



# Great Dam Removal Feasibility and Impact Analysis



Public Meeting  
May 23, 2012

Exeter Town Hall, 9 Front Street, Exeter



# Agenda

Time	Item	Presenter
7:00	Welcome and Introductions	Lionel Ingram Chair, Exeter River Study Committee
7:05	Meeting Objectives and Roles	Dr. Mimi Larsen Becker Co-Chair, Exeter River Study Working Group
7:15	Exeter's Approach to the Study	Paul Vlasich, PE Town Engineer and Project Manager
7:30	Presentation: Preliminary Findings	Peter J. Walker & Rita Walsh, VHB
8:30	Public Comments & Questions	Mimi Becker, Facilitator with Town, Agency and Consultant Personnel
9:30	ADJOURN	



Great Dam Removal Feasibility and Impact Analysis

# MEETING OBJECTIVES & PARTICIPANT ROLES





## Meeting Objectives

- **To review the consultant team's preliminary findings** on how the river would respond to the potential dam removal.
- **To discuss progress to date** on questions such as:
  - How would the potential dam removal affect the river's floodplain?
  - What cultural resources are present along the river and how might these resources be affected?
  - What might the river look like if the dam were removed?
- **To review the process and schedule** for completion of the study.
- To solicit **questions from the public.**



## Project Funding



**Gulf of Maine  
Council on the  
Marine Environment**



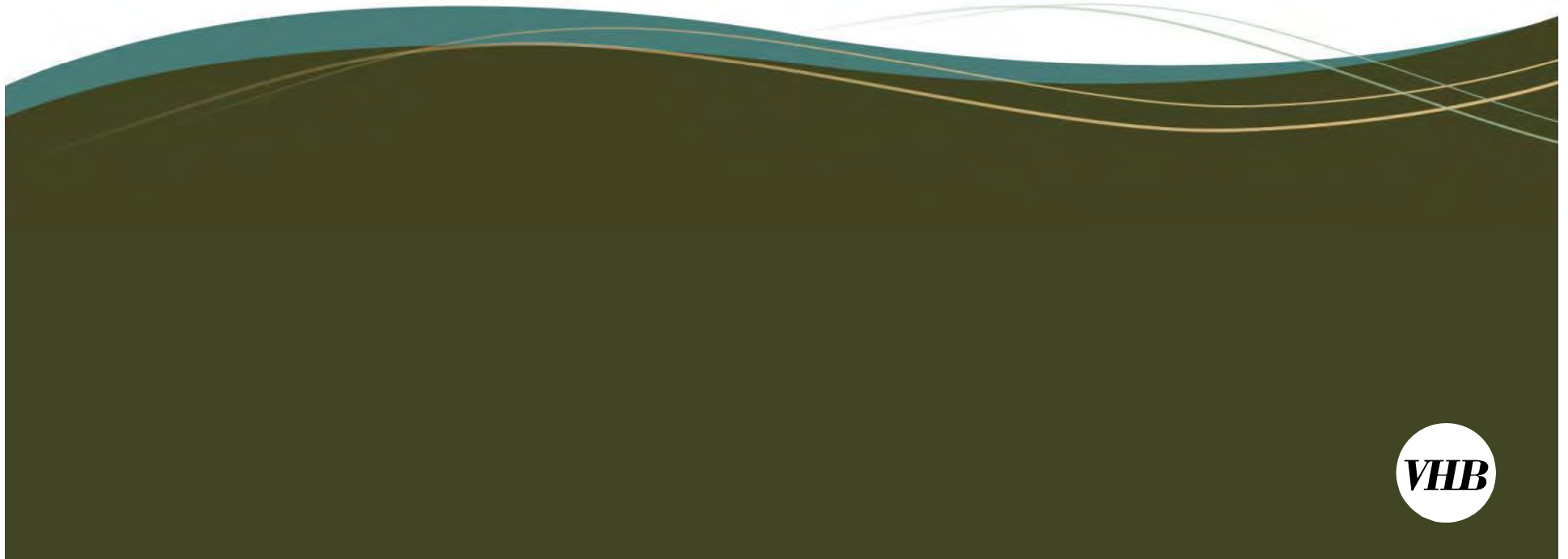
## Exeter River Study Committee - Working Group

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 ERLAC
Sally Soule	NHDES Watershed Assistance
Paul Vlasich	Town of Exeter Engineering Dept.
Roger Wakeman	Exeter River Study Committee



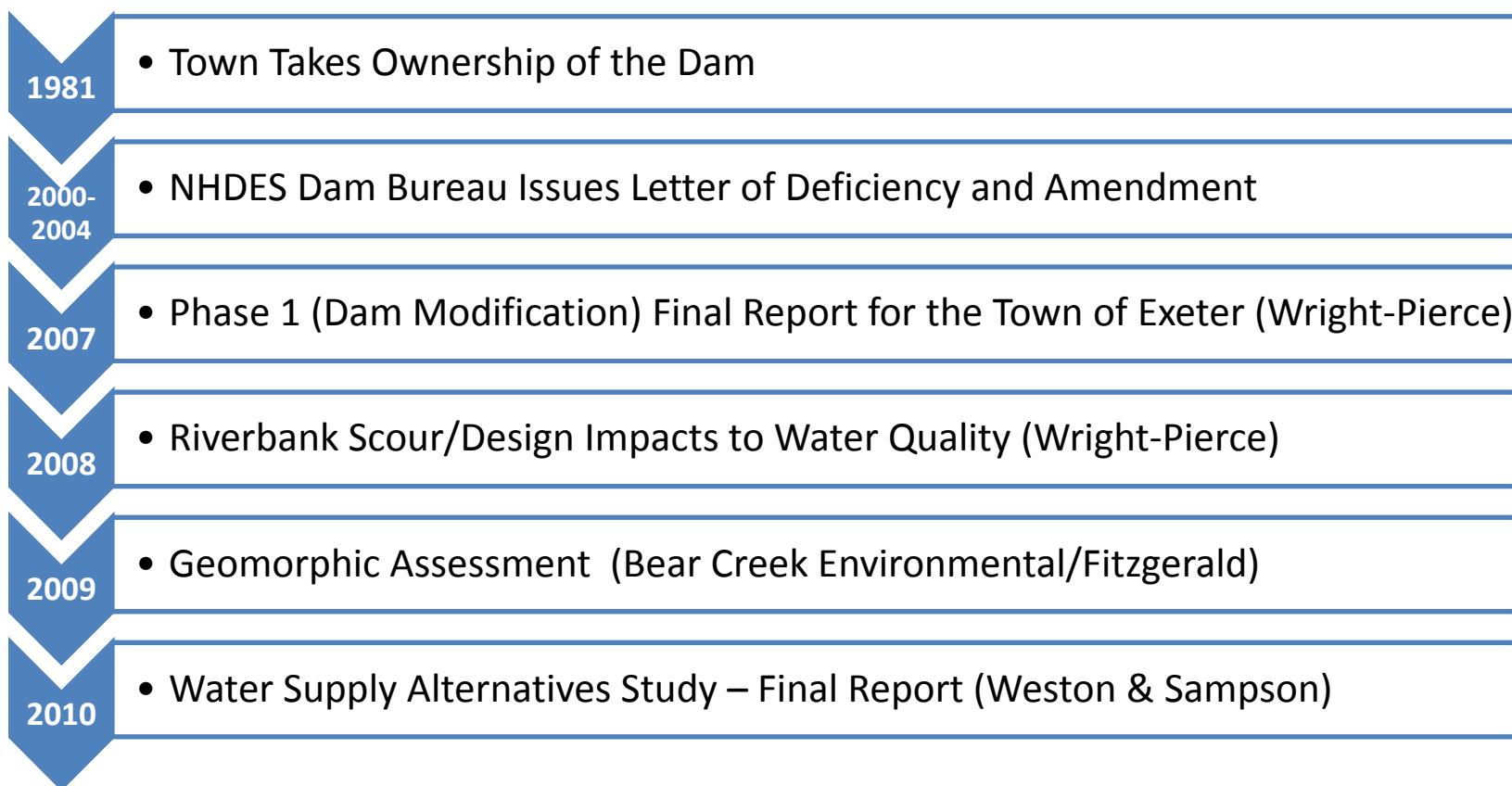
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# EXETER'S APPROACH TO THE STUDY





## Project History – Previous Activities







## 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** and **September 14, 2011**



## 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



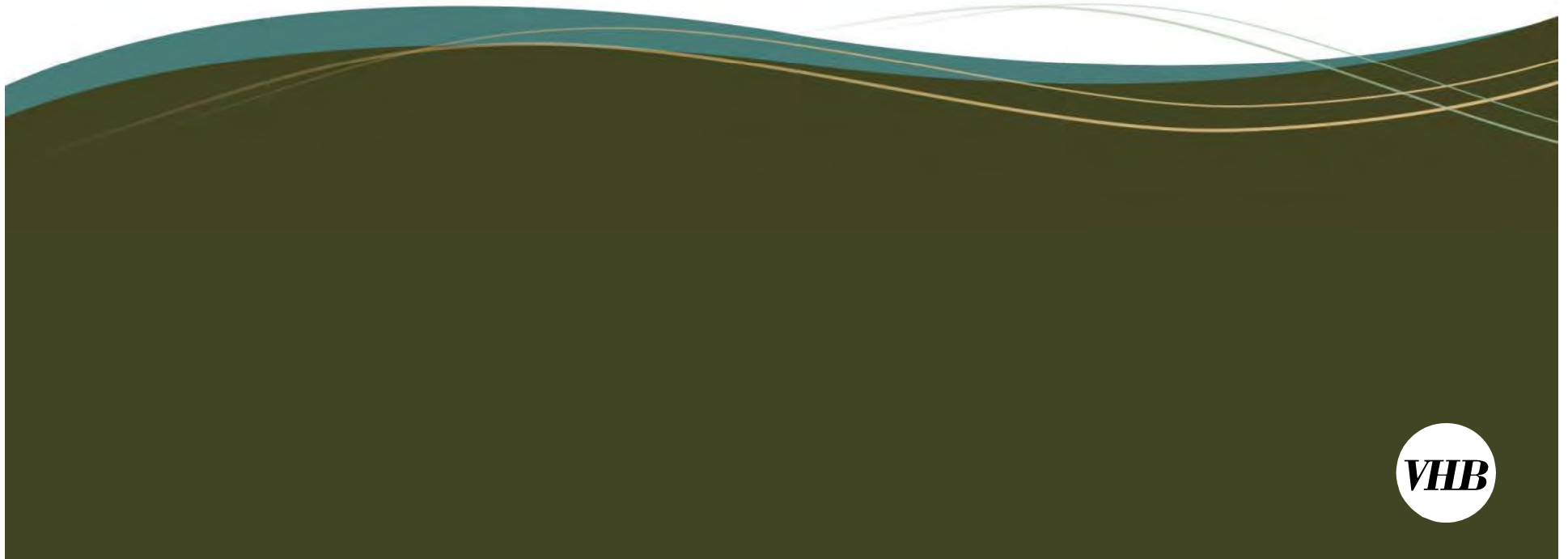
## Project Schedule

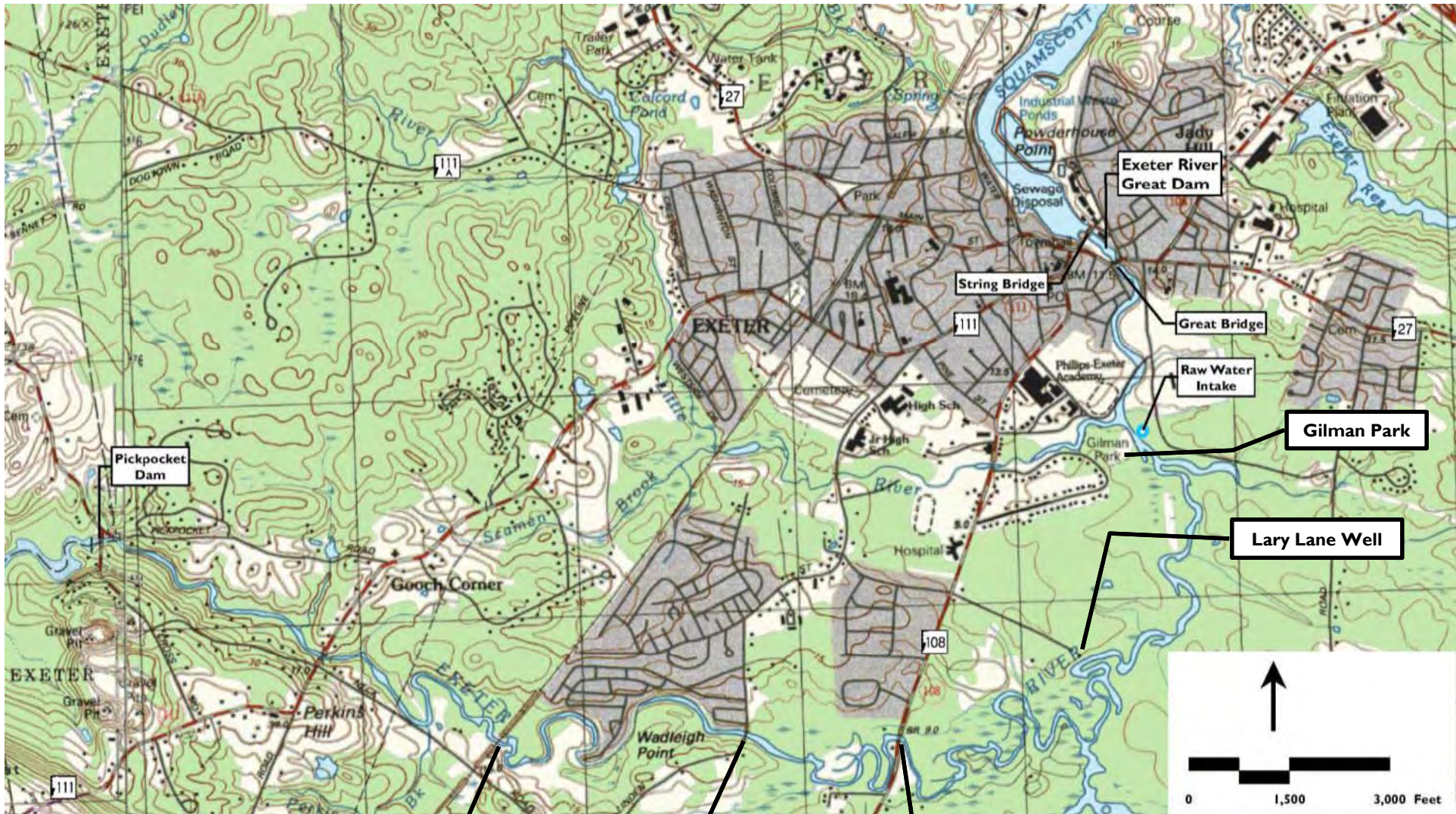
Task	Timeline
Field Surveys	June – October 2011
<b>Public Meeting</b>	<b>September 2011</b>
Preliminary Analysis of Alternatives	Winter – Spring 2012
<b>Public Meeting</b>	<b>Spring 2012</b>
Draft Feasibility Report	Summer 2012
<b>Public Meeting</b>	<b>Fall 2012</b>
Final Feasibility Report Issued	Fall 2012



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## STUDY AREA ORIENTATION





Railroad Bridge

Linden Street Bridge

NH 108/Court Street Bridge

Lary Lane Well

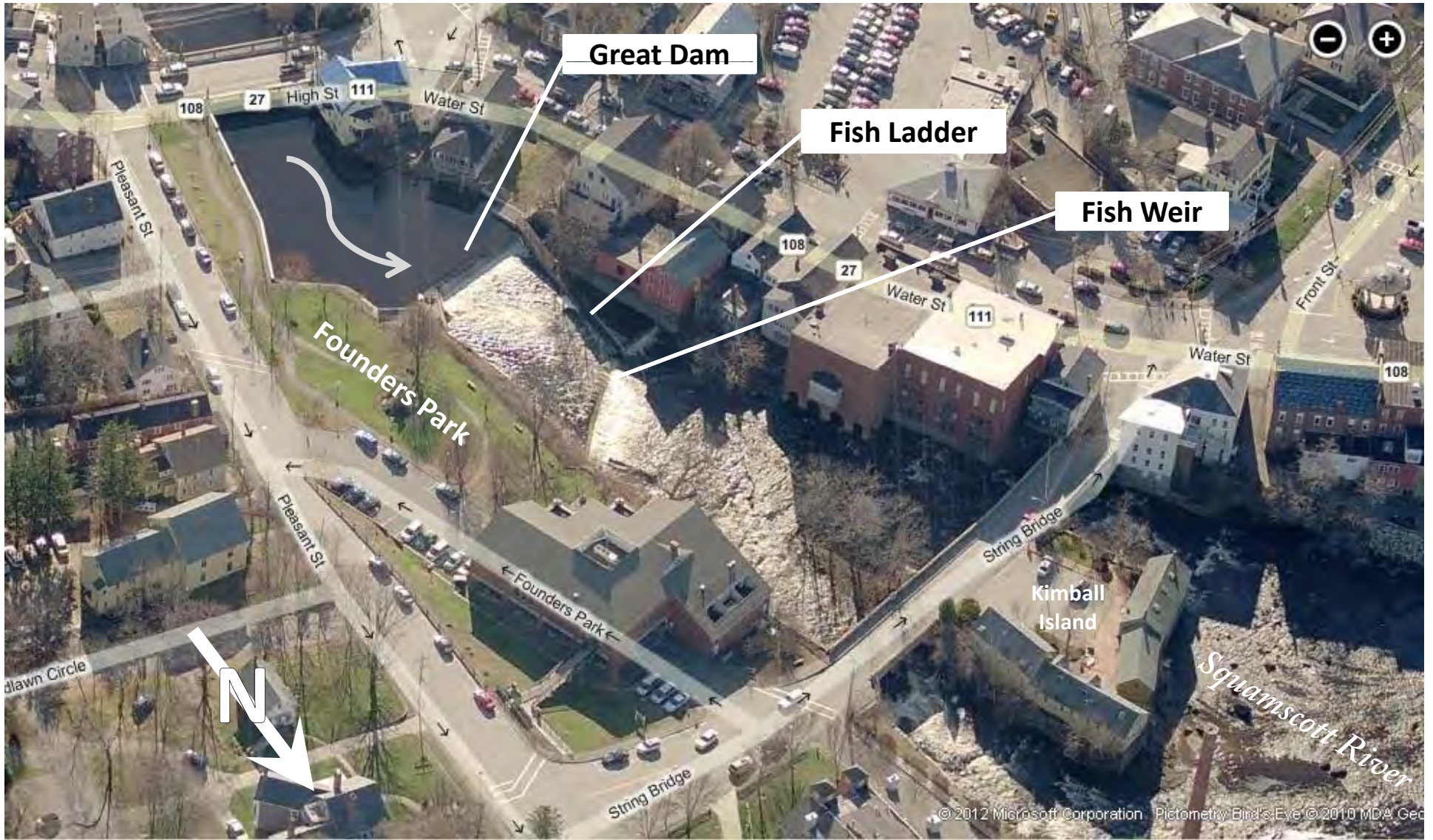
Gilman Park

Great Bridge

Raw Water Intake

String Bridge

Exeter River Great Dam



Great Dam

Fish Ladder

Fish Weir

Founders Park

Kimball Island

Squamscott River

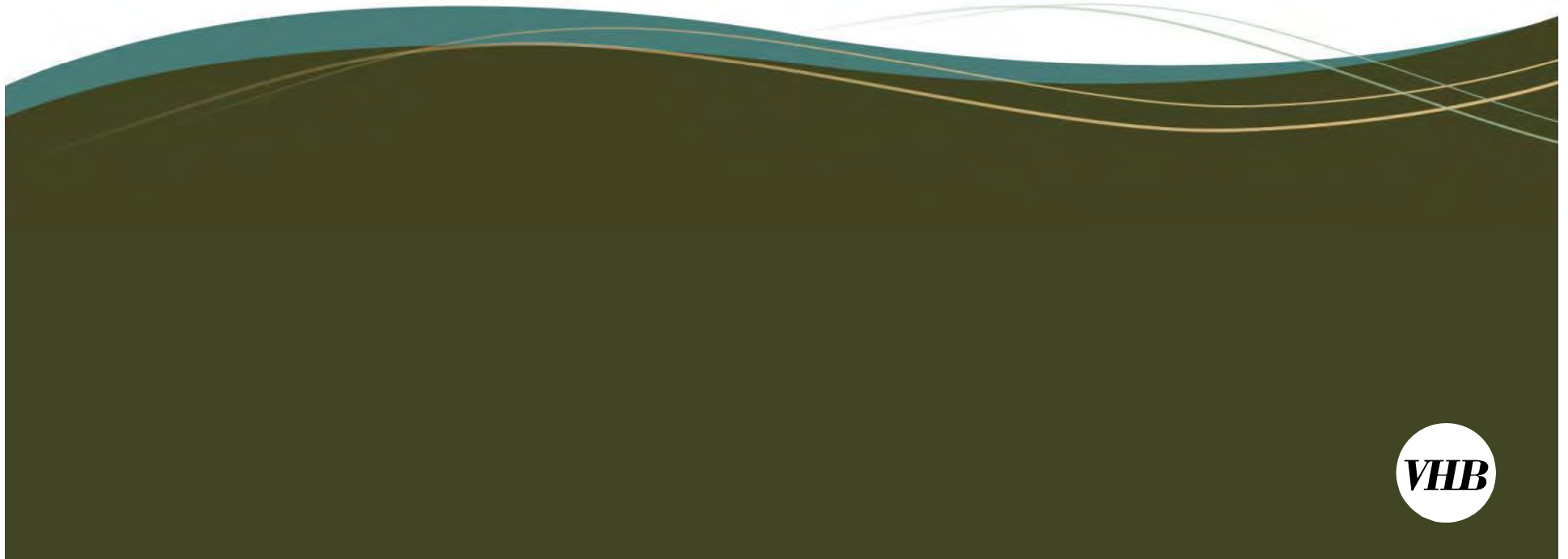
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# EXISTING CONDITIONS





# Field Inspections – Topics Discussed Tonight

- **Geomorphology**

- Field Work Completed
- Preliminary Findings Issued

- **Sediment Sampling**

- Initial Field Sampling Completed
- Agency Consultation in Progress

- **Historic/Archaeological Resources**

- Field Work & Technical Reports Completed
- Agency Consultation On-going

- **Hydrology & Hydraulics (Floodplains)**

- Field Surveys Complete
- Preliminary Findings Under Review





# Field Inspections – Other Issues

- **Natural Resources**
  - Field Work Completed
  - Agency Consultation in Progress
- **Bridge and Infrastructure**
  - Field Inspections Complete
  - Analysis in Progress
- **River Ice Dynamics**
  - Agency Consultation and Field Work Completed
  - No Significant Issues
- **Recreation**
  - Field Work Completed
  - Analysis in Progress
- **Invasive Species**
  - Field Work Completed
  - Analysis in Progress



## River Features – Tidally Influenced Downstream





## River Features – Bedrock at Dam





## River Features – Bedrock at Dam





# River Features – Terrace and Limited Floodplain



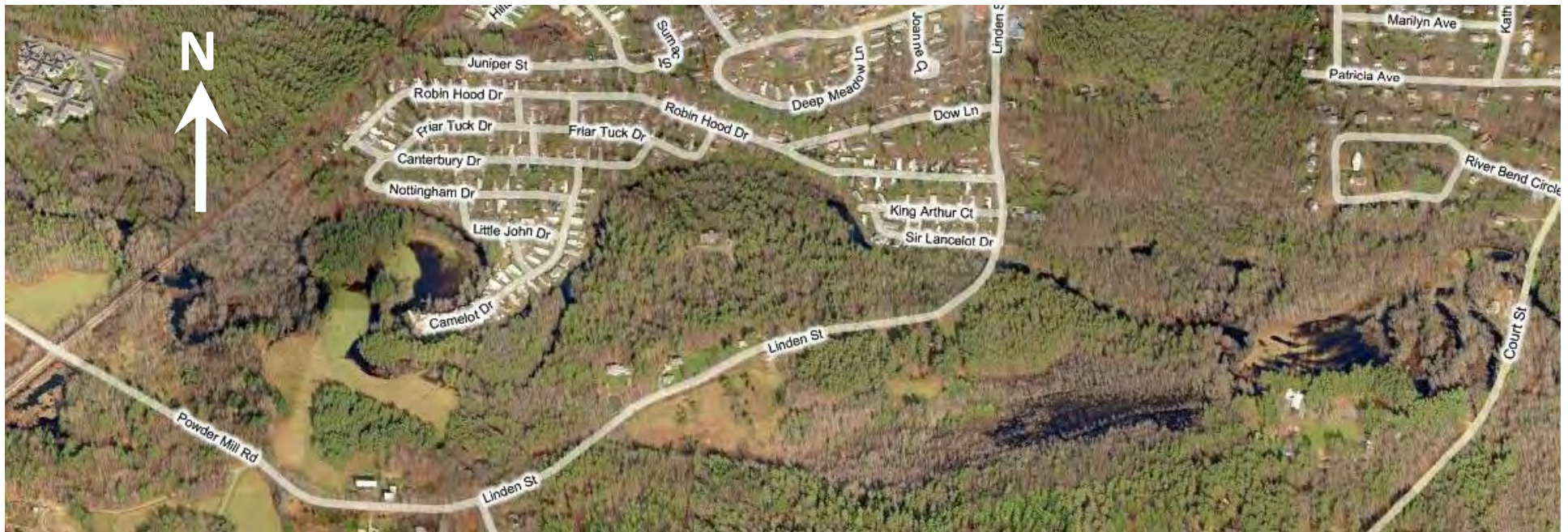


## River Features – Highly Sinuous Meanders





# River Features – Steeper with Terraces





# Sediment Analysis







# Sediment Analysis

- Quality Assurance Project Plan
  - Developed to ensure reliable data is collected
- Sediment Sampling
  - Chemical analysis of sediment from six sites
  - Sampling completed - November 2011
  - Results from Lab - mid-December 2011
  - Analysis submitted to NHDES - February 2012
  - NHDES Review Meeting - March 2012
  - Additional Information Submitted - March/April 2012



## Sediment Analysis

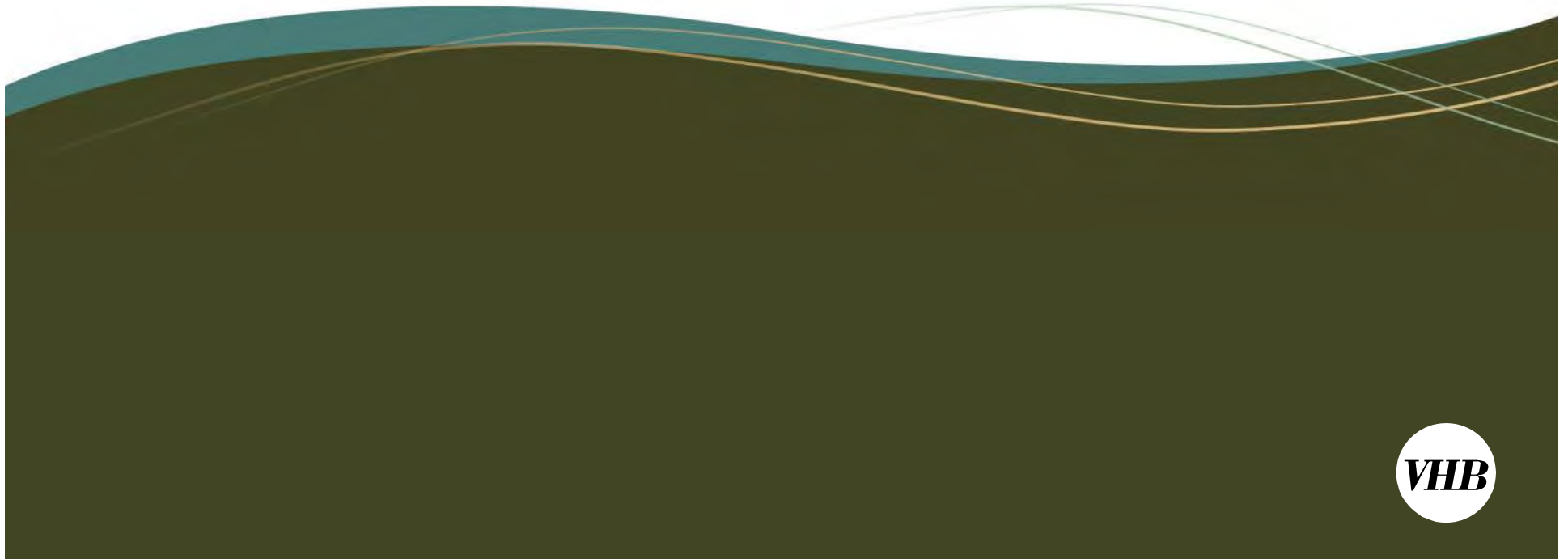
- Sediments were tested for metals, PAHs, PCBs, pesticides, and volatile organics
- PCBs, pesticides and VOCs were below detection limits for all samples
- Metals and PAHs found in multiple samples
- NHDES is reviewing available sediment and hydrological/hydraulic data to evaluate potential risk

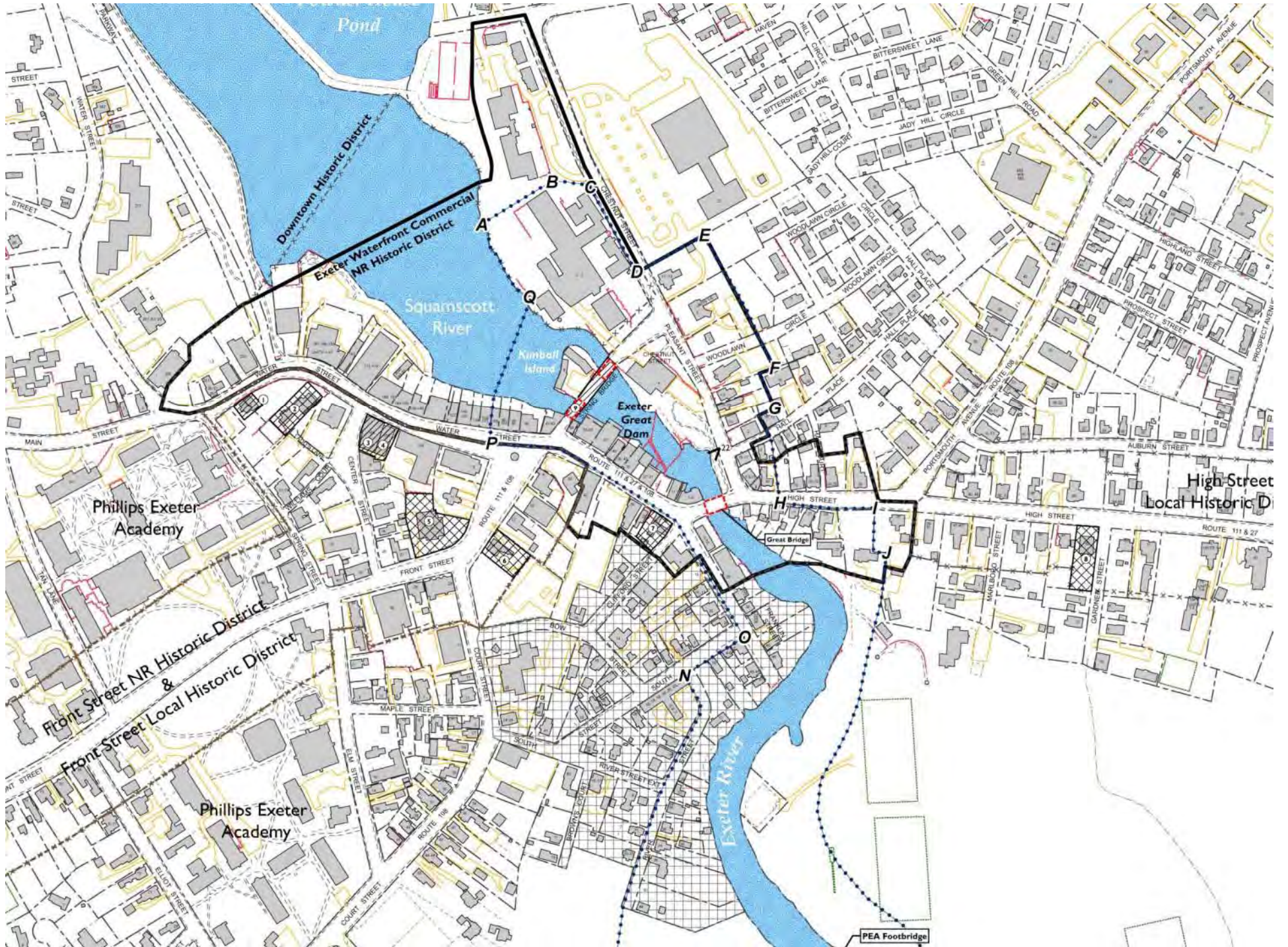




Great Dam Removal Feasibility and Impact Analysis

# CULTURAL RESOURCES SURVEYS





Pond

Downtown Historic District  
Exeter Waterfront Commercial  
NR Historic District

Squamscott  
River

Kimball  
Island

Exeter  
Great Dam

Phillips Exeter  
Academy

Front Street NR Historic District  
&  
Front Street Local Historic District

Phillips Exeter  
Academy

High Street  
Local Historic District

PEA Footbridge



## Cultural Resources



*A view of the Great Dam looking upstream from the String Bridge, October 2011*



## 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**



## Status of Section 106 Review

- Consulting Parties Identified and Contacted
  - Town of Exeter
  - Don Robie, owner of buildings on Kimball's Island
  - Exeter Heritage Commission
  - Exeter Historical Society
  - Exeter Historic District Commission
  - Brian Griset, resident of Exeter
- Individual and Project Area forms and Phase IA report completed
  - The forms were mailed to the consulting parties and to the New Hampshire DHR for their review
  - NHDHR review conducted on May 23



## Cultural Resources – Outcome of Studies

- Project Area Form
  - Discussed previous survey and designation efforts
  - Presented physical development history and description of existing area
  - Recommended additional investigation in Franklin Street area, south of dam; NHDHR concurs
  - NHDHR requests additional research on area east of Exeter River, Gilman Park, and Phillips Exeter Academy fields on both sides of river and footbridges crossing the river





*Franklin Street*



*River Street*



## Cultural Resources – Outcome of Studies

- Great Dam Individual Inventory Form
  - Form included both the dam and its components and the fish passage structure
  - Dam recommended eligible as a contributing resource to the existing historic district, but not individually eligible; fish passage structure recommended not contributing or individually eligible
  - NHDHR agreed with the eligibility recommendations



*Dam & fish ladder, Nov 2011*



*Dam & fish ladder looking upstream, Nov 2011*



*Fish ladder & weir, Nov 2011*



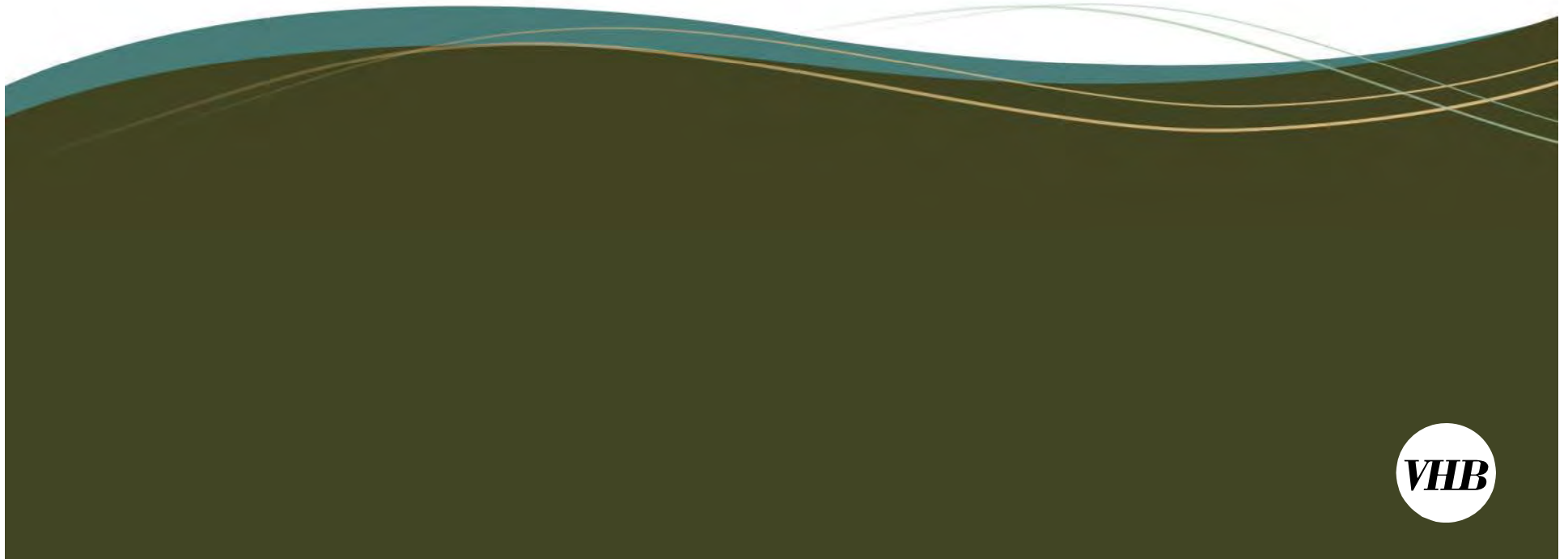
# Cultural Resources – Outcome of Studies

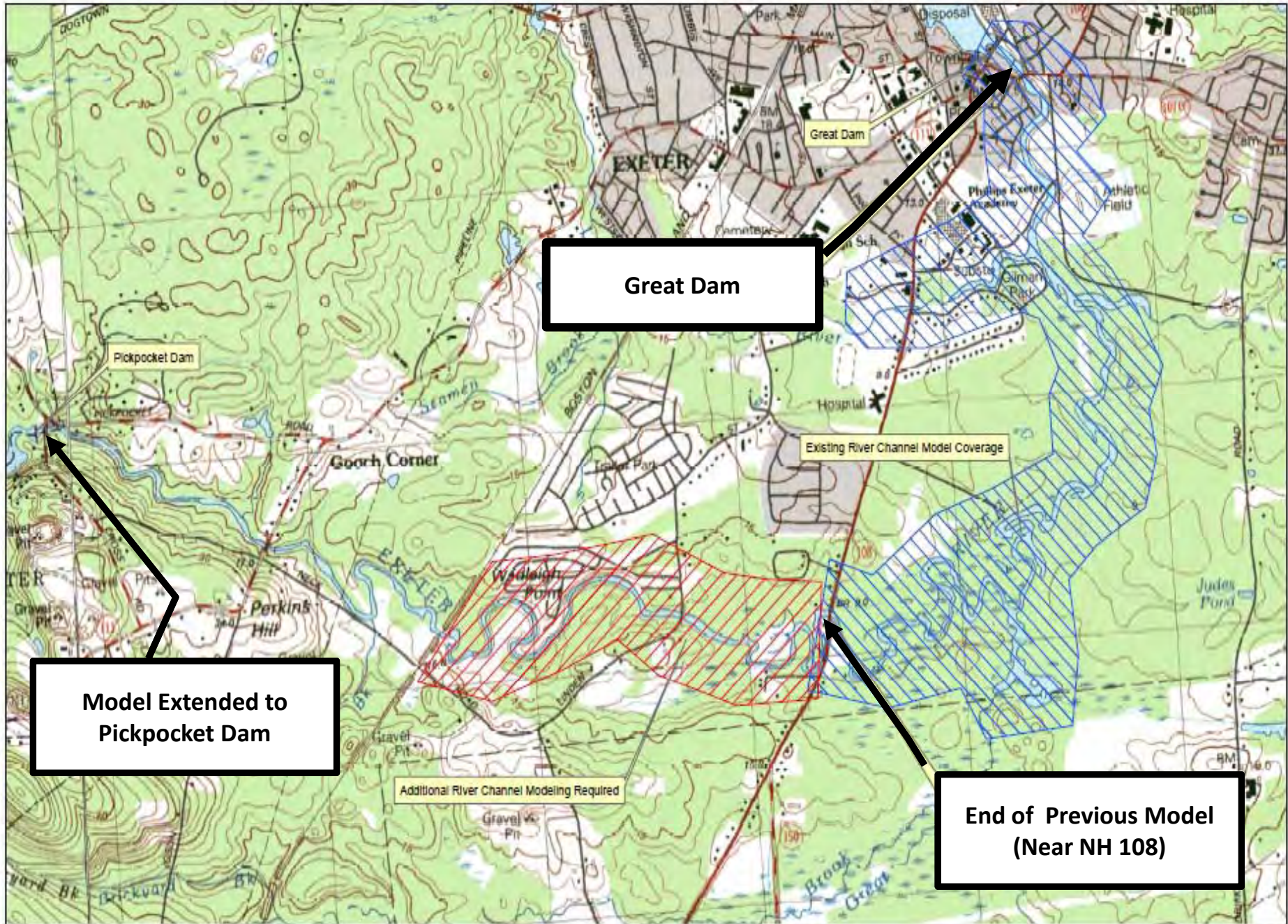
- Phase IA Archaeological Survey
  - Literature search and field visit
  - If dam removal is preferred alternative, soil core testing throughout the Area of Potential Effect is recommended to determine whether there are intact soil horizons below grade and whether those soil horizons could have hosted archaeological sites.
  - Hydraulic modeling results also should be reviewed to determine whether monitoring of archaeologically sensitive areas along upstream river banks is warranted to evaluate the long term effects of changes to the stream flow and to determine whether lowering the water level will expose archaeologically sensitive areas to erosion.
  - NHDHR concurred with VHB recommendations



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# HYDROLOGY & HYDRAULICS





**Great Dam**

**Model Extended to Pickpocket Dam**

Existing River Channel Model Coverage

Additional River Channel Modeling Required

**End of Previous Model (Near NH 108)**



## Hydrology and Hydraulics (What's the Difference?)

- **Hydrology** – How much water is flowing through the river?
  - Flow changes with time and is a function of local climate/weather conditions.
  - Flow is measured in “cubic feet per second” (cfs)
  - Also described in terms of “recurrence intervals,” e.g., “100-year flow” or “2-year flow.”
- **Hydraulics** - What is the depth and velocity of the water?
  - Based on engineering calculations considering the **properties of water** and the **shape of the channel**.
  - “Cross-sections” represent the shape of the channel in a specific location.
  - The hydraulic model uses the shape of the channel to predict the **height and velocity of the water under various flows**.



## 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?
- Will bridges and foundations be more susceptible to **Scour**?



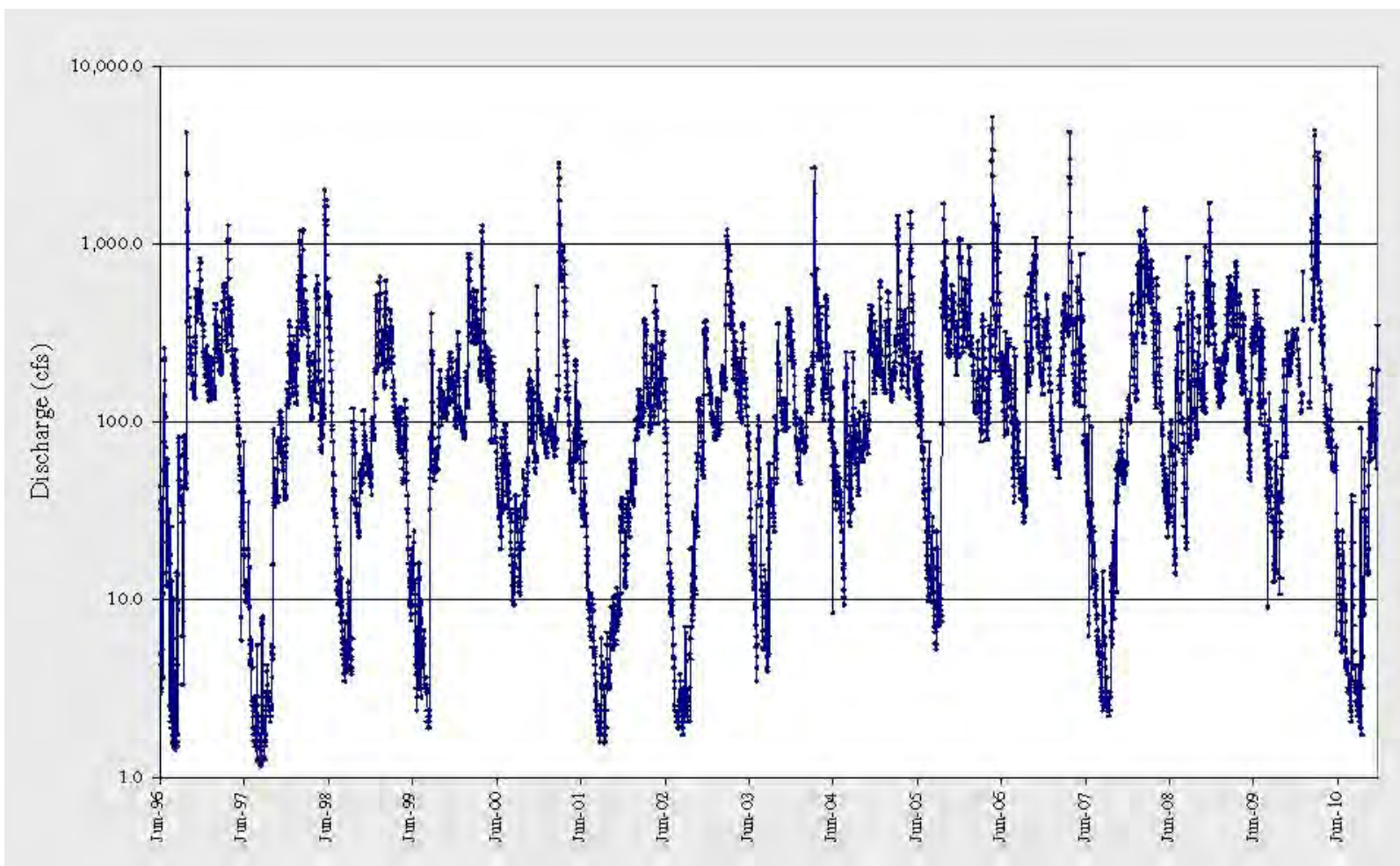


## Hydrology – Two Methods

- **Statistical Approach** - Gage data adjusted using USGS Bulletin 17B, *“Guidelines for Determining Flood Flow Frequency”* & NOAA FS-2011-01 *“Flood Frequency Estimates for New England River Restoration Projects: Considering Climate Change in Project Design”*
- **Watershed Rainfall Runoff Model** – Following methodology in NHDES Dam Bureau rules (Env-Wr 403.05) using:
  - GIS mapping of the watershed, including cover type and soils info
  - Rainfall data from the Northeast Regional Climate Center and the National Resources Conservation Service.



# Hydrology – Exeter River Flows at Haigh Road, 1996 to 2011





# Hydrology – Incorporating Climate Change

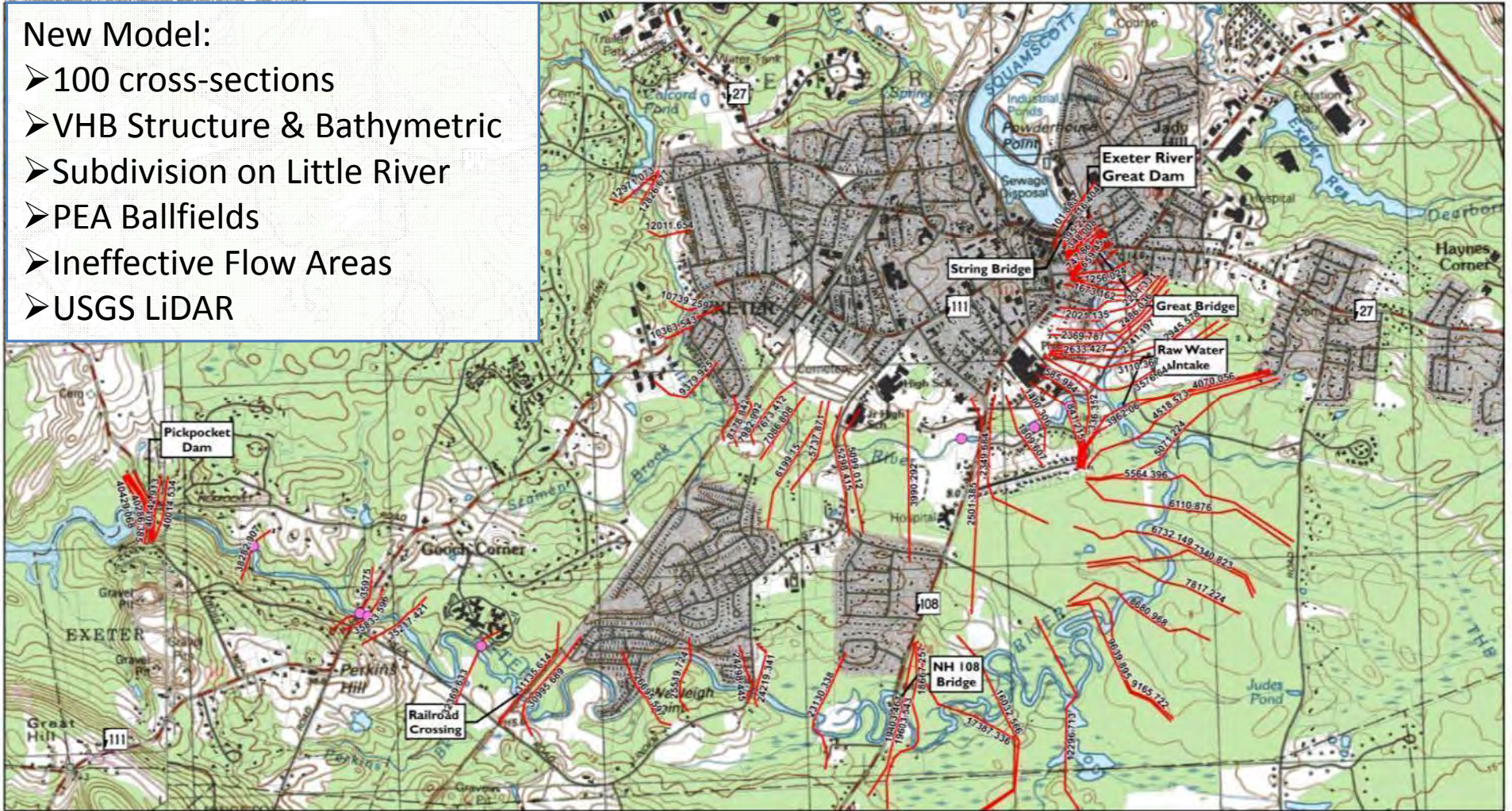
*Design Flow (cubic feet per second)*

<i>Dataset/Source</i>	<i>2-yr</i>	<i>5-yr</i>	<i>10-yr</i>	<i>25-yr</i>	<i>50-yr</i>	<i>100-yr</i>	<i>200-yr</i>	<i>500-yr</i>
<b>1989 (current) FEMA Flood Insurance Study</b>			2,811		4,107	4,827		6,518
<b>2006 Wright-Pierce/Woodlot Alternatives</b>			2,900		4,416	4,949		
<b>Modified Synthetic record (1971-2009)</b>	<b>1,481</b>	<b>2,427</b>	<b>3,245</b>	<b>4,539</b>	<b>5,718</b>	<b>7,109</b>	<b>8,745</b>	<b>11,366</b>

***N.B. – Data are preliminary and subject to change.***

### New Model:

- 100 cross-sections
- VHB Structure & Bathymetric
- Subdivision on Little River
- PEA Ballfields
- Ineffective Flow Areas
- USGS LiDAR



Source: USGS 7.5 Minute Quadrangles: Exeter, Kingston, Town of Exeter, GS

#### Legend

- Impoundment Points
- Model X-Section



**VHB** Vanasse Hangen Brustlin, Inc.

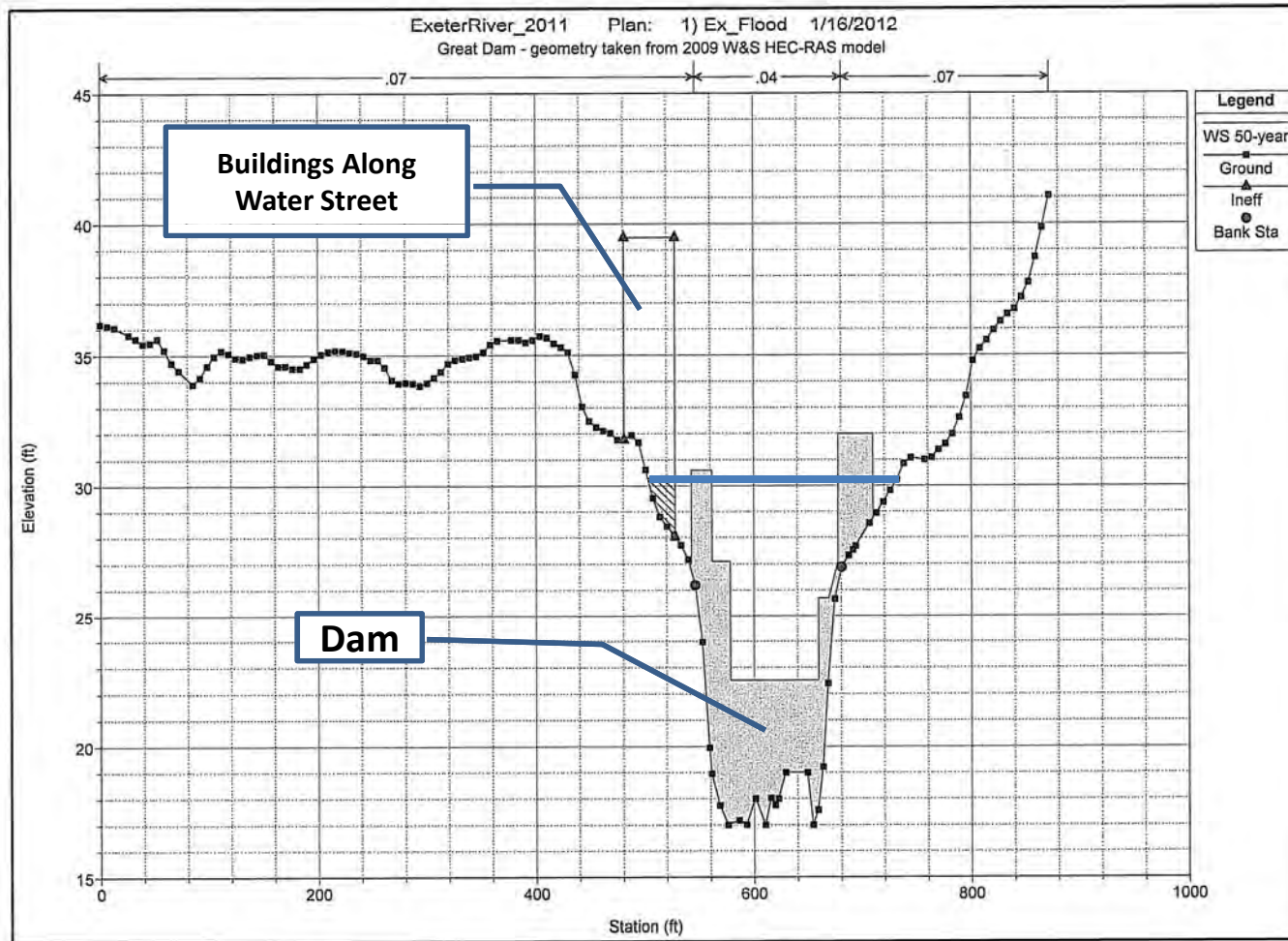
**X-Section Locations**  
Exeter Great Dam Removal  
Feasibility & Impact Analysis

Exeter, NH



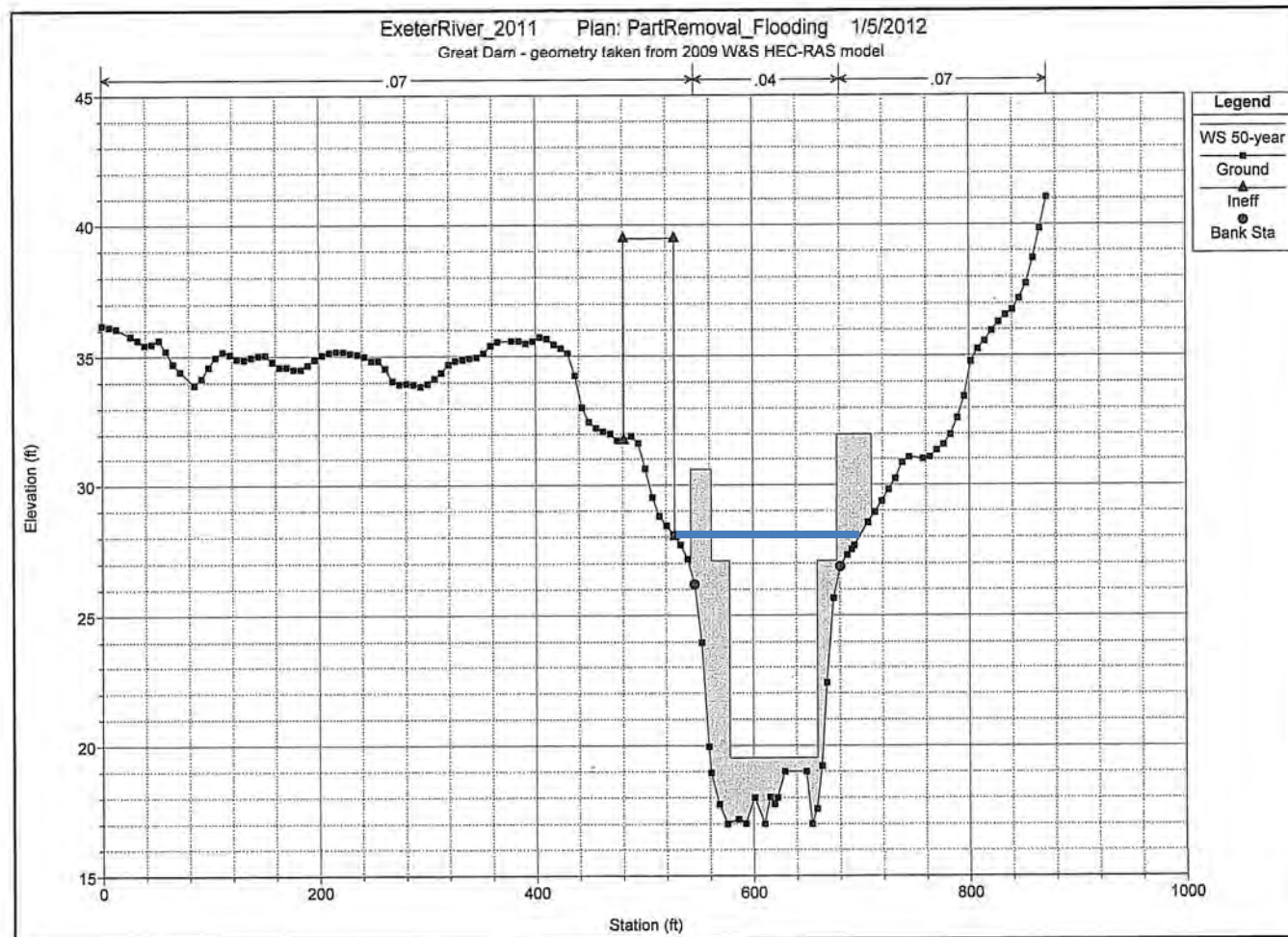


# Alternative 1 – Existing Conditions



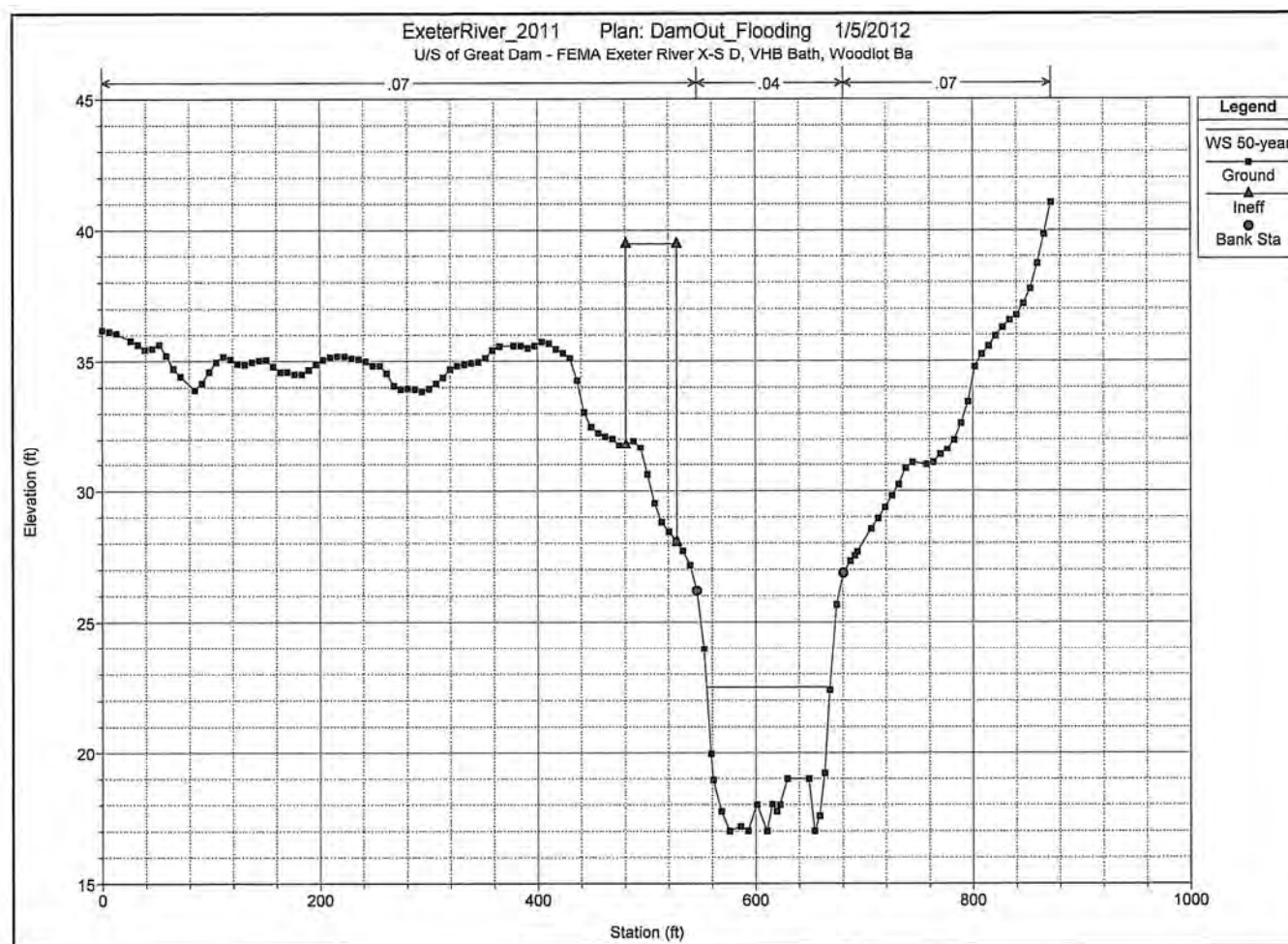


# Alternative 2 – Dam Modification



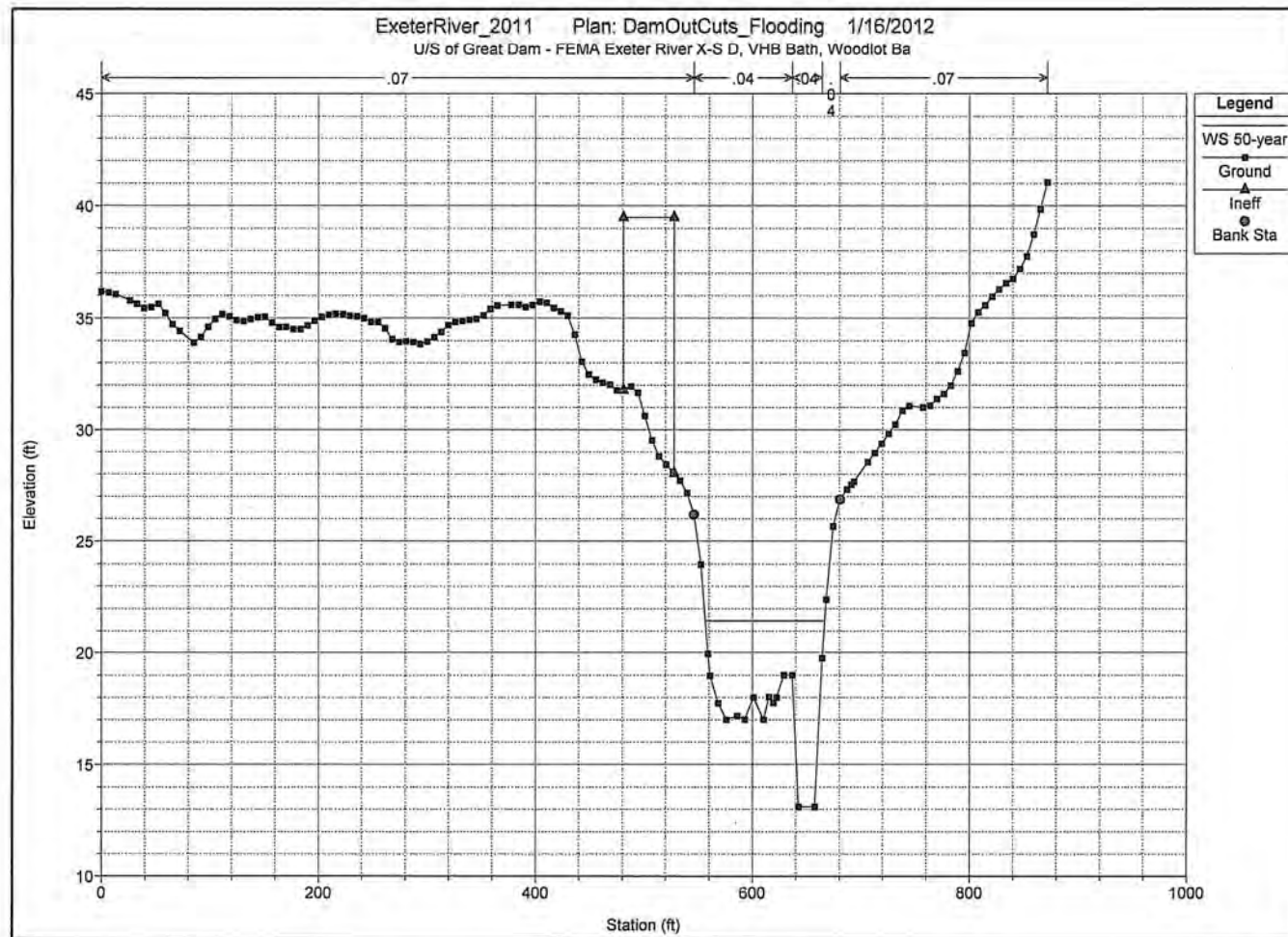


# Alternative 3 – Dam Removal





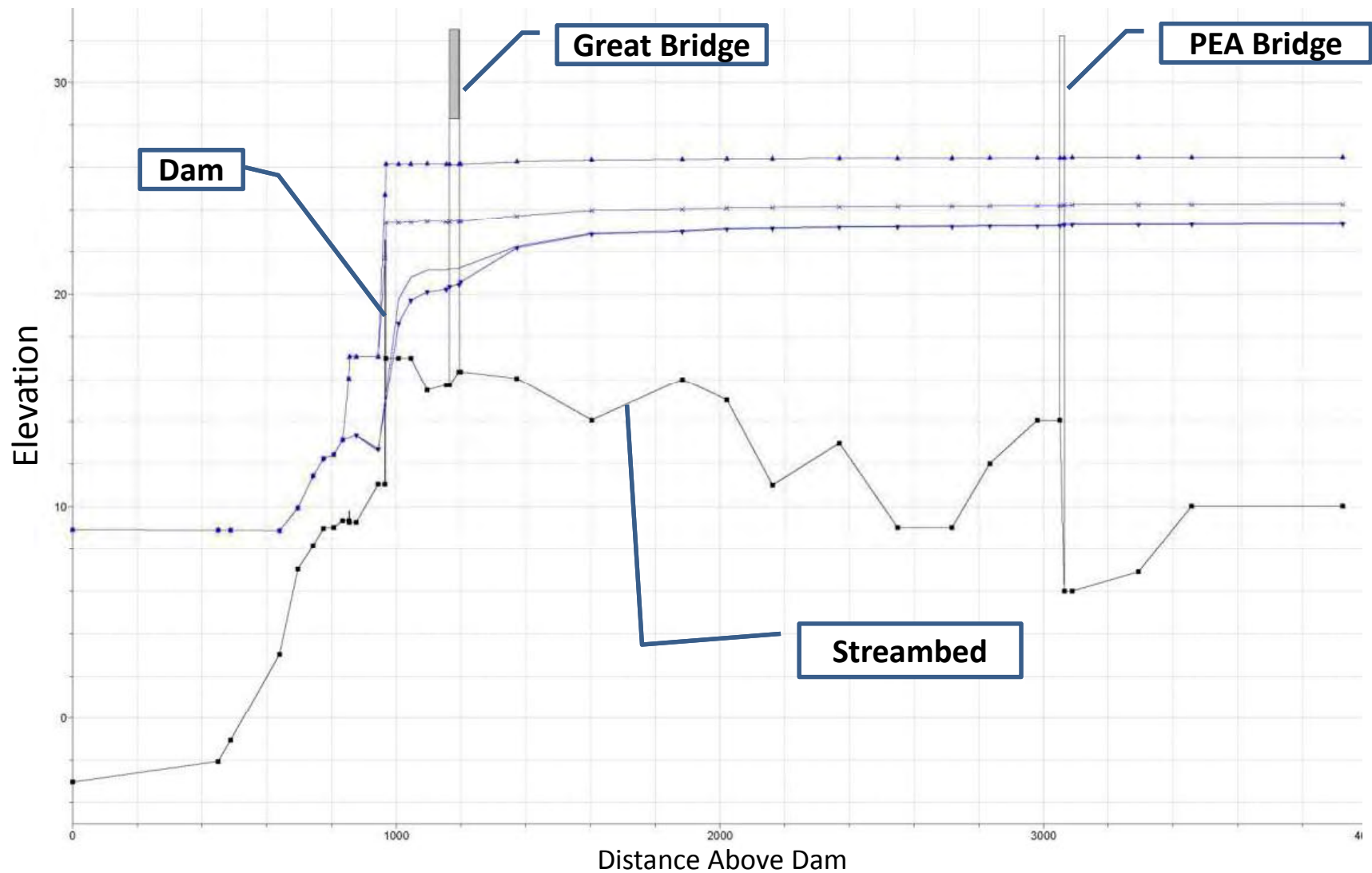
# Alternative 4 – Dam Removal w/ New Channel





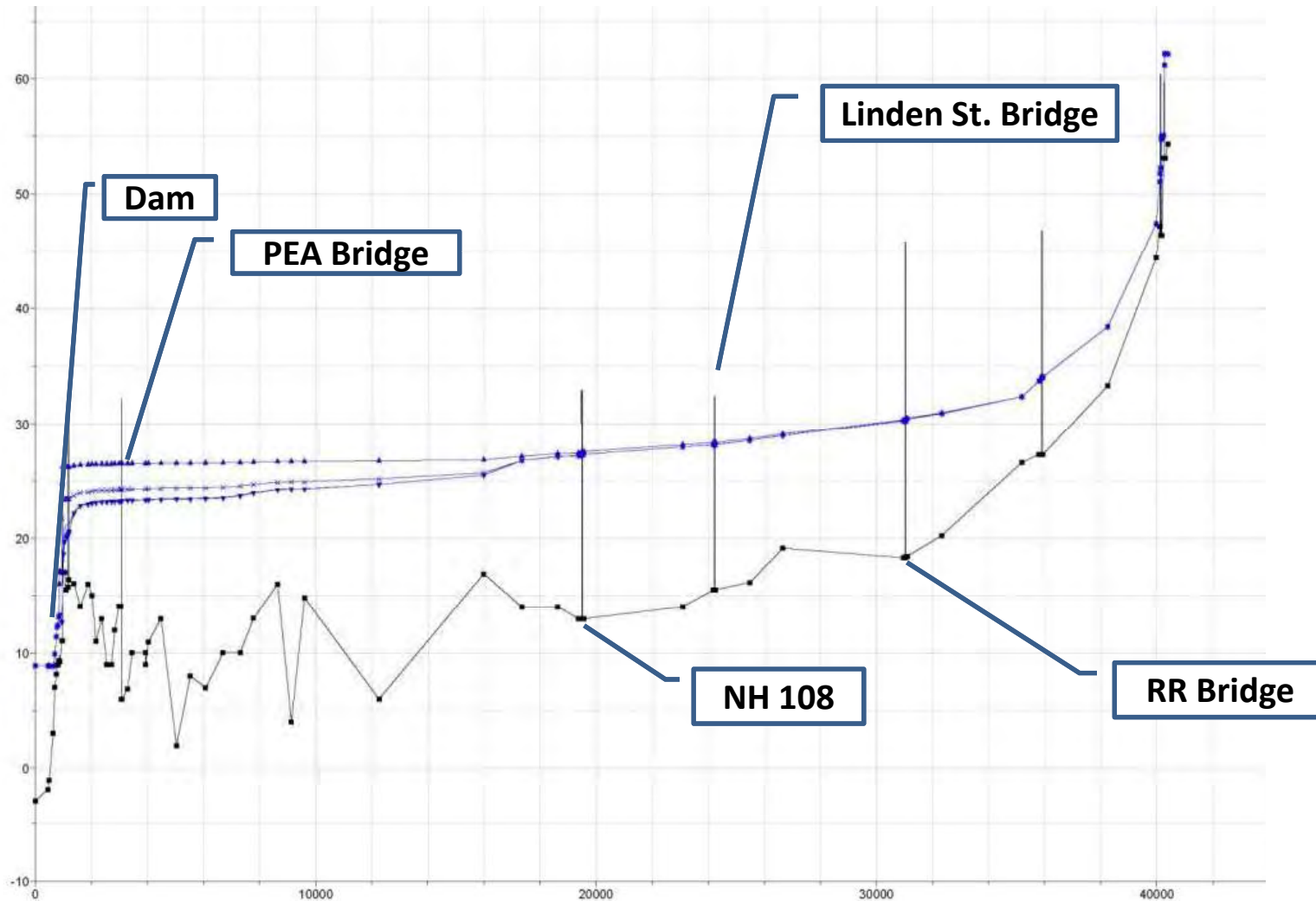


## 2-year Flow – Bankfull (1,481 cfs)



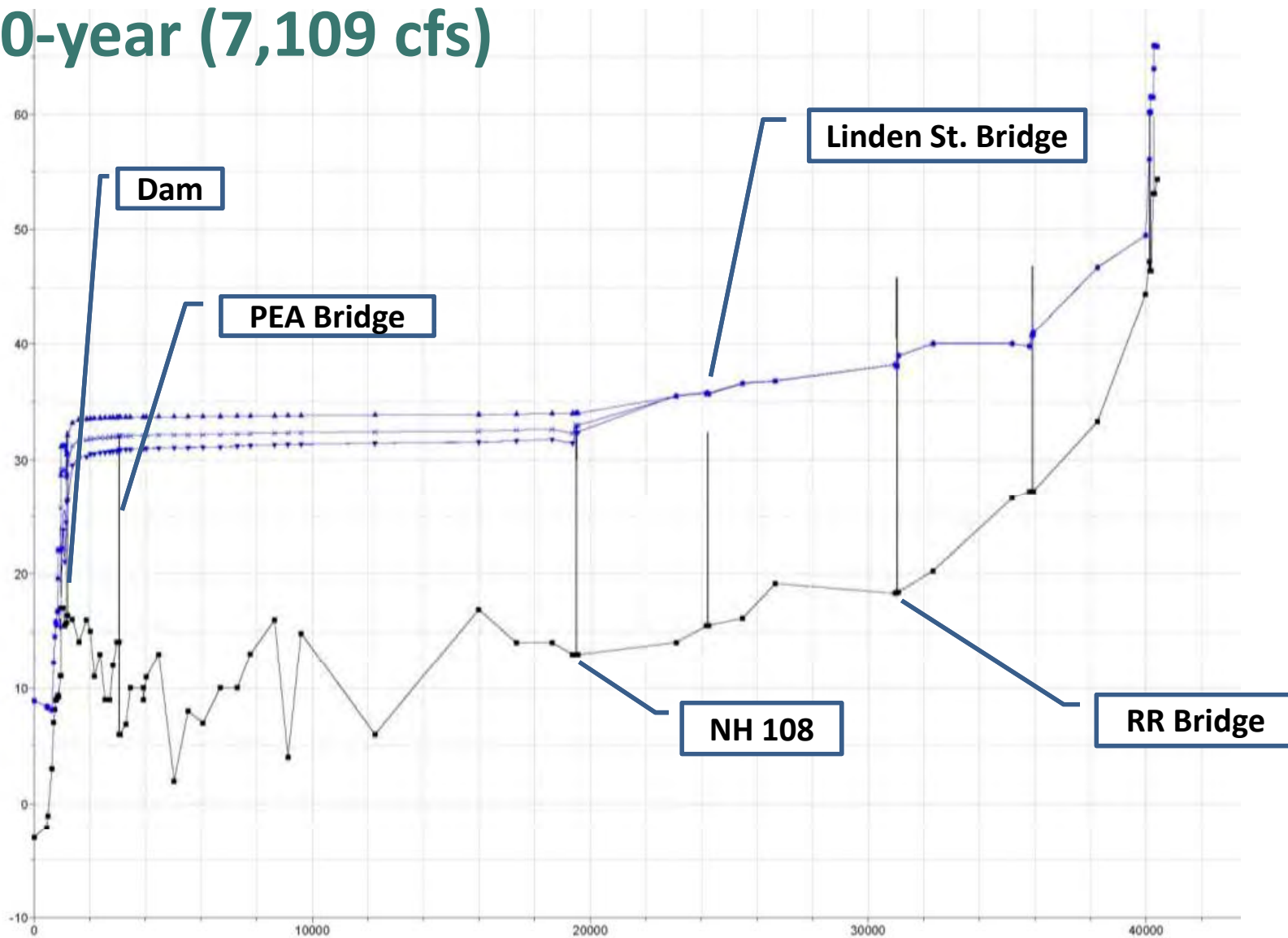


## 2-year Flow- Bankfull (1,481 cfs)





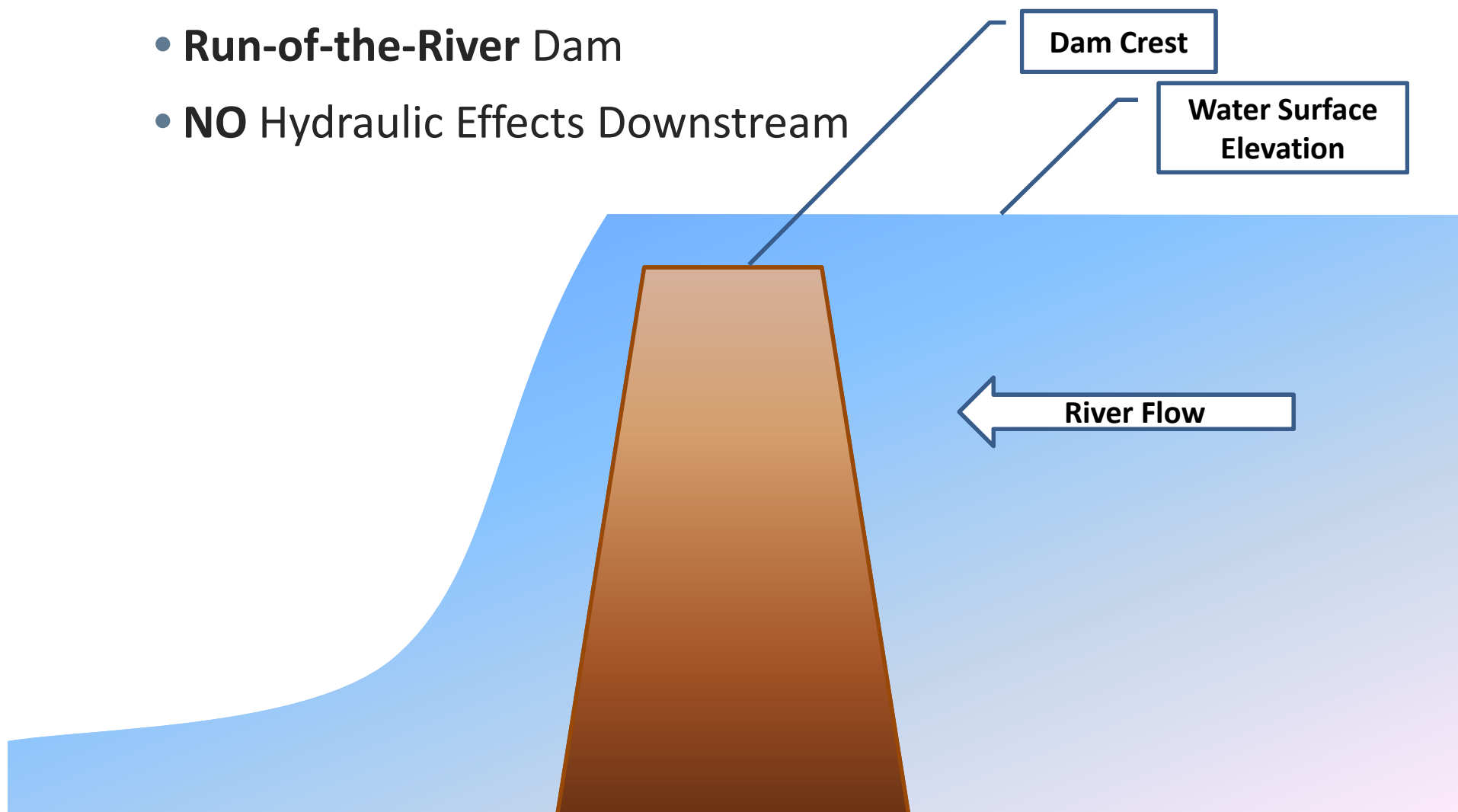
# 100-year (7,109 cfs)





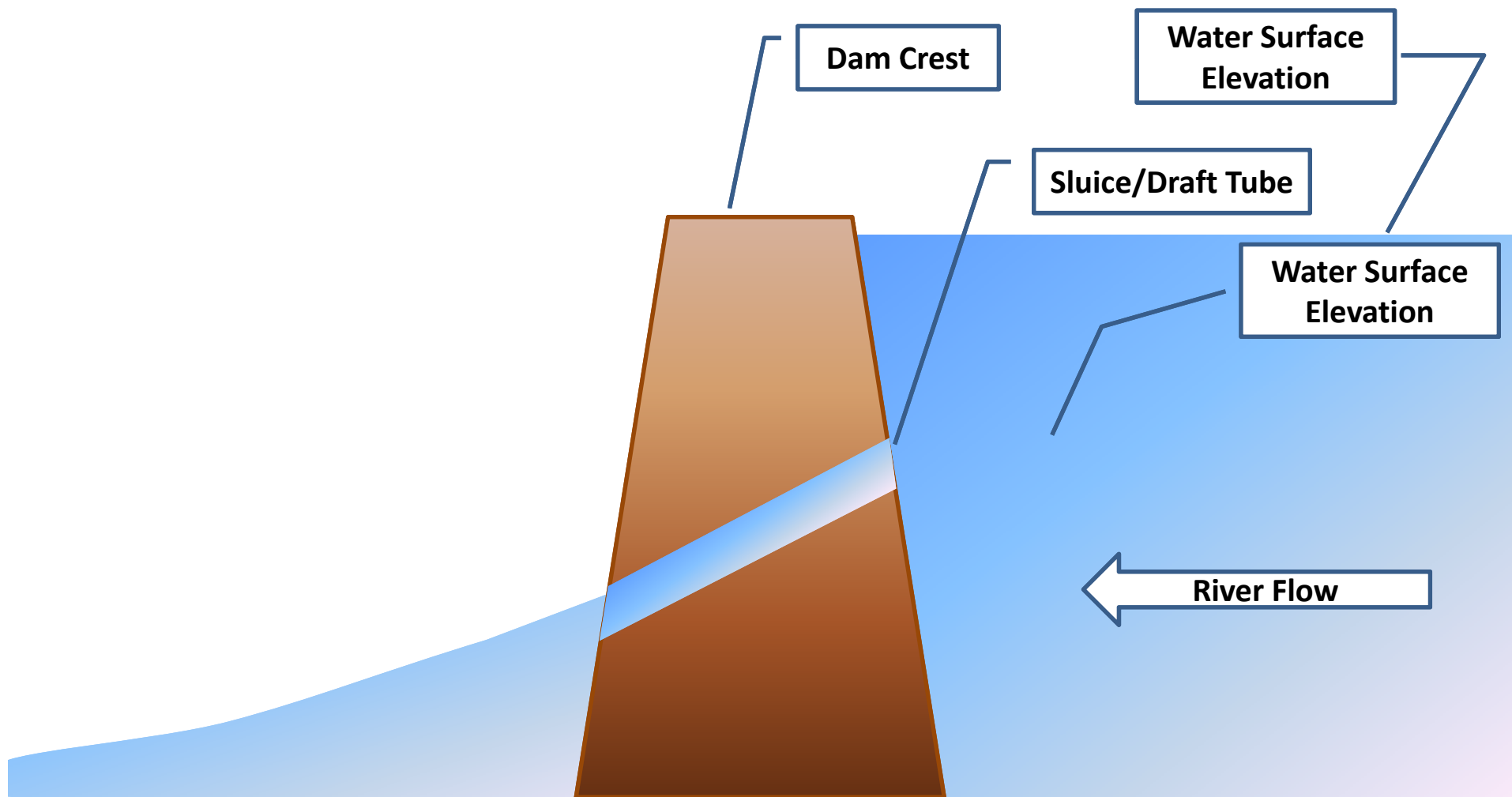
## Hydraulic Model Findings – What does this all mean???

- **Run-of-the-River Dam**
- **NO** Hydraulic Effects Downstream





## Hydraulic Model Findings – What does this all mean?





## Hydraulic Model Findings – What does this all mean???

- Floodplain will **decrease** in size and depth upstream
- Effects **diminish as one moves upstream**. The river depth will decrease:
  - **From about 12 ft deep to about 4-6 feet deep (i.e., 6-8 ft drop)** in immediate vicinity of the dam
  - **From about 14 ft deep to about 10-11 feet deep (i.e., 3-4 ft drop)** at PEA fields and Gilman Park
  - **4 inches** at the NH 108 Bridge (Court Street) under **2-year** conditions
  - **1-2 ft** at the NH 108 Bridge (Court Street) under **100-year** conditions
  - **No effect** at Linden Street under **normal** conditions



## Geomorphology – Preliminary Findings

- Upstream migrating headcut and channel incision is unlikely;
- Could cause increased channel migration in the wider floodplain areas without impacting human infrastructure;
- Could increase the potential for slumping of high banks where the river impinges against a higher terrace with two areas of potential concern associated with this erosion; and
- Should not impact downstream conditions due to the strong influence of tidal forces below the dam.







## What will the river look like?



*A view of the Great Dam during drawdown, November 2009*



## What will the river look like?



*From the Great Bridge (High Street), looking downstream,  
during drawdown, November 2009*



## What will the river look like?



*From the Great Bridge (High Street), looking upstream, during drawdown, November 2009*



## What will the river look like?



*Looking downstream near Gilman Park during drawdown, November 2009*



## What will the river look like?



*Looking upstream from the NH 108/Court Street Bridge during drawdown, November 2009*



## Next Steps

- Hydrology - Determine Final Hydrological Input with NHDES
- Develop a new “Dam Modification” Alternative to account for Climate Change
- Continue Analysis of Hydraulic Modeling Results
- Sediment Evaluation – Possible Additional Sampling
- Review Cultural Resource Studies with NHDHR
- Conduct Remaining Impact Analyses (e.g., water quality, fish passage, wetlands, recreation, wildlife, etc.)
- **Draft Report this Summer**
- **Public Informational Meeting in Fall**
- **Final Report in Fall**



## Project Schedule

Task	Timeline
Field Surveys	June – October 2011
<b>Public Meeting</b>	<b>September 2011</b>
Preliminary Analysis of Alternatives	Winter – Spring 2012
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Draft Feasibility Report	Summer 2012
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Final Feasibility Report Issued	Fall 2012



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# OPEN DISCUSSION/MEETING SUMMARY

## ADJOURN AT 9:30







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**THANK YOU FOR ATTENDING!**

