STATE OF VERMONT
AGENCY OF TRANPORTATION

Scoping Report

FOR

St. Johnsbury BHO 1447(30)

TH 371, Bridge 46 OVER SLEEPERS RIVER

January 18, 2013

I. Contents

I. Site Information 3

Need 3

Traffic 3

Design Criteria 4

Inspection Report Summary 4

Hydraulics 5

Utilities 5

Right Of Way 5

Resources 5

Agricultural: 5

Archaeological: 5

Biological: 5

Hazardous Materials: 6

Historic: 6

Stormwater: 6

II. Maintenance of Traffic 6

Option 1: Temporary Bridge 6

Option 2: Phased Construction 7

Option 3: Off-Site Detour 8

III. Alternatives Discussion 8

No Action 8

Superstructure Replacement 8

Full Bridge Replacement 9

IV. Alternatives Summary 10

V. Cost Matrix 11

VI. Conclusion 12

VII. Appendices 13

I. Site Information

The bridge is located on TH 371 approximately 0.1 miles south of the junction with US 5. TH 371 is a dead end road that services many houses. There are several businesses located on TH 371; South Main Auto Sales and Services, Portland Glass, and Roland's Wrecker Services. The existing conditions were gathered from a combination of a Site Visit, the Inspection Report, the Route Log and the existing Survey. See correspondence in the Appendix for more detailed information.

Roadway Classification	Rural Local Road (Class 3)
Bridge Type	3-Span Concrete T-Beam
Bridge Span	127 feet long
Year Built	1929
Ownership	Town of St. Johnsbury

Need

Bridge 46 is the only access across Sleepers River along TH 371 in this location. The following is a list of the deficiencies of Bridge 46 and TH 371 in this location.

1. The deck and superstructure are in fair condition. There are many cracks and potholes in the bridge pavement, which is an indication of deck deterioration. The tee beams are badly deteriorated with a great deal of reinforcing steel exposed, especially at the bearings.

2. The substructure is in fair condition. The piers have been subject to salt attack, with much deterioration. Cracking has also been observed in the piers. The abutments have spalling and hairline cracking with efflorescence present.

3. The bridge rail is in very poor condition. Most of the concrete spindles have deteriorated fully, so that only reinforcing steel is remaining. Additionally, the approach rail does not meet standard.

4. The horizontal curve of the end approach to the bridge does not meet the current standard for minimum radius.

Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2015 and 2035.

TRAFFIC DATA	2015	2035
AADT	1,200	1,200
DHV	160	160
ADTT	160	200
%T	5.5	6.9
%D	54	54

Design Criteria

The design standards for this bridge project are the Vermont State Standards, dated October 22, 1997. Minimum standards are based on an ADT of 1,200 and a design speed of 30 mph.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 6.3	5(sidewalk)-2-9-9-2 (27')	9'/2' (22')	
Bridge Lane and Shoulder Widths	VSS Table 6.3	5(sidewalk)-1-9-9-1.5 (25.5')	9'/2' (22')	Substandard
Clear Zone Distance	VSS Table 6.5		12' fill / 10' cut	
Banking		4%	8% (max)	
Speed		30 mph (Posted)	30 mph (Design)	
Horizontal Alignment	AASHTO Green Book Exhibit 3-10b	R=250' - North Approach, bridge located on straight segment	R_{min}=1030' @ e=4% (955' @ 4.2% & 506' @ 6.0%)	Substandard
Vertical Grade	VSS Table 6.6	Bridge located in transition from (+)1.5787% grade to (+)6.6821% grade	7% (max) for level terrain	
K Values for Vertical Curves	VSS Table 6.1	Bridge located on sag (K = 41)	30 crest / 40 sag	
Vertical Clearance Issues	VSS Section 6.7	None noted	14'-3" (min)	
Stopping Sight Distance	VSS Table 6.1	219'	200'	
Bicycle/Pedestrian Criteria	VSS Table 6.7		2' Shoulder	Substandard on bridge
Bridge Railing	SM Ch. 13		TL-2	Substandard

Inspection Report Summary

Deck Rating	5 Fair
Superstructure Rating	5 Fair
Substructure Rating	5 Fair
Channel Rating	6 Satisfactory

10/09/2012 – Fair condition structure continues to deteriorate and deck has potential for full depth failures mainly in span 1. Structure piers have heavy scaling. Concrete bridge rail is breaking up. Structure needs extensive reconstruction or full replacement in near future. ~MJK/JM

08/03/2010 – The pavement overlay is in need of full replacement. The bridge guardrails along both sides are in need of major repairs. The sidewalk is in need of repairs. All joint areas above both abutments and the piers are in need of repairs or replacement. Pier cap 2 is in need of major concrete repairs. The downstream radius end areas of both pier shafts are in need of major repairs. ~PLB

7/16/2008 – Bridge needs rehabilitation. Hole in the deck over pier #2 needs repair soon. ~FE

Hydraulics

From preliminary hydraulics report:

The existing bridge meets the hydraulic standard for the Q25 design storm event. This takes into consideration the Passumpsic River under flood conditions which provides the worst case downstream stage elevations. The recommendation is to use a replacement bridge having a minimum 80-foot clear span normal to the stream channel with a low beam elevation at or above 554.0 feet at the south abutment. The stream width at the toe of 3H:2V stone fill slope should be approximately 47 feet (assuming an elevation of 538 feet), while the BFW will be approximately 53 feet assuming an elevation of 540 feet. Therefore, the proposed longer single span structure with stone fill slopes will not constrict the stream channel's upstream bank full width from the current BFW field conditions which is a primary consideration for this replacement structure. The proposed structure will also provide approximately 2.1 feet of freeboard at the Q_{25} design storm event and meet the hydraulic design standard.

Utilities

There are underground telephone lines on the upstream side of the bridge, which are attached to the upstream fascia of the bridge, to cross over Sleepers River.

There are overhead utility lines that parallel TH 371 on the upstream side of the bridge. These lines pass over the roadway both north and south of the bridge at the project location.

There is an underground sanitary sewer line as well as a water line that pass under the bridge.

Right Of Way

The existing Right-of-Way is shown on the Layout sheet. It is anticipated that Right-of-Way will need to be obtained for any rehabilitation or replacement alternative.

Resources

The resources present at this project are shown on the layout sheets.

Agricultural:

No areas at the site have been identified as containing agricultural soils.

Archaeological:

No Archaeological Resources have been identified at the site.

Biological:

The only regulated resource in this area is the watercourse itself. There are no wetlands at the project site. There are no threatened or endangered species, or deer wintering habitat.

<u>Wetlands</u>

There are no wetlands within the project area.

<u>Wildlife Habitat</u>

There are no wildlife corridor issues within the project area.

Rare, Threatened and Endangered Species

There are no mapped rare, threatened or endangered species within the project area.

Hazardous Materials:

According to the Vermont Agency of Natural Resources (VANR) Vermont Hazardous Sites List, there is one known hazardous site in the project area. South Main Body Shop is identified as a Hazardous Waste Site Generator: Site 11698.

Historic:

Per the resource ID, bridge 46 is historic. The adjacent properties are not historic.

Stormwater:

There are no stormwater related concerns for this project. It is however worth mentioning that the impervious surface nearby to the North, Three Rivers Transportation Path has a stormwater discharge permit (5616_INDS.A) and associated treatment areas that cannot be impacted without review and possibly amending the permit. The permit can be found at: http://www.anr.state.vt.us/imaging/StormWater/5616-INDS.A.pdf

II. Maintenance of Traffic

The Vermont Agency of Transportation is in the process of finalizing an Accelerated Bridge Program, which focuses on faster delivery of construction plans, permitting, and Right of Way, as well as faster construction of projects in the field. One practice that will help in this endeavor is closing bridges for portions of the construction period, rather than providing temporary bridges. In addition to saving money, the intention is to minimize the closure period with faster construction techniques and incentives to contractors to complete projects early. The Agency will consider the closure option on most projects where rapid reconstruction or rehabilitation is feasible. The use of precast elements in new bridges will also expedite construction schedules. This can apply to decks, superstructures, and substructures. Accelerated Construction should provide enhanced safety for the workers and the travelling public while maintaining project quality. The following options have been considered:

Option 1: Temporary Bridge

There are complications both upstream and downstream of the existing bridge. Based on the daily traffic volumes and site layout, a one-way temporary bridge with traffic signals would be appropriate. Since there is currently a sidewalk on the bridge, as well as a sidewalk leading up to the bridge on one end, pedestrian access on the temporary bridge would be required. Additionally, utilities would likely be temporarily relocated to the temporary bridge. Both an upstream and downstream temporary bridge alignment would require acquiring temporary rights from adjacent property owners. See the Temporary Bridge Layout Sheets in the appendix.

Upstream:

On the upstream side there is a house located to the south, which would be in close proximity to an upstream temporary bridge. The front porch of this house would likely need to be removed to place the temporary bridge on the upstream side. An upstream temporary bridge would also run through a landscaped area and planting bed at this property. Additionally, there is a new parking

area for trail access to the north on the upstream side, which would be temporarily affected by an upstream temporary bridge.

Downstream:
A temporary bridge on the downstream side would encounter a steep hillside on the north end which would require a large fill volume. Additionally, a downstream temporary bridge would run through the parking lot for South Main Body Shop on the south end.

Advantages: Traffic flow can be maintained along the TH 371 corridor.

Disadvantages: This option would have adverse impacts to adjacent properties. There would be decreased safety to the workers and to vehicular traffic, because of cars driving near the construction site, and construction vehicles entering and exiting the construction site. This traffic control option would be costly, and time consuming, as construction activities would take a second construction season, in order to set up the temporary bridge.

Option 2: Phased Construction

Phased construction is the maintenance of one lane of two-way traffic on the existing bridge while building one lane at a time of the proposed structure. This allows keeping the road open during construction, while having minimal impacts to adjacent property owners. Based on traffic volumes at this site, it is reasonable to close one lane of traffic, and maintain one lane of traffic, both ways, with a traffic signal.

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

Due to horizontal constraints of the existing bridge, phasing traffic is not possible without shifting the alignment of the bridge, or unnecessarily widening the bridge. Since there is a sidewalk on the existing bridge, a pedestrian crossing must be maintained during construction. Even utilizing a temporary pedestrian bridge, the bridge would need to be widened six feet for a superstructure replacement, and nine feet for a full bridge replacement on alignment. Neither of these options is economical, which leaves an alignment shift as the only option that can utilize phased construction.

Advantages: This option would not require a temporary bridge. As a result, there are decreased costs at both the development and construction stages of the project.

Disadvantages: Phased construction at this site would only be possible for an off alignment option. Phased construction generally involves higher costs and complexity of construction.

Costs are usually higher, since many construction activities have to be performed two times. Additionally, since cars are traveling near construction activity, there is decreased safety. There would be some delays and disruption to traffic, since the road would be reduced to one-way traffic.

Option 3: Off-Site Detour

This option would close the bridge to traffic. Bridge 46 is located on a dead end road, and there is no available detour route.

South Main Auto Sales and Services, Portland Glass, and Roland's Wrecker Services are located on TH 371, and closing the road would have a disruption to business during the closure. Additionally, there are many residences on TH 371, and as such, it would not be appropriate to close the road to traffic for an extended period of time.

Advantages: This option would eliminate the need for a temporary bridge, which would significantly decrease cost and time of construction. This option would not require the need to obtain rights from adjacent property owners for a temporary bridge. This option reduces the time and cost of the project both at the development stage and construction.

Disadvantages: Traffic flow would not be maintained during construction.

III. Alternatives Discussion

No Action

This alternative is not recommended. All bridge components are only in fair condition, so something will have to be done to improve this bridge in the near future. Additionally, the bridge railing is in poor condition. Although the bridge is not in imminent danger of collapse, it will eventually be posted for lower traffic loads. In the interest of safety to the traveling public, the No Action alternative is not recommended. No cost estimate has been provided for this alternative since there are no immediate costs.

Superstructure Replacement

A rehabilitation option for this bridge would include removal of the superstructure and replacement with a continuous span Precast Bridge Unit (PBU) system. Additionally there would be some substructure repairs:

- New pier caps would likely be poured, as the existing caps have suffered significant deterioration from leaking joints.

- The piers would require concrete repair, especially on the downstream radius end area where they have been exposed to salt corrosion.

- The material that has filled in between each abutment and pier would be removed to reduce loading on the existing piers.

Since the existing T-beams are integral with the deck, replacement of the deck only is not feasible.

The existing substructure is in fair condition, and with anticipated reconstruction, it could last an additional 30 years. The existing bridge meets hydraulic standards, and thus, a superstructure replacement would satisfy the hydraulic requirements.

The existing shoulders on the bridge are substandard by 6 inches to one foot for bicycles. The existing shoulders are 1 foot and 1.5 feet wide with 1.5 foot curbs and a 5 foot wide sidewalk. By proposing 10 inch wide pedestal mounted bridge railing, and a 4 foot wide sidewalk, the shoulder widths will meet the standard while maintaining a similar fascia to fascia width.

Advantages: This alternative would address the structural deficiencies of the existing bridge, with minimum upfront costs. The town share is 5% for a rehabilitation versus 10% for a full replacement.

Disadvantages: This alternative would only offer 30 years of additional service for this bridge. The sidewalk would be substandard in width for this alternative. Right-of-Way would need to be obtained for this alternative in order to maintain traffic.

Maintenance of Traffic: Phased construction is not possible for a superstructure replacement due to tight horizontal constraints. Additionally, due to the traffic volume and number of businesses on TH 371, it is unacceptable to close the road. A temporary bridge would be the only appropriate method of traffic control for this alternative. Due to the high costs of a temporary bridge, it does not make economic sense to construct a temporary bridge for a 30 year bridge fix.

Full Bridge Replacement

Depending on how traffic is maintained, a new bridge could be placed on the existing horizontal alignment, or on an improved alignment. The curve on the north end of the bridge is substandard, and by realigning the existing bridge, the roadway through the project area could be brought up to current geometric standards.

This alternative would replace the existing bridge with a new superstructure as well as new substructures. The various considerations under this option include: the bridge width and length, skew, superstructure type and substructure type.

By reducing the number of spans, issues regarding deterioration at the joints will be eliminated.

a. Bridge Width

Since a new 80+ year bridge is being proposed, the bridge geometry should meet the minimum standards. A fascia to fascia width of 29 feet will be proposed. This will allow for two nine foot lanes, with two foot shoulders, and a five foot width sidewalk.

b. Bridge Length and Skew

The existing bridge is 130 feet long and with a skew of 15 degrees. Hydraulics has recommended a single span of 83 feet, which is 44 feet shorter than the existing structure. The proposed span will be 90 feet with no skew for an off alignment option, and 90 feet with a 15 degree skew for the on alignment option.

c. Superstructure Type

A precast structure will be the preferred choice, due to decreased construction time. The possible 90' span length bridge types that are most commonly used in Vermont, are steel and composite concrete deck and NEXT beams. The superstructure depth is not critical for meeting hydraulic standards, so the superstructure type shall be determined at a later time.

d. Substructure Type

There is no visible bedrock in the location of the project. However, available information on nearby water wells and previous projects indicates that the site may contain shallow bedrock. Borings should be taken at the project site, to verify the subsurface conditions. The preferred type of substructure is integral abutments on piles. This type of substructure provides scour protection. If shallow bedrock is confirmed, then the preferred substructure type is reinforced concrete abutments on spread footings.

e. Maintenance of Traffic

Either a temporary bridge or phased construction could be utilized for traffic control at this site. A temporary bridge would involve construction of a new bridge on the existing alignment. Phased construction would involve construction of one lane of a new bridge on an upstream alignment while maintaining one lane of traffic on the existing bridge. Traffic would then be shifted onto the new bridge, while the existing bridge is removed, and the second half of the new bridge is constructed.

Advantages: This alternative would be a new structure with an estimated life span of 80 years. The increased road width would meet Vermont State Standards, and would also make the bridge crossing safer for bikes and pedestrians. The off-alignment option would also meet Vermont State Standards for minimum radius.

Disadvantages: This alternative would have the highest upfront costs. Right-of-Way would need to be obtained for this alternative.

IV. Alternatives Summary

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

Alternative 1a: Superstructure Replacement with Traffic Maintained on a Temporary Bridge
Alternative 2a: New Structure off Alignment with Traffic Maintained with Phased Construction
Alternative 2b: New Structure with Traffic Maintained on a Temporary Bridge

V. Cost Matrix[1]

St. Johnsbury BHO 1447(30)		Do Nothing	Alt 1	Alt 2a	Alt 2b
			Superstructure Replacement	Complete Replacement	
			Temporary Bridge	Off Alignment Phased	Temporary Bridge
COST	Bridge Cost	$0	$561,000	$780,000	$710,000
	Removal of Structure	$0	$74,000	$122,000	$111,000
	Roadway	$0	$143,000	$471,000	$492,000
	Maintenance of Traffic	$0	$250,000	$40,000	$250,000
	Construction Costs	$0	$1,028,000	$1,413,000	$1,563,000
	Construction Engineering + Contingencies	$0	$308,400	$423,900	$468,900
	Total Construction Costs w CEC	**$0**	**$1,336,400**	**$1,836,900**	**$2,031,900**
	Preliminary Engineering[2]	**$0**	**$308,400**	**$423,900**	**$468,900**
	Right of Way	**$0**	**$79,000**	**$155,500**	**$79,000**
	Total Project Costs	$0	$1,723,800	$2,416,300	$2,579,800
	Annualized Cost		$57,460	$30,200	$32,250
TOWN SHARE	Total Cost for Town		$86,190 (5%)	$241,630 (10%)	$257,980 (10%)
	Annualized Cost for Town		$ 2,870	$ 3,020	$ 3,220
SCHEDULING	Project Development Duration[2]		>4 years	>4 years	>4 years
	Construction Duration		8 months	8 months	18 months
	Closure Duration (If Applicable)		N/A	N/A	N/A
ENGINEERING	Typical Section - Roadway (feet)	27'	27'	27'	27'
	Typical Section - Bridge (feet)	5 walk-1-9-9-1.5	4 walk-2-9-9-2	5 walk-2-9-9-2	5 walk-2-9-9-2
	Geometric Design Criteria	No Change	Substandard Approach Radius	Meets Criteria	Substandard Approach Radius
	Traffic Safety	No Change	Improved	Improved	Improved
	Alignment Change	No	No	Horizontal Improved	No
	Bicycle Access	No Change	Improved	Improved	Improved
	Hydraulic Performance	No Change	No Change	Improved	Improved
	Pedestrian Access	No Change	Improved	Improved	Improved
	Utility	No Change	Relocation	Relocation	Relocation
OTHER	ROW Acquisition	No	Yes	Yes	Yes
	Road Closure	No	No	No	No
	Design Life	<10 years	30 years	80 years	80 years

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

VI. Conclusion

We recommend **Alternative 2a**; to replace the existing bridge on an improved alignment while maintaining traffic with phased construction.

Structure:
The annualized total cost for a full bridge replacement is less expensive than the superstructure replacement option, since the existing substructures would require costly repairs to gain only an additional 30 years of service. Additionally, the structure cost for a 130 foot superstructure is comparable to that of a 90 foot complete structure.

The proposed structure will have two 9 foot travel lanes with 2 foot shoulders, and a 5 foot sidewalk on the western side of the bridge. Borings will be necessary to determine the substructure type. The existing bridge is considered historic and the proposed bridge should meet historic requirements.

Utilities:
There are underground telephone lines on the upstream side of the bridge, which are attached to the upstream fascia of the bridge, to cross over Sleepers River. There are overhead utility lines that parallel TH 371 on the upstream side of the bridge. These lines pass over the roadway both north and south of the bridge at the project location. Additionally, there is an underground sanitary sewer line as well as a water line that pass under the bridge. Early collaboration will need to be made with the utility companies in order to facilitate the move of these utility lines.

Traffic Control:
Using phased construction would improve the alignment of TH 371 by eliminating the substandard curve on the north side of the bridge and bringing it up to current standards. It would also allow building a portion of the new structure while allowing traffic to utilize the existing structure, eliminating any need for a temporary bridge.

The cost of phasing traffic compared to building a temporary bridge is comparable, however, only the off alignment option with phasing addresses the substandard approach radius.

VII. Appendices

- Site Pictures
- Town Map
- Bridge Inspection Report
- Hydraulics Memo
- Preliminary Geotechnical Information
- Natural Resources Memo
- Archaeology Memo
- Historic Memo
- Stormwater Memo
- Resource ID Completion Memo
- Plans
    - Proposal
        - Existing Conditions
        - Typical Sections
        - Off Alignment Layout
        - Off Alignment Profile
        - Phasing Plans
        - On Alignment Layout
        - On Alignment Profile
        - Temporary Bridge Layouts

Approach Looking North

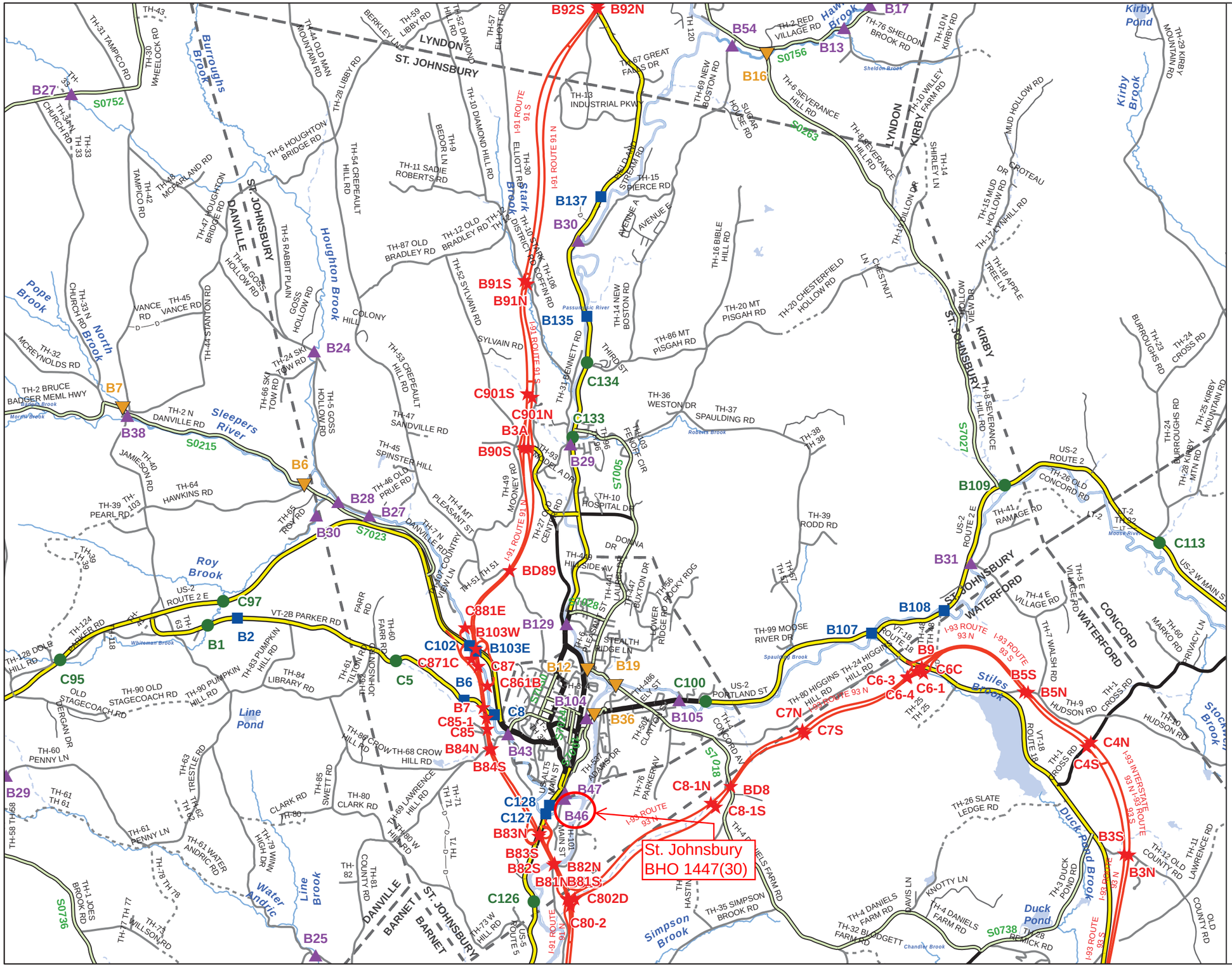
Approach Looking South

Looking Downstream

Looking Upstream

Deteriorating Pier Cap

Deteriorating Tee-Beams



Produced by:
Mapping Unit
Vermont Agency of Transportation
August 2011

ST. JOHNSBURY
CALEDONIA COUNTY
DISTRICT # 7

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

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

Inspection Report for ST. JOHNSBURY **bridge no.:** 00046 **District:** 7

Located on: C3371 **over** SLEEPERS RIVER **approximately** 0.10 MI TO JCT W US 5 **Owner:** 03 TOWN-OWNED

CONDITION

Deck Rating: 5 FAIR

Superstructure Rating: 5 FAIR

Substructure Rating: 5 FAIR

Channel Rating: 6 SATISFACTORY

Culvert Rating: N NOT APPLICABLE

Federal Str. Number: 100311004603111

Federal Sufficiency Rating: 56.8

Deficiency Status of Structure: ND

AGE and SERVICE

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

Service On: 1 HIGHWAY

Service Under: 5 WATERWAY

Lanes On the Structure: 02

Lanes Under the Structure: 00

Bypass, Detour Length (miles): 99

ADT: 000800 **% Truck ADT:** 10

Year of ADT: 2008

GEOMETRIC DATA

Length of Maximum Span (ft): 0052

Structure Length (ft): 000130

Lt Curb/Sidewalk Width (ft): 4.9

Rt Curb/Sidewalk Width (ft): 0.5

Bridge Rdwy Width Curb-to-Curb (ft): 25.4

Deck Width Out-to-Out (ft): 28.6

Appr. Roadway Width (ft): 022

Skew: 22

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 CONC. T- BEAM

Number of Approach Spans: 0002 **Number of Main Spans:** 001

Kind of Material and/or Design: 1 CONCRETE

Deck Structure Type: 1 CONCRETE CIP

Type of Wearing Surface: 6 BITUMINOUS

Type of Membrane 0 NONE

Deck Protection: 0 NONE

APPRAISAL *AS COMPARED TO FEDERAL STANDARDS

Bridge Railings: 0 DOES NOT MEET CURRENT STANDARD

Transitions: 0 DOES NOT MEET CURRENT STANDARD

Approach Guardrail: 0 DOES NOT MEET CURRENT STANDARD

Approach Guardrail Ends: 0 DOES NOT MEET CURRENT STANDARD

Structural Evaluation: 5 BETTER THAN MINIMUM TOLERABLE CRITERIA

Deck Geometry: 4 MEETS MINIMUM TOLERABLE CRITERIA

Underclearances Vertical and Horizontal: N NOT APPLICABLE

Waterway Adequacy: 7 SLIGHT CHANCE OF OVERTOPPING BRIDGE & ROADWAY

Approach Roadway Alignment: 8 EQUAL TO DESIRABLE CRITERIA

Scour Critical Bridges: 3 SCOUR CRITICAL

DESIGN VEHICLE, RATING, and POSTING

Load Rating Method (Inv): 5 NO RATING ANALYSIS PERFORMED

Posting Status: A OPEN, NO RESTRICTION

Bridge Posting: 5 NO POSTING REQUIRED

Load Posting: 10 NO LOAD POSTING SIGNS ARE NEEDED

Posted Vehicle: POSTING NOT REQUIRED

Posted Weight (tons):

Design Load: 2 H 15

INSPECTION and CROSS REFERENCE

X-Ref. Route:

Insp. Date: 102012 **Insp. Freq. (months)** 24 **X-Ref. BrNum:**

INSPECTION SUMMARY and NEEDS

10/9/12 Fair condition structure continues to deteriorate and deck has potential for full depth failures mainly in sp 1. Structure piers have heavy scaling. Concrete bridge rail is breaking up. Structure needs extensive recon or full replacement in near future. ~MJK , JM

08/03/10 The pavement overlay is in need of full replacement. The bridge guardrails along both sides are in need of major repairs. The sidewalk is in need of repairs. All joint areas above both abutments and the piers are in need of repairs or replacement. Pier cap 2 is in need of major concrete repairs. The downstream radius end areas of both pier shafts are in need of major repairs. PLB

07/16/2008 - Bridge needs rehabilitation. Hole in the deck over pier #2 needs repair soon. ~ FE

VT AGENCY OF TRANSPORTATION PROGRAM DEVELOPMENT DIVISION

HYDRAULICS UNIT

TO: Chris Williams, Structures Project Manager

FROM: Brian Bennett, Hydraulics Project Engineer (McFarland Johnson)
via Nick Wark, VTrans Hydraulic Engineer

DATE: November 16, 2012

SUBJECT: ST. JOHNSBURY – BHO-1447(30) – TH 91 Bridge 46 over Sleepers River

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

Existing Bridge Information

The original bridge was constructed in 1929 based on record information. The bridge is owned by the Town. The bridge is a 2-lane 3-span cast-in-place concrete T-beam and deck bridge with an asphalt pavement surface with a sidewalk on the West side and 2 piers constructed of cast-in-place concrete. The bridge is askew to the river by approximately 15°. The total width of bridge is approximately 28.4 feet normal to the roadway which is equivalent to 29.4 feet along the stream. The abutment and piers are basically parallel to the stream. The total clear span along the roadway is approximately 126.6' with individual spans of approximately 36.3' (face to center of pier), 54' (center of pier to center of pier) and 36.3' (center of pier to face), going from Left (North) to Right (South). Taking into the account the width of the piers (i.e. 4' wide at the seat location) and modifying the spans to be normal to the stream, the normal clear spans are approximately 33.1', 48.2', and 33.1' going from Left (North) to Right (South). The superstructure depth for the 2 approach spans is approximately 2.75', while the center span superstructure depth is approximately 4 feet. The stream channel flow runs between the 2 piers of the bridge. This is due to a wing/retaining wall extending upstream from the Left (North) Pier to an old building foundation and fill between the Right (South) Pier and the Right (South) Abutment which blocks the majority of the bridge opening between the piers and the abutments, except at very large storm events. The approximate height to the bottom of the superstructure to the streambed varies due to the bridge sloping at approximately 6.25% from Left (North) to Right (South) across the bridge, but has a minimum height between the piers of approximately 21 feet on the upstream side near the Right (South) Pier.

The existing bridge meets the hydraulic standard for the Q_{25} design storm event. The bridge is located on the Sleepers River at approximately 600 feet upstream of its confluence of the Passumpsic River. The structure is located on a section of the river having a well-defined channel having a sandy-gravelly streambed with some small stones. This bridge site is located at the edge of the floodplain of the Passumpsic River and its backwater effects during flooding events. Thus, the flood stages at this bridge site are governed by the Passumpsic River hydraulics. This Q_{25} design storm event does consider the Passumpsic River under flood conditions which provide the worst case downstream stage elevations.

We did not evaluate the scour for the existing conditions or any proposed bridge configurations as part of the preliminary design. Scour calculations will be performed during final hydraulics.

Recommendations

The bridge option selection criteria should be to provide a bridge opening that does not restrict the

bank full width, nor provide an unrealistic widening of the existing channel, or create any worse backwater flooding conditions than the existing conditions. The VANR Bank Full Width (BFW) Equation estimates the width to be approximately 71 feet, but the actual field conditions have varying natural bank full stream widths within the study reach between 45 to 55 feet.

It has been assumed a replacement structure will be located in the existing roadway alignment having the same basic geometry based on the site constraints. For a replacement structure, we have anticipated that the piers will be removed and the proposed abutments will be vertical face concrete abutments with 3H:2V sloped stone fill scour protection placed in front of the abutments.

Based on our analysis, the recommendation will be to use a replacement bridge having a minimum 80-foot clear span normal to the stream channel (between the abutment faces) with a low beam elevation at or above 554.0 feet at the Right (South) Abutment. Refer to the attached sketch showing the limits of the stone fill slopes and bridge opening cross section configuration. To match the existing roadway alignment, the bridge should have abutments parallel to the stream with the roadway having a skew of approximately 15° which would have a roadway centerline length of approximately 83 feet to achieve the minimum 80-foot normal span normal to the channel. The stream width at the toe of the 3H:2V stone fill slope will be approximately 47 feet (assuming an elevation of 538 feet), while the BFW will be approximately 53 feet assuming an elevation of 540 feet. Therefore, the proposed longer single span structure with stone fill slopes will not constrict the stream channel's upstream bank full width from the current BFW field conditions which is a primary consideration for this replacement structure. The proposed structure will also provide approximately 2.1 feet of freeboard at the Q_{25} design storm event and meet the hydraulic design standard.

As noted above, scour was not reviewed during the preliminary design.

<u>Temporary Bridge/Phasing</u>
Based on pre-scoping information from the Structures Group, it hasn't been determined whether a temporary bridge or phasing of the construction activities will not be used, but it is noted that the bridge is located on a dead-end street.

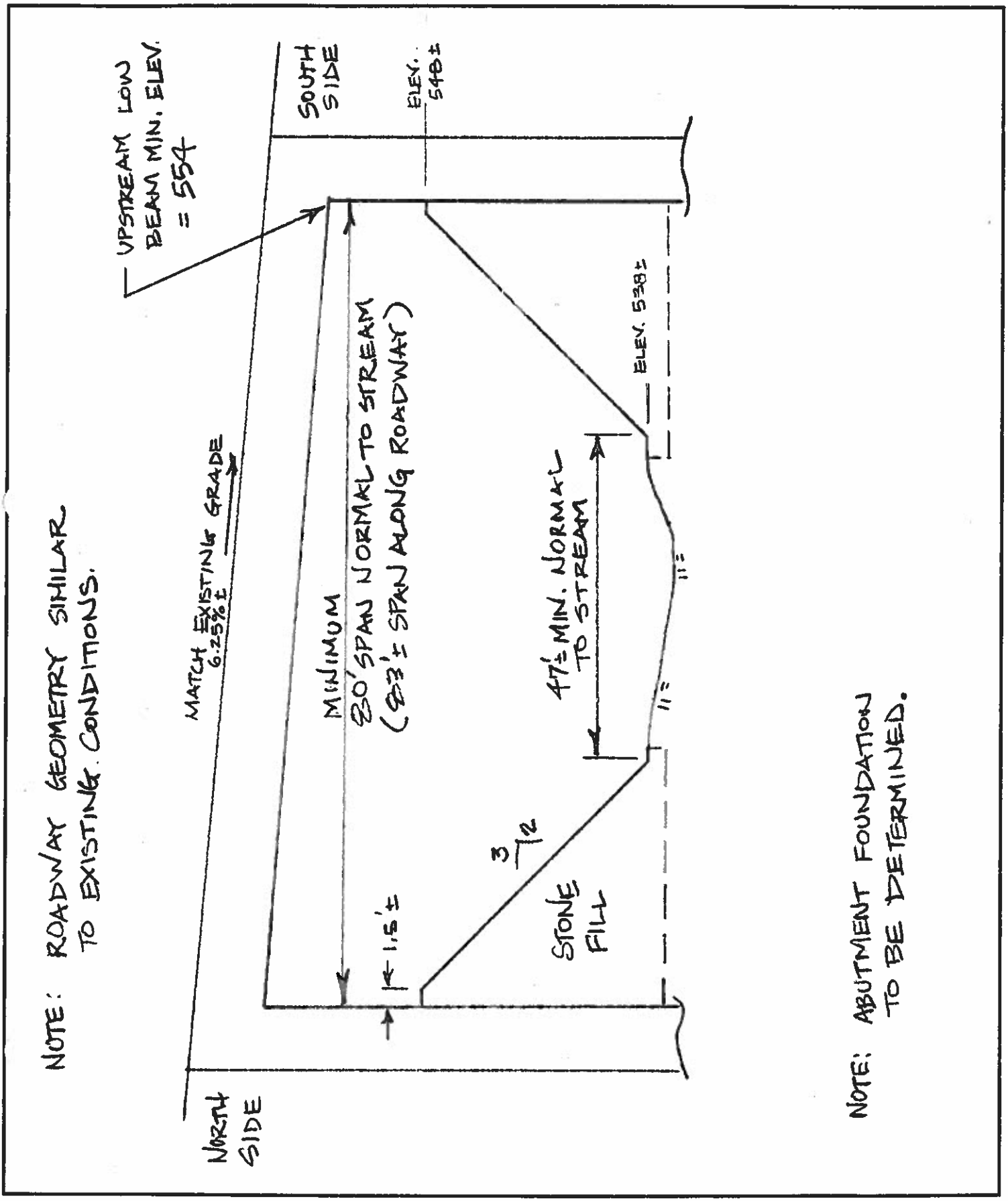
Please contact us if you have any questions or if we may be of further assistance.

BMB
cc: Hydraulics Project File via NJW
Hydraulics Chrono File

VTrans Working to Get You There
Vermont Agency of Transportation

JOB ST. JOHNSBURY TH 91 (C3357) BR 46
BHO-1447(30) 12j164

CALCULATED BY BMB DATE 11-9-12
CHECKED BY NJW DATE 11-15-12
SCALE N.T.S.



AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Chris Williams, Project Manager, Structures

CAA CCB

From: Chad A. Allen, Geotechnical Engineer via Christopher C. Benda, Soils and Foundations Engineer

Date: May 31, 2012

Subject: St. Johnsbury BHO 1447(30) TH C3371, Bridge 46 Geotechnical Scoping Report

1.0 Introduction

In an effort to assist the Structures Section with their bridge type study, the Soils and Foundations Unit within the Materials and Research Section has completed a review of available geological data for Bridge 46 on THC3371 (South Main Street). Bridge 46, see Figure 1, is a three span structure (see Figure 3) that crosses over Sleepers River in St. Johnsbury, VT. This scoping report includes a review of VTrans record plans, VTrans Bridge Inspection Photos, USDA Natural Resources Conservation soil survey records, surficial geology and bedrock maps of the State and the Agency of Natural Resources' water well logs.

Figure 1: South Main St (TH C3371), Bridge 46 over the Sleepers River

2.0 Surficial and Bedrock Geology

The Agency of Natural Resources (ANR) documents and publishes all water wells that are drilled for residential or commercial purposes. Published online, the logs can be used to determine general characteristics of soil strata in the area. The soil description given on the logs is provided by field personnel with unknown qualifications, and as such, should only be used as an approximation. Surrounding well logs were examined for depths to bedrock and soil strata. Well locations are shown in Figure 2 and a summary of the specific wells used to gain

information on the subsurface conditions are presented in Table 1. The three closest wells, wells No. 221, 177 and 40630, are located between 1600 and 1720 ft from the project location.

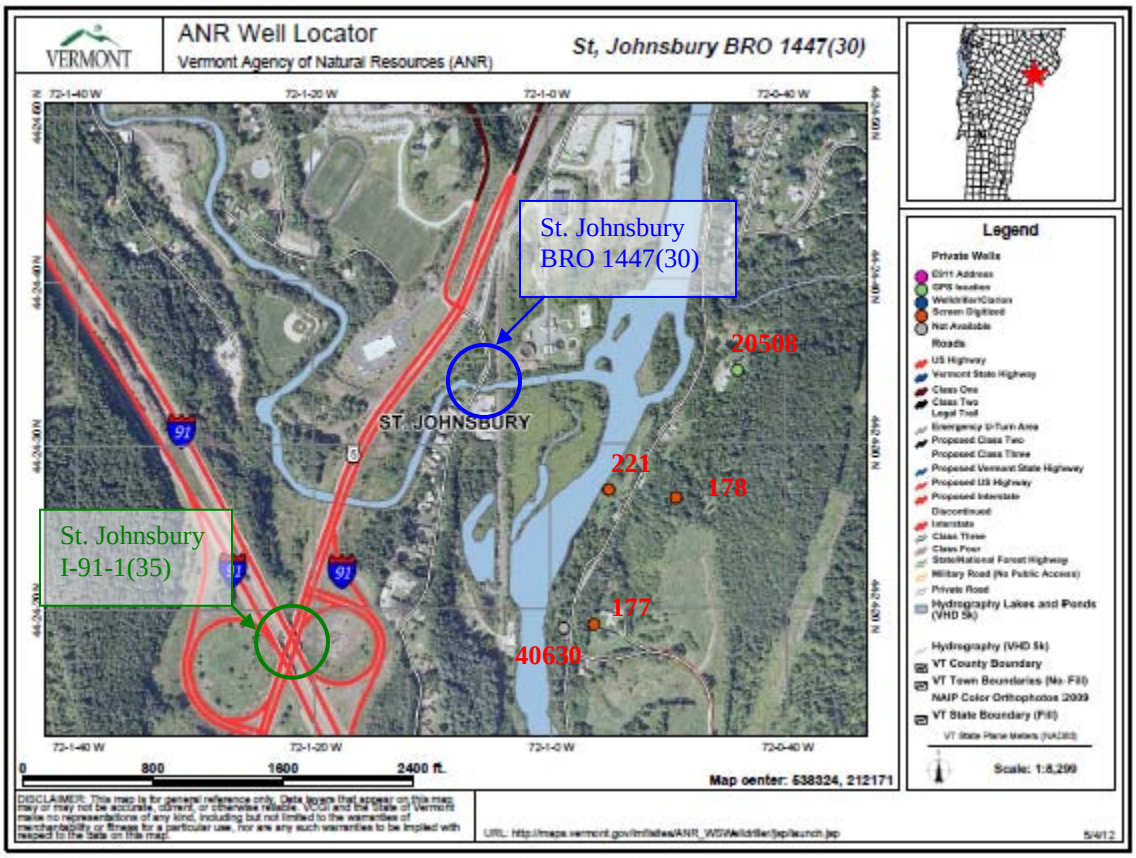


Figure 2: ANR Well Locations near Bridge 46 - South Main Street in St. Johnsbury, VT

Well	Overburden Description	Overburden Thickness
177	Sand and gravel	20
178	N/A	0
221	Gravel	13
20508	Gravel with possibly some clay	28
40630	Gravel	8

Table 1: Summary of ANR Well Data & Well Driller Soil Stratigraphy Notes

The existing 1929 plans (profile shown in Figure 3) do not indicate the soil stratigraphy beneath the existing bridge. The existing abutment footings are believed to be spread footings located at an elevation of either 543 or 548 ft while the pier footings are believed to be founded on timber piles with the bottom of footing elevation at 534 ft, see Figure 3. On the 1929 plans, timber piles were estimated to be 35 ft long for quantity purposes.

Borings drilled for the St. Johnsbury I91-1(35) project (Route 5 and I-91 interchange to the south and west of the existing project site) did have recorded bedrock elevations ranging from 517 to 552 ft. It is not known whether the reference elevation for each project is the same, however, the general assumption is that an elevation of 550 ft for the 1929 project is equivalent to 550 ft for the 1976 project. Based on this assumption and the well log data bedrock is fairly shallow on

both the south and east sides of the project. The north and west sides of the project are relatively undocumented.

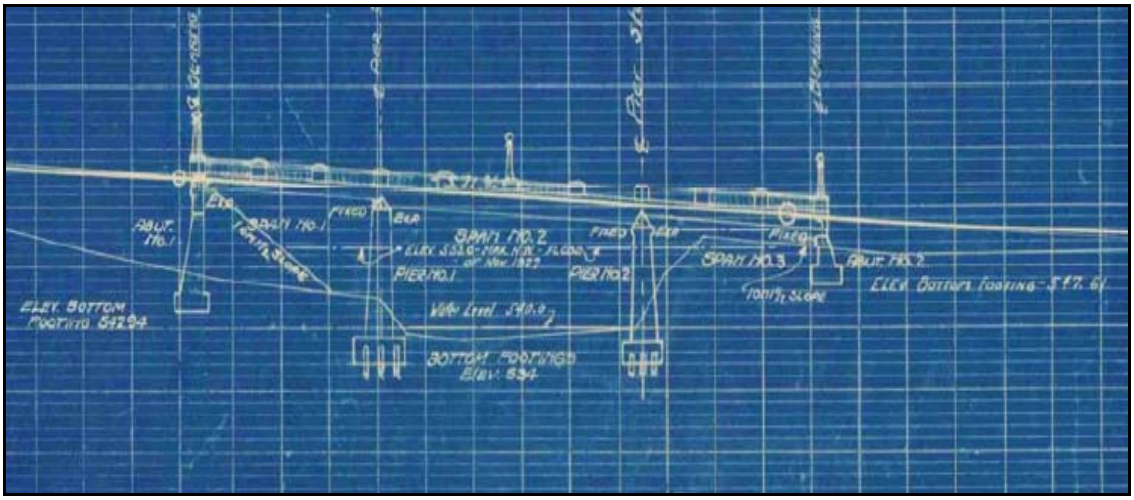


Figure 3: Profile of Existing Bridge from 1929 Plans

Surficial mapping conducted for the 1970 Surficial Geologic Map of Vermont indicates that the St. Johnsbury BRO 1447(30) project site is classified as Urban-land-Adams-Nicholville complex consisting of 0 to 8% slopes. The geological landform is likely either an outwash plain or a lake terrace; therefore, the surficial soils may be underlain by sandy glaciofluvial deposits. The 1976 plans for the I-91 Route 5 overpass corroborate these statements as the material encountered during drilling was predominantly fine sand with silt and some gravel interspersed.

Surficial bedrock maps of the area indicate that the existing bedrock deposit is of the Waits River formation and likely consists of a combination of phyllite, limestone and limited deposits of quartzite.

3.0 Utility / Construction Considerations

This bridge is in an urban setting and there are overhead power lines, underground telephone and water lines on the west side of the bridge. The overhead utilities cross diagonally just south of the bridge. The project site is located on a dead end street so a road closure without a temporary structure is not feasible.

John Vinton [phone number: (802) 748 9694] is the manager of the South Main Street Auto garage located in the southeast corner of this site. He offered that the area where he currently stores snow plows and other equipment could be made available for the bridge project. From a temporary structure perspective, there appears to be sufficient room to channel traffic on the southern end of the bridge, however, the issue would be how to handle a temporary abutment on the northern end of the bridge.

Scour over the years may have exposed several timber piles in the river channel. It may be prudent to remove these timber piles if there are any hydraulic concerns with the exposed piles catching debris and further increasing the localized scour condition.

4.0 Recommendations

The existing bridge is a 130 ft, straight, three span structure and consideration should be given to minimizing the number of spans. The current grade difference between the abutments is approximately 8 to 10 feet based on Figure 3. If an integral abutment bridge type is selected it is theorized that most of the movement would be absorbed by the downhill abutment / piles. The amount of movement for a 130 ft structure even if movement is solely on one end of the bridge is within the current limitations of the VTrans Integral Abutment Design Guidelines.

Scour appears to be a concern at this location in which case spread footings may not be recommended, however, design consideration should be given to the abutments to see if they can be constructed far enough away from the river to avoid potential scour issues.

The subsurface investigation for this structure should include, but not be limited to, a determination of the soil and bedrock properties (strength, material composition, RQD, etc), ground water conditions and the depth of bedrock. A minimum of one boring per substructure unit should be drilled to determine the geotechnical capacity of the soil. Potential borings on the south side of the bridge may be drilled in the southeast corner of the project site - in the South Main Street Auto parking lot. Borings for the northern abutment would require a minimum 10 foot clearance from the overhead power lines placing the borings in the traveled portion of the highway. Final recommendations for the number and location of borings can be provided once an alignment and preliminary structure type have been selected.

Drilling equipment access is limited in the northeast corner due to the high and steep highway embankment and proximity of the existing railroad. Drilling through the existing bridge deck may be required if a multiple span bridge design is recommended. Temporary traffic control, including flaggers, is anticipated to be utilized at this site, especially on the northern end, to maintain a safe work zone.

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

- Pile caps on a single row of H-Piles (integral abutment or pinned superstructure), or
- Reinforced concrete abutments on a conventional pile foundation, or
- Reinforced concrete abutments on a spread footing foundation (pending site specific hydraulic recommendations and limitations) with consideration given to integrating permanent sheet pile for scour mitigation.

If you have any questions, please feel free to contact us at (802) 828-2561.

cc: WEA/Read File
CCB/Project File

Ramsey, Jeff

From: Lepore, John
Sent: Tuesday, April 10, 2012 1:10 PM
To: Ramsey, Jeff; Williams, Chris
Cc: Lepore, John
Subject: St. Johnsbury BHO 1447 (30) - Natural Resources (NEPA)

Jeff / Chris,

Per my review of the mapping and a site visit, I've concluded that the only regulated resource in this area is the watercourse itself. If a temporary bridge is constructed, I ask that it span the brook entirely. Either side of the existing bridge is suitable for a temporary, as the entire area has been impacted by previous activities.

The new structure should avoid the use of a center pier so as to avoid causing debris and scour concerns.

If you have any questions, come see me…

~ John ~

VERMONT

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

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

Agency of Transportation

To: Jeff Ramsey, VTrans Environmental Specialist

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

Date: 6/4/2012

Subject: St.Johnsbury BHO 1447(30) Bridge 46, TH 371 Archaeological Resource Identification

Jeff,

I've completed my initial resource identification for St. Johnsbury BHO 1447(30). A review conducted on 5/4/2012 as part of the 2012 GPS scoping initiative was adequate to identify potential resources in the project area. There are *no archaeological resources* present in the APE, and likewise no concerns for archaeology.

Please feel free to contact me with any questions or concerns.

~Brennan

Brennan Gauthier
VTrans Assistant Archaeologist
tel. 802-828-3965
Brennan.Gauthier@state.vt.us

VTrans Working to Get You There
Vermont Agency of Transportation

Ramsey, Jeff

From: O'Shea, Kaitlin
Sent: Tuesday, June 26, 2012 2:23 PM
To: Ramsey, Jeff; Brady, James; Goldstein, Lee; Gingras, Glenn
Cc: Newman, Scott
Subject: Pilot Scoping Projects - 2012

Hi Jeff, James and Lee,

The historic resource IDs for the remaining pilot scoping projects have been completed, and added to the Historic Preservation geodatabase (in the same manner which Scott and I sent the reclaim resource ID information). I've bookmarked the following projects by "project name – historic." Let me know if there is a better way for me to pass on this information to you.

Barton Village BHF 0286(5)
Calais BHF 037-2(11)
Chelsea BHF 0169(9)
Chelsea BHF 0169(10)
St. Johnsbury BHO 1447(30)

This should complete the historic resource ID for the Chris Williams scoping projects.

Thanks,
Kaitlin

Ramsey, Jeff

From: Armstrong, Jon
Sent: Wednesday, May 23, 2012 1:15 PM
To: Ramsey, Jeff
Subject: RE: Environmental Request NOTIFICATION: ST. JOHNSBURY BHO 1447(30)

Hi Jeff,
I don't have considerable stormwater related concerns for this project at this time. It is however worth mentioning that the impervious surface of nearby to the North, Three Rivers Transportation Path has a stormwater discharge permit (5616_INDS.A) and associated treatment areas that cannot be impacted without review and possibly amending the permit. The permit can be found at: http://www.anr.state.vt.us/imaging/StormWater/5616-INDS.A.pdf

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

"*We forget that the water cycle and the life cycle are one.*"
- Jacques Cousteau

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From: Ramsey, Jeff
Sent: Wednesday, March 28, 2012 4:44 PM
To: Armstrong, Jon; Gingras, Glenn; Gauthier, Brennan; O'Shea, Kaitlin
Cc: Williams, Chris
Subject: FW: Environmental Request NOTIFICATION: ST. JOHNSBURY BHO 1447(30)

Hi all,
This project is one of the Chris Williams Pilot Projects. The entire pilot group will go out to visit a site to work through the process so they all know how to do it and what to look for. That visit will happen in the very near future.

Comments: The resource ID will be conducted by a pilot group under PDWP GIS/GPS work plan. This group is part of the GIS Experimental work plan and is researching innovative ways to streamline the ID process.

Folder Link:
Z:\Projects-Engineering\StJohnsburyBHO1447(30)12j164\Environmental\ResourceIDandClearances\ResourceID

Please let me know if you have any questions.
Thanks,
Jeff

Jeff Ramsey
Environmental Specialist - North Region
Vermont Agency of Transportation
Program Development Division
Environmental Section
1 National Life Drive
Montpelier, VT 05633

OFFICE MEMORANDUM

AOT - PROGRAM DEVELOPMENT DIVISION

RESOURCE IDENTIFICATION COMPLETION MEMO

TO: Chris Williams, Project Manager
FROM: Jeff Ramsey, Environmental Specialist
DATE: July 9, 2012

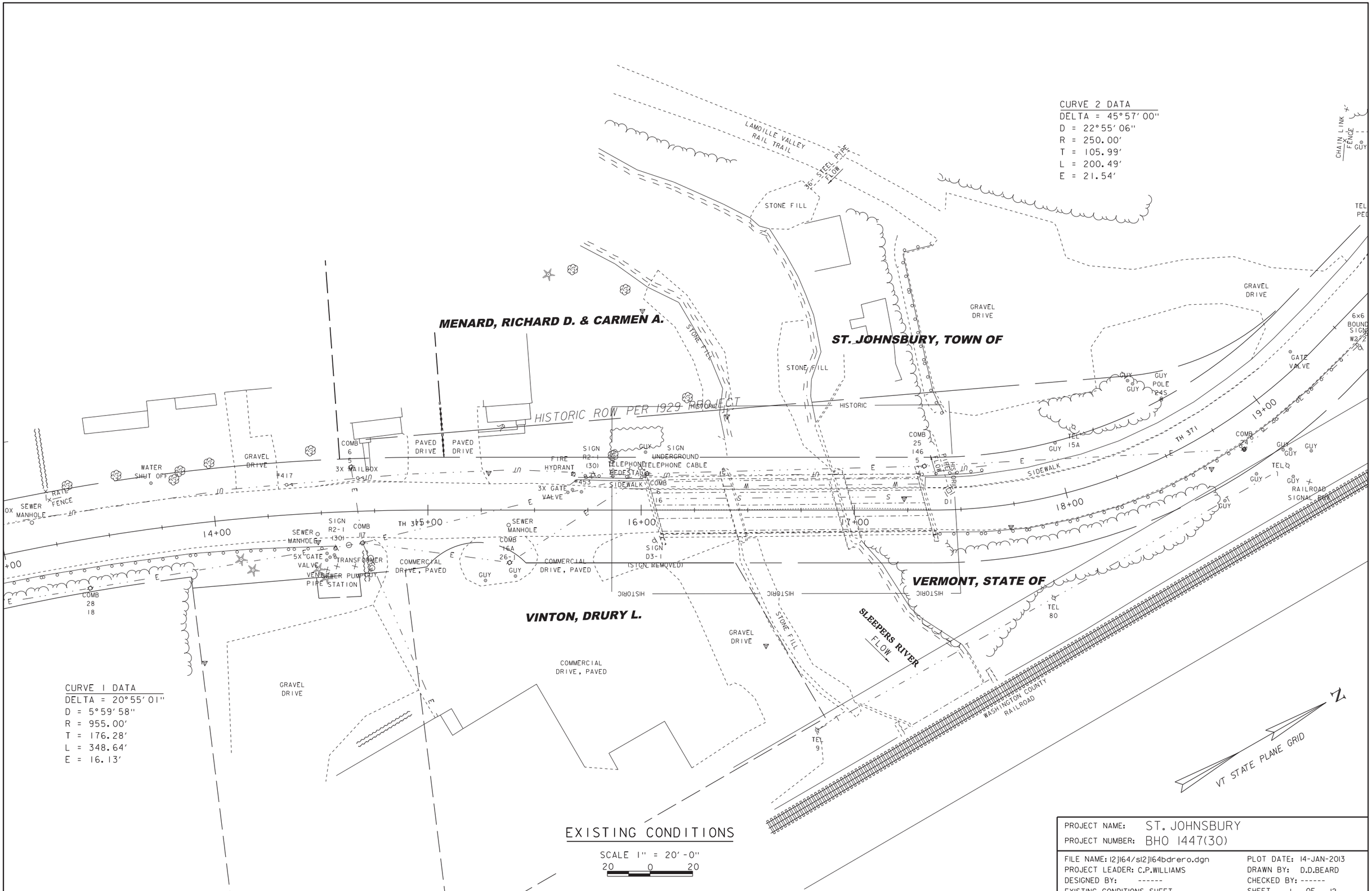
Project: St. Johnsbury BHO 1447 (30)

ENVIRONMENTAL RESOURCES:

Wetlands:	___ Yes	_X_ No	
Historic/Historic District:	_X_ Yes	___ No	see Historic Resource ID
Archaeological Site:	___ Yes	_X_ No	
4(f) Property:	_X_ Yes	___ No	see Historic Resource ID
6(f) Property:	___ Yes	_X_ No	
Agricultural Land:	___ Yes	_X_ No	
Fish & Wildlife Habitat:	_X_ Yes	___ No	the river, see Resource ID Lepore
Endangered Species:	___ Yes	_X_ No	
Hazardous Waste:	_X_ Yes	___ No	Hazardous Waste Site Generator, South Main Body Shop, South Main Street, Site 11698 [-72.01815063, 44.40894718]; labeled on ArcMap layer.
Stormwater:	___ Yes	_X_ No	
USDA-Forest Service Lands:	___ Yes	_X_ No	
Wildlife Habitat Connectivity:	___ Yes	_X_ No	
Scenic Highway/ Byway:	___ Yes	_X_ No	
Act 250 Permits:	___ Yes	_X_ No	

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

cc:
Project File



EXISTING CONDITIONS

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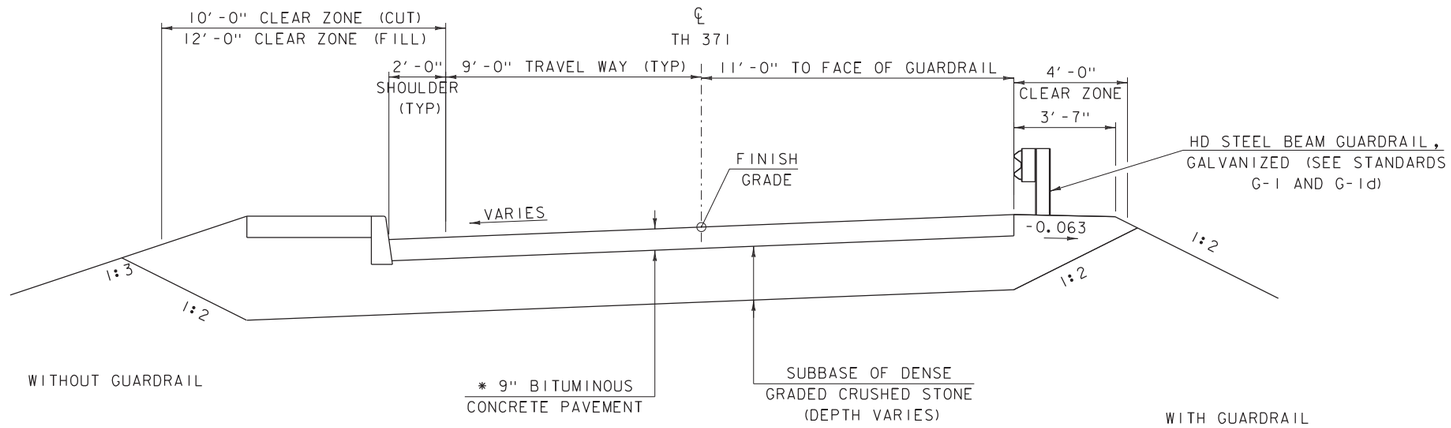
PROJECT NUMBER: BHO 1447(30)	
FILE NAME: 12J164/s12J164bdrero.dgn	PLOT DATE: 14-JAN-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
EXISTING CONDITIONS SHEET	SHEET 1 OF 12



TH 371 ROADWAY TYPICAL SECTION

SCALE: 3/8" = 1'-0"

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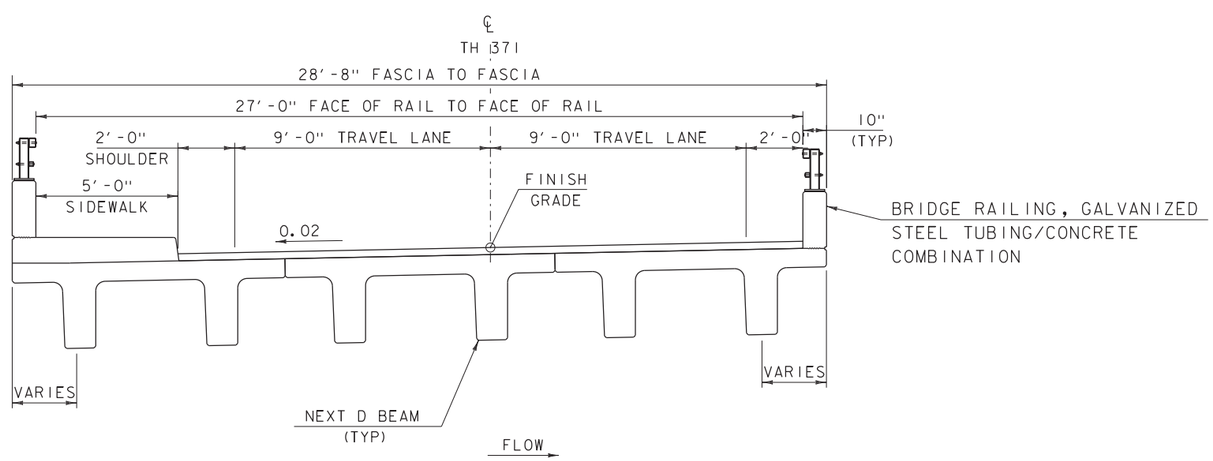


BRIDGE TYPICAL SECTION

SCALE: 3/8" = 1'-0"

MATERIAL TOLERANCES

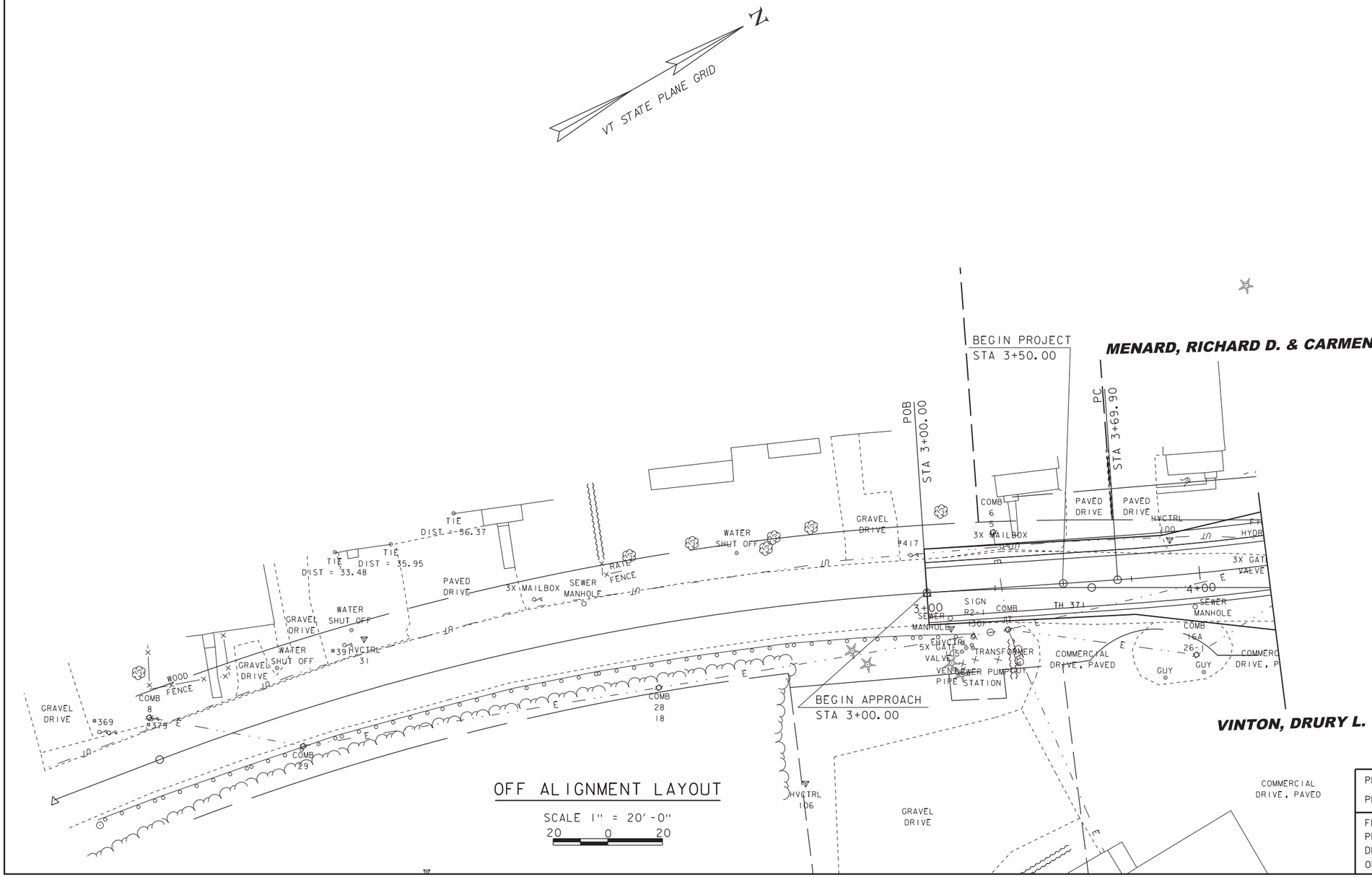
(IF USED ON PROJECT)

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

PROJECT NAME: ST JOHNSBURY
PROJECT NUMBER: BHO 1447(30)

FILE NAME: s12j164typ.dgn
PROJECT LEADER: C.P.WILLIAMS
DESIGNED BY: L.STONE
TYPICAL SECTIONS

PLOT DATE: 14-JAN-2013
DRAWN BY: L.STONE
CHECKED BY:
SHEET 2 OF 12



OFF ALIGNMENT LAYOUT

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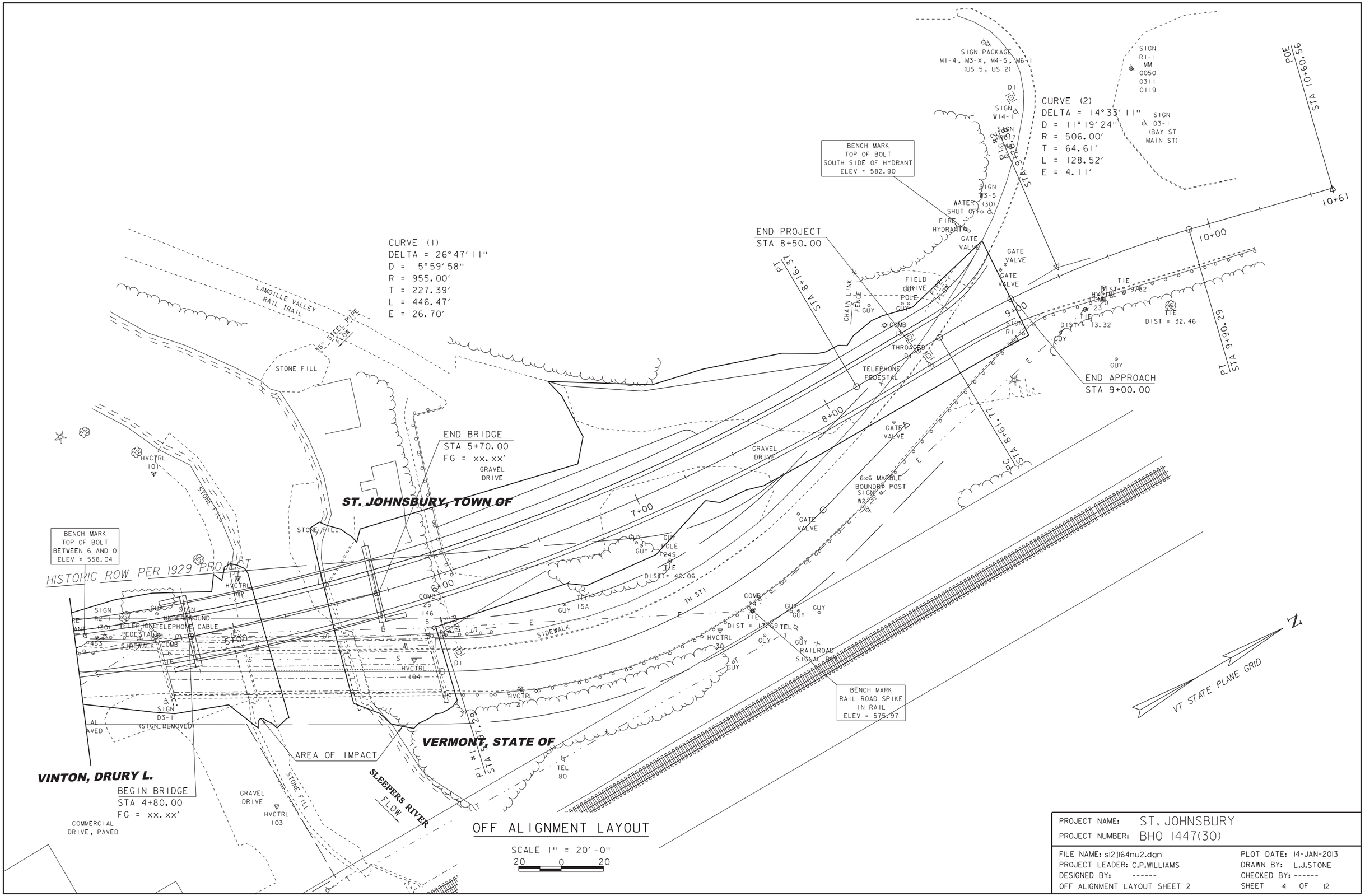
PROJECT NUMBER: BHO 1447(30)	
FILE NAME: s12j164nu2.dgn	PLOT DATE: 14-JAN-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: L.J.STONE
DESIGNED BY: ------	CHECKED BY: ------
OFF ALIGNMENT LAYOUT SHEET 1	SHEET 3 OF 12



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PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: L.J.STONE
DESIGNED BY: ------	CHECKED BY: ------
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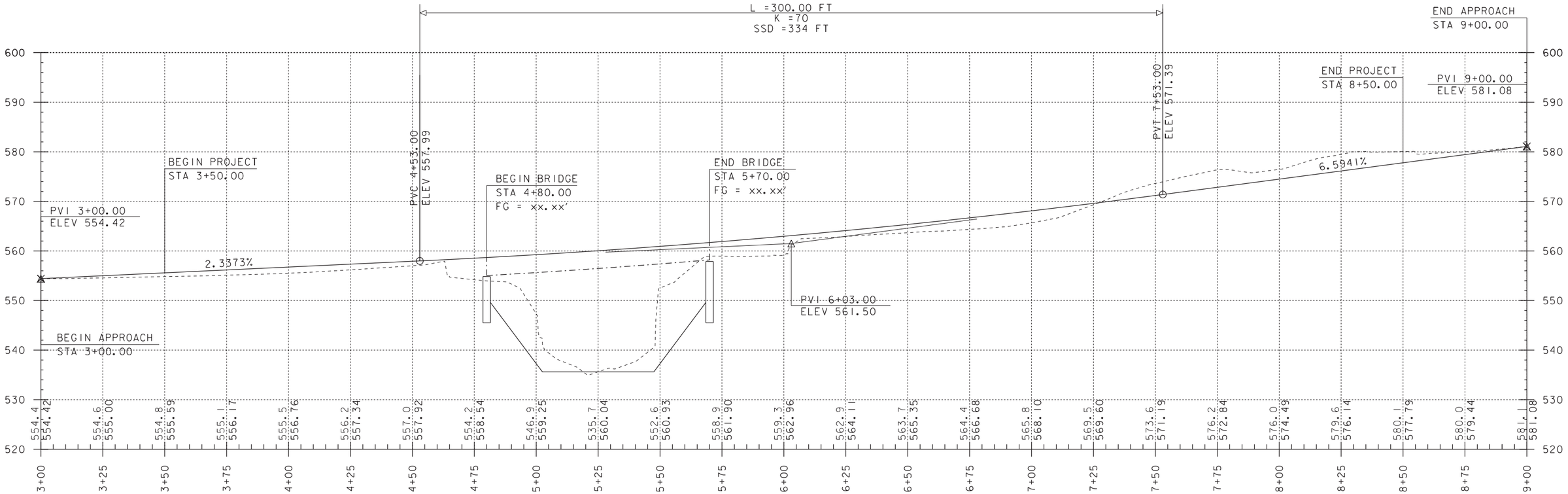

LINE	SURFACE	OFFSET
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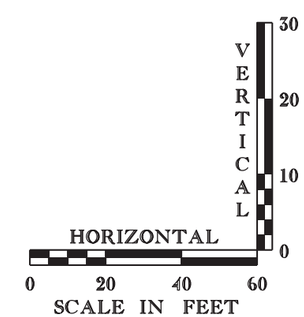
Scaled	2.0000	Times Ver.
Scaled	1.0000	Times Hor.

TH 371 (OLD US 5) PROFILE FOR OFF ALIGNMENT FULL BRIDGE REPLACEMENT



NOTE:

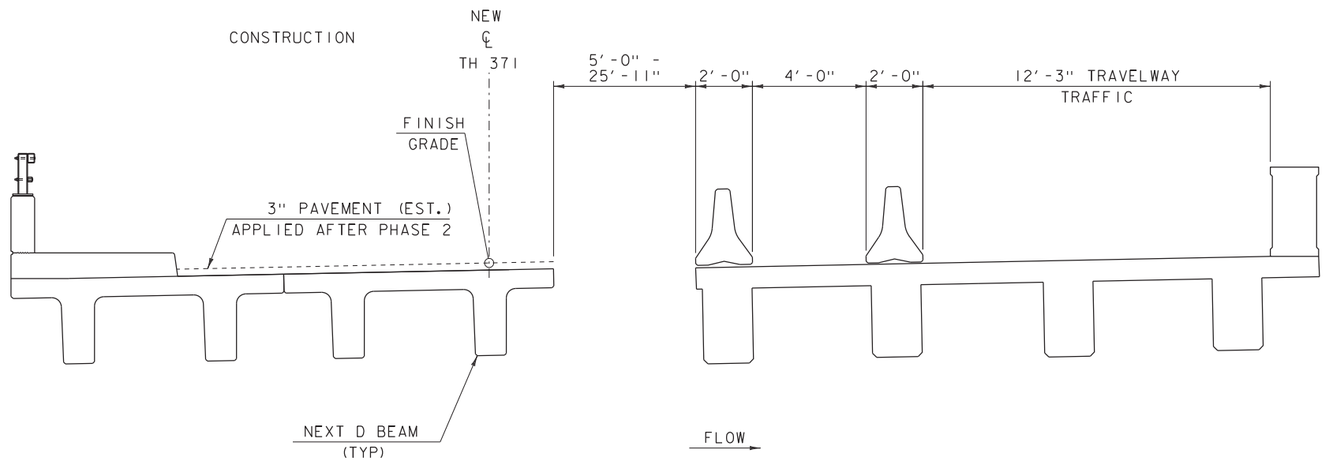
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄

GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: ST. JOHNSBURY
PROJECT NUMBER: BHO 1447(30)

FILE NAME: off align profile.dgn
PROJECT LEADER: C.P.WILLIAMS
DESIGNED BY: ------
PROFILE SHEET

PLOT DATE: 14-JAN-2013
DRAWN BY: L.J.STONE
CHECKED BY: ------
SHEET 5 OF 12



FULL BRIDGE REPLACEMENT PHASE #1 TYPICAL SECTION

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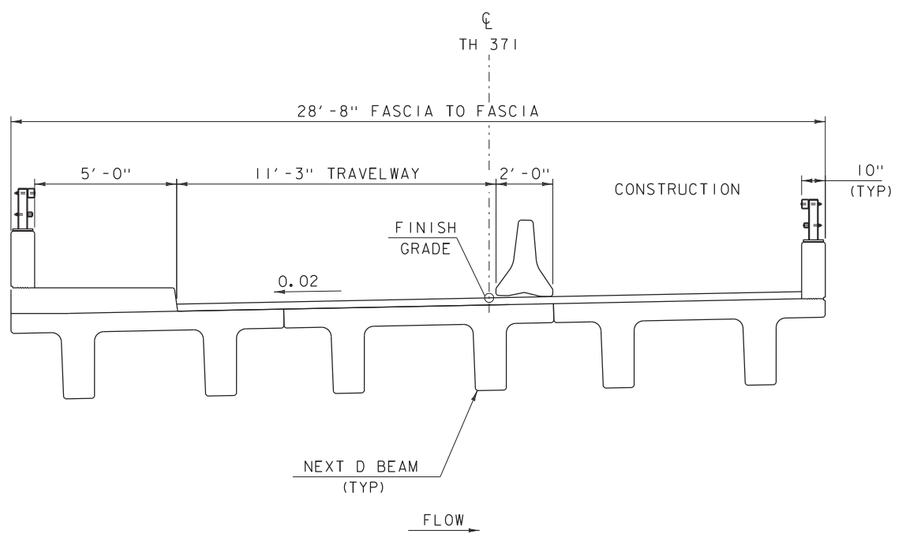

FULL BRIDGE REPLACEMENT PHASE #2 TYPICAL SECTION

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PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: L.STONE
DESIGNED BY: L.STONE	CHECKED BY:
PHASING TYPICAL SECTIONS	SHEET 6 OF 12

MENARD, RICHARD D. & CARMEN A.

ST. JOHNSBURY, TOWN OF

HISTORIC ROW PER 1929 PROJECT

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9+00

12'-3"

AREA OF IMPACT

VERMONT, STATE OF

VINTON, DRURY L.

N

VT STATE PLANE GRID

PHASE I LAYOUT FOR ALTERNATIVE 2A

SCALE 1" = 20'-0"

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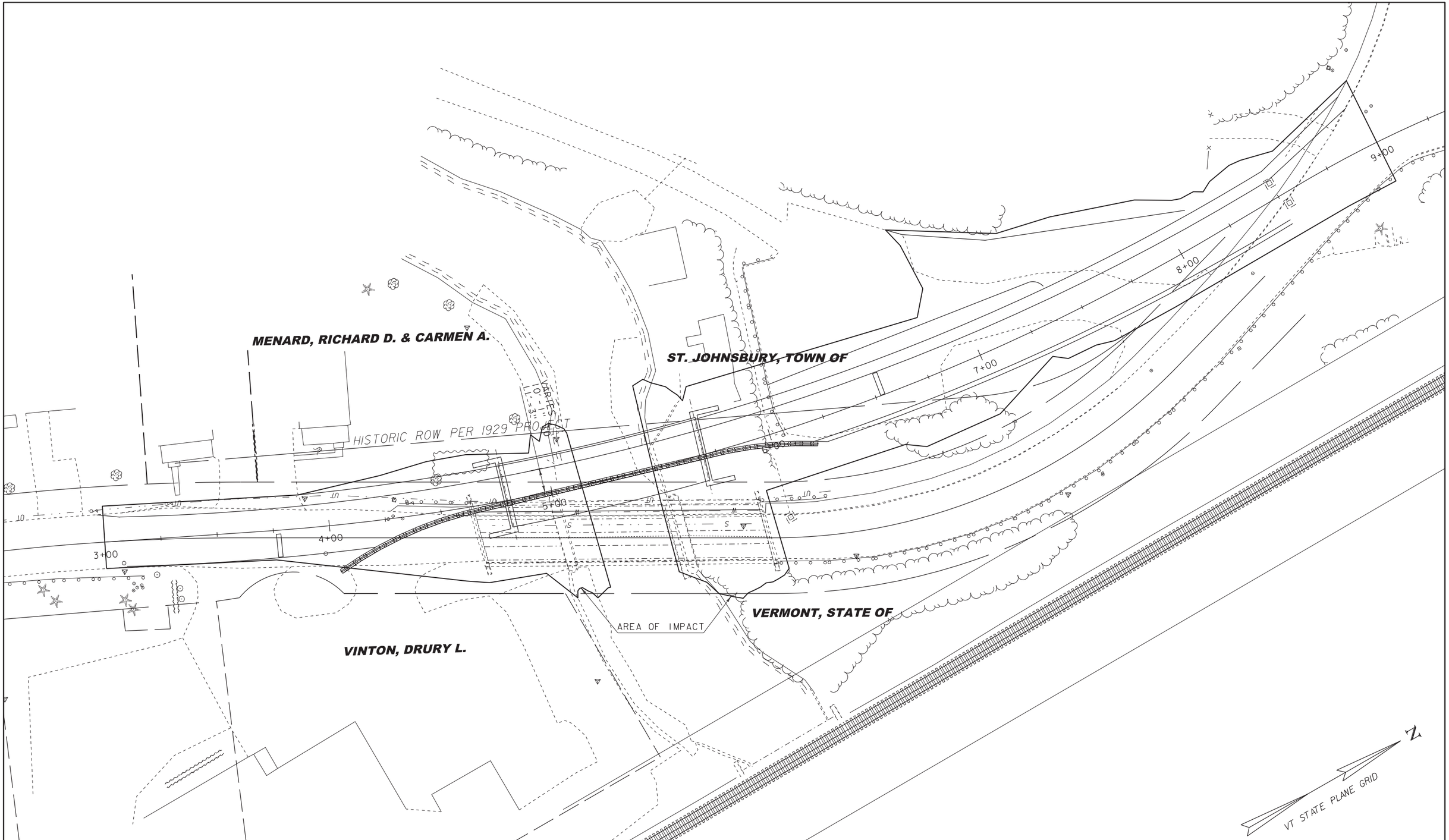
PROJECT NAME: ST. JOHNSBURY	
PROJECT NUMBER: BHO 1447(30)	
FILE NAME: s12j164bdr.dgn	PLOT DATE: 14-JAN-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: L.J.STONE
DESIGNED BY: ------	CHECKED BY: ------
PHASING LAYOUT SHEET	SHEET 7 OF 12



PHASE 2 LAYOUT FOR ALTERNATIVE 2A

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PROJECT NUMBER: BHO 1447(30)	
FILE NAME: s12j164bdr.dgn	PLOT DATE: 14-JAN-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: L.J.STONE
DESIGNED BY: ------	CHECKED BY: ------
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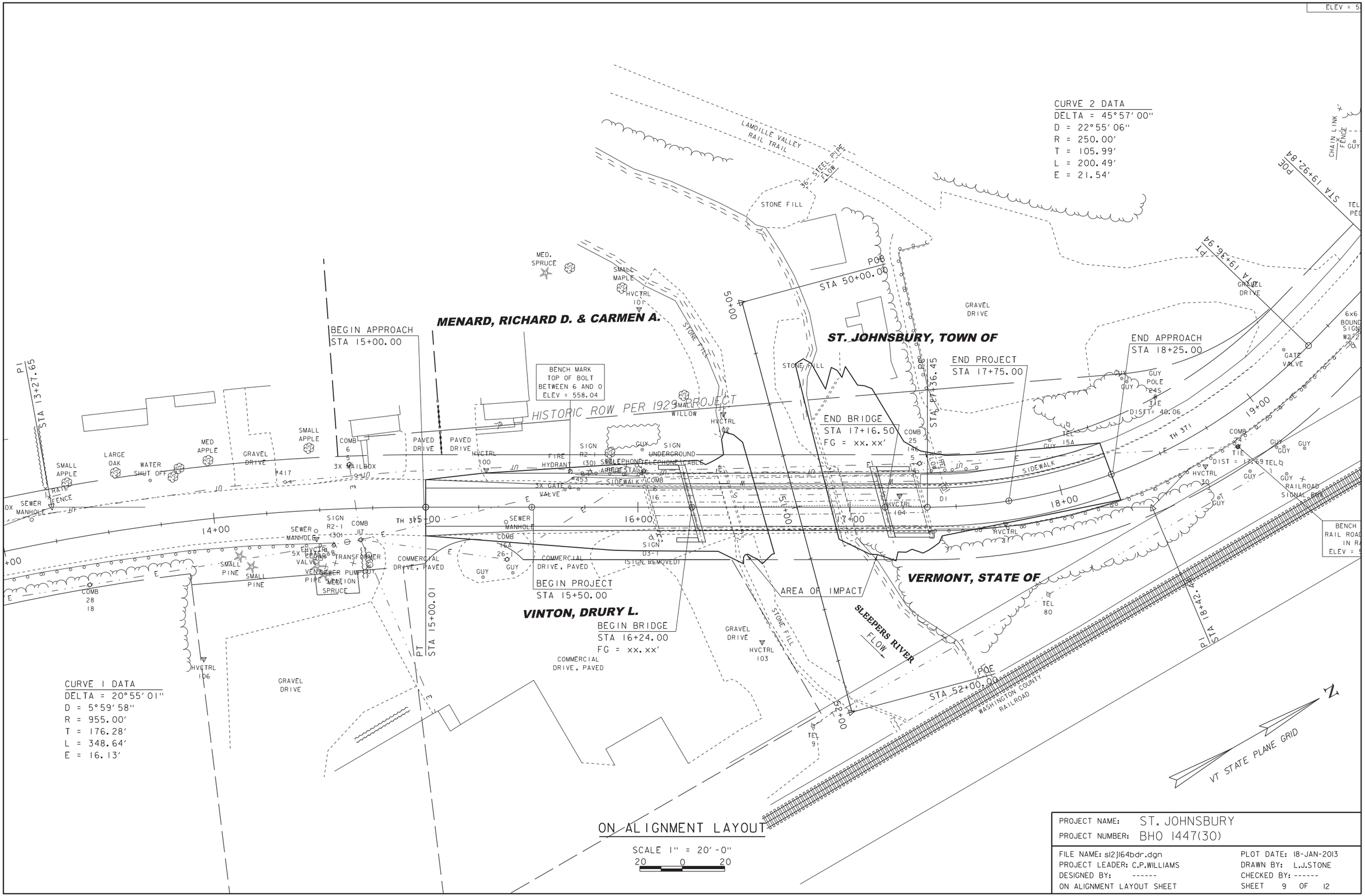

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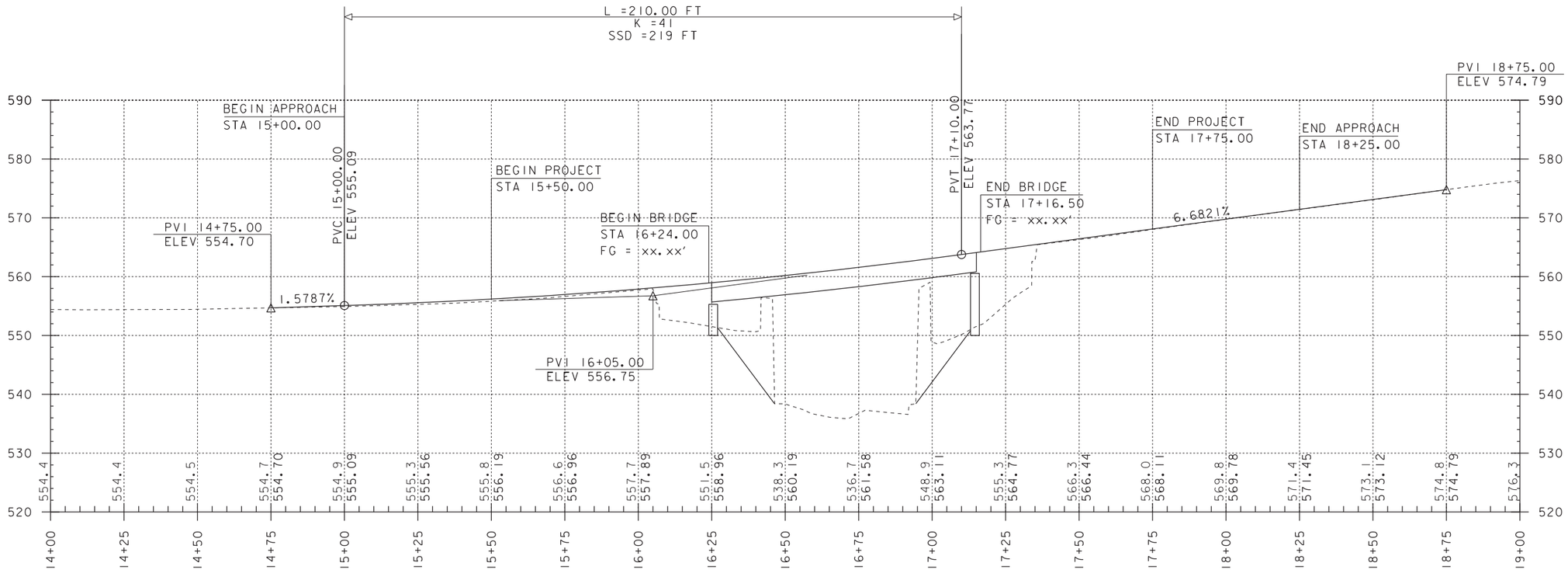
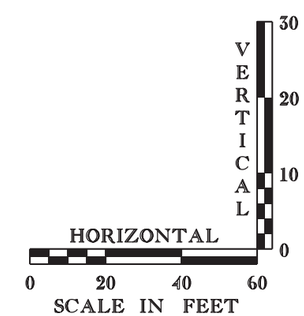
FILE NAME: s12j164bdr.dgn	PLOT DATE: 18-JAN-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: L.J.STONE
DESIGNED BY: ------	CHECKED BY: ------
ON ALIGNMENT LAYOUT SHEET	SHEET 9 OF 12



TH 371 (OLD US 5) PROFILE FOR ON ALIGNMENT FULL BRIDGE REPLACEMENT



NOTE:

GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄

GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

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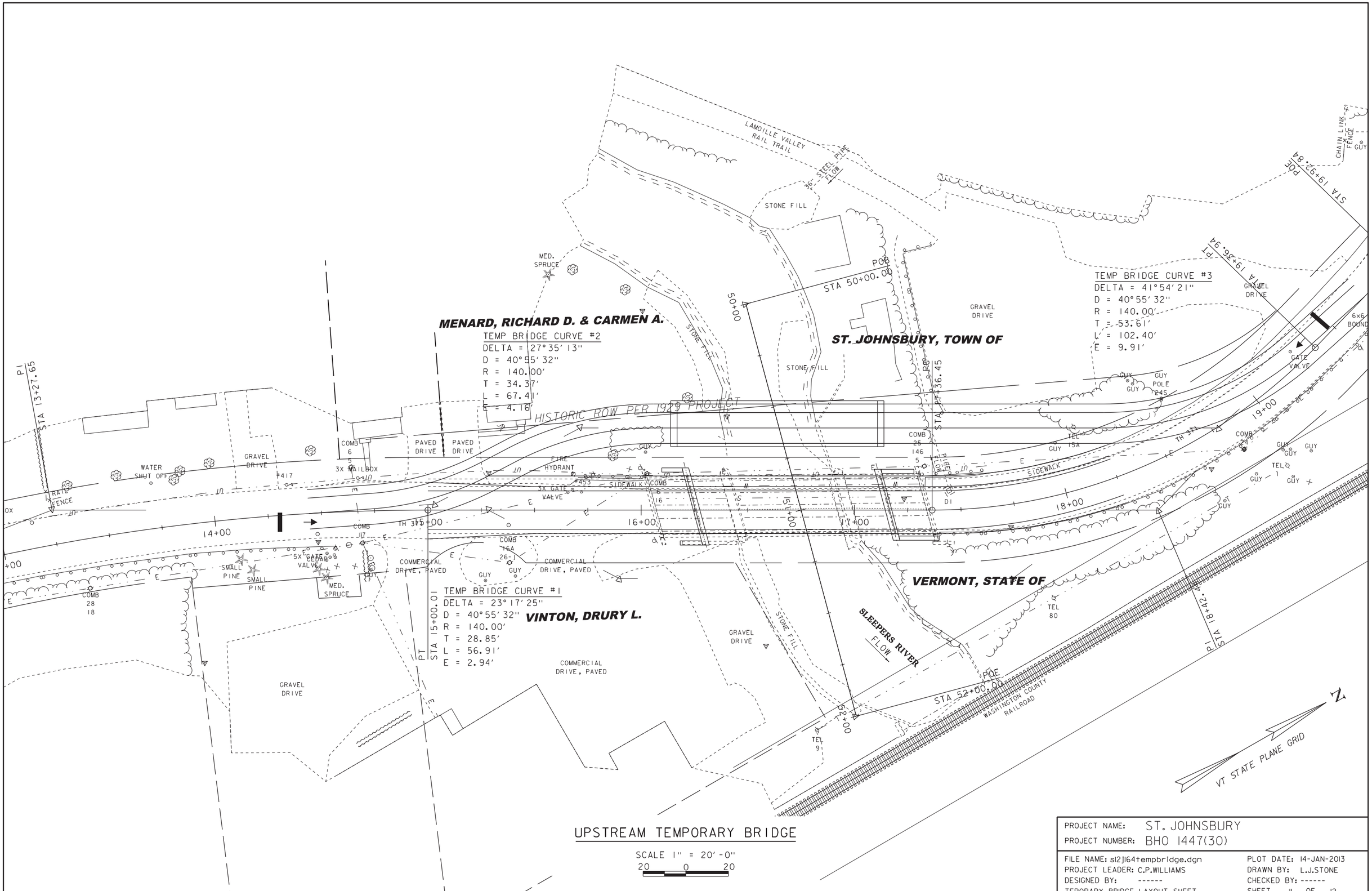
PROJECT NUMBER: BHO 1447(30)	
FILE NAME: s12j164profile.dgn	PLOT DATE: 14-JAN-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: L.J.STONE
DESIGNED BY: ------	CHECKED BY: ------
PROFILE SHEET	SHEET 10 OF 12



UPSTREAM TEMPORARY BRIDGE

SCALE 1" = 20'-0"
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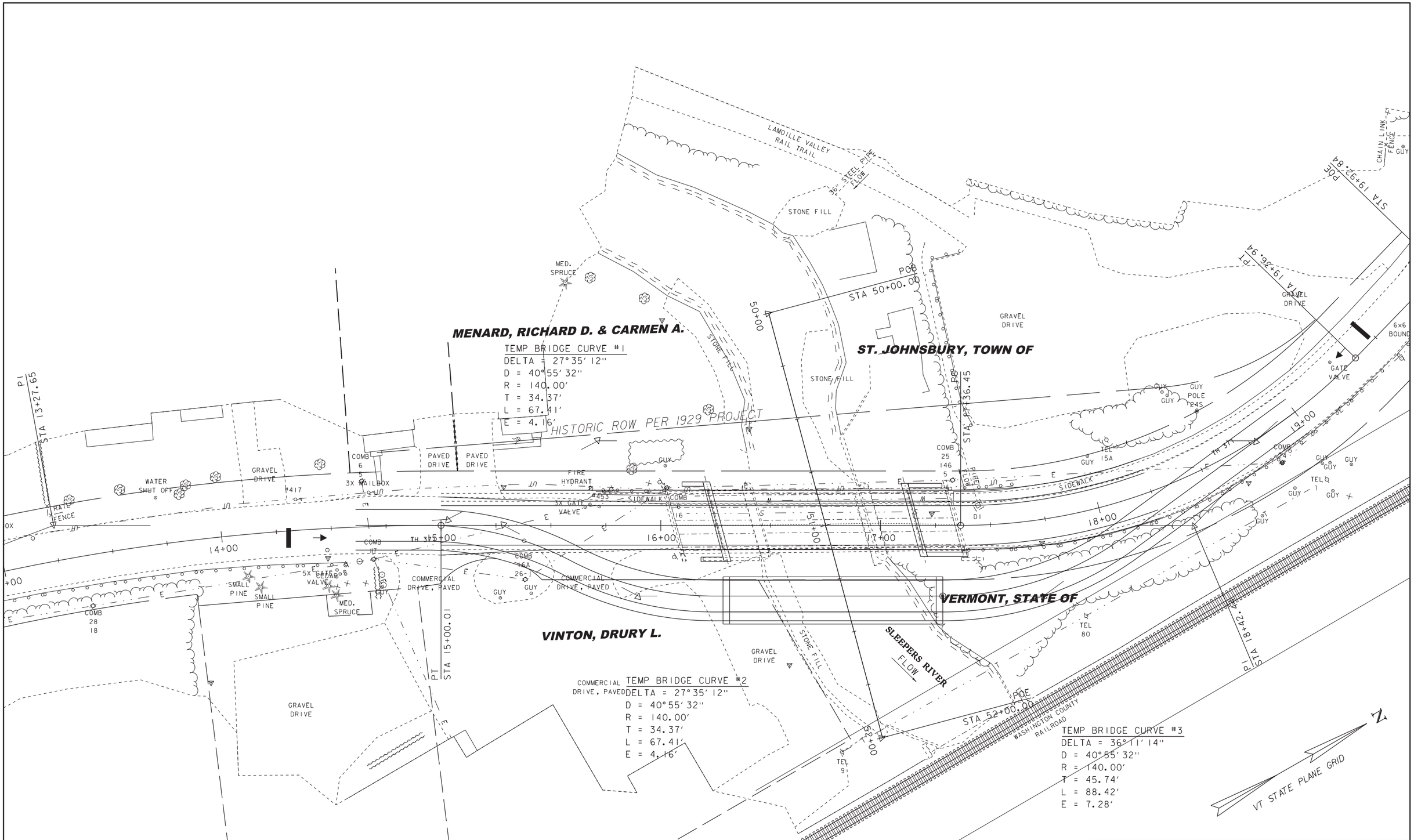
PROJECT NUMBER: BHO 1447(30)	
FILE NAME: s12j164tempbridge.dgn	PLOT DATE: 14-JAN-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: L.J.STONE
DESIGNED BY: ------	CHECKED BY: ------
TEPORARY BRIDGE LAYOUT SHEET	SHEET 11 OF 12



DOWNSTREAM TEMPORARY BRIDGE

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

PROJECT NAME: ST. JOHNSBURY	
PROJECT NUMBER: BHO 1447(30)	
FILE NAME: s12j164tempbridge.dgn	PLOT DATE: 14-JAN-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: L.J.STONE
DESIGNED BY: ------	CHECKED BY: ------
TEPORARY BRIDGE LAYOUT SHEET	SHEET 12 OF 12