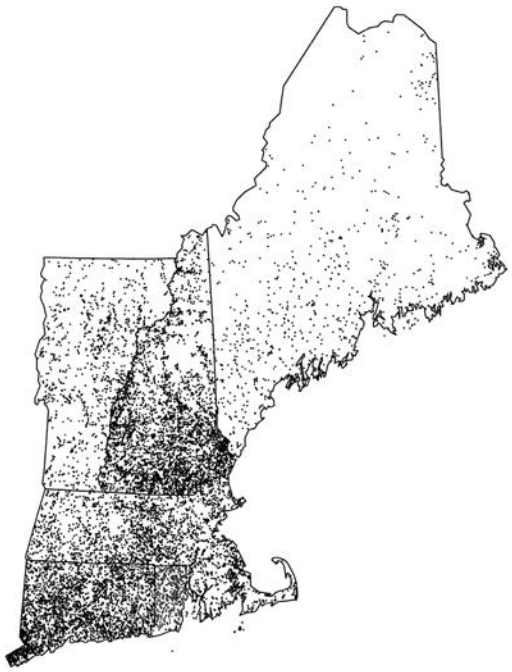
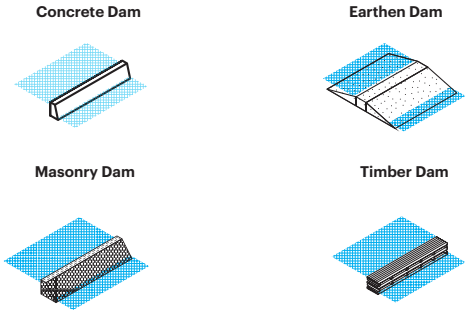
Context

Regional, State, and Watershed Dams



Dam Typologies



1. Dams in New England

10-14,000 Dams

Cultural Significance

- **The historical landscape:**
New England was the birthplace of the Industrial Revolution. Its network of rivers were dammed to power the mills along the shores. These dams are of varying sizes, shapes, and materials. They remain today as relics of the industrial era, and for many they are symbolic of New England's history.

2. Dams in Rhode Island

668 Dams

Industrial Revolution

- **Rhode Island was a highly commercial state:**
Providence was the center of technological advancement in the 1800's. Many industries used hydropower to produce a wide range of goods from lumber and textiles to jewelry and rubber.

3. Watershed Dams

95 Dams

The importance of the Wood-Pawcatuck Watershed

- **The river has a minimal slope, perfect for habitat:**
The Pawcatuck flows westward along an end moraine from the last ice sheet. This protects it from coastal extremes and gives it a minimal grade drop, making it ideal habitat.

- **The watershed is minimally impacted by major highways:**
It is circumnavigated by the I-95, Rt 4, and Hwy 1. This makes it easily accessible, but not impacted by high traffic.

- **The Pawcatuck is minimally impacted by urbanization:**
Unlike the other industrialized rivers in Rhode Island, the Pawcatuck is far from being urbanized.

- **Unique habitat:**
The Wood-Pawcatuck is habitat to many native Rhode Island species and is especially important for salmon and freshwater mussels.

Watershed

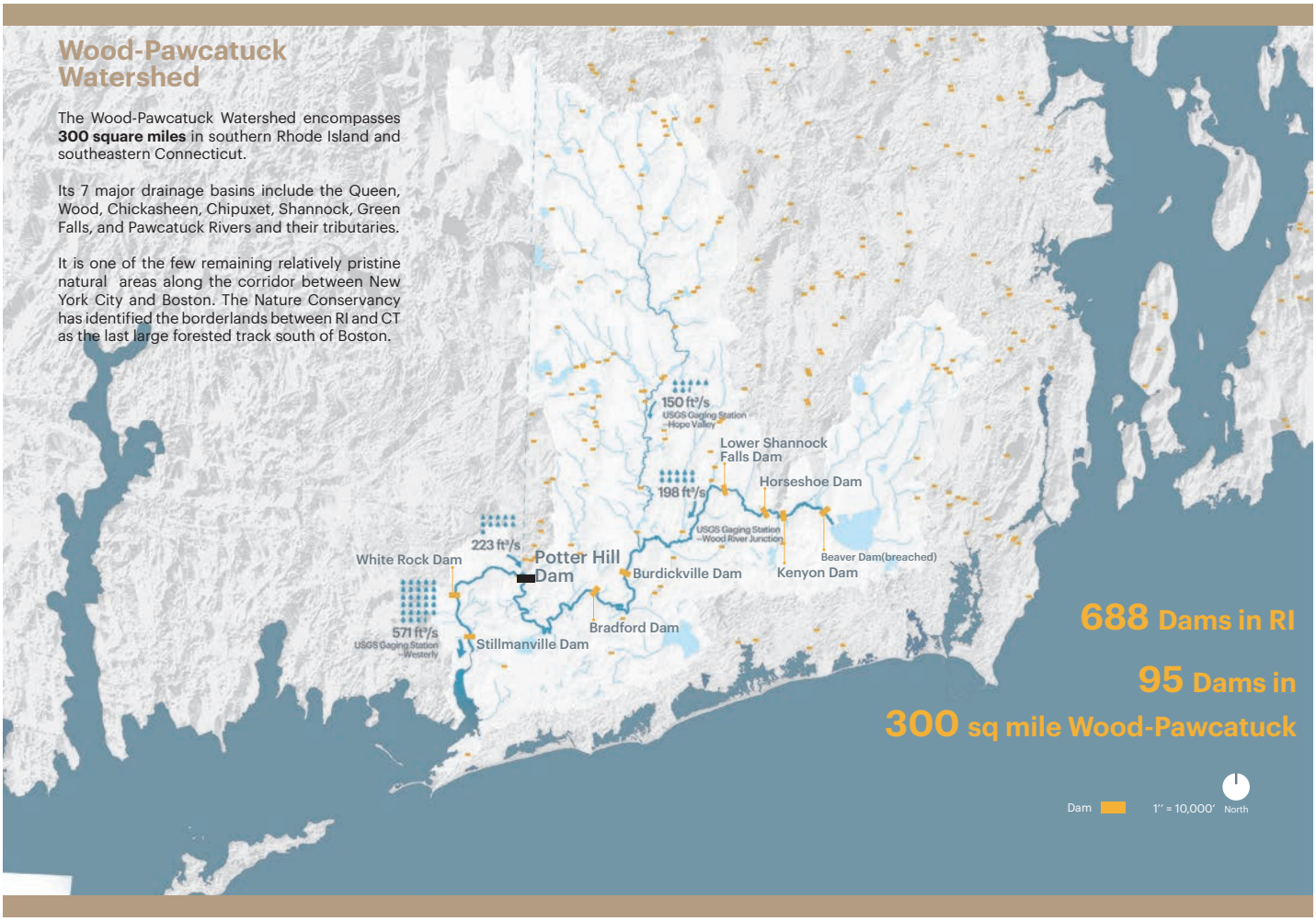
Wood-Pawcatuck Watershed

Wood-Pawcatuck Watershed

The Wood-Pawcatuck Watershed encompasses **300 square miles** in southern Rhode Island and southeastern Connecticut.

Its 7 major drainage basins include the Queen, Wood, Chickasheen, Chipuxet, Shannock, Green Falls, and Pawcatuck Rivers and their tributaries.

It is one of the few remaining relatively pristine natural areas along the corridor between New York City and Boston. The Nature Conservancy has identified the borderlands between RI and CT as the last large forested track south of Boston.



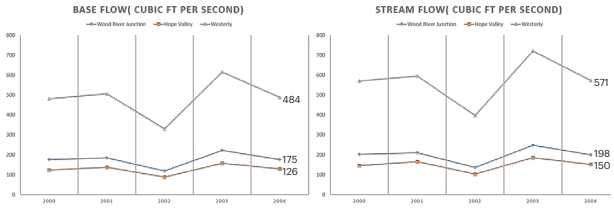
Water Flow

Data is based on daily records from USGS continuous gauges.

Base Flow + Water Recharge = Stream Flow

(Recharge events: storm-water runoff, precipitation)

Base flow is the stream-flow that is not runoff. It results from seepage of water from the ground into a channel slowly over time.



Water Channel

The water channel of Pawcatuck river is largely influenced by the transportation and deposition of sediments in the river. Flow volume, rate, and adjacent river land-use are key factors affecting sediment deposition.

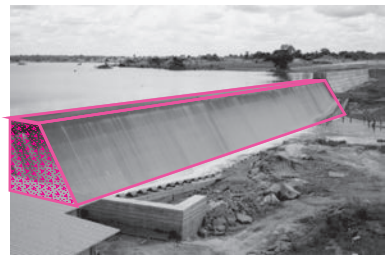
From headwater to the bay, the Pawcatuck River corridor ranges from **forested swamp, oak forest, grassland** to **highly urbanized** area.

How many dams are on Pawcatuck River?

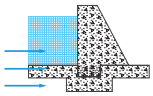
Dam	Height	Condition	Hazard	Fish Passage
Kenyon Dam	**-Ft**	Nature-like fish ladder	Low	√
Horseshoe Dam	**13ft**	-	Low	√
Lower Shannock Falls Dam	**-Ft**	Removed	-	√
Burdickville	**-Ft**	Breached	Low	/
Bradford Dam	**7ft**	-	Significant	√
Potter Hill Dam	**8ft**	-	Low	√
White Rock Dam	**6ft**	Removed	-	√
Stillmanville Dam	**-Ft**	Breached	Low	/

Structure

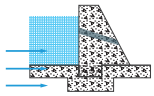
Type, Function and Failure of Dams



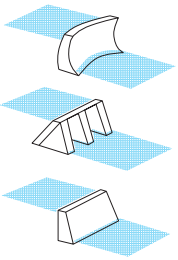
Concrete Dam



Typical Section
bottom > top



Spillways

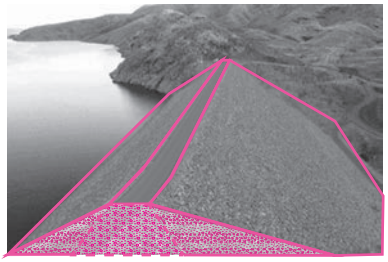


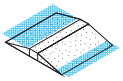
Arch Dam

Butress Dam

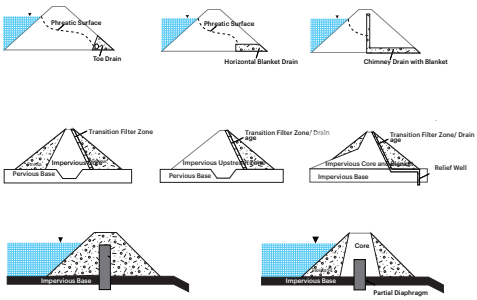
Gravity Dam

100 yr





Earth Dam

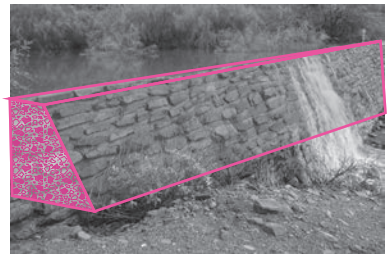


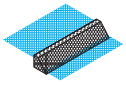
Homogeneous Earth Dam

Zoned Earth Dam

Diaphram Earth Dam

100 yr





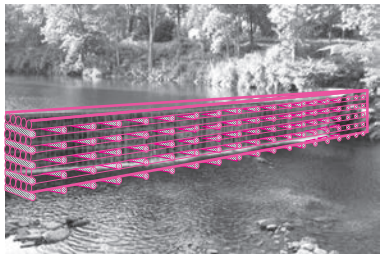
Masonry Dam

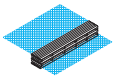
Profiles of Common Small Masonry Dams in New England

Solid Masonry Dam

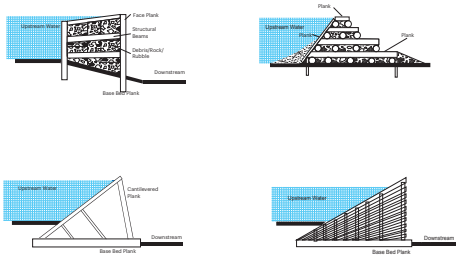
Hollow Masonry Dam

>100 yr



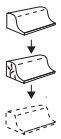


Timber Dam



Timber Crib Dam

Plank Timber Dam

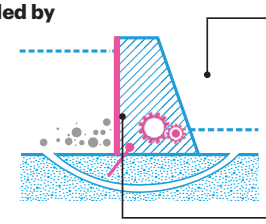


20-50 yr

Dam Failure

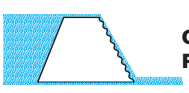
Impoundment: filled by sediment

Foundation: soil erosion

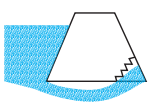


Lifespan of equipment

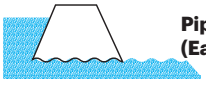
Infilled joints: leaching



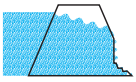
Overtopping Failure



Foundation Failure



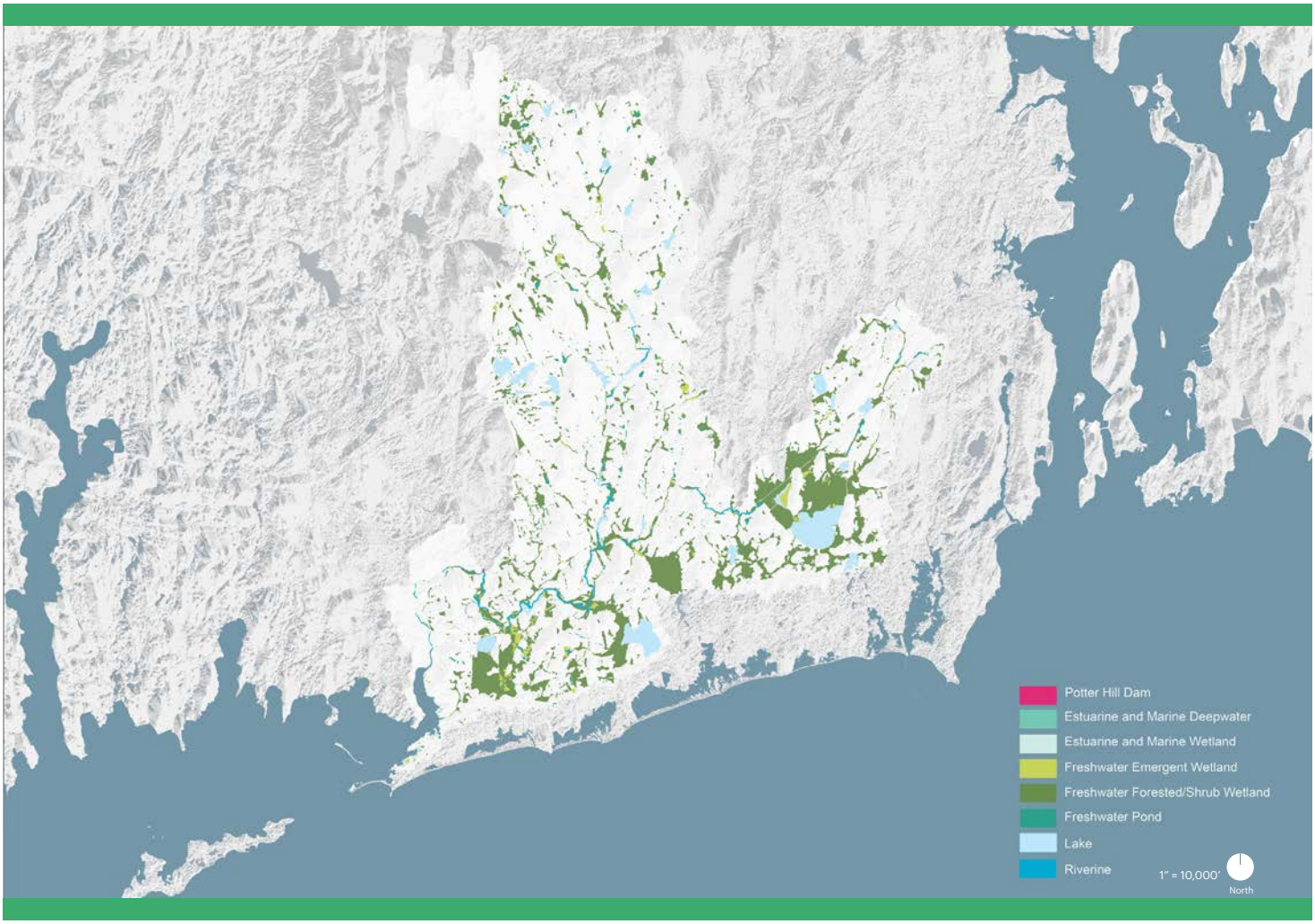
Piping Failure (Earth dam)



Slope Failure

Wetlands

Types and Importance



What is a wetland?

Wetlands are the link between land and water. A wetland is an area that must be filled or soaked with water at least part of the year. It is habitat for many species of fish and wildlife.

Climate, topography, geology, and the movement and salinity of water combine to create a diverse range of wetlands.

Wetland Types

Estuarine

- **Tidal**
- **Deep water** habitat with **adjacent wetlands**
- **Semi-enclosed; access to the ocean** is partially obstructed
- **Saline water, diluted by freshwater** runoff from the land

Riverine

- **Deep water** habitat contained within a **river channel**
- **Dominated by trees, shrubs, persistent emergents,** and **emergent mosses** and **lichen**
- **Salinity level > 0.5%**

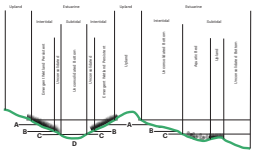
Palustrine

- **Non-tidal**
- **If vegetated,** dominated by **trees, shrubs, persistent emergents,** and **emergent mosses** and **lichen**
- **Size < 20 acres** or **8 ha**
- **Salinity level < 0.5%**
- **No** wave-forming or bedrock shoreline
- **Water depth < 2m** (6.6 ft) at **low water**

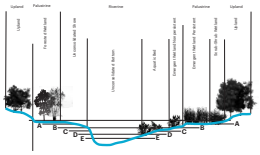
Lacustrine

- **Tidal** or **Non-tidal**
- **Deep water** habitat in a **topographic depression** or a **dammed river** channel
- **Few trees, dominated** by **persistent emergents, moss** and **lichen**
- **Size is unlimited**
- **Salinity level > 0.5%**
- Potential **wave forming** or **bedrock shoreline**
- **Water depth < 2m** (6.6 ft) at **low water**

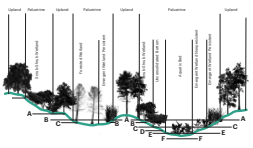
What do these different wetland types look like?



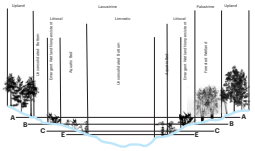
a. Irregularly Flooded
b. Regularly Flooded
c. Irregularly Flooded
d. Subtidal



a. Temporarily Flooded
b. Seasonally Flooded
c. Semipermanently Flooded
d. Intermittently Exposed
e. Permanently Flooded

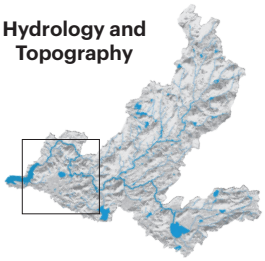


a. Temporarily Flooded
b. Seasonally Flooded
c. Semipermanently Flooded
d. Intermittently Exposed
e. Permanently Flooded
f. Seasonally Saturated

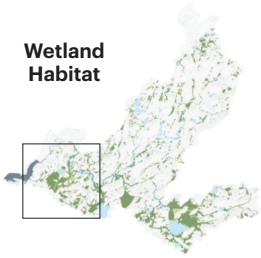


a. Temporarily Flooded
b. Seasonally Flooded
c. Semipermanently Flooded
d. Intermittently Exposed
e. Permanently Flooded

Hydrology and Topography



Wetland Habitat



Why is this important?

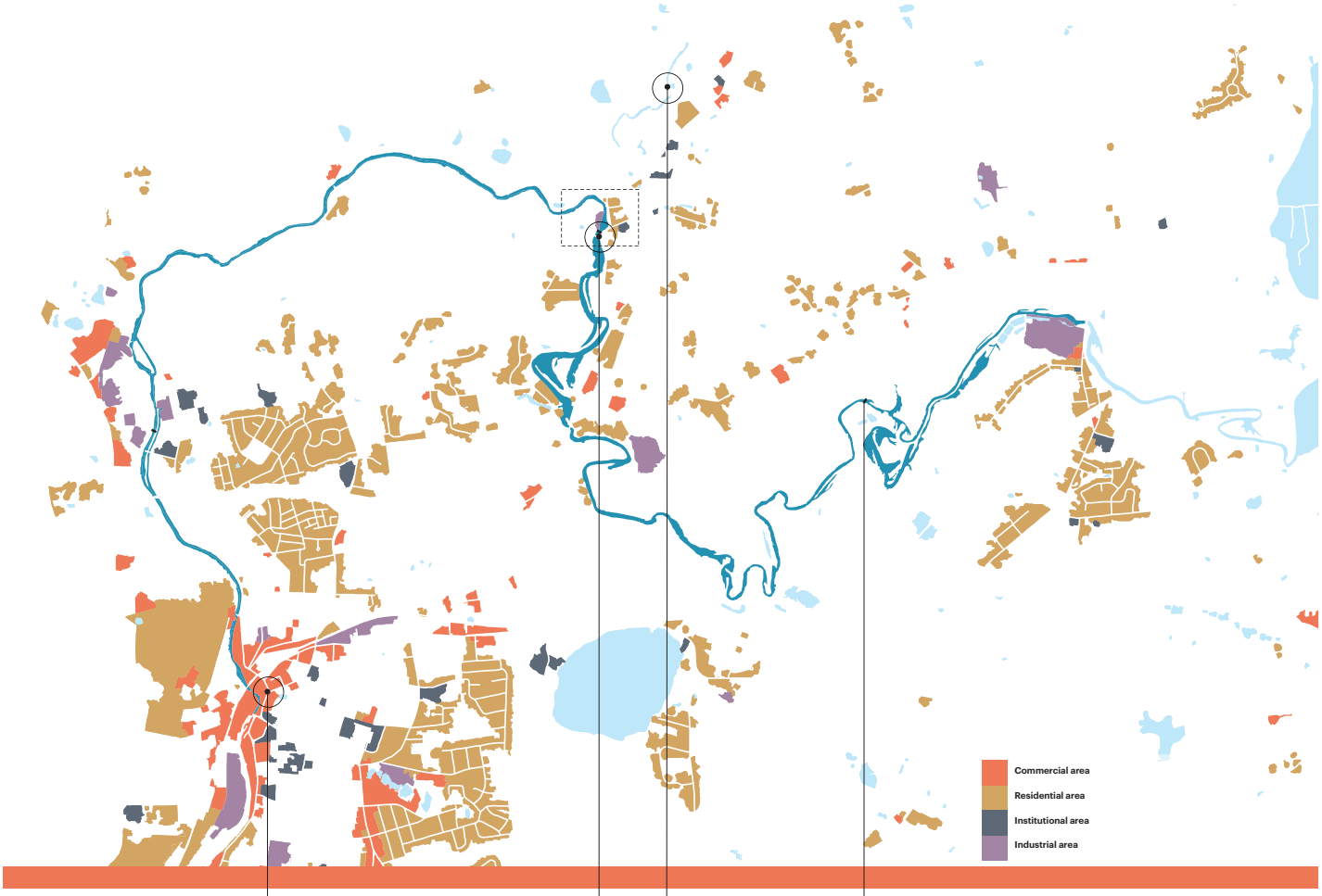
Wetlands are a **crucial system of flood control** and provide **habitat** for diverse species.

Source: EPA. Methods for Evaluating Wetland Condition: # 7 Wetlands Classification. https://www.epa.gov/sites/production/files/documents/wetlands_7classification.pdf

EPA. Wetlands Classification and Types. https://www.epa.gov/wetlands/wetlands-classification-and-types#marshes

Cultural Relationship

Land Use and Surrounding Context



22,787
WESTERLY
The **largest urban center** in southern Rhode Island.
It is located at the point where the Post Road (Route 1) crosses the Pawcatuck River.

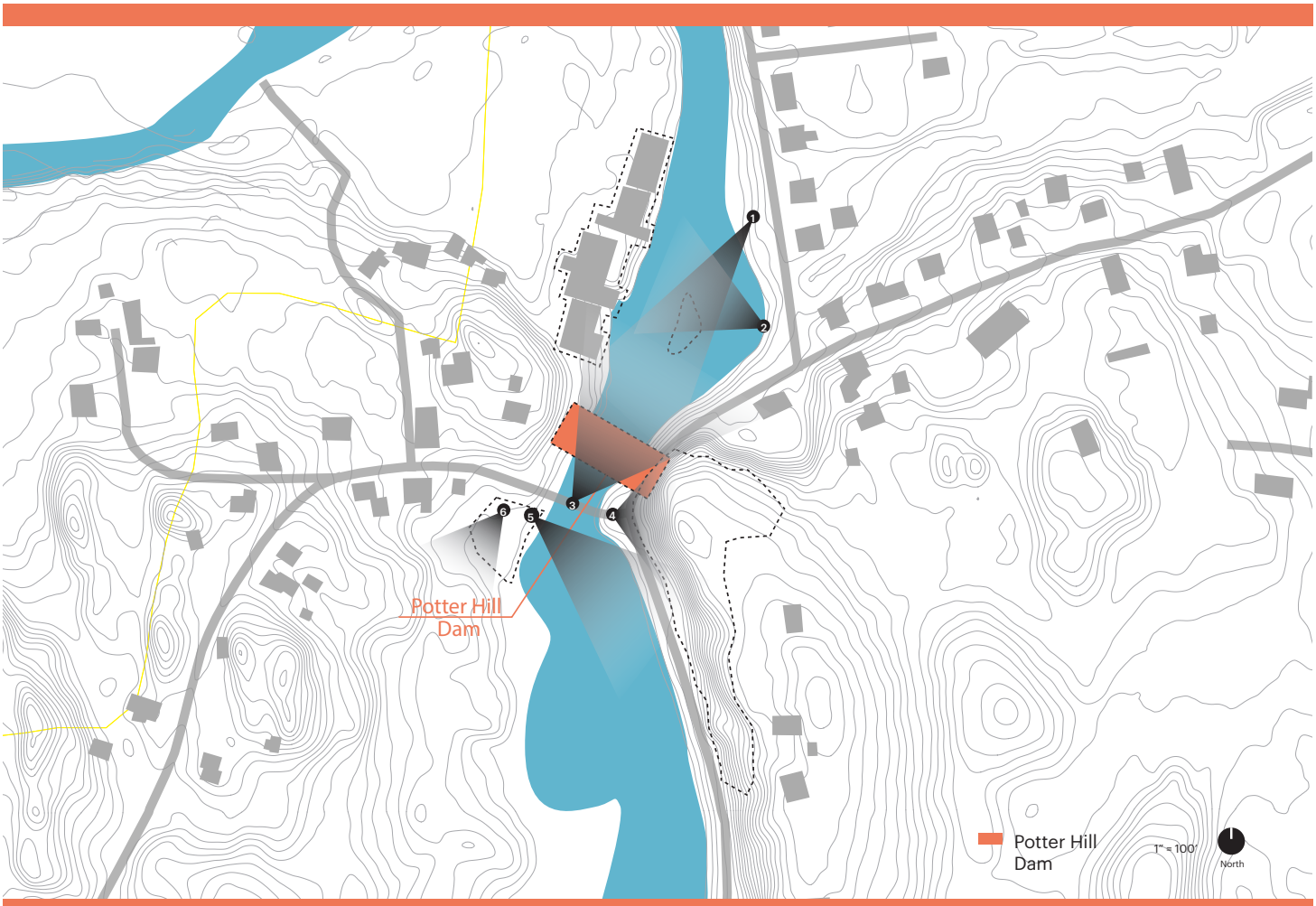
POTTER HILL DAM

14,925
HOPKINTON
In 1757, northern Westerly of the Pawcatuck River became part of a **new town** of Hopkinton.

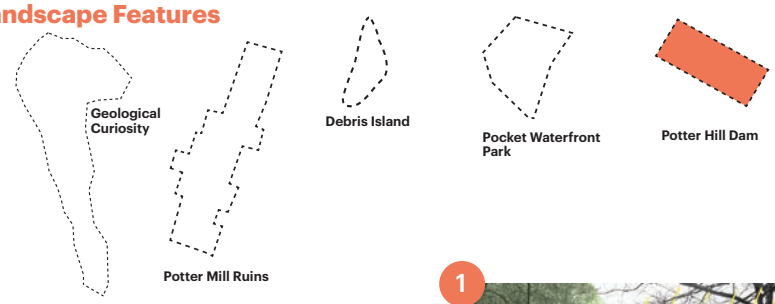
BRADFORD DAM
A **fishing place** of historic importance for the American Indians and early European settlers.

Views

Potter Hill Dam: Landscape Views + Features



Landscape Features

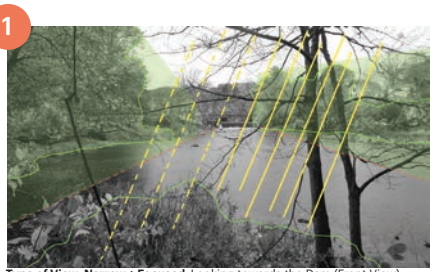


Potter Hill Dam complex has many types of views.

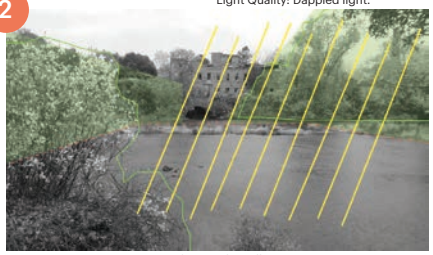
They are composed by the **breadth of the view, the quality of light, the type and texture of the vegetation**, the **structure in ruins,** and the **viewing spots**.

Changes in slope along the river edge create layered vegetation that frames views.

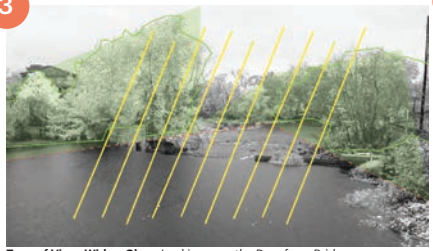
Landscape features contribute to the authentic appeal of te place.



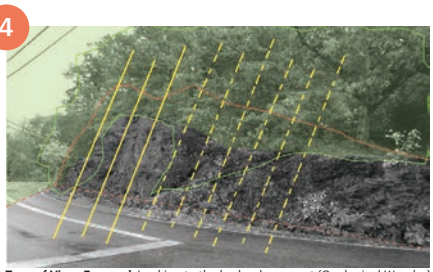
Type of View: Narrow + Focused Looking towards the Dam (Front View)
Space: Enclosed
Light Quality: Dappled and direct



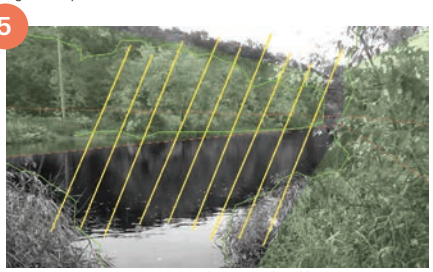
Type of View: Wide + Clear. Looking to the Mill ruins.
Space: Open
Light Quality: Direct



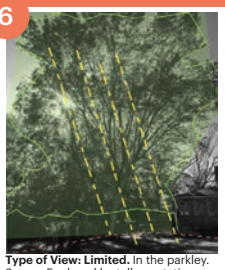
Type of View: Wide + Clear. Looking over the Dam from Bridge.
Space: Open
Light Quality: Direct



Type of View: Focused. Looking to the bedrock remnant (Geological Wonder)
Space: Limited
Light Quality: Dappled light



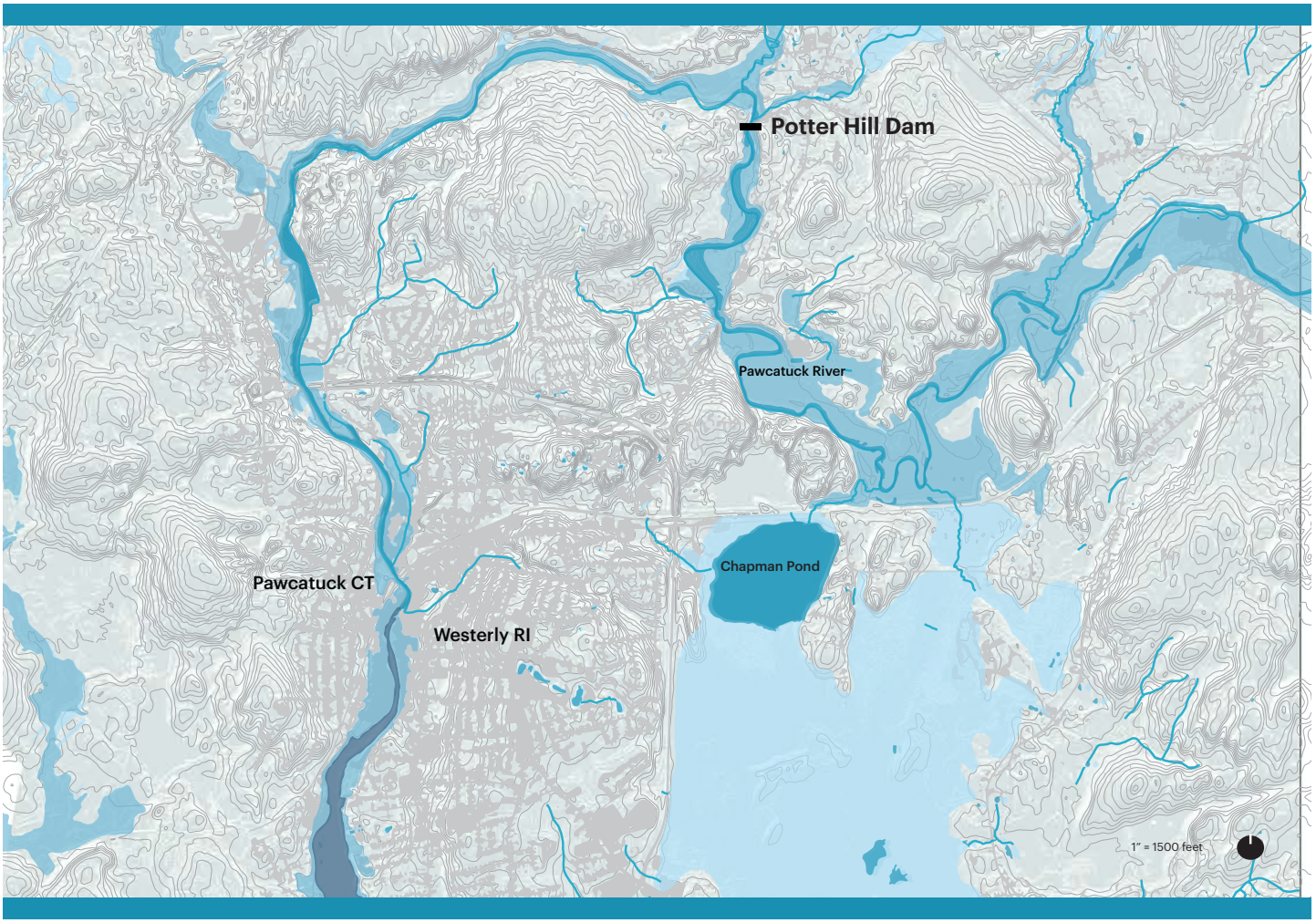
Type of View: Wide + Clear. Impoundment view (South).
Space: Public
Light Quality: Direct



Type of View: Limited. In the parkley.
Space: Enclosed by tall vegetation.
Light Quality: Dappled light.

Flood Hazard

Impacts of Flooding



coastal waters | existent water bodies | 100 yr floodplain | 500 yr floodplain

How does a dam affect flooding?

Even if flood control is not its objective, a dam still has an effect on the natural fluctuation of the river. **Damming a river affects flow along an entire river system** throughout the year. During periods of high flow, for instance during snowmelt in March and April, the dam might in a minor way restrict the amount of water moving downstream.

What is the relationship between Westerly and the Pawtucket River?

Historically rivers were used for fishing and transport of goods, and then channelized to facilitate energy production. Although rivers are not used for energy today, the channelization remains, along with legacy mills and dams.

The proximity of buildings to the river, the edge between river and land, and the depth to the river bottom are all critical factors contributing to flooding.

How does the Pawcatuck change from Potter Hill to Westerly?

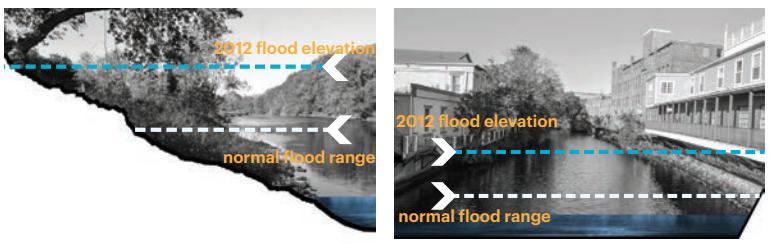
As the Pawcatuck passes over the Potter Hill Dam, the river's character shifts from wild meandering into an urban river. The edge of the river gradually becomes steeper and harder, changing the shape of the river channel from **broad terraced floodplains into a trapezoid**, limiting the space for plant growth and increasing the velocity of the waterflow.

A second factor is the soil permeability. Upstream the ground is much more permeable, allowing water to percolate directly into the ground instead of flowing into the river.

Downstream, flooding can occur much faster. Water runs over the numerous impervious surfaces, roofs, streets, and parking lots, directly into the channelized river.

Dam failure would increase the water in an already potentially catatstrophic flood in Westerly.

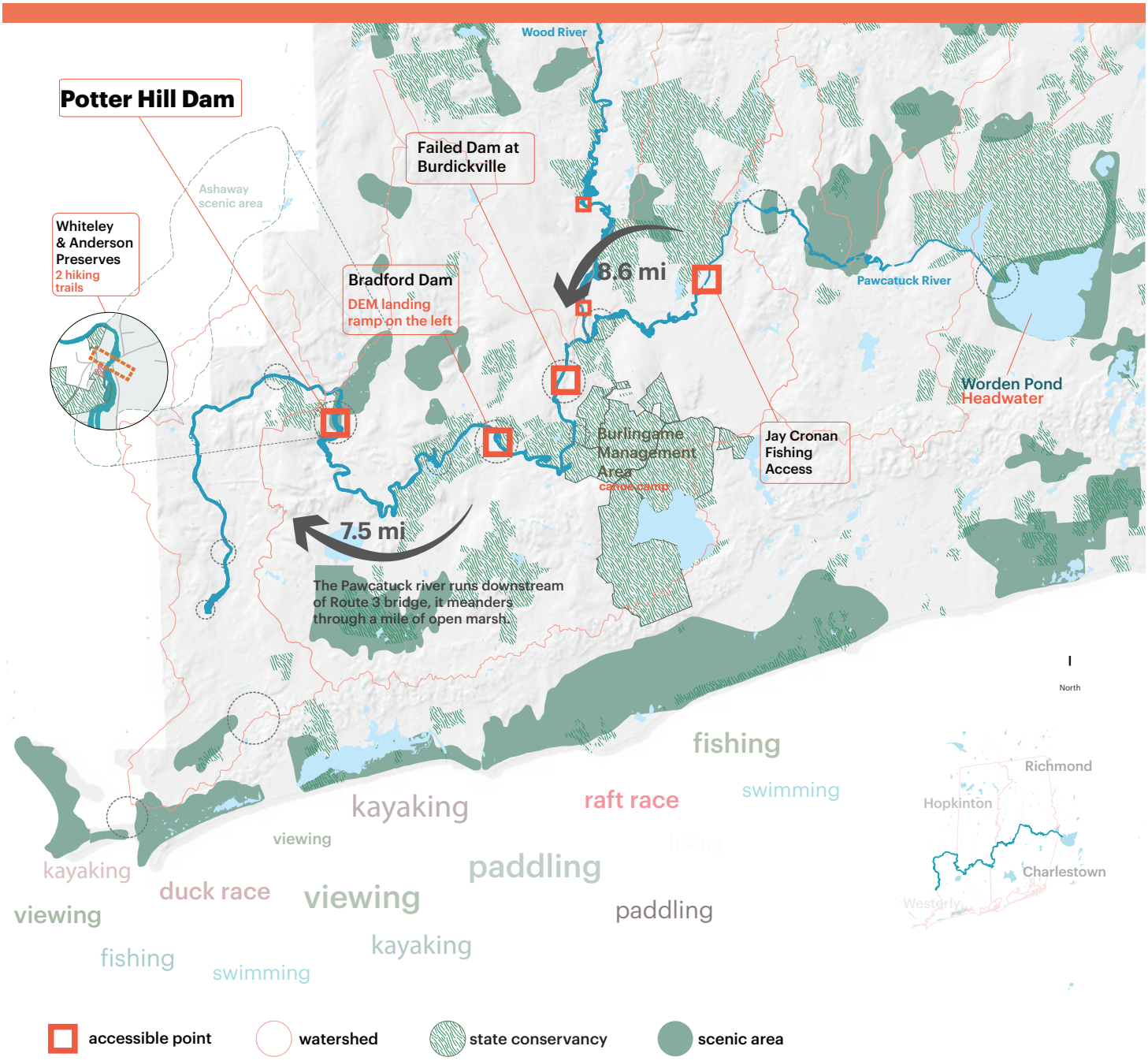
Dams have an effect on the normal flood cycle of a river but are not useful as protection for 100 yr and 500 yr flood events.

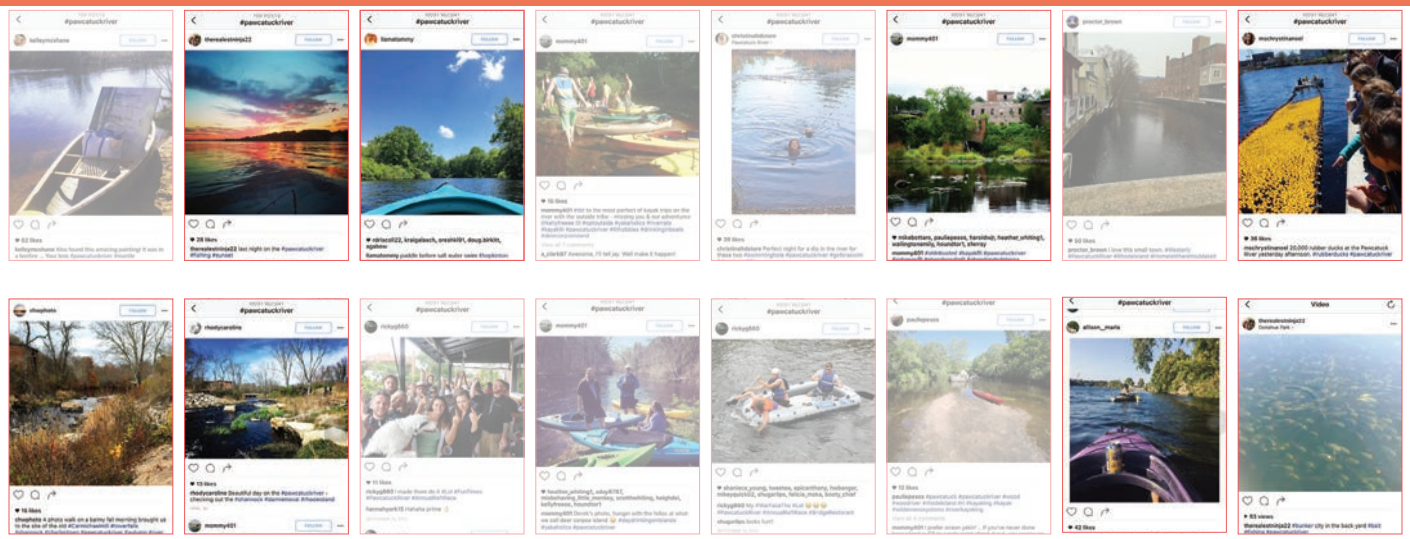


Flooding that beat the 500 year recurrence interval happened three times between 2010 and 2012. Although the waters caused damage to neighboring communities, they are also thought to have benefited downstream estuarine ecologies.

Recreation

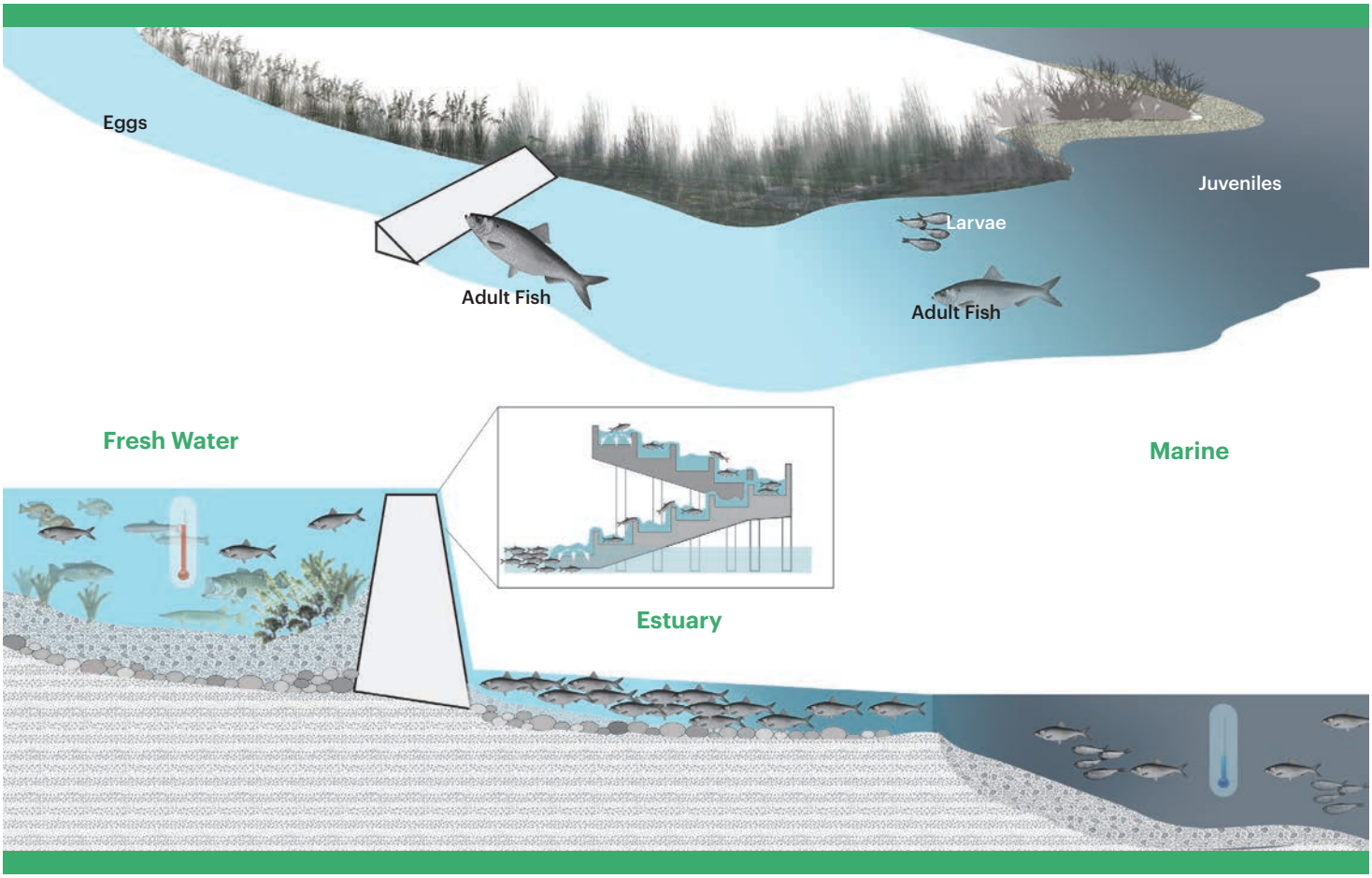
Activities, Access and Scenic Areas



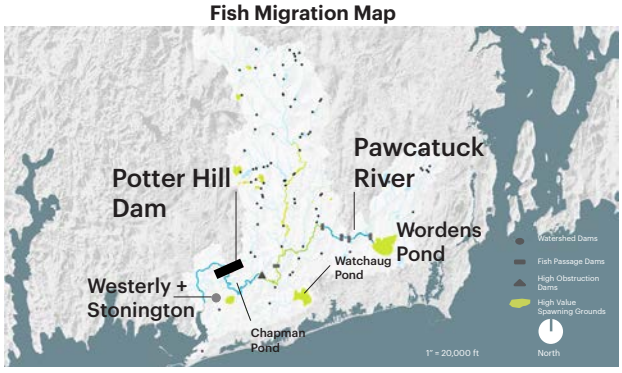


Migratory Fish

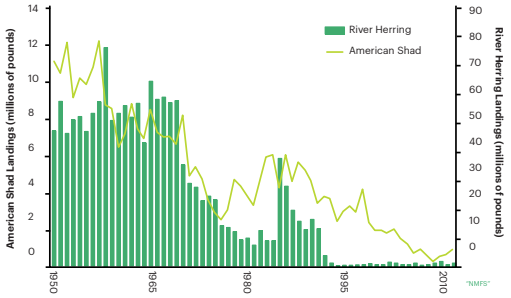
Obstacles to Restoring Fish Passage



Fish Migration Map



National Commercial Landings of Herring and Shad



How do Dams affect these species?

Migratory Fish spend the majority of their life living in coastal waters, but migrate to freshwater streams and ponds to spawn and reproduce (eels follow the opposite pattern).

Dams are physical barriers to upstream high quality spawning grounds. Though many dams incorporate fish passage techniques, many species have difficulty successfully navigating these. Additionally, the infrastructure for passage has often been neglected, making them non-functional. The fish ladder at Potter Hill falls in this category.

Dam removal or improvement links migratory fish habitats, providing access to clean, quality spawning grounds. It also improves riverine nutrient cycles benefiting a range of species, not just fish.

Alewife
Alosa pseudoharengus

The Alewife migrates to freshwater streams where it spawns in large rivers, small streams, and ponds, including barrier beach ponds. Spawning substrates include gravel, sand, detritus, and submerged vegetation with sluggish water flows. Spawn March to June.

Blueback Herring
Alosa aestivalis

Blueback herring have similar habitat requirements to the Alewife, but spawn in swift-flowing, deeper stretches of rivers and streams with an associated hard substrate and in slower-flowing tributaries and flooded low-lying areas adjacent to main streams. Spawn 3-4 weeks after Alewife.

American Shad
Alosa sapidissima

This keystone species migrates to fresh water when temperature reaches 50˚F. Spawns in broad flats of 1-6m deep water. Eggs do best in gravel and rubble substrates. Females lay 650,000 eggs. Juvenile migrate back to ocean in Fall.

Atlantic Salmon
Salmo salar

Atlantic Salmon migrate to freshwater streams to cold water habitats. Spawning occurs in late fall with females laying 7,000-8,000 eggs in redds (holes in river bed dug by female's tail). Juveniles need clean, well-oxygenated water and cobble sized substrate free of sediment. Commonly found in fast flowing riffle.

American Eel
Anguilla rostrata

This highly adaptive freshwater eel migrates from the Sargosa Sea in the mid-Atlantic where it reaches sexual maturity in the freshwater streams and ponds of the east coast. The eels are greatly affected by hydroelectric dams often getting stuck in the turbines on the way up stream.

Historical Timeline

What is the significance of this place through time?

Native American History

Before European contact, Native Americans had settled both Americas.

In New England, they established semi-nomadic patterns of habitation, using the rivers as sources of food and to travel from their summer coastal settlements to hunt and trap inland during the winter.

1683 - 1763

Tension between colonial powers and the growing encroachment of settlements sets off a war known as the French and Indian War.

In 1763 the last Wampanoag chief, Metacomet, is killed in Mt Hope, RI. With the English victory comes the stability needed for early industrialists to begin capitalizing on the area's resources.

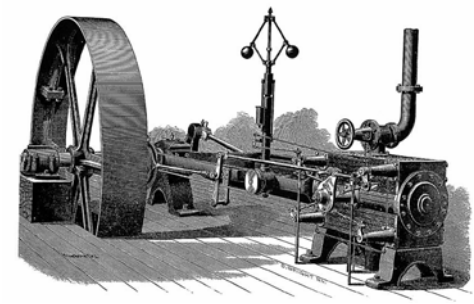
1776

American War of Independence begins

Industrial Era

1780s

With the end of the war, the industrial revolution begins, spreading the practice of damming rivers for hydropower.



1860-1865

American Civil War

The North is the center of industrialization, and the South is the heart of agricultural production. By the end of the war, the Southern economy has tanked, setting the stage for larger shifts in the future of manufacturing and industry.

Modern Era

1950-1970

Industry moves from New England to the Southeast in order to gain access to cheaper land and labor. Textile mills across the region are shut down.

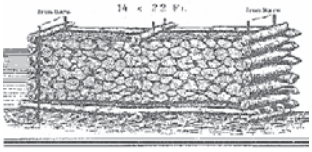
Colonial Era

1634

Roger Williams founds Providence Plantation.

The Narragansett tribe wins a battle against the Pequot for control of the Shannock falls. The battle was over the salmon, which were plentiful in the waters.

After Europeans settle this area, they too will fish from the Pawcatuck.



Potter Hill History

1762

John Davis builds a wooden saw mill and crib dam for processing wood and grist.

1775

Property is sold to the Potter family and the mill is updated for the purposes of shipbuilding and processing cotton fiber

1843

E+H Babcock and Co. builds 3 story stone mill using local Westerly pink granite

1885

JP Campbell & Co. process yarn into cloth and employ nearly 200 people

1903

After nearly 150 years, the original timber crib dam fails during the Spring flooding.

Due to the utility of the dam in relation to the mill's operations, a new concrete dam is built almost immediately. With the addition of a fish ladder in 1973, this is still the same dam existing today.

Pawcatuck Woolen Company also installs a 125 horsepower steam engine to augment the water powered machinery.

1955

The mill is abruptly closed by the new owner after only three years of operation

1977

A fire of unknown origin destroys two of the original mill buildings

1993

The mill is sold to a new owner who seeks redevelopment

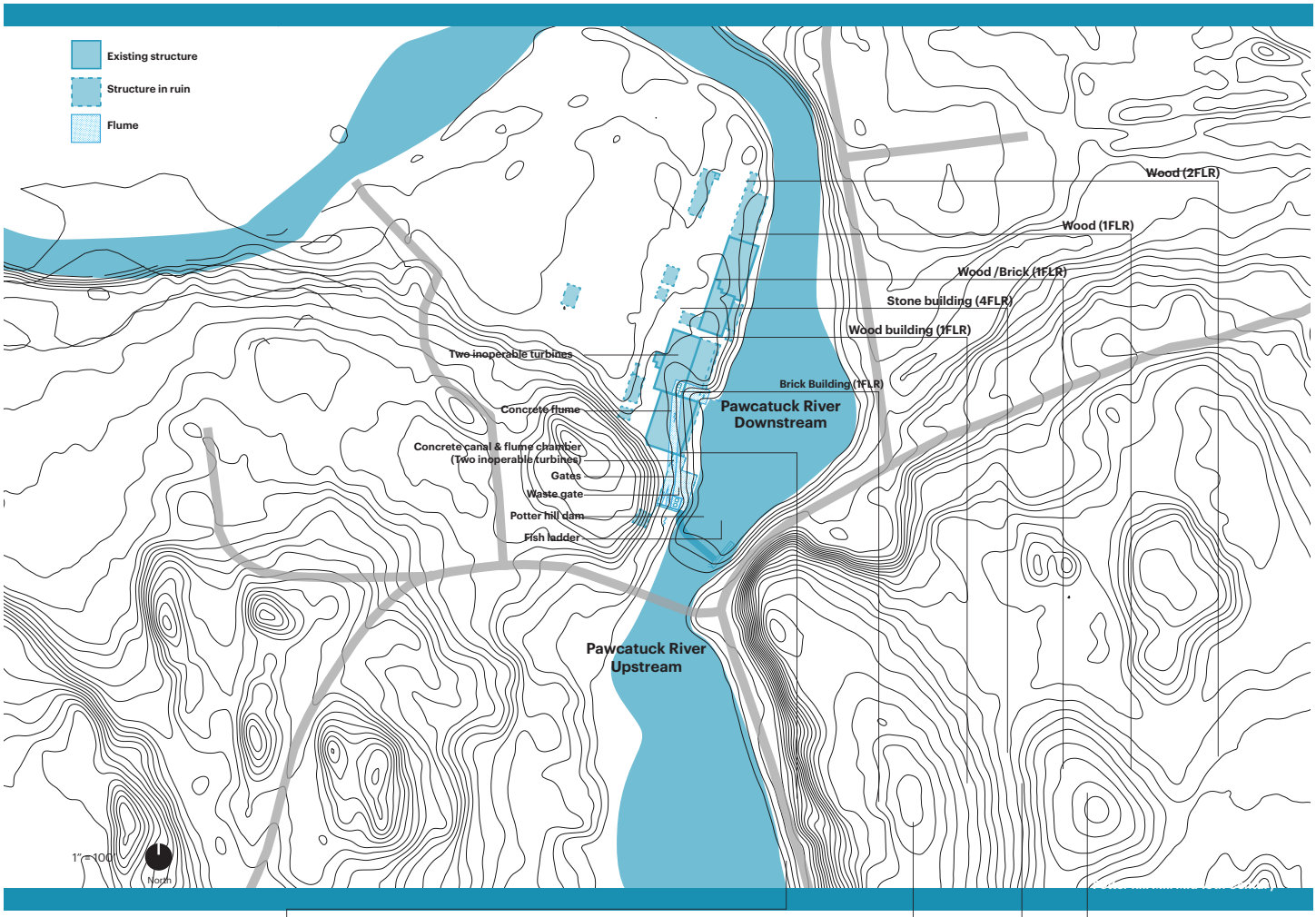
The remains of the mill still stand beside the river, a memory of a long past industry.

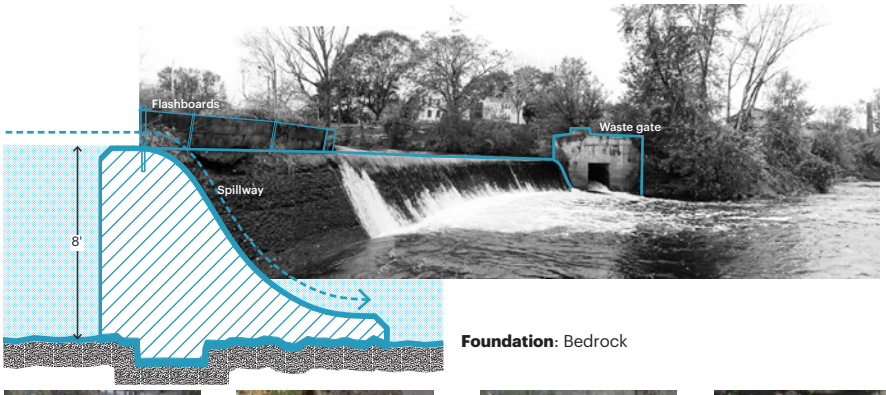
Adjacent to the mill is the nonfunctional dam.

While both hearken back to the era of industrialization, the dam prevents the migration of fish and poses its own set of hazards.

Potter Hill Dam

Potter Hill Dam and Mill





Foundation: Bedrock

Potter Hill Dam

License #: State No. 254, National ID RI01409
Built: 1903
Material: Concrete
Size: 112'x8'

Features:
- **concrete** ogee spillway
- three inoperable gates on the western end.
- two 2"x10" flashboards on right-side, extending 16 inches above the crest.

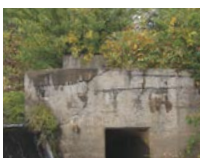
Classification: RIDEM has rated this dam **Low Hazard**; environmental and economic liability is low, no loss of life is expected; liability is limited to the owner.
Observations: major wear on the spillway surface and **poor efficiency** of the fish ladder

Fish Ladder (Built 1973):
- Material: Wood and concrete
- Problems: Poor efficiency, needs repair

Impoundment
- Size: 3.5 acres
- Problem: Sediment build up

Spillway:
- Material: concrete
- Problems: Major wear, cracks, growth of plants

Flashboards:
- Material: Wood
- Problem: Growth of plants

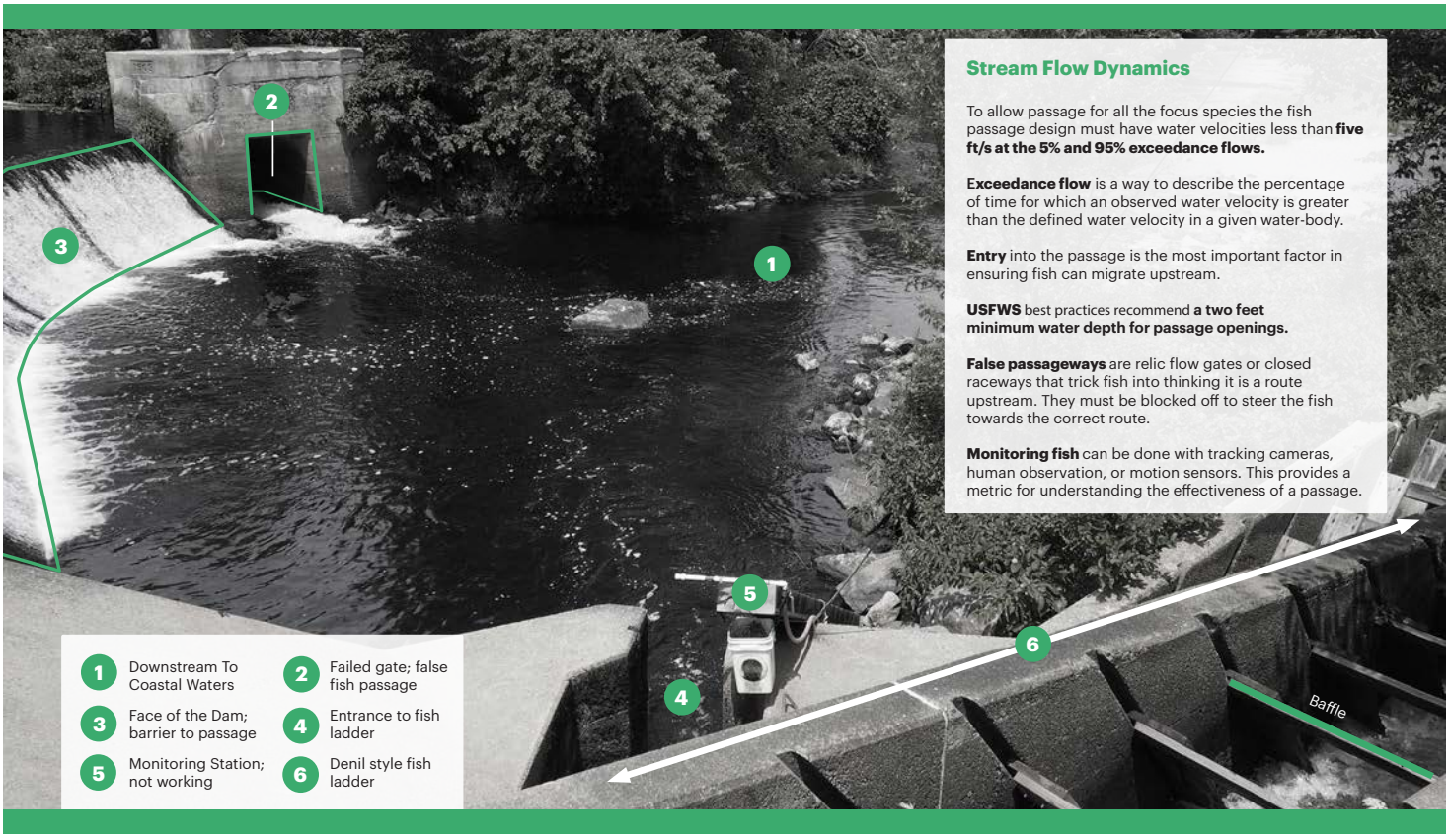


Waste gate:
- Material: Masonry with metal accessories
- Problems: Growth of plants , AAR, Cracking, Rust of metal part

Gates:
Materials: Wood and concrete
Problem: Inoperable

Fish Passages

Technical Requirements



Stream Flow Dynamics

To allow passage for all the focus species the fish passage design must have water velocities less than **five ft/s at the 5% and 95% exceedance flows.**

Exceedance flow is a way to describe the percentage of time for which an observed water velocity is greater than the defined water velocity in a given water-body.

Entry into the passage is the most important factor in ensuring fish can migrate upstream.

USFWS best practices recommend **a two feet minimum water depth for passage openings.**

False passageways are relic flow gates or closed raceways that trick fish into thinking it is a route upstream. They must be blocked off to steer the fish towards the correct route.

Monitoring fish can be done with tracking cameras, human observation, or motion sensors. This provides a metric for understanding the effectiveness of a passage.

To allow passage for all three species, the fish passage design at dams must have water velocities less than five ft/s at the 5% and 95% exceedance flows for the migratory fish run period(s). In addition, USFWS best practices recommend a two feet minimum water depth for passage openings and less than 12.5% slope (technical fish ladder) or 1:30 slope (nature like fish-way).

Denil Fish Ladder (In Disrepair)

~ Low passage rates
Average Slope: 10-25%
$100,000 to repair current ladder

Many fish ladders are decades old and follow out of date design principles. Most commonly, the baffle boards are rotted out or broken, making it significantly more difficult for fish to navigate the ladders. In some cases the concrete foundation may be crumbling. Another problem with these old fish ladders is that they require maintenance. Both entrances and exits to the fishway needs to be kept clear and unobstructed.

Denil Fish Ladder (State of the Art)

~ Medium passage rates
Average Slope 10-25%
~ $1 million; ongoing maintenance costs

Denil fish ladders are rectangular chutes or flumes. These relatively narrow chutes have baffles extending from the sides and bottoms which point upstream. Flow through Denil fishways is very turbulent with large momentum exchange and high energy dissipation. Fish must swim constantly up these fishways, therefore resting pools are necessary in high head situations. Denil Fish ladders are able to provide passage for a large variety of migratory fish.

Pool and Weir Fishway

~ Medium passage rates
Average Slope 5-10%
$800,000 per vertical foot of dam

Pool and weir fish ladders are designed primarily to provide plunging flow and ample resting areas that provide leaping fish with hydraulic assistance in moving upstream. A series of pools allows for fish to make their way up at a slower pace. This needs to be incorporated at a shallower slope than the Denil and takes up a longer section of the river, but doesn't need to be as wide as a NLF.

Nature Like Bypass Channel

~ High passage rates
Average Slope 3-5%
$1 million; no maintenance fees

A nature like bypass channel is a "secondary" stream that runs around the obstacle and creates a natural looking setting for the fish. These channels require a large amount of space and may be more expensive than fish ladder structures, but require almost no maintenance and provide easier and more successful passage for fish. This option can include river access or boat passage as well. The shorelines can be re-vegetated to provide riparian habitat or public shoreline access.

Nature Like Fishway

~ High passage rates
Average Slope: 3-5%
~$750,000

The Nature Like Fishway is the best alternative to full barrier removal. The dam is kept in place and fill is brought in to gradually raise the level of the river to meet the crest of the dam. The use of natural materials, surface roughness, and interstitial spaces provides attractive flow complexity and spawning micro-habitats for migrating fish. Native plant vegetation can easily be incorporated in the design to provide non-aquatic habitat and recreation areas.

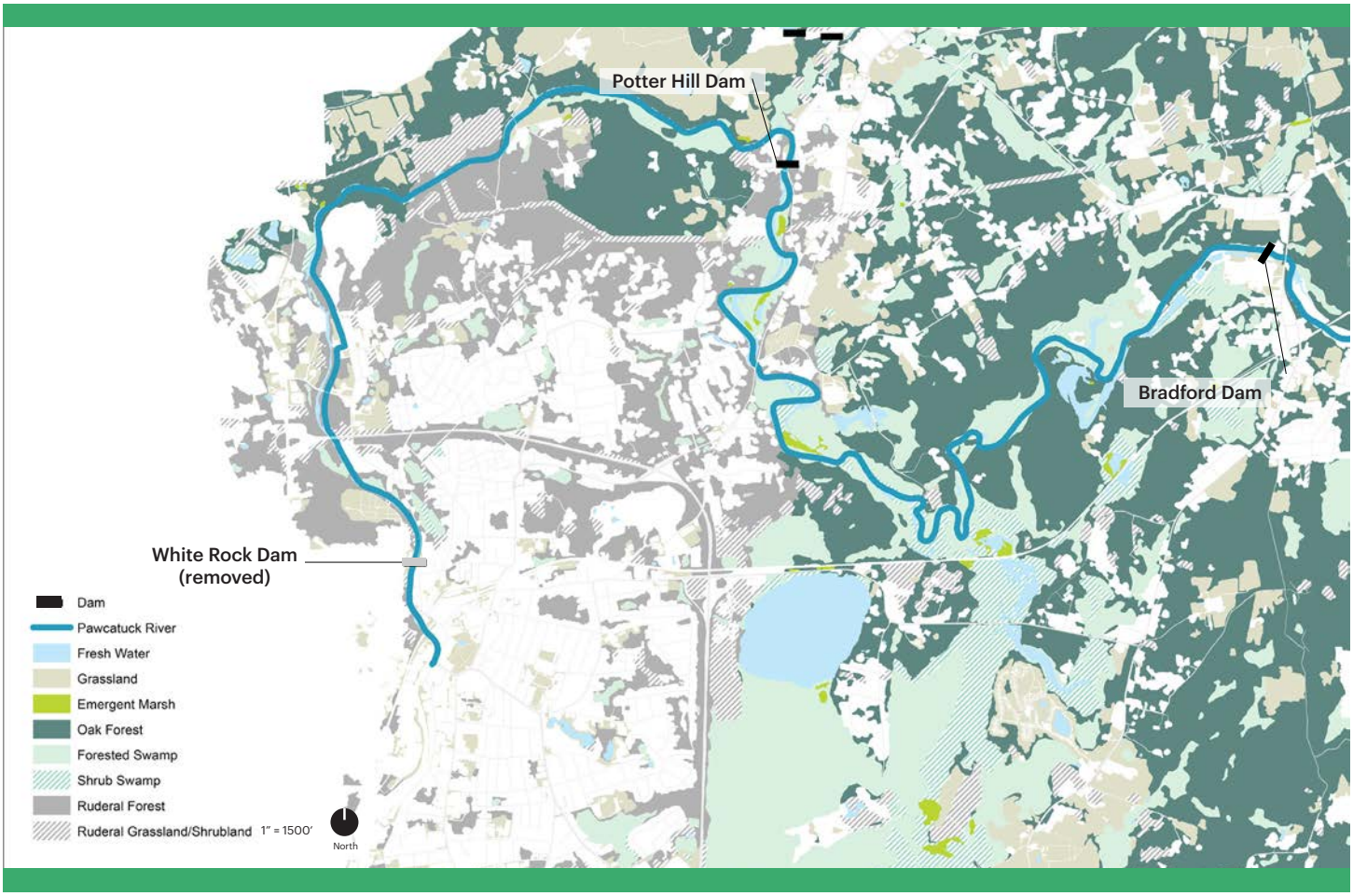
Full Removal: Free Flowing River

~ Optimal passage
Average Slope: Varied
~ $500,000

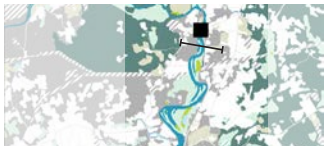
A free, unobstructed river is the ideal condition for migratory fish. Many case studies have proven that rivers are resilient systems and are capable of repairing themselves. Impoundment areas will re-vegetate and wildlife will re-populate. Free flowing rivers allow for natural nutrient cycles to be restored, clean oxygenated waters, and more connected waterways. Dam removal provides direct access to upstream spawning areas.

Habitat

Upstream/Downstream Habitat

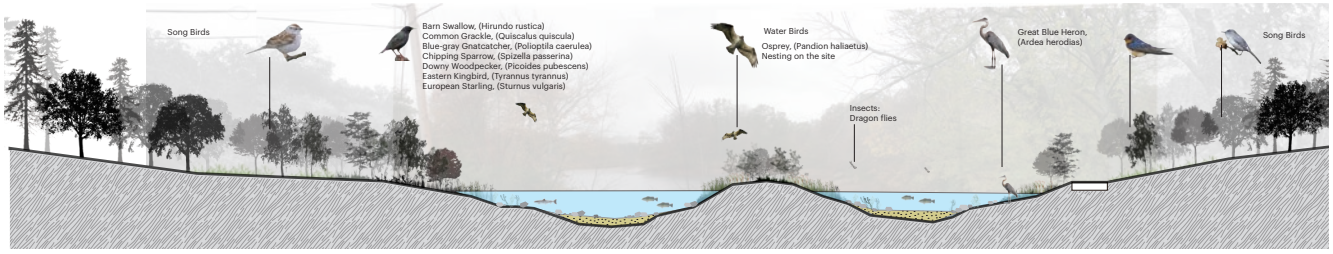


Upstream



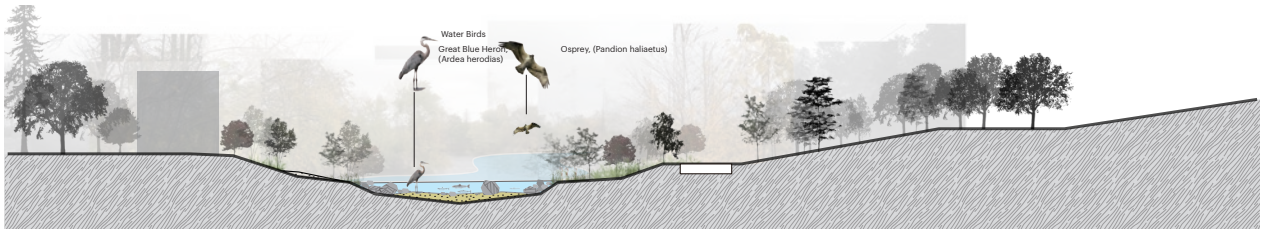
The impoundment of Potter Hill Dam is a lentic aquatic habitat surrounding emergent wetlands.

The upstream habitat attracts species, native and exotic, who establish and form a more complex system than downstream.



Downstream

The downstream of Potter Hill Dam provides a narrow and rocky water channel which creates a more natural riparian stream habitat. Downstream is more attractive to native wildlife species to inhabit. The fast speed, cold, shaded and rocky condition of the downstream habitat could effectively prevent invasive species.



Water Quality

General Information

Why is water quality important?

Good water qualityis the basis for any ecosystem, whether of fish, plants, and other organisms, including humans.

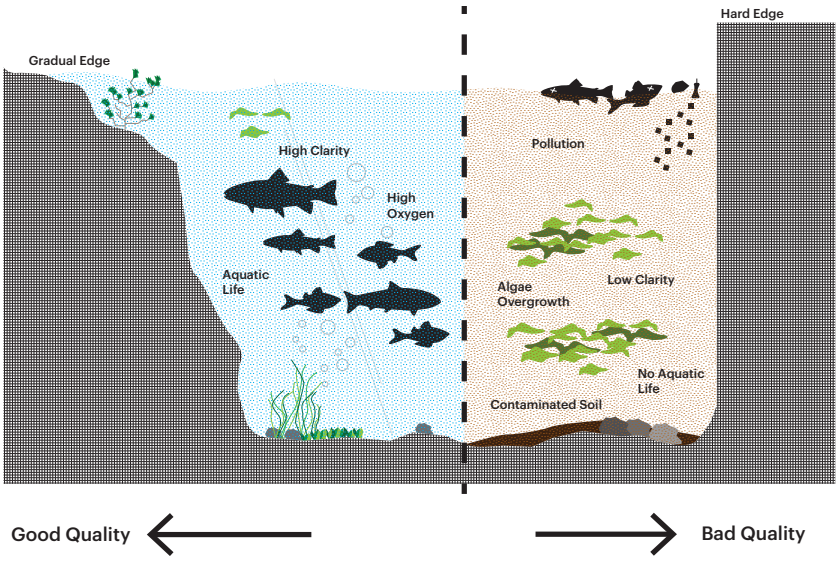
Indicators of ideal water conditions are vegetated edges, high level of clarity of the water, and acceptable levels of **dissolved oxygen.**

Elements that affect water quality

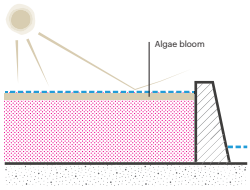
1. Nutrients
2. Water pH
3. Dissolved Oxygen
4. Water Temperature
5. Sediment Build-Up
6. Tidal Salinity
7. Bacteria
8. Contamination

What makes up good water quality?

1. Appropriate levels of Dissolved Oxygen
2. Balanced pH
3. Naturally regulated water temperature
4. Reduced output from waste-water in the river
5. Removal of sediment containing toxins and heavy metals



Nutrients



Within an impoundment, overloads of nutrients create overgrowth of algae, causing the water flowing downstream to become acidic, and oxygen and nutrient-poor.

•Nutrient sources:
• Septic systems, cesspools, upstream agriculture, and wildlife excrement

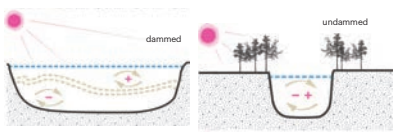
• Standard **Nitrogen levels** should be **less than 1 mg/L.** Concentrations greater than 10 mg/L put freshwater aquatic life at risk. It is also the limit for human consumption.

• The average level of Nitrogen (NO3 and NO2) in the Pawcatuck is about 0.5mg/L.

• **Phosphate level** concentrations of **0.05mg/L are likely** to have an effect on aquatic life while **0.1mg/L will certainlty** do.

• The **Pawcatuck River has an average level of <0.25mg/L.**

Water Temperature



• **Temperature increases as a river's width increases** since more water surface is exposed to the sun.

• Each fish species has specific temperature requirements for survival, growth and reproduction.

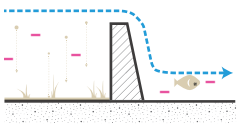
Temperature Classifications:

1. The Short-Term Maximum organisms will live for a few hours

2. The Optimum temperature in which species thrive; ideal for spawning.

• The optimal temperatures for common migratory fish are:
- Alewife: 55ºF-60ºF
- American Shad: 58ºF
- Blue Back Herring: 60ºF
- Atlantic Salmon: 50ºF

Water pH

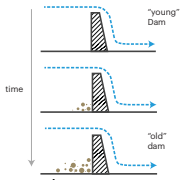


Acidity levels in water are a result of many factors. In an impoundment, decomposition of organic matter causes the potential hydrogen level to drop, making the water more acidic. Potential hydrogen (or pH) **is measured in a scale of 1 to 14,** 1 being the most acidic.

• The largest variety of **freshwater aquatic organisms prefer a neutral pH range between 6.5 to 8.0**.

• The **Pawcatuck River has an average pH of 7-8.**

Sediment Build Up

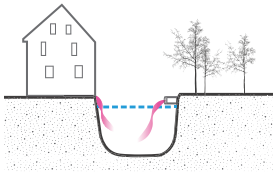


•Over time, **sediments build up behind a dam.**

• This eventually results in **failure,** unless the impoundment is regularly dredged.

• Downstream wetlands are sustained by the accretion of sediment. Without a steady supply, they will shrink.

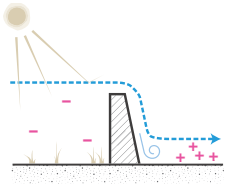
Bacteria



• Fecal coliform and enterococci are disease-causing organisms, and are an indicator of human sewage

• 22 out of 33 monitoring stations along the watershed **exceed** the **standards for recreational contact** such as swimming.

Dissolved Oxygen

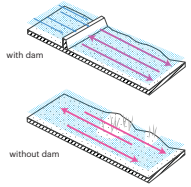


Dissolved oxygen (DO) in a reservoir is lowered by the decomposition of organic matter, warmer water temperature, and limited sunlight reaching the sea grasses.

Overflow dams often **create DO for downstream** habitats but **decrease DO** in the **impoundment.**

An appropriate level of dissolved oxygen is: 7-11 mg/L

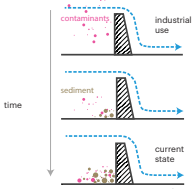
Tidal Salinity



• Dams impede the tidal backwashing of the river.

• If allowed to flow naturally, upstream and downstream ecologies can benefit from more balanced salinity levels.

Contamination

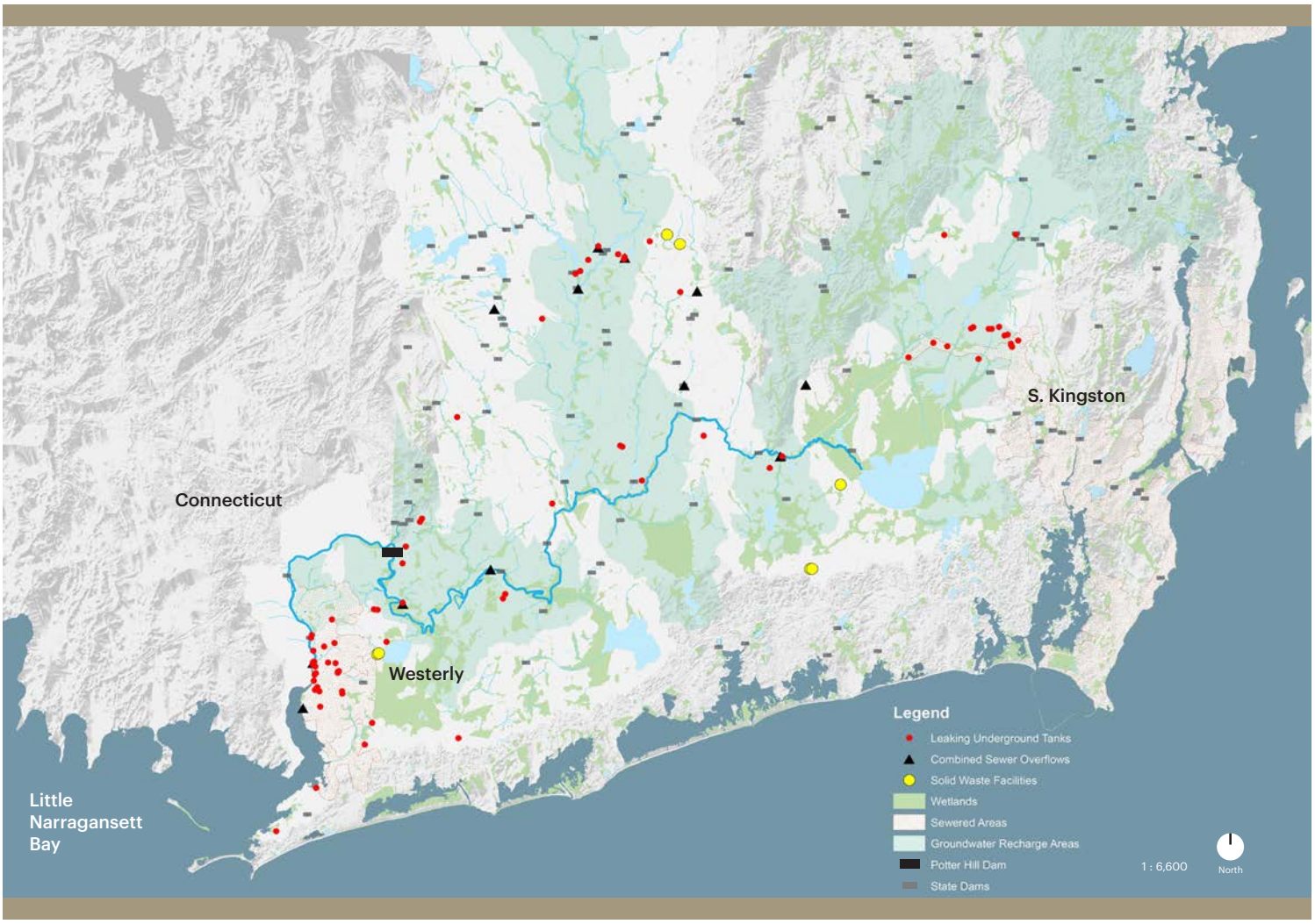


• With historic industrial dams, toxins like heavy metals can gather behind the dam and bind with sediments.

• **Removal** of these toxins is **costly** and **time intensive**, and can make their way downstream if the dam is removed.

Water Quality

Wood-Pawcatuck Watershed

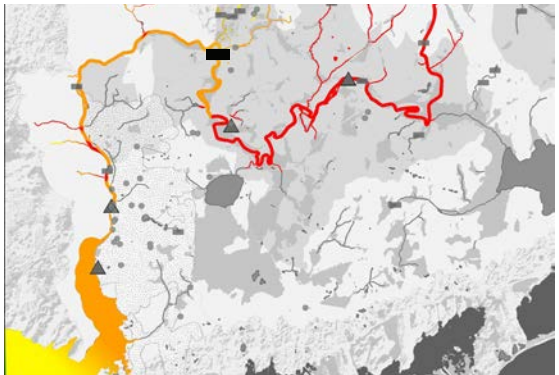


What are the quality classifications in this watershed?

Freshwater(AA,A,B,B1,C) and Seawater (SA,SB,SB1,SC) Classifications

- **Class AA;** public water supply. No allowable wastewater discharges allowed.
- **Class A and SA;** generally high quality streams and rivers. Fishable and swimmable conditions, with no point-source wastewater discharges. Designated waters for shellfish harvesting for direct human consumption.
- **Class B and SB;** fishable and swimmable conditions, with point wastewater discharges. Shellfish harvesting for controlled relay and depuration.
- **Class B1 and SB1;** same as B and SB, except primary recreational contact activities may be impacted due to pathogens from approved wastewater discharges.
- **Class C and SC;** waters designated only for secondary recreational contact activities and fish and wildlife habitat.

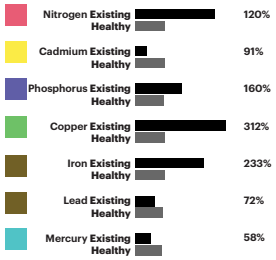
Tidal and Lower Pawcatuck River Classifications



What's impairing our waters?

TMDLs (Total Maximum Daily Load)

- **Federal Clean Water Act** establishes the maximum pollutant load that a waterbody can assimilate and still meet water quality standards. The information collected will also be used by both the Rhode Island and Connecticut shellfish programs to comply with the National Shellfish Sanitation Program's 12-year shoreline survey requirement.
- **Currently, Rhode Island's classification of the tidal Pawcatuck River prohibits the harvesting of shellfish.** (State of Connecticut Department of Energy & Environmental Protection)



Pawcatuck River Impaired Waters