STATE OF VERMONT
AGENCY OF TRANSPORTATION

Scoping Report

FOR

Weybridge-New Haven BF 032-1(19)
VT ROUTE 17, BRIDGE 8 OVER OTTER CREEK

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I. Site Information

Bridge 8 is a state owned bridge located on VT Route 17 connecting the Towns of Weybridge and New Haven, approximately 4.4 miles west of the intersection of VT Route 17 with US Route 7 in the Town of New Haven. The site is surrounded by archeological sensitive areas on all four quadrants and wetlands on three quadrants. The existing conditions were gathered from a combination of a site visit, the Bridge Inspection Report, the Route Log and the existing survey. See correspondence in the Appendix for more detailed information.

Roadway Classification	Rural Minor Arterial
Bridge Type	3 Span Cast-in-Place Concrete Deck on Rolled Steel Beams
Bridge Span	222 feet
Year Built	1934
Ownership	State of Vermont

Need

Bridge 8 carries VT Route 17 over Otter Creek. The following is a list of the deficiencies of Bridge 8 and VT Route 17 at this location.

1. Bridge 8 is Structurally Deficient and Functionally Obsolete.
2. The existing bridge is too narrow for the roadway classification and cannot accommodate two way truck traffic. The lane and shoulder widths are substandard on the roadway and on the bridge.
3. The horizontal alignment of VT Route 17 is substandard for the current posted regulatory speed limit of 45 mph.
4. The existing concrete deck and reinforced overlay have cracking throughout.
5. The existing rolled beams need to be cleaned and painted and the substructure shows signs of deterioration.
6. The existing bridge railing is substandard.

Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation (VTrans). The traffic volumes are projected for the years 2017 and 2037.

TRAFFIC DATA	2017	2037
ADT	1,100	1,200
DHV	120	140
ADTT	190	290
%T	21.3	30.3
%D	54	54

Design Criteria

The design standards for this bridge project are the Vermont State Standards (VSS), dated October 22, 1997, AASHTO's A Policy on Geometric Design of Highways and Streets, 6th Edition (AASHTO Green Book) and the VTrans Structures Design Manual dated 2010. The minimum standards referenced in the following table are for a Two Lane Rural Minor Arterial roadway based on an ADT of 0-1500 and a design speed of 45 mph.

Design Criteria	Source	Existing Condition	Minimum	Comment
Approach Lane and Shoulder Widths	VSS Table 4.3	10'/2.5' (25')	11'/4' (30')	Substandard
Bridge Lane and Shoulder Widths	VSS Table 4.3	9'/1' (20')	11'/4' (30')	Substandard
Clear Zone Distance	VSS Table 4.4	No issues noted	12' fill 1:4 / 10' cut 1:3, 10' cut 1:4	
Banking	VSS Section 4.13	e = 8%	8% (max)	
Speed	VSS Section 4.3	45 mph (Posted)	45 mph (Design)	
Horizontal Alignment	AASHTO Green Book Table 3-10b	R=477', Bridge located approximately 40 ft. beyond PT	R=587' at 8% bank for 45 mph	Substandard
Vertical Grade	VSS Table 4.5	Bridge located on a 1.283% grade	6% (max) for Rolling terrain	
K Values for Vertical Curves	VSS Table 4.1	Profile is on a tangent over the Bridge, Sag East of Bridge with K=65	80 - 120 Crest 70 - 90 Sag	Substandard, sag meets 40 mph design speed
Vertical Clearance Issues	NA	NA	NA	Over River
Stopping Sight Distance	VSS Table 4.1	Limited at intersection with Hallock Road[1]	325' – 400'	Substandard
Bicycle/Pedestrian Criteria	VSS Table 4.7	None[2]	3' Shoulder[3]	Substandard
Bridge Railing	Design Manual Sect. 13 & VTrans Bridge Rail Policy	Safety curb and concrete posts with w-beam rails	TL-4[4]	Substandard
Hydraulics	VSS Sect. 4.8	Passes Q_{50} storm event with 4.3' avg. freeboard and 2.9' min.	Pass Q_{50} storm event with 1.0' minimum of freeboard	
Structural Capacity	Structures Design Manual, Ch. 3.4.1	Functionally Deficient, H15 Design Load LFD	Design Live Load: HL-93	Substandard

[1] There are sight line issues at the intersection of VT Route 17 and Hallock Road, just east of the bridge. The sight lines and stopping sight distances at the bridge are adequate.
[2] None because the existing 9' lane width is not adequate making the existing 1' shoulder unsafe for shared use.
[3] Three feet includes an additional foot required for shoulders on bridges or where the percentage of trucks is greater than 10%. This is exceeded by the four feet required by Table 4.3.
[4] VT Route 17 is not part of the National Highway System but does not clearly fit into the railing recommendations under the VTrans Bridge Railing Policy for "Any New Non-NHS Structure". Based on the posted speed and forecasted truck percentage a TL-4 is recommended above.

Inspection Report Summary

The ratings provided below are from the most recent inspection performed on May 21, 2015.

Deck Rating	5 Fair
Superstructure Rating	5 Fair
Substructure Rating	5 Fair
Channel Rating	7 Good

From the Structure Inspection, Inventory, and Appraisal Sheet:

"05/21/2015 Bridge is in need of extensive reconstruction or replacement with all components rated as fair. Deck overlay was intended as only a repair and has served its purpose for approximately 15 plus years and the deck rating would be rated lower if not for the added reinforced thickness – MJ/MS

05/07/2013 Bridge is in fair condition and should be upgraded in the next few years. – MJ/DK

04/02/2011 Broken northeastern end bridge rail post needs replacement. Rigid deck overlay installed to augment poor original deck is functioning as intended; although will not indefinitely. Superstructure and substructure are still quite sound but deterioration is certainly progressing. Bridge should be considered for replacement within the next 10 years. – MJ/DK

05/26/2009 This structure is in poor to good condition. The concrete overlay helps out but, the overlay has many cracks through out. The ordinal deck is in poor condition. The beams need cleaning and painting. DCP"

Hydraulics

From Preliminary Hydraulics Report (PHR):

"Our calculations indicate the existing structure meets the current hydraulic standards. The Q_{50} WS elevation is 147.3' and the average bottom of superstructure elevation is about 151.6'. So the bridge has about 4.3' of freeboard above the average bottom of superstructure at Q_{50} and meets the standards. Low bottom of beam is about 150.2', so the bridge has about 2.9' of freeboard above the low beam end at Q_{50}. Water overtops the channel banks and flows into the floodplain (adjacent fields) between a Q2.33 and a Q_{10}. However, there is no roadway overtopping below the Q_{100} discharge."

Hydraulic standards require a minimum of 1 foot of freeboard for the Q_{50} discharge for Minor Arterials.

The existing skew is approximately 0 degrees. The existing bankfull width (BFW) varies from 200' to 230' at this location, which is less than recommended for the Otter Creek watershed area at this bridge location according to ANR's Vermont Hydraulic Geometry

Relationships. However, the hydraulics report notes that the current bankfull width at the bridge should not be an issue as there is a large amount of floodplain storage upstream of the structure.

It was assumed in the PHR that any new bridge would be constructed on the current alignment and grade. The report provides the minimum low beam elevation, 148.50', which would meet the hydraulic standards and maintain the Q_{100} water surface elevation. There is a regulatory floodway for the Otter Creek at this location; therefore, floodplain encroachments should be avoided. Any replacement structure proposed off alignment would need to be revaluated for hydraulic impacts.

The toe to toe distance and abutment clear span should not be reduced from the current dimensions and no fill is to be added between the abutments. The existing waterway area must be maintained at a minimum. The PHR recommends expanding the existing channel to match the upstream and downstream embankments if possible.

Utilities

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

Municipal Utilities
There are no municipal water or sewer mains in the vicinity of the bridge.

Public Utilities (Aerial)
There are overhead utility lines consisting of telephone and 7,200 volt three-phase electrical lines running parallel to the structure on the downstream (north) side.

Public Utilities (Underground)
There is no indication of existing underground utilities in the area of the structure.

Based on the utilities' proximity to the existing structure and OSHAs minimum work zone clearance of 25' from high voltage lines, these overhead lines would need to be temporarily relocated during construction regardless of the alternative chosen. The aerial lines that would require relocation are within the state ROW. None of the alternatives being considered in the cost matrix would require permanent relocation of the aerial utility lines.

Right-Of-Way

The existing Right-of-Way (ROW) is shown on the Existing Conditions Layout sheet. The ROW width varies and extends approximately 200' north to the old bridge over Otter Creek which is now used as a snow mobile crossing. The ROW on the upstream side varies between 35' to 55' from the fascia of the existing structure. In the northwest quadrant there is a parcel of land owned by the Agency of Natural Resources (ANR). ROW acquisition of this area will not be an issue and the land will be treated as state ROW for the purposes of this scoping study. The existing bridge is located well within the ROW and it is anticipated that the alternatives that maintain the existing alignment will only require temporary rights for

construction. There are proposed alternatives which would require permanent acquisition of ROW. These limits and the cost associated with ROW acquisition have been considered for all the discussed alternatives.

Resources

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

Biological:

Wetlands/Watercourses

There are mapped Class II wetlands in three quadrants of the project area, the northwest quadrant does not contain wetlands. The southwest quadrant is a semi-wooded floodplain wetland community comprised of Ash, Silver Maple, Elm, Ostrich Fern, Honey Suckle and Water Grape. The wetlands on the southeast and northeast quadrant of the structure is mixed wooded and agricultural use composed of Ash, Reed Canary grass, cattails, and sedges.

Otter Creek is a direct tributary of Lake Champlain and the only watercourse present in the project area.

Wildlife Habitat

There is a good wildlife habitat within the project area that includes a variety of aquatic species such as fish, small and large mammals, and migratory birds. Construction within the waterway will likely need to be restricted to periods of low flow to comply with anticipated permitting requirements from ANR and ACOE.

Rare, Threatened and Endangered Species

There are federal and state mapped threatened and endangered animals within the project area. There is a state threatened species of freshwater mussel (Giant Floater), as well as the state and federal endangered Indiana Bat and Long Eared Bat. Any work within the waterway would likely trigger a survey for the threatened freshwater mussels. Similarly, any tree clearing would trigger a survey for the presence of the Indiana Bat and Long Eared Bat. The report notes that the trees in the area are not the Indiana Bats' preferred habitat.

Agricultural

There are Prime Agricultural soils mapped within the entire project area.

Floodplains

There is an established floodway for the Otter Creek. Any fills within the 100-year floodplain will likely required that compensatory flood storage be provided in accordance with the recently adopted Vermont Flood Hazard Area and River Corridor Rule.

Archeological:

All four quadrants of the project area are considered to be highly sensitive precontact archeology based on environmental factors, known site location, and lack of previous disturbance in the APE. These areas can be seen in Appendix G and any work within the four quadrants would require a Phase 1 survey.

Historic:

This bridge is not historic, and there are no adjacent historic structures within the project area.

Hazardous Materials:

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

Stormwater:

There are no stormwater concerns or existing stormwater permits for this project based on the Natural Resource ID and Preliminary Hydraulic Report. The improvements proposed for the various alternatives are not anticipated to require an operational stormwater permit except for Alternative 4 which proposes more than 5,000 square feet of new or expanded impervious areas which will need to have a net zero increase in Phosphorous from the project to comply with the newly issued TMDL.

II. Safety

VT Route 17 is not a high crash location in the area of the project. The crash history data from 2008-2012 is contained in Appendix J. Currently, the bridge width does not meet VSS standards for the roadway classification and the horizontal curve on the east approach roadway is substandard for the posted speed limit. Since there is not an excessive number of crashes, the bridge width and horizontal curve do not need to be corrected for safety reasons alone, but the alternatives will investigate improving both issues.

The community has also expressed interest in improving the intersection with Hallock Road, east of the bridge, due to the limited sight lines. This will be taken into consideration as the different alternatives are explored below.

III. Alternatives Discussion

Bridge 8 is Structurally Deficient and Functionally Obsolete with substandard travel lane widths, shoulder widths, and bridge railing. The deck, superstructure, and substructure are rated 5, fair condition. The existing channel is rated 7, good, and the bridge meets the current hydraulic standard. The alternatives presented here are based on improvement of the condition of the bridge.

No Action

This alternative leaves the bridge in its current condition. This option is only viable if the existing bridge can stay in place without needing any significant work over the next 10 years. Based on the fair rating of the deck, superstructure and substructure this bridge will require repairs within the next 10 years. The recommendations provided in the January 8, 2016 inspection report support this conclusion.

The narrowness of the roadway is a community safety concern, as it cannot accommodate two way truck traffic and deters pedestrians/cyclists from using the bridge. These issues would remain unaddressed under the "no action" alternative. From the standpoint of safety, economics, and convenience, this alternative is not recommended and will not be considered further.

Rehabilitation

All three elements of the structure are rated fair, but the inspection report recommendations focused on the replacement of the deck. The existing concrete overlay was intended as a temporary repair but has been in service for over 15 years. The first rehabilitation alternative considered would be to replace the existing deck. Patching is not being considered due to the existing substandard roadway width and the nature of the defects in the deck. All rehabilitation alternatives will include widening of the existing roadway to accommodate the proposed bridge widening.

Alternative 1: Deck Replacement

The deck replacement alternative includes: deck replacement, bridge and approach rail replacement and substructure crack and surface defect repair. Cleaning and painting of the existing superstructure is not considered in this report as it would in all likelihood be completed under a separate maintenance contract and would not be completed as part of any deck replacement. The existing curb to curb width of the bridge deck is 20', which is 10' narrower than the recommended 4'-11'-11'-4' minimum Vermont State Standard for a Two Lane Rural Minor Arterial roadway. By placing a new deck on the existing superstructure, the standard lane and shoulder width can be improved slightly, but not to standard minimum widths. The existing overhang is approximately 1.7'. By increasing the overhang on both sides to 3.0', a typical section of 1.5'-10'-10'-1.5' can be provided. A bare deck or light weight concrete should be used for the proposed deck to minimize impacts on the existing superstructure and substructure. New bridge and approach railing would be installed.

Placing a new deck on the existing superstructure may cause issues in the next 10 years, as the superstructure may require significant repairs. The superstructure is rated a 5, fair, and even if it were cleaned and painted, it would not have an estimated service life beyond 15 years. The bridge was built in 1934 but was re-painted in 1989 so it is unlikely that lead paint abatement procedures will be required. The slightly widened bridge would still be substandard by 7', which does not fully address the safety concerns for two way truck traffic or pedestrian/cyclist

use of the bridge. Traffic could be maintained by a detour route or a temporary bridge. Construction phasing is not an option for this alternative due to the limited bridge width.

There is limited roadway approach work required to match to the new bridge width; however this is not anticipated to result in impacts significantly beyond the existing toe of slopes for the roadway embankments. ROW acquisition is not anticipated for this alternative. Use of a temporary bridge during construction could have archeological and natural resource impacts, require temporary easements, and impacts on the schedule and cost.

Alternative 2: Superstructure Replacement

The superstructure replacement alternative includes: deck replacement, superstructure replacement, bridge and approach rail replacement, substructure crack and surface defect repair, and any modifications to the existing bridge seat, such as changes to the existing bearing pedestals, needed to accommodate the new superstructure. A new superstructure offers a longer service life and is more likely to accommodate a wider roadway.

It is assumed that this alternative would have the same typical section as the deck replacement, 1.5'-10'-10'-1.5', since the substructure and alignment are being maintained. A slightly wider typical section may be possible, however, it can only be determined after more detailed structural analysis. Traffic could be maintained by detour route or a temporary bridge. Phasing is not an option for this alternative due to the limited bridge width.

Replacing the superstructure would provide a longer service life than the deck replacement, but the substructure is currently in fair condition and will most likely require significant repairs in the next 15 years. Acquisition of additional ROW is not anticipated for this alternative. Use of a temporary bridge during construction could have archeological and natural resource impacts on the schedule and cost.

Alternative 3: Substructure Widening

The substructure widening alternative includes: deck replacement, superstructure replacement, widening the existing substructure and railing replacement. For this alternative, the two abutments and two piers would be widened either symmetrical or only to one side to accommodate a wider bridge section.

<u>Symmetric Widening</u>
Widening the bridge equally on both sides would maintain the existing alignment and only require full height extension of the abutments. The existing pier walls could be modified into hammerhead piers, minimizing the scope of substructure work below water level. Symmetric widening is only feasible if an off-site detour or temporary bridge is used because phasing the work on the existing alignment would yield a significantly wider proposed bridge than is required by Vermont Sate Standards. In addition, extending the existing substructure to accommodate a wider than necessary bridge section is complex and costly. The existing substructure is rated in fair condition and the anticipated remaining service life would not justify the time and budget associated with this option, especially when compared against the

service life of a full replacement. Symmetrically widening the substructure will not be considered further in this study.

Widening to One Side

Widening the existing substructure on only one side would allow for phased construction. The final bridge section would only be slightly wider than the minimum width required by Vermont State Standards for a Two Lane Rural Minor Arterial. For this alternative both abutments and both pier walls would need to be extended for the full height. The alignment would be shifted several feet in the direction of the widening, which could allow the substandard horizontal curve on the approach roadway east of the structure to be improved. The radius of the curves to either side of the structure could be increased to meet the posted speed limit of 45 mph. The cost and benefits of this are discussed further under Section c. Horizontal Alignment of Alternative 4. However, shifting the approach roadway in either direction would require additional fill slopes and the permanent roadway embankment would impact the abutting wetlands, floodplain and archeologically sensitive areas. This alternative would also require additional temporary rights during construction for fill slope limits.

Alternative 4: New Structure

For a new structure, an integral abutment bridge was not considered based on the site conditions and the preliminary geotechnical report. The existing substructure abutments and piers are founded on bedrock and the preliminary geotechnical report recommends using the same substructure type for any new design. As discussed in more detail below, a new structure could be constructed on-alignment in place of the existing structure or on a new alignment. Improvements to the existing waterway were also considered. Variables for the new structure include:

a. Roadway Width

The current curb to curb width is 20', which is 10' less than the state required minimum for a Two Lane Rural Minor Arterial roadway. The local community has safety concerns regarding the narrow roadway width, as it does not allow for two way simultaneous truck traffic, and deters pedestrians and cyclists from using the roadway. Since a new bridge with an 80+ year life is being proposed, consideration was given to meeting all bridge geometry standards.

The minimum lane and shoulder widths for the proposed bridge to meet the state standards would be a 4'-11'-11'-4' configuration. This section would not allow for phased construction if the new structure is constructed on the same alignment as the existing bridge, as there is inadequate width to accommodate the work zone shifts. The smallest lane and shoulder configuration that would allow for on alignment phased construction would be 6'-12'-12'-6'. For either configuration, the eastbound and westbound approach roadways would be widened to match the proposed bridge section. If the new structure is constructed on a new alignment, then a 4'-11'-11'-4' configuration would be feasible and the existing bridge would be used for traffic during construction. A new alignment would require modifications to the existing approach roadways and would allow improvements to be made to the substandard horizontal and vertical alignment.

b. Span and Skew

The existing structure consists of the three 70' spans with two abutments and two pier walls. The Preliminary Hydraulics Study indicated that providing a three span structure, similar to the existing structure would be acceptable but is not preferred. Other span options such as a two span or single span structure are acceptable as long as the existing waterway area is not reduced under any of the alternatives considered. No fill from the abutments should extend beyond the current embankments and preferably the channel opening should be widened to better match the upstream and downstream channel widths.

Removing one or two piers from the proposed structure would improve the waterway. A new structure with two equal 120' spans and a single pier at the center of the waterway would improve the channel and allow for all of the deck geometry criteria to be met. The depth of superstructure required for a single span bridge would not be economical compared against the two span structure and will not be explored further.

The skew would remain at 0 degrees for the new structure constructed along the existing alignment. A new structure on a proposed alignment would have a slight skew of approximately 7 degrees.

c. Horizontal Alignment

The existing roadway at the west approach is on a tangent. However, there is a horizontal curve located 200' west of the bridge with a radius of 5,730'. The superelevation of the roadway cross section west of the bridge is normal and the normal banked 5,730' radius curve only meets a 40 mph design speed. The bridge is on a tangent, with a normal crown. The existing roadway on the east approach is a horizontal curve with a radius of 477'. The curve is superelevated (banked) at 8% and only meets a 40 mph design speed as well. A posted regulatory speed limit of 45 mph is in place and begins just west of the bridge and extends east across the bridge. The horizontal curve on the east approach contributes to the poor sight lines at the intersection of VT Route 17 and Hallock Road.

<u>On-Alignment</u>
The new structure could be built in the same location with the existing alignment maintained throughout. This would minimize work and impacts to resource areas adjacent to the roadway. The existing approach curves only meet a design speed of 40 mph; however, the Vermont State Standards allows for design speeds to be reduced by as much as 10 mph below the posted regulatory speed limit (if appropriately signed) in cases where limiting impacts to surrounding resource area is desired.

A second option would place the new structure on the current horizontal alignment with minor adjustments to the approaches to achieve a design speed of 45 mph. Flattening the east approach curve to a radius of 590' and maintaining the 8% bank would meet a 45 mph design speed. This would also have the added benefit of improving sightlines to the intersection with Hallock Road. The west approach curve could be flattened to a radius of 6,710' allowing it to also meet a 45 mph design speed, while still maintaining a normal crown.

The increase from a radius of 5,730' to 6,710' on the west approach would require minimal work to the existing roadway. The increase in curve radius on the east approach would result in minor impacts to Class II wetlands, archeologically sensitive areas, and the flood storage area adjacent to the roadway that could be mitigated with steep (1.5H:1V) embankment slopes.

Regardless of whether the curve to the east is flattened, maintaining the existing bridge alignment will require the super-elevation to extend onto the proposed structure. The current transition between the 8% super and the normal cross section on the bridge does not meet AASHTO standards for transition lengths, for either 40 mph or 45 mph.

Any on-alignment option for a new structure would require construction of a temporary bridge and approaches or utilization of a detour.

Off-Alignment

Another alternative would be constructing a new structure on a new alignment either north or south of the existing structure while using the existing bridge to maintain traffic. A new structure off-alignment would allow the super-elevation transitions to remain off of the proposed bridge and longer spans could be used to allow widening of the channel to match the upstream and downstream embankments. Both new alignments, to the north or to the south, would have significant permanent impacts to the surrounding farmland, wetlands, floodplain and archeologically sensitive resource areas. The bridge costs, construction costs and MOT costs for a new alignment to the north or to the south would be similar, as the only differences between the two alignments would be utility relocation, approach work and ROW acquisition.

A new alignment to the north of the existing bridge would require permanent relocation of the high voltage aerial utility lines and would introduce a reverse curve to the west approach horizontal alignment. This alignment would require ROW acquisition in the NW quadrant. A new alignment to the south of the existing bridge would require ROW acquisition in the SE and SW quadrants and the high voltage aerial utility lines would be temporarily shifted to the north to meet OSHA work zone requirements during demolition. The alignment to the south would cross Otter Creek at a skew and minimize the west approach roadway work.

The costs and impacts associated with the two new alignment options are comparable; therefore, only one was included in the Cost Matrix. Alternative 4c investigates a new alignment to the south of the existing structure, using the existing bridge to maintain traffic during construction. It is assumed the Cost Matrix evaluation of Alternative 4c can be similarly applied to a new alignment to the north of the existing structure.

d. Vertical Alignment

The existing vertical alignment over the bridge is satisfactory geometrically, at a constant slope of approximately 1.2 percent, and meets the hydraulic standard with regards to the low chord elevations. The east approach contains a sag curve that only meets a 40 mph design speed. Should the decision be made to improve the horizontal alignment to meet the posted speed of 45 mph, the existing sag curve could also be adjusted with only minimal additional fill. The preliminary hydraulics report indicates that the recommended low beam elevation for this

bridge configuration is 148.50'. There is no need to change the vertical alignment of the bridge for any of the alternatives unless a 45 mph design speed is required.

e. Superstructure Type

The most common superstructure types for comparable spans in Vermont are steel beams/girders with concrete decks, or precast concrete. Steel beams and cast-in-place decks might be an economical solution if rapid construction is not chosen. Precast NEBT beams or Prefabricated Bridge Units (PBUs) could be used if a rapid construction technique is desired. The superstructures will be designed in a later phase of project planning.

f. Substructure Type

The existing abutments and piers are on spread footings, founded on bedrock and keyed in a minimum of 4 inches. The preliminary geotechnical report recommends using the same substructure type for any proposed design. The existing plans provided by VTrans show estimated depth of rock along the existing bridge alignment. This information could be used to approximate the depth of the proposed pier at mid span for a new two span structure. The new abutments could be placed to better match the upstream and downstream channel widths as recommended in the Preliminary Hydraulic Report.

g. Maintenance of Traffic

Either a temporary bridge, phasing, or closure and an off-site detour could be used to accommodate traffic during construction, depending on the alternative chosen.

IV. Maintenance of Traffic

The Vermont Agency of Transportation reviews each new project to determine suitability for the Accelerated Bridge Program which focuses on faster delivery of construction plans, permitting and Right-of-Way, as well as faster construction of projects in the field. One practice that will help in this endeavor is closing bridges for portions of the construction period, rather than maintaining traffic on a portion of the existing bridge during construction or providing temporary bridges. In addition to saving money, the intention is to minimize the closure period with faster construction techniques and incentives to contractors to complete projects sooner. The Agency will consider the closure option on most projects where rapid reconstruction or rehabilitation is feasible. The use of prefabricated elements in new bridges will also expedite construction schedules. This can apply to decks, superstructures and substructures. Accelerated Construction provides enhanced safety for the workers and the traveling public while maintaining project quality.

There are three maintenance of traffic options being considered for this project: Off-Site Detour, Temporary Bridge, and Phased Construction. The Off-Site Detour would utilize accelerated bridge construction practices to minimize the duration of the bridge closure. The other two maintenance of traffic options are based on traditional bridge construction but accelerated practices may still be used by the contractor.

Option 1: Off-Site Detour

This option would close the bridge to all traffic and would utilize an off-site detour route for the duration of the construction. There are two potential detour routes, one to the south of VT Route 17 and another possible route to the north of VT Route 17.

The southern route would bring traffic from the west side of the VT Route 17 bridge south along TH-1 into the Town of Middlebury to US Route 7. The detour route would then utilize Route 7 north to the intersection of VT Route 17. The southern detour has a through distance of 4.6 miles with an approximate travel time of 7 minutes. The southern detour distance is 15.7 miles with an approximate travel time of 23 minutes. The end-to-end distance for the southern detour route is 20.3 miles, with an approximate travel time of 30 minutes. Given the large proportion of truck traffic on VT Route 17, this detour route is not desirable as it would increase congestion in the Middlebury town center.

The route to the north would detour traffic on the west side of the VT Route 17 bridge west to VT Route 22A in Addison. The detour route would then travel north along VT Route 22 through Panton and Vergennes and connect with US Route 7 in Ferrisburgh. The detour route would then travel south along US Route 7 to VT Route 17. The northern detour route has a through distance of 7.3 miles with an approximate travel time of 10 minutes. The northern detour distance is 12.8 miles with an approximate travel time of 18 minutes. The end-to-end distance for the northern route is 20.1 miles, with an approximate travel time of 28 minutes.

It is noted that there is one local bypass route within the Town of Weybridge that would provide a significantly shorter detour route. The local bypass route would utilize Route 23, Drake Road, and Quaker Village Road. The local bypass route has a through distance of 0.4 miles and an approximate travel time of 1 minute. The local bypass route distance is 6.9 miles with an approximate travel time of 11 minutes. The end-to-end distance for the northern route is 7.3 miles, with an approximate travel time of 13 minutes. However, it is noted that the local bypass route has several sharp turns that would not be able to accommodate the heavy vehicles that will need to utilize the signed detour route. Because local bypass routes are comprised of public roads that circumvent the road closure in a shorter distance than the official detour, they may see an increase in traffic from passenger cars as locals use them during the closure.

Maps of the detour routes and local bypass route are contained in Appendix L.

Advantages: Utilizing an off-site detour would eliminate the need to use a temporary bridge or phased construction to maintain traffic. This would decrease the costs of the temporary traffic control, and reduce the duration of construction. The impacts and amount of temporary rights-of-way required to construct the project in this location would also be reduced for this option. Many times, by decreasing the impacts and area of additional right-of-way required, the length of time needed to develop the project can be decreased. The safety of both construction workers and the traveling public will be improved by removing traffic from the construction site.

Disadvantages: Traffic flow would not be maintained through the project corridor during construction. There are farms on either side of the construction site and their day to day business activities would be greatly impacted by the full closure of the bridge. The bridge costs would be higher due to the accelerated schedule and the need for prefabricated bridge elements and systems.

Option 2: Temporary Bridge

A temporary bridge could be placed either upstream or downstream of the existing structure. A downstream temporary bridge would require further relocation of the aerial utility lines that run along the north side of the structure to meet OSHA work zone standards. This could present an issue since the existing aerial utility lines are already at a bend in the utility alignment. Both an upstream and a downstream temporary bridge would have adverse temporary impacts to archeologically sensitive resources, wetlands, and the habitat of threatened and endangered species living in the project area. A temporary bridge located north of the existing bridge would not require Right-of-Way acquisition, while a temporary bridge on the southern side of the structure may require temporary additional rights.

Based on the daily traffic volumes, a one-lane temporary bridge with two-way alternating traffic, controlled by a temporary signal, would be appropriate. There would be some delays and disruption to traffic with the alternating signal and the speed limit would need to be reduced to 25 mph to limit impacts. This is reasonable given the proximity to Hallock Road intersection to the east which has an advisory speed limit of 25 mph under current conditions. Based on a preliminary capacity analysis of the temporary traffic signal, utilizing the Synchro 9 software, average vehicle delays are expected to be approximately 20 seconds, which corresponds with Level of Service (LOS) "C" operating conditions. The vehicle queues at either end of the bridge are expected to be approximately 2-3 vehicles in length. See Appendix K for the Level of Service analysis. Additional costs would be incurred to use a temporary bridge, including the cost of the bridge itself, installation and removal, and restoration of the disturbed area. Additional studies would be triggered by the impacts to the archeologically sensitive areas, wetlands, and habitat of threatened and endangered species in the area. A single span temporary bridge is feasible but costly due to the 230' plus span length required.

See the Temporary Bridge Layout Sheet in the Appendix M.

Advantages: Traffic flow can be maintained along the VT Route 17 corridor. The construction zone would be separate from traffic which allows for the new structure to be built along the existing alignment, minimizing permanent impacts to the site. The temporary traffic signal that would control traffic would operate reasonably well, with short vehicle delays and queues.

Disadvantages: This option would have adverse impacts on the surrounding resources and cause some disruption to the current traffic flow. 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.

Option 3: Maintaining Traffic on the Existing Bridge while a New Bridge is Constructed Off-Alignment

As discussed in the "Alternative 4: New Structure" section of this scoping report, traffic could be maintained on the existing bridge while a new bridge is constructed off-alignment. In this scenario, all existing traffic flow would be maintained, with two lanes of traffic (one in each direction). This would eliminate the need for additional temporary traffic control devices other than warning signs to warn the public of construction vehicles entering/exiting the roadway in the vicinity of the work zone.

Advantages: Traffic flow can be maintained along the VT Route 17 corridor. The construction zone would be separate from traffic which allows for the new structure without disrupting the existing flow of traffic. Two lanes of traffic (one in each direction) would be maintained at all times.

Disadvantages: This option would have adverse impacts on the surrounding resources. 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 demolish the existing bridge and approaches after the new bridge is constructed.

Option 4: Phased Construction

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

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. There will also be increased costs associated with coordinating the phasing of the project and working around traffic. Phased construction entails a more hazardous work environment due to the close proximity of the workers and vehicular traffic to each other in the project area, while also extending the duration required to complete the work.

The existing structure is too narrow for phased construction for deck replacement and superstructure replacement alternatives, as there is not enough room to accommodate a work zone shift while maintaining one travel lane. Phased construction is feasible for a full bridge replacement, but the proposed bridge section would be wider than required by Vermont State Standards in order to accommodate the construction zone shifts.

Phased construction can also be used for widening the existing substructure to accommodate a wider superstructure and deck. Widening the substructure symmetrically would produce the same issue for phased construction as the full replacement. Widening the substructure on one

side however, would allow phased construction to produce a proposed bridge section that approximates the standard minimum.

In all cases, the phased construction would maintain one-lane of traffic open with a temporary traffic signal controlling alternating traffic. The temporary traffic signal would operate similarly to the temporary signal discussed previously in conjunction with the temporary bridge option.

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.

V. Alternatives Summary

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

- Alternative 1a: Deck Replacement with Traffic Maintained along Off-Site Detour
- Alternative 1b: Deck Replacement with Traffic Maintained on Temporary Bridge
- Alternative 2a: Superstructure Replacement with Traffic Maintained along Off-Site Detour
- Alternative 2b: Superstructure Replacement with Traffic Maintained on Temporary Bridge
- Alternative 3: Substructure Widening to One Side with Traffic Maintained by Phased Construction
- Alternative 4a: Full Bridge Replacement On-Alignment with Traffic Maintained by Off-Site Detour
- Alternative 4b: Full Bridge Replacement On-Alignment with Traffic Maintained by Temporary Bridge
- Alternative 4c: Full Bridge Replacement Off-Alignment with Traffic Maintained on the Existing Bridge

VI. Cost Matrix[1]

Weybridge-New Haven BF 032-1(19)		Do Nothing	Alt 1a	Alt 1b	Alt 2a	Alt 2b	Alt 3	Alt 4a	Alt 4b	Alt 4c
			Deck Replacement		Superstructure Replacement		Widening to One Side	Full Bridge Replacement		
								On Alignment		Off Alignment
			Off-Site Detour	Temporary Bridge	Off-Site Detour	Temporary Bridge	Phasing	Off-Site Detour	Temporary Bridge	Existing Bridge
COST	Bridge Cost	$0	$551,300	$466,100	$1,956,200	$1,666,400	$2,440,200	$2,770,200	$2,359,800	$2,359,800
	Removal of Structure	$0	$59,100	$59,100	$180,500	$180,000	$219,100	$209,200	$209,200	$209,200
	Roadway	$0	$9,000	$9,000	$9,000	$9,000	$343,000	$391,000	$391,000	$428,000
	Maintenance of Traffic	$0	$20,000	$322,000	$25,000	$452,000	$100,000	$80,000	$612,000	$20,000
	Construction Costs	$0	$640,000	$857,000	$2,171,000	$2,308,000	$3,103,000	$3,451,000	$3,572,000	$3,017,000
	Construction Engineering + Contingencies	$0	$192,000	$257,100	$651,300	$692,400	$930,900	$1,035,300	$1,071,600	$905,100
	Total Construction Costs w/ CEC	**$0**	**$832,000**	**$1,114,100**	**$2,822,300**	**$3,000,400**	**$4,033,900**	**$4,486,300**	**$4,643,600**	**$3,922,100**
	Preliminary Engineering[2]	**$0**	**$128,000**	**$191,400**	**$434,200**	**$481,600**	**$670,600**	**$690,200**	**$734,400**	**$653,400**
	Right-of-Way	**$0**	**$15,000**	**$15,000**	**$15,000**	**$15,000**	**$15,000**	**$15,000**	**$15,000**	**$150,000**
	Total Project Costs	$0	$975,000	$1,321,000	$3,272,000	$3,497,000	$4,720,000	$5,192,000	$5,393,000	$4,726,000
SCHEDULING	Project Development Duration[3]	NA	2 years	4 years	2 years	4 years	2 years	2 years	4 years	4 years
	Construction Duration	NA	4 months	6 months	6 months	8 months	24 months	12 months	16 months	14 months
	Closure Duration (if applicable)	NA	15 days	NA	30 days	NA	NA	60 days	NA	NA
ENGINEERING	Typical Section - Roadway (feet)	25'	2-11-11-2	2-11-11-2	2-11-11-2	2-11-11-2	5-11-11-5	4-11-11-4	4-11-11-4	4-11-11-4
	Typical Section - Bridge (feet)	1-9-9-1	1.5-10-10-1.5	1.5-10-10-1.5	1.5-10-10-1.5	1.5-10-10-1.5	5-11-11-5	4-11-11-4	4-11-11-4	4-11-11-4
	Geometric Design Criteria	Substandard width	Substandard width	Substandard width	Substandard width	Substandard width	Standard Width	Standard Width	Standard Width	Standard Width
	Traffic Safety	No Change	No Change	No Change	No Change	No Change	Improved	Improved	Improved	Improved
	Alignment Change	No	No	No	No	No	Yes	No	No	Yes
	Bicycle Access	No Change	No Change	No Change	No Change	No Change	Improved	Improved	Improved	Improved
	Hydraulic Performance	Meets Standard	Meets Standard	Meets Standard	Meets Standard	Meets Standard	Meets Standard	Meets Standard	Meets Standard	Meets Standard
	Pedestrian Access	No Change	No Change	No Change	No Change	No Change	Improved	Improved	Improved	Improved
	Utility	No Change	No Change	No Change	Temporary Relocation	Temporary Relocation	Temporary Relocation	Temporary Relocation	Temporary Relocation	Temporary Relocation
OTHER	ROW Acquisition	No	No	Yes	No	Yes	Yes	No	Yes	Yes
	Road Closure	No	Yes	No	Yes	No	No	Yes	No	No
	Design Life	<10 years	20 years		35 years		45 years	80 years		

[1]Costs are estimates only, used for comparison purposes.
[2]Preliminary Engineering costs include costs associated with environmental, utility and archeological mitigation. It is assumed that alternatives utilizing a temporary bridge will have a lower cost associated with archeological impacts as the areas can be protected and no excavation is required. Alternatives 3 and 4c would have permanent impacts and excavation within the archeological areas and therefore have a higher cost for mitigation under Preliminary Engineering.
[3]Project Development Durations are starting from the end of the Project Definition Phase.

VII. Conclusion

We recommend **Alternative 4b**; Full Bridge Replacement On-Alignment with Traffic Maintained by Temporary Bridge.

A full replacement on the existing alignment 20was chosen for this bridge for the following reasons:

- The bridge width provided by deck or superstructure replacement would still be 7' substandard which is not an acceptable alternative. The existing narrowness of the bridge needs to be improved to meet the VTrans standards, as it is both a community and roadway safety concern.
- Substructure widening to one side could provide an acceptable bridge width using phased construction, but the anticipated service life of the final structure would be limited by the fair condition rating of the existing substructure which was built in 1934. The annualized cost of this alternative makes it the least economical option.
- A new structure on a new alignment would require permanent ROW acquisition, large amounts of fill, and by far have the greatest impact on the site's resource areas.
- A 60 day off-site detour is unreasonable for maintenance of traffic based on the limited detour route options and the direct impacts upon the farmers in the area.

Structure

The proposed bridge will meet the Vermont Standard for lane and shoulder widths of 4'-11'-11'-4' and have a TL-4 railing (2 Rail Box Beam, Vermont Standard Detail S-360). The new bridge will be two spans with a steel superstructure, concrete deck and single pier at the middle of the channel. The abutments will be set back from their existing locations so that the channel can be improved to match the upstream and downstream embankments along Otter Creek.

The horizontal curve east of the structure meets Vermont State Standards for a 40 mph design speed but the roadway is posted for 45 mph. It is proposed that the radius of the curve is adjusted to meet Vermont Standards for a 45 mph design speed. This adjustment would slightly shift the centerline of roadway east the bridge to the south but the alignment on the bridge would match the existing alignment.

The recommended alternative meets all VSS requirements as it is presented in the report, cost matrix and plans. Design exceptions could be applied to aspects of the alternative to further mitigate impacts.

Traffic Control

The method of traffic control originally recommended was to install a single lane, single span temporary bridge on the south side of the existing structure. The forecasted 2017 AADT of 1,100 vehicles could be accommodated by a traffic signal with alternating one-way traffic on either side of the temporary bridge.

This method of traffic maintenance would allow for traffic to be maintained for the entire duration of construction. This will result in less impact on the adjacent farm businesses and the local communities than an off-site detour and road closure would.

NOTE REVISION TO PROJECT SCOPE BELOW

Following completion of the scoping process, maintenance repesentatives of the Vermont Agency of Transportation observed indications that deterioration of the bridge was progressing faster than previously recognized. Consequently, the recommended method of traffic control has been revised to include a bridge closure and off-site detour. This change is expected to accelerate the project delivery period by reducing or eliminating the Right-of-Way effort and the Phase I Archaeological study. An engineering study of traffic impacts expected along the detour has been commissioned, but the results are not available at the time of publishing.

VT Agency of Transportation 8/23/16

VIII. Appendices

- A: Site Photos
- B: Town Map
- C: Bridge Inspection Report
- D: Preliminary Hydraulics Report
- E: Preliminary Geotechnical Report
- F: Natural Resources Memo
- G: Archeological Memo
- H: Historic Memo
- I: Community Input
- J: Traffic Research Memo
- K: Level of Service Analysis
- L: Detour Routes
- M: Plans

Appendix A: Site Photos

Photo 1: Bridge 8 – Looking West, Typical Top of Deck

Photo 2: Bridge 8 – West Approach looking East

Photo 3: Bridge 8 - Looking Upstream

Photo 4: Bridge 8 – Looking Downstream (snow mobile bridge shown)

Photo 5: Bridge 8 – Looking at North Fascia, Typical Pier and Typical Superstructure

Photo 6: Bridge 8 – Northeast embankment, North Abutment No. 1

Appendix B: Town Map

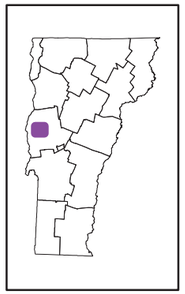
WEYBRIDGE/
NEW HAVEN BR 8
BF 032-1(19)

Scale 1:33,309

N

- INTERSTATE
- STATE LONG
- STATE SHORT
- TOWN LONG
- FAS/FAU
- FAS/FAU HWY
- INTERSTATE
- STATE HIGHWAY
- CLASS 1
- CLASS 2
- CLASS 3
- CLASS 4
- LEGAL TRAIL
- PRIVATE
- DISCONTINUED
- DISTRICT
- POLITICAL BOUNDARY
- NAMED RIVERS-STREAMS
- UNNAMED RIVERS-STREAMS

Produced by:
Mapping Unit
Vermont Agency of Transportation
August 2011



WEYBRIDGE
ADDISON COUNTY
DISTRICT # 5

Appendix C: Bridge Inspection Report

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

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

Inspection Report for : WEYBRIDGE **Bridge No.:** 00008 **District:** 5

Located on: VT 00017 **over** OTTER CREEK **approximately** 3.0 MI E JCT VT 22A **Owner:** STATE-OWNED

CONDITION

Deck Rating: 5 FAIR
Superstructure Rating: 5 FAIR
Substructure Rating: 5 FAIR
Channel Rating: 7 GOOD
Culvert Rating: N NOT APPLICABLE
Federal Str. Number: 200032000801222
Federal Sufficiency Rating: 53.6
Deficiency Status of Structure: FD

AGE and SERVICE

Year Built: 1934 **Year Reconstructed:** 0000
Service On: 1 HIGHWAY
Service Under: 5 WATERWAY
Lanes On the Structure: 02
Lanes Under the Structure: 00
Bypass, Detour Length (miles): 02
ADT: 000960 **% Truck ADT:** 09
Year of ADT: 1998

GEOMETRIC DATA

Length of Maximum Span (ft): 0070
Structure Length (ft): 000222
Lt Curb/Sidewalk Width (ft): 0
Rt Curb/Sidewalk Width (ft): 0.5
Bridge Rdwy Width Curb-to-Curb (ft): 20
Deck Width Out-to-Out (ft): 23
Appr. Roadway Width (ft): 025
Skew: 00
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: 3 SPAN ROLLED BEAM
Number of Approach Spans: 0000 **Number of Main Spans:** 003
Kind of Material and/or Design: 3 STEEL
Deck Structure Type: 1 CONCRETE CIP
Type of Wearing Surface: 1 MONOLITHIC CONCRETE
Type of Membrane: 0 NONE
Deck Protection: 0 NONE

APPRAISAL *AS COMPARED TO FEDERAL STANDARDS

Bridge Railings: 0 DOES NOT MEET CURRENT STANDARD
Transitions: 1 MEETS CURRENT STANDARD
Approach Guardrail: 1 MEETS CURRENT STANDARD
Approach Guardrail Ends: 1 MEETS CURRENT STANDARD
Structural Evaluation: 5 BETTER THAN MINIMUM TOLERABLE
Deck Geometry: 3 INTOLERABLE, CORRECTIVE ACTION NEEDED
Underclearances Vertical and Horizontal: N NOT APPLICABLE
Waterway Adequacy: 6 OCCASIONAL OVERTOPPING OF ROADWAY WITH INSIGNIFICANT TRAFFIC DELAYS
Approach Roadway Alignment: 5 BETTER THAN MINIMUM TOLERABLE CRITERIA
Scour Critical Bridges: 8 STABLE FOR SCOUR

DESIGN VEHICLE, RATING and POSTING

Load Rating Method (Inv): 1 LOAD FACTOR(LF)
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

Insp. Date: 052015 **Insp. Freq. (months):** 24 **X-Ref. Route:** **X-Ref. BrNum:**

INSPECTION SUMMARY and NEEDS

05/21/2015 - Bridge is in need of extensive reconstruction or replacement with all components rated as fair. Deck overlay was intended as only a repair and has served its purpose for approximately 15 plus years and the deck rating would be rated lower if not for the added reinforced thickness. ~ MJ/JS

05/07/2013 - Bridge is in fair condition and should be upgraded in the next few years. ~ MJ/JS

04/2/2011 - Broken northeastern end bridge rail post needs replacement. Rigid deck overlay installed to augment poor original deck is functioning as intended; although will not indefinitely. Superstructure and substructure are still quite sound but deterioration is certainly progressing. Bridge should be considered for replacement within the next 10 years. ~ MJ/DK

Appendix D: Preliminary Hydraulics Report

VT AGENCY OF TRANSPORTATION PROGRAM DEVELOPMENT DIVISION

HYDRAULICS UNIT

TO: Kristin Higgins, Structures Project Manager
Laura Stone, Structures Project Engineer

FROM: David Willey, Hydraulics Project Supervisor

DATE: December 5, 2014

SUBJECT: Weybridge-New Haven BF 032-1(19), VT 17 Br. 8 over Otter Creek

---

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

Existing Conditions

The existing structure is a three span steel beam bridge. It has a clear span, face to face of abutments, of 217'. The two piers are located in the channel. Exposed ledge is visible in the channel near the bridge. Both piers are founded on ledge. Based on information in the bridge inspection files, both abutments may also be founded on ledge, if they were constructed according to plans. Large stone fill and riprap protects the banks in front of the abutments. Channel banks appear stable in the bridge area. There is a snowmobile bridge about 200' downstream. It appears to have been constructed on the old abutments of a previous VT 17 covered bridge.

Our calculations indicate the existing structure meets the current hydraulic standards. The Q50 WS elevation is 147.3' and the average bottom of superstructure elevation is about 151.6'. So the bridge has about 4.3' of freeboard above the average bottom of beam at Q50 and meets the standards. Low bottom of beam is about 150.2', so the bridge has about 2.9' of freeboard above the low beam end at Q50. Water overtops the channel banks and flows into the floodplain (adjacent fields) between a Q2.33 and a Q10. However, there is no roadway overtopping below the Q100 discharge.

The existing bridge and its fill may not meet state stream equilibrium standards for bankfull width (span length). The stone fill slopes in front of the abutments constrict the natural channel width. ANR's Vermont Hydraulic Geometry Relationships anticipate a bankfull width of 256' for stream channels in equilibrium at this watershed size. Those curves may not be valid for this site, due to the large amount of floodplain storage upstream. Based on the project survey, the actual bank full width varies from 200' to 230'. No indications of active vertical or horizontal instability were observed. Ledge in the channel limits scour.

There are flood insurance studies for both Weybridge and New Haven for this section of the Otter Creek. National Flood Insurance Program regulations require no additional fill be placed in the floodway and no increase in the Q100 water surface elevation.

Repair Recommendations

It would be acceptable hydraulically to repair or replace just the superstructure and retain the substructure. No fill should be added between the abutments that would reduce the waterway area of the bridge. Bottom of beams could be lowered to a minimum elevation of 148.5', and still meet the standards and not affect water surface elevations up to Q100. However, lowering the beams that much would affect hydraulics above Q100, so bottom of beams should be kept as high as practical. As there is no roadway overtopping, changing the roadway elevation will have no effects hydraulically and would be acceptable. Abutments and piers would likely need to be extended, to support a wider superstructure. The new extended portions of piers should be no wider than the existing. Extended portions of all substructures should be founded on ledge.

Replacement Recommendations

In sizing a new structure we attempt to select structures that meet both the current VTrans hydraulic standards, state environmental standards with regard to span length and opening height, and allow for roadway grade and other site constraints.

Any of the following structures would be acceptable hydraulically as a replacement; a new three span bridge similar to the existing, a two span bridge with a pier in the middle of the channel or a single span bridge. A new structure should have a span length at least as large as the existing bridge, with a 217' minimum clear span between abutments and a waterway area at least as large as the existing bridge. Increasing the span length and/or reducing fill in front of the abutments to better match the upstream and downstream channel banks would be preferable as it would increase the waterway area and reduce velocities through the bridge. Although beneficial and thus recommended hydraulically, that it is not required for hydraulics but may be required by ANR. Removing one or both piers would improve hydraulics and reduce the potential for debris blockage.

No fill should be added between the abutments that would reduce the waterway area of the bridge to less than the existing and matching upstream and downstream channel banks is recommended. Bottom of beams could be lowered to a minimum elevation of 148.5', and still meet the standards and not affect water surface elevations up to Q100. However, lowering the beams that much would affect hydraulics above Q100, so bottom of beams should be kept as high as practical. As there is no roadway overtopping, changing the roadway elevation will have no effects hydraulically and would be acceptable.

Scour was not calculated at this time. It appears all substructure units will be founded on ledge. If that is not the case, we will need to calculate scour depths after the bridge layout has been determined. We can make recommendations on foundation depths at that time.

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

DCW

cc: Hydraulics Project File via NJW
Hydraulics Chrono File

Appendix E: Preliminary Geotechnical Report

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Chris Williams, P.E., Structures Project Manager
BLS

From: Brendan Stringer, Geotechnical Engineer, via Christopher C. Benda P. E., Geotechnical Engineering Manager
CCB

Date: June 27, 2014

Subject: Weybridge-New Haven BF 032-1(19) Preliminary Geotechnical Report

In an effort to assist the Structures Section with their bridge type study, the Geotechnical Engineering Section within the Construction and Materials Bureau has completed a review of available geological data for Bridge 8 on US Route 17 in Weybridge, which crosses over the Otter Creek. This review included observations made during a site visit, the examination of historical in-house bridge boring files, as-built record plans, USDA Natural Resources Conservation soil survey records, published surficial and bedrock geologic maps and water well logs on-file at the Agency of Natural Resources.

Previous Projects

The record plans found for the project show that the bridge abutments are supported on spread footings that have been keyed into the bedrock a minimum depth of four inches. No boring logs were referenced in the plans and bedrock appears to be shallow at this location.

A search of historical records of subsurface investigations maintained by the Soils and Foundations Unit revealed no nearby borings in Weybridge. These records are GIS based, and contain electronic logs for the majority of borings completed in the past 10 years.

Water Well Logs

The Agency of Natural Resources (ANR) publishes logs for all water wells drilled for residential and commercial purposes. The logs can be used to determine general characteristics of soil strata in the area. The logs contain soil descriptions completed in the field, by unknown personnel, and therefore, should only be used as an approximation. Depths to bedrock were taken from four well logs in close proximity to the project.

Figure 1 shows the project and the locations of surrounding wells. The wells used for information on the subsurface conditions are highlighted by red boxes.

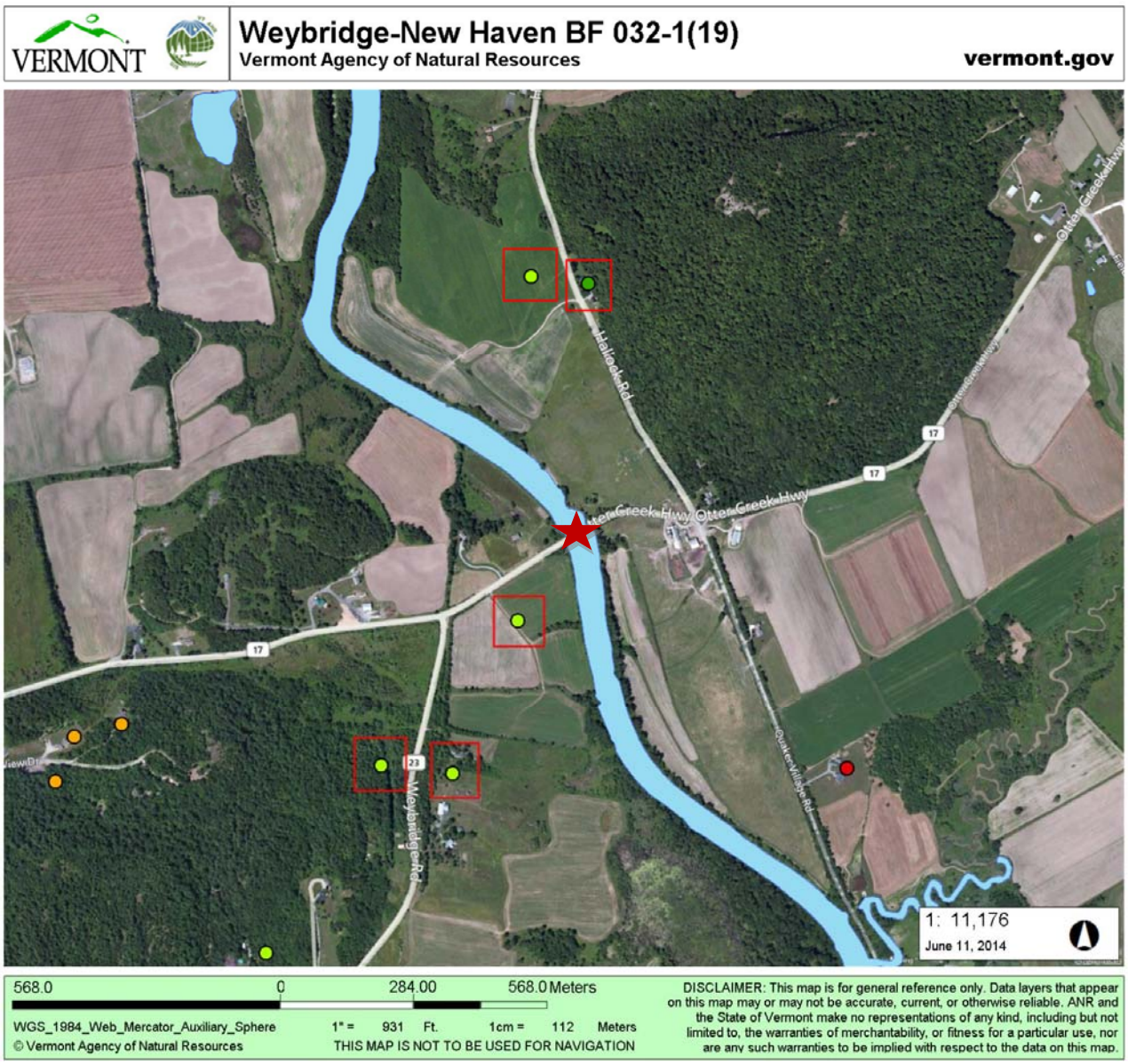


Figure 1. Highlighted well locations near subject project

Table 1 lists the wells used for gathering the surrounding information. Wells are listed with the distance from the bridge project, depth to bedrock, and the static water level. Only one well was within 1000’ of the project and four were within a 2000’ foot radius of the project.

Table 1. Depths to bedrock of surrounding wells

Well ID	Distance From Project (feet)	Depth To Bedrock (feet)	Depth of Static Water Level (feet)
5	2000	85	0
35	780	5	40
44	1940	23	0
227	1860	109	0
12686	1775	0	0

USDA Soil Survey

The United States Department of Agriculture Natural Resources Conservation Service maintains an online surficial geology map of the United States. According to the Web Soil Survey, the strata directly underlying the project site consists of Winooski Very Fine Sandy Loam deep to bedrock. The drainage of the soil in the project area is not known.

Geologic Maps of Vermont

Mapping conducted in 1970 for the Surficial Geologic map of Vermont shows that the project area is underlain by Glaciolacustrine Lake Bottom Settlements and Glaciofluvial Kame Gravel.

According to the 2011 Bedrock Map of Vermont, the project site is underlain with dolostone and limestone from the Chipman Formation.

A site visit was conducted on June 16, 2014, to assess potential issues with boring operations, and to make any other pertinent observations about the project.

Figure 2. View of Bridge, Looking Northeast

Overhead utilities run along the North side of the bridge, Figure 2, but should not conflict with boring operations.

According to record plans for the existing bridge, the abutments are founded on bedrock, however no bedrock outcrops were noted during the site visit.

The surrounding surficial soils are within the floodplain. The sides of the rivers were heavily vegetated and the water had high turbidity which made it difficult to see the streambed or any evidence of erosion of the banks. From what we could observe there was minimal scour and erosion at the bridge piers and river banks. There were a couple large boulders on the North side of the bridge as shown in Figure 3.

Figure 3. Submerged boulders on the North side of the bridge

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

- Reinforced concrete abutments and piers on spread footings founded on rock

Once substructure locations are determined, we recommend a minimum of two borings be taken at each abutment and pier. Borings should be advanced a minimum of 10 feet into sound bedrock in order to assess the subsurface conditions, engineering parameters of the rock, and elevations of the bedrock across the proposed abutments and pier footprint. Additional borings may be required if variable conditions are encountered.

When a preliminary alignment has been chosen, the Geotechnical Engineering Section should be contacted to help determine a subsurface investigation that efficiently gathers the most information.

If you have any questions or would like to discuss this report, please contact us by phone at (802) 828-6910, or via email at chris.benda@state.vt.us.

cc: Project File/CCB
BLS

G:\Soils and Foundations\Projects\Weybridge-New Haven BF 032-1(19)\SCOPING & BACKGROUND

Appendix F: Natural Resources Memo

VERMONT

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

Agency of Transportation

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

To: James Brady, VTrans Environmental Specialist

From: Glenn Gingras, VTrans Environmental Biologist

Date: 05/05/14

Subject: Weybridge-New Haven BF 032-1(19) - Natural Resource ID

I have completed my natural resource scoping review for the above referenced project. My evaluation has included the following resources: wetlands, wildlife habitat, agricultural soils, and rare, threatened and endangered species. I have reviewed all existing mapped information and performed a site review of the project area.

The project involves bridge 8 on VT17 in the towns of Weybridge and New Haven, VT. The bridge carries travelers over Otter Creek at this location. As the project is in scoping an alternative has not been selected. Resources have been identified in the surrounding area to aid in the determination of a least damaging practical alternative.

Wetlands/Watercourses

Wetlands are located within the project area. I have picked up preliminary wetland boundaries to aid in the selection of an alternative. All wetlands were located using GPS technology and were stored in the environmental geodatabase for referencing.

The wetlands are located in all quadrants besides the NW. All wetlands are considered class II and have a regulatory 50' buffer as they are contiguous to mapped class II wetlands. The SW quadrant is dominated by a forested floodplain wetland community comprising of Ash, Silver Maple, Elm, Ostrich Fern, Honey suckle, and River Grape. Soils were loamy and meet hydric criteria. Hydrology indicators were also met within this wetland. The wetlands on the SE and NE quadrants are one wetland divided by the roadway. This wetland was dominated by ash, reed canary grass, cattails, and sedges. Hydrology and soil indicators were met as well. Primary functions of wetlands within the project are would be flood storage and erosion control.

Otter Creek is the only watercourse present in the project area. Otter Creek is a direct tributary of Lake Champlain.

Avoidance alternatives to wetlands and waterways must be examined during the scoping process. The US Corps of Engineers and the Agency of Natural Resources- Department of Environmental Conservation would regulate all activities below ordinary high water within the Otter Creek and adjacent wetlands. Once project plans are conceptualized we can evaluate potential impacts on waterways and evaluate project permits that will be required. Additional field work may be required.

Wildlife Habitat

Good wildlife habitat exists within the project area. A variety of aquatic species including: several fish species, small and large mammals, migratory birds, etc. would occur within and outside the project area. In stream timing restrictions will be likely required during construction to limit work within the waterway to during the low flow period.

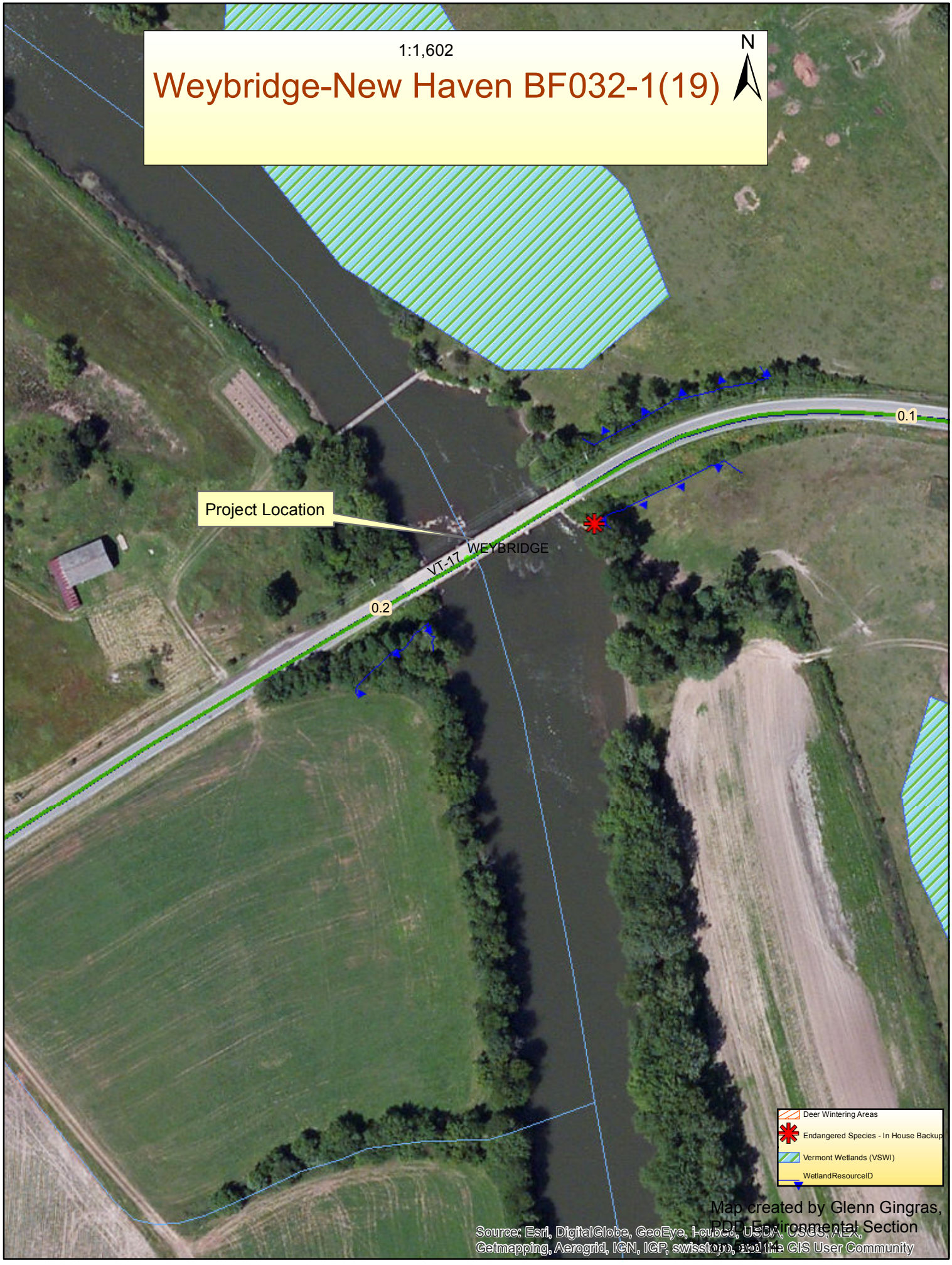
Rare, Threatened and Endangered Species (R/T/E)

I have queried the VT Fish and Wildlife-Wildlife Diversity database and there are R/T/E species within the project area.

The species are freshwater mussels (state-Threatened) *Pyganodon grandis*-Giant Floater and the *Myotis sodalist*- Indiana Bat (state and federally endangered (E)). Work within the waterway will likely trigger the need to be surveyed for fresh water mussels to determine presence or absence. Any tree clearing associated with the project will need to be reviewed for potential Indiana Bat habitat. Preferred habitat is trees with exfoliating bark which serve as roost trees. During my initial review I did not observe trees exhibiting these signs.

Agricultural Soils

Prime agricultural soils are mapped within the entire project area.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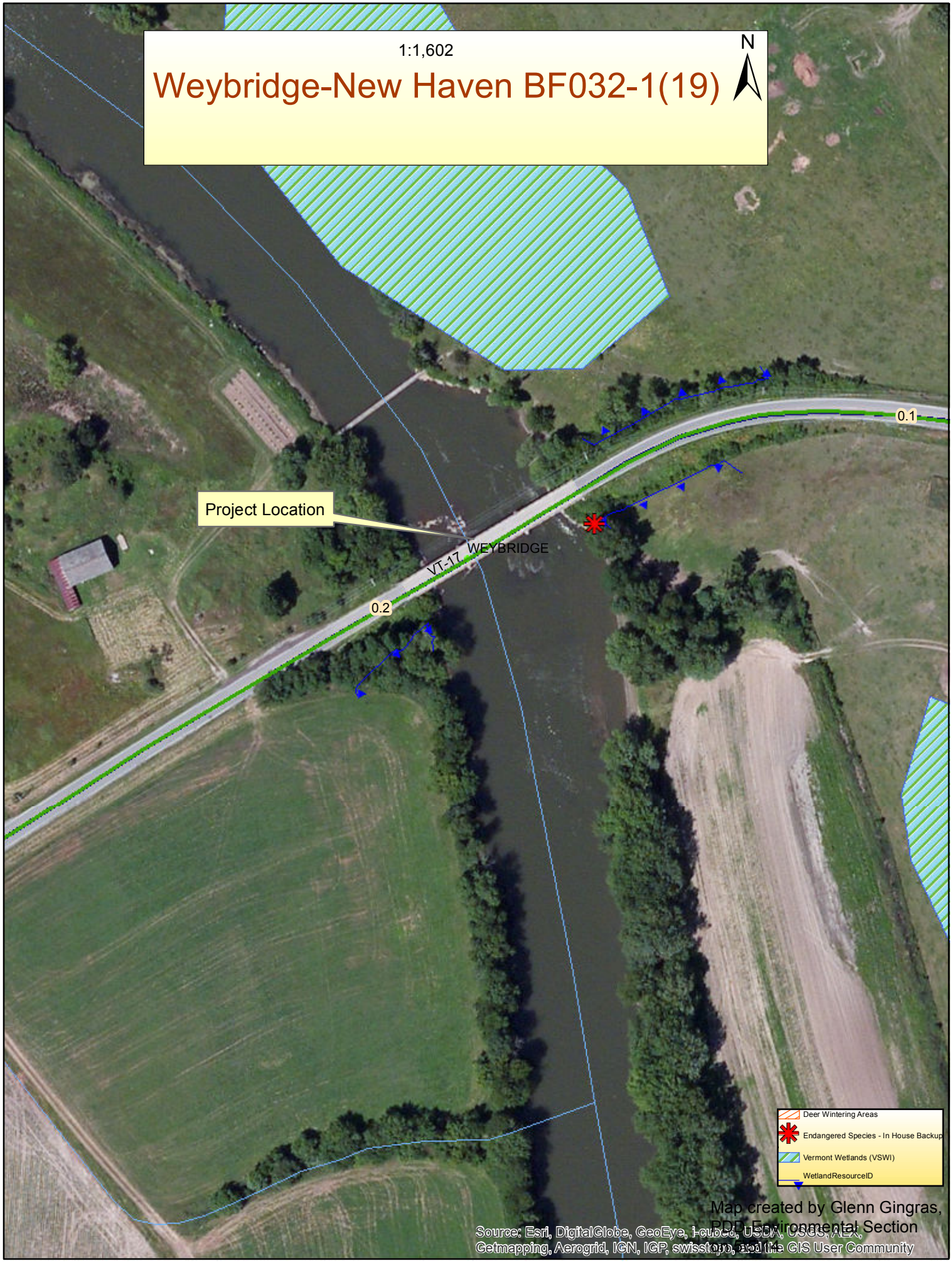
Weybridge-New Haven BF032-1(19)
N
Project Location
WEYBRIDGE
VT-17
0.1
0.2
Deer Wintering Areas
Endangered Species - In House Backup
Vermont Wetlands (VSWI)
WetlandResourceID
Map created by Glenn Gingras,
PDP Environmental Section
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX,
Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


1:1,602
Weybridge-New Haven BF032-1(19)
N
Project Location
WEYBRIDGE
VT-17
0.1
0.2
Deer Wintering Areas
Endangered Species - In House Backup
Vermont Wetlands (VSWI)
WetlandResourceID
Map created by Glenn Gingras,
PDP Environmental Section
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX,
Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Appendix G: Archeological Memo

VERMONT

Jeannine Russell
VTrans Archaeology Officer
State of Vermont
Environmental Section
One National Life Drive
Montpelier, VT 05633-5001
www.aot.state.vt.us

Agency of Transportation

[phone] 802-828-3981
[fax] 802-828-2334
[ttd] 800-253-0191

To: James Brady, VTrans Environmental Specialist

From: Jeannine Russell, VTrans Archaeology Officer
via Brennan Gauthier, VTrans Archaeologist

Date: 5/7/2014

Subject: Weybridge-New Haven BF 032-1(19) – Archaeological Resource ID

James,

I've completed my resource identification for the proposed replacement of Bridge 8 on VT 17 over the Otter Creek in Weybridge, Addison County, Vermont. The area is considered highly sensitive for precontact archaeology based on environmental factors, known site location, and lack of previous disturbance in the APE. Five known precontact sites are located within one mile of the project; VT-AD-320, 105,145,27 and 26 are all situated on similar landscape features along the Otter Creek. For this reason all four quadrants have been marked as sensitive, and any work within these areas will trigger a Ph1 survey.

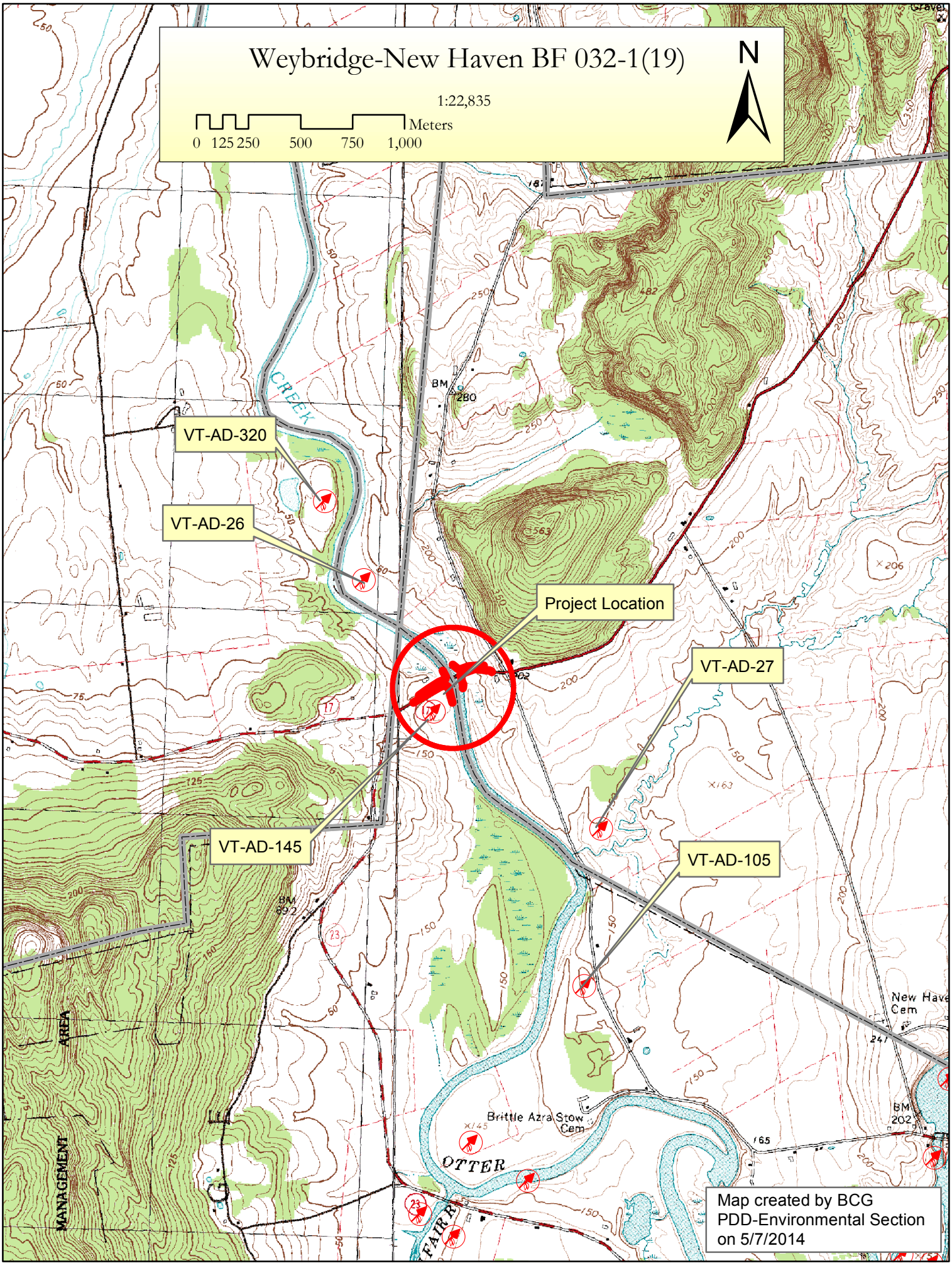
Please find attached a series of maps and images of the project area. Please feel free to contact me with any questions or concerns that may arise.

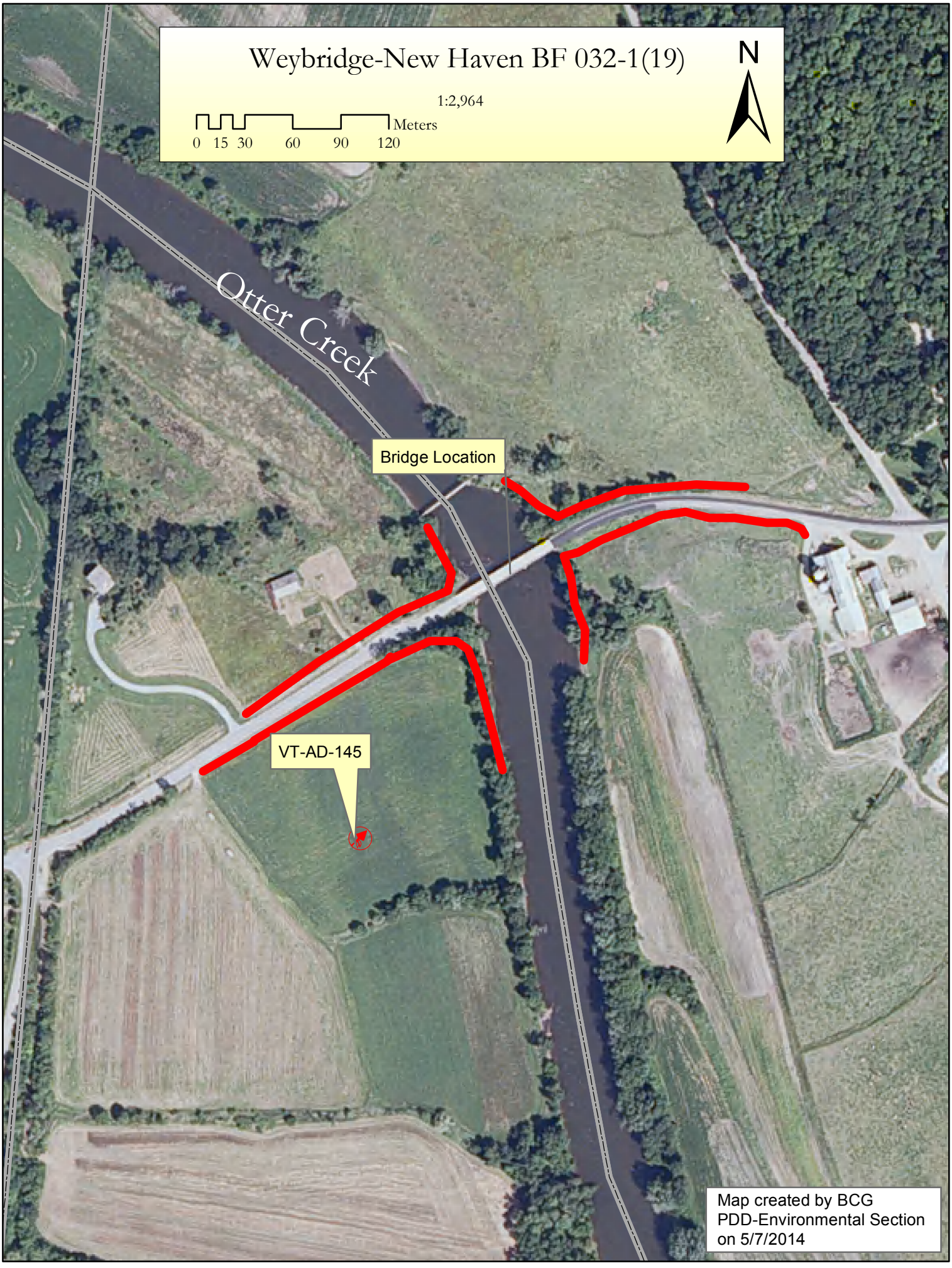
Sincerely,

Brennan

Brennan Gauthier
VTrans Archaeologist
Vermont Agency of Transportation
Program Development Division
Environmental Section
1 National Life Drive
Montpelier, VT 05633
tel. 802-828-3965
fax. 802-828-2334
Brennan.Gauthier@state.vt.us

VTrans Working to Get You There
Vermont Agency of Transportation


Weybridge-New Haven BF 032-1(19)
1:22,835
Meters
0 125 250 500 750 1,000
N
VT-AD-320
VT-AD-26
Project Location
VT-AD-27
VT-AD-145
VT-AD-105
Map created by BCG
PDD-Environmental Section
on 5/7/2014


Weybridge-New Haven BF 032-1(19)
1:2,964
0 15 30 60 90 120
Meters
N
Otter Creek
Bridge Location
VT-AD-145
Map created by BCG
PDD-Environmental Section
on 5/7/2014

Appendix H: Historic Memo

From: O"Shea, Kaitlin
To: Brady, James
Cc: Newman, Scott; Williams, Chris
Subject: Weybridge - New Haven BF 032-1(19) Historic Resource ID
Date: Tuesday, February 18, 2014 10:53:32 AM

Hi James,

I have completed the historic resource ID for the Weybridge-New Haven project. Bridge No. 8 is not a historic bridge. There are nearby historic houses and barns, which have been mapped in Arcmap. The nearby trail is a VAST trail on private property, and not protected by Section 4(f).

There is no preference for railing replacement on this project, as the bridge is not in a district or immediately adjacent to historic properties.

Let me know if you have any questions.

Thanks,
Kaitlin

Kaitlin O'Shea
Historic Preservation Specialist
Vermont Agency of Transportation

802-828-3962
Kaitlin.O'Shea@state.vt.us

Appendix I: Community Input

Town of Weybridge
Selectboard Response
Re: Weybridge-New Haven BF 032-1(19) VT17 Bridge over Otter Creek

Community Considerations

The critical use of this bridge occurs during Addison County Fair and Field Days. A sizable percentage of the yearly use of this facility takes place during Field Days and any closure or restriction during that time would pose a dangerous and unnecessary hazard upon the public and a monumental inconvenience. Field Days is scheduled from August 4th through the 8th of 2015 and August 9th through the 13th of 2016. A minimum of 4 days prior and 3 days after the event should be allowed to accommodate the increased traffic flow on the bridge. (http://www.addisoncountyfielddays.com)

The Weybridge Elementary School bus route crosses this bridge twice daily from late August until mid June. Emergency response times may lengthen slightly in a few select instances, but in both of these instances the impact of closure will be minimal.

Complete closure of the bridge will result in detours through the Town of Weybridge and will have some impact on agricultural operations. Impact will be greatest on the Chalker farm which lies adjacent to the bridge. Complete closure will not only inconvenience the traveling public, it will also subject Weybridge residents to increased traffic volume.

Pedestrian use of the facility is extremely limited, it does see occasional use by bicycles. Weybridge sees a sizable number of bicyclists, both as organized tours and general ridership. Quaker Village Road / Hallock Road, just east of the bridge, is a common bicycle route. It is used for the Kelly Brush Ride (http://ride.kellybrushfoundation.org), which takes place in early September.

There are no public facilities within the immediate proximity of the bridge.

Design Considerations

The intersection immediately east of the bridge has limited sight lines (particularly coming from the east) and is regulated with a flashing yellow light on RT 17. The speed reduction is primarily related to the intersection with Hallock Road, and not the bridge.

The bridge is currently too narrow to allow two large trucks to pass simultaneously. Non-motorized traffic is currently limited, probably in part due to safety concerns. This bridge probably represents the narrowest point on VT17 between the Champlain Bridge and RT 7. A wider bridge would not only offer greater safety to motorized traffic, it would also allow increased non-motorized use. It's current width is detrimental to the safety of everyone.

We are not aware of any historic, archeological, environmental or flooding issues with this bridge.

This bridge exists in a pastoral setting with a VAST bridge immediately downstream for use by snowmobiles. A new design should compliment the rural characteristics of the surrounding countryside.

Donald Mason
Selectman, Town of Weybridge
contact: vtlaaser@gmavt.net 802-545-3003

Appendix J: Traffic Research Memo

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

POLICY, PLANNING AND INTERMODAL DEVELOPMENT DIVISION

TO: Christopher Williams, Structures Project Manager

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

DATE: January 17, 2014

RE: Weybridge-New Haven BF 032-1(19)
VT 17, BR #8 on Weybridge/New Haven T/L

Per your request on December 11, 2013, please find complete estimated traffic data on the above project in the towns of Weybridge and New Haven. The data for the years 2017, 2037 and 2057 is included in the table below.

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

TRAFFIC DATA	2017	2037	2057
AADT	1100	1200	~
DHV	120	140	~
ADTT	190	290	~
%T	21.3	30.3	~
%D	54	54	~
FLEXIBLE ESAL	~	**2017 ~ 2037** 1,709,000	**2017 ~ 2057** 4,076,000

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

Vermont Agency of Transportation

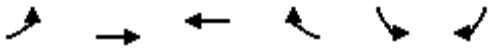
General Yearly Summaries - Crash Listing: State Highways and All Federal Aid Highway Systems

From 01/01/08 To 12/31/12 General Yearly Summaries Information

*	Reporting Agency/ Number	Town	Mile Marker	Date MM/DD/YY	Time	Weather	Contributing Circumstances	Direction Of Collision	Number Of Injuries	Number Of Fatalities	Number Of Untimely Deaths	Direction	Road Group
Route: VT-17 Continued ...													
	VTVSP0600/10C20 0130	Addison	10.13	01/15/2010	05:58	Cloudy	Driving too fast for conditions	Single Vehicle Crash	1	0	0	W	SH
	VTVSP0600/09C20 0440	Addison	10.73	02/22/2009	22:56	Snow	Driving too fast for conditions	Single Vehicle Crash	0	0	0	E	SH
	VTVSP0600/10C20 2103	Addison	10.74	07/30/2010	06:55	Cloudy	Failure to keep in proper lane	Single Vehicle Crash	1	0	0	E	SH
	VTVSP0600/12C20 3236	Addison	UNK	10/19/2012	09:00	Rain	No improper driving	Single Vehicle Crash	0	0	0	E	SH
	VTVSP0600/12C20 3997	Addison	UNK	12/29/2012	15:10	Snow	Driving too fast for conditions	Single Vehicle Crash	0	0	0	W	SH
	VTVSP0600/09C20 1222	Weybridge	0.03	05/28/2009	11:47	Cloudy	No improper driving	Opp Direction Sideswipe	0	0	0	E	SH
	VTVSP0600/09C20 2145	Weybridge	0.17	08/16/2009	17:45	Clear	No improper driving, Inattention	Rear End	0	0	0	E	SH
	VTVSP0600/08C20 3200	New Haven	0.64	11/19/2008	18:30	Clear	No improper driving	Single Vehicle Crash	0	0	0	W	SH
	VTVSP0600/12C20 3596	New Haven	0.95	11/19/2012	14:10	Clear	Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway etc, Failure to keep in proper lane	Single Vehicle Crash	0	0	0	W	SH
	VTVSP0600/10C20 3207	New Haven	2.19	11/06/2010	00:30	Clear	Failure to keep in proper lane	Single Vehicle Crash	0	0	0	E	SH
	VTVSP0600/09C20 2303	Waltham	0.05	08/31/2009	12:19	Clear	Other improper action	Same Direction Sideswipe	0	0	0		SH
	VTVSP0600/08C20 3383	Waltham	0.17	12/13/2008	12:20	Cloudy	Failure to keep in proper lane, Driving too fast for conditions	Single Vehicle Crash	1	0	0	W	SH
	VTVSP0600/11C20 2989	Waltham	0.34	10/26/2011	21:21	Cloudy	Driving too fast for conditions, Failure to keep in proper lane	Single Vehicle Crash	1	0	0		SH
	VTVSP0600/09C20 2400	Waltham	0.71	09/09/2009	11:03	Clear	No improper driving, Failed to yield right of way	No Turns, Thru moves only, Broadside ^<	0	0	0		SH
	VTVSP0600/10C20 0208	Waltham	0.73	01/24/2010	23:16	Sleet, Hail (Freezing Rain or Drizzle)	Driving too fast for conditions, Under the influence of medication/drugs/alcohol	Single Vehicle Crash	0	0	0	E	SH
	VTVSP0600/09C20 0124	New Haven	3.46	01/15/2009	17:33	Clear	Inattention	Rear End	0	0	0	W	SH
	VTVSP0600/09C20 3211	New Haven	3.46	12/08/2009	16:54	Clear	Inattention	Rear End	0	0	0	W	SH
	VTVSP0600/09C20 0305	New Haven	3.47	02/03/2009	17:49	Cloudy	Distracted, Other improper action	Right Turn and Thru, Angle Broadside -->^- -	0	0	0	E	SH
	VTVSP0600/08C20 1232	New Haven	4.83	05/22/2008	21:56	Clear	No improper driving, Wrong side or wrong way	Head On	0	0	0	E	SH
	VTVSP0600/08C20 1761	New Haven	4.83	07/10/2008	14:30	Clear	Failure to keep in proper lane, No improper driving	Right Turn and Thru, Head On v^--	0	0	0	E	SH
	VTVSP0600/10C20 3412	New Haven	4.83	11/27/2010	16:06	Clear	Operating defective equipment, Inattention, Failed to yield right of way	Left Turn and Thru, Angle Broadside -->v--	0	0	0	E	SH
	VTVSP0600/10C20 0703	New Haven	4.87	03/23/2010	16:10	Rain	Followed too closely, Inattention, No improper driving	Rear End	0	0	0	W	SH
	VTVSP0600/11C20 2179	New Haven	4.98	08/12/2011	10:15	Clear	Inattention, Failure to keep in proper lane	Single Vehicle Crash	0	0	0	W	SH
	VTVSP0600/11C20 2404	New Haven	5.17	08/31/2011	08:00	Clear	Followed too closely, No improper driving	Rear End	0	0	0	E	SH
	VTVSP0600/12C20 0290	New Haven	5.46	02/04/2012	03:00	Cloudy	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	Single Vehicle Crash	0	0	0	E	SH
	VTVSP0600/12C20 1889	New Haven	5.62	06/28/2012	22:21	Clear	Exceeded authorized speed limit, Under the influence of medication/drugs/alcohol	Single Vehicle Crash	1	0	0	W	SH
	VTVSP0600/12C20 2742	New Haven	5.91	09/06/2012	17:30	Clear		Rear End	0	0	0	W	SH
	VTVSP0600/08C20 2956	New Haven	6.25	10/24/2008	13:50	Clear	Failure to keep in proper lane	Single Vehicle Crash	1	0	0	E	SH

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

Appendix K: Level of Service Analysis

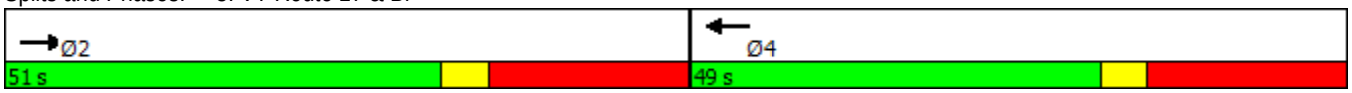


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑			
Traffic Volume (vph)	0	65	55	0	0	0
Future Volume (vph)	0	65	55	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	1570	1570	0	0	0
Flt Permitted						
Satd. Flow (perm)	0	1570	1570	0	0	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)						
Link Speed (mph)		30	30		30	
Link Distance (ft)		440	485		250	
Travel Time (s)		10.0	11.0		5.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	21%	21%	2%	2%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	71	60	0	0	0
Turn Type		NA	NA			
Protected Phases		2	4			
Permitted Phases						
Detector Phase		2	4			
Switch Phase		2	4			
Minimum Initial (s)		4.0	4.0			
Minimum Split (s)		22.5	22.5			
Total Split (s)		51.0	49.0			
Total Split (%)		51.0%	49.0%			
Yellow Time (s)		3.5	3.5			
All-Red Time (s)		15.0	15.0			
Lost Time Adjust (s)		0.0	0.0			
Total Lost Time (s)		18.5	18.5			
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		None	None			
Act Effct Green (s)		9.3	9.1			
Actuated g/C Ratio		0.23	0.23			
v/c Ratio		0.19	0.17			
Control Delay		20.5	20.7			
Queue Delay		0.0	0.0			
Total Delay		20.5	20.7			
LOS		C	C			
Approach Delay		20.5	20.7			
Approach LOS		C	C			
Queue Length 50th (ft)		20	17			
Queue Length 95th (ft)		51	46			
Internal Link Dist (ft)		360	405		170	
Turn Bay Length (ft)						
Base Capacity (vph)		1192	1157			
Starvation Cap Reductn		0	0			
Spillback Cap Reductn		0	0			
Storage Cap Reductn		0	0			

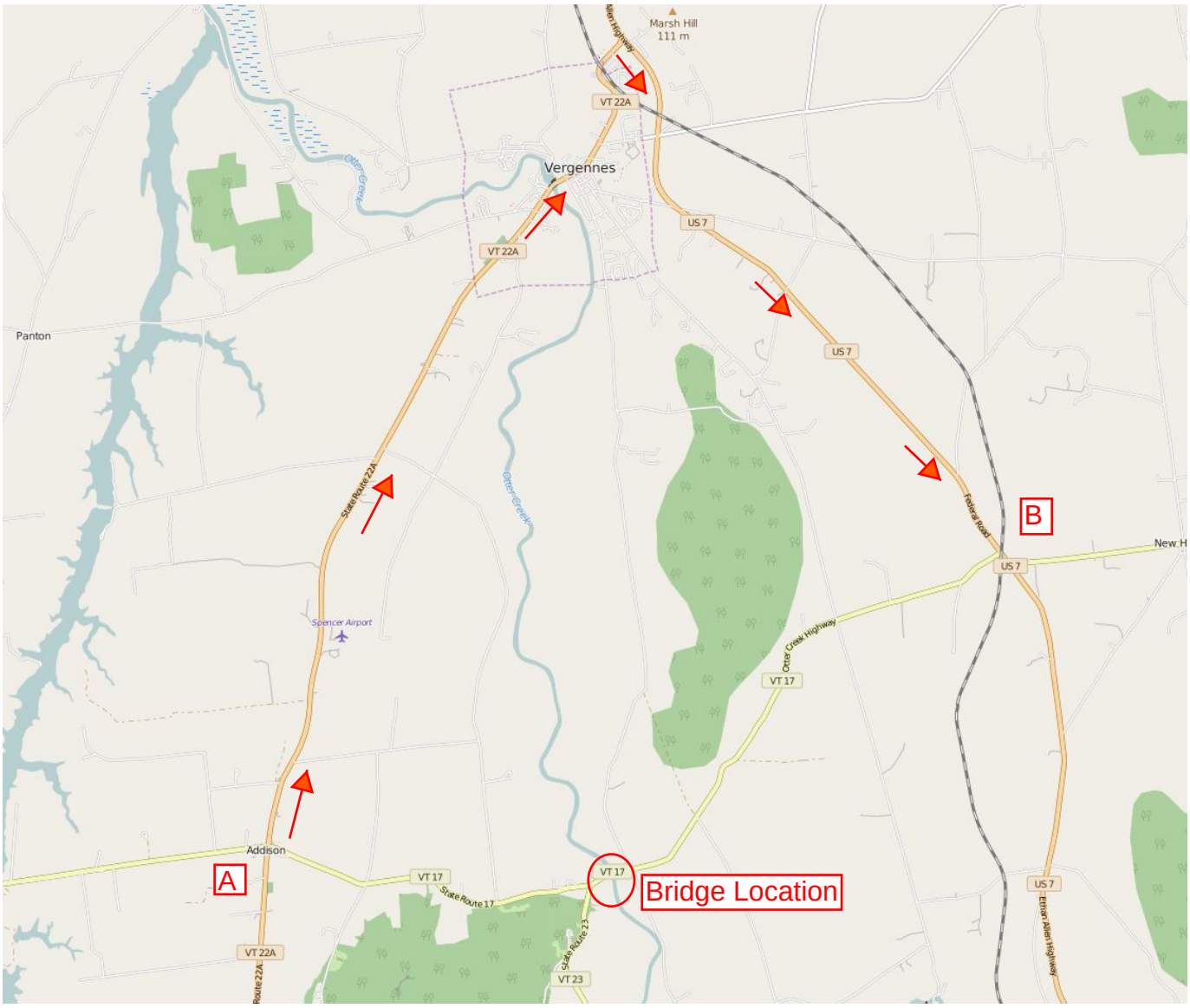
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Reduced v/c Ratio		0.06	0.05			

Intersection Summary			
Area Type:	Other		
Cycle Length: 100			
Actuated Cycle Length: 39.8			
Natural Cycle: 50			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.19			
Intersection Signal Delay: 20.6		Intersection LOS: C	
Intersection Capacity Utilization 18.8%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: VT Route 17 & Br

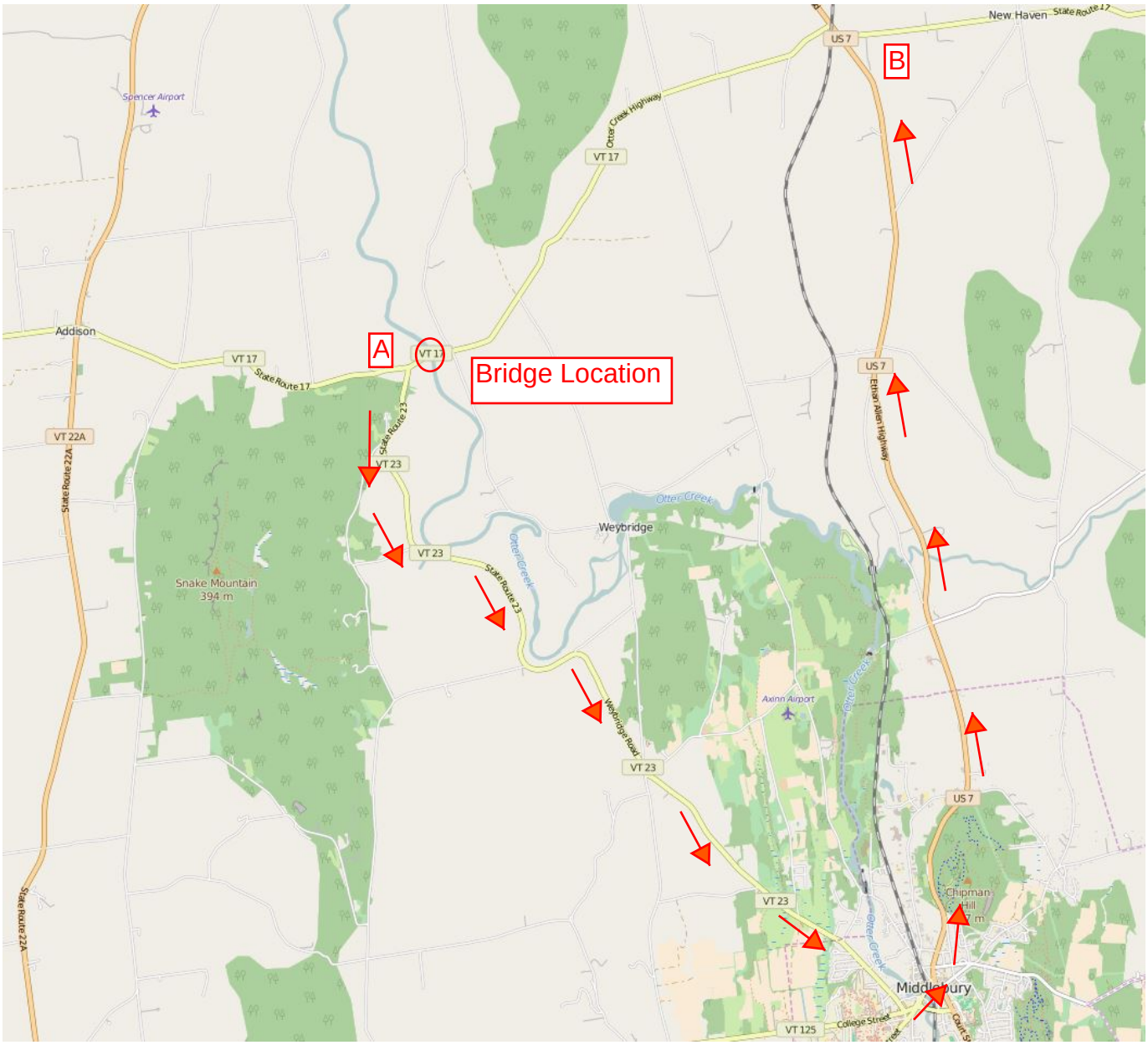


Appendix L: Detour Routes



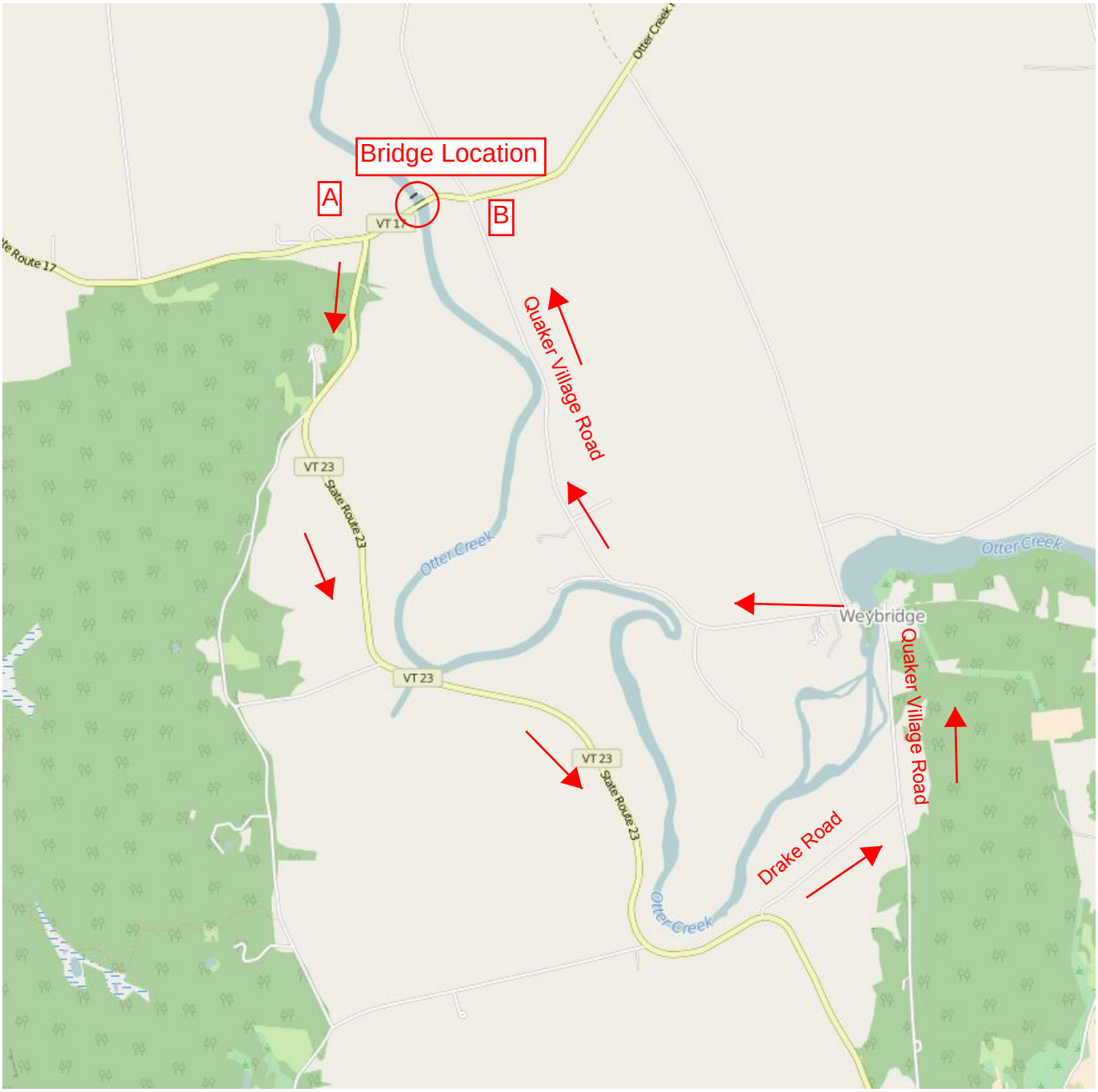
Northern Detour Route
VT Route 22A, to US Route 7, back to VT Route 17

A-B Through Route: 7.3 miles
A-B Detour Route: 12.8 miles
Added Distance: 5.5 miles
End-to-End Distance: 20.1 miles



Southern Detour Route
VT Route 23, to VT Route 30, to US Route 7, back to VT Route 17

A-B Through Route: 4.6 miles
A-B Detour Route: 15.7 miles
Added Distance: 11.1 miles
End-to-End Distance: 20.3 miles



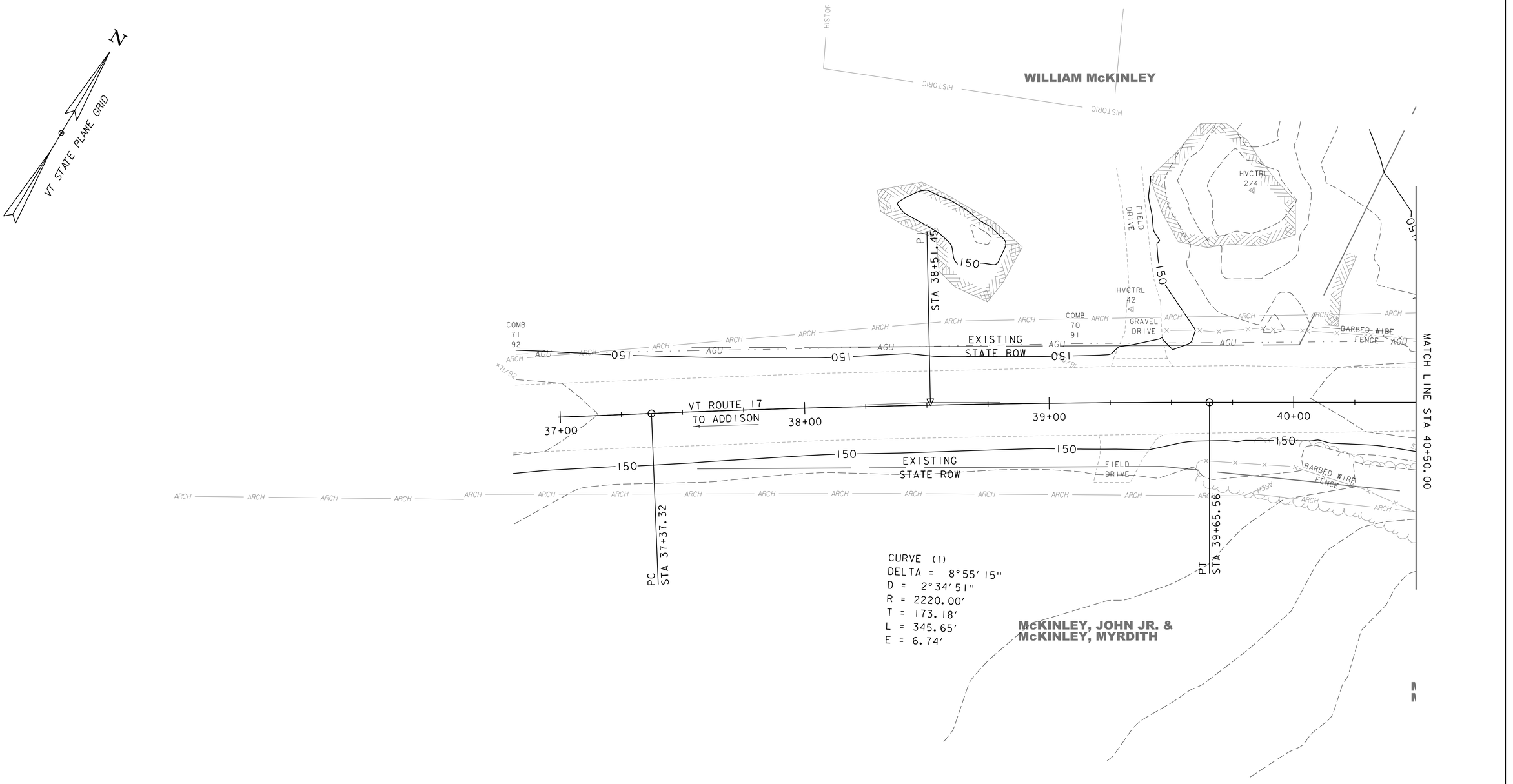
Local Bypass Route
VT Route 23, to Drake Road, to Quaker Village Road, back to VT Route 17

A-B Through Route: 0.4 mile
A-B Detour Route: 6.9 miles
Added Distance: 6.5 miles
End-to-End Distance: 7.3 miles

Appendix M: Plans

INDEX OF SHEETS

SHEET NO.	SHEET DESCRIPTION
1-3	Existing Conditions Layouts
4-5	Existing Conditions Profile
6	Alternatives 1 & 2 Typical Sections
7	Alternatives 1 & 2 Layout
8	Temporary Bridge Typical Section
9-11	Temporary Bridge Layouts
12	Temporary Bridge Profile
13	Alternative 3 Typical Sections
14-16	Alternative 3 Layouts
17	Alternative 3 Phasing Typical Sections
18	Alternative 3 Phase 1 Layout
19	Alternative 3 Phase 2 Layout
20-21	Alternative 3 Profile
22	Alternative 4 Typical Sections
23-25	Alternative 4a & 4b Layouts
26-27	Alternative 4a & 4b Profile
28-30	Alternative 4c Layouts
31-32	Alternative 4c Profile

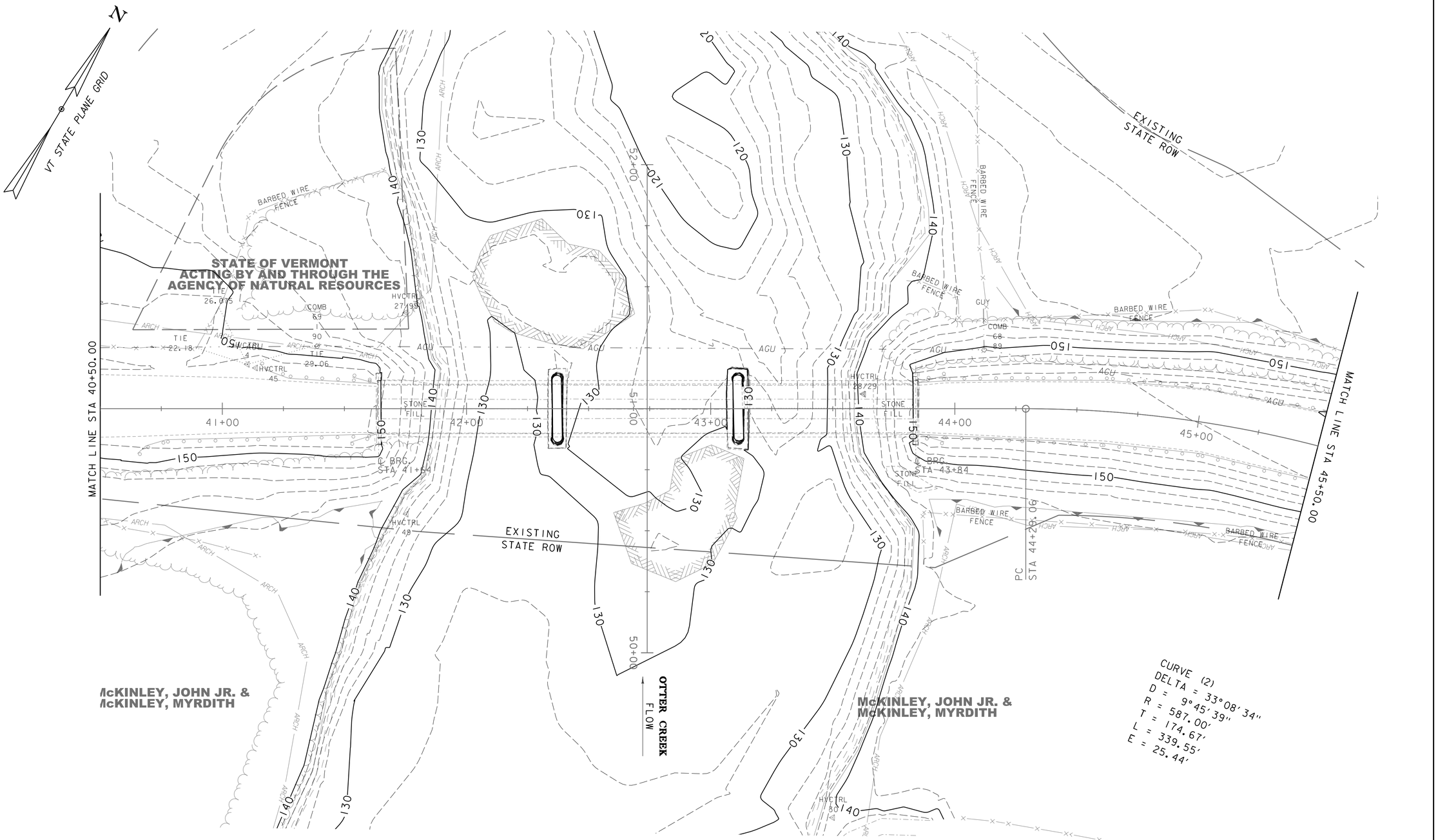


VT ROUTE 17
EXISTING CONDITIONS - LAYOUT 1

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

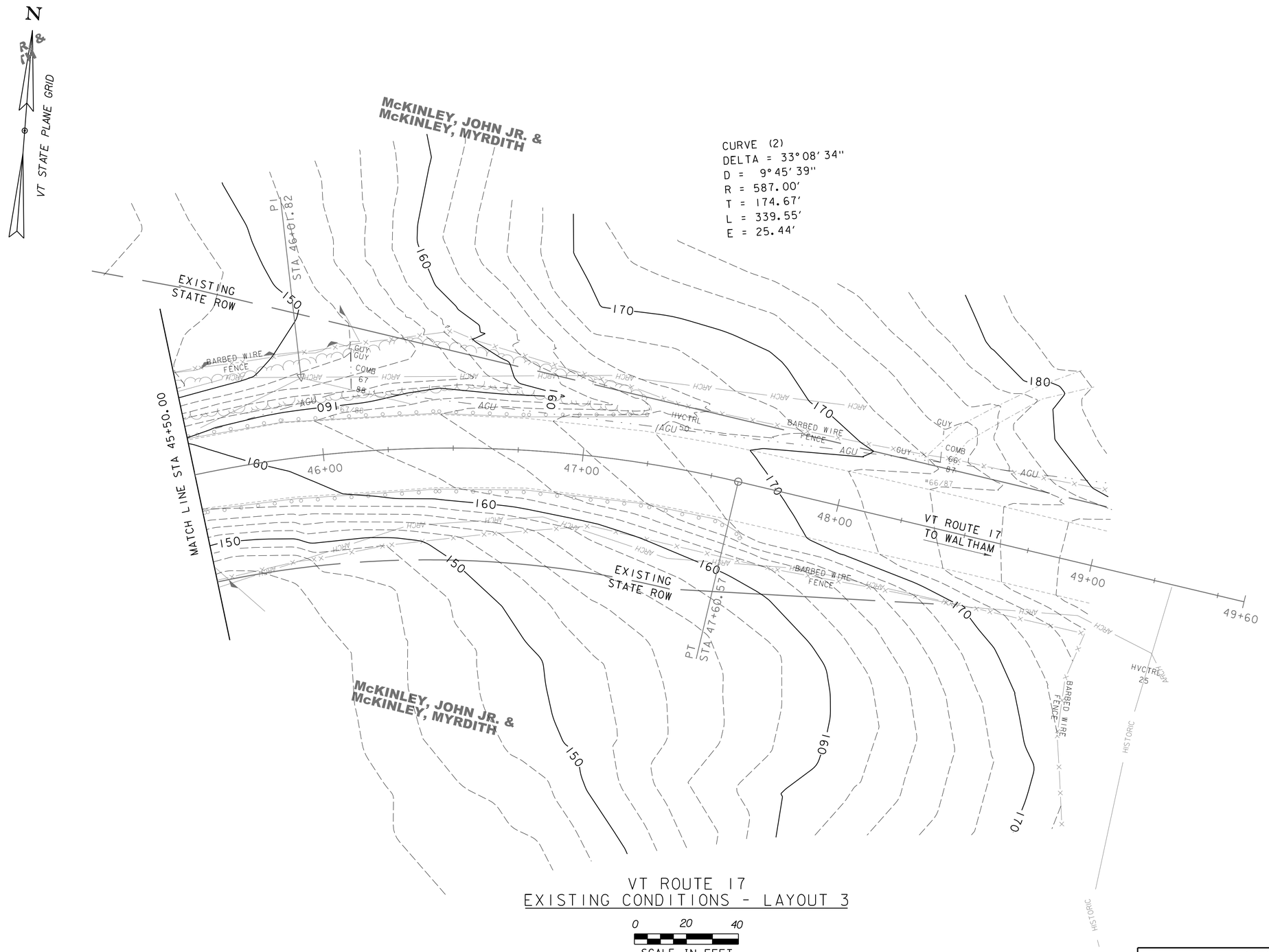
PROJECT NAME: WEYBRIDGE-NEW HAVEN	
PROJECT NUMBER: BF 032-1(19)	
FILE NAME: z12b552bdr.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
EXISTING CONDITIONS - LAYOUT 1	SHEET 1 OF 32



VT ROUTE 17
EXISTING CONDITIONS - LAYOUT 2

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
EXISTING CONDITIONS - LAYOUT 2	SHEET 2 OF 32

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

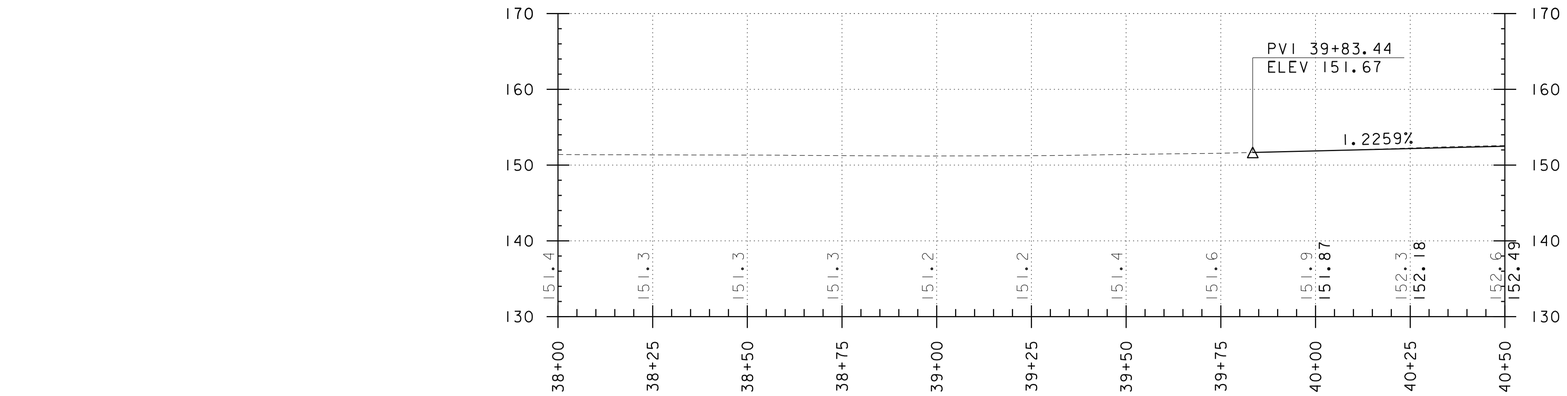


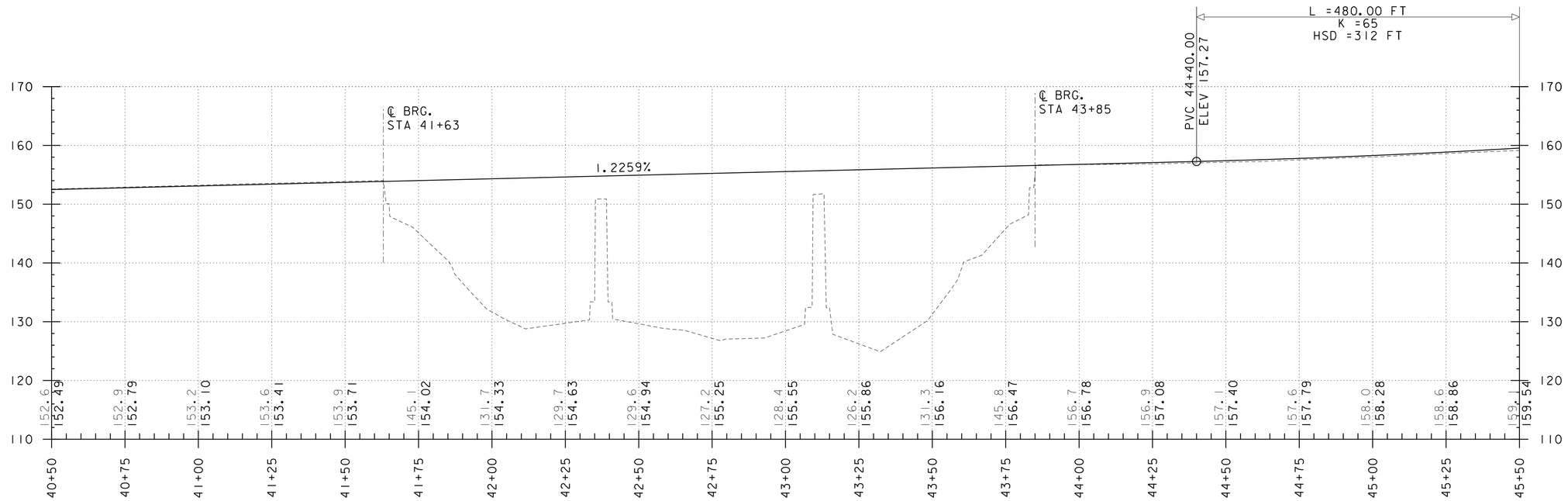
VT ROUTE 17
EXISTING CONDITIONS - LAYOUT 3

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
EXISTING CONDITIONS - LAYOUT 3	SHEET 3 OF 32



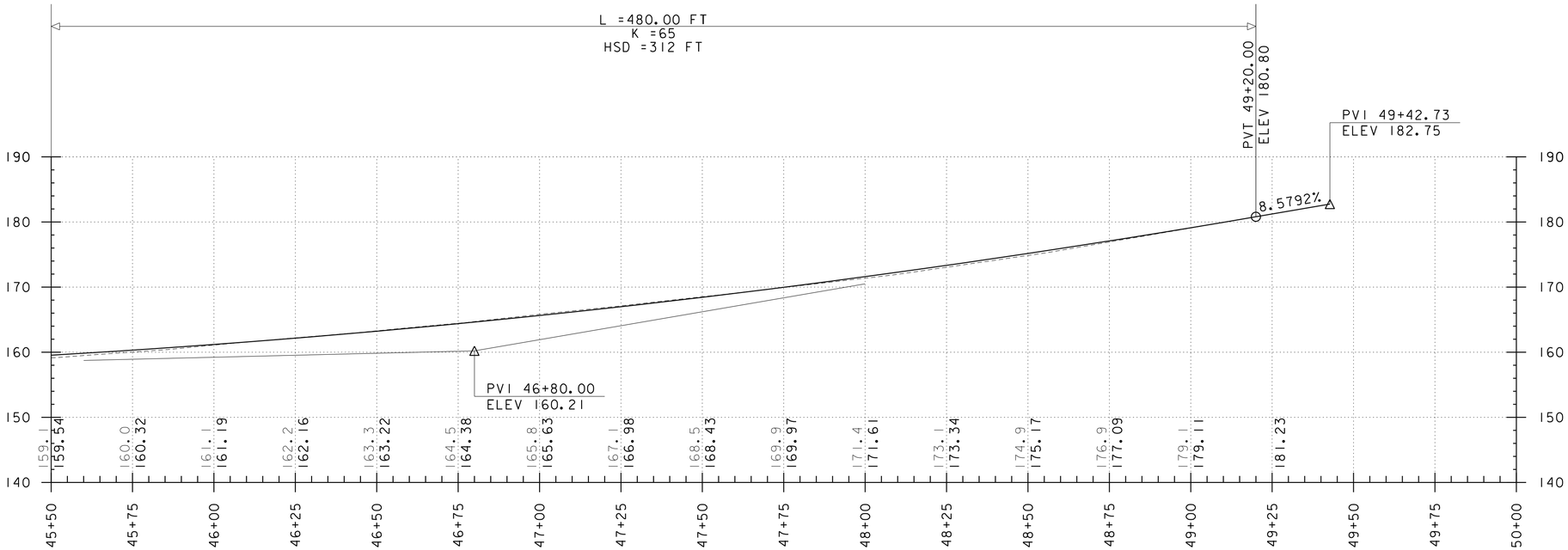


VT ROUTE 17
EXISTING/ALTERNATIVE 1& 2 PROFILE - LAYOUT 1

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

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552xs0 -Existing Profile.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
EXIST/ALTERNATIVE 1&2 PROFILE - LAYOUT 1	SHEET 4 OF 32



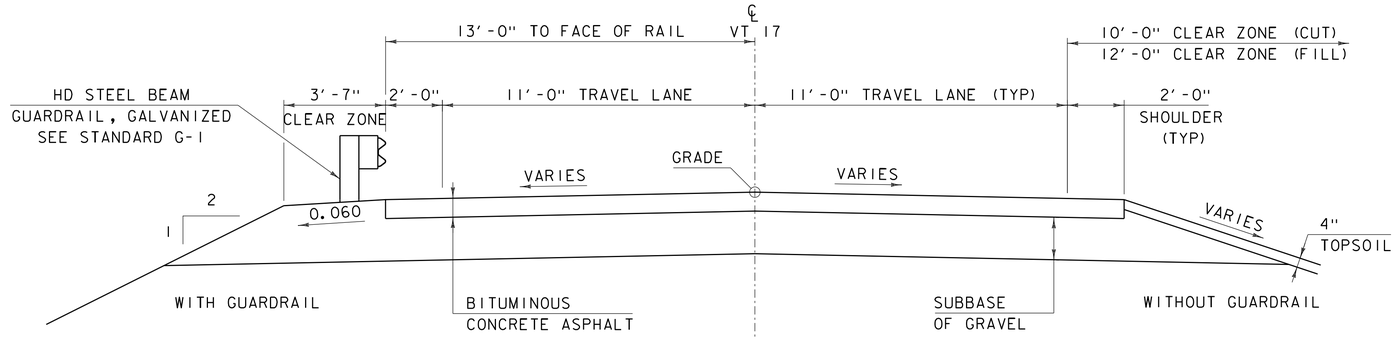
VT ROUTE 17

EXISTING/ALTERNATIVE 1 & 2 PROFILE - LAYOUT 2

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

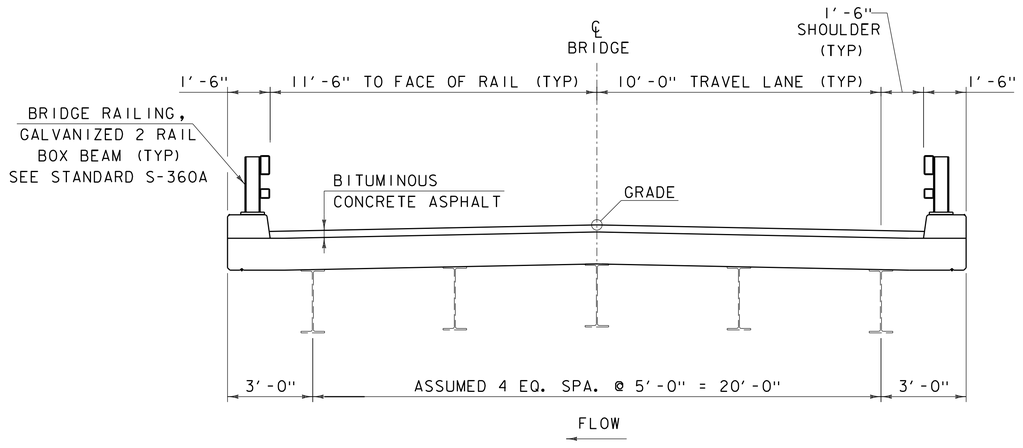
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552xs0 -Existing Profile.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
EXIST/ALTERNATIVE 1&2 PROFILE - LAYOUT 2	SHEET 5 OF 32



ALTERNATIVE 1 & 2 PROPOSED VT ROUTE 17 TYPICAL SECTION

SCALE 3/8" = 1'-0"



ALTERNATIVE 1 & 2 PROPOSED VT ROUTE 17 BRIDGE TYPICAL SECTION

SCALE 3/8" = 1'-0"

MATERIAL TOLERANCES

(IF USED ON PROJECT)

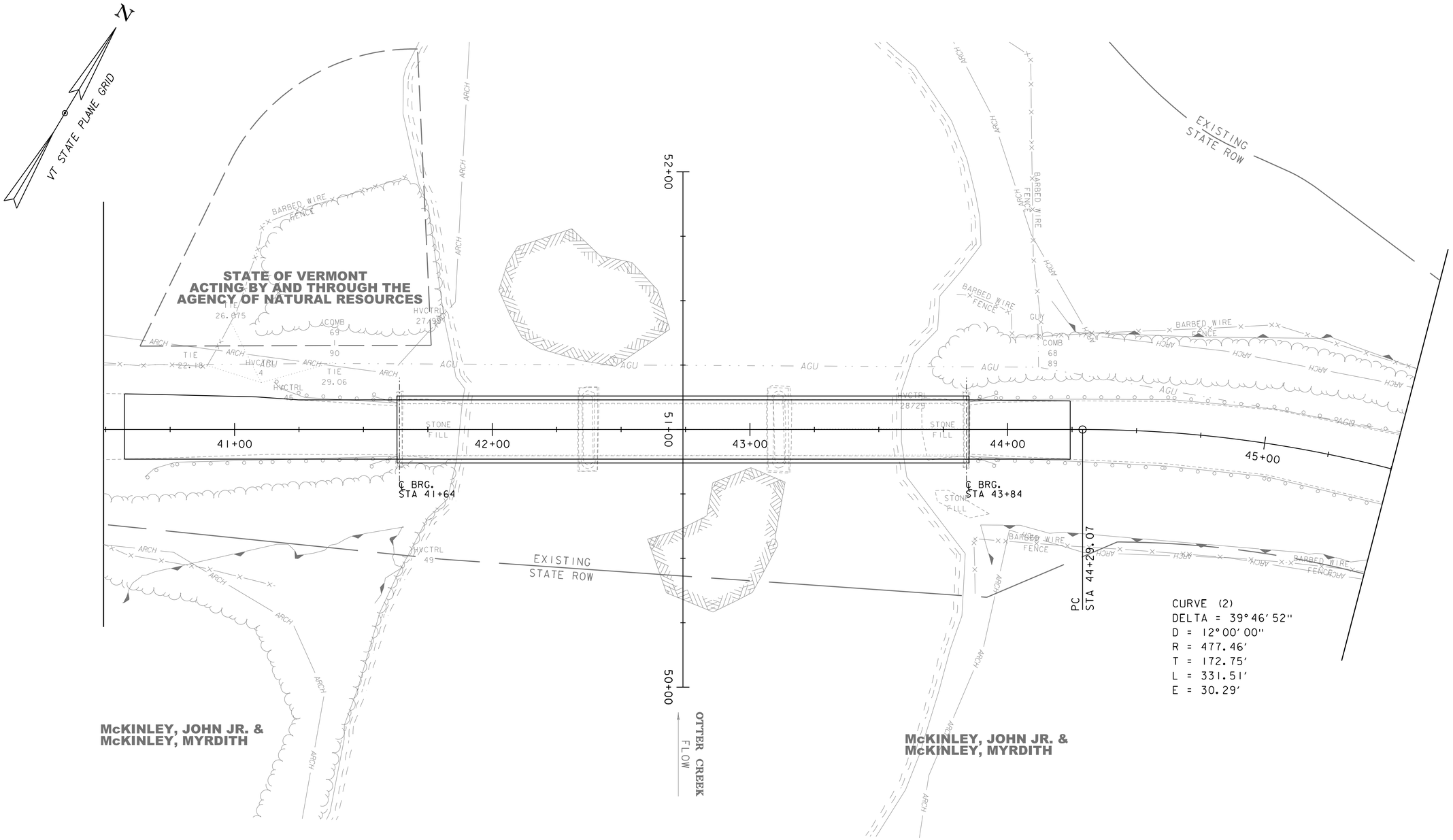
SURFACE	
- PAVEMENT (TOTAL THICKNESS)	+/- 1/4"
- AGGREGATE SURFACE COURSE	+/- 1/2"
SUBBASE	+/- 1"
SAND BORROW	+/- 1"

PROJECT NAME: WEYBRIDGE-NEW HAVEN
PROJECT NUMBER: BF 032-1(19)

FILE NAME: z12b552Typical.dgn
PROJECT LEADER: M. CRUZ
DESIGNED BY: D. TALCOFF
ALTERNATIVE 1& 2 TYPICAL SECTIONS

PLOT DATE: 4/5/2016
DRAWN BY: I. KHALID
CHECKED BY: E. ATKINS
SHEET 6 OF 32

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS



NOTE:

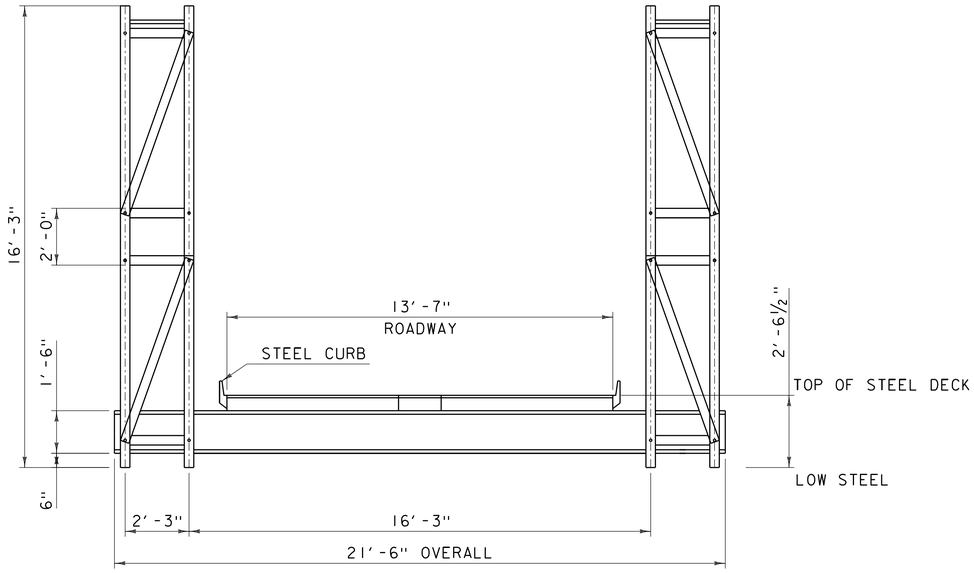
FOR TEMPORARY BRIDGE LAYOUT AND OFFSET SEE SHEET NOS. 8 THROUGH 11.

VT ROUTE 17
ALTERNATIVE 1 & 2 - LAYOUT

0 20 40
SCALE IN FEET

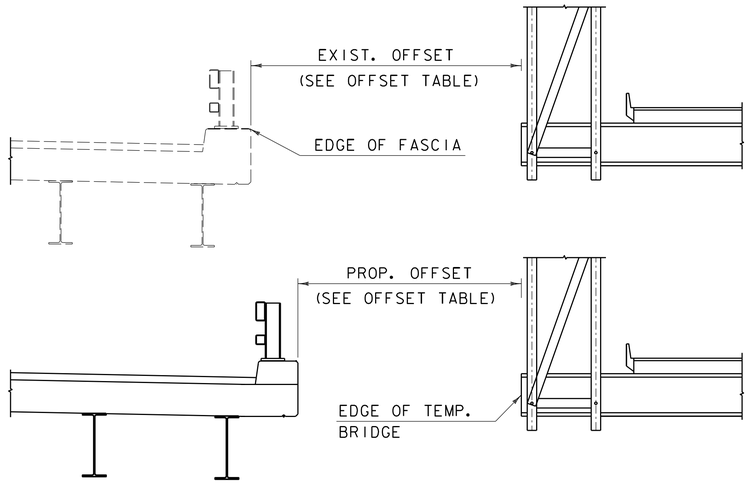
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME: WEYBRIDGE-NEW HAVEN	
PROJECT NUMBER: BF 032-1(19)	
FILE NAME: z12b552bdr - Alt 1&2.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 1& 2 LAYOUT	SHEET 7 OF 32



ONE WAY TEMPORARY BRIDGE TYPICAL SECTION

SCALE ⅜" = 1'-0"



TEMPORARY BRIDGE LAYOUT OFFSET

SCALE ⅜" = 1'-0"

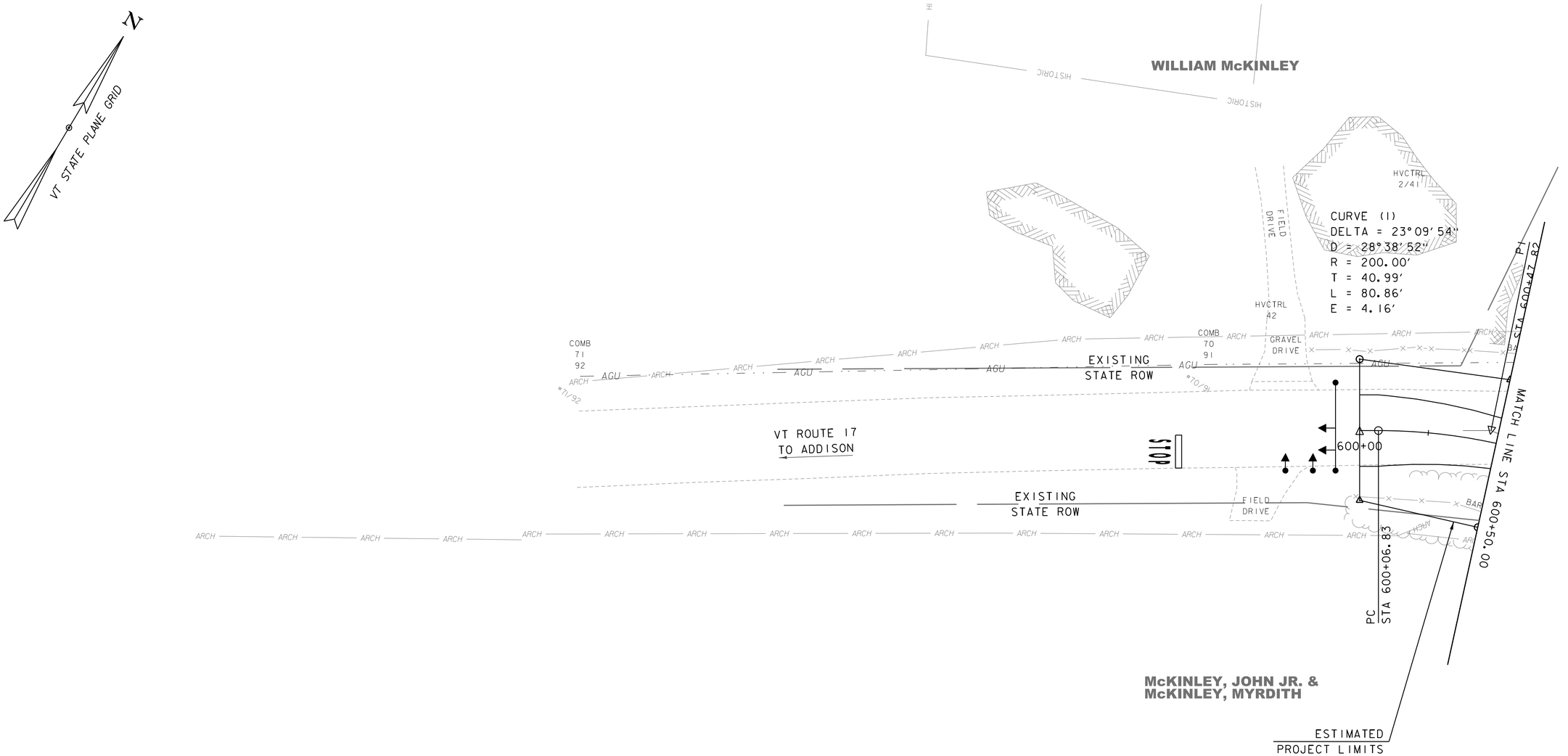
TEMPORARY BRIDGE OFFSET TABLE		
BRIDGE ALTERNATIVES	EXIST. SECTION OFFSET	PROP. SECTION OFFSET
ALTERNATIVES 1 & 2	8'-0"	9'-4"
ALTERNATIVE 3	17'-0"	23'-0"
ALTERNATIVE 4	10'-0"	15'-0"

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME: WEYBRIDGE-NEW HAVEN
PROJECT NUMBER: BF 032-1(19)

FILE NAME: z12b552Typical.dgn
PROJECT LEADER: M. CRUZ
DESIGNED BY: T. CARD
TEMPORARY BRIDGE TYPICAL SECTION

PLOT DATE: 4/5/2016
DRAWN BY: S. BIBINSKI
CHECKED BY: T. CARD
SHEET 8 OF 32

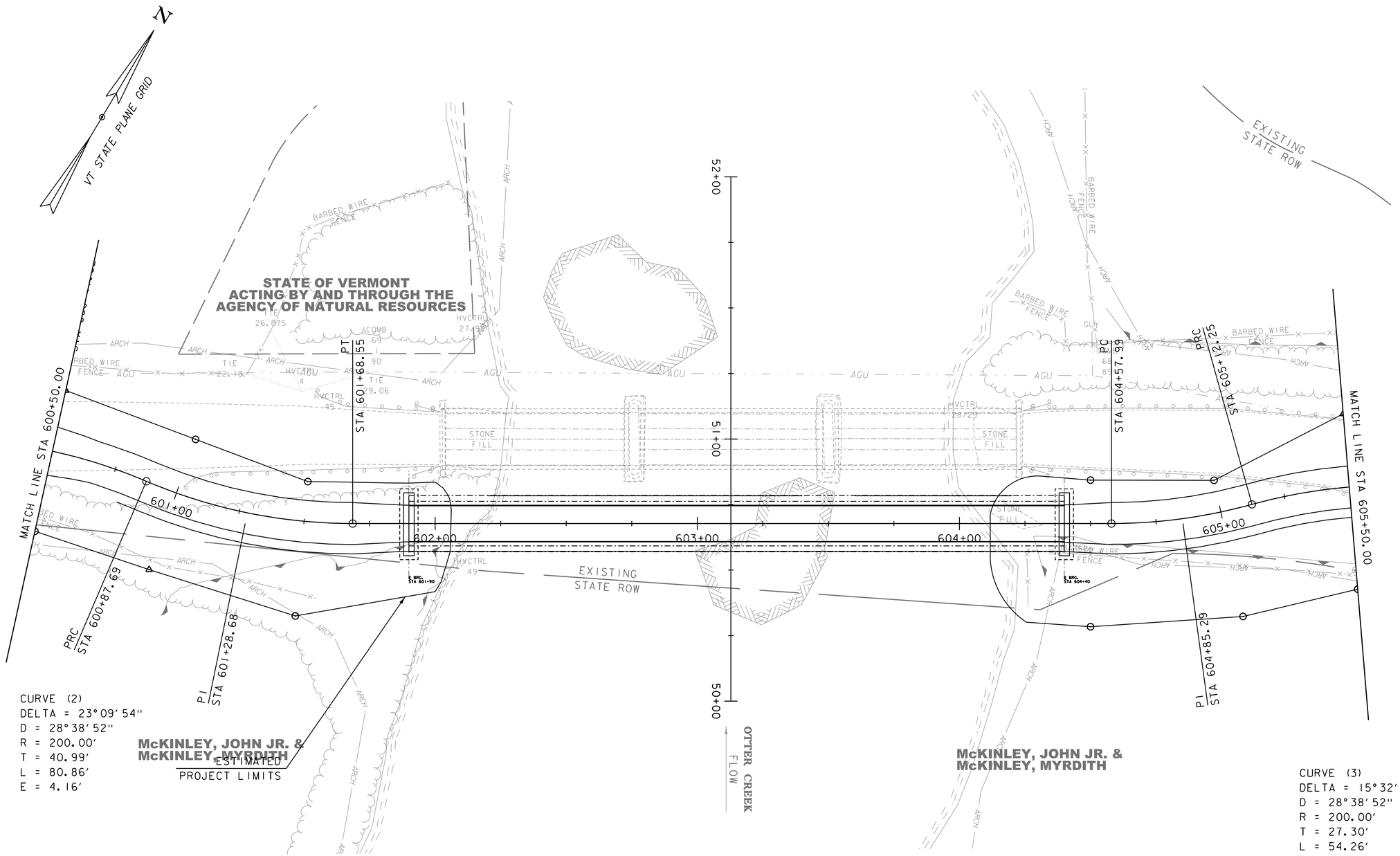


VT ROUTE 17
TEMPORARY BRIDGE - LAYOUT 1

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr - Temp Bridge.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
TEMPORARY BRIDGE - LAYOUT 1	SHEET 9 OF 32



CURVE (2)
DELTA = 23°09′54″
D = 28°38′52″
R = 200.00′
T = 40.99′
L = 80.86′
E = 4.16′

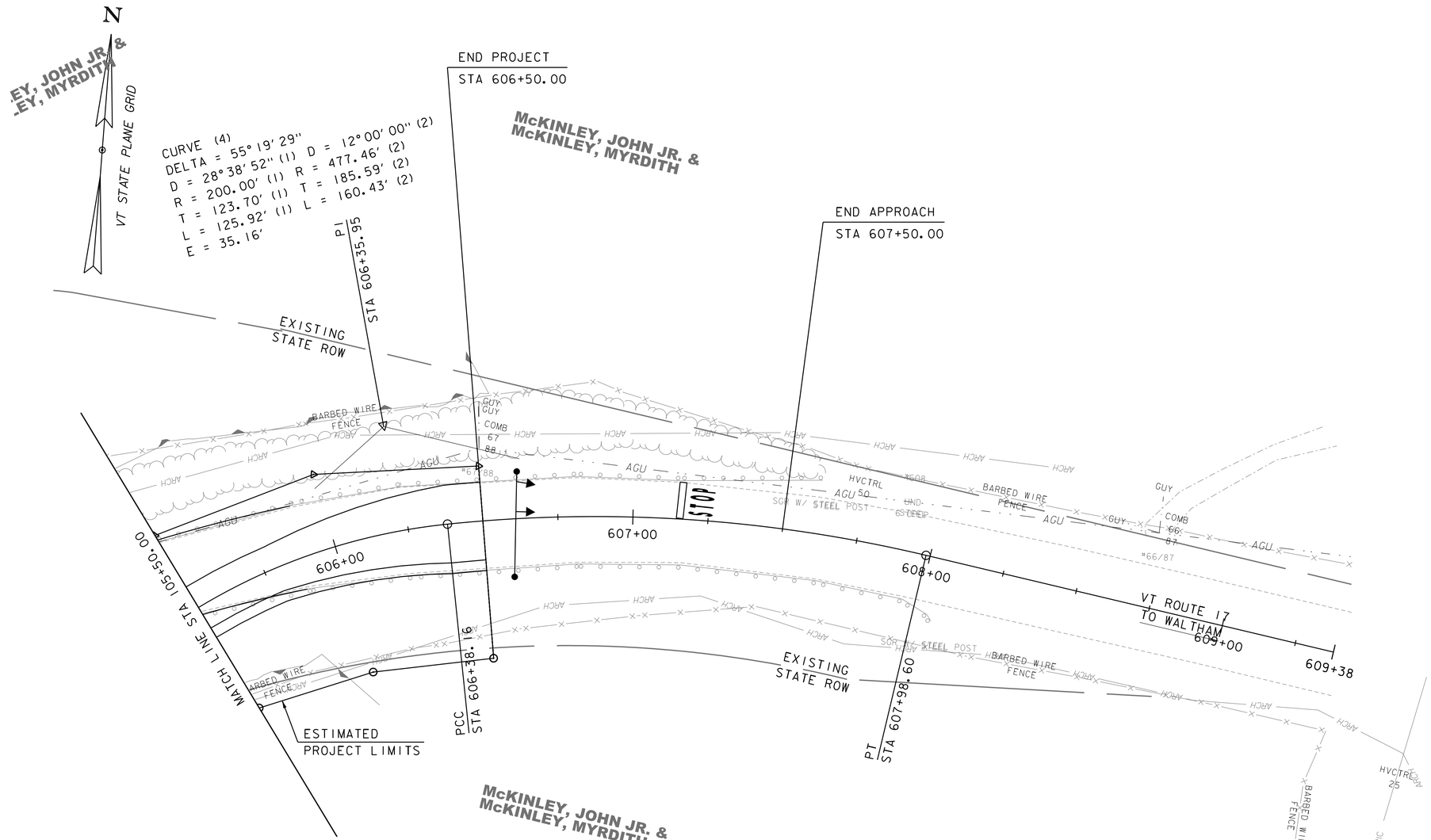
CURVE (3)
DELTA = 15°32′36″
D = 28°38′52″
R = 200.00′
T = 27.30′
L = 54.26′
E = 1.85′

VT ROUTE 17
TEMPORARY BRIDGE - LAYOUT 2

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr - Temp Bridge.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
TEMPORARY BRIDGE - LAYOUT 2	SHEET 10 OF 32

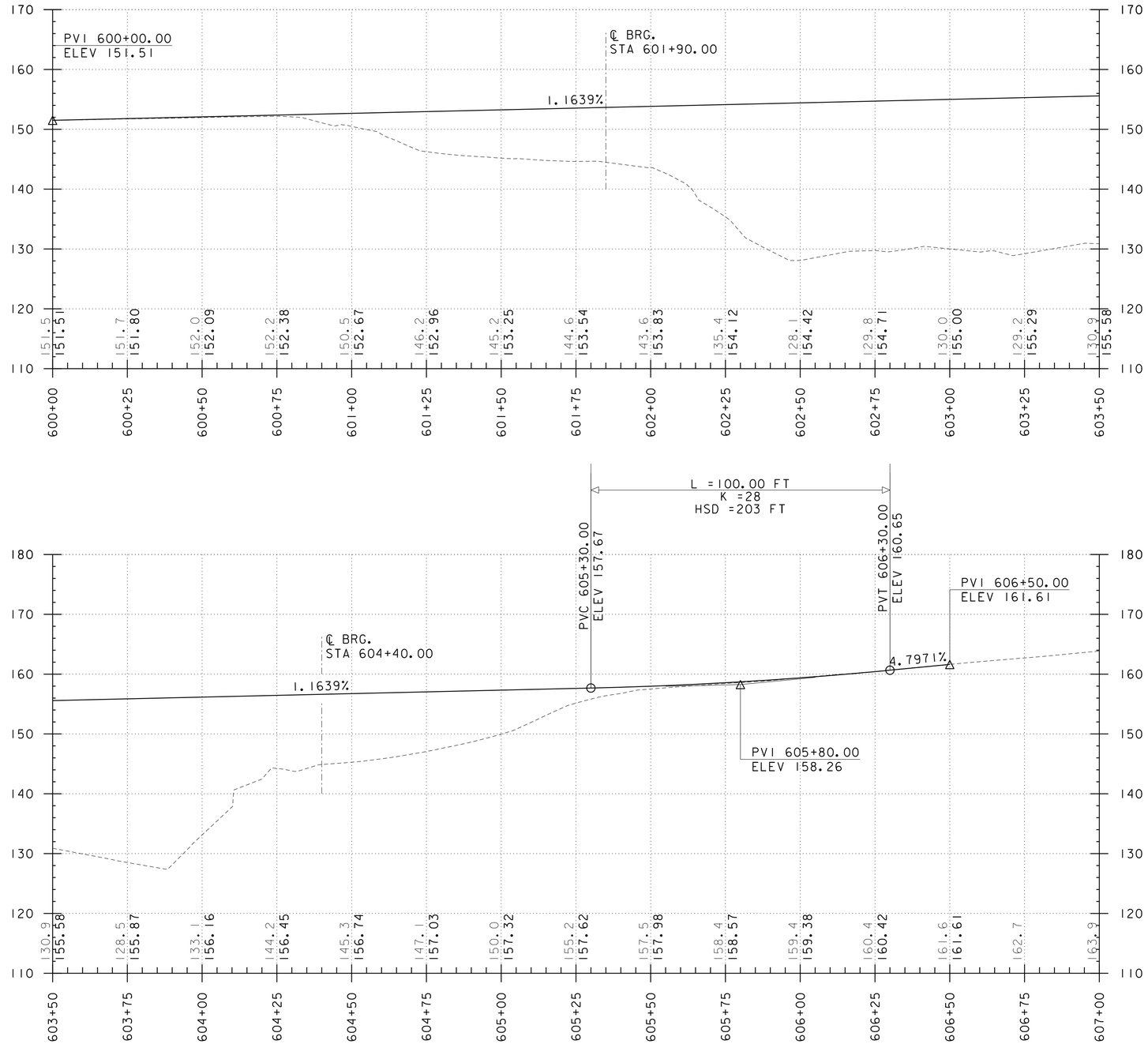


VT ROUTE 17
TEMPORARY BRIDGE - LAYOUT 3

0 20 40
SCALE IN FEET

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr - Temp Bridge.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
TEMPORARY BRIDGE - LAYOUT 3	SHEET 11 OF 32

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

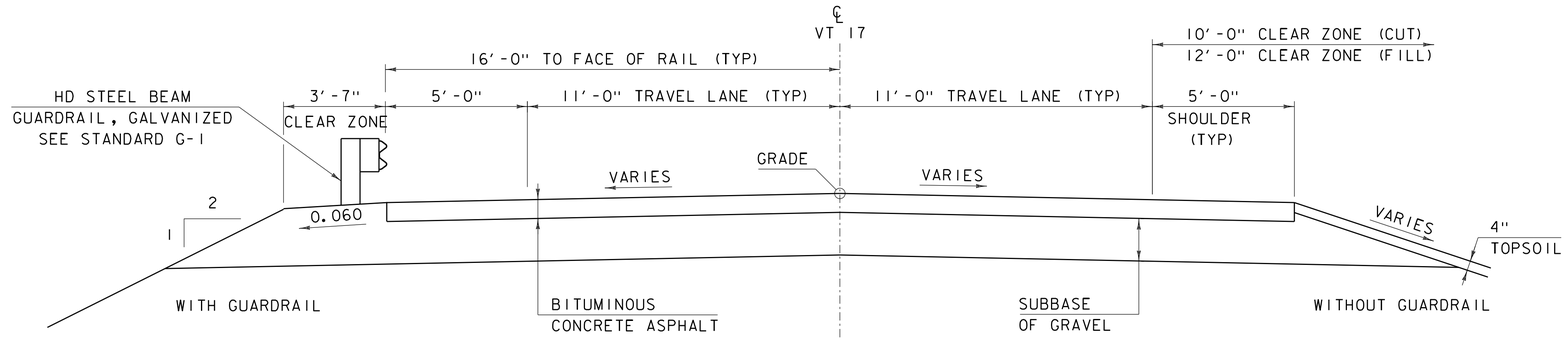


TEMPORARY BRIDGE PROFILE

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

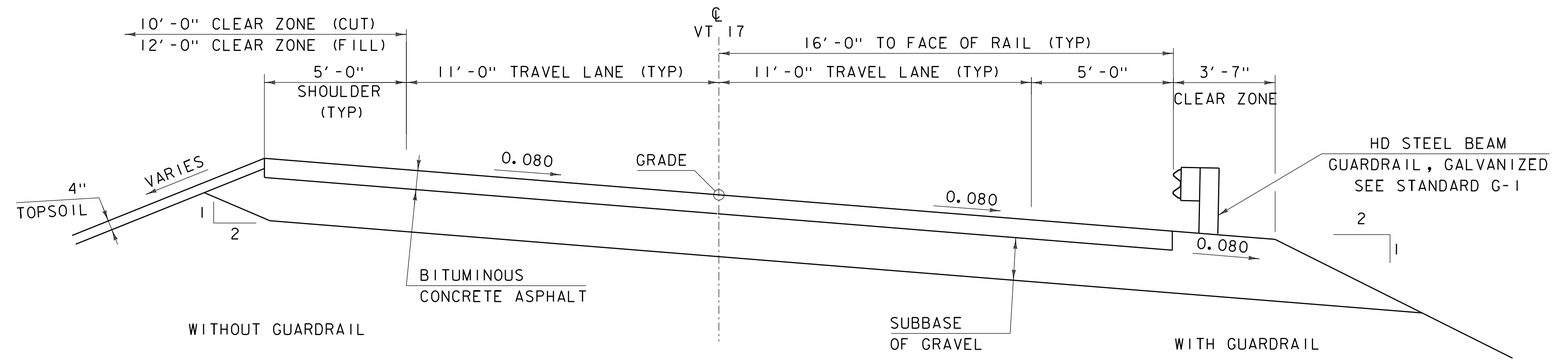
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552xs6 -Temp Bridge.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
TEMPORARY BRIDGE PROFILE	SHEET 12 OF 32



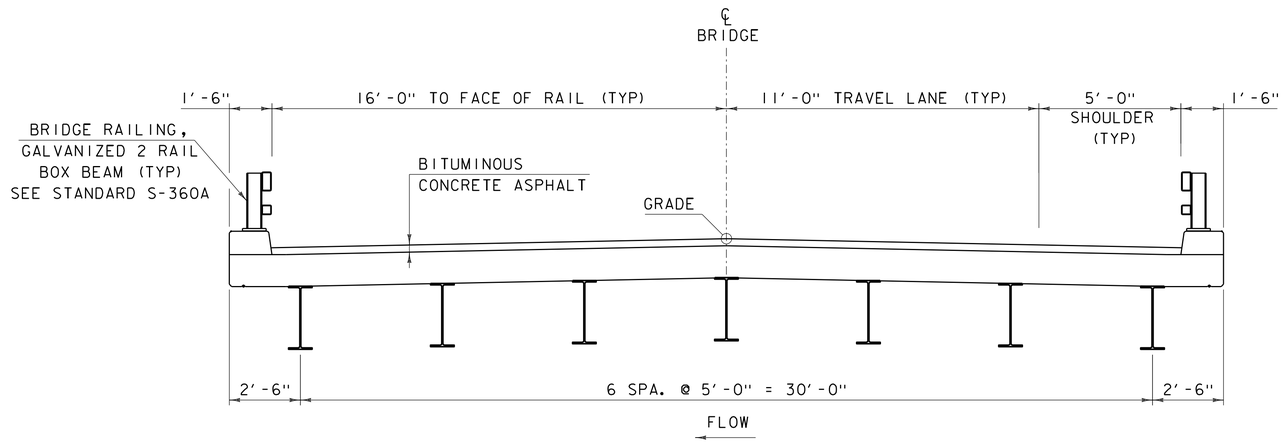
ALTERNATIVE 3 PROPOSED VT ROUTE 17 TYPICAL SECTION

SCALE 3/8" = 1'-0"



ALTERNATIVE 3 PROPOSED VT ROUTE 17 TYPICAL SECTION

SCALE 3/8" = 1'-0"



ALTERNATIVE 3 PROPOSED VT ROUTE 17 BRIDGE TYPICAL SECTION

SCALE 3/8" = 1'-0"

MATERIAL TOLERANCES

(IF USED ON PROJECT)

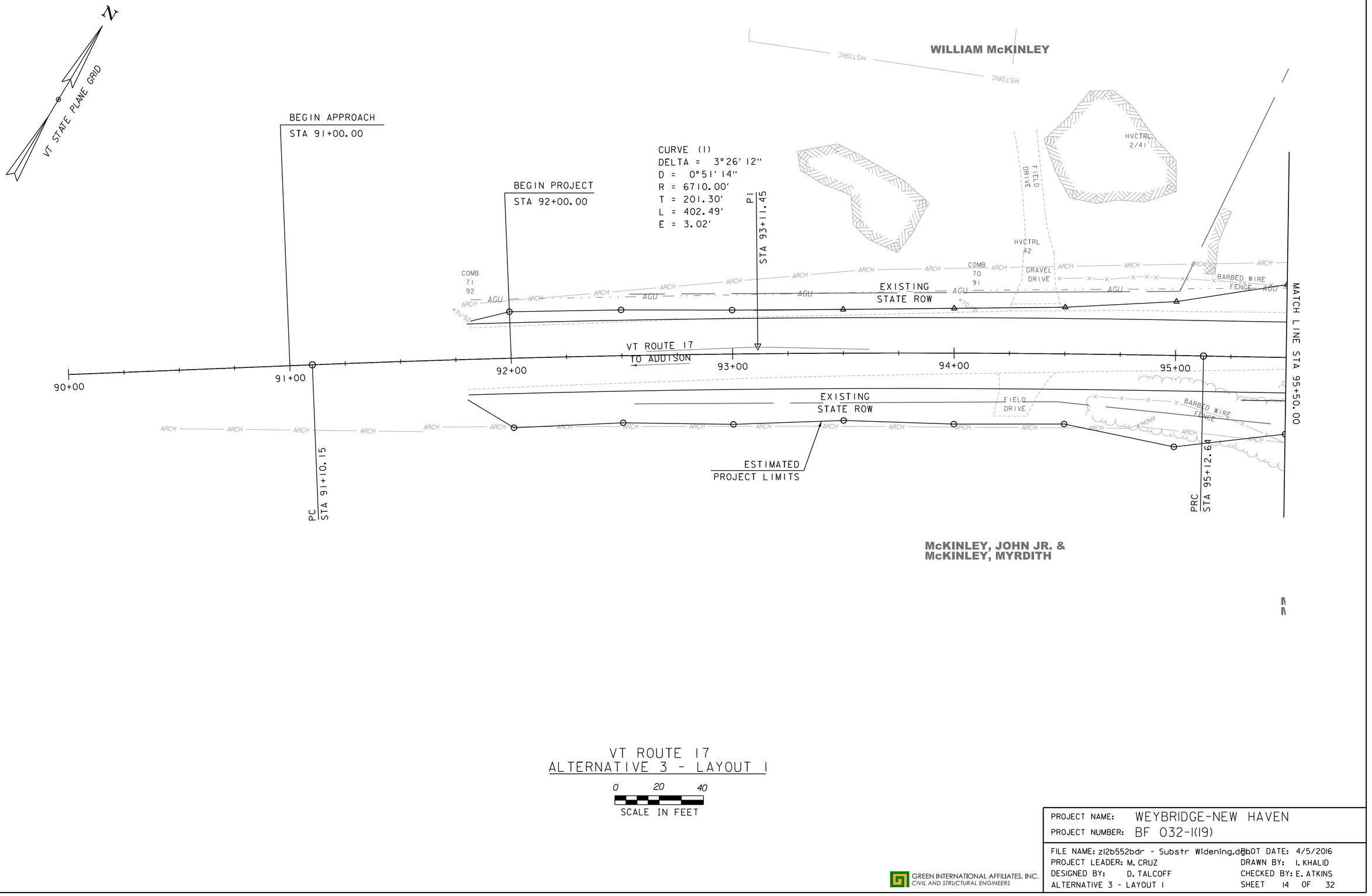
SURFACE	
- PAVEMENT (TOTAL THICKNESS)	+/- 1/4"
- AGGREGATE SURFACE COURSE	+/- 1/2"
SUBBASE	+/- 1"
SAND BORROW	+/- 1"

PROJECT NAME: WEYBRIDGE-NEW HAVEN
PROJECT NUMBER: BF 032-1(19)

FILE NAME: z12b552Typical.dgn
PROJECT LEADER: M. CRUZ
DESIGNED BY: D. TALCOFF
ALTERNATIVE 3 TYPICAL SECTIONS

PLOT DATE: 4/5/2016
DRAWN BY: I. KHALID
CHECKED BY: E. ATKINS
SHEET 13 OF 32

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS



VT ROUTE 17
ALTERNATIVE 3 - LAYOUT 1

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr - Substr Widening.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 3 - LAYOUT 1	SHEET 14 OF 32

N

VT STATE PLANE GRID

STATE OF VERMONT
ACTING BY AND THROUGH THE
AGENCY OF NATURAL RESOURCES

McKINLEY, JOHN JR. &
McKINLEY, MYRDITH

McKINLEY, JOHN JR. &
McKINLEY, MYRDITH

MATCH LINE STA 98+50.00

MATCH LINE STA 100+50.00

PI STA 95+80.23

PC STA 98+96.35

℄ BRG.
STA 96+63.6

℄ BRG.
STA 98+83.6

EXISTING STATE ROW

EXISTING STATE ROW

ESTIMATED PROJECT LIMITS

OTTER CREEK FLOW

52+00

51+00

50+00

96+00

97+00

98+00

99+00

100+00

CURVE (4)
DELTA = 39° 46′ 52″
D = 9° 42′ 40″
R = 590.00′
T = 213.47′
L = 409.64′
E = 37.43′

VT ROUTE 17
ALTERNATIVE 3 - LAYOUT 2

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME: WEYBRIDGE-NEW HAVEN	
PROJECT NUMBER: BF 032-1(19)	
FILE NAME: z12b552bdr - Substr Widening.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 3 - LAYOUT 2	SHEET 15 OF 32

N

VT STATE PLANE GRID

JOHN JR. & WYRDITH

McKINLEY, JOHN JR. &
McKINLEY, MYRDITH

CURVE (4)
DELTA = 39° 46' 52"
D = 9° 42' 40"
R = 590.00'
T = 213.47'
L = 409.64'
E = 37.43'

PI
STA 101+09.82

EXISTING
STATE ROW

BARBED WIRE
FENCE

GUY
GUY

COMB
67
88

ARCH

AGU

#67/88

HVCTRL
#66B

AGU 50

SGR W/ STEEL POST

UND.
65 CLEAR

BARBED WIRE
FENCE

AGU

GUY

COMB
66
87

#66/87

END PROJECT
STA 103+50.00

END APPROACH
STA 104+50.00

MATCH LINE STA 105+50.00

101+00

102+00

103+00

104+00

104+54

VT ROUTE 17
TO WALTHAM

EXISTING
STATE ROW

SGR W/ STEEL POST

BARBED WIRE
FENCE

PT
STA 103+06.00

ESTIMATED
PROJECT LIMITS

HVCTRL
25

BARBED WIRE
FENCE

HISTORIC

McKINLEY, JOHN JR. &
McKINLEY, MYRDITH

VT ROUTE 17
ALTERNATIVE 3 - LAYOUT 3

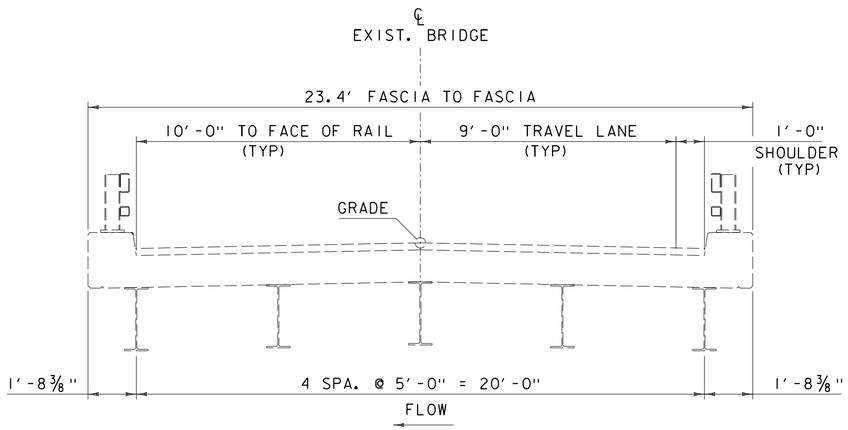
0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME: WEYBRIDGE-NEW HAVEN
PROJECT NUMBER: BF 032-1(19)

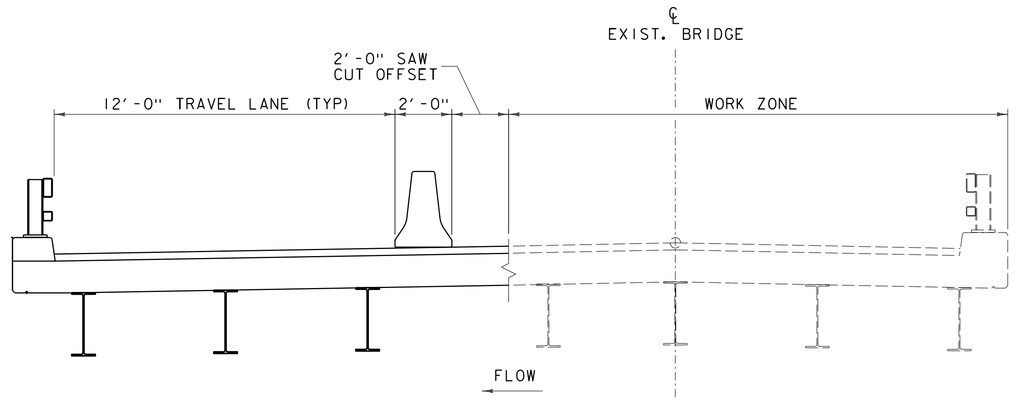
FILE NAME: z12b552bdr - Substr Widening.dgn
PROJECT LEADER: M. CRUZ
DESIGNED BY: D. TALCOFF
ALTERNATIVE 3 - LAYOUT 3

PLOT DATE: 4/5/2016
DRAWN BY: I. KHALID
CHECKED BY: E. ATKINS
SHEET 16 OF 32



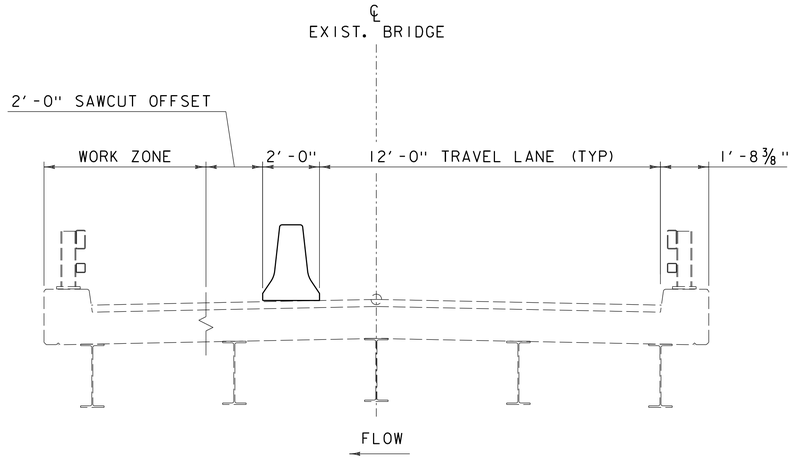
EXISTING BRIDGE TYPICAL SECTION

SCALE 3/8" = 1'-0"



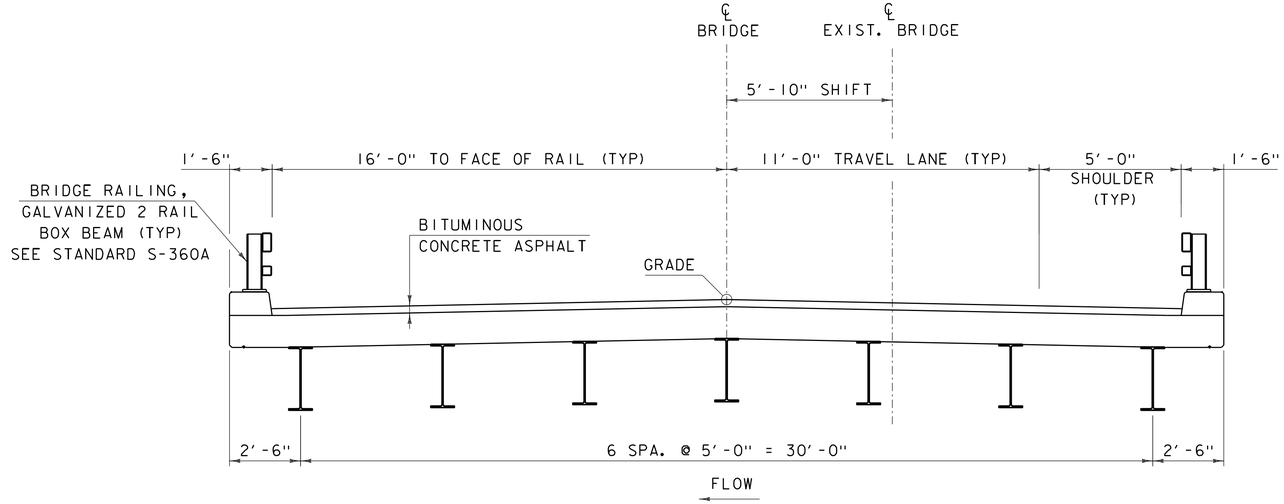
ALTERNATIVE 3 PHASE 2 TYPICAL SECTION

SCALE 3/8" = 1'-0"



ALTERNATIVE 3 PHASE 1 TYPICAL SECTION

SCALE 3/8" = 1'-0"



ALTERNATIVE 3 BRIDGE TYPICAL SECTION

SCALE 3/8" = 1'-0"

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552Typical.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: S. BIBINSKI
DESIGNED BY: T. CARD	CHECKED BY: T. CARD
ALTERNATIVE 3 PHASING TYPICAL SECTIONS	SHEET 17 OF 32

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

McKINLEY, MYRD

N

VT STATE PLANE GRID

HVCTRL 24

STATE OF VERMONT
ACTING BY AND THROUGH THE
AGENCY OF NATURAL RESOURCES

BARBED WIRE FENCE

ARCH

TIE 26.875

COMB 69 90

TIE 22.18

HVCABLE 4

TIE 29.06

HVCTRL 45

AGU

STONE

STOP

HVCTRL 27

HVCTRL 49

EXISTING STATE ROW

McKINLEY, JOHN JR. &
McKINLEY, MYRDITH

OTTER CREEK
FLOW

HVCTRL 28

GUY

COMB 68 89

STONE FILL

HVCTRL 30

McKINLEY, JOHN JR. &
McKINLEY, MYRDITH

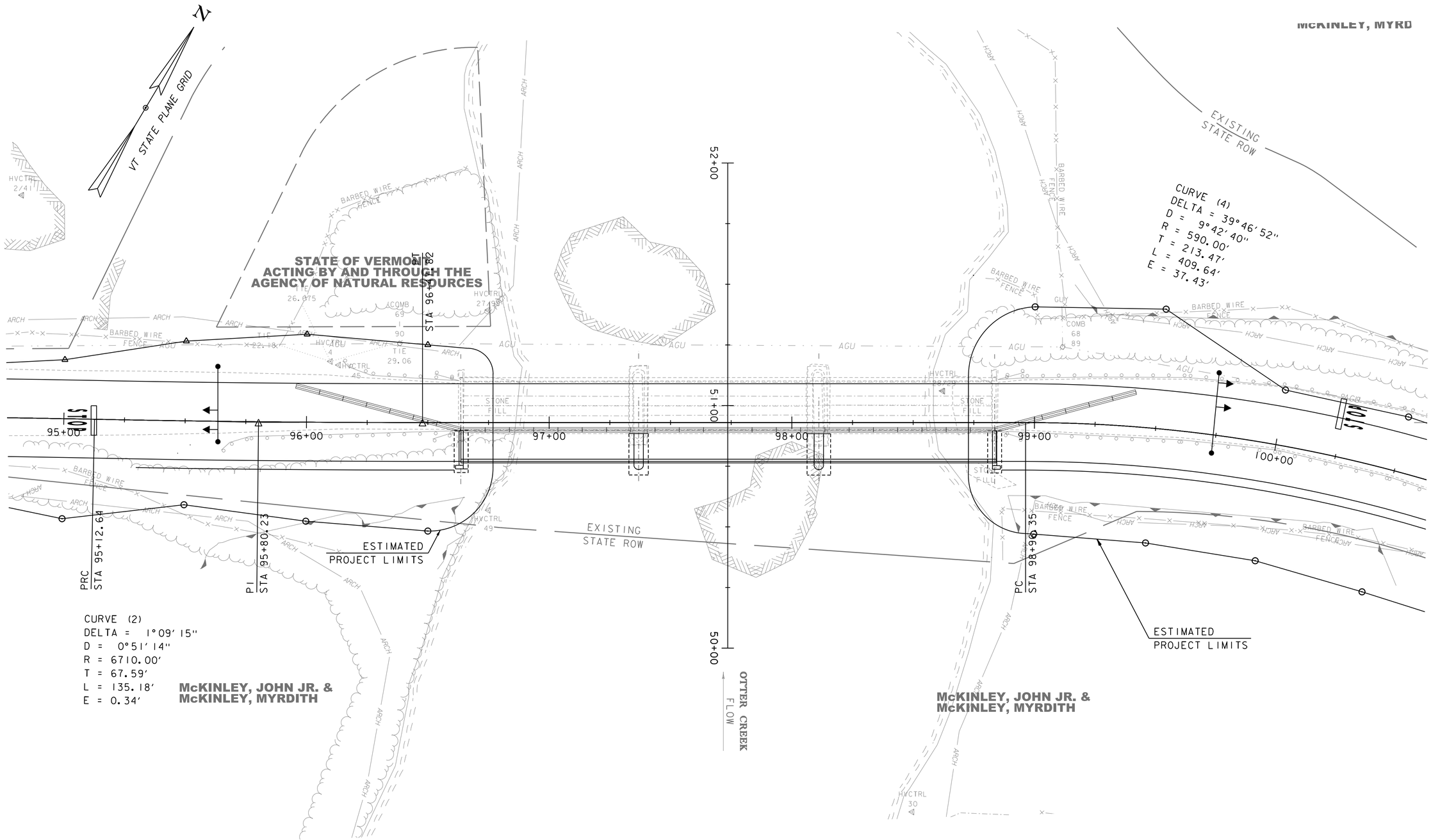
VT ROUTE 17
ALTERNATIVE 3 PHASE 1

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME: WEYBRIDGE-NEW HAVEN
PROJECT NUMBER: BF 032-1(19)

FILE NAME: z12b552bdr - Substr Widening PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF CHECKED BY: E. ATKINS
ALTERNATIVE 3 PHASE 1 SHEET 18 OF 32

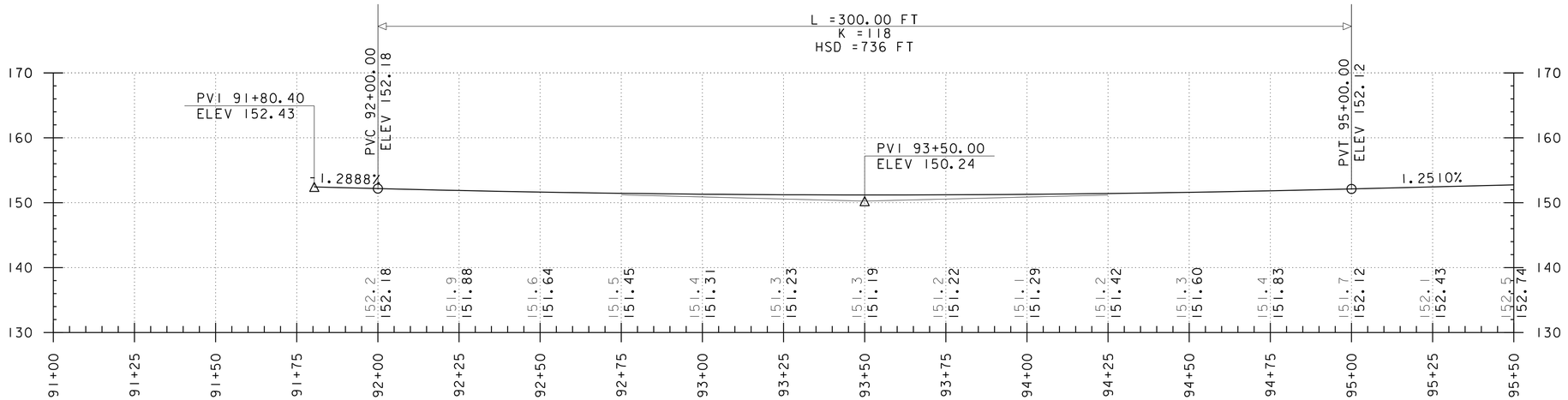


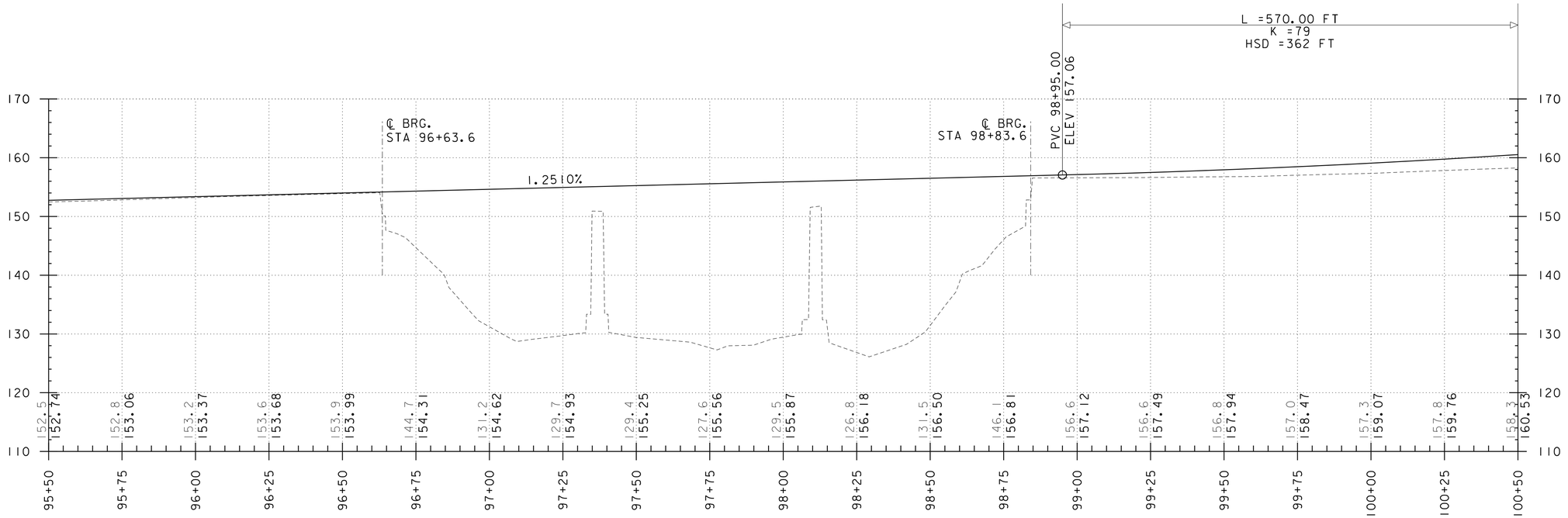
VT ROUTE 17
ALTERNATIVE 3 PHASE 2

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr - Substr Widening Phasing.dgn	PLOTTED: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 3 PHASE 2	SHEET 19 OF 32



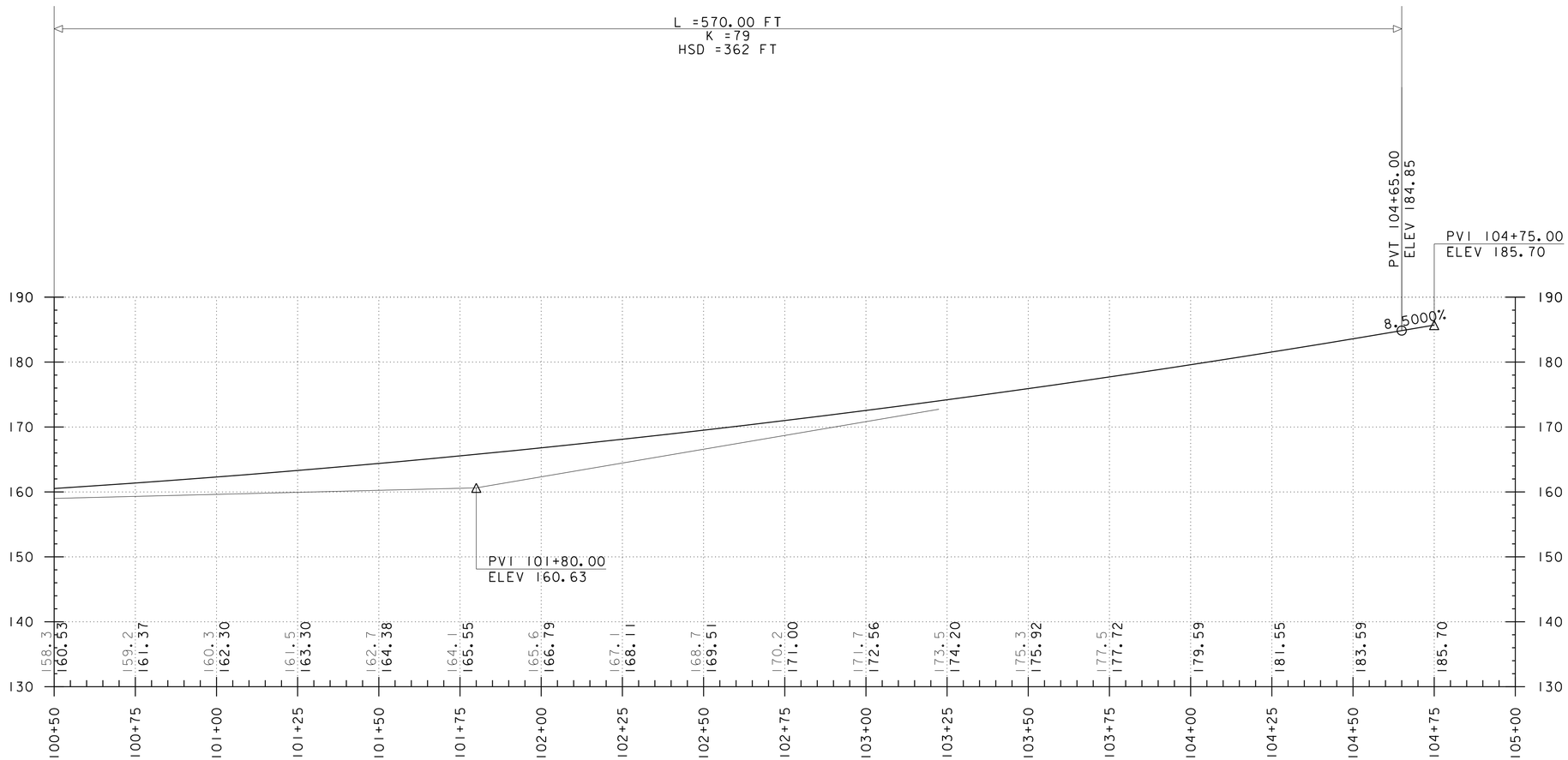


VT ROUTE 17
ALTERNATIVE 3 PROFILE - LAYOUT 1

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

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552xs9 - Bridge Widening.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 3 PROFILE - LAYOUT 1	SHEET 20 OF 32

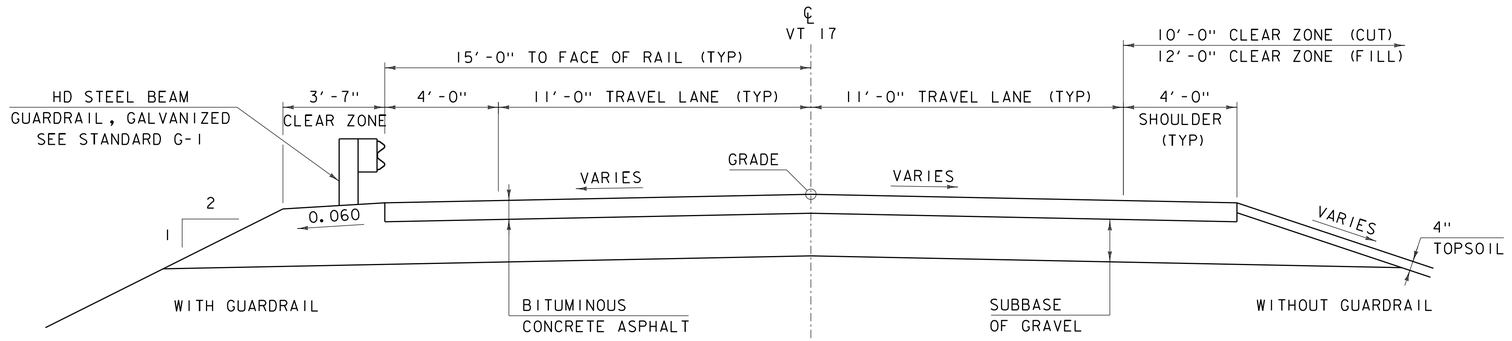


VT ROUTE 17
ALTERNATIVE 3 PROFILE - LAYOUT 2

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

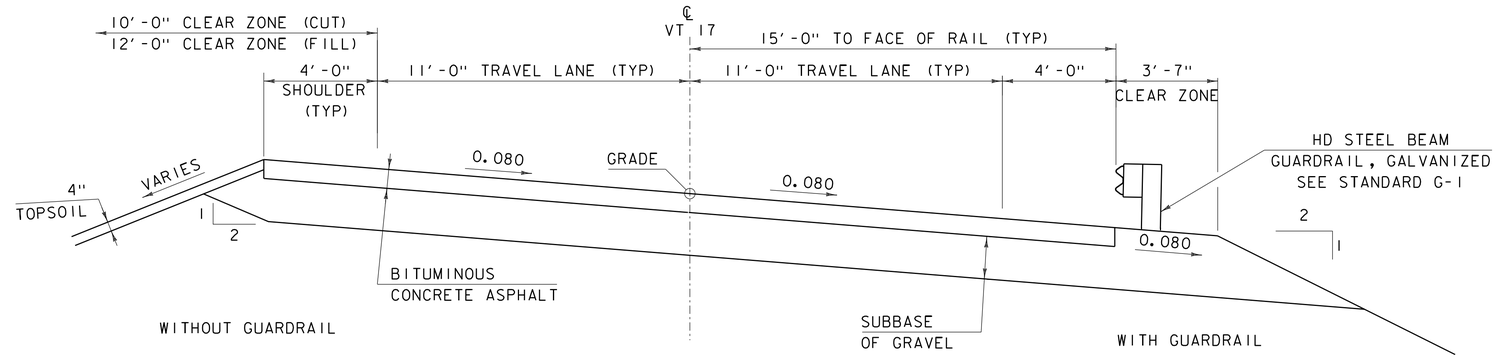
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552xs9 - Bridge Widening.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 3 PROFILE - LAYOUT 2	SHEET 21 OF 32



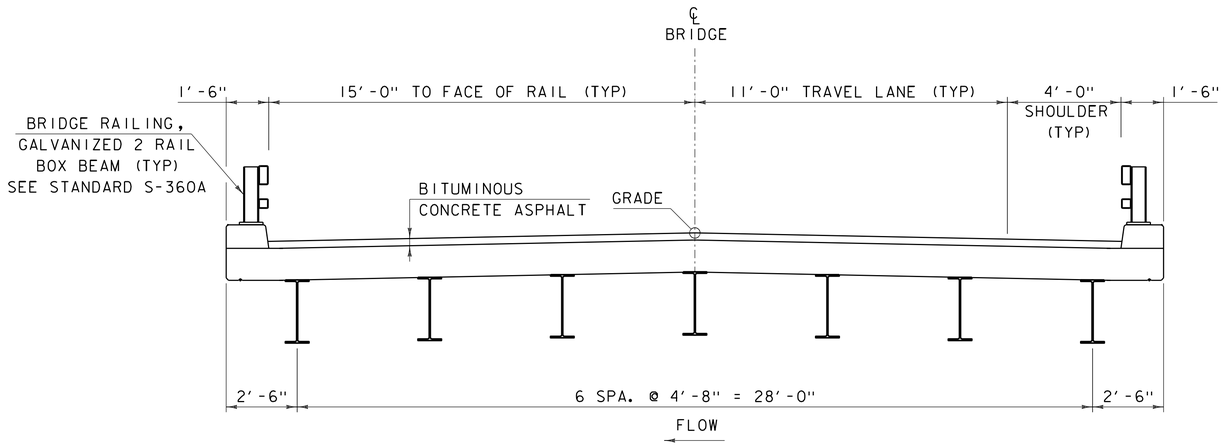
ALTERNATIVE 4 PROPOSED VT ROUTE 17 TYPICAL SECTION

SCALE 3/8" = 1'-0"



ALTERNATIVE 4 PROPOSED VT ROUTE 17 TYPICAL SECTION

SCALE 3/8" = 1'-0"

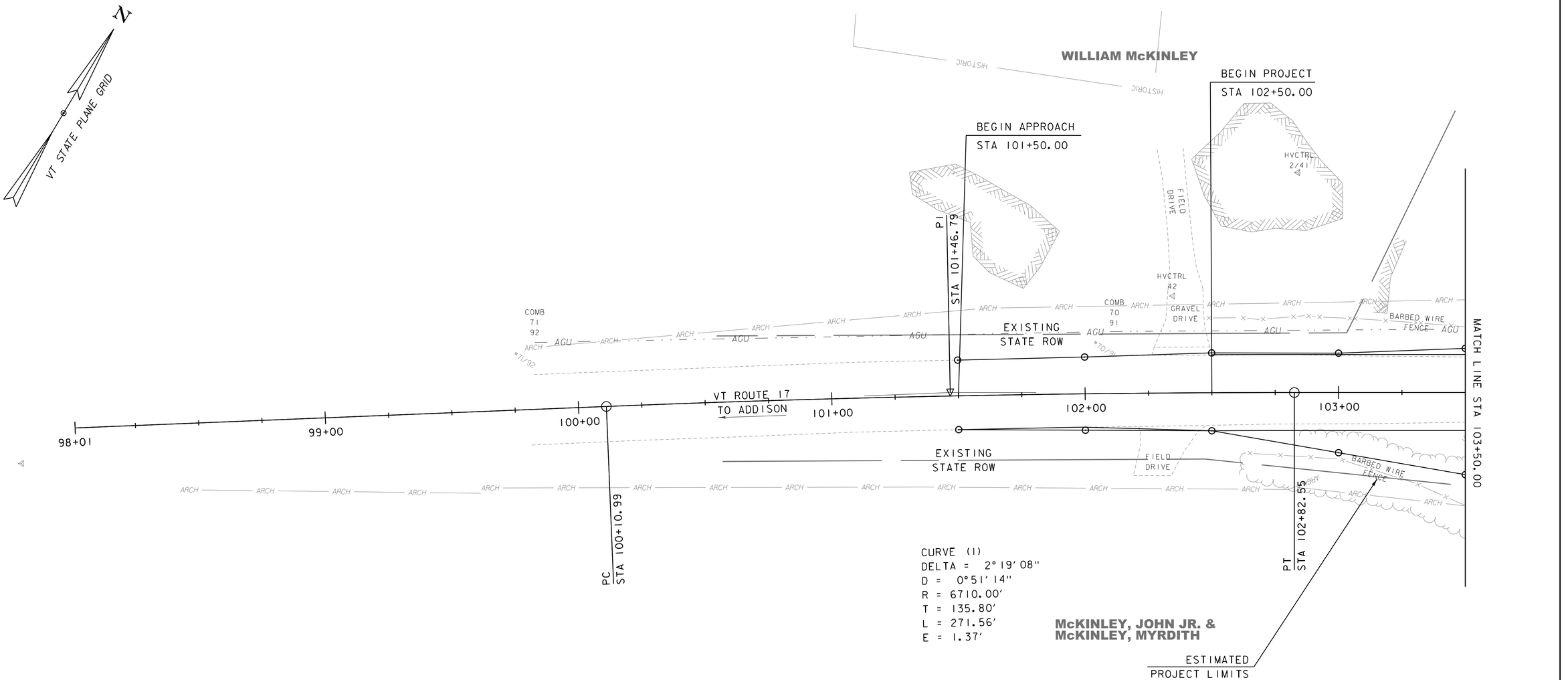


ALTERNATIVE 4 PROPOSED VT ROUTE 17 BRIDGE TYPICAL SECTION

SCALE 3/8" = 1'-0"

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: zi2b552Typical.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4 TYPICAL SECTIONS	SHEET 22 OF 32

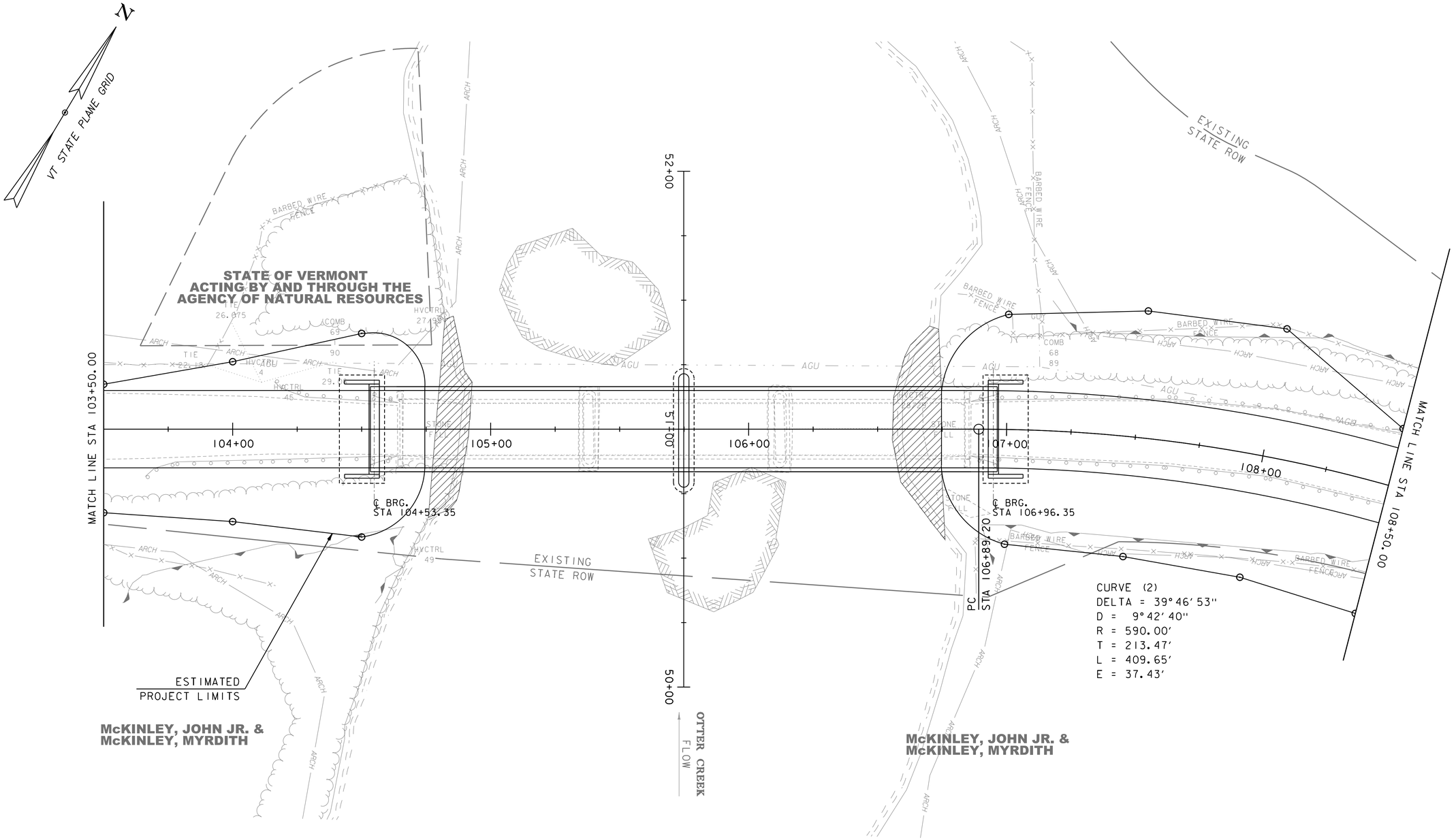


VT ROUTE 17
ALTERNATIVE 4a & 4b - LAYOUT 1

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr - On Align.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4a & 4b - LAYOUT 1	SHEET 23 OF 32



NOTE:

FOR TEMPORARY BRIDGE LAYOUT AND OFFSET SEE SHEET NOS. 8 THROUGH 11.

REMOVAL OF EXISTING ABUTMENT SLOPE

VT ROUTE 17
ALTERNATIVE 4a & 4b - LAYOUT 2

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME: WEYBRIDGE-NEW HAVEN	
PROJECT NUMBER: BF 032-1(19)	
FILE NAME: z12b552bdr - On Align.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4a & 4b - LAYOUT 2	SHEET 24 OF 32

N

VT STATE PLANE GRID

JOHN JR. & WYRDITH

McKINLEY, JOHN JR. &
McKINLEY, MYRDITH

CURVE (2)
DELTA = 39° 46' 53"
D = 9° 42' 40"
R = 590.00'
T = 213.47'
L = 409.65'
E = 37.43'

PI
STA 109+02.67

EXISTING
STATE ROW

ESTIMATED
PROJECT LIMITS

END PROJECT
STA 111+50.00

END APPROACH
STA 112+50.00

PC
STA 112+57.98

MATCH LINE STA 108+50.00

109+00

110+00

111+00

112+00

113+00

VT ROUTE 17
TO WALTHAM

PT
STA 110+98.85

EXISTING
STATE ROW

McKINLEY, JOHN JR. &
McKINLEY, MYRDITH

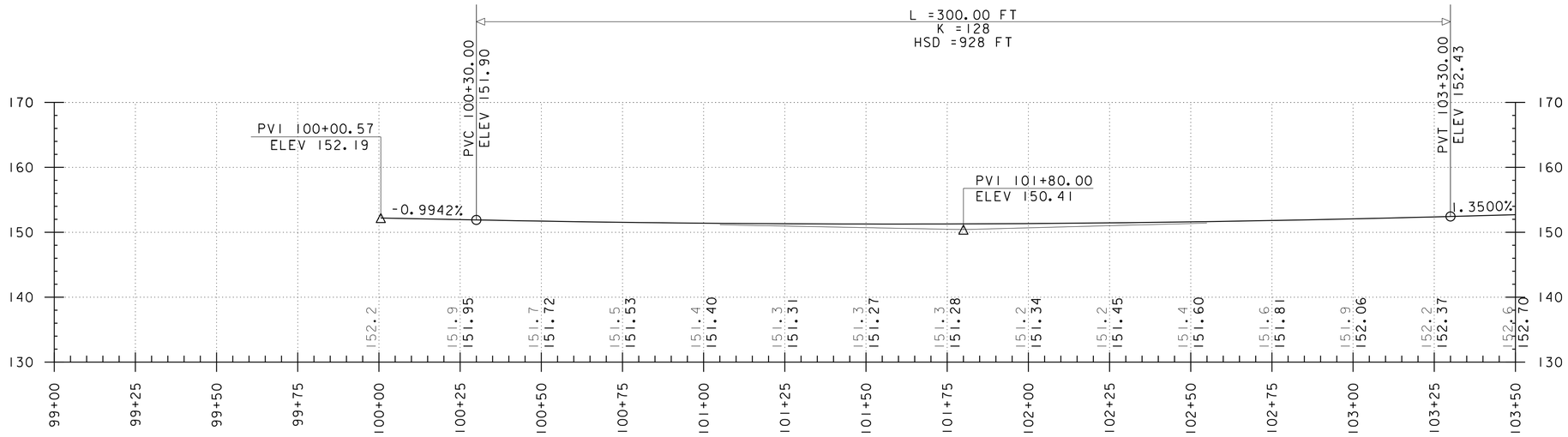
BARBED WIRE FENCE
GUY
COMB 67 88
ARCH
AGU
#67/88
HVCTRL
#68B
SGR W/ STEEL POST
UND
65 CLEAR
#66/87
COMB 66 87
HVCTRL 25
HISTORIC

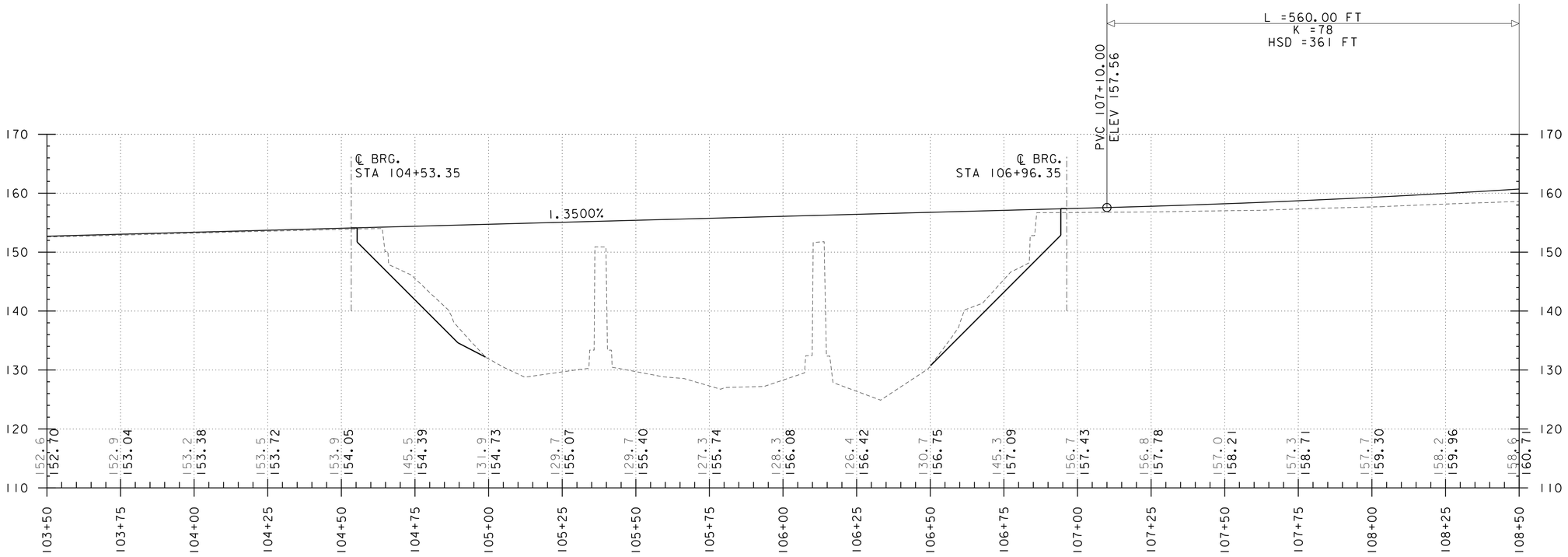
VT ROUTE 17
ALTERNATIVE 4a & 4b - LAYOUT 3

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr - On Align.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4a & 4b - LAYOUT 3	SHEET 25 OF 32



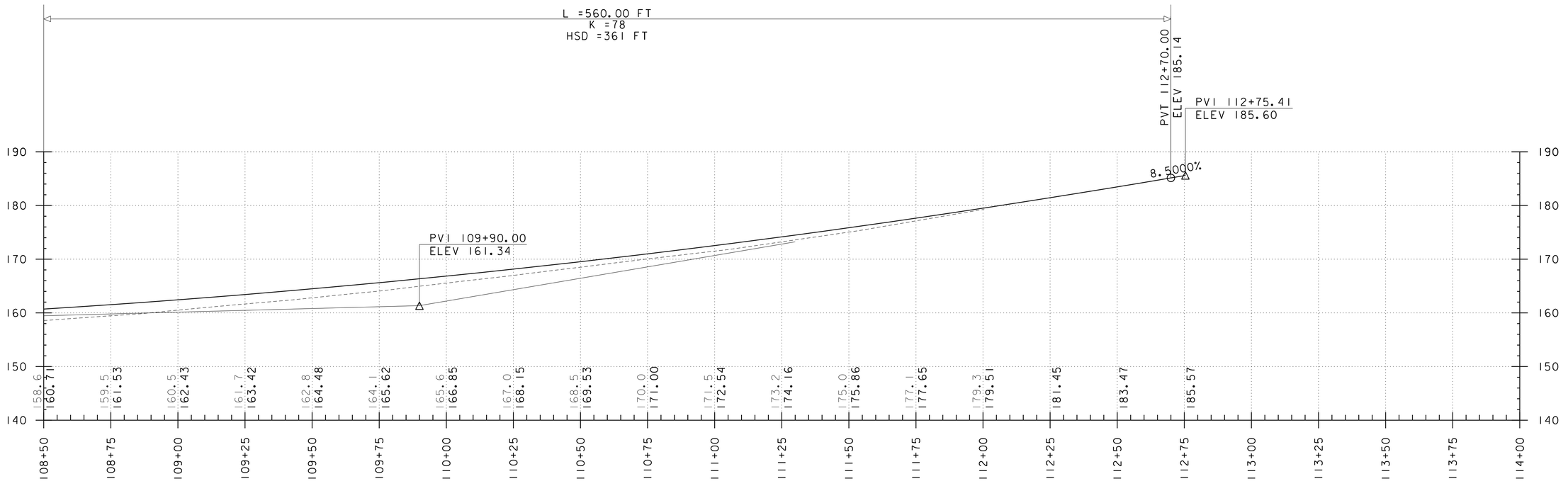


VT ROUTE 17
ALTERNATIVE 4a & 4b PROFILE - LAYOUT 1

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

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552xs10 - On Align.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4a & 4b PROFILE - LAYOUT 1	SHEET 26 OF 32

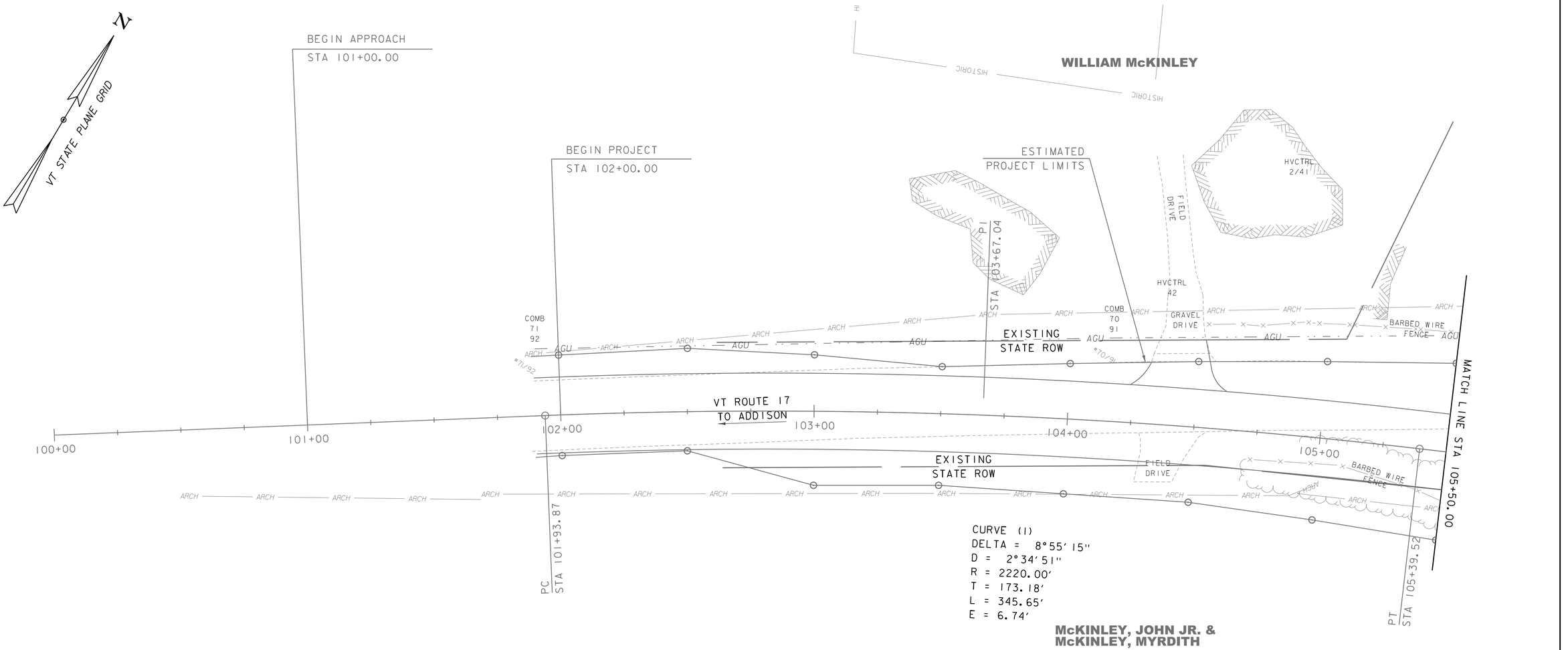


VT ROTUE 17
ALTERNATIVE 4a & 4b PROFILE - LAYOUT 2

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

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552xs10 - On Align.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4a & 4b PROFILE - LAYOUT 2	SHEET 27 OF 32

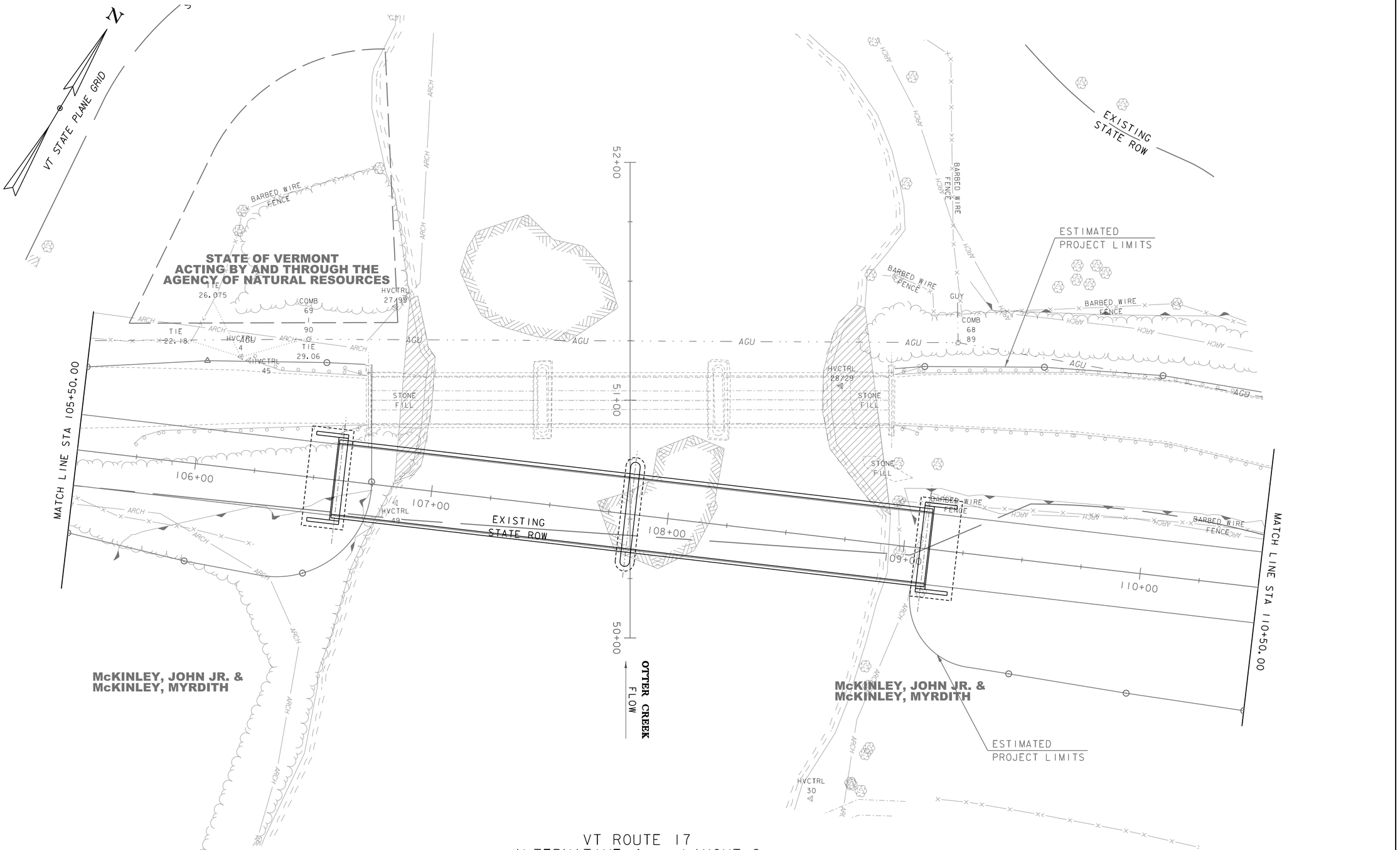


VT ROUTE 17
ALTERNATIVE 4c - LAYOUT 1

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr - Off Align.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4c - LAYOUT 1	SHEET 28 OF 32



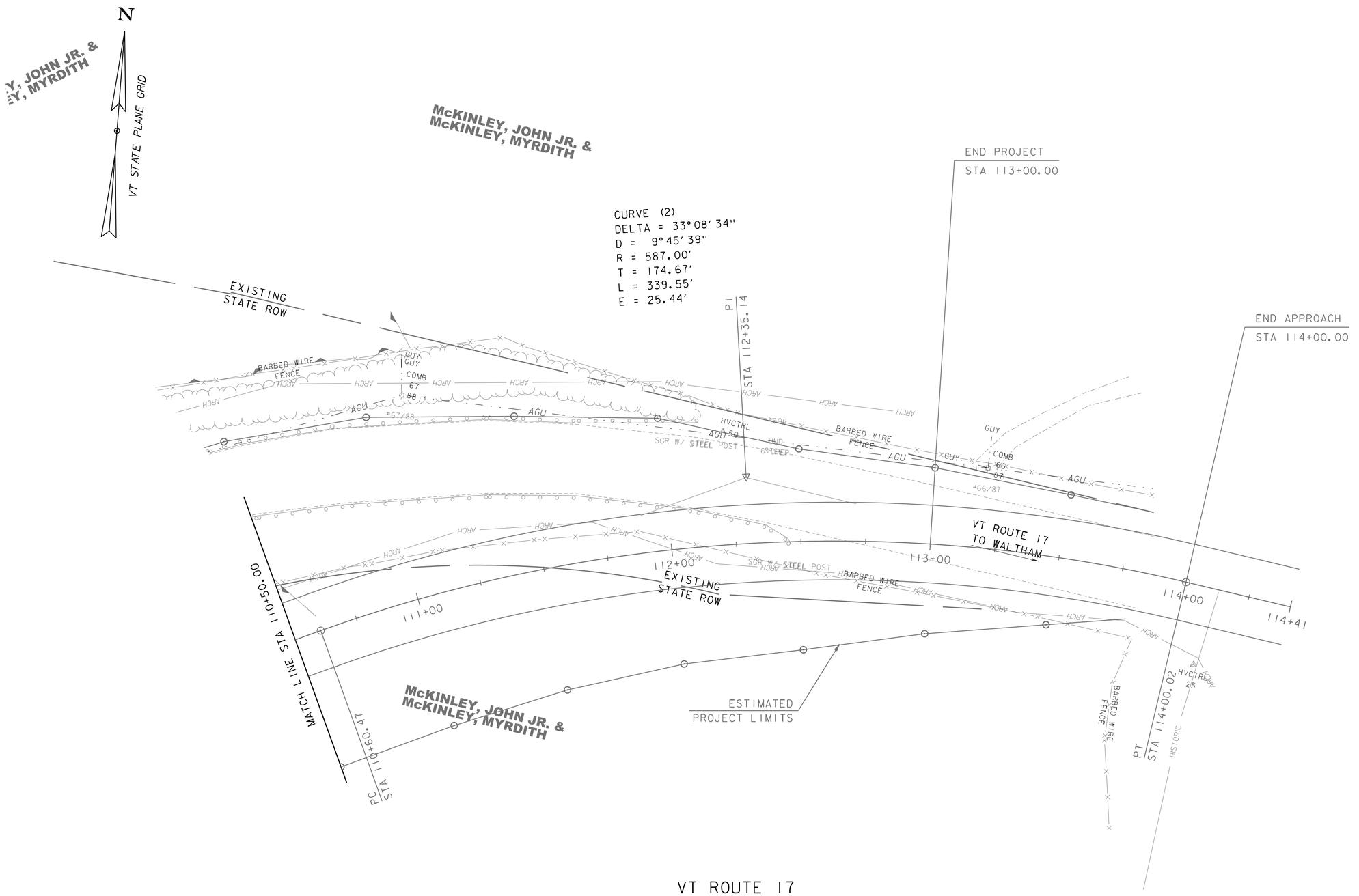
REMOVAL OF EXISTING ABUTMENT SLOPE

VT ROUTE 17
ALTERNATIVE 4c - LAYOUT 2

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr - Off Align.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4c - LAYOUT 2	SHEET 29 OF 32

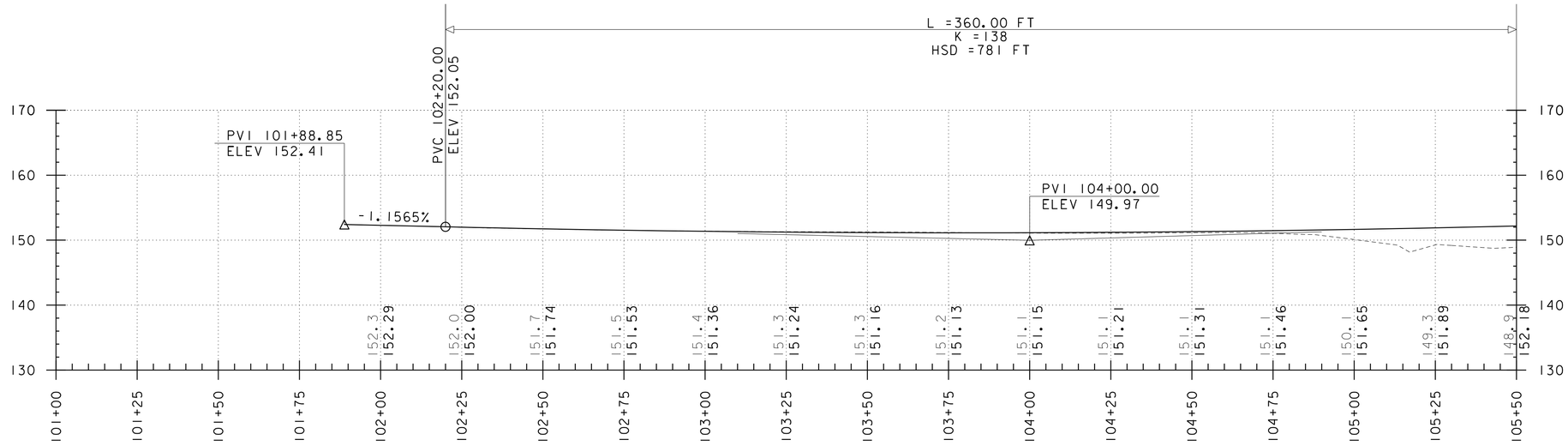


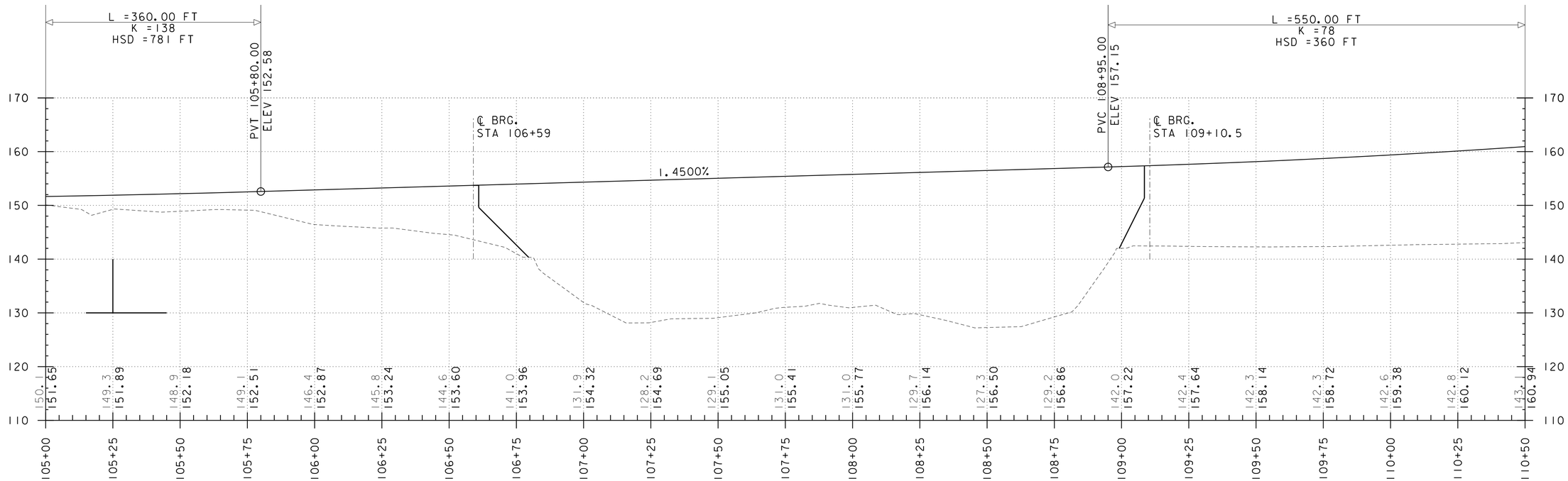
VT ROUTE 17
ALTERNATIVE 4c - LAYOUT 3

0 20 40
SCALE IN FEET

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552bdr - Off Align.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4c - LAYOUT 3	SHEET 30 OF 32



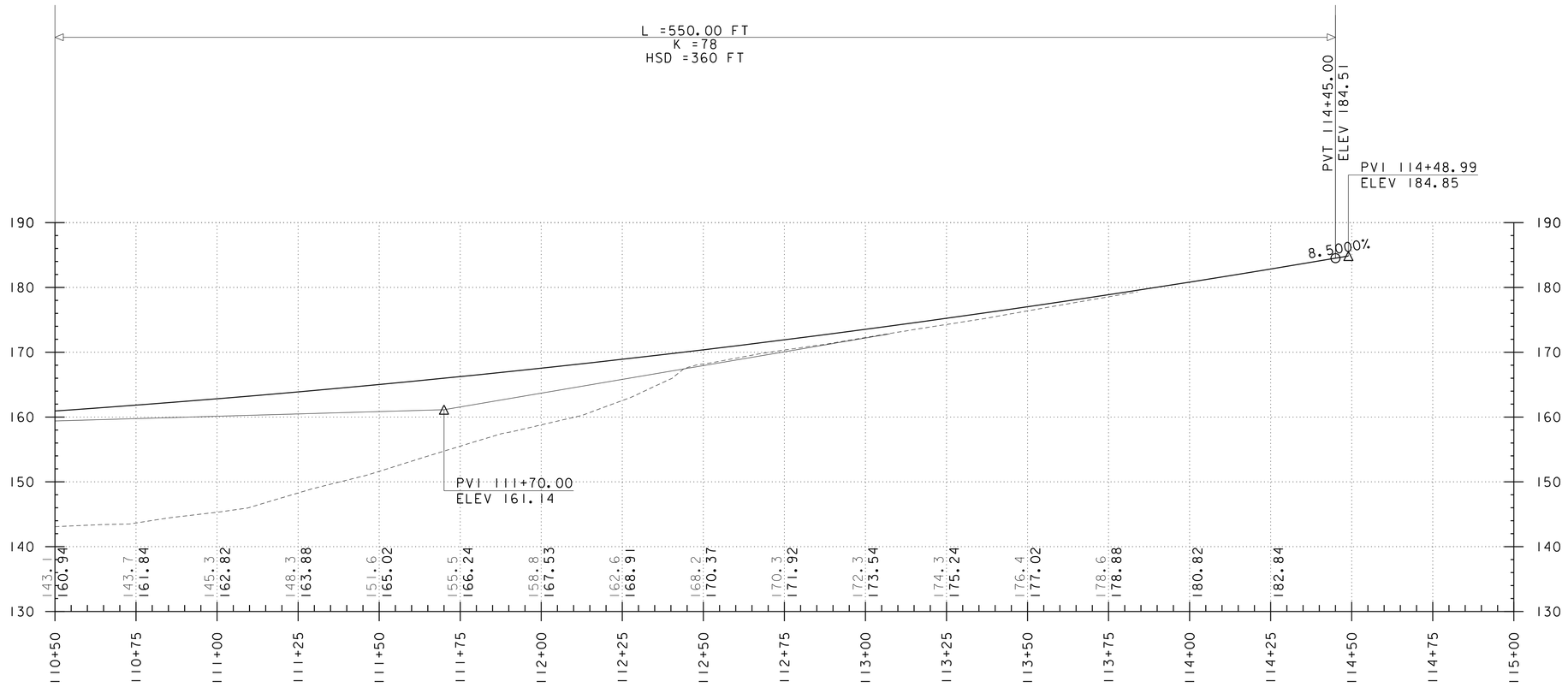


VT ROUTE 17
ALTERNATIVE 4c PROFILE - LAYOUT 1

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

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552xsl - Off Align.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4c PROFILE - LAYOUT 1	SHEET 31 OF 32



VT ROUTE 17
ALTERNATIVE 4c PROFILE - LAYOUT 2

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

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME:	WEYBRIDGE-NEW HAVEN
PROJECT NUMBER:	BF 032-1(19)
FILE NAME: z12b552xsl - Off Align.dgn	PLOT DATE: 4/5/2016
PROJECT LEADER: M. CRUZ	DRAWN BY: I. KHALID
DESIGNED BY: D. TALCOFF	CHECKED BY: E. ATKINS
ALTERNATIVE 4c PROFILE - LAYOUT 2	SHEET 32 OF 32