FY 2023-2027 State of Good Repair (SGR) Project Narrative
Federal ID 18062 (VA Str. No. 089-1947)
Rte. 1 (Jefferson Davis Highway) over Rappahannock River, City of Fredericksburg/Stafford Co.
December 9, 2021, Revised February 8, 2022, February 23, 2022

Project Description

The Route 1 (Jefferson Davis Highway) Bridge over Rappahannock River is located on the City of Fredericksburg/Stafford County line and is 85.1 percent owned/maintained by the Commonwealth of Virginia (State) and 14.9 percent owned/maintained by the City of Fredericksburg. The bridge was built in 1943. The Virginia Structure No. is 1947 and the Federal Structure ID is 18062.

The bridge structure consist of three (3) 65'-0" and four (4) 81'-0" steel beam spans, seven (7) 120'-0" continuous girder spans and two (2) 25'-0" steel girder cantilever arms for a total bridge length of 1416'-5" from back of wall to back of wall (measured along the baseline) and is in a tangent alignment and a constant zero percent gradient[1]. The out-to-out of the Bridge is 54'-6" wide.

The functional classification of Route 1 is Urban Principal Arterial with a current AADT of 34,000 vehicles based on the 2020 traffic data available from the Virginia Department of Transportation's (VDOT) website. Almost 98 percent of the observed AADT in 2020 is comprised of two (2) and four (4) tire vehicles. Pedestrian facilities are provided at this location. Route 1 is on the National Highway System.

Location of VA Structure No. 1947, Rte. 1 over Rappahannock River in Stafford County, VA.
Source: Google Maps

[1] Stage 1 Report by Whitman, Requardt & Associates, LLP and see also the existing drawings

Scope Justification

The 2020 Inspection report rates the deck as being in a Fair condition with a rating of 5, and the superstructure as being poor with a rating of 4 and the substructure as fair with a rating of 5. The Channel and Channel Protection has a rating of 6. This report is to document pre-scoping efforts that will inform repair work to the bridge in accordance with the requirements of Chapter 32 of the VDOT Structures and Bridge Manual, Vol. 5 Part 2 and hence remove it from its current deficient state. As a result, the main effort will be to develop key project assumptions, identifying potential risk, assessing design waivers and/or exceptions, determining project stakeholders and preparing conceptual cost estimates among others.

Significant Scope Elements

1. Bridge Configuration

Existing Structure

The bridge structure consist of three (3) 65’-0” and four (4) 81’-0” steel beam spans, seven (7) 120’-0” continuous girder spans and two (2) 25’-0” steel girder cantilever arms for a total bridge length of 1416’-5” from back of wall to back of wall (measured along the baseline) and is in a tangent alignment and a constant zero percent gradient. This bridge has no skew. Each sidewalk is 4’-1 ½” wide. The out-to-out of the Bridge is 54’-6”. See appendix D for the relevant existing bridge drawings.

Proposed Structure

Two main options are being presented in this report for consideration. The first is a superstructure and substructure repair and the second is a surrogate of the complete structure replacement.

These two options are further discussed below:

Option 1: Superstructure and Substructure Repairs

This repair solution is provided to remove the structure from its current deficient state. This option would repair the existing deck, steel superstructure, substructure and replace the existing railing and sidewalk.

Reinforced Concrete Deck

To repair the existing deck, Type B and C patching will be required to remove any deficient concrete and medium to large cracks would receive epoxy injection[2].

The chloride sampling in the deck has not been performed as of date but with a deck general condition rating (GCR) of 5 and less than 15 percent of compromised area, the deck decision matrix on File No. 32.03-3 of Chapter 32 of VDOT's Structures and Bridge Manual recommends Rigid Overlay over Shallow Hydromilled Substrate. The existing deck would receive a hydromill and overlay with Latex Modified Concrete. The milling operation would remove approximately 1½" so as not to increase the dead load when adding the new latex overlay.

The bridge currently has a lot of expansion joints. This repair work will also explore the feasibility of closing/replacing some of these joints as per the requirements of File No. 32.03-8 of Chapter 32 of VDOT's Structures and Bridge Manual to help reduce the intrusion of water to the superstructure. Additionally, according to the 2020 inspection report, there are no downspouts on the bridge in its current stage. The repair work will therefore include the provision of scuppers and downspouts to help drain the bridge deck.

The existing railing and sidewalk have significant amounts of deterioration that replacement of these has become necessary. Since increasing of the dead loads are a concern, lightweight concrete would be utilized during the sidewalk replacement to minimize these dead loads. For this maintenance work, the sidewalk width would be expanded to meet the current VDOT standard as shown in the Manual of the Structure and Bridge, Part 2, File No. 06.04-8. Due to the historical nature of this area, the Texas C411 Railing is proposed for use as a replacement for the current rail system.

The sidewalk replacement work would be carried out under staged construction using scaffolding mounted outside the existing bridge railing and supported off the substructure. The deck repair work would be carried out using a combination of nighttime work and staged construction as much as it is possible.

Structural Steel

The existing structural steel will require members with significant section loss to be repaired/replaced, including diaphragms, stiffeners, corbels and floor beams located at joints.

To keep the cost of this option down, a zone coat would be applied to areas that are exposed to moisture, including beam ends and all elements within 5 feet of a joint and outside face of

[2] S&B Manual Chp. 32: Hierarchy of Deck Treatment Options

the exterior beams in accordance with part 2, section 32.04 of VDOT's Structure and Bridge manual.
The exterior girders/beams would require reinforcement to be able to adequately support the increased sidewalk width. This reinforcement could be in the form of;

a) Converting the exterior girder/beam into a composite beam section with the deck slab
b) Adding steel plates as required to the girder/beam.

A combination of these two options or any other would also be explored during final design.

The corbels and stringers in the sidewalk may be replaced if possible to receive the new sidewalk width. These and any others would also be explored during final scoping design.

Repair/replacement works to the steel superstructure would be undertaking using platforms suspended from the superstructure at multi-points. This is to help reduce the amount of disturbance to the stream underneath and the wetlands.

Substructure

All the concrete deficiencies (i.e. cracks, delamination, spalling and scaling etc.) on the stems and walls would be addressed as per section 32.5 of the Structures and Bridge Manual. The bearing seat that has seen delamination and spalling exposing reinforcement per the recent inspection report would also be repaired. Repairs to the substructure is expected to be carried out using scaffolding supported off the walls of the substructure.

Chloride content test conducted by Schnabel Engineering[3] at both abutments, Piers 1, 12 and 13 is presented as part of this submittal. Piers 1 and 12 are located beneath an existing expansion deck joint and Pier 13 is located beneath a continuous portion of the deck.

The results for the abutments show Chloride content in the vertical faces of the back walls ranging from 4.03 lb/cy to 6.50 lb/cy. These values are in excess of the 4.0 lb/cy threshold for substructures as indicated on File No. 32.05-9 of Chapter 32 of the manual of the Structures and Bridge Division of VDOT. As stated earlier, a gutter system would be placed underneath the expansion joints at the abutments to help prevent the ingress of water to the substructure. A joint repair/replacement would also be considered for these locations and other deterioration prevention techniques such as thermally sprayed galvanic anodes would also be explored for the abutments.

The Pier results showed Chloride contents in the Pier stems at Piers below joints ranging from 1.7 lb/cy to 5.5 lb/cy with three of the four readings below the 4.0 lb/cy threshold. The

[3] The Schnabel Report has been included as part of this submittal

Chloride content on samples at Pier 13 which is not beneath a deck joint both measured 0.196 lb/cy. Joints closures/elimination/repairs would be explored for the Piers underneath a deck joint. Additionally, protection systems such as thermally sprayed galvanic anodes would be considered for use to protect the piers.

The following is a summary of the work to be performed under this option:

- Perform type B and C patching and epoxy injection to existing cracks
- Replace the existing sidewalk, and railing with a BR411-1.
- Hydromill the Substrate and apply a Latex Modified Overlay
- Repair/replace existing steel members
- Clean and zone coat existing steel
- Perform concrete surface repairs and pressure seal cracks on substructure
- Corrosion protection on the substructure
- Joint closures/elimination/repair where appropriate
- Placing of gutter systems/troughs under the tooth joints

In addition to the above, and per the S&B's IIM-95,[4] to help mitigate future deterioration of the bridge elements, some of the actions that will be taken include but are not limited to the following:

- Downspouts and scuppers would be provided along the length of the bridge to ensure easy drainage of water away from the superstructure.
- Conducting Chloride sampling on the deck.
- Further Chloride sampling test to confirm if Pier 13 is representative of Piers with no joint above them.

The construction time to complete this option is estimated to be about 36 months. For the proposed transverse section, see Appendix A.

Option 2: Bridge Structure Replacement

Refer to alternative 1 of the concept study for Superstructure replacement Draft Report 2020 by AECOM (Included with this submittal) for the narrative and conceptual drawings.

The construction time to complete this option is estimated to be about 48 months.

[4] S&B IIM-95

2. Approach Roadway Configuration

Route 1 is on the National Highway System and is classified as Urban Principal Arterial. The existing approach pavement width is approximately 44 feet. This appears to align with the travel lanes on the bridge.

3. Geotechnical

The geologic formation in the vicinity of the bridge is that of Porphyroblastic Garnet-Biotite Gneiss. This geologic formation can be described as dominantly heterogeneous layered sequence garnetiferous biotite gneiss containing mineral assemblages consistent with rock chemistry. Rocks are therefore expected to be encountered at shallow depths.

The repair work is not expected to include any foundation works. However, the replacement option may require foundation works. During scoping and design, this would be re-accessed further.

4. Hydrologic and Hydraulic Analysis (H&HA)

It is not anticipated that the bridge repair work would require a hydraulic analysis. As noted earlier on, the bridge foundations are believed to be founded on rocks and so it is unlikely that scour countermeasures would be required as part of the rehabilitation work.

Also, for this maintenance work, it is not anticipated that a hydraulically equivalent report (HERS) will be needed.

The low chord elevation of the bridge superstructure is expected to remain as it currently is when the maintenance repair work are completed.

5. Maintenance of Traffic / Traffic

The existing bridge is located in an urban area and carries a large amount of traffic as indicated in the project description. Attempts at finding possible detour routes have proven elusive, as the available routes, all appear to already see a large amount of traffic. Also because of the historic nature of the area and the limited right of way, a traffic diversion would be very expensive and most likely difficult to do.

A staged construction could therefore be utilized in this case, however, this could result in long traffic backups on the bridge. Another option would be to do most of the deck work during the night using rapid bridge techniques so that the closures would occur during the

nighttime. This would allow traffic to be maintained during the day with all four lanes possibly opened.

It must be noted that nighttime work would be more expensive and construction noise will need approval as well. A combination of these options may have to be used to maintain traffic. A traffic analysis would also be conducted to better understand the effect of possible lane closures on the traveling public.

The plan is to use four lanes of 10 feet each to maintain vehicular traffic. This would leave 2 feet at each side of the travel lanes for concrete barrier service to allow for reconstruction of the sidewalk and the railing one side at a time. Access for the demolishing and reconstruction of the sidewalk and railing may be done using a scaffolding constructed outside of the existing bridge railing. This would be done one side at a time so pedestrian traffic can be maintained at all times.

Traffic lanes would be repaired in strips with one lane per side at a time. Using the planning level production rates in the Manual of the Structure and Bridge Division, Part 2, File 32.03-5, for shallow hydromilling and overlay with very high early strength latex modified concrete, approximately 1,200 square feet of roadway can be covered within 12 hours for a one lane closed during operations.

Allowed single lane closures on this road segment are currently set at 10 PM to 9 AM on Friday and Saturday nights which allows a total of 11 hours of closure. Weekday closures are shorter and allow 8 hours of closure northbound and 9 hours of closure southbound.

This suggests that for 11 hours of closure on a Friday and Saturday night, approximately 1,100 square feet of mill and overlay can be completed per night. The total area in a lane is about 15,581.7 square feet (11 feet lane width X 1416.42 feet Bridge length). This translates into about 14 lane closures (or seven weekends) to complete a lane.

If the work is done on four weekday nights with approximately 800 square feet per the allowed 8 hour closure period, and the two weekend nights with approximately 1,100 square feet per the allowed 11 hours, it is expected that it will take on the average about three weeks to complete a lane.

So depending on how this is approached, it could take between three to seven weeks to complete a lane.

This approach would ensure that traffic lanes are not closed for prolonged periods of time and that 4-lanes of traffic would be maintained.

6. Traffic

See maintenance of traffic above.

7. Right-of-way Impacts

As noted earlier on, the bridge is located in a historic area and with a limited right of way. Acquiring additional right of way or permanent easement would be difficult and expensive. Consequently, for this maintenance work, one of the goals would be to explore the feasibility of acquiring aerial easements, before the acquisition of permanent easements.

8. Utility Impacts

A major hurdle to the repair work of the existing bridge structure as well as the bridge replacement will be the relocation of all existing utilities. Due to the numerous utilities being presently carried by the bridge, a preliminary utility coordination meeting would be held to discuss what is on the bridge structure and what would be the requirements for relocating these utilities during the repair work. During this pre-scoping exercise, some of the utility stakeholders identified were Dominion Energy, Verizon, Comcast, Columbia gas and Cox communications.

9. Environmental Impacts and Permits

After a review of the location and the respective agencies that regulate the species, it was noted that the following threatened and endangered species are located near the bridge structure; migratory birds i.e. bald eagles, anadromous fish, dwarf wedge mussel, green floater, yellow lance, and sturgeon, which are of environmental concern. Appendix B shows the relationship of anticipated time of year restrictions for threatened and endangered species and this may affect any construction activity within the watershed. Additionally, a mussel survey may need to be conducted for the green floater mussels if they are present near the bridge structure. The presence of the green floater mussels would be determined early on during the bridge design process because the survey would cause a significant delay for any possible in stream work.

In summary, the following listed items, noted during the scoping process could be of environmental concern during construction:

- The designated scenic river

- Possible wetland impacts
- DCR Natural Heritage Site-Rappahannock River Fall Line
- Potential Mussel relocation
- Falmouth Historic District
- Battle of Fredericksburg I
- Battle of Fredericksburg II
- Chancellorsville Battlefield
- DHR Section 106 adverse effect on project; subsequent effects document type and subsequent effect on water quality permit type
- Possible environmental justice issues if bridge sidewalks are closed during construction of the bridge

These issues would be addressed earlier on in the process to help reduce the impact they are likely to cause to the construction process.

10. Stakeholders

The main stakeholders so far identified would be the utility companies, property owners, various Government agencies and the general public. These stakeholders would be engaged early in the process.

11. Bicycle-Pedestrian Features

The existing sidewalk width of 4'- 1½" (face of rail to face of sidewalk curb) will be increased to 6'-6" (face of rail to face of sidewalk curb). This expansion would make it compliant with the current requirements of the Manual of the Structure and Bridge Division, Part 2, File No. 06.04-8.

12. Constructability Issues

See risk assessment and maintenance of traffic sections. Maintaining four lanes of traffic while replacing the sidewalks will require platforms that extend outside the current right of way (RW).

Also, possible lane closures during deck and sidewalk repair work could adversely impact the traffic situation and cause long backups. In addition, repair work to the substructure may require scaffolding supported off the abutment/pier walls, erection of these may cause some disturbance to the immediate environs of the abutments/piers and these may be of

environmental concern. Access to confined areas such as between superstructure elements at substructure locations, etc. may require innovative techniques.

13. Design Exceptions/Waivers/Approvals and Performance Based Practical Design

A design exception/waiver may be required for the lane widths.

14. Complex project elements, if any

See risk assessment below.

15. Scope Elements not Eligible for SGR

Currently, there are no anticipated elements, which will not be eligible for SGR funding per the IIM-S&B-95.

16. Alternative Analysis

Refer to the Bridge configuration section. This section describes two options a) a repairs option and b) a replacement option. A summary of the cost estimates for these two are summarized in the project cost estimate section.

17. Risk Assessment

The following is a list of potential risks to the project that were noted during the pre-scoping phase:

- Relocation of the existing utilities attached to the bridge to make way for the repair/ replacement works could delay the project.
- The potential for any repair work that are unknown during the pre-scoping phase could increase the project cost as well as extend the project execution time frame.
- Maintaining four lanes of traffic during construction at all times could potentially prolong construction works and increase the project cost.
- The potential for nighttime work to be affected by potential nighttime ordinances.
- Stream impacts appear to be temporary with no mitigation needed. However, there is a potential for wetland disturbance.

- There is a potential for Mussel Survey and subsequent relocation.

- There is a potential for Informal Consultation on the Atlantic Sturgeon.
- There is a potential for likely Migratory Bird Take Permit.
- There is a potential for environmental justice impact should both sidewalks be closed during construction.
- Removal of concrete railing on contributing bridge may result in adverse effects on Falmouth Historic District (NRHP-listed) requiring MOA and stipulations to resolve. However, to address this, the Texas C411 railing is being suggested as a replacement for the railing system.
- Potential for follow-up on archaeological studies beyond the survey level that are time and cost intensive.
- Potential for currently unknown/unevaluated archaeological deposits requiring intensive archaeological evaluation/excavation (e.g., deeply buried archaeology site in floodplain).
- During construction, there might be the potential mitigation for the protection and/or monitoring of historic structures.

The above risk and possibly more are being addressed through the inclusion of appropriate levels of contingency in the Pre-Scoping Cost Estimate in accordance with the suggested contingencies for the given risk level, as shown in Table 1 below. During final scoping efforts, a more complete analysis would be performed, based on more complete investigations by the various disciplines.

	Prescoping Documents (Prior to Project Selection)		
Level of Project Development	0% to10%		
Phase	Low	Medium	High
PE	10%	12%	15%
RW	30%	50%	75%
CN	25%	40%	75%

Table 1: Suggested Contingency for Given Risk Level

From the foregoing pre-scoping risk discussion, the potential for unknown repair work and/or the extent of damage to the bridge elements being identified later on in the process is not a remote possibility. In addition, it is anticipated that carrying out the repair work would require highly skilled personnel and innovative ideas as it might be difficult to access some areas to carry out repair work. These among others informed VDOT's decision to assess a high risk for the PE and CN phases for the repair work.

The potential unknown/unevaluated archeological deposits requiring intensive archeological evaluation and the other potential environmental impacts could significantly affect the progress of work. To address this risk, VDOT assessed a high risk for the environmental phase on both options.

For the RW phase on both options, VDOT assessed a high risk; as there are some properties with historical significance and there are other properties that are also active businesses and zoned commercials among others. Also with the replacement option, VDOT assessed a high risk for the PE and CN phases mainly due to the complexity of the project.

18. Proposed Smart Flags

Currently, the use of smart flags to override any factors within the SGR Bridge Prioritization formula is not anticipated.

19. Conceptual Drawings

See Appendix A for a typical transverse section of the proposed repaired bridge and other conceptual drawings. The existing bridge drawings are included in Appendix D.

20. Project Cost Estimate

The estimates provided in Appendix C are based on historical cost for similar structures. Bridge costs were itemized using bid tabulations. This was further broken into the City of Fredericksburg's portion of the total cost and the State's portion of the total cost. Two cost estimate workbooks (January 2020 version) were also provided for each bridge option (the repair and the replacement) and are each included as separate excel spreadsheets with this submittal. The cost estimate workbooks also include the appropriate inflation cost for the PE, RW and CN phases.

The total estimated cost for each of these options including inflation cost is summarized in Table 2:

Option	Description	City of Fredericksburg's Cost (14.9%)	State's Cost (85.1%)	Total
1	Bridge Repair works	$8,966,496	$51,211,332	$60,177,828
2	Total Bridge Replacement	$34,840,633	$198,988,084	$233,828,717

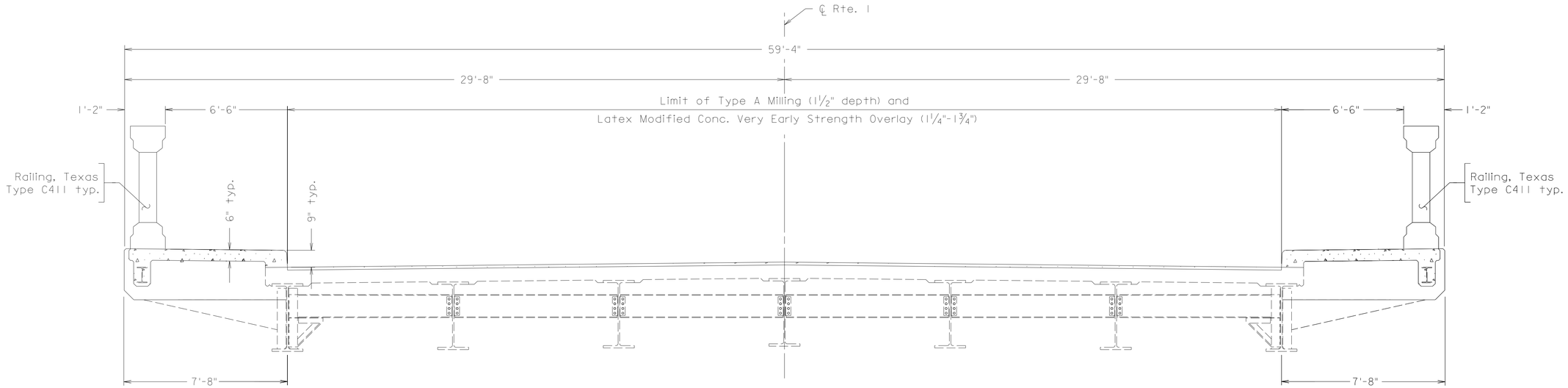
Table 2: Total Estimated Cost per Option distributed between the City and the State

It can thus to noted that the total cost of repair for the bridge compared to the total cost of replacement of the bridge is about 25.7 percent.

The repair option is thus recommended.

APPENDIX A

CONCEPTUAL DRAWINGS



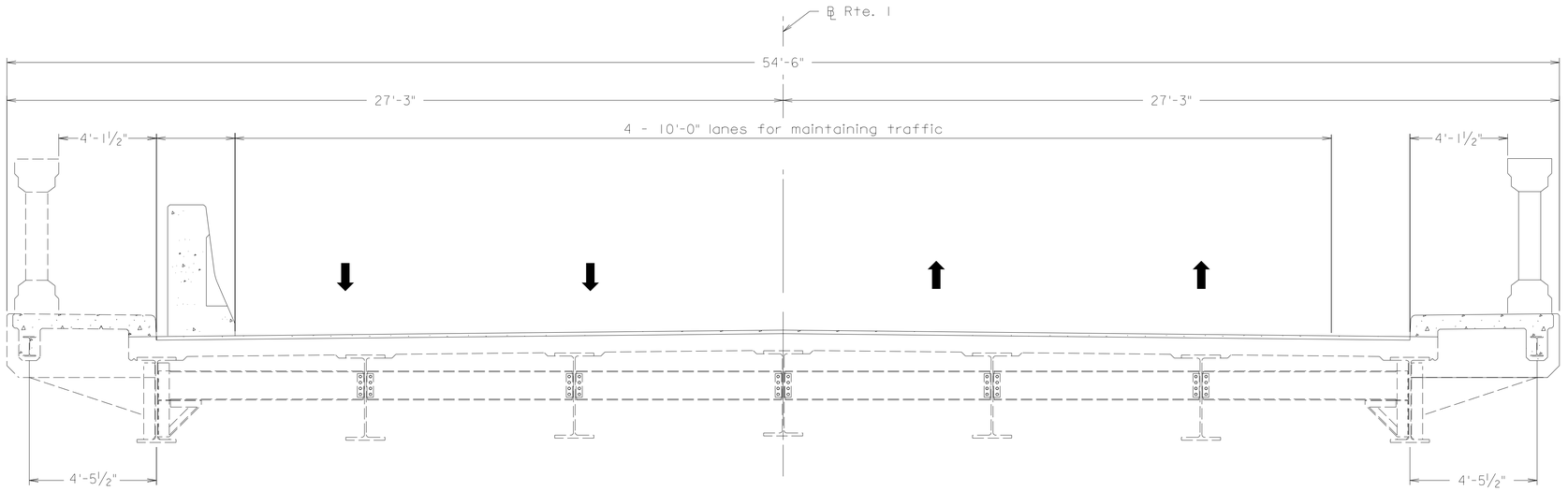
TRANSVERSE SECTION
OPTION 1 - REPAIR WORK

RTE. 1 OVER RAPPAHANNOCK RIVER
(FALMOUTH BRIDGE)

OPTION 1 - REPAIR WORK
TRANSVERSE SECTION

Date : Feb. 2022

Drawing Number : 1 of 1



MOT
Phase 1

Notes:

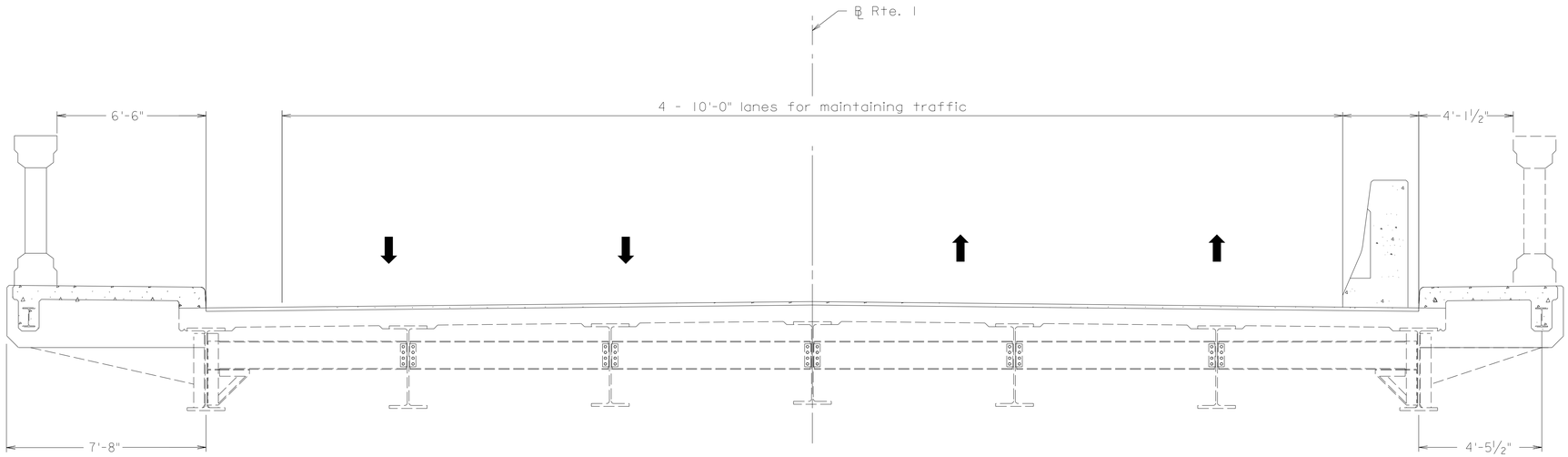
1. Demolish and replace left sidewalk

RTE. 1 OVER RAPPAHANNOCK RIVER
(FALMOUTH BRIDGE)

TRANSVERSE SECTION
(LEFT SIDEWALK REPLACEMENT)

Date : Feb. 2022

Drawing Number : 1 of 2



MOT
Phase II

Notes:

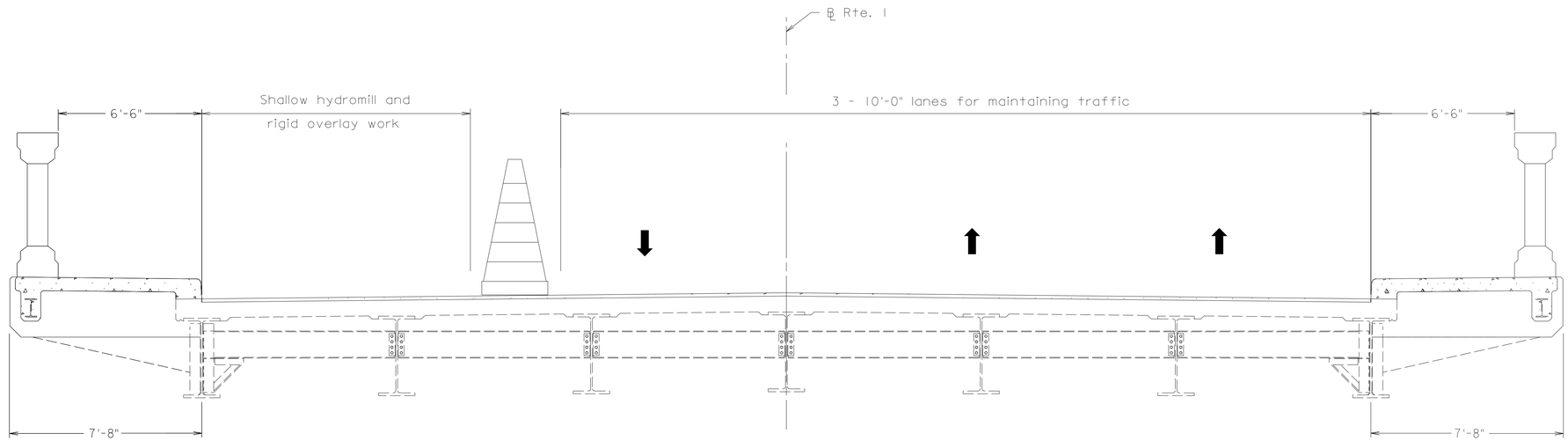
1. Demolish and replace right sidewalk

RTE. 1 OVER RAPPAHANNOCK RIVER
(FALMOUTH BRIDGE)

TRANSVERSE SECTION
(RIGHT SIDEWALK REPLACEMENT)

Date : Feb. 2022

Drawing Number : 2 of 2



MOT

Phase III

Notes:

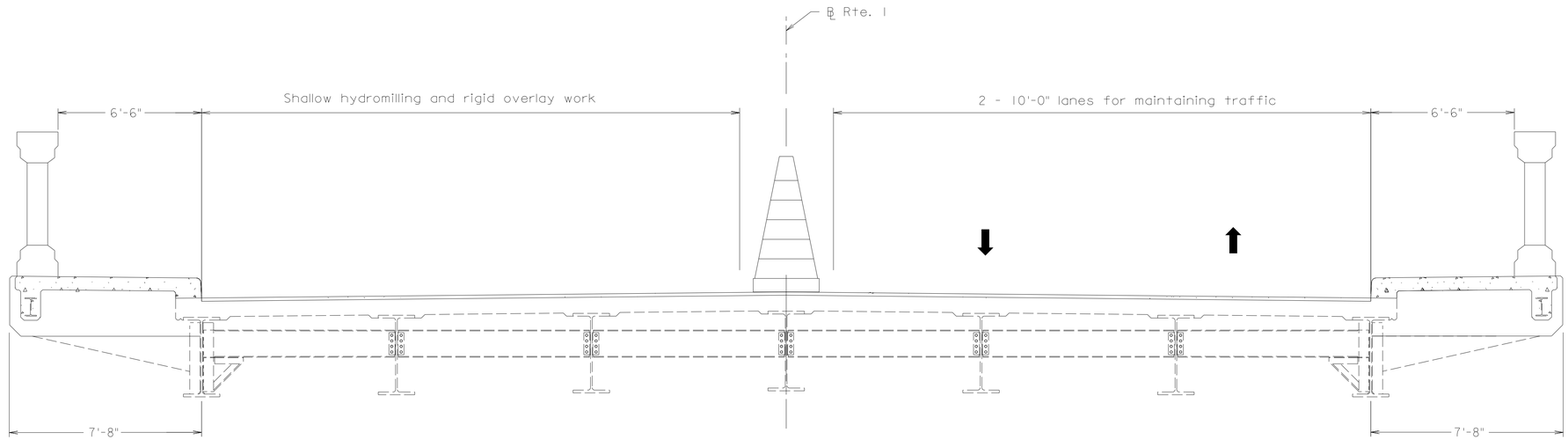
1. Typical traffic control would be similar to that of a one outerlane road closure operation on a Multi-Lane Roadway as per Figure TTC-16.2 of the workzone area protection manual
2. Traffic control is similar for the other side.
3. This is for a typical 1 lane short duration closure

RTE. 1 OVER RAPPAHANNOCK RIVER
(FALMOUTH BRIDGE)

(TTC-16.2: MOT FOR ONE
OUTER LANE CLOSURE)

Date : Feb. 2022

Drawing Number : 1 of 2



MOT
Phase IV

Notes:

1. Typical traffic control would be similar to that of a half road closure operation on a Multi-Lane Roadway as per Figure TTC-41.2 of the workzone area protection manual
2. Traffic control is similar for the other side.
3. This is for a typical 2 lane short duration closure

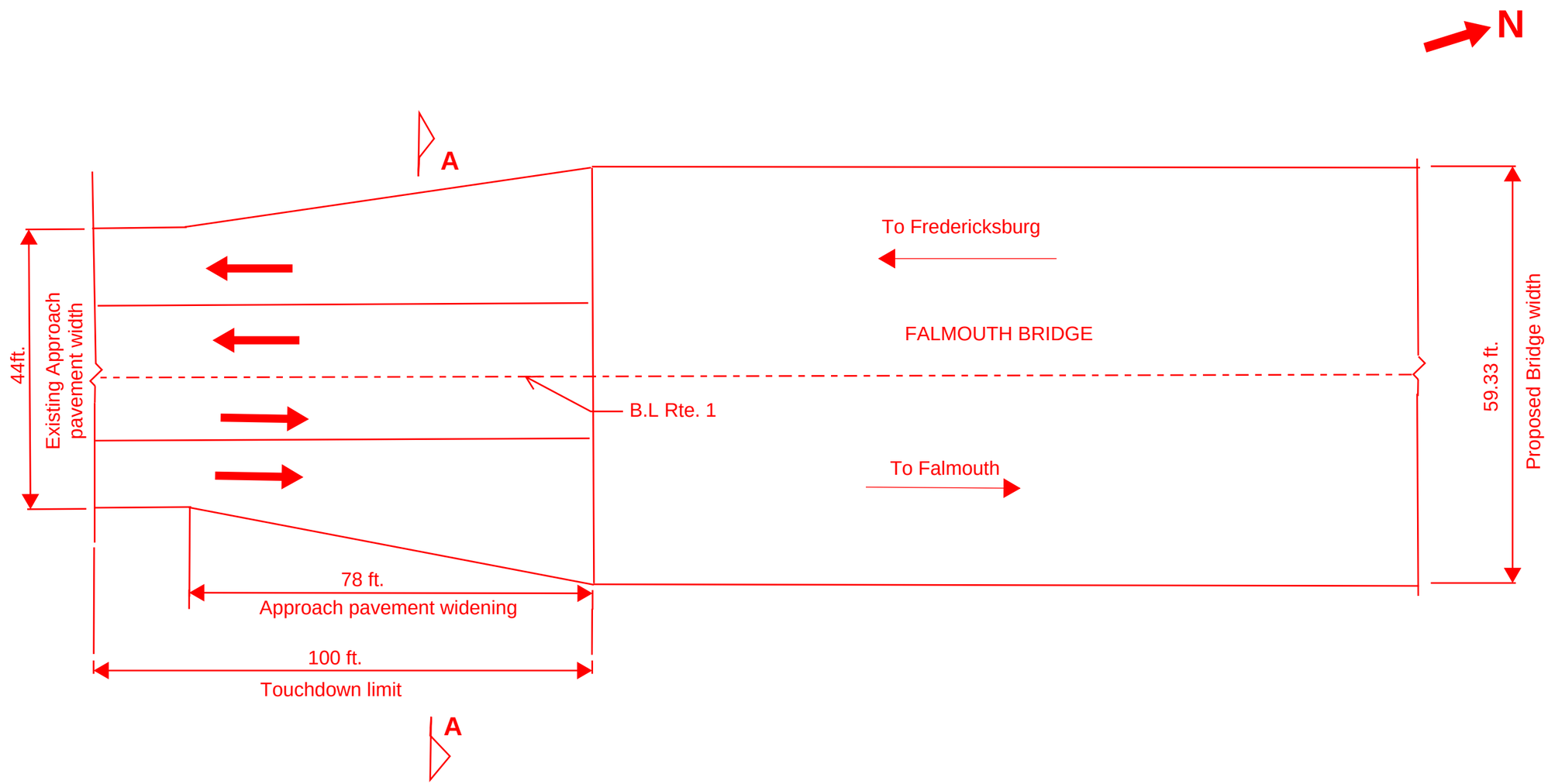
RTE. 1 OVER RAPPAHANNOCK RIVER
(FALMOUTH BRIDGE)

(TTC-41.2: MOT FOR
TWO LANES CLOSED)

Date : Feb. 2022

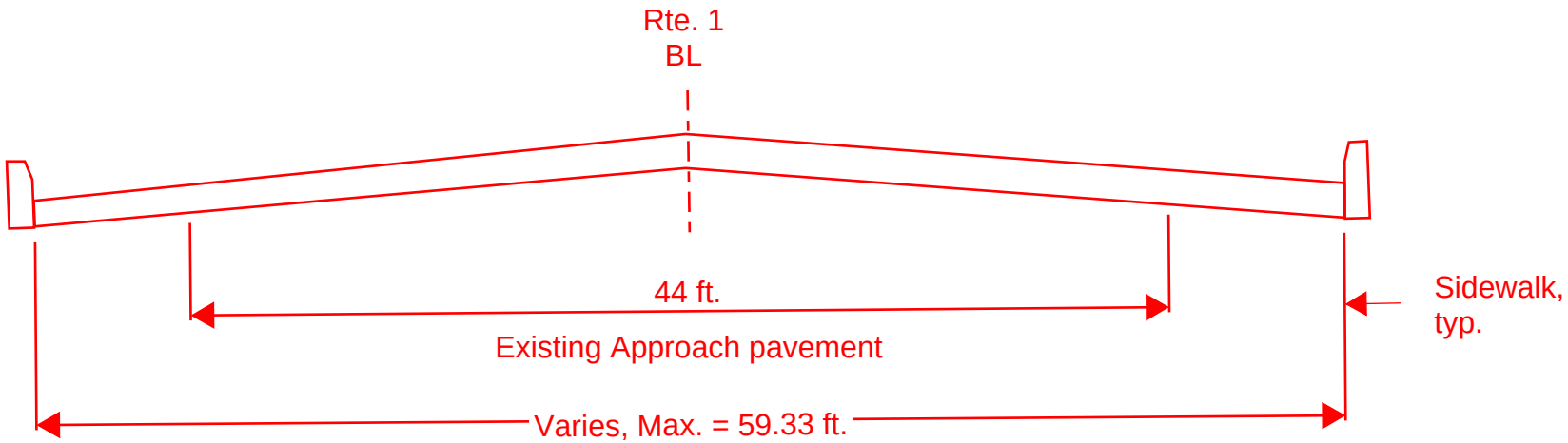
Drawing Number : 2 of 2

FED. ID: 18062: Rte 1 over the Rappahannock: Southern End, Roadway plan view



Note:
A similar detail would be used for the North approach

FED. ID: 18062: Rte 1 over the Rappahannock: Typical Roadway approach section



SECTION A - A

SEE REPORT BY AECOM (INCLUDED WITH THIS SUBMITTAL) FOR REPLACEMENT OPTION CONCEPT DRAWINGS AND M.O.T

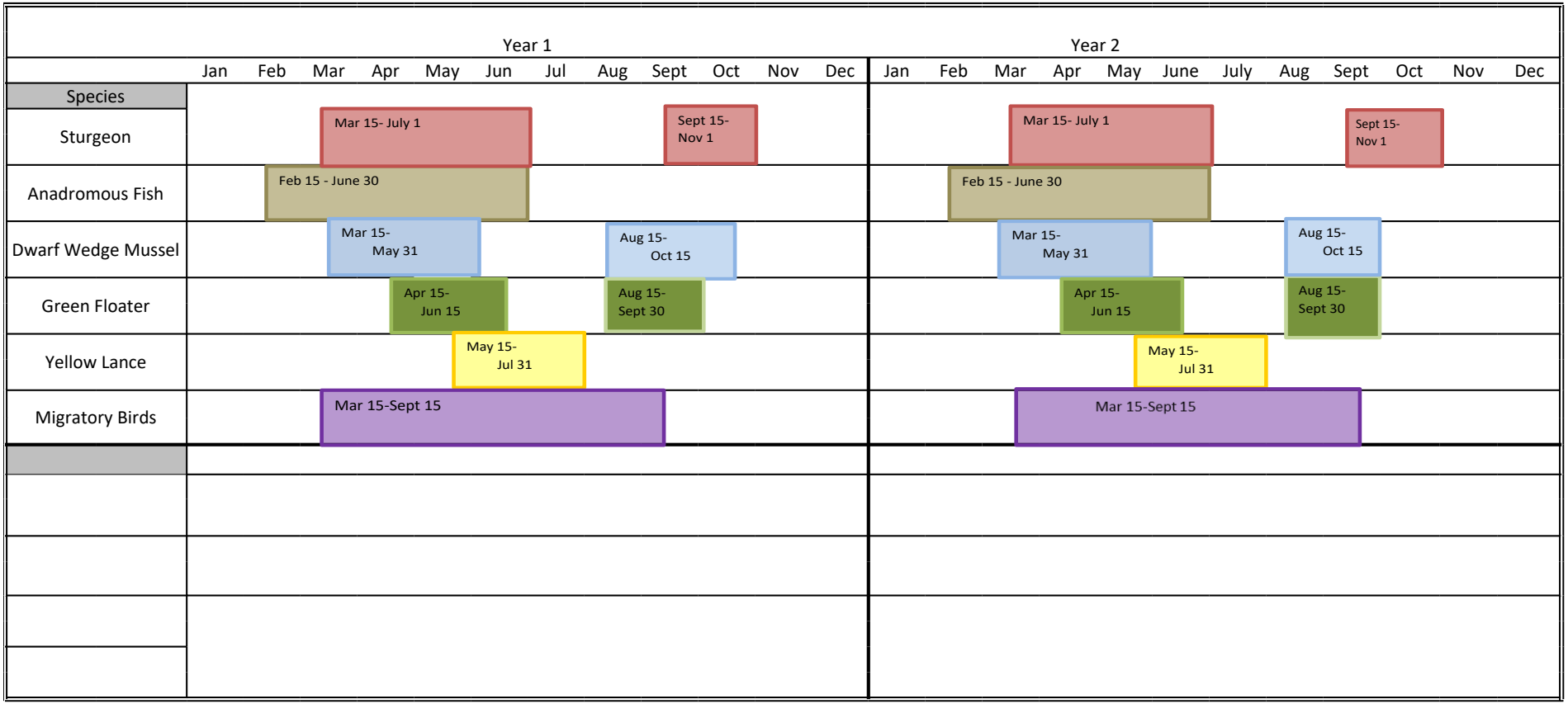
ROADWAY PLANS ARE INCLUDED WITH THIS SUBMISSION AS A SEPARATE FILE:
SEE FILE ROADWAY DRAWINGS

APPENDIX B

TIME OF YEAR RESTRICTIONS FOR THREATENED AND ENDANGERED SPECIES

Falmouth Bridge Project

Species Time of Year Restriction Table



Notes: The presence of the Dwarf Wedge mussel in the river is questionable by DWR; therefore, TOY will likely not be required.