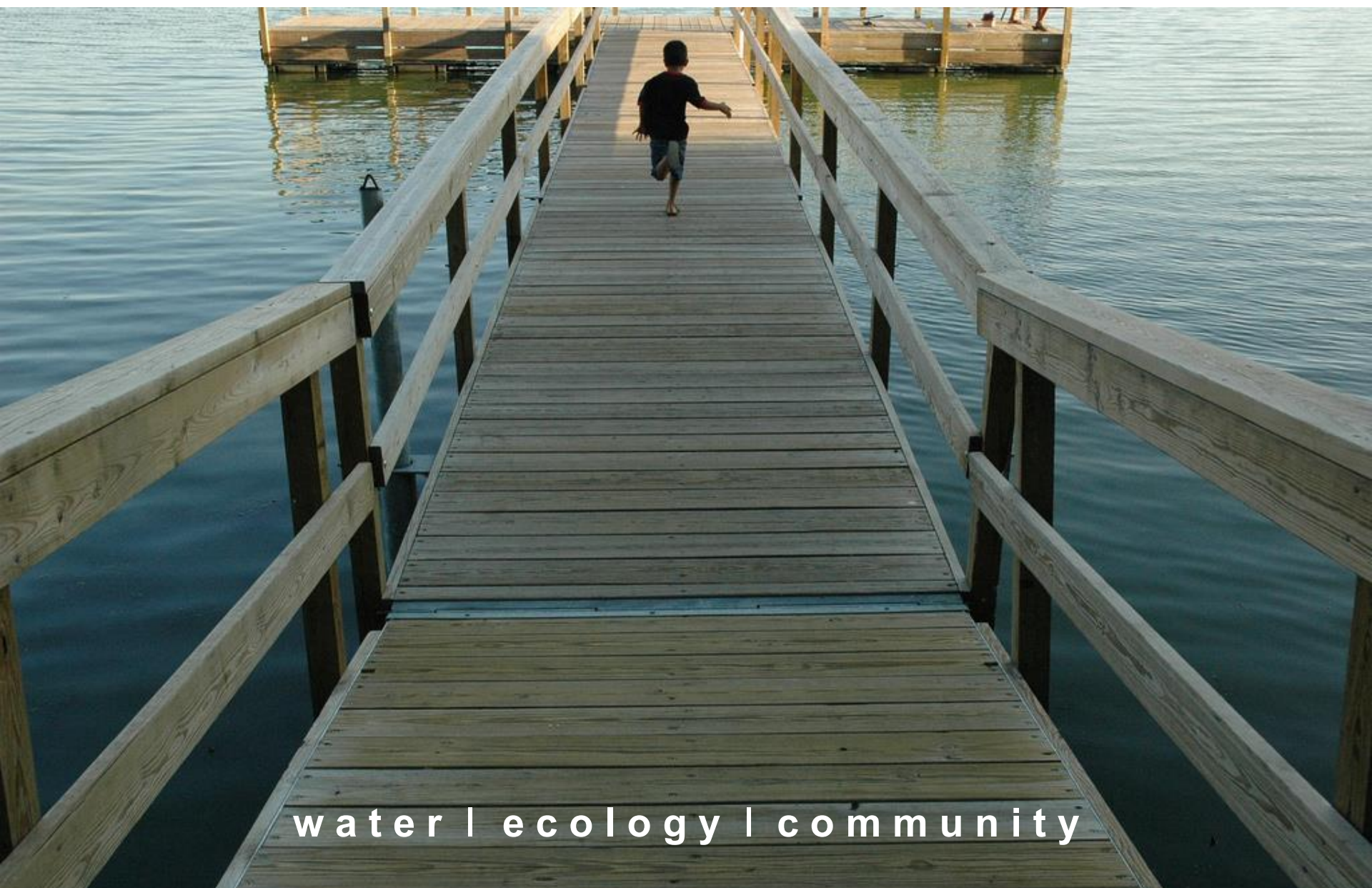


Emmons & Olivier Resources, Inc.



water | ecology | community



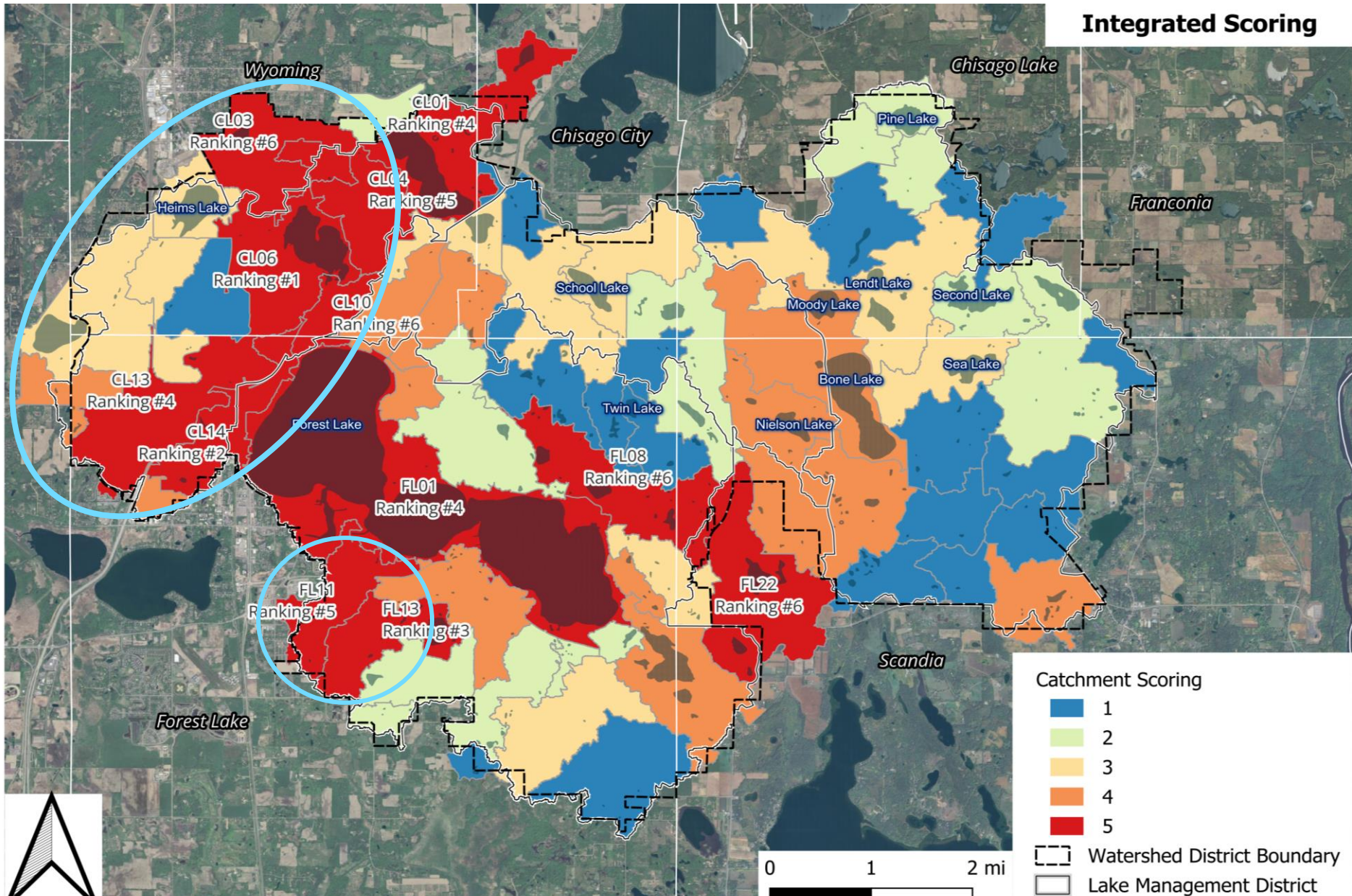
DRAFT CLFLWD Floodplain Resilience Action Plan Framework



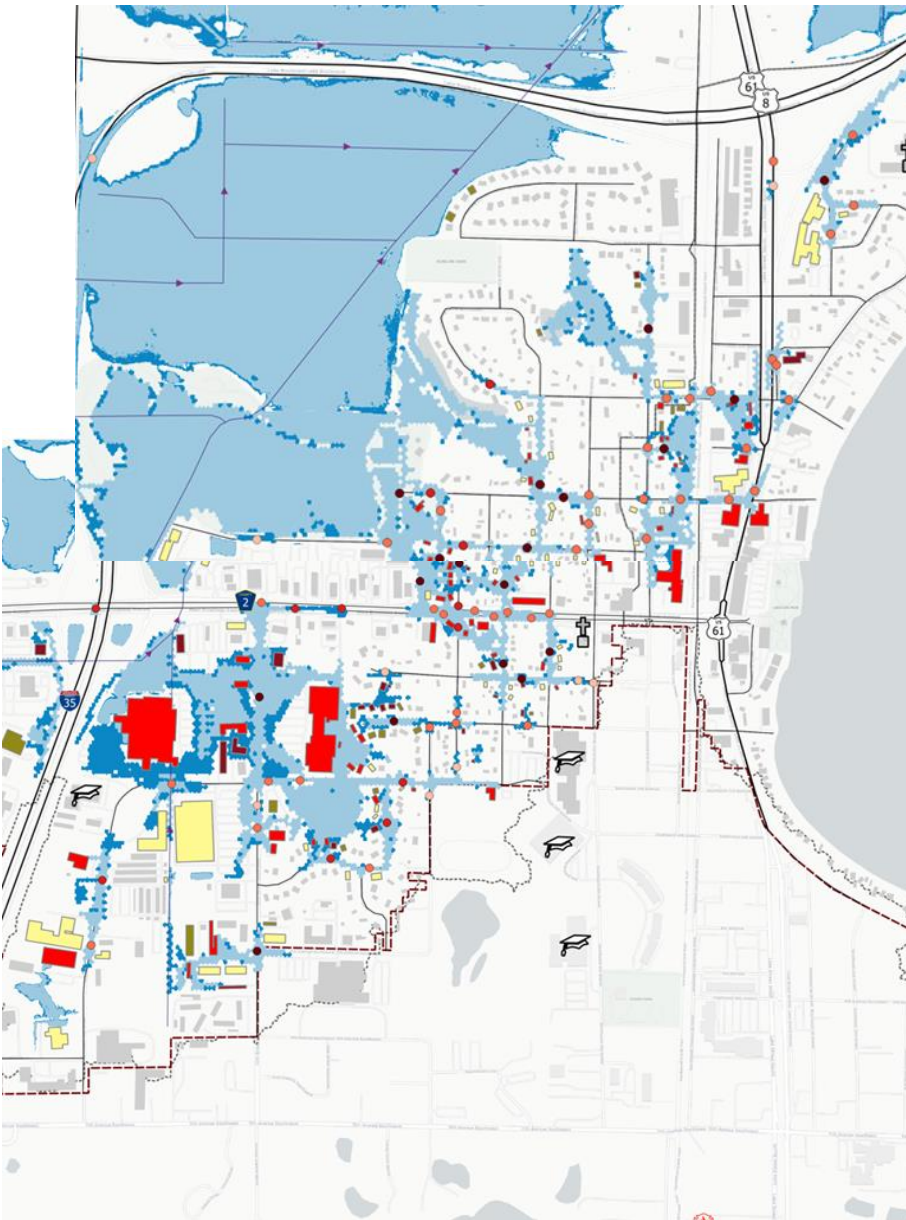
Presentation Overview

- Modeling results and assessment
- Mitigation actions and timeline
- Main anticipated benefits
- Overall conclusions

Phase I – Integrated Scoring



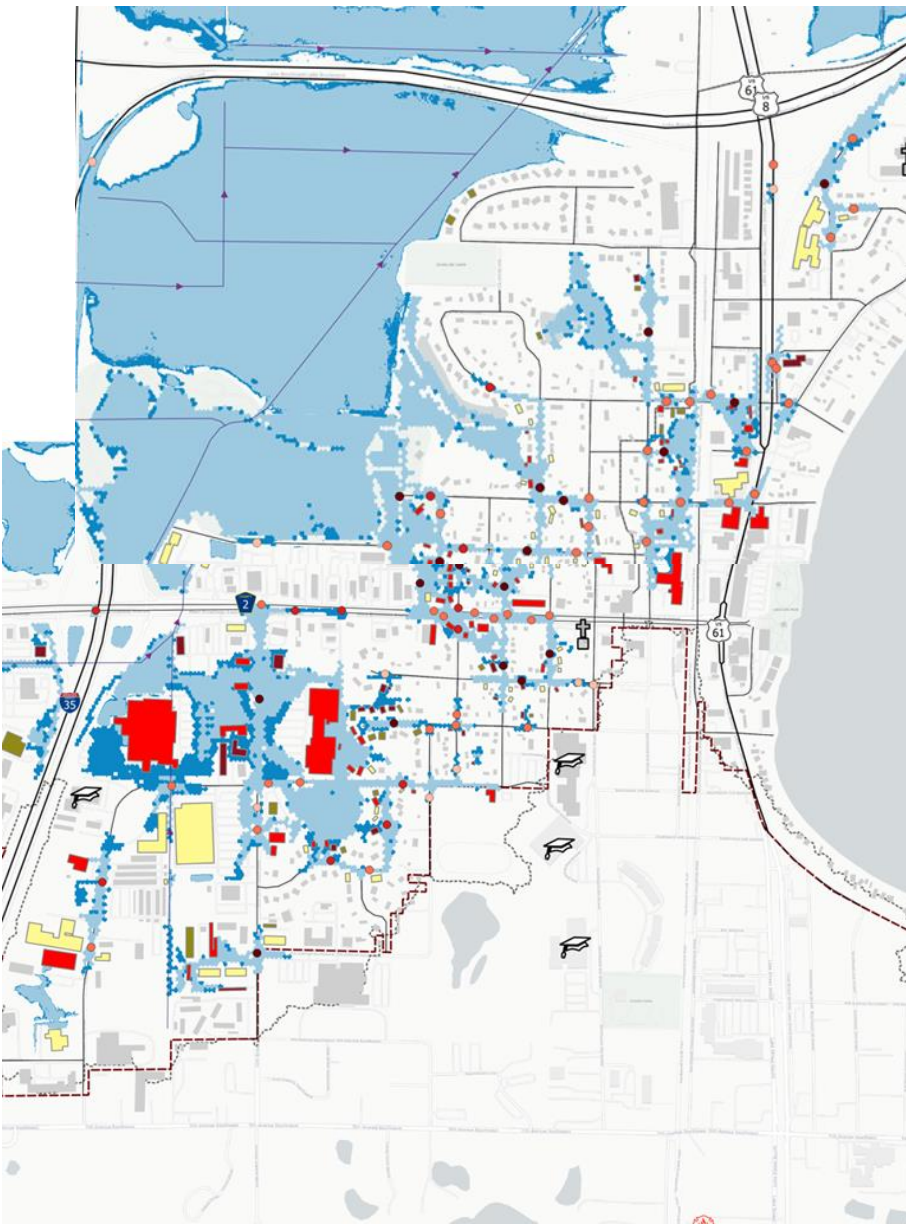
Results – Infrastructure/Roads



- No critical infrastructure (stations, fire, police, water towers, schools)

Rainfall Event	Number Roadways Flooded		
	Forest Lake Urban + SR Corridor + Little Comfort South area	Shields Lake Drainage Area	Total
Present 10-year	18	5	23
Future 10-year	24 (+6)	8 (+3)	32 (+9)
Present 100-year	39	13	52
Future 100-year	48 (+9)	16 (+3)	64 (+12)

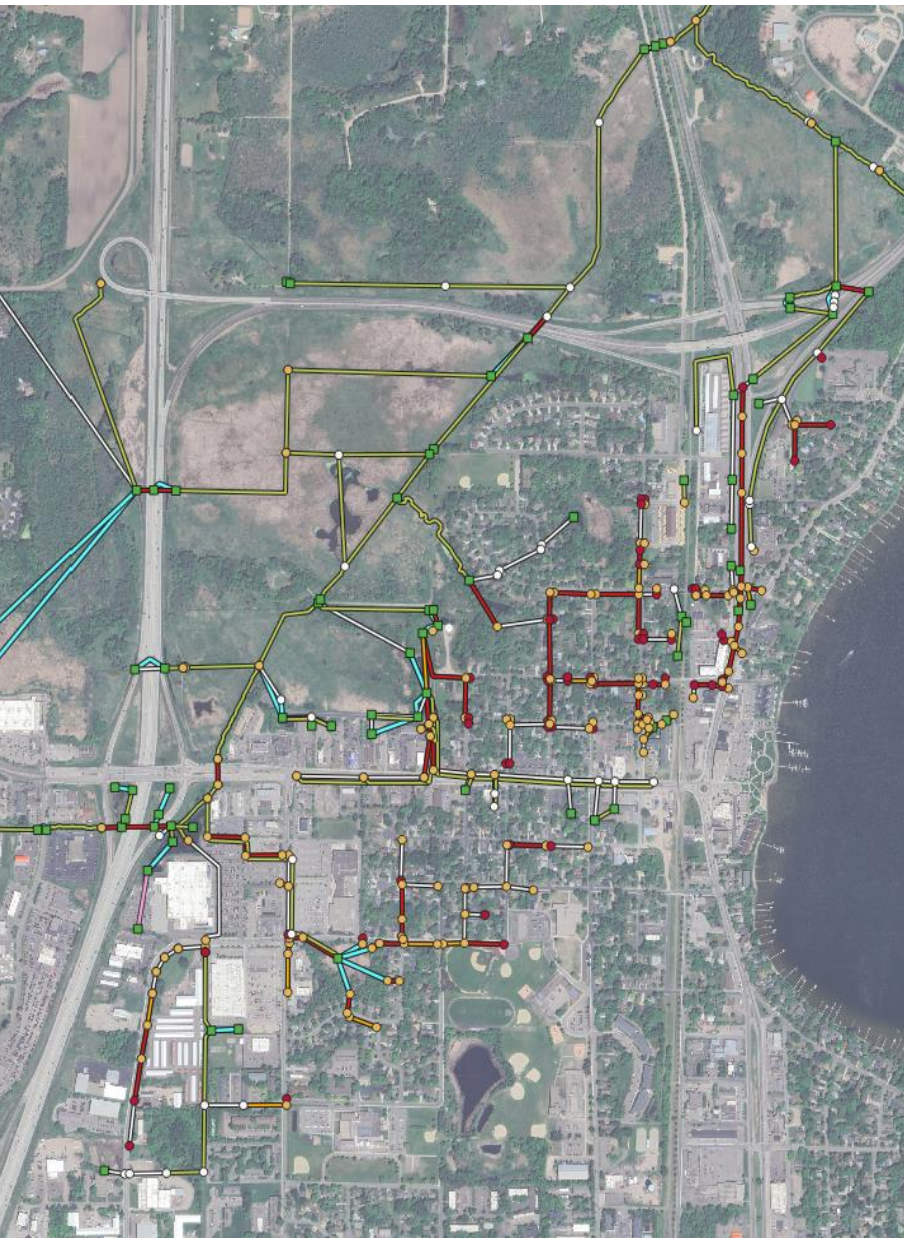
Results – Buildings & Streams



100-year Rainfall Event	Number Buildings Flooded		
	Forest Lake Urban + SR Corridor + Little Comfort South	Shields Lake Drainage Area	Total
Likely Flooding (Present Precip.)	75	2	77
Likely Flooding (Future Precip.)	104 (+29)	5 (+3)	109 (+32)
At Risk Flooding Buffer < 15' (Present Precip.)	155	9	164
At Risk Flooding Buffer < 15' (Future Precip.)	194 (+39)	35 (+26)	229 (+65)

- Sunrise River + Some Urban Ditches + Some Lateral Channels (Peak-flow velocities > 15%)

Results – Network Limitations



Rainfall	1-2 ft. Diameter Pipes		> 2ft. Diameter Pipes	
	1 hour	2 hours	1 hour	2 hours
Pres. 10-yr.	28	20	17	15
Future 10-yr.	39	23	22	18

Rainfall	Surcharged Catch Basins/Manholes		
	10 mins	30 mins	1 hours
Present 10-year	41	9	3
Future 10-year	50	16	3

- Current standard = 10-yr. event
- Template for upgrade priorities
- Pipe/junctions' limitations = Local Flooding



DRAFT CLFLWD Floodplain Resilience Action Plan Framework



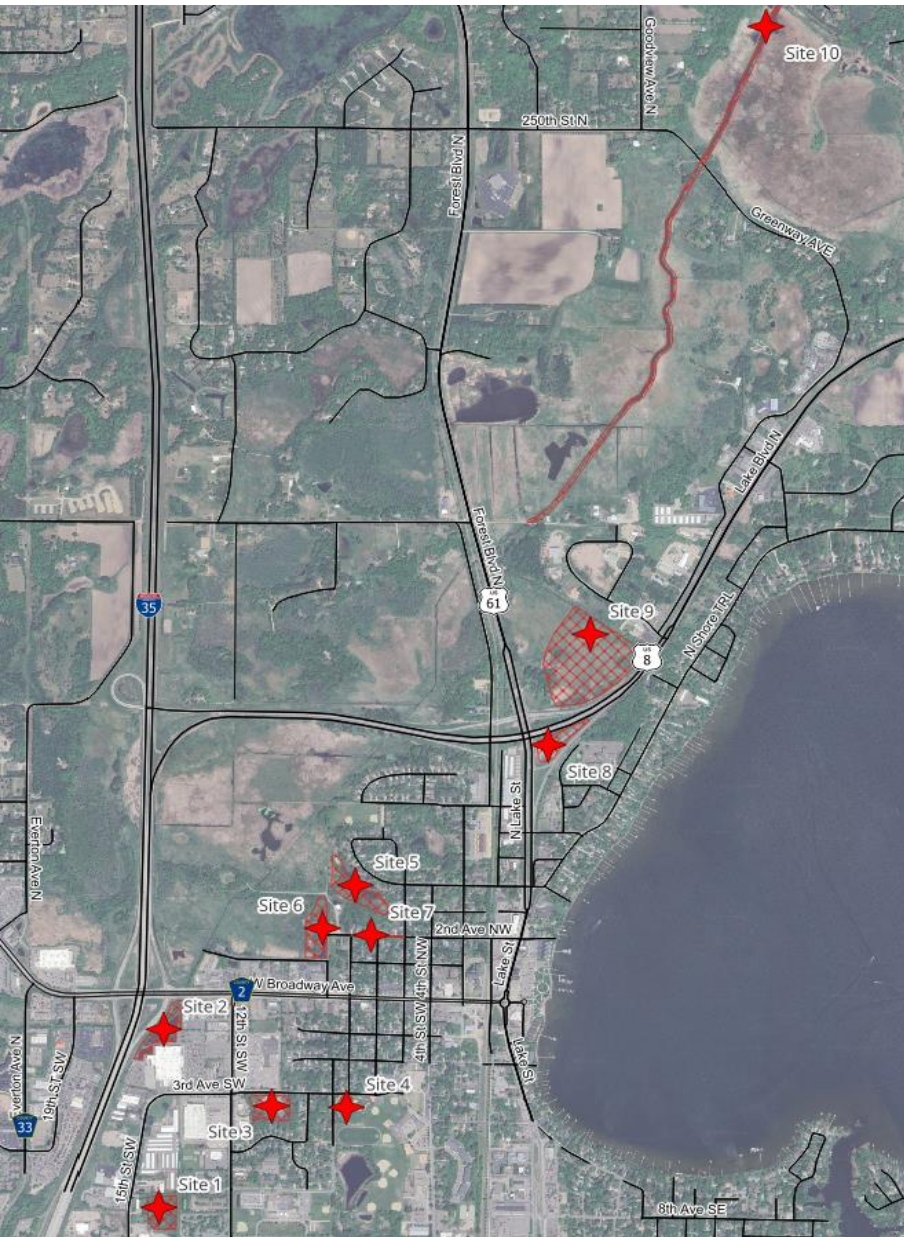
Key Considerations

- Factors outside District's control (e.g., land acquisition, cooperation /coordination with cities, funding)
- Participation, roles & responsibilities of stakeholders (e.g., CLFLWD, Washinton Co., MNDOT, City of Forest Lake, landowners)

Short-Term Mitigation Actions

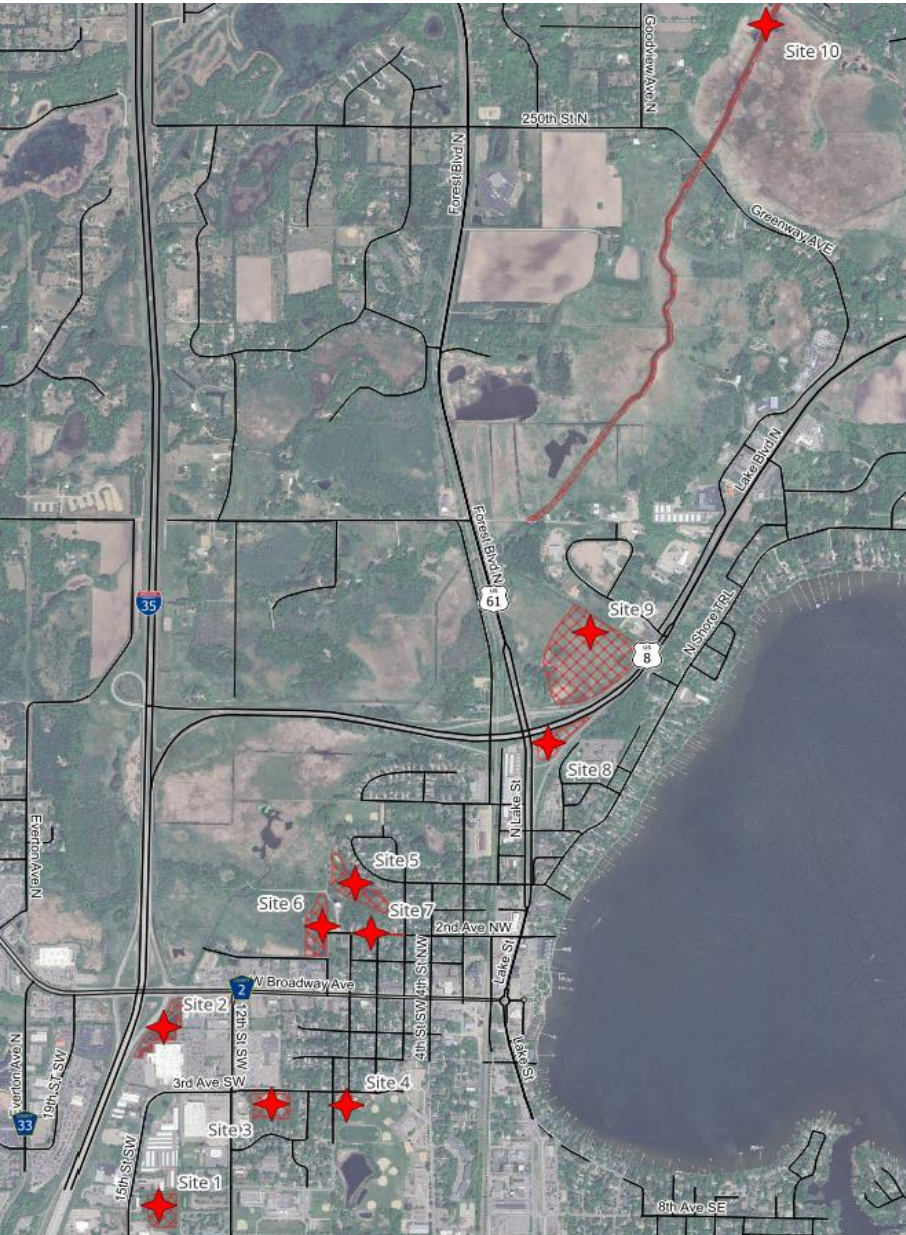


- Discuss report with Forest Lake staff
- Explore Green Infrastructure retrofits opportunities in urban area (e.g., Target site)
- Work with cities to adopt updated stormwater management rules
- Work with the City of Forest Lake to prioritize stormwater infrastructure maintenance (e.g., pipes, ditches)
- In coordination with cities develop a flood reduction community outreach plan and incentives



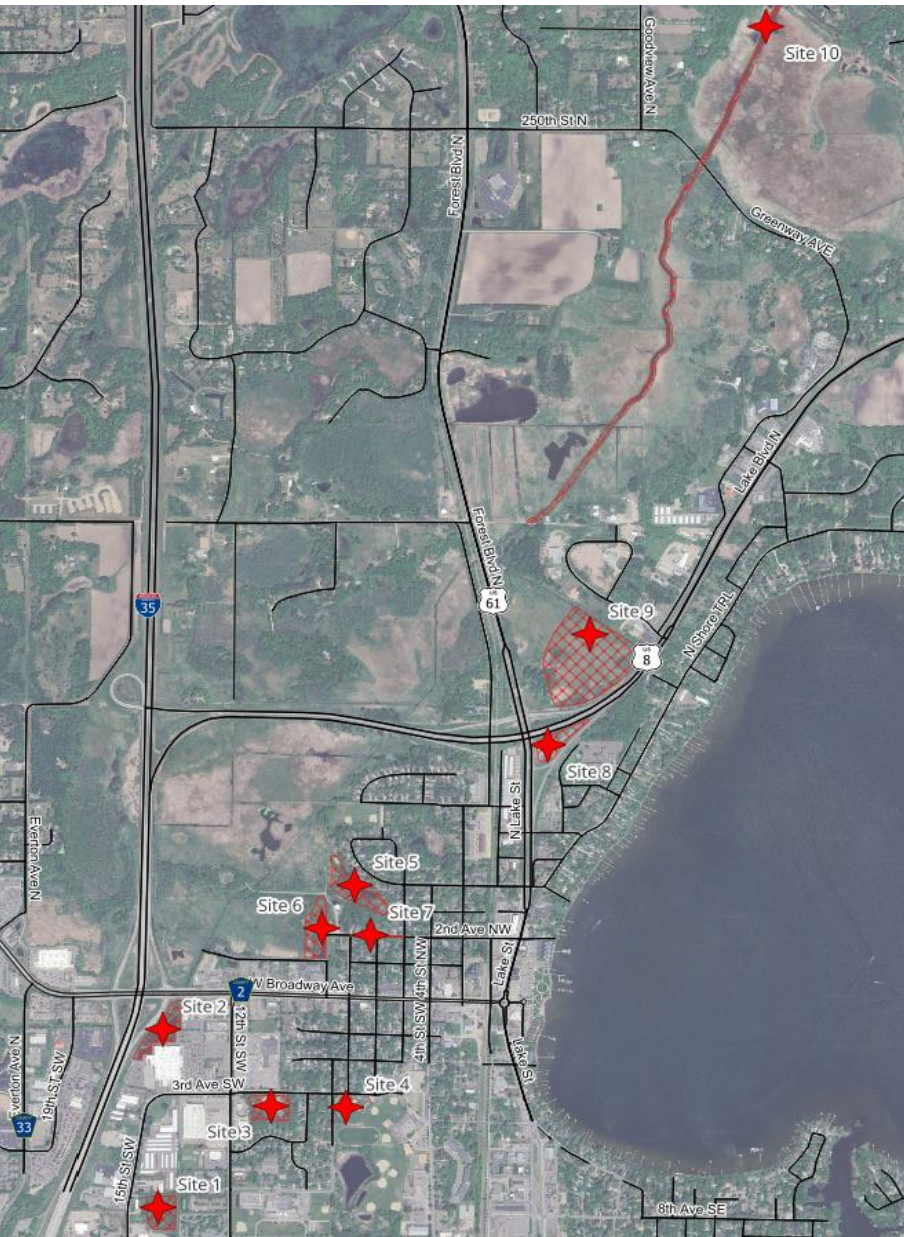
Additional Storage

- **Site 3:** Expand wetland (~ 5 ac-ft) for residential and school runoff
- **Site 2:** Expand basin (~ 10 ac-ft) to attenuate Walmart/Target parking lots and 12th St. SW overtopping
- **Sites 5 and 6:** Excavate/extend Schilling Circle NW and Southeast Bixby Park basins (~ 20 ac-ft)
- **Site 1:** Add flood storage (~5 ac-ft) within the wooden parcels.



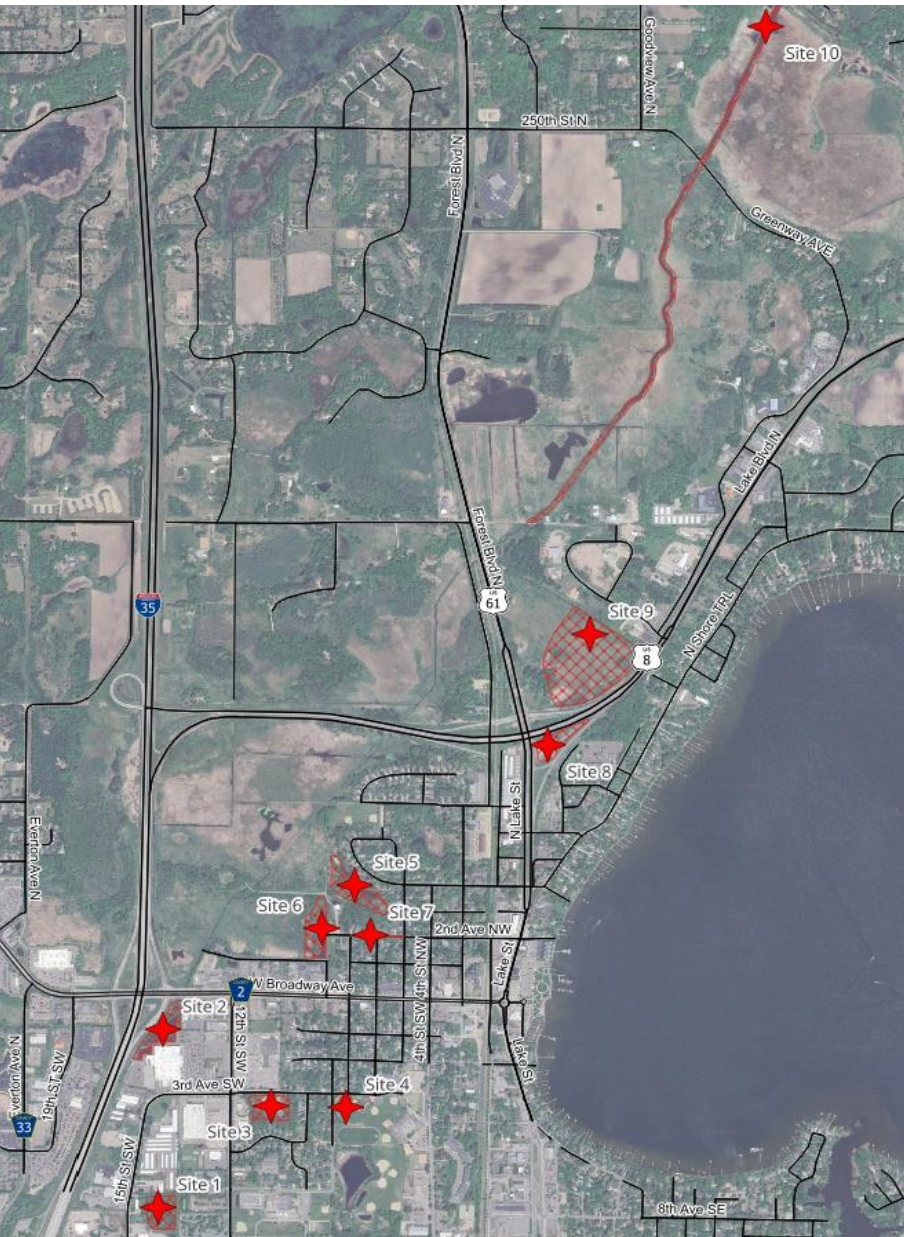
Reuse for Irrigation

- **Site 4:** Underground storage tank (~2 ac-ft) at Forest Lake Elementary School's baseball field for reuse
- Potential significant cost savings in potable water use



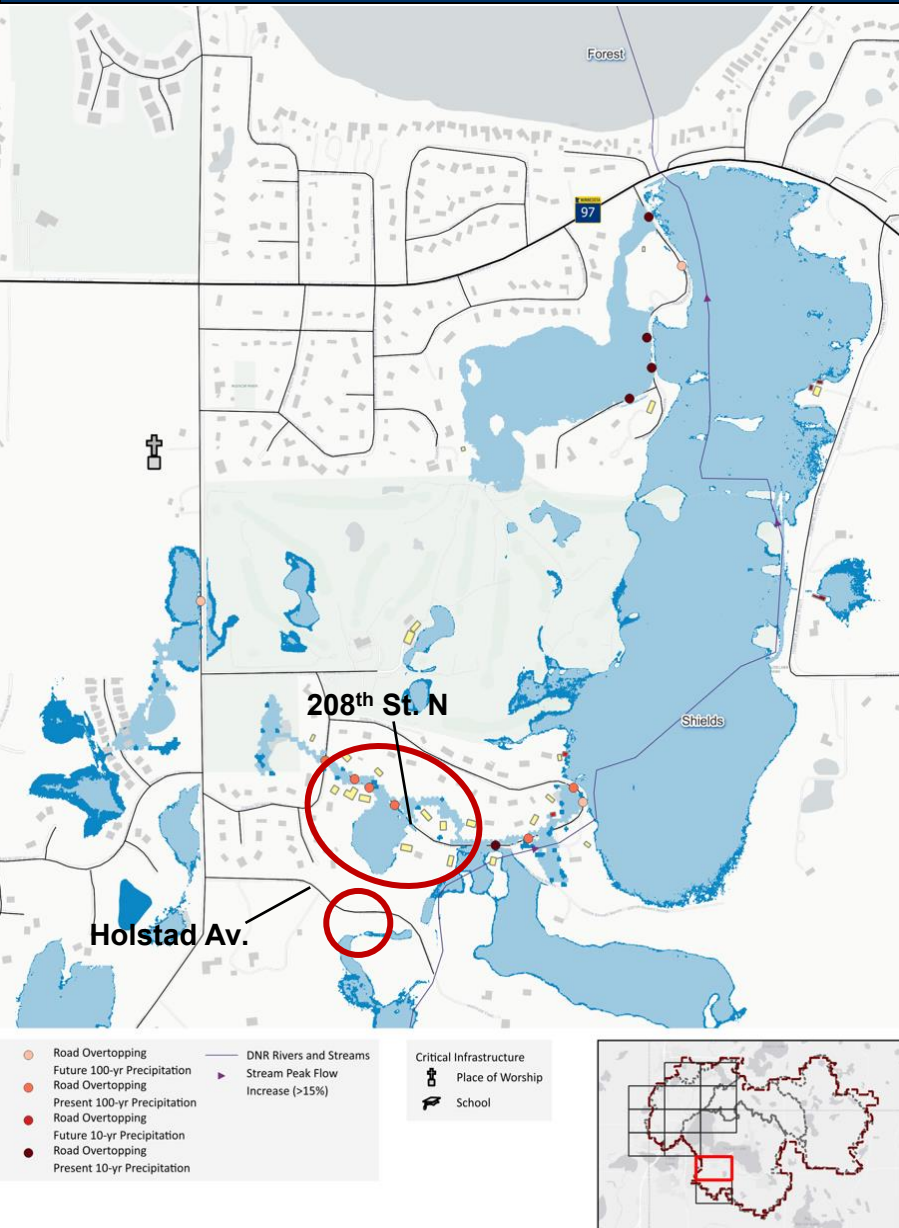
Pipe Network Improvement

- **Site 7:** Upsize the pipe grid east of Site 3 and construct the 2nd Avenue NW and 5th Street NW bypass to route excess flow to the expanded storage at Site 6



Hwy. 8 & Hwy. 61 Detention

- **Site 8:** Regional pond treatment facility (~5 ac-ft) in coordination with MNDOT before wetland expansion at Site 9



Shields Lake Drainage Area

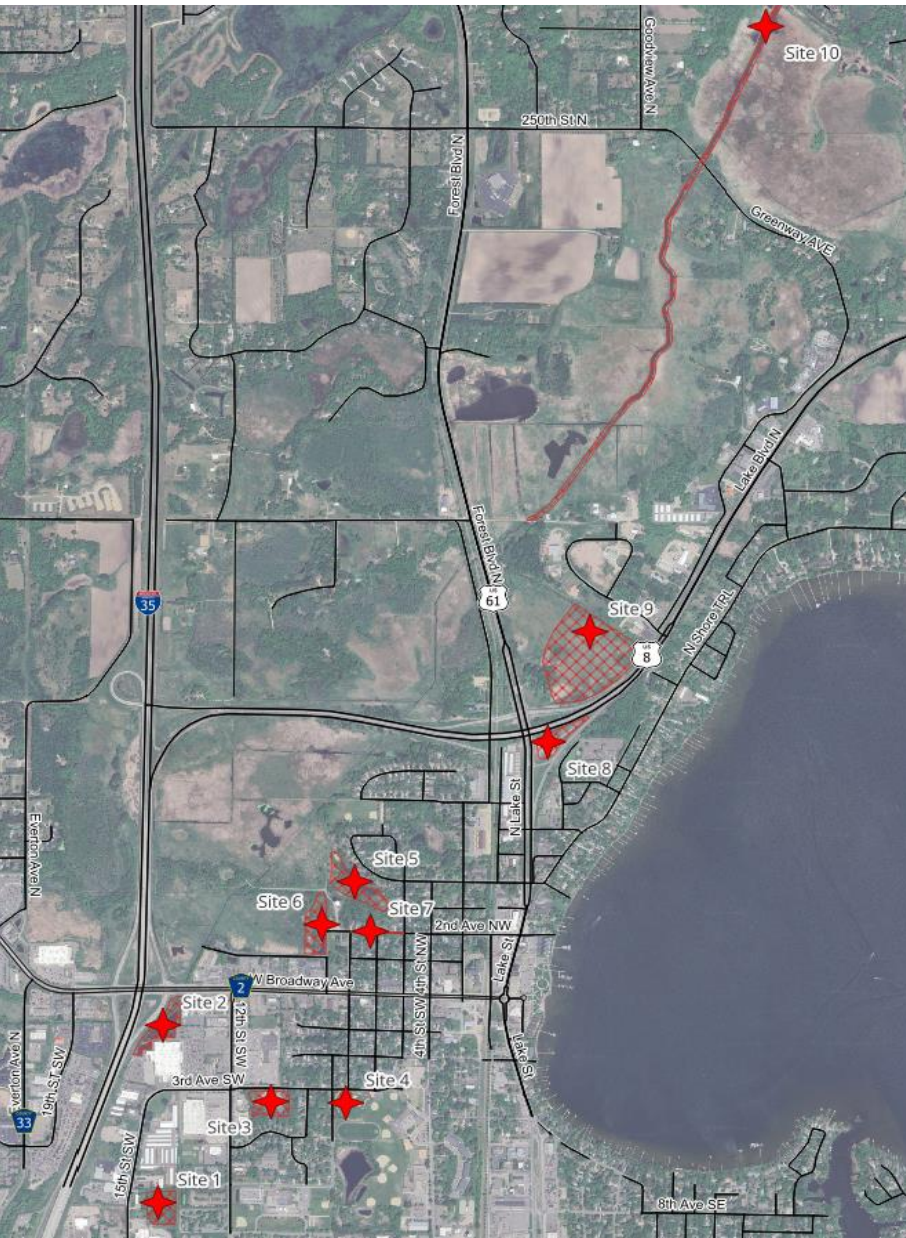
- Limited flooding, just few buildings at risk
- Upgrade culverts and stormwater segments at 208th St N to eliminate roadway overtopping.
- Expand the existing pond east of Hazel Ave N and evaluate the wetland adjacent to Holstad Trail for restoration



Sunrise River Greenway Corridor (Site 10)

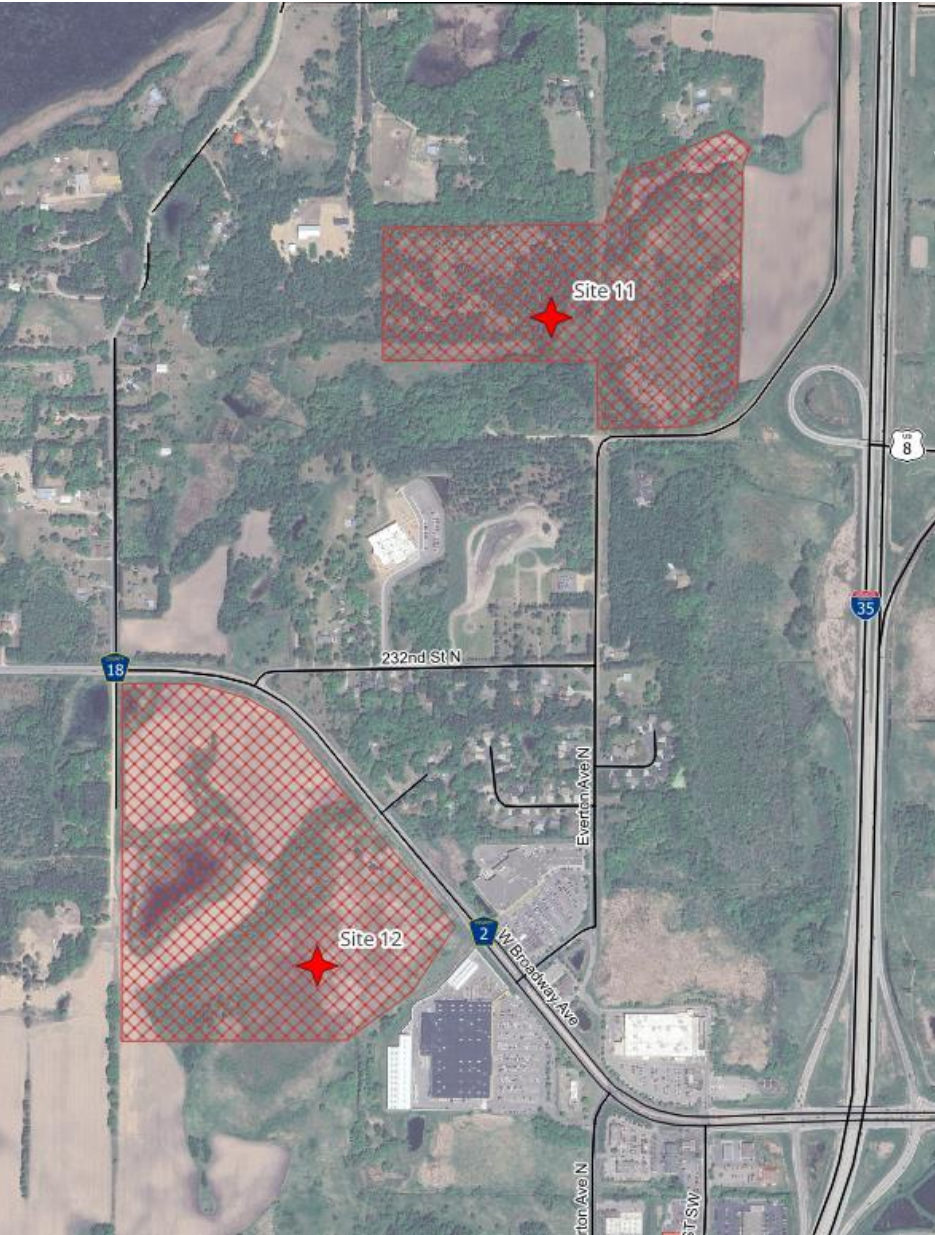
- Implement large scale projects, coupled with land acquisition or easements.
- Projects include protection of existing flood storage and wetlands or expansion of the existing ones
- Project represents a multi-year initiative to couple flood-risk mitigation with water-quality and wetland/habitat restoration gains.





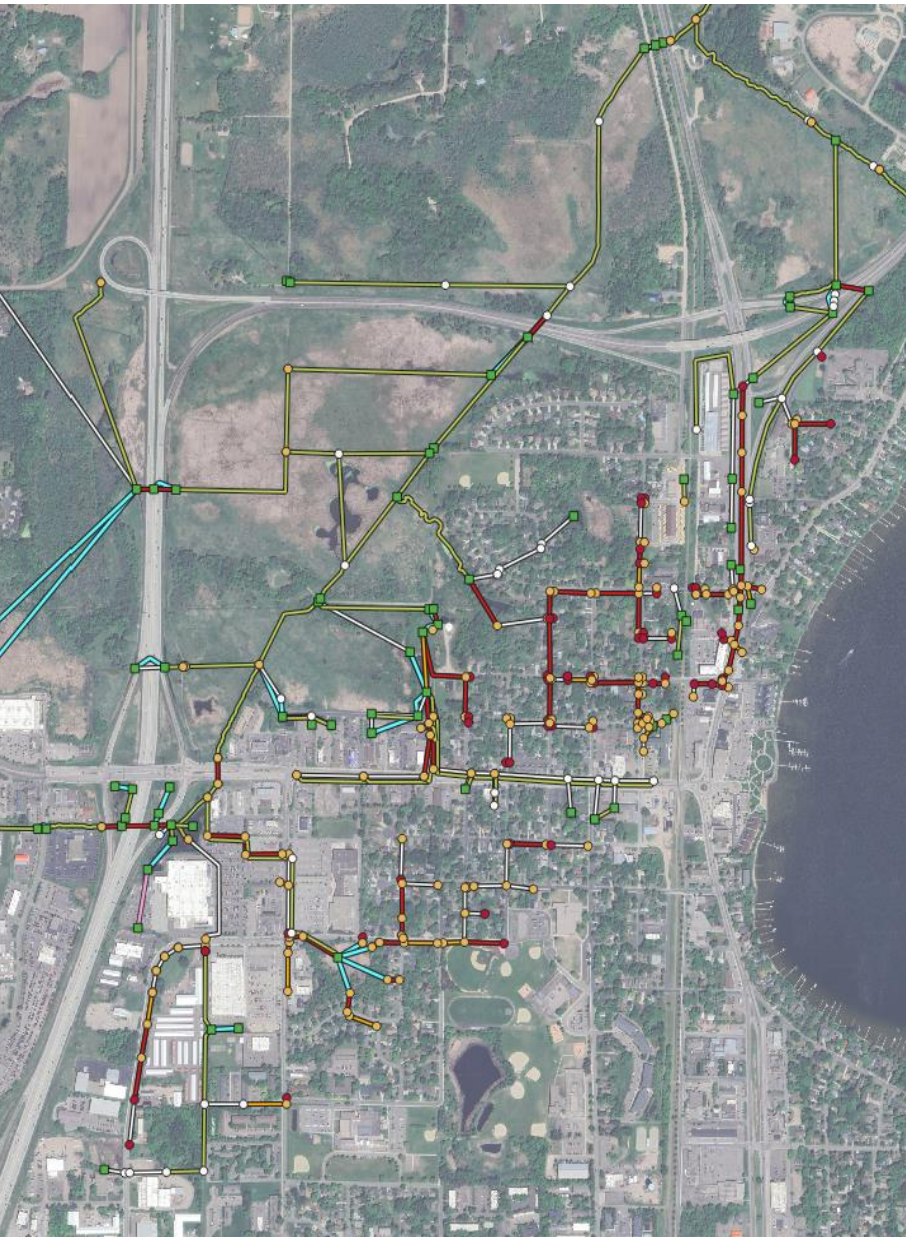
Hwy. 8 Wetland Complex Improvements (Site 9)

- Shaping the channel banks to reconnect and expand the floodplain
- Rerouting the ditch into a natural stream meander
- Rerouting the ditch into a natural stream meander, wetland impoundment, and connection to a trail system.



Regional Storage West of Hwy. 35

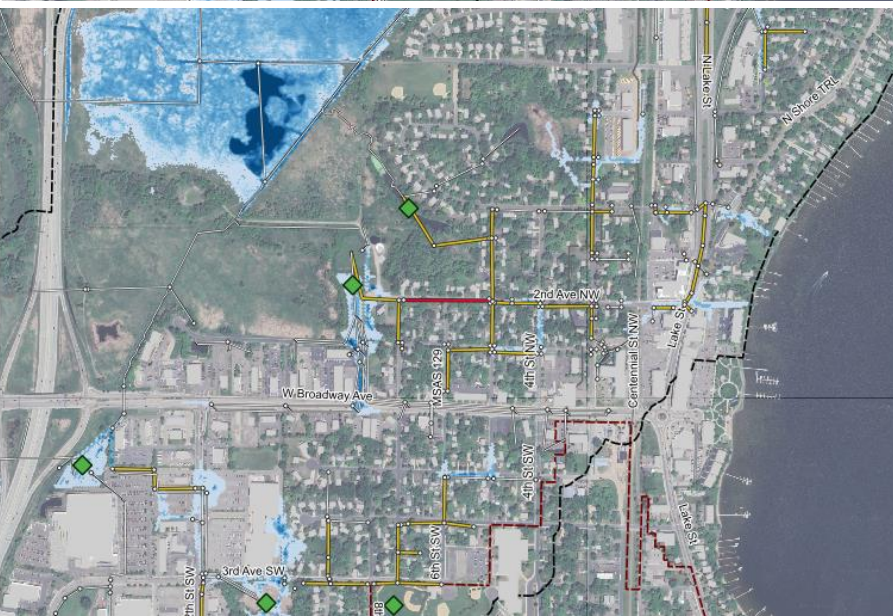
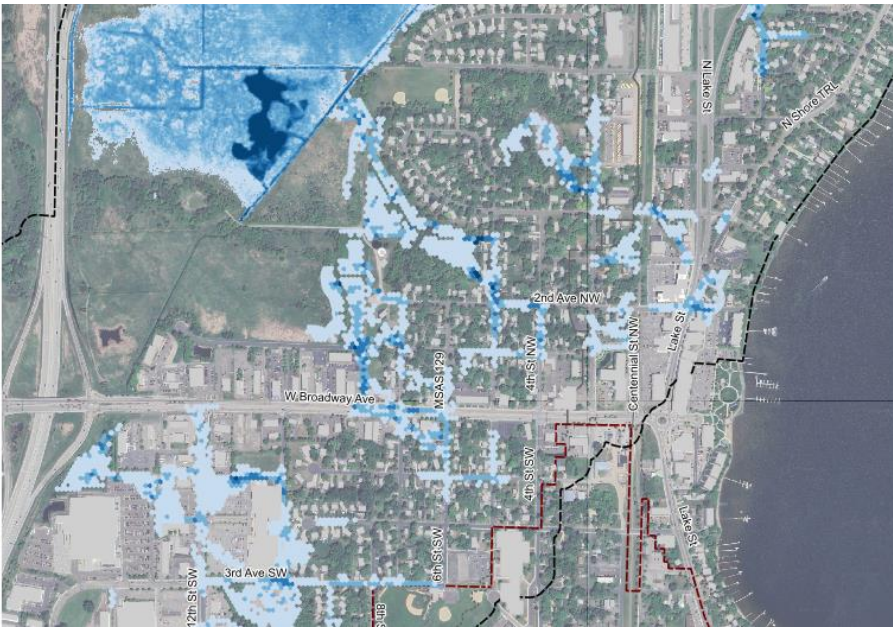
- **Site 11:** Selectively scrape and re-grade to restore wetland hydrology, add shallow storage cells, and improve habitat diversity
- **Site 12:** Restoring and slightly enlarging the depression by partially blocking the ditch outlet with a low berm or adjustable weir.



Stormwater Network Upgrade

- Work with the City of Forest Lake to identify and repair/replace key under capacity stormwater pipes to achieve 10-year standard of service.
- Coordinate with roadway repair

Main Anticipated Benefits



- 10-year flood reduction, both in footprint and depth, if the improvements are implemented
- Localized flooding footprint gets reduced by about 80% to 90%
- Eliminate potential for inundation of approximately 35 - 60 buildings
- Reduce roadway overtopping by 30% - 50%
- Lower peak channel velocities along critical Sunrise River segments by 10% - 20%

Overall Conclusions



DRAFT CLFLWD Floodplain Resilience Action Plan Framework



- Stormwater network undersized for current standards
- No critical infrastructure affected
- Significant number of buildings and roadways flooding
- Increase Sunrise River flow and velocity (>15%) for future conditions
- Proposed actions will significantly mitigate those impacts
- Roles coordination & buy-in from cities, counties, MNDOT, and landowners are key