STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

DATE: June 21, 2021

FROM: Andrew O'Sullivan
Wetlands Program Manager

AT (OFFICE): Department of Transportation
Bureau of Environment

SUBJECT: Dredge & Fill Application
Meredith, 42912
Response to RFMI
(DES#2021-00962)

TO: Karl Benedict, Public Works Permitting Officer
New Hampshire Wetlands Bureau
29 Hazen Drive, P.O. Box 95
Concord, NH 03302-0095

Forwarded herewith is the NHDOT's response to the RFMI dated and received on Monday May 21, 2021.

The following responses will be in corresponding order with the enumerated items identified in the RFMI.

1. Minimization of Impacts & Accessing the Outlet: Alternatives for accessing the outlet of the structure were considered and mentioned briefly within the application's supplemental narrative. NHDOT has elaborated upon this alternative analysis within the included revised supplemental narrative starting on page 8 to address this RFMI item.

2. Temporary Impact Restoration:
   All impacts proposed are temporary; it was the Department's intent to convey adequate information as to how the work could be completed in order to keep these impacts temporary through the supplemental narrative. NHDOT updated the supplemental narrative (pages 8-9) with additional information to address concerns raised within RFMI item #2 as well as updated the construction sequence to clarify and include details to align with the information provided within the supplemental narrative. Please review these documents in conjunction with this memo to address this RFMI item.

   In summary, NHDOT requires the contractor to implement methods that will not permanently impact resources for access. The contractor will be required to construct their access roads using mats or temporary geotextile and stone, and not permitted to permanently cut into the embankment and regrade to make an access road. Grades were determined to be sufficient to establish temporary access roads overtop of the existing resource and topography. No additional methods of restoration are anticipated. Plantings are not proposed; native trees and shrubs will re-establish naturally as the rootmats will be left intact. Wetland seed mix is noted to be used once the mats and/or temporary geotextile stone road are removed to provide any temporary stabilization that may be needed.

3. Impacts D, H, and I- concentrated flow: Additional information has been added to the supplemental narrative (page 8 & 9) to address RFMI item #3 regarding concentrated flows in areas of temporary impact associated with access and temporary access roads.

4. Stream Bank Tree Clearing: As noted in the Supplemental Narrative and Construction Sequence, trees will be cleared but not grubbed, leaving the rootmats of the existing vegetation allowing the native vegetative to grow back. Placement of humus, seed, mulch, and erosion control matting is an additional step of temporary stabilization in addition to only clearing (not grubbing) the surrounding shrubs and trees.

5. Impact Area A- inlet channel: Activities that impact area A were briefly described in the supplemental narrative within the proposed design section. Tree clearing was proposed, however at the time of the application submittal NHDOT was not definitive on if the material built up at the inlet would need to be removed or not. It has been determined that removal of the sediment is not necessary to accomplish the proposed rehabilitation, as noted on page 7 of the revised supplemental narrative.

If and when this application meets with the approval of the Bureau, please send the permit directly to Andrew O'Sullivan, Wetlands Program Manager, Bureau of Environment. Please feel free to reach out to Sarah Large, Wetlands Program Analyst, at 271-6916, or Chris Carucci, NHDOT Highway Design 271-3252 with any questions.

AMO:sel
Attachments: RFMI Letter, Revised Supplemental Narrative, Revised Construction Sequence
Cc: BOE Original
Town of Meredith / Conservation Commission
Chris Carucci, NHDOT Highway Design (via electronic notification)

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The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

May 21, 2021

NH DEPT OF TRANSPORTATION
PO BOX 483
CONCORD NH 03302

Re: Request for More Information – Standard Dredge and Fill Wetlands Permit Application (RSA 482-A)
NHDES File Number: 2021-00962
Subject Property: NH 104 150 Ft Southwest of Corliss Rd, Meredith, Tax Map #N/A, Lot #N/A

Dear Applicant:

On May 21, 2021, the New Hampshire Department of Environmental Services (NHDES) Wetlands Bureau reviewed the above-referenced Standard Dredge and Fill Wetlands Permit Application (Application). Pursuant to RSA 482-A:3, XIV(a)(2) and Rules Env-Wt 100 through 900, the NHDES Wetlands Bureau determined the following additional information is required to complete its evaluation of the Application:

1. To confirm that wetland impacts have been minimized for the overall project please provide additional clarification of considerations for access to the downstream culvert outlet, from the west side of culvert, which would result in significantly less wetland impacts than the proposed access from Corliss Hill Road. Please include considerations for access beyond extent of guardrail.

2. All of the impacts to wetlands for this project have been proposed as temporary impact. The Supplemental Narrative provided with the application does include some methods of impact restoration, however this methodology is not consistent with methodology described in the Construction Sequence or Plan Notes. Please identify the specific methods for accessing project areas by maintaining the existing wetland soils and vegetation, identify considerations of installation methods including use of any temporary culvert pipes, use of geotextile fabric, any proposed fill, timber mats, etc. to maintain existing wetland structure and flow patterns. If additional methods for restoration are required after consideration of these methods please specify. It is noted that the Construction Sequence identifies use of wetland seed mix to restore jurisdictional wetlands. Access methods and specific restoration practices are not identified.

3. Wetland impact areas D, H, and I photos identify concentrated water flow, delineated within PFO1E, PEM1E, and R4SB with outlets to perennial stream bank. Please identify how flows will be maintained through this area during construction operations, and restored after construction.
4. Stream bank slopes may require clearing for access. Per the provided Construction Sequence, restoration is proposed by placement of humus seed, mulch, and matting on slopes. Please identify whether bank restoration can be performed consistent with shoreline structure using native vegetation consistent with existing shoreline vegetation in accordance with Env-Wt 514. Identify any permanent impact areas if necessary.
5. Photos indicate existing stream bed materials at the inlet of the culvert, impact Area A. Please identify whether areas of permanent impact (regrading) will be required at this location and identify any areas of permanent impact at culvert inlet, impact areas A, and identify final stream bed materials if changed.

The requested information must be submitted to NHDES in accordance with the Memorandum of Agreement Between NHDES and the NHDOT Regarding Wetlands Permitting Timeframes (RSA 482-A) dated December 17, 2019. In accordance with applicable statutes and regulations, the applicant is also expected to provide copies of the required information to the municipal clerk and all other interested parties. Pursuant to RSA 482-A:3, XIV(a)(3), the NHDES Wetlands Bureau will approve or deny the Application within 30 days of receipt of all required information, or schedule a public hearing, if required by RSA 482-A or associated rules. Pursuant to RSA 482-A:3, XIV(a)(3), the NHDES Wetlands Bureau will approve or deny the Application within 30 days of receipt of all required information, or schedule a public hearing, if required by RSA 482-A or associated rules.

If you have any questions, please contact me at Karl.Benedict@des.nh.gov or (603) 271-4188.

Sincerely,

Karl D. Benedict
Wetlands Bureau
Land Resources Management, Water Division

cc: Andrew O'Sullivan; NHDOT
Municipal Clerk/Conservation Commission

ec: Andrew O'Sullivan; NHDOT
Sarah Large; NHDOT

Revised draft 6-16-21

CULVERT REHABILITATION
UNNAMED STREAM UNDER NH 104
MEREDITH, NH
NHDOT PROJECT NO. 42912
SUPPLEMENTAL NARRATIVE

Project Description

The project will rehabilitate an existing 90" diameter structural plate pipe x 178' long at a 45° skew to NH 104. The proposed design includes repairing the inlet headwall, constructing temporary access roads to the inlet and outlet ends of the pipe, and fixing sink holes on NH 104 embankments. The 90" pipe will be slipped lined with a 76" (nominal) diameter tunnel liner. Access road locations will be restored to existing conditions upon completion of project.

This is a federally funded culvert rehabilitation project. The proposed advertising date is August 17, 2021, with construction anticipated in summer of 2022.

This project was initiated and is funded under NHDOT's Federal Culvert Replacement/Rehabilitation & Drainage Repair (CRDR) Program. The Program purpose is to address major culvert and drainage needs statewide that are not being addressed through current or future Capital Improvement or other programmatic projects. The Program receives $2,000,000 in total funding annually, which includes construction, engineering, and ROW costs. Projects are selected and scheduled based primarily on the condition of the culvert (risk of failure), and Road Tier, traffic volume, depth of fill, and detour length (potential impact of failure). The Program funding is fully committed for at least the next three years. This culvert is one of the highest statewide priority locations out of nearly 50 known locations eligible for the Program. Failure to address the structural deficiency of this culvert risks further deformation of the culvert which would make rehabilitation impossible and/or collapse of the culvert which could cause serious impacts to public/private infrastructure and the travelling public.

Existing Conditions

The existing culvert is a 90" diameter structural plate pipe 178' long at a skew of 45° to NH 104. Culvert slope is 2.98%. The pipe has a concrete headwall at the inlet and the outlet end is mitered with concrete support walls. Maximum cover is about 18' at the centerline of NH 104, fill height is just under 26'. There are large sinkholes on the embankment of NH 104 near the inlet and outlet.

The culvert was originally constructed in 1963 (see Exhibit 1, Archive plan, included with this supplemental narrative. The culvert has voids along the invert and lower sides and several sections of missing or detached invert. The culvert has separated from the inlet headwall and has significant changes in shape throughout the pipe. The worst location measured 75" high x 82" wide as of 11-12-2020. Based on the level of deterioration and change in shape, the culvert is considered to be at a high risk for structural failure.

The existing ROW shown on the plans was acquired under the 1962 Return of Layout, which included all rights necessary to access, maintain, and repair slopes and drainage structures constructed by the Project (see page 7 of Exhibit 2, Existing ROW information, included with this supplemental narrative). At the time of the Natural Resource Meeting, title research had not been completed so a proposed temporary construction easement was shown and referenced. It has been determined that a new temporary construction easement is not required.

The 90" culvert is Statewide Priority #2, based on, fill height, traffic volume, and risk of failure. NH104 is one of 3 major regional routes connecting I-93 to the Lakes Region and western White Mountains with average daily traffic volumes over 12,000 vehicles per day (2019). Summer time traffic volumes are very high, with hourly counts over 1,100 vehicles per hour.

This crossing is classified as Tier 3 based on drainage area of 1.72 Sq mi. (1101.5 acres) as determined from LIDAR contours, archive plans, and field review. The Streamstats boundary delineation was similar, but slightly smaller at 1.7 Sq mi. (1090.5 acres).

NHDOT Maintenance District 3 reports this crossing has no history of flooding. Analysis indicates the culvert has the capacity to pass the 100-year flow. The inlet area is contained by steep topography to a depth of over 18', bypass flow is unlikely unless the inlet was blocked by debris. In this case, bypass would be over a driveway at Sta 275+14 and then southwest along the toe of the NH 104 embankment for about 500' to a 30" rcp culvert crossing under NH 104 and then back to the un-named stream about 700' downstream of the 90" cmp outlet.

The un-named stream is in generally good condition with no significant bank erosion or sediment deposition, other than some minor sediment buildup at the inlet. There is no perch at the inlet or outlet of the 90" culvert. Baseflow in the culvert has been observed at 8" to 18" deep over several NHDOT field visits.

There is a small waterfall just upstream formed by a bedrock outcrop. The next culvert upstream is a town owned 103"x71" corrugated metal arch pipe with a substantial perch at the outlet. Farther upstream is a large ponded wetland/floodplain. The stream is a tributary to Lake Winnisquam, which is about 1.85 miles downstream of the 90" cmp outlet. There is one road crossing between the 90" outlet and the lake, a state owned bridge on Meredith Center Road just downstream of the Lake Wickwas outlet.

A stream assessment was performed for the un-named stream, finding the stream to be a Rosgen Type B. The stream has highly variable bankfull widths near the 90" culvert inlet and outlet, resulting in an average bankfull width of 20.75' within the proximity of the crossing. Regional curves predict a bankfull width of 16.2' for this crossing based on the Streamstats drainage area of 1.7 Sq mi. A bankfull width of 12.8' was determined for the reference reach (just upstream of Hatch Corner Rd) and a 1.4 entrenchment ratio was used to set the compliant span of 18'.

Natural and Cultural Resources

Threatened and Endangered Species:
There are 2 Federal or State listed endangered or threatened species in the project area: the Northern Long Eared Bat, and the Small-Whorled Pogonia (SWP). USFWS has verified that this project may rely on the revised February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat. The project has a may affect - likely to adversely affect determination for NLEB due to tree clearing and no further consultation is needed. There were no SWP's identified during a site visit in June of 2020.

The Natural Heritage Bureau data check resulted in a determination that there were no records of protected species identified in the project area.

Cultural Resources: The proposed work was reviewed by the Department's Cultural Resources Program and was found to be consistent with the Section 106 Programmatic Agreement (Section 196 PA) among the FHWA, the New Hampshire State Historic Preservation Office, the Advisory Council on Historic Preservation and the Department. The existing 90" culvert is eligible for review under the Program Comment for Post-1945 Bridges and Culverts and is therefore considered to be non-historic. As such, the proposed work has been determined to have no potential to effect historical resources under Appendix B of the Section 106 PA.

Wetlands:
In addition to the un-named perennial stream, other wetland resources present within the project area include a small palustrine forested wetland on the north west side of the culvert inlet and small palustrine emergent wetland and intermittent stream on the east side of the outlet which carries water from a State owned 24" rcp underneath Corliss Hill Road. The 125' long intermittent stream channel has a 4' wide bed with 2:1 side slopes.

Included with this application are Function and Value Assessments, following the US Army Corp of Engineers' Highway Methodology, for the two palustrine wetlands delineated within the project limits. The functions and values of the palustrine forested wetland north of NH Route 104 area: sediment/toxicant retention (principal function), wildlife habitat (suitable), and supports fish and shellfish habitat (suitable) within the adjacent perennial stream that water flows from the wetland to. The functions and values of the palustrine emergent wetland at the outlet of the 24" rcp underneath Corliss Hill Road are: sediment/toxicant retention (principal function) and nutrient removal (principal function). As noted both wetlands' principal function is sediment/ toxicant retention and nutrient removal, which are common functions and values of a wetlands adjacent to development (transportation and residential). The un-named perennial stream has many character defining features and presents natural stream processes such as water and sediment transport and is supported by the surrounding forested landscape.

Per Env-Wt 103.66 and as defined by Env-Wt 103.10 and 102.01, the project temporarily impacts floodplain wetlands contiguous to a Tier 3 watercourse, a Priority Resource Area (PRA). Further details about this designation can be found within Attachment A: Minor and Major Projects section I.VI. The wetland complex upstream of Hatch Corner Road is designated prime wetland by the town of Meredith, however the proposed work at the NH 104 crossing will not directly nor indirectly impact this wetland.

Water Quality:
The level of disturbance meets the Bureau of Alteration of terrain (AOT) threshold of greater than 2,500 SF disturbance within 50' of a surface water, however, the project is consistent with the AOT Permit-by-Rule. The project does not propose to increase the amount of impervious surface. It is anticipated that the project will not result in a negative impact on water quality in the project area and therefore, no permanent stormwater treatment is proposed. A NPDES Discharge General Permit may be required if dewatering within the stream is required. Best Management practices will be utilized to prevent and reduce the likelihood of erosion or sediment entering the wetlands system. See the included erosion control plans for more details regarding BMPs.

Prime Wetlands, Designated Rivers, and Shoreland Water Quality Protection Act:
There are no prime wetlands in the vicinity of the project area and the project is not located within the protected corridor of any designated rivers. The project is not located near any waterbodies protected by the NH Shoreland Water Quality Protection Act.

Floodplains:
The un-named stream is within a FEMA mapped floodplain (Zone A) with no detailed study or regulatory 100-year flood elevations. The digital FIRM map was downloaded, referenced to the project location, and traced onto the Plans. The Zone A boundary does not align well with NHDOT survey and LIDAR contours. No fill in the floodplain is proposed. See Exhibit 3, Floodplain information, included with this supplemental narrative. This exhibit also shows the elevation of ponded water upstream of the inlet at the 100-year storm volume.

Invasive Species: An inventory of invasive plant species was completed on May 18, 2020. No existing populations of invasive species were identified at the time. The Contractor will be required to perform all work activities in accordance with the Department publication "Best Management Practices for the Control of Invasive and Noxious Plant Species" in order to prevent the spread of invasive species to the site during construction.

Conservation Commission: The Town of Meredith Conservation Commission was contacted via letter on April 29, 2020 requesting information about the project area and feedback on the proposed work. No response has been received to date.

Hydrology / Hydraulics

Culvert inverts and edges of pavement in the immediate vicinity of the 90" culvert are from NHDOT survey (NAVD88 datum), completed in October 2020. Detail outside the survey area is from archive plans, aerial photos, and field review. LIDAR contours were developed from UNH Granite data, Merrimack River Watershed, 2011-2012, NAVD88 datum.

USGS Streamstats delineates the drainage boundary at 1.70 Sq Mi. (1,088 acres). Streamstats Q100 prediction is 144 cfs, with a range of 76.8 cfs to 270 cfs. Approximately 22% of the watershed is developed, including paved and gravel roads and residential and commercial uses.

Two other runoff methods were considered using the LIDAR drainage area of 1.72 Sq mi. FHWA Regression method predicts Q100 between 193 cfs and 358 cfs. SCS Method (Hydrocadd) predicts Q100 at 418 cfs (using a 24 hour rainfall depth of 6.67"), but without

considering storage in the numerous upstream wetlands and low areas. This model was not used for design as there was not sufficient accurate data to model storage and discharge in the numerous low areas and wetlands within the drainage area.

Design flows were set at the upper limit of the Streamstats model:
Q2 = 50 cfs, Q10 = 121 cfs, Q50 = 214 cfs, Q100 = 270 cfs

Storage in the large ponded wetland upstream of Hatch Corner Road was evaluated and found to have little to no effect on the incoming flow to the 90" cmp.

FHWA's HY-8 Culvert Analysis Program was used for analysis of the 90" cmp. The existing headwater depth for the Q100 design flow of 270 cfs is 6.13 ft which corresponds to an elevation of 615.54 ft. Outlet velocities range from 7.4 ft/s for Q2 to 11.3 ft/s for Q100.

Alternatives

A fully compliant crossing design was considered, consisting of an 18' span bridge, crossing underneath NH 104 on a new alignment so that stream flow could be maintained in the existing culvert during construction. Impacts and costs for this option were based on open cut with phased construction. Two lanes of traffic would be need to be maintained due to the duration and traffic volumes. A sheet pile cofferdam would likely be used to support the portion of roadway open to traffic and a significant amount of temporary widening would be needed on both sides of NH104. Lane shifts would extend about 800' from the culvert in both directions. Construction could be expected to take a full construction season, with significant impacts to traffic and utilities.

The cost estimate for the fully compliant option is as follows:

Removal of existing 90" CMP	$ 25,000
Concrete Rigid Frame (3-sided) – 44' clear pavement width, 18' span, 45° skew Includes headwalls, wings, bridge curb & rail, excavation and backfill	$1,809,000
Structure Incidentals (water diversion, cofferdams, simulated streambed, etc.)	$ 283,370
Structure Sub-Total	**$2,117,370**
NH 104 Reconstruction (200 LF x 44' wide)	$ 28,424
Guardrail (including terminal units and incidentals, excluding bridge rail)	$ 17,600
Construct and Remove Temporary Widening, Inlet and Outlet (12'wide x 400')	$ 70,000
Temporary Concrete Barrier and temporary end units (600LF + 2 end units)	$ 30,000
Temporary Signals, 4 Units (Including 4 side roads)	$ 40,000
Temporary Access Road to Inlet	$ 10,000
Temporary Access Road to Outlet	$ 20,000
Roadway Sub-Total	**$ 216,024**
Humus, Seed, Mulch (approx. 1 acre)	$ 48,400
Invasive Species Management Plan	$ 3,000
Project Operations Plan (for LRS)	$ 2,500

Field Office, Type C – 1 Season		$ 27,500
	Item Sub-Total	**$2,414,794**
Erosion Control (5% of Sub-Total)		$ 120,740
Traffic Control (5% of Sub-Total)		$ 120,740
Misc. Items and Contingency (15% of Sub-Total)		$ 362,219
	Contract Sub-Total	**$3,018,493**
Mobilization (5% of Contract Sub-Total)		$ 301,849
Fuel & Asphalt Adjustments (fixed amount based on Contract Sub-Total)		$ 40,000
Construction Administration and Inspection (6% of Contract Sub-Total)		$ 301,849
	Construction Total	**$3,662,192**

Note that Design Engineering, additional survey, geotechnical investigation, and ROW and/or Easement acquisition costs are not included in the above Construction Estimate. NHDOT Engineering and Contract preparation costs are typically 5% to 15% of the Construction Total, based on the size and complexity of the project. Engineering costs for projects designed by NHDOT Consultants are typically higher.

Securing the funding and typical design time for such a project would require a delay in the start of construction of at least 3 – 5 years. A delay of this magnitude would significantly increase the risk of structural failure of the existing 90" structural plate pipe.

A hydraulic design was also considered, which would pass the 50 year storm without submerging the inlet. This would be an 8' wide x 6' high x (clear opening) box culvert, embedded 24" below streambed. Costs and impacts were evaluated in the same way as for the fully compliant option. The box culvert would have to be constructed on new alignment so that stream flow could be maintained in the existing culvert during construction. The Construction Cost for this option is estimated at $1.9 million. Delays to secure funding, and design timeline are similar to the bridge option. Construction Duration for this option is less than the bridge option coming in at 9 months.

We also considered replacement in kind, with a cost $1.2 million and at least 6 months duration, Funding, delay in start of construction, and temporary impacts would be similar to the bridge and box options. The estimate assumes the new pipe could be constructed in the same location as the existing pipe.

Note that the estimates provided are only for construction cost. Design engineering, permit fees, mitigation cost (if any), ROW impacts, and reimbursable utility impacts are not included.

None of the replacement options are feasible under the current budget and schedule. This culvert is at high risk of further deformation and structural failure. Rehabilitation using cured in place liners, spray on liners, or shotcrete invert repair are not feasible due to the level of deterioration and change in shape. The only practicable option remaining is sliplining. Potential slipline material options included corrugated metal tunnel liner and HDPE corrugated interior pipe.

The HDPE liner was not selected because this type of liner must be sized to fit through the smallest dimension of the host pipe. A 66" diameter HDPE liner was determined to be the largest pipe liner that would fit vs a 76" tunnel liner. The smaller diameter causes additional reduction in capacity and a larger increase in outlet velocity.

Smooth interior liners were not considered due to the potential adverse effects of increased culvert velocities. For example, a 76" diameter smooth liner with improved inlet efficiency could match the existing 90" cmp capacity but would result in an estimated 19.5 ft/s outlet velocity for the Q100 flowrate.

Proposed Design

The proposed liner is a 76" (nominal) diameter corrugated metal tunnel liner that is constructed in short rings, allowing the workers to be inside the completed rings and allowing them to reach forward to cut out severely deteriorated and /or obstructing portions of the existing pipe. This feature allows the largest diameter liner to be installed. The liner invert will be set at or slightly below the existing 90" invert, eliminating the concern for creating a perch.

Field review of the existing 90" cmp in November 2020 found that the pipe has deformed in places. Approximate measurements at the worst location (about 75' upstream of the outlet) were 75" high x 82" wide. The proposed tunnel liner plate can be factory deformed up to 5% without compromising load carrying capacity. Deformed outside dimensions of the liner would be approximately 73" high x 81" wide indicating that the 76" (nominal) diameter liner will fit. Exact dimensions of the liner will be recommended by the Contractor before the start of construction. See the slipline detail on the "Profiles" sheet included in the Wetland Plans.

The estimated elliptical shape is not available in the HY-8 Culvert Analysis Program. Hydraulic information is reported for the 76" (nominal) circular liner. Elliptical shapes typically perform better that circular shapes because the cross sectional area is at lower elevation, so actual headwater elevations should be lower than reported. The small change in shape will not have a significant effect on velocity results.

Q100 headwater depth for the preferred 76" tunnel liner option would increase by 0.91 ft, from 6.13 ft for existing to 7.04', corresponding to elevation 616.45. The increased area of Q100 inundation would be about 430 SF (see Exhibit 3, Floodplain information, included with this supplemental narrative).

Q100 outlet velocity would increase from 11.3 ft/s for existing to 11.8 ft/s for the 76" liner.
Q2 outlet velocity would increase from 7.4 ft/s for existing to 7.9 ft/s for the 76" liner.
The proposed liner will not have a significant effect on capacity, velocity, flooding, or sediment transport. No effect on FEMA maps or downstream structures is anticipated.

Trees growing within 5' of the inlet and outlet will be will be cut, but removal of the stumps is not proposed. Removal of the small accumulation of sediment at the inlet is not proposed as it not necessary to accomplish the proposed rehabilitation.

Water diversion will be through the existing 90" pipe unless otherwise approved as part of the Contractor's stormwater plan. A Water Diversion Item will be provided with the construction

contract for passing stream flow through the work area. The water diversion will be designed by the Contractor to accommodate a 2-year storm, with the provision that excess flows be allowed through the existing culvert. The proposed slipling process can accommodate these requirements. A typical water diversion for this type of project would be a sandbag dam at the inlet and pump(s) to maintain the upstream water elevation at an acceptable level. The pump discharge hose is typically attached to the inside of the existing host culvert with temporary straps or hangers. In the event of storm predicted to exceed the pump capacity, workers and loose materials would be removed from the culverts and flow would be allowed through or over the dam and into the existing culverts.

Temporary access roads will be required at the inlet and outlet. Access roads are proposed to be along the toe of the NH104 embankments, impacting wetlands and a small intermittent stream. Restricting access to roadway embankment slopes was considered, but embankment slopes are too steep to be traversed by typical equipment and are protected by guardrail. Slopes perpendicular to NH 104 are approximately 2:1.

Access to the outlet from the west was considered, but was determined to have more total impacts, more impacts to the perennial stream's banks since the stream flows nearly perpendicular to the road along this slope, more total clearing, and cutting of larger trees along the stream that provide a buffer and shading to the outlet of the stream.

Temporary impacts in the immediate area of the culvert outlet are required for any access road option and are not included in the following comparison. These impacts are as shown on the plans (Impact Areas E, F, and G) and require about 1,000 SF of tree clearing.

Two options for access from the west are available as follows: From the edge of NH104, behind the guardrail end, length to culvert outlet 300', total clearing 3,375 SF; and using the old roadbed (abandoned end of Bonner Rd), length to culvert outlet 425', total clearing 6,130 SF.

Either option would lead to the perennial stream's top of bank at approximately Sta 274+50, 75' Rt. From this point on excavation and embankment (cut, fill, and grading) would be required to create a suitable temporary access road parallel to and crossing the top of bank to get to the culvert outlet. The roadway slope and stream bank in this access area is 2:1 or slightly steeper. Excavation on this steep of a slope would risk destabilization of the bank and difficult restoration. Temporary impacts to the bank would be approximately 1000 SF (95 LF) and temporary impacts to the channel (for clearing and erosion controls) would be approximately 800 SF (75 LF).

The proposed outlet access from the east has a total length of about 200', about 65 SF of clearing, and 657 SF of temporary impact to the intermittent stream (Wetland #8)

Access road impacts in wetland areas are intended to be temporary. Trees may be cut but stumps and root mat shall not be removed in wetland areas so that vegetation can re-establish naturally. Temporary access roads shall be constructed in a way that will protect the wetland vegetation beneath by implementing a barrier such as timber mats, or a stone or aggregate base over geotextile that will also address any concentrated flows along or beneath the constructed access road and minimize impacts to water quality.

If stone over geotextile is used, concentrated runoff along the edge of the access roads can be managed by creating a temporary ditch (within the uplands adjacent to these impacts) along the road and using typical erosion control bmp's to minimize impacts to water quality such as stone check dams and or other temporary channel protection measures. If mats are used, runoff can pass below or along the mats.

In general, temporary pipes along access roads do not allow for capture of sheet flow that accumulates as the access roads proceed downhill. For this project, a temporary pipe along the edge of the outlet access road may be proposed by the Contractor to convey flow from the 24" pipe crossing under Corliss Hill Rd. This would be in addition to measures proposed by the Contractor to convey other concentrated runoff along the outlet side access road.

Total amount of clearing for the project is estimated at 7,000 SF (0.16 acres) (5,935 sf inlet, 1,065 at outlet). The majority of trees are small, between 3" and 8" diameter. Removal of stumps and root mat is not anticipated. Disturbed wetland areas will be restored using a wetland seed mix and where slopes are steeper than 4:1, a wildlife friendly erosion control matting will be used.

All work will be within the existing ROW or easement rights granted under the 1962 Return of Layout (see page 7 of Exhibit 2, Existing ROW information, included with this supplemental narrative).

Construction is estimated to take 3 months, with no significant impact to traffic, utilities, or other resources.

The preliminary estimate for the proposed option is as follows:

Corrugated metal liner, including cleaning and preparation of the existing pipe, grouting of voids and filling the annular space, and removal of obstructing portions of the existing pipe	$ 191,275
LRS handling and compliance	$ 4,500
Repair inlet and outlet slopes	$ 1,350
Locate underground utilities	$ 375
Fill material for behind inlet and outlet headwalls	$ 1,500
Water Diversion	$ 25,000
Repair of inlet headwall (includes cleaning of headwall and concrete)	$ 2,000
Project wide Items (Access Roads, LRS, reset riprap, humus/seed mulch, etc)	$ 41,050
Erosion Control Items	$ 15,100
Traffic Control Items	$ 42,600
Misc. Items	$ 400
Fuel Adjustment (fixed amount based on Contract Item Total)	$ 2,000
Mobilization (10% of Contract Item Total)	$ 40,000
Contract Total	**$ 367,150**
Construction Administration and Inspection (8% of Contract Total)	$ 30,000
Construction Total	**$ 397,150**

The project was presented as a Repair, Rehabilitation, or Replacement of a Tier 3 Legal Crossing, under Env-Wt 904.09 at the project's Natural Resources Coordination Meeting. The proposed design meets all requirements for permitting under Env-Wt 904.09, except for hydraulic capacity. Modelling indicates a slight decrease in capacity, but the resulting headwater increase is not considered significant. The increase in inundated area is small and the proposed Q100 headwater elevation is below the top of bank. No adverse effect on the environment or public or private infrastructure is anticipated due to the small increase in Q100 ponding area. The increase in headwater for lower flow events is significantly less. For example, the Q2 headwater increase is estimated at 0.13' and the Q10 increase is estimated at 0.4'. Increases in headwater are minimized to the maximum extent practicable by selection of the proposed liner size and type, which considers capacity, velocity, AOP, constructability, and cost. The project is presented as an Alternative Design under Env-Wt 904.10 in this application.

Revised draft 6-16-21

Meredith 42912

CONSTRUCTION SEQUENCE

1. Perform any necessary clearing operations for access and staging.
2. Install perimeter sediment controls and install necessary temporary erosion controls as specified on the strategies sheet. Include all staging areas. Set up dewatering basin.
3. Construct temporary inlet and outlet access roads. Access road impacts in wetland areas are intended to be temporary. Trees may be cut but stumps and root mat shall not be removed in wetland areas so that vegetation can re-establish naturally. Temporary access roads shall be constructed in a way that will protect the wetland vegetation beneath by implementing a barrier such as timber mats, or a stone or aggregate base over geotextile that will also address any concentrated flows along or beneath the constructed access road and minimize impacts to water quality.
4. At outlet side access, maintain drainage from the 24" pipe crossing under Corliss Hill Rd. Temporary extension of the 24" pipe may be required. Drainage from this pipe may be maintained in a ditch section or temporary pipe along the edge of the access road.
5. Install water diversion at inlet and other sedimentation controls/BMP's as needed
6. Clean water bypass shall be through the existing pipe, unless otherwise approved as part of the Contractor's SWPPP.
7. Clean and inspect existing pipe.
8. Install tunnel liner, removing severely deteriorated, detached, or obstructing portions of the existing pipe as needed as liner installation progresses. Installation may begin at the inlet or outlet as proposed by the Contractor and approved by the Engineer. Extend liner through the existing headwall to match the existing 90" culvert inlet location.
9. Repair cracks and spalls in existing concrete inlet headwall.
10. Seal annular space between inside of existing culvert and outside of liner.
11. Fill annular space with grout.
12. Remove water diversion, and re-establish flow through the culvert.
13. Fill sinkholes on roadway embankment slopes.
14. Place humus, seed, mulch, and temporary slope matting on the embankment slopes.
15. Remove temporary access roads.
16. Stabilize disturbed areas with seed, mulch, and temporary slope matting (where steeper than 4:1). Seed placed in jurisdictional wetland areas shall be a wetland seed mix.
17. Remove erosion and sediment controls once the site is stabilized.