Engineering Report

Rochester BHF 0162(17)

Bridge No. 16 – VT 73 over Corporation Brook
Bridge Improvement Project – Rochester, VT

Prepared for: Vermont Agency of Transportation
Prepared by: Vanasse Hangen Brustlin, Inc.
Date: June 29, 2012

Table of Contents

Executive Summary 1

Project Overview 2

Project Background 2

Figure 1: Project Location Map 3

Alternatives Analysis 7

Alternative Identification 7

Figure 2: Evaluation Matrix 10

Recommendations 11

Appendix 12

Appendices

A. Project Photographs
B. VT 73 Bridge No. 16 Structure Inspection, Inventory and Appraisal Sheet
C. Waters Identification and Regulatory Discussion Technical Memorandum
D. Natural Resources Identification Memorandum
E. Archaeological Resource Assessment and Historical Resource Identification Memorandum
F. Preliminary Hydraulics Memorandum
G. Subsurface Investigation Memorandum
H. Traffic Data
I. Project Purpose and Need Statement
J. Local Concerns Meeting Notes

Executive Summary

The purpose of this Engineering Report is to evaluate the replacement alternatives for the bridge on VT 73 over Corporation Brook (Bridge No. 16) in Rochester, Vermont. This report summarizes the study and provides a discussion of the existing conditions, replacement alternatives, and recommendations.

Bridge No. 16 is in fair condition. There is wide spread efflorescence, deterioration, and spalling present on all parts of the structure. There is scour along the western abutment and the footings are exposed. In addition, the bridge does not match the existing roadway width, nor does it meet the required roadway width based on the current Average Daily Traffic (ADT) for a rural collector in accordance with the Vermont State Standards. The bridge is not hydraulically adequate as it constricts the channel width and is poorly aligned with the channel.

The feasible alternatives studied are:

A. Do Nothing
B. Precast Prestressed Concrete NEXT Beam Bridge
C. Precast Prestressed Concrete Slab Bridge

Alternative B, Precast Prestressed Concrete NEXT Beam Bridge is the recommended alternative primarily because it provides the shortest construction duration and is cost effective. The short construction duration will reduce the impacts to the traveling public.

Only minor environmental impacts are anticipated as a result of this project. Acquisitions of Right-Of-Way are not anticipated for this project. Temporary easements are expected as discussed in this report, and are being addressed expeditiously in order to maintain the project schedule.

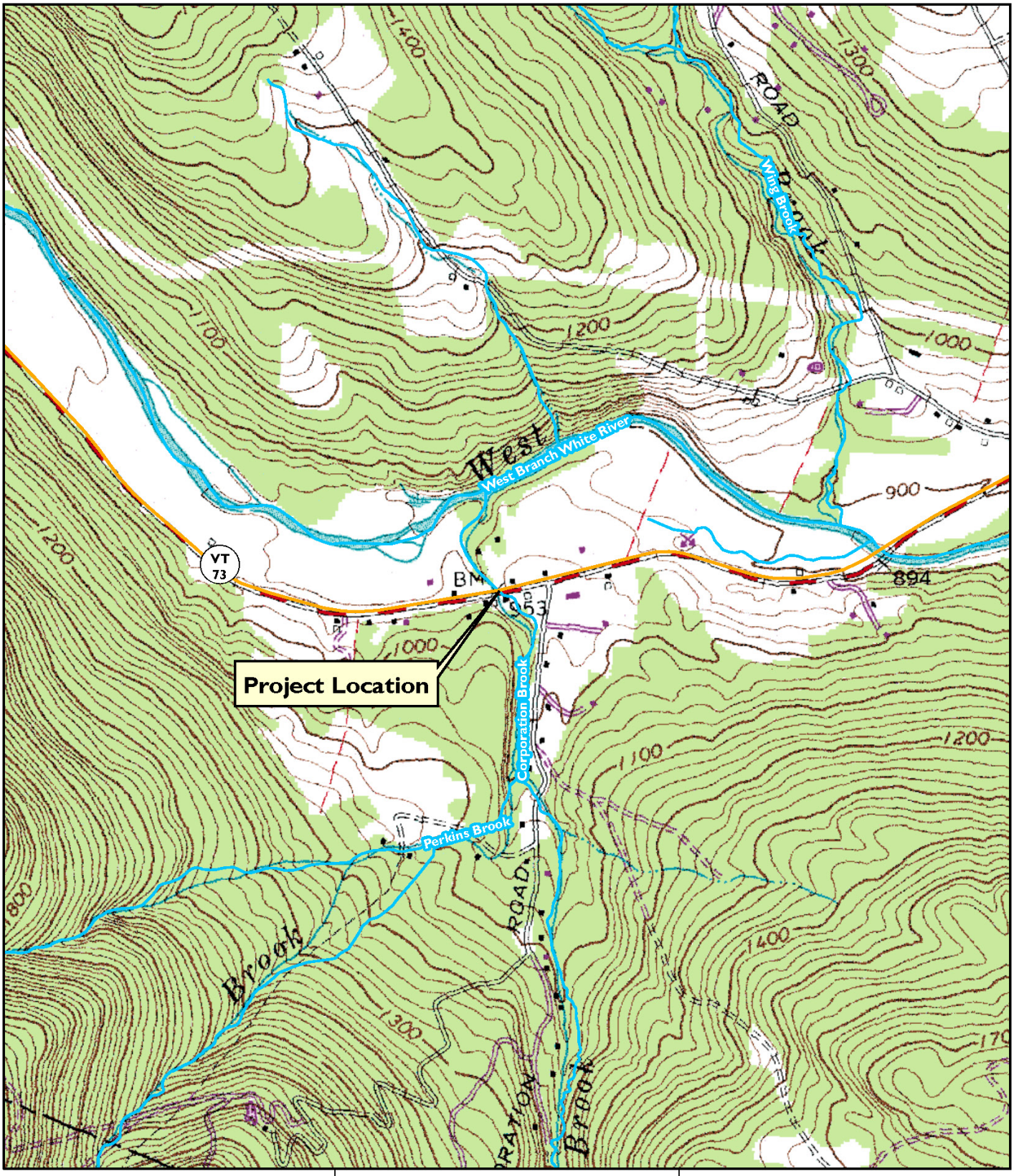
Project Overview

Background

The project is located in the Town of Rochester, Vermont on VT 73 at its intersection with Corporation Brook. The project is located in a rural area with houses adjacent to VT 73 on the northeast and southwest corners of the bridge. All of the houses in the area of the bridge are historic. Corporation Road (TH 40) intersects with VT 73 approximately 450 feet east of the bridge. The brook flows in a northwesterly direction under Bridge No. 16 and continues to flow northwest turning to the east just prior to its confluence with the West Branch of the White River approximately 1000 feet downstream of Bridge No. 16.

The existing bridge is a single span, two lane bridge with a curb to curb distance of 20′-0″. The bridge consists of cast-in-place concrete T-beams with a cast-in-place concrete deck and a bituminous concrete wearing surface. The abutments are cast-in-place concrete. The bridge sustained minimal damage, minor erosion behind the southeast wingwall, from Tropical Storm Irene.

Bridge No. 16 requires replacement due to its deteriorated condition, inadequate hydraulic capacity, potential for scour, poor channel alignment, and functionally obsolete width. Site photos of the existing bridge, roadway, and channel are included in Appendix A.


Project Location
West Branch White River
Wing Brook
Corporation Brook
Perkins Brook
VT 73
ROAD
West
Brook
1400
1300
1200
1100
1000
900
894
BM
953
Legend
State Named Highway
Road
Stream (VHD 08)
N
Prepared by: Jtherrien
Project Location Map
Bridge #16 on VT-73
Over Corporation Brook
Rochester BHF 0162(17)
1,000 500 0 1,000
Feet
Sources: Background - USGS Topo Quads (Rochester, 1997); Roads downloaded from VCGI (2010); VHD streams downloaded from VCGI (2009).
Vanasse Hangen Brustlin, Inc.
F:\57527.00\GIS\Project\USGS_SiteMap_8.5x11.mxd

CORPORATION BROOK

Corporation Brook originates on the eastern slopes of the Green Mountains in the Town of Pittsfield, VT, southwest of Rochester. The Brook flows in generally a northeast direction to Rochester where it turns to the northwest and follows Corporation Brook Road (TH 40) before turning northeast prior to its confluence with the West Branch of the White River. The Brook has a drainage area of approximately 6.0 square miles and an average gradient of 11% from its divide. The stream gradient is shallower, 4.5% when it crosses VT 73 at Bridge No. 16. While Bridge No. 16 is located approximately 1000 feet upstream of Corporation Brook's confluence with the West Branch of the White River, the channel elevation is greater than the Q100 elevation for the West Branch and as a result there is no tailwater from the West Branch at Bridge No. 16.

VT 73 BRIDGE NO. 16

VT 73 is a two lane, west to east state highway starting to the west in Orwell at the intersection of VT 22A and ending to the east in Rochester at the intersection with VT 100. A majority of the road is maintained by the State, including the project area. The roadway through the immediate project area is a rural major collector and is in a sag vertical curve with a steeper grade immediately east of the bridge and a relatively flat grade west of the bridge. The posted speed limit is 50 miles per hour, and the estimated 2014 AADT is 770 vehicles per day.

The existing bridge is a single span, two lane bridge, constructed in 1929. The bridge is 25-feet in length and 20-feet curb to curb. The bridge superstructure consists of cast-in-place concrete T-beams with a cast-in-place concrete deck and a bituminous concrete pavement wearing surface. W-beam guardrail is directly attached to the concrete bridge posts. The bridge superstructure is supported by cast-in-place concrete abutments.

The existing superstructure components are noted as being in fair condition with wide-spread areas of map cracking, efflorescence and spalling prevalent on the fascias and underside of the concrete T-beams and deck. Rusted reinforcing is visible in several areas on the bottoms of the T-beams and rust staining is present along the webs of the T-beams. The concrete deterioration; map cracking, efflorescence, and spalling, is also noticeable on the exposed areas of the abutments. The tops of the footings are exposed and the bridge is rated as scour critical according to the latest bridge inspection report. Additionally, the latest bridge inspection report states that the deck geometry is "intolerable, replacement needed" due to the narrow bridge, and on 06/20/2011 it was noted that the "T-beams will need full replacement some future time". The roadway approach guardrail and the bridge rail do not meet the current design standards as noted in the VTrans Inspection Report (Appendix B). There are overhead utility lines within the project area.

Right-Of-Way

The State Right-of-Way on VT 73 is approximately three (3) rods throughout the project area. There are no Right-of-Way acquisitions or permanent easements required for this project. However, there will be temporary easements required for the removal of the existing structure, placement of stone fill on the channel banks, and construction of the roadway slopes and drives due to a slight increase in the vertical grade through the project area.

Environmental Resources

A Technical Memorandum, dated March 6, 2012, was prepared by VHB to summarize waters identification and regulatory discussion (Appendix C). A Resource Identification Completion Memo was prepared by VTrans on August 23, 2011 (Appendix D). The following summarizes the resource assessment to date:

- There are no mapped or field sittings of wetland features, or rare, threatened, or endangered species.
- A flood hazard area permit may be required as the project occurs within a Special Flood Hazard Area.
- The entire project area is considered to have statewide significant soils.

Cultural Resources

An Archeological Resource Assessment was provided by VTrans dated July 25, 2011 (see Appendix E). Clearance has not been provided by VTrans. The bridge itself is not considered historic. However, because historic properties are adjacent to the project area, more information needs to be known regarding the proposed bridge and its Right-of-Way impacts prior to clearance. The historic properties identified within the project area are identified in the map included in Appendix E.

Hydraulic Study

The VTrans Hydraulics Unit conducted a preliminary hydraulic study for this project site on September 1, 2011 (Appendix F). The study indicates that water is up onto the beams below the Q50 and that the bridge does meet the requirements of one (1) foot of freeboard at Q50. The bridge also caused approximately four (4) feet of backwater at the Q100. The Study also indicated this site is in Zone A of the flood insurance study, which means there is no detailed study for this river. There is a detailed study for the West Branch of the White River, which is about 1000 feet downstream. The Q100 for the West Branch at the confluence with Corporation Brook is approximately 925' which is +/-15 feet lower than the channel elevation at the bridge.

The recommendation for replacement structures from a hydraulics perspective are as follows:

- The new structure shall have a 35-feet minimum clear span, measured perpendicular to the channel. The average low chord elevation of the superstructure shall be 949.0′ to provide one (1) foot of freeboard at Q50. The bridge should be skewed with the abutments aligned with the channel. Stone Fill, Type IV shall be used to protect the substructure and the slopes in front of the abutments and wingwalls shall match the upstream and downstream slopes of the channel.

Geotechnical Investigation

VTrans performed subsurface investigations and prepared a Subsurface Investigation Memorandum submitted on April 27, 2012 (Appendix G). The purpose of the geotechnical investigations was to determine the existing soil conditions and verify the depth of ledge at the bridge location. As part of the subsurface investigation four (4) borings were completed.

The subsurface investigations revealed that ledge was approximately 16.5 to 18.0 feet below existing grade and the recommended substructure should be a precast arch or reinforced concrete abutments supported on spread footings.

Integral abutments where not recommended due to the shallow depth of the bedrock. However, after further discussions with VTrans, the use of integral abutments was allowed with the addition of rock anchors on the pile caps to prevent the entire structure from overturning during a high water storm event.

Alternatives Analysis

Alternative Identification

This section of the report provides a discussion of alternatives which have been identified for this project, involving a combination of structure types and methods of construction.

Following are the most critical considerations in development and evaluation of the project alternatives (not in order of priority):

- Depth and Transportability of superstructure components
- Best fit for existing roadway geometry
- Construction costs
- Future maintenance costs
- Environmental impacts
- ROW impacts

Alternative A: Do Nothing

The "Do Nothing" alternative would allow the existing bridge to continue to function in its current condition. Although this is not a viable alternative, it is included in our study. The Do Nothing alternative would result in the continued deterioration of the existing superstructure, inadequate hydraulic capacity of the structure, and the continued scour of the substructure. The Do Nothing alternative does not meet the project need.

Alternative B: Precast Prestressed Concrete NEXT Beam Bridge

Construction of a prestressed concrete NEXT beam bridge using integral abutments, each on a single row of piles, is a simple and cost effective solution for this type of project. The required span length, based on the specified hydraulic opening, is approximately 30′ longer than the existing span. The increase in structure length places the proposed abutments behind the existing abutments. This feature, in combination with the proposed style of abutment, will allow the new abutments to be constructed while leaving the existing abutments in-place and undisturbed. The proposed abutments can be constructed using daytime single lane closures while the

existing bridge remains open. After the abutments are constructed the existing bridge will be closed for an extended weekend, at which time the bridge will be removed and the proposed superstructure will be set in-place and opened to traffic. The NEXT beam superstructure for the specified bridge width requires three precast superstructure units, whereas a box beam superstructure requires eight precast beams. This alternative has a structure depth of approximately 3′, which is potentially a few inches deeper than the box beam alternative, depending on final design, which will need to be evaluated hydraulically. The channel embankments at the bridge will be armored with stone fill.

Advantages of Alternative B

- Rapid construction and short construction duration
- Simple method of construction
- Fewest number of required precast superstructure units
- Low construction cost
- Low future maintenance costs

Disadvantages of Alternative B

- Requires weekend bridge closure for superstructure replacement
- Slightly deeper structure depth

Alternative C:
Precast Prestressed Concrete Slab Bridge

The prestressed concrete slab bridge is another alternative that provides ease and low cost of construction, and can be constructed using daytime lane closures and an extended weekend closure similar to Alternative B. This alternative also utilizes integral abutments, each supported by a single row of piles. Proposed substructure location, construction sequencing, and duration is identical to that of Alternative B. The major difference between this alternative and Alternative B is the type of superstructure. The prestressed slab superstructure for the specified bridge width requires eight precast superstructure units, whereas Alternative B requires four precast NEXT beams. Additionally, box beam bridges require transverse post-tensioning to ensure sufficient load sharing between adjacent beams. Because there are more superstructure units, there is greater flexibility in bridge width if phased construction is used, however for construction cost, schedule, and safety reasons phased construction is not desirable at this location. Additionally, the superstructure depth is approximately 6 inches less than that of the NEXT beam alternative, which allows for greater hydraulic efficiency. The channel embankments at the bridge will be armored with stone fill.

Advantages of Alternative C

- Rapid construction and short construction duration
- Low construction cost
- Low future maintenance costs

- Shallow overall structure depth
- Conducive to phased construction for this bridge width (not recommended for this location)

Disadvantages of Alternative C

- Requires weekend bridge closure for superstructure replacement
- Greater number of required precast superstructure units
- Transverse post-tensioning required

Maintenance of Highway Traffic during Construction

An offline temporary single lane bridge with alternating one-way traffic is a viable option. However, utilizing a temporary bridge will increase the project cost, extend the construction duration, require temporary easements, and decrease safety for the traveling public. Another option for maintaining one-way alternating traffic is phased construction. Phased construction however has the same drawbacks as the temporary bridge option. An increase in project cost, an extension of the construction duration, and a decrease in safety for the traveling public as well as for the contractor. Therefore as discussed in both Alternative B and Alternative C above the preferred method of maintaining traffic during construction is to utilize single lane daytime closures with an extended (6 PM Friday to 6 AM Monday) weekend closure. Flaggers would be used for the single lane daytime closures and a detour would be required for the extended weekend roadway closure. As there are no local detours the detour would require traffic to continue north on VT 100 or US 7 and head west or east on VT 125. The approximate detour length would be 34 miles. The distance between Rochester and Brandon on VT 73 is 17 miles.

Evaluation Matrix - Rochester VT 73 Bridge No. 16 over Corporation Brook				
Scoping Report		**Alternative A**	**Alternative B**	**Alternative C**
		Do Nothing	Precast PreStressed Concrete Next Beam Bridge	Precast Prestressed Concrete Slab Bridge
Cost	Roadway Improvements	$0.00	$300,000.00	$300,000.00
	Bridge Improvements	$0.00	$700,000.00	$700,000.00
	Construction Engineering	$0.00	$200,000.00	$200,000.00
	Right-of-Way Acquisition	$0.00	$50,000.00	$50,000.00
	Preliminary Engineering	$40,000.00	$40,000.00	$40,000.00
	SUBTOTAL:	$40,000.00	$1,290,000.00	$1,290,000.00
	TOTAL:	**$40,000.00**	**$1,300,000.00**	**$1,300,000.00**
Engineering	Typical Section Roadway	No Change	3-11-11-3	3-11-11-3
	Typical Section Bridge	No Change	3-11-11-3	3-11-11-3
	Traffic Safety	No Change	Enhancement	Enhancement
	Alignment Change	No Change	No Change	No Change
	Hydraulic Performance	No Change	Enhancement	Enhancement
	Utility	No Change	No Change	No Change
Impacts	Agricultural Lands	No	Yes	Yes
	Archaeological	No	No	No
	Historic Structures, Sites and Districts	No	Yes	Yes
	Hazardous Materials	No	No	No
	Floodplain	No	Yes	Yes
	Fish & Wildlife	No	No	No
	Rare, Threatened & Endangered Species	No	No	No
	Public Lands	No	No	No
	LWCF	No	No	No
	Wetlands	No	No	No
Local and Regional Issues	Concerns	Not Met	Satisfied	Satisfied
	Community Character	No Change	No Change	No Change
	Economic Impacts	No Change	Unknown	Unknown
	Satisfies Project Need	No	Yes	Yes
Permits	Act 250 Amendment	No	No	No
	401 Water Quality	No	Yes	Yes
	404 ACOE Permit	No	Yes	Yes
	Stream Alteration Coordination	No	Yes	Yes
	Vermont Wetlands Permit	No	No	No
	Stormwater Discharge	No	No	No
	Lakes and Ponds	No	No	No
	Endangered and Threatened Species Taking	No	No	No
	Construction Stormwater Discharge	No	No	No
	SHPO	No	Yes	Yes
Other	Land Acquisition	No	No	No

Figure 2 – Evaluation Matrix

Recommendations

Alternative B – Precast Prestressed Concrete NEXT Beam Bridge with integral abutments and rock anchors is the recommended alternative, primarily because it provides a low construction cost, allows the bridge to be replaced quickly, thereby minimizing disturbance to the traveling public, and is simple to construct.

Appendix

APPENDIX A

PROJECT PHOTOGRAPHS

Looking East on VT 73

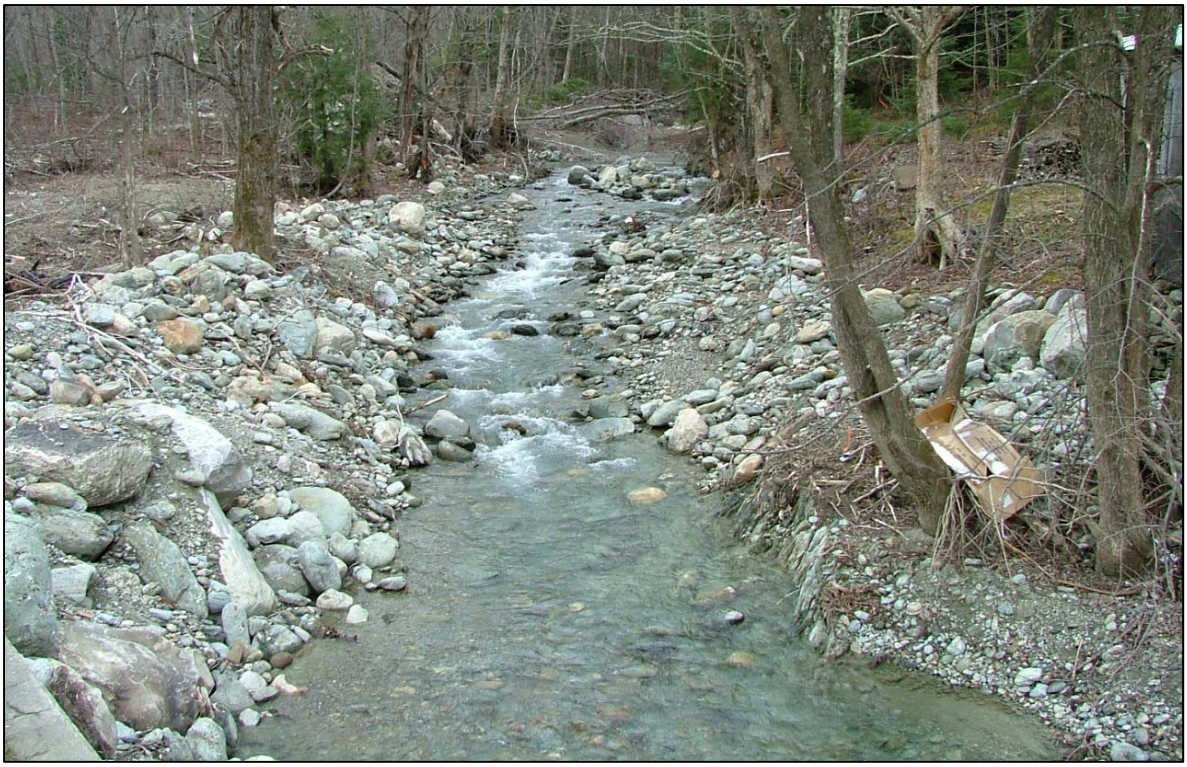
Looking West on VT 73

Drive on Northeast Corner of Bridge

Drive on Southwest Corner of Bridge

North Elevation of Bridge No. 16

Concrete T-Beams and Underside of Deck



Looking Upstream

Looking Downstream

APPENDIX B

STRUCTURE INSPECTION, INVENTORY AND APPRAISAL SHEET

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

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

Inspection Report for ROCHESTER **bridge no.:** 00016 **District:** 4

Located on: VT 00073 ML **over** CORPORATION BROO **approximately** 2.5 MI W JCT. VT.100 **Owner:** 01 STATE-OWNED

CONDITION

Deck Rating: 6 SATISFACTORY

Superstructure Rating: 5 FAIR

Substructure Rating: 7 GOOD

Channel Rating: 5 FAIR

Culvert Rating: N NOT APPLICABLE

Federal Str. Number: 200162001614152

Federal Sufficiency Rating: 64.1

Deficiency Status of Structure: FD

AGE and SERVICE

Year Built: 1929 **Year Reconstructed:** 0000

Service On: 1 HIGHWAY

Service Under: 5 WATERWAY

Lanes On the Structure: 02

Lanes Under the Structure: 00

Bypass, Detour Length (miles): 19

ADT: 001300 **% Truck ADT:** 06

Year of ADT: 1998

GEOMETRIC DATA

Length of Maximum Span (ft): 0025

Structure Length (ft): 000028

Lt Curb/Sidewalk Width (ft): 0.5

Rt Curb/Sidewalk Width (ft): 0.5

Bridge Rdwy Width Curb-to-Curb (ft): 20.1

Deck Width Out-to-Out (ft): 23.5

Appr. Roadway Width (ft): 022

Skew: 15

Bridge Median: 0 NO MEDIAN

Min Vertical Clr Over (ft): 99 FT 99 IN

Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD

Min Vertical Underclr (ft): 00 FT 00 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: CONCRETE T-BEAM

Number of Approach Spans: 0000 **Number of Main Spans:** 001

Kind of Material and/or Design: 1 CONCRETE

Deck Structure Type: 1 CONCRETE CIP

Type of Wearing Surface: 6 BITUMINOUS

Type of Membrane: 0 NONE

Deck Protection: 0 NONE

APPRAISAL *AS COMPARED TO FEDERAL STANDARDS

Bridge Railings: 0 DOES NOT MEET CURRENT STANDARD

Transitions: 0 DOES NOT MEET CURRENT STANDARD

Approach Guardrail: 0 DOES NOT MEET CURRENT STANDARD

Approach Guardrail Ends: 0 DOES NOT MEET CURRENT STANDARD

Structural Evaluation: 5 BETTER THAN MINIMUM TOLERABLE CRITERIA

Deck Geometry: 2 INTOLERABLE, REPLACEMENT NEEDED

Underclearances Vertical and Horizontal: N NOT APPLICABLE

Waterway Adequacy: 6 OCCASIONAL OVERTOPPING OF ROADWAY WITH INSIGNIFICANT TRAFFIC DELAYS

Approach Roadway Alignment: 8 EQUAL TO DESIRABLE CRITERIA

Scour Critical Bridges: 3 SCOUR CRITICAL

DESIGN VEHICLE, RATING, and POSTING

Load Rating Method (Inv): 2 ALLOWABLE STRESS (AS)

Posting Status: A OPEN, NO RESTRICTION

Bridge Posting: 5 NO POSTING REQUIRED

Load Posting: 10 NO LOAD POSTING SIGNS ARE NEEDED

Posted Vehicle: POSTING NOT REQUIRED

Posted Weight (tons):

Design Load: 2 H 15

INSPECTION and CROSS REFERENCE

X-Ref. Route:

Insp. Date: 062011 **Insp. Freq. (months)** 24 **X-Ref. BrNum:**

INSPECTION SUMMARY and NEEDS

09/06/2011 - Irene note: Bridge open. Bridge fine. Minor erosion behind southeastern wing wall. ~ MJ/DK

06/20/2011 & 11/22/2011 The right beam rail of approach No.2 is in need of repairs. T-beams will need full replacement some future time. 11/22/2011 The channel rating is raised due to work done on the waterway after Tropical Storm Irene. PLB

06/11/2009 The overall condition of this bridge is less than satisfactory, due to progressive deterioration of the T-beams and slow ongoing deterioration of the deck soffit area. PLB

APPENDIX C

WATERS IDENTIFICATION AND REGULATORY DISCUSSION TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM
Rochester BRF 0162(17)
Rochester, Vermont

Proposed Bridge Replacement

Town of Rochester Bridge No. 16, Route 73, Over Corporation Brook,
Rochester, Vermont

Date: Draft: March 6, 2012
Re: Waters Identification and Regulatory Discussion

INTRODUCTION:
Vanasse Hangen Brustlin, Inc. (VHB) performed stream Top-of-Slope and Ordinary High Water delineations in support of Bridge No. 16 replacement on Vermont Route 73 (Project), near the intersection of Corporation Road and Vermont 73 in Rochester, Vermont. The location currently consists of a single span concrete T-beam bridge, with concrete abutments. This technical memorandum describes the applicable Vermont and Federal regulatory programs for the stream resources investigated, site characteristics, study methods, and resource determinations conducted for the investigation area. Additional Natural Resource work was previously conducted by VTRANS in June, 2011. Included in the Attachment are the Waters Delineation and Natural Resources Map, Watershed Sizes Map, and Waters Delineation Representative Photographs.

The study for the site included both database review as well as a field investigation, and is intended to include an evaluation of the following resources:

Waters (*Vermont Title 19 Stream Alteration Review, Vermont Stream Obstruction Review, USACE Section 404, Section 10 of the Rivers and Harbors Act, VT DEC Section 401 Water Quality Certification Review, Federal Emergency Management Agency (FEMA) Special Flood Hazard Areas/National Flood Insurance Program (NFIP), and Essential Fish Habitat (EFH)*)
Currently, non-exempt work within a perennial stream often requires a Stream Alteration Permit (SAP) from the VT DEC, which is reviewed under 19 VSA Section 10 (12) for VTrans Projects (VT DEC 2011). In-stream work may also require stream obstruction review by a Vermont Agency of Natural Resources (ANR) fisheries biologist[1]. The Section 404 regulatory program, administered by the USACE, regulates the placement of fill within jurisdictional waters of the United States; unavoidable impacts resulting from Project activities may require authorization under Sections 404 and/or 401 of the Clean Water Act. Additionally, work in or over designated navigable waters may require approval under Section 10 of the Rivers and Harbors Act[2]. As part of a Permit screening process, USACE will coordinate with National Marine Fisheries Service (NMFS) to determine EFH protective measures. Work within designated FEMA Special Flood Hazard Areas may require approval by VT DEC Rivers Management Program under NFIP regulations (VT ANR 2007).

SITE DESCRIPTION:
Town of Rochester Bridge 16 on Route 73 is located near the intersection of Corporation Road and Route 73 and is located in a rural area (43°50′54.39"N, 72°50′58.67"W) with scattered residential development (see Attachment, page 1, Waters Delineation and Natural Resources Map). The study site is within Windsor County, in the Town of Rochester, Vermont and located in the White River Sub-basin, Vermont. (HUC 8: 01080105). The investigation concentrated on an approximately one acre around the bridge that would likely be needed for replacement construction activities. The investigation area occurs at approximately 950 feet above sea level and the soil types within the investigation area are composed of Colton fine sandy loam (8-15 percent slopes and 3-8 percent

[1] Stream Obstruction Vermont law (10 V.S.A. § 4607) prohibits the installation of a structure that prevents fish movement, such as a rack, weir or other obstruction, unless an approval has been granted by the Commissioner of Fish and Wildlife.
[2] Section 10 of the Rivers and Harbors Appropriation Act of 1899. (33 U.S.C. 403. Construction of bridges, overhead lines, causeways, dams or dikes generally)

slopes). Corporation Brook has bank slumping due to flooding related to the late August 2011 Tropical Storm Irene. The existing bridge does not align well with channel width and the abutment has signs of scouring, therefore it is deemed necessary for replacement.

ASSESSMENT METHODOLOGIES:

Waters

VHB Environmental Scientists Chelsea Martin and Nicholas Sibley conducted the waters delineation on February 7, 2012. Ordinary High Water (OHW) width and Top of Bank (TOS) was flagged in the field using guidance provided in the USACE "Regulatory Guidance Letter: Subject- Ordinary High Water Identification" (USACE 2005). Streams are also flagged according to the Agency of Natural Resources (ANR) Riparian Buffer Guidance (ANR 2005). Stream Top-of-Bank is flagged using orange survey tape and labeled "TOS" and includes the stream ID and flag number (e.g., VHB 2012-TOS-1a-1). OHW limits in the investigation area are marked with blue flagging tape and labeled by stream ID and flag number (e.g., VHB 2012-OHW-1a-1). Stream flow regimes are typically preliminarily classified as ephemeral, intermittent, or perennial and are determined based on qualitative observations of instream hydrology indicators at the time of observation, as well as geomorphic characteristics.

FEMA floodway data was obtained from the Vermont Center for Geographic Information (VCGI) (2010) and included on the Waters Delineation and Natural Resources Map (page 1, of the Attachment). Stream drainage areas were obtained using VT DEC Watershed Sizes Maps (VT DEC 2011) and the U.S. Geological Survey (USGS) website Stream Stats (USGS 2012). The bank full width was calculated by inputting the approximate drainage area into the Vermont Regional Hydraulic Geometry Curve (VT DEC 2006).

FEMA floodway data was received from Vermont Center for Geographic Information (VCGI) (2010) and included on the Waters Delineation and Natural Resources Map (page 1, of the Attachment). VHB also reviewed the USACE list of navigable waters in New England to determine if Brandon Brook is considered a Section 10 navigable water (USACE 2007).

EFH locations were reviewed to determine if NMFS has declared the bridge site portion of Brandon Brook to be EFH (USACE 2007).

VHB located stream delineation flags in the field using a Trimble® GPS unit capable of sub-meter accuracy. Data was post-processed using Trimble® Pathfinder software for enhanced accuracy.

RESULTS:

Waters

VHB delineated one perennial stream feature, Corporation Brook, within the investigation area. Stream features are shown on the Waters Delineation and Natural Resources Map (Page 1 of the Attachment). The OHW and TOS of Corporation Brook were delineated using the methodologies described above and are identified in the field as 2012-TOS-1 and 2012-OHW-1. Corporation Brook crosses Vermont 73 and flows into the White River approximately 780 feet downstream of the investigation area. The substrate of Corporation Brook is large boulder and cobble material. Corporation Brook has an OHW range of approximately 15 to 33 feet within the investigation area. (See photos of stream features on page 3 of the Attachment).

Corporation Brook is considered a Class B water under the Vermont Water Quality Standards (NRB 2008). According to the VT DEC Watershed Sizes Map (page 2, in the Attachment) the drainage area for Corporation Brook is 1-10 square miles at the bridge site (approximately 6 square miles according to stream stats). Based on the calculated drainage area using the Vermont Regional Hydraulic Geometry Curve, the bank full width of Corporation Brook at the Project site would be 28.7 feet (VT DEC 2006).

The investigation area is located within a FEMA Special Flood Hazard Area (see Waters Delineation Map, page 1 in the Attachment). Corporation Brook is not considered a navigable water and also not considered EFH by the NMFS (USACE 2007).

REGULATORY DISCUSSION:

The following is a brief discussion of the most pertinent regulatory programs that may be applicable to this review and also provides VHB's recommendations to coordinate under the specific program requirements:

Vermont Stream Alteration Permit

Any work within a perennial stream will require Stream Alteration Consultation under Title 19 review for VTrans projects. The Corporation Brook watercourse has a drainage area mapped less than 10 square miles therefore Title 19 review following the requirements of a Stream Alteration General Permit may be required.
VHB recommends initial coordination with the Vermont River Management Engineer (Patrick Ross) to identify if the Project is exempt from Stream Obstruction review. Equilibrium conditions of Brandon Brook should be maintained if the Project can maximize adherence with the equilibrium standard.

Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act

The USACE regulates the placement of fill material into U.S. waterways and their tributaries including adjacent wetlands under Section 404 of the Clean Water Act. As a waterway crossing activity under Appendix A.I (c), the project will likely qualify for a General Permit under Category 1, if certain conditions can be met. If the conditions of Category 1 cannot be met, the Project may be considered for a Category 2 General Permit or Individual Permit (USACE 2007).

Section 401 of the Clean Water Act

If the Project requires a Section 404 permit for impacts to jurisdictional waters of the United States, then a Section 401 Water Quality Certification from the VT DEC would be required. If a Department of the Army Vermont General Permit is applicable then a General 401 Water Quality Certification is included. If a USACE Individual Permit is necessary then an Individual 401 Water Quality Certification would be required.

National Flood Insurance Program (NFIP)

A flood hazard area permit may be required as the Project occurs within a Special Flood Hazard Area. These permits are reviewed by Vermont ANR to ensure compliance with NFIP minimum standards (VT ANR 2007). To determine NFIP requirements, coordination with the Vermont ANR Rivers Management Program is recommended.

REFERENCES

U.S. Army Corps of Engineers (USACE). 2005. "Regulatory Guidance Letter. Subject: Ordinary High Water Mark Identification." No. 05-05. Available online at: http://www.usace.army.mil/cw/cecwo/reg/rglsindx.htm

U.S. Army Corps of Engineers (USACE). 2007. Department of the Army General Permit State of Vermont. Effective December 5, 2007. Available online at http://www.nae.usace.army.mil/Regulatory/SGP/VT_PGP.pdf

U.S. Geological Survey (USGS). 2012. Vermont Stream Stats Basing Characteristic Report. Available online at http://streamstatsags.cr.usgs.gov/vt_ss/default.aspx?stabbr=vt&dt=1329238683658

Vermont Agency of Natural Resources (VT ANR). 2005. Riparian Buffer Guidance: December 9, 2005. Available online at http://www.state.vt.us/site/ht ml/buff/ anrbuffer2005.htm

Vermont Agency of Natural Resources (VT ANR). 2007. Flood Hazard Area Permit: December 27, 2007. Available online at http://www.anr.state.vt.us/dec/permit_hb/sheet32_3.pdf

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Vermont Department of Environmental Conservation (VT DEC). 2006. The Vermont Regional Hydraulic Geometry Curves.
Available online at: http://www.anr.state.vt.us/dec/waterq/rivers/docs/rv_hydraulicgeocurves.pdf

Vermont Department of Environmental Conservation (VT DEC). 2011. The Vermont Stream Alteration regulatory program guidelines and watershed size maps can be found at http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_management.htm

Vermont Natural Resources Board (NRB). 2008. Vermont Water Quality Standards (Vt. Code R 12 004 052), Effective January 1, 2008.

Attachments:

- Waters Delineation and Natural Resources Map
- Rochester Watershed Sizes Map
- Waters Delineation Representative Photographs

Rochester BRF 0162(17)
Waters Delineation and Natural Resources Map
VT 73 over Corporation Brook
Bridge 16
Rochester, Vermont

March 06, 2012

100 50 0 100
Feet

Legend

- VHB Investigation Area
- VHB Ordinary High Water
- VHB Stream Top of Slope
- VHD Stream (08)
- 100 Year Floodzone
- VSWI Wetland
- Hydric Soils
- Prime Agricultural Soils
- Deer Wintering Habitat (VT ANR)
- RTE Species/ Communities (NHIP)
- County Boundary
- Town Boundary
- Roads (VTRANS)
- 50' Contours
- Direction of Stream Flow

N

Vanasse Hangen Brustlin, Inc.

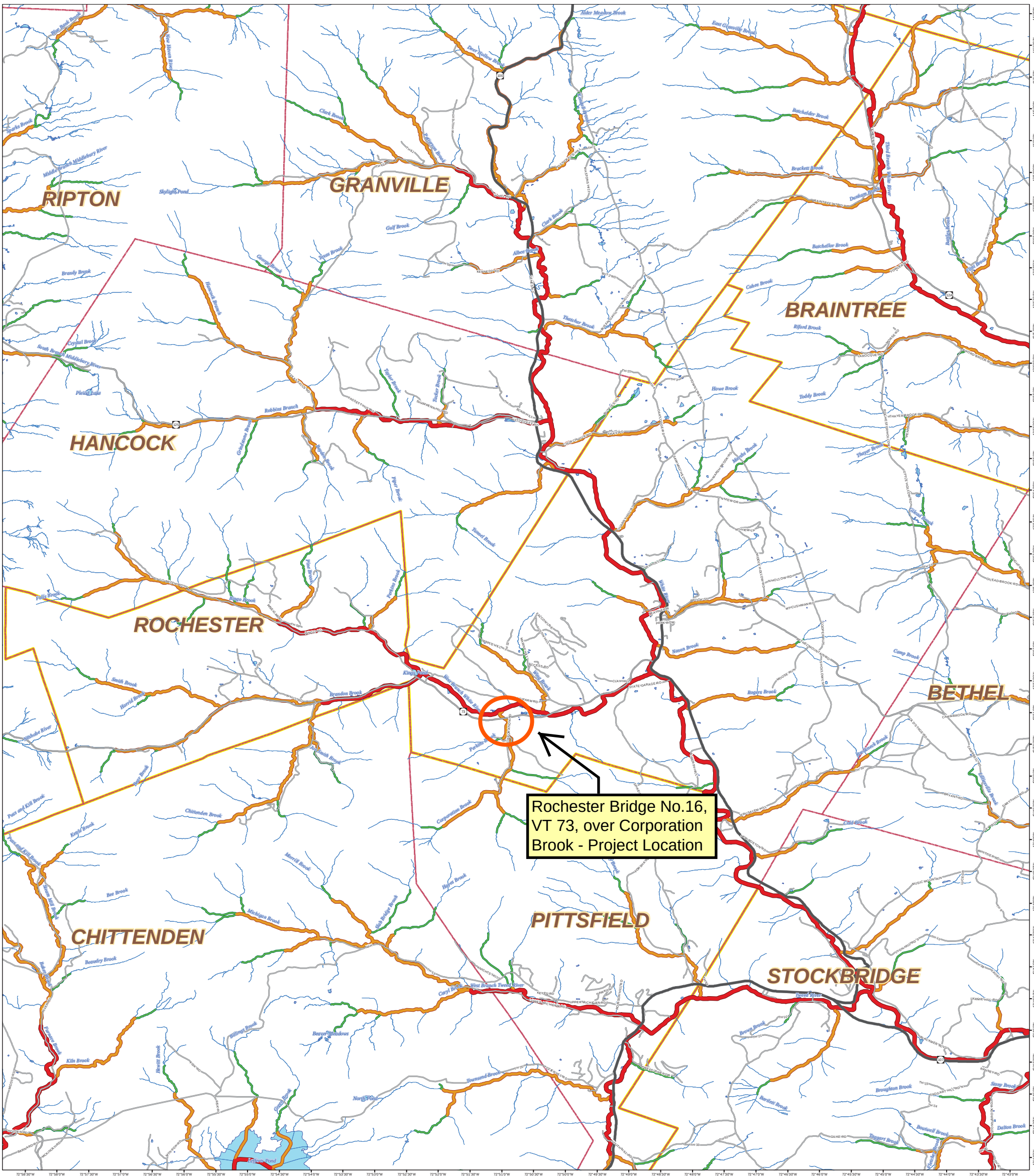
Sources: BING Maps Aerial (2011); VHD Streams, Flood data, Contours, Town and County Boundaries, HydricSoils and Roads from VCGI (2010); VSWI Features by ANR (2011); VHB Investigation Area and TOS by VHB (2012)

Prepared by: NSibley

Path: F:\57527.00\GIS\Project\RochesterWetland_fieldmap_Bridge16.mxd

Watershed Sizes Used as Guidance in Stream Alteration Regulations

ROCHESTER



Map Disclaimer

This map represents guidance on watershed sizes using data and methods that have a certain amount of error associated with them. The accuracy of watershed sizing maps using the Vermont Hydrography Data Set and produced with computer automated methods may be exceeded by other methods using more accurate data. The regulated public may request River Management Program (RMP) approval, or the RMP may decide, to use watershed sizes based on more accurate methods and data.

0 0.45 0.9 1.8 2.7 3.6 Miles

Map Description

This map product indicates the reaches of stream and river in a given town that would be at or below the 0.5, 1.0, and 10.0 square mile watershed thresholds used for jurisdictional determinations under the Vermont ANR Stream Alteration Regulatory Program.

RMP contacts and information about the Stream Alteration GP may be obtained at: http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_management.htm

Map Created by, Erik Engstrom. ANR GIS. April 1st, 2011.

LEGEND

Roads
- Principal Arterial
- Minor Arterial
- Urban
- Rural
- Local

Drainage Area
- >10 Square Miles
- 1 - 10 Square Miles
- .5 - 1 Square Mile
- <.5 Square Mile
- Lake/Pond

- VT Town Boundaries
- VT County Boundary

N

Rochester BHF 0162(17)
Town of Rochester Bridge No. 16, VT 73, over Corporation Brook
Rochester, Vermont
Waters Delineation Representative Photographs

Photograph 1. View looking upstream on Corporation Brook to Bridge 16

Photograph 2. View looking downstream Corporation Brook from Right Bank descending

Photograph 3. View of Corporation Brook and Bridge No. 16 concrete span and abutments

Photograph 4. Looking upstream outside investigation area at debris and bank slumping along Corporation Brook

Photograph 5. View of Corporation Brook looking upstream of Bridge No. 16

Photograph 6. View looking downstream at Bridge 16 and VT-73 ROW

Photograph taken by VHB Environmental Scientist Chelsea Martin on February 7 and 9, 2012

APPENDIX D

NATURAL RESOURCES IDENTIFICATION MEMORANDUM

OFFICE MEMORANDUM

AOT - PROGRAM DEVELOPMENT DIVISION

RESOURCE IDENTIFICATION COMPLETION MEMO

TO: Chris Williams, Project Manager
FROM: James Brady, Environmental Specialist
DATE: 08/23/2011

Project: Rochester BHF 0162(17)

ENVIRONMENTAL RESOURCES:

Wetlands:	____	Yes	X	No	See – RochesterBHF0162(17)-NR.pdf
Historic/Historic District:	X	Yes	____	No	See – RochesterBHF0162(17)-Historic.pdf & RochesterBHF0162(16)-Historic_Memo.pdf
Archaeological Site:	____	Yes	X	No	RochesterBHF0162(17)-ARA-ONLY.pdf
4(f) Property:	X	Yes	____	No	See – RochesterBHF0162(17)-Historic.pdf & RochesterBHF0162(16)-Historic_Memo.pdf
6(f) Property:	____	Yes	X	No	See – RochesterBHF0162(17)-Wildlife-ConservedLand.pdf
Agricultural Land:	X	Yes	____	No	See – RochesterBHF0162(17)-NR.pdf
Fish & Wildlife Habitat:	____	Yes	X	No	See – RochesterBHF0162(17)-NR.pdf
Floodplains:	X	Yes	____	No	FEMA Map is informational only, do not draw, use hydraulics report
Endangered Species:	____	Yes	X	No	See – RochesterBHF0162(17)-NR.pdf
Hazardous Waste:	____	Yes	X	No	See – RochesterBHF0162(17)-HazardousWaste.pdf
Stormwater:	____	Yes	X	No	See – RochesterBHF0162(17)-SW.pdf
USDA-Forest Service Lands:	____	Yes	X	No	See – RochesterBHF0162(17)-Wildlife-ConservedLand.pdf
Wildlife Habitat Connectivity:	X	Yes	____	No	See – RochesterBHF0162(17)-Wildlife-ConservedLand.pdf
Scenic Highway/ Byway:	____	Yes	X	No	N/A
Act 250 Permits:	____	Yes	____	No	Unknown: If fee simple more investigation may be required

If you have any questions or need additional information please let me know.
Thanks,

James
cc:
Chris Williams, PM
Project File

State of Vermont
Program Development Division
One National Life Drive
Montpelier, VT 05633-5001
www.aot.state.vt.us

[phone] 802-828-3979
[fax] 802-828-2334
[ttd] 800-253-0191

Agency of Transportation

Memorandum

To: James Brady, VTrans Environmental Specialist

From: Glenn Gingras, VTrans Environmental Biologist

Date: 6/30/11

Subject: **Rochester BRF 0162(17)**
Natural Resource Identification

I have identified resources for the above mentioned project. I have reviewed existing mapped environmental mapping and I performed a field visit.

The above referenced project is located on VT 73, Bridge #16 over the Corporation Brook in the town of Rochester.

Wetlands/Watercourses:
No wetlands exist within the project area. Corporation Brook, a tributary of the West Branch of the White River is regulated by the US COE and the River Management Division of ANR. This brook flows southerly through the project area.

Rare, Threatened and Endangered (R/T/E) Species:
No R/T/E species are mapped within the project area.

Agricultural Soils:
All the soils within the project area are considered statewide significant.

Fish and Wildlife Habitat:
Corporation Brook would support a variety of aquatic organisms. As this is a bridge project aquatic organism passage is not an issue.

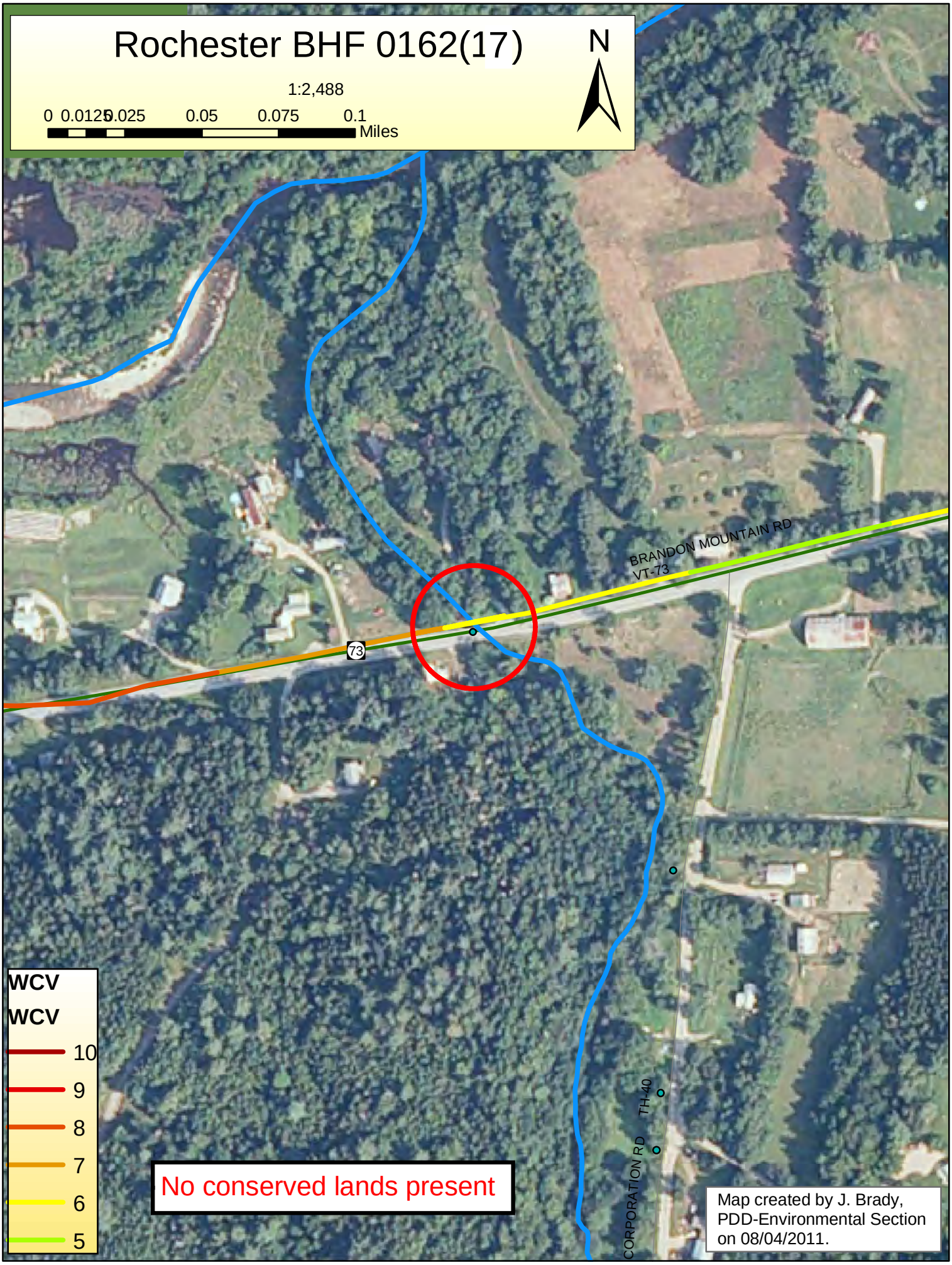
Temporary Bridge Options:
A temporary bridge on either side of the existing structure would be ok for natural resources.

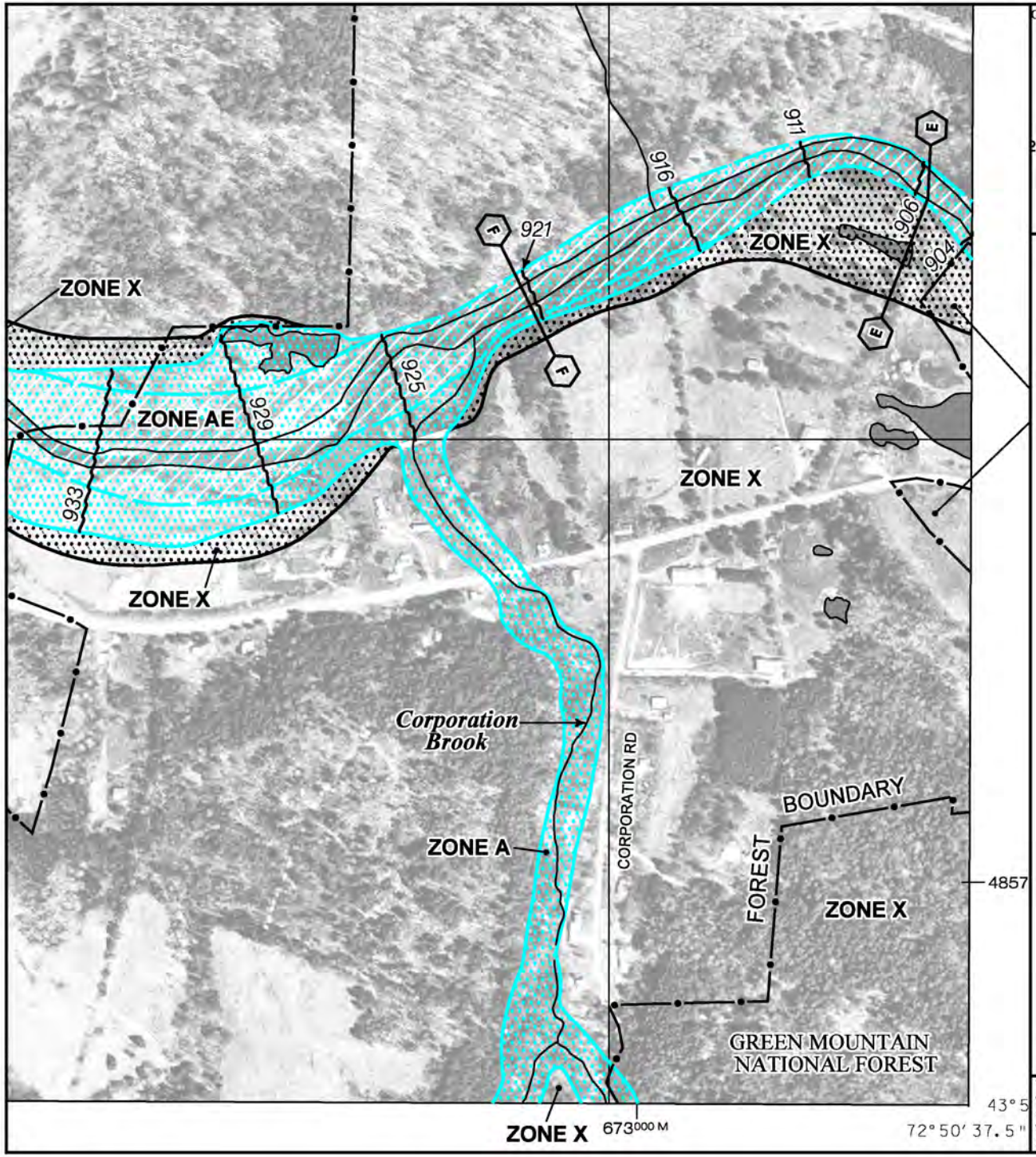
If you have any questions, please feel free to contact me.

Cc

Chris Williams, VTrans Project Manager
Natural Resource Environmental File

Z:\PDD\EnvironmentalHydraulics\GlennGingras\Windsor County\Rochester BRF 0162(17)\nrid_rochester17_63011.docx


Rochester BHF 0162(17)
N
1:2,488
0 0.0125 0.025 0.05 0.075 0.1
Miles
BRANDON MOUNTAIN RD
VT-73
73
TH-40
CORPORATION RD
WCV
WCV
10
9
8
7
6
5
No conserved lands present
Map created by J. Brady,
PDD-Environmental Section
on 08/04/2011.



onal Flood Insurance Program at 1–800–638–6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0126E

FIRM

FLOOD INSURANCE RATE MAP

WINDSOR COUNTY
VERMONT
(ALL JURISDICTIONS)

PANEL 126 OF 831

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ROCHESTER, TOWN OF	500299	0126	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
50027C0126E

EFFECTIVE DATE
SEPTEMBER 28, 2007

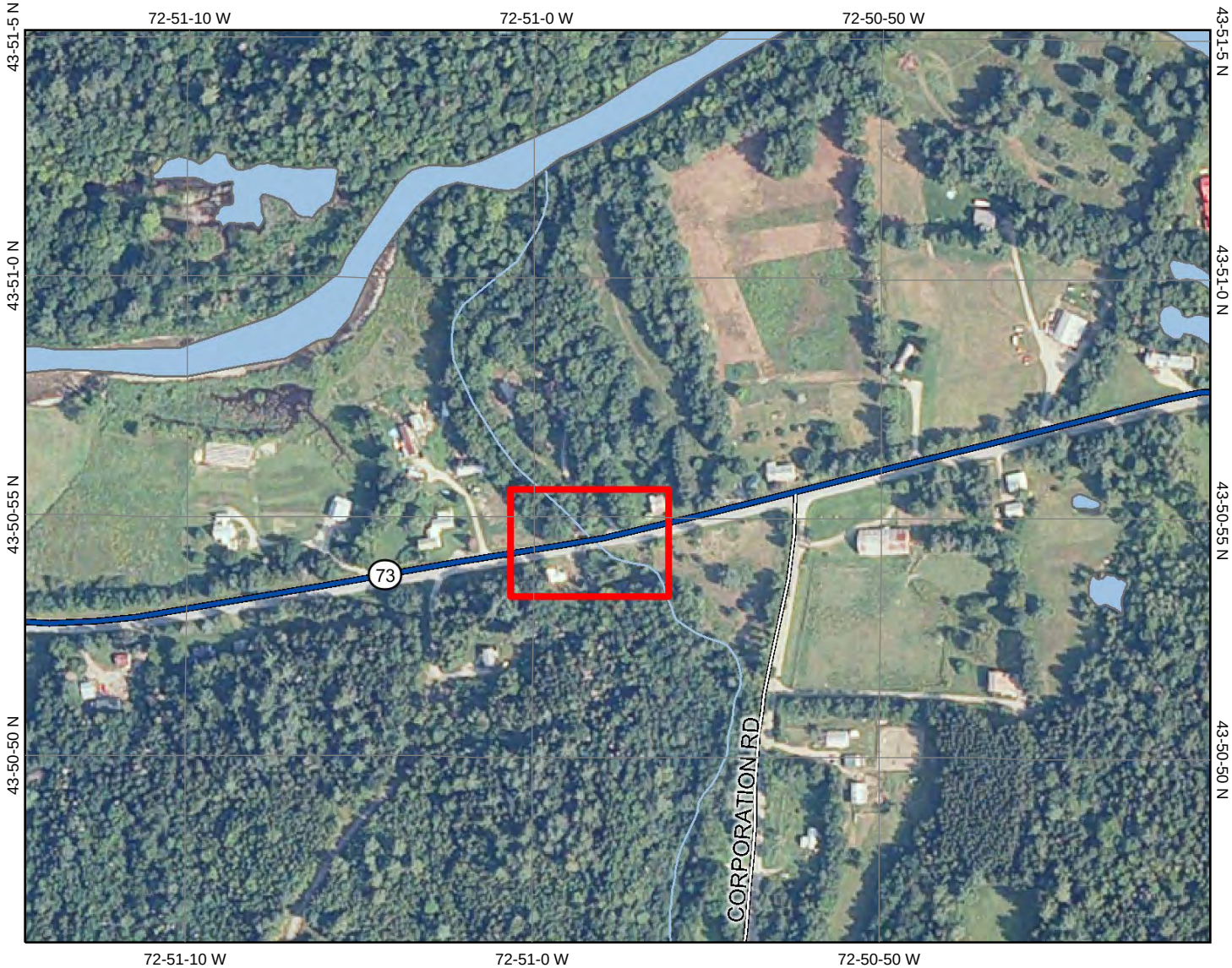
Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

ANR Environmental Interest Locator

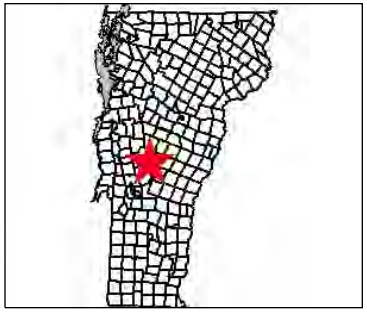
Vermont Agency of Natural Resources (ANR)

Rochester BHF 0162(17)



0 400 800 1200 ft.

Map center: 471912, 149900



Legend

- Brownfields
- ACT250 PERMITS
- Hazardous Waste Site
- Hazardous Waste Site Generator
- Underground Storage Tank

Roads

- US Highway
- Vermont State Highway
- Class One
- Class Two
- Legal Trail
- Emergency U-Turn Area
- Proposed Class Two
- Proposed Class Three
- Proposed Vermont State Highway
- Proposed US Highway
- Proposed Interstate
- Discontinued
- Interstate
- Class Three
- Class Four
- State/National Forest Highway
- Military Road (No Public Access)
- Private Road
- Hydrography Lakes and Ponds (VHD 5k)
- Hydrography (VHD 5k)
- VT County Boundary
- VT Town Boundaries (No Fill)
- NAIP Color Orthophotos 2009
- VT State Boundary (Fill)

VT State Plane Meters (NAD83)

N

Scale: 1:4,112

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. VCGI 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.

URL: http://maps.vermont.gov/imf/sites/ANR_NATRESViewer/jsp/launch.jsp

8/4/11

Brady, James

From: Armstrong, Jon
Sent: Monday, July 25, 2011 1:05 PM
To: Brady, James
Subject: RE: Rochester BHF 0162(17) Resource ID & Plot

James,
I have nothing to add related to stormwater. I do not anticipate the need for an operational stormwater discharge permit for this project at this time (for NEPA) but will need to confirm when more information becomes available.

Thanks,
Jon

Jonathan B. Armstrong, PE
VTrans Stormwater Management Engineer
(802) 828-1332

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·.¸.,..·´`·.. ><((((º>`·.¸¸.·´`·.¸.·´¯`·...><((((º>
```

From: Brady, James
Sent: Thursday, July 21, 2011 4:48 PM
To: Russell, Jeannine; Armstrong, Jon; Gingras, Glenn; Newman, Scott
Cc: Williams, Chris
Subject: Rochester BHF 0162(17) Resource ID & Plot

Hello All,

Linked below is a location map and area layout for the Rochester BHF 0162(17) bridge project. Please identify and plot any resources present. If there aren't any resources present, please feel free to issue a Resource Clearance for the CE as well.

There may be efficiency in combining this resource ID request with the request for Rochester BRF0162(16) that was made on 6/30/11 since these projects are close together.

Location Map, Project Area and Resource ID & Plot Memo are located in the following folder:
Z:\PDD\EnvironmentalHydraulics\SWRegion\ProjectsByTown\Rochester\Rochester BHF 0162(17)\ResourceIDandClearances

If you have any questions or need additional information please let me know.
Thanks,

James Brady
Environmental Specialist
Vermont Agency of Transportation
1 National Life Drive
Montpelier, VT 05633-5001
(802) 828-3978

APPENDIX E

ARCHAEOLOGICAL RESOURCE ASSESSMENT AND HISTORIC RESOURCE IDENTIFICATION MEMORANDUM

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

FROM: Jeannine Russell, VTrans Archaeology Officer
DATE: **7/25/2011**
SUBJECT: **ARCHAEOLOGICAL RESOURCE ASSESSMENT ONLY. NOT A CLEARANCE.**
Field Visit: YES ☒ **NO** ☐

Project Name: Rochester Bridge 16 Replacement
Project Number: BHF 0162(17)

On 7/25/2011, the VTrans Archaeology Officer reviewed the above project with the Transportation Archaeologist(s) and agreed to the following:

**********Archaeological Resource Assessment**********

☒ That the Archaeological Resource Assessment of the Area of Potential Effect (APE) conducted by **VTrans** ☒, **Consultant** ☐ _____, or **Sub-consultant** ☐ _____ and dated 7/25/2011 is adequate to identify archaeological resources, and **Does** have a CADD map with the archaeological resources on it.
Date ARA was approved 7/25/2011.

☐ **Plans dated** _____ reviewed by **VTrans** ☐, **Consultant** ☐_____or **Sub-consultant** ☐_____.
Recommendations:
☐ Project **CLEARED** as **EXEMPT** (based on the PA 12/28/00).
☐ Project **CLEARED** with avoidance to all archaeologically sensitive areas.
☐ Project **CLEARED** with the following Conditions(See Conditions below)
☐ Recommend more archaeological study - **Phase I**

**********PHASE 1 & Beyond**********

☐ **ARA Proposal received** _____ and **approved** _____.

☐ **The above project is being reviewed at which level: ARA.**
Authorization Date: _____ Consultant Firm _____.
End of field letter/report Date _____.
Determination of Effect: **NO EFFECT**(NE) ☐
CONDITIONAL NO ADVERSE EFFECT ☐(See conditions below)
NO ADVERSE EFFECT(NAE) ☐ **ADVERSE EFFECT**(AE) ☐
Consultant Recommends:_____
Draft Report Received:_____
Comments to Consultant:_____
Final Report Received:_____
Clearance of **Phase I** Date:_____
Phase I Costs: $_____
Number of sites found:_____
Number of National Register(NR) sites:_____
Number of NR sites Mitigated:_____

☒ **Additional comments or conditions that apply to this project.(see page 2 for additional conditions)**

J Russell
_____ 8-8-11
(***Signature of VTrans Archaeology Officer***) (***Date***)

Project: Rochester BHF 0162(17)

Additional Comments from Page 1:

A field visit conducted on 6/17/2011 located no obvious areas of potential archaeological sensitivity directly adjacent to the bridge location. Known sites within the generalized area are confined primarily to house foundations and small-scale industrial mill activity. The location is unlikely to yield undisturbed prehistoric strata.

Brady, James

From: O'Shea, Kaitlin
Sent: Tuesday, August 23, 2011 2:19 PM
To: Brady, James
Cc: Newman, Scott
Subject: Rochester BRF 0162(17)
Attachments: Rochester BRF 0162(17) historic resource id.pdf

James,

I have completed the historic resource ID for Rochester BRF 0162(17) – though NERD says BHF not BRF, fyi.

A copy is attached and I have placed one in the project file folder.

The bridge itself is not considered historic; however, historic properties are adjacent to the project area. Therefore, we will need to know what is planned to replace this bridge. And we will need to know of any takes/easements when available.

Thanks!
Kaitlin

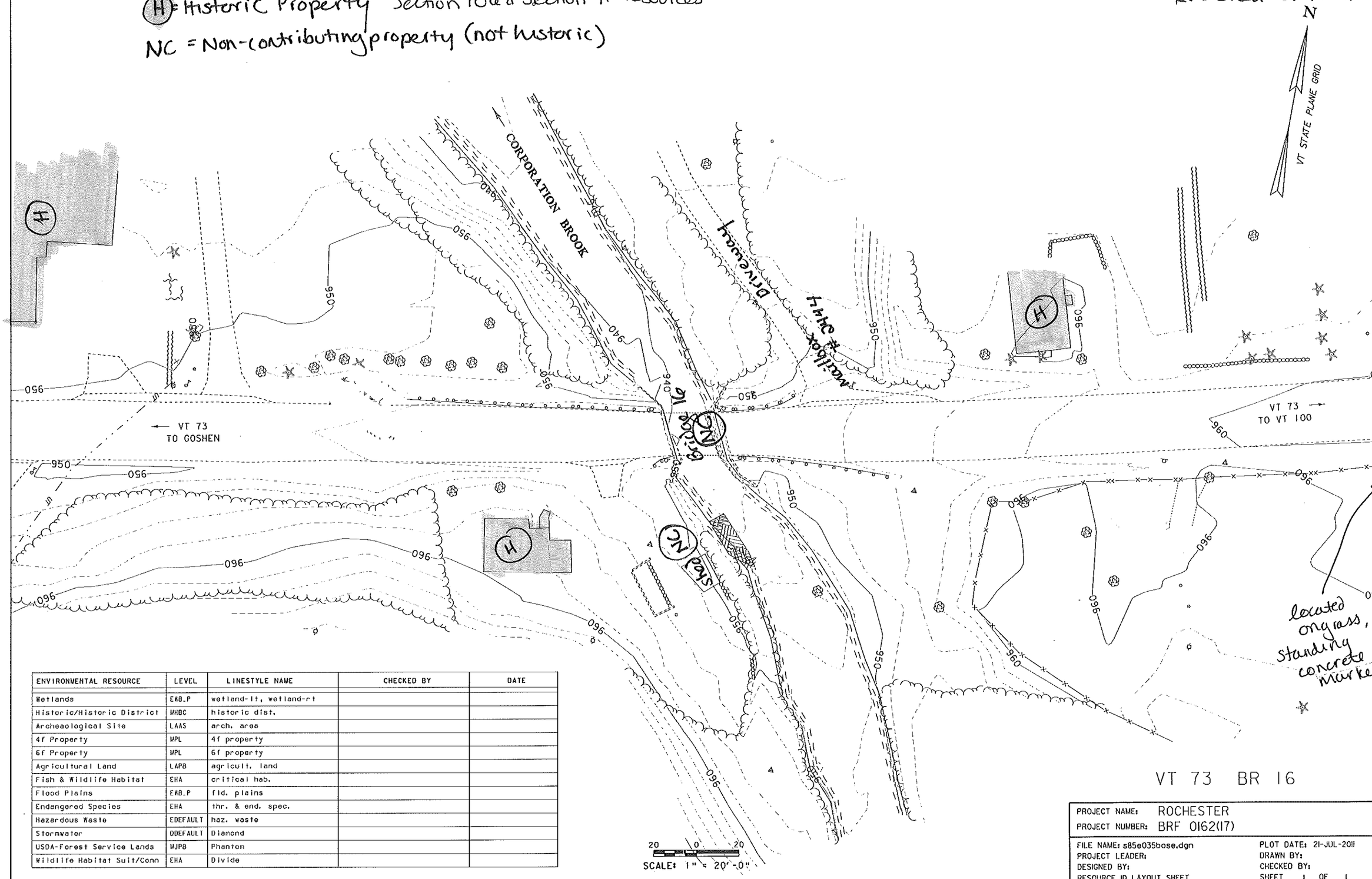
Kaitlin O'Shea
Historic Preservation Specialist
Program Development - Environmental Section
Vermont Agency of Transportation
1 National Life Drive
Montpelier, VT 05633-5001

cell: 802-279-0869
fax: 802-828-2334

Kaitlin.O'Shea@state.vt.us

Historic Resource ID
K. O'Shea 8/8/2011

(H) = Historic Property Section 106 & Section 4f resources
NC = Non-contributing property (not historic)



ENVIRONMENTAL RESOURCE	LEVEL	LINESTYLE NAME	CHECKED BY	DATE
Wetlands	EWB_P	wetland-lt, wetland-rt		
Historic/Historic District	MHBC	historic dist.		
Archeaological Site	LAAS	arch. area		
4f Property	MPL	4f property		
6f Property	MPL	6f property		
Agricultural Land	LAPB	agricult. land		
Fish & Wildlife Habitat	EHA	critical hab.		
Flood Plains	EWB_P	fld. plains		
Endangered Species	EHA	thr. & end. spec.		
Hazardous Waste	EDEFAULT	haz. waste		
Stormwater	ODEFAULT	Diamond		
USDA-Forest Service Lands	MJPB	Phantom		
Wildlife Habitat Suit/Conn	EHA	Divide		

PROJECT NAME: ROCHESTER
PROJECT NUMBER: BRF 0162(17)

FILE NAME: s85e035bose.dgn
PROJECT LEADER:
DESIGNED BY:
RESOURCE ID LAYOUT SHEET

PLOT DATE: 21-JUL-2011
DRAWN BY:
CHECKED BY:
SHEET 1 OF 1

APPENDIX F

PRELIMINARY HYDRAULICS MEMORANDUM

VT AGENCY OF TRANSPORTATION PROGRAM DEVELOPMENT DIVISION

HYDRAULICS UNIT

TO: Chris Williams, Structures Project Manager
Rob Young, Structures Project Engineer

FROM: David Willey, Hydraulics Project Supervisor

DATE: September 1, 2011

SUBJECT: Rochester BRF 0162(17) VT 73 Br. 16 over Corporation Brook

---

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

EXISITNG BRIDGE INFORMATION

The existing bridge was built in 1929, apparently after the previous bridge was damaged in the 1927 flood. Record plans show one abutment of the previous bridge was retained. The bridge is a single span concrete T-beam, with concrete abutments. It has a hydraulic clear span length of about 18' and a clear height of about 9'. The stream is straight through the bridge reach. The bridge constricts the channel width and is not aligned well with the channel. There is scour along the western abutment and the footings are exposed. The bridge is rated Scour Critical.

Our calculations show the existing structure is not adequate hydraulically. Water is up onto the beams below the Q50 and the bridge does not have 1' of vertical clearance above the design Q50, as required to meet the standards. The bridge causes about 4' of backwater at Q100.

RECOMMENDATIONS

Due to the condition of the abutments, the scour concerns and the fact that the existing bridge does not meet the hydraulic standards, complete replacement is recommended. We anticipate a new bridge would be constructed on the existing alignment.

We recommend a new bridge have a 35' minimum clear span, measured perpendicular to the channel. In order to have 1' of freeboard at Q50, as required to meet the standards, the average bottom of beams would need to be above elevation 949.0'. The bridge should be skewed more have the abutments be aligned with the channel. Stone fill slopes in front of the abutments should match the upstream and downstream channel banks. It is always desirable for a new structure of this size to have flared wingwalls at the inlet and outlet, to smoothly transition flow through the structure, and to protect the structure and roadway approaches from erosion. The wingwalls should match into the channel banks. Any new structure should be properly aligned with the channel.

Stone Fill, Type IV should be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet. The stone fill should not constrict the channel or structure opening.

Temporary Bridge

Temporary bridge recommendations will be provided with Final Hydraulics, if it is determined a temporary bridge is needed and when the location and duration of that bridge are determined.

Please contact us if you have any questions or if we may be of further assistance.

DCW
cc: Hydraulics Project File via NJW
Hydraulics Chrono File

Z:\Projects-Engineering\RochesterBRF0162(17)85e035\Hydraulics\PreliminaryHydraulicsAugust2011\MemoPrelHydVT73Br16.docx

ROCHESTER, BRF 0162(17), VT 73 Br. 16 over the CORPORATION BROOK

Preliminary Hydraulics by D.C. Willey, August 2011
CADD Files on M:85e035
NonCADD files on Z drive under project name and number

PROJECT HISTORY and BACKGROUND

The existing bridge was built in 1929, apparently after the previous bridge was damaged in the 1927 flood. Record plans show one abutment of the previous bridge was retained. The stream is relatively straight through the bridge reach. The bridge constricts the channel and is not aligned well with the channel. That has resulted in scour along one abutment. The bridge is rated scour critical.

We did preliminary hydraulics for this bridge in 1986, without survey. Most information from that study has been microfilmed. The existing bridge was said to be 25' x 8' and we recommend a new bridge be no smaller.

This site is in Zone A of the flood insurance study, meaning there is no detailed study for this river. There is a detailed study for West Branch White River, which is about 800' downstream. The Q100 for that river at the confluence is about elevation 925'. That is about 15' lower than the channel at the bridge. So there is no tailwater from the West Branch at this site.

We have been requested to provide preliminary hydraulics. The project is for complete replacement of the existing bridge with a new bridge that will be basically on existing alignment. A temporary bridge may be required.

HYDROLOGY

I used our normal hydrologic methods to determine the following:

D.A. = 6.0 sq. mi.
Q2.33 = 400 cfs
Q10 = 860 cfs
Q25 = 1150 cfs
Q50 = 1400 cfs
Q100 = 1650 cfs
Q500 = 2300 cfs (Based on 1.4 X Q100)

HYDRAULICS

I will use Hydraulics Engineering Center - River Analysis System (HEC-RAS) version 4.1.0 for the hydraulic analysis. Channel section information required in HEC-RAS was taken from CADD - Inroads. CADD files are on the CADD server under the PMS# 85e035 in the Hydraulics directory. I created a channel line down the center of the channel, with station going from upstream to downstream. Inroads channel stationing runs from 3+00 upstream to 6+66 downstream. Sections were cut along that channel line, from left to right facing downstream. Hec-Ras stationing has to run from downstream to upstream, but the sections are supposed to face from left to right facing downstream. So the section orientation is correct, but the stationing had to be revised to go from downstream to upstream.

The most downstream section in HEC-RAS is at hydraulics channel line sta. 6+50 = HEC-RAS river station 650. This point is about 160' downstream of the center of the bridge. Inroads Channel Station 3+00 = Hec-Ras river station 1000 at the upstream limit of the study

With the channel alignment in place, sections were cut upstream and downstream of the subject bridge. A channel section station/offset/elevation report file was created in Inroads. That file was converted to channel sections.xls in Excel, and the information copied from there to HEC-RAS.

Inroads was also utilized to check the profile along VT 73, which was used to build the Hec-Ras roadway and bridge model.

I selected the following critical channel sections to use in HEC-RAS:

Channel station	HEC-RAS river station	Description
6+50	650	downstream limit of the study
5+30	770	use for BRDN
4+95	805	center of bridge
4+50	850	use for BRUP
3+00	1000	upstream limit of study

Some sections had to be extended due to lack of survey. (See the descriptions of channel section modifications on the sections in HEC-RAS.)

Downstream conditions used normal depth with a slope of 0.017'/', based on the slope at the downstream section. Upstream conditions used critical depth.

Existing Bridge HEC RAS Modeling:

Bridge width is 23' measured along the channel and the upstream fascia is approx. 32' from river station 850, making the upstream fascia at RS 818.

The existing bridge has a 20' minimum clear span measured along the roadway at the inlet. This was measured in the field. With the skew, that equals about an 18' clear span perpendicular to the abutments at the inlet. The eastern abutment is an unusual shape as there is an inset just downstream from the inlet. There is also a knee-wall at the bottom on the downstream end and the abutment is battered above that knee-wall. This results in many abutment lines in the survey and makes it difficult to determine or model the exact abutment dimensions. I input a somewhat simplified shape based on the survey and my site visit. Using the channel alignment as a baseline for the Hec-Ras input (station offset data) the following are the positions used for the abutments. Bridge upstream section face of abutments are at -13' and +5', providing an 18' clear span. Bridge downstream section face of abutments are at -6' and +11'at the bottom, providing a 17' clear span at the bottom of abutments. Based on the survey, the top of the right abutment appears to be at +14', providing a 20' clear span at the top. I don't think the abutment is battered that much, so will input less batter. I will input the top at +13, resulting in a top span of 19' and an average of 18'. That is the same as the upstream end. There is a 1.3' wide knee-wall in front of the right abutment on the downstream end. The top of that knee-wall is about elev. 944'. The sloping abutment option was used to input the downstream end of the right (eastern) abutment.

There are no piers. Existing roadway elevations were taken from the profile in the plans and from Inroads. The roadway overtopping elevation is 952.6' on the western approach, as determined in Inroads. The existing finish grade elevation on each end of the bridge was found to be 952.7' and 952.8'. The bridge superstructure depth was determined to be 2.9', from a site visit on 8-23-11. That results in bottom of beam elevations of 949.8' to 949.9', with an average of 949.8'. There is a 0.5' high curb on top of the deck.

Internal bridge sections were adjusted vertically to fit the profile better. Expansion and contraction coefficients will be set from .1 and .3 in the natural channel to .2 and .4 through the constriction area caused by the bridge.

Results show water overtops the roadway above the Q100. The Q50 WS elevation is 950.5' at RS 875, and the average bottom of superstructure elevation is 949.8'. So the bridge does not have freeboard at Q50, as required to meet the standards. Therefore, the bridge is not adequate hydraulically. The bridge constricts the channel and causes 4.1' of backwater at Q100.

Proposed Bridge HEC RAS Modeling:
The new bridge will probably be on existing alignment. New bridge HEC-RAS sections are the same as used for the existing bridge.

The proposed bridge will need to be larger to convey the design Q50 and meet the standards and to fit the channel better. The bridge should also be skewed more to be better aligned with the channel. ANR curves give a Bank Full Width of 29' for this size drainage area. My field notes say a new bridge should be at least 30' to 35' long to fit the channel better.

I will try a 30' clear span bridge. The abutments should be aligned with the channel. Using the channel alignment as a baseline for the Hec-Ras input (station offset data) the face of abutments = -15' and +15', providing a 30' clear span. The clear span along the roadway is about 36', due to the skew. Bridge width is estimated to be 40', measured along the channel and the upstream fascia is approx. 20' from Station 818. There will be no piers. I will assume the new roadway profile will be about the same as the existing, although it could be raised a little. The bottom of bridge superstructure elevations will be set to provide at least 1.0' of freeboard at Q50. A 30' span bridge results in a Q50 WS elevation of 948.4', at RS 875. So 1' of freeboard requires the average bottom of superstructure to be at elevation 949.4'. That is about 0.4' lower than the existing, which may be required as the new superstructure may be deeper than the existing. This 30' bridge causes 1.4' of backwater at Q100.

I also tried a 35' clear span. After several trials I found a bridge with a 40' clear span and the average bottom of superstructure elevation of 434.0' will meet the standards. It will have 1.0' of freeboard at Q50 and there is no roadway overtopping below Q50. A 35' span bridge results in a Q50 WS elevation of 947.9', at RS 875. So 1' of freeboard requires the average bottom of superstructure to be at elevation 948.9'. That is about 0.9' lower than the existing, which may be required as the new superstructure may be deeper than the existing. This 35' bridge causes 1.3' of backwater at Q100. Increasing the span from 30' to 35' lowers Q50 by 0.5' at RS 875 and 0.9' at RS 850. This seems like a significant improvement for the extra length.

Scour:
The scour problems with the existing bridge appear to be due to it constricting the channel width, its poor alignment and the fact the footings are not deep enough. A new longer bridge that is properly aligned with the channel should not have much scour problem. The plans appear to show some ledge in the channel upstream. At this time we do not know what type of abutments they will use. We will calculate scour and make recommendations for design to withstand scour when we do Final Hydraulics.

Stone Fill
Based on the size of material in the channel, I recommend Type IV stone fill.

Temporary Bridge
Temporary bridge recommendations will be provided with Final Hydraulics, if requested, as is the normal practice.

HEC RAS Models created:
Natural channel
Existing 20' clear span bridge
New 30' clear span bridge
New 35' clear span bridge

APPENDIX G

SUBSURFACE INVESTIGATION MEMORANDUM

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Jennifer Fitch, Structures Project Manager

NSM CCB

From: Nicholas S. Meltzer, Geotechnical Engineer, via Christopher C. Benda, P.E., Soils and Foundations Engineer

Date: April 27, 2012

Subject: Rochester BHF 0162(17) Preliminary Information

1.0 INTRODUCTION

We have completed our preliminary investigation for the proposed replacement of Bridge 16 on VT 73, in the town of Rochester, VT. The proposed project includes the replacement of the existing bridge with a new structure on the same alignment, with related channel and approach work. Contained herein are the results of our subsurface investigation and foundation recommendations.

2.0 FIELD INVESTIGATION

The field investigation was conducted between April 4th and April 10th, 2012. Four standard penetration borings were drilled to determine the subsurface profile to aid in design and construction. A summary of the location of each boring can be found in Table 1. The values for the northings and eastings found on the logs are based on the Vermont State Plane Grid NAD 83 Coordinate System.

Table 1. Boring Locations

Boring	Station (ft)	Offset (ft)	Ground Elev. (ft)	Depth of Bedrock
B-101	3+69.6	-6.0	952.7	16.5
B-102	3+78.3	5.3	952.7	18.0
B-103	4+17.7	-5.7	9572.9	18.3
B-104	4+21.7	5.5	952.8	16.5

Two borings were initially completed at opposite corners to determine soil information for design. Sampling was continuous until bedrock encountered, upon which it was cored for 10'. When bedrock was encountered at a depth less than 20' from the ground surface, two additional borings were completed at the remaining corners, to ascertain the level of bedrock. These borings were sampled at 5' intervals, and bedrock was cored for 5'.

Soil samples were visually described in the field and SPT blow counts were recorded on the boring logs. Soil samples were then preserved and returned to the Materials and Research Laboratory for testing and further evaluation. Upon completion of the laboratory testing, the field boring logs were revised to reflect the results of the laboratory classification tests. The attached boring logs indicate

the types of soils and strata encountered and include the laboratory test results, SPT data, and any pertinent observations made by the boring crew.

3.0 FIELD AND LABORATORY TESTS

The standard penetration resistance of the in-situ soil is determined by the number of blows required to drive a 2 inch OD split barrel sampler into the soil with a 140 pound hammer dropped from a height of 30 inches, in accordance with procedures specified in AASHTO T206. During the standard penetration test (SPT), the sampler is driven for a total length of 2.0 feet, while counting the blows for each 6 inch increment. The SPT N-value, which is defined as the sum of the number of blows required to drive the sampler through the second and third increments, is commonly used with established correlations to estimate a number of soil parameters, particularly the shear strength and density of cohesionless soils. The N values provided on the boring logs are raw values and have not been corrected for energy, borehole diameter, rod length or overburden pressure. The VT Agency of Transportation has determined a hammer correction value, C_E, to account for the efficiency of the SPT hammer on the drill rig. For this project, a CME 45 Track Rig was used, with a C_E=1.34. This value, included on the boring logs, was used in calculations to determine soil parameters. Selected specimens obtained from the standard penetration borings were tested in the laboratory to assess their physical properties. Moisture contents were determined, as well as the percent of each soil type. Boring logs can be found attached.

A detailed description of the rock cores is presented on the logs including run length, drill times, recovery and Rock Quality Designation (RQD). Recovery is defined as the length of core obtained expressed as a percentage of the total length cored. In accordance with ASTM D6032, RQD is the total length of core pieces, 4 inches or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams, jointing and bedding planes. The Rock Mass Rating (RMR) is also included on the logs, which is AASHTO's preferred classification of rock cores, and in based on five different parameters, that all have relative ratings which combine to form the RMR. Additional information can be found in AASHTO Section 10.4.6.4

4.0 RECOMMENDATIONS

Based on this information, possible foundation options for a bridge replacement include the following:

- A precast arch or reinforced concrete abutments supported on spread footings

Based on the short span, low load values, and shallow bedrock, it is our belief that spread footings on soil or rock would be best suited to this project. Piles for integral abutments would be unsuitable due to not enough embedment to achieve fixity.

If additional foundation options would like to be discussed, or a detailed analysis completed, please contact us.

5.0 CONCLUSION

Computer generated boring logs are attached and are available at:
M:Projects\85E035\MaterialsResearch.

If you would like to discuss this report or have any other questions, please contact us by phone at (802) 828-6911, or via email at Nick.Meltzer@state.vt.us.

Attachments: Boring Logs (4)

c: Read File/WEA
Project File/CCB
NSM

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

ROCHESTER
BHF 0162 (17)
VT-73 BR-16

Boring No.: **B-101**
Page No.: 1 of 1
Pin No.: 85E035
Checked By: NSM

Boring Crew: SALISBURY, GARROW
Date Started: 4/06/12 Date Finished: 4/06/12
VTSPG NAD83: N 491676.92 ft E 1548162.92 ft
Station: 3+69.65 Offset: -6.40
Ground Elevation: 952.7 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 45C TRACK	C_F = 1.34

Groundwater Observations		
Date	Depth (ft)	Notes
		Same day drilling.
		None Taken.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		Asphalt Pavement, 0.0 ft - 1.0 ft								
		A-1-a, SaGr, brn, Moist, Rec. = 0.7 ft, Broken Rock was within sample. NXDC				8-17-22-14 (39)	10.7	60.6	26.9	12.5
		A-1-b, GrSa, brn, Moist, Rec. = 0.6 ft, Broken Rock was within sample.				6-3-20-10 (23)	14.1	36.0	45.9	18.1
5										
		Field Note:, NXDC, Cobbles								
		A-1-a, SaGr, brn, Wet, Rec. = 0.4 ft, Broken Rock was within sample. Lost water at 10.0 ft.				4-7-7-8 (14)	14.4	57.2	29.2	13.6
10										
		Field Note:, NXDC, Cobbles								
		A-1-b, SaGr, brn, Moist, Rec. = 1.0 ft, Broken Rock (Cobbles) were within sample.				26-36-20-14 (56)	11.2	50.0	35.5	14.5
15										
		Field Note:, NXDC, Cobbles								
		16.5 ft - 21.5 ft, Light-greenish-gray to pale-green, chlorite-muscovite-quartz Phyllite, with some quartz beds and pyrite. Moderately soft, Fair rock, NXMDC, Moderately weathered from 18.2' to 20.1'. Remainder of core run unweathered. RMR = 44	1 (65)	92 (32)	4 3 2 2 2	Top of Bedrock @ 16.5 ft				
20										
		Hole stopped @ 21.5 ft								
25										
30										

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

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

ROCHESTER
BHF 0162 (17)
VT-73 BR-16

Boring No.: **B-102**
Page No.: 1 of 1
Pin No.: 85E035
Checked By: NSM

Boring Crew: SALISBURY, GARROW
Date Started: 4/10/12 Date Finished: 4/10/12
VTSPG NAD83: N 491666.19 ft E 1548173.68 ft
Station: 3+78.26 Offset: 6.12
Ground Elevation: 952.7 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 45C TRACK	C_F = 1.34

Groundwater Observations		
Date	Depth (ft)	Notes
		Same day drilling.
		None Taken.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		Asphalt Pavement, 0.0 ft - 1.0 ft								
		A-1-b, SaGr, brn, Moist, Rec. = 1.2 ft, NXDC				9-12-6-4 (18)	7.5	47.6	40.2	12.2
		A-1-b, SaGr, brn, Moist, Rec. = 1.0 ft, NXDC				4-3-2-4 (5)	12.9	48.5	42.3	9.2
5		A-1-b, GrSa, brn, Moist, Rec. = 0.7 ft, NXDC				3-2-1-1 (3)	15.8	43.3	48.7	8.0
		A-1-b, GrSa, brn, Moist, Rec. = 1.0 ft				9-5-6-15 (11)	14.0	40.1	51.8	8.1
10		Field Note:, NXDC, Cobbles								
15		A-1-b, SaGr, brn, Moist, Rec. = 1.0 ft, Lots of Broken Rock was within sample.				5-7-18-22 (25)	12.8	58.3	22.0	19.7
		A-2-4, SaSiGr, brn, Moist, Rec. = 1.4 ft, Lots of Broken Weathered Rock.				19-16-35-R@3.5" (51)	13.8	48.9	22.6	28.5
		18.0 ft - 19.0 ft, White, Quartzite, Very hard, Slightly weathered, Poor rock, NXMDC, RMR = 39	1 (50)	50 (0)	3	Top of Bedrock @ 18.0 ft				
20		19.0 ft - 23.0 ft, Light-greenish-gray to pale-green, chlorite-muscovite-quartz Phyllite, with some quartz beds. Moderately soft, Slightly to moderately weathered, Poor rock, NXMDC, RMR = 39	2 (50)	100 (0)	3 4 7 6					
25		23.0 ft - 28.0 ft, Light-greenish-gray to pale-green, chlorite-muscovite-quartz Phyllite, with some quartz beds. Moderately soft, Unweathered, Fair rock, NXMDC, RMR = 44	3 (50)	84 (46)	3 3 4 4 4					
30		Hole stopped @ 28.0 ft								

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

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

ROCHESTER
BHF 0162 (17)
VT-73 BR-16

Boring No.: **B-103**
Page No.: 1 of 1
Pin No.: 85E035
Checked By: NSM

Boring Crew: SALISBURY, GARROW
Date Started: 4/04/12 Date Finished: 4/06/12
VTSPG NAD83: N 491686.40 ft E 1548209.96 ft
Station: 4+17.69 Offset: -6.91
Ground Elevation: 952.9 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 45C TRACK	C_F = 1.34

Groundwater Observations		
Date	Depth (ft)	Notes
		Same day drilling.
		None Taken

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		Asphalt Pavement, 0.0 ft - 1.0 ft								
		A-1-a, SaGr, brn, Moist, Rec. = 0.7 ft				11-40-R@3.5"	9.0	58.3	32.6	9.1
		Field Note:, NXDC, Cobbles								
		Lab Note, Broken Rock (Cobbles) were within sample. NXDC., brn, Moist, Rec. = 0.7 ft				7-4-3-2 (7)	12.4	60.0	33.2	6.8
5		A-1-a, SaGr, brn, Wet, Rec. = 0.4 ft				3-14-2-1 (16)	19.9	49.6	34.0	16.4
		Field Note:, Broken Rock (Cobbles) were within sample. NXDC., brn, Moist, Rec. = 0.5 ft				5-13-11-6 (24)	12.7	65.9	21.2	12.9
10		Visual Description:, Mostly Broken Rock with some weathering, grn, Moist, Rec. = 0.3 ft, Insufficient sample for testing. NXDC.				22-R@4.5"				
		Field Class:, NXDC, Decayed rock								
		Visual Description:, Broken Rock with sand, brn, Moist, Rec. = 0.3 ft, Insufficient sample for testing.				3-6-9-12 (15)				
		Lab Note, Broken Rock (Cobbles) were within sample. NXDC., brn, Moist, Rec. = 1.5 ft				15-25-22-22 (47)	9.2	39.4	42.2	18.4
15		Lab Note, Very Weathered & soft rock., gry, Moist, Rec. = 1.3 ft				13-13-14-11 (27)	9.9	50.8	35.0	14.2
		Lab Note, Very Weathered & soft rock., gry, Moist, Rec. = 0.5 ft				2-13-R@3.5"	11.3	44.4	36.4	19.2
20		18.3 ft - 21.3 ft, Light-greenish-gray to lustrous pale-green, chlorite-muscovite-quartz Phyllite, with some quartz beds. Moderately soft, Unweathered, Fair rock, NXMDC, RMR = 49	1 (65)	100 (53)	4 3 4	Top of Bedrock @ 18.3 ft				
		21.3 ft - 23.3 ft, Light-greenish-gray to lustrous pale-green, chlorite-muscovite-quartz Phyllite, with some quartz beds. Moderately soft, Unweathered, Fair rock, NXMDC, RMR = 49	2 (65)	60 (50)	10 8					
25		23.3 ft - 28.3 ft, Light-greenish-gray to lustrous pale-green, chlorite-muscovite-quartz Phyllite, with some quartz beds. Moderately soft, Unweathered, Fair rock, NXMDC, RMR = 53	3 (65)	96 (86)	2 2 3 3 3					
30		Hole stopped @ 28.3 ft								

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

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

ROCHESTER
BHF 0162 (17)
VT-73 BR-16

Boring No.: **B-104**
Page No.: 1 of 1
Pin No.: 85E035
Checked By: NSM

Boring Crew: SALISBURY, GARROW
Date Started: 4/06/12 Date Finished: 4/06/12
VTSPG NAD83: N 491673.96 ft E 1548216.45 ft
Station: 4+21.67 Offset: 6.53
Ground Elevation: 952.9 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 45C TRACK	C_F = 1.34

Groundwater Observations

Date	Depth (ft)	Notes
04/09/12	11.0	AM

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		Asphalt Pavement, 0.0 ft - 1.0 ft								
		A-1-b, SaGr, brn, Moist, Rec. = 0.9 ft, Broken Rock was within sample. NXDC				6-7-7-6 (14)	9.0	44.9	41.0	14.1
		A-1-a, SaGr, grn-brn, Moist, Rec. = 0.5 ft, Broken Rock was within sample.				5-4-8-8 (12)	9.6	64.7	25.2	10.1
5										
		Field Note:, NXDC, Appears to be Gravel								
		Visual Description:, Broken Rock with silt & sand, grn-brn, Wet, Rec. = 0.2 ft, Insufficient sample for testing.				2-2-1-4 (3)	16.3			
10										
		Field Note:, NXDC, Cobbles								
15										
		16.5 ft - 17.5 ft, Light-greenish-gray to lustrous pale-green, chlorite-muscovite-quartz Phyllite, with some quartz beds. Moderately soft, Unweathered, Poor rock, NXMDC, RMR = 39	1 (65)	100 (0)	5	Top of Bedrock @ 16.5 ft				
		17.5 ft - 21.5 ft, Light-greenish-gray to lustrous pale-green, chlorite-muscovite-quartz Phyllite, with some quartz beds. Moderately soft, Unweathered, Poor rock, NXMDC, RMR = 39	2 (65)	40 (12)	2 2 3 3					
20										
		Hole stopped @ 21.5 ft								
25										
30										

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

APPENDIX H

TRAFFIC DATA

CPW

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

POLICY, PLANNING AND INTERMODAL DEVELOPMENT DIVISION

TO: Christopher P. Williams, Structures Project Manager

FROM: Maureen Carr, Traffic Analysis Engineer MC
Colin Philbrook, Traffic Analysis Technician CCP

DATE: July 18, 2011

RE: Rochester BRF 0162(16)
VT 73, BR #15 > Also use for Rochester BRF 0162(17) VT 73, Br. 16

As requested in your May 31, 2011 email, please find complete estimated traffic data on the above project in the town of Rochester. The data for the years 2014, 2034 and 2054 is included in the table below.

If you have any questions, or if further information is needed, please call at x3667.

TRAFFIC DATA	2014	2034	2054
AADT	770	810	~
DHV	160	160	~
ADTT	65	100	~
%T	8.7	12.6	~
%D	65	65	~
FLEXIBLE ESAL	~	2014~ 2034 398,000	2014~ 2054 950,000

CC: Chris Cole, Director of Policy, Planning and Intermodal Development
Data Analysis Files

Rochester BRF 0162(16) Memo.doc

APPENDIX I

PROJECT PURPOSE AND NEED STATEMENT

ROCHESTER

BHF 0162(17)

VT 73 Bridge #16 over Corporation Brook

Project Purpose & Need:

The purpose of the project is to replace the existing structure with one that is hydraulically adequate and will increase the current bridge width. The existing western abutment footing is exposed due to scour and the bridge has reached the end of its design life and is structurally inadequate.

The need for the project is due to a hydraulically undersized structure, a structurally deficient bridge, and a narrow bridge width.

Right of Way

New ROW Acquisition	fee simple	Yes _____	No ___X___
	permanent easement	Yes ___X___	No _____
	temporary easement	Yes ___X___	No _____

Description of taking _____

Public Participation Opportunity

Pre-Design Site Meeting	Yes _____	No ___X___	Date _____
Public Information Meeting	Yes ___X___	No _____	Date ___5/14/2012___
Public Hearing Required (502)	Yes _____	No ___X___	Date _____

Comments by Local Officials/RPC's: none

APPENDIX J

LOCAL CONCERNS MEETING NOTES

Transportation
Land Development
Environmental
Services

Vanasse Hangen Brustlin, Inc.

7056 US Route 7
Post Office Box 120
North Ferrisburgh, VT 05473
Telephone 802.425.7788
Fax 802.425.7799
www.vhb.com

Local Concerns Meeting Notes

Attendees:	Joanne McDonnell, Larry Straus, Doon Hinderyckx, Rob Young (VTrans), Mark Colgan (VHB), public audience	Date/ Time:	2/ 13/ 2012 6:30 PM – 7:30 PM
		Project No.:	57517.00, 57518.00, 57526.00, 57527.00
Place:	Rochester Town Office 67 School Street Rochester, VT	Re:	Rochester VT 73 Four Bridges
		Notes taken by:	M. Colgan

MEETING PURPOSE:

The purpose of this Local Concerns Meeting was to provide the public and the local and regional officials an opportunity to provide input on their concerns for the projects.
The four projects are as follows:

Rochester ER STP 0162(19) – Bridge 13: VT73 over Brandon Brook
Rochester BRF 0162(16) – Bridge 15: VT73 over Brandon Brook
Rochester BRF 0162(17) – Bridge 16: VT73 over Corporation Brook
Rochester ER BRF 0162(18) – Bridge 19: VT73 over White River

Following are the comments received from the public during the Local Concerns Meeting. VHB responses are in ***bold italics*** following each comment.

COMMENTS:

ROCHESTER ER STP 0162(19) – BRIDGE 13 – No comments

ROCHESTER BRF 0162(16) – BRIDGE 15 –

1. A new alignment behind properties would make more sense.

   This concept will be discussed as part of the alternatives analysis. The current goal is to minimize property impacts for all four projects.

2. Channel constriction is a problem for water and ice. Would we need a longer bridge?

   A longer bridge has been recommended as part of the preliminary hydraulics analysis.

3. The State had a design ten years ago that went behind the church. Will that design be considered with this new project?

   This concept will be discussed as part of the alternatives analysis.

4. The alignment needs to be fixed.

   Options for alignment improvements will be evaluated.

ROCHESTER BRF 0162(17) – BRIDGE 16 – No comments

ROCHESTER ER BRF 0162(18) – BRIDGE 19 –

1. Please don't close the road. Through traffic should be maintained.

   Traffic control options will be evaluated for all four projects that will include both "closure" and "no closure" alternatives.

2. Will property owners receive special consideration for their concerns?

   Individual meetings will be held with those property owners who have parcels with proposed impacts.

3. There is some concern that a longer bridge would impact property more, but agreed that it should be lengthened.

   Longer bridge options would likely move the west abutment further west as existing channel is in line with the east abutment and the proximity of VT 100 restricts lengthening eastward.

4. Concern about the selection of a contractor by the low bid selection. Will the contractor be qualified?

   Vermont has a prequalification process and generally has a strong list of qualified bidders on any typical project. The procurement process requires a low bid selection.

5. Residents were labeled the "Island People" on VT 73 after Tropical Storm Irene.

   We understand many of the local hardships Rochester experienced post-Irene and we were involved in the recovery efforts locally. Efforts will be made to reduce impacts to traveling public where possible, but impacts must occur in order to replace these structures.

6. The turning radius is too tight.

   We will evaluate the truck turning radius on the East approach to the bridge.

7. How would a new bridge be built in the same place?

   There are options for this that include "no closure" and "temporary closure" of VT 73. We will evaluate both on-alignment and off-alignment options.

8. Will the septic system be impacted?

   The septic system impacts will be evaluated as part of the alternatives evaluation process.

9. Will you come back to present alternatives to the town?

   Yes, we will return to present the results of the alternatives analysis.

Rochester BRF 0162(17)
VHB Vanasse Hangen Brustlin, Inc.