SLRCONSULTING.COM

Shokan – West Shokan Local Flood Analysis

May 7, 2026

SLR

AGENDA

- Introductions
- Review of Shokan – West Shokan LFA study areas and Shokan Stormwater Management area
- Local Flood Analysis approach refresher
- Initial modeling results
- Next Steps and Meeting Schedule – Public Meeting #3
- Recommendations and Examples from Neighboring Communities

Meet the Team

Mark Carabetta, CFM
US Manager of Climate Resilience Planning

Allison Lent
Associate Water Resources Engineer

Matt Trueheart
Associate Water Resources Engineer

Adam Doan
Principal Water Resources Scientist

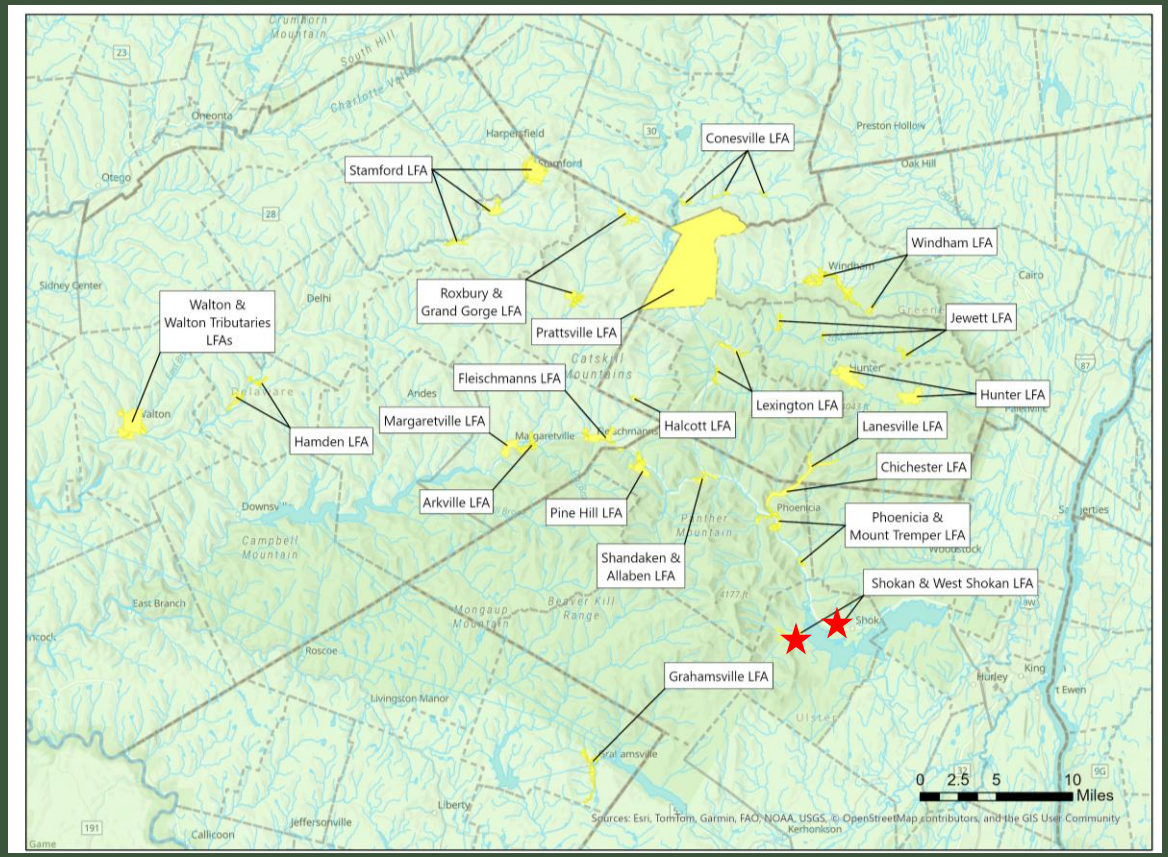
Ethan Ely
Associate Water Resources Engineer

- **Town of Olive**
- **Olive Flood Advisory Committee (OFAC)**
  - **Town of Olive (officials and residents)**
  - **Cornell Cooperative Extension of Ulster County (CCEUC)**
  - **Ulster County Department of the Environment (UCDOE)**
  - **Ulster County Soil and Water Conservation District (UCSWCD)**
  - **New York City Department of Environmental Protection (NYCDEP)**
  - **Catskill Watershed Corporation (CWC)**

Ashokan Watershed Stream Management Program (AWSMP)

LFAs completed by SLR

- Prattsville (2013)
- Walton (2015)
- Windham (2015)
- Lexington (2016)
- Fleischmanns (2016)
- Phoenicia & Mount Tremper (2016)
- Arkville (2017)
- Conesville (2017)
- Hamden (2017)
- Walton Tributaries (2015)
- Tannersville (2018)
- Shandaken & Allaben (2018)
- Hunter (2018)
- Halcott (2019)
- Roxbury & Grand Gorge (2019)
- Stamford (2020)
- Grahamsville (2022)
- Jewett (2022)
- Pine Hill (2023)
- Lanesville (2025)
- Margaretville (2025)
- Shokan-West Shokan (underway)
- Chichester (underway)



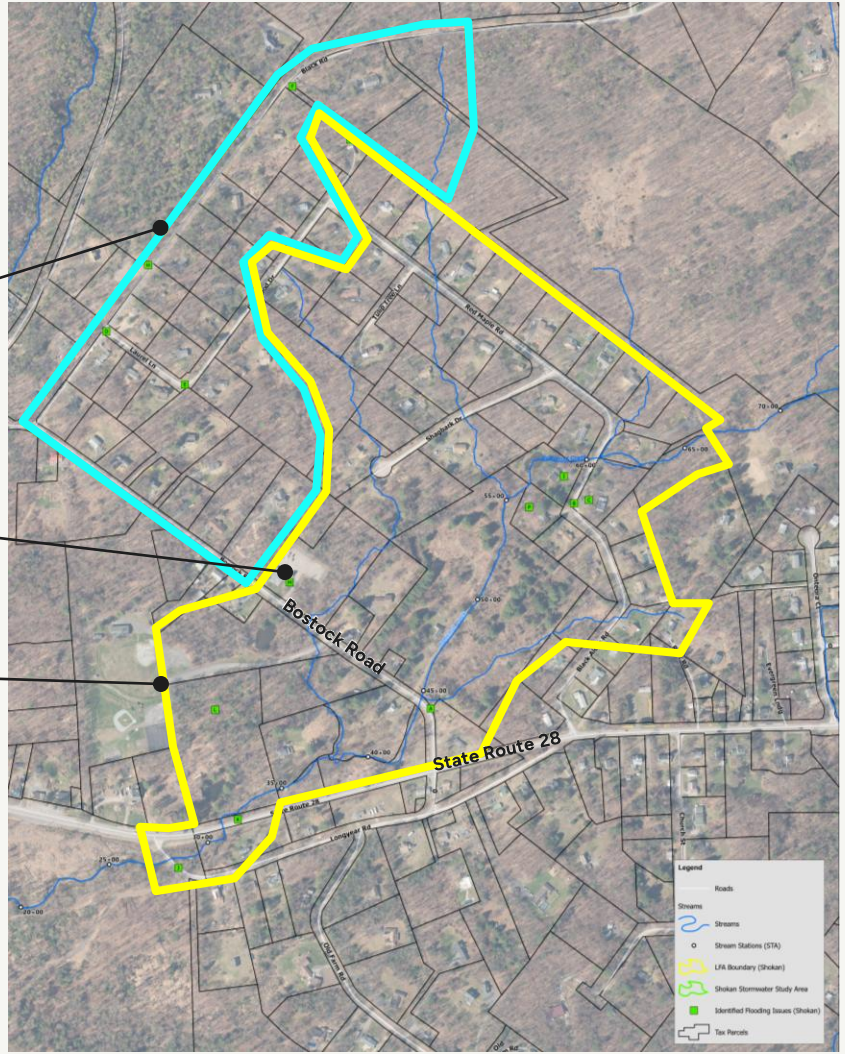
Final LFA Reports: http://catskillstreams.org/lfa/

Shokan LFA Project Area and Stormwater Study Area

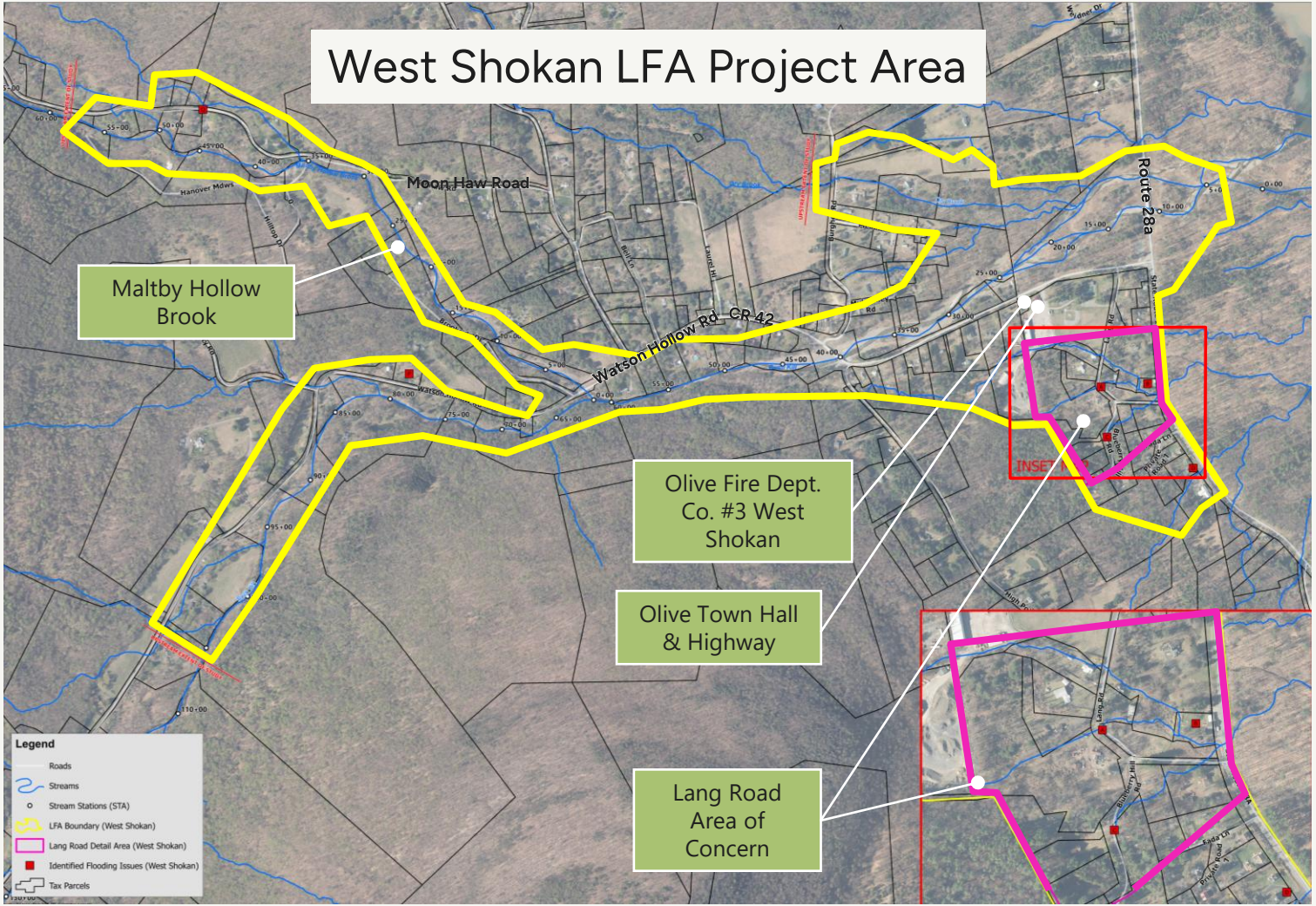
Shokan Stormwater Study Area

Olive Town Courthouse

Shokan LFA Study Area



West Shokan LFA Project Area



Our analysis focuses on:

- Flood prone homes and businesses adjacent to Bush Kill, Maltby Hollow, Butternut Creek, and tributaries
- Critical facilities and anchor businesses
- Vulnerable or undersized bridges and culverts
- Flood prone or vulnerable areas of roadway
- Threats to water quality
- Homes and businesses at risk from erosion
- Stormwater flooding in Shokan adjacent to the LFA study area (Stormwater Study Area – Project 3)

Public Input – Help us understand flooding patterns and problems

Engineering Analysis – Hydraulic modeling of flood mitigation scenarios

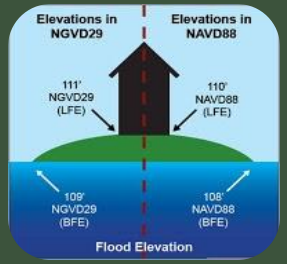
Benefit Cost Analysis – To understand viability

Funding - Identification of potential funding sources

LFA Report and Plan - Blueprint for near- and long-term flood mitigation

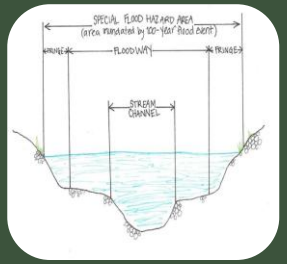
Implementation – Funding sought to implement recommended projects

Key Terms



Elevations

Vertical position often relative to another known position



Base Flood

Flood that has 1% chance of occurring in a given year (100-yr flood)

Standard for development regulations and flood insurance

Discharge

River flow

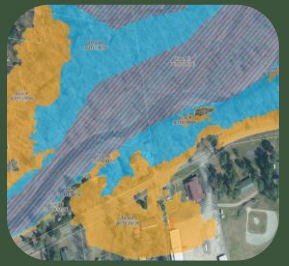
Volume of water over unit of time

Cubic feet per second (cfs)

Hydrology

Study of water's movement, distribution, water cycle and interactions with the landscape

Process of determining flood flows



Floodplain vs Floodway

Floodplain is area adjacent to a river prone to flooding

Floodway is the channel and adjacent land needed to safely convey floodwaters without raising water levels (regulatory)

Riverine vs Stormwater

Riverine sourced flooding occurs when rivers overtop streambanks

Stormwater flooding occurs when drainage systems are overwhelmed in developed areas

Flood Mitigation Toolbox

Bridges, Dams, Culverts

- Removal
- Operational Changes
- Modification
- Replacement

Channel Alteration

- Dimension (Widening - Deepening)
- Profile (Slope)
- Pattern (Realignment)

Floodplain

- Reclamation
- Creation
- Enhancement

Planning

- Flood Code Enforcement
- Wetland Protection
- Limiting Impervious Cover
- Zoning Modifications

River/ Watershed Management

- Repair of Eroding Banks
- Watershed Management
- Stormwater Detention
- Sediment or Debris Management

Individual Building Treatments

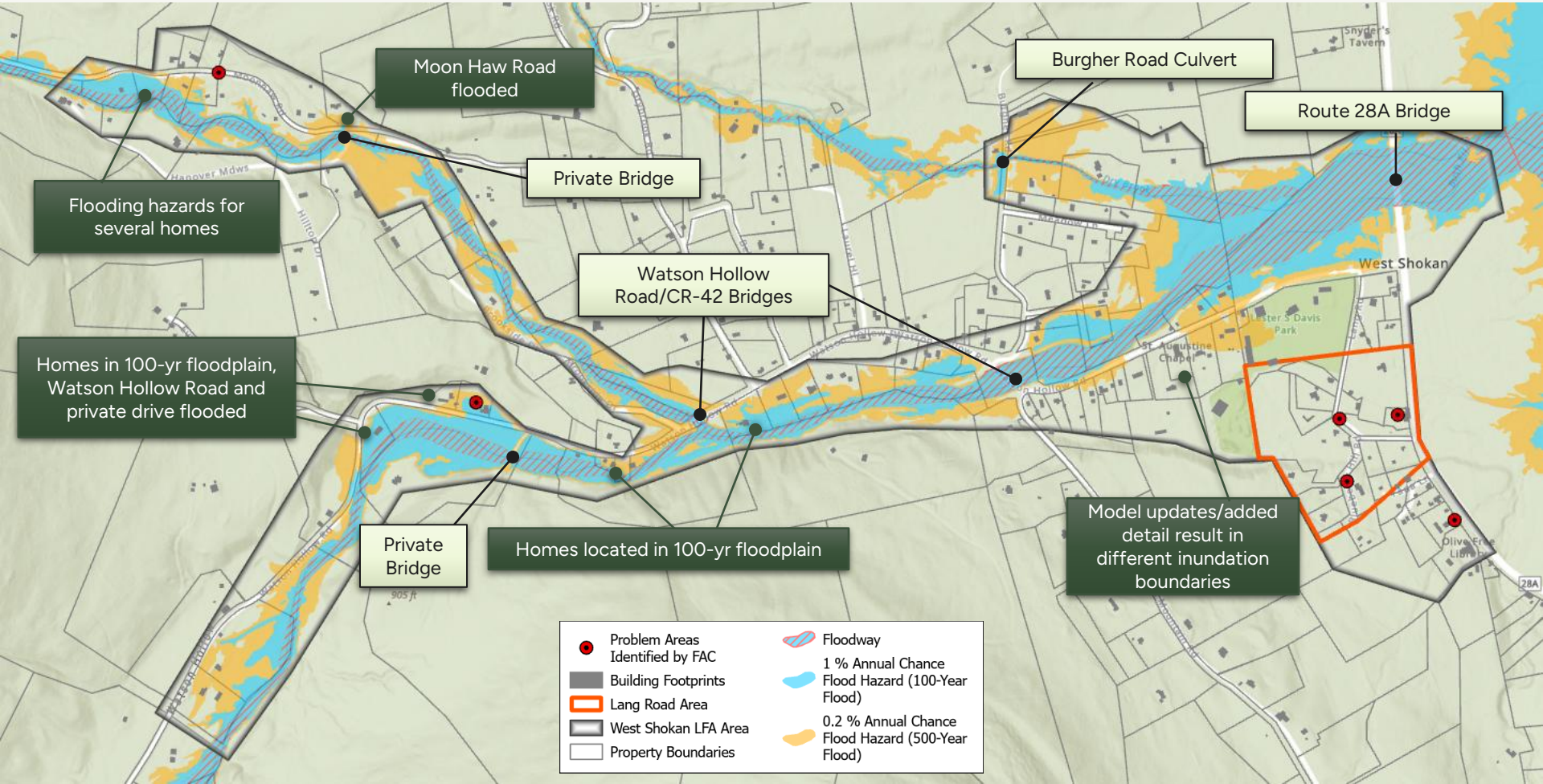
- Flood-proofing
- Elevation of Structures
- Relocation
- Voluntary Buy-Out

September kick-off meeting

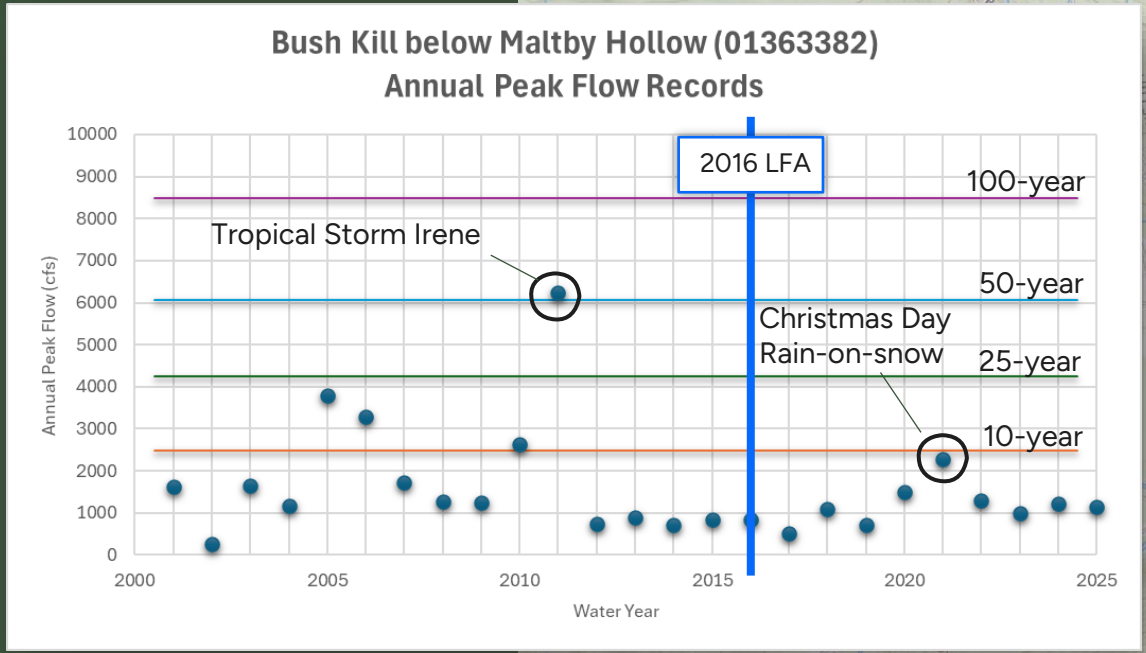
Thank you for your input and participation!

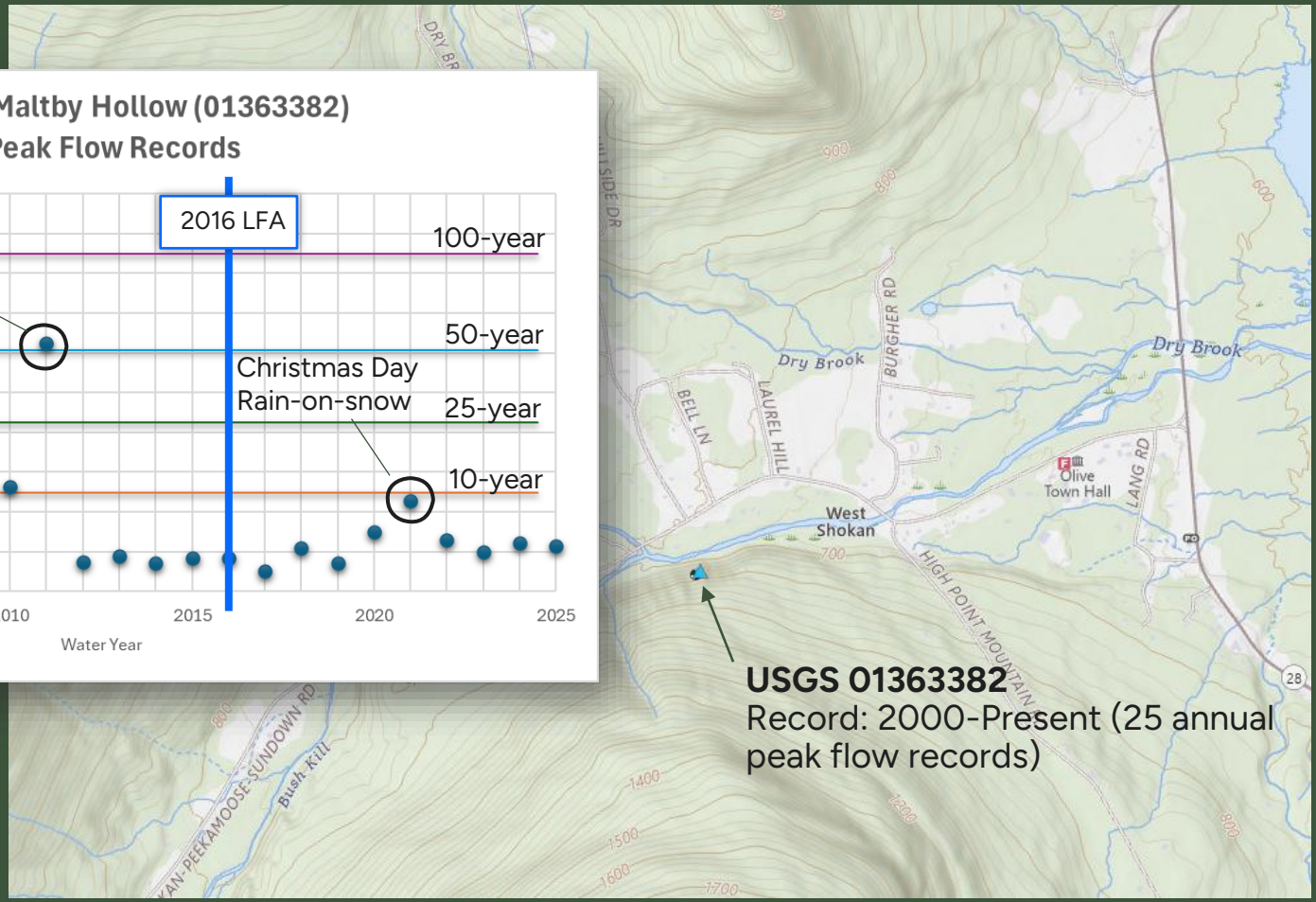
West Shokan

West Shokan LFA Study Area



Hydrology – West Shokan





USGS 01363382
Record: 2000-Present (25 annual peak flow records)

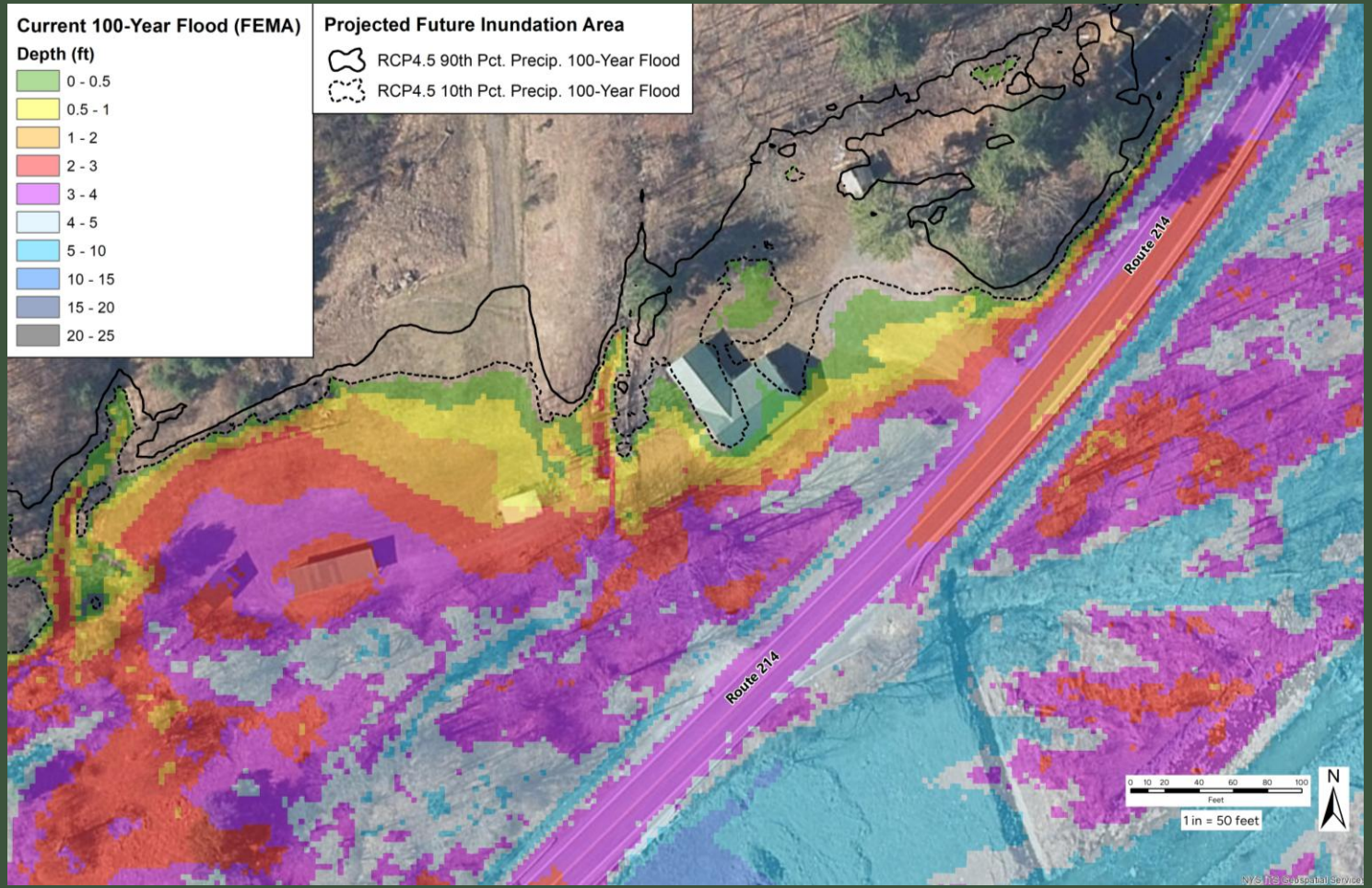
Projected Future Flood Hydrology

Location	Discharge (cfs)			
	Current FEMA 50-Year	**Future 50-Year RCP 4.5 Mean**	Current FEMA 100-Year	**Future 100-Year RCP 4.5 Mean**
Bush Kill above Maltby Hollow Brook	3,046 →	**3,715**	4,271 →	**5,307**
Bush Kill Above Dry Brook	6,058 →	**7,395**	8,484 →	**10,500**
Bush Kill At Ashokan Reservoir	6,938 →	**8,472**	9,725 →	**12,038**
Maltby Hollow Brook Above Bush Kill	2,919 →	**3,551**	4,067 →	**5,034**
Projected increase in peak discharge by 2100	**+22% in 50-year flood**		**+24% in 100-year flood**	

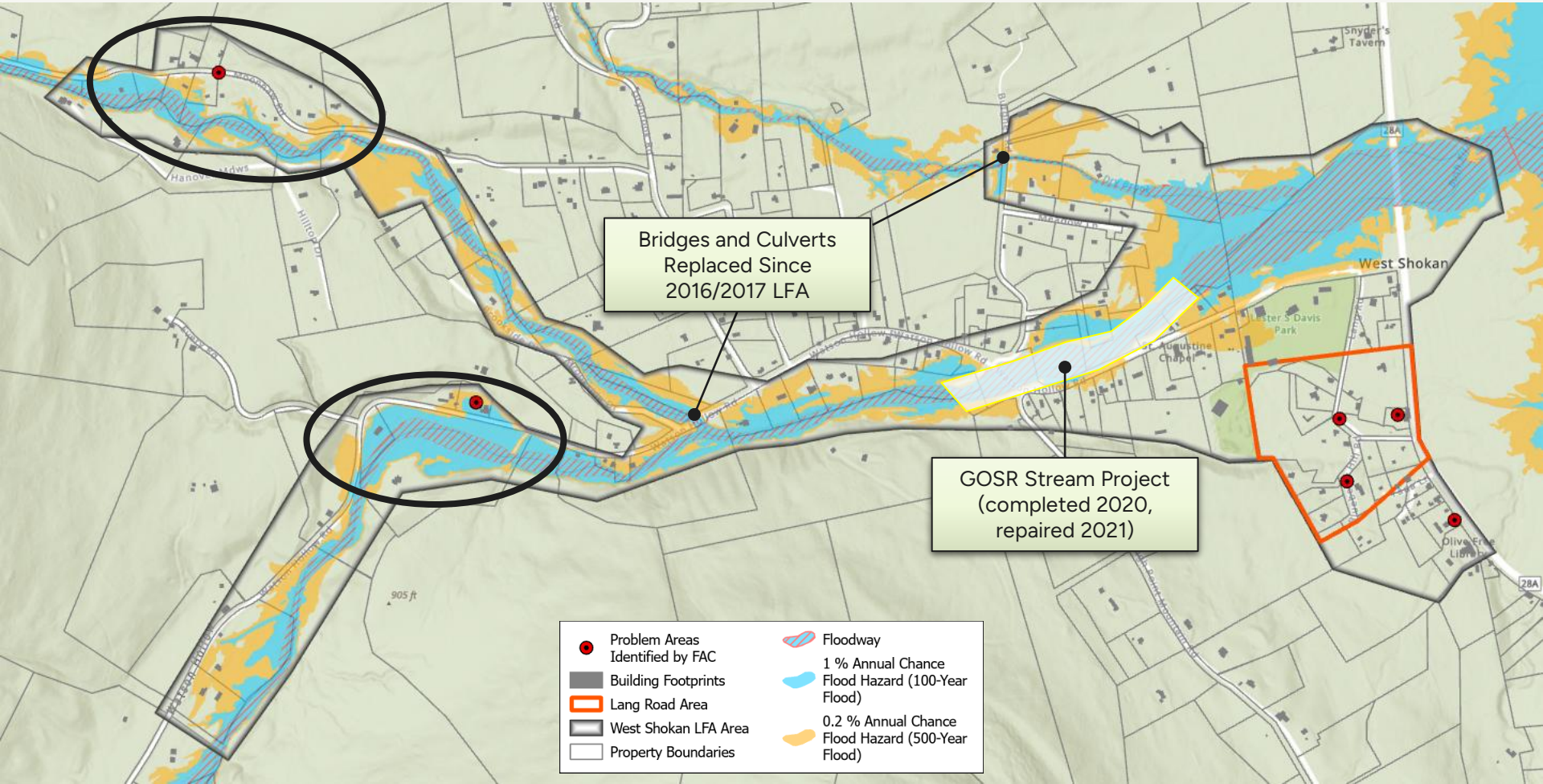
Cornell University Northeast Regional Climate Center model for predicting frequency and magnitude of extreme precipitation in the northeastern U.S.

RCP = Representative Concentration Pathways (greenhouse gas emission scenario)

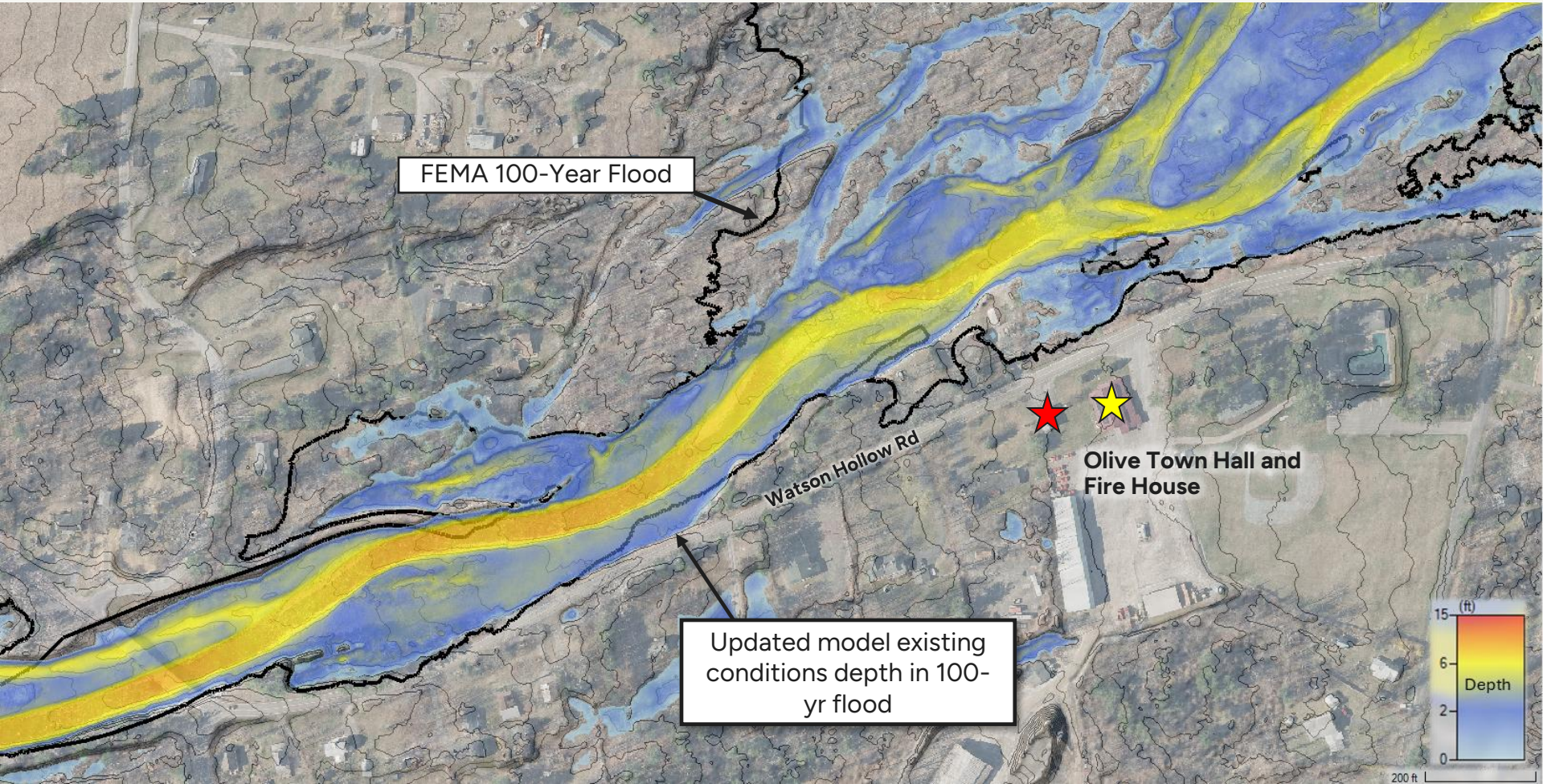
Projected Future Flood Hydrology – Flood Risk Assessment Example



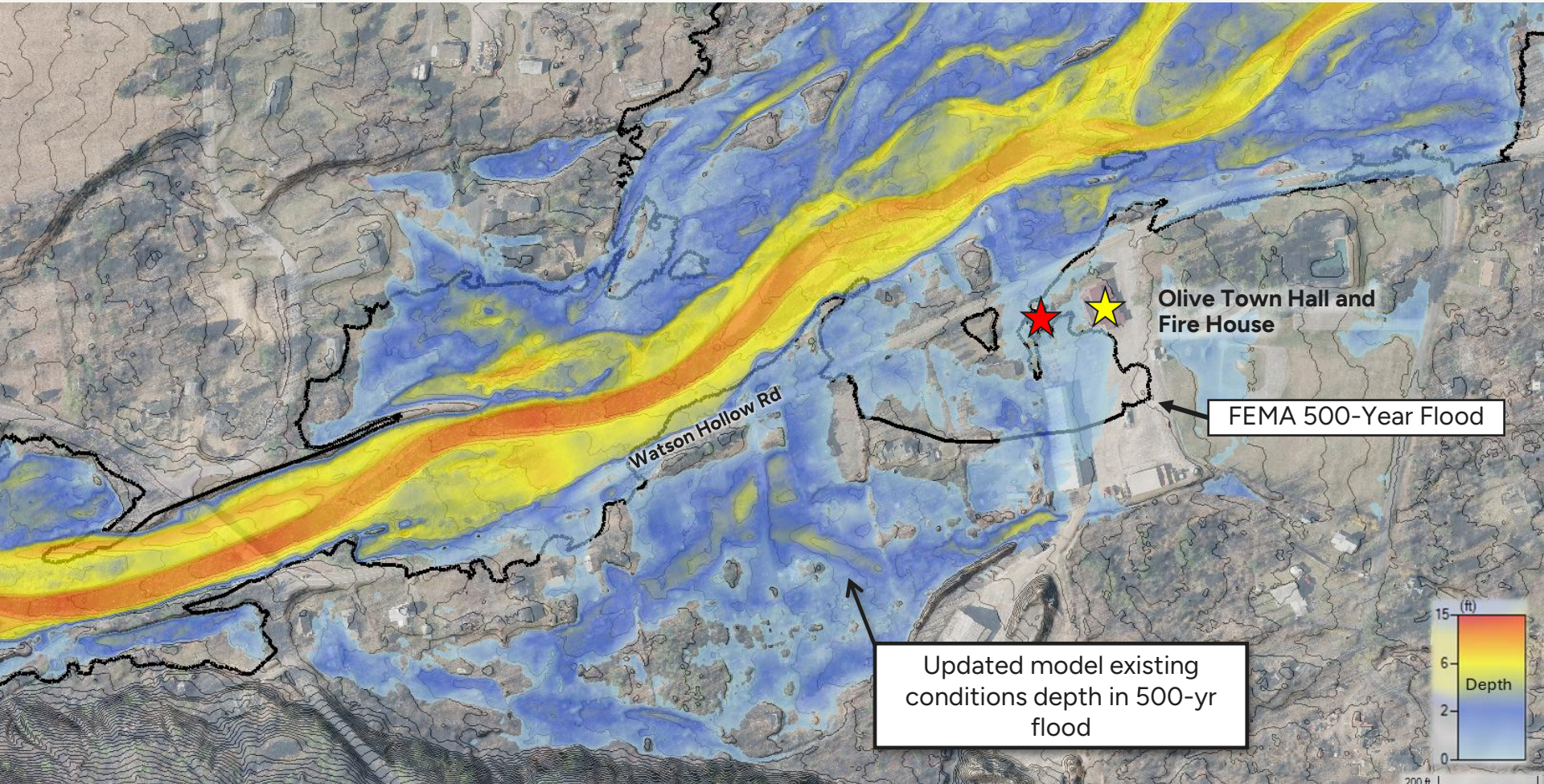
West Shokan LFA – Hazard Areas and Model Updates



Bush Kill Existing Conditions: 100-year flood depths



Bush Kill Existing Conditions: 500-year flood depths



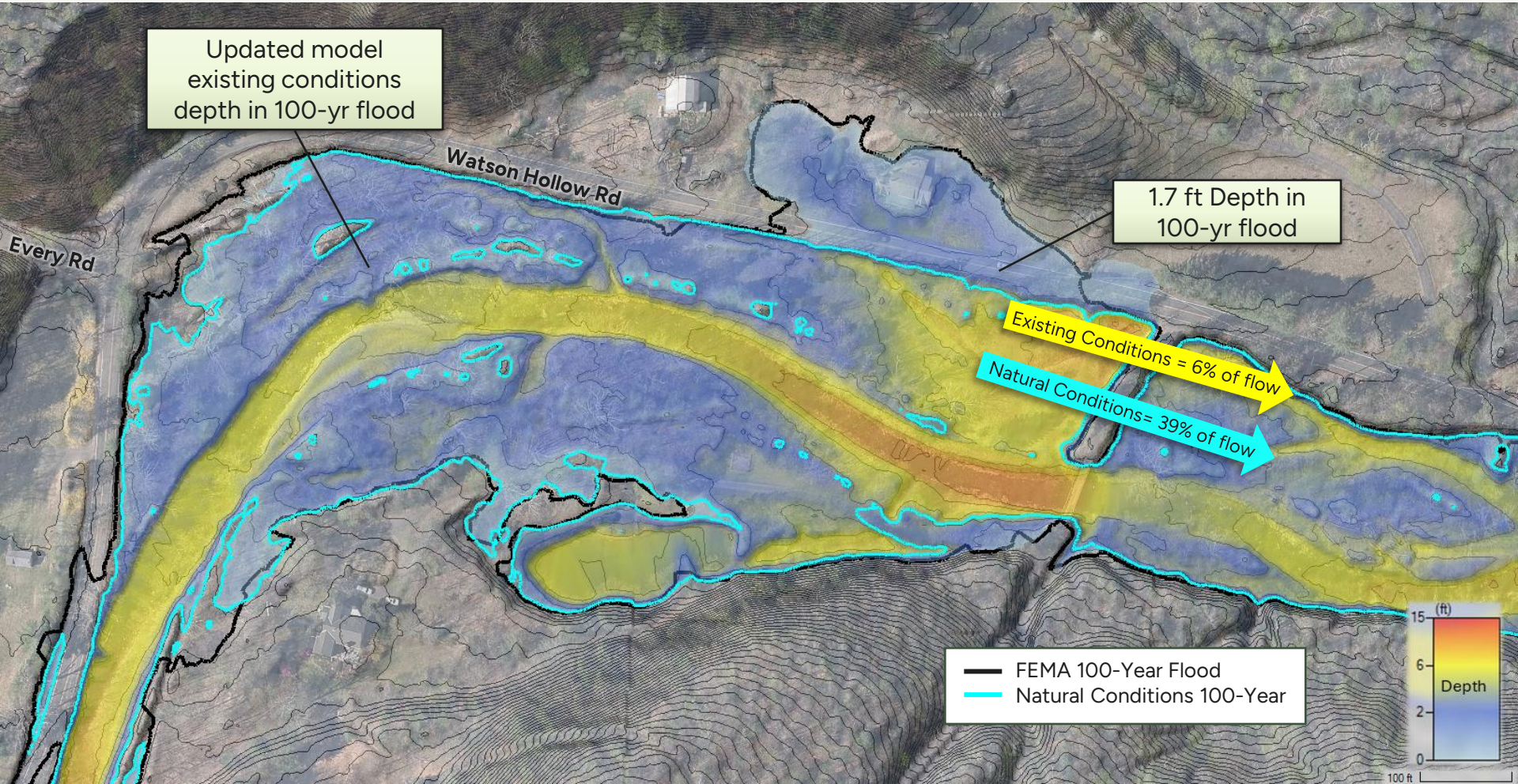
Bridges & Culverts

Stream	Road Crossing	Year Built	Flood Performance (FEMA Flood Hydrology)
Bush Kill	Route 28a	2009	Adequate for 500-year flood
	Watson Hollow Rd	1993	Adequate for 500-year flood
	Private Drive		Impacted 10-year flood, flanked in 100-year flood
Maltby Hollow Brook	Watson Hollow Road	2022	Impacted 500-year flood
	Private Drive		Impacted 10-year flood, flanked/overtopped in 50-year flood
Dry Brook	Burgher Road	2022	Meets NYSDOT hydraulic performance standards (future 50-year flood); overtopped in 100-yr flood

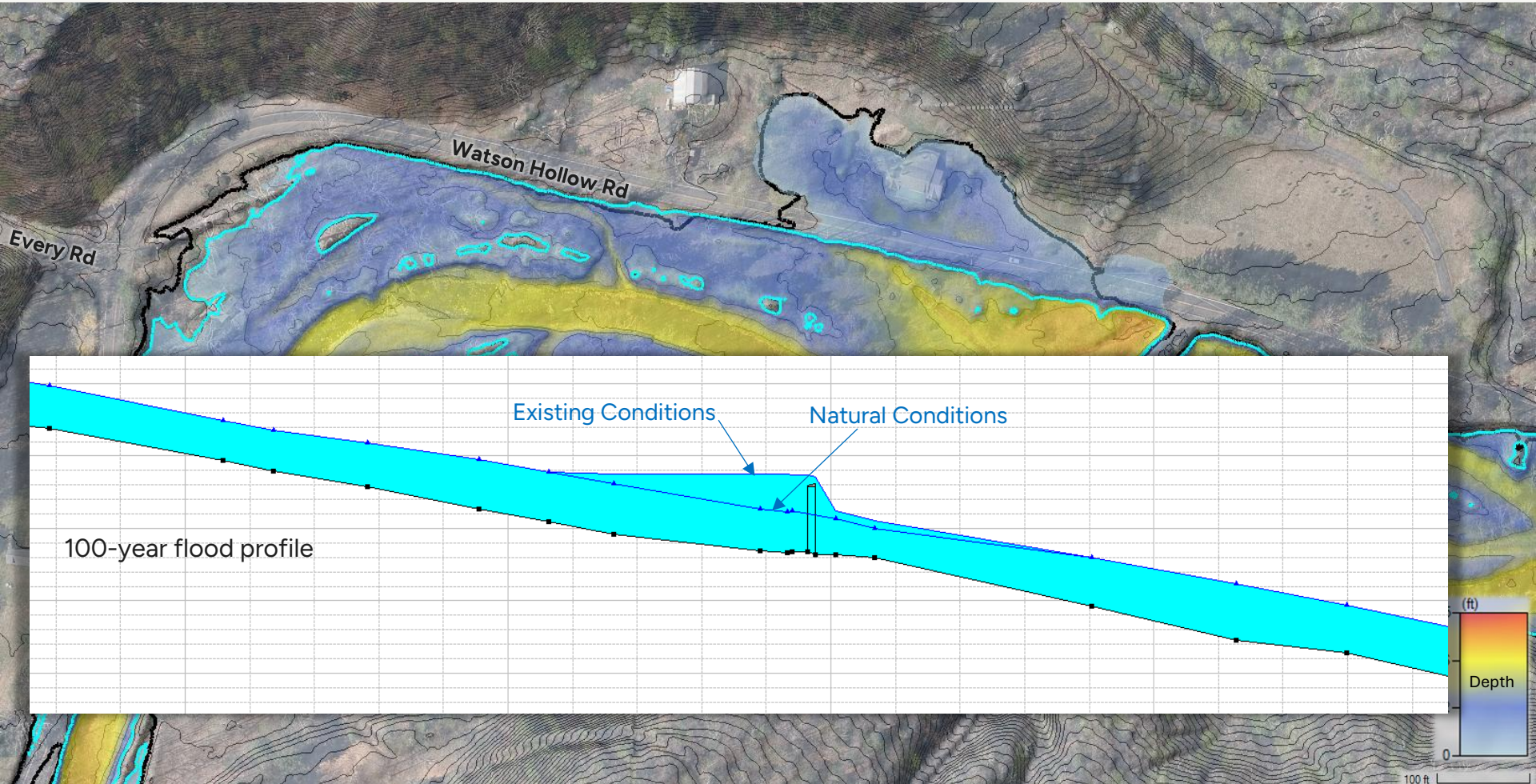
Exploring Mitigation Solutions
Initial Modeling Results

- Test different scenarios for reducing flood hazards
- Welcome feedback!

Bush Kill – Every Road to Private Drive



Bush Kill – Every Road to Private Drive

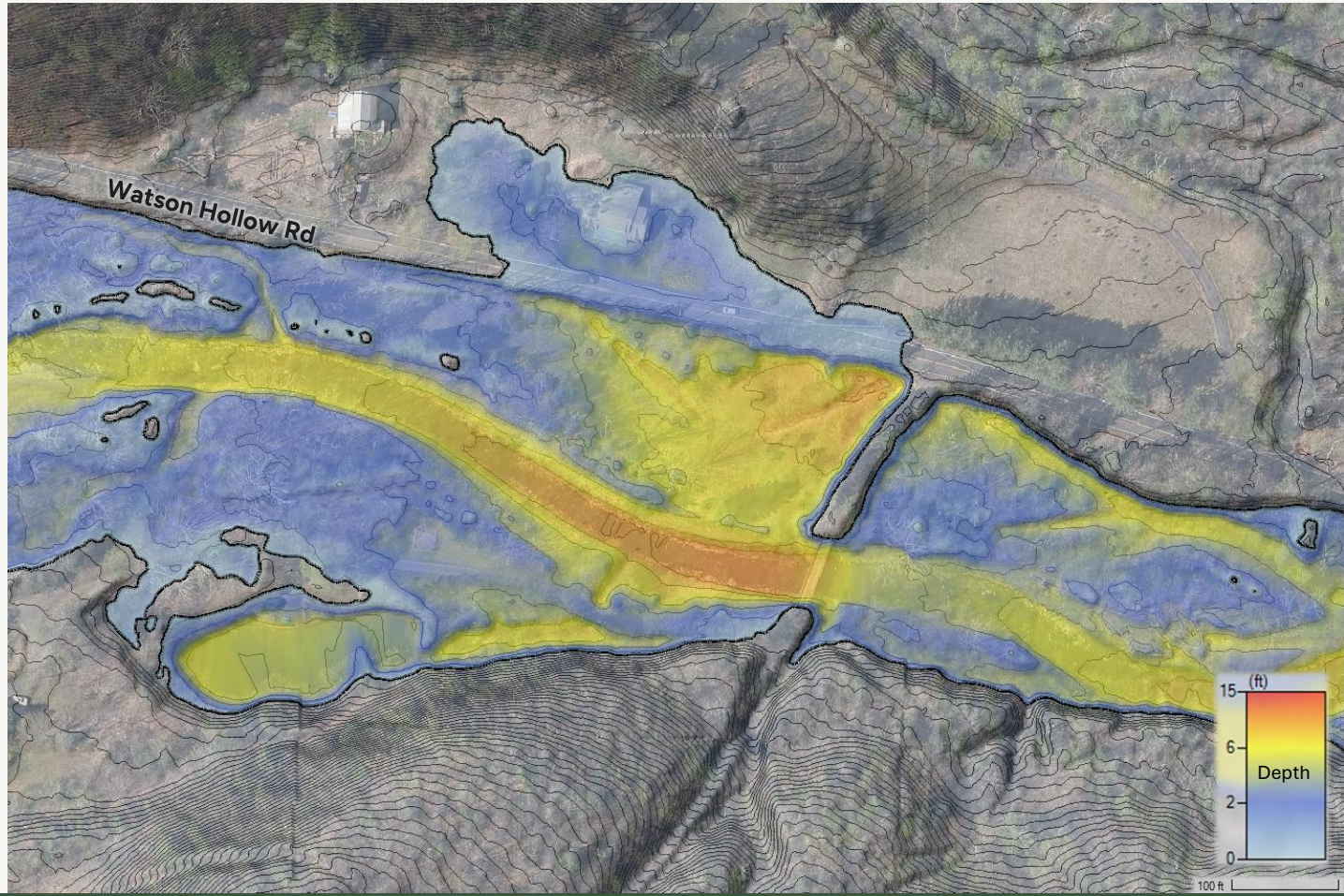


Bush Kill– Every Road to Private Drive

Flood Hazard Mitigation Scenarios

Existing Conditions

- Private driveway cuts off floodplain and causes severe backwater
- Watson Hollow Road inundated by 1.7 feet at deepest point in 100-yr (3.7 feet in 500-yr)
- House flooded on other side of Watson Hollow Road
- Bridge not overtopped in 100-yr flood, but left approach of driveway overtopped by 0.9 ft of water
- Bridge overtopped in 500-yr flood



Bush Kill– Every Road to Private Drive

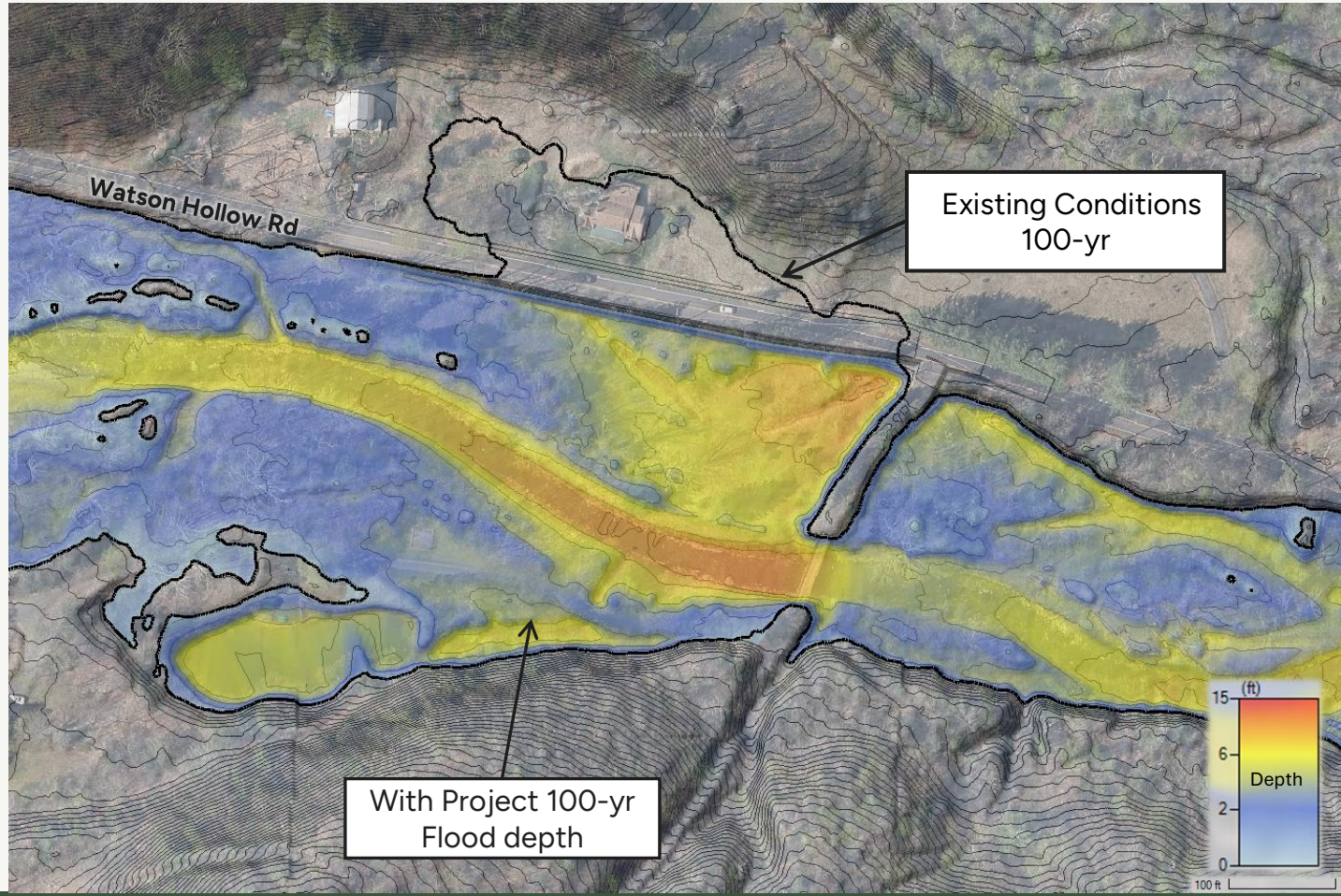
Flood Hazard Mitigation Scenarios

Elevate Watson Hollow Road:

- Raise road 3 feet to alleviate flooding in 100-yr flood, raise 4 feet for 500-yr flood

Results:

- Watson Hollow Road is no longer flooded in 100-yr or 500-yr
- Road acts as berm and house on other side has some protection
- Minor increases in water surface elevation or flow velocity through bridge



Bush Kill– Every Road to Private Drive

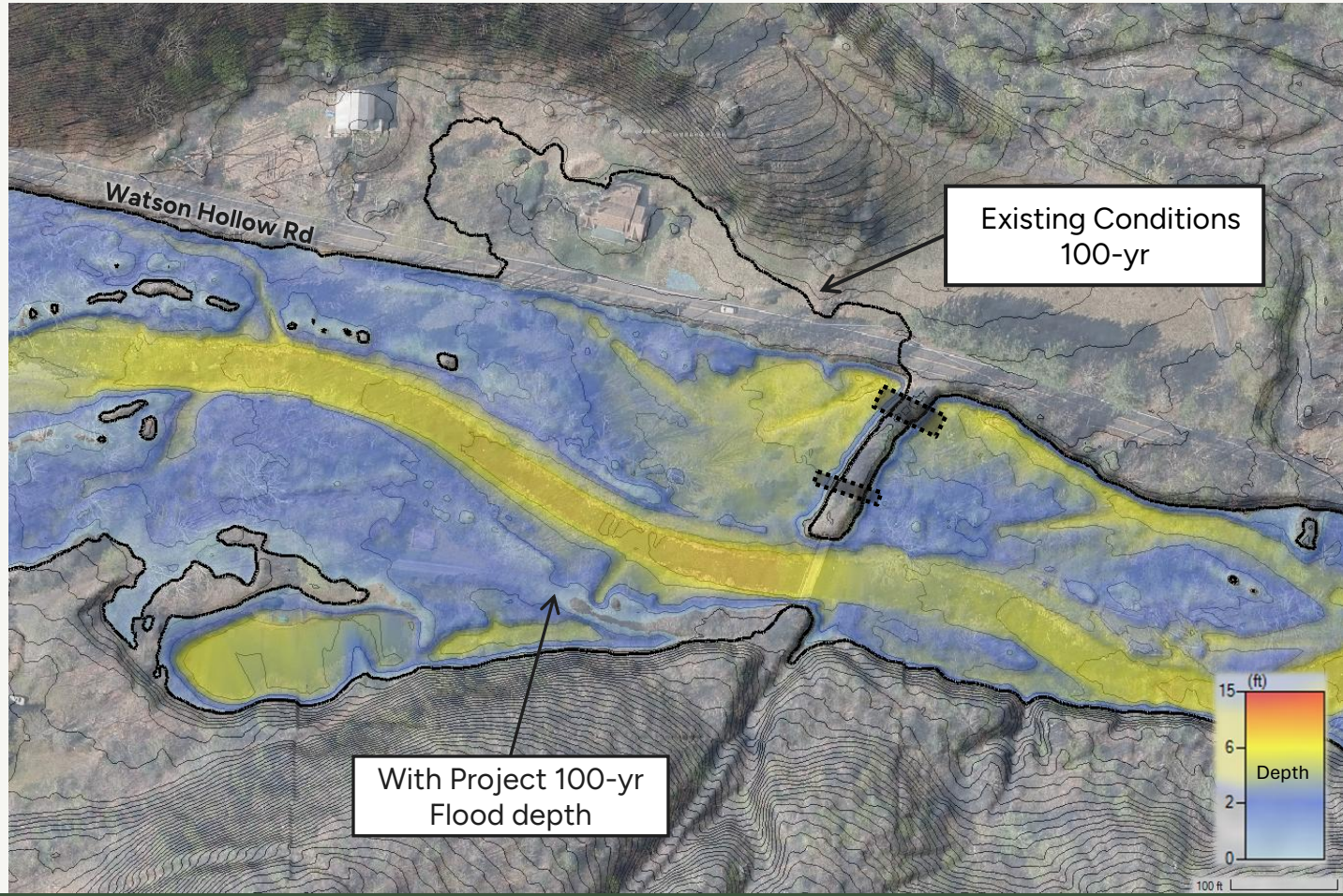
Flood Hazard Mitigation Scenarios

Install Floodplain Relief Culverts:

- Two large culverts with minimum of 9-ft spans

Results:

- 2.7 feet of reduction in water surface elevation, reducing flooding of Watson Hollow Road and private driveway
- Some improvements in channel flow velocity

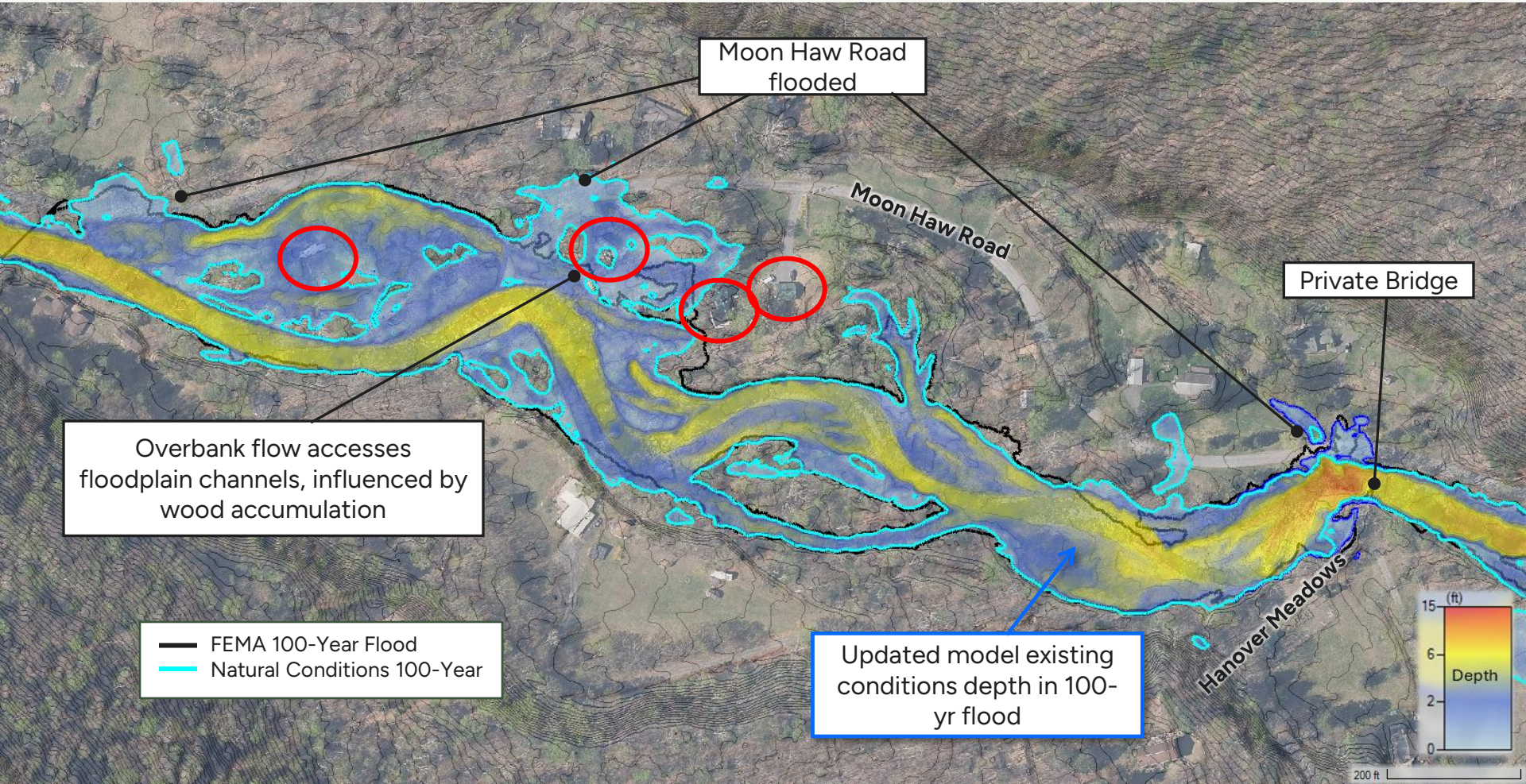


Bush Kill– Every Road to Private Drive

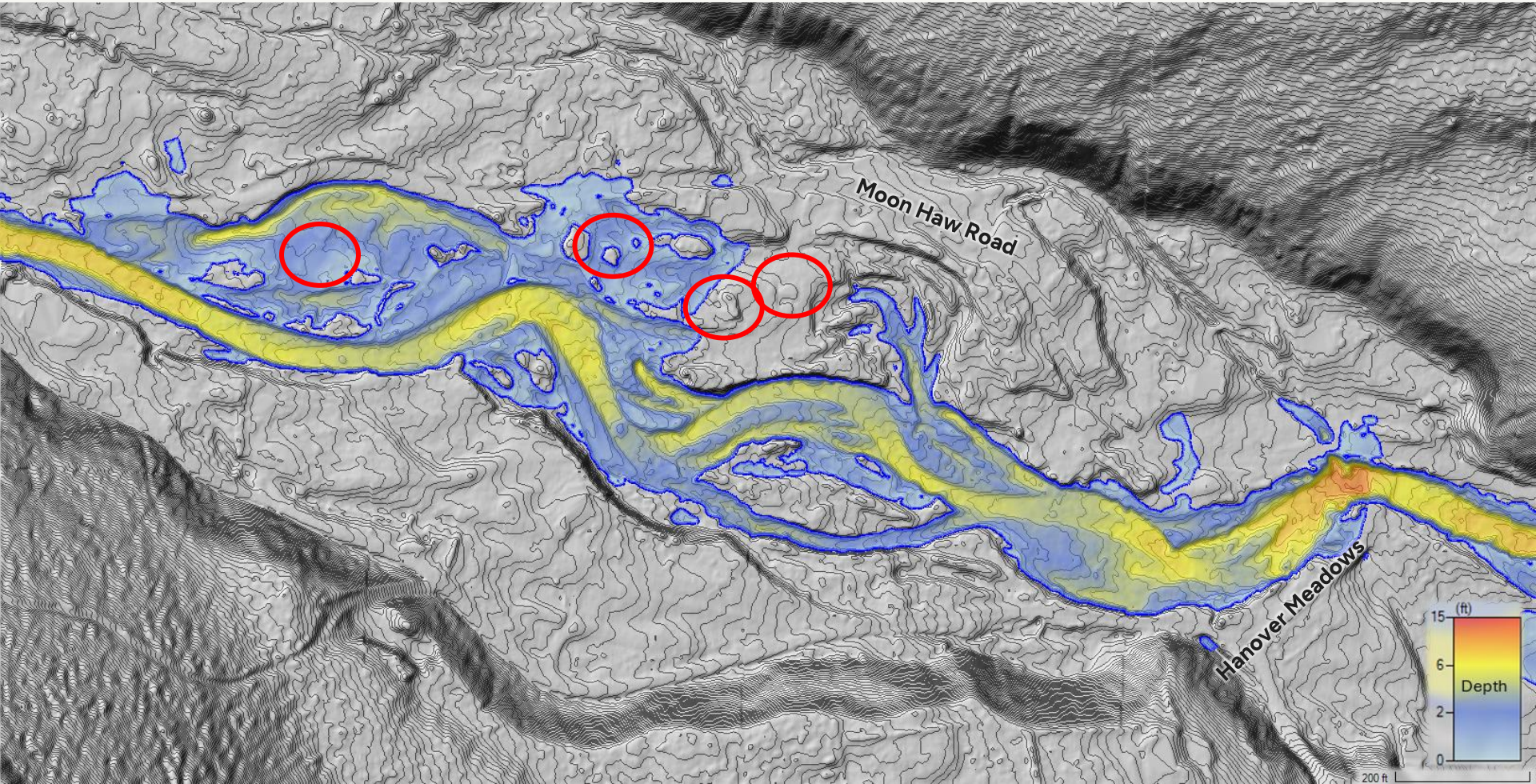
Flood Hazard Mitigation Scenarios

Scenario	Change in 100-yr Flood Water Surface Elevation	Impacts in 100-yr flood
No Project	0 ft	- 375 feet of Watson Hollow Road inundated with a maximum depth of 1.7 feet - Private driveway overtops with 0.9 ft of water
Elevate Watson Hollow Road	+ 0.1 ft	- No flooding of Watson Hollow road - Private driveway overtops with 1.0 ft of water
Install floodplain relief culverts	- 2.7 ft	- No flooding of Watson Hollow Road - No flooding of private driveway

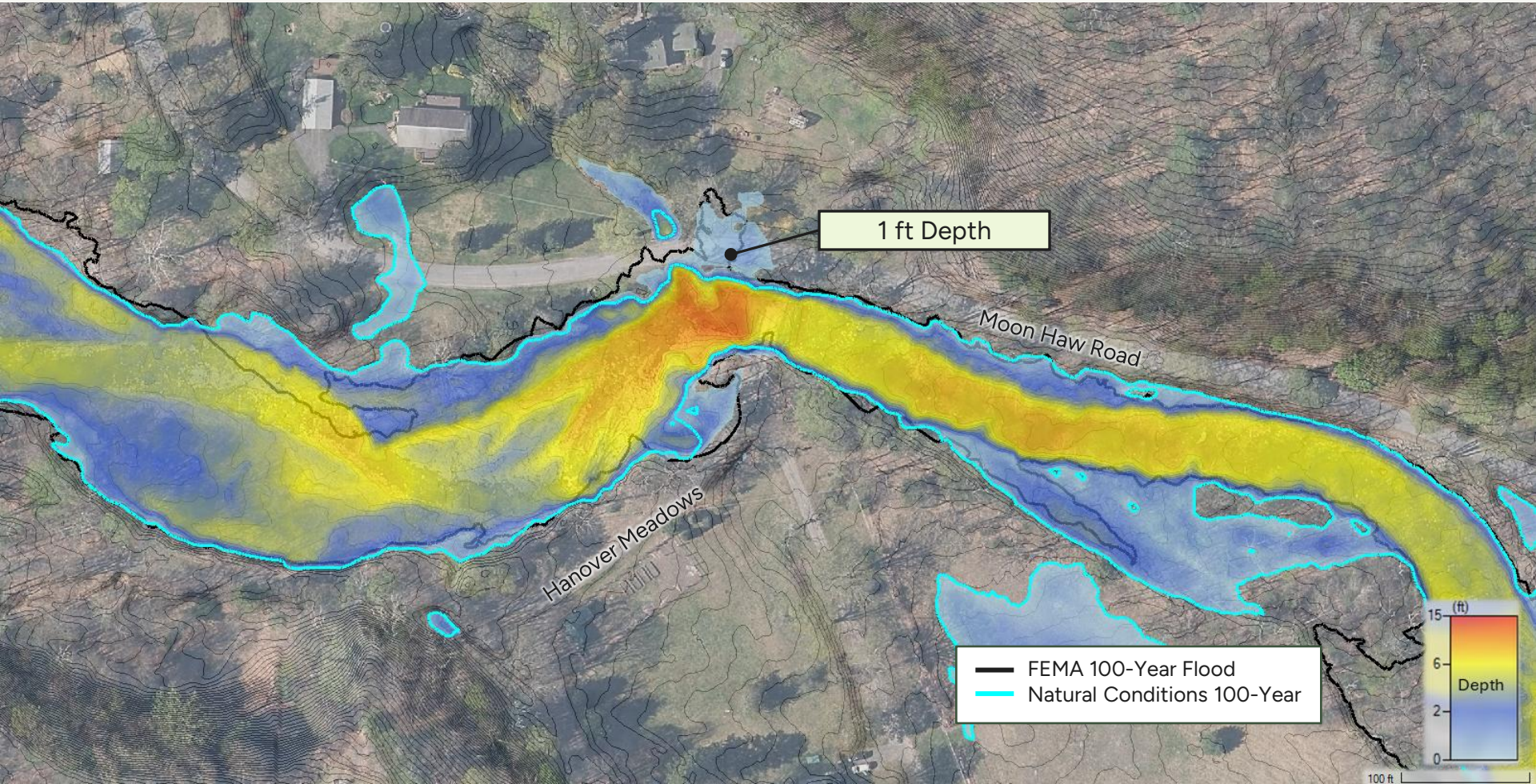
Maltby Hollow Brook –Hanover Meadows Drive and Upstream



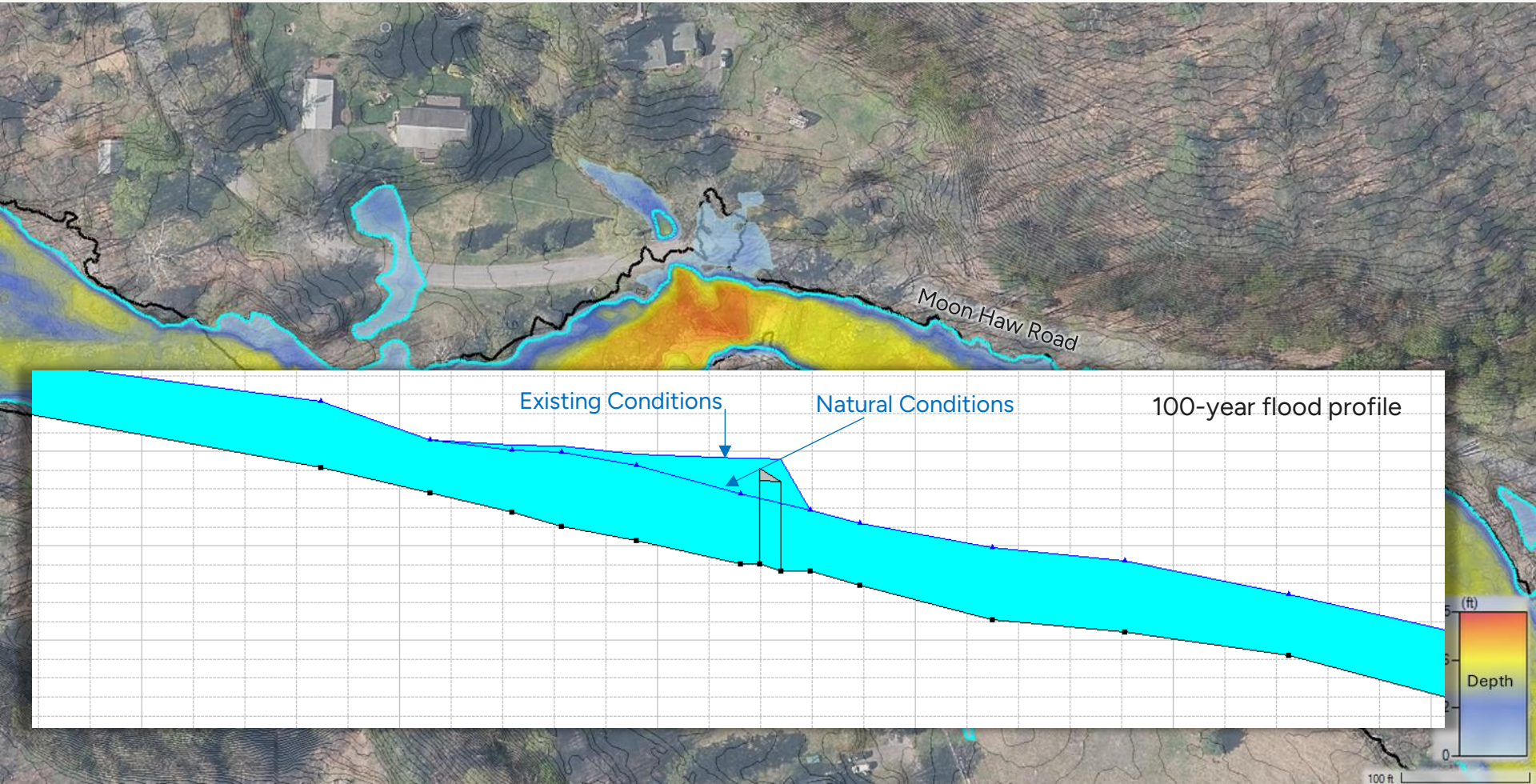
Maltby Hollow Brook –Hanover Meadows and Upstream



Maltby Hollow Brook – Hanover Meadows (Private Drive)



Maltby Hollow Brook – Hanover Meadows (Private Drive)



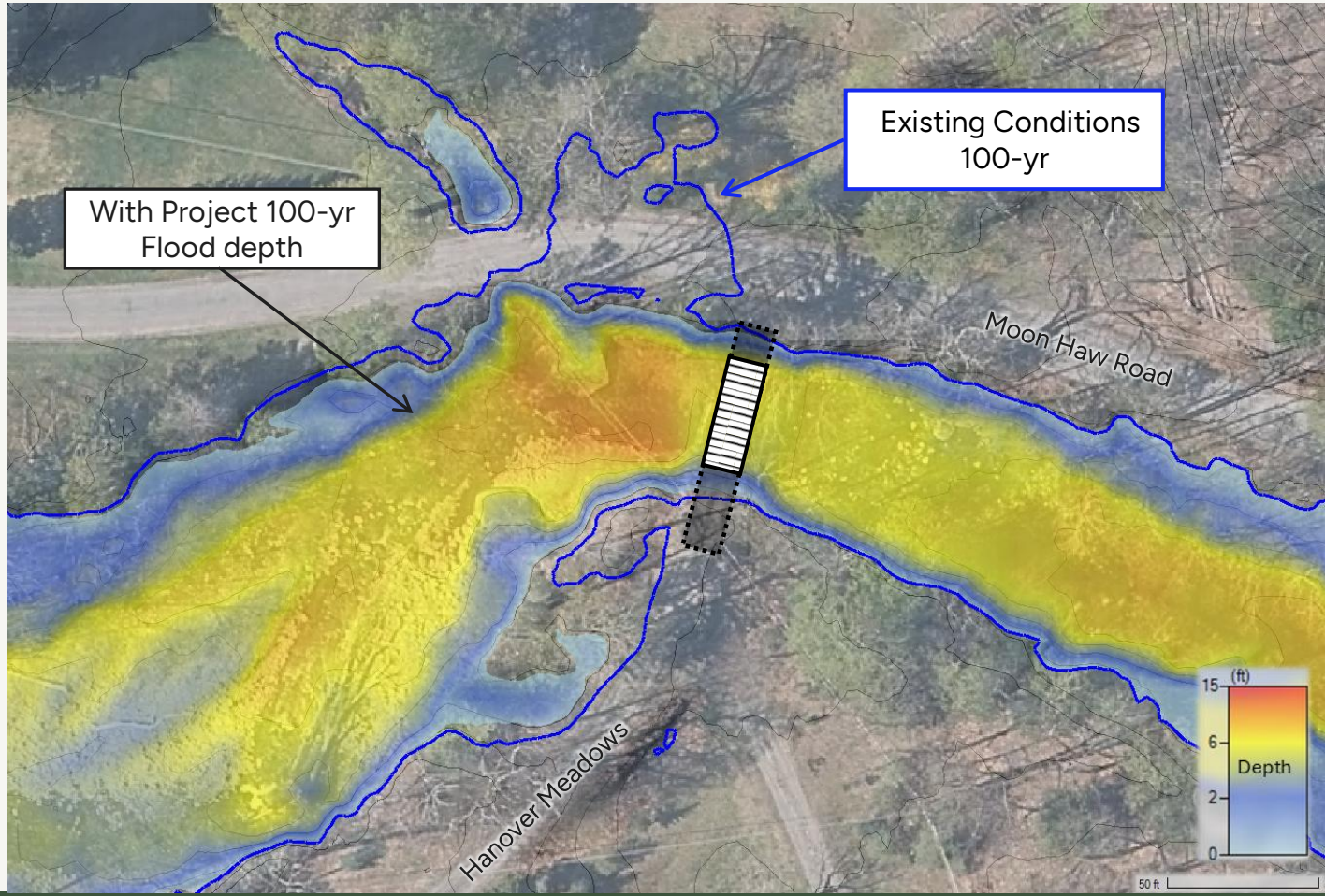
Maltby Hollow Brook – Hanover Meadows (Private Drive)

Existing Conditions:

- Bridge span is 32.5 ft with protruding abutments
- Private bridge overtops in 100-yr flood by 0.6 ft
- Moon Haw Road inundated with 1 ft of depth

Proposed Increase in Bridge Span:

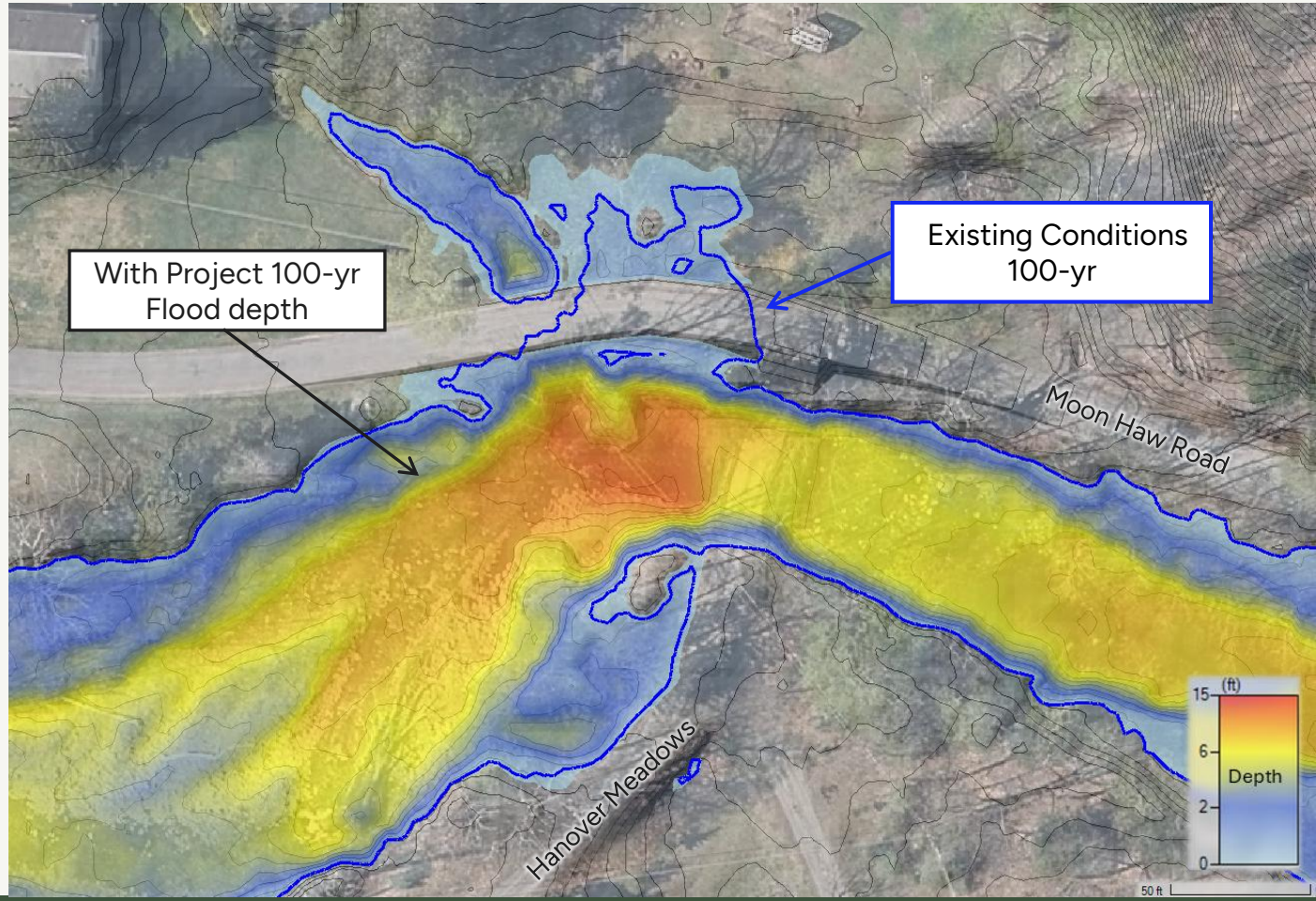
- Increase span to 65 feet and cut back right streambank 20 feet
- Reduces 100-yr water surface elevation by 1.3 feet
- Moon Haw Road and bridge are not overtopped in 100-yr flood



Maltby Hollow Brook – Hanover Meadows (Private Drive)

Proposed Elevating Moon Haw Road:

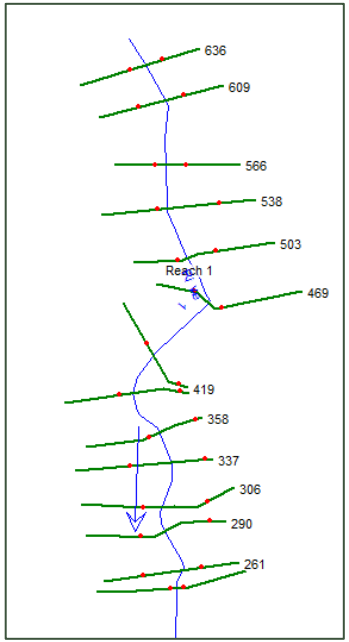
- Elevate road by 2.4 feet
- Increases 100-yr water surface elevation by 0.33 feet with approximately 1 foot of water over bridge
- Moon Haw Road has 1 foot of clearance above 100-year flood water surface

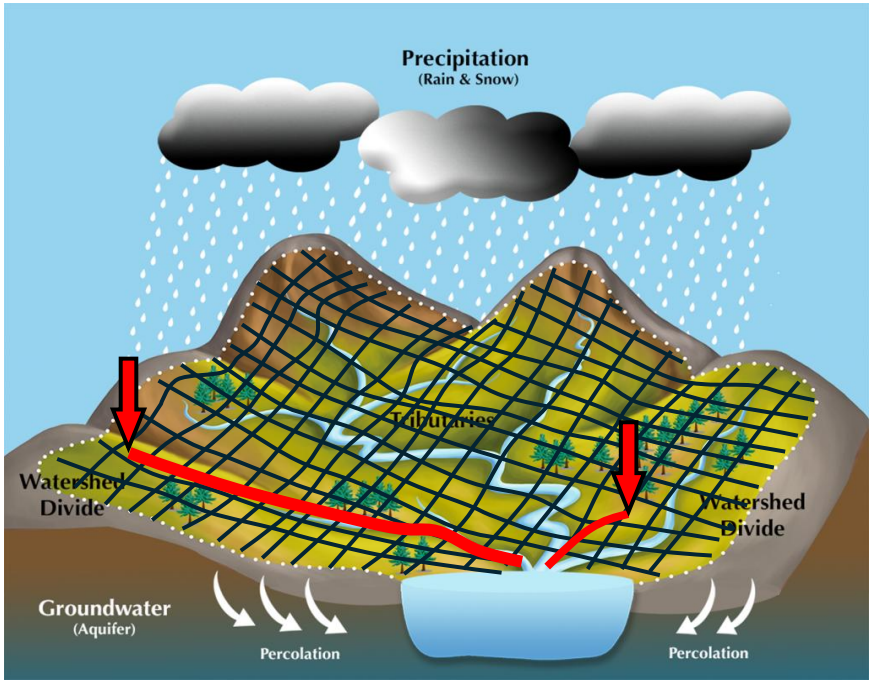


Lang Road Area

What is 2D modeling?

- 2D vs 1D
- 2D Rain on Grid





Graphic from SeaCoast Science Center

Lang Road Flooding Issues

Road overtops impacting nearby houses; No culvert

Small informal channel becomes less defined causing flow to spread out

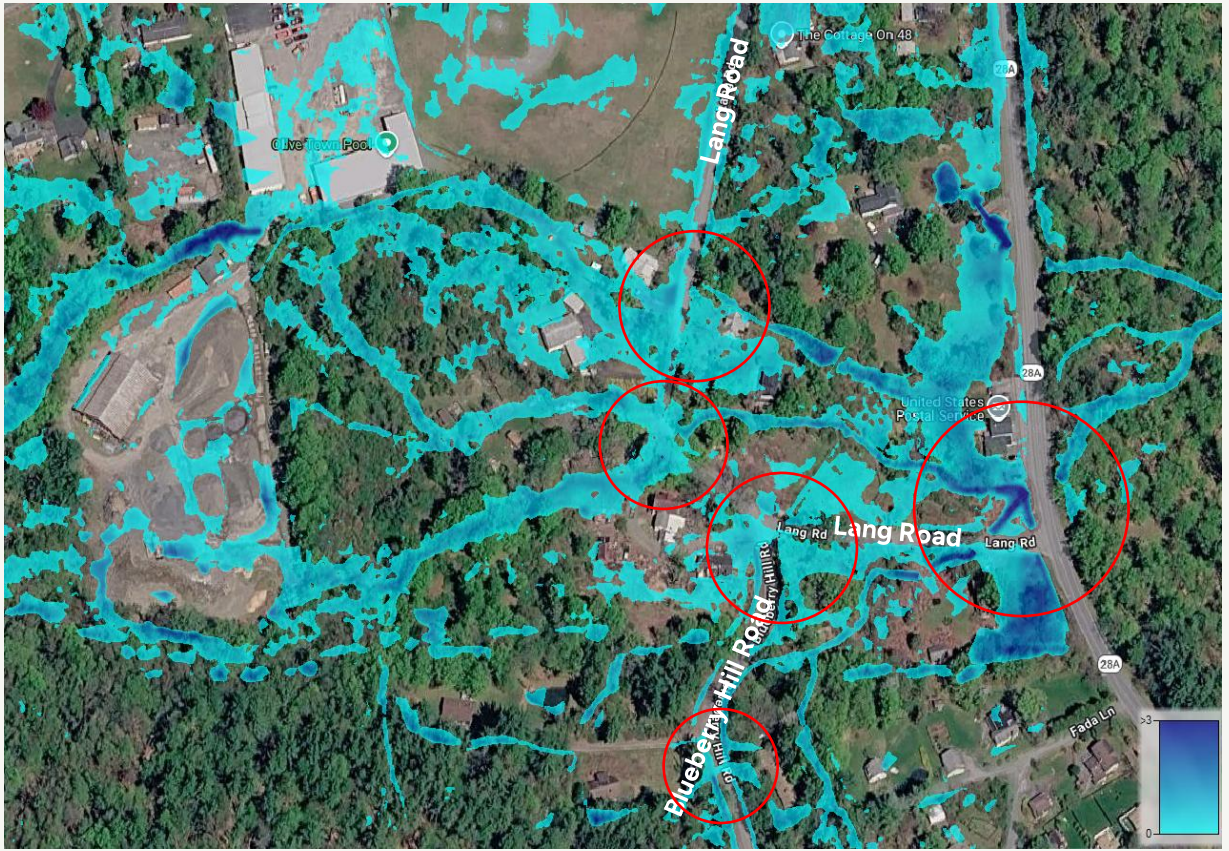
Ponding upstream of culvert impacts Post Office

Road overtops frequently during storms; driveways become inundated

Road overtops at drainage culvert

Existing Conditions Modeling Results – 5-Year Storm

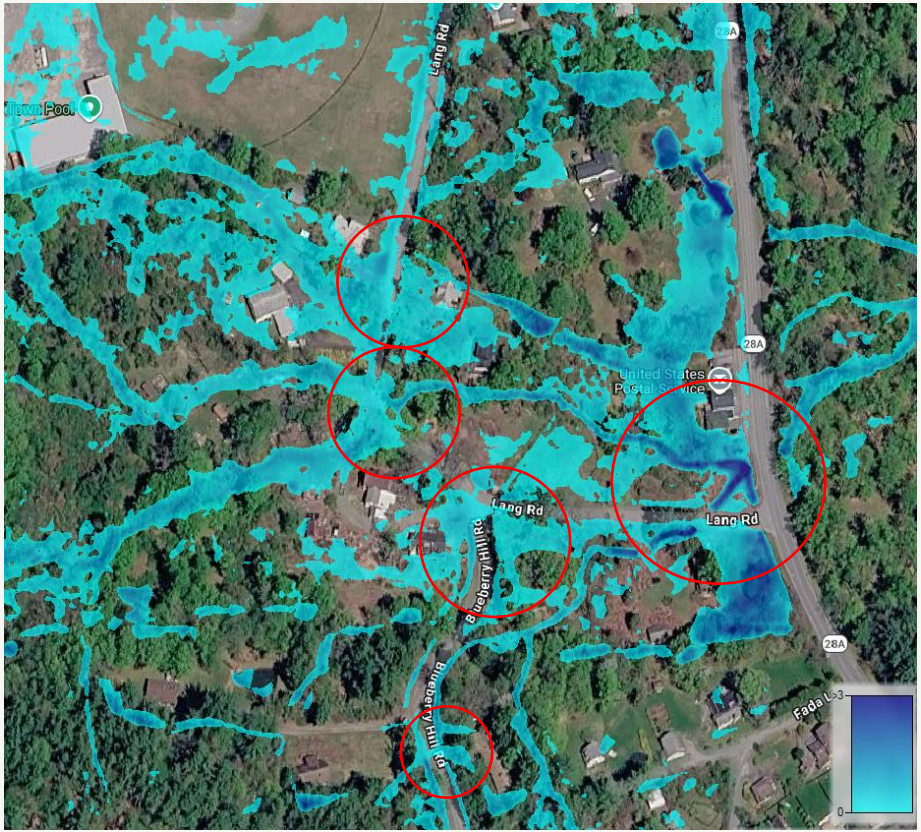
- Inundation/overtopping of Lang Road in several location
- Flooding of driveways along Land Road
- Flooding of the Post Office due to ponding upstream of RT 28A culvert
- Overtopping of Blueberry Hill Road at culvert crossing



Flood Mitigation Alternatives

Modeling Results – 5-Year Storm

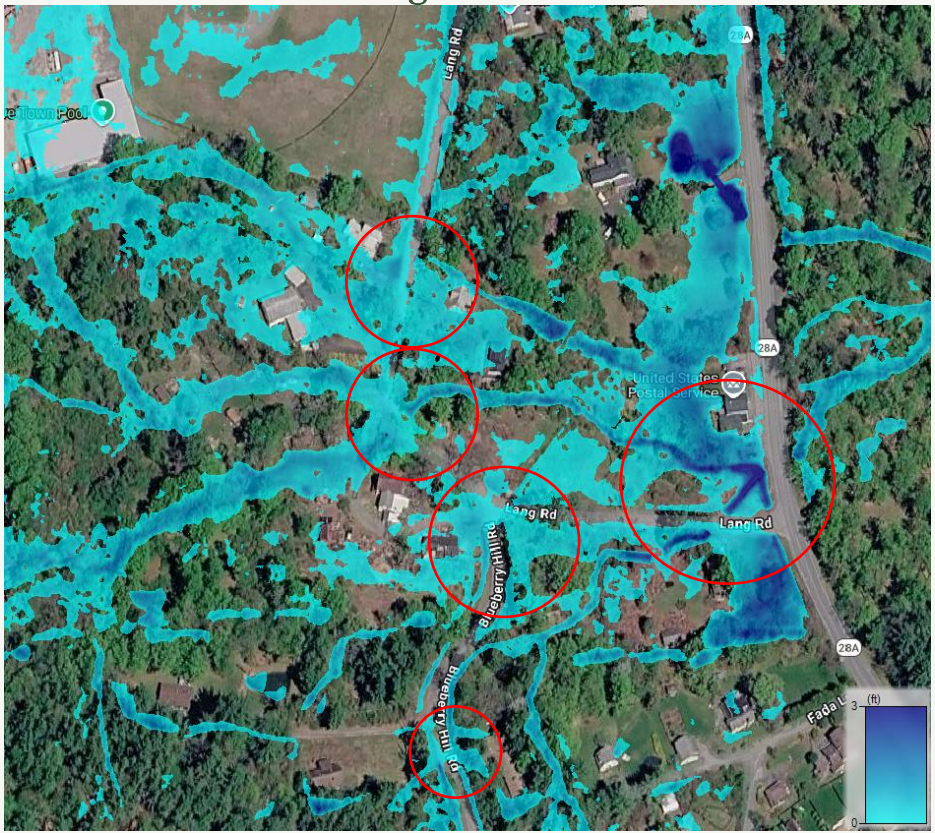
Existing Conditions



Proposed Conditions

Modeling Results – 10-Year Storm

Existing Conditions



Proposed Conditions

Shokan LFA and Stormwater Area

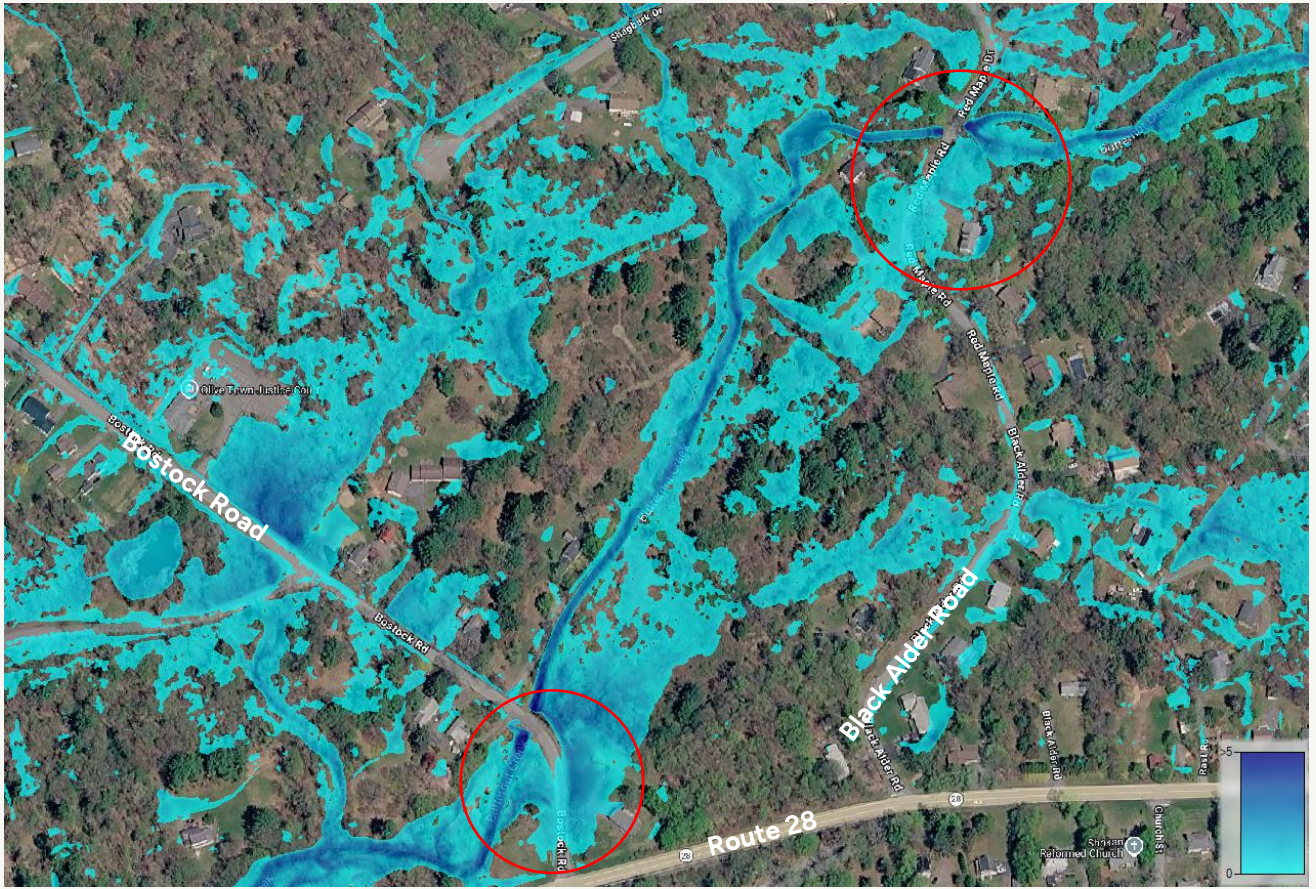
Bostock Road - December 18, 2023

Red Maple Road - December 18, 2023

Shokan LFA Area – Flooding Issues

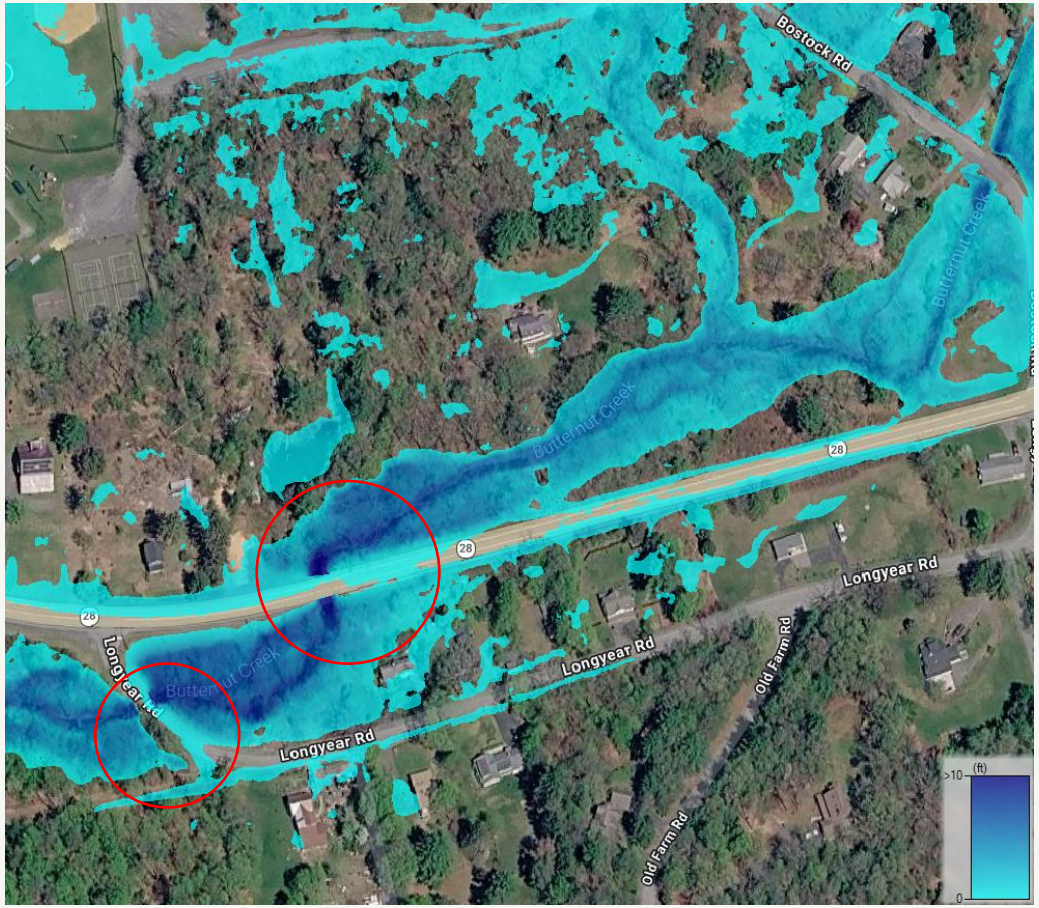
Existing Conditions Modeling Results – 10-Year Storm

- Flooding of properties along Red Maple Road
- Inundation/overtopping of Red Maple Road and Bostock Road along Butternut Creek

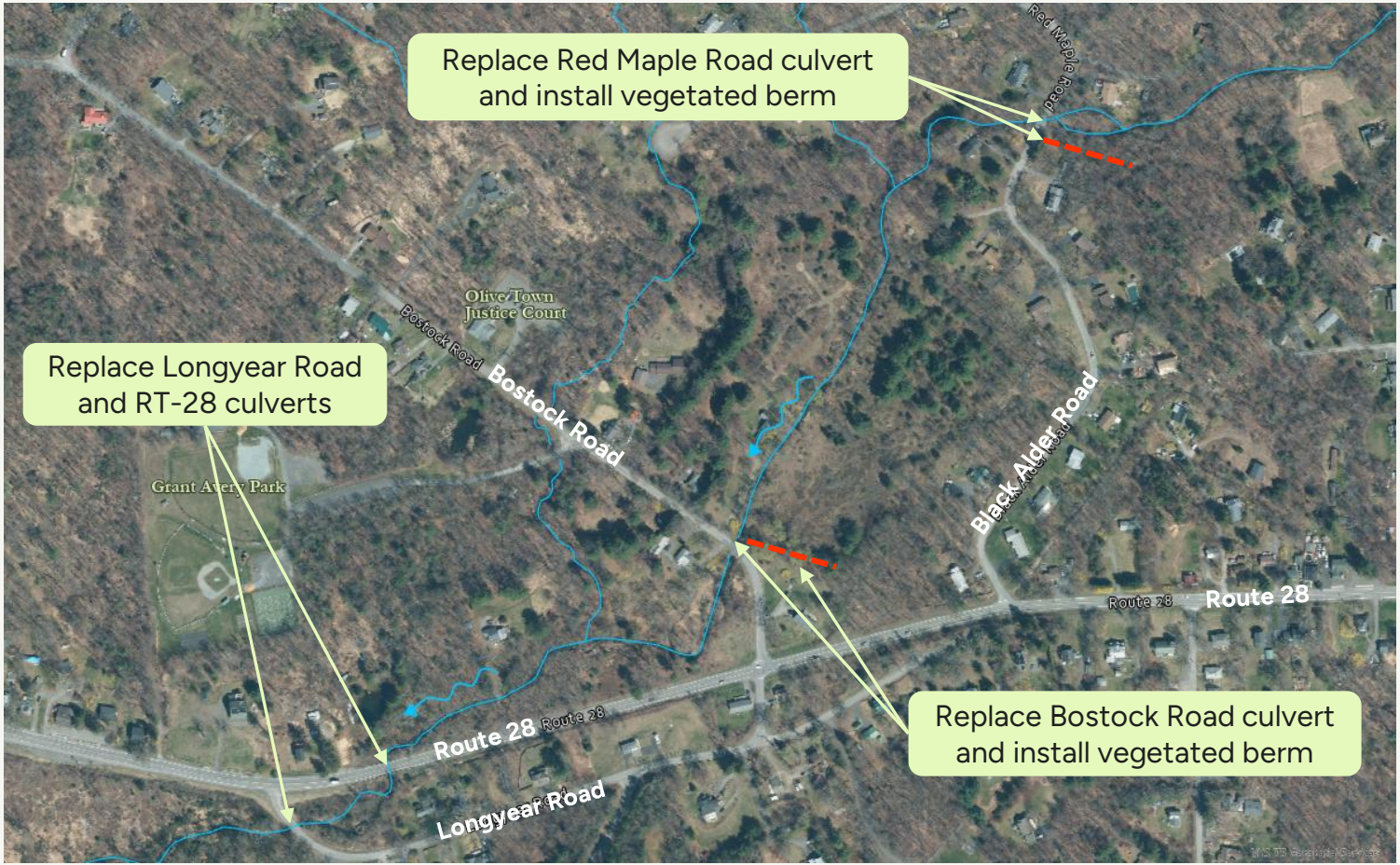


Existing Conditions Modeling Results – 50-Year Storm

- Inundation/overtopping of Route 28 and Longyear Road

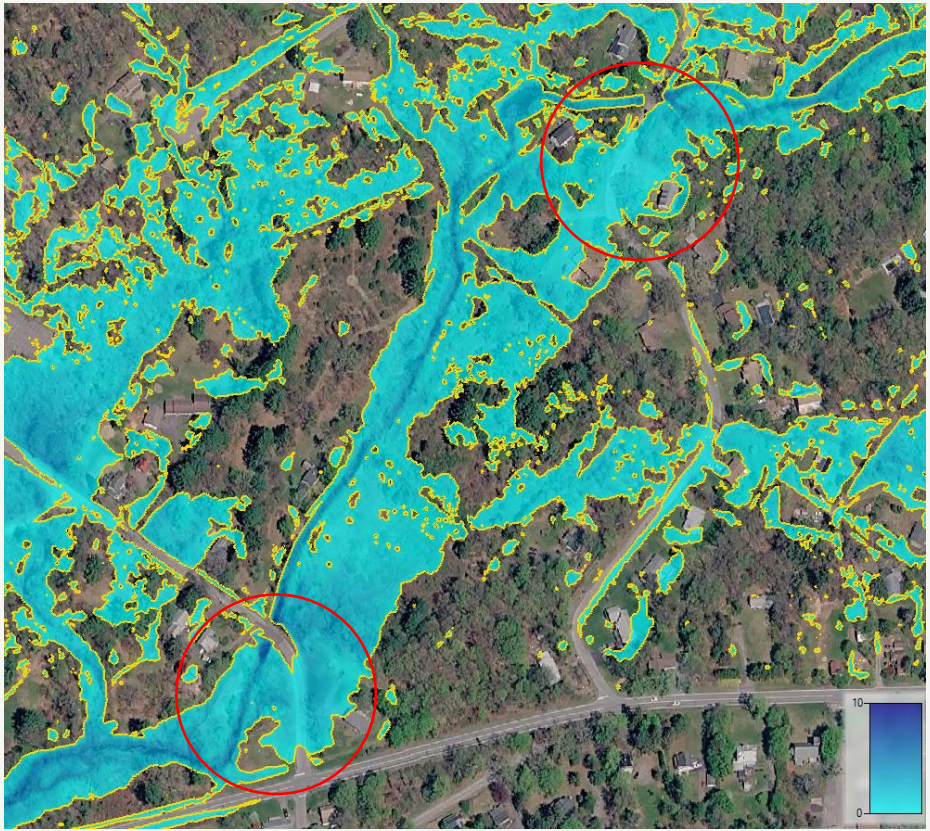


Flood Mitigation Alternatives – Shokan LFA Area

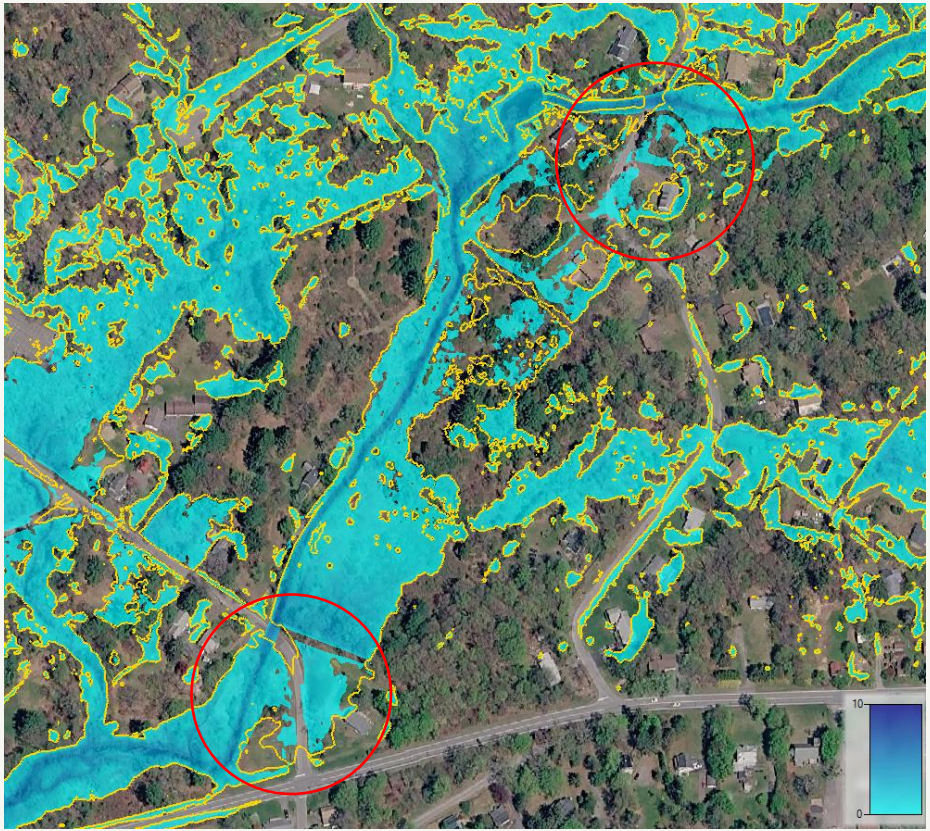


Modeling Results – 25-Year Storm

Existing Conditions

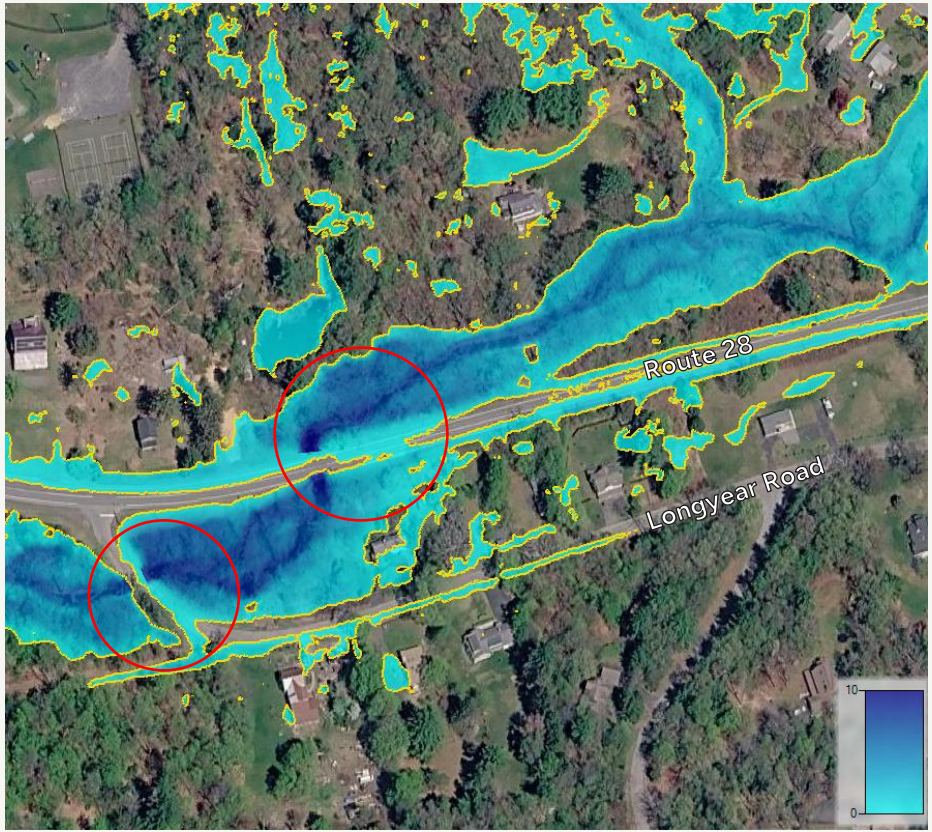


Proposed Conditions

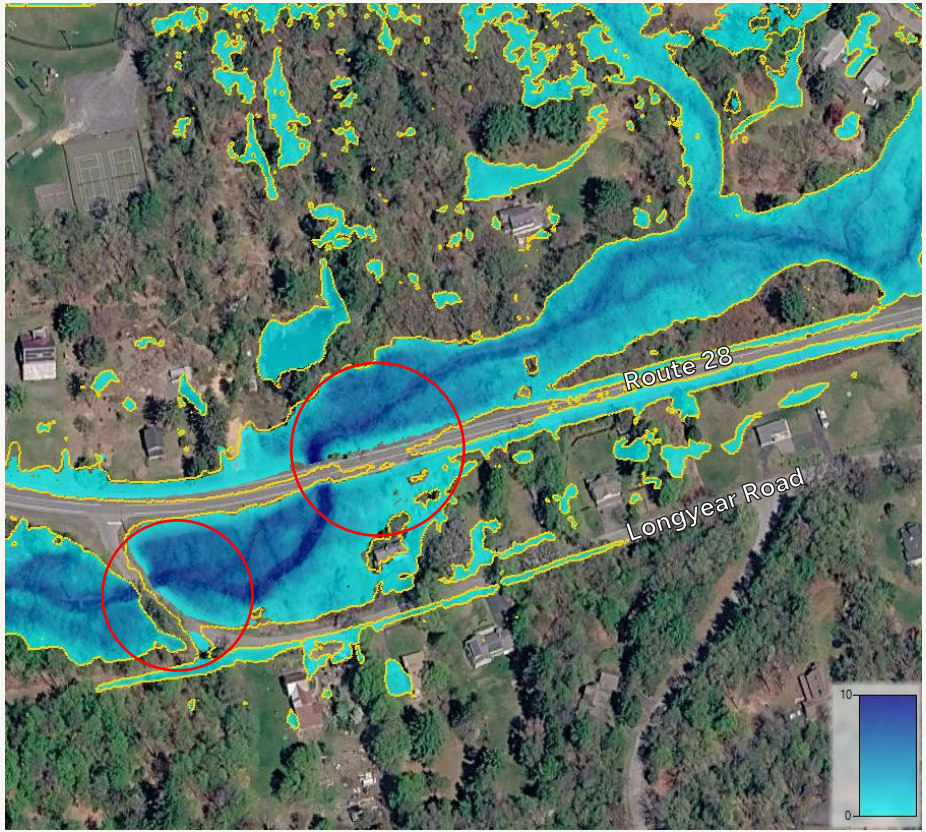


Modeling Results – 50-Year Storm

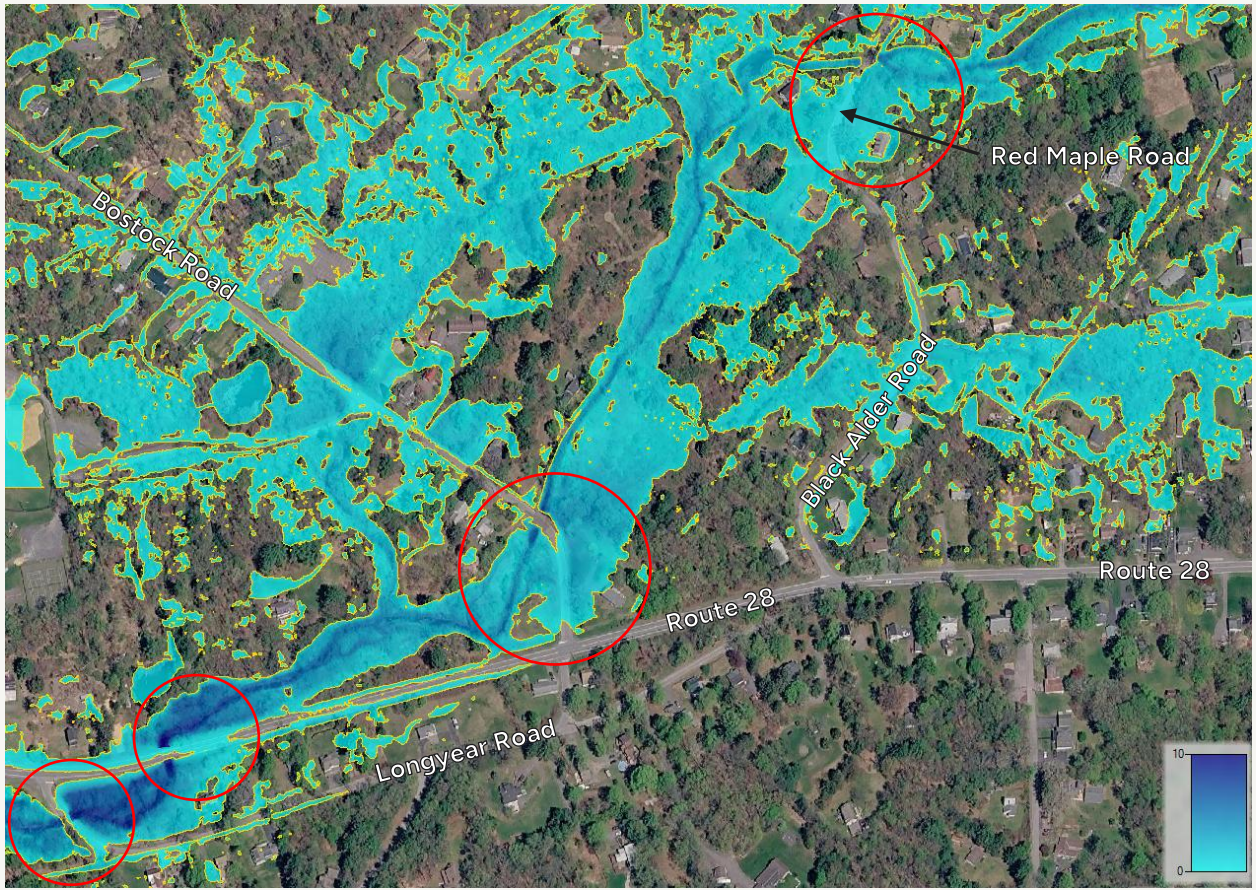
Existing Conditions



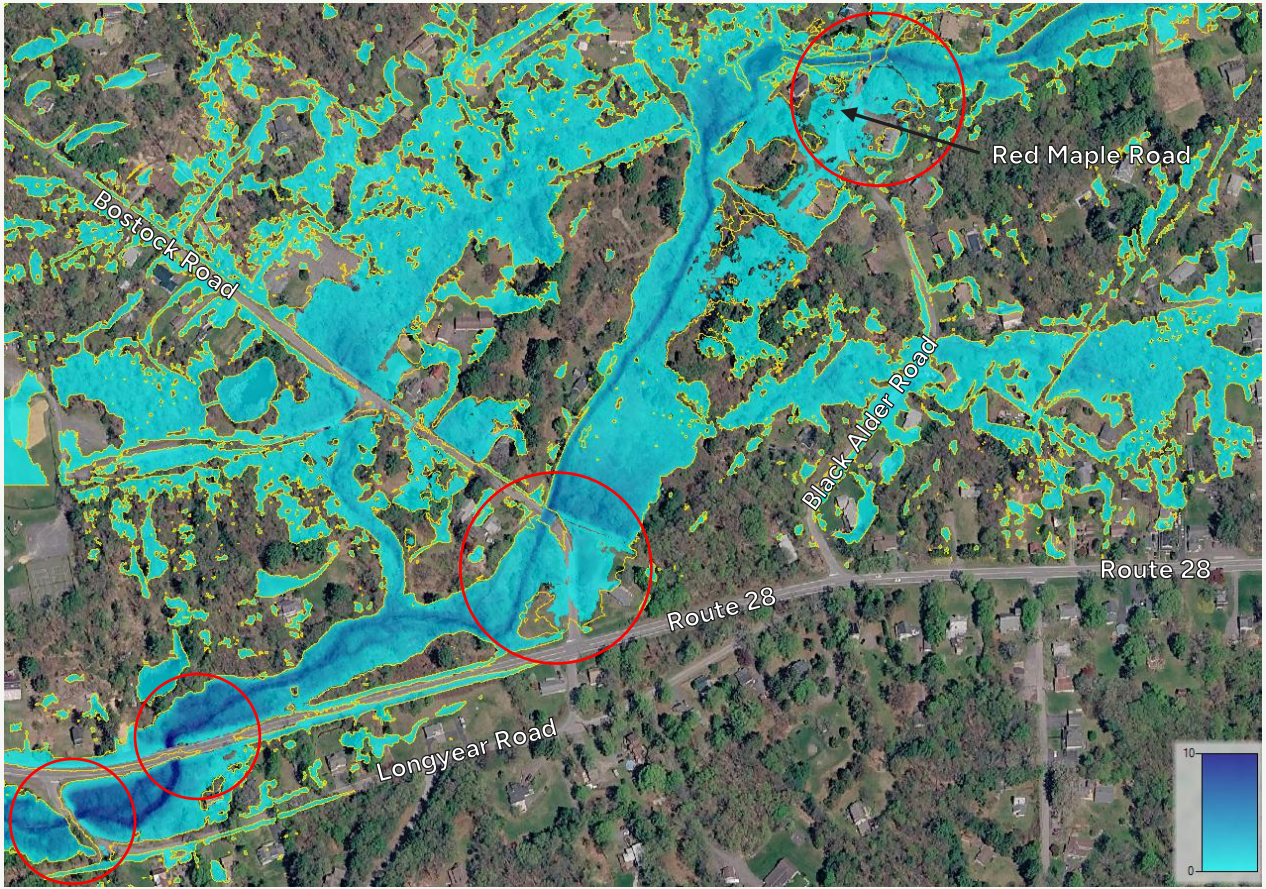
Proposed Conditions



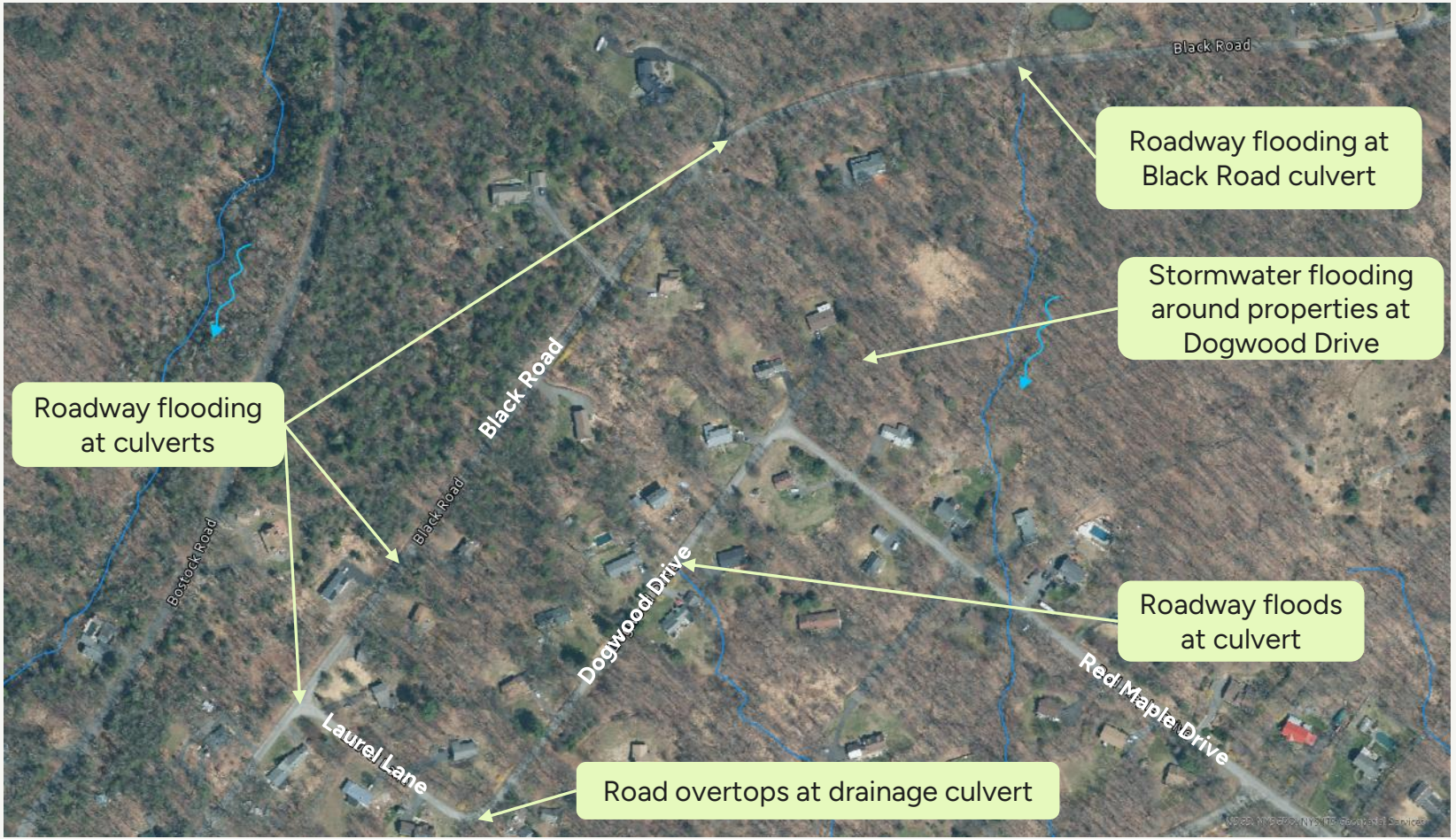
Modeling Results – 100-Year Storm – Existing Conditions



Modeling Results – 100-Year Storm – Proposed Conditions



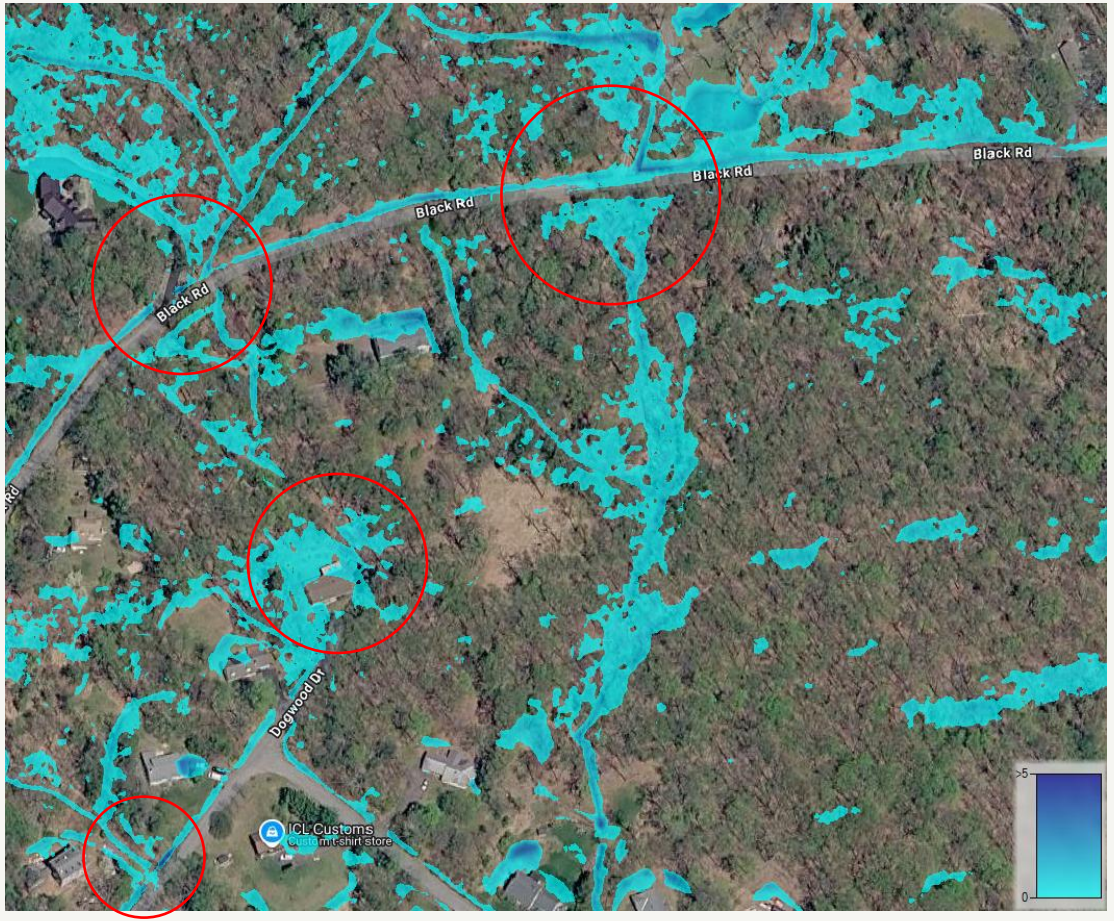
Shokan Stormwater Issues



Shokan Stormwater Issues

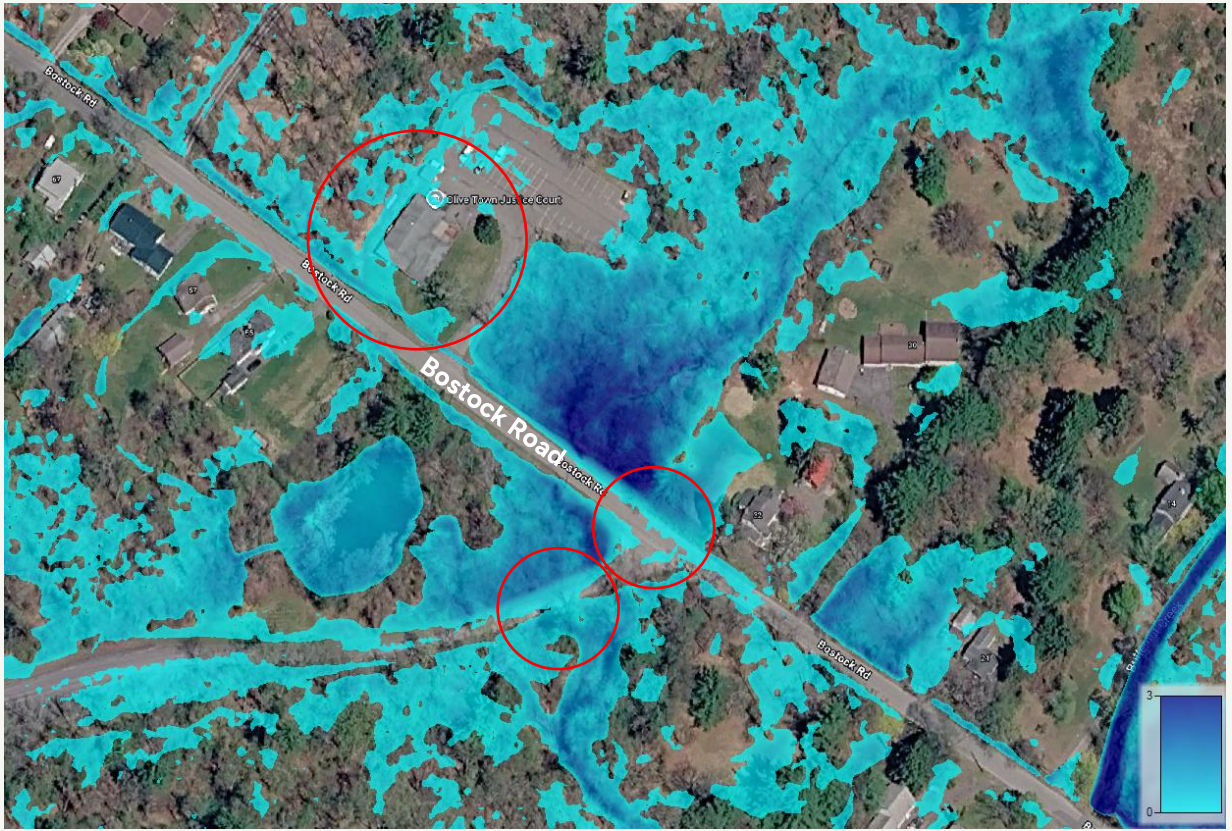
Existing Conditions Modeling Results – 10-Year Storm

- Flooding of properties along Dogwood Drive
- Inundation/overtopping of Dogwood Drive, Black Road, and intersection of Dogwood Drive and Laurel Lane

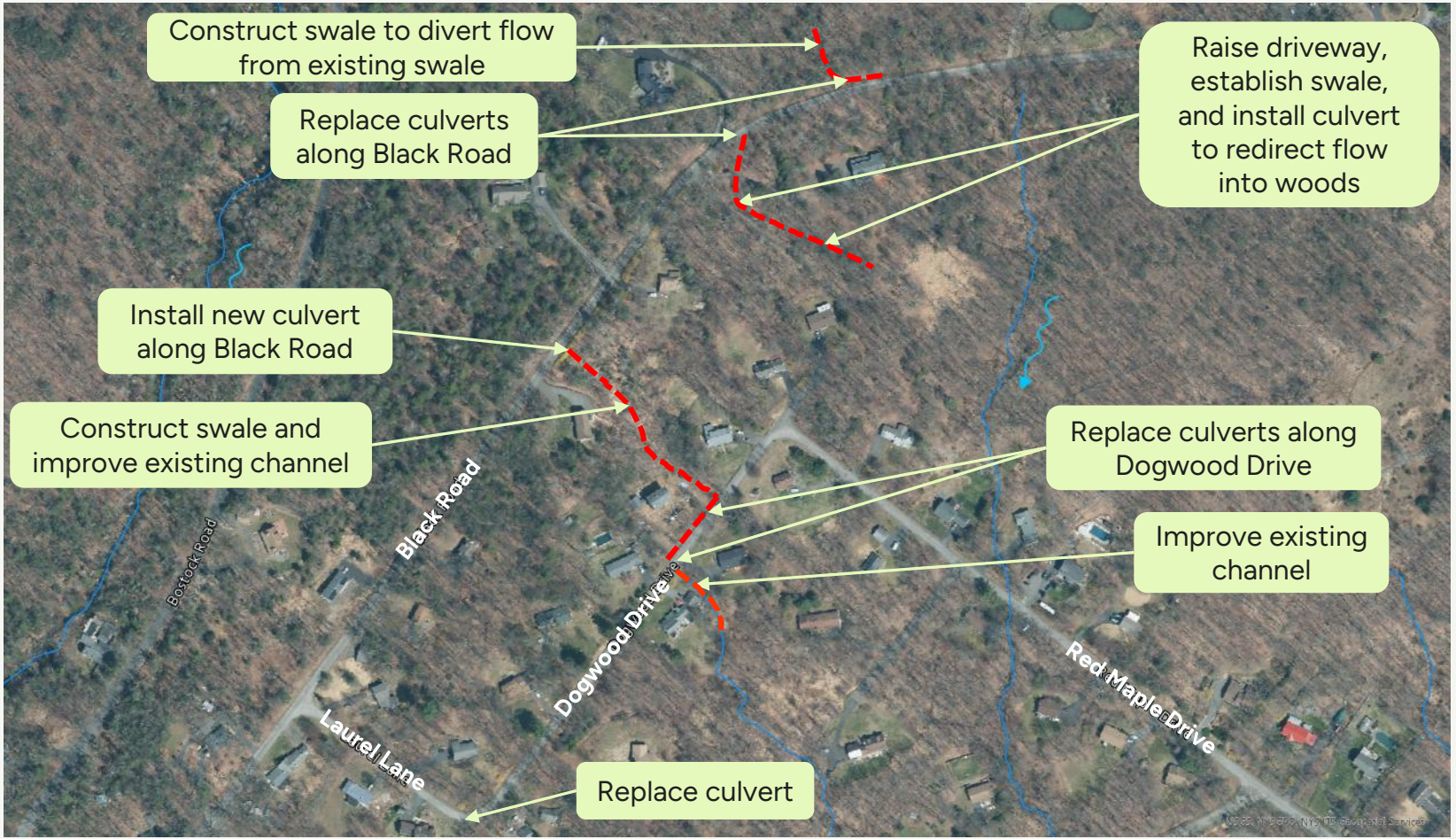


Existing Conditions Modeling Results – 10-Year Storm

- Flooding of Olive Town Justice Court and parking lot
- Inundation/overtopping of Bostock Road and Grant Avery Park access road

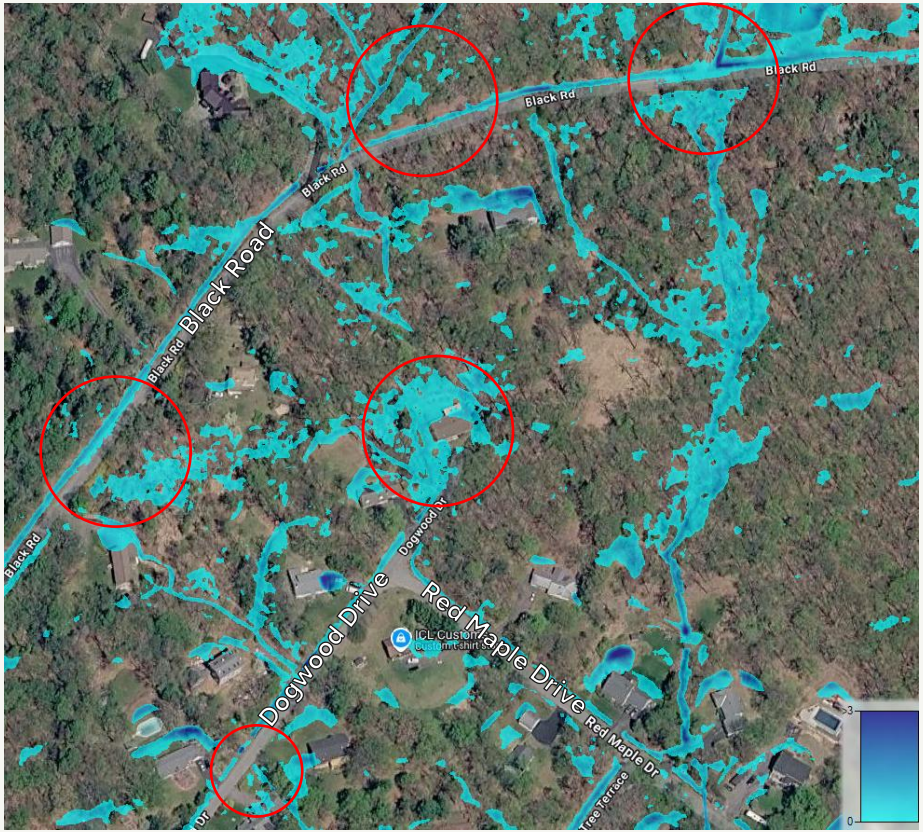


Stormwater Mitigation Alternatives

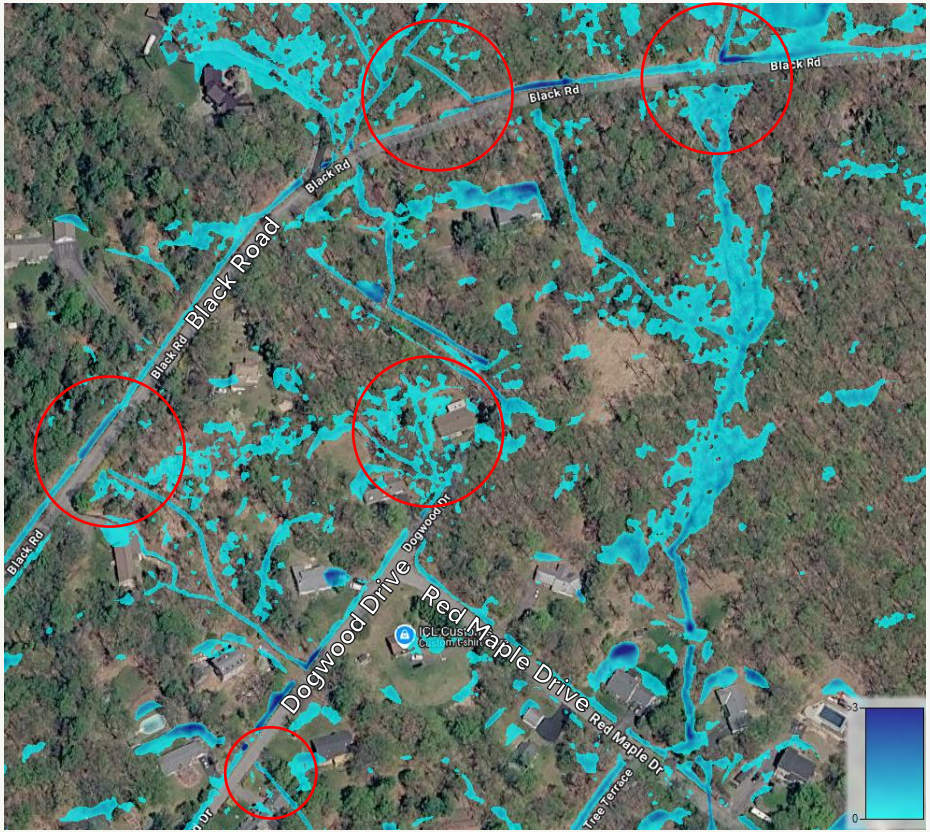


Modeling Results – 10-Year Storm – Stormwater Area

Existing Conditions



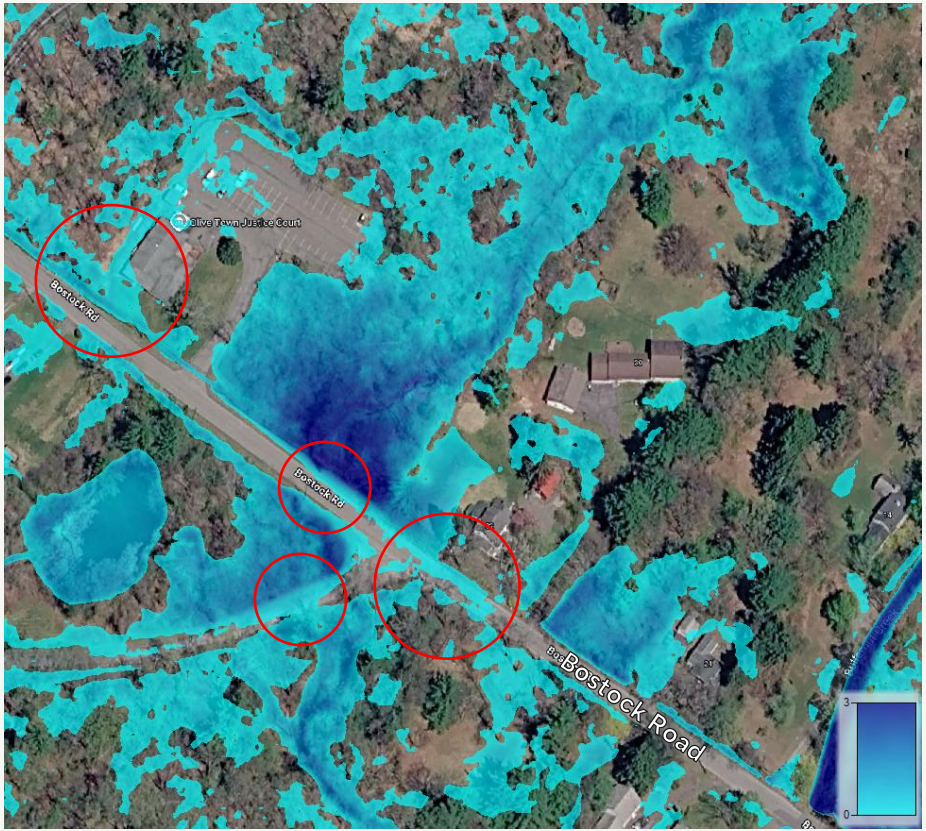
Proposed Conditions



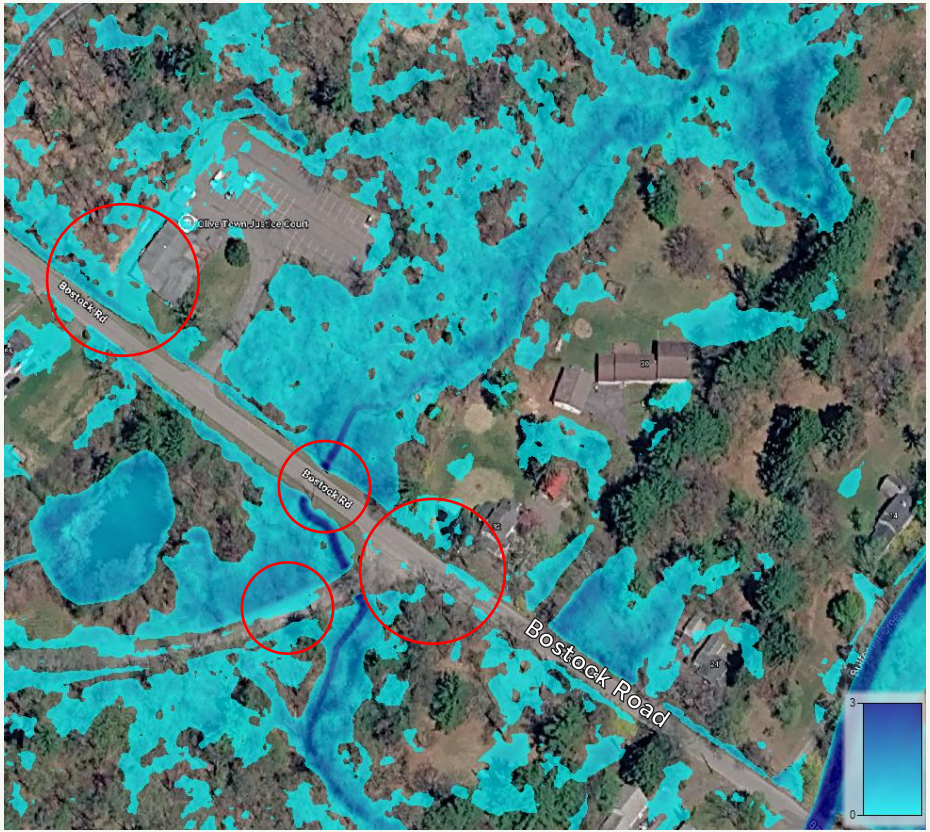
Stormwater Mitigation Alternatives

Modeling Results – 10-Year Storm – Stormwater Area

Existing Conditions

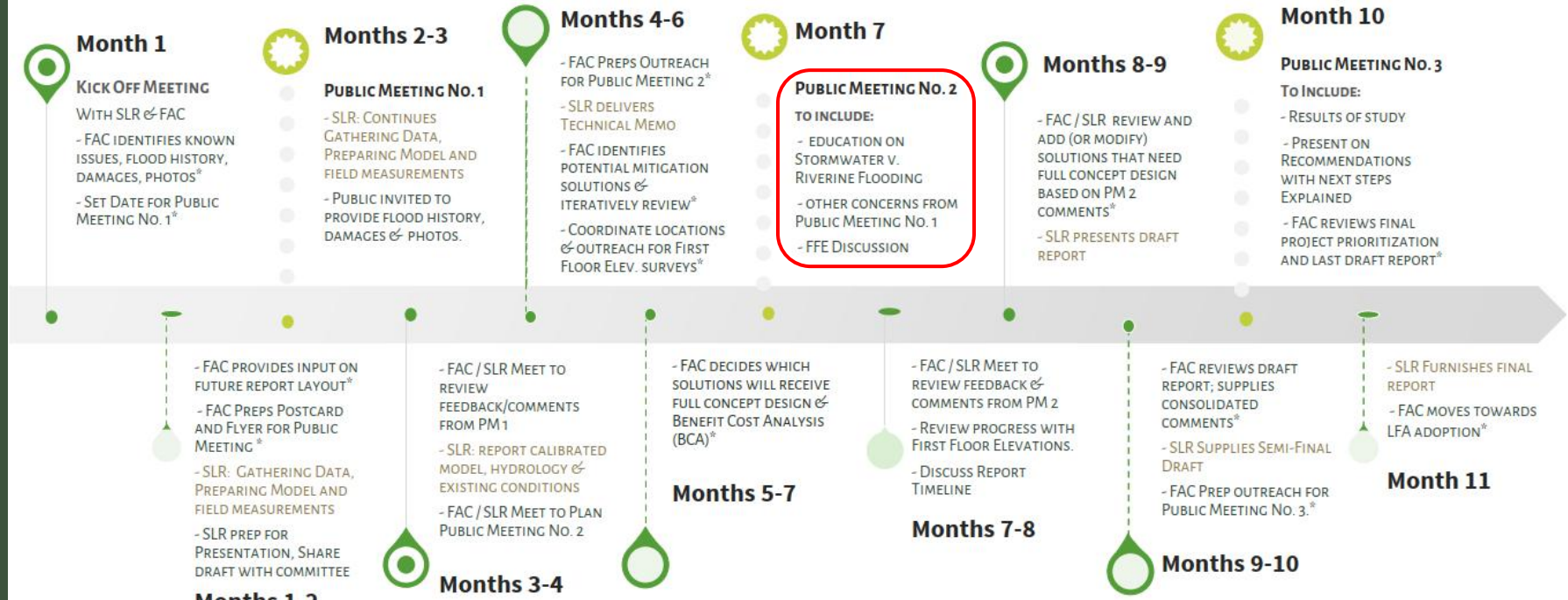


Proposed Conditions




Questions?

Shokan-West Shokan LFA Study Milestones



FAC: Flood Advisory Committee

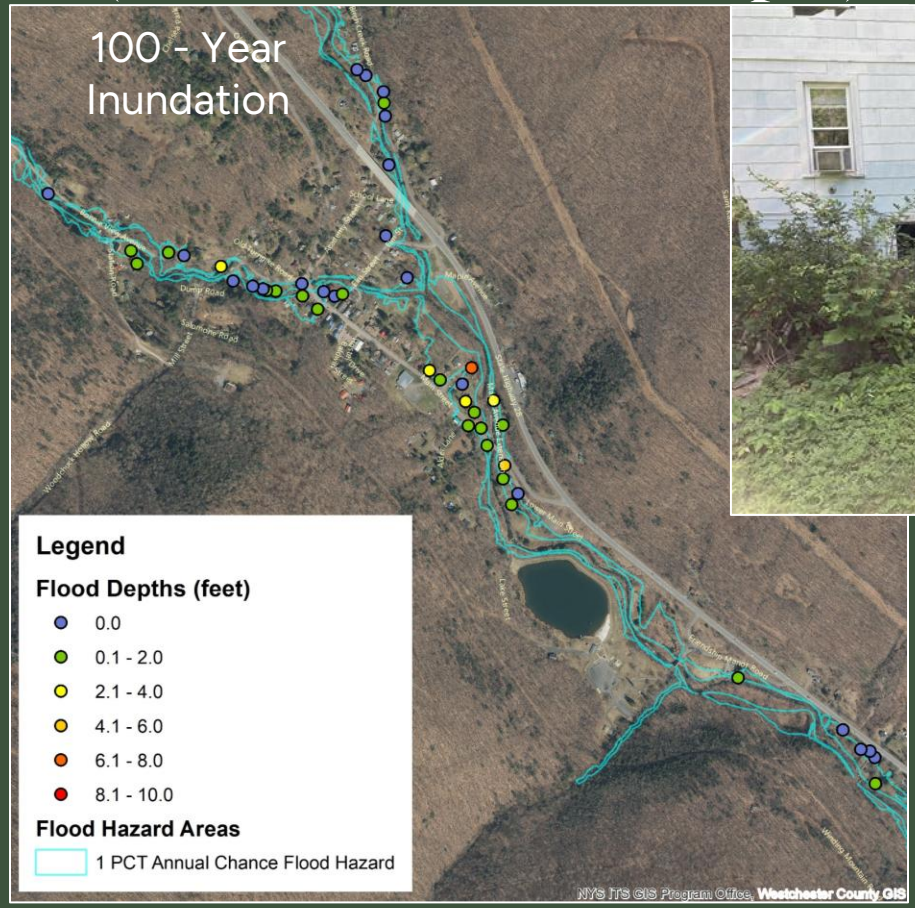
Timeline above is prepared for planning purposes and may be subject to change, in good faith, as the project may dictate.

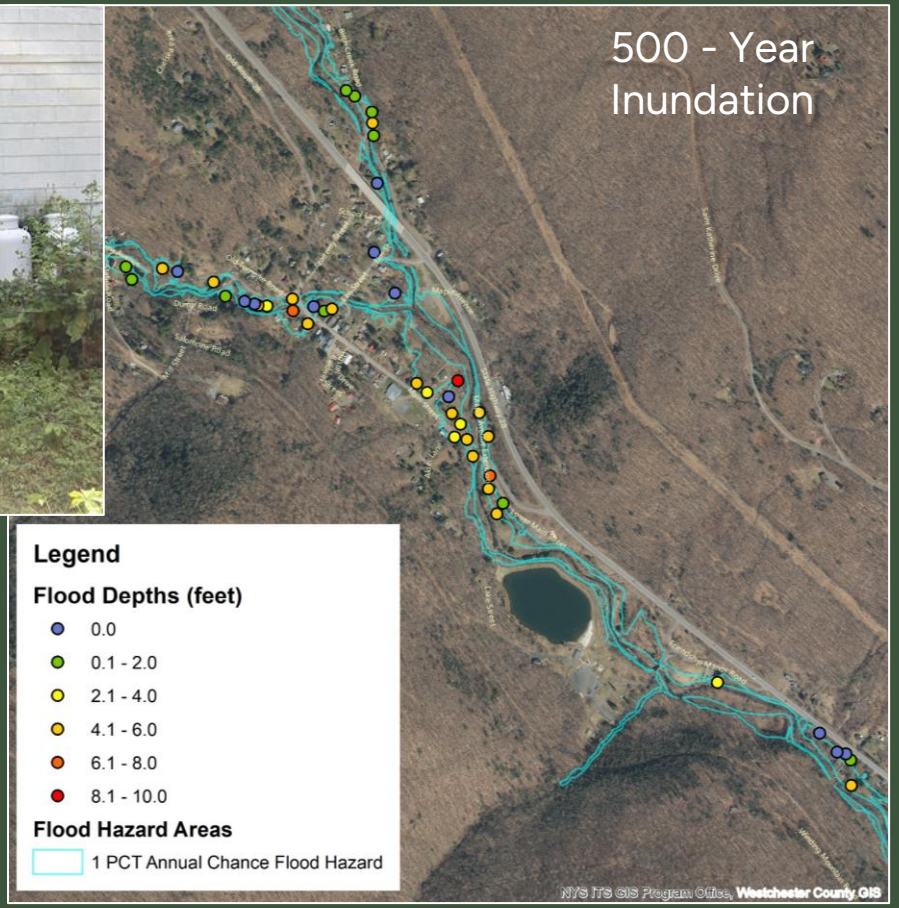
*Indicates FAC Feedback & Participation Required

First Floor Elevation Survey Signup (Pine Hill LFA Example)

100 - Year Inundation

500 - Year Inundation





Olive Fire Dept., Co. No. 5 Relocation, Boiceville

(recommended in Olive LFA, completed 2017)

Background

- Located in Floodplain; 6' inundation @ 100yr
- Inundated @ > 30yr floods
- Land was deeded to Town by NYC for sole purpose of providing fire protection in 1959 (nearby school built in 1952)
- OFD is its own entity (contract w/town)
- #1 recommendation in LFA was to address this critical facility

Timeline/Process

Town & OFD worked w/DEP to find suitable site (2018)

Subdivided, purchased (2019-20)

Design and lining up construction financing (2020-2021)

Site work and construction (2021-23)

Buyout (2024) and demolition (2025) of former structure & public recreational access (2026…)

Mitigation Solution

- Rebuilt half-mile away, outside floodplain
- ~ $3M Total Cost
  $1,032,400 (CWC); ~$2M (OFD)
  - $50,000 (septic)
  - $827,400 (design / construction)
  - $155,000 (property purchase)

The FIRST critical facility relocation in the watershed under this program

DeSilva Road Culvert Replacement, Boiceville
Recommended in Olive LFA, completed 2017
Constructed 2020 to 2021

Before

- Circular metal pipe
- Diameter of 7.5 feet
- Passes 10-year flow
- Overtopped by 25-year flow

After

- Embedded four-sided box culvert
- 12-foot span, 8-foot rise
- Passes 50-year future flow
- Daylighted underground section of channel

Upper Boiceville Road Culvert Replacement, Boiceville
Recommended in Olive LFA, completed 2017
Constructed 2020 to 2021

Before

- Steel beam deck atop concrete abutments
- 7-foot span, 5-foot rise
- Passes 25-year flow
- Overtopped in 50-year flow

After

- Embedded four-sided box culvert
- 18-foot span, 7-foot rise
- Passes 50-year future flow with freeboard for potential debris jams

Fellow Mountain Café Elevation, Hunter

(recommended in Hunter LFA, completed 2018)

Background

- Former Odd Fellows Hall
- History of basement w/utilities flooding
- First floor below BFE
- Renovation = Substantial Improvement = NFIP compliance required
- 2019 CWC design ($19,000), construction ($278,115), tank anchor ($3,500)

Mitigation Solution

- Elevated 3.25′ (BFE +2′)
- Poured foundation with flood vents; no basement
- Utilities elevated; fuel tanks anchored
- Cost = $300,615 (CWC); private funding
- New commercial business on Main Street

Townsend Elementary School Floodproofing, Walton
(recommended in Walton Tributaries LFA, completed 2017)

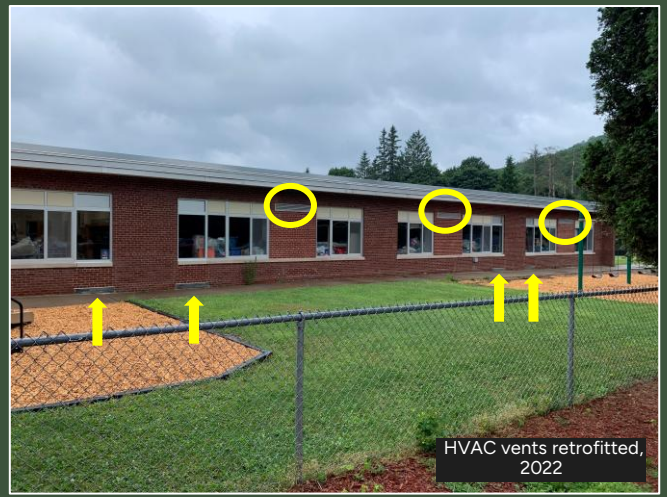

Post-flood, August 2011

Background

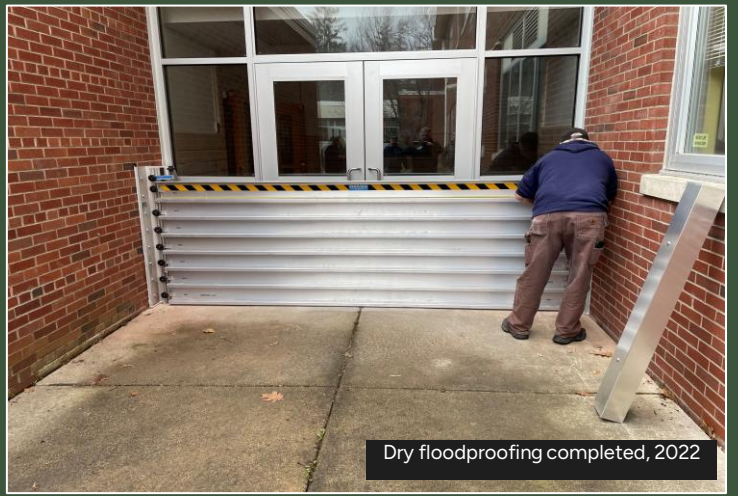
- Gym, Kindergarten and 2nd Grade wing flooded in 2006 & 2011
- Location vulnerable to winter ice jam formation resulting in flooding
- 2019 CWC design ($96,760) and 2020 construction ($647,403)

Mitigation Solution

- Construction completed in 2022
- 10 exterior entranceways retrofitted to accommodate flood panels (dry floodproofing); Stored on site, annual training exercise
- Elevation of 12 HVAC vents and retrofit of > dozen additional openings
- Elevation of utilities
- Total Cost = $744,162 (CWC); contribution from Walton CSD


HVAC vents retrofitted, 2022


Flood log installation


Dry floodproofing completed, 2022

Fuel Tank Anchoring

500-yr floodplains throughout the watershed

- No cost for residents or businesses in floodplains (may be basements or exterior)
- Residential up to 330 gallons (oil), 420 pounds (propane)
- Commercial tanks eligible (w/engineered designs)

Why you should anchor tanks

Anchored propane tank

Anchored fuel oil tank

Preparation of concrete pad

Pre-construction
2014 imagery

During construction
2021 imagery

Route 28 Bridge Replacement, Bridge Removal, Road Elevation, & Floodplain Restoration

(recommended in Mt Tremper LFA, completed 2016)

<u>Background</u>

- Undersized (336') "Critical" bridge w/2 piers in active channel
- Undersized berm that overtops
- Inundation of Rte. 212 and 13 improved properties (incl. SRL & RL)
- Upstream bridge closed for 30yrs due to prior flood damage

<u>Mitigation (2017 - ?)</u>

- ~$32M ($28.3 NYSDOT; $1.1 FEMA; $1.6 DEP; $1 CWC)
- 800' bridge (100yr flow) w/1 pier in active channel; low chord 5' higher
- Elevated & re-aligned Rte. 212; realignment of problematic stream
- FEMA. NYC, and DOT buyouts of 17 properties (4 vacant); 1 relocation
- ACOE berm removed to create floodplain bench; material re-used to elevate Rte. 212
- Future town park


Pre-construction
Summer 2021

Post-construction
December 2023

Railroad Avenue, Tannersville

Tannersville LFA completed 2018
Constructed in 2023

- Relocation of Sawmill Creek channel away from roadway embankment
- Correcting incised condition that precludes left bank floodplain activation
- Restoration of three-stage channel including a bankfull channel, lower floodplain, and upper floodplain
- Stabilization of the Railroad Avenue roadway embankment
- Restoration of in-stream features and vegetated riparian zone

Construction cost: ~$1M

Ashokan Watershed Stream Management Program (AWSMP)

- Funds, helps facilitate, and provides technical support for the LFA process
- Aids the Olive Flood Advisory Committee
- **Funds** and provides technical assistance for the **design** phase of recommended **projects**
- **Funds construction** and construction phase engineering services

SHOKAN – WEST SHOKAN LOCAL FLOOD ANALYSIS
UP-TO-DATE PROJECT INFO:

www.ashokanstreams.org/shokan-local-flood-analysis/

Comments or Feedback? Email:
xxxxx@slrconsulting.com

https://ashokanstreams.org/shokan-local-flood-analysis/

CWC Flood Hazard Mitigation Implementation Program

www.cwconline.org/programs/flood-hazard-mitigation/

- Communities that have completed a LFA and recommended the following:
  - Relocation assistance for residence and businesses
  - Alterations to public infrastructure
  - Property protection measures (from municipality or property owner)
  - Elimination of potential sources of pollution
  - Stream related construction work
  - Relocation assistance for anchor business
  - Relocation assistance for critical community facilities
- Throughout Watershed (not restricted to LFA communities)
  - Stream debris removal after serious storm event
  - Tank anchoring (Oil and Propane)
  - Relocation assistance to residential or business property owners participating in City-funded Flood Buyout Program

ADDITIONAL INFORMATION NEEDS

- Observations, photos, or videos of flood damages and road washouts
- Bridges/culverts that overtopped or became clogged with debris
- Observations of bank erosion and channel behavior
- Locations of critical facilities and anchor businesses
- Sources of potential water quality impairment during a flood

https://ashokanstreams.org/shokan-local-flood-analysis/

Thoughts/Questions/Comments?