Wetland Rules Training
Stream Crossings: Env-Wt 900

NHDES Water Division

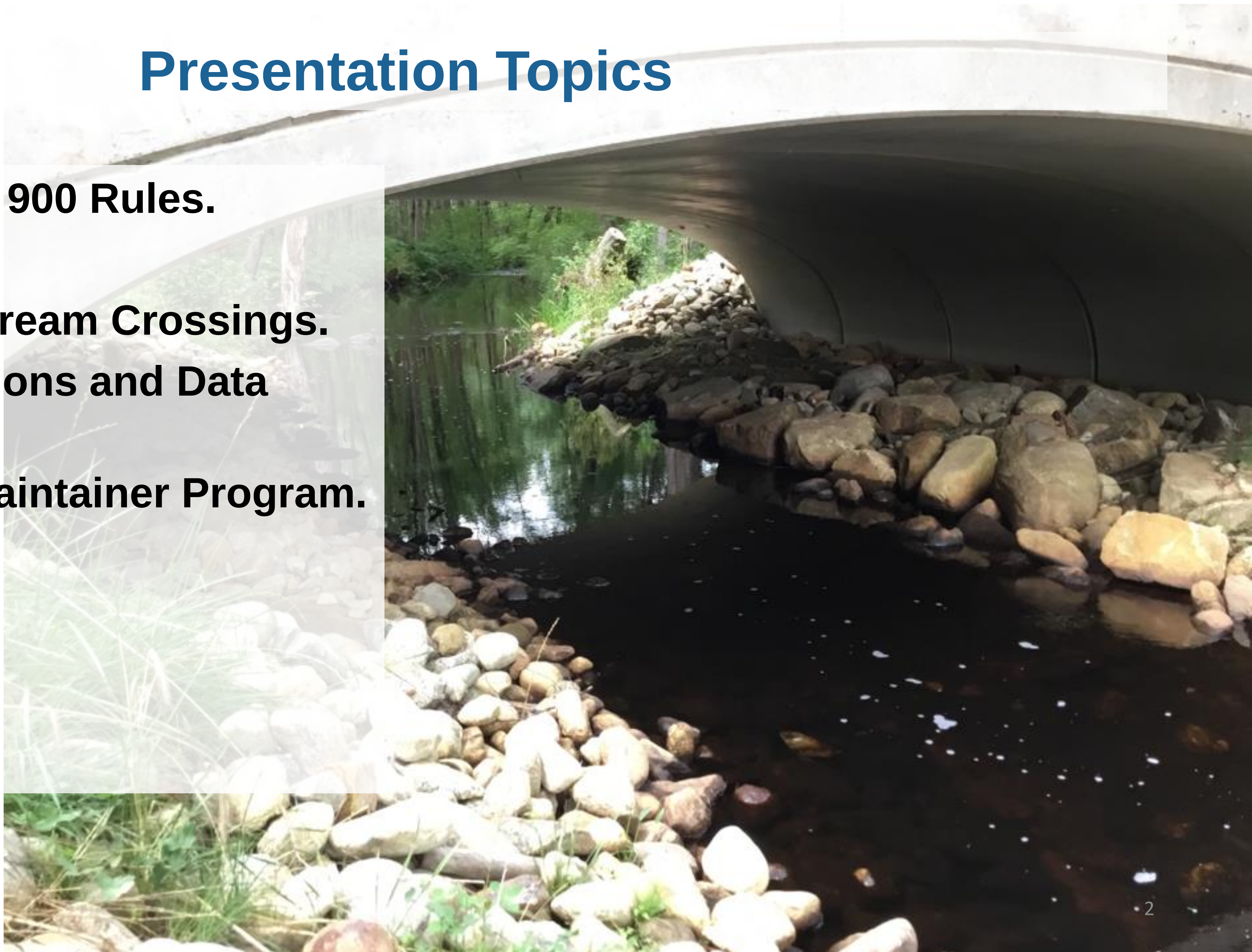
Land Resources Management

Wetlands Bureau

Karl Benedict

Presentation Topics

- **Purpose of Env-Wt 900 Rules.**
- **New Definitions.**
- **Classification of Stream Crossings.**
- **Design Considerations and Data Collection.**
- **Certified Culvert Maintainer Program.**
- **Resources.**



Purpose of Stream Crossing Rules (1)
(Env-Wt 900)

- Enhance public safety by establishing standards for stream crossing design.
  - Lessen the risk of blockages, washouts, and flooding.
- Preserve functions and values of streams.
  - Support restoration of streams to their natural state.
  - Improve aquatic life passage.
  - Improve sediment transport.
- Implement the culvert maintainer program.
  - Certify individuals to maintain, repair, replace, or modify existing culverts.

Catastrophic culvert failure
Warren Brook, Alstead 2005

Purpose of Stream Crossing Rules (2)
(Env-Wt 900)

- The goal is a structure that is ***Compatible*** with:
  - Hydraulics.
    - Structure can pass water during a specified storm event.
  - Geomorphology.
    - Structure maintains natural water and sediment transport processes of the stream.
  - Aquatic Organism Passage.
    - Structure simulates the natural channel in substrate and water depth/velocities for animal passage.

Purpose of Stream Crossing Rules (3)
(Env-Wt 900)

- The goal is a structure that is ***Compatible*** with:
  1. Hydraulics.
  2. Geomorphology.
  3. Aquatic Organism Passage.

★ Large size to pass 100-year recurrence flood with freeboard for debris.

★ Open-arch design preserves natural stream channel.

★ Spans channel width.

★ Natural streambed with substrate continuity provides good conditions for aquatic organisms.

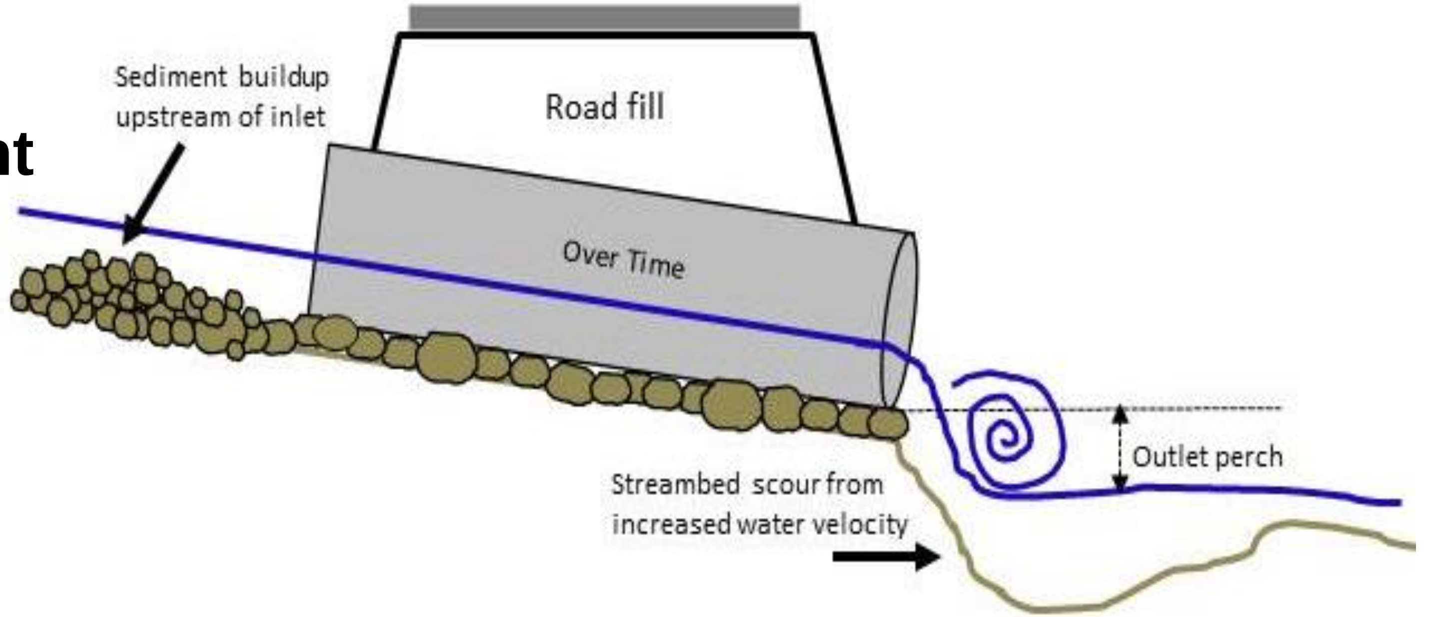
Water velocity and depth match reference stream conditions.

Deficient crossings are a flood hazard

- **Public safety hazard.**
  - Harm to people and property.
- **Damage to roads.**
  - Prohibit travel/ detours.
  - Expensive to repair.
- **Instream and riparian habitat degradation.**
  - Bank and streambed erosion.
  - Washed-out sediment and road material ends up in rivers.
- **Increased risk of failure with:**
  - Watershed development.
  - Aging infrastructure.

Deficient crossings impact how water and sediment move downstream (1)

- **Undersized culverts increase water velocity and alter sediment transport.**
- **Impacts over time:**
  - Sediment accumulation.
  - Clogged inlet.
  - Channel widens upstream.
  - Bank erosion.
  - Bed scour.
  - Perched.



Deficient crossings impact how water and sediment move downstream (2)

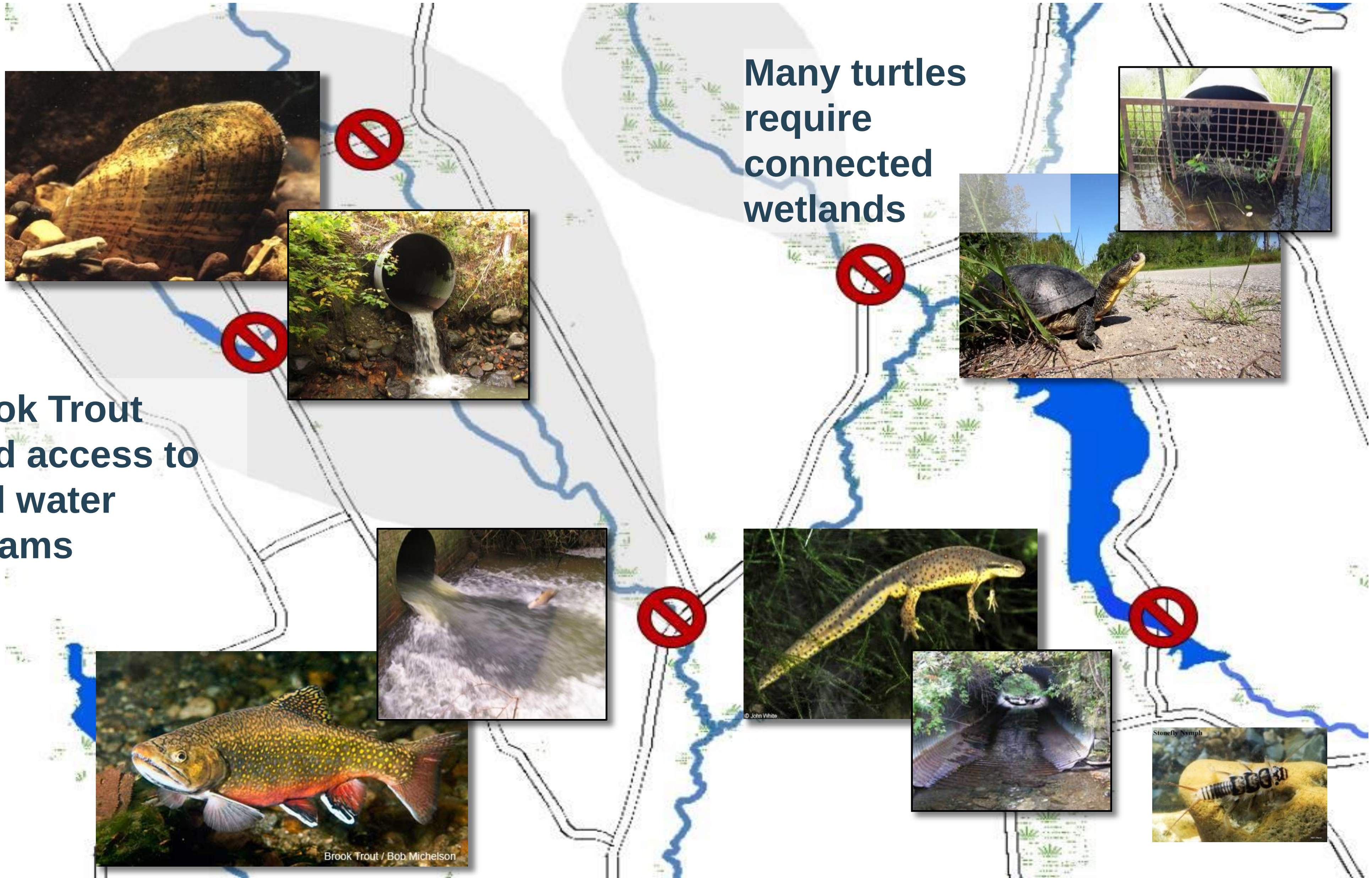
- Create a “pinch point” in the stream.
- Upstream ponding and aggradation and downstream scour.

Left: Upgraded fish-friendly culvert in Alaska. Right: Same road-stream intersection prior to being fitted with a culvert designed to better accommodate fish and water. Photos: Ken Ayers, Lounsbury & Associates, Inc.

Deficient crossings disrupt aquatic connectivity

Brook Trout need access to cold water streams

Many turtles require connected wetlands



New Definitions included in Env-Wt 900

- **902.13** “Geomorphic Compatibility”
- **902.17** “Longitudinal profile”
- **902.22** “Reference reach”
- **902.23** “Rehabilitation”
- **902.24** “Repair”
- **902.26** “Replacement”
- **902.27** “Self-mitigating”
- **902.28** “Sinuosity”
- **902.36** “Tier 3”
- **902.37** “Tier 4”

New Definition: Geomorphic Compatibility

- **Geomorphic Compatibility.**
  - **Env-Wt 902.13.**
  - The long-term ability of a stream crossing to:
    - Minimize potential for obstruction by sediment, wood and debris,
    - Preserve the natural alignment of the stream,
    - Accommodate the entrenchment ratio, bank full depth, and channel slope of the stream.

This...

***Not* this...**

New Definition: Self-mitigating

- **Self-mitigating.**
  - **Env-Wt 902.27**
  - Design of the new crossing incorporates features to <u>offset the loss</u> of the affected resource's functions and values.
  - Examples of self-mitigating features are but not limited to:
    - Eliminating a barrier to aquatic organism passage,
    - Improving the hydraulic capacity of an under-sized crossing,
    - Improving geomorphic compatibility.

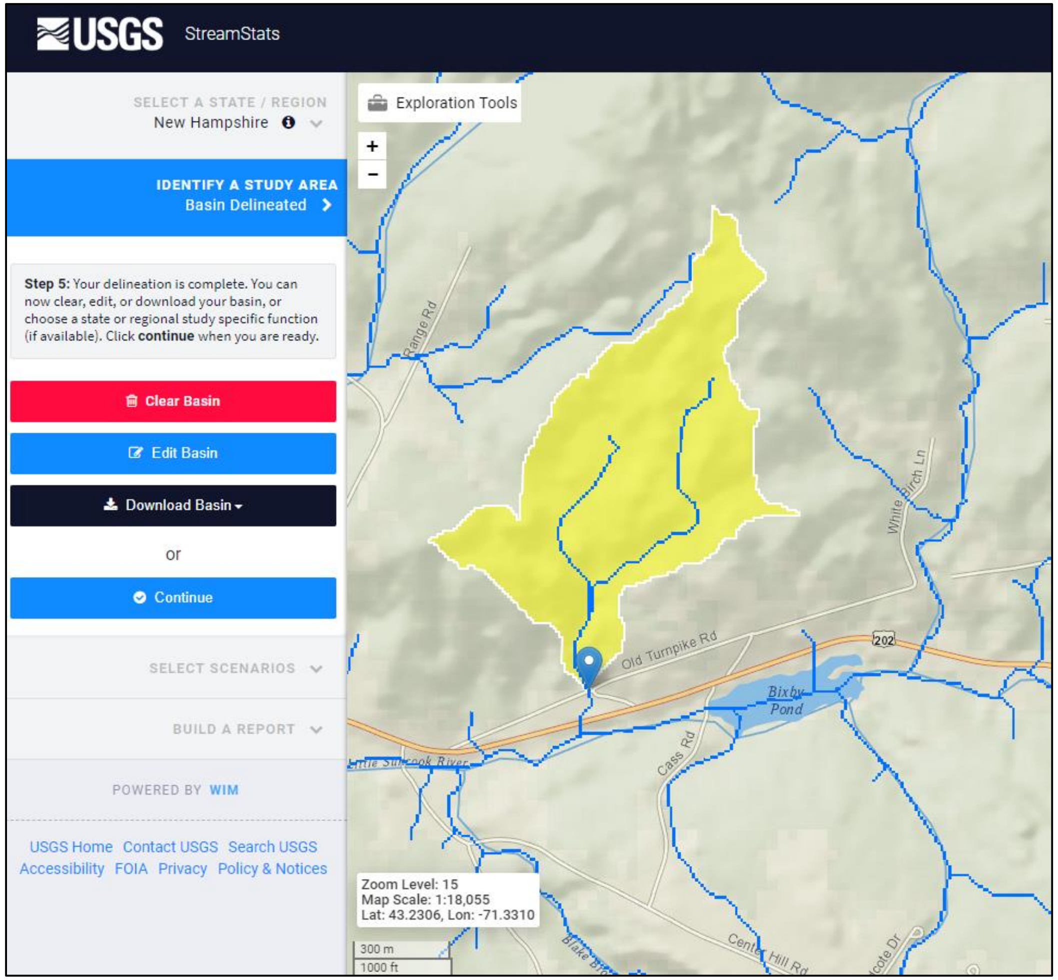
Going from this…

To this…

Classification of Stream Crossings: Tiers

- **Stream Crossing Tier Sizing**
  - Env-Wt 904.03
  - Env-Wt 904.04
  - Env-Wt 904.05
  - Env-Wt 904.06

  - Structure Type requirements are based upon contributing watershed area, and waterbody type (tidal crossings).



Tier 1	Tier 2	Tier 3	Tier 4
≤200 acres	>200 - <640 acres	Greater than 640 acres	Tidal Watercourse

Classification of Stream Crossings: Tier 1

- **What are the criteria for a <u>Tier 1</u> Crossing Type?**
  - Contributing watershed ≤200 acres.
  - Does not have any of the characteristics in Env-Wt 904.04, Env-Wt 904.05, or Env-Wt 904.06.
  - Headwater streams, Smaller tributary streams, can be Intermittent streams.

Classification of Stream Crossings: Tier 2

- **What are the criteria for a <u>Tier 2</u> Crossing Type?**
  - Contributing watershed >200 acres and <640 acres.
  - Does not have any of the characteristics in Env-Wt 904.05 or Env-Wt 904.06.

Classification of Stream Crossings: Tier 3

- **What are the criteria for a Tier 3 Crossing Type?**
  - On a watercourse where the contributing watershed is ≥640 acres.
  - Within a designated river corridor (unless exempt).
  - Within a 100-year flood plain.
  - In a jurisdictional area having any protected species or habitat.
  - In a prime wetland or within a duly-established 100-foot buffer,
    - Unless a waiver has been granted pursuant to RSA 482-A:11, IV(b) and Env-Wt 706.

Classification of Stream Crossings: Tier 4

- **What are the criteria for a <u>Tier 4</u> Crossing Type?**
  - Located on a tidal watercourse.
  - Design Criteria:
    - Span structure or a culvert specifically designed for the geomorphic and habitat conditions of the tidal environment.
    - Hydraulic analysis accounts for fluctuating tides, bidirectional flows, tidal inundation, and coastal storm surge.
    - Prevents a restriction on tidal flows.
    - Accounts for tidal channel morphology and impacts from sea level rise.

Coastal Program

NHCP

Resilient Tidal Crossings Project

Tidal Stream Crossings

A tidal stream crossing (tidal crossing) is a bridge or culvert that conveys tidal flow below a traveled way, such as a road, pedestrian path, or railroad. When properly designed and maintained, tidal crossings can balance the needs of people and the environment by providing a functional, reliable and safe transportation network that supports the continuous movement of people, goods, and services across coastal communities while allowing adequate tidal flow to maintain healthy tidal marshes.

Resilient Tidal Crossings New Hampshire

In 2018, the NHDES Coastal Program and its partners assessed all known tidal crossings in New Hampshire's 17 coastal communities in accordance with the New Hampshire Tidal Crossing Assessment Protocol. Tidal crossing assessment data were used to rank and prioritize sites based on structure condition, flood risk, and ecosystem health. The Resilient Tidal Crossings NH Project was designed to better enable community officials and road managers to enact the strategic repair/replacement of tidal crossing infrastructure and to identify high priority restoration and conservation opportunities at tidal crossing sites.

Compatibility: General Design Considerations (1)

(Env-Wt 904.01)

- **All stream crossings shall be designed and constructed so as to:**
  - Not be a barrier to sediment transport.
  - Not restrict high flows and maintain existing low flows.
  - Not obstruct or otherwise substantially disrupt the movement of aquatic organisms indigenous to the waterbody beyond the actual duration of construction.
  - Not cause an increase in the frequency of flooding or overtopping of banks.
  - Maintain or enhance geomorphic compatibility by:
    - Minimize potential for obstructions and preserving the natural alignment of the stream channel.
  - Preserve watercourse connectivity.
  - Not cause erosion, aggradation, or scouring upstream or downstream of the crossing.
  - Not cause water quality degradation.

Compatibility: General Design Considerations (2)

(Env-Wt 904.01)

- **Restore watercourse connectivity where:**
  - Connectivity previously was disrupted as a result of human activities, AND
  - Restoration of connectivity will benefit aquatic organisms upstream or downstream of the crossing.
- **Stream crossings over tidal waters.**
  - Match the velocity, depth, cross-sectional area, and substrate of the natural stream.
  - Be of sufficient size to not restrict bi-directional tidal flow over the natural tide range above below, and through the crossing.

Design Criteria for Tier 2, Tier 3, and Tier 4

(Env-Wt 904.07)

- **Tier 2 and tier 3 stream crossings shall be designed in accordance with the NH Stream Crossing Guidelines.**

(1) To meet the **general design considerations** specified in Env-Wt 904.01.

(2) Of sufficient size to accommodate the greater of:

a. The **100-year 24-hour design storm**;

b. Flows sufficient to:

1. Prevent an increase in flooding on upstream and downstream properties; and
2. Not affect flows and sediment transport characteristics in a way that could adversely affect channel stability; or

c. Applicable federal, state, or local requirements;

(3) With the bed forms and streambed characteristics necessary to cause water depths and velocities within the crossing structure at a variety of flows to be comparable to those found in the **natural channel** upstream and downstream of the stream crossing;

(4) To provide a vegetated bank on both sides of the watercourse or to provide a wildlife shelf of suitable substrate and access to allow for wildlife passage;

(5) To preserve the natural alignment and gradient of the stream channel, so as to accommodate natural flow regimes and the functioning of the natural floodplain;

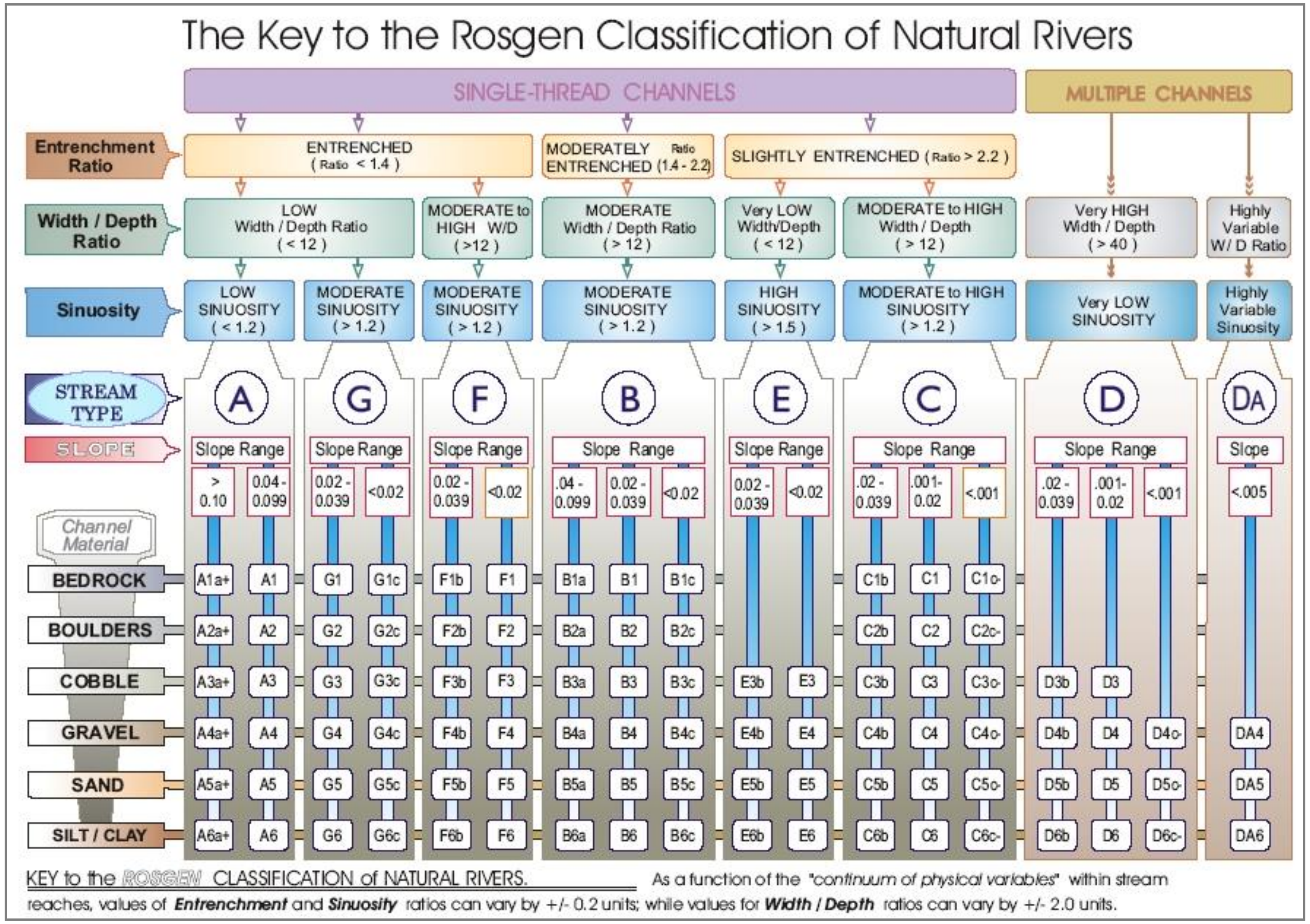
(6) To simulate a natural stream channel;

(7) So as not to alter sediment transport competence; and

(8) To avoid and minimize impacts to the stream in accordance with Env-Wt 313.03.

How do we assess compatibility?

- **Where?**
  - Review watershed scale.
  - Review conditions of representative stream reach:
    - 7-10 bankfull widths up and downstream.
- **What?**
  - Watershed characteristics.
  - Stream channel geometry.
  - Floodplain topography.
  - Longitudinal profile.
  - Substrate distributions.
- **How?**
  - Evaluate existing conditions.
  - Online tools.
  - Field survey data.



How do we assess compatibility? Hydraulics

- Factors to consider:
  - Watershed characteristics.
    - Drainage area.
    - Land use.
    - Impervious area.
  - Flood frequency interval.
  - Extreme Precipitation Tables.
    - Northeast Regional Climate Center.

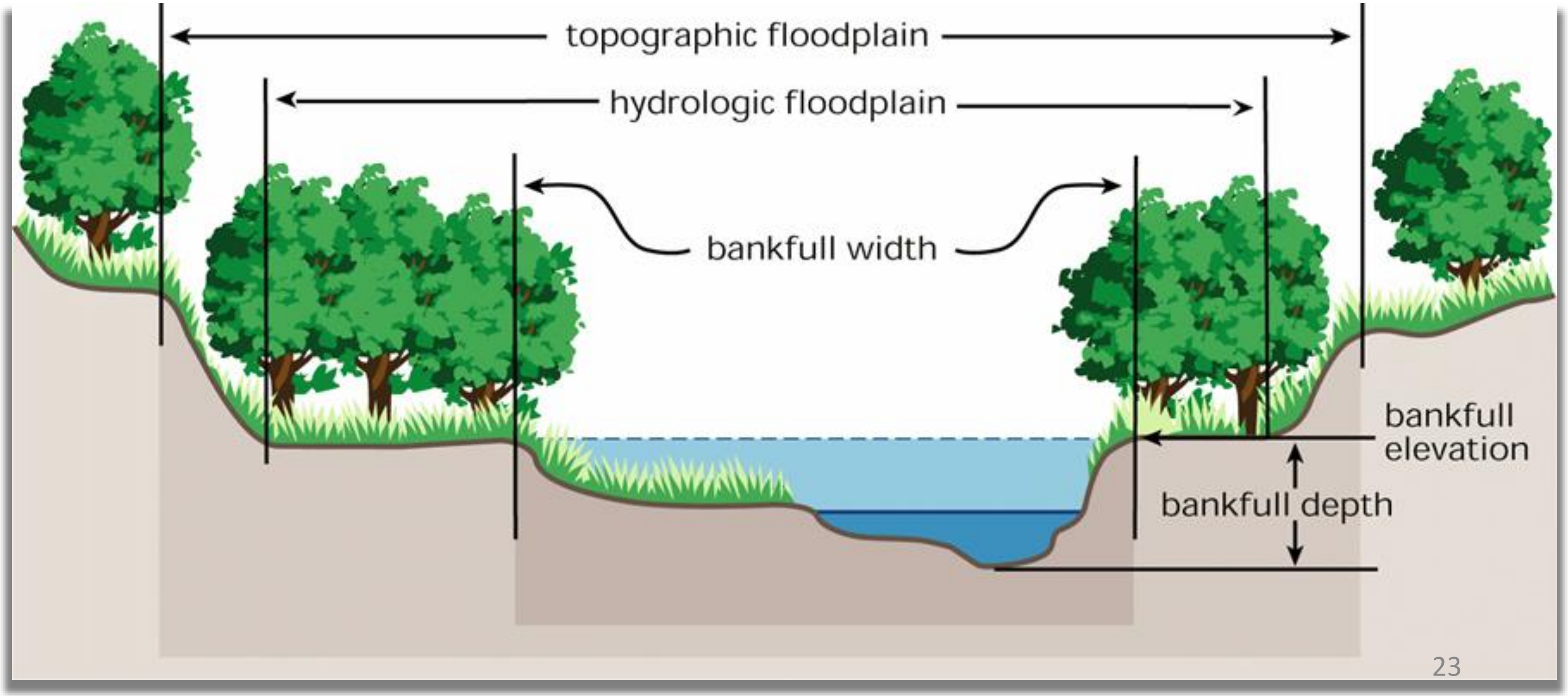
Predict quantity of flow through crossing for specified storm event.

Dictates the size of crossing required to transport flow amount.



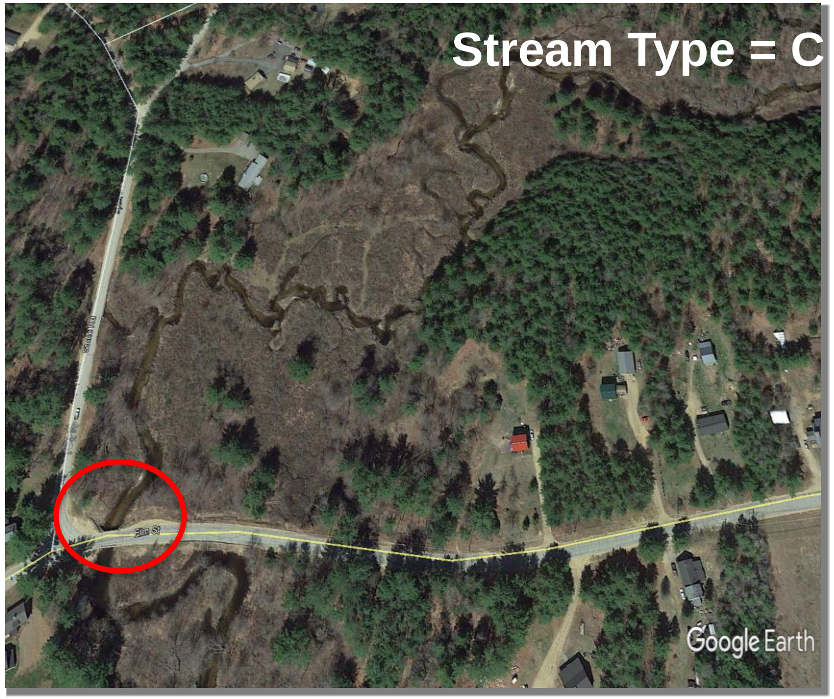
How do we assess compatibility? Geomorphology (1)

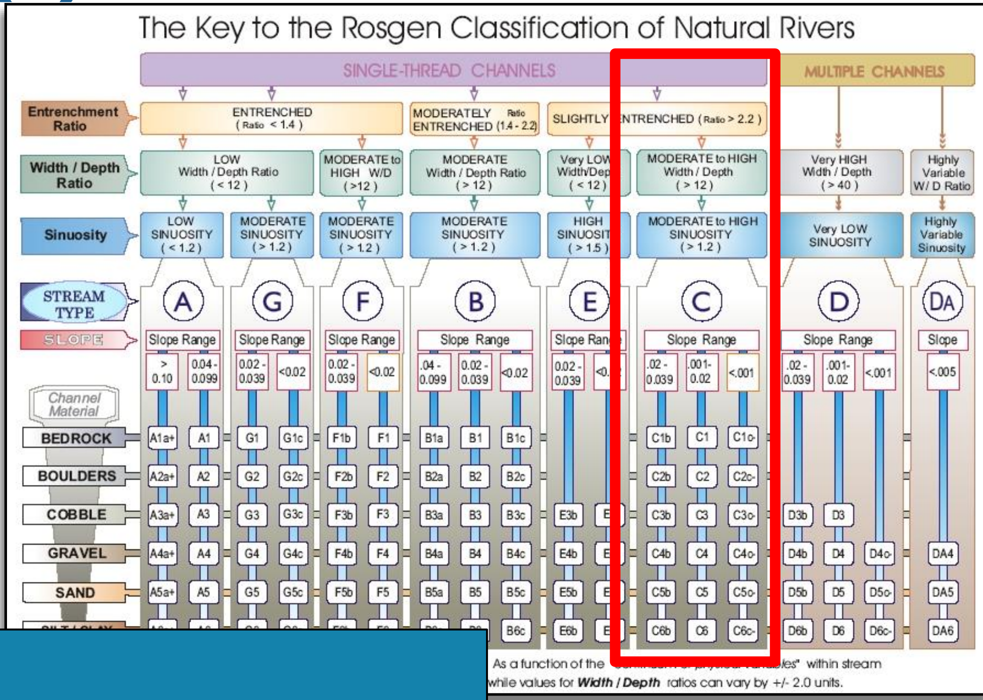
- **Bankfull Widths.**
  - Stage at which water overtops the bank onto the active flood plain.
  - Channel forming flow with frequency of 1.5-2 years.
  - Cross sections.



How do we assess compatibility? Geomorphology (2)

- Bankfull Widths.
- Rosgen Stream Type.
  - Determines entrenchment ratios.
  - Sinuosity.

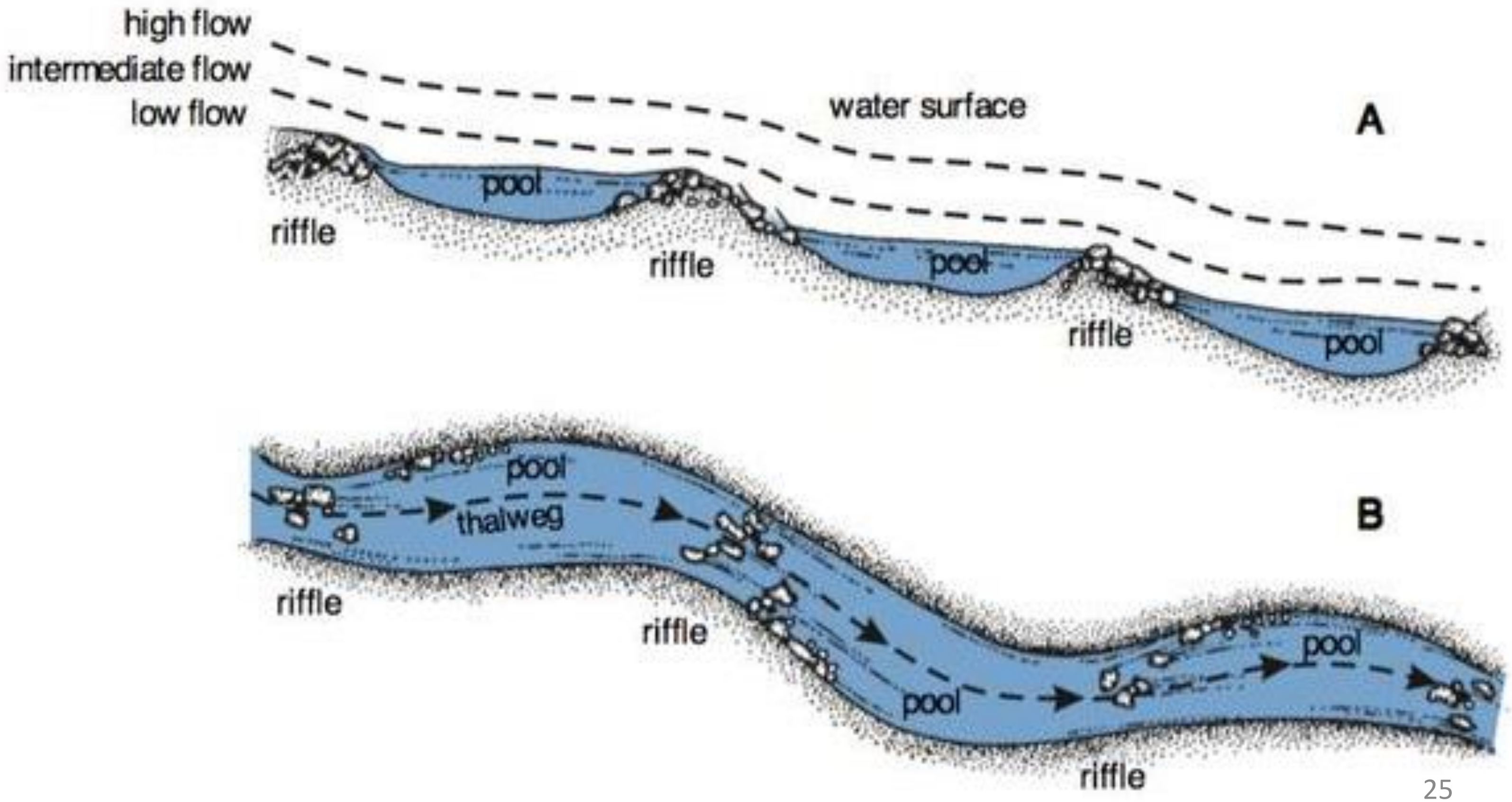




Single Thread
Entrenchment Ratio > 2.2 ± 0.2
slightly entrenched
W:D > 12 ± 2
Sinuosity > 1.2 ± 0.2
Slope = 0.008
W_{BKF} = 39’

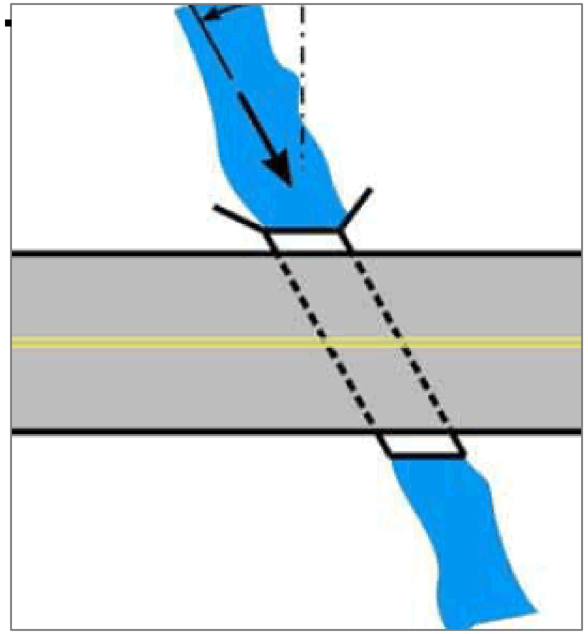
How do we assess compatibility? Geomorphology (3)

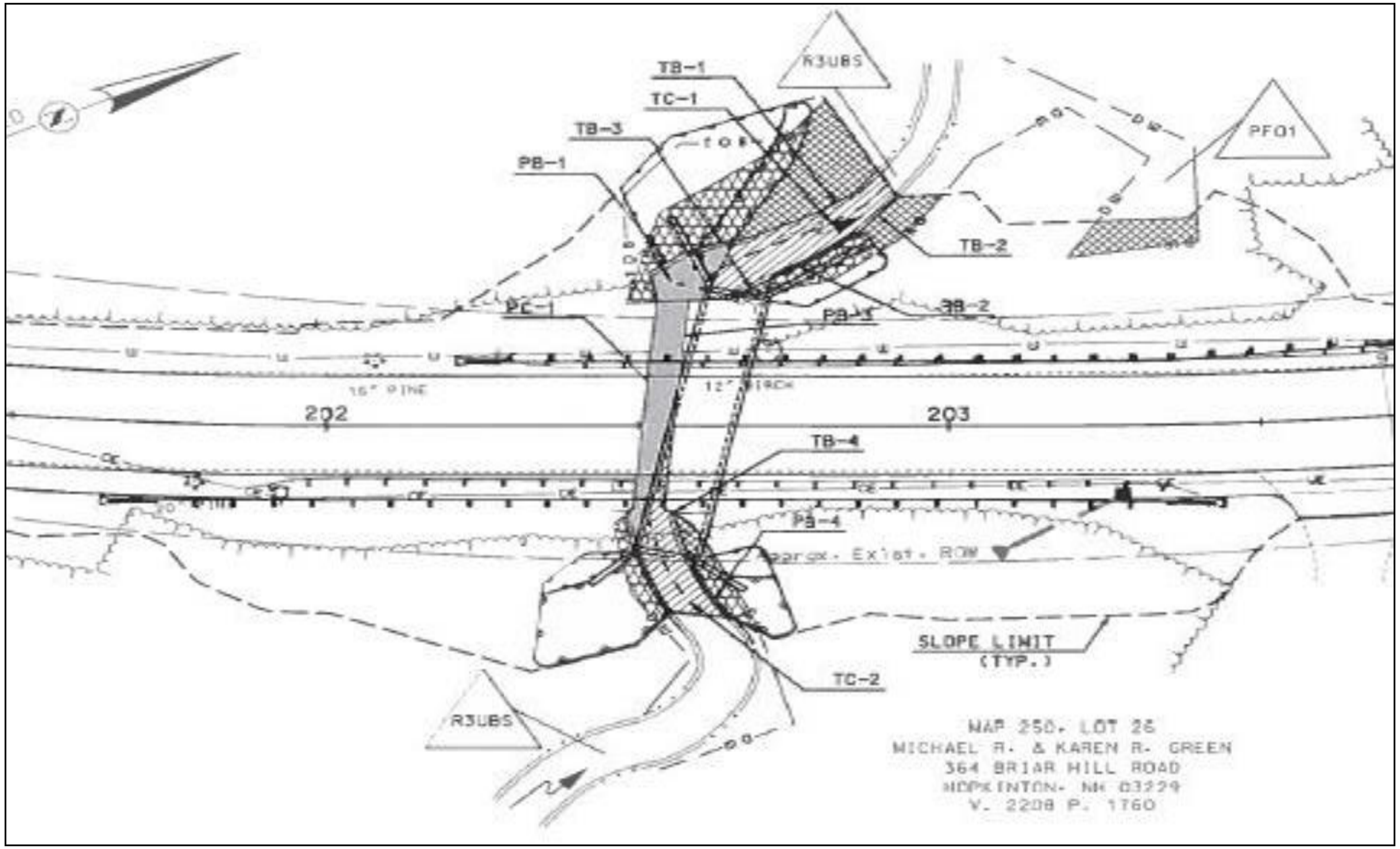
- Bankfull Widths.
- Rosgen Stream Type.
- Longitudinal Profile.
  - Aggradation.
  - Scour.
  - Jump heights.



How do we assess compatibility? Geomorphology (4)

- Bankfull Widths.
- Rosgen Stream Type.
- Longitudinal Profile.
- Alignment
  - Crossing orientation to the stream.

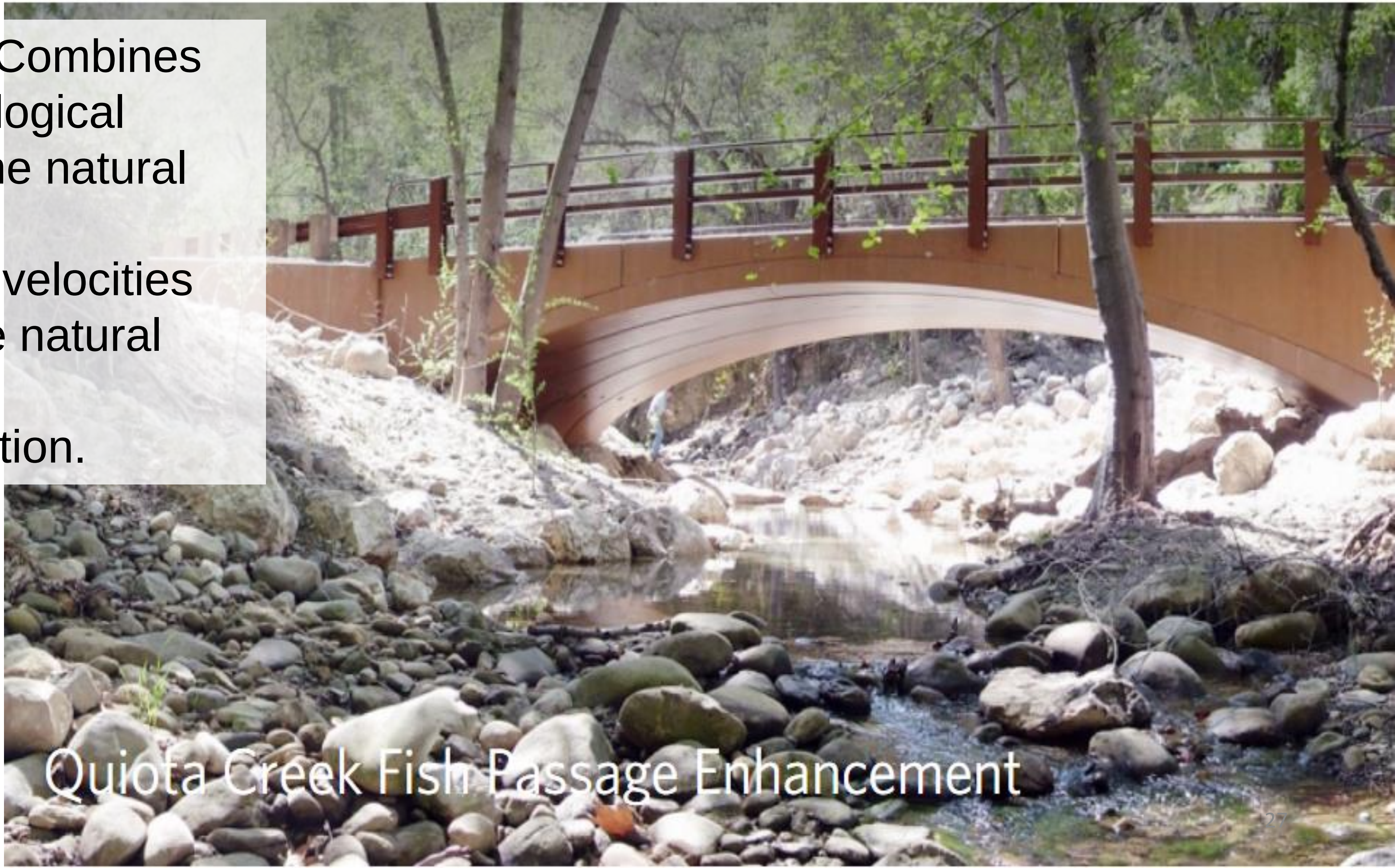




How do we assess compatibility?
Aquatic organism passage (1)

Stream Simulation Combines geomorphic and ecological principles to mimic the natural channel.

- Water depths and velocities match those of the natural stream.
- Streambed simulation.



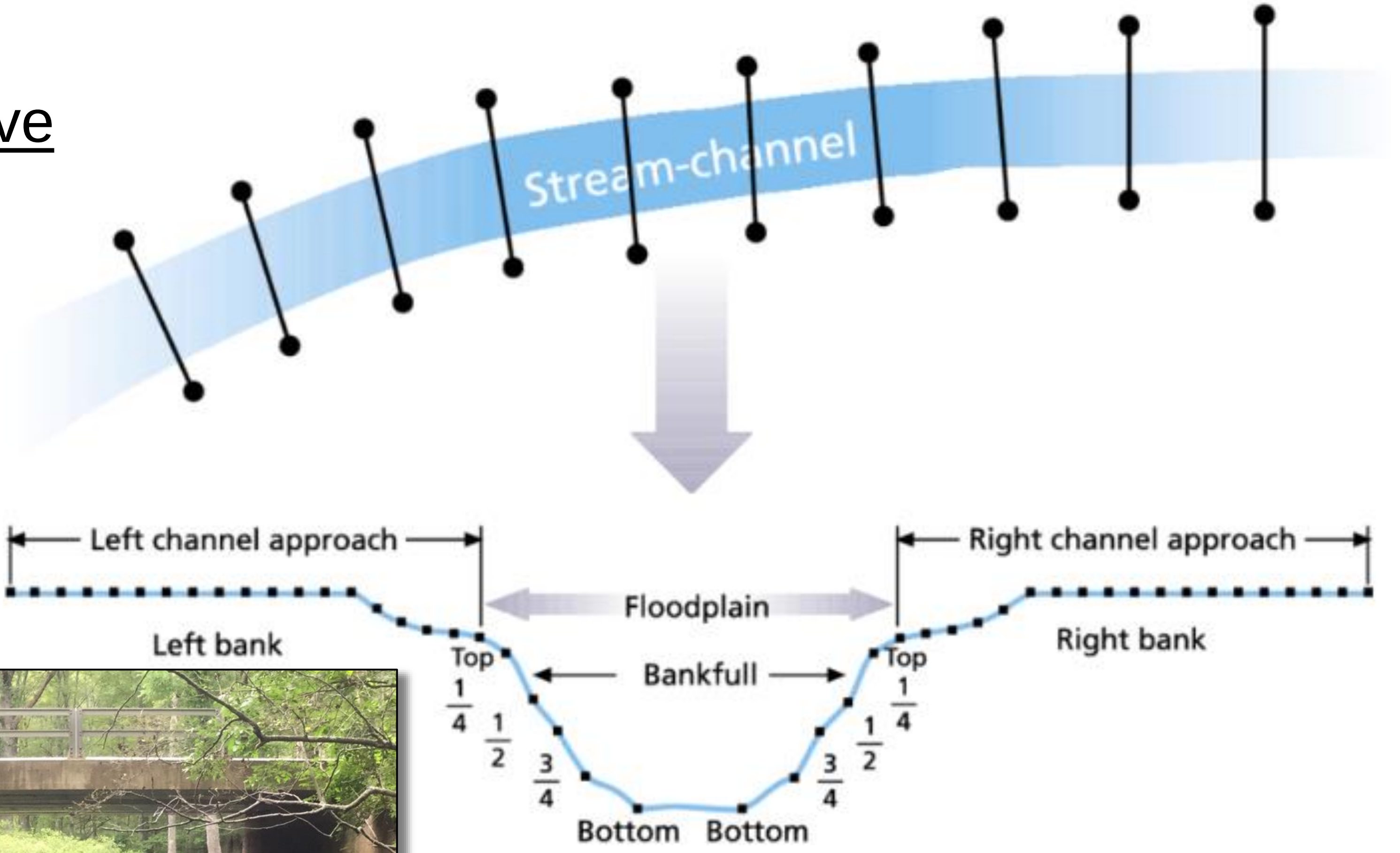
How do we assess compatibility? Aquatic organism passage (2)

- Water depths and velocities match those of the natural stream.
- Streambed simulation.
  - Natural sediment continuity throughout the crossing.
- Wildlife passage shelf.
- No significant jumps in longitudinal profile (no perch).

Data Collection: Channel Shape and Form

Channel shape and form

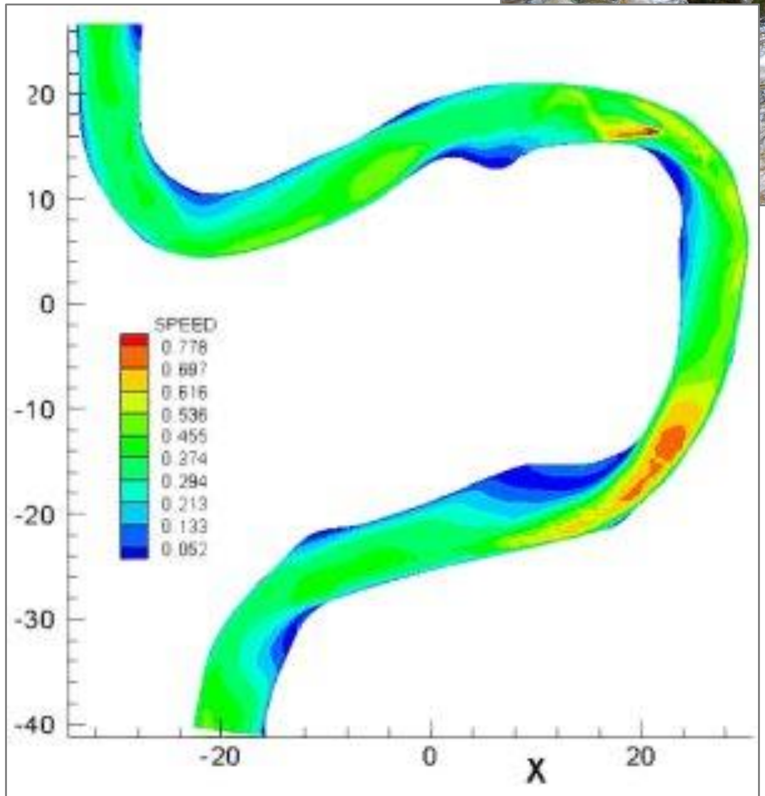
- Recommend three <u>representative cross</u> sections:
  - Bankfull width (Wbkf).
  - Bankfull depth (Dbkf).
  - Floodplain width.
  - Flood stages.
- Longitudinal profile showing:
  - Cross section stations.
  - Slope of the reach.



Data Collection: Streambed Substrate

Streambed substrate

- Predicted sediment transport capacity using hydraulic models.
  - Estimate water velocities and carrying capacity of flow through structure.
- Substrate sizes and distributions through crossing and upstream/downstream.



Data Collection: Flooding History

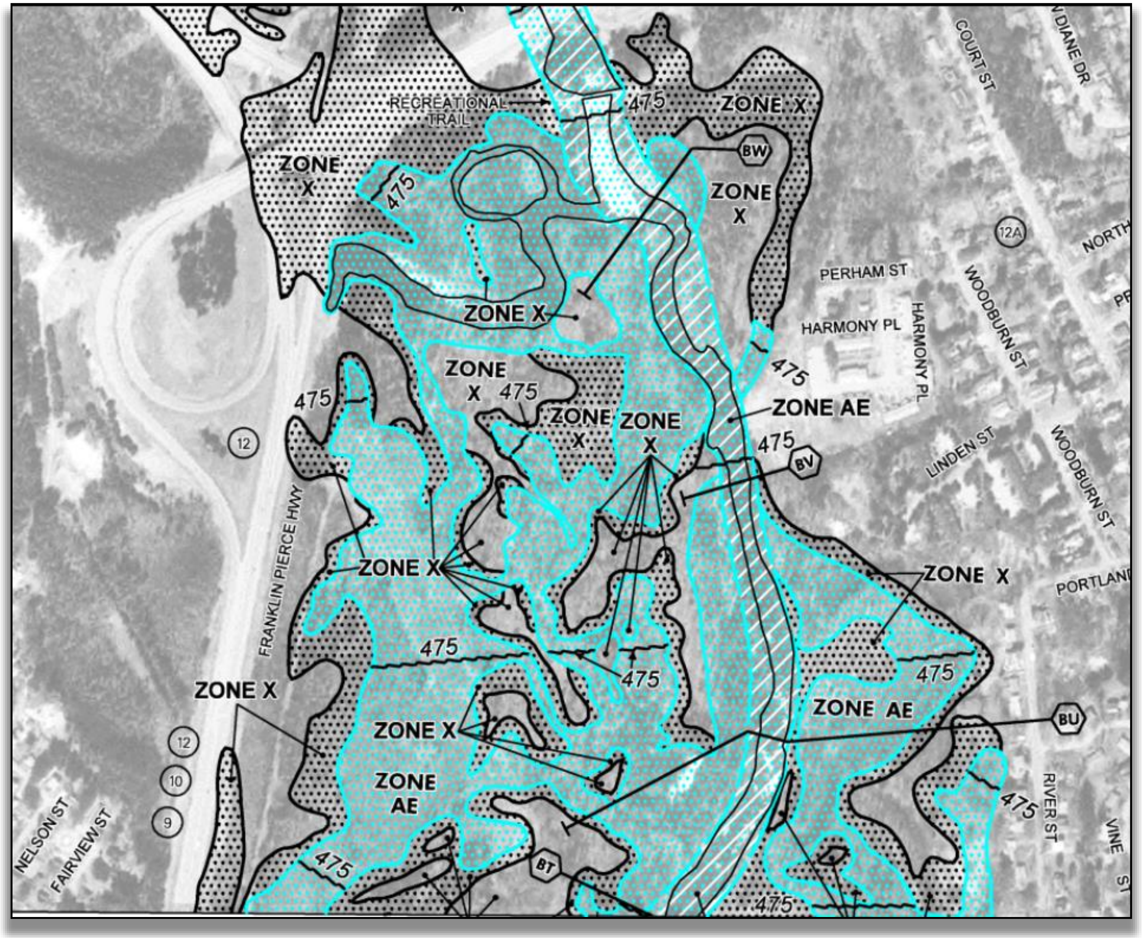
Site flooding history

- Is the location vulnerable to flooding?
- Predicted to be flood under specific storm events?

Data Collection: Mapped Flood Hazards

FEMA DFIRMs

- Identify 100-year floodplain boundaries and floodways.

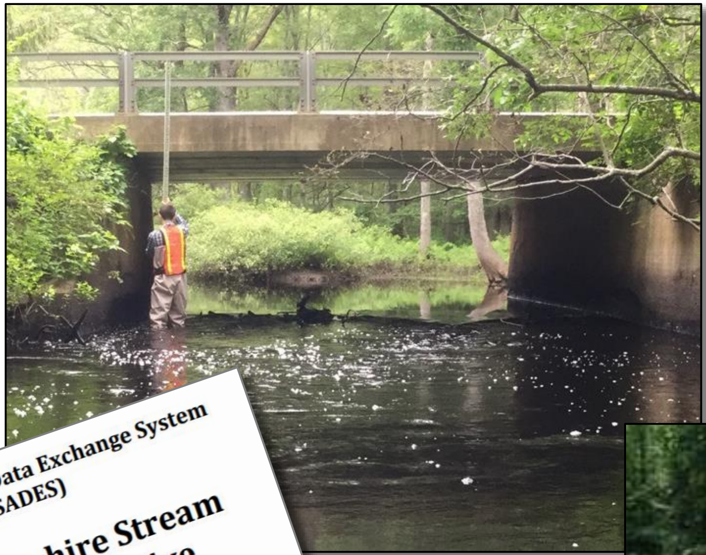


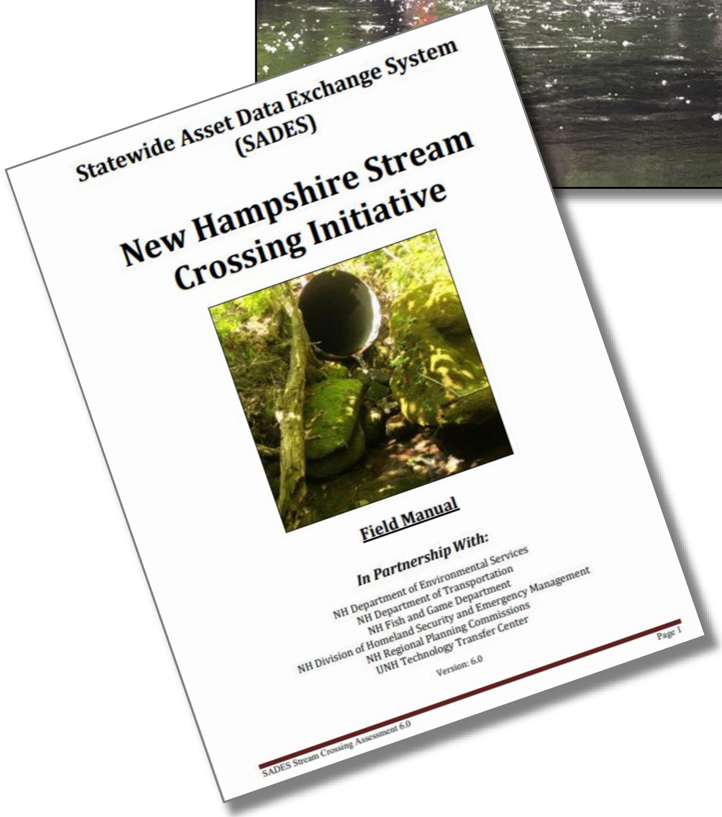
New Hampshire
Stream Crossing Initiative

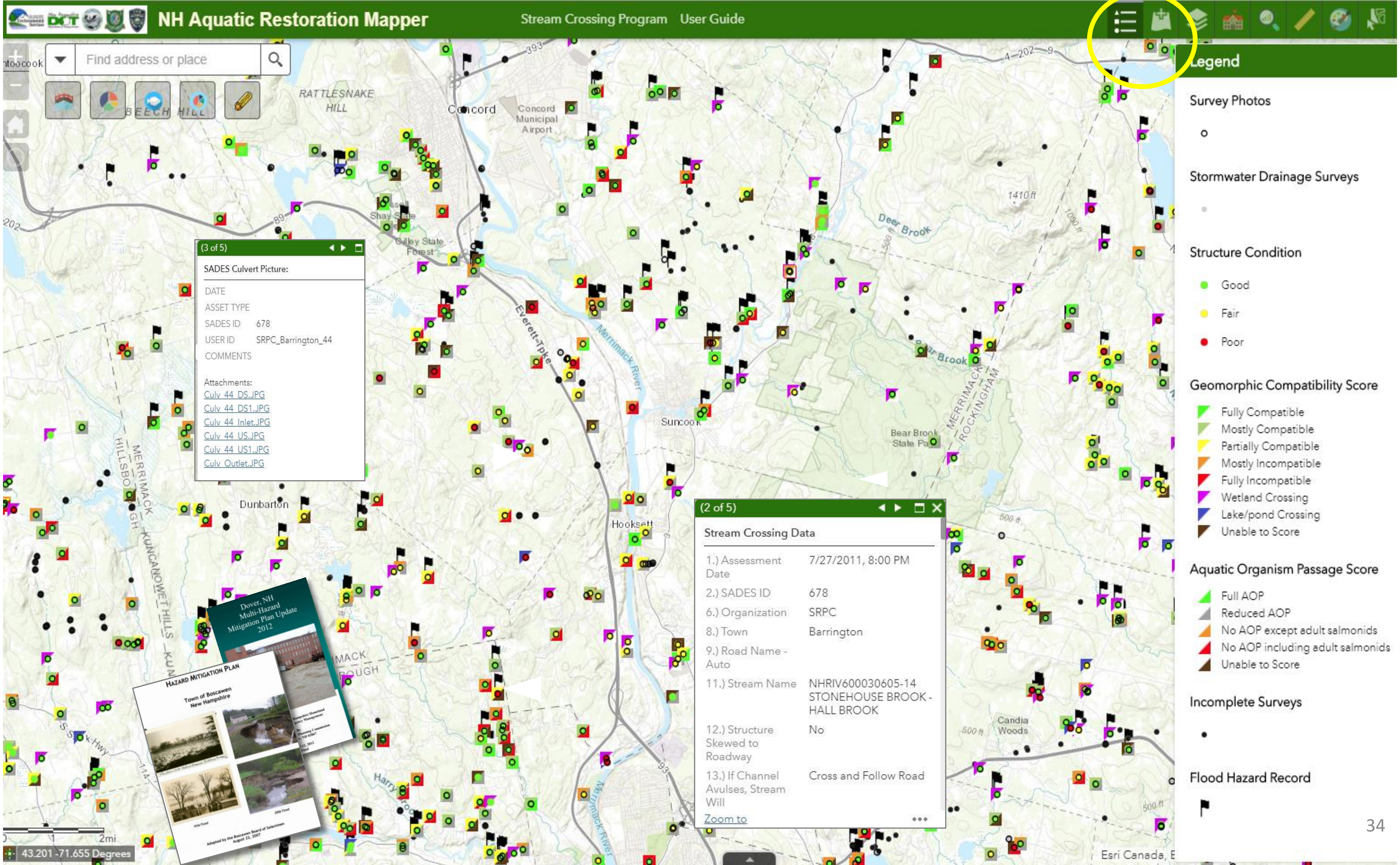
- Stream crossing surveys across the state.
- Consistent protocol.
- Data on stream channel and current structure conditions.

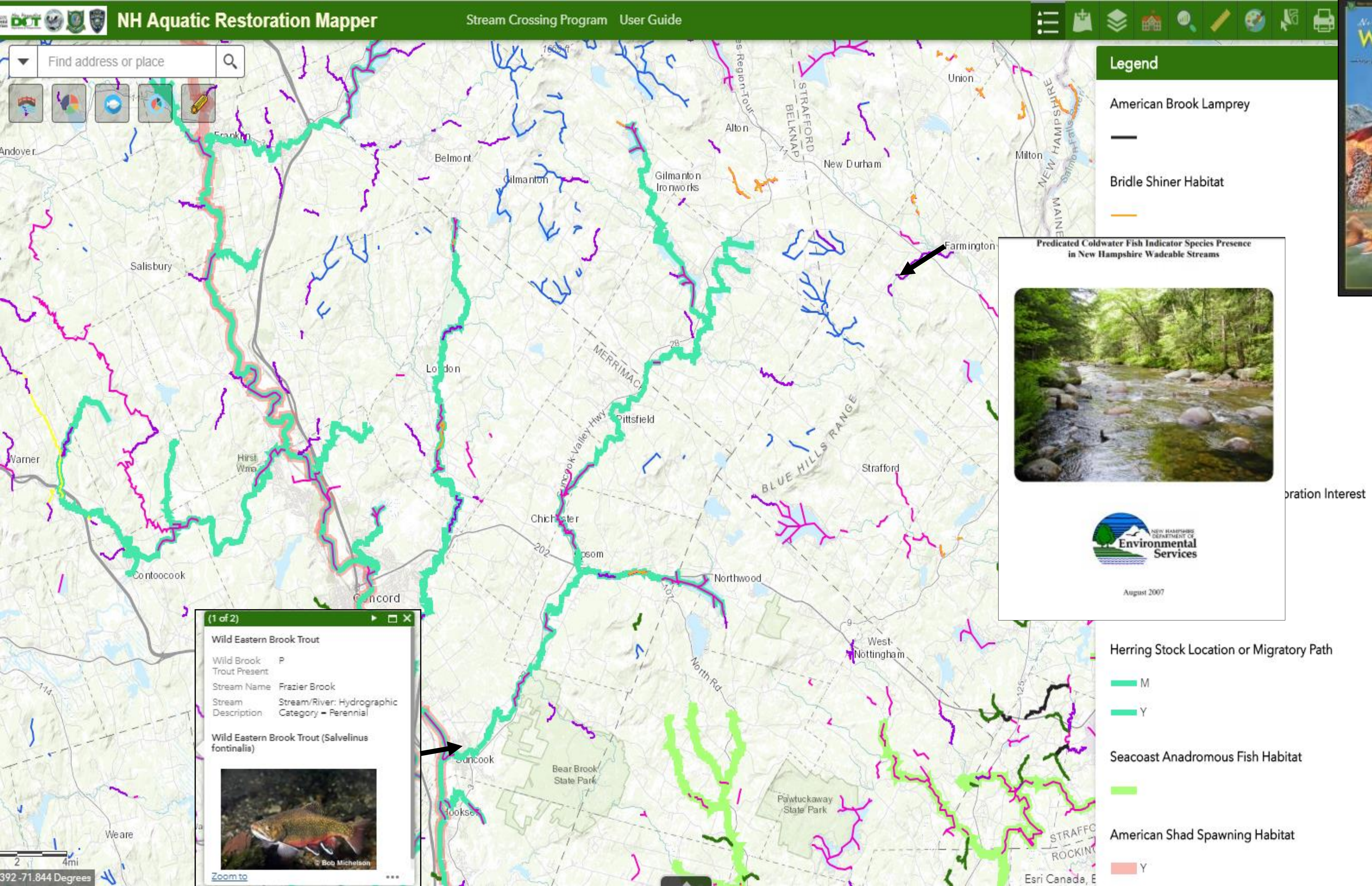
- **[Score culverts]**

✓ Geomorphic compatibility
✓ Aquatic organism passage
✓ Asset condition
✓ Flood vulnerability






NH Aquatic Restoration Mapper
Stream Crossing Program
User Guide
Find address or place
Legend
Survey Photos
Stormwater Drainage Surveys
Structure Condition
Good
Fair
Poor
Geomorphic Compatibility Score
Fully Compatible
Mostly Compatible
Partially Compatible
Mostly Incompatible
Fully Incompatible
Wetland Crossing
Lake/pond Crossing
Unable to Score
Aquatic Organism Passage Score
Full AOP
Reduced AOP
No AOP except adult salmonids
No AOP including adult salmonids
Unable to Score
Incomplete Surveys
Flood Hazard Record
(3 of 5)
SADES Culvert Picture:
DATE
ASSET TYPE
SADES ID 678
USER ID SRPC_Barrington_44
COMMENTS
Attachments:
Culv_44_DS.JPG
Culv_44_DS1.JPG
Culv_44_Inlet.JPG
Culv_44_US.JPG
Culv_44_US1.JPG
Culv_Outlet.JPG
(2 of 5)
Stream Crossing Data
1.) Assessment Date 7/27/2011, 8:00 PM
2.) SADES ID 678
6.) Organization SRPC
8.) Town Barrington
9.) Road Name - Auto
11.) Stream Name NHRIV600030605-14 STONEHOUSE BROOK - HALL BROOK
12.) Structure Skewed to Roadway No
13.) If Channel Avulses, Stream Will Cross and Follow Road
Zoom to
Concord
Concord Municipal Airport
Rattlesnake Hill
Beech Hill
Dunbarton
Hooksett
Suncook
Bear Brook State Park
Deer Brook
Merrimack River
Everett Tpke
Candia Woods
Dover, NH Multi-Hazard Mitigation Plan Update 2012
Hazard Mitigation Plan
Town of Boscawen New Hampshire
43.201 -71.655 Degrees
Esri Canada


NH Aquatic Restoration Mapper
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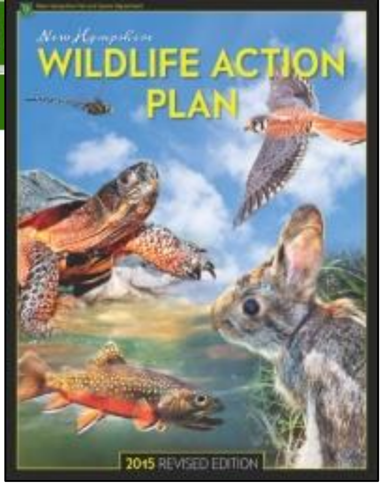
American Brook Lamprey
Bridle Shiner Habitat
ration Interest
Herring Stock Location or Migratory Path
M
Y
Seacoast Anadromous Fish Habitat
American Shad Spawning Habitat
Y
(1 of 2)
Wild Eastern Brook Trout
Wild Brook Trout Present
P
Stream Name
Frazier Brook
Stream Description
Stream/River: Hydrographic Category = Perennial
Wild Eastern Brook Trout (Salvelinus fontinalis)
Zoom to
Franklin
Andover
Belmont
Gilmanton
Gilmanton Ironworks
Alton
New Durham
Union
Milton
Farmington
Salisbury
Loudon
Pittsfield
Warner
Strafford
Chichester
Epsom
Northwood
Contoocook
Concord
West Nottingham
Suncook
Bear Brook State Park
Pawtuckaway State Park
Weare
BLUE HILLS RANGE
MERRIMACK
STRAFFORD
BELKNAP
NEW HAMPSHIRE
MAINE
Esri Canada, E
Predicated Coldwater Fish Indicator Species Presence in New Hampshire Wadeable Streams
New Hampshire Department of Environmental Services
August 2007


New Hampshire
WILDLIFE ACTION PLAN
2015 REVISED EDITION

Data Collection: Stream Crossing Worksheet (1)

NHDES-W-06-71

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

WETLANDS PERMIT APPLICATION
STREAM CROSSING WORKSHEET
Land Resources Management
Wetlands Bureau

NOTE: This worksheet can be used to accompany Wetlands Permit Applications when proposing stream crossings.

RSA 482-A/ Env-Wt-900

1. Tier Classifications

Determine the contributing watershed size at USGS StreamStats

Note: Plans for Tier 2 and 3 crossings shall be designed and stamped by a professional engineer who is licensed under RSA 310-A to practice in New Hampshire.

Size of contributing watershed at the crossing location: ___________ acres

☐ Tier 1: A *tier 1* stream crossing is a crossing located on a watercourse where the contributing watershed size is less than or equal to 200 acres

☐ Tier 2: A *tier 2* stream crossing is a crossing located on a watercourse where the contributing watershed size is greater than 200 acres and less than 640 acres

☐ Tier 3: A *tier 3* stream crossing is a crossing that meets any of the following criteria:
- ☐ On a watercourse where the contributing watershed is more than 640 acres
- ☐ Within a Designated River Corridor unless:
  - a. The crossing would be a tier 1 stream based on contributing watershed size; or
  - b. The structure does not create a direct surface water connection to the designated river as depicted on the national hydrography dataset as found on GRANIT
- ☐ On a watercourse that is listed on the surface water assessment 305(b) report
- ☐ Within a 100-year floodplain (see *section 2* below)
- ☐ In a jurisdictional area having any protected species or habitat (NHB DataCheck)
- ☐ In a Prime Wetland or within a duly-established 100-foot buffer, unless a waiver has been granted pursuant to RSA 482-A:11,IV(b) and Env-Wt 706

☐ Tier 4: A *tier 4* stream crossing is a crossing located on a tidal watercourse

2. 100-year Floodplain

Use the FEMA Map Service Center to determine if the crossing is located within a 100-year floodplain. Please answer the questions below:

☐ No: The proposed stream crossing *is not* within the FEMA 100-year floodplain.

☐ Yes: The proposed project *is* within the FEMA 100-year floodplain. Zone = ___________
- ☐ Elevation of the 100-year floodplain at the inlet: ___________ feet (FEMA El. or Modeled El.)

3. Calculating Peak Discharge

Existing 100-year peak discharge (Q) calculated in cubic feet per second (CFS): ___________ CFS	Calculation method: ___________
Estimated Bankfull discharge at the crossing location: ___________ CFS	Calculation method: ___________

Note: If Tier 1 then skip to Section 10

4. Predicted Channel Geometry based on Regional Hydraulic Curves
For Tier 2, Tier 3 and Tier 4 Crossings Only

Bankfull Width: ___________ feet | Mean Bankfull Depth: ___________ feet

Bankfull Cross Sectional Area: ___________ square feet

5. Cross Sectional Channel Geometry: Measurements of the Existing Stream within a Reference Reach
For Tier 2, Tier 3 and Tier 4 Crossings Only

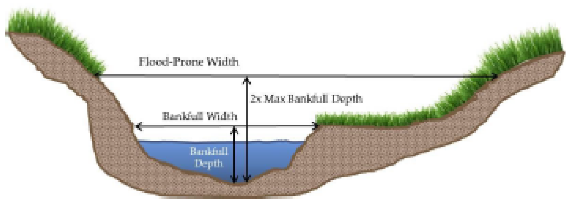
Describe the reference reach location: ___________

Reference reach watershed size: ___________ acres

Parameter	Cross Section 1 Describe bed form (e.g. pool, riffle, glide)	Cross Section 2 Describe bed form (e.g. pool, riffle, glide)	Cross Section 3 Describe bed form (e.g. pool, riffle, glide)	Range
Bankfull Width	______ feet	______ feet	______ feet	______ feet
Bankfull Cross Sectional Area	______ SF	______ SF	______ SF	______ SF
Mean Bankfull Depth	______ feet	______ feet	______ feet	______ feet
Width to Depth Ratio	______	______	______	______
Max Bankfull Depth	______ feet	______ feet	______ feet	______ feet
Flood Prone Width	______ feet	______ feet	______ feet	______ feet
Entrenchment Ratio	______	______	______	______

Use Figure 1 below to determine the measurements of the Reference Reach Attributes

Figure 1: Determining the Reference Reach Attributes



6. Longitudinal Parameters of the Reference Reach and Crossing Location
For Tier 2, Tier 3 and Tier 4 Crossings Only

Average Channel Slope of the Reference Reach: ___________
Average Channel Slope at the Crossing Location: ___________

7. Plan View Geometry
For Tier 2, Tier 3 and Tier 4 Crossings Only

Sinuosity of the Reference Reach: ___________
Sinuosity of the Crossing Location: ___________

Note: Sinuosity is measured a distance of at least 20 times bankfull width, or 2 meander belt widths

Data Collection: Stream Crossing Worksheet (2)

8. Substrate Classification based on Field Observations *For Tier 2 and Tier 3 Crossings Only*	
% of reach that is *bedrock*	______ %
% of reach that is *boulder*	______ %
% of reach that is *cobble*	______ %
% of reach that is *gravel*	______ %
% of reach that is *sand*	______ %
% of reach that is *silt*	______ %

9. Stream Type of Reference Reach *For Tier 2 and Tier 3 Crossings Only*	
Stream Type of Reference Reach:	______

*Refer to Rosgen Classification Chart (**Figure 2**) below*

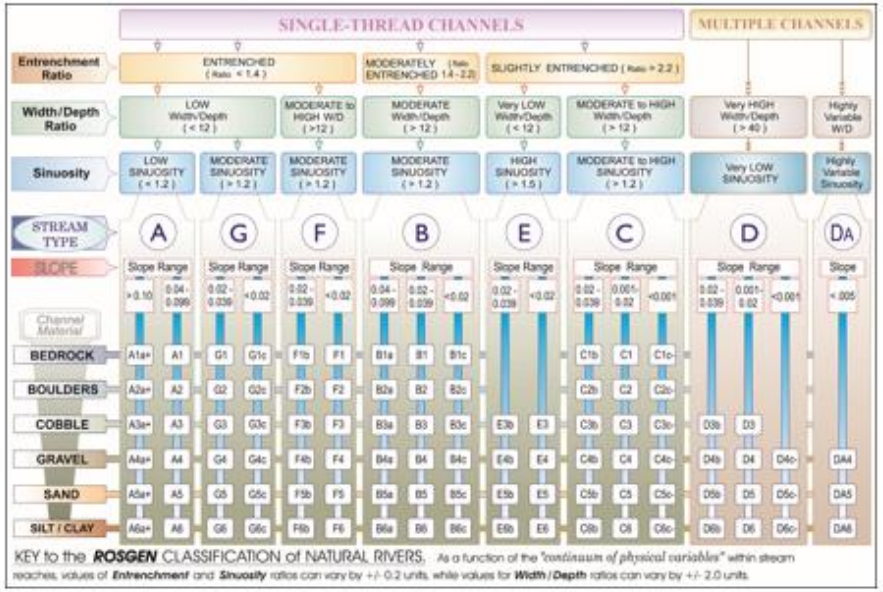


Figure 2. Reference from Applied River Morphology, Rosgen, 1996

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	10. Crossing Structure Metrics				
Existing Conditions	**Existing Structure Type:**	☐ Bridge Span ☐ Pipe Arch ☐ Open-bottom Culvert ☐ Closed-bottom Culvert ☐ Closed-bottom Culvert with stream simulation ☐ Other: ______			
	Existing Crossing Span *(perpendicular to flow)*	______ feet	**Culvert Diameter** ______ feet **Inlet Elevation** ______		
	Existing Crossing Length *(parallel to flow)*	______ feet	**Outlet Elevation** ______ **Culvert Slope** ______		
Proposed Conditions	**Proposed Structure Type:**	**Tier 1**	**Tier 2**	**Tier 3**	**Alternative Design**
	Bridge Span	☐	☐	☐	☐
	Pipe Arch	☐	☐		☐
	Closed-bottom Culvert	☐	☐		☐
	Open-bottom Culvert	☐	☐	☐	☐
	Closed-bottom Culvert with stream simulation	☐	☐	☐	☐
	Proposed structure Span *(perpendicular to flow)*	______ feet	**Culvert Diameter** ______ feet **Inlet Elevation** ______		
	Proposed Structure Length *(parallel to flow)*	______ feet	**Outlet Elevation** ______ **Culvert Slope** ______		
	Proposed Entrenchment Ratio* *For Tier 2 and Tier 3 Crossings Only*	______	*Note: To accommodate the entrenchment ratio, floodplain drainage structures may be utilized*		

* *Note: Proposed Entrenchment Ratio must meet the minimum ratio for each stream type listed in **Figure 3**, otherwise the applicant must address the Alternative Design criteria listed in Env-Wt 904.09*

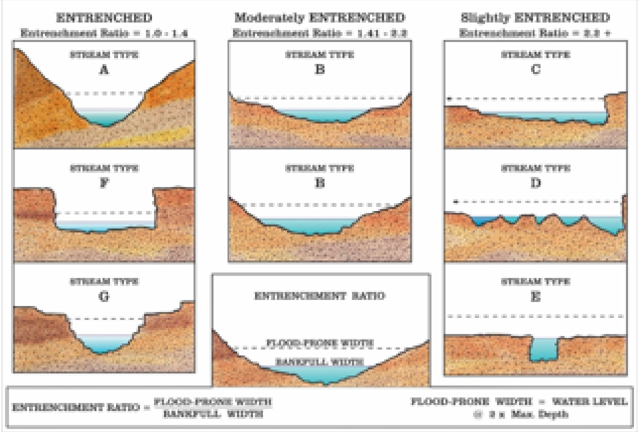

Figure 3. Reference from Applied River Morphology, Rosgen, 1996

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Data Collection: Stream Crossing Worksheet (3)

11. Crossing Structure Hydraulics		
	Existing	**Proposed**
100 year flood stage elevation at inlet		
Flow velocity at outlet in feet per second (FPS)		
Calculated 100 year peak discharge (Q) for the proposed structure in CFS		
Calculated 50 year peak discharge (Q) for the proposed structure in CFS		

12. Crossing Structure Openness Ratio
For Tier 2 and Tier 3 Crossings Only

Crossing Structure Openness Ratio =

Openness box culvert = (height x width)/length

Openness round culvert = (3.14 x radius²)/length

13. General Design Considerations

Env-Wt 904.01 requires all stream crossings to be designed and constructed according to the following requirements. Check each box if the project meets these general design considerations.

All stream crossings shall be designed and constructed so as to:

- ☐ Not be a barrier to sediment transport.
- ☐ Prevent the restriction of high flows and maintain existing low flows.
- ☐ Not obstruct or otherwise substantially disrupt the movement of aquatic life indigenous to the waterbody beyond the actual duration of construction.
- ☐ Not cause an increase in the frequency of flooding or overtopping of banks.
- ☐ Preserve watercourse connectivity where it currently exists.
- ☐ Restore watercourse connectivity where:
  (1) Connectivity previously was disrupted as a result of human activity(ies); and
  (2) Restoration of connectivity will benefit aquatic life upstream or downstream of the crossing, or both.
- ☐ Not cause erosion, aggradation, or scouring upstream or downstream of the crossing.
- ☐ Not cause water quality degradation.

14. Tier Specific Design Criteria

Stream crossings must be designed in accordance with the Tier specific design criteria listed in Part Env-Wt 904.

☐ The proposed project meets the Tier specific design criteria listed in Part Env-Wt 904 and each requirement has been addressed in the plans and as part of the wetland application.

15. Alternative Design

NOTE: If the proposed crossing does not meet all of the general design considerations, the Tier specific design criteria, or the minimum entrenchment ratio for each given stream type listed in **Figure 3**, then an alternative design plan and associated requirements must be addressed pursuant to Env-Wt 904.09.

☐ I have submitted an alternative design and addressed each requirement listed in Env-Wt 904.09

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Repair, Rehabilitation, or Replacement
(Env-Wt 904.08 & 904.09)

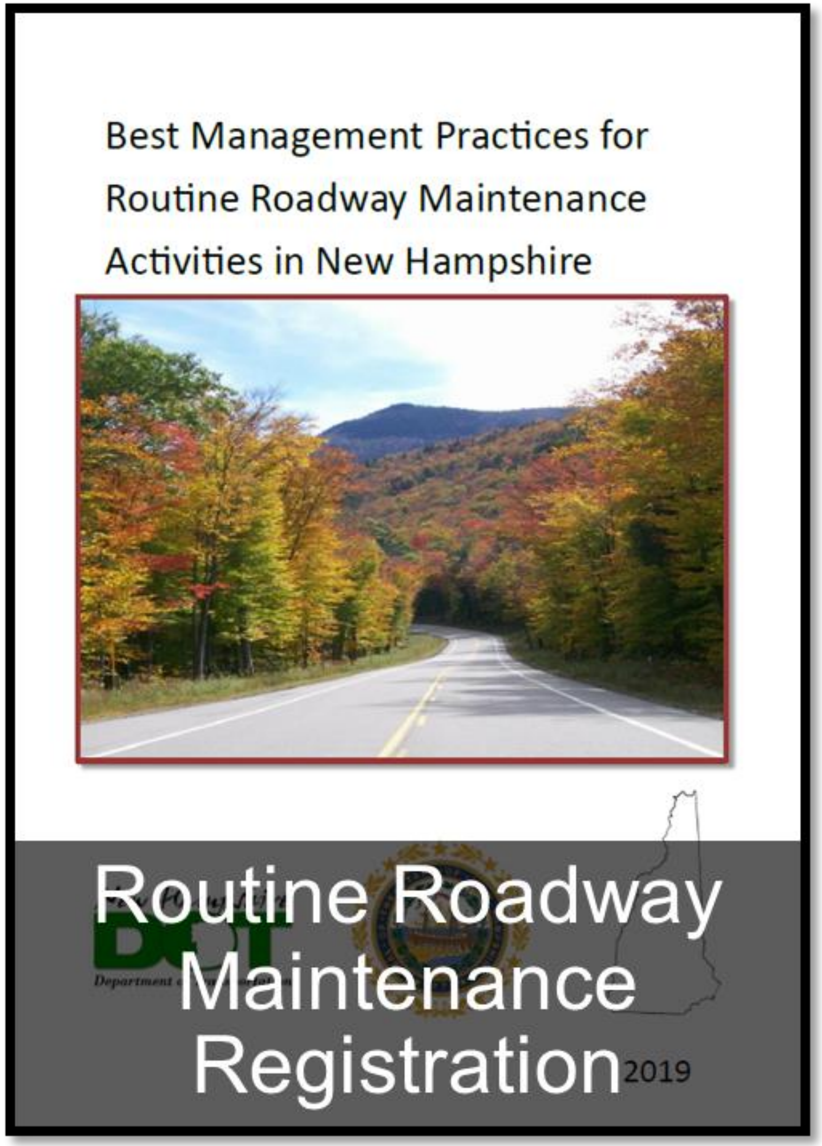
Repair, Rehabilitation, or Replacement of existing legal stream crossings

Professional engineer certifies:

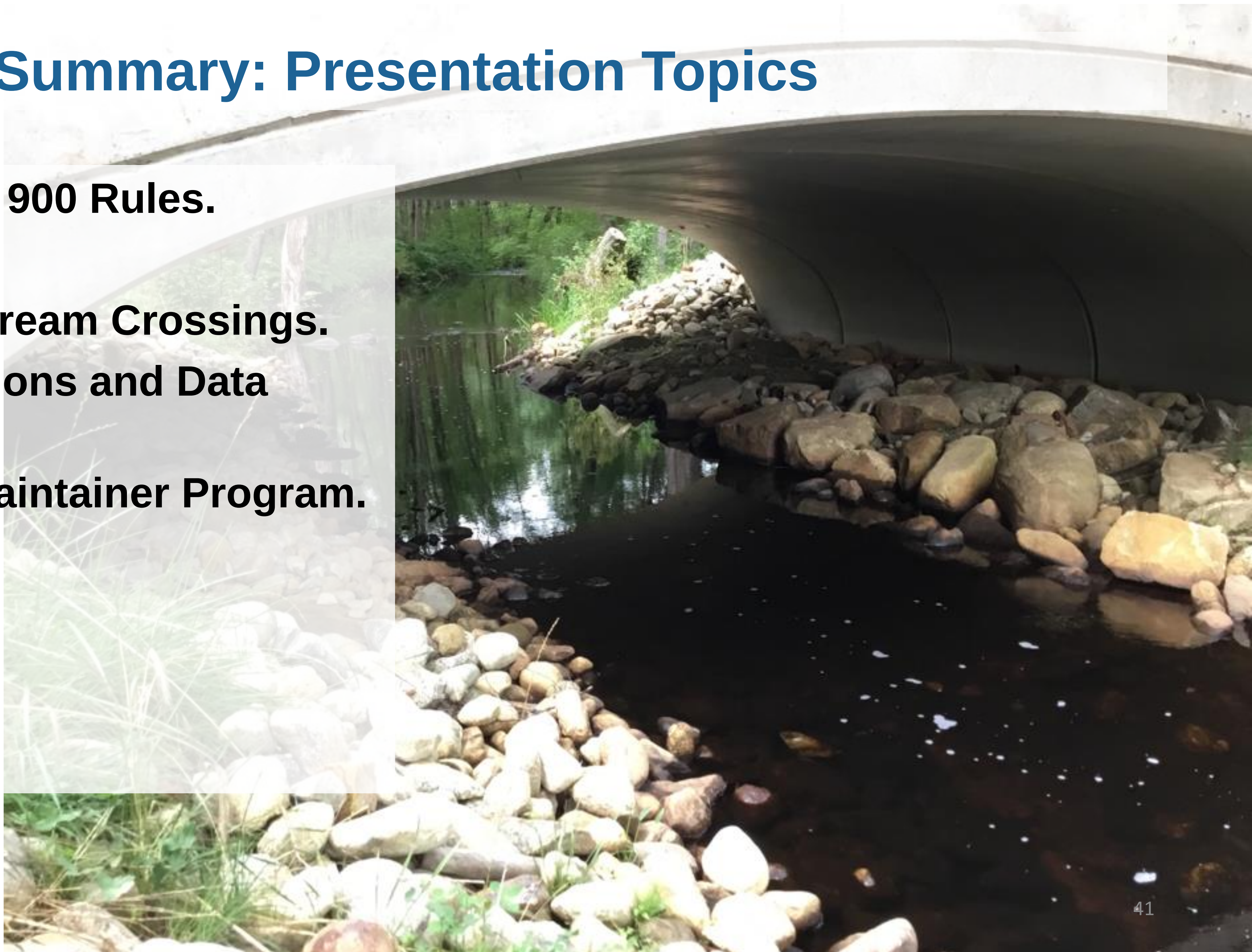
- No history of flooding that damages the crossing, other infrastructure, or protected species habitat.
- Proposed crossing meets or exceed general criteria and maintains or enhances:
  - Hydraulic capacity.
  - Aquatic organism.
  - Connectivity between upstream and downstream reaches.
- Not cause an increase in flooding or overtopping the banks upstream or downstream.

NHDOT BMP for Routine Roadway Maintenance
(2019)

- Culvert Maintenance or Repair.
- Culvert Extension.
- Culvert Relocation.
- Embankment Stabilization.
- In-kind Headwall repair.
- Headwall Construction, repair or construction.
- Roadside Ditch maintenance.
- Maintenance of culvert inlets and outlets.
- Temporary scaffolding.



Summary: Presentation Topics



- Purpose of Env-Wt 900 Rules.
- New Definitions.
- Classification of Stream Crossings.
- Design Considerations and Data Collection.
- Certified Culvert Maintainer Program.
- Resources.

Thank you!