STATE OF VERMONT
AGENCY OF TRANSPORTATION

Scoping Report

FOR

STATEWIDE NORTHWEST STP CULV(90): ESSEX VT289 BR #17-A

VT ROUTE 289, BRIDGE 17-A OVER UNNAMED BROOK

May 22, 2023

Table of Contents

I. Site Information

Bridge 17-A is a State-owned bridge located on VT Route 289 in the Town of Essex approximately 1.3 miles north of the junction with VT Route 117. The existing conditions were gathered from a combination of a Site Visit, the Inspection Report, the Route Logs, and the existing Survey. See correspondence in the Appendices for more detailed information.

Roadway Classification	Other Principle Arterial (National Highway System)
Bridge Type	Corrugated Galvanized Metal Plate Pipe
Culvert Span	7 feet
Culvert Barrel Length	565 feet
Avg. Cover over Culvert	60 feet
Year Built	1993
Ownership	State of Vermont

Need

Bridge 17-A carries VT Route 289 across an unnamed Brook leading to Alder Brook. The following is a list of deficiencies of Bridge 17-A and VT Route 289 in this location:

1. The culvert is in Fair condition:
    a. The pipe has numerous small rust holes along the invert.
    b. The second construction joint has leakage with efflorescence and rust staining.
    c. The slopes need stabilization work to help stop the erosion.

Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2027 and 2047.

TRAFFIC DATA	2027	2047
AADT	5,351	5,870
DHV	660	710
%T	4.7	6.0
%D	54	54
ADTT	328	546
Flexible ESALS:	**2027~2047**	**2027~2067**
	958,000	2,149,000

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 5,870, a DHV of 710, and a design speed of 50 mph for a Principal Arterial.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Roadway Lane and Shoulder Widths	VSS Table 3.3	12'/8' (42')	12'/8' (42')	Meets Minimum Standards
Clear Zone Distance	VSS Table 3.4	>24ft on eastern bank, 10ft shoulder on western bank with guardrail (steep banks on western side)	20' fill (1:4 slope) / 12' cut (1:3 slope) 14' cut (1:4 slope)	
Banking	VSS Section 3.13	Superelevated 4.6%	8% (max)	Meets Minimum Standards
Speed	VSS Section 3.3	50 mph (posted)	50 mph (design)	
Horizontal Alignment	AASHTO Green book Table 3-10b	R = 2,384ft	R_{min} = 2,280 ft @ e=4.6%	Meets Minimum Standards
Vertical Grade	VSS Table 3.5	0.4% avg over culvert	4% (max) for level terrain	
K Values for Vertical Curves	AASHTO	K_{crest} = 510	84 crest / 96 sag	
Vertical Clearance	VSS Section 3.8	No Issues Noted	16'-3" (min)	
Stopping Sight Distance	AASHTO	1055'	425'	
Bicycle/Pedestrian Criteria	VSS Table 5.8	10' shoulders	Match existing	No bike or pedestrian access allowed on this roadway
Hydraulics	VTrans Hydraulics Section	HW/D @ 2% AEP = 0.44 HW/D @ 1% AEP = 0.47 Span: 7 feet	HW/D < 1.2 @ 2% AEP HW/D < 1.5 @ 1% AEP Minimum Bankfull Width: 2-4 feet	Meets Minimum Standards
Structural Capacity	SM, Ch. 3.4.1	Structurally Sufficient	Design Live Load: HL-93	

Inspection Report Summary

Culvert Rating	5 Fair
Channel Rating	7 Good
Wingwall/Headwall Rating	7 Good
Approach Rating	8 Very Good

11/27/2018 Culvert barrel: along pipe invert has numerous holes anywhere from 1/2" to 6" in diameter mostly along the first third of the pipe, then more small holes forming from outside in, along haunch areas more near outlet third portion. Culvert Invert: rusted through in areas - shape of pipe is still good - no distortion to speak of. Pipe should be considered for a poured invert repair or sleeve repair. ~ MJ/SP

11/5/2013 Culvert should be evaluated for a concrete invert. ~FRE/MJK

6/16/2008 Culvert is in fair to good condition. Invert is deteriorating and will need corrective action soon. Rip rap should be installed on the slopes to help stop the erosion. ~DS

Hydraulics

The existing structure meets the current hydraulic standards of the VTrans Hydraulic manual. Hydraulics has made several recommendations for a rehabilitation or replacement structure; these options are outlined in the preliminary hydraulics report in Appendix D.

Utilities

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

Underground:

- Town of Essex Public Works
- Vermont Electric Power Company
- Vermont Gas Systems

Right Of Way

The existing Right-of-Way (ROW) is plotted on the Existing Conditions Layout Sheet. Minimal ROW acquisition may be required for trenchless options and for access to the existing structure for all aternatives.

Environmental and Cultural Resources

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

Biological

VTrans hired the consultant, Bear Creek Environmental, to perform a natural resource evaluation at this site.

Wetlands/Floodplains

There are wetland complexes mapped on both the inlet and outlet end of the culvert within the study area. The wetland above the culvert inlet is Palustrine, dominantly Emergent, non-persistent wetland and is seasonally flooded. The wetland a short distance below the culvert outlet is beaver influenced and is characterized as Palustrine, dominantly Emergent, Nonpersistent, Semi permanently flooded mixed with Scrub-Shrub, broadleaved deciduous. For additional information, see the Existing Conditions Layout Sheet and the Natural Resources Memo in Appendix G.

Rare, Threatened, and Endangered Species

There were no rare, threatened, or endangered species documented within the vicinity of this project site.

Wildlife Habitat

Riparian and Wildlife Connectivity are rated as the highest priority both upstream of the culvert under VT Route 289 upstream and downstream on the culvert outlet within the Alder Brook corridor.

Archeological

The VTrans Archaeology group conducted a resource identification study on December 14th, 2022, and found no areas of archaeological sensitivity.

Historic

Bridge 17-A is not a historic structure. This structure is a common CMP from the 1990s that is not historically significant. No other buildings, structures, or objects within a likely area of potential effect.

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.

Stormwater

There are no stormwater concerns for this project. The culvert under VT Route 289 in Essex conveys an unnamed tributary of Alder Brook and is not located within a stormwater impaired watershed. This location is within the limits of the historical stormwater permit that was obtained for VT Route 289. That permit is no longer in existence; however, the treatment features remain, including a grass swale running along the eastern side of the road at the culvert location.

Landscape Clearance

The VTrans landscape architect conducted a resource identification study on April 18th, 2022, and determined that there are potentially minor buffer impacts occurring as a result of the proposed work. It is recommended that re-vegetating the area with native trees and shrubs for river buffers and a diverse pollinator seed mix be used.

II. Safety

There have been 57 crashes along VT Route 289 in Essex in the last five-year period. 5 of those crashes were within 1 mile of the structure. The bridge is not located within a high crash location.

III. Local Concerns

A local concerns questionnaire was sent to the town. The town of Essex sent a reply on July 25th, 2022, and didn't have any concerns or issues with the project, but they did provide some comments in the Land Use section of the questionnaire. There is a copy of the questionnaire in Appendix N.

IV. Operations Concerns

An Operations questionnaire was sent to the VTrans maintenance District 5. No response has been received to date. There is a copy of the questionnaire in Appendix O.

V. Maintenance of Traffic

The Vermont Agency of Transportation has created an Accelerated Bridge Program, which focuses on faster delivery of construction plans, permitting, and Right of Way, as well as faster construction of projects in the field. One practice that helps in this endeavor is closing bridges for portions of the construction period, rather than providing temporary bridges. In addition to saving money, the intention is to minimize the closure period with faster construction techniques and incentives to contractors to complete projects early. 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 will also expedite construction schedules. This can apply to decks, superstructures, and substructures. Accelerated Construction should 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 bridge and reroute traffic onto an official, signed State detour. There are two detours that could be used if the bridge is closed during construction. The potential State-signed detour is as follows:

1. From the VT 289 and Essex Way interchange get onto VT 289 W, exit VT 289 to VT 15, to Railroad St, to VT 117, back to the VT 289 E interchange marking the ending of VT289 (6.1 miles end-to-end).

This detour route option will require approval from the Town of Essex in order to use Railroad St as part of our state route detour option. There is a potential Local bypass detour option described as follows:

2. From the VT 289 and Essex Way interchange travel along Essex Way, to VT 15, to Jericho Road, to Sand Hill Road, to VT 117, back to the VT 289 E interchange marking the end of VT289 (6.7 miles end-to-end).

A map of the detour routes can be found in Appendix P.

Advantages: This option would not require the need to obtain rights from adjacent property owners for a temporary bridge. Also, this option would have minimal impacts to natural resources located up and downstream of the structure. This option reduces the time and cost of the project both at the development stage and construction. This is the safest traffic control option since the traveling public is removed from the construction site.

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

Option 2: Phased Construction

Phased construction is the maintenance of traffic on the existing bridge while building one lane at a time of the proposed structure. This allows keeping the road open during construction, while having minimal impacts to adjacent property owners and environmental resources.

While the time required to develop a phased construction project would remain the same, the time required to construct a phased construction project increases because some of the construction tasks must be performed multiple times. In addition to the increased design and construction costs mentioned above, the costs also increase for phased construction because of the inconvenience of working around traffic and the effort involved in coordinating the joints between the phases. Another negative aspect of phased construction is the decreased safety of the workers and vehicular traffic, which is caused by increasing the proximity and extending the duration that workers and moving vehicles are operating in the same confined space. Phased construction is usually considered when the benefits include reduced impacts to resources and decreased costs and development time by not requiring the purchase of additional ROW.

Based on the current traffic volumes, 2-way traffic would need to be maintained. Based on the width of the roadway, maintaining two lanes of traffic is feasible. There is approximately 60 feet of vertical fill over the existing culvert, which would need to be held back for phased construction, making this alternative costly.

Advantages: Two-way traffic flow would be maintained through the project corridor during construction. Also, this option would have minimal impacts to adjacent properties and environmental resources. Right-of-Way would not be required for this maintenance of traffic option.

Disadvantages: Phased construction generally involves higher costs and complexity of construction. Costs are usually higher and construction duration is longer since many construction activities must be performed two times. Additionally, since cars are traveling near construction activity, there is decreased safety.

Option 3: Temporary Bridge

From a constructability standpoint, a temporary bridge could be placed either upstream or downstream of the existing structure. The culvert is located in a rural area, and a temporary bridge on the upstream (northeastern) or downstream (southwestern) side of the road would only have impacts to wetlands if the temporary bridge was built near the existing brook. If this option is selected as the maintenance of traffic selection, then a temporary bridge on the upstream side should be considered. A downstream temporary bridge is impracticable due to the waterway flowing parallel to the road in this area.

There is a buried gas line running parallel to the northern side of the road and if the temporary bridge were placed on the upstream side, the gas line would need to be relocated. If the temporary bridge were placed on the downstream side, the line would need to be stabilized so that it would be safe to work around. The downstream side of the road may need temporary right of way acquired if the bridge is built there as there is less right of way on that side of the road.

Additional costs would be incurred to construct a temporary bridge, including the cost of fill for the approaches and the bridge itself, installation and removal of the temporary bridges and approaches, and restoration of the disturbed area.

If a temporary bridge is chosen as the preferred method of traffic control, based on the traffic volumes and site conditions, it should be a two-lane bridge with alternating traffic to minimize impacts to surrounding resources. See the Temporary Bridge Layout Sheets in Appendix Q.

Advantages: Traffic flow can be maintained along the VT Route 289 corridor.

Disadvantages: This option would potentially require additional Right-of-Way acquisition. This option might have adverse impacts to wetlands if placed near the brook where class 2 wetlands were found. There would be decreased safety for the workers and to vehicular traffic, because of cars driving near the construction site, and construction vehicles entering and exiting the construction site. This traffic control option would be more costly and time-consuming then an offsite detour. This option may require relocation of utilities for construction.

VI. Alternatives Discussion

No Action

This alternative is not recommended. The culvert is in fair condition and will continue to deteriorate if no action is taken. The pipe invert condition has been deteriorating for over 15 years and numerous small rust holes have been worsening the structure condition. The culvert also needs additional slope work to prevent erosion, specifically at the outlet end. 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.

Alternative 1: Rehabilitation

This alternative involves the rehabilitation of the existing corrugated metal pipe structure.

Rehabilitation options considered:

a. Invert Repair
b. Pipe Liner

All rehabilitation options would employ the use of hydroblasting or hydrodemolition 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 headwall with beveled inlets would be recommended for all rehabilitation alternatives.

a. Invert Repair

Invert repair can be utilized on corrugated steel pipe, and typically consists of paving the invert or pouring a concrete invert. Much of the deterioration is located along the invert in the first third of the pipe, making this a suitable repair for the culvert. This option involves removal of the degraded invert and pouring a 2- to 3-inch-thick section of concrete in its

place. Additionally, there may be repair of any holes along the circumference of the pipe, including the large perforation at the outlet of the pipe on the south side. This option would have the least impact on the hydraulic capacity of the existing culvert. While this option is a good solution to the current degradation of the culvert invert, it adds little structural stability to the current structure. There has been no evidence of distortion, and as such, additional structural capacity is not required.

The VTrans Hydraulics section modeled the existing culvert with a 1-foot-thick concrete paved invert, providing a 6-foot clear height and 35 square feet of waterway opening. This option had high outlet velocities and may require Stone Fill, Type III for downstream channel bank protection.

b. Pipe Liner:

A pipe liner involves inserting a culvert liner into the existing culvert and grouting between the two. Slip lining 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 slip lining 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 liner 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 approximately 50 years, and resists temperature changes.

The VTrans Hydraulics section modeled the existing culvert with a corrugated metal pipe liner with a diameter of 6 feet, providing 28.3 square feet of waterway opening. The slip-lined culvert was modeled centered inside the existing structure.

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. Additionally, it would have minimal impact on resources. The existing pipe is in fair condition so rehabilitation would be a very cost-effective option for this pipe since it's under so much fill, such a long structure, and under a highly traveled road.

Disadvantages: The rehabilitation alternative is only a repair and not a new structure. The life span of the repair work is estimated to be 15 to 50 years. Aquatic Organism Passage and wildlife connectivity would not be improved. It is assumed that for any rehabilitation alternative, minor temporary right-of-way will be necessary for the contractor's access to the ends of the culvert and to set up staging areas and access roads for construction equipment.

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

Alternative 2: Structure Replacement Using Trenchless Methods

This option would replace the existing culvert with a new culvert installed next to the existing pipe, on the southern side of the existing structure. The new pipe would be installed using one of several trenchless technologies while traffic is maintained on the road above. Regardless of the method used, the new pipe would be a steel casing and have a design life of 75 years and a diameter of 84

inches, which would meet the hydraulic standard. Additionally, each option would include headwalls and wingwalls at the inlet and outlet, as well as a beveled inlet.

Culvert replacement using a trenchless method is considered a more cost-effective solution than open cut when there is a large amount of fill over the culvert. In this case it's a better option since the average amount of fill over the culvert is 60 ft across 565ft length of pipe.

The options are as follows:
a. Pipe Jacking
b. Pipe Ramming
c. Microtunneling

a. Pipe Jacking:

Pipe Jacking is a method for installing a steel casing through the ground using a jack, or hydraulic thrusters, behind the pipe. The thrust power of the hydraulic jack forces the pipe forward through the ground as the fill at the front of the pipe is being excavated. Generally, 6-to-8-foot segments of casing are jacked at a time, and subsequent segments are welded onto the installed pipe. Pipe jacking lengths can be increased using intermediate jacking stations. The intermediate jacking stations may be installed at intervals along the pipe, and allow the pipe to be jacked in sections, rather than all at once. Existing ground conditions, including soil type, presence of groundwater and possible obstructions such as boulders can significantly limit the use of pipe jacking.

b. Pipe Ramming:

Pipe Ramming is a method for hammering a steel pipe or casing through the ground using pneumatic tool to install the pipe or casing into the ground. The spoils stay in the pipe and are mechanically removed when the drive is completed. If adequate space is available at the site the entire length of pipe can be welded together and rammed as one unit or if space is a limiting factor the pipe can be rammed in short sections, welding them together as the bore progresses.

Pipe ramming is preferred when the fill contains obstructions such as boulders, as the casing will usually break up obstructions, shovel them into the casing, or push them aside as it continues through the embankment. This method is frequently used under railway and road embankments for installation of medium to large diameter pipes. Pipe ramming is typically used for pipe installations over relatively short distances, usually less than 150 feet. However, lengths as long as 300 feet may be successfully installed.

c. Microtunneling:

Microtunneling is very similar to Pipe jacking, however, the machinery is operated remotely, and continuous support is provided to the excavation face.

Five independent systems are incorporated into Microtunneling systems. They are as follows:
• Microtunnel boring machine
• Jacking or propulsion system
• Spoil removal system
• Laser guidance and remote-control system
• Pipe lubrication system

There is a wide variety of Microtunnel boring machine cutter head attachments that can be tailored to different soil conditions. Therefore, it is important to know soil properties prior to construction, so that the appropriate cutter head can be chosen. Microtunneling may be chosen as the best alternative when driving accuracy is import, as it is the most accurate technology of the trenchless options discussed here.

For any of the trenchless methods, the contractor would need access to the end of the culvert. This access may have impacts to mapped wetlands and require additional Right-of-Way.

Advantages: The trenchless pipe method would have minimal impact on traffic. This alternative would meet hydraulic standards.

Disadvantages: Trenchless techniques are generally more cost effective with 60-inch diameter pipes and smaller, with pipes being driven into favorable soil conditions. This technology is dependent on existing soil conditions determined by a geotechnical investigation. If there are large amounts of boulders, cobbles, and blasted ledge within the new pipe alignment this option may not be feasible.

Maintenance of Traffic: The trenchless alternatives do not affect traffic. Traffic will remain open during construction, except for intermittent lane closures for some construction activities.

Alternative 3: Structure Replacement Using Open Cut

This option involves removing the existing Corrugated Galvanized Metal Plate Pipe and replacing it with a precast box culvert with a minimum span of 7-ft. Since there is approximately 60 feet of fill above the 565ft long existing culvert, there would be a considerable amount of earthwork required to replace the structure. The new structure should have headwalls and flared wingwalls at the inlet and outlet to make a smooth transition between the channel and the culvert. If this alternative is considered the existing roadway width and alignment would be reconstructed to match existing conditions.

The existing upstream “debris rack” is an indication that debris clogging has been an issue at this site in the past. For this reason, the Hydraulics team recommended replacement options that are similar in size to the existing structure. The existing culvert has a span of 7 feet, which provides a generous headwater to depth ratio and ample access for maintenance activities.

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. This option would have minimal future maintenance costs.

Disadvantages: This option has the higher upfront costs compared to the rehabilitation options. Open cutting this structure to replace it would significantly increase the construction duration of the project and would have a massive impact on traffic and natural resources. Additionally, there would need to be a large offsite waste area found that could store all excavated fill during construction, preferably on site or very nearby. If no available nearby offsite waste area is feasible then trucking time and costs to haul the excavated fill back and forth to a distant waste site would be another factor to consider in the cost estimation and construction duration.

Maintenance of Traffic: Either an off-site detour, phased construction, or a temporary bridge would be appropriate measures for traffic control at this site. This alternative has the most impact on traffic out of all options considered.

VII. Alternatives Summary

Based on the existing site conditions, culvert condition, and recommendations from hydraulics and others, the following alternatives are offered:

- Alternative 1: Culvert Rehabilitation with Traffic Maintained on Existing Culvert
- Alternative 2: Structure Replacement Using Trenchless Methods with Traffic Maintained on Existing Culvert
    a. Pipe Jacking
    b. Pipe Ramming
    c. Microtunneling
- Alternative 3a: Structure Replacement Using Open Cut with Traffic Maintained on Offsite Detour
- Alternative 3b: Structure Replacement Using Open Cut with Traffic Maintained with Phased Construction
- Alternative 3c: Structure Replacement Using Open Cut with Traffic Maintained on a Temporary Bridge

A cost evaluation for each of the alternatives is shown below.

VIII. Cost Matrix[1]

Essex VT289 Br17-A		Do Nothing	Alternative 1			Alternative 2			Alternative 3		
			Culvert Rehabilitation			Culvert Replacement using Trenchless Methods			Culvert Replacement using Open Cut Method		
			On-Alignment			Off-Alignment			On-Alignment		
			a. Invert Repair	b. Slip Liner	c. Spray-On Liner	a. Pipe Jacking	b. Pipe Ramming	c. Microtunneling	a. Off-site Detour	b. Phased Construction	c. Temporary Bridge
COST	Structure Cost	$0	$497,200	$649,229	$836,200	$4,456,563	$3,171,188	$3,467,813	$6,104,434	$7,020,099	$6,104,434
	Removal of Structure	$0	$395,500	$395,500	$395,500	$395,500	$395,500	$395,500	$395,500	$454,825	$395,500
	Roadway	$0	$150,440	$148,384	$151,344	$318,394	$241,271	$259,069	$426,111	$612,534	$426,111
	Maintenance of Traffic	$0	$64,040	$64,040	$64,040	$64,040	$64,040	$64,040	$89,300	$196,600	$689,040
	Construction Costs	$0	$1,107,180	$1,257,153	$1,447,084	$5,234,496	$3,871,999	$4,186,421	$7,015,345	$8,284,058	$7,615,085
	Construction Engineering & Contingencies	$0	$166,077	$377,146	$434,125	$1,046,899	$774,400	$837,284	$1,403,069	$1,656,812	$1,523,017
	Accelerated Premium	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Total Construction Costs w CEC	$0	$1,273,257	$1,634,299	$1,881,209	$6,281,396	$4,646,399	$5,023,706	$8,418,413	$9,940,870	$9,138,101
	Preliminary Engineering	$0	$221,436	$251,431	$289,417	$1,046,899	$774,400	$837,284	$1,403,069	$1,656,812	$1,523,017
	Right of Way	$0	$0	$0	$0	$5,000	$5,000	$5,000	$0	$0	$5,000
	Total Project Costs	$0	$1,494,693	$1,885,729	$2,170,626	$7,333,295	$5,425,798	$5,865,990	$9,821,482	$11,597,681	$10,666,118
	Annualized Costs	$0	$99,700	$37,800	$43,500	$97,800	$72,400	$78,300	$131,000	$154,700	$142,300
TOWN SHARE		No Local Share									
TOWN %											
SCHEDULEING	Project Development Duration	N/A	2 years	2 years	2 years	2 years	2 years	2 years	2 years	2 years	2 years
	Construction Duration	N/A	4 months	4 months	4 months	6-8 months	6-8 months	6-8 months	8 months	18 months	18 months
	Closure Duration (If Applicable)	N/A	NA	NA	NA	NA	NA	NA	Construction Season	NA	NA
ENGINEERING	Typical Section - Roadway (feet)	No Change	42	42	42	42	42	42	42	42	42
	Geometric Design Criteria	No Change	Meets Minimum Standard			Meets Minimum Standard			Meets Minimum Standard		
	Traffic Safety	No Change	No Change	No change	No Change	No Change	No Change	No Change	No Change	No Change	No Change
	Alignment Change	No Change	No Change	No change	No Change	Alignment shifted upstream			No Change	No Change	No Change
	Bicycle Access	No Change	No Change	No change	No Change	No Change	No Change	No Change	No Change	No Change	No Change
	Pedestrian Access	No Change	No Change	No change	No Change	No Change	No Change	No Change	No Change	No Change	No Change
	Hydraulics	No Change	Meets Minimum Standards			Meets Minimum BFW and VTrans Hydraulic Standards			Meets Minimum BFW and VTrans Hydraulic Standards		
	Utilities	No Change	No Change	No change	No Change	May need underground relocation			May need underground relocation		
OTHER	ROW Acquisition	No Change	No	No	No	Yes	Yes	Yes	No	No	Yes
	Road Closure	No Change	No	No	No	No	No	No	Yes	No	No
	Design Life (years)	No Change	15	50	50	75	75	75	75	75	75

[1] Costs are estimates only, used for comparison purposes.

IX. Conclusion

Alternative 1 is recommended; to rehabilitate the existing culvert while traffic is maintained on the existing culvert during construction.

Structure:
The existing culvert is 30 years old and is rated in a fair condition due to numerous holes along the pipe invert, and more small holes forming along the haunch areas. The structure meets the required standards of the VTrans Hydraulic Manual and the requirements of bankfull width. The existing structure does not provide AOP but through discussions with ANR, AOP is not required for this structure. Therefore, a rehabilitation of this structure is recommended.

Due to the relatively "young" age and fair condition of the existing culvert a rehabilitation is a more cost-effective option than replacing it with a new structure. The existing culvert is 565ft long and under approximately 60ft of fill. Both trenchless and open cut replacement methods were considered in the scoping process but would take far longer to construct and have higher upfront costs and more impacts to traffic. Additionally, this existing culvert already meets bankfull width and hydraulic standards, so rehabilitation is an effective solution to this problem.

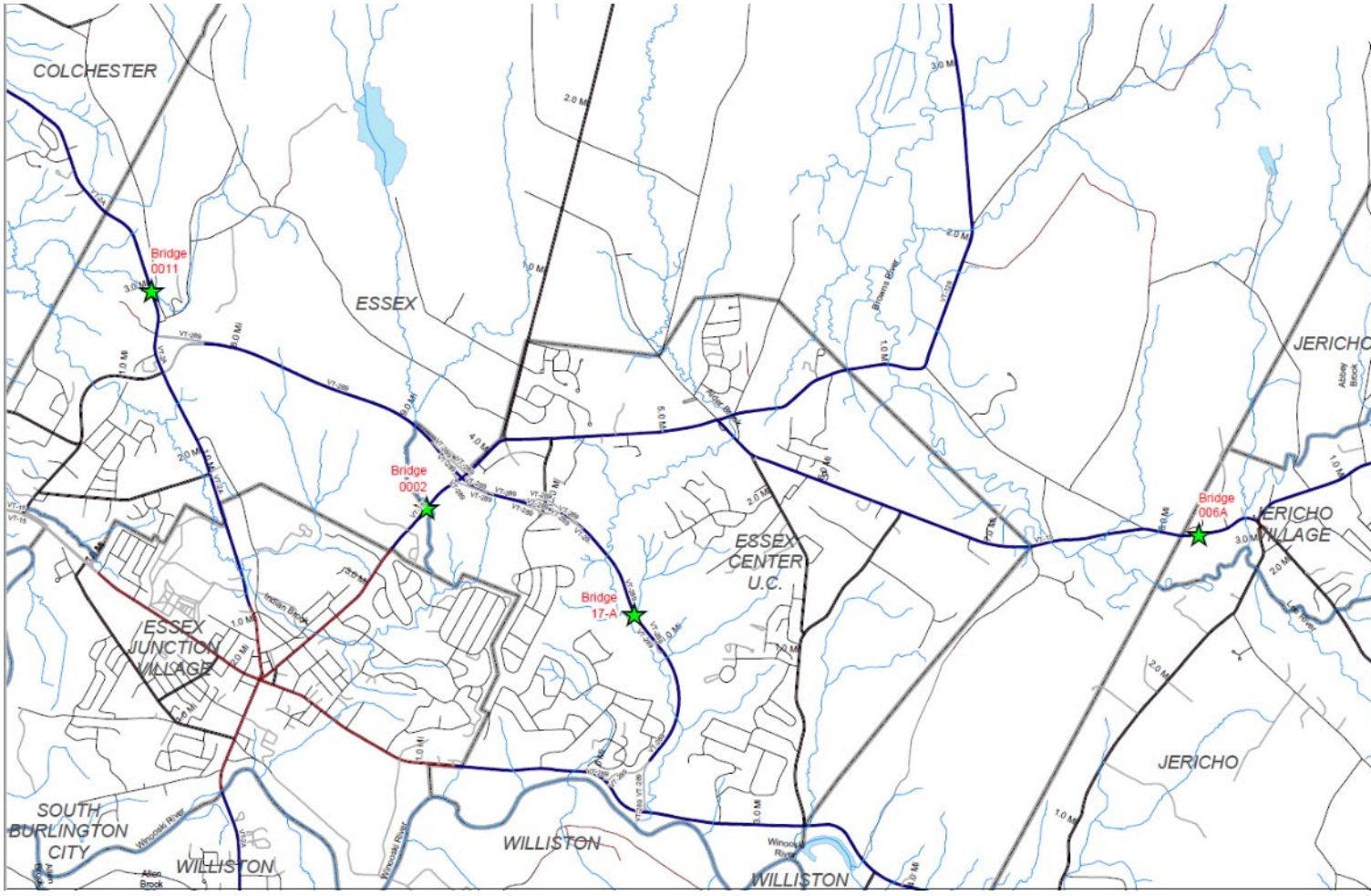
Rehabilitation treatment options include concrete invert repair or culvert lining systems such as slip or spray-on liner systems. The specific rehab treatment method will be chosen in the design phase of the project.

Traffic Control:
Traffic will be maintained on the existing culvert and will not be significantly affected by the construction activities with the rehabilitation of this culvert. There may be occasional lane or shoulder closures in order to mobilize or demobilize construction equipment and manage truck traffic.

Statewide Northwest STP CULV(90) Bundle Bridge Locations:
There are several structures within the Statewide Northwest STP CULV(90) project bundle. The structures are as follows:

- ESSEX VT2A Bridge 11 over unnamed brook.
- ESSEX VT15 Bridge 2 over Indian brook.
- ESSEX VT289 Bridge 17-A over unnamed brook.
- JERICHO VT15 Bridge 6A over unnamed brook.

These bridges are being bundled together for the scoping process.



X. 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 Identification Completion Memo
- Appendix G: Natural Resources Memo
- Appendix H: Archeology Memo
- Appendix I: Historic Memo
- Appendix J: Environmental Specialist resource ID
- Appendix K: Hazardous Sites Map
- Appendix L: Stormwater Resource ID
- Appendix M: Landscape Clearance Resource ID
- Appendix N: Local Input
- Appendix O: Operations Input
- Appendix P: Detour Map
- Appendix Q: Plans

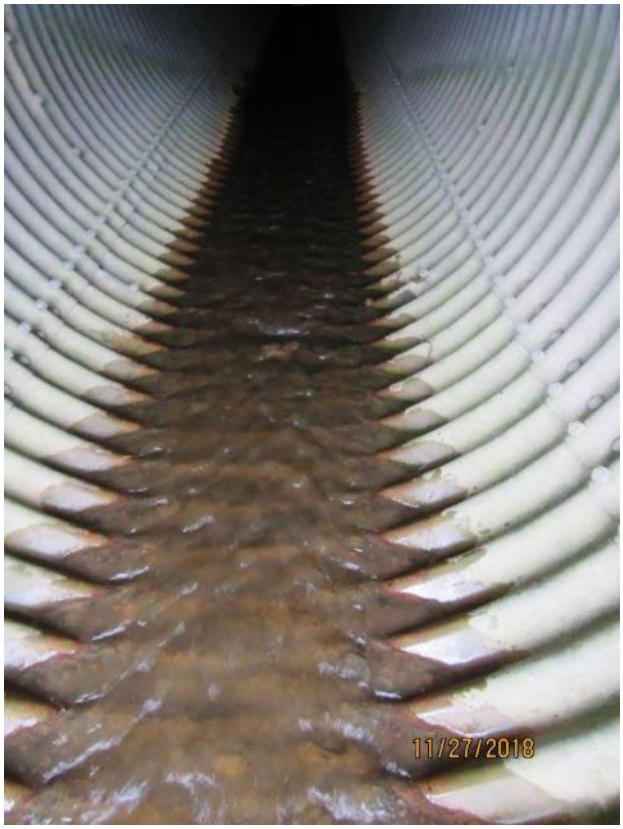
Appendix A: Site Pictures

Upstream view of structure inlet (Inspection photo 2018)

Structure inlet (Hydraulics/Scoping site visit photo 10/10/2022)

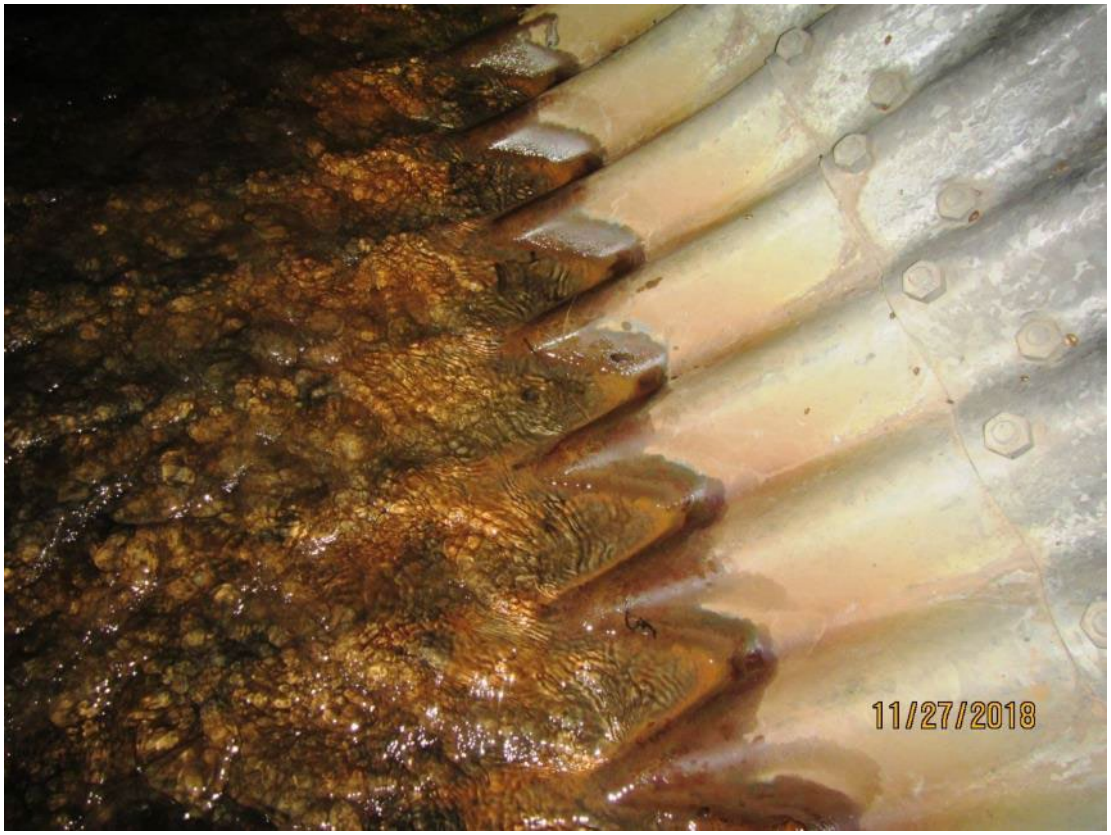
Upstream view of structure inlet (Hydraulics/Scoping site visit photo 10/10/2022)

Train rail beaver barrier fence at culvert inlet, (Hydraulics/Scoping site visit photo 10/10/2022)



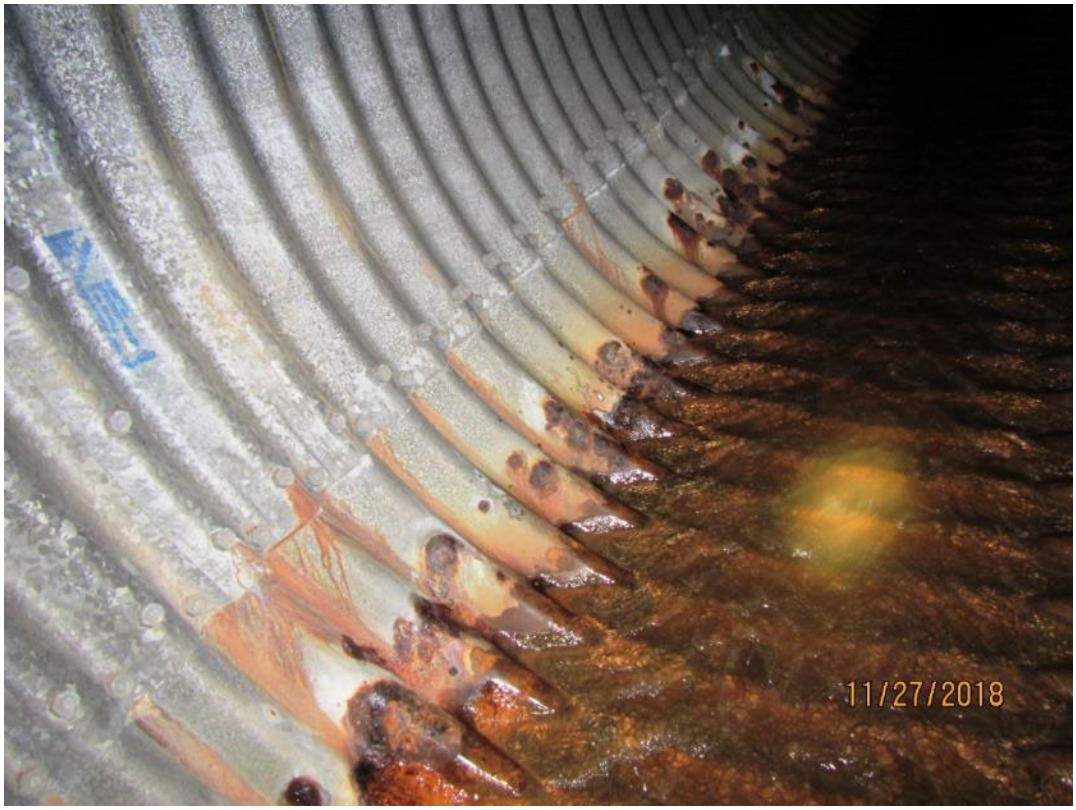
Barrel finding photo (Inspection photo 2018)


Culvert barrel (Hydraulics/Scoping site visit photo 10/10/2022)



Invert damage, (Inspection finding photo 2018)

Culvert barrel (Inspection finding photo 2018)



Invert damage, (Inspection finding photos 2018)

Downstream View of Culvert (Inspection photo 2018)

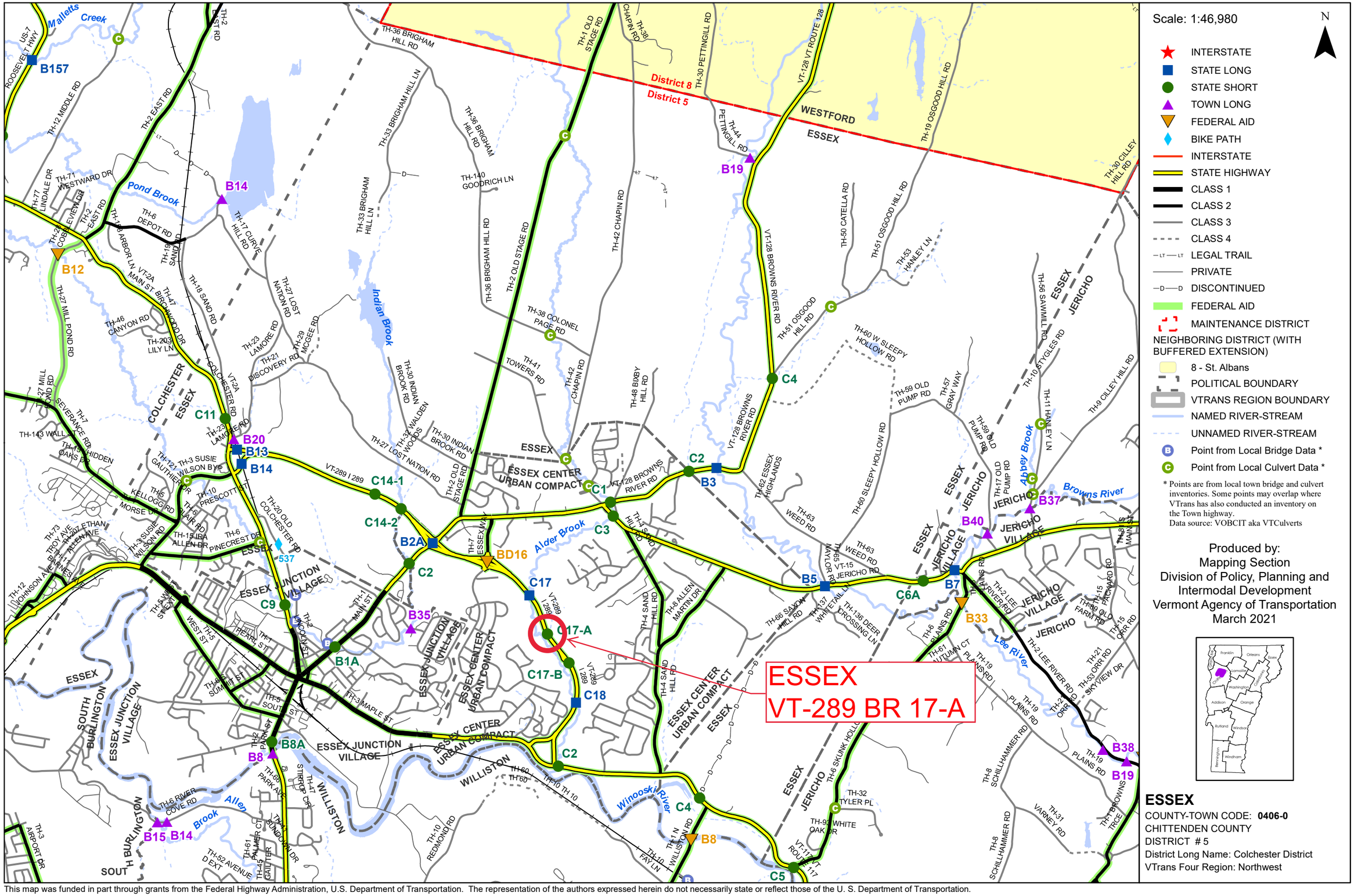
Downstream View of Culvert (Hydraulics/Scoping site visit photo 10/10/2022)

Downstream view (Hydraulics/Scoping site visit photo 10/10/2022)

Downstream view from inside structure (Inspection photo 2018)

Downstream view (Inspection photo 2018)

Appendix B: Town Map



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

Appendix C: Bridge Inspection Report

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

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

Inspection Report for : ESSEX **Bridge No.:** 17-A **District:** 5

Located on: VT289 **over** BROOK **approximately** 1.3 MI N JCT VT 117 **Maintained By:** STATE-OWNED

CONDITION

Deck Rating: N NOT APPLICABLE

Superstructure Rating: N NOT APPLICABLE

Substructure Rating: N NOT APPLICABLE

Channel Rating: 7 GOOD

Culvert Rating: 5 FAIR

Federal Str. Number: 30033017-A04061

AGE and SERVICE

Year Built: 1993 **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): 2

ADT: 2500 **Year of ADT:** 1996

GEOMETRIC DATA

Length of Maximum Span (ft): 7

Structure Length (ft): 7

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): 42

Skew: 38

Bridge Median: 0 NO MEDIAN

Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD

Min Vertical Underclr (ft): 00 FT 00 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: CGMPP

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): 565

Average Cover Over Culvert (ft): 50

Waterway Area Through Culvert (sq.ft.): 38

Wingwall/Headwall Rating: 7 GOOD CONDITION

APPRAISAL

Appr. Rdwy. Alignment: 8 EQUAL TO DESIRABLE CRITERIA

INSPECTION

Inspection Date: 112018 **Inspection Frequency (months):** 60

INSPECTION SUMMARY and NEEDS

11/27/2018 - Pipe has numerous small rust holes along invert and should be considered for a poured invert repair or sleeve repair. ~ MJ/SP

11/5/2013 Culvert should be evaluated for a concrete invert. ~FRE/MJK

Culvert is in fair to good condition. Invert is deteriorating and will need corrective action in the near future. Rip rap should be installed on the slopes to help stop the erosion. Inspected 6-16-08 ~DS

Appendix D: Hydraulics Memo

VERMONT

State of Vermont
Structures and Hydraulics Section
Barre City Place, 219 North Main Street
Barre, Vermont 05641
vtrans.vermont.gov

Agency of Transportation

[phone] 802-595-6493

TO: Laura Stone, Structures Scoping Project Manager

CC: Patrick Ross, Hydraulics Engineer

FROM: Keith Friedland, Hydraulics Technician

DATE: March 24, 2023

SUBJECT: STATEWIDE - NORTHWEST STP CULV(90), pin#22b044
Essex VT-289, Br17-A
Site location: mm10.8, over unnamed tributary to Alder Brook
Coordinates: 44.496056, -73.068643

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

VTrans Hydraulics Unit visited this site with ANR on 10/10/2022. It was indicated by ANR on site that this crossing was non-jurisdictional. An email was sent to the ANR on 10/10/2022 summarizing the site visit, indicating that we are modeling this structure as an intermittent stream crossing.

Design Storm Flow is 2% AEP.

Existing Structure:

- Corrugated metal plate pipe with a diameter of 7 feet, providing 38.5 square feet of waterway opening.
- Our calculations, field observations and measurements indicate the existing structure does meet current standards of the VTrans Hydraulic Manual.
- This structure results in a headwater depth of approximately 3.1 feet at 2% AEP and 3.3 feet at 1% AEP.

Proposed Structures:

Option 1: Rehabilitation with invert repair

- Existing culvert with a 1-foot-thick concrete paved invert, providing a 6-foot clear height and 35 square feet of waterway opening.
- This structure results in a headwater depth of 3.9 feet at 2% AEP and 4.1 feet at 1% AEP.
    - *HW depths in this case include the 1-foot invert repair.*
- *This option has high outlet velocities and may require Stone Fill, Type III for downstream channel bank protection.*

Option 2: Rehabilitation with slip-liner

- Corrugated metal pipe with a diameter of 6 feet, providing 28.3 square feet of waterway opening.
- The slip-lined culvert was modeled centered inside the existing structure.
- This structure results in a headwater depth of 3.3 feet at 2% AEP and 3.5 feet at 1% AEP.

Option 3: Replacement structure

- Corrugated metal pipe with a diameter of 7 feet, providing 38.5 square feet of waterway opening.
- This structure results in a headwater depth of 3.1 feet at 2% AEP and 3.3 feet at 1% AEP.

Option 4: Replacement structure

- Corrugated metal pipe arch with a clear span of 95 inches and height of 67 inches, providing 37 square feet of waterway area.
- This structure results in a headwater depth of 2.7 feet at 2% AEP and 2.9 feet at 1% AEP.

Any similar structure that fits the site's conditions could be considered.

All proposed structures were modeled with a headwall.

For the proposed structures we assumed a similar structure alignment, skew, and slope as the existing conditions.

The existing upstream "debris rack" is an indication that debris clogging has been an issue at this site in the past. For this reason, we have recommended replacement options that are similar in size to the existing. The existing culvert diameter provides a generous HW/D ratio and ample access for maintenance activities.

General Comments:

Stone Fill, Type II should be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet, up to a height of at least one-foot above the top of the opening. The stone fill should not constrict the channel or structure opening.

It is always desirable for a new structure to have flared wingwalls, matched into the channel banks at the inlet and outlet, to smoothly transition flow and protect the structure and roadway approaches from erosion. It is also recommended that full height concrete headwalls be constructed at the inlet and outlet. Any closed bottom structure should also be equipped with cutoff walls, extending to a depth equal to the culvert rise, up to 4 feet, or to ledge, to serve as undermining prevention. Any new structure should be properly aligned with the channel, span the natural channel width, and be constructed on a grade that matches the channel.

The proposed structures meet the requirements of the VTrans Hydraulics Manual. Other similar sized structures could be considered for this site. If another alternative is considered, coordinate with the Hydraulics Unit to perform additional analyses.

Please contact us with any questions.

Appendix E: Preliminary Geotechnical Information

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Laura Stone, P.E., Scoping Engineer

From: Stephen Madden, Geotechnical Engineer SPM

Date: July 22nd, 2022

Subject: Statewide-Northwest STP CULV(90) – Essex VT-289, Br. 17-A, Preliminary Geotechnical Information

1.0 INTRODUCTION

As requested, we have completed our preliminary geotechnical investigation of Bridge 17-A, located on VT-289 in the Town of Essex, VT. The culvert is located approximately 1.2 miles north of the intersection of VT-289 and VT Route 117. The project consists of rehabilitation or replacement of the existing 565 ft long, 7ft diameter, corrugated metal plate pipe (CGMPP) culvert. This review included the examination of as-built record plans, water well logs and hazardous site information on file at the Vermont Agency of Natural Resources (ANR), as well as published surficial and bedrock geologic maps, and information we gained from in-house bridge inspection reports and photos. This culvert is currently in the scoping phase and comprises one of the four culverts bundled into the Statewide-Northwest STP CULV(90) project.

2.0 SUBSURFACE INFORMATION

2.1 Published Geologic Data

Mapping conducted in 1970 for the Surficial Geologic Map of Vermont shows that the project site consists of a Glaciolacustrine deposit which consists predominantly of delta sand (Doll, 1970).

According to the 2011 Bedrock Map of Vermont, published by the State of Vermont and USGS, the site is underlain with phyllite of the Fairfield Pond Formation (Ratcliffe, et. al, 2011).

The Geotechnical Engineering Section maintains a GIS database of historical boring logs throughout the state, which contains electronic records of the majority of investigations completed in the past 15 years. During the research into this project, the database revealed 2 projects within 1.5 miles that could be referenced for information of value:

- Essex BF 5400(9) included 2 borings advanced for a bridge replacement project, located approximately 1.2 miles south of culvert 17-A. Borings generally reported medium dense sands and gravels to 16-18 feet (ft) below ground surface (bgs), over dense to very dense sand and gravel, and encountered bedrock at depths of 94.0 – 101.3 ft bgs (corresponding to top of bedrock elevations of 189.2 ft and 195.4 ft).
- Williston-Essex STP SGNL(46) included 13 borings (of 15 total) advanced in support of mast arm foundations along VT-15 and VT-289, generally located between 1.3 and 1.5 miles from the culvert location. Where encountered, top of bedrock was reported between 12.5 and 22.5 ft bgs. Overburden soils were variable

and included sands, gravels, and silts of varying densities and limited amounts of medium stiff to very stiff clay.

2.2 Water Well Logs

The Vermont (ANR) documents and publishes a database of all public and private wells that have been drilled in the state. Published online, these logs may provide general characteristics of the soil strata and depth to bedrock in the area. There were no wells in close enough proximity to the project location to provide any valuable information

2.3 Hazardous Materials and Underground Storage Tanks

The ANR Natural Resource Atlas also maintains records of any hazardous material sites and underground storage tanks. Their records show the location of the project is not on the Hazardous Site List. There is one hazardous waste generator (Essex Middle School) and one hazardous site (15 Windridge Rd, Essex) within an approximate 0.5-mile radius of the project. These sites are not anticipated to impact construction activities.

2.4 Record Plans

Historic record plans from the culvert construction (construction project reportedly completed June 1994) were reviewed as part of this investigation. The Bridge Detail Sheet stated the invert elevation of the pipe at the inlet (El. 350.3 ft) and outlet (El. 345.5 ft). This sheet also indicated that there is a 10’ x 36’ stone pad located under the headwall at the outlet. There was no other subsurface or foundation information on the plans.

3.0 FIELD OBSERVATIONS

A site investigation was not conducted by Geotechnical Section staff; however, photos from bridge inspection reports and satellite imagery were reviewed to evaluate the feasibility of boring operations and assess general site conditions as they relate to the proposed project. No overhead utilities were visible in the vicinity of the site and the embankment slopes appeared to be shallow grades containing little vegetation. Access would need to be evaluated to determine the best approach for performing borings adjacent to the inlet and outlet of the culvert. The average depth of fill is reportedly 50 ft.

4.0 RECOMMENDATIONS

It is our understanding that this culvert is a candidate for rehabilitation, possibly including installation of a liner, rather than full replacement. Given the age of the structure and the general conditions noted, we agree with this assessment and would recommend rehabilitating the existing culvert.

4.1 Proposed Subsurface Investigation

If a full replacement is selected as the proposed alternative, we would recommend advancing a series of borings along the length of any new structure, including at the inlet and outlet locations. Given the overall length of the existing pipe it likely than more than two borings would be necessary to assess the subsurface conditions within the footprint of any replacement structure.

5.0 CLOSING

If a culvert rehabilitation is the preferred alternative, the Geotechnical Section can provide input on any geotechnical components of such a project that should be considered. If a culvert replacement is the preferred alternative, the Geotechnical Section can assist in developing a subsurface investigation plan that efficiently gathers adequate information for design of the replacement structure.

If you have any questions or would like to discuss this report, please contact the Geotechnical Section 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 7/14/2022.

cc: Electronic Read File/MG
Project File/SPM

Appendix F: Resource ID Completion Memo

OFFICE MEMORANDUM

AOT - PDB - ENVIRONMENTAL SECTION

RESOURCE IDENTIFICATION COMPLETION MEMO

TO: Daniel Beard, Project Manager
FROM: Julie Ann Held, Environmental Specialist (802)917-4319
DATE: December 14, 2022
Project: **Statewide – Northwest STP CULV(90)**

ENVIRONMENTAL RESOURCES:

Archaeological Site:	X	Yes	See Archaeological Resource ID Memo Issued: 12/14/2022
Historic/Historic District:	X	Yes	See Historic Resource ID Memo Issued: 05/26/2022
4(f) Property:		Yes X No	
Wetlands:	X	Yes	See Natural Resource ID Memo Issued: 08/08/2022
Agricultural Land:	X	Yes	See Natural Resource ID Memo Issued: 08/08/2022
Fish & Wildlife Habitat:	X	Yes	See Natural Resource ID Memo Issued: 08/08/2022
Wildlife Habitat Connectivity:		Yes X No	
Endangered Species:	X	Yes	
Stormwater:		Yes X No	
6(f) Property:		Yes X No	
Hazardous Waste:		Yes X No	
VTrans Limited Reuse Soils:	X	Yes	See ES Resource ID
USDA-Forest Service Lands:		Yes X No	
Scenic Highway/Byway:		Yes X No	
Act 250 Permits:	X	Yes	See ES Resource ID
FEMA Floodplains:	X	Yes	Flood Hazard Area/River Corridor Permit may be required
Flood Hazard Area/ River Corridor**:**	X	Yes	Potential Flood Hazard area, may need permits depending on the scope of work.
US Coast Guard:		Yes X No	
Lakes and Ponds:		Yes X No	
Environmental Justice:		Yes X No	
303D List/ Class A Water/ Outstanding Resource Water:		Yes X No	
Source Protection Area:		Yes X No	
Public Water Sources/ Private Wells:		Yes X No	
Other:		Yes X No	

cc:
Project File

Appendix G: Natural Resources Memo

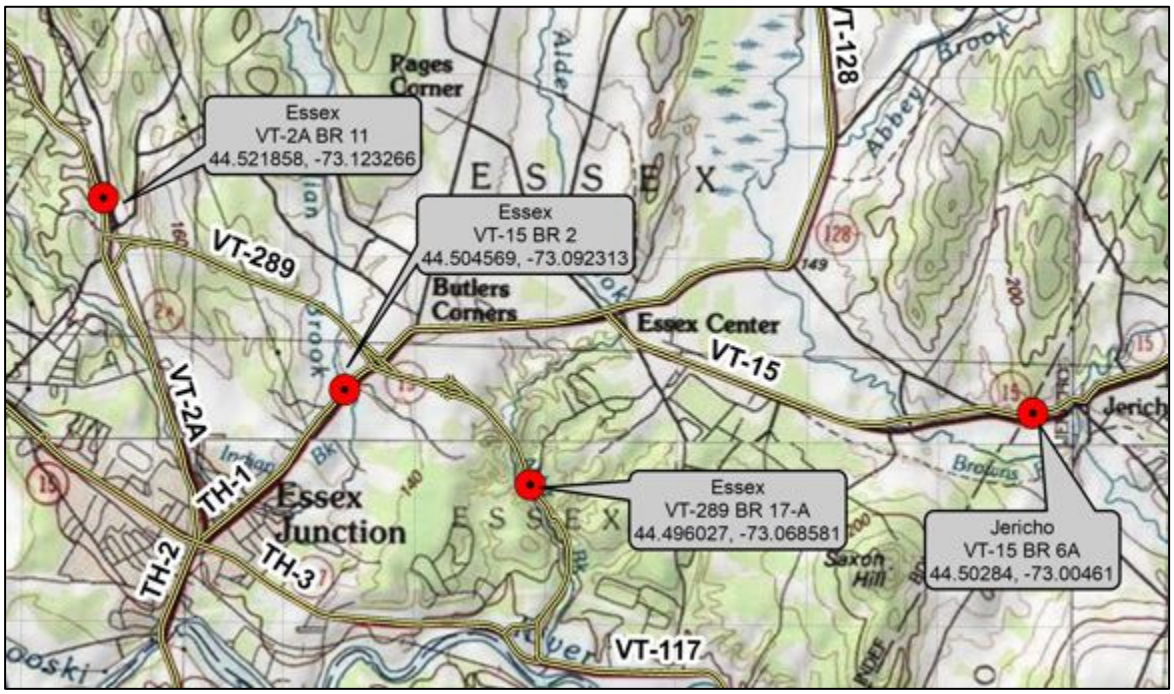
Natural Resource Evaluation

Vermont Agency of Transportation

Northwest STP CULV (90)

- **Essex VT-2A BR 11**
- **Essex VT-15 BR 2**
- **Essex VT-289 BR 17-A**
- **Jericho VT-15 BR 6A**

September 6, 2022
Revised February 8, 2023



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 summer 2022, the Bear Creek Environmental (BCE) Natural Resource Services Team conducted a scoping level natural resource assessment of four stream crossing sites included under the project Northwest CULV (90). Three of the stream crossing sites are located in Essex, and the fourth is in Jericho. This Natural Resource evaluation was revised in February 2023 to correct the location of the Jericho structure, which was originally evaluated as a bridge on the Browns River, rather than a 6-foot diameter structure near Mountain View Road.

- The study area included 75 feet upstream and downstream of the structure and 100 feet on both approaches to the culvert.

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

- Rare, threatened, and endangered species occurrence reports were reviewed for the project sites. There are several RTE plants that have reported occurrences near the Essex VT-2A BR 11 site. Many of these RTE plants are associated with the Dry Pine-Oak-Heath Sandplain Forest. A botanical survey was performed of the Essex VT-2A BR 11 and the Essex VT-15 BR 2 sites. No RTE plant species were observed.

- The Creek Heelsplitter, a Species of Greatest Conservation Need (SGCN) with a State protection status of S2, has an element occurrence report for locations in Indian Brook below the Essex VT-15 BR 2 study area. Mark Ferguson, a biologist with the VT Department of Fish and Wildlife Department was consulted for guidance regarding this rare mussel. Mr. Ferguson requested that he be contacted four weeks prior to commencement of construction activities to allow time for him to search for and relocate any Creek Heelsplitters from the project area.

- The Bear Creek Environmental team delineated wetlands within the study areas of Essex VT-2A BR 11, Essex VT-15 BR 2, Essex VT-289 BR 17-A sites. A site visit with District Wetland Ecologist, Elijah Schumacher, was completed on July 28, 2022 to confirm the wetland boundaries at the three Essex sites.

- Remote sensing was utilized to identify potential wetlands with the Jericho VT 15 BR 6A study area during winter 2022/2023. Based on imagery, Streetview, Hillshade, and LiDAR contours, the extent of a Class 2 wetland within the study area downstream of the culvert was determined based on best professional judgment. A wetland delineation within the growing season is recommended to verify the extent and class.

- The Vermont Fish and Wildlife Department (VDFW) was consulted regarding requirements of aquatic organism passage (AOP) for the three Essex structures that are culvert crossings during summer 2022. Based on email correspondence from September 1, 2022, full aquatic organism passage will be required for replacement of structures at all three sites. In the event the VT-2A BR 11 and VT-15 BR 2 structures were modified, retrofits of the structures would be required to allow full AOP. Given the close proximity of the structure outlet to Alder Brook, and the long

culvert length, AOP would not be required for modifications to the Essex VT-289 BR 17-A structure.

- During February 2023, the VDFW was contacted regarding AOP recommendations for the Jericho VT-15 BR 6A culvert. Given the small watershed size, the Department has opted to wait until electrofishing can be conducted during the spring or summer to make a determination regarding AOP.

- The project area was not evaluated for RTE bat presence nor was potential habitat quantified; 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 sites.

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 four VTrans stream crossing sites that are included in the Northwest CULV (90) project. The project, which currently is at a scoping level, includes sites:

- VT-2A BR 11 in Essex
- VT-15 BR 2 in Essex
- VT-289 BR 17-A in Essex, and
- VT-15 BR 6A in Jericho.

The sites are located in Essex and Jericho, as shown on the map on page 1 of Appendix A.

Assessment work included remote sensing analysis to evaluate resources at and in the vicinity of the project site. A desktop analysis of wildlife connectivity was also performed.

3.0 REMOTE SENSING

A remote sensing review of natural resources was performed by Bear Creek Environmental for the four study sites. The study involved a review of historic occurrences of rare, threatened, and endangered (RTE) plant and animal species in the vicinity of the project site, as well as an assessment of wildlife connectivity. Ecological Resource maps of the four project sites are provided on pages 2 through 5 of Appendix A.

RTE Plants

The Essex 2A BR 11 was the only site with rare, threatened, and endangered (RTE) plants documented within the vicinity of the project site, based on the Vermont Natural Heritage database. The ecological map on page 2 of the Appendix A includes six RTE plant species, most of which are associated with the Dry Pine-Oak-Heath Sandplain Forest natural community. The RTE plant species documented within the vicinity of Essex 2A BR 11 are:

- *Crocanthemum canadense* (Canada Frostweed) – S2S3
- *Lactuca hirsuta* (Hairy Lettuce) – S1S2 (SGCN)
- *Helianthus strumosus* (Harsh Sunflower) – S2S3 (SGCN)
- *Carex muehlenbergii* var. muehlenbergii (Muehlenberg's Sedge) – S2 (SGCN)
- *Cyperus houghtonii* (Houghton's Flatsedge) – S2 (SGCN)
- *Solidago squarrosa* (Squarrose Goldenrod) – S2S3 (SGCN)

RTE Animals

Lasmigona compressa (Creek Heelsplitter), a rare (S2 state rank) freshwater mussel, is the only rare animal species that has been documented within the vicinity of the four project sites according to the Vermont Natural Heritage database. Occurrences of Creek Heelsplitter from 2002 and 2006 were recorded several tenths of a mile downstream of the VT-15 BR 2 study area in Indian Brook, as shown on the map on page 3 of the Appendix A.

Mark Ferguson of the Vermont Fish and Wildlife Department was contacted for a determination of whether a mussel survey of Indian Brook would be required if instream work for a culvert project were needed. In an email response dated Thursday, August 11, 2022 (Appendix A, page 6), Mr. Ferguson stated the following:

"Since there is little chance of any threatened or endangered mussel species occurring in this stream section, I don't see a need for a formal mussel survey. Since there is some potential for Creek Heelsplitter bring there, I request that I be contacted within four weeks prior to commencement of construction/prep activities so that I can search for and relocate any Creek Heelsplitters from within the project area."

Wildlife Habitat

The Vermont Conservation Design database on the Vermont Agency of Natural Resources BioFinder Mapping Tool was reviewed to assess landscape scale wildlife habitat. A narrative and maps of the results are provided by Alexandra Marcucci of SLR on pages 1 through 6 of Appendix B. A brief summary of the landscape scale wildlife habitat in the vicinity of each study area is provided below:

- VT Route 2A BR 11 – Within the study area, Surface Water and Riparian Areas and Physical Landscape Diversity are rated as highest priority. Residential development along Gentes Road and commercial development on Colchester Road contribute to fragmentation of Riparian and Wildlife Connectivity.

- VT Route 15 BR 2 – Surface Water and Riparian Areas and Physical Landscape Diversity are rated as highest priority adjacent to Indian Brook within the study area.

- VT Route 289 BR 17A – Riparian and Wildlife Connectivity are rated as highest priority both upstream of the culvert under Route 289 and upstream and downstream on the culvert outlet within the Alder Brook corridor.

- VT Route 15 BR 6A – None of the wildlife habitat components were identified as priority or highest priority within the study area.

4.0 FIELD OBSERVATION OF RTE SPECIES

Plants

A site visit was conducted by botanist Elizabeth McLane on July 4, 2022 to investigate the presence of rare plant species within the VT Route 2A BR 11 and the VT Route 15 BR 2 study areas. These two sites were recommended for an RTE plant survey for the following reasons:

- Area dominated by sand and sea-bed soils that can lead to unusual natural community types and associated RTE species;
- Located in vicinity of remnant Dry Pine-Oak-Heath Sandplain Forest Natural Community;
- Not uncommon for rare plant species to be associated with road and stream edges;
- Rare plant species occurrences have been reported within the vicinity of the VT Route 2A BR 11 study area.

No rare or significant Natural Communities were noted at either site during the plant survey. A memorandum summarizing the botanical findings is provided in Appendix C.

Bats

The project area was not evaluated for RTE bat presence nor was potential habitat quantified; 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 sites.

5.0 WETLANDS AND STREAMS

Methods

Mary Nealon of Bear Creek Environmental and Alex Marcucci of SLR visited the three Northwest CULV (90) study areas in Essex during July 2022 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

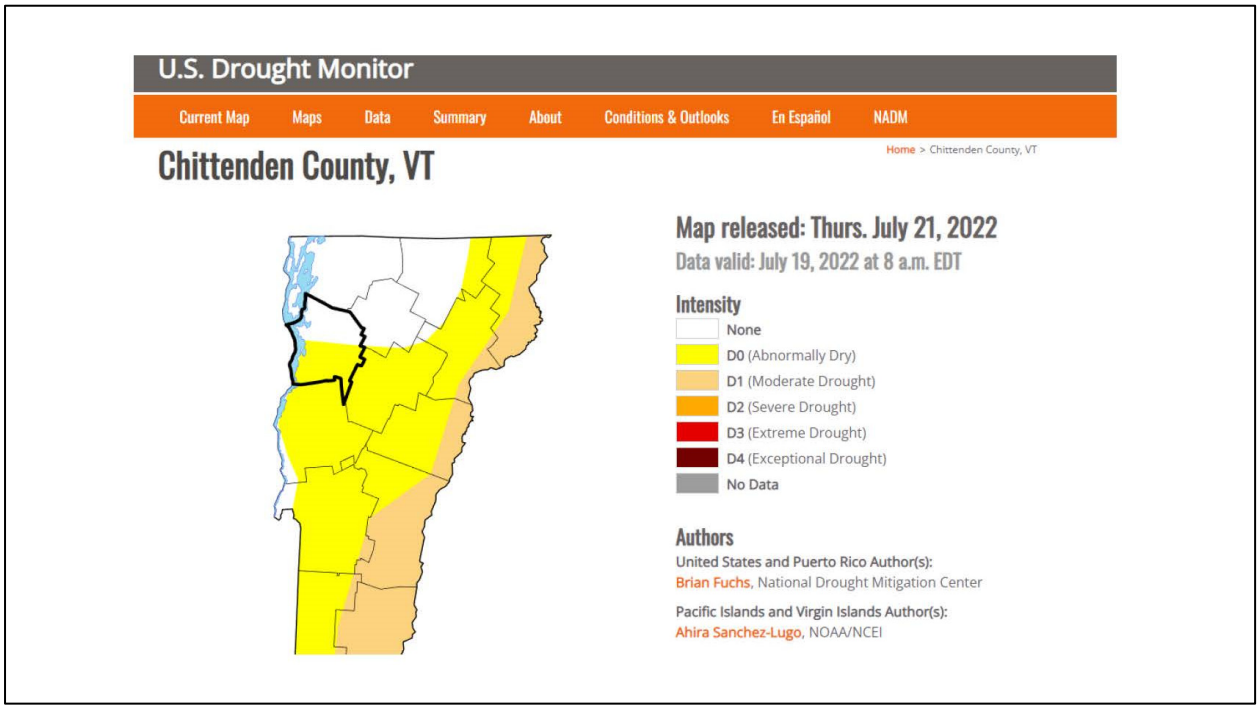
Delineation Manual: Northcentral and Northeast Region". The locations of wetlands were documented in the field using a submeter GPS unit, and functional evaluations were performed. Wetlands were delineated through field observations of soils, vegetation, and hydrology.

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).

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).

Results

Maps showing the wetland delineations that were verified by Elijah Schumacher, Vermont Wetland Ecologist on July 28, 2022, are provided on pages 1 through 4 of Appendix D. Climatic / hydrologic conditions at the time of the wetland delineation field work was normal to Abnormally Dry, based on the U.S. Drought Monitor data for Chittenden County.



The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Map courtesy of NDMC.

The Wetland Determination Forms are provided on pages 5 through 25 of Appendix D, with the Functions and Values following on pages 26 through 58. All the wetlands at the three Essex project sites are palustrine. Palustrine wetlands are defined as nontidal wetlands dominated by trees, shrubs, persistent emergent, emergent mosses or lichens. No wetlands were found at the Jericho site (VT Route 15 BR 6A).

Available stream crossing inventory data was acquired from the Vermont Fish and Wildlife Department link on the Vermont Natural Resources Atlas. Methods for data collection and analysis of the stream crossing data followed the Vermont Agency of Natural Resources (VANR 2009, Milone & MacBrook 2008 and 2009). The stream crossing reports are provided on pages 59 and 60 of Appendix D and are summarized below in Table 1. No report is available for the Route 289 BR17A or the Route 15 BR 6A structure.

The Vermont Fish and Wildlife Department was contacted by Bear Creek Environmental regarding requirements for aquatic organism passage (AOP), should the structure be replaced or retrofitted. Recommendations from the VFWD are included in Appendix D on pages 61 through 67.

Table 1. Stream Crossing Inventory Data from Vermont Agency of Natural Resources

Type and Structure No.	Stream	Road	AOP Coarse Screen	AOP Geomorphic Compatibility	Percent Bankfull Width	Assessment Date
Culvert 2A BR 11 SgaID 400024000004061	Unnamed Tributary to Indian Brook	VT Route 2A, Railroad, Gentes Road	No AOP including Adult Salmonids	Partially Compatible	54%	11/23/2015
Culvert 15 BR 2 SgaID 300015000004062	Indian Brook	VT Route 15 (Upper Main St.)	Reduced AOP	Mostly Compatible	48%	11/23/2015

NA – not applicable
AOP – aquatic organism passage

VT Route 2A BR 11

Wetlands

Wetlands were identified within the VT Route 2A BR 11 study area boundary (page 1 of Appendix D) both above and below the concrete box culvert, which conveys a tributary to Indian Brook.

The size of the upstream wetland within the study area is 0.16 acres. Based on the VSWI Wetland Class Layer, the upstream wetland is connected to a Class II wetland to the east of the study area. Approximately 0.05 acres of wetland was delineated downstream of the box culvert adjacent to the tributary. The entire Class II wetland complex is estimated to be about 3.4 acres.

Wetland above the culvert is classified as Palustrine, dominantly Scrub-Shrub, broadleaved deciduous (PSS1C) and is seasonally flooded. This exhibited saturation and water-stained leaves as primary hydrology indicators and geomorphic position and FAC-neutral test as secondary indicators. Vegetation was dominated by American Elm, Box Elder, Speckled Alder, Sensitive Fern, and Tall Meadowrue (Figure 1).

Wetland below the culvert is Palustrine, dominantly Scrub-Shrub, broadleaved deciduous, mixed with emergent, non-persistent and is seasonally flooded (PSS1/EM2C). Primary indicators of hydrology include: surface water, high water table, saturation, and water-stained leaves. Geomorphic position and FAC-neutral test are secondary hydrology indicators. The wetland below the culvert is dominated by herbaceous vegetation including: Sensitive Fern and Spotted Joe Pyeweed. Speckled Alder is present in the shrub layer (Figure 2).

The wetland complex was found to have the following functions and values: water storage for flood water and storm runoff, surface and groundwater protection, fish habitat, wildlife habitat, and erosion control through binding and stabilizing the soil.

Stream Crossing

The drainage area at the concrete box culvert (7 ft wide and 5 ft high) under Route 2A is 0.79 sq. miles. A culvert assessment was completed on 11/23/2015 of the 100-foot-long stream crossing. Based on the assessment report, there is "no aquatic organism passage (AOP) including adult salmonids" and the structure has partial geomorphic compatibility. A free fall drop of 0.3 was reported at the outlet.

The Vermont Fish and Wildlife Department is requiring full AOP for both culvert retrofit and replacement of this structure.

Figure 1. VT Route 2A BR 11 Wetland above box culvert

Figure 2. VT Route 2A BR 11 Wetland below box culvert

VT Route 15 BR 2

Wetlands

Indian Brook flows through the wetlands at the VT Route 15 BR 2 site. There is a small section of wetland on each side of Indian Brook at the upstream end of the site, totaling less than 0.005 acres (page 2 of Appendix D). This upstream wetland is hydrologically connected to the downstream wetland within the study area, which includes about 0.15 acres below the culvert and adjacent to Indian Brook. Wetland within the study area is connected to a Class II wetland on the VSWI Class Layer, making a total estimated wetland size of about 3.9 acres.

The area adjacent to Indian Brook below the culvert is dominated by Phragmites and wetland grasses, making the wetland a Palustrine, dominantly Emergent, persistent system that is seasonally flooded (PEM1C) as shown in Figure 3. Secondary wetland hydrology indicators include: drainage patterns, geomorphic position, and FAC-Neutral Test.

Figure 3. VT Route 2A BR 11 Wetland below box culvert

The wetland complex was found to have the following functions and values: water storage for flood water and storm runoff, surface and groundwater protection, fish habitat, wildlife habitat, rare, threatened, and endangered species habitat, open space and aesthetics, and erosion control through binding and stabilizing the soil.

Stream Crossing
The drainage area at the outlet of the concrete box culvert (6 ft x 8 feet) is 3.6 square miles. The structure provides reduced AOP and is mostly geomorphically compatible.

The Vermont Fish and Wildlife Department is requiring full aquatic organism passage for both replacement and retrofit of this Route 2A BR 11 structure.

VT Route 289 BR 17A

The study area of the Route 289 BR 17A site was the largest of the four study areas given the length of the culvert.

The wetland above the culvert inlet was dominated by Reed Canary Grass and an obligate wetland grass, *Glyceria striata* (Fowl Manna Grass) as shown in Figure 4. The wetland is Palustrine, dominantly Emergent, non-persistent wetland and is seasonally flooded (PEM2C). A small amount of Salix bebbiana (Bebb's Willow) was present in the upper layer of vegetation. Although the wetland area in the study area was less than 0.04 acres (page 3 of Appendix D), the wetland continues out of the study area to the north and appears to connect into a Class II wetland on the VSWI Class layer.

Figure 4. VT Route 289 BR 17 A wetland above culvert.

Downstream of the culvert, a wetland mosaic is present with a mix of deep water (2 to 2 ½ feet deep) in Alder Brook and wetland areas dominated by Bulrushes, Common Juncus, Giant Goldenrod, Speckled Alder, Willows, and Manna Grasses. The unnamed Tributary to Alder Brook travels only a short distance (~ 20 feet) before reaching Alder Brook (Figure 5), and this mosaic wetland begins along the southern edge of this channel and continues downstream along the eastern side of Alder Brook. The wetland below the culvert is beaver influenced and is characterized as Palustrine, dominantly Emergent, Nonpersistent, Semi permanently flooded mixed with Scrub-Shrub, broadleaved deciduous (PEM2Fb/SS1).

The wetland complex was found to have the following functions and values: water storage for flood water and storm runoff, surface and groundwater protection, fish habitat, wildlife habitat, and erosion control through binding and stabilizing the soil.

Stream Crossing

The Route 289 BR 17A culvert is greater than 500 feet in length and is a 7.1 ft high 6.6 ft high CMP. The outlet of the culvert is free fall (Figure 6) with a scour pool below the structure. At the time of the wetland delineation on July 15, 2022 there was very little water flowing through the structure; however, given the abnormally dry conditions at the time of the survey, it is likely the stream is perennial. Based on StreamStats, the drainage area at the culvert outlet of the unnamed Tributary to Alder Brook is 0.28 square miles.

Given the short distance from the outlet structure to Alder Brook (Figure 7) and the outlet drop of greater than a couple of feet, it would not be possible to retrofit the culvert for AOP. In addition, baffles would likely be needed throughout the 500-foot structure to address the velocity barrier.

Lee Simard, Fisheries Biologist, visited the Route 289 BR 17A site in late August 2022, and has made the recommendation that AOP will only be required if the structure were replaced.

Figure 5. VT 289 BR 17A Beaver Influenced Wetland

Figure 6. VT Route 289 BR 17 A Culvert Outlet

Figure 7. Unnamed Tributary to Alder Brook downstream of VT 289 Culvert

VT Route 15 BR 6A

Wetlands

The resource evaluation of the Route 15 BR 6A site occurred outside of the growing season. Therefore, a wetland delineation could not be performed. Based on remote sensing, possible wetland habitat within the study area was identified. Google Streetview, Bing Streetview, imagery, hillshade, and LiDAR contours were used in combination to identify "possible wetlands". Google Streetview was particularly useful for seeing the vegetated drainage, where the farmer had fenced off. Based on imagery and Streetview, it seems likely the wetland extends outside of this fenced area and is greater than 0.5 acres. A wetland greater than 0.5 acres is assigned a Class 2 wetland designation in Vermont. A map showing the possible extent of the wetland within the Route 15 BR 6A study area boundary is provided in a page 4 of Appendix D. The size of the possible wetland within the study area is approximately 0.05 acres. An open wetland boundary is included to indicate the wetland likely continues to the south.

Figure 7. Google Streetview showing a possible wetland downstream of the Route 15 6A culvert

Stream Crossing

An inspection report for VT-15 BR 6A (VT Agency of Transportation, 2021, indicates the structure is a 6-foot diameter steel culvert that intersects a brook. No photos of the upstream or downstream channel without snow cover are available in the inspection report. Photos of the structure and narrative in the inspection report provide evidence of heavy rust and small holes in the barrel. The size of the channel upstream and downstream of the structure is not reported.

Bear Creek Environmental used a hydrology model in ArcGIS to calculate a rough drainage area at the culvert inlet. The hydrology model uses a Digital Elevation Model (DEM) and flow direction and accumulation. Based on the hydrology model, the drainage area at the culvert inlet is approximately 0.009 sq. miles (Appendix D, page 4). This drainage area seems low relative to the size of the culvert diameter, and may possibly underrepresent the drainage due to manmade alterations in drainage patterns. Field verification of the drainage area could not be completed due to snow cover.

The VFWD was contacted on February 1, 2023 regarding recommendations for AOP at this structure. The Department has deferred a recommendation until this spring or summer, when electrofishing can be conducted to determine if fish are present (refer to email correspondence included in Appendix D, pages 68 and 69).

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

Milone & MacBroom, Inc. 2008. The Vermont Culvert Geomorphic Compatibility Screening Tool. South Burlington, VT. 43 pp.

Milone & MacBroom, Inc. 2009. The Vermont Culvert Aquatic Organism Passage Screening Tool. South Burlington, VT 120 pp.

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

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 Natural Resources (VANR). 2009. Bridge and Culvert Assessment, Appendix B, Stream Geomorphic Assessment Handbooks. 22 pp.

Vermont Agency of Transportation. 2021. Route VT15, Bridge #006A (Routine), VT15 over Brook, Inspection Date: November 29, 2021. 9 pp.

Geospatial and remote sensing data sources include:

Vermont Agency of Natural Resources (VANR). 2022. BioFinder Mapping Tool. Available at: https://anrmaps.vermont.gov/websites/BioFinder/

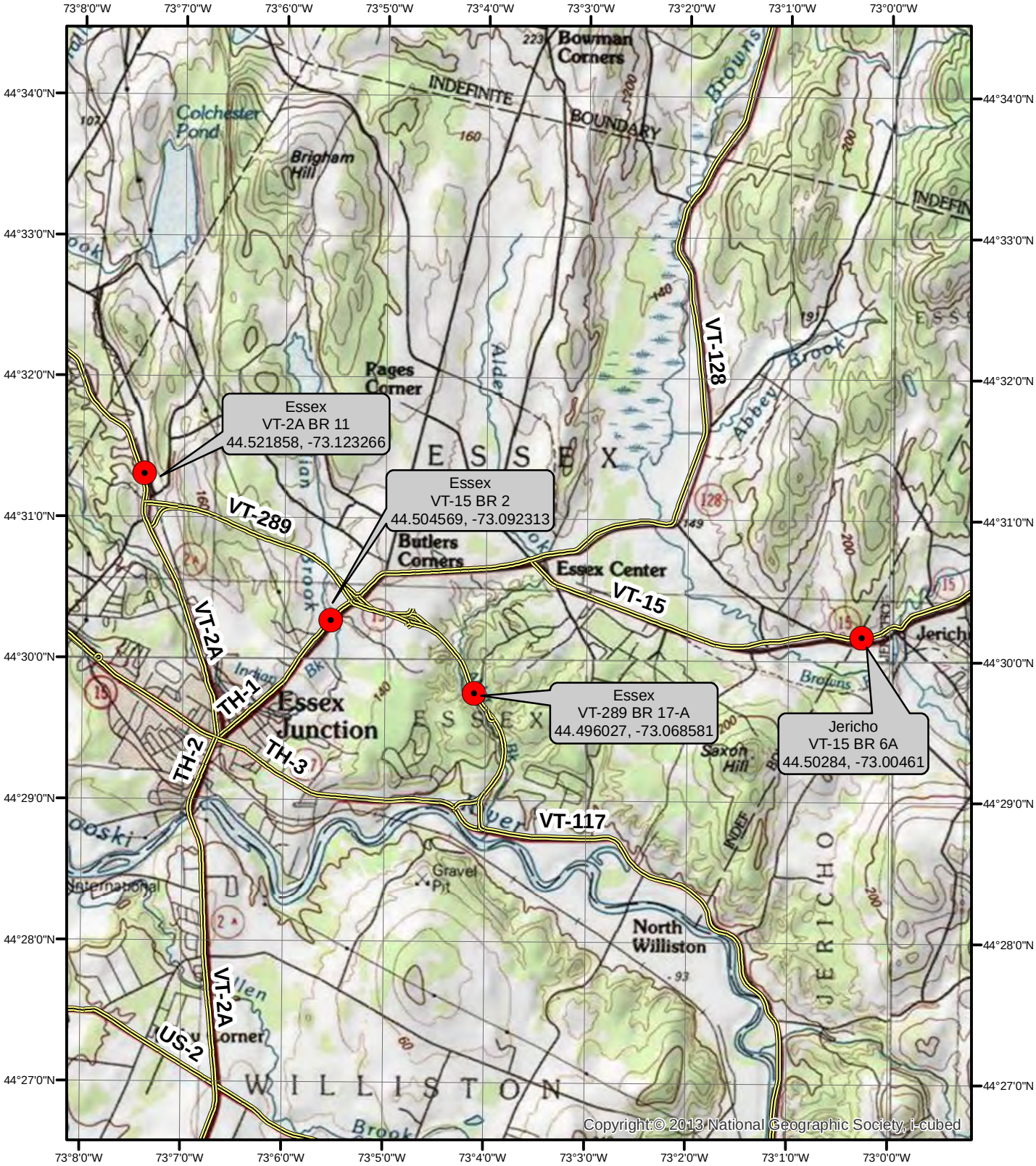
Vermont Agency of Natural Resources (VANR). 2022. Natural Resources Atlas. Available at: http://anrmaps.vermont.gov/websites/anra5/

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

Appendix A

Site Location, Ecological Resource Maps and Correspondence

Project Location Map for Northwest STP CULV (90)
Vermont Routes 2A, 15, and 289
Essex and Jericho, Vermont



Legend

- Culvert
- Major Road

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

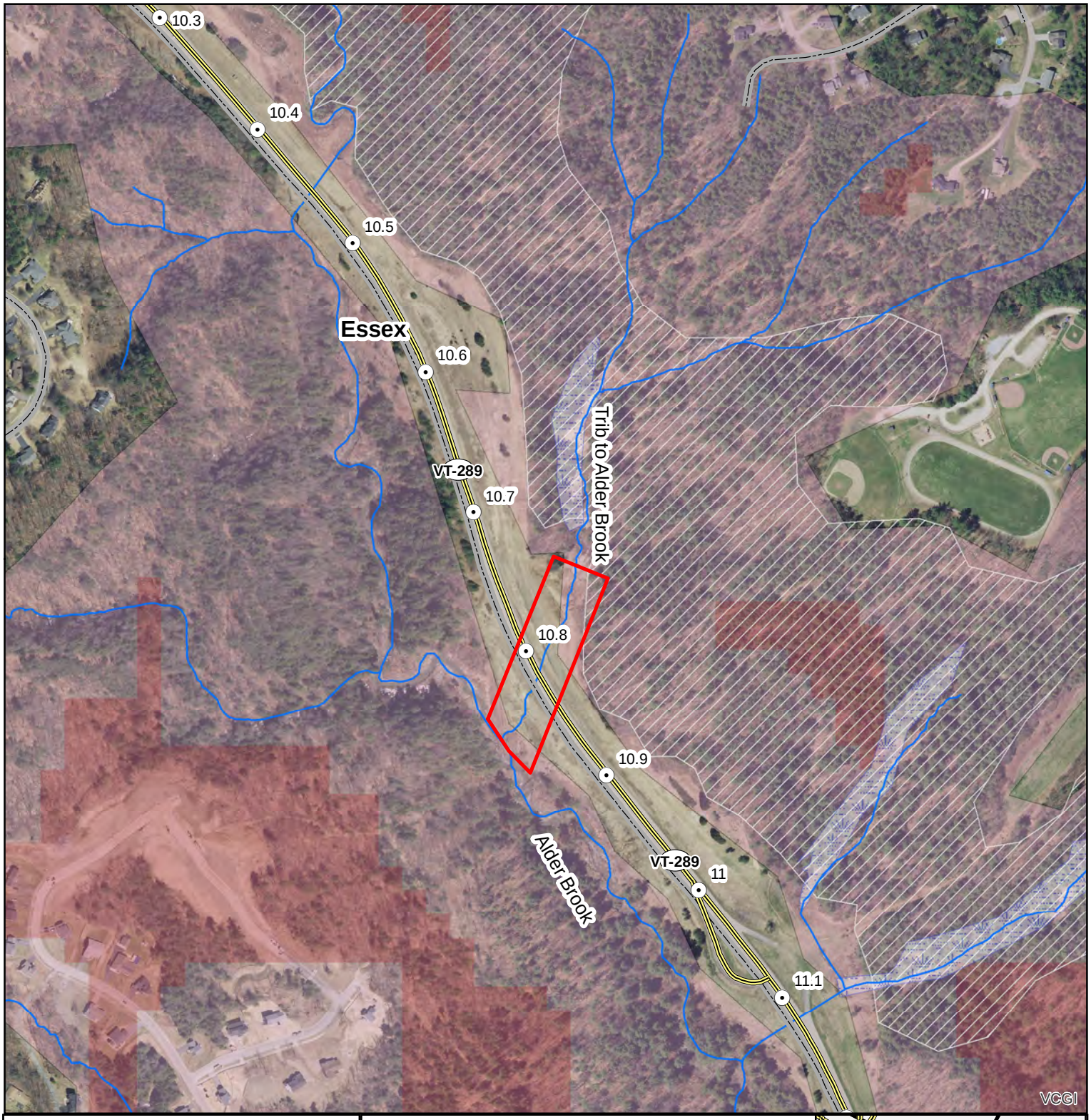
Map composed on June 27, 2022, Revised on January 5, 2023.

Bear Creek Environmental

0 3,000 6,000 Feet

1 inch = 6,000 feet

N



Resource Map - Ecological

Vermont Agency of Transportation
Northwest STP CULV (90)
Vermont Route 289 BR 17-A
Essex, VT
Chittenden County

Bear Creek Environmental

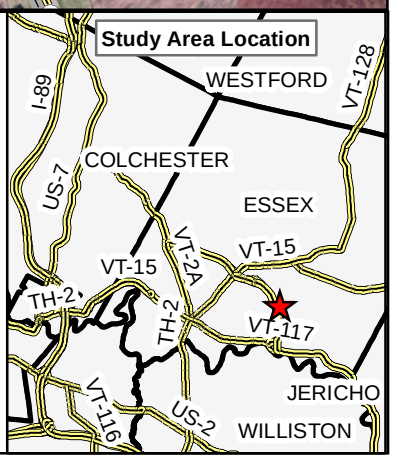
Legend

- Study Area
- Mile Marker - Tenths
- Major Road
- Road
- VHD Stream
- Significant Natural Community
- VSWI Class Layer
- RTE Animal Species
- RTE Plant Species
- Deer Wintering Area
- Core Habitat
- Habitat Block

N

0 125 250 500 Feet

Data sources include Vermont Agency of Natural Resources and Bear Creek Environmental. Map composed on July 13, 2022



Appendix B

Wildlife Habitat

Vermont Agency of Transportation
Northwest CULV (90)
Essex and Jericho, Vermont

Wildlife Habitat

A desktop analysis was performed to review wildlife habitat in the vicinity of the four project sites. The BioFinder tool published by the Vermont Fish and Wildlife Department and available at https://anrmaps.vermont.gov/websites/BioFinder/ was used to evaluate landscape-scale wildlife habitat. The mapping tool contains two primary datasets – a Landscape Scale layer and a Community and Species Scale layer. The Landscape Scale layer is a composite of six components – Interior Forest Blocks, Connectivity Blocks, Riparian Wildlife Connectivity, Surface Water and Riparian Areas, Physical Landscape Blocks, and Physical Landscape Diversity. The components are ranked as highest priority, priority, or not a priority by geographic area. BioFinder also displays Communities and Species Scale data, which contains the following components: Natural Communities, Aquatic Habitats, Wetlands, Terrestrial Wildlife Crossings, Riparian Wildlife Crossings, and Rare and Uncommon Species.

Essex VT-2A BR 11

The Essex Vermont Route 2A BR 11 site was reviewed using the BioFinder tool. Wildlife habitat data are portrayed on a map on page 3 of Appendix B. The site is the location of a culvert underneath Gentes Road, the railroad, and Vermont Route 2A. The culvert conveys flow from an unnamed tributary to Indian Brook, which is a direct tributary to Lake Champlain. Lands surrounding the project study area are primarily residential, with small areas of forest interspersed. There are numerous houses along Gentes Road and several businesses on Route 2A. Class II wetlands were found at the site during the wetland delineation performed by BCE and SLR on the floodplain of the unnamed tributary both upstream and downstream of the culvert. The riparian area of the brook has received a ranking of highest priority for the following landscape habitat components: Surface Water and Riparian Areas, Riparian and Wildlife Connectivity, and Physical Landscape Diversity. Lands to the west of Route 2A (downstream of the culvert) have been identified as highest priority for the following landscape scale components: Interior Forest Blocks, Connectivity Blocks, and Physical Landscape Diversity. Forested lands to the east of Gentes Road (upstream side of the culvert) have been identified as highest priority for the following components: Connectivity Blocks and Physical Landscape Diversity. There is also a forest block present east of Lamore Road that is noted as highest priority for Connectivity Blocks and Physical Landscape Diversity.

Essex VT-15 BR 2

The Essex Vermont Route 15 BR 2 site was also evaluated for wildlife habitat. The project site centers around a culvert under Route 15 that conveys flow from Indian Brook beneath the road. Lands surrounding the project site are a mix of residential and commercial, with a large meadow and a small amount of forested land present. Lands to the west of Route 15 (upstream side of the culvert) are noted in the BioFinder tool as highest priority for Surface Water and Riparian Areas and Physical Landscape Diversity. Lands to the east of the road (downstream of the culvert) are also highest priority for the same components. Open lands to the northeast of the culvert on the Lang Farm property are designated as priority for Surface Water and Riparian Areas. Sections of the corridor along Indian Brook are also

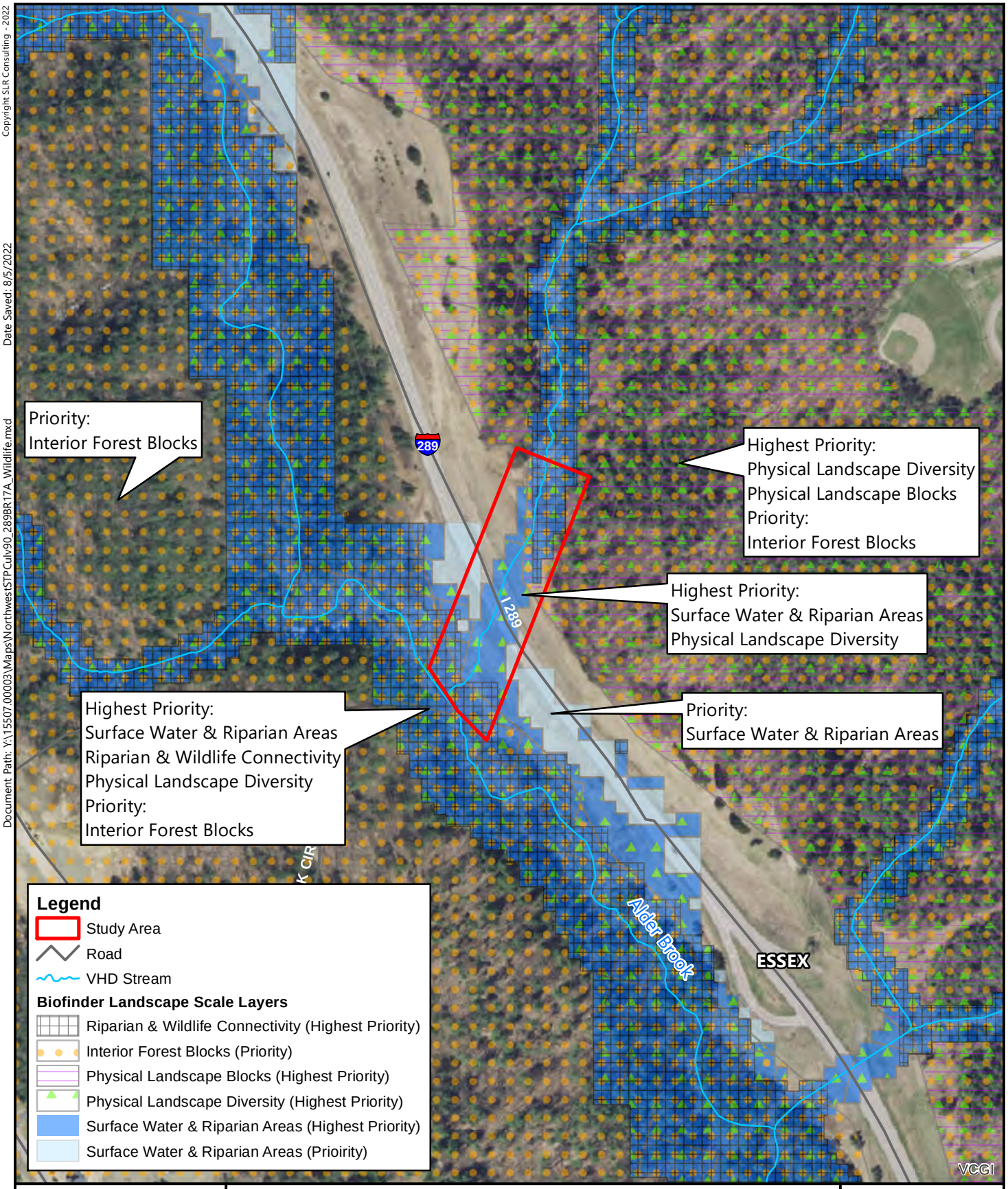
designated as highest priority for Riparian and Wildlife Connectivity. Landscape scale habitat features for the Essex Route 15 site are shown on a map on page 4 of Appendix B.

Essex VT-289 BR 17A

The Interstate 289 BR 17A site is a culvert that conveys flow from an unnamed tributary to Alder Brook beneath Interstate 289. The site is surrounded primarily by forested land and has Class II wetlands both east and west of the road. Forested lands to the east of the road (upstream of the culvert) have been identified as highest priority for the following landscape scale components: Physical Landscape Diversity and Physical Landscape Blocks. They are also priority for Interior Forest Blocks. Alder Brook flows parallel to Interstate 289 to the west of the road through forested land and shrub-sapling wetlands. Beyond the forested land to the west is a residential development. The swath of land along Alder Brook has been identified as highest priority for the following components: Surface Water and Riparian Areas, Riparian and Wildlife Connectivity, and Physical Habitat Diversity, as well as priority for Interior Forest Blocks. Lands to the west in the vicinity of the residential development are priority for Interior Forest Blocks. There is also a narrow band of priority Surface Water and Riparian Areas identified between Alder Brook and I-289, as shown on the map on page 5 of Appendix B.

Jericho VT-15 BR 6A (Revised February 7, 2023)

The Vermont Route 15 BR 6A site is located at a culvert under Route 15 near the intersection with Mountain View Road. Lands within the study area boundary are not identified as priority or highest priority for any of the BioFinder wildlife habitat components. Lands immediately along Route 15 are residential and agricultural. Forested lands are present north of the project site at the edge of a residential development. These forested lands have been identified as priority for the BioFinder landscape component Connectivity Blocks. The Browns River flows through agricultural lands south of the project site. A large area encompassing the corridor of the Browns River has been identified as highest priority for Surface Water and Riparian Areas and Physical Landscape Diversity. A narrower band of land immediately adjacent to the river is also identified as highest priority for Riparian and Wildlife Connectivity.



Date Saved: 8/5/2022

Document Path: Y:\15507.00003\Maps\NorthwestSTPCulv90_289BR17A_Wildlife.mxd

SLR

1 SOUTH MAIN ST
WATERBURY, VT 05676
802.882.8335

Wildlife Landscape Habitat Map

Vermont Agency of Transportation
Northwest STP CULV (90)
Interstate 289 BR 17A
Essex, VT
Chittenden County

N

0 500
Feet

Biofinder data from Vermont Conservation Design Landscape Scale Components layer published by the Vermont Agency of Natural Resources (last updated March 24, 2022).

SCALE 1 " = 500 '
DATE 8/5/2022
146.15507.00003
PROJ. NO.

WILDLIFE MAP

Appendix C

Botanical Resources

Elisabeth McLane, Ecological Consulting.
22 Blue Moon Road
South Strafford, VT 05070
802 765-4745, tii.mclane0123@gmail.com

MEMORANDUM

TO: Mary Nealon, Bear Creek Environmental; VTRANS
FROM: Elisabeth McLane
SUBJECT: VTRANS PROJECT: Statewide – Northwest STP CULV (90).
RTE Plants Evaluation of Rte 2A BR 11, and Rte 15 BR 2.
DATE: July 8, 2022

A site visit for these VRANS-designated culvert projects took place on July 4th, 2022. These two culvert areas were chosen out of the group of 4 named in the project description because they are located in the vicinity of remnant Dry Pine-Oak-Heath Sandplain Forest Natural Communities where many rare plant species have been found. For the Rte 2A culvert, the east side of Gentes Road and the west side of Rte 2A were included. The central area, between those two roads, is the railroad right-of-way and was not surveyed (although a remote evaluation of the area was made). The area surveyed included 100 ft to the east of Gentes Road and 100 ft to the west of Rte 2A, extending for approximately 350 feet along the road edge. The culvert is located in the northern half of the survey area. For the Rte 15 culvert, the survey area was roughly square and centered over the culvert, extending along the road approximately 220 feet and 100 ft to the east and west of the road edge. The site visit to these two culvert areas was designed to determine if Rare, Threatened, or Endangered (RTE) plants or natural communities are present within the site boundaries.

No RTE plants were noted at the Rte 2A-BR 11 and Rte 15-BR 2 sites.

Route 2A BR 11

The Rte 2A site is a complex of wetland, streamside, and moderate to steep wooded slopes bordering a moderately-wide stream valley. Soil maps show this area to be underlain by Munson-Raynham silt loams, with Adams-Windsor loamy sands found just out of the survey area. The latter soil is commonly the substrate underlying the Dry Pine-Oak-Heath Sandplain Forest community, a community that frequently supports RTE plants.

Most of this survey site has been fairly heavily disturbed through road, railroad, and housing development. Throughout most of the survey area, vegetation is dense, with a mix of native and non-native plants. Non-native Robinia pseudo-acacia (black locust) is common in the overstory, and Rhamnus cathartica (common buckthorn), rosa multiflora (multiflora rose), Alliaria petiolata (garlic mustard), and Lonicera morrowii (Morrow's honeysuckle) are all found in the understory, concentrated most heavily on the steep banks to the stream. Phalaris arundinaceae (reed canary grass) is common in the wet stream valley and Lythrum salicarium (purple loosestrife) was noted more occasionally there. Dominant and common native trees include: Acer negundo (box-elder), Fraxinus americana (white ash), Populus deltoides (cottonwood), Quercus rubra (red oak), Ulmus americana (American elm), Rhus typhina (stag-horn sumac), and occasional Carpinus caroliniana (musclewood). Dominant or common native plants include Parthenocissus quinquefolia (Virginia creeper), Solidago canadensis (Canada goldenrod), Solidago gigantea (smooth goldenrod), Circaea canadensis (enchanter's nightshade), Ribes Americanum (American gooseberry), Solanum dulcamara (deadly nightshade), Apios americana (common ground

nut), and vitis spp (grape). The stream drainage floor has been less disturbed, generally, and supports a variety of wet-soil plants and small concentrated wetland areas. Onoclea sensibilis (sensitive fern) is generally a dominant plant throughout, and there are small patches dominated by a variety of different plant species including: Impatiens capensis (jewel-weed), Glyceris grandis (American manna grass), Typha latifolia and T. angustifolia (cattail), Alnus incana (speckled alder), Eurochium maculatum (spotted joe-pye weed), Phalaris arundinacea (reed canary grass), Sambucus pubens (common elder), and Tussalago farfara (coltsfoot). Green and black ash were occasionally found here. These small wetlands are best described as woodland seeps that grade occasionally into cattail marsh or alluvial shrub swamp in the flat floodplain areas next to the brook.

Heavy disturbed forest areas are hard to identify to Natural Community, but the mostly likely fit for this survey area is the Red Oak-Northern Hardwood Forest Natural Community. The southwest corner of this survey area appears significantly drier, with a rolling terrain, and slightly sparser vegetative cover. This area appeared likely to be transitioning to Adams-Windsor loamy sands, the soil type more likely to support the Dry Pine-Oak-Heath Sandplain Forest Natural Community type. The forest in this section is more intact than over the rest of the survey area, but is similarly second growth and is dominated by mid to early successional trees such as: red maple, cottonwood, American elm, white ash, red oak, basswood, and, closer to the stream, box elder. Rhamnus cathartica is a common plant in the mid to under-story. Plants present here and not seen elsewhere included: Hamamelis virginiana (witchhazel), Diervilla lonicera (Canada fly honeysuckle), amphicarpa bracteata (hog peanut), carex leptonervia (nerve-less sedge), solidago caesia (blue-stemmed goldenrod), equisetum hymenale (scouring rush), carex rosea (rosy sedge), carex prasina (drooping sedge), and Polystichum acrostichoides (Christmas fern). Although the vegetation and soils differ somewhat here, the Natural Community Type is still best described by the Red Oak-Northern Hardwood Forest, and no RTE plants were noted here.

Route 15 BR 2

The Rte 15 site divides more simply into distinct communities. Mowed-grass areas are found dominating much of the northeast quarter and very northwest corner. These areas are too heavily disturbed to evaluate effectively and are unlikely to support rare plants. The southeast quarter is dominated by herbaceous plants, with Elymus repens common along the road edge, grading into dense Solidago canadensis to the east. Solidago provides almost complete cover, except for scattered Onoclea sensibilis and Impatiens capensis. A shrub-dominated forest edge begins at the very eastern edge of the survey area. Invasive Rhamnus cathartica and Lonicera morrowii are common here along with native Viburnum recognitum, and Cornus sericea. In a narrow band on the south side of the stream, these species mix with Alnus incana to create a small area of alluvial shrub swamp. Typical wet-soil herbaceous plants are found here and include: Onoclea sensibilis, Eurochium maculatum, Impatiens capensis, Thalictrum pubescens (tall meadow-rue), and Typha angustifolium. The northside of the stream, south of the mowed grass-area, is dominated by a dense thicket of invasive Phragmites australis (common reed). The natural communities that would likely be identifiable here, if not for the dominant Phragmites, include Cattail Marsh or Shallow Emergent Marsh, or a combination of these.

The western side of Rte. 15 is old field that has regenerated to mixed shrubs and trees. Pinus strobus (white pine) is common, as is invasive Robinia pseudo-acacia. Rhus typhina sometimes dominates. Invasive plants are common and include: Rhamnus cathartica, Lonicera morrowii, Alliaria petiolate, and Centauria jacea (brown knapweed). The stream valley is not wide here, with old field re-growth extending almost to the stream edge. Evaluating natural community type in such a disturbed area is difficult, but the most likely choices for the non-wetland areas of this survey areas are Northern Hardwood Forest and Red Oak-Northern Hardwood Forest.

Botanical Findings

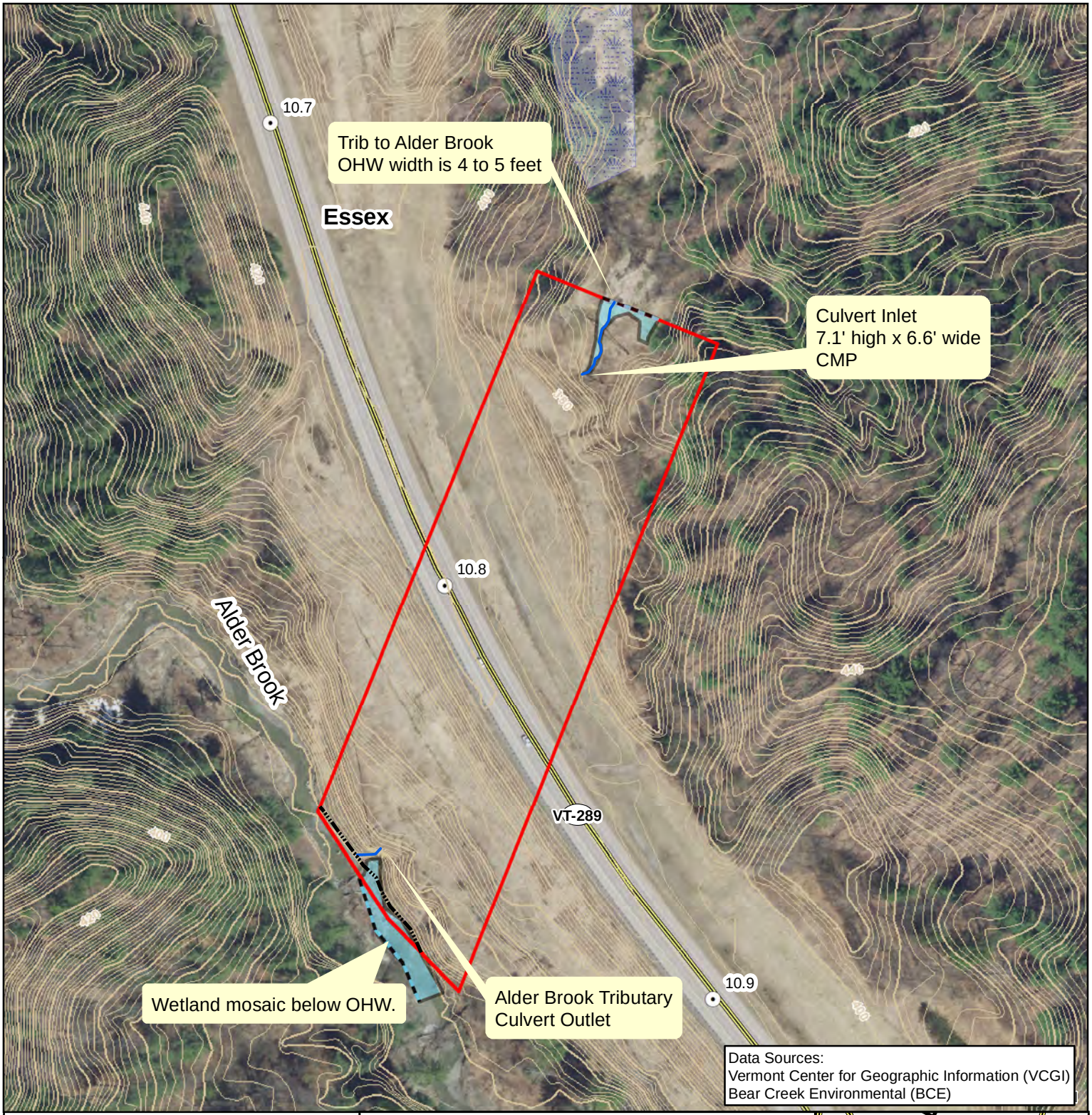
No RTE plants were noted at either the Rte 2A-BR11, or the Rte 15-BR 2 sites.

Natural Community Findings

No rare or significant Natural Communities were noted at either the Rte 2A-BR11, or the Rte 15-BR 2 sites. Invasive plants pose a threat to native plants at both sites.

Appendix D

Wetland and Stream Resources



Field Delineated Wetlands

Vermont Agency of Transportation
Northwest STP CULV (90)
Vermont Route 289 BR 17A
Essex, VT
Chittenden County

Bear Creek Environmental

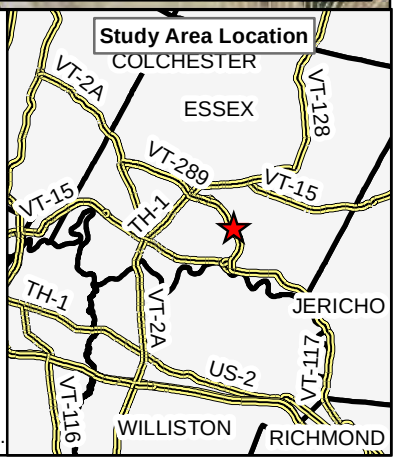
Legend

- Study Area
- **Field Delineated Wetland**
- Class 2
- Wetland Open Boundary
- Alder Brook Tributary (Approx.)
- Alder Brook OHW (approx.)
- VSWI Class Layer
- Mile Marker - Tenths
- Major Road
- Text

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 July 15, 2022. 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 July 19, 2022 and revised on August 1, 2022. Delineation confirmed by Elijah Schumacher, VT District Wetland Ecologist, on July 28, 2022.



WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: VTrans NW STP CULV (90) - VT 289 BR17A City/County: Essex / Chittenden Sampling Date: 7/15/22

Applicant/Owner: VTrans State: VT Sampling Point: Aup

Investigator(s): Mary Nealon (BCE), Alex Marcuci (SLR) Section, Township, Range:

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 2

Subregion (LRR or MLRA): LRR R Lat: 44.497099 Long: -73.068175 Datum: WGS 1984

Soil Map Unit Name: Duane and Deerfield soils, 5 to 12 percent NWI classification: NA

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**
Hydric Soil Present?	Yes ____	No X	**within a Wetland?** **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:
Culvert is 7.1' high by 6.6' wide CMP

VEGETATION – Use scientific names of plants. Sampling Point: Aup

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Herb Stratum (Plot size:)			
1. *Solidago altissima*	80	Yes	FACU
2. *Rubus idaeus*	5	No	FACU
3. *Impatiens capensis*	5	No	FACW
4. *Lonicera morrowii*	2	No	FACU
5. *Onoclea sensibilis*	5	No	FACW
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	97 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	=Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	0	x 3 =	0
FACU species	87	x 4 =	348
UPL species	0	x 5 =	0
Column Totals:	97 (A)		368 (B)

Prevalence Index = B/A = 3.79

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: Aup

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
0-15	10YR 3/3	90	5YR 5/8	10	C	M	Loamy/Clayey	15'+

[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 NW STP CULV (90) - VT 289 BR17A City/County: Essex / Chittenden Sampling Date: 7/15/22

Applicant/Owner: VTrans State: VT Sampling Point: Awet

Investigator(s): Mary Nealon (BCE), Alex Marcuci (SLR) Section, Township, Range:

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

Subregion (LRR or MLRA): LRR R Lat: 44.497080 Long: -73.068084 Datum: WGS 1984

Soil Map Unit Name: Duane and Deerfield soils, 5 to 12 percent NWI classification: PEM

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)

- X Surface Water (A1)
- x High Water Table (A2)
- x 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)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes x	No	Depth (inches):	0.5
Water Table Present?	Yes x	No	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes x	No	Depth (inches):	0

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

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

Remarks:
Culvert is 7.1' high by 6.6' wide CMP

VEGETATION – Use scientific names of plants. Sampling Point: Awet

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix bebbiana*	5	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	5	=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size:)			
1. *Phalaris arundinacea*	80	Yes	FACW
2. *Glyceria grandis*	40	Yes	OBL
3. *Impatiens capensis*	15	No	FACW
4. *Atropa bella-donna*	5	No	UPL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	140	=Total Cover	
Woody Vine Stratum (Plot size:)			
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	40	x 1 =	40
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	5	x 5 =	25
Column Totals:	145 (A)		265 (B)

Prevalence Index = B/A = 1.83

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 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** X **No** ___

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

SOIL

Sampling Point: Awet

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
0-22	10YR 4/1	95	10YR 5/8	5	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**)
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- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
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- ___ 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) Revised 2/8/23

VERMONT WETLAND EVALUATION FORM

Wetland ID#: VT-289 BR 17A, Wetland A Project #: VTrans NW STP CULV (90)

Date: 8/8/22 Investigator: Mary Nealon (BCE), Alex Marcucci (SLR)

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**	0
4. Wildlife Habitat	H	**9. Open Space and Aesthetics**	0
5. Exemplary Wetland Natural Community	0	**10. Erosion Control through Binding and Stabilizing the Soil**	H

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

■ 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.
- ■ 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.
- ☐ 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.
- ■ 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.
- ■ 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.
  - ■ 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.

- [x] 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.
- [ ] 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;
  - [ ] 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

☐ 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.
- ☐ 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

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

- ☐ Can be readily observed by the public; and
  - ☐ Possesses special or unique aesthetic qualities; or
  - ☐ 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

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

- ■ Erosive forces such as wave or current energy are present and any of the following are present as well:
  - ■ Dense, persistent vegetation along a shoreline or stream bank that reduces an adjacent erosive force.
  - ■ Good interspersion of persistent emergent vegetation and water along course of water flow.
  - ☐ 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
- ☒ 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.

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

- ☒ 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.

From:	Eldridge, William
To:	mary@bearcreekenvironmental.com; Simard, Lee
Cc:	Pientka, Bernie
Subject:	RE: VTrans Northwest CULV (90) - stream crossings
Date:	Thursday, September 1, 2022 8:50:06 AM

Lee and Mary,

Lee, thanks for visiting the site and reporting your observations to Mary.

Mary, thanks for sharing your concerns and making sure everything is adequately addressed.

Thanks,
Will

VERMONT
Will Eldridge | Aquatic Habitat Biologist
Vermont Fish and Wildlife Department | Fish Division
802-585-4499 cell | william.eldridge@vermont.gov

From: mary@bearcreekenvironmental.com <mary@bearcreekenvironmental.com>
Sent: Thursday, September 1, 2022 7:16 AM
To: Simard, Lee <Lee.Simard@vermont.gov>; Eldridge, William <William.Eldridge@vermont.gov>
Cc: Pientka, Bernie <Bernie.Pientka@vermont.gov>
Subject: RE: VTrans Northwest CULV (90) - stream crossings

Hi Lee,

Thanks for getting back to me. I will add your recommendations to the VTrans report.

Mary

From: Simard, Lee <Lee.Simard@vermont.gov>
Sent: Thursday, September 1, 2022 6:49 AM
To: mary@bearcreekenvironmental.com; Eldridge, William <William.Eldridge@vermont.gov>
Cc: Pientka, Bernie <Bernie.Pientka@vermont.gov>
Subject: RE: VTrans Northwest CULV (90) - stream crossings

Hi Mary,

I was able to stop by this site, although unfortunately with time constraints without bringing a backpack shocker with me. That said, I walked some distance upstream of the culvert and immediately adjacent wetland area and found a well-defined channel with clear flowing water that could serve as suitable habitat for a number of fish species.

I do not believe this changes our recommendations but instead reconfirms that AOP would be required if the structure were to be replaced. If the project does move in this direction, I'd be happy to review the site further if necessary.

I'll be in the field most of today but let me know if you have any questions.
Thanks,
Lee

VERMONT

Lee Simard | Fisheries Biologist
Vermont Fish and Wildlife Department
Fisheries Division
111 West Street | Essex Junction, VT 05452
802-879-5697 office | 802-622-4017 cell | 802-879-5649 fax
www.vtfishandwildlife.com

The Agency of Natural Resources supports telework, and there are times when I may be working from another office location. I am available to connect by phone and email. I am also available to connect in-person upon request.

From: mary@bearcreekenvironmental.com <mary@bearcreekenvironmental.com>
Sent: Sunday, August 28, 2022 1:15 PM
To: Simard, Lee <Lee.Simard@vermont.gov>; Eldridge, William <William.Eldridge@vermont.gov>
Cc: Pientka, Bernie <Bernie.Pientka@vermont.gov>
Subject: RE: VTrans Northwest CULV (90) - stream crossings

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

Thanks for your offer to swing by the RT 289 site on your way home from work. I'm tied up with field work this week, and won't be able to join you.

Please let me know your thoughts after your site visit. I plan to finalize my VTrans report no later than Thursday of this week.

Best regards,

Mary

From: Simard, Lee <Lee.Simard@vermont.gov>
Sent: Thursday, August 25, 2022 2:42 PM
To: Eldridge, William <William.Eldridge@vermont.gov>; mary@bearcreekenvironmental.com
Cc: Pientka, Bernie <Bernie.Pientka@vermont.gov>
Subject: RE: VTrans Northwest CULV (90) - stream crossings

Hi Mary,

Those recommendations were solely based on a desktop review of watershed size at each structure and the corresponding requirements through the SAGP. If the watershed size is greater than 0.25 mi^2 at a location or fish are known to be present, our recommendation will consistently be that AOP be provided unless the applicant flags specific issues that would negate the need for AOP at a site (e.g., an impassable natural barrier near the structure) or can justify a replacement. Thanks for providing that additional context for this crossing.

I agree with Will's statement that the request for AOP would be based on this structure being replaced. Our preference will usually be for a structure to be replaced rather than repaired to achieve AOP, but do understand the cost constraints, especially in instances such as this where there may be limited habitat upstream of the structure. Ultimately that decision will be made in consultation with the RME.

In this instance, LIDAR imagery does suggest there is some amount of stream channel further upstream, so I'd be interested in conducting a site visit to take a closer look to do my due diligence. I'd be willing to stop by sometime next week on my way home from work but could also coordinate a time with you if you'd like to be present.

Thanks,
Lee

VERMONT

Lee Simard | Fisheries Biologist
Vermont Fish and Wildlife Department
Fisheries Division
111 West Street | Essex Junction, VT 05452
802-879-5697 office | 802-622-4017 cell | 802-879-5649 fax
www.vtfishandwildlife.com

The Agency of Natural Resources supports telework, and there are times when I may be working from another office location. I am available to connect by phone and email. I am also available to connect in-person upon request.

From: Eldridge, William <William.Eldridge@vermont.gov>
Sent: Tuesday, August 23, 2022 4:36 PM
To: mary@bearcreekenvironmental.com
Cc: Simard, Lee <Lee.Simard@vermont.gov>; Pientka, Bernie <Bernie.Pientka@vermont.gov>
Subject: RE: VTrans Northwest CULV (90) - stream crossings

Hi Mary,

I don't know the site and will defer to Lee or Bernie on the habitat quality upstream.

Your points about the constraints to achieving AOP through a retrofit are well taken. I think we would ask that AOP be provided if the structure is replaced.

Thanks,
Will

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

From: mary@bearcreekenvironmental.com <mary@bearcreekenvironmental.com>
Sent: Tuesday, August 23, 2022 2:58 PM
To: Eldridge, William <William.Eldridge@vermont.gov>
Cc: Simard, Lee <Lee.Simard@vermont.gov>; Pientka, Bernie <Bernie.Pientka@vermont.gov>
Subject: RE: VTrans Northwest CULV (90) - stream crossings

Hi Lee, Bernie and Will,

I thought I would follow up on your request for AOP at the VT 289 site. I wondered if you had seen this site in the field, and what your thoughts were regarding a new structure or the possibility of retrofitting the existing one.

I've attached a map of the site. The culvert is more than 500 feet in length. There was flow coming out of the culvert when I was there in July, but the channel above the inlet had very little water (photo 5431) and offered minimal habitat. The outlet drop is substantial (Photo 5438), and the distance the trib flows to Alder Brook under low flow conditions is only 15 to 20 feet (Photo 5432).

Without doing any sort of modeling, it would seem that a AOP retrofit would not work. Because Alder Brook is so close to the mouth of the trib, it would be impossible to address the outlet drop without raising Alder Brook. It also seems like baffles would be needed throughout the 500 foot structure to address the velocity barrier.

Although a new structure could potentially provide AOP, it seems like it would be an expensive project due to distance and the highway.

I would be interested in your thoughts and suggestions.

Thanks,

Mary

From: mary@bearcreekenvironmental.com <mary@bearcreekenvironmental.com>
Sent: Monday, August 22, 2022 1:41 PM
To: 'Eldridge, William' <William.Eldridge@vermont.gov>
Cc: 'Simard, Lee' <Lee.Simard@vermont.gov>; 'Pientka, Bernie' <Bernie.Pientka@vermont.gov>
Subject: RE: VTrans Northwest CULV (90) - stream crossings

Thanks Will

Yes, the VT-15 BR 6A site is a bridge in a gorge. The four stream crossings were part of the same project. I'm sorry if my request for AOP requirements was confusing. I should have noted it was a bridge when I sent you my request.

Thanks for the input from the District Biologists.

Mary

From: Eldridge, William <William.Eldridge@vermont.gov>
Sent: Monday, August 22, 2022 1:26 PM
To: mary@bearcreekenvironmental.com
Cc: Simard, Lee <Lee.Simard@vermont.gov>; Pientka, Bernie <Bernie.Pientka@vermont.gov>
Subject: RE: VTrans Northwest CULV (90) - stream crossings

Hi Mary,

Here's the feedback I got from the District Biologists.

VT-15 BR 6A: A little confused by the AOP request here as it's a bridge. It's a cascade/gorge area, that I'd assume is impassable (Bernie would you agree? I haven't spent a lot of time staring at it), so maybe that is part of it. But it's a bridge??

VT-289 BR 17-A: This a trib to Alder Brook which has many fish species present (DEC sampling station just downstream). Watershed size = 0.2835 square miles. AOP required.

VT-15 BR 2 (Bernie's area): Indian Brook, 3.63 square miles. AOP required

VT-2A BR 11 (Bernie's area): watershed = 0.786 square miles. AOP required

Let me know if you need more information.

Thanks,

Will

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

From: mary@bearcreekenvironmental.com <mary@bearcreekenvironmental.com>
Sent: Thursday, August 18, 2022 9:31 AM
To: Eldridge, William <William.Eldridge@vermont.gov>
Subject: RE: VTrans Northwest CULV (90) - stream crossings

Hi Will,

I'm writing to check in with you regarding the email I sent last week. Please let me know if you would like me to provide additional information for you to make a determination regarding AOP requirements for the three stream crossing locations in Essex.

Feel free to give me a call if you have questions (802-223-5140).

Thanks,

Mary

From: mary@bearcreekenvironmental.com <mary@bearcreekenvironmental.com>
Sent: Tuesday, August 9, 2022 5:00 PM
To: 'Eldridge, William' <William.Eldridge@vermont.gov>
Subject: VTrans Northwest CULV (90) - stream crossings

Good Afternoon Will,

The Bear Creek Environmental Natural Resources Services Team has been retained by VTrans to conduct a scoping level study of four stream crossing projects. I have attached a topo map showing the four locations.

Glenn Gingras has asked me to reach out to you and inquire if AOP will be required for these sites. I'm happy to send along Ecological maps of each site, if that would be helpful. I also have some photographs of the structures and the channels in the vicinity of the structures, if you would like that information.

I appreciate any input you may have.

Best regards,

Mary

Mary Nealon
Principal / River Scientist
Professional in Erosion and Sediment Control
Certified Floodplain Manager

Bear Creek Environmental

131 Elm Street, Suite 1
Montpelier, Vermont 05602
Phone: (802) 223-5140
Email: Mary@BearCreekEnvironmental.com
Website: http://www.bearcreekenvironmental.com

Appendix H: Archeology Memo

VERMONT

Brennan Gauthier
VTrans Senior Archaeologist
Vermont Agency of Transportation
Project Delivery Bureau
Environmental Section
tel. 802-279-1460
Brennan.Gauthier@Vermont.gov

To: Julie Ann Held, VTrans Environmental Specialist

From: Brennan Gauthier, VTrans Senior Archaeologist

Date: 12/14/2022

Subject: Statewide Northwest STP CULV(90) Archaeological Resource Identification

Dear Julie Ann,

I have completed my background research and field inspection of the four separate locations requested as part of this resource ID request in the northwest part of the state. I will explain each in an individual section below and add any areas of archaeological sensitivity into the archaeology geodatabase for inclusion in future plan sets.

Bridge No.11, VT-2A, Essex, Chittenden County, Vermont

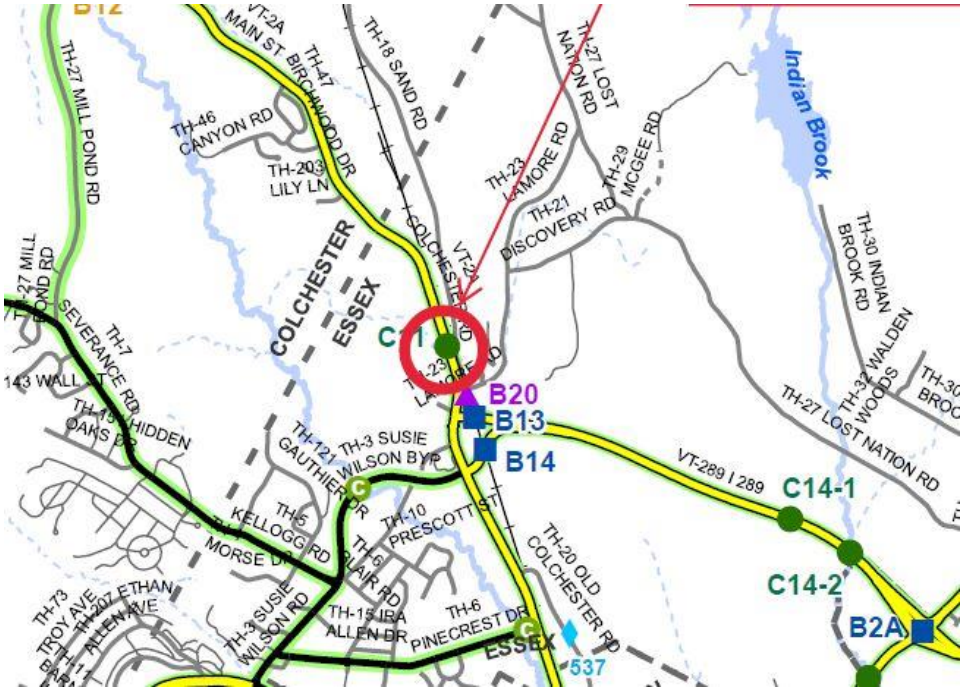


Figure 1: Bridge Location.

A review of known archaeological sites in the VAI database shows several known VAI archaeological sites within a half kilometer of the project site. These sites are Native American in origin and were discovered during the 1990s Circumferential Highway archaeological survey. Both sites, VT-CH-0613 and VT-CH-0622, are located on a sandy outwash plain directly to the south of Bridge No. 11. Due to the close proximity and being situated near/on the same geologic feature, any undisturbed areas outside of the culvert, roadway and railroad prism are considered sensitive for precontact archaeological site presence. Additionally, the median between the rail and the roadway appears to be disturbed.

Figure 2: Project Location.

A review of the Beers and Walling map series show no industrial activity at the bridge location, but there may be older sites not represented. However, the archaeological sensitivity mapped for precontact sites covers the potential for historics. See ***Figure 4*** below for a view of the sensitive areas as mapped using LiDAR hillshade.

Figure 3: Project LiDAR View and VAI Site Location.

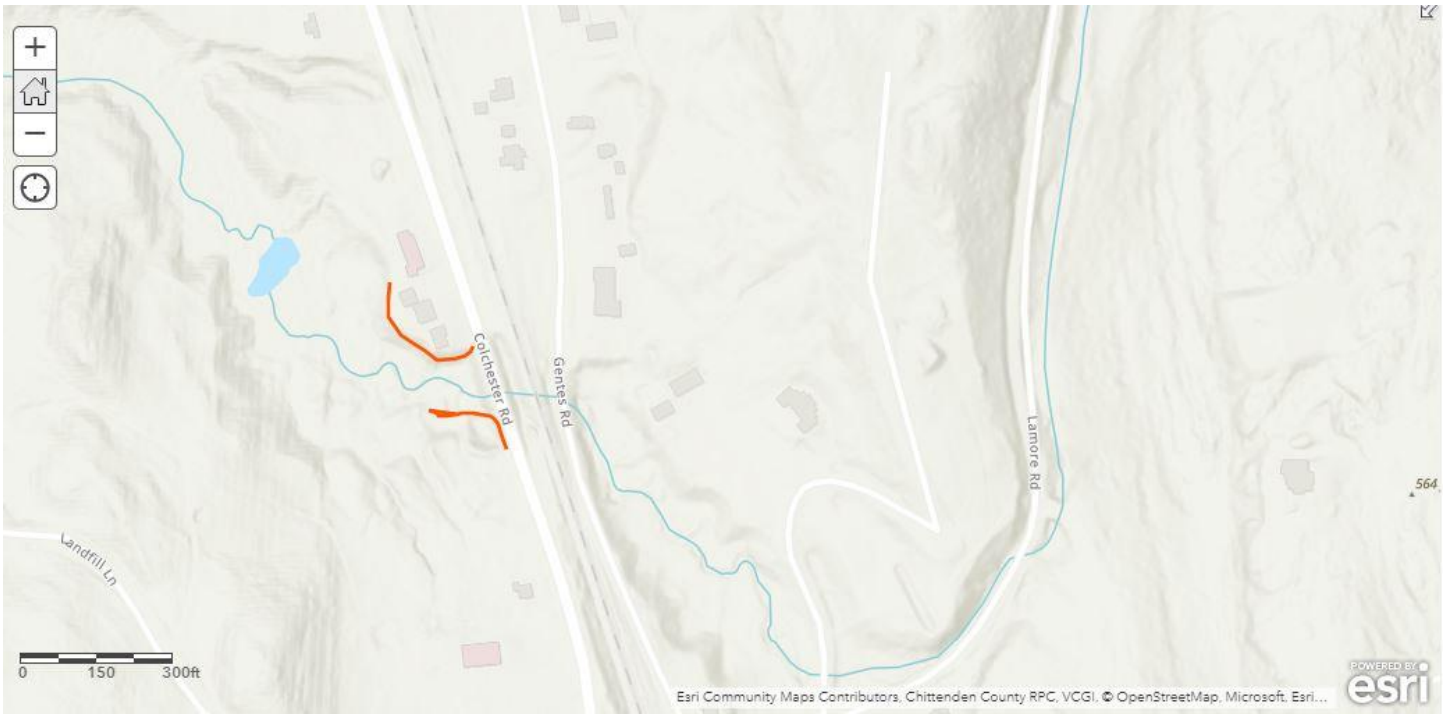


Figure 4: Arch Sensitive Areas.

In conclusion, there are two mappable archaeologically sensitive areas related to rehabilitation of Bridge No. 11 that have been added to the archaeology geodatabase for inclusion in future plans.

Bridge No. 2, VT-15, Essex, Chittenden County, Vermont

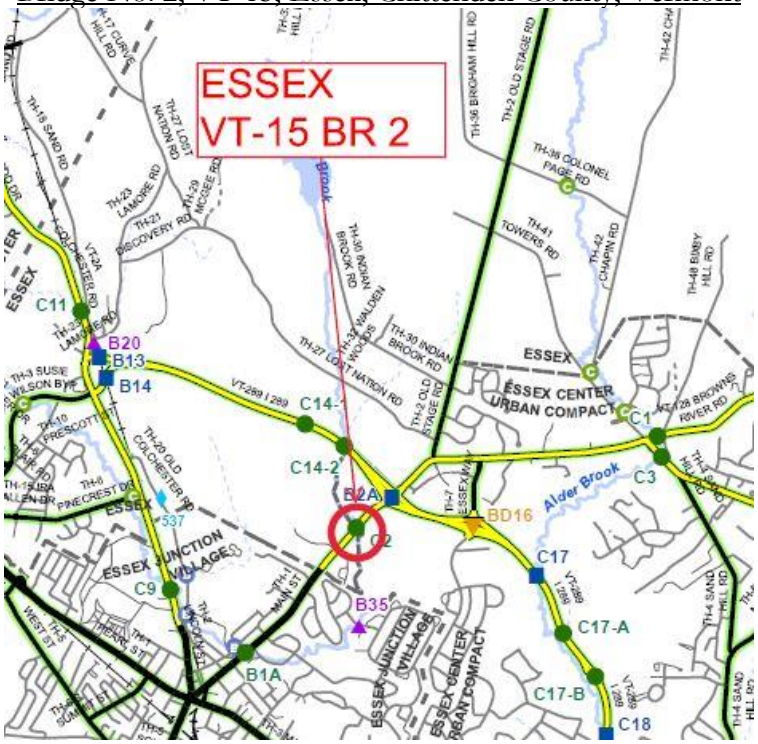


Figure 5: Bridge Location.

A review of known archaeological sites in the VAI database shows one known VAI archaeological site (VT-CH-9191) within a half kilometer of Bridge No. 2 over Indian Brook on Vermont Route 15 in Essex. This site is Native American in origin and were discovered during a field walkover of the farm to the east of the project location. Due to the close proximity of the site to the bridge, it is advisable to mark all undisturbed areas as archaeologically sensitive. Roadway prism disturbance is obvious at this location, so any area outside of the prism and/or utilities is deemed archaeologically sensitive. A field review was conducted during the 2022 field season and the areas of sensitivity were drawn using LiDAR hillshade. Please refer to ***Figure 7*** for a visual representation of the archaeologically sensitive areas.

Figure 6: Bridge Location.

Figure 7: Archaeologically Sensitive Areas.

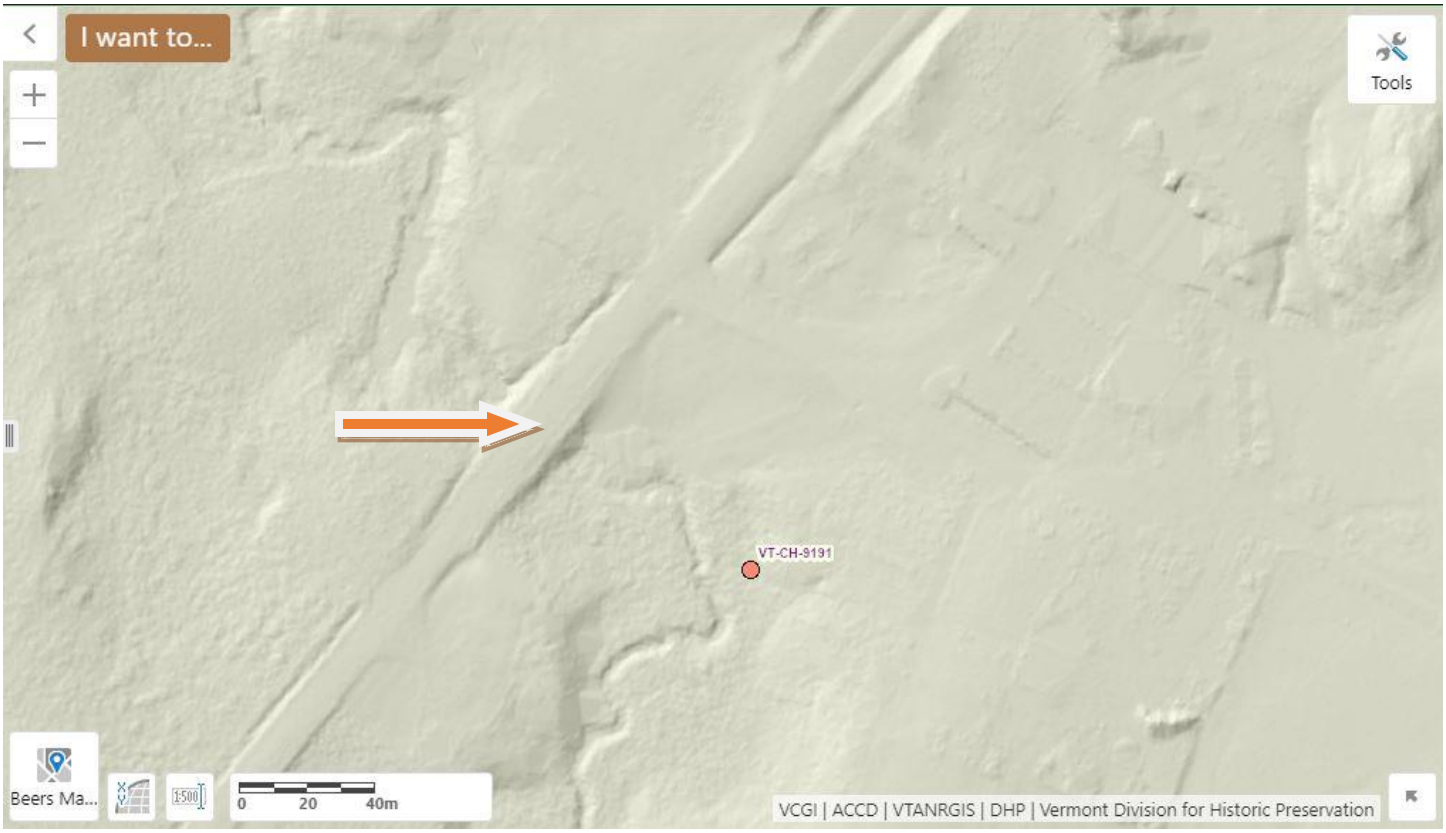


Figure 8: LiDAR View of Project Location.

Bridge No.17A, Vermont Route 289, Essex, Chittenden County, Vermont

Figure 9: Project Location.

A review of known archaeological sites in the VAI database shows one known VAI archaeological site (VT-CH-0207) within a half kilometer of Bridge No.17A on Vermont Route 289 in Essex. This site is Native American in origin and were discovered during review work for the Circumferential Highway in the 1980s. Although located in a general location to Bridge No. 17A, the site is located well outside any work likely to take place during project construction. Additionally, the bridge (really a small culvert) is located completely within the previously disturbed roadway prism of Vermont Route 289. There are no archaeologically sensitive areas to map as part of this project.

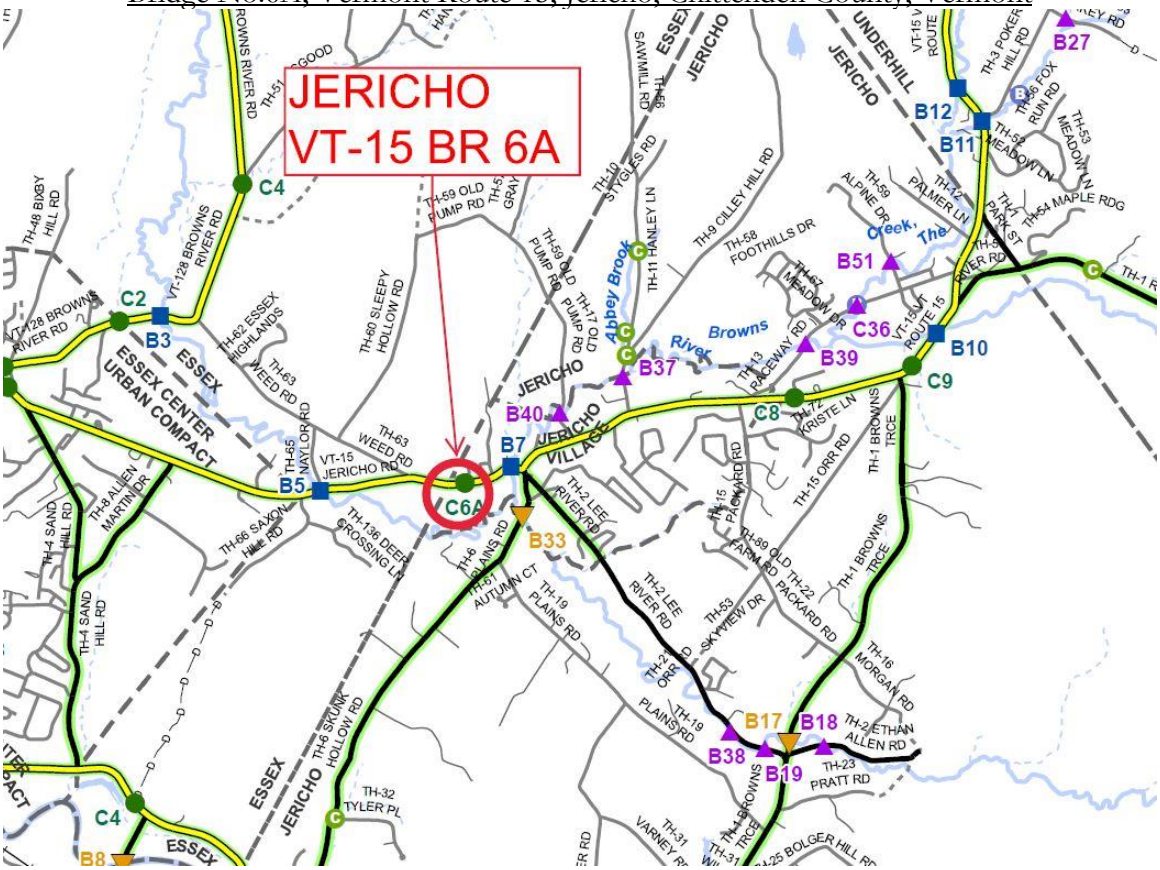


Figure 10: Project Location.

A review of known archaeological sites in the VAI database shows no known archaeological sites within a half kilometer of Bridge No.6A on Vermont Route 15 in Jericho. A site visit conducted in the summer of 2022 was adequate to identify the area to the south as archaeologically sensitive based on its location on an outwash plain above a floodplain of the Winooski River. This area seems as though it could be easily avoided during construction and has been added to the archaeological geodatabase (***Figure 13***) for inclusion in project plans.

Figure 11: Project View.

Figure 12: LiDAR View.

Figure 13: Archaeological Sensitivity.

Appendix I: Historic Memo

Kyle Obenauer
Senior Architectural Historian

Vermont Agency of Transportation

Project Delivery Bureau - Environmental Section
219 N. Main Street
Barre, VT 05641

kyle.obenauer@vermont.gov
(802) 279-7040
www.vtrans.vermont.gov

Re: Statewide STP CULV(90) – Above Ground Resource ID

Date: 05/26/2022

This Resource Identification effort is being undertaken to identify cultural resources within broad preliminary survey areas that could be potentially impacted by future culvert projects at the locations below in Essex and Jericho, Chittenden County, Vermont. Once a project has been defined at the conceptual design phase, VTrans Cultural Resources staff will be able to determine a formal Area of Potential Effect (APE) for purposes of Section 106 and 22 VSA § 14, as well as more conclusively determine potential impacts to protected property types, including Section 4(f) properties.

Culvert locations:

Essex

- Bridge No. 11, Vermont Route 2A
    - Although an early concrete culvert (c. 1930s), this structure does not appear to possess the historic significance necessary for inclusion in the National Register of Historic Places (NRHP). If work is confined to the existing ROW, there will likely be no other buildings, structures, or objects within a project APE.

- Bridge No. 2, Vermont Route 15/Upper Main Street
    - **Historic property - see below**

- Bridge No. 17A, Vermont Route 289
    - This structure is a common CMP from the 1990s that is not historically significant. No other buildings, structures, or objects within a likely APE.

Jericho

- Bridge No. 6A, Vermont Route 15A
    - This structure is also a common CMP that is not historically significant. If work is confined to the existing ROW, there will likely be no other buildings, structures, or objects within a project APE.

Historic Property Identified

Of the four culvert locations above, a potentially NRHP-eligible property within a likely APE was identified at 38 Upper Main Street in Essex, at the northeastern quadrant of Bridge No. 2 (*Figures 1;3*). This vernacular Greek Revival-style two story eaves front brick house is listed in the Vermont State Register of Historic Places (Survey 0405-123; listed 1980; *Figure 2*). Although it's fenestration has been altered and associated outbuildings modified and/or removed, the NRHP-eligibility of the former Abbott House should be considered further since this building and the former Lang Farmhouse directly across the road (to the south) are two increasingly rare examples of mid-19th century brick architecture on the fringes of Essex.

The building at 38 Upper Main Street in Essex should also be considered a Section 4(f) property type.

Impacts to the former Abbott House at 38 Upper Main Street will most likely be avoided if work associated with replacing Bridge No. 2 is confined to the existing right of way.

Please, let me know if there are any questions.

Images and Illustrations

Figure 1. 38 Upper Main Street at northeastern corner of Bridge No. 2 in Essex.

Figure 2. 38 Upper Main Street, photographed in 1980s.

Figure 3. 38 Upper Main Street at northeastern quadrant showing adjacent parcel boundaries, with Bridge No. 2 at arrow.

Figure 4. Bridge No. 11, Essex

Figure 5. Bridge No. 17A, Essex

Figure 6. Bridge No. 6A, Jericho

Appendix J: Environmental Specialist resource ID

VERMONT

State of Vermont
Highways-PDB-Environmental
219 N. Main Street
www.aot.state.vt.us

Agency of Transportation

Date: September 12, 2022
Project: **Statewide – Northwest STP CULV(90)**

6(f) Properties:
There aren't any 6(f) Properties within the project area.

Hazardous Waste:
There aren't any Hazardous Wastes Sites identified within the project area.

Contaminated Soils:
There aren't any Contaminated Soils within the project area.

Contaminated Soils/ Urban Background Soils general language
-Sections of the proposed project are located within Urban Background Soils areas as mapped on the ANR Atlas. Proposed project limits will determine if impacts are anticipated, and if coordination with the Hazard Waste Coordinator is required. Disturbed soils within this project should be expected to be kept on site, or follow Notice to bidders guidance.

Wild Scenic Rivers:
There aren't any designated Wild Scenic Rivers within the project area.

Act 250 Permits:
There are adjacent parcels that have Act 250 Permits and may need to be amended if impacted.

FEMA Floodplains:
There are FEMA Floodplains mapped within the project area and a Flood Hazard Area/ River Corridor Permit may be required if there are impacts.

River Corridor:
There are River Corridors mapped within the project area and a Flood Hazard Area/ River Corridor Permit may be required if there are impacts.

Protected Lands:
There aren't any Protected Lands within the project area.

US Coast Guard:
There aren't any US Coast Guard navigable waterways within the project area.

Lakes and Ponds:
There aren't any lakes or ponds within the project area.

Scenic Highway/ Byway:
There aren't any Scenic Highway/ Byways within the project area.

Environmental Justice:
There are no EJ populations present within the study area, therefore there is no potential to have a disproportionately high and adverse effect.

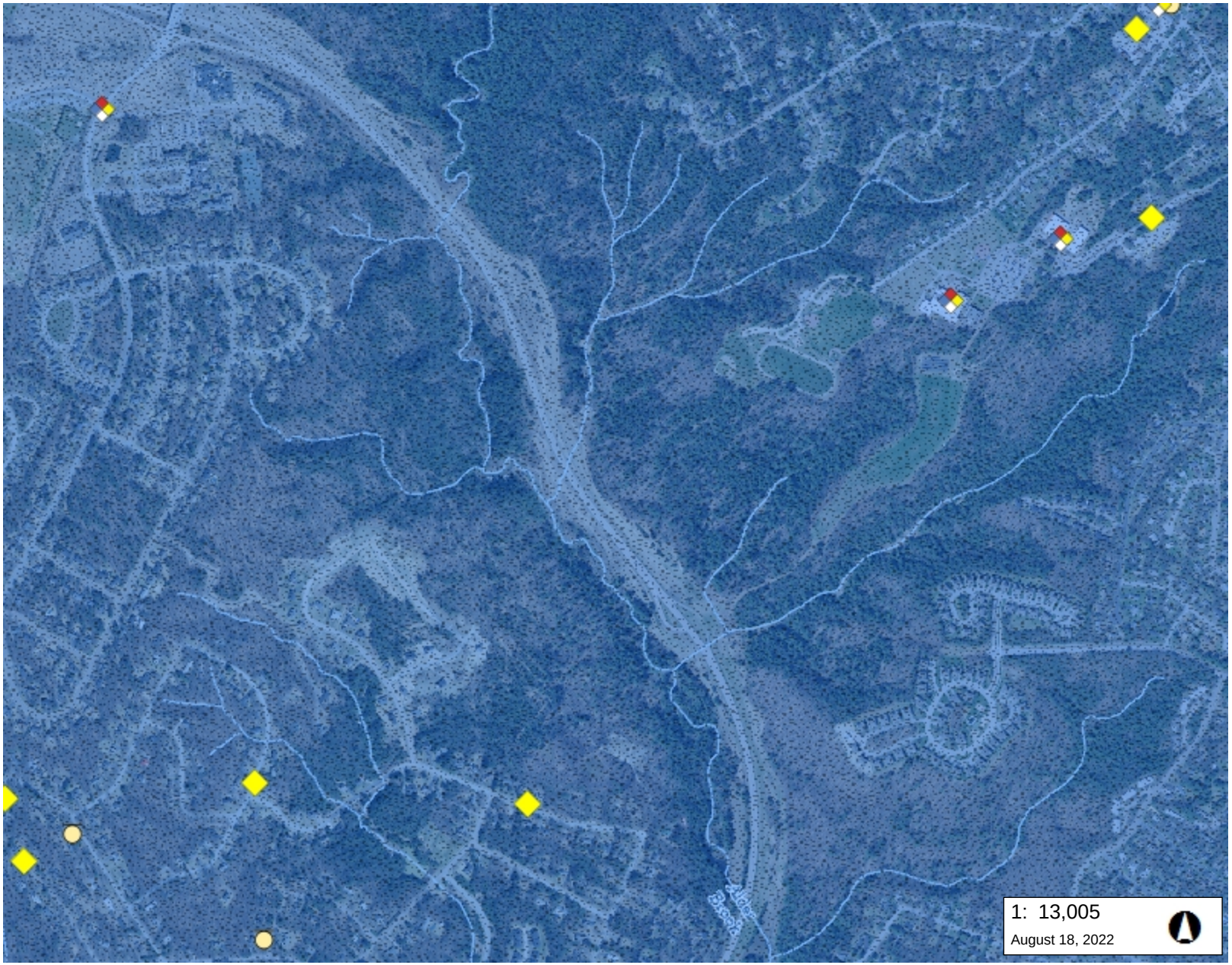
Other:
There aren't any other resources within the project area.

Appendix K: Hazardous Sites Map

Natural Resources Atlas

Vermont Agency of Natural Resources

vermont.gov



LEGEND

- Landfills
  - OPERATING
  - CLOSED
- Land Use Restrictions
  - Class IV GW Reclass
  - Class VI GW Reclass
  - Deed Restriction
  - Easement
  - Land Record Notice
  - Other
- Hazardous Site
- Hazardous Waste Generators
- Brownfields
- Salvage Yard
- Aboveground Storage Tank
- Underground Storage Tank (w
- Dry Cleaner
- Urban Soil Background Areas
- Protected Lands
  - Private Organizations
  - Vermont Municipalities
  - State
  - Federal
- Stream/River
  - Stream
  - Intermittent Stream

NOTES

Map created using ANR's Natural Resources Atlas

661.0 0 330.00 661.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 1084 Ft. 1cm = 130 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

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

Appendix L: Stormwater Resource ID

VERMONT

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

Agency of Transportation

[phone] 802-498-5787

To: Julie Ann Held, VTrans Environmental Specialist
From: Heather Voisin, VTrans Green Infrastructure Engineer
Date: August 18, 2022
Subject: Statewide – Northwest STP CULV(90) - Stormwater Resource ID Review

Project Description: I have reviewed the project area for Statewide – Northwest STP CULV(90) for stormwater related regulatory and water quality concerns. The project will involve repair or replacement to 4 different culverts in locations as follows:

- Essex VT-15 Br2
- Essex VT-2A Br 11
- Essex VT-289 Br 17
- Jericho VT-15 Br 6
-

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
Depending on how much impervious surface area is associated with repairing these culverts, an Operational Stormwater may be required, and, if any of the project work areas require greater than 1 acre of earth disturbance, the culverts would need to follow the GAP procedure considering opportunities for post-construction stormwater treatment.

For the Essex VT Route 15 culvert, several of the adjacent properties have existing operational stormwater permits, however it is not anticipated that repair or replacement of the culverts would impact those permits. This culvert conveys Indian Brook and is located within the Indian Brook watershed, which is considered impaired due to stormwater-related issues and is listed on EPA's 303(d) list. This designation is unlikely to affect the culvert projects, but it does elevate the need for a design that is sensitive to this context, as noted in the design considerations below.

The Essex VT Route 2A culvert carries an unnamed tributary of Indian Brook under the roadway and is located just outside of the stormwater-impaired portion of the Indian Brook watershed.

The culvert under VT Route 289 in Essex conveys an unnamed tributary of Alder Brook and is not located within a stormwater-impaired watershed. This location is within the limits of the historical stormwater permit that was obtained for VT Route 289. That permit is no longer in existence; however, the treatment features remain, including a grass swale running along the eastern side of the road at the culvert location.

For the Jericho culvert on VT Route 15, there do not appear to be any existing stormwater permits immediately adjacent to the project site and there are no noteworthy stormwater regulatory concerns at this time.

Design Considerations
It is strongly encouraged that drainage work associated with this project, particularly around any ditching and culvert work, be aligned with the VTrans Phosphorus Control Highway Drainage Management Standards, as this may allow future credit toward achieving phosphorus reduction goals required by the Agency's TS4 permit.

VERMONT

Appendix M: Landscape Clearance Resource ID

State of Vermont | Agency of Transportation
Environmental Section
219 North Main
Barre, VT 05641
Vtrans.vermont.gov

To: Project File
From: Bonnie Kirn Donahue, *VTrans Landscape Architect*
Date: July 21, 2022
Project: **STATEWIDE – NORTHWEST IM CULV(90) 22B044**
Subject: Landscape (LA) Clearance for Resource ID

SUMMARY

I have reviewed the locations for **STATEWIDE – NORTHWEST IM CULV(90) 22B044** dated 4/18/2022, and have determined that there are potentially minor riparian buffer impacts occurring as a result of the proposed work:

- This project includes 4 culverts:
  - Essex VT-2A Br 11
  - Essex VT-15 Br 2
  - Essex VT-289 Br 17-A
  - Jericho VT-15 Br 6A

DESCRIPTION OF IMPACT

The repair or replacement of culverts may require construction impacts to the riparian buffer and/or tree clearing.

Riparian Buffer:

Riparian and wetland buffers serve an important purpose for the health of Vermont's water quality and wildlife. They prevent erosion on steep embankments, provide shade, food sources and woody debris for healthy aquatic habitat, and provide wildlife corridors along wetlands and streams. With a vegetated riparian buffer, sediment and pollutants like phosphorus are prevented from entering water bodies, keeping our rivers, ponds and lakes clear from algae and cool for fish and other aquatic species to thrive. Revegetating areas where riparian and wetland buffers are impacted establishes a connection between the newly completed project with the existing conditions. Selecting native plants that complement the character of the area will make projects more visually appealing and merge the transportation asset with its surroundings.

Using native trees and shrubs in addition to a seed mix speeds up natural succession, establishing an effective riparian buffer more quickly than using seed alone. Selecting plants that have already started to grow will also have a better chance of establishing before invasive plants have a chance to fill in.

Tree Clearing

Trees and forests play a critical role in maintaining a healthy planet. Trees convert carbon dioxide to oxygen, filtering pollutants from the air and providing clean air to breathe. Roots and leaves work together to prevent soil erosion and control movement of sediment. Roots hold soil in place and soak up water, while leaves catch and slow down rainwater. Providing shade and performing evapotranspiration, trees also cool air and surface temperatures. Additionally, trees provide habitat, food and shelter for countless species, including insects, birds, and mammals.

Clearing of trees and forested areas can result in a loss of these benefits. Minimizing tree clearing, and replanting after construction are excellent ways to maintaining these benefits and support a healthy ecosystem.

RECOMMENDATIONS

1. I recommend re-vegetating the area with native trees and shrubs for river buffers, willow fascines or live stakes (depending on soil conditions at the waters' edge) and a diverse pollinator seed mix.
    a. See the *2022 VTrans Riparian Planting Toolkit* for design guidelines and species (link).

NOTES

1. I would be glad to assist with a plant list and plan (bonnie.donahue@vermont.gov).

Appendix N: Local Input

Project Summary

This project, PROJ #, focuses on Bridge 17-A on Route 289 in Essex, 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.

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

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.

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?

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?

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

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

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

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

Schools

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

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

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

Pedestrians and Bicyclists

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

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

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

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

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).

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?

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?

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

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

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

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

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

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

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

Land Use & Zoning

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

2. Are there any existing, pending or planned development proposal that would impact future transportation patterns near the culvert? If so, please explain.
    a. No current development projects are expected to directly impact this culvert, though there is a proposal for additional residential development nearby which will require stormwater treatment overflowing just downstream of the culvert. Plans are currently under review; contact Town Planner Darren Schibler (dschibler@essex.org, 802-878-1343) for details.
    b. In addition, the culvert is used as a crossing point for wildlife (as well as informally by people). Community members have expressed a desire to have pedestrian / bicycle connection at or near this point to enable connectivity between two major parts of Essex, particularly to allow students to get to Essex Middle School / Founders Memorial School more easily. Please consider accommodating this in the culvert's design.

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.
    a. No public transit currently uses this route, nor is it likely to in the foreseeable future.

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.
    a. Essex Reporter
    b. Essex ReTorter
    c. Town Meeting TV
    d. Front Porch Forum
    e. Town of Essex Facebook page (contact Tammy Getchell, tgetchell@essex.org, (802) 876-5773)
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?

Appendix O: Operations Input

Bridge Scoping Project PROJ#(##)
Operations Input Questionnaire

The Structures Section has begun the scoping process for PROJ#(##), ROUTE ##, Bridge ##, over the FEATURE. This is a BRIDGE TYPE bridge constructed in YEAR. The Structure Inspection, Inventory, and Appraisal Sheet (attached) rates the deck as # (RATING), the superstructure as # (RATING), and the substructure as # (RATING). 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 road overt 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?

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?

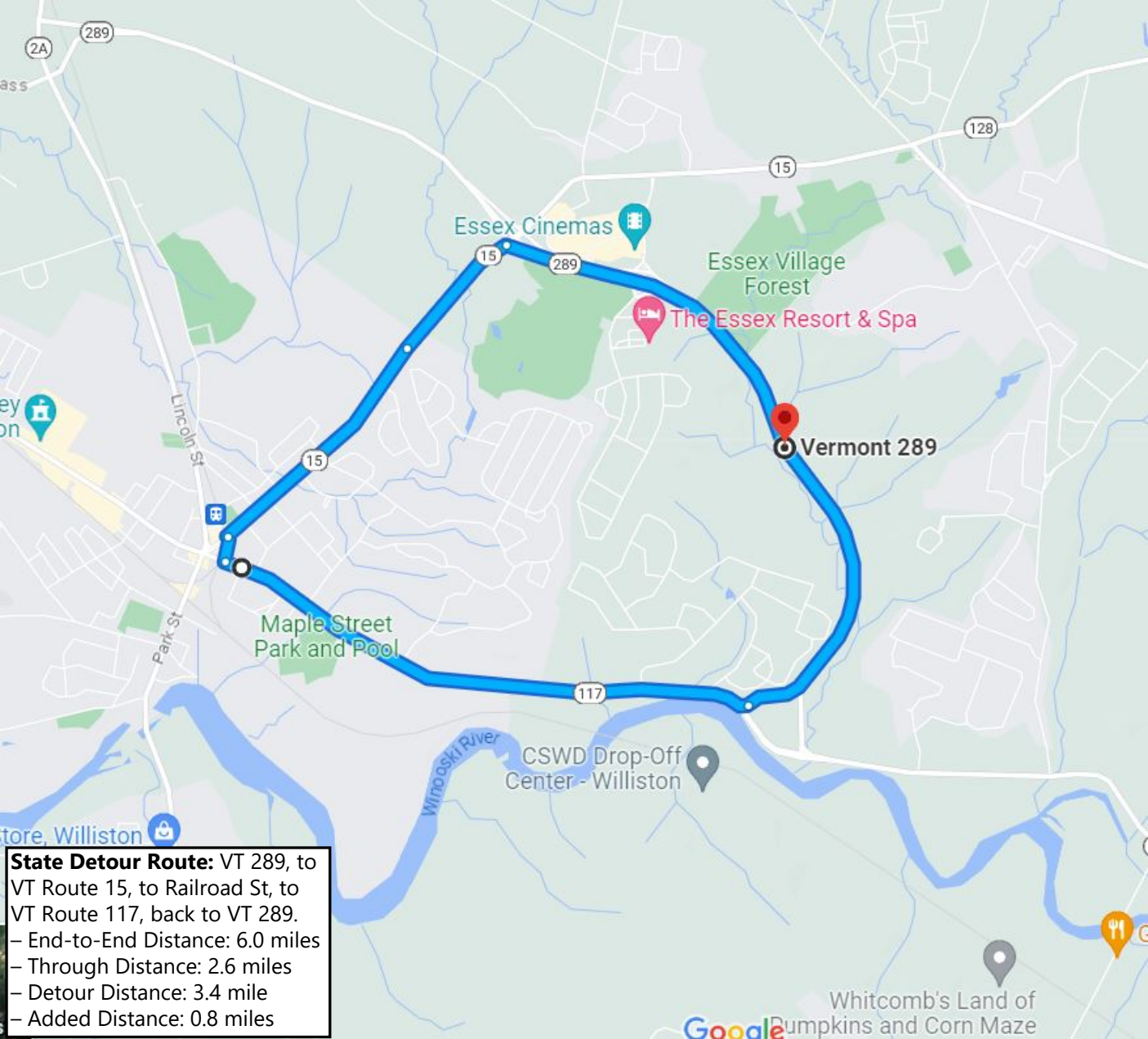
12. Please describe any larger projects that you have completed that may not be reflected on the attached Appraisal sheet, such as deck patches, paving patches, railing replacement with new type, steel coating, etc.

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

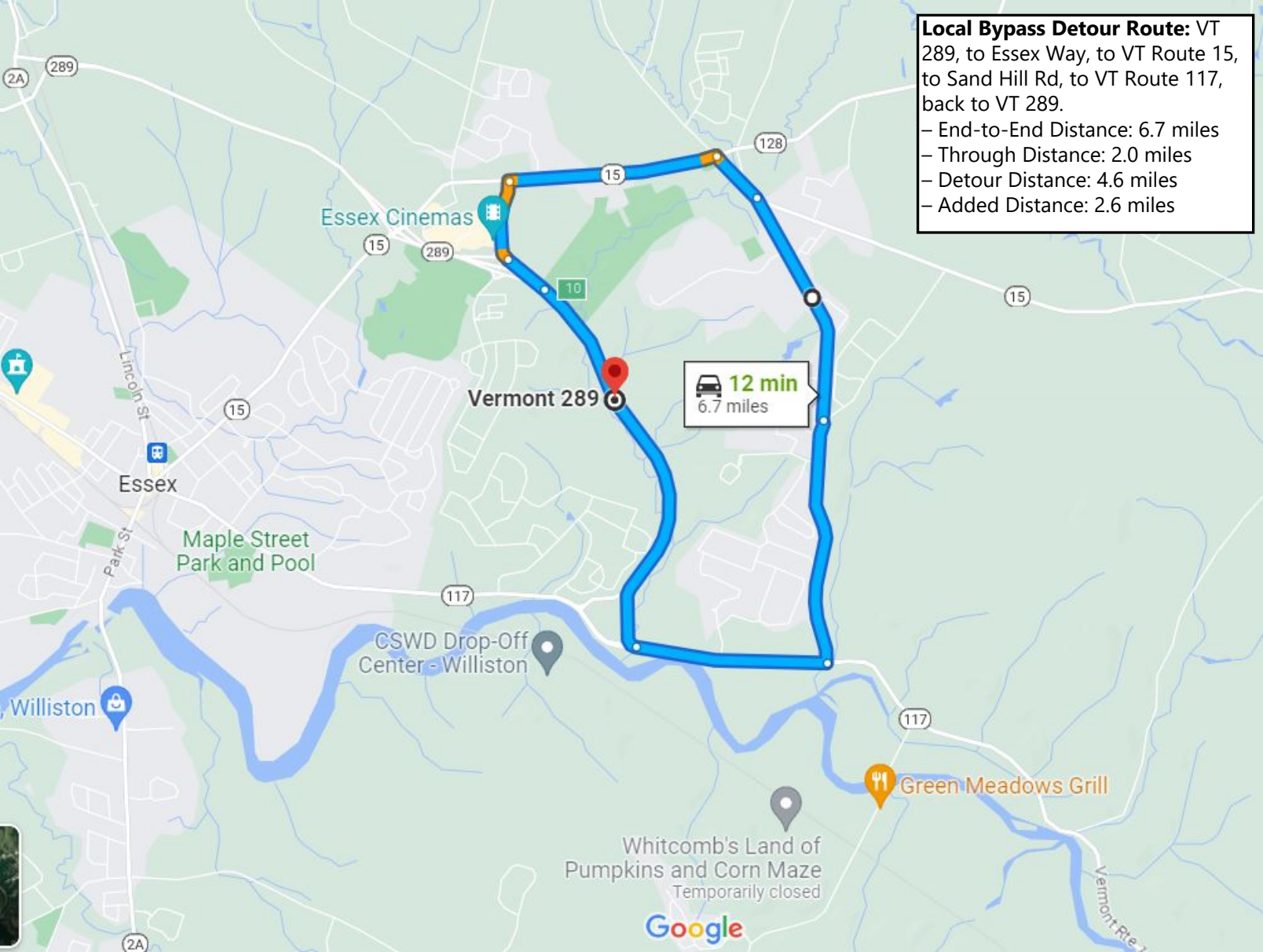
14. Are you aware of any complaints that the public has about issues that we can address on this project?

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

Appendix P: Detour Maps



State Detour Route: VT 289, to VT Route 15, to Railroad St, to VT Route 117, back to VT 289.
– End-to-End Distance: 6.0 miles
– Through Distance: 2.6 miles
– Detour Distance: 3.4 mile
– Added Distance: 0.8 miles


Local Bypass Detour Route: VT 289, to Essex Way, to VT Route 15, to Sand Hill Rd, to VT Route 117, back to VT 289.
– End-to-End Distance: 6.7 miles
– Through Distance: 2.0 miles
– Detour Distance: 4.6 miles
– Added Distance: 2.6 miles
Essex Cinemas
Vermont 289
12 min
6.7 miles
Essex
Maple Street Park and Pool
CSWD Drop-Off Center - Williston
Williston
Green Meadows Grill
Whitcomb's Land of Pumpkins and Corn Maze
Temporarily closed
Google

Appendix Q: Plans

VT STATE PLANE GRID

N

BENCHMARK
NORTHERN TOP OF
BOUNDRY MARKER
ELEV. =369.48

APPROX. EXISTING STATE R.O.W.

N/F
ALLEN BROOK DEVELOPMENT, INC.

Permanent Channel Rights Acquired By Condemnation Order of State Transportation Board Essex Land Records Book 251 Page 78

TIE
DIST=17.61
TIE

HVCTRL
100

BOUNDRY
MARKER

WOVEN WIRE FENCE

STA 570+93.00=
CHAN 53+81.66
Δ=53°06'00" RT

UNDERGROUND GAS LINE

SIGN
DIST=84.52
S23°41'01.32"W

84" CCMP
FLOW

VT ROUTE 289
573+00 VT ROUTE 117

HVCTRL
101

WOVEN WIRE FENCE

HVCTRL
102

51+00
52+00
53+00
54+00
55+00
56+00
571+00
572+00
570+00
569+00

PI 570+72.99

CURVE (x)
DELTA = 19°57'29"
D = 02°24'12"
R = 2384.00'
T = 419.46'
L = 830.42'
e = 36.62'

SIGN
DIST=13.40
DIST=28.25
SIGN
R4-1

18" CMP
FLOW

ALDER BROOK
FLOW

EXISTING BRIDGE INFORMATION
84" X 565' CCMPP
BUILT 1993
50' AVERAGE COVER
38 SQFT WATERWAY AREA

VT ROUTE 289
TO VT ROUTE 15

Permanent Channel Rights Acquired By Condemnation Order of State Transportation Board Essex Land Records Book 251 Page 78

EXISTING CH(P)

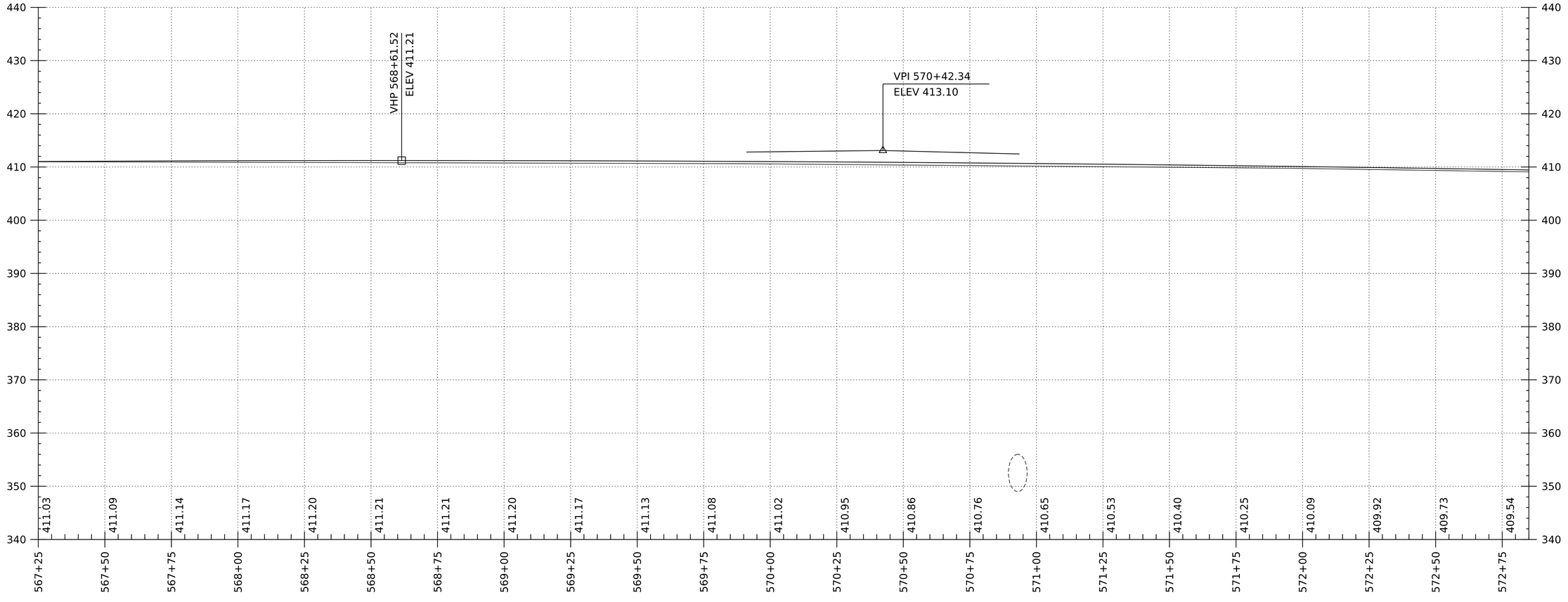
APPROX. EXISTING STATE R.O.W.

N/F
PINEWOOD MANOR, INC.

EXISTING CONDITIONS

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_BDR_ExistingCond.dgn	PLOT DATE: 20-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
EXISTING CONDITIONS LAYOUT	SHEET 1 OF 33



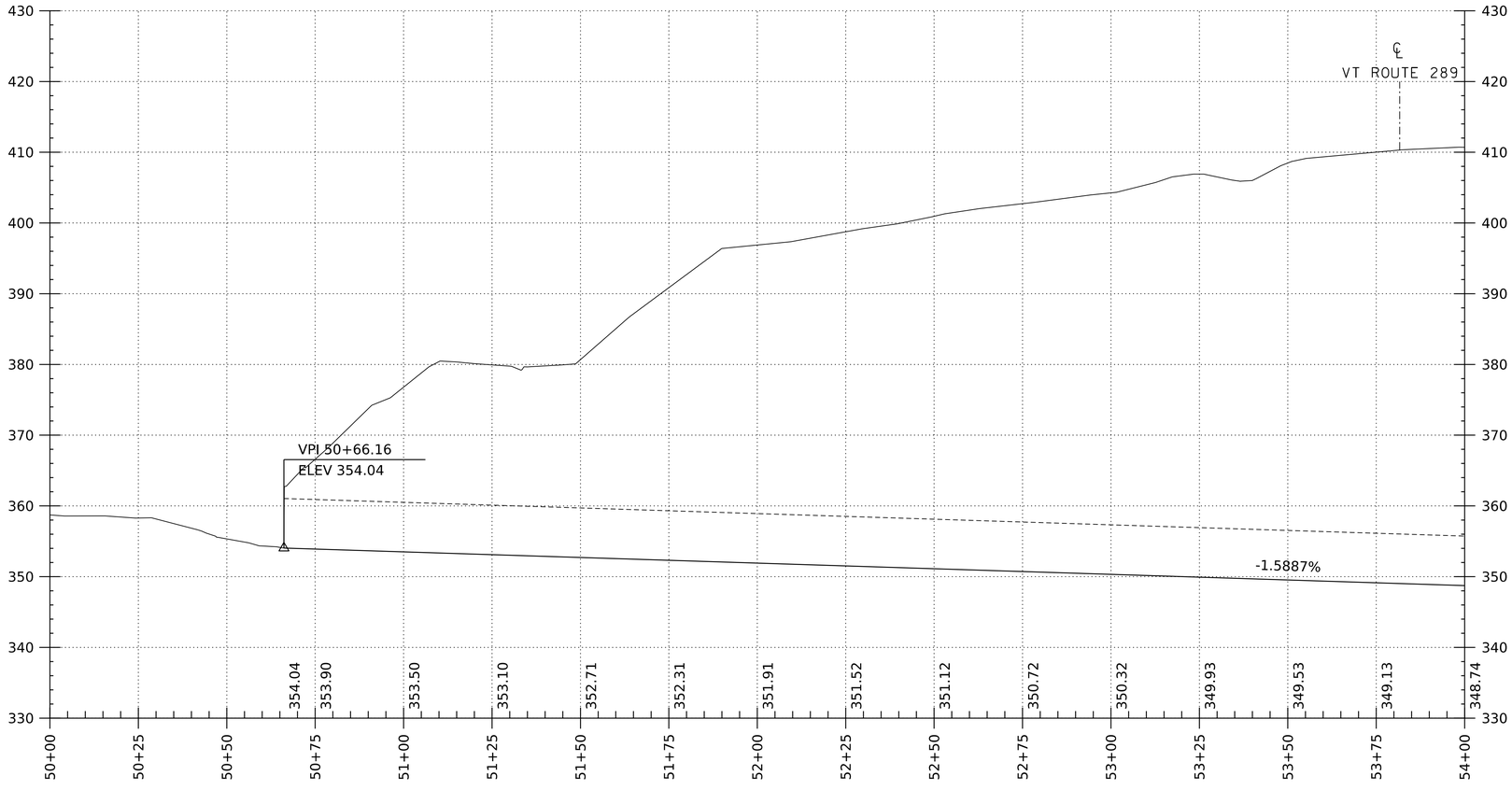
VT ROUTE 289 PROFILE

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: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_prof.dgn PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE DRAWN BY: D.D.BEARD
DESIGNED BY: ------ CHECKED BY: ------
EXISTING MAINLINE PROFILE SHEET SHEET 2 OF 33

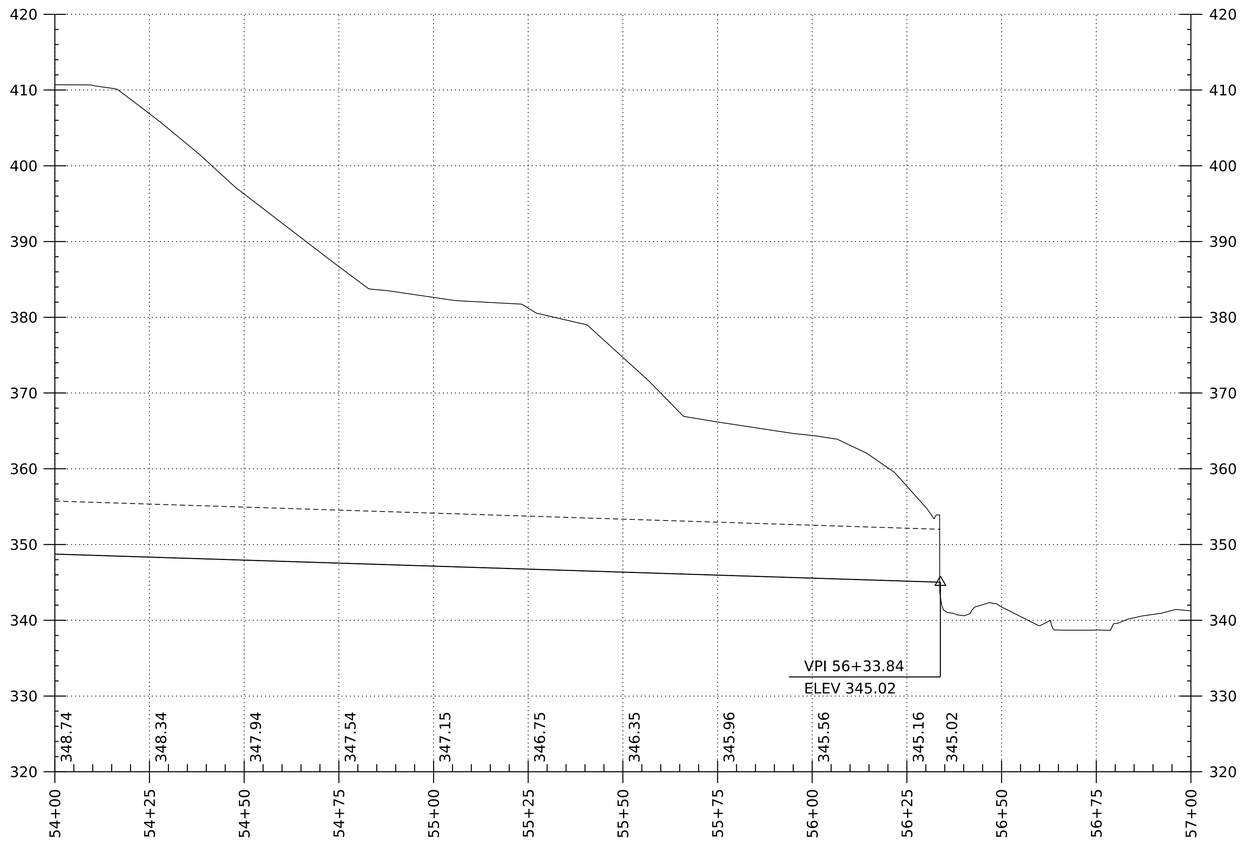


CHANNEL PROFILE

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

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

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_pro01e.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
EXISTING CHANNEL PROFILE SHEET 1	SHEET 3 OF 33

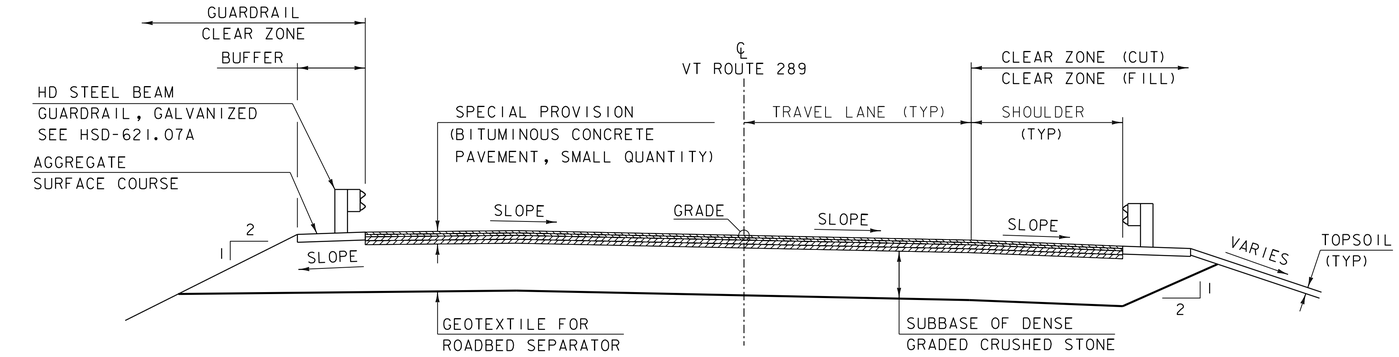


CHANNEL PROFILE

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

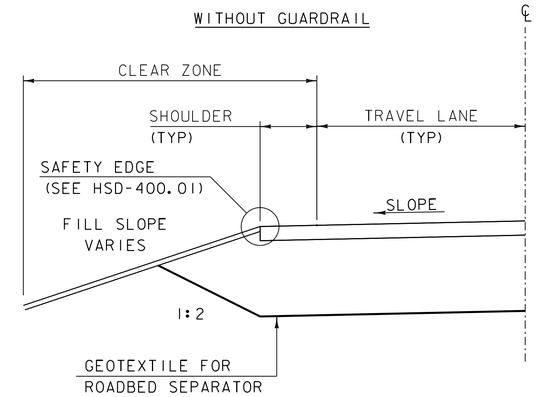
NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_profile.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
EXISTING CHANNEL PROFILE SHEET 2	SHEET 4 OF 33



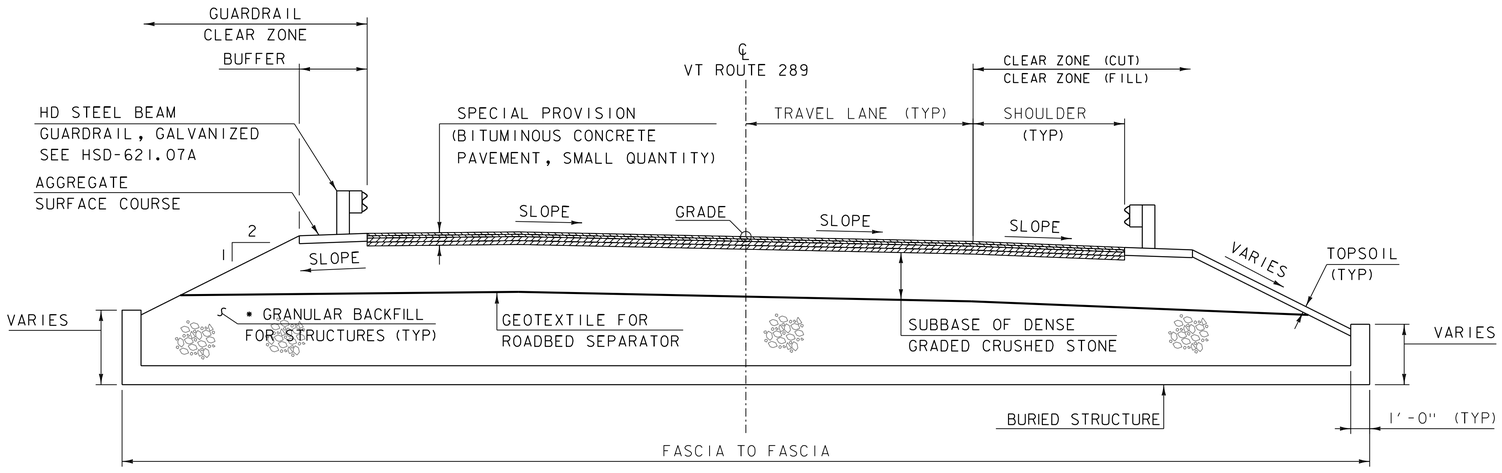
VT ROUTE 289 TYPICAL SECTION

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



ROADWAY TYPICAL SECTION

NOT TO SCALE



VT ROUTE 289 BURIED STRUCTURE TYPICAL SECTION

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

ROAD TYPICAL INFORMATION

	LEFT		RIGHT	
	WIDTH	SLOPE	WIDTH	SLOPE
TRAVEL LANE	12'-0"	VARIES	12'-0"	VARIES
SHOULDER	8'-0"	VARIES	8'-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.

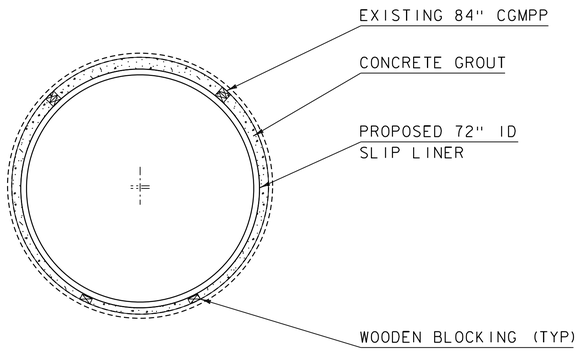
MATERIAL TOLERANCES

(IF USED ON PROJECT)

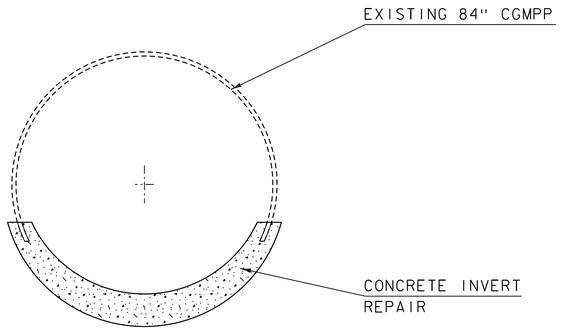
SURFACE	
- PAVEMENT (TOTAL THICKNESS)	+/- 1/4"
- AGGREGATE SURFACE COURSE	+/- 1/2"
SUBBASE	+/- 1"
SAND BORROW	+/- 1"

PROJECT NAME: STATEWIDE - SOUTHWEST
PROJECT NUMBER: STP CULV(90)

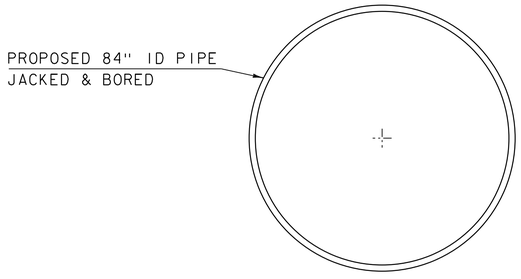
FILE NAME: 22b044/Essex VT 289 Br 17-A typ02.dgn
PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE
DRAWN BY: D.D.BEARD
DESIGNED BY: ------
CHECKED BY: ------
ROADWAY TYPICAL SECTION
SHEET 5 OF 33



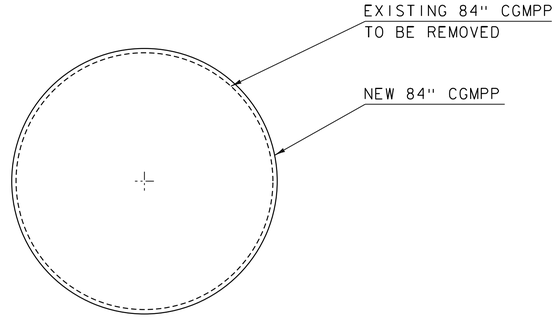
SLIP LINER TYPICAL SECTION



INVERT REPAIR TYPICAL SECTION



TRENCHLESS REPLACEMENT TYPICAL SECTION



CULVERT REPLACEMENT TYPICAL SECTION

MATERIAL INFORMATION

	THICKNESS	TYPE
STONE FILL	2'-0"	TYPE II
STONE FILL, CULVERT LINING	2'-0"	E-STONE TYPE II
STONE FILL, STREAM BED MATERIAL	2'-0"	E-STONE TYPE II

PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: 22b044/Essex VT 289 BR 17-A typical.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ----------
CULVERT TYPICAL SECTIONS

PLOT DATE: 10-APR-2023
DRAWN BY: D.D.BEARD
CHECKED BY: ----------
SHEET 6 OF 33

VT STATE PLANE GRID

N

BENCHMARK
NORTHERN TOP OF
BOUNDRY MARKER
ELEV. = 369.48

APPROX. EXISTING STATE R.O.W.

WOVEN WIRE FENCE

HVCTRL
100

BOUNDRY
MARKER

STA 570+93.00=
CHAN 53+81.66
Δ=53°06'00" RT

UNDERGROUND GAS LINE

SIGN
R4-1

S23°41'01.32"W
84" CGMP
FLOW

51+00 52+00 53+00 54+00 55+00 56+00

571+00

572+00

573+00

VT ROUTE 289
TO VT ROUTE 117

HVCTRL
101

HVCTRL
102

WOVEN WIRE FENCE

570+00

569+00

VT ROUTE 289
TO VT ROUTE 15

PI 570+72.99

SIGN
R4-1

18" CGMP
FLOW

CURVE (x)
DELTA = 19°57'29"
D = 02°24'12"
R = 2384.00'
T = 419.46'
L = 830.42'
e = 36.62'

WOVEN WIRE FENCE

ALDER BROOK
FLOW

WOVEN WIRE FENCE

APPROX. EXISTING STATE R.O.W.

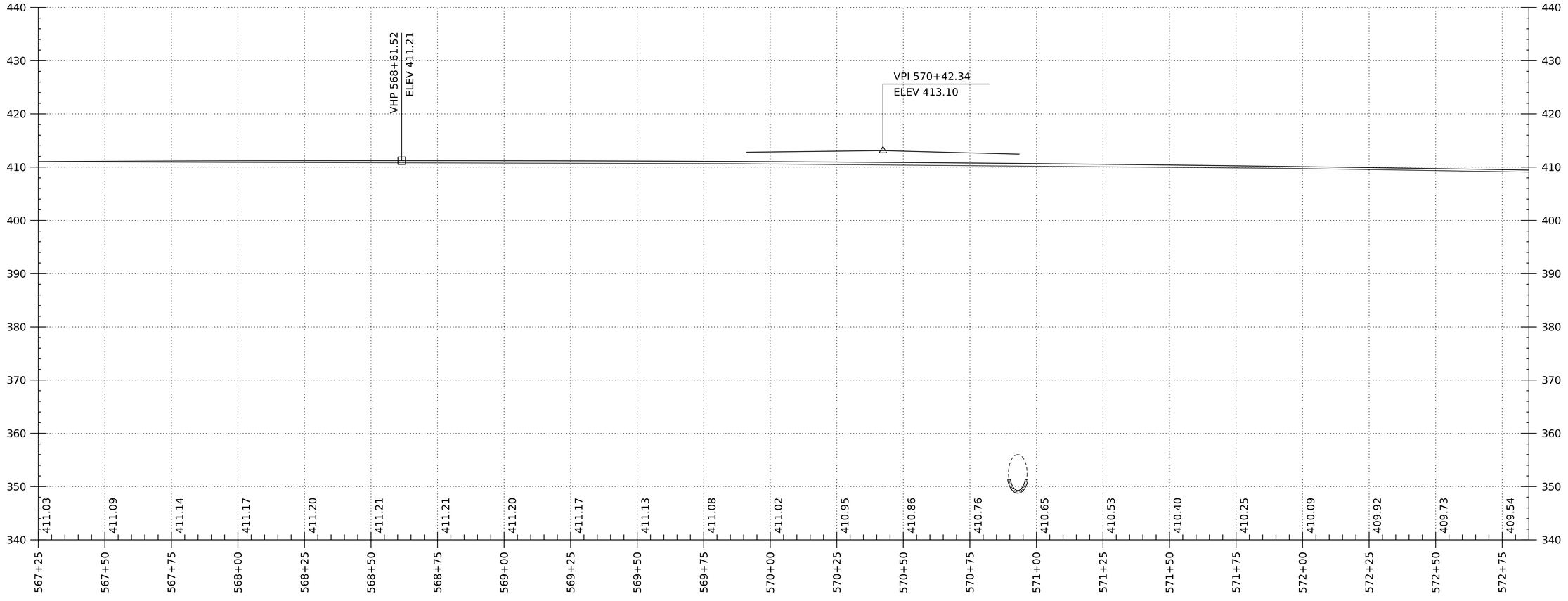
EXISTING BRIDGE INFORMATION
84" X 565' CGMPP
BUILT 1993
50' AVERAGE COVER
38 SQFT WATERWAY AREA

INVERT REPAIR

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_BDR.dwg PLOT DATE: 04 APR 2023
PROJECT LEADER: L.J.STONE DRAWN BY: D.D.BEARD
DESIGNED BY: ------ CHECKED BY: ------
INVERT REPAIR LAYOUT SHEET 7 OF 33

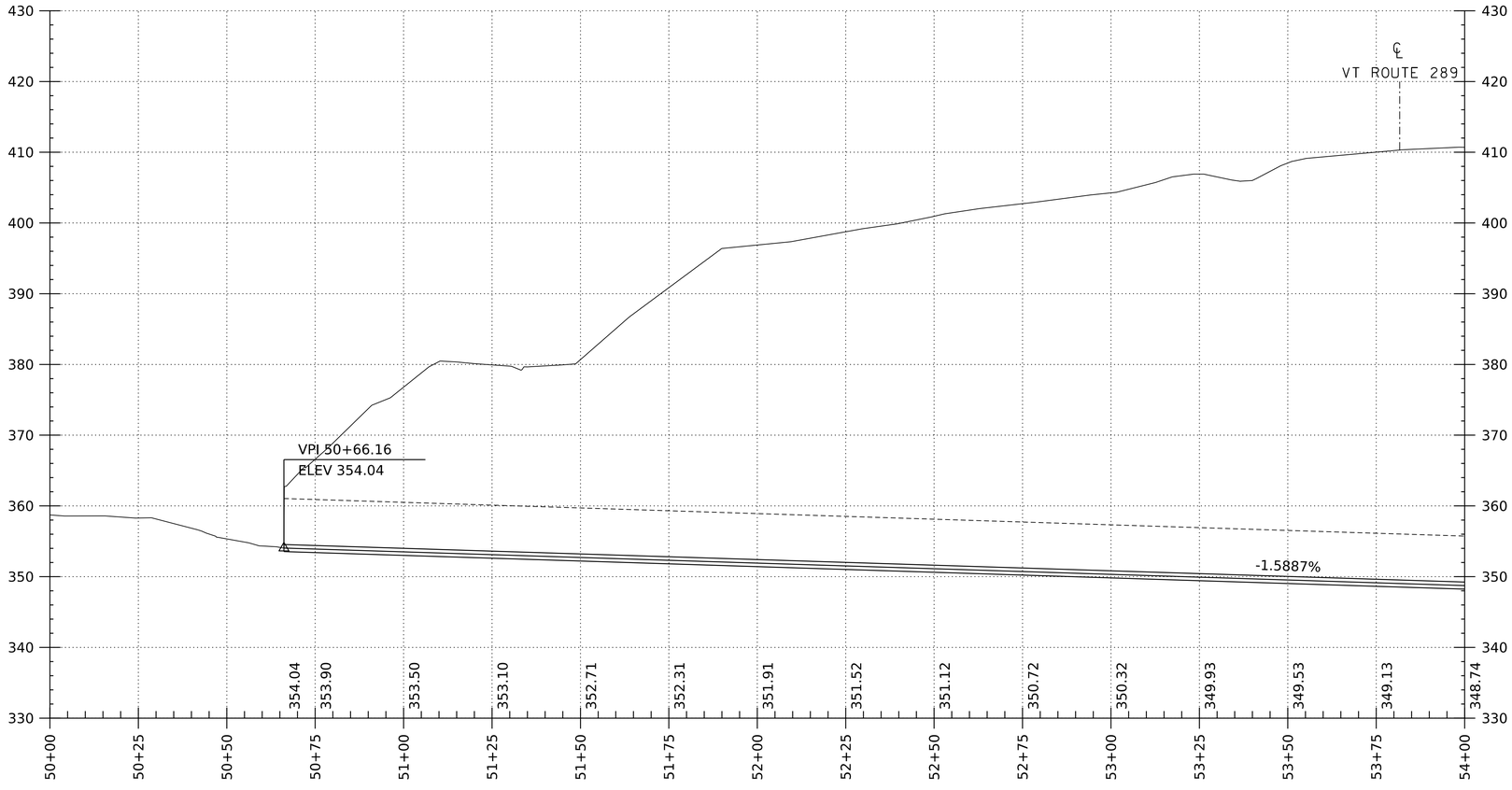


VT ROUTE 289 INVERT REPAIR PROFILE

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:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_profile.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
INVERT REPAIR MAINLINE PROFILE SHEET	SHEET 8 OF 33

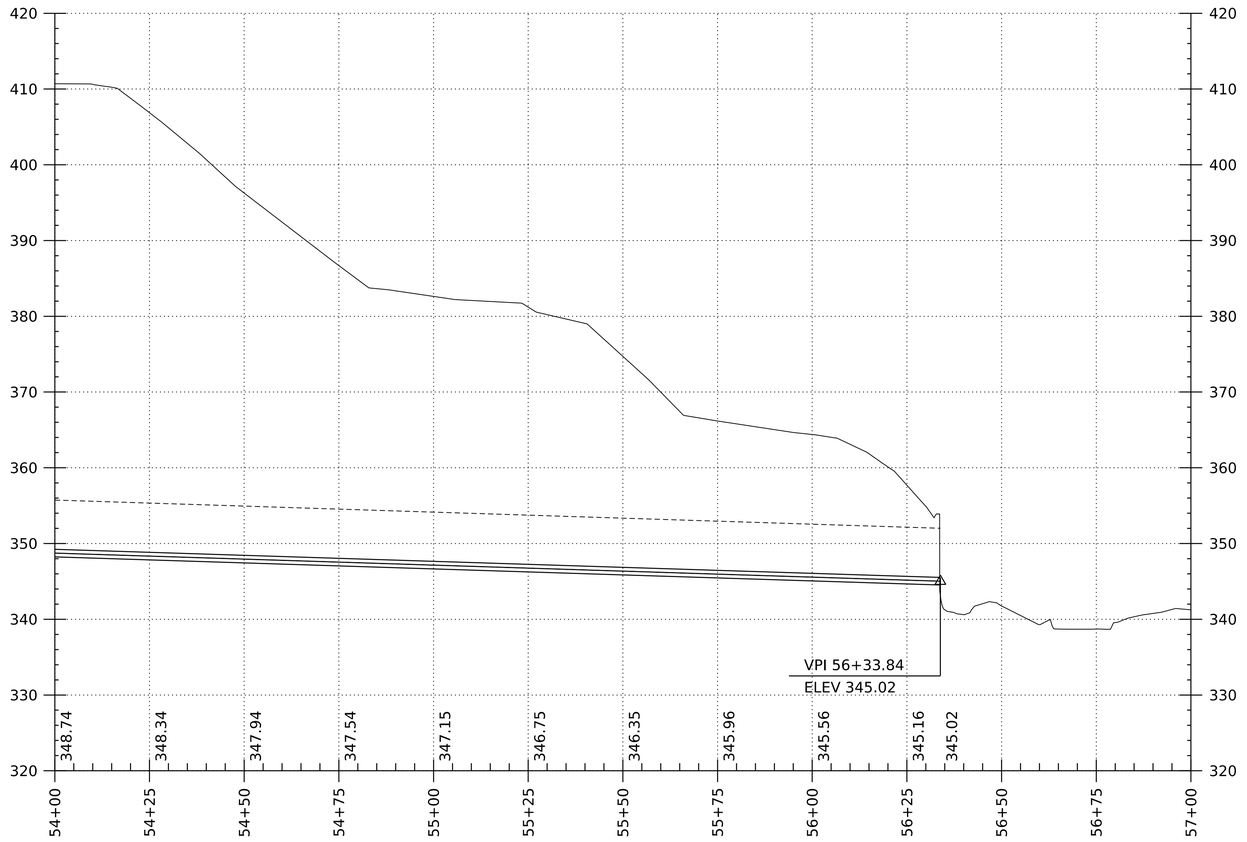


INVERT REPAIR CHANNEL PROFILE

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

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

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_prof1e.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
INVERT REPAIR CHANNEL PROFILE SHEET 1	SHEET 9 OF 33



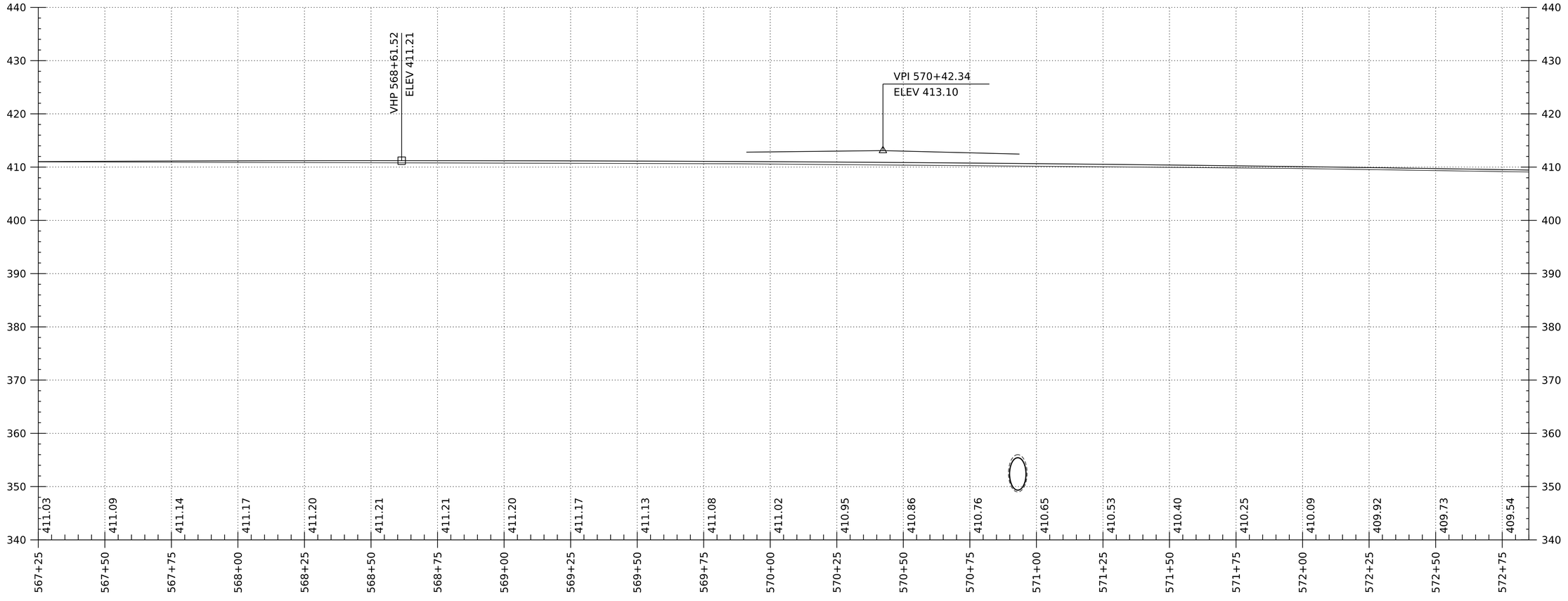
INVERT REPAIR CHANNEL PROFILE

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

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

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_profile.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
INVERT REPAIR CHANNEL PROFILE SHEET 2	SHEET 10 OF 33


VT STATE PLANE GRID
N
BENCHMARK
NORTHERN TOP OF
BOUNDRY MARKER
ELEV.=369.48
APPROX. EXISTING STATE R.O.W.
HVCTRL
100
BOUNDRY
MARKER
WOVEN WIRE
FENCE
UNDERGROUND
GAS LINE
STA 570+93.00=
CHAN 53+81.66
Δ=53°06'00" RT
SIGN
R4-1
S23°41'01.32"W
84" CGMP
FLOW
51+00
52+00
53+00
54+00
55+00
56+00
VT ROUTE 289
TO VT ROUTE 117
573+00
572+00
571+00
570+00
569+00
HVCTRL
101
HVCTRL
102
WOVEN WIRE
FENCE
PI 570+72.99
CURVE (x)
DELTA = 19°57'29"
D = 02°24'12"
R = 2384.00'
T = 419.46'
L = 830.42'
e = 36.62'
SIGN
R4-1
18" CGMP
FLOW
ALDER BROOK
FLOW
WOVEN WIRE
FENCE
APPROX. EXISTING STATE R.O.W.
VT ROUTE 289
TO VT ROUTE 15
EXISTING BRIDGE INFORMATION
84" X 565' CGMPP
BUILT 1993
50' AVERAGE COVER
38 SQFT WATERWAY AREA
SLIP LINER
SCALE 1" = 20'-0"
20 0 20
PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_BDR_Slip Liner.dgn
PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE
DRAWN BY: D.D.BEARD
DESIGNED BY: ------
CHECKED BY: ------
SLIP LINER LAYOUT
SHEET 11 OF 33



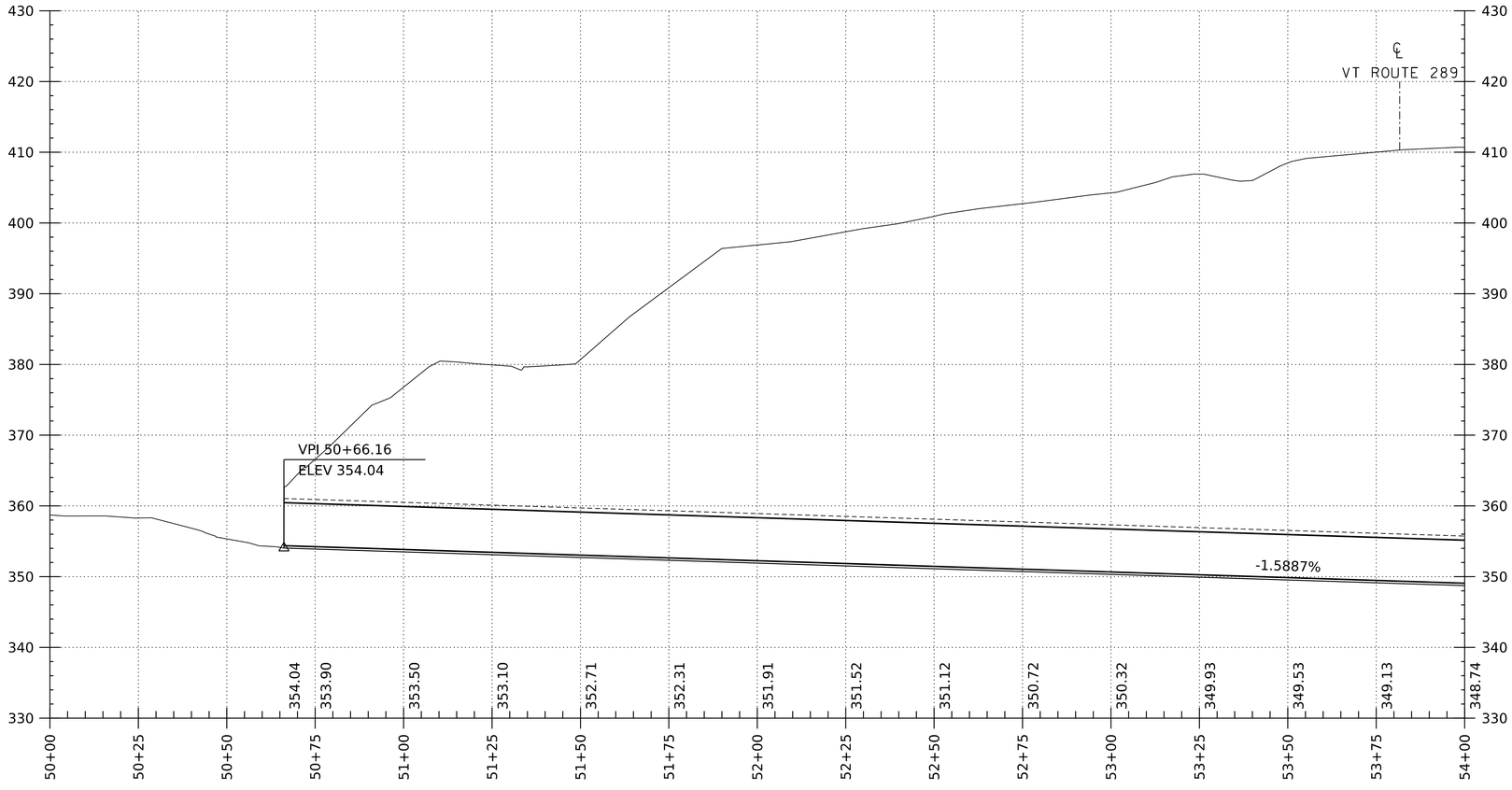
VT ROUTE 289 SLIP LINER PROFILE

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: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_profile.dgn PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE DRAWN BY: D.D.BEARD
DESIGNED BY: ------ CHECKED BY: ------
SLIP LINER PROFILE SHEET SHEET 12 OF 33

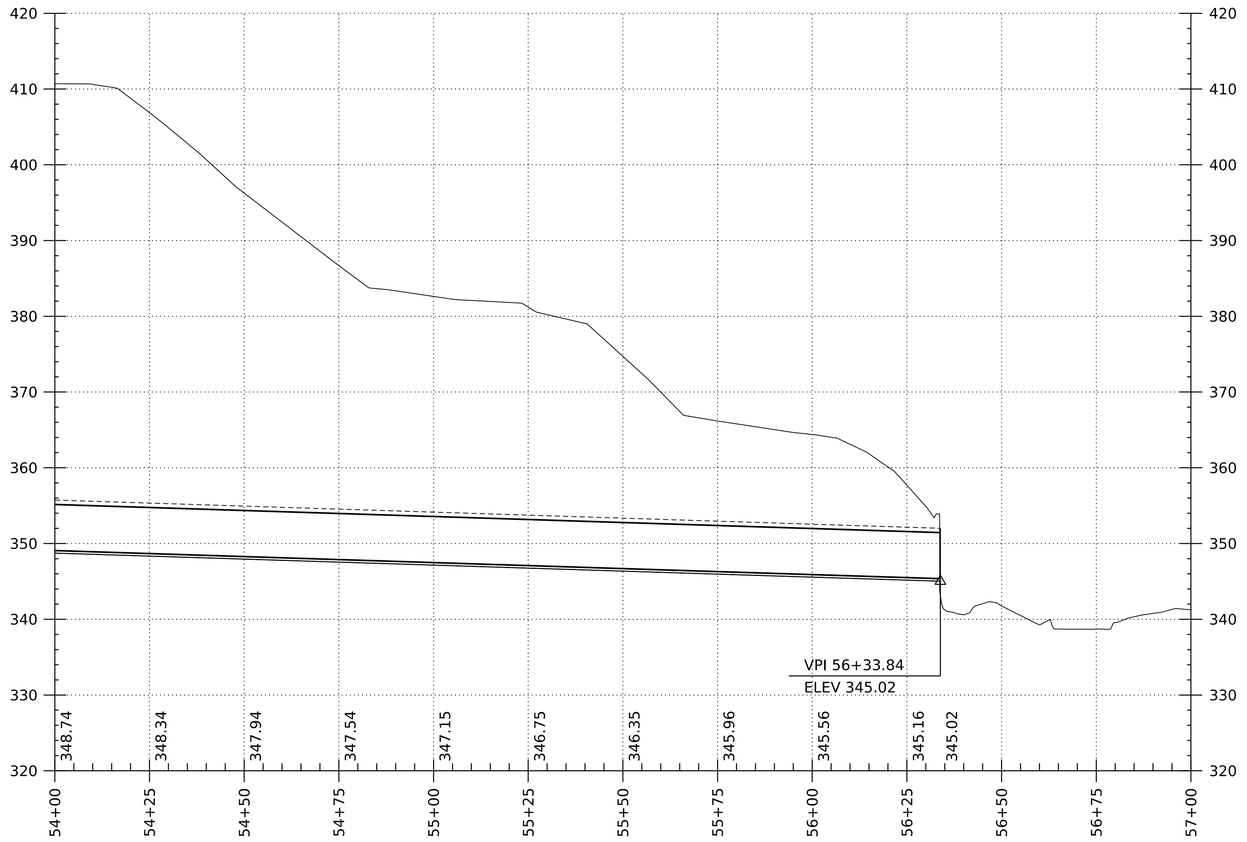


SLIP LINER CHANNEL PROFILE

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

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

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_prof1e.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
SLIP LINER CHANNEL PROFILE SHEET 1	SHEET 13 OF 33



SLIP LINER CHANNEL PROFILE

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

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

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_profile.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
SLIP LINER CHANNEL PROFILE SHEET 2	SHEET 14 OF 33

VT STATE PLANE GRID

N

BENCHMARK
NORTHERN TOP OF
BOUNDRY MARKER
ELEV. = 369.48

APPROX. EXISTING STATE R.O.W.

WOVEN WIRE FENCE

HVCTRL
100

BOUNDRY
MARKER

UNDERGROUND GAS LINE

STA 570+93.00=
CHAN 53+81.66
Δ=53°06'00" RT

SIGN
R4-1

S23°41'01.32"W

84" CGMP
FLOW

VT ROUTE 289
TO VT ROUTE 15

VT ROUTE 289
TO VT ROUTE 117

572+00

573+00

571+00

570+00

569+00

HVCTRL
101

HVCTRL
102

WOVEN WIRE FENCE

51+00

52+00

53+00

54+00

55+00

56+00

PI 570+72.99

CURVE (x)
DELTA = 19°57'29"
D = 02°24'12"
R = 2384.00'
T = 419.46'
L = 830.42'
e = 36.62'

SIGN
R4-1

18" CGMP
FLOW

ALDER BROOK
FLOW

APPROX. EXISTING STATE R.O.W.

EXISTING BRIDGE INFORMATION
84" X 565' CGMPP
BUILT 1993
50' AVERAGE COVER
38 SQFT WATERWAY AREA

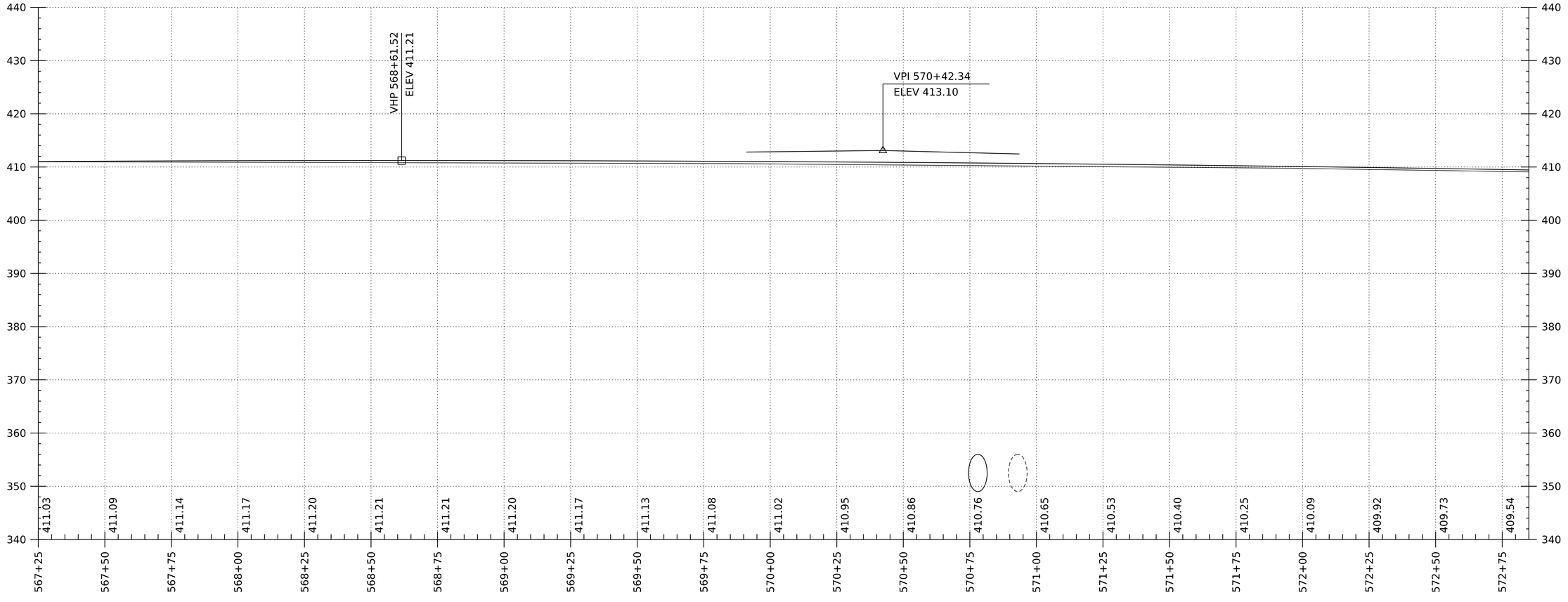
TRENCHLESS PIPE

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_BDR_OT_Orthless-Pipe.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
TRENCHLESS PIPE LAYOUT

PLOT DATE: 6-APR-2023
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 15 OF 33



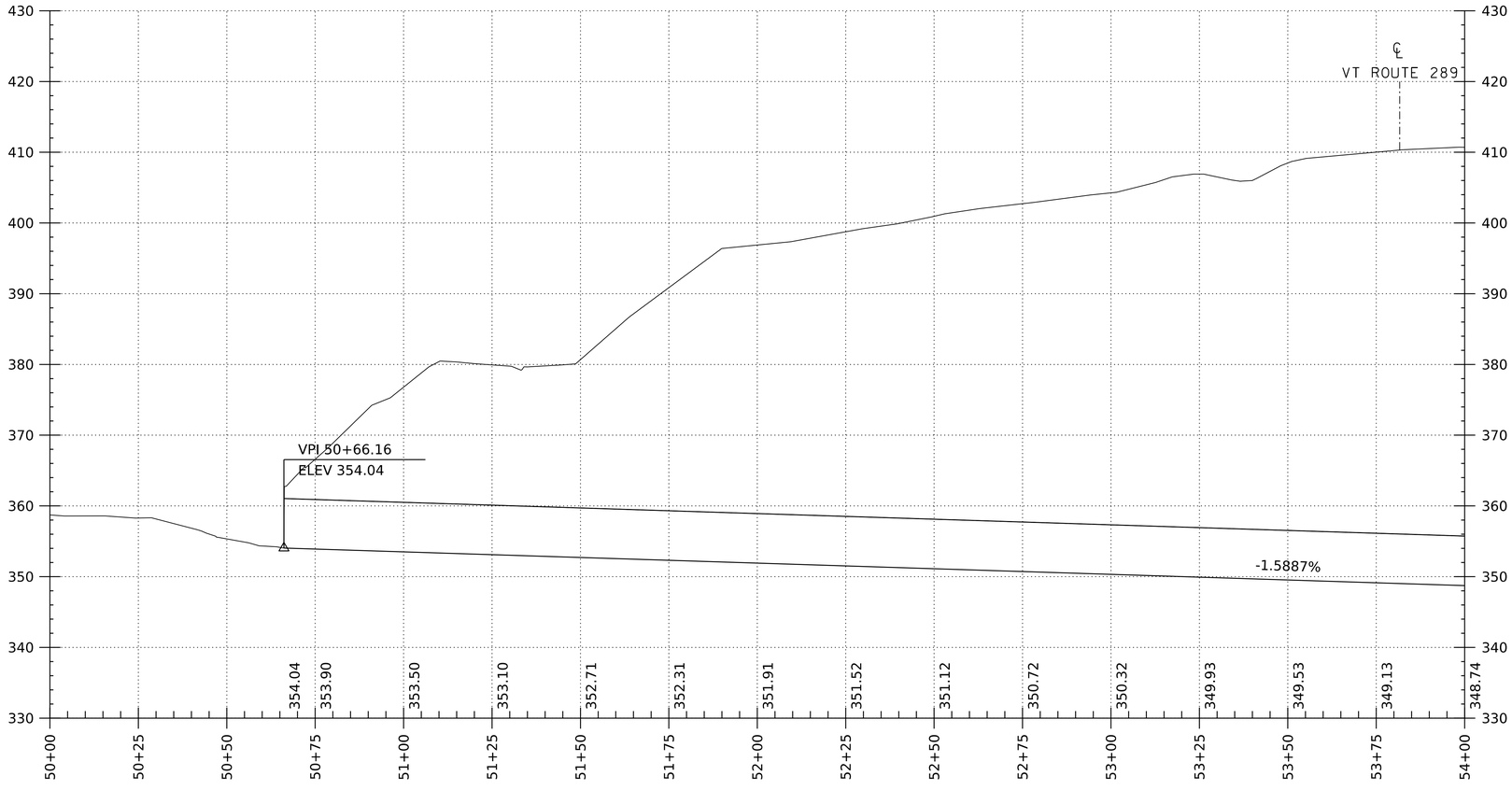
VT ROUTE 289 TRENCHLESS PROFILE

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: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_profile.dgn PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE DRAWN BY: D.D.BEARD
DESIGNED BY: ------ CHECKED BY: ------
TRENCHLESS MAINLINE PROFILE SHEET SHEET 16 OF 33



TRENCHLESS CHANNEL PROFILE

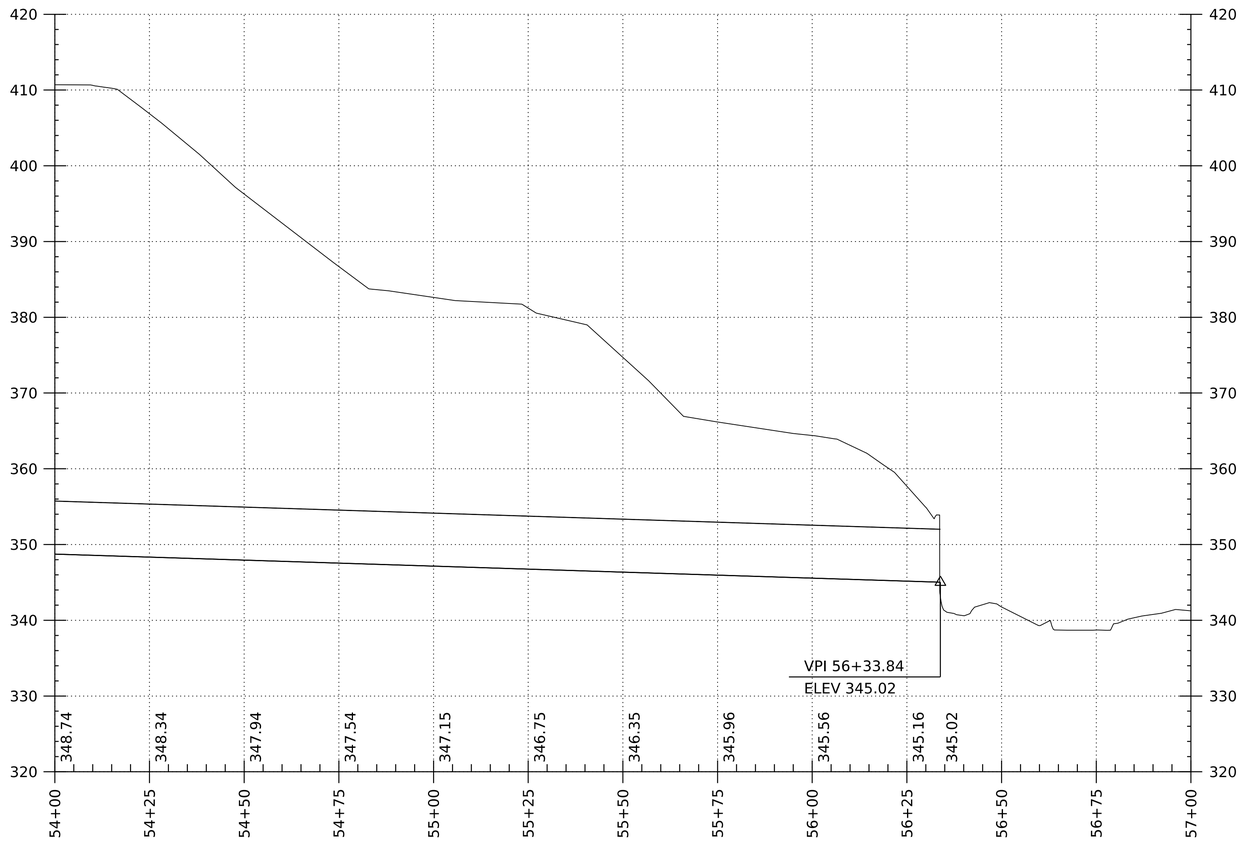
SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

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

PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_prof1e.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
TRENCHLESS CHANNEL PROFILE SHEET 1

PLOT DATE: 10-APR-2023
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 17 OF 33

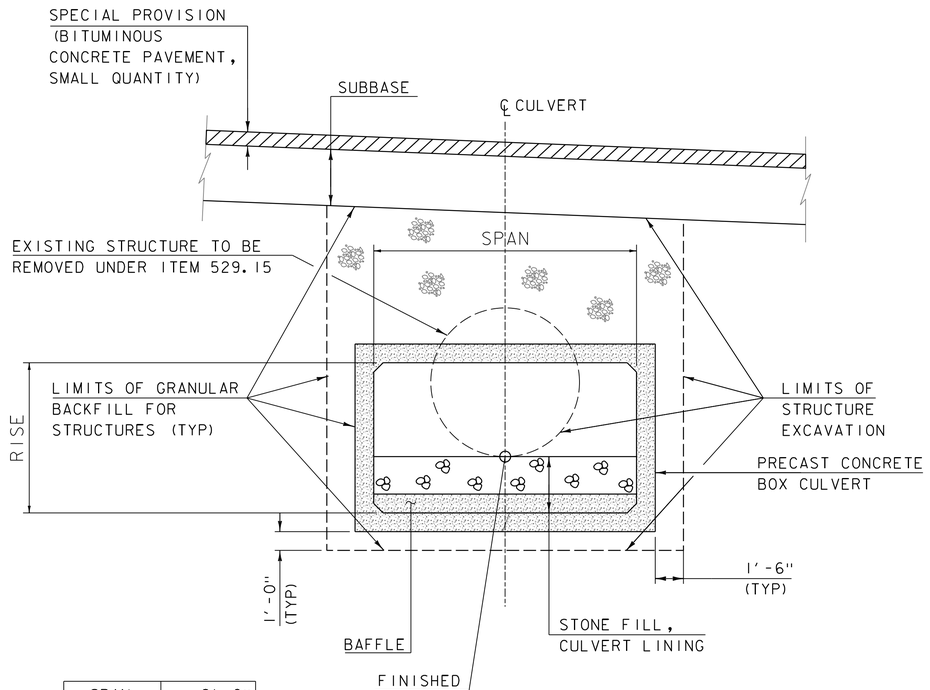


TRENCHLESS CHANNEL PROFILE

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

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

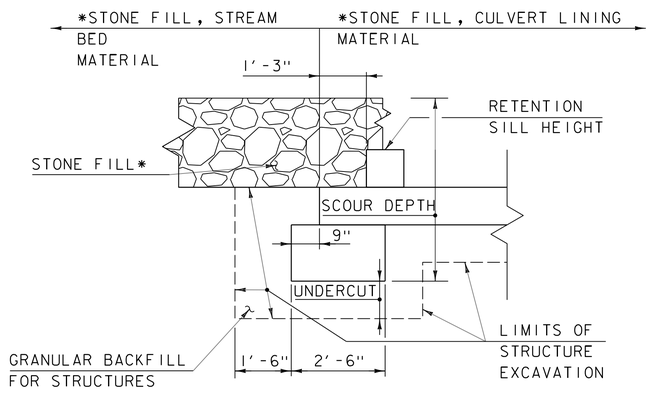
PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_profile.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
TRENCHLESS CHANNEL PROFILE SHEET 2	SHEET 18 OF 33



SPAN	8'-0"
RISE	7'-0"
LENGTH	570'-0"

CULVERT TYPICAL SECTION

NOT TO SCALE



CUTOFF WALL TYPICAL SECTION

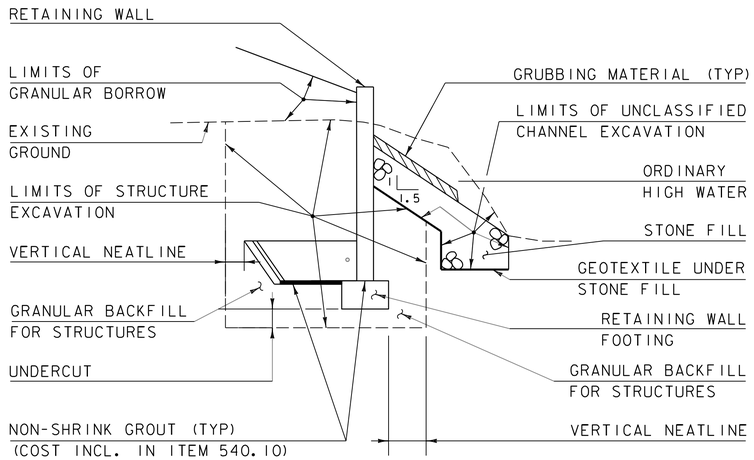
NOTE:

NOT TO SCALE

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

CUTOFF WALL - CRITICAL DIMENSIONS

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



RETAINING WALL EARTHWORK TYPICAL SECTION

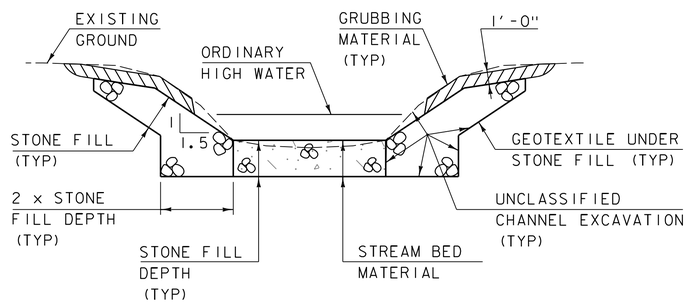
NOT TO SCALE

NOTE:

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

RETAINING WALL - ASSUMED DIMENSIONS

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



TYPICAL CHANNEL SECTION

(NOT TO SCALE)

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

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

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

MATERIAL INFORMATION

	THICKNESS	TYPE
STONE FILL	2'-0"	TYPE II
STONE FILL, CULVERT LINING	2'-0"	E-STONE TYPE II
STONE FILL, STREAM BED MATERIAL	2'-0"	E-STONE TYPE II

PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: 22b044/Essex VT 289 Br I7-A_typ07.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
PRECAST CULVERT TYPICAL SECTION SHEET

PLOT DATE: 10-APR-2023
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 19 OF 33

VT STATE PLANE GRID

N

BENCHMARK
NORTHERN TOP OF
BOUNDRY MARKER
ELEV. = 369.48

APPROX. EXISTING STATE R.O.W.

WOVEN WIRE FENCE

HVCTRL
100

BOUNDRY
MARKER

UNDERGROUND
GAS LINE

STA 570+93.00=
CHAN 53+81.66
Δ=53°06'00" RT

SIGN
R4-1

S23°41'01.32"W
84" CGMP
FLOW

51+00

52+00

53+00

54+00

55+00

56+00

571+00

572+00

573+00

VT ROUTE 289
TO VT ROUTE 117

HVCTRL
101

HVCTRL
102

WOVEN WIRE FENCE

570+00

569+00

VT ROUTE 289
TO VT ROUTE 15

SIGN
R4-1

18" CGMP
FLOW

PI 570+72.99

CURVE (x)
DELTA = 19°57'29"
D = 02°24'12"
R = 2384.00'
T = 419.46'
L = 830.42'
e = 36.62'

WOVEN WIRE FENCE

ALDER BROOK
FLOW

WOVEN WIRE FENCE

APPROX. EXISTING STATE R.O.W.

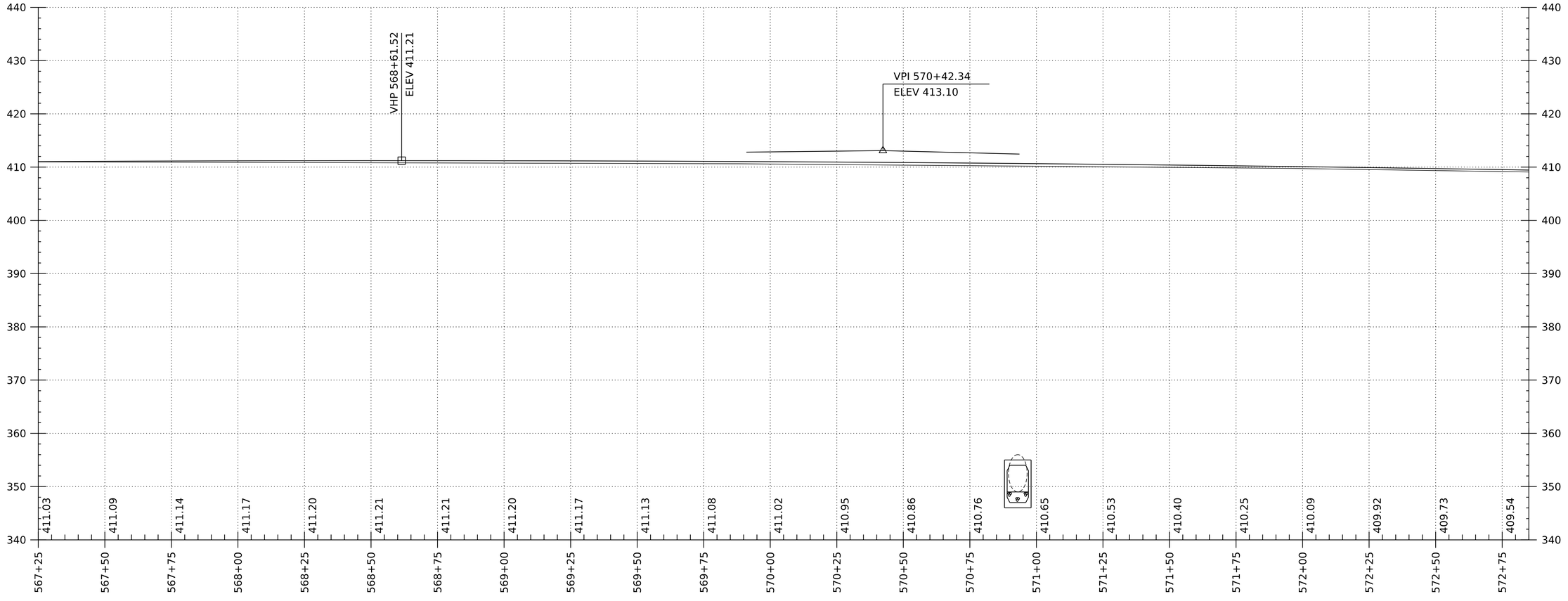
EXISTING BRIDGE INFORMATION
84" X 565' CGMPP
BUILT 1993
50' AVERAGE COVER
38 SQFT WATERWAY AREA

NEW PRECAST BOX

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_BOX.dgn PLOT DATE: 20-APR-2023
PROJECT LEADER: L.J.STONE DRAWN BY: D.D.BEARD
DESIGNED BY: ------ CHECKED BY: ------
NEW PRECAST BOX LAYOUT SHEET 20 OF 33

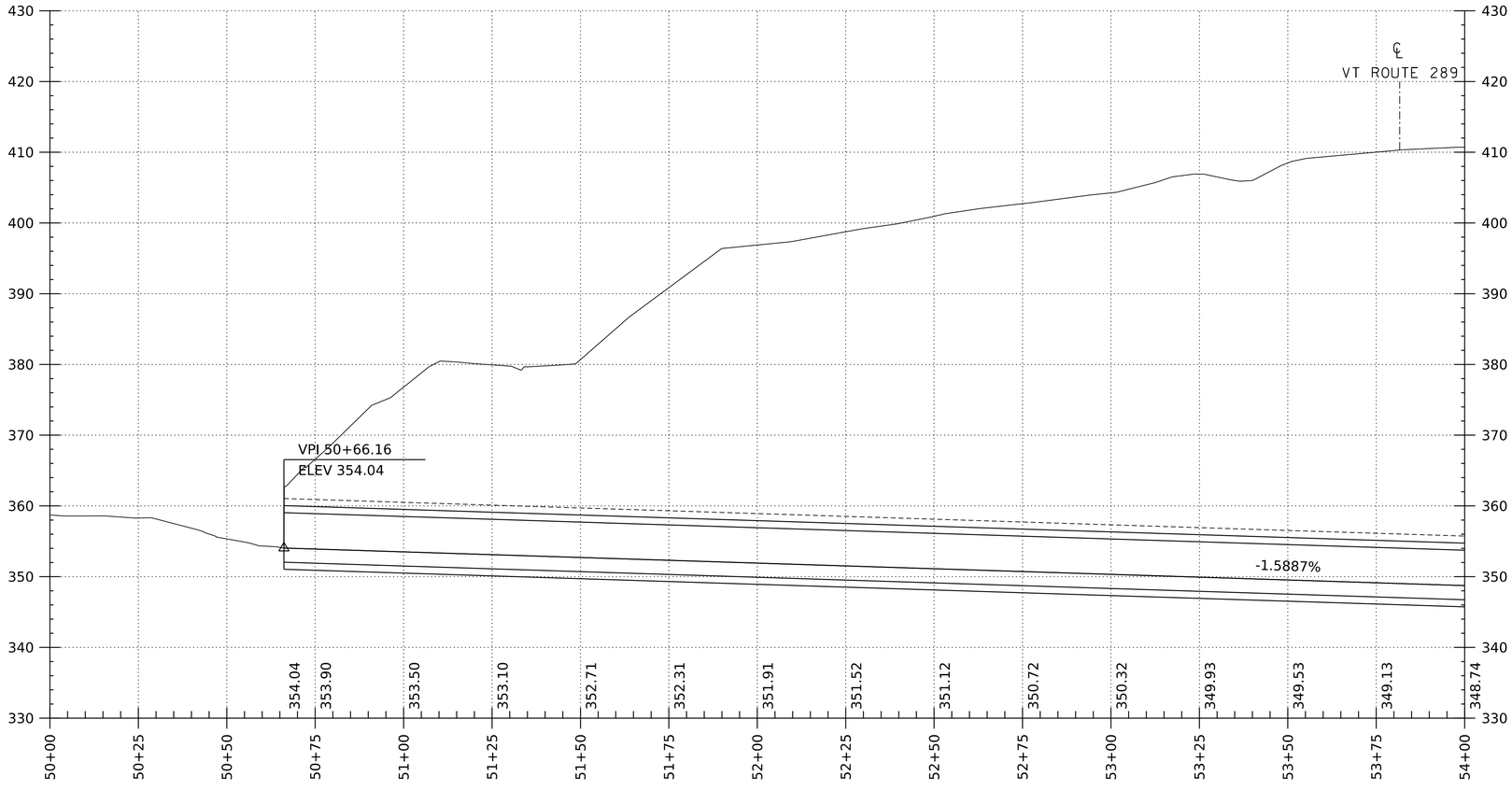


VT ROUTE 289 NEW PRECAST CULVERT PROFILE

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:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_prof.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
NEW PRECAST CULVERT MAINLINE PROFILE SHEET	SHEET 21 OF 33

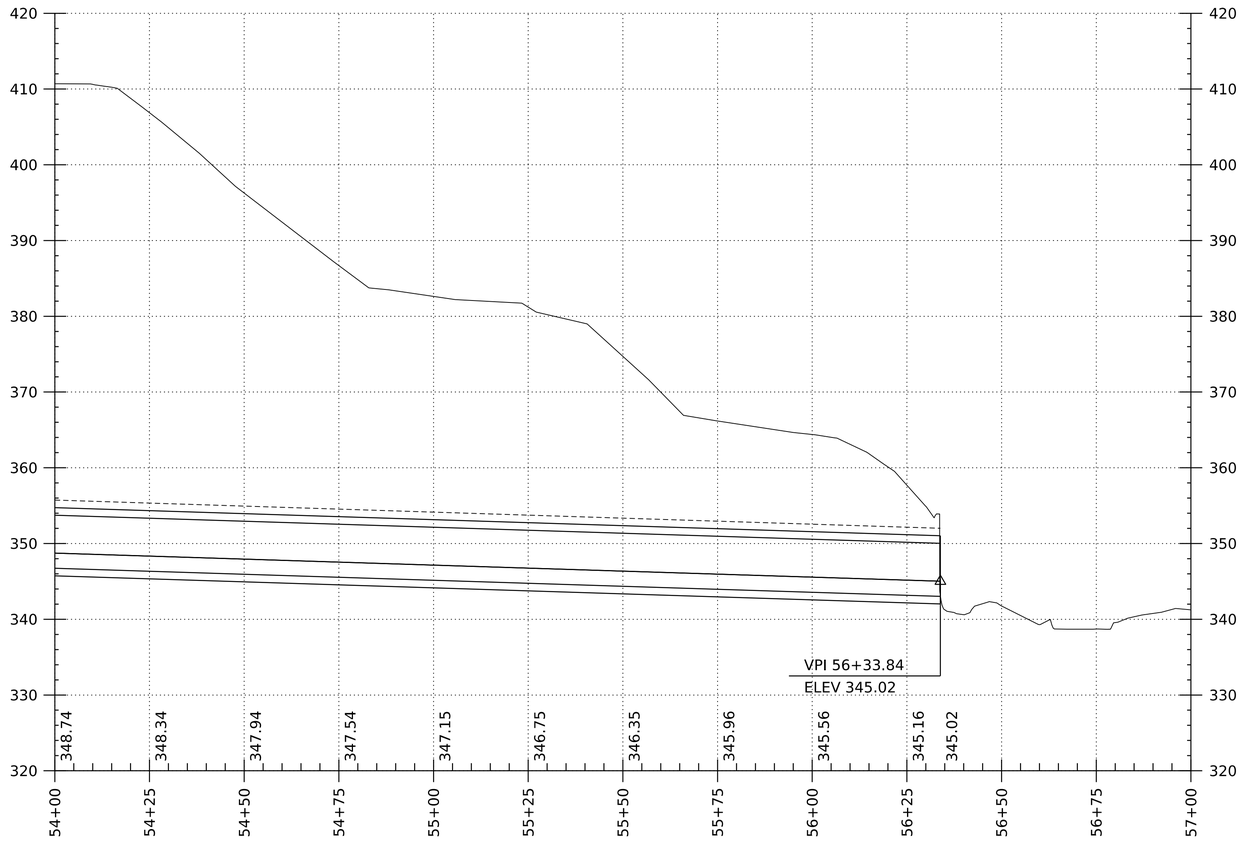


NEW PRECAST CULVERT CHANNEL PROFILE

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

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

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_profile.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
NEW PRECAST CULVERT CHANNEL PROFILE SHEET	SHEET 22 OF 33



NEW PRECAST CULVERT CHANNEL PROFILE

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

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

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_profile.dgn	PLOT DATE: 10-APR-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
NEW PRECAST CULVERT CHANNEL PROFILE SHEET	SHEET 23 OF 33

VT STATE PLANE GRID

N

APPROX. EXISTING STATE R.O.W.

STA 570+93.00=
CHAN 53+81.66
Δ=53°06'00" RT

UNDERGROUND GAS LINE

S23°41'01.32"W
84' CCMP
FLOW

51+00 52+00 53+00 54+00 55+00 56+00

571+00 572+00 573+00

VT ROUTE 289
TO VT ROUTE 117

570+00 569+00

PI 570+72.99

CURVE (x)
DELTA = 19°57'29"
D = 02°24'12"
R = 2384.00'
T = 419.46'
L = 830.42'
e = 36.62'

18" CCMP
FLOW

VT ROUTE 289
TO VT ROUTE 15

ALDER BROOK
FLOW

APPROX. EXISTING STATE R.O.W.

PHASE I

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_BDR_Phase1.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
PHASE I LAYOUT

PLOT DATE: 22-MAY-2023
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 24 OF 33

VT STATE PLANE GRID

N

APPROX. EXISTING STATE R.O.W.

UNDERGROUND GAS LINE

STA 570+93.00=
CHAN 53+81.66
Δ=53°06'00" RT

S23°41'01.32"W
84' CCMP FLOW

18" CCMP FLOW

ALDER BROOK FLOW

VT ROUTE 289
TO VT ROUTE 15

VT ROUTE 289
TO VT ROUTE 117

569+00

570+00

571+00

572+00

573+00

PI 570+72.99

CURVE (x)
DELTA = 19°57'29"
D = 02°24'12"
R = 2384.00'
T = 419.46'
L = 830.42'
e = 36.62'

51+00

52+00

53+00

54+00

55+00

56+00

APPROX. EXISTING STATE R.O.W.

PHASE 2

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME:	PLOT DATE: 22-MAY-2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
PHASE 2 LAYOUT	SHEET 25 OF 33

VT STATE PLANE GRID

N

BENCHMARK
NORTHERN TOP OF
BOUNDRY MARKER
ELEV. =369.48

APPROX. EXISTING STATE R.O.W.

WOVEN WIRE FENCE

HVCTRL
100

BOUNDRY
MARKER

STA 570+93.00=
CHAN 53+81.66
Δ=53°06'00" RT

UNDERGROUND
GAS LINE

SIGN
R4-1

S23°41'01.32"W
84" CGMP
FLOW

51+00 52+00 53+00 54+00 55+00 56+00

571+00

572+00

573+00

VT ROUTE 289
TO VT ROUTE 117

HVCTRL
101

HVCTRL
102

WOVEN WIRE FENCE

CURVE (x)
DELTA = 19°57'29"
D = 02°24'12"
R = 2384.00'
T = 419.46'
L = 830.42'
e = 36.62'

PI 570+72.99

570+00

569+00

SIGN
R4-1

18" CGMP
FLOW

VT ROUTE 289
TO VT ROUTE 15

WOVEN WIRE FENCE

WOVEN WIRE FENCE

APPROX. EXISTING STATE R.O.W.

ALDER BROOK
FLOW

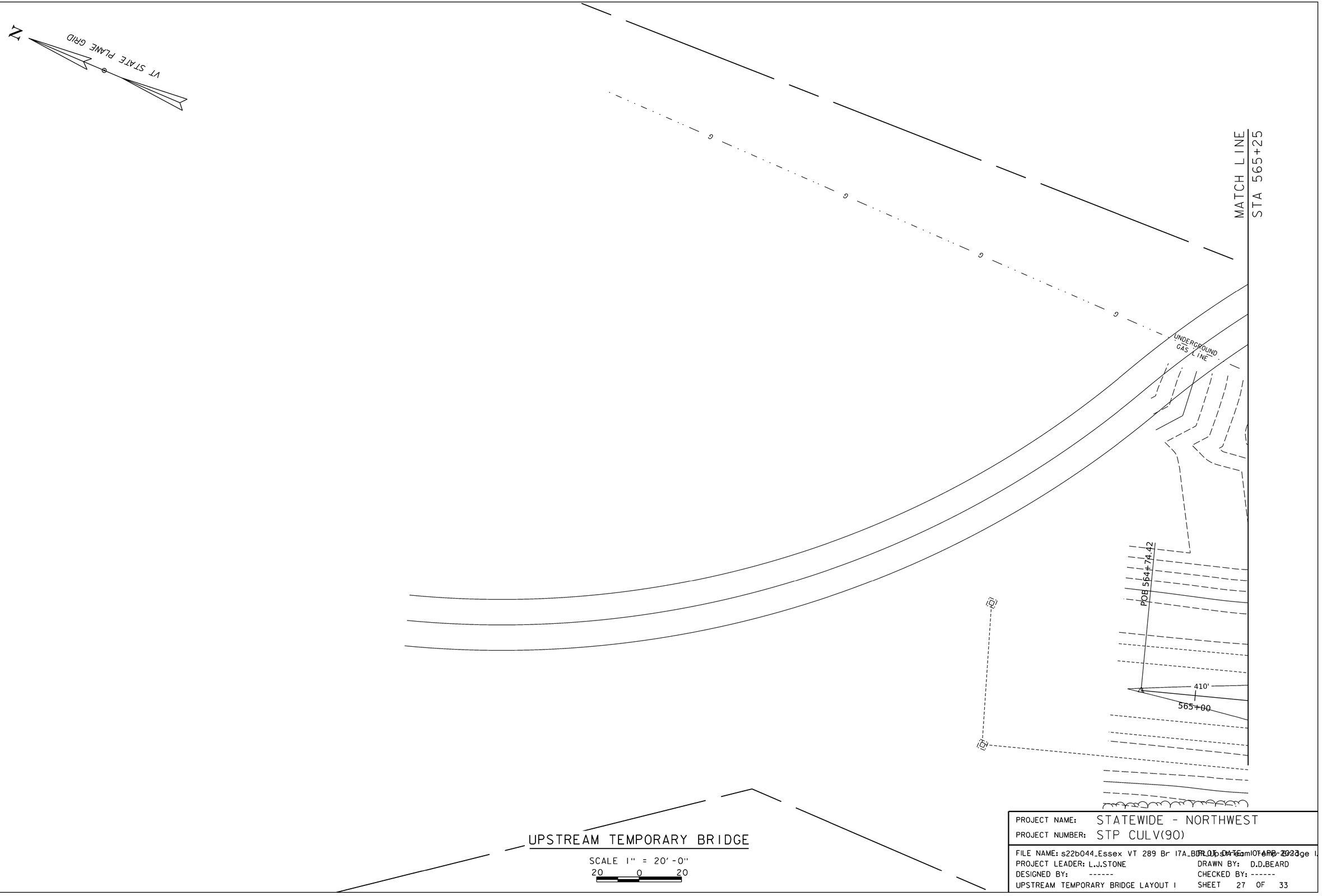
EXISTING BRIDGE INFORMATION
84" X 565' CGMPP
BUILT 1993
50' AVERAGE COVER
38 SQFT WATERWAY AREA

ON ALIGNMENT TEMPORARY BRIDGE

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_BDR.dgn PLOT DATE: 10 APR 2023
PROJECT LEADER: L.J.STONE DRAWN BY: D.D.BEARD
DESIGNED BY: ------ CHECKED BY: ------
ON-ALIGNMENT TEMPORARY BRIDGE LAYOUT SHEET 26 OF 33



UPSTREAM TEMPORARY BRIDGE

SCALE 1" = 20'-0"

20 0 20

PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_BDR_Ops_Temp Bridge I...
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
UPSTREAM TEMPORARY BRIDGE LAYOUT 1
PLOT DATE: 10-APR-2023
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 27 OF 33

PROJECT NAME: STATEWIDE - NORTHWEST

PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_BDR_UpstreamTempBridge 2 PLOT DATE: 10-APR-2023

PROJECT LEADER: L.J.STONE DRAWN BY: D.D.BEARD

DESIGNED BY: ------ CHECKED BY: ------

UPSTREAM TEMPORARY BRIDGE LAYOUT 2 SHEET 28 OF 33

N

VT STATE PLANE GRID

MATCH LINE
STA 571+25

R.O.W.

390'

400'

UNDERGROUND
GAS LINE

PT 574+83.95

POE 575+39.59

S37°38'10.92"E

575+00

574+00

VT ROUTE 289
TO VT ROUTE 117

573+00

572+00

410'

400'

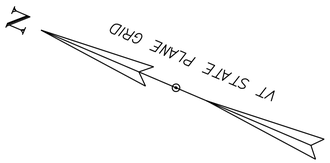
390'

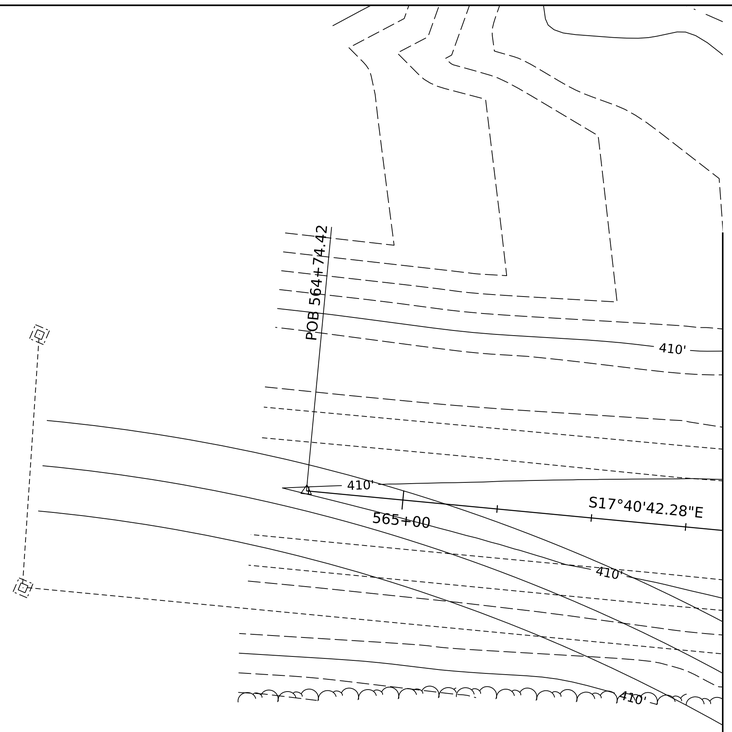
UPSTREAM TEMPORARY BRIDGE

SCALE 1" = 20'-0"

20 0 20

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_BDR_Upstream Temp Bridge 3	PLOT DATE: 10 APR 2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
UPSTREAM TEMPORARY BRIDGE LAYOUT 3	SHEET 29 OF 33

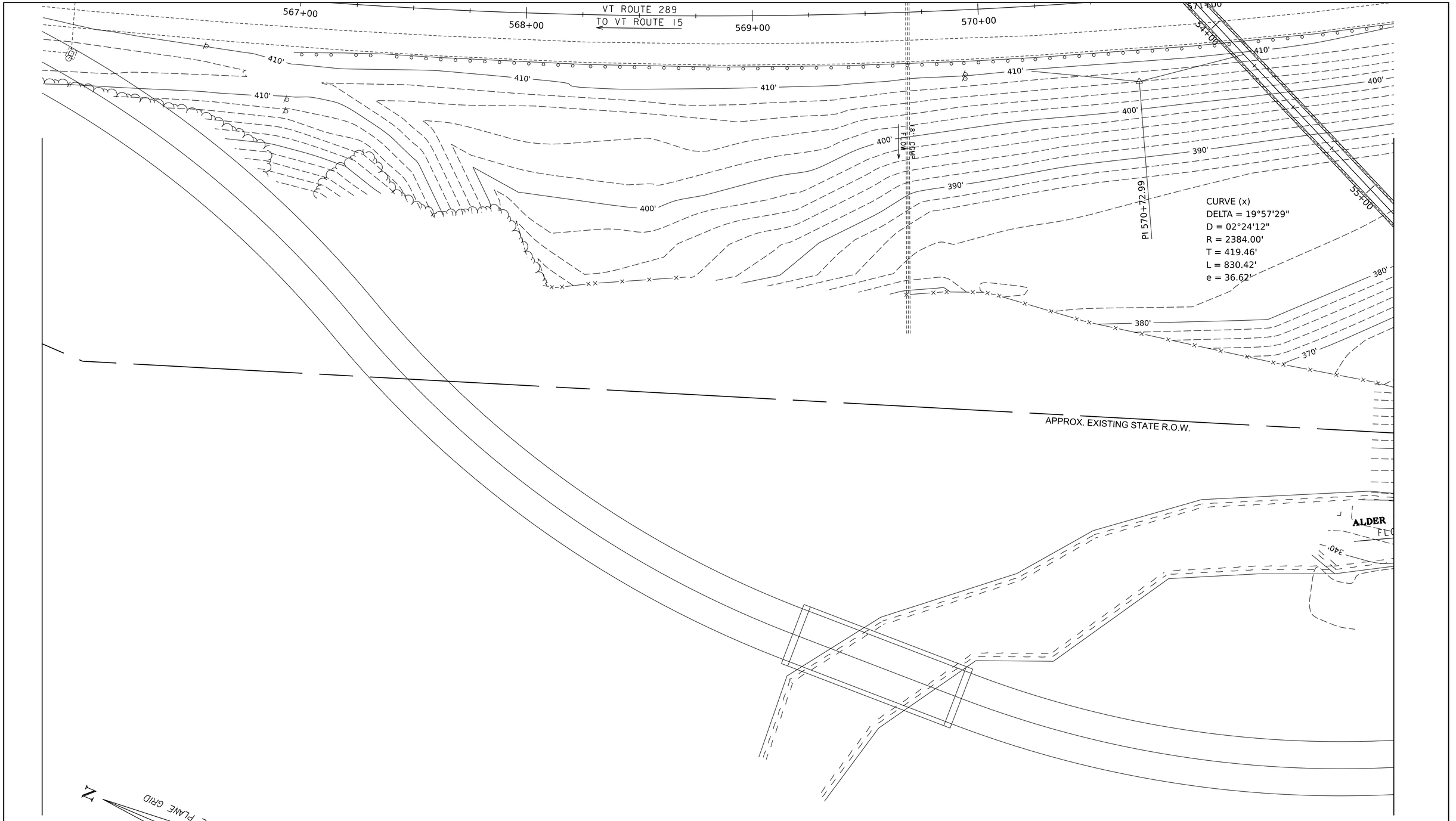




DOWNSTREAM TEMPORARY BRIDGE

SCALE 1" = 20'-0"
20 0 20

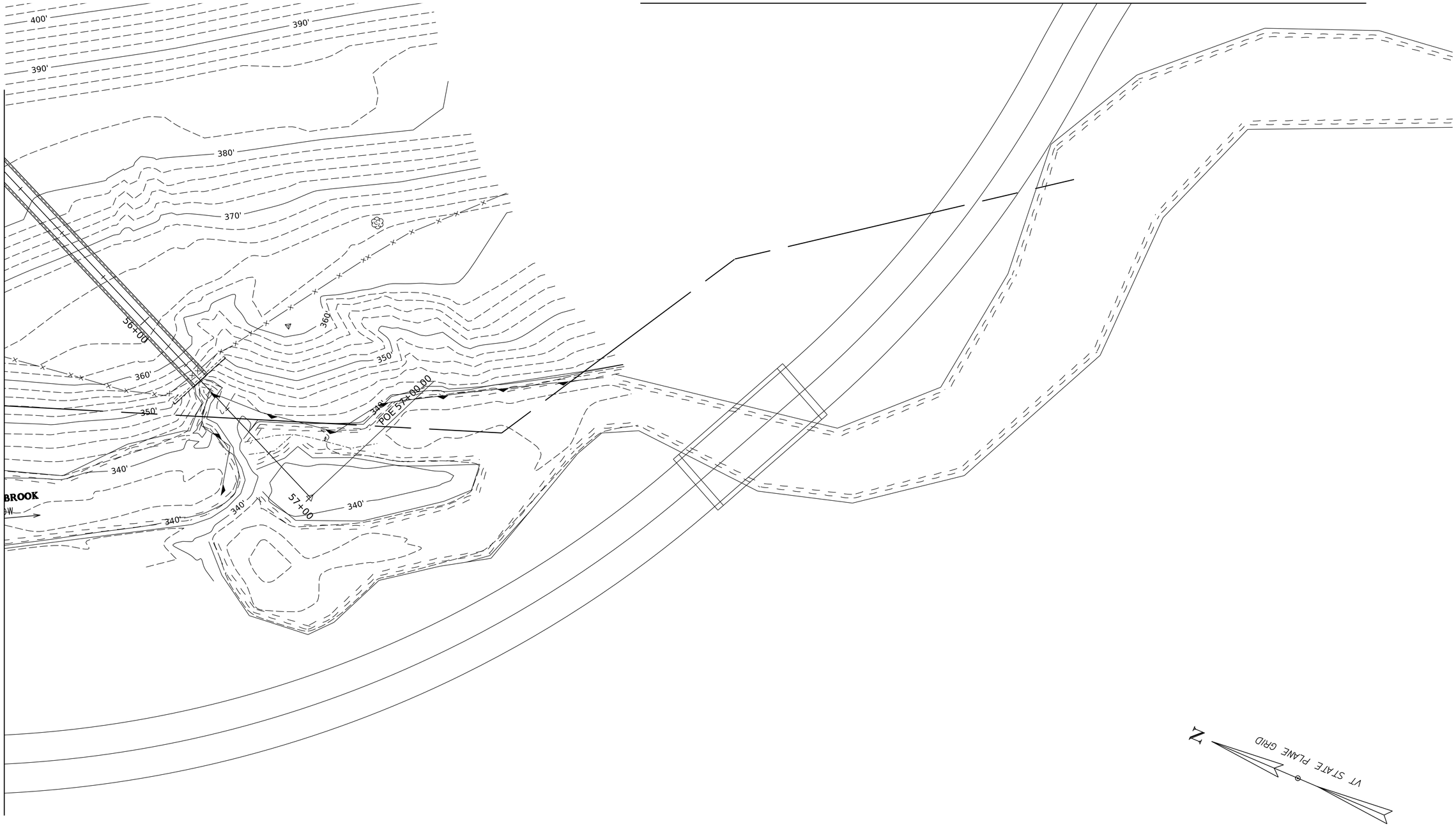
PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_BDT_Downstream Temp Bridge	PLOT DATE: 6/APR/2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
DOWNSTREAM TEMPORARY BRIDGE LAYOUT I	SHEET 30 OF 33



DOWNSTREAM TEMPORARY BRIDGE

SCALE 1" = 20'-0"
20 0 20

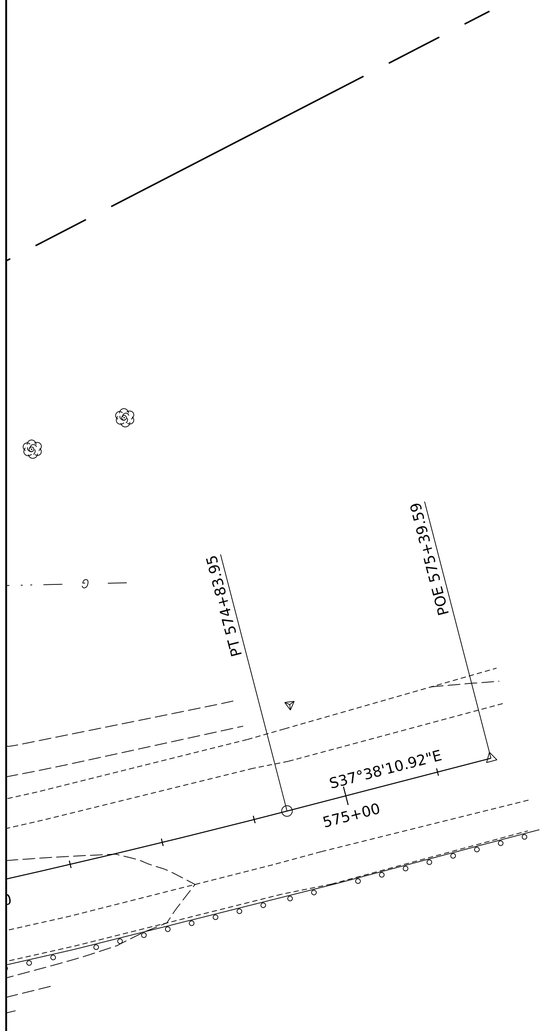
PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_BDR Downstream Temp Bridge	PLOT DATE: 04 APR 2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
DOWNSTREAM TEMPORARY BRIDGE LAYOUT 2	SHEET 31 OF 33

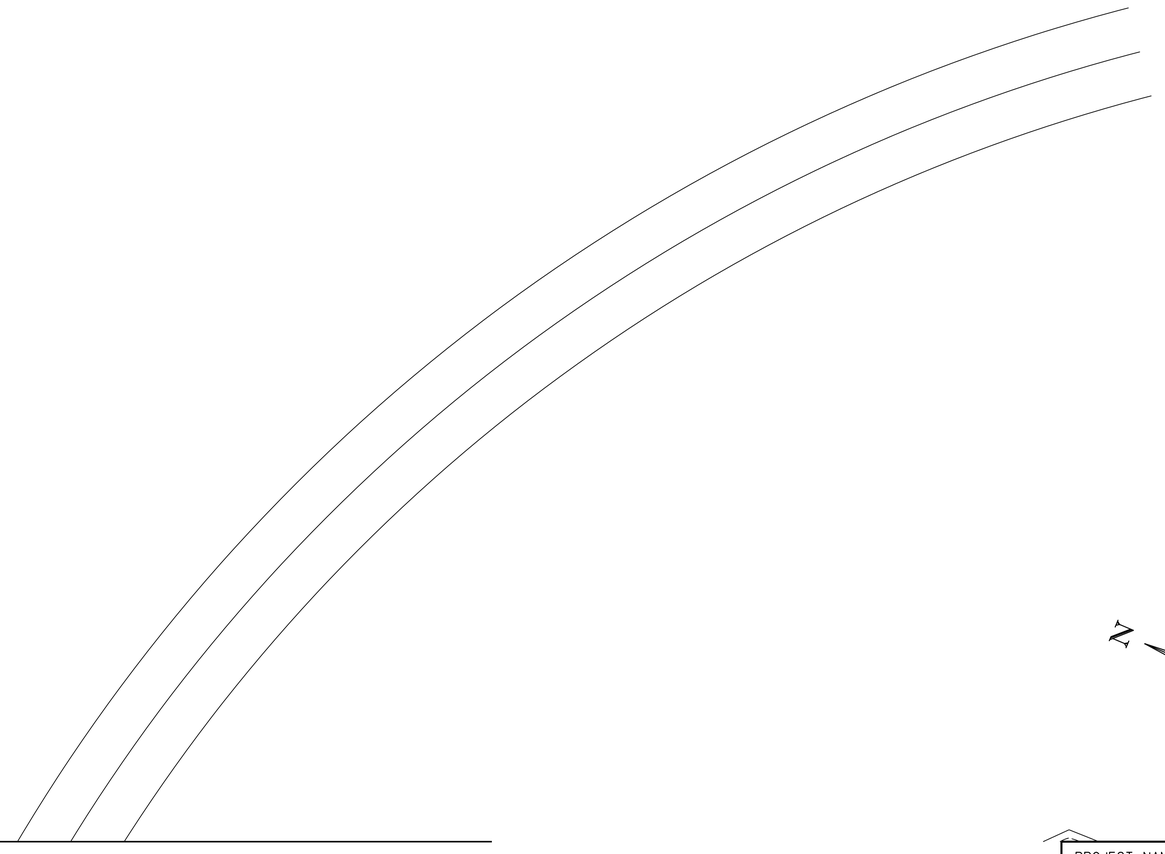


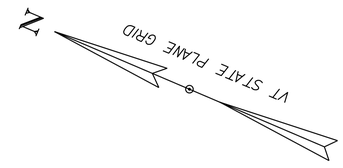
DOWNSTREAM TEMPORARY BRIDGE

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME:	STATEWIDE - NORTHWEST
PROJECT NUMBER:	STP CULV(90)
FILE NAME: s22b044_Essex VT 289 Br 17A_BR_Downstream_Temp_Bridge	PLOT DATE: 6/14/2023
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
DOWNSTREAM TEMPORARY BRIDGE LAYOUT 3	SHEET 32 OF 33







DOWNSTREAM TEMPORARY BRIDGE

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME: STATEWIDE - NORTHWEST
PROJECT NUMBER: STP CULV(90)

FILE NAME: s22b044_Essex VT 289 Br 17A_BRIDGE_Downstream_Temp_Bridge
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
DOWNSTREAM TEMPORARY BRIDGE LAYOUT 4
PLOT DATE: 9 APR 2023
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 33 OF 33