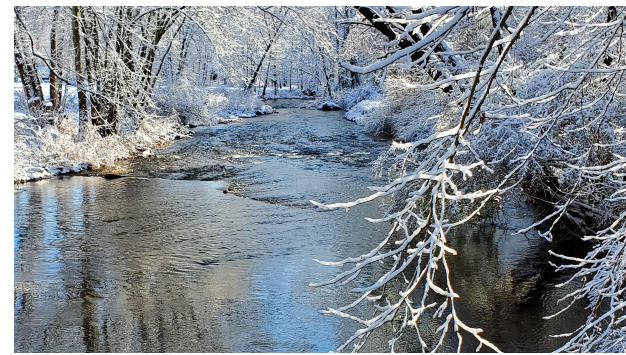
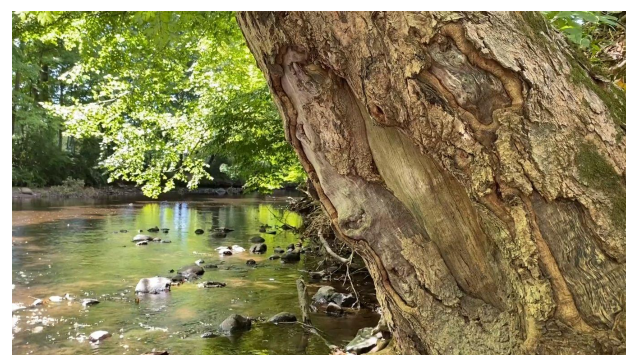


# Road- Stream Crossing Assessments

February 2024







# Agenda

- **Welcome & Introductions**
- **What is a Watershed?**
- **NAACC Protocol Overview**
- **NAACC Steps**
- **Woodbury Assessment Results**
- **Infrastructure and Flooding**
- **Questions & Discussion**





# Welcome & Introductions



**Carol Haskins**  
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# PRWC Mission

Pomperaug River Watershed Coalition's mission is to advocate for excellent water quality water in the Pomperaug Watershed communities through the use of science and education.

We share our knowledge and expertise with others committed to the protection of water resources for future generations.





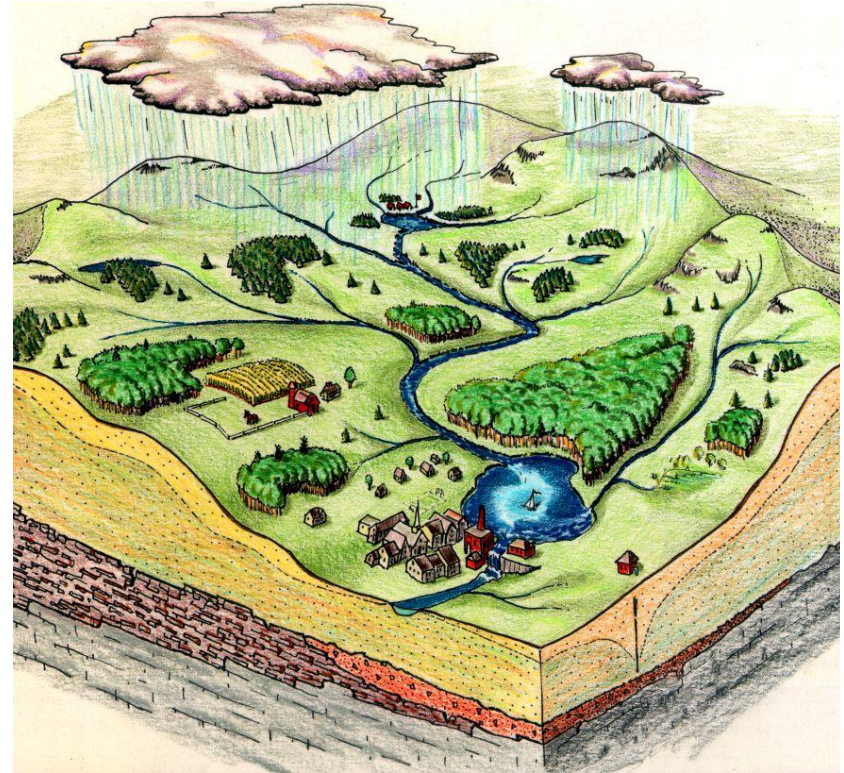
# What is a Watershed?

A **watershed** is a section of land that drains to a common point.

Water flows downhill from higher elevations and collects in streams, rivers, lakes, wetlands, and eventually the ocean.

It is all the land surrounding a body of water that – when it rains – drains to that body of water.

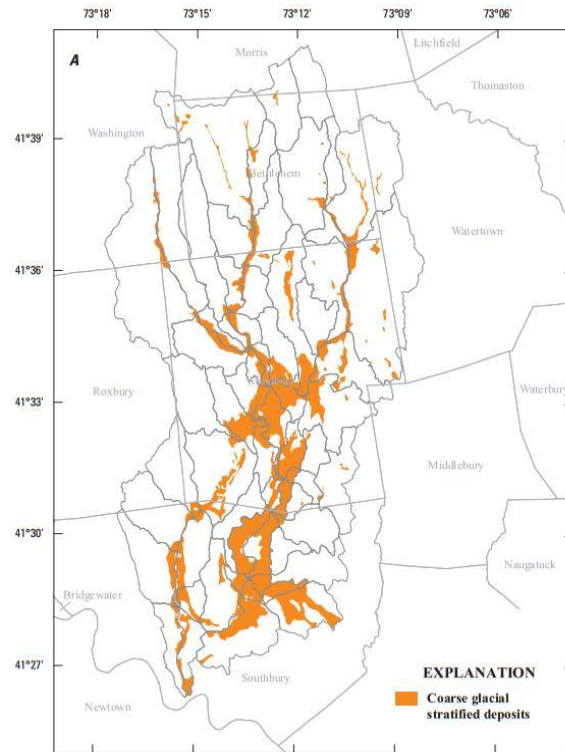
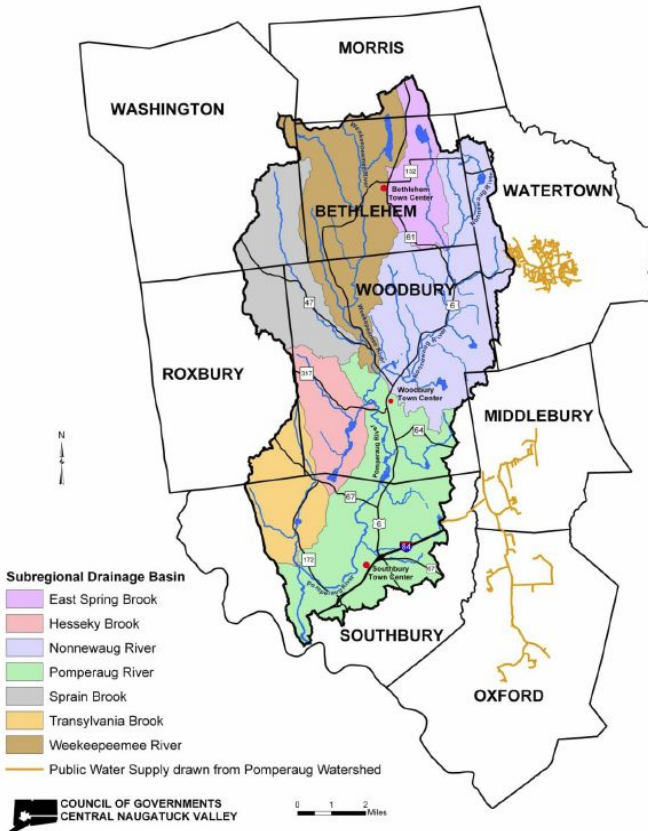
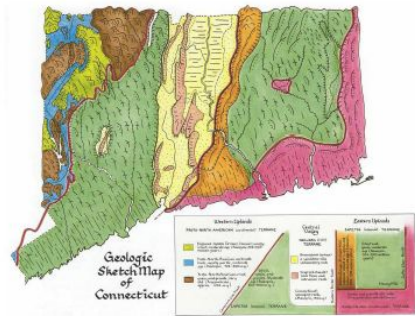
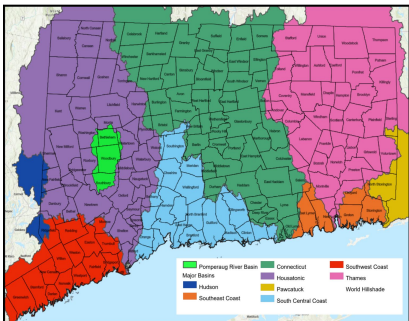
A watershed typically is **named for the body of water.**





# Pomperaug River Watershed

A 90-square mile watershed that drains to the Housatonic River Watershed in western Connecticut and that has geology mimicking the centrally located Connecticut River Watershed.



Base from U.S. Geological Survey, 1:24,000, 1969 to 1984  
Connecticut State Plane projection



# Road-Stream Crossing Assessments Overview



- Starting in the 2020 field season, PRWC began surveying **road-stream crossings** in the Pomperaug Watershed following protocol from the **North Atlantic Aquatic Connectivity Collaborative (NAACC)**.
- Aquatic life passage is difficult and sometimes impossible when streams and rivers are fragmented by inadequate stream crossings.
- Through these assessments, data collected by field assessors are submitted to NAACC and processed to be classified and listed in their database.
- This helps provide **mapped information on culverts, bridges, or crossings that may need to be prioritized for repair or replacement** to improve the connectivity of the stream or river.

# Crossing Evaluation Overview

## NAACC Stream Crossing Instruction Manual for Aquatic Passability Assessments in Non-tidal Stream and Rivers



North Atlantic Aquatic Connectivity Collaborative



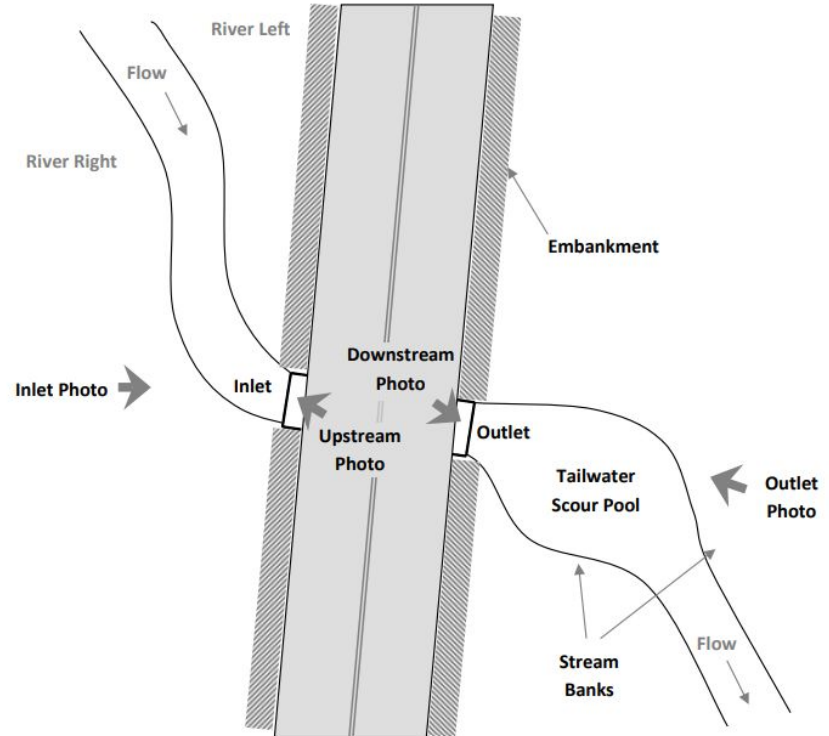
Version 1.3 – June 2, 2019  
(for Data Form dated May 26, 2016)

### CONTACTS

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For more information, go to: [www.streamcontinuity.org/naacc](http://www.streamcontinuity.org/naacc)

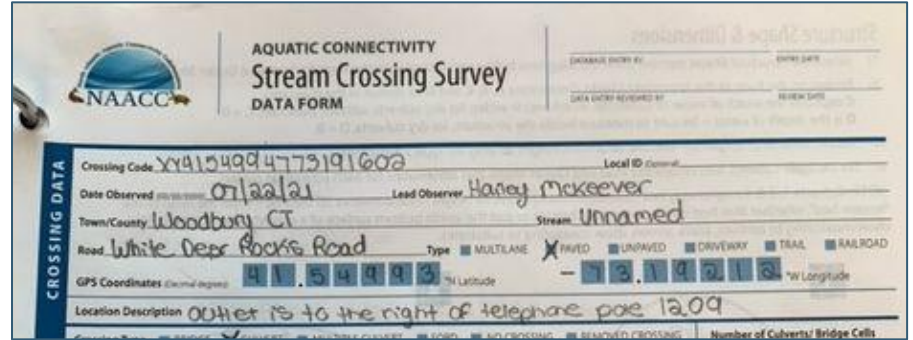




# NAACC Evaluations: Crossing Data

## General ID data:

- Crossing Code (generated by x,y coordinates)
- Date
- Observer
- Town
- Stream
- Road
- Road Type (paved/unpaved)
- GPS Coordinates (cross-checks code)
- Site Description (to aid in finding location)

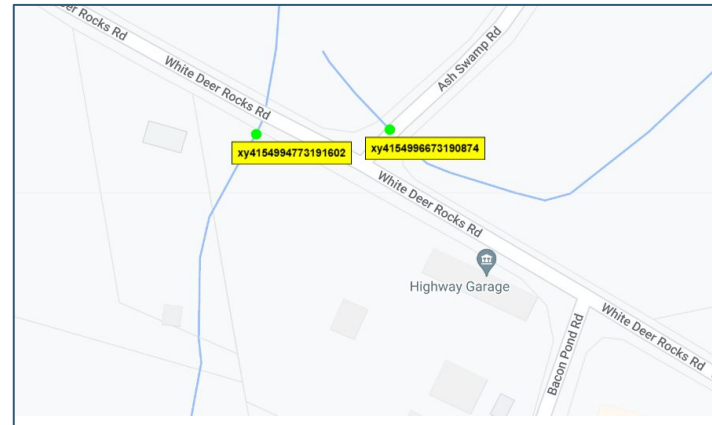


**AQUATIC CONNECTIVITY Stream Crossing Survey DATA FORM**

NAACC

CROSSING DATA

Crossing Code: xy4154994773191602 Local ID:           
 Date Observed: 07/22/21 Lead Observer: Honey McKeever  
 Town/Country: Woodbury CT Stream: Unnamed  
 Road: White Deer Rocks Road Type:  MULTILANE  PAVED  UNPAVED  DRIVEWAY  TRAIL  RAILROAD  
 GPS Coordinates: 41.54994 N Latitude -73.19213 W Longitude  
 Location Description: outer is to the right of telephone pole 12.09  
 Number of Culverts/ Bridge Cells:         



# Crossing Type and Shape



Round Culvert



Elliptical Culvert/  
"Squashed Pipe"



Box Culvert



Open Bottom  
Arch Bridge



Bridge with  
Side Slopes



Box/Bridge with  
Abutments



Bridge with Side Slopes  
and Abutments



Ford



# Multiple Culverts



- Crossings with more than one cell are indicated as **multiple culverts**.
- Each culvert is evaluated individually and **numbered from left to right** at the crossing inlet.



Old Grassy Hill Rd, Woodbury



Weekeepemee Rd, Woodbury



Painter Hill Rd, Woodbury

# Material



- Stream-road crossing infrastructure can be made of many materials including **metal, concrete, plastic, rock/stone, or a combination of materials.**
- Certain materials and their condition can help reveal the relative age of the bridge/culvert.







# General Condition



**NEW**  
Hazel Plain Rd &  
Sprain Brook,  
Woodbury



**POOR**  
Constitution Hill &  
unnamed stream,  
Southbury



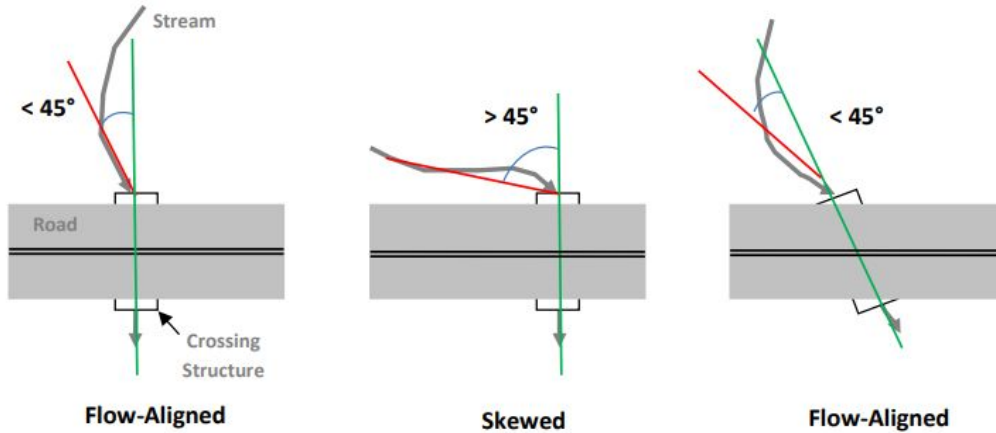
**OK**  
Curt Smith Rd &  
unnamed stream,  
Southbury



**UNKNOWN**  
Judd Hill Rd &  
Eightmile Brook,  
Woodbury

# Alignment

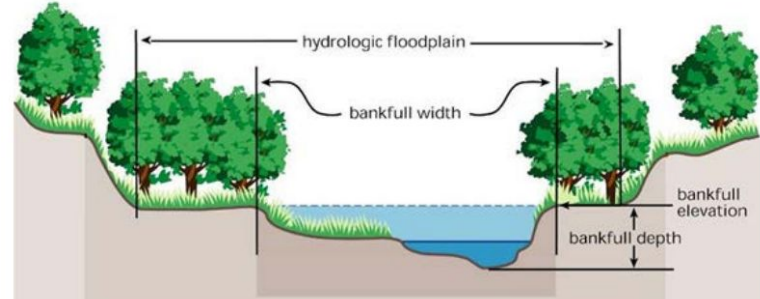
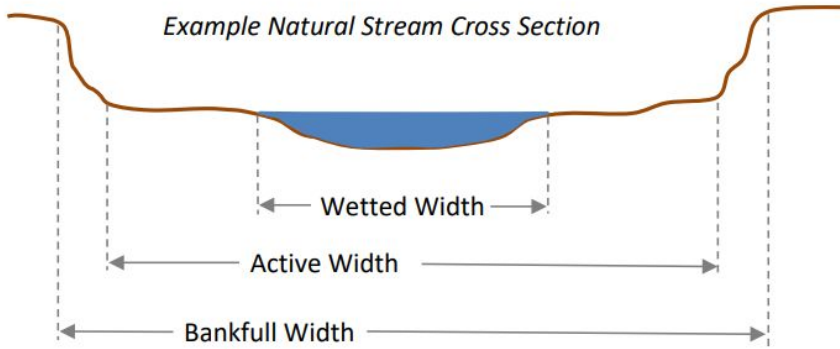
## Skewed vs. Flow-aligned



White Deer Rock Rd & unnamed stream off Cat Swamp Pond, Woodbury

\*Skewed alignment can result in scouring around the culvert inlet (see above - scour on left side of inlet)

# Stream Width



**Bankfull** width is a measure of the stream at the point where water **completely fills the stream channel** and any additional water would **overflow** into the floodplain

The **active width** is the area of the stream that is very **frequently affected by flowing water** (can be close to bankfull width).

The **wetted width** is the area of the stream that contains **water at the time of survey**.

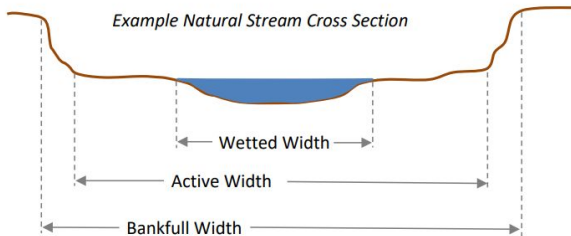




# Constriction & Velocity

**Constriction** assesses how the width of the crossing compares to the width of the natural stream channel

- **Spans Full Channel & Banks:** The crossing spans *beyond* the Bankfull Width of the natural stream.
- **Spans Only Bankfull/Active Channel:** The crossing spans the width of the bankfull/active channel.
- **Moderate:** The crossing is greater than half the bankfull width, but does not span the full bankfull width.
- **Severe:** The total width of the crossing is less than half of the bankfull width, or the total wetted width of the crossing is less than half of the wetted width of the stream.



- When a stream is constricted, the velocity of the water is increased.
- When the velocity of flowing water is increased, so is its erosive power.
- This can lead to scour around and underneath the culvert and stream bottom/streambank erosion

**Church Hill Rd &  
unnamed stream off  
East Meadow Brook,  
Woodbury**

**Bankfull width: 15.5ft**

**Inlet width: 3ft**



# Inlet Types



**\*Inlets can have both a headwall and wingwalls, just a headwall, or just wingwalls!**



# Inlet Grade



**\*At stream grade**



**Perched**



**Submerged**



# Outlet Grade



**\*At stream grade**



**Cascade**



**Free fall**



**Free fall onto  
Cascade**

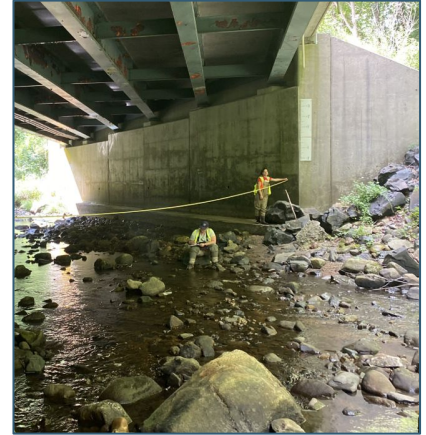
# Substrate & Dry Passage



**\*Substrate goal inside a structure is to match the stream— fish shouldn't know they're in a culvert!**

Substrate type and coverage within the crossing structure are noted, as well as whether the substrate in the structure matches the substrate of the stream.

Substrate Type	Feet	Approximate Relative Size
Silt	< 0.002	Finer than salt
Sand	0.002 – 0.01	Salt to peppercorn
Gravel	0.01 – 0.2	Peppercorn to tennis ball
<b>Cobble</b>	0.2 – 0.8	Tennis ball to basketball
Boulder	> 0.8	Bigger than a basketball
Bedrock	Unmeasurable	Unknown - buried



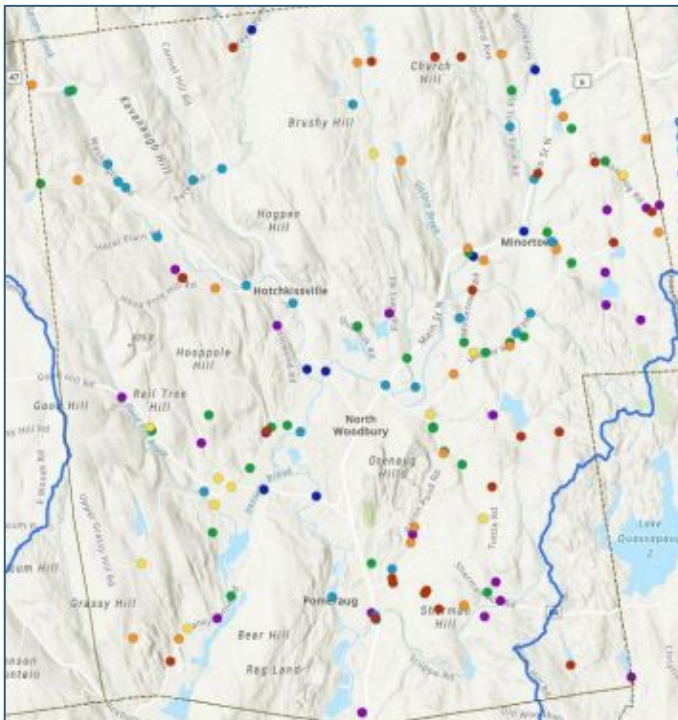
**Can a terrestrial animal move through without getting its feet wet?**

**Dry passage is important for terrestrial species!**

Height above dry passage determines the size of animals that can pass through.



# Mapping Overview



1. The colored circles on the map represent surveyed NAACC crossings (Non-tidal Aquatic Connectivity, Terrestrial Connectivity, Tidal Aquatic Connectivity or Culvert Condition Assessments) and colored squares represent UMass Stream Continuity Project crossings color coded as follows:

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

**TIP:** To get the most recent information (i.e. most recent 'Date observed in field' AND most recent 'Last updated') for a surveyed crossing, click on it. Please be aware that to view all records for a surveyed crossing, you must use the "Search Crossings" page to search using the crossing code.

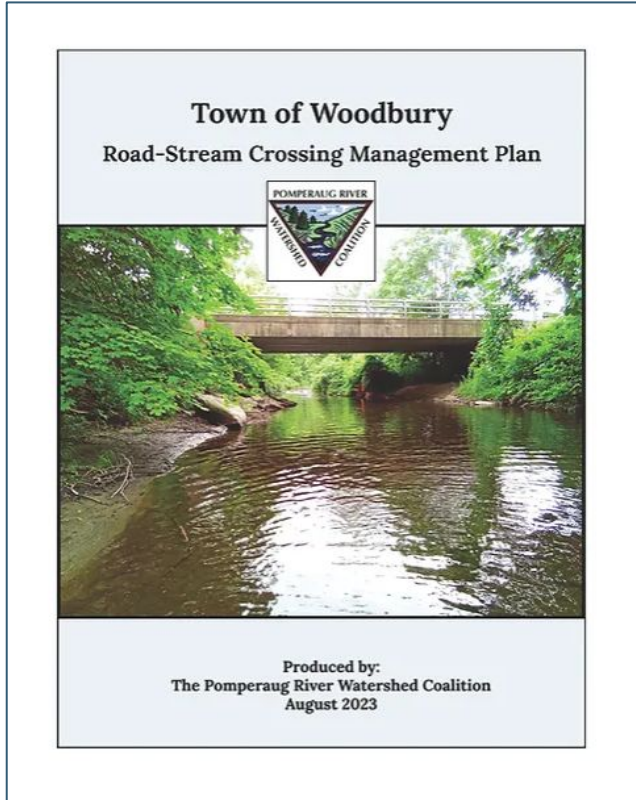
2. **Black circles** ● are unsurveyed crossings that have been assigned xy crossing codes by using Geographic Information System (GIS) software. Depending on the area covered by your search results, you may not see any black circles until you have zoomed in. When you hover over black points, the xy crossing code will appear.

*To view crossing data, visit <https://naacc.org>*

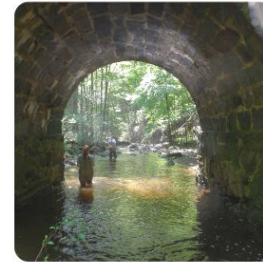




# Road-Stream Crossing Progress & Plan



- As of August 2023, PRWC has completed assessments for all of the **safely accessible road-stream crossings in Woodbury** (163 public crossings out of the 171 that have been identified)
- With this data, **PRWC has created a Road-Stream Crossing Management Plan for the Town of Woodbury** to help the Town prioritize repair or replacement of the crossings with an added layer of climate resiliency planning.
- **PRWC has also assessed 164 of approx. 316 road-stream crossing assessments in Southbury** and will assess the remaining 150 crossings in Southbury in Summer 2024.



*To read this report and others, visit [www.pomperaug.org/scientific-reports](http://www.pomperaug.org/scientific-reports)*

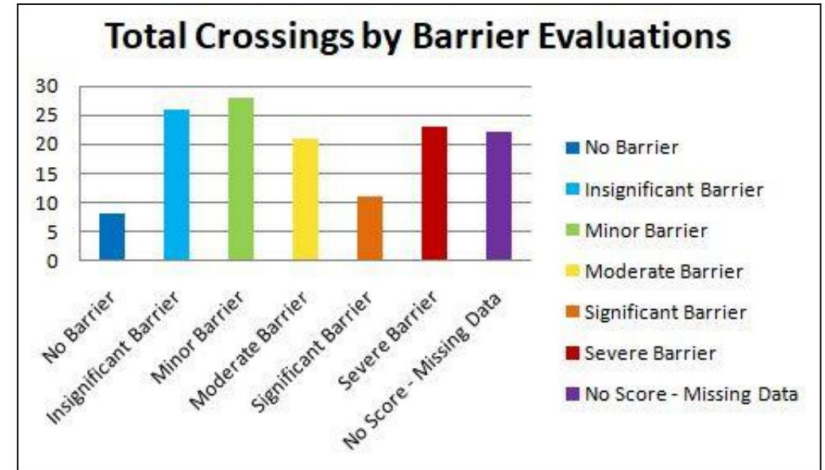


# Woodbury Assessment Results

Summary of Aquatic Organism Passage (AOP) Barrier Ratings for Road-Stream Crossings in Woodbury, CT as of July 2023

AOP Barrier Evaluation	Number of Crossings	Percentage of total*
No Barrier (full passage)	8	5.8%
Insignificant Barrier	26	18.7%
Minor Barrier	28	20.1%
Moderate Barrier	21	15.1%
Significant Barrier	11	7.9%
Severe Barrier	23	16.5%
No Score - Missing Data	22	15.8%
<b>Total</b>	<b>139</b>	<b>100.0%</b>

\*Values rounded to the nearest tenth of a percent



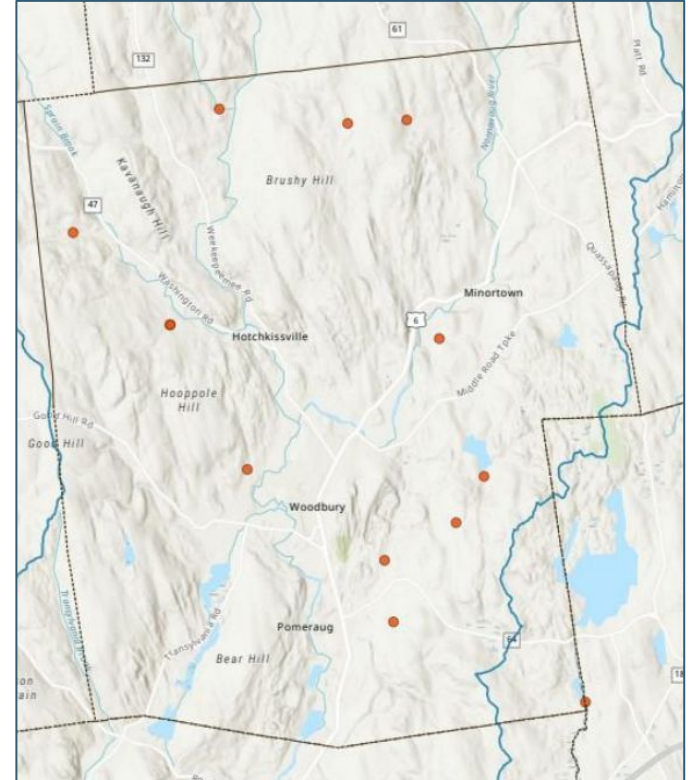
\*\*No score values can be contributed to fully or partially inaccessible crossings



# Woodbury Assessment Results

## High Priority Crossings for Infrastructure Improvements

Crossing Number	Road Name	Stream Name
xy4160214373229100	☆ Weekepeemee Road	Dowd Brook
xy4160104673191226	Church Hill Rd	Harvey Brook
xy4156947773239317	Hoop Pole Hill Road	Unnamed Stream off Sprain Brook
xy4154866173176309	White Deer Rock Road	Unnamed Stream off Cat Swamp Pond
xy4156939273184719	Minortown Road	Clark Brook
xy4154909273222915	Westside Rd	Unnamed Stream
xy4157046773237964	Sprain Brook Road	Unnamed Stream off Sprain Brook
xy4152623373192282	Hyland Ave	Unnamed Stream
xy4154160673181722	Tuttle Road	Unnamed Stream
xy4160037273203247	Church Hill Road	Unnamed Stream off East Meadow Brook
xy4153611473195547	☆ Joshua Hill Road	Unnamed Stream
xy4151553773155910	☆ Judd Hill Road	Eightmile Brook / Kelly Pond
xy4158398973257459	Painter Hill Rd	Unnamed Stream off Sprain Brook







# Weekeepeemee Rd/Dowd Brook

## Results:

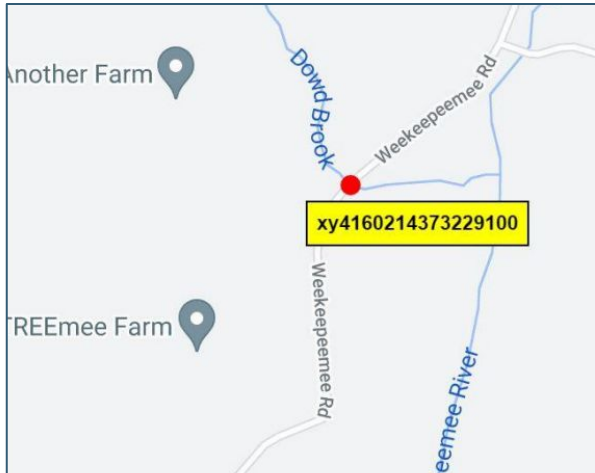
Barrier Evaluation: **Severe Barrier**

Crossing Condition: **Poor**

NAACC Aquatic Passability Score: **0.00**

AOP: **No AOP**

Rank: **#1**



## Comments:

- The stream is flowing under the culvert.
- Moderate sediment deposition was noted before the culvert inlet.
- The headwall at the inlet is leaning.
- The culvert segments have separated
- Severe constriction
- Large tailwater scour pool at outlet caused by freefall onto cascade outlet
- Culvert is not flow-aligned

**\*Outlet drop to the water surface: 2.9 ft**





# Joshua Hill Rd/Unnamed Stream

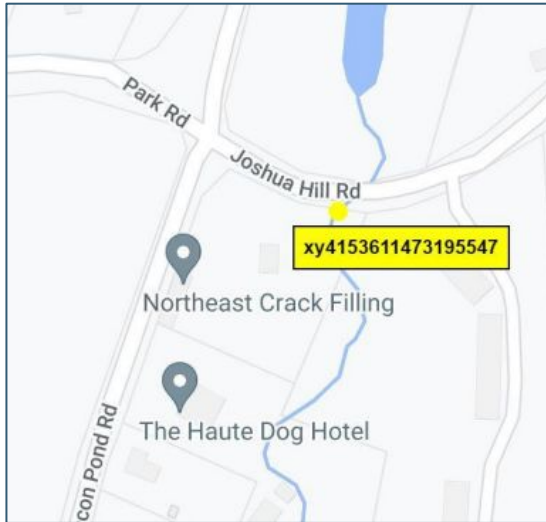
## Results:

Barrier Evaluation: **Moderate Barrier**

Crossing Condition: **OK**

NAACC Aquatic Passability Score: **0.45**

AOP: **No AOP**



## Comments:

- It appears that the stream may overtop the roadway in large rain events.
- Riprap is present around the culvert inlet
- The concrete headwall shows signs of deterioration
- There is a large tailwater scour pool at the outlet due to freefall (.1 ft drop).







# Judd Hill Rd/ Eighthme Brook (Kelly Pond)

## Results:

Barrier Evaluation: **No Score - Missing Data**

Crossing Condition: **OK**

NAACC Aquatic Passability Score: **No Score - Missing Data**

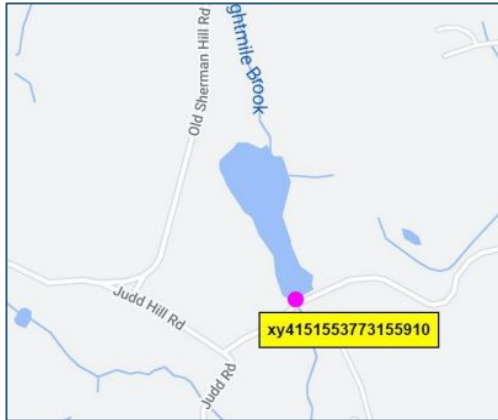
AOP: **No Score - Missing Data**

^ No score can be calculated because inlet is obscured



## Comments:

- Plant material is caught in the beaver grate at the culvert inlet resulting in a moderate debris/sediment barrier.
- Severe constriction
- Water can be seen flowing downstream from under the road, 140 ft east of the culvert outlet.
- ^A 1979 Dam inspection report by the Supt. of Dam Maintenance noted two culverts at Judd Hill Rd, so this flow could be the result of a collapsed second culvert.
- There is increasing development downstream
- The road above the culvert exhibits damage.







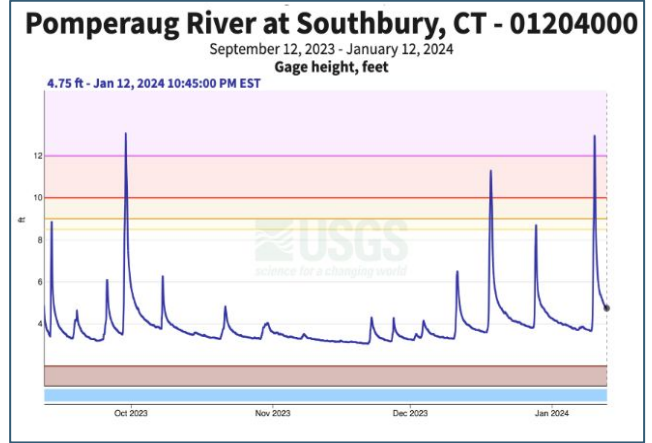
# Flooding 2023/2024



2023 was the 3rd wettest year on record for CT!



The impacts of flooding are intensified by aging and undersized stormwater infrastructure



Flood stages in ft



On January 10th, the Pomperaug River reached flood stage for the 5th time in 5 months! Flooding events occurred on Sept. 13th, Sept. 29th, Dec. 18th, and Dec. 28th, 2023 and Jan. 10th, 2024.



# Culvert Washouts





# What Can Be Done?

**Follow-up  
evaluation  
(engineering survey  
of existing  
conditions to  
evaluate flood  
hazard risk / storm  
design capacity)**

**Develop engineering  
plans following  
climate resilient  
practices to handle  
project storm return  
volumes**

**Look to see if other  
projects are already  
being planned for  
these roads and  
integrate  
infrastructure  
improvements into  
existing plans**

**Seek funding for  
replacements – look  
to community  
resiliency grant  
pools and  
infrastructure grants**





# Example of a Well-Designed/Sized Crossing

## Middle Quarter Rd & South Brook, Woodbury

### Results:

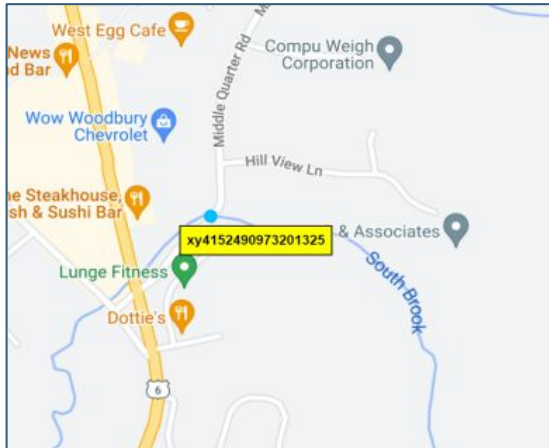
Barrier Evaluation: **Insignificant**

Barrier

Crossing Condition: **OK**

NAACC Aquatic Passability Score: **.97**

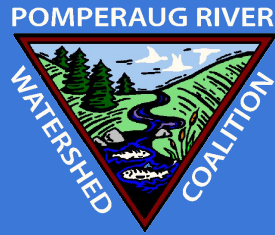
AOP: **Full AOP**



### Positive Characteristics:

- The culvert spans the **full width of the active channel** and does not constrict the streamflow at typical flows.
- The inlet and outlet are both **at stream grade**, allowing fish and other aquatic organisms to pass through safely.
- **No scour** or need for additional armoring.
- The culvert being **flow-aligned** instead of skewed ( $>45^\circ$ ) reduces bank and culvert erosion and maintains proper streamflow direction and velocity.
- The **100% cobble substrate** at base of the culvert matches that of the stream and aids organism passage through the structure.
- **No physical barriers** restrict streamflow/aquatic organism passage.
- The stream's water **depth and velocity are maintained** through the structure.

# Thank you!



# Questions?

For more information visit [www.pomperaug.org](http://www.pomperaug.org)  
or email us at [outreach@pomperaug.org](mailto:outreach@pomperaug.org)

