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Update on Bloody Brook and Sugarloaf Brook Watershed Analysis

Town of Deerfield

Municipal Vulnerability Preparedness (MVP)
Core Group Meeting

Rosalie Starvish, GZA

Nicolas Miller, Field Geology Services

May 7, 2025



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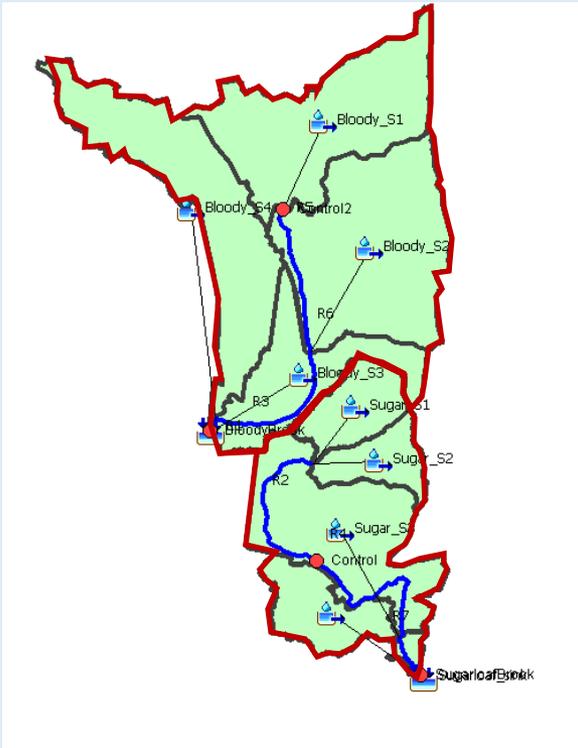
SCOPE OF SERVICES

Hydrologic and Hydraulic Analysis

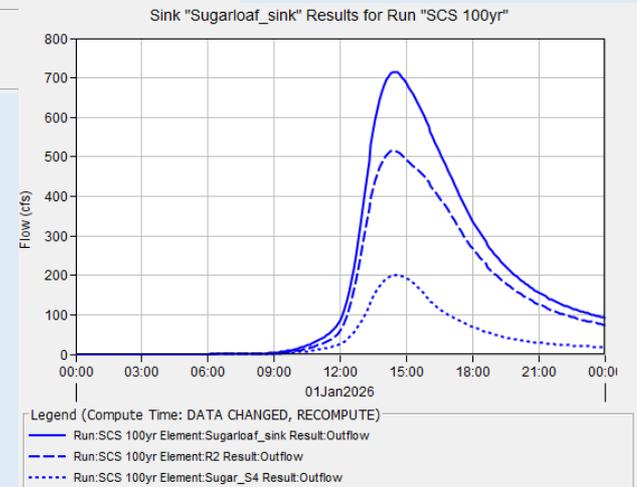
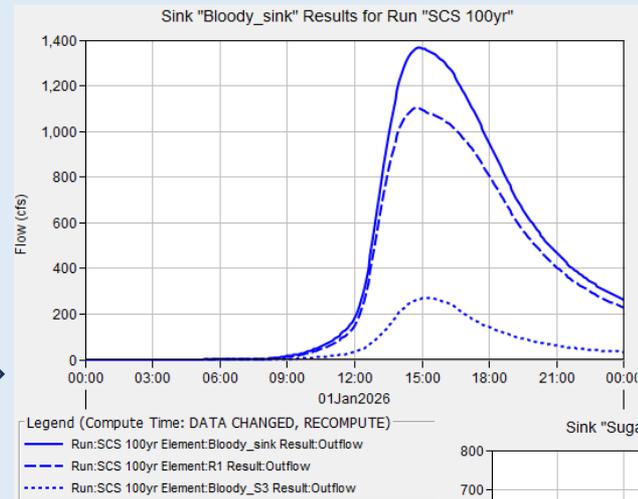


Hydrology - Estimate inflow to Site from the watershed

Hydrologic Model



Inflows into Site



Hydrologic Input

RAINFALL DATA (precipitation in inches)								
Time Period	1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Present	2.45	3.01	3.91	4.66	5.68	6.44	7.27	9.94
Late Century	3.70	4.50	5.90	7.00	8.60	9.80	11.00	15.1
WATERSHED DATA								
	Bloody Brook				Blacksmith/Sugarloaf Brook			
Watershed Area	Bloody_S1: 0.91 mi ² Bloody_S2: 1.08 mi ² Bloody_S3: 0.50 mi ² Bloody_S4: 0.91 mi ² 3.4 mi²				Sugarloaf_S1: 0.26 mi ² Sugarloaf_S2: 0.21 mi ² Sugarloaf_S3: 0.80 mi ² Sugarloaf_S4: 0.33 mi ² 1.6 mi²			
SCS Curve Number	Bloody_S1: 80 Bloody_S2: 75 Bloody_S3: 82 Bloody_S4: 79				Sugarloaf_S1: 78 Sugarloaf_S2: 72 Sugarloaf_S3: 71 Sugarloaf_S4: 79			
Lag Time (0.6 x Time of Concentration)	Bloody_S1: 111.1 minutes Bloody_S2: 236.6 minutes Bloody_S3: 180.3 minutes Bloody_S4: 141.7 minutes				Sugarloaf_S1: 104.5 minutes Sugarloaf_S2: 99.9 minutes Sugarloaf_S3: 202.9 minutes Sugarloaf_S4: 141.7 minutes			



Estimated Bloody Brook and Blacksmith/Sugarloaf Peak Flows in the Mid- and Late 21st Century

Recurrence Interval (RI)	Estimated Peak Inflow of Bloody Brook Downstream of Interstate-91 (cfs)		Estimated Peak Inflow of Blacksmith/Sugarloaf Brook at Confluence with Connecticut River (cfs)	
	<i>Present</i>	<i>Late Century</i>	<i>Present</i>	<i>Late Century</i>
1-year	134	270	51	111
2-year	192	364	77	153
5-year	271	536	112	232
10-year	384	675	163	297
25-year	509	878	221	393
50-year	604	1032	265	466
100-year	708	1186	315	539
500-year	1050	1713	477	790

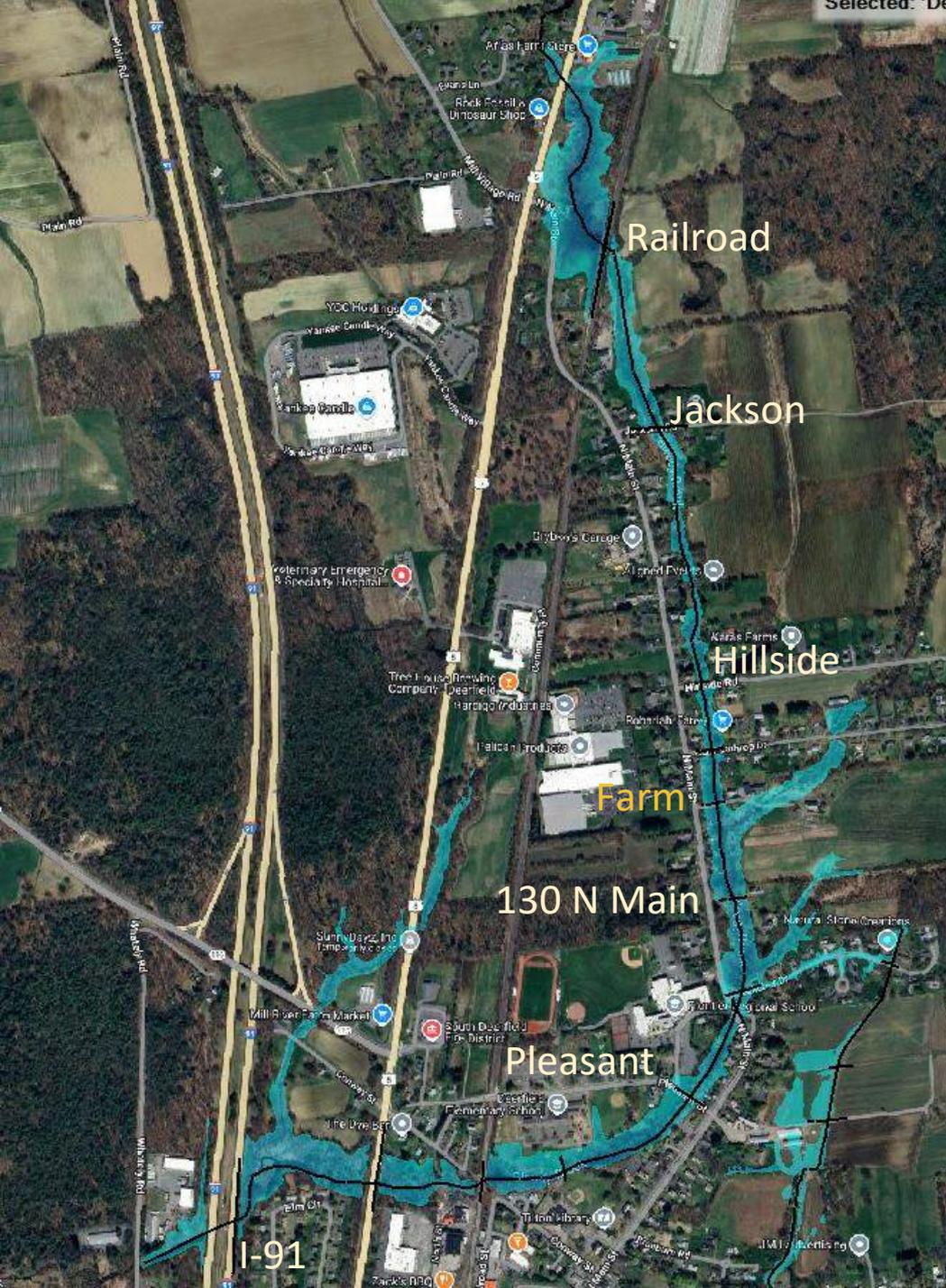
Present 100-year recurrence interval flow approximately equals 10-year flow Late Century flow



Summary of Anticipated Structure Overtopping on the Bloody Brook and Blacksmith/Sugarloaf Brook Main Channel

Name in Hec-RAS	Anticipated Overtopping															
	Present								Late Century							
	1yr	2yr	5yr	10yr	25yr	50yr	100yr	500yr	1yr	2yr	5yr	10yr	25yr	50yr	100yr	500yr
Bloody Brook Main Channel																
Upper Railroad																
Jackson Rd	-NO	-NO	-NO	-NO	-NO	-NO	YES	YES	-NO	-NO	-NO	YES	YES	YES	YES	YES
Hillside Rd	-NO	-NO	-NO	-NO	-NO	-NO	YES	YES	-NO	-NO	-NO	-NO	YES	YES	YES	YES
Ave	-NO	-NO	-NO	-NO	-NO	-NO	-NO	YES	-NO	-NO	-NO	-NO	YES	YES	YES	YES
Driveway	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
130 N Main St	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Kelleher St	-NO	-NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N Main St	-NO	-NO	-NO	-NO	YES	-NO	YES	YES	-NO	-NO	YES	-NO	YES	YES	YES	YES
Pleasant St	-NO	-NO	-NO	YES	YES	YES	YES	YES	-NO	YES	YES	YES	YES	YES	YES	YES
Pedestrian Crossing	-NO	-NO	-NO	-NO	YES	YES	YES	YES	-NO	YES	YES	YES	YES	YES	YES	YES
Lower Railroad	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	YES	YES
Route 5	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO
I-91	-NO	-NO	-NO	-NO	-NO	-NO	-NO	NO	-NO	-NO	-NO	-NO	-NO	-NO	YES	YES
Blacksmith/Sugarloaf Main Channel																
Kelleher St	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Galenski Farm1	-NO	-NO	-NO	-NO	YES	-NO	YES	-NO	-NO	-NO	-NO	-NO	YES	YES	YES	YES
Galenski Farm2	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	YES
Graves St	-NO	-NO	-NO	-NO	-NO	YES	-NO	YES	-NO	-NO	-NO	-NO	YES	YES	YES	YES
Sugarloaf St	-NO	-NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Coates Ave	-NO	-NO	-NO	YES	YES	YES	YES	YES	-NO	-NO	YES	YES	YES	YES	YES	YES
Thayer St	-NO	-NO	-NO	-NO	-NO	YES	-NO	YES	-NO	-NO	-NO	-NO	YES	YES	YES	YES
Route 116	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	YES
Extension	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO
River St	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO	-NO

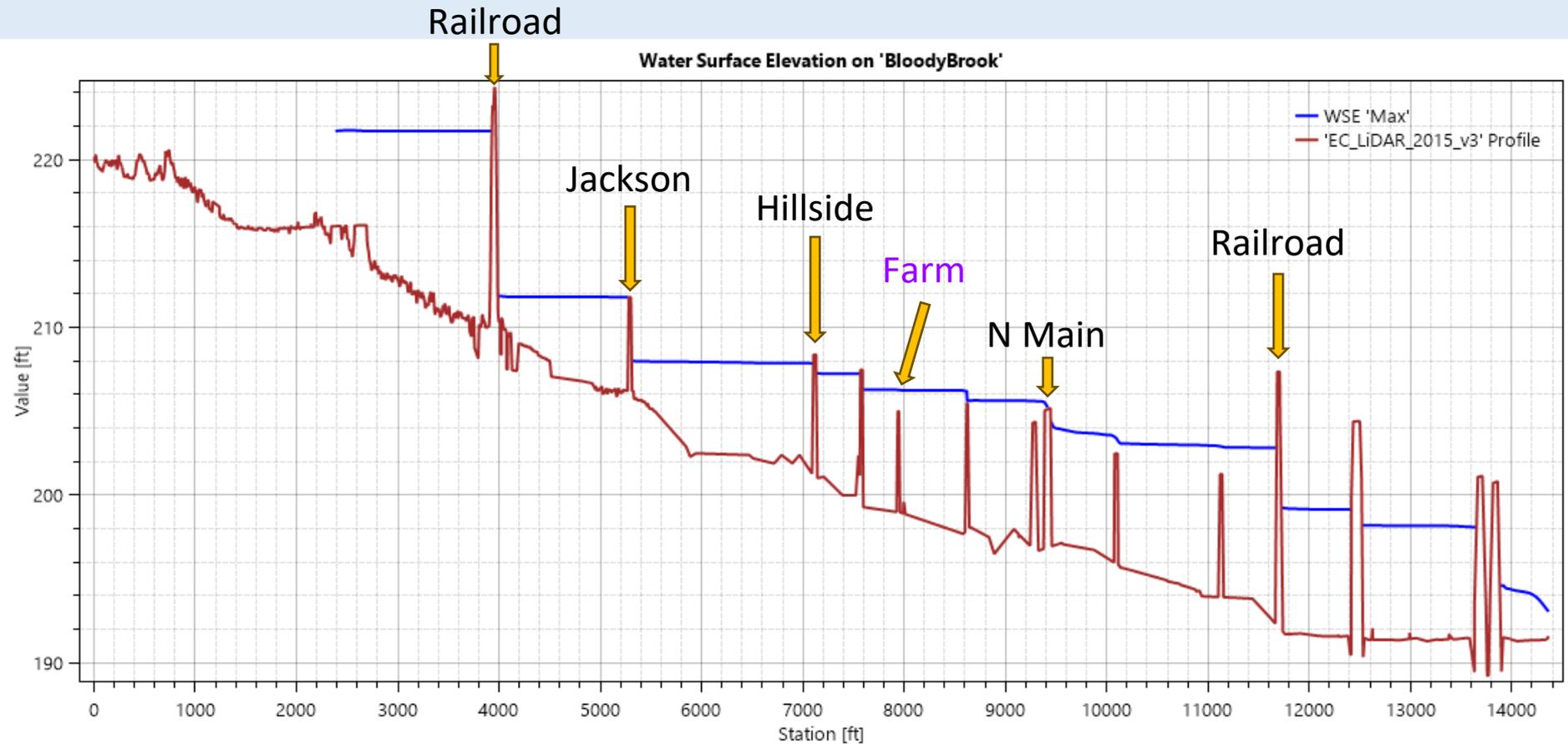
Bloody Brook



25-year flow event



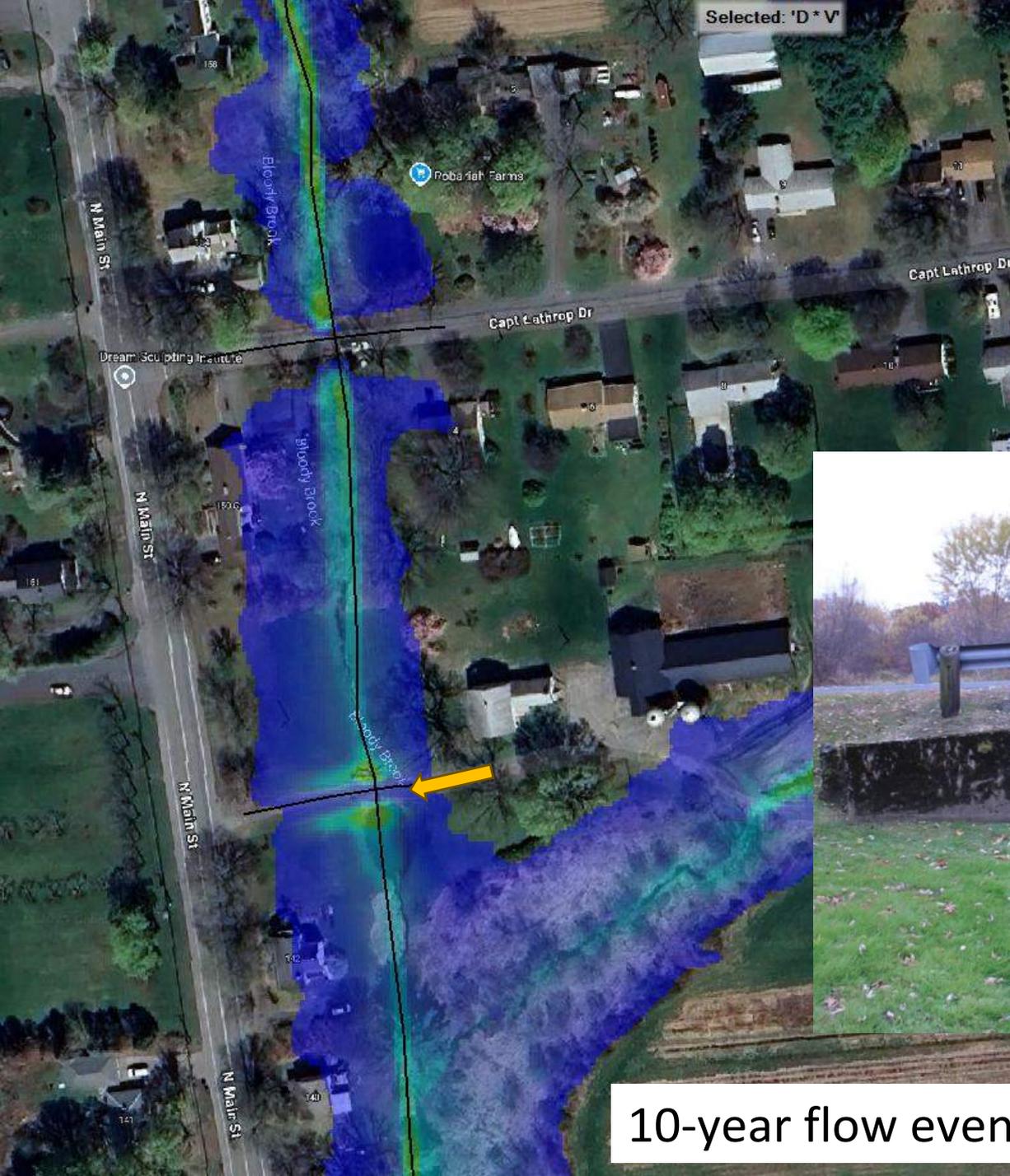
Longitudinal Stream Profile



Present 100-year flow event



Private Drive Bloody Brook Farm

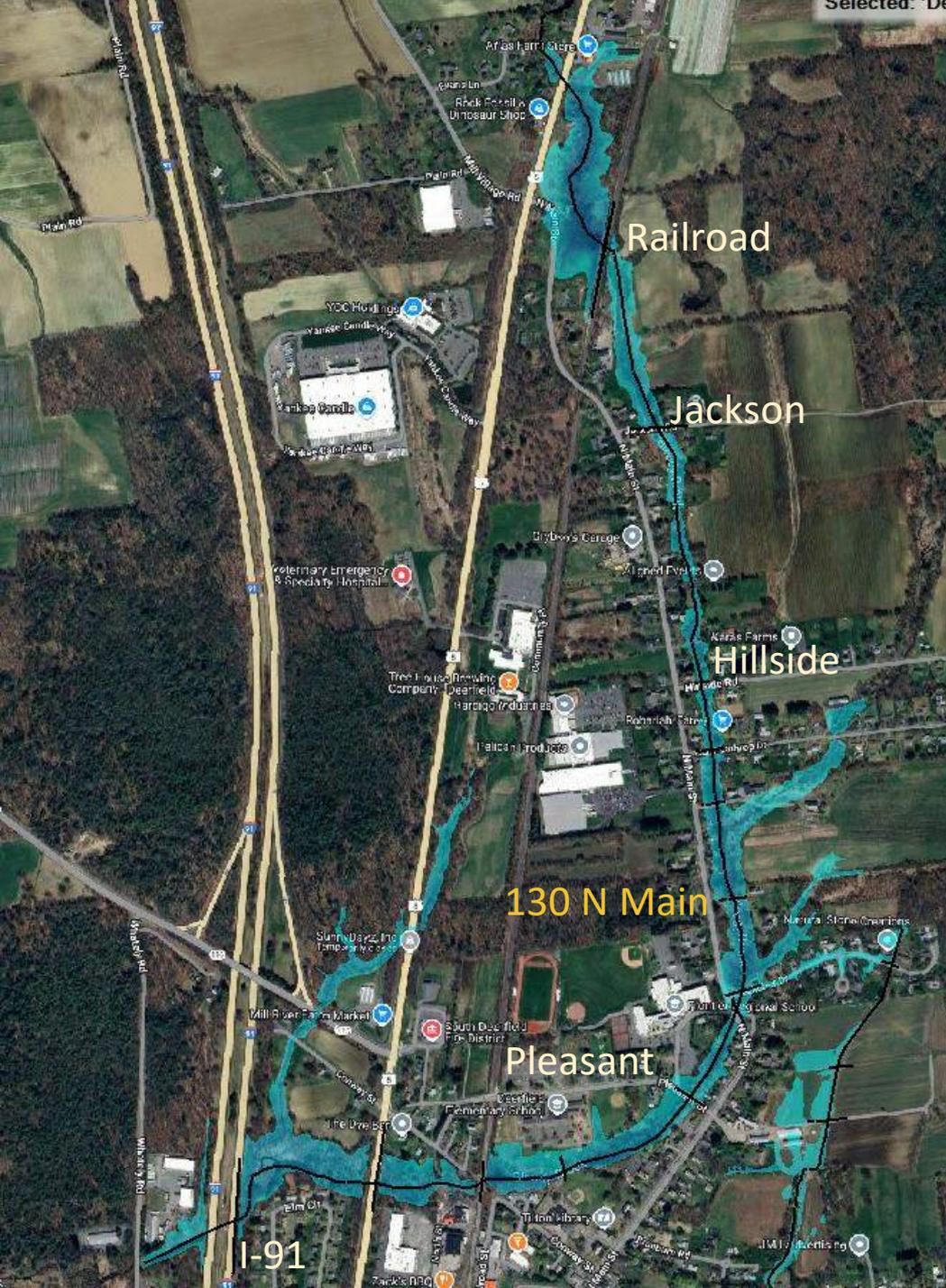


10-year flow event



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Bloody Brook

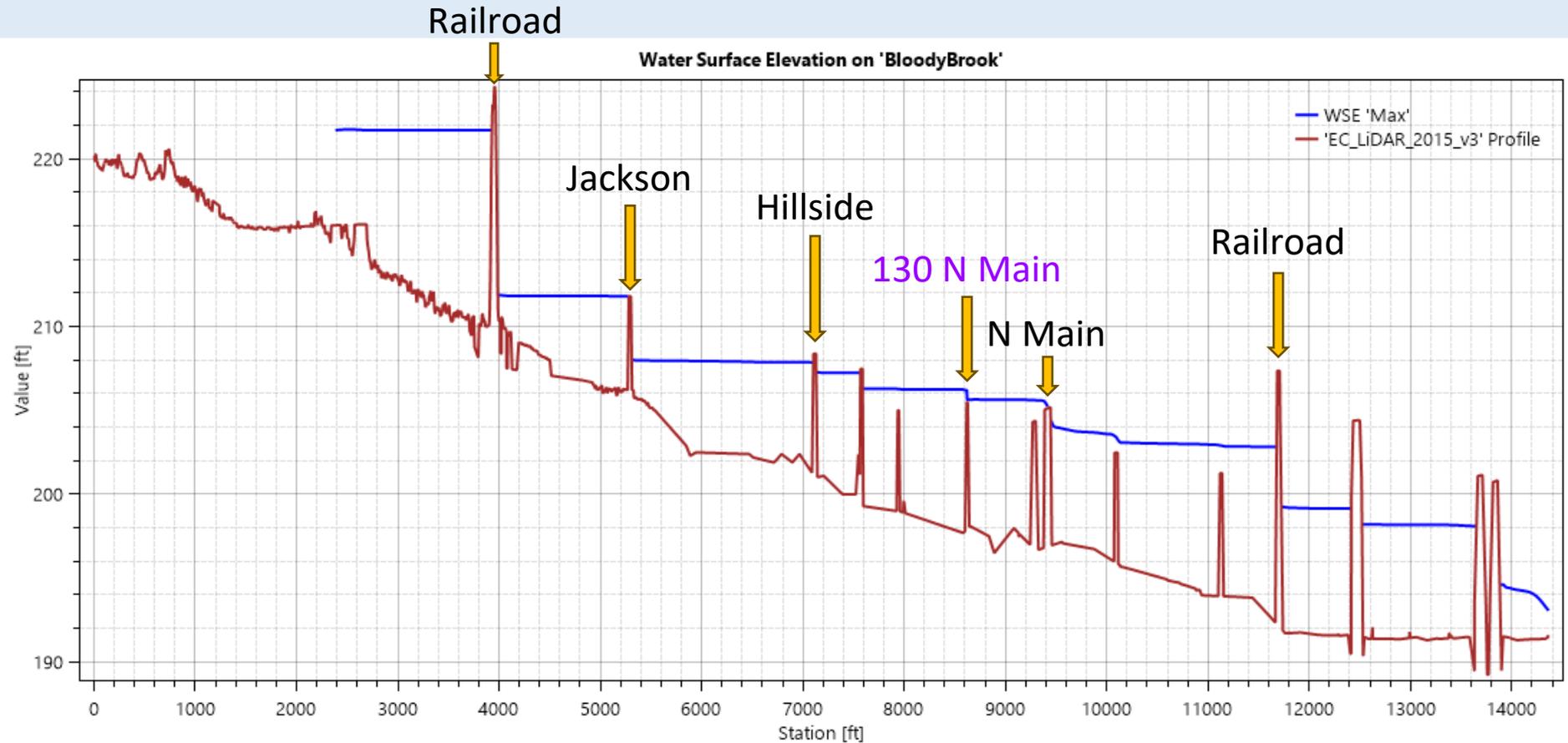


25-year flow event



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Longitudinal Stream Profile



Present 100-year flow event



Private Drive 130 N. Main St

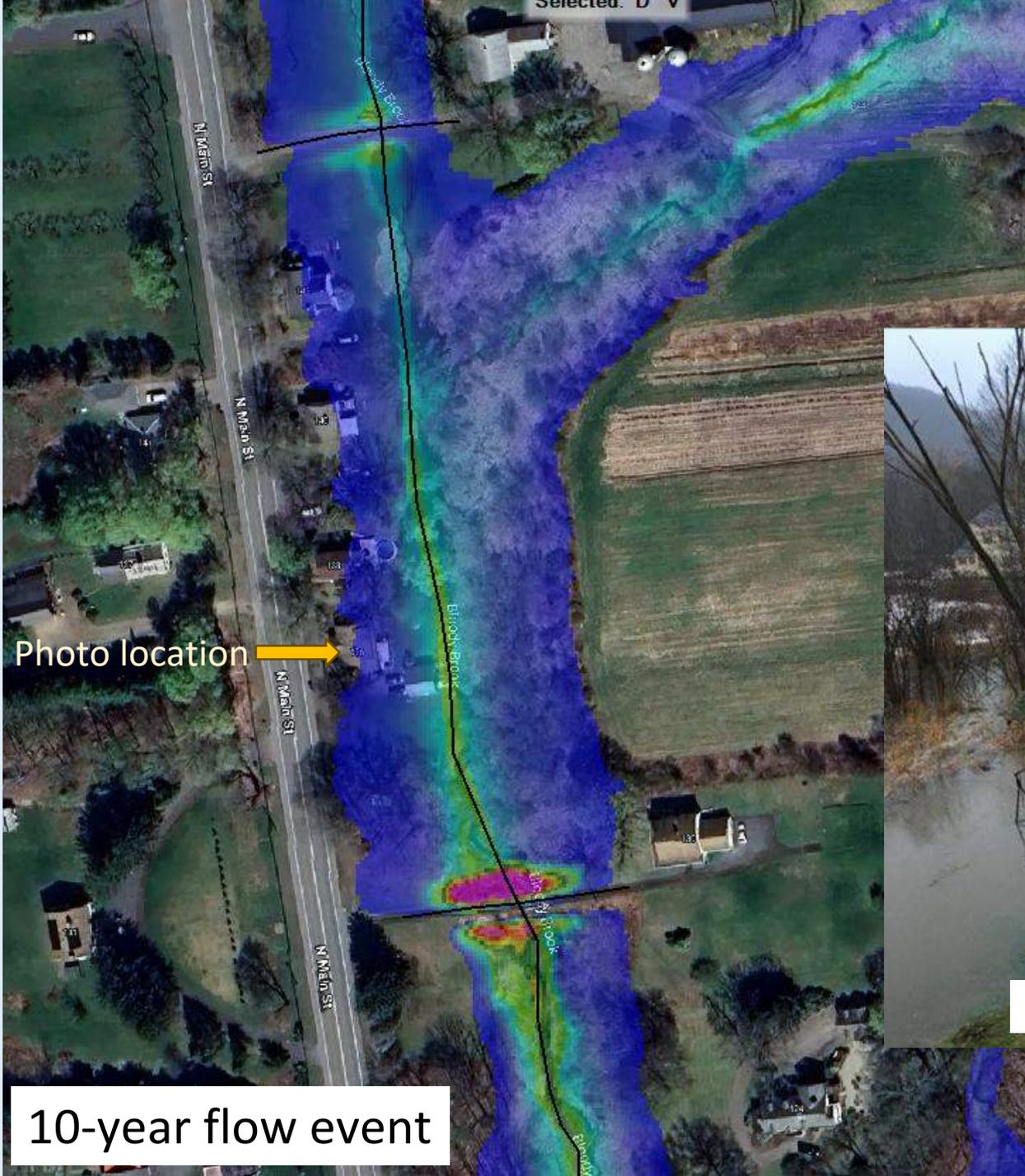


Photo location

10-year flow event



Courtesy of Michael and Stacy Martin



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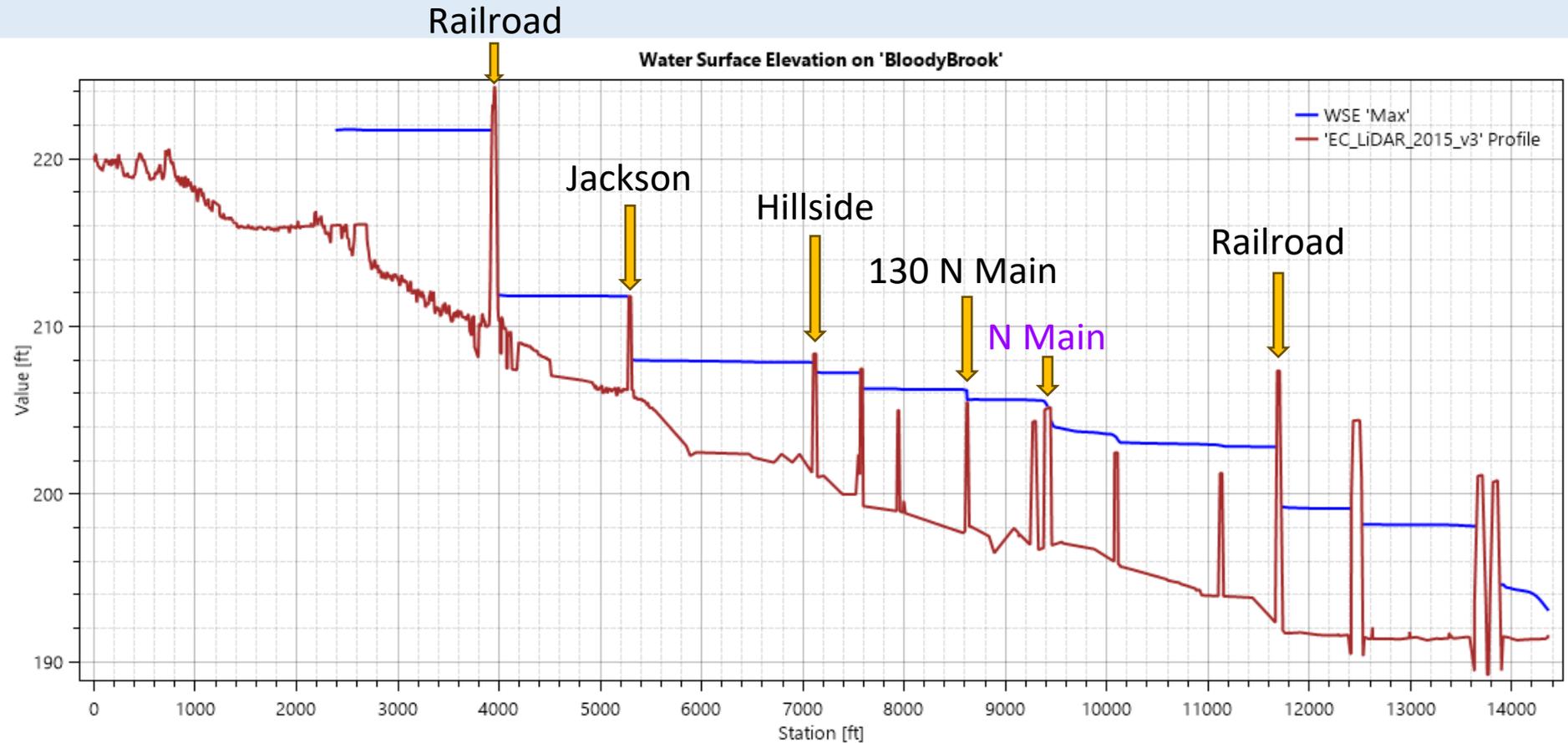


Private Drive 130 N. Main St

Cross-Section Name in HEC RAS	Distance Upstream from Bloody Brook outlet (mi)	Min. Top of Road Elevation	Average Maximum Value in Cross Section	Flood Return Period															
				Present							Late Century (2090)								
				1yr	2yr	5yr	10yr	25yr	50yr	100yr	500yr	1yr	2yr	5yr	10yr	25yr	50yr	100yr	500yr
130N Main St Driveway	1.1	205.0	WSE (ft)	205.6	205.7	205.8	205.9	206.0	206.0	206.3	207.2	205.8	205.9	206.1	206.0	206.9	207.2	207.4	208.0
			Overtopping Depth (ft)	0.6	0.7	0.8	0.8	1.0	1.0	1.2	2.2	0.8	0.9	1.0	0.9	1.9	2.1	2.3	3.0
			Velocity (ft/s)	5.3	5.5	5.6	6.0	4.4	6.1	5.9	5.9	5.6	5.7	5.7	5.7	5.9	5.9	5.9	5.8
			DV (ft ² /s)	2	3	3	3	4	4	4	4	3	3	4	3	4	4	4	5



Longitudinal Stream Profile



Present 100-year flow event

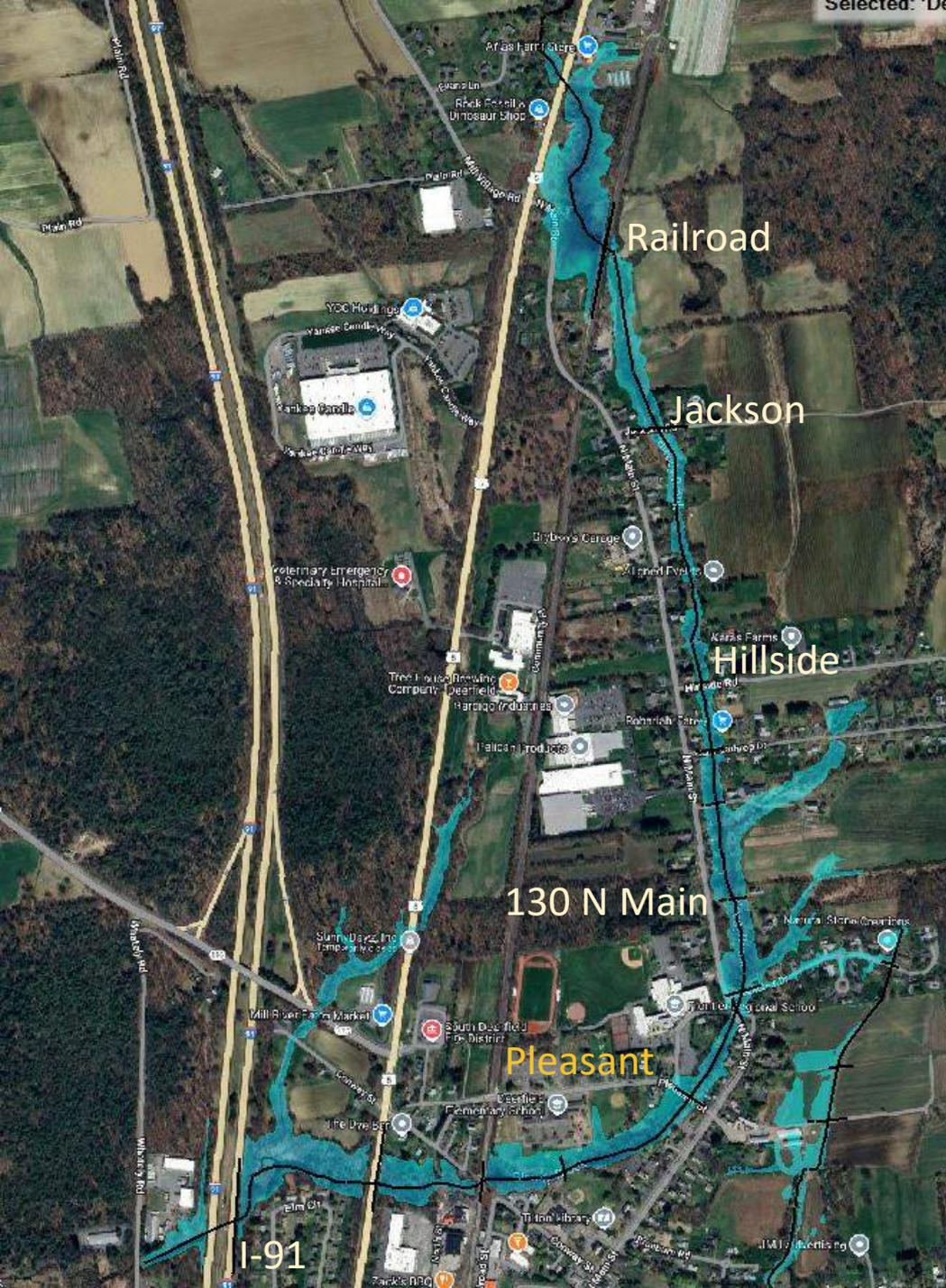


Selected: 'D * V'

N. Main St culvert



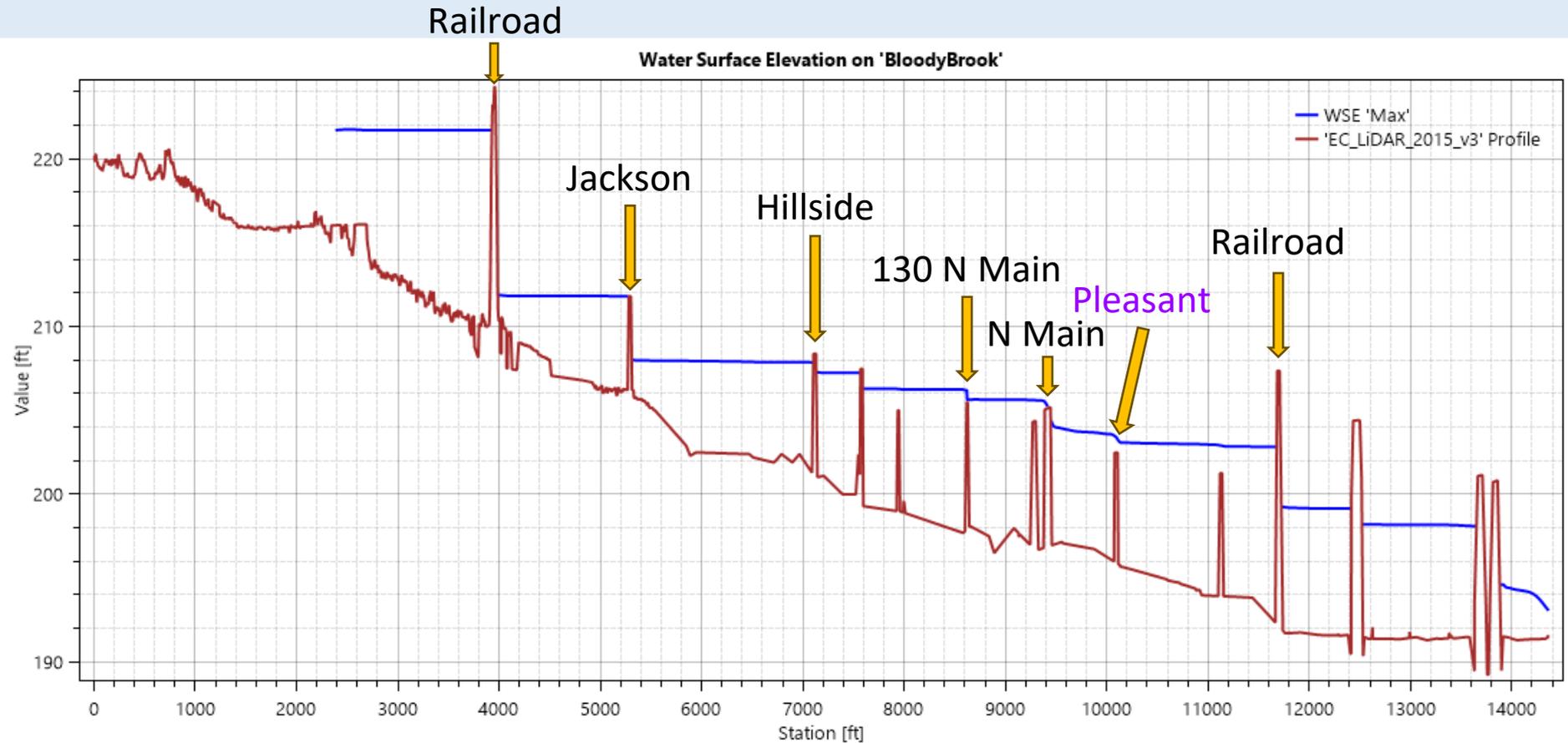
Bloody Brook



25-year flow event



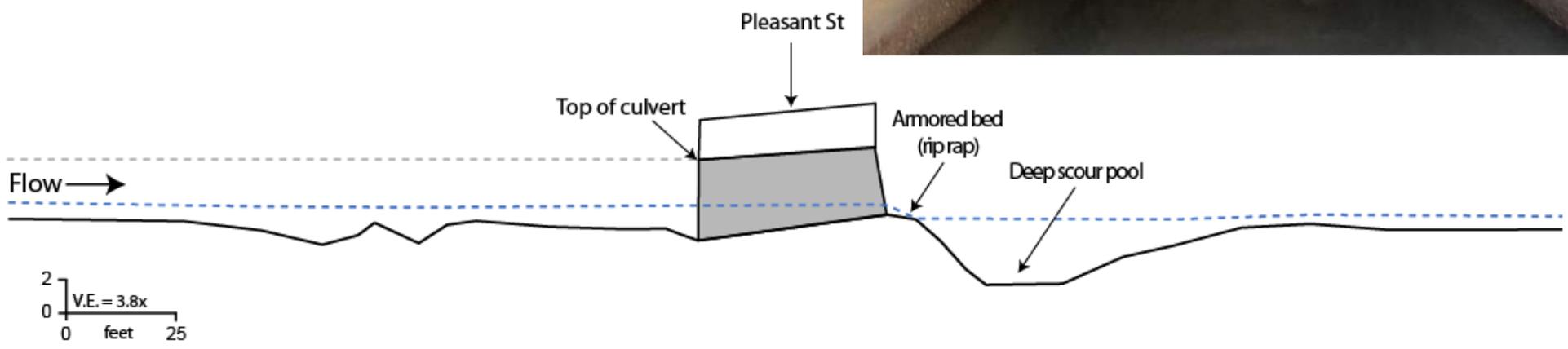
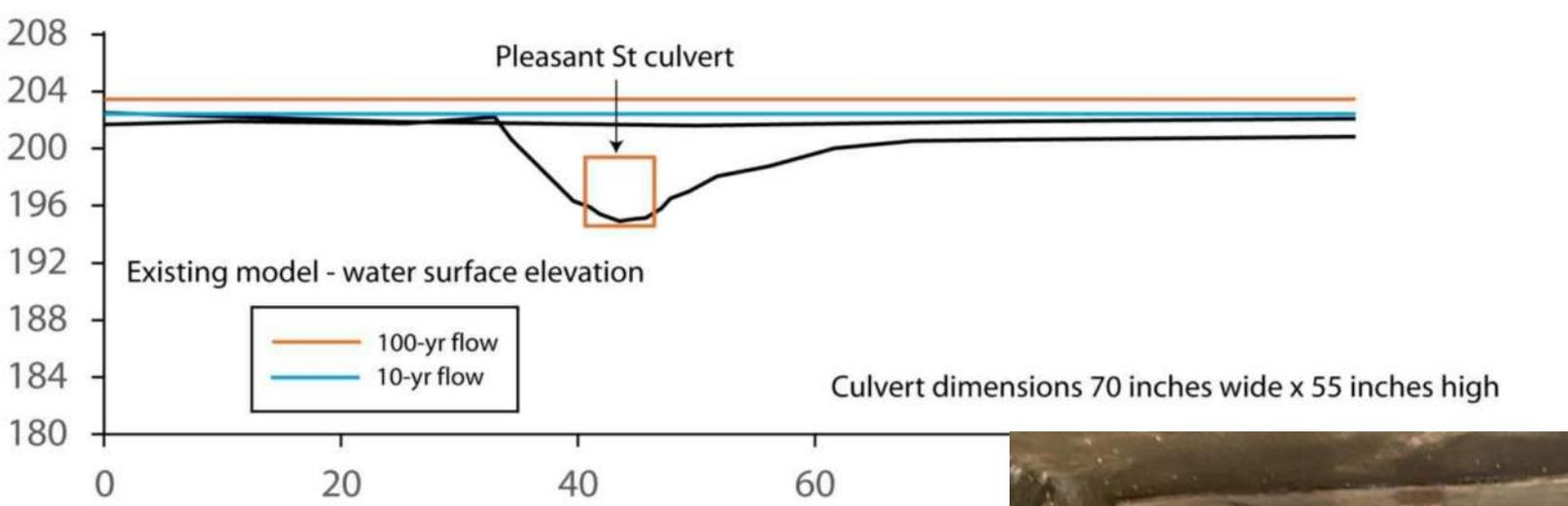
Longitudinal Stream Profile



Present 100-year flow event

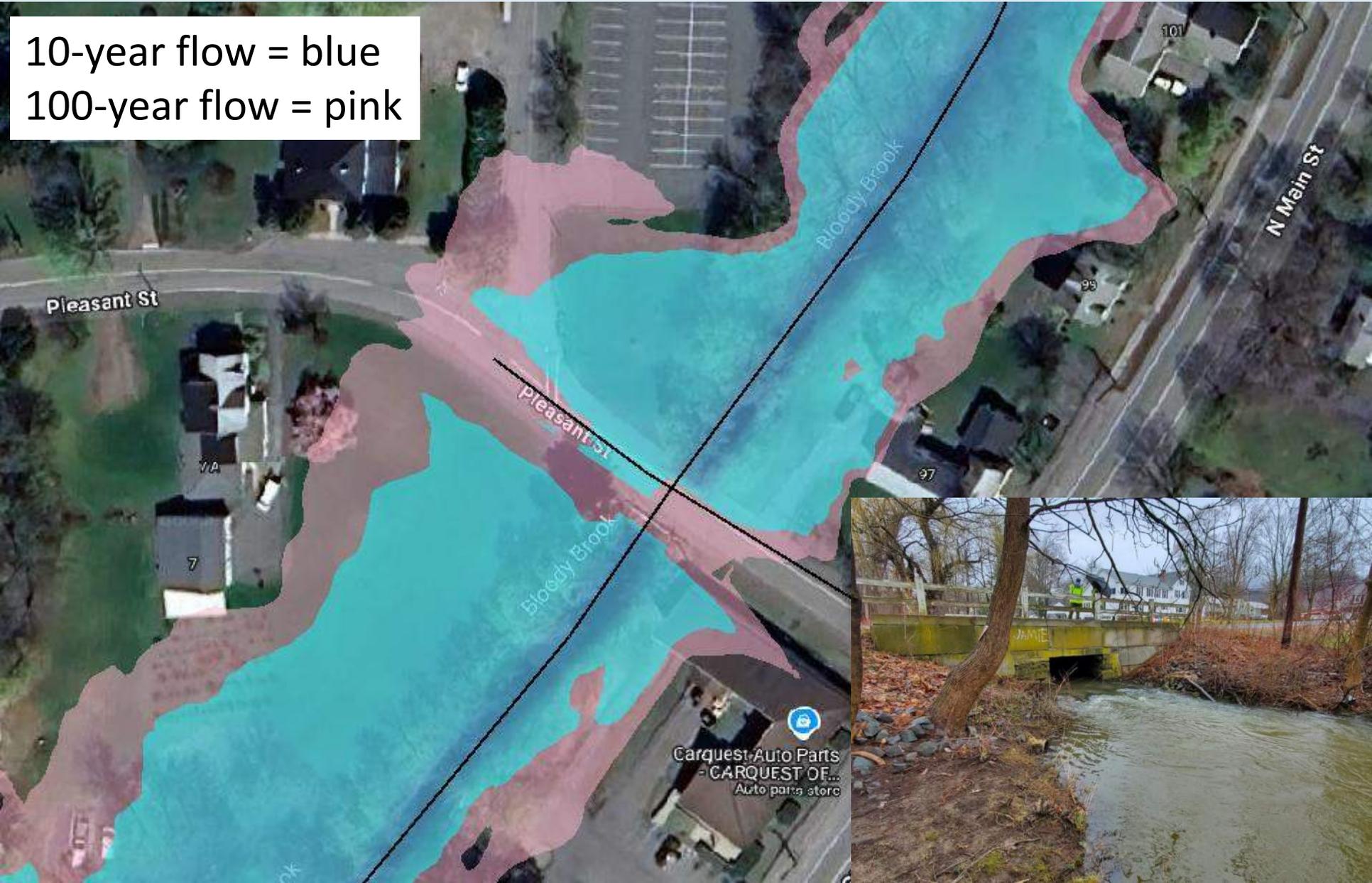


Pleasant St culvert

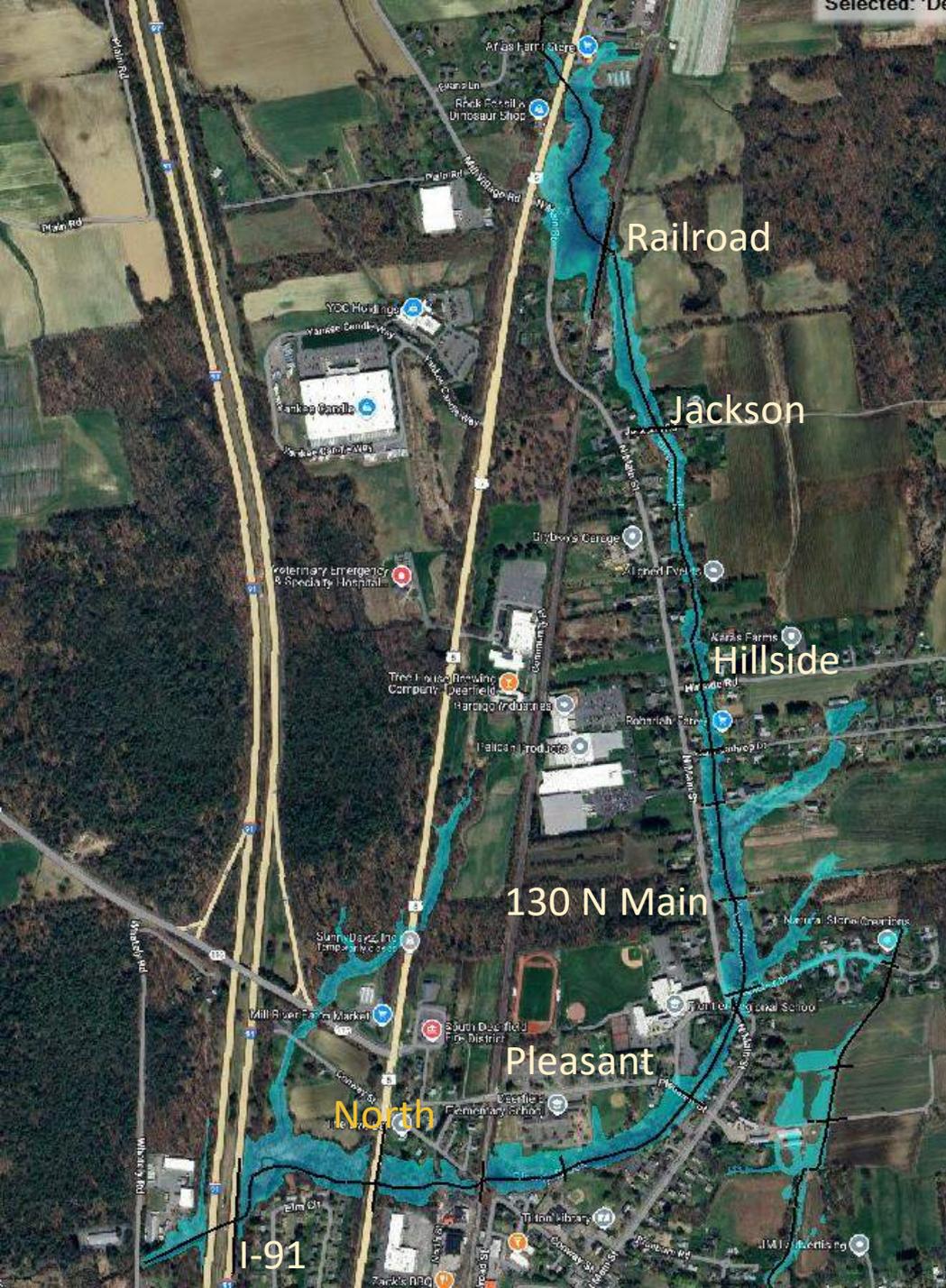


Pleasant St culvert

10-year flow = blue
100-year flow = pink

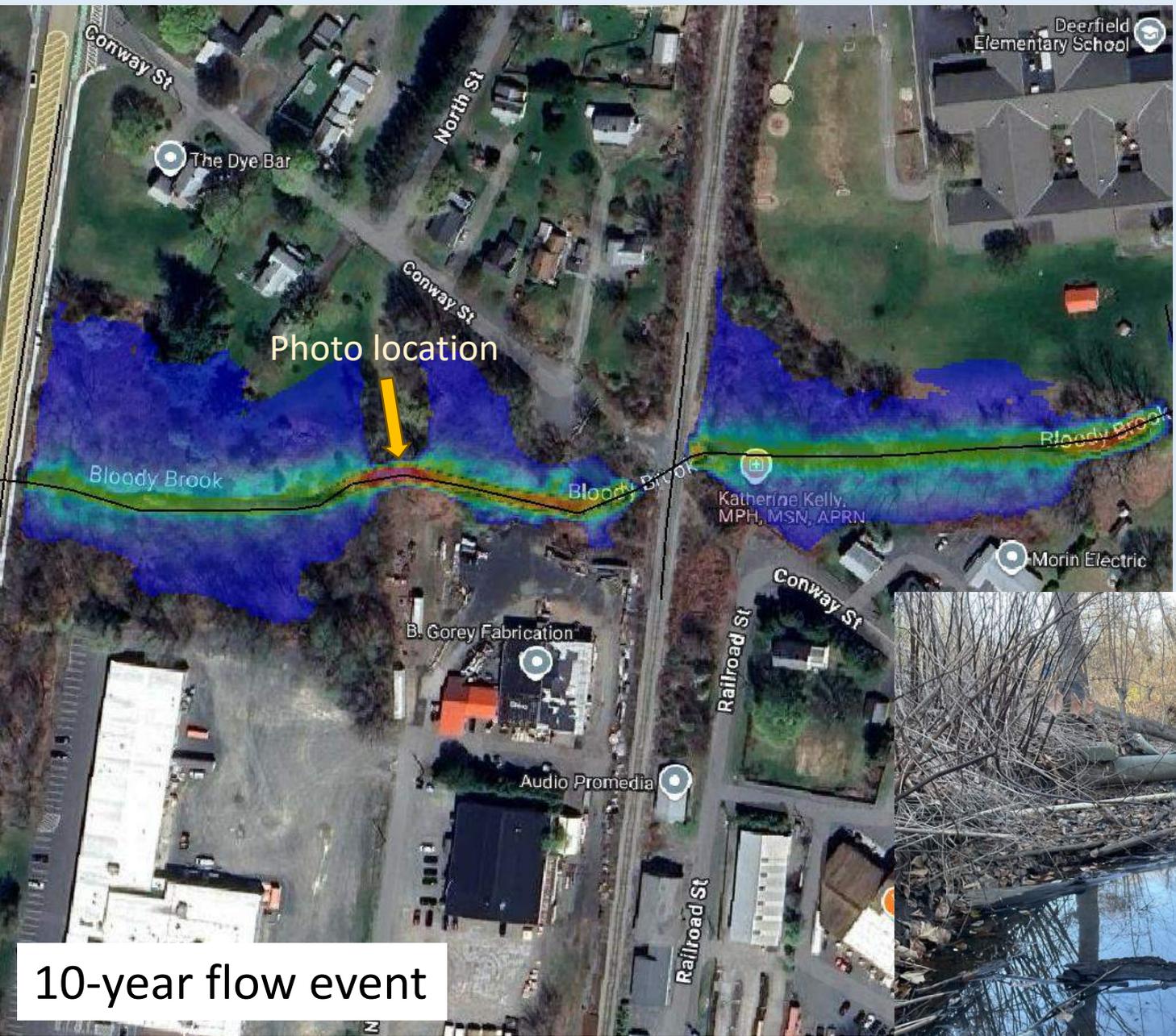


Bloody Brook



25-year flow event





North St Crossing

10-year flow event

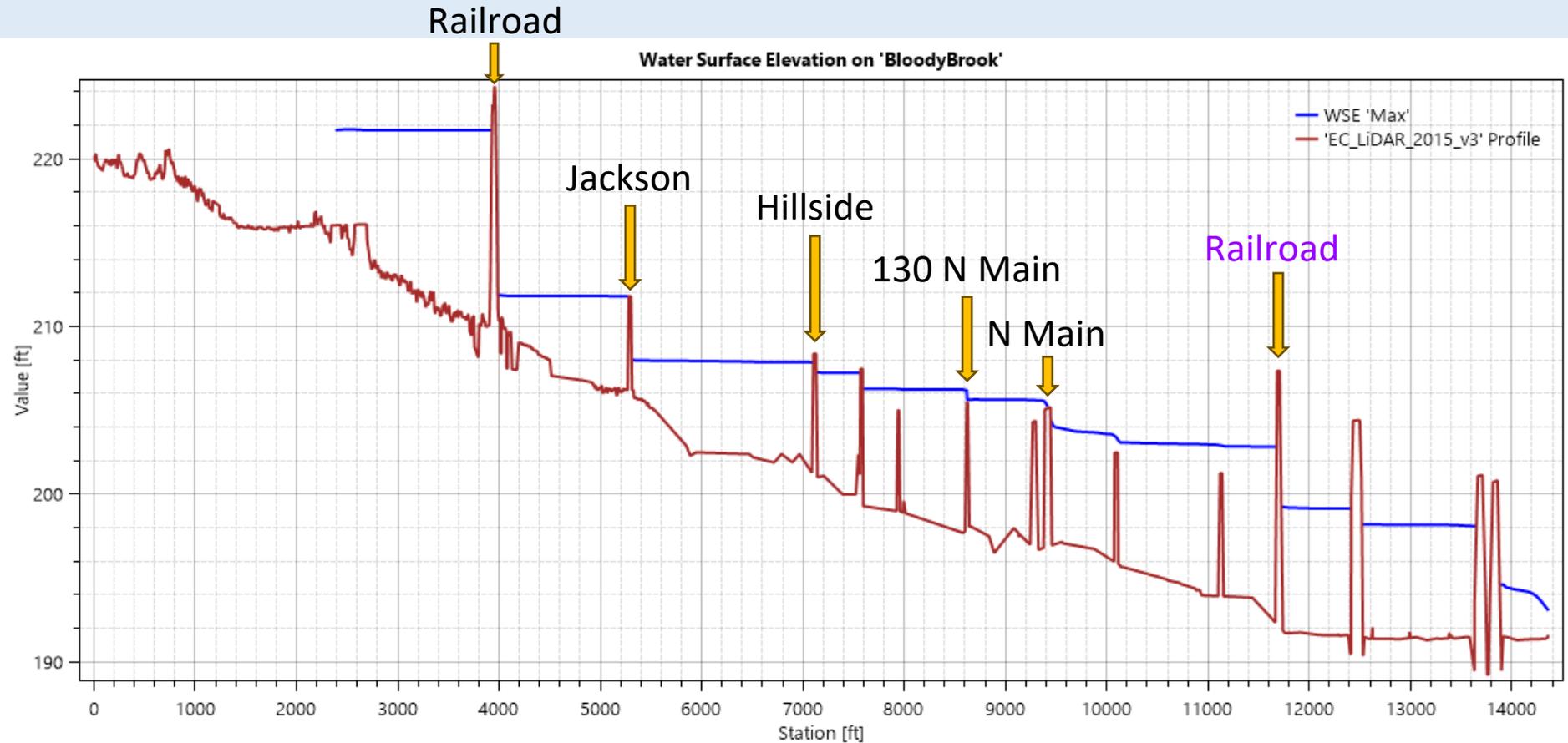




North St Crossing



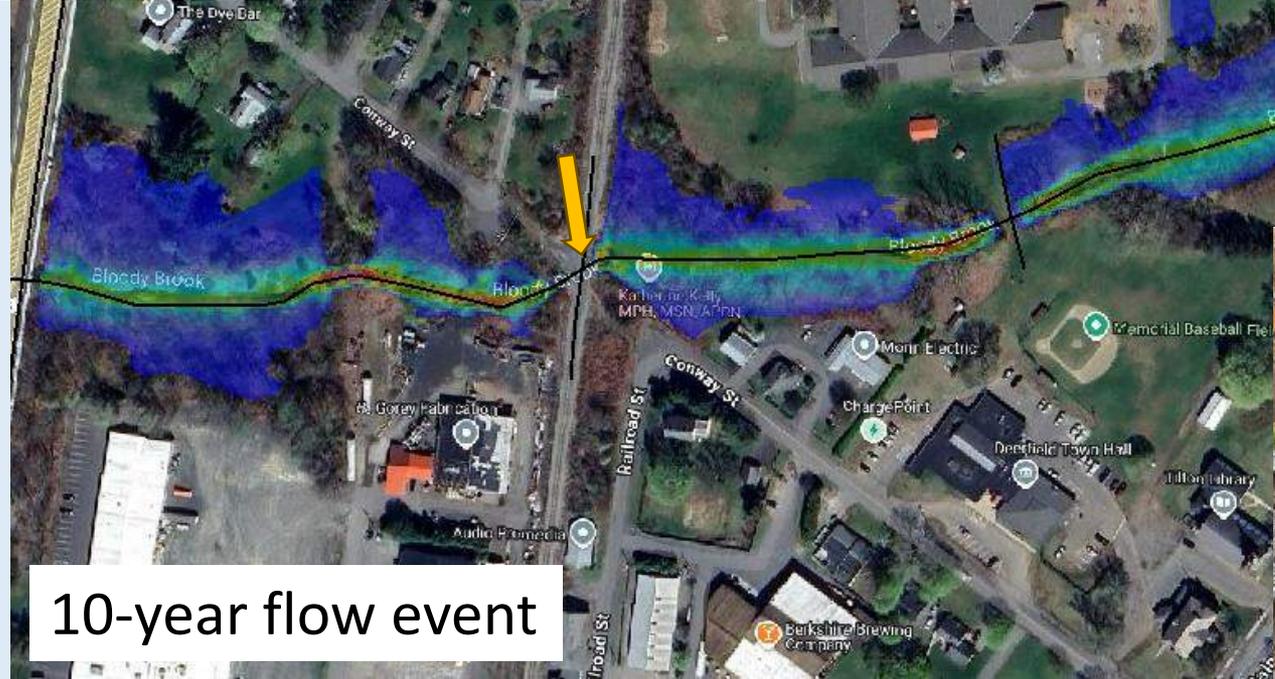
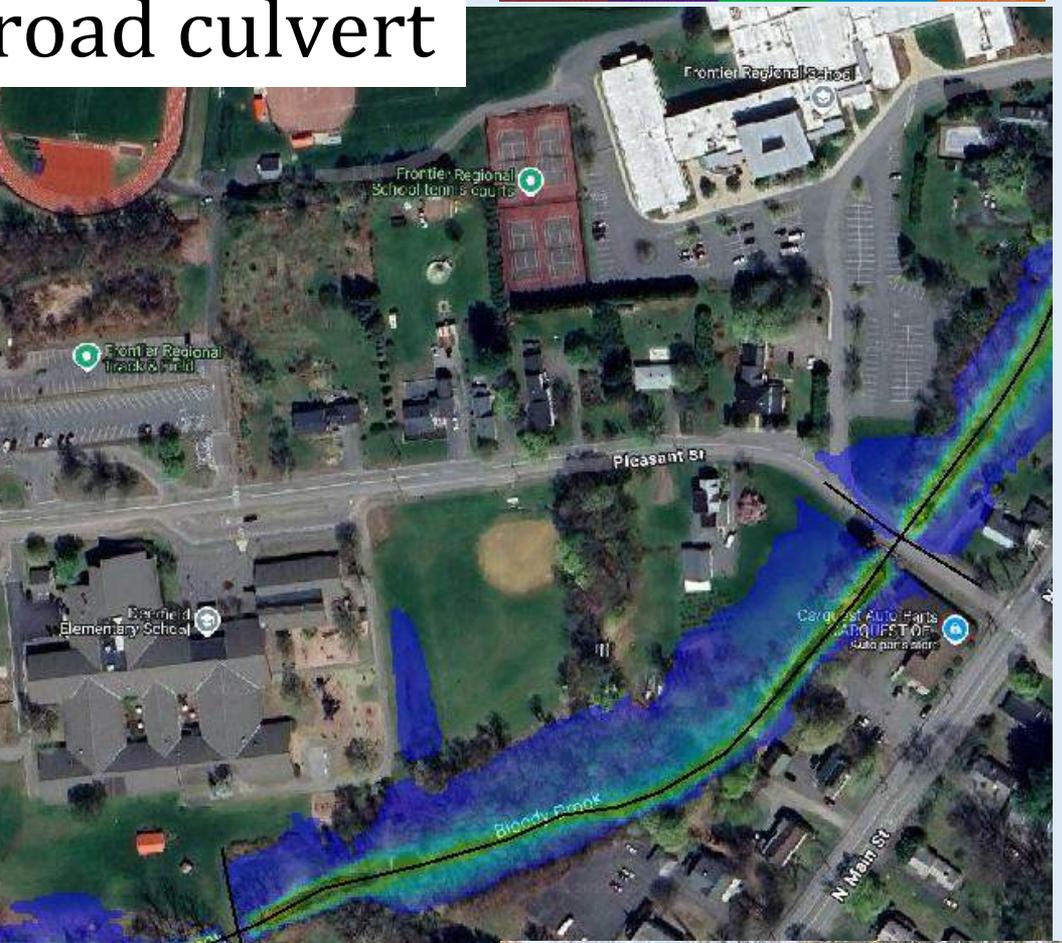
Longitudinal Stream Profile



Present 100-year flow event



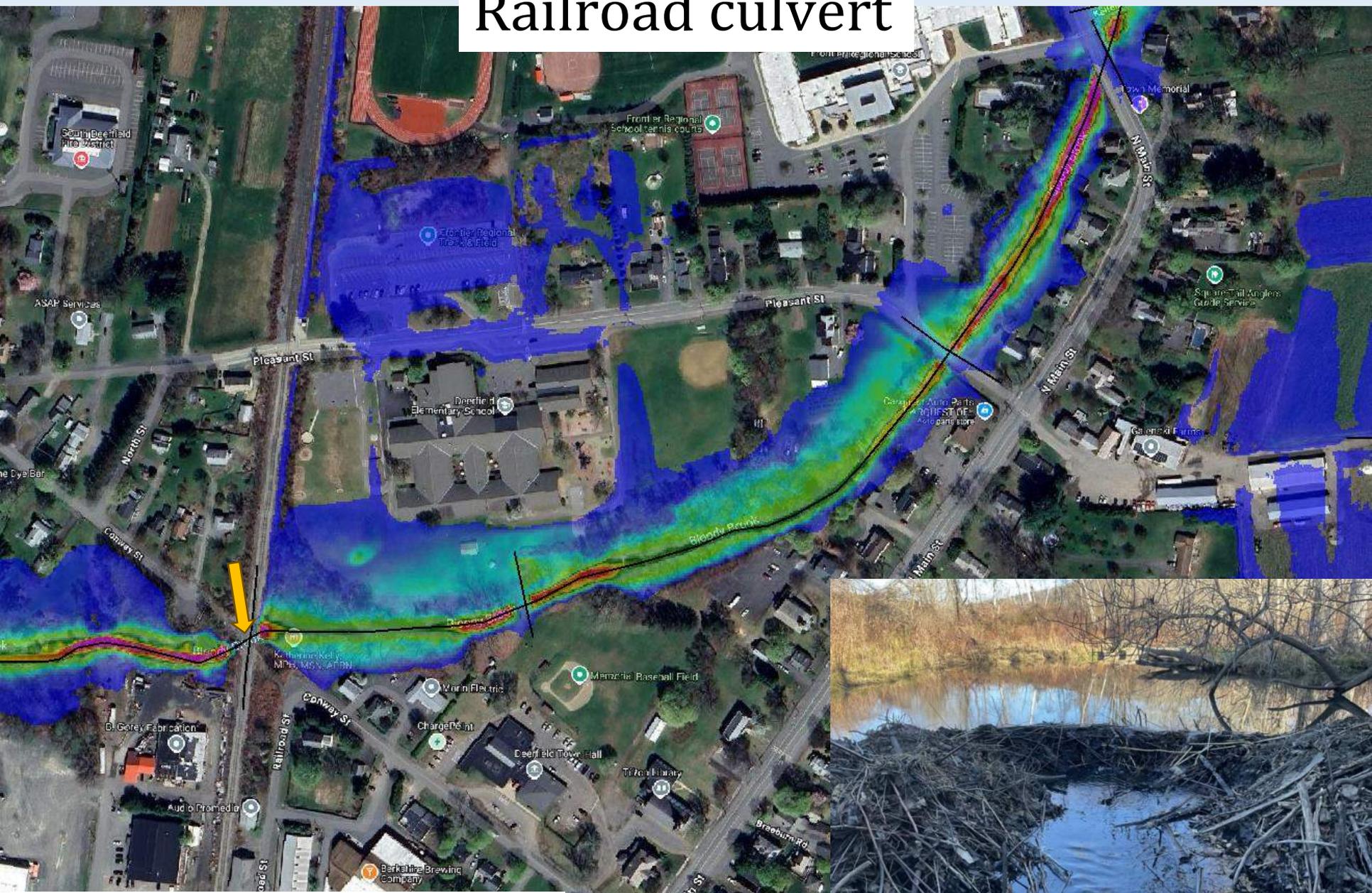
Railroad culvert



10-year flow event

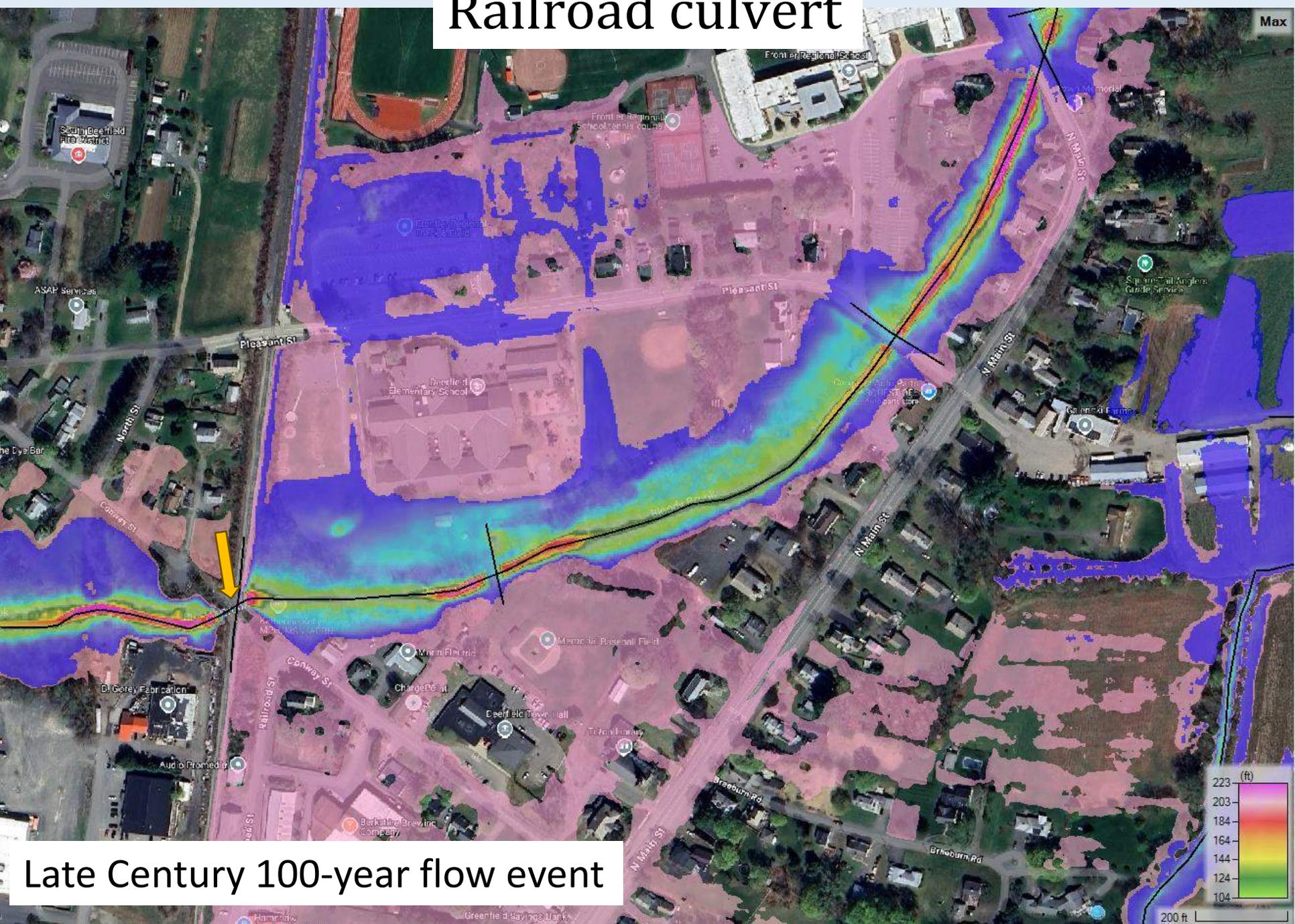


Railroad culvert

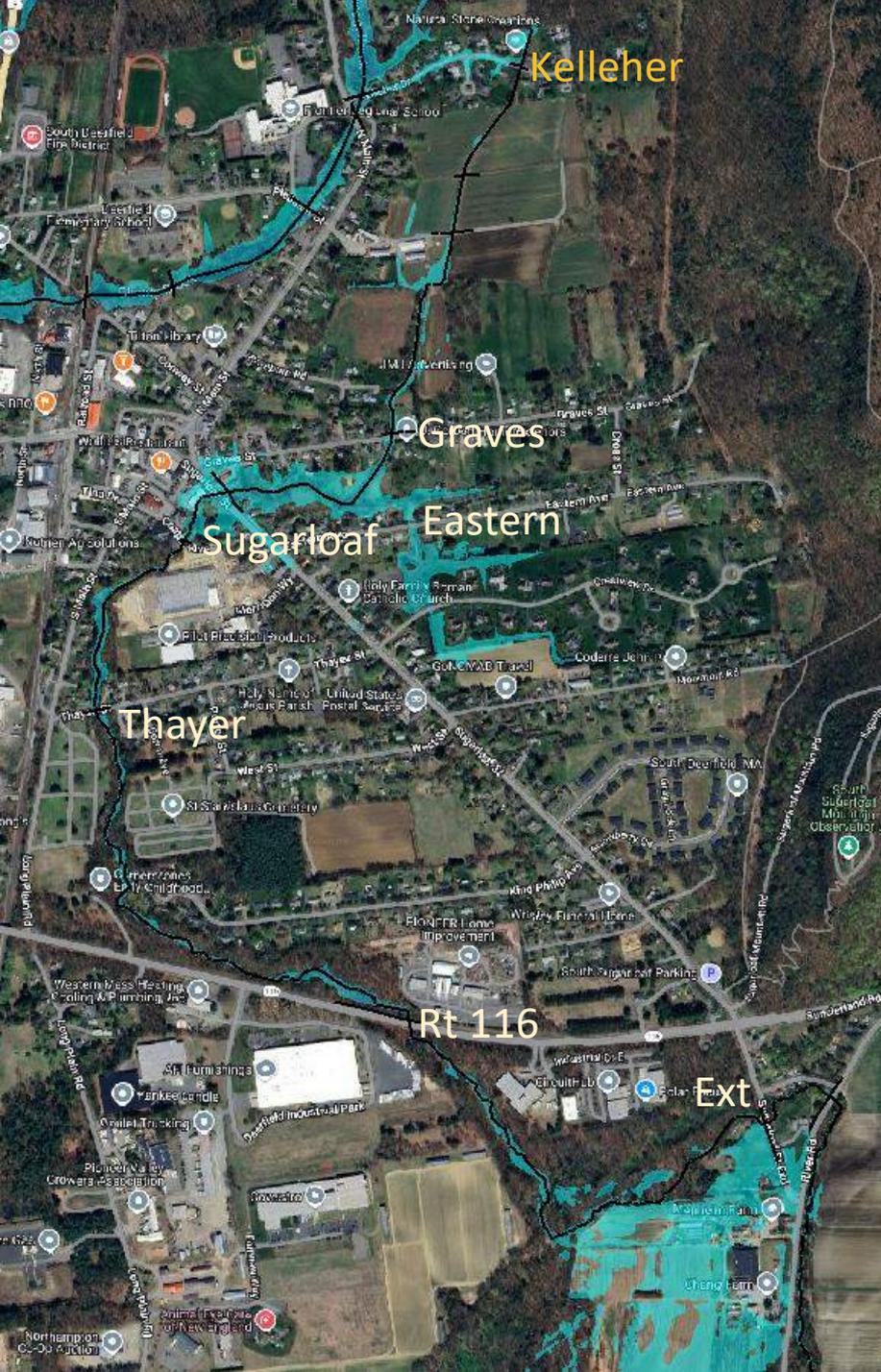


Present 100-year flow event

Railroad culvert



Late Century 100-year flow event



Blacksmith/Sugarloaf Brook

25-year flow event



Longitudinal Stream Profile

Kelleher

Graves

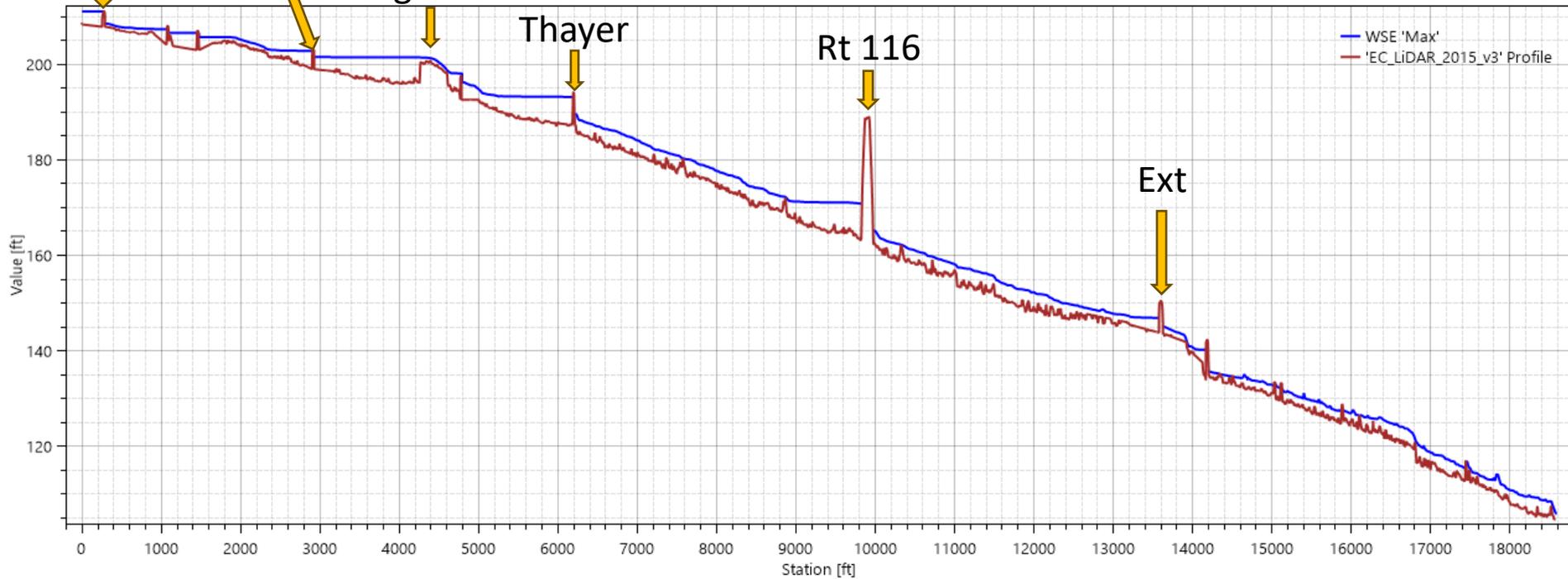
Sugarloaf

Thayer

Rt 116

Ext

Water Surface Elevation on 'SugarloafBrook'



Present 100-year flow event



Kelleher St culvert



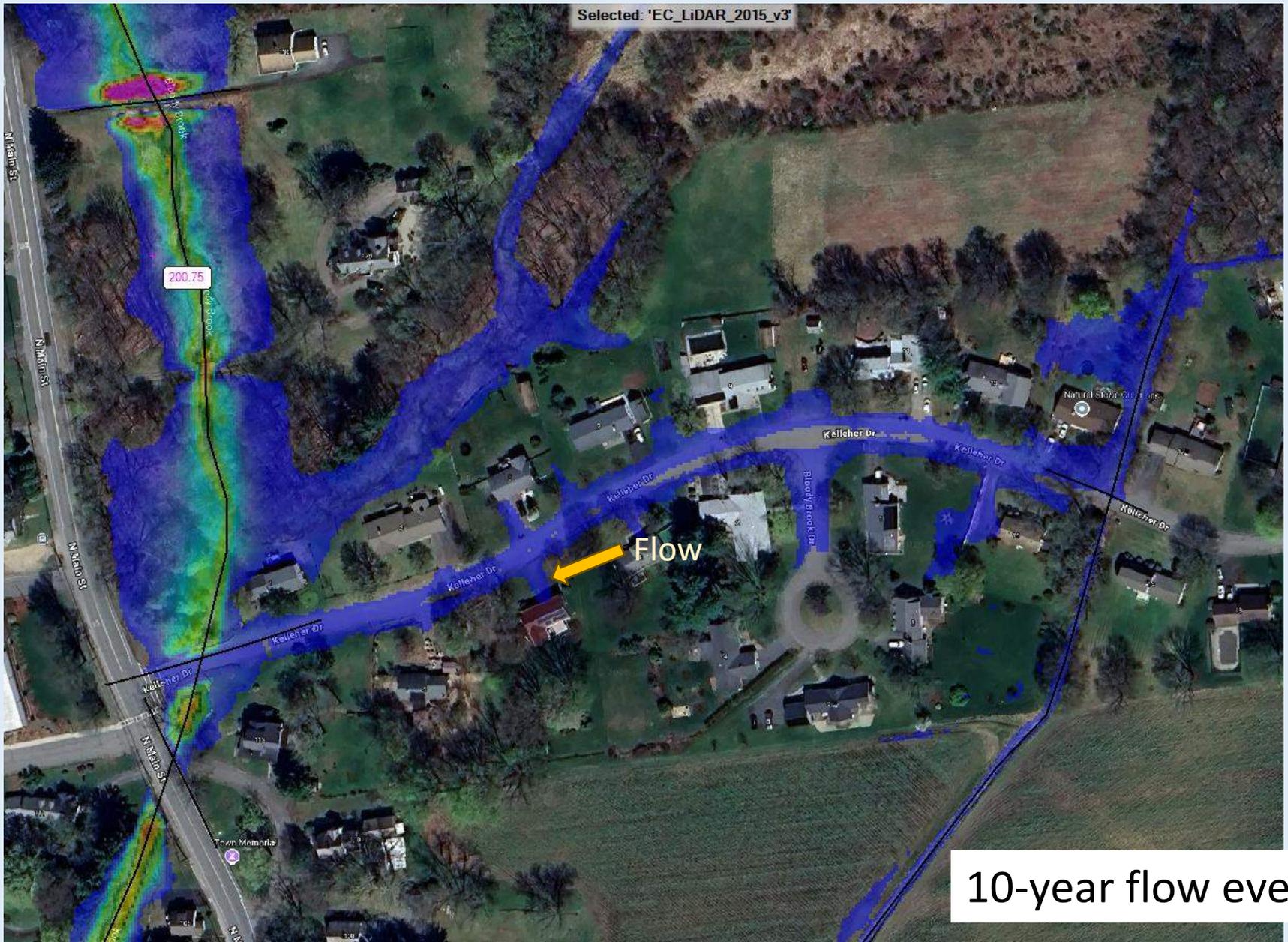
Kelleher St culvert



Existing culvert = 13in wide x 7in high (crushed)

10-year flow event

Kelleher St culvert



Sugarloaf St culvert



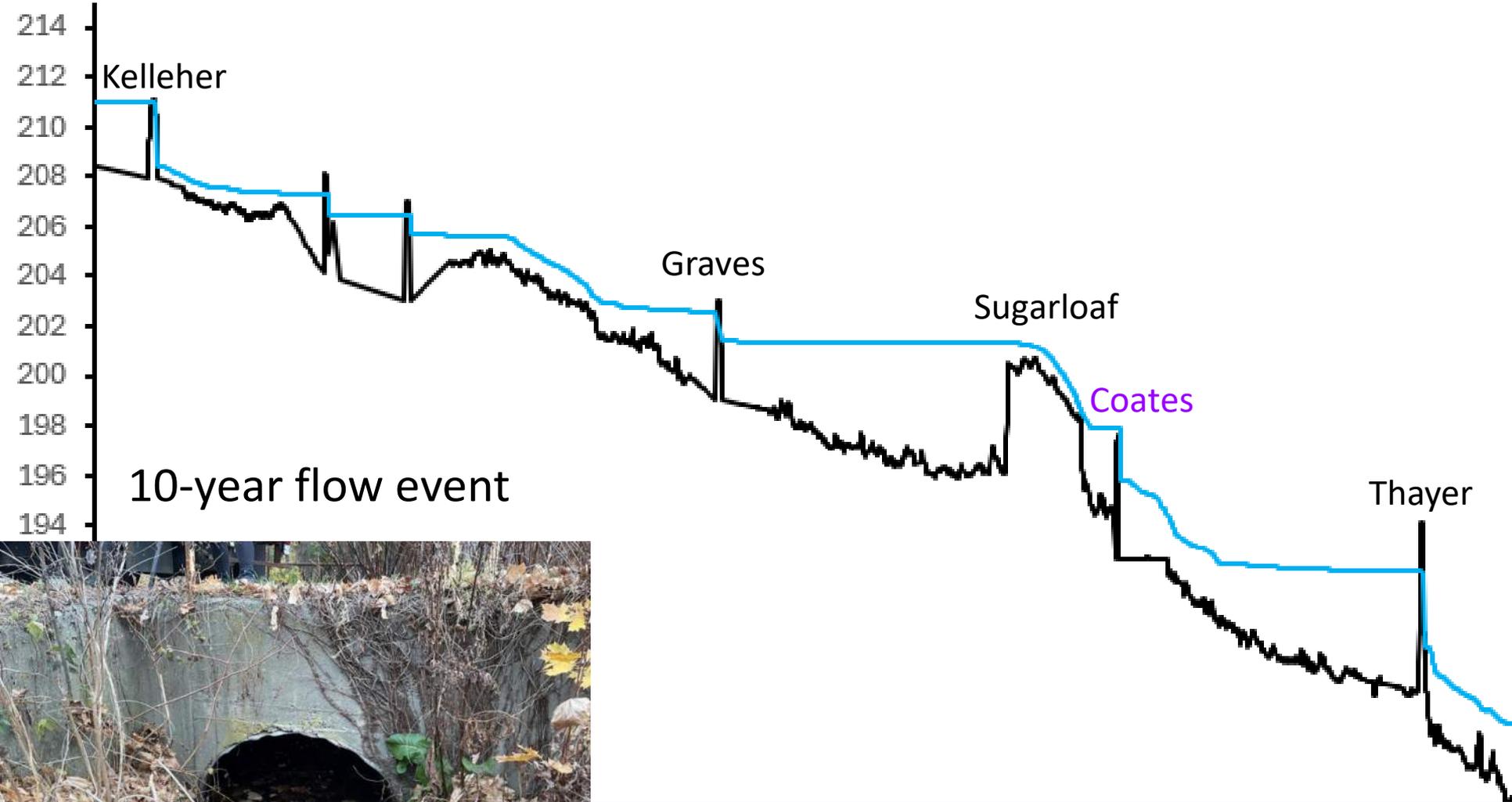
Sugarloaf St culvert

10-year flow event



Water depths up to 16 inches over Sugarloaf St

Coates Ave culvert

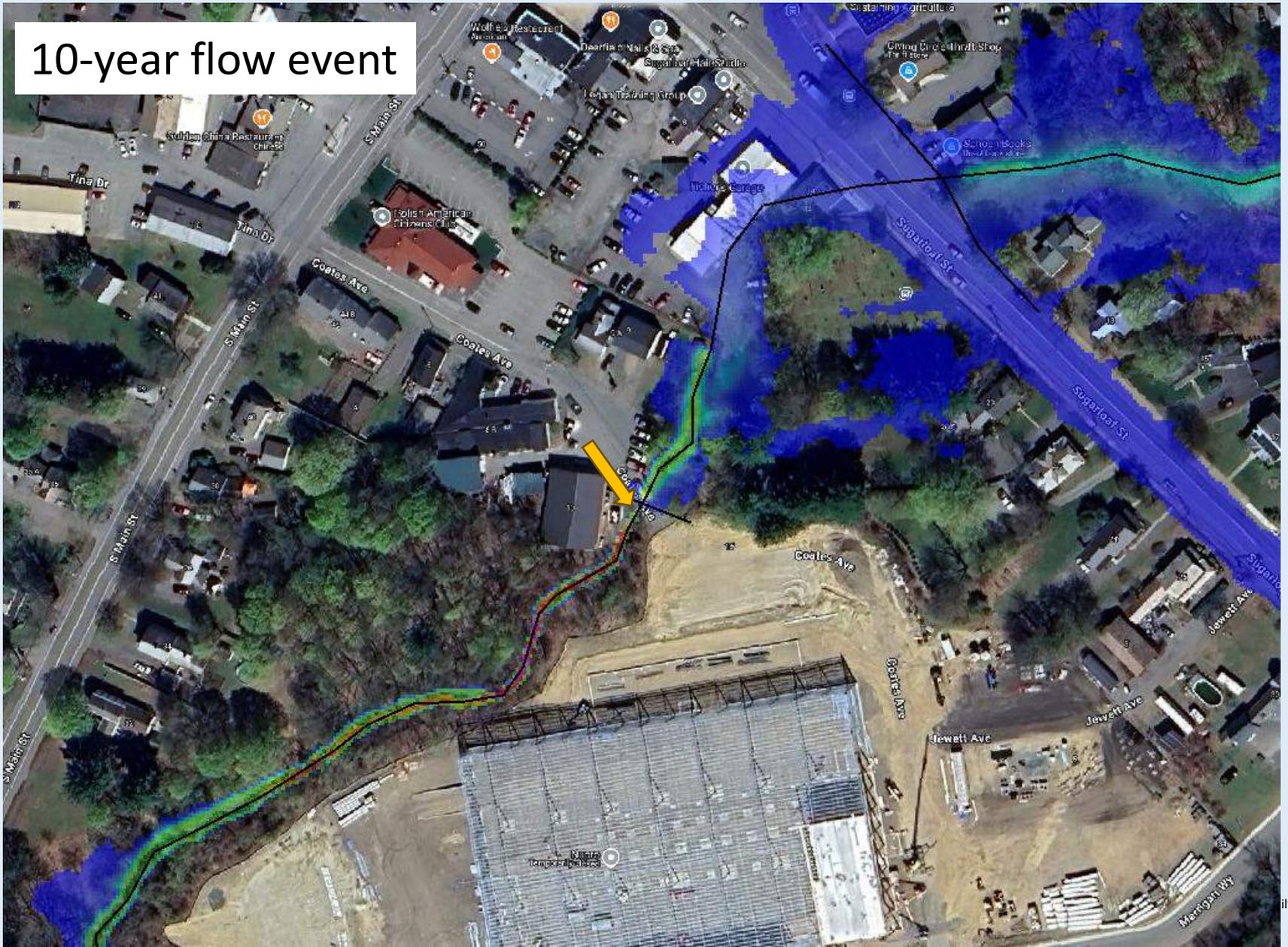


48in wide x 30in high
Filled halfway w sand

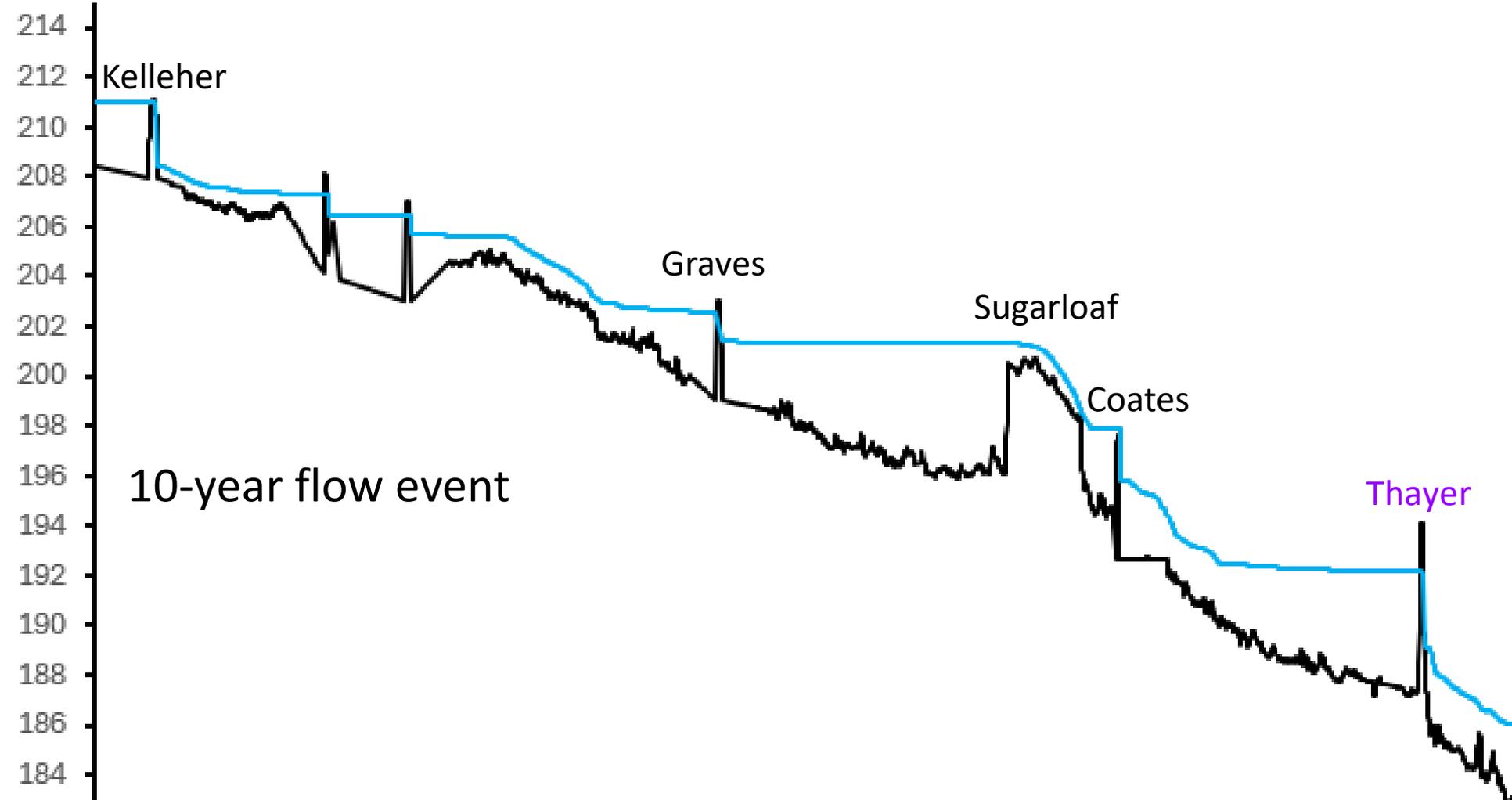


Coates Ave culvert

10-year flow event



Thayer St culvert



Thayer St culvert

10-year flow event



Next Steps

Proposed Conditions Modeling



A Well Designed Crossing

Large size suitable for handling high flows

Open-arch design preserves natural stream channel

Openness ratio greater than 0.5m, suitable for most settings

Crossing span helps maintain dry passage for wildlife

Water depth and velocity are comparable to conditions upstream and downstream

Natural substrates create good conditions for stream-dwelling animals

Scott Jackson photo

Next Steps

Proposed Conditions Modeling

	Hydraulic Design Flood AEP (Years)	Estimated Bankfull Width, ft	1.2 x Bankfull Width (ft) = Prop. Culvert Width	Current Culvert Size
Bloody Brook Main Channel				
Bloody Brook Farm Driveway	10	15	18	3.7' wide x 4.2' high rectangular stonework
130 N Main St	10	18	22	5' wide x 6.1' high bridge with concrete abutments and concrete span
Kelleher St	10	20	24	9.8' wide x 5.25' high bottomless rectangular concrete
N Main St	25	20	24	8' wide x 5.9' high bottomless rectangular concrete / 11.25' wide x 4.6' high concrete-encased span and concrete abutments
Pleasant St	25	20	24	5.8' wide x 4.6' high concrete box culvert
Lower Railroad	100	21	25	9.2' wide x 5.8' high metal arch on concrete footings
Blacksmith/Sugarloaf Main Channel				
Kelleher Dr	10	5	5	13" wide x 7" high corrugated metal pipe (crushed)
Sugarloaf St	25	11	13	6' wide x 3.75' high concrete box
Coates Ave	10	12	14	4' wide x 2.5' high corrugated metal pipe/arch
Thayer St	10	12	14	6' wide x 5.75' high open bottom concrete box

Next Steps

Project Identification, prioritization, report and conceptual designs

Resilience Projects -

Stormwater: *reduce impervious cover, promote infiltration, manage near the source*

Wetland restoration/floodplain reconnection: *remove historic floodplain fill*

Vegetated riparian buffers

Channel maintenance (dredging)

Landscaping/yard maintenance - Best Management Practices

Floodplain reconnection examples

2016 Restoration

- Lowered floodplain 3 feet; removed 3500 cu.yd. sediment/loam
- Invasive species mitigation
- 2020 native trees/shrubs planting (Friends of the South River)



South River Meadow – Conway, MA



South River Meadow – Conway, MA



Courtesy of Janet Chayes

Whetstone Brook – Brattleboro, VT

2023 Restoration of 12-acre floodplain parcel

- Former Cersosimo Lumber site
- Removed 40,000 cu.yds of gravel fill
- Restored wetland
- Planted 100 ft wide riparian buffer
- New park provides recreational asset for downtown Brattleboro area



Long Creek – South Portland, ME



Big Spring Run – Chesapeake Watershed, PA



Sediment load reductions

- Total sediment removed = 25,955 tons
- Annual sediment reduction = 109 tons
- Total stream length restored = 3,000 ft restored

<http://www.bsr-project.org/overview.html>



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Impaired riparian buffer



Landscaping / yard maintenance

