STATE OF VERMONT
AGENCY OF TRANSPORTATION

Scoping Report

FOR

Coventry BF 0251(49)

VT Route 14, Bridge 132 over Stony Brook

October 14, 2021

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I. Site Information

Bridge 132 is a State-owned bridge located on VT Route 14 over Stony Brook. The bridge is approximately 2.7 miles south of the intersection of VT Route 14 and VT Route 100. The bridge is at a skew to the roadway and is located under an average of 4 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	Corrugated Galvanized Metal Plate Pipe Arch (CGMPPA)
Culvert Span	8 feet
Culvert Length	108 feet
Year Built	1959
Ownership	State of Vermont

Need

Bridge 132 carries VT Route 14 across Stony Brook. The following is a list of deficiencies of Bridge 132 and VT Route 14 in this location:

1. The culvert is in serious condition. There are large holes throughout the culvert invert, with the worst area being in the center of pipe where what remains of the invert has broken off and resulting in no support for the barrel above. There is heavy rusting throughout the culvert barrel above the haunch line. The outlet end of the pipe has heavy undermining resulting in minor settlement of the pipe.

2. The existing culvert does not meet the minimum hydraulic standard or the calculated bank full width.

3. VT Route 14 though the project area is substandard in width for the speed and traffic volumes present.

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	2,200	2,400
DHV	250	270
ADTT	250	340
%T	12.2	14.9
%D	58	58

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 2,400, a DHV of 270, and a design speed of 50 mph for a Major Collector.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 5.3	11’/2.5’ (27’)	11’/4’ (30’)[1]	Substandard
Bridge Lane and Shoulder Widths	VSS Section 5.7	11’/2.5’ (27’)	11’/4’ (30’)[1]	Substandard
Clear Zone Distance	VSS Table 5.4	No issues noted	20’ fill / 12’ cut (1:3) 14’ cut (1:4)	
Banking	VSS Section 5.13	e = 4.4%	8% (max)	Substandard
Speed		50 mph	50 mph (Design)	
Horizontal Alignment	AASHTO Green Book Table 3-10b	R = 2,080’	R_{min} = 2,040’ @ e = 5% R_{min} = 2,410’ @ e = 4.4%	Substandard
Vertical Grade	VSS Table 5.6	<1%	6% (max) for level terrain	
K Values for Vertical Curves	VSS Table 5.1	K_{sag} = 177	110 crest / 90 sag	
Vertical Clearance	VSS Section 5.8	No Issues Noted	14’-3” (min)	
Stopping Sight Distance	VSS Table 5.1	>400’	400’	
Bicycle/Pedestrian Criteria	VSS Table 5.7	2.5’ shoulder	4’ Shoulder	Substandard
Bridge Railing	Structures Design Manual Section 13	N/A	TL-3	
Hydraulics	VTrans Hydraulics Section	• HW/D $_{(1\% AEP)}$ = 1.58 • Clear span: 7.67 feet	• HW/D $_{(1\% AEP)}$ < 1.2 • BFW: 12 feet	Substandard
Structural Capacity	SM, Ch. 3.4.1	Structurally Deficient	Design Live Load: HL-93	Substandard

Inspection Report Summary

Culvert Rating 3 Serious
Channel Rating 3 Serious

11/20/2020 – Pipe is in very poor condition with invert completely rusted through at approx. mid span and support has been lost. Rest of invert has holes and slotted holes throughout with piping surprisingly roadway doesn't show settlement yet. Holes are also outside of invert along haunches and outlet end south miter end is pushed in with settlement. Pipe needs repairs or replacement as sinkhole are imminent. ~MJK

11/21/2019 – Pipe remains in poor condition and should be replaced soon. Large holes throughout, with worst area being in the center of pipe where what remains of the invert has broken off and resulting in no support for the barrel above. ~ABC/JAS

12/5/2018 – No access to pipe due to snow levels and rushing water. Inspection will be moved to Spring 2019 ~ABC/JAS

[1] A shoulder width of 3-feet is required for adequate safety and service per Table 5.3 of the Vermont State Standards. A 4-foot shoulder is required for adequate accommodation of bicycles per Table 5.7. Table 5.7 specifies a 3-foot shoulder for shared use. An additional 1-foot is added per Table 5.7 footnote (a) for truck traffic >10%.

11/16/2017 – This culvert is in need of an invert before the shape changes and then full replacement would be needed. Large area of holes will soon cause the culvert to settle and with piping, sinkholes will develop in roadway. ~JAS/FRE

10/25/2016 – This structure should have a concrete invert installed that repairs deterioration up to the top of the water line. ~JW/TB

11/4/2015 – Culvert is in poor condition. Due to the large holes in random locations and the start of crushing culvert should be replaced soon. Channel repairs should be made up and downstream. ~FRE/TJB

11/12/2014 – Culvert is in poor condition due to the invert having scattered perforations. Culvert should be evaluated for a concrete invert. Erosion up and downstream should be repaired. ~FRE/TJB/SP

Hydraulics

The existing structure does not meet the current hydraulic standards of the VTrans hydraulic manual. Additionally, the existing structure constricts the channel width, as it does not meet the 12-foot bank full width, resulting in an increased potential for debris blockage. Additionally, the stream overtops the road at both the design and check storm event. The VTrans Hydraulics Unit recommends either a precast box with a waterway opening of 12-feet x 6.75-feet, or other structure with a minimum span of 12-feet and rise of 7-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>

- The Town of Coventry does not have any water or sewer mains within the project area.

<u>Public Utilities</u>

<u>Underground:</u>

- There are no underground utilities in the project area.

<u>Aerial:</u>

- The aerial utilities in the project area owned by, Vermont Electric Power Co-op (Three Phase), Vermont Electric Power Company (Transmission line), Comcast, and Consolidated Communications.

- Depending on the extents of this project a utility relocation may be necessary for a service line.

Right-Of-Way

The existing Right-of-Way is plotted on the Existing Conditions Layout Sheet. The existing culvert is located entirely within the State-Owned Right-of-Way. It is anticipated that Right-Of-Way will be required if traffic is maintained on a temporary bridge during construction.

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>

Several wetlands were identified within the project area. See Appendix G for additional information.

<u>Rare, Threatened, and Endangered Species</u>

Several rare, threatened, or endangered species have been documented within a two mile radius of the project site. See appendix G for additional information.

The project area is within the range of the northern long-eared bat.

<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.

<u>Agricultural Soils</u>

Agricultural soils were not identified within the project area.

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 132 is not historic and there are no historic or Section 4(f) resources in the project area.

Archeological:

There are no areas of archaeological sensitivity 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 serious 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.

Culvert Rehabilitation

Since the minimum hydraulic opening would be substandard for all options, and any rehabilitation will reduce the waterway area, it is assumed that an improved beveled inlet would be required for each option to optimize hydraulic performance and to funnel the stream into the culvert.

This alternative involves the rehabilitation of the existing corrugated metal plate pipe arch.

Rehabilitation options considered:

a: Invert Repair
b: Pipe Liner: Slip Liner or Spray-On Liner

All rehabilitation options would employ the use of hydro-blasting or hydro-demolition to appropriately clean the existing pipe interior prior to rehabilitation. In addition to cleaning, some grouting would be needed to plug holes in the pipe and fill all voids on the outside of the pipe. Curing in dry conditions would be required in most cases, necessitating a re-routing of the stream flow during the work and for a prescribed curing period (usually 24 hours).

a. Invert Repair

In many cases, invert repair is used to rehabilitate reinforced concrete pipe where the invert has eroded. Invert repair can be utilized on corrugated steel pipe, and typically consists of paving the invert or pouring a concrete invert. There is significant rusting in the pipe that extends to the haunch located almost halfway up the pipe. Additionally, an invert repair offers little additional structural integrity to the current structure. As such an invert repair is not recommended.

b. Pipe Liner

<u>Slip Liner:</u>
A slip liner involves inserting a culvert liner into the existing culvert and grouting between the two. Sliplining can be done using several different types of pipe material including corrugated steel, aluminum, reinforced concrete, and polyethylene, and can restore the structural integrity of the culvert. The outside diameter of the pipe used for sliplining is generally specified to be at least 4 inches smaller than the inside diameter of the host pipe to allow the grout to be injected into the annular space between the two pipes. A greater reduction would be required at this site since the existing pipe is elliptical. Therefore, the type of liner chosen should have a minimum inner diameter of 5-feet. The reduced waterway would have a substandard bankfull width and hydraulic opening with roadway overtopping at the design storm event. The slipliner option is anticipated to have the longest life expectancy of the rehabilitation alternatives, since the grout provides an increased structural capacity, prevents liner collapse, prevents fatigue failure, stabilizes the pipe, extends the design life from uncertainty to at least 40 years, and resists temperature changes.

<u>Spray-On Liner:</u>
Spray-On liners provide a new rigid interior surface for the pipe and use either cementitious materials (polymer-enhanced cement mortar) or polyurea. These liners are spray applied either

by hand or machine, although some users have had better quality control with hand-applied methods. Cementitious liners installed by these methods can provide full structural support, depending on thickness applied. Proper curing is essential to using spray-on liners to avoid bond failures. There could be water quality impacts associated with the application of these liners, their degree of impact related to selection of materials, and adherence to curing requirements. If a spray-on liner is selected, the polymer-enhanced cement mortar is recommended for environmental and safety reasons. Even with a spray-on liner, the minimally reduced waterway would have a substandard bankfull width and hydraulic opening.

Advantages: A repair alternative would address the ongoing deterioration issues with the invert of the existing culvert without affecting traffic flow, and with minimum upfront costs. The rehabilitation alternative would be the most cost-efficient option. It would have minimal impacts to surrounding resources.

Disadvantages: The rehabilitation alternative is only a repair and not a new structure. The life span of the repair work is estimated to be 40 years. The existing culvert does not meet the minimum bank full width standard or the minimum hydraulic standard, which would be made worse with the rehabilitation options.

Maintenance of Traffic: The rehabilitation alternative has minimal effect on traffic. Traffic will remain open during the duration of the project, with the exception of intermittent lane closures for some construction activities.

Culvert Replacement – New Buried Structure
This option involves removing the existing corrugated galvanized metal plate pipe arch and replacing it with a new buried structure having a waterway opening of at least 12 feet wide and 6.75 feet high.

Since there is an average of 4 feet of fill above the existing culvert, there would not have to be an extremely large amount of earthwork, making this a good site for a new precast buried structure using an open cut. Any new structure should have flared wingwalls and headwalls extending down at least four feet, 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 current roadway width is 27-feet. This does not meet the minimum standard of 30-feet. Since a new 75+ year structure is being proposed, the roadway geometry should meet the minimum standards through the project limits. Two 11-foot lanes with 4-foot shoulders will be constructed for a 30-foot paved width.

b. Structure Type

The most common structure types for the recommended hydraulic opening are a 4-sided concrete box culvert, or a 3-sided open bottom concrete structure. Due to the limited amount of fill over the existing culvert, a metal pipe is not recommended.

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.

c. Culvert Size, Length and Skew

The existing culvert has a span of 8 feet, which constricts the natural channel width and does not provide adequate hydraulic capacity. Hydraulics has recommended a box with a minimum 12 foot wide and 9.75-foot-high inside opening, with the invert buried 3 feet, resulting in a 12-foot by 6.75-foot waterway opening. The culvert will have a skew of 60 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 110 feet long.

d. Roadway Alignment

The existing horizontal alignment can be brought up to the minimum standard with adjustment of the roadway banking through the project area. Additionally, the vertical alignment meets the minimum standards. As such, both the horizontal and vertical alignment will remain unchanged.

e. Maintenance of Traffic

Either an off-site detour, phased construction, or a 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 75-year design life. This option would meet the minimum hydraulic standards and provide adequate AOP. The roadway width through the project area would be improved for this option.

Disadvantages: This option has the highest upfront costs.

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 culvert and reroute traffic onto a regional detour. The shortest regional detour has an end-to-end distance of 14.5 miles and adds approximately 5.1 miles to travel distance. The available regional detour routes are as follows:

Regional Detour Route: VT Route 14, to VT Route 105 and US Route 5, back to VT Route 14. (14.5 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 14 is closed during construction. The most likely local bypass routes are as follows:

1. VT Route 14, to Alderbrook Road, VT Route 105 and US Route 5, back to VT Route 14. (11.2 miles 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 M.

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 adjacent properties and 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, while having minimal impacts to adjacent property owners. There is an average of 4 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 N. The following is a description of the phases:

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

- Phase 2: A single lane open to traffic on the upstream 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 precast culvert sections installed on the downstream 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, and surrounding wetlands.

Disadvantages: Phased construction generally involves higher costs and complexity of construction. Costs are usually higher and construction duration is longer, since many construction activities have to 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 be placed on either the upstream or downstream side of the existing culvert. A downstream temporary bridge would have greater impacts to aerial utilities and require a more significant utility relocation. Both an upstream and downstream temporary bridge would have impacts to wetlands and would require additional rights from adjacent property owners.

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

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 properties, 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: Culvert Rehabilitation with a Culvert Invert and Minimal Impacts to Traffic
Alternative 1b: Culvert Rehabilitation with a Slip Liner and Minimal Impacts to Traffic
Alternative 2a: New Precast Box Culvert with Traffic Maintained on Offsite Detour
Alternative 2b: New Precast Box Culvert with Traffic Maintained with Phased Construction
Alternative 2c: New Precast Box Culvert with Traffic Maintained on a Temporary Bridge

V. Cost Matrix[2]

Coventry BF 0251(49)		Do Nothing	Alternative 1 Culvert Rehabilitation		Alternative 2 New Precast Box		
			a. Culvert Invert	b. Pipe Liner	a. Offsite Detour	b. Phased Construction	b. Temporary Bridge
COST	Bridge Cost	$0	666,250	643,174	1,165,040	1,540,765	1,165,040
	Removal of Structure	$0	24,948	24,948	75,600	86,940	75,600
	Roadway	$0	137,438	133,976	339,228	445,229	339,228
	Maintenance of Traffic	$0	41,540	26,540	119,300	271,600	451,373
	Construction Costs	$0	870,176	828,638	1,699,168	2,344,534	2,031,241
	Construction Engineering & Contingencies	$0	304,561	290,023	424,792	586,134	507,810
	Accelerated Premium	$0	0	0	67,967	0	0
	Total Construction Costs w CEC	$0	1,174,737	1,118,661	2,191,927	2,930,668	2,539,052
	Preliminary Engineering[3]	$0	261,053	248,591	424,792	586,134	507,810
	Right of Way	$0	5,000	5,000	0	0	25,000
	Total Project Costs	$0	1,440,790	1,372,253	2,616,719	3,516,802	3,071,862
	Annualized Costs	$0	28,816	27,445	34,890	46,891	40,958
SCHEDULEING	Project Development Duration[4]	N/A	2 years	2 years	2 years	2 years	2 years
	Construction Duration	N/A	6 months	8 months	6 months	8 months	8 months
	Closure Duration (If Applicable)	N/A	N/A	N/A	3 days	N/A	N/A
ENGINEERING	Typical Section - Roadway (feet)	27'	27'	27'	30'	30'	30'
	Typical Section - Bridge (feet)	N/A	N/A	N/A	N/A	N/A	N/A
	Geometric Design Criteria	Substandard	Substandard	Substandard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard
	Traffic Safety	Structurally Deficient Culvert	Improved	Improved	Improved	Improved	Improved
	Alignment Change	N/A	No Change	No Change	No Change	No Change	No Change
	Bicycle Access	No Change	Substandard	Substandard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard
	Pedestrian Access	N/A	No Change	No Change	Improved	Improved	Improved
	Hydraulics	Substandard Hydraulics and BFW	Substandard Hydraulics and BFW	Substandard Hydraulics and BFW	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard
	Utilities	No Change	No Change	No Change	No Change	No Change	No Change
OTHER	ROW Acquisition	No	For Access	For Access	No	No	Yes
	Road Closure	No	No	No	Yes	No	No
	Design Life	<10	50	50	75	75	75

[2] Costs are estimates only, used for comparison purposes.
[3] Preliminary Engineering costs are estimated starting from the end of the Project Definition Phase.
[4] 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 precast box culvert while maintaining traffic on an offsite detour.

Structure:
The existing culvert is in serious condition and needs replacement. Due to the minimal amount of fill over the culvert, a concrete box is recommended. The current culvert does not meet the minimum hydraulic standard for capacity or bank full width and does not provide adequate Aquatic Organism Passage. As such, a culvert replacement with a larger structure is recommended.

Per hydraulics' recommendations, the new culvert will be 4-sided concrete box with a 12-foot span x 9.75-foot rise. The structure invert is to be buried 3-feet and provide a minimum waterway opening of 12-foot span x 6.75-foot clear height with a waterway area of 81.0 sf. Bed retention sills should be added in the bottom of the structure. Sills should be 12 inches high and flat across the full width of the box. Sills should be spaced no more than 8 feet apart throughout the structure with one sill placed at both the inlet and the outlet

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

The existing roadway width does not meet the minimum standard. As such, it is recommended that the new culvert be lengthened to provide the minimum standard roadway width through the project. Two 11-foot lanes with 4-foot shoulders will be constructed for a 30-foot paved width.

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 5.1 miles to the through route and have an end-to-end distance of 14.5 miles. The option to close the road is the least expensive and the safest option. Based on the serious condition of this culvert, and the need to accelerate project delivery, it seems reasonable to close the road since the benefits outweigh the temporary inconvenience. By closing the road, there will be less impacts to Right-of-Way and environmental resources, and the project can be delivered sooner.

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
- Appendix L: VTrans Operations Input – No Response Received
- Appendix M: Crash Data
- Appendix N: Detour and Local Bypass Maps
- Appendix O: Plans

Appendix A: Site Pictures

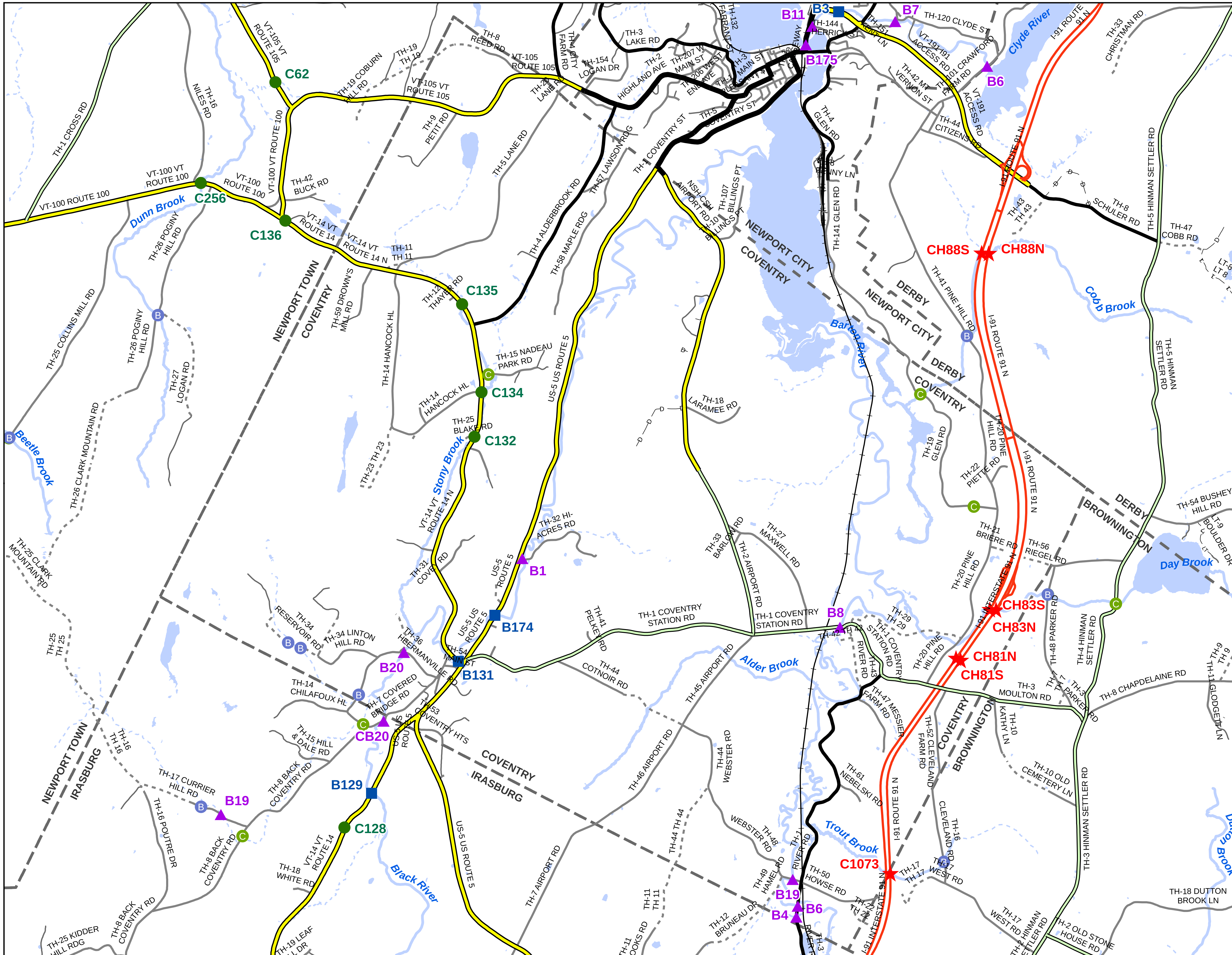
Looking north overt bridge 132

Looking south over bridge 132

Culvert Barrel

Looking Downstream

Appendix B: Town Map



Scale: 1:47,550

N

- INTERSTATE
- STATE LONG
- STATE SHORT
- TOWN LONG
- FAS/FAU
- BIKE PATH
- INTERSTATE
- STATE HIGHWAY
- CLASS 1
- CLASS 2
- CLASS 3
- CLASS 4
- LEGAL TRAIL
- PRIVATE
- DISCONTINUED
- FAS/FAU HWY
- MAINTENANCE DISTRICT
- POLITICAL BOUNDARY
- VTRANS REGION BOUNDARY
- NAMED RIVER-STREAM
- UNNAMED RIVER-STREAM
- Point from Local Bridge Data *
- Point from Local Culvert Data *

* Points are from local town bridge and culvert inventories. Some points may overlap where VTrans has also conducted an inventory on the Town highway.
Data source: VOBCIT aka VTCulverts

Produced by:
Mapping Section
Division of Policy, Planning and Intermodal Development
Vermont Agency of Transportation
May 2017

COVENTRY

COUNTY-TOWN CODE: **1005-0**
ORLEANS COUNTY
DISTRICT # 9
District Long Name: Derby District
VTrans Four Region: Northeast

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 : COVENTRY | **Bridge No.:** 0132 | **District:** 9

Located on: VT14 **over** BROOK | **approximately** 2.7 MI S 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: 3 SERIOUS

Federal Str. Number: 300251013210051

AGE and SERVICE

Year Built: 1959 **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): 4

ADT: 1800 **Year of ADT:** 1996

GEOMETRIC DATA

Length of Maximum Span (ft): 8

Structure Length (ft): 8

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): 27

Skew: 56

Bridge Median: 0 NO MEDIAN

Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD

Min Vertical Underclr (ft): 05 FT 00 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: CGMPPA

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): 108

Average Cover Over Culvert (ft): 04

Waterway Area Through Culvert (sq.ft.): 24

Wingwall/Headwall Rating: N NOT APPLICABLE

APPRAISAL

Appr. Rdwy. Alignment: 8 EQUAL TO DESIRABLE CRITERIA

INSPECTION

Inspection Date: 112020 **Inspection Frequency (months):** 12

INSPECTION SUMMARY and NEEDS

11/20/2020 Pipe is in very poor condition with invert completely rusted through at approx. mid span and support has been lost. Rest of invert has holes and slotted holes throughout with piping surprisingly roadway doesn't show settlement yet. Holes are also outside of invert along haunches and outlet end south miter end is pushed in with settlement. Pipe needs repairs or replacement as sinkhole are imminent. MJK

11/21/2019 - Pipe remains in poor condition and should be replaced soon. Large holes throughout, with worst area being in the center of pipe where what remains of the invert has broken off and resulting in no support for the barrel above. - ABC/JAS

12/5/2018 - No access to pipe due to snow levels and rushing water. Inspection will be moved to Spring 2019 - ABC/JAS

11/16/2017 This culvert is in need of an invert before the shape changes and then full replacement would be needed. Large area of holes will soon cause the culvert to settle and with piping, sinkholes will develop in roadway. JAS/FRE

10/25/2016 This structure should have a concrete invert installed that repairs deterioration up to the top of the water line. JW/TB

11/4/2015 Culvert is in poor condition. Due to the large holes in random locations and the start of crushing culvert should be replaced soon. Channel repairs should be made up and downstream. ~FRE/TJB

11/12/2014 Culvert is in poor condition due to the invert having scattered perforations. Culvert should be evaluated for a concrete invert. Erosion up and downstream should be repaired. ~FRE/TJB/SP

11/13/2013 Culvert is in poor condition. Should be evaluated for a possible invert in the near future. Scour on the outlet should be filled in to help stop the undermining. ~FRE/SJH

10/31/2012 Culvert should be evaluated for a concrete invert or replacement in the near future. ~FRE/JAS

10/12/2011 Culvert will need to be replaced in the near future. ~FRE/DCP

7/22/2010 This structure is a good candidate for a concrete invert which would extend the service life many more years. Other than the invert, the rest of the culvert is in good shape. With a new concrete invert the piping and undermining could be arrested. Upstream vegetation should be cut back to open the waterway. ~DS/RF

Appendix D: Hydraulics Memo

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

[phone] 802-371-7326
[fax] 802-828-3566
[ttd] 800-253-0191

Agency of Transportation

TO: Laura Stone, Structures, Scoping Engineer

CC: Nick Wark, Hydraulics Engineer

FROM: Jeff DeGraff, Hydraulics Project Engineer

DATE: September 10, 2021

SUBJECT: Coventry BF 0251(49) pin #21B025
Coventry, VT-14 Br132, over Stony Brook
Site location: MM 2.077
Coordinates: 44.892981, -72.258707

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

On 8/12/21 we met with ANR at the site. In an email on 8/12/21 ANR indicated a minimum span of 12-feet should be used to span bankfull width (BFW).

Design Storm Flow is 2% AEP (Q50).

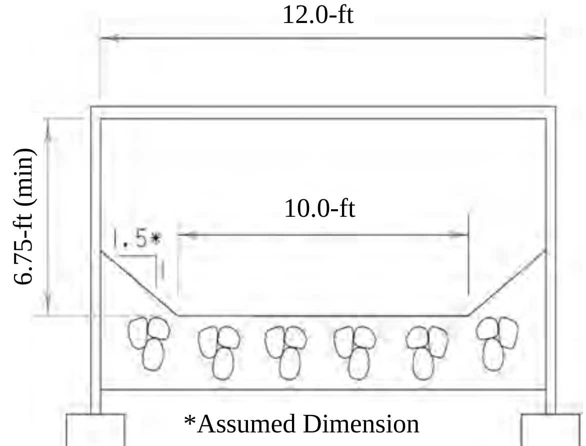
The following options were analyzed:

Existing Conditions: 7.67-ft span by 5.5-ft rise corrugated metal pipe arch Culvert

- Provides a Headwater to Depth ratio (HW/D) of 1.48 and 1.58 during the design and check storm event, respectively. Headwater depths of 8.15-ft and 8.40-ft were determined during the design and check storm event, respectively.
- Roadway overtopping occurred during the design and check and storm event.
- The existing culvert does not meet the current hydraulic standards.

Option 1: Bridge (3 sided), 12.0-foot span x 6.75-foot clear height w/sloping fill

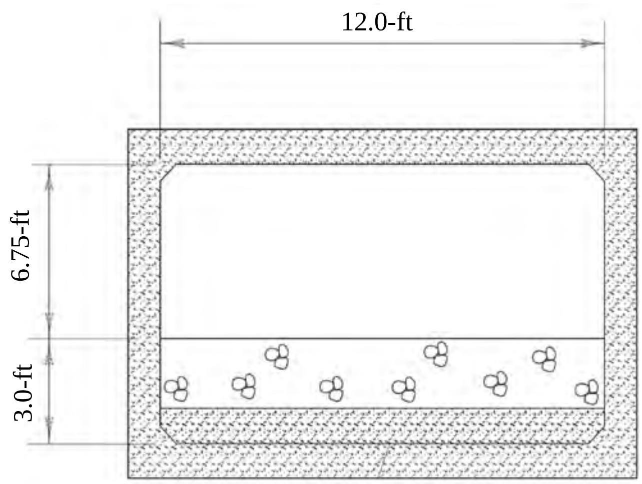
- There is approximately 1.1-feet of freeboard at the design AEP, providing a minimum waterway area of 80.3 sq. ft ±.
- Does not increase the 100-year base flood elevations
- Assumes no changes to the existing structure alignment/skew



Option 1: Typical Section

Option 2: Four-Sided Concrete Box (closed bottom) 12-foot span x 9.75-foot rise

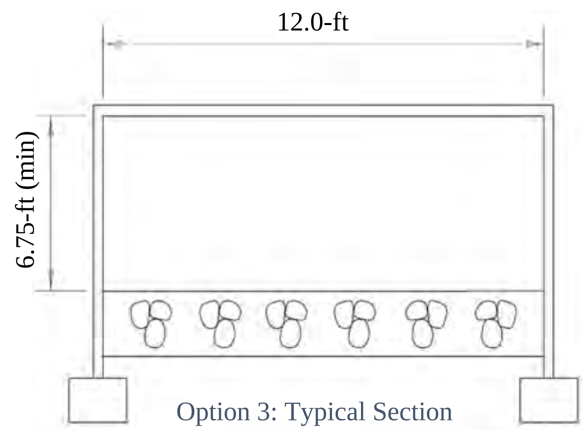
- There is approximately 1.1-feet of freeboard at the design AEP.
- Structure invert is to be buried 3-feet and provide a minimum waterway opening of 12-foot span x 6.75-foot clear height with a waterway area of 81.0 sq. ft.
- Bed retention sills should be added in the bottom of the structure. Sills should be 12 inches high and flat across the full width of the box. Sills should be spaced no more than 8 feet apart throughout the structure with one sill placed at both the inlet and the outlet
- Does not increase the 100-year base flood elevations
- Assumes no changes to the existing structure alignment/skew



Option 2: Typical Section

Option 3: Bridge (3-sided) 12-foot span x 7.0-foot clear rise

- There is approximately 1.1-feet of freeboard at the design AEP, providing a minimum waterway area of 81.0 sq. ft.
- Does not increase the 100-year base flood elevations
- Assumes no changes to the existing structure alignment/skew



Option 3: Typical Section

For options 1 through 3, E-Stone, Type III will need to be used to grade the channel through the respective structures. Stone Fill, Type III shall be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet.

If the Existing crossing were to be slip- or spray lined and retrofitted with baffles, fish passage standards may be met. Based on the field visit with ANR, this crossing appears to be a viable candidate for rehabilitation. ANR has stated that they will revisit the site this summer with Fish and Wildlife to further determine the effectiveness of a retrofit option.

Options 1 through 3 meet or surpass the current hydraulic standards, as well as minimum bankfull width criteria.

A preliminary scour analysis was performed as part of this study for Options 1 and 3 assuming a D50 of 1-mm. Based on the analysis a contraction scour depth of 4-ft was computed. However, for preliminary design assume that the bottom of footing elevation is 6-ft below the streambed or founded on ledge. A final scour analysis and countermeasure design will be performed during final design. If Option 1 or 3 is chosen as the preferred alternative, streambed grab samples are suggested to be obtained at the following depths: 0-1 foot and 1-2 feet below the stream bed.

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., P.I.I.T. Project Manager

AJA

From: August Arles, Geotechnical Engineer

Date: July 1st, 2021

Subject: Coventry BF 0251(49) Preliminary Geotechnical Information

1.0 INTRODUCTION

As requested, we have completed our preliminary geotechnical investigation for Bridge No. 132 on VT Route 14 over Stony Brook as part of the Coventry BF 0251(49) project. Bridge No. 132, an 8-foot diameter steel pipe culvert, is located approximately 2.0 miles north from the intersection of VT Route 14 and US Route 5 in the town of Coventry, VT. This review included a subsurface investigation, the examination of well log data, hazardous site information on file at the Vermont Agency of Natural Resources (ANR), as well as published surficial and bedrock geologic maps. The subject project is currently in the scoping phase.

2.0 SUBSURFACE INFORMATION

2.1 Published Geologic Data

Mapping conducted in 1970 for the Surficial Geologic Map of Vermont shows the project site consists of postglacial fluvial deposits consisting of alluvium (Doll, 1970).

According to the Bedrock Map of Vermont from 2011, published by the USGS and State of Vermont, the project site is underlain with bedrock consisting of metasandstone and metalimestone of the Waits River Formation (Ratliffe, et. al, 2011).

2.2 Water Well Logs

The Vermont ANR maintains a record of private and public wells drilled in their Atlas database. Published online, these logs may provide general characteristics of the soil strata and depth to bedrock in the area. The three closest logs of wells WRN 63, WRN 73 and TAG 45635 were located approximately 640 feet (ft), 700 ft, and 930 ft from the project site, respectively, and reported bedrock at depths of 130 ft, 143 ft, and 70 ft, respectively.

2.3 Hazardous Materials and Underground Storage Tanks

The ANR Atlas also maintains a database of all known hazardous waste sites and underground storage tanks. According to their published data there are no sites located within a 0.5-mile radius of the project, and the location of the project is not on the Hazardous Site List. No impact from other hazardous waste sites is anticipated.

2.4 Record Plans

A review of historical record plans was also a part of this investigation; however, no record plans were available for this project.

3.0 FIELD INVESTIGATION

A field investigation was conducted between June 14th, 2021, and June 15th, 2021. Two standard penetration borings were advanced near the inlet and outlet of the existing structure to evaluate the subsurface profile and aid in design and construction of a replacement structure. During drilling operations, split spoon samples and standard penetration tests (SPT) were taken continuously until 15 feet (ft) below ground surface (bgs), and then at 5 ft intervals from a depth of 20 ft to 25 ft bgs. Both borings were terminated at a depth of 27 ft bgs.

4.0 SOIL PROFILE

The field investigation indicates that the soil strata of the project site generally consist of medium dense to very dense granular soils consisting primarily of sandy gravel and gravelly sand. Cobbles and boulders were encountered in one of the borings from a depth of 8 feet (ft) below ground surface (bgs) to about 10 ft bgs. No bedrock was encountered in either of the borings.

5.0 RECOMMENDATIONS

Based on this information, possible foundation options for a culvert replacement at a similar elevation as the existing structure include the following:

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

When a design alternative as well as a preliminary alignment has been chosen, the Geotechnical Engineering Section can review the preferred alternative and assist with any further geotechnical analyses and review of foundation elements required.

If you have any questions or would like to discuss this report, please contact us via email.

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 6/18/21.

Reviewed by: Stephen Madden, Geotechnical Engineer SPM

cc: Electronic Read File/MG
Project File/CEE
AJA

Appendix F: Resource ID Completion Memo

OFFICE MEMORANDUM

AOT - PDB - ENVIRONMENTAL SECTION

RESOURCE IDENTIFICATION COMPLETION MEMO

TO: Laura Stone, Project Manager
FROM: Lee Goldstein, Environmental Specialist
DATE: June 23, 2021
Project: **Coventry BF 0251(49)-21B025; VT Route 14, BR 132 spanning Stony Brook**

ENVIRONMENTAL RESOURCES:

	Yes	No	
Archaeological Resources:		X	See Archaeological Resource Assessment (ARA) dated 06/18/2021
Historic Resources:		X	See Historic Resource ID Memo (06/18/21) and Survey (06/07/21)
Wetlands:	X		See Natural Resource Evaluation dated 06/22/2021
Aquatic Organism Passage:	X		See Natural Resource ID Memo
Agricultural Soils:		X	See Natural Resource Evaluation dated 06/22/2021
Wildlife Habitat:	X		See Natural Resource Evaluation dated 06/22/2021
Endangered Species:	X		See Natural Resource Evaluation dated 06/22/2021
Stormwater Considerations:		X	See Stormwater Resource ID Memo dated 06/11/2021
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 proposed over the Stony Brook; any impacts in or along the Brook will require a Title 19 Consultation.
US Coast Guard:		X	
Lakes and Ponds:	X		Stony Brook to Black River to Lake Memphremagog
Other:		X	

cc:
Project File

Appendix G: Natural Resources Memo

Natural Resource Evaluation

Vermont Agency of Transportation
Coventry BF 0251(49)
Vermont Route 14
Coventry, Vermont

June 22, 2021

Prepared for:
Vermont Agency of Transportation
219 North Main Street
Barre, VT 05641

Prepared by:
Bear Creek Environmental, LLC
Natural Resource Services Team
131 Elm Street, Suite 1
Montpelier, VT 05602

Table of Contents

1.0 EXECUTIVE SUMMARY

- During Spring 2021, the Bear Creek Environmental (BCE) Natural Resource Services Team conducted a natural resource assessment of a 3.6 acre area surrounding a culvert on Vermont Route 14 in Coventry for the Vermont Agency of Transportation (VTrans).

- The BCE team conducted mapping exercises to identify pertinent natural resources within and surrounding the study area. In addition to these desktop analyses, the team also conducted a field survey to evaluate wetlands.

- Bear Creek Environmental delineated several small Class II wetlands and one Class III wetland within the study area. A site visit was performed on June 16, 2021 with District Wetland Ecologist, Shannon Morrison, to confirm the wetland boundaries. A functional evaluation was prepared for the wetland complex following procedures set forth by the State of Vermont Wetlands Program.

- The culvert within the study area conveys Stony Brook, a tributary to the Black River. The Black River flows into Lake Memphremagog. Stony Brook is a valuable fishery providing year-round habitat for resident Brook Trout and Rainbow Trout, as well as providing important spawning and rearing habitat for Lake Memphremagog steelhead. The District Fisheries Biologist with the Vermont Fish and Wildlife Department has recommended a structure with full aquatic organism passage for this site.

- There are no records of federally listed or state-listed animal species within the project area. The project area was not evaluated for RTE bat presence or potential habitat presence; however, it is possible that the Little Brown Bat (state-endangered) and/or Northern Long-eared Bat (state-endangered, federally threatened) could be found in the vicinity of the project.

- Impacts to Class II wetlands and their 50-foot buffer zones should be avoided whenever possible in accordance with the Vermont Wetland Rules. Culvert replacement at the site provides an opportunity to improve fish and wildlife habitat connectivity through a new structure.

2.0 BACKGROUND

The Bear Creek Environmental Natural Resource Services Team was retained by the Vermont Agency of Transportation (VTrans) to evaluate wetland and wildlife resources in the vicinity of a culvert under Vermont Route 14 in Coventry. The culvert conveys flow from Stony Brook from northeast to southwest under Route 14. The site is located at the intersection with Blake Road at mile marker 2.1 on VT-14 in Coventry. An area roughly 3.6 acres in size adjacent to the culvert was evaluated for the presence of wetlands. The location of the study area is shown on a map on page 1 of the Attachment.

Vermont Route 14 is classified by VTrans as a Major Collector roadway. This classification is based on the function of the roadway and the proximity of other nearby roadways. Major Collectors gather traffic from local roads and connect them to the Arterial network (USDOT, 2013). Route 14 runs roughly 110 miles north-south from the New Hampshire border in White River Junction to the intersection with Route 100 in Newport Town.

Assessment work included remote sensing analysis to evaluate resources at and in the vicinity of the project site. The results of this analysis are portrayed on a map on page 2 of the Attachment. A desktop analysis of wildlife connectivity was performed, in addition to a field wetland delineation.

3.0 WETLANDS

The Vermont Significant Wetlands Inventory (VSWI) dataset provides a statewide tool for identifying wetlands through geospatial analysis. This dataset indicates the presence of significant wetlands within the southwestern quadrant of the study area. On May 27, 2021 and June 1, 2021, Alex Marcucci and Mary Nealon of Bear Creek Environmental visited the site to delineate jurisdictional wetlands and to perform a functional evaluation of the wetlands. The delineation was performed in accordance with the methods described in the manual prepared by the US Army Corps of Engineers dated 2012 and titled "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region". The locations of wetlands were documented in the field using a submeter GPS unit, and a functional evaluation was performed. Wetlands were delineated through field observations of soils, vegetation, and hydrology. A site visit with District Wetlands Ecologist, Shannon Morrison, was performed on June 16, 2021 at the Coventry site. Morrison reviewed the delineation and classification of wetlands at the site. The results of the wetland delineation are portrayed on a map on page 3 of the Attachment.

Several wetlands were identified within the study area boundary. The total size of wetlands delineated within the 3.6 acre study area is 0.67 acres. Most of the wetlands continue outside of the study area boundary, where mapping did not occur, and all are classified as Class II, with the exception of Wetland B, which is in an isolated depression west of Route 14 (Class III).

Class II wetlands are protected under the Vermont Wetland Rules. As such, impacts to Class II wetlands and their 50-foot buffer zones should be avoided whenever possible, in accordance with the rules. If impacts cannot be avoided, they should be minimized. Mitigation may be required for unavoidable wetland impacts to replace impacted functions and values (VANR, 2018).

The wetlands were identified using the codes of wetland cover types in the United States Fish and Wildlife Service document titled Classification of Wetlands and Deepwater Habitats of the United States 2nd Edition (1.4MB PDF), 2013, by Cowardin, Lewis M. et al. (FGDC, 2013). In the Cowardin system, wetlands are categorized first by landscape position (tidal, riverine, lacustrine, and palustrine), followed by cover type (cover types described below), and then by hydrologic regime (ranging from saturated or temporarily-flooded to permanently flooded).

The wetlands at the project site are palustrine. Palustrine wetlands are defined using the system as nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens. Wetlands identified at the site fell into the following categories: Palustrine Emergent (PEM), which is defined as wetlands in which emergent plants are the tallest life form with at least 30% areal coverage, and Palustrine Scrub-Shrub (PSS), defined as wetlands in which woody plants less than 6 m or 20 ft tall are dominant (at least 30% areal coverage). Wetland characteristics are described below, with wetlands grouped together based on similarities in community type.

Wetland A and Wetland B

Wetlands A and B are primarily PEM, with one area of PSS in Wetland A. These wetlands exhibited the secondary hydrology indicators of Geomorphic Position and FAC-Neutral Test. Vegetation was dominated by reed canary grass, sensitive fern, and Bebb's willow (Figure 1).

Figure 1. Wetland A (May 27, 2021).

Wetland C and Wetland D

Wetlands C and D are primarily PSS with areas of PEM. These wetlands exhibited the secondary hydrology indicators of Geomorphic Position and FAC-Neutral Test. Vegetation was dominated by speckled alder, wrinkle-leaf goldenrod, and tall meadow rue (Figure 2).

The wetland complex as a whole was found to have the following functions and values: flood water and storm runoff, surface and groundwater protection, fish habitat, wildlife habitat, recreational value and economic benefits, open space and aesthetics, and erosion control through binding and stabilizing the soil. Data forms and the functional evaluation for the wetland are provided on pages 4 through 26 of the Attachment.

Figure 2. Wetland D (May 27, 2021).

4.0 STREAM RESOURCES

The culvert within the Coventry BF 0251(49) study area conveys water from Stony Brook. Stony Brook flows southerly along VT Route 14/VT 105 to meet the Black River, which then flows northeasterly into Lake Memphremagog. The drainage area at the culvert within the study area is approximately 4.7 square miles. Fisheries data from the Vermont Department of Environmental Conservation (VTDEC) and the Vermont Fish and Wildlife Department (VDFW) are available for Stony Brook in the vicinity of Blake Road.

Based on records for the VTDEC, Stony Brook scored "Very Good" using the mixed water index of biotic integrity (MWIBI) based on electrofishing conducted in September 2009, just upstream of Spencer Hill on Route 14 (River Mile 1.8). The fish community included Rainbow Trout, Brook Trout, Slimy Sculpin, Creek Chub and Pumpkinseed.

According to Jud Kratzer, District Fisheries Biologist with the Vermont Fish and Wildlife Department (VFWD) (email communication dated 6/17/21), "Stony Brook is one of the most important spawning and rearing tributaries for Lake Memphremagog steelhead." Based on the Department's most recent sampling, which was conducted downstream of the RT 14 culvert near Blake Road, Brook trout was also present, but they did not find brown trout. Kratzer advocated strongly for aquatic organism passage at the Coventry BF 0251(49) site in his email communication of June 17, 2021 (page 27 and 28 of Attachment).

The VTDEC Structures Database was used to determine the number of river miles that could be opened up on Stony Brook, if the current structure on Route 14, near Blake Road were replaced with one that provided full aquatic organism passage (AOP). The AOP coarse screen of structures on Stony Brook and the northern tributary, above the study area, indicate none of the culverts provide full AOP, as shown on the map on page 29 of the Attachment.

The Route 14 culvert near Blake Road was assigned a rating of reduced AOP, due to the lack of material throughout the bottom of the culvert. The culvert bottom is deteriorated and in poor condition. Photographs of the culvert are provided on page 30 of the Attachment.

The closest culvert to the structure near Blake Road is on Nedeau Park Road. The Nedeau Park also received a rating of reduced AOP. If the Route 14 culvert near Blake Road were to be replaced with one that provided full AOP, it would open up approximately 0.6 miles of stream.

5.0 WILDLIFE RESOURCES

A remote sensing review of wildlife resources was performed by Bear Creek Environmental for the Route 14 study site. The study involved a review of historic occurrences of rare, threatened, and endangered (RTE) species in the vicinity of the project site, as well as an assessment of wildlife connectivity.

Several rare, threatened, or endangered species have been documented within a two mile radius of the project site. The closest occurrence, about ¼ mile south of the project site, is a 2016 sighting of the uncommon Wood Turtle (S3, high priority species of greatest conservation need). Additionally, the Greater Redhorse has been documented in the Black River roughly ¾ miles east of the project site, within the reach above where Stony Brook flows into the Black River. Approximately 1 mile east of the project site, Woodland Cudweed (S2) has been documented in an upland coniferous forest (1998). An Upland Sand Piper was observed roughly 1.5 miles east of the project site in 1989. The project area was not evaluated for RTE bat presence or potential habitat presence; however, it is possible that the Little Brown Bat (state-endangered) and/or Northern Long-eared Bat (state-endangered, federally threatened) could be found in the vicinity of the project.

The Vermont Conservation Design database on the Vermont Agency of Natural Resources BioFinder Mapping Tool was reviewed to assess landscape scale wildlife habitat. The results of this review are presented on page 31 of the Attachment. The stream crossing location is ranked as highest priority for the following categories: surface water and riparian areas and physical landscape diversity. Additionally, lands adjacent to the site on the eastern side of Route 14 have been identified as priority connectivity blocks and lands to the west of Route 14 as priority interior forest and connectivity blocks. The location of this stream crossing offers a corridor between areas of relatively undeveloped forest land. Development is denser both to the north and south of the study site.

At present, the Route 14 culvert does not facilitate wildlife movement. The culvert at the site is undersized and has a large plunge pool at the outlet. Replacing the culvert with a larger box culvert with natural substrate that is 1.5 times bankfull width could enhance wildlife movement.

References

Federal Geographic Data Committee (FGDC). 2013. Classification of Wetlands and Deepwater Habitats of the United States. Second Edition. Available at: https://www.fws.gov/wetlands/documents/Classification-of-Wetlands-and-Deepwater-Habitats-of-the-United-States-2013.pdf

U.S. Army Corps of Engineers. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region. Available at: https://usace.contentdm.oclc.org/utils/getfile/collection/p266001coll1/id/7640

U.S. Department of Transportation (USDOT), Federal Highway Administration. 2013. Highway Functional Classification Concepts, Criteria and Procedures. Available at: https://www.fhwa.dot.gov/planning/processes/statewide/related/highway_functional_classifications/fcauab.pdf

Vermont Agency of Natural Resources (VANR). 2018. Department of Environmental Conservation, Watershed Management Division – Wetlands Program. Guidance for Determining Wetland Jurisdiction. Available at: http://dec.vermont.gov/sites/dec/files/wsm/wetlands/docs/wl_ClassificationGuidance.pdf

Vermont Agency of Transportation (VTrans). 2016. Map Showing Functional Classification of Vermont Highways. Available at: ftp://vtransmaps.vermont.gov/Maps/Publications/Maps/FunctionalClassMaps/RuralFunclStatewide_2016.pdf

Geospatial and remote sensing data sources include:

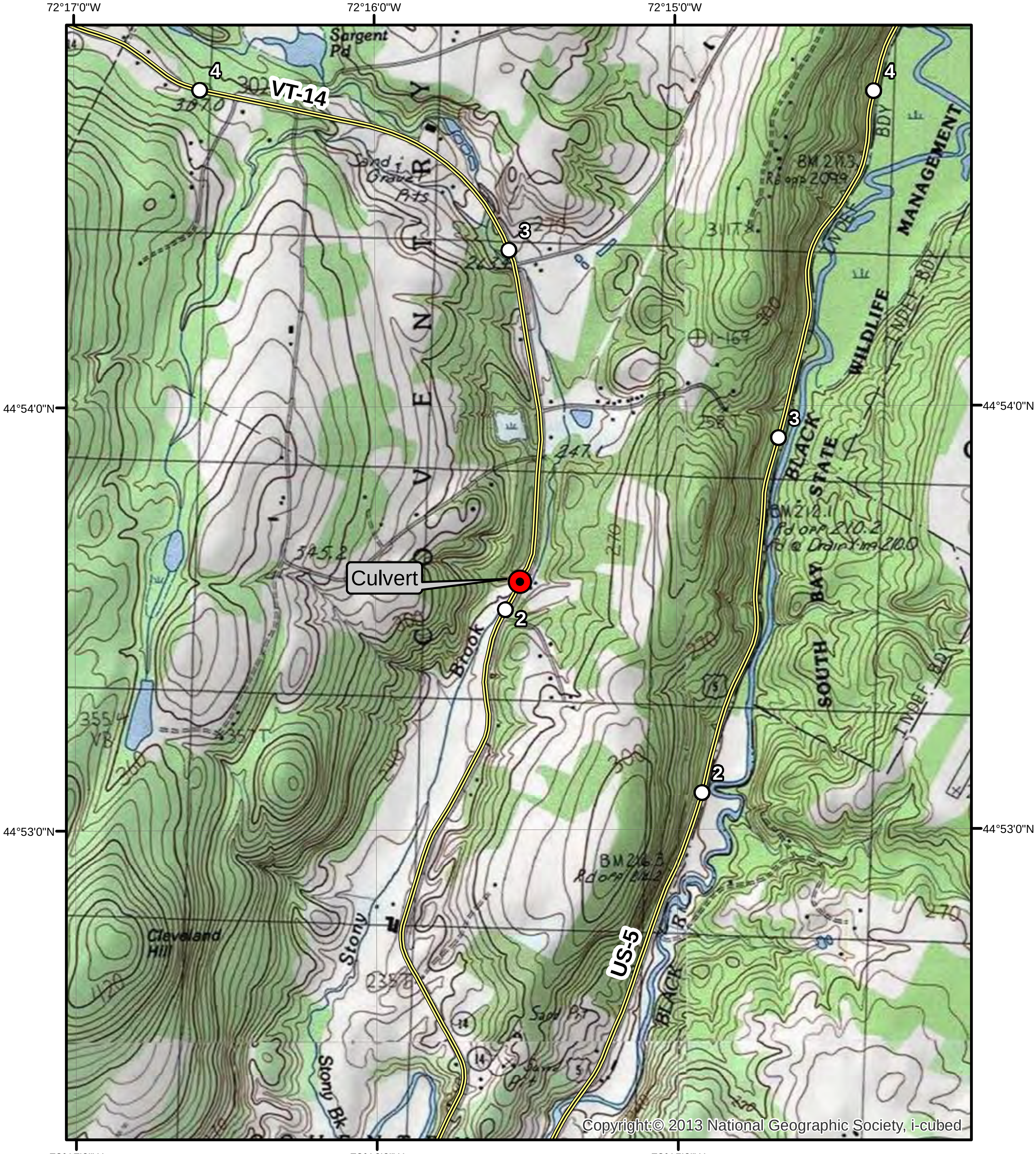
Vermont Agency of Natural Resources (VANR). 2020. BioFinder Mapping Tool. Available at: https://anrmaps.vermont.gov/websites/BioFinder/

Vermont Agency of Natural Resources (VANR). 2020. Natural Resources Atlas. Available at: http://anrmaps.vermont.gov/websites/anra5/

Vermont Center for Geographic Information (VCGI). Data available at: http://gis.vtanr.opendata.arcgis.com/

Attachment

Project Location Map for Coventry BF 0251(49)
Vermont Route 14
Coventry, Vermont



Legend

Mile Marker

Major Road

0 1,000 2,000 Feet

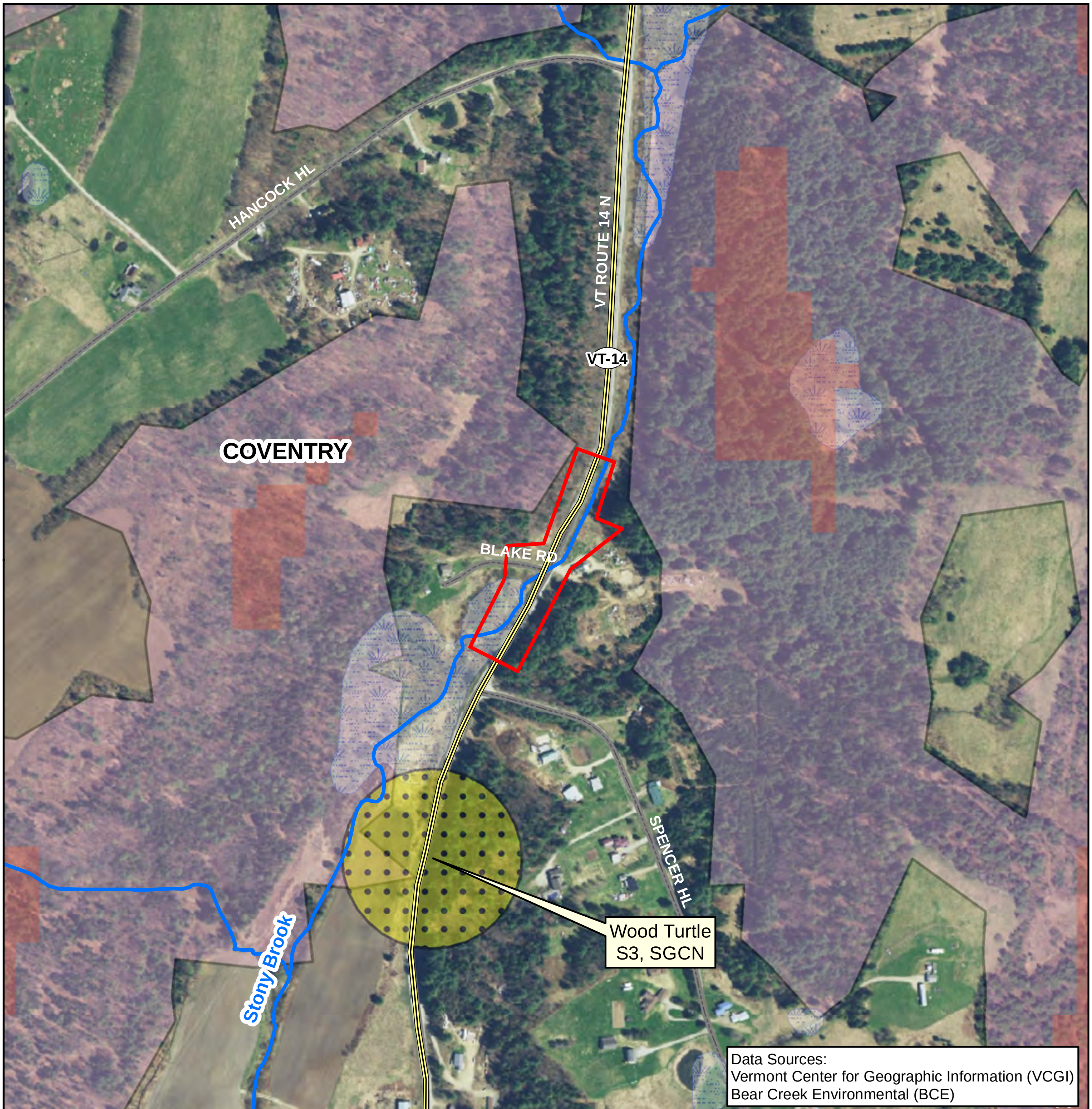
1 inch = 2,000 feet

N

Data sources include:
Vermont Center for Geographic Information (VCGI)

Map composed on June 15, 2021.

Bear Creek Environmental



Resource Map - Ecological

Vermont Agency of Transportation
Coventry BF 0251(49)
Vermont Route 14
Coventry, VT
Orleans County

Bear Creek Environmental

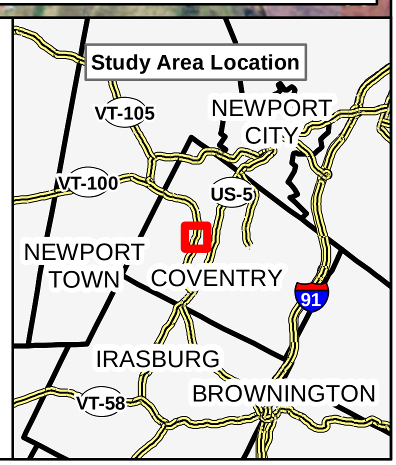
Legend

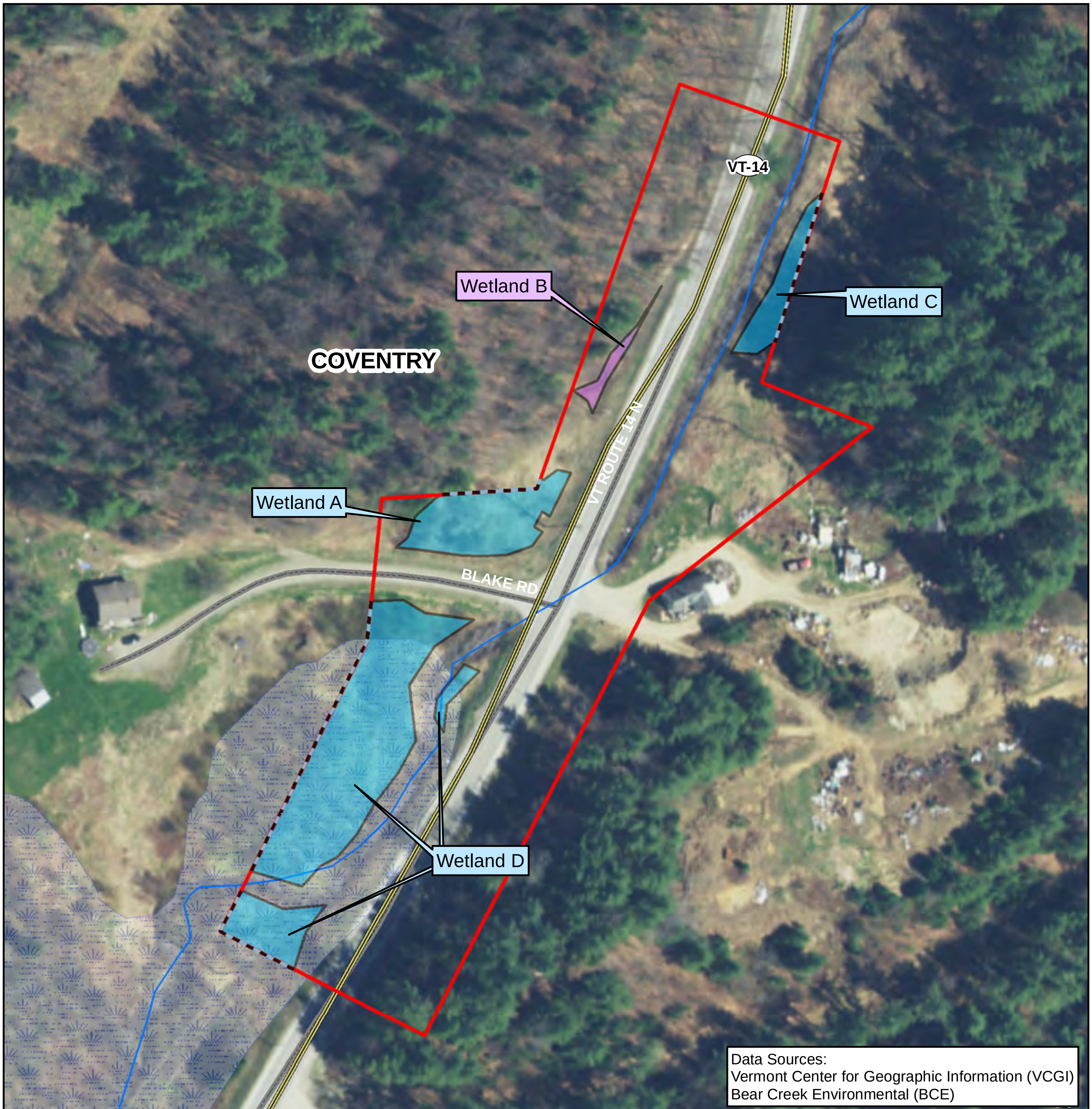
- Study Area
- VHD Stream
- Deer Wintering Area
- RTE Species
- Core Habitat
- Vermont Sig. Wetland Inventory
- Habitat Block
- Major Road
- Road

0 125 250 500 Feet

N

Map composed May 12, 2021.





Data Sources:
Vermont Center for Geographic Information (VCGI)
Bear Creek Environmental (BCE)

Resource Map - Field Delineated Wetlands

Vermont Agency of Transportation
Coventry BF 0251(49)
Vermont Route 14
Coventry, VT
Orleans County

Bear Creek Environmental

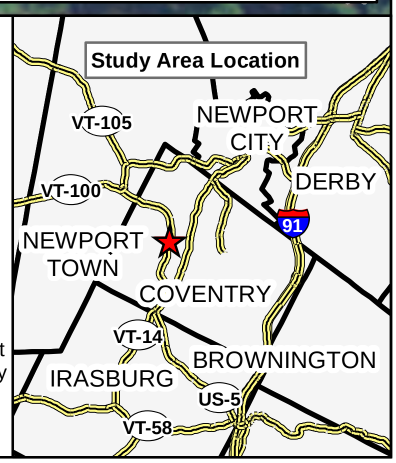
Legend

Study Area
Field Delineated Wetland
Class II
Class III
Major Road
VHD Stream
Vermont Sig. Wetland Inventory
Road

0 37.5 75 150 Feet

N

A wetland delineation was performed in accordance with the methods described in the manual prepared by the US Army Corps of Engineers dated 2012 and titled "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region". Wetland delineation performed on May 27, 2021 & June 1, 2021. Wetland delineation and classification were verified by Shannon Morrison, District Ecologist with the VT Wetlands Program at a site visit on June 16, 2021. Field delineated wetlands continue beyond the study area boundary, but mapping only occurred within the study area. Wetlands that extend farther are shown with an open boundary (dotted line). Map composed on June 8, 2021. Updated June 17, 2021.



WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: VTrans Coventry BF 0251(49) City/County: Coventry/Orleans Sampling Date: 5/27/21

Applicant/Owner: Vtrans State: VT Sampling Point: A/B wet

Investigator(s): Alex Marcucci, Mary Nealon Section, Township, Range: ______

Landform (hillside, terrace, etc.): depression Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR or MLRA): LRR R Lat: 44.893243 Long: -72.258768 Datum: WGS 1984

Soil Map Unit Name: Rumney fine sandy loam, 0-3% slopes, frequently flooded NWI classification: PEM/PSS

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___ , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___	**Is the Sampled Area**
Hydric Soil Present?	Yes X	No ___	**within a Wetland?** **Yes** X **No** ___
Wetland Hydrology Present?	Yes X	No ___	If yes, optional Wetland Site ID: ______

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)	___ Water-Stained Leaves (B9)	
___ High Water Table (A2)	___ Aquatic Fauna (B13)	
___ Saturation (A3)	___ Marl Deposits (B15)	
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)	
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)	
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)	
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)	
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)	
___ Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)	
___ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes ___	No x	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No x	Depth (inches): ___

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: A/B wet

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Salix bebbiana*	20	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	20	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Phalaris arundinacea*	70	Yes	FACW
2. *Onoclea sensibilis*	30	Yes	FACW
3. *Solidago canadensis*	10	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	110	=Total Cover	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	120	x 2 =	240
FAC species	0	x 3 =	0
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	130 (A)		280 (B)

Prevalence Index = B/A = 2.15

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: A/B wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/2	95	7.5YR 4/6	5	C	M	Loamy/Clayey	
8-16+	2.5Y 3/2	85	7.5YR 4/6	15	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)

___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: none

Depth (inches): N/A

Hydric Soil Present? **Yes** X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: VTrans Coventry BF 0251(49) City/County: Coventry/Orleans Sampling Date: 5/27/21

Applicant/Owner: Vtrans State: VT Sampling Point: A/Bup

Investigator(s): Alex Marcucci, Mary Nealon Section, Township, Range: ____

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): convex Slope (%): 5

Subregion (LRR or MLRA): LRR R Lat: 44.893330 Long: -72.258770 Datum: WGS 1984

Soil Map Unit Name: Rumney fine sandy loam, 0-3% slopes, frequently flooded NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: A/Bup

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Malus*	5	Yes	
2.			
3.			
4.			
5.			
6.			
7.			
	5	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Salix bebbiana*	20	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	20	=Total Cover	
Herb Stratum (Plot size: 5)			
1. Unknown grasses	65	Yes	
2. *Galium mollugo*	30	Yes	FACU
3. *Phalaris arundinacea*	10	No	FACW
4. *Solidago canadensis*	5	No	FACU
5. *Taraxacum officinale*	5	No	FACU
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	115	=Total Cover	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:	
OBL species	0	x 1 =	0
FACW species	30	x 2 =	60
FAC species	0	x 3 =	0
FACU species	40	x 4 =	160
UPL species	0	x 5 =	0
Column Totals:	70 (A)		220 (B)

Prevalence Index = B/A = 3.14

Hydrophytic Vegetation Indicators:

__ 1 - Rapid Test for Hydrophytic Vegetation

__ 2 - Dominance Test is >50%

__ 3 - Prevalence Index is ≤3.0[1]

__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** __ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: A/Bup

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12+	10YR 3/4	100					Sandy	Sand and gravel

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: VTrans Coventry BF 0251(49) City/County: Coventry/Orleans Sampling Date: 5/27/21

Applicant/Owner: Vtrans State: VT Sampling Point: D/Cwet

Investigator(s): Alex Marcucci, Mary Nealon Section, Township, Range: ____

Landform (hillside, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR or MLRA): LRR R Lat: 44.892153 Long: -72.259587 Datum: WGS 1984

Soil Map Unit Name: Rumney fine sandy loam, 0-3% slopes, frequently flooded NWI classification: PSS

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ___	**Is the Sampled Area**	
Hydric Soil Present? Yes X No ___	**within a Wetland?**	**Yes** X **No** ___
Wetland Hydrology Present? Yes X No ___	If yes, optional Wetland Site ID: ___	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)	___ Water-Stained Leaves (B9)	
___ High Water Table (A2)	___ Aquatic Fauna (B13)	
___ Saturation (A3)	___ Marl Deposits (B15)	
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)	
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)	
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)	
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)	
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)	
___ Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)	
___ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes ___	No x	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No x	Depth (inches): ___

Wetland Hydrology Present? Yes X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: D/Cwet

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Alnus incana*	40	Yes	FACW
2. *Cornus alternifolia*	5	No	FACU
3.			
4.			
5.			
6.			
7.			
	45	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Solidago rugosa*	30	Yes	FAC
2. *Thalictrum pubescens*	30	Yes	FACW
3. *Clematis virginiana*	5	No	FAC
4. *Rubus idaeus*	5	No	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	70	=Total Cover	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	70	x 2 =	140
FAC species	35	x 3 =	105
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	115 (A)		285 (B)

Prevalence Index = B/A = 2.48

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: D/Cwet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/3	100					Loamy/Clayey	
6-13	10YR 3/2	60	7.5YR 4/6	40	CS	M	Loamy/Clayey	loam w gravel - iron around gravel
13-15+	10YR 3/2	90	7.5YR 4/6	10	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
_X_ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** _X_ **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: VTrans Coventry BF 0251(49) City/County: Coventry/Orleans Sampling Date: 6/1/21

Applicant/Owner: Vtrans State: VT Sampling Point: D/C up

Investigator(s): Alex Marcucci, Mary Nealon Section, Township, Range: ______

Landform (hillside, terrace, etc.): hillside of fill Local relief (concave, convex, none): none Slope (%): 40

Subregion (LRR or MLRA): LRR R Lat: 44.892182 Long: -72.259470 Datum: WGS 1984

Soil Map Unit Name: Rumney fine sandy loam, 0-3% slopes, frequently flooded NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID: ______

Remarks: (Explain alternative procedures here or in a separate report.)
road embankment - soil is fill

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)	___ Water-Stained Leaves (B9)	
___ High Water Table (A2)	___ Aquatic Fauna (B13)	
___ Saturation (A3)	___ Marl Deposits (B15)	
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)	
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)	
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)	
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)	
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)	
___ Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)	
___ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: D/C up

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Galium mollugo*	50	Yes	FACU
2. *Solidago rugosa*	15	Yes	FAC
3. *Unidentifiable grasses*	10	No	
4. *Solidago gigantea*	5	No	FACW
5. *Equisetum arvense*	5	No	FAC
6. *Taraxacum officinale*	5	No	FACU
7. *Rubus idaeus*	5	No	FACU
8. *Ranunculus acris*	5	No	FAC
9.			
10.			
11.			
12.			
	100	=Total Cover	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	25	x 3 =	75
FACU species	60	x 4 =	240
UPL species	0	x 5 =	0
Column Totals:	90 (A)		325 (B)

Prevalence Index = B/A = 3.61

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: D/C up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10+	10YR 4/3	100					Sandy	Sand with gravel (rd embankment fill)

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth (inches): ____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

VERMONT WETLAND EVALUATION FORM

Project Name: VTrans Coventry BF0251(49) Project #:

Date: May 27 & June 1, 2021 Investigator: Alex Marcucci and Mary Nealon

SUMMARY OF FUNCTIONAL EVALUATION:
Each function gets a score of 0= not present; L = Low; P = Present; or H = High.

1. Water Storage for Flood Water and Storm Runoff	H	**6. Rare, Threatened, and Endangered Species Habitat**	0
2. Surface & Ground Water Protection	H	**7. Education and Research in Natural Sciences**	0
3. Fish Habitat	P	**8. Recreational Value and Economic Benefits**	P
4. Wildlife Habitat	H	**9. Open Space and Aesthetics**	P
5. Exemplary Wetland Natural Community	0	**10. Erosion Control through Binding and Stabilizing the Soil**	P

Note:

- ***When to use this form:*** This is a field form to help you compile data needed to evaluate the 10 possible functions and values of a wetland as described in the Vermont Wetland Rules. All information in this form is replicated in the applications for both wetland determinations and wetland permits.
- ***Both a desktop review and field examination*** should be employed to accurately determine surrounding land use, hydrology, hydroperiod, vegetation, position in the landscape, and physical attributes.
- ***The entire wetland or wetland complex*** in question must be evaluated to determine the level of function in all ten (10) categories for accurate classification. A wetland complex can be defined as a series of interconnected wetland types.
- ***The surrounding upland and outflow area*** of the wetland should be examined to determine land use, development, nearby natural resources, and hydrology. The surrounding land use, previous development, and cumulative impacts may play a role in the current function of the wetland. For best results please read all descriptions prior to scoring activity.
- ***Evaluation***: The first portion in each section determines whether the wetland does or does not provide the function. If none of the conditions listed in the first section are met, proceed

to the next section. If any of these conditions are met, determine if the wetland provides this function at a higher or lower level based on the information listed in the subsequent sections.

- ***Presumptions:*** Please note that many wetlands are already presumed to be significant under the Vermont Wetland Rules. A wetland is presumed to be significant if:
    - The wetland is mapped on the VSWI map
    - The wetland is contiguous to a VSWI mapped wetland
    - The wetland meets the presumptions of significance under Section 4.6
    - The wetland has a preliminary determination that it is Class II

1. Water Storage for Flood Water and Storm Runoff

☒ Function is present and likely to be significant: Any of the following physical and vegetative characteristics indicate the wetland provides this function.

- ☒ Constricted outlet or no outlet and an unconstricted inlet.
- ☒ Physical space for floodwater expansion and dense, persistent, emergent vegetation or dense woody vegetation that slows down flood waters or stormwater runoff during peak flows and facilitates water removal by evaporation and transpiration.
- ☒ If a stream is present, its course is sinuous and there is sufficient woody vegetation to intercept surface flows in the portion of the wetland that floods.
- ☒ Physical evidence of seasonal flooding or ponding such as water stained leaves, water marks on trees, drift rows, debris deposits, or standing water.
- ☐ Hydrologic or hydraulic study indicates wetland attenuates flooding.

If any of the above boxes are checked, the wetland provides this function. Complete the following to determine if the wetland provides this function above or below a moderate level:

☐ Check box if any of the following conditions apply that may indicate the wetland provides this function at a *lower* level.

- ☐ Significant flood storage capacity upstream of the wetland, and the wetland in question provides this function at a negligible level in comparison to upstream storage (unless the upstream storage is temporary such as a beaver impoundment).
- ☐ Wetland is contiguous to a major lake or pond that provides storage benefits independently of the wetland.
- ☐ Wetland's storage capacity is created primarily by recent beaver dams or other temporary structures.
- ☐ Wetland is very small in size, not contiguous to a stream, and not part of a collection of small wetlands in the landscape that provide this function cumulatively.

☒ Check box if any of the following conditions apply that may indicate the wetland provides this function at a *higher* level.

- ☐ History of downstream flood damage to public or private property.
- ☒ Any of the following conditions present downstream of the wetland, but upstream of a major lake or pond, could be impacted by a loss or reduction of the water storage function.
  - ☐ 1. Developed public or private property.
  - ☒ 2. Stream banks susceptible to scouring and erosion.
  - ☒ 3. Important habitat for aquatic life.
- ☒ The wetland is large in size and naturally vegetated.

☐ Any of the following conditions present upstream of the wetland may indicate a large volume of runoff may reach the wetland.

- ☐ 1. A large amount of impervious surface in urbanized areas.
- ☐ 2. Relatively impervious soils.
- ☐ 3. Steep slopes in the adjacent areas.

2. Surface and Ground Water Protection

☒ Function is present and likely to be significant: Any of the following physical and vegetative characteristics indicate the wetland provides this function.

- ☒ Constricted or no outlets.
- ☒ Low water velocity through dense, persistent vegetation.
- ☒ Hydroperiod permanently flooded or saturated.
- ☒ Wetlands in depositional environments with persistent vegetation wider than 20 feet.
- ☐ Wetlands with persistent vegetation comprising a defined delta, island, bar or peninsula.
- ☐ Presence of seeps or springs.
- ☒ Wetland contains a high amount of microtopography that helps slow and filter surface water.
- ☐ Position in the landscape indicates the wetland is a headwaters area.
- ☒ Wetland is adjacent to surface waters.
- ☐ Wetland recharges a drinking water source.
- ☐ Water sampling indicates removal of pollutants or nutrients.
- ☐ Water sampling indicates retention of sediments or organic matter.
- ☐ Fine mineral soils and alkalinity not low.
- ☐ The wetland provides an obvious filter between surface water or ground water and land uses that may contribute point or nonpoint sources of sediments, toxic substances or nutrients to the wetland, such as: steep erodible slopes; row crops; dumps; areas of pesticide, herbicide or fertilizer application; feed lots; parking lots or heavily traveled road; and septic systems.

If any of the above boxes are checked, the wetland provides this function. Complete the following to determine if the wetland provides this function above or below a moderate level.

☐ Check box if any of the following conditions apply that may indicate the wetland provides this function at a *lower* level.

- ☐ Presence of dead forest or shrub areas in sufficient amounts to result in diminished nutrient uptake.

- ☐ Presence of ditches or channels that confine water and restrict contact of water with vegetation.
- ☐ Wetland is very small in size, not contiguous to a stream, and not part of a collection of small wetlands in the landscape that provide this function cumulatively.
- ☐ Current use in the wetland results in disturbance that compromises this function.

☒ Check box if any of the following conditions apply that may indicate the wetland provides this function at a *higher* level.

- ☐ The wetland is adjacent to a well head or source protection area, and provides ground water recharge.
- ☐ The wetland provides flows to Class A surface waters.
- ☐ The wetland contributes to the protection or improvement of water quality of any impaired waters.
- ☒ The wetland is large in size and naturally vegetated.

3. Fish Habitat

☒ Function is present and likely to be significant: Any of the following physical and vegetative characteristics indicate the wetland provides this function.

- ☒ Contains woody vegetation that overhangs the banks of a stream or river and provides any of the following: shading that controls summer water temperature; cover including refuges created by overhanging branches or undercut banks; source of terrestrial insects as fish food; or streambank stability.
- ☒ Provides spawning, nursery, feeding or cover habitat for fish (documented or professionally judged). Common habitat includes deep marsh and shallow marsh associates with lakes and streams, and seasonally flooded wetlands associated with streams and rivers.
- ☐ Documented or professionally judged spawning habitat for northern pike.
- ☐ Provides cold spring discharge that lowers the temperature of receiving waters and creates summer habitat for salmonoid species.
- ☐ The wetland is located along a tributary that does not support fish, but contributes to a larger body of water that does support fish. The tributary supports downstream fish by providing cooler water, and food sources.

4. Wildlife Habitat

[X] Function is present and likely to be significant: Any of the following physical and vegetative characteristics indicate the wetland provides this function.

- [ ] Provides resting, feeding staging or roosting habitat to support waterfowl migration, and feeding habitat for wading birds. Good habitats for these species include open water wetlands.
- [ ] Habitat to support one or more breeding pairs or broods of waterfowl including all species of ducks, geese, and swans. Good habitats for these species include open water habitats adjacent shallow marsh, deep marsh, shrub wetland, forested wetland, or naturally vegetated buffer zone.
- [ ] Provides a nest site, a buffer for a nest site or feeding habitat for wading birds including but not limited to: great blue heron, black-crowned night heron, green-backed heron, cattle egret, or snowy egret. Good habitats for these species include open water or deep marsh adjacent to forested wetlands, or standing dead trees.
- [X] Supports or has the habitat to support one or more breeding pairs of any migratory bird that requires wetland habitat for breeding, nesting, rearing of young, feeding, staging roosting, or migration, including: Virginia rail, common snipe, marsh wren, American bittern, northern water thrush, northern harrier, spruce grouse, Cerulean warbler, and common loon.
- [ ] Supports winter habitat for white-tailed deer. Good habitats for these species include softwood swamps. Evidence of use includes deer browsing, bark stripping, worn trails, or pellet piles.
- [X] Provides important feeding habitat for black bear, bobcat, or moose based on an assessment of use. Good habitat for these types of species includes wetlands located in a forested mosaic.
- [X] Has the habitat to support muskrat, otter or mink. Good habitats for these species include deep marshes, wetlands adjacent to bodies of water including lakes, ponds, rivers and streams.
- [ ] Supports an active beaver dam, one or more lodges, or evidence of use in two or more consecutive years by an adult beaver population.
- [X] Provides the following habitats that support the reproduction of Uncommon Vermont amphibian species including:
  - [ ] 1. Wood Frog, Jefferson Salamander, Blue-spotted Salamander, or Spotted Salamander. Breeding habitat for these species includes vernal pools and small ponds.
  - [X] 2. Northern Dusky Salamander and the Spring Salamander. Habitat for these species includes headwater seeps, springs, and streams.
  - [ ] 3. The Four-toed salamander; Fowler’s Toad; Western or Boreal Chorus frog, or other amphibians found in Vermont of similar significance.

- [ ] Supports or has the habitat to support significant populations of Vermont amphibian species including, but not limited to Pickerel Frog, Northern Leopard Frog, Mink Frog, and others found in Vermont of similar significance. Good habitat for these types of species includes large marsh systems with open water components.

- [X] Supports or has the habitat to support populations of uncommon Vermont reptile species including: Wood Turtle, Northern Map Turtle, Eastern Musk Turtle, Spotted Turtle, Spiny Softshell, Eastern Ribbonsnake, Northern Watersnake, and others found in Vermont of similar significance.

- [X] Supports or has the habitat to support significant populations of Vermont reptile species, including Smooth Greensnake, DeKay's Brownsnake, or other more common wetland-associated species.

- [ ] Meets four or more of the following conditions indicative of wildlife habitat diversity:

  - [ ] 1. Three or more wetland vegetation classes (greater than 1/2 acre) present including but not limited to: open water contiguous to, but not necessarily part of, the wetland, deep marsh, shallow marsh, shrub swamp, forested swamp, fen, or bog;

  - [ ] 2. The dominant vegetation class is one of the following types: deep marsh, shallow marsh, shrub swamp or, forested swamp;

  - [X] 3. Located adjacent to a lake, pond, river or stream;

  - [X] 4. Fifty percent or more of surrounding habitat type is one or more of the following: forest, agricultural land, old field or open land;

  - [ ] 5. Emergent or woody vegetation occupies 26 to 75 percent of wetland, the rest is open water;

  - [X] 6. One of the following:

    - [ ] i. hydrologically connected to other wetlands of different dominant classes or open water within 1 mile;

    - [X] ii. hydrologically connected to other wetlands of same dominant class within 1/2 mile;

    - [ ] iii. within 1/4 mile of other wetlands of different dominant classes or open water, but not hydrologically connected;

- [ ] Wetland or wetland complex is owned in whole or in part by state or federal government and managed for wildlife and habitat conservation; and

- [X] Contains evidence that it is used by wetland dependent wildlife species.

If any of the above boxes are checked, the wetland provides this function. Complete the following to determine if the wetland provides this function above or below a moderate level.

- [ ] Check box if any of the following conditions apply that may indicate the wetland provides this function at a *lower* level.

  - [ ] The wetland is small in size for its type and does not represent fugitive habitat in developed areas (vernal pools and seeps are generally small in size, so this does not apply).

- ☐ The surrounding land use is densely developed enough to limit use by wildlife species (with the exception of wetlands with open water habitat). Can be negated by evidence of use.
- ☐ The current use in the wetland results in frequent cutting, mowing or other disturbance.
- ☐ The wetland hydrology and character is at a drier end of the scale and does not support wetland dependent species.

☒ Check box if any of the following conditions apply that may indicate the wetland provides this function at a *higher* level.

- ☒ The wetland complex is large in size and high in quality.
- ☒ The habitat has the potential to support several species based on the assessment above.
- ☒ Wetland is associated with an important wildlife corridor.
- ☐ The wetland has been identified by ANR-F&W as important habitat.

5. Exemplary Wetland Natural Community

☐ Function is present and likely to be significant: Any of the following physical and vegetative characteristics indicate the wetland provides this function.

- ☐ Wetlands that are identified as high quality examples of Vermont’s natural community types recognized by the Natural Heritage Information Project of the Vermont Fish and Wildlife Department, including rare types such as dwarf shrub bogs, rich fens, alpine peatlands, red maple-black gum swamps and the more common types including deep bulrush marshes, cattail marshes, northern white cedar swamps, spruce-fir-tamarack swamps, and red maple-black ash seepage swamps are automatically significant for this function.

The wetland is also likely to be significant if any of the following conditions are met:

- ☐ Is an example of a wetland natural community type that has been identified and mapped by, or meets the ranking and mapping standards of, the Natural Heritage Information Project of the Vermont Fish and Wildlife Department.
- ☐ Contains ecological features that contribute to Vermont’s natural heritage, including, but not limited to:
  - ☐ Deep peat accumulation reflecting a long history of wetland formation;
  - ☐ Forested wetlands displaying very old trees and other old growth characteristics;
  - ☐ A wetland natural community that is at the edge of the normal range for that type;

- ☐ A wetland mosaic containing examples of several to many wetland community types; or
- ☐ A large wetland complex with examples of several wetland community types.

6. Rare, Threatened, and Endangered Species Habitat

☐ Function is present and likely to be significant: Any of the following physical and vegetative characteristics indicate the wetland provides this function.

- ☐ Wetlands that contain one or more species on the federal or state threatened or endangered lists, as well as species that are rare in Vermont, are automatically significant for this function.

  The wetland is also likely to be significant if any of the following apply:

- ☐ There is creditable documentation that the wetland provides important habitat for any species on the federal or state threatened or endangered species lists;
- ☐ There is creditable documentation that threatened or endangered species have been present in past 10 years;
- ☐ There is creditable documentation that the wetland provides important habitat for any species listed as rare in Vermont (S1 or S2 ranks), state historic (SH rank), or rare to uncommon globally (G1, G2, or G3 ranks) by the Natural Heritage Information Project of the Vermont Fish and Wildlife Department;
- ☐ There is creditable documentation that the wetland provides habitat for multiple uncommon species of plants or animals (S3 rank).

List name of species and ranking:

7. Education and Research in Natural Sciences

☐ Function is present and likely to be significant: Any of the following characteristics indicate the wetland provides this function.

- ☐ Owned by or leased to a public entity dedicated to education or research.
- ☐ History of use for education or research.
- ☐ Has one or more characteristics making it valuable for education or research.

8. Recreational Value and Economic Benefits

[x] Function is present and likely to be significant: Any of the following characteristics indicate the wetland provides this function.

- [ ] Used for, or contributes to, recreational activities.
- [ ] Provides economic benefits.
- [x] Provides important habitat for fish or wildlife which can be fished, hunted or trapped under applicable state law.
- [ ] Used for harvesting of wild foods.

Comments:

9. Open Space and Aesthetics

[X] Function is present and likely to be significant: Any of the following physical and vegetative characteristics indicate the wetland provides this function.

- [X] Can be readily observed by the public; and
  - [ ] Possesses special or unique aesthetic qualities; or
  - [X] Has prominence as a distinct feature in the surrounding landscape;
- [ ] Has been identified as important open space in a municipal, regional or state plan.

10. Erosion Control through Binding and Stabilizing the Soil

[x] Function is present and likely to be significant: Any of the following physical and vegetative characteristics indicate the wetland provides this function.

- [x] Erosive forces such as wave or current energy are present and any of the following are present as well:
  - [x] Dense, persistent vegetation along a shoreline or stream bank that reduces an adjacent erosive force.
  - [X] Good interspersion of persistent emergent vegetation and water along course of water flow.
  - [X] Studies show that wetlands of similar size, vegetation type, and hydrology are important for erosion control.

What type of erosive forces are present?

- [ ] Lake fetch and waves
- [x] High current velocities
- [ ] Water level influenced by upstream impoundment

If any of the above boxes are checked, the wetland provides this function. Complete the following to determine if the wetland provides this function above or below a moderate level.

- [ ] Check box if any of the following conditions apply that may indicate the wetland provides this function at a *lower* level.
  - [ ] The stream is artificially channelized and/or lacks vegetation that contributes to controlling the erosive force.
- [x] Check box if any of the following conditions apply that may indicate the wetland provides this function at a *higher* level.
  - [x] The stream contains high sinuosity.
  - [ ] Has been identified through fluvial geomorphic assessment to be important in maintaining the natural condition of the stream or river corridor.

RE: VTrans Coventry BF0251(49)

From: Kratzer, Jud <Jud.Kratzer@vermont.gov>
Sent: Thu, Jun 17, 2021 at 11:16 am
To: Eldridge, William, mary@bearcreekenvironmental.com
Cc: Alex@BearCreekEnvironmental.com, Emerson, Peter

image002.jpg (3.4 KB) image003.jpg (4.1 KB) – **Download all**

Images not displayed. **SHOW IMAGES** | **ALWAYS SHOW IMAGES FROM THIS SENDER**

Hi Mary and Will,

This site would be a definite yes for AOP. Stony Brook is one of the most important spawning and rearing tributaries for Lake Memphremagog steelhead. Brook trout are also present. We did not find brown trout in our most recent sampling just downstream of this culvert.

Thanks,
Jud

From: Eldridge, William <William.Eldridge@vermont.gov>
Sent: Thursday, June 17, 2021 10:12 AM
To: mary@bearcreekenvironmental.com
Cc: Alex@BearCreekEnvironmental.com; Emerson, Peter <Peter.Emerson@vermont.gov>; Kratzer, Jud <Jud.Kratzer@vermont.gov>
Subject: FW: VTrans Coventry BF0251(49)

Mary,

I'm fairly certain the answer is YES to AOP, but I'm cc'ing the District Biologists who cover this area to be sure. Stony Brook is a very productive coldwater tributary to the Black supporting brook, brown and rainbow trout.

Description: Description: Description: Description: momVT
Will Eldridge | Aquatic Habitat Biologist
Vermont Fish and Wildlife Department
3902 Roxbury Road | Roxbury, VT 05669
802-585-4499 cell
https://vtfishandwildlife.com/vthabitatstamp

Due to the coronavirus (COVID-19), the Agency of Natural Resources is taking additional safety measures to protect our employees, partners and customers. We are now working remotely and focused on keeping our normal business processes fully functional. We encourage you to communicate electronically or via phone to the greatest extent possible. Thank you for your patience and understanding that responses may occasionally be delayed.

From: mary@bearcreekenvironmental.com <mary@bearcreekenvironmental.com>
Sent: Wednesday, June 16, 2021 5:14 PM
To: Eldridge, William <William.Eldridge@vermont.gov>
Cc: 'Alex Marcucci' <Alex@BearCreekEnvironmental.com>
Subject: VTrans Coventry BF0251(49)

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.
Hi Will,

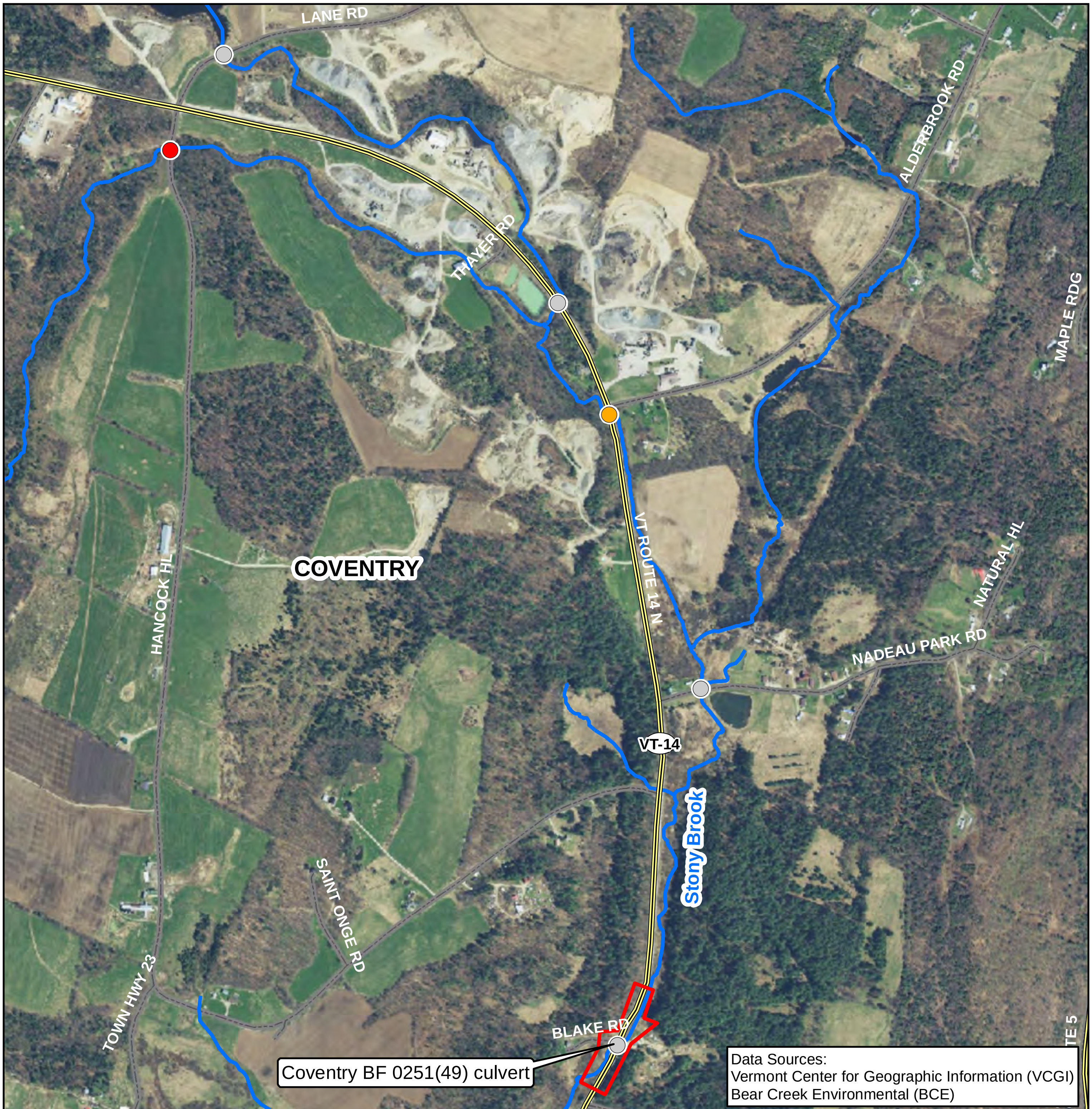
We have been retained by VTrans to conduct a natural resource assessment of the Coventry BF0251 (49) project that is currently at the scoping level. The focus of the project is a pipe arch, located on VT Route 14 in Coventry (please see attached site location map). Stoney Brook, a tributary to the Black River, flows through this pipe arch. I've attached some photos of the arch pipe, which is 6'H x 6.8W x 90' long. The drainage area of Stoney Brook is approximately 4.7 square miles at that location.

Glenn Gingras has suggested we contact you to see if AOP would be required at this site. We are aiming to get Glenn a report by the end of this week. I would be interested in any recommendations you have for this location.

Thanks,

Mary

Mary Nealon
Principal / River Scientist
Professional in Erosion and Sediment Control
Certified Floodplain Manager
BClogo-fullcolor
131 Elm Street, Suite 1
Montpelier, Vermont 05602
Phone: (802) 223-5140
Email: Mary@BearCreekEnvironmental.com
Website: http://www.bearcreekenvironmental.com



Resource Map - Culverts

Vermont Agency of Transportation
Coventry BF 0251(49)
Vermont Route 14
Coventry, VT
Orleans County

Bear Creek Environmental

Legend

Culvert

AOP Coarse Screen

- Full AOP
- Reduced AOP
- No AOP Except Adult Salmonids
- No AOP Including Adult Salmonids

- Study Area
- VHD Stream
- Deer Wintering Area
- Major Road
- Road

0 250 500 1,000 Feet

N

Map composed June 17, 2021.

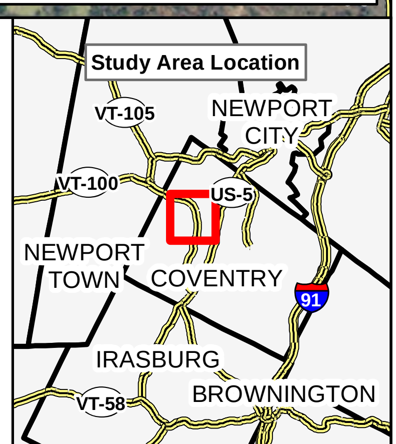


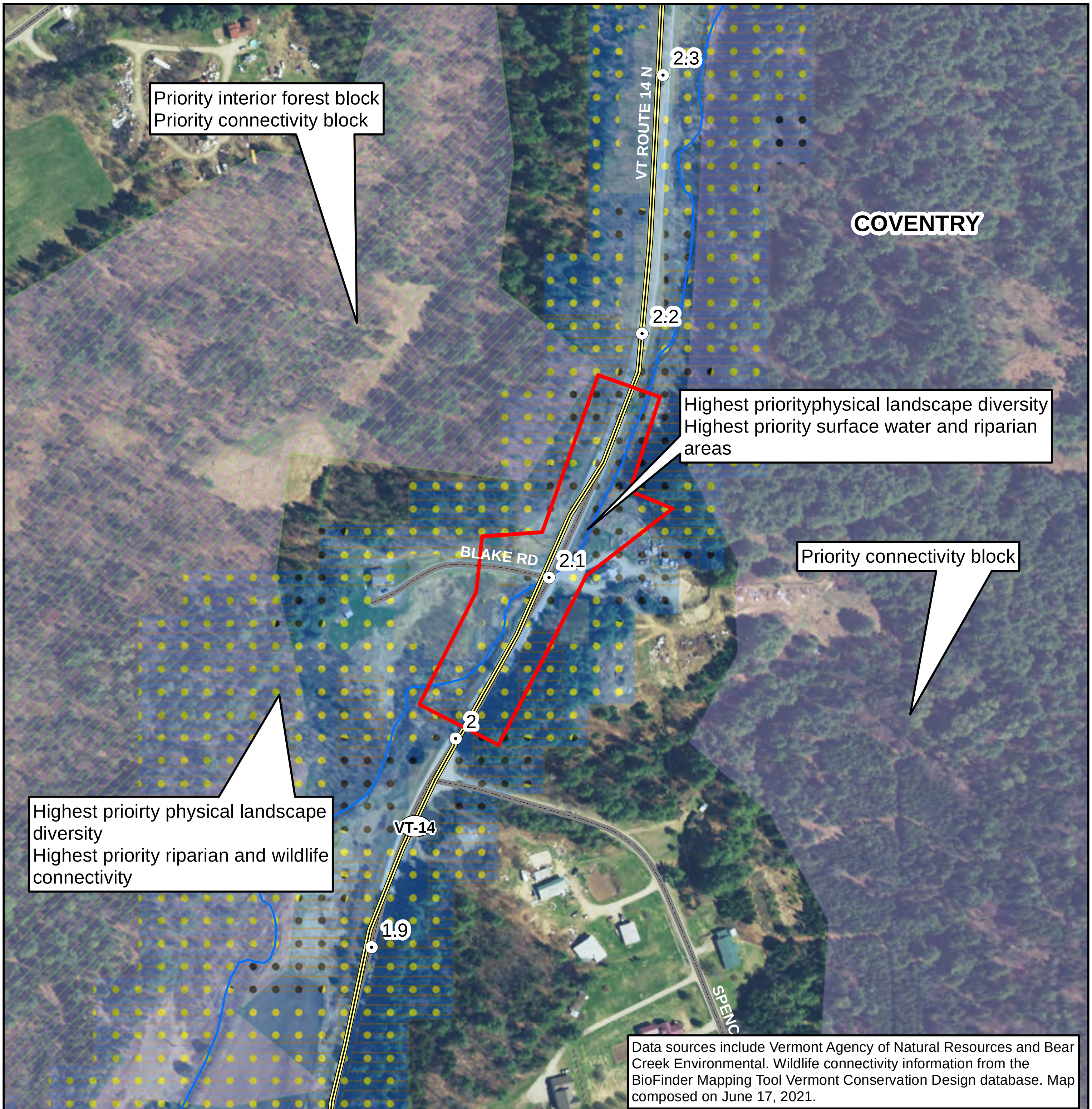
Figure 1. Stoney Bk above VT RT 14 pipe arch

Figure 2. VT Route 14 culvert inlet

Figure 3. Deteriorated VT Route 14 culvert inlet

Figure 4. VT Route 14 culvert outlet

Figure 5. Stoney Brook below culvert outlet



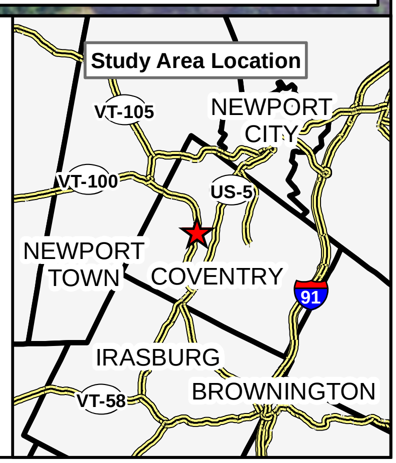
Resource Map - Wildlife Connectivity

Vermont Agency of Transportation
Coventry BF0251(49)
Vermont Route 14
Coventry, VT
Orleans County

Bear Creek Environmental

Legend

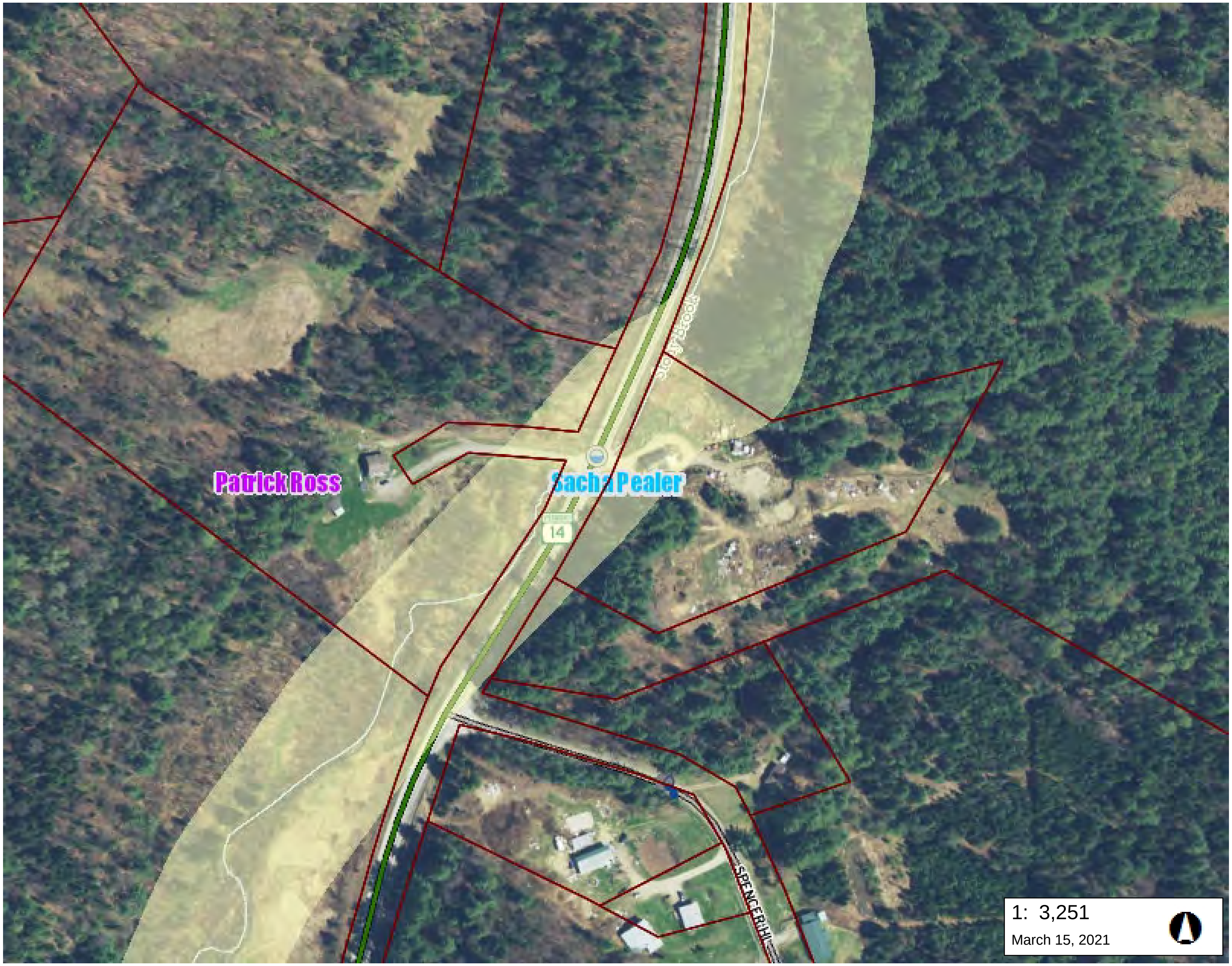
- Study Area
- Mile Marker - Tenths
- Major Road
- Road
- VHD Stream
- Highest Priority Physical Landscape Diversity - Representative
- Highest Priority Physical Landscape Diversity - Responsibility
- Highest Priority Connectivity Blocks
- Connectivity Blocks - Priority
- Highest Priority Wildlife Connectivity
- Highest Priority Surface Water and Riparian
- Priority Surface Water and Riparian
- Highest Priority Interior Forest Blocks - Highest Priority
- Priority Interior Forest Blocks
- VT Sig. Wetland Inventory



FloodplainsRiversMap

Vermont Agency of Natural Resources

vermont.gov



1: 3,251

March 15, 2021

LEGEND

- DFIRM X-Sections
- DFIRM - Letter of Map Revisio
- DFIRM Panels
- DFIRM Floodways
- Flood Hazard Areas (Only FEI
  - AE (1-percent annual chance flood
  - A (1-percent annual chance floodpl
  - AO (1-percent annual chance zone feet)
  - 0.2-percent annual chance flood ha
- River Corridors (Aug 27, 2019)
- .5 - 2 sqmi.
- .25-.5 sqmi.
- River Management Engineer D
- Floodplain Manager Regions
- Parcels (standardized)
- River Area
- VTRANS State and Town Long
- VTRANS State Short Structure
- Town Bridge
- Town Culvert
- Roads
  - Interstate
  - US Highway; 1
  - State Highway
  - Town Highway (Class 1)
  - Town Highway (Class 2,3)
  - Town Highway (Class 4)

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

NOTES

Map created using ANR's Natural Resources Atlas

Appendix H: Archeology Memo

ARCHAEOLOGICAL RESOURCE ASSESSMENT COVENTRY CULVERT NO. 132, VT ROUTE 14 BF-0251(49)

Town of Coventry, Orleans 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
Coventry Culvert No. 132, VT Route 14
BF-0251(49)

Town of Coventry, Orleans 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 improvements to Coventry Culvert No. 132, VT 14, Orleans 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, 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 determined that no previously recorded precontact or historic archaeological sites are 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 improvements to Coventry Culvert No. 132, VT Route 14, Orleans 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. Dr. Vavrasek completed the background research and wrote the report with assistance from 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.

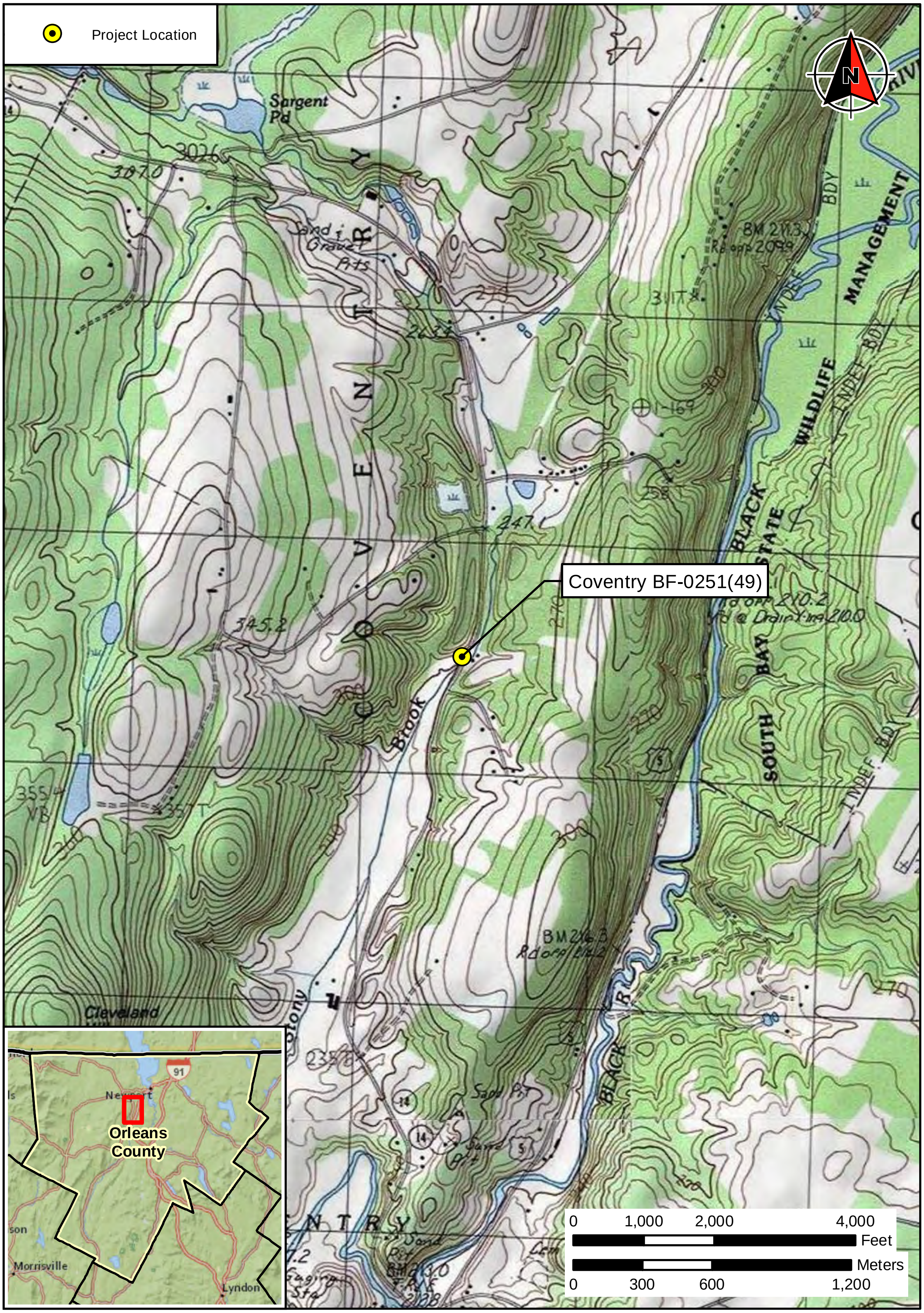

FIGURE 1: Location of Project BF-0251(49) (ESRI USA Topo Maps 2019)

FIGURE 2: Project APE (VCGI 2018)

II. Environmental Setting

A. General Setting

The APE is located along VT 14 and Stony Brook, approximately 2.82 kilometers (1.75 miles) north of the Town of Coventry and 1.1 kilometers (0.7 mile) west of the Black River (see Figure 2). It lies within the Connecticut Valley Gaspé physiographic province of eastern Vermont. The region is underlain by 300- to 400-million-year-old granite and mudstone deposits. The area includes limestones, sand, and shales that originated in highlands to the west (Doolan 1996). The APE is in the Waits River Formation (Ratcliffe et al. 2011). The region is characterized by a broad plateau dissected by streams and overlain with calcium-rich soils (Griffith et al. 2009; Vermont Fish & Wildlife Department 2014). The dominant water source in the region is Lake Memphremagog, and the APE is in the Black River watershed (United States Geological Survey [USGS] 2018).

The landscape in the APE includes a combination of agricultural land, residential lawns, and roadside modifications, including drainage ditches and built-up road berms.

B. Soils in the APE

The APE contains one general soil type. Rumney fine sandy loam (0 to 3 percent slopes) consists of recent alluvium present on floodplains. The Rumney series is very deep and poorly drained (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
Rumney fine sandy loam (60A)	Ap Bg1 Bg2 Cg	0-23 cm (0-9 in) 23-51 cm (9-20 in) 51-76 cm (20-30 in) 76-165 cm (30-65 in)	Vr Dk Gy Bn Dk Gy Bn Gy Bn Ol Bn	Fi Sa Lo Fi Sa Lo Sa Lo Lo Sa	60A (0-3%)	Poorly Drained	Floodplains

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

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

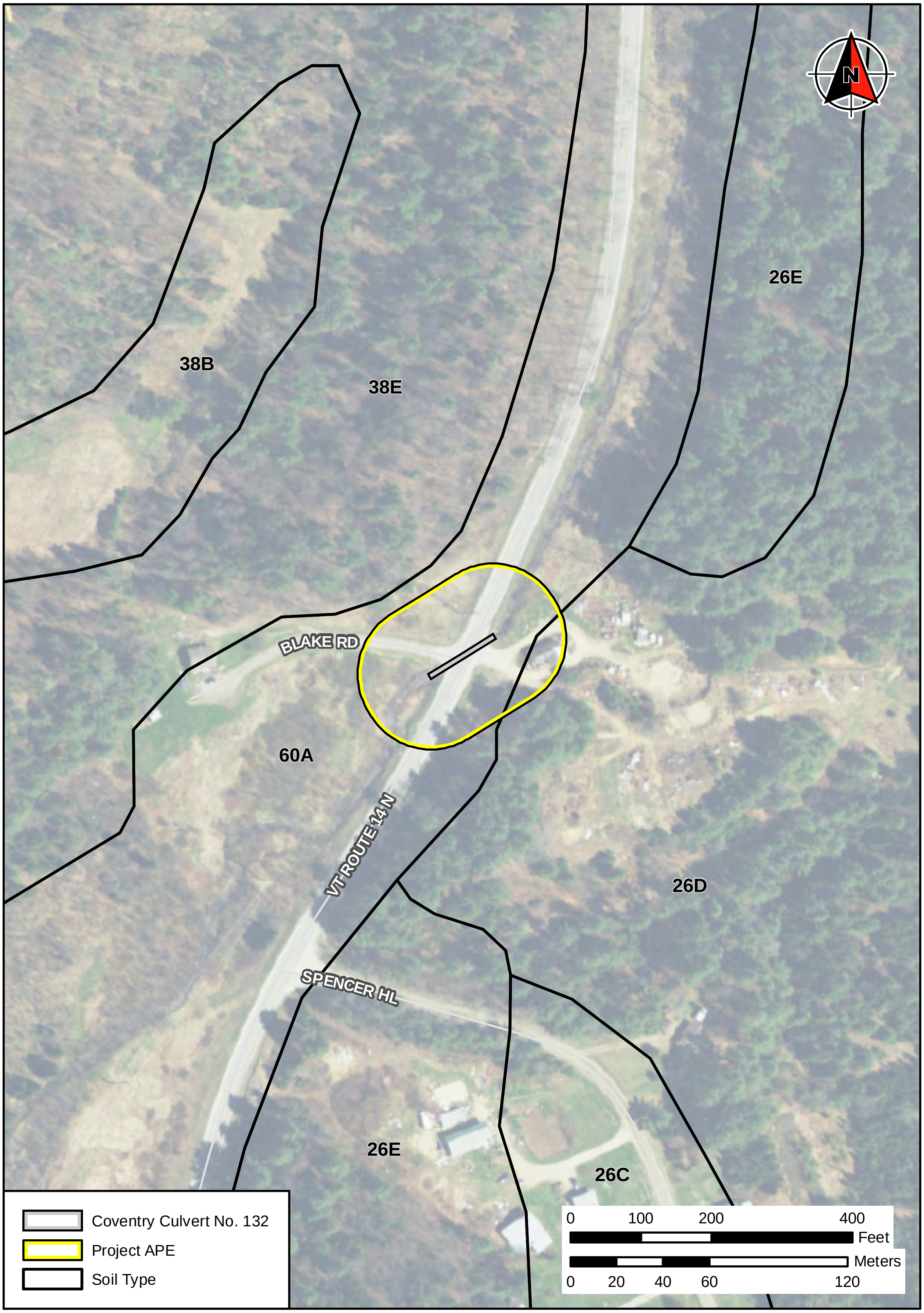

FIGURE 3: Soils in Project APE (USDA-NRCS 2020; VCGI 2018)

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 to northeastern 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 northeastern 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 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 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 Orleans County

a. County Formation

The APE is in the northern half of Orleans County, which is in the northeastern portion of the state and bounded by the U.S.-Canadian national border to the north. The county was formed from Chittenden and Orange counties in 1792 (Newberry Library 2021). Early settlement and growth were slowed by the threat of hostilities during the War of 1812. Following a late frost in 1816 that destroyed many crops, settlers cleared tracts of forest and harvested ash from the felled trees to trade for commodities. The population grew throughout the nineteenth century and represented the largest growth in the state between 1850 and 1860 (Hemenway 1877:33). Euro-American settlements were mostly pastoral, and animal husbandry, maple sugar harvesting, and agriculture were common (Child 1883; Hemenway 1877).

b. Town of Coventry

Swift (1977:335) writes that Orleans County was named for the Duke of Orleans, a leading French advocate for the cause of the American Revolution and a wealthy supporter of its ideals. The location of the county between the Green Mountains of Vermont to the west and the White Mountains of New Hampshire to the east did not create a geographically attractive location for early historic settlers, and after American independence Orleans County was slow to develop, as settlement focused on the more geographically desirable locations of the larger rivers and lakes found elsewhere in Vermont (Swift 1977:336).

Maj. Elias Buel and 59 others were granted a charter in November 1780 for 26.2 square miles of land in Orleans County (White River Paper Company 1882:136). Buel named the new township after his birthplace, Coventry, Connecticut. Settlement in Coventry did not begin until 1800, when Samuel and Tisdale Cobb brought their families from Westmoreland, New Hampshire, to settle in the town (White River Paper Company 1882:137). The first public roads were laid out in 1805 with a north-south route cleared of trees and stumps. The following year a road leading east to west through the town was laid out, beginning at the upper falls of the Black River and running southwest through the town (White River Paper Company 1882:142-143). By 1821 the population of the town was 300, with only two sawmills and only one schoolhouse. That same year, Calvin and Argalus Harmon of Vergennes began clearing 5 acres of land purchased in 1813 for a village, present-day Coventry (Coventry Vermont Historical Society n.d.).

As the population of the town increased, so did the network of roads. By 1839 two postal routes extended from Derby south to Irasburg through Coventry (now U.S. Route 5) and to Barton through Brownington. A coach road ran from Derby to Newport (VT 100), and a cross coach road traveled from Coventry to Newport (VT 14) (Burr 1839). By 1869 an extensive network of roads had been established in the town and the Connecticut and Passumpsic River Railroad had been constructed along the Barton River.

The fertile valleys of the Black and Barton rivers supported the growth of diverse agricultural products, including corn, grains, hay, potatoes, and dairy products such as milk and cheese. By 1860 Orleans County as a whole led the state in the production of barley with over 21,000 bushels (United States Census Bureau [U.S. Census] 1860).

From the end of the nineteenth century through the beginning of the twentieth century, the population of the town decreased with every census. In 1890 the population was 879, decreasing to 728 in 1900 and to 616 in 1910 (U.S. Census 1910). In 1930 the population of the town was 610, and 10 years later the population fell to 549 (U.S. Census 1940). By 1940 little in Coventry had changed over many decades, and census enumeration maps of the town show approximately the same number of residences up to that point (U.S. Census 1940). Today Coventry maintains a rural character, and numerous historic homes are still extant. According to the 2010 census, the town is home to 1,086 residents (U.S. Census 2010).[1]

C. Historical Map Review

The earliest map of Orleans County dates to 1857 (Walling 1859) (Figure 4). The map shows dispersed settlement along local roads in the vicinity of the APE, as well as a sawmill, cooper's shop, and school. The Beers (1878) county atlas shows little change to the area (Figure 5).

Topographic maps from 1923 and 1925 show a north-south road with a similar, although not exact, alignment to VT 14. Topographic maps from 1938 to 1986 show a structure immediately east of the VT 14/Stony Brook crossing. The current alignment of VT 14 was established by 1986, as evidenced by the 1986 topographic map (Nationwide Environmental Title Research [NETR] 2021).

[1] Sources on the history of Coventry in the twentieth century are limited.

FIGURE 4: Project APE in 1857 (Walling 1857)

FIGURE 5: Project APE in 1878 (Beers 1878)

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 archaeological site, VT-OL-0002, is located 4.7 kilometers (2.9 miles) to the northeast and consists of a 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 archaeological site, VT-OL-0061, is located 5.3 kilometers (3.3 miles) to the southeast and consists of a historic stone foundation.

Based on the existing site data, it was expected that there would be a moderate potential for archaeological sites in the APE's vicinity. Historical maps depict nineteenth- and twentieth-century Euro-American settlement in the vicinity, including a structure that was located immediately east of the APE between the 1930s and 1980s.

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 Online Resource Center (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 Coventry, 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 and 5) 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 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. That 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 Inspection

The results from the field inspection, in combination with the background research, indicate that the APE has no areas of archaeological concern. The area immediately surrounding the culvert was built up during the construction of the roadway that traverses it (Plate 1). As a result any modifications to this portion of the surrounding landscape will only impact soils that were already modified in the past. In addition, the culvert appears to be part of a modern stream diversion/drainage system that includes the construction of large drainage ditches to direct large amounts of water (Plates 2 and 3). The surrounding landscape would have been disturbed during the construction of these ditches and creating even more disturbed areas in the APE.

PLATE 1: Built-up Roadway Going Over Culvert, View South

PLATE 2: North End of Culvert with Modern Ditch Used to Direct Stream/Runoff Water, View East

PLATE 3: South End of Culvert with Possible Stream, View South

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.

The results of utilizing Louis Berger's (2005) Historic Front Yards study showed that there is a low historic archaeological sensitivity within then APE. Although 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 installation, causing changes to the historic road-space of the APE.

V. Conclusions

On behalf of VTrans, WSP completed an ARA for proposed improvements to Coventry Culvert No. 132, VT 14, Orleans 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 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 survey was to survey the entire APE to determine if archaeologically sensitive areas are present. The survey included background research, field inspection conducted on April 8, 2021, and application of the predictive model.

No previously recorded precontact or historic archaeological sites lie within the APE. No precontact or historic archaeological sites are recorded within 1.6 kilometers (1 mile) of the APE. 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 90- 180 m	12 6	
2) Distance to Intermittent Stream	0- 90 m 90-180 m	8 4	
3) Confluence of River/River or River/Stream	0-90 m 90 –180 m	12 6	
4) Confluence of Intermittent Streams	0 – 90 m 90 – 180 m	8 4	
5) Falls or Rapids	0 – 90 m 90 – 180 m	8 4	
6) Head of Draw	0 – 90 m 90 – 180 m	8 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 90 -180 m	12 6	
11) Confluence of River or Stream	0-90 m 90 –180 m	12 6	
12) Lake Cove/Peninsula/Head of Bay		12	
C. WETLANDS:			
13) Distance to Wetland (wetland > one acre in size)	0- 90 m 90 -180 m	12 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 20) [ ] Natural Travel Corridor [ ] Sole or important access to another drainage [ ] Drainage divide 21) Existing or Relict Spring 22) Potential or Apparent Prehistoric Quarry for stone procurement 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)	 0 – 90 m 90 – 180 m 0 – 180 m	 32 12 8 4 32 32	
F. OTHER HIGH SENSITIVITY FACTORS: 24) High Likelihood of Burials 25) High Recorded Site Density 26) High likelihood of containing significant site based on recorded or archival data or oral tradition		 32 32 32	
G. NEGATIVE FACTORS: 27) Excessive Slope (>15%) or Steep Erosional Slope (>20) 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 - 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: Jeff Ramsey, Environmental Specialist Supervisor

From: Judith Williams Ehrlich, VTrans Historic Preservation Officer

Date: June 18, 2021

Subject: Historic Resource Identification for Coventry BF 0251(49)

I have completed a resource identification (ID) for Coventry BF 0251(49). At this time, the project is expected to involve replacement of the subject culvert, but project details have not been developed.

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 the consulting firm WSP review the project area and write up a Resource ID report for this project location. WSP submitted the report titled, "Architectural Resource Identification Survey, Coventry Culvert No. 132, VT 14. BF 0251(49). Coventry, Orleans County, Vermont" and dated June 7, 2021. The following is from the report's *Abstract*:

> WSP identified two previously unsurveyed resources in the APE that are older than 45 years. One resource is the subject property, Coventry Culvert No. 132 over Brook. It is WSP's opinion that the bridge is not eligible for the SRHP/NRHP as it is a common culvert type that lacks distinction. The second property, 1976 VT Route 14, is not eligible for listing in the SRHP/NRHP because it lacks historic signifi9cance and integrity. No Section 4(f) resources were located in the APE.

I concur with WSP's assessment that neither Culvert 132 nor the property at 1976 VT Route 14 is historic. Therefore, there are no historic properties in the project area as delineated at this time.

Please see the attached report for details and do not hesitate to contact me should you require additional information.

Attachments

- "Architectural Resource Identification Survey, Coventry Culvert No. 132, VT 14. BF 0251(49). Coventry, Orleans County, Vermont" and dated June 7, 2021

Architectural Resource Identification Survey
Coventry Culvert No. 132, VT 14
BF-0251(49)

Coventry, Orleans 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 7, 2021

Architectural Resource Identification Survey
Coventry Culvert No. 132, VT 14
BF-0251(49)

Coventry, Orleans County, Vermont

Prepared for:

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

Prepared by:

Camilla McDonald and Amber Courselle

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

June 7, 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 Coventry Culvert No. 132, VT Route 14, Orleans 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 survey 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 two previously unsurveyed resources in the APE that are older than 45 years. One resource is the subject property, Coventry Culvert No. 132 over Brook. It is WSP's opinion that the bridge is not eligible for the SRHP/NRHP as it is a common culvert type that lacks distinction. The second property, 1976 VT Route 14, is not eligible for listing in the SRHP/NRHP because it lacks historic significance and integrity. No Section 4(f) resources were located in the APE.

It is WSP's opinion 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 all issues that may arise and to 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 Coventry Culvert No. 132.

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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 Coventry Culvert No. 132, VT 14, Orleans 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 on VT Route 14 in the Town of Coventry, Orleans 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 culvert to include all four quadrants of the culvert 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 properties 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, Architectural Historian Amber Courselle conducted the fieldwork, and Ms. McDonald and Amber Courselle wrote the report. Principal Draftsperson Jacqueline L. Horsford prepared the graphics. Principal Editor Anne Moiseev edited the report.

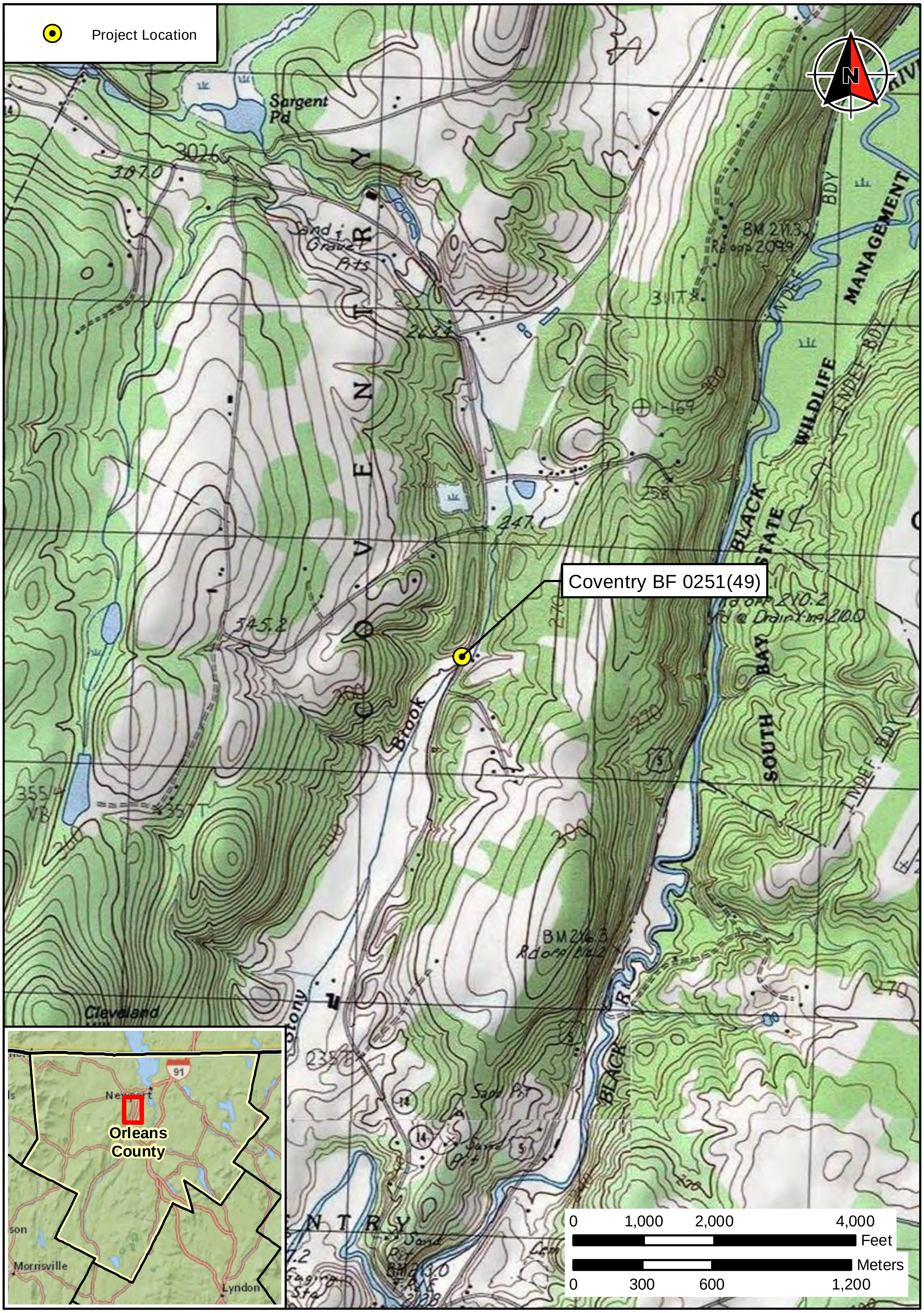

FIGURE 1: Location of Project BF-0251(49) (ESRI USA Topo Maps 2019)

FIGURE 2: Project APE (VCGI 2018)

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 2018), 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. Town of Coventry

Esther Swift (1977:335) writes that Orleans County was named for the Duke of Orleans, a leading French advocate for the cause of the American Revolution and a wealthy supporter of its ideals. The location of the county between the Green Mountains of Vermont to the west and the White Mountains of New Hampshire to the east did not create a geographically attractive location for early historic settlers, and after independence Orleans County was slow to develop, as settlement focused on the more geographically desirable locations of the larger rivers and lakes found elsewhere in Vermont (Swift 1977:336).

Major Elias Buel and 59 others were granted a charter in November 1780 for 26.2 square miles of land in Orleans County (White River Paper Company 1882:136). Buel named the new township after his birthplace, Coventry, Connecticut. Settlement in Coventry didn't begin until 1800, when Samuel and Tisdale Cobb brought their families from Westmoreland, New Hampshire, to settle in the town (White River Paper Company 1882:137). The first public roads were laid out in 1805 with a north-south route cleared of trees and stumps. The following year a road leading east to west through the town was laid out, beginning at the upper falls of the Black River and running southwest through the town (White River Paper Company 1882:142-143). By 1821 the population of the town was 300, with only two sawmills and only one schoolhouse. That same year, Calvin and Argalus Harmon of Vergennes began clearing 5 acres of land purchased in 1813 for a village, present-day Coventry (Coventry Vermont Historical Society n.d.).

As the population of the town increased, so did the network of roads. By 1839 two postal routes extended from Derby south to Irasburg through Coventry (now U.S. Route 5) and to Barton through Brownington. A coach road ran from Derby to Newport (VT 100), and a cross coach road traveled from Coventry to Newport (VT 14) (Burr 1839). By 1869 an extensive network of roads had been established in the town and the Connecticut and Passumpsic River Railroad had been constructed along the Barton River. Figure 3 shows the area in 1878 (Beers 1878).

The fertile valleys of the Black and Barton rivers supported the growth of diverse agricultural products, including corn, grains, hay, potatoes, and dairy products such as milk and cheese. By 1860 Orleans County as a whole led the state in the production of barley with over 21,000 bushels (United States Bureau of the Census [U.S. Census] 1860).

From the end of the nineteenth century through the beginning of the twentieth century, the population of the town decreased with every census. In 1890 the population was 879, decreasing to 728 in 1900 and to 616 in 1910 (U.S. Census 1910). In 1930 the population of the town was 610, and 10 years later the population fell to 549 (U.S. Census 1940). By 1940 little in Coventry had changed over many decades, and census enumeration maps of the town show approximately the same number of residences up to that point (United States Bureau of the Census 1940). Today Coventry maintains a rural character, and numerous historic homes are still extant. According to the 2010 census, the town is home to 1,086 residents (U.S. Census 2010).[1]

[1] Sources on the history of Coventry in the twentieth century are limited.

FIGURE 3: Map of Coventry, 1878 (Beers 1878)

IV. Survey Results

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

WSP identified two properties in the APE that are 45 years old or older, the subject property, Coventry Culvert No. 132, and a house (Figure 4; Table 1). No other properties are located in the APE.

Both Coventry Culvert No. 132 and the adjacent house had not been previously surveyed. WSP found the culvert not eligible for the SRHP/NRHP as it does not meet the registration requirements outlined in the Multiple Property Documentation (MPD) (Louis Berger 2018:F70-F72). The house is not eligible for the SRHP/NRHP as it is a common example of its type that lacks distinction and integrity.

TABLE 1: NEWLY IDENTIFIED HISTORIC ARCHITECTURAL RESOURCES IN APE

ID No.	NRHP ELIGIBILITY	NAME	ADDRESS
Coventry-1	Not Eligible	Coventry Culvert No. 132	VT 14, Coventry
Coventry-2	Not Eligible	House	1976 VT 14, Coventry

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. Coventry-1

Coventry Culvert No. 132 over Brook, VT Route 14; constructed 1959 (Plates 1-3)

This multi-plate pipe culvert is 8 feet wide and 108 feet long and is set at a 56-degree skew. Different sections are bolted together to form the pipe-arch shape of the culvert. The bottom sections show severe corrosion. The east side of the culvert has dry-laid stone wingwalls. The west side appears to have the remnants of a concrete wingwall. The VTrans inspection report has an original construction date for this culvert of 1959, with no date in the reconstruction field, so it is assumed that the culvert dates to 1959.

Coventry Culvert No. 132 over Brook does not meet registration requirements outlined in the MPD (Louis Berger 2018:F70-F72). Under NRHP Criterion A, the culvert is not a contributing element of major bridge, road, or highway construction project, including association with the Good Roads movement, that is eligible for the NRHP for reasons that include the construction of the subject culvert. As VT 14 was constructed around 1839 as a cross coach road, the current (1959) culvert was likely a replacement for an earlier structure.

The structure does not meet any NRHP Criterion C registration requirements as it is a common culvert type that lacks distinction. It is WSP's opinion that the Coventry Culvert No. 132 is not eligible for listing in the SRHP/NRHP.

FIGURE 4: Location of Surveyed Resources in APE (VCGI 2018)

PLATE 1: Coventry Culvert No. 132, Facing South

PLATE 2: Coventry Culvert No. 132, Facing Northwest

PLATE 3: Coventry Culvert No. 132, Facing Northeast

2. Coventry-2

House, 1976 VT Route 14; constructed ca. 1900 (Plates 4 and 5)

Facing south, on the east side of VT Route 14, the one-and-one-half-story dwelling is clad in vinyl siding. Standing-seam metal covers the roof, which is pierced with a concrete-block chimney and a front slope dormer window. The windows appear to be modern vinyl replacements, although the wood entry door appears to be original. Spanning the main block is a modern uncovered wood deck. The eastern side ell has a cross-gable form.

The building is not eligible for the SRHPNRHP. It does not possess historical significance or associations to meet Criteria A or B, and it has lost material integrity with new windows and siding.

C. Section 4(f) Resources

No Section 4(f) resources were identified in or adjacent to the project APE.

PLATE 4: 1976 VT Route 14, Facing Southeast

PLATE 5: 1976 VT Route 14, Facing North

V. Conclusions

On behalf of VTrans, WSP, completed a historic architectural resource identification survey and effects assessment for the proposed improvements to Coventry Culvert No. 132, VT Route 14, Orleans 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 culvert approaches.

The goal of the survey was to identify (1) historic architectural resources (properties) in the APE previously listed in the 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.

WSP identified two previously unsurveyed resources in the APE that are older than 45 years. One resource is the subject property, Coventry Culvert No. 132 over Brook. It is WSP's opinion that the bridge is not eligible for the SRHP/NRHP. The other property, 1976 VT Route 14, is not eligible for the SRHP/NRHP because it lacks historical significance and integrity. No Section 4(f) resources were located in the APE.

It is WSP's opinion 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 all issues that may arise and to 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 Coventry Culvert No. 132.

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Appendix J: Stormwater Memo

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

Agency of Transportation

[phone] 802-498-5787

To: Lee Goldstein, VTrans Environmental Specialist
From: Heather Voisin, VTrans Green Infrastructure Engineer
Date: June 11, 2021
Subject: Coventry BF 0251(49) - Stormwater Resource ID Review

Project Description: I have reviewed the project area for Coventry BF 0251(49) for stormwater related regulatory and water quality concerns. The project will involve replacing the existing bridge over Stony Brook on Vermont Route 14 in Coventry, VT. 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 expected that an Operational Stormwater permit will be required for this project and there do not appear to be any existing stormwater permits near the site area. The adjacent driveway (Blake Road) is classified as being a Hydrologically Connected Road, however it is listed as Low Risk.

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

- This project site is not within a designated public water supply source protection area.
- The project site does not include an impaired (303(d) list) or stressed waters.

Existing Drainage

Based on a review of Google Street view, there is no evidence of existing stormwater or drainage infrastructure, such as catch basins.

Appendix K: Local Input

Project Summary

This project, BF 0251(49), focuses on Bridge 132 on VT Route 14 in Coventry, 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.
   None know at this time.
2. Is there a "slow season" or period of time from May through October where traffic is less or no events are scheduled?
   No not really.

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 main Town Garage is located on Main Street in the village area. A closure of VT Route 14 would cause longer trips than usual for maintenance. For emergency services, please contact Newport Ambulance, Newport Fire, and the Orleans Sheriff for more information.

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?
   Yes, I am sure that there are, but these are unknown to me at this time.

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?
   None with a close proximity.

What other municipal operations could be adversely affected by a road/culvert closure or detour?
None know at this time.

6. 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.
Alderbrook Road and Lane Road may receive additional traffic due to unusual routing from people trying to circumvent the detour. But this is just my opinion.

7. 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.
None at this time.

8. 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)?
The school is located in the village area. Contact Todd Rohlen at Todd.Rohlen@ncsuvt.org for more information.

2. Is this project on specific routes that school buses or students use to walk to and from school?
Unknown please refer question to the school.

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?
Unknown

2. Are the current lane and shoulder widths adequate for pedestrian and bicycle use?
   No not in my opinion.

3. Does the community feel there is a need for a sidewalk or bike lane over the culvert?
   No

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

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 plans at this time.

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 not in my opinion.

Design Considerations

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?
   No not in my opinion.

2. Are there any concerns with the width of the existing culvert?
   No not in my opinion.

3. Are there any special aesthetic considerations we should be aware of?
   No not in my opinion.

4. Does the location have a history of flooding? If yes, please explain.
   No not in my opinion.

5. Are there any known Hazardous Material Sites near the project site?
   No not in my opinion.

6. Are there any known historic, archeological and/or other environmental resource issues near the project site?
   No not in my opinion.

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 not in my opinion.

8. Are there any other issues that are important for us to understand and consider?
   No not in my opinion.

Land Use & Zoning

1. Please provide a copy of your existing and future land use map or zoning map, if applicable.
   No zoning in Coventry.

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

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

Communications

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.
   No not in my opinion.

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?
   Please keep the Town Administrator and the Select Board fully informed as the project design and potential road closures move forward in the process.

Appendix L: VTrans Operations Input – No Response Received

Culvert Scoping Project BF 0251(49)
Operations Input Questionnaire

The Structures Section has begun the scoping process for BF 0251(49), VT Route 14, Culvert 132, over an unnamed brook. This is a culvert constructed in 1959. The Structure Inspection, Inventory, and Appraisal Sheet (attached) rates the culvert as a 3 (serious), 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?

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

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

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

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).

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.

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.

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?

9. Does this culvert seem to catch an unusual amount of debris from the waterway?

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

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?

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.

13. Are there any drainage issues that we should address on this project?

14. Are you aware of any complaints that the public has about issues that we can address on this project?

15. Is there anything else we should be aware of?

Appendix M: Crash Data

Vermont Agency of Transportation

09/06/2019

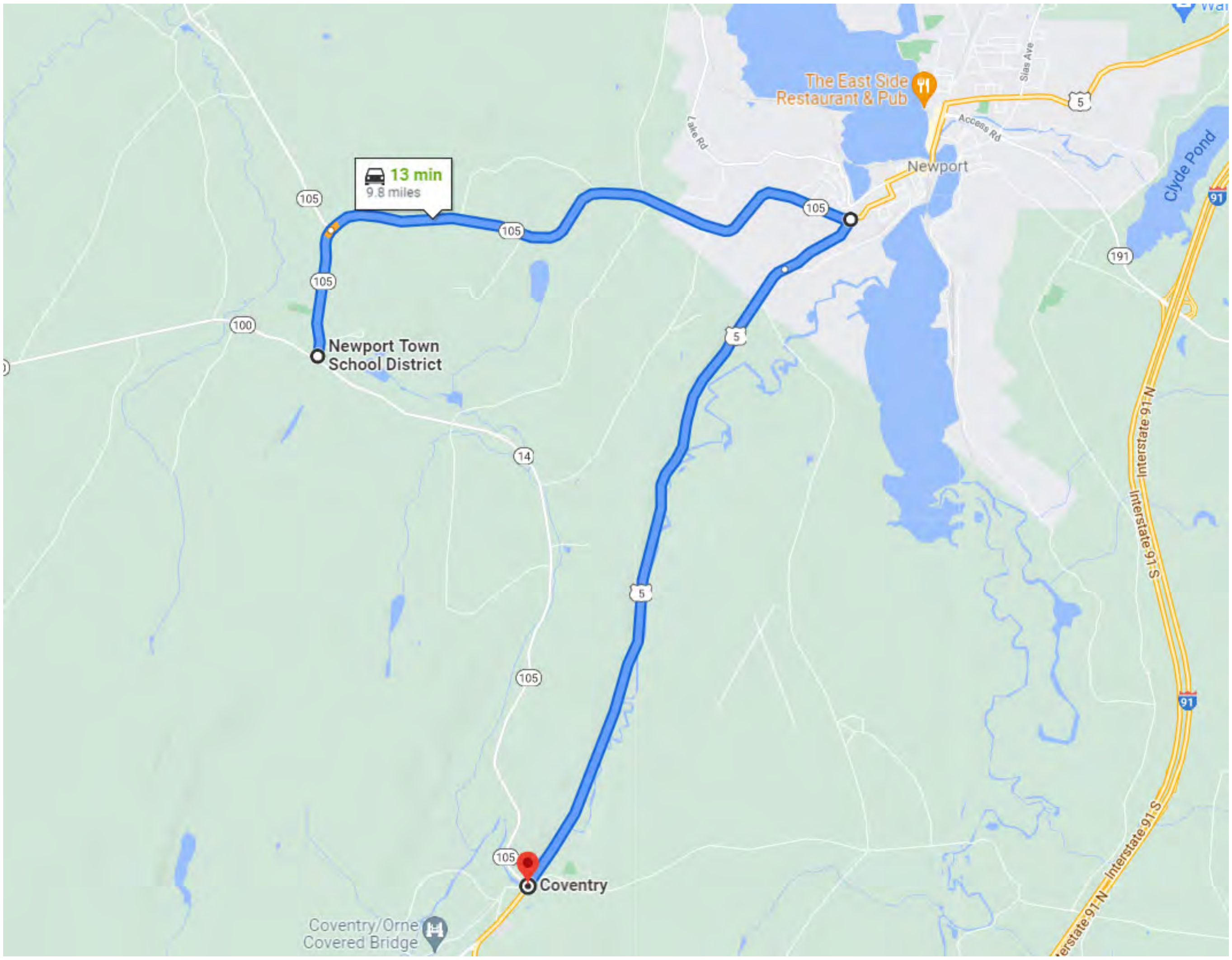
General Yearly Summaries - Crash Listing: State Highways and All Federal Aid Highway Systems

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
	VTVSP0800/18A503529	Irasburg	7.15	09/16/2018	16:38	Clear	Under the influence of medication/drugs/alcohol	Single Vehicle Crash	1	0	0	S	SH State Owned
	VTVSP0800/14B200776	Irasburg	7.33	03/11/2014	06:49	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP0800/16B200493	Irasburg	UNK	02/12/2016	22:03	[No Weather]		[No Direction of Collision]	0	0	0		SH State Owned
	VTVSP0800/14B200521	Coventry	0.11	02/13/2014	20:50	Snow	Exceeded authorized speed limit	Single Vehicle Crash	0	0	0	N	SH
	VTVSP0800/14B203437	Coventry	0.25	10/20/2014	20:39	Clear	Failure to keep in proper lane, Other improper action	Single Vehicle Crash	0	0	0	S	SH
	VTVSP0800/15B200409	Coventry	0.25	02/08/2015	13:20	Snow	Driving too fast for conditions, No improper driving	Head On	0	0	0	S, N	SH
	VTVSP0800/16B203529	Coventry	0.63	09/16/2016	07:42	Clear	Inattention, Followed too closely, No improper driving	Rear End	0	0	0	N	SH State Owned
	VTVSP0800/14B201521	Coventry	1.24	05/14/2014	16:40	Clear	No improper driving	Single Vehicle Crash	0	0	0	N	SH
	VTVSP0800/16B200715	Coventry	1.40	03/01/2016	19:06	[No Weather]		[No Direction of Collision]	0	0	0		SH State Owned
	VTVSP0800/18A501603	Coventry	1.67	05/05/2018	13:23	Clear	Failure to keep in proper lane, Fatigued, asleep, No improper driving	Opp Direction Sideswipe	0	0	0	S, N	SH State Owned
	VTVSP0800/15B200008	Coventry	1.74	01/01/2015	09:28	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP0800/16B200470	Coventry	2.10	02/11/2016	07:00	[No Weather]		[No Direction of Collision]	0	0	0		SH State Owned
	VTVSP0800/16B201584	Coventry	2.43	05/10/2016	15:21	[No Weather]		[No Direction of Collision]	0	0	0		SH State Owned
	VTVSP0800/17A503953	Coventry	2.55	09/29/2017	20:44	Clear	Failure to keep in proper lane, Failed to yield right of way, No improper driving	Same Direction Sideswipe	0	0	0	S	SH State Owned
	VTVSP0800/17A505106	Coventry	3.02	12/17/2017	18:32	Snow	No improper driving, Driving too fast for conditions	Rear End	0	0	0	E	SH State Owned
	VTVSP0800/14B200532	Coventry	3.37	02/14/2014	15:04	Snow	Failed to yield right of way, No improper driving	No Turns, Thru moves only, Broadside ^<	0	0	0	N, E	SH
	VTVSP0800/14B203950	Coventry	3.93	12/02/2014	23:40	Snow	Driving too fast for conditions, Other improper action	Left Turn and Thru, Angle Broadside -->v--	0	0	0	N, S	SH
	VTVSP0800/18A501257	Coventry	4.00	04/08/2018	09:47	Cloudy	Failure to keep in proper lane	Single Vehicle Crash	0	0	0	S	SH State Owned
	VTVSP0800/15B202323	Coventry	UNK	07/14/2015	20:23	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP0800/14B200177	Newport Town	0.18	01/16/2014	07:40	Snow	Driving too fast for conditions, Operating defective equipment	Single Vehicle Crash	2	0	0	W	SH
	VTVSP0800/17A501284	Newport Town	0.34	03/31/2017	00:23	Clear	Fatigued, asleep, Failure to keep in proper lane	Single Vehicle Crash	0	0	0	S	SH State Owned

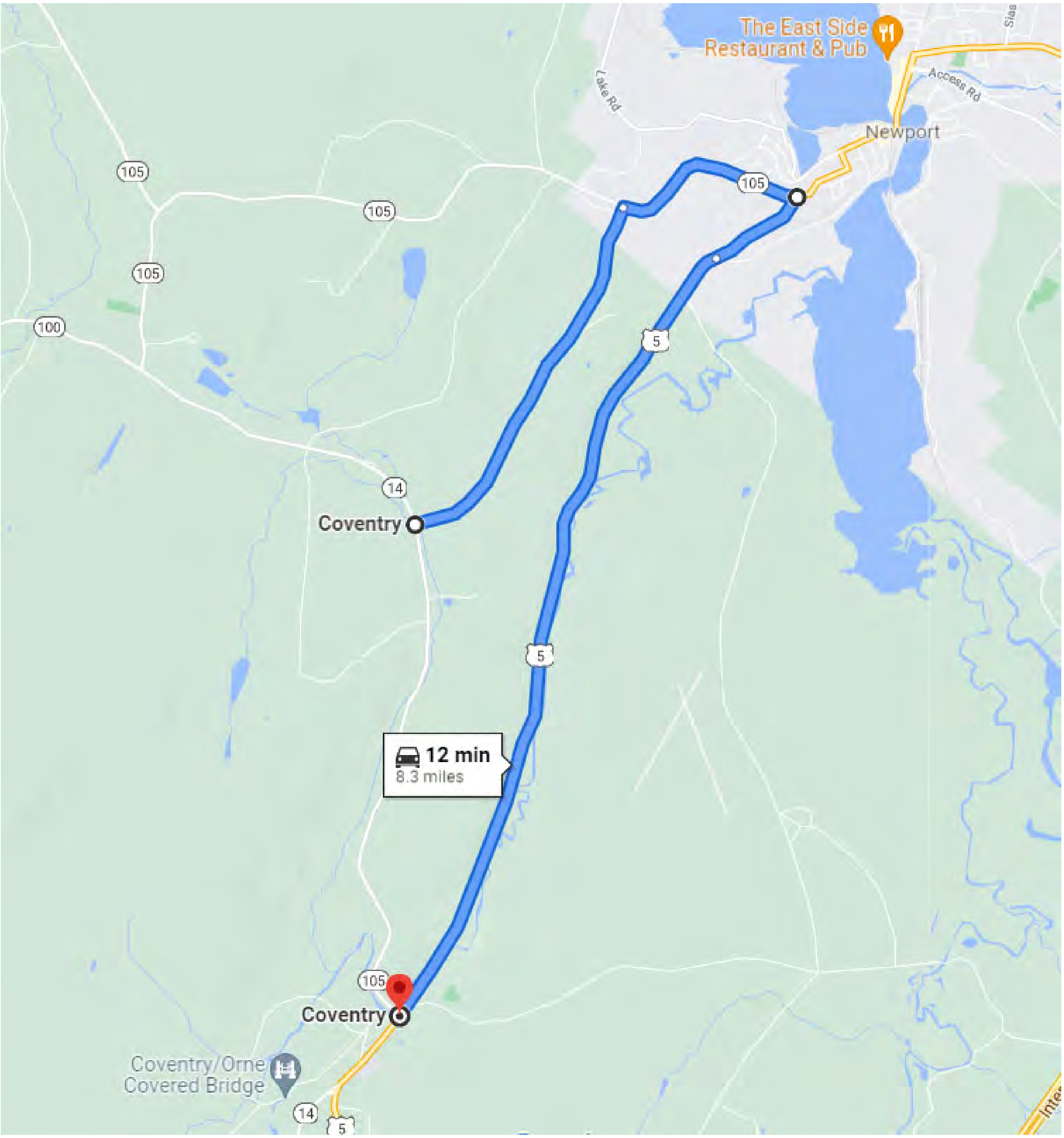
**Crash occurred prior to the last Highway Improvement Project. This data should not be used in a crash analysis. UNK indicates Mile Marker is Unknown.*

Appendix N: Detour and Local Bypass Maps



Regional Detour Route: VT Route 14, to VT Route 105 and US Route 5, back to VT Route 14.

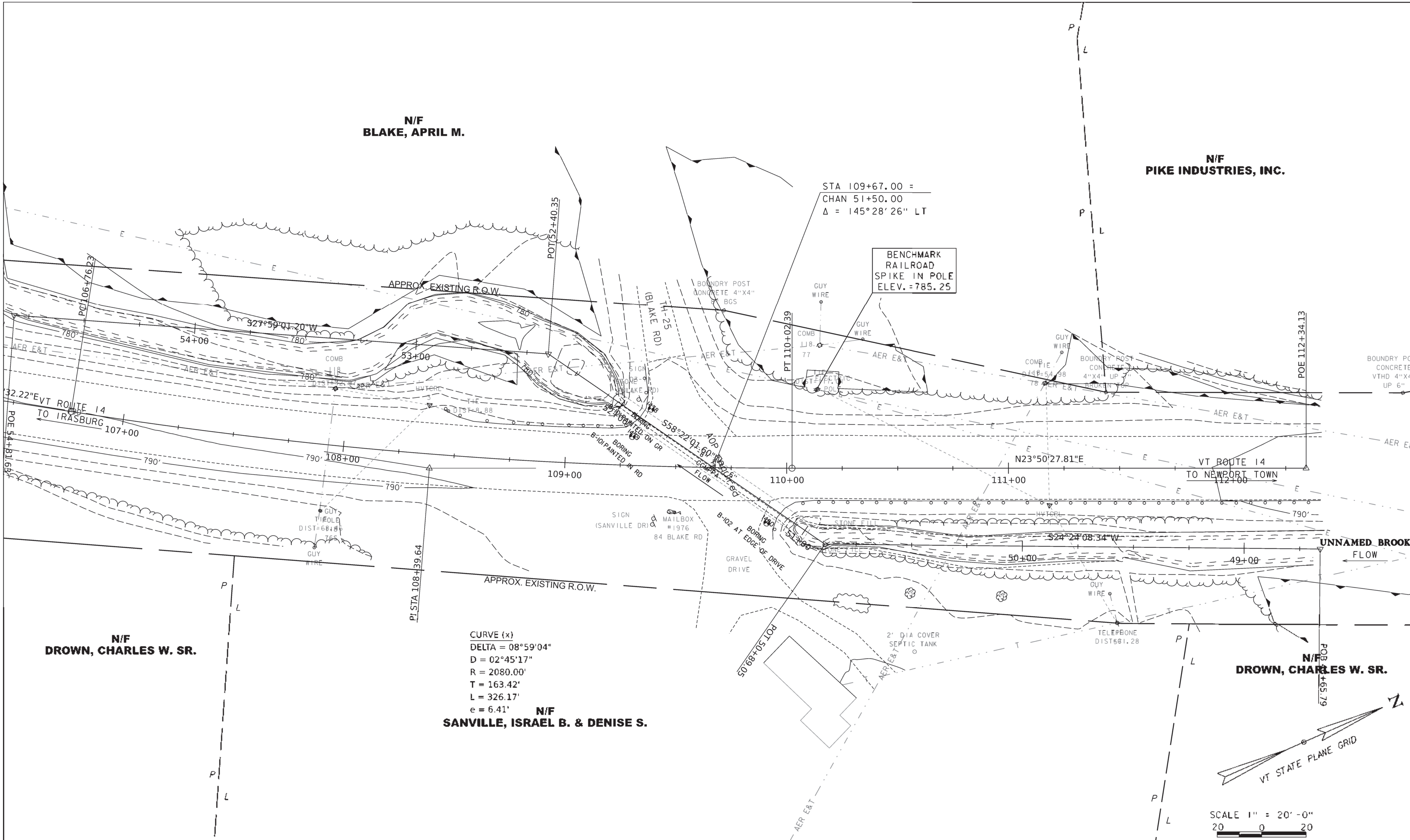
Through Route: 4.7 miles
Detour Route: 9.8 miles
End-to-end Distance: 14.5 miles
Added Distance: 5.1 miles



Local Bypass Route: VT Route 14, to Alderbrook Road, VT Route 105 and US Route 5, back to VT Route 14.

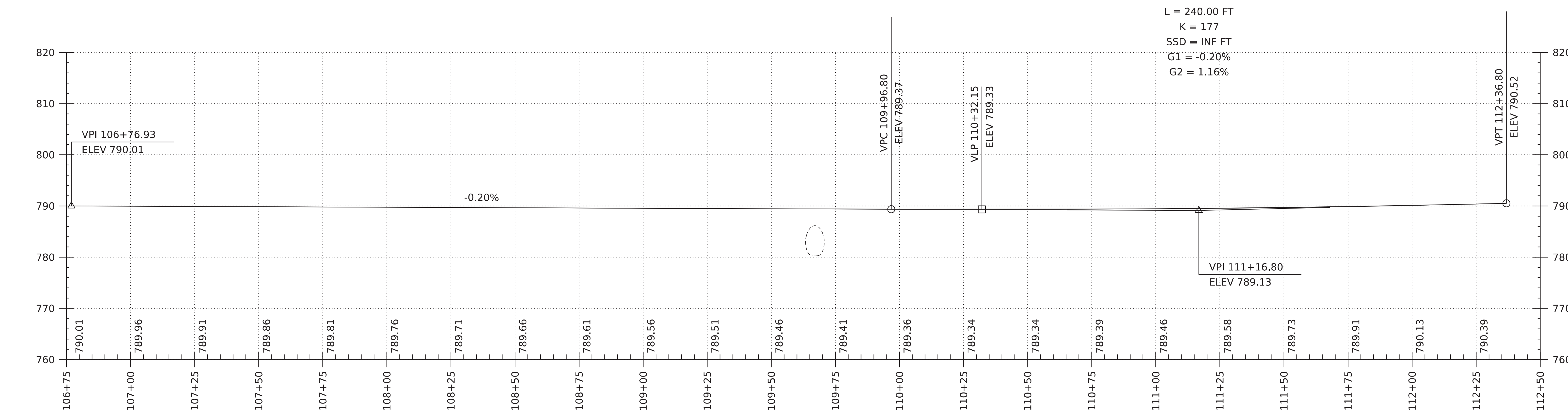
Through Route: 2.9 miles
Detour Route: 8.3 miles
End-to-end Distance: 11.2 miles
Added Distance: 5.4 miles

Appendix O: Plans



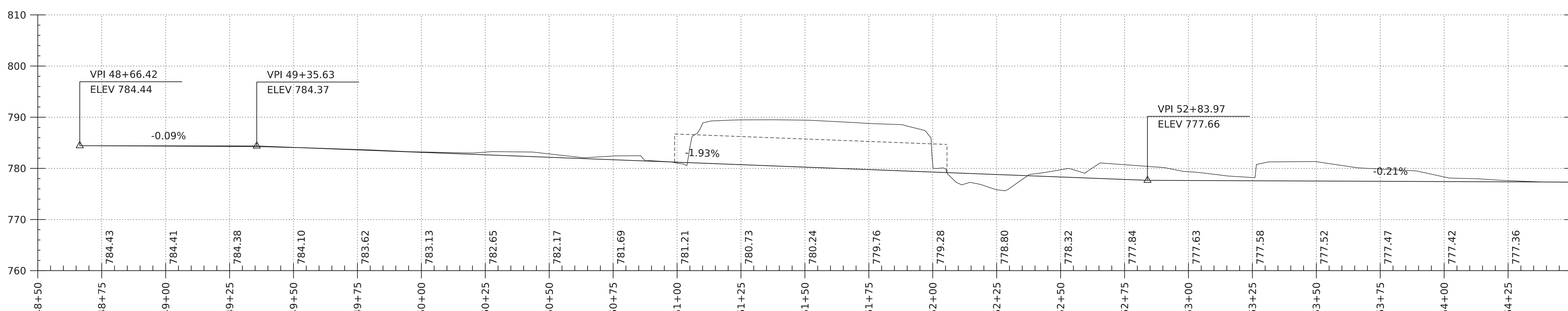
EXISTING BRIDGE INFORMATION
7'-8" X 5'-6" X 108' CGMPPA
BUILT 1959
24 SF WATERWAY AREA
4' AVERAGE COVER

PROJECT NAME: COVENTRY	
PROJECT NUMBER: BF 0251(49)	
FILE NAME: s21b025BDR_Existing.dgn	PLOT DATE: 1-OCT-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
EXISTING CONDITIONS	SHEET 1 OF 13



VT ROUTE 14 PROFILE

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

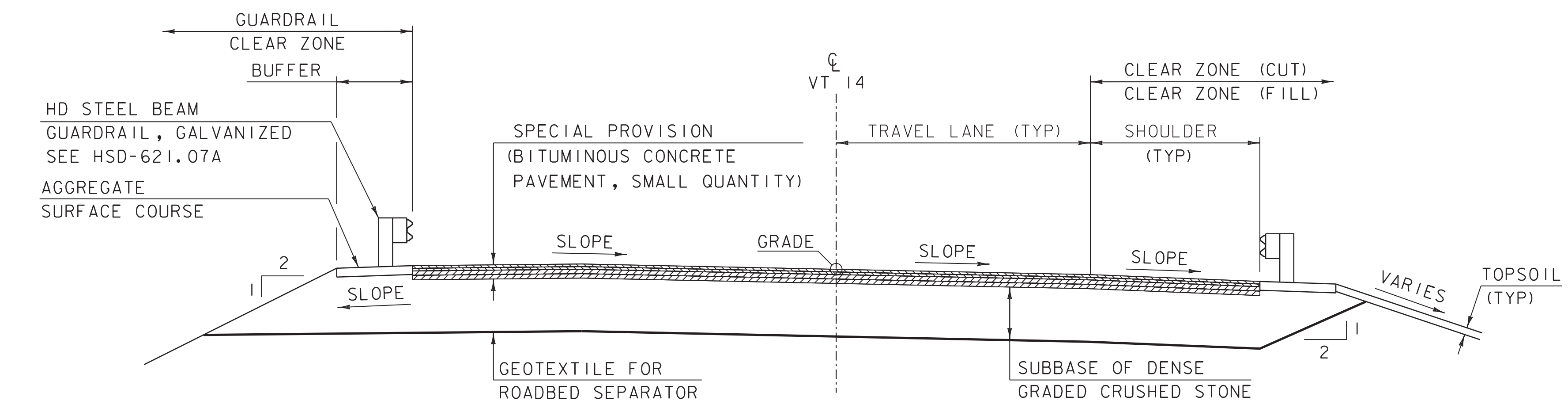


BRIDGE 132 PROFILE

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

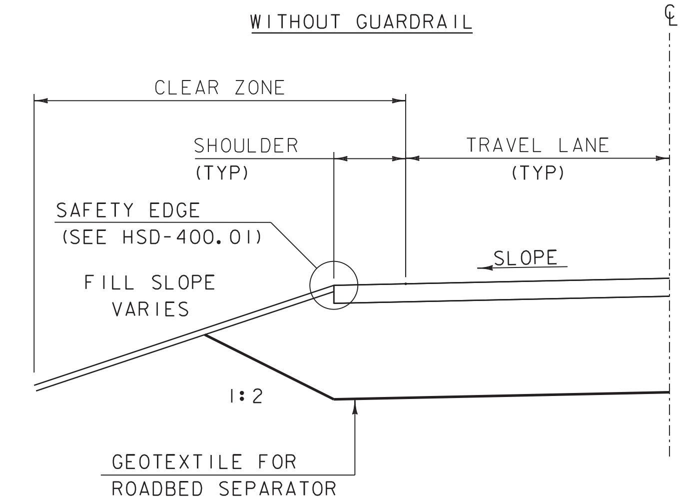
NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: COVENTRY	
PROJECT NUMBER: BF 0251(49)	
FILE NAME: s2lb025profile.dgn	PLOT DATE: 1-OCT-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
PROFILE SHEET	SHEET 2 OF 13



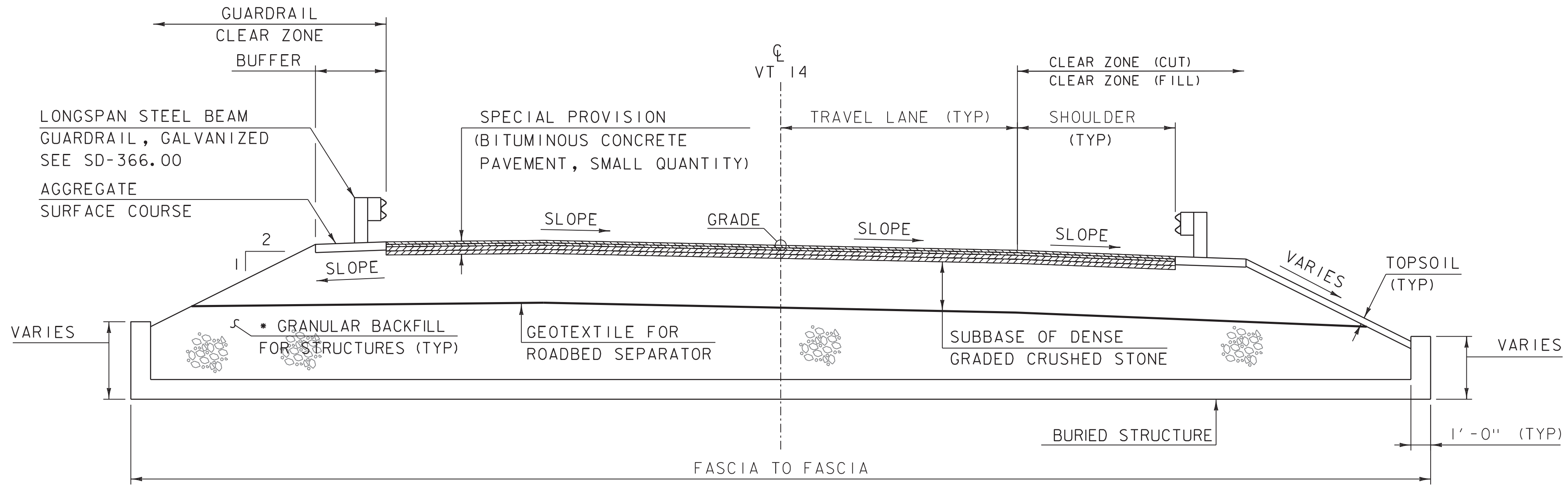
VT ROUTE 14 TYPICAL SECTION

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



ROADWAY TYPICAL SECTION

NOT TO SCALE



VT ROUTE 14 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	4'-0"	VARIES	4'-0"	VARIES
BUFFER	3'-7"	-0.060	3'-7"	-0.060
FILL SLOPE	---	VARIES	---	VARIES
CLEAR ZONE (CUT)	14'-0"	---	14'-0"	---
CLEAR ZONE (FILL)	20'-0"	---	20'-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	XX"	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

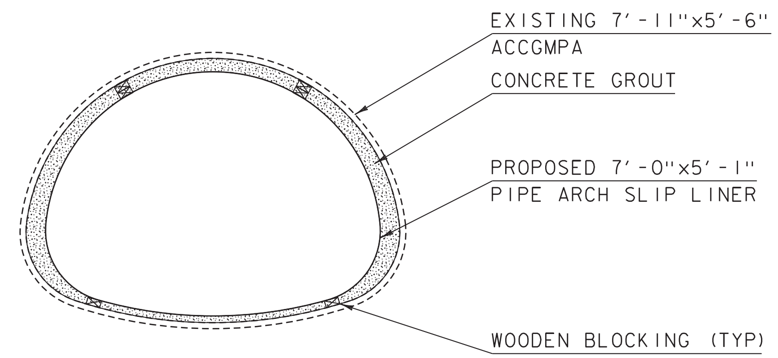
(IF USED ON PROJECT)

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

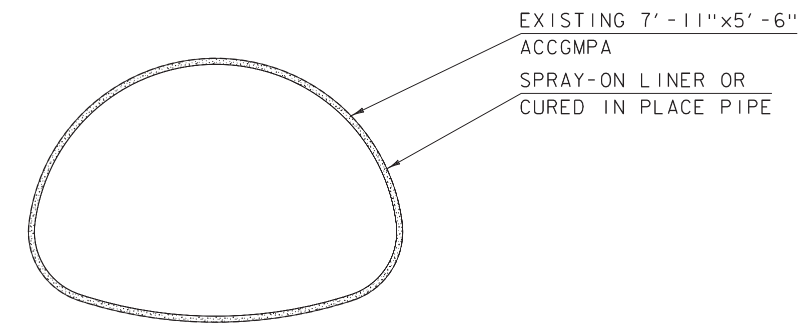
PROJECT NAME: COVENTRY
PROJECT NUMBER: BF 0251(49)

FILE NAME: 21b025/s21B025typ.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
TYPICAL SECTION SHEET 1

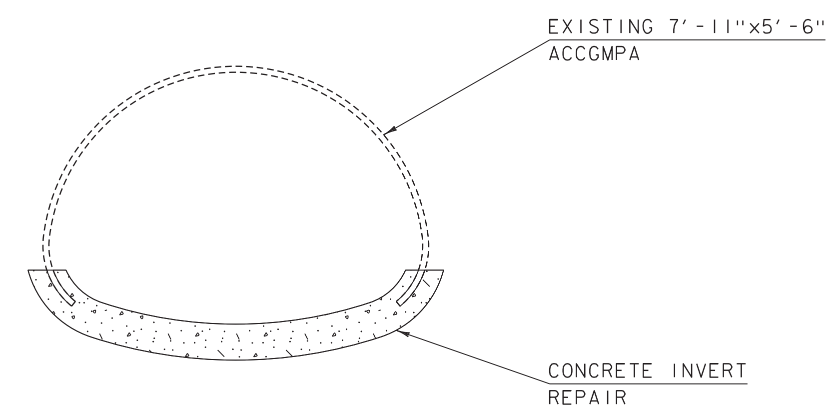
PLOT DATE: 1-OCT-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 3 OF 13



CULVERT SLIP LINER TYPICAL SECTION

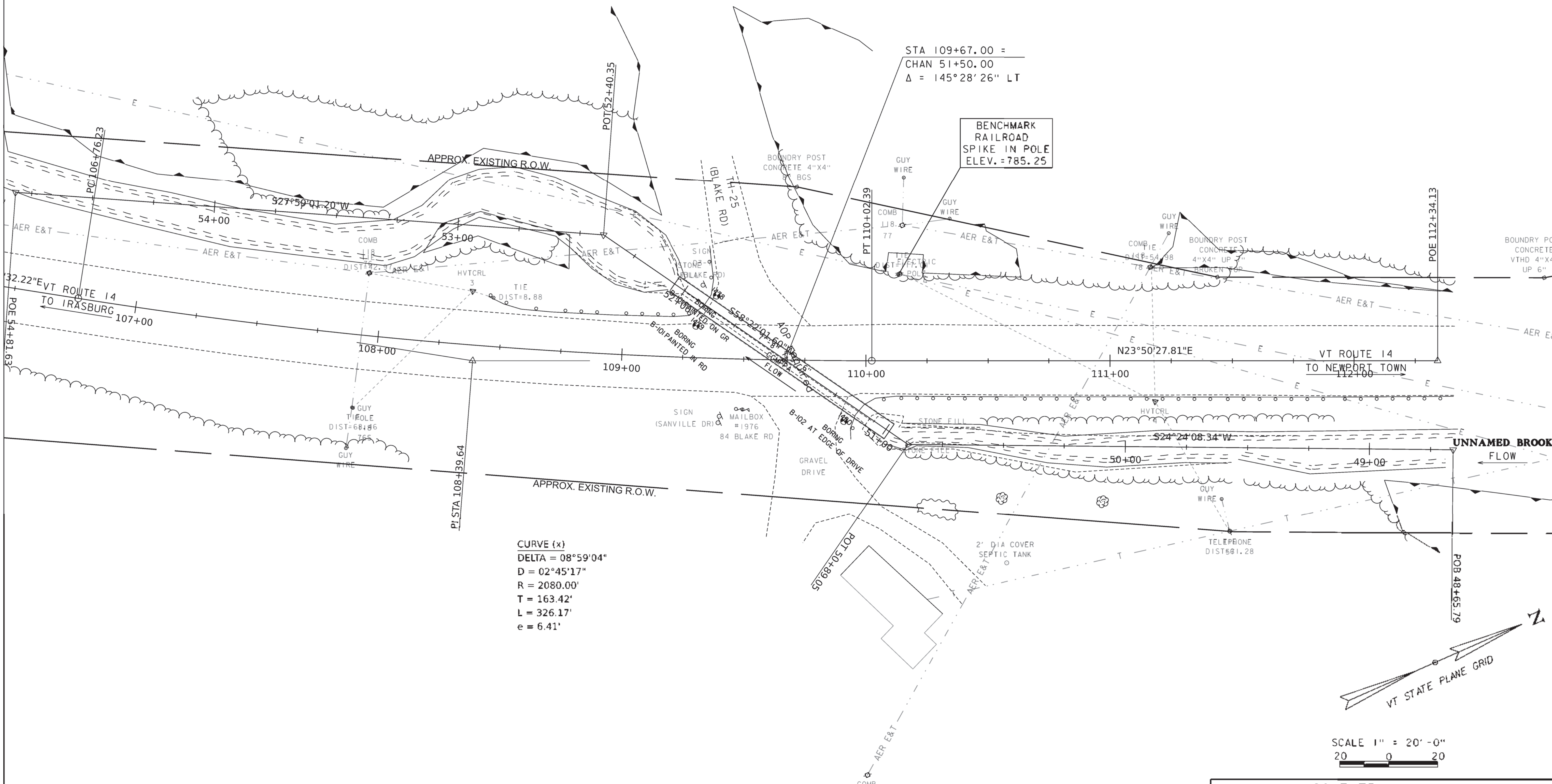


CULVERT SPRAY-ON LINER TYPICAL SECTION



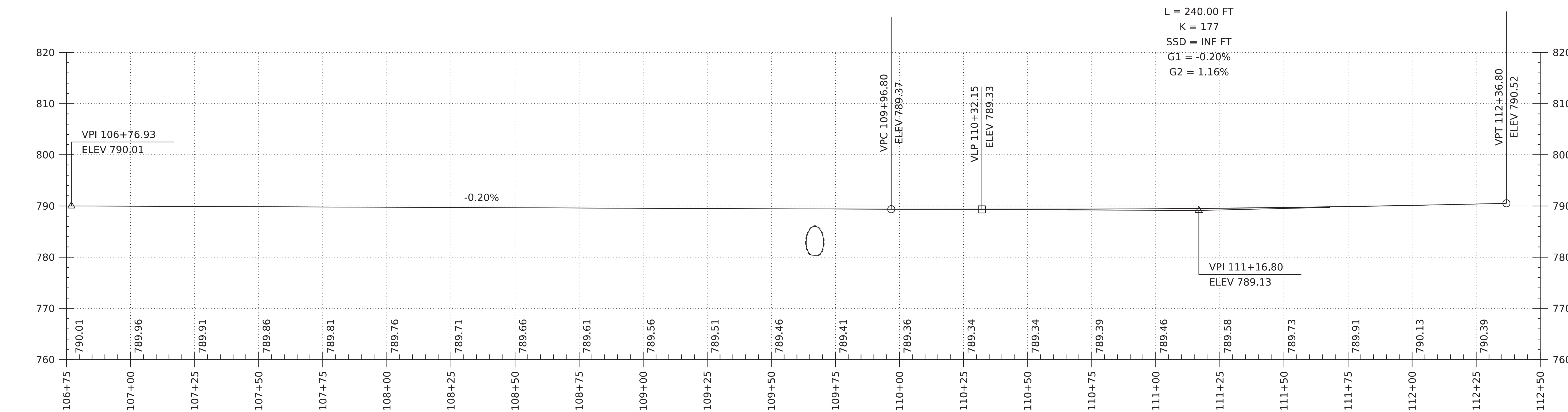
INVERT REPAIR TYPICAL SECTION

PROJECT NAME: COVENTRY	
PROJECT NUMBER: BF 0251(49)	
FILE NAME: 21b025/s21b025typical.dgn	PLOT DATE: 1-OCT-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ----------	CHECKED BY: ----------
REHABILITATION TYPICAL SECTIONS	SHEET 4 OF 13



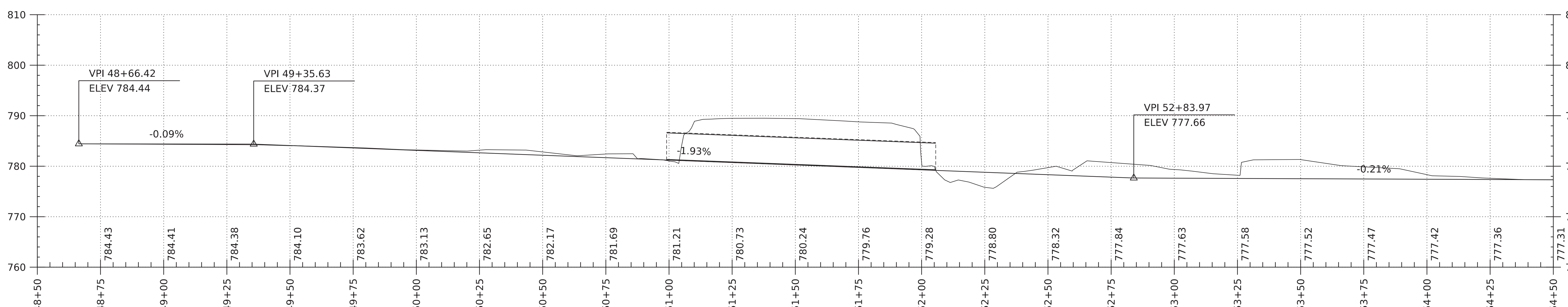
EXISTING BRIDGE INFORMATION
7'-8" X 5'-6" X 108' CGMPPA
BUILT 1959
24 SF WATERWAY AREA
4' AVERAGE COVER

PROJECT NAME: COVENTRY	
PROJECT NUMBER: BF 025I(49)	
FILE NAME: s2lb025BDR_Rehab.dgn	PLOT DATE: 1-OCT-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
CULVERT REHABILITATION LAYOUT	SHEET 5 OF 13



VT ROUTE 14 PROFILE

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

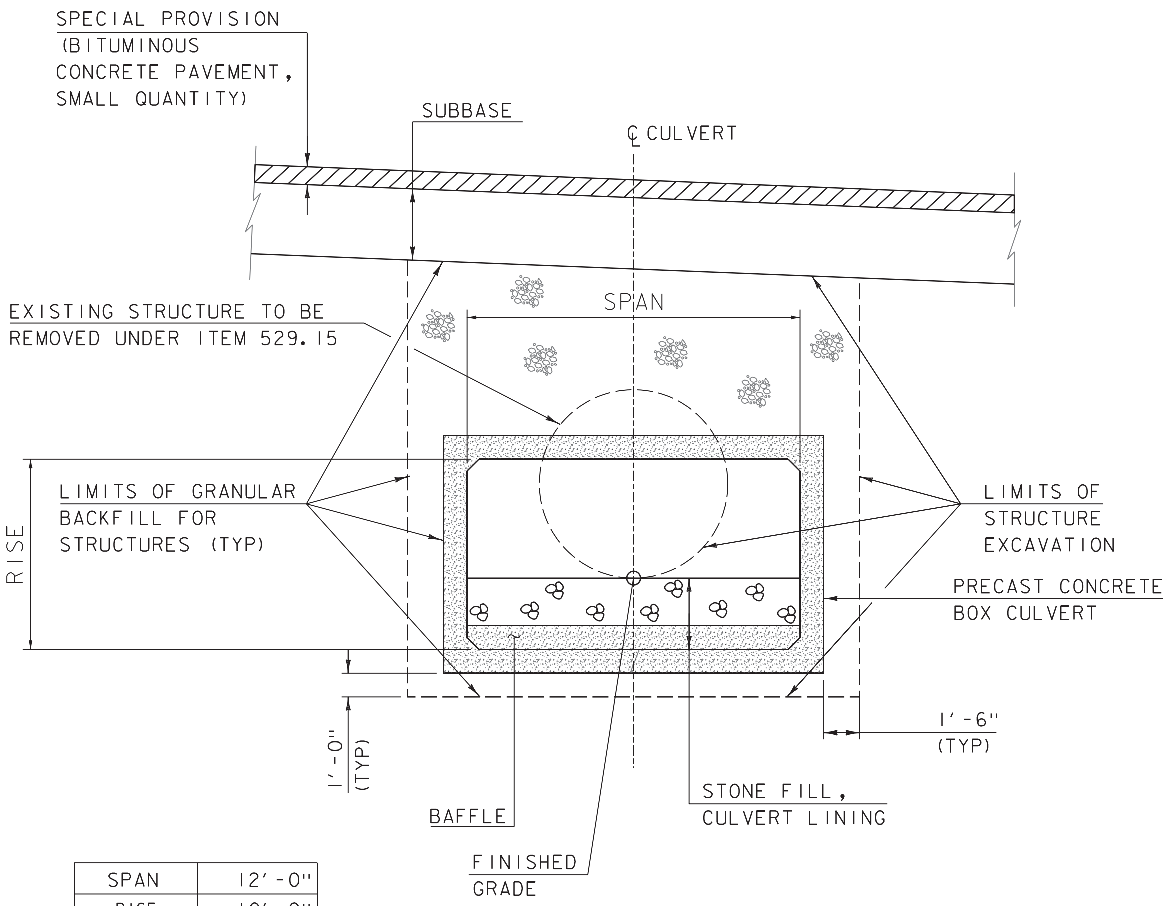


BRIDGE 132 PROFILE

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 ℄

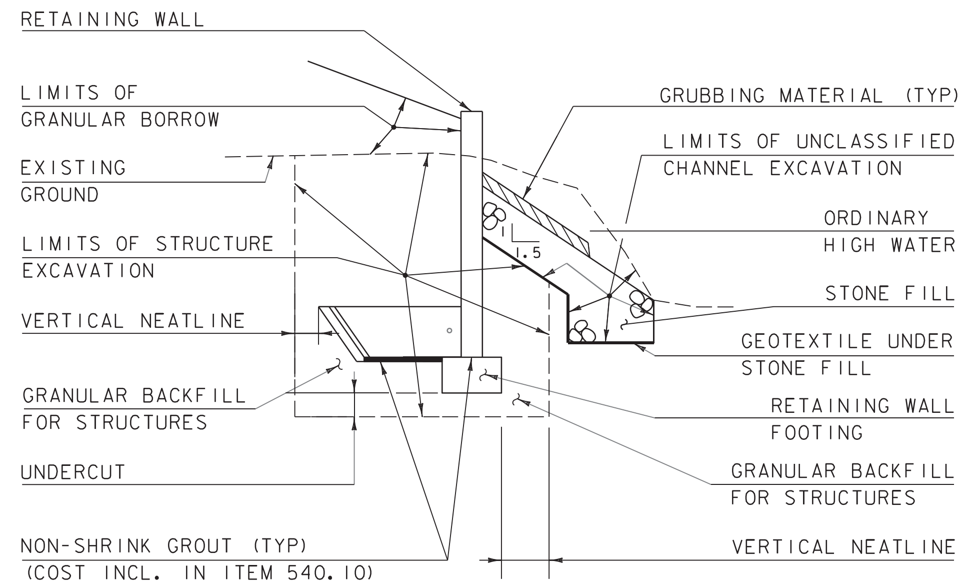
PROJECT NAME: COVENTRY	
PROJECT NUMBER: BF 0251(49)	
FILE NAME: s2lb025profile.dgn	PLOT DATE: 1-OCT-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
REHABILITATION PROFILE SHEET	SHEET 6 OF 13



SPAN	12'-0"
RISE	10'-0"
LENGTH	100'-0"

CULVERT TYPICAL SECTION

NOT TO SCALE



RETAINING WALL EARTHWORK TYPICAL SECTION

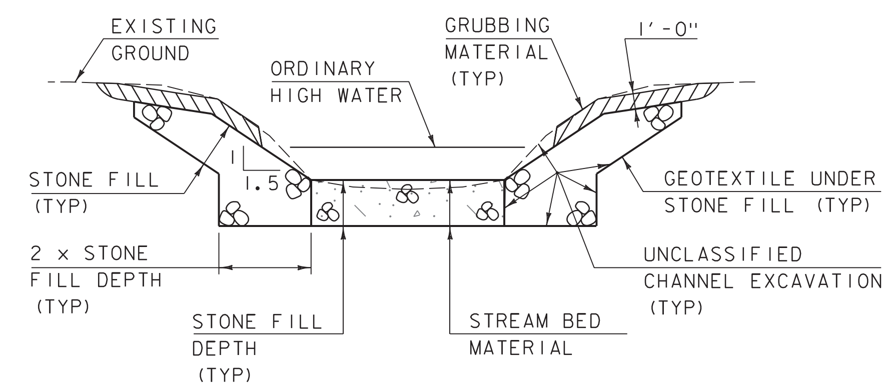
NOT TO SCALE

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"



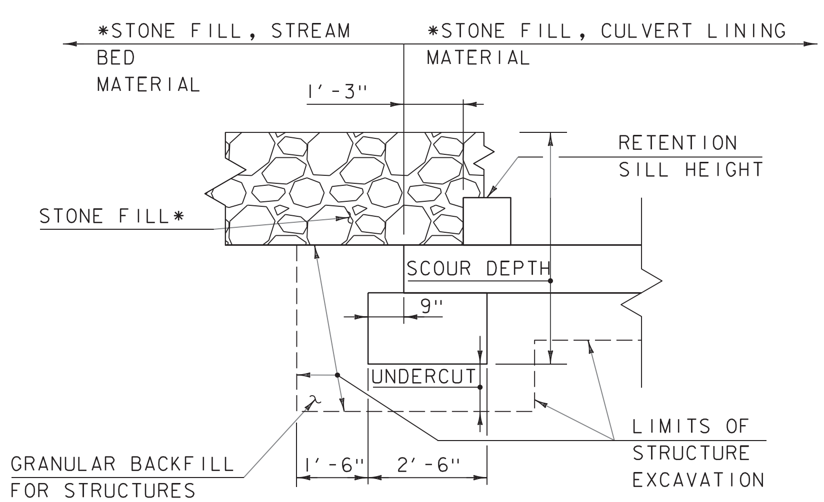
TYPICAL CHANNEL SECTION

(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.



CUTOFF WALL TYPICAL SECTION

NOT TO SCALE

NOTE:

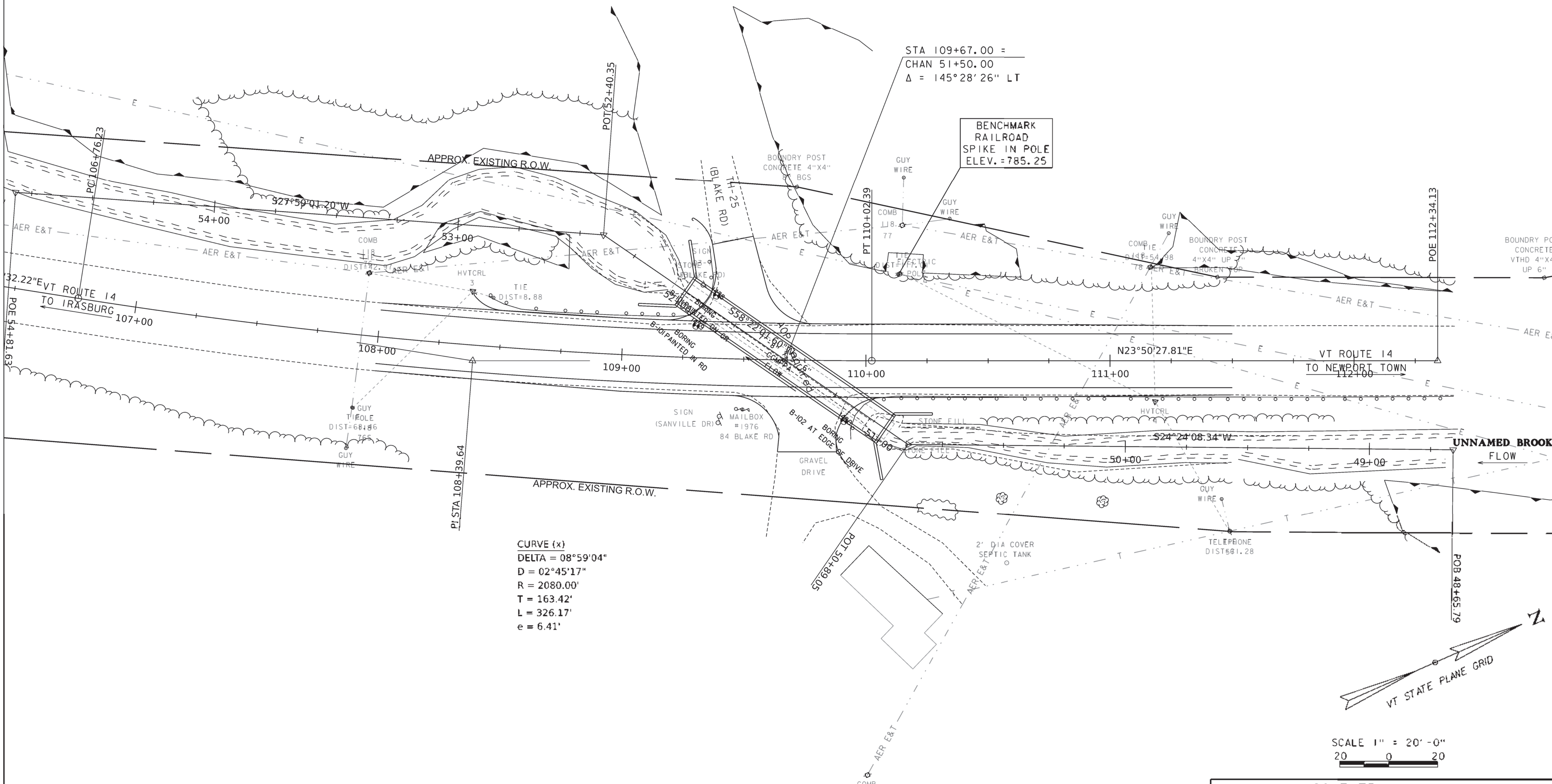
THE CUTOFF WALL MAY BE OMITTED IF THE DEPTH OF CULVERT LINING MATERIAL PLUS THE THICKNESS TO THE BOTTOM OF THE BOX MEETS OR EXCEEDS THE LISTED SCOUR DEPTH.

CUTOFF WALL - CRITICAL DIMENSIONS

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

MATERIAL INFORMATION

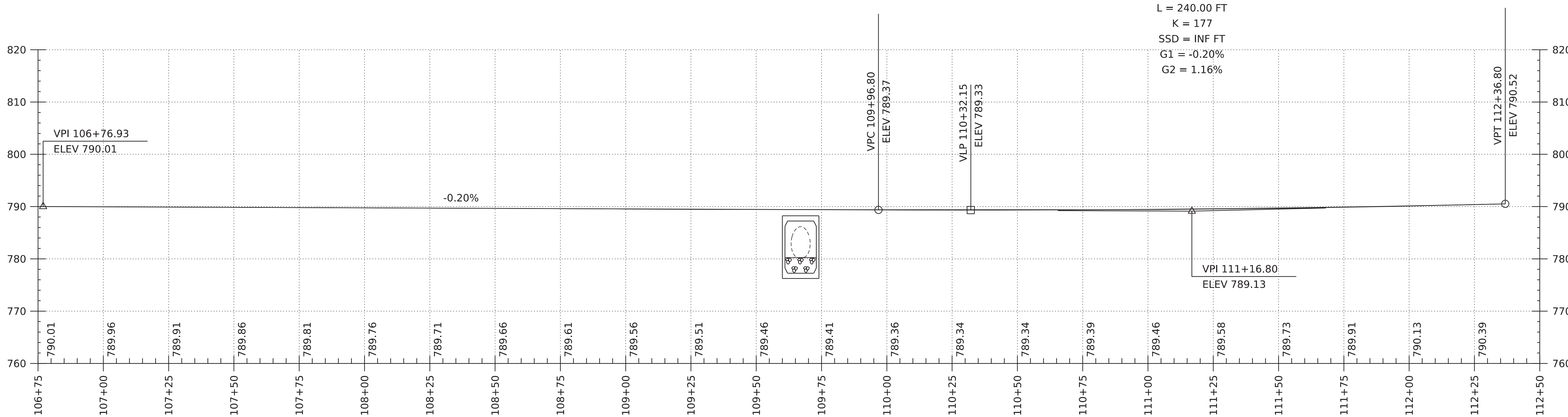
	THICKNESS	TYPE
STONE FILL	3'-0"	TYPE III
STONE FILL, CULVERT LINING	3'-0"	E-STONE TYPE III
STONE FILL, STREAM BED MATERIAL	3'-0"	E-STONE TYPE III



EXISTING BRIDGE INFORMATION
7'-8" X 5'-6" X 108' CGMPPA
BUILT 1959
24 SF WATERWAY AREA
4' AVERAGE COVER

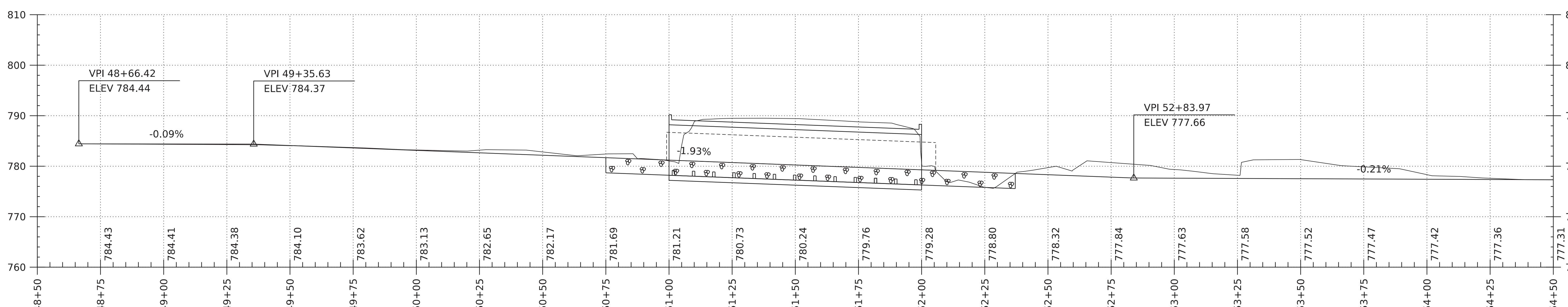
PROJECT NAME:	COVENTRY
PROJECT NUMBER:	BF 025l(49)

FILE NAME: s2lb025BDR_New Box Culvert.dgn	PLOT DATE: 1-OCT-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
BOX CULVERT LAYOUT	SHEET 8 OF 13



VT ROUTE 14 PROFILE

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



BRIDGE 132 PROFILE

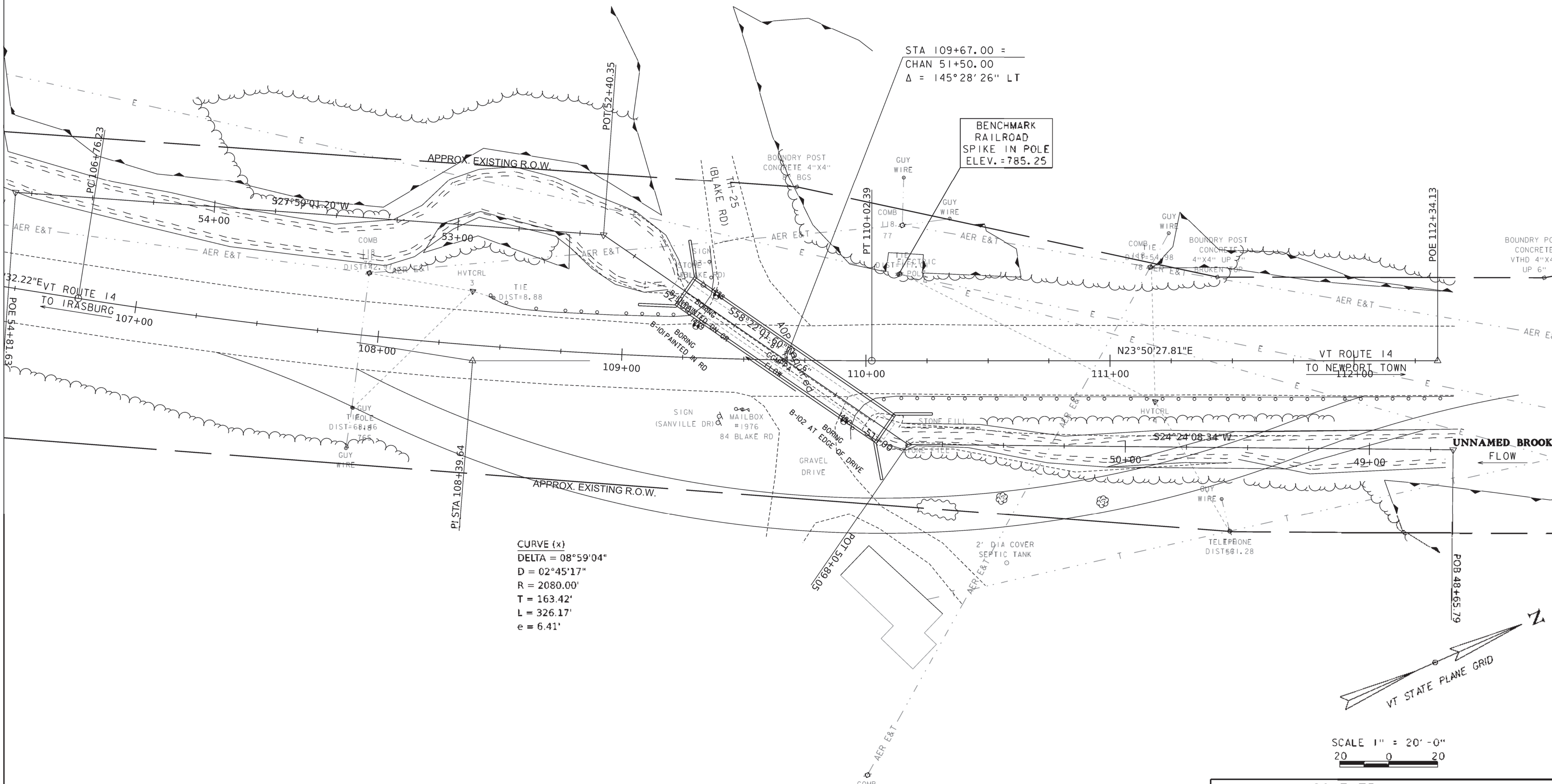
SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

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

PROJECT NAME: COVENTRY
PROJECT NUMBER: BF 0251(49)

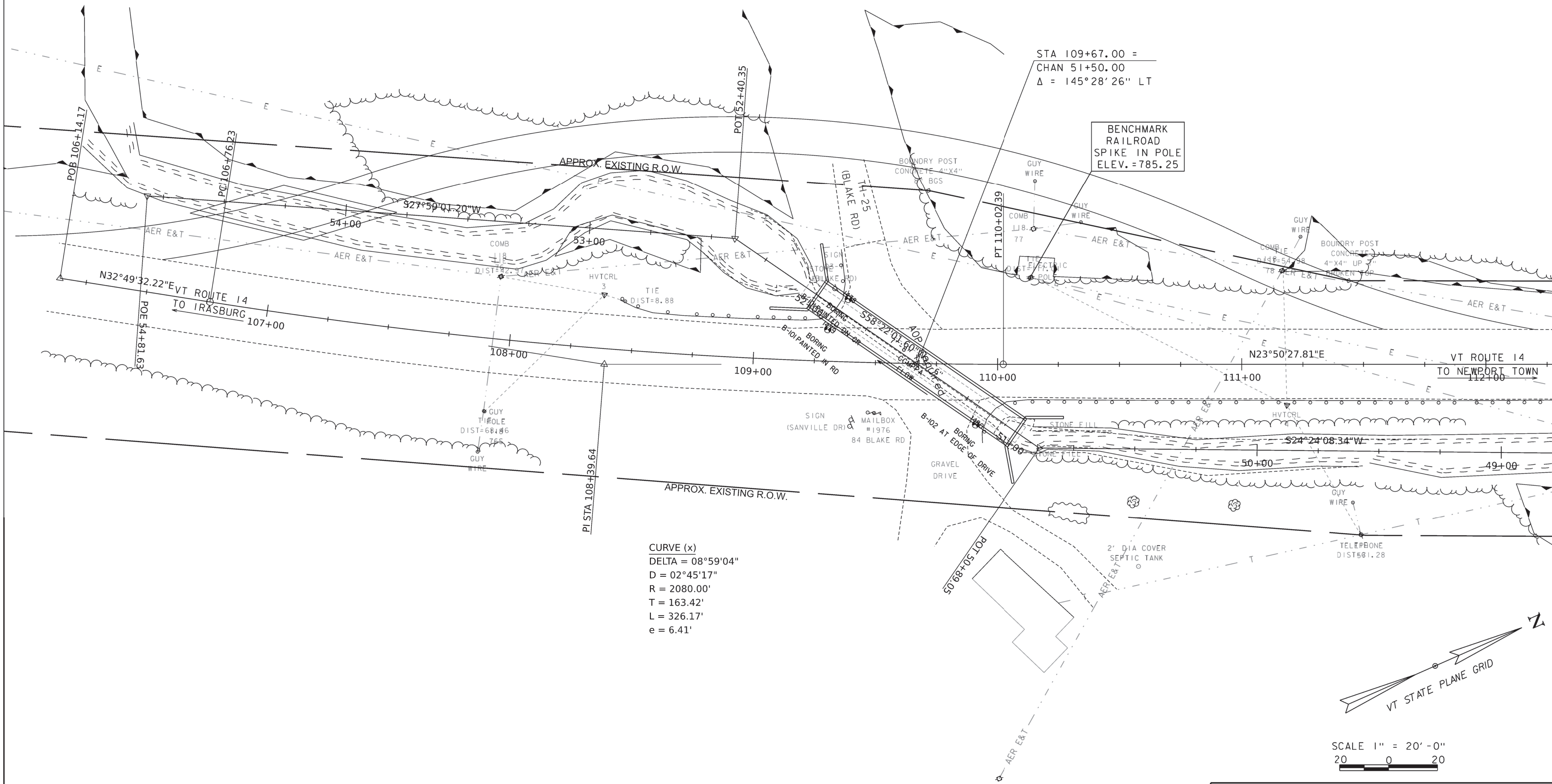
FILE NAME: s2lb025profile.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
4-SIDED BOX PROFILE SHEET

PLOT DATE: 1-OCT-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 9 OF 13



PROJECT NAME: COVENTRY
PROJECT NUMBER: BF 025I(49)

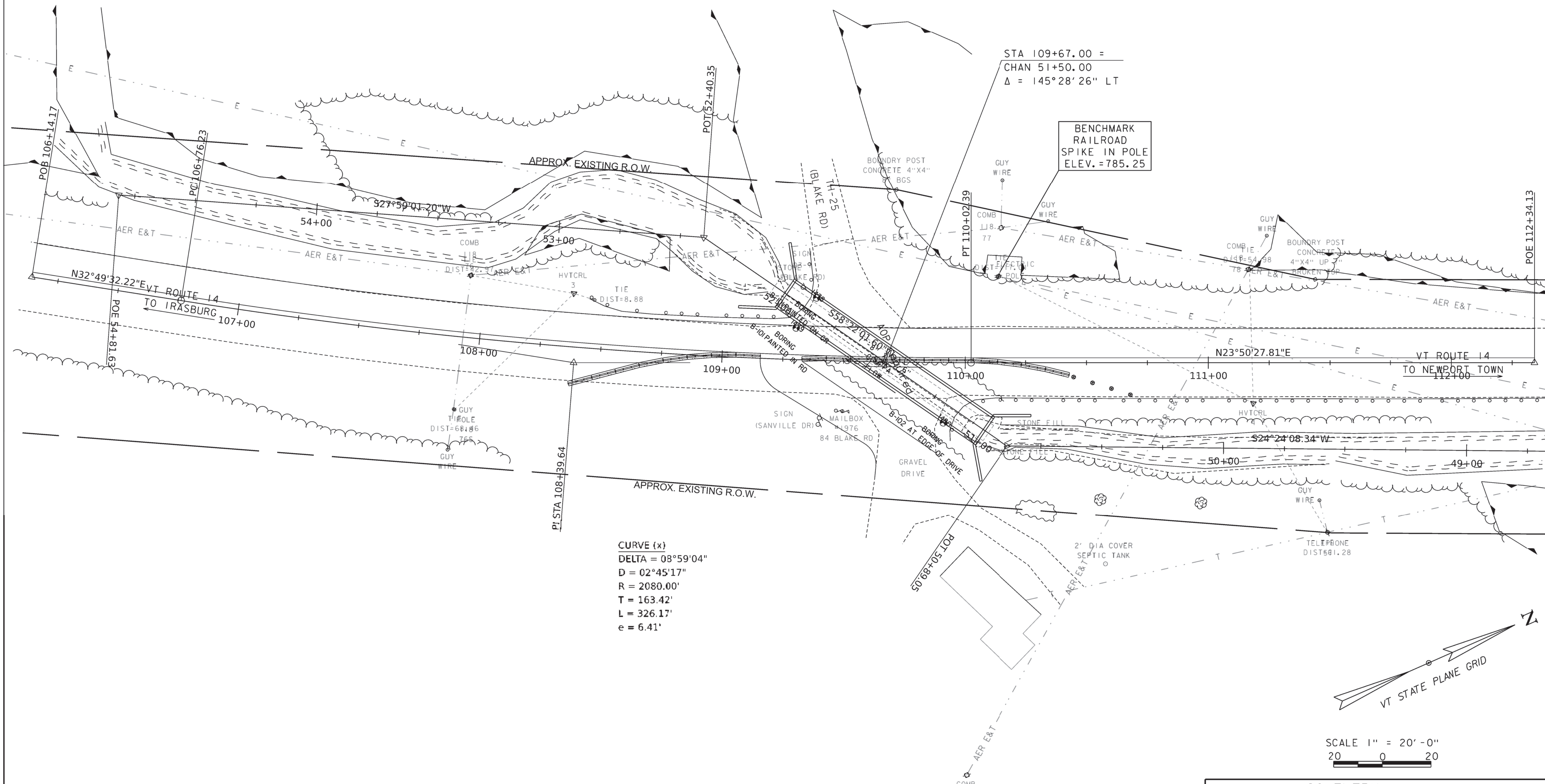
FILE NAME: s2lb025BDR_Temp Bridge Up.dgn
PLOT DATE: 1-OCT-2021
PROJECT LEADER: L.J.STONE
DRAWN BY: D.D.BEARD
DESIGNED BY: ------
CHECKED BY: ------
UPSTREAM TEMPORARY BRIDGE
SHEET 10 OF 13



PROJECT NAME: COVENTRY
PROJECT NUMBER: BF 0251(49)

FILE NAME: s21b025BDR_Temp Bridge Down.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
DOWNSTREAM TEMPORARY BRIDGE

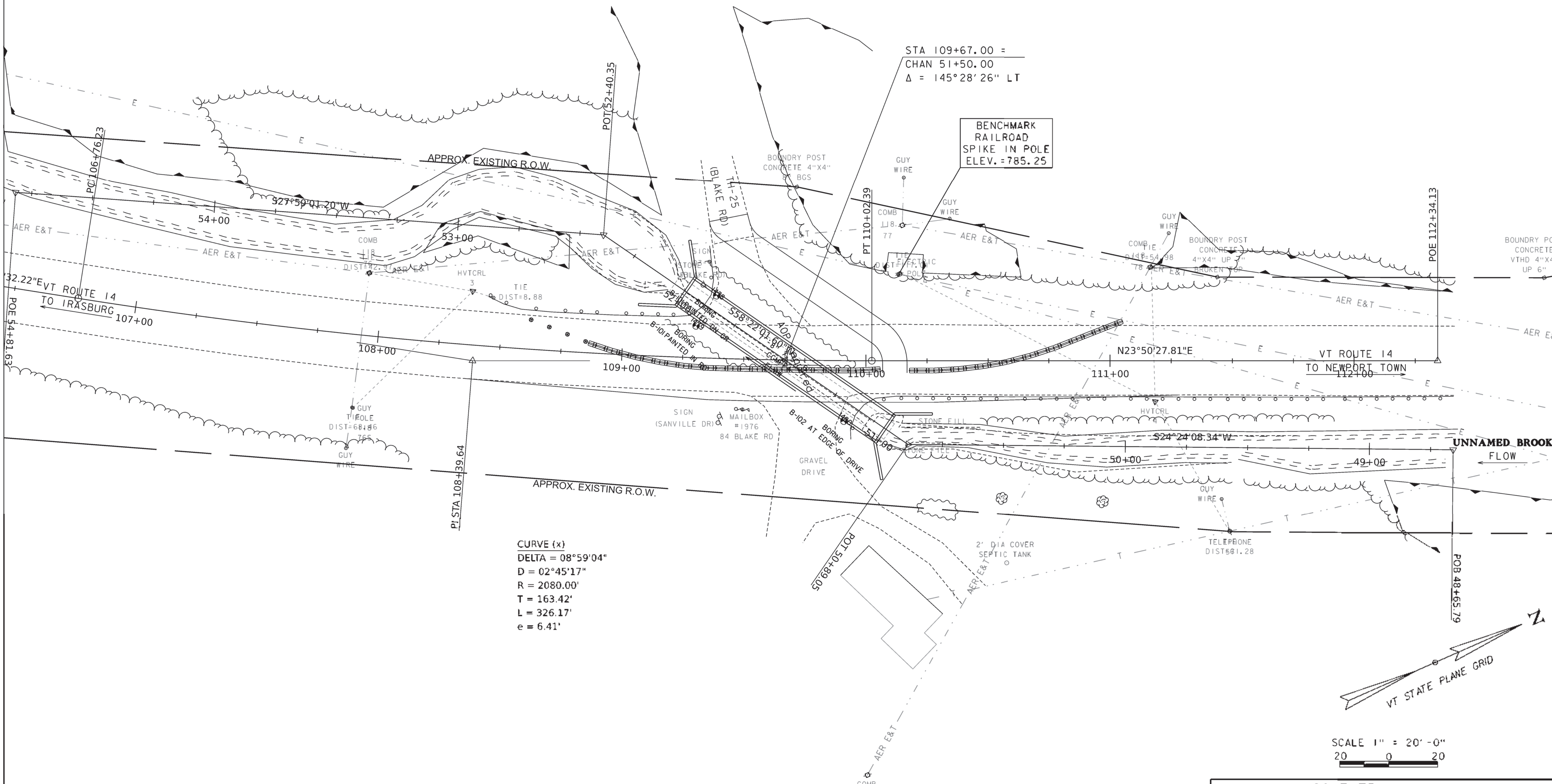
PLOT DATE: 1-OCT-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 11 OF 13



PROJECT NAME: COVENTRY
PROJECT NUMBER: BF 0251(49)

FILE NAME: s21b025BDR_Phase 1.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
PHASE I LAYOUT

PLOT DATE: 1-OCT-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 12 OF 13



CURVE (x)
DELTA = 08°59'04"
D = 02°45'17"
R = 2080.00'
T = 163.42'
L = 326.17'
e = 6.41'

PROJECT NAME: COVENTRY	
PROJECT NUMBER: BF 025I(49)	
FILE NAME: s2lb025BDR_Phase 2.dgn	PLOT DATE: 1-OCT-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
PHASE 2 LAYOUT	SHEET 13 OF 13