STATE OF VERMONT
AGENCY OF TRANSPORTATION

Scoping Report

FOR

Brunswick BF 0271(23)
VT ROUTE 102, Bridge 6 OVER PAUL STREAM

December 9, 2013

I. Contents

I. Site Information

The bridge is located in a rural area along VT Route 102 at mile marker 2.59 (2.59 miles from the boundary with the Town of Maidstone), and approximately 0.4 miles north of the intersection with Maidstone Lake Access Road (MNC S0782). The bridge is located on a curved segment of VT 102. 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 Major Collector
Bridge Type	3 Span Concrete tee-beam, abutments supported by timber piles
Bridge Span	109 ft. long, maximum span 40 ft.
Year Built	1932
Ownership	State of Vermont

Need

The following is a list of the deficiencies of Bridge 6.

1. The deck is in poor condition and superstructure and substructure are in fair condition. The bridge has an overall Federal Sufficiency Rating of 51 and is rated as structurally deficient. Deterioration has progressed to the point where full depth holes in the deck are possible at any time.

2. The approach and deck widths are substandard.

3. The bridge rail is described in the latest inspection report as meeting current standards, but the posts, curbs, and deck on which the bridge rail depends are in poor condition.

4. The existing bridge does not have adequate hydraulic capacity.

5. The bridge and approaches are on a horizontal curve that does not meet the current standard.

Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2016 and 2036.

TRAFFIC DATA	2016	2036
ADT	550	580
DHV	75	75
ADTT	65	100
%T	11.2	16.1
%D	58	58

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 400-1500 and a design speed of 50 mph.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 5.3	10’/3’ (26’)	10’/4’(28’)[1]	Substandard
Bridge Lane and Shoulder Widths	VSS Table 5.3	9’/1’ (20’)	10’/4’ (28’)[1]	Substandard
Clear Zone Distance	VSS Table 5.5		12’ fill / 8’ cut (1:3), 8’ cut (1:4)	
Banking	VSS Section 5.13	2.5%	8% (max), 6% (max) at side roads	Substandard
Speed	VSS Section 5.3	50 mph (By default – unposted)	50 mph (Design)	
Horizontal Alignment	AASHTO Green Book Table 3-10b	Bridge located on a horizontal curve, R=925’	R_{min}=4700’(approx) @ 2.5%	Substandard
Vertical Grade	VSS Table 5.6	Bridge located in transition from (-)2.8571% grade to 0.000% grade	6% (max) for level terrain	
K Values for Vertical Curves	VSS Table 5.1	Bridge located on sag (K = 111)	110 crest / 90 sag	
Vertical Clearance Issues	VSS Section 5.8	None noted	14’-3” (min)	
Stopping Sight Distance	VSS Table 5.1	538’	400’	
Bicycle/Pedestrian Criteria	VSS Table 5.8	1’ Shoulder	2’ Shoulder[1]	Substandard
Bridge Railing	Structures Manual Section 13		TL-3 (Design Speed = 50mph)	
Hydraulics	VTrans Hydraulics Section	Passes Q_{50} with 0.7’ of freeboard	Pass Q_{50} storm event with 1.0’ of freeboard	Substandard
Structural Capacity	SM, Ch. 3.4.1	H15	Design Live Load: HL-93	Substandard

[1] The Vermont State Standards call for a 10’/3’ width for this project. A 10’/4’ width will be used because it is required to meet Highway Safety and Design Engineering Instruction HSDEI 11-004 for minimum width for snowplows.

Inspection Report Summary

Deck Rating	4 Poor
Superstructure Rating	5 Fair
Substructure Rating	5 Fair
Channel Rating	5 Fair

From the latest Inspection Reports

07/11/2011 - The deck and beams continue to deteriorate. The deck could have full depth holes especially in span 2 at abutment 1. The windslot drains are spalling up to the fascia tee beams and in the shoulders. – *DCP/FRE*

07/14/2009 – Overall condition of the bridge is fair. The deck condition is a concern with localized areas of advanced deterioration. Full depth holes could occur any time, any place, especially in bay 2. - *DCP*

Hydraulics

From preliminary hydraulics report:

"In its existing configuration, the existing bridge does not meet the VTrans hydraulic standard for the Q_{50} design storm event, but is close with the flow passing through the structure and having 0.7 ft. of freeboard, instead of 1 ft, just upstream of the structure."

The Q_{100} event does pass through the structure. Although the Bridge Inspection report lists the bridge as stable for scour, the preliminary hydraulics report indicated that a 3-5 ft. deep scour hole was observed just upstream of the bridge and along the inside of the north pier.

<u>Recommendations</u>

If the bridge is replaced fully, the present low beam elevation is acceptable for either single span or three span alternatives, provided that modifications are made to the stream bank side slopes. In the three span alternative, the recommendation is that the new pier locations be no closer than they currently are to each other. Without side slope modifications, the low beam elevations would need to be raised slightly.

The Preliminary Hydraulics Report and accompanying sketches are shown in the appendix.

Utilities

<u>Underground:</u>

There are no municipal water or sewer facilities in the project area. There is a municipally-owned dry fire hydrant in the northwest quadrant of the project area. Nearby homes have private wells and septic systems.

<u>Aerial:</u>

There are single phase electric and telephone lines passing along VT 102 west of the bridge. They cross the road approximately 125 ft. south of the bridge. It is likely that these utilities will require relocation for any of the alternatives considered for the project.

Right Of Way

The existing Right-of-Way is shown on the Layout sheet. The width is 3 Rods south of the bridge, and 4 Rods on and north of the bridge. The step occurs near the south end of the bridge.

Resources

The resources present at this project are shown on the Existing Conditions Layout Sheet, and are described in the appendix. They are as follows:

Biological:

Wetlands

There are no wetlands within the project area.

Wildlife Habitat

The only regulated resource in the immediate area of bridge 6 is the Paul Steam itself.

Rare, Threatened and Endangered Species

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

Agricultural

There are prime agricultural soils south of the project area and statewide significant soils north of the site.

Archaeological:

The Southeast quadrant of the bridge area has been identified as archaeologically sensitive. The area in question is shown in the appendix.

Historic:

There are no Historic or Section 4(f) properties in the project area.

Hazardous Materials:

There are no hazardous sites on the Vermont Agency of Natural Resources Hazardous Sites List. No impacts to or from hazardous waste sites are anticipated.

Stormwater:

There are no stormwater concerns for this project.

Scenic Byways:

VT 102 is listed as part of the Connecticut River Byway system, and has also been listed as part of the National Byway System. The current guidance is to meet Vermont State Standards on Byway Systems.

II. Maintenance of Traffic

The Vermont Agency of Transportation has created an Accelerated Bridge Program, which focuses on faster delivery of construction plans, permitting, and Right of Way, as well as faster construction of projects in the field. One practice that 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 prefabricated elements in new bridges will also expedite construction schedules. This can apply to decks, superstructures, and substructures. Accelerated Construction should provide enhanced safety for the workers and the travelling public while maintaining project quality. The following options have been considered:

Option 1: Temporary Bridge

If a temporary bridge is chosen, it should be a one lane bridge with traffic signals at each end, to maintain alternating one-way traffic. Guidelines for temporary bridges indicate that for the current traffic volumes, traffic signals may not be necessary, but since the project is on a curve, and railings and grade may compromise sight distance, traffic signals are recommended. There are challenges for either an upstream or a downstream temporary bridge location. Upstream, a house is located close to the bridge in the northwest quadrant and there are aerial utilities along the west side of VT 102. There is also a dry hydrant on the upstream side. There is a house on the downstream side, further away, and an archaeologically sensitive area in the southeast quadrant that will be difficult to completely avoid. A temporary bridge would require Right of Way acquisition, which would extend the project development phase, extend the construction phase, and increase costs in both phases.

Temporary Bridge Layouts can be seen in the appendix.

Advantages: Traffic flow would be maintained through the project corridor during construction.

Disadvantages: This option would require the acquisition of additional temporary rights, and would be relatively high in cost. The potential for impacts to neighboring properties and sensitive areas are increased. There would be some minor delays and disruption to traffic, since the road would be reduced to alternating one-way traffic.

Option 2: Phased Construction

Phased construction is the maintenance of one lane of alternating 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 and resources. The time required to develop this project for phased construction would be comparable to the time required to develop a project with a temporary bridge, since Right of Way is expected to be required for either. There is little savings in the time required to complete the construction of a phased project because some of the construction tasks have to be performed multiple times. The inconvenience of working around traffic and the effort involved in coordinating the joints between the phases also increases the construction costs for phased construction. Another negative aspect of phased construction is the decreased safety of the workers and vehicular traffic, which is caused by the proximity and the extended 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 Right Of Way. Due to the narrow width of Bridge 6, phasing traffic for this project would require shifting the alignment of the bridge, or widening the bridge beyond that required by the standards. Shifting the alignment would require Right of Way and lengthen the project so that the new alignment can match into the existing.

Because phasing offers few of the benefits mentioned above, phasing is not considered further for this project.

Option 3: Off-Site Detour

This option would close the bridge and reroute traffic during a portion of the construction. The only State detour available here would include a route through Island Pond, Lyndon, St. Johnsbury, and Guildhall, and would include VT Routes 102,105, 114, and US Routes 2 and 5.

The route between the intersection of VT 102 and VT 105 in the Town of Bloomfield, and the intersection of VT 102 and TH-2 in Guildhall, is approximately 16 miles. The State detour would be approximately 83 miles, adding 67 miles. This detour has an end-to-end distance of 100 miles.

Since this detour is so long, an alternate route was considered, which would shorten the length of the detour, but would include Town highways in Burke, Victory, Granby, and Guildhall. These Town roads are all Class 2 and mostly gravel surfaces. The alternate route was discarded since these roads are inadequate from a geometric and safety standpoint.

When discussing detours, there is typically consideration of the local bypasses that may be used. Bypasses are not signed detours, but may experience higher non-truck traffic volumes if VT 102 is closed during construction. There are no bypasses within the Town of Brunswick.

To illustrate the length of a State detour route for this project, a map was included in the appendix. Because of the length of the off-site detour, and the undue burden that would be disproportionately borne by local residents, the off-site detour option for traffic maintenance will not be considered further for this project.

III. Alternatives Discussion

The deficiencies of Bridge 6 include structural condition, lane and shoulder widths, and hydraulics. The existing bridge and approach geometry are substandard for horizontal alignment. The alternatives presented here address the bridge deficiencies and, depending on the alternative selected, portions of the roadway.

No Action

This alternative leaves the bridge in its current condition. The deck, rated 4 (poor) will continue to deteriorate and additional full depth holes will occur. The superstructure and substructure are also approaching the end of their useful lives. It is expected that work, especially on the deck, will be required within the next ten years. Eventually, the bridge will no longer be capable of carrying the required traffic loads and will have to be posted for reduced loads or closed. In the interest of safety, economics, and convenience, the No Action alternative is not recommended.

Alternative 1: Rehabilitation

Rehabilitation of this bridge would include both deck and superstructure replacement since the two are monolithic, and some minor substructure repair. Placing a new superstructure on an existing substructure makes economic sense if the substructures are in good condition. However, the existing substructures are 80 years old and only in fair condition (rating of 5). It can be assumed that this option could add approximately 30 years to the remaining service life of this bridge, at which point the entire bridge would need to be replaced.

Additionally, the existing deck width is substandard in width by eight feet. This means that either the deck would be replaced with a substandard width, or extensive and costly work would be required to all piers and abutments to widen them in place, including some work in the river. It does not make economic sense to replace the deck and superstructure while leaving an 80 year old substructure which will need to be replaced within 30 years. This alternative has not been considered any further.

Alternative 2: New Structure

This alternative would replace the entire bridge. The considerations for a completely new structure are as presented below:

a. Horizontal Alignment

The existing roadway centerline is on a compound curve, 1100 ft. radius south of the bridge, and 925 ft. radius on and north of the bridge. The existing bridge superstructures consist of three spans of tee-beams, which are straight. The horizontal approach geometry is substandard, but could be improved by adjusting the banking on the approaches and bridge. Reconstruction on the existing alignment is considered to be a viable option. Banking on the new bridge and approaches would be improved to accommodate the 50 mph speed and the radius judged to be the best fit for each option. Reconstruction off-alignment was considered but discarded since there was no benefit seen to building off-alignment.

b. Vertical Alignment

Regarding the vertical alignment, the Preliminary Hydraulics Report states that the present low beam elevation is acceptable with either a new single span or a new three span if the stream bank slopes are modified. By inference, it is assumed that this applies to the two span alternative as well. Maintaining the existing low beam elevation means that the bridge and roadway would need to be raised because the depth of the proposed superstructure and deck would exceed the existing. For a three span bridge, the bridge elevation would have to be raised approximately 3". For a two span bridge, the elevation would be raised approximately 6" and for a single span, the bridge would be raised approximately 15". Roadway off each end of the bridge needs to be raised correspondingly. A bare deck should be considered to minimize the depth of the superstructure.

c. Bridge Width

The current rail to rail width is 19.9 feet. This does not meet the minimum standard of 28 feet. If a new 80+ year bridge is proposed, the bridge geometry should meet the minimum standards. A 28 foot width bridge (rail to rail) will be proposed.

d. Bridge Length and Skew

The existing three span bridge is 109 feet long. The Preliminary Hydraulics Report indicates an existing skew of 30 degrees, which is in disagreement with the 20 degree skew in the latest Inspection Report. It appears from a visual review of the survey of existing conditions that 30 degrees is the better fit between the channel and the piers and abutments. The 30 degree skew will be assumed to be correct. The choices for length are as follows:

1. A new single span bridge would be constructed to have a minimum span of 80 ft clear, normal to the river. With a 30 degree skew, and assuming 3 ft. wide abutments, a roadway span would need to be a minimum of 101 ft. A curved girder bridge should be considered, as 101 ft. is beyond the normal range for NEXT beams.
2. A new two span bridge would be constructed to have a minimum span of 86 ft. normal to the river between abutments, 107 ft. normal to the roadway. The spans are assumed to be equal, or 53.5 ft. each. Skew would be 30 degrees.
3. A three span bridge would have approximately the same abutment placement as the existing. The piers could be constructed slightly further apart than the existing to improve the uniformity of channel width through the bridge area. It is recommended that a center span of 40 ft. normal to the river be considered (existing is 38 ft.). This would provide a roadway center span of 52 ft. minimum. Total bridge length at 30 degree skew would be approximately 114 ft.

For any option, some modification to the channel slopes in the vicinity of the bridge would be required to attain the stone-protected slopes of 1V:2H for three span or 1V:1.5H for the single span.

e. Superstructure Type

The superstructure types for this project will be affected by the number of spans selected:

- For a new single span bridge, a curved girder superstructure would be appropriate. NEXT Beams would not be considered for a single span due to the span length and skew. Although prefabricated sections are commonly considered when rapid construction is anticipated, prefabricated curved girder sections involve added complexities. Therefore conventional cast-in-place construction is proposed for the single span alternative. In addition, if a temporary bridge is used, the time advantage offered by prefabricating a girder and deck bridge is diminished by the Right of Way process.
- For two and three span options, girder type bridges would be appropriate. Consideration could be given to curved or straight NEXT beams for short spans.

The superstructure should be designed to minimize depth.

f. Substructure Type

The preferred substructure type is an integral abutment. The present bridge, according to the original drawings, is supported on timber piles. Fine sand and fine gravel were encountered during the original explorations. Bedrock in nearby water supply wells seems quite deep. In the event that it is not possible to drive piles to an adequate depth for integral abutments due to shallow bedrock, then reinforced concrete abutments and piers could be supported on the bedrock. There is no visible bedrock in the location of the project. Borings should be taken at the project site, to determine if the subsurface is conducive for an integral abutment at this location. A pile supported substructure would provide the best scour protection for this location.

g. Maintenance of Traffic

Both phased construction and off-site detours have been eliminated from consideration in the discussions above, leaving a temporary bridge as the most likely option for traffic maintenance.

IV. Alternatives Summary

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

Alternative 2a: New Single Span with Temporary Bridge
Alternative 2b: New Two Span with Temporary Bridge
Alternative 2c: New Three Span with Temporary Bridge

V. Cost Matrix[1] — Complete Bridge Replacement

Brunswick BF 0271(23)		Do Nothing	Alt 2a	Alt 2b	Alt 2c
			Single Span	Two Span	Three Span
			Temporary Bridge		
COST	Bridge Cost	$0	$1,065,000	$1,238,000	$1,394,000
	Removal of Structure	$0	$124,000	$124,000	$124,000
	Roadway	$0	$402,000	$443,000	$483,000
	Maintenance of Traffic	$0	$200,000	$200,000	$200,000
	Construction Costs	$0	$1,791,000	$2,005,000	2,201,000
	Construction Engineering + Contingencies	$0	$519,000	$581,000	$638,000
	Total Construction Costs w CEC	**$0**	**$2,310,000**	**$2,586,000**	**$2,839,000**
	Preliminary Engineering[2]	**$0**	**$412,000**	**$461,000**	**$506,000**
	Right of Way	**$0**	**$125,000**	**$140,000**	**$154,000**
	Total Project Costs	$0	$2,847,000	$3,187,000	$3,499,000
SCHEDULING	Project Development Duration[3]	N/A	4 years	4 years	4 years
	Construction Duration	N/A	15 months	15 months	15 months
	Closure Duration (If Applicable)	N/A	N/A	N/A	N/A
ENGINEERING	Typical Section - Roadway (feet)	3-10-10-3	28'	28'	28’
	Typical Section - Bridge (feet)	1-9-9-1	4-10-10-4	4-10-10-4	4-10-10-4
	Geometric Design Criteria	No Change	Meets Standard	Meets Standard	Meets Standard
	Traffic Safety	No Change	Improved	Improved	Improved
	Alignment Change	No	Vertical	Vertical	Vertical
	Bicycle Access	No Change	Improved	Improved	Improved
	Hydraulic Performance	No Change	Meets Standard	Meets Standard	Meets Standard
	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	80 years	80 years	80 years

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

VI. Conclusion

We recommend **Alternative 2a**; construct a new single span structure on the current alignment. Traffic would be maintained on a temporary bridge east of the project location. A curved girder design should be considered.

<u>Structure:</u>

A single span is expected to be least expensive, as new piers and associated cofferdams are not necessary. The single span is also preferred because of the reduced environmental impacts to the site. Hydraulic standards will be met, and the horizontal geometry of the approaches and bridge can be corrected to meet current standards.

<u>Traffic Maintenance:</u>

The off-site detours available to this project are not reasonable. There are no local bypasses. The existing bridge deck is too narrow to phase properly without changing the alignment. We therefore concluded that a temporary bridge is the most reasonable method for maintenance of traffic.

VII. Appendices

- Site Pictures
- Town Map
- Bridge Inspection Report
- Hydraulics Memo
- Preliminary Geotechnical Information
- Natural Resources and Resource ID Completion Memos
- Archaeology Memo
- Historic Memo
- Local and Regional Input
- Detour Route
- Plans
    - Existing Conditions
    - Proposal
        - Typical Sections
        - Layouts
        - Profiles
        - Temporary Bridge Layouts

Looking South

Looking North

Paul Stream, Downstream from Bridge

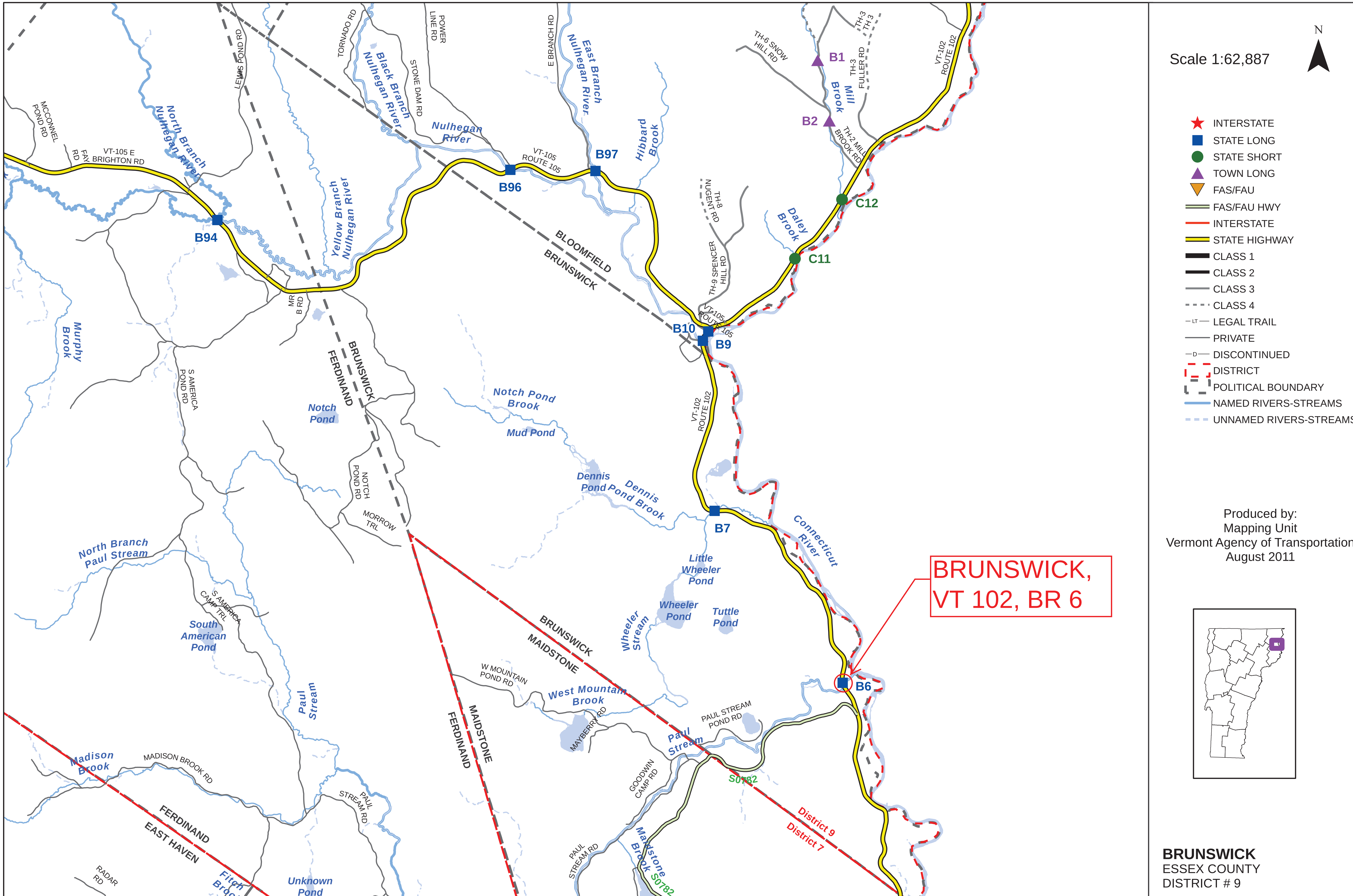
Paul Stream, Upstream from Bridge


Advanced Deterioration of Curb and Fascia


Advanced Deterioration of Curb and Deck

Deterioration of Tee-Beam Superstructure

Deterioration of Fascia and Substructure


BRUNSWICK, VT 102, BR 6
Scale 1:62,887
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
BRUNSWICK
ESSEX COUNTY
DISTRICT # 9
B1
B2
B6
B7
B9
B10
B94
B96
B97
C11
C12
BLOOMFIELD
BRUNSWICK
FERDINAND
MAIDSTONE
EAST HAVEN
District 9
District 7
Connecticut River
Nulhegan River
VT-102 ROUTE 102
VT-105 ROUTE 105
S0782

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

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

Inspection Report for BRUNSWICK | bridge no.: 00006 | District: 9

Located on: VT 00102 ML over PAUL STREAM | approximately 4.8 MI S JCT. VT.105 | Owner: 01 STATE-OWNED

CONDITION

Deck Rating: 4 POOR

Superstructure Rating: 5 FAIR

Substructure Rating: 5 FAIR

Channel Rating: 5 FAIR

Culvert Rating: N NOT APPLICABLE

Federal Str. Number: 200271000605052

Federal Sufficiency Rating: 050.7

Deficiency Status of Structure: SD

AGE and SERVICE

Year Built: 1932 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): 01

ADT: 000560 % Truck ADT: 06

Year of ADT: 1998

GEOMETRIC DATA

Length of Maximum Span (ft): 0040

Structure Length (ft): 000109

Lt Curb/Sidewalk Width (ft): 0

Rt Curb/Sidewalk Width (ft): 0

Bridge Rdwy Width Curb-to-Curb (ft): 19.9

Deck Width Out-to-Out (ft): 23.3

Appr. Roadway Width (ft): 026

Skew: 20

Bridge Median: 0 NO MEDIAN

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

Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD

Min Vertical Underclr (ft): 00 FT 00 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: 3 SP CONC TBEAM

Number of Approach Spans: 0000 Number of Main Spans: 003

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: 1 MEETS 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 CRITERIA

Deck Geometry: 2 INTOLERABLE, REPLACEMENT NEEDED

Underclearances Vertical and Horizontal: N NOT APPLICABLE

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

Approach Roadway Alignment: 7 BETTER THAN MINIMUM CRITERIA

Scour Critical Bridges: 8 STABLE FOR SCOUR

DESIGN VEHICLE, RATING, and POSTING

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

Posting Status: A OPEN, NO RESTRICTION

Bridge Posting: 5 NO POSTING REQUIRED

Load Posting: 10 NO LOAD POSTING SIGNS ARE NEEDED

Posted Vehicle: POSTING NOT REQUIRED

Posted Weight (tons):

Design Load: 2 H 15

INSPECTION and CROSS REFERENCE

X-Ref. Route:

Insp. Date: 072011 Insp. Freq. (months) 24 X-Ref. BrNum:

INSPECTION SUMMARY and NEEDS

7/11/2011 The deck and beams continue to deteriorate. The deck could have full depth holes especially in span2 at abutment1. The windslot drains are spalling upto the fascia tee beams ands in the shoulders. ~DCP/FRE

07/14/09 - Overall condition of the bridge is fair. The deck condition is a concern with localized areas of advanced deterioration. Full depth holes could occur any time, any place, especially in bay 2 - DCP

VT AGENCY OF TRANSPORTATION PROGRAM DEVELOPMENT DIVISION

HYDRAULICS UNIT

TO: Chris Williams, Structures Project Manager

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

DATE: September 6, 2013

SUBJECT: Brunswick – BF-0271(23) – VT 102 BR 6 over Paul Stream

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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 bridge site is located on Paul Stream approximately 900' upstream from its confluence with the Connecticut River. The original bridge was constructed in 1932 based on record information. The bridge is owned by the State. The structure is a 3-span 2-lane concrete T-beam and concrete deck bridge with an asphalt pavement surface, as well as 2 concrete piers. Also, the bridge is askew to the stream at approximately 30°. The existing concrete abutments are set back from the edge of the stream at the tops of the banks. There are no wing walls and sloped embankments from the abutments to the normal low flow edge of stream. The embankments under the bridge structure are armored with small cobble stone. The normal stream channel flow runs between the 2 piers of the bridge and the bridge is located at the downstream end of a large 90° bend. Stone masonry abutment remnants of an original bridge crossing are located just upstream of the existing bridge structure. Both of the existing abutments and 2 piers appear to be basically parallel with the stream channel at this location. The abutments foundations appear to be above the streambed elevations based on the record information and visual observation, but do not appear to be effected by the stream flow, even under large events. From the record plans, it appears the abutments and piers are set on a large footing with piles, but this could not be verified. The approximate overall outside normal width of the bridge is 23.2 feet (20.5' curb-to-curb), but it is approximately 26.5 feet along the stream which is skew to the bridge. It was further observed that the bridge is on a slight curve. The total clear span along the roadway is approximately 105' (abutment face to abutment face) with individual spans along the roadway centerline of approximately 31.4' (face to center of Right (South) pier), 43' (center of pier to center of pier) and 31.4' (center of Left (North) pier to face), going from Right (South) to Left (North). Modifying these distances to be normal to the river, the spans are approximately 27.7', 38', and 26.3', Right (South) to Left (North) for a total clear span of 92' between abutment faces. When calculating the clear spans and deducting the width of the piers (i.e. 2.6' wide at the seat location), the clear spans are 26.4', 35.4', and 25' going from Right (South) to Left (North) for a total clear opening spans totally 86.8 feet.

The stream has well-defined stream banks within the study reach with some erosion of the banks and a large scour hole (3' to 5' deep) located just upstream of the bridge and along the inside of the Left (North) Pier (which is to be expected since the bridge is sited at the downstream end of a large bend). The well-defined channel has a silty-gravelly streambed with some small stones. In its existing configuration, the existing bridge does not meet the VTrans hydraulic standard for the Q_{50} design storm event, but is close with the flow passing through the structure and having 0.7 ft of freeboard, instead of 1-foot, just upstream of the structure. However, it is noted that the Q_{100} event does pass through structure based on modeling. 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 since the foundation types and configurations have not been determined at this time.

Analysis & Recommendations

The bridge option selection criteria should provide a bridge opening that does not restrict the existing 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 75 feet, but the actual field conditions have varying natural bank full stream widths within the study reach of between 50 to 85 feet and the existing structure does not appear to adversely constrict the stream.

It was assumed a replacement structure will be located in the existing roadway alignment using the similar basic roadway geometry given the location and site constraints. As noted above with the bank side slopes through the bridge remaining similar to the existing configuration, the low beam will need to be raised to 872.9 feet to meet hydraulic standards. For proposed condition hydraulic modeling and since the Existing Conditions model was close to meeting hydraulic standards, it was determined the Existing Conditions 3-span bridge would be used for as the basis of design. Having the bank side slopes steepened through the bridge to be 2H:1V at the abutment faces and using the top of the existing banks near the piers was evaluated. From this modeling, it has been shown that the existing bridge configuration with the existing low beam elevation of 872.6 feet could be used. It is recommended that any proposed replacement piers should not be wider than the existing piers or moved closer together toward the center channel. Moving the piers away from the center channel may be beneficial in terms of hydraulics, but we understand this could have ramifications to the superstructure depth. If this is an option, please let us know and we can give you more detailed information. Also part of steepening of the side slopes against the abutments through the bridge, it is recommended that these slopes "blend" back into the existing banks by modifying the bank side slopes near the bridge.

A single span option was not reviewed given the large span between abutments. However, this alternative could be analyzed if the Structures Group would like to pursue that option.

Temporary Bridge/Phasing

Based on pre-scoping information from the Structures Group, it is our understanding that this will be reviewed further in detail to select the best alternative.

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

MAH/BMB

cc: Hydraulics Project File via NJW
Hydraulics Chrono File

VT AGENCY OF TRANSPORTATION PROGRAM DEVELOPMENT DIVISION

HYDRAULICS UNIT

TO: Chris Williams, Structures Project Manager

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

DATE: October 2, 2013

SUBJECT: Brunswick – BF-0271(23) – VT 102 BR 6 over Paul Stream

---

It was requested by the PIIT Structures Group that we perform additional analysis to have a single span structure for the above noted bridge location. We have completed the request for additional preliminary hydraulic study and offer the following information for your use:

Analysis & Recommendations

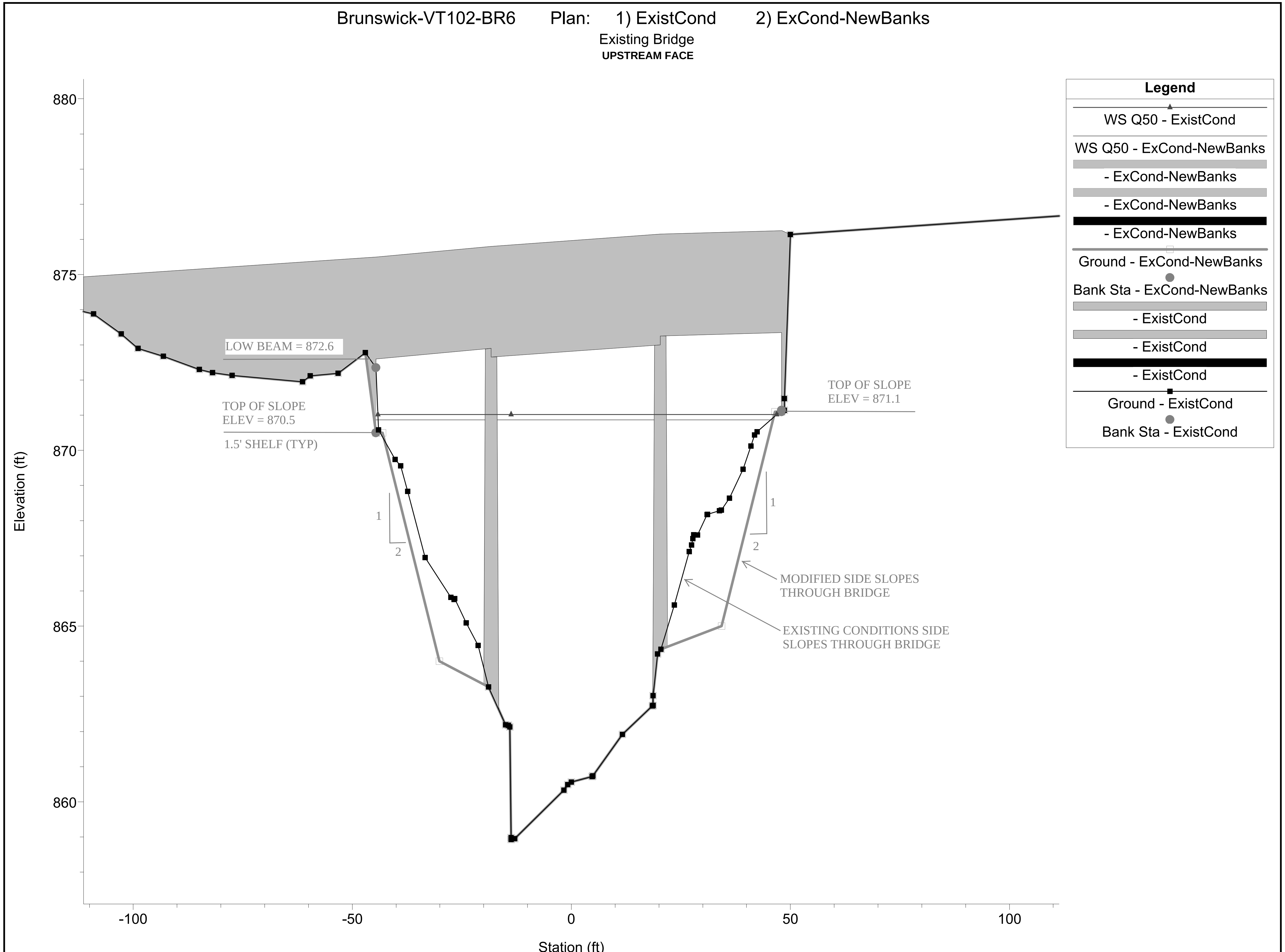
As previously noted in the original analyses, the bridge option selection criteria should provide a bridge opening that does not restrict the existing bank full width, nor provide an unrealistic widening of the existing channel, or create any worse backwater flooding conditions than the existing conditions. The VANR Bank Full Width (BFW) Equation estimates the width to be approximately 75 feet, but the actual field conditions have varying natural bank full stream widths within the study reach of between 50 to 85 feet.

For the hydraulic modeling, it was assumed the single span replacement structure will be located in the existing roadway alignment using similar basic roadway geometry given the location and site constraints. From the hydraulic modeling, it was determined that a single span bridge having an 80-foot normal clear span (or approximately 92 feet along the roadway skew) with a low beam elevation of 872.6 feet will meet the VTrans hydraulic standard. The hydraulic modeling also included using stone armored bank side slopes (at a 3H:2V slope) through the bridge in front of the abutment faces. As part of providing side slopes against the abutments through the bridge, it is recommended that the top of these armored stone slopes "blend" back into the existing banks and to modify the existing bank side slopes near the bridge, especially on the upstream Right (South) bank and downstream Left (North) bank to provide a better hydraulic entrance and exit to the bridge.

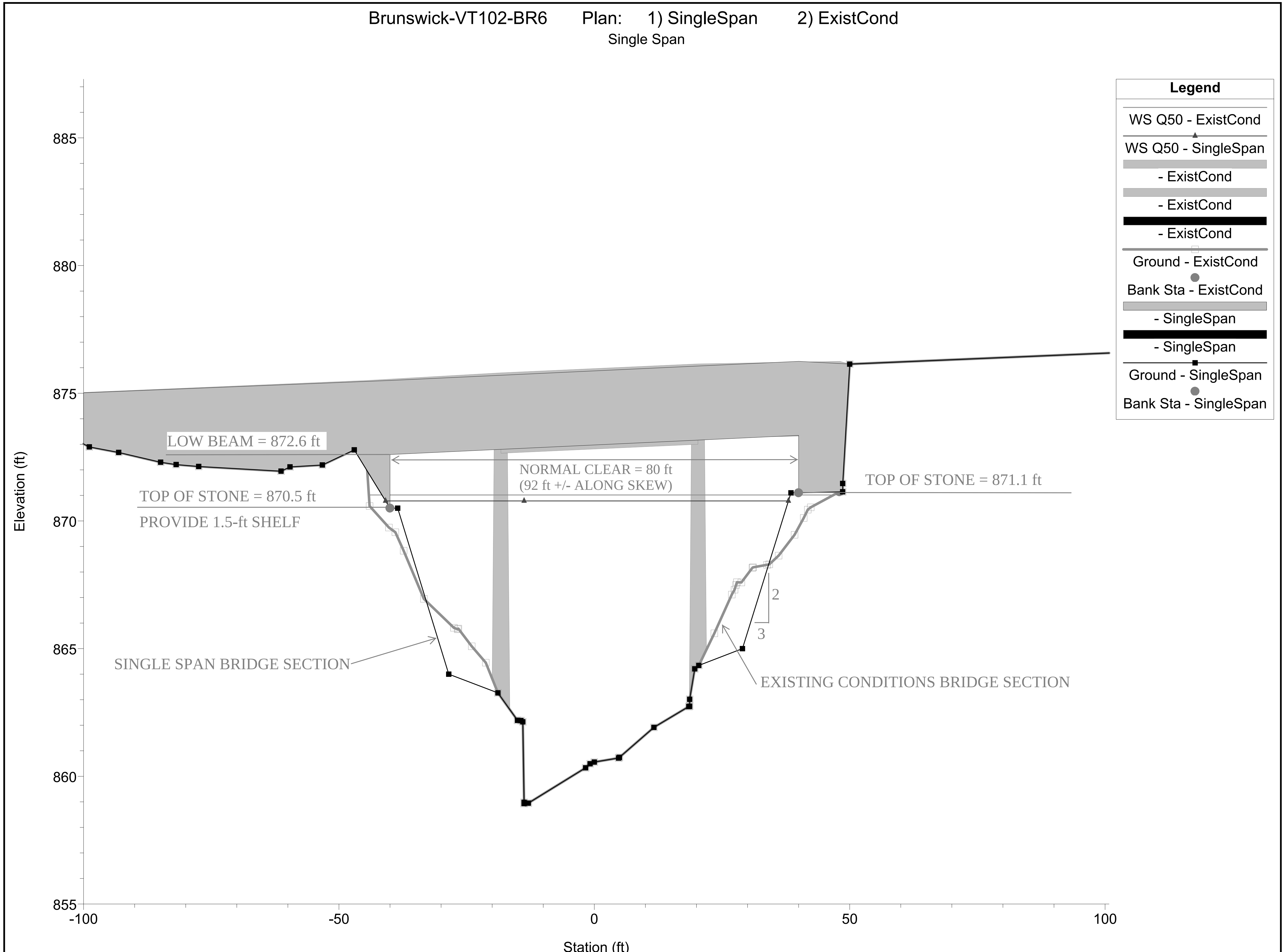
Please contact us if you have any questions or if we may be of further assistance.

BMB

cc: Hydraulics Project File via NJW
Hydraulics Chrono File



Brunswick-VT102-BR6 Plan: 1) ExistCond 2) ExCond-NewBanks
Existing Bridge
UPSTREAM FACE
Legend
WS Q50 - ExistCond
WS Q50 - ExCond-NewBanks
- ExCond-NewBanks
- ExCond-NewBanks
- ExCond-NewBanks
Ground - ExCond-NewBanks
Bank Sta - ExCond-NewBanks
- ExistCond
- ExistCond
- ExistCond
Ground - ExistCond
Bank Sta - ExistCond
LOW BEAM = 872.6
TOP OF SLOPE
ELEV = 870.5
1.5' SHELF (TYP)
TOP OF SLOPE
ELEV = 871.1
1
2
1
2
MODIFIED SIDE SLOPES
THROUGH BRIDGE
EXISTING CONDITIONS SIDE
SLOPES THROUGH BRIDGE
Elevation (ft)
880
875
870
865
860
Station (ft)
-100
-50
0
50
100



1 in Horiz. = 25 ft 1 in Vert. = 5 ft

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

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

MLM CCB

From: Marcy Meyers, Geotechnical Engineer, via Christopher C. Benda, P.E., Soils and Foundations Engineer

Date: July 24th, 2013

Subject: Brunswick BF 0271(23) – BR # 6 Preliminary Geotechnical Information

---

1.0 INTRODUCTION

We have completed our preliminary geotechnical investigation for the replacement of Bridge # 6 on VT 102 crossing over Paul Stream, located in the Town of Brunswick, VT. The subject project consists of replacing the existing three-span, concrete T-beam bridge. This report documents our initial search of historical information to determine the characteristics of the site. A number of materials were reviewed including: VTrans boring files and record plans, Agency of Natural Resources (ANR) Natural Resources Atlas, USDA Surficial Geologic maps and VTrans Bridge Inspection Photos.

2.0 SUBSURFACE INFORMATION

2.1 Previous Projects

Original record plans for the subject bridge, dated in 1932, were found on the DPR website. Soil information from these plans indicated fine sand and fine gravel to be present at both the pier and abutment locations. Both the pier and abutment foundations are supported on approximately 35 foot timber piles.

Additional surrounding projects were searched for in the Soils & Foundations' GIS based historical record of subsurface investigations which contains electronic records for the majority of borings completed in the past 10 years. An exploration of this map revealed three borings drilled for the Maidstone STP 0271(20) project (located approximately 10 miles from the subject project). Information from these borings revealed a mix of sand and silt. Bedrock was not encountered in any of the borings. Due to the distance away from the proposed project, this soil information should be considered ancillary.

2.2 Water Well Logs & USDA Soil Survey

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. Based on subsurface information reported by well drilling reports on file at ANR and the USDA web soil survey, the surficial geology in the vicinity of the subject area is expected to consist of a mix of sand, silt, and gravel.

Figure 1 contains the project, surrounding well locations, and surrounding uncommon species (vertebrate animals) area found using the ANR Natural Resources Atlas. The Maidstone STP 0271(20) project was not depicted on the map due to the scale, but is approximately 10 miles south along VT 102. The specific wells used to gain information on the subsurface conditions are highlighted by a red box. Three water wells within an approximate 1400 ft radius were used to get an estimate of the depth to bedrock likely to be encountered for the project.

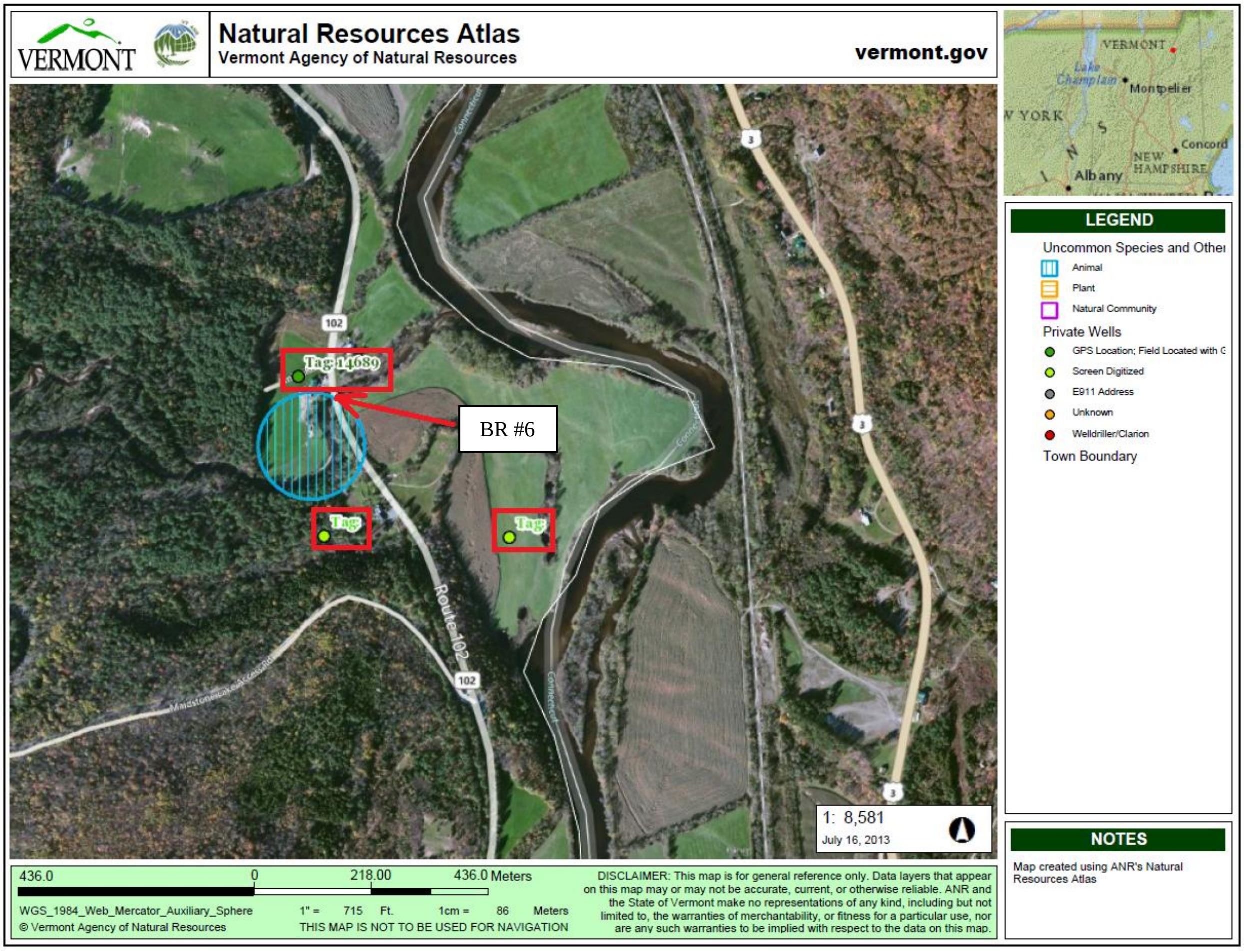


Figure 1. Highlighted Well Locations near Subject Project

Table 1 lists the well sites used in gathering the surrounding information and includes the approximate distance from the bridge project and depth to bedrock.

Table 1. Well Information Including Depths to Bedrock

Well Number	Approximate Distance From Project (feet)	Depth To Bedrock (feet)
14689	260	185
7	850	91
5	1390	>156

Information from these wells suggests that shallow bedrock will probably not be encountered at the project area. Information about the bedrock, taken from the ANR Natural Resource Atlas, indicates “almost-white to dark-gray, locally pink, medium- to coarse-grained hypidiomorphic, granular, biotite-muscovite-microcline-plagioclase granite; accessories include apatite, sphene, pyrite, and magnetite”. Based on the USDA Soil Map, the soils to be encountered at the project location are classified as a mix of Adams loamy fine sand and Podunk fine sandy loam. The Adams loamy fine sand is classified as somewhat excessively drained with 0-3% slopes, has a depth to bedrock of greater than 80 inches, and a depth to groundwater of greater than 80 inches. The Podunk fine sandy loam is classified as moderately well drained with 0-2% slopes, has a depth to bedrock of greater than 80 inches, and a depth to groundwater of 18-36 inches. It should be noted that the Podunk fine sandy loam is also classified as occasionally flooded.

2.4 Bridge Inspection Photos

Based on the latest bridge inspection photos from July 2011, large portions of the piers and deck have deteriorated, as seen in Figures 2 and 3.

Figure 2. Severe Pier Deterioration

Figure 3. Severe Deck Deterioration

Despite the major spalling of concrete on the piers and abutments, no visible erosion or undermining was evident on either abutment. There does appear to be some undermining developing along one of the piers as shown in Figure 4. This undermining was confirmed during the site visit and rebar is currently exposed along the base.

Figure 4. Undermining Developing along Pier

FIELD OBSERVATIONS

A preliminary site visit was conducted on July 17th, 2013 to determine possible obstructions inhibiting boring operations and other site characteristics. Information from this visit indicated no above ground utilities present directly above the bridge; however, power lines are located along the western side as seen in Figure 5.

Figure 5. Power Lines Located Along Western Side

No visible bedrock outcrops were seen in the area. The stream bed did have some small cobbles as evident in Figure 6.

Figure 6. Cobbles Lining Stream Bed

The soils surrounding the stream bank appeared to be sandy and no visible bank erosion was evident.

3.0 RECOMMENDATIONS

Based on the soil conditions at the site, we recommend new integral abutments as a feasible replacement alternative.

We recommend a minimum of two borings be taken at opposite corners of the proposed bridge, in order to more fully assess the subsurface conditions at the site including, but not limited to, the soil properties, groundwater conditions, and depth to bedrock. If shallow bedrock is present, borings should be performed at all four corners of the bridge to get an idea of the bedrock profile across the abutment.

5.0 CONCLUSION

If you have any questions or would like to discuss this report, please contact us by phone at (802) 828-6911.

cc: WEA/Read File
CCB/Project File
MLM

G:\Soils and Foundations\Projects\Brunswick BF 0271(23)\REPORTS\Brunswick BF 0271(23) Scoping Report.doc

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

TO: Jeff Ramsey, Environmental Specialist

FROM: John Lepore, Transportation Biologist

DATE: May 1, 2013

SUBJECT: Brunswick B_F 0271 (23)
VT 102, Br. 6 over Paul Stream
Natural Resource ID & Comments

The initial resource identification for this project was conducted on April 25, 2013 and based on that, which included a site visit, I have concluded that the only regulated natural resource in the immediate area of Bridge 6 is the Paul Stream itself. The existing structure is a three-span bridge.

If possible, the new structure should be designed as a single-span with a hydraulic opening equal to or greater than that which is between the existing abutments. As for a temporary bridge, if one is needed, placing it on either side of the downstream side of the existing structure would more favorable, and it appears that it could span the limits of Ordinary High Water in entirety.

If you have any questions about this, call me at 828-3963.

OFFICE MEMORANDUM
AOT - PROGRAM DEVELOPMENT DIVISION

RESOURCE IDENTIFICATION COMPLETION MEMO

TO: Chris Williams, Project Manager
FROM: Jeff Ramsey, Environmental Specialist
DATE: 06/03/13
PIN: 13C056

Project: BRUNSWICK BF 0271(23)

ENVIRONMENTAL RESOURCES:

Resource	Yes	No	Comments
Wetlands:		X	
Historic/Historic District:		X	
Archaeological Site:	X		SE quadrant as archaeologically sensitive
4(f) Property:		X	
6(f) Property:		X	
Agricultural Land:	X		statewide north and prime south, but no effects
Fish & Wildlife Habitat:	X		Paul Stream
Endangered Species:		X	uncommon animal occurrence south of the bridge in the Paul Stream
Hazardous Waste:		X	
Stormwater:		X	
USDA-Forest Service Lands:		X	
Wildlife Habitat Connectivity:	X		replacement should not affect connectivity
Scenic Highway/ Byway:	X		Connecticut River Byway
Act 250 Permits:		X	

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

cc:
Project File

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: Jeff Ramsey, VTrans Environmental Specialist

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

Date: 5/30/2013

Subject: Brunswick BF 0271(23) – Archaeological Resource ID

Jeff,

I've completed my review of Bridge 6 along VT102 in Brunswick. Given the proximity to the Connecticut River and the concentration of archaeological sites near analogous landforms in the general project area, I've marked the SE quadrant as archaeologically sensitive. The SE area appears to be relatively undisturbed below the plow zone and registers as moderate to high on the environmental predictive model. 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


Brunswick BF 0271(23)
Arch Resouce ID
0 2040 80 120 160
Feet
1:1,511
N
Bridge Location
Arch Sensitive Area
bing
Map created by BCG,
PDD-Environmental Section
on 5/30/2013.

Ramsey, Jeff

From: Newman, Scott
Sent: Monday, May 13, 2013 5:06 PM
To: Ramsey, Jeff
Cc: Williams, Chris; O'Shea, Kaitlin
Subject: Brunswick BF 0271(23) resource id
Attachments: image.jpeg; ATT00001.txt; image.jpeg

This once historic and now crumbling span is conveniently located in the middle of nowhere. There are no Historic or Section 4(f) properties in the project area.

 Brunswick - Paul Stream Bridge

Community Considerations

1. Are there any scheduled public events in the community that will generate increased traffic (e.g. vehicular, bicycles and/or pedestrians), or may be difficult to stage if the bridge is closed during construction? Examples include: a bike race, festivals, cultural events, farmers market, concerts, etc. that could be impacted? If yes, please provide date, location and event organizers' contact info. There is concern for local farmers who have fields on both sides of the bridge which involves spring planting, harvesting and upkeep. Also could impact Maidstone State Park traffic. Fire service and ambulance service is provided by Stratford Hollow and Northumberland so response time would be greatly impacted.
2. Is there a "slow season" or period of time from May through October where traffic is less? No
3. Please describe the location of emergency responders (fire, police, ambulance) and emergency response routes. As stated in number one, both services are provided by communities south of us.
4. Where are the schools in your community and what are their schedules? No schools, all students are privately transported by parents.
5. Is the proposed project on an established or planned school bus or public transit route(s)?No

Are there any businesses (including agricultural operations) that would be adversely impacted either by a detour or due to work zone proximity? Yes, farmers. milk truck, mail delivery

6. Are there any important public buildings (town hall or community center) or community facilities (recreational fields or library) in close proximity to the proposed project? No
7. Are there any town highways that might be adversely impacted by traffic bypassing the construction on another local road?No
8. Are there any other municipal operations that could be adversely impacted if the bridge is closed during construction? If yes, please explain.No
9. Please identify any local communication channels that are available—e.g. weekly or daily newspapers, blogs, radio, public access TV, Front Porch Forum, etc. Also include any unconventional means such as local low-power FM. No
10. Is there a local business association, chamber of commerce or other downtown group that we should be working with? No

Design Considerations

1. Are there any concerns with the alignment of the existing bridge? For example, if the bridge is located on a curve, has this created any problems that we should be aware of? In the past there have been numerous accidents on the bridge.
2. Are there any concerns with the width of the existing bridge? Accidents that occurred were most often caused by the width (very narrow) Difficult for 2 vehicles to meet on the bridge especially if one is a larger type vehicle.
3. What is the current level of bicycle and pedestrian use on the bridge? Bicycle use is common because of the rural route. Few pedestrians.
4. If a sidewalk or wide shoulder is present on the existing bridge, should the new structure have one? There is no sidewalk or wide shoulder present at this time.
5. Is there a need for a sidewalk or widened shoulder if one does not currently exist? Please explain. Widened shoulder for bicycles would be helpful.
6. Does the bridge provide an important link in the town or statewide bicycle or pedestrian network such that bicycle and pedestrian traffic should be accommodated during construction? Not sure.
7. Are there any special aesthetic considerations we should be aware of? No
8. Are there any traffic, pedestrian or bicycle safety concerns associated with the current bridge? If yes, please explain. Too narrow for safe passing if both vehicles and bicycles (or pedestrian) meet.
9. Does the location have a history of flooding? If yes, please explain. No, but it is in the flood plain area and ice jams have caused ice to hit the under deck.
10. Are you aware of any nearby Hazardous Material Sites? No
11. Are you aware of any historic, archeological and/or other environmental resource issues? No
12. Are there any other comments you feel are important for us to consider that we have not mentioned yet? There is a dry hydrant next to the bridge that is important to fire safety in the community.

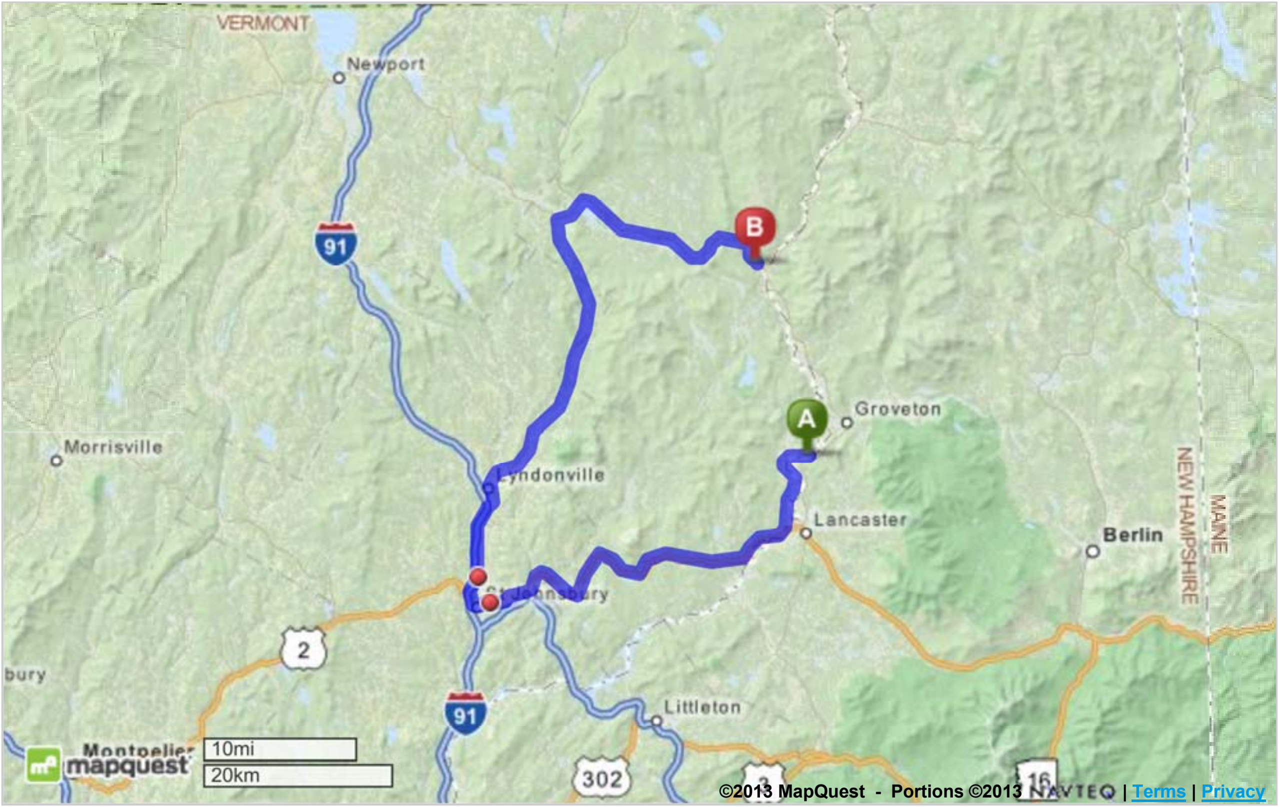
Land Use & Public Transit Considerations – to be filled out by the municipality or RPC.

1. Does your municipal land use plan reference the bridge in question? If so please provide a copy of the applicable section or sections of the plan. No

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

3. Are there any existing, pending or planned development proposal that would impact future transportation patterns near the bridge? If so please explain. No

4. Is there any planned expansion of public transit service in the project area? If not known please contact your Regional Public Transit Provider.No



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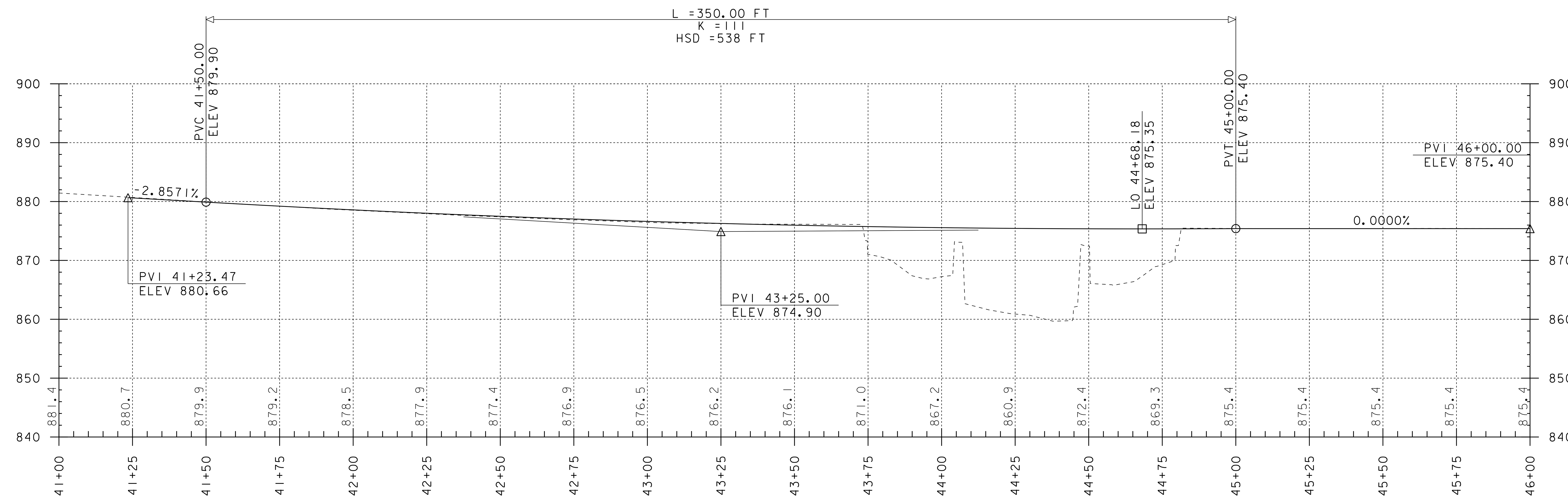
State Detour Route
ADT 550
Through Route A-B: 16 miles
Detour Route A_B: 83 miles
End to End: 99 miles

EXISTING CONDITIONS

SCALE 1" = 20'-0"

20 0 20

PROJECT NAME: BRUNSWICK	
PROJECT NUMBER: BF 0271(23)	
FILE NAME: 13c056/s13c056border.dgn	PLOT DATE: 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
LAYOUT SHEET	SHEET 1 OF 24



VT 102 EXISTING PROFILE

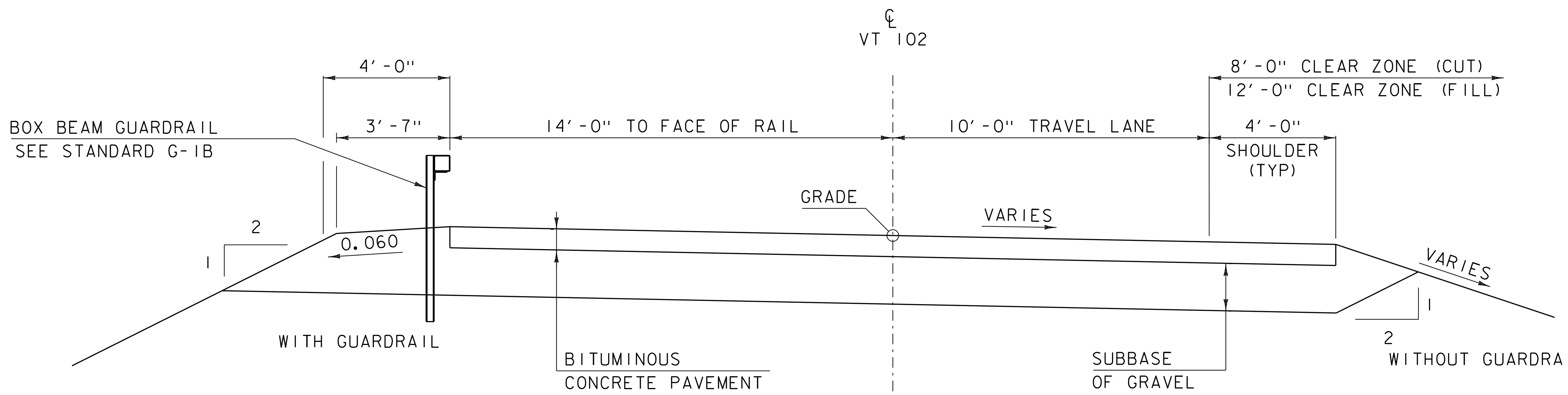
SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

NOTE:

GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄

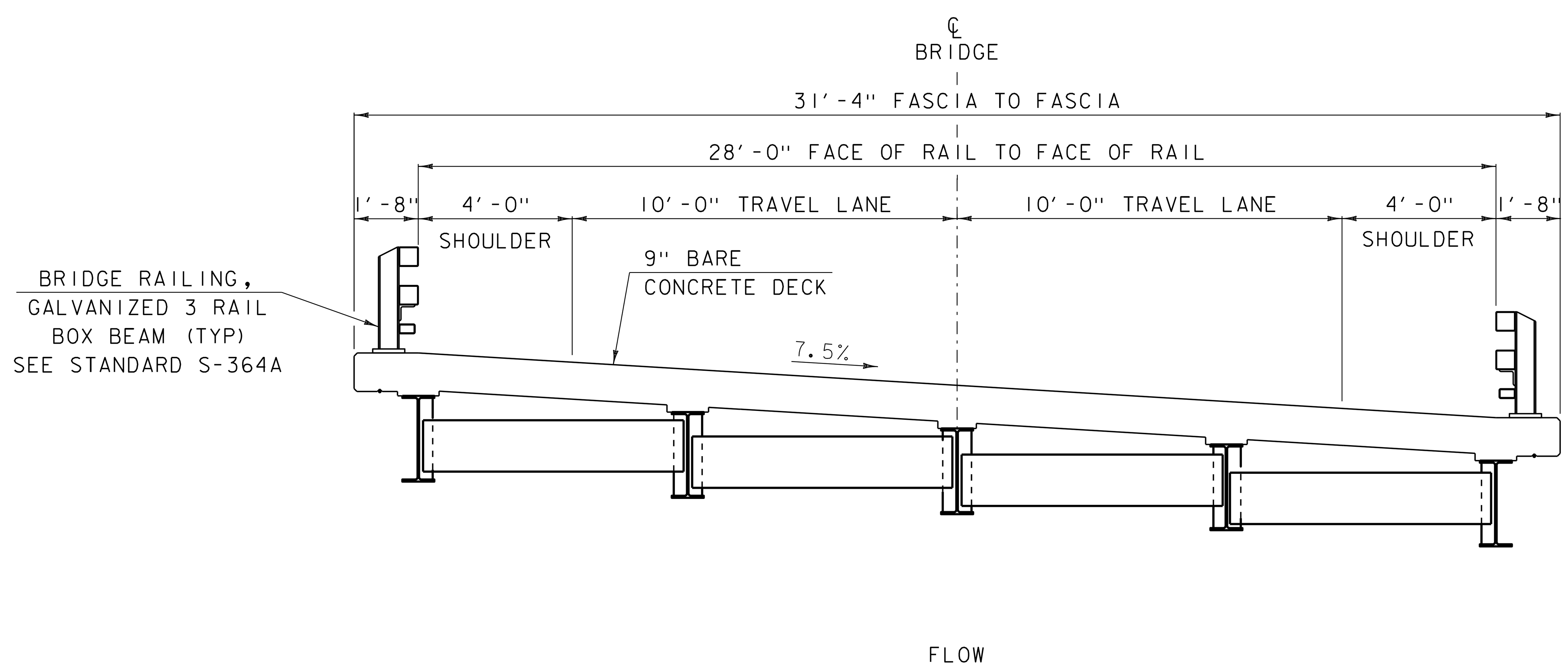
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: BRUNSWICK	
PROJECT NUMBER: BF 0271(23)	
FILE NAME: 13c056/s13c056profile.dgn	PLOT DATE: 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: O.M.DARISSE
DESIGNED BY: ------	CHECKED BY: ------
PROFILE SHEET	SHEET 2 OF 24



PROPOSED VT 102 TYPICAL SECTION

SCALE ⅜" = 1'-0"



PROPOSED BRIDGE TYPICAL SECTION

SCALE ⅜" = 1'-0"

NOTE: GIRDERS SHOWN FOR EXAMPLE,
SUPERSTRUCTURE NOT YET DESIGNED

MATERIAL TOLERANCES

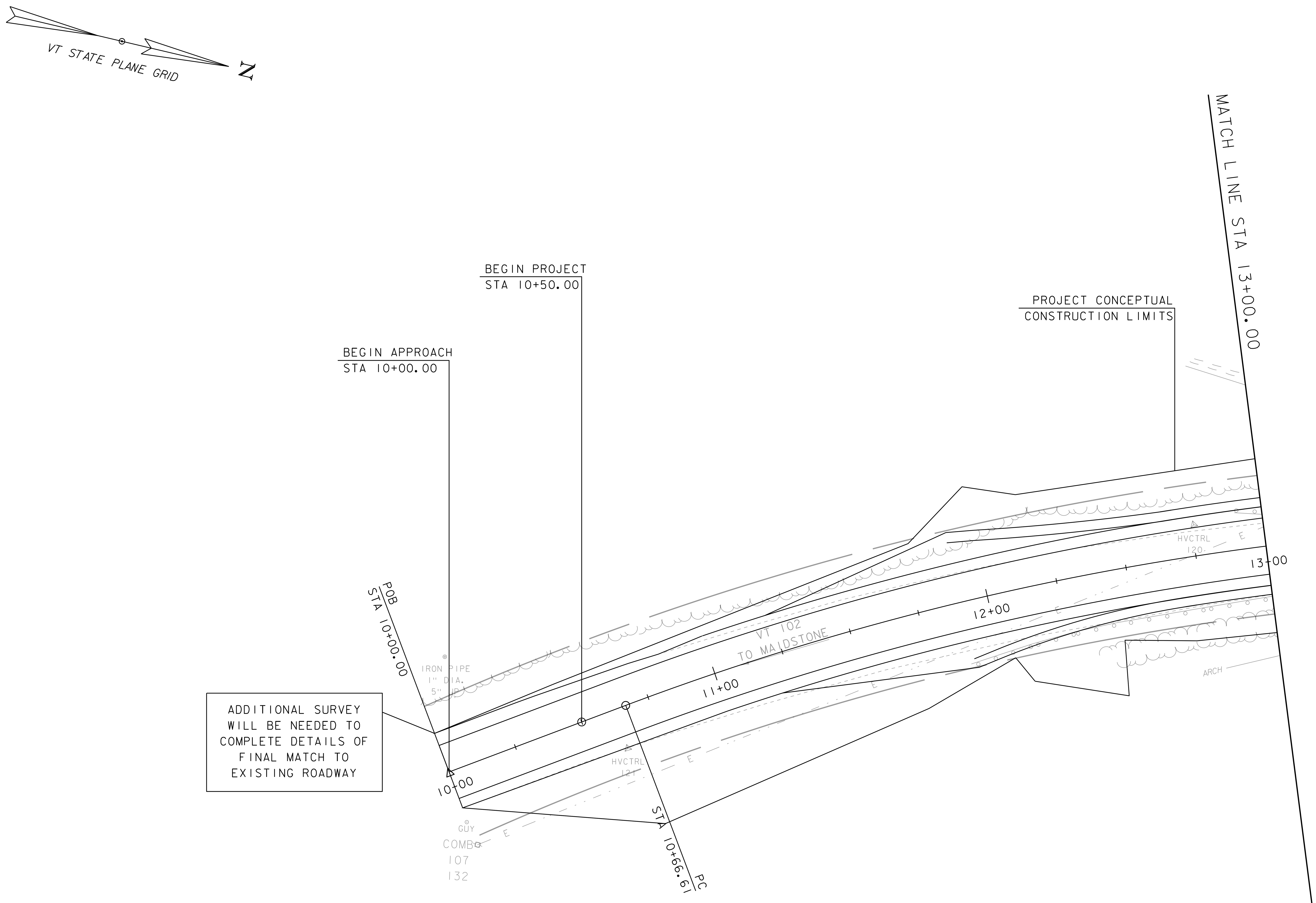
(IF USED ON PROJECT)

SURFACE	
- PAVEMENT (TOTAL THICKNESS)	+/- ¼"
- AGGREGATE SURFACE COURSE	+/- ½"
SUBBASE	+/- 1"
SAND BORROW	+/- 1"

PROJECT NAME: BRUNSWICK
PROJECT NUMBER: BF 0271(23)

FILE NAME: 13c056\s13c056typical.dgn
PROJECT LEADER: C.P.WILLIAMS
DESIGNED BY: ----------
TYPICAL SECTIONS

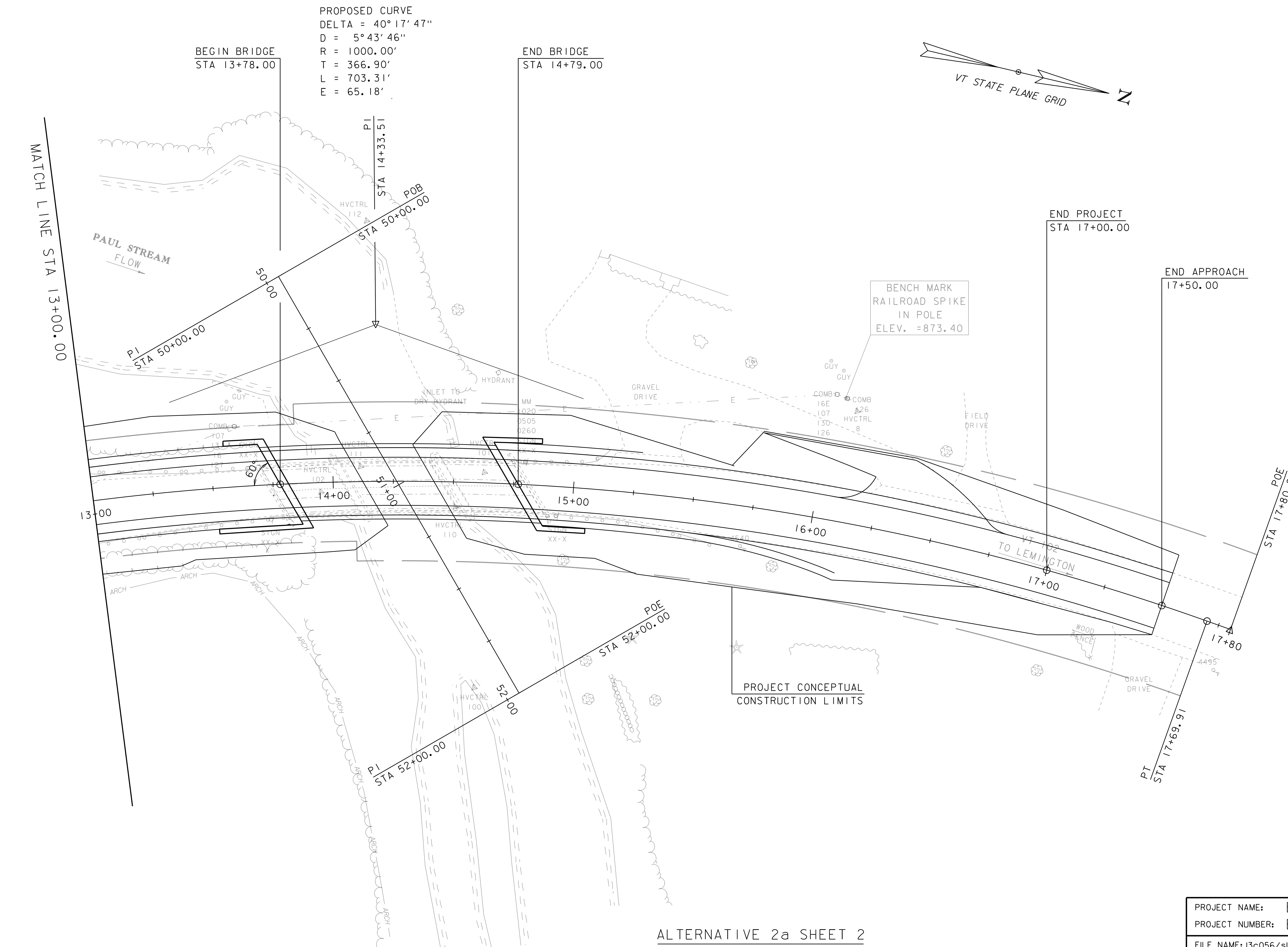
PLOT DATE: 02-DEC-2013
DRAWN BY: G. SWEENY
CHECKED BY: ------
SHEET 3 OF 24



ALTERNATIVE 2a SHEET 1

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

PROJECT NAME: BRUNSWICK	
PROJECT NUMBER: BF 0271(23)	
FILE NAME: 13c056/sl3c056border.dgn	PLOT DATE: 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: O.M.DARISSE
DESIGNED BY: ------	CHECKED BY: ------
ALTERNATIVE 2a LAYOUT SHEET 1	SHEET 4 OF 24



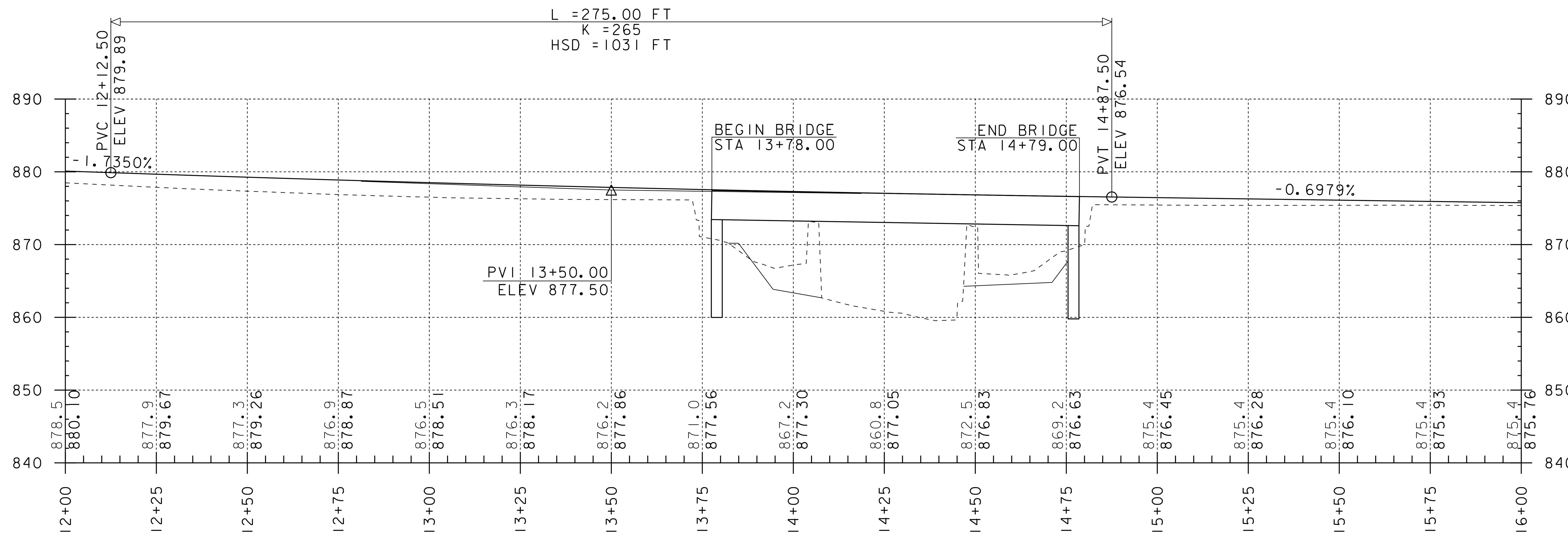
ALTERNATIVE 2a SHEET 2

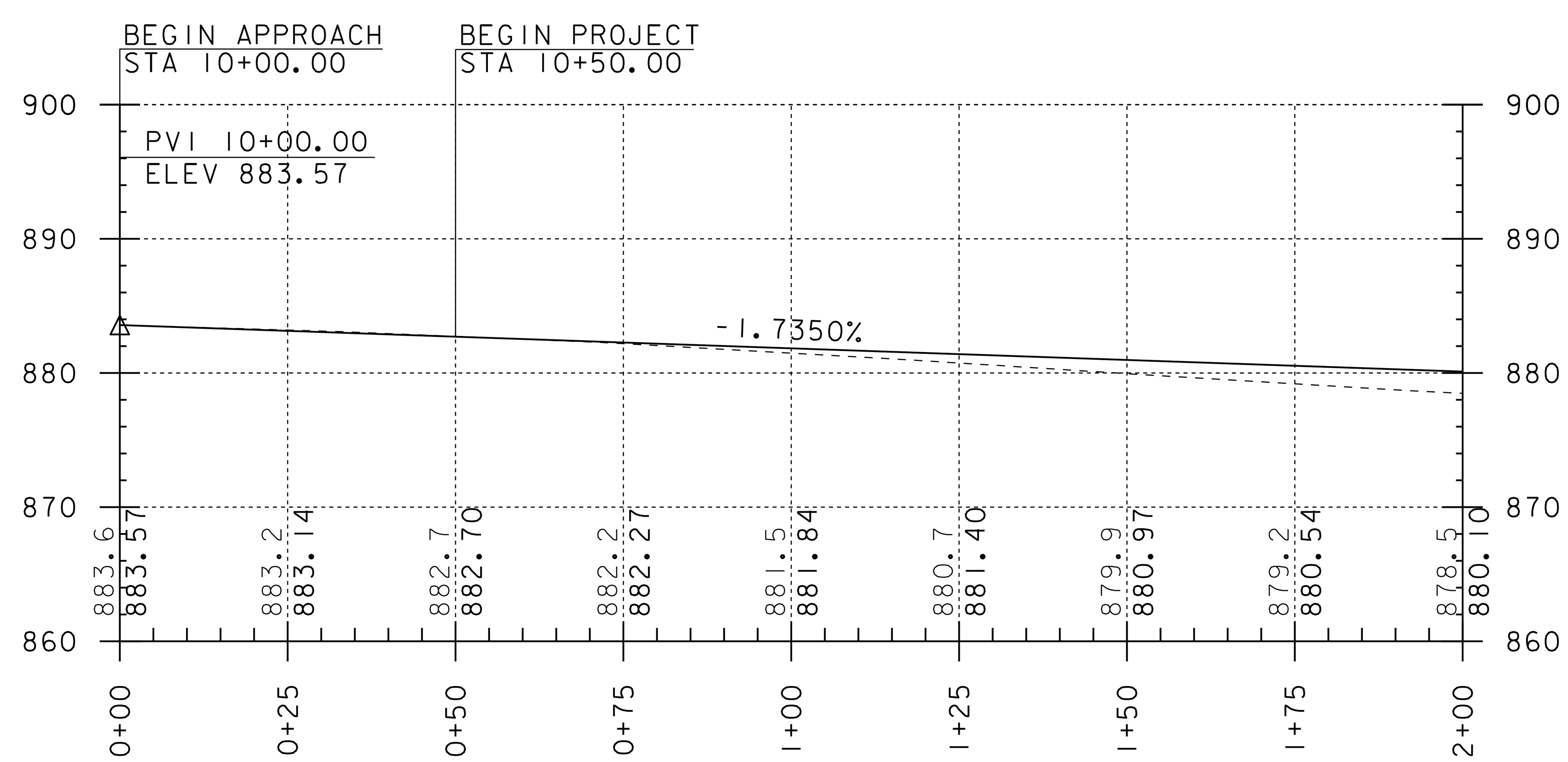
SCALE 1" = 20'-0"

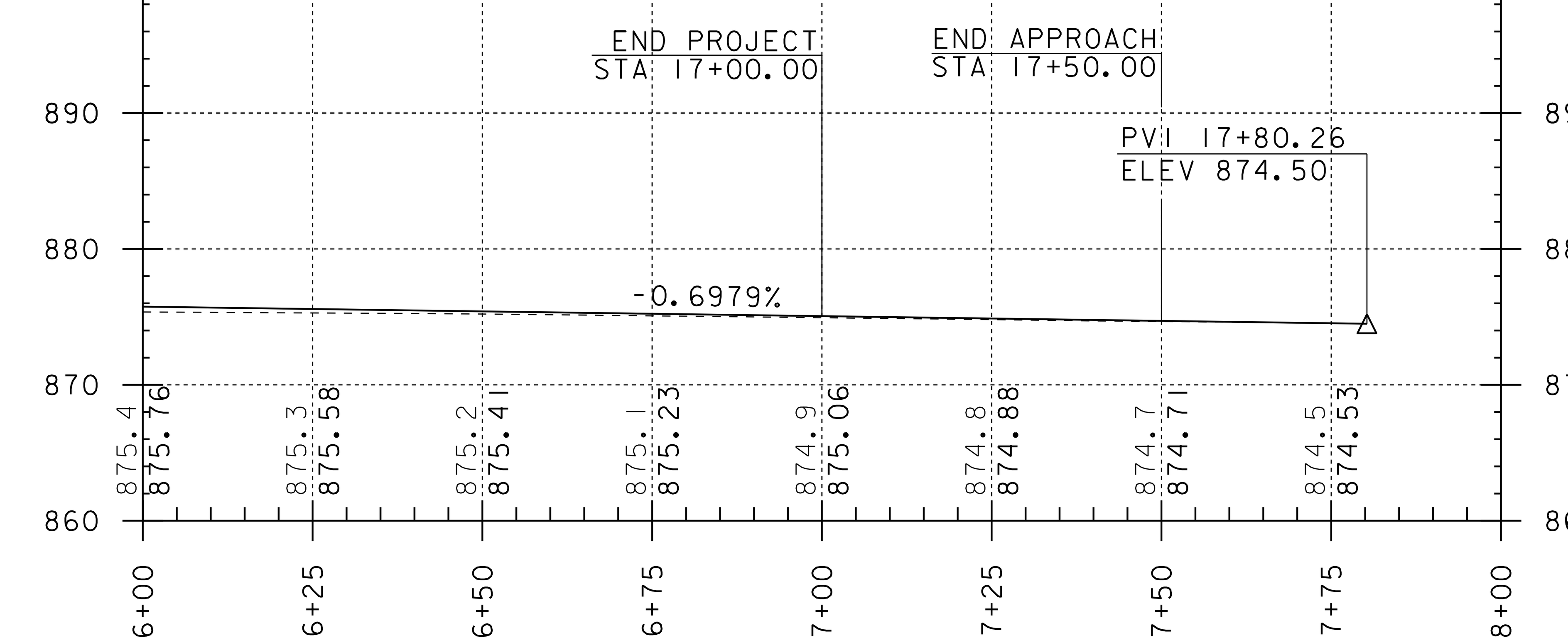
20 0 20

PROJECT NAME:	BRUNSWICK
PROJECT NUMBER:	BF 0271(23)

FILE NAME: 13c056/sl3c056border.dgn	PLOT DATE: 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: O.M.DARISSE
DESIGNED BY: ------	CHECKED BY: ------
ALTERNATIVE 2a LAYOUT SHEET 2	SHEET 5 OF 24







ALTERNATIVE 2a PROFILE

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

NOTE:

GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄

GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: BRUNSWICK	
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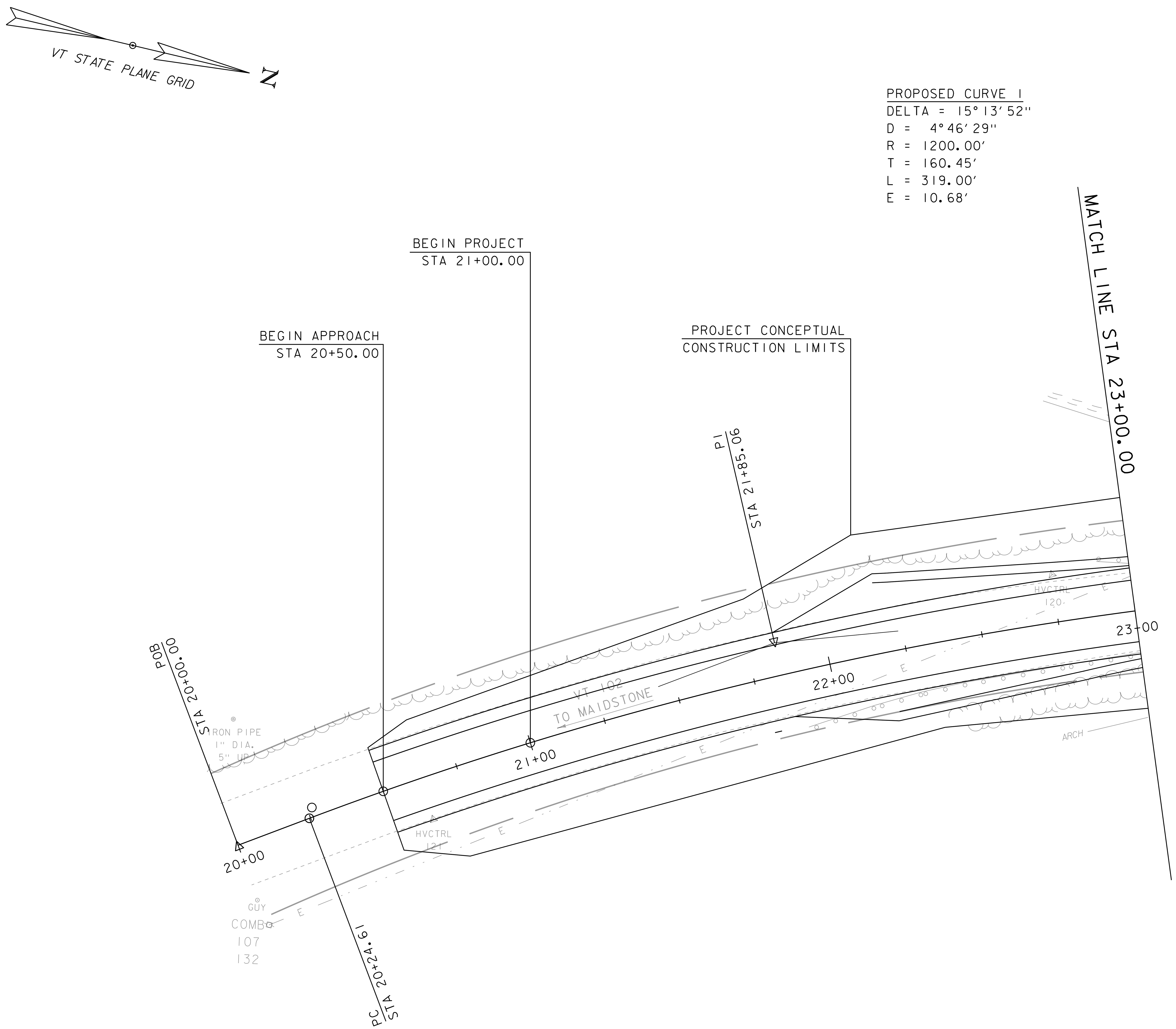
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: O.M.DARISSE
DESIGNED BY: ------	CHECKED BY: ------
ALTERNATIVE 2a PROFILE	SHEET 6 OF 24

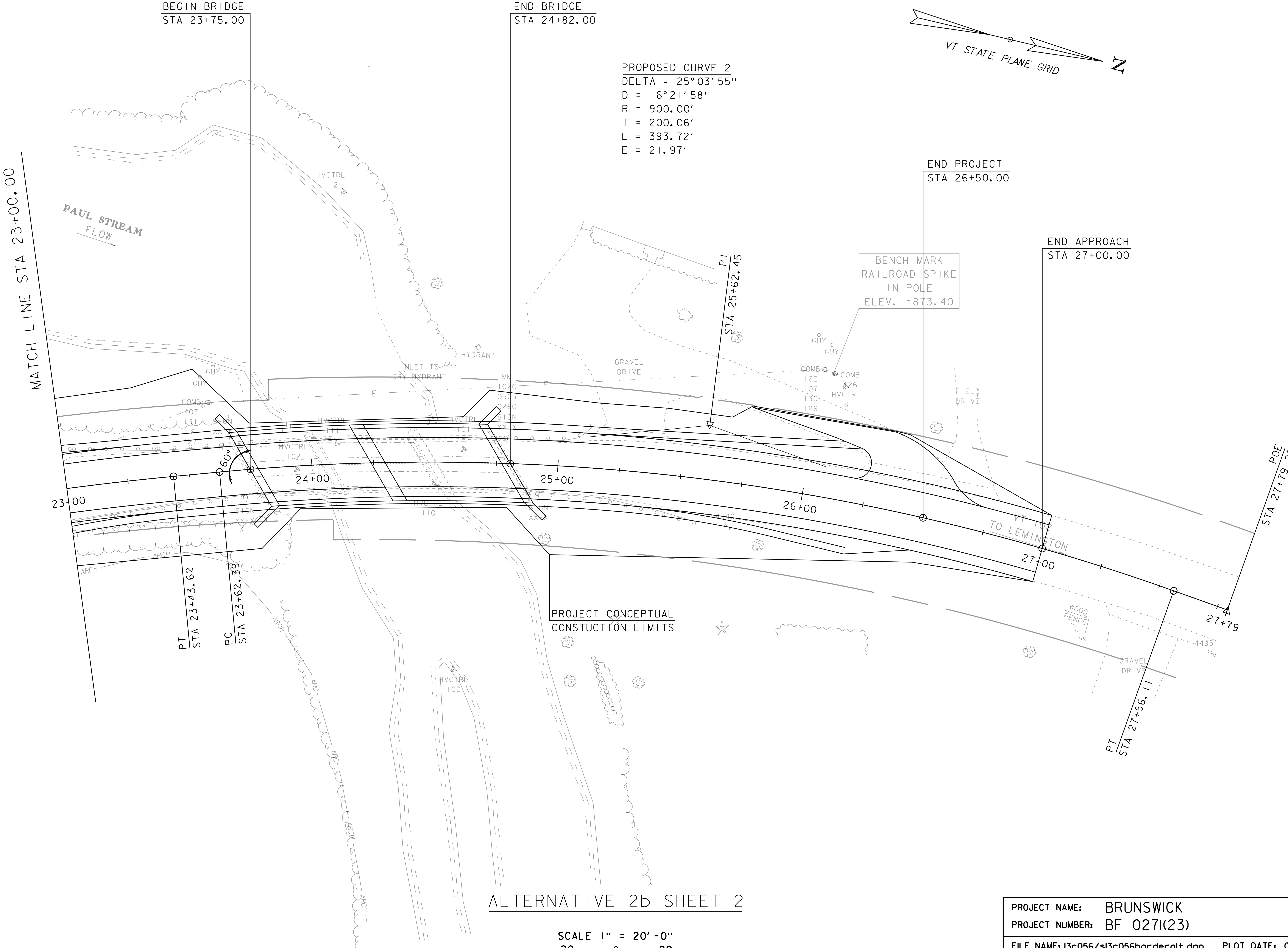


ALTERNATIVE 2b SHEET 1

SCALE 1" = 20'-0"

20 0 20

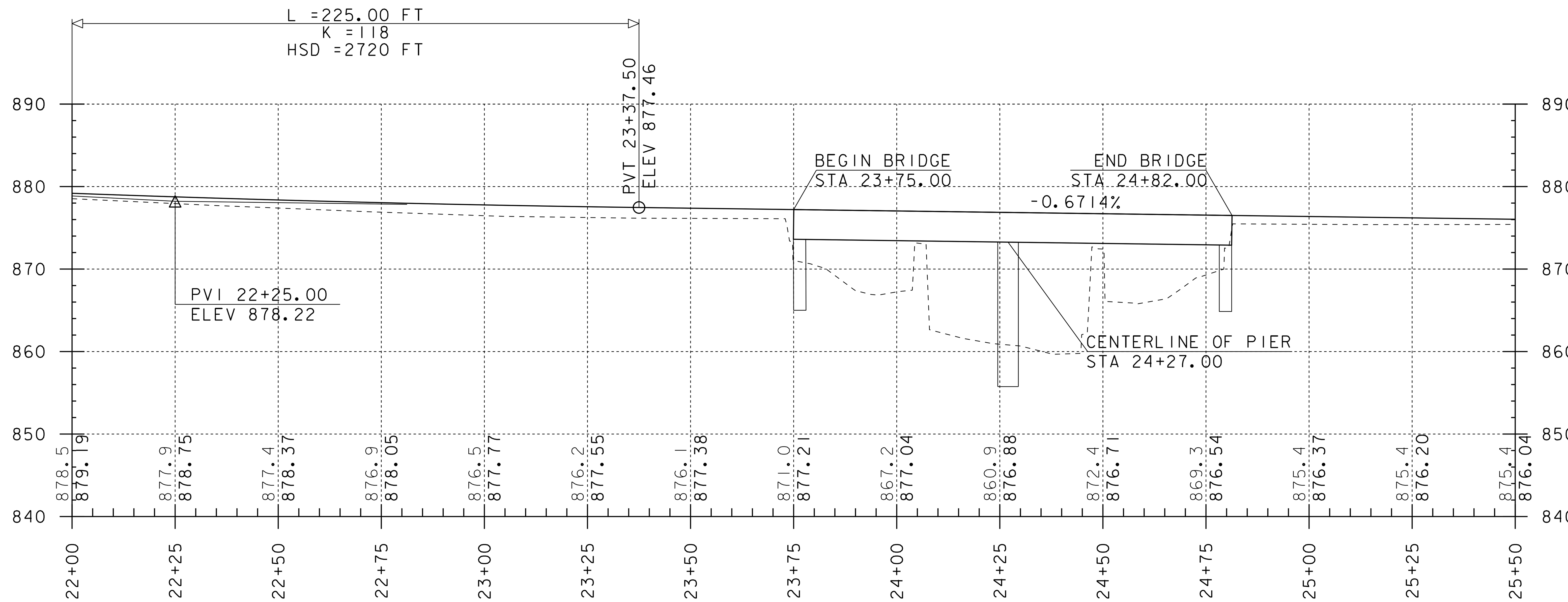
PROJECT NAME: BRUNSWICK	
PROJECT NUMBER: BF 0271(23)	
FILE NAME: 13c056/s13c056borderalt.dgn	PLOT DATE: 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: O.M.DARISSE
DESIGNED BY: ------	CHECKED BY: ------
ALTERNATIVE 2b LAYOUT	SHEET 7 OF 24

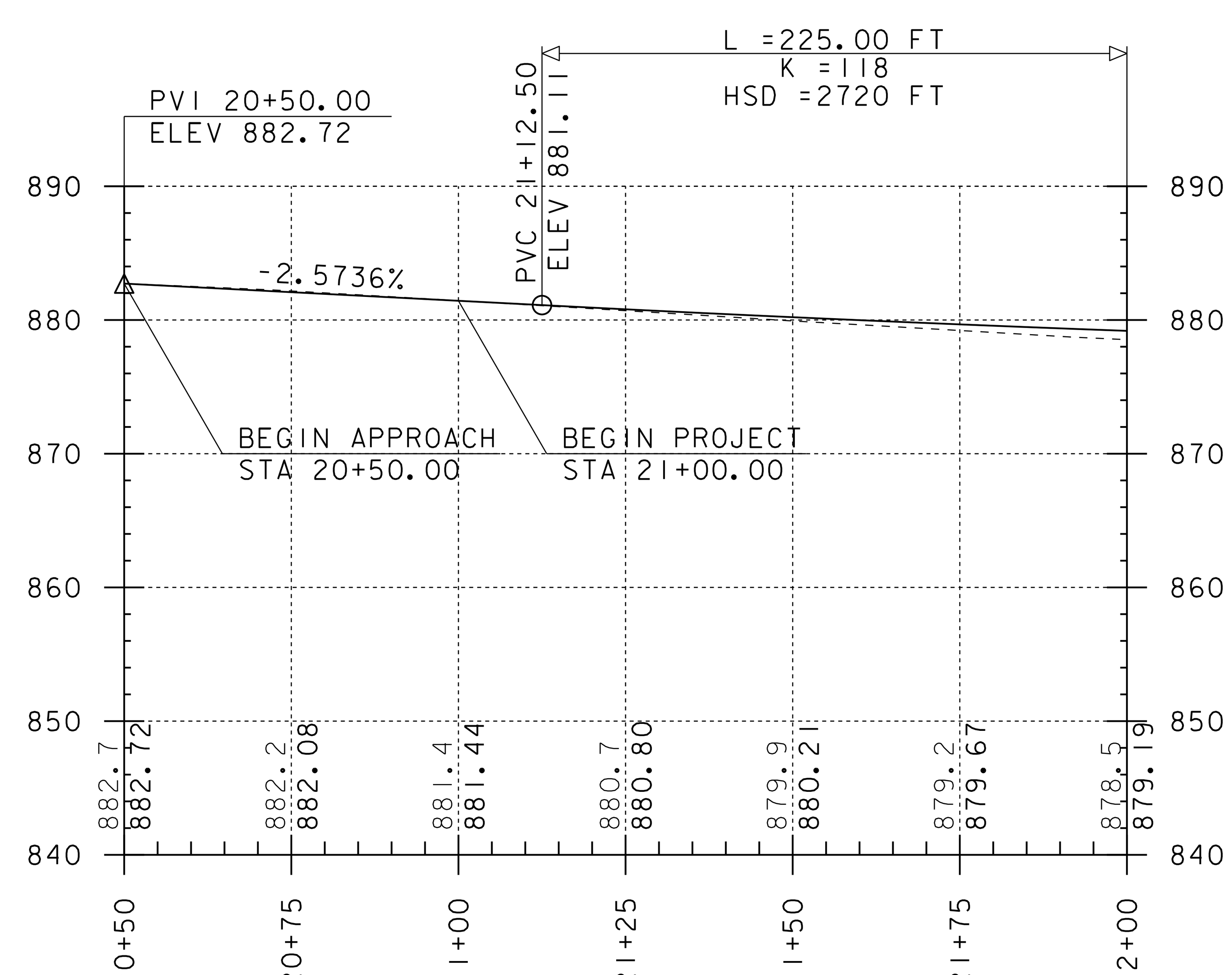


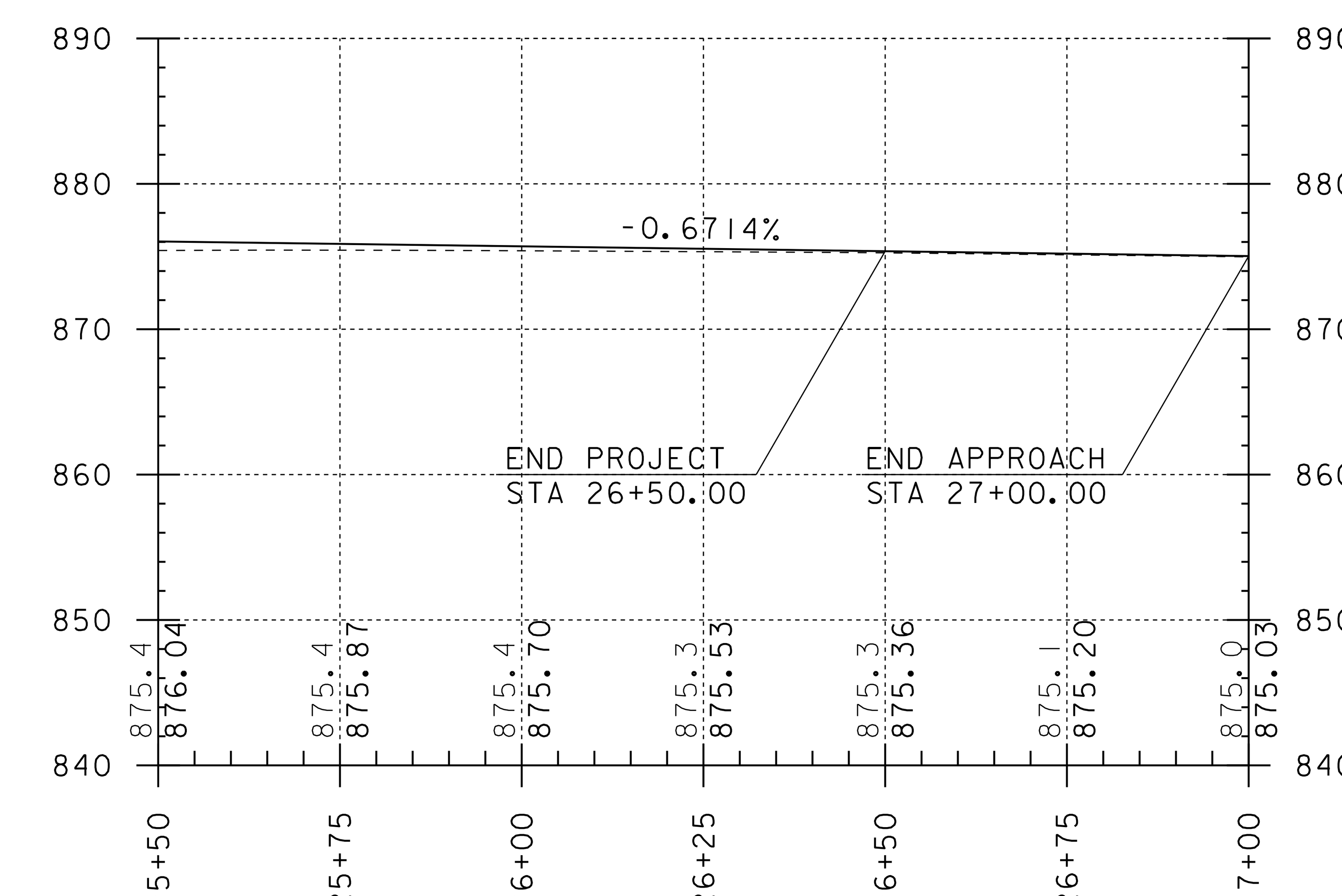
ALTERNATIVE 2b SHEET 2

SCALE 1" = 20′-0"
20 0 20

PROJECT NAME: BRUNSWICK	
PROJECT NUMBER: BF 0271(23)	
FILE NAME: 13c056/s13c056borderalt.dgn	PLOT DATE: 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: O.M.DARISSE
DESIGNED BY: ------	CHECKED BY: ------
ALTERNATIVE 2b LAYOUT	SHEET 8 OF 24







ALTERNATIVE 2b PROFILE

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

NOTE:

GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄

GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

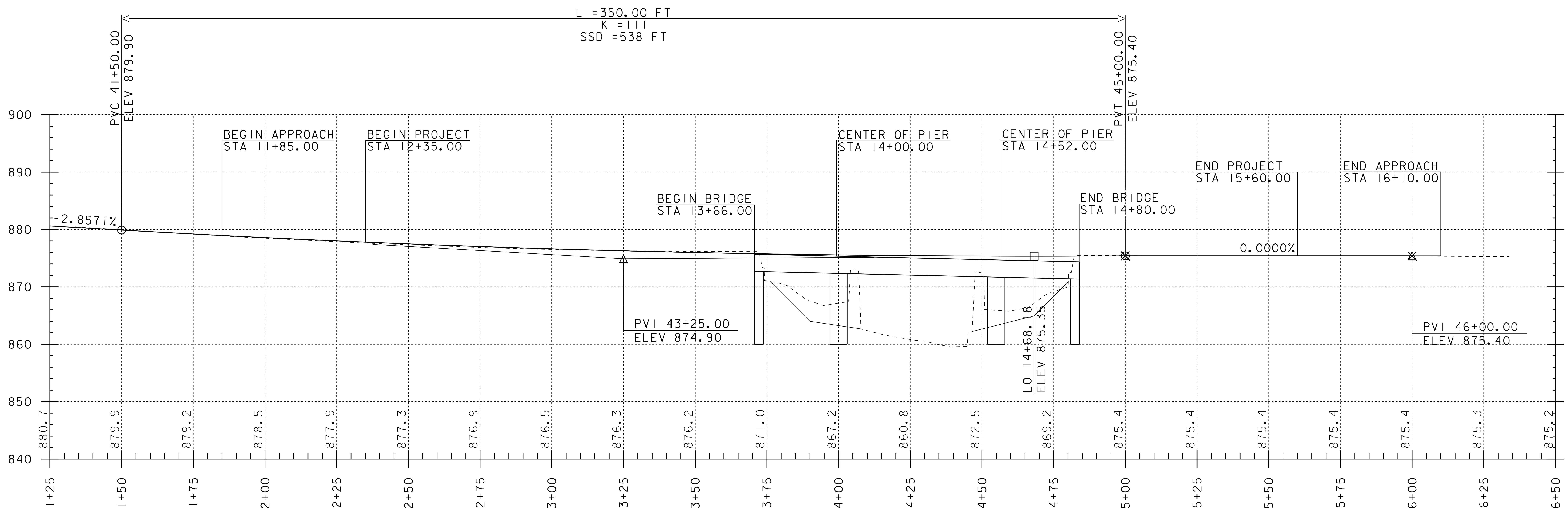
PROJECT NAME: BRUNSWICK	
PROJECT NUMBER: BF 0271(23)	
FILE NAME: 13c056/s13c056profile.dgn	PLOT DATE: 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: O.M.DARISSE
DESIGNED BY: ------	CHECKED BY: ------
ALTERNATIVE 2b PROFILE	SHEET 9 OF 24

ALTERNATIVE 2c

SCALE 1″ = 20′-0″

20 0 20

PROJECT NAME: BRUNSWICK	
PROJECT NUMBER: BF 0271(23)	
FILE NAME: 13c056/sl3c056border.dgn	PLOT DATE: 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: O.M.DARISSE
DESIGNED BY: ------	CHECKED BY: ------
ALTERNATIVE 2c LAYOUT SHEET	SHEET 10 OF 24



ALTERNATIVE 2c PROFILE

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

NOTE:

GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄

GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: BRUNSWICK	
PROJECT NUMBER: BF 0271(23)	
FILE NAME: 13c056/sl3c056profile.dgn	PLOT DATE: 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: O.M.DARISSE
DESIGNED BY: ------	CHECKED BY: ------
ALTERNATIVE 2c PROFILE	SHEET 11 OF 24

DESIGN SPEED: 20 M.P.H.
ONE 14.6-FT WIDE LANE
SEE STANDARD E107

UPSTREAM ONE-LANE TEMPORARY BRIDGE LAYOUT

SCALE 1" = 20'-0"

20 0 20

PROJECT NAME: BRUNSWICK	
PROJECT NUMBER: BF 0271(23)	
FILE NAME: 13c056/sl3c056border.dgn	**PLOT DATE:** 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	**DRAWN BY:** O.M.DARISSE
DESIGNED BY: ------	**CHECKED BY:** ------
UPSTREAM TEMPORARY BRIDGE	**SHEET** 16 **OF** 24

DESIGN SPEED: 20 M.P.H.
ONE 14.6-FT WIDE LANE
SEE STANDARD E107

DOWNSTREAM ONE-LANE TEMPORARY BRIDGE LAYOUT

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

PROJECT NAME: BRUNSWICK	
PROJECT NUMBER: BF 0271(23)	
FILE NAME: l3c056/sl3c056border.dgn	PLOT DATE: 02-DEC-2013
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: O.M.DARISSE
DESIGNED BY: ------	CHECKED BY: ------
DOWNSTREAM TEMPORARY BRIDGE	SHEET 17 OF 24