INLAND FLOODING ANALYSIS UPDATE

Updates to Transportation Risk & Vulnerability Assessment using new data

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CAC Committee Meeting
September 11, 2025

Agenda Item #3

National Capital Region
Transportation Planning Board

Agenda

- Natural Hazards + Transportation Impacts
- Resilience work at TPB to date
- Prior transportation asset flood risk analysis
- Updated flood risk analysis
- Key takeaways & what you can do
- Wrap-Up, Q&A

Word Cloud

What does the term “resilience” mean to you with regards to transportation in our region?

Natural Hazards to Transportation

- **Extreme heat** causes
  - Rails to overheat and expand, risking train derailments
  - Concrete roads to crack and asphalt to soften
  - Bridge joints to expand
- **Extreme winter conditions** causes
  - Freeze/thaw cycle that create roadway potholes and cracking
- **Extreme precipitation and flooding** causes
  - Erosion and collapse of roadways and supporting structures
  - Road closures during and immediately following a flood event

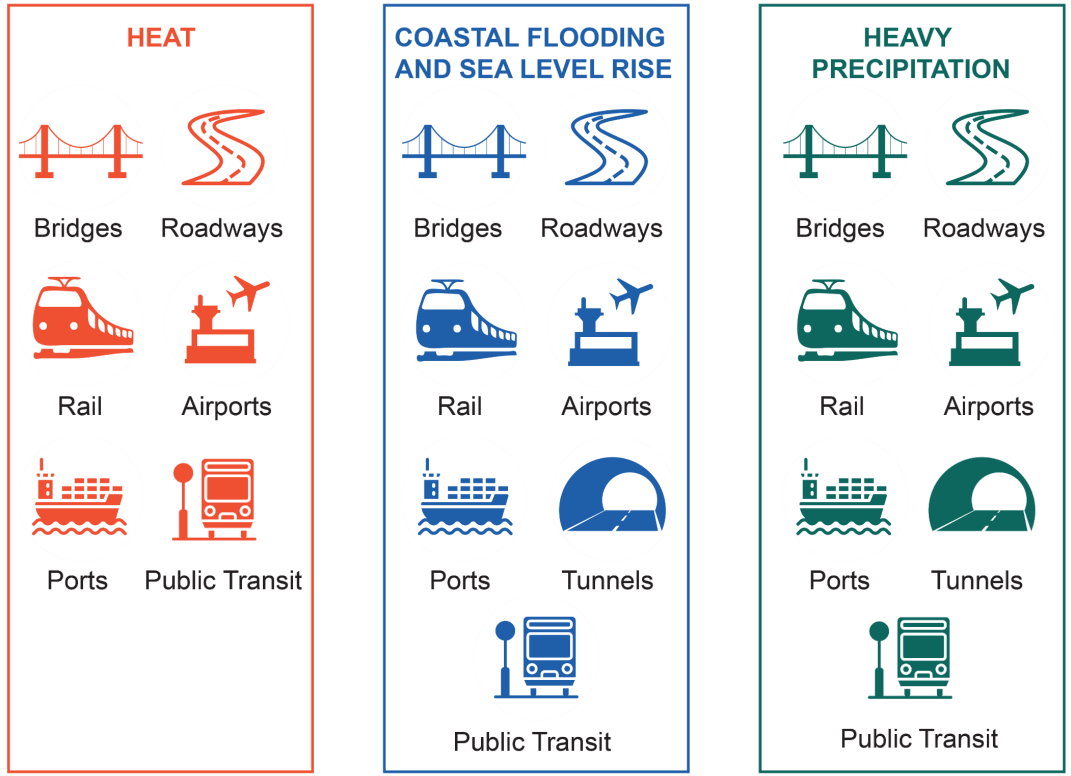


Figure: Fourth National Climate Assessment, Transportation Chapter

Resilience

- **Resilience** is the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions from natural hazards.

Motorists stranded on a section of Canal Road in Washington DC due to flash flooding on July 8, 2019 (WTOP, 2019)

TPB's Road to Resilience

2020

Adopted the goal of becoming a Climate Ready Region and making significant progress to be a Climate Resilient Region by 2030

2021

Developed the TPB Resiliency Study, which synthesizes adaptation planning within the region and helped inform TPB's vulnerability assessment

Integrated resilience into Visualize 2045

2022

Hosted a Climate Resiliency Planning Webinar Series to engage member agencies, help them understand climate vulnerabilities, and build their capacity to advance resilience efforts

2023

Held a Regional Resiliency Forum and convened a working group of transportation and planning agencies

Developed an interactive mapping tool of the results from TPB's vulnerability assessment

2024

Published the Risk-Based Vulnerability Assessment

Published the Transportation Resilience Improvement Plan (TRIP), which lists priority resilience projects for the region

Formed Subcommittee

2025 & Beyond

Annually solicit resilience projects to add to the TRIP priority project list

Complete additional studies, such as the Flooding Impact Analysis

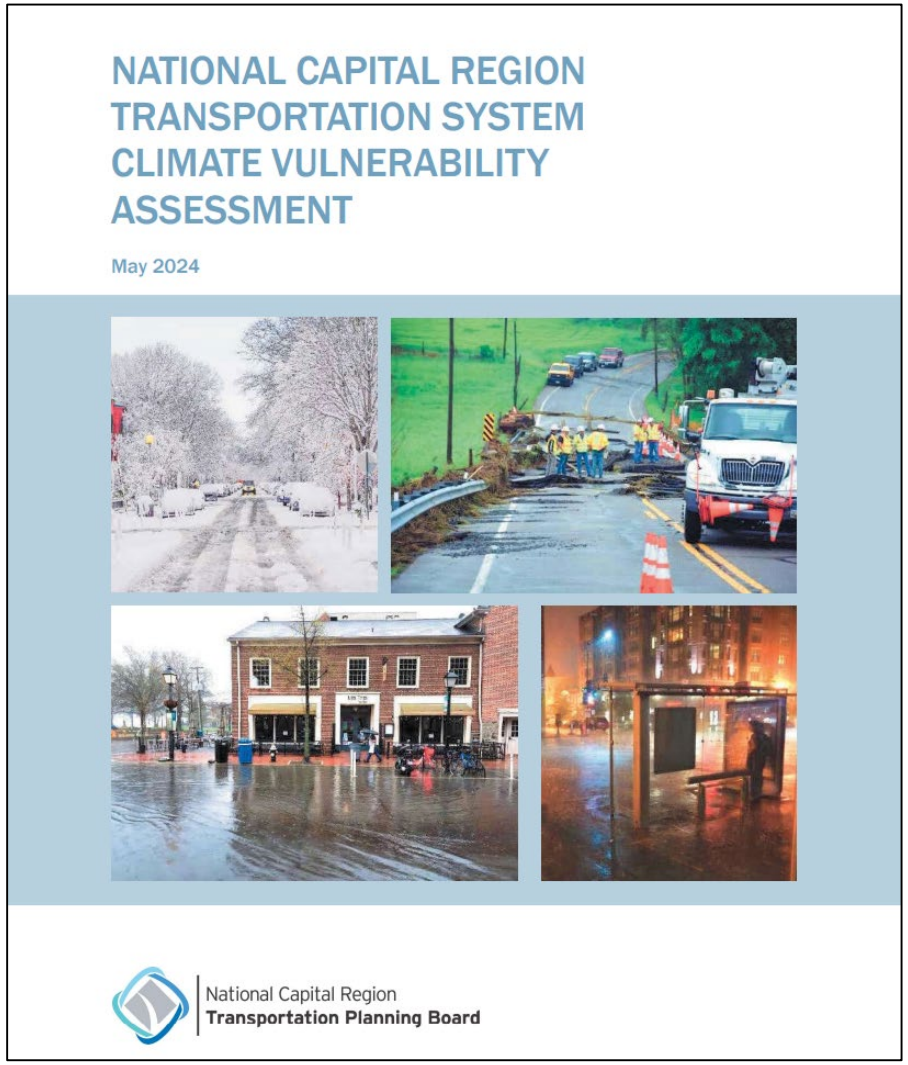
Continue to facilitate collaboration

2024 Risk-Based Vulnerability Assessment

Found that many of the region's transportation assets are at risk to coastal and riverine flooding using FEMA Floodplain data:

- 13.8% of roads/highway miles
- 4% of bus stops
- 6.9% of rail stops
- 39.1% of rail line miles

But that wasn't the whole story…



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Different types of flooding

Coastal and Riverine Flooding – 2020 Route 50 flooding event in Prince George's county – within a FEMA floodplain

Route 50 flooding in Prince George's County, 2020 (WTOP News)

Different types of flooding

Sea Level Rise – King Street in Old Town Alexandria floods regularly with severe tides

Flooding in Alexandria, 2021 (Chesapeake Bay Program/Flickr)

Different types of flooding

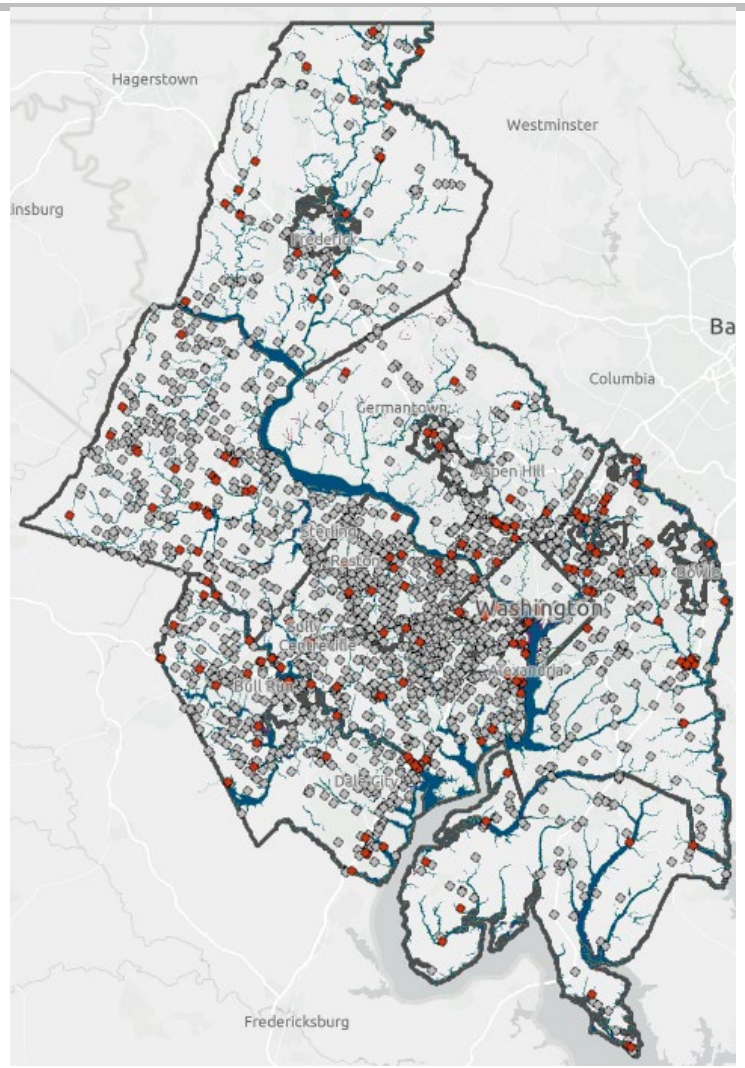
Urban Flooding – Historic flooding events at Rhode Island Ave and Bloomingdale neighborhood were *not* within FEMA floodplain

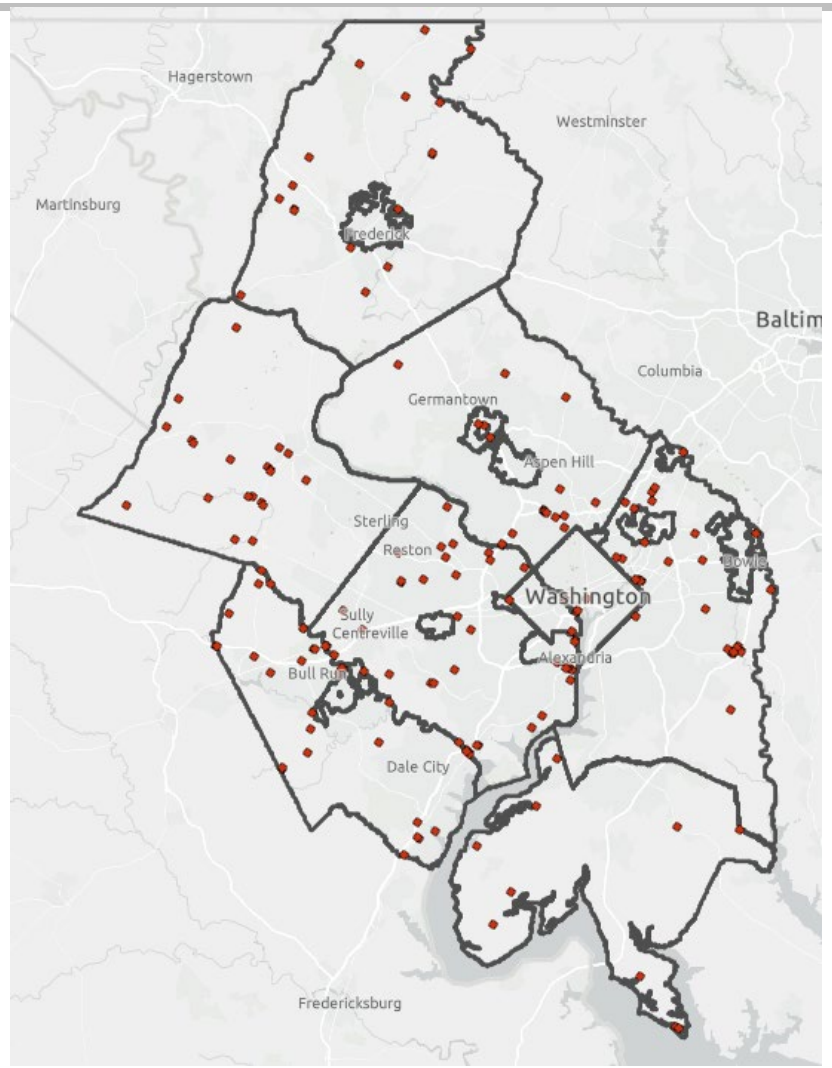
Rhode Island Ave Flooding, 2022 (WJLA)

Poll/Discussion question:

Have you seen or experienced flooding that has affected either a transportation asset or the ability of you or someone you know to get somewhere they needed to be? When or where?

Reported events inside/outside FEMA floodplain





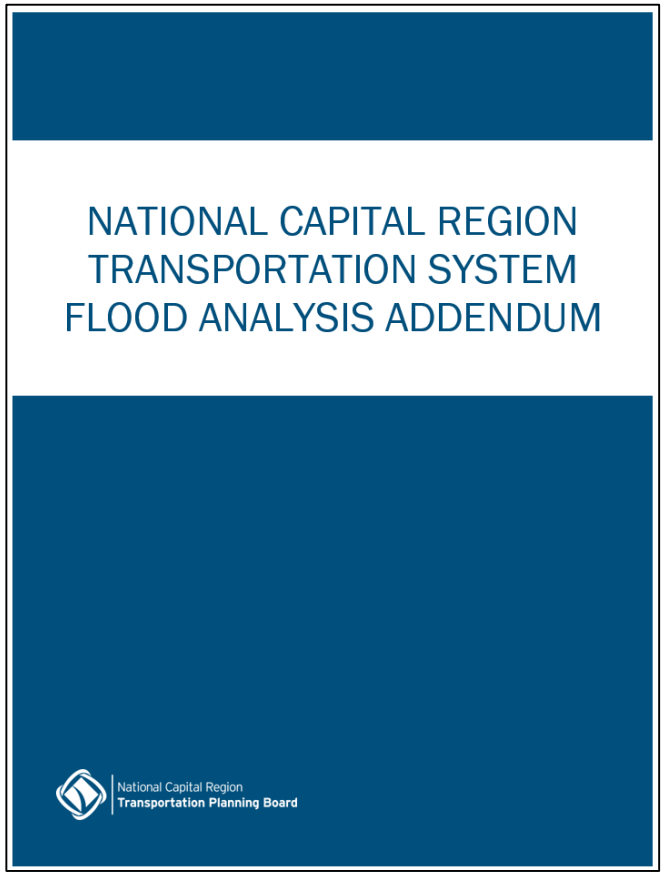
Goal of the new analysis:

Improve TPB's understanding of future inland flood risk and increase the region's resilience and long-term planning.

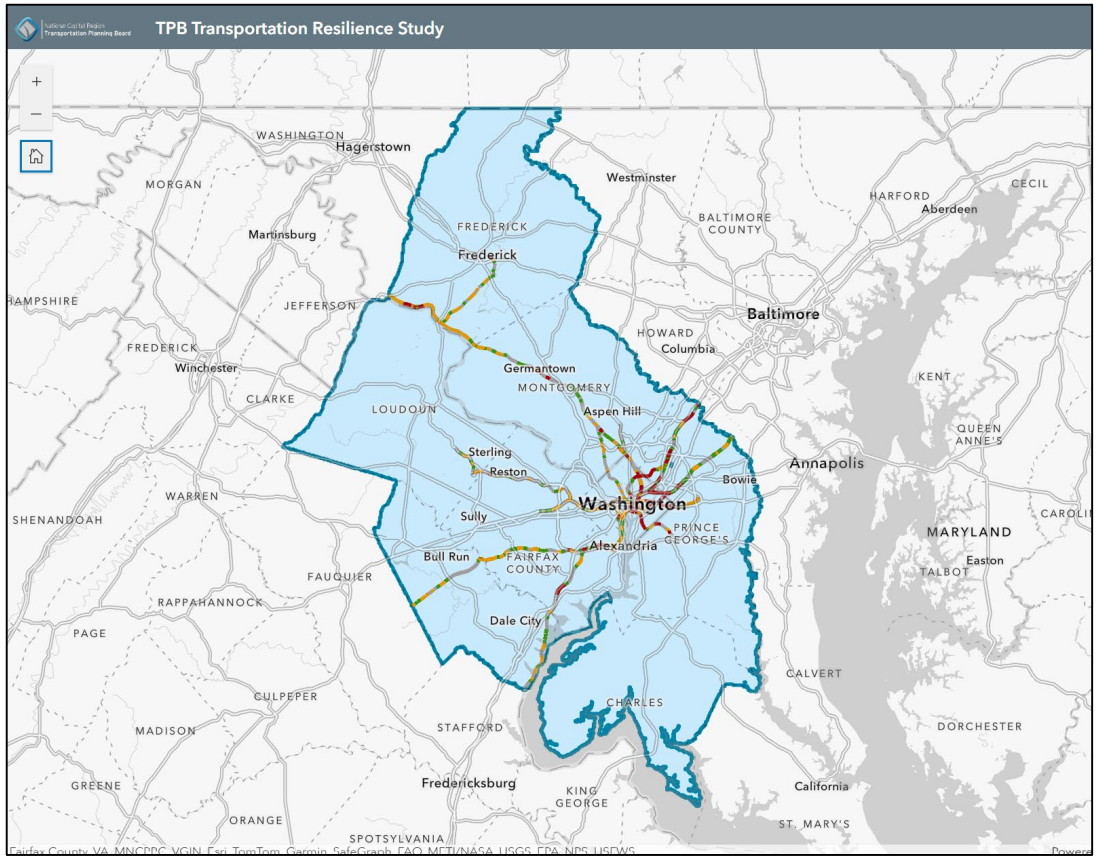
ANALYSIS RESULTS

Analysis Products

Flood Analysis Addendum



Regional Interactive Resilience Mapping Tool Update



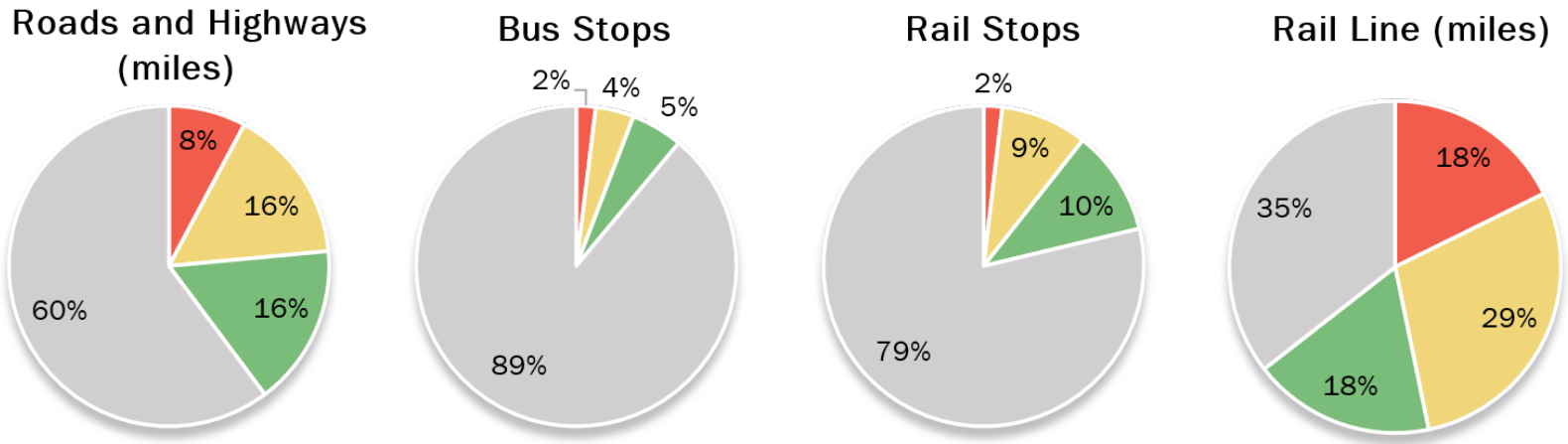
Key Takeaway

More transportation assets are at risk to temporary flooding based on the Fathom-informed analyses relative to the FEMA-informed analysis across historical and future time horizons.

Percent change in exposed assets identified in the 2020 Fathom-informed analysis compared to the FEMA-informed analysis

+25%	+7%	+13%	+25%
Road and Highway Miles	Bus Stops	Rail Stops	Rail Line Miles

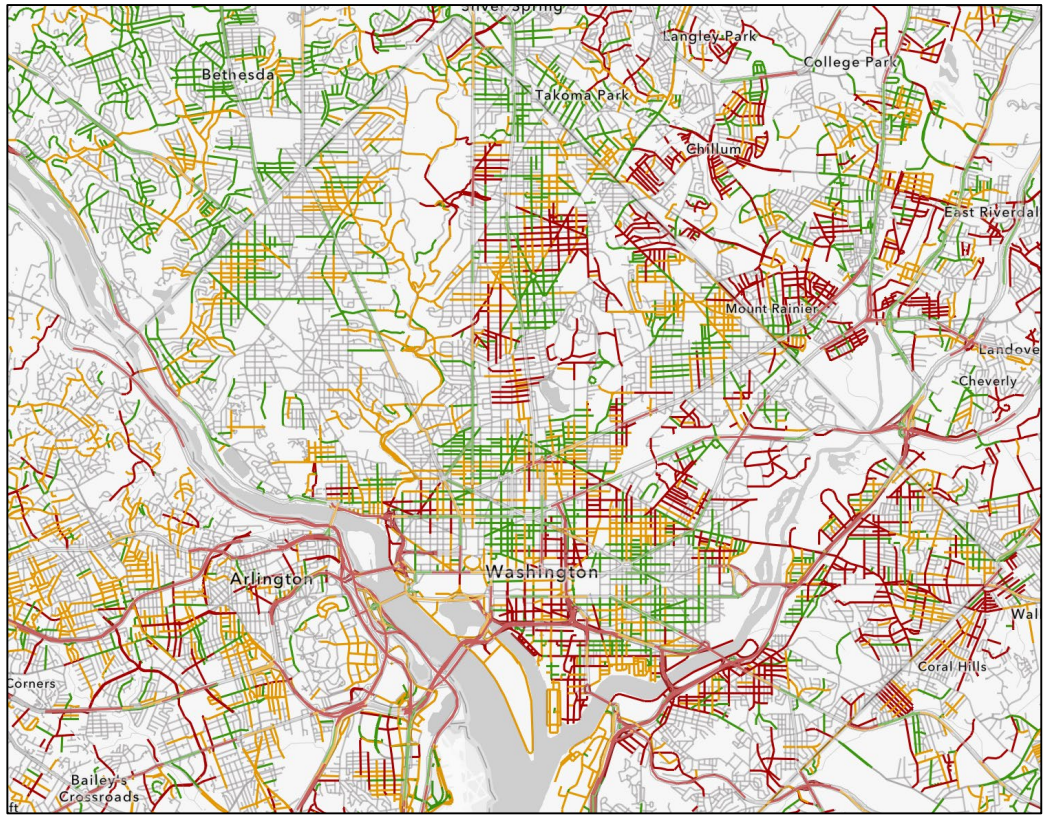
Risk score distribution for 2050 Fathom-informed analysis



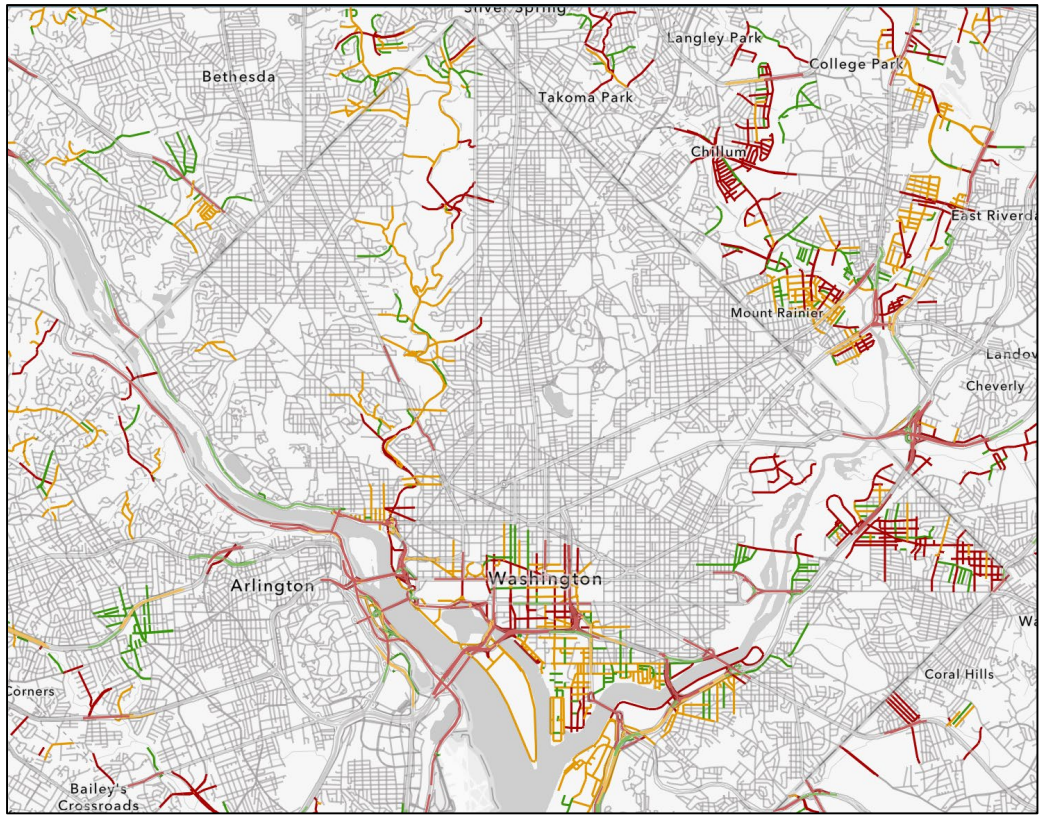
Road and Highway

Fathom-informed analysis identified **38% of road and highway miles at risk in 2020**, compared to 14% in FEMA-informed analysis.

Fathom-informed SSP2-4.5 2020



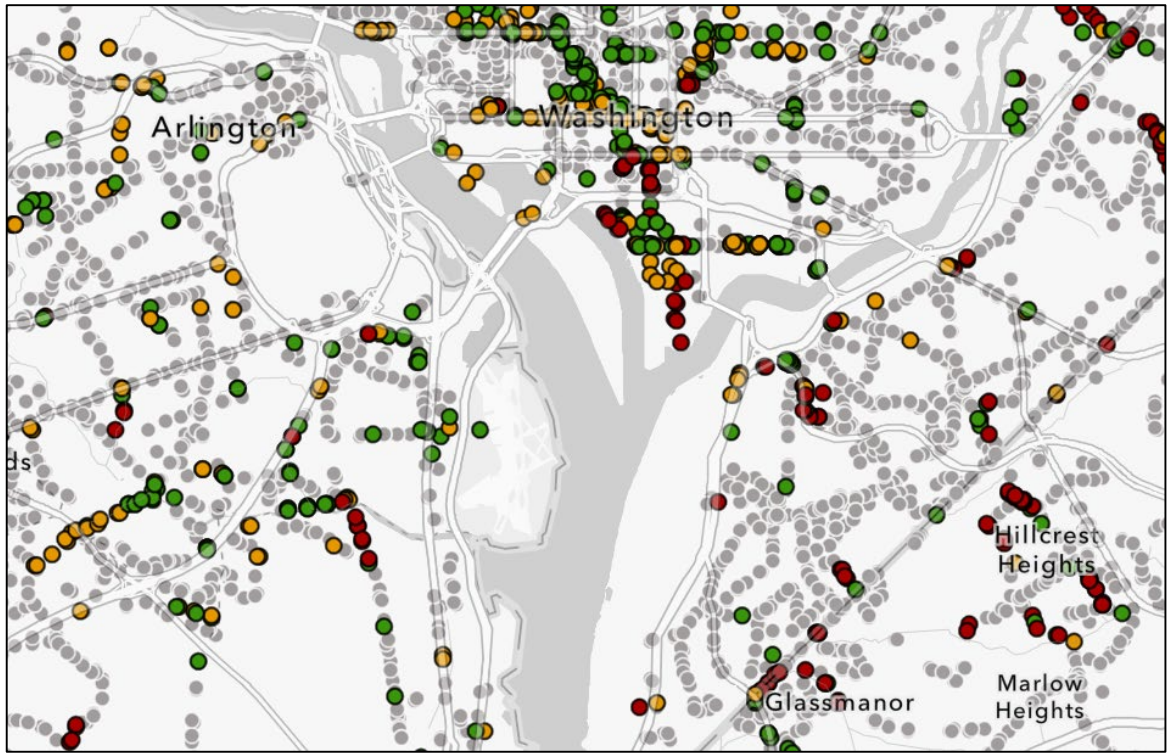
FEMA-informed



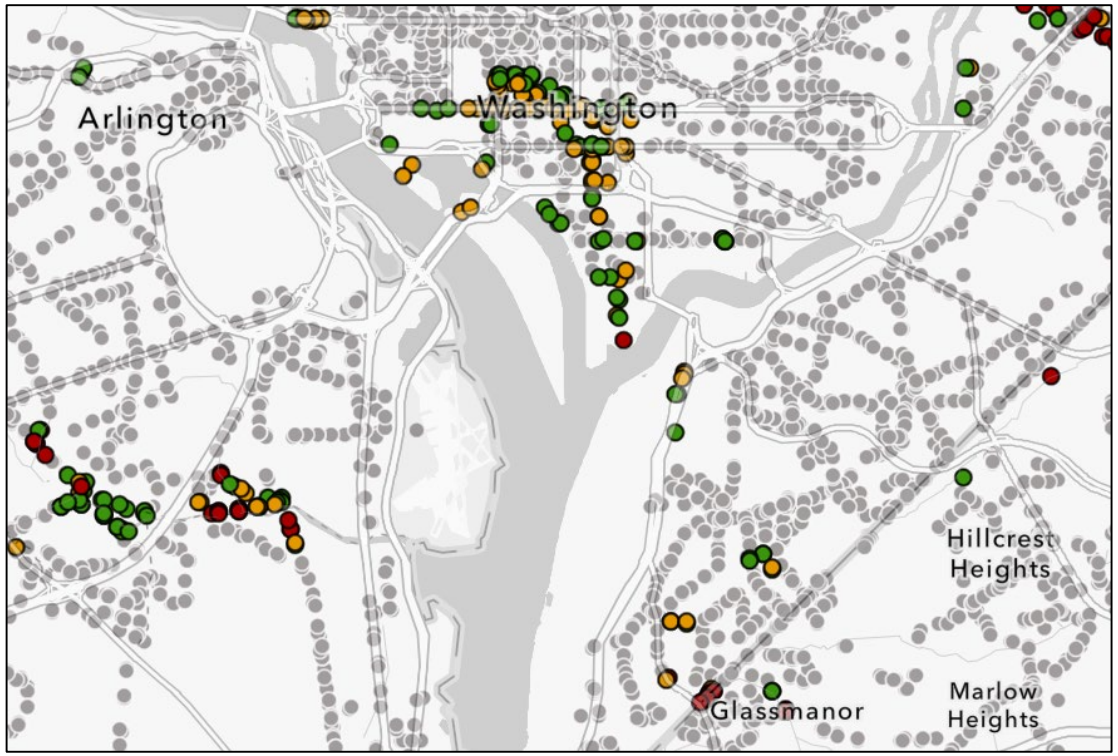
Bus Stops

Fathom-informed analysis identified **11% of bus stops at risk in 2020**, compared to 4% in the FEMA-informed analysis.

Fathom-informed SSP2-4.5 2020



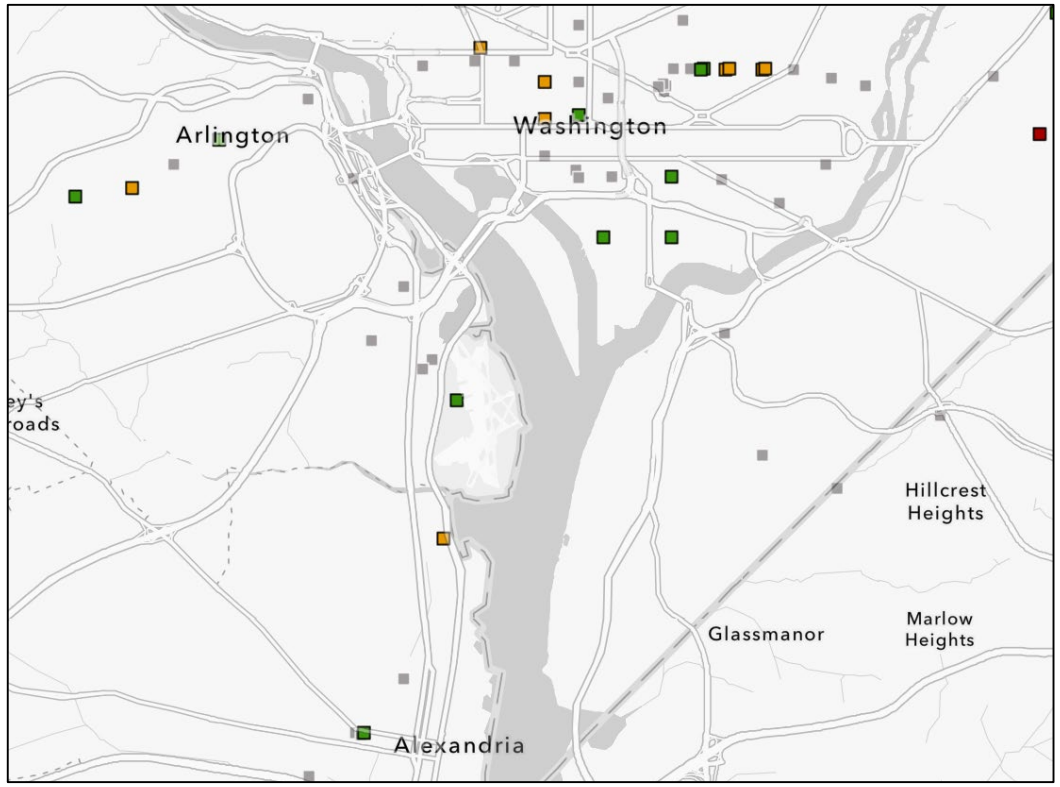
FEMA-informed



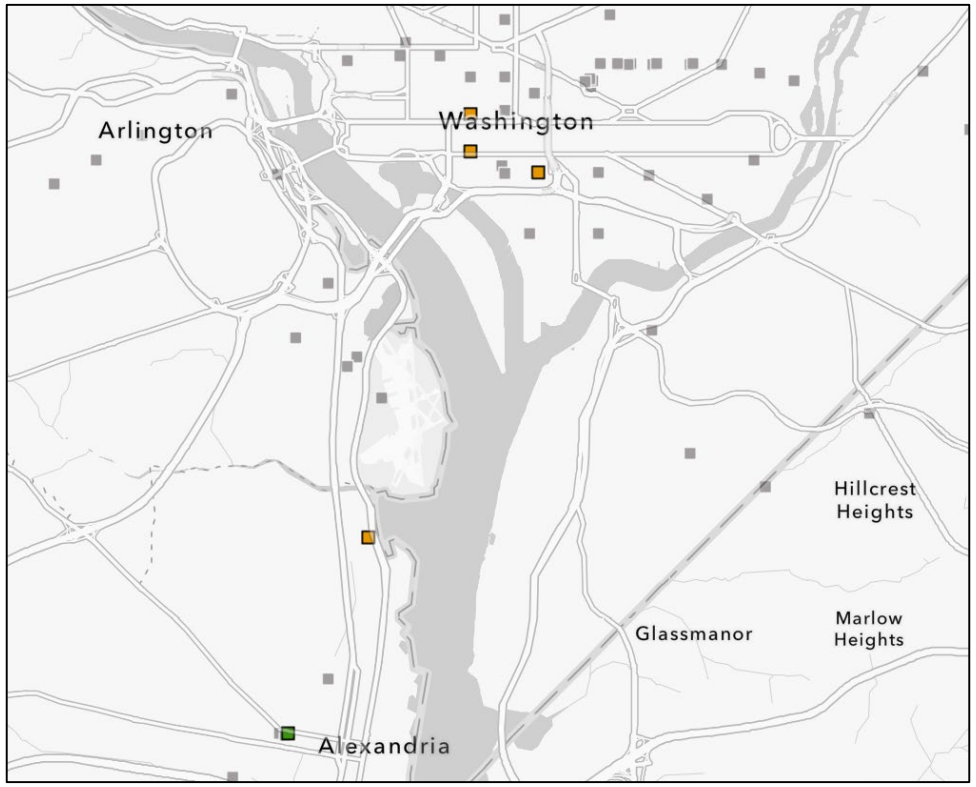
Rail Stops

Fathom-informed analysis identified **21% of rail stops at risk in 2020,** compared to 7% in the FEMA-informed analysis.

Fathom-informed SSP2-4.5 2020



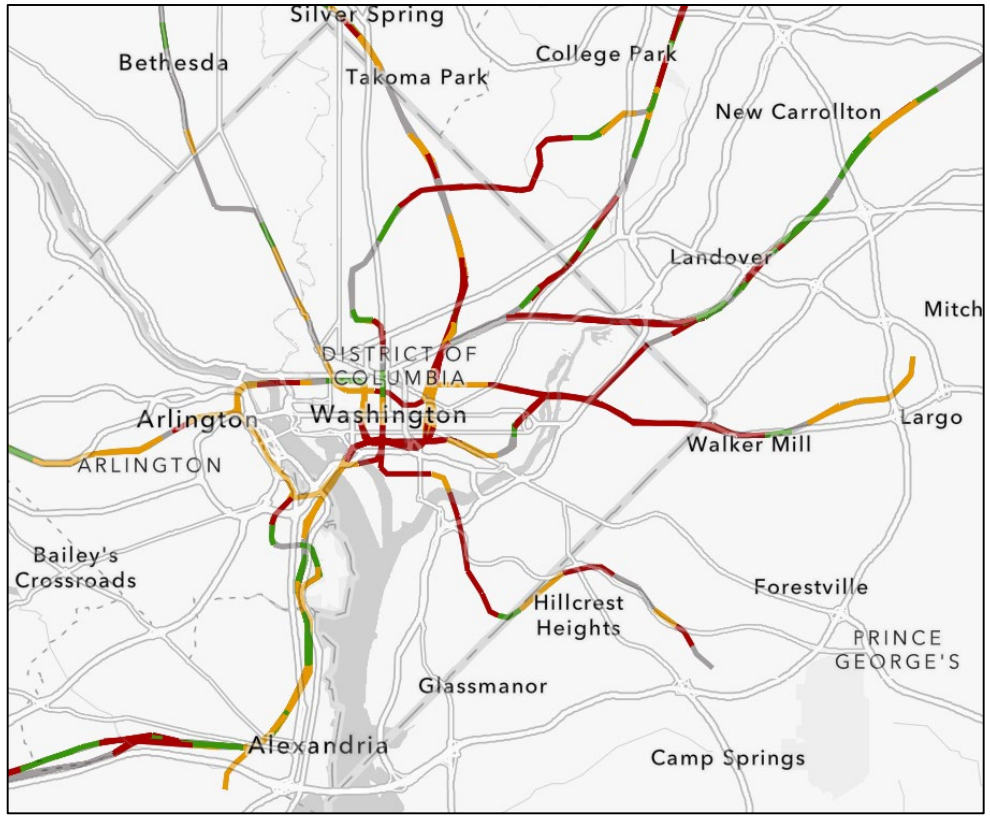
FEMA-informed



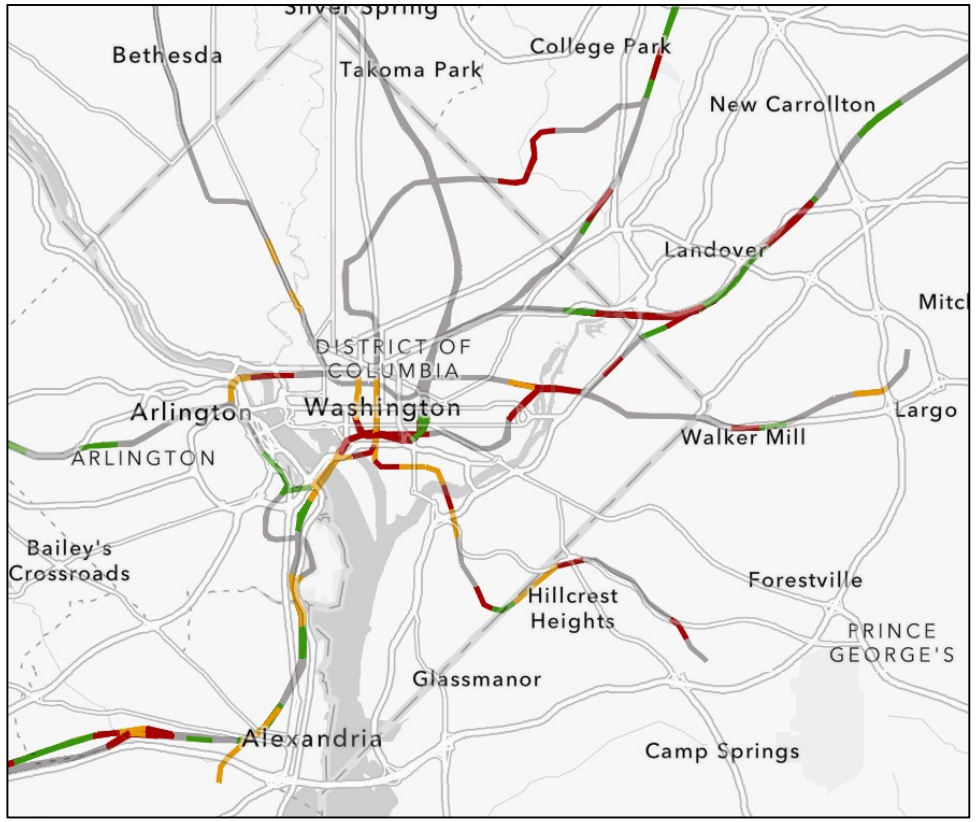
Rail Lines

Fathom-informed analysis identified **64% of rail line miles at risk in 2020,** compared to 39% in the FEMA-informed analysis.

Fathom-informed SSP2-4.5 2020



FEMA-informed



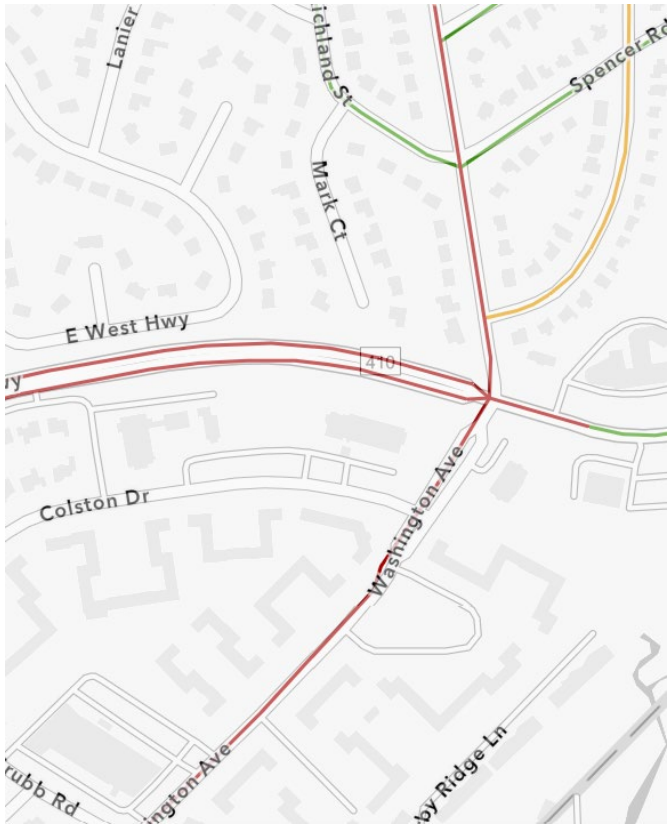
Poll/Discussion prompt:

Do any of these top-level results surprise you?

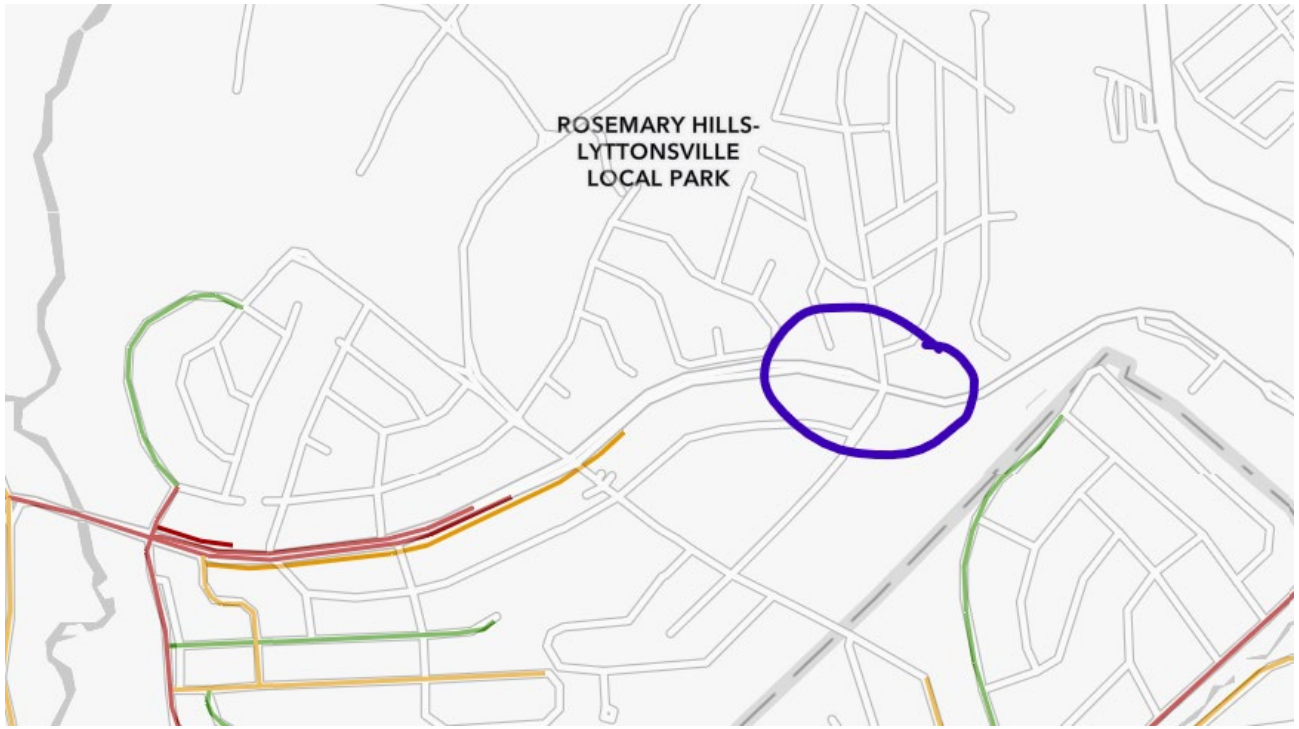
Example from July 19, 2025

Intersection of East-West Highway and Sundale Drive in Silver Spring MD (Montgomery County)

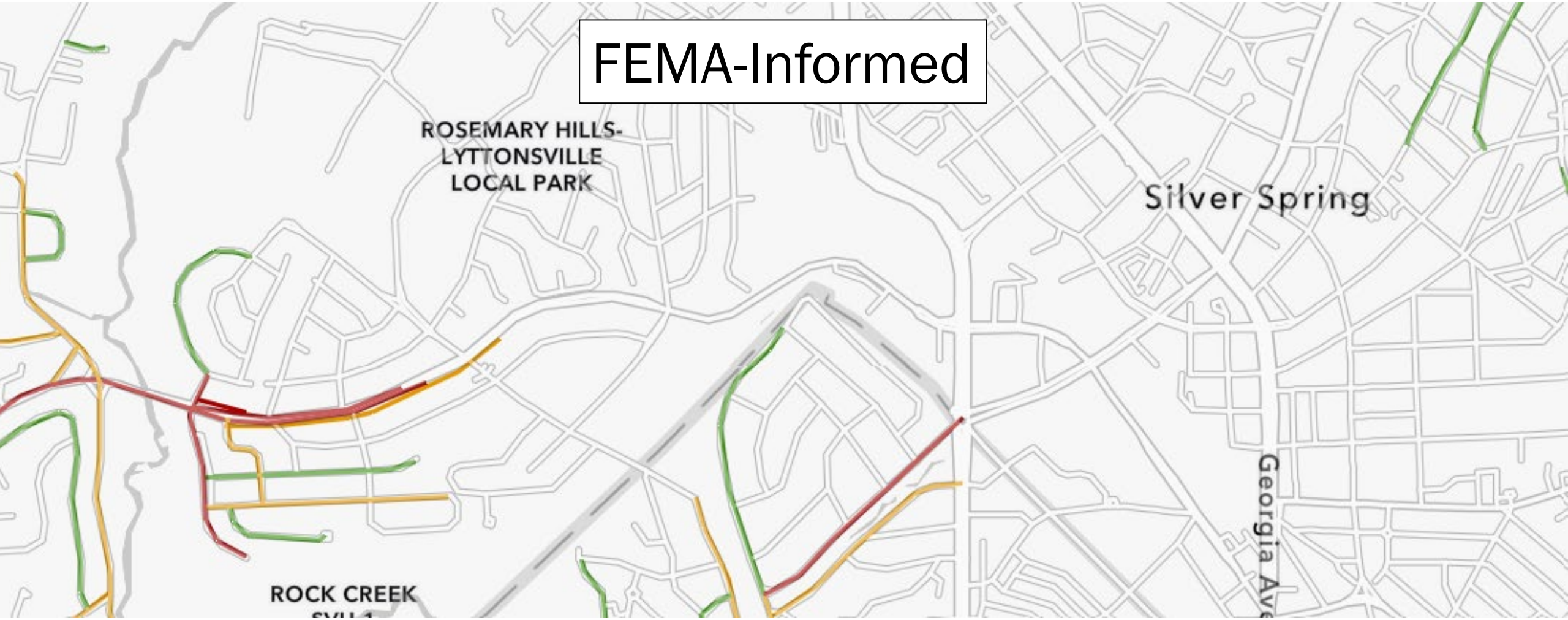
Fathom-informed SSP2-4.5 2020



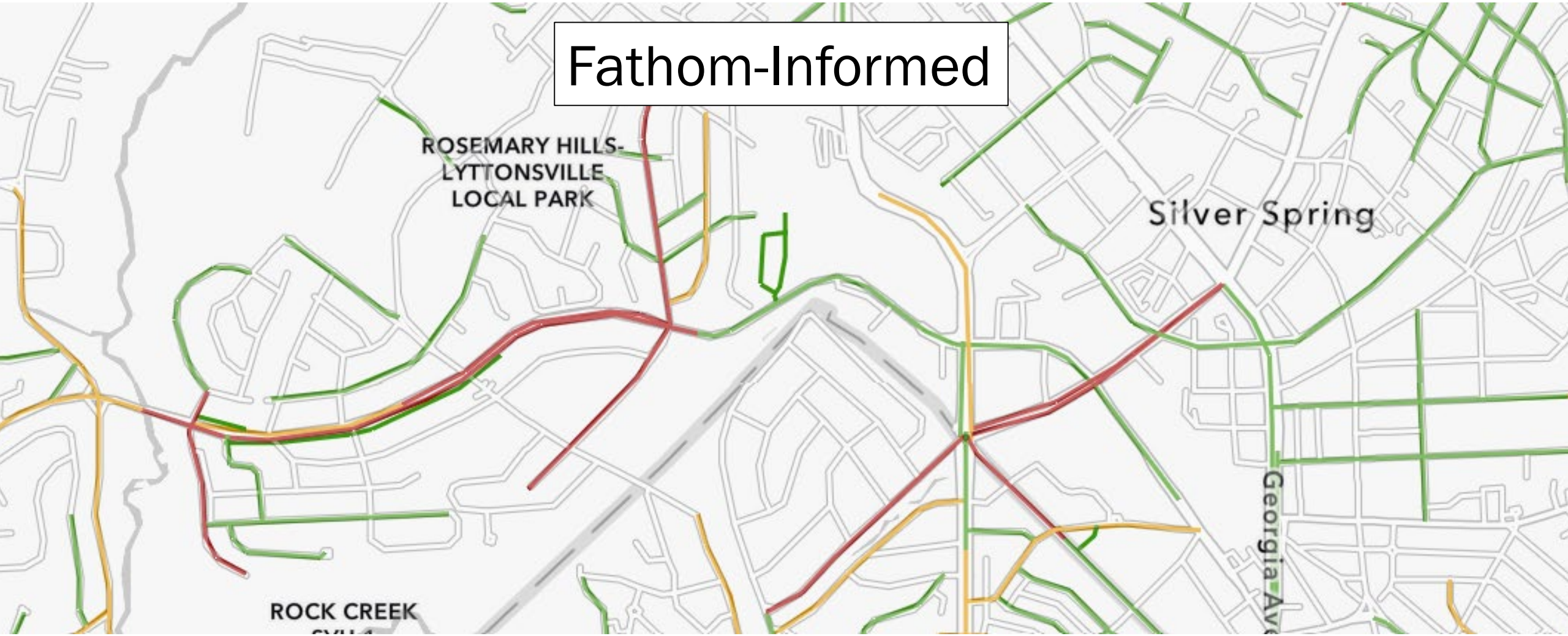
FEMA-informed



FEMA-Informed



Fathom-Informed

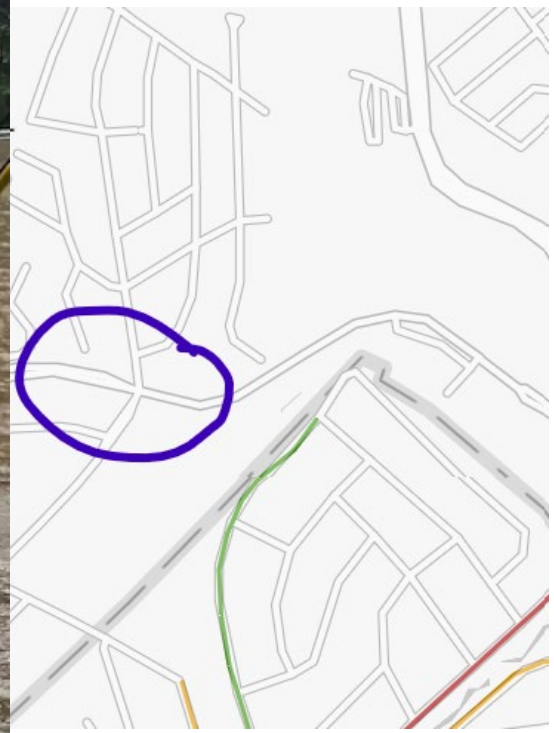


Example

Intersection of E tgomery County)

Fa ormed

A car inundated by floodwaters along East-West Highway in Silver Spring, Maryland, on Saturday. (Dave Dildine) Source: Washington Post



Map Demo:

If time permits, let’s walk through how to use the mapping tool and look at a few locations based on CAC member interest.

Final Takeaways

This updated temporary flooding analysis provides:

Enhanced Flood Risk Insights: Fathom-informed inland flood modeling provides a more comprehensive understanding of total flood risk for transportation infrastructure in TPB's service area, complementing existing FEMA-informed flood data.

Long-Term Planning Support: Empowers planners to evaluate resilience investments and transportation projects across multiple future scenarios and planning horizons.

Bolstered Regional Resilience: Strengthens the region's overall preparedness and ability to adapt to future inland flooding challenges.

How can you use this analysis?

- Be aware that more assets than just those in FEMA Floodplains may be at risk to flooding
- Use tool as a resource when prioritizing funding for infrastructure maintenance
- Use tool as a resource when opportunities arise to go after additional funding for new projects, better specificity about vulnerability for grant applications
- Reach out to TPB with any questions or a more in-depth presentation or discussion of findings or how to use the tool
- CAC – how would you like to see this tool used? Open discussion.

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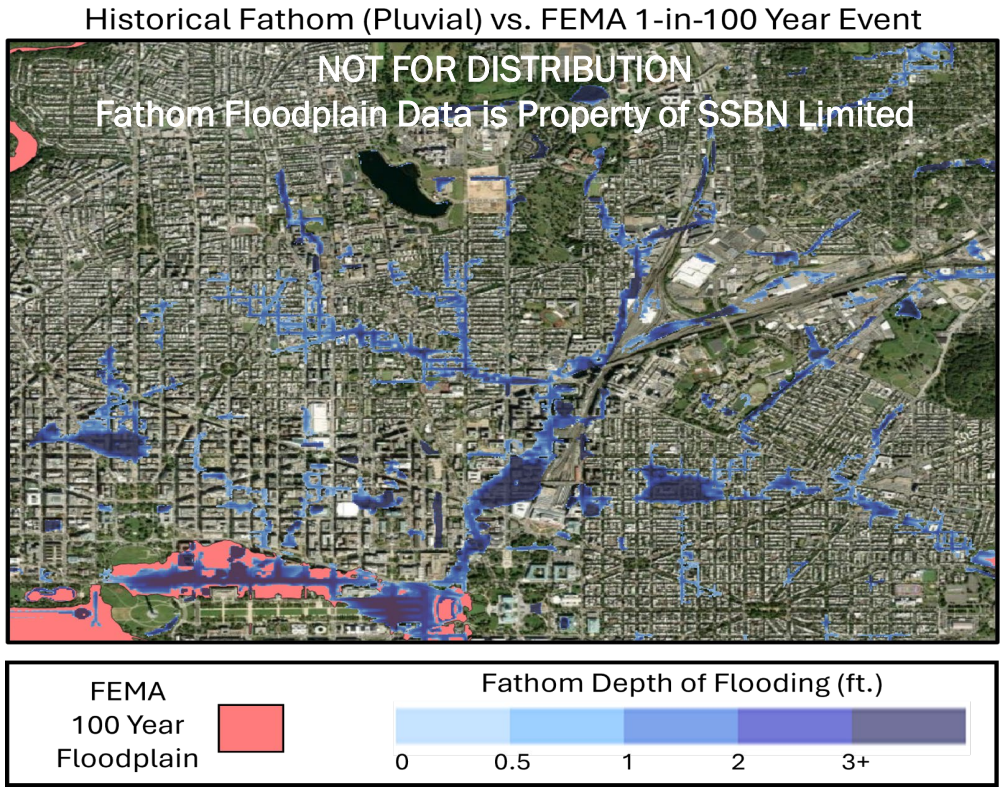
ADDITIONAL SLIDES

Fathom Data Selection

TPB selected the **Fathom US Flood Maps,** which:

- Better captures flood extents relative to FEMA by incorporating pluvial flooding and potential future changes in floodplain extent and depth due to heavy precipitation
- Multiple emission scenarios, return period floods, time horizons, and different flood types (e.g., pluvial and riverine)
- Nationally recognized and ready-to-use floodplain data

Fathom-informed analysis provides an additional, forward-looking understand of pluvial and fluvial flood that complements the original present-day FEMA-informed analysis.



Spatial comparison between Historical 1-in-100-year event extents between Fathom and FEMA.

Fathom-Informed Temporary Flooding: Methodology

The Fathom-informed analysis scores exposure based on **floodplain extent** and **inundation depth**, rather than relying solely on floodplain extent.

Exposure scoring rubric for Fathom-informed temporary flooding.

Weighting	50%		50%	
Indicator	Exposure Score	Flood extent	Exposure Score	500-year flood depth
Fathom U.S. Flood Maps	3	100-year floodplain	3	>24 inches
	2	500-year floodplain	2	>12 inches
	1	500-year floodplain + differential buffer	1	>0 inches
	0	None	0	None

The 12- and 24-inches inundation depth thresholds **align with the Maryland DOT SHA vulnerability assessment and FEMA Flood Risk and Analysis guidance**

Time Horizons: 2020 (historical), 2030, 2050, 2080
Emission Scenarios: SSP2-4.5 (moderate emissions), SSP5-8.5 (high emissions)

Fathom-Informed Temporary Flooding: Risk Methodology

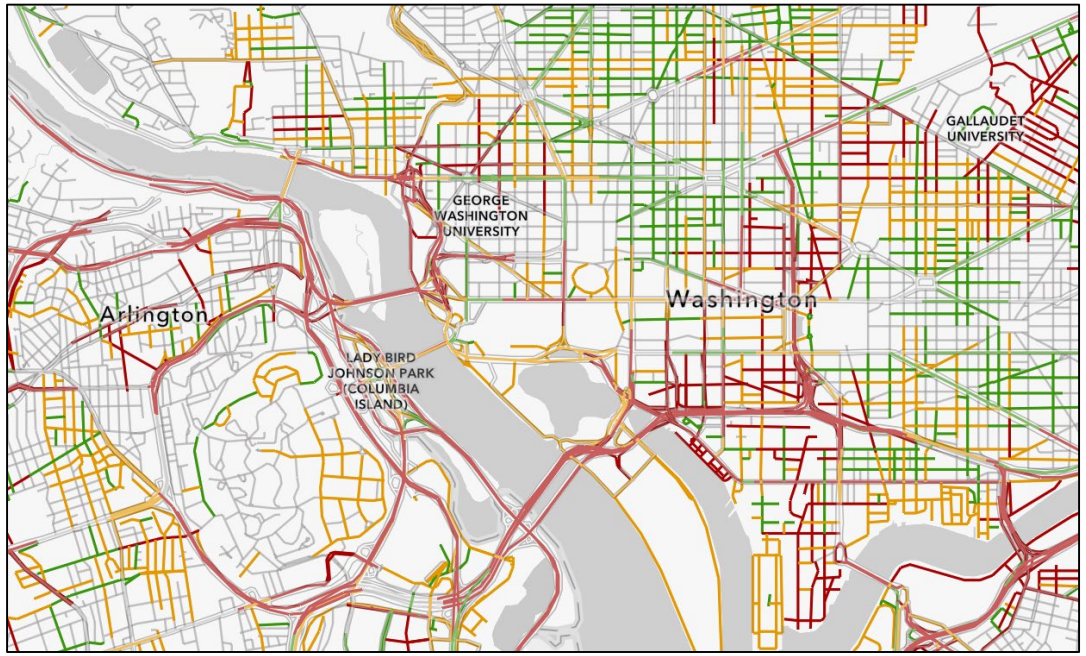
The Fathom-informed analysis used the same risk calculation used in the vulnerability assessment:

- **Exposure indicator:** Hazard Exposure (70% weighting)
- **Criticality indicator:** MWCOG Equity Emphasis Areas, Functional Classification, Detour Length (30% weighting)

Assets are classified as having **high**, **medium**, **low**, or **no risk**.

Assets: Roads and highways, bus stops, rail stops, and rail lines

Screenshot from Mapping Tool demonstrating risk score categories



Updated Mapping Tool

The Mapping Tool is updated with the Fathom-informed temporary flooding analysis, with the following scenarios:

- SSP2-4.5
  - 2020 (historical)
  - 2030
  - 2050
  - 2080
- SSP5-8.5
  - 2020 (historical)
  - 2030
  - 2050
  - 2080

[TPB Mapping Tool]

Example of the updated selection panel