Climate Vulnerability Assessment

Localized Flood Risk

Land Use Advisory Committee

November 16, 2017

METROPOLITAN COUNCIL

Today's Discussion

- Overview
- Localized Flooding (Bluespot)
  - Approach and Limitations
  - Methodology
- Transportation &Transit Overview
- Mapping Tool & Story Map
- Next Steps

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Why Conduct a Climate Vulnerability Assessment?

Sustainability Outcome

- Integrating climate mitigation, adaptation, and resilience into the Council's management of regional systems and supporting local governments in their planning and implementation.

Lead by Example

Building in Resilience Land Use Policy

- Develop local resiliency to the impacts of climate change. The Council will identify and address potential **vulnerabilities** in regional systems as a result of increased frequency and severity in temperature, precipitation, and extreme weather.

Collaborate Across the Region

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Why Rain & Heat?

Climate Change Trends in Minnesota through 2099

Hazard	*Projections Through 2099*	*Confidence in Projected Changes*
Warming Winters	Continued loss of cold extremes and dramatic warming of coldest conditions	**Highest**
Extreme Rainfall	Continued increase in frequency and magnitude; unprecedented flash-floods	
Heat Waves	More hot days with increases in severity, coverage, and duration of heat waves	**High**
Drought	More days between precipitation events, leading to increased drought severity, coverage, and duration	**Moderately High**
Heavy Snowfall	Large events less frequent as winter warms, but occasional very large snowfalls	**Moderately Low**
Severe Thunderstorms & Tornadoes	More “super events” possible, even if frequency decreases	

SOURCE: *MN DNR State Climatology Office.*

Project Timeline

2015

- CDC Work Plan Item

2016

- COW Climate Change Presentation
- Met Council Earth Day Presentation
- LUAC Scoping Discussion
- CDC Project Update

2017

- LUAC – Human Vulnerability Presentation
- COW – Update and Discussion
- LUAC – Strategies & Tools

CONTINUED PROJECT DEVELOPMENT

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What are We Assessing?

System or Focus	Assets	Council Role
Council-owned Housing	Housing	Owns & Maintains
Facilities	Buildings & Structures	Owns & Operates
Land Use	N/A	Planning & Collaboration with Stakeholders
Transit	LRT, Bus Network, Metro Mobility, & Commuter Rail	Owns & Operates; Collaboration with Stakeholders
Transportation	N/A	Planning & Collaboration with Stakeholders
Regional Parks & Trails	N/A	Planning & Collaboration with Implementing Agencies
Wastewater	Wastewater Treatment Plans, Interceptor Pipes, Lift Stations, Maintenance Holes	Owns & Operates
Water Quality	N/A	Planning & Collaboration with Stakeholders
Water Supply	N/A	Planning & Collaboration with Stakeholders

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LUAC's Input on How to Communicate the Localized Flooding Tool

Challenges

- Property Rights & DFIRM
- Community Sensitivities
- Target Audience
- Clear, Concise Purpose
- Technical Jargon

Opportunities

- Screening Tool
- Truthing, Pre-planning
- Community Staff/Officials
- 1 in a Set of Tools
- Plain Language

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Localized Flooding (Bluespot)

Approach and Limitations

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IMAGE SOURCE: City of St. Louis Park

Observation of Mega Rain Events* in MN

Over half of Mega Rain Events since 1866 occurred since 2002

Challenges

Most infrastructure planned for 5 to 10 year storm events

Under new modelling, the 100-year event has increased by 25%

*Defined as 6” or greater rains covering at least 1000sq mile and a peak amount of 8” or greater

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Localized Flooding (Bluespot)

Council Approach –

- Create localized flooding data layer from existing data
- Keep data simple to allow for broad application
- Group flood depth hazards to assist in screening Council assets

IMAGE SOURCE: Twitter, Lowry Ave, NE Minneapolis, 7/5/2016

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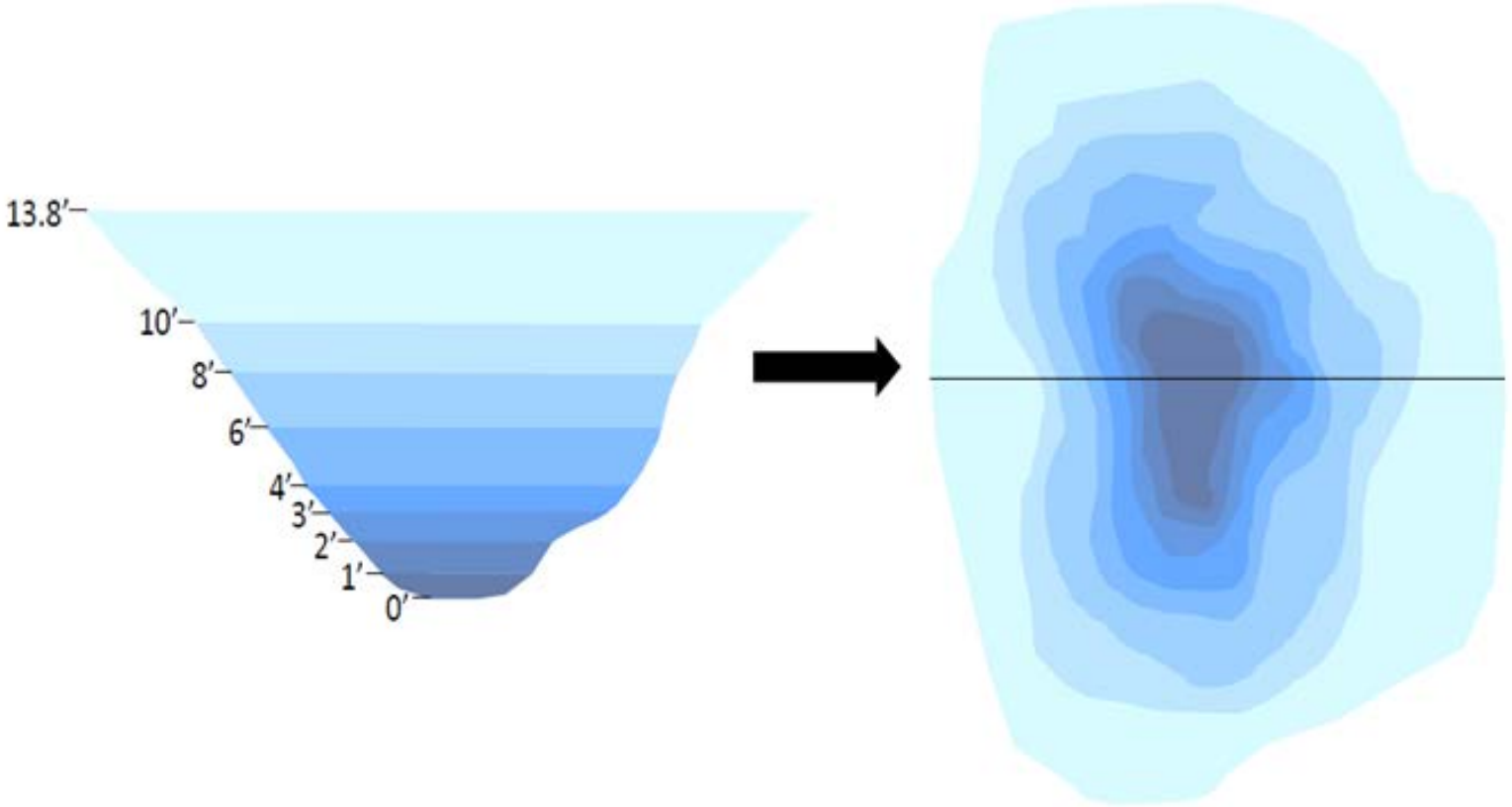
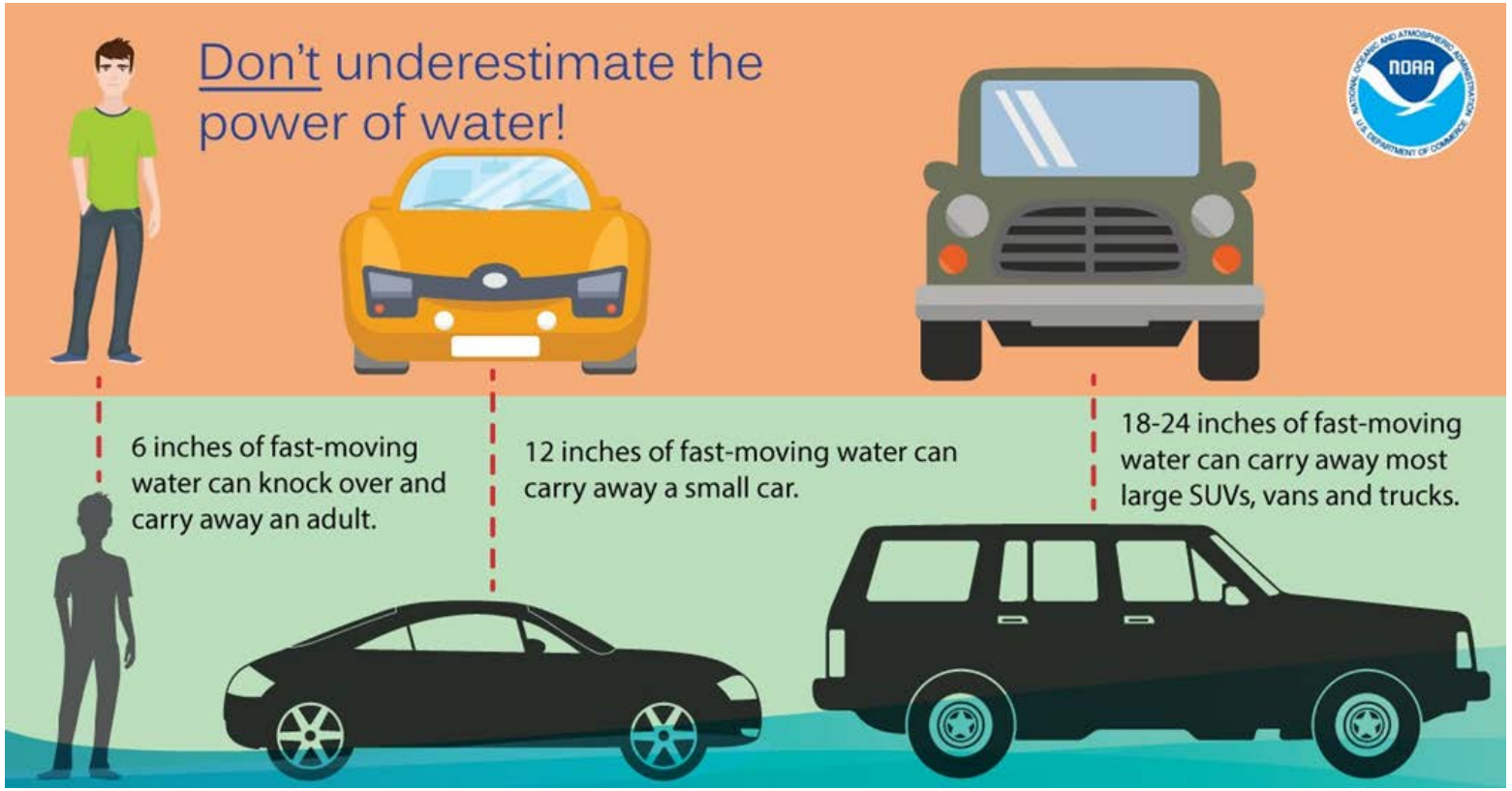
Localized Flooding

Example Cross-section of a Bluespot



Flood Hazards



SOURCE: National Weather Service, 2017

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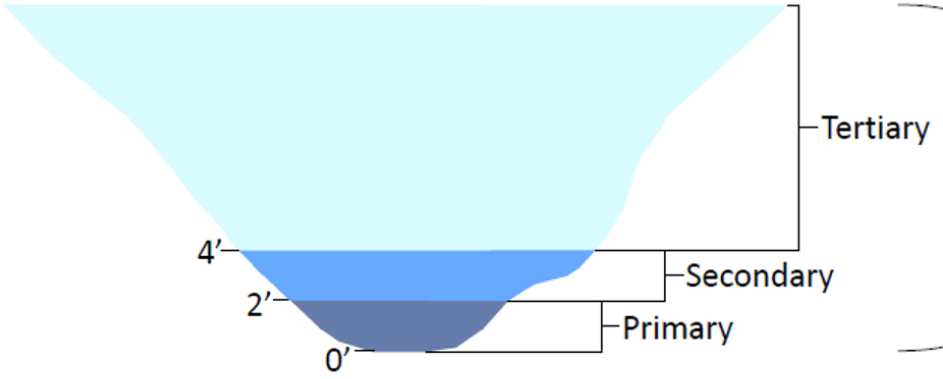
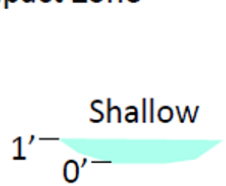
Council Bluespot Categorization

Bluespot Depth	Flood Hazard Category	Bluespot Symbology
3in -1 foot	Shallow	
0-1 feet	Primary	
1-2 feet	Primary	
2-3 feet	Secondary	
3-4 feet	Secondary	
4-6 feet	Tertiary	
6-8 feet	Tertiary	
8-10 feet	Tertiary	
>10 feet	Tertiary	

Isolated 3in – 1ft Bluespots

Flood Impact Zone (FIZ)





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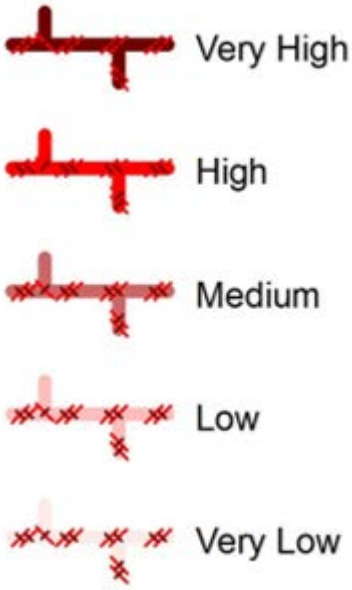
How is Potential Vulnerability Shown?

‘In’ or ‘Out’ Vulnerability

Weighted Vulnerability



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Limitations of Localized Flooding Analysis

- **Data**
  - Limited data
    - No regional stormwater infrastructure data
  - No information on locally-owned infrastructure
  - Detention basins and stormwater ponds included
  - Analysis is static
    - represents a snapshot in time
  - Elevation data is from 2011


IMAGE SOURCE: MC Staff, 38th Street & Stevens Ave, 6/11/2017

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Limitations of Localized Flooding Analysis

- **Discretion**
  - Flood Impact Zones based on Council assets
- **Therefore:**
  - The data is best used for screening and prioritization, should be considered as ***potential*** vulnerability in the event of stormwater infrastructure failure
  - More site-specific analysis should incorporate other data

IMAGE SOURCE: MC Staff, 38th Street & Stevens Ave, 6/11/2017

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Transportation & Transit Overview

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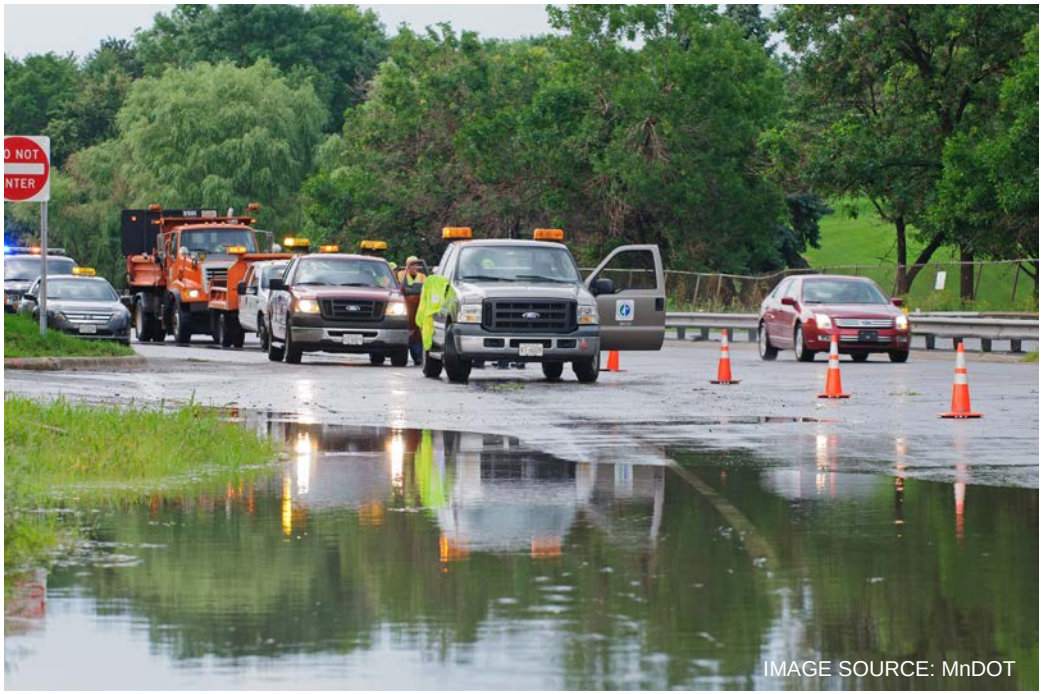
Transportation & Transit

Format for Analysis of Each Asset

- ❑ Asset Overview
- ❑ Local Example

Rationale
GIS Methodology
Analysis
Considerations
Existing Strategies
Proposed Strategies
    MC Strategies
    Local Strategies



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Transportation & Transit

Method

Transportation-Transit Asset	Low	Medium	High
Bus Routes by Type	*Express*	*Local*	*Hi Frequency*
Bus Routes by Number Affected	*1 route*	*2-3 routes*	*≥ 4 routes*
Bus & Transit Stops*, by Routes Served	*1 route*	*2-3 routes*	*≥ 4 routes*
Roadways, by Functional Class	*Local & Collector*	*All other Arterials*	*Principal Arterials*
Rail Lines, Airport Runways, Bicycle Network	*- Sensitivity/Exposure defined by Flood Impact Zone only. Primary, and in some cases Shallow/Primary, represent the highest vulnerability.*		

Transit stops include Rail Stations, bus stops within 1/8 mi. of rail stations, park and ride facilities, and Transit Center facilities.

Flood Hazard		Vulnerability		
		Low*	**Medium***	**High***
Flood Impact Zone	Shallow	*Very Low*	*Low*	*Medium*
	Primary	*Medium*	*High*	*Very High*
	Secondary	*Low*	*Medium*	*High*
	Tertiary	*Very Low*	*Low*	*Medium*

This extra step is performed for Bus Routes, Transit Stops, and Roadways. The Low, Medium, or High from Table 1 is inputted into this matrix to determine vulnerability when intersected with the Flood Hazards.

Transportation & Transit

82.6% of Assets Outside Flood Impact Zone

			Flood Impact Zone % for Assets in a FIZ				
Asset	Total	Total Assets in FIZ*	Primary	Secondary	Tertiary	FIZ Average Max. Depth**	Shallow
Bus Routes	5,976 mi.	17.4%	36.3%	27.3%	25.3%	4.76ft	11.1%
LRT/Commuter Lines	111 mi.	9.6%	47.5%	25.2%	18.4%	3.75ft	8.9%
All Transit Stops	19,422 stops	12.8%	46.6%	12.4%	12.9%	3.39ft	28.1%
All Roadways	44,266 mi.	12.8%	38.1%	25.2%	24.2%	3.87ft	12.5%
Regional Highways	24,584 mi.	16.2%	34.9%	26.4%	27.1%	4.28ft	11.6%
Bicycle Routes	6,773 mi.	15.5%	34.2%	26.6%	27.5%	4.02ft	11.6%

**Refer to Total Asset in FIZ column to determine total exposure to potential localized flooding for each asset. More than 80% of all Council assets are outside of a FIZ.*

***FIZ Average Maximum Depth refers to Primary, Secondary, and Tertiary FIZ. It does not include Shallow.*

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Transportation & Transit

Overview Findings

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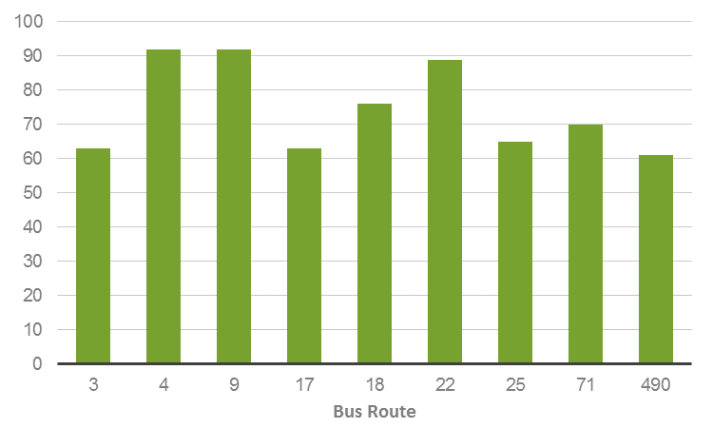
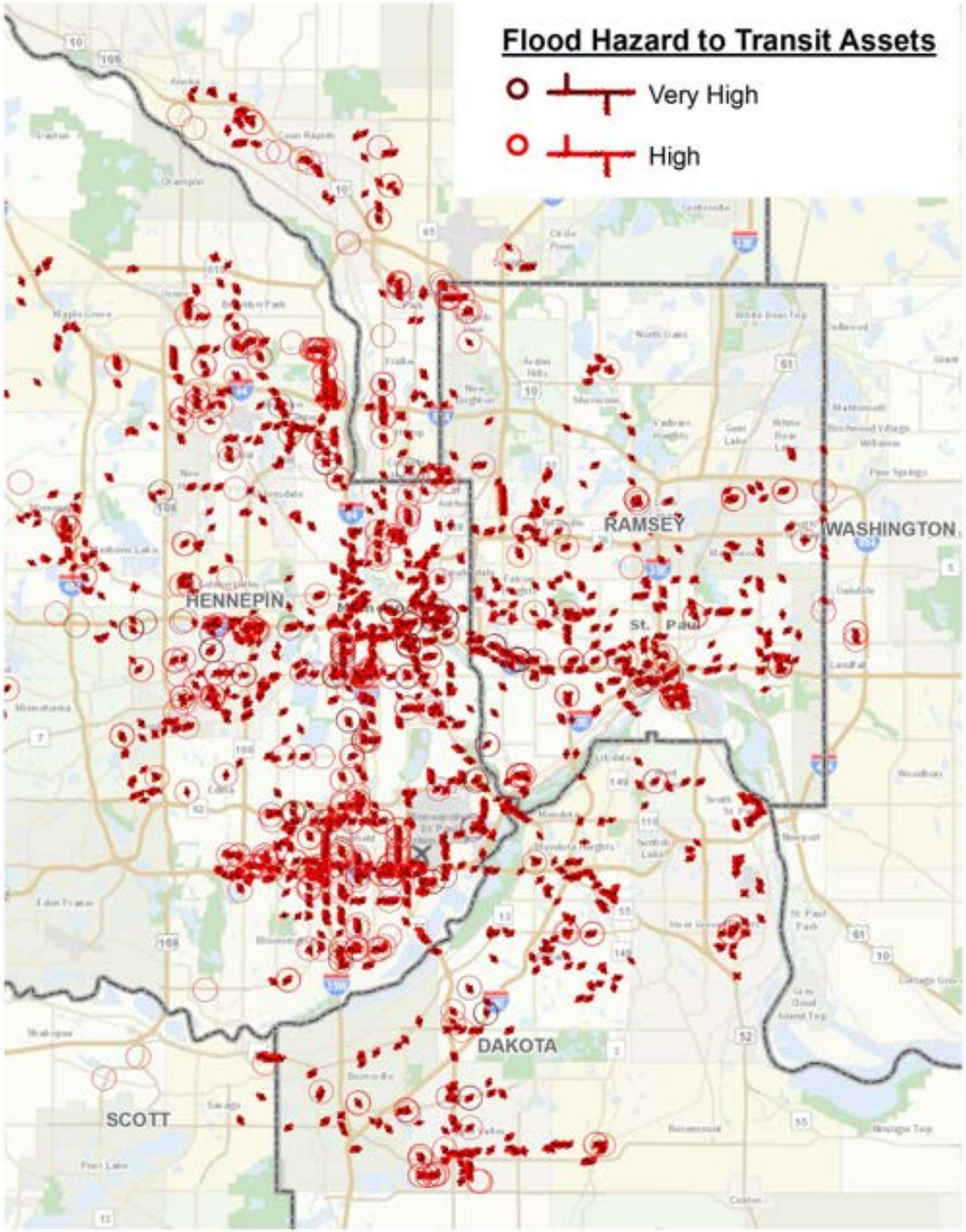
Bus Transit

Overview Analysis

Bus Routes & Stops - Potential Flood Vulnerability

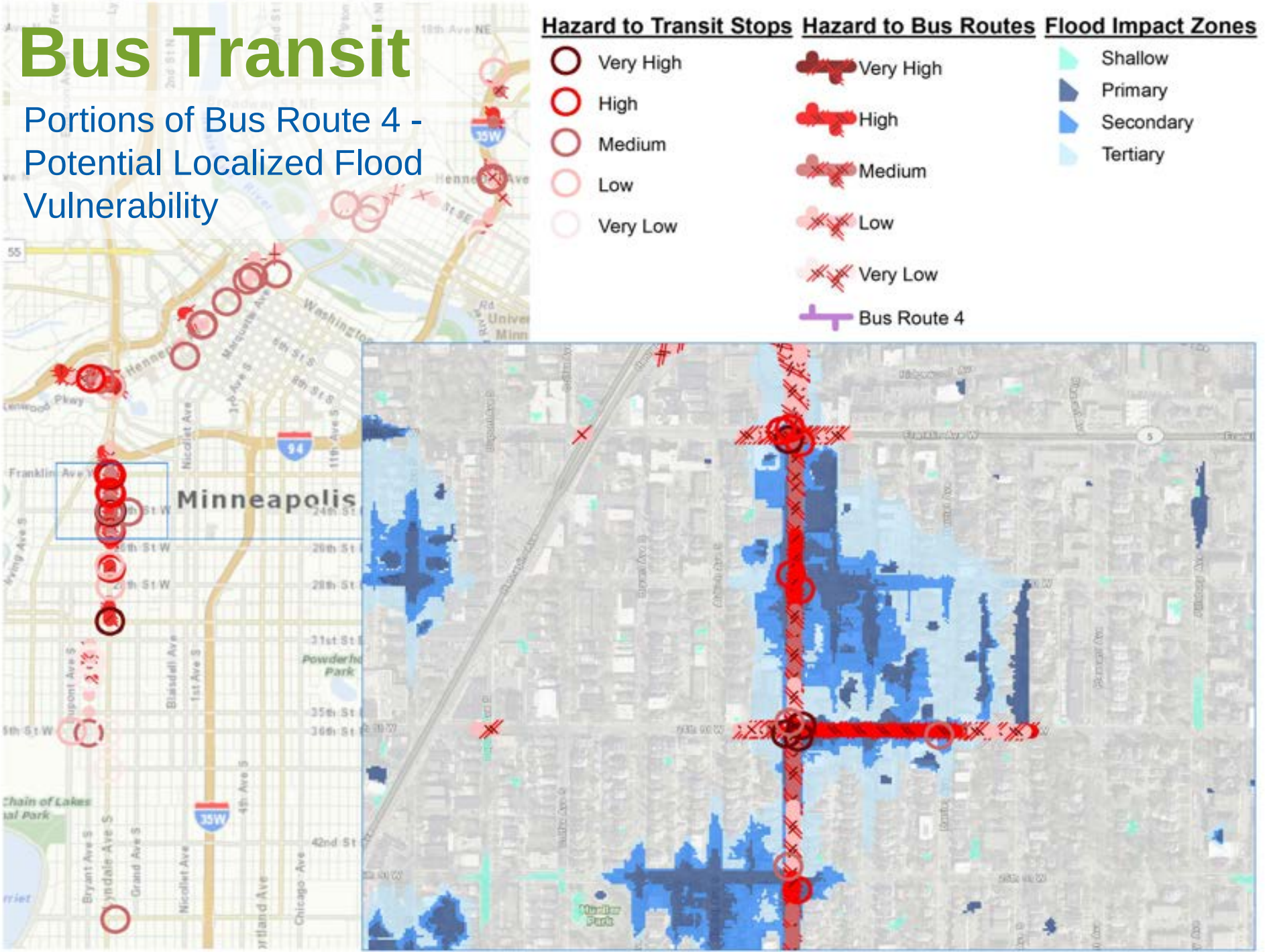


High Vulnerability Bus Routes by Number of Stops in Flood Impact Zones



Bus Transit

Portions of Bus Route 4 - Potential Localized Flood Vulnerability



Bus Transit

Proposed Strategies

- Metro Transit to conduct a more detailed analysis and prioritization of all vulnerable routes and stops across the network
- Metro Transit to develop re-routing plans for potential vulnerable areas on a route-by-route basis
- Metro Transit to leverage local knowledge of experienced drivers for re-routing and temporary stop planning
- Metro Transit to work with relevant local stakeholders to institute volunteer adopt-a-drain programs for local bus stops, using vulnerable routes and bus stop areas for prioritization
- Metro Transit to prioritize vulnerable routes and bus stops to communicate localized flooding potential to riders in a variety of formats and languages

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Next Steps with Transportation & Transit

- Relevant work units to perform more in-depth analysis of high vulnerability system assets
- Go beyond hazard mitigation
- Build equity into policies and strategies
- Consider this data for the next iteration of *Thrive MSP 2040*

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Mapping Tool & Story Map

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How to Communicate the Localized Flooding Tool?

Challenges

- Property Rights & DFIRM
- Community Sensitivities
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Opportunities

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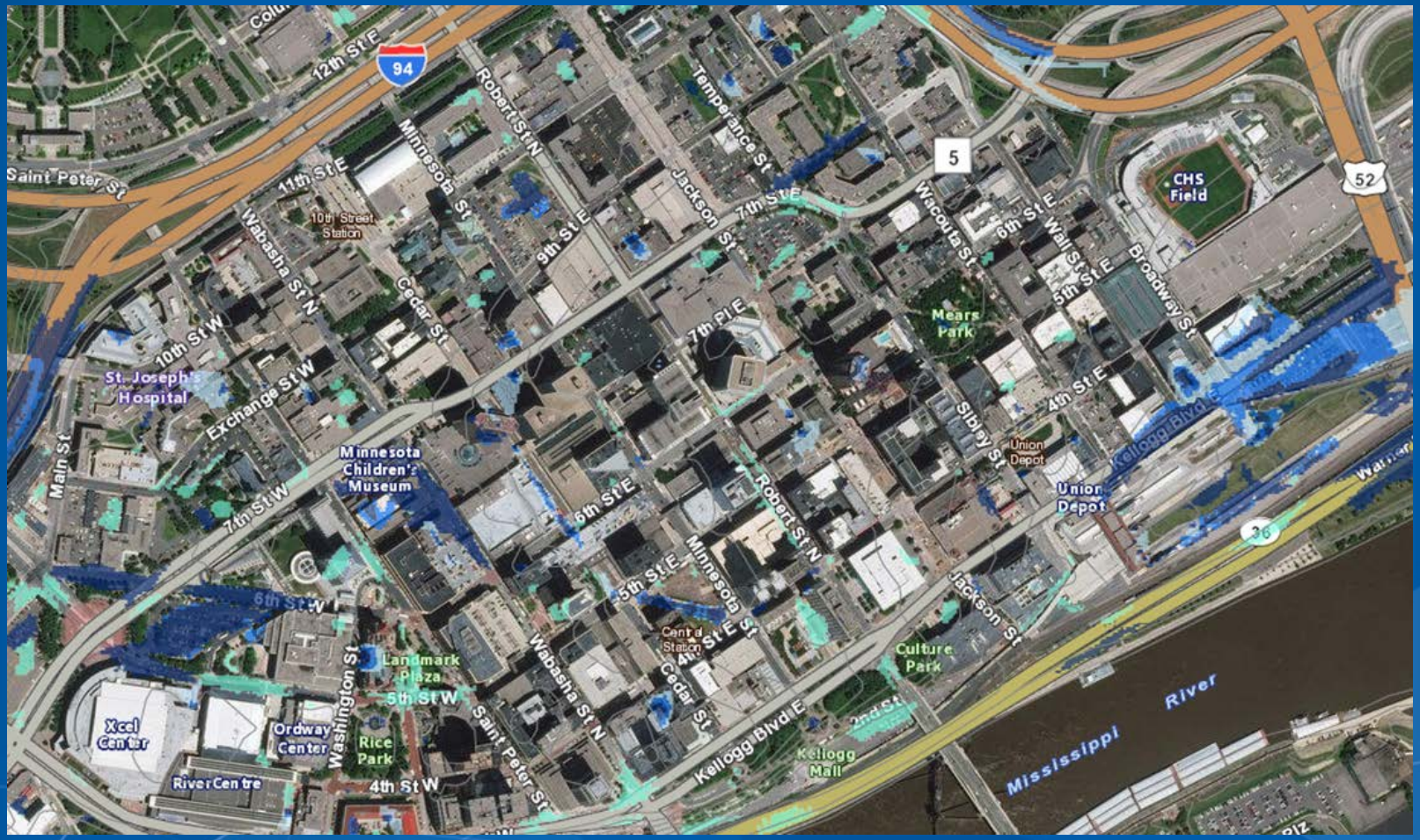
Mapping Tool



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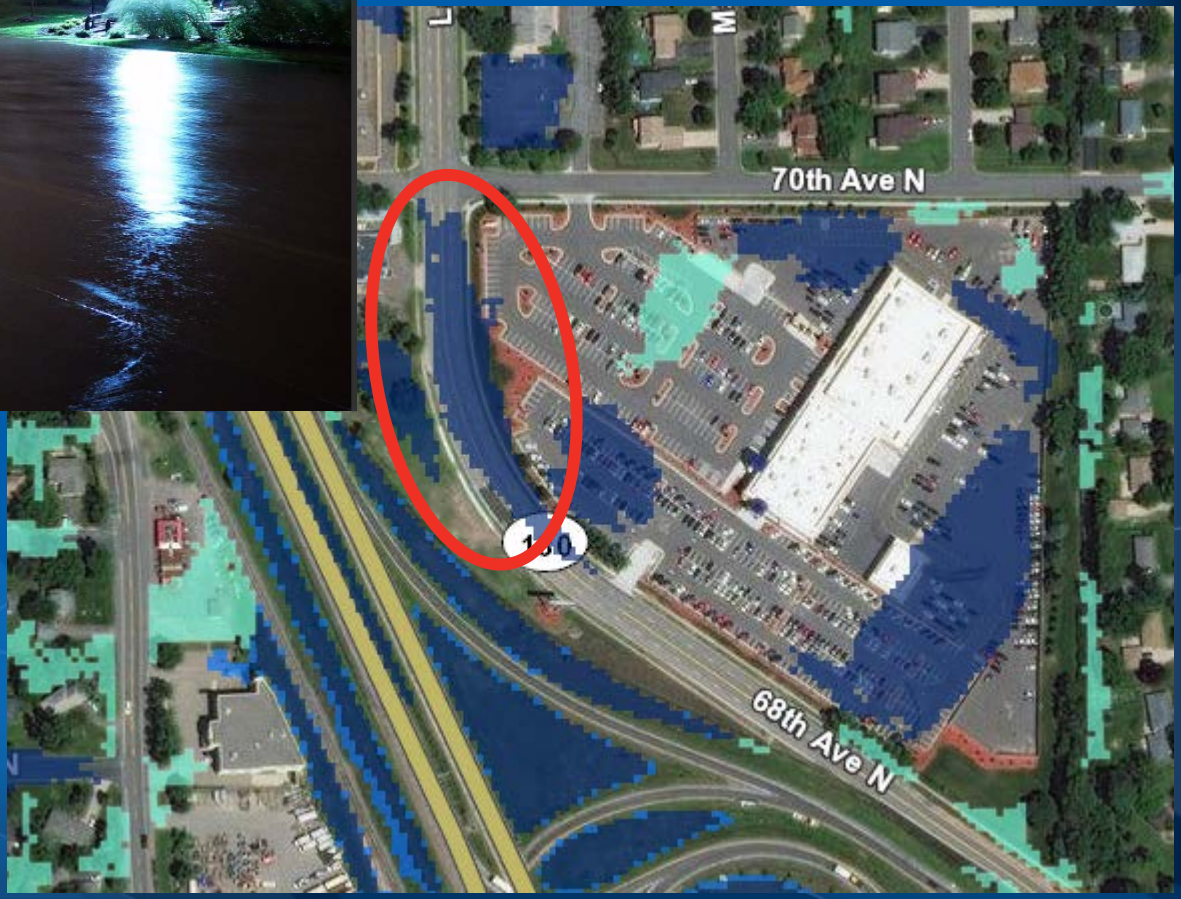
Verification

Image Source: Twitter, 70th Ave North and Lakeland, Brooklyn Park, 9/22/2016



Verification

Image Source: Twitter, Weaver Lake Road and Zachary Lane North, Maple Grove, 9/22/2016

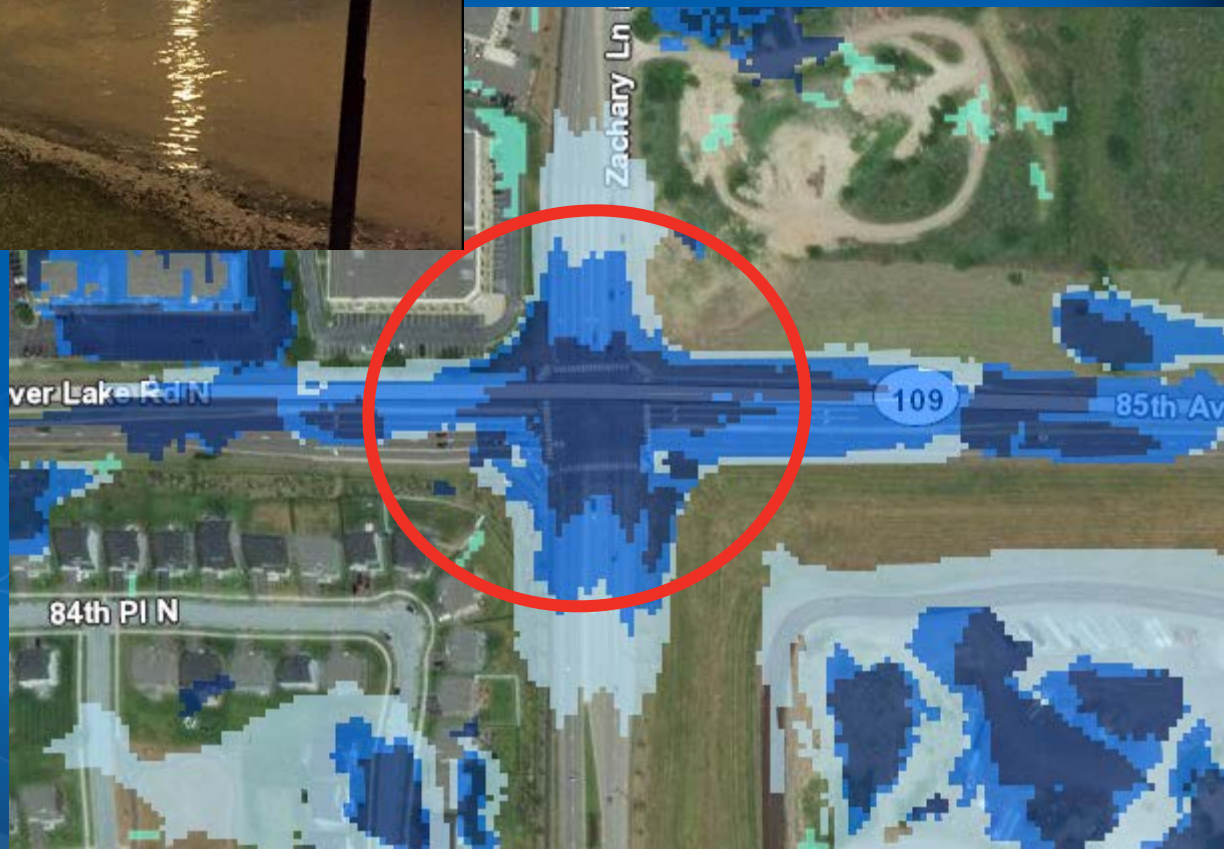


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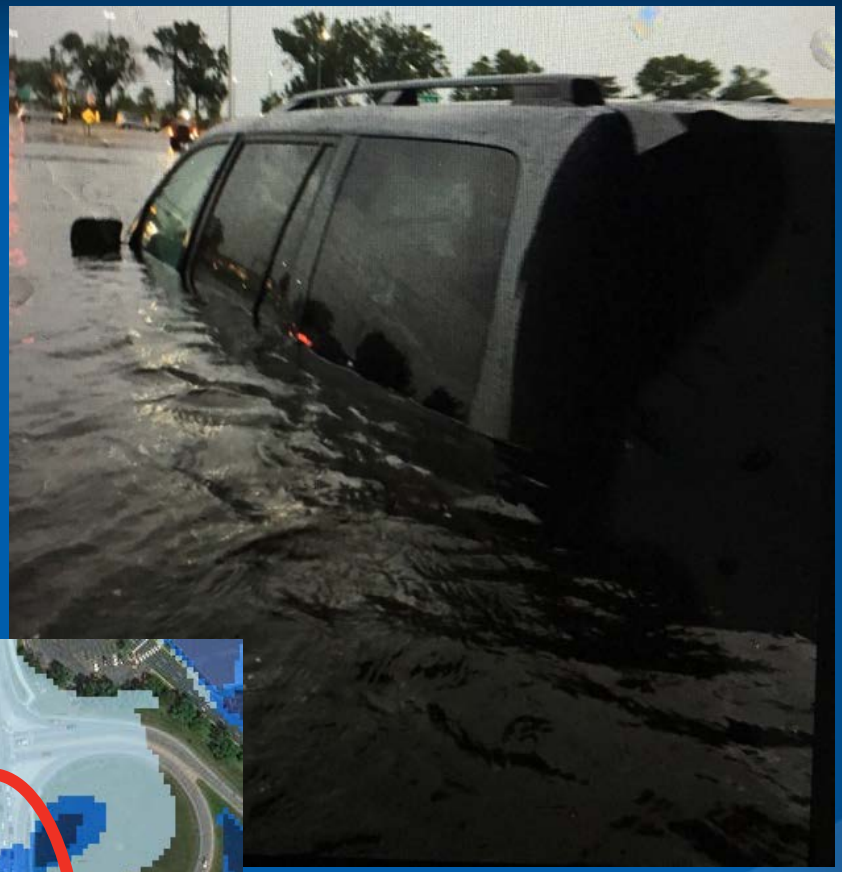
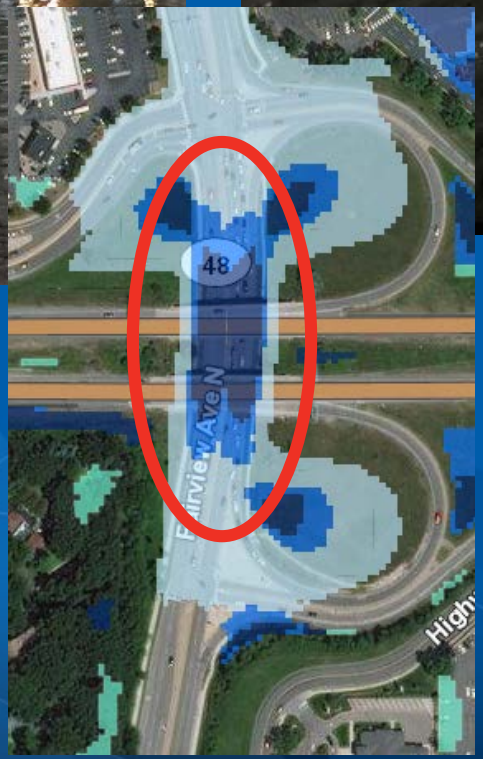
Image Source: Fox News, Fairview Ave & Hwy 36, Roseville, 7/5/2016





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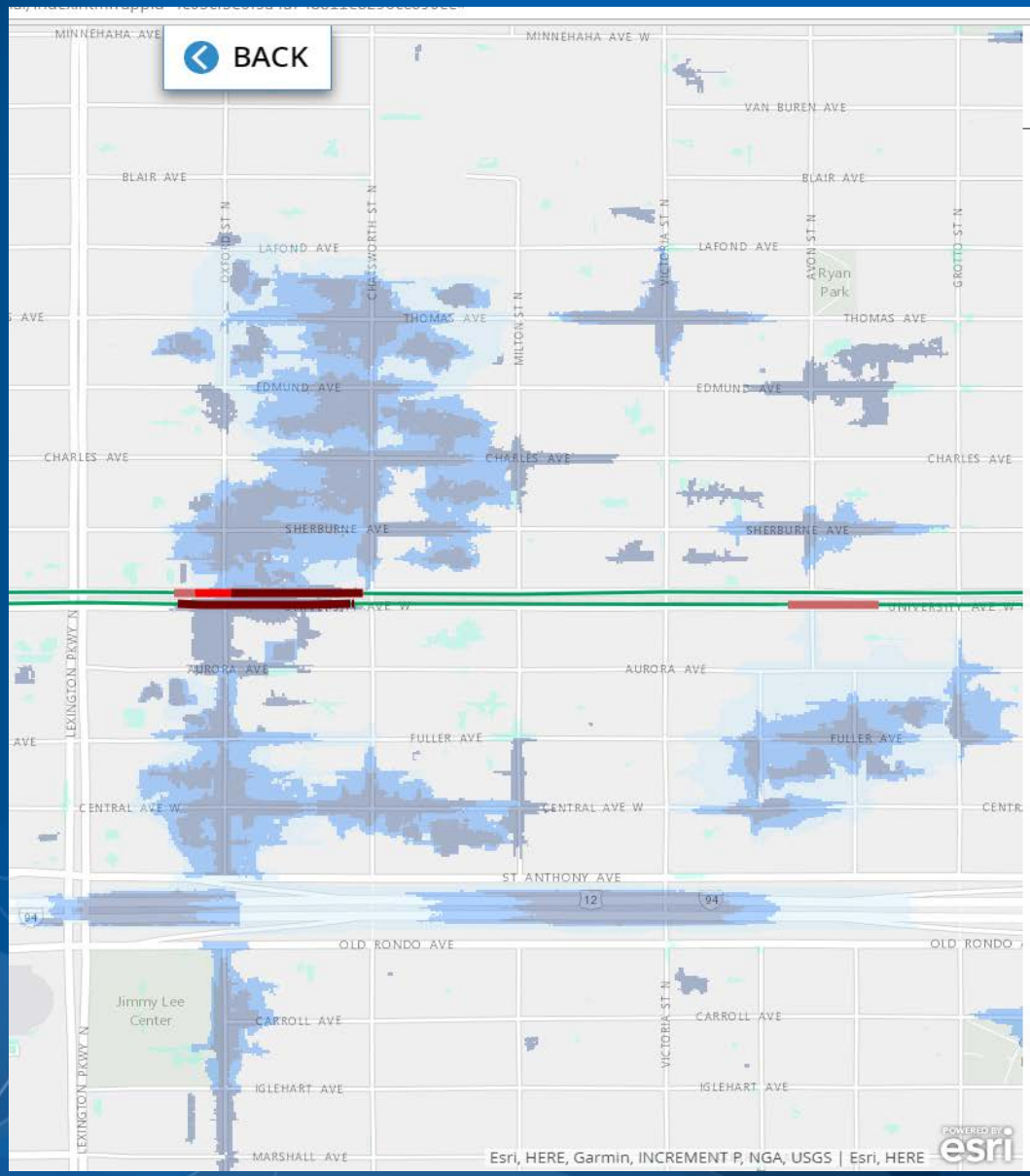
Story Map



Metropolitan Council Environmental Se...

Climate Vulnerability Assessment

Green Line

- **18.01 mi** of track
- **12.7 million trips** in 2016
- Connects Minneapolis and St. Paul downtowns
- Serves: University of Minnesota and home facilities of every major Minnesota professional sports franchise

- **3.52 mi** of line subject to bluespot flooding
- **54.5%** of bluespots are highest category risk
- Frequent intersection (similar to blueline), but **less severe**

Passengers wait as a METRO Green Line train pulls up to the Raymond Avenue Station.

Local Example - Click to Zoom to Analysis

- **Large potential flood events** could complicate alternative service and emergency planning
- **High obstruction risk** between stations

Next Steps

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Complete Project Work

- Additional Localized Flooding CVA (Chapters) Forthcoming:
  - Regional Parks
  - Facilities and Council Housing
  - Wastewater and Water Resources
- Part 2: Extreme Heat
- Part 3: Human Vulnerability
- Other Deliverables:
  - Finalized Mapping Tool (Localized Flooding & Extreme Heat)
  - Story Map

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Additional Direction

- Would your community find the mapping tool useful?
- How do we communicate the application of the tool to local communities?
- Are there other things we should be providing or considering?
- Would you like to see details as our work contintues?
- Other questions?

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Any Questions?

THANKS!

Project Manager

Eric Wojchik
Local Planning Assistance
651-602-1330
eric.wojchik@metc.state.mn.us

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