City of Newburyport Massachusetts

Surface Water Supply Protection Update

April 24, 2024, 2pm

Newburyport Senior/Community Center

Presenters: *Jon-Eric White, PE, City Engineer*
Tom Cusick, WTO Superintendent

Outline

1. Brief history of our resiliency work
2. Summary of our surface water supply system
3. Describe how climate change is impacting our system
4. Ongoing efforts to protect our surface water supply

Newburyport Resiliency Committee

- Est. 2015
- Final Report October 2020
- Monthly newsletters
- Numerous events throughout the year
- Very active

Primary Impacts Climate Change Has on Surface Water Supplies:

- *Rising seas: Our reservoirs are connected to the Merrimack River which is tidal at this location and impacted by rising seas. Eventually the sea will overtake our reservoirs.*
- *More intense storm events: Heavy rains will wash away more pollutants and send them further downstream without the benefit of getting absorbed into the ground for filtering.*
- *Droughts: Lack of rain prevents recharging of our water supplies and eventually the supply runs out as we use those supplies. Droughts also accelerate the evaporation process. Dry air, winds, and atmospheric pressures can lower water levels inches per day.*
- *Hotter atmospheric temps mean hotter water, more evaporation, more algal blooms, more difficult to treat for water consumption.*

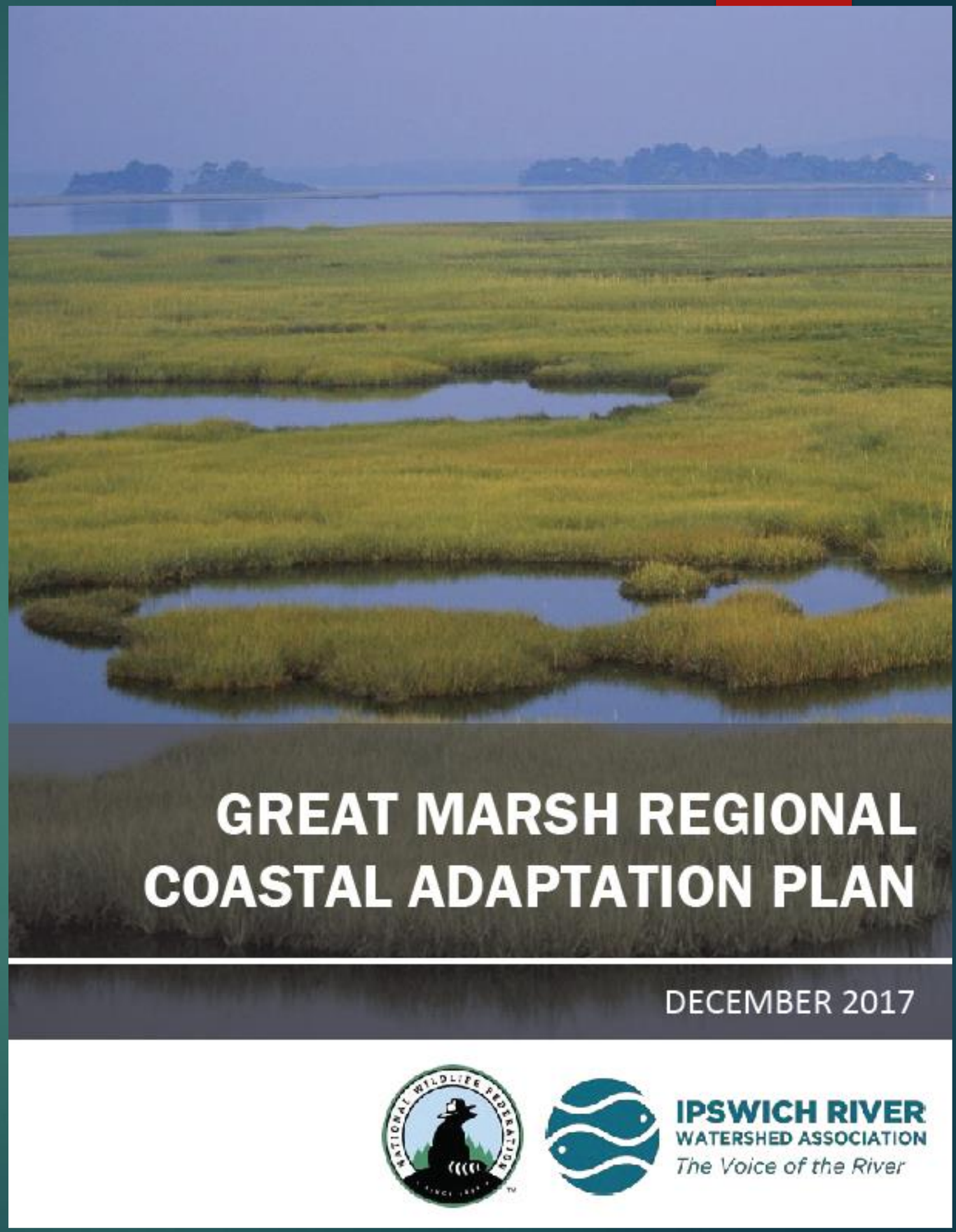
National Wildlife Federation & Ipswich River Watershed Association

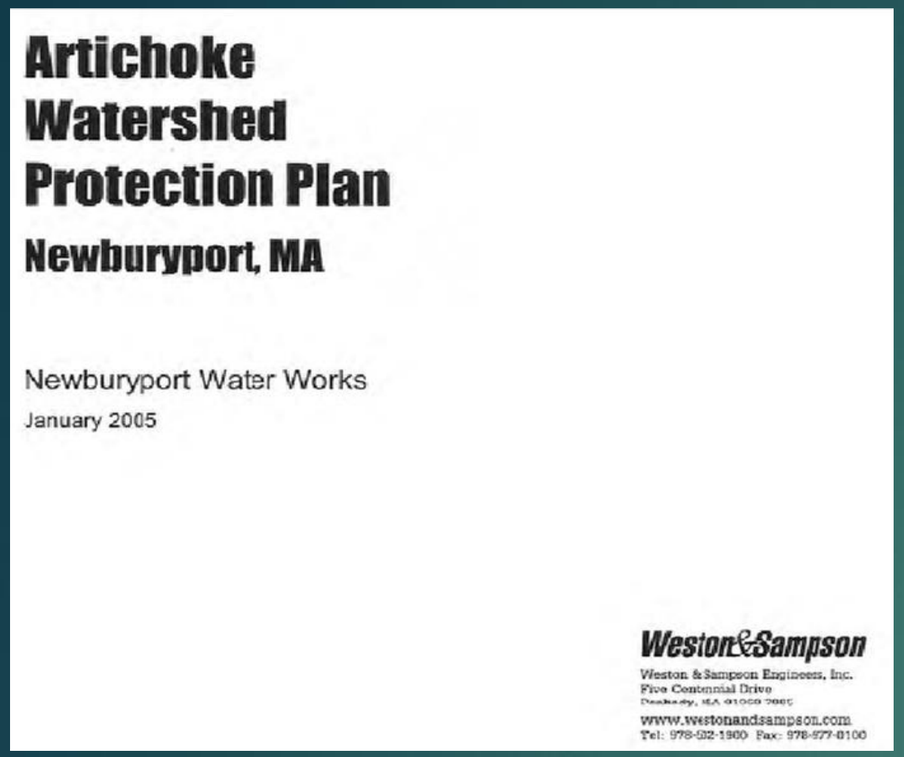
Great Marsh Adaptation Project:

- ***Salisbury***
- ***Newbury***
- ***Newburyport***
- ***Essex***
- ***Ipswich***
- ***Rowley***

Task Force created April 2015

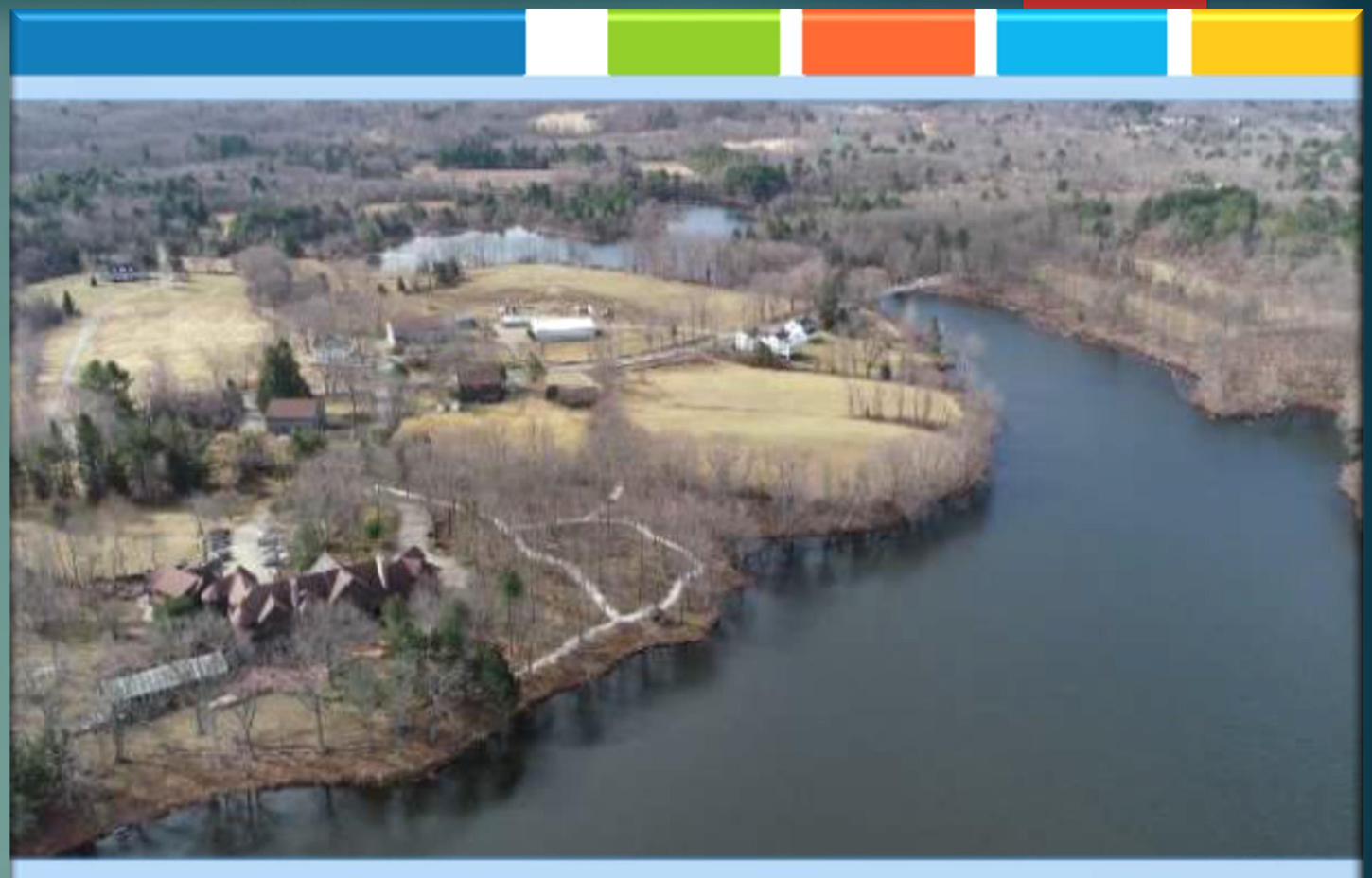
Final Report December 2017

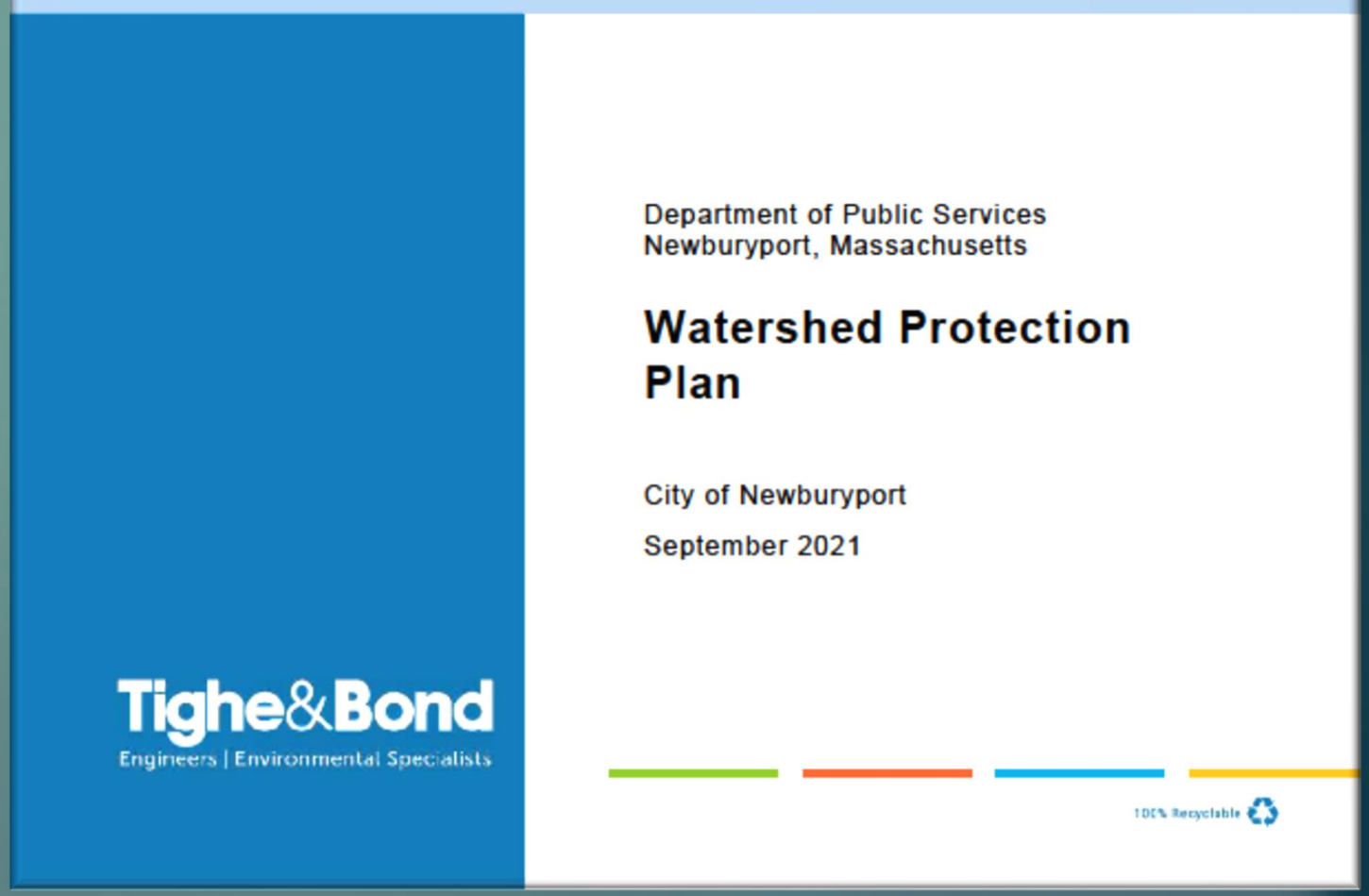


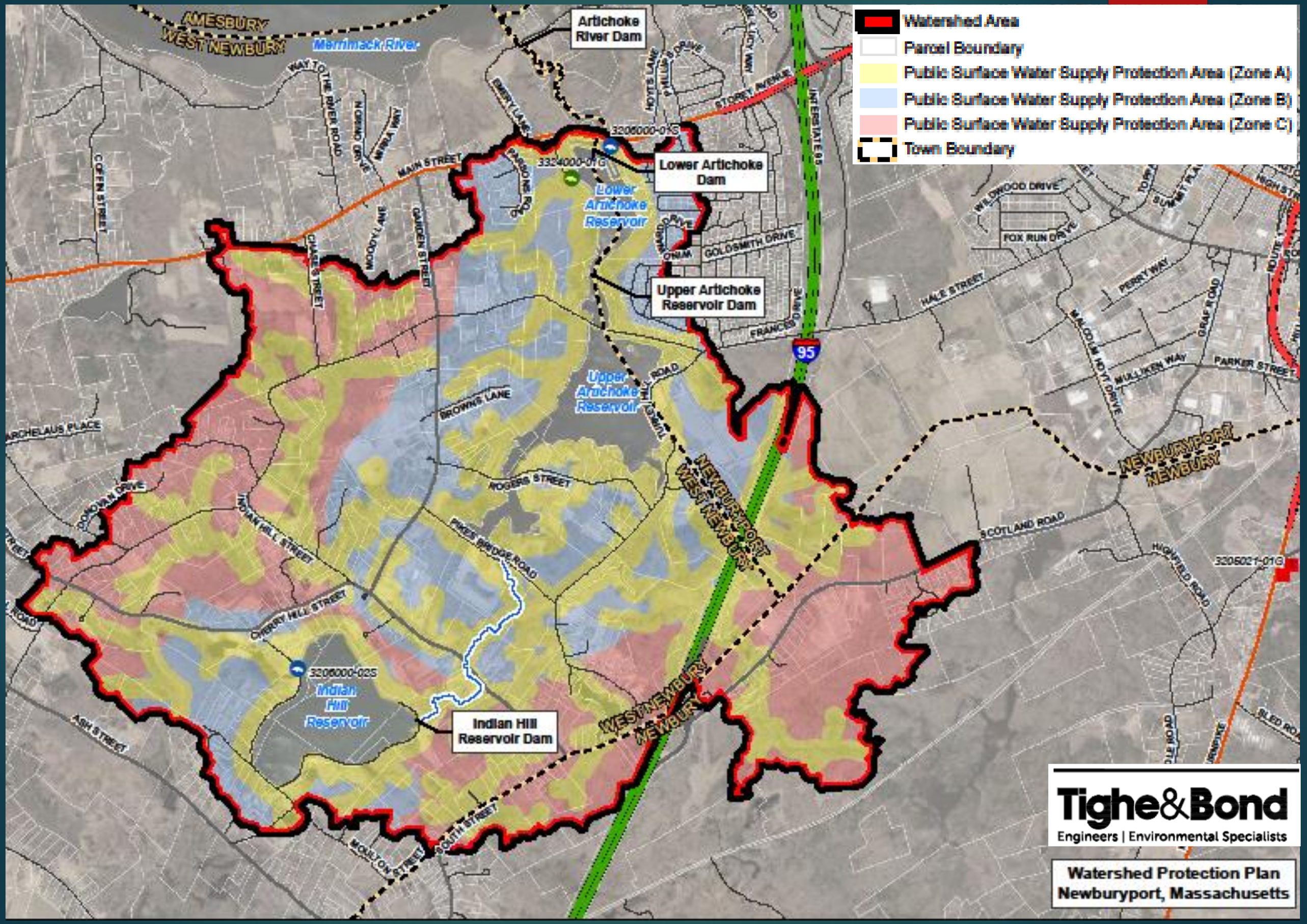


Watershed Protection Plan needed to be updated to include climate impacts

Final Report September 2021






Watershed Area
Parcel Boundary
Public Surface Water Supply Protection Area (Zone A)
Public Surface Water Supply Protection Area (Zone B)
Public Surface Water Supply Protection Area (Zone C)
Town Boundary
Artichoke River Dam
Lower Artichoke Dam
Upper Artichoke Reservoir Dam
Indian Hill Reservoir Dam
Lower Artichoke Reservoir
Upper Artichoke Reservoir
Indian Hill Reservoir
3206000-01S
3324000-01S
3206000-02S
3206021-01S
Merrimack River
AMESBURY
WEST NEWBURY
NEWBURYPORT
NEWBURY
MAIN STREET
STOREY AVENUE
INTERSTATE 95
95
HALE STREET
FOX RUN DRIVE
GOLDSMITH DRIVE
FRANCES DRIVE
PERRY WAY
PARKER STREET
MULLIKEN WAY
MALCOLM HOYT DRIVE
GRAF ROAD
SCOTLAND ROAD
HIGHFIELD ROAD
BROWNS LANE
ROGERS STREET
PIKES BRIDGE ROAD
CHERRY HILL STREET
INDIAN HILL STREET
ASH STREET
SOUTH STREET
MOULTON STREET
TURKEY HILL ROAD
COFFIN STREET
CHASE STREET
MOODY LANE
GARDEN STREET
PARSONS ROAD
WAY TO THE RIVER ROAD
NORTH GREEN DRIVE
ELM FARM
STOREY LANE
HOYTS LANE
PHILLIPS DRIVE
LUCY WAY
WILDWOOD DRIVE
SUMMIT PLACE
HIGH STREET
ROUTE 1
ARCHELAUS PLACE
DONOVAN DRIVE
Tighe&Bond
Engineers | Environmental Specialists
Watershed Protection Plan
Newburyport, Massachusetts

Indian Hill Reservoir

Completed 1979

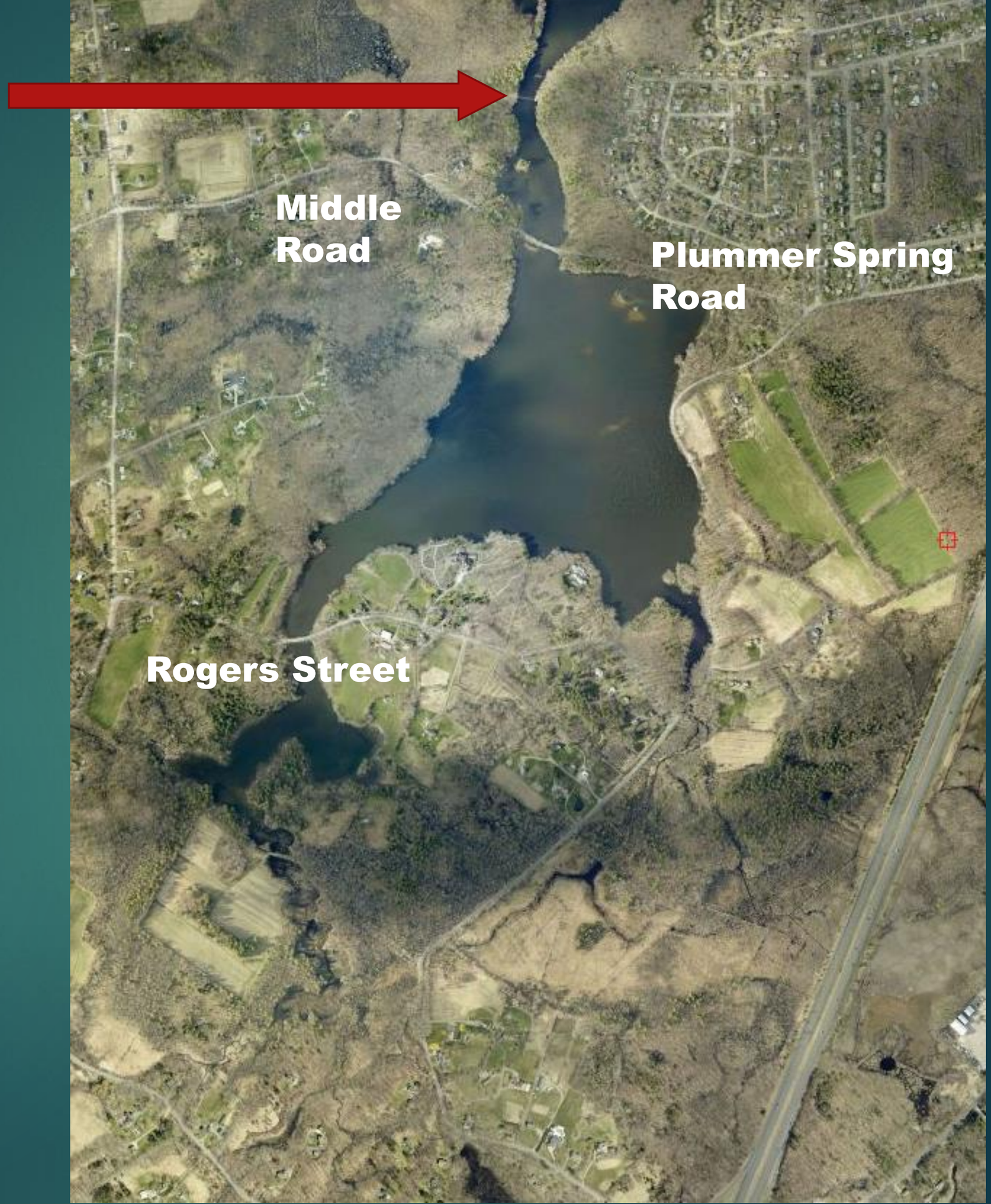
- *Max. Depth 25.4 ft*
- *Avg. Depth 20.8 ft*
- *Sediment Layer 1.0 ft*
- *Volume 755 MG*

Dam Built 1914+/-

Upper Artichoke Reservoir

Stats:

- *Max. Depth 12.2 ft*
- *Avg. Depth 6.9 ft*
- *Sediment Layer 1.7 ft*
- *Volume 269 MG*



Dam
Built 1920

Lower Artichoke Reservoir

Stats:

- Max. Depth 11.0 ft
- Avg. Depth 4.7 ft
- Sediment Layer 1.7 ft
- Volume 50 MG

Upper Dam

Lower Artichoke Reservoir Dam

80’ Concrete Spillway

[3.2 ft. below FEMA 100-yr flood elevation]

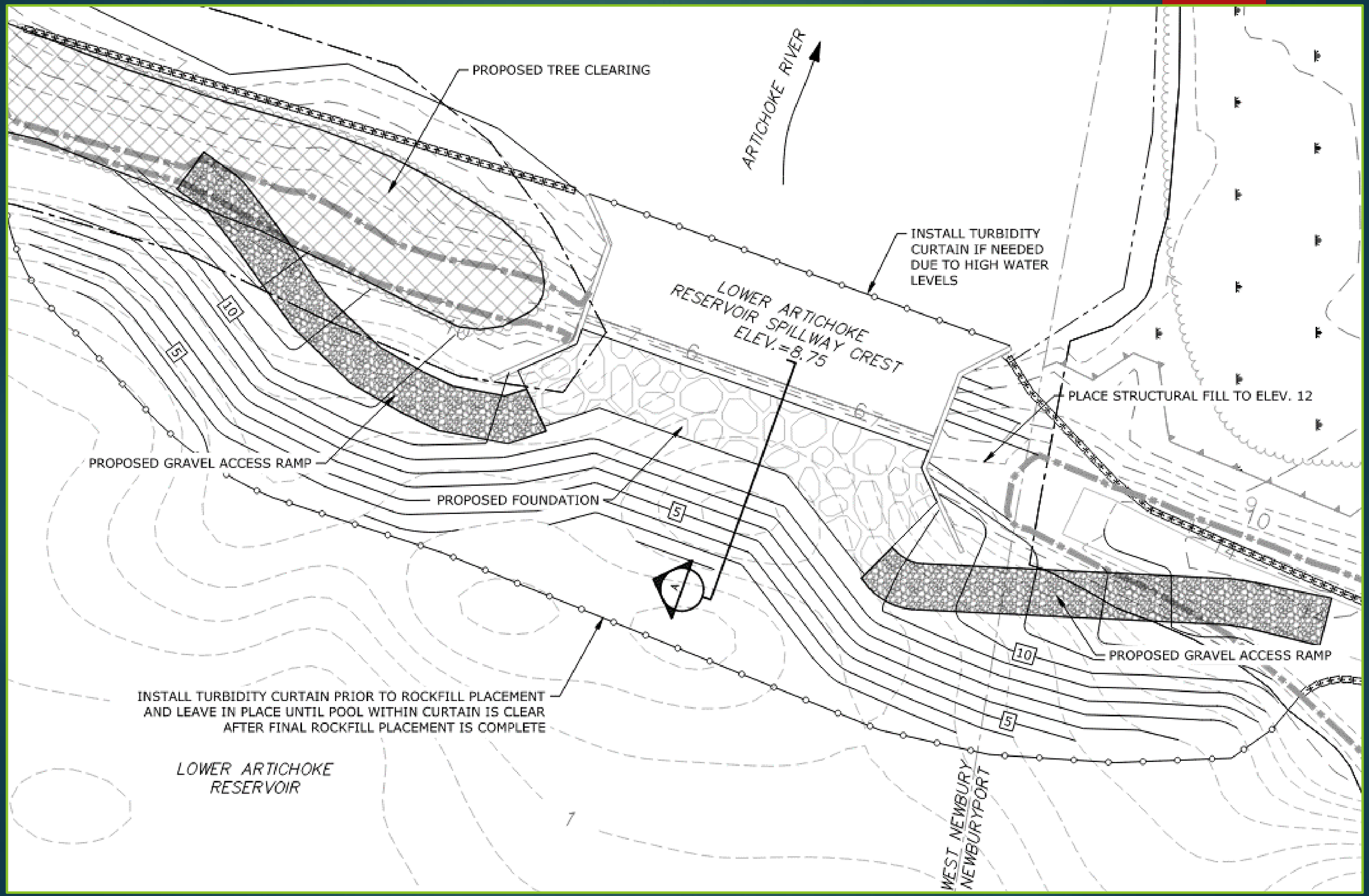
Lower Artichoke Reservoir Dam

4,300’ Earthen Embankment

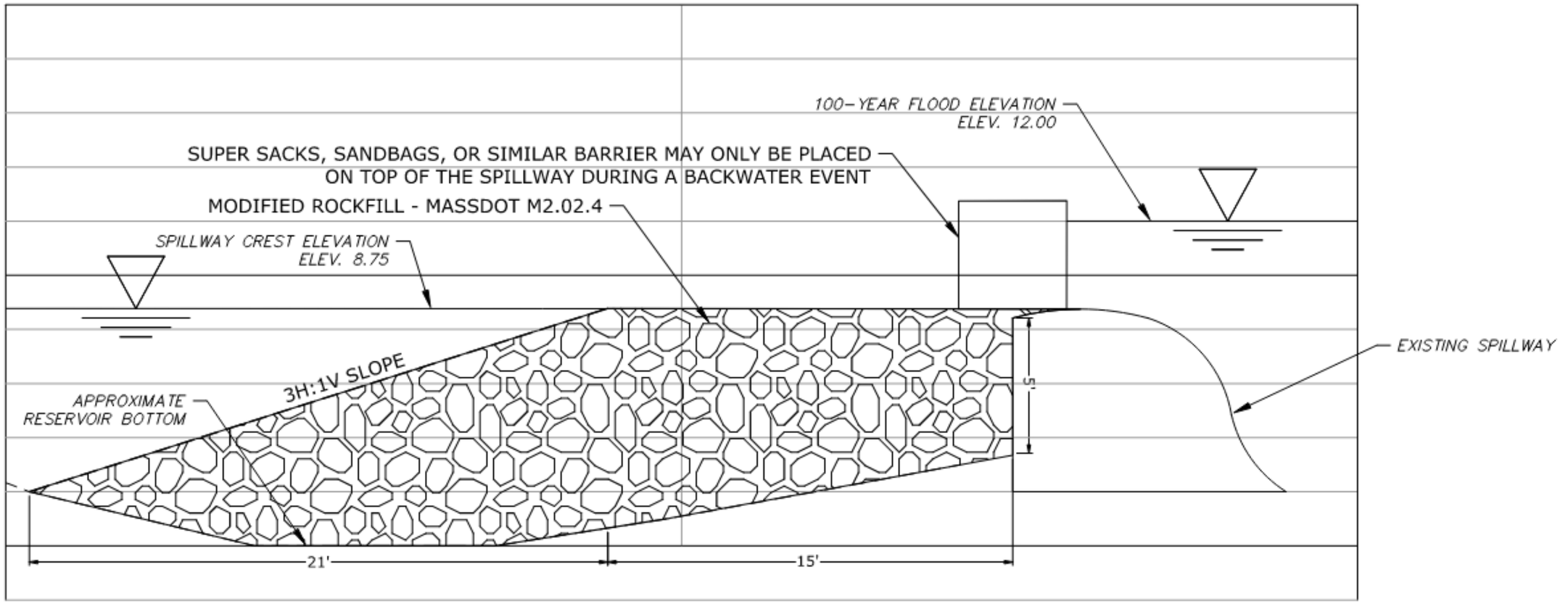
Reference: Weston & Sampson
Inspection Report
August 2009

Spillway Protection Project
Design and Permitting: 2020-2023

PREFERRED OPTION (UP TO 100-YR STORM)



POTENTIAL TEMPORARY SOLUTION (UP TO 100-YR STORM)



TYPICAL SPILLWAY CROSS SECTION

SECTION A
1"=5' -

Temporary Flood Control

Super Sacks Being Installed on Plum Island

Construction Phase

Public Bidding Process Sept. 2023

Awarded to:
T Ford, Inc.
Georgetown, MA

Began Construction:
Jan. 31, 2024


Mayer
TREE SERVICE
1-888-88-MAYER


Mayer Tree Service
Mayer 1750


MAYER
mayer

EXISTING PROTECTIONS FROM A BREACH

- 3,900’ FROM THE MERRIMACK RIVER TO THE LOWER DAM
- LOWER ARTICHOKE RIVER (CURZON MILL) DAM PROTECTS UP TO ELEVATION 5.7’ (JUST ABOVE MEAN HIGH WATER)

Artichoke River (Curzon Mill) Dam

[Elevations in NAVD88 Datum]

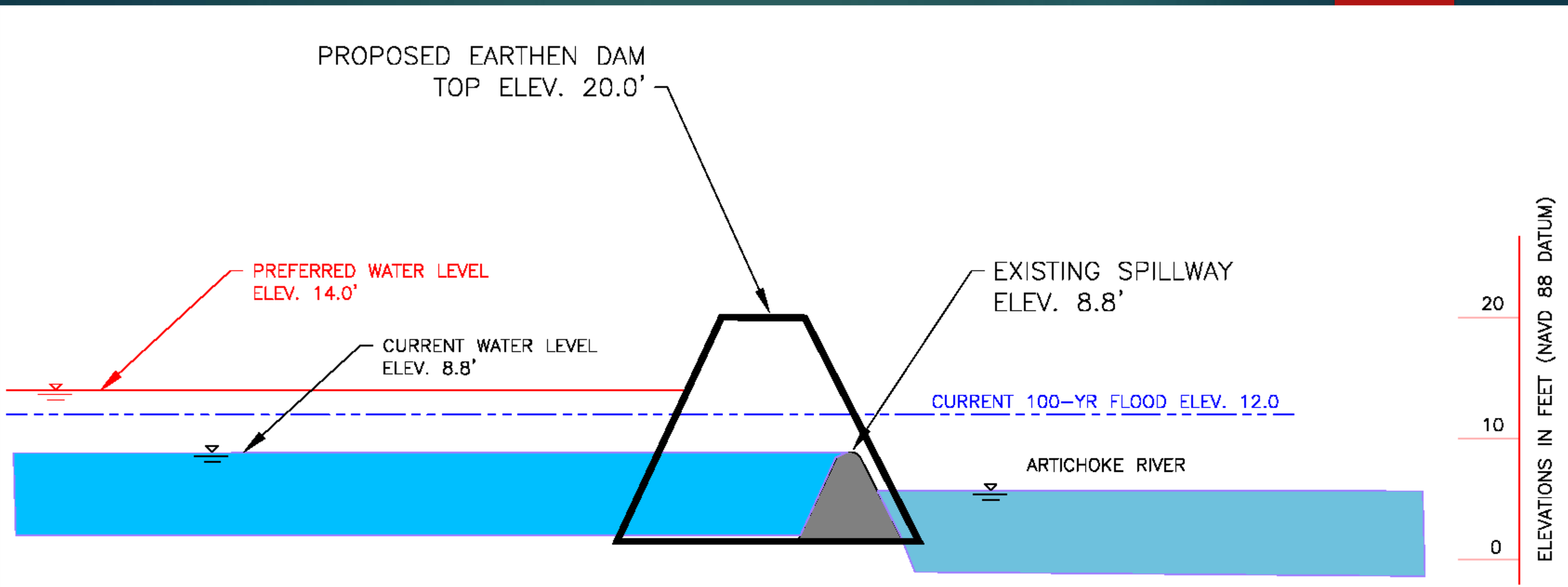
MOVIE CLIP FROM DRONE WORK

PROPOSED PROTECTIONS TO OUR SURFACE WATER SUPPLY:

1. Raise the Lower Artichoke Dam to prevent Merrimack River floodwaters from backing up into our reservoirs.
   a) Install flood control gates to mitigate rising sea levels.
   b) Work with MA DEP and DCR to determine if raising the reservoir levels for improvements to water quality and storage volumes are viable and what the consequences and costs will likely be.
2. Install the Indian Hill raw water transmission line.
3. Purchase more land to prevent more nutrient and pollutant loadings.
4. Stop pollutants, nutrients, and toxins from entering our water supplies. Install BMP's for treatment and prevention.

PROPOSED PROTECTIONS TO OUR SURFACE WATER SUPPLY (CONT.):

5. Remove nutrient-rich sediments from all reservoirs.
6. Seek new sources of water supply to meet future needs.
7. Provide an interconnect to a permanent source for emergency purposes.
8. Upgrades to the WTP to provide enhanced treatment methods to remove nutrients, toxins, algae, taste, and/or odors.

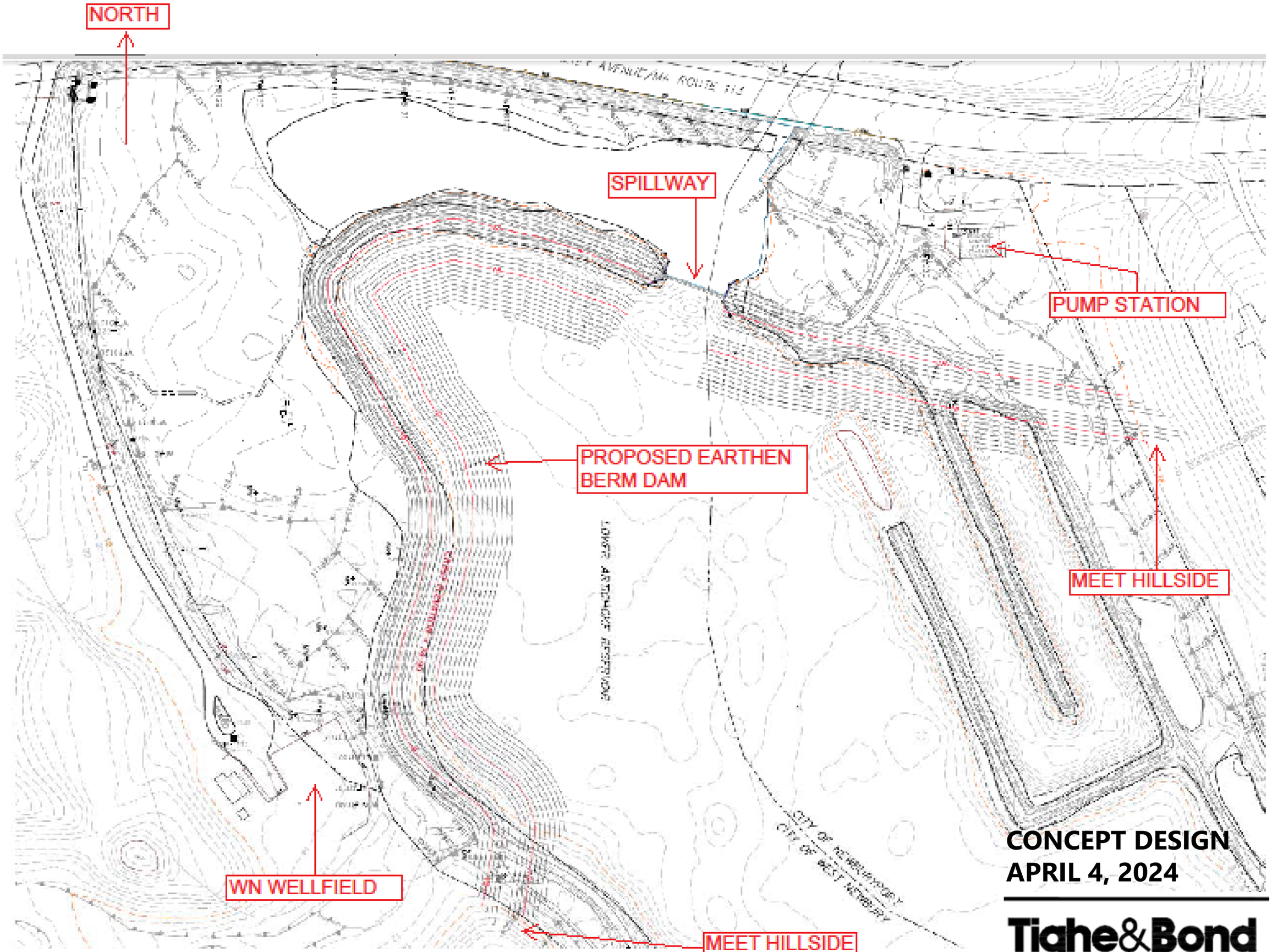


PROFILE

LOWER ARTICHOKE RESERVOIR DAM

CONCEPTUAL DESIGN

RAISE THE LOWER ARTICHOKE DAM

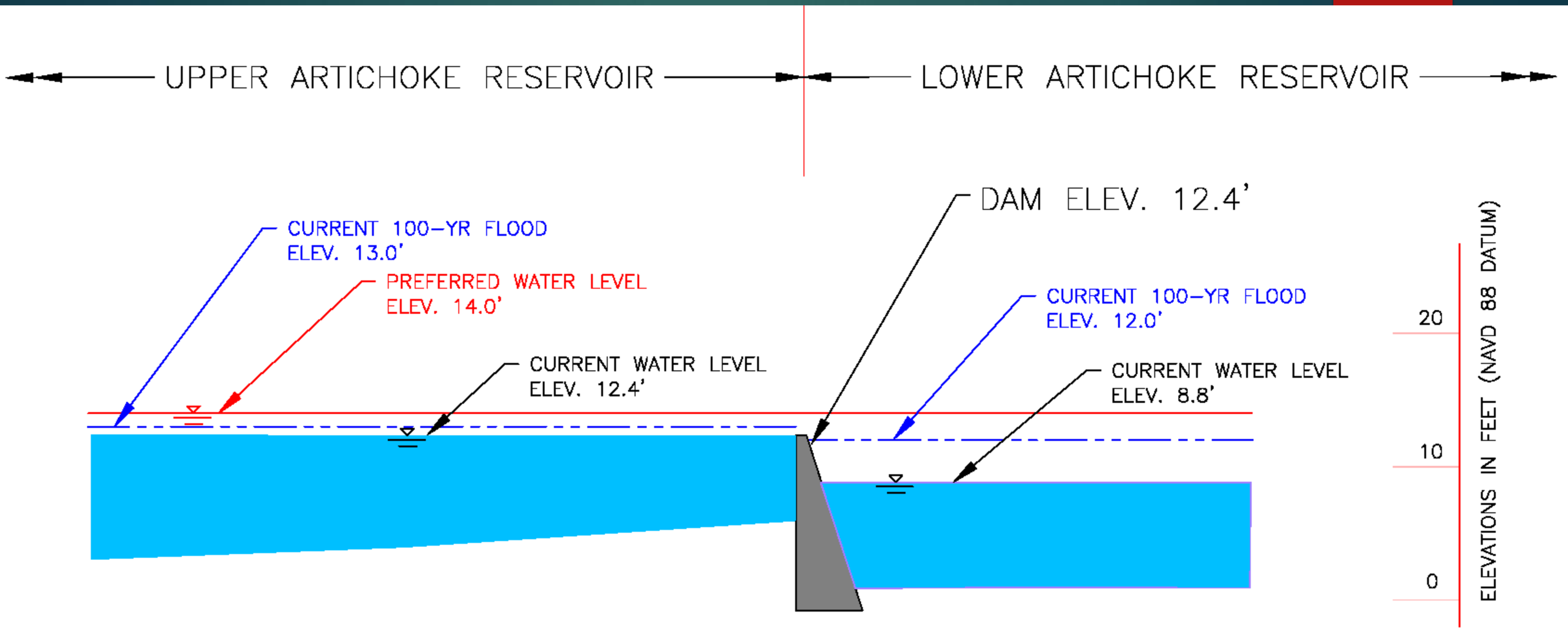


CONCEPT DESIGN
APRIL 4, 2024

Tighe&Bond
Engineers | Environmental Specialists

Courtesy of Tighe and Bond

Adjustable Flood Gates to Mitigate Rising Seas and Storms

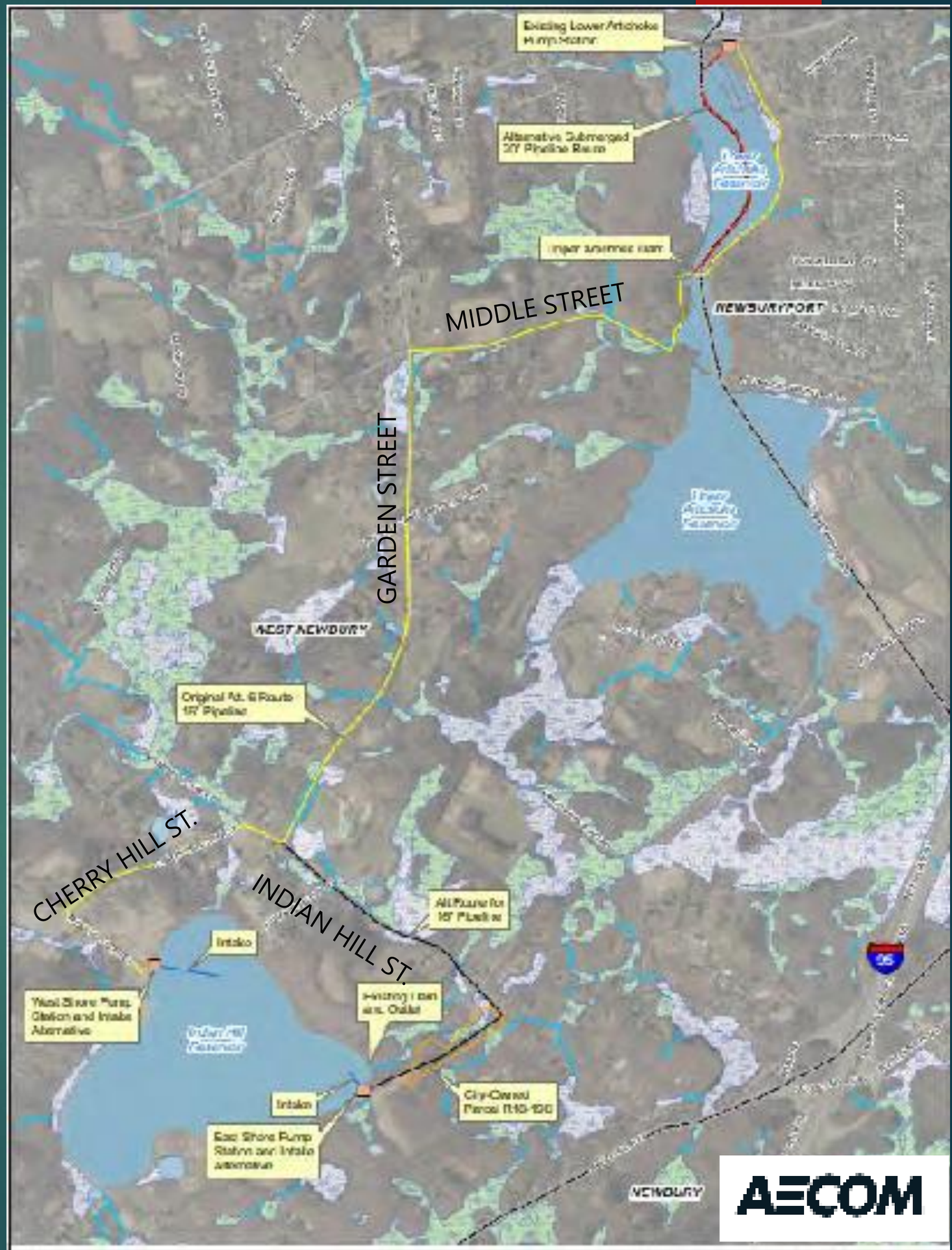


PROFILE

UPPER ARTICHOKE RESERVOIR DAM

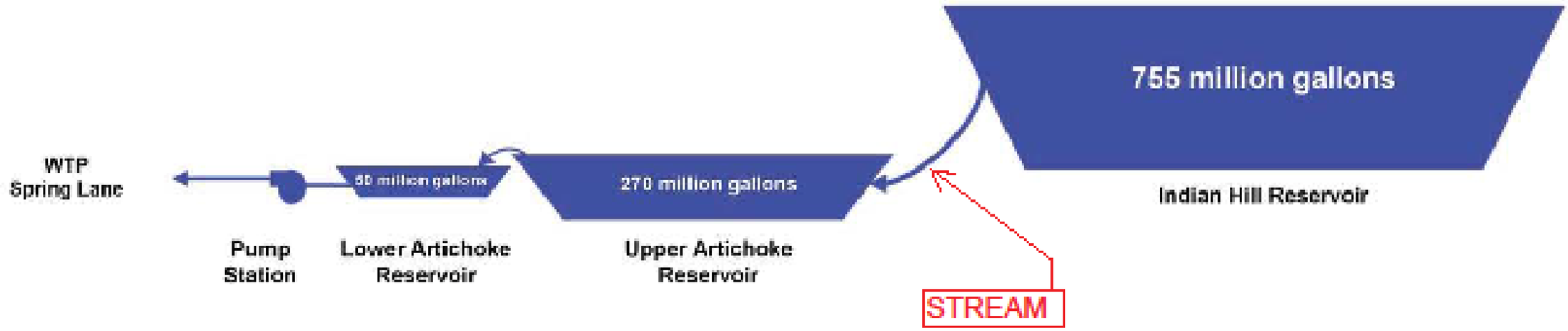
INDIAN HILL RESERVOIR WATER TRANSMISSION LINE AND PUMP STATION

- ELIMINATES LOST WATER IN STREAM FROM INDIAN HILL TO UPPER ARTICHOKE
- ALLOWS FOR REVERSE FLOW FOR WATER MANAGEMENT PURPOSES
- PROVIDES UNINTERUPTED WATER SUPPLY TO THE CITY IF THE ARTICHOKE RESERVOIRS ARE OUT OF COMMISSION

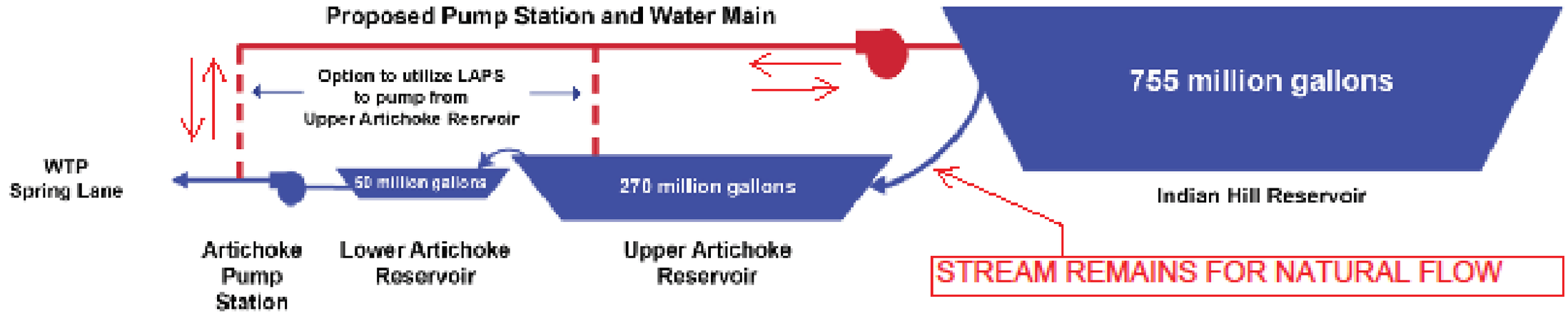


Proposed Raw Water Line from Indian Hill Reservoir

Existing Water Flow

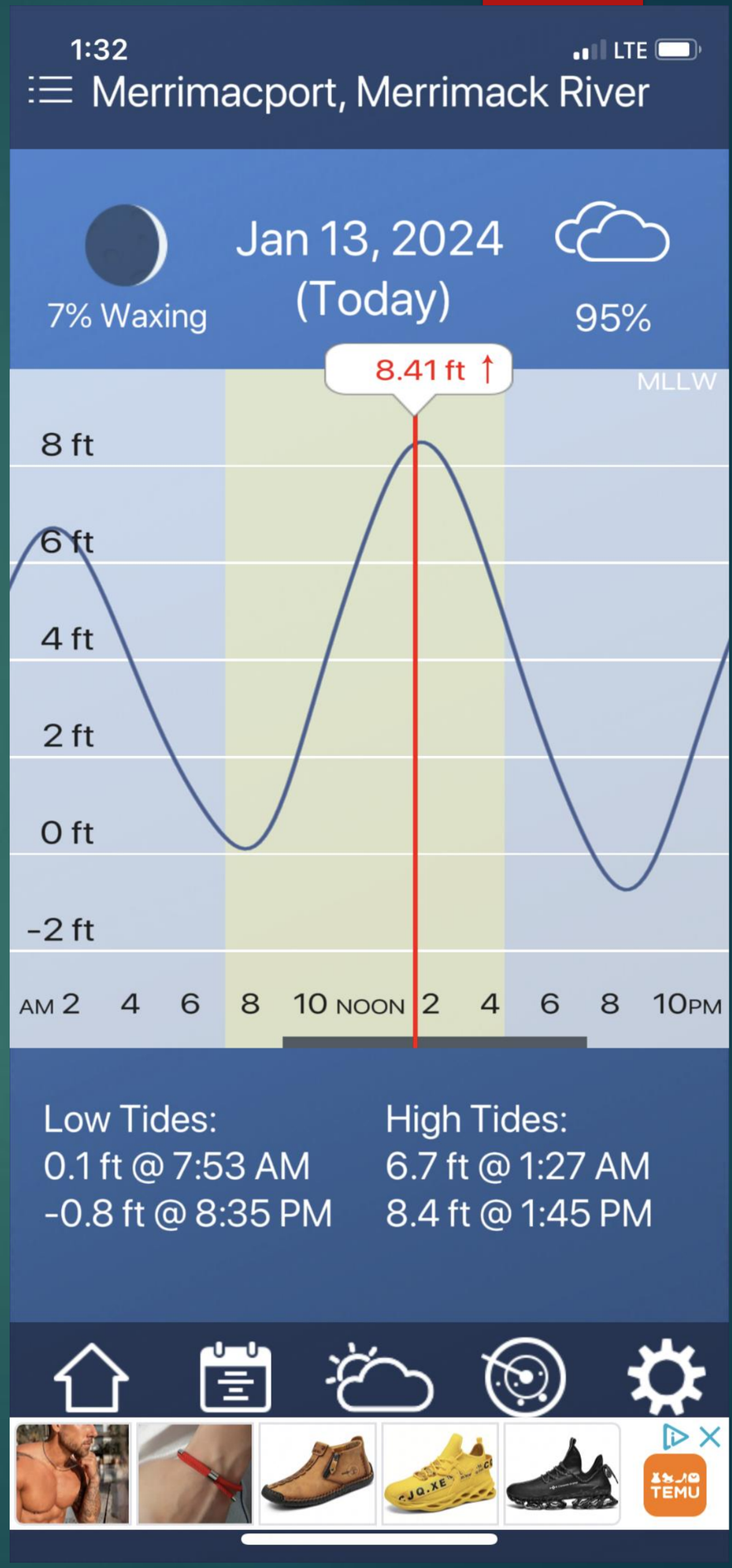


Proposed Raw Water Pipeline



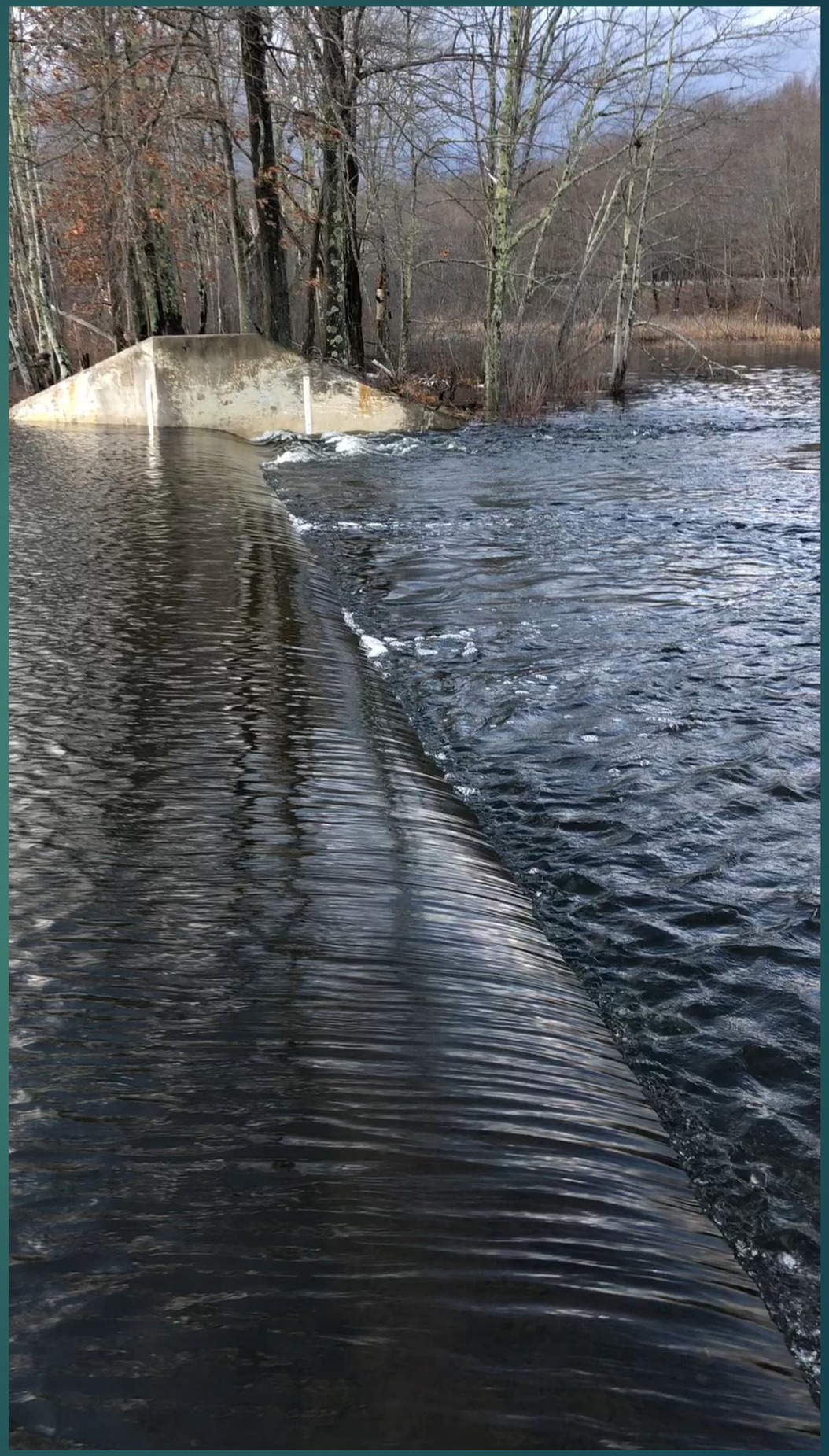
THE NO-NAME FLOOD OF JANUARY 13, 2024

- DPS ON-SITE
- PROTECTIVE MEASURES TAKEN
- NO INTRUSION INTO OUR INTAKE PIPE
- ARTICHOKE PUMP STATION SHUTDOWN AS A PRECAUTION
- ENTIRE EVENT LASTED UNDER AN HOUR



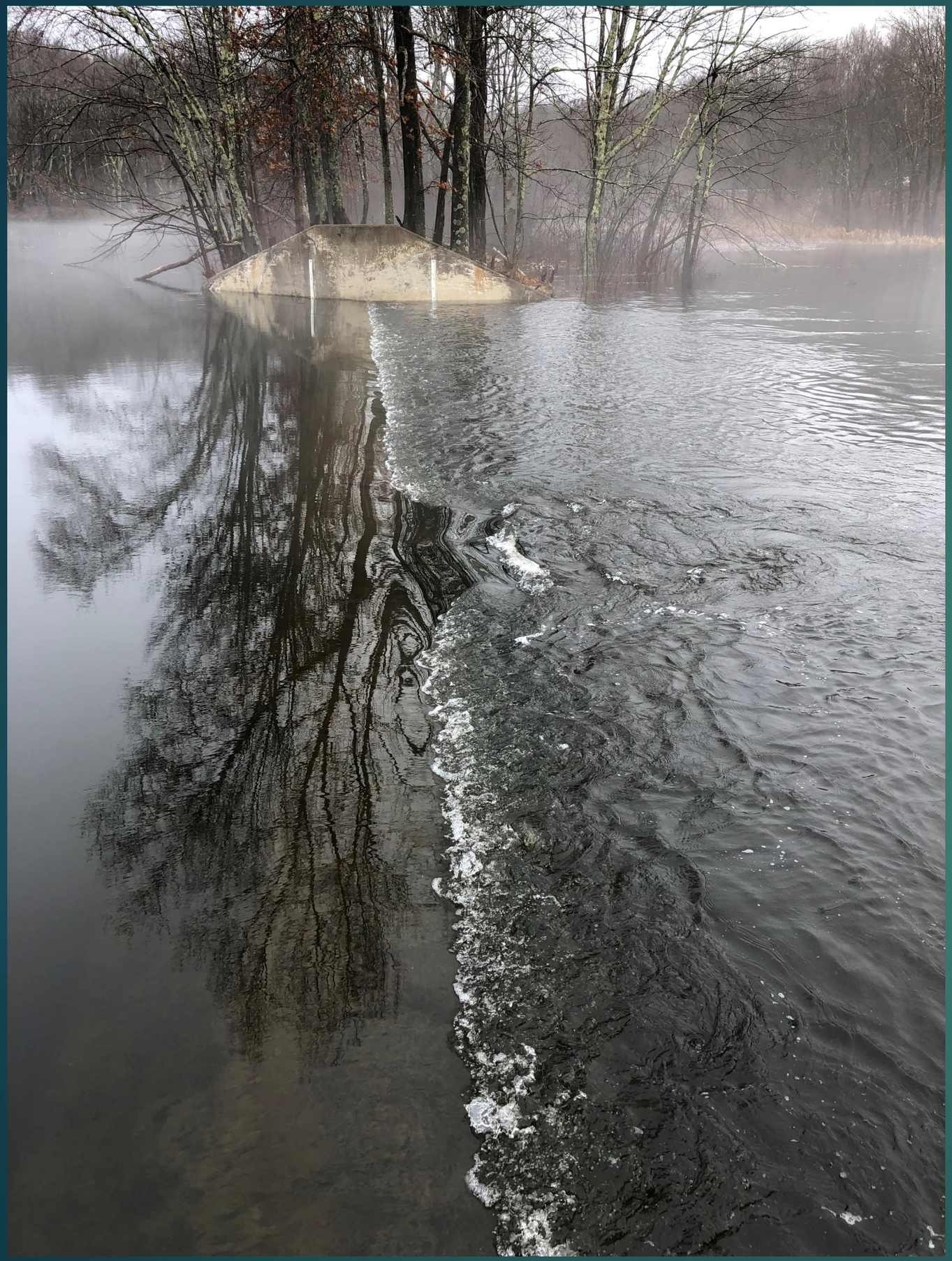
INCOMING TIDE JUST PRIOR TO BREACH

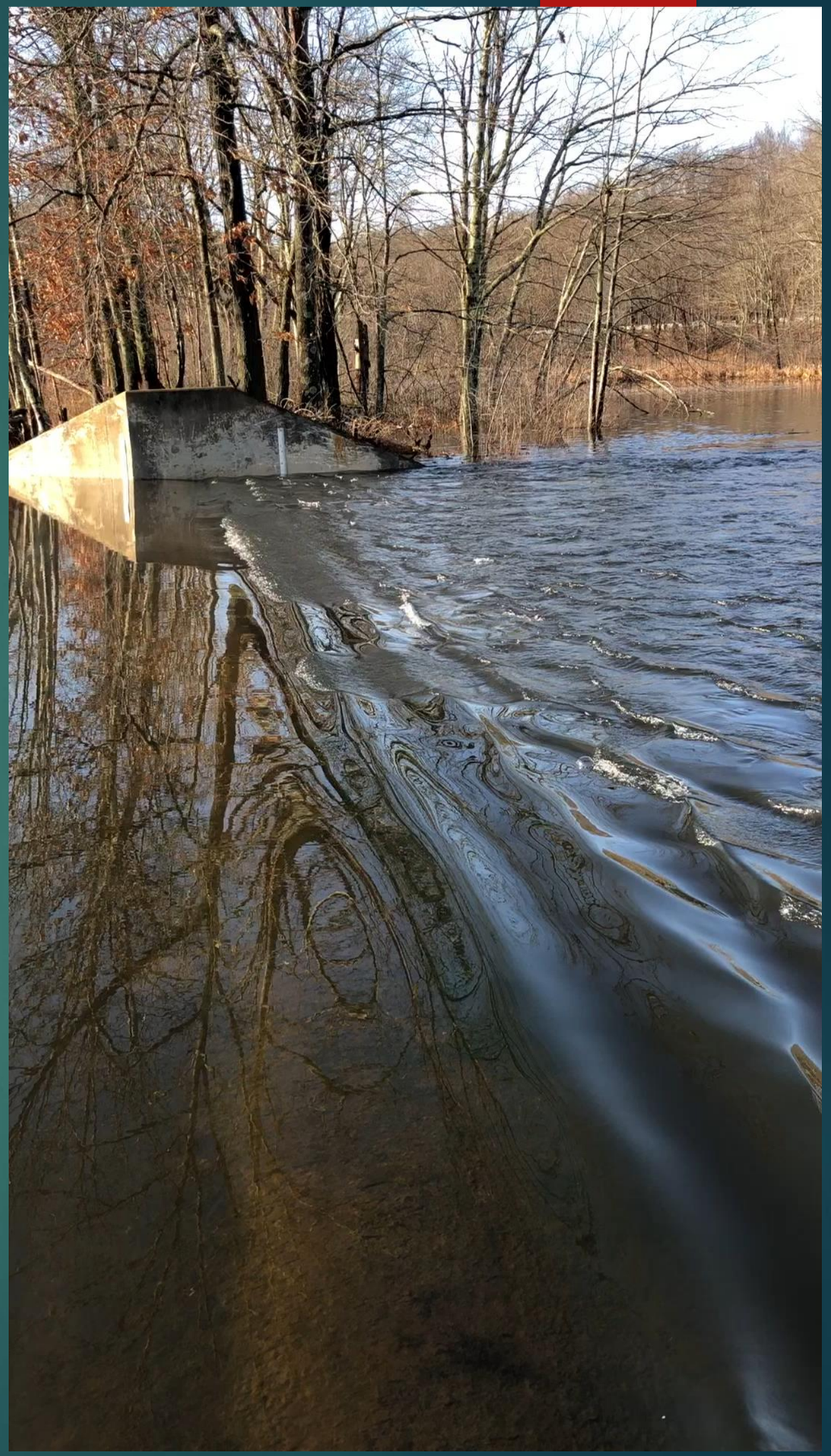
- RESERVOIR WATER LEVEL WAS HIGH SO WATER WAS FLOWING OVER THE SPILLWAY
- THIS HELPS PUSH BACK DOWNSTREAM WATER
- BREACHES ARE MORE WORRISOME IF THE RESERVOIR WATER LEVEL IS BELOW THE TOP OF THE SPILLWAY



PEAK TIDE - MINOR BREACH

- WATER THAT OVERTOPPED THE SPILLWAY WAS JUST DISCHARGED FROM THE RESERVOIR (i.e. CLEAN WATER)
- MERRIMACK RIVER WATER WAS 2,000’+ DOWNSTREAM





TIDE HEADING OUT

Questions?