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Flood Risk Project

Tompkins County, New York, Hydraulics Results Discussion

October 6, 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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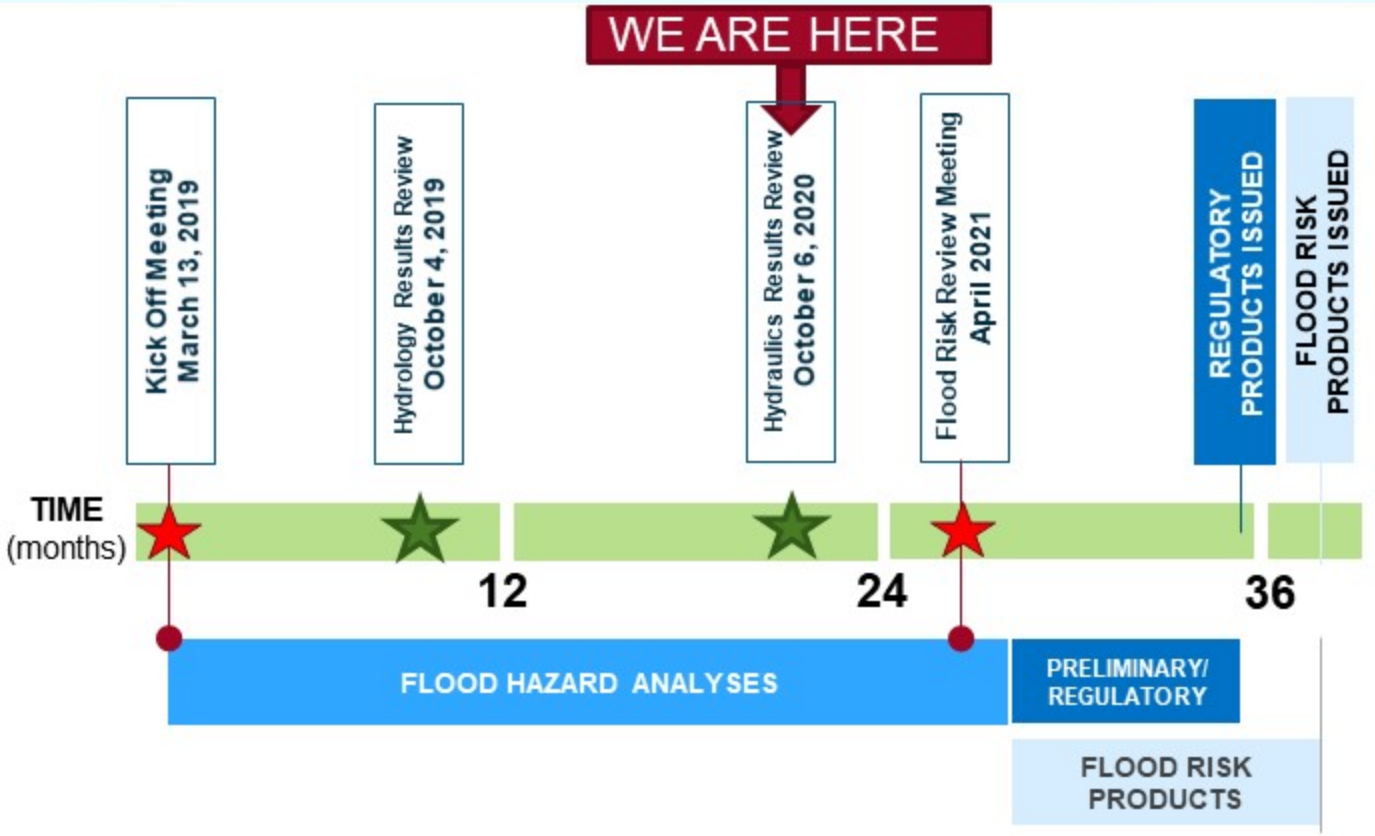
Overall Flood Risk Project Timeline



Touchpoint - Webinar

Touchpoint – In person

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Countywide Flood Risk Study
Stream Study Scope

- **First time digital countywide maps**
- **Includes 2018 Seneca Watershed Study**
- **Location and Study Streams**
  - 55 miles of detailed (Zone AE) study
  - 147 miles of approximate (Zone A) study
  - 38 miles of Lake Gage Analysis (Cayuga Lake)

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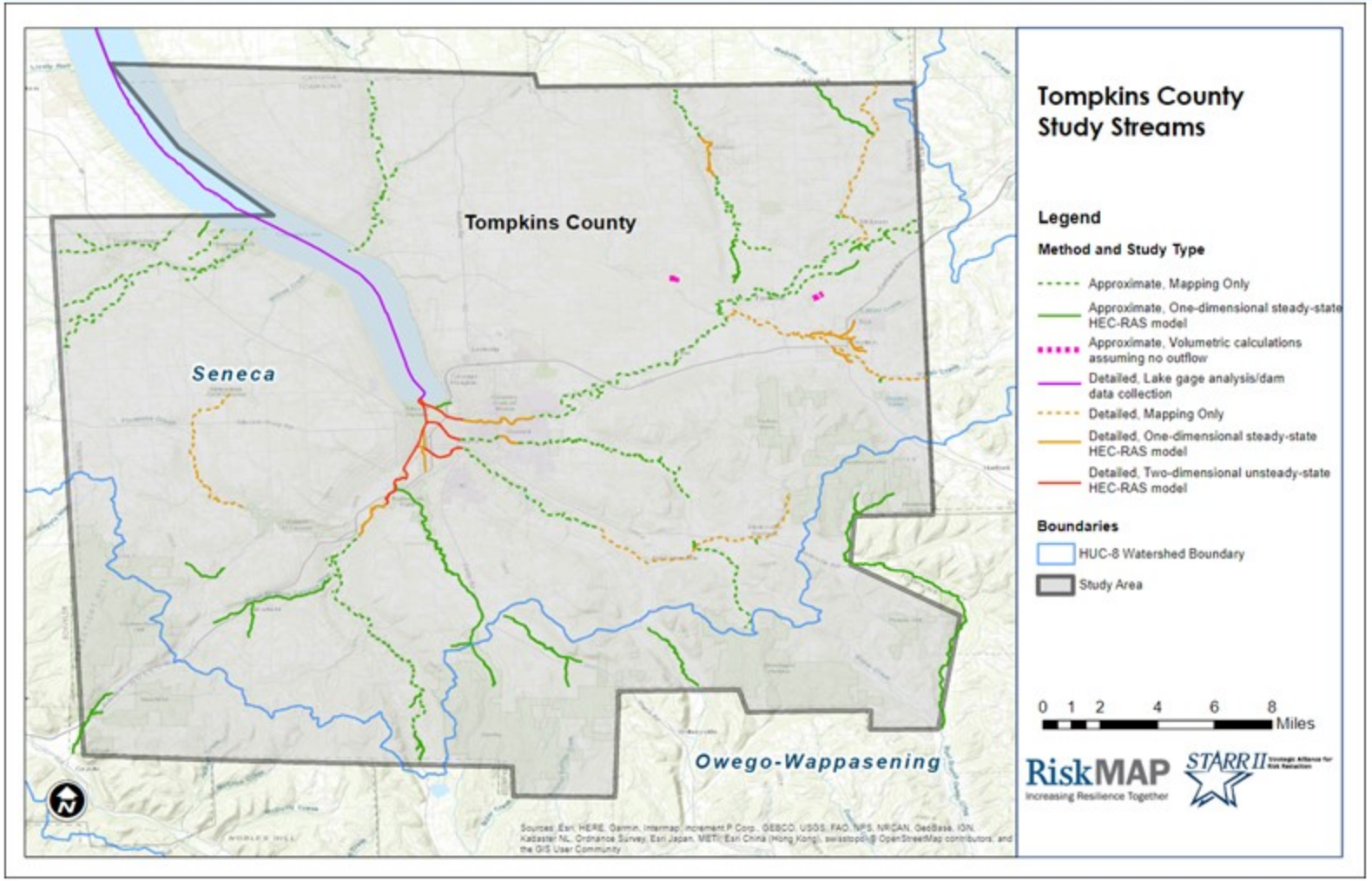
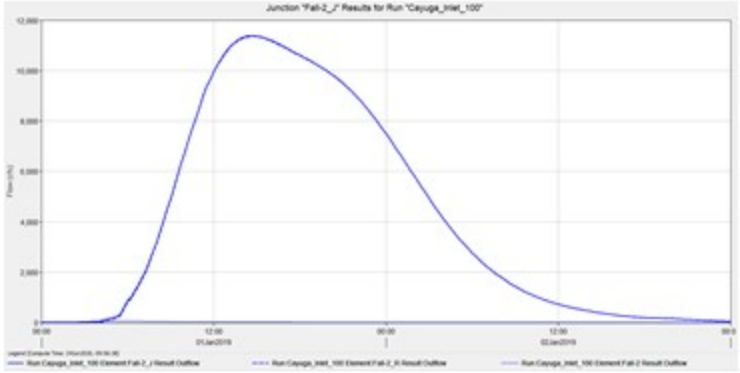
Countywide Flood Risk Study
Stream Study Scope



Hydrologic Analysis

- **Hydrology Results Review Meeting – October 2019**
- **Detailed Studies**
  - Gage Analysis – Cayuga Lake
  - Rainfall-Runoff Modeling
    - 18 Flooding Sources
    - USACE's HEC-HMS Program
    - 1D, Steady State models = peak discharges
    - 2D, Unsteady State models = hydrographs
- **Approximate Studies**
  - State of New York Region 5 Regression Equations
    - 28 Flooding Sources
    - USGS StreamStats web-based application
  - Volumetric Analysis
    - 3 lake-like storage areas
    - USACE's HEC-HMS Program
- **Discharges developed for 10%, 4%, 2%, 1%, 1%-plus, 1%-minus, and 0.2%-annual chance events**



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Where are we now?
Hydraulics Analysis Review

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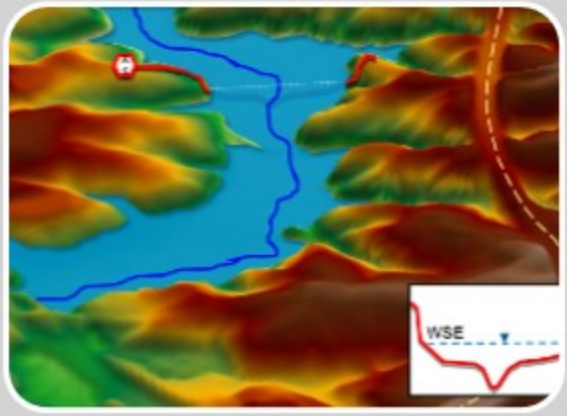
Flood Hazard Analysis



Hydrology

Volume of water?
Peak Flows?

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

Hydraulics

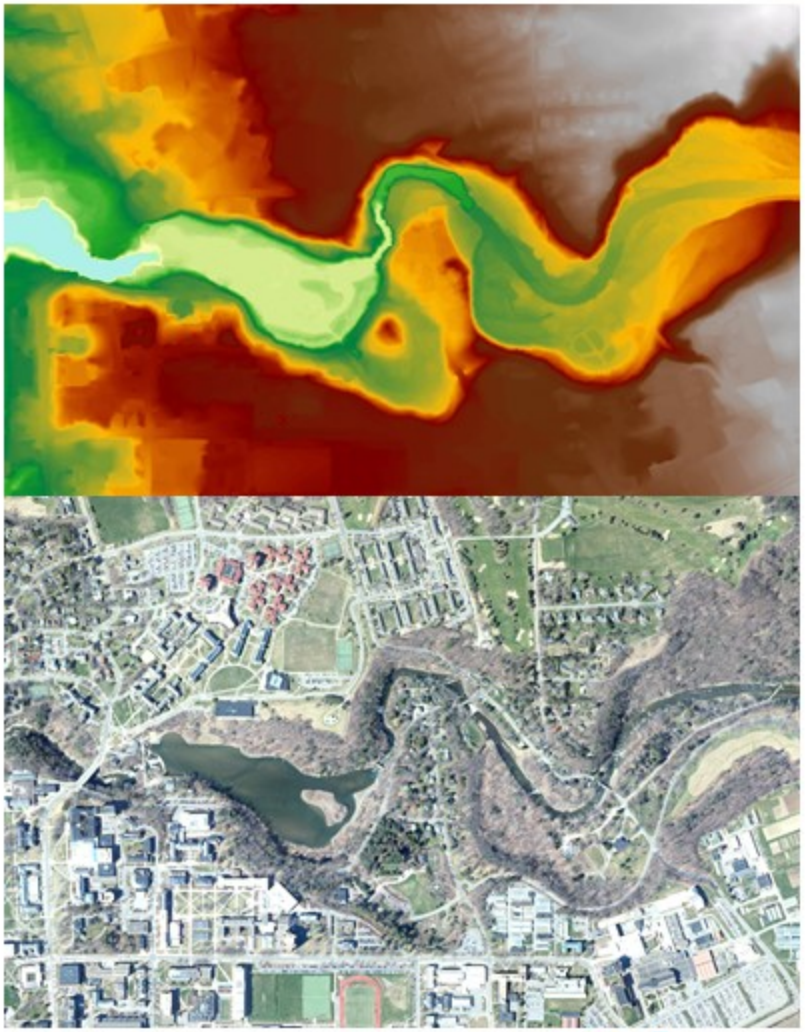
Will the stream in question be able to convey all storm water or runoff that arrives?

Floodplain Mapping

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

Data Sources – Base maps

- **Topography**
  - 2-meter Digital Elevation Model from New York State (2008)
- **Aerial Imagery**
  - New York Statewide Digital Orthoimagery Database (2018)



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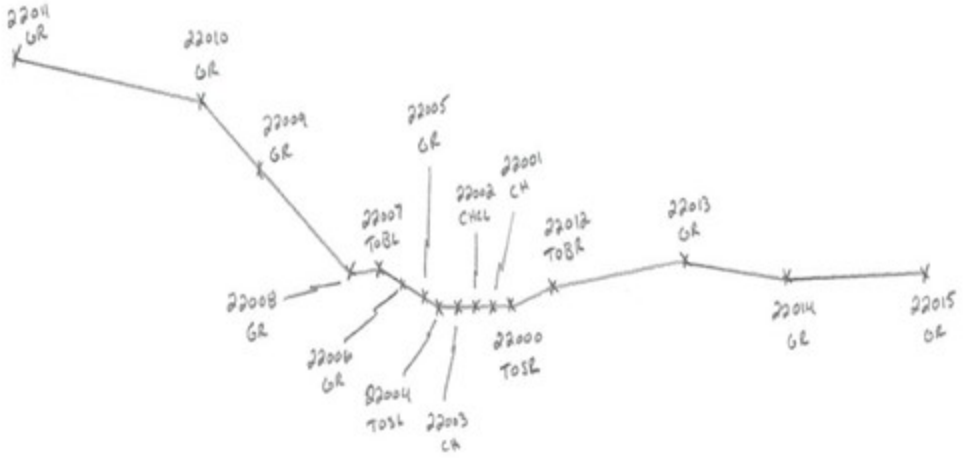
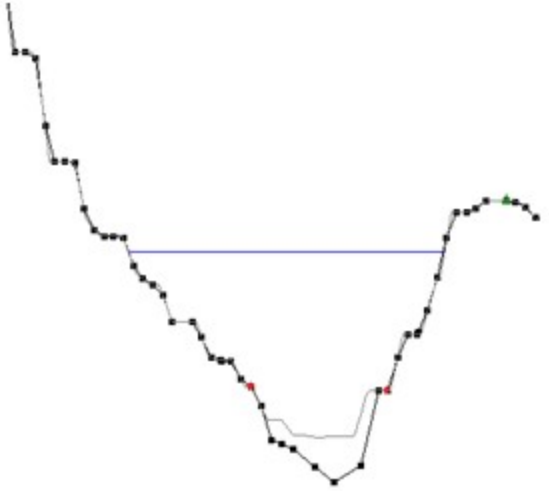
Data Sources - Survey

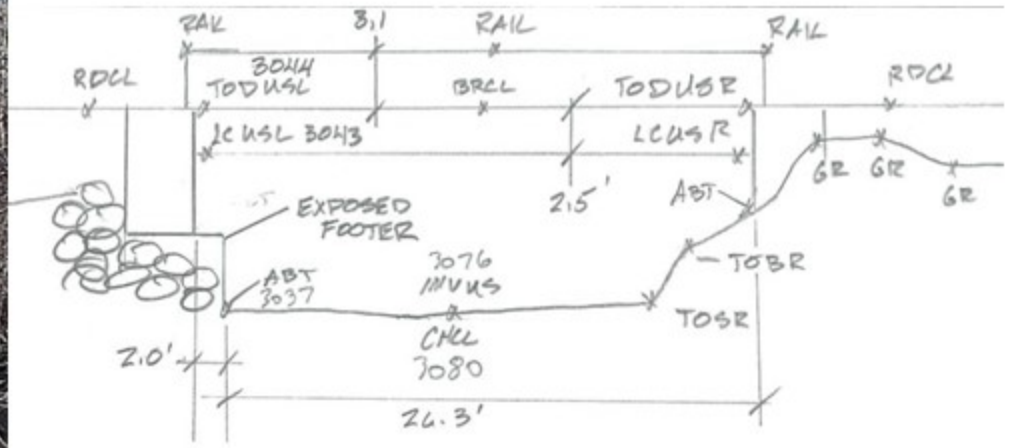
- **Channel and floodplain geometry**
  - For approximate reaches, extracted from LiDAR data
    - Updated with field reconnaissance measurements
  - For detailed reaches, survey data incorporated
    - USGS 2016 Bathymetric Survey in Ithaca





Data Sources - Structures

- **Bridges, culverts, and dams**
  - New York State's Inventory of Dams (approximate reaches)
  - NYDOT Bridge Inventory (approximate reaches)
  - Field reconnaissance (approximate reaches)
  - Survey (detailed reaches)

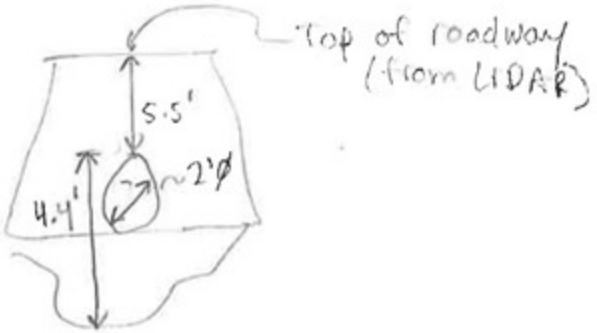


Data Sources - Field Reconnaissance

- Visited various study reaches in Tompkins County
- Observe site conditions
  - Channel – brush, grass, river cobbles?
  - Floodplain – grass, development, trees?
- Bridges and Culverts

Data Sources – Field Reconnaissance

- Identified 15 most "critical" bridges or culverts
  - Approximate reaches only
  - Bridges and culverts where as-built data not available
  - In proximity to homes, schools, or other buildings
  - Preliminary modeling shows that structures affect flooding elevations



Data Sources – Mannings "n"

- For approximate reaches, land use from National Land Cover Database (2016)
- For detailed reaches, further refined using aerial imagery, survey, and field reconnaissance

Description	Manning's "n"
Open Water	0.025
Developed, Low Density	0.07
Developed, Medium Density	0.08
Developed, High Density	0.09-0.12
Woods / Forest	0.07-0.12
Grassland / Herbaceous	0.04
Pasture / Hay / Cultivated Crop	0.04
Channel	0.025-0.055

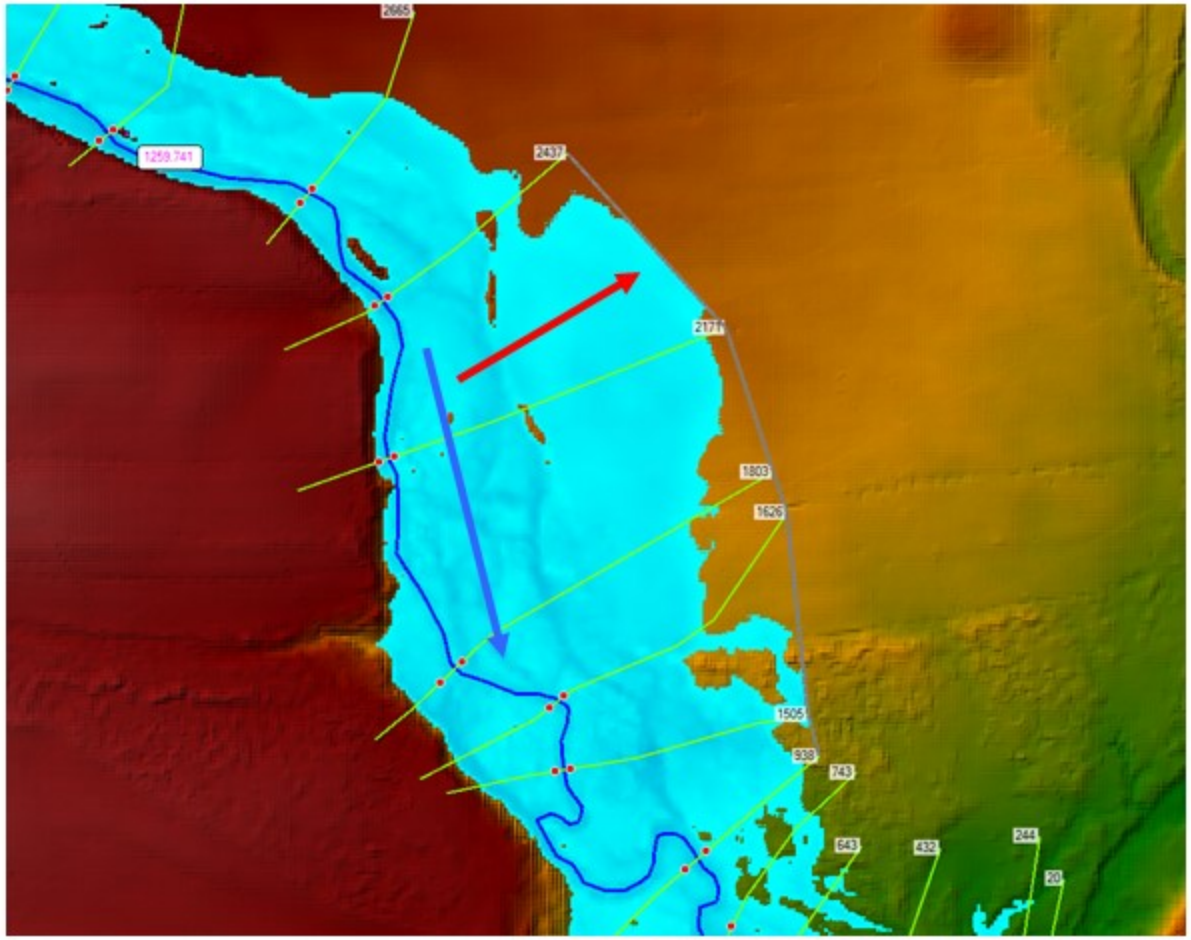
Modeling Approaches

- **USACE's HEC-RAS v. 5.0.7**
- **Boundary Conditions**
  - Steady Flow – known water surface elevation (to tie-in to adjacent studies) or normal depth slope
  - Unsteady Flow – flow and stage hydrographs

1D - Overflow Conditions

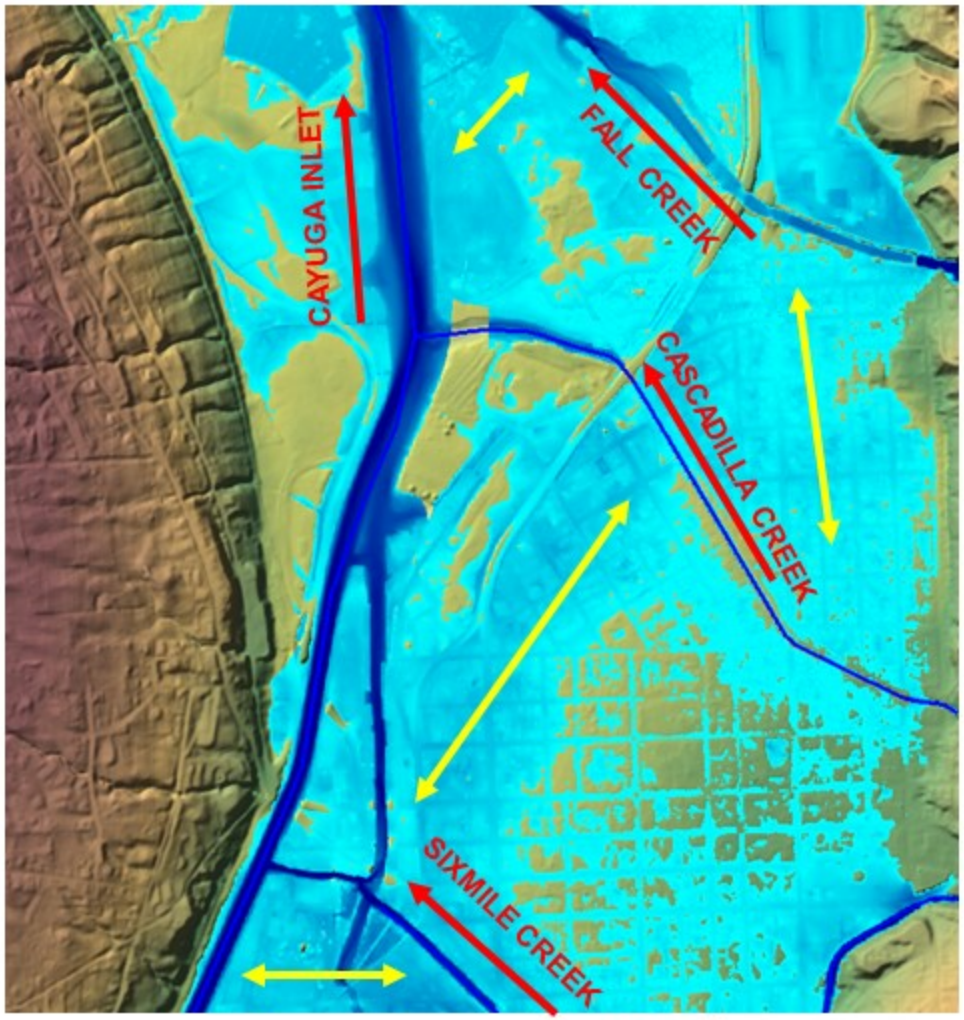
- **Flood waters rise higher than the local topography and leave immediate watershed**
- **Lateral structures included to calculate amount of flow leaving the system**
  - More accurate results downstream

1D - Overflow Conditions



1D/2D Modeling – Scope Change

- **Ithaca Valley**
  - Cascadilla Creek, Fall Creek, and Sixmile Creek originally scoped for 1D study
  - Urbanized topography allows for flow transfer between watersheds
  - Better suited for 2D modeling
    - Able to account for multi-directional overbank flows



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1D/2D Modeling – Scope Change

- **Blue = 1D Study**
- **Red = 1D/2D Study**
- **Yellow = Mapping Only**

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1D/2D Modeling – Scope Change

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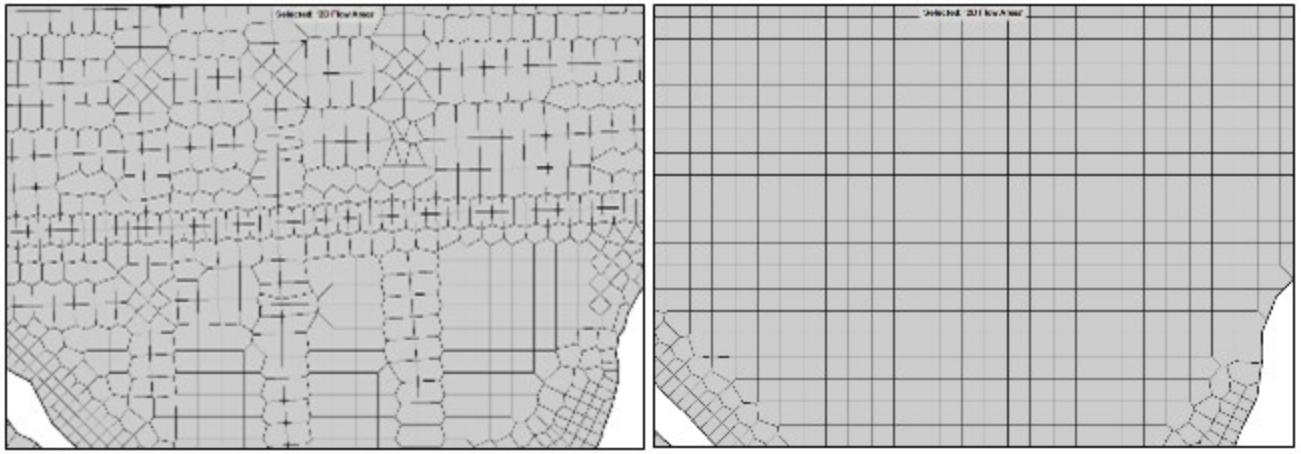
1D/2D Modeling Approach

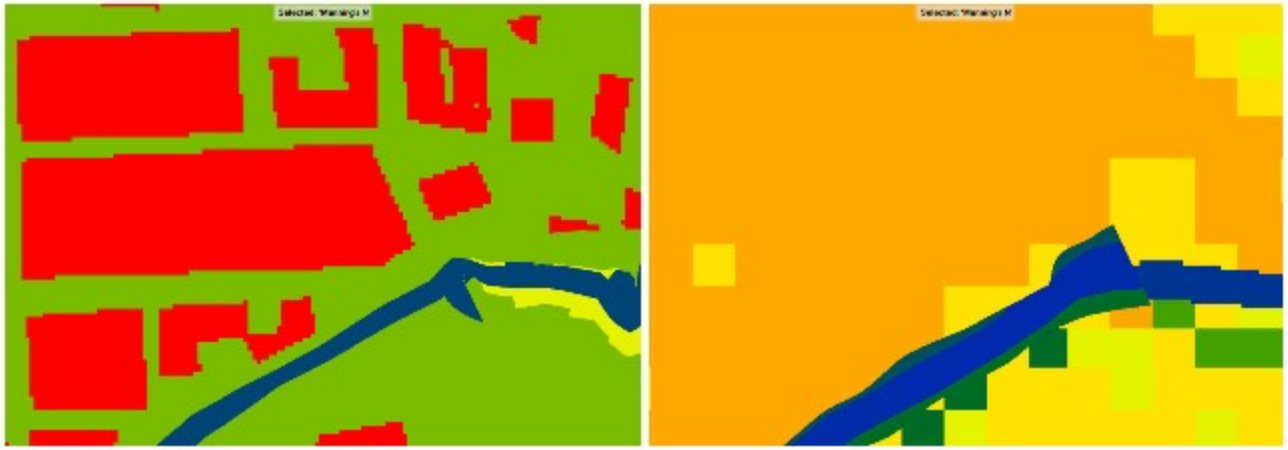
- **USGS 1D/2D Model for SIR 2018-5167**
- **Model refinements**
  - Set computation tolerances based on HEC-RAS guidance
    - Split USGS model into 3 models for 1D/2D stability
  - Added approximately 200 1D cross sections
    - Cross sections added to model bridges and culverts
    - Cross sections added for model stability
  - Added breaklines to 2D mesh
    - Enforce flow paths like roads
  - Updated 2D Manning's n-values
    - Better representation of buildings (no flow) and roads (more flow)

1D/2D Model Refinements

STARR II Model

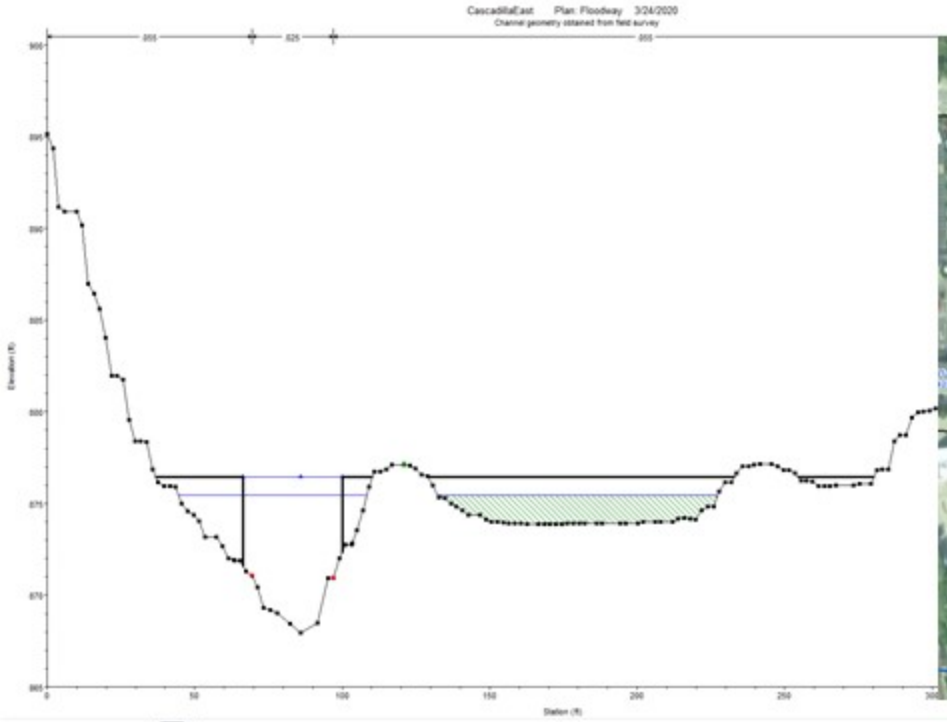
USGS Model





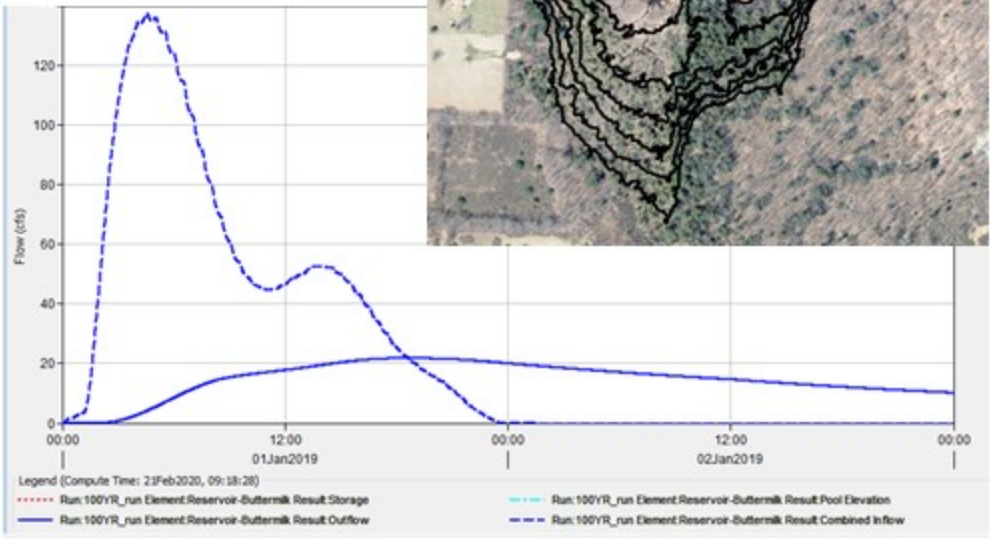
Floodway Analysis

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



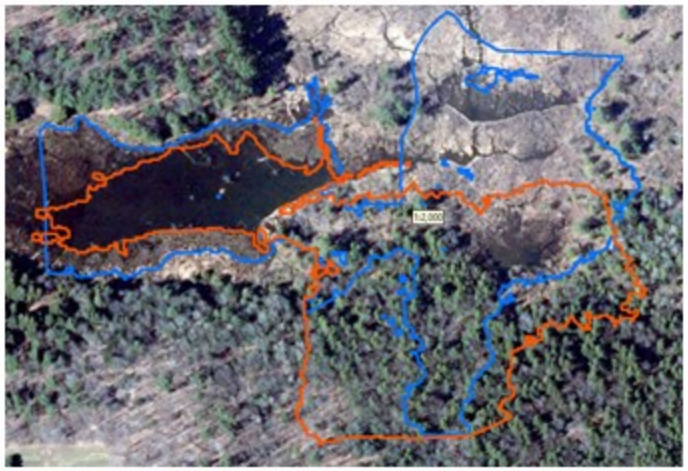
Volumetric Analysis

- **Pond-Like / Storage Areas**
  - Use topography data to find volume that basin can hold
  - Use hydrology to find the volume of runoff entering basin
  - Create a stage-storage curve to find elevation within basin



Volumetric Analysis

- **Jennings Pond**
  - Used for modeling of Buttermilk Creek
- **Placemark / Placemark Unnamed Tributary**
  - Volumetric (red) + Riverine (blue) analyses performed
- **Unnamed Tributary**
  - Volumetric (red) + Riverine (blue) analyses performed



Floodplain Mapping Comparisons

- **New countywide digital data**
  - Previous maps produced in 1970s-1980s
  - Reasons for changes in floodplains and Base Flood Elevations:
    - Updated topography
    - Channel and structure survey
    - Changes to land use
    - Changes to rainfall
    - Detailed hydrologic and hydraulic analyses
- **Draft FIRM maps to be presented at upcoming Flood Risk Review Meeting**

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What's Next?
Path Forward

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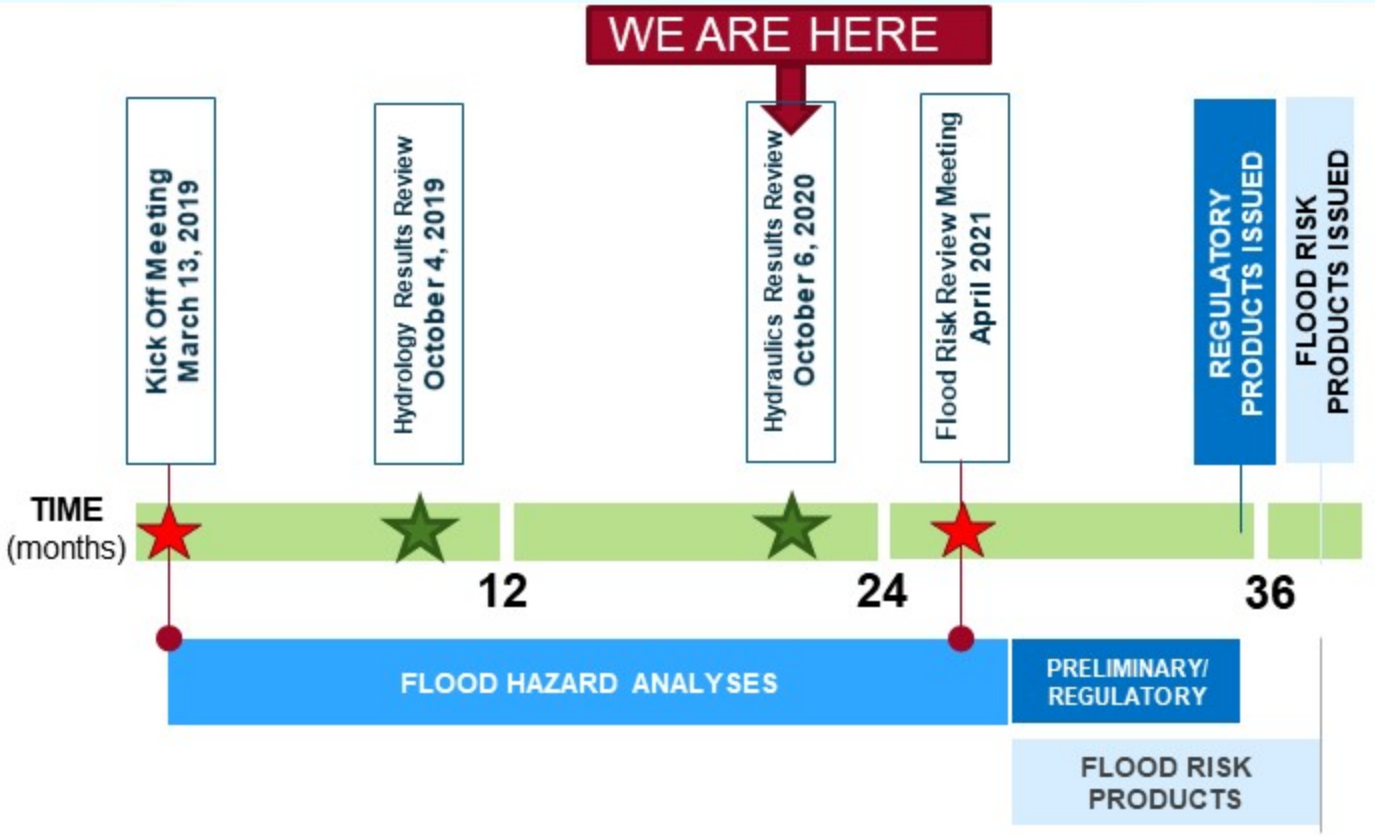
Next Steps

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



Touchpoint - Webinar

Touchpoint – In person

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Contacts

- **FEMA Project Monitor**
  - Shudipto Rahman
  - 202-702-4273
  - shudipto.rahman@fema.dhs.gov
- **FEMA Outreach Coordinator**
  - Stephanie Gootman
  - 202-802-3137
  - stephanie.gootman@fema.dhs.gov
- **STARR II Project Manager**
  - Inger Sarappo
  - 615-812-3597
  - inger.srappo@stantec.com
- **STARR II Regional Support Center**
  - Curtis Smith
  - 646-490-3929
  - curtis.smith@stantec.com

Questions? Comments?

Thank you!

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