NEW YORK
STATE OF
OPPORTUNITY

Department of
Environmental
Conservation

Dam Removal: Data & Resources

Brian Buchanan, Hydrologist
Connecting Our Streams Workshop

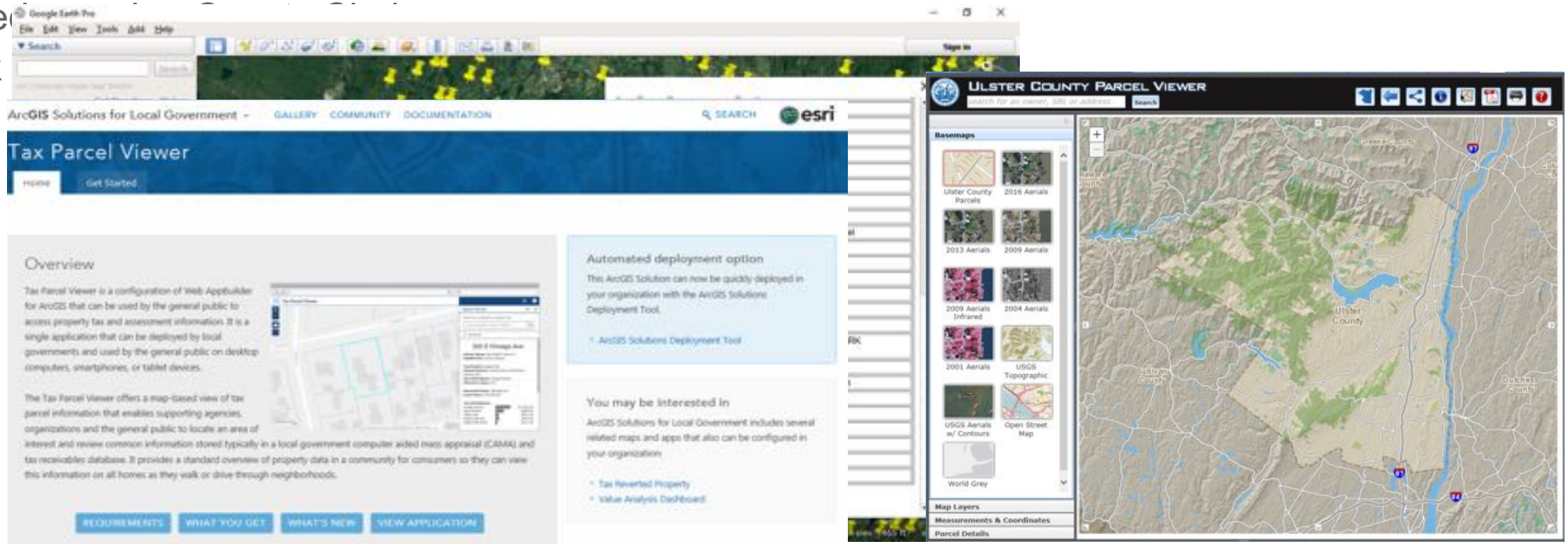
Outline

- Initial Reconnaissance
- Prioritization Tools
- Ghost Dams
- Existing Guidance
- Dam Removal Costs
- Funding Opportunities

Initial Reconnaissance

Dam or Nearby Property Ownership

- Dam Inventory – NYS GIS Data Clearinghouse & Google Earth
- Tax parcels – NYS GIS Data Clearinghouse; parcel viewers
- Dee
- Ask

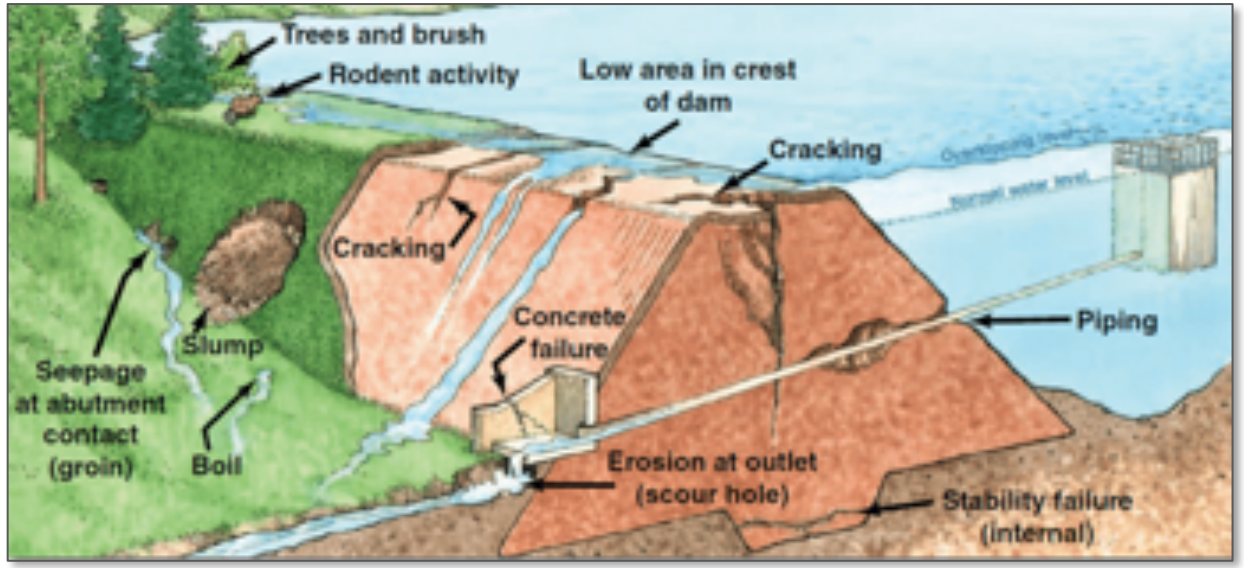


Initial Reconnaissance

Existing issues with the dam(s)

- NYSDEC Dam Safety: guidance documents
- NYSDEC Dam Safety: inspection reports
- Consult with dam owner and nearby property owners

Common Structural Issues



Spalling and Cr

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Certified Letter, Return Receipt Requested

October 15, 2018

Chris E. Wieland
Superintendent of Public Utilities
25 Water Plant Road
Troy, NY 12182

Patrick Madden, Mayor
City of Troy
433 River Street, City Hall
Troy, NY 12180

Re: Ida Lake Dam, DEC ID# 226-1391
Troy (C), Rensselaer County
Class A – Low Hazard Dam
Condition Rating: "Unsound – Deficiency Recognized"

Dear Mr. Wieland and Mayor Madden:

Mr. Tom Blanchard and I conducted an emergency inspection of the Ida Lake Dam, a low hazard dam, on September 28, 2018 as part of the Department of Environmental Conservation's (Department) ongoing Dam Safety program. I am writing you as it is my understanding that you represent the owner of this structure. A copy of the Visual Observations Report is enclosed.

Inspection

The left/right nomenclature used in this letter and in the enclosed Visual Observation Report is based on looking downstream from the center of the service spillway at the dam's crest.

Condition Rating

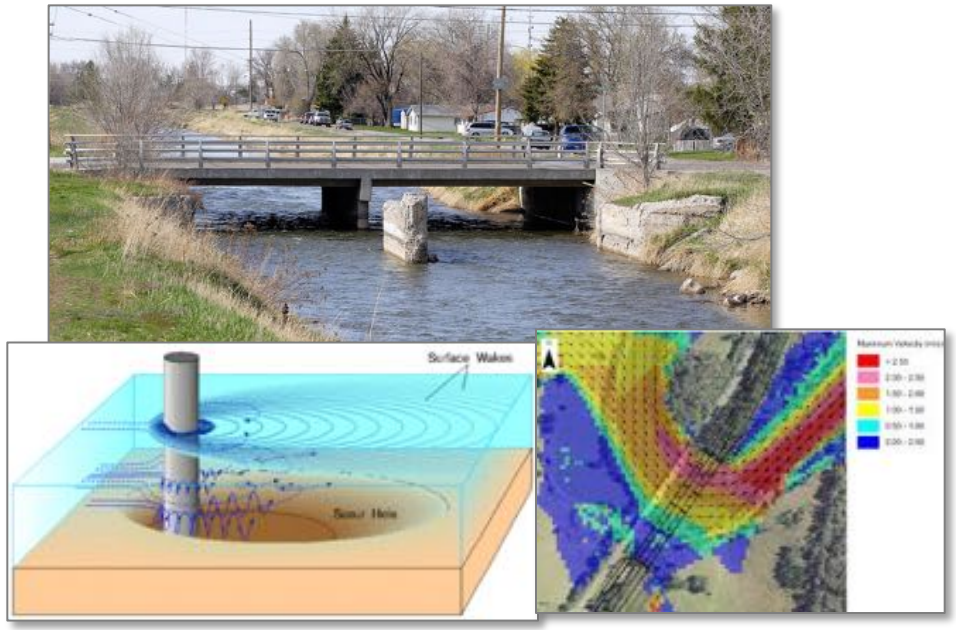
The September 19, 2018 letter report (Letter Report) by Schnabel Engineering (Schnabel) indicates that structural failure of spanning timbers will progress over the next twelve months within Bays F-13 and F-14, likely resulting in dam failure. As such, the Department hereby assigns a Condition Rating of "Unsound – Deficiency Recognized" to the Ida Lake Dam in accordance with 6 NYCRR Part 673.16. The owner of a dam with a condition rating of "Unsound – Deficiency Recognized" is in violation of ECL Article 15, Section 0507 and 6 NYCRR Part 673.16. As per Part 6 NYCRR Part

Initial Reconnaissance

Issues with nearby infrastructure

- Field recon and desktop analyses (overlay of streams, roads, utility networks, etc)
- Hydraulic modeling

Bridges



Utility Lines

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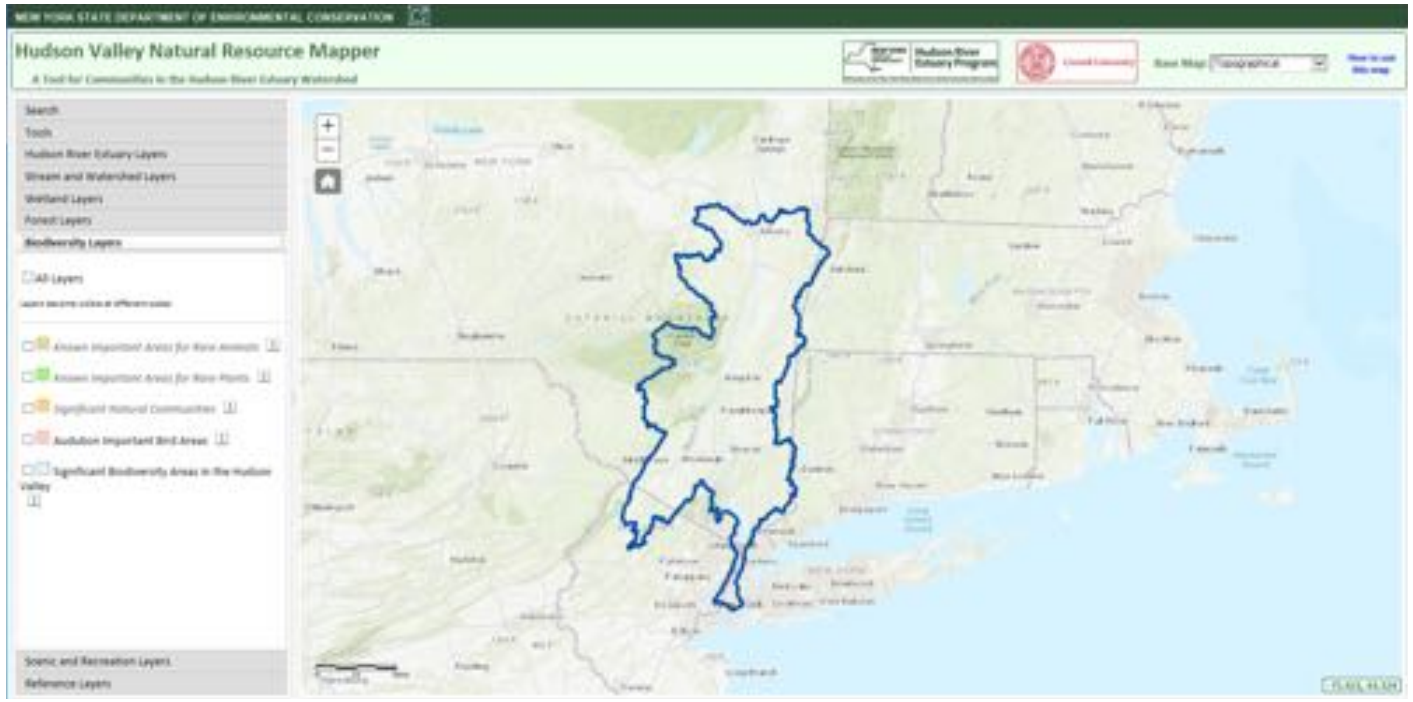
Initial Reconnaissance

Impacts to Rare Species or Habitats

- Hudson Valley Natural Resource Mapper
- Biological Surveys of Site



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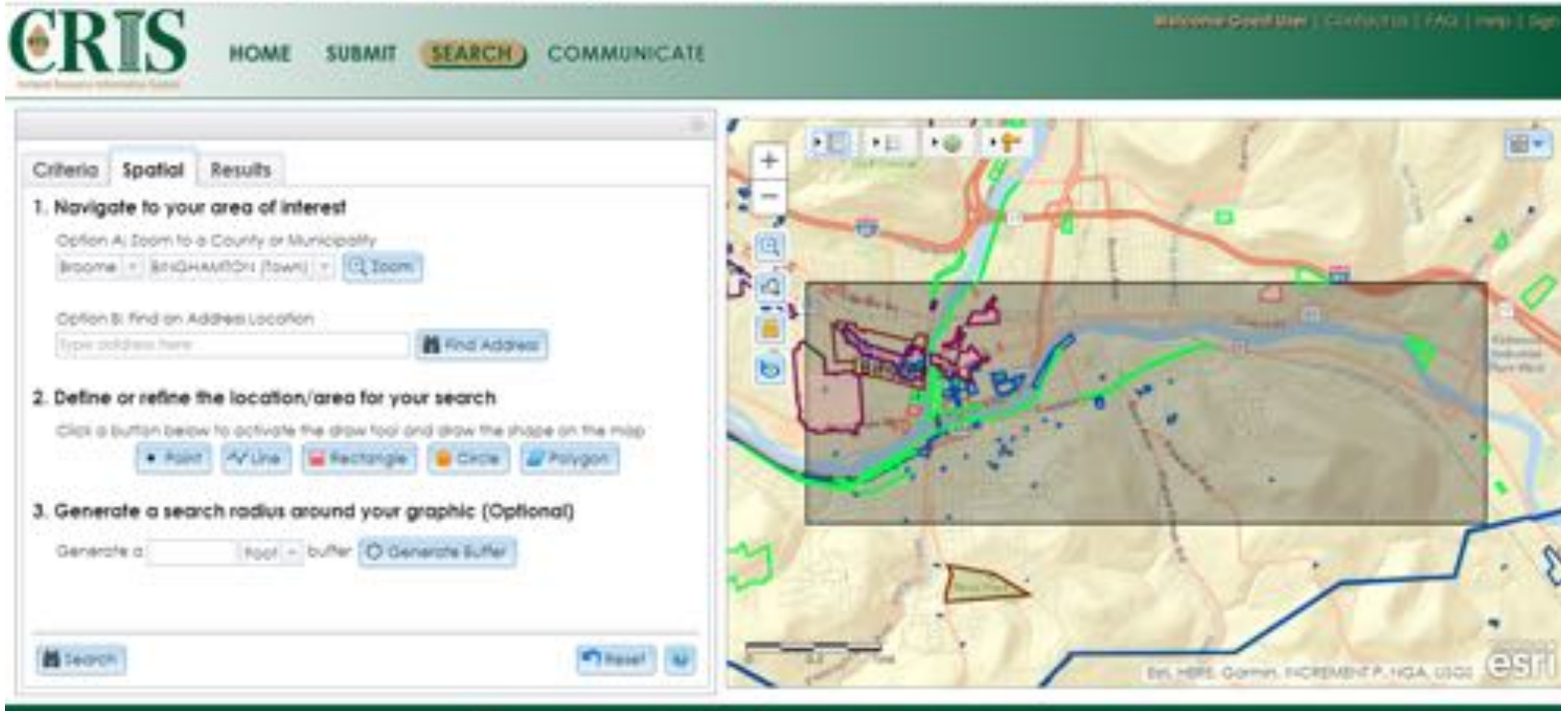
Initial Reconnaissance

Impacts to Historic or Cultural Resources

- Cultural Resource Information System Web Tool
- Contact the State Historic Preservation Office



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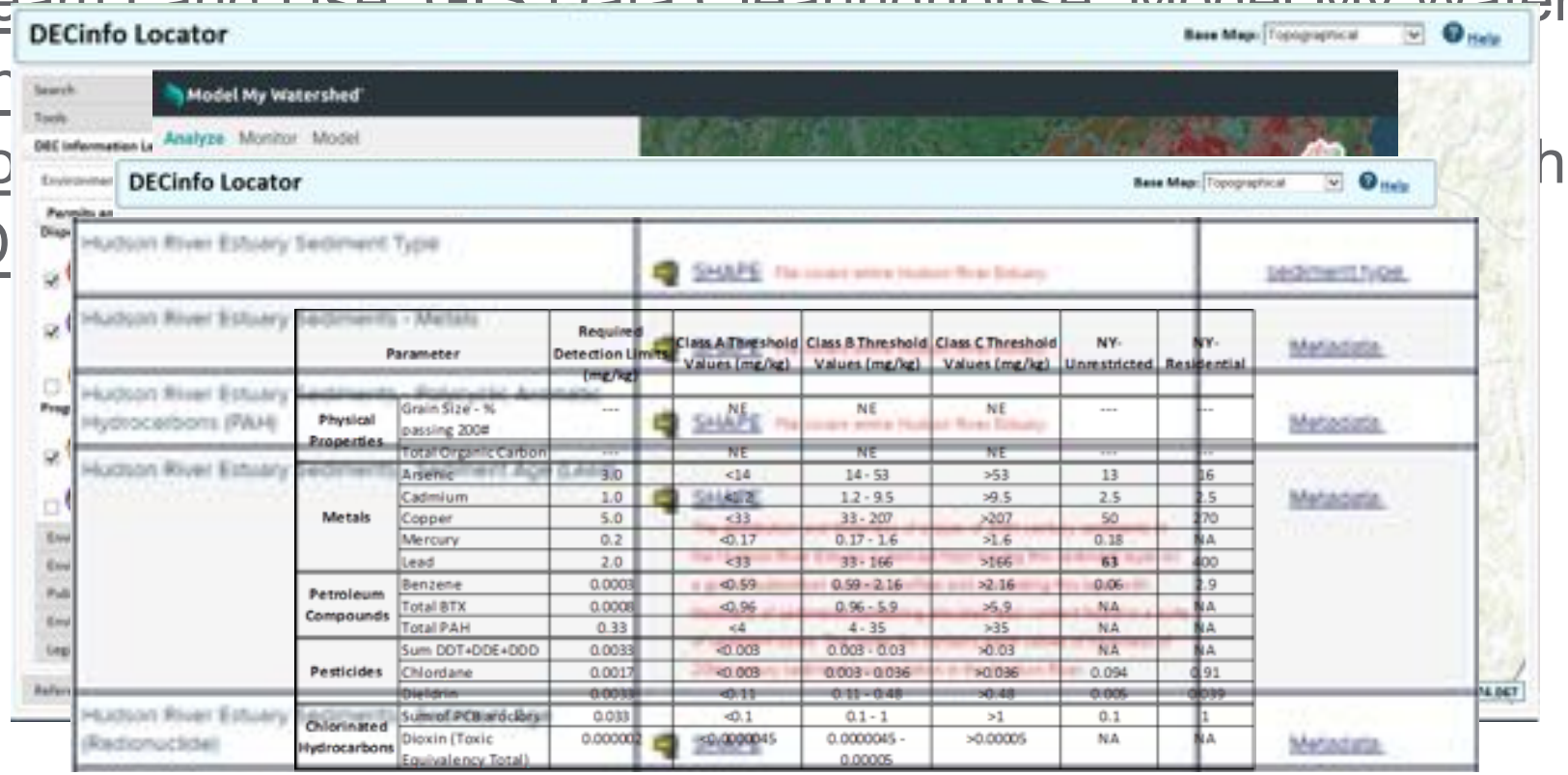
Initial Reconnaissance

Sediment Quality & Quantity

- Upstream Contaminant Sources: DEC Info Locator
- Upstream Land Use: GIS Data Clearinghouse; Model My Watershed
- Existin
- Hudso house
- NYSD



	Parameter	Required Detection Limits (mg/kg)	Class A Threshold Values (mg/kg)	Class B Threshold Values (mg/kg)	Class C Threshold Values (mg/kg)	NY-Unrestricted	NY-Residential
Physical Properties	Grain Size - % passing 200#	---	NE	NE	NE	---	---
	Total Organic Carbon	---	NE	NE	NE	---	---
Metals	Arsenic	3.0	<14	14 - 53	>53	13	16
	Cadmium	1.0	<4.2	1.2 - 9.5	>9.5	2.5	2.5
	Copper	5.0	<33	33 - 207	>207	50	270
	Mercury	0.2	<0.17	0.17 - 1.6	>1.6	0.18	NA
	Lead	2.0	<33	33 - 166	>166	63	400
Petroleum Compounds	Benzene	0.0003	<0.59	0.59 - 2.16	>2.16	0.06	2.9
	Total BTX	0.0008	<0.96	0.96 - 5.9	>5.9	NA	NA
	Total PAH	0.33	<4	4 - 35	>35	NA	NA
Pesticides	Sum DDT+DDE+DDD	0.0033	<0.003	0.003 - 0.03	>0.03	NA	NA
	Chlordane	0.0017	<0.003	0.003 - 0.036	>0.036	0.094	0.91
	Dieldrin	0.0033	<0.11	0.11 - 0.48	>0.48	0.005	0.039
Chlorinated Hydrocarbons	Sum of PCB Aroclors	0.033	<0.1	0.1 - 1	>1	0.1	1
	Dioxin (Toxic Equivalency Total)	0.000002	<0.0000045	0.0000045 - 0.00005	>0.00005	NA	NA

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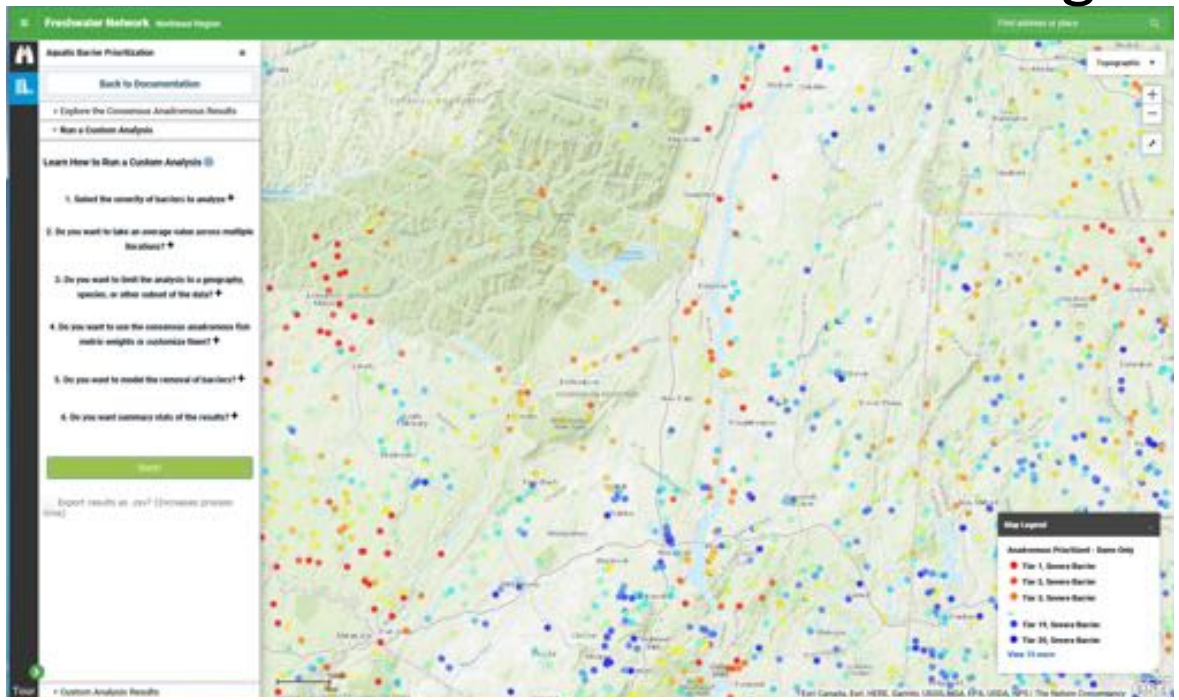
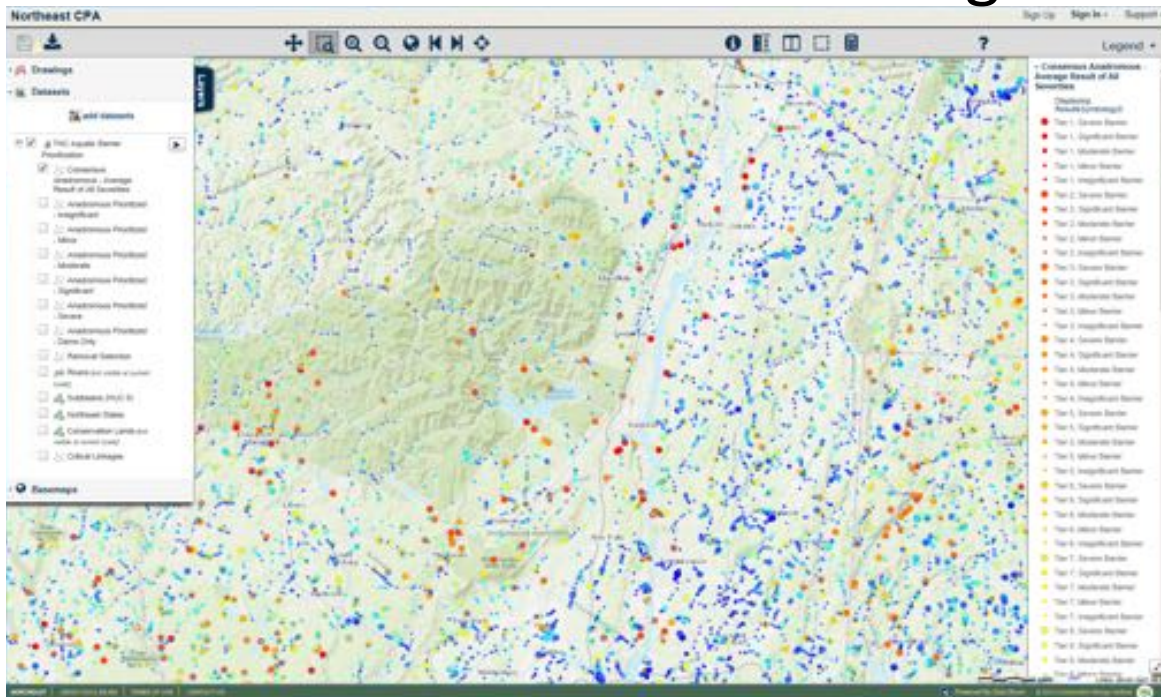
Prioritization Tools

Freshwater Network - Northeast Region



Northeast Conservation Planning Atlas



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Ghost Dams

Automated approach to identify hidden dams in the Estuary Watershed

Watershed	NYS Dams	Ghost Dams	Increase
Foundry Brook	12	41	3.4
Lattintown Creek	4	53	13.3

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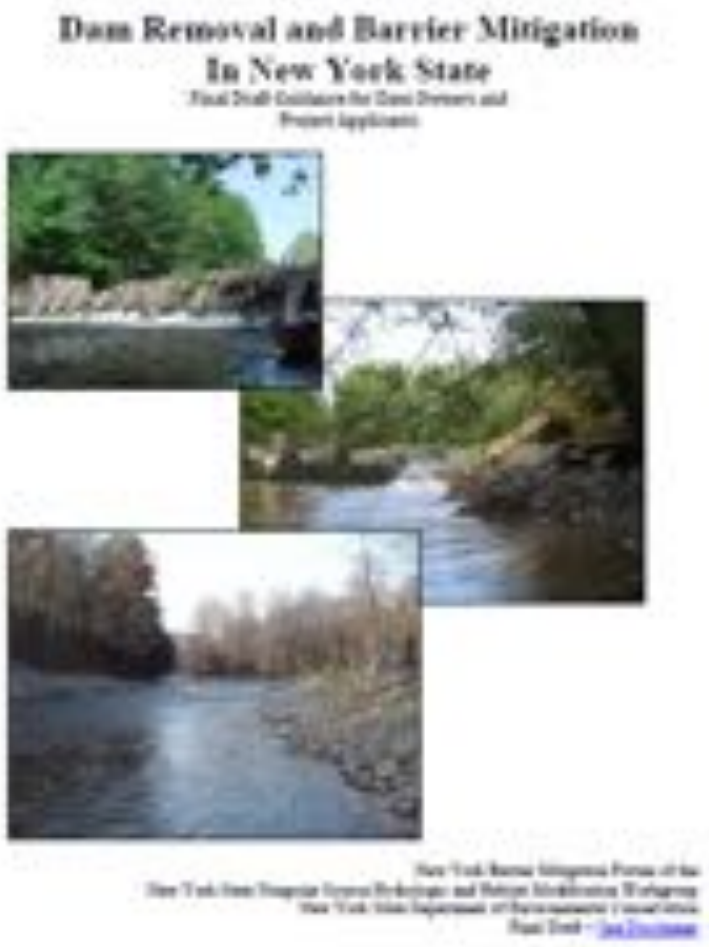
NYSDEC Dam Removal Guidance



Step One: Consider Your Options and Who Can Help You

Step Two: Research, Plan and Design Project

Step Three: Prepare Permit Application Package

Step Four: File All Required Permit Application and Comply with Permit Review and Issuance Procedures

Step Five: Implement Project and Consider Any Post-Removal Mitigation Measures

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Dam Removal Costs

Cost Estimator Spreadsheet

Input Parameters	
Dam Height (ft)	25
Dam Length (ft)	200
Purpose	No Important Purpose
Type	Other

Outputs				
Parameter	Source			
	Zheng et al., 2009	Neeson et al., 2015)	McManammay et al., 2019	NYSDEC
Estimated Cost	$ 182,525	$ 370,802	$ 356,891	$ 902,201
Inflation Factor	1.27	1.12	1	1
Final Cost	$ 231,553	$ 415,298	$ 356,891	$ 902,201

Output Attributes				
Sample Size	118	108	35	32
Data Source	Maclin and Sicchio, 1999; ICF Consulting, 2005; American Rivers, 2007	American Rivers	Rhode Island Habitat Restoration Portal	Friends of the Earth, American Rivers, Trout Unlimited
Dollar Year	2006	2012	2019	2001
Inputs	Height, Length, Purpose	Height	Height	Height
Range of Dam Heights	Unknown	Unknown	Unknown	3ft - 20ft

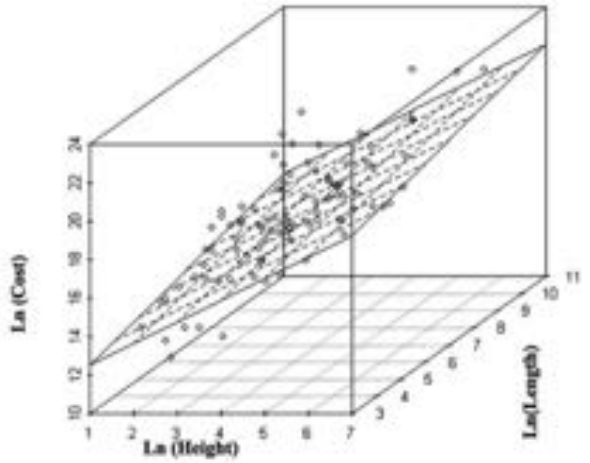

Figure 2. Scatterplot of dam removal cost (2006 dollars) versus dam height (ft, 3.28 ft = 1 m) and length (ft) (log transformed).

$$\ln\left(C_j^{dam}\right) = \underbrace{7.79}_{(S.E.=0.52)} + \overbrace{\underbrace{0.80}_{(0.1}\left(\ln\left(Height_j\right)\right) + \underbrace{0.33}_{(0.}\left(\ln\left(Length_j\right)\right)}^{DamSize}$$

$$+ \overbrace{\underbrace{1.49}_{(0.26)}\left(Fu\right.}^{DamPur}$$

Northeast U.S. Cost Breakdowns

Phase	Range	Median
Feasibility	$15,000 - 145,000	$30,000
Engineering Design	$10,000 - 100,000	$33,000
Permitting*	$4,000 - 80,000	$20,000
Construction†	$35,000 - 290,000	$150,000

*estimated range because work often done in-house with staff time, for significantly less than consultant costs

† includes construction oversight

Cost of Repair vs. Removal

Dam (removal date)	Repair ($)	Cost ($)	% More Expensive to Repair	Times More Expensive to Repair
Lake Christopher Dam, CA (1994)	$ 160,000	$ 100,000	60%	1.6
Edwards Dam, ME (1999)	$ 9,000,000	$ 2,100,000	329%	4.3
Grist Mill Dam, ME (1998)	$ 150,000	$ 56,000	168%	2.7
Sandstone Dam, MN (1995)	$ 1,000,000	$ 208,000	381%	4.8
Two-Mile Dam, NM (1994)	$ 4,100,000	$ 3,200,000	28%	1.3
Rat Lake Dam, WA (1989)	$ 261,000	$ 52,000	402%	5.0
Waterworks Dam, WI (1998)	$ 694,600	$ 213,770	225%	3.2
Mounds Dam, WI (1998)	$ 3,300,000	$ 500,000	560%	6.6
Newport No.11 Dam, VT (1996)	$ 783,000	$ 550,000	42%	1.4
Pilchuck Diversion Dam (2020)	$ 2,000,000	$ 1,500,000	33%	1.3
Bartlett Pond Dam, MA (2014)	$ 671,000	$ 325,000	106%	2.1
Condit Dam, WA (2012	$ 52,400,000	$ 24,800,000	111%	2.1
Whittenton Pond Dam, MA (2013)	$ 1,900,000	$ 447,000	325%	4.3

Repair/Replace 1.3 – 6.6 times more expensive

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Funding Opportunities

Grant Name	Funder	Brief Description	Funding Range	Match Requirement	Deadline	Eligibility	Website	Category
NYSDEC Hudson River Tributary Restoration Grant	NYSDEC	Grants support restoration of free-flowing waters by funding planning and construction projects to remove dams and remove/right-size culverts. Eligible projects must conserve or restore habitat connectivity for American eel or river herring in tributary streams of the Hudson River.	$10,500 - $1,025,000	None	Typically Jan-Feb.	Non-profits, conservation groups/agencies, municipaliities	https://www.dec.ny.gov/enb/20180214_not0.html	Implementation
Hudson River Estuary Program - Local Stewardship Planning	NYSDEC	Grant projects must benefit the estuary ecosystem and can include resilience planning, habitat restoration planning, green infrastructure planning and others.	$10,500 - $50,000	15% Local Match	Typically July	Non-profits, private consultants, conservation groups, municipalities	http://www.dec.ny.gov/lands/5091.html	Planning
Restoration of Watershed Connectivity, Hudson River Estuary Program	NEIWPCC	Supports projects that will help restore aquatic habitat connectivity for herring and eel and reduce local flood risks.	$100k - $105k	None	Typically Jan-Feb.	Non-profits, private consultants, conservation groups, municipalities	http://neiwpcc.org/wp-content/uploads/2018/02/2018-Watershed-Reconnection.pdf	Planning
Water Quality Improvement Project (WQIP) Program	NYSDEC	WQIP funds projects that directly address documented water quality impairments and/or barriers to aquatic passage (bridges, culverts, dams).	$0 - $250k	25% match for habitat restoration	--	Non-profits, conservation groups/agencies, municipaliities	https://www.dec.ny.gov/pubs/4774.html	Planning & Implementation
Community-based Habitat Restoration Project	NOAA	Provides funds to restore coastal ecosystems, support species recovery and help rebuild fish populations, and likely yield community and economic benefits.	$75k - $3mil	none	01/14/19	private landowners, state & local gov't, universities, nonprofits and for-profits	https://www.fisheries.noaa.gov/feature-story/noaa-seeks-applications-community-based-habitat-restoration-project-funding	Planning & Implementation
FEMA Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA) grant programs	FEMA	Provides pre- and post-disaster funds to address Localized Flood Risk Reduction, Floodplain and Stream Restoration, and Infrastructure Retrofits, including dam removal and culvert right-sizing.	max = $4mil	25%	--	individuals, industry, communities & nonprofits may apply via a local/state/tribal gov't that must have an FEMA-approve Hazard Mitigation Plan	https://www.fema.gov/hazard-mitigation-grant-program; https://www.fema.gov/flood-mitigation-assistance-grant-program; https://www.fema.gov/pre-disaster-mitigation-grant-program#	Planning & Implementation
Green Innovation Grant Program - New York State Environmental Facilities Corporation	NYSEFC	Provides grants to projects that improve water quality and demonstrate green infrastucture practices in New York. GIGP has supported dam removals and stream restoration projects.	--	10% - 60%	July	state & interstate agencies, local gov't, nonprofits, private entities, soil and water conservation districts	https://www.efc.ny.gov/GIGP	Implementaion

Water Quality Improvement Project (WQIP) Program

The Water Quality Improvement Project (WQIP) program is a competitive, statewide reimbursement grant program that funds projects that directly address documented water quality impairments or protect a drinking water source. This funding is for construction/implementation projects, not projects that are exclusively for planning.

Water Quality Improvement Project (WQIP) Program

Round 16 (2019) WQIP project types :

- Wastewater Treatment Improvement
- Nonagricultural Nonpoint Source Abatement and Control
- Land Acquisition for Source Water Protection
- Salt Storage
- Aquatic Connectivity Restoration
- Municipal Separate Storm Sewer Systems (MS4)

Water Quality Improvement Project (WQIP) Program

Aquatic Connectivity Restoration

- Projects to replace culverts and bridges or remove dams;
- Purpose is to eliminate barriers to fish and other wildlife;
- Other benefits: reduce flooding and erosion;
- Projects of up to $250,000
- Match – 25% of the total award
- Municipalities, SWCDs, & Not-for-Profits

Water Quality Improvement Project (WQIP) Program

Nonagricultural Nonpoint Source

- Eight (8) project subtypes Including "Culvert Repair and Replacement"

- Primary purpose must be to address erosion;
- AOP is not the primary goal although projects that also improve AOP, reduce flooding and protect infrastructure will receive additional points.
- Projects up to $1,000,000;
- Match – 25% of award total
- Municipalities and SWCDs

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EXTRAS

Initial Reconnaissance

Community Concerns

- Interviews with stakeholders to document any social barriers to removal

Feasibility/Design/Permitting Costs

Median consulting costs from 20+ northeast U.S. projects (not all projects include each cost item)

General project management	$4,700
Meetings (per meeting consultant fees)	$1,400
Existing data collection & analysis	$3,500
Surveying (structure, x-sections, profile, bathymetry, refusal depths)	$10,100
Hydrology & Hydraulics	$7,600
Sediment characterization (quantity and grain size)	$5,000
Sediment quality (cost per core)	$400-1,000
Concept design drawings and narrative	$8,100
Final design drawings and specs	$11,400
Cost estimating	$2,300
Permitting	$20,000

Construction Costs

Median costs from 10 northeast projects (actual project costs or engineer's probable cost estimates)

Staging and mobilization (silt fencing, moving equipment, signage, staking, fencing, etc.)	$20,200
Dewatering (pumping, piping, channeling, coffer dams, sandbagging, etc.)	$13,200
Structure removal/disposal	$22,200
Clean sediment removal/disposal (~4,000 c.y.)	$50,000
Contaminated sediment removal/disposal (~4,000 c.y.) (at hazardous waste facility)	$1,800,000
Channel/habitat work (channel construction, bioengineering, habitat features, grade control, etc.)	$10,500
Planting/seeding	$8,000
Construction oversight	$21,000
Contingency (15-30%)	$28,000

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Potentially Expensive “Extras”

Contaminant management

- ex. $1.8 million for removal/disposal of 4,000 c.y. at hazardous waste facility

Replacing uses

- ex. $62,000 to replace fire protection water supply with two 20,000 gallon tanks

Infrastructure protection or replacement

- ex. $230,000 to replace bridge (~20-ft. span)

Relocating/protecting utilities

- ex. $32,000 to relocate sewer/water pipes