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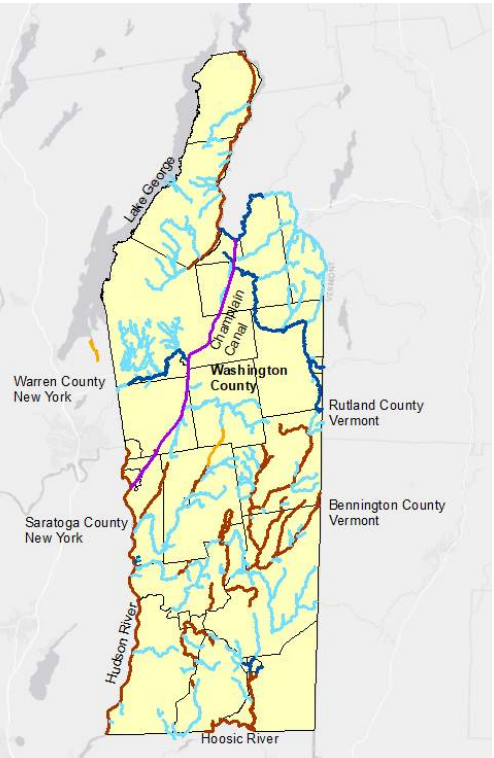
Flood Risk Project



Washington County, New York, Hydraulics Results Discussion

November 19, 2020

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Agenda

Recap/Refresh

Hydraulics Analysis Review

Path Forward

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What Have We Done So Far?
Recap/Refresh

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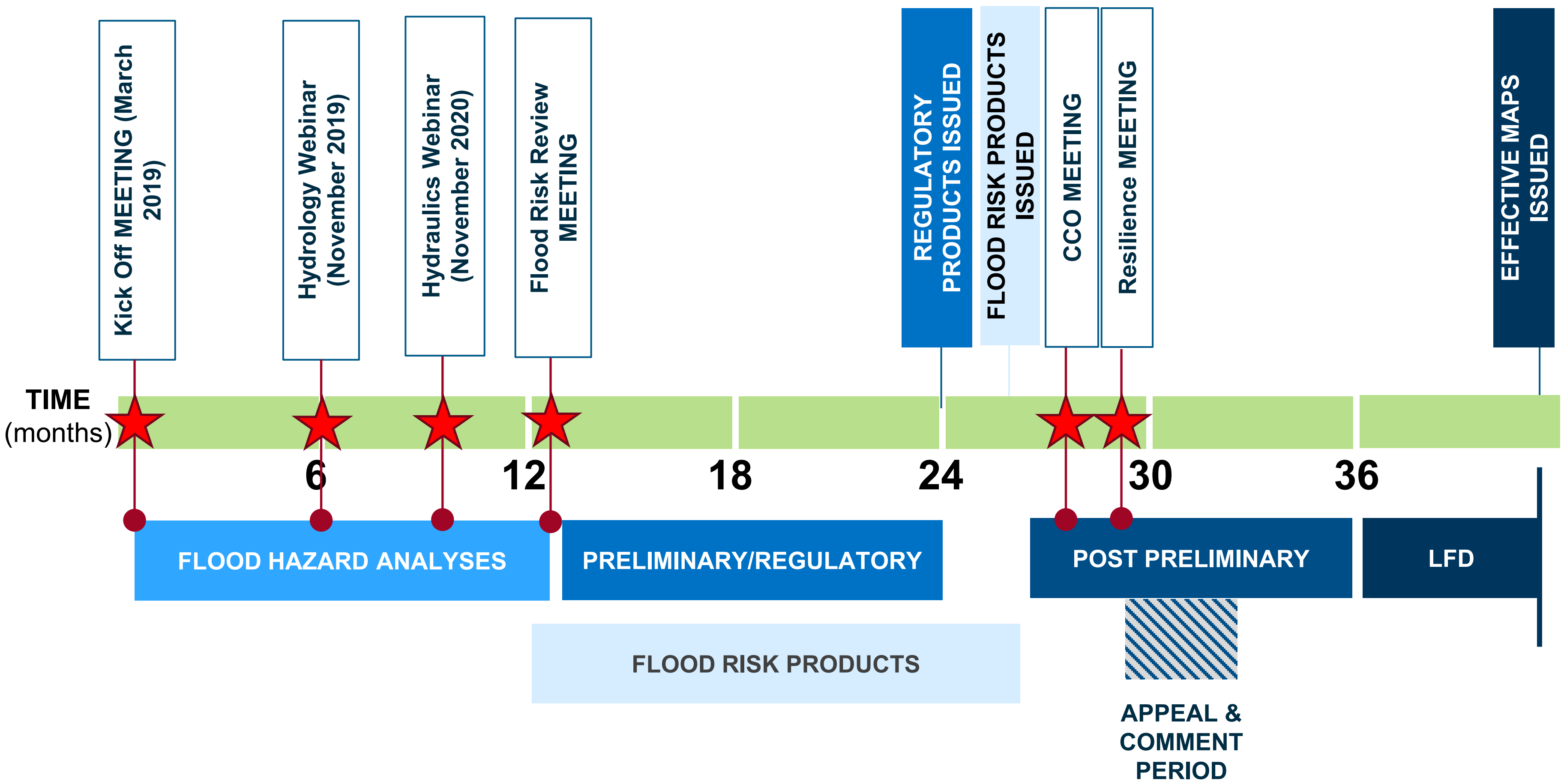
Overall Flood Risk Project Timeline



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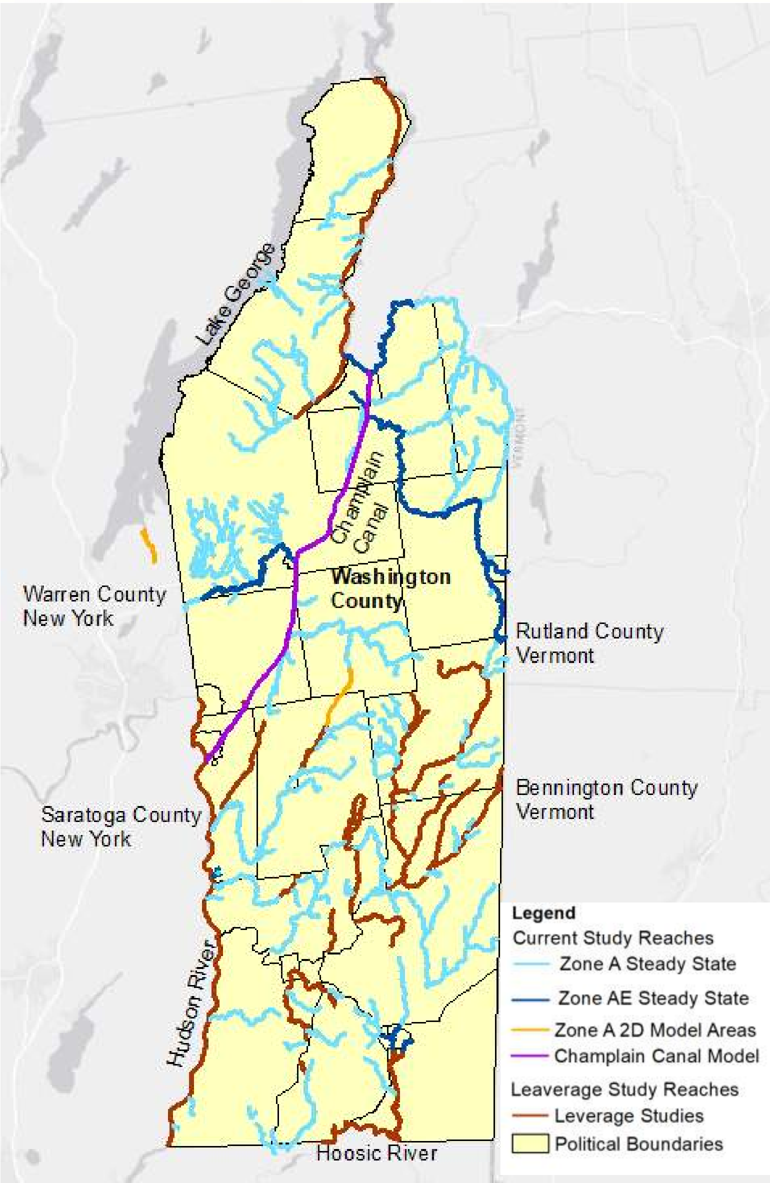
Countywide Flood Risk Study
Stream Study Scope

- **First time digital countywide maps**
- **Additional riverine flooding sources analyzed**
  - 65.0 miles - Detailed (AE) streams
  - 428.6 miles – Approximate (A) streams Steady-State
- **Additional lake/pond sources analyzed**
  - 4 Detailed (AE) Lake Studies 17 Areas - Volumetric Analysis(Zone A)
  - 12 miles - Lake Gage Analysis (Zone AE)
- **Includes Previously Completed Studies**
- **25 affected communities**
- **174 map panels**
- **Multiple touchpoints**



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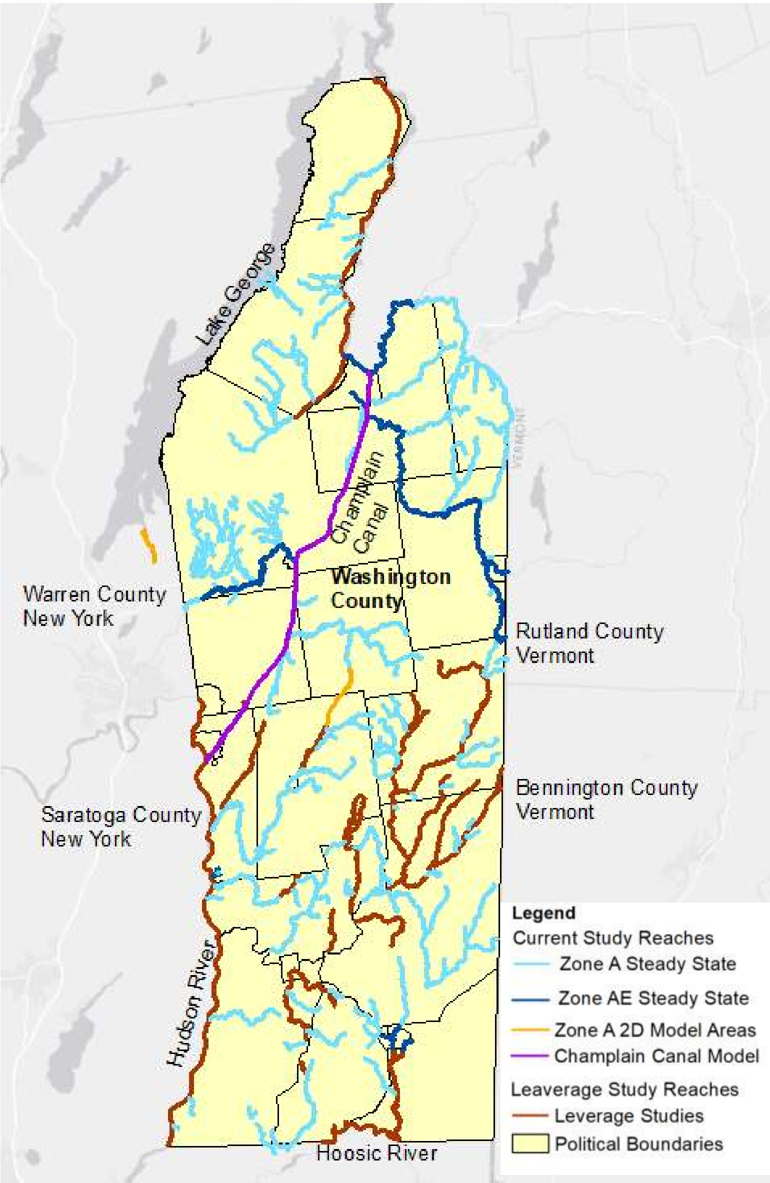
Countywide Flood Risk Study
Detailed Studies

- **16 Flooding Sources**
- **Hydrologic Analyses**
  - Stage-Discharge relationship
    - Copeland Pond, Hadlock Pond, Lake Nebo, Lakes Pond
  - Lake Gage Anlaysis– Lake George
  - Rainfall-Runoff Modeling
    - Halfway Creek, Indian River, Mettawee River, Wood Creek
  - Regression/Gage
    - Cambridge Creek, Owl Kill, Poultney River, Tributary A, B, C, White Creek Cambridge
  - Discharges developed for
    - 10%, 4%, 2%, 1%, 1%+, 1%-, 0.2%



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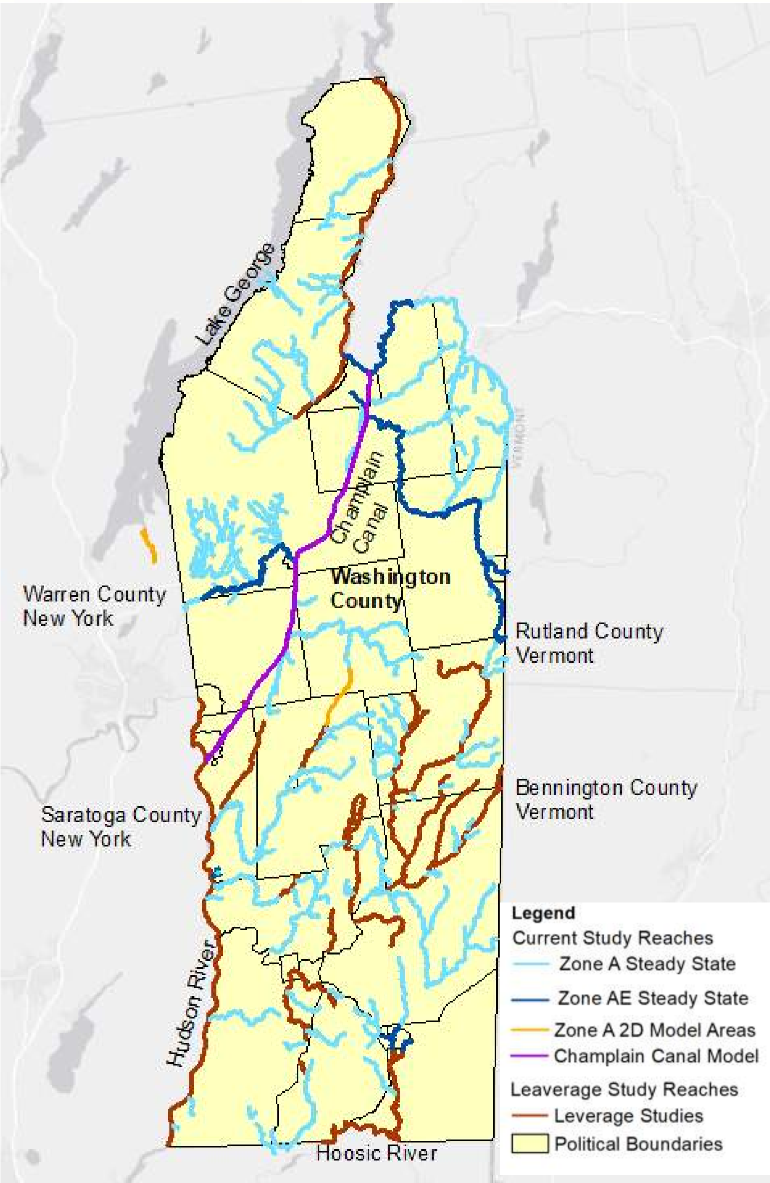
Countywide Flood Risk Study
Approximate Studies

- **182 Study Reaches**
- **Hydrologic Analyses**
  - State of New York Region 1 Regression Equations and State of Vermont equations
  - Streamstats – GIS web based application @ https://streamstats.usgs.gov/ss/
  - Gage analysis performed for 3 stream gages on Zone A streams.
  - Discharges developed for
    - 10%, 4%, 2%, 1%, 1%+, 1%-, 0.2%



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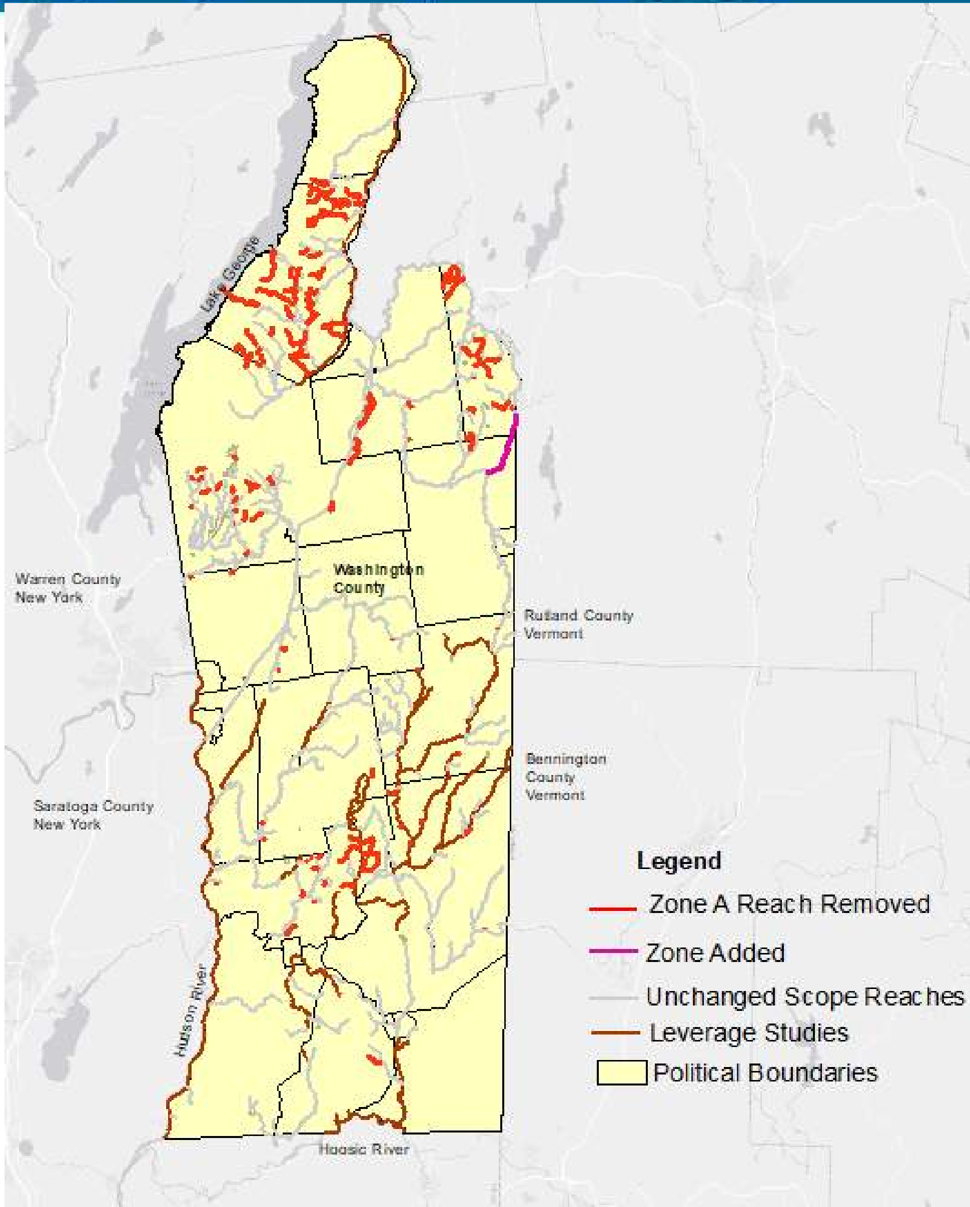
Countywide Flood Risk Study
Changes to Hydraulics Scope

- **Reaches Removed From the Scope**
  - Approximate Scope removed based on indications that the area is not floodprone (87.5 miles)
  - Controlled by backwater (7.7 miles)
  - Zone A floodplain no longer mapped due to reduction in backwater (6.5 miles)
- **Reaches Added to the Scope**
  - Mettawee River Tributary 2 – 4.8 miles of Zone A



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Direct Volume Calculation

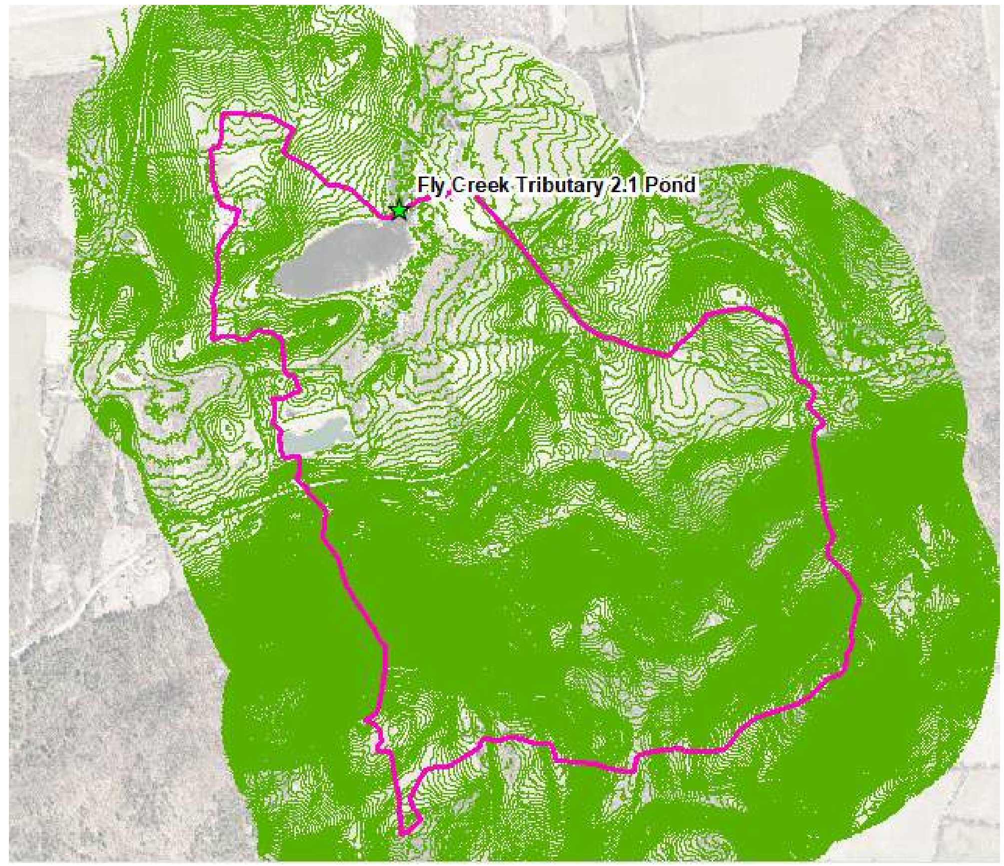
- **Direct Runoff Calculation**
  - Computation of runoff depth and volume based on TR-55 methodology
  - Curve Numbers determined using same approach as Rainfall-Runoff Modeling

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \qquad \text{[eq. 2-1]}$$

where

Q = runoff (in)
P = rainfall (in)
S = potential maximum retention after runoff begins (in) and
I_a = initial abstraction (in)

$$I_a = 0.2S \qquad \text{[eq. 2-2]}$$



Where are we now?
Hydraulics Analysis Review

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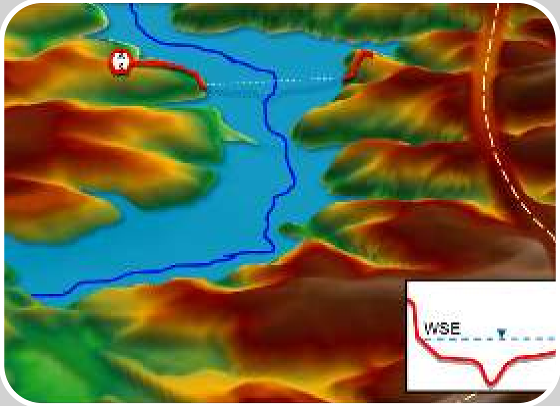
Flood Hazard Analysis



Hydrology

Volume of water?

Peak Flows?

When will storm water or runoff make it to the stream?

Hydraulics

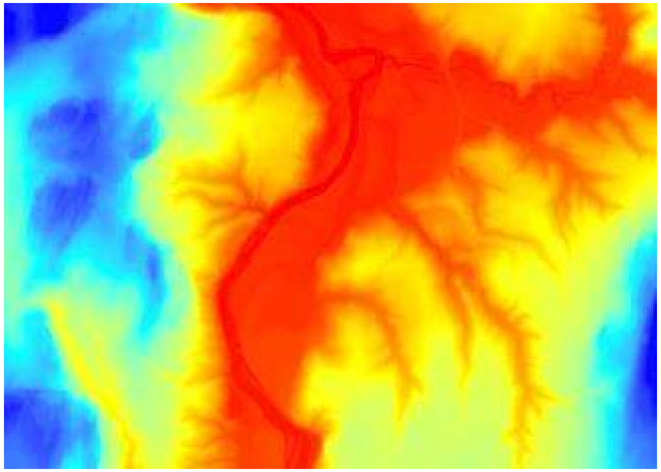
Will the stream in question be able to convey all storm water or runoff that arrives?

Floodplain Mapping

What areas of a community will be inundated based on engineering analysis?

Data Sources – Base maps

- **Topography**
  - 2012 - 2-Meter Digital Elevation Model (DEM) from FEMA
  - 2013 - 2-Meter DEM from New York State
  - 2015 - 1-Meter DEM From New York State
- **Aerial Imagery**
  - New York Information Technology Service GIS Program Office(2017)

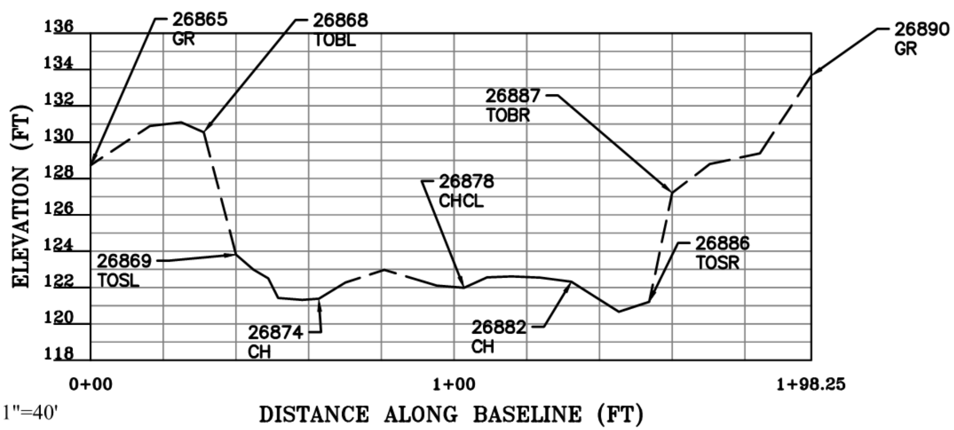


Data Sources - Survey

- **Channel and floodplain geometry**
  - For approximate reaches, extracted from LiDAR data
    - Updated with field reconnaissance measurements
  - For detailed reaches, survey data incorporated

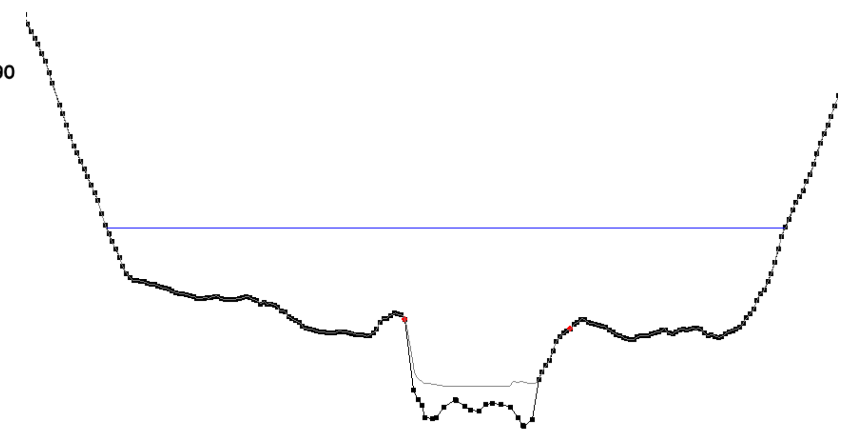
Profile View

LOOKING DOWNSTREAM



Scale: H: 1"=40'

V: 1"=8'



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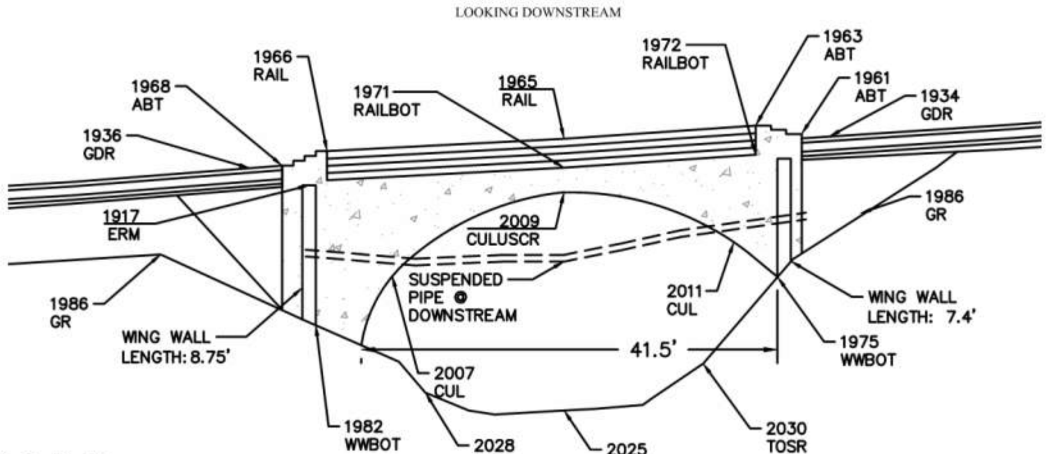
Data Sources - Structures

- **Bridges, culverts, and dams**
  - NYDOT Bridge Inventory (approximate reaches)
  - Field reconnaissance (approximate reaches)
  - Survey (detailed reaches)



Scale: 1"=15'

Data Sources - Field Reconnaissance

- 3.5 days of field visits in November 2019
- Site conditions observations
  - Roadway deck thickness
  - Span (using laser measuring device)
  - Channel – brush, grass, river cobbles?
  - Floodplain – grass, development, trees?

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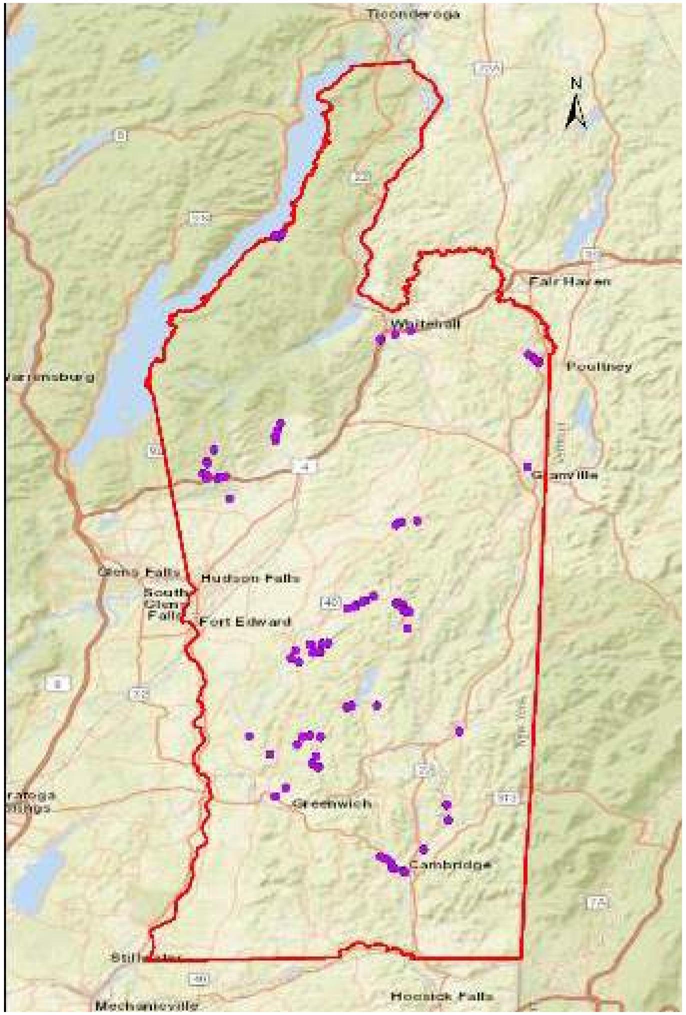
Data Sources – Field Reconnaissance

- **Field Reconnaissance**
  - Identified 60 most “critical” bridges or culverts and lakes and outlets
  - In proximity to homes, schools, or other buildings
  - Collected data for 100 structures.



Data Sources

- **Manning's "n"**
  - For approximate reaches, land use from National Land Cover Database (2016)
  - For detailed reaches, further refined using aerial imagery/ survey data and field visit

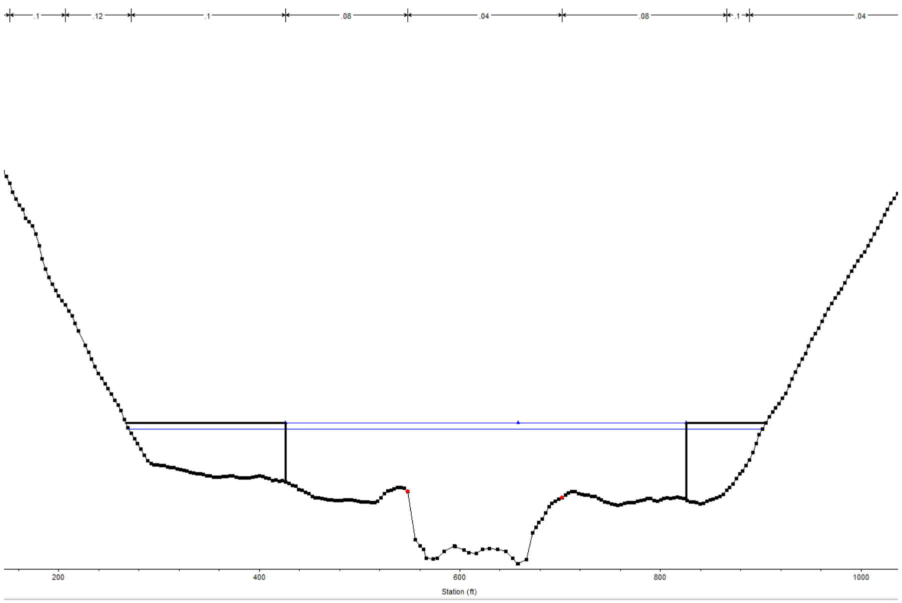
Description	Manning's n
Roadway	0.013
Open Water	0.03
Developed, Open Space	0.06
Developed, Low Intensity	0.07
Developed, Medium Intensity	0.08
Developed, High Intensity	0.1
Barren Land	0.04
Deciduous Forest	0.1
Evergreen Forest	0.12
Mixed Forest	0.1
Shrub/Scrub	0.07
Grasslands/Herbaceous	0.035
Pasture/Hay	0.04
Cultivated Crops	0.05
Woody Wetlands	0.08
Emergent Herbacous Wetlands	0.07

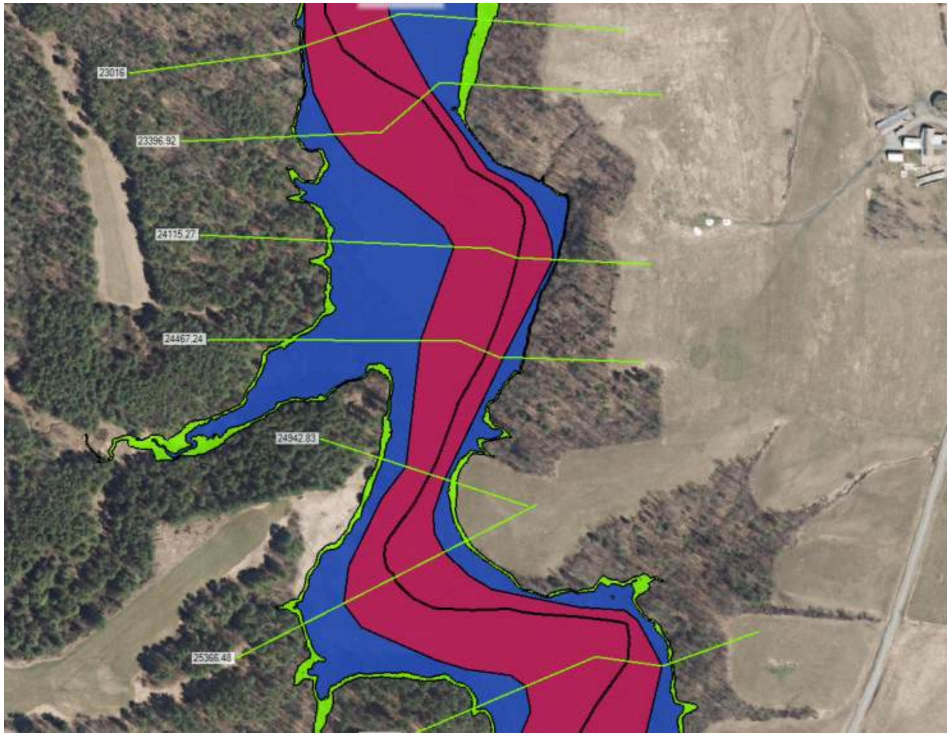
Modeling Approaches

- **USACE's HEC-RAS 5.0.7**
- **Boundary Conditions**
  - 1D – Known water surface elevation (to tie-in to adjacent studies) or normal depth slope

Floodway Analysis

- Detailed Streams only
- Encroachments placed to achieve target 1.0’ rise





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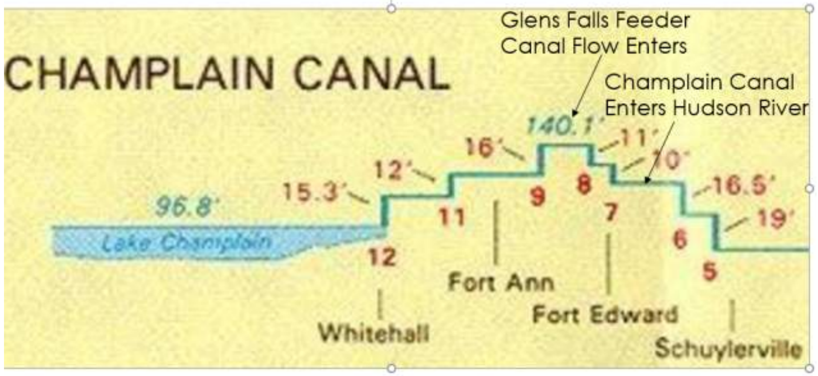
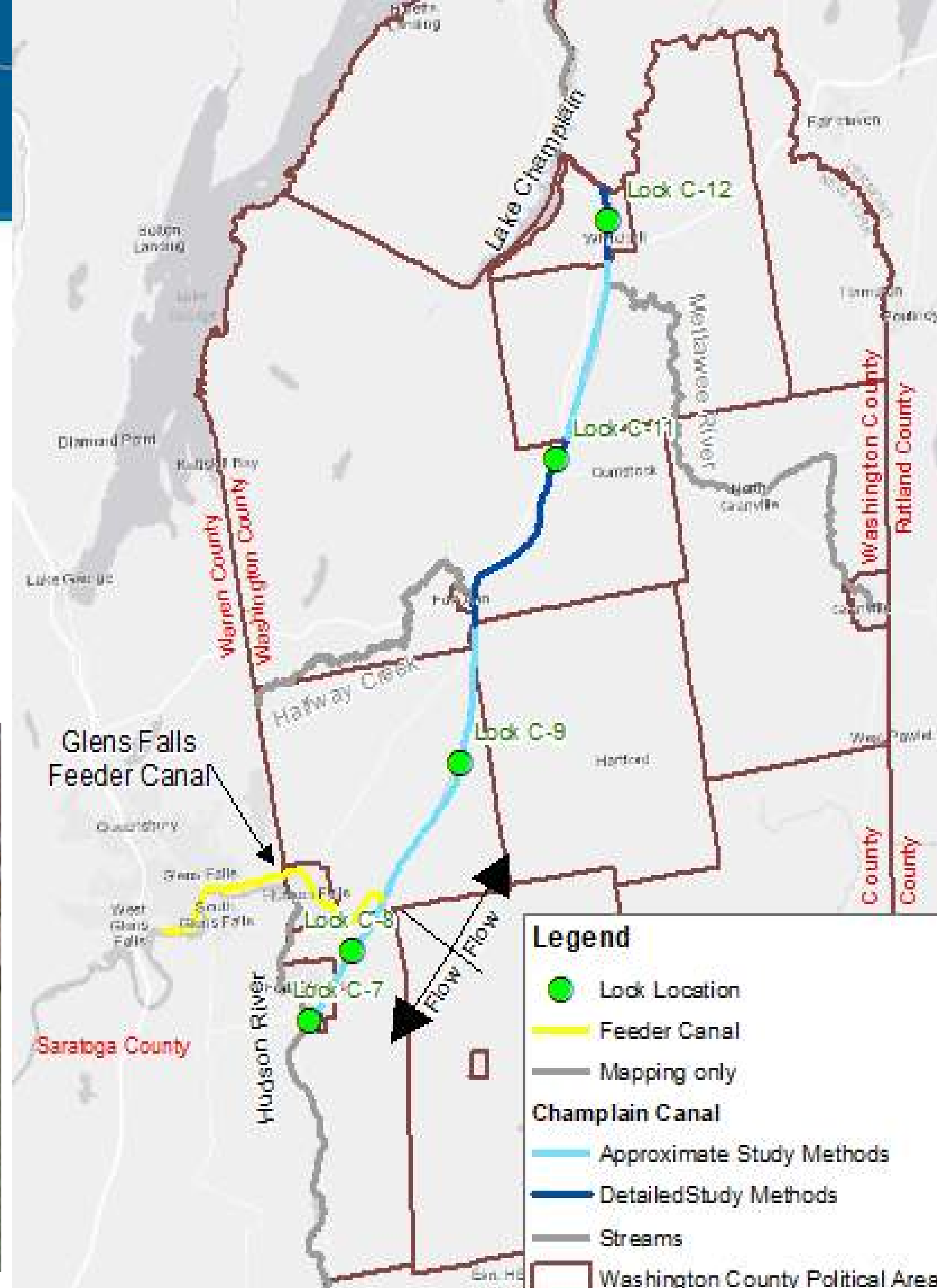
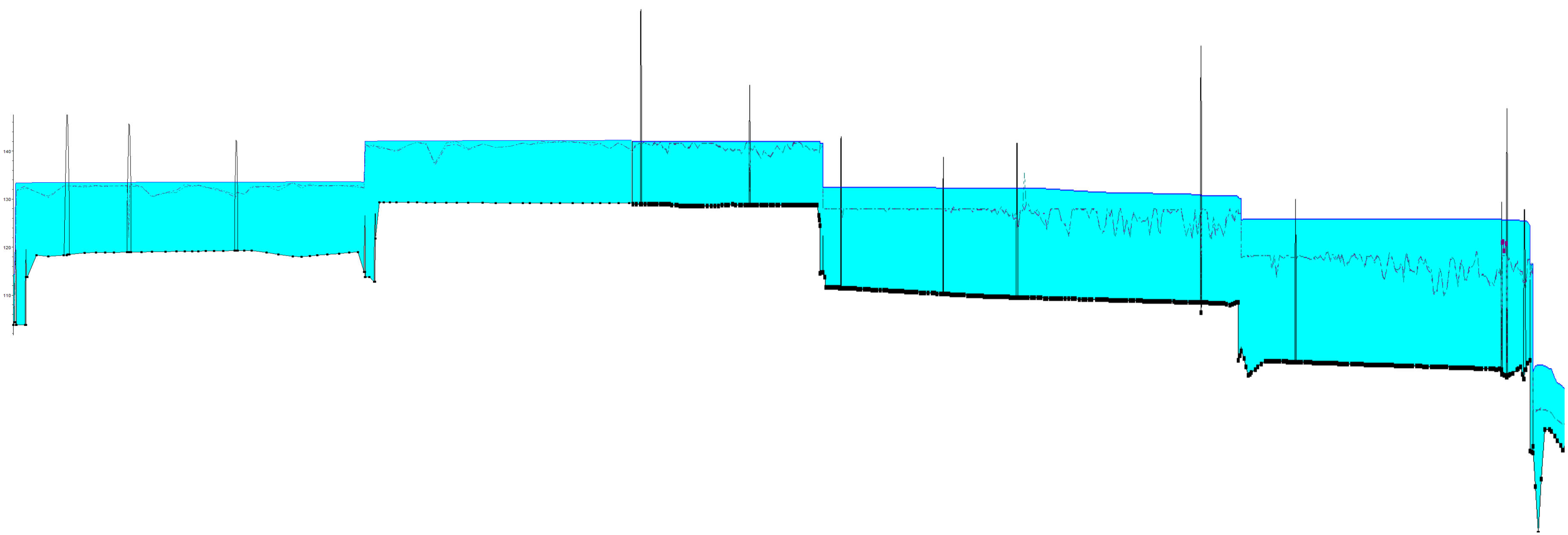
Champlain Canal Modeling





Champlain Canal

- **Unsteady 1-D Model**
- **Two Reaches** (North and South) – split at Glens Falls Feeder Canal



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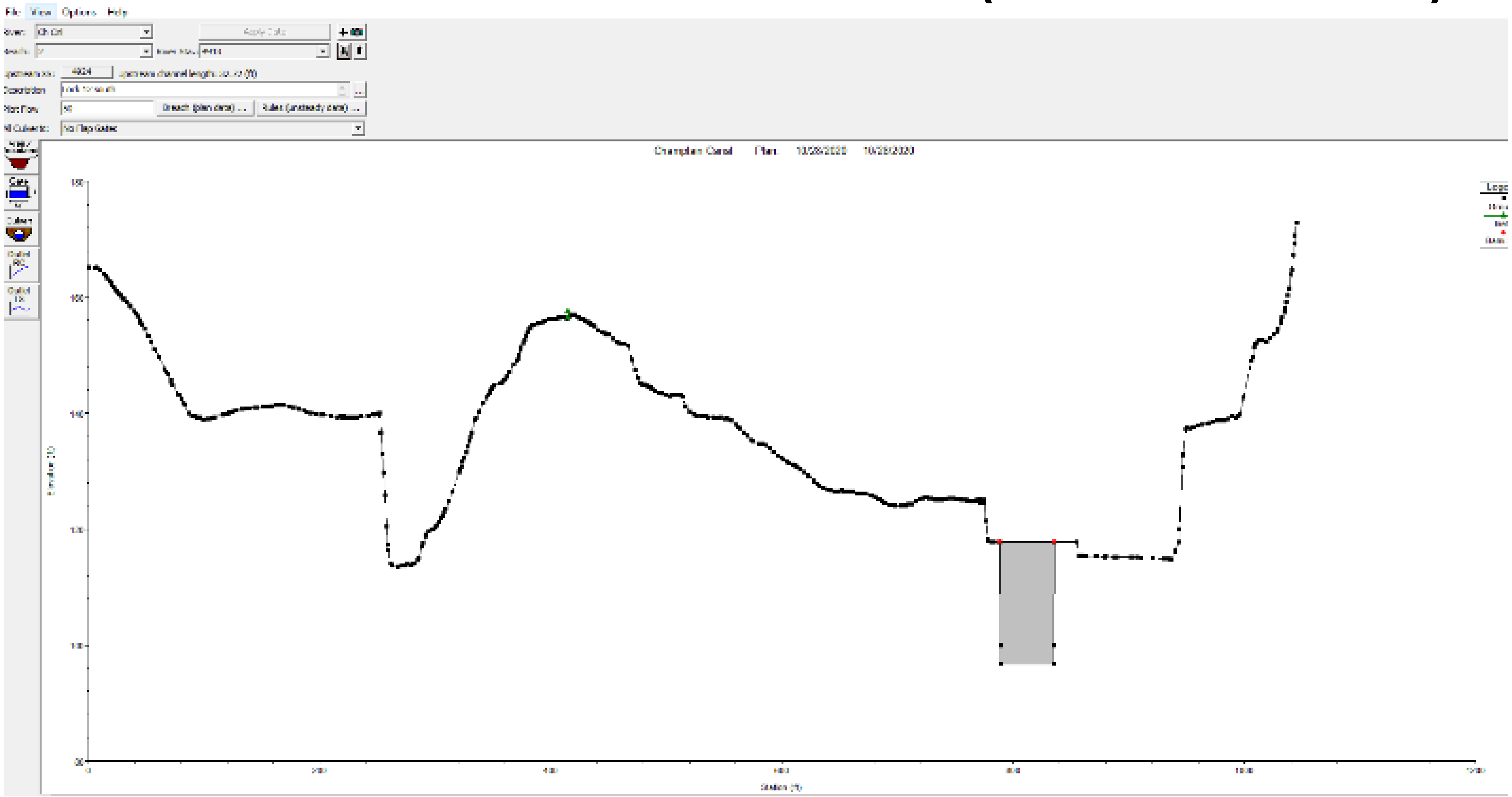
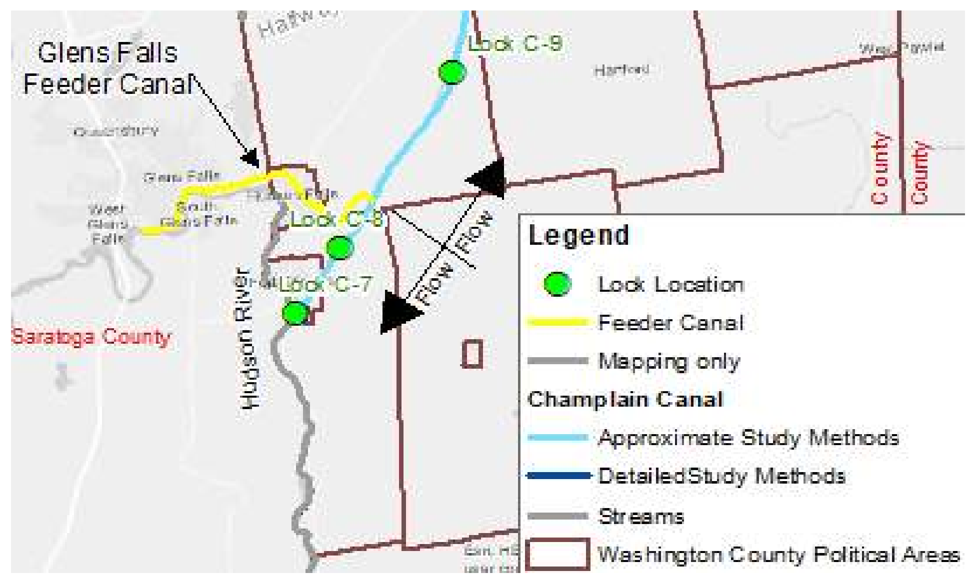
Champlain Canal

- **Locks modeled as inline structures (assumed closed)**



Glens Falls Feeder Canal Flow Distribution

Reach	Peak Flow 1% (100-yr) (cfs)	Peak Flow 0.2% (500-yr) (cfs)	Peak Water Surface Elevation 1% At Tie-In (ft –NAVD88)	Peak Water Surface Elevation 0.2% At Tie-In (ft –NAVD88)
Total Peak Inflow	2830	4320		
Canal North	990	1300	142.3	142.4
Canal South	1840	3020	142.4	142.8



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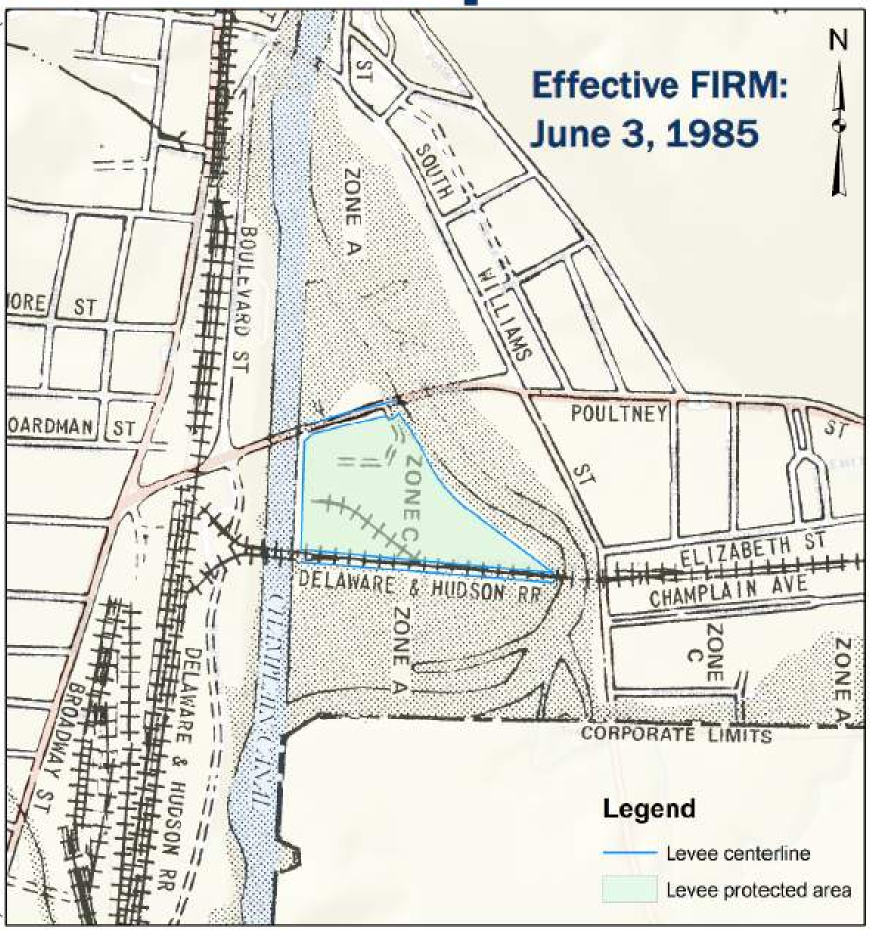
Champlain Canal & Wood Creek Levee



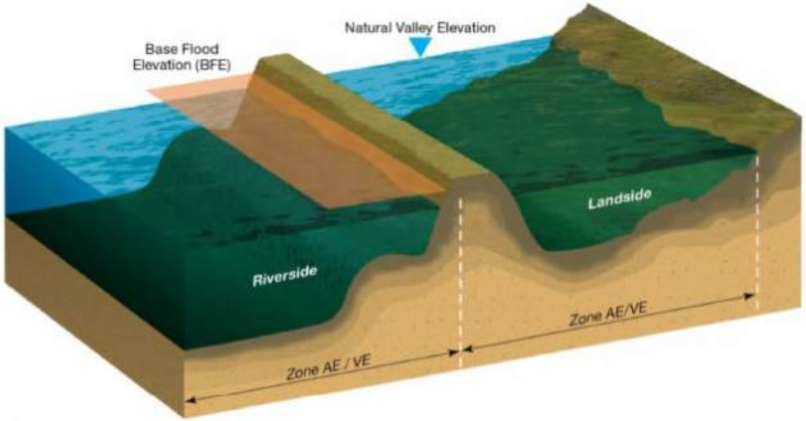
- Shown as providing protection on effective FIRM
- Built in 1935. Overtopping or flooding noted here in 1974, 1988, 1996, 1998, 2011
- Not Accredited – Scoped for Natural Valley Analysis

Champlain Canal & Wood Creek Levee

Natural Valley Procedure

This analysis identifies the landside flood risk as though the levee does not impact the flood elevation.

Application: Levee does not meet 44CFR65.10



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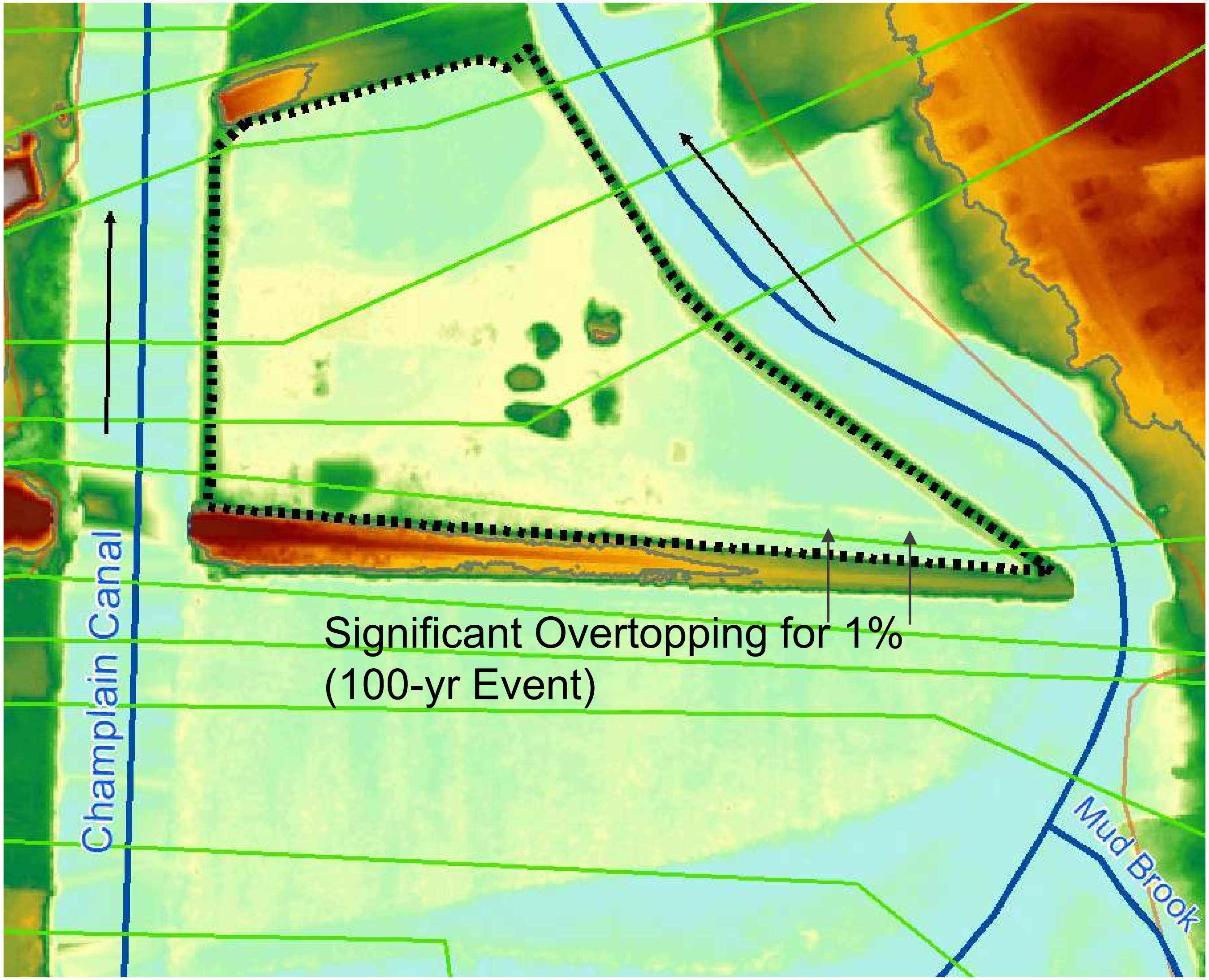
Champlain Canal & Wood Creek Levee



Overtopping up to 5 feet

Natural Valley Results were similar to Base Model

Not Hydraulically Significant

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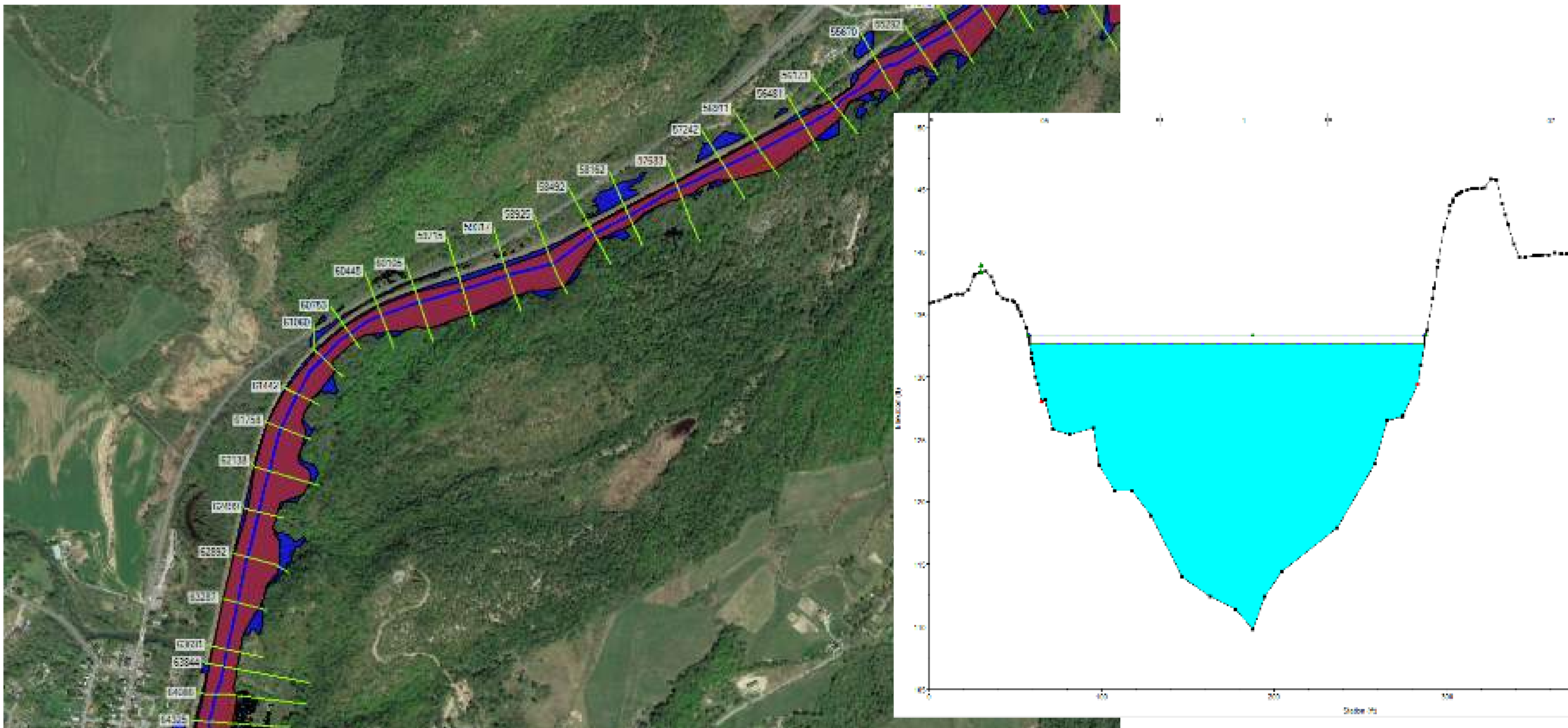
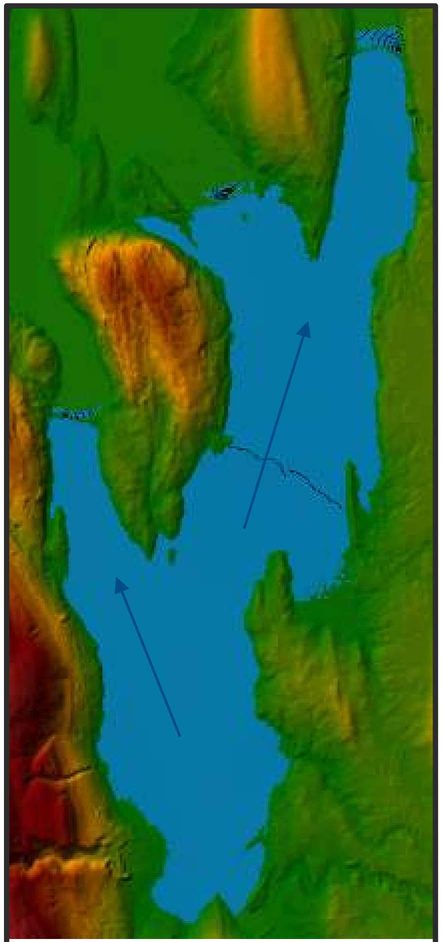
Champlain Canal

- **Floodway generated using Unsteady Encroachments**

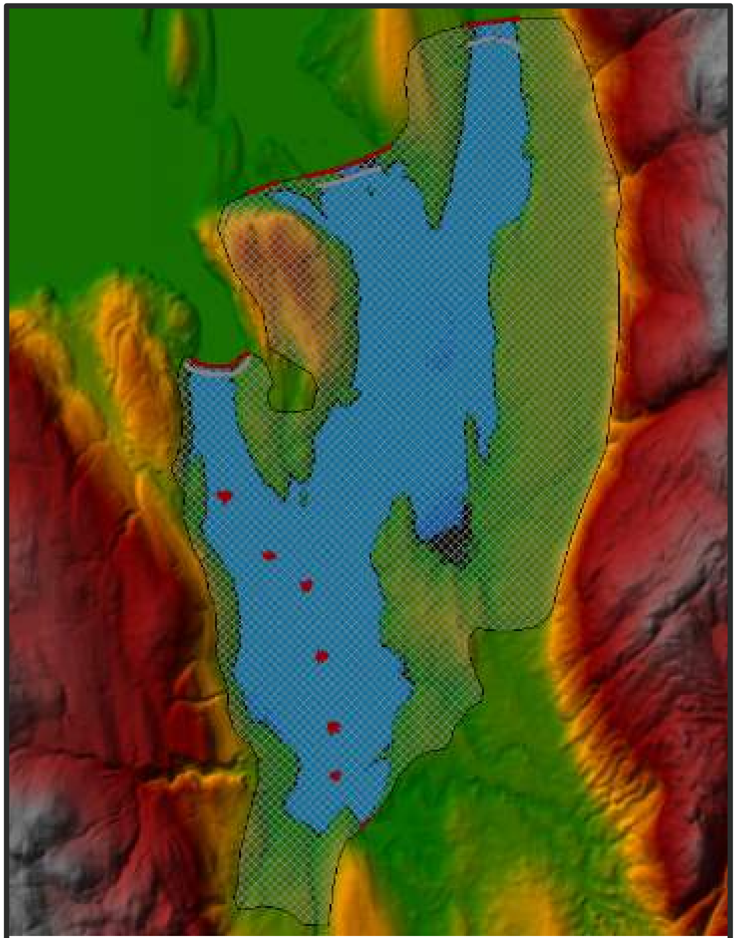


2D Models – Dunhams Bay Tributary

- **Overview**
  - Mainstem and two side branches flowing into Dunhams Bay
  - All outlet locations controlled by road crossings
  - Multiple inflow locations to account for flow change along mainstem



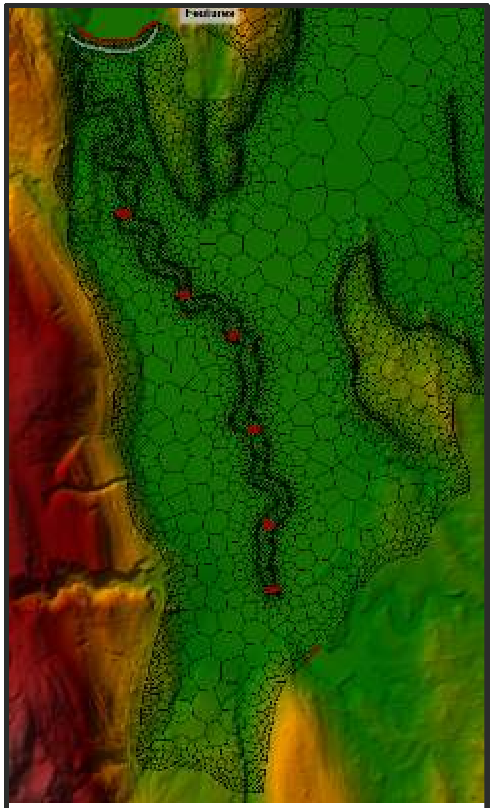
Model Results: 0.1 ft contours



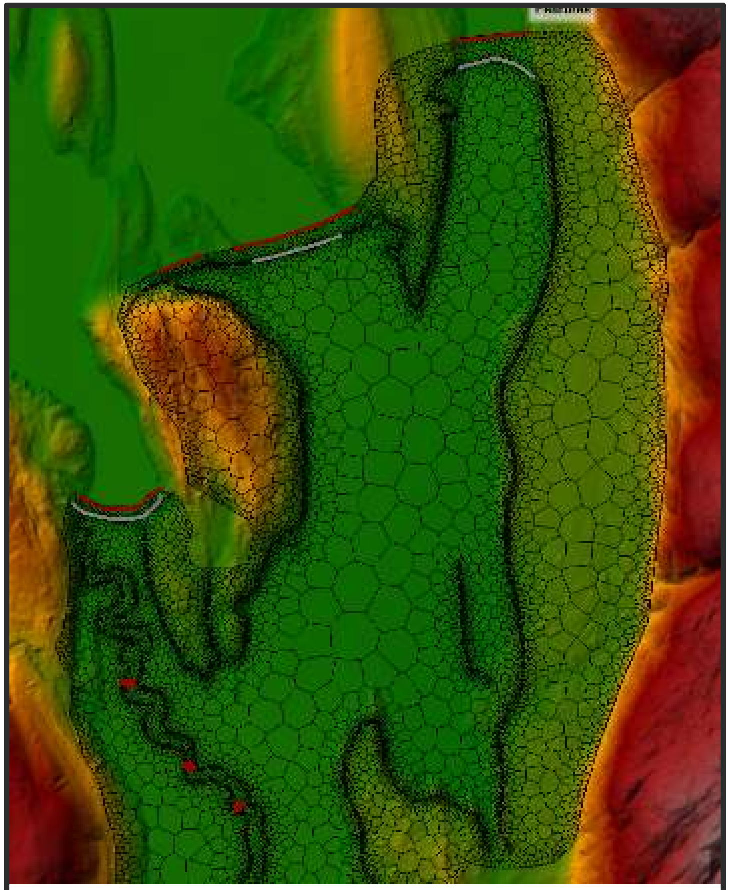
Model results with structures and boundary conditions

2D Models – Dunhams Bay Tributary

- **Computational Mesh**
  - GeoHECRAS adaptive mesh allows for larger cells in open areas and smaller cells around areas of interest



Main Channel



Side Channels

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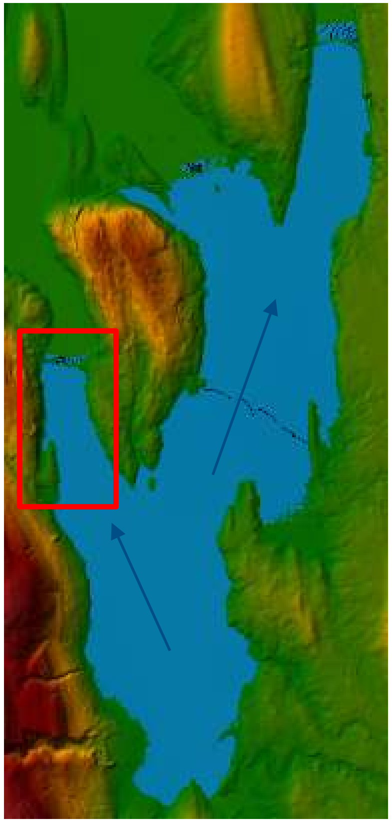
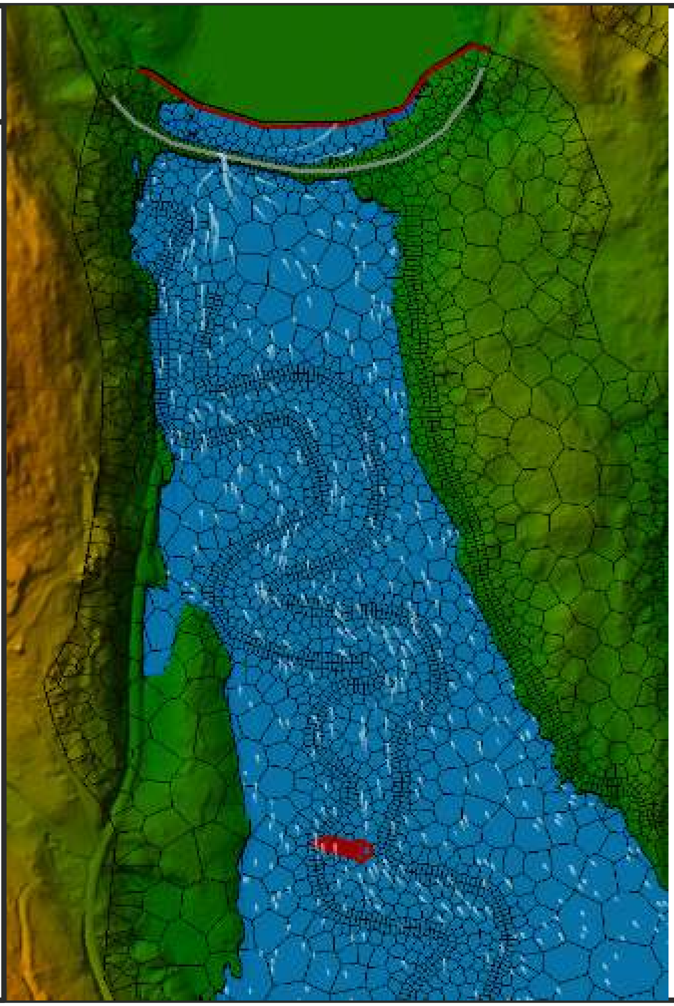
2D Models – Dunhams Bay Tributary

- **Results**

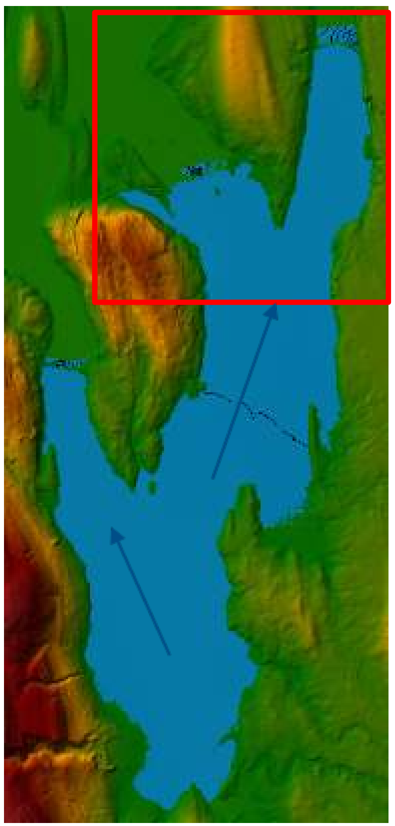


Particle Tracking at Downstream end of main channel

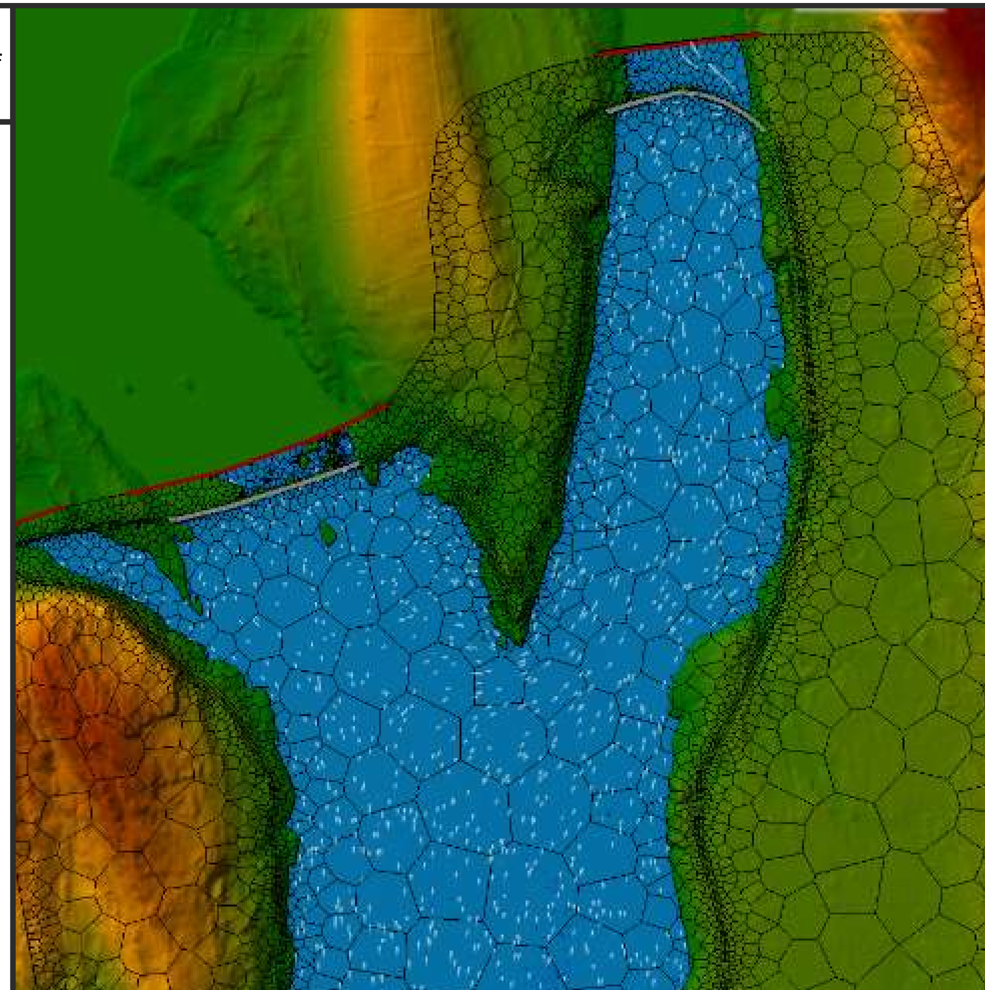


2D Models – Dunhams Bay Tributary

- **Results**

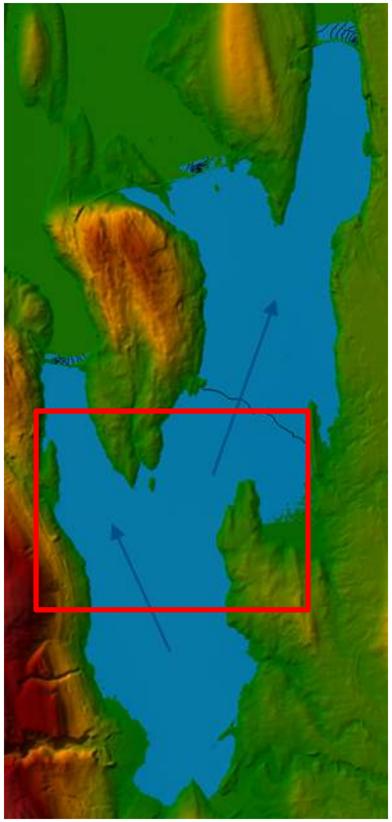


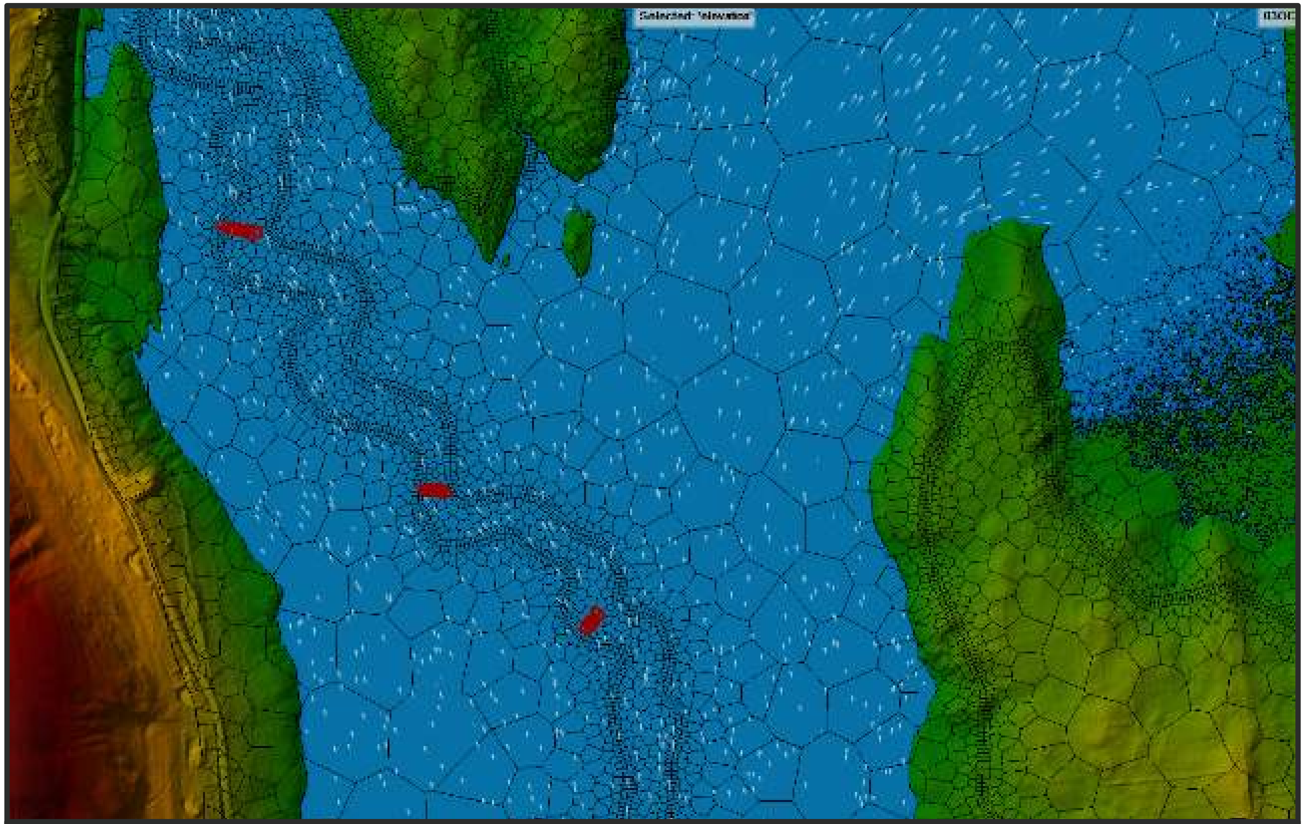
Particle Tracking at Downstream end of side channels



2D Models – Dunhams Bay Tributary

- **Results**

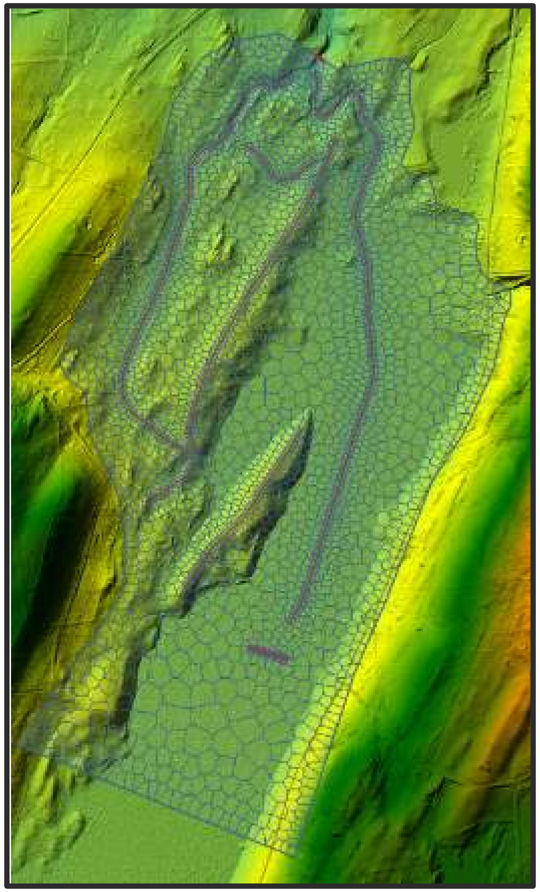




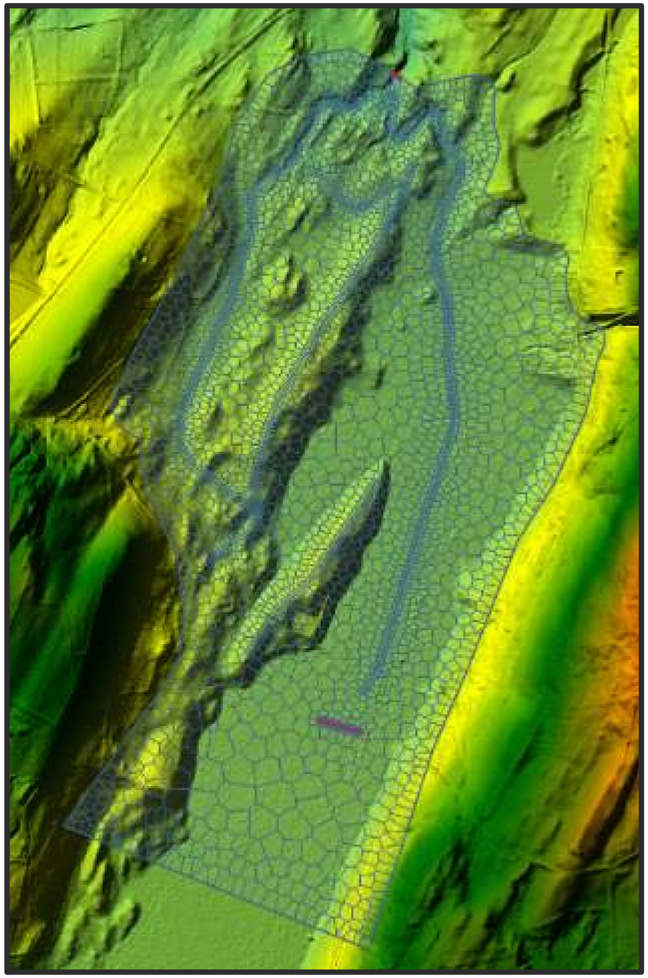
Particle Tracking at split from main channel

2D Models – Unnamed Stream 2

- **Computational Mesh**



Adaptive Mesh with Breaklines



Adaptive mesh

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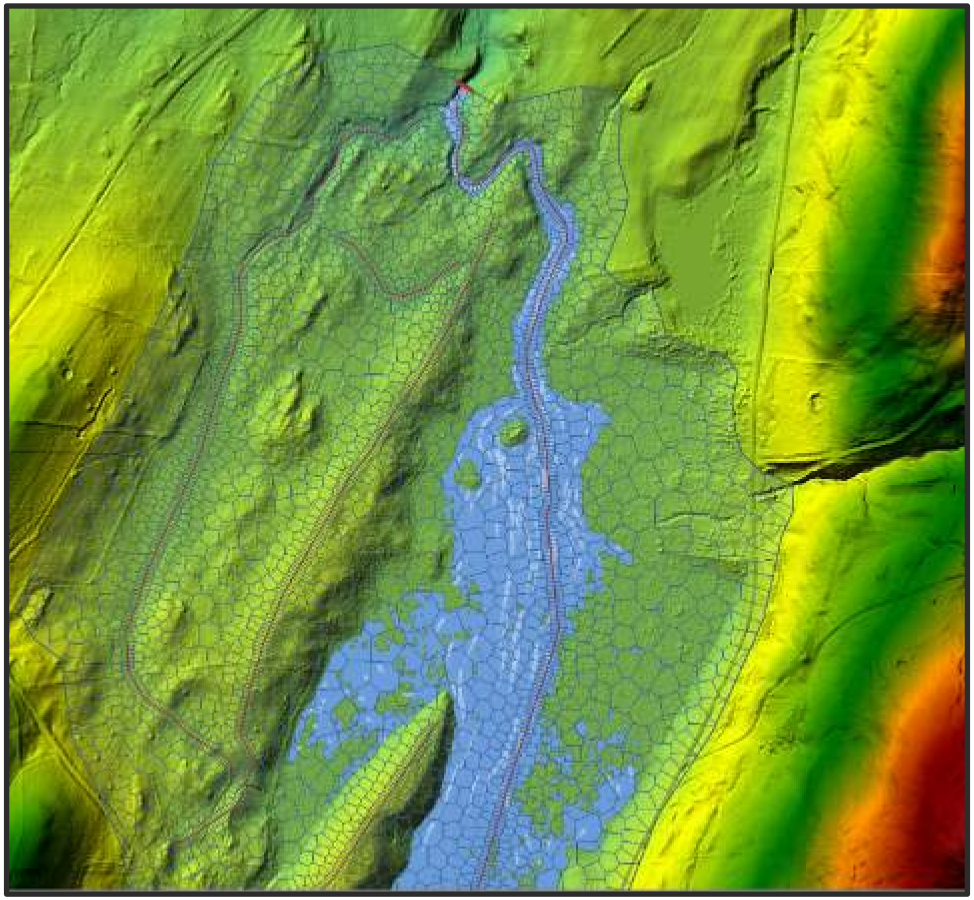
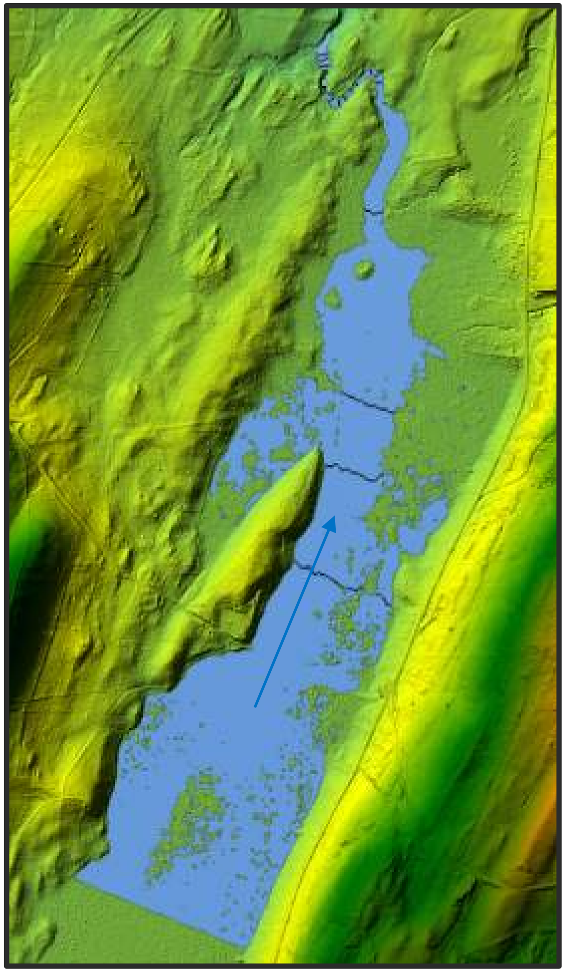
2D Models – Unnamed Stream 2

- **Results**



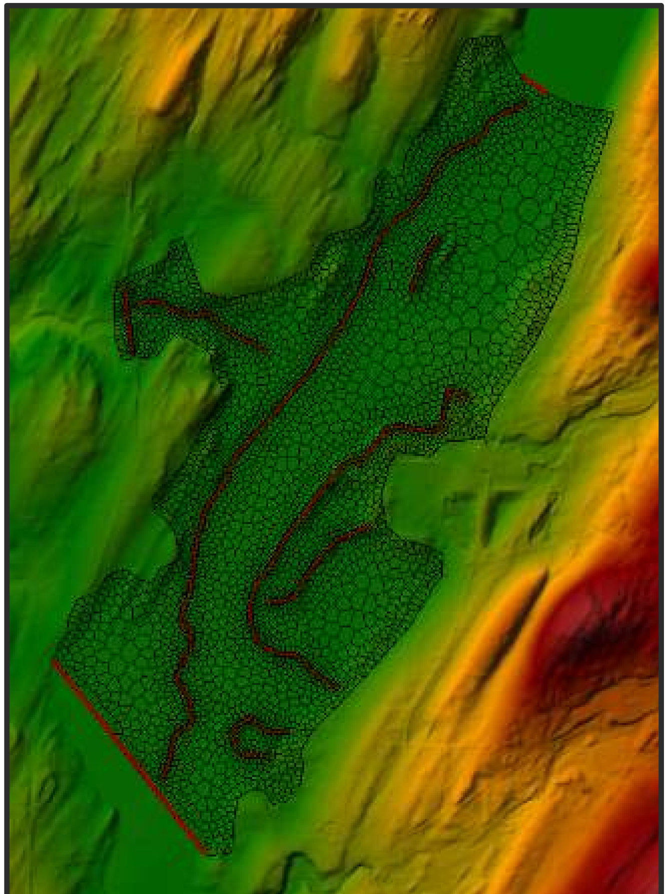
Particle Tracking Along Channel



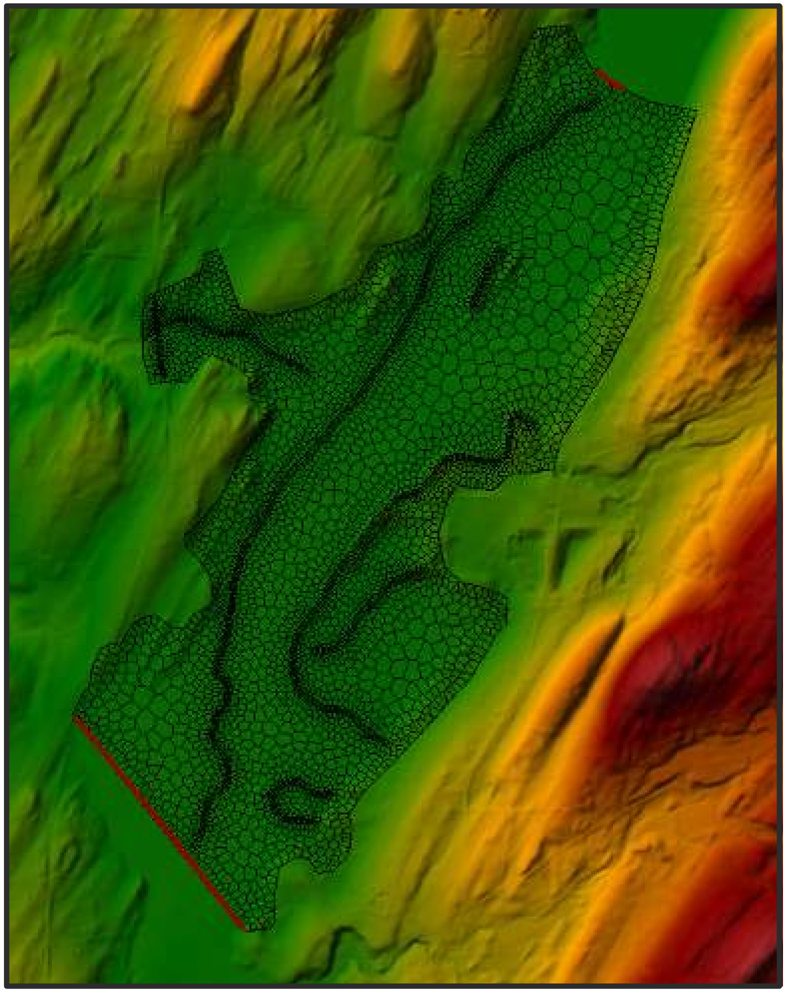
Results with 1 ft contours

2D Models – Unnamed Stream 3

- **Computational Mesh**



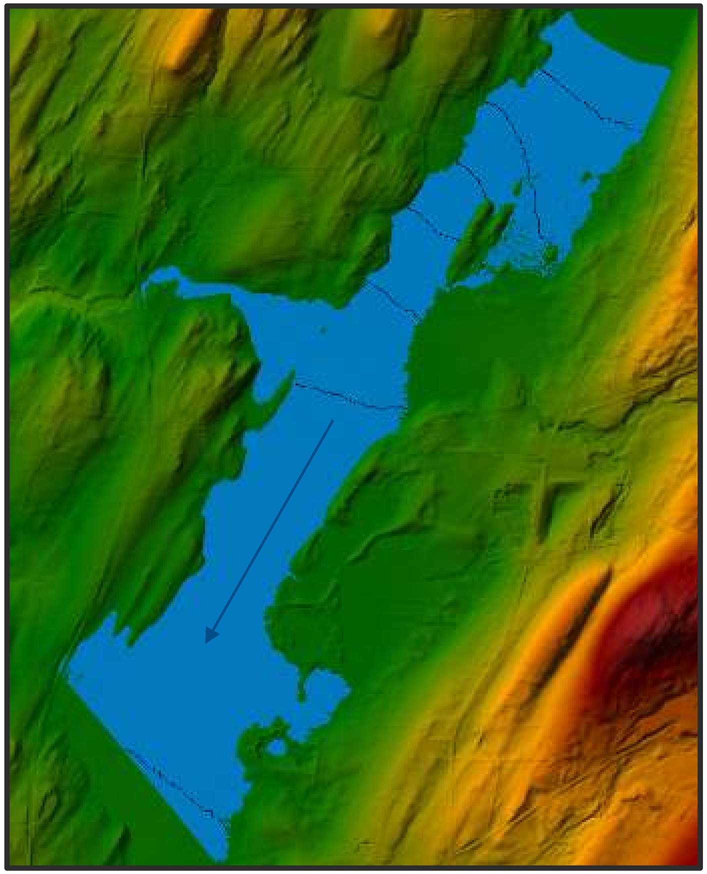
Adaptive Mesh with Breaklines



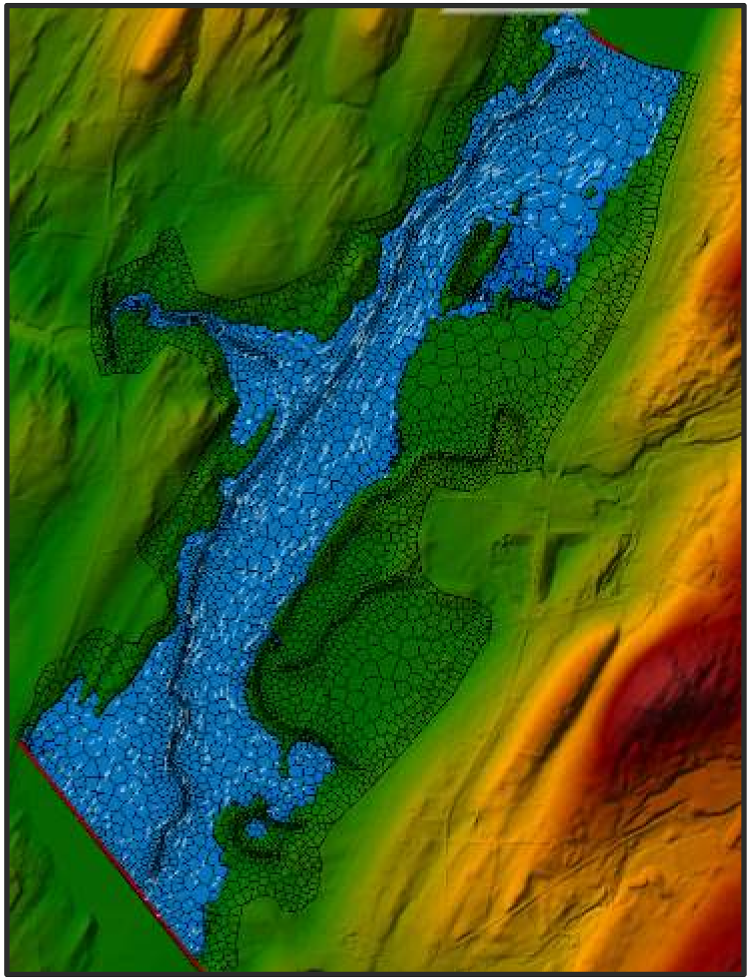
Adaptive mesh

2D Models – Unnamed Stream 3

- **Results**



Results with 1 ft contours



Particle Tracking Along Channel

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Results of the Study

- **New countywide floodplains data**
  - Expanded floodplain coverage
  - Added additional streams with Base Flood Elevations
  - Continuous modeling and mapping outside of community boundaries
    - To support future community development
  - Includes 500-year floodplain

Floodplain Mapping Considerations

- **New countywide digital data**
  - Previous maps produced in 1970s-2000s

1970's	1980's	1990's
Town of Argyle	Town of Cambridge	Town of Dresden
Village of Argyle	Town & Village of Fort Edward	Town of Easton
Town of Kingsbury	Town & Village of Granville	Town of Fort Ann
	Town of Hampton	Town of Greenwich
	Town of Hartford	Town of Hebron
	Village & Town of Salem*	Town of Jackson
	Town of White Creek	Town of Putnam
	Town & Village of Whitehall	

2000-2010 – Villages of Cambridge, Greenwich

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Floodplain Mapping Considerations

- **New countywide digital data**
  - Reason for changes in Floodplains and Base Flood Elevations (BFEs)
    - New Topography
    - Channel and Structure Survey
    - Changes to Land Use
    - Changes to Rainfall
    - Detailed Hydrologic and Hydraulic Analysis

Floodplain Mapping Comparisons

Stream Name	Location	Effective Elevation (feet NAVD88)	Current Study Elevation (feet NAVD88)
Cambridge Creek	Approximately 310 feet upstream of Coila Road	507.1	509.4
Cambridge Creek	Approximately 730 feet upstream of West Main Street	492.6	493.4
Cambridge Creek	Approximately 780 feet downstream of South Union Street	476.9	479.5
Owl Kill	Approximately 820 feet upstream of North Park Street	493.4	494.3
Owl Kill	Approximately 950 feet upstream of Spring Street	489.1	491.1
Owl Kill	Approximately 310 feet downstream of confluence with Cambridge Creek	476.6	477.7
Owl Kill	Downstream Study Limit	467.1	467.9
Tributary A	Approximately 290 feet downstream of Duer Road	121.7	119.7
Tributary A	Approximately 220 feet downstream of Blodgett Road	128.7	128.3
Tributary B	Upstream Limit of Study	126.5	125.6
Tributary C	Approximately 130 feet upstream of Blodgett Road	128.8	128.6
White Creek Cambridge	Approximately 960 feet downstream of the Cambridge/Town of White Creek boundary	509.3	511.9
White Creek Cambridge	Approximately 380 feet upstream of the Cambridge/Town of White Creek boundary	497.4	501.2

Elevation in NAVD88 = Elevation NGVD29-0.5 feet

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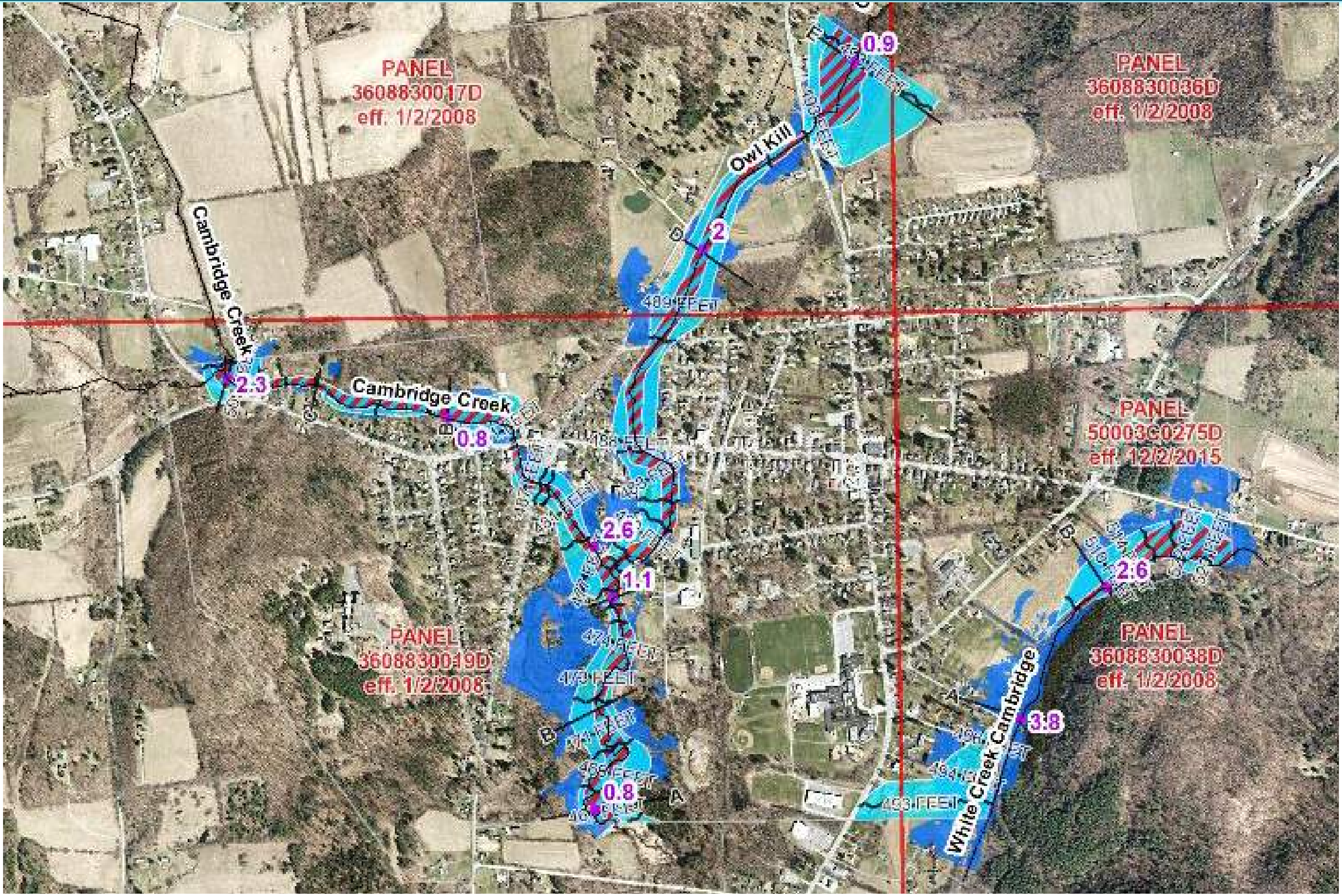
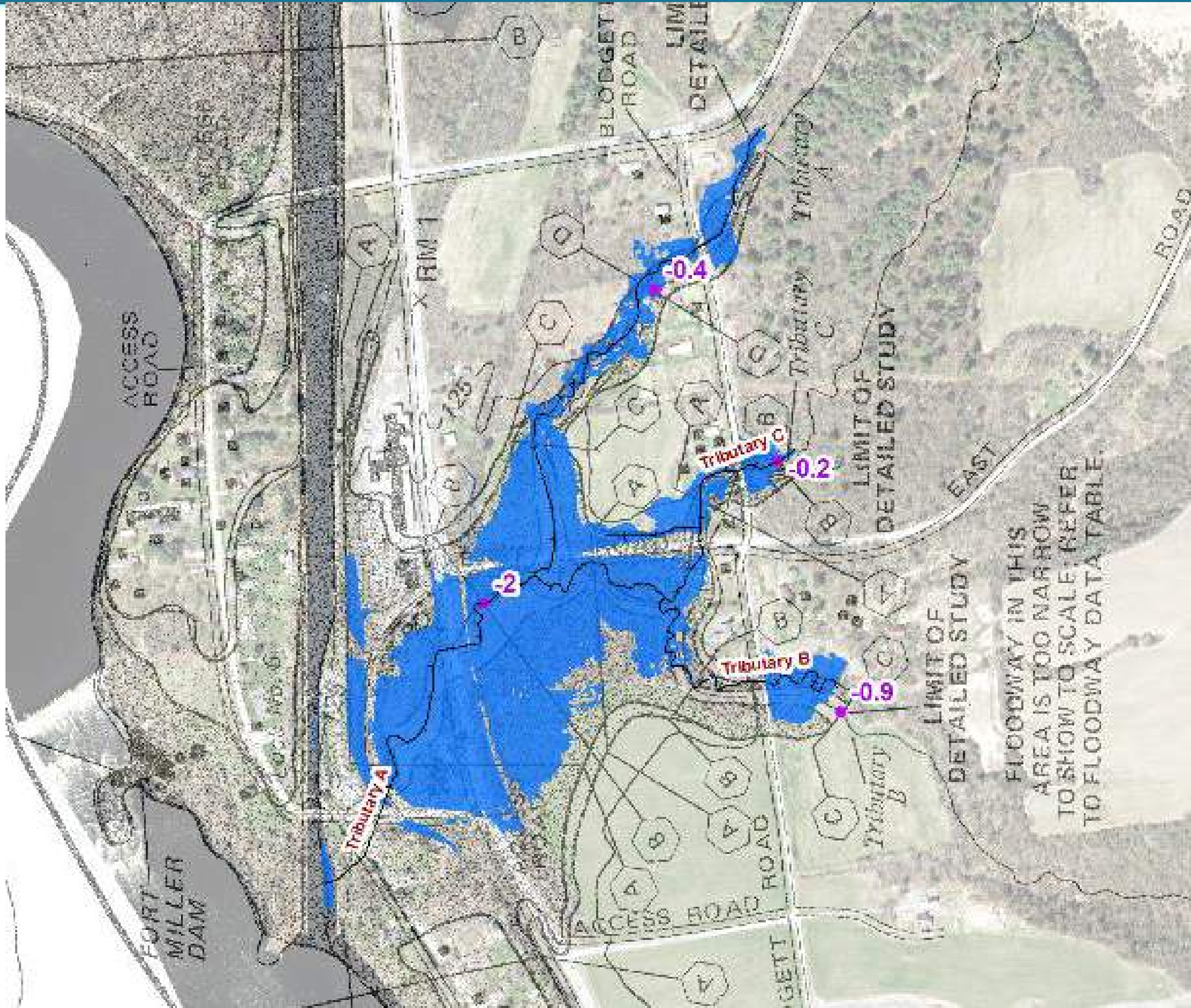
Floodplain Mapping Comparisons



Floodplain Mapping Comparisons



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What's Next?

Path Forward

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Next Steps

1

Finalizing Hydraulic Analysis

2

Development of Draft Floodplain Mapping/Workmaps

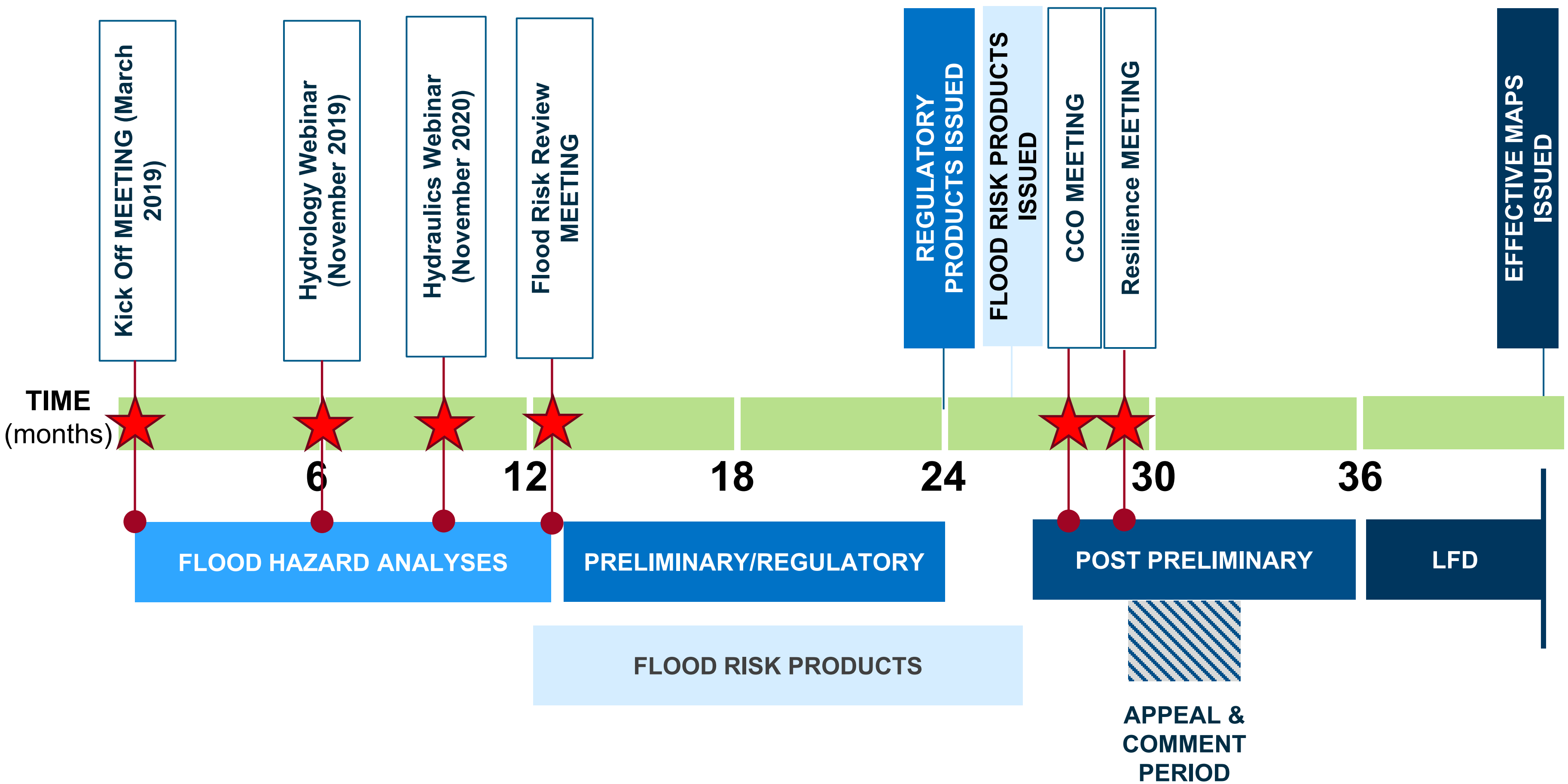
3

Development of Additional Flood Risk Products

4

Preliminary FIRM Issuance

Overall Flood Risk Project Timeline



Contacts

FEMA

- **Project Monitor**
  - Robert Schaefer
  - 212-680-8808
  - Robert.Schaefer@fema.dhs.gov
- **Outreach Coordinator**
  - Stephanie Gootman
  - 202-802-3137
  - Stephanie.Gootman@fema.dhs.gov

STARR II (Technical Partner)

- **Project Manager**
  - Tiffany Coleman
  - 859-422-3024
  - Tiffany.Coleman@Stantec.com
- **Regional Support Center Lead**
  - Curtis Smith
  - 646-490-3929
  - Curtis.Smith@stantec.com

Questions? Comments?

Thank you!