STATE OF VERMONT
AGENCY OF TRANSPORTATION

Scoping Report

FOR

Brattleboro BF 2000(28)

VT Route 9, Bridge 54 Over Whetstone Brook

August 5, 2021

Contents

I. SITE INFORMATION 3
- NEED 3
- TRAFFIC 4
- DESIGN CRITERIA 4
- INSPECTION REPORT SUMMARY 5
- HYDRAULICS 5
- UTILITIES 6
- RIGHT-OF-WAY 7
- RESOURCES 7
- *Biological:* *7*
- *Historic:* *7*
- *Archaeological:* *8*
- *Hazardous Materials:* *8*
- *Stormwater:* *8*

II. SAFETY 8
- OFF-SITE DETOUR 8
- PHASED CONSTRUCTION 9
- TEMPORARY BRIDGE 10

III. ALTERNATIVES DISCUSSION 11
- NO ACTION 11
- ARCH REHABILITATION 11
- ARCH REHABILITATION WITH ADDITIONAL BEAMS FOR ROADWAY WIDENING 12
- FULL BRIDGE REPLACEMENT – NEW REINFORCED CONCRETE ARCH ON-ALIGNMENT 13
- FULL BRIDGE REPLACEMENT – NEW CONVENTIONAL BRIDGE 14

IV. ALTERNATIVES SUMMARY 15

V. COST MATRIX 16

VI. CONCLUSION 17

VII. APPENDICES 18
- APPENDIX A: SITE PHOTOS 19
- APPENDIX B: TOWN MAP 26
- APPENDIX C: BRIDGE INSPECTION REPORT – BRIDGE 54 28
- APPENDIX D: PRELIMINARY HYDRAULICS REPORT 30
- APPENDIX E: PRELIMINARY GEOTECHNICAL REPORT 34
- APPENDIX F: RESOURCE ID COMPLETION MEMO 41
- APPENDIX G: NATURAL RESOURCES MEMO 43
- APPENDIX H: ARCHEOLOGICAL MEMO 48
- APPENDIX I: HISTORIC MEMO 54
- APPENDIX J: CRASH DATA 65
- APPENDIX K: COMMUNITY INPUT 69
- APPENDIX L: WEST BRATTLEBORO BICYCLE AND PEDESTRIAN SCOPING STUDY 90
- APPENDIX M: UTILITIES ID 169
- APPENDIX N: DETOUR ROUTE 173
- APPENDIX O: PLANS 177

I. Site Information

The bridge is located on Town Highway 2 (VT Route 9/Western Ave) in the Town of Brattleboro within the West Brattleboro Urban Compact, approximately 0.9 miles west of the I-91 exit 2 interchange and just west of the intersection with Melrose Street. Town Highway 2 (VT Route 9) is classified as a Class 1 Town Highway through the project area and is located on the National Highway System. The existing conditions were gathered from a combination of the Inspection Report, the Route Log and the existing Survey. See correspondence in the Appendix for more detailed information.

Roadway Classification	Principal Arterial, NHS, Urban (Class 1 TH)
Bridge Type	Single Span Cast-in-Place Concrete Arch
Bridge Span	60 feet
Existing Skew	20 degrees
Year Built	1914
Ownership	Town of Brattleboro
County	Windham
Maintenance District	1 – Wilmington Garage

Need

The following is a list of the deficiencies of Brattleboro Bridge 54 and Town Highway 2 (VT Route 9) in this location:

1. The concrete arch is in satisfactory condition with a rating of 6. There are several maintenance concerns as follows:

   a. There is longitudinal map cracking in the bituminous pavement along the outer edges with depressions throughout and patching on the downstream side.

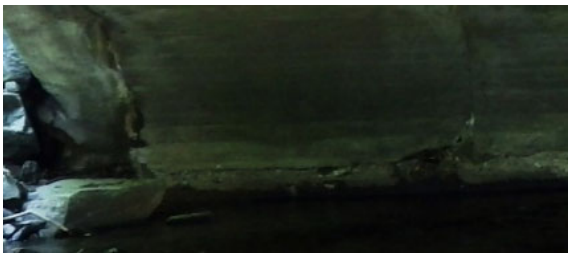
   b. The sidewalk is in poor condition and does not meet the standard width.

   c. The barrel of the arch has scattered fine longitudinal and map cracks below the fascia areas with efflorescence staining.

   d. The headwalls have scattered fine map cracks with areas of efflorescence staining.

   e. There is leakage and saturation in the concrete immediately surrounding the embedded waterline.

f. There is heavy abrasion along the water line at both abutments.



2. The bridge is substandard in width by 18-feet.

3. While the arch meets the minimum hydraulic standards, the embedded exposed waterline readily blocks high flood flows and catches debris. The arch is located within a flood insurance study area.

4. There is leakage and saturation in the concrete immediately surrounding the embedded waterline.

Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2023 and 2043.

TRAFFIC DATA	2023	2043
AADT	16,000	17,500
DHV	1,700	1,700
ADTT	1,000	1,600
%T	6.1	8.5
%D	54	54

Design Criteria

The design standards for this bridge project are the Vermont State Standards (VSS), dated October 22, 1997. Minimum standards are based on a DHV>400 and a design speed of 30 mph.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 3.6	12'/8' (40')	11'/8' (38')	
Bridge Lane and Shoulder Widths	VSS Section 3.6	11'/1' (24') with a 4-foot sidewalk on northern side of VT Route 9	11'/10' (42')[1] with a 5-foot sidewalk on north and south side of VT Route 9	Functionally Deficient
Clear Zone Distance	VSS Table 3.4		16' Fill 14' Cut	
Banking	VSS Section 3.13	NC	Banking not required on urban streets	

[1] Footnote b in Table 3.6 of the VSS requires the addition of 2' to the shoulder width in guard rail areas on principal arterials where the DHV is over 400 vph.

Speed	VSS Section 3.3	30 mph (Car) 25 mph (Bus, Truck)	30 mph (Design)	
Horizontal Alignment	AASHTO Green Book Table 3-10b	No curve over bridge, 1,500' radius curve on eastern approach	Banking not required on urban streets	
Vertical Grade	VSS Table 3.6	Bridge located on crest vertical curve between slopes of 2.54% and 0.23%.	9% (max) for rolling terrain in urban settings	
K Values for Vertical Curves	VSS Table 3.1	K=65 (crest) on bridge, K=60 (sag) on east approach	30 crest / 40 sag	
Vertical Clearance	VSS Section 3.8	None noted	16'-3" (min)	
Stopping Sight Distance	VSS Table 3.1	>500', both approaches	200'	
Bicycle/Pedestrian Criteria	VSS Table 3.8	8 ft. shoulder	4' shoulder	
Bridge Railing	Structures Manual Section 13	Reinforced Concrete Rail	TL-4	
Hydraulics	VTrans Hydraulics Section/Manual	Passes Q50 storm event with 2.9 feet of freeboard Clearspan: 47'	Pass Q_{50} storm event (2% AEP) with 1' of freeboard Minimum BFW: 52'	Substandard BFW
Structural Capacity	SM, Ch. 3.4	Significant deterioration	Design Live Load: HL-93	Substandard

Inspection Report Summary

Culvert Rating 6 Satisfactory
Channel Rating 6 Satisfactory

From the Structure Inspection, Inventory, and Appraisal Sheet:

6/17/2019 – This structure is in good to satisfactory condition. Consider installing an upstream fascia extension for the sidewalk to improve the roadway width. ~JW/MC

6/7/2017 – This structure is in satisfactory condition. ~JW/SP

6/11/2015 – Structure is in fair to good condition. ~FRE/TJB/SP

6/17/2013 – Structure is in fair to good condition. Stone should be added to the south end of the arch to help stop the scour. ~FRE/DAK

Hydraulics
The existing 60-foot span arch has abutments that are poorly aligned to the channel, and as such provide a hydraulic clearspan of 47-feet. This does not meet the minimum bankfull width

of 52 to 55-feet. The existing crossing is prone to debris blockages, primarily due to a 16-inch watermain that protrudes through the structure's waterway. The VTrans Hydraulics unit analyzed the existing crossing with and without debris blockage with the following findings:

- Existing Conditions without Debris Blockage (Free Flow Conditions): There is approximately 3.7- and 2.9-feet of freeboard (measured from the crown elevation) at the 2% and 1% AEP. Roadway overtopping occurs approximately 200-feet west of the bridge at the 1% AEP (Q_{100}) with an approximate maximum water depth of 0.2-feet.

- Existing Conditions with Debris Blockage: There is no freeboard (measured from the bottom of the waterline) at the 2% and 1% AEP. Roadway overtopping occurs approximately 200 ft west of the bridge at the 1% AEP with an approximate maximum water depth of 0.62-feet.

The preliminary hydraulics memo found in Appendix D, also evaluates a new single span bridge providing a minimum clearspan of 52-feet with abutments aligned in the direction of flow. This structure should have a minimum low chord elevation of 426.1 feet and would have approximately 1.1- and 0.3-feet of freeboard at the 2% and 1% AEP, respectively. Roadway overtopping occurs approximately 200 ft west of the bridge at the 1% AEP with an approximate maximum water depth of 0.2-feet.

Based on this analysis, relocating the waterline would improve hydraulic conditions and debris passage.

The roadway approach to the west of the project site overtops before the 1% AEP storm. The area upstream of the bridge has also had issues with flooding in the past. Upstream flooding appears to be caused by the following but not limited to upstream controls: split flow, buildings, and the low point in the road where overtopping occurs. Roadway overtopping could be mitigated with roadway regarding and/or retrofitting the existing stormwater system.

Utilities

The VTrans Utilities and Permits unit investigated the existing utility within the project limits. The existing utilities identified are shown on the Existing Conditions Layout Sheet, and are as follows:

<u>Aerial</u>

- Green Mountain Power Company (Electric)
- Consolidated Communications (Cable & Fiber)
- FirstLight Fiber
- Comcast (Coax & Fiber)

<u>Underground</u>

- Consolidated Communications (12 – 4" Conduits) Parallel to the existing bridge. The conduits are approximately 32' to the south (downstream side) of the bridge. Conduits run from telephone manhole to telephone manhole.

<u>Municipal</u>

- The Town of Brattleboro, Public Works Department, Utilities Division has a water main located on the bridge.

- The Town of Brattleboro, Public Works Department, Utilities Division has sewer is in vicinity of the bridge but not in the bridge. The sewer crosses the river to the south of the bridge but is on the East and west sides of the bridge.

Depending on the scope of the work to be accomplished this project will most likely have significant utility impacts. Any Aerial relocations that would be necessary will be challenging as this site is congested and aerial lines come in from several directions.

Any impact to water line on bridge will be required to be addressed as part of the project since it is located within class 1 Town Highway limits. Underground Utilities should be outside of the scope of work.

Right-Of-Way

There is an existing 3-rod Right-of-Way (ROW) centered on VT Route 9 which is shown on the Existing Conditions Layout sheet. The existing wingwall in the northwest quadrant is outside of the existing Right-of-Way. As such, all alternatives considered in this report, except for "Do Nothing", will require additional Right-of-Way.

Resources

The resources present at this project are shown on the Existing Conditions Layout Sheet and are based on information provided by the VTrans Environmental Section, and are as follows:

Biological:

Wetlands/Watercourses

There are no wetlands within the review area.

The bridge at this location crosses over Whetstone Brook, a perennial stream regulated by the US Army Corps of Engineers.

Wildlife Habitat

The current bridge allows for full aquatic organism passage, this should remain if any changes are made.

There is likely some movement of terrestrial wildlife under this structure. Any vegetation removal along the riparian area should be reestablished during construction of a new bridge or repair of the existing bridge at this location.

Rare, Threatened and Endangered Species

The only listed species in the review area is the federally threatened northern long-eared bat. The bridge itself is not considered suitable habitat.

Agricultural Soils

The review area is mapped as prime agricultural soil.

Historic:

There are multiple historic resources in the project area: Bridge No. 54, and several surrounding properties.

Surrounding 4(f) properties
The following properties are likely considered contributing resources to an expanded NRHP-listed West Brattleboro Green Historic District:

- **755 Western Avenue**; a two story, gable roofed clapboarded ell-shaped home constructed around 1850, with later Queen Anne detailing in the gables;
- **747 Western Avenue**; one of the older homes in West Brattleboro, a short 1 ½ story gable roofed, clapboarded home with several character defining stages of construction
- **787 Western Avenue**; a large 2 ½ story vernacular house with some Greek Revival details and an associated detached barn with cupola and side chimney.

These are considered Section 4(f) property types.

Bridge No. 54

Completed in August of 1908, Bridge 54 was the second concrete arch bridge constructed in the state and was noticed in local newspapers for its use of reinforced concrete.

Archaeological:
There are two areas of archaeological sensitivity in the project area based on environmental factors conducive to Native American site usage. These factors include proximity to a stream, well-drained soils and location within a well-known natural travel corridor. The sensitive areas are located in the SW and SE quadrants. The NE and NW quadrants show evidence of heavy disturbance and are not considered sensitive.

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 or existing stormwater permits for this project.

II. Safety

Bridge 54 is located at MM 5.10 on VT Route 9 in Brattleboro. While there are several high crash location sections located along VT Route 9 in Brattleboro, MM 5.1 is not located within any of the high crash segments.

Off-Site Detour

This option would close the bridge and reroute traffic onto an offsite detour. Since the bridge is located on a class 1 Town Highway, it would be the responsibility of the State of Vermont to choose the preferred detour route with input from the Town of Brattleboro, and to sign it according to the MUTCD.

There are several routes that could serve as an appropriate detour for pedestrians and passenger cars at this site.

The shortest route goes through the Melrose Terrace Community and is not appropriate for a signed detour route for cars due to the roadway geometry. This route however has an end-to-end distance of 0.7 miles and adds approximately 0.3 miles to travel distance, making this a good option for a pedestrian detour. Since there is a sidewalk on the existing bridge, a pedestrian detour is necessary. The pedestrian detour route is a follows:

- Pedestrian Bypass Route: VT Route 9, to Melrose Street, and George F. Miller Drive, back to VT Route 9 (0.7 mi end-to-end)

There are several routes that could serve as an appropriate detour for passenger cars at this site. However, many bypass routes around the bridge are not appropriate for trucks due to geometric constraints and the high volume of traffic on VT Route 9. The shortest passenger car route available is as follows:

- Passenger Car Route: VT Route 9, to Orchard Street and Meadowbrook Road, back to VT Route 9 (3.7 mi end-to-end)

The passenger car route specified above is not appropriate for trucks due to geometric constraints. Therefore, a separate truck route would be needed. The regional truck route has an end-to-end distance of 64.8 miles and adds approximately 26 miles to travel distance. The truck detour route is as follows:

- State Signed Truck Detour Route: VT Route 9, to VT Route 30, and VT Route 100, back to VT Route 9 (64.8 mi end-to-end)

A map of these detour routes can be found in Appendix N.

Advantages: This option would eliminate the need for phasing construction or a temporary bridge, which would significantly decrease cost and time of construction. This option reduces the time and cost of the project both at the development stage and construction. The Town of Brattleboro would reduce their local share by 50% for choosing to close the bridge during construction per ACT 153 of the 2012 legislative session.

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

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 complete a phased construction project increases because some of the construction tasks have to 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.

Due to the high volume of traffic at this site, two lanes would have to be provided for the duration of each phase if all traffic is expected to go through the project site. Additionally, since there is a sidewalk on the existing structure, pedestrian traffic needs to be considered as well – either on the existing structure or detoured around Melrose Street. The existing arch is not wide enough to accommodate these requirements. Even if the existing structure is widened, it would be difficult to maintain two lanes of traffic and allow sufficient room for construction equipment due to the tightly constrained site.

As such, phased construction is not recommended.

Advantages: Traffic flow would be maintained through the project corridor during construction. This option would have minimal impacts to adjacent properties and natural resources.

Disadvantages: A project constructed using phased construction will cause delays for all who travel through the work zone, throughout the duration of construction. Phased construction decreases the safety of the workers and vehicular traffic due to the close proximity of the two operating in the same confined space. The time required to complete a project using phased construction is typically longer, as some of the construction tasks must be performed multiple times. There is also the added inconvenience of coordinating work with traffic shifts and joints between phases.

Temporary Bridge

A temporary bridge would be difficult to place on the upstream side. On the upstream side, there is a historic house in very close proximity in the northeastern quadrant. There would be additional complications due to the alignment of Melrose Street which intersects with VT Route 9 just east of Bridge 54. Aerial utilities are also located on the upstream side of VT Route 9. The downstream side would be more conducive to a temporary bridge. The sewer and underground telephone on the south side of VT Route 9 may be impacted by a temporary bridge. Additionally, tree clearing would be needed. A temporary bridge on either side would require additional Right-of-Way acquisition.

Based on the daily traffic volumes, a two-lane temporary bridge with pedestrian accommodations would be appropriate.

Advantages: Traffic flow can be maintained along VT Route 9. The construction zone would be separate from traffic which allows for the structure to be rehabilitated or constructed along the existing alignment, minimizing permanent impacts to the site.

Disadvantages: There would be decreased safety for workers and 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 costly and time consuming, as construction activities could require a second construction season in order to construct the temporary bridge and approaches.

III. Alternatives Discussion

No Action

This alternative would involve leaving the bridge in its current condition. A good rule of thumb for the "No Action" alternative is whether the bridge can stay in place without any work being performed on the bridge in the next 10 years. The existing concrete arch has significant cracking along the fascia. Additionally, the existing arch does not provide the standard roadway width needed for safety for service. In the interest of safety to the traveling public, the No Action alternative is not recommended. A cost estimate has not been provided for this alternative since there are no immediate costs.

Arch Rehabilitation

An arch rehabilitation would include repairs or replacement to the outer portions of the arch ring and spandrel walls, new bridge railing, and repairs to the foundation. Additionally, there is leakage and saturation in the concrete immediately surrounding the embedded waterline. This waterline has a history of catching debris during large storm events, reducing the hydraulic capacity. The waterline should be relocated, and the existing exposed pipe should be removed. New pavement and a new sidewalk would also be included for a rehabilitation.

The existing arch ring is in satisfactory condition, and as such, a design life of 40 years should be assumed for this option.

Any deteriorated concrete would need to be removed and patched with the appropriate level of concrete repair. When replacing concrete of this age with new concrete, it is required that the old concrete is removed down to "sound concrete".

The existing bridge railing failed and was replaced with concrete barrier. A new bridge railing should be constructed. The bridge is located on the National Highway System, so a TL-4 railing would be required.

The existing bridge is a two-way bridge with 11-foot travel lanes with 1-foot shoulders on each side and a 4-foot-wide sidewalk on the north side of VT Route 9. The rehabilitated bridge would maintain the existing width to have a 24-foot curb to curb typical, which is substandard by 18-feet. Additionally, the 4-foot-wide sidewalk width does not meet the minimum standard of 5-feet. There is currently a network of sidewalks that lead up to the bridge and continues over the bridge. Just to the east and the west of the bridge, there are sidewalks located on both sides of VT Route 9. The Town has stated that 'there is high level of bicycle and pedestrian use on the bridge and that safety issues persist for bicyclists that must encounter large trucks and vehicles on the narrowed bridge.' However, by maintaining the existing span of the bridge, the historic character of the original arch can be maintained.

There would be difficulties in predicting the loading capacity of a rehabilitated bridge since there are no record plans that indicate the amount of reinforcing in the original arch. The existing bridge is currently not posted. According to the Historic Resource ID, the original arch was designed for a 40 Ton vehicle.

Advantages: This alternative would address the structural deficiencies of the existing bridge, with minimum disruption to the historic value of this bridge. This option would have minimal impacts to adjacent properties and utilities.

Disadvantages: The concrete is over 100 years old, and the outer portions of the arch ring are deteriorating at a fast pace. It would be difficult to load rate the bridge due to a lack of record plans. The original arch ring was likely designed for much lower vehicle loads than are used today, and the additional weight of new bridge railing may reduce the loading capacity. The existing typical section is grossly substandard for safety and service and does not provide a shoulder for bicyclists – this option would not improve this condition.

Arch Rehabilitation with Additional Beams for Roadway Widening

An arch rehabilitation would include repairs or replacement to the outer portions of the arch ring and spandrel walls, new bridge railing, and repairs to the foundation. As part of this alternative, additional beams with a composite concrete deck would be added to the upstream and downstream fascia to allow for widening of the bridge to the minimum standard. Additionally, there is leakage and saturation in the concrete immediately surrounding the embedded waterline. This waterline has a history of catching debris during large storm events, reducing the hydraulic capacity. The waterline should be relocated, and the existing exposed pipe should be removed. New pavement and a new sidewalk would also be included for a rehabilitation.

Any deteriorated concrete would need to be removed and patched with the appropriate level of concrete repair. When replacing concrete of this age with new concrete, it is required that the old concrete is removed down to "sound concrete".

The existing bridge railing failed and was replaced with concrete barrier. A new bridge railing should be constructed on the new widened sections. The bridge is located on the National Highway System, so a TL-4 railing would be required.

The existing arch ring is in satisfactory condition, however, accelerated deterioration would be expected at the longitudinal joints between the rehabilitated arch portion and new widened sections, which would reduce the anticipated service life. A design life of 30 years is assumed for this option.

The existing bridge is a two-way bridge with 11-foot travel lanes with 1-foot shoulders on each side and a 4-foot-wide sidewalk on the north side of VT Route 9. The rehabilitated bridge would have beams added on either side to widen to the minimum standard width, to provide a 42-foot width curb to curb typical section. Additionally, the 4-foot-wide sidewalk width does not meet the minimum standard of 5-feet. There is currently a network of sidewalks that lead up to the bridge and continues over the bridge. Just to the east and the west of the bridge, there are sidewalks located on both sides of VT Route 9. The Town has stated that 'there is high level of bicycle and pedestrian use on the bridge and that safety issues persist for bicyclists that must encounter large trucks and vehicles on the narrowed bridge.' However, by maintaining the existing width of the bridge, the historic character of the original arch can be maintained.

There would be difficulties in predicting the loading capacity of a rehabilitated bridge since there are no record plans that indicate the amount of reinforcing in the original arch. The existing bridge is currently not posted.

Advantages: This alternative would address the structural deficiencies of the existing bridge, with minimum disruption to the historic value of this bridge. This option would have minimal impacts to adjacent properties and utilities.

Disadvantages: The concrete is over 100 years old, and the outer portions of the arch ring are deteriorating at a fast pace. It would be difficult to load rate the arch section due to a lack of record plans. The original arch ring was likely designed for much lower vehicle loads than are used today, and the additional weight of new bridge railing may reduce the loading capacity. Accelerated deterioration would be expected at the longitudinal joints between the arch portion and new widened sections.

Full Bridge Replacement – New Reinforced Concrete Arch On-Alignment

This alternative would replace the existing reinforced concrete arch with a new widened reinforced concrete arch as well as a new substructure with similar proportions and characteristics at the existing location. The various considerations under this option include: the bridge width and length, skew, superstructure type and substructure type.

a. Bridge Width

The existing bridge is a two-way bridge with 11-foot travel lanes and 1-foot shoulders on each side and a 4-foot-wide sidewalk on the north side of VT Route 9. The existing width of 24-feet curb to curb is substandard by 18-feet. Additionally, the 4-foot-wide sidewalk width does not meet the minimum standard of 5-feet. There is currently a network of sidewalks that lead up to the bridge and continues over the bridge. Just to the east and the west of the bridge, there are sidewalks located on both sides of VT Route 9. As such, any new structure should include a new 5-foot-wide sidewalk on both the northern and southern side of the bridge to match the existing corridor conditions.

b. Bridge Length and Skew

The existing bridge is 60 feet long with a 20-degree skew. This provides a clear span normal to the channel of approximately 42 feet. Due to constraints on the east end of the bridge, lengthening the bridge significantly is only prudent on the western side of the road. The preliminary hydraulics report identified that the existing abutments do not line up well with the channel. If a new arch were constructed, a 75-foot span arch skewed 40-degrees to the roadway would be proposed to match the characteristics of the channel. The barrel length of the arch would also be lengthened to provide the minimum typical section with sidewalks on each side as described above in section (a).

c. Superstructure Type

This option would provide a new reinforced concrete arch similar to existing historic arch. The original structure featured a unique arch not often seen in concrete arch bridges. The bridge's arch is in the form of a unique shallow pointed arch. The arch has a span of 60-feet

and 13-foot waterway from the apron to the top of the arch. It is proposed that any new concrete arch structure match these features and proportions for the longer span for mitigation.

d. Substructure Type

Both foundations are currently not visible. Borings should be taken at the foundation locations to verify the subsurface properties. To reduce construction time, precast components may be used where possible.

Maintenance of Traffic: Traffic could be maintained on an off-site detour or a temporary bridge. By closing the bridge to traffic during construction, the Town's share of the project cost would be reduced by 50%.

Full Bridge Replacement – New Conventional Bridge

The remaining substandard criteria at this site that cannot be easily rectified with a rehabilitation project is the substandard width and bank full width. In order to meet the minimum bank full width standards, the bridge span would need to be lengthened. By maintaining the existing horizontal and vertical alignments, impacts to resources and adjacent properties will be minimized.

This alternative would include construction of a new widened bridge on the existing alignment. Due to the constraints at the project site discussed above, only the current horizontal and vertical alignments will be considered. This alternative would replace the existing bridge with a new superstructure as well as a new substructure at the existing location. The new bridge would have a 100-year design life. The various considerations under this option include: the bridge width and length, skew, superstructure type and substructure type.

a. Bridge Width

The existing bridge has 11-foot-wide lane widths and 1-foot-wide shoulders; this does not meet the minimum standard of 11-feet and 10-feet respectively. In addition to the existing lane and shoulder widths, there is a 4-foot-wide sidewalk on the north side of VT Route 9.

Any new bridge should be widened to have a 42-foot curb to curb typical, to meet the minimum standard. Additionally, the 4-foot-wide sidewalk width does not meet the minimum standard of 5-feet. There is currently a network of sidewalks that lead up to the bridge and continues over the bridge. Just to the east and the west of the bridge, there are sidewalks located on both sides of VT Route 9. Any new structure should include a new 5-foot-wide sidewalk on both the northern and southern side to match the existing configuration.

b. Bridge Length and Skew

The existing bridge is 60 feet long with a 20-degree skew. This provides a clear span normal to the channel of approximately 42 feet. Due to constraints on the east end of the bridge, lengthening the bridge significantly is only prudent on the western side of the road. The preliminary hydraulics report identified that the existing abutments do not line up well with the channel. Vertical abutments with a bridge span of approximately 75 feet with a skew of 40 degrees will be recommended in order to match the existing site conditions.

c. Superstructure Type

While a precast structure is the preferred choice due to decreased construction time, the possible 75' span length bridge types that are most commonly used in Vermont (steel and composite concrete deck (Precast Bridge Units), and NEXT beams) are not prudent due to the 40-degree skew. As such, a composite steel and concrete deck is recommended. The superstructure should have a minimum low chord elevation of 426.1-feet to meet the minimum hydraulic standard.

d. Substructure Type

There is no visible bedrock in the location of the project. There are large cobbles and boulders within the streambed and along the embankments upstream and downstream of the bridge. Available information from nearby wells suggests that either shallow bedrock may or may not be encountered. Borings should be taken early on in the design process, to verify the subsurface conditions at this location. Possible foundation options are spread footings, or Integral Abutments supported on a single row of H-piles or semi-integral abutments supported on spread footings.

e. Maintenance of Traffic:

Traffic could be maintained on an off-site detour or a temporary bridge. By closing the bridge to traffic during construction, the Town's share of the project cost would be reduced by 50%.

IV. Alternatives Summary

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

- Alternative 1a: Arch Rehabilitation with Traffic Maintained along Off-Site Detour
- Alternative 1b: Arch Rehabilitation with Traffic Maintained on Temporary Bridge
- Alternative 2a: Arch Rehabilitation with Widening and Traffic Maintained along Off-Site Detour
- Alternative 2b: Arch Rehabilitation with Widening and Traffic Maintained on Temporary Bridge
- Alternative 3a: Full Bridge Replacement with New Widened Reinforced Concrete Arch and Traffic Maintained along Off-Site Detour
- Alternative 3b: Full Bridge Replacement with New Widened Reinforced Concrete Arch and Traffic Maintained on Temporary Bridge
- Alternative 4a: Full Bridge Replacement with Conventional Bridge and Traffic Maintained along Off-Site Detour
- Alternative 4b: Full Bridge Replacement with Conventional Bridge and Traffic Maintained on Temporary Bridge

V. Cost Matrix[2]

Brattleboro BF 2000(28)		Do Nothing	Alt 1a	Alt 1b	Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4a	Alt 4b
			Arch Rehabilitation		Arch Rehabilitation with Widening		Full Bridge Replacement with new Arch		Full Bridge Replacement with New Steel Beam Bridge	
			a. Off-Site Detour	b. Temporary Bridge	a. Off-Site Detour	b. Temporary Bridge	a. Off-Site Detour	b. Temporary Bridge	a. Off-Site Detour	b. Temporary Bridge
COST	Bridge Cost	$0	829,500	829,500	1,077,472	1,077,472	2,714,900	2,714,900	2,038,400	2,038,400
	Removal of Structure	$0	3,240	3,240	9,720	9,720	6,750	6,750	225,000	225,000
	Roadway	$0	145,000	145,000	167,000	167,000	416,000	416,000	494,000	494,000
	Maintenance of Traffic	$0	104,300	435,290	104,300	435,290	104,300	435,290	194,300	525,290
	Construction Costs	$0	1,082,040	1,413,030	1,358,492	1,689,482	3,241,950	3,572,940	2,951,700	3,282,690
	Construction Engineering & Contingencies	$0	270,510	353,258	339,623	422,371	551,132	714,588	678,891	656,538
	Accelerated Premium	$0	75,743	0	95,094	0	226,937	0	206,619	0
	Total Construction Costs w CEC	$0	1,428,293	1,766,288	1,793,209	2,111,853	4,020,018	4,287,528	3,837,210	3,939,228
	Preliminary Engineering[3]	$0	324,612	423,909	407,548	506,845	810,488	893,235	442,755	820,673
	Right of Way	$0	15,000	15,000	25,000	25,000	15,000	15,000	15,000	50,000
	Waterline Relocation	$0	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000
	Total Project Costs	$0	2,117,905	2,555,197	2,575,757	2,993,697	5,195,506	5,545,763	4,644,965	5,159,901
	Annualized Costs	$0	52,948	63,880	73,593	85,534	51,955	55,458	46,450	51,599
TOWN SHARE			52,948	127,760	64,394	149,685	259,775	554,576	232,248	515,990
			2.5%	5.0%	2.5%	5.0%	5.0%	10.0%	5.0%	10.0%
SCHEDULE	Project Development Duration[4]	NA	2 years	2 years	4 years	4 years	4 years	4 years	4 years	4 years
	Construction Duration	NA	4 months	9 months	6 months	18 months	8 months	18 months	8 months	18 months
	Closure Duration (If Applicable)	NA	21 days	NA	30 days	NA	120 days	NA	60 days	NA
ENGINEERING	Typical Section - Roadway (ft)	24	24	24	42	42	42	42	42	42
	Typical Section - Bridge (ft)	1-11-11-1 with 4' sidewalk on north side	1-11-11-1 with 4' sidewalk on north side		10-11-11-10 with 5' sidewalk on north and south side		10-11-11-10 with 5' sidewalk on north and south side		10-11-11-10 with 5' sidewalk on north and south side	
	Geometric Design Criteria	Substandard Width	Substandard Width		Meets Minimum Standard		Meets Minimum Standard		Meets Minimum Standard	
	Traffic Safety	Substandard Width for Safety and Service	Substandard Width for Safety and Service		Improved - Meets Minimum Standard		Improved - Meets Minimum Standard		Improved - Meets Minimum Standard	
	Alignment Change	NA	No	No	No	No	No	No	No	No
	Bicycle Access	Substandard Width for Shared Use	Substandard Width for Shared Use		Improved - Meets Minimum Standard		Improved - Meets Minimum Standard		Improved - Meets Minimum Standard	
	Pedestrian Access	Substandard Sidewalk Width	Substandard Sidewalk Width		Improved - Meets Minimum Standard		Improved - Meets Minimum Standard		Improved - Meets Minimum Standard	
	Hydraulics	Substandard	Substandard	Substandard	Substandard	Substandard	Meets Minimum Standard		Meets Minimum Standard	
	Utilities	No Change	Municipal Water Line Relocation		Municipal Water Line and Aerial Relocation		Municipal Water Line and Aerial Relocation		Municipal Water Line and Aerial Relocation	
OTHER	ROW Acquisition	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Road Closure	No	Yes	No	Yes	No	Yes	No	Yes	No
	Design Life (yrs)	<10 years	40	40	35	35	100	100	100	100

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

VI. Conclusion

We recommend **Alternative 4b**; a full bridge replacement with a new widened conventional bridge while maintaining traffic on a downstream temporary bridge.

Structure:
The existing arch has significant historic value and should be preserved as a first choice. However, the existing structure is grossly substandard in width for safety, service, and share-use and does not match the corridor width, which meets the minimum standards. Repairs and retrofits to widen the existing bridge would be extensive and expensive. Additionally, any new concrete would have accelerated deterioration from the reaction with old concrete, including the two longitudinal joints where the arch would be widened, reducing the design life. This structure is located on the National Highway System and should meet the minimum standard for width. Because of all these reasons, a rehabilitation project would be costly while having a reduced design life, and as such, a full replacement is recommended.

The new structure will result in a brand new 100-year bridge. Due to hydraulic needs of the new structure, a conventional bridge is recommended over an arch. The skew of the bridge will increase to 40-degrees in addition to lengthening for improved hydraulics. The new structure should have an approximate 75-foot span and a skew of 40-degrees to align with the channel and provide a minimum clearspan of 52-feet.

The new bridge will have 11-foot-wide travel lanes with 10-foot-wide shoulders, resulting in a curb-to-curb width of 42-feet to meet the minimum standard. Additionally, a 5-foot-wide sidewalk should be constructed on both the upstream and downstream sides of the new bridge to match the corridor.

Traffic Maintenance:
The recommended method of traffic control is to maintain traffic on a two-way downstream temporary bridge during construction. The average daily traffic volume on VT Route 9 though the project area is 16,000 vehicles per day, which is considered high. Additionally, the available detour routes are relatively long. Since there is a sidewalk on the existing bridge, pedestrians should be accommodated on the temporary bridge or on an offsite pedestrian detour during construction.

A temporary bridge on the downstream side will require a complicated relocation of aerial utilities.

Additional Considerations:

Utilities

- Construction will require an extensive utility relocation. Both overhead and underground utilities will need to be relocated; coordination should take place early in the design phase.

VII. Appendices

- A: Site Photos
- B: Town Map
- C: Bridge Inspection Report
- D: Preliminary Hydraulics Report
- E: Preliminary Geotechnical Report
- F: Resource ID Completion Memo
- G: Natural Resources Memo
- H: Archeological Memo
- I: Historic Memo
- J: Crash Data
- K: Community Input
- L: West Brattleboro Bicycle and Pedestrian Scoping Study
- M: Utilities ID
- N: Detour Routes
- O: Plans

Appendix A: Site Photos

Picture 1: Looking East over Bridge 54

Picture 2: Looking West over Bridge 54

Picture 3: Looking Downstream

Picture 4: Looking Upstream

Picture 5: Concrete Barrier Railing

Picture 6: Poor Sidewalk Condition

Picture 7: Upstream Fascia

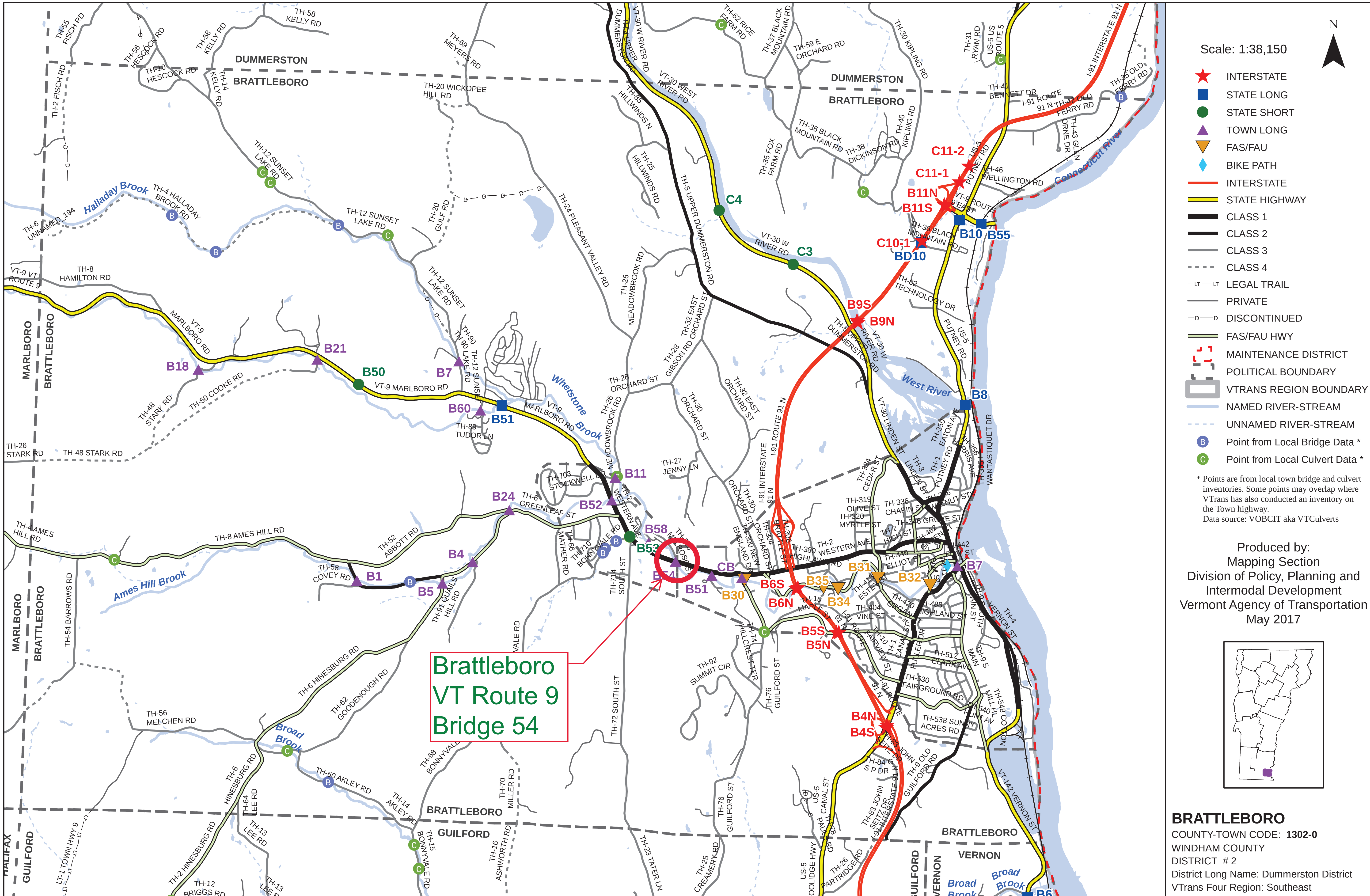
Picture 8: Downstream Fascia

Picture 9: Arch Ring – Note cracking, seepage and efflorescence at fascia and seepage at the embedded waterline

Picture 10: Arch Ring – Note cracking, seepage and efflorescence at fascia and seepage at the embedded waterline

Picture 11: Barrel of the arch - note scattered fine longitudinal and map cracks below the fascia areas with efflorescence staining

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 – Bridge 54

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

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

Inspection Report for BRATTLEBORO **bridge no.:** 00054 **District:** 2

Located on: VT 00009 ML **over** WHETSTONE BROOK **approximately** 0.9 MI W JCT. I91 EX. 2 **Owner:** 04 CITY-OWNED

CONDITION

Deck Rating: N NOT APPLICABLE

Superstructure Rating: N NOT APPLICABLE

Substructure Rating: N NOT APPLICABLE

Channel Rating: 6 SATISFACTORY

Culvert Rating: 6 SATISFACTORY

Federal Str. Number: 200010005413022

Federal Sufficiency Rating: 042.8

Deficiency Status of Structure: FD

AGE and SERVICE

Year Built: 1914 **Year Reconstructed:** 0000

Service On: 5 HIGHWAY-PEDESTRIAN

Service Under: 5 WATERWAY

Lanes On the Structure: 02

Lanes Under the Structure: 00

Bypass, Detour Length (miles): 29

ADT: 016300 **% Truck ADT:** 07

Year of ADT: 1998

GEOMETRIC DATA

Length of Maximum Span (ft): 0060

Structure Length (ft): 000070

Lt Curb/Sidewalk Width (ft): 4.5

Rt Curb/Sidewalk Width (ft): 0

Bridge Rdwy Width Curb-to-Curb (ft): 27.5

Deck Width Out-to-Out (ft): 31.3

Appr. Roadway Width (ft): 029

Skew: 20

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 ARCH

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

Kind of Material and/or Design: 1 CONCRETE

Deck Structure Type: N NOT APPLICABLE

Type of Wearing Surface: N NOT APPLICABLE

Type of Membrane: N NOT APPLICABLE

Deck Protection: N NOT APPLICABLE

APPRAISAL *AS COMPARED TO FEDERAL STANDARDS

Bridge Railings: 1 MEETS CURRENT STANDARD

Transitions: 1 MEETS CURRENT STANDARD

Approach Guardrail: 0 DOES NOT MEET CURRENT STANDARD

Approach Guardrail Ends: 1 MEETS CURRENT STANDARD

Structural Evaluation 4 MEETS MINIMUM TOLERABLE CRITERIA

Deck Geometry: N NOT APPLICABLE

Underclearances Vertical and Horizontal: N NOT APPLICABLE

Waterway Adequacy: 7 SLIGHT CHANCE OF OVERTOPPING BRIDGE & ROADWAY

Approach Roadway Alignment: 8 EQUAL TO DESIRABLE CRITERIA

Scour Critical Bridges: U UNKNOWN FOUNDATION

DESIGN VEHICLE, RATING, and POSTING

Load Rating Method (Inv): 0 NO RATING ANALYSIS PERFORMED

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: 062019 **Insp. Freq. (months)** 24 **X-Ref. BrNum:**

INSPECTION SUMMARY and NEEDS

6/17/2019 This structure is in good to satisfactory condition. Consider installing an upstream fascia extension for the sidewalk to improve the roadway width. JW/MC

6/7/2017 This structure is in satisfactory condition. JW/SP

6/11/2015 Structure is in fair to good condition. ~FRE/TJB/SP

6/17/2013 Structure is in fair to good condition. Stone should be added to the south end of the arch to help stop the scour. ~FRE/DAK

04/11/2011 Structure is in satisfactory condition. Delams should be cleaned and patched in the barrel. DCP & FRE

Appendix D: Preliminary Hydraulics Report

VERMONT

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

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

Agency of Transportation

TO: Laura Stone, Structures, Scoping Engineer

CC: Nick Wark, Hydraulics Engineer

FROM: Christian Boisvert, Hydraulics Project Engineer

DATE: May 24, 2021

SUBJECT: Brattleboro BF 2000(28), pin#12J608
Brattleboro, VT-9, Br54, over Whetstone Brook
Site location: MM 5.099
Coordinates: 42.851336, -72.594355

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

VT-9 is a Principal Arterial. Therefore, Design Storm Flow is 2% AEP (Q50).

A desktop review was preformed using available resources and found a bankfull width ranging from 52 – 55 ft. A site visit has not been performed with ANR due to current COVID restrictions. Scott Jenson visited the site and recommended a minimum clear span of 52 ft should be used to span bankfull width in an email on 4/9/21. ANR also noted the abutments are poorly aligned and should be corrected with any new bridge.

Historically, the existing crossing is prone to debris blockages, primarily due to a 16-inch watermain that protrudes through the structure's waterway. The watermain is located at an elevation of 426.2-ft +/- (3-ft below crown line elevation) and acts as a debris catch. For this project, the hydraulics unit analyzed the existing crossing with and without debris blockage. The debris blockage area was estimated using methodologies found in Hydrologic Engineering Circular No. 9 (HEC-9) – Design of Debris Control Countermeasures for Culvert and Bridge Structures.

The following was analyzed:

Existing Conditions: Reinforced Concrete Arch Bridge

- 60-foot span structure (from abutment to abutment) with a crown elevation of 429.2 feet.
- A 16-inch water main hangs below the top of the arch with a bottom elevation of 426.2 feet.
- The existing abutments are poorly aligned with the flow resulting in an approximate hydraulic clear span of 47-feet.

Analysis results:

Existing Conditions without Debris Blockage (Free Flow Conditions)

- There is approximately 3.7- and 2.9-feet of freeboard (measured from the crown elevation) at the 2% and 1% AEP, respectively providing a minimum waterway area of 587 sq. ft ±.

- Roadway overtopping occurs approximately 200 ft west of the bridge at the 1% AEP with an approximate maximum water depth of 0.2-feet.
- Preliminary scour calculations provide a value of 3.1 ft for the check design scour depth.

Existing Conditions with Debris Blockage

- Using a conservative hydraulic analysis approach, there is no freeboard (measured from the bottom of the waterline) at the 2% and 1% AEP, providing a minimum waterway area of 439 sq. ft ±.
- Roadway overtopping occurs approximately 200 ft west of the bridge at the 1% AEP with an approximate maximum water depth of 0.62-feet.
- The scour analysis for this condition is complex and a scour depth ranging from 2.5 to 5.2 ft may be experienced.

Option 1: Single Span Bridge w/ Abutments Aligned with Direction of Flow

- A minimum span of 52-feet with abutments aligned with flow.
- A minimum low chord elevation of 426.1 feet
- There is approximately 1.1- and 0.3-feet of freeboard at the 2% and 1% AEP, respectively providing a minimum waterway area of 525 sq. ft ±.
- Roadway overtopping occurs approximately 200 ft west of the bridge at the 1% AEP with an approximate maximum water depth of 0.2-feet.
- Does not appear to increase upstream 100-year base flood elevations.
- Preliminary scour calculations provide a value of 2.1 ft for the check design scour depth.

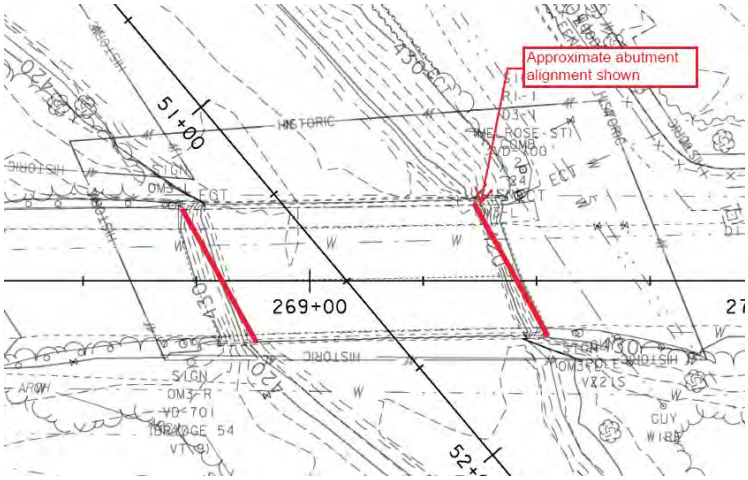


Figure 1 – Proposed Abutment realignment

Based on this analysis, relocating the waterline would improve hydraulic conditions and debris passage. If the waterline is relocated, hydraulic conditions would be similar to the Existing Conditions without Debris Blockage (free flow condition) shown above.

The roadway approach to the west of the project site overtops before the 1% AEP storm. The area upstream of the bridge has also had issues with flooding in the past. Based on our analysis, when comparing the free flow existing and proposed conditions, it appears the roadway overtopping depths are unchanged. Upstream flooding appears to be caused by the following but not limited to upstream controls: split flow, buildings, and the low point in the road where overtopping occurs. Roadway overtopping could be mitigated with roadway regarding and/or retrofitting the existing stormwater system. If roadway regrading or improvements to the stormwater system are considered, coordinate with the hydraulics unit to determine if upstream base flood elevations are increased.

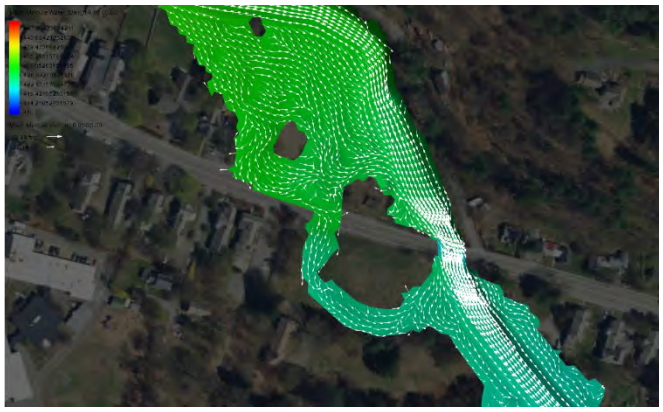


Figure 2 – 100-yr Floodplain Extents

inlet and outlet. A final scour countermeasure design will be performed during final design.

Preliminary scour analyses were performed as part of this study and resulting scour depths are reported above. A D50 of 35 mm was determined by utilizing available Phase II geomorphic assessments for all conditions. If Option 1 is the preferred alternative assume that the bottom of footing elevation is at least 6-ft below the streambed or founded on ledge. The hydraulics unit recommends that streambed grab samples are obtained to determine adequate gradations for a final scour analysis during the final design phase.

If Option 1 is chosen, coordination with the hydraulics unit and ANR is recommended to confirm bankfull width requirements and correct the alignment of the abutments.

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

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

Appendix E: Preliminary Geotechnical Report

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Nick Wark, P.E., P.I.I.T. Program Manager

From: August Arles, Geotechnical Engineer, via Callie Ewald, P.E., Geotechnical Engineering Manager

Date: February 24th, 2020

Subject: Brattleboro BF 2000(28) Preliminary Geotechnical Information

1.0 INTRODUCTION

As requested, we have conducted our preliminary geotechnical investigation of Bridge No. 54 on VT Route 9 over Whetstone Brook in the town of Brattleboro, VT. Bridge No. 54 is located 0.9 miles west of the intersection of VT Route 9 and Interstate 91, immediately west of the intersection of VT Route 9 and Melrose St. The subject project consists of replacing or rehabilitating the existing single span, concrete arch bridge. This review included the examination of as-built record plans, historical in-house boring logs, water well logs and hazardous site information housed in the Vermont Agency of Natural Resources (ANR), published surficial and bedrock geologic maps. A site visit was not conducted by Geotechnical Section staff, however, photos from bridge inspection reports and available satellite imagery were reviewed as part of this preliminary investigation.

2.0 SUBSURFACE INFORMATION

2.1 Published Geologic Data

Mapping conducted in 1970 for the Surficial Geologic Map of Vermont shows that the project area consists of postglacial fluvial deposits consisting of sand and gravel (Doll, 1970).

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

The Geotechnical Engineering Section maintains a GIS based historical record of subsurface investigations, which contains electronic records for the majority borings completed in the past 10 years. An exploration of this database revealed no nearby projects within a 0.5-mile radius of the project site.

2.2 Water Well Logs

The Vermont ANR documents and publishes all water wells that are drilled for residential or commercial purposes. Published online, these logs may provide general characteristics of the soil strata and depth to bedrock in the area. The three closest recorded water wells were TAG 43735, TAG 18659, and WRN 288 located approximately 577 feet, 1,548 feet and 1,992 feet from the project site, respectively. Bedrock was reported at a depth of 28

feet, 3 feet, and 6 feet below the ground surface for wells TAG 43735, TAG 18659, and WRN 288, respectively.

2.3 Hazardous Materials and Underground Storage Tanks

The ANR Natural Resources Atlas also maps the location and information of known hazardous waste sites and underground tanks. According to the Atlas there are four hazardous waste sites within 0.5-mile radius of the project site location. Table 2.3 lists the three closest sites along with their address, approximate distance in feet from the project, and reported contaminant or storage substance. The project site location is not listed on the Hazardous Site List

Table 2.3 Information for Nearby Underground Storage Tanks and Hazardous Sites

Type of Hazard	Location	Approximate Distance from Project (ft)	Contaminant/Storage Substance
Hazardous Site	59 Brookside Drive	1,650	Heating Oil
Hazardous Site	59 Glen St	1,870	Heating Oil
Hazardous Site	570 Western Ave	1,920	Heating Oil/Gasoline

2.4 Record Plans

There were no record plans, foundation information, or subsurface information available for this project.

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 feasibility of boring operations and assess general site conditions as they relate to the proposed project. Overhead utilities are present running parallel to the westbound lane of VT Route 9, as shown in Figure 3.1. There are large cobbles and boulders within the streambed and along the embankments upstream and downstream of the bridge, as seen in Figures 3.2 through 3.4. The presence of bedrock was not obvious from the satellite imagery, photos, or inspection reports.

Figure 3.1 *Looking eastbound on VT Route 9; notice overhead utilities present running parallel to westbound travel lane. [Inspection photo dated 2019].*

Figure 3.2 *Looking upstream of Whetstone Brook; notice cobbles in the streambed. [Inspection photo dated 2015]*

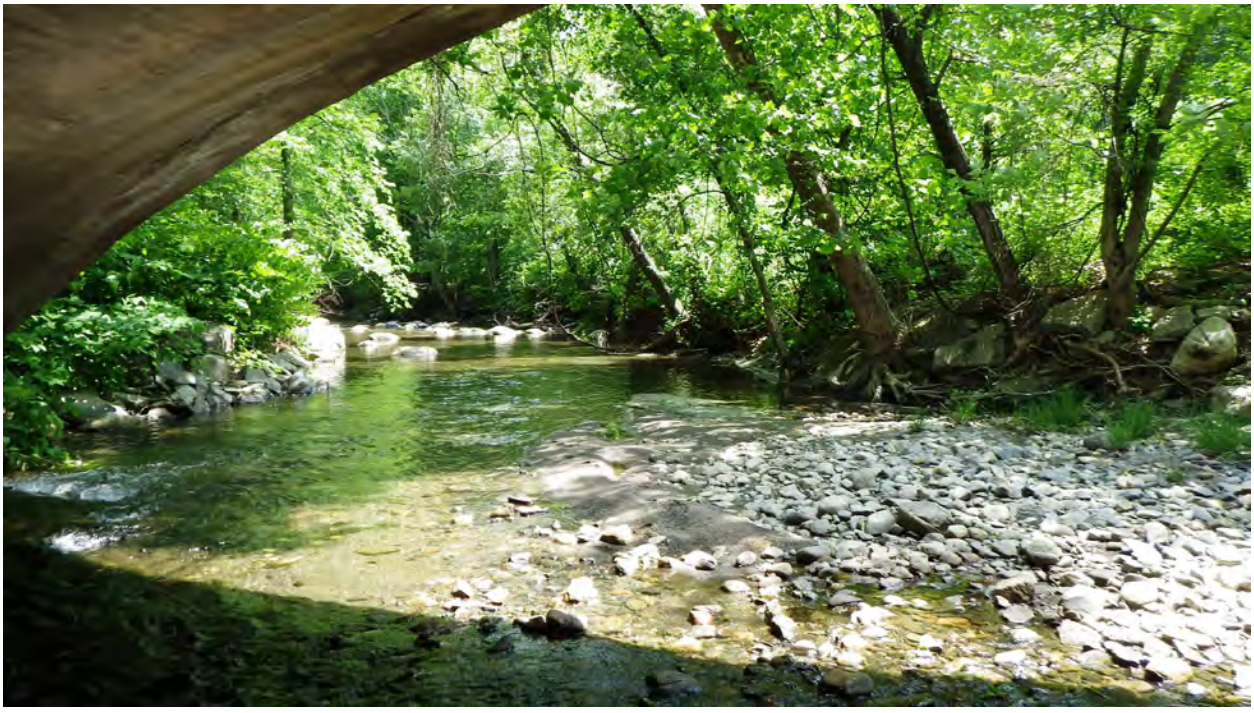


Figure 3.3 *Looking downstream from underneath bridge; note cobbles and boulders in streambed and along embankments. [Inspection photo dated 2015]*

Figure 3.4 *Looking upstream at bridge; note cobbles in streambed and utility pipe on underside of bridge. [Inspection photo dated 2015]*

4.0 RECOMMENDATIONS

4.1 Preliminary Foundation Alternatives

Based on the preliminary information review during this investigation, if a full bridge replacement option is chosen as the preferred alternative, foundation options for a replacement structure include the following:

- Concrete rigid frame or precast or steel arch bridge supported on H-piles, micro piles, or spread footings
- Integral abutments supported on a single row of H-piles or semi-integral abutments supported on spread footings

4.2 Proposed Subsurface Investigation

Once a proposed alignment for the replacement bridge is chosen, we recommend advancing a minimum of one test boring at each abutment location on opposite sides of the roadway at the locations of the proposed abutments in order to more fully assess the subsurface conditions at the site including, but not limited to, the soil properties, groundwater conditions, and depth to bedrock (if applicable). If shallow bedrock is encountered during drilling operations, additional borings will likely be required to profile the bedrock elevation across the footprint of the proposed structure.

5.0 CLOSING

When a design alternative as well as a preliminary alignment has been chosen, the Geotechnical Engineering Section can assist in designing a subsurface investigation that efficiently gathers adequate information for the alternative chosen.

If you have any questions or would like to discuss this report, please contact us by phone at (802) 828-2561.

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 2/06/2020.

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

Appendix F: Resource ID Completion Memo

OFFICE MEMORANDUM

AOT - PDB - ENVIRONMENTAL SECTION

RESOURCE IDENTIFICATION COMPLETION MEMO

TO: Laura Stone, Project Manager
FROM: Lee Goldstein, Environmental Specialist, SE Region
DATE: November 12, 2019
Project: **Brattleboro BF 2000(28); 12j608**

ENVIRONMENTAL RESOURCES:

Archaeological Site:	X	No	see Archaeological Resource ID memo
Historic/Historic District:	X	No	see Historic Resource ID memo
Wetlands:		X	see Natural Resource ID memo
Agricultural Land:	X	No	See Natural Resource ID Memo
Fish & Wildlife Habitat:	X	No	See Natural Resource ID Memo
Wildlife Habitat Connectivity:	X	No	See Natural Resource ID Memo
Endangered Species:	X	No	See Natural Resource ID Memo
Stormwater:		X	
6(f) Property:		X	
Hazardous Waste:		X	See ANR map
ANR Urban Background Soils:	X	No	See ANR map. Further coordination with Environmental Section is required at permitting.
USDA-Forest Service Lands:		X	See ANR map
Scenic Highway/Byway:	X	No	Molly Stark Byway-see
Act 250 Permits:		X	See ANR map
FEMA Floodplains:	X	No	See FEMA Firmette; permitting coordination required
Flood Hazard Area/ River Corridor:	X	No	See ANR map; permitting coordination required
US Coast Guard:	X	No	Possibly; will contact USCG
Lakes and Ponds:		X	
303D List/ Class A Water/ Outstanding Resource Water:		X	See ANR map
Surface and Ground Water (SPA) Source Protection Area:		X	See ANR map
Groundwater Classification:		X	See ANR map
Public Water Sources/ Private Wells:		X	See ANR map
Other:		X	

cc:
Project File

Appendix G: Natural Resources Memo

State of Vermont *Agency of Transportation*
Program Development Division
One National Life Drive [phone] 802-279-2562
Montpelier, VT 05633-5001 [fax] 802-828-2334
vtrans.vermont.gov [ttd] 800-253-0191

To: Project File

From: James Brady, VTrans Environmental Biologist

Date: November 12, 2019

Subject: Brattleboro BF 2000(28) - Natural Resource ID

I have completed my natural resource report for the above referenced project. My evaluation has included wetlands, wildlife habitat, agricultural soils and rare, threatened and endangered species.

Wetlands/Watercourses
There are no wetlands within the review area.

The bridge at this location crosses over Whetstone Brook, a perennial stream regulated by the US Army Corps of Engineers.

Wildlife Habitat
The current bridge allows for full aquatic organism passage, this should remain if any changes are made.

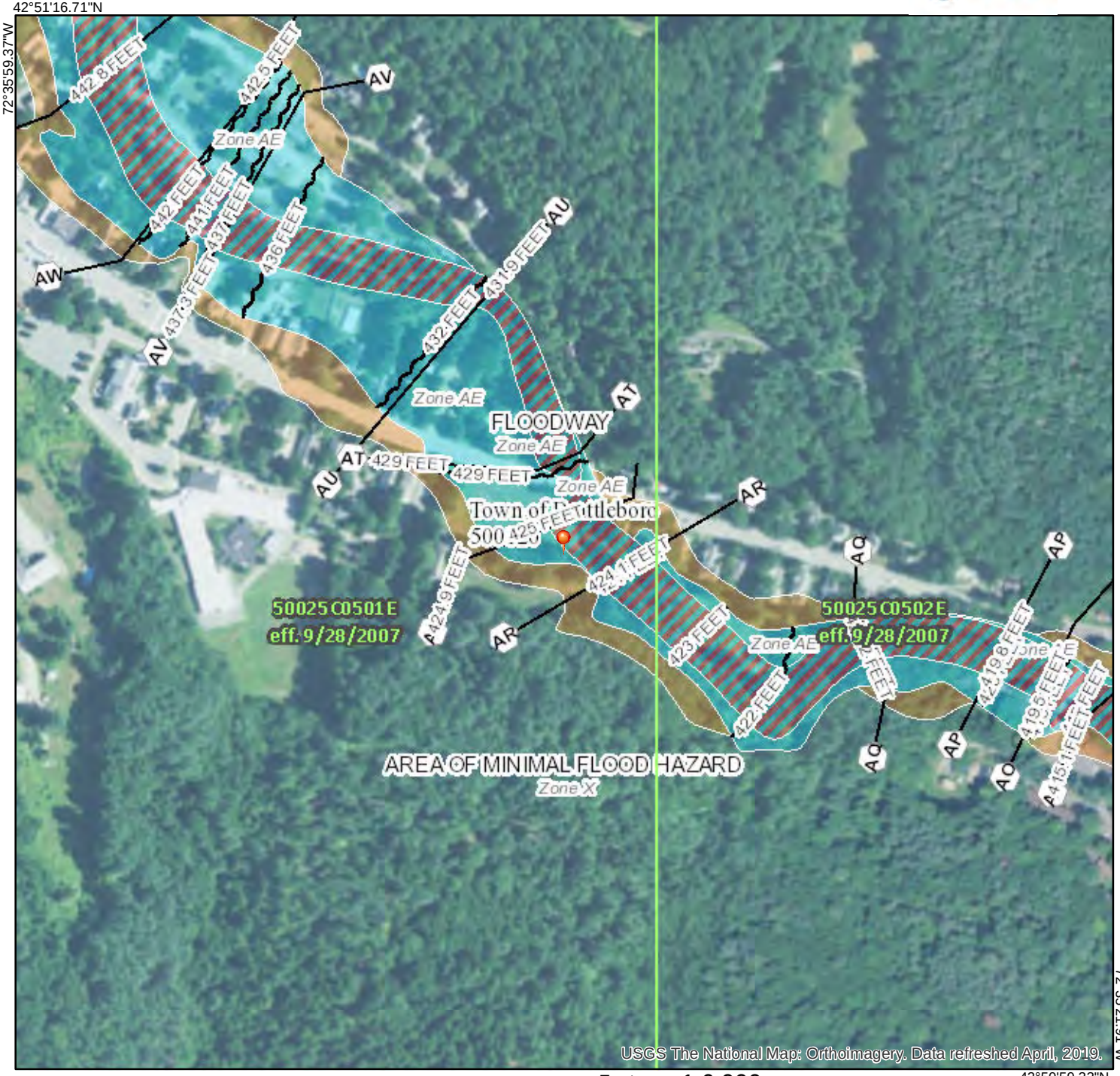
There is likely some movement of terrestrial wildlife under this structure. Any vegetation removal along the riparian area should be reestablished during construction of a new bridge or repair of the existing bridge at this location.

Rare, Threatened and Endangered Species
The only listed species in the review area is the federally threatened northern long-eared bat. The bridge itself is not considered suitable habitat.

Agricultural Soils:
The review area is mapped as prime agricultural soil.

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

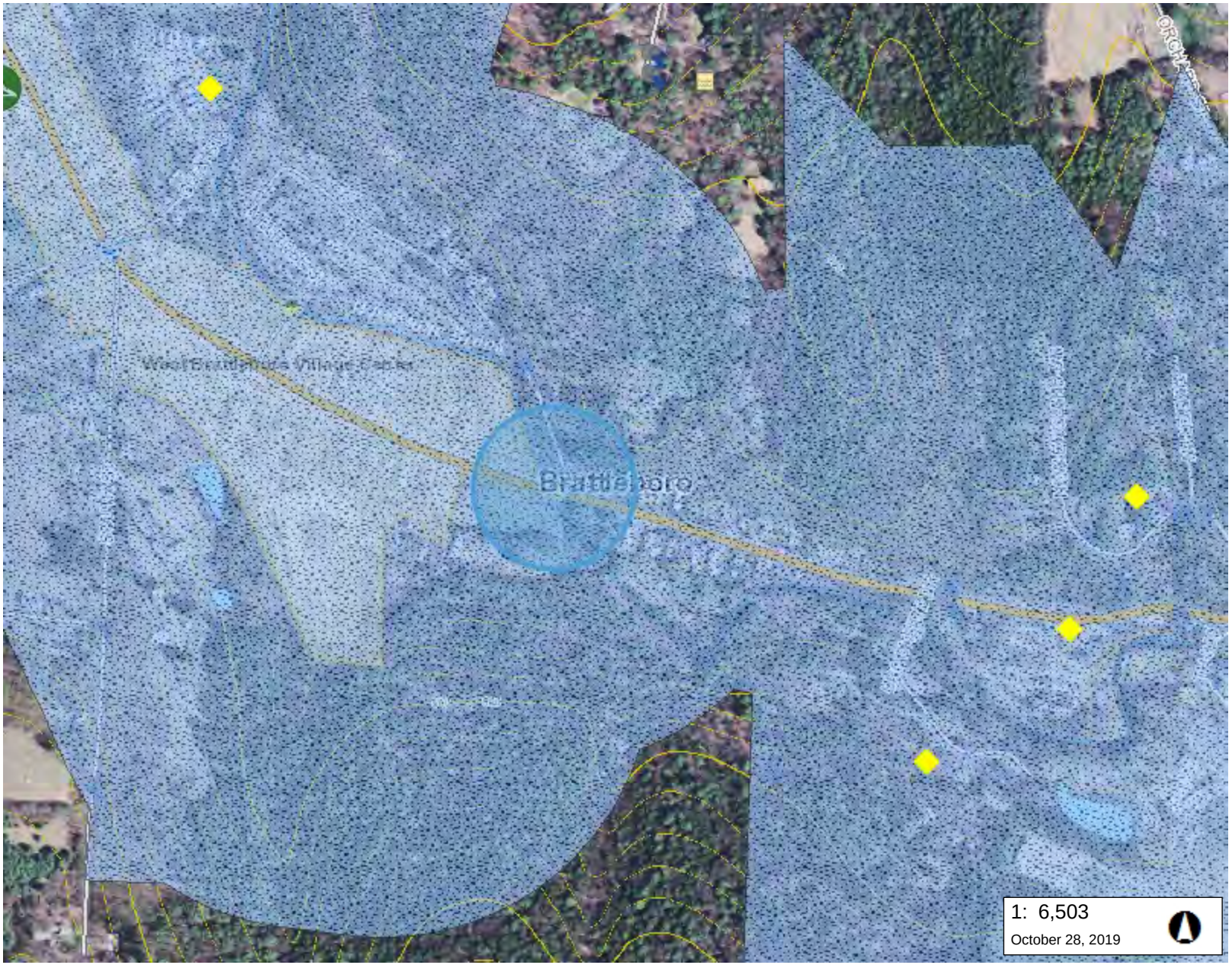
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/28/2019 at 3:58:19 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

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
- Act250 Permits **INCOMPLET
- VTRANS State and Town Long
- VTRANS State Short Structure
- Town Bridge
- Town Culvert
- Railroads
- Roads
  - Interstate
  - Principal Arterial
  - Minor Arterial

NOTES

Brattleboro BF 2000(28)-no HazMat sites but Urban Background Soils present.
Map created 10/28/2019 using ANR's Natural Resources Atlas.

330.0 0 165.00 330.0 Meters

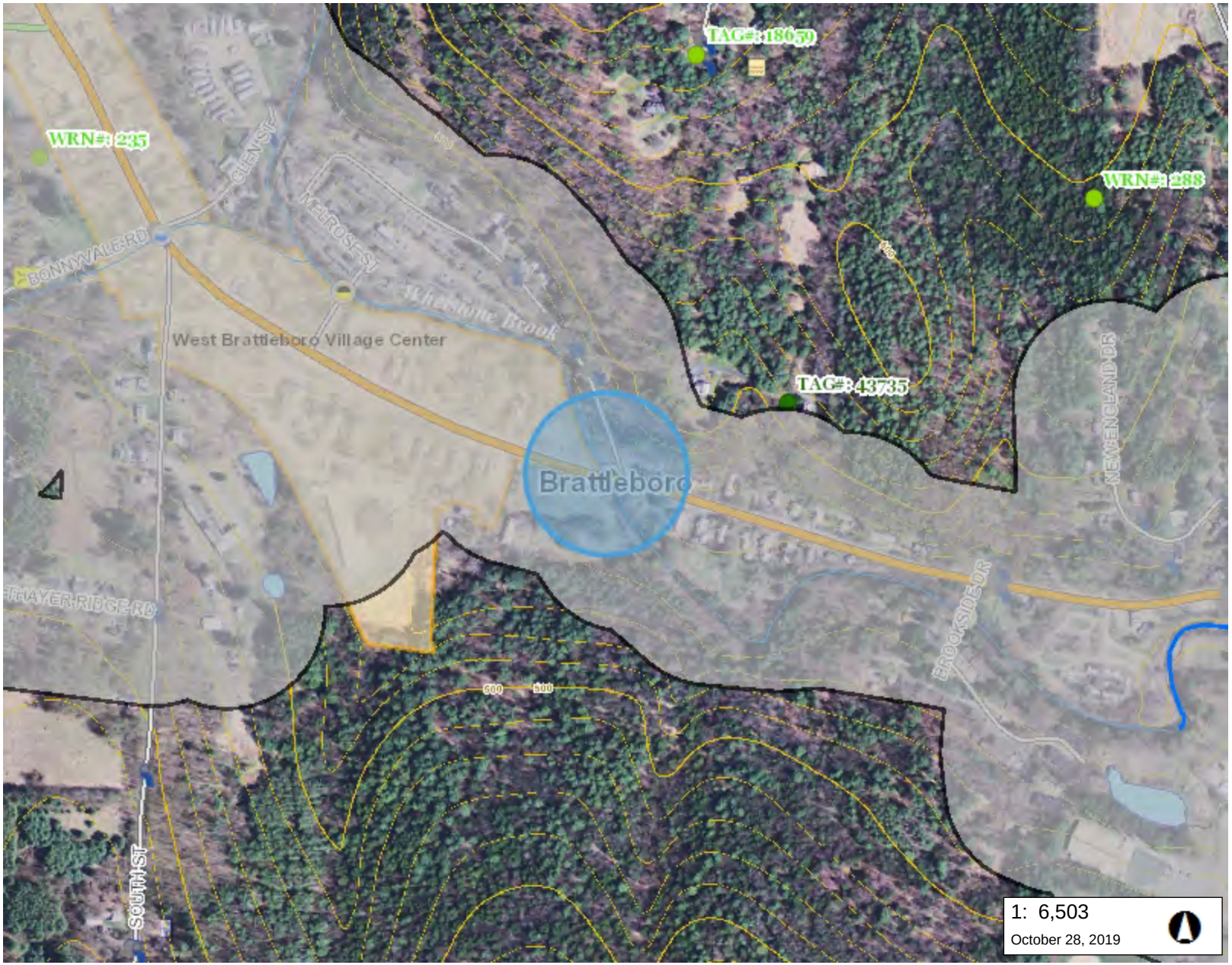
WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 542 Ft. 1cm = 65 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Natural Resources Atlas

Vermont Agency of Natural Resources

vermont.gov



LEGEND

- 303(d) List of Impaired Stream
- Watersheds for 303(d) List
- Priority Waters List (Streams a
  - Part B (impaired TMDL not required
  - Part D (impaired with approved TM
  - Part E (altered exotic species)
  - Part F (altered flow regulation)
- Stressed Waters List (Streams
- Designated ORW (Streams an
- Prospective ORW (Streams an
- Prospective ORW (Lakes and
- Class A(1) Ecological Waters
- Class A(2) Public Water Suppli
- Mixed Classifications for Uses
- Green Mountain National Fores
- Waste Water Facilities
- Sewer Service Area
- Private Wells
  - Incorrectly Located
  - GPS Located
  - Screen Digitized
  - E911 Address Matched
  - Welldriller/Clarion
  - Unknown Location Method
- Public Water Sources
  - Active
  - Proposed
  - Inactive

330.0 0 165.00 330.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 542 Ft. 1cm = 65 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

NOTES

Brattleboro BF 2000(28)-no water quality resource concerns. Sewer service area. Map created 10/28/2019 using ANR's Natural Resources Atlas.

Appendix H: Archeological Memo

VERMONT

Brennan Gauthier
VTrans Senior Archaeologist
Vermont Agency of Transportation
Project Delivery Bureau
Environmental Section
1 National Life Drive
Montpelier, VT 05633
tel. 802-279-1460
Brennan.Gauthier@Vermont.gov

To: Lee Goldstein, VTrans Environmental Specialist
From: Brennan Gauthier, VTrans Senior Archaeologist
Date: 10/15/2019
Subject: Brattleboro BF 2000(28) Archaeological Resource Identification

Dear Lee,

I have completed my field inspection and background review of the currently unscoped bridge replacement project for Bridge No. 54 along Vermont Route 9 in the town of Brattleboro, Windsor County, Vermont. Replacing a badly damaged 1895 iron bridge, the "West Brattleboro Bridge" is a 60' concrete arch that was designed by Walter M. Denman and constructed by the Ley Construction Co. in 1908. Spanning Whetstone Brook, Bridge No. 54 is currently rated at a 6/10 and is considered to be in satisfactory condition. This structure is one of the last remaining concrete arch bridges in the state that were a popular structure in the early part of the 20th century as new innovations in construction techniques began to be implemented in Vermont.

Careful background review of known archaeological sites in the area failed to identify any previously recorded sites within a broadly defined area around Bridge No. 54. A site inspected in the summer of 2019 was adequate to identify two areas of archaeological sensitivity in the project area based on environmental factors conducive to Native American site usage. These factors include proximity to a stream, well-drained soils and location within a well-known natural travel corridor. These quadrants, the SW and SE, have been mapped into the archaeology geodatabase for inclusion in future plans. The NE and NW quadrants show evidence of heavy disturbance and are not considered sensitive. Please refer to ***Figure 8*** for a visualization of the two southern quadrants.

As always, feel free to reach out with any questions or concerns that may arise as part of this project. I can provide additional images or illustrations if desired.

Sincerely,

Brennan

VTrans Working to Get You There
Vermont Agency of Transportation

Images and Illustrations

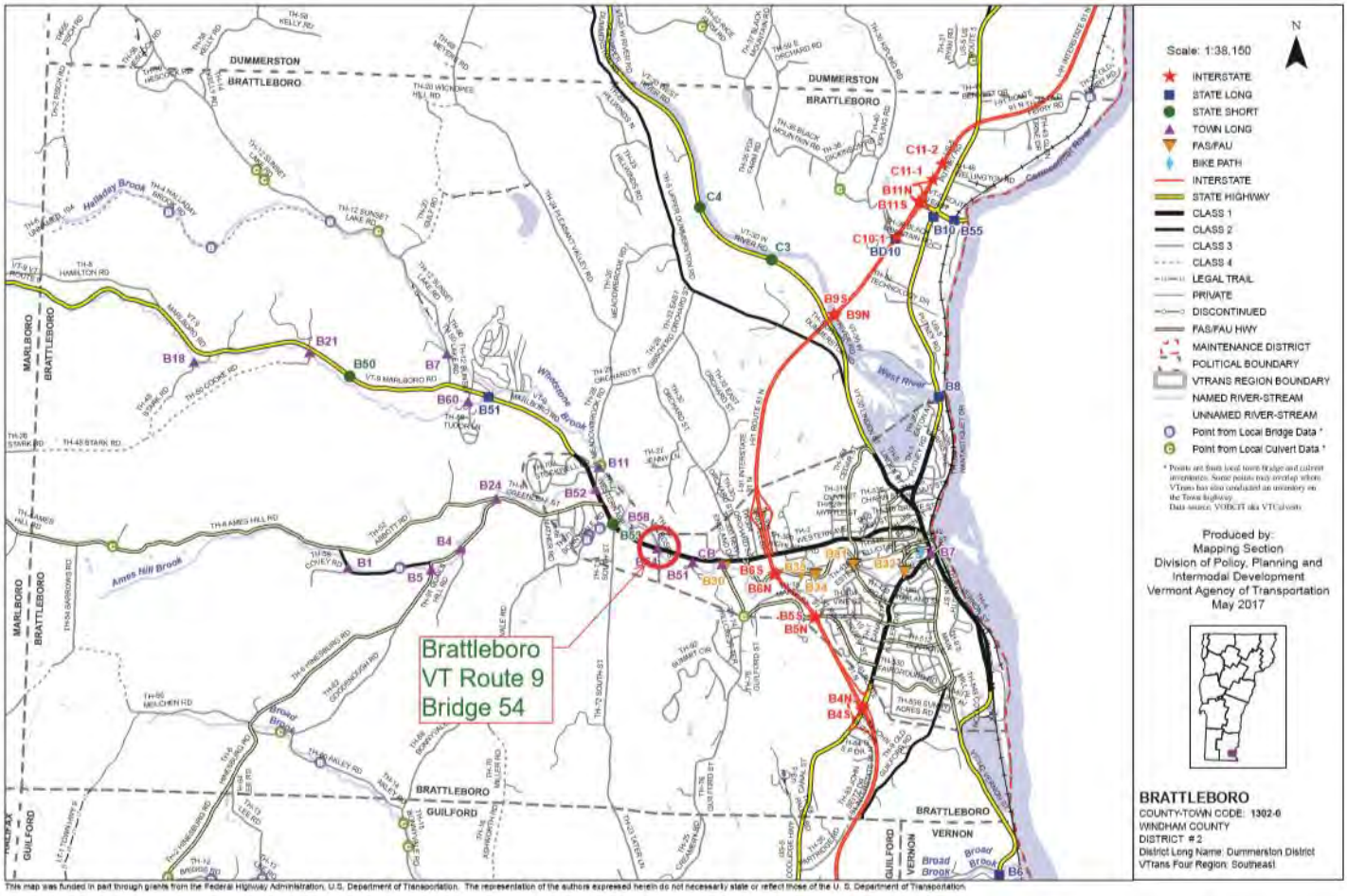


Figure 1: Project Location Map.

Figure 2: Aerial View of Project Area.

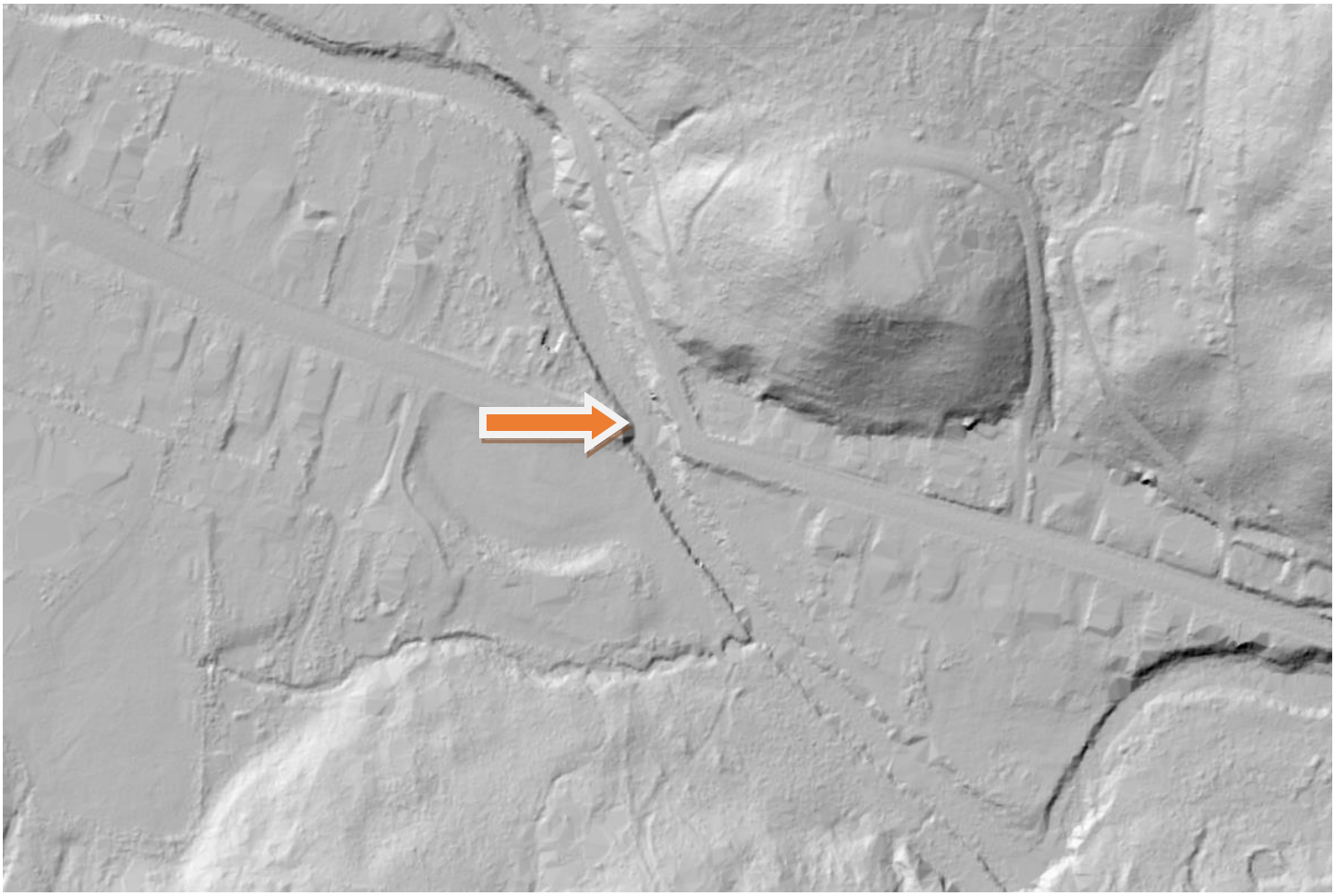


Figure 3: LiDAR View of Project Area.

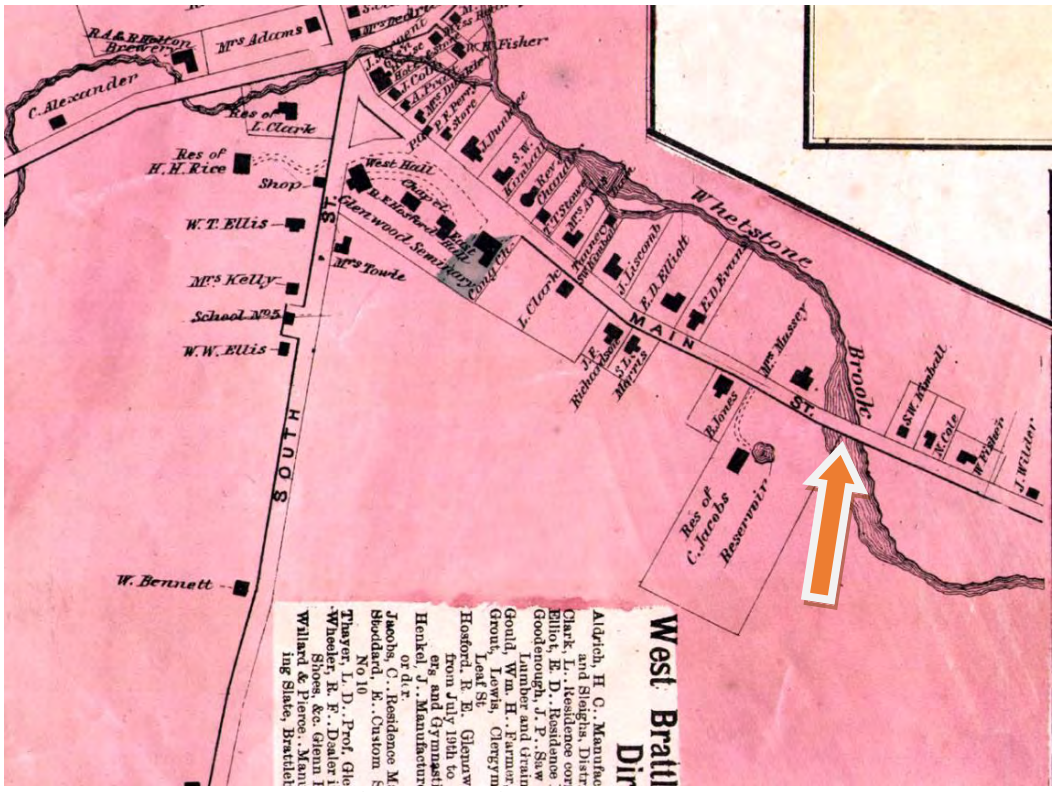


Figure 4: Project Area Ca. 1870.

Figure 5: View of Bridge South.

Figure 6: View of Bridge North.

A BRIDGE IN WEST BRATTLEBORO

Figure 7: Bridge Illustration Ca. 1912.

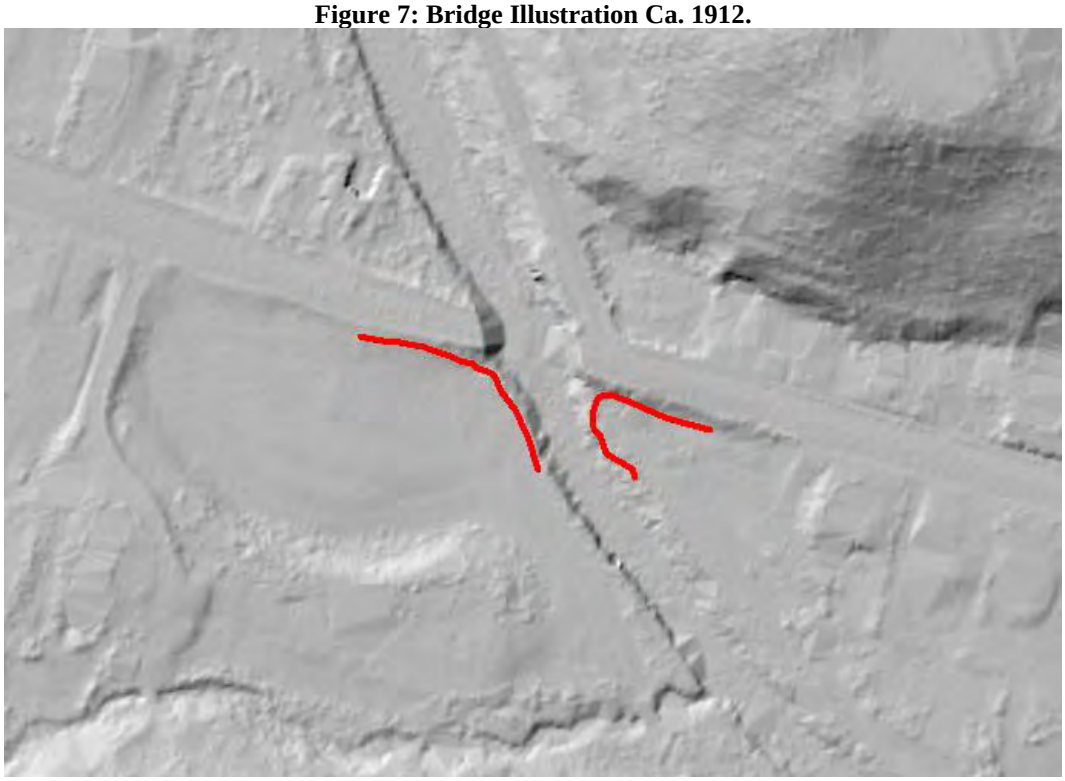


Figure 8: Archaeologically Sensitive Areas.

Appendix I: Historic Memo

Kyle Obenauer
Historic Preservation Specialist

Vermont Agency of Transportation

Project Delivery Bureau - Environmental Section
One National Life Drive
Montpelier, VT 05633-5001

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(802) 279-7040
www.vtrans.vermont.gov

Historic Preservation Resource Identification Memo

To: Lee Goldstein, VTrans Environmental Specialist
Cc: Brennan Gauthier, VTrans Archaeologist

Date: 10/17/2019

Subject: Brattleboro BF 2000(28)

Lee,

This Resource Identification effort is being undertaken to identify cultural resources within a broad preliminary survey area that could possibly be impacted by a future project at Bridge No. 54 on Vermont Route 9, near mile marker 5.09 in Brattleboro, Windham County, Vermont (F*igures 1-2)*. Once a project has been defined at the conceptual design phase, VTrans Cultural Resources staff will be able to determine a formal APE for purposes of Section 106 and 22 VSA § 14.

Constructed in August 1908, Bridge No. 54 is listed in the Vermont State Register of Historic Places (Site No. 1302-24) and appears individually eligible for inclusion in the National Register of Historic Places (NRHP). This bridge is a good example of an exceedingly rare property type in Vermont *(Figure 3)*. Two similar reinforced concrete arches in Newfane (Williamsville) and Bellows Falls also built as part of the state's earliest generation of reinforced concrete arches are currently scheduled for replacement within the next few years, placing additional significance on Bridge No. 54. Rehabilitation in accordance with the Secretary of the Interior's Standards should be considered as the preferred project alternative for a future project at Bridge No. 54, if feasible and prudent (Appendix A).

Within the preliminary survey area, several other historic resources were identified during desk review and a field visit conducted in early-October 2019 *(Figures 4-6)*. Although not individually eligible for inclusion in the NRHP, these properties would most likely be considered contributing resources to an expanded NRHP-listed West Brattleboro Green Historic District and include:

- **755 Western Avenue**; a two story, gable roofed clapboarded ell-shaped home constructed around 1850, with later Queen Anne detailing in the gables;

- **747 Western Avenue;** one of the older homes in West Brattleboro, a short 1 ½ story gable roofed, clapboarded home with several character defining stages of construction; and,
-
- **787 Western Avenue;** a large 2 ½ story vernacular house with some Greek Revival details and an associated detached barn with cupola and side chimney.

The historic resources identified in this memorandum are also considered Section 4(f) properties and have been mapped in ArcMap *(Figure 10)*.

Additional Information - Bridge No. 54

The first concrete arch bridge in the state was built in Williamsville (Newfane), completed in June of 1908.[1] The Williamsville arch bridge (Bridge No. 12) in Newfane was heralded in local papers for its use of reinforced concrete. Mere months behind its Williamsville counterpart, Bridge No. 54 in Brattleboro was completed in August of 1908, with similar anticipation noted in regional newspapers *(Figures 7-8)*.

According to the *Brattleboro Reformer*, Town Selectmen began looking for options to replace an existing bridge at today's Bridge No. 54 in February of 1908, after it was discovered that water leaking through the electric railroad track had caused extensive corrosion to an iron bridge at the crossing that was only 13 years old. Selectmen had to weigh the cost of repair ($800) with that of a new steel girder bridge with a concrete floor ($4000), against future estimates on a steel-reinforced concrete bridge.[2]

By April of 1908, the Town had formally chosen a reinforced concrete bridge and specifics were given to the public. The bridge would be 60 feet long with a 24-foot roadway, including space for electric car track. A concrete structure was favored since it was almost impossible to prevent corrosion of iron stringers under the electric car tracks.[3] The project was due to begin construction in June of 1908, but construction was slightly delayed. Selectmen awarded the contract to the Ley Construction Company of Springfield, MA for $4,600, one third of which was going to be paid by the electrified trolley company that shared the crossings' roadway. The bid of the local firm Crosby & Park was for $4,616 and that of the Loring N. Farnum Company of Boston $4,570. In the contract given to the Ley Construction Company, the bridge was ordered to be completed within 40 days once construction began.[4]

Work quickly began in earnest, and by July townsfolks eagerly watched the construction of the new bridge as forms were added and removed and the bridge began to take shape. By early August, the bridge was able to support electric cars on the roadway, and the temporary bridge was removed at the end of the same month. The new bridge was formally announced to the public in newspapers on September 4, 1908.[5] The bridge ended up taking more time than the specified 40 days of construction, nearing two months to complete the bridge, perhaps because parts of the old bridge were carefully removed to be used on smaller bridges.

Despite the slight delays, at the end of the construction period the Selectmen approved the work on the new bridge. It had a 60-foot span, 32-foot road width and 13-foot waterway from the apron to the top of the arch. The bridge was protected from traffic by battlements two feet high and eight inches thick. The structure was rated to stand up under a 40-ton car, with tensile strength of 450 pounds per square inch. The *Brattleboro Reformer* continues to elaborate on the specifics in its article "The New Concrete Bridge: It Crosses the Whetstone Brook in West Brattleboro and Is O.K.", stating: "Three-fourths inch steel rods form the network which binds the concrete

[1] See the *Brattleboro Reformer* article for June 26, 1908, page six for an article celebrating the construction of the Williamsville concrete arch bridge.
[2] *Brattleboro Reformer*. Brattleboro, Vermont. Friday February 14, 1908. Page six.
[3] *Brattleboro Reformer*. Brattleboro, Vermont. Friday April 24, 1908. Page five.
[4] *Brattleboro Reformer*. Brattleboro, Vermont. Friday June 12, 1908. Page five.
[5] *Brattleboro Reformer*. Brattleboro, Vermont. Friday September 4, 1908. Page three.

together in every direction, thus making it stronger than solid rock."[6] The details, it appears, were a very important element when discussing this new form of bridge building technology.

As the second concrete bridge in the state, Bridge No. 54 in Brattleboro and Bridge No. 12 in Newfane were the forerunners of reinforced concrete arch bridges in Vermont. No sooner did Brattleboro complete its bridge did the city think of constructing another bridge in the new concrete form, but so too did others. In 1908 and 1909, reinforced concrete arch bridges were built in Newfane, Brattleboro, Bellows Falls, and Richford (in that order), representing the first bridges of this type to be built in Vermont, with spans from 36 to 96 feet.[7] Though reinforced concrete arch culverts began to be built in 1902 in this state, it took several years before bridges could be accomplished.

Not only was Bridge No. 54 the second reinforced concrete arch bridge in the state, but it features a unique arch not often seen in concrete arch bridges. The bridge's arch is in the form of a unique shallow pointed arch that is credited to engineer Walter M. Denman. Denman was a proponent of concrete arches, citing not only their "artistic fitness" but also their low maintenance, claiming "the first cost of a concrete bridge is its last." It is believed that Denman drew his designs from those developed and patented by Daniel B. Luten between 1900 and 1906, who taught engineering at the University of Michigan, however this has not been completely proven.[8]

Though reinforced concrete arch design technology had been around for more than a decade, prohibitive costs limited the use in public spaces. By the time the Whetstone Brook crossing was conceptualized, several aspects throughout the country had changed making this form of technology more favorable. Costs had dropped as new manufacturers joined the fray, advertising by cement manufacturers emphasizing durability was frequent, and simple construction methods made erection easier.

After the successful completion of Newfane No. 12 and Brattleboro No. 54, amongst others, the popularity of concrete arch bridges in Vermont only rose. Beginning in 1912, the field of engineering professionals, led by the Vermont Society of Engineers, favored the form and the Vermont State Highway Department began to offer funding and free plans to municipalities, which would go on to change the Town-State relationship in regards to bridge building.[9]

Please, let me know if there are any questions.

---

[6] *Brattleboro Reformer*. Brattleboro, Vermont. Friday September 4, 1908. Page three
[7] Robert McCullough, *Crossings: A History of Vermont Bridges* (Barre, VT: Vermont Historical Society and Vermont Agency of Transportation, 2005), 176.
[8] McCullough, 177.
[9] McCullough, 182.

Images

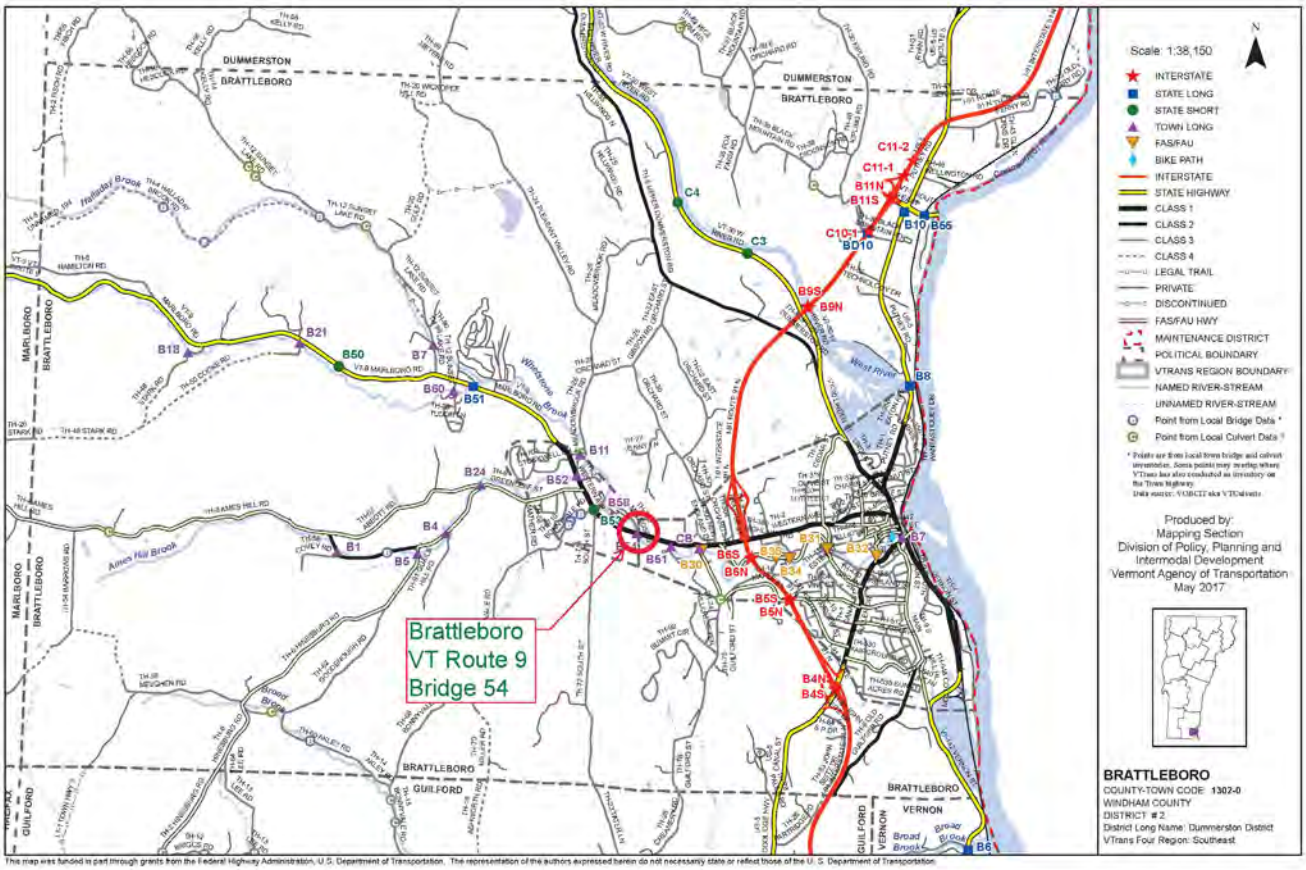


Figure 1. Location

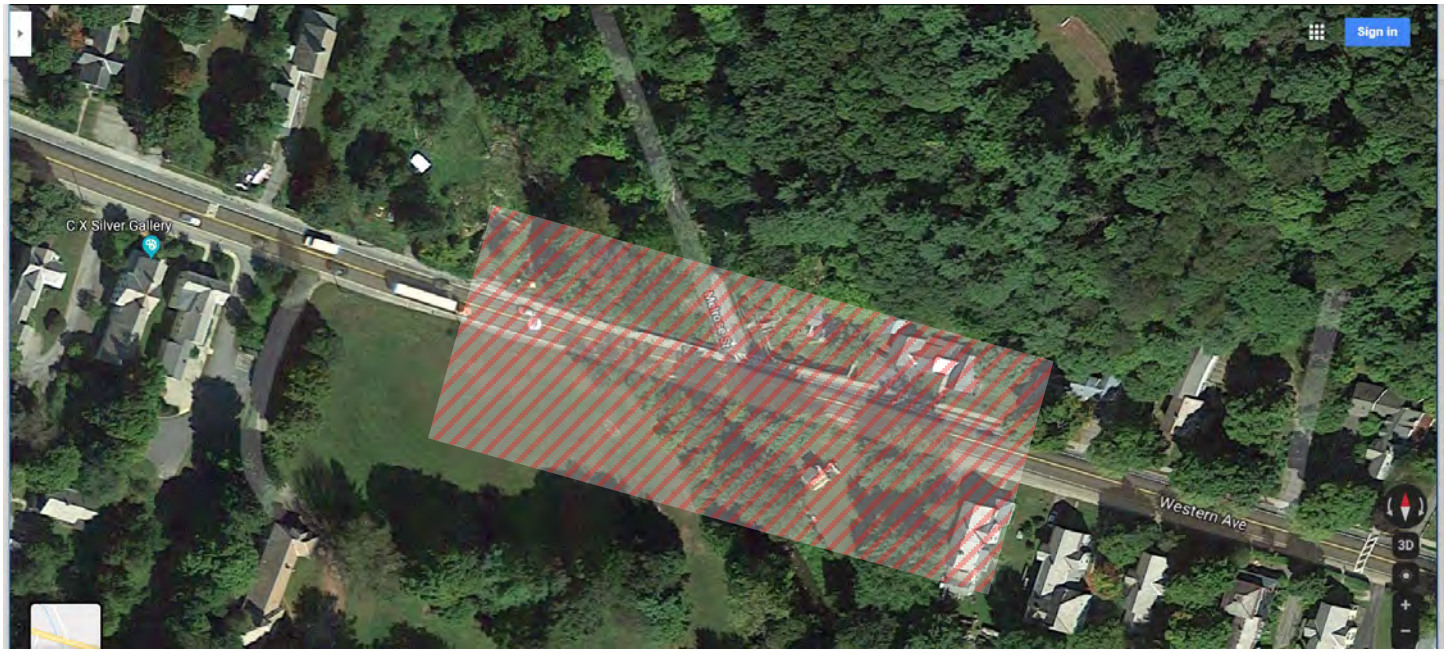


Figure 2. Preliminary Survey Area

Figure 3. Bridge No. 54

Figure 4. 747 Western Avenue

Figure 5. 755 Western Avenue

Figure 6. 787 Western Avenue

The steel reinforced concrete bridge under construction over Whetstone Brook, at West Brattleboro, is now approaching a condition where it is interesting to watch the daily developments, and we would suggest that you ride out on the street cars and see the interesting progress.

Figure 7. Brattleboro Reformer article, Page 5; July 3, 1908.

THE NEW CONCRETE BRIDGE.
It Crosses Whetstone Brook in West Brattleboro and Is O. K.

The concrete bridge over Whetstone brook near Melrose street corner is completed and is a credit to the town and its builders. It replaces the iron bridge which was erected 13 years ago and found last spring to be unsafe on account of rusted framework underneath the street railroad track. It is nearly two months since the street was torn up on account of the work. A temporary bridge was built and the old one carefully removed in sections in order that parts of it may be used for smaller bridges.

The board of selectmen awarded the contract for the work to the Ley Construction company of Springfield, Mass., at $4,600, and since its completion they express their approval of the work and are assured it will prove a permanent structure. It is a 60-foot span, 32 feet wide and 13 feet waterway from the apron to top of the arch. The traffic which passes over the bridge is protected by battlements two feet high and eight inches thick. The apron which covers the bed of the brook is two feet thick and 37 feet wide and serves to prevent washouts in the brook-bed or at the ends of the bridge. A 16-inch tile is embedded in the concrete and can be connected at either end with the water-main. It is absolutely protected from leaks or breakage. The bridge is a reinforced cement structure and warranted to stand up under a 40-ton car. It shows a tensile strength of 450 lbs. per square inch. Three-fourths inch steel rods form the network which binds the concrete together in every direction, thus making it stronger than solid rock. The concrete of the bridge is covered with eight inches of gravel, thus affording good road surface.

Figure 8: Brattleboro Reformer article, Page 3; September 4, 1908.

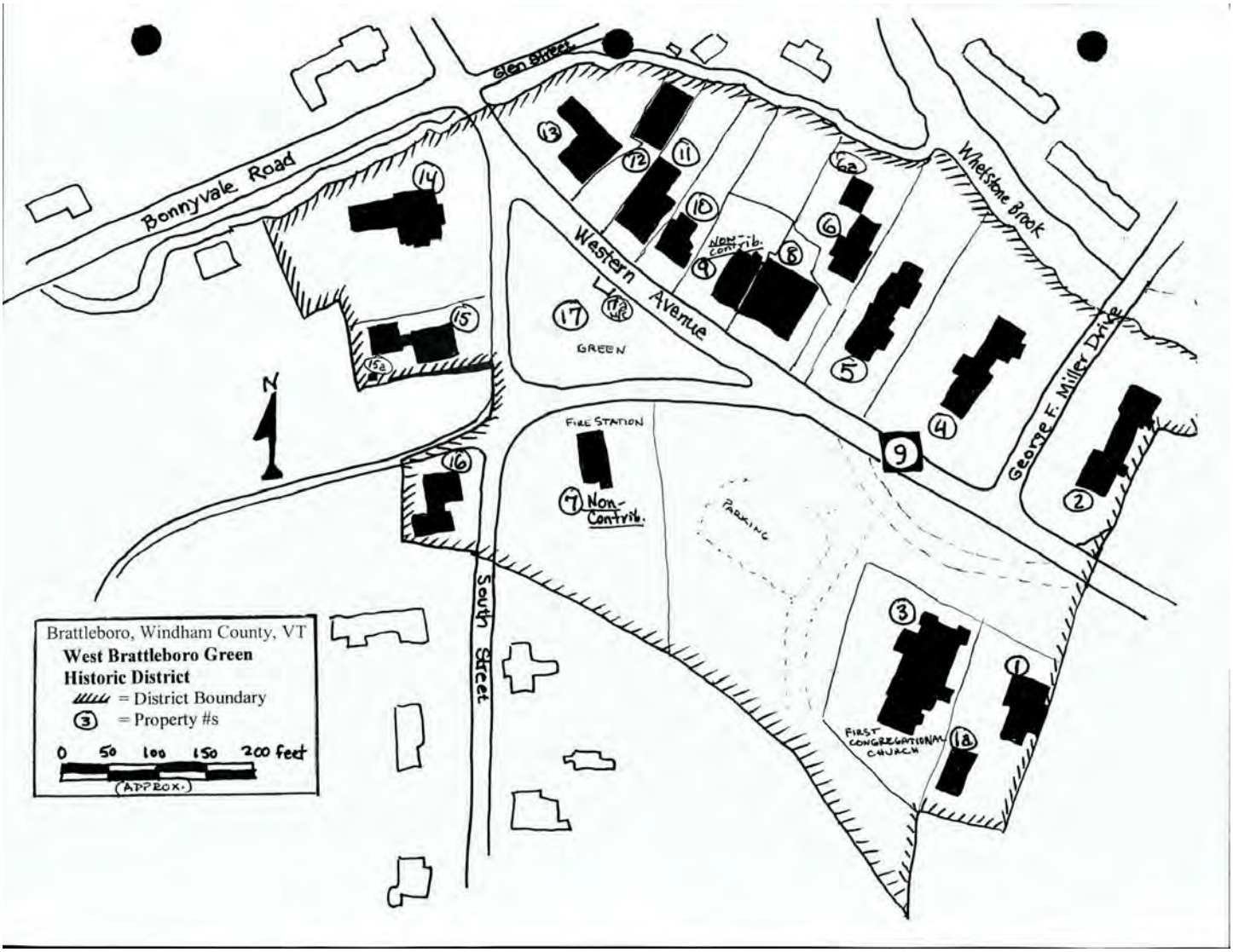


Figure 9. Existing boundaries of NRHP-listed West Brattleboro Green Historic District, west of Bridge No. 54.

Figure 10. Historic resources identified within preliminary survey area.

Appendix A – Secretary of the Interior's Standards for Rehabilitation (36 CFR 67)

1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.

2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.

3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.

4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property shall be preserved.

6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.

8. Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

More information can be found here: https://www.nps.gov/tps/standards/rehabilitation.htm

Appendix J: Crash Data

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

WHERE Year of Crash >= 2012 AND Year of Crash <= 2016

*	Reporting Agency/ Incident No.	City/Town	Mile Marker	Crash Date	Time	Weather	Contributing Circumstances	Direction of Collision	Number Of Injuries	Number Of Fatalities	Number Of Untimely Deaths	Direction	Road Group
	VT0130200/14BB03274	Brattleboro	4.61	05/12/2014	20:02	Clear	Other improper action	No Turns, Thru moves only, Broadside ^<	1	0	0	W	SH
	VT0130200/15BB04712	Brattleboro	4.61	06/12/2015	15:20	Clear	Failed to yield right of way	No Turns, Thru moves only, Broadside ^<	1	0	0	N, E	SH
	VT0130200/15BB04747	Brattleboro	4.61	06/13/2015	19:13	[No Weather]		Rear End	0	0	0	W	SH
	VT0130200/15BB04795	Brattleboro	4.61	06/15/2015	10:04	Clear		Rear End	0	0	0	E	SH
	VT0130200/15BB03666	Brattleboro	4.63	05/11/2015	14:13	Clear	Inattention	Rear End	0	0	0	E	SH
	VT0130200/14BB02722	Brattleboro	4.65	04/21/2014	16:27	Clear	Inattention, Driving too fast for conditions	[No Direction of Collision]	0	0	0	W	SH
	VT0130200/15BB09707	Brattleboro	4.65	11/24/2015	16:51	Clear	Failed to yield right of way, Inattention	No Turns, Thru moves only, Broadside ^<	0	0	0	W, E	SH
	VT0130200/16BB10782	Brattleboro	4.65	12/26/2016	16:56	Rain	Inattention, Unknown	Rear End	0	0	0	E	SH Class 1 TH
	VT0130200/14BB04541	Brattleboro	4.71	06/24/2014	[No Time]	[No Weather]		[No Direction of Collision]	0	0	0	W	SH
	VT0130200/13BB09357	Brattleboro	4.74	12/08/2013	15:05	Cloudy	Failed to yield right of way	Same Direction Sideswipe	0	0	0	W	SH
	VT0130200/12BB03525	Brattleboro	4.75	05/15/2012	08:22	Cloudy	No improper driving	Rear End	0	0	0	E	SH
	VT0130200/16BB01609	Brattleboro	4.75	03/04/2016	15:11	Clear	Inattention	Rear End	0	0	0	E	SH State Owned
	VT0130200/15BB01999	Brattleboro	4.77	03/15/2015	19:12	Clear	No improper driving	Other - Explain in Narrative	0	0	0	E, P	SH
	VT0130200/13BB03501	Brattleboro	4.79	05/18/2013	11:42	Clear	Inattention	Rear End	0	0	0	W	SH
	VT0130200/15BB08382	Brattleboro	4.79	10/04/2015	03:57	Clear	Under the influence of medication/drugs/alcohol, Fatigued, asleep	Rear End	1	0	0	W	SH
	VT0130200/14BB06305	Brattleboro	4.81	08/19/2014	18:49	Clear		Rear End	0	0	0	P, W	SH
	VT0130200/15BB09704	Brattleboro	4.81	11/24/2015	15:56	Clear	Inattention	Rear End	2	0	0	W	SH
	VT0130200/16BB09084	Brattleboro	4.81	10/26/2016	19:45	Clear	Failed to yield right of way	Same Direction Sideswipe	0	0	0	W	SH Class 1 TH
	VT0130200/13BB00416	Brattleboro	4.82	01/17/2013	08:15	[No Weather]		[No Direction of Collision]	0	0	0	W	SH
	VT0130200/16BB07063	Brattleboro	4.82	08/26/2016	11:23	Clear	Unknown	Other - Explain in Narrative	0	0	0	E, W	SH State Owned
	VT0130200/13BB08053	Brattleboro	4.86	10/19/2013	12:42	Clear	Failed to yield right of way	No Turns, Thru moves only, Broadside ^<	1	0	0	N, E	SH
	VT0130200/14BB00195	Brattleboro	4.87	01/09/2014	07:59	[No Weather]		Rear End	2	0	0	E	SH
	VT0130200/16BB02525	Brattleboro	4.87	04/04/2016	15:02	Snow	Inattention, Other Activity, Electronic Device	Rear End	0	0	0	E	SH Class 1 TH
	VT0130200/16BB07741	Brattleboro	4.87	09/14/2016	14:20	[No Weather]		[No Direction of Collision]	0	0	0	P	SH State

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

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

WHERE Year of Crash >= 2012 AND Year of Crash <= 2016

*	Reporting Agency/ Incident No.	City/Town	Mile Marker	Crash Date	Time	Weather	Contributing Circumstances	Direction of Collision	Number Of Injuries	Number Of Fatalities	Number Of Untimely Deaths	Direction	Road Group
													Owned
	VT0130200/13BB00760	Brattleboro	4.88	01/31/2013	15:20	Clear	Followed too closely	Rear End	0	0	0	W	SH
	VT0130200/16BB10615	Brattleboro	4.88	12/18/2016	16:05	Cloudy	Followed too closely	Rear End	0	0	0	W	SH Class 1 TH
	VT0130200/12BB01611	Brattleboro	4.91	03/03/2012	16:04	Clear	Failed to yield right of way, Inattention	Same Direction Sideswipe	0	0	0	S	SH
	VT0130200/15BB02887	Brattleboro	4.91	04/15/2015	08:30	[No Weather]		[No Direction of Collision]	0	0	0	N, P	SH
	VT0130200/15BB09051	Brattleboro	4.91	10/29/2015	08:33	Clear		Other - Explain in Narrative	0	0	0	S, W	SH
	VT0130200/15BB09098	Brattleboro	4.91	10/30/2015	16:04	Clear	Unknown	[No Direction of Collision]	0	0	0	W	SH
	VT0130200/16BB00810	Brattleboro	4.92	02/04/2016	12:28	Clear	Visibility obstructed	Other - Explain in Narrative	0	0	0	N, W	SH Class 1 TH
	VT0130200/12BB03427	Brattleboro	4.94	05/11/2012	15:02	Cloudy	Under the influence of medication/drugs/alcohol, Fatigued, asleep, No improper driving	Rear End	3	0	0	W	SH
	VT0130200/14BB01154	Brattleboro	4.96	02/18/2014	18:17	Snow	Driving too fast for conditions	Rear End	1	0	0	E	SH
	VT0130200/16BB07150	Brattleboro	4.98	08/29/2016	07:59	Clear	Followed too closely, Inattention	Rear End	1	0	0	E	SH State Owned
	VT0130200/13BB04858	Brattleboro	4.99	07/03/2013	20:06	Clear	Inattention, Followed too closely	Rear End	0	0	0	W	SH
	VT0130200/16BB02382	Brattleboro	4.99	03/30/2016	16:39	Clear	Followed too closely	Rear End	1	0	0	W	SH Class 1 TH
	VT0130200/16BB05389	Brattleboro	4.99	07/05/2016	17:09	Clear	Inattention, Other Inside Vehicle	Head On	2	0	0	E	SH Class 1 TH
	VT0130200/13BB04535	Brattleboro	5.01	06/22/2013	13:14	Clear	No improper driving, Inattention	Same Direction Sideswipe	2	0	0	E	SH
	VT0130200/16BB09175	Brattleboro	5.01	10/28/2016	18:47	Cloudy	Failure to keep in proper lane, Under the influence of medication/drugs/alcohol, No improper driving	Head On	0	0	0	W, E	SH Class 1 TH
	VT0130200/12BB07148	Brattleboro	5.04	09/15/2012	16:00	Clear	Followed too closely, Inattention	Rear End	0	0	0	E	SH
	VT0130200/13BB01737	Brattleboro	5.10	03/13/2013	20:01	Clear	Under the influence of medication/drugs/alcohol, Failure to keep in proper lane	Opp Direction Sideswipe	0	0	0	E	SH
	VT0130200/15BB02211	Brattleboro	5.10	03/23/2015	09:13	Clear	Fatigued, asleep	Opp Direction Sideswipe	0	0	0	W, E	SH
	VT0130200/12BB06686	Brattleboro	5.15	08/30/2012	08:06	Clear		[No Direction of Collision]	0	0	0	E	SH
	VT0130200/16BB00122	Brattleboro	5.17	01/06/2016	05:00	[No Weather]		[No Direction of Collision]	0	0	0	E	SH Class 1 TH
	VT0130200/13BB07333	Brattleboro	5.23	09/25/2013	08:26	Other - Explain in Narrative	Followed too closely, Inattention	Rear End	0	0	0	E	SH
	VT0130200/13BB02651	Brattleboro	5.31	04/19/2013	05:03	Clear	Inattention	Single Vehicle Crash	0	0	0	W	SH

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

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

WHERE Year of Crash >= 2012 AND Year of Crash <= 2016

*	Reporting Agency/ Incident No.	City/Town	Mile Marker	Crash Date	Time	Weather	Contributing Circumstances	Direction of Collision	Number Of Injuries	Number Of Fatalities	Number Of Untimely Deaths	Direction	Road Group
	VT0130200/12BB03925	Brattleboro	5.35	05/29/2012	13:13	Clear	Distracted	Rear End	0	0	0	E	SH
	VT0130200/13BB02221	Brattleboro	5.35	04/02/2013	20:02	Clear	No improper driving	Other - Explain in Narrative	0	0	0	W	SH
	VT0130200/14BB03567	Brattleboro	5.35	05/22/2014	15:19	Clear	Distracted	Rear End	2	0	0	E	SH
	VT0130200/15BB09608	Brattleboro	5.35	11/19/2015	18:00	[No Weather]		[No Direction of Collision]	0	0	0	W	SH
	VT0130200/16BB09604	Brattleboro	5.35	11/12/2016	16:27	Clear	Failure to keep in proper lane	[No Direction of Collision]	0	0	0	W	SH Class 1 TH
	VT0130200/15BB07111	Brattleboro	5.43	08/24/2015	10:41	Clear		Rear End	0	0	0	W	SH
	VT0130200/14BB06454	Brattleboro	5.44	08/24/2014	09:54	Clear	Followed too closely	[No Direction of Collision]	0	0	0	W	SH
	VT0130200/12BB01473	Brattleboro	5.46	02/27/2012	18:14	Clear	Unknown, Inattention	Single Vehicle Crash	0	1	0	W	SH
	VT0130200/12BB03466	Brattleboro	5.48	05/13/2012	13:00	Clear	Inattention, No improper driving	Rear End	0	0	0	E	SH
	VT0130200/13BB08785	Brattleboro	5.50	11/14/2013	16:56	Clear	Failure to keep in proper lane, Fatigued, asleep, No improper driving	Opp Direction Sideswipe	3	0	0	W, E	SH
	VT0130200/12BB01403	Brattleboro	5.53	02/04/2012	13:41	Rain	Inattention, Distracted, No improper driving	Rear End	0	0	0	W	SH
	VT0130200/12BB01278	Brattleboro	5.53	02/19/2012	13:49	Clear	Inattention	Rear End	0	0	0	W	SH
	VT0130200/12BB02459	Brattleboro	5.53	04/04/2012	11:22	Clear	Followed too closely, No improper driving	Rear End	0	0	0	W	SH
	VT0130200/12BB02608	Brattleboro	5.53	04/11/2012	08:45	Clear	Visibility obstructed	Rear End	1	0	0	E	SH
	VT0130200/12BB01700	Brattleboro	5.54	03/07/2012	12:43	Clear	Failed to yield right of way, No improper driving	Left Turn and Thru, Angle Broadside -->v--	0	0	0	N, W	SH
	VT0130200/13BB08984	Brattleboro	5.55	11/21/2013	23:57	Clear	Made an improper turn	Single Vehicle Crash	0	0	0	S	SH
	VT0130200/14BB01303	Brattleboro	5.58	02/24/2014	18:33	Clear	Driving too fast for conditions, Followed too closely	Rear End	1	0	0	W	SH
	VT0130200/14BB03936	Brattleboro	5.58	06/04/2014	08:43	Cloudy	Failure to keep in proper lane	Head On	1	0	0	E, W	SH
	VT0130200/14BB07780	Brattleboro	5.58	10/12/2014	15:21	Clear	Followed too closely	Rear End	0	0	0	W	SH
	VT0130200/15BB06552	Brattleboro	5.58	08/07/2015	14:46	Clear	Inattention	Rear End	0	0	0	W	SH
	VT0130200/16BB02150	Brattleboro	5.58	03/23/2016	07:55	[No Weather]		[No Direction of Collision]	0	0	0	N	SH State Owned
	VT0130200/13BB05760	Brattleboro	5.59	08/02/2013	15:55	Clear	Followed too closely	Rear End	1	0	0	E	SH
	VT0130200/12BB04212	Brattleboro	5.62	06/08/2012	17:03	Clear	Inattention, No improper driving	Rear End	0	0	0	W	SH
	VT0130200/13BB01805	Brattleboro	5.62	03/16/2013	13:16	[No Weather]	Inattention	Rear End	0	0	0	W	SH
	VT0130200/13BB05149	Brattleboro	5.62	07/13/2013	13:33	Rain	Failed to yield right of way, Inattention	[No Direction of Collision]	2	0	0	W, E	SH
	VT0130200/15BB01917	Brattleboro	5.62	03/12/2015	16:04	Clear	Failed to yield right of way	Other - Explain in Narrative	0	0	0	N, E	SH
	VT0130200/16BB10427	Brattleboro	5.62	12/12/2016	10:14	Snow	No improper driving	Other - Explain in Narrative	0	0	0	E	SH Class 1

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

Appendix K: Community Input

Project Summary

This project, BF 2000(28), focuses on a culvert on VT Route 9 in Brattleboro, Vermont. The culvert is in satisfactory structural condition but needs either an extension with new sidewalks, or replacement. Potential options being considered for this project include an extension to the upstream fascia, 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 bridge 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.

   The Brattleboro Area Farmer's Market, located at 570 Western Ave., runs from 9 am – 2 pm every Saturday from May to October.

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

   Traffic is less when school is out of session

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 bridge, one-way traffic, or lane closures and provide contact information (names, address, email addresses, and phone numbers

   The Brattleboro Police Department is located on the north end of Town off of I-91 Exit 3. There are two fire stations, Central Station in downtown Brattleboro and Station 2 located in West Brattleboro. Rescue, Inc. provides ambulance services it is located adjacent to the I-91 Exit 1 northbound on-ramp.

   Route 9 is the main east-west arterial road servicing Brattleboro. Emergency response routes will be affected by the closure of the bridge.

   Brattleboro Police Department
   62 Black Mountain Rd #101, Brattleboro
   Michael Fitzgerald, Chief of Police
   (802) 257-7946
   Michael.Fitzgerald@vermont.gov

Brattleboro Central Fire Station
103 Elliot Street, Brattleboro
Michael Bucossi, Chief
802-254-4831
mbucossi@brattleboro.org

Brattleboro Station 2
16 South Street
Michael Bucossi, Chief
802-254-4831
mbucossi@brattleboro.org

Rescue Inc.
541 Canal Street, Brattleboro
802) 257-7679
Drew Hazelton, Chief of Operations

Brattleboro Public Works
211 Fairground Round, Brattleboro
Steve Barrett, Public Works Director
802-254-4255
sbarrett@brattleboro.org

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?

   Route 9 is the main east-west arterial highway servicing southern Vermont. It has high truck traffic. Delivery trucks

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?

   Living Memorial Park – 61 Guilford Street

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

   Curbside trash, recycling and compost pickup

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 bridges, etc), including those that may be or go into other towns.

   Potential bypass routes could not accommodate heavy truck traffic due to weight limits on the road. Orchard Street is a Class 3 Town highway with only a portion of it being pave. Meadowbrook Road is also a Class 3 highway, part of which is paved and part of which is unpaved.

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.

   - West Brattleboro Association – Michael Bosworth, mlb@sover.net
   - Brattleboro Chamber of Commerce – Kate O'Connor, kate@brattleborochamber.com, 802-254-4565
   - Brattleboro Development Credit Corporation – Adam Grinold, agrinold@brattleborodevelopment.com, 802-257-7731 Ex 224
   - Downtown Brattleboro Alliance – Stephanie Bonin, Stephanie@brattleboro.com, 802-257-4886

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

   Connecticut River Transit provide in-town bus service in Brattleboro via the Current. The red, line provide bus service to/from downtown and West Brattleboro. Southeast Vermont Transit operates the Moover which provides Monday-Friday transit between Wilmington and Brattleboro.

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)?

   All public schools are in session generally from the last week of August to third week of June. There are three elementary schools in town. Students do not necessarily attend the school located closest to them, instead the elementary school population is divided by the number of students in each grade level and placed in one of the following schools:

   - Academy School, 860 Western Ave. in West Brattleboro Village. This school is near the bridge.
   - Green Street School – 164 Green St.
   - Oak Grove School – 15 Moreland Ave.

Brattleboro Union High School, Brattleboro Area Middle School, Windham Region Career Center, share a campus. BUHS is located at 131 Fairground Rd., BAMS is at 109 Sunny Acres Road, and the Career Center is at 80 Atwood St. Students travel from the west of Town along Route 9 to attend these schools.

There are several private schools in town that attract students from both Brattleboro and nearby towns.

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

   The project is on a route to Academy School. There is a lot of bus traffic as well as pedestrian traffic associated with the school.

   BUHS, BAMS and the Career Center are regional schools. Buses utilize Route 9 as transportation route.

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

   No

Pedestrians and Bicyclists

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

   There is high level of bicycle and pedestrian use on the bridge. Safety issues persist for bicyclists that must encounter large trucks and vehicles on the narrowed bridge.

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

   No. The sidewalk is currently 4 ft. wide and only accommodates single file walking. There is no shoulder to the bridge and therefore, no safe space for bicycle use.

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

   Yes, this has been well-documented in discussions with the Traffic Safety Committee.

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

   Yes

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

   The 2014 West Brattleboro Bicycle and Pedestrian Scoping Study states the following:

"The changes in the eastern segment of the preferred alternative is a continuation of the road section across the bridge. The plan proposes that when the new bridge is constructed, a five-foot bike lane in each direction, along with a curbed sidewalk on both north and south sides of the street would continue across the bridge. When the main bridge is updated, the prefabricated bridge for the sidewalk can be removed and reused elsewhere in the Town. The preferred alternative also includes the temporary crosswalk on the west side of the Whetstone Brook road bridge if the prefabricated pedestrian bridge is not constructed at the same time that the south side sidewalk is extended east." (p. 37).

A copy of the report is attached to the email.

6. In the vicinity of the bridge, 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?

   The area includes a diverse mix of land uses, including street-front retail, single- and multi-family homes, professional offices, schools, and churches, all flanking along Western Avenue. Given the various destinations on both sides of the street, including schools and youth activities, it is important to ensure that pedestrians and bicyclists continue to be accommodated and that their safety is improved.

Design Considerations

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

   The bridge is skewed at 39 degrees from the direction of river flow. This influences flooding (see discussion below under the history of flooding).

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

   This bridge is an undersized structure with an effective opening width of 47 feet (78% of the channel bankfull width). The bridge backs up flood waters (see discussion of history of flooding below).

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

   No

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

   According to a 2015 Hydrologic and Hydraulic Analysis of the Melrose Terrace Results Report, this bridge is an undersized structure with an effective opening width of 47 feet (78% of the channel bankfull width). The bridge backs up flood waters, and the model shows a rise of 5.3 feet from downstream to upstream of the bridge for the Irene flood. The bridge is skewed at 39 degrees from the direction of river flow, further reducing the effective size of the opening by

20% (actual width is 61 feet and the effective width is 47 feet). The arch shape of the opening is narrow at the top where flood levels reach that blocks debris and readily clogs the opening. A 16-inch water main hangs below the top of the arch that blocks high flows and catches debris. This pipe is vulnerable to damage as it hangs below the lowest bridge beam. The low point in the road is to the west of the bridge where water flowed over during Irene. The model shows that storms greater than the 10-year flood level overtop the bridge.

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

   None known

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

   None known

7. Are there any utilities (water, sewer, communications, power) attached to the existing bridge? Please provide any available documentation.

   There is a 16-inch water main that is attached to the existing bridge, water & sewer mains east & west of bridge structure (see jpg attached to the email)

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

   No

9. 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.

   See attached. The future land use map matches the zoning map.

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

   No

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

   None known

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.

   Daily Newspaper: Brattleboro Reformer
   Weekly Newspaper: The Commons
   Citizen Journalism Websites:
   iBrattleboro – www.ibrattleboro.org
   Front Porch Forum - https://frontporchforum.com/areas/219
   Radio: WTSA - https://wtsaradio.com/
   WKVT - https://brattfm.com/
   Community Radio: WVEW - https://www.wvew.org/
   Facebook: Town of Brattleboro

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?

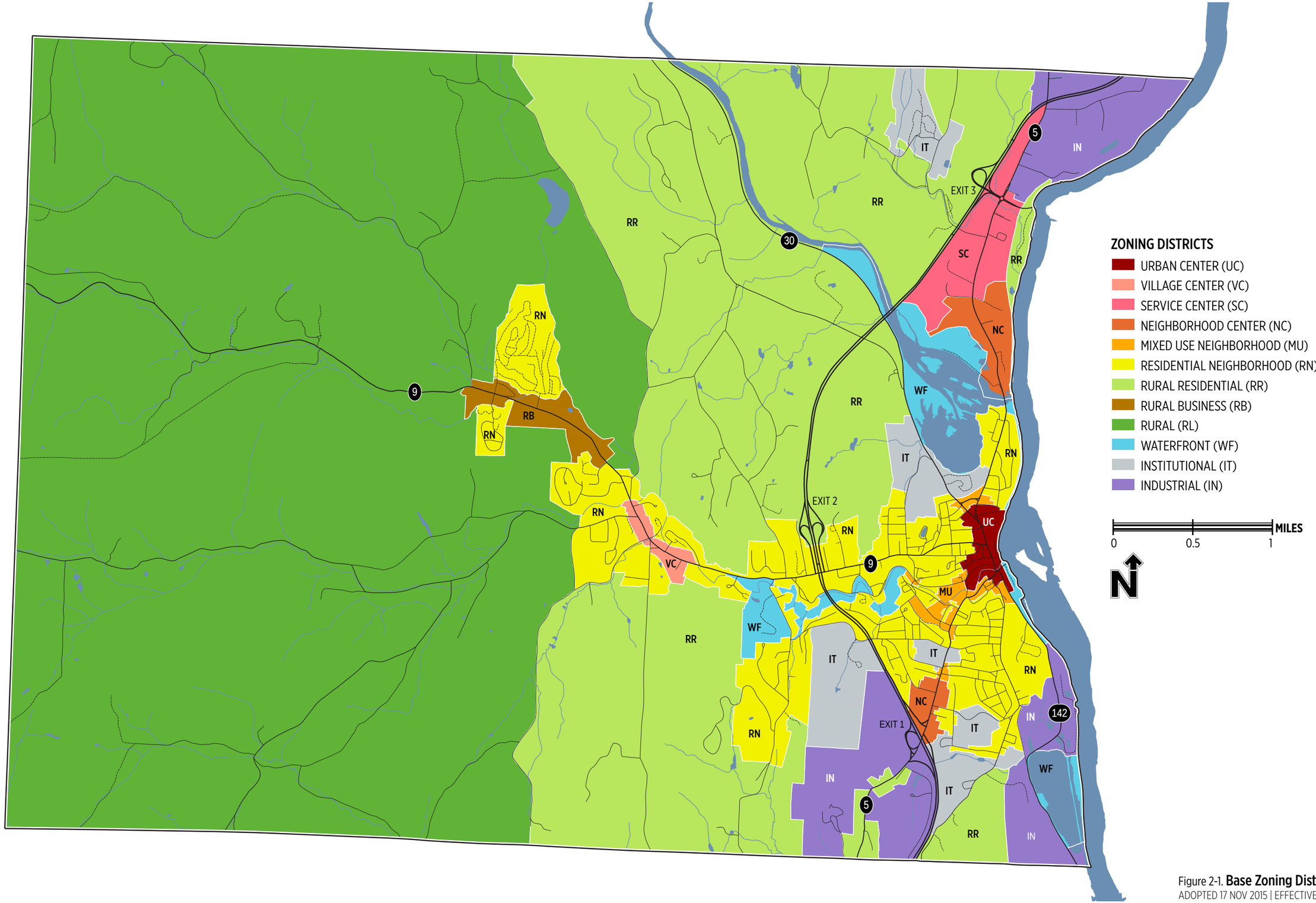


Figure 2-1. **Base Zoning District Map**
ADOPTED 17 NOV 2015 | EFFECTIVE 8 DEC 2015

Memorandum

TO: **Brattleboro Housing Authority**

FROM: **Roy Schiff & Jessica Louisos, Milone & MacBroom**

DATE: **June 30, 2015**

RE: Hydrologic & Hydraulic Analysis of Melrose Terrace Results Report

Introduction

Melrose Terrace and other areas in Brattleboro, Vermont have experienced repetitive flooding, most recently during Tropical Storm Irene. As a result of the flooding, the Brattleboro Housing Authority (BHA) will be relocating the housing currently located at Melrose Terrace. BHA is exploring options at the site for the next users.

This study explored flood mitigation alternatives around Melrose Terrace to inform the best uses of the property in order to reduce future flood and erosion risks both at the subject property and at surrounding properties. The analysis considered risks to roads and bridges, the ability to maintain useable building areas that have acceptable risk levels, environmental benefits, and feasibility (i.e., permitting needs and cost).

Hydrology

Design flows used in hydraulic modeling were obtained from the FEMA effective flows (FEMA, 2007) or by scaling flows from surrogate USGS stream gauges to the project area for flood recurrence intervals not calculated by FEMA (Table 1). Multiple sources of hydrology were considered and compared including USGS Vermont StreamStats regression equations (Olson, 2002, 2014), steep streams regression equations (Jacobs, 2010), and the FEMA Effective flows (FEMA, 2007). Also included were USGS Bulletin 17B (USGS, 1982) analyses using HEC-SSP (USACE, 2010b) from the Dog River at Northfield Falls (USGS gauge 04287000) the Mad River at Moretown (USGS gauge 04288000) and Ayers Brook at Randolph (USGS gauge 01142500). Bulletin 17B analyses were also included for these three gauges using only post 1970 flow data, based on a NOAA recommendation that indicates an increase in peak flood flows in the northeast starting in 1970 (Collins, 2009; NMFS, 2011). The current FEMA effective flows were chosen as a conservative estimate of design flows at the project site, and scaled flows from the Dog River were chosen for recurrence intervals not included in the FEMA flows because they fit the magnitudes of the effective flows.

Multiple sources of flow data were considered for estimates of peak flows during Tropical Storm Irene. Flow estimates were calculated from the flow exceedance curve of effective flows (MMI, 2012), and by scaling Irene peak flows from the Dog River at Northfield Falls (USGS gauge 04287000), Mad River at Moretown (USGS gauge 04288000), Ayers Brook at Randolph (USGS gauge 01142500), and Saxtons River at Saxtons River (USGS gauge 01154000) to the project site by drainage area. Irene flows used in the hydraulic modeling were chosen by improving upon previous flow estimates (MMI, 2012) during the model calibration procedure using known high water marks and flow patterns.

TABLE 1
Design Flows

2-yr**	5-yr**	10-yr*	25-yr**	50-yr*	100-yr*	500-yr*	Irene
1,454	2,437	3,182	4,623	5,994	7,400	11,500	5,800

*FEMA effective flows.
**Scaled from USGS gauge, Dog River at Northfield Falls, VT.

Duplicate Model

Whetstone Brook has a detailed hydraulic study that defines the Special Flood Hazard Area (FEMA, 2007). Any proposed projects to be implemented in the floodway or 100-year floodplain would be required to submit hydraulic modeling to either show no increase in flood levels or to propose a change to the effective FEMA flood maps. One required element of this submission is to create a FEMA duplicate model and build upon that to link the proposed hydraulic changes back to the FEMA effective model. A FEMA duplicate model and revised duplicate model have been prepared as part of this project to assist with future projects that may be pursued at the project site.

A duplicate of the 1982 HEC-2 hydraulics model for the Town of Brattleboro was created by entering the original HEC-2 data into the HEC-RAS (USACE, 2010a). The original HEC-2 data were truncated to cover the 1.3-mile long project reach from the confluence of Whetstone Brook and Ames Hill Brook (FEMA cross section BB) to just downstream of the Brookside Drive Bridge (FEMA cross sections AL). HEC-RAS is used to compute water surface profiles for one-dimensional, steady-state, and gradually varied flow. HEC-RAS is capable of modeling water surface profiles under subcritical, supercritical, and mixed-flow conditions. The basic computational procedure is based on the solution of the one-dimensional energy equation. Energy losses are evaluated by friction (Manning's Equation) and contraction/expansion (coefficient multiplied by the change in velocity head).

A revised duplicate model was created by making minor alterations to the HEC-2 data at bridges so that the HEC-RAS model would run without errors. Results were compared to the effective profile (FEMA, 2007). The average difference between the revised duplicate HEC-RAS model and the FEMA effective 100-year profile is 0.2 feet, with a range of 3.0 feet to -3.2 feet. As expected, the modeled flood levels deviated further from the FEMA profile near bridges due to different modeling approaches used between RAS and HEC-2.

Existing Conditions Model

An existing conditions model was developed using new survey on the Whetstone Brook for 4,600 feet (0.9 miles) of channel from Ames Hill Brook near Hayes Court to the river bend downstream of VT Route 9. FEMA cross section locations were maintained where possible and resurveyed to reflect the existing channel and floodplain geometry. Additional cross sections were added to include the locations controlling hydraulics as determined during a site walk by Milone & MacBroom on May 11, 2015. Survey data were collected in the wet channel, across the floodplain, and on bridges by MSK Engineering and Design in May 2015. Topography was supplemented with previous survey of Melrose Terrace by Stevens & Associates in April 2012. All elevations refer to the 1988 North American Vertical Datum (NAVD88). Manning's hydraulic roughness values are based on field observations. Buildings are included as blocked obstructions.

Flood water jumped its banks (i.e., avulsed) from the Whetstone Brook channel just upstream of Melrose Terrace during Tropical Storm Irene and followed Melrose Street and a swale behind residential buildings to rejoin the main channel flow downstream of Melrose Terrace. The floodpath has been included in a second version of the existing conditions hydraulic model to represent the split that led to the unusual condition of dry buildings at the FEMA floodway yet flood damages to buildings along the back edge of the FEMA floodplain. The partitioning of flow at the split flow junction is optimized by HEC-RAS by matching the energy grade line at in the floodpath and the main channel. The split flow model results in lower water surface elevations in the main channel and higher water surface elevations in the floodpath as observed during Tropical Storm Irene. The split flow model was used as the existing conditions model and in alternatives where water is still expected to travel behind buildings along Melrose Street.

Subcritical flow (i.e., deep and slower moving water) is used in the existing conditions model, both because it was used in the FEMA effective model and because it allows for stabilization of the model during split flow optimization. Mixed and subcritical flow regime results were compared and showed equal water surface elevations at most locations in the model, with the mixed flow regime resulting in local dips in the water surface elevation downstream of the George F. Miller Bridge and at Glen Park. The subcritical flow regime is acceptable for analysis of alternatives even though some instances of supercritical (i.e., shallow and jetting water) are known to exist near the bridges.

Model Validation

The hydraulic model was compared to known measured water surface elevations from Tropical Storm Irene and found to have an accuracy of +/- 2 feet in most locations (Table 2). Known water surface elevations were collected from FEMA surveyed high water marks. Differences between observed and modeled elevations may be due to debris and obstructions that were in the channel during Tropical Storm Irene. The FEMA observed values are all adjacent to bridges that are areas that are known to have complex hydraulic patterns and are therefore not the most ideal spots for validation. The hydraulic model is adequate for a comparative evaluation of alternatives.

TABLE 2
Model Results Compared to Known Water Surface Elevations for Tropical Storm Irene

NON-SPLIT FLOW, subcritical			Average = 5,800 cfs		
River Station	Location Description	Observed Water Surface Elevation (feet NAVD88)	Modeled Water Surface Elevation (feet NAVD88)	Difference (feet)	Data Source
3035	US of George Miller Drive Bridge	436.6	439.0	2.4	Fair, FEMA High Water Mark by USGS
2954	DS of George Miller Drive Bridge	437.0	434.1	-2.9	Good, FEMA High Water Mark by USGS
1915	US of Route 9 Bridge	428.6	430.6	2.0	Fair, FEMA High Water Mark by USGS
1660	DS of Route 9 Bridge	424.8	425.1	0.3	Good, FEMA High Water Mark by USGS
SPLIT FLOW, subcritical optimized			**Average = 5,800 cfs**		
River Station	**Location Description**	**Observed Water Surface Elevation (feet NAVD88)**	**Modeled Water Surface Elevation (feet NAVD88)**	**Difference (feet)**	**Data Source**
3035	US of George Miller Drive Bridge	436.6	438.4	1.8	Fair, FEMA High Water Mark by USGS
2954	DS of George Miller Drive Bridge	437.0	432.9	-4.1	Good, FEMA High Water Mark by USGS
1915	US of Route 9 Bridge	428.6	430.6	2.0	Fair, FEMA High Water Mark by USGS
1660	DS of Route 9 Bridge	425.4	425.1	-0.3	Good, FEMA High Water Mark by USGS

Alternatives Analysis

Flood mitigation alternatives (Table 3, Appendix 1) were evaluated by altering the existing conditions model and comparing existing and proposed flood levels (Appendix 2) and velocities. Each alternative is summarized below and a description of hydraulic changes is provided. Change in water surface elevation for the modeled Tropical Storm Irene flow is discussed because it is a recent large flood that many people in the community can visualize. The concept-level alternatives evaluated here are based on finding the best flood mitigation solutions and do not explicitly consider willingness of landowners to participate where alternatives include lands surrounding the BHA property.

TABLE 3
Summary of Alternatives and Project Objectives

			OBJECTIVES						
Group	**ID**	**Alternative**	**Reduce Flood & Erosion Risks @ BHA Property**	**Reduce Flood & Erosion Risks @ Surrounding Properties**	**Reduce Flood & Erosion Risks @ Roads and Bridges**	**Maintain Usable Building Area**	**Environmental Benefits**	**Permitting**	**Cost**
	1	No Action	-	-	-	+	-	+	+
	2	Remove all buildings.	o	-	-	-	o	+	+
Full Floodplain Restoration (River Corridor plus Known Damage Areas) - Remove all buildings and lower land	3a	All natural site. George F. Miller bridge and road also removed.	+	+	+	-	+	+	o
	3b	George F. Miller bridge and road retained.	+	+	+	-	o	+	o
	3c	George F. Miller bridge and road retained. Build wall around upstream portion of site.	+	o	+	-	o	-	-
Partial Floodplain Restoration (FEH Zone) - Remove 11 buildings and lower land	4a	George F. Miller bridge and road also removed.	+	o	+	o	o	+	o
	4b	George F. Miller bridge and road retained.	o	o	-	o	o	+	o
	4c	George F. Miller bridge and road retained. Build wall around upstream portion of site.	o	o	-	o	-	-	-
	5	Floodplain restoration at bend downstream of Melrose Terrace by lowering land elevation.	-	o	o	+	+	+	+
Bridge Alternatives	6a	Enlarge bridge on George F. Miller Drive.	+	o	+	+	+	o	-
	6b	Remove bridge on George F. Miller Drive.	+	o	+	+	+	o	o
	6c	Overflow Culvert at George F. Miller Drive.	o	o	+	+	+	o	o
	7a	Enlarge bridge at Route 9. Create a 2-yr floodbench at bridge.	-	+	+	+	+	o	-
	7b	Enlarge bridge at Route 9. Create a 10-yr floodbench at bridge.	-	o	o	+	+	o	-
Partial Floodplain Restoration (FEMA Floodway) - Remove 6 buildings and lower land	8a	George F. Miller bridge and road also removed.	+	o	+	o	o	+	+
	8b	George F. Miller bridge and road retained.	-	-	-	o	-	-	+
	8c	George F. Miller bridge and road retained. Build wall around upstream portion of site.	-	-	-	o	-	-	o
	9	Floodwall around Melrose Terrace.	-	-	-	+	-	-	o
Combinations		5 + 7a	-	+	+	+	+	+	-
		3a + 7a	+	+	+	+	+	+	-
		3a + 7a + 5	+	+	+	+	+	+	-
	LEGEND: + good; o moderate; - poor								

Alternative 1: No Action

The first alternative is the no action alternative where existing conditions are left to remain. The split flow model is considered the existing conditions base model because it best represents the high flow floodpath observed during Irene. The split flow model passes 24% of the flow behind the homes lining Melrose Street during the modeled Irene storm.

The bridges located near the project site constrict flow and lead to backwatering – the condition where water is slowed down, blocked, and has increased flood levels. During the simulated Irene flood, the George F. Miller Bridge increases flood levels 5.5 feet and the Route 9 Bridge increased flood levels 5.3 feet.

Water surface elevations in the floodpath are between 1 and 6 feet higher in elevation than the flow in the main channel. The separation of flow is why many of the homes along the main channel and in the FEMA floodway were not damaged while homes at the back of the floodplain were damaged during Irene. With no action, it is expected that flooding and possible avulsion will take place during the 10-year flood and larger.

Alternative 2: Remove All Buildings

This alternative assumes that all of the buildings owned by the Brattleboro Housing Authority at Melrose Terrace will be removed from the site. All obstructions from the buildings were removed from the model. The flood wall and all above ground utilities are assumed to be removed. The ground surface is assumed to remain at its current elevation and continue to be covered with mowed grass, trees, and shrubs. Floodwater will be able to flow freely across the site and no buildings are present to trap the water away from the channel. This condition was modeled with the non-split flow model. Water surface elevations in the main channel increase up to 1.2 feet because the water previously in the floodpath is now redistributed across the floodplain and main channel. The water surface elevations in the floodpath at the back of the site are reduced between 1.0 and 5.4 feet.

Alternative 3: Full Floodplain Restoration (River Corridor plus Known Damage Areas)

A full floodplain restoration assumes that all buildings, walls, and utilities have been removed from the Melrose Terrace site southwest of Melrose Street. This area approximately coincides with the VTANR River Corridor boundary. One additional residential building near the back of the floodplain was also removed. Melrose Street is maintained to access the existing private homes. The land in the restored floodplain area is lowered to the 2-year flood level in order to provide additional flood conveyance, sediment and debris storage, and slow flood waters to reduce erosion potential. Stabilization would be needed along the back of the floodplain restoration scenarios to reduce erosion risk. A slope of 3 horizontal to 1 vertical was assumed. This alternative was modeled with non-split flow because water would be able to freely drain to the river and no longer be trapped behind buildings. This alternative has been modeled with three variations:

3a. George F. Miller Bridge and road are also removed. (site fully naturalized)
3b. George F. Miller Bridge and road remain.
3c. George F. Miller Bridge and road remain and a flood wall is built along the upstream edge of the floodplain.

Alternative 3a results in flood reductions of up to 5.0 feet at the middle of Melrose Terrace in Whetstone Brook, 6.9 feet in the floodpath, and 1.9 feet at the upstream end of Melrose Terrace at the lower end of Glen Park. This alternative leads to large flood reductions, yet also reduces access to the site and other properties on Melrose Street given the bridge removal.

Alternative 3b reduces the likelihood of avulsion and provides many of the benefits of alternative 3a, but leaving the George F. Miller Bridge reduces the flood benefits at the middle of the Melrose Terrace property from 5.0 feet to 3.8 feet. Benefits remain at the upstream and downstream ends of the property similar to alternative 3a. This alternative provides good flood reduction benefits and should be considered if removal of the George F. Miller Bridge is not preferred.

Alternative 3c has similar water surface elevation reductions on the Melrose Terrace site as alternative 3b, with the exception that there is a 0.2 feet lower flood reduction at the upstream end of the site near Glen Park. The inclusion of a flood wall at the upstream end of the property would require participation from the landowner at the end of Melrose Street to block water from the floodpath. The effects of a taller floodwall may push water onto other properties across the river, especially if debris jamming takes place. Modeling shows that the wall increases risk and raises the water surface elevation, increases the velocity, or increases both for the Irene, 100-year, and 500-year floods beyond alternative 3b.

Alternative 4: Partial Floodplain Restoration (FEH, Fluvial Erosion Hazard Zone)

A partial floodplain restoration assumes that eleven buildings, and the associated flood wall and utilities, closest to the river are removed from the Melrose Terrace site. This area approximately coincides with the previously mapped fluvial erosion hazard (FEH) zone. Some of the existing buildings are assumed to remain near the back of the floodplain and Melrose Street is maintained to access the existing private homes. The land in the proposed floodplain restoration area would be lowered to the 2-year water surface elevation in order to provide additional flood conveyance, sediment and debris storage, and slow flood waters to reduce erosion. This alternative was modeled with non-split flow because water would be able to freely drain to the river and is no longer be trapped behind buildings. This alternative has also been modeled with three variations:

4a. George F. Miller Bridge and road are also removed. (site fully naturalized)
4b. George F. Miller Bridge and road remain.
4c. George F. Miller Bridge and road remain and a flood wall is built along the upstream edge of the floodplain.

Alternative 4a reduces flood levels 4.5 feet at the middle of Melrose Terrace main channel, 7.3 feet in the floodpath, and 1.9 feet at the upstream end of Melrose Terrace at the lower end of Glen Park. The reduced floodplain size compared to alternative 3a does lower flood reduction benefits by 0.5 to 1.0 feet at the middle of Melrose Terrace, but has similar benefits at the upstream and downstream ends of the site. This alternative leads to large flood reductions, yet also reduces access to the site and other properties on Melrose Street given the bridge removal.

Alternative 4b has almost zero flood reduction benefit in the middle of Melrose Terrace due to leaving the George F. Miller Bridge in place that backs up water. The bridge approach (i.e., the fill under the road as it approaches the bridge) blocks almost the entire proposed floodplain area and reduces the flood benefits at the middle of the Melrose Terrace property from 4.5 feet to 0.1 feet compared to

alternative 4a. Flood reduction benefits remain at the upstream and downstream ends of the property similar to alternative 4a.

Alternative 4c has similar water surface elevation reductions on the Melrose Terrace site as alternative 4b, with the exception that there is a 0.2 feet lower flood reduction at the upstream end of the site near Glen Park. This alternative would require a 4- to 5-foot tall floodwall to contain the 500-year flood in the channel. The inclusion of a flood wall at the upstream end of the property would require participation from the landowner at the end of Melrose Street. The effects of a floodwall would likely increase risk and push some water across the river towards other properties, especially if a sediment and debris jam takes place. Modeling shows that the wall raises the water surface elevation, increases the velocity, or increases both for the Irene, 100-year, and 500-year floods beyond alternative 4b.

Alternative 5: Floodplain Restoration at the Bend Downstream of Melrose Terrace

The channel is narrow and incised without floodplain as it takes a hard right turn (facing downstream) downstream of the Melrose Terrace site approaching the VT Route 9 Bridge. An incised channel is not able to access its floodplain to dissipate energy and deposit sediment and debris. This condition can increase the erosion potential and the chances of sediment and debris clogging the VT Route 9 Bridge. This alternative creates a new floodplain area along the channel on the right bank from the downstream end of Melrose Terrace to the VT Route 9 Bridge that is connected to the channel. The new floodplain would include excavation of the land to lower it to the 2-year water flood level. The current floodplain is located at approximately the 10-year flood level.

The new floodplain area is backwatered by the Route 9 Bridge, meaning water backs up against the structure and ponds on the upstream side. Flood reduction benefits thus require an increase in the size of the VT Route 9 Bridge in addition to the floodplain restoration. Qualitative benefits include allowing water to slow, spread, and deposit sediment and debris before reaching the bridge. This alternative was thus tested in combination with increasing the size of the VT Route 9 Bridge. This alternative reduces velocity in the channel and thus lowers the erosion risk at the Melrose Street road embankment.

Alternative 6: George F. Miller Bridge

The George F. Miller Bridge is a 55-foot wide single span structure. The bankfull width of the channel is 60 feet as determined during a 2007 stream channel assessment. The bridge backs up flood waters, and the model shows a rise of 5.5 feet from downstream to upstream of the bridge for the Irene flood. All storms greater than the 25-year flood overtop the bridge. When overtopped, floodwater spills over the river banks and flows towards Melrose Terrace. Three scenarios were tested at the bridge including:

6a. Enlarge bridge on George F. Miller Drive.
6b. Remove bridge on George F. Miller Drive.
6c. Overflow culvert at George F. Miller Drive.

Alternative 6a includes replacement of the bridge with a 95-foot long single span bridge. This alternative also includes widening the channel upstream and downstream of the structure to create small floodbenches at the 2-year water surface elevation to create a smooth transition through the structure and provide additional flood conveyance area. The replacement bridge is able to pass all modeled storms without overtopping, although water is still flowing in the floodpath. Flood reduction benefits are 3.9 feet directly upstream of the bridge. This benefit extends approximately 500 feet

upstream of the bridge. The reduced backwatering does not extend up to the avulsion site so the hydraulics at the floodpath are unchanged from existing conditions.

Alternative 6b includes removal of the bridge and installation of the small floodbenches at the former bridge location. The bridge removal lowers the Irene flood level an additional 1.0 foot beyond the benefits of enlarging the bridge. The removal of the bridge has been explored in combination with floodplain restoration (alternatives 3a and 4a).

Alternative 6c includes installation of an overflow culvert under the northwest approach to the existing George F. Miller Bridge. The proposed concrete box culvert is 15 feet wide and 5 feet that would require creation of a small floodbench upstream and downstream to transition flow between the channel and structure. Flood reduction benefits are 2.9 feet directly upstream of the bridge, which is 1 foot less than replacing the bridge (alternative 6a). The 100-year and 500-year floods still overtop the bridge deck.

Alternative 7: VT Route 9 Bridge

The VT Route 9 Bridge is an undersized structure with an effective opening width of 47 feet (78% of the channel bankfull width). The bridge backs up flood waters, and the model shows a rise of 5.3 feet from downstream to upstream of the bridge for the Irene flood. The bridge is skewed at 39 degrees from the direction of river flow, further reducing the effective size of the opening by 20% (actual width is 61 feet and the effective width is 47 feet). The arch shape of the opening is narrow at the top where flood levels reach that blocks debris and readily clogs the opening. A 16-inch water main hangs below the top of the arch that blocks high flows and catches debris. This pipe is vulnerable to damage as it hangs below the lowest bridge beam. The low point in the road is to the west of the bridge where water flowed over during Irene. The model shows that storms greater than the 10-year flood level overtop the bridge.

A new bridge was modeled that has a single span bridge with a width of 120 feet. The new bridge assumes that the low chord is level with the bottom of the existing water main. The new bridge would be designed to protect the water main behind the bridge beams. The road surface would remain near its existing elevation. A railing structure would remain and therefore continues to block high flows. The bridge skew of 39% was maintained as realignment was not deemed practical. A small floodbench was included through the bridge to widen the conveyance area and provide a smooth transition in and out of the bridge. Two flood bench scenarios were tested:

7a. 2-year floodbench
7b. 10-year floodbench

In alternative 7a, the new bridge will pass the Irene flow without overtopping. Flood reductions are 2.5 feet upstream of the bridge and extend upstream to the Melrose Terrace property. Overtopping would still occur for the 50-, 100-, and 500-year floods, but at a greatly reduced depth. For example, the 100-year flood depth over Route 9 would be reduced to 0.8 feet, a reduction of 2.2 feet from existing conditions. Bridge replacement is recommended to reduce flood risks both at Melrose Terrace and along VT Route 9.

Alternative 7b proposes to create a higher floodbench at the 10-year flood level was included because the upstream and downstream tops of banks are currently located at approximately the 10-year

elevation. This bench level would provide a smoother transition between the bridge and channel. The flood reduction upstream of the bridge is reduced by 1.0 foot upstream compared to alternative 7a.

A combination alternative was evaluated that increases the size of the bridge opening and create a new floodplain at the bridge (combination 5 + 7a). The floodplain provides flood reductions between 0.5 and 0.7 feet at the downstream end of Melrose Terrace and the area upstream of VT Route 9, beyond the reductions provided by the bridge replacement alone.

Alternative 8: Partial Floodplain Restoration (FEMA Floodway)

Residential buildings, walls, and utilities are located in the FEMA floodway of Whetstone Brook. This alternative will remove the six (6) residential buildings and associated infrastructure in the floodway. The land in this area will be excavated to create a floodplain at the 2-year water surface elevation. This smaller version of a floodplain restoration alternative is recommended to be implemented first if phased removal of housing takes place at Melrose Terrace. This alternative has been modeled with three variations:

8a. George F. Miller Bridge and road are also removed. (site fully naturalized)
8b. George F. Miller Bridge and road remain.
8c. George F. Miller Bridge and road remain and a flood wall is built along the upstream edge of the floodplain.

Alternative 8a provides flood reduction benefits of between 4.3 and 1.3 feet upstream of the George F. Miller Bridge and up to 2.7 feet in the floodpath. The 10-year flood will no longer avulse and travel through the Melrose Terrace property, and flood discharge in the floodpath is reduced for larger storms. Flood benefits are up to 1.7 feet less than full floodplain restoration (alternative 3a).

Alternative 8b maintains the George F. Miller Bridge. Less floodwater avulses out of the Whetstone Brook main channel traveling behind the homes on Melrose Terrace with 2.5 feet lower water surface elevations at the back of the site. Water surface elevations in the main channel increase up to 0.7 feet due to the redistribution of water at the site. The 10-year flood no longer will avulse and travel through the Melrose Terrace property. Flood reduction benefits provided by the floodplain restoration are not seen in water surface elevation reductions because the George F. Miller Bridge still backwaters the channel.

Alternative 8c is not recommended for implementation. The floodwall around the remaining homes, in combination with the George F. Miller Bridge, raises flood water 1.2 feet above existing conditions around the site. The Melrose Terrace remaining buildings would be dry, but the increase in flooding would affect adjacent properties. A 7 foot tall wall would be required to exclude the 500-year flood from the remaining portion of Melrose Terrace. The George F. Miller Bridge would still overtop for the 25-year recurrence interval and higher storms, allowing floodwater into the site at that location.

Alternative 9: Floodwall around Melrose Terrace

To keep floodwater out of the Melrose Terrace site and maintain all other existing conditions would require a tall floodwall around the entire site that is over 12 feet tall at the upstream end. The wall was assumed to remain in the existing location, but connected completely around the property and made tall enough to contain the 500-year flood in the channel. The negative aesthetics of a 12-foot tall wall

would ruin the feel of Melrose Terrace and surrounding properties. The completion of a wall while maintaining the George F. Miller Bridge would be difficult to design because the water surface is so high above the bridge deck during large storms that the water would run down the road and into Melrose Terrace. The flood wall alternative increases flood and erosion risks at surrounding properties and is thus not recommended and likely not permittable.

A floodwall would have many negative effects and is not recommended for implementation. Although the Melrose Terrace site may remain dry, this alternative increases water surface elevation and risk on many adjacent properties. Glen Park could experience almost 4 feet higher flooding in an Irene size flood. Properties across the river from Melrose Terrace could experience 3.2 feet higher flooding. Velocities would also increase, increasing risk of erosion damage to the George F. Miller Bridge and adjacent properties. These negative impacts to other properties are expected to outweigh the benefits to Melrose Terrace.

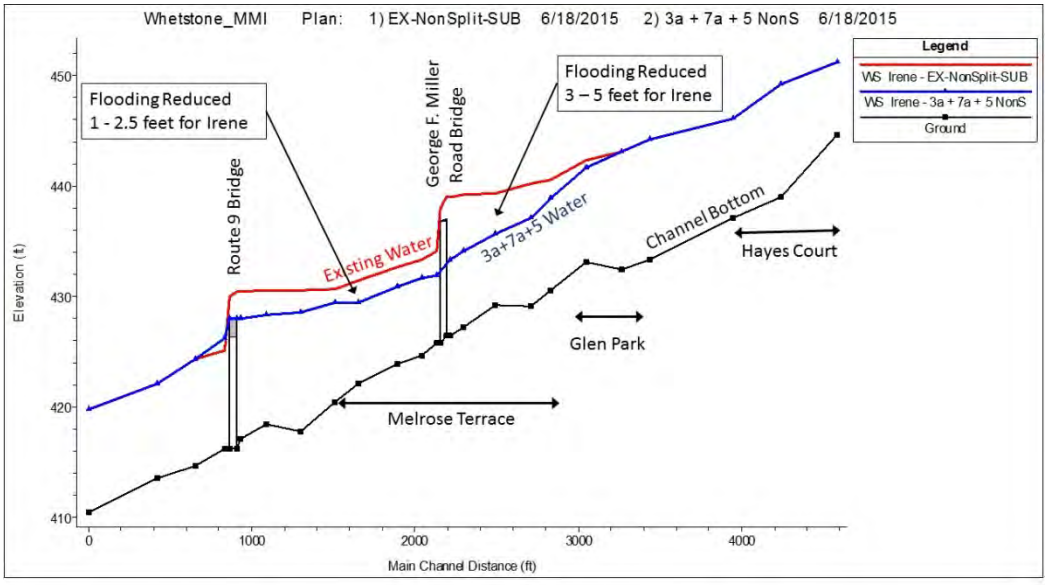
Combination with Largest Flood Reduction Benefit

A combination of alternatives is able to address multiple issues that are all contributing to flooding in the vicinity of Melrose Terrace. This alternative provides the largest flood reduction benefit at the Melrose Terrace site and surrounding properties. The following alternatives are recommended:

3a. Full floodplain restoration with George F. Miller Bridge and road are also removed;
7a. Route 9 Bridge replacement; and
5. Floodplain restoration at bend downstream of Melrose Terrace.

The combined benefits of these alternatives reduce flooding from the VT Route 9 Bridge, extending upstream through the Melrose Terrace site. Flood reductions range between 1.0 and 5.1 feet (Figure 1). Larger flood reduction up to 7.6 feet occurs in the floodpath along the back of Melrose Terrace. The combination of alternatives provides additional benefits beyond the individual alternatives because as backwatering is reduced each subsequent alternative can function more effectively.

Figure 1
Existing and Proposed Flood Profile for Modeled Tropical Storm Irene Flood



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Appendix L: West Brattleboro Bicycle and Pedestrian Scoping Study

WEST BRATTLEBORO

BICYCLE AND PEDESTRIAN SCOPING STUDY

BRATTLEBORO, VERMONT

NOVEMBER 2014

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PREPARED FOR:
TOWN OF BRATTLEBORO

SUBMITTED BY:
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CONTENTS

EXECUTIVE SUMMARY V

1.1 Project Area and Background v
1.2 Alternatives Analysis vi
1.3 Preferred Alternative vi

1.0 INTRODUCTION 1

1.1 Methodology 1
1.2 Project Area and Background 2

2.0 EXISTING CONDITIONS 7

2.1 Roadway Characteristics 7
2.2 Safety and Crash History 8
2.3 Land Use and Zoning 10
2.4 Pedestrian Facilities 12
2.5 Bicycle Facilities 13
2.6 Transit Service 13
2.7 Natural Resources 14
2.8 Hazardous Material Sites 14
2.9 Historic Sites and Structures 15
2.10 Archeological Sites 15
2.11 Existing Utilities 15

3.0 PURPOSE AND NEED OF THE PROJECT 17

3.1 Purpose 17
3.2 Needs 17

4.0 ALTERNATIVES 19

4.1 No Build Alternative 19
4.2 Alternative 1 – Continuous Sidewalk and Bike Lane 20
4.3 Alternative 2 – Curbed Medians 26
4.4 Alternative 3 – Shared use Path 31
4.5 Impacts and Issues 33
4.6 Order of Magnitude Cost Estimates 35
4.7 Preferred Alternative 35

5.0 IMPLEMENTATION 43

5.1 Implementation Strategy 43
5.2 Order of Magnitude Cost Estimates 44
5.3 Funding Sources 46

6.0 PUBLIC OUTREACH A1-1

6.1 Stakeholder Meeting 1 – March 6, 2014 ..... A1-1
6.2 Local Concerns Meeting – March 6, 2014 ..... A1-3
6.3 Public Meeting 2 – May 13, 2014 ..... A1-3

7.0 ARCHAEOLOGICAL SITE INSPECTION A2-1

8.0 TRAFFIC AND SPEED DATA A3-1

9.0 PUBLIC MEETING MINUTES A4-1

10.0 SELECTBOARD MEETING MINUTES A5-1

EXECUTIVE SUMMARY

The Town of Brattleboro, in recognizing the need to improve pedestrian and bicycle safety as well as roadway and streetscape enhancements in the heart of West Brattleboro, applied and received funding through the Vermont Agency of Transportation (VTrans) for a the West Brattleboro Bicycle and Pedestrian Scoping Study – STP Bike (59). RSG lead the scoping study effort, and in association with Broadreach Planning & Design (Broadreach), worked closely with staff from the Town of Brattleboro to identify issues and potential improvements to pedestrian and bicycle infrastructure along Western Avenue (VT Route 9).

The project goal is to look comprehensively at the full network of bicycling and walking facilities to create a unified set of recommendations for future improvements that will make it more comfortable for a range of users, including students, residents, visitors, and customers to walk and bike on Western Avenue.

The Consultant team worked with the Town to publicize the scoping project in order to receive community feedback throughout the process. The team held three public work sessions as well as individual meetings with West Brattleboro stakeholder groups and VTrans to arrive at the preferred alternative.

Project Area and Background

The project area is nearly 3000 feet in length and located on the main corridor of the West Brattleboro Village Center, between Greenleaf Street and Melrose Street along Western Avenue (VT Route 9). Route 9 is a major east-west corridor across southern Vermont and carries over 13,000 vehicles per day through West Brattleboro, including over 500 trucks per day. There are also several cut through roads that intersect with Route 9 in the project area.

The area includes a vibrant and diverse mix of land uses, including street-front retail, single- and multi-family homes, professional offices, schools, and churches, all flanking along Western Avenue. Given the various destinations on both sides of the street, including schools and youth activities, it is important to ensure that pedestrians can safely cross the street and that facilities are in place to accommodate bicyclists, pedestrians, and to alert drivers of their presence.

Alternatives Analysis

To address the purpose and needs of the project area, three build alternatives were developed, analyzed, and compared to the No Build alternative.

Alternative 1 creates continuous four- to five-foot bicycle lanes and widened five-foot sidewalks on both sides of the road throughout the entire length of the Study Area corridor. In addition, the plan proposes several highly visible crosswalks at regular intervals throughout the length of the corridor, supplemented by bulb-outs where possible to reduce crossing distances and calm traffic.

Alternative 2 focuses on enhancing the streetscape through a variety of traffic calming measures, such as planters, curbed islands, and landscaping help slow vehicles, shield pedestrians from adjacent traffic, and provide a more welcoming environment for walking and bicycling. This alternative also proposes a continuous sidewalk and key crossings to comply with ADA standards.

In searching for a fresh solution to link pedestrians and bicyclists comfortably along the Western Avenue corridor, separated from traffic, the consultant team developed Alternative 3, which creates a shared use path south of Western Avenue, running behind the buildings fronting on the street and meeting the sidewalk at the corner of Greenleaf Street and at the Academy School.

The proposed alternatives have not recommended new crosswalks closer than 200 feet to any other crosswalks. The existing crosswalks in front of the church and leading to the Academy School are closer than 200 feet, but the study proposes to retain them as they are at key crossing locations.

Preferred Alternative

The final preferred plan proposes a continuous four- to five-foot bicycle lane and widened five-foot sidewalks on both sides of the road throughout the entire length of the Study Area corridor. The plan also proposes maximizing the Village Green and extending the sidewalk and bike lane on both sides of the road across the bridge at the eastern end of the project area.

On the east side of the project extent, the existing sidewalk continues on the north side of Route 9 across the bridge but the south side sidewalk does not. The preferred alternative recommends a widened bridge to accommodate sidewalks on both sides. In the interim, the plan proposes a crosswalk on the west side of existing bridge to connect to the extended south side sidewalk.

The preferred alternative recommends that the speed limit for all vehicles be the same. The current speed limits are 25 miles per hour (mph) for trucks and 30 mph for cars. The Town may recommend that changing the speed limit to 25mph or 30mph for all motorists depending on further speed studies. The current speed limit in the school zone is 20 mph and the plan recommends maintaining the current speed restrictions through this designated village area.

Preferred Alternative, with road signage

FIGURE 1.1: STUDY AREA

1 INTRODUCTION

The Town of Brattleboro, in recognizing the need to improve pedestrian and bicycle safety as well as roadway and streetscape enhancements in the heart of West Brattleboro, applied and received funding through the Vermont Agency of Transportation (VTrans) for a the West Brattleboro Bicycle and Pedestrian Scoping Study – STP Bike (59).

RSG lead the scoping study effort, and in association with Broadreach Planning & Design (Broadreach), worked closely with staff from the Town of Brattleboro to identify issues and potential improvements to pedestrian and bicycle infrastructure along Western Avenue (VT Route 9). The purpose of this scoping report is to document the analysis and development of alternative improvements, as well as the public input received in arriving at the preferred alternative.

Methodology

In seeking endorsement of a preferred alternative, the Consultant team followed a methodical approach in gathering information, identifying constraints, developing alternative ideas, and receiving feedback throughout the course of the project. The process involved:

- Holding Project Kickoff Meeting
- Compiling and document existing conditions
- Holding meetings and outreach
  - Stakeholder Committee Meetings
  - Local Concerns Meeting
  - Selectboard Meeting
- Identifying constraints
  - Land Use
  - Right-of-Way
  - Environmental/Cultural
  - Utility
- Developing conceptual alternatives
- Selecting preferred alternative
- Preparing preliminary cost estimates
- Completing implementation Strategy

FIGURE 1.2: STUDY AREA CONTEXT

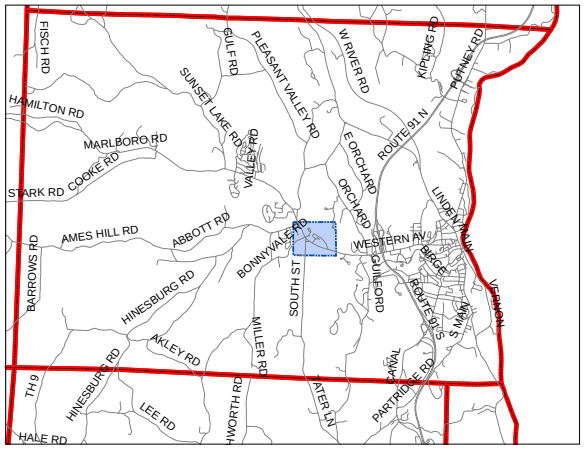
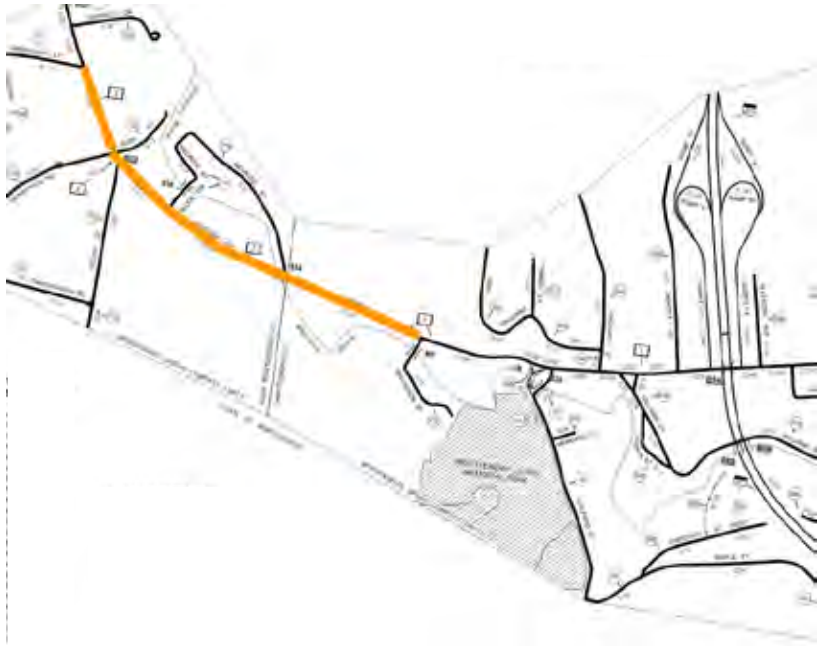


FIGURE 1.2: STUDY AREA ZOOM-IN



Project Area and Background

The project area, shown in Figure 1.2, is located on the main corridor of the West Brattleboro Village Center, between Greenleaf Street and Melrose Street along Western Avenue (VT Route 9). Route 9 is a major east-west corridor across southern Vermont and carries over 13,000 vehicles per day through West Brattleboro, including over 500 trucks per day. It is also a designated National Highway System (NHS) road. There are also several cut through roads that intersect with Route 9 in the project area.

The area includes a vibrant and diverse mix of land uses, including street-front retail, single- and multi-family homes, professional offices, schools, and churches, all flanking along Western Avenue. Given the various destinations on both sides of the street, including schools and youth activities, it is important to ensure that pedestrians can safely cross the street and that facilities are in place to accommodate bicyclists, pedestrians, and to alert drivers of their presence.

For the purposes of our analysis, Western Ave is organized in three distinct corridor segments:

- Western Segment: From Greenleaf Street to Bonnyvale Road
- Central Segment: From Bonnyvale Road to the Academy School exit
- Eastern Segment: From the Academy School exit to Melrose Street

FIGURE 1.3: WESTERN SEGEMENT – FROM GREENLEAF STREET TO BONNYVALE ROAD

FIGURE 1.4: CENTRAL SEGMENT – FROM BONNYVALE ROAD TO ACADEMY SCHOOL EXIT

FIGURE 1.5: EASTERN SEGMENT – FROM THE ACADEMY SCHOOL EXIT TO MELROSE STREET

2

EXISTING CONDITIONS

The land use in the project area is mixed, with commercial retail, churches, single- and multi-family housing, schools, town buildings, and professional offices lining both sides of Western Ave between Greenleaf Street and Melrose Road. The Village serves as home to two local churches, school buildings, and many activities that encourage community gathering, such as concerts on the Village Green, farmers market less than half mile south of the Academy School along Western Avenue, and occasional gallery walks and church chicken cook-outs.

Roadway Characteristics

VT State Route 9, or locally known as Western Avenue from I-91 through West Brattleboro Village, is a main transportation corridor through Southern Vermont. The road is classified as a Class 1 highway between I-91 and the western end the Village and is a designated as part of the National Highway System (NHS) network. While the State of Vermont has shared jurisdiction of this Class 1 roadway, it is owned and maintained by the Town of Brattleboro, with the exception of repaving activities. West of Edwards Heights, it becomes Marlboro Road and is classified as a Principle Arterial State Highway, owned and maintained by the VTrans. The speed limit for cars along the stretch within West Brattleboro is 30 mph, with a 25 mph speed limit for buses and trucks, and a 20 mph speed limit within the school zone near the Academy School. West Brattleboro is a Vermont designated village and the town has set a lowered speed limit within the school zone. Recent actual speed data calculated for the 85th percentile speeds confirm that the 30 mph limit is appropriate. (See data in Appendix)

The majority of roads that stem from the project corridor are residential in nature and continue either out of Town or end in a loop or dead-end residential street. This creates a situation where all traffic must funnel onto Western Ave at the project corridor, some from the few connecting streets to other surrounding towns.

The road is also a local village main street, with on-street parking available in several locations along Western Avenue for businesses, institutional facilities, and residences that directly front along the roadway.

Traffic data collected from the Windham Regional Commission in 2006 show that the annual average daily traffic (AADT) volume in the village is approximately 12,962 vehicles per day, with higher levels of traffic on the east end of the village compared to the west.

Safety and Crash History

There are a notable number of crashes along Western Avenue, particularly at key crossing locations with reduced sight lines, such as the intersection of South Street and Western Avenue. The clustered crash locations where there are issues of safety include:

- The exiting traffic from the Academy School onto Western Avenue,
- The wide angle turn between the northern segment of South Street and Western Avenue,
- Along the entire open frontage of the corner gas station and retail at the western end of the study corridor.

The crash circumstances also varied based on location. Several of the crashes that occurred in the western end near the gas station were due to a variety of reasons, many involving failures to stay in the correct lane or yielding to right of way. Failure to yield and following too closely were also issues around the village green at South Street and Western Avenue.

FIGURE 2.1: NUMBER OF CRASHES (2008-2012)

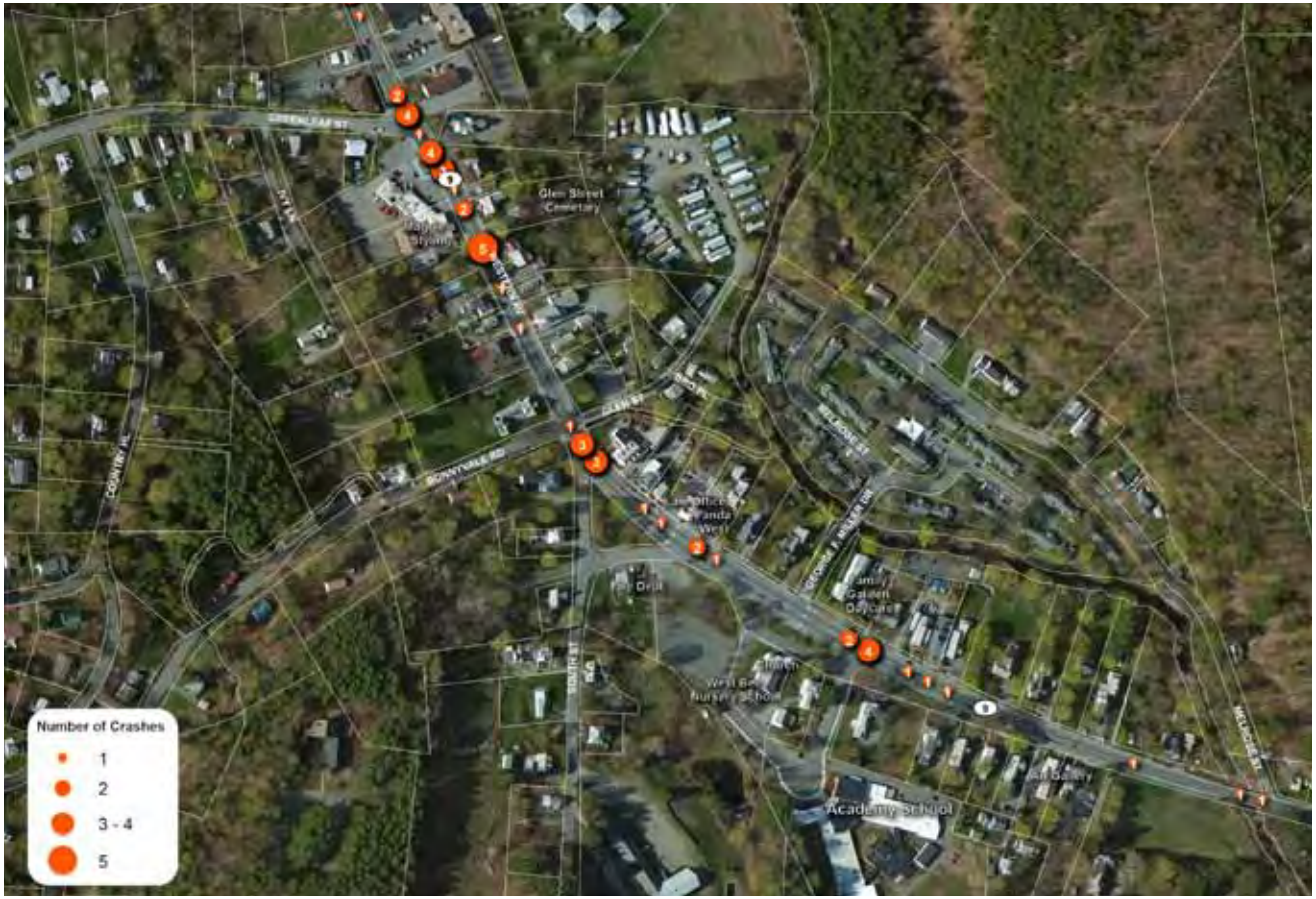


FIGURE 2.2: CRASH CIRCUMSTANCES (2008-2012)

Inattention was one of the largest contributing factors to crashes around the Academy School exit. The crash circumstances highlight the need to improve access management, especially in the retail area at the western end, improve sight lines around the village green, and calm traffic and alert drivers' attention, especially around the church and Academy School. This included studying the following measures: Eliminating the potential for conflicting turns at the southwest corner of Route 9 and Greenleaf Street; Reducing the number of potential conflicts at the Bonnyvale/Glen Street intersection; and providing traffic calming measures to reduce the overall speed of vehicular traffic flow.

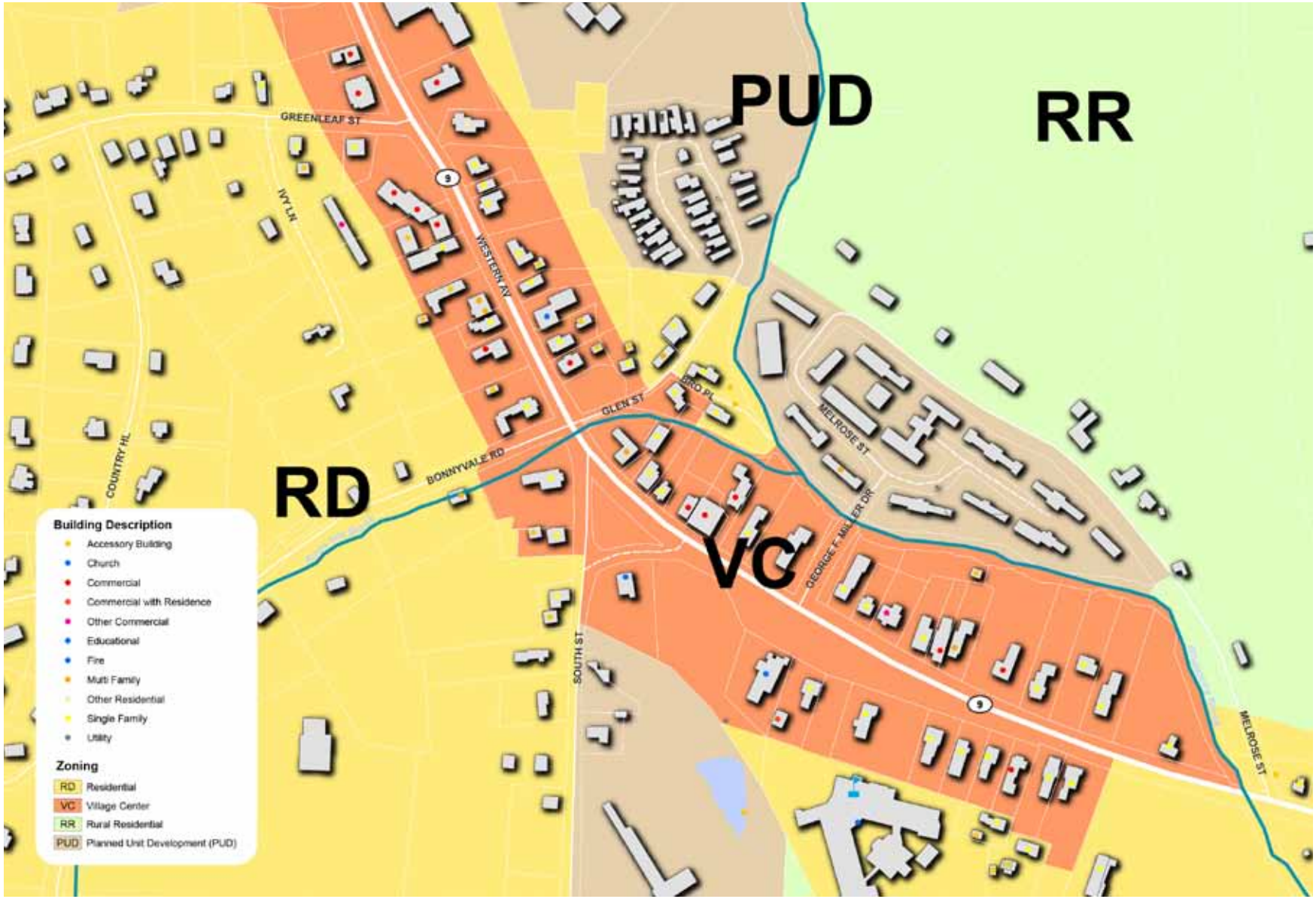
Land Use and Zoning

The project area sits entirely within a Village Center zoned area, surrounded by residential to the immediate north and south, a planned unit development (PUD) to the north, and rural residential beyond. (Figure 2.3) According to the Town of Brattleboro ordinance, the following are zoning considerations for Village Center designation that are relevant to this scoping study:

- Purpose: To preserve the medium intensity, mixed-use neighborhood surrounding the center of West Brattleboro.
- Permitted uses: Residential (single- and multi-family); Public assembly facility; Recreational; Office; and Commercial.
- Parking: Uses in the Village Center District should take advantage to every extent possible of public and on-street parking opportunities. Where possible, shared parking is strongly encouraged. The Board shall determine the maximum reduction where shared parking is used. Parking areas shall be landscaped to reduce glare and heat and shall sufficiently buffer the view of parking area surfaces from passing motorists.
- Access: Only one curb cut will be permitted per lot and curb cuts will be no closer than 50 feet. Lots which share a curb cut may be entitled to a partial waiver of parking and coverage requirements.
- Sidewalks and Curbs: Where no sidewalk currently exists, a sidewalk built to Town specifications shall be required for all newly developed properties. Such a sidewalk shall extend the entire length of the frontage property.
- Trees: Every effort shall be made to preserve existing old-growth trees either at the roadside or on site.
- Landscaping: Landscaping shall be considered critical in visually integrating any project with its surroundings.
- Signage: The goal of this section is to deter excessive visual competition and its subsequent clutter and confusion.
- Lighting: Lighting shall be controlled in both height and intensity in order to maintain the rural character of the Village Center.

The State of Vermont has designated West Brattleboro as a Village Center from Bonnyvale Road to the Whetstone Brook at Melrose Street.

FIGURE 2.3: ZONING



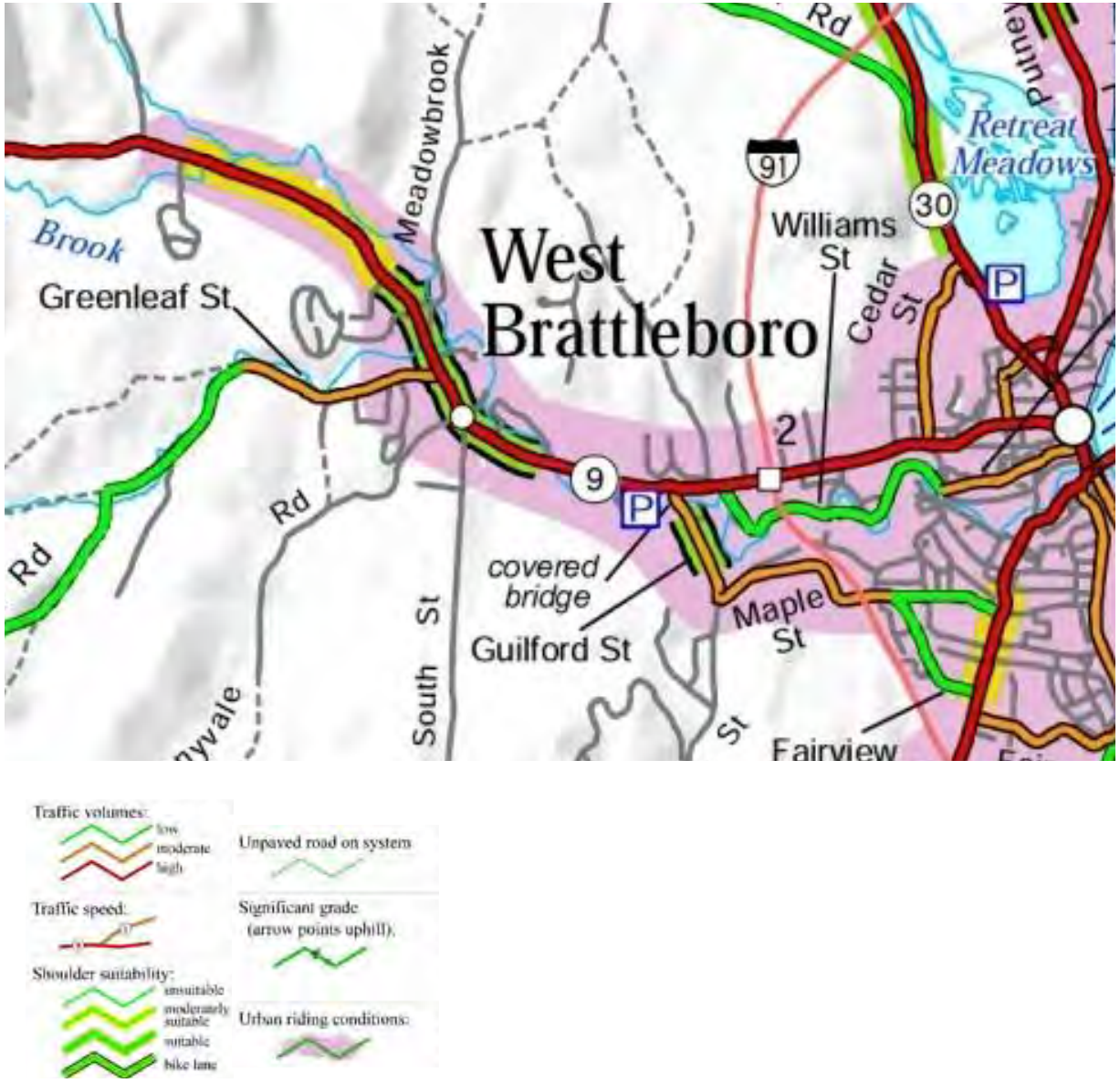
Pedestrian Facilities

There are currently a number of pedestrian and bicycle facilities in place within the village that help create a safer walking and bicycling environment. They include nearly a mile of sidewalks, striped bicycle lanes, and five crosswalks between just north of Greenleaf Road and Melrose Road. In addition, the town has placed two flashing lights at opposite ends of Western Avenue to alert drivers to slow down as they enter the Village

The West Brattleboro Master Plan (the Master Plan) indicated that pedestrian traffic was highest in the village area and near the Farmer's Market, but also in the surrounding residential communities, including Westgate and Mountain Home Park.

FIGURE 2.4: EXISTING PEDESTRIAN AND BICYCLE FACILITIES

FIGURE 2.5: SOUTHEASTERN VERMONT BICYCLE SUITABILITY MAP



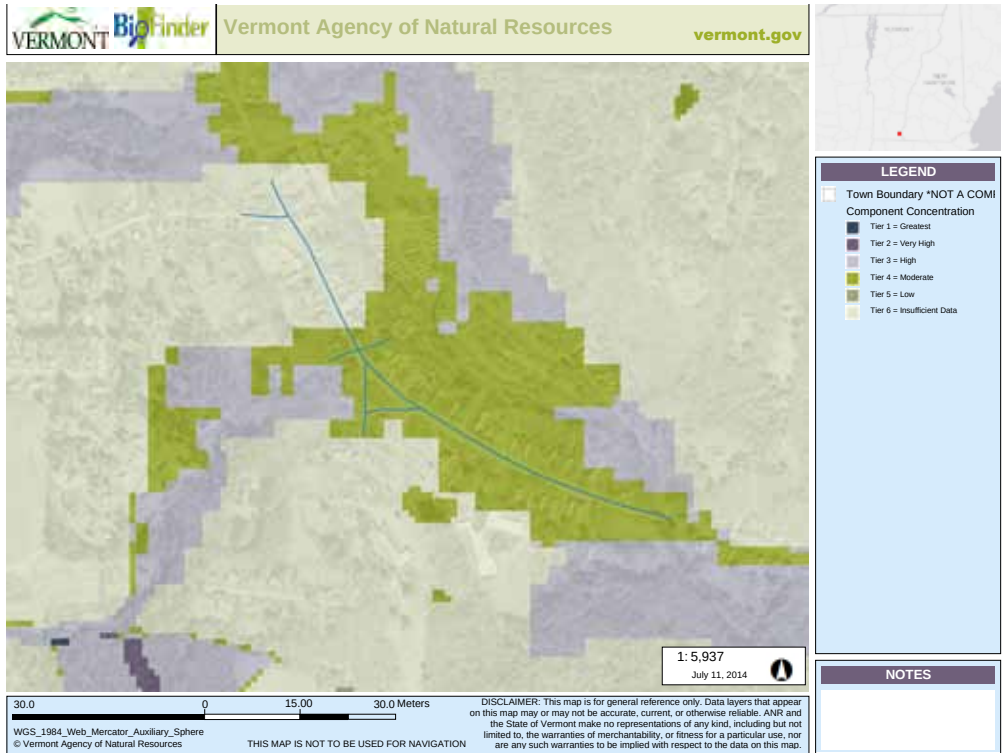
Bicycle Facilities

As part of the 2012 Windham Regional Planning Commission Transportation Plan, the Southeastern Vermont Bicycle Suitability Map (Figure 2.5) shows the project corridor as an area with high traffic volumes with a bike lane or suitable shoulder in urban riding conditions. Here, cyclists encounter vehicles moving at slower speeds of 25 mph to 35 mph, but have other challenges including higher traffic volumes, frequently turning vehicles, on-street parking, storm drainage, rough pavement, and pedestrians.

Transit Service

West Brattleboro is served by the Deerfield Valley Transit Association MOOver bus that connects between the Brattleboro Transportation Center, through West Brattleboro along Route 9, and to Wilmington in the west. There are six stops between 6:30 AM and noon every weekday at Western Avenue and Creamery Bridge, and an additional six stops in the afternoon between noon and 5:15 PM at those same locations. There is currently a bus shelter located at the village green at South Street, but no transit currently serves that location.

FIGURE 2.6: VERMONT AGENCY OF NATURAL RESOURCES - BIODIVERSITY



Natural Resources

The Whetstone Brook is an important natural asset for the community, running eastward behind dense residential and commercial on the north side of Western Avenue in the project area, and then crossing to the south just north of Melrose Street, where pedestrians cross above it on the Creamery Covered Bridge, and then continues toward downtown Brattleboro. There is also a 3,783 square foot Class 2 wetland located directly to the west of the Academy School and overlaps with portions of the existing sidewalk.

At the center of West Brattleboro is the Village Green, a small triangle portion of land adjacent to the fire station that is used sporadically for community events. Less than half a mile east of the study area on the south side of the corridor is the Living Memorial Park and the Brattleboro Farmer's Market, which serves the greater community with ski areas and a skating rink in the winter and a picnic, playground, and pool for summer and other seasons.

Hazardous Material Sites

There are no known active hazardous material sites within the project study area. There was formally one underground storage tank facility (Site number 951832) for the Fleming Oil Co located adjacent to the Academy School at 108 Western Ave. The closure date is in 1996 and wells were closed per the 12/31/13 DBE report. The site is now designated a SMAC (site management activity completed).

Historic Sites and Structures

The corridor falls within the Village Center designation by the State of Vermont, from Bonnyvale Road to the Whetstone Brook at Melrose Street. Within the project area, the traditional architectural character of the Village defines the look and feel of West Brattleboro, with a mix of one-to-two story wood frame buildings with steep, gabled roofs.

Archeological Sites

There are no known archaeological sites that exist within, or immediately adjacent, to the proposed project parcel, nor are there any within 1.5 miles of the proposed project area. A field inspection and background research determined that the proposed project limits do not contain any areas of sensitivity for pre-contact Native American archaeological sites. Both sides of VT Route 9 have been significantly disturbed by historic construction activities and there are no impact areas of archaeological sensitivity along its alignment.

Appendix A2: Archeological Site Inspection, dated April 16, 2014, contains the full documentation and findings from the University of Vermont Consulting Archaeology Program.

Existing Utilities

There are currently overhead utility poles lining both sides of Western Avenue, with a break on the south side at the village green. Water and sewer lines cross the roadway in several areas: at the intersection of Bonnyvale Road; water lines cross at South Street; and Sewer lines cross just before the brook crossing at the eastern end of the project area.

FIGURE 2.7: EXISTING UTILITIES

3

PURPOSE AND NEED OF THE PROJECT

The walking and bicycling conditions in West Brattleboro along Western Avenue have been improving incrementally over the years. The Town of Brattleboro is now looking comprehensively at the full network of bicycling and walking facilities to create a unified set of recommendations for future improvements. The upgrades will include ways to make it easier for a range of users, including students, residents, visitors, and customers to use different travel modes.

Purpose

The purpose of bicycle and pedestrian improvements in West Brattleboro along Western Avenue is to improve the safety and mobility experience for the following users:

- Students walking or bicycling to and from the Academy School,
- West Brattleboro residents and visitors walking to nearby stores and services,
- Bicyclists moving more comfortably east and west through the village and to reach the Brattleboro downtown area, and
- Calming vehicular and truck traffic on Western Avenue in West Brattleboro.

Needs

Needs for the improvements include:

- The variable compliance of existing sidewalks, including narrowness and irregular surfaces, to current ADA standards,
- The lack of crosswalks to key destinations along the West Brattleboro village corridor, and
- The significant number of crashes along Western Avenue.


SCHOOL
Vermont

4

ALTERNATIVES

Western Avenue is a Town-maintained road that transitions from a state highway – VT 9 – into two-lane mixed-use community street through the West Brattleboro neighborhood. To address the purpose and needs of the project area, three build alternatives were developed, analyzed, and compared to the No Build alternative.

The following descriptions of the alternatives are organized in three distinct corridor segments:

- Western Segment: From Greenleaf Street to Bonnyvale Road
- Central Segment: From Bonnyvale Road to the Academy School exit
- Eastern Segment: From the Academy School exit to Melrose Street

The division into sections makes it easier to focus the discussion on specific areas and makes it clear that it would be possible to mix and match the ideas to create the most appropriate set of recommendation for the Study Area.The preferred alternative may ultimately include a mix of elements from one or more of the proposed build alternatives.

No Build Alternative

The No Build Alternative would leave the road conditions as they are today. Without any additional planned transportation and streetscape improvements programmed that would retrofit and extend bicycle and pedestrian ways through this West Brattleboro village corridor, it will be difficult for non-motorists to find the space to navigate safely through the corridor or across the street on either side of the corridor.

Alternative 1 – Continuous Sidewalk and Bike Lane

One of the primary goals of the plan is to create a corridor that is safe and accessible by a variety of transportation modes, including walking and bicycling. Alternative 1 creates continuous four- to five-foot bicycle lanes and widened five-foot sidewalks on both sides of the road throughout the entire length of the Study Area corridor. In addition, the plan proposes several highly visible crosswalks at regular intervals throughout the length of the corridor, supplemented by bulb-outs where possible to reduce crossing distances and calm traffic.

WESTERN SEGMENT

At the western-most end of the project corridor, at Greenleaf Street and Western Avenue, the plan accommodates a continuous bike lane and widened sidewalk by removing the left turn lane on Western Avenue and adding in colored and stamped crossings. These amenities serve as signals to motorists that they are entering a mixed-use village community.

The plan proposes to make the retail and gas station corner safer by promoting access management and reducing driveway widths in and out of the 7-11 gas station on the southwest corner of Greenleaf Street and Western Avenue. Shown in Figure 4.3, Alternative 1 also proposes converting head-in parking just southeast of the gas station into parallel parking to allow for a continuous sidewalk in front of the retail shops and space for additional landscaped setback. This alternative eliminates all other on-street parking within the western segment to accommodate a widened ADA accessible five-foot sidewalk and bike lanes on both sides.

CENTRAL SEGMENT

One key feature in Alternative 1 is the proposed closure of the northern South Street intersection at Western Avenue and the use of the additional right-of-way to expand the village green northwards. By closing the northern exit of South Street, traffic is rerouted to the eastern exit onto Western Avenue, with a more clearly defined intersection that enhances traffic safety at a high crash location. A dedicated left-turn lane from Western Avenue towards South Street would allow for cars to queue without blocking through traffic.

At the center of the eastern edge of the green, fronting Western Avenue, a separated bus lane with a boarding island and shelter provides a safe and comfortable area for transit users, as well as creating a protected lane for cyclists. Curbed and tapered bulb-outs at the intersection of Western Avenue and Bonnyvale Road reduces the crossing distances and provide bicyclists with a protected edge at a high crash intersection.

Parking along the south side of the street in front of the First Congregational Church would be relocated to pull-off parking on the driveway-side to allow a continuous sidewalk and bike lane to front the edge of the roadway, shown in Figure 4.4. On-street parking between Glen Street and George F. Miller Drive would be limited to areas in front of commercial and retail businesses near Glen Street to allow for a narrowing of the roadway width in this busy section of the corridor, which creates a safer atmosphere for cyclists and pedestrians.

EASTERN SEGMENT

Alternative 1 proposes narrowing the exit from the First Congregational Church and the Academy School to two lanes outbound, limiting all left-turn movements into the church and Academy School into a one-way loop on the northwest side of the church green. A curbed center island proposed directly in front of the First Congregational Church provides a pedestrian crossing refuge and also allows for landscaping or other treatments that would help calm traffic, keep motorists in their correct lanes, eliminate the potentially risky left-turn from Western Avenue onto George Miller Drive and improve the overall experience of traveling along this corridor. .

In this alternative, the sidewalk would extend along the south side of Western Avenue to the Whetstone Brook, with a freestanding prefabricated pedestrian bridge just south of the roadway bridge to allow for continuous pedestrian access along the south side of the road. An additional crossing of Western Avenue is added one block west of the bridge.

FIGURE4.1: ALTERNATIVE 1 CONCEPT

Top: Colored and textured pavement at crossing for graphical purposes, may be replaced with state design standards.

Bottom: Buffered bike lane, with bus boarding island.

This page shows the proposed improvements for the western segment of Alternative 1. The opposite page shows the improvements for the central and eastern segments.

FIGURE 4.2: ALTERNATIVE 1 PLAN

Central & East

FIGURE 4.3: CORNER GAS STATION

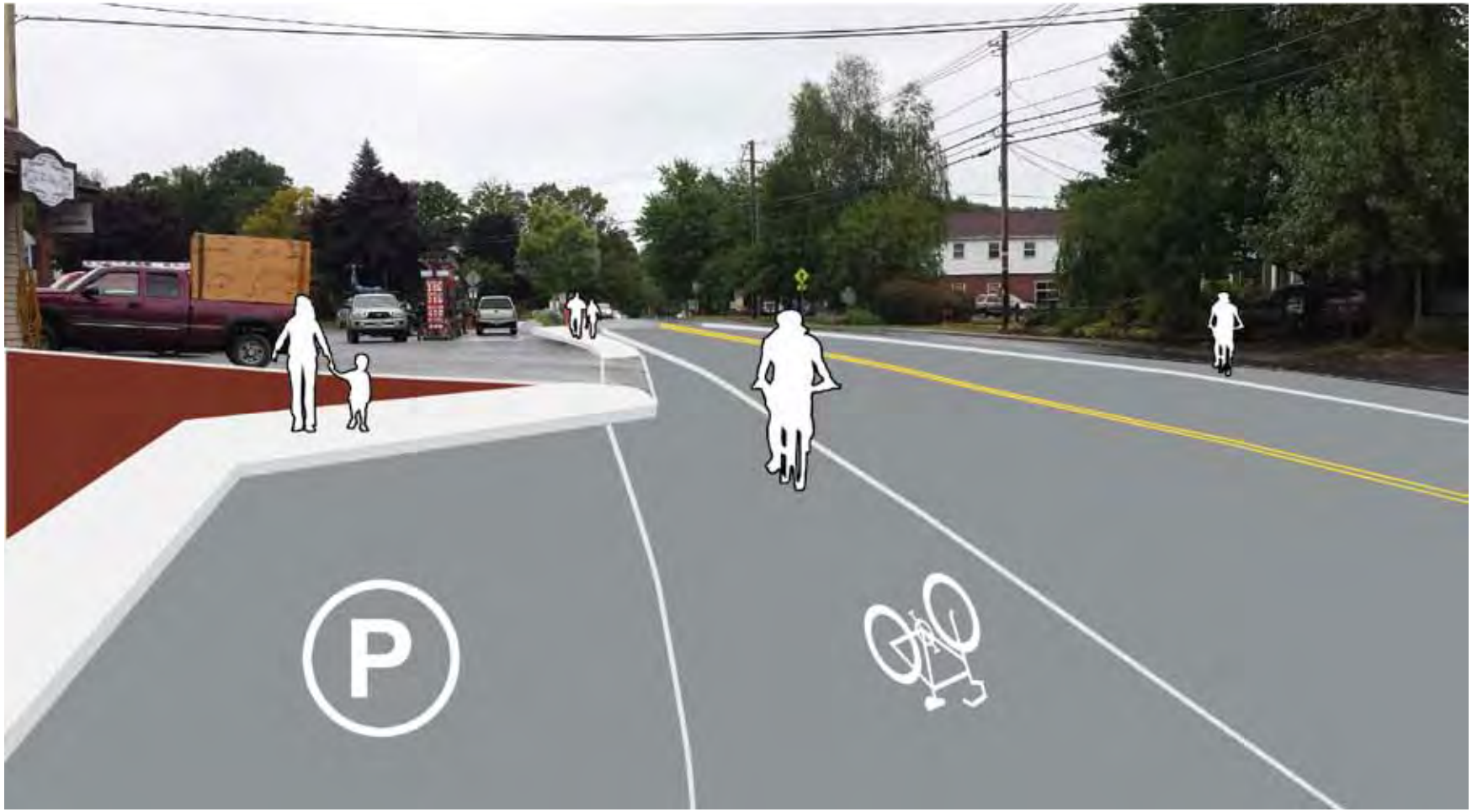


FIGURE 4.4: CROSSING IN FRONT OF CHURCH

Alternative 2 – Curbed Medians

Planters, curbed islands, and landscaping help slow vehicles, shield pedestrians from adjacent traffic, and provide a more welcoming environment for walking and bicycling. Alternative 2 focuses on enhancing the streetscape through a variety of traffic calming measures, as well as providing a continuous sidewalk and key crossings to comply with ADA standards.

WESTERN SEGMENT

At the western-most end of the project corridor, Alternative 2 maintains the separated left-turn lane on both Greenleaf Street and Western Avenue with added colored pavement at the crossings to highlight pedestrian activity. To accommodate cyclists, the travel lanes would be marked with pavement and road signs to indicate that they are shared-lanes, or "sharrows", to be used by both bicyclists and motorists.

Similar to Alternative 1, this plan proposes reducing driveway access widths in and out of the southwest corner retail shopping area to 25 feet, using a creative mix of planters and curbing, depending on the width of the road, in order to separate the roadway from the gas station. Alternative 2 suggests keeping the head-in parking spaces southeast of the gas station, but routing the curbed sidewalk directly in front of the stores.

Between the West Brattleboro Baptist Church and the corner retail shopping center, a center island median stretches for approximately 320' along the western segment, creating opportunities for landscaping, drainage, and gateway features. The median would be constructed so that it is mountable for fire truck ladder access. This alternative reduces on-street parking within the western segment to accommodate a widened ADA accessible five-foot sidewalk and the landscaped center median.

CENTRAL SEGMENT

To continue the landscaped parkway experience along Western Avenue, center medians flank both sides of the intersection at Bonnyvale Road and Glen Street, as shown in Figure 4.7. This helps isolate the two lanes of motor vehicles at this high-crash intersection; it also provides further opportunities to beautify this community corridor on the approach towards the village green. To create a safer intersection surrounding the green, Alternative 2 proposes to close the eastern intersection of South Street with Western Avenue and convert it into a dedicated access for the new Fire Station. This allows for the expansion of the green to include the old firehouse as a community center or other public use.

For transit users, a bus pull-off is located directly fronting the green, with a wide center median linking the green to the commercial area across the street and providing a safe refuge for pedestrians crossing Western Avenue. The same wide median could be mirrored on the other side of the fire department access way if the Fire Department believes it is acceptable to eliminate the left turn lane into the relocated Fire Station.

Parking along the south side of the street in front of the First Congregational Church would be relocated to pull-off parking on the church's driveway to allow a continuous sidewalk and bike lane to front the edge of the roadway. On-street parking between Glen Street and George F. Miller Drive would be eliminated in order to narrowing the roadway width in this busy section of the corridor to create a safer experience for cyclists. Parking in the central portion is encouraged to locate in available side and rear parking lots. The bike lanes would remain, with increased safety stemming from fewer conflicts with vehicles parked on-street.

EASTERN SEGMENT

Like Alternative 1, this plan proposes narrowing the exit from the First Congregational Church and the Academy School to two lanes outbound, limiting all left-turn movements into the church and Academy School into a one-way loop on the western side of the church green. A curbed center island proposed directly in front of the First Congregational Church provides a pedestrian crossing refuge and allows for landscaping or other treatments that would improve the experience of traveling along this corridor. In addition, the curbed median helps calm traffic, keeps motorists in their correct lanes, and eliminates the potentially risky left-turn from Western Avenue onto George Miller Drive.

On street parking would remain in areas east of the church along both sides of the street to accommodate visitors as well as parents dropping off their children. This plan proposes adding an additional crosswalk at the eastern end of the residential units along the south side of Western Avenue where the sidewalk currently ends and the bike lanes transitions into shared travel lanes.

FIGURE 4.5: ALTERNATIVE 2 CONCEPT

FIGURE 4.6: ALTERNATIVE 2PLAN

Top: Landscaped curbed median

Bottom: Shared lane markings indicating shared use of bicycle and vehicles in the travel lane

This page shows the proposed improvements for the western segment of Alternative 2. The opposite page shows the improvements for the central and eastern segments.

Central & East

FIGURE 4.7: CROSSING AND MEDIAN ON WESTERN AVE NEAR BONNYVALE RD

Alternative 3 – Shared use Path

In searching for a fresh solution to link pedestrians and bicyclists comfortably along the Western Avenue corridor, separated from traffic, the consultant team developed Alternative 3, which creates a shared use path south of Western Avenue and runs behind the buildings fronting on the street and meets the sidewalk at the corner of Greenleaf Street. The concept plan is shown in Figure 4.8.

WESTERN SEGMENT

This plan proposes a new storm water treatment and collection system at the rear of the 7-11 property and the other properties west of Western Avenue between Greenleaf Street and Bonnyvale Road, with an outfall to "Bonnyvale" Brook. The collection pipe would serve dual purposes: It would facilitate with drainage and flooding issues noted at the rear of the retail shopping center, as well as provide the additional easement space for the alignment of the shared use path.

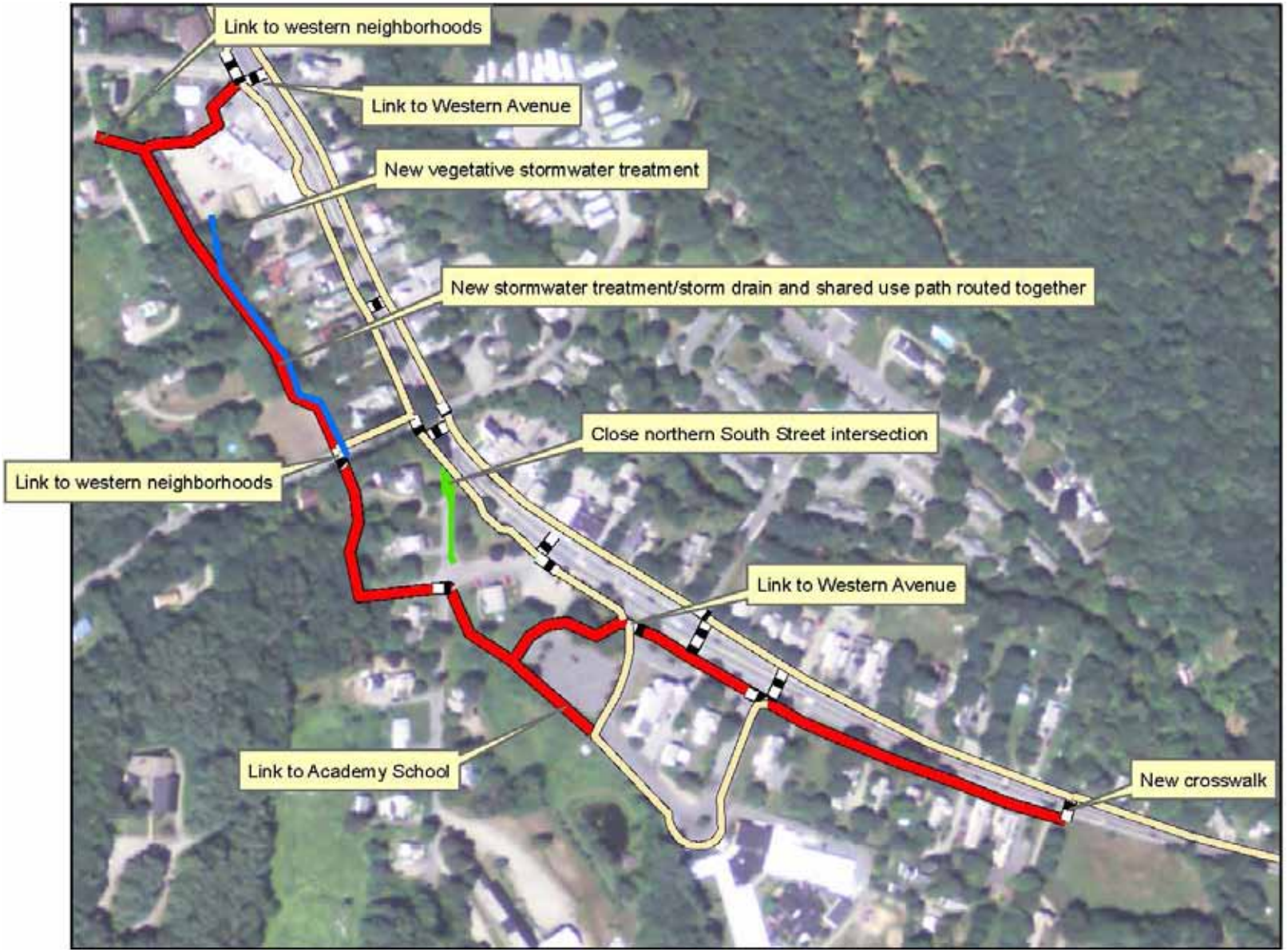
CENTRAL SEGMENT

Alternative 3 provides a central link to the west side of the village green and proposes a new sidewalk on Bonnyvale Street to provide a connection between the existing Western Avenue sidewalk and the shared use path. Similar to Alternative 1, the shared use plan proposes closing off the northern intersection of South Street with Western Avenue and expanding the green.

EASTERN SEGMENT

The shared use path would split to that one section shifts closer to Western Avenue by going south of the existing fire station and north of the church/school/Village parking area. The other section continues to the southeast to join with the existing sidewalks that lead to the Academy School. The main portion of the path heads southeast in front of the church and the residential homes fronting the south side of Western Avenue. The path would continue along the south side of the roadway until the end of the residential block just west of the bridge crossing. A new crossing at this eastern-most location would connect pedestrians across both sides of the roadway. New safety signage on Western Avenue and the shared use path near residential driveway crossings will help direct non-motorized users to the new path.

FIGURE 4.8: ALTERNATIVE 3 - SHARED USE PATH ALIGNMENT



Impacts and Issues

Table 4.1 provides a comparison of the potential impacts and issues associated with the different alternatives.

TABLE 4.1: COMPARISON MATRIX

	No Action	Alternative 1 Bicycle Lanes	Alternative 2 Center Median	Alternative 3 Shared Use Path
Meets Purpose and Need	No - Since not all bicyclists would be comfortable bicycling in the traffic lanes	Possibly, if bicyclists of all ages and abilities are comfortable bicycling on Western Avenue	No - Since not all bicyclists would be comfortable bicycling in the traffic lanes, even with sharrows	Yes - Provides facilities for users of all ages and abilities
Serves users with direct routes	No	Yes	Yes	No - they shared use path is slightly circuitous
Impacts to natural resources	No	No	No	No
Impacts to cultural resources	No	No - redesigned roadway does not move the edge of existing sidewalk any closer to historic structures	No - redesigned roadway does not move the edge of existing sidewalk any closer to historic structures	Possibly; places new paved path behind four historic homes
Maintenance Requirements	Typical roadway & Sidewalk maintenance requirements	Special snowplowing considerations in one spot with center median; additional plant care needed for one center median	Special snowplowing considerations with center medians; additional center median plantings require maintenance	Special winter snow plowing considerations
Permitting Issues	None	Needs local permits and Vtrans concurrance with plans; might need a stream disturbance permit depending on bridge design	Needs local permits and Vtrans concurrance with plans.	Needs local permits; State Pollutant Discharge Elimination System or Stormwater Discharge permits might be needed, depending on design of stormwater system

TABLE 4.1: COMPARISON MATRIX (CONTINUED)

	No Action	Alternative 1 Bicycle Lanes	Alternative 2 Center Median	Alternative 3 Shared Use Path
Impacts to above ground utilities	Utility poles would remain in their current position	Utility poles on the north side of Western Avenue would remain in current position; utility poles on the south side would need to be relocated	Utility poles on the north side of Western Avenue would remain in current position; utility poles on the south side would need to be relocated	Utility poles would remain in their current positions
Requires permanent or construction easements	No	Might require construction easement for reconstruction of sidewalks	Might require construction easement for reconstruction of sidewalks	Yes - up to ten permanent easements needed
Protects existing trees	Trees would not be disturbed	Trees on the south side of Western Avenue would need special protection during construction to remain healthy	Trees on the south side of Western Avenue would need special protection during construction to remain healthy	Trees would need to be removed - the specific number would depend on the exact route of the path
Helps slow vehicular traffic	No	Yes, the presence of bicycle lanes typically lowers overall motor vehicle speeds	Yes, the median would create visually narrower travel lanes which typically lowers overall motor vehicle speeds	No - minimal changes to the existing roadway that would induce slower moving vehicle speeds
Minimizes conflicts between motorized and non-motorized users	No, bicyclists transition between shared and separated bike lanes.	Yes, bicyclists ride in striped 5’ wide lanes, with a buffer between the bike lane and parked vehicles.	Yes, bicyclists ride in striped 5’ wide lanes, with a buffer between the bike lane and parked vehicles.	Yes - brings bicyclists across residential driveways

Order of Magnitude Cost Estimates

The construction cost estimate in Table 4.2 demonstrates the preliminary summary of the costs associated with each of the three alternatives. Alternative 1 includes the cost of constructing a new pedestrian bridge on the south side; without the bridge costs, Alternative 1 would be slightly less than Alternative 2 in cost, around $700,000 to $800,000. Alternative 2 is slightly more expensive than Alternative 1 because there would be more vertical curbing and drainage added in order to construct the medians. Alternative 3 has the least amount of curbing, and therefore results in lower construction costs. However, there are property impacts in order to route the shared use path along the back side of properties which may result in the need to gain easements or purchase additional property.

TABLE 4.2: ALTERNATIVES COST ESTIMATE

Alternative	Cost Estimate
1. Continuous Bike Lanes and Pedestrian Paths	$800,000 - $950,000, including $100,000 for new ped bridge
2. Median Parkway	$775,000 - $875,000
3. Shared Use Path	$625,000 - $700,000, not including property impact costs

Preferred Alternative

A second public meeting was held on May 13, 2014 to solicit feedback from the community on the three alternative options proposed for Western Ave. The meeting was attended by approximately 20 people. It was advertised broadly via flyers and on the town's website. The results of the public involvement portions are detailed in Appendix 1: Public Outreach. A second meeting held by the Highway and Utilities Superintendent and Traffic Safety Committee members reached an agreement that continuous bike lanes was a safety priority for this segment of Western Ave, with the potential of extending bike lanes to the areas east and west of the project area in the future.

The preferred alternative is a variation of Alternative 1: Continuous Bike Lanes, shown in Figure 4.9. The final preferred plan proposes a continuous four- to five-foot bicycle lane and widened five-foot concrete sidewalks on both sides of the road throughout the entire length of the Study Area corridor. The plan also proposed changing the speed limit so that Western Ave is 30mph for all motorists, versus the existing condition that limits 25 mph for trucks and 30mph for cars. Speed data analysis confirms that this limit is appropriate (see Appendix for data).

All existing crosswalks remain in their current location. The existing crosswalk on the south side of the intersection with Greenleaf Street links the existing sidewalk on south side of Greenleaf Street with the sidewalk and businesses on the east side of Western Ave. This is the only crosswalk on Western Avenue at this intersection and should be retained. The next crosswalk is the existing mid-block crosswalk in front of the church. This crosswalk provides a convenient location, espe-

cially for those going to the church, for a mid block crossing between the crosswalks at the Greenleaf Street and Bonnyvale Rd intersections, which are over 775 feet apart. The plan recommends that it remain in place. The existing crosswalk on the south side of the Glen Street/Bonnyvale Rd intersection provides a place to cross Western Ave for pedestrians coming from either of the side streets and should be retained. The next existing crosswalk to the south is across Western Ave on the northern side of the remaining, southern South Street intersection. This crosswalk links the existing bus stops on either side of Western Ave and also provide a crossing for pedestrians coming to the village area from South Street. The plan retains this crosswalk because of the link between bus stops; transit users need to use this crosswalk at least once a day for either their departing or returning transit trips to reach their final destination in West Brattleboro. The existing crosswalk in front of the First Congregational Church provides access to the school during the week and is heavily used on Sundays for pedestrians heading to the church. It aligns with a sidewalk leading to the church entrance and should be retained. The next existing crosswalk to the south is at the driveway that provides direct access to the Academy School. It is used every weekday by students walking to the school and should be retained. One additional short-term crosswalk is proposed at the end of the residential block just west of the stream crossing on the eastern end of the study area. This crosswalk will provide continuity for pedestrians heading east on Western Ave until the sidewalk is extended to the east. Once the sidewalk is extended to the stream, this crosswalk would not necessarily be needed and could be removed if the Town prefers. An new temporary crosswalk on Western Ave should be added at the new end of the sidewalk, if the prefabricated bridge on the south side of the Whetstone Brook road bridge is not installed at the same time. This crosswalk would allow pedestrians heading east on the south side sidewalk to cross Western Ave and continue on the eastward journey. Once the prefabricated bridge is installed and the sidewalk extended even further east on the south side of Western Ave, this crosswalk would not be needed and should be removed. Road signage would be updated to reflect the new speed limit, the new crosswalk at the eastern end of the project area, and replacing "lane ahead" and "lane ends" bike signage with consistent bike route signs.

The key updates between Alternative 1 and the preferred alternative are highlighted below.

WESTERN SEGMENT

There are no changes between Alternative 1 and the Preferred Alternative in the segment between Greenleaf Street and Bonnyvale Rd. An additional crosswalk across Western Ave was discussed for the west side of Bonnyvale Rd and Glen Rd. However, this idea was dismissed because it is not at a signalized intersectionl. In addition, from a traffic operations perspective, a second Western Ave crosswalk can potentially slow traffic down further by having two crosswalks within a short span of road without significantly improving pedestrian safety.

CENTRAL SEGMENT

In the preferred concept plan, the Village Green is expanded to 0.4 acres from 0.26 acres by narrowing the former western South Street connection to a 12' driveway width for accessibility to the corner parcel. An path is added to connect between the driveway and Western Ave to serve pedestrians, but also functions as an access way that is traversable by emergency vehicles.

There is currently on-street parking on much of the north side of Western Ave east of Glen Street. In order to accommodate bike lanes on both sides and a dedicated left-turn lane, the preferred alternative proposes removing on-street parking between the South Street and George Miller Dr. Based on GIS parcel lines, the ROW is approximately 60 feet, which is insufficient to accommodate for on-street parking and also leave room for snow storage in the winter. Four additional parallel parking spaces are added in the loop in front of the church to help offset some of the on-street parking that

However, the existing sidewalk is showing outside of the ROW and a future more detailed survey may reveal that the ROW is wider here than shown on the GIS parcel lines. If that is the case, on-street parking may potentially remain on the north side of the street through the central segment.

EASTERN SEGMENT

The changes in the eastern segment of the preferred alternative is a continuation of the road section across the bridge. The plan proposes that when the new bridge is constructed, a five-foot bike lane in each direction, along with a curbed sidewalk on both north and south sides of the street would continue across the bridge. When the main bridge is updated, the prefabricated bridge for the sidewalk can be removed and reused elsewhere in the Town. The preferred alternative also includes the temporary crosswalk on the west side of the Whetstone Brook road bridge if the prefabricated pedestrian bridge is not constructed at the same time that the south side sidewalk is extended east.

FIGURE 4.9: CROSS-SECTION ON WESTERN AVE AT THE FIRST CONGREGATIONAL CHURCH

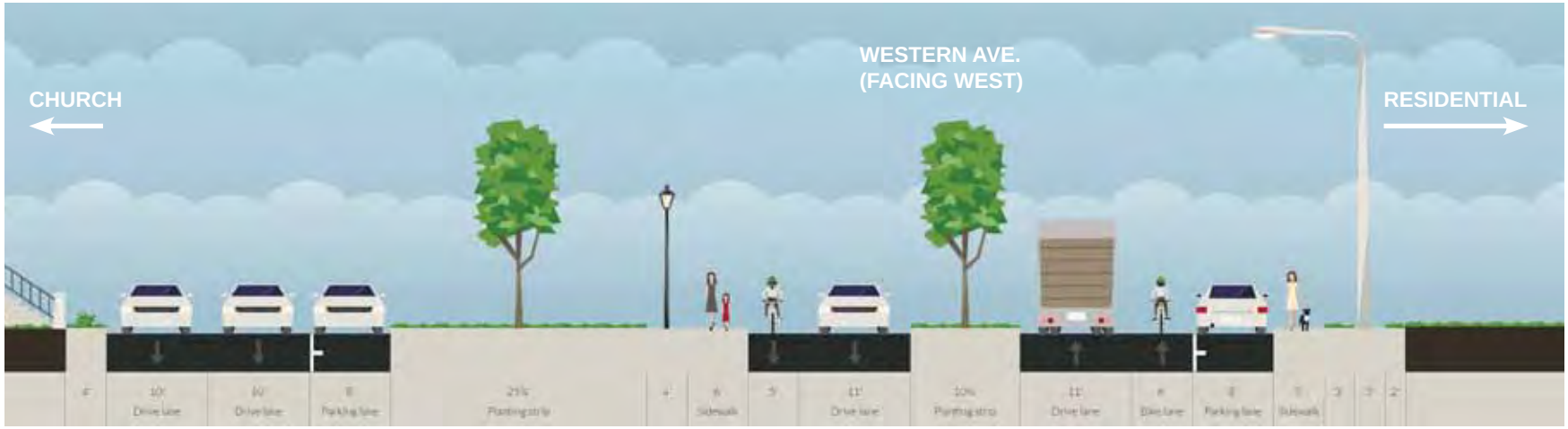


FIGURE 4.9: PREFERRED ALTERNATIVE - CONTINUOUS BIKE LANES

Central & East

FIGURE 4.10: PREFERRED ALTERNATIVE – ROAD SIGNAGE

Central & East

5

IMPLEMENTATION

Implementation Strategy

PHASING

Because the Town might not be able to undertake implementation of the project at one time, the Selectboard could consider a phased implementation. Possible phases would include:

- Greenleaf Street to the south side of the Bonnyvale Rd/ Glen St. intersection;
- Bonnyvale Road/Glen Street intersection to the Whetstone Brook for on road improvements and Bonnyvale Rd to the eastern end of the residences on the south side of Western Ave for sidewalk improvements; and
- The sidewalk extension on the south side of Western Ave to Whetstone Brook; and
- The prefabricated bridge across Whetstone Book in conjunction with and additional extension of the south side sidewalk further to the east on Western Ave.

These first three phases could be implemented in any order. The fourth phase would only make sense after the sidewalk on the south side of Western Ave was extended.

PERMITS

The implementation of the recommended improvements should occur wholly within the Town's right-of-way. It should also not result in a significant increase in impervious surface within the study area, since most of the work is either restriping existing pavement or replacing and slightly widening existing sidewalks. Consequently, other than local approvals, the recommendations should not require any other approvals or permits.

For the phase which the pedestrian/bicycle bridge over Whetstone Brook, the crossing will need natural resource review and permitting.

PROCEDURES

As a first step towards implementing the recommendations of this study, the Town Selectboard should accept and endorse the report. It will be difficult to proceed with the recommendations for the Town without this endorsement. Once the report is endorsed by the Town, it can undertake these steps, but not necessarily in the order listed here:

- Begin looking and applying for funding opportunities through grants, bonding or other sources the Town considers appropriate.
- Keep the Town residents, especially those in West Brattleboro, up to date on the process of implementing the recommendations.
- Hire a consultant if needed to assist with the design of the sidewalk and other improvements.
- Design and implement the road restriping to create the bicycle lanes and other on-road features in a trial basis.

Order of Magnitude Cost Estimates

The construction cost estimate in Table 5.1 shows an overall approximate summary of the costs associated with improvements throughout the project area. The estimate contains realistic costs, as of 2014, for construction, surveying, engineering, and permitting services where applicable.

The concept plan falls within the Town right-of-way with no need to acquire properties outside this limit. There are areas that will require obtaining a temporary construction easement from some abutters at no anticipated costs to the Town.

Table 5.1 Overall Approximate Cost Estimate

Western Avenue (VT Route 9) - Greenleaf Street to Whetstone Brook

Item No.	Description	Quantity	Unit	Cost/Unit	Total	Notes
201.10	CLEARING AND GRUBBING, INCLUDING TREES & STUMPS	1	LS	$10,000.00	$ 10,000	
203.15	COMMON EXCAVATION	770	CY	13.01	$ 10,018	
203.28	EXCAVATION OF SURFACES AND PAVEMENTS	310	CY	34.95	$ 10,835	
301.35	SUBBASE OF DENSE GRADED CRUSHED STONE	1200	CY	36.35	$ 43,620	
406.25	BITUMINOUS CONCRETE PAVEMENT	310	T	110	$ 34,100	
604.40	CHANGING ELEVATION OF DI,CB OR MH	12	EA	788.43	$ 9,461	
604.42	CHANGING ELEVATION OF SEWER MANHOLE	3	EA	708.99	$ 2,127	
609.10	DUST CONTROL WITH WATER	20	MGL	91.94	$ 1,839	
616.21	VERTICAL GRANITE CURB	5690	LF	26.65	$ 151,639	
616.41	REMOVAL OF EXISTING CURB	500	LF	4.48	$ 2,240	
618.10	PORTLAND CEMENT CONC. SIDEWALK, 5 INCH	2290	SY	46.4	$ 106,256	
618.11	PORTLAND CEMENT CONC. SIDEWALK, 8 INCH	231	SY	63.2	$ 14,606	
618.30	DETECTABLE WARNING SURFACE	168	SF	110.34	$ 18,537	
629.20	ADJUST ELEVATION OF VALVE BOX	4	EA	171.64	$ 687	
630.15	FLAGGERS	340	HR	23.53	$ 8,000	
631.16	TESTING EQUIPMENT, CONCRETE	1	LS	850	$ 850	
631.17	TESTING EQUIPMENT, BITUMINOUS	1	LS	540	$ 540	
635.11	MOBILIZATION/DEMOBILIZATION	1	LS	25000	$ 25,000	
641.10	TRAFFIC CONTROL	1	LS	4000	$ 4,000	
646.40	DURABLE 4 INCH WHITE LINE , THERMOPLASTIC	13000	LF	0.92	$ 11,960	
646.41	DURABLE 4 INCH YELLOW LINE , THERMOPLASTIC	6200	LF	1.25	$ 7,750	
646.50	DURABLE X-WALK MARKING , THERMOPLASTIC	1234	LF	7.69	$ 9,493	
653.40	INLET PROTECTION DEVICE, TYPE 1	10	EA	128.55	$ 1,286	
653.55	PROJECT DEMARCATION FENCE	3000	LF	1.42	$ 4,260	
656.85	TREE PROTECTION	1	LS	3000	$ 3,000	
900.68	S.P. (HAND PLACED BITUMINOUS CONCRETE PAVEMENT)	250	SY	33	$ 8,250	
649.11	EROSION CONTROL	1	LS	6000	$ 6,000	
650	LANDSCAPING	1000	SY	20	$ 20,000	
SP 900	BIKE/PED BRIDGE - PRE-FAB STEEL	1	LS	100000	$ 100,000	
				Subtotal Construction:	$ 626,352	
				Contingency (15%):	$ 93,953	
				Survey, Engineering, & Permitting (10%):	$ 72,030	
				Local Project Administration (10%):	$ 72,030	
				Construction Inpspection (10%):	$ 72,030	
				TOTAL	**$ 936,396**	

Basis of Estimate is Vtrans 2 Year Averaged Price List

MAINTENANCE COSTS AND CONSIDERATIONS

Based on RSG and the Town of Brattleboro's calculations, the maintenance cost estimates for the streetscapeand sidewalk is $15,500 per year. Table 5.2 details the summary of items being considered that need continual upkeep. This is based on Public Works Department estimates provided during this project.

Table 5.2: Maintenance Costs and Considerations

Bicycle & Pedestrian Improvements	Annual Maintenance Cost
Sidewalk, plowing, sanding, etc.	$ 10,000
Landscaping	$ 5,000
TOTAL	$ 15,000

Funding Sources

Funding for the recommendations might be able to be secured from a variety of sources. Below is a list of various funding sources that could be used to help with the implementation of the recommendations, including:

- Transportation Alternatives Program (TA Funds): TA funds can be used to increase bicycle and pedestrian mobility. These funds will cover a maximum of 80 percent of the project with the remaining portions most likely coming from the project-sponsoring organization. TA funds are distributed in Vermont through a competitive grant program.
- Bicycle and Pedestrian Program: These State funds cover specific bicycle and pedestrian improvement projects and are provided via a competitive grant program.
- One Time Tax: A one-year-only increase in the tax rate by one or two cents by the Town could raise funds for one phase or serve as matching funds for competitive grant programs.
- Private Fundraising: The Town could work to raise private funds for the new sidewalks or other pedestrian improvements, at least in part, possibly with some memorial that acknowledges the contributions.
- Bonds: The Town could opt to use bonds to generate funds to undertake one or all of the phases at once.
- Bikes Belong Grants: These grants are given by the Bikes Belong organization to improve bicycling conditions throughout the United States. The grants are for both facilities and advocacy. Additional information can be found at: http://www.bikesbelong.org/grants/apply-for-a-grant/who-can-apply/.

A new online tool developed by a partnership between the Alliance for Biking and Walking and the League of American Bicyclists helps find potential federal funding sources for alternative transportation projects. The site can be reached at http://bit.ly/11xhEtr.

Other funding sources may be available for the construction of some of the improvements, including:

- Potential health grants promoting healthy living;
- The Robert Wood Johnson Foundation (see
- http://www.rwjf.org/content/rwjf/en/grants/search.html?k=walking&d=&l=);
- MCI/Worldcom Royalty Donation Program (For this and several subsequent ideas, see http://www.americantrails.org/resources/funding/TipsFund.html);
- People for Bikes grants (see http://www.peopleforbikes.org/pages/community-grants); and
- RockShox's Grants (seehttp://www.sramcyclingfund.org/fund-overview.html).

Even other potential sources exist. Some additional resources that may provide insight into additional funds include:

- http://www.americantrails.org/resources/funding/Funding.html,
- http://rlch.org/, and
- http://atfiles.org/files/pdf/bicentennialsourcebook.pdf.

A1

PUBLIC OUTREACH

To allow as much participation as possible by the residents of West Brattleboro in the development of the recommendations of this study, the Consultant team worked with the Town to hold three public work sessions within the study area. They also held individual meetings with several groups in West Brattleboro to encourage their participation in the process.

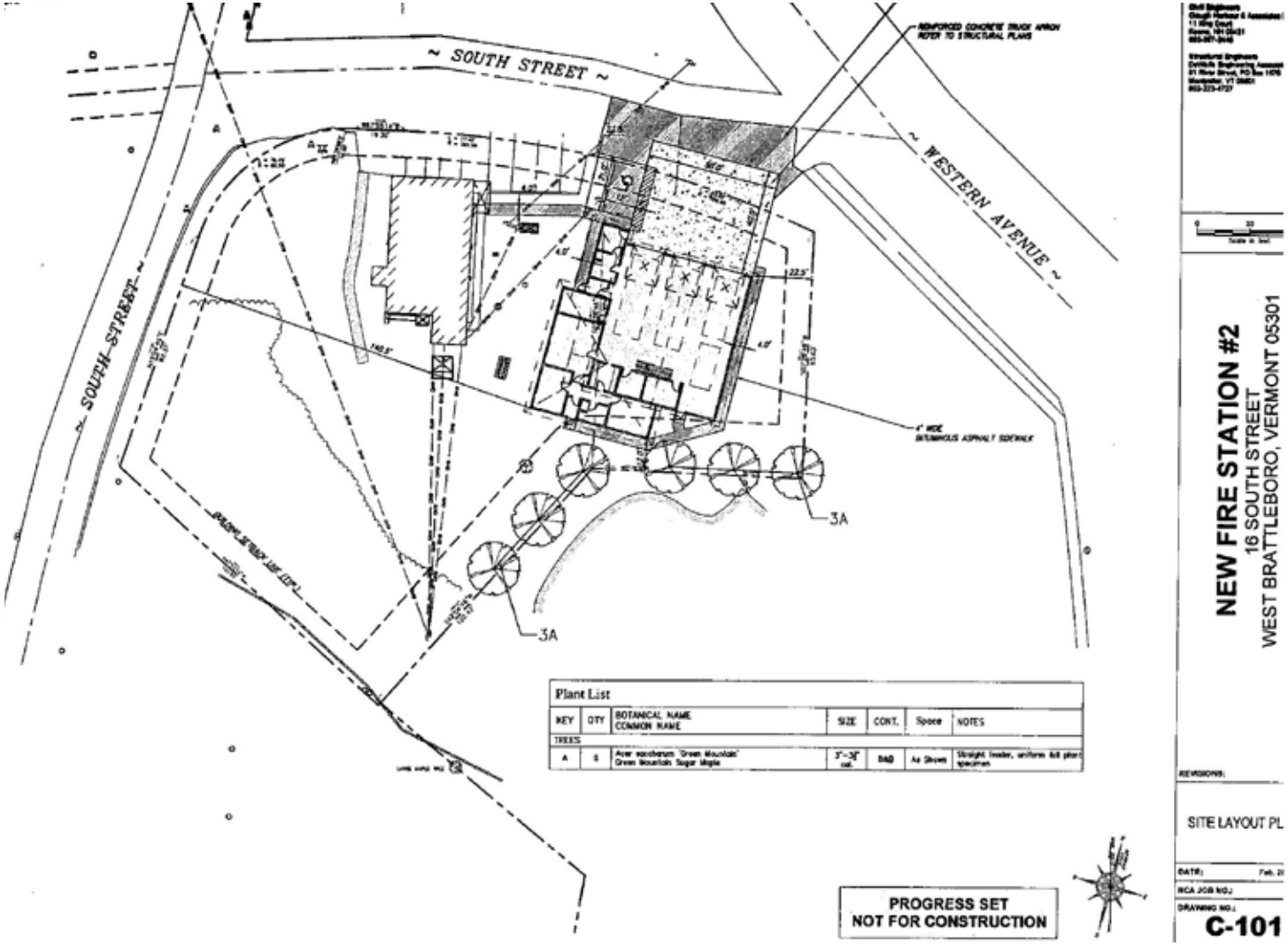
Stakeholder Meeting 1 – March 6, 2014

The West Brattleboro Association has been active for several years encouraging public and private improvements to West Brattleboro. The Consultant team met with representatives of the West Brattleboro Association to learn about their previous recommendations for improving bicycling and walking options along Western Avenue. They also discussed other potential improvements to the area that the association has encouraged in the past. Prior planning efforts have focused on creating a grand loop with a center green along Western Ave, as well as narrowing the roadway by adding wider sidewalks.

The association emphasized their concerns about safety and traffic calming, as well as adding bike lanes, enhancing the village green, and improving the corner retail at Greenleaf and Western. They felt that the current roadway was too wide, which encourages speeding and makes crossing widths long and dangerous for pedestrians. The group also touched on the need to have more usable green spaces and that South Streets have slowly encroached on the green space over time. They shared that the village green is historically significant, having once been owned by Benjamin Wheaton, an early African American landowner.

The Consultant team also met with representative of the Brattleboro Fire Department to understand their plans for building a new fire station, shown in Figure 1.1. They described plans for a new building closer to Western Avenue on the northeast of the current fire station. They also discussed options for refining the dual intersections of South Street with Western Avenue. The Fire Station thought that either option might work, as long as they still had direct access to Western Avenue as well as to South Street across an emergency only access way. The group also spoke about parking utilization; evenings and weekends were typically busiest in front of the restaurant and daytime parking in front of the daycare and school during drop-off and pick-up times. The fire department representatives also stressed the need for 16 to 20 feet in order to set up a ladder truck to access upper stories.

FIGURE A1.1: NEW BRATTLEBORO FIRE STATION PLAN



Local Concerns Meeting – March 6, 2014

The Consultant Team organized the first public work session to present information on the walking and bicycling conditions along Western Avenue in West Brattleboro and to let the residents express their concerns, suggestions or questions relating to the study. The meeting was held on March 6, 2014 at the Academy School but participation by the community was minimal.

Public Meeting 2 – May 13, 2014

The second work session allowed the community to review the conceptual alternatives and provide their input as to which one(s) were more appropriate. Academy school was again host to the second public work session on May 13, 2014 and there was significantly more community participation. The Consultant team explained the alternatives and then took comments and questions from the audience.

The meeting participants engaged in a healthy discussion of the merits of each of the alternatives for over an hour. There was general agreement that improvements were needed and that improving both the bicycling conditions on Western Avenue and the walking conditions next to it were equally important. There was strong support for extending a sidewalk to and over Whetstone Brook with a new bridge. The loss of parking spaces in the eastern section did not appear to concern anyone but there was some discussion of the loss of parking spaces in the Central Section but no conclusions as to whether it was acceptable or not.

By the end of the meeting, the participants were split on shared lanes versus continuous bike lanes and were not able to come away with a preference. Those in support of adding continuous wide shoulders to Western Avenue in the village area but not for the addition of continuous bike lanes reasoned that the bike lanes did not continue further north or south from the Village Area and they were concerned about the change in on-road bicycling facilities. Those for a striped continuous bike lane wanted a safer way to ride through this busy section of Western Ave.

The last public work session will be held in front of the Brattleboro Selectboard on August 6, 2014.

A2

ARCHAEOLOGICAL SITE INSPECTION

Archaeological Site Inspection for the proposed Brattleboro STP Bike (59) Project, Brattleboro, Windham County, Vermont

Submitted to:

Joseph Wildey
Proposal Coordinator
Resource Systems Group
55 Railroad Row
White River Junction, VT 05001

Submitted by:

Charles Knight, Ph.D.

University of Vermont
Consulting Archaeology Program
111 Delehanty Hall
180 Colchester Ave.
Burlington, VT 05405

Report No. 787

April 16, 2014

Archaeological Site Inspection for the proposed Brattleboro STP Bike (59) Project, Brattleboro, Windham County, Vermont

Project Description

The Town of West Brattleboro, with the assistance of Resource Systems Group, proposes the Brattleboro STP Bike (59) Project, Brattleboro, Windham County, Vermont (Figure 1). The Town of Brattleboro, with assistance from Resource Systems Group, proposes to construct a sidewalk/multi-use path within the area of Western Avenue from the Academy School to the intersection with Greenleaf Street taking into consideration the existing conditions. The roadway in this area is unusually wide to accommodate turning lanes, breakdown lanes, and bicycle lanes. Due to the fact that there is an elementary school and a church within the area of the study, the pedestrian volume is particularly large.

The University of Vermont Consulting Archaeology Program (UVM CAP) conducted an Archaeological Resources Assessment (ARA) of the APE for the proposed Brattleboro STP Bike (59) Project and no areas of archaeological sensitivity were identified.

Study Goal

The goal of an ARA (or "review") is to identify portions of a specific project's APE that have the potential for containing precontact and/or historic sites. An ARA is to be accomplished through a "background search" and a "field inspection" of the project area. For this study, reference materials were reviewed following established guidelines. Resources examined included the National Register of Historic Places (NRHP) files; the Historic Sites and Structures Survey; and the USGS master archaeological maps that accompany the Vermont Archaeological Inventory (VAI). Relevant town histories and nineteenth-century maps also were consulted. Based on the background research, general contexts were derived for precontact and historic resources in the study area.

Archaeological Site Potential

No known archaeological sites exist within, or immediately adjacent to the proposed project parcel, nor are there any known from within 2.5 km of the proposed project area. Although the proposed project area parallels Whetstone Brook and crosses an unnamed tributary of Whetstone Brook, very little development that would stimulate a regulatory archaeological investigation has occurred in the area, contributing to the dearth of archaeological information of the area. Although the proposed project corridor is almost completely developed, none of the development along it has stimulated archaeology as part of the regulatory process. The closest known precontact Native American archaeological sites are located over 3 km to the northeast at the mouth of the West River. Nonetheless, the Whetstone Brook would have been an inland avenue from the Connecticut River, which was well travelled in the precontact era.

In regard to historic period resources, both the historic 1856 Wallings map (Figure 2) and

the 1869 Beers map (Figure 3) show a series of buildings along both side of VT Rte 9. These structures appear to represent the majority of the structures that still exist along the same route. The main exception is along the west side of VT Rte 9 at its intersection with Greeleaf Street, where a 7-Eleven, gas station pumps and other commercial buildings have replaced the original building. Nonetheless, none of the historic period structures depicted in either historic map will be disturbed by the proposed bike project.

Desk Review

As part of the desk review, the UVM CAP utilized the Vermont Division of Historic Preservation's (VDHP) predictive model for identifying precontact Native American archaeological sites. The Brattleboro STP Bike (59) Project scores 24 on the Predictive Model, due to its location within 90 m of a permanent stream (12), within 90 m of the confluence of a tributary of Whetstone Brook and Whetstone Brook (12). In addition to the paper-based predictive model, the desk review uses a Geographical Information System (GIS) developed jointly by the UVM CAP, and its consultant Earth Analytic, Inc., which operationalizes the paper-based model. It does this by applying the VDHP's sensitivity criteria to all lands within the State of Vermont. In these maps, archaeological sensitivity is depicted by the presence of one or more overlapping factors, or types of archaeological sensitivity (i.e. proximity to water, etc.). The Brattleboro STP Bike (59) Project crosses areas that exhibit 8 overlapping sensitivity factors, which are Drainage, Waterbody, Wetland, Stream confluence, Paleosol, Kame Terrace, Floodplain, and Level Terrain (see Figure 1).

Field Inspection

A field inspection of the project area was carried out on April 14, 2014 by Charles Knight, Assistant Director of the UVM CAP. Knight walked the entire project alignment. As mentioned, the project alignment crosses an unnamed tributary of the Whetstone Brook. The crossing however, has been fully developed as the tributary passes underneath VT Rte 9 through a cement culvert (Figure 4). Further south, near the intersection of South Street, a wide green space exists between VT Rte 9 and the sidewalk and between South Street and the exit drive for the Unitarian church (Figure 5). Nonetheless, this area is not located near any water and has been disturbed by street and adjacent parking lot construction. The area near the northern terminus of the project alignment, where VT Rte 9 intersects with Greenleaf Street, has been extensively disturbed as a result of the construction of a parking lot and several commercial buildings (Figure 6). The eastern side of VT Rte 9 is dominated by residences, none of which contain areas of archaeological sensitivity in their front lawns. In general, any widening of VT Rte 9 to incorporate the proposed project will not disturb archaeologically sensitive areas. The proposed alignment is too far from Whetstone Brook to be archaeologically sensitive and the crossing of a tributary of Whetstone Brook has already been completely disturbed.

Conclusions

The Town of West Brattleboro proposes the Brattleboro STP Bike (59) Project, Brattleboro, Windham County, Vermont. The UVM CAP conducted an Archaeological

Resources Assessment of the proposed bike path alignment and identified no portion of the proposed project limits as archaeologically sensitive. The project limits have either been disturbed by the construction of the existing buildings or the construction of VT Rte 9 and associated sidewalks and side streets. As a result, the Brattleboro STP Bike (59) Project will have no impact on significant cultural resources and no additional archaeological work is recommended.

Thank you for working with us on this project. Please let me know if you have any questions or comments.

Charles Knight, Ph.D.
Assistant Director

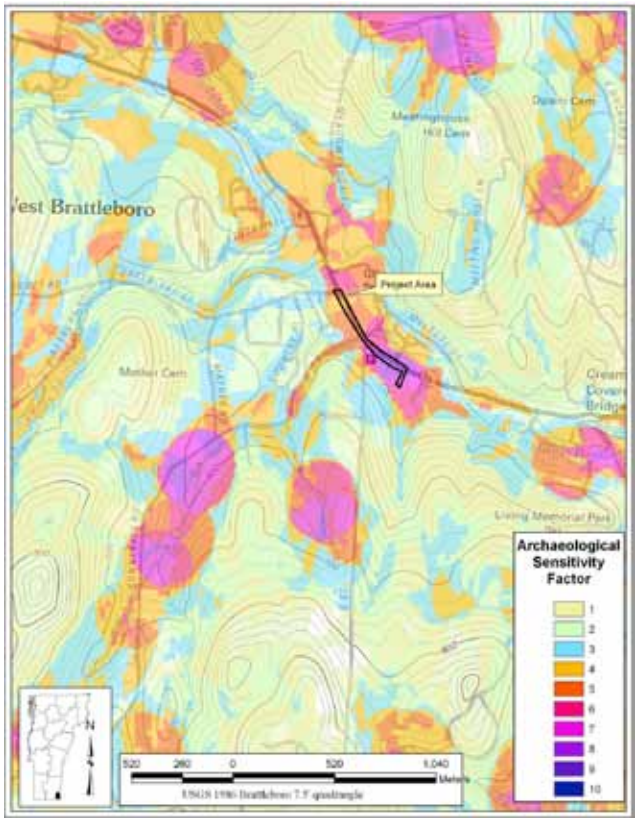


Figure 1. Map showing the location of the proposed Brattleboro STP Bike (59) Project, in relation to archaeological sensitivity factors, Brattleboro, Windham County, Vermont.

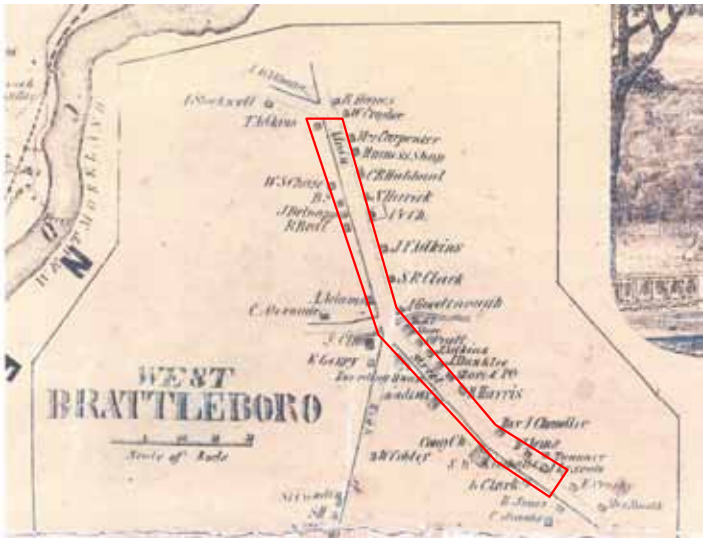


Figure 2. Historic 1856 Wallings Map showing the approximate location of the proposed Brattleboro STP Bike (59) Project, Brattleboro, Windham County, Vermont.

Figure 3. Historic 1869 Beers Map showing the location of the proposed Brattleboro STP Bike (59) Project, Brattleboro, Windham County, Vermont.

a

b

Figure 4. Photographs looking southeast (a) and northwest (b) at the stream crossing along the western side of VT Rte 9 in West Brattleboro for the proposed Brattleboro STP Bike (59) Project, Brattleboro, Windham County, Vermont.

a

b

Figure 5. Photographs looking southeast (a) and northwest (b) along VT Rte 9 in the vicinity of the intersection with South Street for the proposed Brattleboro STP Bike (59) Project, Brattleboro, Windham County, Vermont.

a

b

Figure 6. Photographs looking north (a) and northwest (b) along VT Rte 9 in the vicinity of the northern terminus near the intersection with Greenleaf Street for the proposed Brattleboro STP Bike (59) Project, Brattleboro, Windham County, Vermont.

A3

TRAFFIC AND SPEED DATA

All Traffic Solutions
9/2/2014 12:00:00 AM to 9/5/2014 11:59:00 PM
File: W ave eb 9-5-14.tdf
Speed Limit: Variable: 25, 30
Display On/Off: On

Summary Data

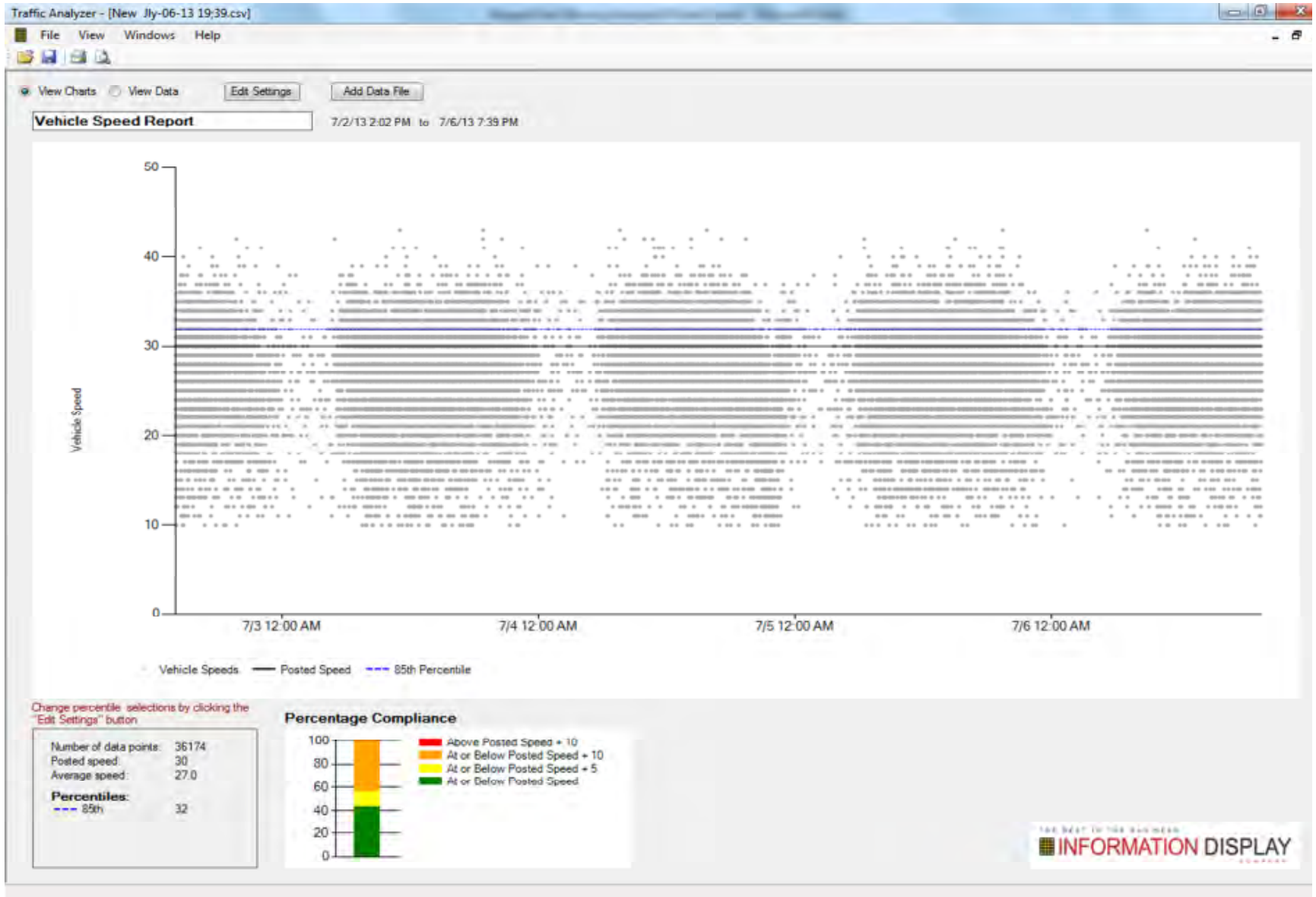
File	W ave eb 9-5-14.tdf
Date Range	9/2/2014 to 9/5/2014
Total Days of Data	4
Speed Limit	Variable: 25, 30
Time Range	12:00 AM to 11:59 PM
Average Speed	25.00
85% Speed	30
50% Speed	25
10 mph Pace Speed	25 to 34
High Speed	70
Low Speed	5
Display On/Off	On
Average Volume per Day	5920

All Traffic Solutions
9/5/2014 12:00:00 AM to 9/9/2014 11:59:00 PM
File: Traffic Data 9-9-2014.tdf
Speed Limit: 25
Display On/Off: On

Summary Data

File	Traffic Data 9-9-2014.tdf
Date Range	9/5/2014 to 9/9/2014
Total Days of Data	5
Speed Limit	25
Time Range	12:00 AM to 11:59 PM
Average Speed	26.00
85% Speed	33
50% Speed	26
10 mph Pace Speed	26 to 35
High Speed	100
Low Speed	5
Display On/Off	On
Average Volume per Day	7562

Bagged Data: Individual Targets with Posted Speed.



Bagged Data: Moving Average with Posted Speed.

A4

PUBLIC MEETING MINUTES

FIGURE A4.1: STAKEHOLDER MEETING NOTES (MARCH 6, 2014)

MEETING NOTES

PRESENT: Academy School: Hannah O'Connell, Steve Barrett, Dirk Grotenhuis (RSG), Grace Wu (RSG)
LOCATION: Academy School and Fire Department, Brattleboro, VT
DATE: March 6, 2014
SUBJECT: Stakeholder Meeting -STP BIKE(59) Brattleboro Bicycle and Pedestrian Scoping Study

ITEM 1: Academy School – 10 AM to 11 AM

- Route 9 is dangerous for crossing, particularly the eastern-most crossing that has a crossing guard during school hours.
  - 6 auto crashes, mainly rear ends where cars do not anticipate or leave enough space for sudden stops for pedestrians crossing. Cars aren't prepared to yield and are driving at high speeds, 40mph
  - 3 pedestrian fatalities in the past 14 months
  - Crossing distances are too long
  - Flashing lights to alert drivers to reduce speed in school zone have helped a little, but many people don't notice them (although some do notice when the bulb is out).
  - Crossing guard is out from 7:30am to 2:3pm during school hours. However, lots of activities are outside of school hours, such as the activity and ball fields behind the school.
- Destinations/activities on the north and south sides
  - North: Pool, residential communities, more sidewalk
  - South: School, preschool, Silver Lake
- Bus operations and Parking
  - Increase in parents driving to school and kids not walking/biking. This is a negative cycle where more parents drive, leading to increased congestion, which leads to decrease in safety, which only leads to more parents driving.
  - Designated lanes in front of church, with one-way loop, has helped. Although there is still sometimes issues with parents turning in the wrong direction in the one-way loop and parking on both sides of the loop.
  - Preschool at church starts at 8:30am, Academy School starts at 8am, buses arrive around 7:50am.
- Traffic
  - Lots of morning traffic arriving from the west.
  - Not a lot of enforcement on speeding, although when police are around, the cars do slow down.
  - U-turn out of 7-11 onto Greenleaf
  - Cut-through traffic coming from Bonnyvale at high speeds
- Traffic Calming
  - Seasonal median bollards have helped to reduce traffic speeds.
  - Flashing lights are 20 years old, looking to new technology
  - Radar feedback signs, pedestrian button flashing crossings

ITEM 2: West Brattleboro Association

- Explaining the VTrans LTF process
  - Establish purpose and need and to establish more funding
  - This scoping study will give guidelines to preliminary concepts and a preferred alternative goes to final report
  - Design and technical construction is in next phase
  - Alternatives matrix of issues and priorities, might be multiple preferred but helps direct the next steps
  - LTF grant from the state helps the town start from the beginning, with state support
  - Prioritize the safety features and how we could phase 2020 or 2025 reconstruction
- Safety and Traffic calming
  - Bollards have helped slow down traffic, particularly around the Bonnyvale Rd
  - Width of the road: Road is too wide which encourages speeding
  - Crossing widths are very long, make it dangerous for pedestrians who have to poke their head out carefully into traffic
  - Difficult sight distances, particularly at the green
  - Incrementally bump the curbs out
  - Slideshow by Paula mountains from Chelsea Diner to Route 2* Steve to send to RSG
- Village Green
  - The community would like more usable green spaces. The street has encroached on the village green space
  - Fire station in and out, apron fits within the right of way
  - Former concept of showing a Village Green in the center of the road
  - Public private partnership for landscaping
  - Review West Brattleboro Masterplan - will get copy from WBA*
  - Look at closing off one of the legs of South Road adjacent to the green
  - Transit shelter: maintained by bus company
  - Parks and rec maintain the Village Green, including trash and mowing
- 7/11/Shopping center

  - One of the previous studies suggested roundabout at the Greenleaf/Western Ave intersection
  - Analyze whether stoplight is needed
  - Western most crosswalk seems dangerous with cars turning in and out of the shopping center/gas station
  - Turn lanes are good for traffic but create blind spots with crosswalks
  - Another crosswalk by yoga place just west of Greenleaf
- Bike lanes
  - See lots of cyclists along Route 9, both commuters and recreational weather
  - Big issue for cyclists is the pinch point at the bridge
  - The flooding issue was due to bridges being too small, constrict the water at Melrose and George Miller Bridges
  - Sunset and Lake Road, $1M for a one lane bridge
- Historical information
  - History of the village green owned by Benjamin Wheaten, early African American land owner
  - Trolley line that ran up and down the street
  - Melrose Bridge used to be a covered bridge

ITEM 3: Brattleboro Fire Department

- Fire Station Access
  - Pull onto South St and back in with 35' truck, although looking at someday having 42-47' truck → Need ample space to make the left turn westbound
  - The current building may remain or the Town may sell it
  - Bonnyvale intersection is narrow and tough to get in and out of. Parking is restricted near Bonnyvale intersection.
  - Second crosswalk from west is particularly dangerous.
  - Need 20 feet to set the ladder truck up to accesses the upper stories, so the median would prevent cutting across → would consider mountable sloped granite (existing mountable curb at Main St)
  - NFPA regulations for 16' to 20'
- Parking
  - Evenings and weekends are busy parking in front of restaurant
  - Daytime parking in front of daycare and school for drop offs
  - Diagonally parking accidentally in front of restaurant
- Connections
  - Look at the larger connections for sidewalk and where gaps are and what happens beyond study area
  - A lot of traffic coming from Greenleaf to Guilford and Halifax
  - Map out the destinations, including restaurants, eateries, delis…places where people park, congregate

FIGURE A4.2: PUBLIC MEETING NOTES (MAY 14, 2014)

Academy School Scoping Study
May 14, 2014 6:00 pm
Academy School

These minutes are for the public portion of the presentation ONLY.
Nancy Barber: Turning left out of the north/west leg of South Street is very difficult. I prefer the option that comes out in front of the FD.

Mary Durland: I do not think that Western Avenue is a wide road when you take into consideration the amount and type of vehicles on it. Also, it is visually busy – there are too many signs, crosswalks, etc. If you are unfamiliar with the area, it is difficult to take it all in. Please use a minimum of signage in this upgrade. I would also like to see increased enforcement of vehicles not stopping for pedestrians. This should supplement the existing/proposed traffic devices. I like the off road shared use path.

Response: Jim Donovan discussed safety statistics regarding the shared use path on the edge of road due to the number of driveways in this area. We like the idea of a shared use path here, but as engineers we cannot recommend an unsafe facility. Presenters discussed the MUTCD and required signage. Stated that they will be doing a sign inventory as part of this study and will eliminate unnecessary signage and check for regulatory signage.

Unknown: What ever became of the Whetstone Pathway idea?

Response: This project was discontinued due to costs. The Whetstone Bridge was installed As part of that project.

Matt Mann: Are the existing cross walks being used to the degree that they are warranted? Some of the crosswalks could be eliminated which will eliminate some of that signage.

Stewart McDermott: The WBA is hopeful that the Village Green would be expanded and improved more. We were hoping that it could take some of the real estate on Western Avenue. Do I understand that Western Avenue will be staying the same width? Also, did you receive the email from Tim Cuthbertson regarding the Greenleaf Street intersection? It is a very complex, dangerous intersection.

Response: What all the proposals include is closing the shopping center entry onto Greenleaf And defining the corner and intersection more. It is difficult to see in the alternatives, but We are actually narrowing up Western Avenue a tiny bit. If we go with sharrows in this area, we Can substantially narrow up the road.

Matt Mann: Do drivers understand what sharrows are?

Response: It is improving. There is some good signage that explains it.

Jim Donovan: How do people feel about eliminating bike lanes and having only bike lanes?

Micah Ranquist: You stated that the purpose of this project is to connect communities, but we aren't connecting any of the major communities in West Brattleboro. There aren't ANY crosswalks or sidewalks out there. Why can't it be considered to extend the project?

Response: This grant only covers the area from Academy School to Greenleaf Street.

Kate Anderson: I am advocating for the sharrows. I think they are a better option for the long term. The bigger issue is education with regards to bikes and pedestrians being on the road with vehicle traffic. How do we educate everyone to use the roads well and respectfully and safely.

Mollie Burke: Are there statistics about the safety of sharrows vs. bike lanes? I'm excited about the dedicated bike lanes and keeping the bikes out of traffic. I like the idea of more education. We need to be more like Montpelier where traffic stops when they see people getting ready to cross. I like the idea of an off street path, but I think it would get bogged down in ROW. Also, there were discussions at Westgate to look into a crosswalk to the property across the street and it wasn't supported at the time.

Hugh Bronson: I'm in support of closing the north/west leg of South Street. It is very difficult to turn out of there with the Bonnyvale Road intersection.

Sue Aldridge: My big concern is traffic speed. I don't think the off road shared use pathway will have any effect on traffic speed. I like the colored cross walks. I like the pedestrian bridge at Melrose. I like the median planters, it is a nice continuation from the Exit 2 area. Truck traffic goes too fast through here.

Hannah: What would you propose as a treatment to color the crosswalks?
Jim Donovan: There are various treatments that have different costs. Some have longer Life expectancies.

Michael Bosworth: We would really like to see more green space on the Village Green. How does the fire department feel about shutting off one of these legs?

Hannah: We will follow up with the emergency services. We haven't presented any concepts For discussion until we had a better idea of what the public wanted.

Michael Bosworth: Will the medians/planters be curbed? Will you be able to drive over it?

Response: There will be options to the community – you can do curbed medians (these Are the most calming) or painted. They have various merits.

Michael Bosworth: Discussion of turning into George Miller Drive if there are medians – left hand turns. Discussion of 7-11/Shopping center plaza.

Dave Cohen: I think we need to consider EVERYTHING to be traffic – bikes, pedestrians, and vehicles. I like both the sharrows and bike lanes. I really want to express concern about the Melrose bridge – it is very, very narrow. We need to investigate the whole 25/30 mph speed limit issue on Western Avenue.

General discussion of construction time frame, funding, etc.

Mary Durland: In support of colored crosswalks that are more durable. Would it be possible to break out costs by feature? For example this island costs $x.

Matt Mann: Is it possible in the proposal to include information about maintenance costs of the various treatments that you will suggest with regards to traffic volume?

Timberly Hund: In support of the bus stop feature in the first concept. Have you considered a bike lane down the center that is curbed?

> Response: Yes those are called Cycle Tracks and are typically used in urban environments. They Are great in some applications, but here you would need to provide a means for cyclists to get in and out of the Cycle Track. It is also a difficult feature to maintain in the winter and it is a Relatively short expanse that we are affecting on Route 9.

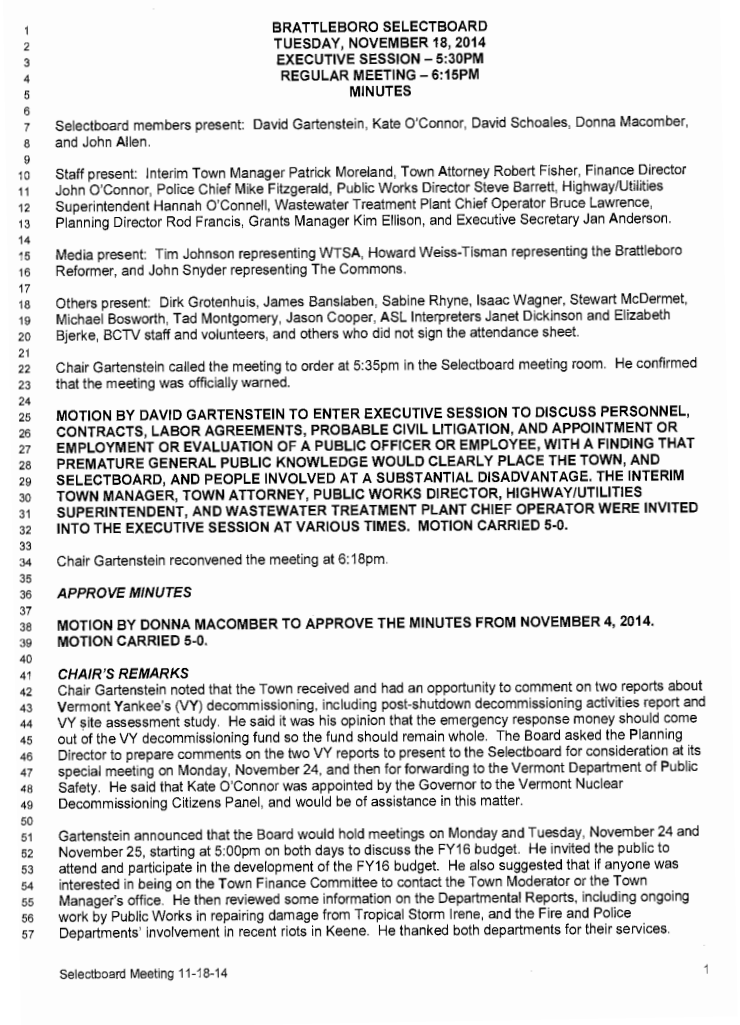
Nancy Barber: We need to investigate other types of street markings because the current paint is not holding up.

> Response: There are other means of street markings – thermoplastic, grinding down, etc. The Usage/implementation of those comes down to what the community wants and the budget.

A5

SELECTBOARD MEETING MINUTES

FIGURE A5.1: SELECTBOARD MEETING NOTES (NOVEMBER 18, 2014)



BRATTLEBORO SELECTBOARD
TUESDAY, NOVEMBER 18, 2014
EXECUTIVE SESSION – 5:30PM
REGULAR MEETING – 6:15PM
MINUTES

Selectboard members present: David Gartenstein, Kate O'Connor, David Schoales, Donna Macomber, and John Allen.

Staff present: Interim Town Manager Patrick Moreland, Town Attorney Robert Fisher, Finance Director John O'Connor, Police Chief Mike Fitzgerald, Public Works Director Steve Barrett, Highway/Utilities Superintendent Hannah O'Connell, Wastewater Treatment Plant Chief Operator Bruce Lawrence, Planning Director Rod Francis, Grants Manager Kim Ellison, and Executive Secretary Jan Anderson.

Media present: Tim Johnson representing WTSA, Howard Weiss-Tisman representing the Brattleboro Reformer, and John Snyder representing The Commons.

Others present: Dirk Grotenhuis, James Banslaben, Sabine Rhyne, Isaac Wagner, Stewart McDermet, Michael Bosworth, Tad Montgomery, Jason Cooper, ASL Interpreters Janet Dickinson and Elizabeth Bjerke, BCTV staff and volunteers, and others who did not sign the attendance sheet.

Chair Gartenstein called the meeting to order at 5:35pm in the Selectboard meeting room. He confirmed that the meeting was officially warned.

MOTION BY DAVID GARTENSTEIN TO ENTER EXECUTIVE SESSION TO DISCUSS PERSONNEL, CONTRACTS, LABOR AGREEMENTS, PROBABLE CIVIL LITIGATION, AND APPOINTMENT OR EMPLOYMENT OR EVALUATION OF A PUBLIC OFFICER OR EMPLOYEE, WITH A FINDING THAT PREMATURE GENERAL PUBLIC KNOWLEDGE WOULD CLEARLY PLACE THE TOWN, AND SELECTBOARD, AND PEOPLE INVOLVED AT A SUBSTANTIAL DISADVANTAGE. THE INTERIM TOWN MANAGER, TOWN ATTORNEY, PUBLIC WORKS DIRECTOR, HIGHWAY/UTILITIES SUPERINTENDENT, AND WASTEWATER TREATMENT PLANT CHIEF OPERATOR WERE INVITED INTO THE EXECUTIVE SESSION AT VARIOUS TIMES. MOTION CARRIED 5-0.

Chair Gartenstein reconvened the meeting at 6:18pm.

APPROVE MINUTES

MOTION BY DONNA MACOMBER TO APPROVE THE MINUTES FROM NOVEMBER 4, 2014. MOTION CARRIED 5-0.

CHAIR'S REMARKS

Chair Gartenstein noted that the Town received and had an opportunity to comment on two reports about Vermont Yankee's (VY) decommissioning, including post-shutdown decommissioning activities report and VY site assessment study. He said it was his opinion that the emergency response money should come out of the VY decommissioning fund so the fund should remain whole. The Board asked the Planning Director to prepare comments on the two VY reports to present to the Selectboard for consideration at its special meeting on Monday, November 24, and then for forwarding to the Vermont Department of Public Safety. He said that Kate O'Connor was appointed by the Governor to the Vermont Nuclear Decommissioning Citizens Panel, and would be of assistance in this matter.

Gartenstein announced that the Board would hold meetings on Monday and Tuesday, November 24 and November 25, starting at 5:00pm on both days to discuss the FY16 budget. He invited the public to attend and participate in the development of the FY16 budget. He also suggested that if anyone was interested in being on the Town Finance Committee to contact the Town Moderator or the Town Manager's office. He then reviewed some information on the Departmental Reports, including ongoing work by Public Works in repairing damage from Tropical Storm Irene, and the Fire and Police Departments' involvement in recent riots in Keene. He thanked both departments for their services.

Selectboard Meeting 11-18-14 1

MANAGER'S COMMENTS

None.

SELECTBOARD COMMENTS AND COMMITTEE REPORTS

Allen said that the Police-Fire Facilities Building Committee met recently and continued to look into different locations for the Police Department. He also thanked Renaud Brothers for the fine work on the Sunset Lake Road Bridge, and for being accommodating to the neighbors during the reconstruction.

Schoales announced that the Elementary School District's Community Forum was scheduled tomorrow at 6:00pm at Academy School to discuss the use of testing and assessments to guide instruction and to report on the progress of the new Common Core.

PUBLIC PARTICIPATION

Tim Johnson announced that Project Feed the Thousands kicked off its campaign a week ago in order to meet its goal of $100,000 in cash and 200,000 meals to serve the greater Windham County area. He asked for support from the public.

LIQUOR COMMISSIONERS

MOTION BY DAVID SCHOALES TO CONVENE AS LIQUOR COMMISSIONERS. MOTION CARRIED 5-0.

Special Event Permit – *Saxtons River Distillery, LLC.* Moreland said that the Board was asked to approve a Special Event Permit for Saxtons River Distillery for the Cotton Mill Open Studio Holiday Sale at 74 Cotton Mill Hill on Saturday, December 6, and Sunday, December 7, from 9:00am to 7:00pm. There was a brief discussion.

MOTION BY DAVID SCHOALES TO APPROVE A SPECIAL EVENT PERMIT FOR SAXTONS RIVER DISTILLERY, LLC, FOR AN EVENT AT COTTON MILL STUDIOS, 74 COTTON MILL HILL ON SATURDAY, DECEMBER 6, FROM 9:00AM TO 7:00PM, AND ON SUNDAY, DECEMBER 7, FROM 9:00AM TO 7:00PM. MOTION CARRIED 5-0.

Special Event Permit – *Whetstone Cider Works, LLC.* Gartenstein said that the Board was asked to approve a Special Event Permit for Whetstone Cider Works, LLC for the Cotton Mill Open Studio Holiday Sale at 74 Cotton Mill Hill, on Saturday, December 6, from 10:00am to 6:00pm, and Sunday, December 7, from 10:00am to 4:00pm. There was a brief discussion.

MOTION BY KATE O'CONNOR TO APPROVE A SPECIAL EVENT PERMIT FOR WHETSTONE CIDER WORKS, LLC, FOR AN EVENT AT COTTON MILL STUDIOS, 74 COTTON MILL HILL ON SATURDAY, DECEMBER 6, 10:00AM TO 6:00PM, AND ON SUNDAY, DECEMBER 7, 10:00AM TO 4:00PM. MOTION CARRIED 5-0.

Educational Sampling Event Permit – *Brattleboro Food Co-Op, Inc.* Sabine Rhyne, from the Brattleboro Food Co-Op, asked the Board to approve an Educational Sampling Event Permit for the Brattleboro Food Co-Op's fourth annual Holiday Beer and Wine Tasting to be held at the Brattleboro Museum and Art Center on Friday, December 12, from 5:30pm until 8:00pm. There was a brief discussion.

MOTION BY DONNA MACOMBER TO APPROVE AN EDUCATION SAMPLING PERMIT FOR THE BRATTLEBORO FOOD CO-OP, INC., FOR THEIR FOURTH ANNUAL HOLIDAY BEER AND WINE TASTING EVENT TO BE HELD AT THE BRATTLEBORO MUSEUM AND ART CENTER ON DECEMBER 12 FROM 5:30PM TO 8:00PM. MOTION CARRIED 5-0.

MOTION BY DAVID SCHOALES TO ADJOURN AS LIQUOR COMMISSIONERS. MOTION CARRIED 5-0.

The Board agreed to adjust the agenda to move items C and D (Staffing Level Reviews at Department of Public Works) before the Water and Sewer Commissioners.

Selectboard Meeting 11-18-14 2

WATER AND SEWER COMMISSIONERS

MOTION BY JOHN ALLEN TO CONVENE AS WATER AND SEWER COMMISSIONERS. MOTION CARRIED 5-0.

Staffing Level Review – *Engineering Technician, Department of Public Works.* Public Works Director Steve Barrett and Highway/Utilities Superintendent Hannah O'Connell were present and discussed the tasks and responsibilities of the Engineering Technician position. Barrett said that Gary King was retiring in December. He said that the position was a unique position in that it required a background in engineering, would be responsible for record keeping and mapping, would occasionally act as water treatment plant operator and required a CDL license to drive equipment when necessary. There was a brief discussion by the Board. Gartenstein said that the review was for informational purposes and no action would be taken by the Board.

NO ACTION TAKEN.

Staffing Level Review – *Water Treatment Division, Department of Public Works.* Public Works Director Barrett said there was a vacancy in the water treatment plant and spoke about the requirements and certifications required for the position. There was a brief discussion by the Board. This matter was informational only and no action was required.

NO ACTION TAKEN.

MOTION BY DONNA MACOMBER TO ADJOURN AS WATER AND SEWER COMMISSIONERS. MOTION CARRIED 5-0.

NEW BUSINESS

Financial Report – *Monthly Report, October, Finance Department.* Finance Director John O' Connor discussed the financial report for the month ending October 31. There was some discussion by the Board.

NO ACTION TAKEN.

West Brattleboro Bicycle Pedestrian Scoping Study – *Public Comment, Discussion, Department of Public Works.* Public Works Director Barrett, Highway/Utilities Superintendent O'Connell, and RSG Engineering representative Dirk Grotenhuis were presented and discussed the West Brattleboro Bicycle and Pedestrian Scoping Study. Barrett provided some history on the project and discussed safety concerns in the area covered in the study.

Gartenstein opened the public hearing.

O'Connell discussed the purpose of the study and requirements of the VTrans grant that was awarded by the State to perform the scoping study. She discussed the process and public involvement around a number of public and local concerns meetings in order to collect community input for concerns and improvements. She said that the study was not a design but was a conceptual study, and that it would be very beneficial in applying for grants and other funding necessary to complete improvements for the area. Grotenhuis confirmed that the scoping study was a planning exercise to identify and improve bicycle and pedestrian safety in the area utilizing existing documents and data available. He discussed safety issues in the area and many aspects of the scoping study, including many concerns and considerations, pedestrian crossings and pathways, uniform speed limits, revising intersections, expanding the Village Green, three main alternatives suggested for improvements, the preferred alternative, costs, and making improvements in phases.

Gartenstein opened the floor for public comments.

First speaker (unidentified) spoke of her concerns about the pedestrian crossing and other safety concerns at the intersection with Greenleaf Street.

Michael Bosworth spoke of his general support of the study and discussed his concerns around pedestrian activity, improvements to Melrose Bridge, increasing the green space at West Village Green, the suggested alternatives, concerns at Greenleaf Street and George Miller Drive, and parking spaces on Western Avenue near Stockwell Store.

Stewart McDermet, member of the West Brattleboro Association, spoke in support of the public involvement with the study and in support of the preferred alternative. He encouraged the Selectboard to accept and endorse the report presented.

Tad Montgomery spoke of his concerns for bicyclists on the section of Route 9 from Melrose Bridge east to the Interstate, and he encouraged the Board to include that area in any discussion about improvements to the road.

There was substantial discussion by the Board, including many substantial safety concerns along the defined area and beyond, methods to proceed with funding and improvements, funding for design and construction, increasing the length of the sidewalk from Greenleaf Street to the Interstate, and many aspects and recommendations in the scoping study.

MOTION BY DAVID SCHOALES TO ACCEPT AND ENDORSE THE WEST BRATTLEBORO BICYCLE AND PEDESTRIAN SCOPING STUDY. MOTION CARRIED 5-0.

Gartenstein closed the public hearing.

Community Development Block Grant (CDBG) – *Approve Resolution, Public Hearing, Windham & Windsor Housing Trust VCDP Implementation Grant.* A representative from Windham-Windsor Housing Trust, Isaac Wagner, and Grants Manager Kim Ellison, were present to discuss WWHT's CDBG grant application. Board member Kate O'Connor noted her citizen appointment to the Community Development Block Grant Board at the State level.

Gartenstein opened the public hearing.

Wagner said that Windham & Windsor Housing Trust (WWHT) would be reconstructing and improving five affordable housing properties owned by WWHT and the construction costs were estimated to be approximately $2.3 million. He discussed the improvements to the buildings and the CDBG funding request in the amount of $425,000. He said that the Town would be the applicant on the CDBG grant and it would be a pass-through grant from the Town to WWHT. Grants Manager Ellison said that WWHT would provide the Town with a security interest on the properties. Tad Montgomery inquired about the planned energy improvements to the buildings. There was some discussion by the Board, including the requirement that the Town be reimbursed for its administrative costs in connection with the grant.

MOTION BY DAVID SCHOALES TO ADOPT THE RESOLUTION FOR GRANT APPLICATION AUTHORITY AS PRESENTED, TO IDENTIFY KIM ELLISON AS THE POINT OF CONTACT, AND TO IDENTIFY PATRICK MORELAND, INTERIM TOWN MANAGER, AS THE AUTHORIZING OFFICIAL. MOTION CARRIED 5-0.

Gartenstein closed the public hearing.

Approve Grant Application – *Brownfields Assessment Grant, Planning Services.* Planning Director Rod Francis said that the Board was asked to approve a grant application to the Environmental Protection Agency in the amount of $400,000 to fund a local Brownfields program to facilitate the process of environmental review at redevelopment sites in Brattleboro. There was a brief discussion.

MOTION BY DAVID GARTENSTEIN TO APPROVE THE PLANNING DEPARTMENT APPLICATION FOR A $400,000 BROWNFIELDS ASSESSMENT GRANT FROM THE EPA TO INVENTORY, CHARACTERIZE, ASSESS AND CONDUCT PLANNING AND COMMUNITY INVOLVEMENT RELATED TO BROWNFIELDS IN BRATTLEBORO. MOTION CARRIED 5-0.

Presentation – *Sustainable Energy Funding Program.* Tad Montgomery was present and said that he understood that the matter had been withdrawn by the requester, and that he was not a representative for the requester. He spoke in support of utilizing the Sustainable Energy Funding Program in other projects around Town. Moreland said that he had not been notified by the requester that this matter had been withdrawn. There was some discussion by the Board about the lack of notice of the withdrawal and the agenda-setting process.

NO ACTION TAKEN.

CORRESPONDENCE AND MEETINGS

Macomber read the dates and times of Town committee meetings and other upcoming events.

Gartenstein said that the Board would enter into executive session and reconvene at a later time but that no further business would be conducted.

MOTION BY DAVID GARTENSTEIN TO ENTER INTO EXECUTIVE SESSION TO DISCUSS APPOINTMENT, EMPLOYMENT, OR EVALUATION OF A PUBLIC OFFICER OR EMPLOYEE WITH A FINDING THAT PREMATURE GENERAL PUBLIC KNOWLEDGE WOULD CLEARLY PLACE THE PUBLIC BODY OR PERSON INVOLVED AT A SUBSTANTIAL DISADVANTAGE. MOTION CARRIED 5-0.

Chair Gartenstein reconvened the meeting at 9:00pm. There was no further business.

MOTION BY DAVID SCHOALES TO ADJOURN AT 9:00PM. MOTION CARRIED 5-0.

_____

David Schoales, Clerk

RSG

BROADREACH
Planning & Design

The UNIVERSITY of VERMONT
CONSULTING ARCHAEOLOGY PROGRAM

Appendix M: Utilities ID

Brattleboro BF 2000(28)

Existing Utilities within Project Limits Report 08-27-2019

Bridge 54 on VT Route 9 in Brattleboro, Vt.

AERIAL

-Green Mountain Power Company (Electric)
-Consolidated Communications (Cable & Fiber)
-FirstLight Fiber
-Comcast (Coax & Fiber)

UNDERGROUND

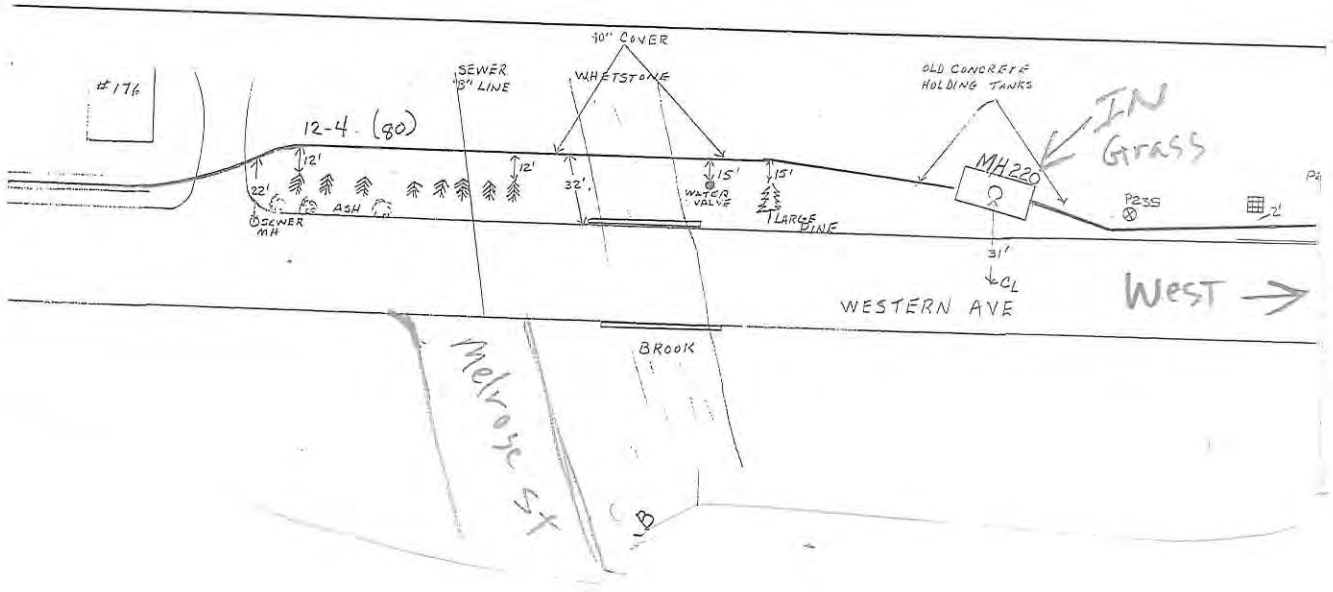
- Consolidated Communications (12 – 4" Conduits) Parallel to the existing bridge. The conduits are approximately 32' to the south (downstream side) of the bridge. Conduits run from telephone manhole to telephone manhole.

MUNICIPAL

The Town of Brattleboro, Public Works Department, Utilities Division has a water main located on the bridge.

The Town of Brattleboro, Public Works Department, Utilities Division has sewer is in vicinity of the bridge but not in the bridge. The sewer crosses the river to the south of the bridge but is on the East and west sides of the bridge.

- **Depending on the scope of the work to be accomplished this project will most likely have significant utility impacts. Any Aerial relocations that would be necessary will be challenging as this site is congested and areal lines come in from several directions.**
- **Any impact to water line on bridge will be required to be addressed as part of the project. (Within class 1 limits)**
- **Underground Utilities should be outside of scope of work.**


#176
12-4 (80)
SEWER 8" LINE
30" COVER
WHETSTONE
OLD CONCRETE HOLDING TANKS
IN Grass
MH 220
P235
12'
22'
12'
32'
15'
WATER VALVE
15'
LARGE PINE
SEWER MH
2 ASH
31'
CL
WESTERN AVE
West
BROOK
Melrose St
B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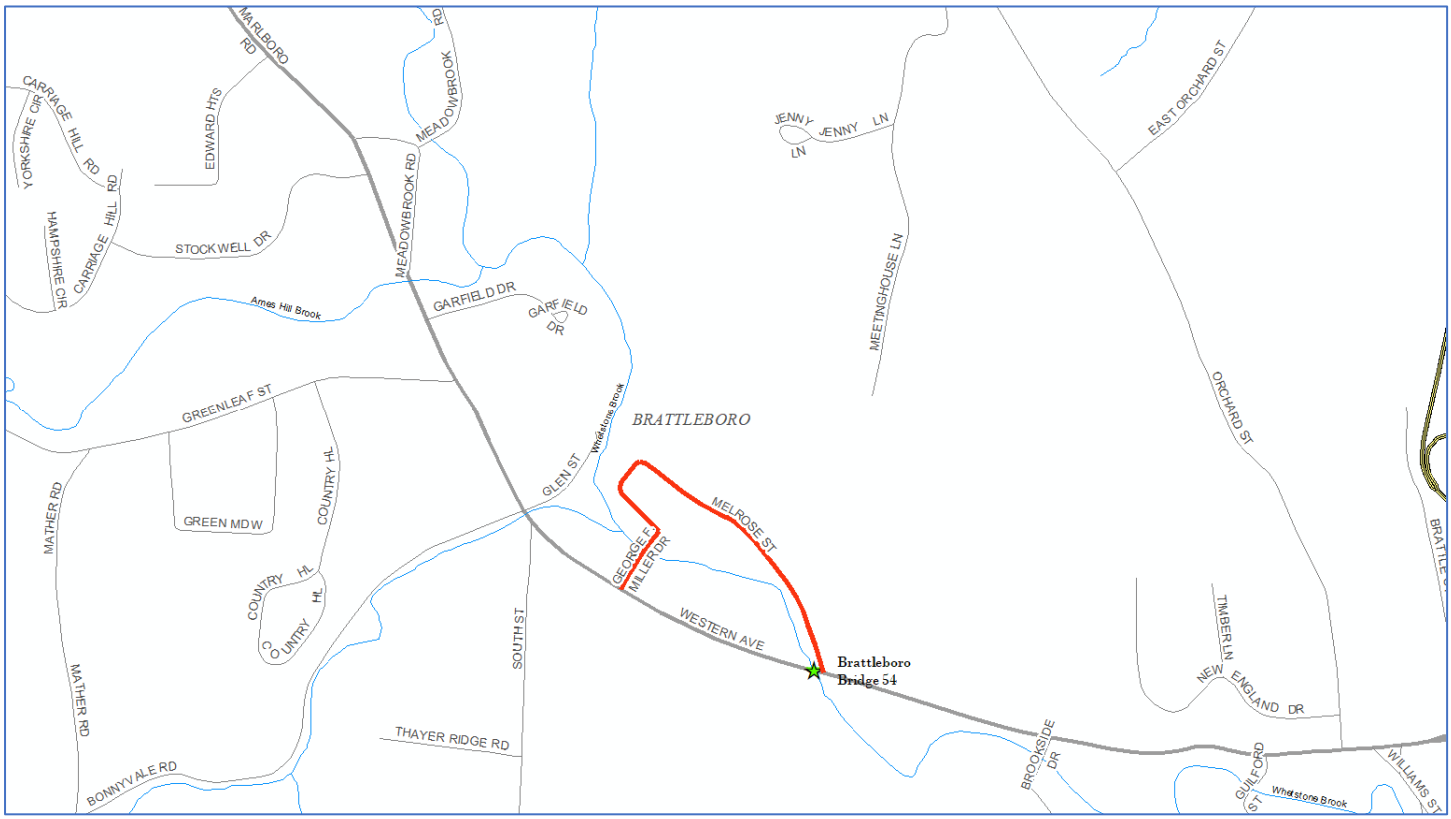
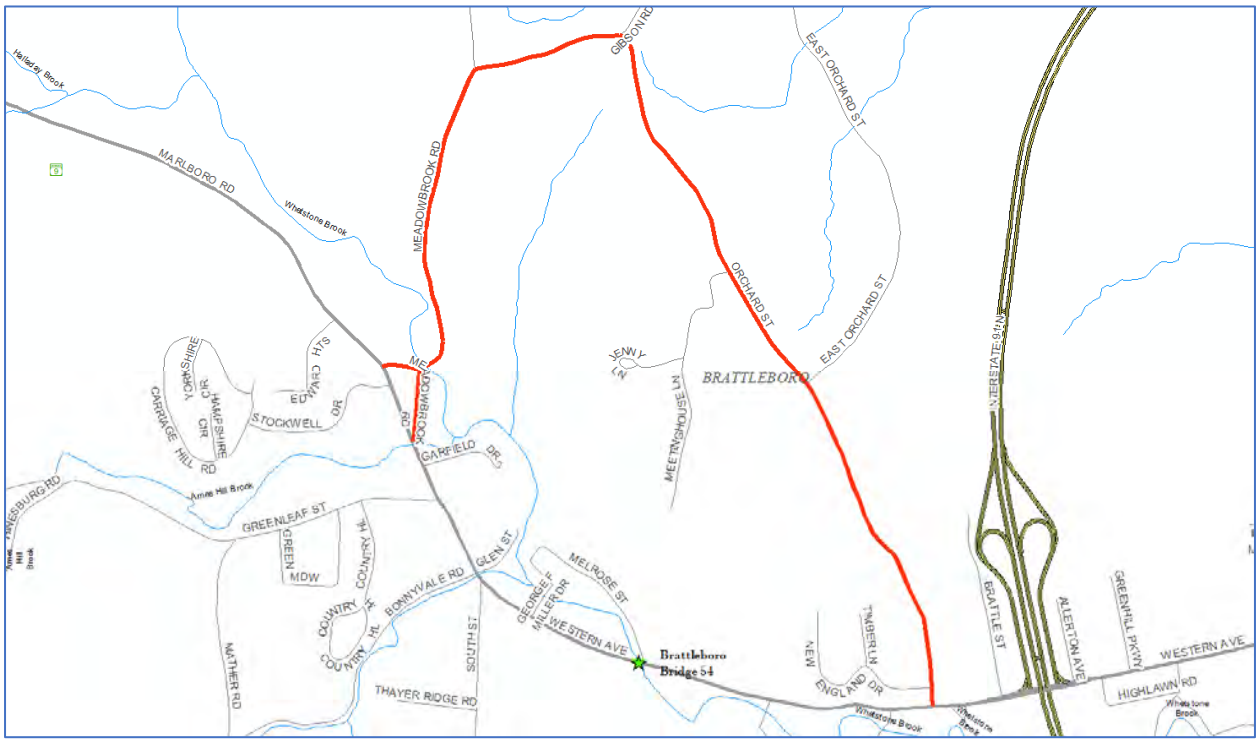
Appendix N: Detour Route

Pedestrian Bypass Route: VT Route 9, to Melrose Street, and George F. Miller Drive, back to VT Route 9 (0.7 mi end-to-end)



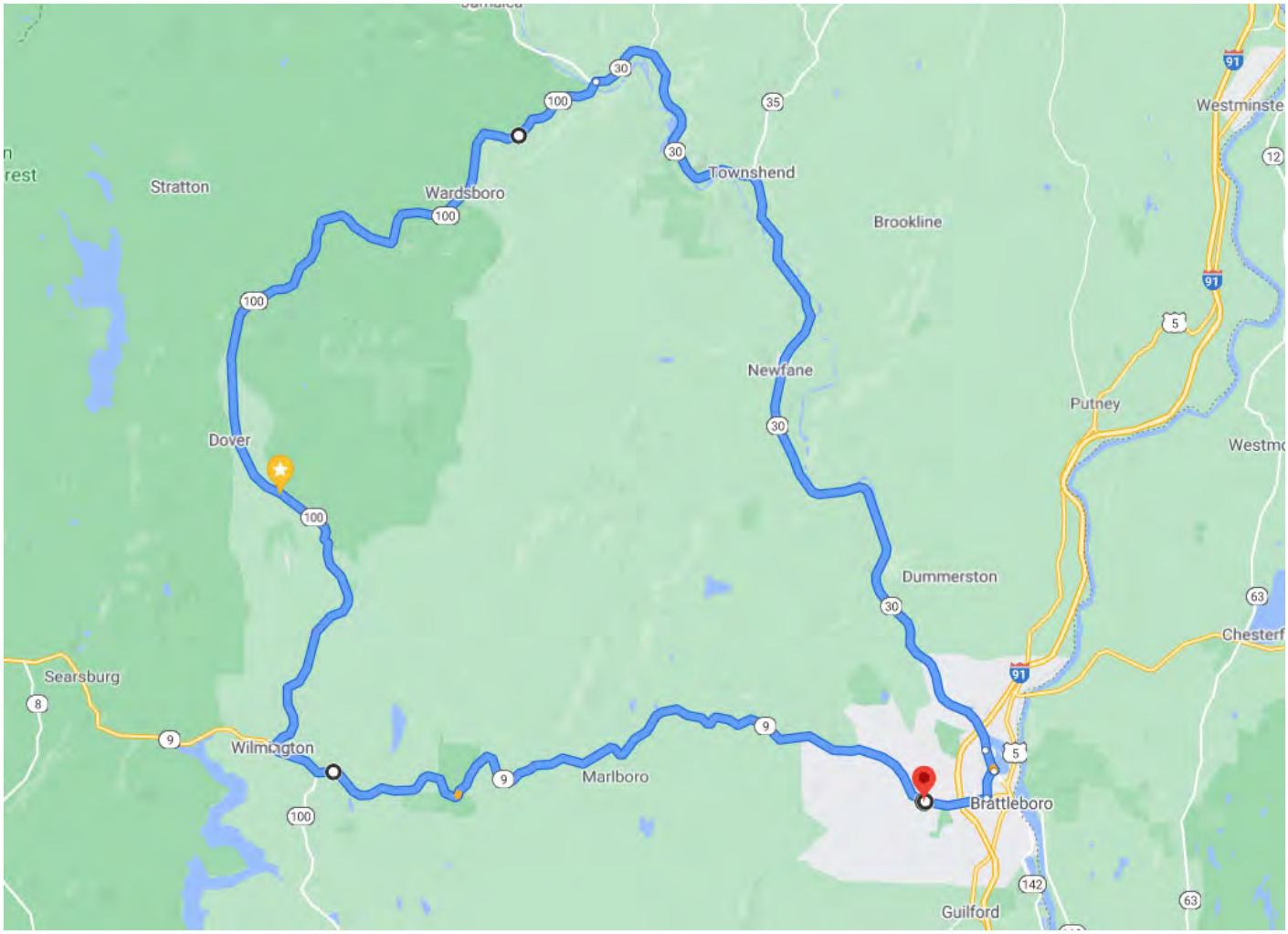
Detour Route: 0.5 miles
Through Route: 0.2 miles
End-to-end Distance: 0.7 miles
Added Distance: 0.3 miles

Passenger Car Route: VT Route 9, to Orchard Street and Meadowbrook Road, back to VT Route 9 (3.7 mi end-to-end)



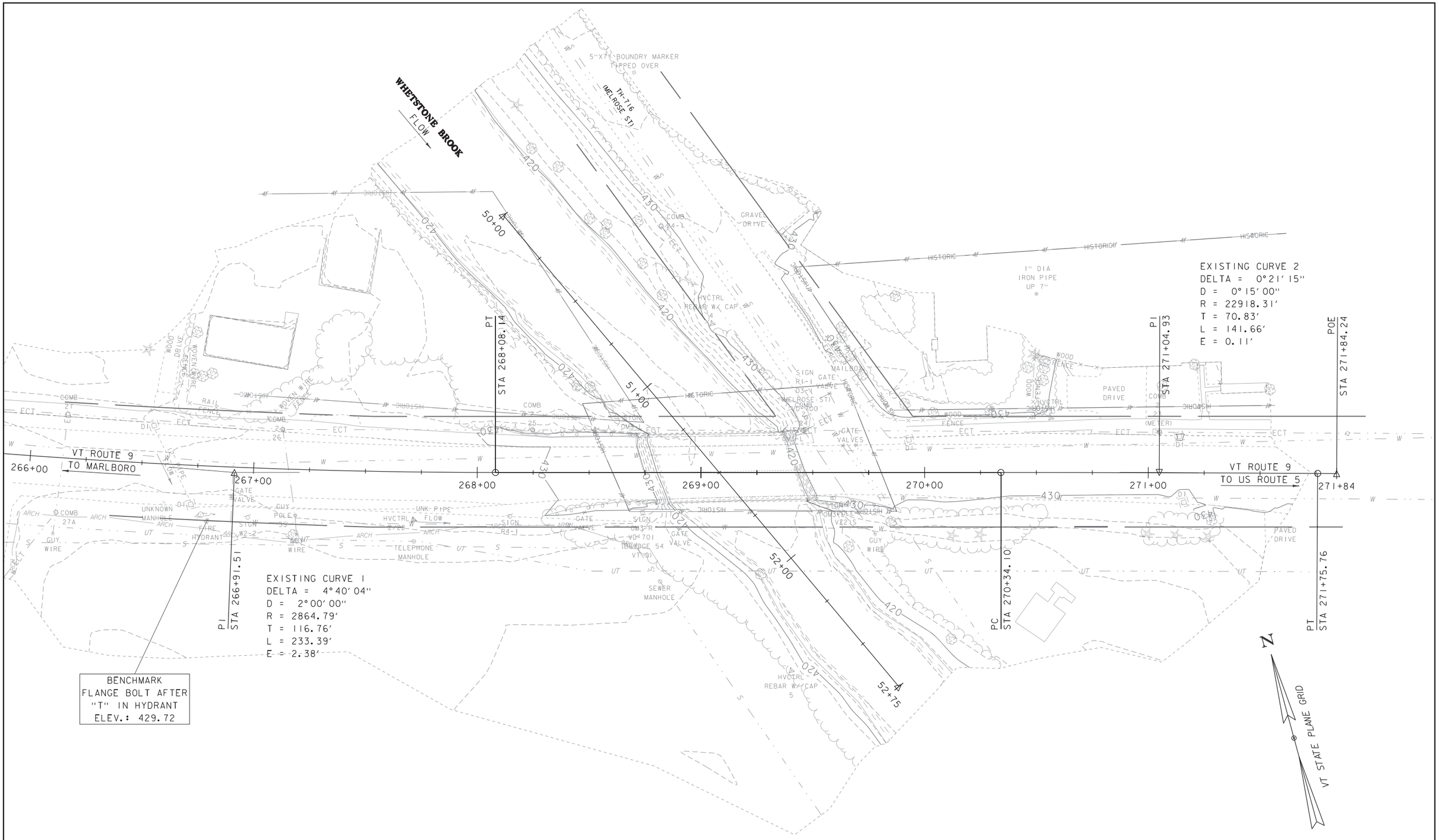
Detour Route: 2.5 miles
Through Route: 1.2 miles
End-to-end Distance: 3.7 miles
Added Distance: 1.3 miles

State Signed Truck Detour Route: VT Route 9, to VT Route 30, and VT Route 100, back to VT Route 9 (64.8 mi end-to-end)



Detour Route: 45.4 miles
Through Route: 19.4 miles
End-to-end Distance: 64.8 miles
Added Distance: 26.0 miles

Appendix O: Plans

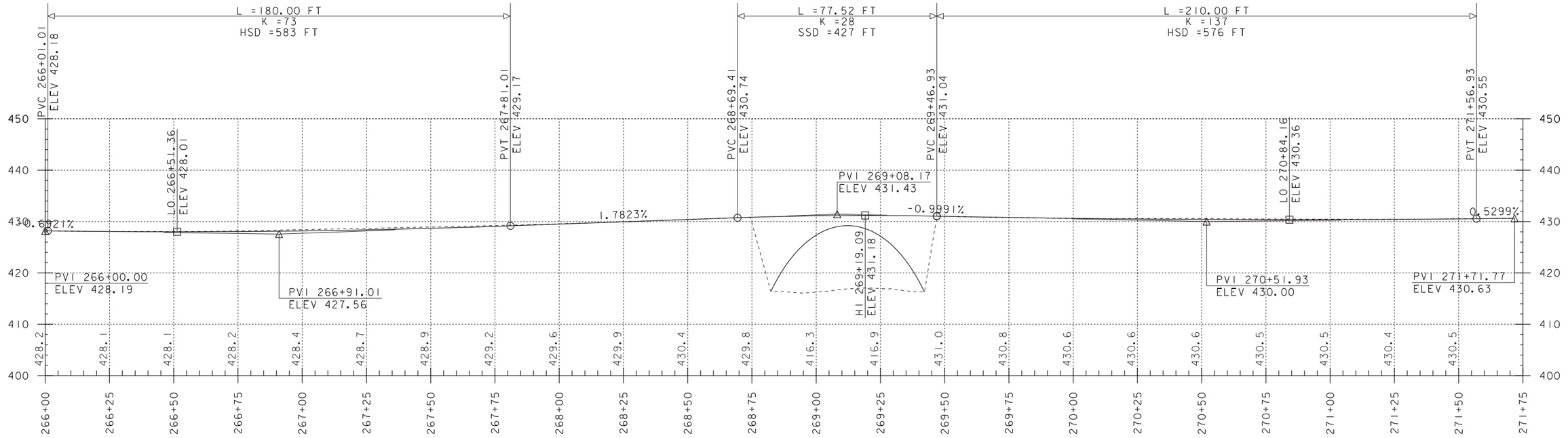


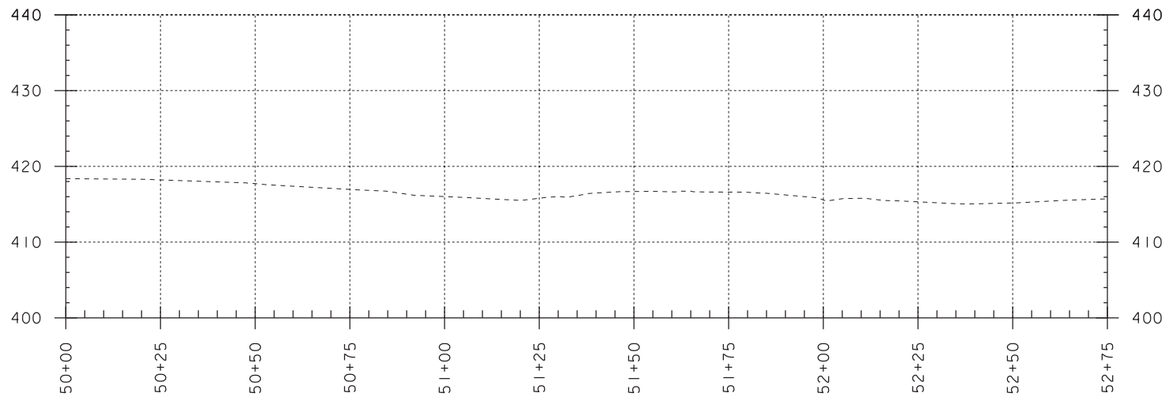
EXISTING BRIDGE INFORMATION
BUILT 1914
SINGLE SPAN CONCRETE ARCH
MAX SPAN: 60'

EXISTING CONDITIONS

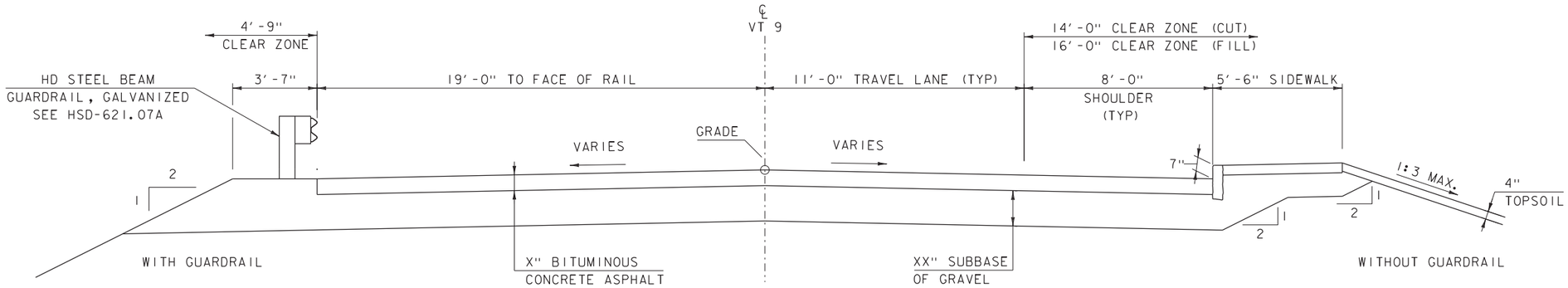
SCALE 1" = 20'-0"
20 0 20

PROJECT NAME:	BRATTLEBORO
PROJECT NUMBER:	BF 2000(28)
FILE NAME: 12j608/sl2j608border.dgn	PLOT DATE: 12-MAY-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
EXISTING CONDITIONS LAYOUT SHEET	SHEET 1 OF 10



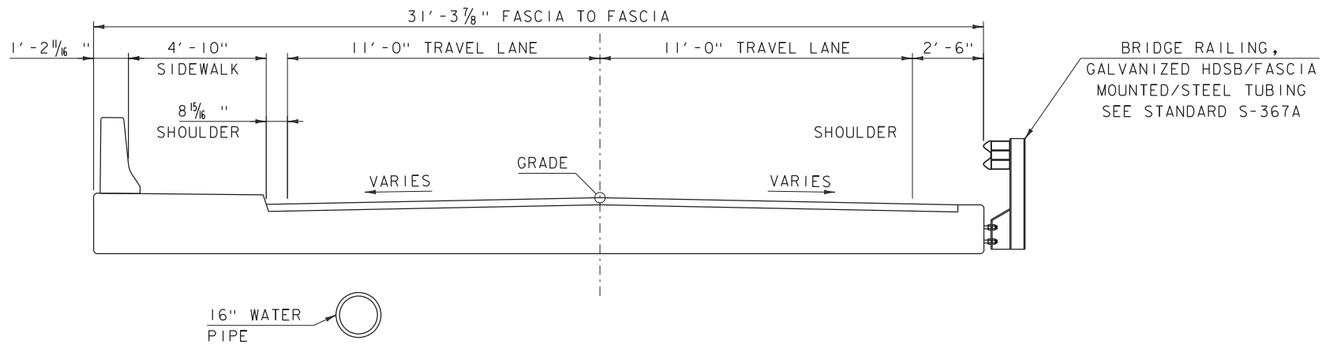


PROJECT NAME:	BRATTLEBORO
PROJECT NUMBER:	BF 2000(28)
FILE NAME: I2j608/sl2j608profile.dgn	PLOT DATE: I2-MAY-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
EXISTING PROFILE SHEET	SHEET 2 OF 10



PROPOSED VT ROUTE 9 TYPICAL SECTION

SCALE 3/8" = 1'-0"



BRIDGE REHABILITATION TYPICAL SECTION

SCALE 3/8" = 1'-0"

MATERIAL TOLERANCES

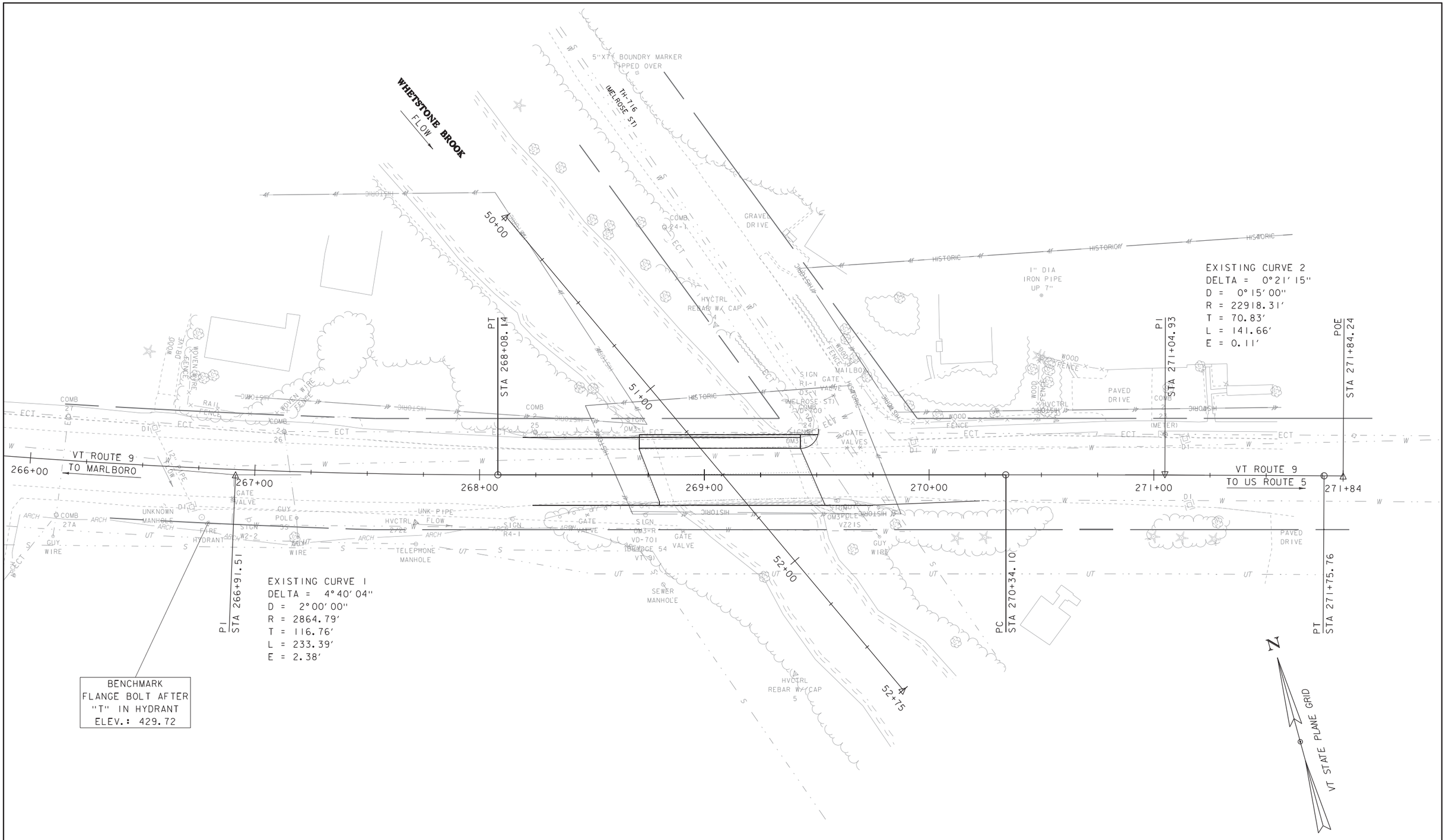
(IF USED ON PROJECT)

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

PROJECT NAME: BRATTLEBORO
PROJECT NUMBER: BF 2000(28)

FILE NAME: 12j608\sl2j608typical.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ----------
BRIDGE REHAB TYPICAL SECTIONS

PLOT DATE: 12-MAY-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------



EXISTING BRIDGE INFORMATION
BUILT 1914
SINGLE SPAN CONCRETE ARCH
MAX SPAN: 60'

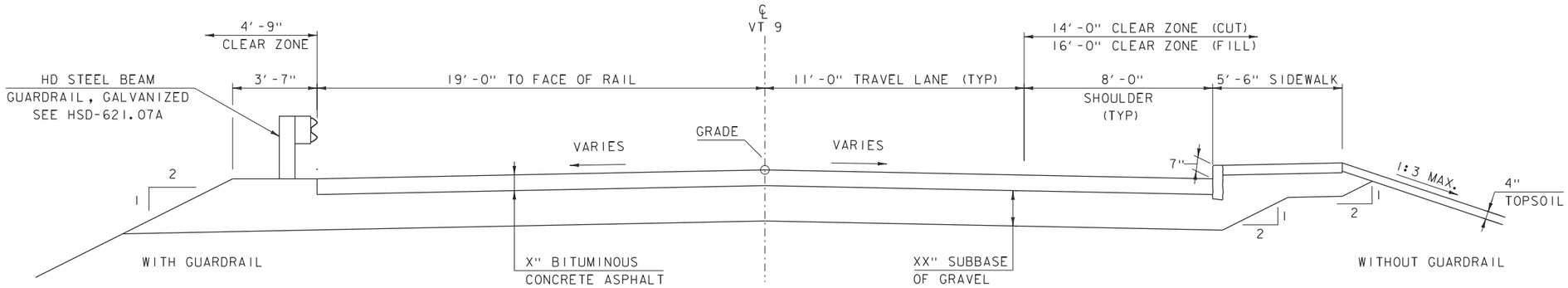
BRIDGE REHABILITATION

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

PROJECT NAME: BRATTLEBORO
PROJECT NUMBER: BF 2000(28)

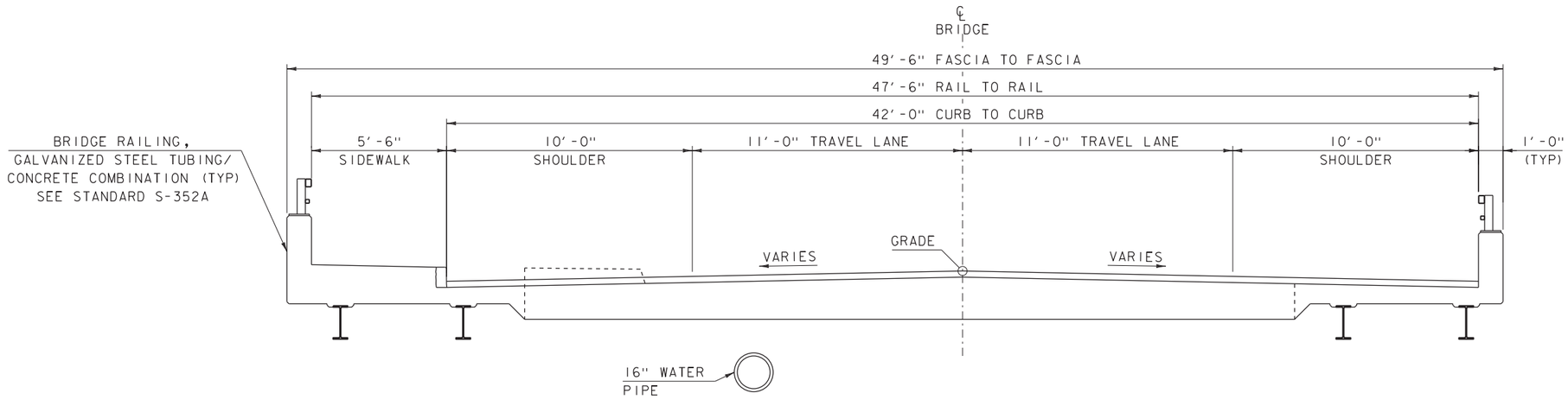
FILE NAME: 12j608/sl2j608border.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
BRIDGE REHABILITATION LAYOUT SHEET

PLOT DATE: 12-MAY-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 4 OF 10



PROPOSED VT ROUTE 9 TYPICAL SECTION

SCALE 3/8" = 1'-0"



PROPOSED BRIDGE EXPANSION TYPICAL SECTION

SCALE 3/8" = 1'-0"

MATERIAL TOLERANCES

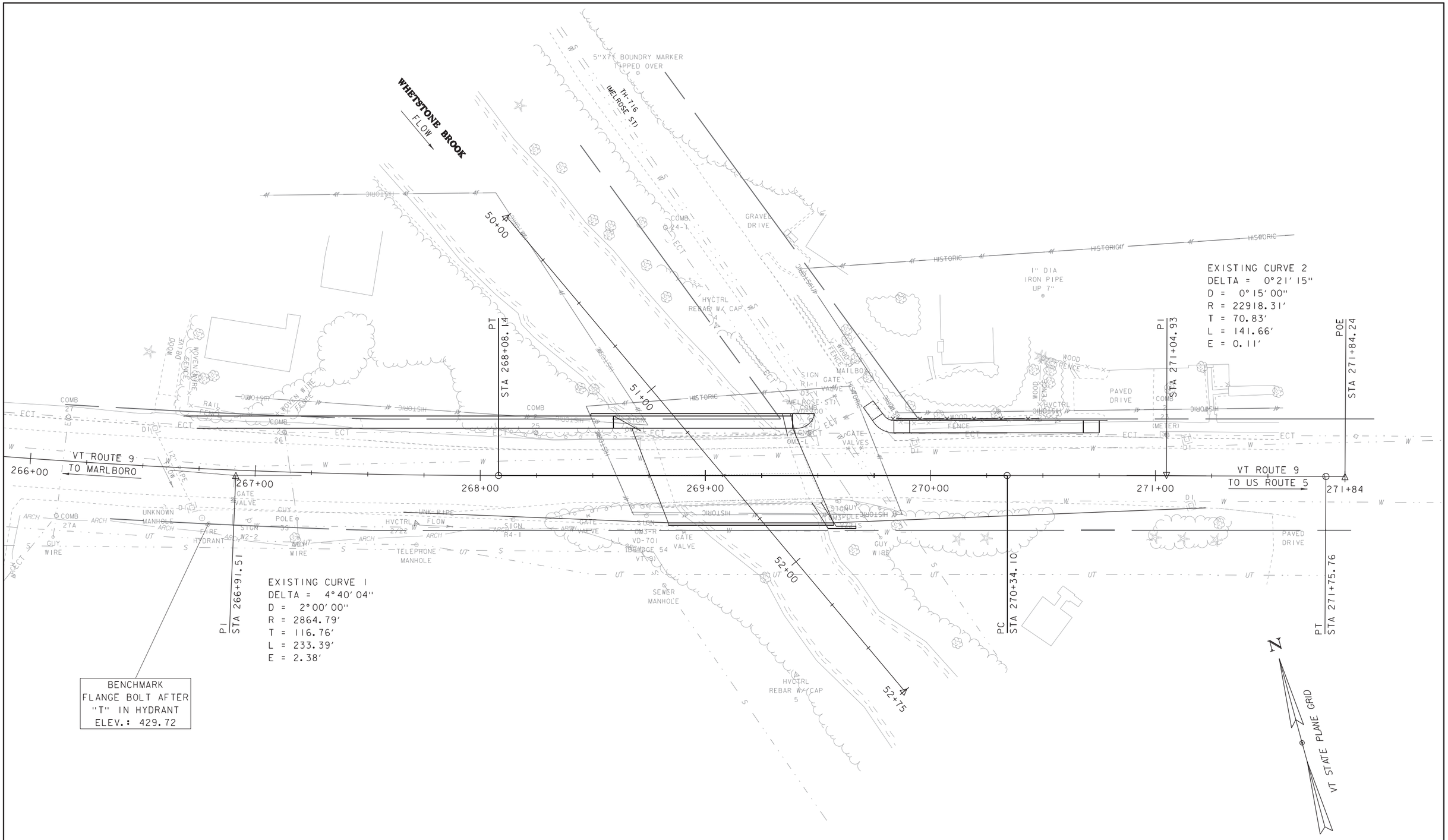
(IF USED ON PROJECT)

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

PROJECT NAME: BRATTLEBORO
PROJECT NUMBER: BF 2000(28)

FILE NAME: 12j608\sl2j608typical.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ----------
BRIDGE EXPANSION TYPICAL SECTIONS

PLOT DATE: 12-MAY-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 5 OF 10



EXISTING BRIDGE INFORMATION
BUILT 1914
SINGLE SPAN CONCRETE ARCH
MAX SPAN: 60'

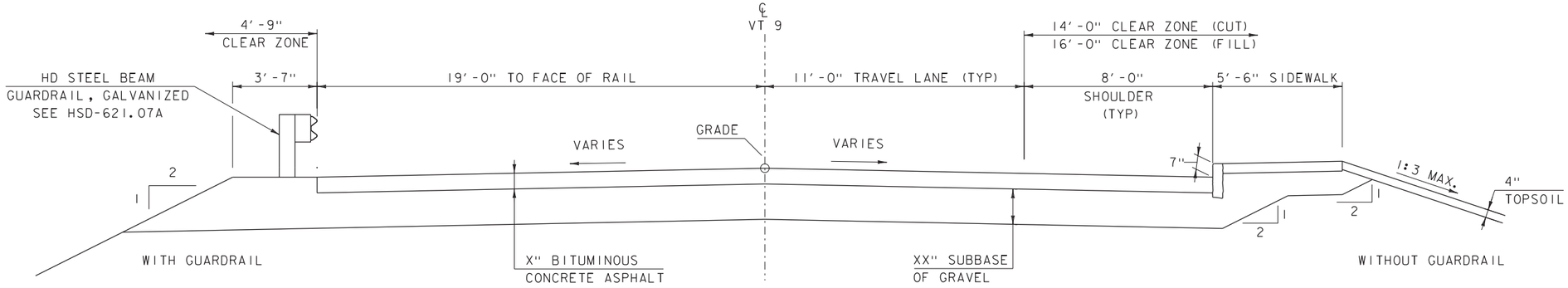
BRIDGE EXPANSION

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

PROJECT NAME: BRATTLEBORO
PROJECT NUMBER: BF 2000(28)

FILE NAME: 12j608/sl2j608border.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ------
BRIDGE EXPANSION LAYOUT SHEET

PLOT DATE: 12-MAY-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 6 OF 10



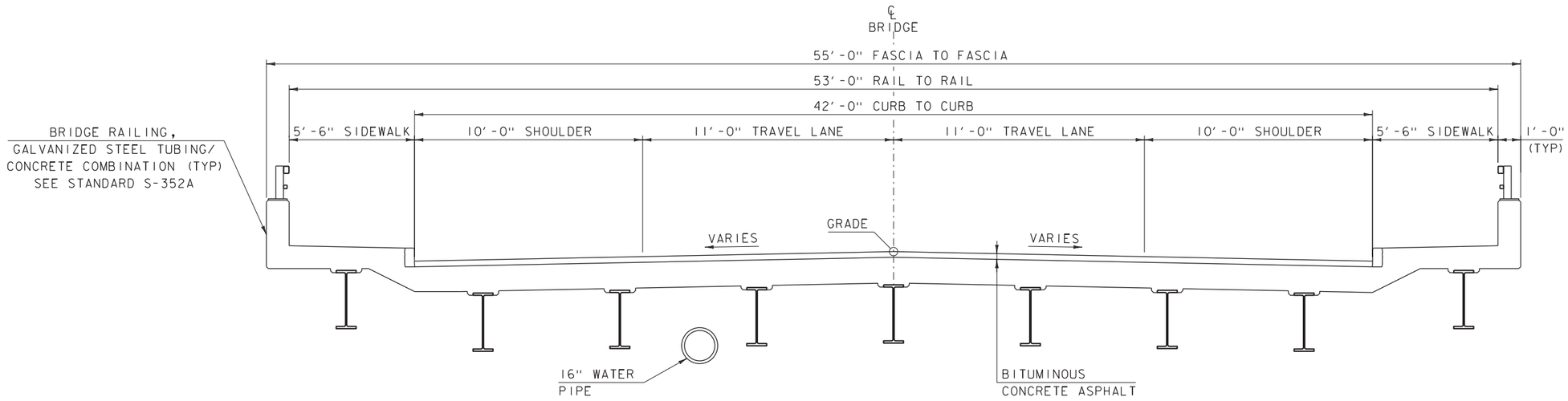
PROPOSED VT ROUTE 9 TYPICAL SECTION

SCALE 3/8" = 1'-0"

MATERIAL TOLERANCES

(IF USED ON PROJECT)

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



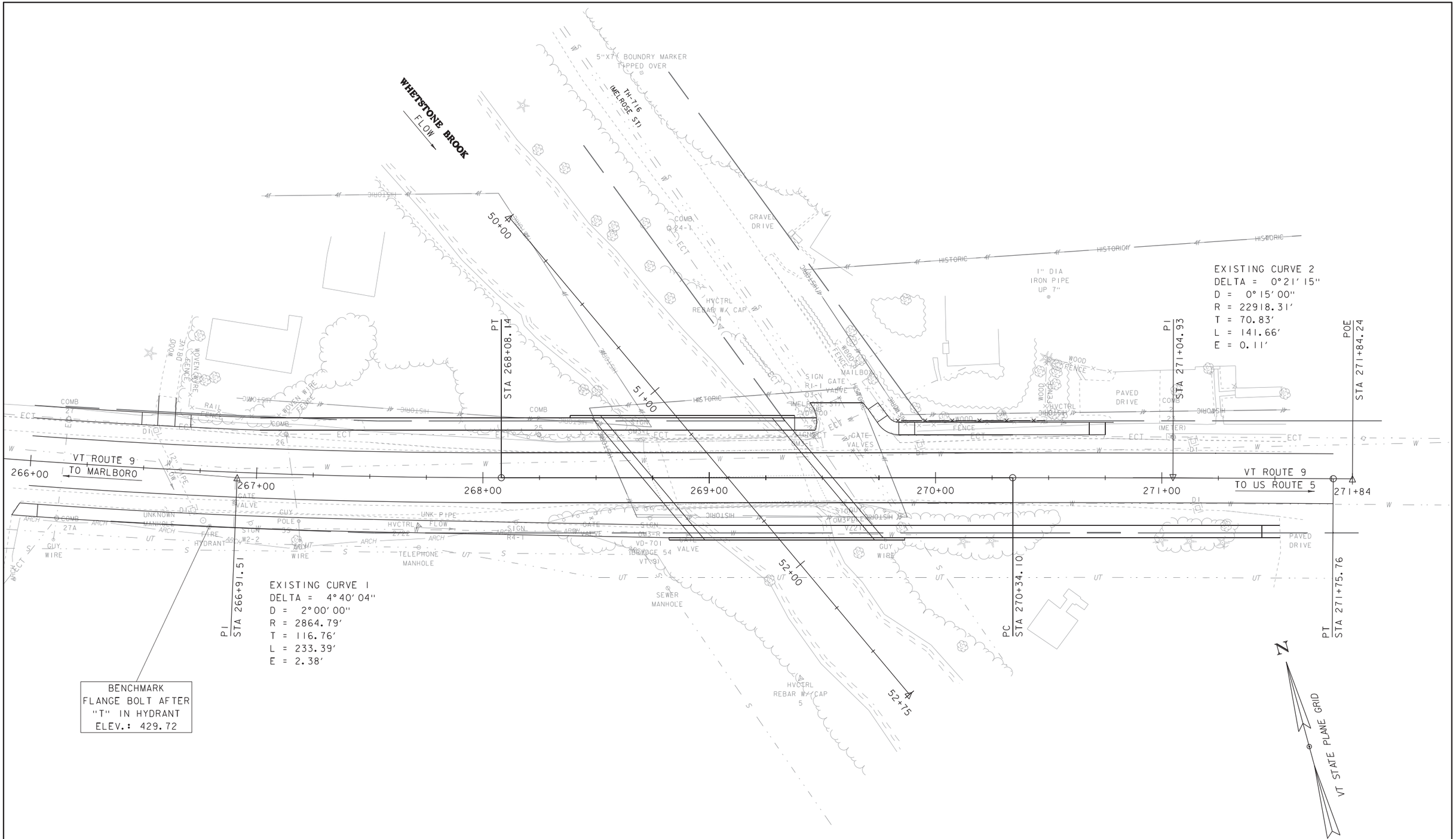
PROPOSED BRIDGE TYPICAL SECTION

SCALE 3/8" = 1'-0"

PROJECT NAME: BRATTLEBORO
PROJECT NUMBER: BF 2000(28)

FILE NAME: 12j608\s12j608typical.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: ----------
BRIDGE REPLACEMENT TYPICAL SECTIONS

PLOT DATE: 12-MAY-2021
DRAWN BY: D.D.BEARD
CHECKED BY: ------

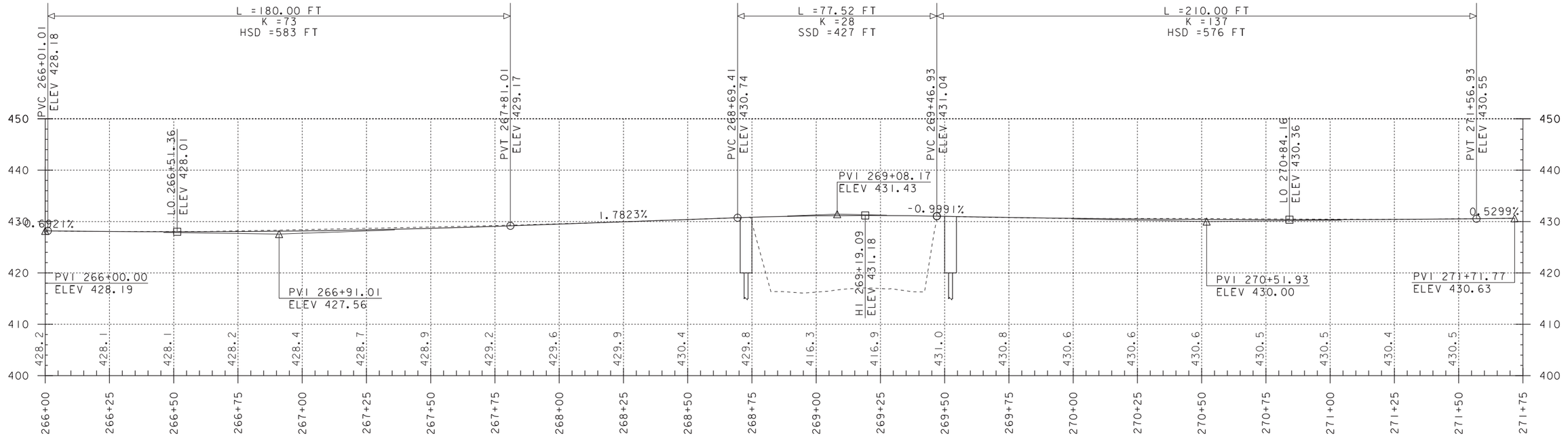


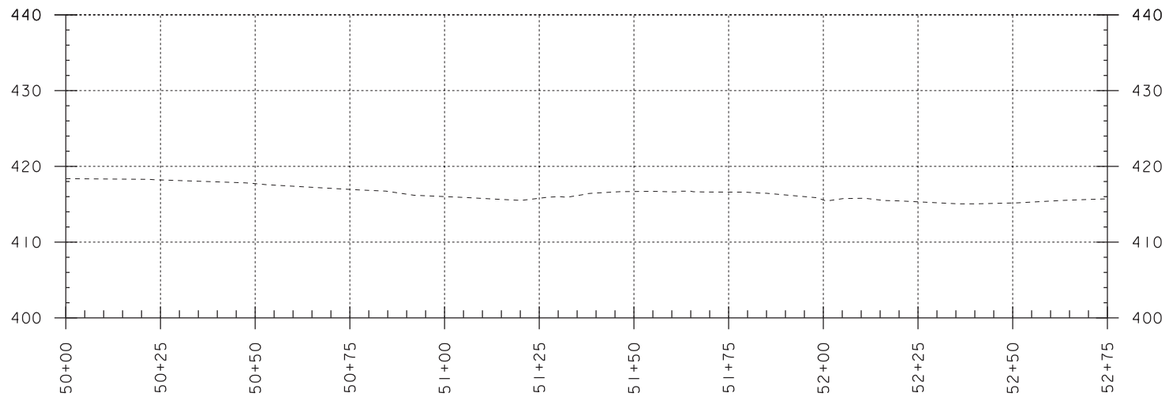
EXISTING BRIDGE INFORMATION
BUILT 1914
SINGLE SPAN CONCRETE ARCH
MAX SPAN: 60'

BRIDGE REPLACEMENT

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

PROJECT NAME:	BRATTLEBORO
PROJECT NUMBER:	BF 2000(28)
FILE NAME: 12j608/sl2j608border.dgn	PLOT DATE: 12-MAY-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
BRIDGE REPLACEMENT LAYOUT SHEET	SHEET 8 OF 10





PROJECT NAME: BRATTLEBORO	
PROJECT NUMBER: BF 2000(28)	
FILE NAME: 12j608/sl2j608profile.dgn	PLOT DATE: 12-MAY-2021
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
NEW BRIDGE PROFILE SHEET	SHEET 9 OF 10

ASSUMED 3-ROD R.O.W.'S
DO NOT HAVE ANY SUPPORTING EVIDENCE (IN-HOUSE)
CANNOT DO FULL RESEARCH LAND RECORDS AT THIS TIME
DUE TO COVID-19 VIRUS

WHETSTONE BROOK
FLOW

TH-716
(MELROSE ST)

5"X7" BOUNDRY MARKER
TIPPED OVER

APPROX. EXISTING TOWN R.O.W.

N/F
STEINER,
CARL W. JR.

N/F
DIAMONDSTONE,
PETER I. & DORIS E.

N/F
BOMMER,
JOHN F.

N/F
DAVIS,
RICHARD R. & ELAINE

N/F
BOMMER,
JOHN F.

APPROX. EXISTING TOWN R.O.W.

APPROX. EXISTING TOWN R.O.W.

50+00

51+00

52+00

52+15

PT
STA 268+08.14

PI
STA 271+04.93

POE
STA 271+84.24

PC
STA 270+34.10

PT
STA 271+75.76

PI
STA 266+91.51

EXISTING CURVE 2
DELTA = 0°21'15"
D = 0°15'00"
R = 22918.31'
T = 70.83'
L = 141.66'
E = 0.11'

EXISTING CURVE 1
DELTA = 4°40'04"
D = 2°00'00"
R = 2864.79'
T = 116.76'
L = 233.39'
E = 2.38'

266+00
267+00
268+00
269+00
270+00
271+00
271+84

VT ROUTE 9
TO MARLBORO

VT ROUTE 9
TO US ROUTE 5

N/F
KRATZ,
JOHN & PAMELA MOORE

N/F
SMITH,
AARON R. & JENNIFER L.

BENCHMARK
FLANGE BOLT AFTER
"T" IN HYDRANT
ELEV.: 429.72

EXISTING BRIDGE INFORMATION
BUILT 1914
SINGLE SPAN CONCRETE ARCH
MAX SPAN: 60'

N

VT STATE PLANE GRID

DOWNSTREAM TEMPORARY BRIDGE

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

PROJECT NAME:	BRATTLEBORO
PROJECT NUMBER:	BF 2000(28)
FILE NAME:	12j608/sl2j608TCborder.dgn
PROJECT LEADER:	L.J.STONE
DESIGNED BY:	------
DOWNSTREAM TEMP BRIDGE LAYOUT SHEET	
PLOT DATE:	12-MAY-2021
DRAWN BY:	D.D.BEARD
CHECKED BY:	------
SHEET	10 OF 10