

Rye Tidal Crossing Route 1A

DOT No. 43002



The Nature
Conservancy



NH Route 1A





Durham

Newington

Kittery

New Castle

Portsmouth

Great Bay

Newmarket

Atlantic Ocean

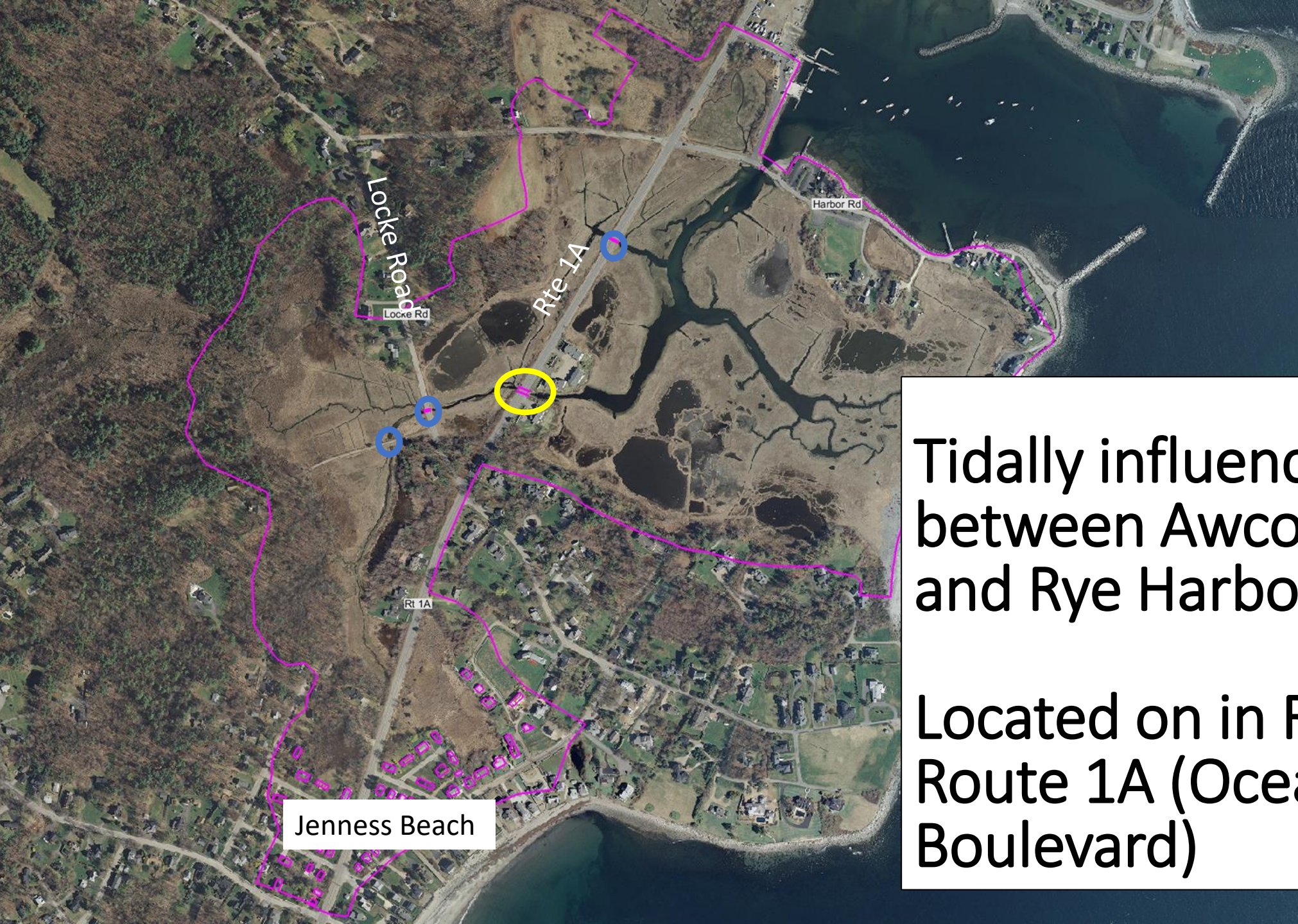
Rye #43002
Culvert

Greenland

Rye

Newfields

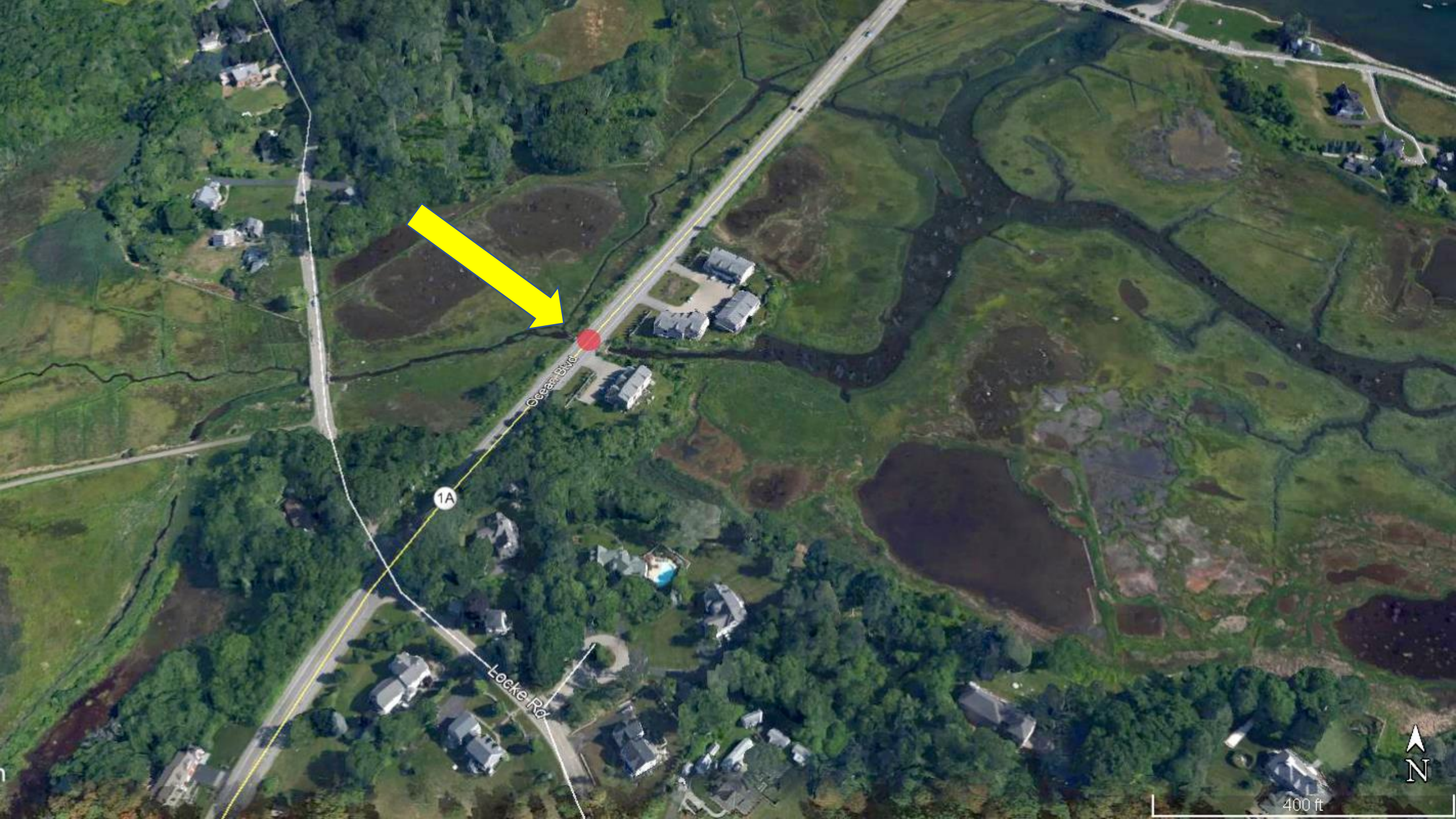
Stratham



Tidally influenced culvert
between Awcomin Marsh
and Rye Harbor

Located on in Rye under
Route 1A (Ocean
Boulevard)

Jenness Beach



Cedar Blvd

1A

Locke Rd



400 ft

Existing culvert

3.5 ft wide, Mixed materials, Structural deficiencies



Rye Culvert No. 43002 was evaluated as part of NH Resilient Tidal Crossings project

- All tidal crossings (culverts and bridges) in NH state were evaluated in 2018.
- Resilient Tidal Crossings report released May 2019 by NHDES, NHCP, and others.
- The culvert was selected as priority project due to:
 - Environmental sensitivity of salt marshes and Sea Level Rise (SLR),
 - Possible restrictions to tidal flow and stormwater flow
 - Existing structural deficiencies

Project implementation

- The Nature Conservancy (TNC) arranged for and administered funding for:
 - Hydraulics and Hydrology (H&H) evaluations (Phase 1)
 - Evaluation of culvert replacement alternatives, and selection (Phase 1)
 - Preliminary Design, draft Wetlands Permit, and draft CE Environmental Document (Phase 2)
 - Phase 2 is being finalized in October 2022

NHDOT will administer Final Design, Bidding, and Construction

Goals of project – Conventional Culvert Replacement

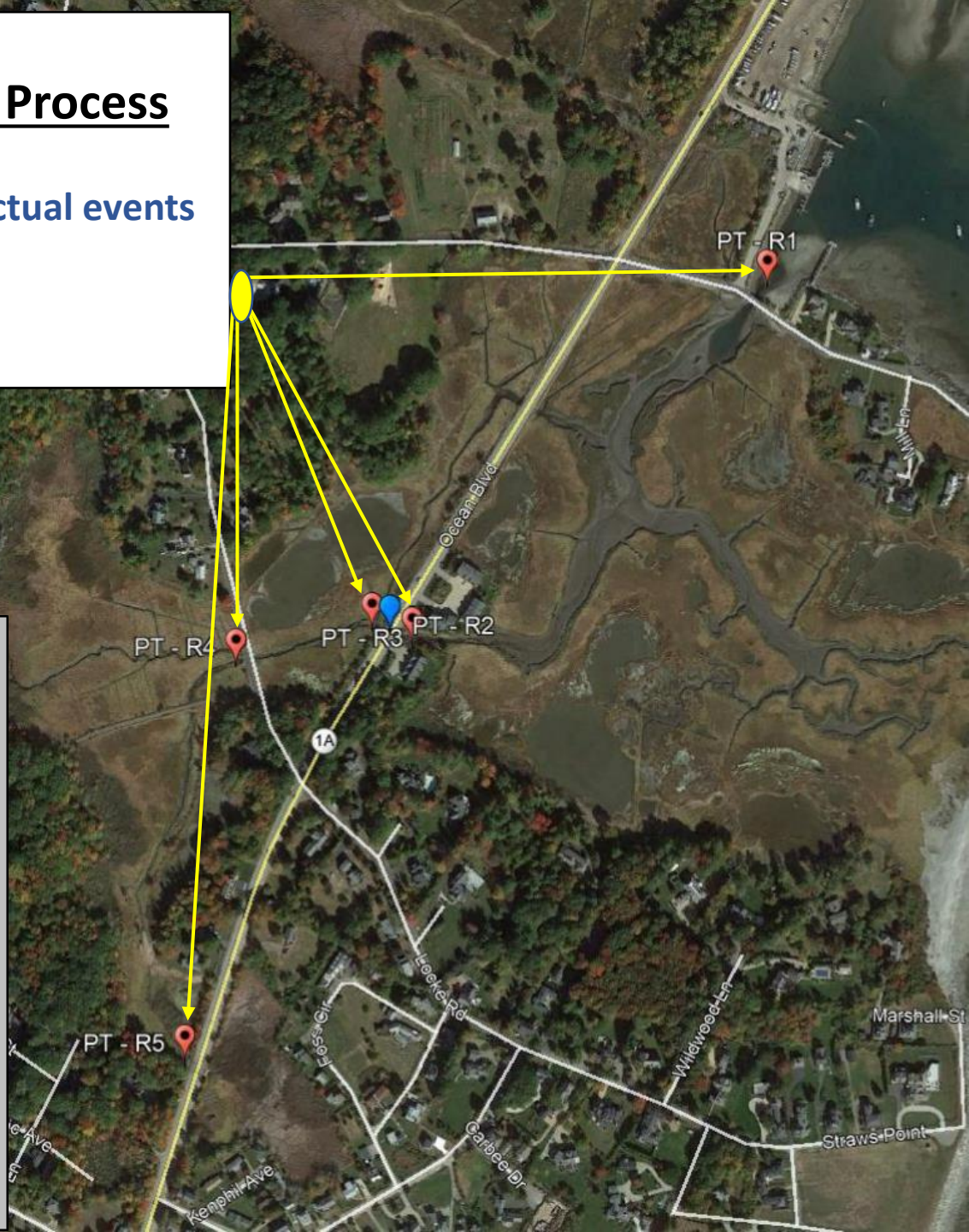
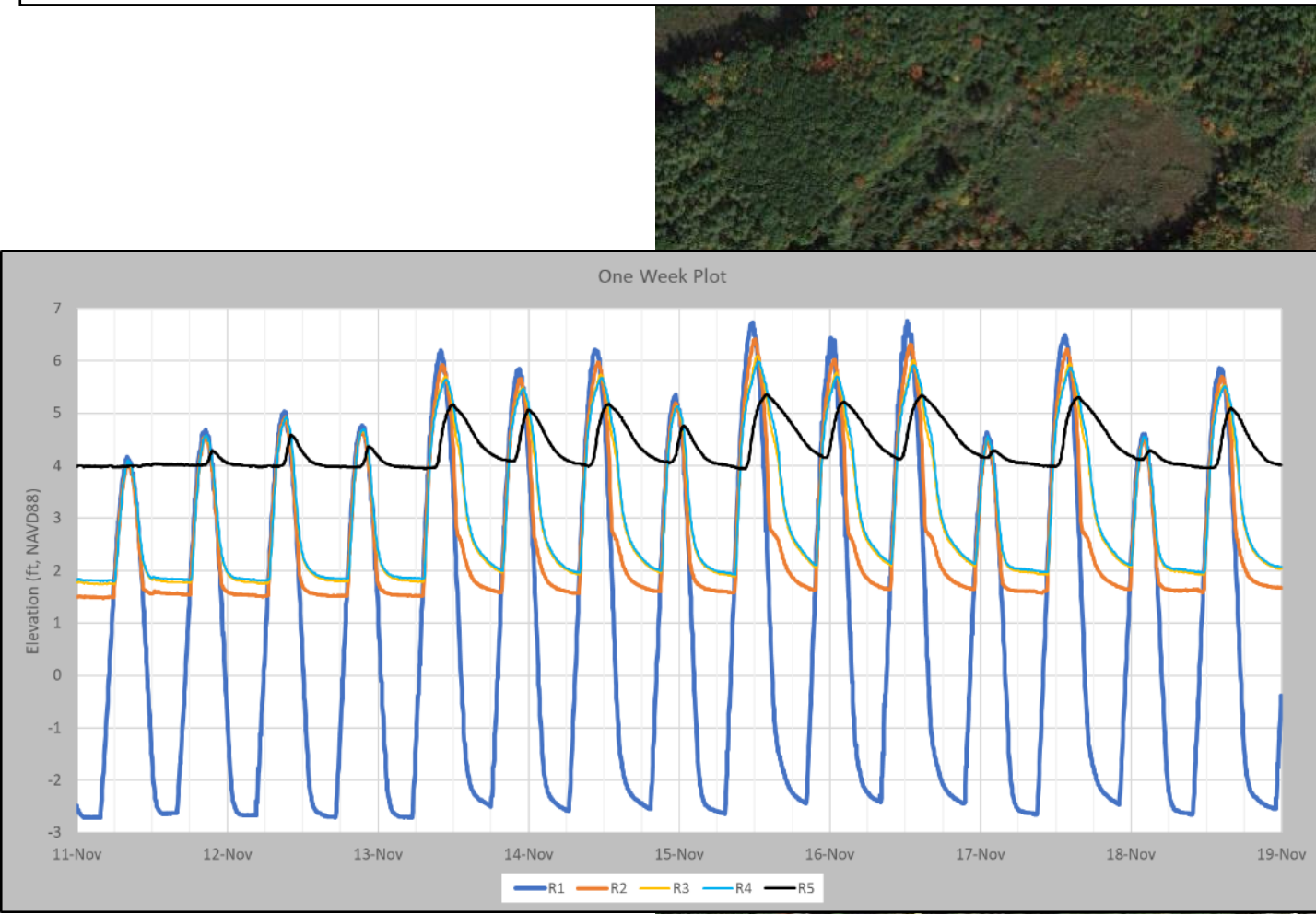
- Long term solution - 70 years
- Hydraulically suitable
- Efficient maintenance
- Integrated with roadway; ROW

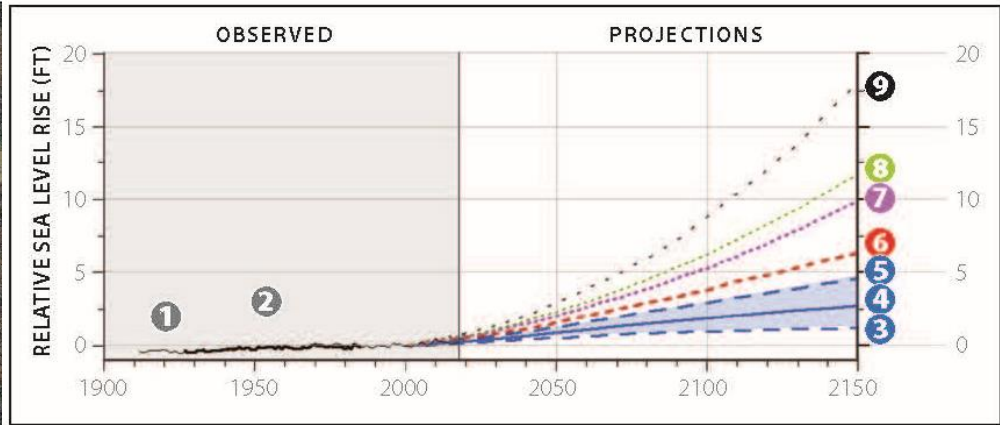
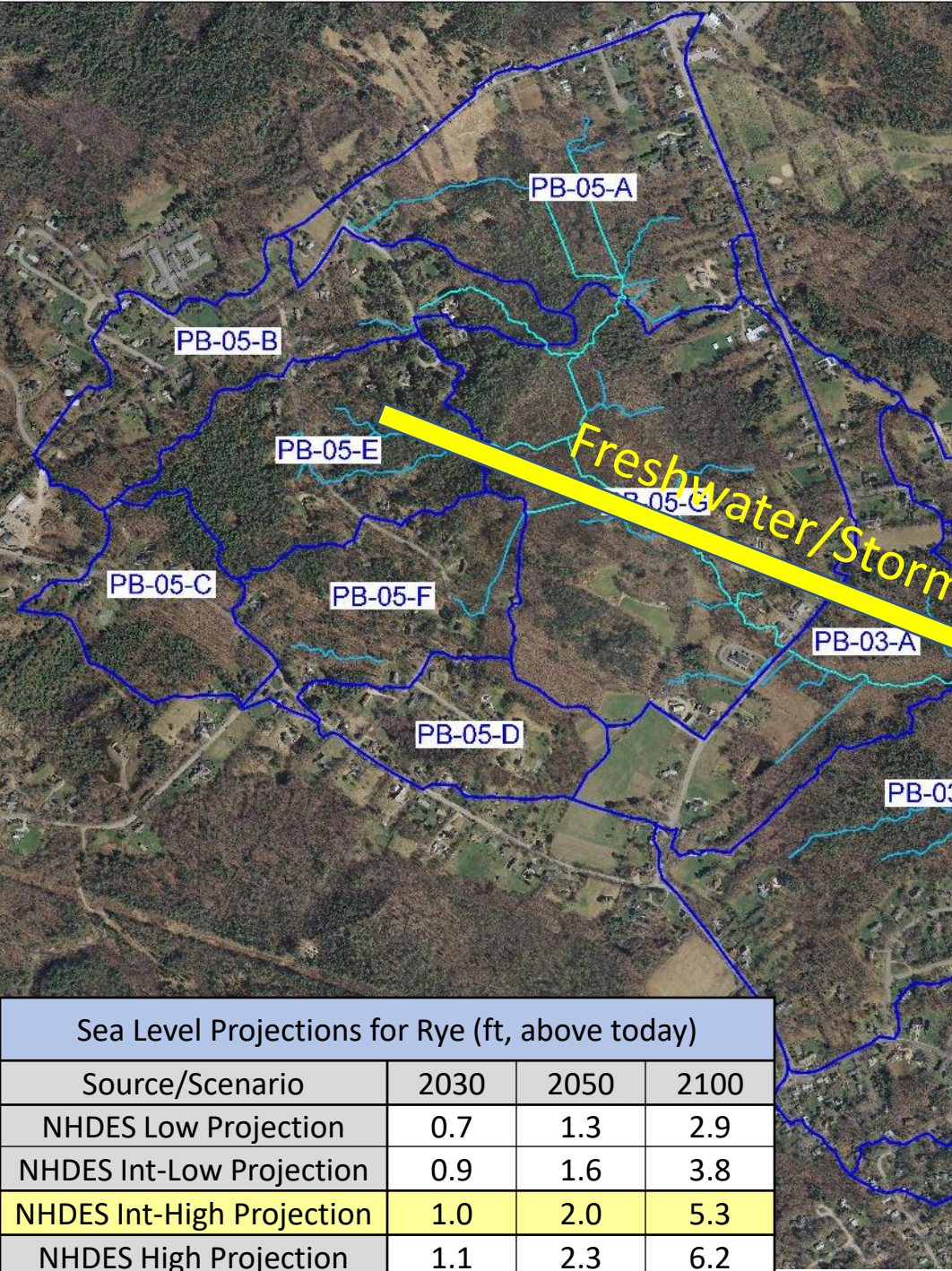
Goals of Tidal Crossing projects- Related to Environment and Climate Change

- Sea Level Rise
 - 5.3 feet by 2100 per NHDES relative risk criteria
 - Increasing tidal flows headed upstream towards uplands
- Increasing Stormwater flows due to increasing intensity and frequency
 - Increasing stormwater flows downstream toward ocean

Relatively Complex 2-Dimensional Hydraulic Modeling Process

- Hydraulics and hydrology were modeled and calibrated to match actual events
- Model used for evaluation of conditions and culvert alternatives





- ① Historical data for Portland, ME (1912-2018; thin black line)
- ② Historical data for Seavey Island, ME (1927-1986; thick black line)
- ③ Lower end of "likely range"
- ④ Central estimate
- ⑤ Upper end of "likely range"
- ⑥ 1-in-20 chance estimate
- ⑦ 1-in-100 chance estimate
- ⑧ 1-in-200 chance estimate
- ⑨ 1-in-1000 chance estimate

Sea Level Projections for Rye (ft, above today)			
Source/Scenario	2030	2050	2100
NHDES Low Projection	0.7	1.3	2.9
NHDES Int-Low Projection	0.9	1.6	3.8
NHDES Int-High Projection	1.0	2.0	5.3
NHDES High Projection	1.1	2.3	6.2

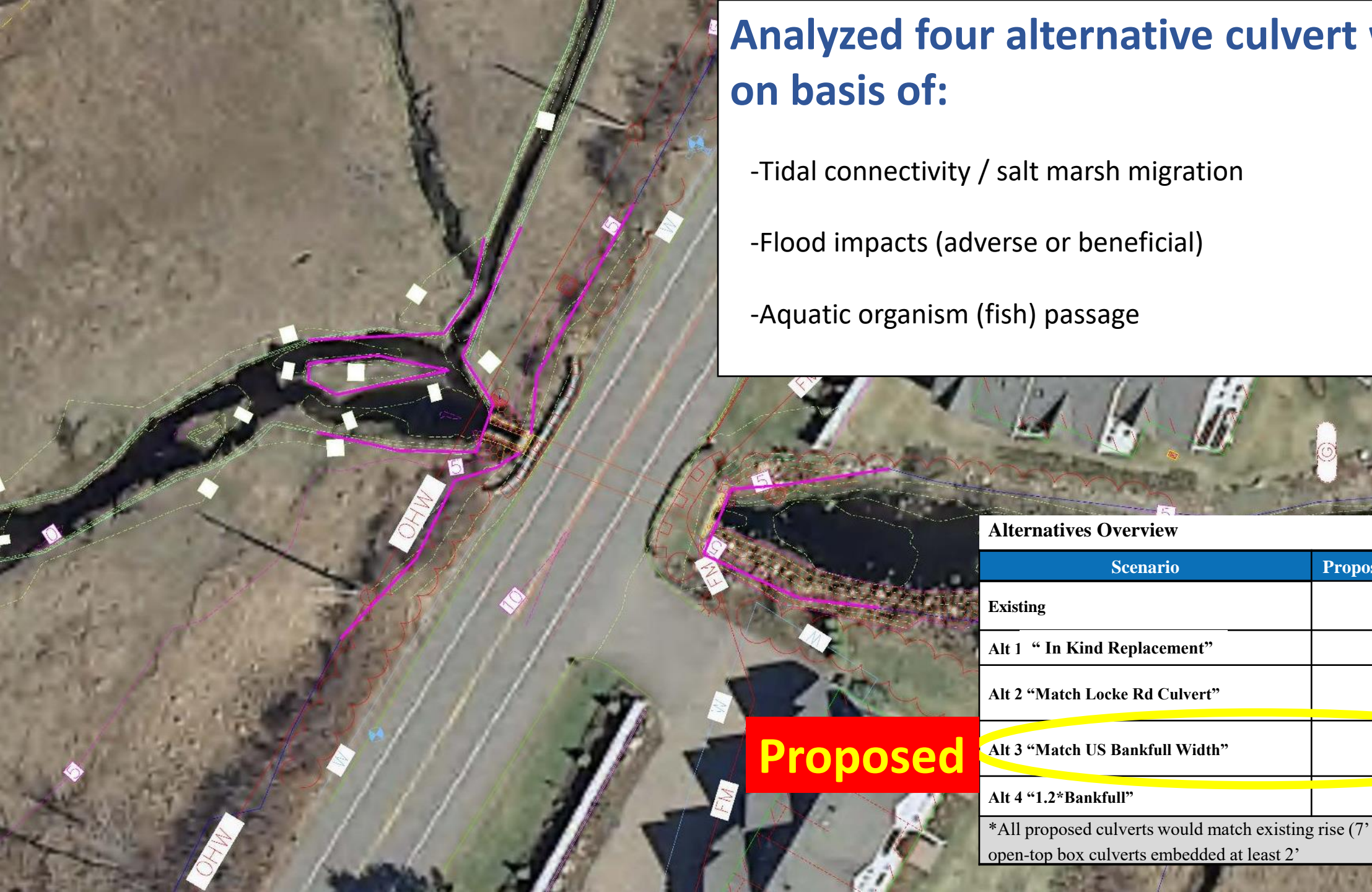
Modeling accounted for:

- Rainfall-induced flooding
- Tidal flooding and storm surge
- Projected sea-level rise in 2050 and 2100

Analyzed four alternative culvert widths on basis of:

- Tidal connectivity / salt marsh migration
- Flood impacts (adverse or beneficial)
- Aquatic organism (fish) passage

Widths:
3.5' (exist)
9.0'
15'
18'



Alternatives Overview

Scenario	Proposed Span and Shape*
Existing	3.5'
Alt 1 "In Kind Replacement"	3.5' Conc Box
Alt 2 "Match Locke Rd Culvert"	9.0' Conc Box
Alt 3 "Match US Bankfull Width"	15.0' Conc Box
Alt 4 "1.2*Bankfull"	18.0' Conc Box

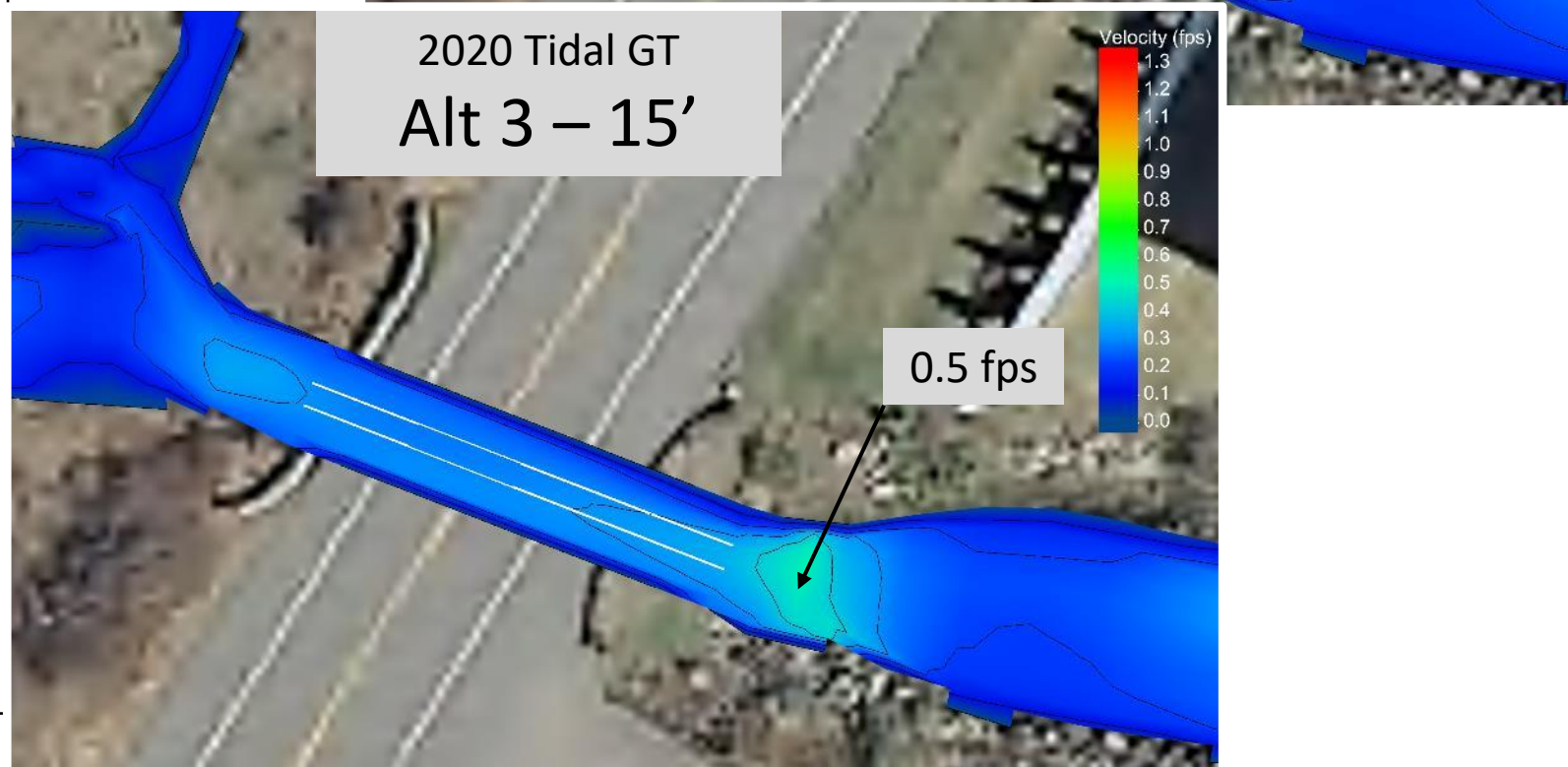
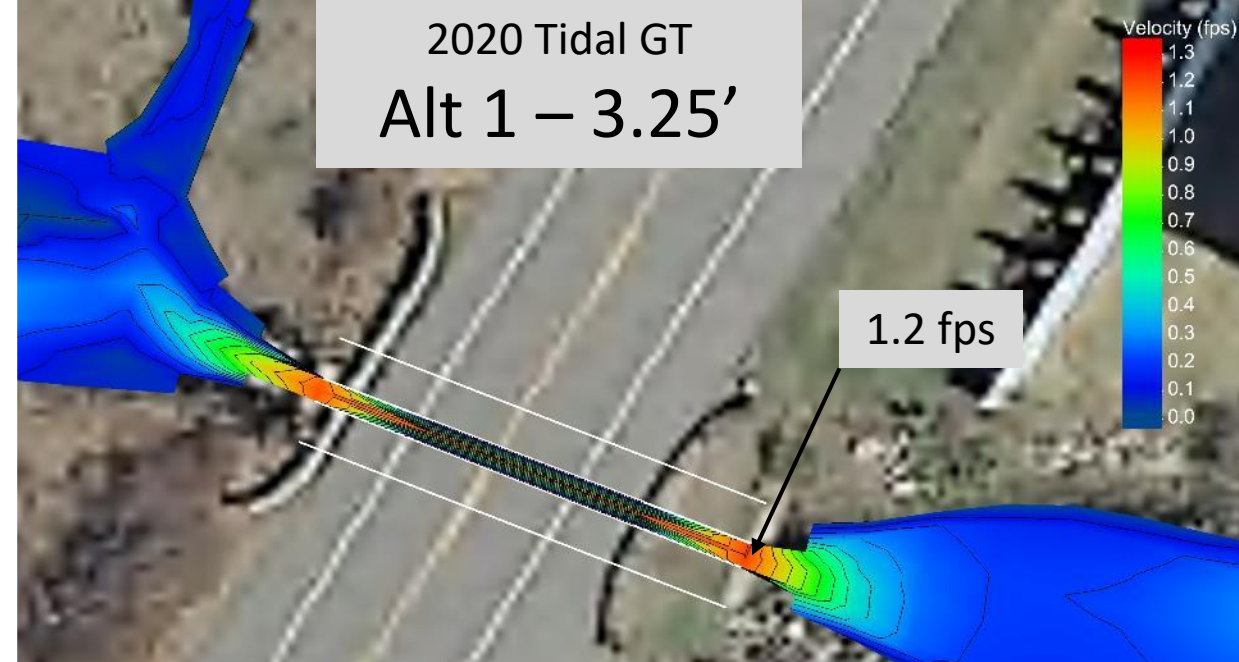
*All proposed culverts would match existing rise (7' effective) and be open-top box culverts embedded at least 2'

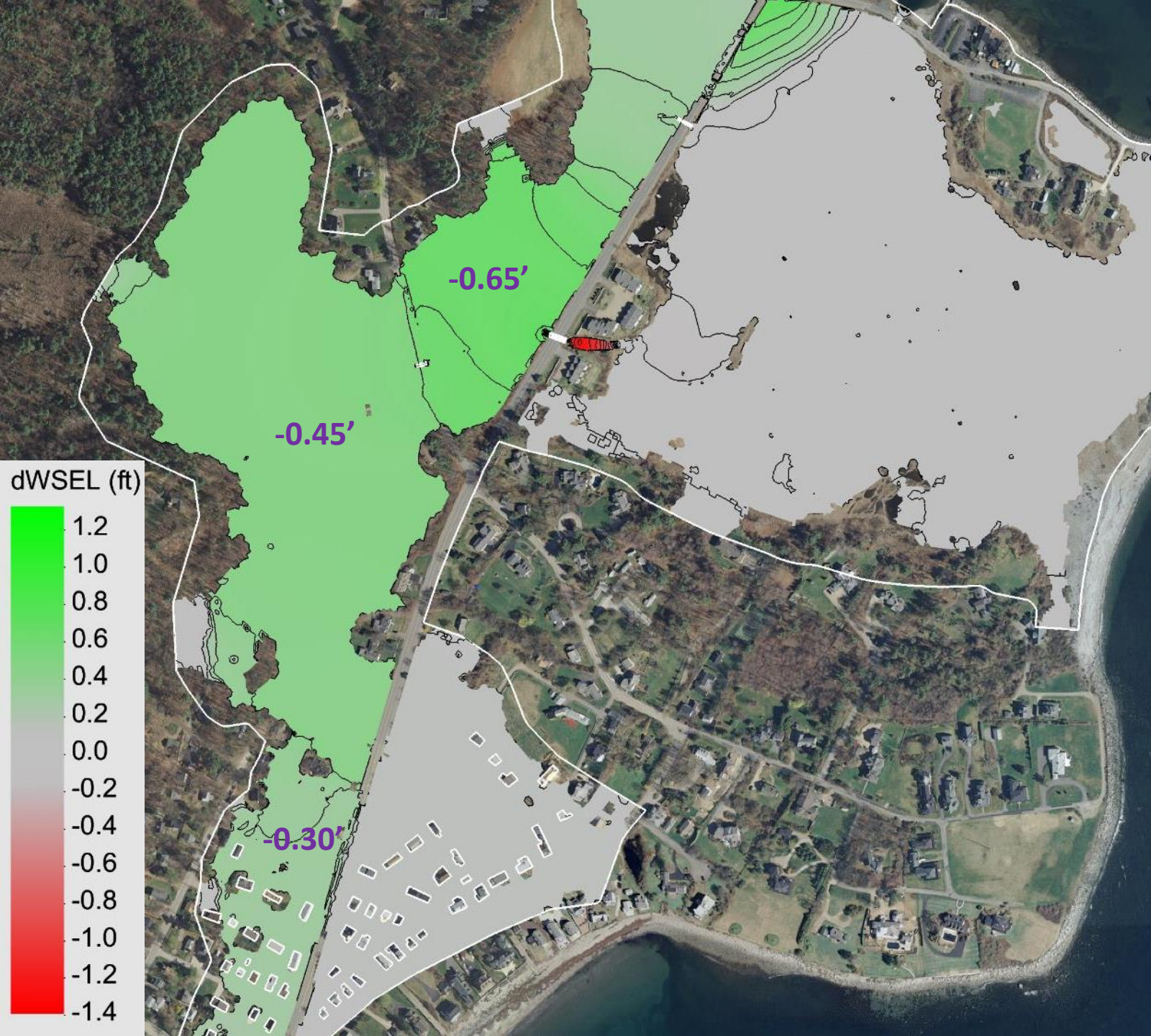
Project Impacts (Tidal)

- All but smallest culvert alternative similarly improve tidal connectivity between ocean and marshes. No significant differences.
- Culvert alternative sizing has negligible affect on tidal flooding. Storm surge will separately overtop roadway, regardless of culvert.
- Improved fish and terrestrial passage.
- Improves marsh migration potential by adding 5-10 minutes of high marsh inundation each high tide.

Items of note:

- Tidal/storm surges will become dominant source of flooding with sea-level rise, overtopping Rt 1A at current roadway elevations (north and south of culvert).
- Negligible to no impact to upstream infrastructure or residences/private property.





Project Impacts (Freshwater)

- Under current conditions, no practical culvert size could convey 1-in-100 chance annual storm without overtopping Rt 1A north and south of culvert.
- Rt 1A will likely flood for 1-in-50 and greater events if not raised, in future.
- With proposed culvert, areas upstream of the culvert show reduced flooding due to high rainfall/stormwater
- And reduced time for wetlands immediately upstream to drain after storms events.
- Jenness Beach Neighborhood flooding unaffected by increasing culvert size. Future flooding from SLR separately.

Design Detail – All Alternatives :

- **Good foundation soils- sands and gravels**
- **Satisfactory strength**
- **Supports 3-Sided box with separate foundations**
- **Precast Concrete Structures**
- **Natural channel**

Application of NHDES Stream Crossing Rules and NHDES Tier IV Tidal Crossing Guidelines

- **Alternatives Evaluated:**

3.5' (existing)

9'

15' (BFW)

18' (1.2 BFW)

- **Factors for Evaluation:**

Hydraulics

Flow velocities

AOP and TOP

Roadway flooding

- Prevent flooding
- Consideration of Sea Level Rise Risk
- Culvert channel should be as wide (or wider than) natural channels upstream and downstream
- Channel surface within culvert to be similar to natural channels: "*Geomorphic compatibility*"
- Allow for free passage of aquatic and terrestrial organisms
- Encourage Salt Marsh Migration with Sea Level Rise

Preferred Alternative:

15'-wide x 7' three-sided precast concrete structures

- Similar hydraulics modeled for 9', 15', and 18' widths
- All have sufficient capacity to pass peak tidal and stormwater flows; largely unaffected by culvert size.
- Salt Marsh Migration unchanged
- Jenness Beach neighborhood not affected differently by alternatives
- Velocities Aquatic and Terrestrial Organism Passage improves between 9 to 15'
- Meets nominal NHDES target of Bank Full Width (but not 1.2 BFW)

Project Permitting

(draft documents completed)

1. NHDES Wetlands Bureau

Standard Dredge and Fill Permit

(per NHRSA 482-A, and Rules Env-Wt 100-900)

Process includes US ACOE review

2. Programmatic Categorical Exclusion Document

16 criteria considered, including

- NEPA Section 106 (Historic and cultural resources)
- Several land, water, air, and other environmental issues

The Nature Conservancy NHDOT Tidal Crossings Rye Culvert Replacement At Ocean Boulevard (NH Route 1A)

Preliminary Design
October 2022

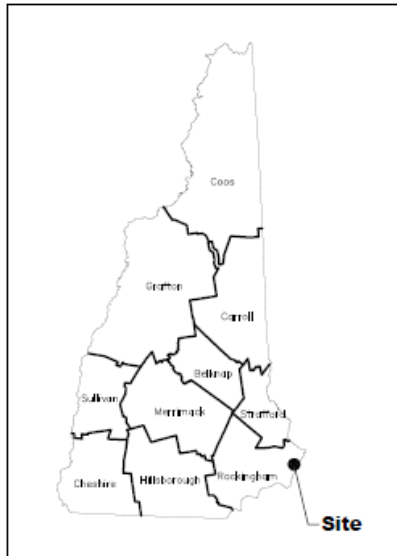
ISSUED FOR REVIEW – NOT FOR CONSTRUCTION

THIS PROJECT WAS FUNDED BY A NATIONAL FISH AND WILDLIFE FOUNDATION COASTAL RESILIENCE GRANT WITH FUNDING FROM THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA), NOAA'S OFFICE FOR COASTAL MANAGEMENT UNDER THE COASTAL ZONE MANAGEMENT ACT IN CONJUNCTION WITH THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES COASTAL PROGRAM, AND THE NATURE CONSERVANCY.

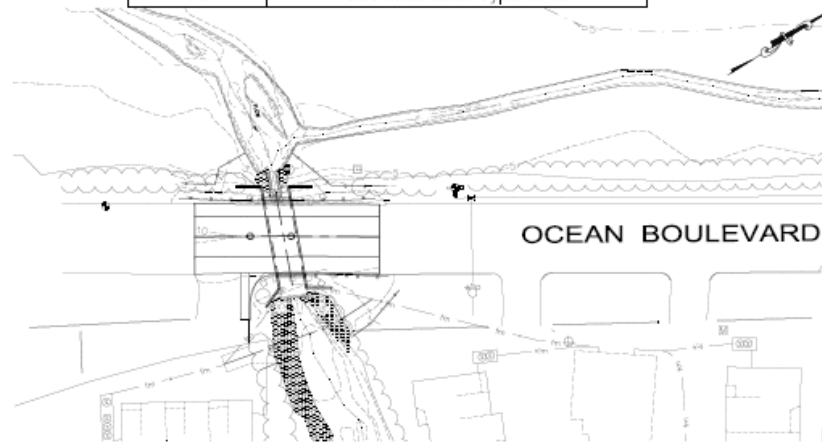
Sheet List Table	
Sheet Number	Sheet Title
1	Cover
2	Notes and Legend
3	Existing Conditions Plan
4	General Plan and Profile
5	Culvert Layout and Longitudinal Section
6	Culvert Details – Future Condition
7	Miscellaneous Details
8	Erosion Control Strategies
9	T101 Bridge and Approach Rail
10	Terminal Unit Type G-2



NEW HAMPSHIRE
DEPARTMENT OF
**Environmental
Services**



Locus Plan



SITE OVERVIEW

SCALE 1" = 40'

Prepared For:

**New Hampshire Department of Transportation
and The Nature Conservancy**

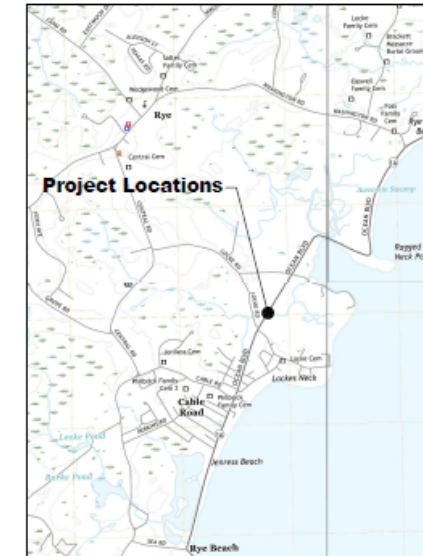
Prepared By:



CIVIL/ENVIRONMENTAL/STRUCTURAL

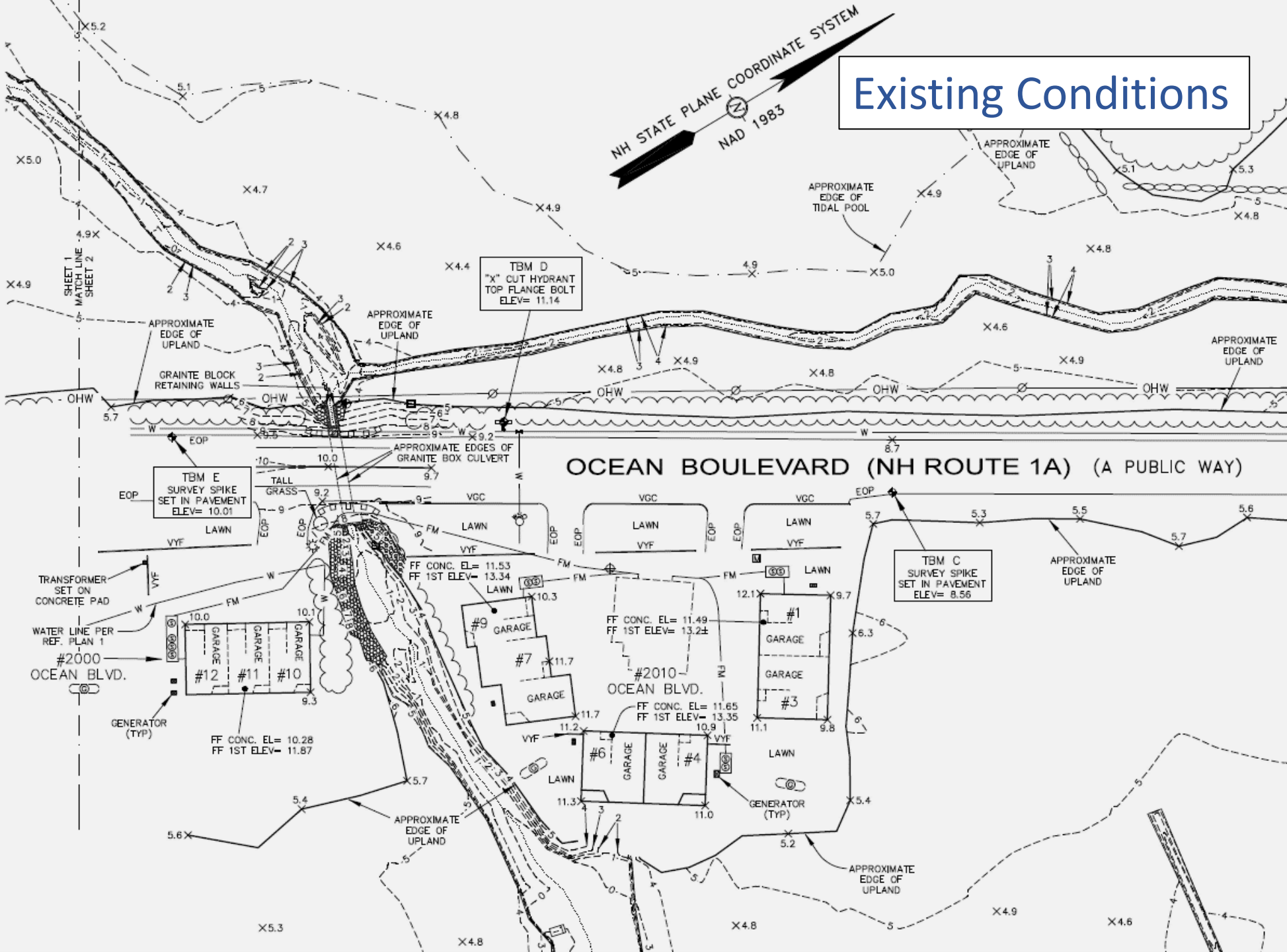
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603-431-4196 • 603-827-0708 • 207-841-4223

cmaengineers.com

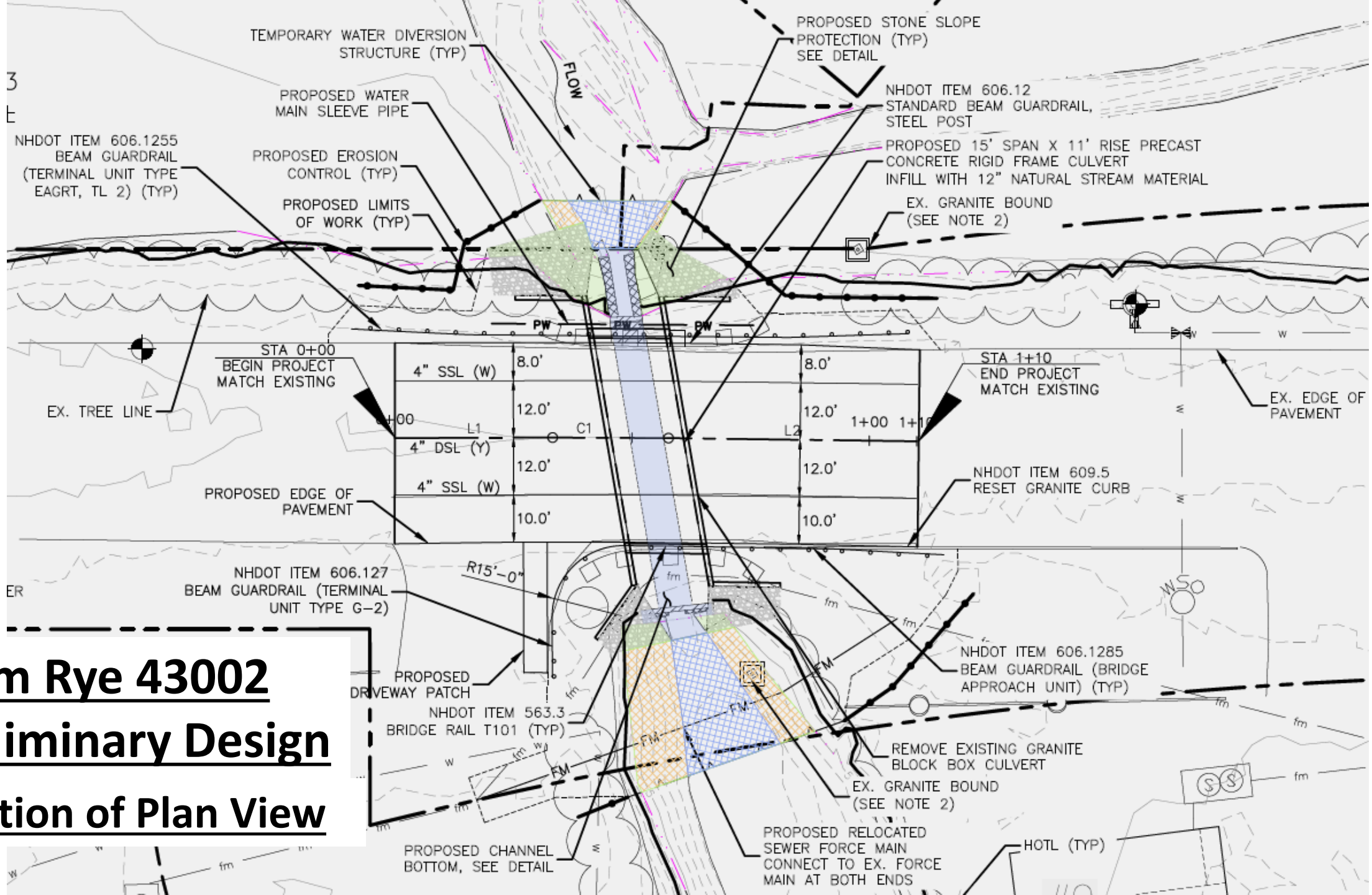


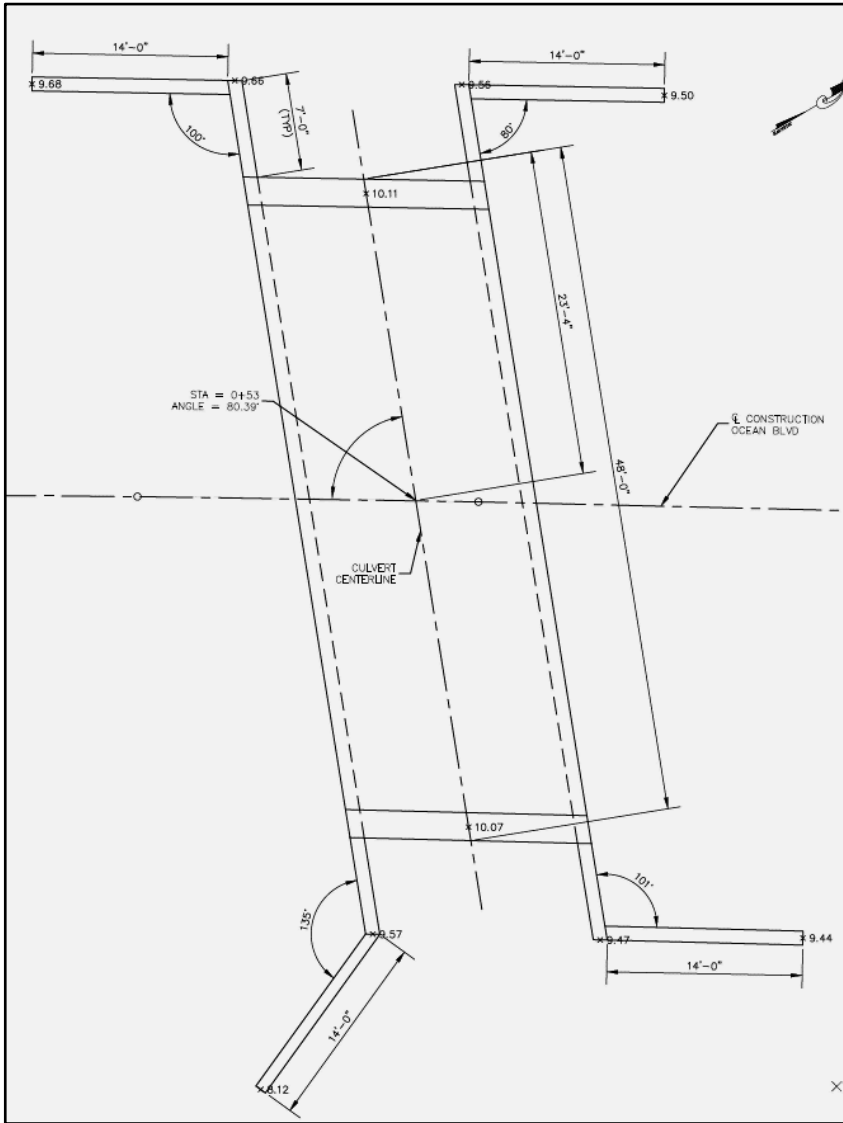
Project Locations

Existing Conditions

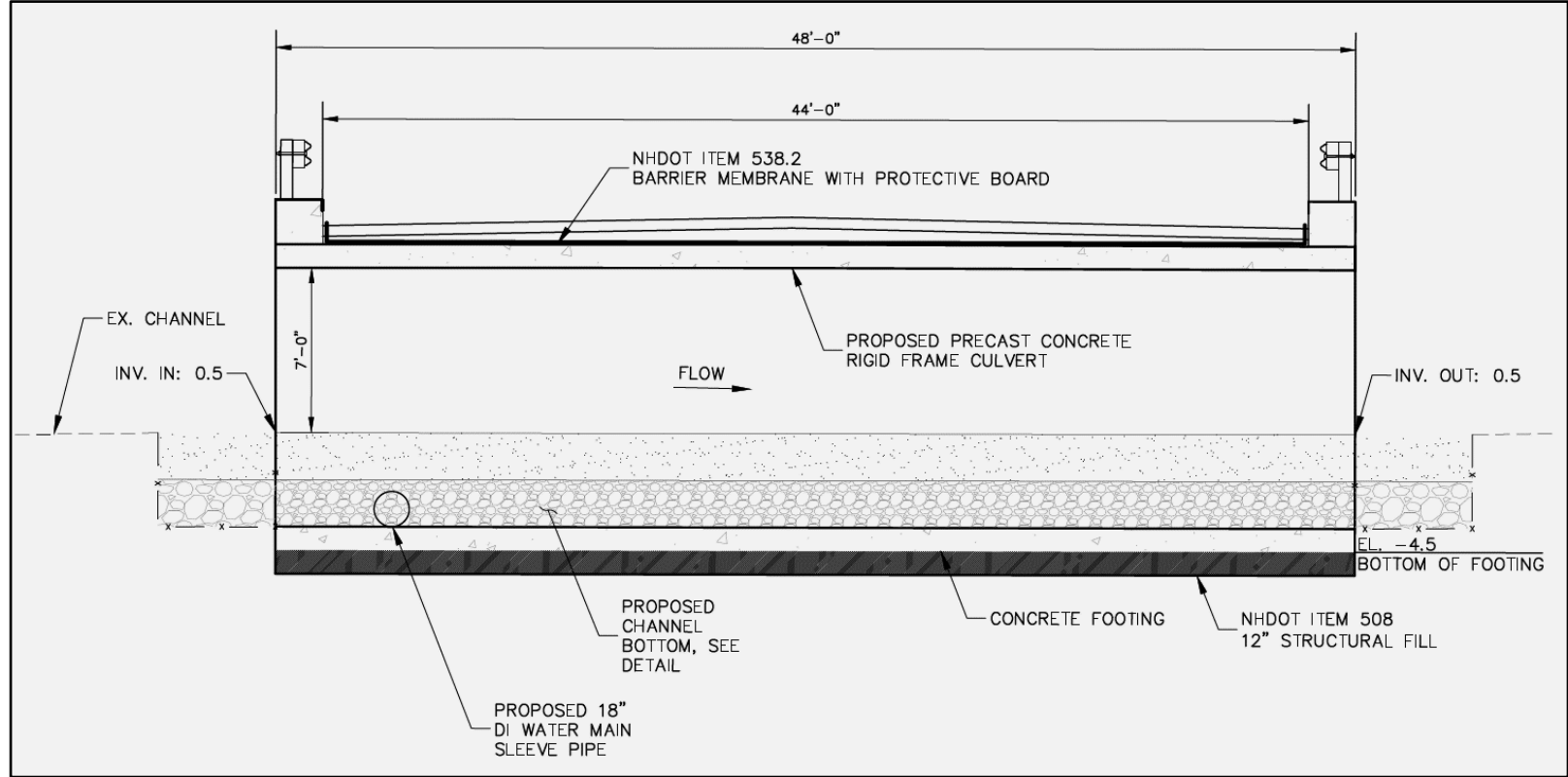


From Rye 43002
Preliminary Design
Portion of Plan View





Culvert Geometry



Longitudinal Section View

From Rye 43002
Preliminary Design

Further adaptation for Sea Level Rise may be considered in the future

- Culvert designed to structurally accept some potential future raising of roadway
- Many issues associated in that question: Amount, lateral extent, and cost

Designed to be within State of NH ROW

- Final ROW to be determined in final design
- Minor impacts, if any, outside of ROW

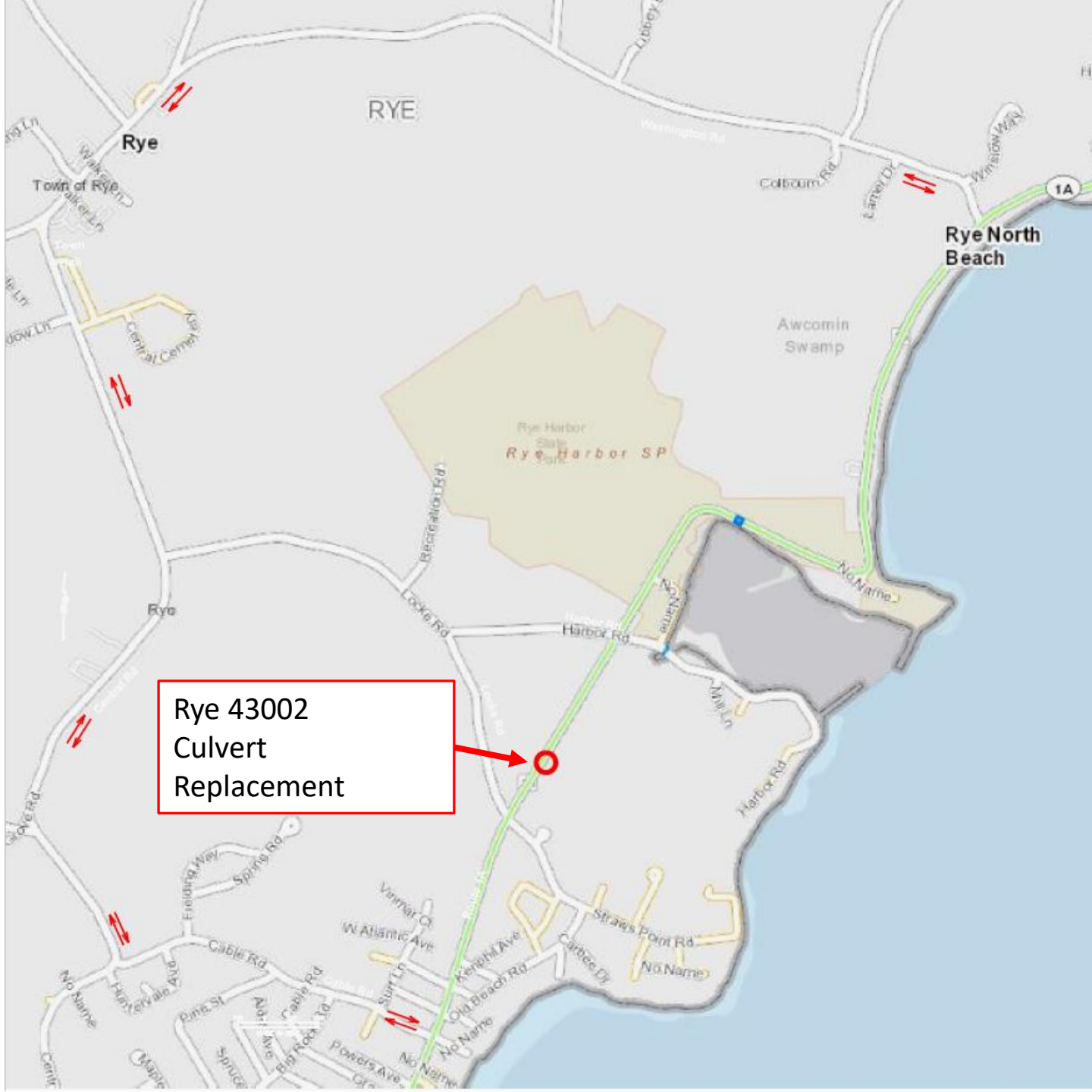
No impacts to properties outside ROW

Traffic Impacts -

- Road closure during construction?
- Alternating Traffic?



Questions and Comments



Rye 43002
Culvert
Replacement