National Capital Region
Transportation Planning Board

TPB REGIONAL PUBLIC TRANSPORTATION (RPTS) AND REGIONAL TRANSPORTATION RESILIENCE (RTRS) SUBCOMMITTEES

Tuesday, February 25, 2025
12:00 – 2:00 P.M.
COG Meeting Room #1
In-person/Hybrid

RPTS Chair: Stephen Miller, MDOT-MTA
RTRS Chair: David Snyder, City of Falls Church

JOINT MEETING AGENDA

12:00 P.M. **1. LUNCH**

12:10 P.M. **2. INTRODUCTION**
Stephen Miller, RPTS Chair
David Snyder, RTRS Chair

12:20 P.M. **3. TRANSPORTATION RESILIENCE**

A. NVRC's Rain Gauge Platform and Regional Flood Risk Tracking
Nora Jackson, NVRC Resiliency Planner

B. How Climate Ready DC Helps the District's Transportation Network Adapt to Changing Conditions
Erin Garnaas-Holmes, DOEE Climate Program Analyst

1:05 P.M. **4. TRANSIT RESILIENCE**

A. MTA's Shot Tower Metro Station Flood Mitigation Feasibility Study
Paola Ariza, MTA Environmental Planner

B. NJ Transit's Capital Planning Resiliency Program
Emily Korman, NJ Transit Resiliency Capital Planning Manager

1:50 P.M. **5. OTHER BUSINESS**
Stephen Miller, RPTS Chair
David Snyder, RTRS Chair

2:00 P.M. **6. ADJOURN**

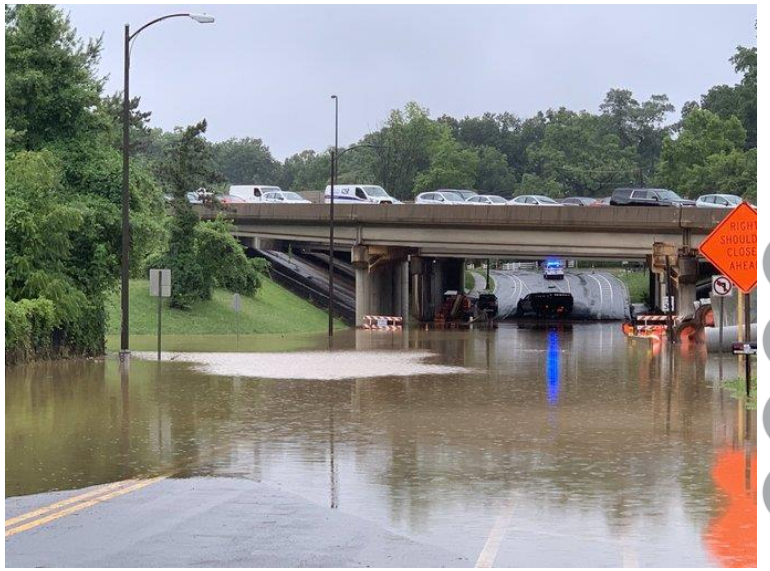
The next regular meeting of the RPTS is March 25, 2025 and is virtual.
The next regular meeting of the RTRS is in Q2 2025 and is in-person/hybrid.

Reasonable accommodations are provided upon request, including alternative formats of meeting materials.
Go to www.mwcog.org/accommodations or call (202) 962-3300 | (202) 962-3213 (TDD) for more info.

NVRC Rain Gauge Platform and Flood Risk Tracking

Tuesday, February 25, 2025

Regional Transportation Resilience Subcommittee-
Addressing the nexus of climate resilience, adaptation and public transit



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NOVA Flood Mitigation and Resiliency Workgroup

The Northern Virginia Regional Commission is a council of thirteen local governments in the Northern Virginia suburbs of Washington DC. NVRC is one of 21 planning districts that serve the Commonwealth of Virginia.

What: Ad hoc group of individuals interested in navigating increasingly complex flooding patterns and to find ways to deal with a rising level of rain-related property damage.

Purpose: Identify common trends/issues related to current and future flood risk and damages. Discuss potential solutions and strategies for implementation.

Who: Northern Virginia City, Town, County floodplain administrators and other staff involved in stormwater or floodplain management; state and academic partners

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Climate Hazards

Yes, Virginia, we are seeing more – and more intense – rainfall

Climate change risks overwhelming infrastructure

WEATHER

July 8, 2019: The day DC saw nearly a month's worth of rain in one hour

One year ago, big time rains flooded streets, caused a commuting nightmare and damage across the D.C. region.

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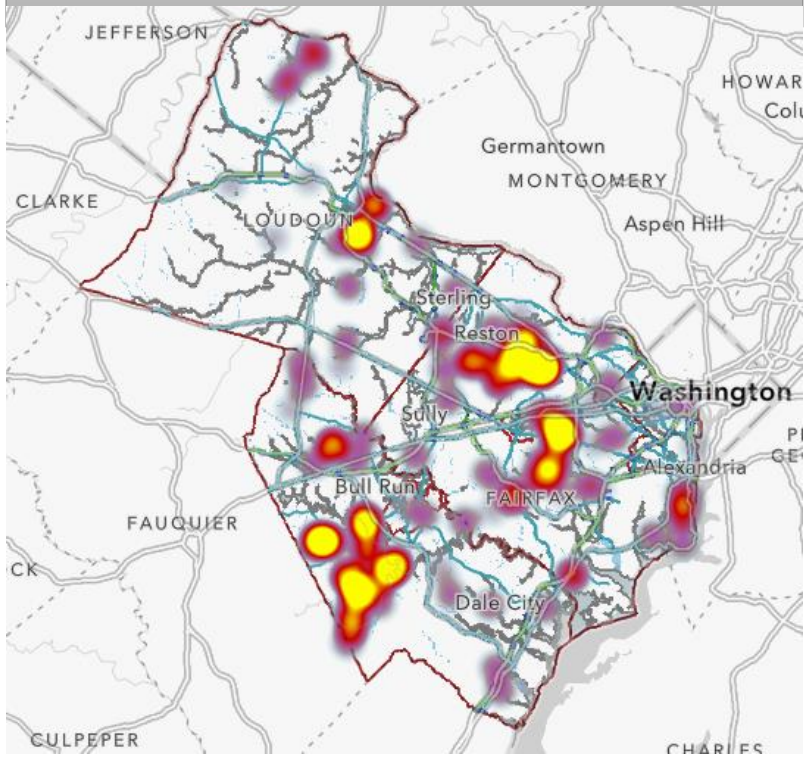
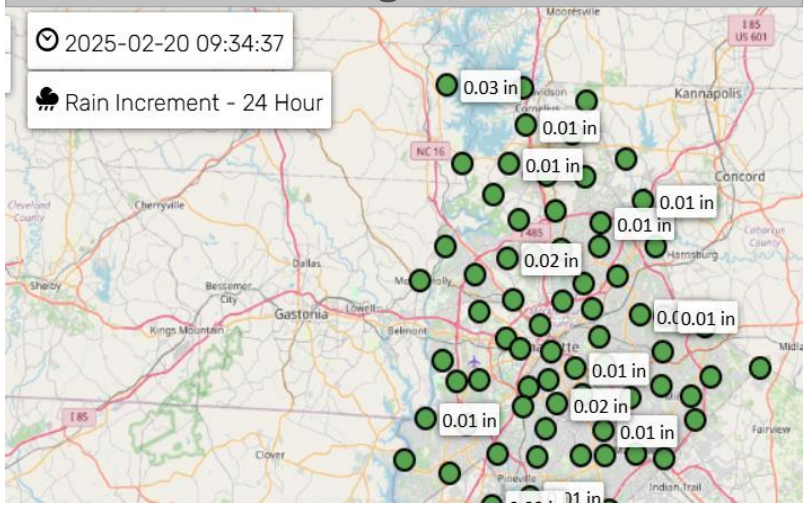
NVRC Resiliency Projects

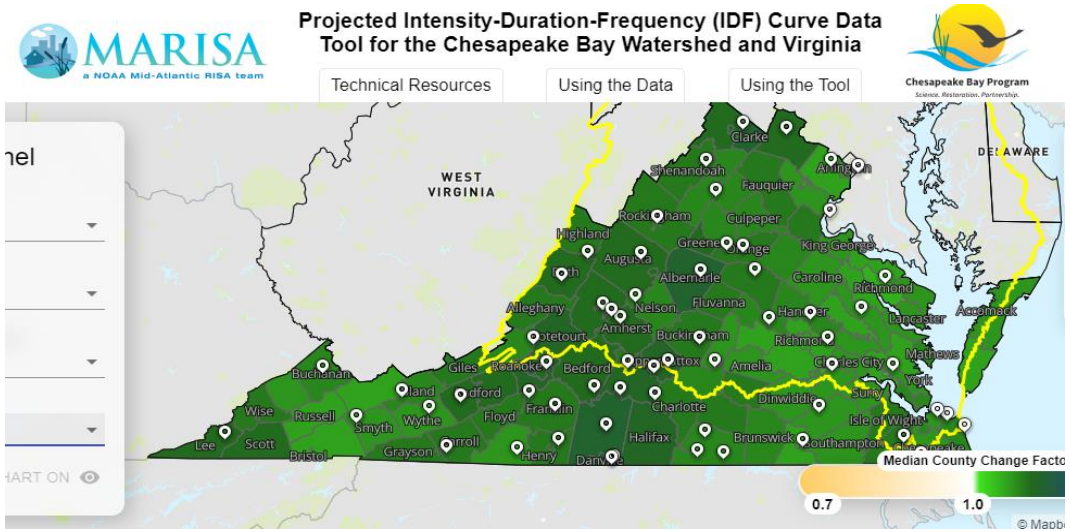
Flooded Roads Mapping Exercise



Rain Gauge Platform



Resilient Design Guidelines



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Rain Gauge Platform

Aug 2021- established workgroup

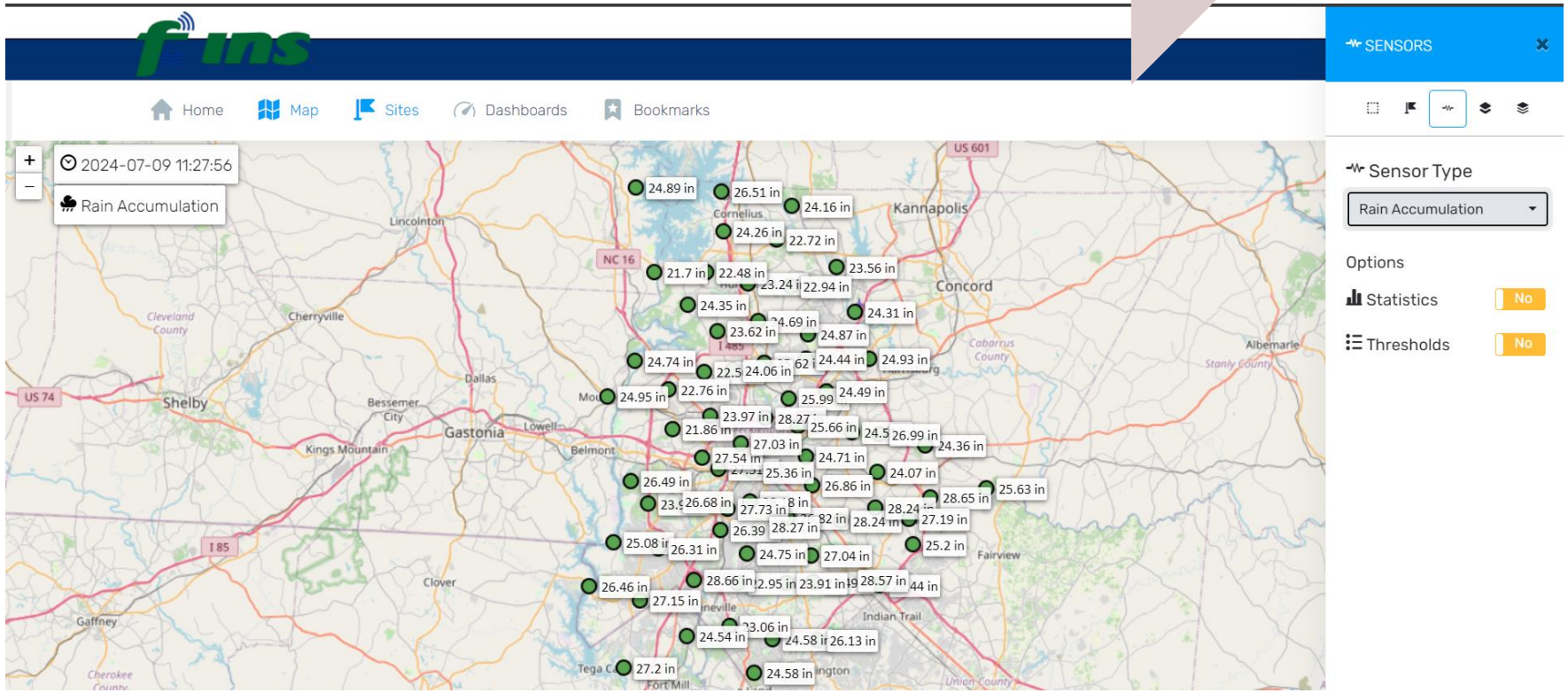
Fall 2021- applied for CFPF funding to integrate the existing network

March 2022 – received CFPF funds, less than requested

April 2022- applied for additional funding to build platform

February 2023- develop scope of work

Effort to regionalize recent additions to the monitoring networks in NOVA



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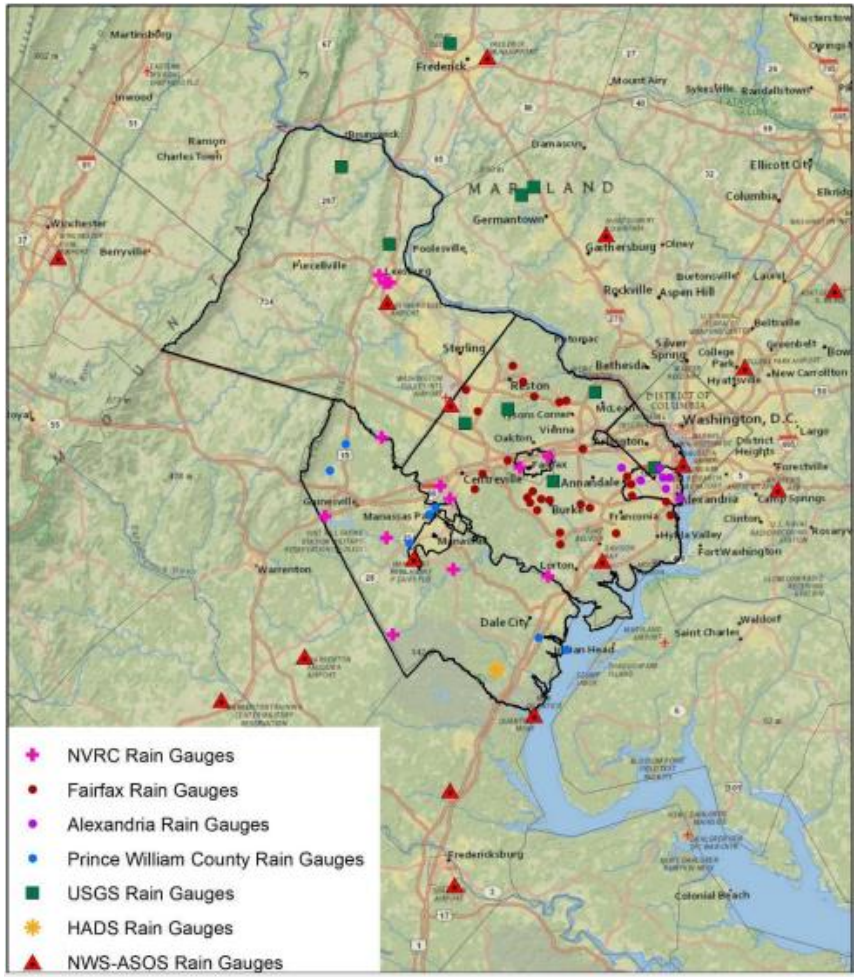
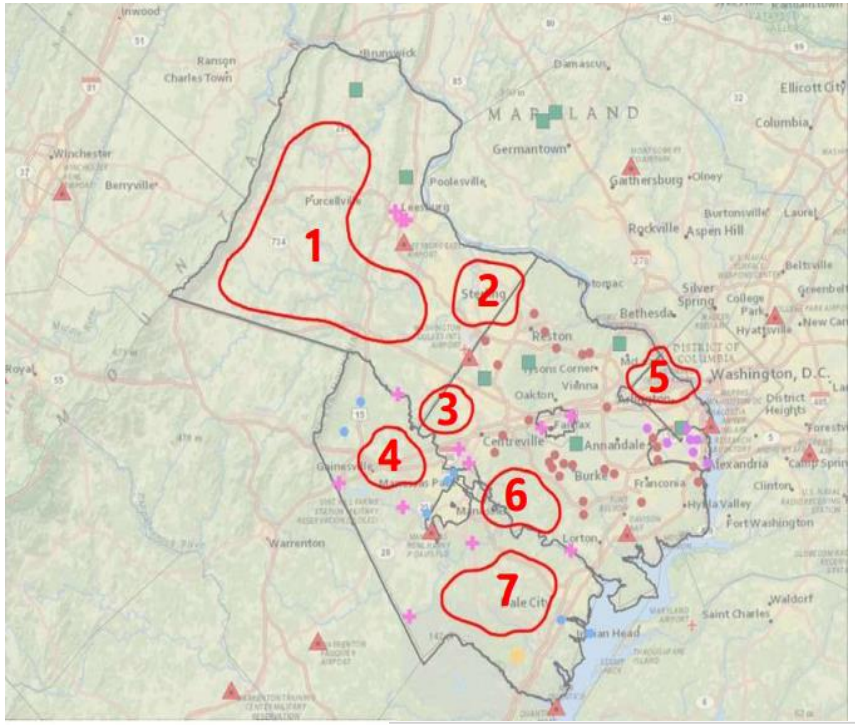
Rain Gauge Platform

Summer 2023- worked on the audit

April 2024- audit completed. worked with jurisdictions to determine use of CDS money

Summer 2024- scope of work, data sharing addendum to COG's existing agreement





NVRC Rain Gauges
Fairfax Rain Gauges
Alexandria Rain Gauges
Prince William County Rain Gauges
USGS Rain Gauges
HADS Rain Gauges
NWS-ASOS Rain Gauges

Table 2. Proposed Rain Gauge Summary

Figure 5 Location	Number of Additional Rain Gauges	Prioritization
Area 1	5-6	1
Area 2	1	4
Area 3	1	6
Area 4	1	3
Area 5	1	5
Area 6	1	7
Area 7	1–2	2

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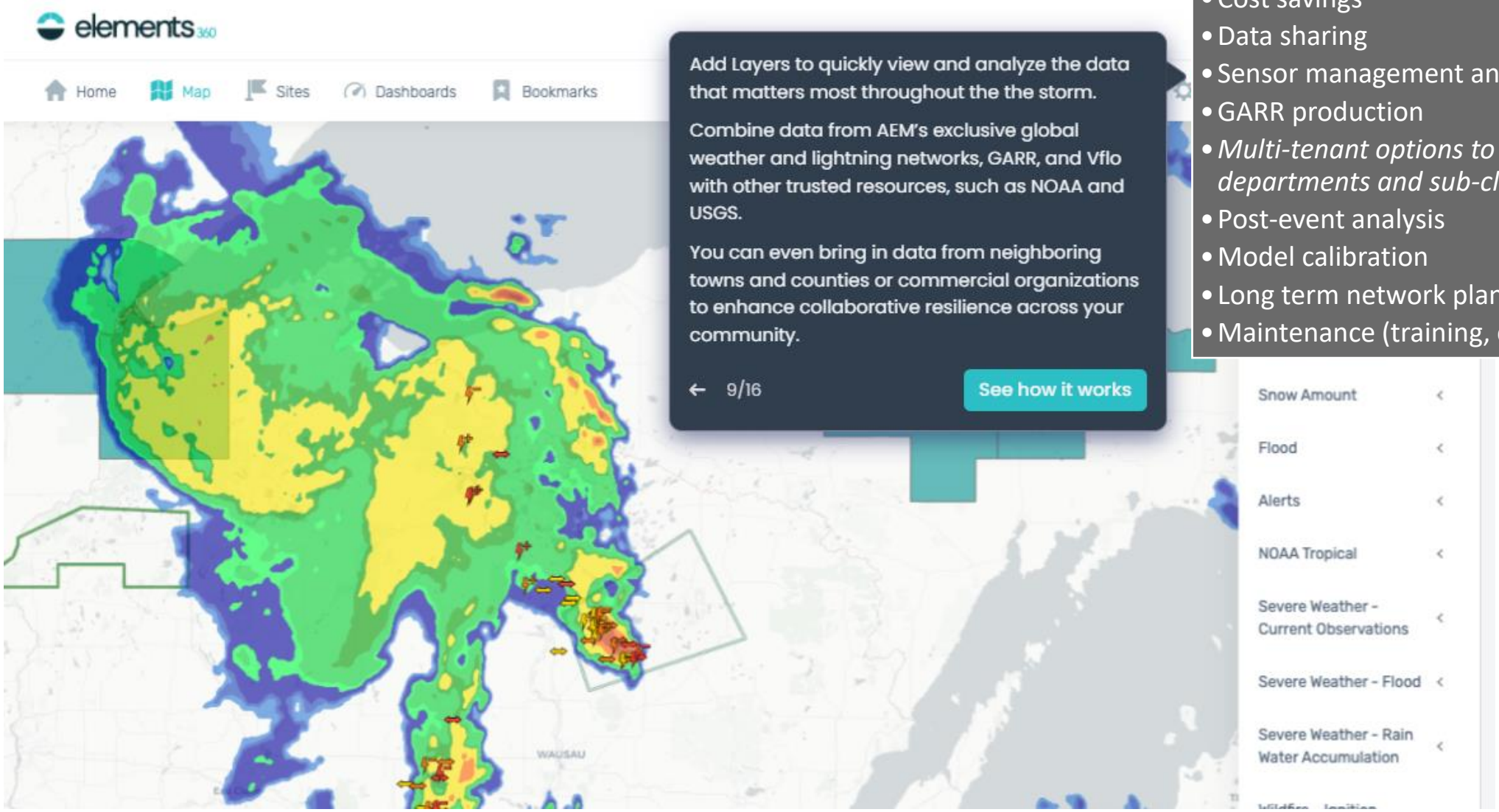
Public Rain Gauge Platform



5-year pilot to look at:

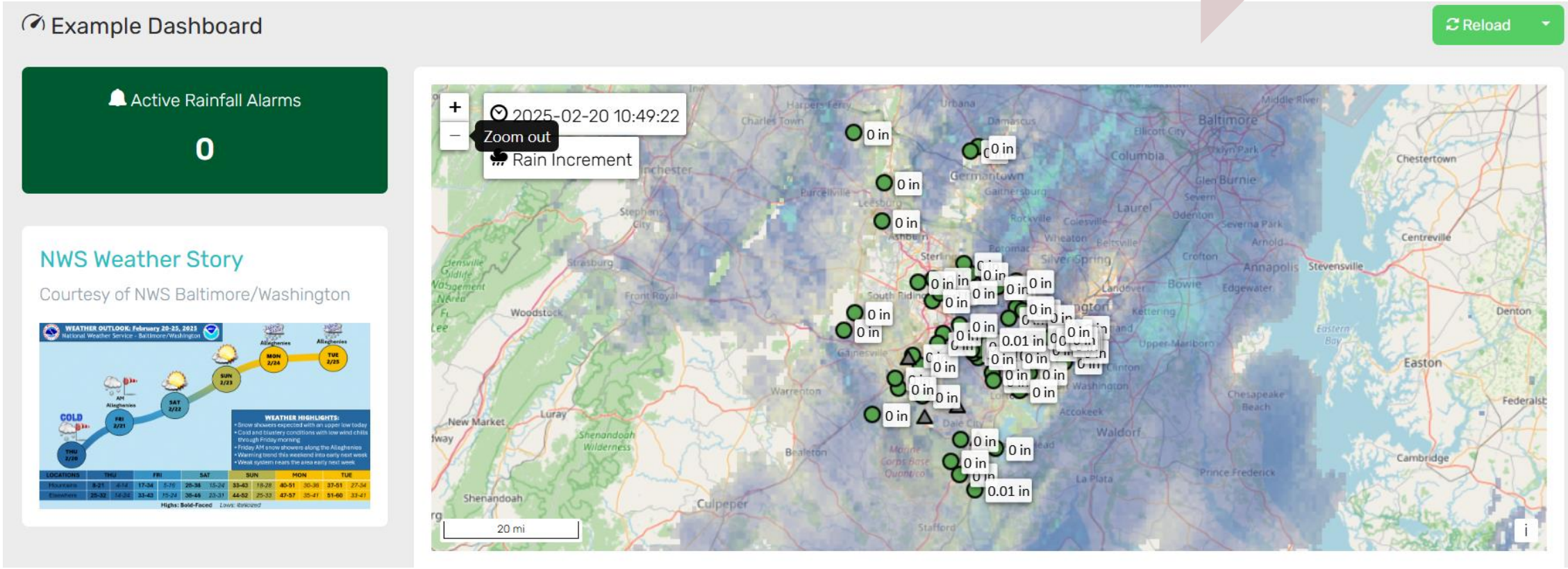
- Cost savings
- Data sharing
- Sensor management and reporting
- GARR production
- *Multi-tenant options to support different departments and sub-clients*
- Post-event analysis
- Model calibration
- Long term network planning
- Maintenance (training, coordination, funding)

Rain Gauge Platform

Fall/Winter 2024- contrail starts building the platform

February 2025- administrator training and dashboard design

March 2025- release "publicly" for Flood Awareness Week



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Flooded Roads Mapping Exercise

Wherever it rains, it can flood.

to use public transportation, people still need to be able to access pickup locations/stations

We were selected as one of the partners for the pilot of the Virginia Climate Center at GMU- climate data extension services for Virginia.

GEORGE MASON UNIVERSITY

FLOOD Hazards Research Lab

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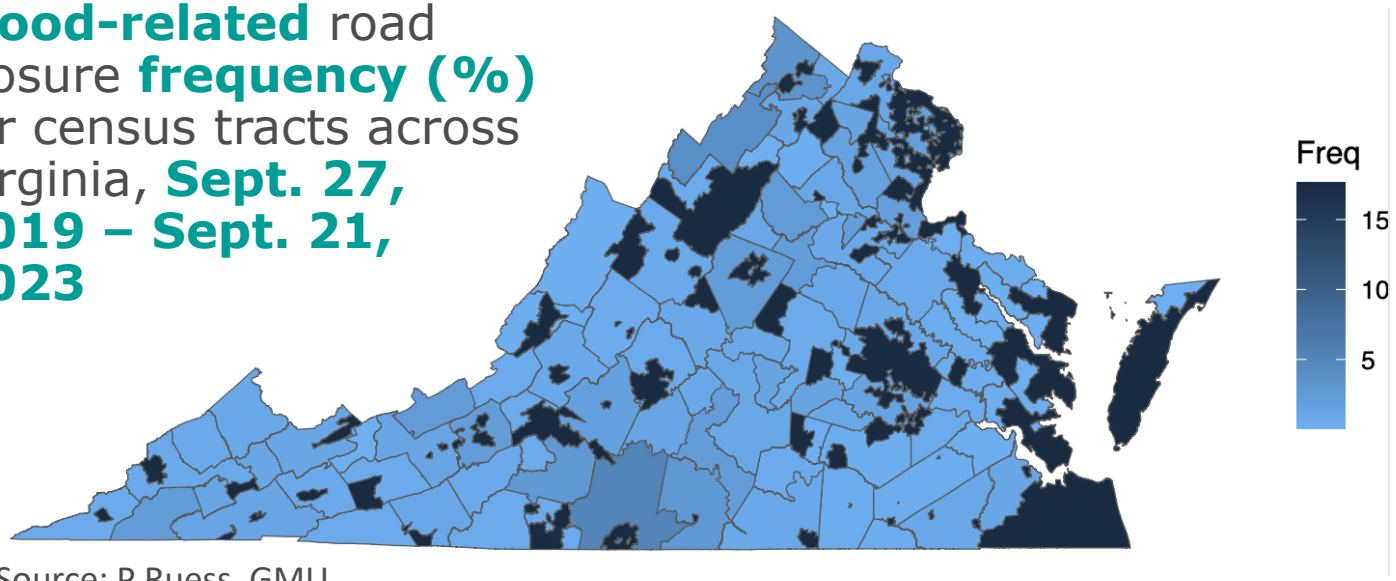
Virginia Department of Transportation (VDOT): Smarter Roads Data

Data download, processing and meta-analysis

Flood-related road closure **frequency (%)** for census tracts across Virginia, **Sept. 27, 2019 – Sept. 21, 2023**



Source: P Ruess, GMU

Events stored as individual JSON files

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VDOT

511 Virginia Traffic Information

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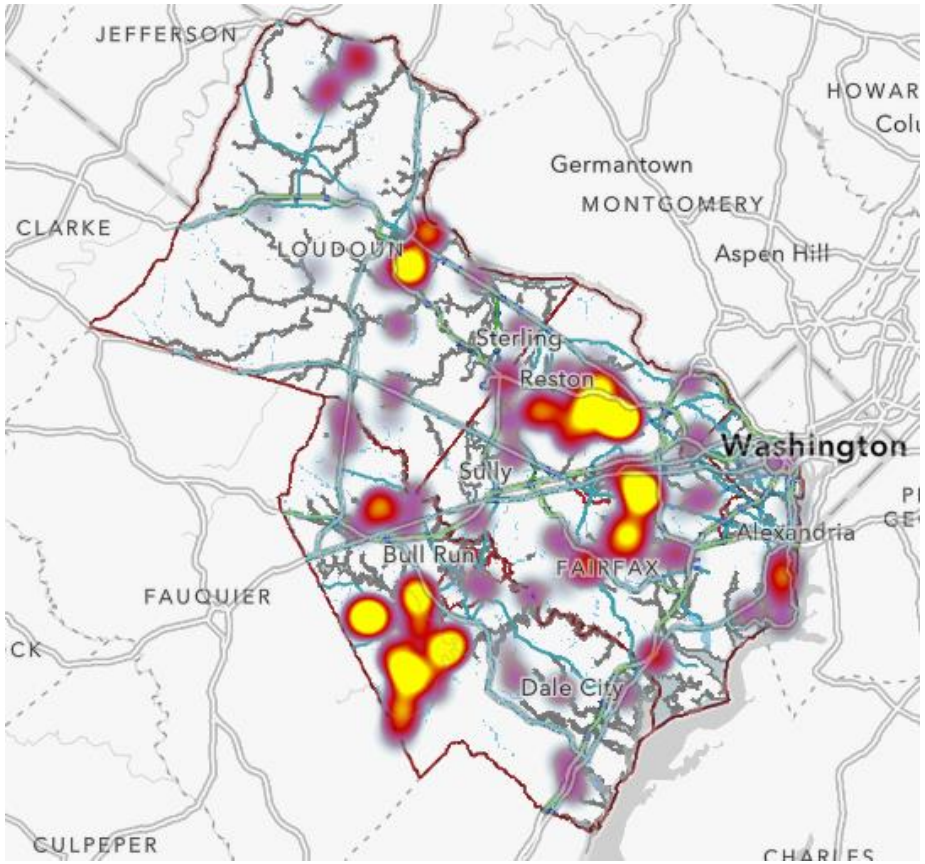
Cumulative Flooded Road Closures, Oct 2019-Aug 2023



How many were inside the FEMA special flood hazard area (regulatory floodplain)?

37 of 287.

Photo by Celso Ferreira, captured during July 5, 2023. Numerous swift water rescues were later reported in the area.

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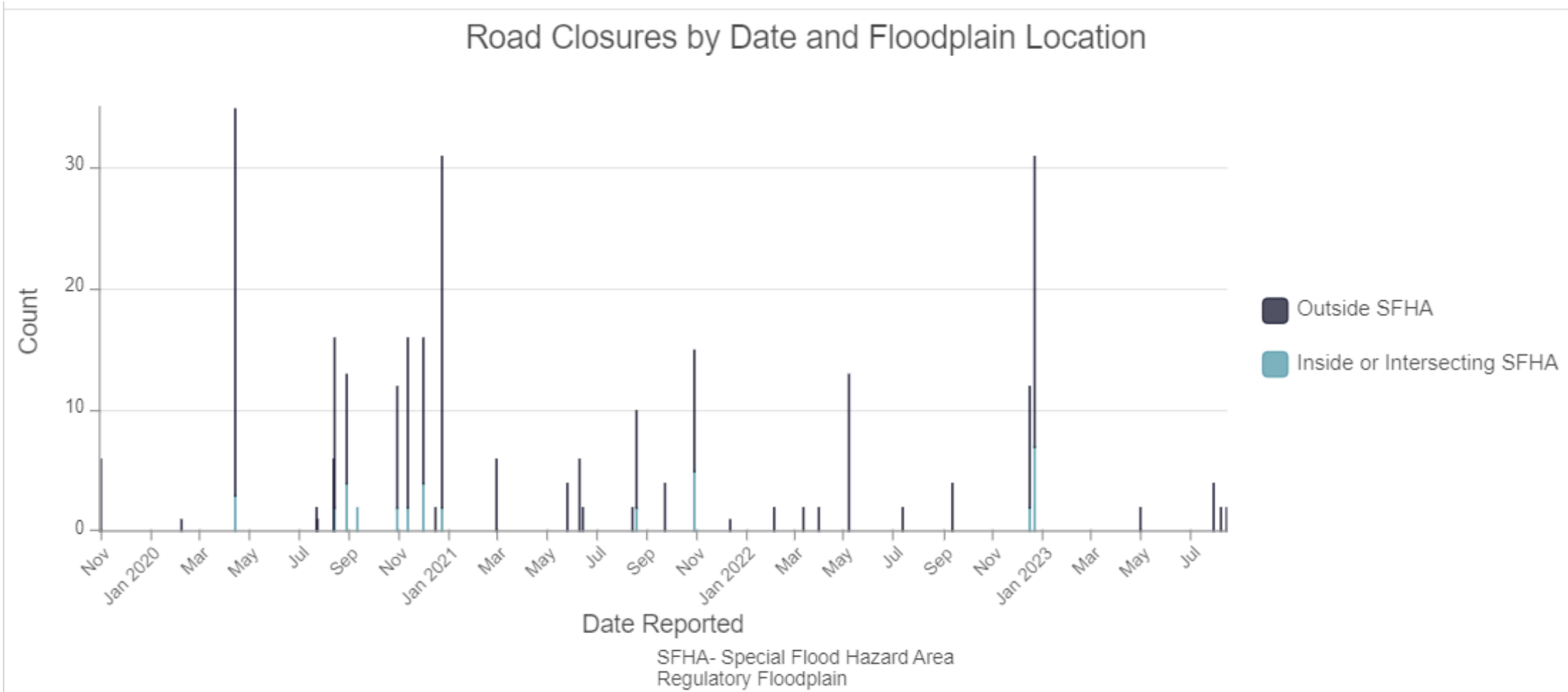
Cumulative Flooded Road Closures, Oct 2019-Aug 2023



Cumulative Flooded Road Closures, Oct 2019-Aug 2023

VDOT Road Closure due to Flooding

Primary Roads

- LIMITED ACCESS HIGHWAY FRONTAGE
- LIMITED ACCESS HIGHWAYS
- RAMPS
- US AND VA PRIMARY HIGHWAYS

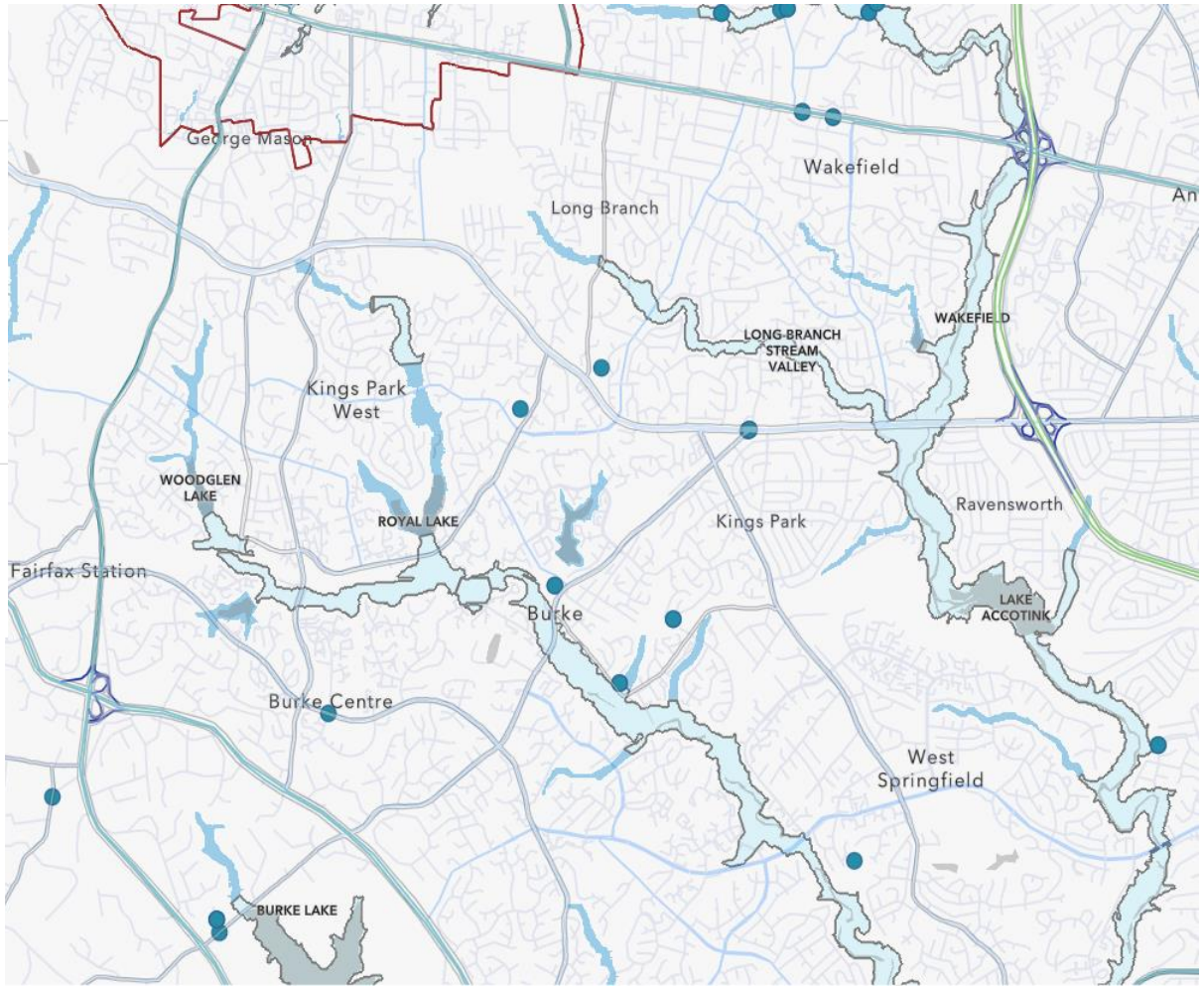
Secondary Roads

- LOCAL MAIN ARTERIES
- LOCAL SECONDARIES

FEMA: Flood Hazard Layer

FEMA_100y

- A
- AE
- AH
- AO
- D
- VE



Dense stream network

Demonstrates how flooding is happening outside of the regulatory floodplain

The FEMA flood hazard layer is the only available data for regional or multi-governmental scales

Translating Research to Practice to Create Climate Ready Communities

Pilot different types of road sensors and ground truth reports

Launch a data collection campaign to include citizen reported events, photos, details

Prioritize projects in repeat areas with high social vulnerability

Utilize in conjunction with a flood hazard public awareness campaign

Document the need for complete overland flow modeling

Support real-time flood forecasting

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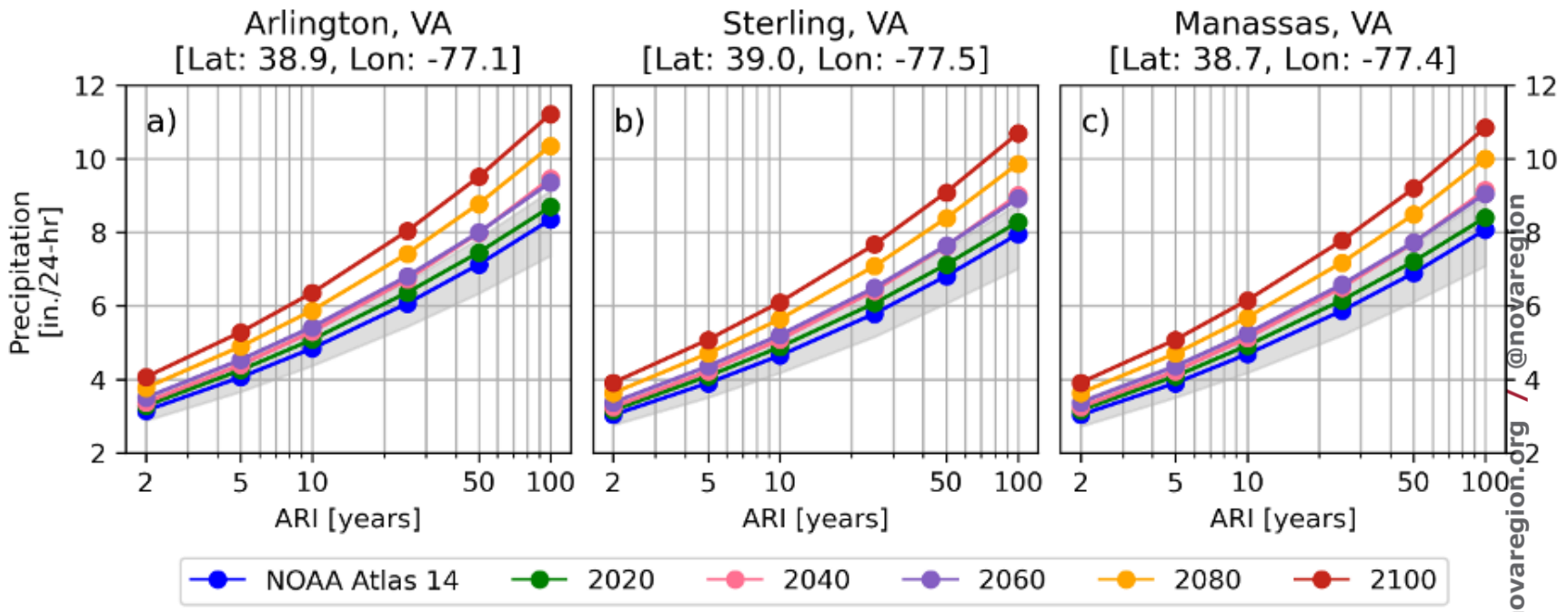
Resilient Design Guidelines

"develop and coordinate a regional approach that addresses the development of potential regional Intensity, Duration, Frequency (IDF) Curves to assist localities in stormwater planning in the context of climate change"

Contracted to Dewberry. Kickoff in January 2025, estimated completion in December 2026



Source: Coelho, Ferreira and Kinter (2022) "Potential Impacts of Future Extreme Precipitation Changes on Flood Engineering Design across the Contiguous United States" *Water Resources Research*

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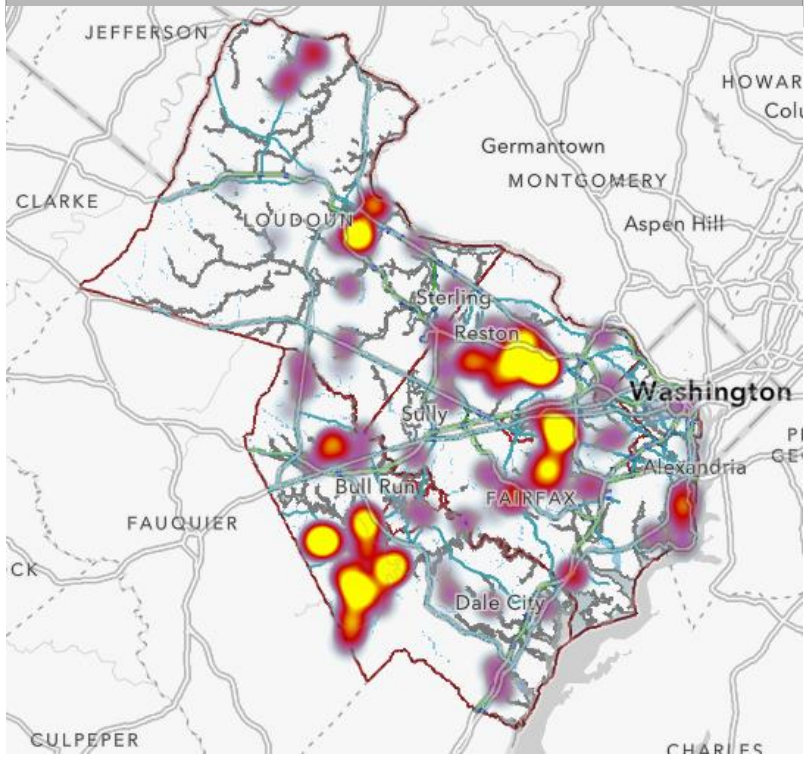
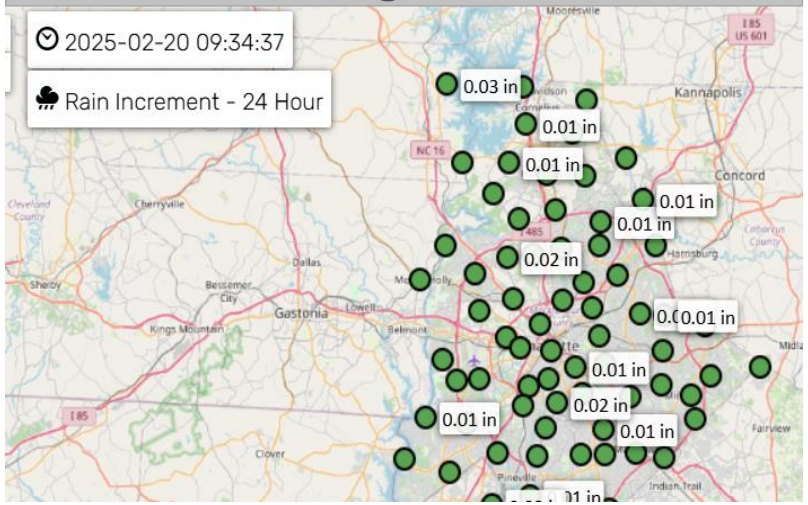
Funding Source: Community Flood Preparedness Fund

NVRC Resiliency Projects

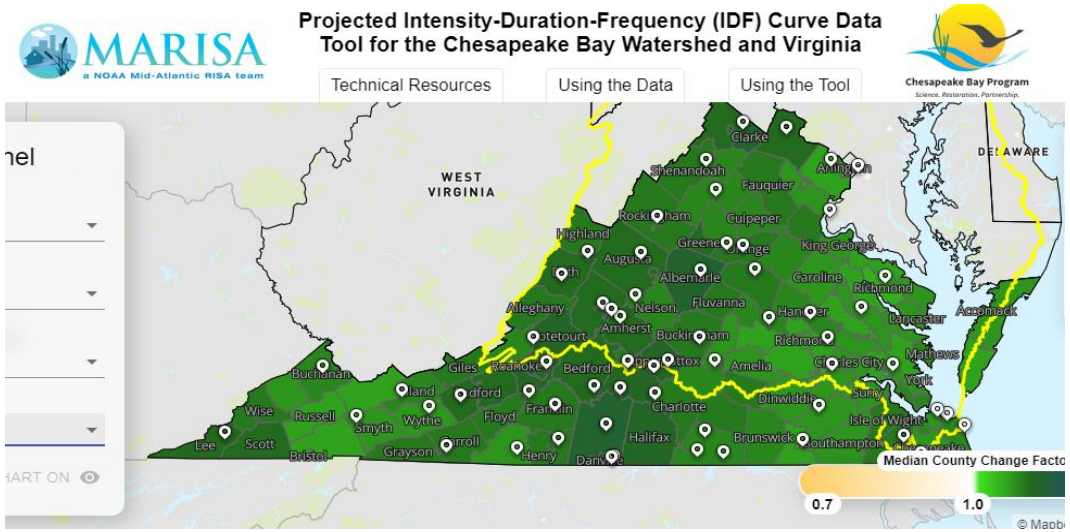
Flooded Roads Mapping Exercise



Rain Gauge Platform



Resilient Design Guidelines



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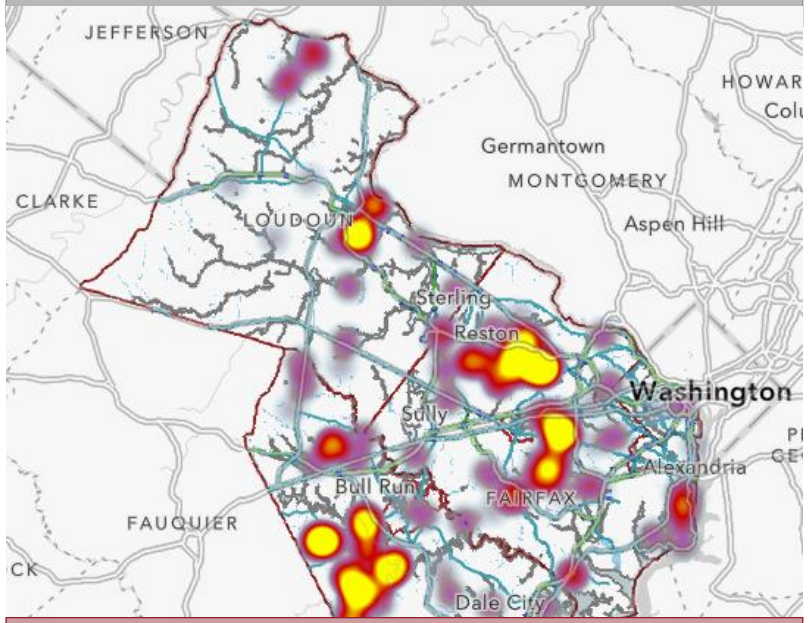
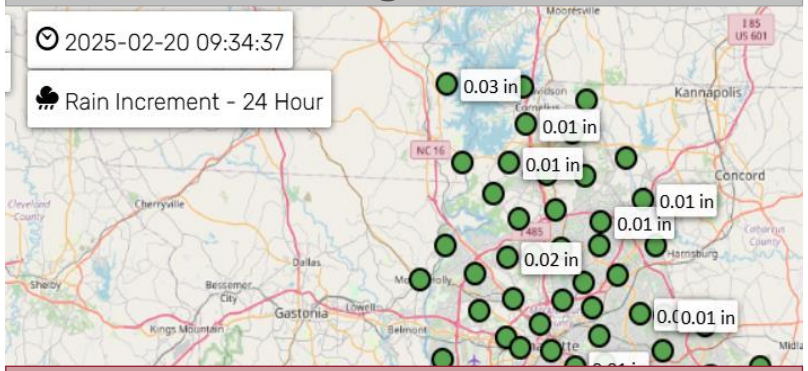
Key Takeaways

Flooded Roads Mapping Exercise



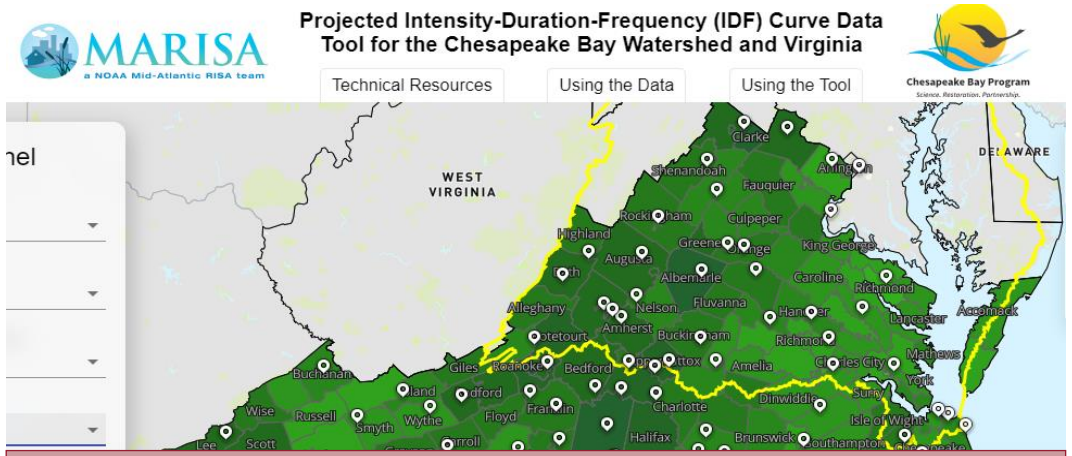
Leverage community partnerships, skills, and resources

Rain Gauge Platform



Importance of cross-jurisdiction communication

Resilient Design Guidelines



Regionalism as a tool to advance implementation

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Thank you!

njackson@novaregion.org

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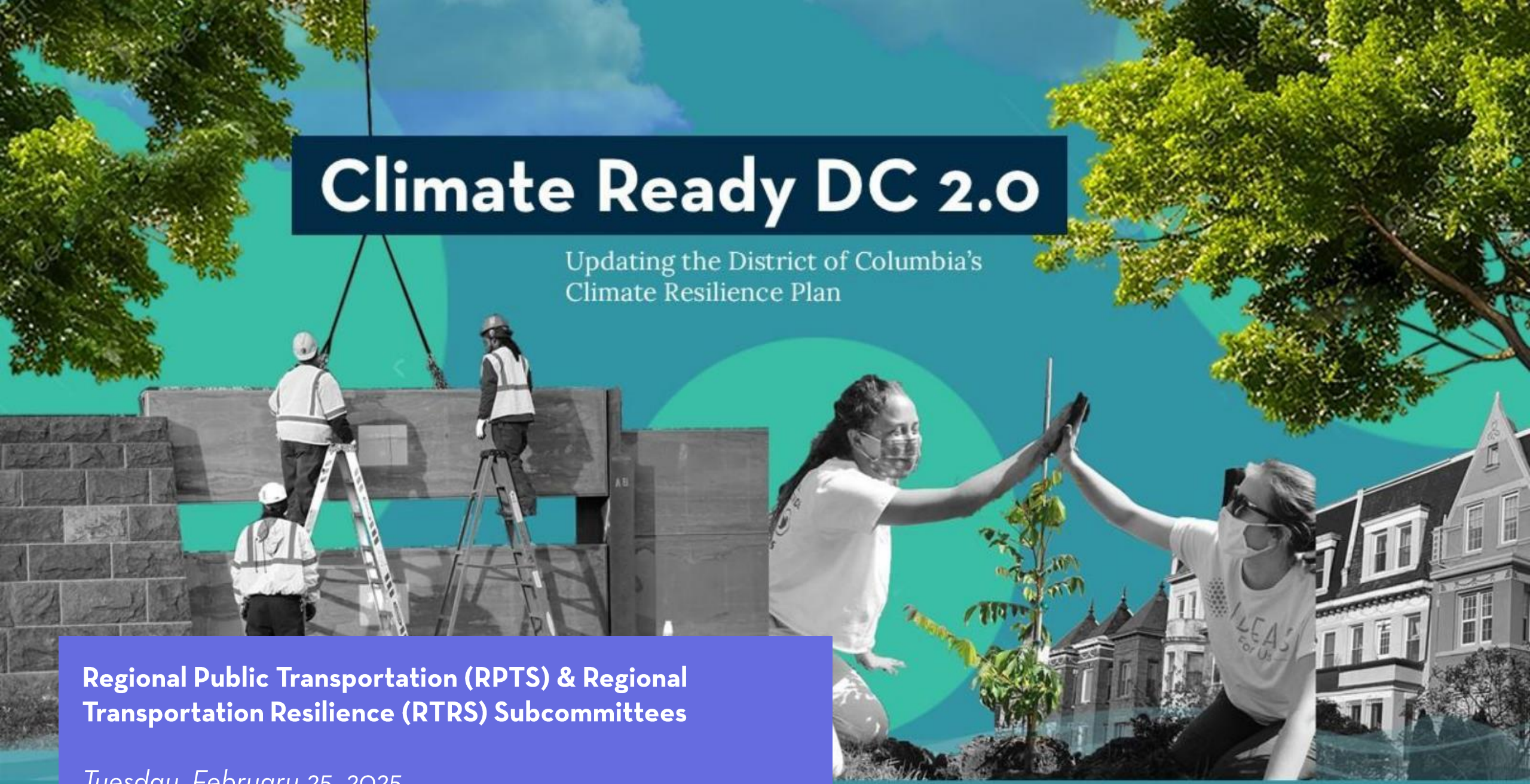


Regional Public Transportation (RPTS) & Regional Transportation Resilience (RTRS) Subcommittees

Tuesday, February 25, 2025

DEPARTMENT OF ENERGY & ENVIRONMENT

GOVERNMENT OF THE DISTRICT OF COLUMBIA
MURIEL BOWSER, MAYOR

Introduction

Erin Garnaas-Holmes

Climate Ready DC

Erin.Garnaas-Holmes@dc.gov

(202) 525-8995

CLIMATE READY DC

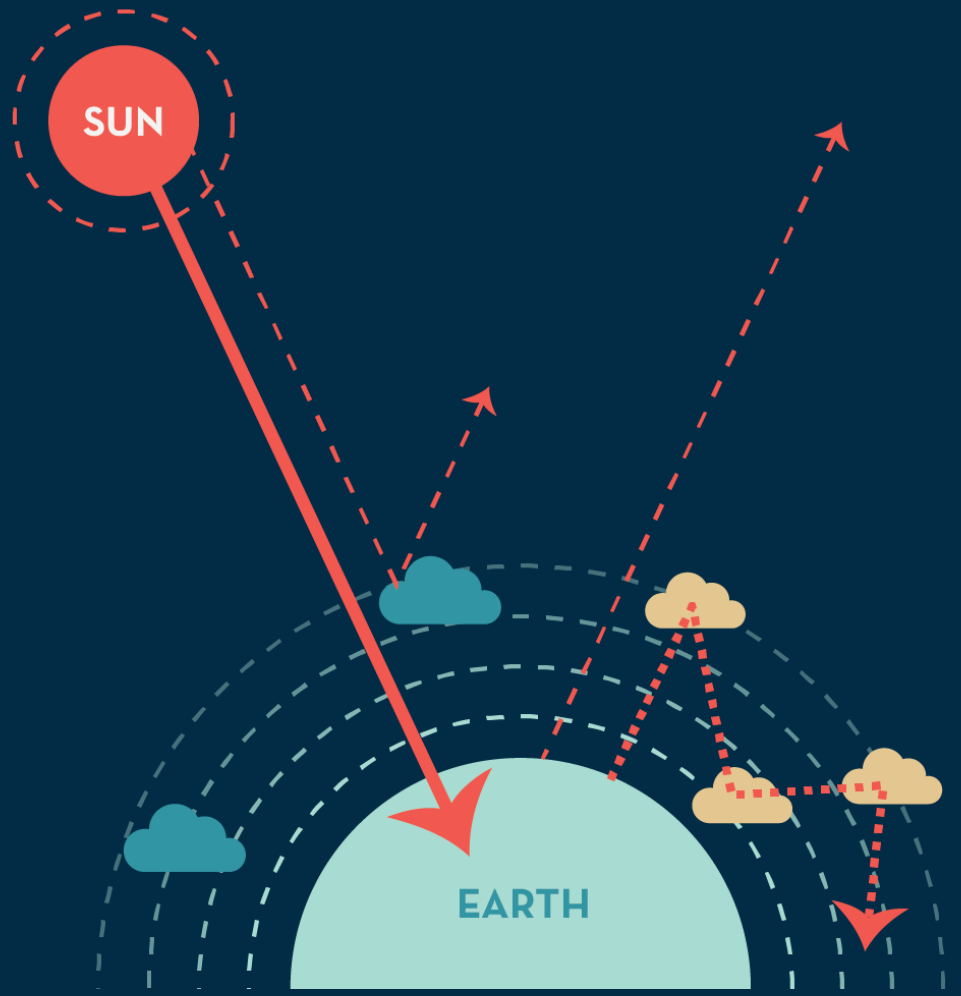
KEEP COOL DC

Contents

2024

Updated Climate

Projections



The District will experience in the future...

HOTTER

Annual average and summer **temperatures will continue to increase.**

Heat waves will become more intense and will last for longer periods of time.

WETTER

The **frequency** and **intensity** of **extreme precipitation events** are expected to **increase.**

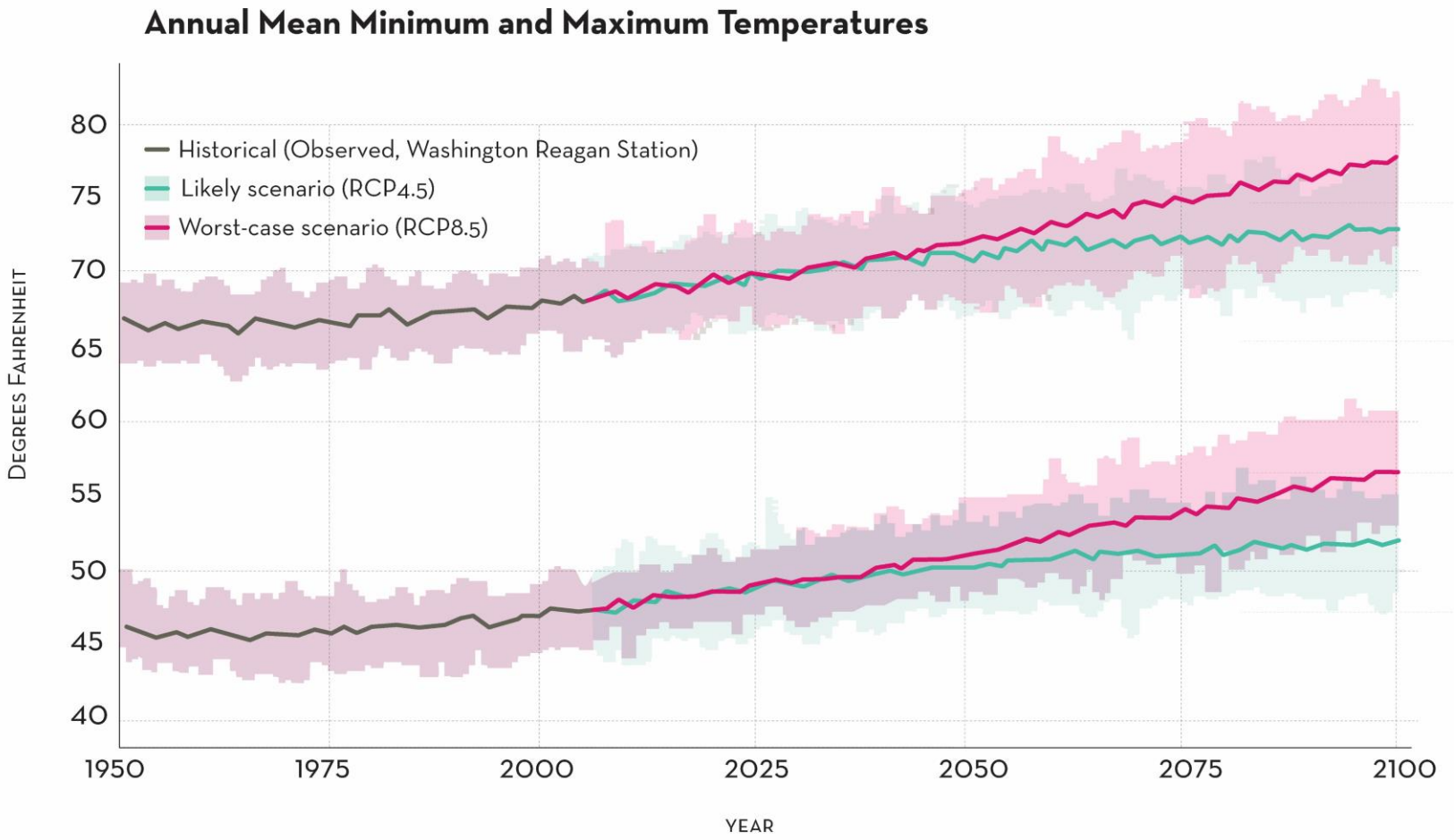
Sea level rise is expected to continue and **will accelerate in the future** due to global ice sheet melting.

WILDER

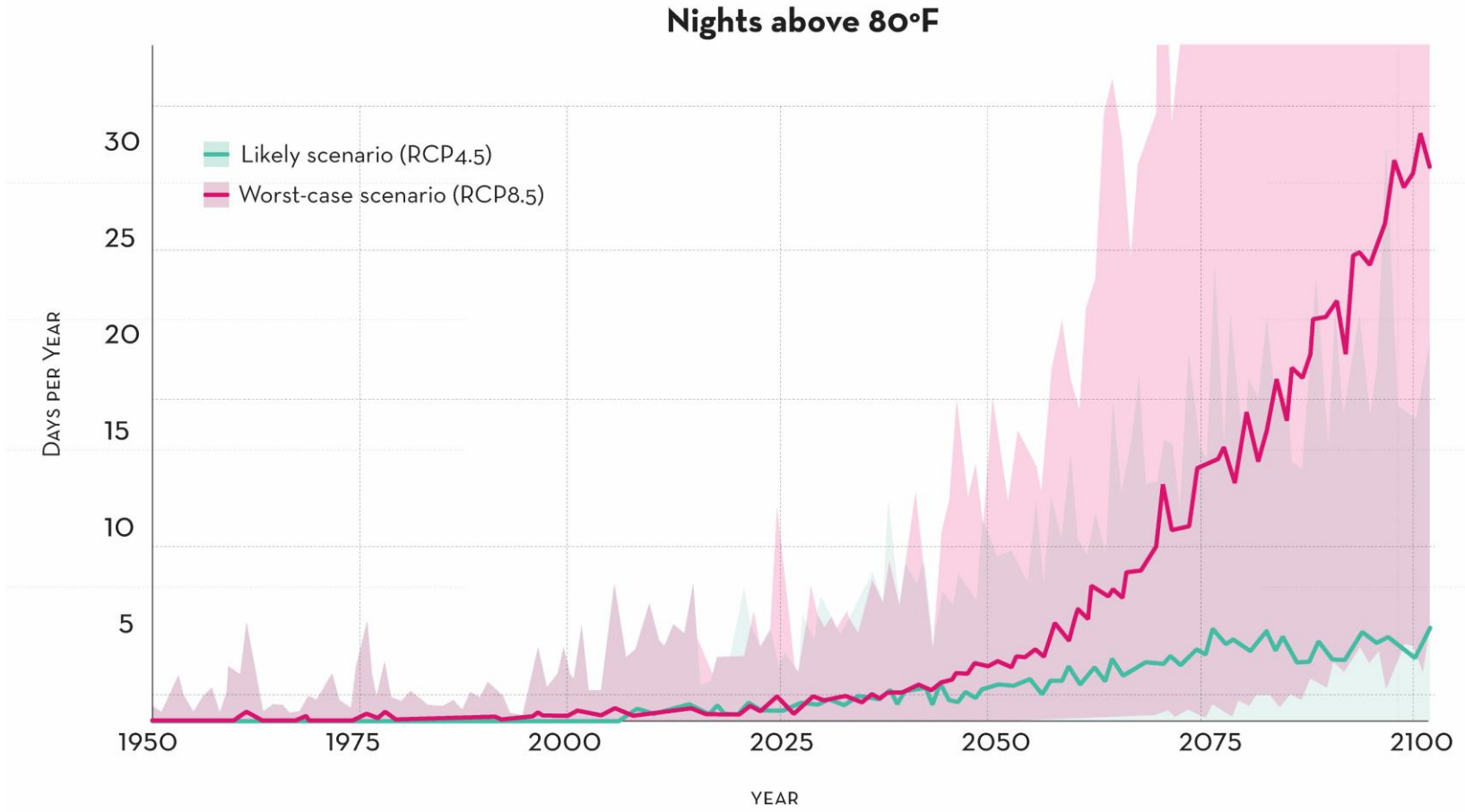
The **intensity of extreme storms** like derechos and hurricanes is likely to **increase**.

Unseasonably warm or cold days in the shoulder seasons will become more likely.

Extreme heat



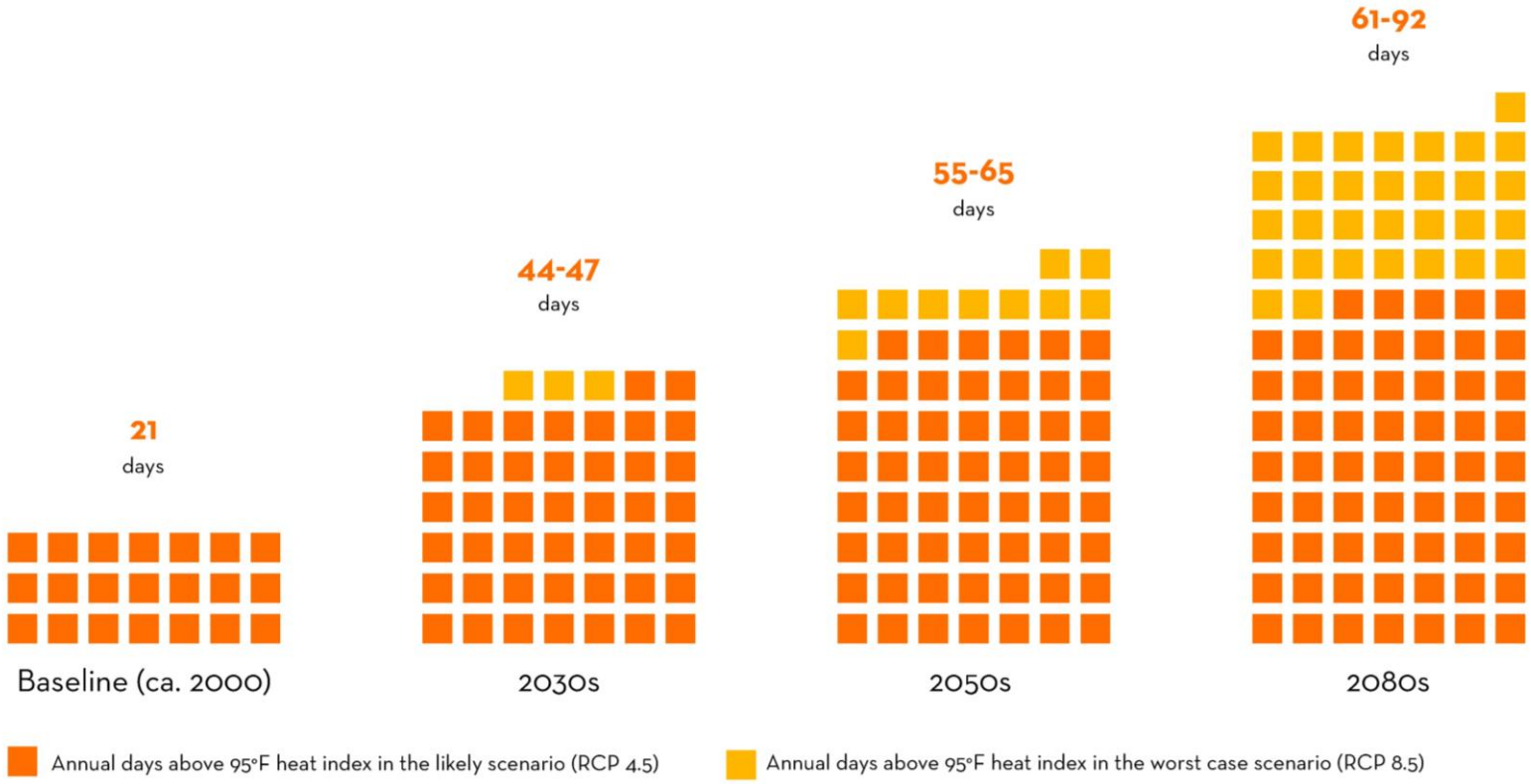
Extreme heat



The new **Nights Above 80°F** metric could be considered in planning for human health risks for residents who are unhoused or who do not have access to air conditioning.

Extreme heat

Projected Heat Emergency Days per Year



1900s 1950s 2000s 2050s 2100s

Dawn

Born: 1935.

In 2015, Dawn is 80. She doesn't like going outside in the heat.

Mary

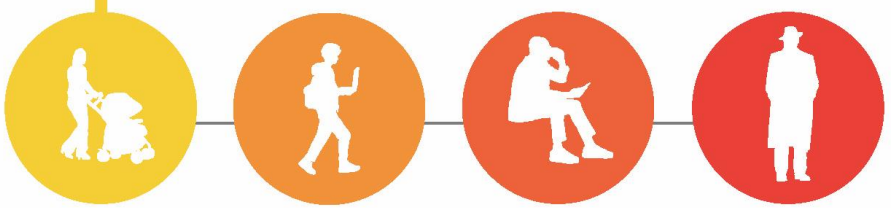
Born: 1963
(baby boomer)

In 2043, Mary is 80 years old. She is considering moving north to escape the heat as she ages.

Michelle

Born: 1991
(millennial)

In 2071, Michelle is 80 years old. Frequent heat emergencies make it unsafe for her to leave the house in the summer.

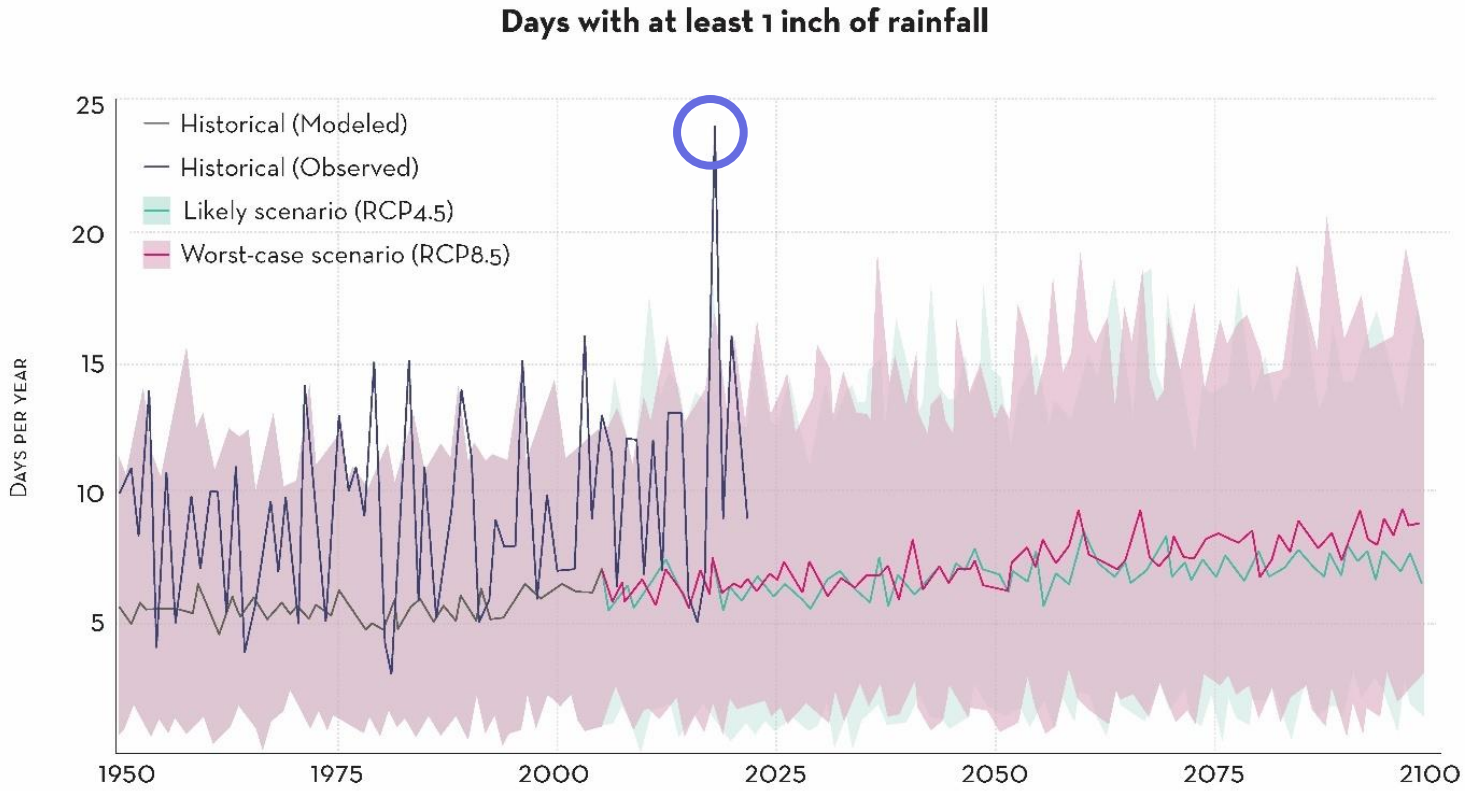


Casey

Born: 2023
(gen alpha)

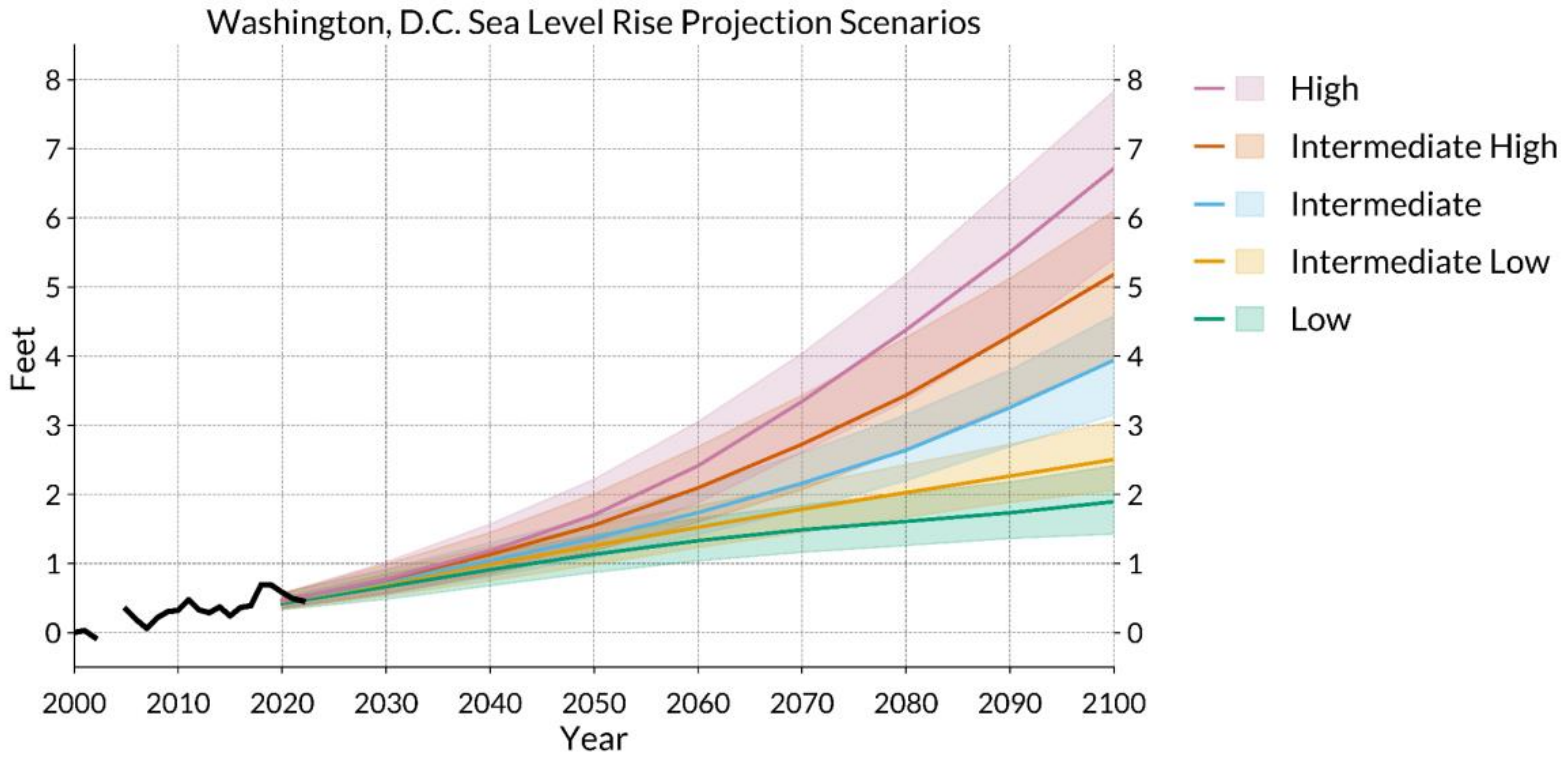
In 2103, Casey is 80 years old. The District is in a state of heat emergency for the majority of the summer and he in constant danger of heat-related illness.

Precipitation



2018, the wettest year in observed District history, received 24 days with at least one inch of rain. This exceeds even the maximum of the worst-case warming scenario projections by the year 2100, indicating that this model should be understood as a conservative estimate.

Sea level rise

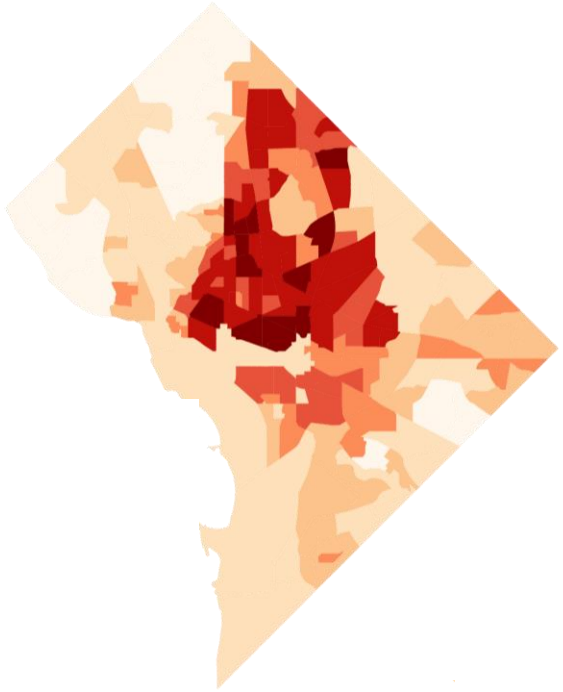


Data: 2022 Sea Level Rise and Coastal Flood Hazard Scenarios and Tools Interagency Task Force report

Extreme Weather

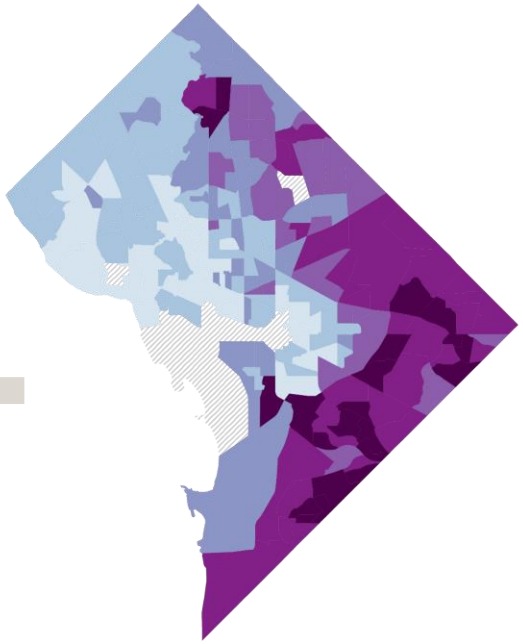
- Storms of all types are expected to get more intense in the future
- Weather is expected to become more volatile and more difficult to predict.

Understanding Climate Risk: Heat



Heat Exposure Index

- Low
- Moderate
- High



Heat Sensitivity Index

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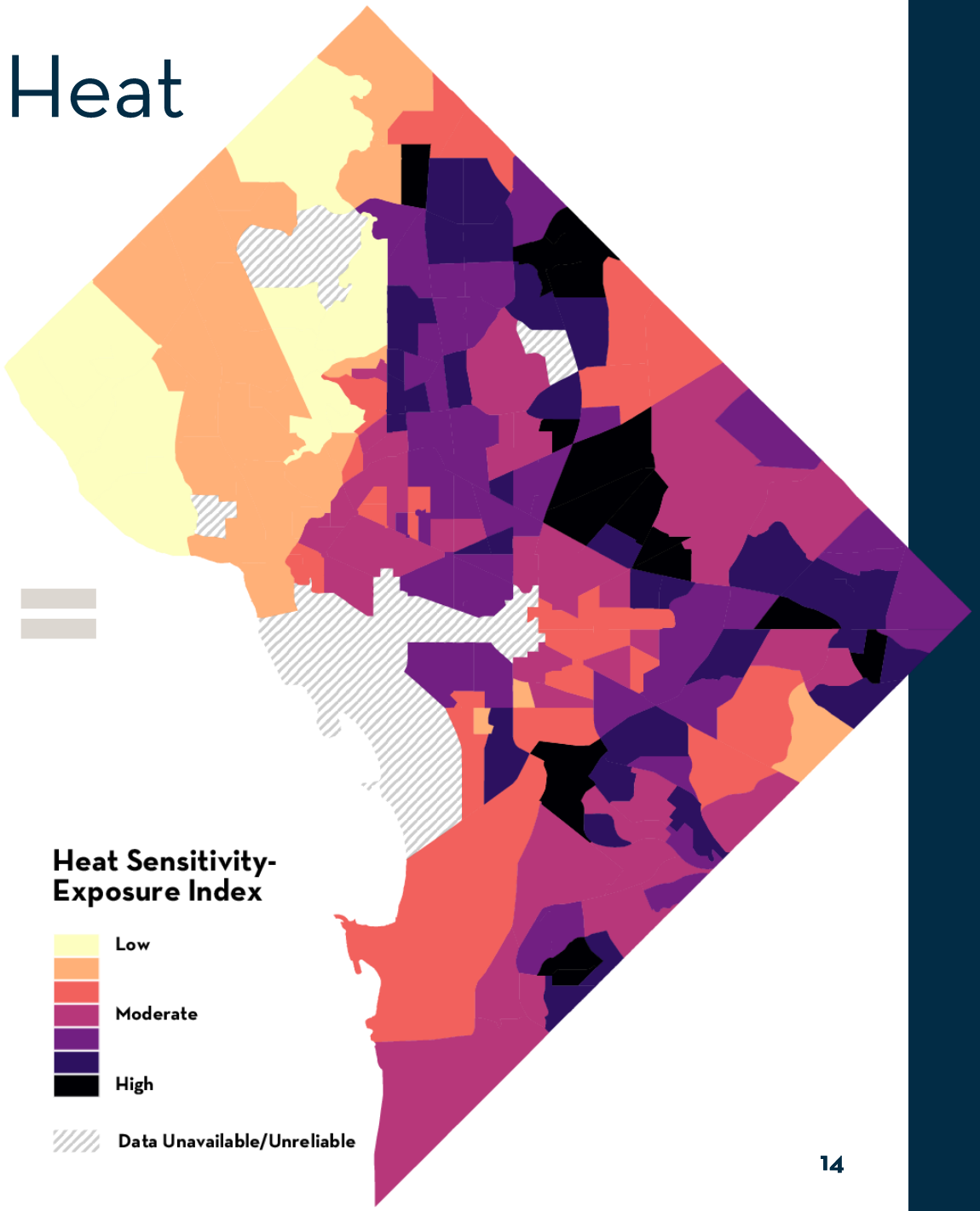


Heat Sensitivity-Exposure Index

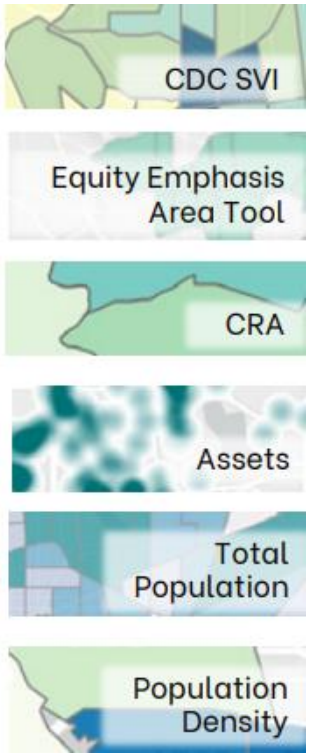
- Low
- Moderate
- High
- Data Unavailable/Unreliable

Understanding Climate Risk: Flooding

Climate Risk Exposure

+

Socio-economic Sensitivity



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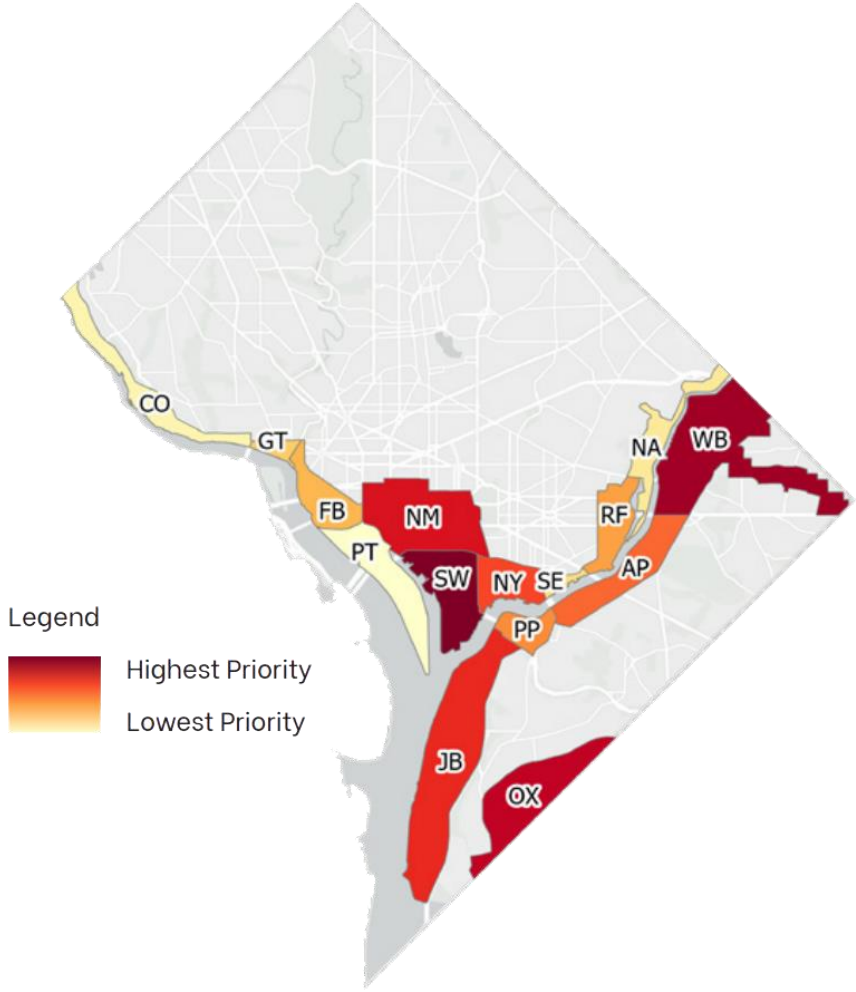
Actionability

=

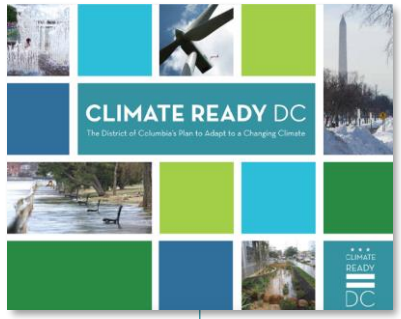
Flood Resilience Focus Areas

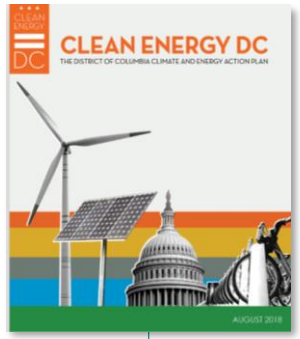


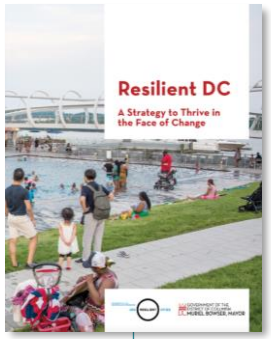
An interagency approach to updating

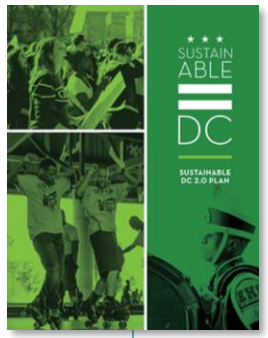
Climate Ready DC

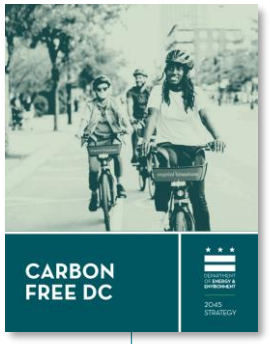
Districtwide Climate-related Plans:





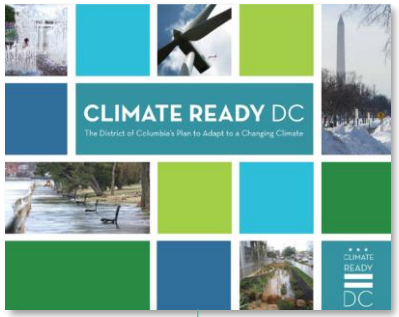






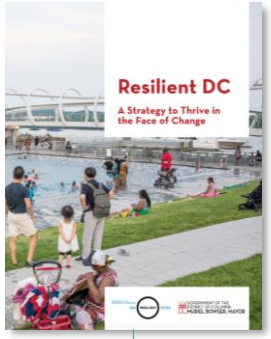
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

Districtwide Climate-related Plans:



Mayor's 2016 plan to adapt to changing climate

DEPARTMENT OF ENERGY & ENVIRONMENT



DC's 2019 strategy to thrive in the face of change

HOMELAND SECURITY EMERGENCY MANAGEMENT DC

CONSOLIDATE

Climate Ready DC 2.0
Citywide Climate Resilience Plan

Interagency Workshops

Workshop #1
December 12, 2023

- Identify successes and barriers to implementing Climate Ready DC

Workshop #2
February 27, 2024

- Discuss mechanisms for implementation, inter-agency collaboration, and what support is needed.

Workshop #3
June 25, 2024

- Identify strategies to center racial equity in climate resilience planning in the District

Workshop #4
October 29, 2024

- Recap of community engagement and review of proposed goals, objectives, actions

Interagency Workshops

40-50 participants per workshop

17+ entities represented

Interagency Advisory Group

- Working group for 14+ District agencies
- Quarterly meetings
  - Coordinate efforts
  - Advise on CRDC update

CRDC 2.0


Jul 2023
Oct
Jan 2024
Apr
Jul
Oct
Jan 2025
Apr
Resilient DC Online Interactive Storymaps (4/5 published)
Update Climate Projections
Mapping, analysis and racial equity assessments.
Develop new actions
Draft outline
Drafting the plan
Interagency workshops
Agency Feedback on Plan
Quarterly Climate Resilience Interagency Advisory Group Meetings
Interviews with agency staff
Public Survey
Tabling and Community Presentations
Open Houses
Legend
Plan development
Agency engagement
Community engagement

Transportation-related

Resilience Actions

Goals

1. **Support District residents** to become more climate ready.
2. **Protect buildings & infrastructure** from climate impacts
3. **Institutionalize climate change preparedness** in District government.
4. **Use the best available science & tools** to understand climate risks.

High Priority S.M.A.R.T. actions

1 **Support District residents** to become more climate ready.

2 **Protect buildings & infrastructure** from climate impacts

3 **Institutionalize climate change preparedness** in District government.

4 **Use the best available science & tools** to understand climate risks.

- 1.1
- 1.2
- 1.3
- 1.4
- 1.5
- 1.6
- 1.7

S.M.A.R.T.:

- a **specific (S)** step to take that builds from momentum or best practice
- a **measurable (M)** indicator of success, which will be tracked by DOEE and HSEMA
- an **achievable (A)** target
- a **relevant (R)** action that works toward the Goal, and
- a **timeline (T)** for hitting the target within the 5-year implementation period.

1

Support District residents to become more climate

1.5 Develop "**cool corridors**" in neighborhoods vulnerable to extreme heat.

1.6 Expand the number of **shaded bus shelters** in heat vulnerable communities and pilot new design strategies for DDOT-managed bus shelters to provide better protection from extreme heat.

1.7 Add additional tree shade or shade structures along heavily used **pedestrian and bicycle trails**.

2

Protect **buildings & infrastructure** from climate

2.2 Develop a climate risk screening tool and a **climate resilience cost benefit analysis tool** to be used before project costs are estimated and put into the Capital Improvement Plan.

2.3 Develop language related to climate resilience and incorporate it into **capital improvement scopes of work** (SOWs) and **requests for proposals** (RFPs) for District of Columbia funded projects.

2.4 Design and implement **neighborhood-scale blue-green infrastructure networks.**

2.5 Incorporate shade analysis and **higher shade standards** into planning and design.

3

Institutionalize climate change preparedness in District government.

3.3 Establish a **Climate Champion** in each agency and establish a broader Climate Cohort that staff in any agency may join.

3.4 Create a **chief heat officer** position.

4

Use the best available **science & tools** to understand climate risks.

4.5 Conduct a **cost-of-inaction study** to better understand the District's climate risk in financial terms.

Thank you

Shot Tower Flood Mitigation Study: A Resiliency Program Initiative

MARYLAND DEPARTMENT OF TRANSPORTATION

Resiliency Transportation Programs:

MDOT MTA'S
Resilient Transportation Program

Vision: Manage increased climate risk and expedite recovery from weather events through effective and equitable program, project, and purchasing decisions.

Storm Surge

Fells Point, Baltimore City

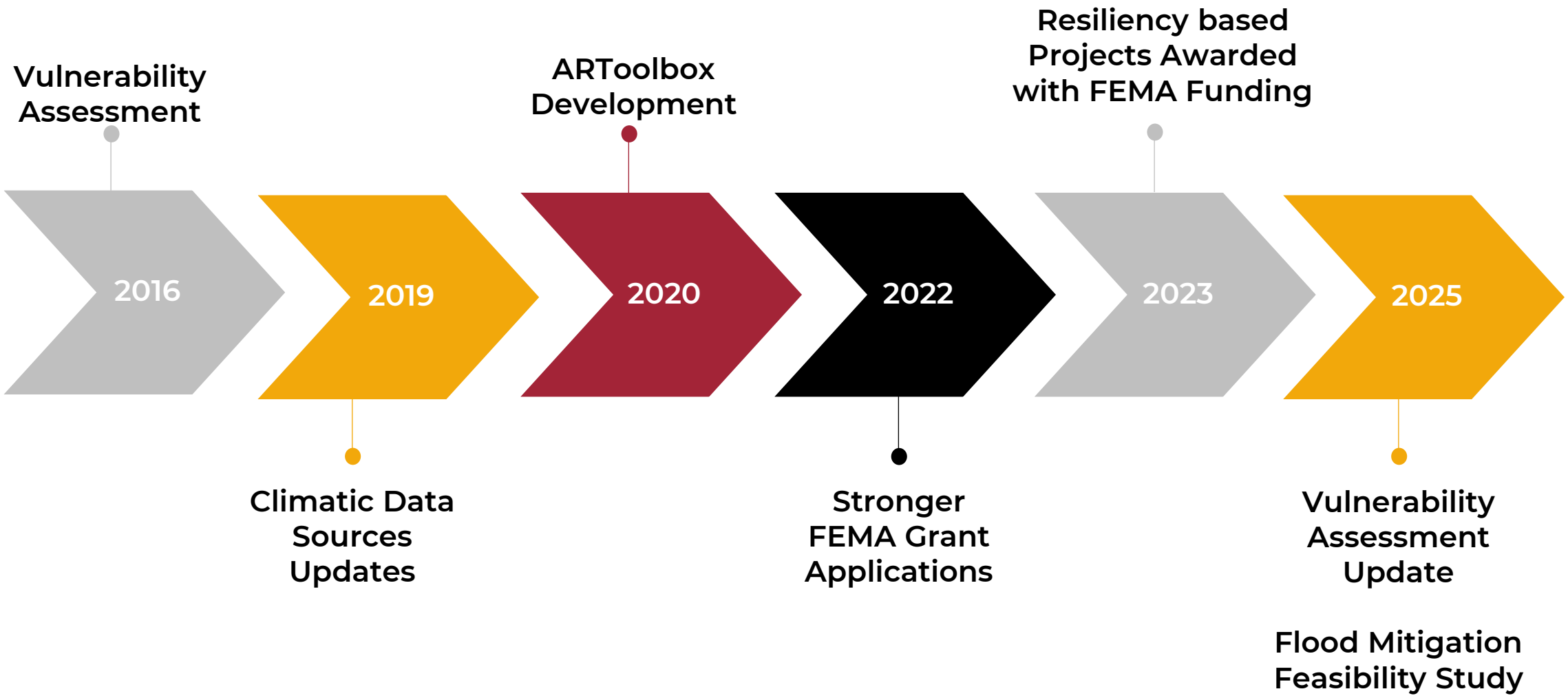
Track Wash Outs

Light Rail, Baltimore Highlands

Sea Level Rise

Smith Island, Somerset County

Resiliency Program Timeline of Progress



The Adaptation & Resiliency Toolbox (ARToolbox)

Asset Navigation Tool

Long-Term Solutions
Mid-Term Solutions
Short-Term Solutions

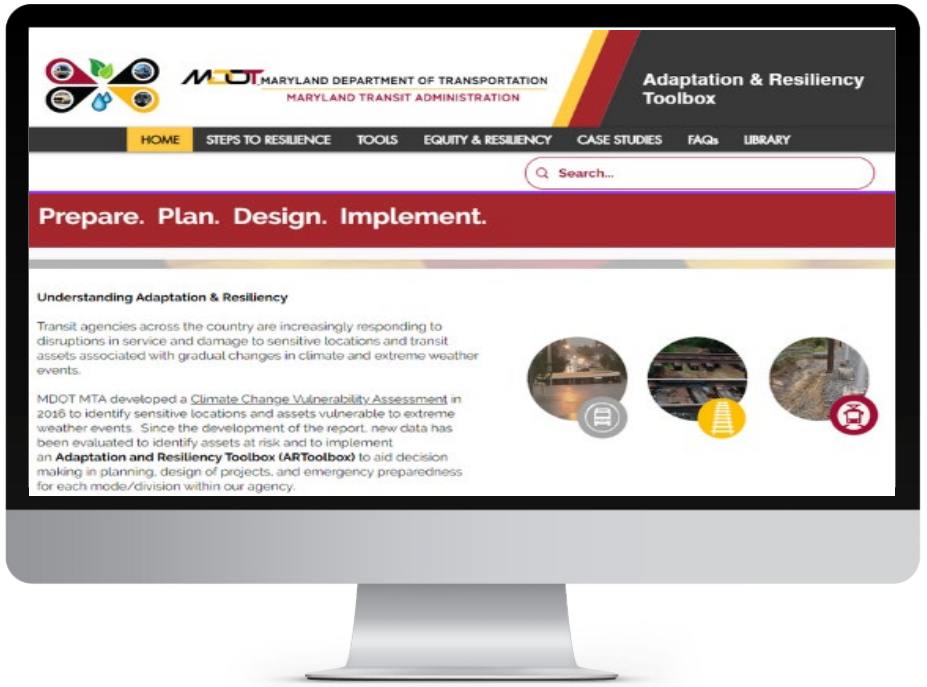
Resiliency Search Tool

Vulnerability Mapping Tool

Library

Funding Resources

Case Studies



Resilience Integration Wins & Projects

Supporting Data for Funding Program Applications

Projects Awarded FEMA Funding

Shot Tower Metro Station: Flood Mitigation Feasibility Study

Projects Awarded FEMA Funding

	Location	Problem	Solution	Funding
Design (30%)	**Metro Tunnel Pumping Stations (Baltimore City)**	▪ Outdated Pumping Infrastructure at Seven Locations ▪ Very High Risk (Due to Sea Level Rise and Floodplain Inundation) ▪ Service Interruptions	▪ Track Drainage Study ▪ 30% Design	▪ Project Cost: $750K ▪ Federal Share: $675K (90%)
Construction	**Mt Washington Light Rail Protection (Baltimore City)**	▪ Erosion and Bank Instability ▪ Potential for Track Overtopping ▪ Very High Risk (Due to Floodplain Inundation)	▪ Permanent Fix Construction ▪ Stabilization to Stream Banks ▪ Erosion and Sediment Control ▪ Riprap and Gabion Baskets	▪ Project Cost: $500K ▪ Federal Share: $450K (90%)

Shot Tower: Flood Mitigation Feasibility Study

Existing Condition Analysis of Station Components

Identification of Flood Risk Reduction Alternatives (Conceptual Engineering Level)

Benefit-Cost Analysis of Alternatives

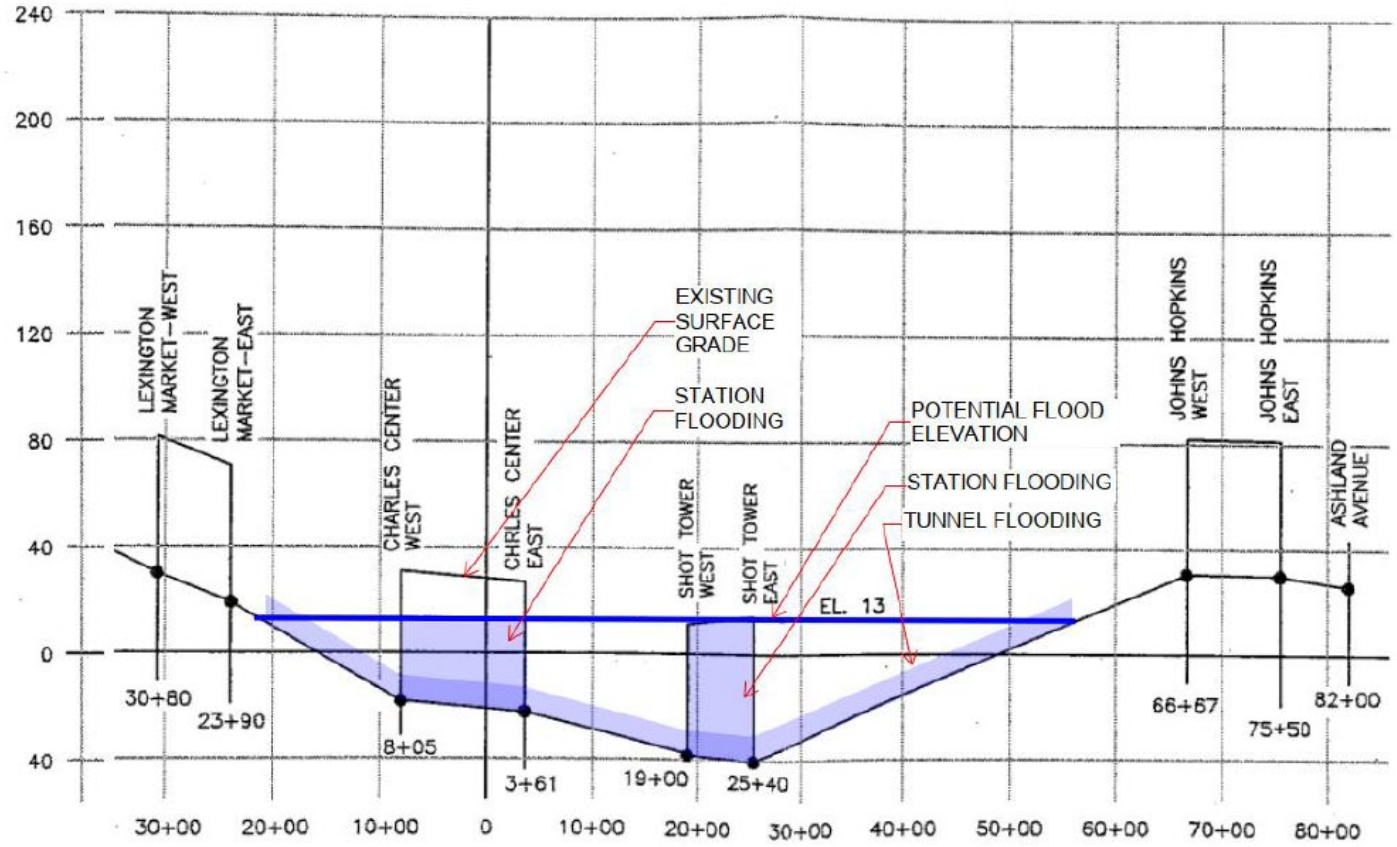
Support Data for Funding Application

(e.g., FEMA Grant Programs)

Existing Conditions

Part of the underground section of the Metro system and located at the lowest elevation.

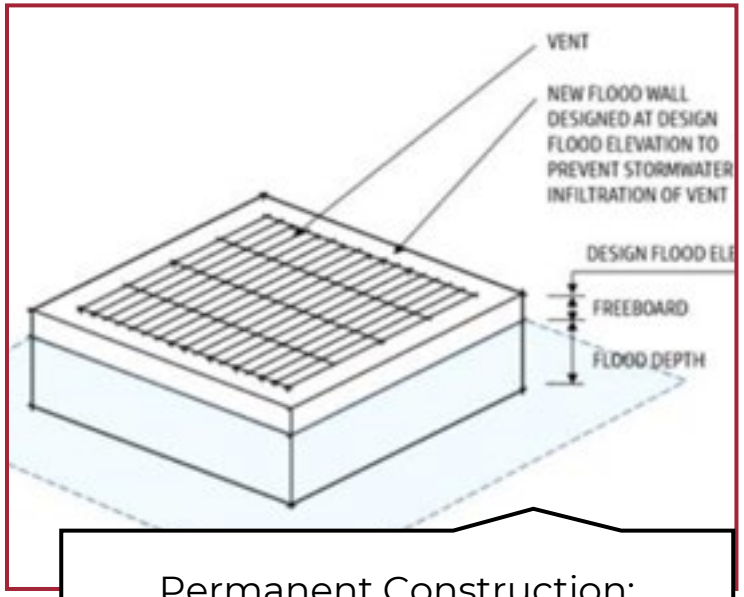
In an area with Very High risk of flooding due to surge events, major rainfall events, and sea-level rise.



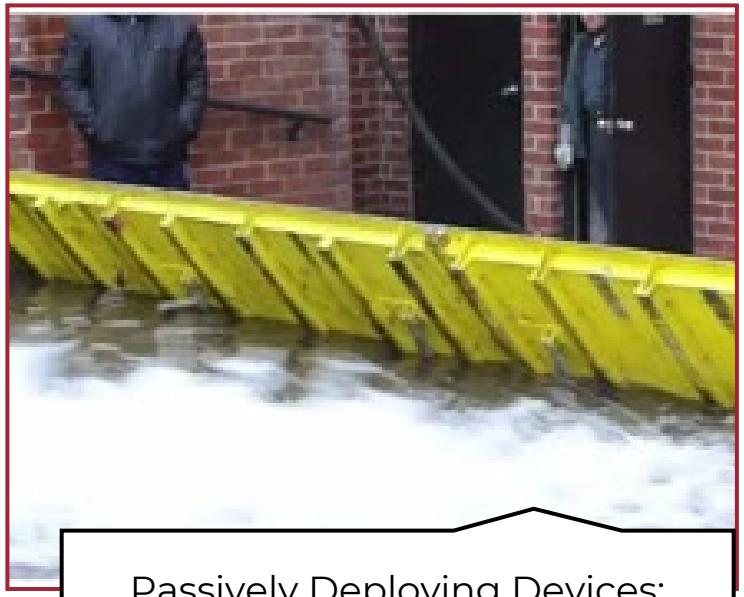
Existing Conditions (cont'd)

Complex solution needed due to the multiple potential water entry points to station, platform, and tunnel.

Proposed Risk Reduction Measures



Permanent Construction: Building structures that provide constant protection



Passively Deploying Devices: Systems that activate without human intervention

Manual Deployment System: Procedures requiring human action to set up flood defenses

BCA Findings

Vertical Passive Barrier

Flip-Up Barrier

Horizontal Vent Flood Barrier

Waterproof Doors

Alternative 2

- Passively Deployed Mitigation Measures

Total Benefits	$266 Million
Total Costs	$17.3 Million
Benefit-Cost Ratio	15.4

Next Steps

Explore a phased approach to implement proposed measures

Finalize the feasibility study

Use the study to pursue funding opportunities through established grant programs (e.g., FEMA, PROTECT) and other potential sources

Replicate the study for other vulnerable MTA assets

THANK YOU!

Any Questions?

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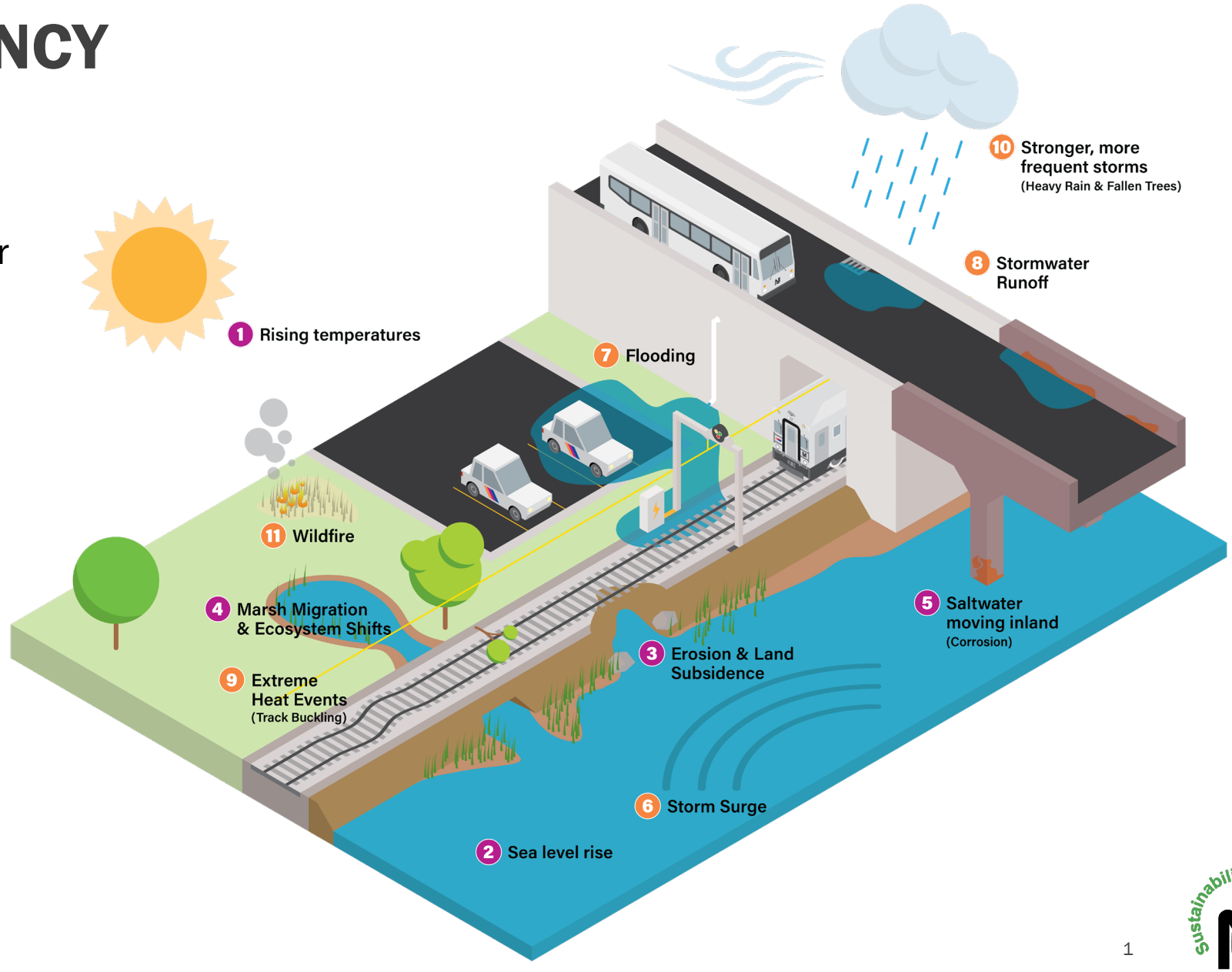
Maryland Transit Administration
Office of Statewide Planning
Environmental Planning Division

NJ TRANSIT CAPITAL PLANNING RESILIENCY PROGRAM

Emily Korman
Resiliency Capital Planning Manager

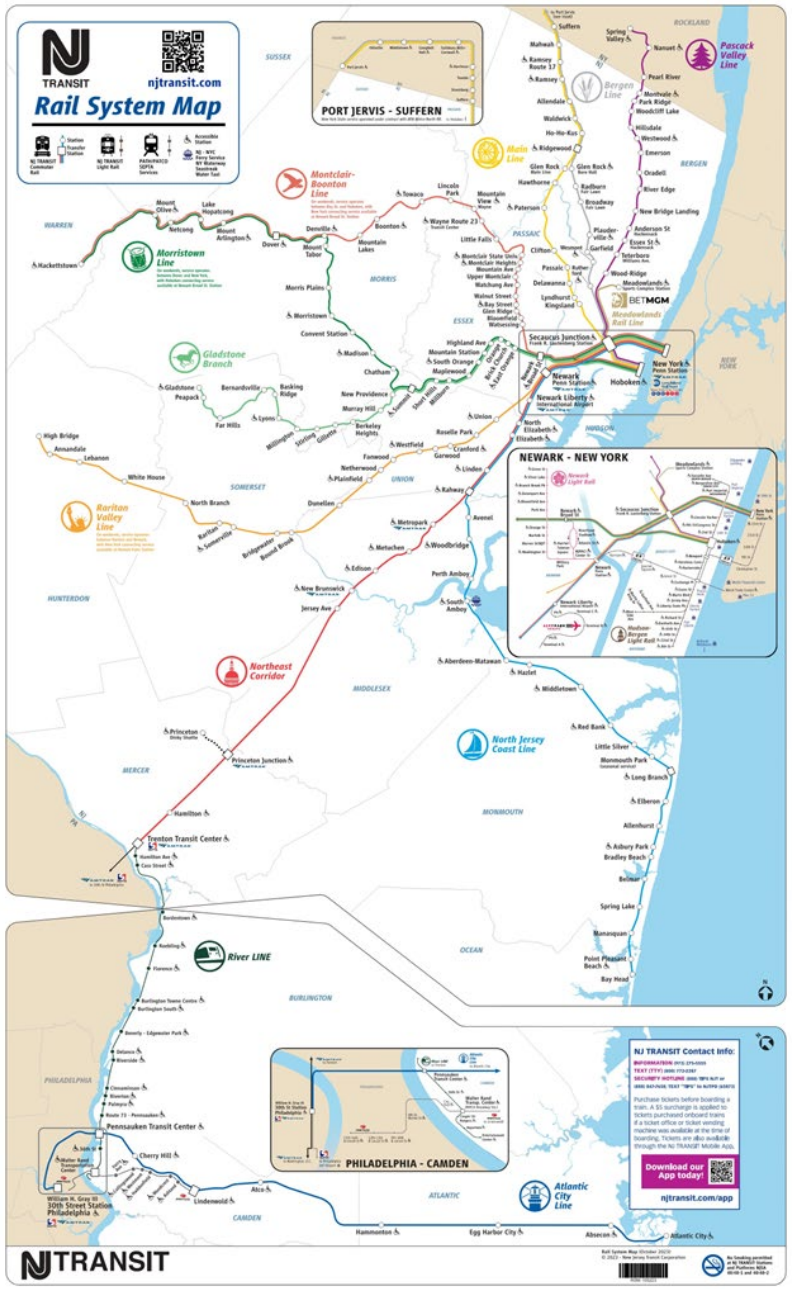


AGENDA

- NJ TRANSIT Climate Concerns
- Complete Resiliency Projects
- Long-Term Resiliency Strategy
- Questions

ABOUT NJ TRANSIT

- **Our Mission:** Move New Jersey and the region by providing safe, reliable and affordable public transportation that connects people to their everyday lives, one trip at a time.
- Largest statewide public transit agency
- Third largest provider of bus, rail, and light rail transit
- Provide more than 517,000 weekday trips on 253 bus routes, 3 light rail lines, 12 commuter rail lines, and NJ TRANSIT Access Link (paratransit service)
- Our fleet consists of 2,258 Buses, 171 Locomotives, 1,040 Cars, 73 Light Rail Cars, and 583 Access Link vehicles



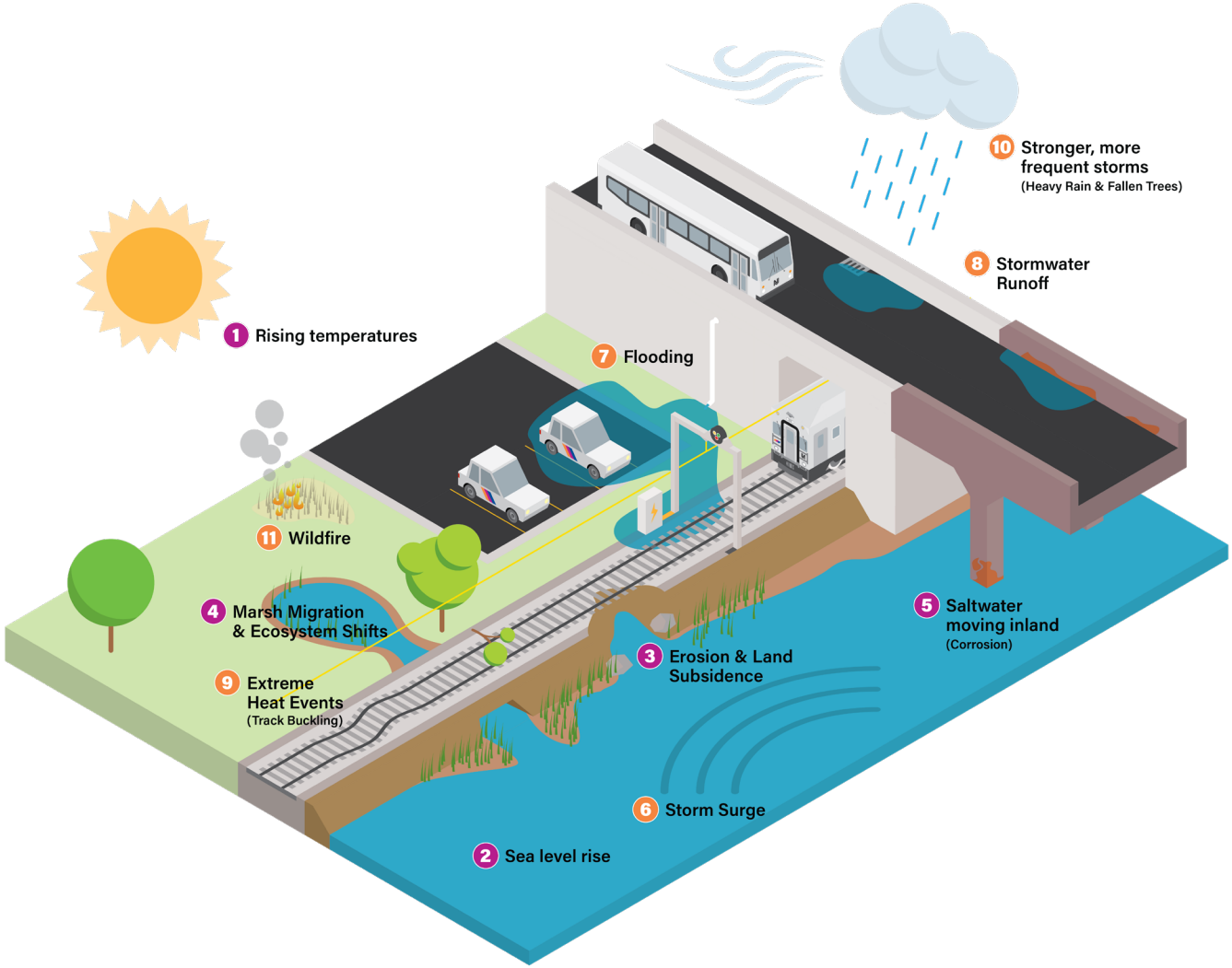
CLIMATE CHANGE CONCERNS

Gradual Processes

1. Rising Temperatures
2. Sea Level Rise
3. Erosion & Land Subsidence
4. Marsh Migration & Ecosystem Shifts
5. Saltwater Moving Inland

Intermittent Events

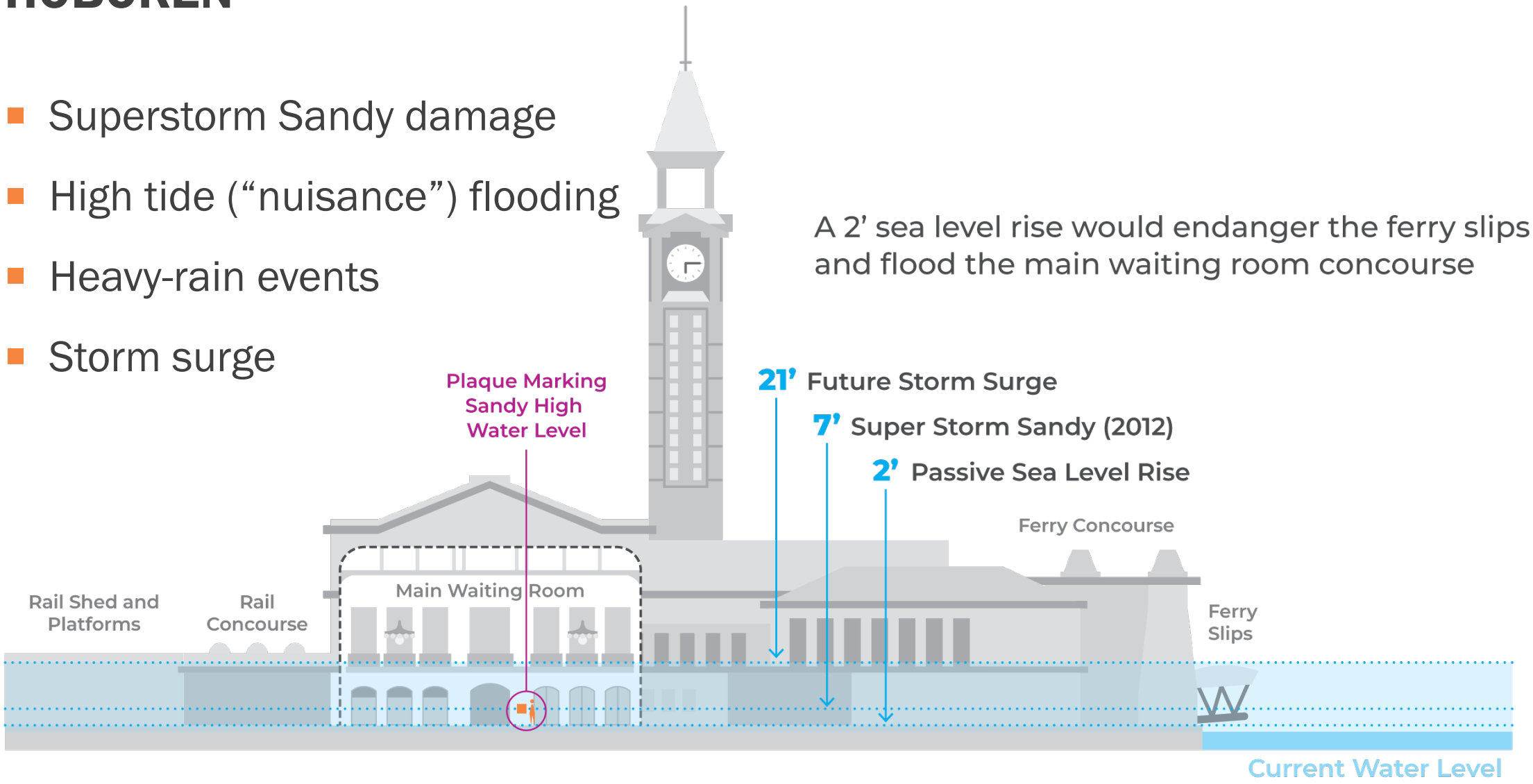
6. Storm Surge
7. Flooding
8. Stormwater Runoff
9. Extreme Heat Events
10. Stronger, More Frequent Storms
11. Wildfire



HOBOKEN

- Superstorm Sandy damage
- High tide (“nuisance”) flooding
- Heavy-rain events
- Storm surge

A 2’ sea level rise would endanger the ferry slips and flood the main waiting room concourse



COMPLETED RESILIENCY PROGRAM PROJECTS

SUPERSTORM SANDY PROJECTS

GLADSTONE CATENARY POLE RESILIENCY PROJECT

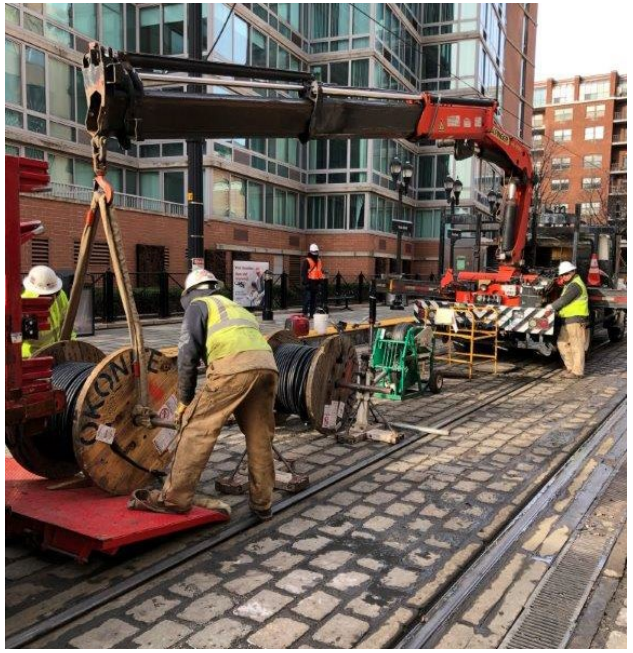
- Wind, rain during Sandy caused structural failure of several wooden catenary poles along Gladstone Branch right-of-way.
- Project Scope:
  - Replaced 163 wooden catenary poles along Gladstone Branch with new steel catenary poles
  - 155 locations between New Providence Station and Gladstone Rail Yard
- Construction duration: ~3 years

Fig. 1. Damage from Superstorm Sandy to catenary polls along Gladstone Branch commuter line.

Fig. 2. New steel catenary polls installed along Gladstone ROW.

HUDSON-BERGEN LIGHT RAIL TRACTION POWER & SIGNAL

- Sections of Hudson-Bergen Light Rail (HBLR) inundated with storm surge during Sandy
- Damaged cabling, catenary poles, switches, signal houses, and HBLR maintenance facility
- Project Scope:
  - Raised Traction Power Substations and Communication Information Huts; repaired damaged facilities
  - Raised 14 Central Instrument Houses (CIH); built a floodwall around 1 (raising not feasible)
  - Components vulnerable to inland fluvial flooding or coastal storm surge raised above FEMA BFE



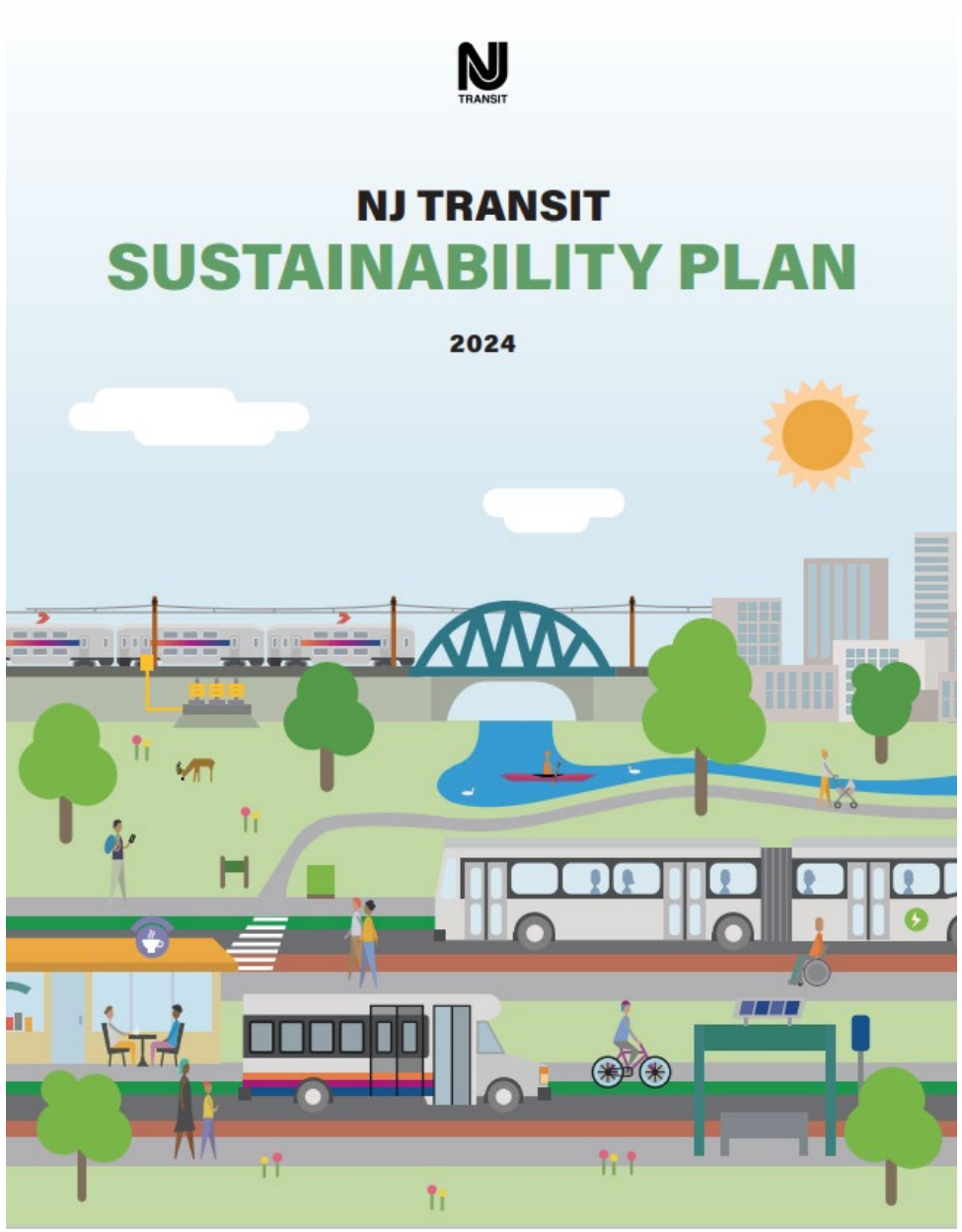
HOBOKEN SUBSTATION PROJECTS

- Impacts 3 substations that power different components of Hoboken Terminal Complex
- Project Scope:
  - **Depot** - relocated above design flood elevation to the second floor of the Pullman & Immigrant building
  - **Observer** - partially relocated to the second floor of the Immigrant / Pullman Building; modifications and repairs to the building structure/envelope necessary to accommodate installation of substation equipment
  - **Henderson** – new substation elevated to DFE, built to withstand contact with salt water where elements couldn't be raised

Fig. 3 (TOP): Depot Substation West Elevation. Fig. 4 (BELOW): Depot Substation 13.2Kv Switchgear

LONG-TERM RESILIENCY STRATEGY

njtransit.com/sustainability/sustainabilityplan



SUSTAINABILITY PLAN

4 Resilient Strategies, Initiatives, and Investments

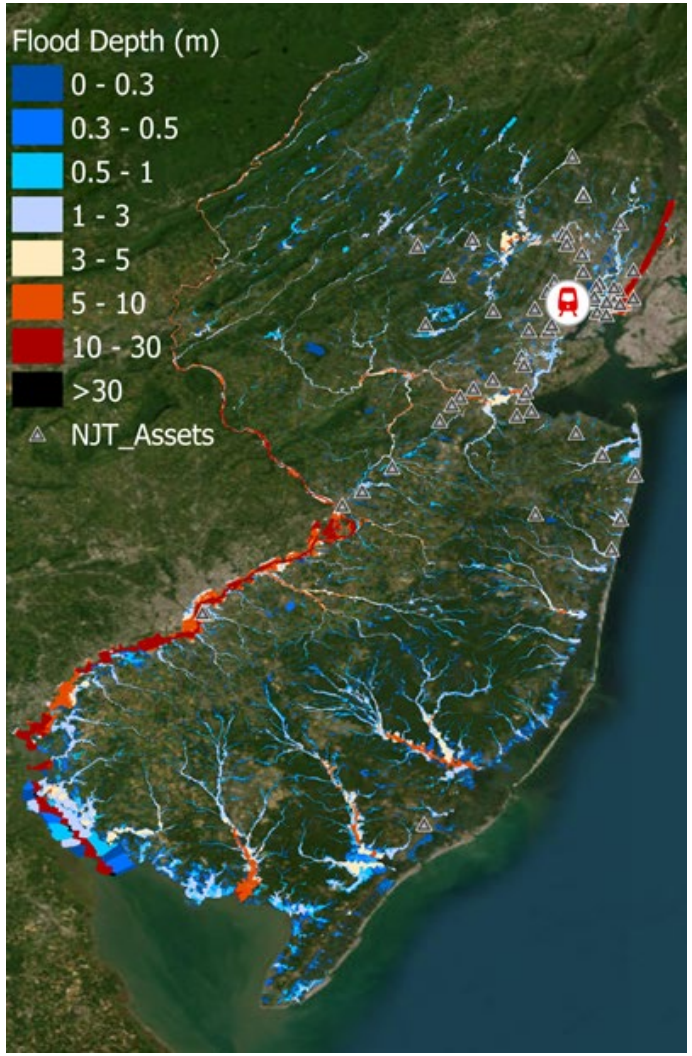
- 4.1 Defining Resiliency for NJ TRANSIT
- 4.2 Operational Practices that Promote Resiliency
- 4.3 Capital Investments that Promote Resiliency
- 4.4 Partnerships and Initiatives

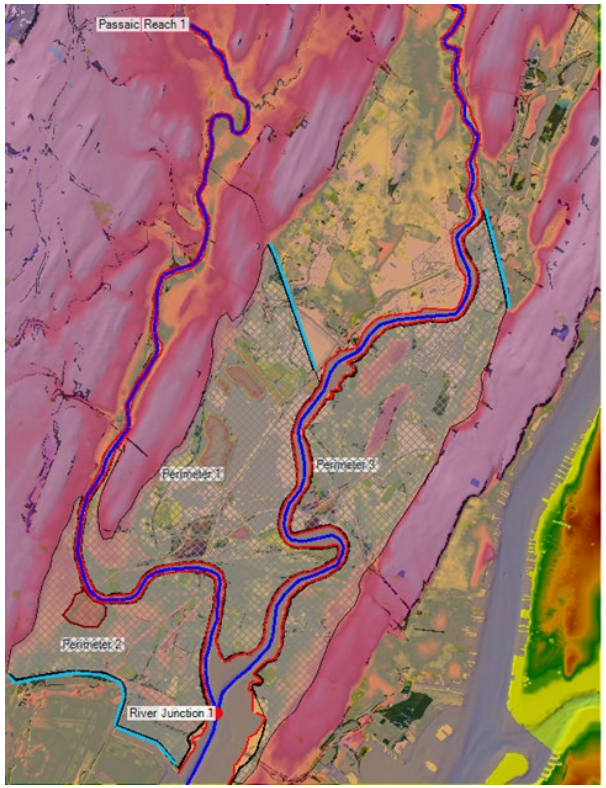
RESILIENCY PLANNING GOALS

- Incorporate long term resiliency planning in the capital planning process.
- Manage complex risk modelling for climate vulnerabilities.
- Identify, gather, and develop global best practices in strategies, standards and practices for NJ TRANSIT to adopt.
- Manage the agency's development and planning activities for capital projects and programs focused on resiliency.
- Coordinate between Capital Programs and the Office of Emergency Management.
- Support the agency's ability to win resiliency-focused grant opportunities.

RESILIENCY PLANNING DEVELOPMENT APPROACH

- Leveraging partnership with Rutgers CAIT to perform the agency's first statewide climate Resiliency Assessments
  - Facility specific modeling
  - Site specific climate risk assessments
  - Identify vulnerabilities, potential mitigation strategies.
- Develop the agency's first Resilient Design Standards and Guidelines



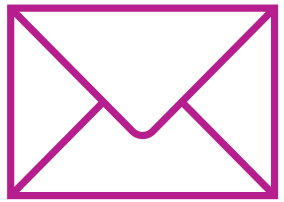


RESILIENCY PLANNING WINS + NEXT STEPS

- Sustainability Plan is NJ TRANSIT's first comprehensive sustainability and resiliency roadmap
- Contributed to the 2024 State Hazard Mitigation Plan Update, NJTPA Resilience Improvement Plan
- Continuing coordination with NJT Office of Emergency Management
- Scoping line-specific vulnerability assessments + long-term infrastructure investments
- Develop a long-term resiliency investment plan for NJ TRANSIT

QUESTIONS?

Website:
njtransit.com/sustainability



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