Great Dam Removal
Feasibility and Impact Analysis

Public Meeting
June 26, 2013
Exeter High School

Agenda

Time	Item	Presenter
6:30	Welcome and Introductions	Lionel Ingram Chair, Exeter River Study Committee
6:35	Meeting Goals & Participant Roles	Dr. Mimi Larsen Becker Co-Chair, Exeter River Study Working Group
6:45	Exeter's Approach to the Study	Paul Vlasich, PE Town Engineer and Project Manager
7:00	Presentation: Study Findings	Peter J. Walker, VHB
8:00	Presentation: Next Steps	Dr. Mimi Larsen Becker Co-Chair, Exeter River Study Working Group
8:15	Public Comments & Questions	Public, Town Officials, Agencies, Consultant Facilitated by Mimi Larsen Becker
9:30	ADJOURN	

Great Dam Removal Feasibility and Impact Analysis

MEETING OBJECTIVES & PARTICIPANT ROLES

Meeting Objectives

- **To review the study findings regarding the potential removal or modification of the Great Dam.**
- **To present the immediate next steps and process for making a decision.**
- **To solicit questions and comments from the public.**

Project Funding

Gulf of Maine Council on the Marine Environment

Exeter River Study Committee - Working Group

Member	Representing
Mimi Larsen Becker, Co-Chair	Exeter River Study Committee
Rod Bourdon	Exeter River Study Committee
Phyllis Duffy	Town of Exeter Engineering Dept.
Richard Huber	Exeter River Study Committee
Eric Hutchins	NOAA Restoration Center
Deborah Loiselle, Co-Chair	NHDES Dam Bureau
Kristen Murphy	Town of Exeter Planning Dept.
Peter Richardson	Exeter ConCom and ESRLAC
Sally Soule	NHDES Watershed Assistance
Paul Vlasich	Town of Exeter Engineering Dept.
Roger Wakeman	Exeter River Study Committee

Great Dam Removal Feasibility and Impact Analysis

EXETER'S APPROACH TO THE STUDY

Project History – Previous Activities

1981	• Town Takes Ownership of the Dam
2000-2009	• NHDES Dam Bureau Issues Letter of Deficiency and Amendment
2007	• Phase 1 (Dam Modification) Final Report for the Town of Exeter (Wright-Pierce)
2008	• Riverbank Scour/Design Impacts to Water Quality (Wright-Pierce)
2009	• Geomorphic Assessment (Bear Creek Environmental/Fitzgerald)
2010	• Water Supply Alternatives Study – Final Report (Weston & Sampson)

Project History – Why Another Study?

- Previous studies addressed **dam modifications**, but did not analyze the option of **dam removal**
- This study is focused on **dam removal**
- Considering the **"no-action"** and **"modification"** alternatives for comparison
- This study complements previous studies and, when taken together, provides a **complete picture of alternatives**
- The scope of the current study is a result of the feedback received at public meetings on **April 29, 2010, September 14, 2011** and **May 23, 2012.**

List of Issues to be Addressed

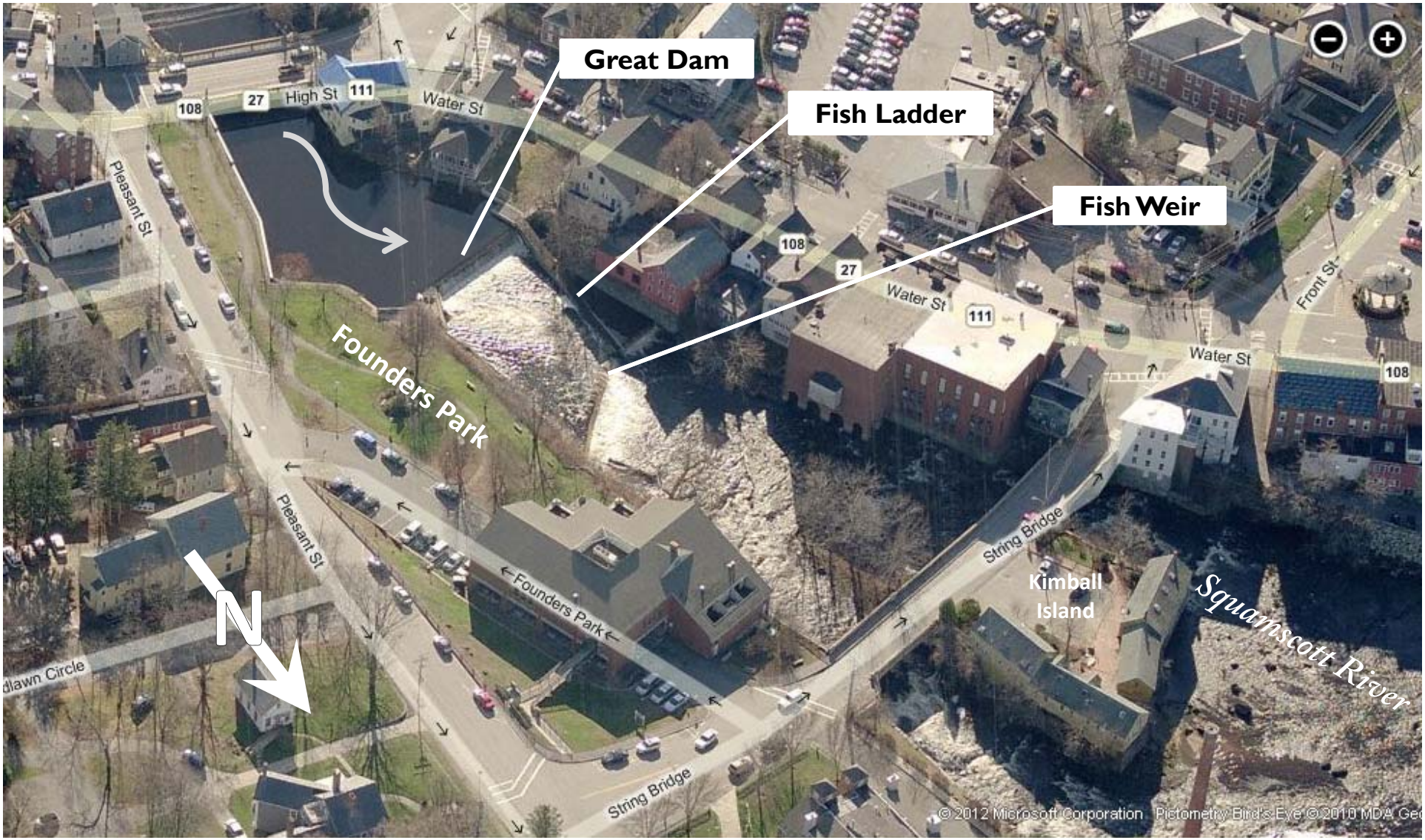
- Survey, Deed & Title Research
- Potential Sediment Contamination
- Sediment Quantity
- Hydrology and Hydraulics (e.g., flooding and erosion)
- Historic/Archaeological Resources
- Wetlands
- Wildlife
- Fish Passage
- Bridge and Infrastructure Impacts
- River Ice Dynamics
- Water Quality
- Groundwater Supplies
- Surface Water Withdrawals
- Recreation
- Invasive Species
- Aesthetics

Competing Issues and Priorities

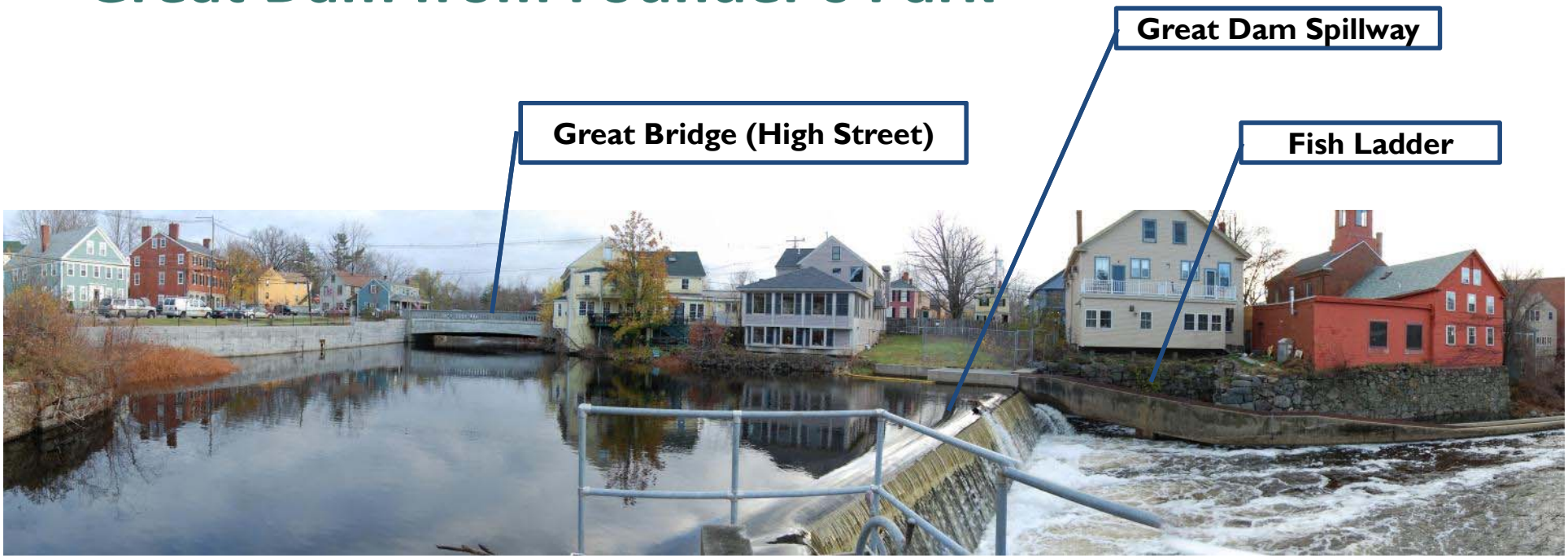
Great Dam Removal Feasibility and Impact Analysis

STUDY AREA ORIENTATION

Great Dam, Exeter River

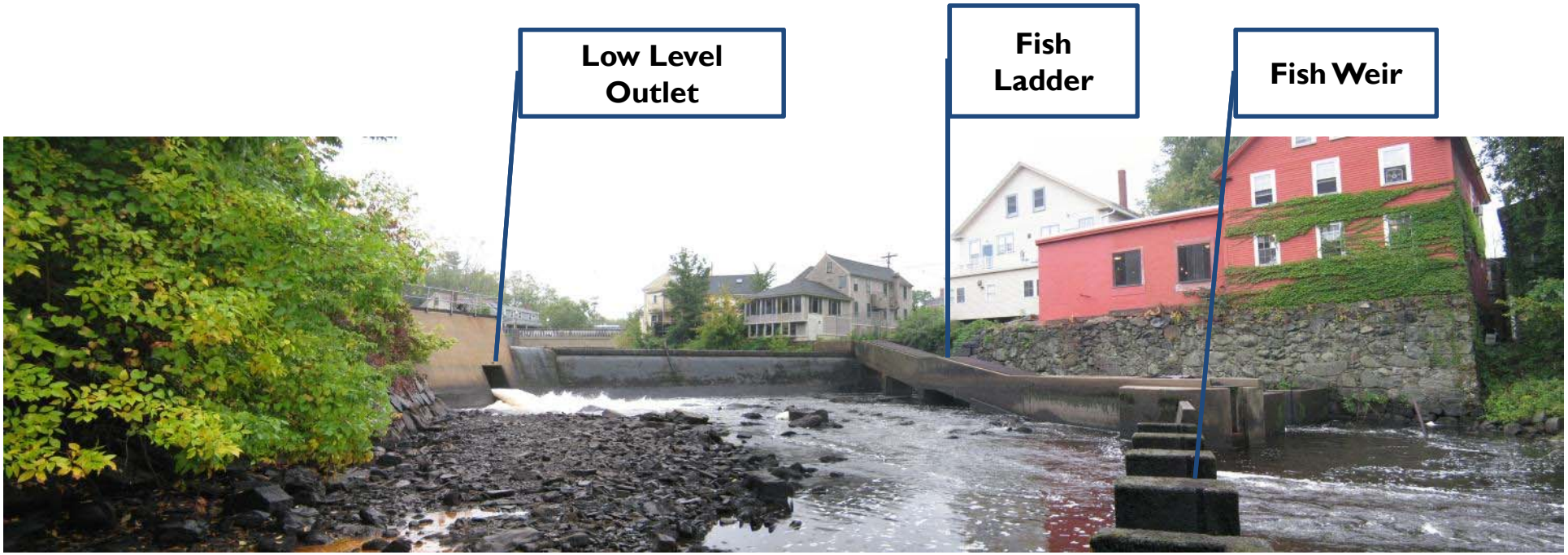


Great Dam from Founder's Park



Looking West

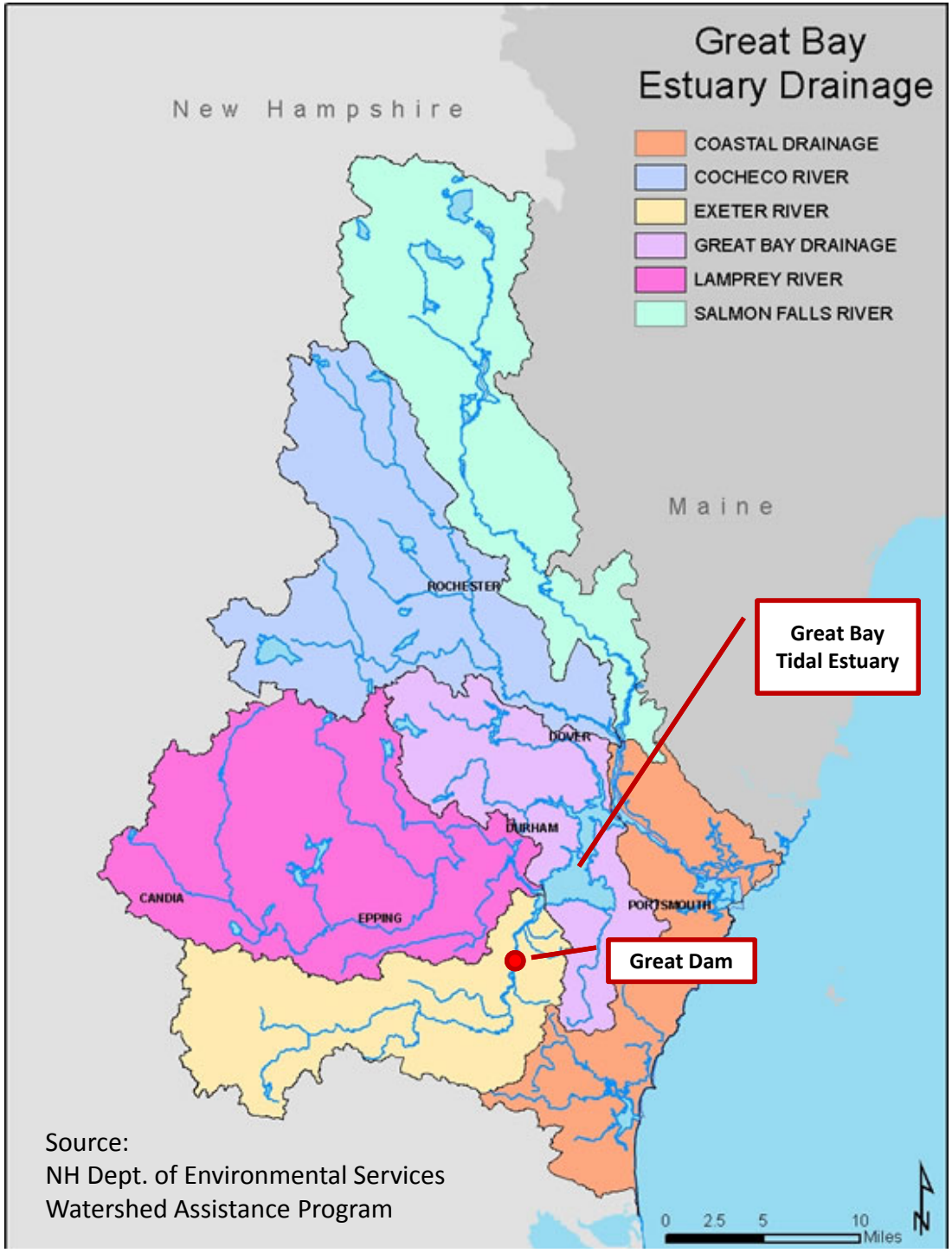
Great Dam from Downstream



Looking upstream (south)

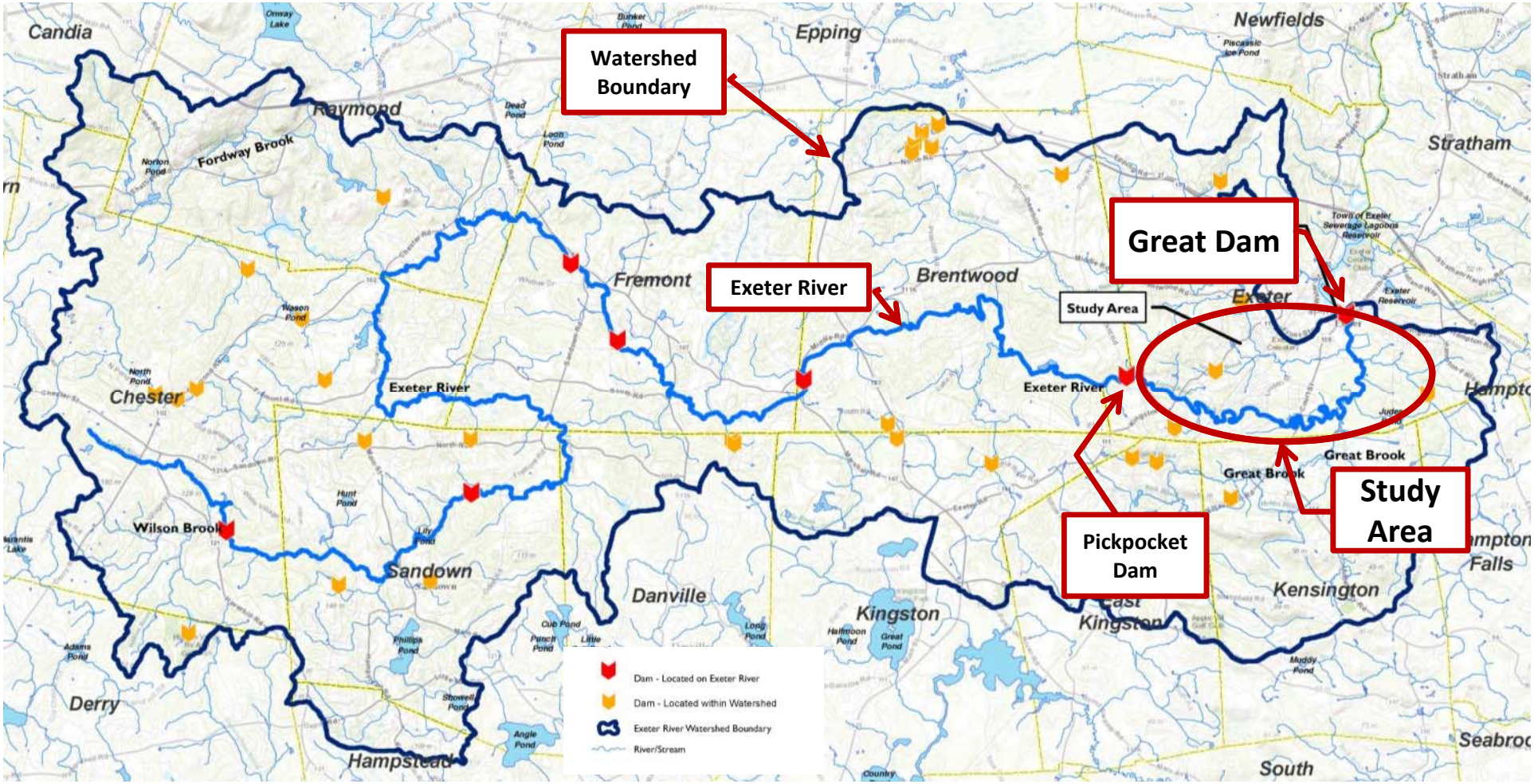
Great Dam Headworks (Looking East)

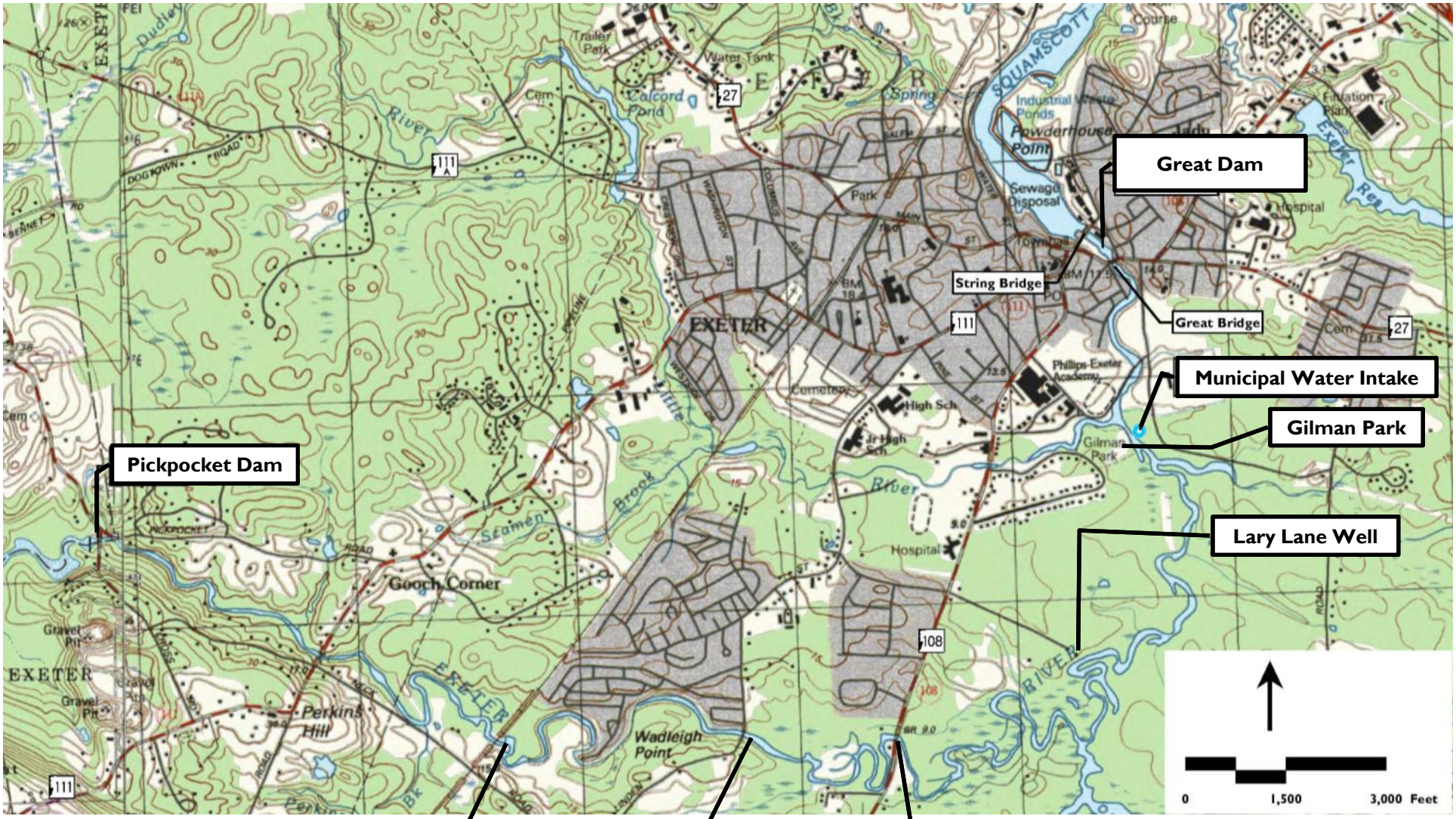
Great Dam Headworks (Looking East)



Source:
NH Dept. of Environmental Services
Watershed Assistance Program

Exeter River Watershed




Great Dam
String Bridge
Great Bridge
Municipal Water Intake
Gilman Park
Lary Lane Well
Pickpocket Dam
Railroad Bridge
Linden Street Bridge
NH 108/Court Street Bridge
EXETER
Gooch Corner
Wadleigh Point
Perkins Hill
Seamen Brook
Little River
Exeter River
Squamscott River
Powderhouse Point
Phillips Exeter Academy
Hospital
Cemetery
Sewage Disposal
Industrial Waste Ponds
Water Tank
Trailer Park
Golf Course
Gravel Pit
0
1,500
3,000 Feet

Great Dam Removal Feasibility and Impact Analysis

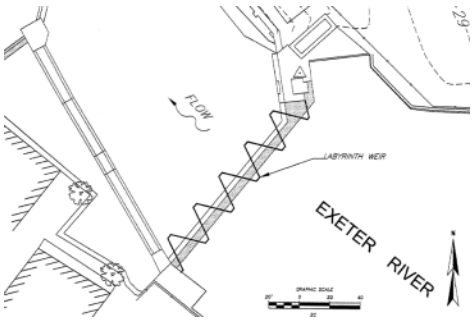
ALTERNATIVES

Dam Safety

- Dam is classified as a “Class A Dam” (Low hazard)
- Class A Dams shall pass a 50-year flood or shall be stable enough so that it is safe under the specified flood conditions
- Great Dam ***does not pass the 50-year flow*** with 1 ft freeboard and ***does not meet stability criteria***

General Alternatives

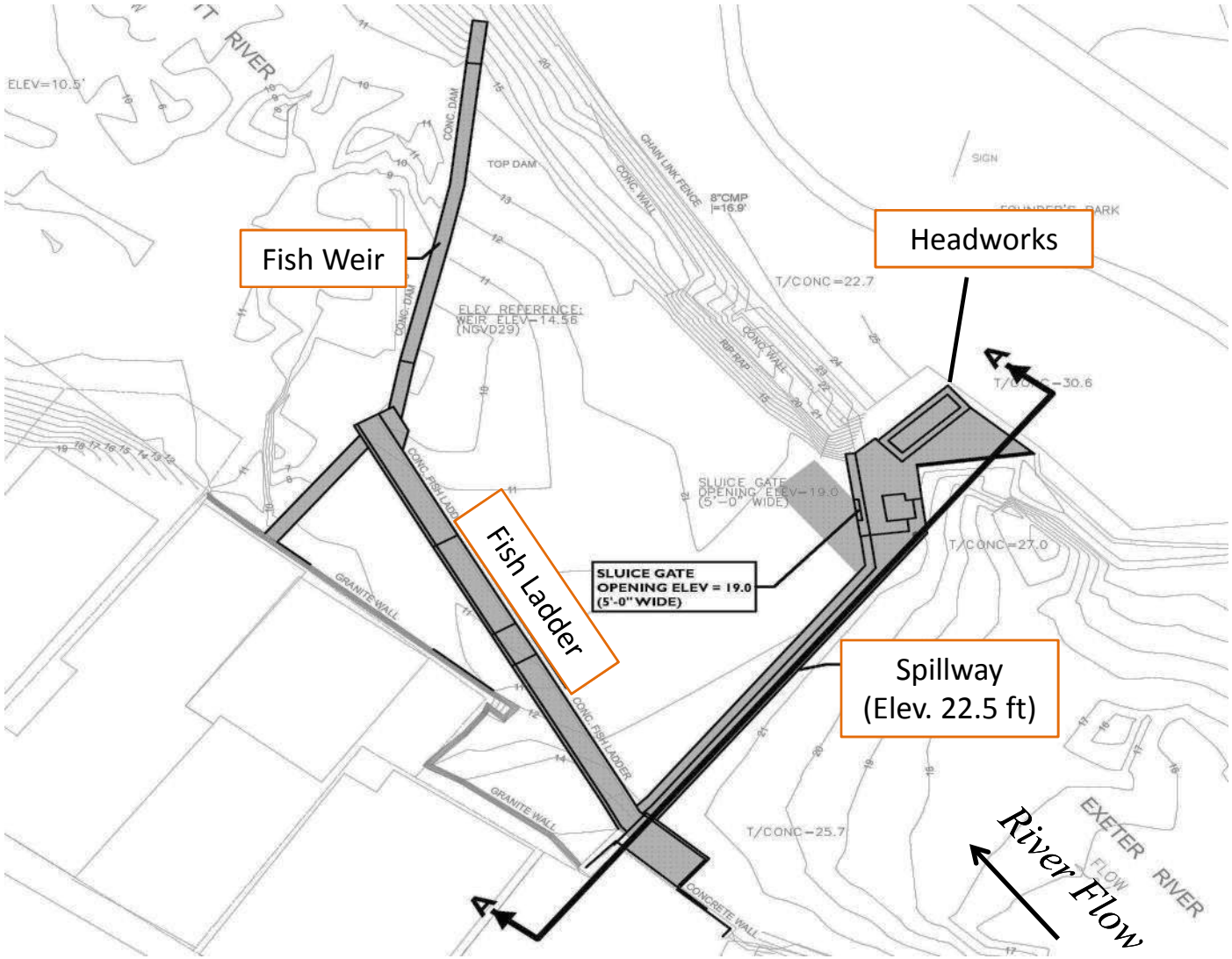
- **Lower spillway** by various amounts
  - Carried forward
- **Adjustable spillway** using alternative systems
  - Carried forward.
- **Extension of the existing spillway** into Founder's Park.
  - (Discarded: Too much impact to Founder's Park – 300 ft)
- Creation of an **additional spillway** in Founder's Park.
  - (Discarded: Too much impact to Founder's Park & Penstock)
- Construction of a **labyrinth spillway**.
  - (Discarded: Not enough gain in hydraulic capacity)



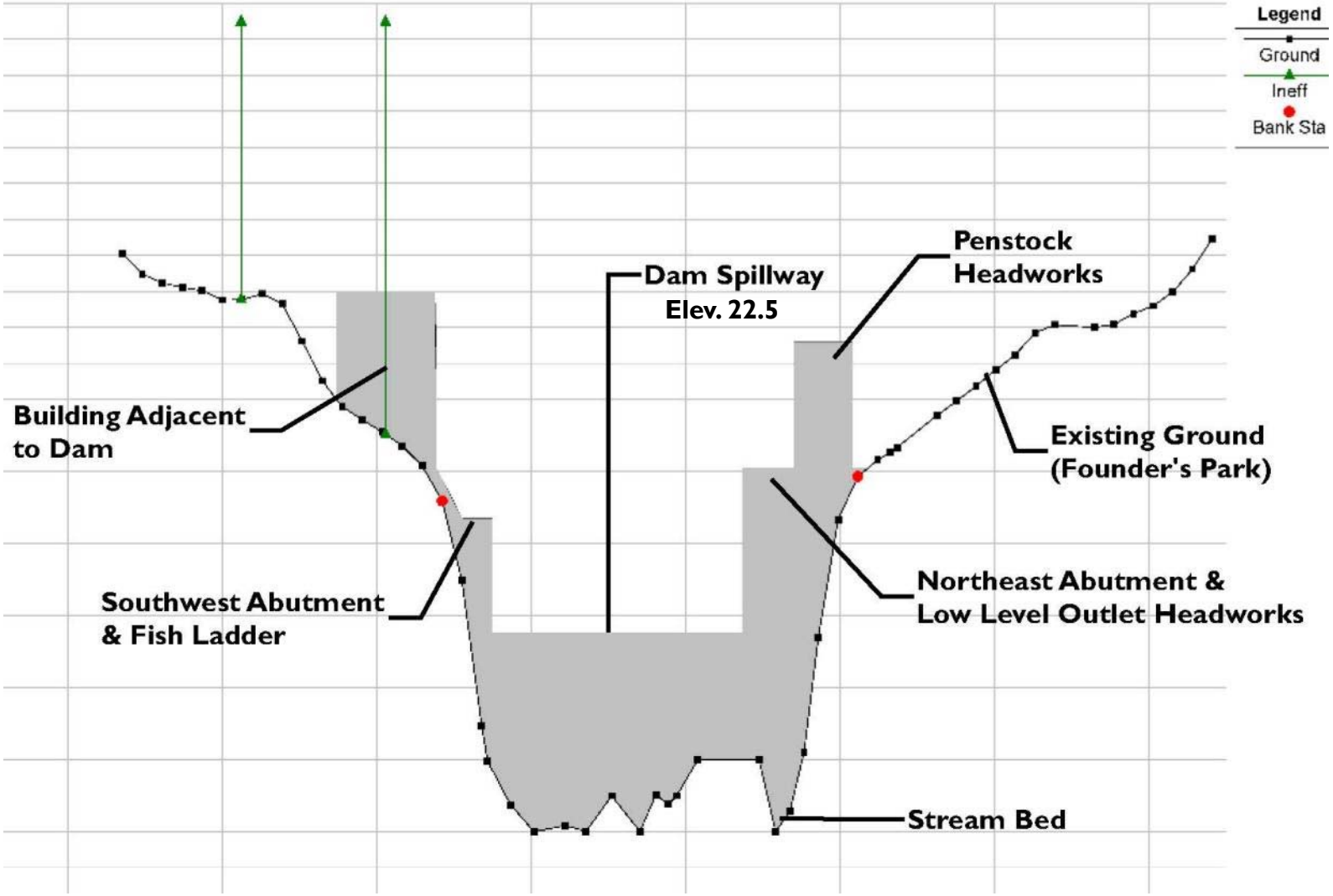
Alternatives Considered

- **Alternative A** – **No Action/Existing Condition**
- **Alternative B – Dam Removal**
- **Alternative C** – Dam Modification Concept 2 (W-P 2007)
- **Alternative D** – Revised Dam Modification Concept 2 (0 ft Freeboard)
- **Alternative E** – Revised Dam Modification Concept 2 (1 ft Freeboard)
- **Alternative F** – **Partial Removal**
- **Alternative G – Stabilize in Place**
- **Alternative H** – **Dam Modification** - Inflatable Flashboard/Gate System

Alternative A – Existing Condition/No Action

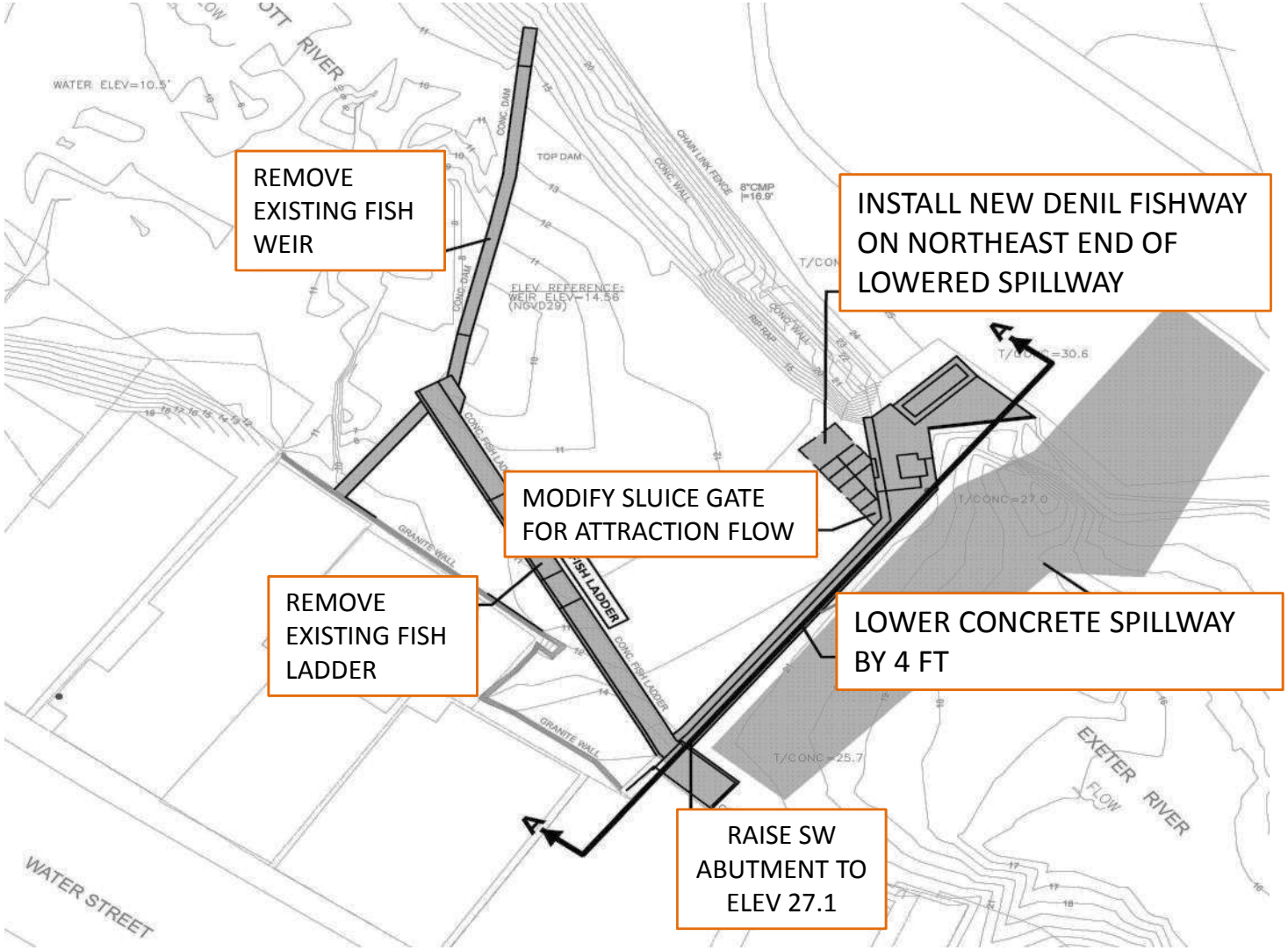


Alternative A – Existing Condition/No Action

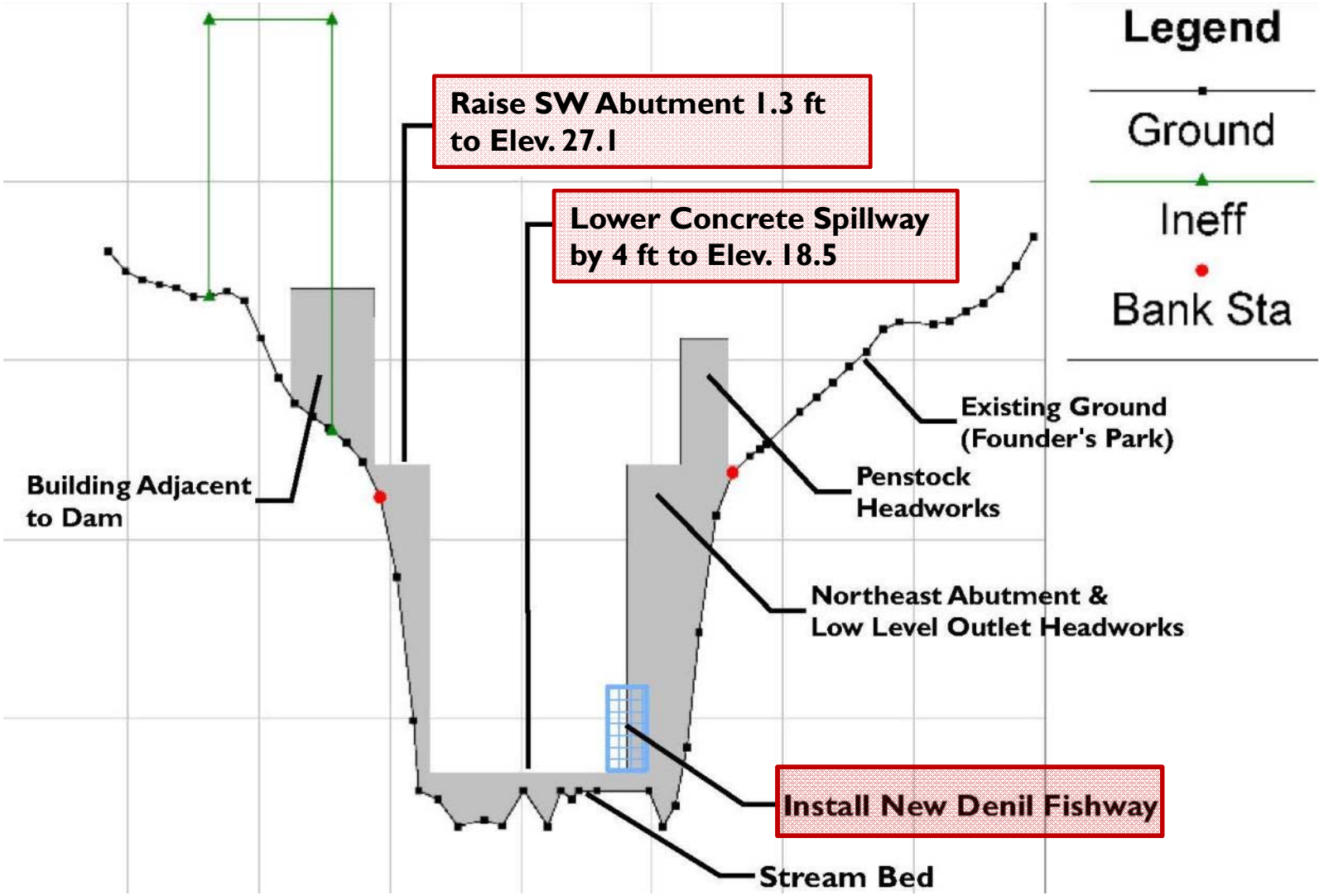


Alternative B – Dam Removal

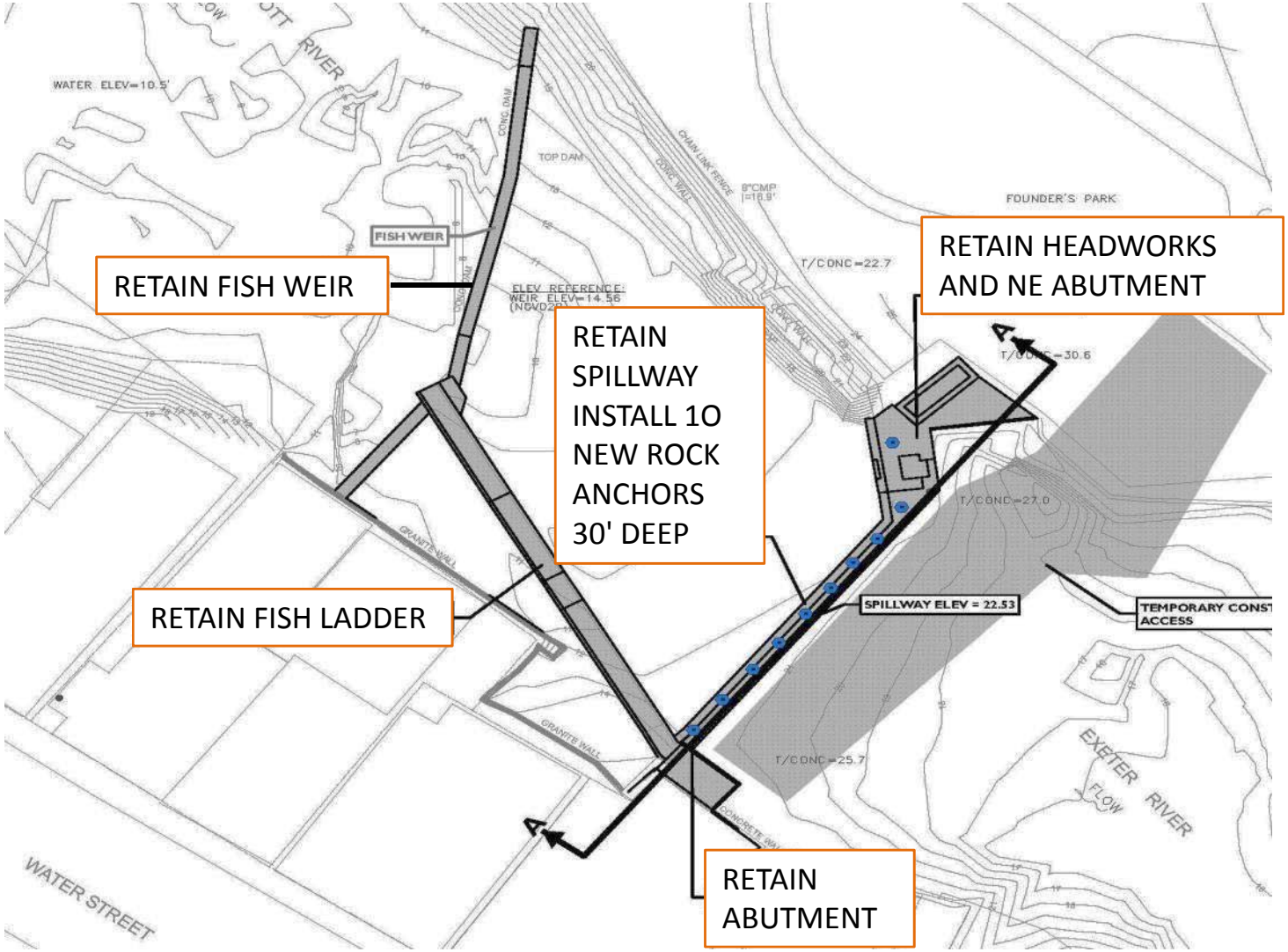
Alternative F – Partial Removal



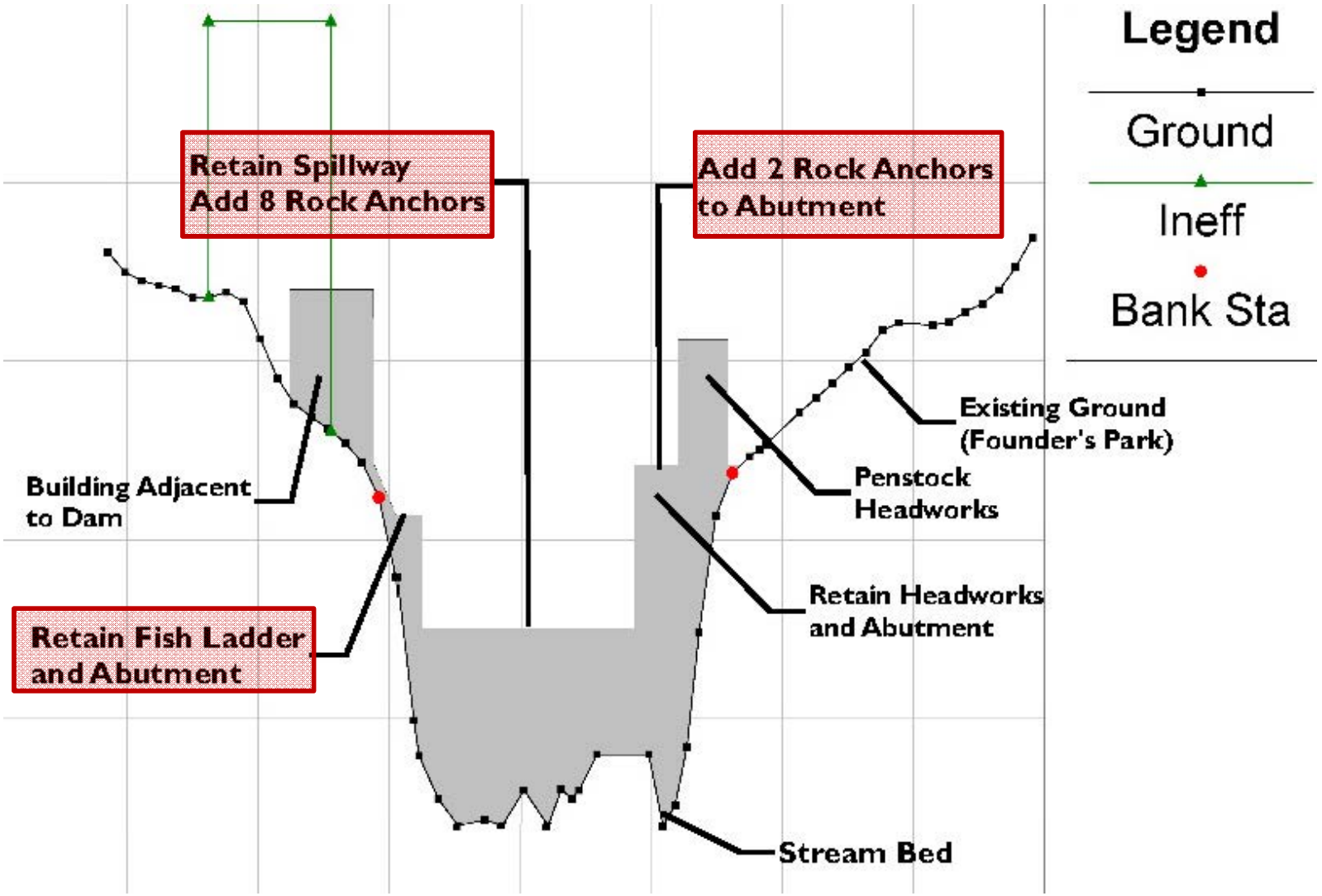
Alternative F – Partial Removal



Alternative G – Stabilize in Place



Alternative G – Stabilize in Place

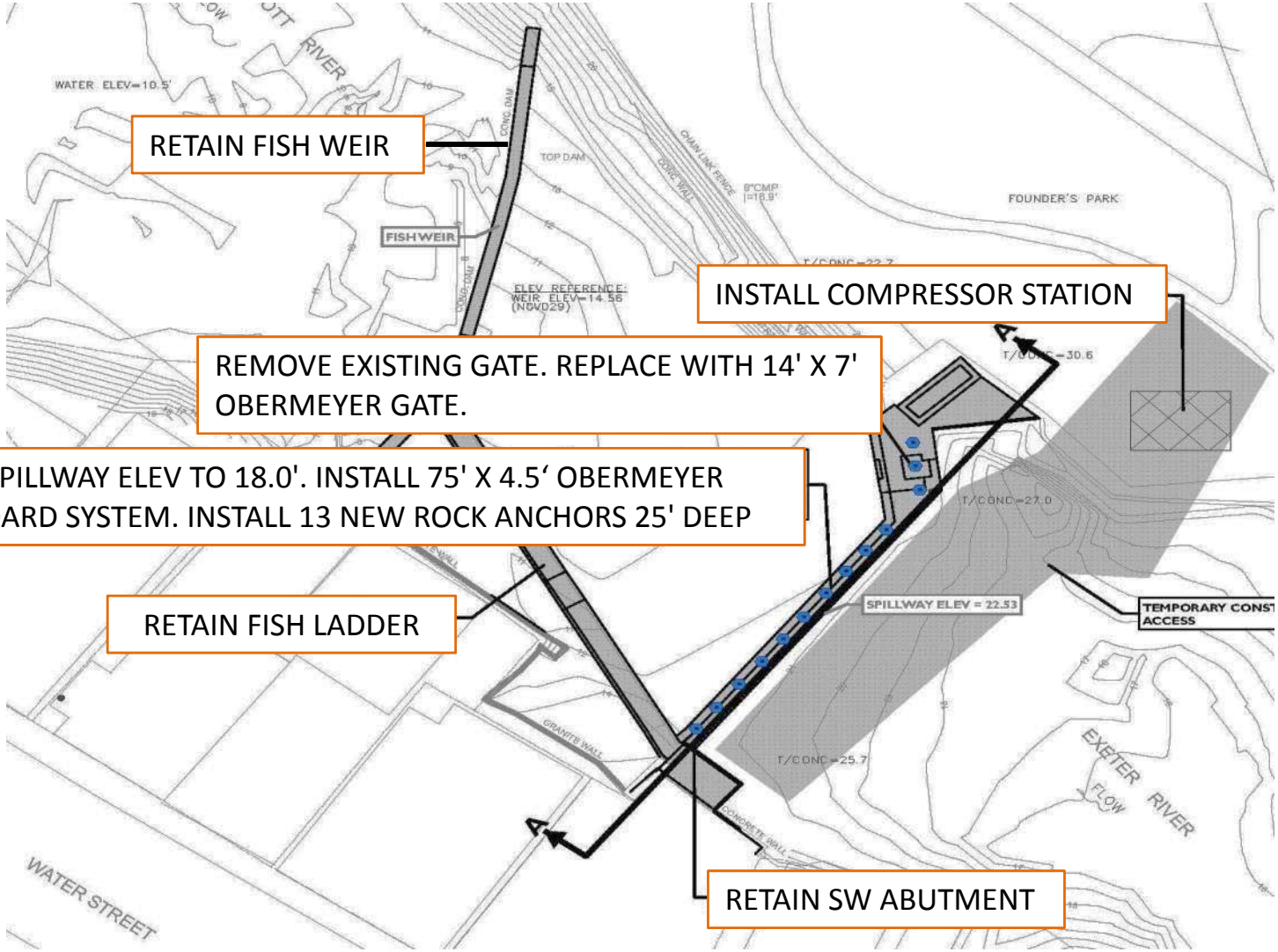


Alternative G – Stabilize in Place

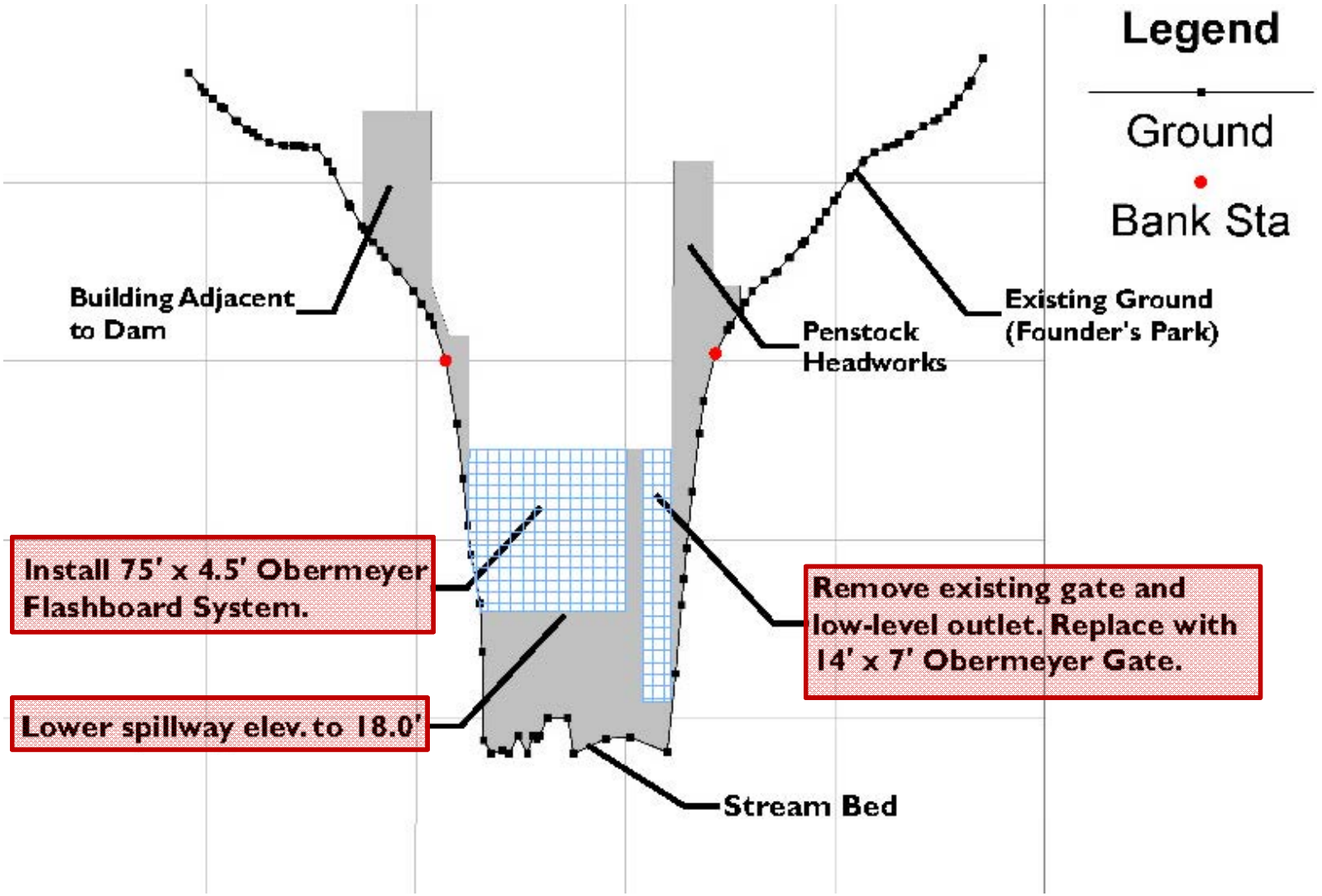
Drilling the Dam

Installing the Anchors

Alternative H – Dam Modification



Alternative H – Dam Modification



Obermeyer Flashboards

Obermeyer Flashboards

Great Dam Removal Feasibility and Impact Analysis

HYDROLOGY & HYDRAULICS

Hydrology and Hydraulics

- **Hydrology** : How much water is flowing through the river?
  - **Recurrence Interval:** 2-year, 50-year, etc.
  - **Flow measurement:** Cubic feet per second

- **Hydraulics:** What is the depth and velocity of the water?
  - Varies depending on **Location** and **Flow**

Hydrology – Incorporating Recent Climate Data

Flow (cubic feet per second)

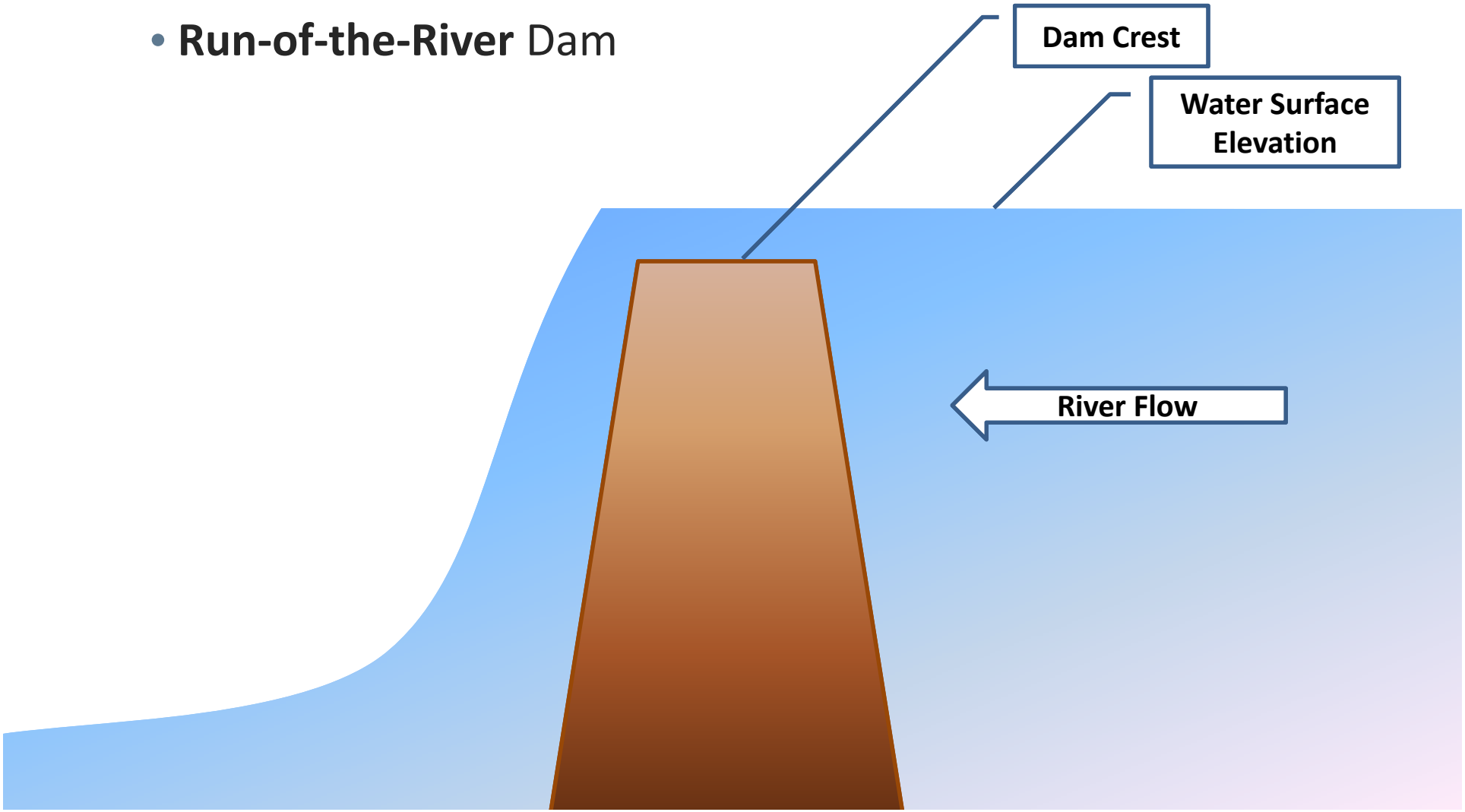
Dataset/Source	Sept	Annual	May	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1989 (current) FEMA Flood Insurance Study						2,811		4,107	4,827
2006 Wright-Pierce						2,900		4,416	4,949
Modified Synthetic record (1971-2009)				1,481	2,427	3,245	4,539	5,718	7,109
Final Design Flows	5.9	**71**	104	**1,481**	2,427	3,245	4,539	**5,858**	7,109

Hydraulic Modeling – What will this tell us?

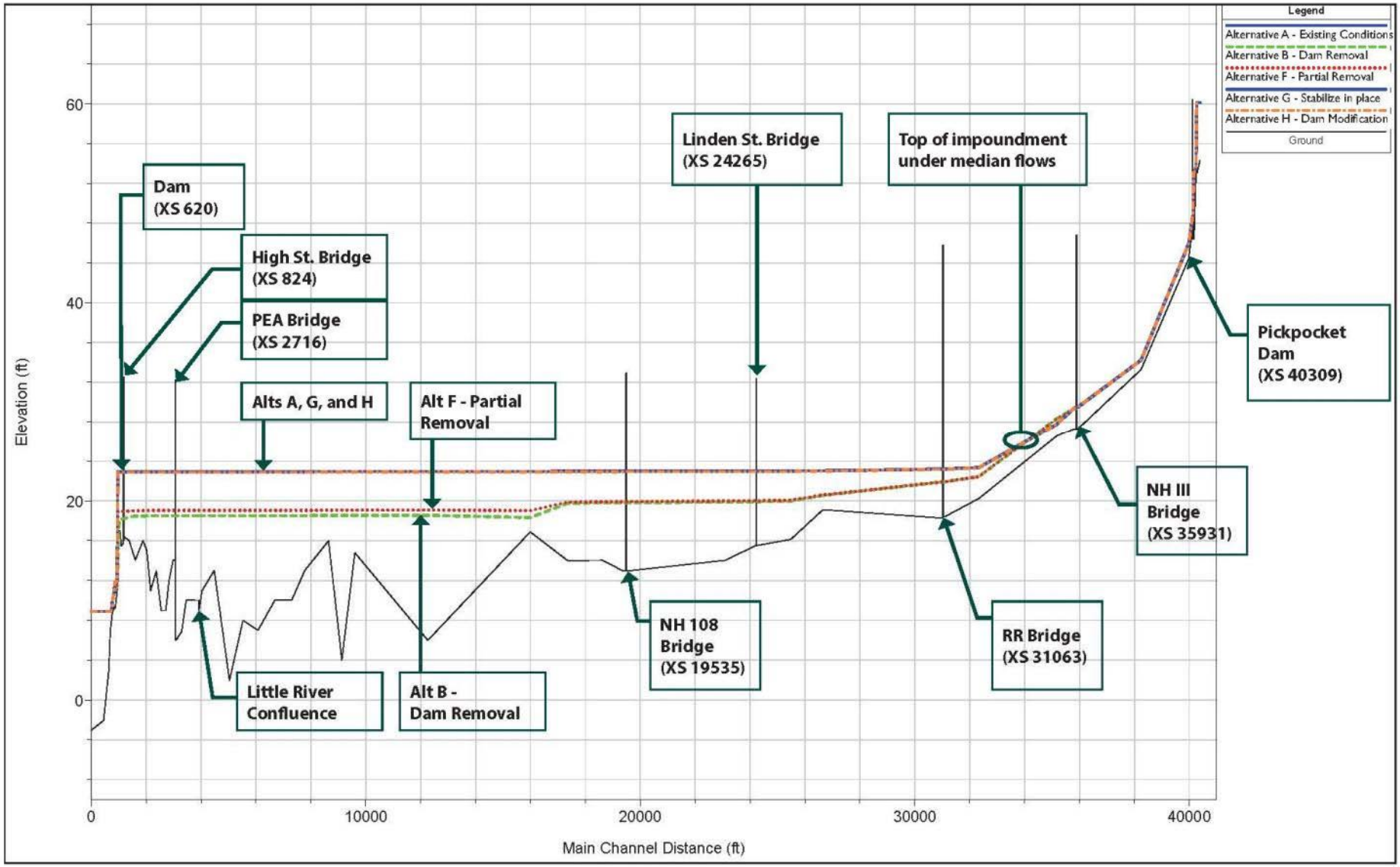
- How will **Flooding** change adjacent to river (horizontal and vertical)?
- How would **Wetlands** and **Aquatic Habitat** be affected?
- How would **Water Intakes** and **Groundwater** conditions be affected?
- How would **Sediment Transport** (i.e., erosion and deposition) change?

Hydraulic Findings: No Significant Change Downstream

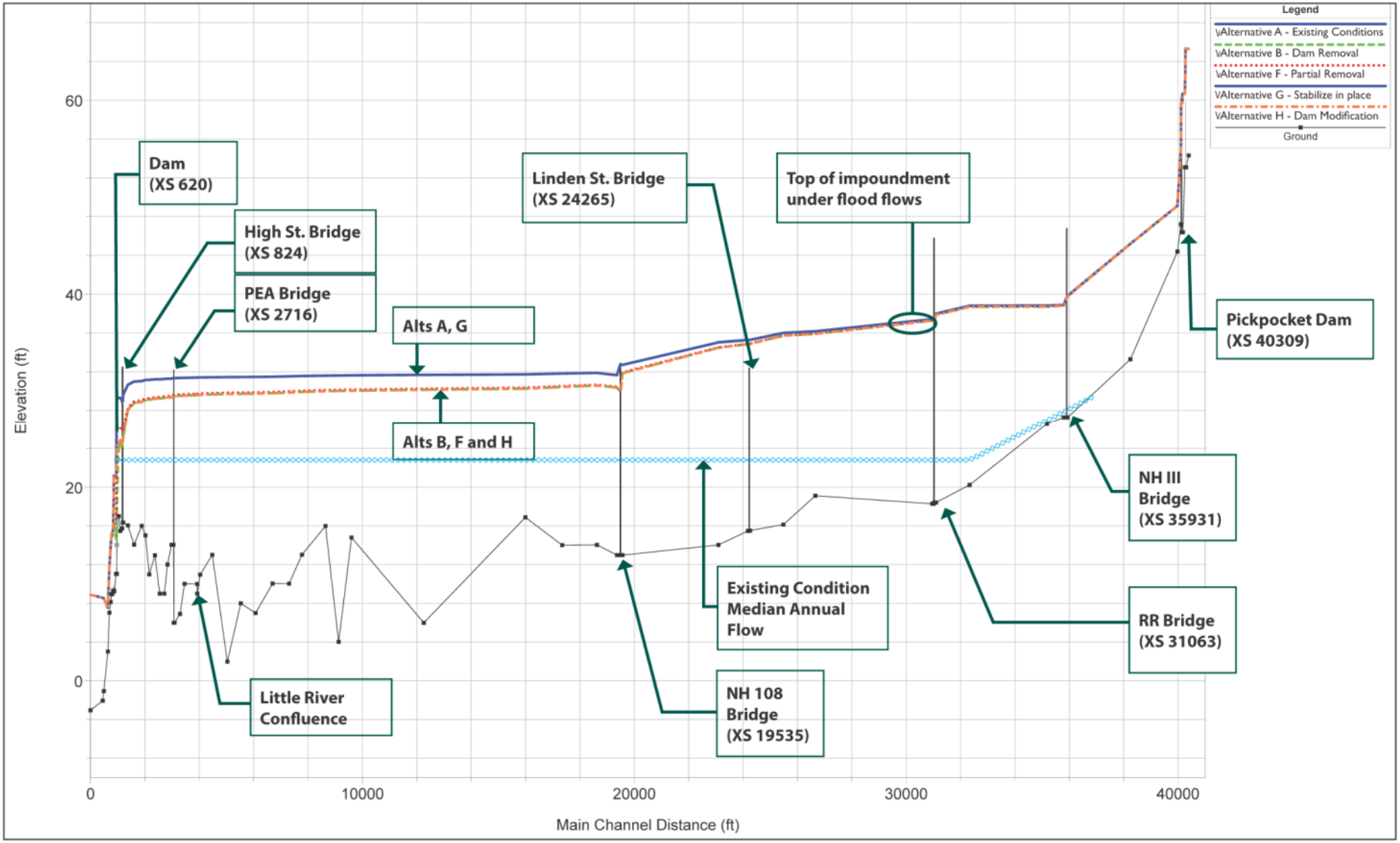
- **Run-of-the-River** Dam



River Profile – Annual Flow (71 cfs)



River Profile – 50-yr Flow (5,858 cfs)



Hydraulic Findings: Substantial Flooding Decreases

Mother's Day Storm (May 14-15, 2006)

- Gage data shows **5,949 cfs** at the Great Dam
- Model 50-year design flow **5,858 cfs**

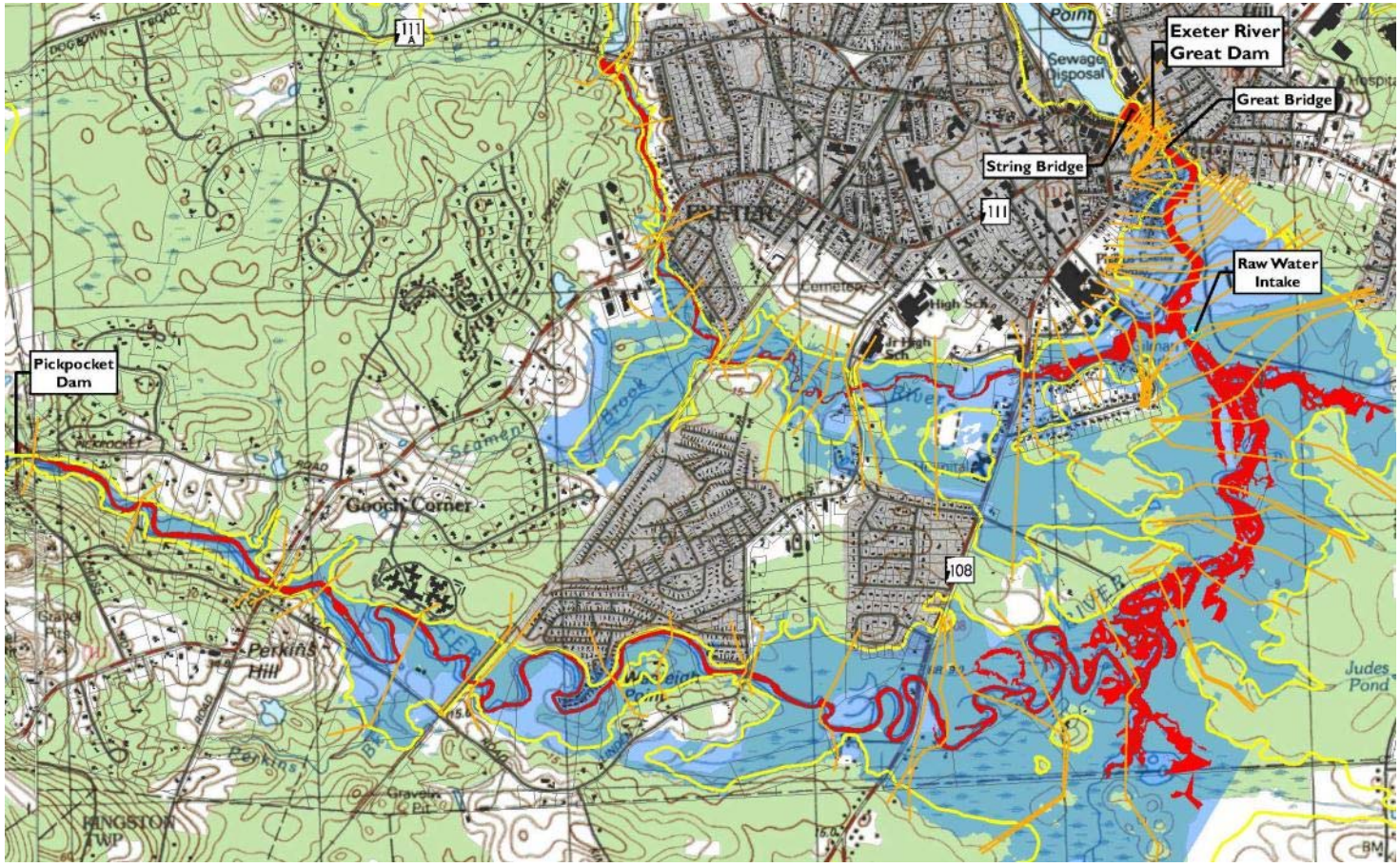
- Using this information, we can ask, ***How do the various alternatives change predicted flood depths for a storm like the Mother's Day flood?***

Mother's Day Flood - 2006

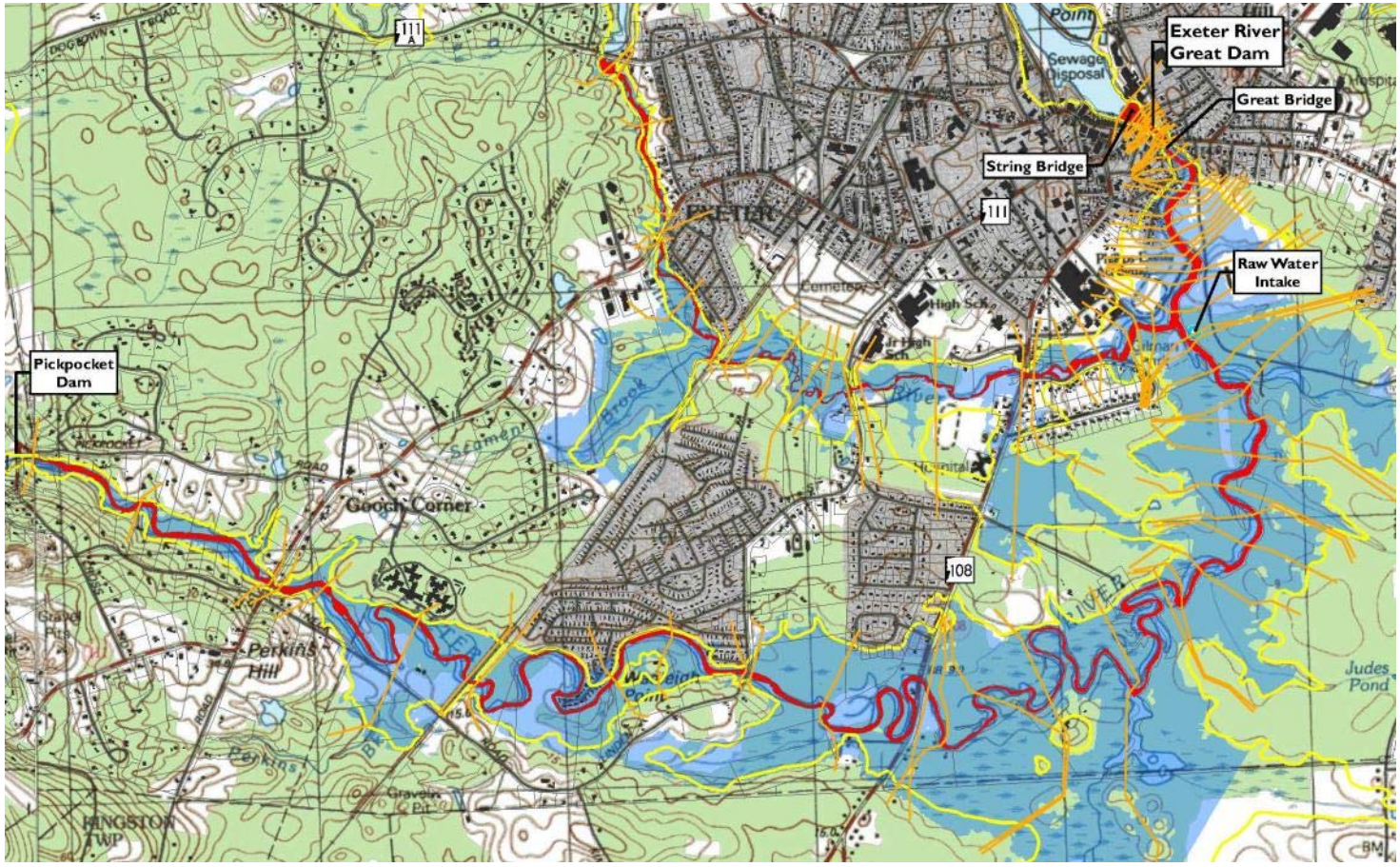
Projected Flood Reductions, Mother's Day Flood

Location	Flood Depth Decrease Relative to Existing Condition (ft)			
	Removal	Partial Removal	Stabilize in Place	Dam Modification
Upstream of High Street	4.5	3.6	0.0	4.5
Franklin Street Neighborhood	2.2	2.1	0.0	2.2
PEA Athletic Fields	1.9	1.8	0.0	1.9
NH 108/Court Street Bridge	1.3	1.2	0.0	1.3
Linden Street Bridge	0.4	0.4	0.0	0.4
Robin Hood Drive	0.3	0.3	0.0	0.3
Amtrak RR Crossing	0.1	0.1	0.0	0.1

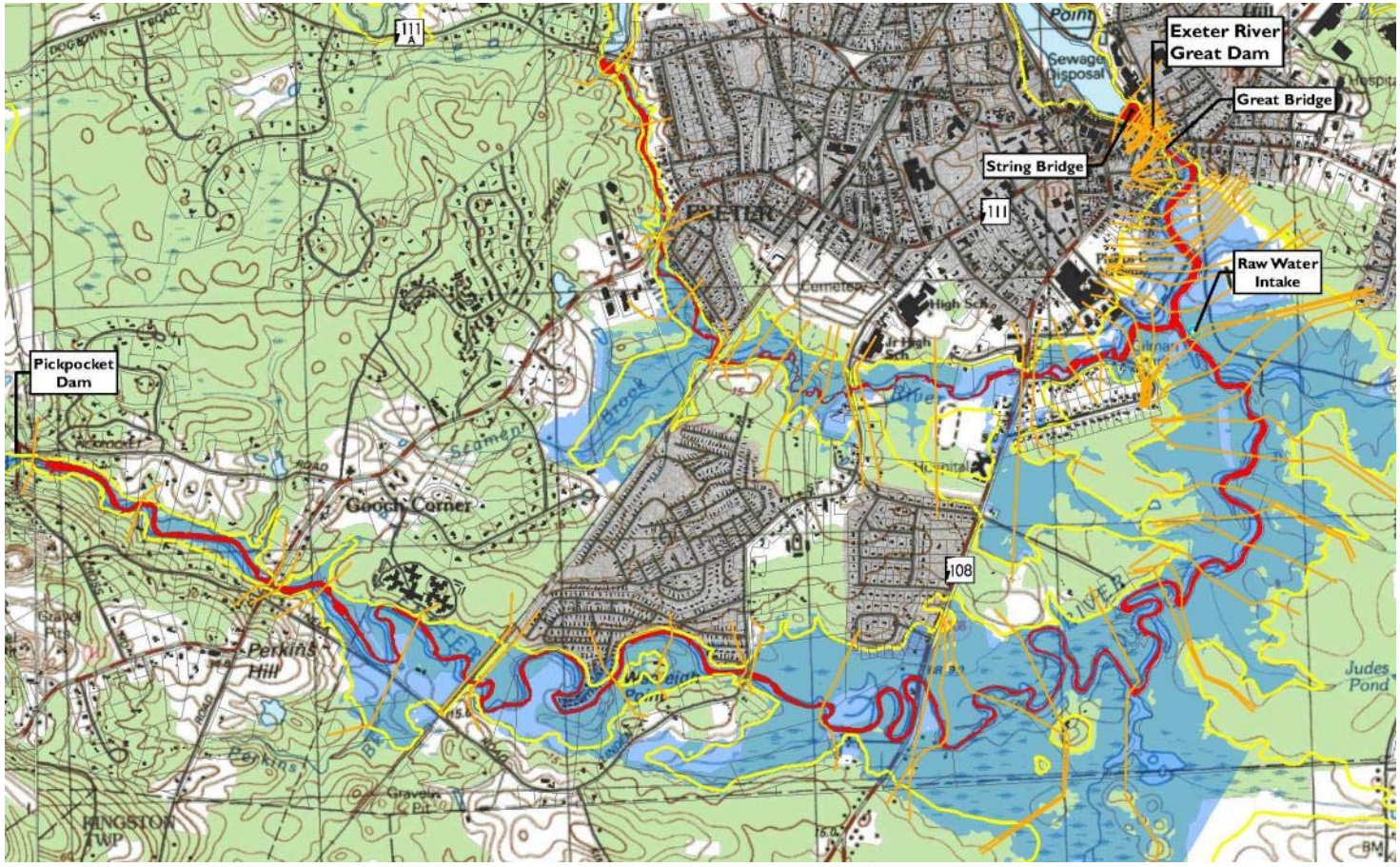
Alt A – Existing Condition – Inundation Map



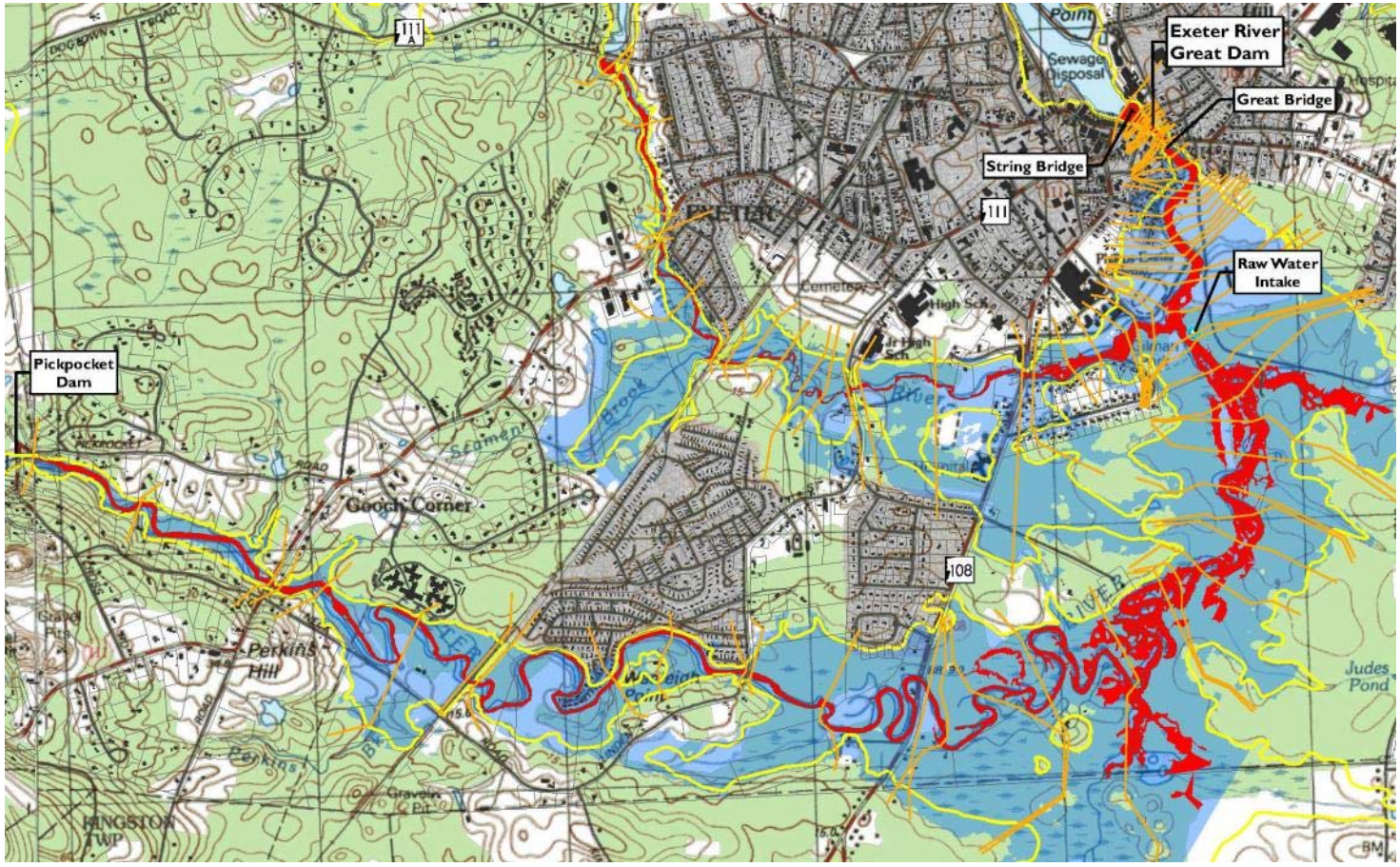
Alt B – Dam Removal – Inundation Map



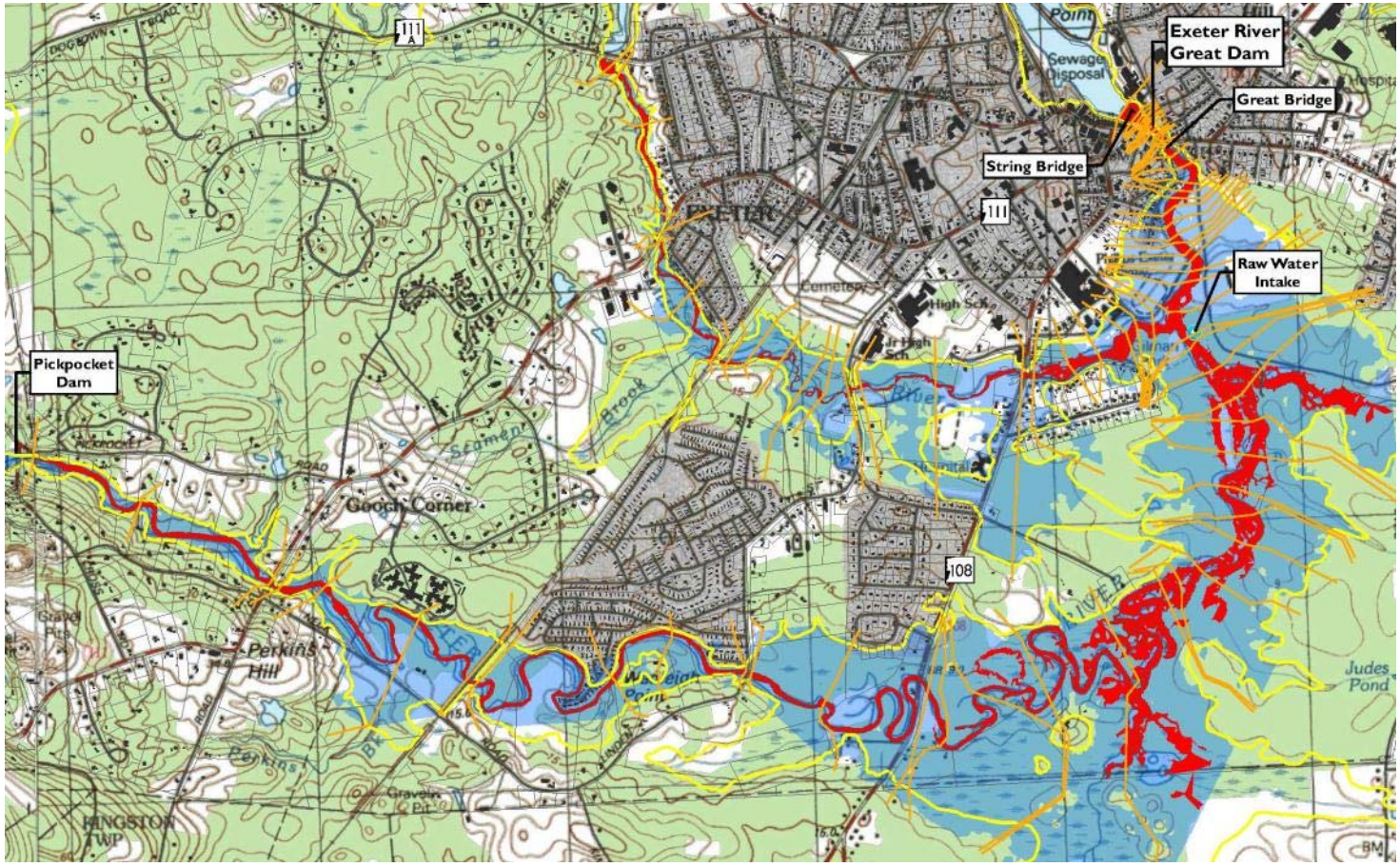
Alt F – Partial Removal – Inundation Map



Alt G – Stabilize in Place – Inundation Map



Alt H – Dam Modification – Inundation Map



Great Dam Removal Feasibility and Impact Analysis

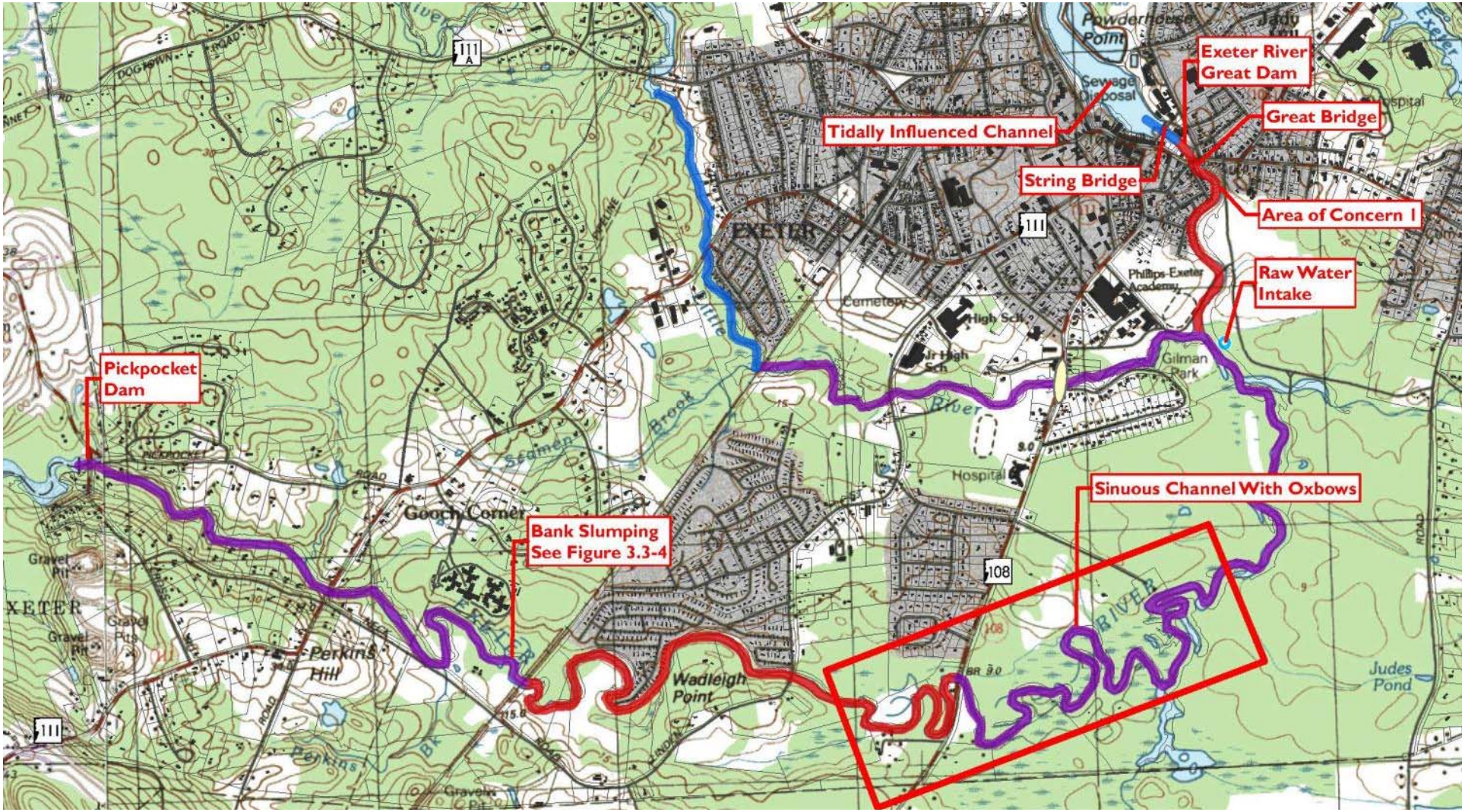
SEDIMENT AND EROSION

Sediment Sampling Locations

Sediment Analysis

- Sediments were tested for metals, PAHs, PCBs, pesticides, and volatile organics
- PCBs, pesticides and VOCs were below detection limits for all samples
- Metals and PAHs found in multiple samples
- Completed preliminary risk analysis: Calculation of “Hazard Quotients” and “Bioaccumulation Analysis”
- Levels of metals and PAHs were generally lower than downstream, therefore relatively low risk

Sediment Transport and Geomorphic Response

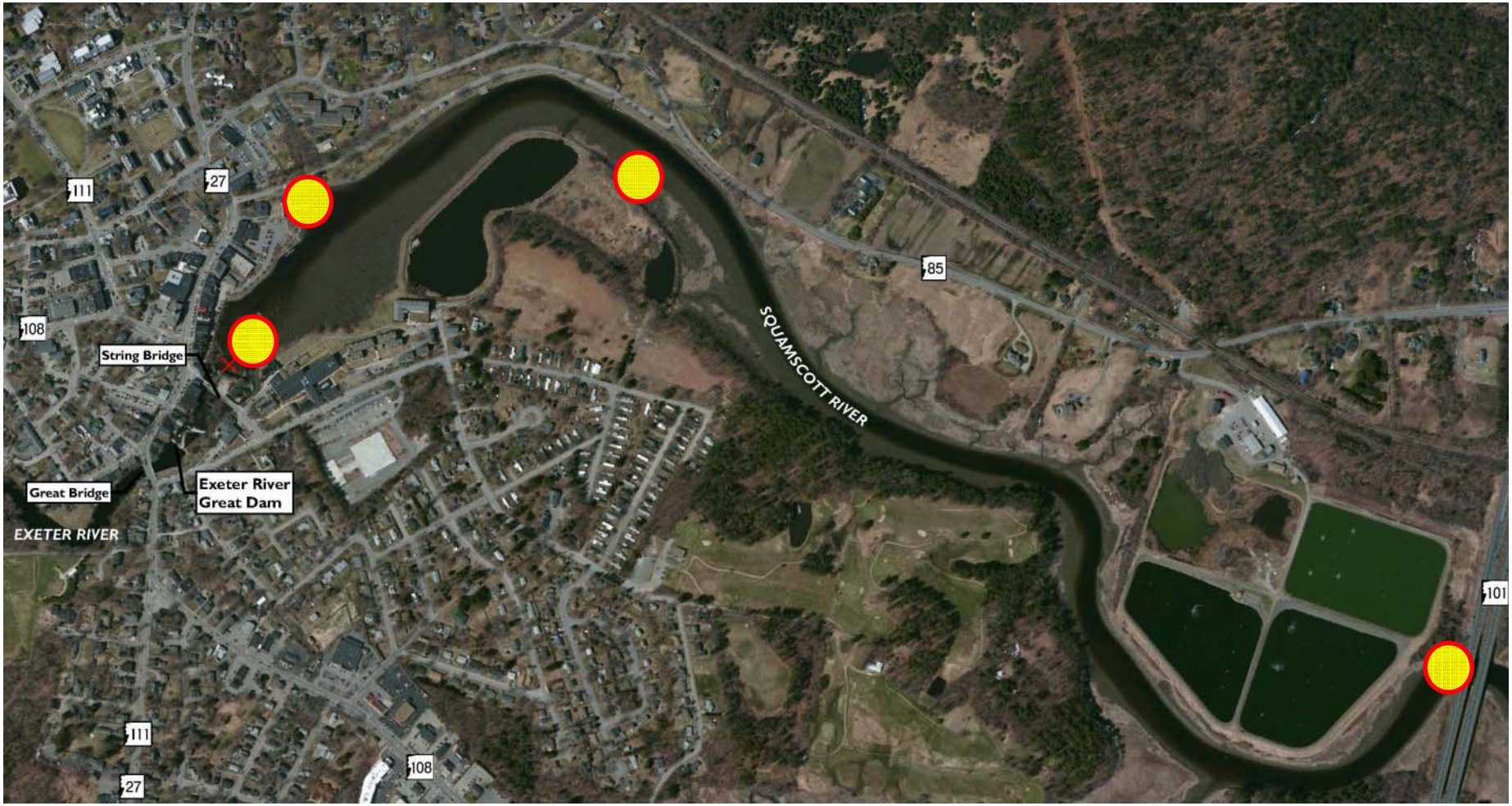


Sediment Transport Findings

- Increased sediment transport associated with Full Removal, Partial Removal and Dam Modification
- Bedrock will prevent headcut
- Exeter River will eventually reach new equilibrium
- Tidal flushing in Squamscott River is likely to remain the dominant process downstream

Action: Understand downstream depositional areas & determine appropriate management

Potential Depositional Areas, Squamscott River



Upper Squamscott River - Resources

Sediment Management Plan

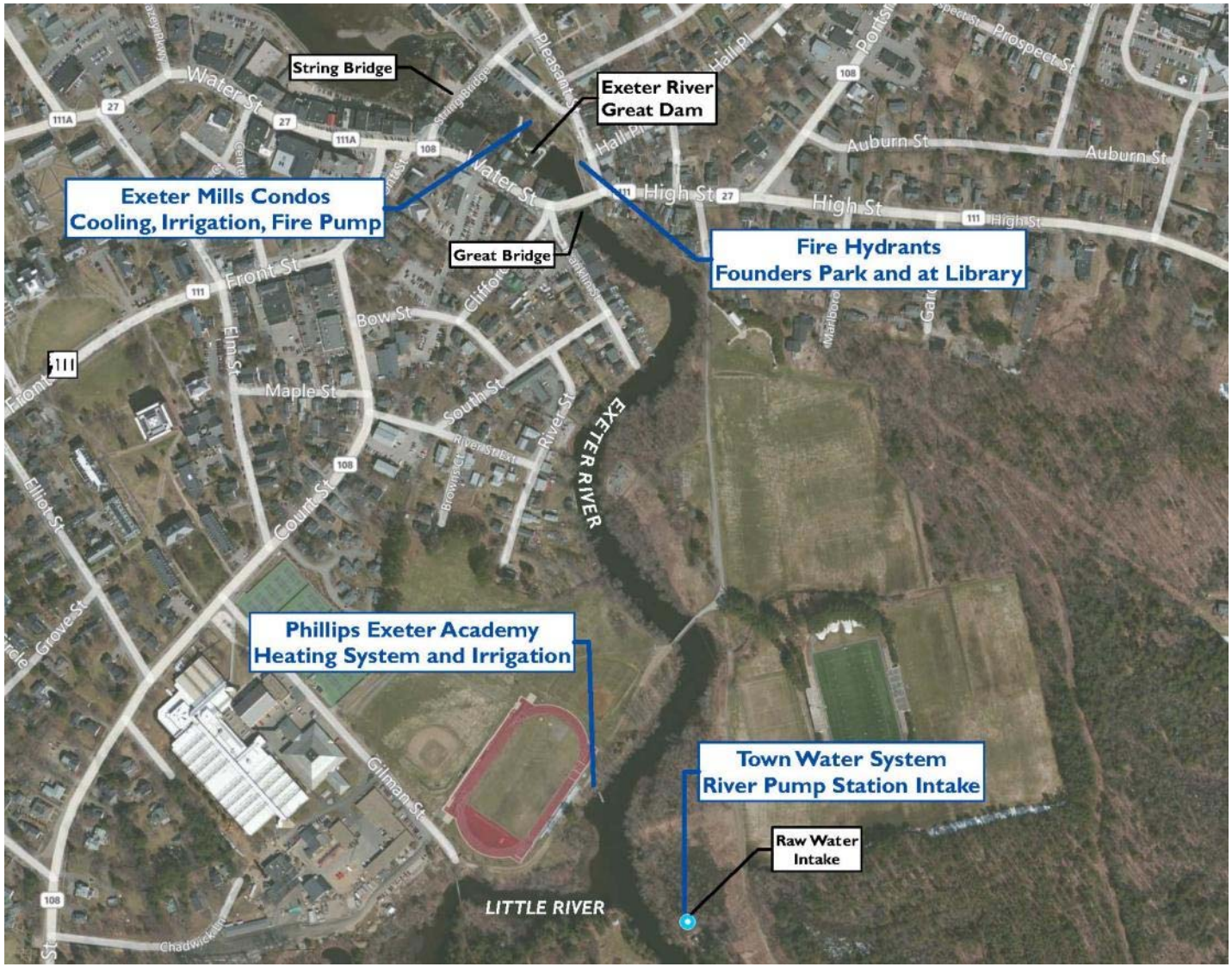
- Passive Strategy – Dredging doesn't make sense
- Early and controlled drawdown
- Strategic seeding of exposed banks
- Consider sediment curtain at boat launch & basin in Squamscott
- Delay smelt habitat restoration for at least a year
- Monitoring

Great Dam Removal Feasibility and Impact Analysis

INFRASTRUCTURE

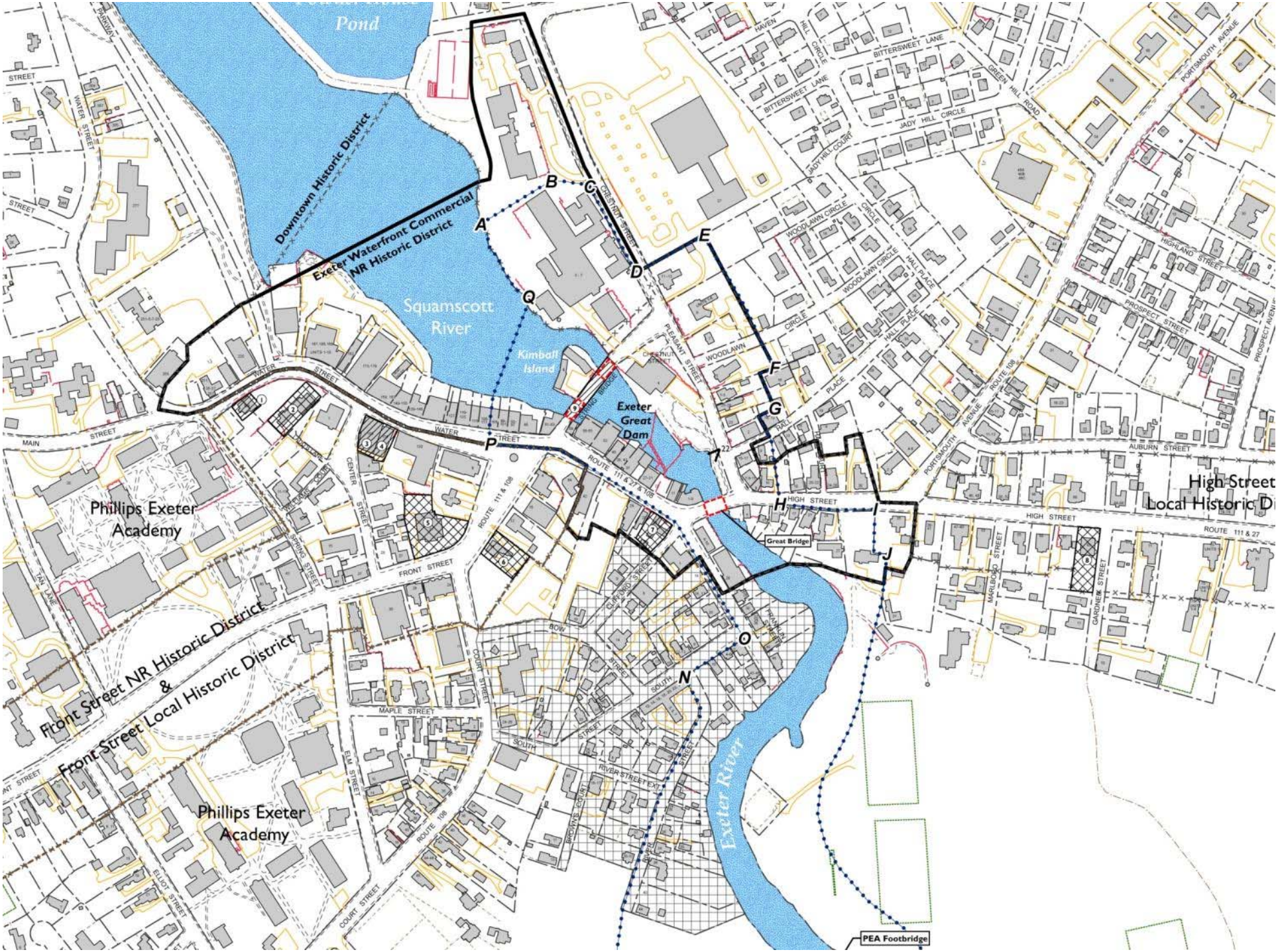
Infrastructure: Walls and Foundations

Water Intakes



Great Dam Removal Feasibility and Impact Analysis

CULTURAL RESOURCES


Pond
Downtown Historic District
Exeter Waterfront Commercial
NR Historic District
Squamscott
River
Kimball
Island
Exeter
Great
Dam
Great Bridge
PEA Footbridge
Exeter River
Phillips Exeter
Academy
Phillips Exeter
Academy
Front Street NR Historic District
&
Front Street Local Historic District
High Street
Local Historic D
A
B
C
D
E
F
G
H
I
J
N
O
P
Q
WATER STREET
MAIN STREET
FRONT STREET
HIGH STREET
AUBURN STREET
CHESTNUT STREET
PLEASANT STREET
WOODLAWN CIRCLE
HALL PLACE
PROSPECT STREET
HIGHLAND STREET
PORTSMOUTH AVENUE
ROUTE 108
ROUTE 111 & 27
ROUTE 111 & 27 & 108
CENTER STREET
SPRING STREET
MAPLE STREET
ELM STREET
COURT STREET
TAN LANE
ELLIOT STREET
CLIFFORD STREET
BOW STREET
BROWN'S COURT
RIVER STREET EXT
MARLBORO STREET
GARDNER STREET
BITTERSWEET LANE
JADY HILL CIRCLE
JADY HILL COURT
GREEN HILL ROAD
HAVEN HILL CIRCLE
CRESTWAY STREET
PARKMAN STREET

Cultural Resources

- Great Dam: **Contributing Element** 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.
- **Dam Modification** would also be an impact to a historic structure – Obermeyer gates are modern – visual impact.
- The area around the Great Dam is considered sensitive for **archaeological resources** which could be impacted by either removal or modification of the dam.

Cultural Resources – Section 106

- **Section 106** of the National Historic Preservation Act
- The **NH Division of Historical Resources** is the State Historic Preservation Office
- For this project, the National Oceanic and Atmospheric Administration is the **Lead Federal Agency**
- Further consultation and studies pending Town decision

Great Dam Removal Feasibility and Impact Analysis

RECREATION AND VISUAL RESOURCES

Recreation and Visual

- The **Stabilize in Place** and **Dam Modification Alternatives** would not change the recreational experience on the river.
- **Dam Removal** or **Partial Removal** would alter the recreational experience on the river, but opportunities would still be plentiful.
- **Navigation**: Shallower river under normal and low flows
- **Angling**: Improved cold water fishing opportunities; significant benefit to diadromous fish

Visual Simulation at Dam Site

Visual Simulation at Dam Site

Visual Simulation at Gilman Park

Great Dam Removal Feasibility and Impact Analysis

NATURAL RESOURCES

Water Quality

- Lower Exeter River – Class B, **Impaired**
- **Full or Partial Removal Alternatives** = ***substantial net benefit*** on water quality in the river.
- **Stabilize in Place** or **Dam Modification** = ***no/negligible benefit***.

	Residence Times (Days)				% Decrease Relative to Existing Condition		
Flow	Alt A	Alt B	Alt F	Alt H	Alt B	Alt F	Alt H
Median Annual	2.06	0.91	1.47	2.06	56%	29%	0%
2-Year Flood	0.61	0.29	0.29	0.29	53%	53%	52%
10-Year Flood	0.74	0.47	0.47	0.48	36%	36%	35%
50-Year Flood	0.80	0.58	0.58	0.60	28%	27%	26%

Natural Resources

- The removal of the Great Dam would have a significant benefit to diadromous and resident fish populations.
- The project is not expected to result in significant adverse impacts to wildlife populations.
- The full or partial removal of the Great Dam could affect wetlands and floodplain forests which rely to some degree on flooding, including a rare swamp white oak forest community upstream.

Great Dam Removal Feasibility and Impact Analysis

COST ESTIMATES

Opinions of Probable Costs, Build Alternatives (2013 dollars)

Alternative	Construction, including Contingency	Engineering/ Permitting/ Monitoring	Total
Alt B – Dam Removal	$613,500	$118,650	**$732,000**
Alt F – Partial Removal	$1,133,340	$205,290	**$1,339,000**
Alt G – Stabilize in Place	$341,000	$77,000	**$418,000**
Alt H – Dam Modification	$875,000	$141,000	**$1,016,000**

Infrastructure and Environmental Mitigation

Total Cost of Mitigation, by Alternative							
Alternative	**Water Intake Retrofits**	**Historic Study**	**Site Phase IB**	**Archaeological Monitoring**	**Fish Passage Field Study**	**Water Quality**	**Total**
Alt A - No Action	$0	$0	$0	$0	$0	$550,000	**$550,000**
Alt B – Dam Removal	$1,748,000	$30,000	$15,000	$25,000	$0	$0	**$1,818,000**
Alt F – Partial Removal	$1,748,000	$30,000	$15,000	$25,000	$150,000	$250,000	**$2,218,000**
Alt G – Stabilize in Place	$0	$0	$15,000	$0	$0	$550,000	**$565,000**
Alt H – Dam Modification	$0	$30,000	$15,000	$0	$150,000	$550,000	**$745,000**

Total Initial Investment (Construction & Mitigation)

Alternative	Design, Permitting and Construction	Infrastructure and Environmental Mitigation	Total
Alt A - No Action	-	$550,000	**$550,000**
Alt B – Dam Removal	$732,000	$1,818,000	**$2,550,000**
Alt F – Partial Removal	$1,339,000	$2,219,000	**$3,557,000**
Alt G – Stabilize in Place	$418,000	$565,000	**$983,000**
Alt H – Dam Modification	$1,016,000	$745,000	**$1,761,000**

Total Costs including O&M and Replacement (30 Year Analysis)

Alternative	Initial Cost	O&M and Replacement Costs	Total
Alt A - No Action	$550,000	-	**$550,000**
Alt B – Dam Removal	$2,550,000	$0	**$2,550,000**
Alt F – Partial Removal	$3,557,000	$385,000	**$3,942,000**
Alt G – Stabilize in Place	$983,000	$181,894	**$1,165,000**
Alt H – Dam Modification	$1,761,000	$616,724	**$2,378,000**

Summary of Alternatives

	Alternative A No Action	Alternative B Dam Removal	Alternative F Partial Removal	Alternative G Stabilize in Place	Alternative H Dam Modification
Total Cost (30 year)	$550,000	$2.6 million	$3.9 million	$1.2 million	$2.4 million
Achieve Dam Safety?	No	Yes	Yes	Yes	Yes
Reduce Flooding?	No	Moderate Benefit	Moderate Benefit	No	Moderate Benefit
Improve Fish Passage?	No	Major Benefit	No	No	No
Improve Water Quality?	No	Major Benefit	Moderate Benefit	No	No

Great Dam Removal Feasibility and Impact Analysis

NEXT STEPS

Next Steps

Step	Expected Timeline
Public Comment Period	June 26—August 14
Exeter River Committee Work Group Reviews	Early September
Modify Report and Issue Final Report	September
Exeter River Study Committee Reviews and Submits Report with its Findings to Exeter Select Board	October
Select Board Makes Recommendations	
Town Meeting Deliberations and Decision 2014	

Great Dam Removal Feasibility and Impact Analysis

OPEN DISCUSSION/MEETING SUMMARY
ADJOURN AT 9:30

Great Dam Removal Feasibility and Impact Analysis

THANK YOU FOR ATTENDING!