



Right Size that Culvert!

A Practical Overview of Right-Sizing
Considerations



Today's To-Do List

- 1) Basic overview of NAACC.
- 2) Understand basic stream principles
- 3) Recognize common features of an Undersized Crossing
- 4) Recognize common features of Passage Barriers
- 5) Identify factors that guide Right Sizing Designs
- 6) Identify Resources for Assistance.

QUESTION: HOW MANY CULVERTS DO YOU DRIVE OVER EVERY DAY?
I cross 9 culverts on the 5 mile drive to school drop off!



NAACC Road Stream Crossing Assessments

- Methodology to Identify and Assess Road Stream Crossings.
- Conducted by trained observers (SWCDs, DEC, Nonprofits: TU, TNC)
- Record features of crossings, ie:
 - Location,
 - Size,
 - Type,
 - Condition,
 - Alignment
 - Constriction
- Rate the passage capability of the crossing.
- Serves as Level 1 Prioritization for future work.
- <https://streamcontinuity.org/naacc>





NAACC Data Center

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



Welcome to the NAACC Data Center!

This website stores all the North Atlantic Aquatic Connectivity Collaborative data in Excel or Shapefile format without logging on. If you are logged on, pages will show your user data and download the [Offline Data Manager](#). Only certified NAACC users can access the page.

About the NAACC

The [NAACC](#) is a network of individuals from agencies and organizations working together to assess crossings (culverts and bridges) to assess and score crossings for fish and wildlife passage.

Contact

contact@naacc.org

Anyone can access the data compiled about crossings in their area of interest.

How to use the online NAACC Tool



Stream Crossing Explorer (SCE):

To analyze search results with the SCE, check the box before choosing your search parameters.

Note that **only** parameters still showing after checking the box will be used for your search. ☐

Location (choose multiple towns, watersheds):

New York [30155] ▼

Chatham [365]
Chautauqua [0]
Chazy [55]
Cheektowaga [0]

All NY streams ▼

All NY Watersheds
Ausable River
Black
Bronx

Personnel:

Any Observer ▼

Any Coordinator ▼

Other:

Survey ID:

Crossing Code:

All NAACC Evaluations ▼

25 per page ▼

Choose Data Sets (choose multiple):

Non-tidal Connectivity Assessments
NAACC (after 6/1/2015)
UMass Stream Continuity Project (2005-2017)
Connecticut (2004-2013)
Vermont (11/20/2002-10/29/2015)
Maine (2007-2015)
New Hampshire (2006 - 2016)
Subsistence Assessments

Dates:

"Date observed" is not available

Last updated from ...

All

Last updated until ...

All

Date observed from ...

All

Date observed until ...

All

Search

Lat/Long
of crossing

Showing 400 Records , 25 per page.

Sort by any field

[Next \[375\]](#)

Survey ID	Crossing Code	Date Observed	Last Updated	Town	Stream	Road	Evaluation	Culvert
30188	xy4248665773558329	2016/05/03	2016/05/09	Chatham NY	unnamed	ny 66	Significant barrier	1
30189	xy4248586873559350	2016/05/03	2016/05/09	Chatham NY	unnamed	ny 66	Severe barrier	1
30190	xy4248570873560038	2016/05/03	2016/05/09	Chatham NY	unnamed	ny 66	Severe barrier	1
30191	xy4248053573566544	2016/05/03	2017/12/05	Chatham NY	Green Brook	ny 66	Insignificant barrier	1
30204	xy4247573173580307	2016/05/05	2016/05/09	Chatham NY	unnamed	Pratt Rd	Severe barrier	1
30205	xy4247130673589800	2016/05/05	2016/05/09	Chatham NY	Unnamed	Hoes Rd	Insignificant barrier	1
30206	xy4247546973591246	2016/05/05	2016/05/09	Chatham NY	unnamed	Albany Turnpike Rd	Severe barrier	1
30207	xy4248208473573541	2016/05/05	2016/05/09	Chatham NY	unnamed	Bachus Rd	Severe barrier	1
30208	xy4248251573575342	2016/05/05	2016/05/09	Chatham NY	unnamed	Pratt Rd	Severe barrier	1
30209	xy4248085273572944	2016/05/05	2016/05/09	Chatham NY	unnamed	driveway off Bachus Rd	Significant barrier	1
30210	xy4248110573573150	2016/05/05	2016/05/09	Chatham NY	unnamed	driveway off Bachus	Moderate barrier	1
30211	xy4248419973575398	2016/05/05	2016/05/09	Chatham NY	unnamed	Fredenberg Rd	Moderate barrier	1
30212	xy4247739773578641	2016/05/05	2016/05/09	Chatham NY	unnamed	Pratt Rd	Severe barrier	1
30213	xy4248460173574853	2016/05/05	2016/05/09	Chatham NY	unnamed	Pratt Rd	Severe barrier	1
30215	xy4248064873575619	2016/05/05	2016/05/09	Chatham NY	unnamed	Pratt Rd	Moderate barrier	1
30396	xy4246992573532314	2016/05/13	2016/05/18	Chatham NY	unnamed	County Rd 13	Severe barrier	1
30397	xy4246961273529636	2016/05/13	2016/05/18	Chatham NY	unnamed	County Rd 13	Significant barrier	1
30398	xy4246981873527374	2016/05/13	2016/05/18	Chatham NY	Green Brook	County Rd 13	Severe barrier	1
30399	xy4247429273523312	2016/05/13	2016/05/18	Chatham NY	unnamed	County Rd 13	Significant barrier	1
30400	xy4247450973523392	2016/05/13	2016/07/26	Chatham NY	unnamed	private driveway off county rd 13	no score - missing data	0
30401	xy4247921373521869	2016/05/13	2016/05/18	Chatham NY	unnamed	County Rd 13	Significant barrier	1
30402	xy4247170673525317	2016/05/13	2016/05/18	Chatham NY	unnamed	County Rd 13	Minor barrier	1
30403	xy4248307973539440	2016/05/13	2016/05/18	Chatham NY	unnamed	Ashley Hill Rd	Moderate barrier	1
30404	xy4248180973540082	2016/05/13	2016/05/18	Chatham NY	unnamed	Ashley Hill Rd	Severe barrier	1
30428	xy4244483873565854	2016/05/20	2016/05/20	Chatham NY	unnamed	Albany Turnpike Rd	Severe barrier	1

[Next \[375\]](#)

Survey Id: 30206 Crossing Code: xy4247546973591246
AOP Coarse Screen: No AOP NAACC Aquatic Passability Score: 0.11
Data checked and accurate by Josh Thiel on 07-20-2016



xy4247546973591246(downstream)5-5-16.jpg



xy4247546973591246(inlet)5-5-16.jpg



xy4247546973591246(outlet)5-5-16.jpg



xy4247546973591246(upstream)5-5-16.jpg

Non-tidal Aquatic Connectivity Crossing Data

Database Entry By: No data
Coordinator: Josh Thiel
GPS to Crossing Distance (meters): 0.0
Crossing Code: xy4247546973591246
Date Observed: 05-05-2016
Town/County: Chatham, NY
Road: Albany Turnpike Rd
GPS: Lat: 42.47547, Long: -73.59125
Location Description: intersect albanys turnpike rd and syring rd
Crossing Type: Culvert
Flow Condition: Moderate
Tidal Site: No
Road Fill Height (feet) : 3
Bankfull Width Confidence: No data
Tailwater Scour Pool: Large
Crossing Comments: stream takes 90 degree turn left downstream

Entry Date: 05-09-2016
Last Updated: 05-09-2016
NHD-HUC8 Watershed: Middle Hudson
Local ID: No data
Lead Observer: Erica Capuana
Stream/River: unnamed
Type: Paved

Number of Culverts/Bridge Cells: 1
Crossing Condition: OK
Alignment: Flow-Aligned
Bankfull Width (feet): No data
Constriction: Severe

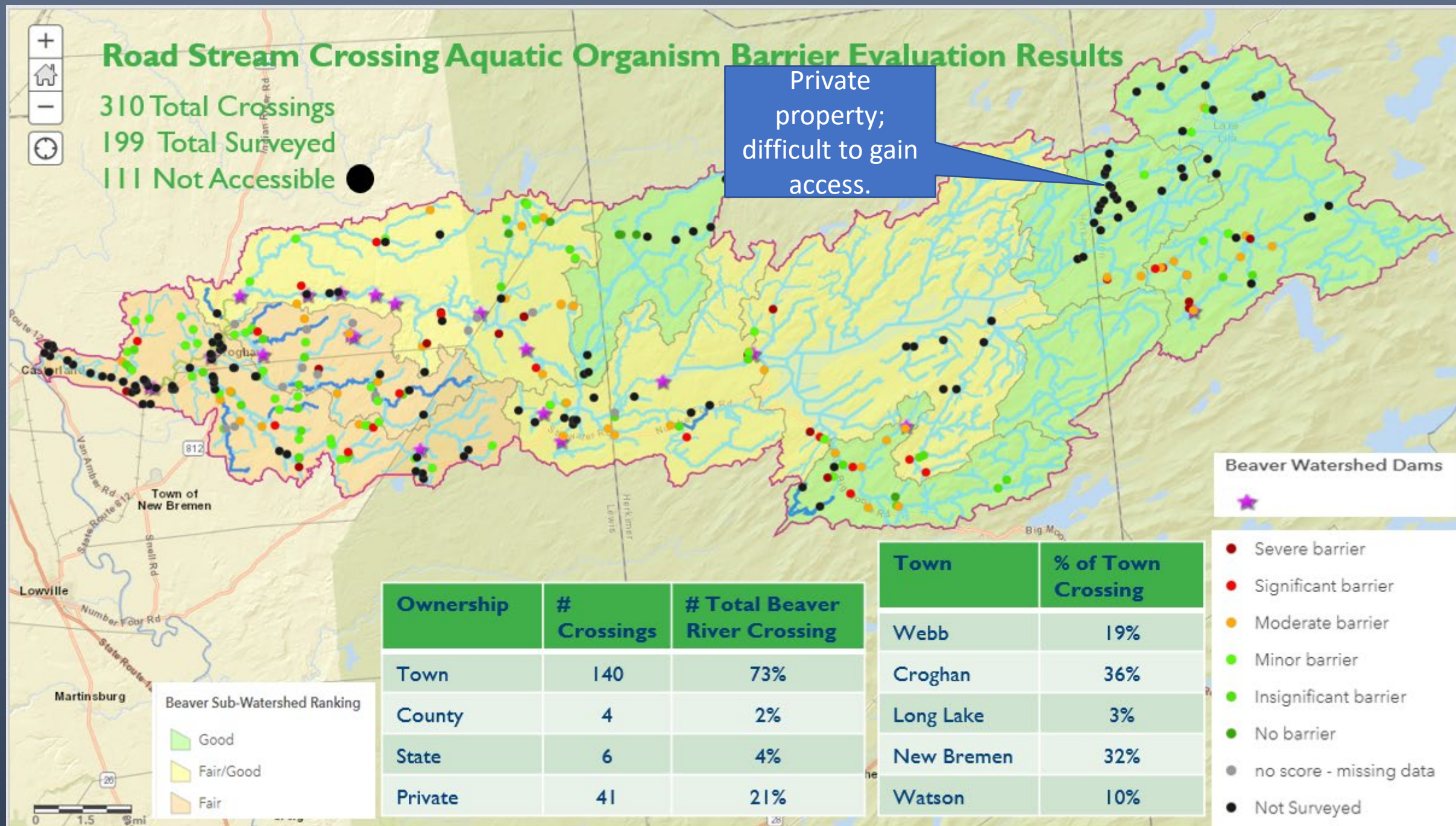
Evaluation of this stream crossing is estimated as: **SEVERE BARRIER**

- Great baseline information.
- Identifies priorities.
- Next steps:
 - Connect with highway supers,
 - Assess from a design/build standpoint.
 - Funding & Access are critical.

Road Stream Crossing Aquatic Organism Barrier Evaluation Results

310 Total Crossings
199 Total Surveyed
111 Not Accessible

Private property;
difficult to gain access.



Prioritization - Multiple Objectives to Prioritize Sites

Municipal Priority

- Maintenance Issues:
(Wood, boulders)
- Public Safety Concerns
 - Flooding
 - Failing structure
(headwalls,
wingwalls, road)



Ecological Priority

- Aquatic Passage
- Priority Watershed
- Miles reconnected
- Habitat Quality
- Brook trout value
- Freshwater Type
- WQ Standard

Community Priority

Current Flood Risk
Future Flood Risk

What can go wrong with an undersized crossing?

- Public Safety Hazards
- Costly Maintenance
- Frequent Response/Maintenance Efforts
- Property Damage, and
- **Habitat Disconnection**



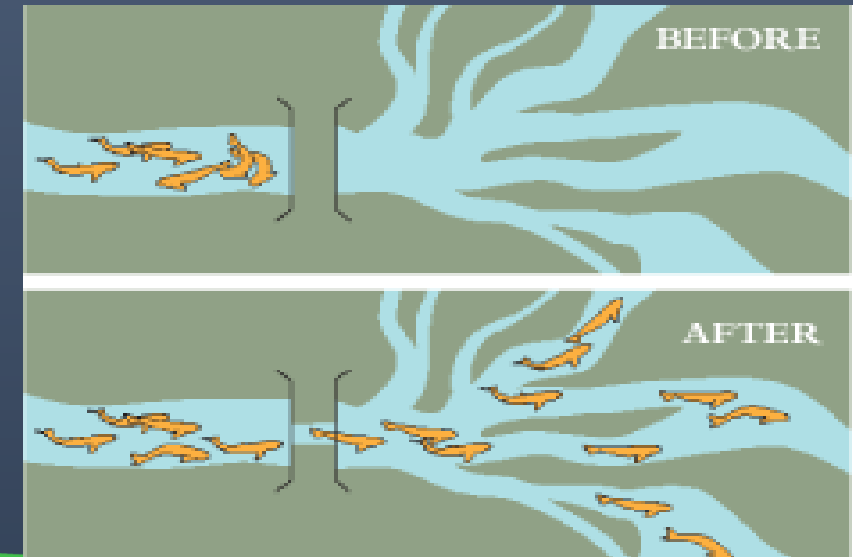
Trout and other aquatic organisms need connected streams to thrive and to complete their life cycle.



Access driveway required to hog out material -even in small events.



Undersized culvert failed in large event and took road with it.



Stream Basics: What is a Watershed?

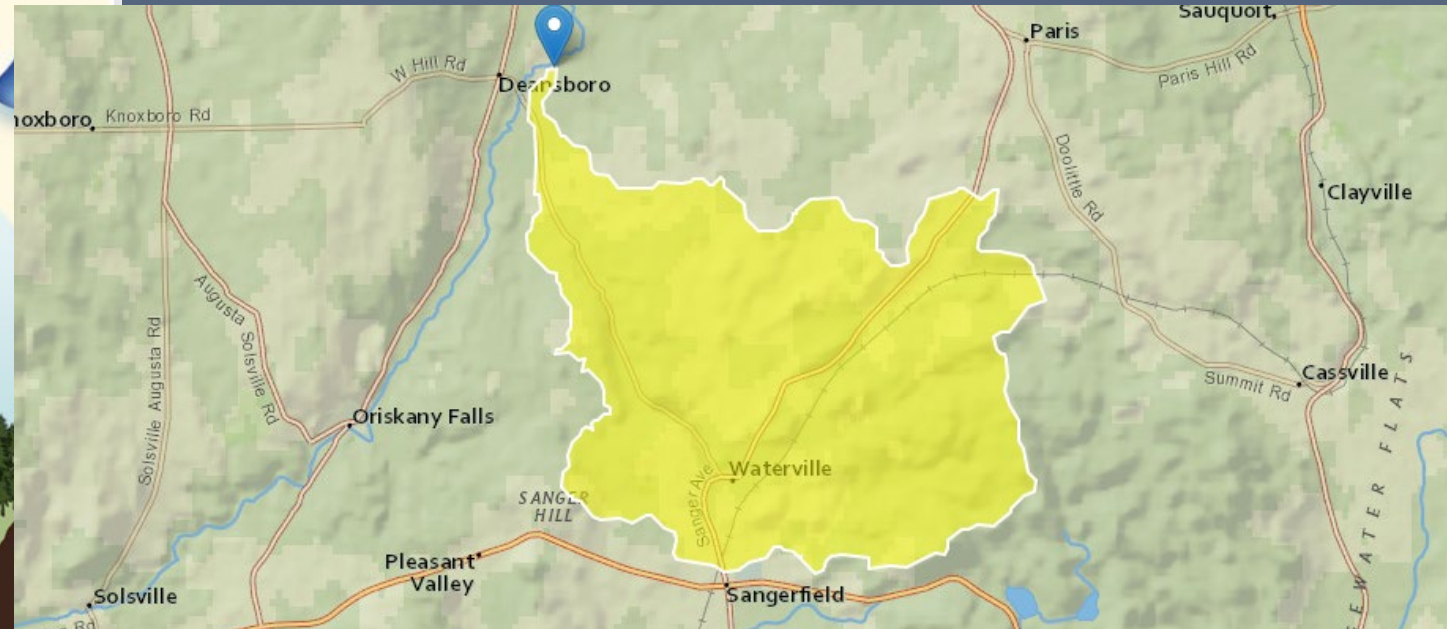


WHAT IS A WATERSHED?

The Making of a River



Center for Watershed Protection



Stream appearance is a partly a function of watershed properties:

LAND USE: ie, % forested, % developed, % ag

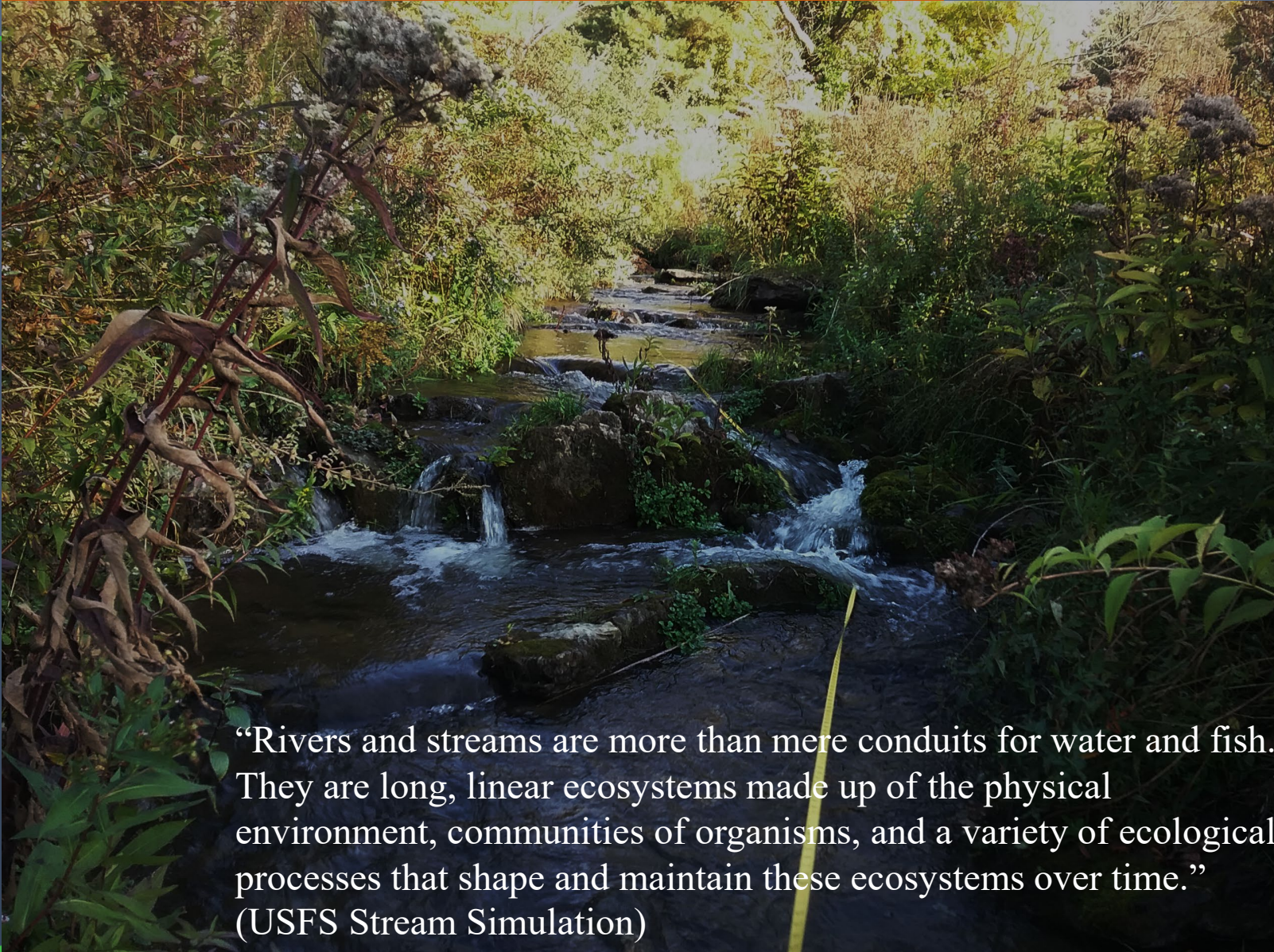
SOILS

SLOPE: Mountains? Rolling Hills? Flat?

SHAPE

PRECIPITATION

Streams are dynamic, living systems!



“Rivers and streams are more than mere conduits for water and fish. They are long, linear ecosystems made up of the physical environment, communities of organisms, and a variety of ecological processes that shape and maintain these ecosystems over time.”
(USFS Stream Simulation)

Stable streams convey flows and transport sediment without excessive erosion or deposition.

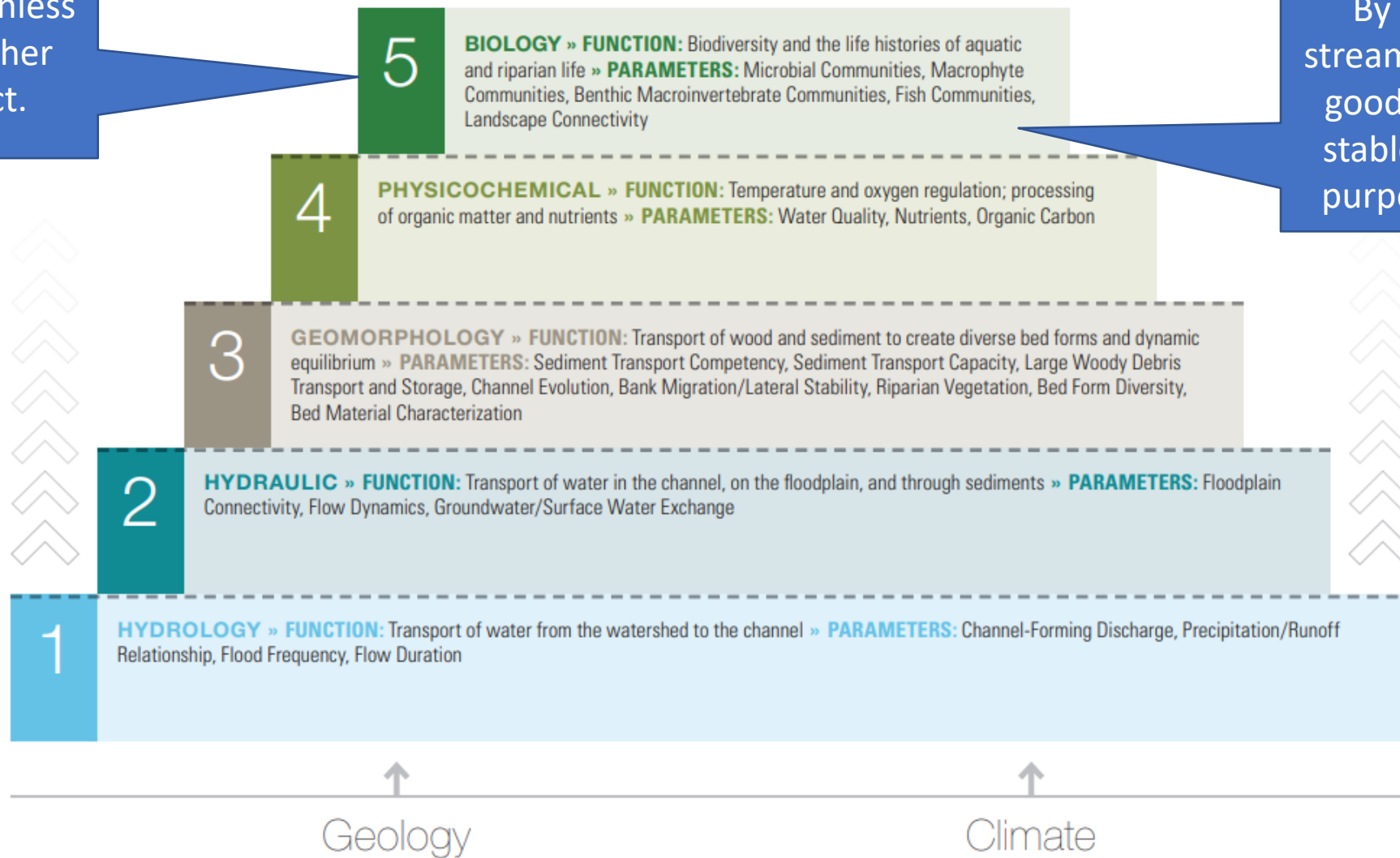
They are stable for **both** the human community and the aquatic and terrestrial organisms that reside there.

Stream Functions Pyramid

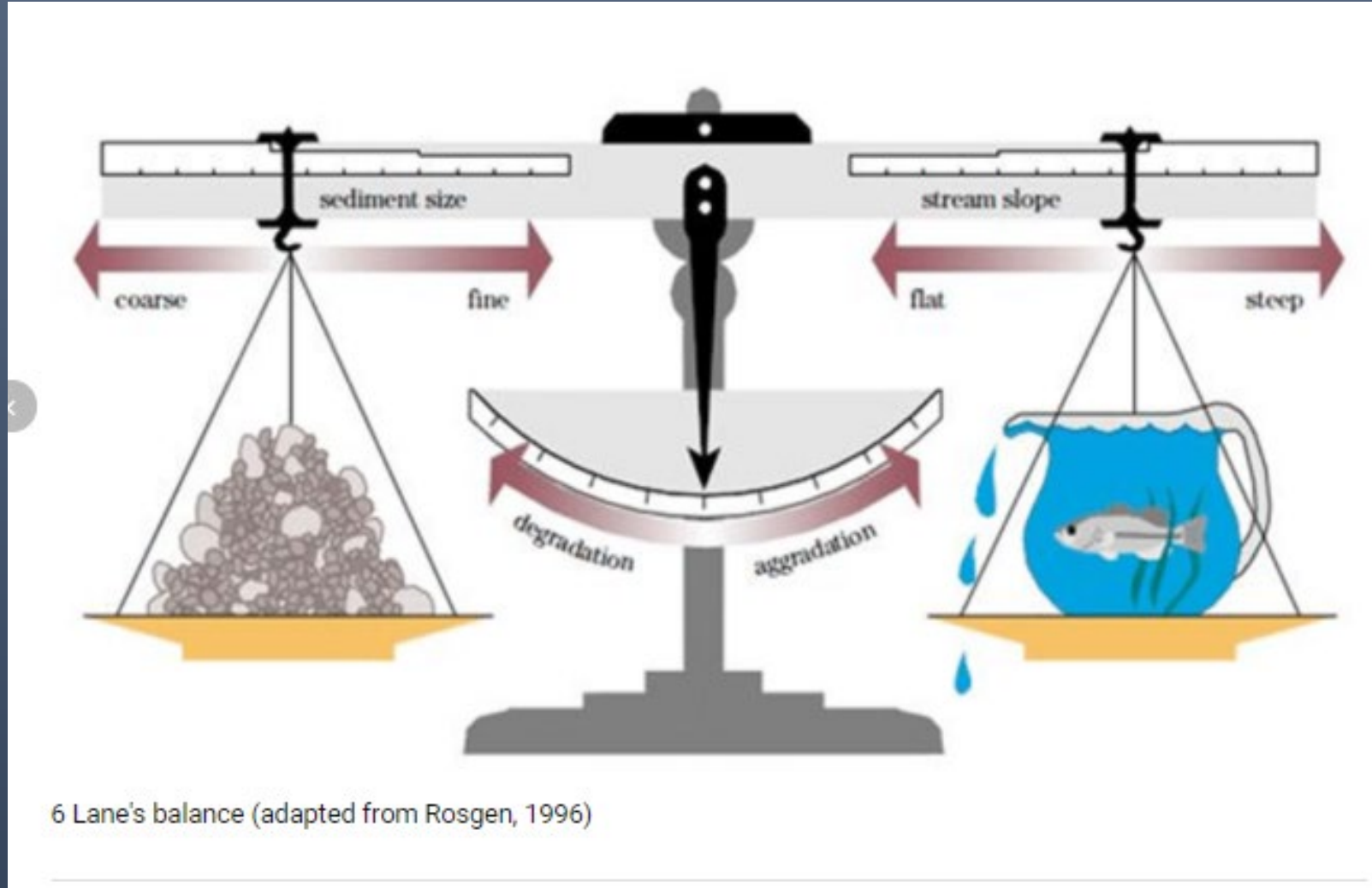
A Guide for Assessing & Restoring Stream Functions » FUNCTIONS & PARAMETERS

We can't achieve good habitat unless we get the other steps correct.

By the time a stream can support good habitat, it's stable for human purposes as well.



Streams move Water AND Sediment.
A Stable Stream BALANCES water flow and sediment transport.



Sediment:

Streambank erosion
Streambed incision
Landslides
Surface erosion

DEPOSITION

Water:

Rainfall
Snowmelt
Stormwater
Drainage
Loss of Greenspace

**EROSION OF BED
AND BANKS!**

What does a Stable Stream Look Like?



Balances flows and sediment transport.
Maintains dimensions and pattern in multiple storms.
Has access to a vegetated floodplain.
Vegetation creates roughness to slow flow.
Bridge doesn't squeeze channel.



Floodplains spread out and slow down flows
and trap sediment.

No Excessive Erosion or Deposition Present!

Stable Streams are good for everyone!



Unstable: Deposition – Sediment Transport Problems.



Unstable: Over-wide

- Upstream erosion or bed failure.
- Center Bar Deposition upstream of crossing where energy is low.
- Crossing acts like a dam.
- Center bar splits channel
- Both banks become unstable.
- More sediment delivered downstream.

Unstable: Incision (Bed Scour): Erosion Mobilizes Sediment.



Unstable:

- Bed Scour (Incision) caused by undersized culvert.
- Stream is overly narrow, no floodplain, digs deeper.
- Wing Wall is collapsing.
- When the bed fails, the banks fail.
- Driveway and Road are at the top of the bank!
- Sediment delivered downstream.





Top Priority: Reconnect to Floodplains!

Floodplain Function: Slow it down! Spread it out!

- Vegetation creates roughness. Roughness slows down the water and traps sediment.
- Slow water is less erosive!
- Floodwater spreads out and absorbs into the soil.
- No floodplain = more energy stays in the stream = more erosion = more sediment bars.
- **If this was bermed, the flow and sediment would be forced downstream.**





No Floodplain:

- Channelized,
- Moved to make room for a parking lot,
- No floodprone area,
- Undersized culvert
- Road floods,
- Downstream home incurs flood damages.

No Floodplain:

- Incised channel
- Flows cannot reach a floodplain;
- Banks undermined.
- Property Damage
- Deposition above crossing.
- **HEADCUTTING VIDEO!**





Headcutting



Removal of beaver dam triggered a headcut that moved upstream into the tributary. Approx. 2'.



How Can You Tell if a Crossing is Undersized?

Crossing is narrower than Bankfull width:
Bankfull width here is ~15', but the pipe is 5' diameter...



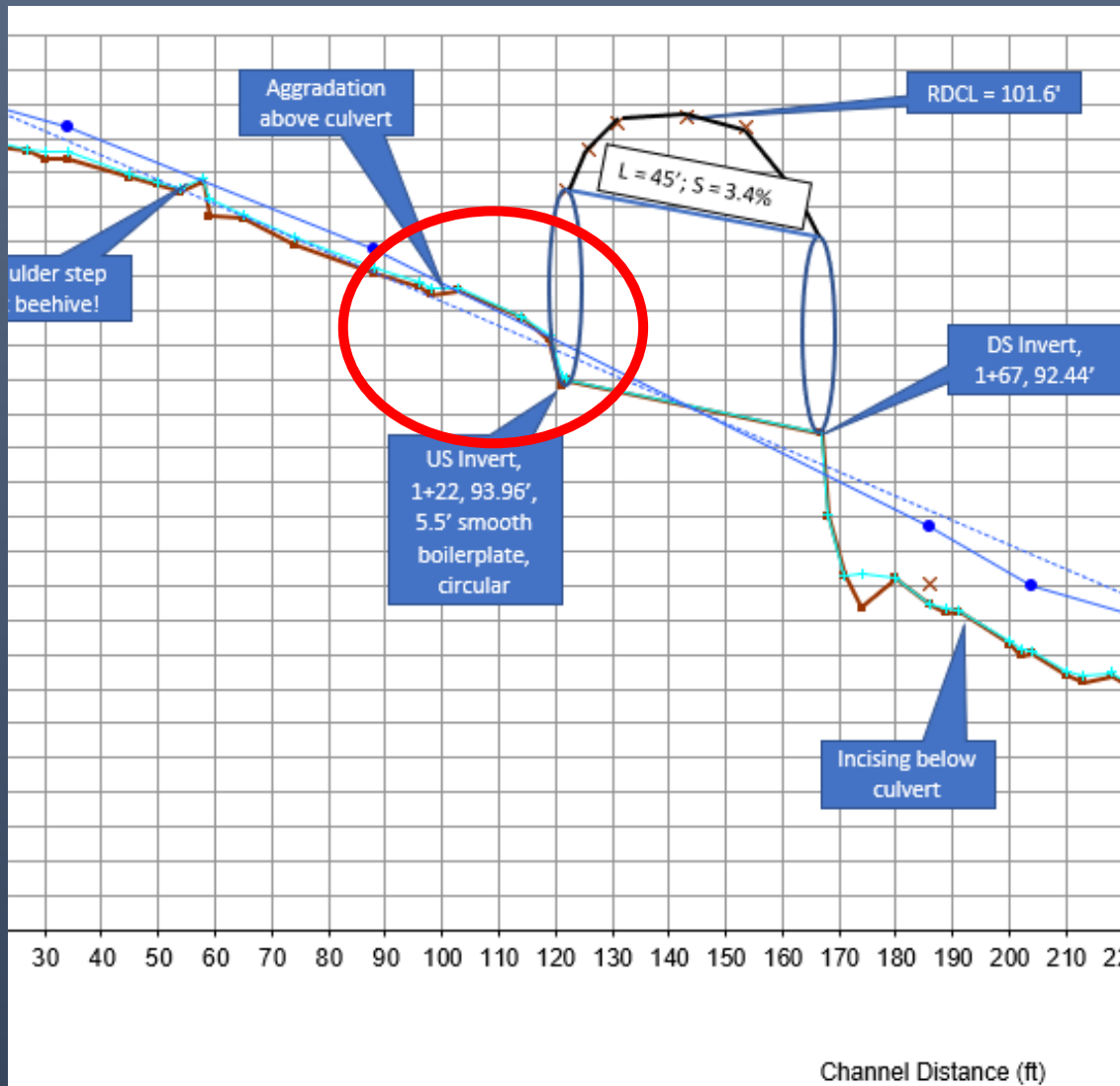
WHY BANKFULL?

- Channel forming flow
- Enable debris to pass without clogging.
- Make crossing invisible to stream.
- CAUTION: Wetted Width $\neq$ Bankfull Width
- Find Bankfull width ABOVE the influence of the road.



STATE & FED: New Xing 1.25x BF Width!

Undersized Crossing: Acts like a dam on upstream side.
Deposition at the inlet leads to post storm dredging.



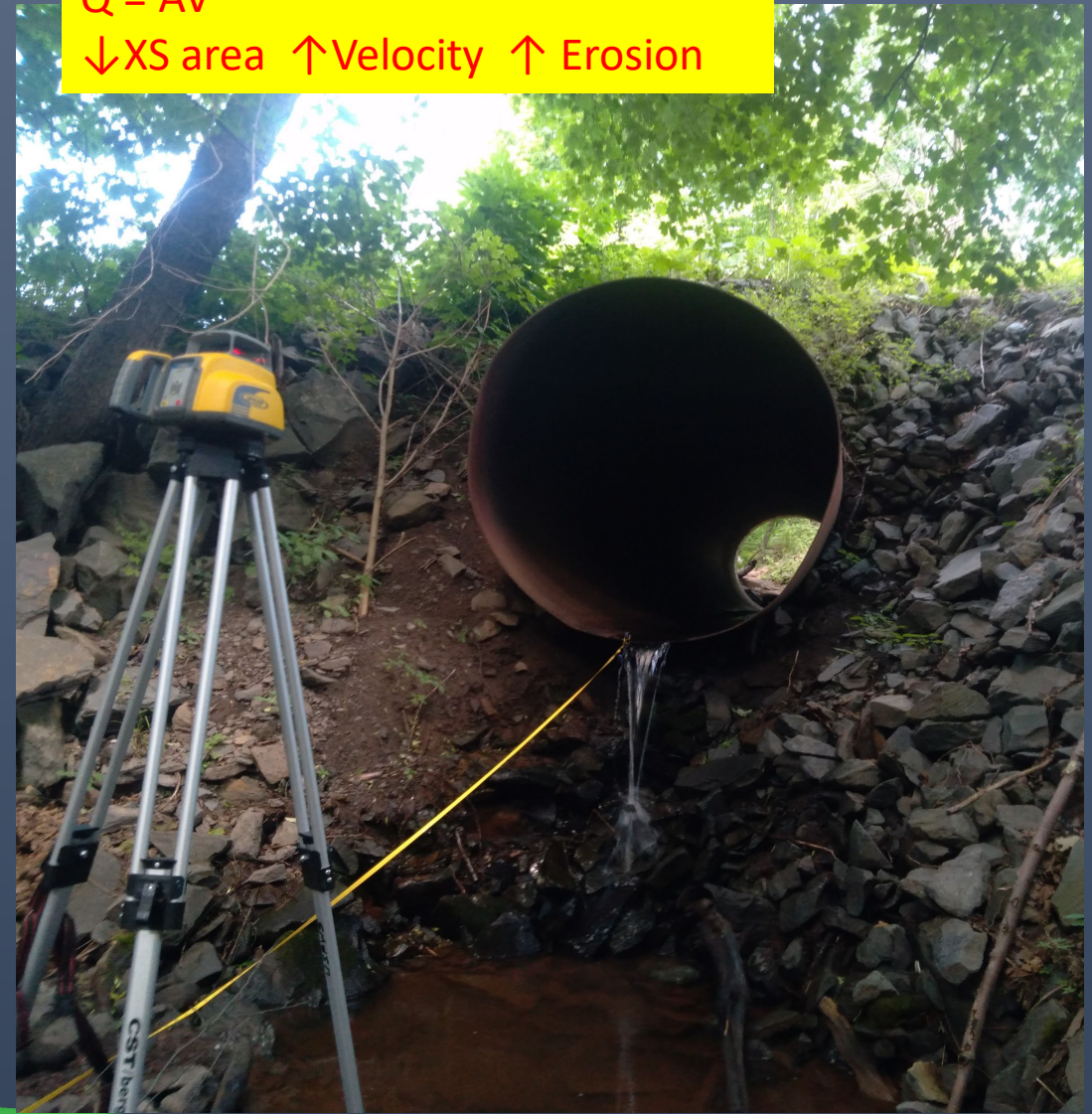
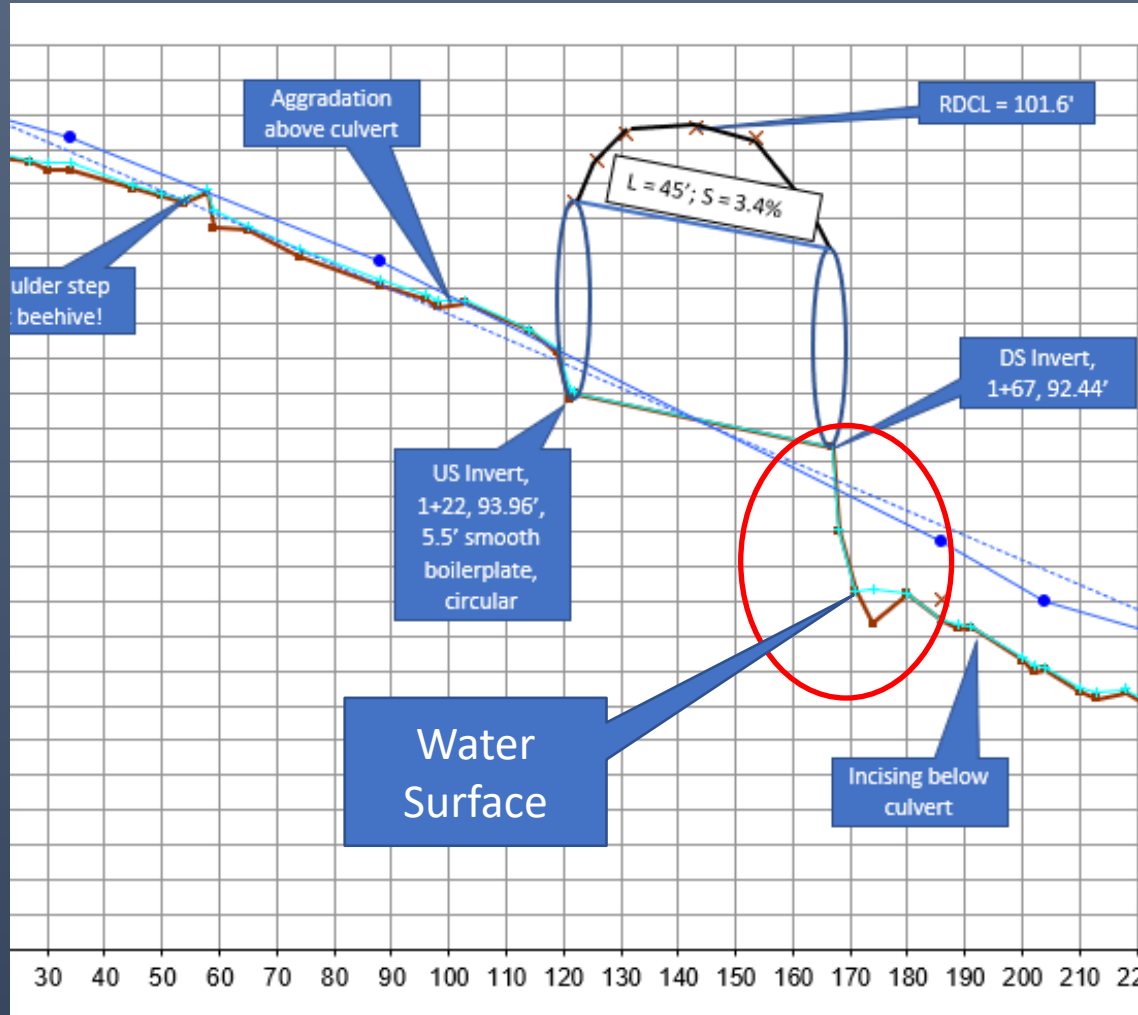
Undersized Crossing:

Perched culvert: High Velocity at outlet = High Scour.



$$Q = AV$$

↓XS area ↑Velocity ↑Erosion



Undersized Crossing

Oversized pool at outlet.

Not a Barrier...yet – Important to work toward ensuring that the **Replacement** doesn't become a Barrier!



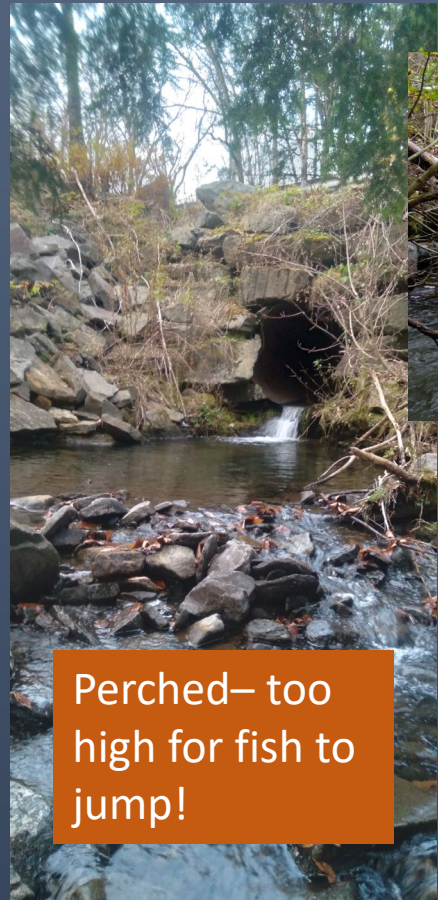
Prevention of a Barrier is Just As Important!



SMOOTH INTERIOR ROUND PIPES AT GRADE ARE VERY LIKELY TO BECOME BARRIERS!!!
High velocity through smooth culvert scours the outlet, erodes the bed and creates the barrier.

Aquatic Organism Passage Barriers

- Perched culverts: Free fall >0.7 feet is not passable for most native trout.
- High Velocity: Less than 3 feet/second is ideal.
- High Turbulence
- Shallow Depth: Low flow channel in natural bed is ideal.
- Long Distance (ie, length of pipe): The longer the pipe, the more difficult to make it through the barrel.



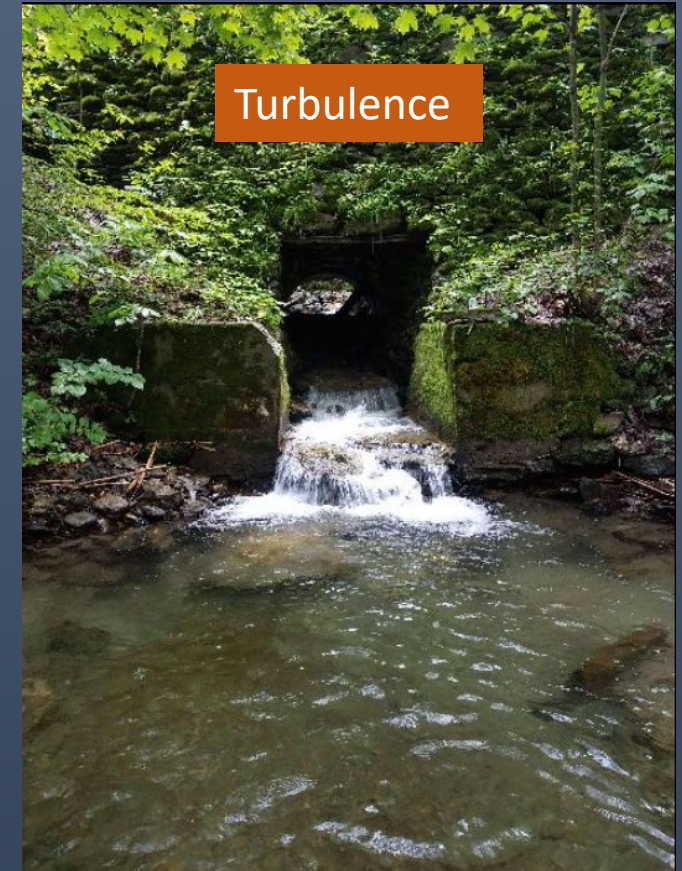
Perched— too high for fish to jump!



Perched and HIGH Velocity

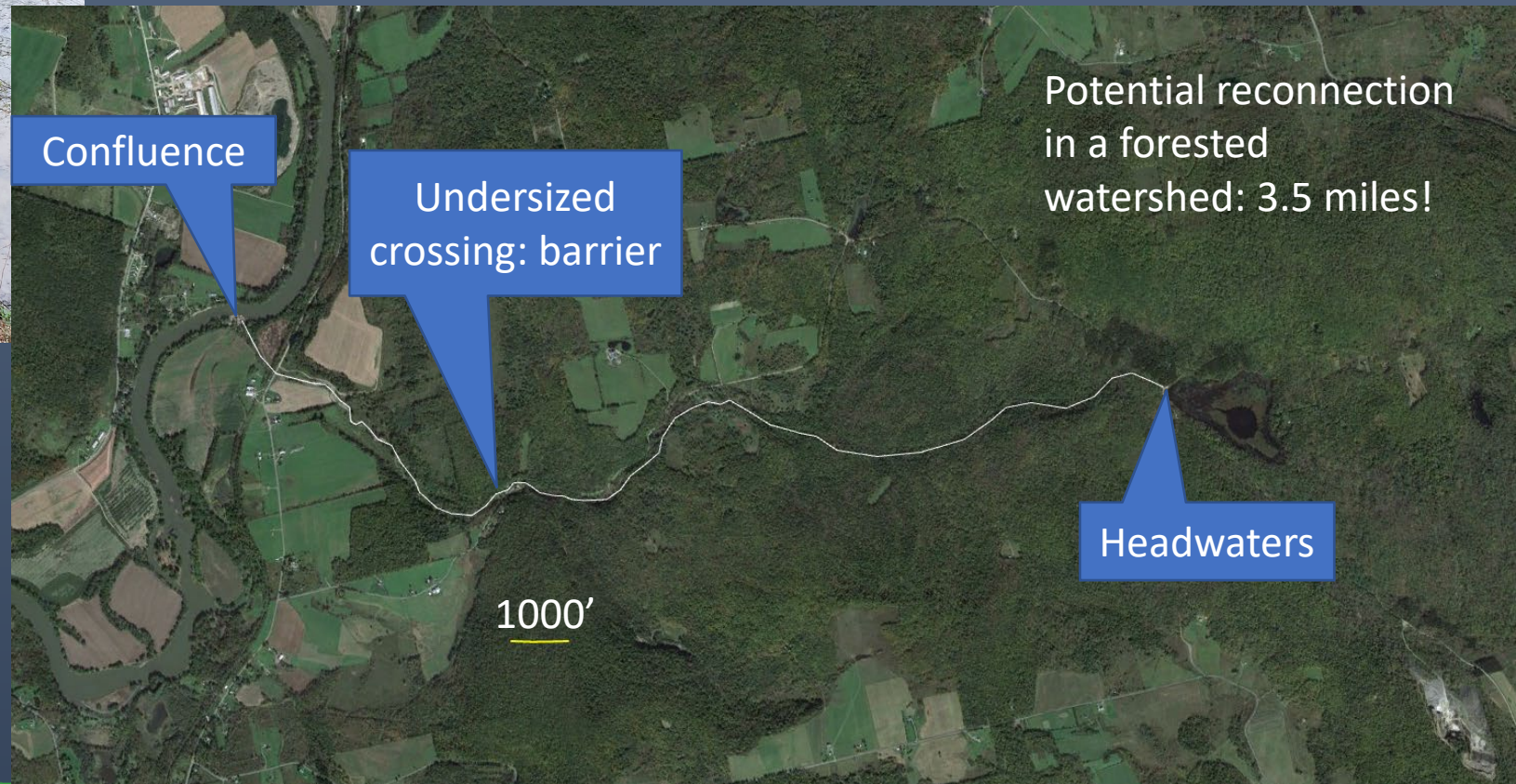


Perched and shallow; no natural bed.



Turbulence

ECOLOGICAL CONSIDERATIONS: HOW MANY MILES OF RECONNECTION ARE POSSIBLE?



Common Goals for a Right Sized Crossing



- Safe structure for the public.
- Provide capacity for future events.
- Reconnected habitat for native species.
- Limited maintenance needs.
- Affordable installation.
- Minimal disruption in road access.
- Stable stream reach.
 - Make the crossing invisible to the stream.
 - Natural, stable bed with ample span to convey flows and debris.
 - Diverse bed features



Considerations for Right Sizing a Crossing



- **Cost:** Should not be first on list but economic realities exist!
- Bankfull Dimensions
- Capacity: Flow, Sediment, Wood
- Alignment
- Cover
- Utilities
- Access:
 - Municipal ROW
 - Landowner permission
- Time
- PERMITTING!



Information to Collect: Site History



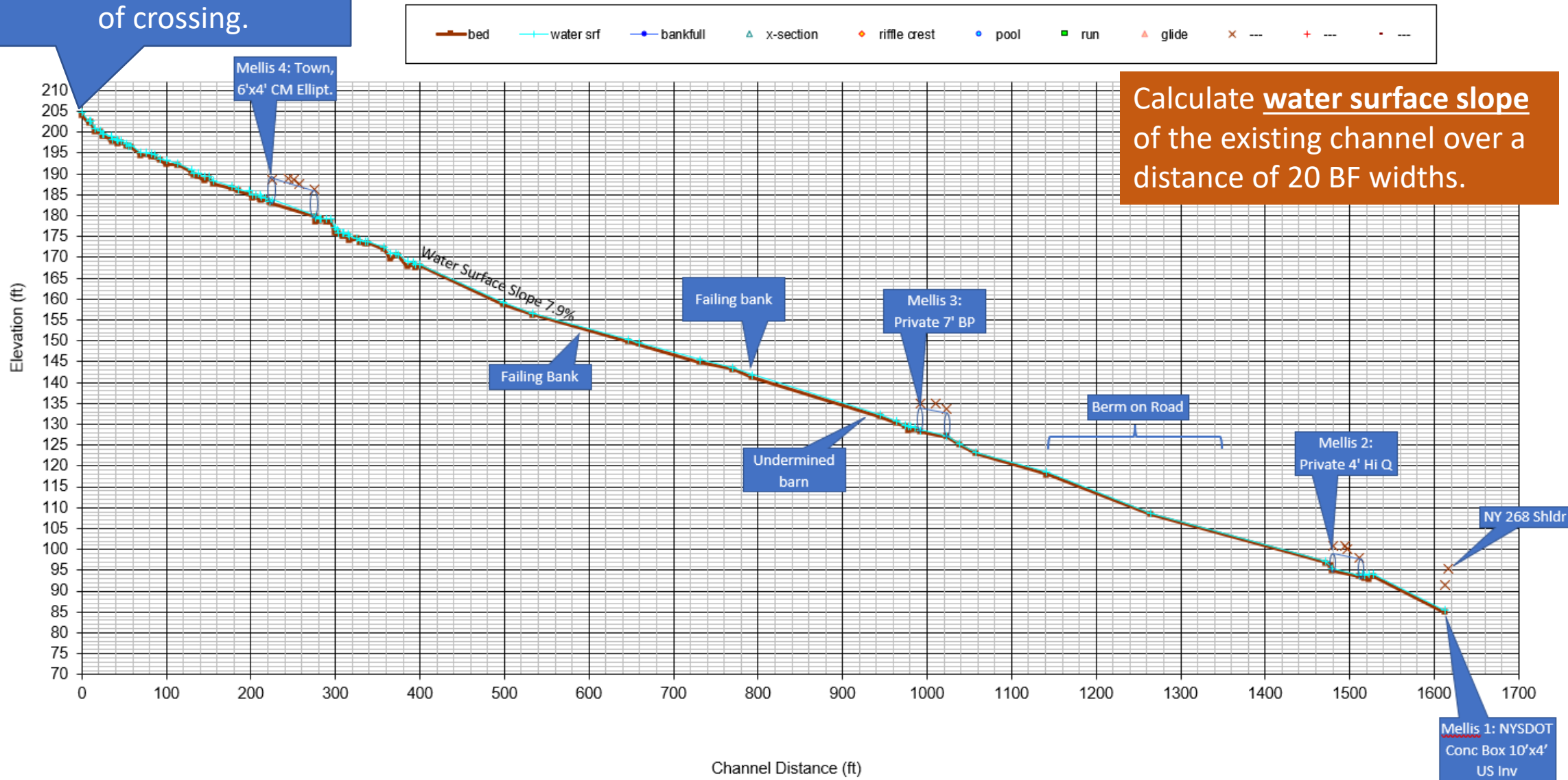
- Property Ownership
- Road ROW
- Wood
- Ice
- Flooding
- Road Closure
- Property damage (private and public)



Information to Collect: Longitudinal Profile

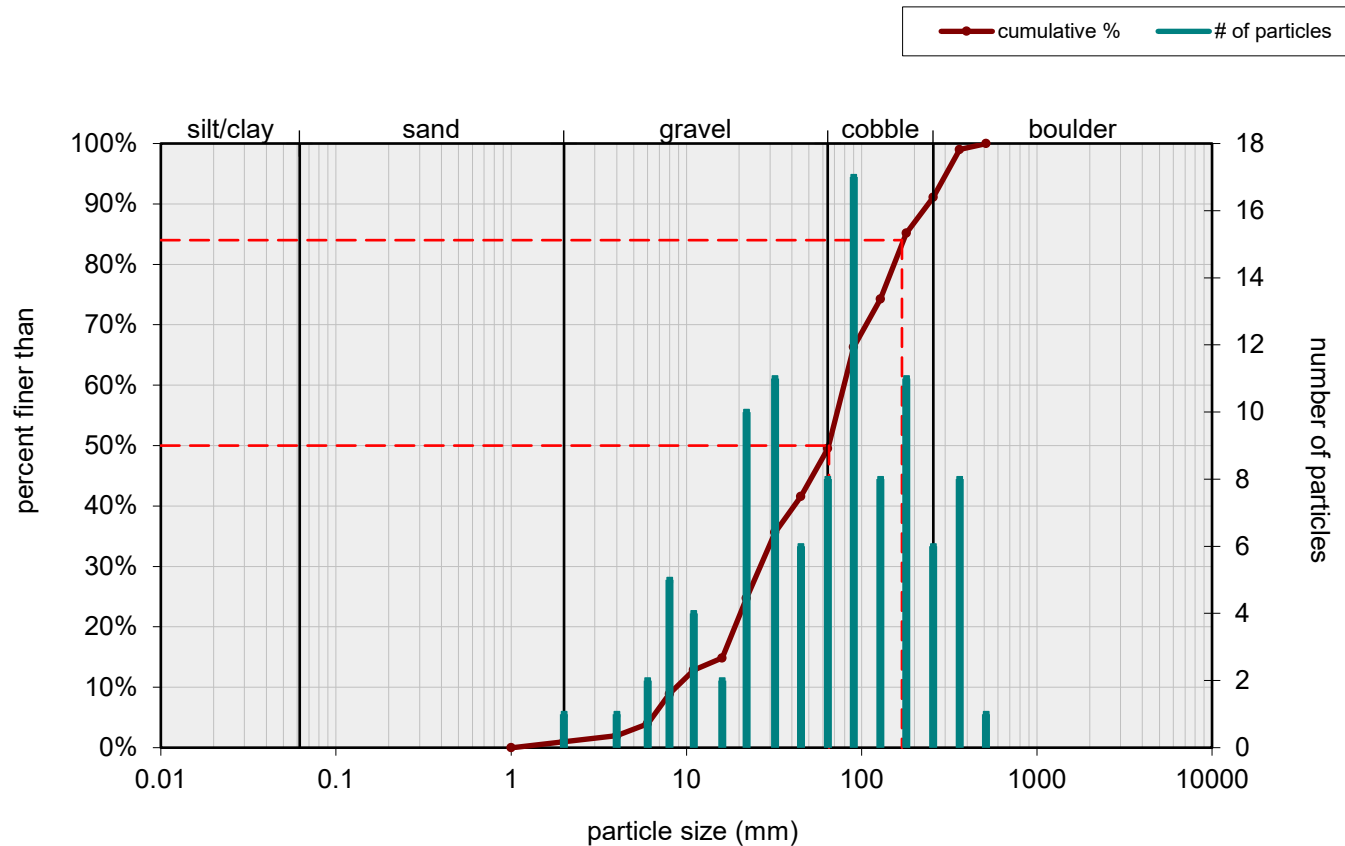


Capture above influence of crossing.



Information to Collect: Pebble Count

Riffle Surface Pebble Count, Federal Hill

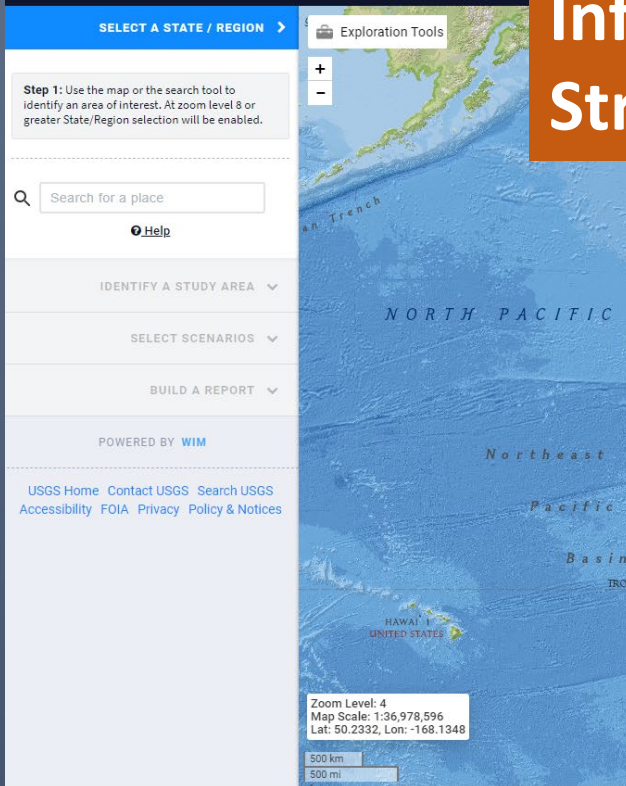


- What size moves in which event?
- Helps calculate Shear Stress and Stream Power
- Helps determine what size boulders to use for grade controls.

Size (mm)	
D16	17
D35	31
D50	65
D65	88
D84	170
D95	300

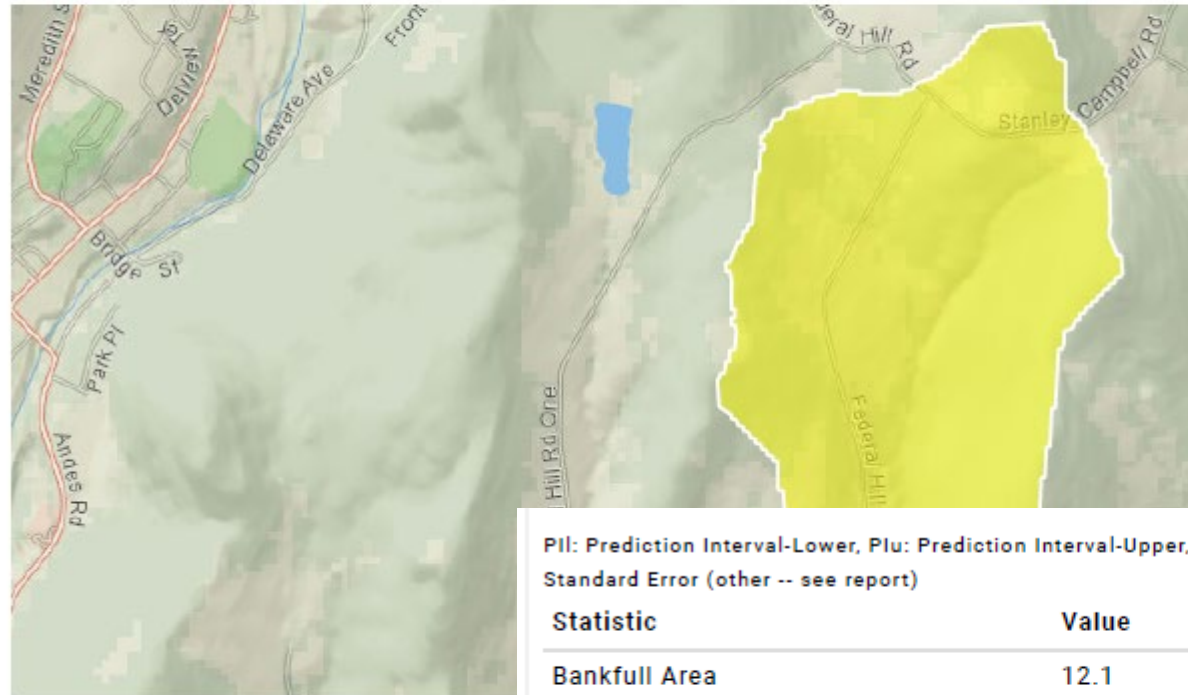


Information to Collect: Stream Dimensions



StreamStats Report:

Region ID: NY
 Workspace ID: NY20191015195337950000
 Clicked Point (Latitude, Longitude): 42.26261, -74.87371
 Time: 2019-10-15 15:53:53 -0400



Bankfull Dimensions:

- Difficult to identify bankfull in a degraded reach!
- Identify bankfull based on veg, sed, capacity, etc.

State and Federal Permits:
1.25x BF Width!

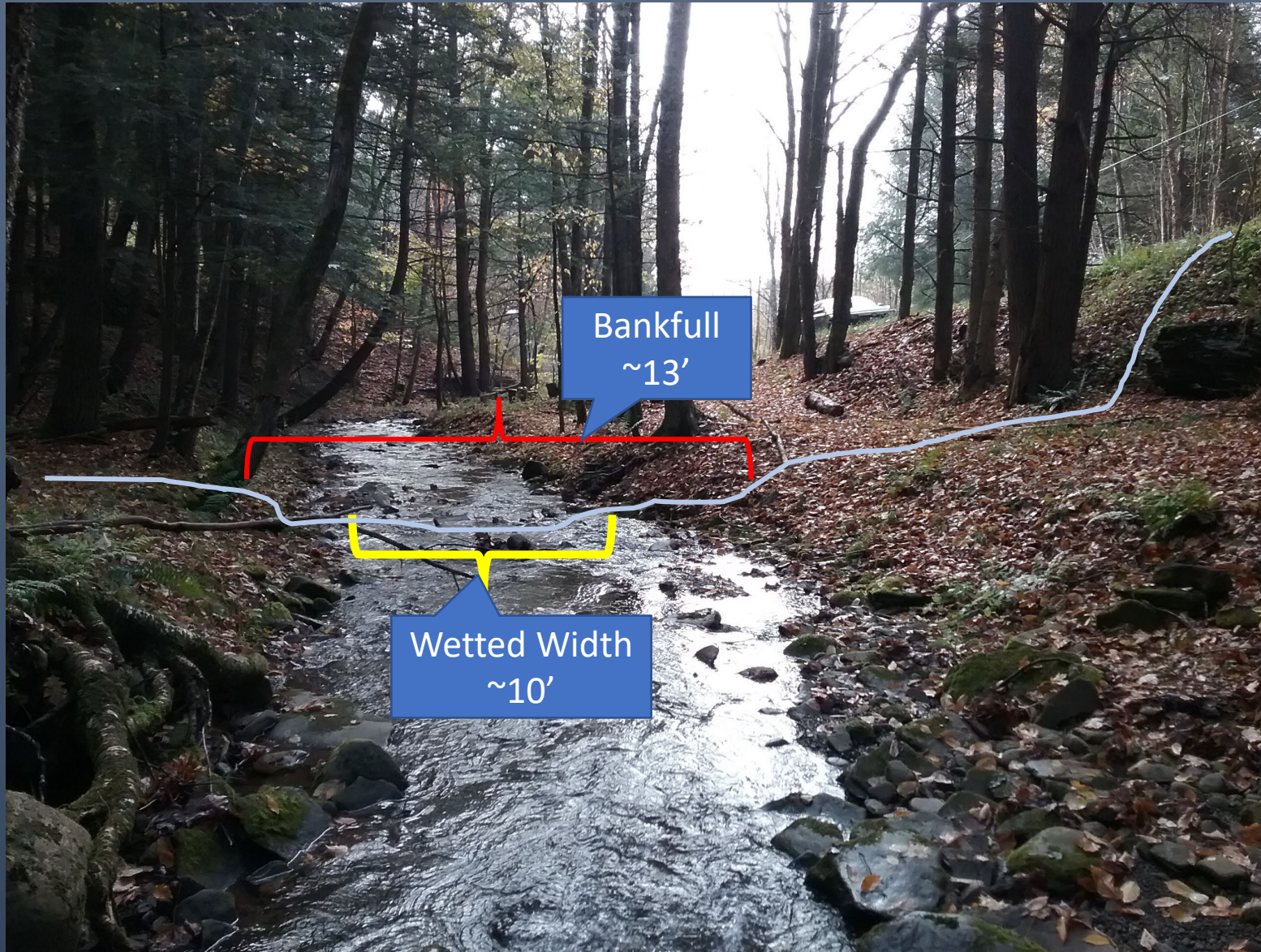
USGS StreamStats:

- Free tool,
- Good starting point,
- Drainage Area,
- Est. Bankfull dimensions,
- Peak flows.
- **Field Truthing is needed!**

Pll: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	Pll	Plu
Bankfull Area	12.1	ft ²	5.22	28.1
Bankfull Depth	0.864	ft	0.382	1.95
Bankfull Streamflow	51.1	ft ³ /s	7.5	348
Bankfull Width	14.4	ft	6.06	34.1

Information to Collect: Bankfull Dimensions



Bankfull Dimensions:

Very hard to id in incised reach!!

- Incipient point of flooding.
- NOT WETTED WIDTH!
- Depositional
- Look for stable reach
- This is not a reference!
- Est. BF can be over-wide in an unstable reach!
- Document existing conditions above the influence of the crossing.

StreamStats Flow Data: Estimates



Peak-Flow Statistics Flow Report [2006 Full Region 2]

PlI: Prediction Interval-Lower, Plu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

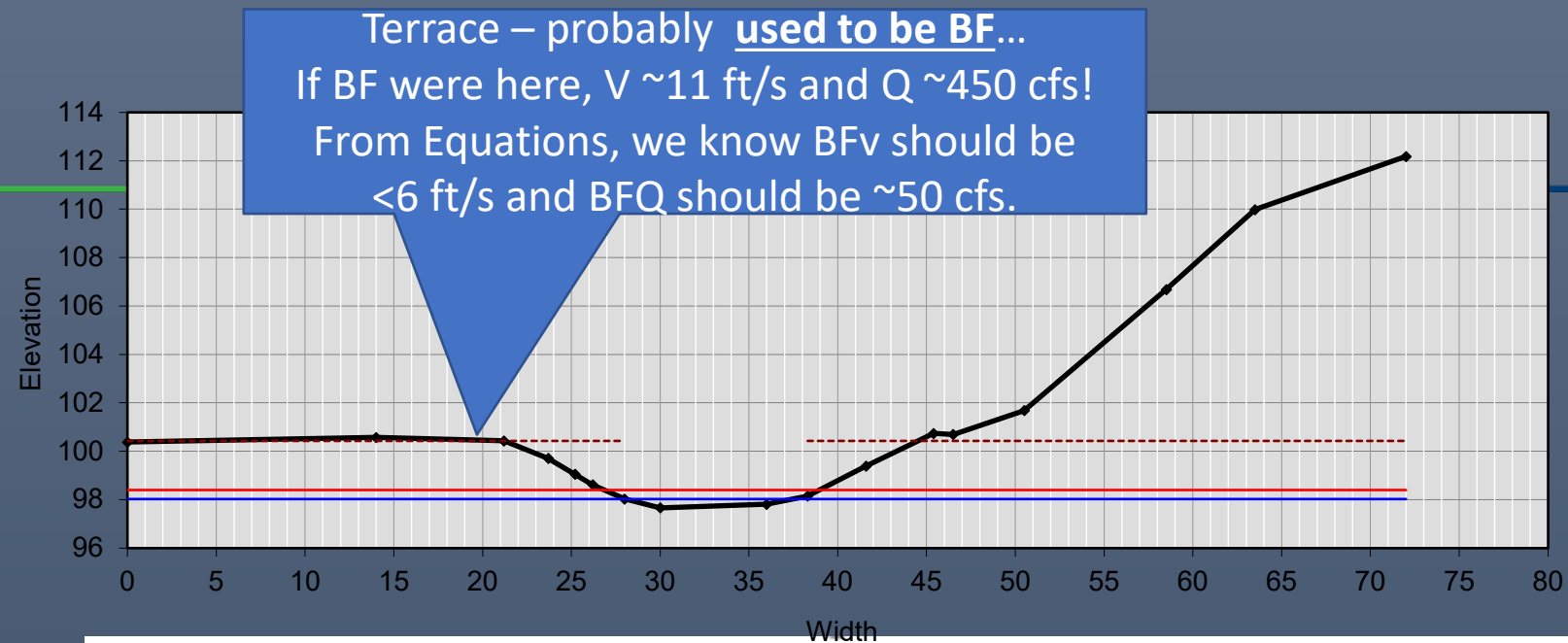
Statistic	Value	Unit	SE	ASEp	Equiv. Yrs.
80-percent AEP flood	54.1	ft ³ /s	25.5	25.5	4.8
66.7-percent AEP flood	66.2	ft ³ /s	25.6	25.6	4.3
50-percent AEP flood	83.7	ft ³ /s	25.8	25.8	4.4
20-percent AEP flood	139	ft ³ /s	27	27	7.3
10-percent AEP flood	185	ft ³ /s	28.2	28.2	10.1
4-percent AEP flood	255	ft ³ /s	29.9	29.9	13.6
2-percent AEP flood	316	ft ³ /s	31.5	31.5	15.8
1-percent AEP flood	383	ft ³ /s	33.3	33.3	17.6
0.5-percent AEP flood	459	ft ³ /s	35.3	35.3	18.9
0.2-percent AEP flood	574	ft ³ /s	38.4	38.4	20.1

Standard Error

66.7% ~ BF Flow

1% = "100 year"

Cross Section for Stream Dimensions



Put Profile, Pebble Count
and Cross Section
information together to
calculate Forces and
Power.

BF Velocity ~ 4 ft/s

Bankfull Dimensions	Flood Dimensions	Materials
9.3 x-section area (ft.sq.)	28.3 W flood prone area (ft)	65 D50 Riffle (mm)
13.4 width (ft)	2.1 entrenchment ratio	170 D84 Riffle (mm)
0.7 mean depth (ft)	2.8 low bank height (ft)	144 threshold grain size (mm)
1.0 max depth (ft)	2.9 low bank height ratio	
13.7 wetted parimeter (ft)		
0.7 hyd radi (ft)		
19.4 width-depth ratio		
Bankfull Flow	Flow Resistance	Forces & Power
4.5 velocity (ft/s)	0.067 Manning's roughness	6.9 channel slope (%)
41.8 discharge rate (cfs)	0.60 D'Arcy-Weisbach fric.	2.93 shear stress (lb/sq.ft.)
0.96 Froude number	3.7 resistance factor u/u^*	1.23 shear velocity (ft/s)
	1.2 relative roughness	13.4 unit strm power (lb/ft/s)

Capacity: Published Data From USGS StreamStats

What are the peak flows in the channel?

What can the existing structure convey?

What will the proposed structure convey?

Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	86.9	ft ³ /s	27.9	27.9	2.5
5 Year Peak Flood	139	ft ³ /s	24.7	24.7	4.2
10 Year Peak Flood	179	ft ³ /s	23.1	23.1	6.5
25 Year Peak Flood	233	ft ³ /s	22	22	9.9
50 Year Peak Flood	277	ft ³ /s	21.6	21.6	12.6
100 Year Peak Flood	323	ft ³ /s	21.6	21.6	15
200 Year Peak Flood	371	ft ³ /s	21.7	21.7	17.1
500 Year Peak Flood	437	ft ³ /s	22.4	22.4	19.4



Capacity: On paper, this culvert can take the 50 year storm (2% storm)...but only if it isn't blocked with trees. Sediment and wood transport are essential considerations in culvert replacements.

Information to Collect: Culvert and Road Data



Parameter	Value
DISCHARGE DATA	
Discharge Method	Minimum, Design, and Maximum
Minimum Flow	101.000
Design Flow	121.000
Maximum Flow	200.000
TAILWATER DATA	
Channel Type	Trapezoidal Channel
Bottom Width	10.000
Side Slope (H:V)	2.000
Channel Slope	0.0450
Manning's n (channel)	0.048
Channel Invert Elevation	91.500
Rating Curve	View...
ROADWAY DATA	
Roadway Profile Shape	Constant Roadway Elevation
First Roadway Station	0.000
Crest Length	20.000
Crest Elevation	100.200
Roadway Surface	Paved
Top Width	20.000

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
98.46	101.00	101.00	0.00	1
98.97	110.90	110.90	0.00	1
99.54	120.80	120.80	0.00	1
99.55	121.00	121.00	0.00	1
100.42	140.60	134.64	5.95	5
100.57	150.50	136.91	13.54	5
100.70	160.40	138.83	21.55	5
100.82	170.30	140.52	29.70	4
100.93	180.20	142.09	38.05	4
101.04	190.10			
101.14	200.00			
100.20	131.40			

Display

☒ Crossing Summary Table

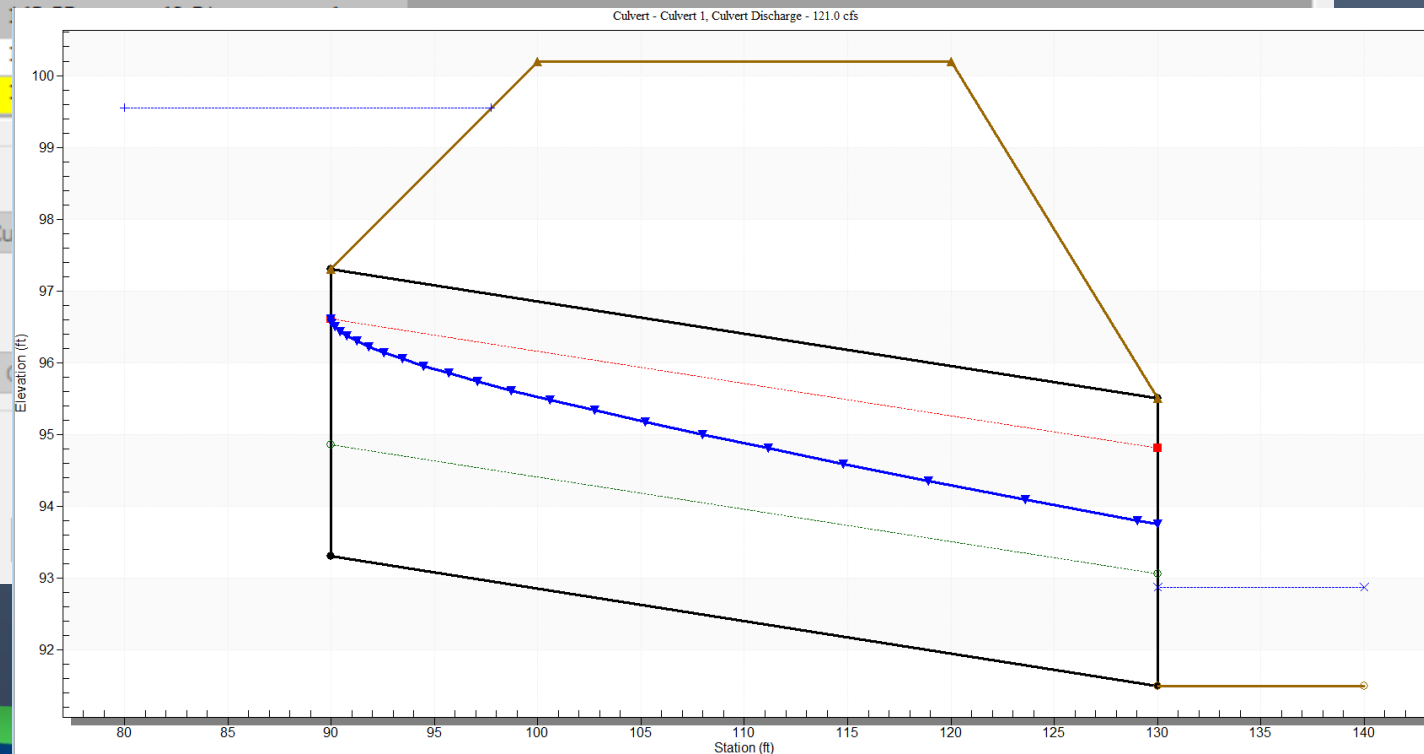
☐ Culvert Summary Table

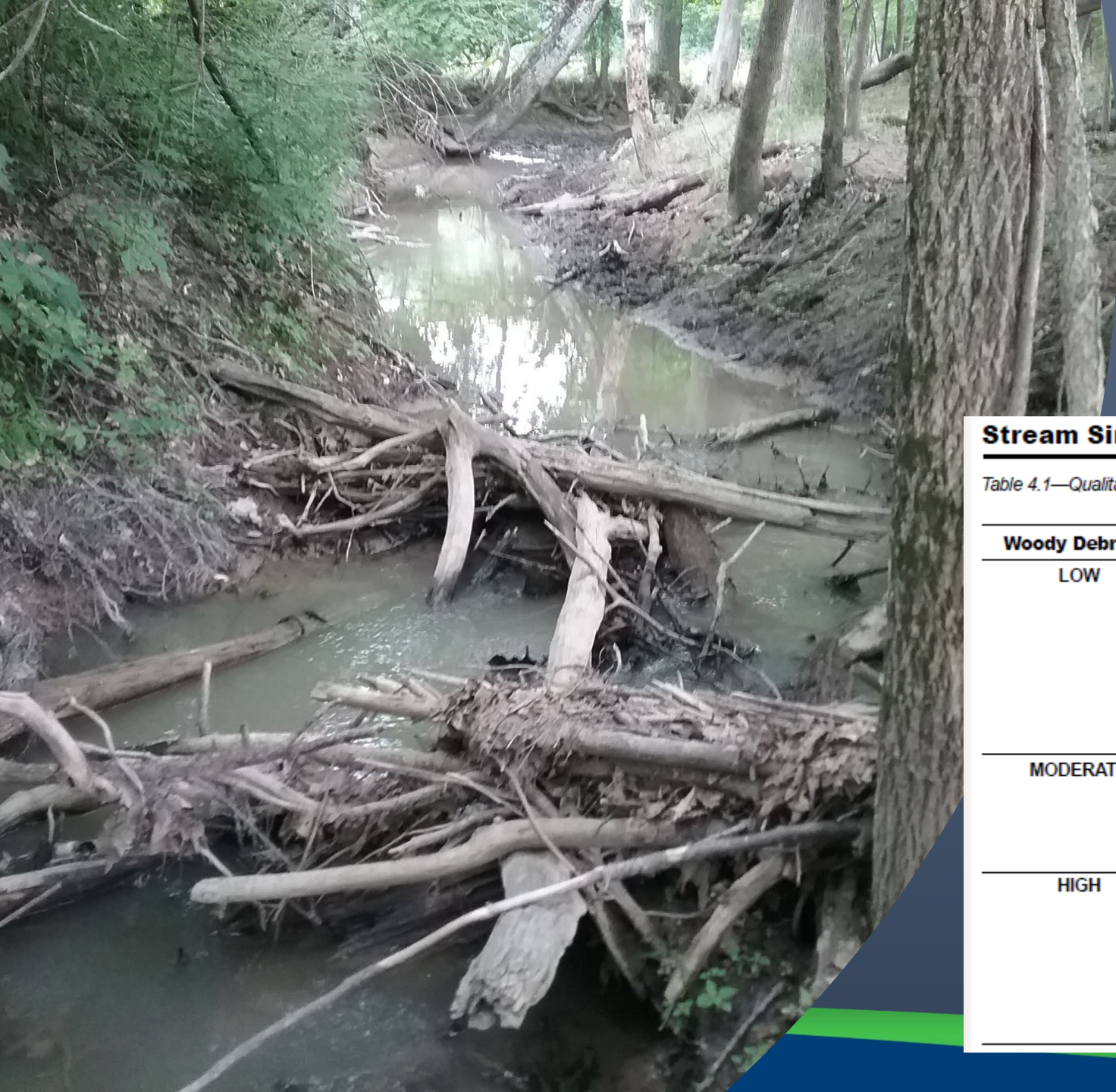
☐ Water Surface Profiles

☐ Tapered Inlet Table

☐ Customized Table

HY-8 Program
(Federal Highway Admin)
Inputs for Existing Crossing
Est. Capacity at Road
Design for Proposed Structures.





Wood:

- Wood is a natural part of a stream;
- Build a crossing that prevents wood from blocking the entrance

Stream Simulation

Table 4.1—Qualitative criteria for assessing the risk of plugging by **woody** debris at a road-stream crossing structure

Woody Debris Risk	Description
LOW	• Debris mostly absent or well anchored on banks and in channel. • Debris dispersed uniformly along the reach (i.e., it has not moved). • Available wood is much larger than the stream's ability to move it (i.e., large trees in small streams). • Little or no wood available for local recruitment. • Bed material not anchored by debris. • Woody debris likely to remain at or near source area.
MODERATE	• Most wood pieces anchored in the channel bed or channel banks. • Potential for local recruitment of wood. • History of occasional maintenance to remove wood at the crossing. • Small translational slides or undercut slopes adjacent to channel.
HIGH	• Unstable accumulations of woody debris present along banks, gravel bars, and channel constrictions. • Most wood pieces not anchored to bed or banks. • Considerable wood available for local recruitment. • History of frequent maintenance to remove wood at the crossing. • Upstream watershed susceptible to debris flows.

Is wood transport an issue at the crossing?



Existing Crossing is undersized for Wood and Flows!
Consider a floodplain culvert to help with overflows.

Trees deposited in
high water event.



Cover

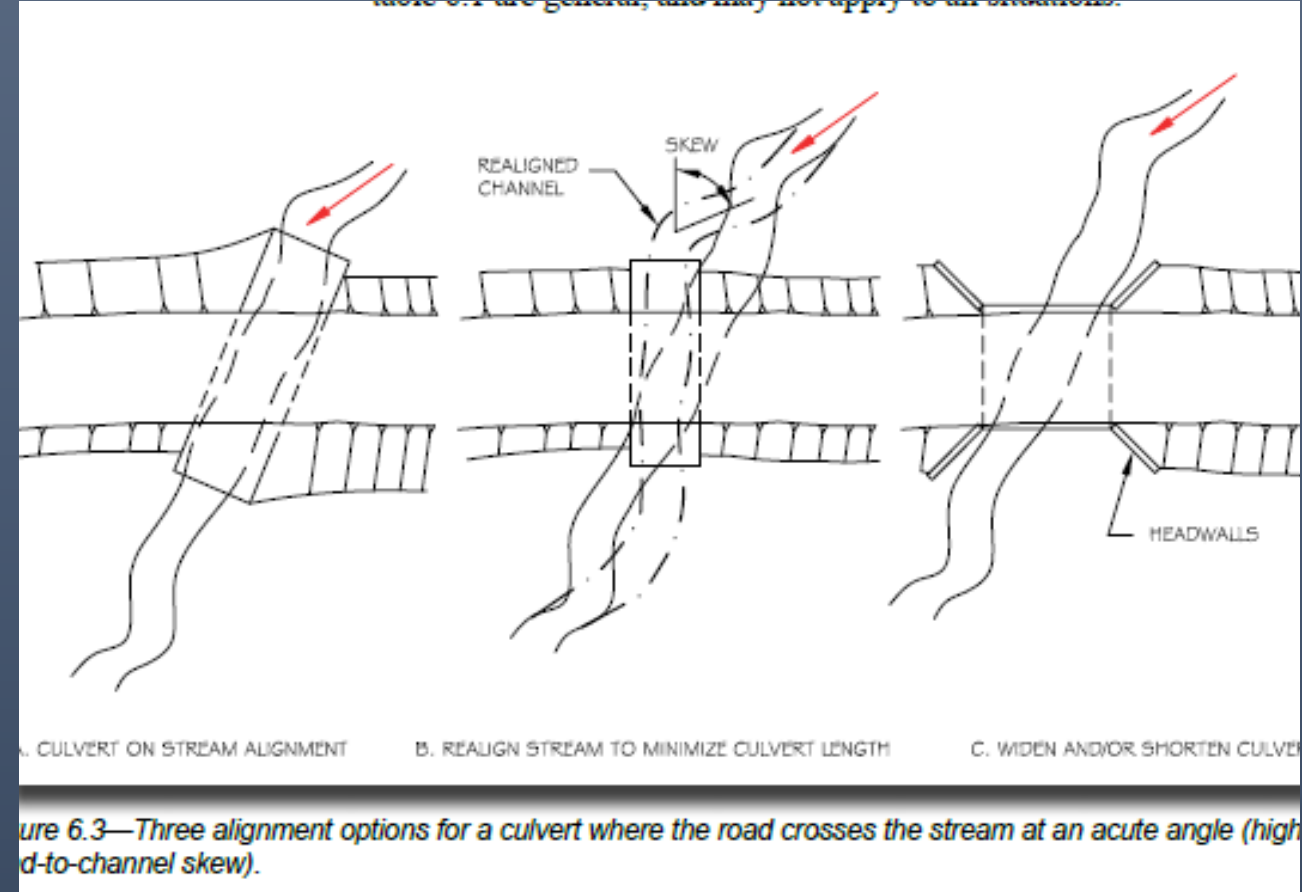
- Minimal cover is a common concern:
- Road is on the box;
- Not easy to raise road elevation for this site;
- Concrete box proposed to accommodate low cover.



Alignment issues



How to address skewed alignment?
A wider span helps with alignment
and wood transport.



ADDITIONAL RIGHT-SIZING CONSIDERATIONS



Access & Tree Removal (minimize)



Utilities

Geotechnical:
Bedrock Depth
Soil Bearing Capacity
Footer design



Construction
Duration:



Department of
Environmental
Conservation

Office of
General Services

Department
of State

Permitting:



US Army Corps
of Engineers

JOINT APPLICATION FORM

For Permits for activities affecting streams, waterways, waterbodies, wetlands, coastal areas, sources of water, and endangered and threatened species.

You must separately apply for and obtain Permits from each involved agency before starting work. Please read all instructions.

Grade Controls

- Grade controls prevent headcutting.
- Project USUALLY REQUIRES GC UPSTREAM AND DOWNSTREAM
 - MUNICIPAL ROW
 - LANDOWNER PERMISSION
- Place inside the new structure
- Construct with Rock or Logs
- Tie in critical to avoid outflanking
- Vertical spacing of GC is 0.7'.
- Horizontal spacing is guided by the slope of the proposed bed.
- Steeper beds need more structures.
- Each structure consists of a step and a pool.
- Provides bed diversity and cover.
- Can be used to retrofit a crossing.



Permitting!

- Even if Class C, need a DEC Water Quality Cert.
- Stream Classification
- Wetlands,
- Natural Communities/Rare Plants or Animals
- Regulated Flood Hazard Areas may require HEC-RAS analysis.
- Cultural Resources
- Dam(s) in watershed; Hazard Level
- Dewatering Regs vary by Region and Watershed!

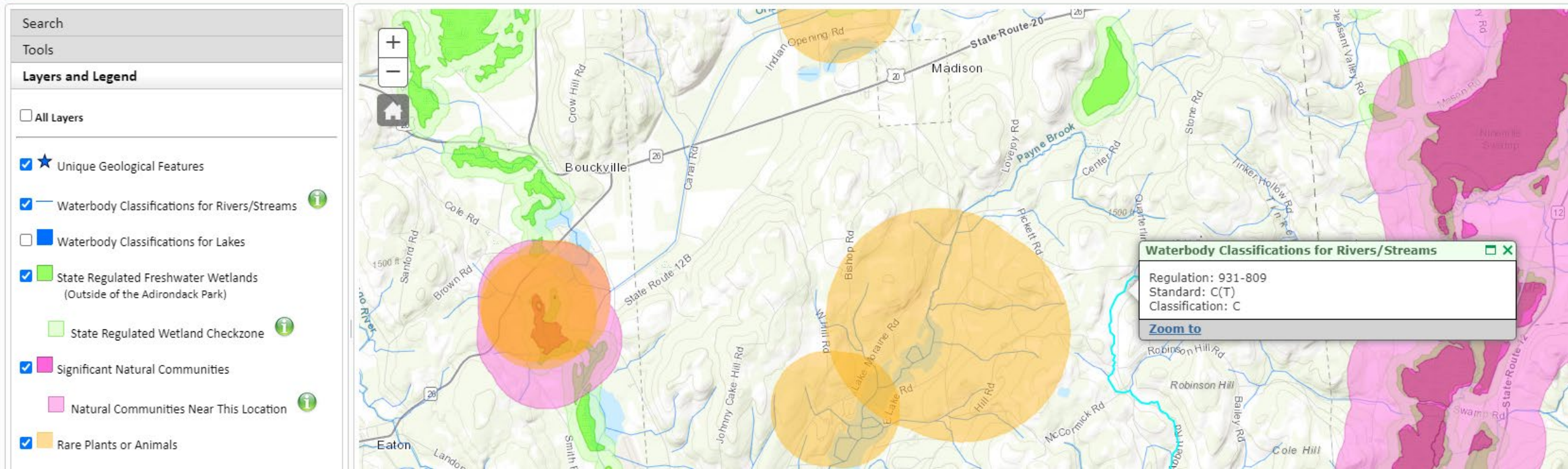


NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION



Environmental Resource Mapper

Base Map: T



DEWATERING



Pump around is often required for the duration of the project. Pump around must remain active during curing time.

Criteria Spatial Results

1. Navigate to your area of interest

Option A: Zoom to a County or Municipality

Allegany ALFRED (Town) Zoom

Option B: Find an Address Location

type address here

Find Address

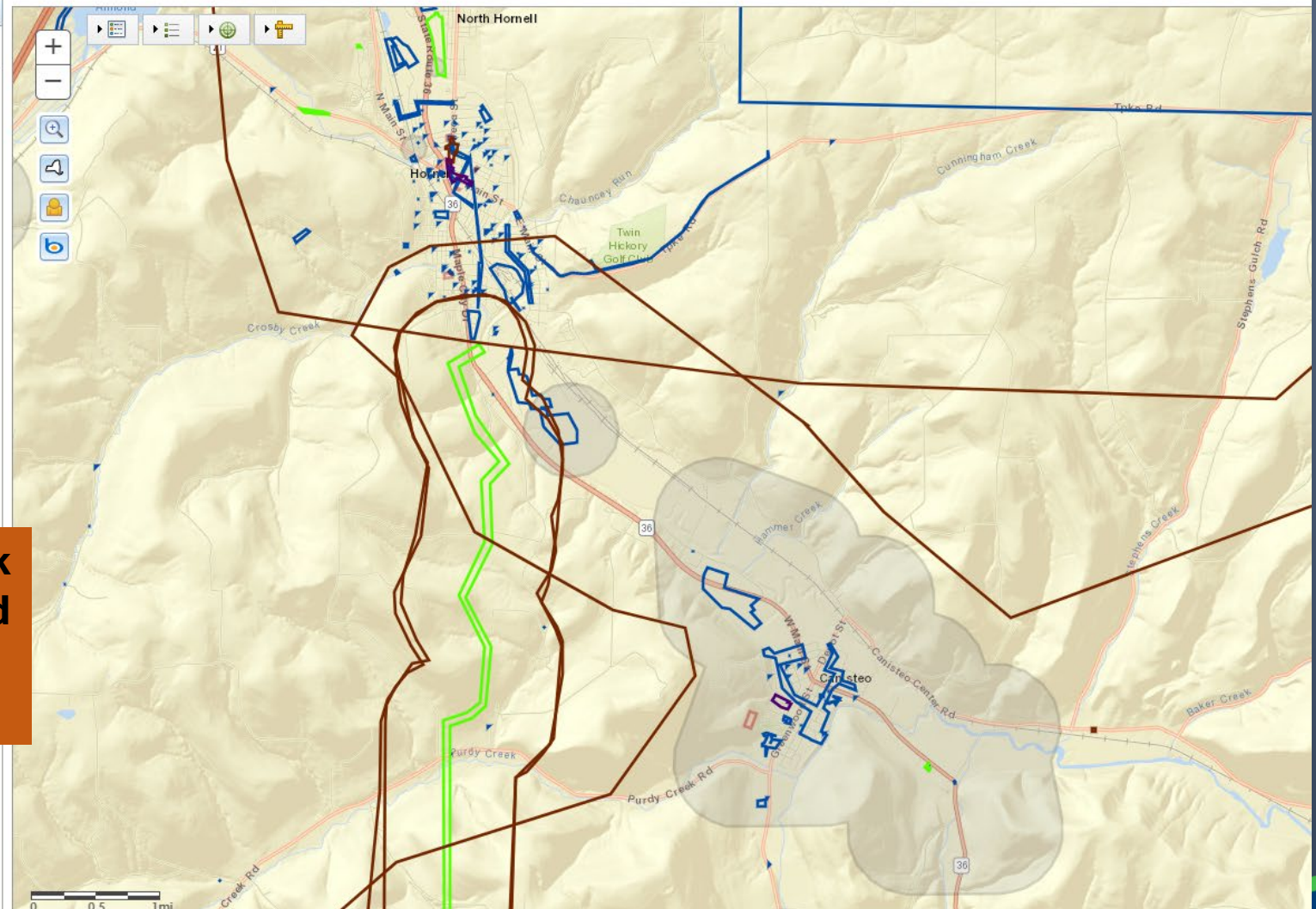
2. Define or refine the location/area for your search

Click a button below to activate the draw tool and draw the shape on the map

Point Line Rectangle Circle Polygon

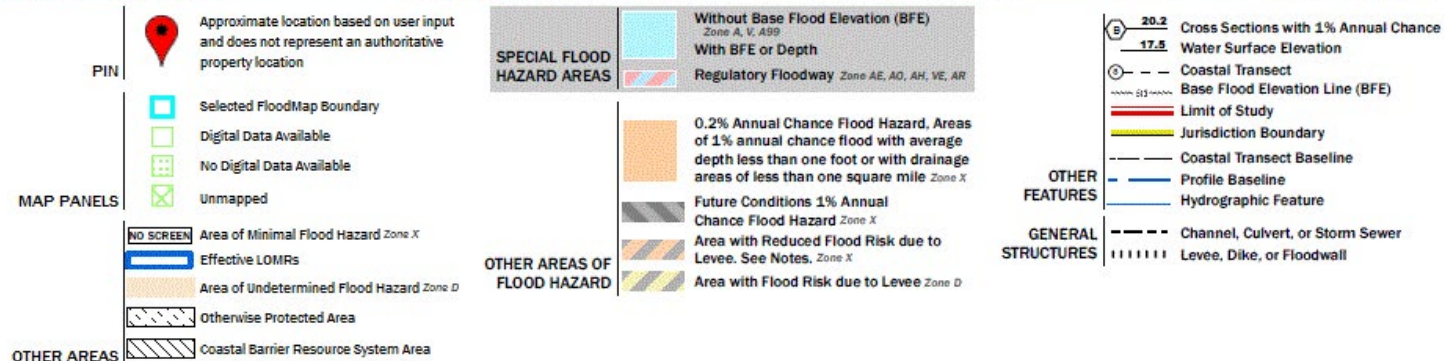
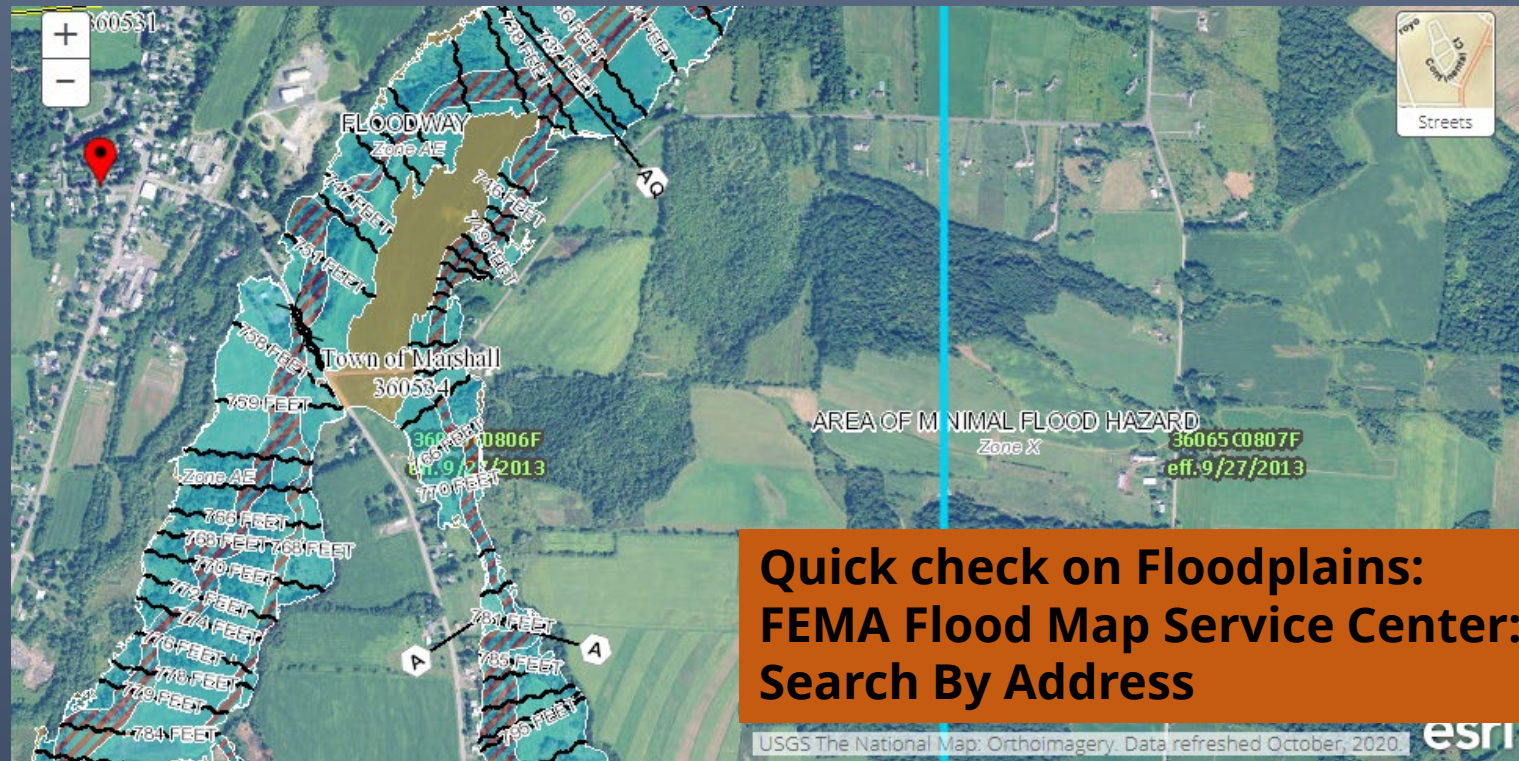
3. Generate a search radius around your graphic (Optional)

Generate a Foot buffer Generate Buffer

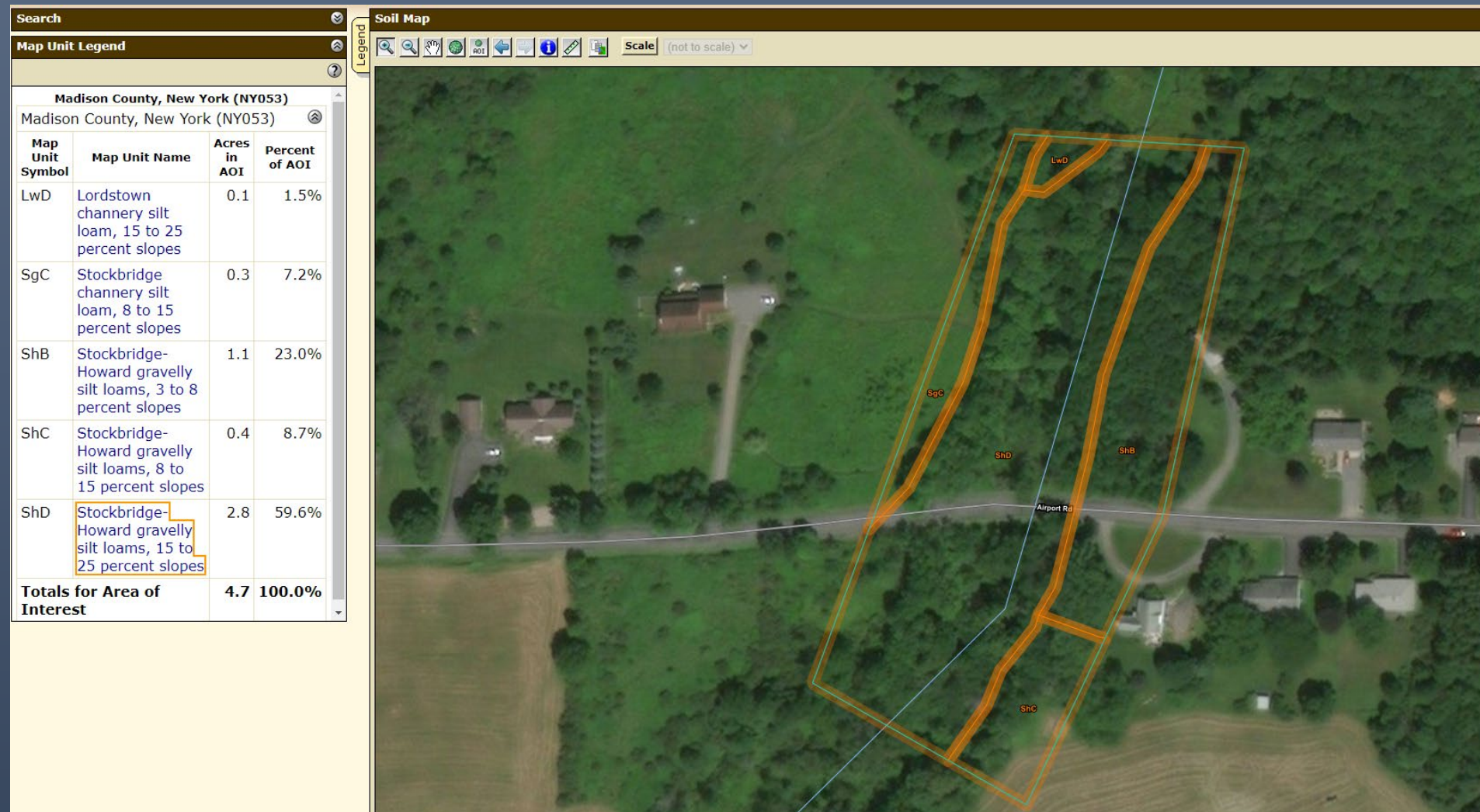


CRIS was developed by the New York State Office of Parks, Recreation and Historic Preservation's Division for Historic Preservation.

Permitting: Flood Zones: Work in regulated Flood Hazard Area may require HEC RAS



USDA NRCS Web Soil Survey: First step in Soil Bearing Capacity for structures.



Replacement Options

Pipe Arch:

- We look at these if the site has a bankfull of 13' or less;
- Bury the pipe to create natural bed;
- Install with an excavator;
- Requires 18-30" of fill depending on span.
- Relatively low price;
- Quick Install
- No Footers needed
- Rises are high so not ideal for sites with minimal cover.
- **NOT FOR STEEP SITES!!**

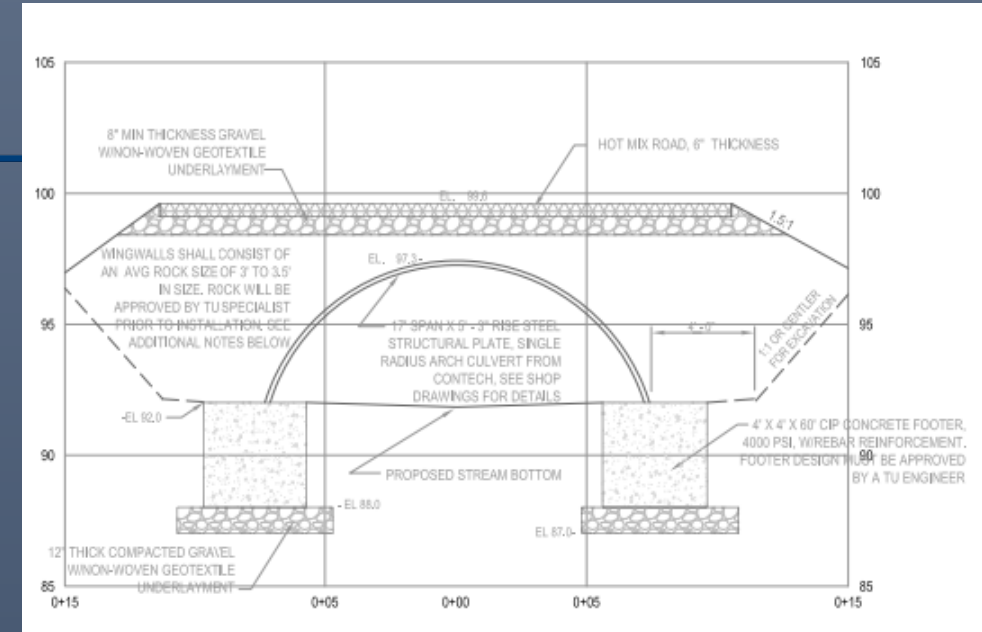


Replacement Options



Single Radius Arch

- Good for creating wide span with natural bed.
- Requires concrete footers
 - Cast In Place requires curing time.
 - Extends duration of road closure.
- Low price for structure relative to ABC and Concrete.
- But, Footer costs vary based on local contractors.
- Footer design usually based on Geotech.
- Requires 18"-30" cover depending on span.
- EXTENSIVE DE-WATERING REQUIREMENTS UNTIL CURE TIME COMPLETED.



Replacement Options



Aluminum Box Culvert

Ideal for wide-span low rise scenarios.
Can be installed with 1.4' cover minimum.
Can be installed with full invert which reduces construction duration.

STATE REGS: NO BOTTOMS ON SLOPES >3%

If full invert is used (buried for natural bed): **Max Cover is 4'**

Not good for sites with more than 4.5' cover!

MATERIAL More costly than SRA and PA; **LABOR** is easier.

Place with an excavator.

Concerns with durability voiced by some partners.



Replacement Options



Concrete :

- Ideal for wide span and minimal cover.
- Requires a crane for installation.
- Durable structure
- Most costly up front.
- 3 sided on footers or 4 sided box allow for natural bed.
- **BURY THE BOX** FOR A NATURAL BED!
- Use grade controls to hold bed material in place.



Replacement Options



Pre-Fab Bridge (can be less than 20' span)

- Ideal for wide span, low cover.
- Pre-fab components can be installed quickly
- Competitive pricing with ABCs depending on required span.
- Cover not an issue
- Good for sites with alignment issues.
- Photo Courtesy Colin Lawson, Beebe River, NH

Bridges:

- Any span $\geq 20'$ is a “bridge” (NYS).
- If Bankfull width is over 17 feet, then the 1.25x rule can result in a bridge.
- If Drainage Area is ~ 0.75 square miles (~ 450 acres), a bridge may be recommended.
- Bridges usually require more stringent design
- Bridges require annual inspection to conform with NYSDOT requirements.
- **Cost:Benefit important especially on low traffic crossings.**



CAUTION!!

- Each site is different with different challenges and constraints!



Avoid Multiple Pipes – prone to blockage.



Smooth, round pipes set at-grade are common culprits in failures and barriers.

Retrofitting: Restoring Connectivity in Existing Structure



Consider Downstream Grade Controls to restore a natural bed and reconnect the stream.

Cost: Replacement is Expensive but there is help!



- DON'T REPLACE A CULVERT BASED SOLELY ON COST!
- ALMOST ALWAYS THE DRIVING FACTOR IN PERMANENTLY UNDERSIZED INFRASTRUCTURE!
- FEDERAL/STATE/NONPROFIT ASSISTANCE LIKELY AVAILABLE.

	Option 1	Option 2
Size	16'8"x7'6"x50'	16'x8'4"x50'
Flow (cfs)	900	800
Type	ABC	SRA
Lifespan (yrs)	50	50
Constructability	ABC with invert can reduce construction duration	SRA requires footers to cure which prolongs construction time and road closure duration.
Maintenance	Minimal	Minimal
Road Closure	1 week	1 month
Costs		
Structure	\$ 47,350.00	\$ 13,200.00
Footer	\$ 11,313.00	\$ 11,378.00
Grade Control	\$ 2,333.00	\$ 2,333.00
Headwall/Wingwall	\$ 7,038.00	\$ 7,038.00
Dewatering	\$ 5,000.00	\$ 5,000.00
E&S/Restoration	\$ 1,000.00	\$ 1,000.00
Labor	\$ 26,250.00	\$ 33,250.00
Road Resurfacing	\$ 10,000.00	\$ 10,000.00
Sub-Total	\$ 110,284.00	\$ 83,199.00
15% Contingency	\$ 16,542.60	\$ 12,479.85
Total Estimated	\$ 126,826.60	\$ 95,678.85

Funding for your Culvert Replacement



New York State Funding

NYS Department of Conservation Water Quality Improvement Project Program Grant

Aquatic Habitat Restoration Projects

- Statewide projects to improve aquatic connectivity through culvert replacement of culverts considered an aquatic barrier
- Eligible Applicants – Municipalities, Soil and Water Conservation Districts, Nonprofits

No Ag Non-Point Source Abatement and Control Projects

- Statewide projects to improve water quality – culvert replacement address erosion caused by inadequately sized culverts.
- Eligible Applicants – Municipalities, Soil and Water Conservation Districts

Climate Smart Communities Program Grants

State Support for Local Climate Action

Adaptation and Mitigation Projects

- Reducing future flood risk
- Preparing for future extreme events



Funding for your Culvert Replacement



Federal Funding Sources

FEMA Program

Pre and Post Disaster Funding – NEW Building Resilient Infrastructure and Communities (BRIC) Mitigation Planning Funding

- Statewide and National Ranking of Projects – **Tied to Hazard Mitigation Plans!**
- New BRIC Program is focused on fostering NEW ways of thinking about mitigation planning
- Reduce vulnerabilities over the long term – Natural Based Solutions
- Flood mitigation - Partnerships
- Eligible Applicants – Municipalities ; **September LOI, January Grant Deadline**

USFWS Fish Passage Program

Conserve America's Fisheries

- Aquatic Passage Projects – Brook Trout Focus
- Projects must meet permit requirements and improve connectivity in priority brook trout watersheds

Eastern Brook Trout Joint Venture

Aquatic Passage Projects – Brook Trout Focus

- Projects must meet permit requirements and improve connectivity in priority brook trout watersheds
- Coordinated with USFWS – VERY COMPETITIVE as projects are ranked across the entire Brook Trout Range of the East Coast.

Helpful References



U.S. Department
of Agriculture

Forest Service

National Technology
and Development
Program

7700—Transportation Mgmt
0877 1801—SDTDC
August 2008



AREA FOR HUMBURG AND EAST
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TO BE APPROVED BY THE COR.



STREAM SIMULATION: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings



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Recreation Nature Prevent & Control Pollution Regulatory News & Learning Search

Home » Permits, Licenses, and Registrations » Waterways, Coastlines & Wetlands Permits » Protection of Waters Program »

Stream Crossings

Protecting and Restoring Stream Continuity

[Printable version of this page \(PDF, 508 KB\)](#)

[Printable brochure about Stream Crossings \(PDF, 248 KB\)](#)

This information was developed for those involved in designing and constructing stream crossings - with an eye toward protec

The guidelines and standards presented here describe minimum criteria to avoid fragmentation of streams. The objective is to guidelines meet this objective, additional engineering design may be necessary to ensure structural integrity and appropriate i

Introduction

New York State is rich with many miles of high quality, productive streams. This valuable resource sustains natural communit spawning areas for fish and wildlife. It also provides innumerable additional benefits to us, such as recreation and aesthetic ei

Streams are long, linear ecosystems. The processes that nourish these ecosystems are interrelated and dependent on "conti result in fragmentation of streams. Many stream crossings, such as bridges and culverts, act as barriers to fish and wildlife. A maintaining stream continuity.

The design and condition of stream crossings determines whether a stream can function naturally and whether animals can n assuring the overall health of the system. This web page describes stream crossing designs that promote natural stream conc maintaining our access and transportation needs.

Stream Continuity and Natural Comm

The continuity of streams, as well as their connection to rip and installing stream crossings, the needs of invertebrates seasonally, through the stream and adjacent areas. Finding and connection to the watershed.

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

Part 654 Stream Restoration Design National Engineering Handbook

Chapter 11

Rosgen Geomorphic Channel Design

Natural Channel Design REVIEW CHECKLIST



StreamMechanics



ACTIVITIES AUTHORIZED BY 2017 NATIONWIDE PERMIT WITHIN THE STATE OF NEW YORK Expiration March 18, 2022

B. Nationwide Permits

USACE NATIONWIDE PERMITS





Questions?

Tracy Brown

Tracy.Brown@tu.org

Jacob Fetterman

Jacob.Fetterman@tu.org

Jo-Anne Humphreys

Joanne.Humphreys@tu.org

