INLAND FLOODING ANALYSIS UPDATE

Updates to Transportation Risk & Vulnerability Assessment using Fathom Data

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Agenda Item 2A

National Capital Region
Transportation Planning Board

Recap from last meeting

The 2024 Vulnerability Assessment evaluated inland flooding using FEMA floodplains.

However, **FEMA floodplains are not forward-looking** and **do not account for pluvial flooding** from heavy precipitation.

	Climate Hazards
	Extreme heat: The quantitative analysis considered median land surface temperature in order to identify current hot spots, as these locations are likely to remain hot spots in the future. The qualitative analysis considered a broader set of variables to understand how extreme heat is projected to change, such as number of days where maximum temperature exceeds 95°F.
	Temporary flooding (coastal and riverine): The quantitative analysis includes assets exposed to the FEMA Flood Insurance Rate Map (FIRM) coastal and riverine 100-year and 500-year floods (plus an expanded buffer on the 500-year event). The qualitative analysis highlights that local records indicate a prevalence of urban (i.e., pluvial) flooding issues outside of these floodplains, which the region is working to better understand.
	Permanent flooding (sea level rise): The quantitative analysis considered inundation depth under the 2060 intermediate-high sea level rise scenario (i.e., 2 feet of sea level rise compared to 2012). In exposed locations along the tidal portions of the Potomac and Anacostia riverfronts, this flooding represents areas that would be flooded during the average high tide event (i.e., more-or-less permanently, with flooding becoming more and more common over time). The qualitative analysis considered a wider range of potential impacts (e.g., 4 to 8 feet of sea level rise by 2100), and the ancillary impacts of shoreline erosion and coastal storm surge.
	Extreme winter conditions: Geospatial data was not available to complete a quantitative GIS analysis. However, there is a large body of literature on historical and projected extreme winter conditions. The qualitative analysis considered how the frequency and intensity of extreme winter conditions are expected to change in the future, with a focus on the impacts of heavy snow and freezing temperatures.
	Extreme wind: Geospatial data was not available to complete a quantitative GIS analysis. However, there is a large body of literature on historical and projected extreme wind. The qualitative analysis considered how the frequency and intensity of extreme wind events are expected to change in the future, with a focus on the impacts of extreme storms with high winds, such as hurricanes, tropical storms, and microbursts.

Goal of the Analysis:

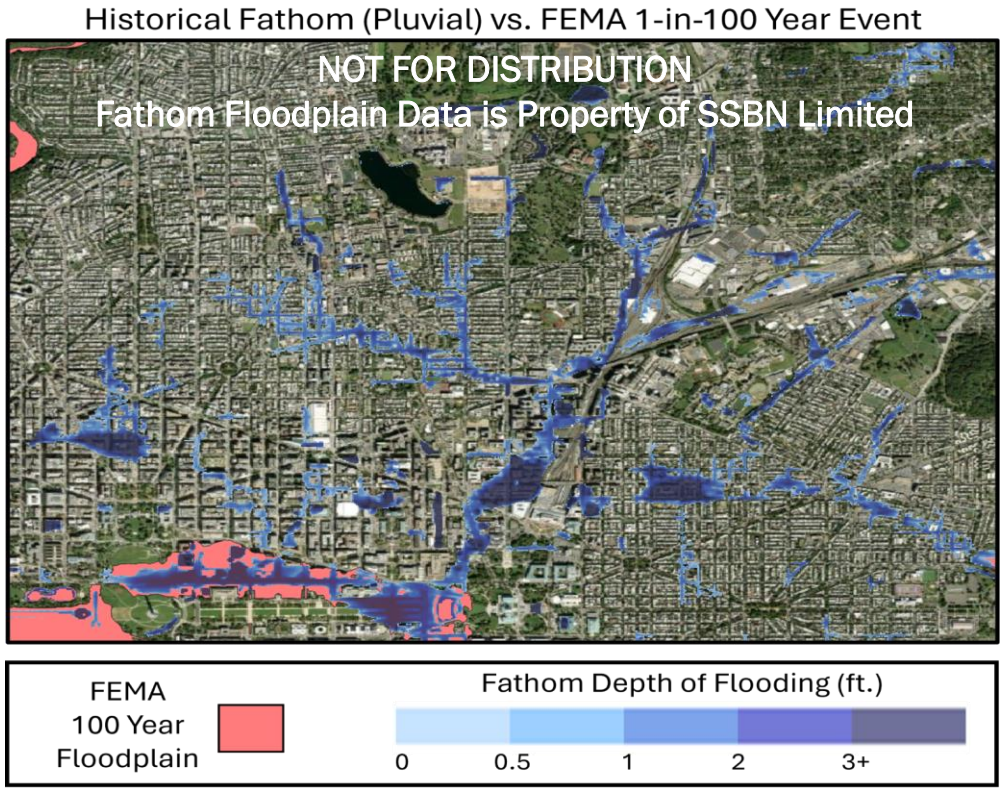
Improve TPB's understanding of future inland flood risk and increase the region's resilience and long-term planning.

Recap from last meeting

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

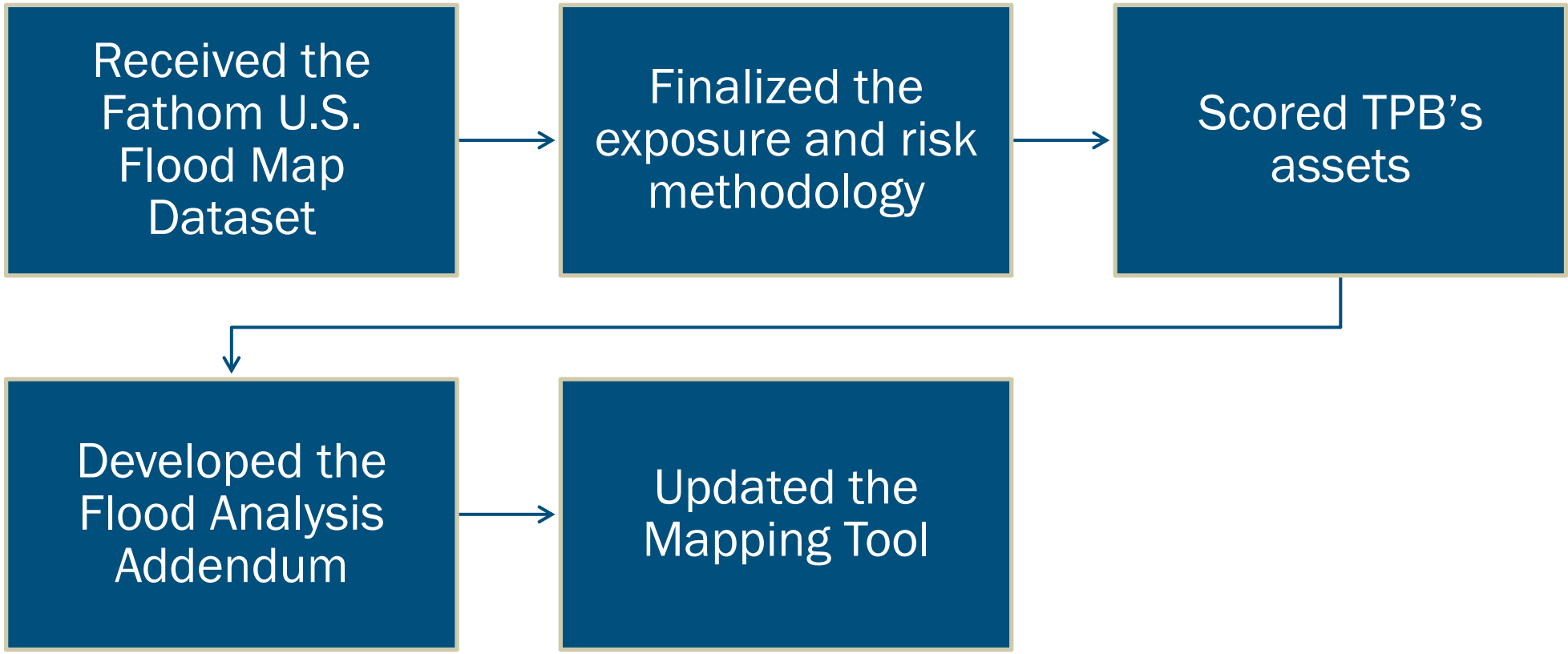
- Better captures flood extents relative to FEMA by incorporating pluvial flooding and potential future changes in floodplain extent and depth due to heavy precipitation
- Multiple emission scenarios, return period floods, time horizons, and different flood types (e.g., pluvial and riverine)
- Nationally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

Progress since the last meeting



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

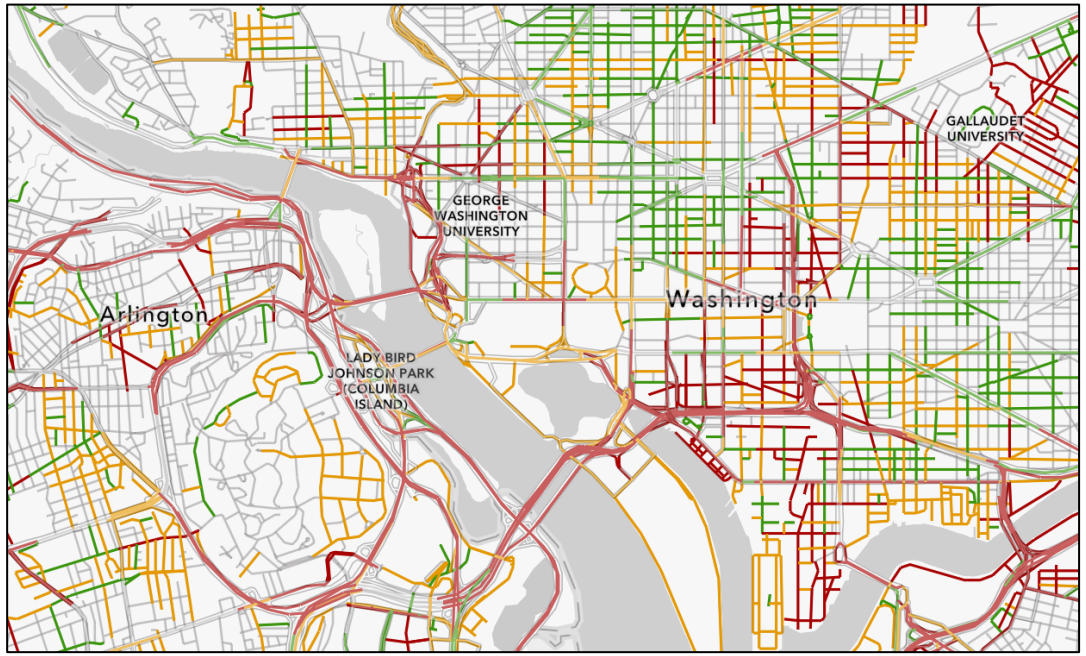
The Fathom-informed analysis used the same risk calculation used in the vulnerability assessment:

- **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



ANALYSIS RESULTS

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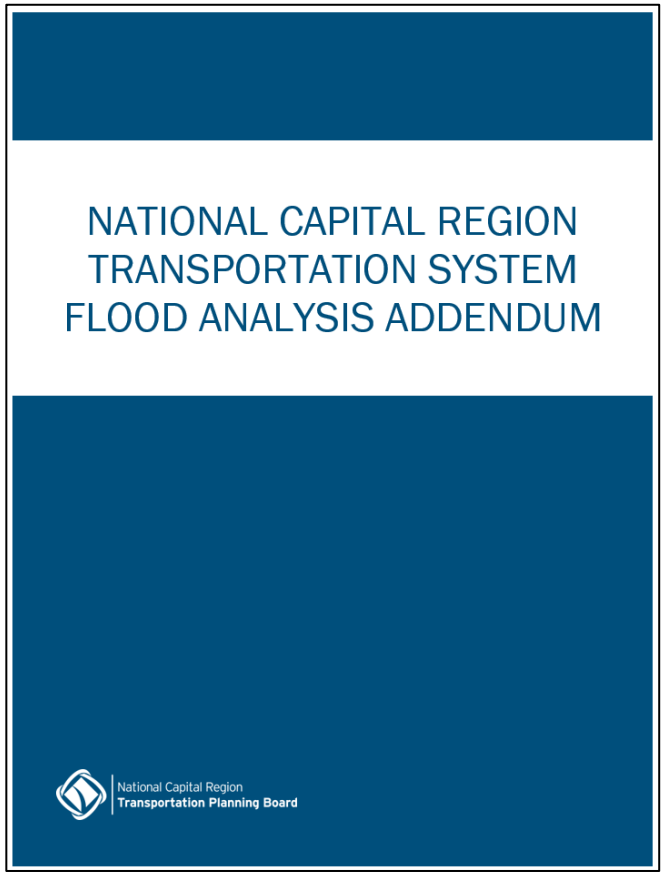
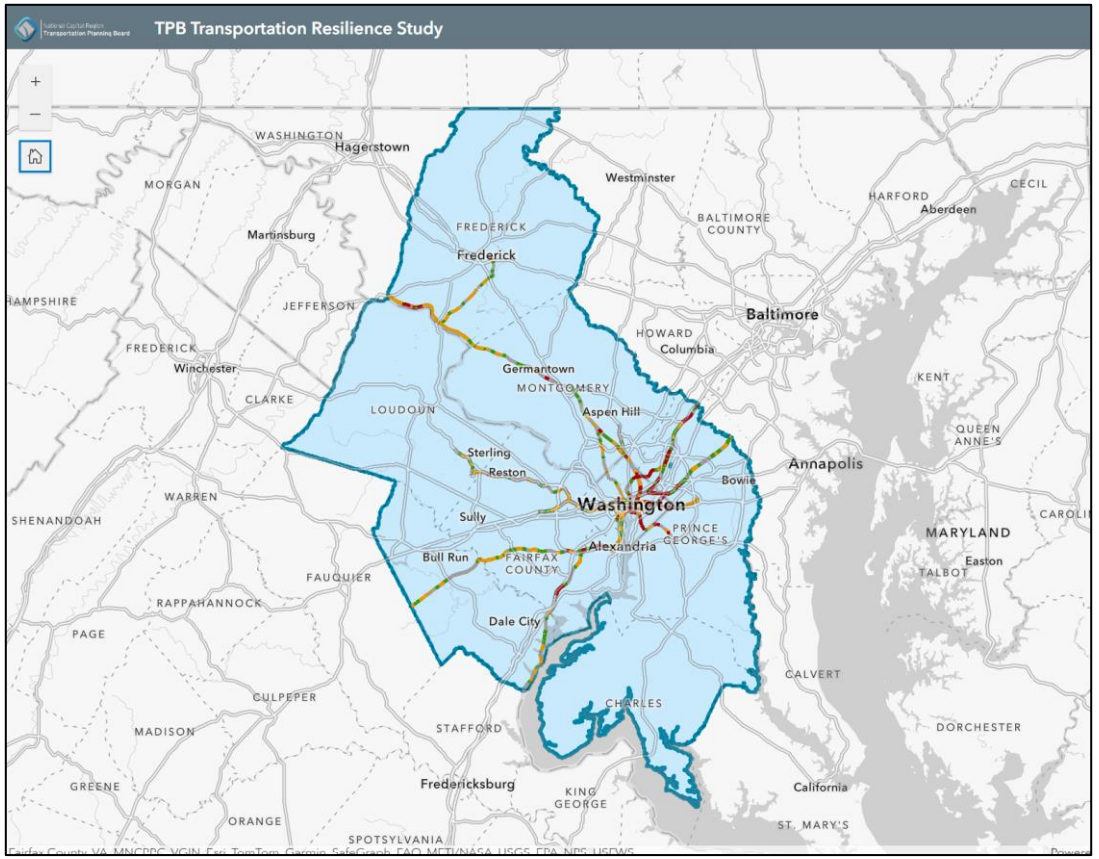
Analysis Products

Flood Analysis Addendum



Regional Interactive Resilience Mapping Tool Update



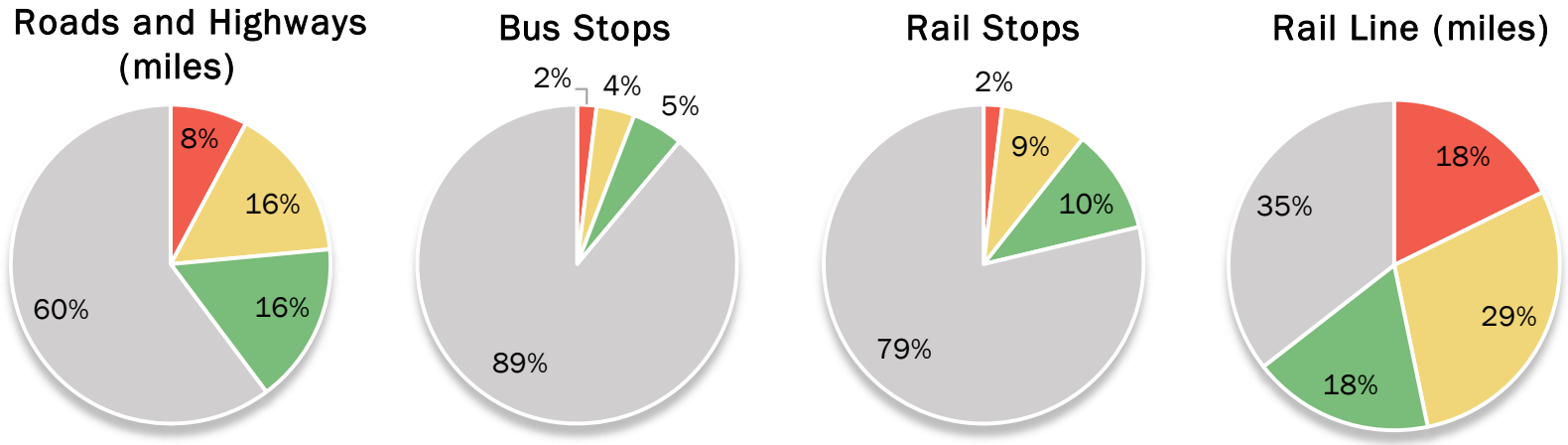
Key Takeaway

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

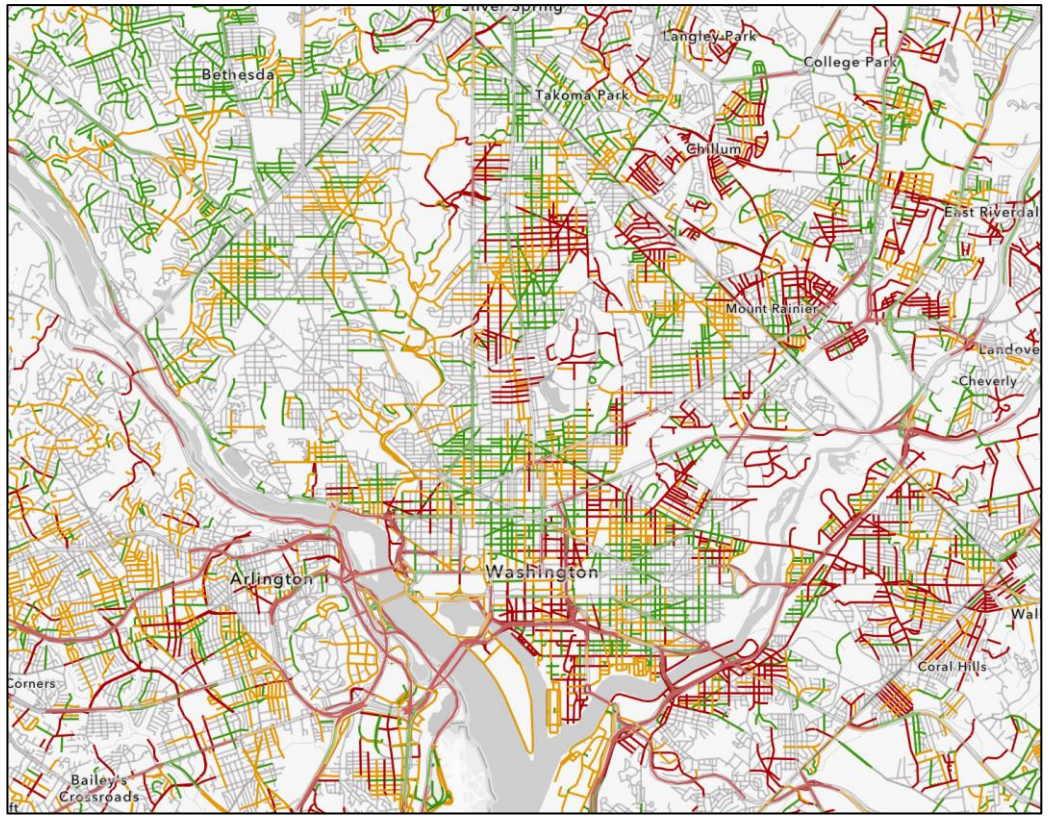
Risk score distribution for 2050 Fathom-informed analysis



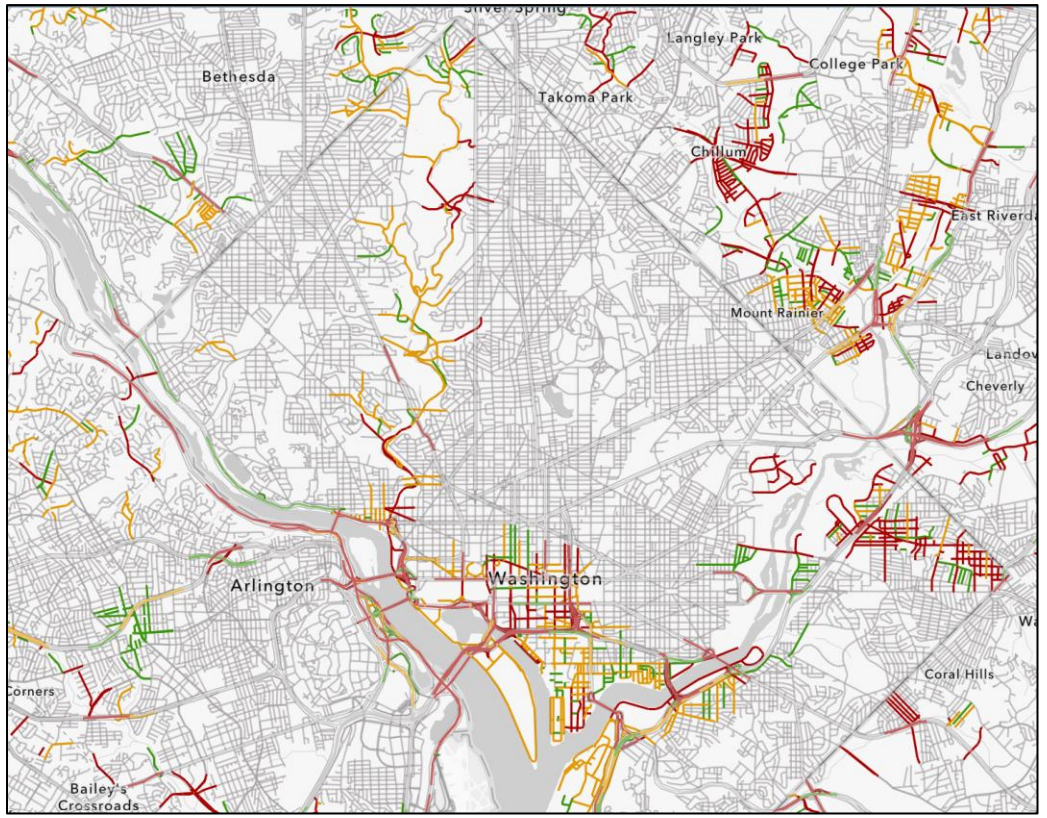
Road and Highway

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



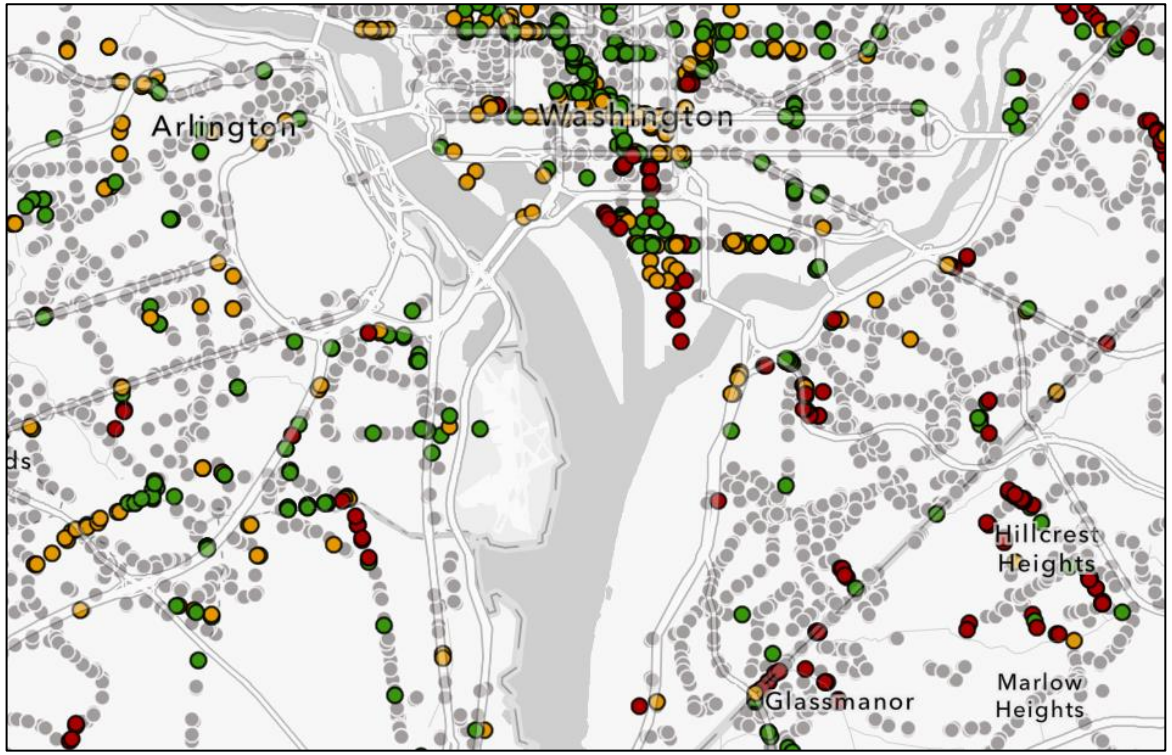
FEMA-informed



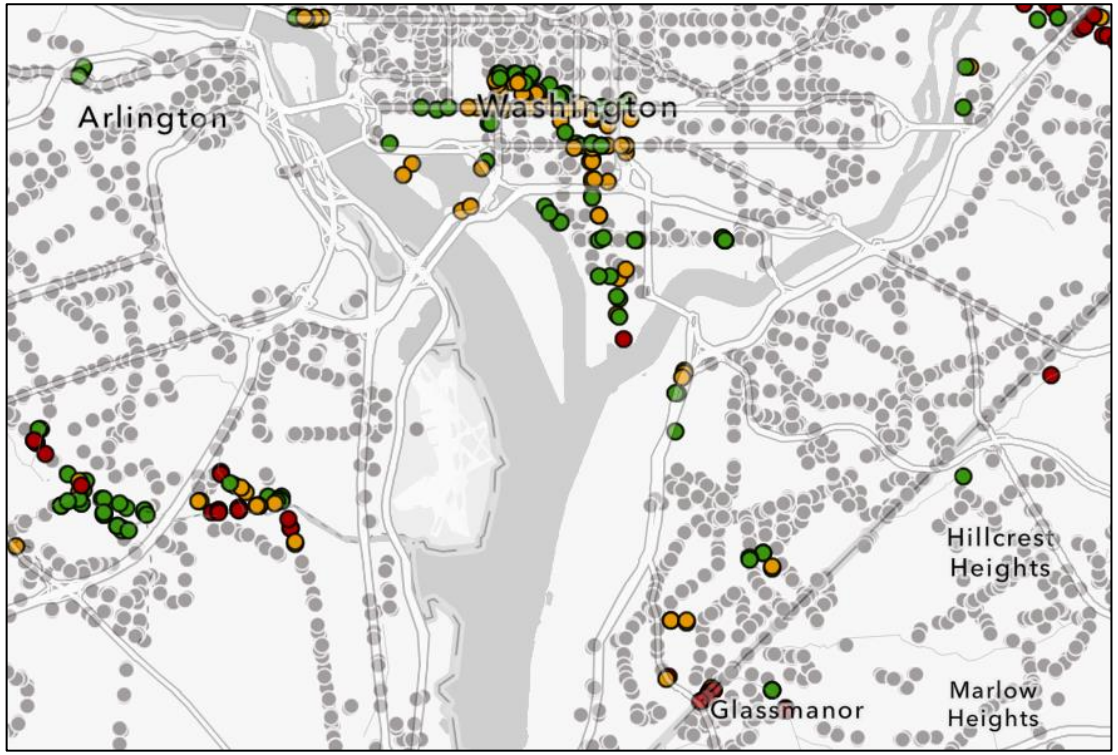
Bus Stops

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



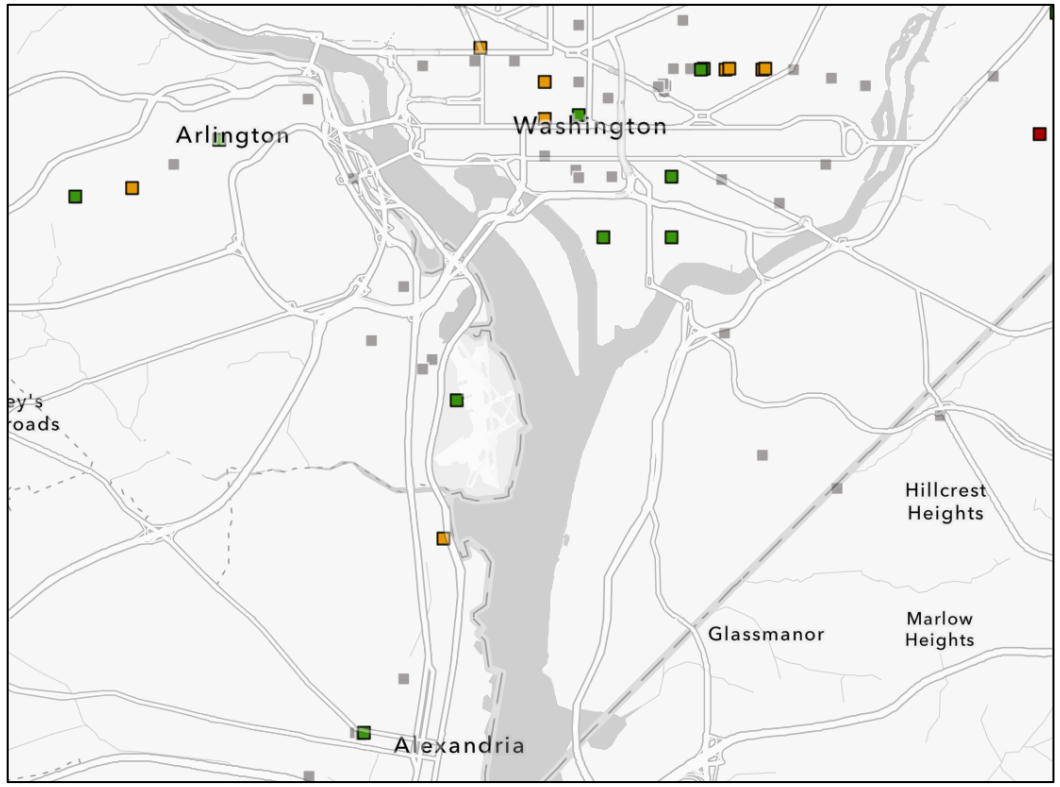
FEMA-informed



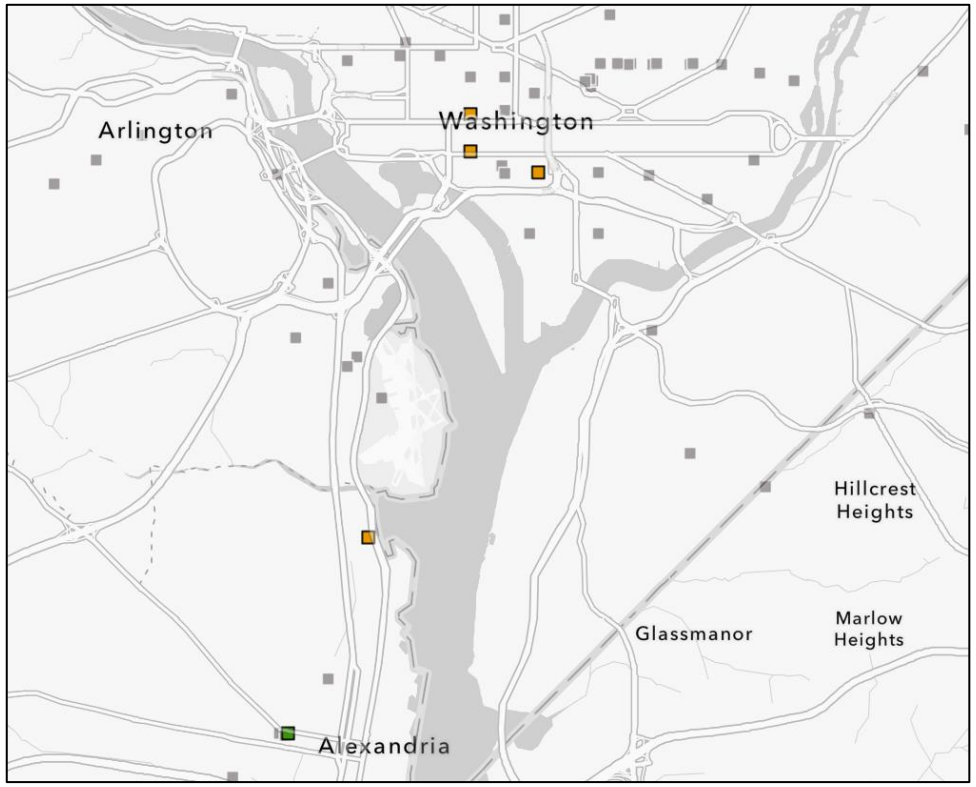
Rail Stops

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



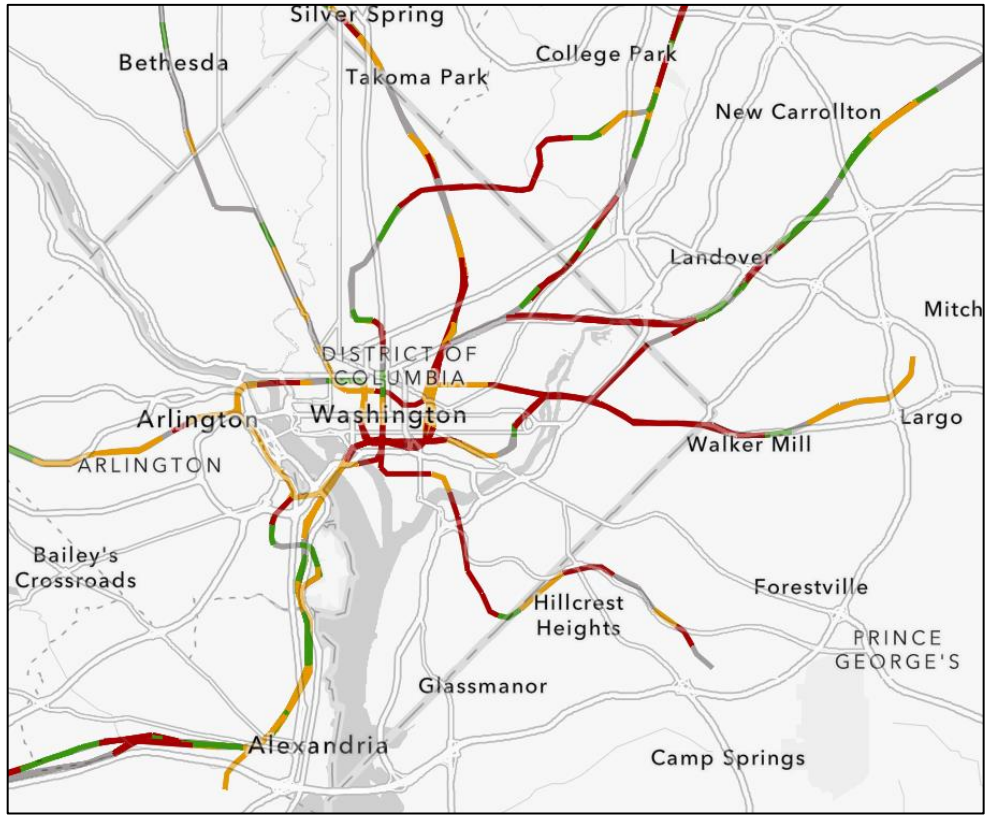
FEMA-informed



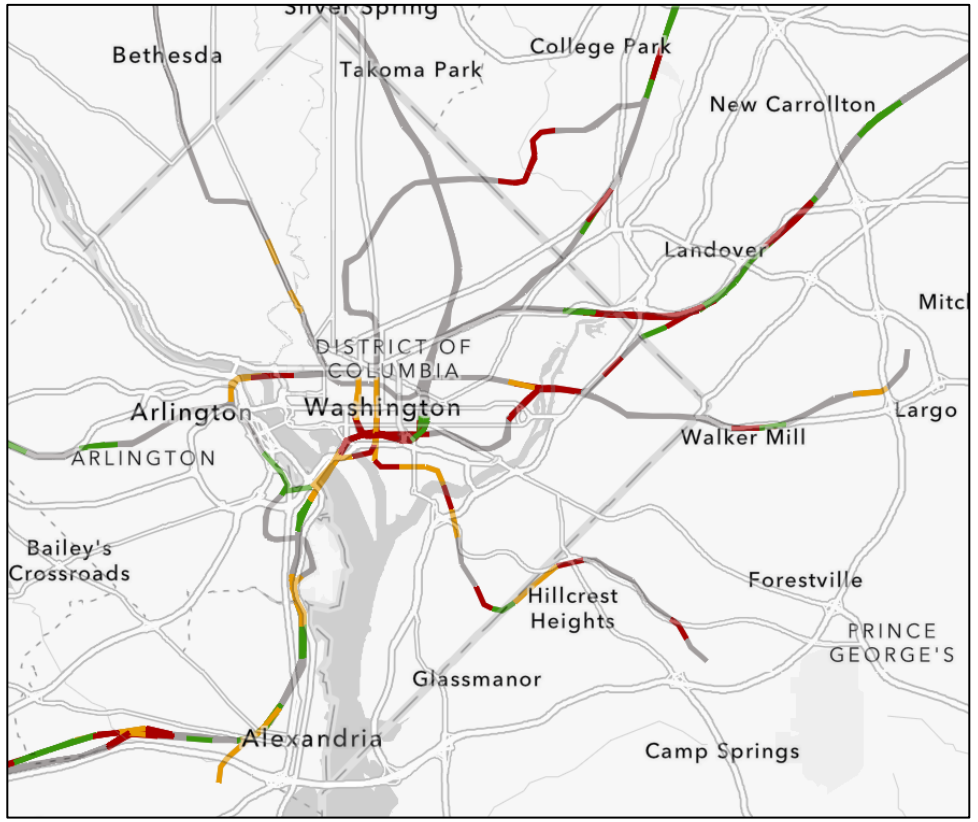
Rail Lines

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



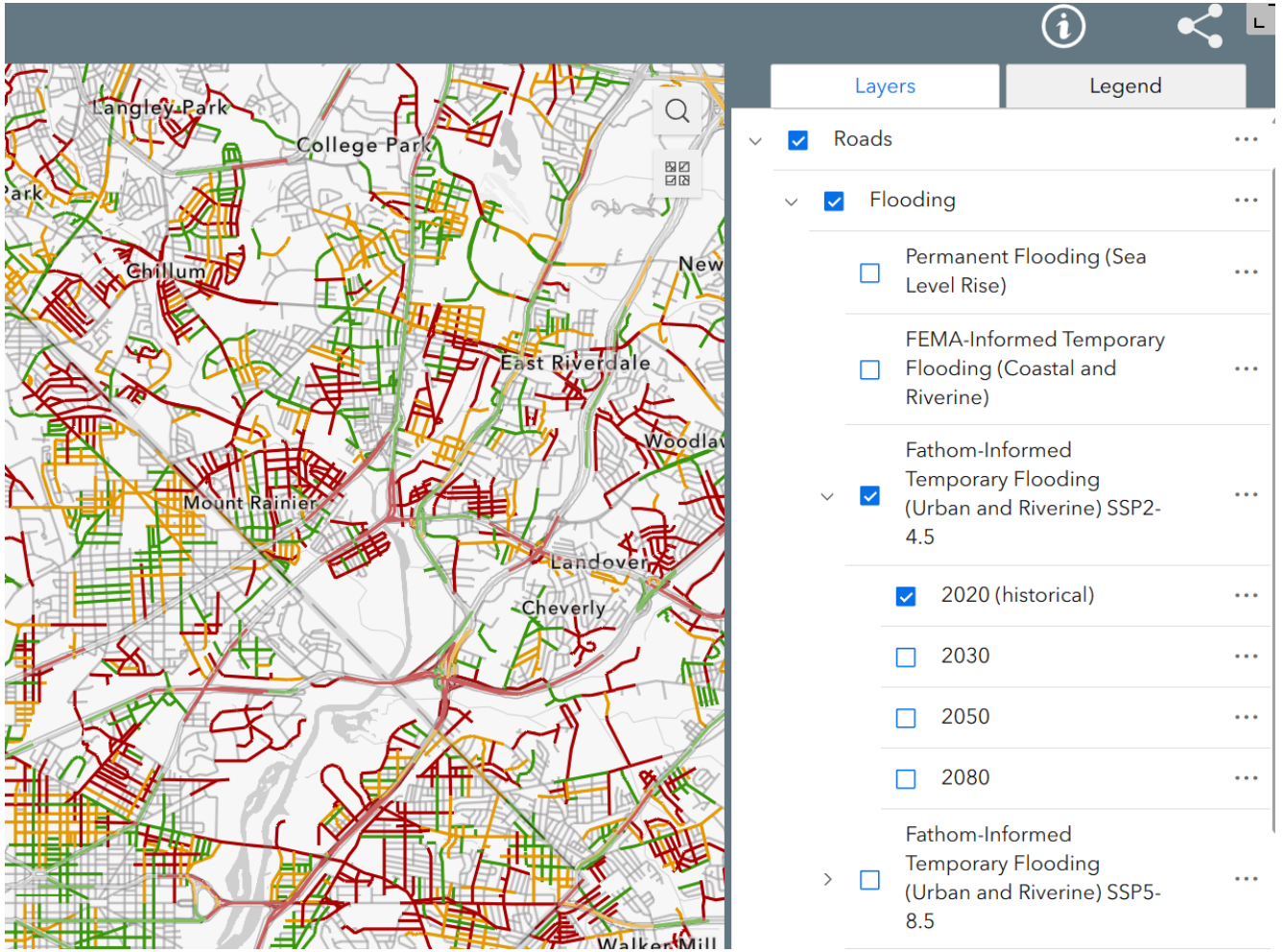
Updated Mapping Tool

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



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.

Questions?

How do you envision using the results of the Fathom-informed analysis?

Next Steps

- Finalizing Flood Analysis Addendum
- Presenting to the Technical Committee and Board
- Further GIS analysis & story maps

Thank You!

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