STREAM PASSAGE IMPROVEMENT FOR INFRASTRUCTURE, FISH PASSAGE, AND FLOOD MITIGATION

Melinda Bubier, EIT, Wetlands Mitigation Program
Shane Csiki, Ph.D., CFM, New Hampshire Geological Survey
New Hampshire Department of Environmental Services
March 24, 2017

PRESENTATION OVERVIEW

- Why are stream crossings important?
- Why do we care about stream crossings?
- Who is coordinating the stream crossing initiative?
- How is the work being completed?.
- Where have crossings been assessed?
- What other initiatives are underway?
- Where do we begin?

NEW HAMPSHIRE
STATE STREAM CROSSING STEERING TEAM

Lead by:

NH Department of Environmental Services
- Geological Survey
- Wetlands Bureau

Co-Leads and Partners:

NH Department of Transportation

NH Fish and Game Department

NH Division of Homeland Security and Emergency Management

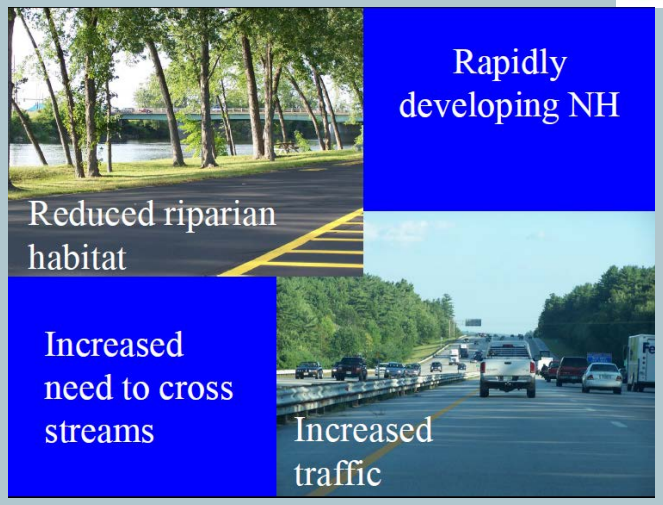
- Partnership-based management
  - distributed management structure, across agencies, directing priorities
- Transportation and environmental concerns
  - Combined protocol
- Individual agency responsibility
  - Criteria development based on specific missions and expertise
- Assessments are coordinated
  - Minimize duplication of effort
- Consistent messaging to the public on data outputs and scoring

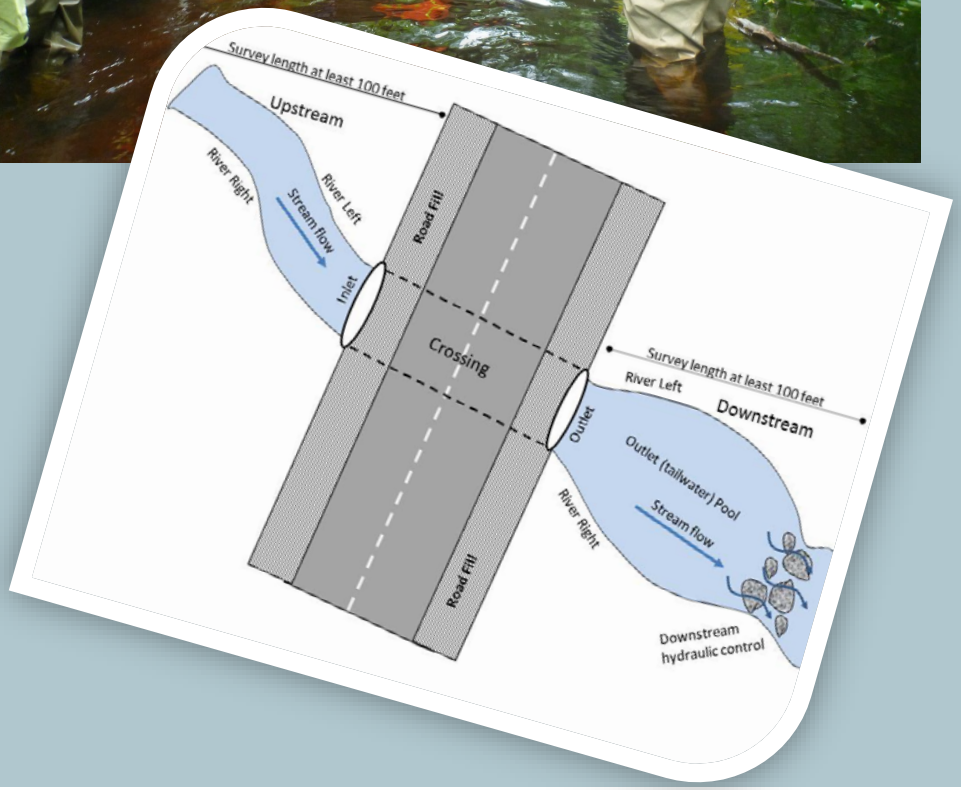
ROAD WASHOUTS: BAD FOR EVERYONE!

- Inconvenient
- Flood hazards
- Critical infrastructure
- Increased Risk Due to:
  - Increased rain events
  - Increased development
  - Aging infrastructure

- Expensive
- Public safety
- Habitat destruction
- Inconvenient

WILDLIFE DEPEND ON CROSSINGS AS MUCH AS WE DO!



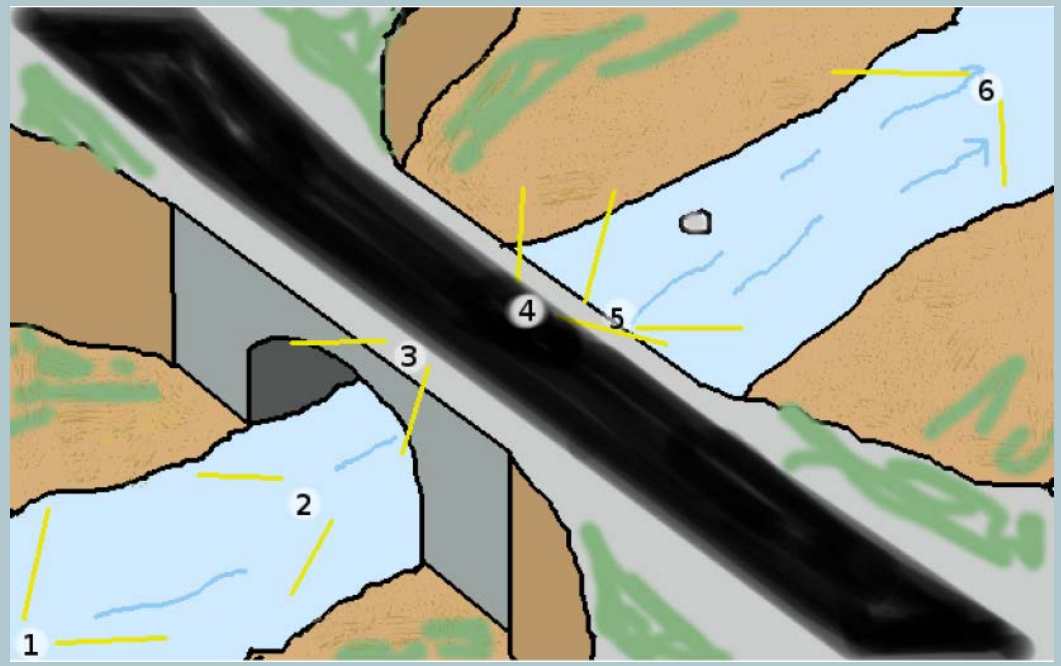


STREAM CROSSING ASSESSMENT PROTOCOL

- Training each spring for State funded stream collectors
  - -Classroom session
  - -Field training
- QAQC data “realtime” and provide feedback
- Field visits with collectors to provide guidance and feedback
- ~125 Parameters total: --
  - -Environmental
  - -Transportation
- Three compatibility characterization types:
  - -Geomorphology
  - -Aquatic organism passage
  - -Hydrology/Hydraulic
- Entry method:
  - - iPad / ESRI Collector App

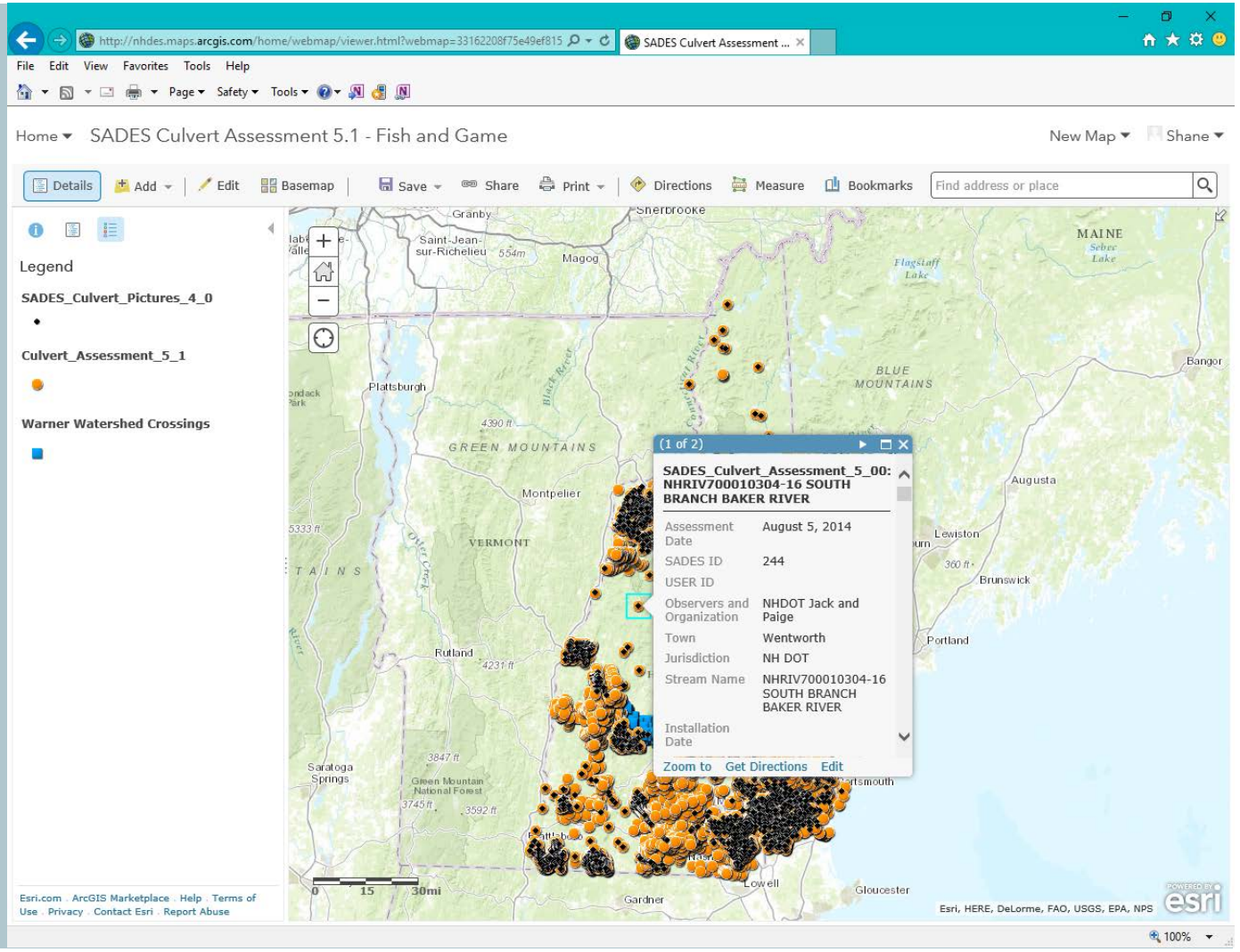
QUALITY CONTROL REVIEW PROCESS

- 6 photos per crossing
- Cross-reference of photos with data
- Issues/comments to collectors
- Work in turn to address comments and complete process to enable running of geomorphic and AOP passage tools



DATA STORAGE AND DELIVERY

- Common data delivery and QAQC interface
- Accessible to all project partners
- Maintained by DOT as an asset management database



GEOMORPHIC SCORES

Category Name	Screen Score	Threshold Conditions	Description of structure-channel geomorphic compatibility
Fully compatible	20<GC≤25	n/a	Structure fully compatible with natural channel form and process. There is a low risk of failure. No replacement anticipated over the lifetime of the structure. A similar structure is recommended when replacement is needed.
Mostly compatible	15<GC≤20	n/a	Structure mostly compatible with current channel form and process. There is a low risk of failure. No replacement anticipated over the lifetime of the structure. Minor design adjustments recommended when replacement is needed to make fully compatible.
Partially compatible	10<GC≤15	n/a	Structure compatible with either current form or process, but not both. Compatibility likely short term. There is a moderate risk of structure failure and replacement may be needed. Re-design suggested to improve geomorphic compatibility.
Mostly incompatible	5<GC≤10	% Bankfull Width + Approach Angle scores ≤ 2	Structure mostly incompatible with current form and process, with a moderate to high risk of structure failure. Re-design and replacement planning should be initiated to improve geomorphic compatibility.
Fully incompatible	0≤GC≤5	% Bankfull Width + Approach Angle scores ≤ 2 **AND** Sediment Continuity + Erosion and Armoring scores ≤ 2	Structure fully incompatible with channel and high risk of failure. Re-design and replacement should be performed as soon as possible to improve geomorphic compatibility.

GEOMORPHIC SCORES

Score	% Bankfull Width	Sediment Continuity	Slope	Approach Angle	Erosion and Armoring
5	%BFW ≥ 120	No upstream deposition or downstream bed scour	Structure slope equal to channel slope, and no break in valley slope	Naturally straight	No erosion **or** armoring
4	100 ≤ %BFW < 120	**Either** upstream deposition **or** downstream bed scour, **without** upstream deposits taller than 0.5 bankfull height **or** high downstream banks	n/a	n/a	No erosion **and** intact armoring, **or** low upstream **or** downstream erosion **without** armoring
3	75 ≤ %BFW < 100	**Either** upstream deposition **or** downstream bed scour, **with** either upstream deposits taller than 0.5 bankfull height **or** high downstream banks	Structure slope equal channel slope, with local break in valley slope	Mild bend	Low upstream **or** downstream erosion **with** armoring
2	50 ≤ %BFW < 75	**Both** upstream deposition **and** downstream bed scour, **without** upstream deposits taller than 0.5 bankfull height **or** high downstream banks	Structure slope higher or lower than channel slope, and no break in valley slope	Channelized straight	Low upstream **and** downstream erosion
1	30 ≤ %BFW < 50	**Both** upstream deposition **and** downstream bed scour, **with** upstream deposits taller than 0.5 bankfull height **or** high downstream banks	n/a	n/a	Severe upstream **or** downstream erosion
0	%BFW < 30	**Both** upstream deposition **and** downstream bed scour, **with** upstream deposits taller than 0.5 bankfull height **and** high downstream banks	Structure slope higher or lower than channel slope, with local break in valley slope	Sharp bend	Severe upstream **and** downstream erosion, **or** failing armoring upstream **or** downstream

AQUATIC ORGANISM PASSAGE SCORES

VT Aquatic Organism Passage Coarse Screen	Full AOP	Reduced AOP	No AOP	
Updated 2/25/2008	for all aquatic organisms	for all aquatic organisms	for all aquatic organisms except adult salmonids	for all aquatic organisms including adult salmonids
AOP Function Variables / Values	**Green (if all are true)**	**Gray (if any are true)**	**Orange**	**Red**
Culvert outlet invert type	at grade **OR** backwatered	cascade	free fall **AND**	free fall **AND**
Outlet drop (ft)	= 0		> 0 , < 1 ft **OR**	≥ 1 ft **OR**
Downstream pool present			= yes (= yes **AND**	= no **OR** (= yes **AND**
Downstream pool entrance depth / outlet drop			n/m ≥ 1)	n/a < 1) **OR**
Water depth in culvert at outlet (ft)				< 0.3 ft
Number of culverts at crossing	1	> 1		
Structure opening partially obstructed	= none	≠ none		
Sediment throughout structure	yes	no		

ACCESSING THE DATA

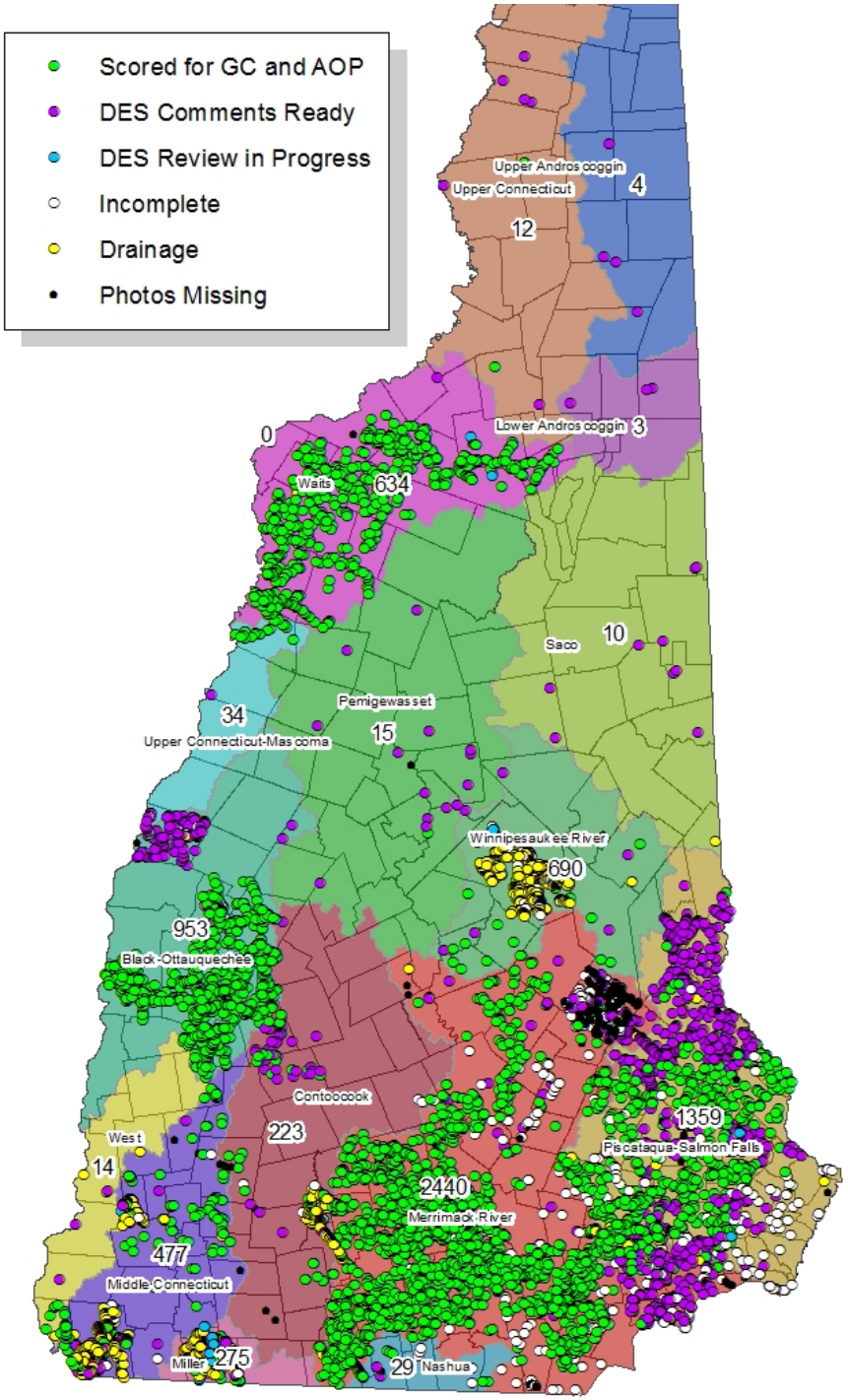
- Contact the New Hampshire Geological Survey at NHDES
  - Tom Taggart – Primary Contact
    - Email: Thomas.Taggart@des.nh.gov
    - Phone: 603-271-5762
  - Shane Csiki
    - Email: Shane.Csiki@des.nh.gov
    - Phone: 603-271-2876
- Access directly via the New Hampshire Coastal Viewer

  http://nhcoastalviewer.unh.edu/

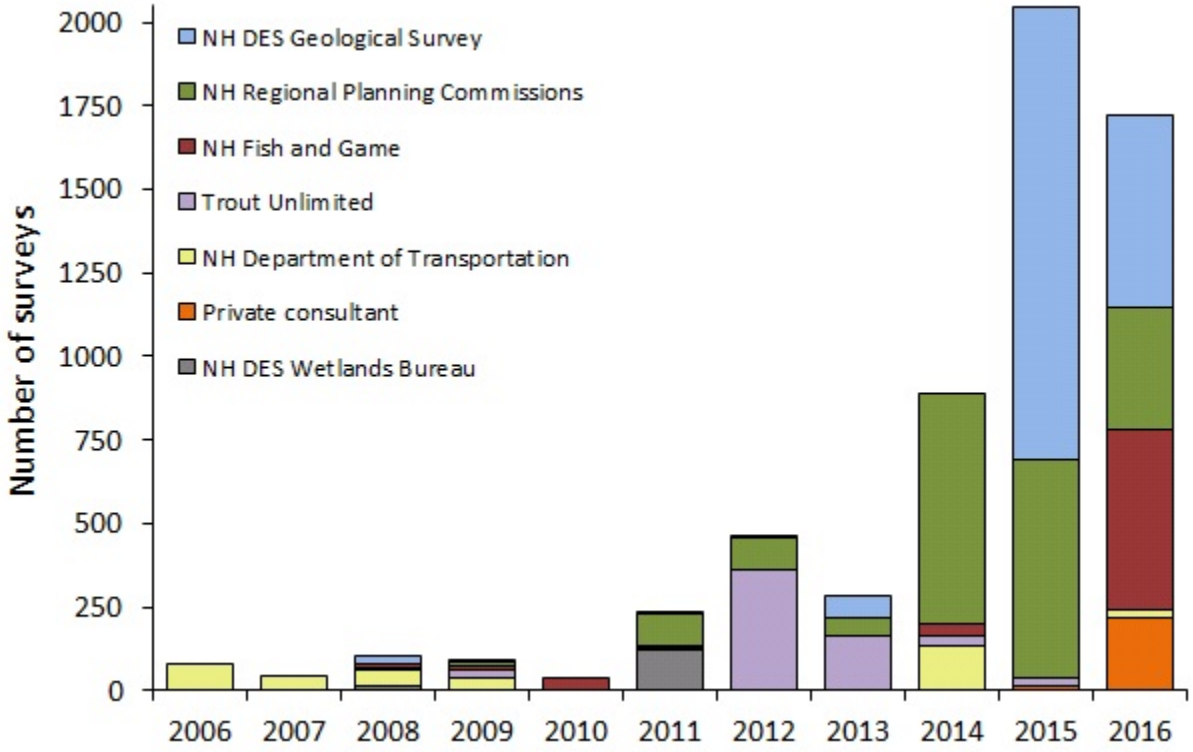
Project Progress

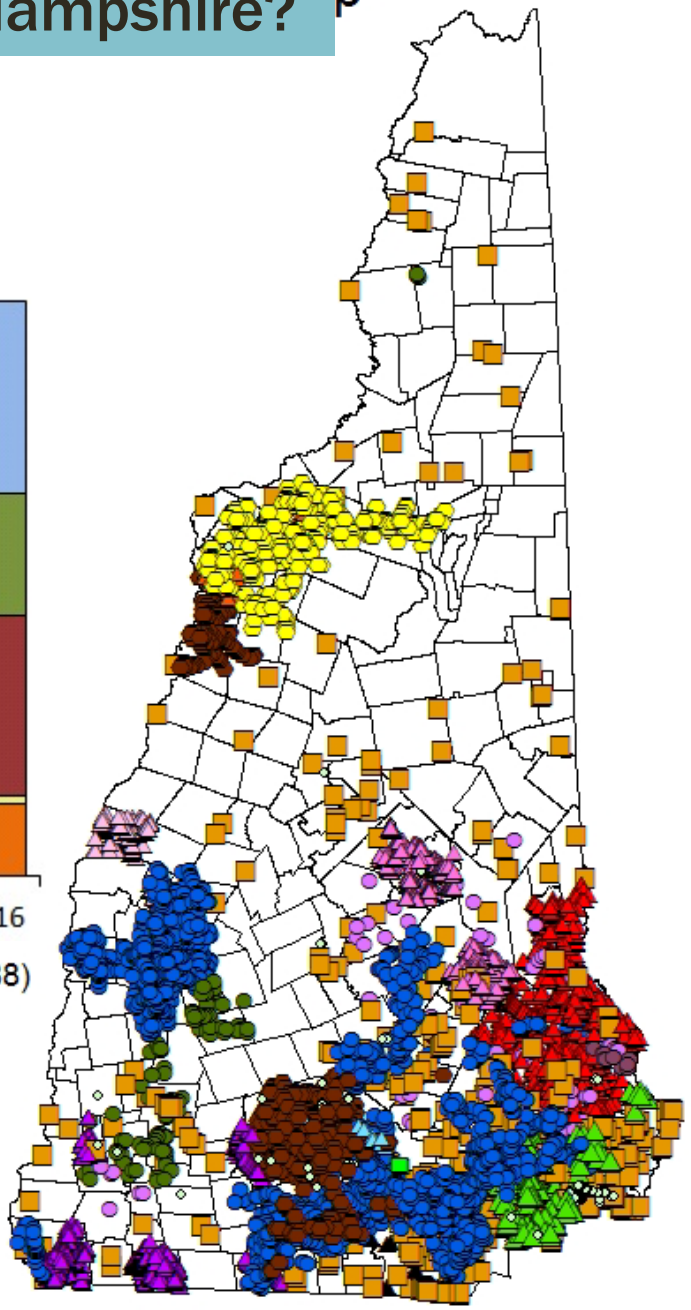
- Assessment status
  - ~7,500 structures are on SADES
  - ~1,100 are drainages and will not be scored
  - ~800 are incomplete
  - ~5,600 culverts or bridges to score
- ~4,500 crossings have been run through AOP and GC screens
- QC process on SADES

Total crossings 7,500
(~35% of known crossings in NH)



Who collects culvert data in New Hampshire?

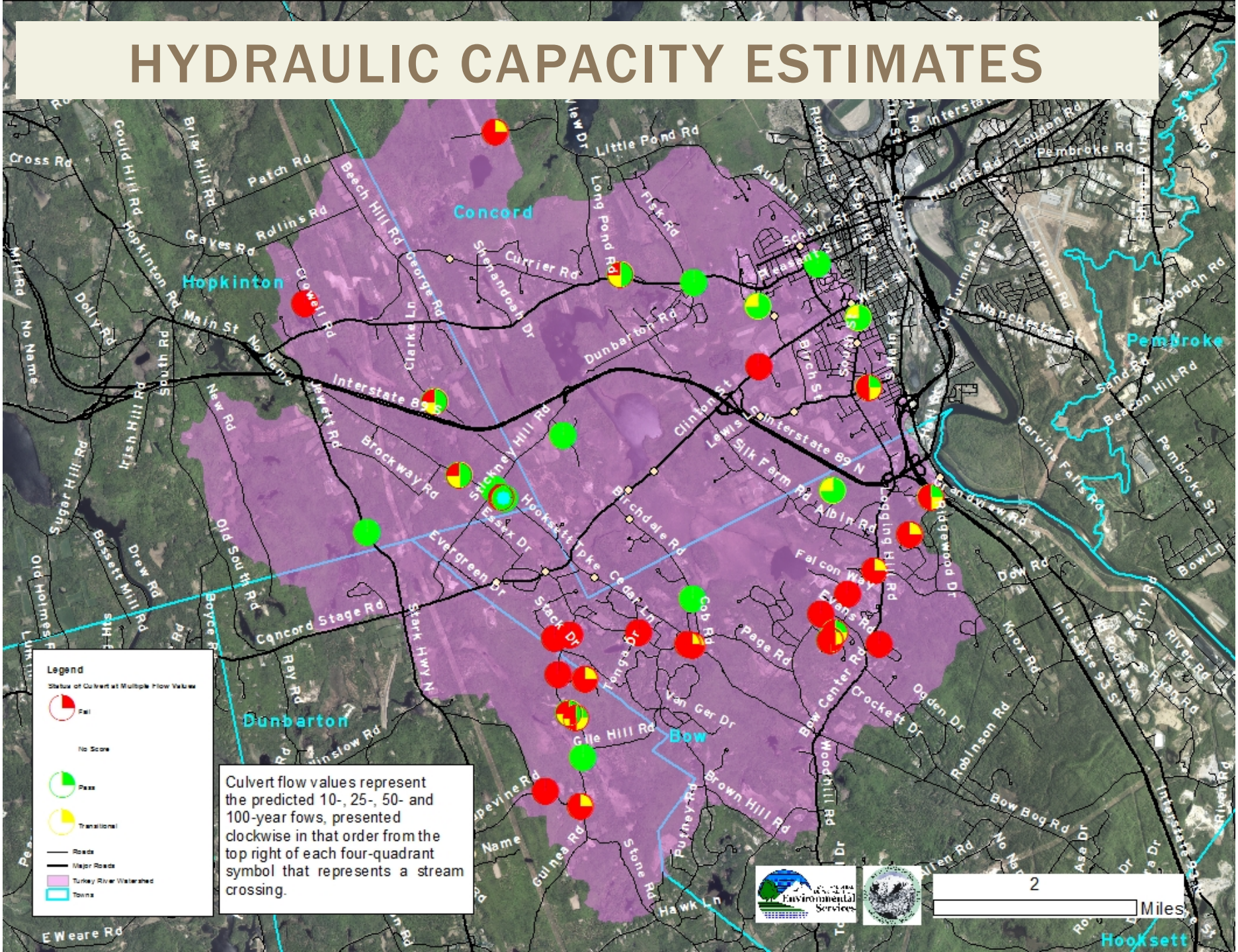




CURRENT AND FUTURE DIRECTIONS

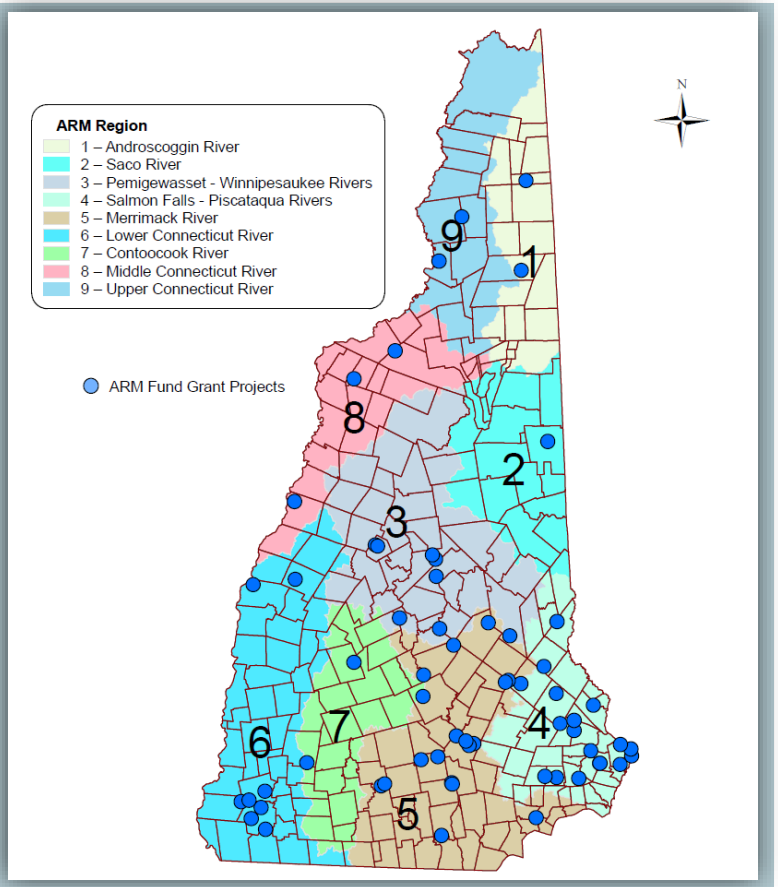
- Hydraulic Capacity **Estimates –Coarse Screening Model**
  - Streamworks – Trout Unlimited Model
    - 1st Order estimates of Hydraulic Capacity
    - Inputs: Topography, land cover, soils, wetlands/ponds, precip, streamflow
    - Basis: HY-8 (FHWA)
- Flood Modeling
  - Initial investigations of 1D/2D Flood models underway
  - Currently in literature review and inputs analysis phase
- Protocol Refinement
  - Sub-committees tackling reduction of assessment parameters
  - Streamlining of QAQC process to reduce data management overhead

HYDRAULIC CAPACITY ESTIMATES



AQUATIC RESOURCE MITIGATION FUND
RSA 482-A:28 - 33

- Additional wetland mitigation option available to applicants.
- Option for projects that have difficulty in finding good mitigation.
- Process of providing a payment into a fund that pools money together to be spent in the “watershed” where impacts occurred.
- Funds go toward wetland restoration, preservation of land adjacent to aquatic resources, wetland creation or aquatic resource improvements.



ARM FUND PROJECT AWARD SITES 2009-2015

Culvert Assessments and ARM

- Assist and provide funds for improving a crossing that is deemed eligible for the stream mitigation program

- Utilize information for mitigation option to replace deficient crossings for aquatic passage and address infrastructure needs

STREAM PASSAGE IMPROVEMENT PROJECTS

- Aquatic resource of concern?
  - Species present/potential?
- Overall Mitigation Potential/Protection.
  - AOP and Geomorphic scores
- How much of the aquatic resource will be protected.
- Buffers.
- Connections.
- Likelihood of project success.
  - Project Partners
  - Concept Design
- Flood hazard.
- Critical infrastructure

Fall Brook Culvert Replacement, Swanzey, NH

Funding: =$165,000

Total Project Cost: $250,572

Project Objective: Increase access to cold water headwaters habitat

Project Partners: Trout Unlimited, Cheshire County Conservation District, Town of Swanzey, NRCS, Fish &Game, Harris Center for Conservation

Bankfull width, immediately upstream = 30 feet
Reference reach = 21 feet

Indicative of a frequently backwatered crossing inlet

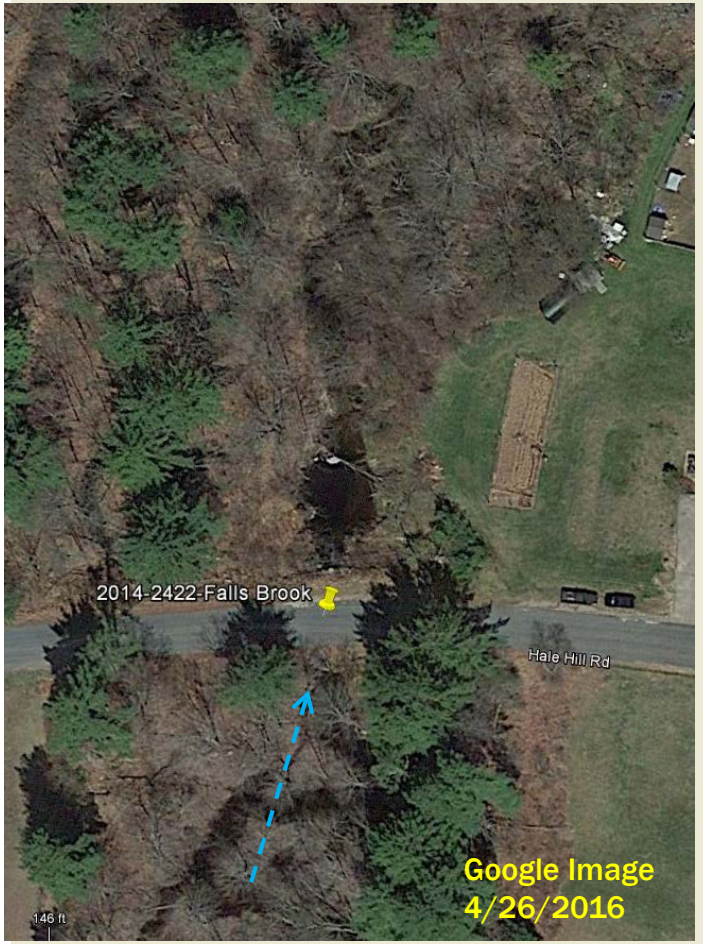
Lack of natural substrate within the culvert

- Upstream (Inlet) side of culvert

May 10, 2011

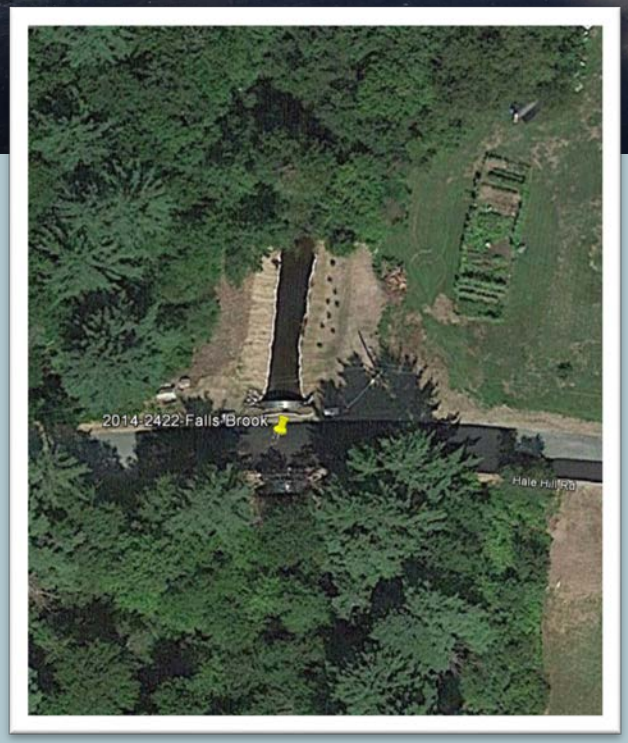
Downstream/Outlet side of structure
May 10, 2011

6-foot diameter, 50-foot long corrugated metal pipe



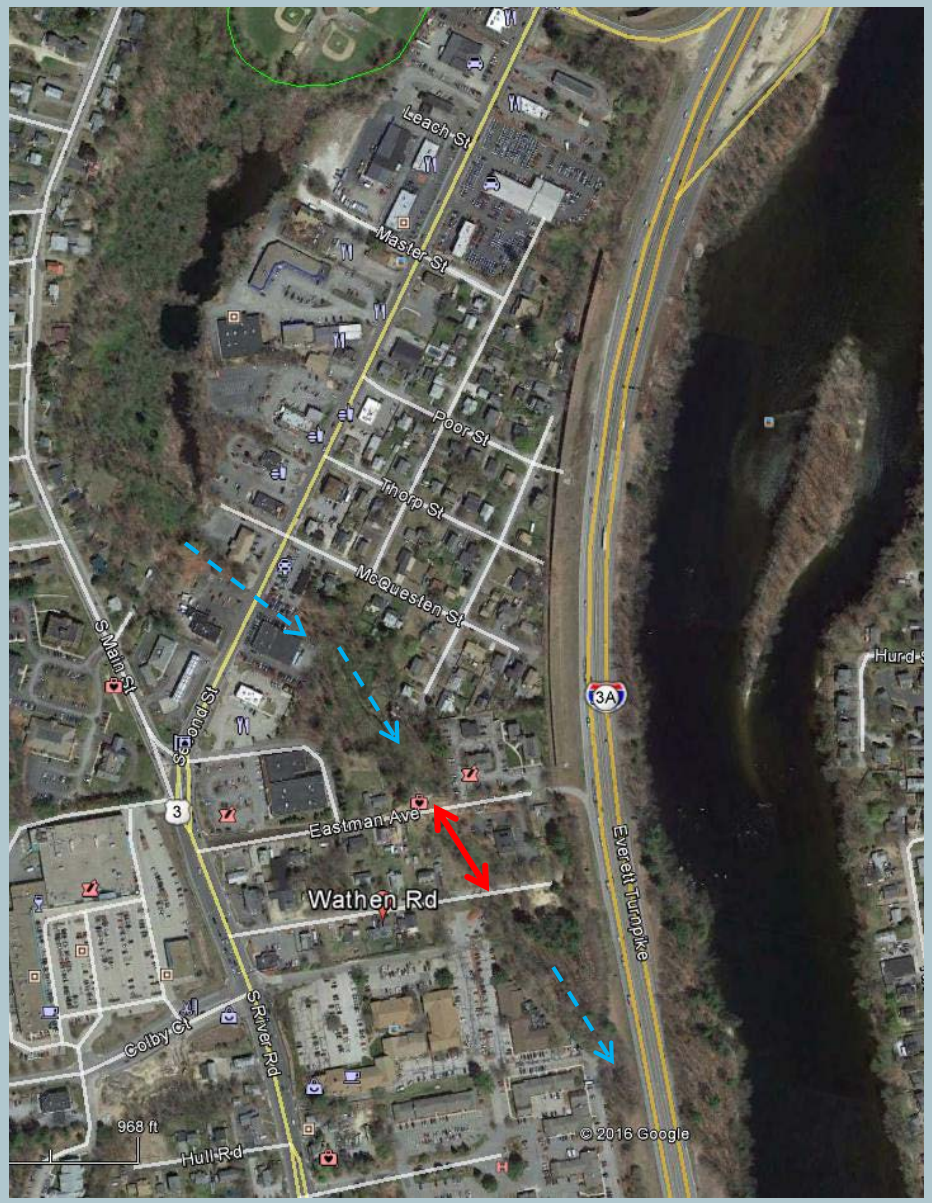
Upstream (inlet) side of culvert August 19, 2016

- Install 23-foot wide open bottom arch
- Connection to approximately ten miles of upstream, barrier free, spawning and rearing aquatic habitat.
- Access to spawning habitat on approximately 6 smaller tributaries.



DOWNSTREAM/OUTLET SIDE OF STRUCTURE AUGUST 19/23, 2016

MCQUESTEN BROOK CULVERT REPLACEMENT/REMOVAL



Funding: = $354,000

Total Project Cost:
Approx. $800,000

Project Objective:

- Increase access to 1,950 feet of brook,
- Reconnect 2.57 acres of wetland habitat
- Stormwater treatment

Project Partners:
New Hampshire Rivers Council, NHDES Watershed Assistance Program, Town of Bedford, McFarland Johnson, and John Fields.

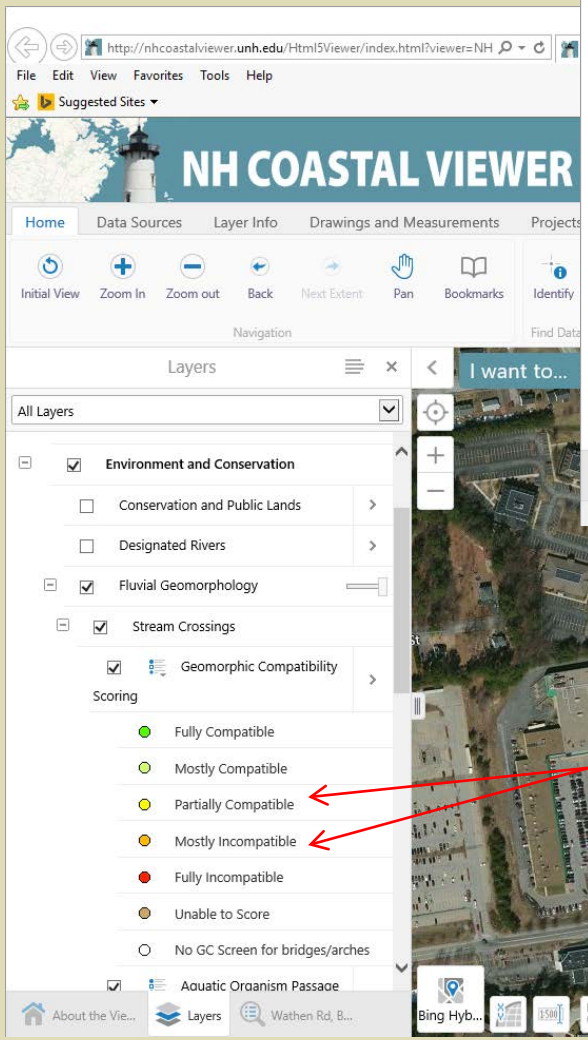
Left: Eastman Upstream 2014

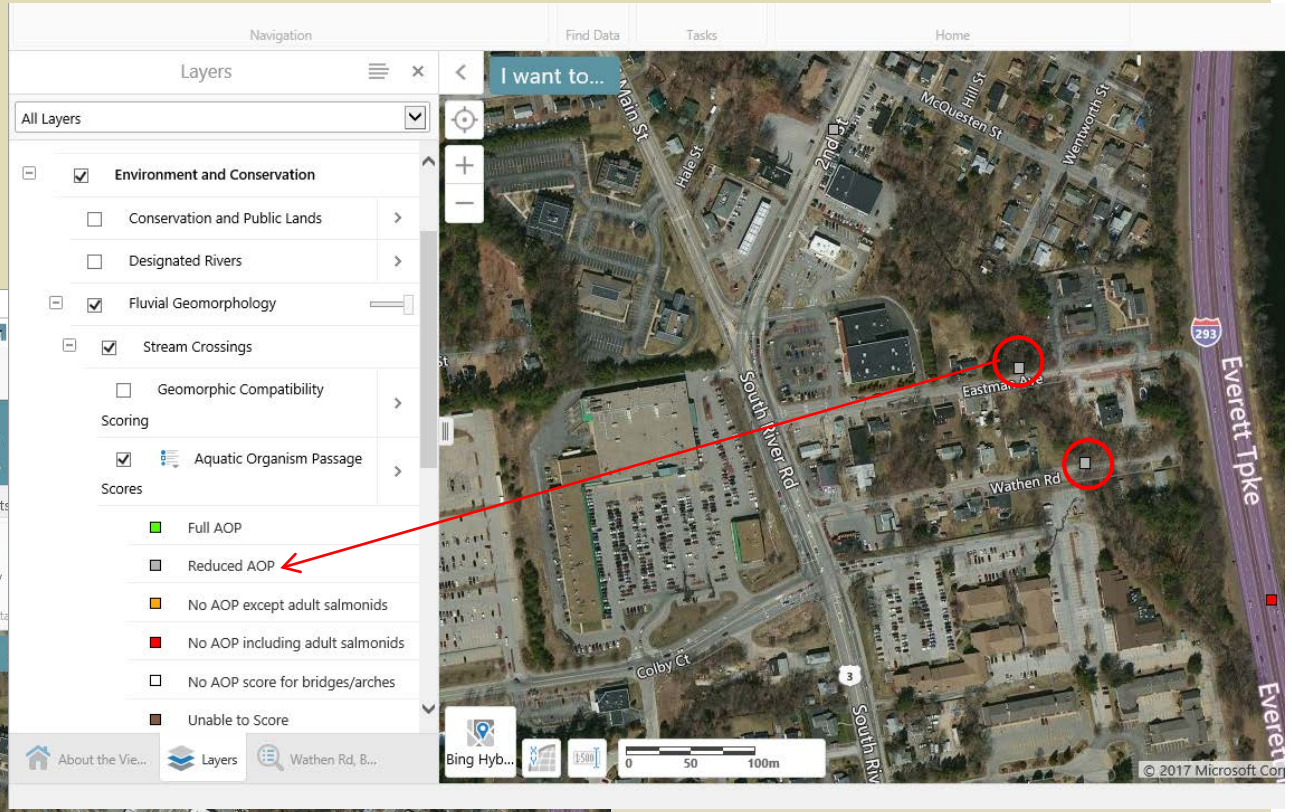
Right: Eastman Downstream 2014

Left: Wathen Upstream 2014

Right: Wathen Downstream 2014

Aquatic Organism Screen = Reduced AOP





Geomorphic Compatibility Screen:

Eastman = Mostly Incompatible
Wathen = Partially Incompatible

Completed 15’ foot span

Left: Eastman Downstream
April 29, 2016

Below Eastman Upstream
April 29, 2016

Below Left: Eastman Upstream
August 16, 2016

- Wathen “Inlet” July 2016
- Work overseen by John Fields

WATHEN AVE FLOODPLAIN RESTORATION

RESTORATION PROJECT REQUIREMENTS

- Restoration Plan
  - Plan must be submitted and approved prior to commencing work. The restoration plan can often be part of the wetland permit.
  - Coordination with wetlands permitting staff and ARM staff
- Monitoring Plan
  - Must include measurable performance objectives and metrics to establish project success.
  - Must be developed in coordination with ARM Staff and approved by the ACOE.
- Post-Construction Report
- Five Years of Monitoring and Monitoring Reports

2018 ARM FUND GRANT ROUND DEADLINES

Majority of watersheds with available funding

2 Page Pre-proposal deadline:	April 30, 2018
Final application materials deadline:	August 31, 2018
Site Selection Committee review:	Sept. – Oct., 2018
Army Corps and Wetland Council Review:	November, 2018
Awards Announced	December, 2018

QUESTIONS? / IDEAS?

Mindy Bubier
Melinda.bubier@des.nh.gov
603-271-0727

http://www.des.nh.gov/organization/divisions/water/wetlands/wmp/documents/arm-fund-web.pdf