Flood Risk Project

Chautauqua County, New York

Hydrology Review Meeting

September 23, 2021

FEMA

Agenda

Recap/Refresh

Hydrology Analysis Review

Path Forward

Project Recap

- **Projects in Chautauqua County**
  - Chautauqua County Scoping of Priorities
    - Completed in November 2020
  - Western New York BLE
    - Completed in November 2020
  - Lake Erie Coastal
    - December 2017
- **Current Chautauqua Study Progress**
  - Kickoff meeting: Held virtually February 8, 2021
  - Engineering models notification: March 2, 2021
  - Field survey: Spring 2021 – Fall 2021
  - Hydrologic analysis: June 2021 – Present

BLE Data Available - Draft Data Viewer

Coastal Data Available - Draft Data Viewer

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Project Scope

- First time digital maps
- Flooding sources analyzed
  - Detailed riverine studies (AE) – 47 streams, 78 miles
  - Detailed lake studies (AE) – 3 Lake, 22 miles
  - Approximate studies (A) – multiple streams, 977 miles
  - Will tie in to existing coastal mapping
- 45 Updated Communities – 232 Map Panels
- Review Meetings
  - Hydrology Meeting
  - Hydraulics Meeting
  - Flood Risk Review Meeting

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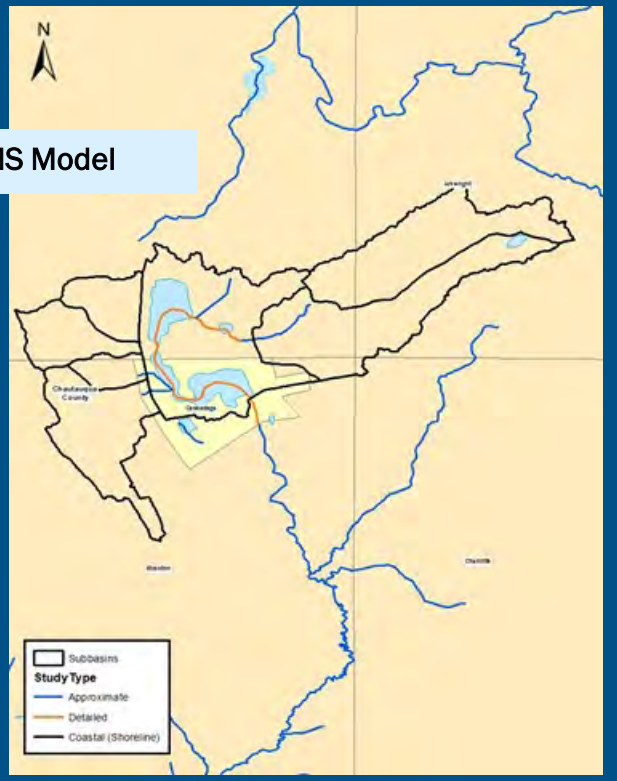
Hydrologic Analysis Methods

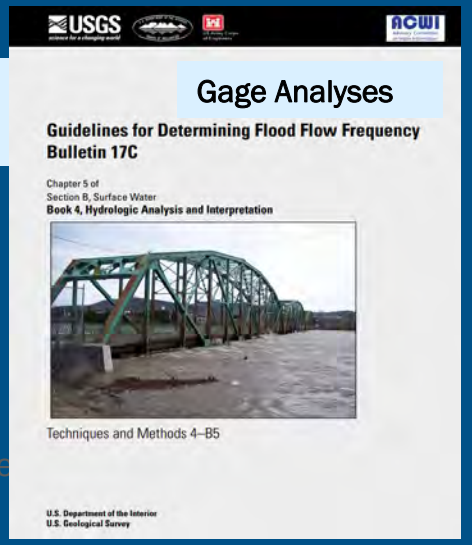
- Typical Methods FEMA utilizes
  - Statistical Gage Analyses
  - Regression Analyses
  - Rainfall Runoff Modeling
- Gage/Regression are based on stream gage data
- Rainfall-Runoff based on estimated hydrologic parameters
- Discharges developed for
  - 10%, 4%, 2%, 1%, 1%+, 1%-, 0.2%
  - Inputs for hydraulic analyses

HEC-HMS Model



Regression Report

Gage Analyses



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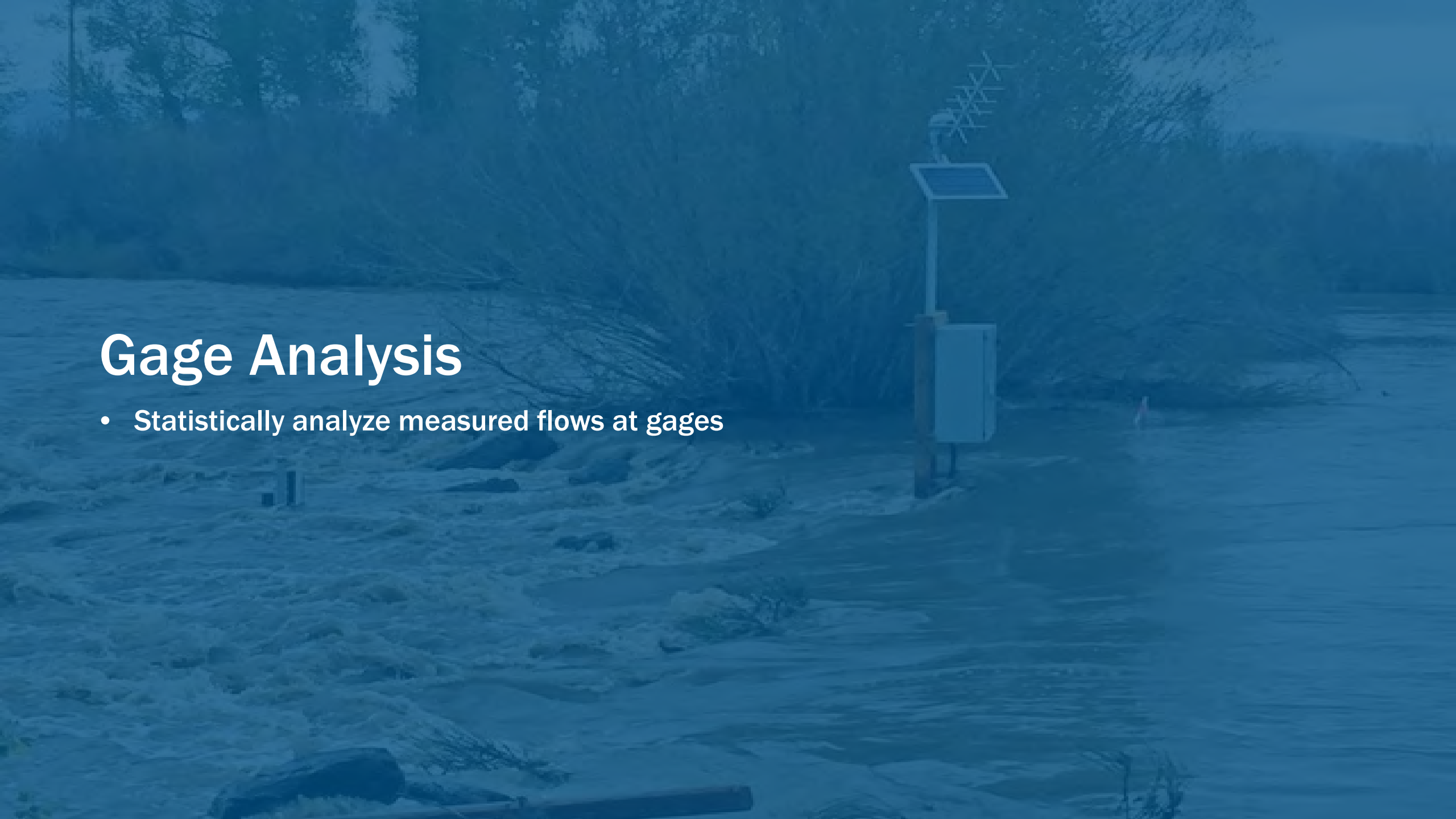

Gage Analysis

- Statistically analyze measured flows at gages

Hydrology – Stream Gage Analysis

USGS Gage Number	Stream Name	Stream Gage Name	Drainage Area (mi^2)	Number of Systematic Peaks	Period of Record (Years)
03013800	Ball Creek	Ball Creek at Stow, NY	9.6	39	1974 – 2012
04213376	Canadaway Creek	Canadaway Creek at Fredonia, NY	32.9	34	1979 – 2020
04213500	Cattaraugus Creek	Cattaraugus Creek at Gowanda, NY	436	79	1940 – 2020
03014500	Chadakoin River	Chadakoin River at Falconer, NY	194	85	1935 – 2019
03013000	Conewango Creek	Conewango Creek at Waterboro, NY	290	56	1939 – 1994

- Flow gage analysis performed in support of regression analysis
- Viable gage = minimum 10 years current record
- Bulletin 17C methodology

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Hydrology – Lake Gage Analysis

USGS Gage Number	Stream Name	Stream Gage Name	Drainage Area (mi^2)	Number of Systematic Peaks	Period of Record (Years)
03013946	Chautauqua Lake	Chautauqua Lake at Bemus Point, NY	189	22	1976 – 1998

- Statistical distribution fitting analysis

Regression Analysis

- USGS Regression Equation Discharges leveraged from Western NY BLE Project
- Relationships between peak flows and watershed characteristics
- Regional Regression Equations
- Gage Weighting

Hydrology – Regression Analysis

- Regression Analysis = Chautauqua (1,043 miles)
  - 66 miles of Detailed streams (AE Zone)
  - 977 miles of Approximate streams (A Zone)

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Hydrology – Regression Analysis

- USGS New York regression equations
  - SIR 2006-5112
- Study area falls within USGS NY regression Region 5
- Method for Zone A streams

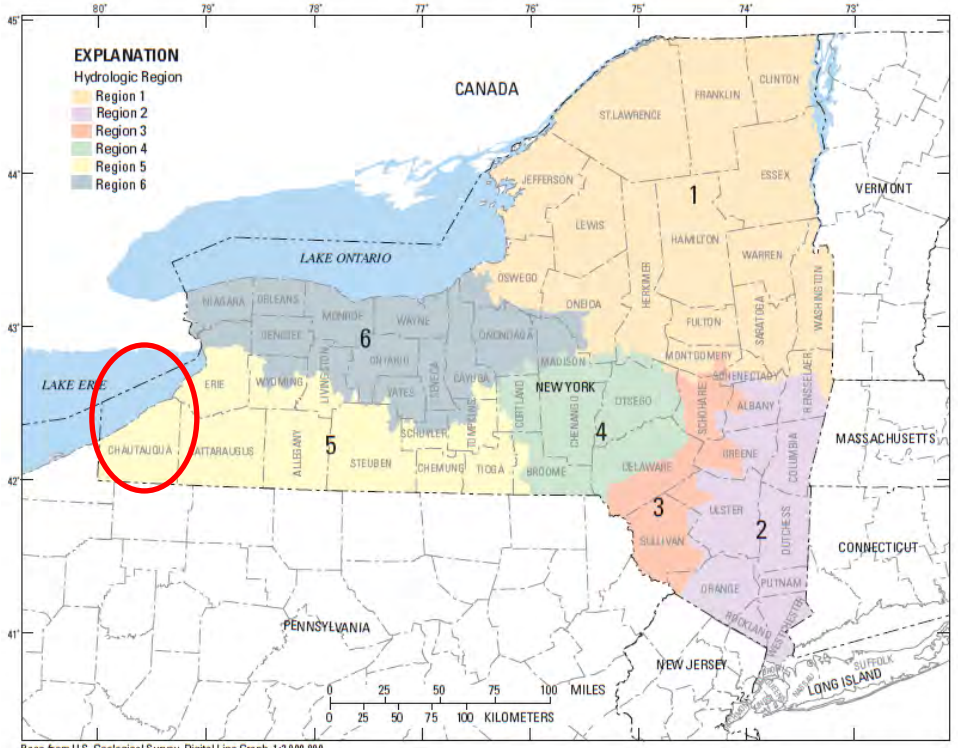


Figure 2. Six hydrologic regions of New York and locations of 388 streamflow-gaging stations represented in this study. (Map numbers refer to streamflow-gaging stations shown in tables 7 and 8.)

Summary of Regression Equations

Factors Considered

- Drainage area (square miles)
- Mean annual precipitation (inches per year)
- Main channel slope (feet/mile)

Summary of Gage Weighting Streams with Regression Discharges

- Gaged Sites
  - Log Pearson Type III, Bulletin 17C analysis to determine the discharges
- Ungaged Sites on Gaged Streams
  - For unregulated streams, the gage discharge is weighted with the regression discharge.
    - Performed at all the flow change locations within 50% to 150% of the gage drainage area

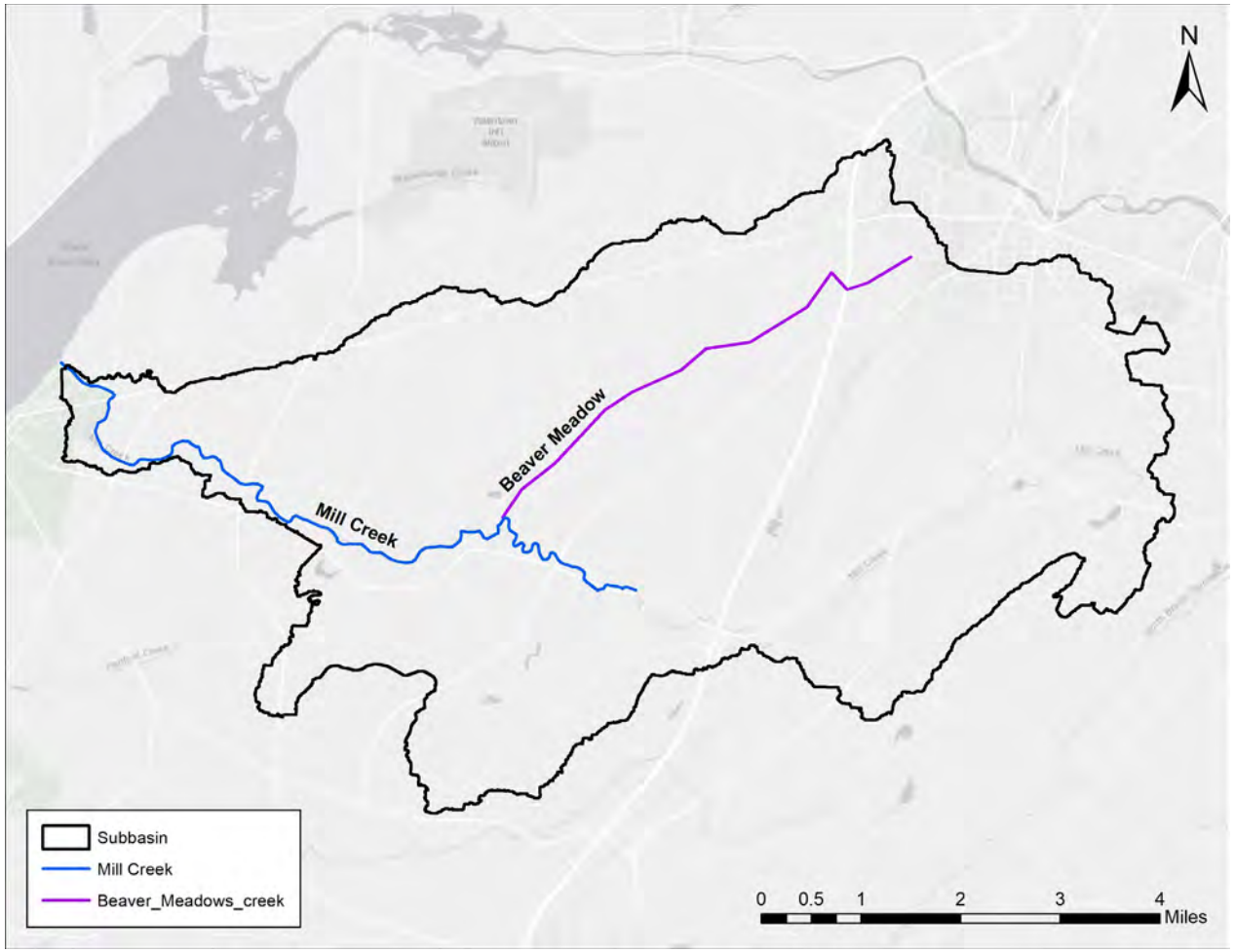
Example stream gage. Source: USGS/ Robert Swanson

Rainfall-Runoff Analysis

- Creation of hydrologic models to calculate flows at outlet, node or subbasin
- Estimated inputs required

Hydrology – Rainfall-Runoff Modeling

- 2 lakes (39.6 sq. mi)
  - Cassadaga Lakes - 3 miles
  - Findley Lake - 2 miles
  - Scoped to be studied using stage frequency analysis.
  - No gage data – HECHMS rainfall runoff model used to estimate frequency stages.



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Rainfall-Runoff Methodology

- HEC-HMS 4.6.1 was used
- Rainfall Depths: NOAA Atlas 14 Precipitation Frequency Data Server, 24-hour duration.
- Loss Methodology: SCS Curve Number
- Hydrograph Methodology: SCS Unit Hydrograph
  - Lag Time (60% of Time of Concentration)
- Channel Routing: Muskingum-Cunge using 8-point cross-sections
- Reservoir Routing: Stage-Discharge curve developed for all reservoirs/ Lakes using HEC-RAS
  - Reservoir/lakes then modeled as a function of storage (Elevation-Area-Discharge) method

Model Validation / Results

- Check computed flows against results from Effective FIS

Gage Analysis

Gage Analysis results – Comparison with FIS values

Stream Name	Drainage Area (mi^2)	Effective Discharge (cfs)		Restudied Discharge (cfs)		Difference	
		1-Pct	0.2-Pct	1-Pct	0.2-Pct	(%)	(%)
Ball Creek	9.7	1,430.0	1,850.0	2,004.9	2,531.7	40%	37%
Canadaway Creek	33.3	5,760.0	7,900.0	11,056.3	16,941.2	92%	114%
Canadaway Creek	33.0	5,620.0	7,180.0	11,044.2	16,941.2	97%	136%
Canadaway Creek	30.7	5,330.0	6,820.0	10,141.9	15,404.3	90%	126%
Canadaway Creek	27.2	4,890.0	6,800.0	8,816.8	13,161.5	80%	94%
Cattaraugus Creek	561.6	45,150	57,000	48,800	64,300	8%	13%
Chadakoin River	198.9	2,100.0	2,300.0	2,484.6	2,913.5	18%	27%
Chadakoin River	193.8	2,100.0	2,300.0	2,420.8	2,838.8	15%	23%
Chadakoin River	188.8	2,050.0	2,300.0	2,358.4	2,765.5	15%	20%

Lake Analysis

Lake Analysis results – Comparison with FIS values

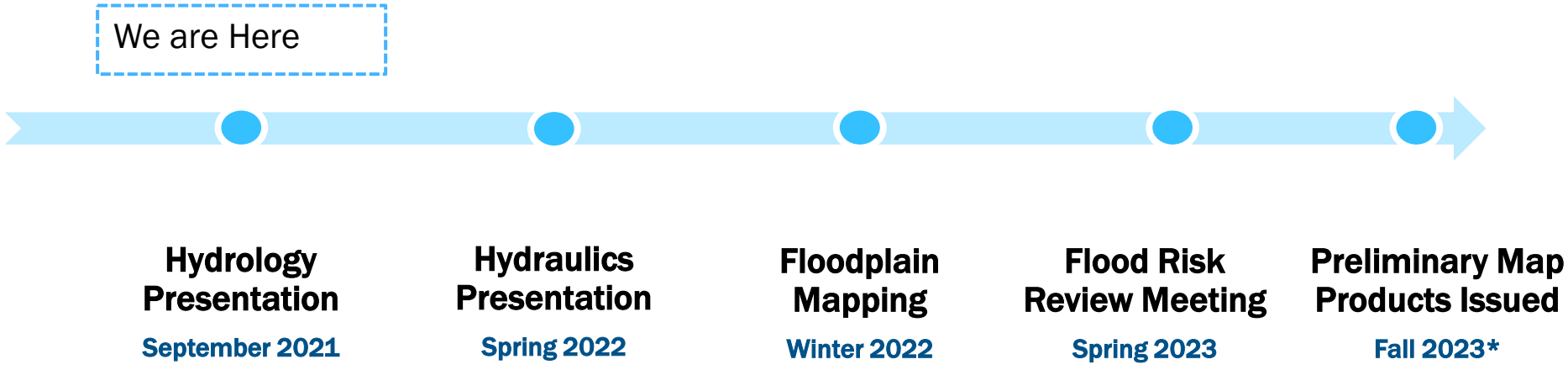
Stream Name	Drainage Area (mi^2)	Effective Water Surface Elevation (ft NAVD 88)		Restudied Water Surface Elevation (ft NAVD 88)		Difference	
		1-Pct	0.2-Pct	1-Pct	0.2-Pct	(ft)	(ft)
Cassadaga Lakes	6.0	1307.9	1308.9	1307.9	1308.9	0.0	0.0
Findley Lake	4.9	1422.2	1422.8	1421.6	1422.7	-0.6	-0.1
Chautauqua Lake	189	1310.0	1310.3	1310.5	1310.9	0.5	0.6

Chautauqua County Next Steps

Chautauqua County Next Steps

- Hydraulic analysis
  - Hydraulic modeling/report/submittal
  - Hydraulic analysis webinar
- Floodplain Mapping
- Flood Risk Review meeting
  - Comment period for communities

Project Timeline towards Preliminary Issuance



*Current timeline could be impacted by Flood Risk Review Comments

Graphic Above Not to Scale

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Thank you!

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