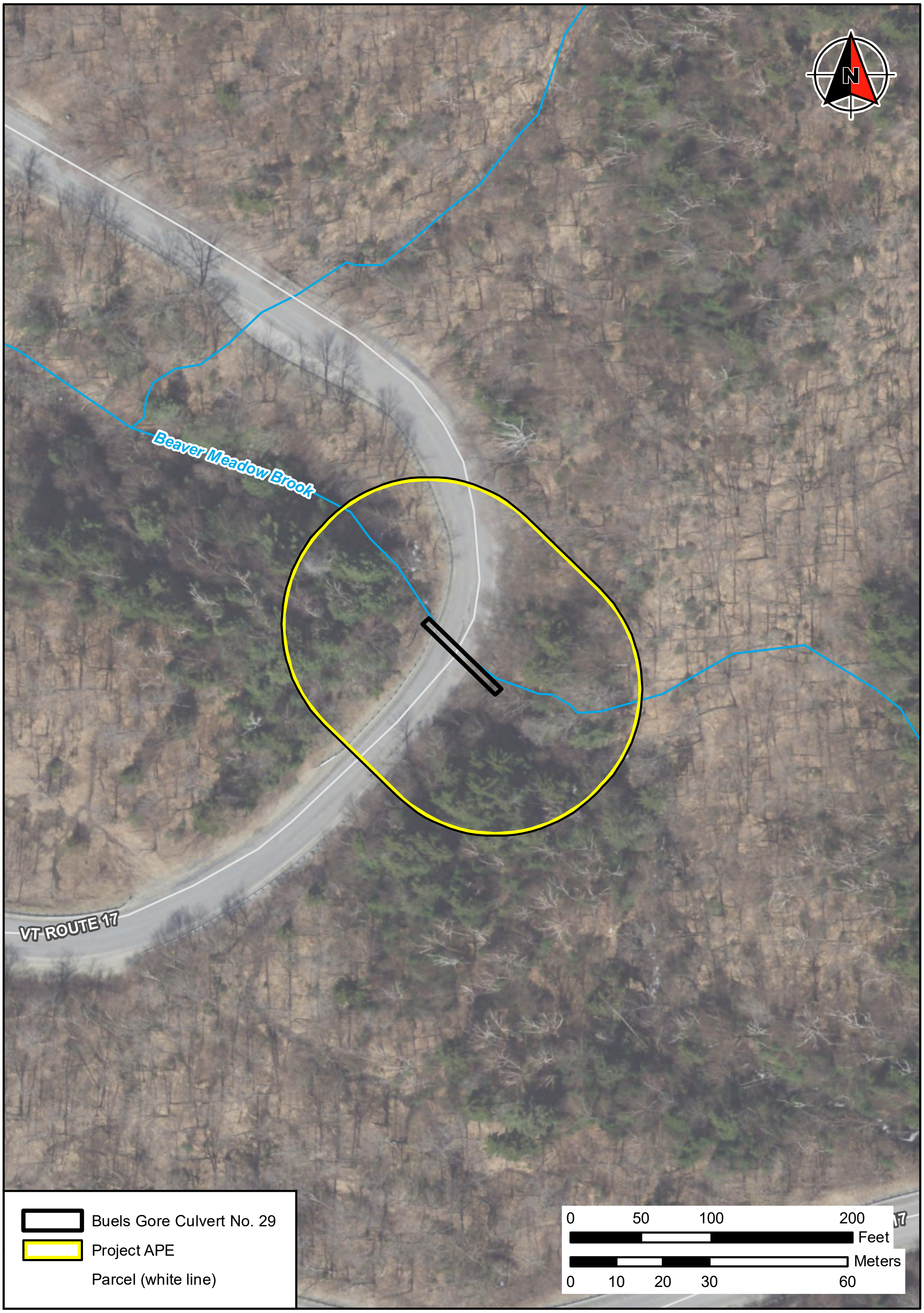

FIGURE 2: Project APE (VCGI 2017)

II. Methodology

WSP's primary task in the architectural resource identification survey and effects assessment was to identify historic architectural resources (properties) in the APE listed in or eligible for listing in the SRHP/NRHP. WSP reviewed site files at the VDHP, identifying documented resources in the APE that are already either listed in or eligible for listing. Location information on the identified properties was mapped, and nomination forms and eligibility determination data were copied for comparison against current conditions during the field survey. Available historic context data on the development of the community in the APE were gathered from VDHP files and other sources to assist in the evaluation of additional historical resources identified during the field survey.

During fieldwork WSP staff checked the current status of the historic properties identified during the site file check and previously surveyed properties that meet the 45-year age mark. WSP collected information on each property's architectural and historical integrity and eligibility for listing in the SRHP/NRHP. Each resource in the APE was documented through digital photographs and narrative field notes. Properties not visible from the right-of-way were examined through historical and current aerial photographs to determine their age. Results of the background research and field survey were analyzed to determine the NRHP eligibility of each architectural resource, whether previously recorded or newly identified.

According to the NRHP Criteria for evaluation, properties may be eligible for the NRHP if:

A. they are associated with events that have made a significant contribution to the broad patterns of our history; or

B. they are associated with the lives of significant persons in our past; or

C. they embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. they have yielded or may be likely to yield, information important in history or prehistory (National Park Service 2002:7).

WSP's assessments of eligibility were further guided by *Multiple Property Documentation for Metal Truss, Masonry and Concrete Bridges of Vermont, 1820-1978* (Louis Berger 2018a), which establishes standards of integrity for listing bridges in Vermont in the SRHP/NRHP.

III. Historic Context

A. Historical Overview of Northern Vermont

The first Euro-Americans to venture into the region that would become Vermont were trappers and hunters in the eighteenth century. Access to much of this area was impeded by mountains, and colonization was slow because the political situation was unsettled. Recurring hostilities between the British and French authorities initially inhibited settlers from making Vermont their home; however, even before the final surrender of the French to the British at Quebec in 1760, applications for land grants were being made by many parties.

The colony of Connecticut made the first land grants within what is now Vermont in the early eighteenth century, after Massachusetts, which had erroneously granted its own citizens 436 square kilometers (172 square miles) within the borders of Connecticut, transferred these land grants (the "equivalent lands") to Connecticut. Connecticut immediately sold these lands to people from both Connecticut and Massachusetts, who in turn sold the land to prospective settlers at a profit. After the final resolution of the Massachusetts-New Hampshire territorial disputes in 1740, these lands became New Hampshire territory. Nevertheless, most of the region's settlers continued to come from Connecticut and Massachusetts (Tosi 1948:48-49). European settlement was slow in all parts of today's Vermont until 1761, when Benning Wentworth, governor of New Hampshire, claimed the lands for New Hampshire and began establishing illegal land grants. These territories became the State of Vermont in 1791.

Prior to 1830, subsistence farming was the dominant economic activity. The earliest economic activity outside the household was the sale of potash and lumber obtained from land clearing. Potash, owing to its high market value and use in the production of glass, became the only inspected product in Vermont at that time (Elliott 1977:18). Small manufacturers, including gristmills and sawmills, sprang up throughout the region to process locally grown materials. Distilleries (using rye and corn) and starch factories (using potatoes) also developed. Taverns and general stores opened to cater to the local populace in nearly every town. By 1830 the region's agricultural economy was concentrated on the cultivation of potatoes and grains, some of which was shipped to Eastern and Southern markets. Wheat was initially an important crop, so much so that it was used as money by the earliest settlers. As transportation increased to wider markets, farmers focused more on a smaller number of specialized products.

Apple growing in particular became an important part of the Vermont economy. John McIntosh, born in 1776, eventually began selling his apple seedlings to settlers, and the McIntosh apple became the dominant apple in Vermont because of its acclimation to cool nights and warm, sunny days. In 1899 Vermont boasted 1,675,131 apple trees and produced 1,176,822 bushels of apples. Commercial apple production in Vermont continued into the twentieth century but declined owing to the lack of modernized facilities. The introduction of the automobile boosted apple production again; in 1955 Vermont produced over 1,100,000 bushels, and in the 1980s roughly 79 commercial growers on 3,500 bearing acres of land produced roughly 1.25 million bushels annually (VDHP 1990).

By the late eighteenth century some industry had begun to develop in Vermont. Lumbering in the oak forests brought much-needed money into the state and also cleared land for farming (Stratton 1980:250). Large fallen trees were ideal for making masts for ships and were usually shipped to Quebec. Production of hats was also an early trade, which used local wool and beaver hides from trappers. Other early businesses included blacksmithing, brick making, and dyeing.

The developing livestock industry rapidly took over in Vermont as both cattle and horses thrived on the local grasslands and climate (Bearse 1968; Tosi 1948:58-59; VDHP 1990). During the early nineteenth century the Spanish Merino sheep, an outstanding wool producer easily adapted to rugged terrain and climate, arrived in Vermont. The self-sufficiency of the Vermont farmers diminished considerably as many turned to sheep farming for an alternative source of income almost to the complete exclusion of other agricultural products. The improved machinery and larger wool mills that were introduced around 1830 permitted Vermont farmers to produce more wool, and 33 wool factories were built in Vermont during that period. In addition to wool, raw cotton was imported into Vermont mills for processing (Meeks 1986; Tosi 1948:62).

Although some textile production occurred in fulling and cleansing mills, and later also carding mills, the production of textiles remained a household activity until about 1820. After about 1820 factories took over the production of textiles, and the number of fulling and carding mills increased by 200 percent (from 136 to 273) and 275 percent (from 87 to 234), respectively. By 1830 the home manufacture of textiles was almost non-existent. Since a typical textile mill required the labor of about nine or so workers, the mills typically sprang up where the workers lived. In many cases the wool factories were an outgrowth of earlier textile mills as the mills became suppliers for developing wool factories (Meeks 1986; Steponaitis 1975:43-50).

The breeding of wool sheep reached its peak in Vermont in the early 1840s, but by the end of the decade, the industry had begun to decline, partly the result of lower protective tariffs on imported wool and partly the result of competition from the West with its larger pastures, less costly grain, and better transportation following the opening of the Ohio and Pennsylvania canal systems (Tosi 1948:59-60; VDHP 1989b). The number of wool factories in Vermont decreased from 97 in the mid-1840s to 89 a decade later. In addition, the number of textile concerns in Vermont began to drop as the industry consolidated into fewer, larger firms using more efficient machinery and located along more traveled transportation routes. The number of mills fell from a peak of over 400 in the 1820s to only 75 in the early 1850s. The sheep industry revived briefly in the 1860s and immediately afterward, as the Civil War prompted a greater demand and higher prices for wool products because of the low availability of Southern cotton as well as the imposition of higher tariffs (Steponaitis 1975:60-67).

With the initial decline of the sheep and wool industry in the late 1840s, many farmers returned to breeding cattle, although not before mutton sheep slowly infiltrated many farms formerly devoted to wool-bearing sheep (VDHP 1989a:2). Dairy farming in Vermont and elsewhere in New England had been introduced by the 1840s (Barron 1980; Russell 1982). Dairying proved to be a protection against the fluctuating price of wool and allowed farmers to take advantage of expanding urban markets to the south. The introduction of dairy breeds to replace beef cattle was a slow and intermittent process. Barron (1980) believes that one reason farmers in Vermont were slow to switch from wool to dairy was problems with labor. The young of Vermont were moving out West and to the big cities, depopulating the countryside during the second half of the nineteenth century (discussed further below). Because sheep farming was far less labor-intensive, it remained a more efficient use of resources during this period even as prices for wool dropped. Dairy farming, on the other hand, was becoming more labor-intensive, and Barron (1980:333) estimates that because of technological changes, the labor demand for cows grew by 68 percent per cow between 1850 and 1910. As a result, since the available pool of labor was declining after the mid-nineteenth century, farmers were hesitant to make the switch from wool to dairy even though the wool market was unstable. It was not until the market for wool completely collapsed at the end of the century that the switch from sheep to cows became complete.

Up until the 1850s, only private dairying took place. As the industry became more widespread, cheese factories, and later creameries, were built to service entire dairying communities. The three staple crops for the mid-nineteenth century Vermont farmer became wool, butter, and maple sugar, and dairy farming dominated the agriculture of eastern Vermont after the Civil War (Bremer 1929:587; Tosi 1948:63). Butter and cheese were manufactured in centrally located factories, although up until 1900 almost 40 percent of manufactured dairy products were produced privately in the home for sale to a private clientele. The number of dairy cows in some Vermont counties reached a peak in 1900. By the close of the nineteenth century, however, the Vermont dairy farmer faced direct competition from the dairy industries of Ohio and Wisconsin, for whom the transport of perishable goods did not pose as great an obstacle after development of the railroads connected these states with the East. Dairying declined slowly until 1920, then rose sharply until 1930 (Tosi 1948:62-64). By the end of the twentieth century, however, the need for expensive equipment had put many small hill-country farmers out of business (VDHP 1989a).

The wool industry in Vermont changed in the late nineteenth century with the emergence of large town-based manufacturing firms (those employing more than 100 employees) in places such as Bennington, Winooski, Rutland, Johnson, and Fair Haven. Vermont still enjoyed prominence in the manufacture of wool and knit goods during the 1880s; however, the state's industry declined steadily through the first half of the twentieth century despite a brief rise during the World War II years (Steponaitis 1975:118; VDHP 1991:10-11). Mills gradually closed after the end of the nineteenth century as they became unable to compete with mills and factories in the South (Barron 1980:326).

The population decline during the second half of the nineteenth century produced one of the greatest historical effects on the landscape. As the United States expanded, new opportunities arose and young people moved to the West. Many of the Vermont's rural youth left for jobs in the growing big cities, although Barron (1980) describes contemporary writing of abandoned farms as "hyperbole," writing that agriculture in New England did not collapse after the Civil War but only experienced stagnation. He points out that throughout Vermont two-thirds of male household heads remained farmers/farm laborers throughout the second half of the nineteenth century, 90 percent of farms were family-owned, and two-thirds of the land remained agricultural land. In short, the number, size, and location of farms throughout Vermont remained stable. In addition, the output of wool, butter, and maple sugar from these farms remained constant into the late 1890s. The number of tradesmen also remained constant, although a number of mills and factories were replaced because they could not compete with those in the South (Barron 1980:326). Vermont farmers may have been able to survive the slow attrition of labor throughout the second half of the nineteenth century, but the lack of available labor ultimately prevented them from adapting to more economically advantageous forms of farming.

B. Buels Gore

Buels Gore is located in the far southern tip of Chittenden County. A gore is an unincorporated portion of a Vermont county that is not a part of any town and has limited government. Gores are often uninhabited. The total area of Buels Gore is 5 square miles with only one road, VT 17, running east to west across the north end of the gore. Buels Gore was chartered on November 4, 1780, by the Vermont General Assembly. It is named for Maj. Elias Buel, who with family members and a group of proprietors petitioned the Vermont legislature for the land grant. At the time of the petition, very little land was available. Several small gores, which were unconnected pieces of land left over in the land surveying process, were offered to the petitioners.

The Walling (1857) map does not even acknowledge Buels Gore, showing the area as part of the Town of Huntington to the north. The Beers (1869) map shows Buels Gore as separate from the Town of Huntington and labeled merely as "Gore" (Figure 3). VT 17 had not been constructed yet, and only four dwellings and a small cemetery are shown in the far northwest corner of the gore (Beers 1869).

There are no official historical accounts of Buels Gore. The gore had a population of only 18 people in 1840 but had 35,000 sheep (Bushnell 2017).

Originally called the McCullough Turnpike, the route now designated VT 17 was first authorized as a private toll turnpike by legislative act No. 168 of the Acts of 1933, and the rights to the McCullough Turnpike were sold to Vermont in 1935. Early construction efforts along the turnpike include the construction of a 1.27-mile standard gravel highway completed by the Civilian Conservation Corps (CCC)

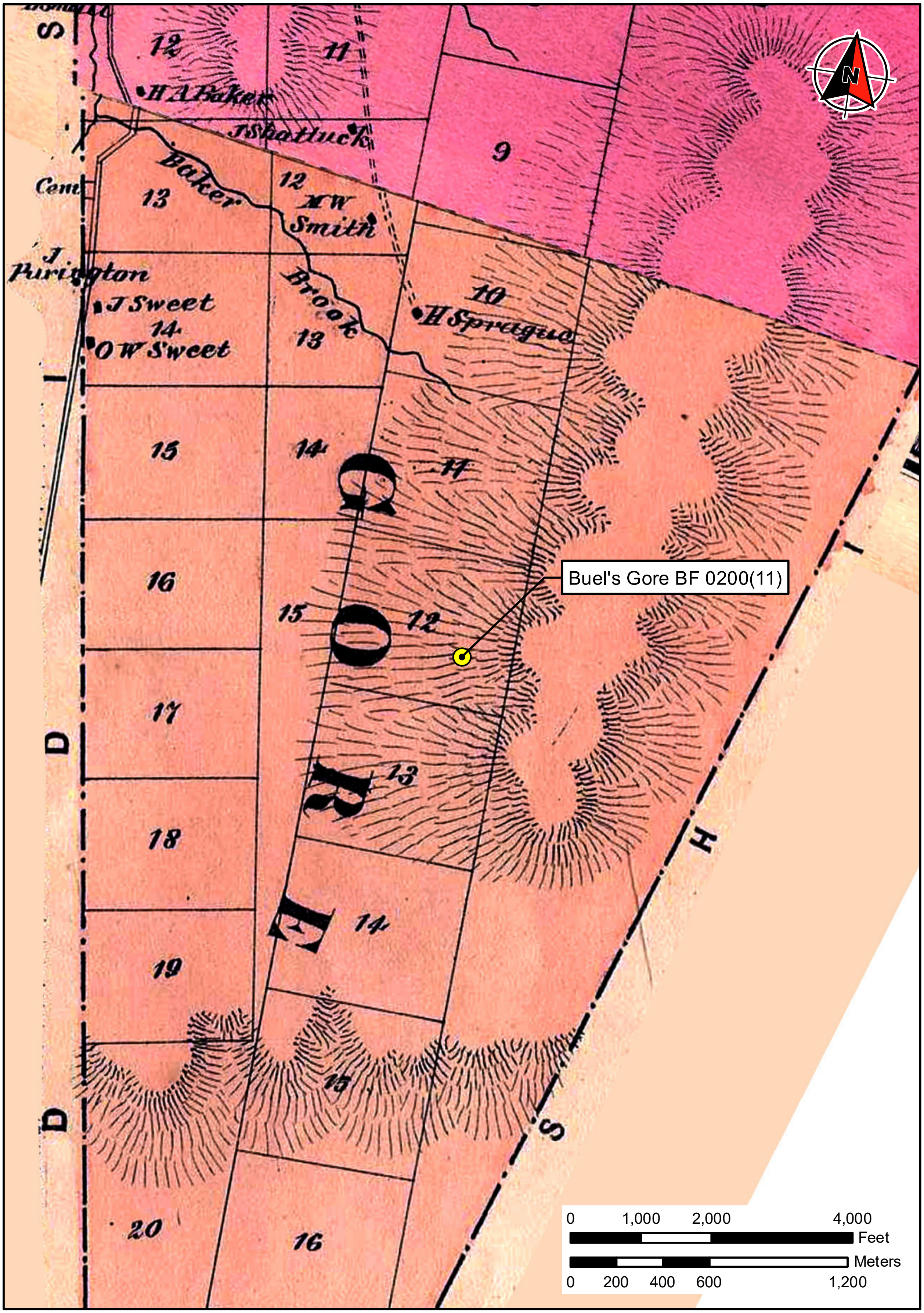

FIGURE 3: Map of Buels Gore, 1869 (Beers 1869)

and later improvements to access the Mad River ski development. An additional graveled one-way stretch of 1.4 miles with turnouts, which extended to the divide at the Appalachian Gap, was completed by 1954 (Figure 4). At that time only a 1.7-mile connection from the Appalachian Gap down the west side of the Green Mountain range was left unconstructed (Vermont State Highway Board 1952-1954:24). This section had an elevation change of 900 feet and traversed through very rugged terrain in state forest lands. Completion of the connecting road came before the legislature and passed on May 6, 1955, with the requirement that the road be completed by November 1, 1956 (*Burlington Free Press* 1955:2). Completion of the road was stalled because of funding issues, and the legislation set aside lumber sales from the state park to fund the road, which covered only a fraction of the total cost. This last section of road had wood post and wire fencing along the 20-foot-wide roadway (Figure 5). That same year the existing access road to the Mad River ski development was hard-surfaced with gravel (Vermont State Highway Board 1954-1956:11). The route was open to traffic by October 1956, but the entire route was not paved until the summer of 1957 (*Burlington Daily News* 1956). Along with providing access to the ski resort, the completed route provided a passage through the Appalachian Gap (*Burlington Free Press* 1957:10) (Louis Berger 2018b).

FIGURE 4: Excavation for McCullough Turnpike Connector (Vermont State Highway Board 1954-1956)

FIGURE 5: Completed McCullough Turnpike Connector(Vermont State Highway Board 1954-1956)

IV. Survey Results

The APE for the architectural survey and effects assessment extends 30.5 meters (100 feet) from either end of the bridge to include all four quadrants of the bridge approaches.

The APE contains one structure, Buels Gore Culvert No. 29 over Brook (Figure 6; Table 1). No other properties are located in the APE. One 4(f) resource, Camel's Hump State Park, was identified in the APE.

Buels Gore Culvert No. 29 had not been previously surveyed. WSP found this resource not eligible for the SRHP/NRHP as it does not meet the registration requirements outlined in the Multiple Property Documentation Form, *Metal Truss, Masonry and Concrete Bridges of Vermont, 1820-1978* (Louis Berger 2018a:F70-F72).

TABLE 1: NEWLY IDENTIFIED HISTORIC ARCHITECTURAL
AND 4(F) RESOURCES IN OR ADJACENT TO APE

ID No.	NRHP ELIGIBILITY	NAME	ADDRESS
Buels Gore-1	Not Eligible	Buels Gore Culvert No. 29 over Brook	US 2, Buels Gore
Buels Gore -2	N/A	Camel's Hump State Park	Both sides of US 2, Buels Gore

A. Vermont SRHP/NRHP-Listed Properties

No Vermont SRHP/NRHP-listed properties are located in or adjacent to the project APE.

B. Newly Surveyed Properties

1. Buels Gore-1

Buels Gore Culvert No. 29 over Brook, VT17; constructed 1957 (Plates 1 and 2)

This multi-plate pipe culvert is 6 feet wide and 72 feet long and is set at a 25-degree skew. The plates of the culvert are bolted together in concentric rings, similar to current pipe culverts. There are no wingwalls on the south (downstream) side. The VTrans inspection report lists an original construction date for this culvert as 1957 with no date in the reconstruction field, so it is assumed that the culvert dates to 1957.

As noted in the historic context, the McCullough Turnpike was constructed in stages, with the original CCC segment constructed as a 1.27-mile gravel highway at the east end of the current VT 17. The highway was extended 1.4 miles to the Appalachian Gap to the west by 1954. The final segment of the turnpike through the Camel's Hump State Park was not completed until 1956 and was paved in 1957. Thus it appears that the Buels Gore culvert was constructed as part of the final paving of McCullough Turnpike segment, perhaps not finished until 1957 owing to the steel shortage of 1956 (U.S. Committee on Public Works 1956).

The Buels Gore Culvert No. 29 over Brook does not meet registration requirements outlined in the MPD, *Metal Truss, Masonry and Concrete Bridges of Vermont, 1820-1978* (Louis Berger 2018a:F70-F72). Under NRHP Criterion A, the culvert is not a contributing element of the McCullough Turnpike, which appears to be eligible as a major highway construction project, as it was not included in the original construction of the road and was constructed one year after the road was complete and open to traffic. The culvert does not meet any NRHP Criterion C as it is not an innovative, specialized, or patented design but rather a common type of culvert that lacks distinction. In WSP's opinion Buels Gore Culvert No. 29 is therefore not eligible for listing in the SRHP/NRHP.

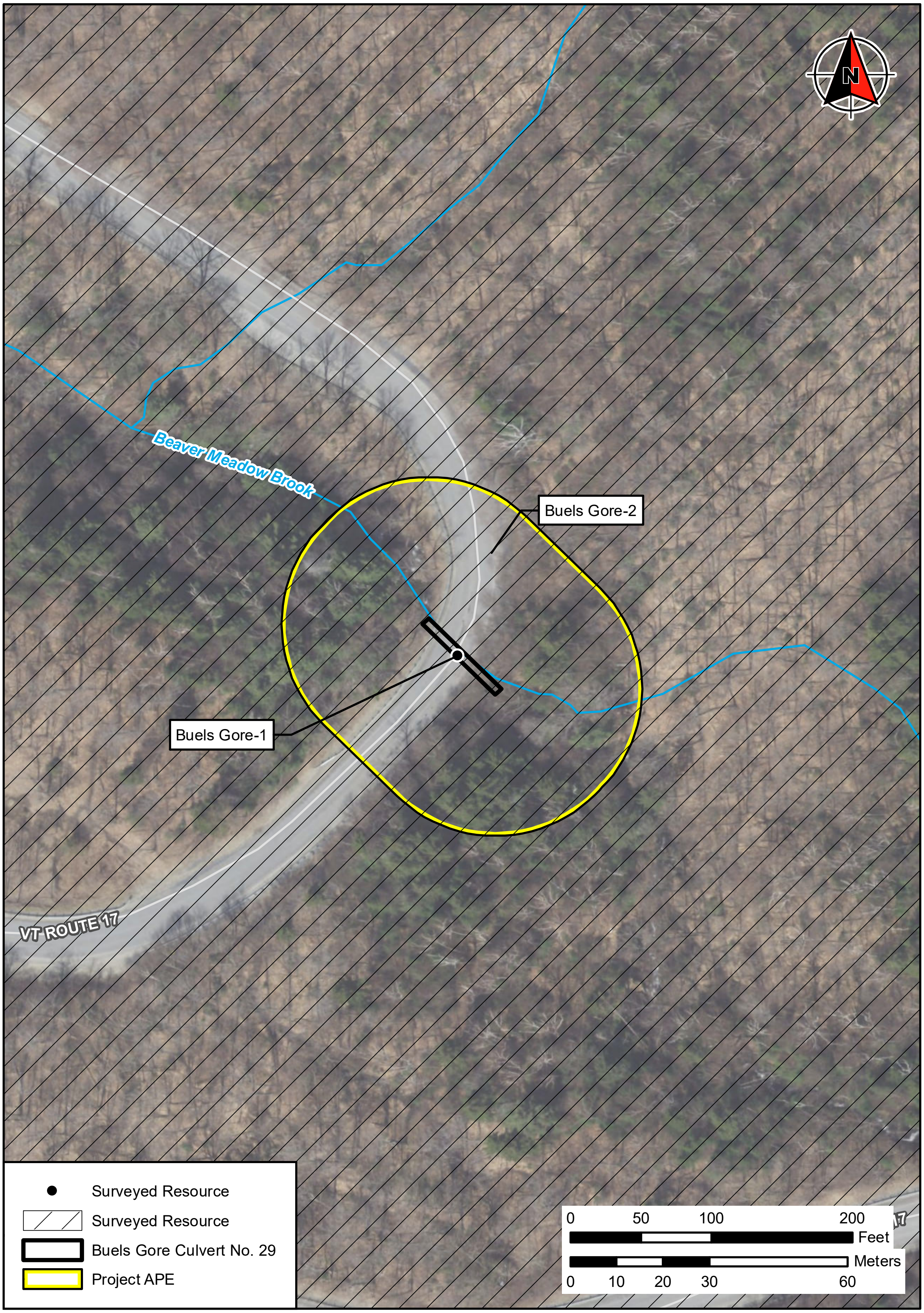

FIGURE 6: Location of Surveyed Resources in APE (VCGI 2017)

PLATE1: Buels Gore Culvert No. 29, Facing Southeast

PLATE 2: Buels Gore Culvert No. 29, View of East Side

C. Section 4(f) Resources

1. Buels Gore-2

Camel's Hump State Park

Camel's Hump State Park, under the ownership of the Vermont State Agency of Natural Resources (SPAN: 108-252-10027), is located on both sides of VT 17 in Buels Gore. This is an undeveloped park of over 2,000 acres with hiking trails and primitive camping. No trails or other camping features appear to be adjacent to the project APE. No right-of-way is delineated along this section of VT 17 as the land is owned by the state.

V. Conclusions

On behalf of VTrans, WSP completed a historic architectural resource identification survey and effects assessment for the proposed improvements to Buels Gore Culvert No. 29, VT 17, Chittenden County. WSP conducted this survey and resource assessment to take into account the potential effects of site access, temporary bridge construction, approach work, staging, and other potential project activities associated with improvements at the site of the bridge. The APE for the survey extends 30.5 meters (100 feet) from either end of the bridge to include all four quadrants of the bridge approaches (see Figure 2).

The goal of the survey was to identify (1) historical architectural resources (properties) in the APE previously listed in the SRHP/NRHP (the criteria for both are identical), and (2) previously unsurveyed historical architectural resources in the APE that may be eligible for listing in the SRHP/NRHP. As the project is still in the planning stages and may take several years to be put into action, WSP identified properties that meet the 45-year age mark for NRHP evaluation. Fieldwork took place in April 2021.

WSP identified one historic resource in the APE over 45 years old, which was previously unsurveyed, the subject property, Buels Gore Culvert No. 29 over Brook. It is WSP's opinion that this resource is not eligible for the SRHP/NRHP as it does not meet registration requirements outlined in the MPD (Louis Berger 2018a:F70-F72). No other architectural resources were identified in the APE. Camel's Hump State Park was identified as a Section 4(f) resource in the project APE.

It is WSP's opinion that an intensive survey is not warranted at this time. Should project activities expand beyond the current project APE, a supplemental survey may be warranted to identify and fully evaluate adjacent resources with respect to NRHP Criteria, identify all issues that may arise, and establish mitigation efforts that can be put in place to ensure the protection of resources. This will allow VTrans to consider historic resources in planning the improvements to Buels Gore Culvert No. 29.

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Appendix J: Stormwater Memo

VERMONT

State of Vermont
Environmental Section
219 North Main Street
Barre, Vermont 05641
Vtrans.vermont.gov

Agency of Transportation

[phone] 802-595-9143

To: Julie Ann Held, VTrans Environmental Specialist
From: Jon Armstrong, Stormwater Management Engineer
Date: July 9, 2021
Subject: Buels Gore BF 0200(11) Stormwater Resource ID Review

Project Description: I have reviewed the project area for stormwater related regulatory and water quality concerns. This project involves Br. 29 (a corrugated metal pipe culvert) on VT17 in Buels Gore. conveying Beaver Meadow brook under VT17. The scope of the project has yet to be defined but likely will involve replacement of the structure.

My evaluation has included the review of existing imagery and mapping (ANR Natural Resource Atlas, VTrans Operational Stormwater Permits) to capture existing stormwater features and existing drainage.

Regulatory Considerations

It is not anticipated that an Operational Stormwater permit will be required for this project. However, construction of a detour or realignment of the roadway could possibly push the area of disturbance above 1 acre, which would trigger the need for a construction SW permit and also require the project to follow the TS4 "Gap" procedure and incorporate feasible post construction treatment measures. There are no existing stormwater permits near the site area. No formal stormwater treatment is located within the ROW.

The following are not noteworthy stormwater regulatory concerns at this time.

> This project site is not within a designated groundwater public water supply source protection area. The project site is not located within a stormwater impaired (303(d) list) watershed.

Existing Drainage

The project area appears to consist of sheet flow over the fairly steep (in places) paved road embankment into the adjacent brook upstream of the structure with a roadside ditch on the other side of the road draining into the brook.

Design Considerations

To the extent feasible, sheet flow through vegetation should be encouraged with the roadway drainage design. Soils in the project area are shown as hydrologic soil group D, which are not well suited for infiltration practices.

VERMONT

Appendix K: Local Input

Project Summary

This project, BF 0200(11), focuses on Culvert 29 on VT Route 17 in Buels Gore, Vermont. The culvert is deteriorating and is in need of either a major maintenance action or replacement. Potential options being considered for this project include a new liner applied to the interior of the existing culvert pipe, removal of the existing pipe and replacement with a new culvert placed in the same location, or removal of the existing pipe and replacement in a new location. It is possible that VTrans will recommend a road closure and detour traffic away from the project site for the duration of the work. Efforts will be made to limit the detour to State roads.

Community Considerations

1. Are there regularly scheduled public events in the community that will generate increased traffic (e.g. vehicular, bicycles and/or pedestrians), or may be difficult to stage if the culvert is closed during construction? Examples include annual bike races, festivals, parades, cultural events, weekly farmers market, concerts, etc. that could be impacted? If yes, please provide approximate date, location and event organizers' contact info.

YES: The Vermont Grand Fondo bicycle race is run on an annual basis along Route 17 through the Gore in June. Most recent contact information is Todd Warnock, Event Director, 802 377 7871/ todd@vermontgrandfondo.com.

2. Is there a "slow season" or period of time from May through October where traffic is less or no events are scheduled?

Early May likely sees the least traffic, especially if there is an extended mud season. Fall sightseers increase traffic in September-October.

3. Please describe the location of the Town garage, emergency responders (fire, police, ambulance) and emergency response routes that might be affected by the closure of the culvert, one-way traffic, or lane closures and provide contact information (names, address, email addresses, and phone numbers.

The Gore has no garage or emergency response facilities. Residents are served by the Bristol and Starksboro rescue squads. Route 17 is the only means of ingress and egress throughout the Gore with the exception of ½ mile of town road from Route 17 to Hanksville/Huntington.

4. Are there businesses (including agricultural operations and industrial parks) or delivery services (fuel or goods) that would be adversely impacted either by a detour or due to work zone proximity?

An automotive garage, located at 5720 Route 17, is the only commercial enterprise in the Gore doing public commerce. However, as Route 17 is the only traveled route in the Gore aside from the afore-mentioned town road, any encroachment on access will affect the entire Gore.

5. Are there important public buildings (town hall, community center, senior center, library) or community facilities (recreational fields, town green, etc.) close to the project?

No.

6. What other municipal operations could be adversely affected by a road/culvert closure or detour?

The Gore has no municipal facilities.

7. Are there any town highways that might be adversely impacted by traffic bypassing the construction on other local roads? Please indicate which roads may be affected and their condition (paved/unpaved, narrow, weight-limited culverts, etc), including those that may be or go into other towns.

There is a single town road extending for ½ mile in the Gore between Route 17 and Hanksville/Huntington. It is not expected that through traffic on this road would be significantly increased due to any closures as the road terminates at its junction with Route 17.

8. Is there a local business association, chamber of commerce, regional development corporation, or other downtown group that we should be working with? If known, please provide name, organization, email, and phone number.

No.

9. Are there any public transit services or stops that use the culvert or transit routes in the vicinity that may be affected if they become the detour route?

No.

<u>Schools</u>

1. Where are the schools in your community and what are their yearly schedules (example: first week in September to third week in June)?

There are no schools in the Gore

2. Is this project on specific routes that school buses or students use to walk to and from school?

Yes. Students travel to surrounding communities to attend school, generally accessing Route 17.

3. Are there recreational facilities associated with the schools nearby (other than at the school)?

No.

<u>Pedestrians and Bicyclists</u>

1. What is the current level of bicycle and pedestrian use on the culvert?

Minimal.

2. Are the current lane and shoulder widths adequate for pedestrian and bicycle use?

No.

3. Does the community feel there is a need for a sidewalk or bike lane over the culvert?

Yes.

4. Is pedestrian and bicycle traffic heavy enough that it should be accommodated during construction?

No.

5. Does the Town have plans to construct either pedestrian or bicycle facilities leading up to the culvert? Please provide any planning documents demonstrating this (scoping study, master plan, corridor study, town or regional plan).

No.

6. In the vicinity of the culvert, is there a land use pattern, existing generators of pedestrian and/or bicycle traffic, or zoning that will support development that is likely to lead to significant levels of walking and bicycling?

No.

<u>Design Considerations</u>

1. Are there any concerns with the alignment of the existing culvert? For example, if the culvert is located on a curve, has this created any problems that we should be aware of?

Yes. The curve of the road in this location is extreme and has been the scene of frequent traffic accidents at all times of year.

2. Are there any concerns with the width of the existing culvert?

No.

3. Are there any special aesthetic considerations we should be aware of?

No.

4. Does the location have a history of flooding? If yes, please explain.

No.

5. Are there any known Hazardous Material Sites near the project site?

No.

6. Are there any known historic, archeological and/or other environmental resource issues near the project site?

No.

7. Are there any existing, pending, or planned municipal utility projects (communications, lighting, drainage, water, wastewater, etc.) near the project that should be considered?

No.

8. Are there any other issues that are important for us to understand and consider?

No.

<u>Land Use & Zoning</u>

1. Please provide a copy of your existing and future land use map or zoning map, if applicable.

   N/A

2. Are there any existing, pending or planned development proposal that would impact future transportation patterns near the culvert? If so, please explain.

   No.

3. Is there any planned expansion of public transit or intercity transit service in the project area? Please provide the name and contact information for the relevant public transit provider.

   No.

<u>**Communications**</u>

1. Please identify any local communication outlets that are available for us to use in communicating with the local population. Include weekly or daily newspapers, blogs, radio, public access TV, Facebook, Front Page Forum, etc. Also include any unconventional means such as local low-power FM.

The Gore Supervisor maintains a list of addresses and emails for residents of the Gore. Other means could include online media.

2. Other than people/organizations already referenced in this questionnaire, are there any others who should be kept in the loop as the project moves forward?

Mad River Glen Cooperative operates a ski resort accessible via Route 17. Off season operations are unknown but could be impacted.

Appendix L: VTrans Operations Input

Culvert Scoping Project BF 0200(11)
Operations Input Questionnaire

The Structures Section has begun the scoping process for BF 0200(11), VT Route 17, Culvert 29, over an unnamed brook. This is a culvert constructed in 1957. The Structure Inspection, Inventory, and Appraisal Sheet (attached) rates the culvert as a 4 (poor), and the channel as a 5 (fair). We are interested in hearing your thoughts regarding the items listed below. Leave it blank if you don't wish to comment on a particular item.

1. What are your thoughts on the general condition of this culvert and the general maintenance effort required to keep it in service? Needs to be replaced.

2. What are your comments on the current geometry and alignment of the roadway over the culvert (curve, sag, banking, sight distance)?Good

3. Do you feel that the posted speed limit is appropriate? Yes

4. Is the current roadway width adequate for winter maintenance including snow plowing? Yes

5. Are the railings constantly in need of repair or replacement? What type of railing works best for your district? (We are recommending more and more box beam guardrail on our culverts because of crash-worthiness and compatibility with accelerated projects). I would like to see galvanized box beam installed.

6. Are you aware of any unpermitted driveways within close proximity to the culvert? We frequently encounter driveways that prevent us from meeting railing and safety standards. No

7. Are you aware of abutting property owners that are likely to need special attention during the planning and construction phases? These could be people with disabilities, elderly, or simply folks who feel they have been unfairly treated in the past. No

8. Do you find that extra effort is required to keep the slopes and river banks around the culvert in a stable condition? Is there frequent flood damage that requires repair? No.

9. Does this culvert seem to catch an unusual amount of debris from the waterway? No.

10. Are you familiar with traffic volumes in the area of this project? Very lite.

11. Do you think a closure with off-site detour and accelerated construction would be appropriate? Do you have any opinion about a possible detour route, assuming that we use State route for State projects and any route for Town projects? Are there locations on a potential detour that are already congested that we should consider avoiding? No feasible detour route available.

12. Please describe any larger projects that you have completed that may not be reflected on the attached Appraisal sheet, such as deck patches, paving patches, railing replacement with new type, steel coating, etc. None known.

13. Are there any drainage issues that we should address on this project? No

14. Are you aware of any complaints that the public has about issues that we can address on this project? No

15. Is there anything else we should be aware of? No

Appendix M: Crash Data

Vermont Agency of Transportation

09/06/2019

General Yearly Summaries - Crash Listing: State Highways and All Federal Aid Highway Systems

WHERE Year of Crash >= 2014 AND Year of Crash <= 2018

*	Reporting Agency/ Incident No.	City/Town	Mile Marker	Crash Date	Time	Weather	Contributing Circumstances	Direction of Collision	Number Of Injuries	Number Of Fatalities	Number Of Untimely Deaths	Direction	Road Group
	VTVSP0600/17B500269	Starksboro	4.69	01/27/2017	11:30	Snow	Driving too fast for conditions, Failure to keep in proper lane	Single Vehicle Crash	1	0	0	E	SH State Owned
	VTVSP0600/16C204014	Starksboro	4.91	12/02/2016	18:22	Sleet, Hail (Freezing Rain or Drizzle)	No improper driving	Single Vehicle Crash	2	0	0	N	SH State Owned
	VTVSP0600/15C201274	Starksboro	5.20	04/30/2015	01:57	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP0600/18B500302	Starksboro	5.20	01/27/2018	19:29	Clear	Driving too fast for conditions	Single Vehicle Crash	0	0	0	S	SH State Owned
	VTVSP0100/14A102526	Buels Gore	0.05	06/07/2014	14:12	Clear	Driving too fast for conditions	Single Vehicle Crash	2	0	0	N	SH
	VTVSP0600/16C201732	Buels Gore	0.05	06/10/2016	15:30	Clear	Exceeded authorized speed limit	Single Vehicle Crash	1	0	0	W	SH State Owned
	VTVSP0100/15A105009	Buels Gore	0.25	09/26/2015	17:46	Clear	Unknown	Single Vehicle Crash	0	0	0	W	SH
	VTVSP0600/16C204018	Buels Gore	0.28	12/03/2016	05:15	Snow	Driving too fast for conditions	Head On	0	0	0	E	SH State Owned
	VTVSP0100/15A105006	Buels Gore	0.30	09/26/2015	17:46	Clear	Other improper action	Single Vehicle Crash	1	0	0	W	SH
	VTVSP0100/14A104244	Buels Gore	0.50	09/24/2014	15:44	Clear	Driving too fast for conditions	Single Vehicle Crash	1	0	0	N	SH
	VTVSP0100/18A103001	Buels Gore	0.50	07/01/2018	13:19	Clear	Driving too fast for conditions	Single Vehicle Crash	1	0	0	E	SH State Owned
	VTVSP0100/18A104035	Buels Gore	0.50	09/07/2018	17:38	Clear	No improper driving	Single Vehicle Crash	0	0	0	E	SH State Owned
	VTVSP0100/15A102820	Buels Gore	1.07	06/05/2015	16:15	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP0100/15A102822	Buels Gore	1.07	06/05/2015	17:39	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP0100/15A102824	Buels Gore	1.07	06/05/2015	17:57	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP0100/14A103972	Buels Gore	1.08	09/07/2014	13:01	Clear	Driving too fast for conditions	Single Vehicle Crash	1	0	0	W	SH
	VTVSP0100/15A103828	Buels Gore	1.08	07/25/2015	10:30	Clear	Made an improper turn	Single Vehicle Crash	1	0	0	W	SH
	VTVSP0100/17A103073	Buels Gore	1.71	07/07/2017	17:25	Cloudy	Failure to keep in proper lane	Single Vehicle Crash	1	0	0	E	SH State Owned
	VTVSP0100/15A105007	Buels Gore	2.43	09/26/2015	16:30	Clear	Failure to keep in proper lane	Single Vehicle Crash	0	1	0	W	SH
	VTVSP1200/16A301093	Buels Gore	2.48	03/11/2016	07:15	Severe Crosswinds	Failure to keep in proper lane, Driving too fast for conditions	Single Vehicle Crash	0	0	0	W	SH State Owned
	VTVSP0100/15A101534	Buels Gore	2.49	03/26/2015	16:45	Snow	Driving too fast for conditions, Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway etc	Single Vehicle Crash	0	0	0	S	SH
	VTVSP0100/14A102761	Buels Gore	2.51	06/22/2014	14:45	Clear	Driving too fast for conditions	Single Vehicle Crash	1	0	0	W	SH

**Crash occurred prior to the last Highway Improvement Project. This data should not be used in a crash analysis. UNK indicates Mile Marker is Unknown.*

Appendix N: Hazardous Sites Map

Hazardous Waste Urban Soils Map

Vermont Agency of Natural Resources

vermont.gov

1: 3,251

April 7, 2021

LEGEND

- Parcels (standardized)
- River Area
- VTRANS State and Town Long
- VTRANS State Short Structure
- Town Bridge
- Town Culvert
- Railroads
- Roads
  - Interstate
  - US Highway; 1
  - State Highway
  - Town Highway (Class 1)
  - Town Highway (Class 2,3)
  - Town Highway (Class 4)
  - State Forest Trail
  - National Forest Trail
  - Legal Trail
  - Private Road/Driveway
  - Proposed Roads
- Waterbody
- Stream/River
  - Stream
  - Intermittent Stream
- Town Boundary

165.0 0 82.00 165.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 271 Ft. 1cm = 33 Meters

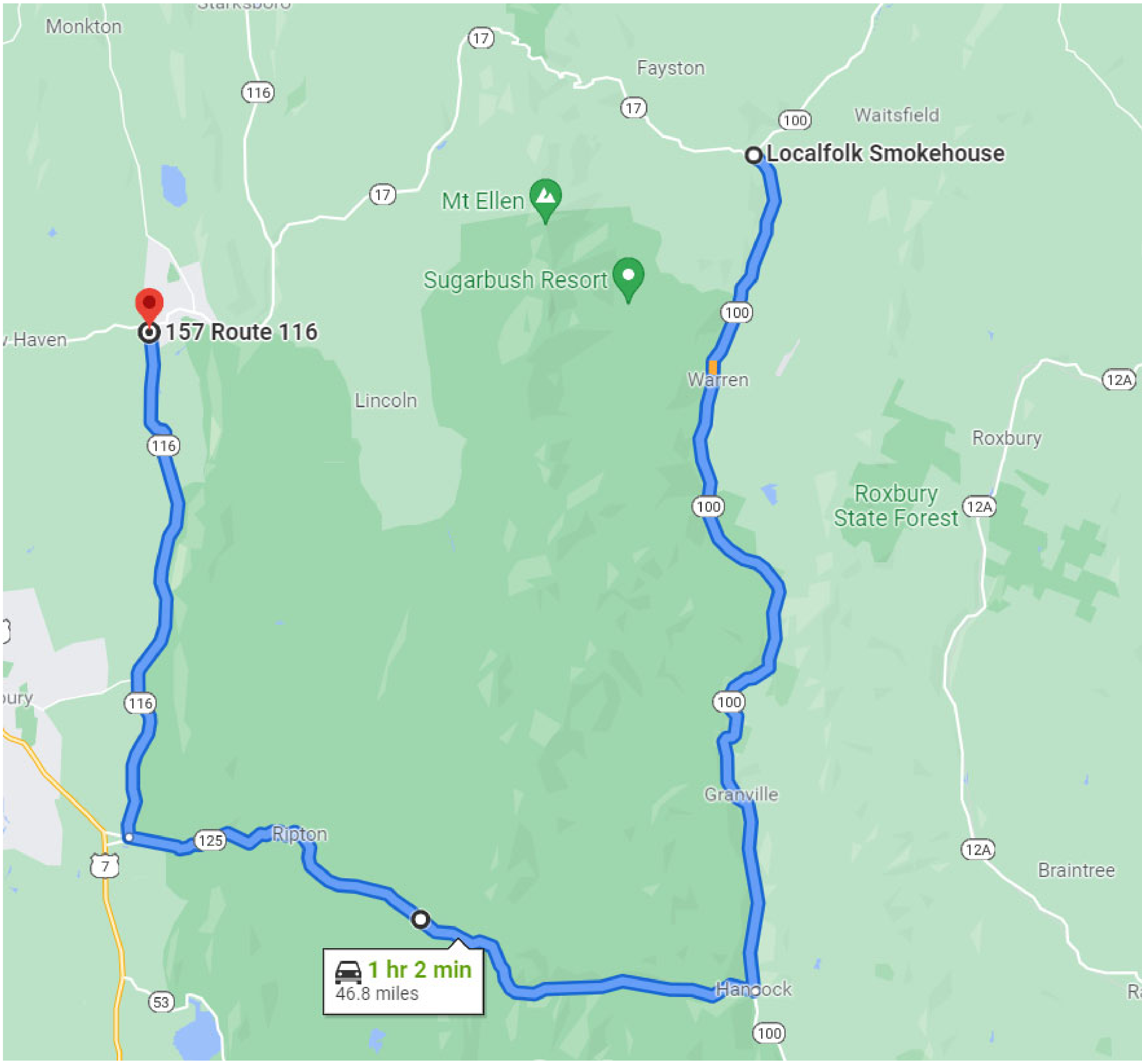
THIS MAP IS NOT TO BE USED FOR NAVIGATION

DISCLAIMER: This map is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. ANR and the State of Vermont make no representations of any kind, including but not limited to, the warranties of merchantability, or fitness for a particular use, nor are any such warranties to be implied with respect to the data on this map.

NOTES

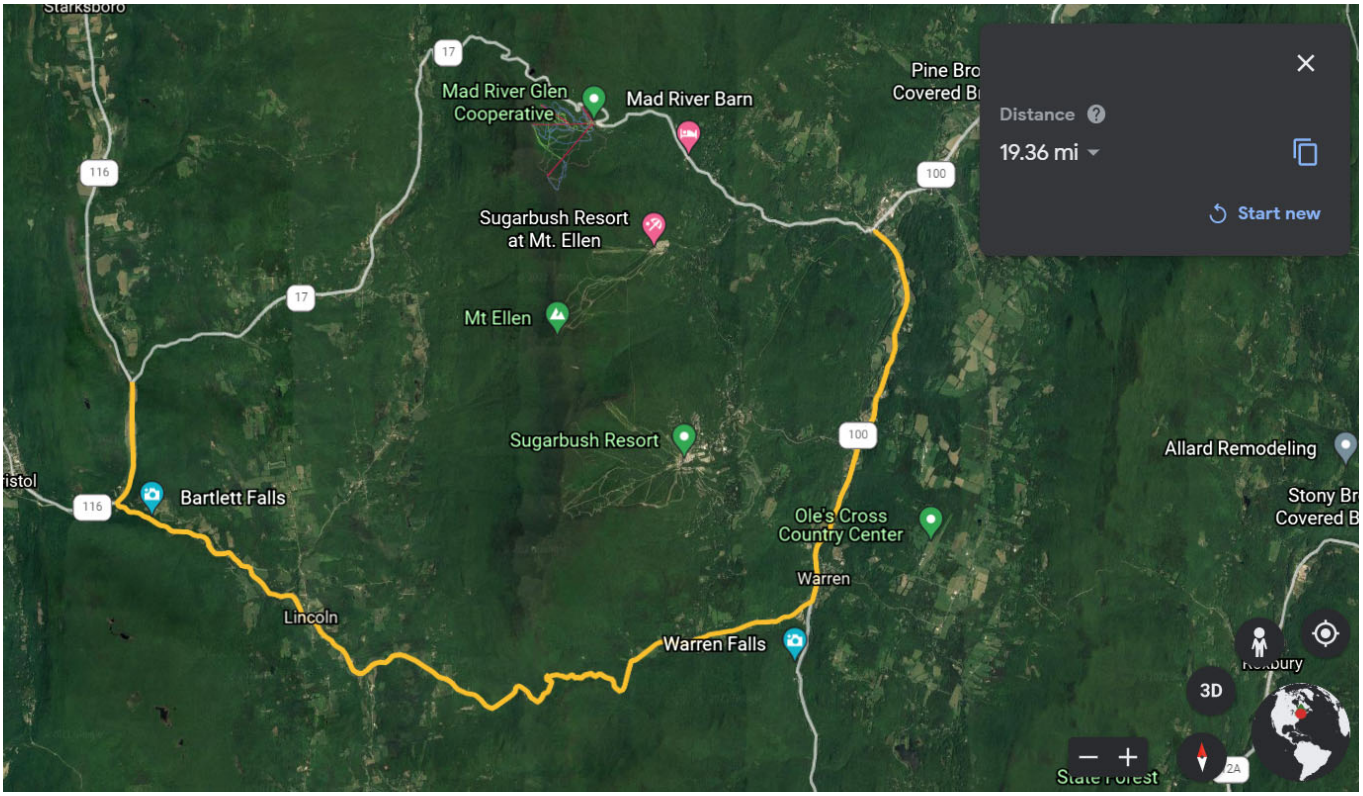
Map created using ANR's Natural Resources Atlas

Appendix O: Detour and Local Bypass Maps



Regional Detour Route: VT Route 17, to VT Route 100, VT Route 125, and VT Route 116 back to VT Route 17

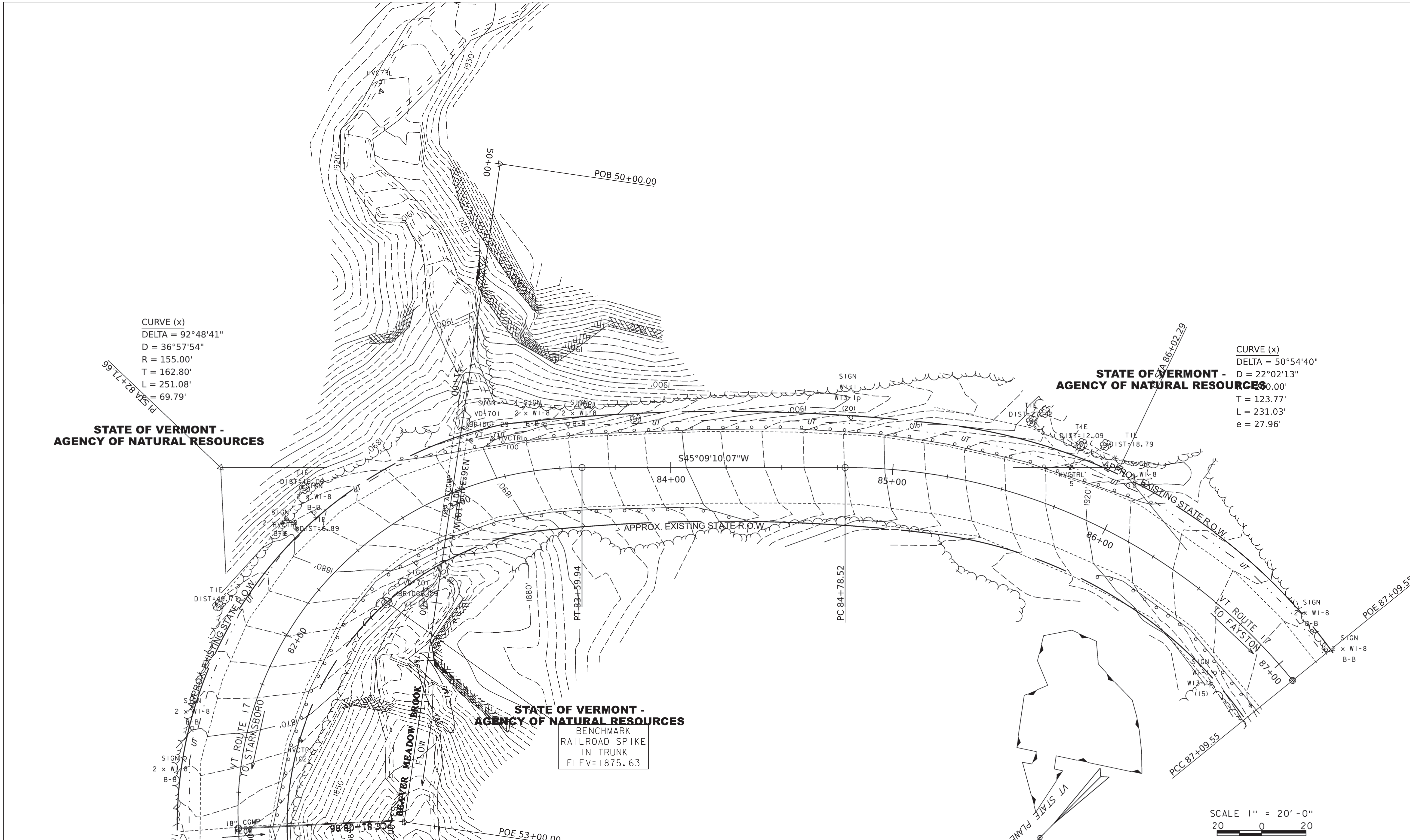
Through Route: 20.3 miles
Detour Route: 46.8 miles
End-to-end Distance: 67.1 miles
Added Distance: 26.5 miles



Local Bypass Route: VT Route 100, to Lincoln Gap Road (closed mid-October through mid-May), E. River Road, W River Road, Lincoln Road, VT Route 116 and back to VT Route 17

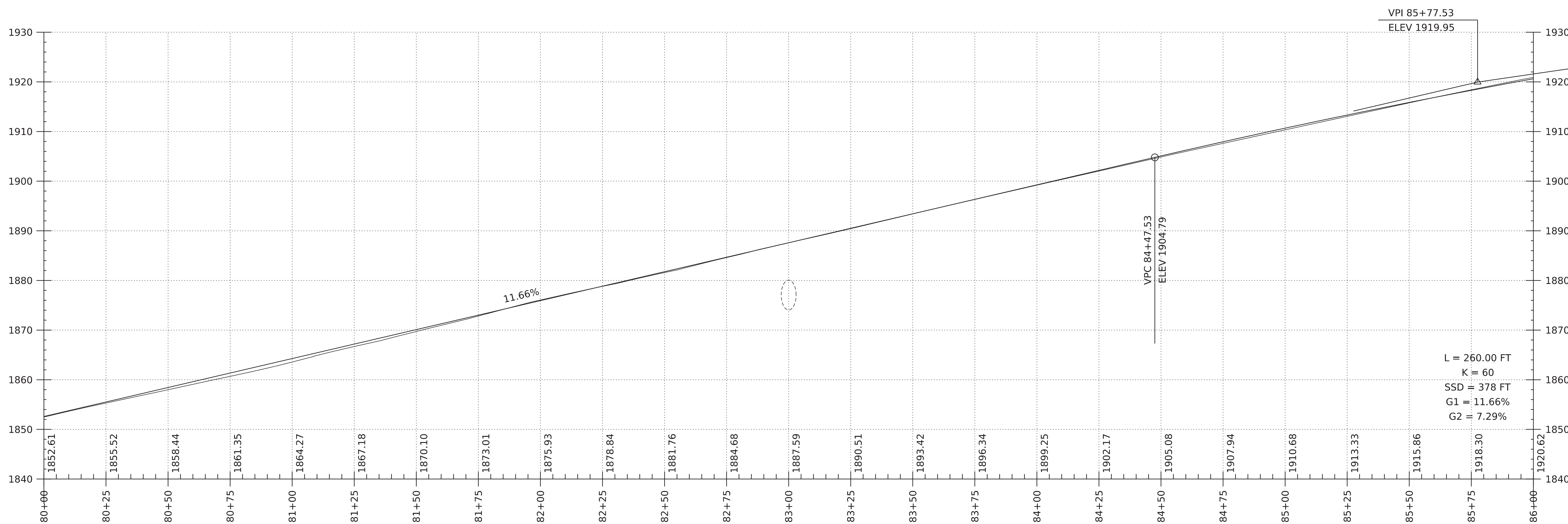
Through Route: 15.8 miles
Detour Route: 19.4 miles
End-to-end Distance: 35.2 miles
Added Distance: 3.6 miles

Appendix P: Plans



PROJECT NAME:	BUEL'S GORE
PROJECT NUMBER:	BF 0200(11)

FILE NAME: s21b027BDR_Existing.dgn	PLOT DATE: 10-DEC-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
EXISTING CONDITIONS LAYOUT	SHEET 1 OF 14



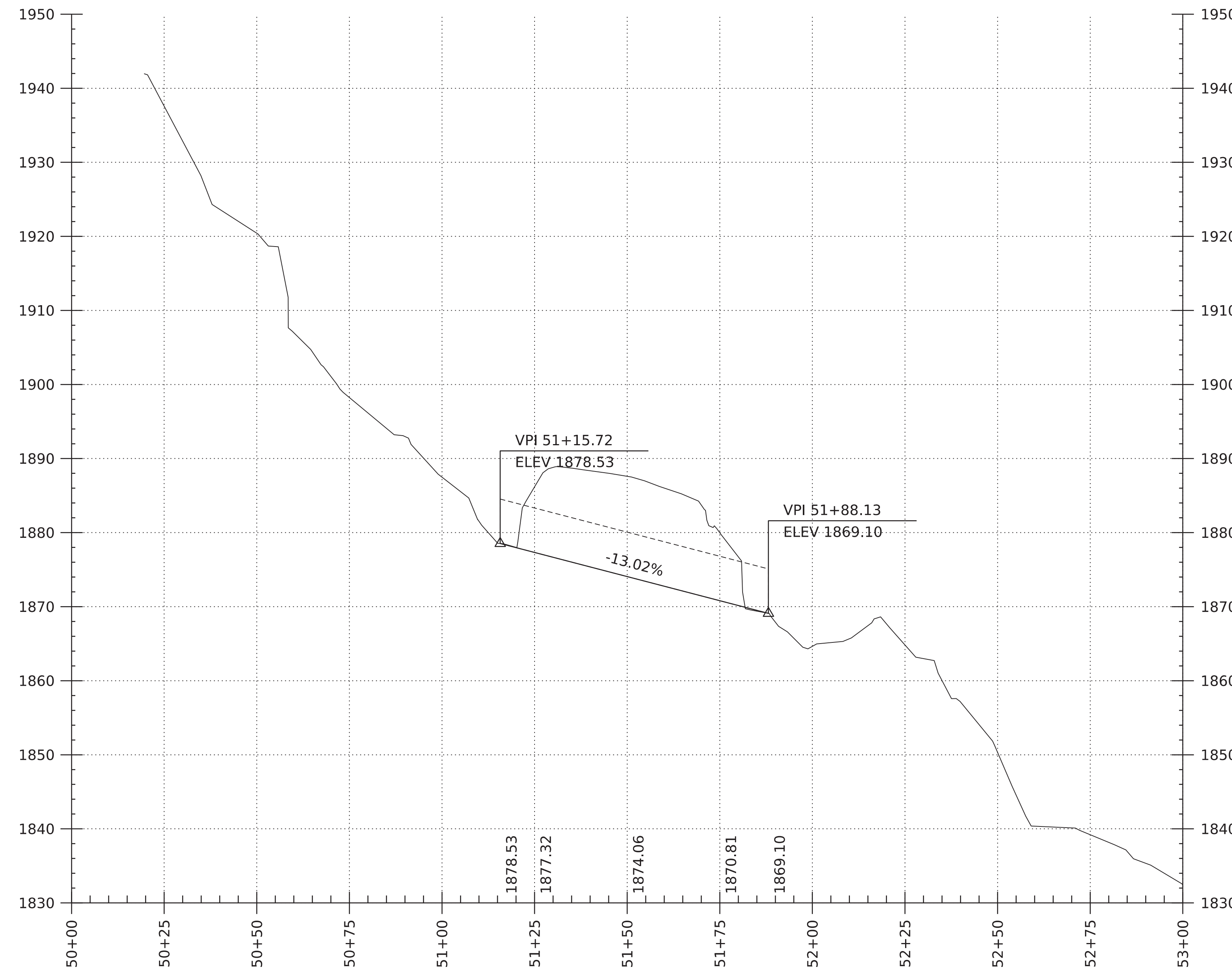
VT ROUTE 17 PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: BUEL'S GORE
PROJECT NUMBER: BF 0200(11)

FILE NAME: s21b027profile.dgn	PLOT DATE: 10-DEC-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
ROADWAY PROFILE SHEET	SHEET 2 OF 14

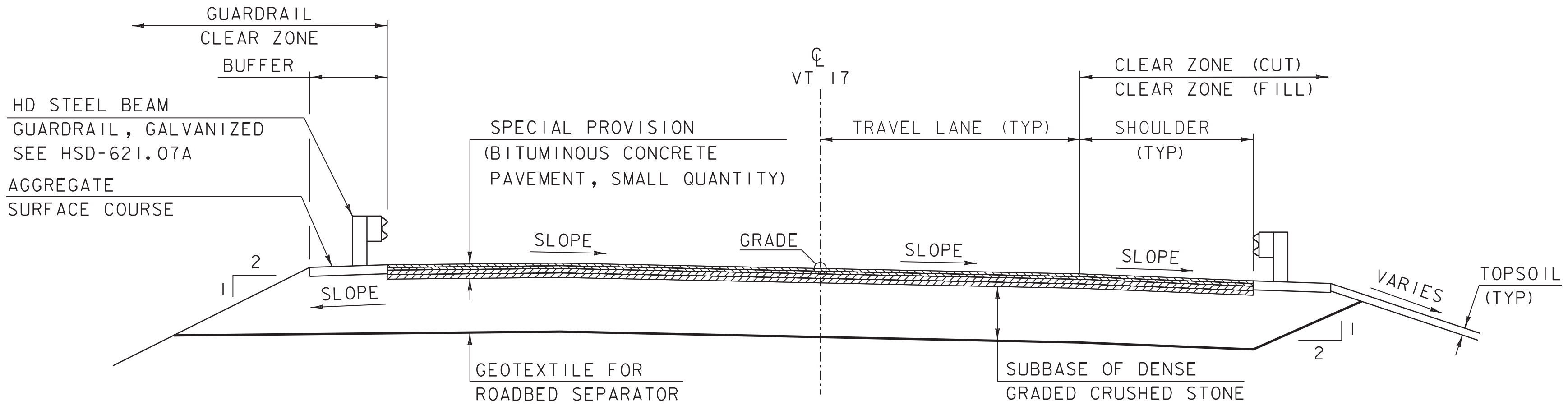


CHANNEL PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

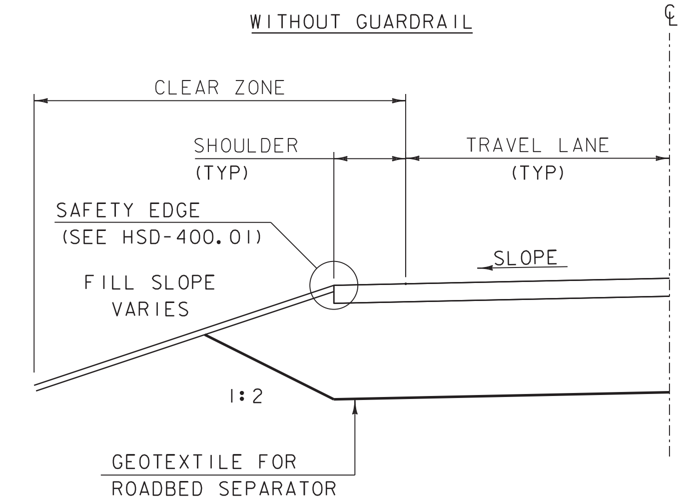
NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: BUEL'S GORE	
PROJECT NUMBER: BF 0200(11)	
FILE NAME: s21b027profile.dgn	PLOT DATE: 10-DEC-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
CULVERT 29 PROFILE SHEET	SHEET 3 OF 14



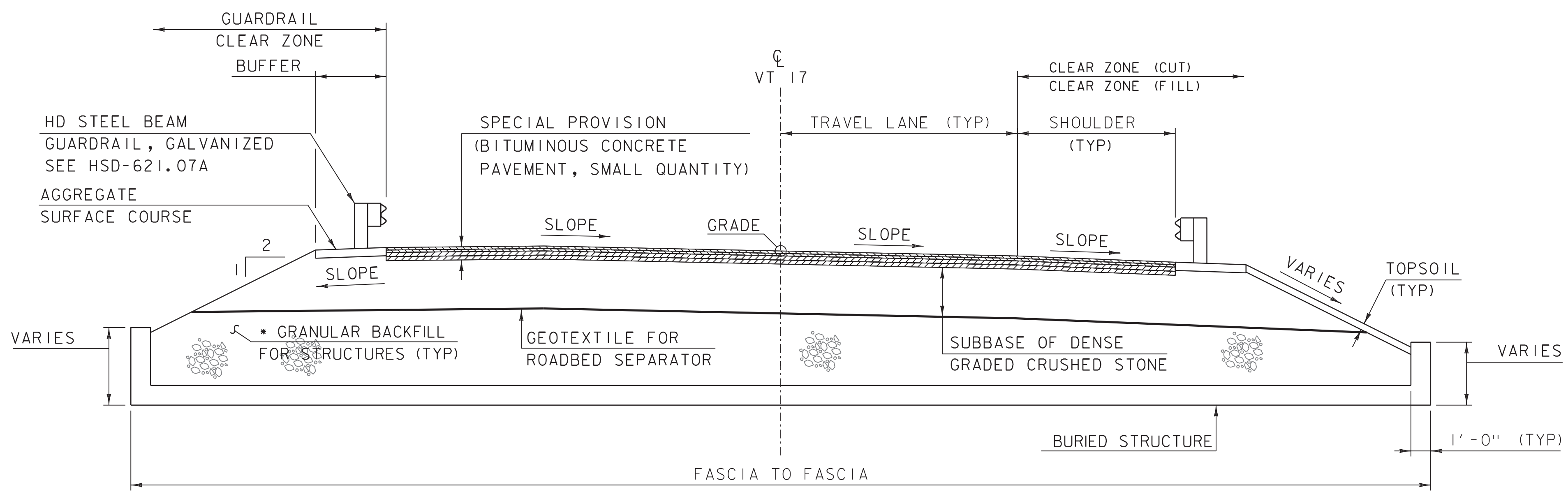
VT ROUTE 17 TYPICAL SECTION

SCALE: 1/4" = 1'-0"



ROADWAY TYPICAL SECTION

NOT TO SCALE



VT ROUTE 17 BURIED STRUCTURE TYPICAL SECTION

SCALE: 1/4" = 1'-0"

ROAD TYPICAL INFORMATION

	LEFT		RIGHT	
	WIDTH	SLOPE	WIDTH	SLOPE
TRAVEL LANE	11'-0"	VARIES	11'-0"	VARIES
SHOULDER (MIN)	3'-0"	VARIES	3'-0"	VARIES
BUFFER	3'-7"	-0.060	3'-7"	-0.060
FILL SLOPE	---	VARIES	---	VARIES
CLEAR ZONE (CUT)	10'-0"	---	10'-0"	---
CLEAR ZONE (FILL)	12'-0"	---	12'-0"	---
CLEAR ZONE (GUARDRAIL)	4'-9"	---	4'-9"	---

MATERIAL INFORMATION

	THICKNESS	TYPE
WEARING COURSE	1½"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IVS)
BINDER COURSE	1½"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IVS)
BASE COURSE #2	2½"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IIS)
BASE COURSE #1	2½"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IIS)
BUFFER	8"	AGGREGATE SURFACE COURSE
SUBBASE	24"	SUBBASE OF DENSE GRADED CRUSHED STONE
TOPSOIL	4"	TOPSOIL

TACK COAT: EMULSIFIED ASPHALT IS TO BE APPLIED AT A RATE OF 0.025 GAL/SY BETWEEN SUCCESSIVE COURSES OF PAVEMENT AND 0.080 GAL/SY ON COLD PLANED SURFACES AS DIRECTED BY THE ENGINEER.

MATERIAL TOLERANCES

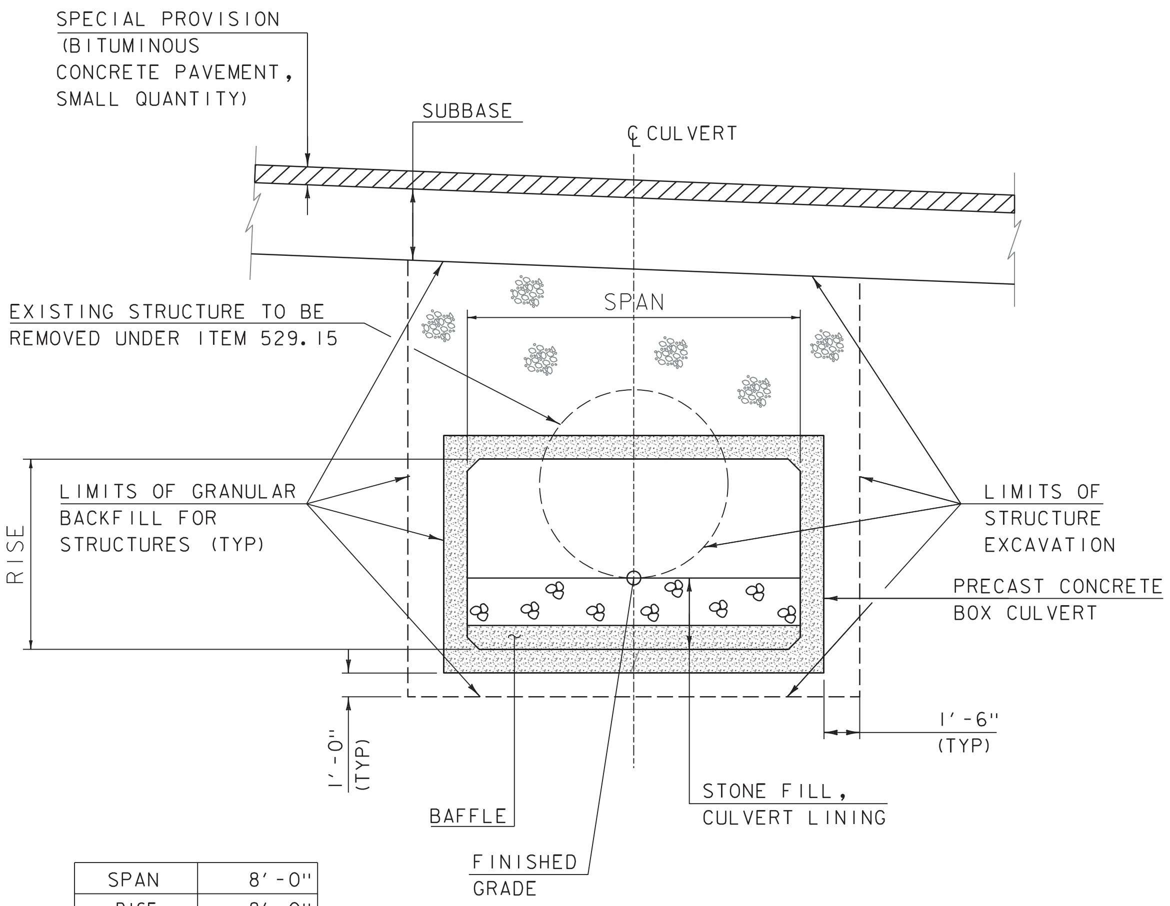
(IF USED ON PROJECT)

SURFACE	
- PAVEMENT (TOTAL THICKNESS)	+/- 1/4"
- AGGREGATE SURFACE COURSE	+/- 1/2"
SUBBASE	+/- 1"
SAND BORROW	+/- 1"

PROJECT NAME: BUEL'S GORE
PROJECT NUMBER: BF 0200(II)

FILE NAME: 21b027/s21b027typ.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
TYPICAL SECTION SHEET 1

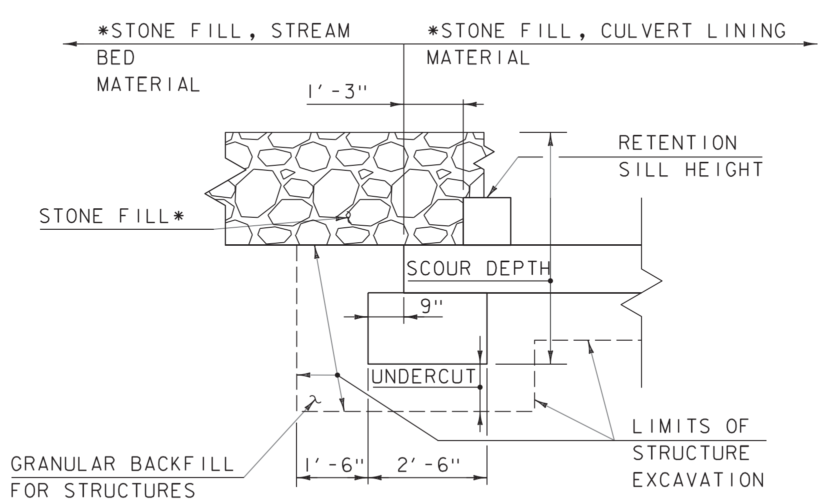
PLOT DATE: 10-DEC-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------



SPAN	8'-0"
RISE	8'-0"
LENGTH	70'-0"

CULVERT TYPICAL SECTION

NOT TO SCALE



CUTOFF WALL TYPICAL SECTION

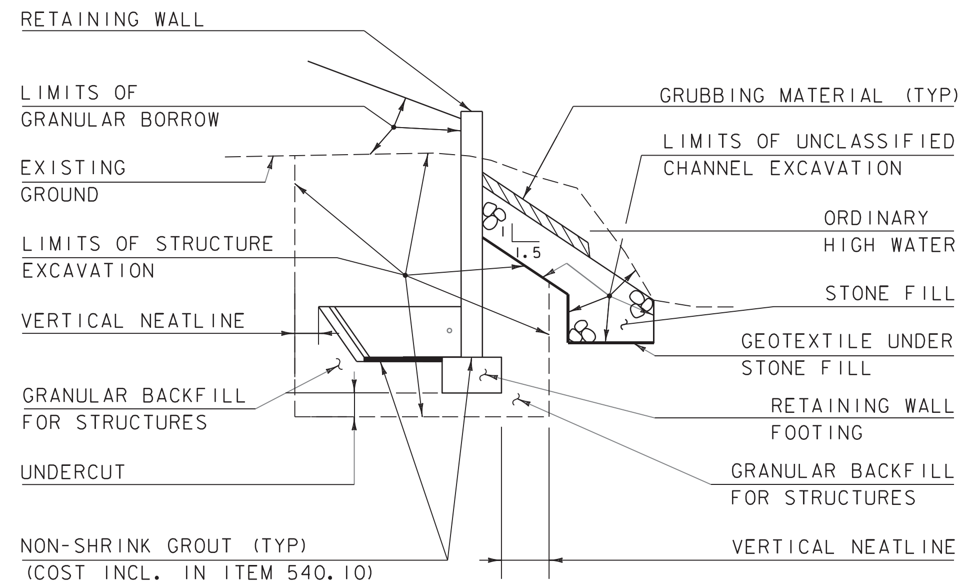
NOT TO SCALE

NOTE:

THE CUTOFF WALL MAY BE OMITTED IF THE DEPTH OF CULVERT LINING MATERIAL PLUS THE THICKNESS TO THE BOTTOM OF THE BOX MEETS OR EXCEEDS THE LISTED SCOUR DEPTH.

CUTOFF WALL - CRITICAL DIMENSIONS

	DIMENSION
SCOUR DEPTH	4'-0"
RETENTION SILL HEIGHT	1'-0"
UNDERCUT	1'-0"

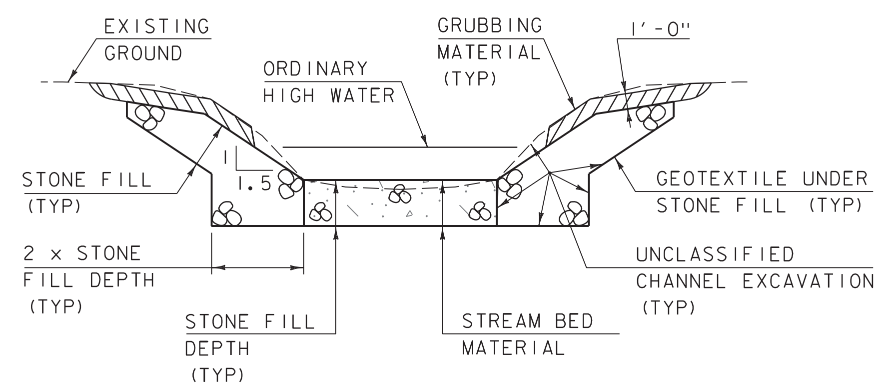


RETAINING WALL EARTHWORK TYPICAL SECTION

NOT TO SCALE

NOTE:

TOP OF RETAINING WALL FOOTING SHALL BE AT OR BELOW BOTTOM OF BOX CULVERT.



TYPICAL CHANNEL SECTION

(NOT TO SCALE)

1) WHENEVER CHANNEL SLOPE INTERSECTS ROADWAY SUBBASE, GRUBBING MATERIAL SHALL BEGIN AT THE BOTTOM OF SUBBASE.

2) THE CONTRACTOR SHALL CREATE A LOW FLOW CHANNEL IN THE STREAM BED MATERIAL AS DIRECTED BY THE ENGINEER.

3) GRUBBING MATERIAL SHALL BE PLACED UNDERNEATH STRUCTURES WHERE THERE IS MORE THAN 6 FEET VERTICALLY FROM ORDINARY HIGH WATER (OHW) TO THE BOTTOM OF SUPERSTRUCTURE AND MORE THAN 6 FEET HORIZONTALLY FROM OHW LINE TO FRONT FACE OF ABUTMENT. THIS MATERIAL SHALL START JUST ABOVE THE OHW ELEVATION AND TERMINATE 3 FEET HORIZONTALLY FROM THE FRONT FACE OF THE ABUTMENT. THIS MATERIAL SHALL NOT BE PLACED UNDERNEATH DOWNSPOUTS. SEE THE CHANNEL SECTIONS FOR ADDITIONAL DETAILING.

MATERIAL INFORMATION

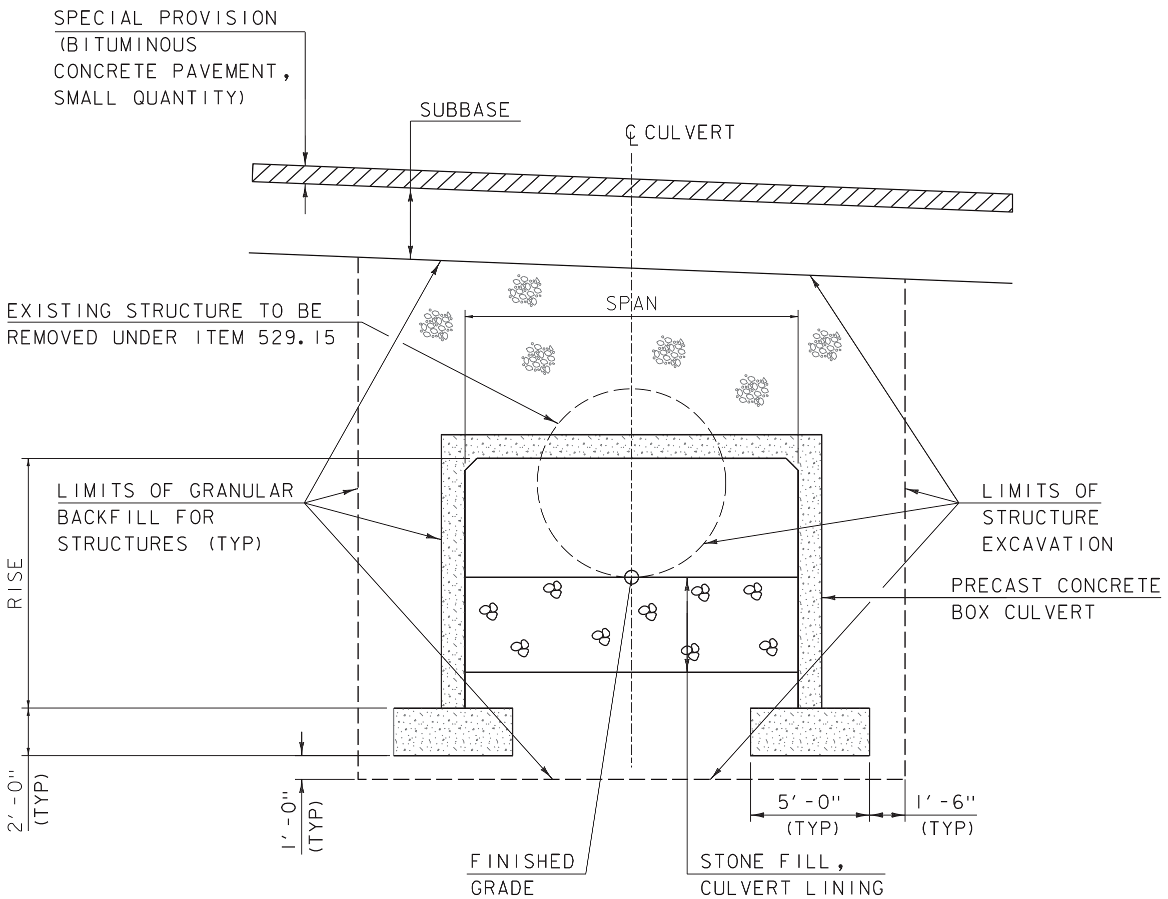
	THICKNESS	TYPE
STONE FILL	4'-0"	TYPE IV
STONE FILL, CULVERT LINING	4'-0"	E-STONE TYPE IV
STONE FILL, STREAM BED MATERIAL	4'-0"	E-STONE TYPE IV

RETAINING WALL - ASSUMED DIMENSIONS

LEVELING PAD	
	DIMENSION
WIDTH	2'-6"
TOE	0'-9"
HEEL	0'-9"
THICKNESS	1'-0"
UNDERCUT	1'-0"
WALL	
THICKNESS	1'-0"
HEIGHT	VARIES
EXCAVATION LIMITS	
VERTICAL NEATLINE	1'-6"
UNDERCUT	1'-0"

PROJECT NAME: BUEL'S GORE
PROJECT NUMBER: BF 0200(11)

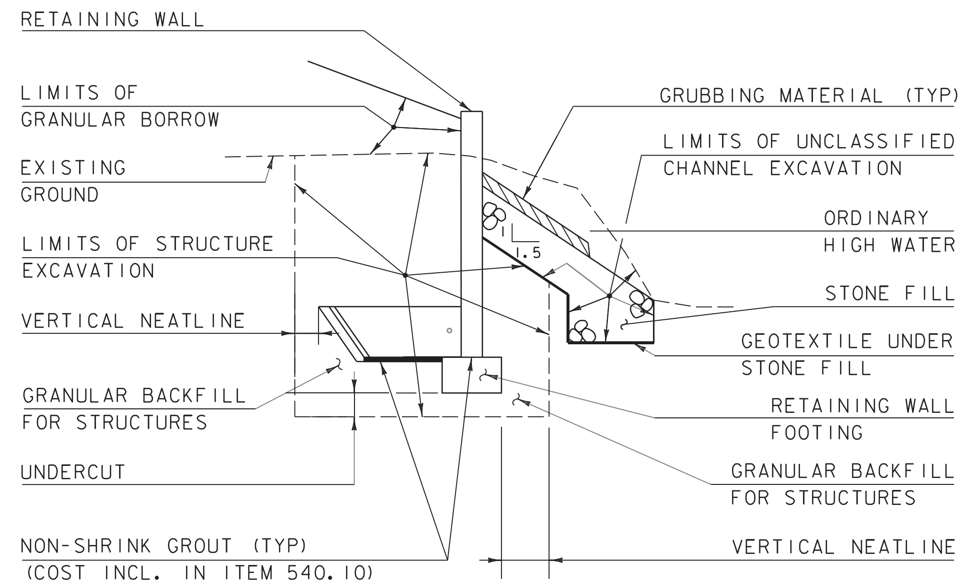
FILE NAME: 21b027/s21b027typ.dgn	PLOT DATE: 10-DEC-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
4-SIDED BOX TYPICAL SECTION	SHEET 5 OF 14



SPAN	8'-0"
RISE	8'-0"
LENGTH	70'-0"

CULVERT TYPICAL SECTION

NOT TO SCALE



RETAINING WALL EARTHWORK TYPICAL SECTION

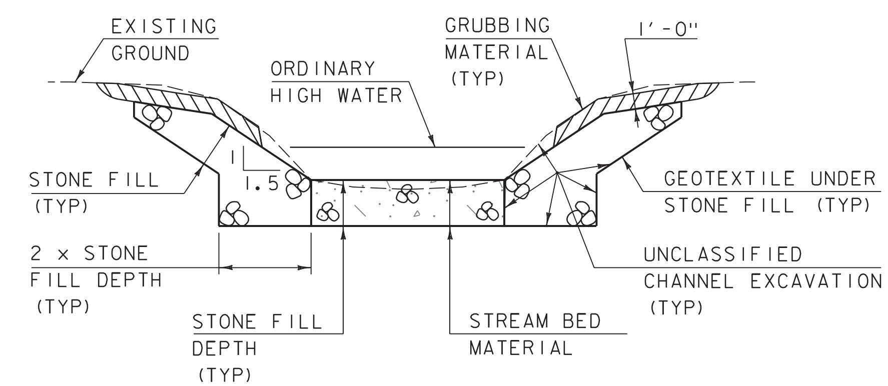
NOT TO SCALE

NOTE:

TOP OF RETAINING WALL FOOTING SHALL BE AT OR BELOW BOTTOM OF BOX CULVERT.

RETAINING WALL - ASSUMED DIMENSIONS

LEVELING PAD	
	DIMENSION
WIDTH	2'-6"
TOE	0'-9"
HEEL	0'-9"
THICKNESS	1'-0"
UNDERCUT	1'-0"
WALL	
THICKNESS	1'-0"
HEIGHT	VARIES
EXCAVATION LIMITS	
VERTICAL NEATLINE	1'-6"
UNDERCUT	1'-0"



TYPICAL CHANNEL SECTION

(NOT TO SCALE)

1) WHENEVER CHANNEL SLOPE INTERSECTS ROADWAY SUBBASE, GRUBBING MATERIAL SHALL BEGIN AT THE BOTTOM OF SUBBASE.

2) THE CONTRACTOR SHALL CREATE A LOW FLOW CHANNEL IN THE STREAM BED MATERIAL AS DIRECTED BY THE ENGINEER.

3) GRUBBING MATERIAL SHALL BE PLACED UNDERNEATH STRUCTURES WHERE THERE IS MORE THAN 6 FEET VERTICALLY FROM ORDINARY HIGH WATER (OHW) TO THE BOTTOM OF SUPERSTRUCTURE AND MORE THAN 6 FEET HORIZONTALLY FROM OHW LINE TO FRONT FACE OF ABUTMENT. THIS MATERIAL SHALL START JUST ABOVE THE OHW ELEVATION AND TERMINATE 3 FEET HORIZONTALLY FROM THE FRONT FACE OF THE ABUTMENT. THIS MATERIAL SHALL NOT BE PLACED UNDERNEATH DOWNSPOUTS. SEE THE CHANNEL SECTIONS FOR ADDITIONAL DETAILING.

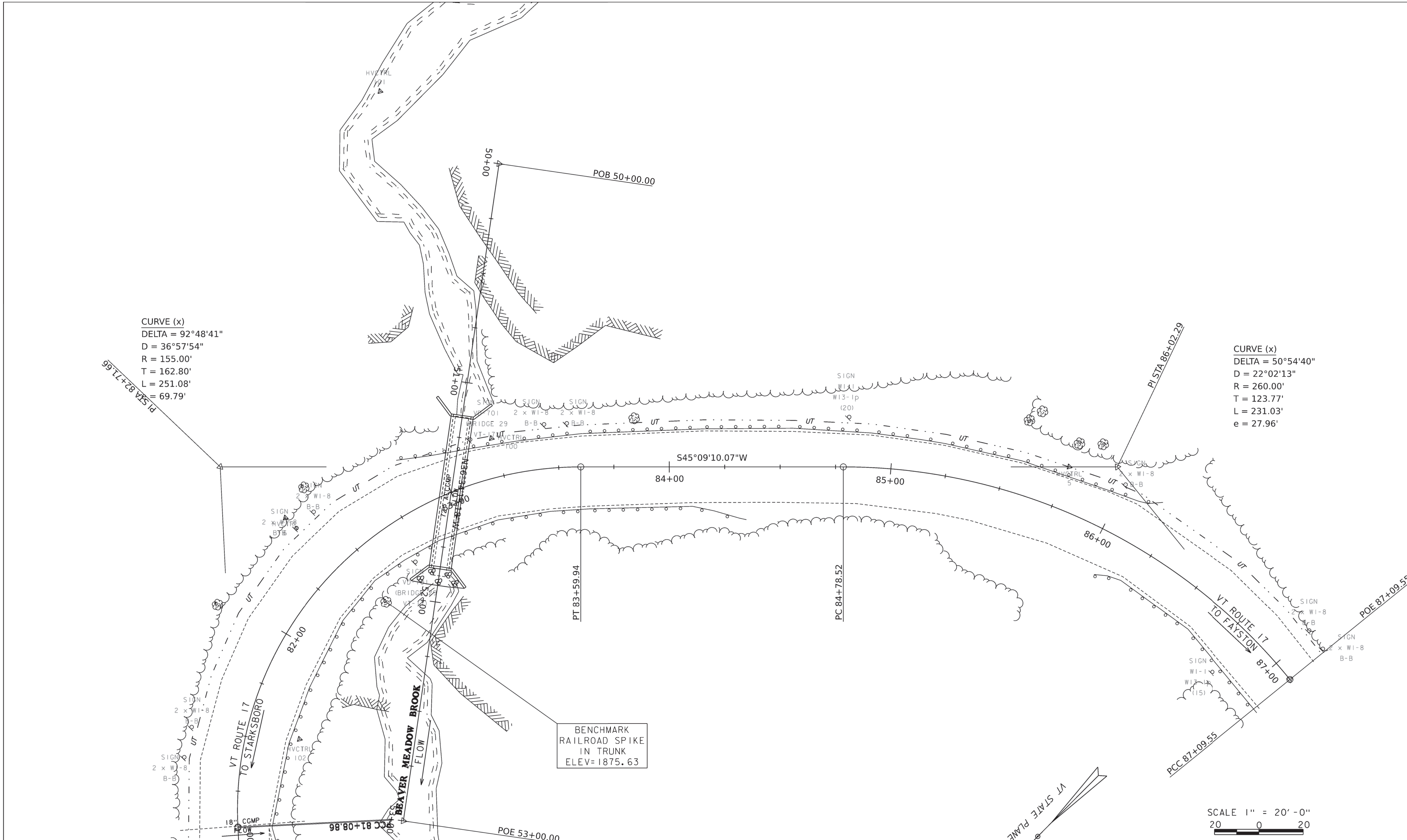
MATERIAL INFORMATION

	THICKNESS	TYPE
STONE FILL	4'-0"	TYPE IV
STONE FILL, CULVERT LINING	4'-0"	E-STONE TYPE IV
STONE FILL, STREAM BED MATERIAL	4'-0"	E-STONE TYPE IV

PROJECT NAME: BUEL'S GORE
PROJECT NUMBER: BF 0200(11)

FILE NAME: 21b027/s21b027typ.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
THREE SIDED BOX TYPICAL SECTION

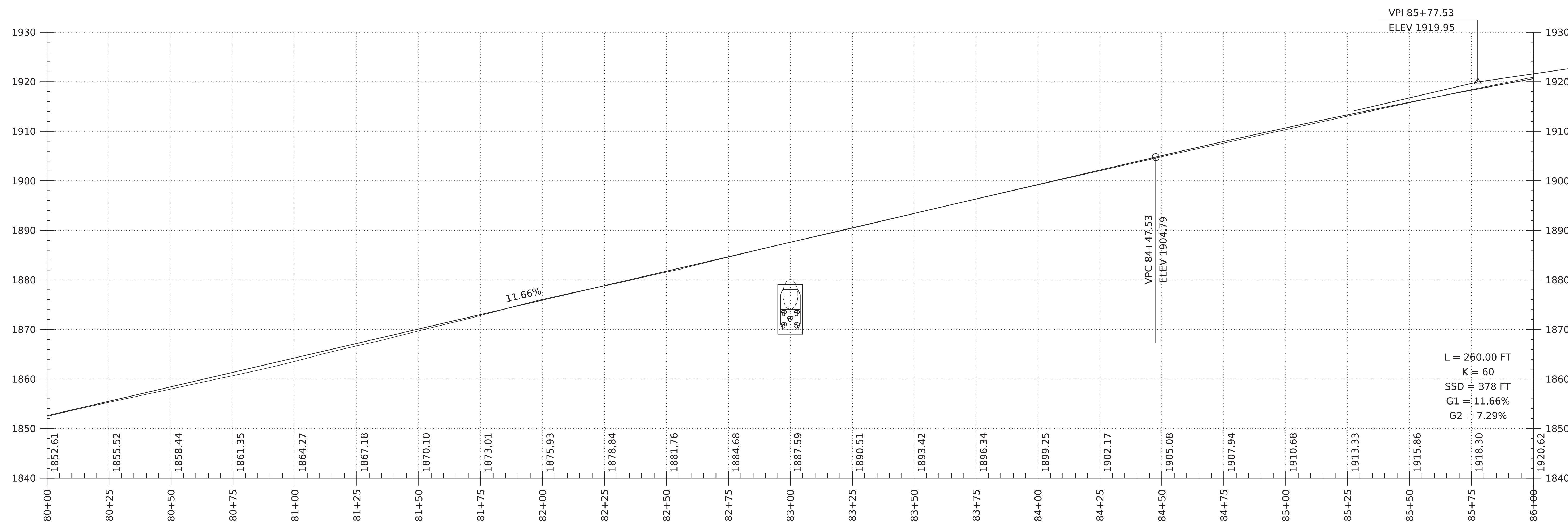
PLOT DATE: 10-DEC-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 6 OF 14



PROJECT NAME: BUEL'S GORE
PROJECT NUMBER: BF 0200(11)

FILE NAME: s21b027BDR_New Culvert.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
NEW CULVERT LAYOUT

PLOT DATE: 10-DEC-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 7 OF 14

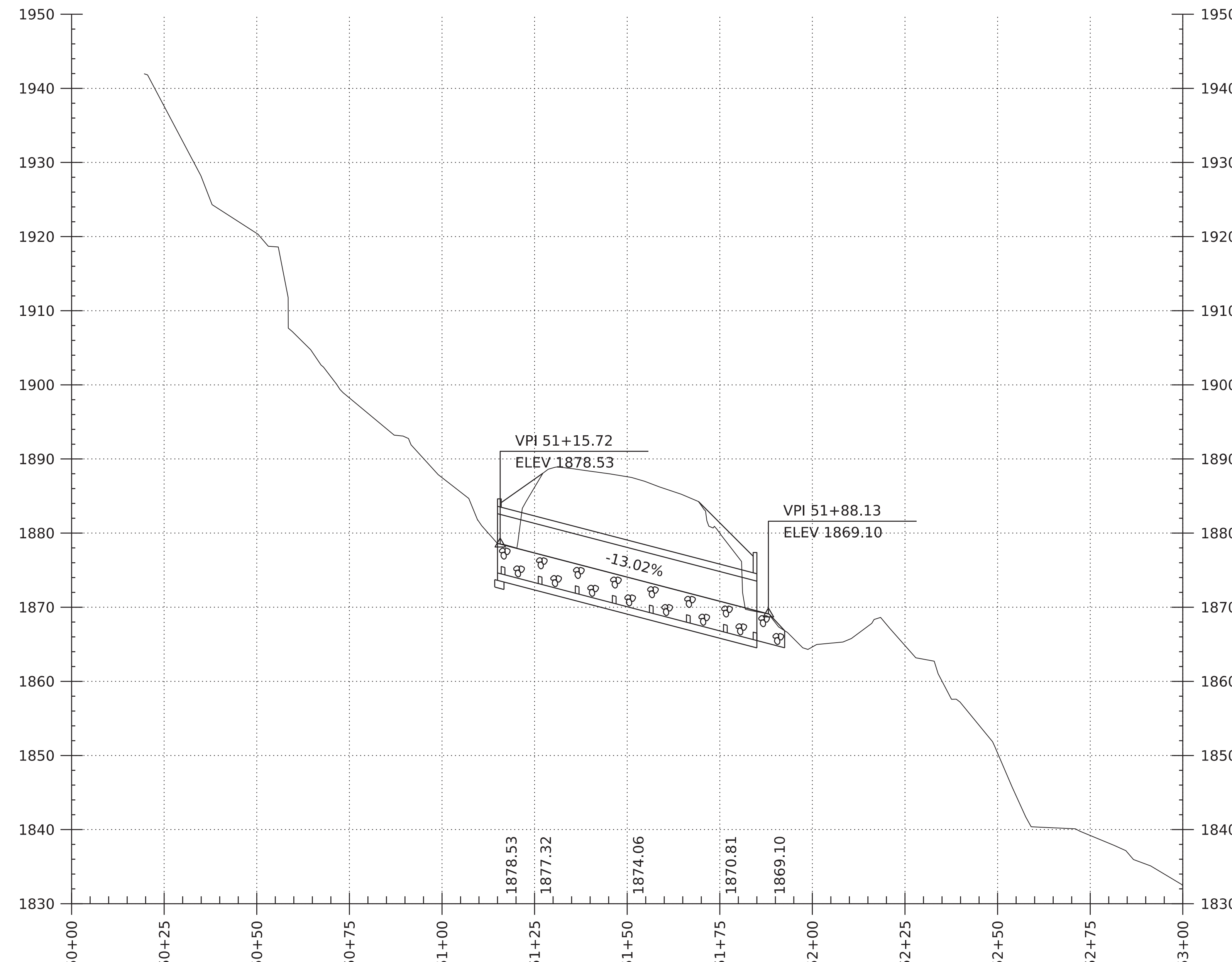


PROPOSED 4-SIDED BOX CULVERT VT ROUTE 17 PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: BUEL'S GORE	
PROJECT NUMBER: BF 0200(11)	
FILE NAME: s21b027profile.dgn	PLOT DATE: 10-DEC-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
PROPOSED 4 SIDED BOX ROADWAY PROFILE	SHEET 8 OF 14

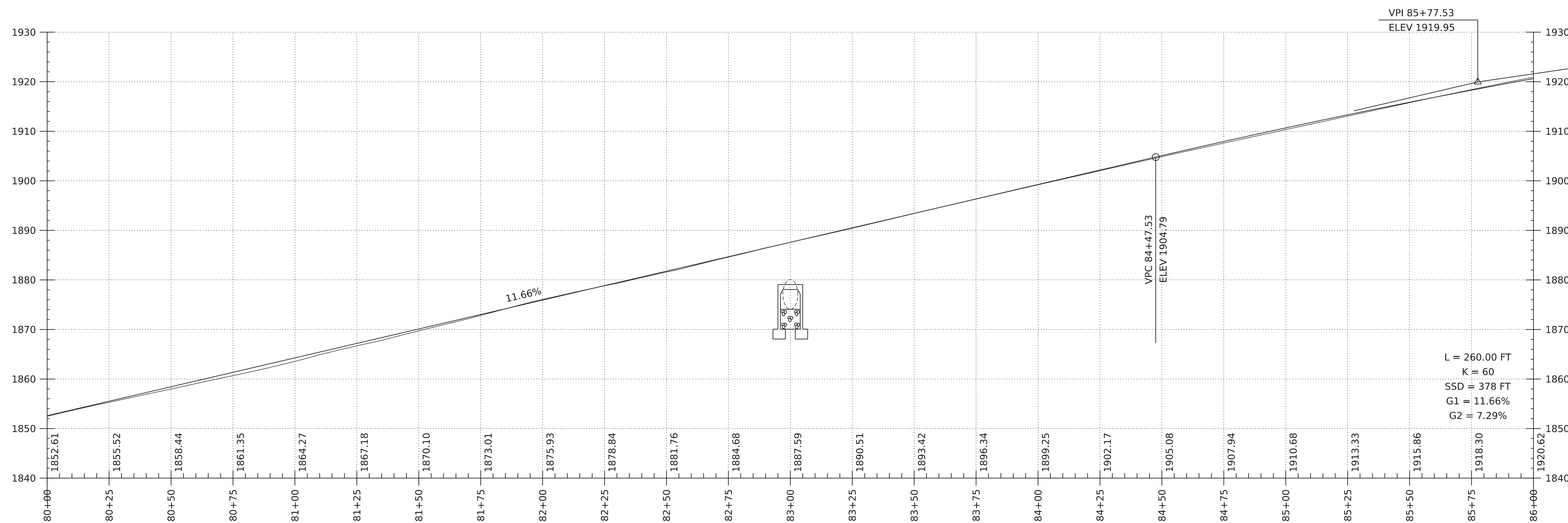


PROPOSED 4-SIDED BOX CULVERT CHANNEL PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: BUEL'S GORE	
PROJECT NUMBER: BF 0200(11)	
FILE NAME: s21b027profile.dgn	PLOT DATE: 10-DEC-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
PROPOSED 4 SIDED BOX PROFILE SHEET	SHEET 9 OF 14

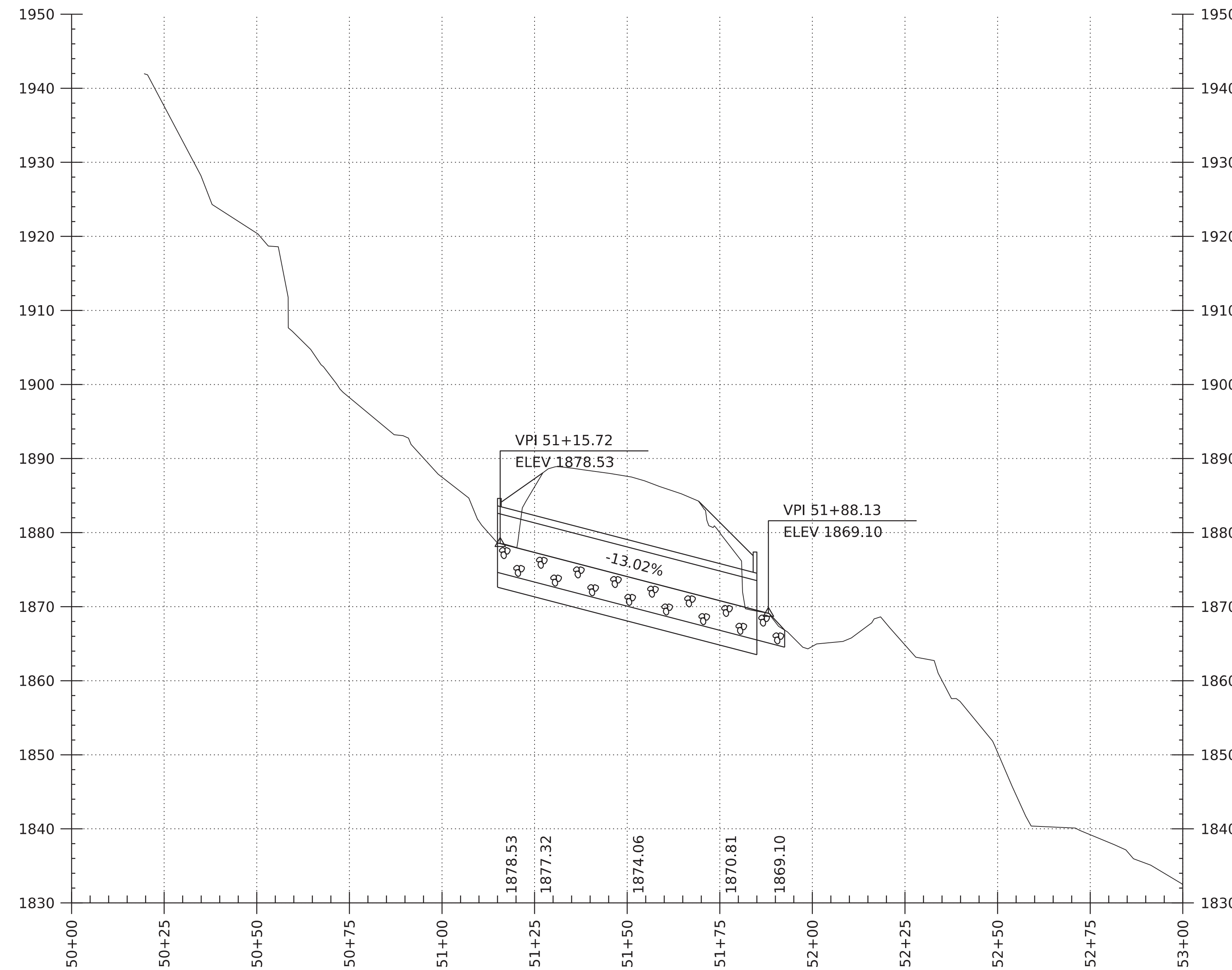


PROPOSED ARCH VT ROUTE 17 PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: BUEL'S GORE	
PROJECT NUMBER: BF 0200(11)	
FILE NAME: s21b027profile.dgn	PLOT DATE: 10-DEC-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
PROPOSED ARCH CULVERT ROADWAY PROFILE	SHEET 10 OF 14

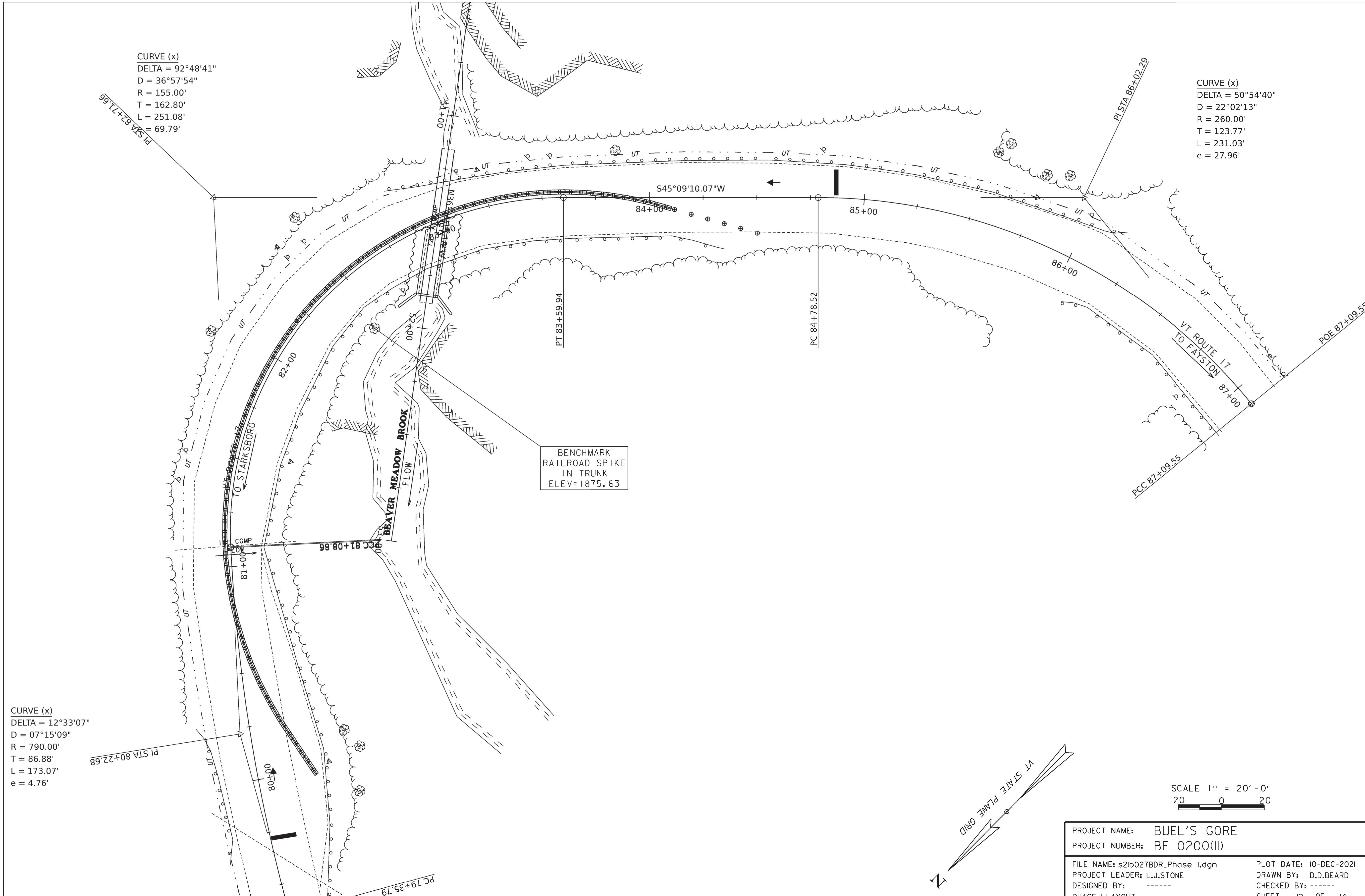


PROPOSED ARCH CHANNEL PROFILE

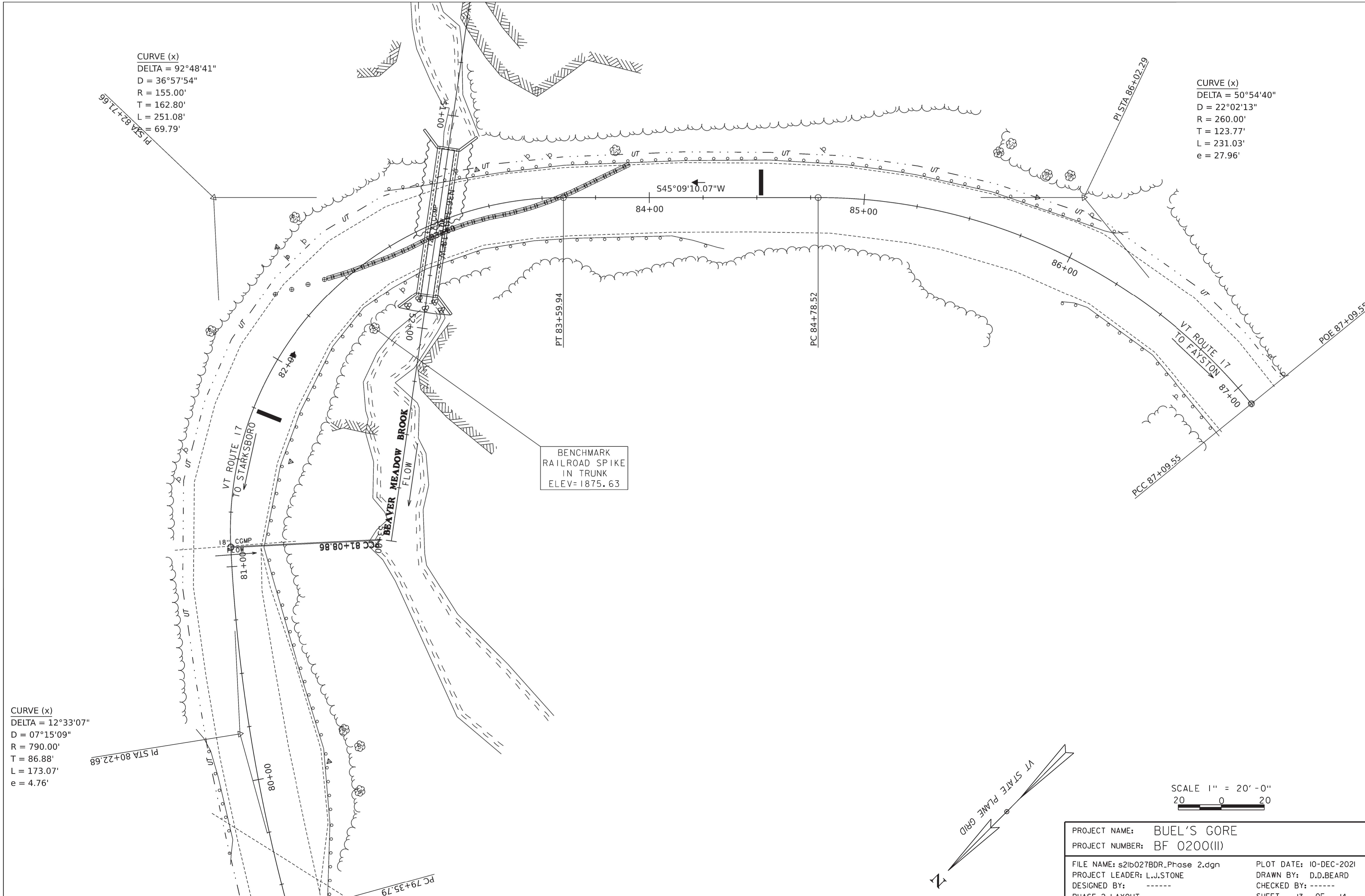
SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: BUEL'S GORE	
PROJECT NUMBER: BF 0200(11)	
FILE NAME: s21b027profile.dgn	PLOT DATE: 10-DEC-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
PROPOSED ARCH CULVERT PROFILE SHEET	SHEET 11 OF 14



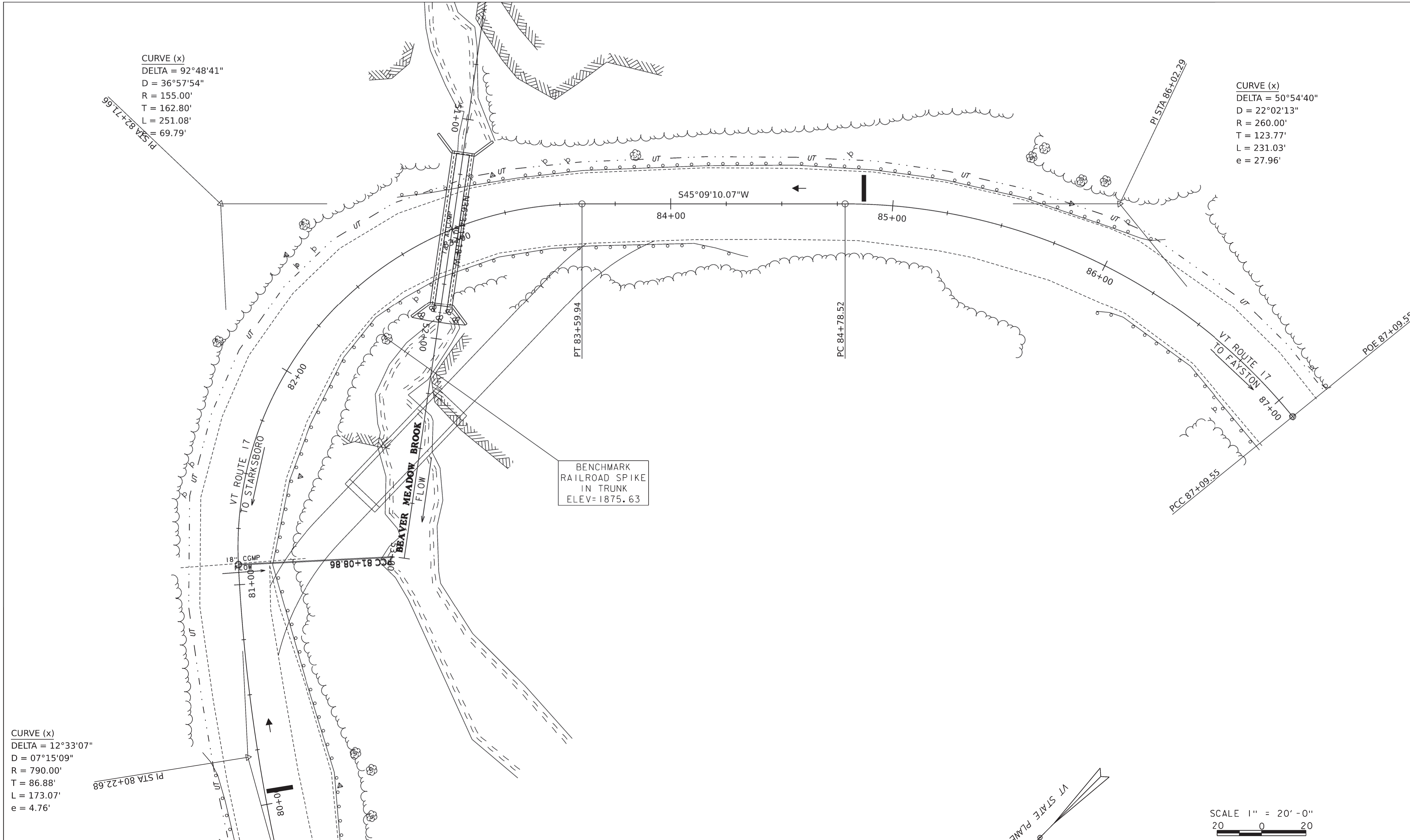
PROJECT NAME:	BUEL'S GORE
PROJECT NUMBER:	BF 0200(11)
FILE NAME: s21b027BDR_Phase 1.dgn	PLOT DATE: 10-DEC-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
PHASE I LAYOUT	SHEET 12 OF 14



PROJECT NAME: BUEL'S GORE
PROJECT NUMBER: BF 0200(11)

FILE NAME: s21b027BDR_Phase 2.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
PHASE 2 LAYOUT

PLOT DATE: 10-DEC-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 13 OF 14



PROJECT NAME:	BUEL'S GORE		
PROJECT NUMBER:	BF 0200(II)		
FILE NAME:	s21b027BDR_Downstream Temp Bridge.dgn	PLOT DATE:	10-DEC-2021
PROJECT LEADER:	L.J.STONE	DRAWN BY:	D.D.BEARD
DESIGNED BY:	------	CHECKED BY:	------
DOWNSTREAM TEMPORARY BRIDGE LAYOUT		SHEET 14 OF 14	