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## Stream Crossings II: The North Atlantic Aquatic Connectivity Collaborative: A Coordinated Effort to Evaluate the Effects of Road-Stream Crossings on Aquatic Connectivity

Scott Jackson

*University of Massachusetts Amherst*

Alex Abbott

*University of Massachusetts Amherst*

Jessie Levine

*University of Massachusetts Amherst*

Erik Martin

*University of Massachusetts Amherst*

Melissa Ocana

*University of Massachusetts Amherst*

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[https://scholarworks.umass.edu/fishpassage\\_conference/2016/June22/22](https://scholarworks.umass.edu/fishpassage_conference/2016/June22/22)

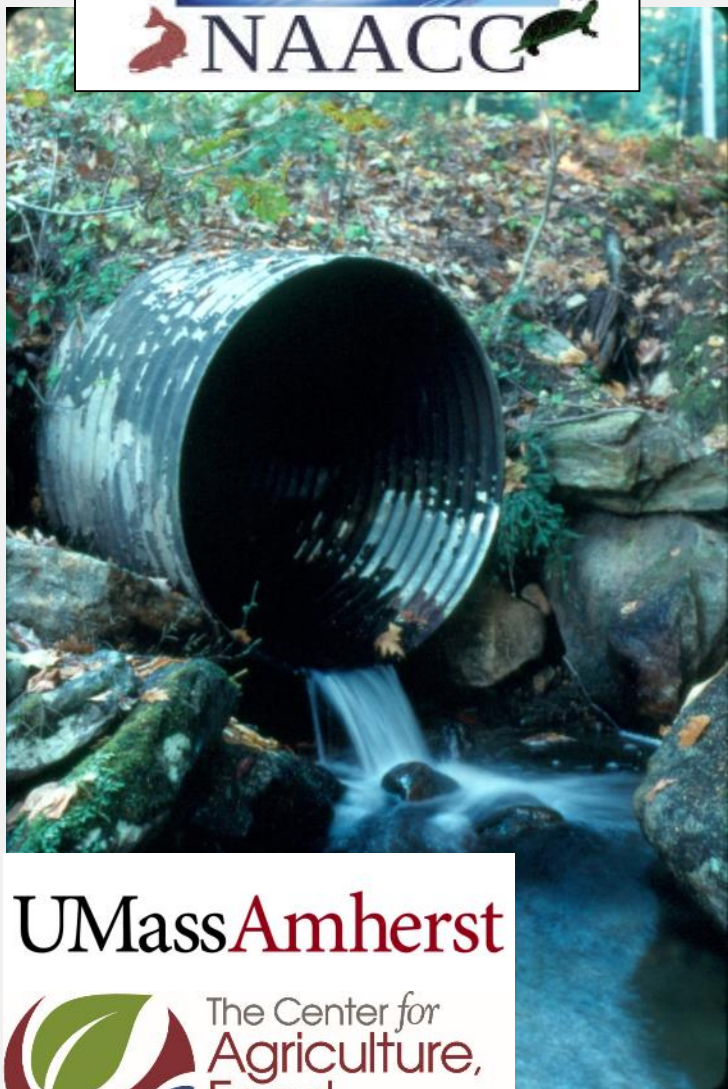
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# The North Atlantic Aquatic Connectivity Collaborative

## A Coordinated Effort to Evaluate the Effects of Road-Stream Crossings on Aquatic Connectivity

Scott Jackson, Alex Abbott, Jessie Levine,  
Erik Martin & Melissa Ocana



UMassAmherst







# Dams









# North Atlantic Aquatic Connectivity Collaborative (NAACC)

UMASS  
AMHERST

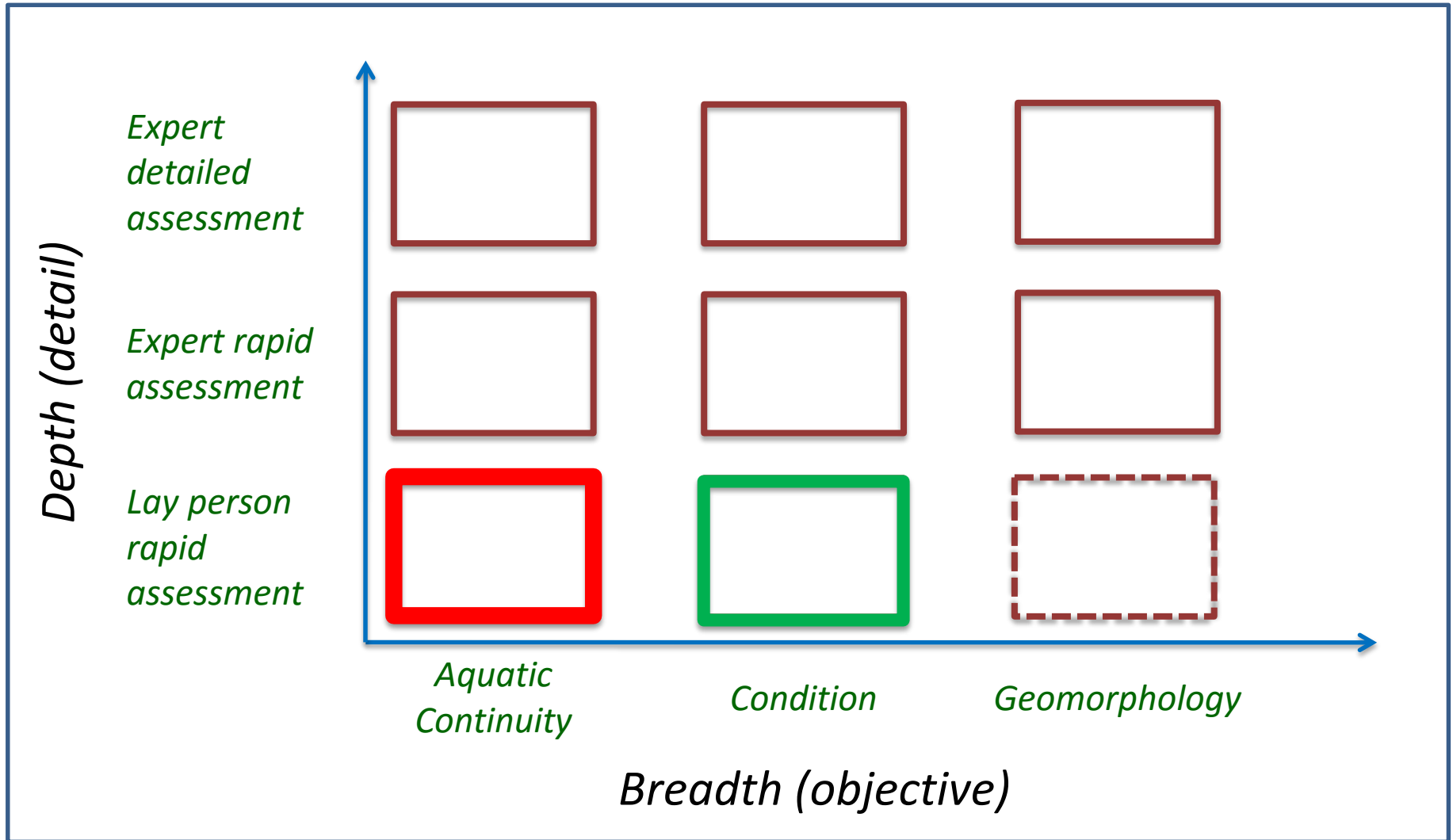


# North Atlantic Aquatic Connectivity Collaborative (NAACC): Objectives

- Reconnect streams & rivers to support healthier populations of fish & wildlife
- Proactively identify and prioritize sites for stream crossing upgrades/replacements
- Facilitate communication and information sharing among partners

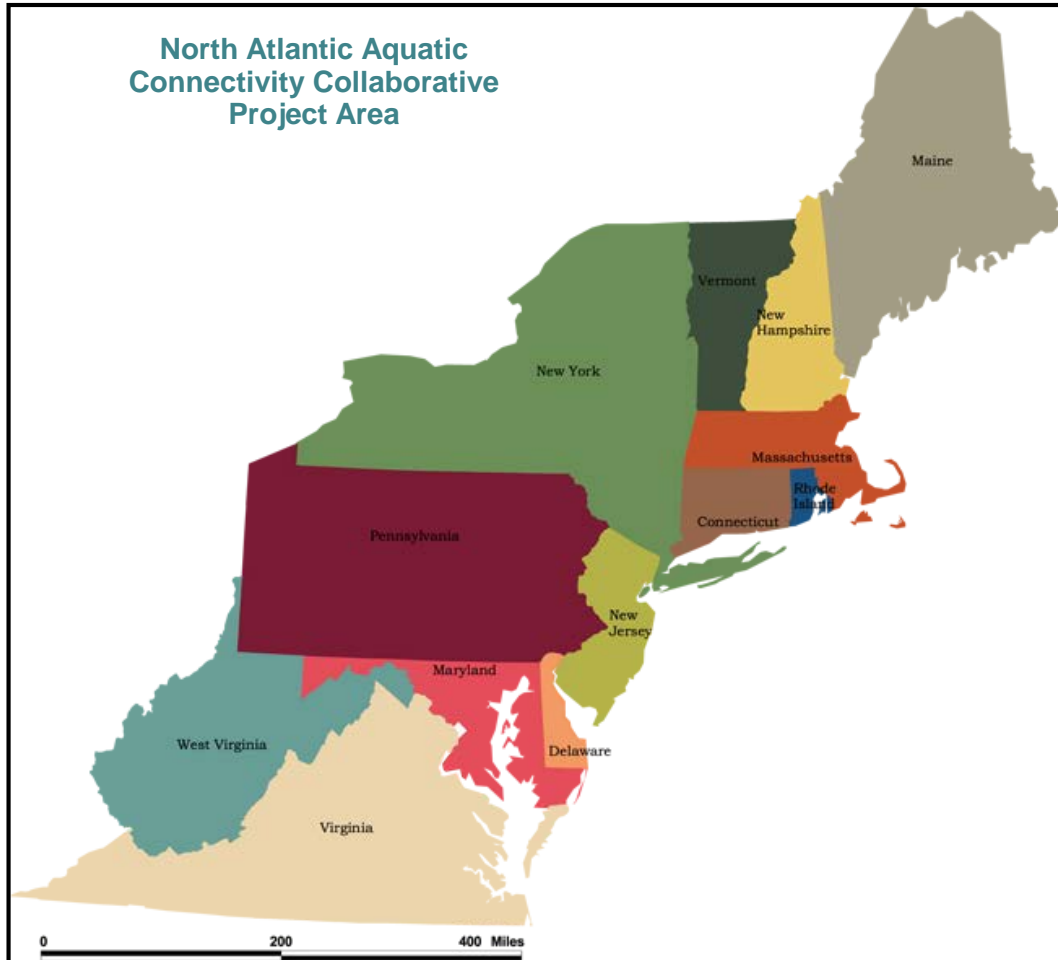


# Modular approach to crossing assessment



# Distributed Coordination

North Atlantic Aquatic  
Connectivity Collaborative  
Project Area



## Lead Observers (data collectors)

- Technicians
- Volunteers

L1: Local Coordinators

L2: Regional Coordinators

L3: Central Coordinators

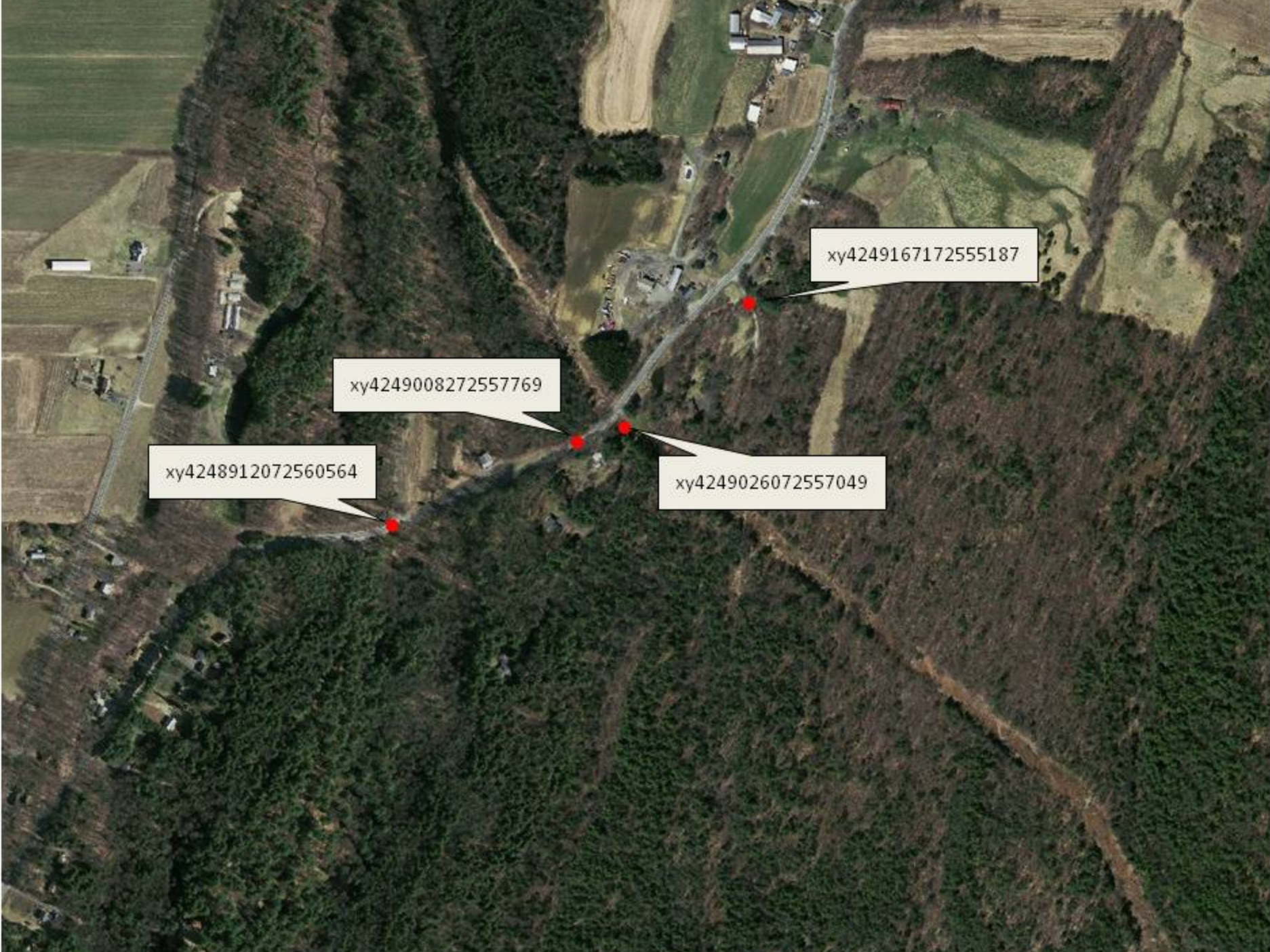
Trainers





# Project Infrastructure

- Crossing codes
- Protocols & field data forms
- Electronic data collection
- Online Database
  - Data storage & retrieval
  - Scoring
  - Mapping interface
- Prioritizing crossings for assessment
- Prioritizing crossings for mitigation
  - TNC Northeast Connectivity Project
  - UMass Critical Linkages Project



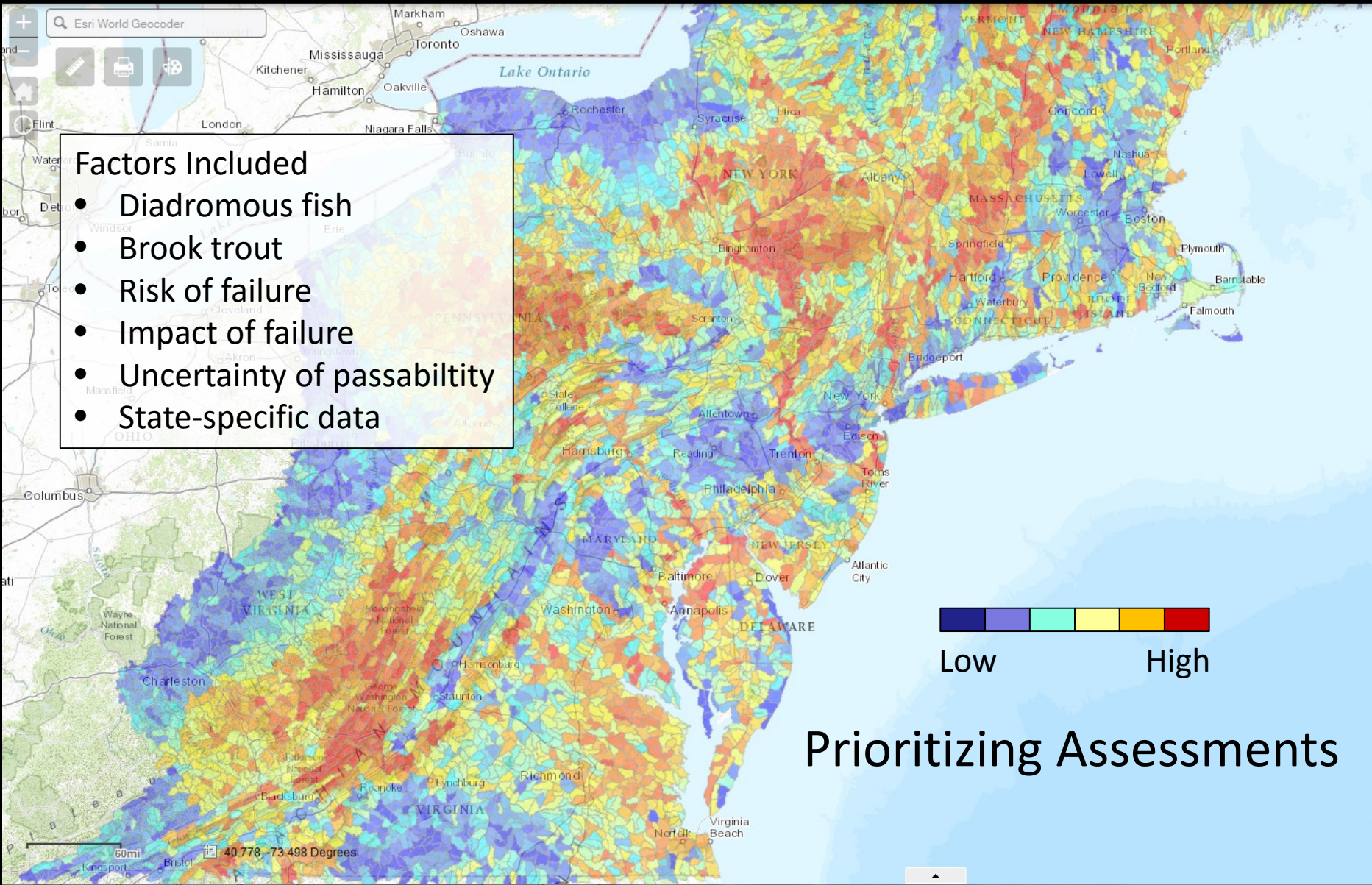
xy4248912072560564

xy4249008272557769

xy4249026072557049

xy4249167172555187









# AQUATIC CONNECTIVITY Stream Crossing Survey DATA FORM

DATABASE ENTRY BY \_\_\_\_\_ ENTRY DATE \_\_\_\_\_

DATA ENTRY REVIEWED BY \_\_\_\_\_ REVIEW DATE \_\_\_\_\_

CROSSING DATA

Crossing Code \_\_\_\_\_ Local ID (Optional) \_\_\_\_\_

Date Observed (DD/MM/YYYY) \_\_\_\_\_ Lead Observer \_\_\_\_\_

Town/County \_\_\_\_\_ Stream \_\_\_\_\_

Road \_\_\_\_\_ Type  MULTILANE  PAVED  UNPAVED  DRIVEWAY  RAIL  RAILROAD

GPS Coordinates (Decimal degrees) \_\_\_\_\_ °N Latitude \_\_\_\_\_ °W Longitude \_\_\_\_\_

Location Description

Crossing Type  BRIDGE  CULVERT  MULTIPLE CULVERT  FORD  NO CROSSING  REMOVED CROSSING  BURIED STREAM  INACCESSIBLE  PARTIALLY INACCESSIBLE  NO UPSTREAM CHANNEL  BRIDGE ADEQUATE

Number of Culverts/ Bridge Cells \_\_\_\_\_

Photo IDs  INLET  OUTLET  UPSTREAM  DOWNSTREAM  OTHER \_\_\_\_\_

Flow Condition  NO FLOW  TYPICAL LOW  MODERATE  HIGH  Crossing Condition  OK  POOR  NEW  UNKNOWN

Tidal Site  YES  NO  UNKNOWN  Alignment  FLOW-ALIGNED  SKEWED (>45°)  Road Fill Height (Top of culvert to road surface, bridge = 0) \_\_\_\_\_

Bankfull Width (Optional) \_\_\_\_\_ Confidence  HIGH  LOW/ESTIMATED  Constriction  SEVERE  MODERATE  SPANS FULL CHANNEL & BANKS  SPANS ONLY BANKFULL/ACTIVE CHANNEL

Tailwater Scour Pool  NONE  SMALL  LARGE

Crossing Comments \_\_\_\_\_



## STRUCTURE 1

OUTLET

Structure Material  METAL  CONCRETE  PLASTIC  WOOD  ROCK/STONE  FIBERGLASS  COMBINATION

Outlet Shape  1  2  3  4  5  6  7  FORD  UNKNOWN  REMOVED  Outlet Armoring  NONE  NOT EXTENSIVE  EXTENSIVE

Outlet Grade (Pick one)  AT STREAM GRADE  FREE FALL  CASCADE  FREE FALL ONTO CASCADE  CLOGGED/COLLAPSED/SUBMERGED  UNKNOWN

Outlet Dimensions A. Width \_\_\_\_\_ B. Height \_\_\_\_\_ C. Substrate/Water Width \_\_\_\_\_ D. Water Depth \_\_\_\_\_

Outlet Drop to Water Surface \_\_\_\_\_ Outlet Drop to Stream Bottom \_\_\_\_\_ E. Abutment Height (Type 7 bridges only) \_\_\_\_\_

L. Structure Length (Overall length from inlet to outlet) \_\_\_\_\_

INLET

Inlet Shape  1  2  3  4  5  6  7  FORD  UNKNOWN  REMOVED

Inlet Type  PROJECTING  HEADWALL  WINGWALLS  HEADWALL & WINGWALLS  BITTERED TO SLOPE  OTHER  NONE

Inlet Grade (Pick one)  AT STREAM GRADE  INLET GRADE  PERCHED  CLOGGED/COLLAPSED/SUBMERGED  UNKNOWN

Inlet Dimensions A. Width \_\_\_\_\_ B. Height \_\_\_\_\_ C. Substrate/Water Width \_\_\_\_\_ D. Water Depth \_\_\_\_\_

ADDITIONAL CONDITIONS

Slope % (Optional) \_\_\_\_\_ Slope Confidence  HIGH  LOW  Internal Structures  NONE  Baffles/Weirs  SUPPORTS  OTHER \_\_\_\_\_

Structure Substrate Matches Stream  NONE  COMPARABLE  CONTRASTING  NOT APPROPRIATE  UNKNOWN

Structure Substrate Type (Pick one)  NONE  SILT  SAND  GRAVEL  COBBLE  BOULDER  BEDROCK  UNKNOWN

Structure Substrate Coverage  NONE  25%  50%  75%  100%  UNKNOWN

Physical Barriers (Pick all that apply)  NONE  DEBRIS/SEDIMENT/ROCK  DEFORMATION  FREE FALL  FENCING  DRY  OTHER

Severity (Choose carefully, based on barrier type(s) above)  NONE  MINOR  MODERATE  SEVERE

Water Depth Matches Stream  YES  NO-SHALLOWER  NO-DEEPER  UNKNOWN  DRY

Water Velocity Matches Stream  YES  NO-FASTER  NO-SLOWER  UNKNOWN  DRY

Dry Passage through Structure?  YES  NO  UNKNOWN  Height above Dry Passage \_\_\_\_\_

Comments \_\_\_\_\_



# Training Requirements

## Lead Observers

- Classroom training either online or in-person (2-4 hours)
- In-person field training (1/2 day, ~ 5 crossings)
- Shadow a certified lead observer (20 crossings)

## Coordinators

- Certification as a lead observer
- Online coordinator training unit

# Online Crossings Database



## North Atlantic Aquatic Connectivity Collaborative

[Search Crossings](#) [Login](#)

### Location:

All States [298]

All Streams

All Watersheds

### Personnel:

Any Observer

Any Coordinator

### Other:

Survey ID:

Crossing Code:

All Evaluations

25 per page

### Dates:

Last updated from ...

7/5/2015

Last updated until ...

8/3/2015

Date observed from ...

6/2/2015

Date observed until ...

8/3/2015

### Search Help

- Set filters above to search for particular road/stream crossing records and then click 'Search'.
- If you want to keep your search filter settings when you leave the search page, use the back button to return.




# Data Input

- Paper forms
- Electronic data collection
- Bulk uploads

← → ↻ 🏠 [https://63.134.242.172/cdb2/naacc\\_add\\_correct\\_crossing.cfm?err=0#top](https://63.134.242.172/cdb2/naacc_add_correct_crossing.cfm?err=0#top) 🔍 ☆

📱 Apps 📁 Getting Started 📁 Imported From Firef...



North Atlantic Aquatic Connectivity Collaborative  
**NAACC**

## North Atlantic Aquatic Connectivity Collaborative

[Search Crossings](#) [Add New Record](#) [Add-Edit-View Observers](#) [Edit-View Coordinators](#) [Login](#) [LogOut](#)

### Crossing Data

No images uploaded for this crossing

Date observed in field: (m/d/yyyy)  /  /  Coordinator:

Lead Observer:  Town:

Stream/River:  Road:

Road type:  Multilane road (>2 lanes)  Paved  Unpaved  Driveway  Trail  Railroad

Location:

GPS Decimal Coordinates: (WGS 84 EPSG:4326) Lat:  Long:

When done entering GPS coordinates, click 'View map' to choose a crossing code:

Crossing code:  GPS to crossing distance (meters):

Crossing type:  
 Bridge  Culvert  Multiple Culvert  Ford  Removed Crossing  Inaccessible  Buried Stream  No crossing  Unknown

Number of Culverts/Bridge Cells:

Crossing Comments:

Flow condition:  No Flow  Typical low-flow  Moderate  High

Condition of Crossing:  OK  Poor  New  Unknown

Tidal Site:  Yes  No  Unknown Alignment:  Flow-Aligned  Skewed (>45°)

Road Fill Height (ft) (Top of culvert to road surface; Bridge = 0)  Tailwater Scour Pool:  None  Small  Large  Unknown

Bankfull Width (optional):  Bankfull Width Confidence:  High  Low/Estimated

Constriction:  Severe  Moderate  Spans Only Bankfull/Active Channel  Spans Full Channel & Banks  Unknown

Please first complete the form above to prevent data entry validation messages from interfering with uploading images, and then add at least two images in JPEG format. Four images are recommended, and seven is the maximum. The upload file size limit is 5MB per image file.

After browsing to your image files, click "Add Images", and wait for the images to appear at the top of this page before clicking "Save Crossing Information." Your images will be automatically reduced in file size to below 250KB and renamed according to NAACC convention, which can take a few seconds per image depending on file size. Please be careful to upload the correct image for each "Browse" button because the image will be named using the text to the left of the button.

Inlet Photo:  No file chosen

Outlet Photo:  No file chosen

Upstream Photo:  No file chosen

Downstream Photo:  No file chosen

Other 1 Photo:  No file chosen

Other 2 Photo:  No file chosen

Other 3 Photo:  No file chosen

# Data Validation

## Database rules that can't be violated

- Programmed in
- Examples
  - Required fields
  - Acceptable range of measurements
  - GPS units must be within bounding box
- Electronic data collection: applied at time of collection in the field
- Paper data collection: applied when data are entered to the database

# Scoring Systems

## AOP Coarse Screen

- Categorization
- Limited number of variables used
- 3 Categories
  - No AOP
  - Reduced AOP
  - Full AOP

## Aquatic Passability Score

- Numeric scoring
- Based on a weighted combination of 14 variables
- Scores range from
  - 0.0 (impassable) to
  - 1.0 (fully passable)



# AOP Coarse Screen

Metric	Flow Condition	Crossing Classification		
		Full AOP	Reduced AOP	No AOP
		<i>If all are true</i>	<i>If any are true</i>	<i>If any are true</i>
Inlet Grade		At Stream Grade	Inlet Drop or Perched	
Outlet Grade		At Stream Grade		Cascade, Free Fall onto Cascade
Outlet Drop to Water Surface		= 0		≥ 1 ft
Outlet Drop to Water Surface/ Outlet Drop to Stream Bottom				> 0.5
Inlet or Outlet Water Depth	Typical-Low	> 0.3 ft		< 0.3 ft w/Outlet Drop to Water Surface > 0
	Moderate	> 0.4 ft		< 0.4 ft w/Outlet Drop to Water Surface > 0
Structure Substrate Matches Stream		Comparable or Contrasting		
Structure Substrate Coverage		100%	< 100%	
Physical Barrier Severity		None	Minor or Moderate	Severe

# Aquatic Passability Score

parameter	weight
Outlet drop	0.161
Physical barriers	0.135
Constriction	0.090
Inlet grade	0.088
Water depth	0.082
Water velocity	0.080
Scour pool	0.071
Substrate matches stream	0.070
Substrate coverage	0.057
Openness	0.052
Height	0.045
Outlet armoring	0.037
Internal structures	0.032

*Aquatic Passability Score = Min[Composite Score, Outlet Drop score]*

# Data Reports

- *Excel files*
- *Shapefiles*
- *Mapping interface*

[https://www.streamcontinuity.org/cdb2/naacc\\_search\\_crossing.cfm?sp=1](https://www.streamcontinuity.org/cdb2/naacc_search_crossing.cfm?sp=1)

**North Atlantic Aquatic Connectivity Collaborative**  
[Search Crossings](#) [Login](#)

**Location** (choose multiple towns, watersheds):  
 Pennsylvania [531]  
 All PA Cities/Towns or Counties  
 Abbott [0]  
 Abbottstown [0]  
 Abington [0]  
 All PA streams  
 All PA Watersheds  
 Bald Eagle  
 Beaver  
 Brandywine-Christina

**Other:**  
 Survey ID:   
 Crossing Code:   
 All Evaluations  
 25 per page  
 Choose Data Sets (choose multiple):  
 NAACC (after 6/1/2015)  
 UMass Stream Continuity Project (through 8/31/2015)

**Dates:**  
 Last updated from ...  
 2/22/2005  
 Last updated until ...  
 1/7/2016  
 Date observed from ...  
 8/5/2002  
 Date observed until ...  
 1/7/2016

**Personnel:**  
 Any Observer  
 Any Coordinator

[Search](#)

[Map results](#)    Export: [Shapefile NAACC](#) - [Excel Simple NAACC](#) - [Excel Comprehensive NAACC](#)

Showing 532 Records , 25 per page.

[Next \[507\]](#)

Survey ID	Crossing Code	Date Observed	Last Updated	Town	Stream	Road	Evaluation	Culvert
20345	<a href="#">xy4099648977528049</a>	2015/08/04	2016/01/01	Lamar PA	Spring Run	Unnamed driveway	Coming soon...	2
20346	<a href="#">xy4099071677492480</a>	2015/08/04	2016/01/01	Lamar PA	Cherry Run	Narrows Road	Coming soon...	1
20762	<a href="#">xy4098538677487394</a>	2015/08/05	2016/01/01	Lamar PA	Bear Run	Narrows Road	Coming soon...	1
21058	<a href="#">xy4135100677924898</a>	2015/08/17	2016/01/01	Leidy PA	Kettle Ck.	Kettle Creek Road	Coming soon...	3
21094	<a href="#">xy4133738477904410</a>	2015/08/17	2016/01/01	Leidy PA	UNT to Kettle Ck.	Kettle Creek Road	Coming soon...	1
21095	<a href="#">xy4134134677909855</a>	2015/08/17	2016/01/01	Leidy PA	Summerson Run	Kettle Creek Road	Coming soon...	2
21144	<a href="#">xy4136872177932930</a>	2015/08/17	2016/01/01	Leidy PA	UNT to Kettle Ck.	Kettle Creek Road	Coming soon...	1
21145	<a href="#">xy4137790977930855</a>	2015/08/17	2016/01/01	Leidy PA	Bearfield Run	Kettle Creek Road	Coming soon...	1



# Online Crossings Database

← → ↻ 🏠 [https://www.streamcontinuity.org/cdb2/naacc\\_search\\_crossing.cfm](https://www.streamcontinuity.org/cdb2/naacc_search_crossing.cfm) 🔍 ☆

📱 Apps 📄 Getting Started 📁 Imported From Firef...



## North Atlantic Aquatic Connectivity Collaborative

Search Crossings LogIn

Location (choose multiple towns, watersheds):

Pennsylvania [531] ▼

All PA Cities/Towns or Counties ▲  
Abbott [0]  
Abbottstown [0]  
Abington [0] ▼

All PA streams ▼

All PA Watersheds ▲  
Bald Eagle  
Beaver  
Brandywine-Christina ▼

Personnel:

Any Observer ▼

Any Coordinator ▼

Other:

Survey ID:

Crossing Code:

All Evaluations ▼

25 per page ▼

Choose Data Sets (choose multiple) ▼

NAACC (after 6/1/2015) ▲  
UMass Stream Continuity Project (through 8/31/2015) ▼

Dates:

Last updated from ...

Last updated until ...

Date observed from ...

Date observed until ...

Search

Location (choose multiple towns, watersheds):

All States [8692]

All NHD-HUC8 Watersheds  
Albemarle  
Allagash  
Appomattox

Personnel:

Any Observer

Any Coordinator

Other:

Survey ID:

Crossing Code:

All Evaluations

25 per page

Choose Data Sets (choose multiple):

NAACC (after 6/1/2015)  
UMass Stream Continuity Project (2005-2016)  
Connecticut (2004-2013)

Dates:

Last updated from ...

All

Last updated until ...

All

Date observed from ...

All

Date observed until ...

All

Map results

Data Set	GIS		Excel Reports	
NAACC (after 6/1/2015)	<a href="#">shapefile</a>	<a href="#">simple</a>	<a href="#">detailed</a>	Not available

Showing 6252 Records , 25 per page.

Map information

Click to show/hide map information

Welcome to

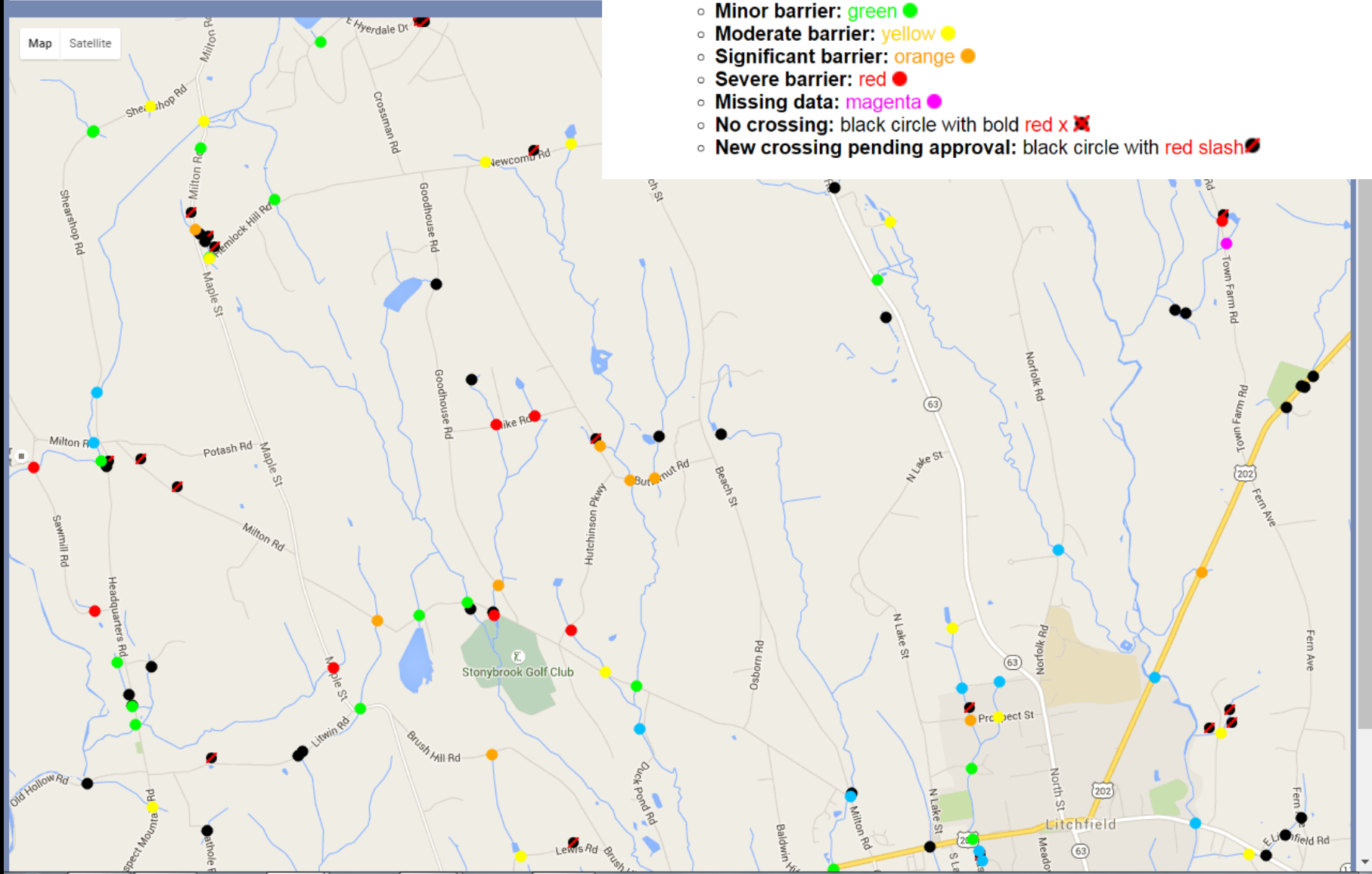
(Note that 1105 of 1116 surveyed records in your search results have been mapped. O records with du

Map information

Click to show/hide map information

1. The colored circles on the map represent surveyed crossings color coded as follows:

- o **No barrier:** blue ●
- o **Insignificant barrier:** blue green ●
- o **Minor barrier:** green ●
- o **Moderate barrier:** yellow ●
- o **Significant barrier:** orange ●
- o **Severe barrier:** red ●
- o **Missing data:** magenta ●
- o **No crossing:** black circle with bold red x ❌
- o **New crossing pending approval:** black circle with red slash ⚡





Map Satellite

xy4150390977698092

xy4150181677683126

xy4150095477682922

xy4149532977680383

xy4149220577679720

xy4148733377673668

xy4148258177681854

Poplar Hollow

Spring Brook

Spring Brook

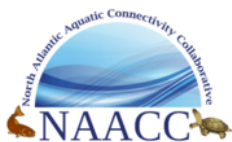
Spring Brook

12 Mile Rd

Rd

12 Mile Rd

Pe



# North Atlantic Aquatic Connectivity Collaborative

Search Crossings

Login

Data checked and accurate by Phil, Thomas on 11-25-2015

### NAACC Data Set:

Crossing Code: xy4148288877681870

AOP Coarse Screen: No AOP

Aquatic Passability Score: 0.86



[xy4148288877681870\(inlet\)5-27-2015.jpg](#)



[xy4148288877681870\(outlet\)5-27-2015.jpg](#)



[xy4148288877681870\(upstream\)5-27-2015.jpg](#)

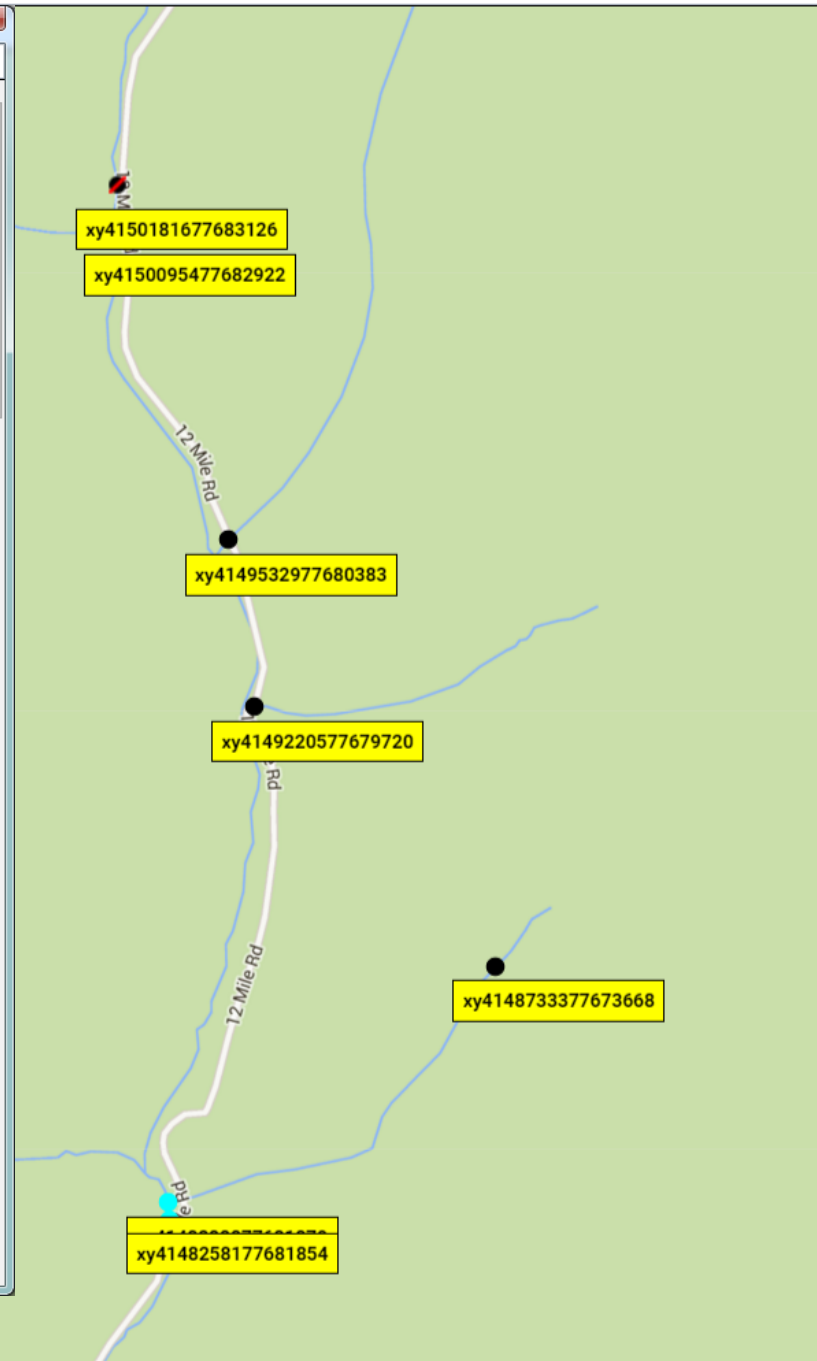


[xy4148288877681870\(downstream\)5-27-2015.jpg](#)

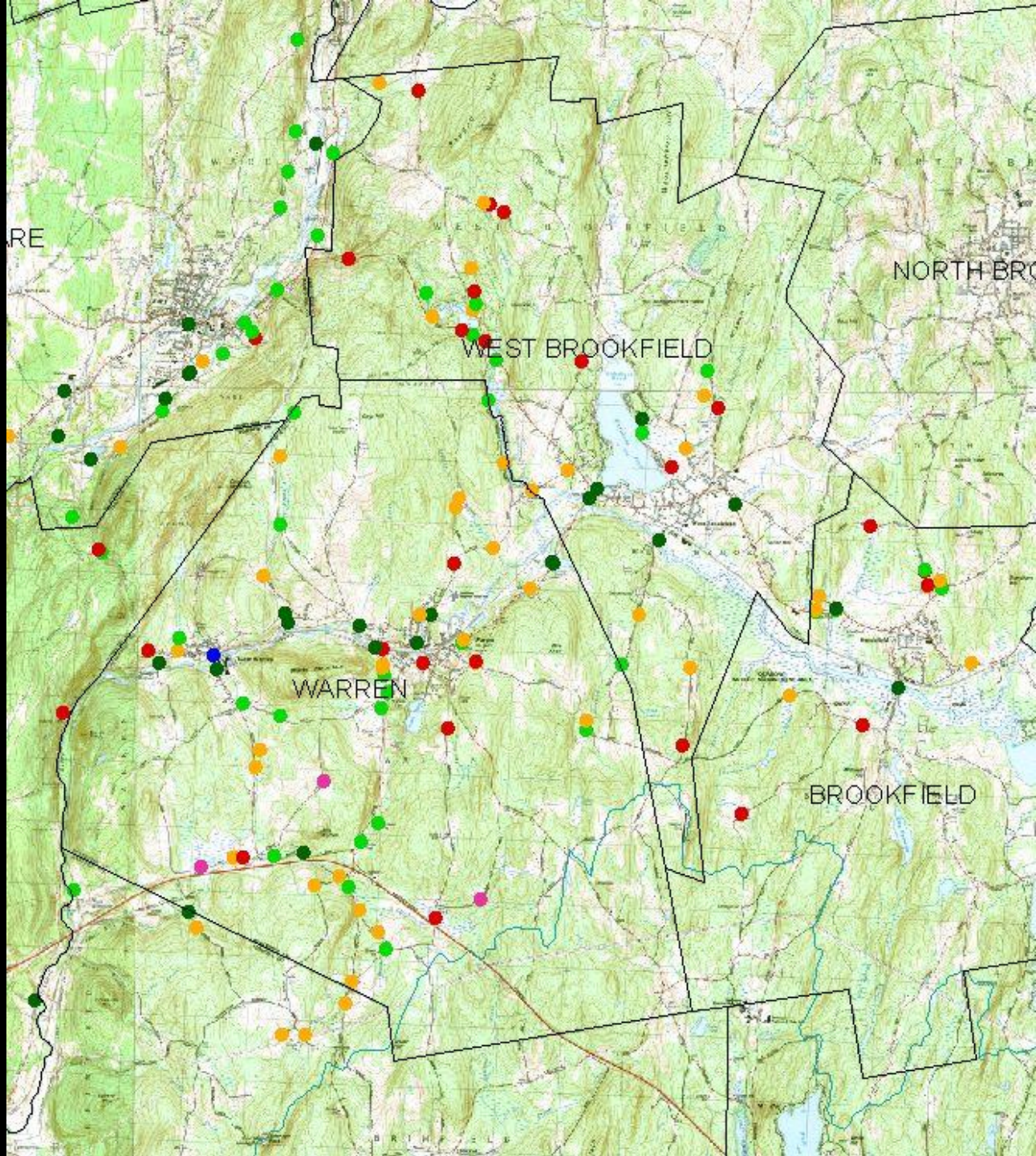
### Crossing Data:

Coordinator: Phil Thomas

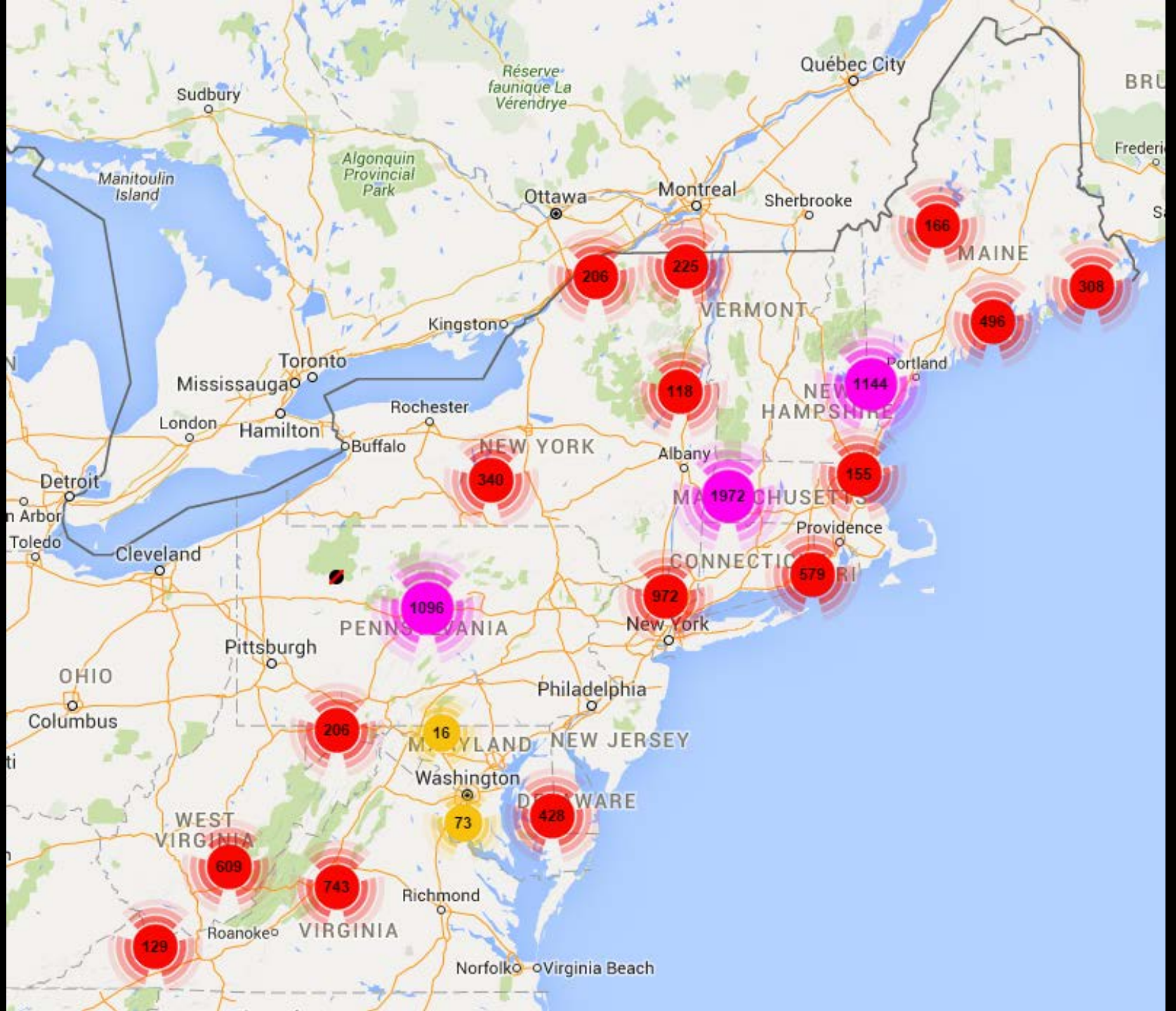
Crossing Code: xy4148288877681870















## Contacts

Scott Jackson

[sjackson@umass.edu](mailto:sjackson@umass.edu)

Jessica Levine

[jlevine@TNC.org](mailto:jlevine@TNC.org)

[www.streamcontinuity.org](http://www.streamcontinuity.org)

