Stoney Bridge Road Culvert Replacement Alternatives Analysis

PRESENTATION FOR

Town of Templeton
160 Patriots Road
East Templeton, MA

JUNE 5, 2019

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AGENDA

- Project Background
- Work Completed to Date
- Concept Overview
- Next Steps

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PROJECT BACKGROUND

- Former Industrial Mill Complex in 1800's
- Partial Collapse Closed to Thru Traffic August 2018
- Significant Environmental and Recreational Resources
  - Ware River Rail Trail
  - Adjacent Department of Fish & Game Property
  - Stone Bridge Pond

Figure 2: Historic Stone Bridge Monument

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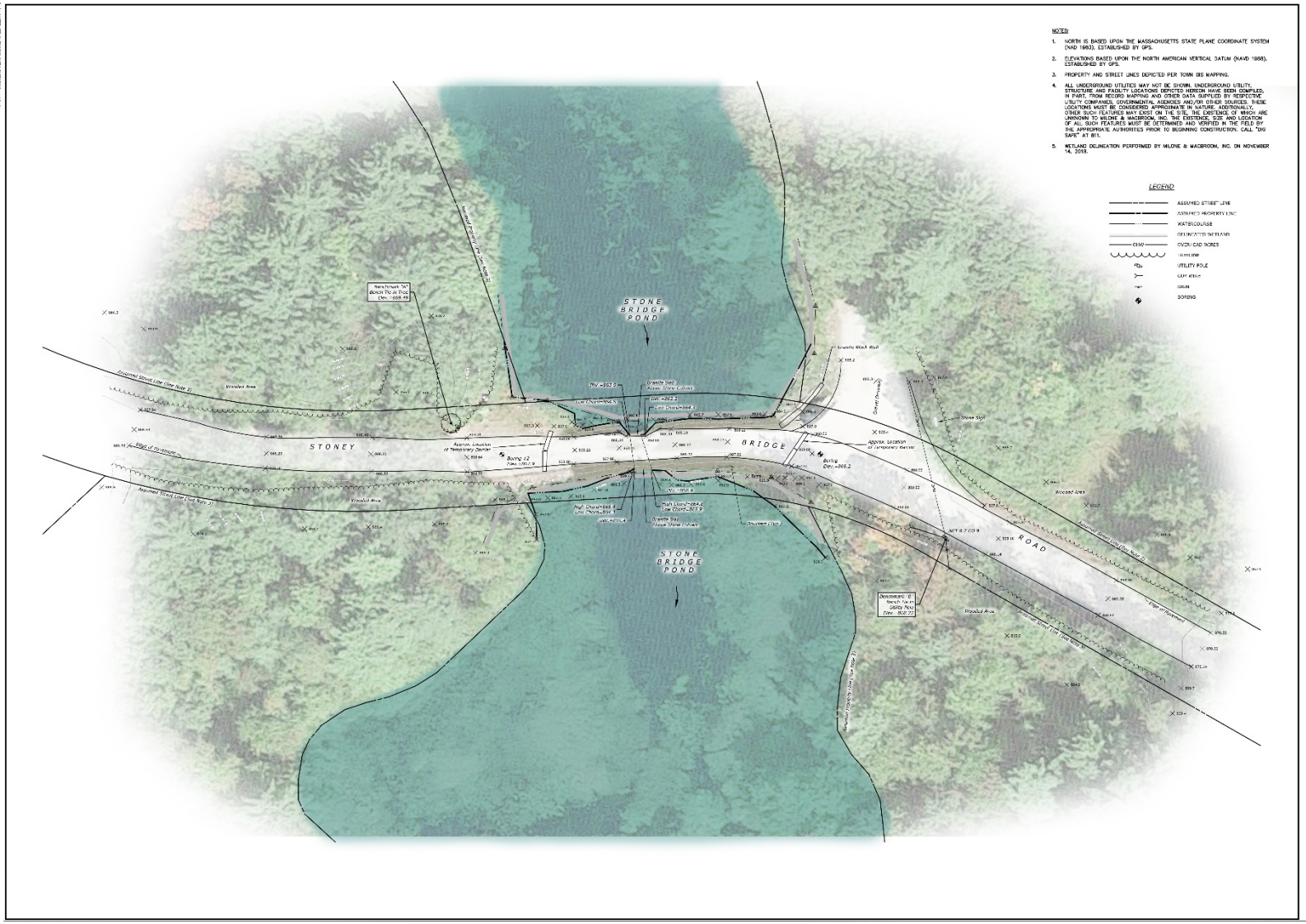
EXISTING CONDITIONS



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ENVIRONMENTAL RESOURCE AREAS

- Protected and Recreational Open Space
- Federal Emergency Management Agency (FEMA) Flood Zone
- DCR Water Supply Protection Area
- Wetland Resource Areas
  - Stone Bridge Pond – Land Under Water/Inland Bank
  - Burnshirt River – 200’ Riverfront Area

WORK COMPLETED TO DATE

- Field Survey and Base Plan
- Wetland Delineation
- Geotechnical Investigation
- Coordination with Other Agencies
  - Town of Phillipston Police, Fire, and Highway Dept.
  - Town of Templeton Police, Fire, and Highway Dept.
  - Narragansett Regional School
  - Templeton Community Preservation Committee
  - Massachusetts Historical Commission (MHC)

Figure 3: USGS Site Location Map
Stoney Bridge Road Culvert Replacement
Templeton, Massachusetts

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0 1,000 2,000
Feet
1 in = 2,000 feet
N

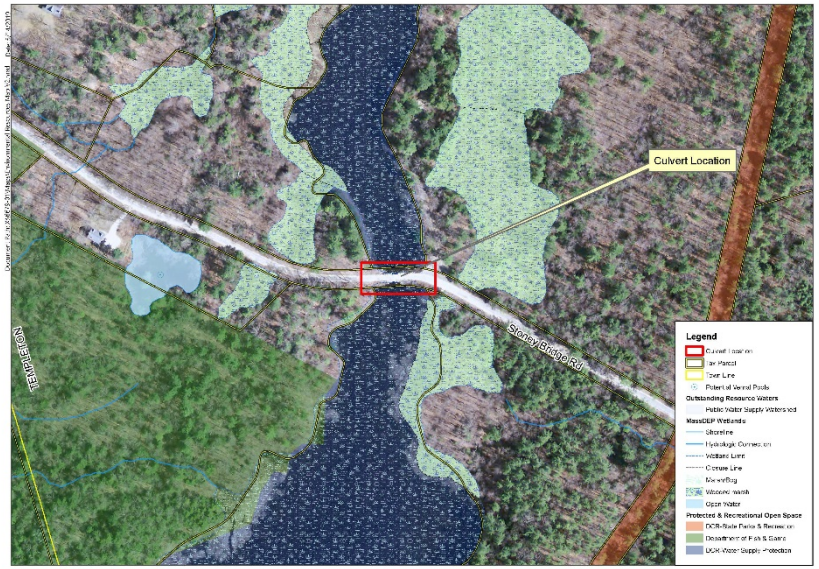

Figure 4: Environmental Resources Map
Stoney Bridge Rd Culvert Replacement
Templeton, MA

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0 100 200 Feet
N

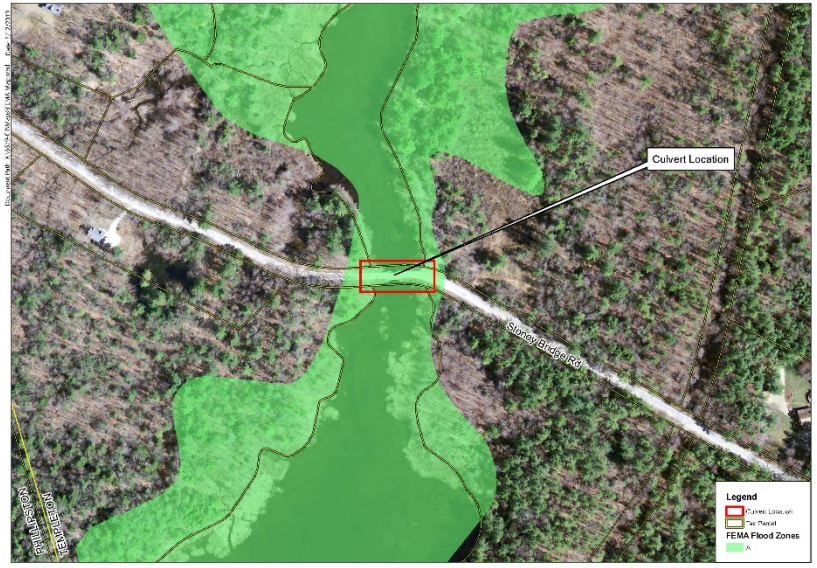

Figure 5: FEMA Map
Stoney Bridge Rd Culvert Replacement
Templeton, MA

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0 100 200 Feet
N

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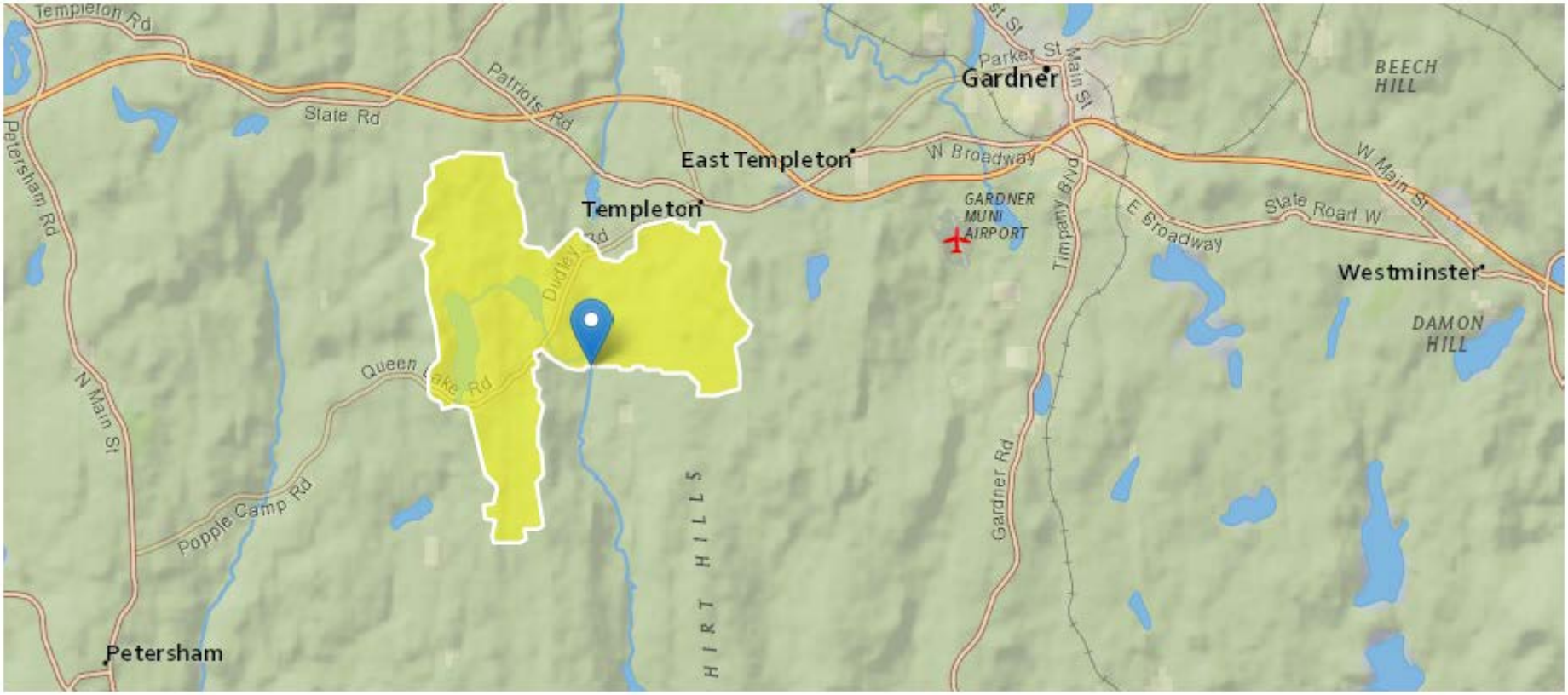
WATERSHED DESCRIPTION



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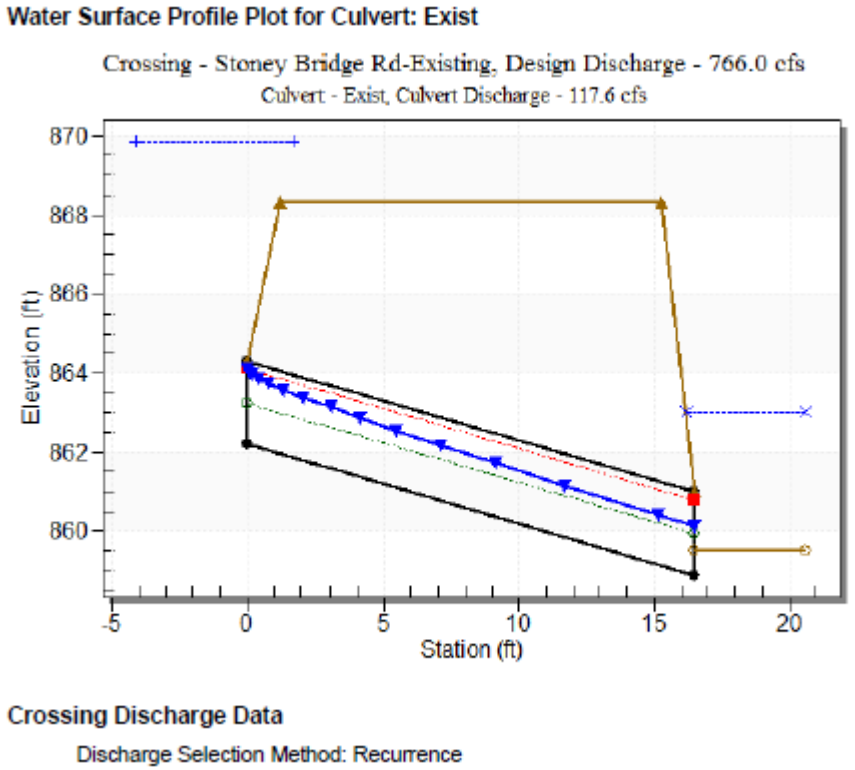
HYDRAULIC MODELING

- HY-8 Hydraulic Analysis Objectives
  - Meet MA Stream Crossing Standards
  - 10-Year Design Storm
  - Improve Flood
  - Enhance Aquatic Passage



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AQUATIC ORGANISM PASSAGE (AOP) ANALYSIS

TABLE 2
Fish Passage Hydraulic Criteria (Bates and Kirn, 2009)

FISH PASSAGE HYDRAULIC CRITERIA (BATES AND KIRN, 2009)			
Brook Trout			
Lifestage	**Adult**	**Juvenile**	**Notes**
Maximum velocity (fps)	2.40	0.80	Length 40 to 100 feet
Maximum outlet drop (ft)	0.67	0.33	
Target low-flow depth (ft)	0.35	0.18	
Brown Trout			
Lifestage	**Adult**	**Juvenile**	**Notes**
Maximum velocity (fps)	4.30	1.70	Length 40 to 100 feet
Maximum outlet drop (ft)	0.67	0.33	
Target low-flow depth (ft)	0.63	0.15	

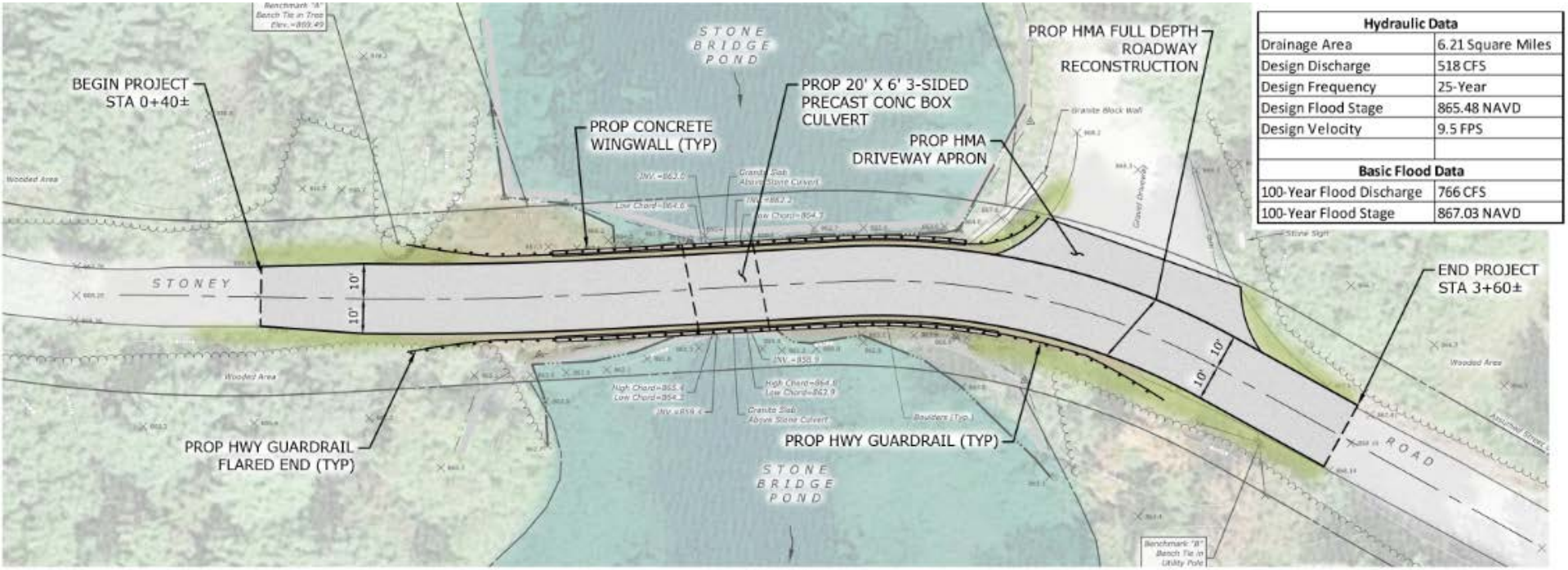
The AOP hydraulic analysis was conducted using the *FishXing* modeling software (Furniss et al., 2009). Results indicate that velocity is a barrier for fish passage through the existing structure and that fish are unlikely to pass the structure over the range of low and high estimated fish passage flows.

TABLE 3
AOP Summary (Existing Culvert)

		Low Passage Flow		High Passage Flow		
Species	**Age**	**Q (cfs)**	**Barrier Type**	**Q (cfs)**	**Barrier Type**	**Passability (%)**
Brook Trout	Adult	0.9	None	107	Velocity	23.9%
Brook Trout	Juvenile	0.9	None	107	Velocity	7.4%
Brown Trout	Adult	0.9	None	107	Velocity	43.9%
Brown Trout	Juvenile	0.9	None	107	Velocity	16.7%

ALTERNATIVE 1

COMPLETE CULVERT REPLACEMENT AND RESTORE TWO-WAY VEHICLE TRAFFIC



Hydraulic Data	
Drainage Area	6.21 Square Miles
Design Discharge	518 CFS
Design Frequency	25-Year
Design Flood Stage	865.48 NAVD
Design Velocity	9.5 FPS
Basic Flood Data	
100-Year Flood Discharge	766 CFS
100-Year Flood Stage	867.03 NAVD

PLAN

SCALE: 1"=30'

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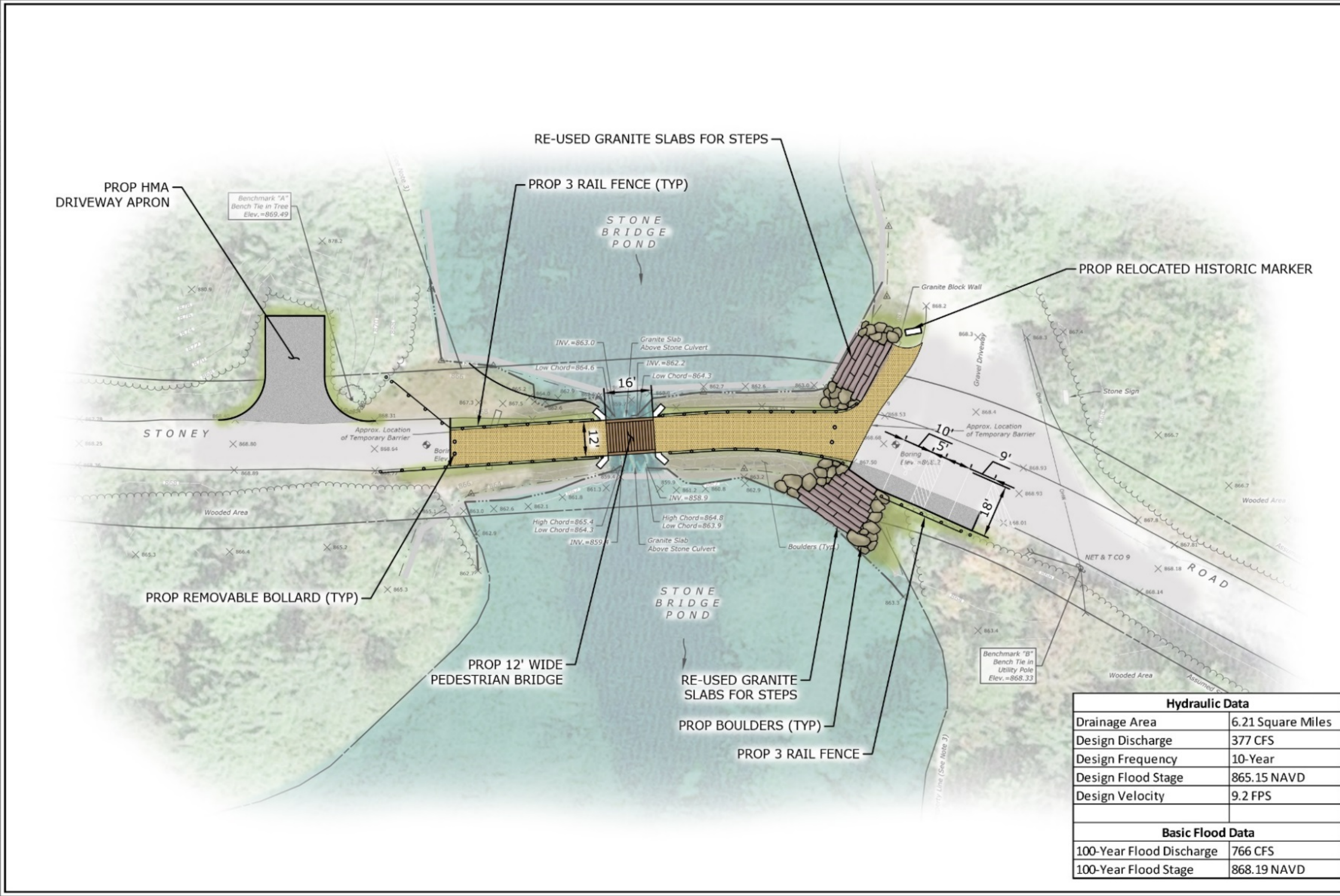
ALTERNATIVE 2

PEDESTRIAN CROSSINGS WITH 12’ BRIDGE AND
ALTERNATIVE 2A PEDESTRIAN CROSSING WITH 6’ BRIDGE



RE-USED GRANITE SLABS FOR STEPS
PROP 3 RAIL FENCE (TYP)
PROP HMA DRIVEWAY APRON
STONE BRIDGE POND
PROP RELOCATED HISTORIC MARKER
Granite Block Wall
16'
12'
10'
5'
9'
18'
STONEY
ROAD
Approx. Location of Temporary Barrier
Wooded Area
Boulders (Typ.)
PROP REMOVABLE BOLLARD (TYP)
PROP 12' WIDE PEDESTRIAN BRIDGE
RE-USED GRANITE SLABS FOR STEPS
PROP BOULDERS (TYP)
PROP 3 RAIL FENCE
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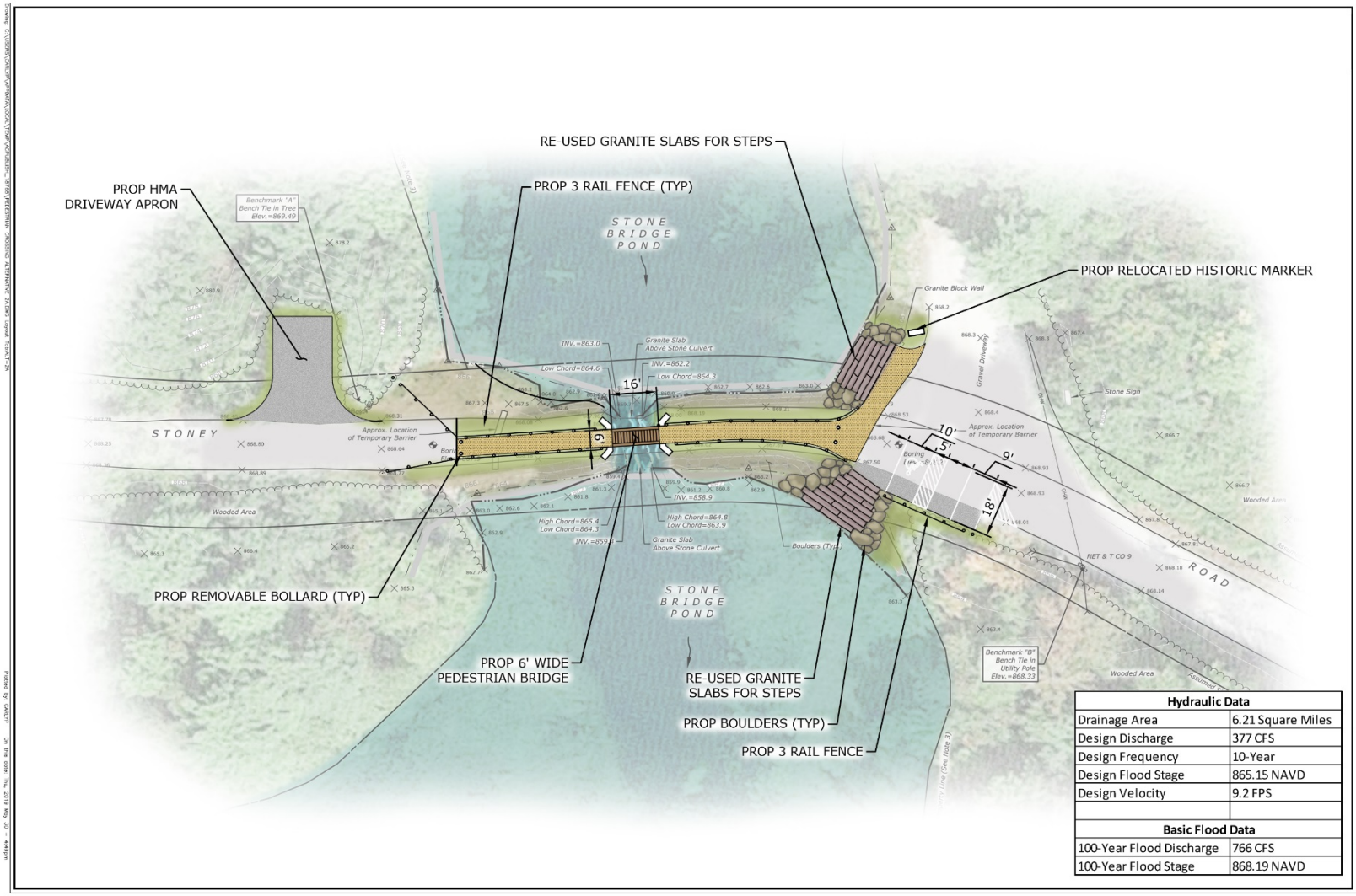
REVISIONS
ALTERNATIVE NO. 2 - PEDESTRIAN CROSSING WITH 12 FT BRIDGE
STONEY BRIDGE ROAD CULVERT CROSSING
TEMPLETON, MASSACHUSETTS
MRA
HMM
MRG
1"=30'
MARCH 14, 2019
6679-01
ALT-2

Hydraulic Data	
Drainage Area	6.21 Square Miles
Design Discharge	377 CFS
Design Frequency	10-Year
Design Flood Stage	865.15 NAVD
Design Velocity	9.2 FPS
Basic Flood Data	
100-Year Flood Discharge	766 CFS
100-Year Flood Stage	868.19 NAVD

ALTERNATIVE 2A



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Basic Flood Data	
100-Year Flood Discharge	766 CFS
100-Year Flood Stage	868.19 NAVD

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100 MAIN STREET, SUITE 900
SPRINGFIELD, MA 01103
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REVISIONS

ALTERNATIVE No. 2A - PEDESTRIAN CROSSING WITH 6 FT BRIDGE
STONEY BRIDGE ROAD
CULVERT CROSSING
TEMPLETON, MASSACHUSETTS

MRA	HMM	MRG
DESIGNED	DRAWN	CHECKED

1"=30'
SCALE

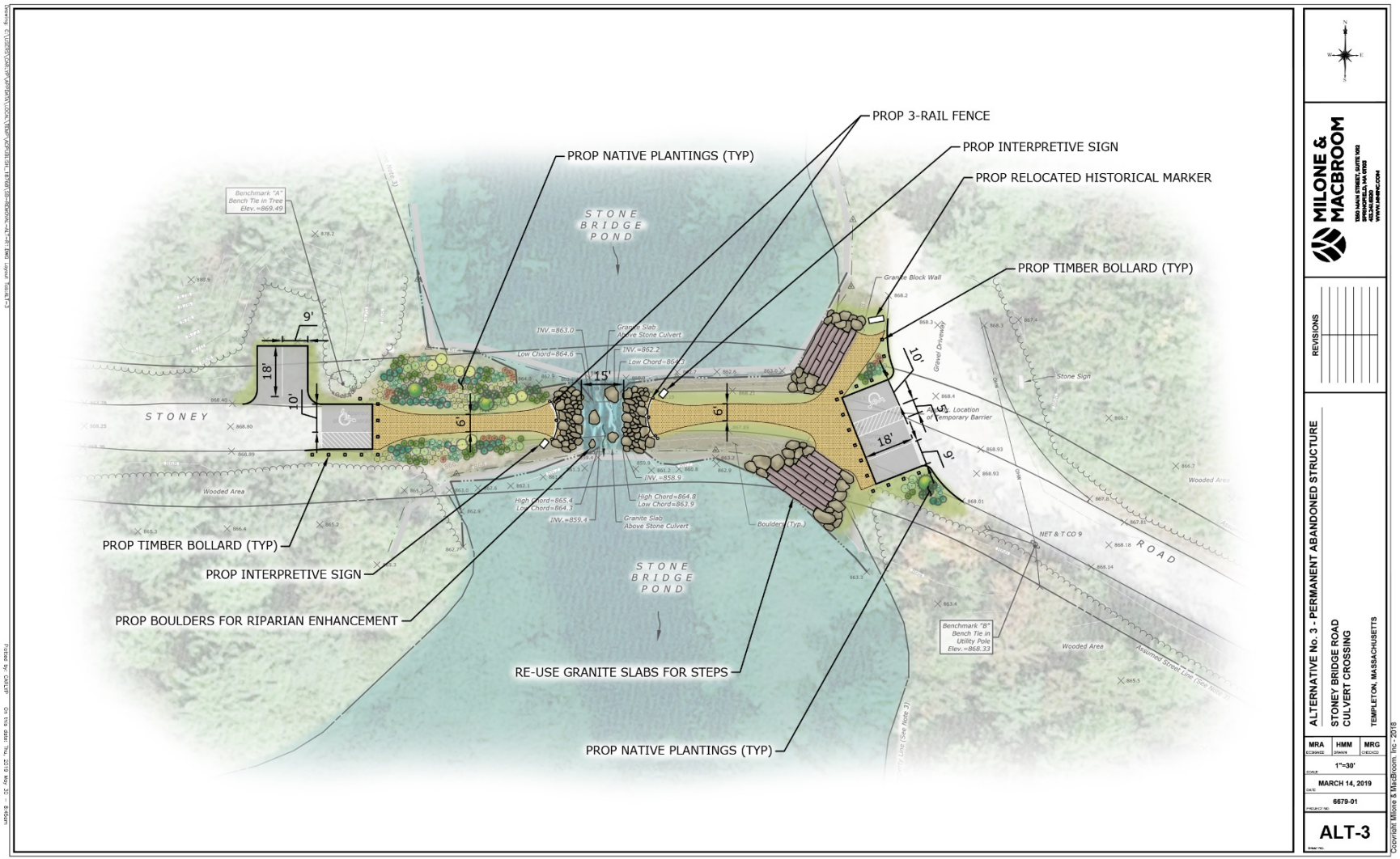
MARCH 14, 2019
DATE

6679-01
PROJECT NO.

ALT-2A
SHEET NO.

ALTERNATIVE 3

ABANDON STRUCTURE



ALTERNATIVES ANALYSIS MATRIX

TABLE 4
Alternatives Matrix

Alternative	Description	Reduce Outlet Drop	Lower Velocity in Culvert	Increase Low Flow Depth	Retain Sediment in Structure	Improve Conveyance of Water & Sediment	Improve Flood Resiliency	Sustainability	Comparative Installation Cost	Brook Trout		Brown Trout		Permits[1]	Remarks
										Fish Passage Barrier(s)	% Fish Passability (AB, JB)	Fish Passage Barrier(s)	% Fish Passability (AB, JB)		
Existing Structure	5.5′ ± wide, 2.1′ high, 18′ long, open bottom structure, stone masonry abutments, granite slab top	-	-	-	-	-	-	O	Low	Velocity	23.9, 7.4	Velocity	43.9, 16.7	N/A	Sediment deposition at inlet, scour hole at outlet, roadway overtopping for 2-yr storm
Alt-1 Full Vehicle Crossing	20′ span concrete arch x 6′ high, wingwalls, 26′ wide	+	+	+	+	+	+	O	High	Velocity	80.5, 26.1	Velocity	100, 56.6	NOI, ENF, WQC, PCN	Structure supports full two-way vehicle roadway traffic
Alt-2 Pedestrian Crossing	16′ span concrete arch x 6′ high, headwalls, 12′ wide	+	+	+	+	+	+	+	Moderate	Velocity	64.4, 20.8	Velocity	100, 45.3	NOI, WQC, SV	Pedestrian crossing with capability for emergency vehicle crossing only
Alt-2A Pedestrian Crossing	16′ span concrete arch x 6′ high, headwalls, 6′ wide	+	+	+	+	+	+	+	Moderate	Velocity	64.8, 21.0	Velocity	100, 45.6	NOI, WQC, SV	Pedestrian crossing only
Alt-3 Permanently Abandon Structure	Increase channel width to 15′, remove stone abutments, grade 2:1 with riprap revetment	+	+	+	+	+	+	+	Low	N/A	N/A	N/A	N/A	NOI, SV	Alternative abandons existing crossing, with open channel, flood benches and boulder riparian enhancement

Key: **+** = good; **o** = none; **-** = poor

Note 1: Permit Abbreviations

NOI = Massachusetts Wetland Protection Act Notice of Intent
ENF = Massachusetts Environmental Policy Act Environmental Notification Form
WQC = MassDEP 401 Water Quality Certification
SV = United States Army Corps of Engineers Self-Verification Eligible
PCN = United States Army Corps of Engineers Pre-Construction Notification Required

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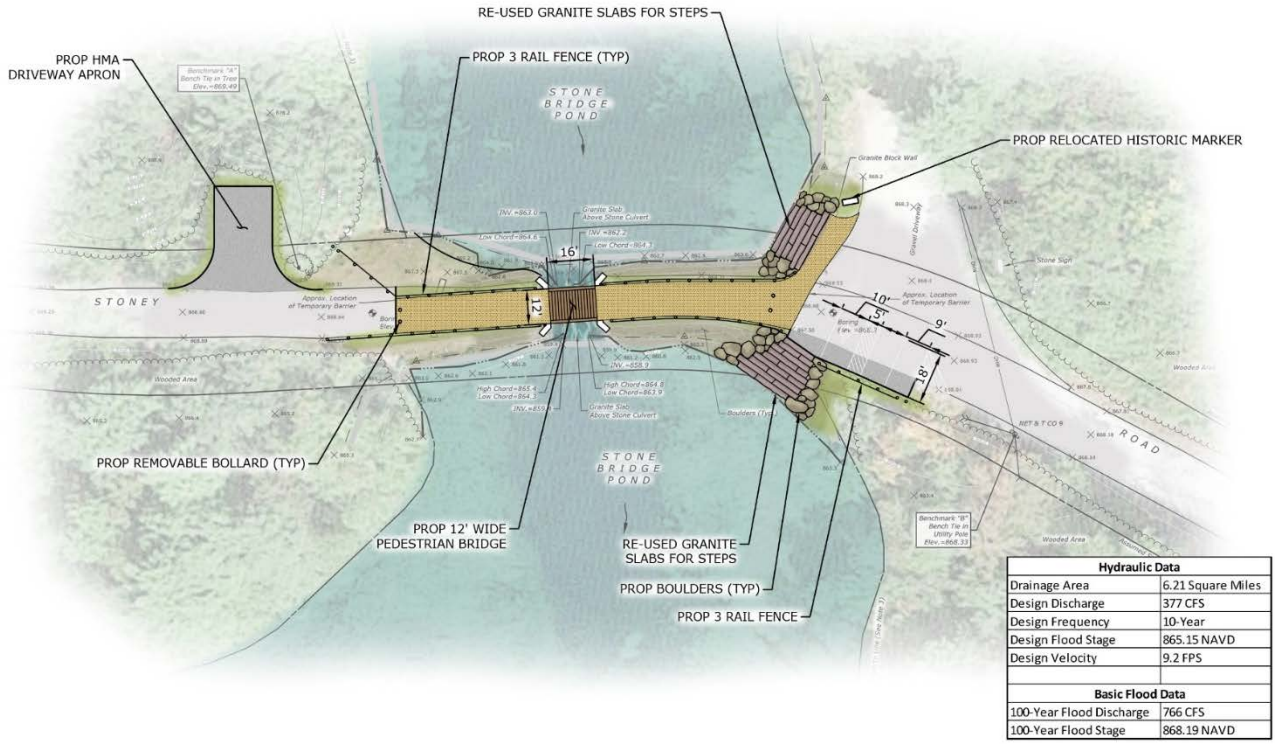
PREFERRED ALTERNATIVE

ALTERNATIVE 2:

- Adequate Conveyance for 10-Year Design Storm
- Significant Aquatic and Wildlife Passage Improvements
- Recreation Enhancements with Emergency Vehicle Access



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NEXT STEPS

- Seek Grant Funding Opportunities
  - Division of Ecological Restoration (DER) Culvert Replacement Municipal Assistance Grant Program (Application Pending)
  - Community Preservation Act (CPA)
  - Mass Municipal Vulnerability Preparedness (MVP) Program
  - FEMA Hazard Mitigation Grant Program (HMGP)
  - FEMA Culvert Grants and Environmental and Historic Preservation (EHP)
  - Surface Transportation Program (STP)
- Final Design-Permitting-Bid-Construction


Q&A
THANK YOU
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