Increasing Climate Resiliency through Selective Dam Removal While Preserving Our Past

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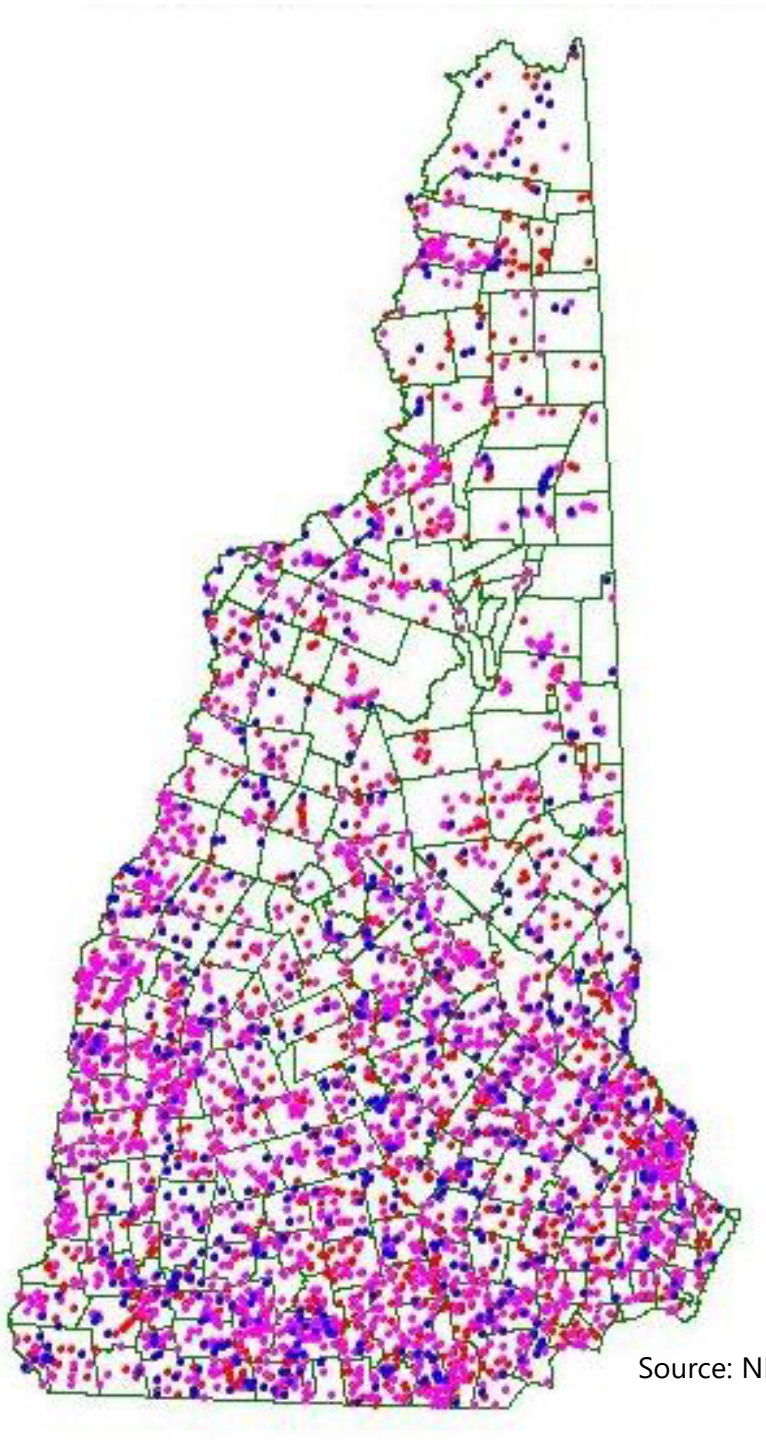
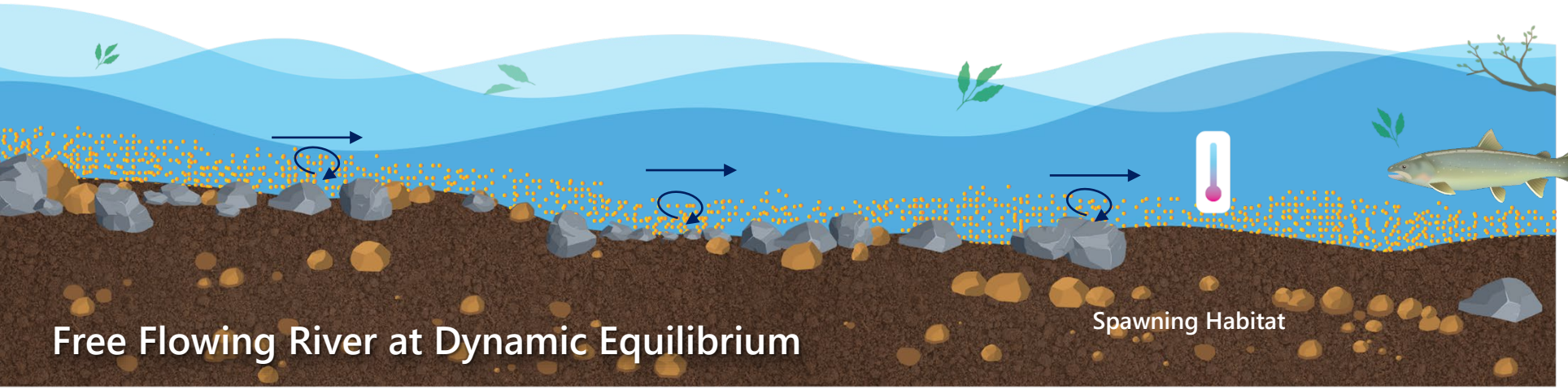
Dams are Ubiquitous

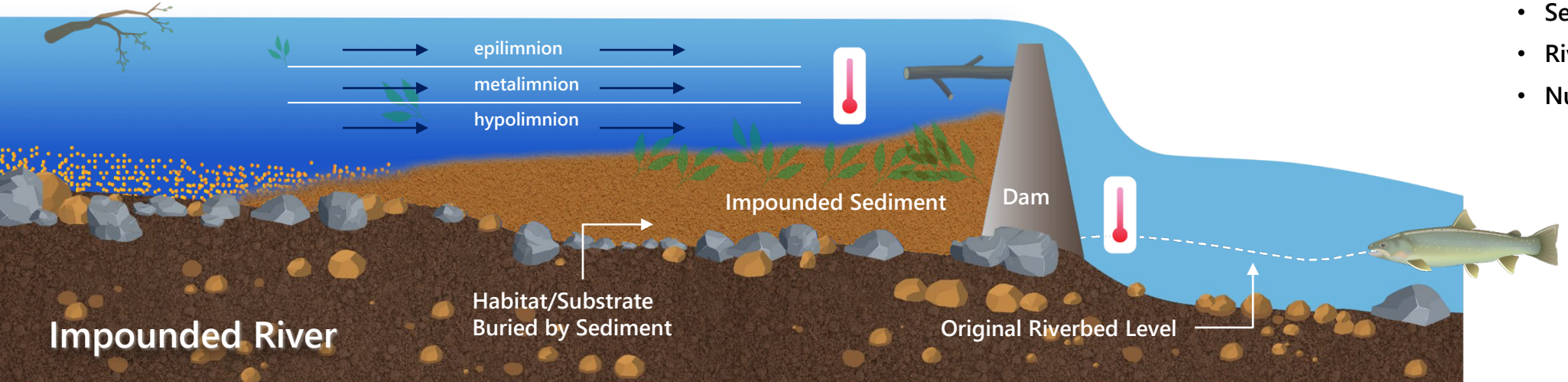
- National Inventory of Dams (NID) (n= 625)
- NID + Remaining Active Dams (n=2,624)
- NID + Active + Inactive Dams (n=4,549)



Source: NHDES Dam Bureau, NH GRANIT

Free Flowing vs Impounded River





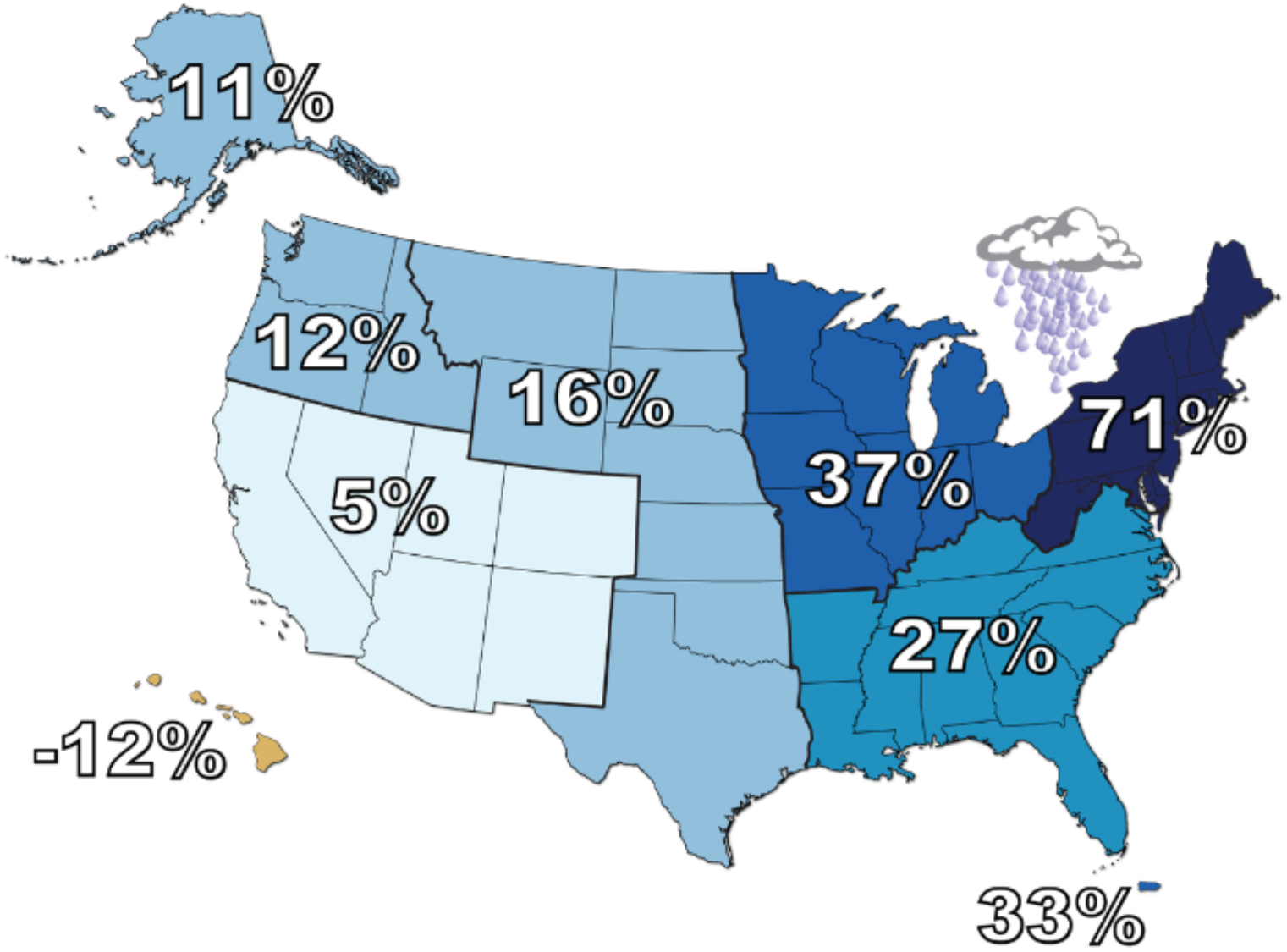
Impoundment

- Increased Flooding
- Stratification (loss of mixing)
- Increased Temperatures
- Organics & Debris Trapped
- Oxygen Depletion
- Algae Blooms
- Sediment Trapped
- Pollutants Accumulate
- Upstream Fish Passage

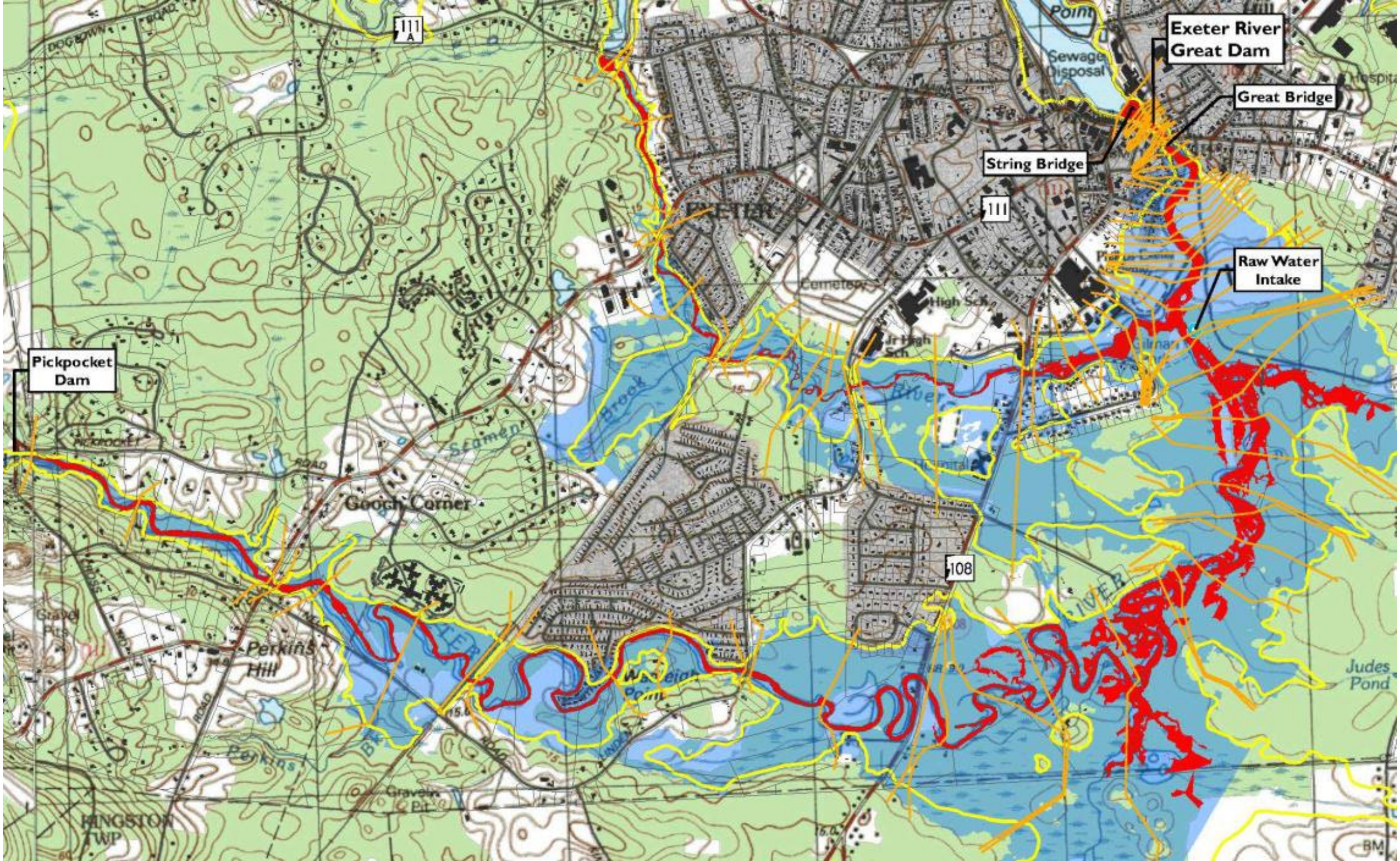
Downstream

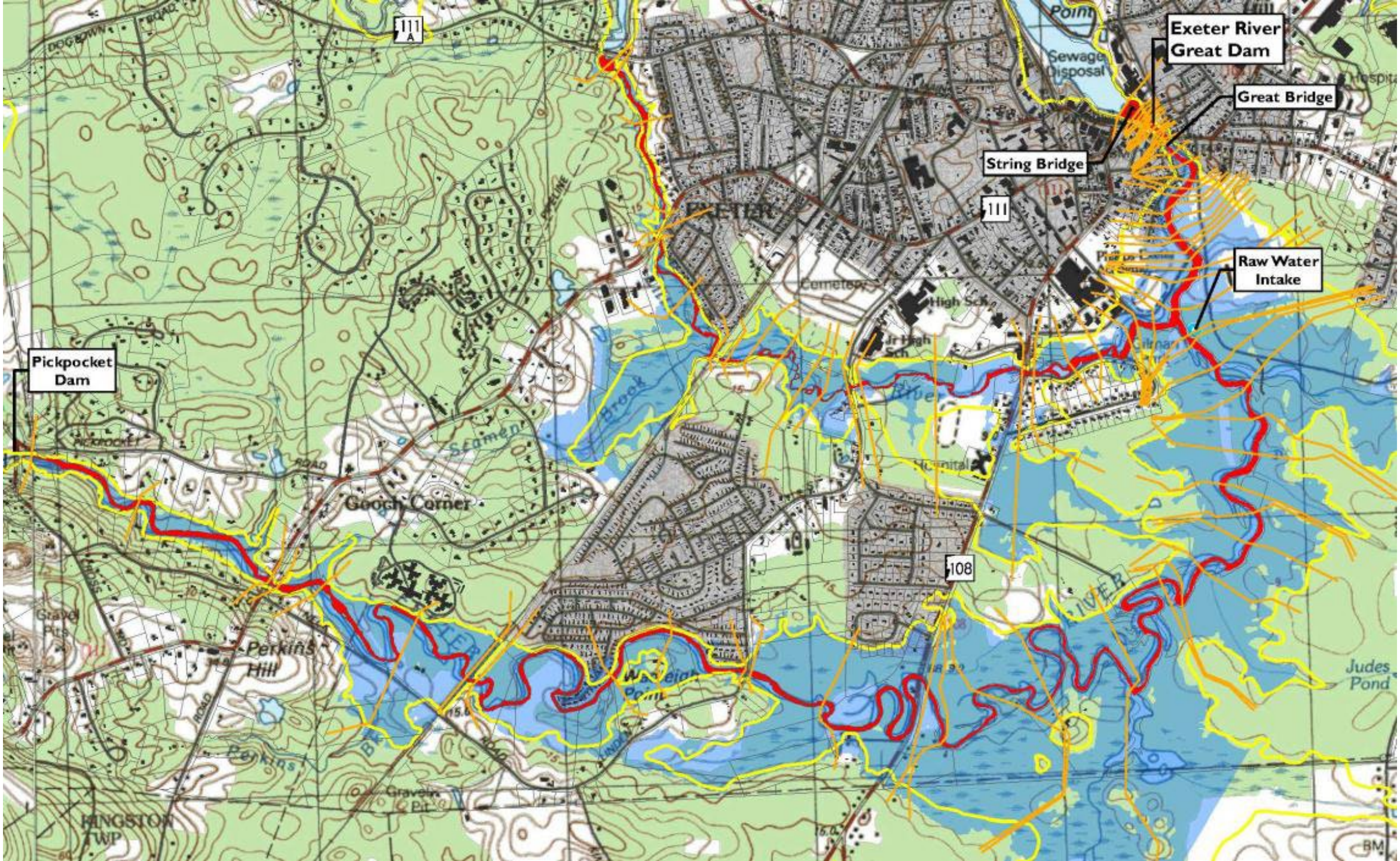
- Water Quality is Reduced
- Temperatures Modified
- Sediment Starved
- Riverbed Degrades
- Nutrient Starved

Observed Change in Very Heavy Precipitation



Percent changes in the amount of precipitation falling in very heavy events (the heaviest 1%) from 1958 to 2012 for each region.


Exeter River Great Dam
Great Bridge
String Bridge
Raw Water Intake
Pickpocket Dam
Gooch Corner
Perkins Hill
111
111A
108
Sewage Disposal
Cemetery
High Sch
Jr High Sch
Jude's Pond
KINGSTON TWP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108

Benefits of Dam Removal–One Example

- Flood Resiliency–lower upstream flood elevations by 2.5 ft
- Avoid flood damage costs ($1.7M-$3.4M over 10 years)
- Public Safety–eliminate unsafe dam structure
- Avoid dam maintenance costs ($620k over 30 years)
- Water quality (thermal stratification, dissolved oxygen)
- Fish Passage–barrier removed, anadromous fish restoration
- Restore 21 miles of river to free-flowing condition

Dam Removal and Historic Preservation


Sacrificing the Dam Helps Save a District

Mill Pond Dam
Oyster River
Durham, NH

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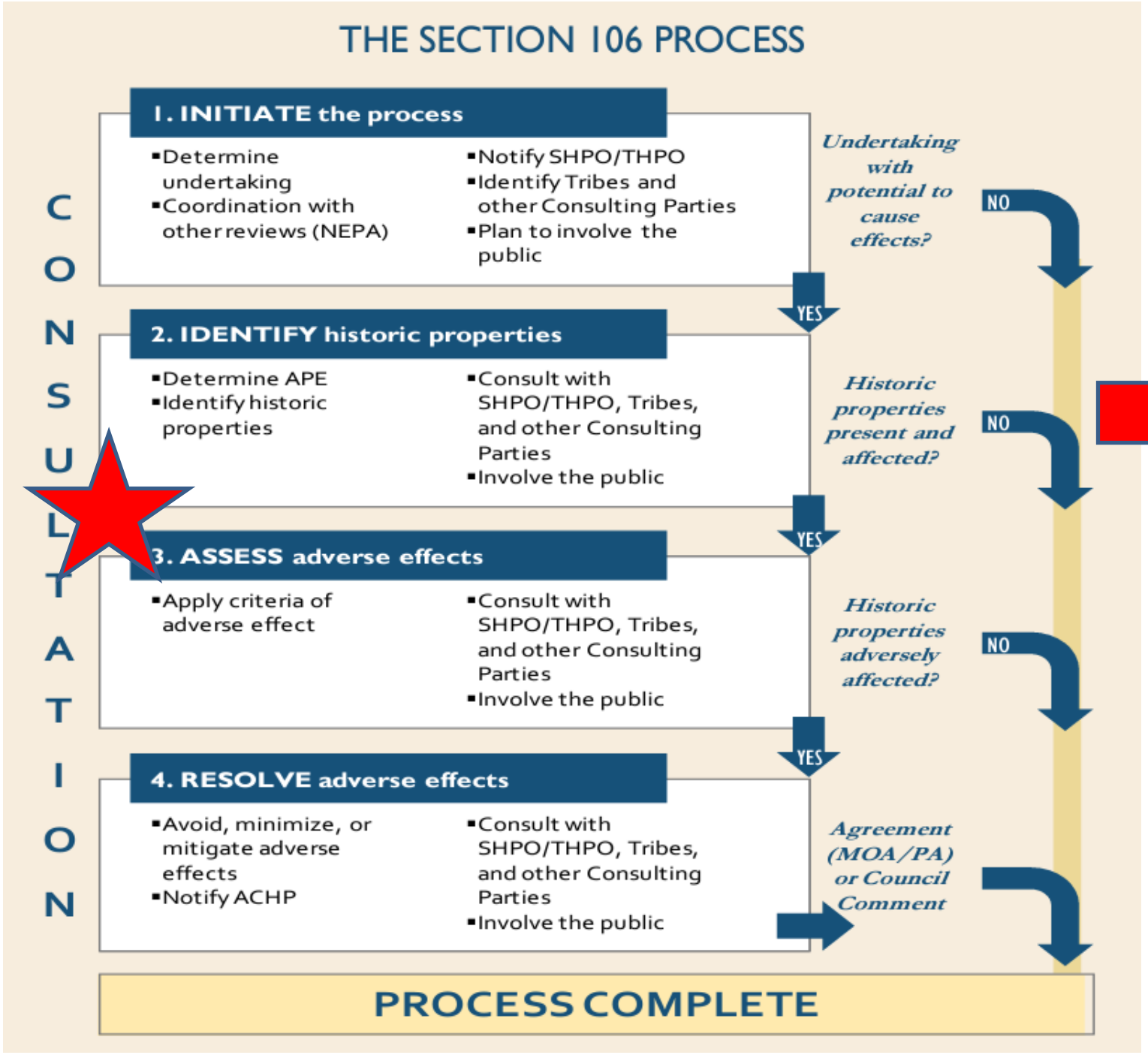
Mill Pond Dam, Durham, NH

- Mill Pond Dam: Listed on the State Register of Historic Places and Contributing Resource to the National Register-listed Durham Historic District
- Ambursen-type concrete dam constructed in 1913 replaced an earlier timber dam.
- Town voted to fully remove the dam
- On-going Section 106 Consultation Process
  - Currently in the Identification of Resources and Determination of Effects Stage



For purposes of Section 106, historic resources are defined as those that are eligible for or listed in the National Register of Historic Places.

Mill Pond Dam: Section 106 Process

Working with Agencies and Consulting Parties

- Working with consulting parties from multiple interest groups including property abutters, the historical commission and association, environmental groups, and Native American representation.

Identification of Historic Properties

- Compiling and mapping numerous potential historical and archaeological sites provided by the consulting parties for review.
- Concurrence from NHDHR/ACOE on the identified Historic Properties that will need to be evaluated for potential impacts.

Mill Pond Dam: Determination of Effects

An *Adverse Effect* is found when an undertaking may:

- Alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register of Historic Places in a manner that would dimmish the integrity of the property's location, design, setting, materials, workmanship, feeling or association.

Examples include:

- Physical destruction of or damage to a historic property
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features
- Change of the character of the property's use or of physical features within the property's setting that contribute to its historic features

Homestead Woolen Mills Dam
Ashuelot River
West Swanzey, NH

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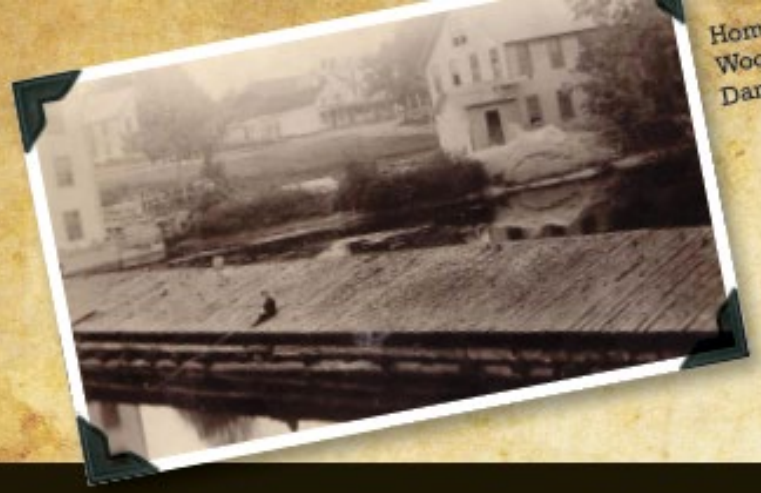
Homestead Woolen Mills Dam, Swanzey, NH

- Dam may have been constructed as early as 1860 to serve the Stratton Woolen Mill and wooden ware shops
- Rock filled, timber crib dam
  - Reliable, economical dam design common in the Ashuelot watershed
- The Homestead Woolen Mills and Dam are eligible for National Register listing and in addition, the Mills and Dam are contributing resources to the National Register-eligible West Swanzey Historic District
- Earliest water power site in Swanzey (1730s)

Homestead Woolen Mills Dam: Mitigation

- Agencies and Consulting Parties Involved in the Section 106 Process:
  - National Marine Fisheries Service (NMFS): Lead Federal Agency
  - NH Division of Historical Resources (NHDHR)
  - National Oceanic and Atmospheric Administration (NOAA)
  - NH Department of Environmental Services (NHDES)
  - Homestead Woolen Mills, Inc (HWM): the Project Proponent
  - Town of Swanzey
- Memorandum of Agreement was executed in 2009 and included the following stipulations:
  - Historic American Engineering Record (HAER)-level documentation of the Dam
  - NH Historical Highway Marker erected near the site of the Mill and Dam
  - Brochure for a self-guided walking tour within the West Swanzey Village Historic District and featuring the Homestead Woolen Mills and Dam
  - Archaeological visual assessments to occur over the course of a year



Homestead
Woolen Mills
Dam ca. 1860

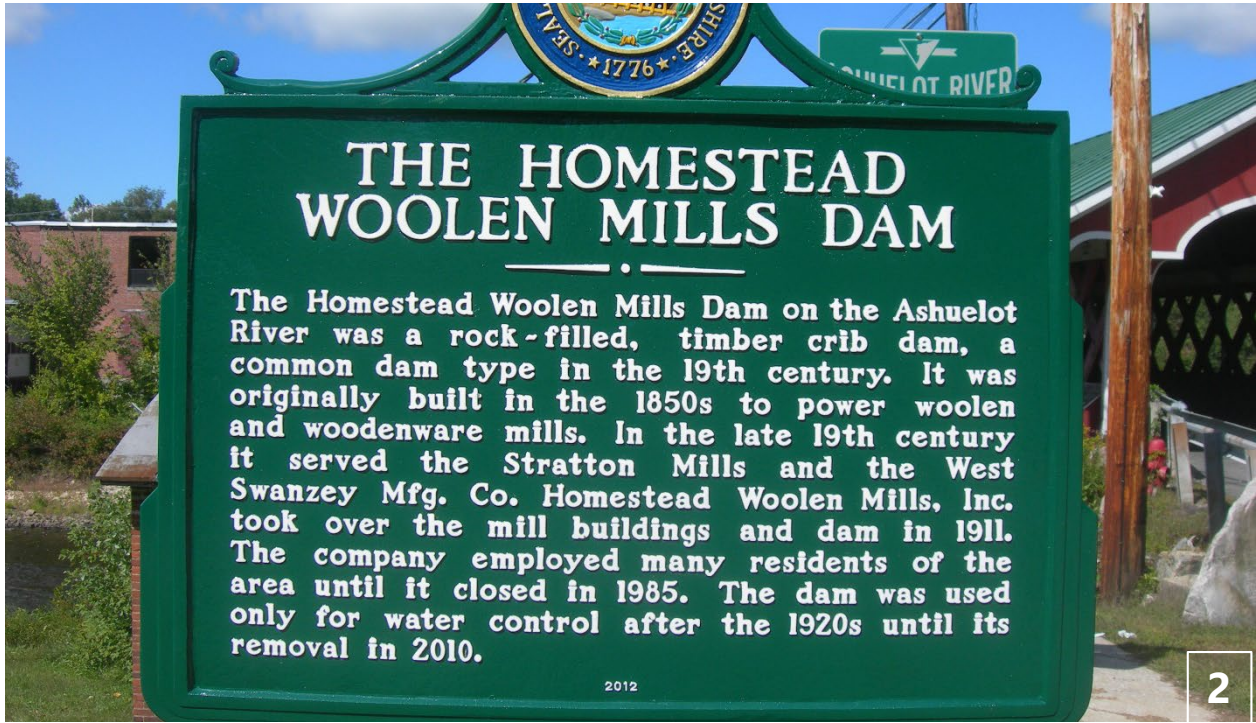
West Swanzey Village Historic District Walking Tour

West Swanzey, New Hampshire

This walking tour brochure highlights important places and people in the West Swanzey Historic District, a mill village whose history and intact appearance make it eligible for listing in the National Register of Historic Places. Developing in the 18th century around the falls in the Ashuelot River, the small village grew and prospered as the river was dammed, enabling mills of various kinds to tap the energy potential of the 55-mile long river. Manufacturing flourished in the 19th and 20th centuries, as larger operations in woodworking and textiles took advantage not only of the mill dam, but eventually of steam power, railroad transportation, and finally electrification. The closure of the last and largest mill, Homestead Woolen Mills, in 1985, left the Homestead Dam – itself the last timber-crib dam on the Ashuelot – without purpose and increasingly vulnerable to river flooding. After a formal review process, the dam was removed in 2010. This

3

1



2

Great Dam
Exeter River
Exeter, NH

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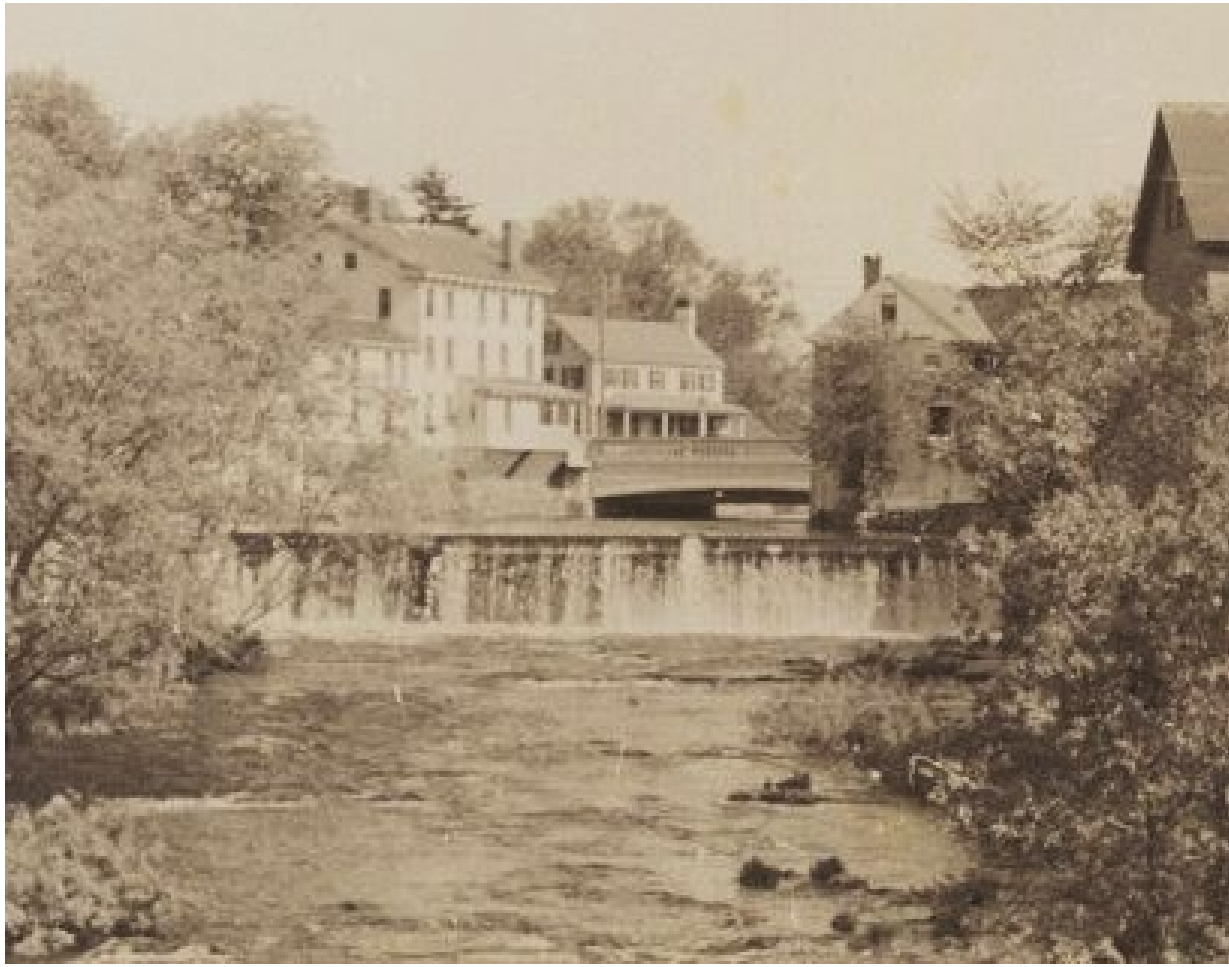
Great Dam, Exeter, NH

- Great Dam was constructed in 1914
- Contributing resources of Exeter Waterfront Commercial Historic District
- Full or partial dam removal would be an impact to a historic structure important to downtown Exeter and would modify the Historic District setting.
- The area around the Great Dam is considered sensitive for archaeological resources which could be impacted by either removal or modification of the dam.



Great Dam: Mitigation

- Agencies and Consulting Parties Involved in the Section 106 Process:
  - US Army Corps of Engineers (USACE): Lead Federal Agency
  - NHDHR
  - Town of Exeter: the Project Proponent
  - Exeter River Study Committee
  - Exeter Historic District Commission
  - Exeter Heritage Commission
  - Exeter Historical Society
  - and 2 individuals
- MOA was executed in 2015 with 6 stipulations.

Stipulation 1

Preservation of the headworks, the underground penstock, and the gears on top of the headworks

Stipulation 4

High-resolution photography during the dam removal.

Stipulation 5

Outside marker explaining the history and evolution of the dam site

Stipulation 6

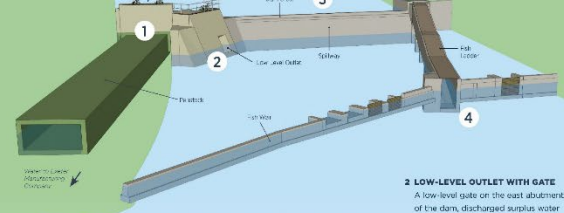
Interior exhibit commemorating the dam on display inside the Exeter Public Library

Bringing Water Power to Exeter

Dams have one purpose—to control the flow of water. Whether the goal is to harness the power of rapidly-flowing water, regulate water for year-round irrigation, create a reservoir, or control flooding, dams have been used for thousands of years to manipulate river flow and benefit surrounding communities and businesses.

The 1913 Great Dam was a gravity dam. Unlike the more widely-used embankment dams, which have a dense, waterproof core to prevent water from breaking through the dam, gravity dams rely entirely on their own weight and mass to resist the enormous force of the water they hold back. The Great Dam was used to hold back the river flow in a reservoir impoundment, and the water was used for powering the mills located along the river downstream. Later, the upstream impoundment was used by the town as a water supply, using a withdrawal pipe and pump house installed near Gilman Park in the early 1970s.

One of the biggest threats to dams is "overtopping," which occurs when the water level rises too high. It is important to control how and where the excess water flows, so it doesn't erode the sides of the dam and riverbank, causing a collapse of the entire structure. The 1913 Great Dam was removed in 2016, following a number of studies analyzing the safety of the structure, flooding events within the town, and declining water quality. Removal of the dam was a complex operation, requiring the reconstruction of the altered river channel to best accommodate fish migration and increase the riverbank's stability during floods.



The Great Dam had four major elements

1 HEADWORKS & PENSTOCK
Water power was harnessed for the nearby Exeter Manufacturing Company through the use of a penstock. The penstock transported water from the impoundment located behind the dam directly to the mill complex via an underground mill race tunnel. Two wood gates at the east end of the dam let water into the penstock and mill race, and were operated by a wheel and gear mechanism on the river bank, which has been preserved in Founders Park. Water traveled 200 yards north to the mills, turning the blades of a turbine that, in turn, generated power throughout the complex.

2 LOW-LEVEL OUTLET WITH GATE
A low-level gate on the east abutment of the dam, discharged surplus water directly to the lower level of the river below the dam.

3 CONCRETE DAM
Perhaps the most important feature of the Great Dam was its concrete spillway, measuring 137 ft. long by 12 ft. high. This concrete spillway created a wall across the river that impounded water several miles upstream. The spillway's sloped surface allowed the river water to flow smoothly over the crest of the dam.

4 FISH LADDER AND WEIR
In 1968, a fish ladder was added on the west side of the river. This dedicated tunnel bypassed the dam and weir, providing a series of ascending pools that allowed fish to migrate upstream. Fish leaped through the rushing water from pool to pool, until they reached the upper level of the river above the dam. A concrete weir stretching across the river helped direct fish toward the ladder entrance.

The 1913 Great Dam was removed in 2016, to address concerns regarding structural safety, flooding events, and declining water quality. This operation required more than just the removal of the structure; reconstruction of the altered river channel to best accommodate fish migration and increase the riverbank's stability during flooding was necessary as well. The complexity of the 2016 dam removal is a reminder of just how integral the 1913 Great Dam and its predecessors were to the Town of Exeter. For centuries, dams in the heart of downtown powered the town's growth and prosperity.

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