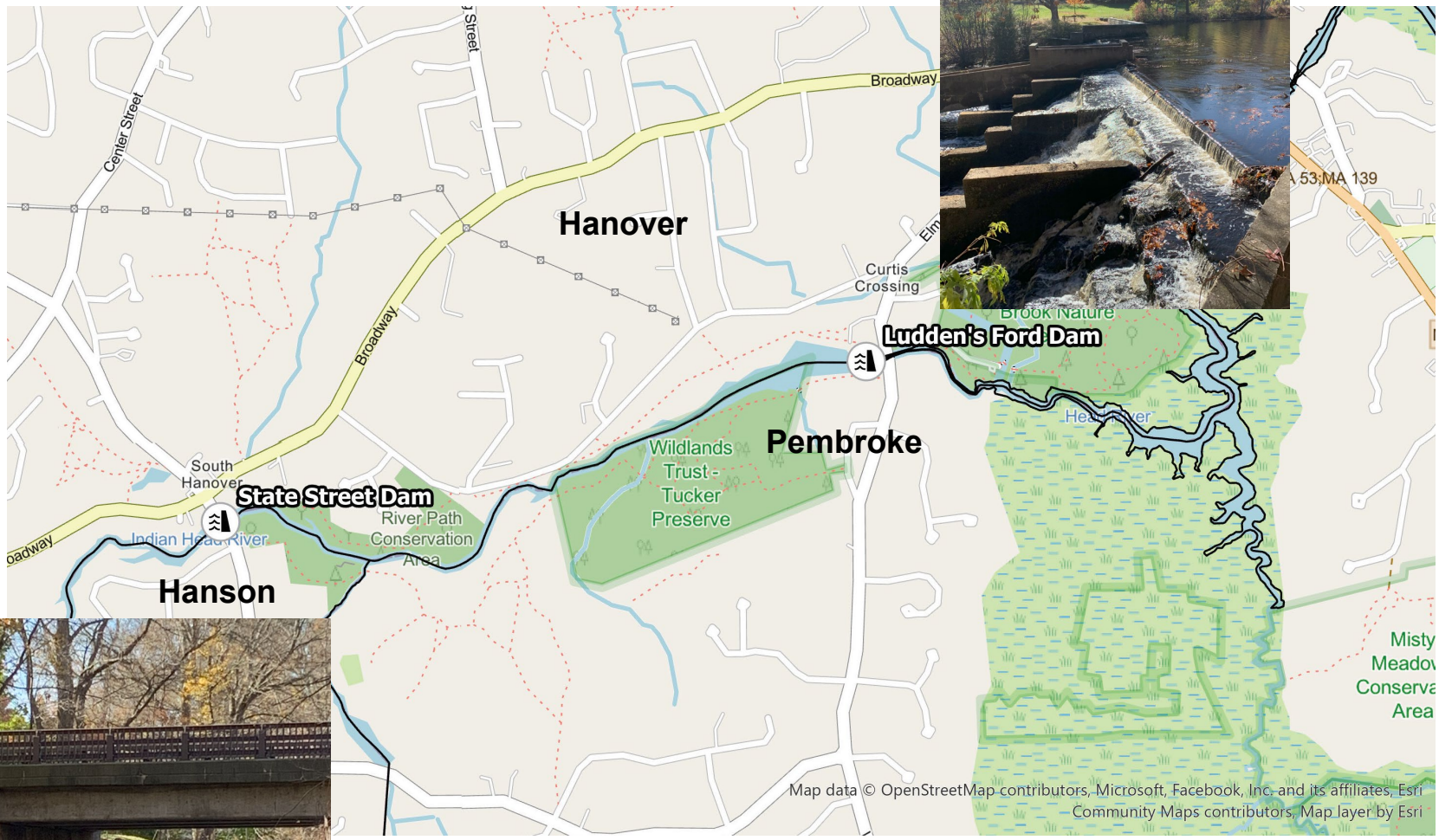
INDIAN HEAD RIVER RESTORATION (IHRR):
RECONNECTING OUR RIVERS AND ESTUARIES

50 YEARS
1970 2020
NSRWA


Broadway
Center Street
Hanover
Curtis Crossing
Ludden's Ford Dam
Pembroke
Wildlands Trust - Tucker Preserve
South Hanover
State Street Dam
River Path Conservation Area
Indian Head River
Hanson
Misty Meadow Conserva Area
Map data © OpenStreetMap contributors, Microsoft, Facebook, Inc. and its affiliates, Esri Community Maps contributors, Map layer by Esri

IHRR Project Objectives

Restore native fish habitat

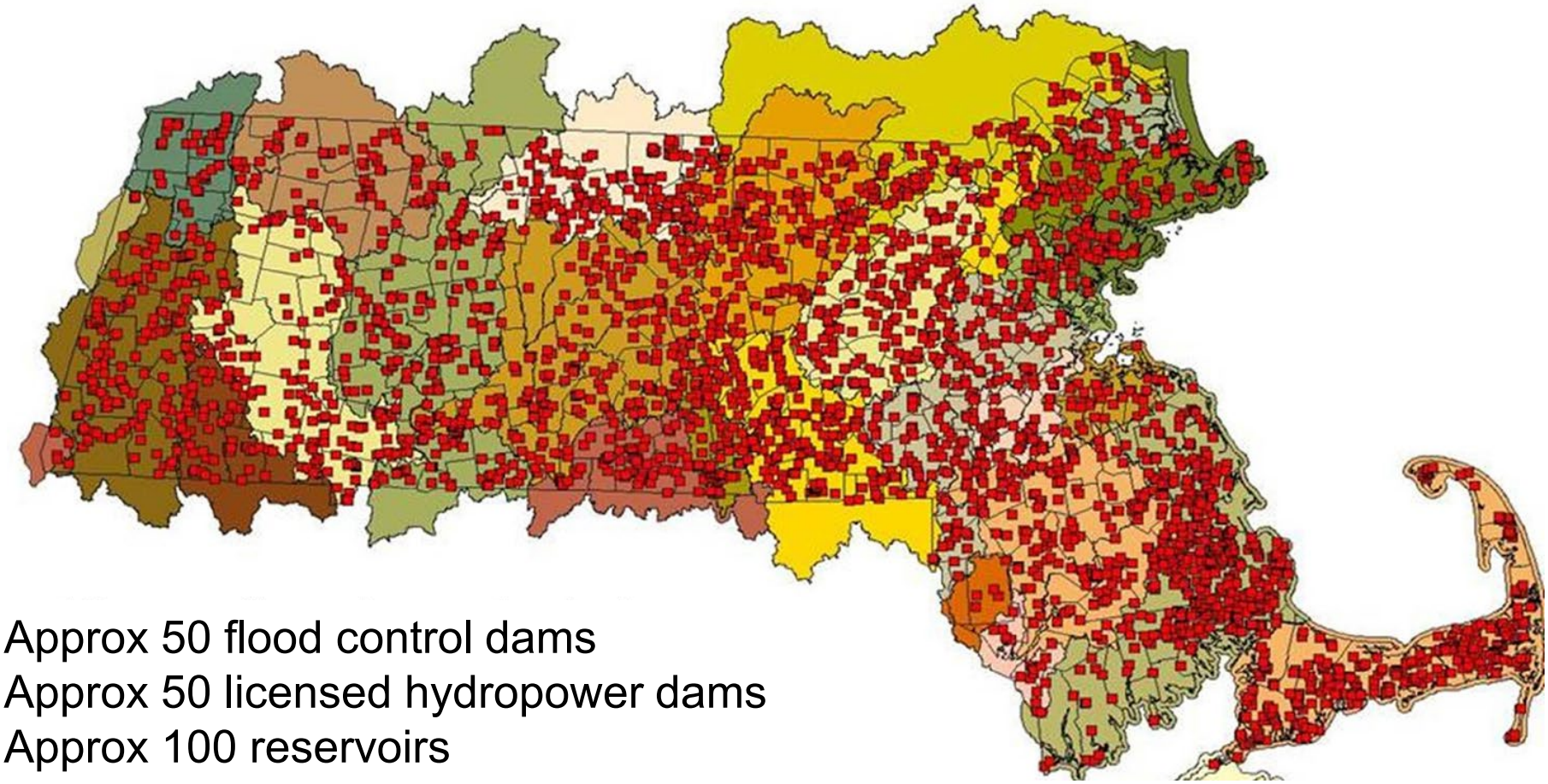
Remove aging infrastructure

Reduce liability for dam owners

Improve water quality, aquatic habitat and natural riverine processes

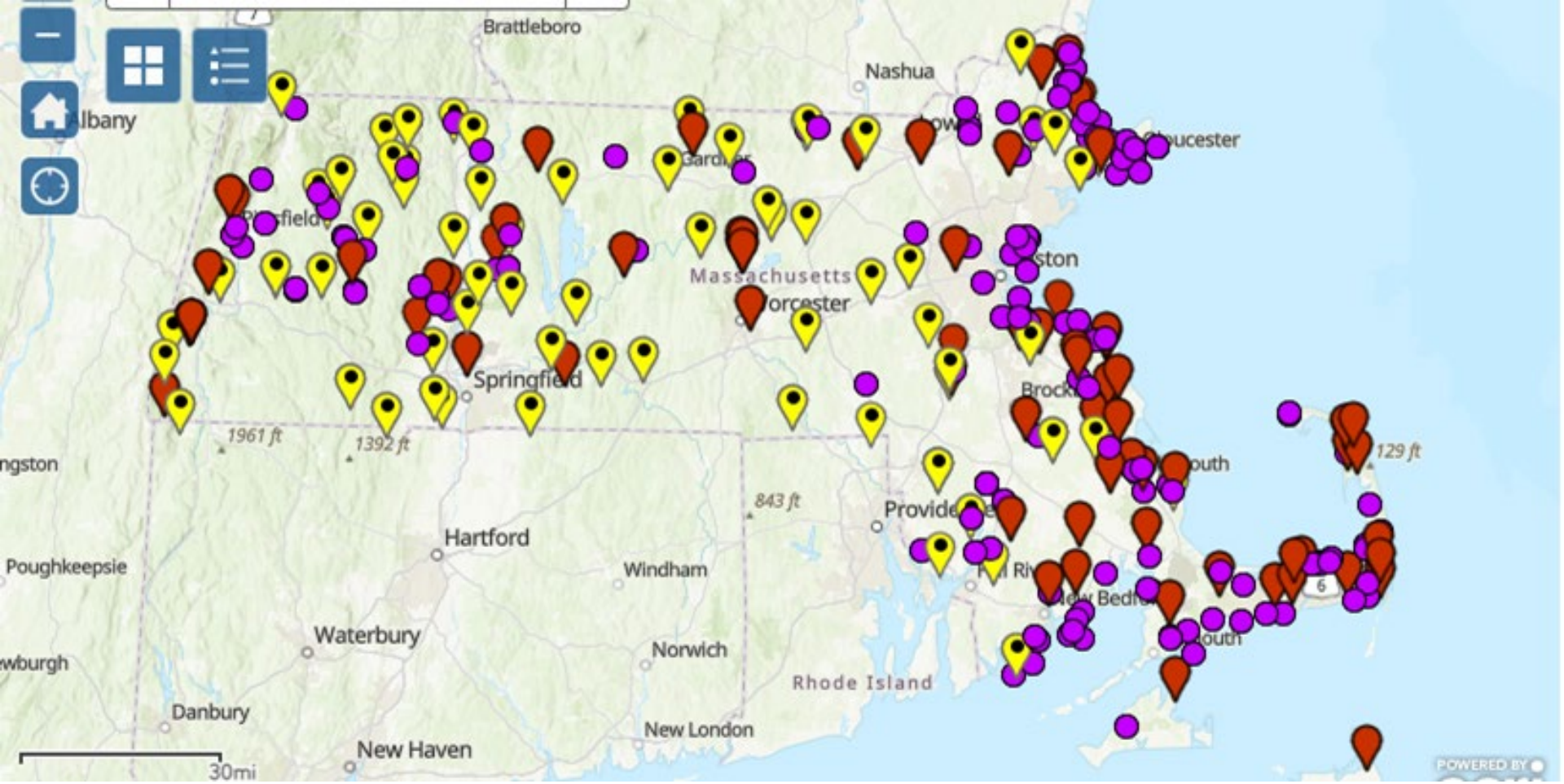
Eliminate ongoing maintenance

Increase resilience to climate change



Approx 50 flood control dams
Approx 50 licensed hydropower dams
Approx 100 reservoirs

OVER 3,000 DAMS IN MASSACHUSETTS



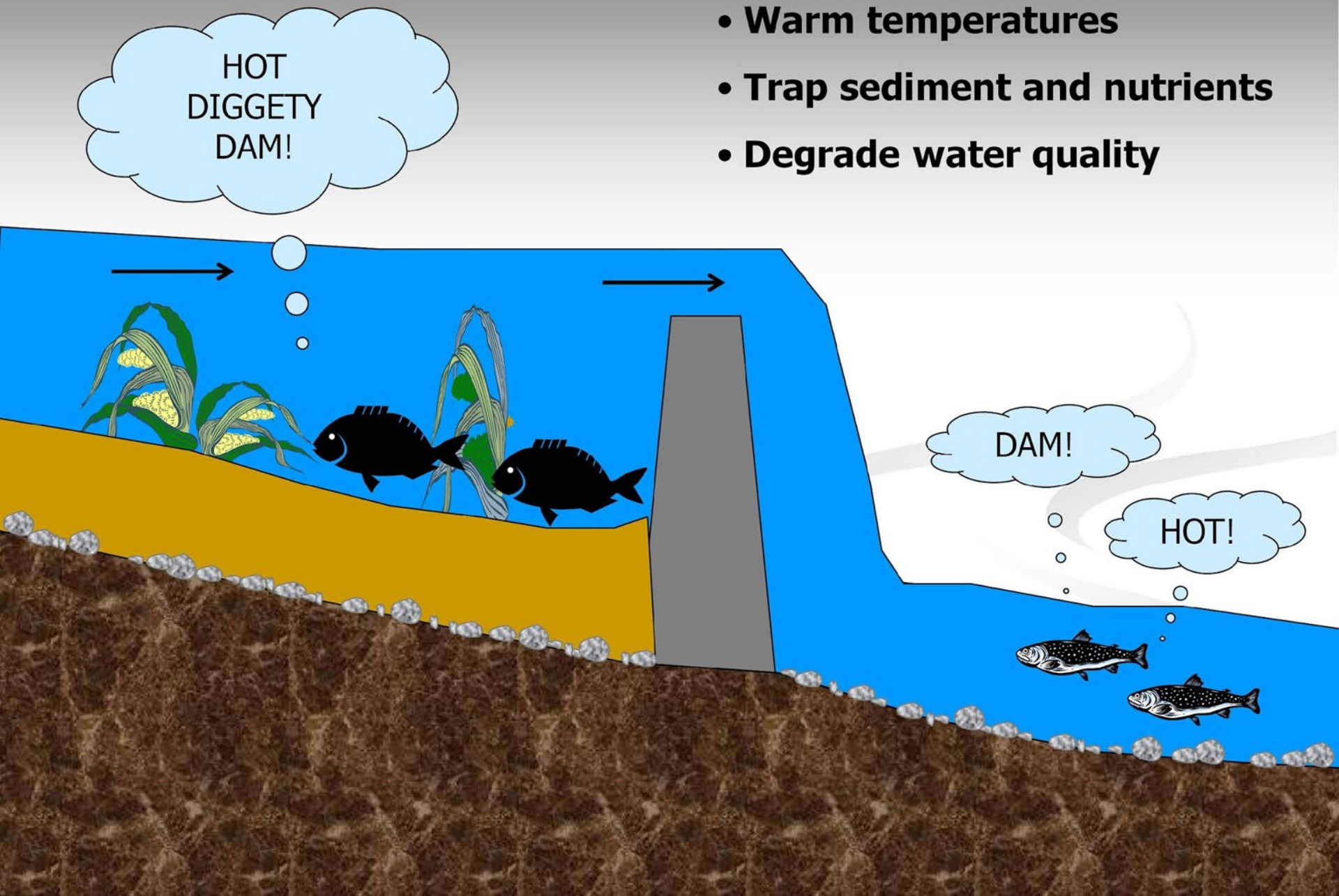
DAM REMOVAL IN MASSACHUSETTS

Map Legend

- Culvert Replacement Municipal Assistance Grant
- Active Project
- Completed Project

Impacts of Dams on Rivers

- Block fish passage
- Warm temperatures
- Trap sediment and nutrients
- Degrade water quality



MassDEP Natural Resource Damages Fund

MassDEP received $6.9M in bankruptcy funds to restore natural resources injured by the Former National Fireworks Site. Injured natural resources include sediment, surface water, fisheries, aquatic life, and fish consumption advisories.

These funds are separate from the funds that are to be used for cleanup at the Fireworks Site and can only be used towards restoration.

Ludden's Ford and State Street/Cross Street Dam Removals Restoration Feasibility Project

December 5, 2023

Sondra Shah, Inter-Fluve
Neal Price, Horsley-Witten

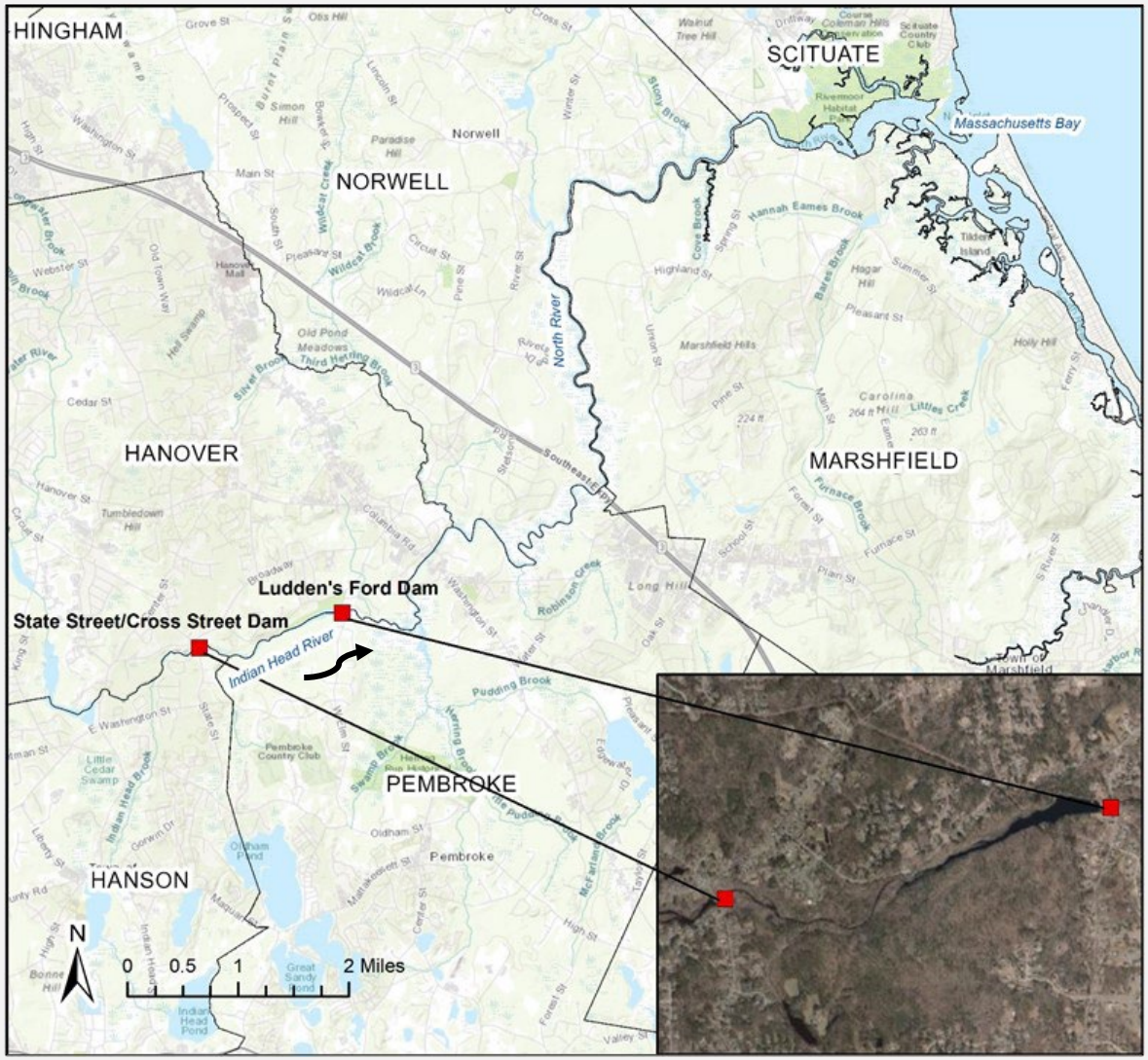
Outline:

- Work Completed by Team
- Findings of Feasibility Study
- Case Studies

The Team

- Consultants:
  - Inter-Fluve
  - Horsley-Witten
  - Herring Pond Tribe
  - Public Archaeology Lab (PAL)
- IH Steering Committee:
  - Towns of Hanover, Pembroke, and Hanson
  - North and South Rivers Watershed Association (NSRWA)
  - MassDEP's Natural Resource Damages Program

Overview Map



Existing Conditions at Ludden's Ford

Existing Conditions at State St/Cross St

Dam Removal Process

- Concepts
- Feasibility Study
- Fundraising
- Preliminary Designs
- Permitting and community outreach
- Fundraising
- Final Designs
- Fundraising
- Bidding
- Construction
- Monitoring

- Review Existing Conditions
- Evaluate Feasibility of Removal
- Determine costs, benefits, impacts of removal and other alternatives
- Develop Conceptual Plans
  - Consideration for regulatory framework

Assessment and Investigation

- Cultural resources assessment
- Hydrology and Hydraulics (flow and flooding)
- Sediment sampling, analysis and management planning

Cultural Resources Assessment

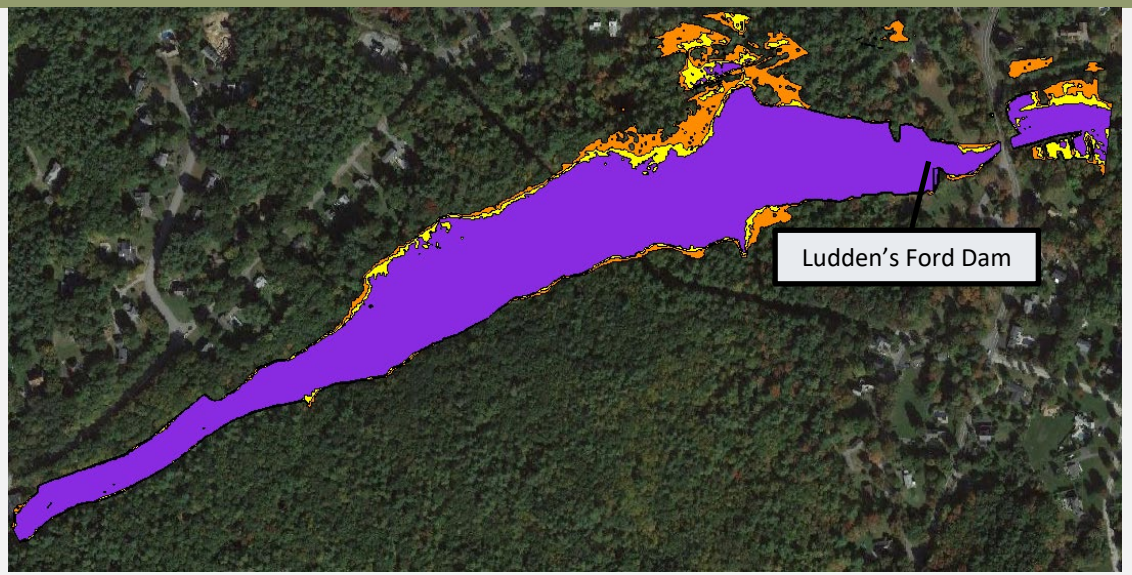
- Native Americans relied on the IH River for food, transport, and more.
  - Pre-contact Native American archaeological sites were discovered on both sides of Ludden's Ford Dam in the 1980s/90s.
- European settlers began harnessing the IH River in the late 17th century.
  - Saw mill (wood)
  - Grist mill (grain)
  - Carding mill (wool)
  - Tack and nail factory (tacks for shoes, furniture, upholstery, carpet)
  - Iron works forge (anchors and cannonballs)
  - Rubber plant

Cultural Resources Assessment

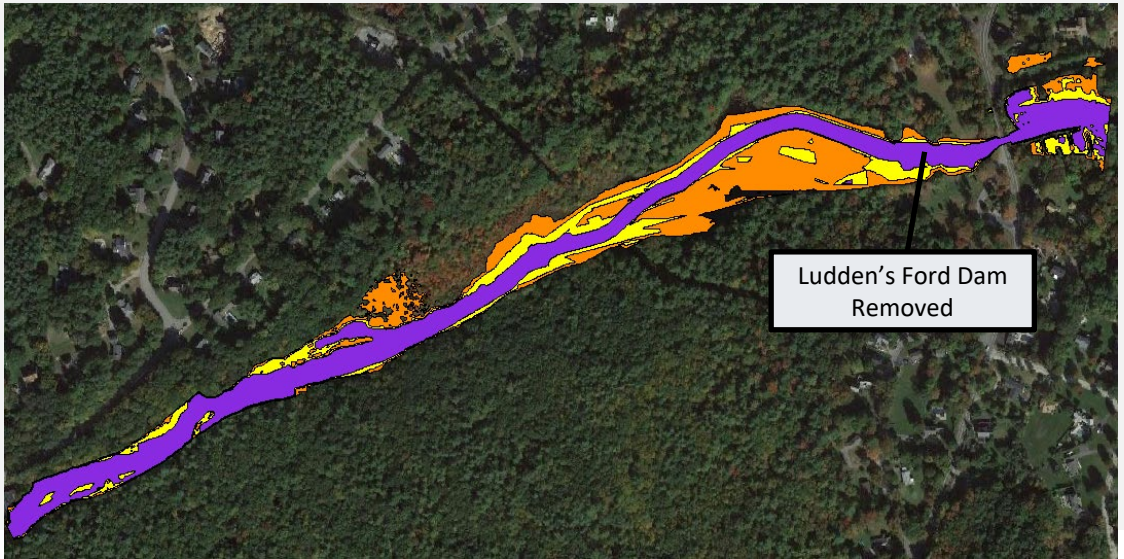
- Both sites characterized as high sensitivity for pre-contact Native American cultural deposits and post-contact industrial archaeological resources.
  - Dam removals will have no effect on historic architectural resources, provided measures are taken to protect the historic Elm Street Bridge.
- Understanding the history of industrial land use for manufacturing informed sediment sampling.

Ludden's Ford Flood Mapping (2, 10, and 100-year flood events)

Existing



Proposed

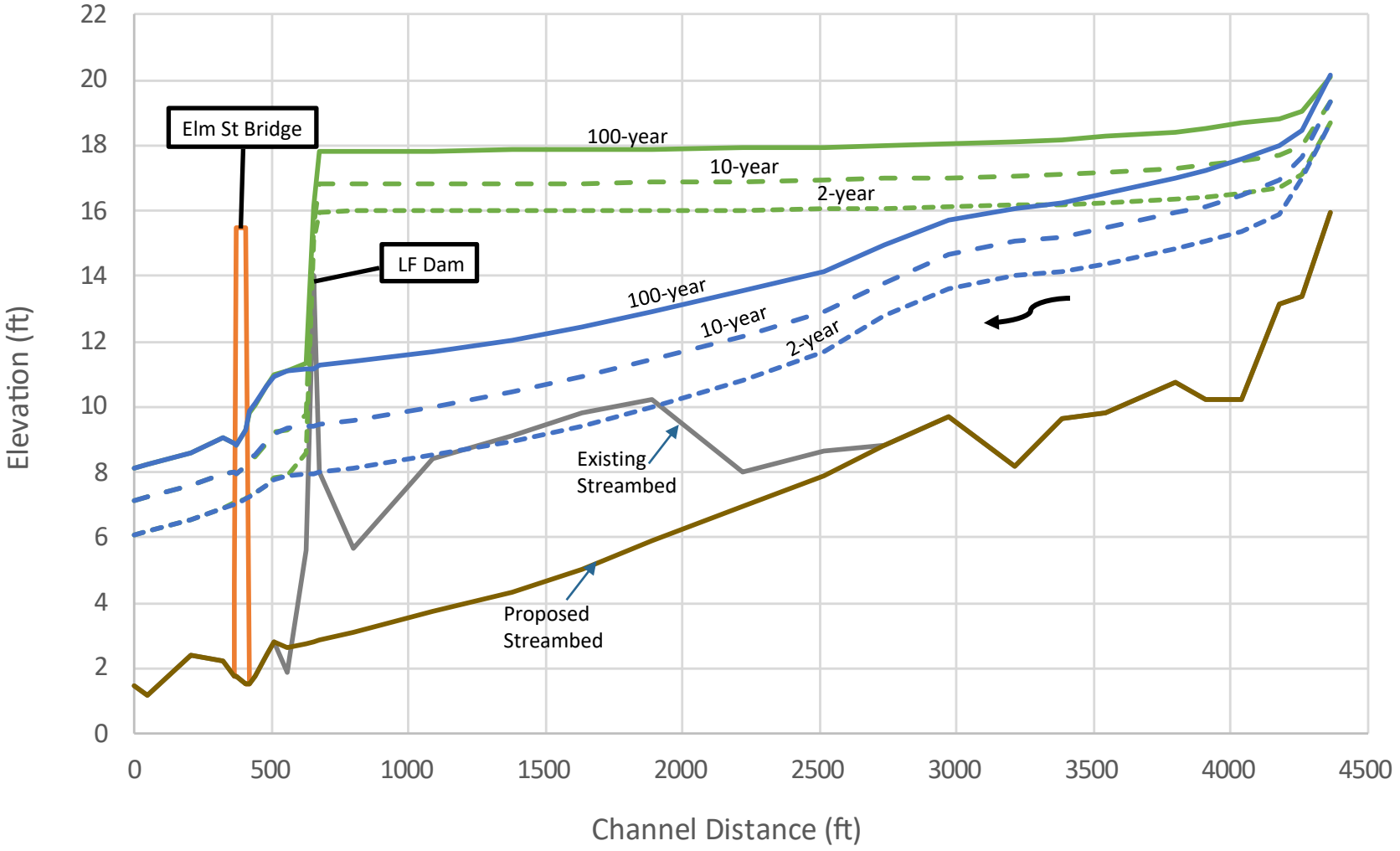


2-year

10-year

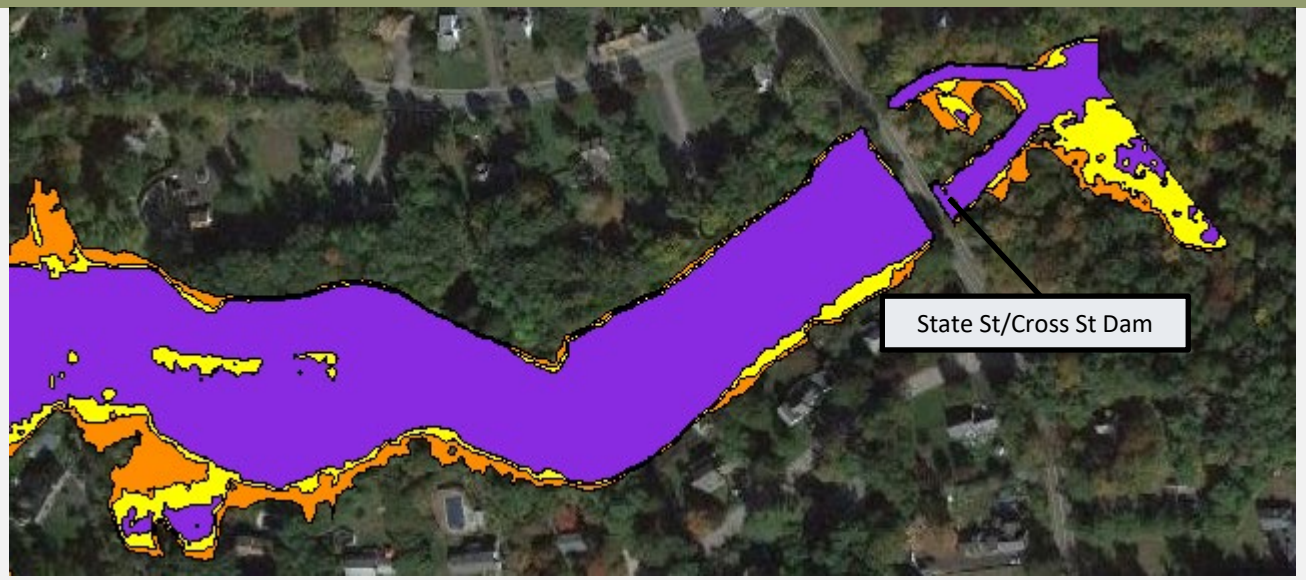
100-year

Ludden's Ford:
Existing (green) vs Proposed (blue) Water Surface Profiles

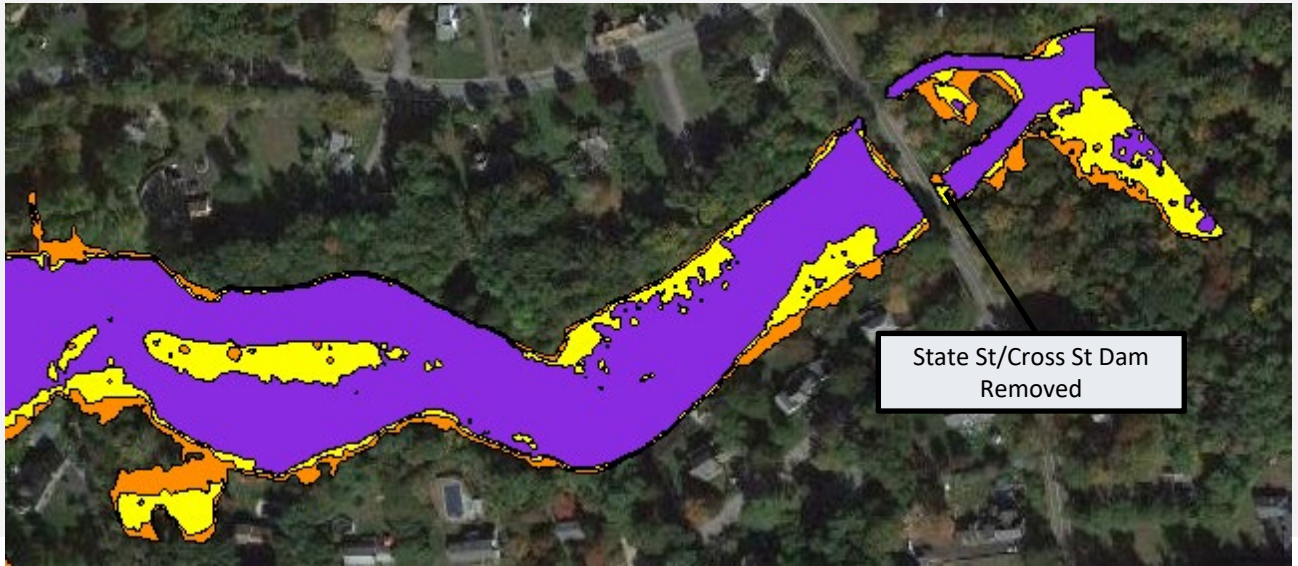


State St/Cross St Flood Mapping (2, 10, and 100-year flood events)

Existing



Proposed

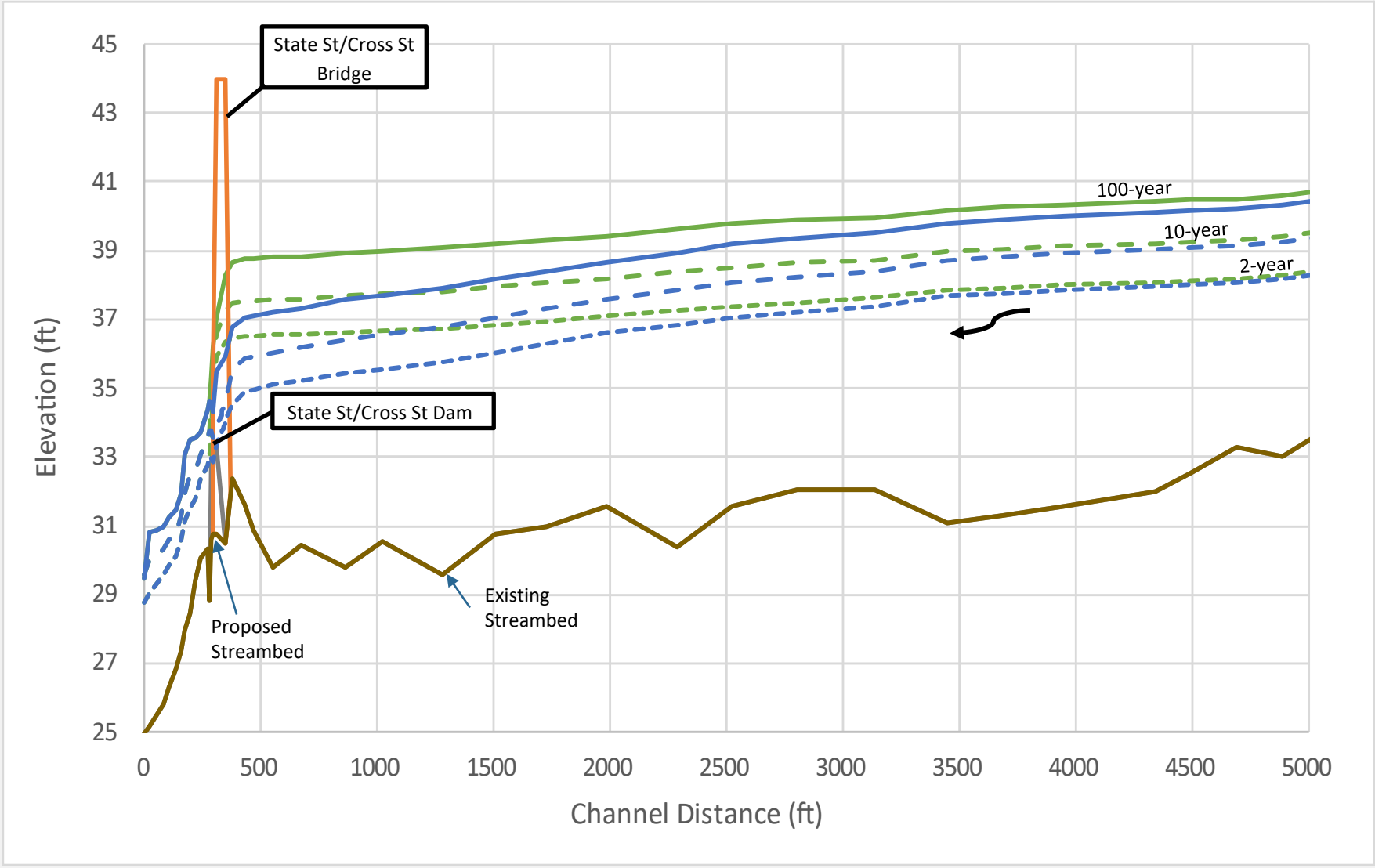


2-year

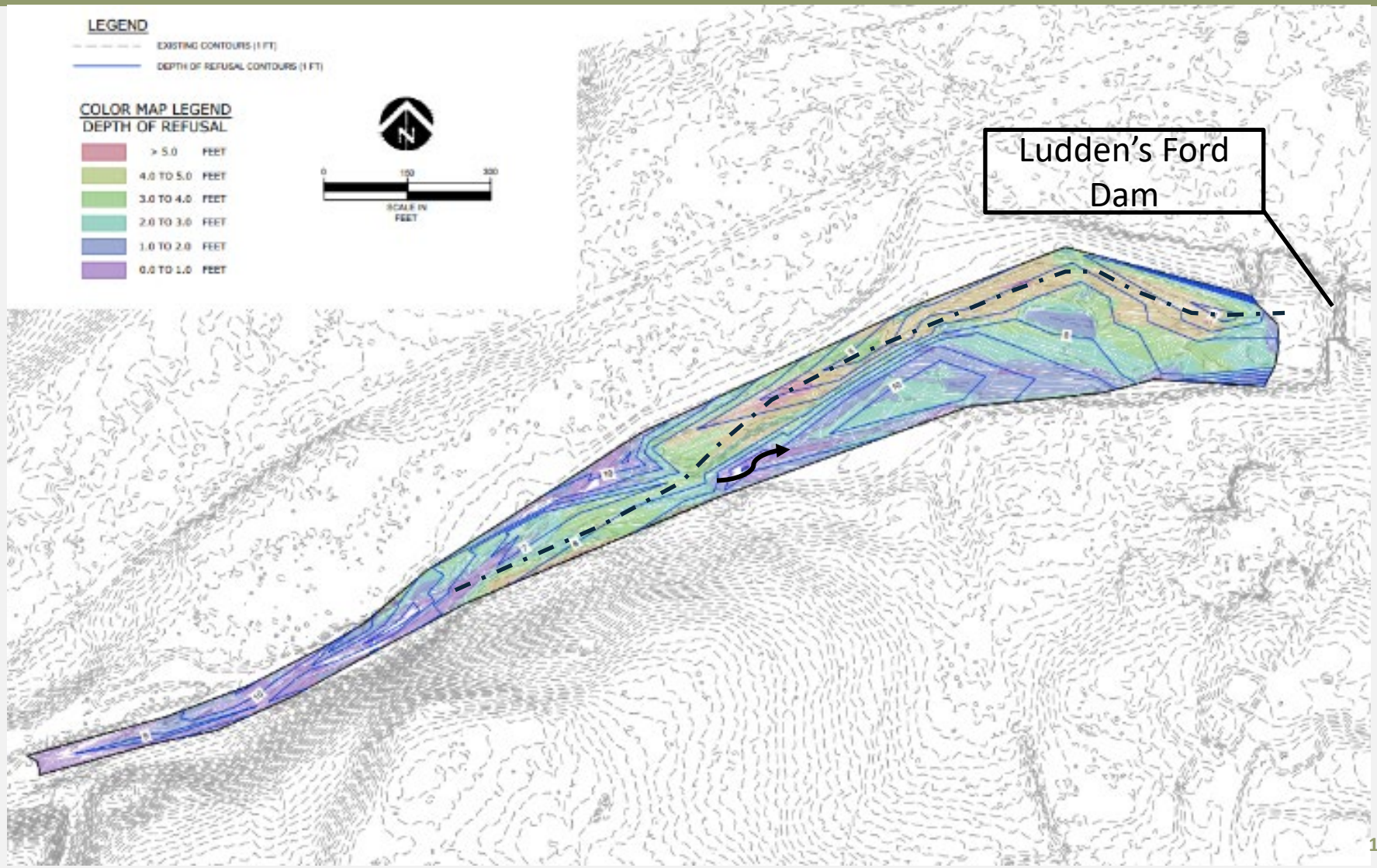
10-year

100-year

State St/Cross St:
Existing (green) vs Proposed (blue) Water Surface Profiles



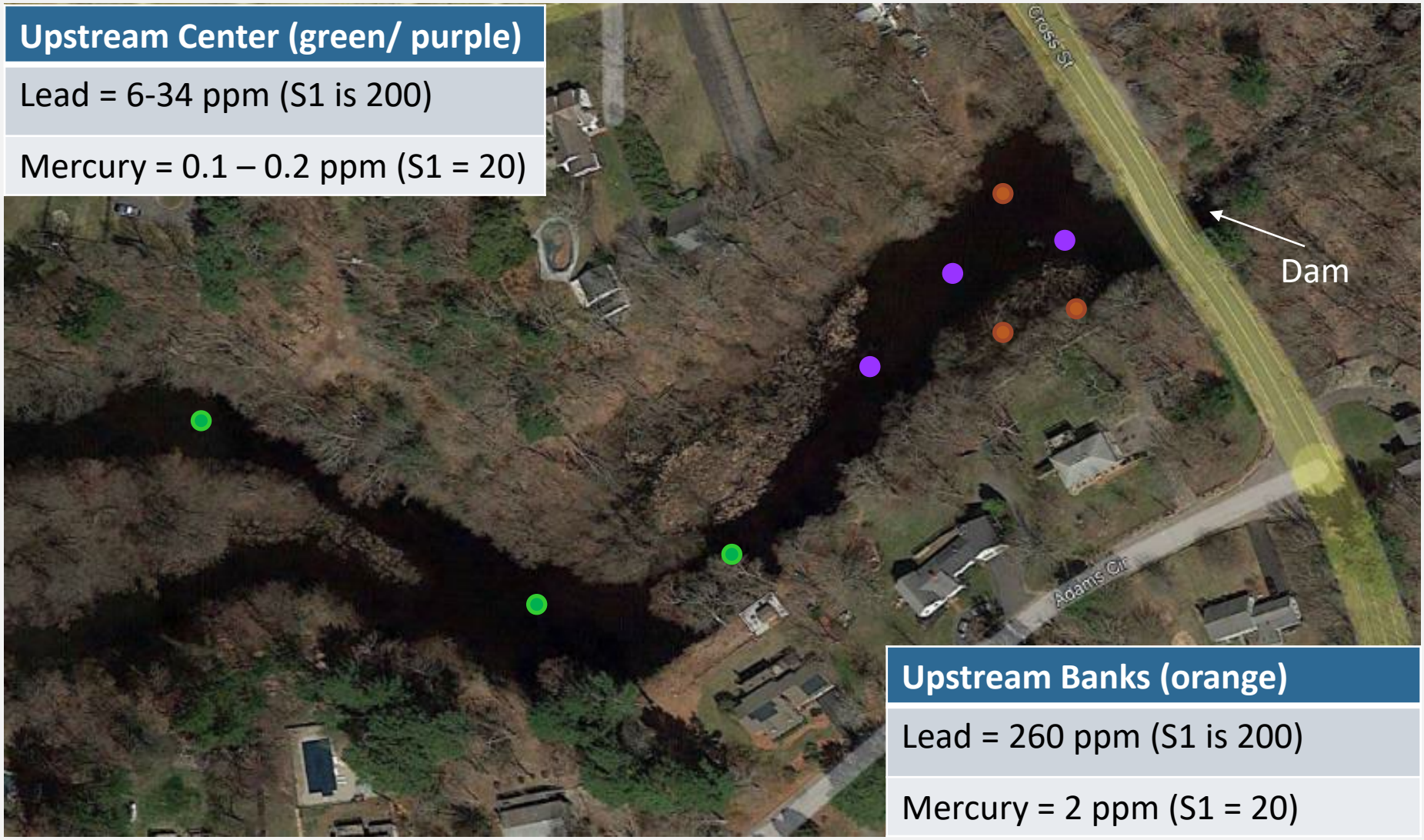
Sediment Depth Analysis



Sediment Sampling Plan

- Developed sediment sampling plan based on:
  - Due diligence review
  - MassDEP 401 WQC Regulations
  - Site Conditions
  - Mass DEP comments
- Took a total of 7 composite samples (3 cores per sample)
  - Downstream of Ludden's Ford: 1 sample
  - Ludden's Ford Impoundment: 3 samples
  - State St/Cross St Impoundment: 3 samples

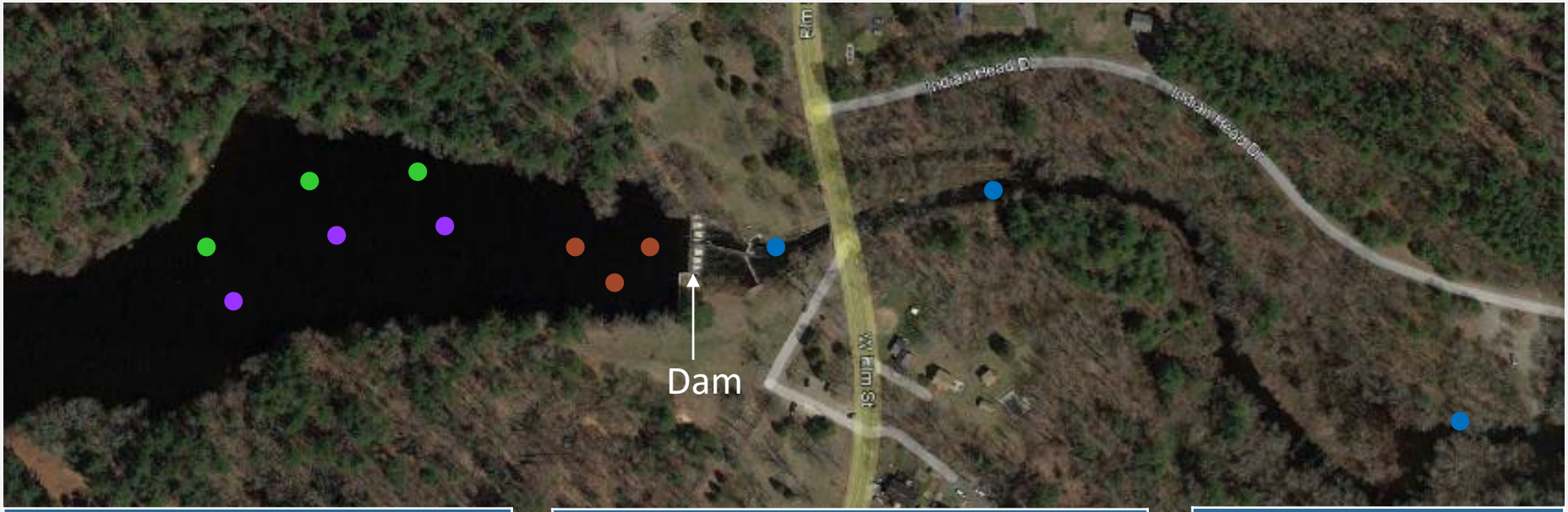
State St/Cross St
Sediment Sampling Locations and Results



Upstream Center (green/ purple)
Lead = 6-34 ppm (S1 is 200)
Mercury = 0.1 – 0.2 ppm (S1 = 20)

Upstream Banks (orange)
Lead = 260 ppm (S1 is 200)
Mercury = 2 ppm (S1 = 20)

Ludden's Ford
Sediment Sampling Locations and Results



Upstream Left (green)	Upstream Center (purple/orange)	Downstream (blue)
Lead = 453 ppm (S1 is 200)	Lead = 57 - 380 ppm	Lead = 302 ppm
Mercury = 46 ppm (S1 = 20)	Mercury = 0.1 - 19 ppm	Mercury = 0.2 ppm

Sediment Results in Context

- 4/7 samples had concentrations of lead and/or mercury that exceed MassDEP S1 standards. Generally 1-2X S1 standards.
- 7/7 samples had concentrations of lead and/or mercury that exceed MassDEP ecological screening values.
- Concentrations of lead in both impoundments were similar to the concentrations of lead downstream of Ludden's Ford.
- Highest concentrations above both dams along riverbanks.

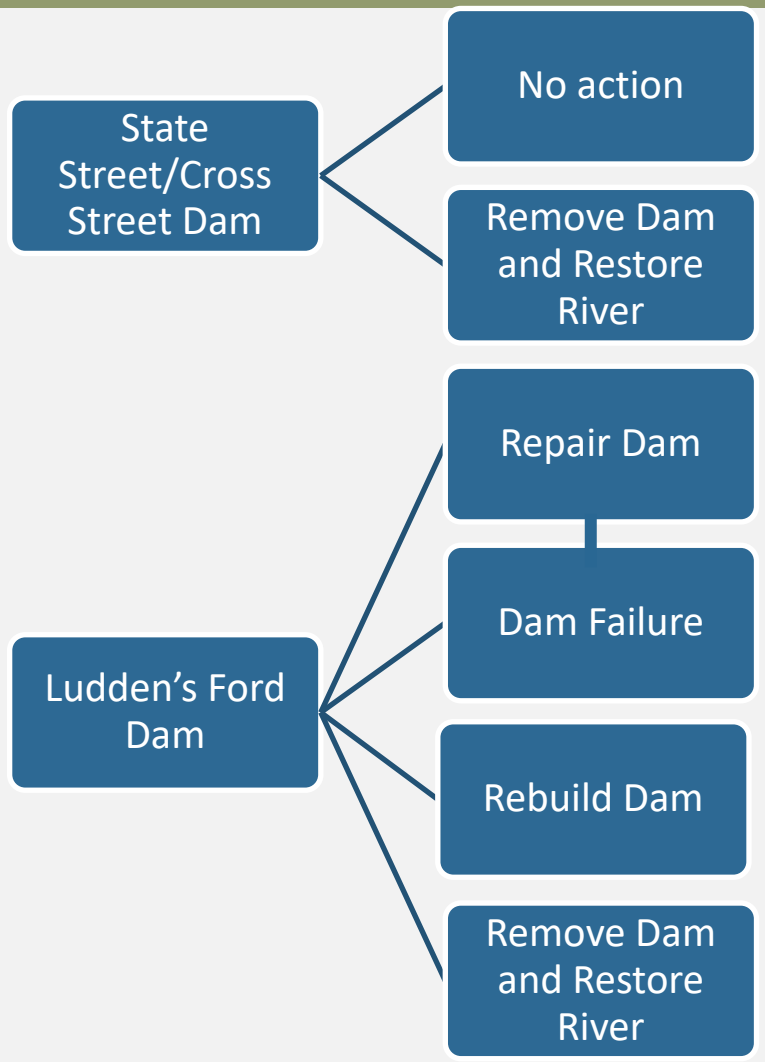
Sediment Results in Context

- Concentrations of mercury are 33-50% less than what was found in Factory Pond.
- Concentrations of lead are 50-95% less than what was found in Factory Pond.
- Results are consistent with similar former industrial dam settings.
- More sampling will be needed to better refine extents of higher metal concentrations.

Sediment Management Alternatives

- Passive Downstream Release: sediment is not managed and allowed to evacuate the impoundment naturally.
- Partial Removal: sediment is excavated and removed from higher metals concentration areas and from portions of the designed channel. Remaining sediment allowed to passive release.
- Partial Stabilization: higher metals concentration areas are stabilized in place. Remaining sediment allowed to passive release.
- Full Removal: all mobile sediment is excavated from the impoundment.
- Excavated sediment may be placed on site and capped with clean soil or removed from the site.

Decision Making Tree



Dam Repair

Dam Repair

Pros:

- Quick fix
- Keep flat water recreation

Pro/Con: Delay sediment management

Cons:

- Major improvements are needed
- Annual maintenance
- Safety concerns
- Legal & liability concerns for Towns
- Dams will continue to alter IH River ecosystem
- Historic fish run, important to Tribes, still blocked

Cost to repair: $800,000 over 50 years

https://www.youtube.com/watch?v=t0UNUwGWlB0be

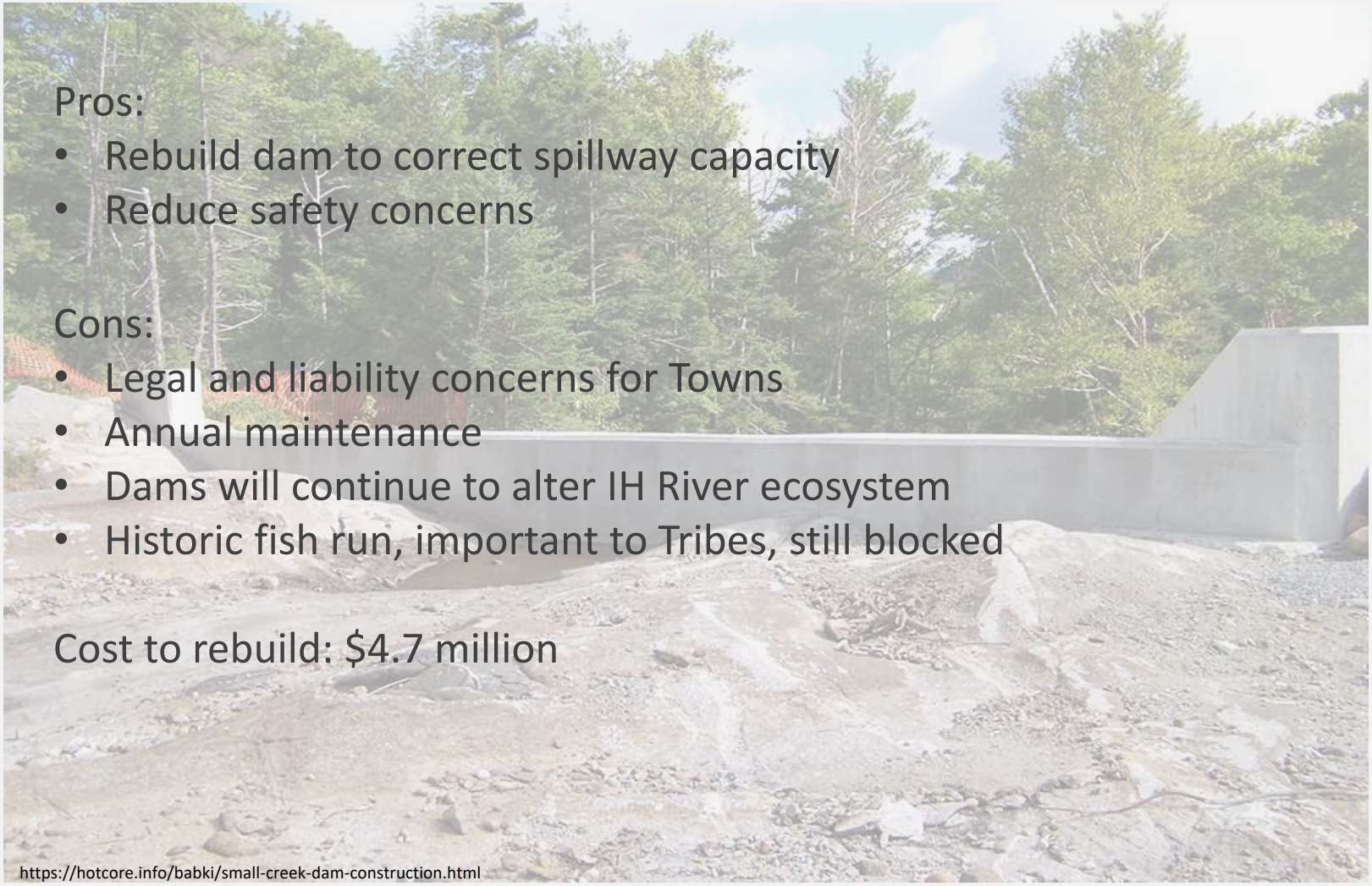
Dam Failure

Edenville Dam as it breached in historic flooding (detroitnews.com)

Dam Rebuild

https://hotcore.info/babki/small-creek-dam-construction.html

Dam Rebuild



Pros:

- Rebuild dam to correct spillway capacity
- Reduce safety concerns

Cons:

- Legal and liability concerns for Towns
- Annual maintenance
- Dams will continue to alter IH River ecosystem
- Historic fish run, important to Tribes, still blocked

Cost to rebuild: $4.7 million

https://hotcore.info/babki/small-creek-dam-construction.html

Dam Removal & River Restoration

Dam Removal & River Restoration

Pro/Con: Sediment management

Pros:

- Improve aquatic organism passage and habitat
- Remove safety concerns
- Remove legal & liability concerns for Towns
- Improve water quality
- Promote recreation supported by uninterrupted river
- Restore natural hydrologic and sediment regimes

Cost for restoration: $2-5.6 million (depending on sediment management decisions)

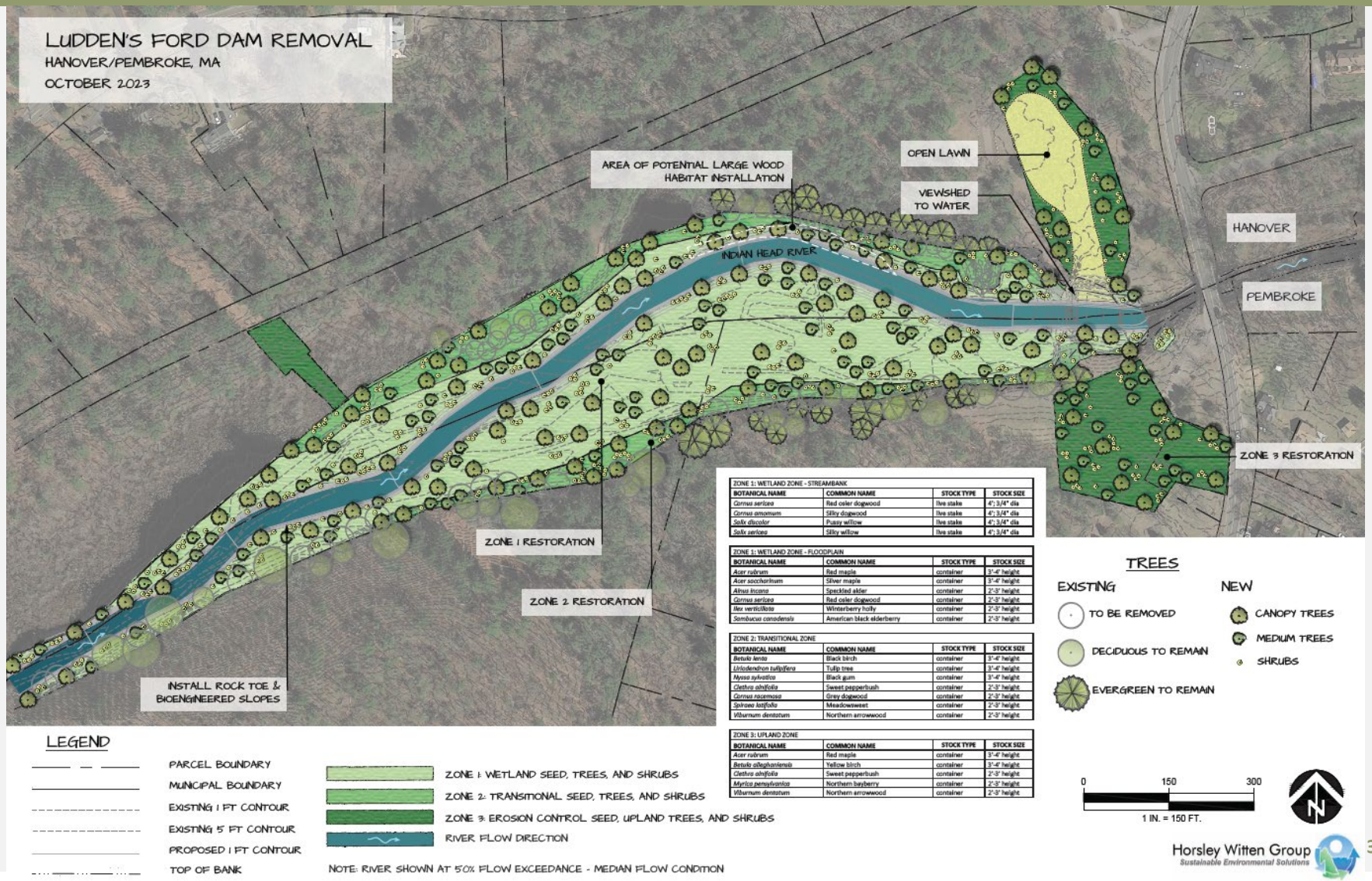
Ludden's Ford Dam

Ludden's Ford Dam Removal and Restoration

Ludden's Ford Dam Removal and Restoration

- Protect sensitive areas.
- Remove dam spillway, right abutment, and detach left abutment from foundation remnants.
- Excavate sediment to construct channel.
- Establish a riffle at site of the dam.
- Install large wood in outer banks of meander bends to provide for additional fish habitat.
- Stabilize banks with fabric covered slope and plantings.

Ludden's Ford Dam Removal and Restoration



Horsley Witten Group
Sustainable Environmental Solutions

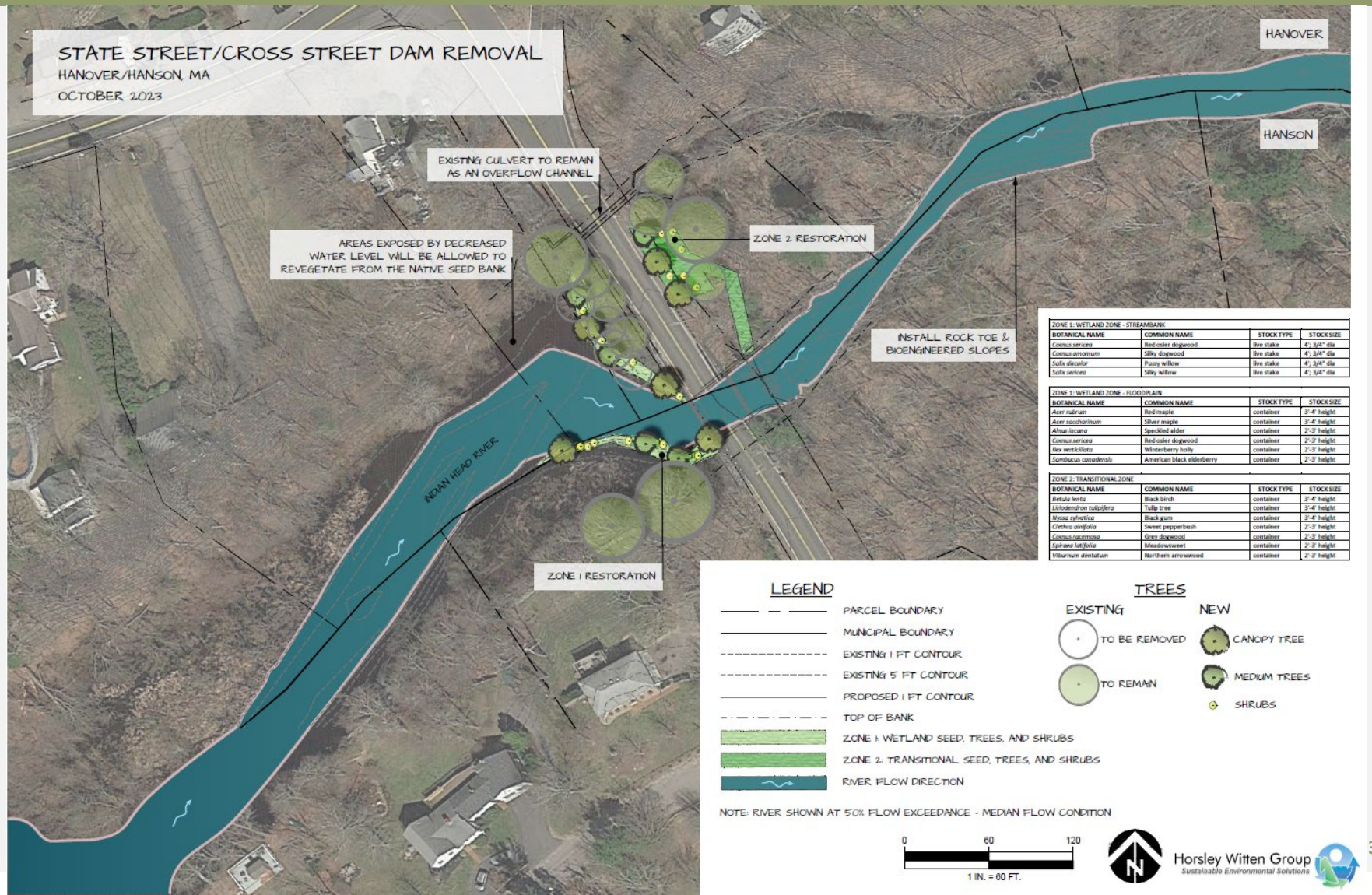
State St/ Cross St Dam

State St/ Cross St Dam Removal and Restoration

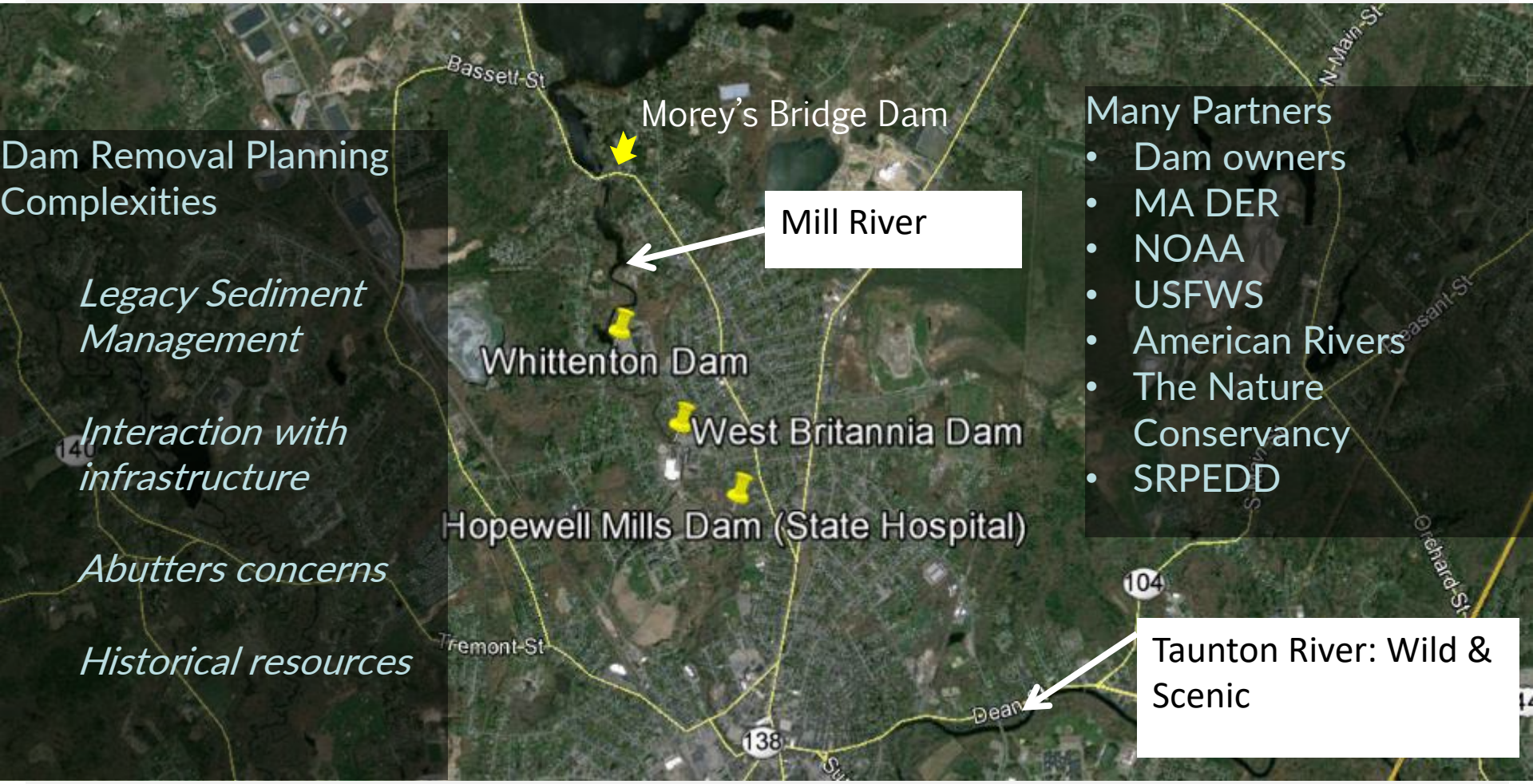
State St/Cross St Dam Removal and Restoration

- Protect sensitive areas.
- Remove vertical extent of dam spillway, right abutment, and left abutment.
- Remove selected stones to grade channel that provides fish passage.
- Addition of scour protection measures at the bridge.
- Stabilize banks with fabric covered slope and plantings.

State St/Cross St Dam Removal and Restoration



Case Study 1 – Mill River, Taunton, MA



Dam Removal Planning Complexities

Legacy Sediment Management

Interaction with infrastructure

Abutters concerns

Historical resources

Many Partners

- Dam owners
- MA DER
- NOAA
- USFWS
- American Rivers
- The Nature Conservancy
- SRPEDD

Hopewell Mills


Hopewell Mills Dam, Mill River, Taunton, MA
~14,000 cubic yards of impounded sediment

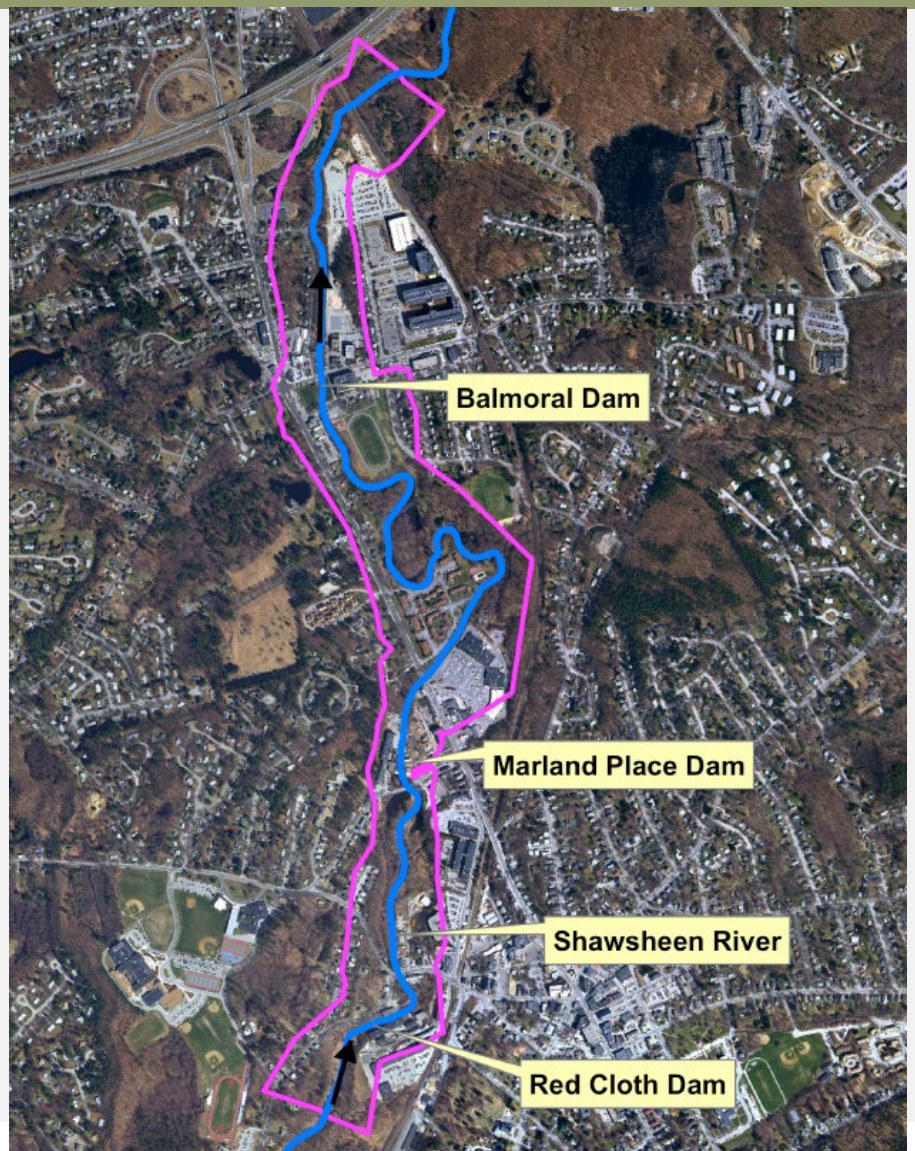
Hopewell Mills Dam, Mill River, Taunton, MA – During Construction
Active sediment removal and channel construction


Hopewell Mills Dam, Mill River, Taunton, MA – 3 years after Construction

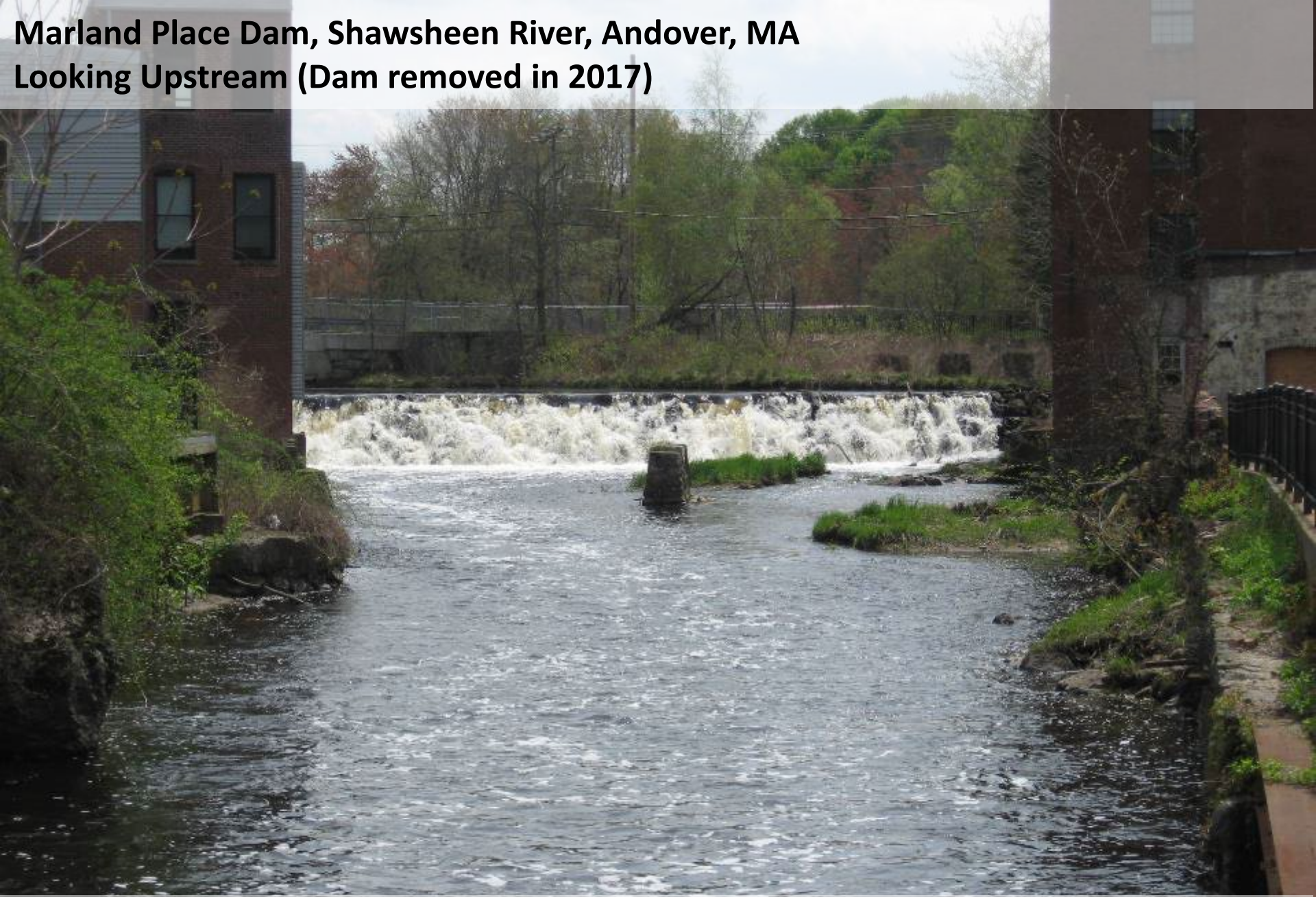
1st migratory season after removal of Hopewell Mills Dam

Photos: Mike Bednarski and Mike Trainor, Mass. Division of Marine Fisheries

Case Study 2 – Shawsheen River, Andover, MA



Marland Place Dam, Shawsheen River, Andover, MA
Looking Upstream (Dam removed in 2017)



Lead exceeded human health thresholds and was higher than what was found in the Ludden's Ford and State Street/Cross Street impoundments.


Marland Place – Post Construction – 2022
Looking Upstream
Around 3,000 cu. yds of sediment removed to an offsite landfill

Marland Place Dam – Pre-Construction
Looking Downstream

Marland Place – During Construction
Looking Downstream

Marland Place – Post-Construction – 2019
Looking Downstream

Thank You!

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Neal Price
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What We Know	What We Don't Know
Dam removal is possible at both sites	How Superfund will impact this project
Dam removal won't increase downstream flooding	How long these dams will be able to withstand current and future climate conditions
Dam removal will increase suitable habitat for fish, birds and other species	Exactly how much sediment will need to be removed
Removing State St Dam will be easier than removing Ludden's Ford Dam	Source of the contaminated sediment behind these dams
Recreation will change	
Funding is available for habitat restoration	

Alternatives Analysis

	Option 1: Dam Repair	Option 2: Dam Rebuild	Option 3: Dam Removal & Restoration
Funding Available	X	X	√
Restore native fish habitat	X	X	√
Remove aging infrastructure	X	√	√
Reduce liability for dam owners	X	√	√
Improve water quality and aquatic habitat	X	X	√
Eliminate ongoing maintenance	X	X	√
Increase resilience to climate change	X	√	√

Next Steps

Towns decide to pursue restoration

Additional sediment sampling for Ludden’s Ford

75% Design

Permitting & Fundraising

Construction

Questions?

Becky Malamut
becky@nsrwa.org

Resources

IHRR Story Map

https://storymaps.arcgis.com/stories/8727e82202ed4beaa27d11d440abb6ad

IHRR Landing Page

https://www.nsrwa.org/protect-our-waters/healthy-rivers/dam-removals/indian-head-river-restoration/

Related Pages

https://www.nsrwa.org/history-of-fireworks-site/

https://www.nsrwa.org/fireworks-proposed-as-superfund-site/

https://www.nsrwa.org/fireworks-clean-up-update-factory-pond-and-downstream/