



# City of Alexandria's Flood Resilience Plan

*Presentation to the Environmental Policy Commission  
December 15, 2025*



**FLOODACTION**

ALEXANDRIA

# Agenda



- Stormwater management and water resources in the City
- Flood Action Alexandria Program
- Flood Action Progress
- Flood Resilience Plan

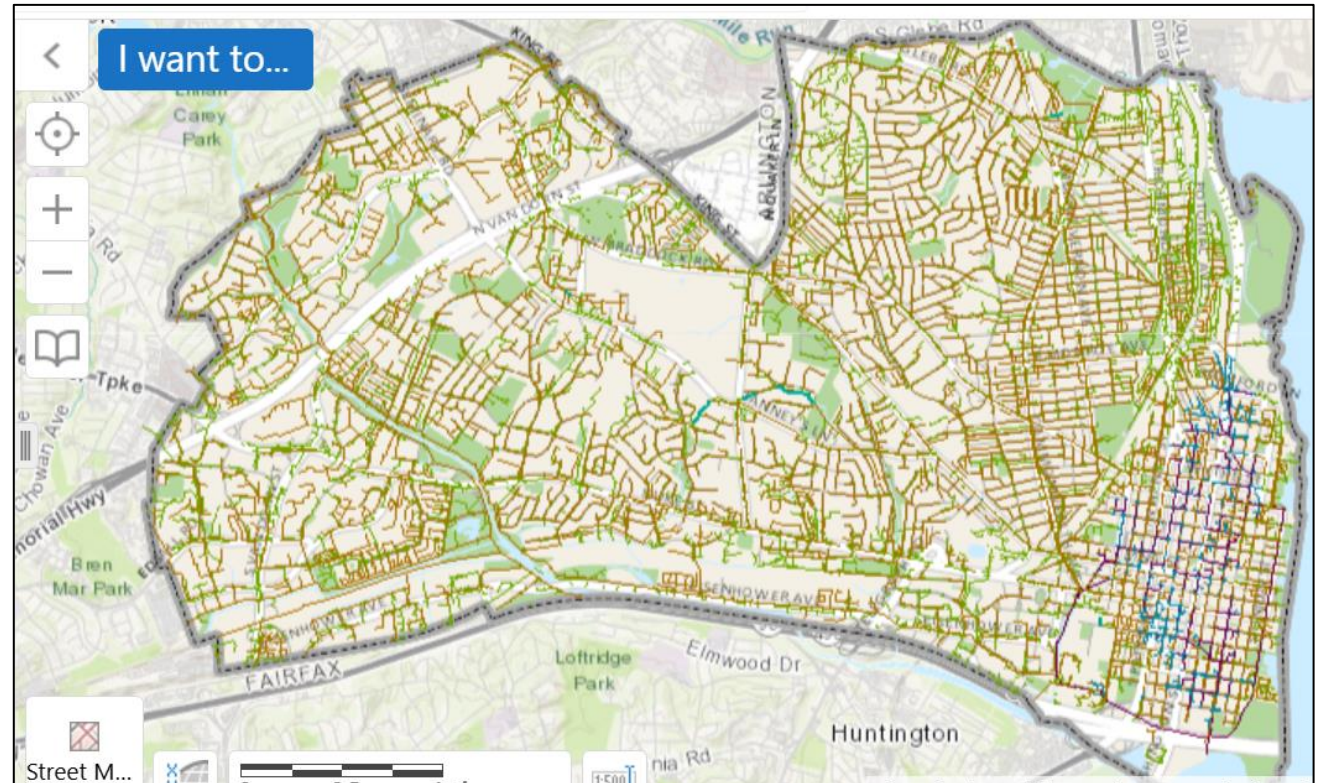
# Stormwater Management



- Phase II Municipal Separate Storm Sewer System (MS4) Permit, includes Chesapeake Bay and Local TMDLs
- Community Rating System (CRS) Class 6: Up to 20% off Flood Insurance
- Combines Sewer Overflows → RiverRenew by AlexRenew

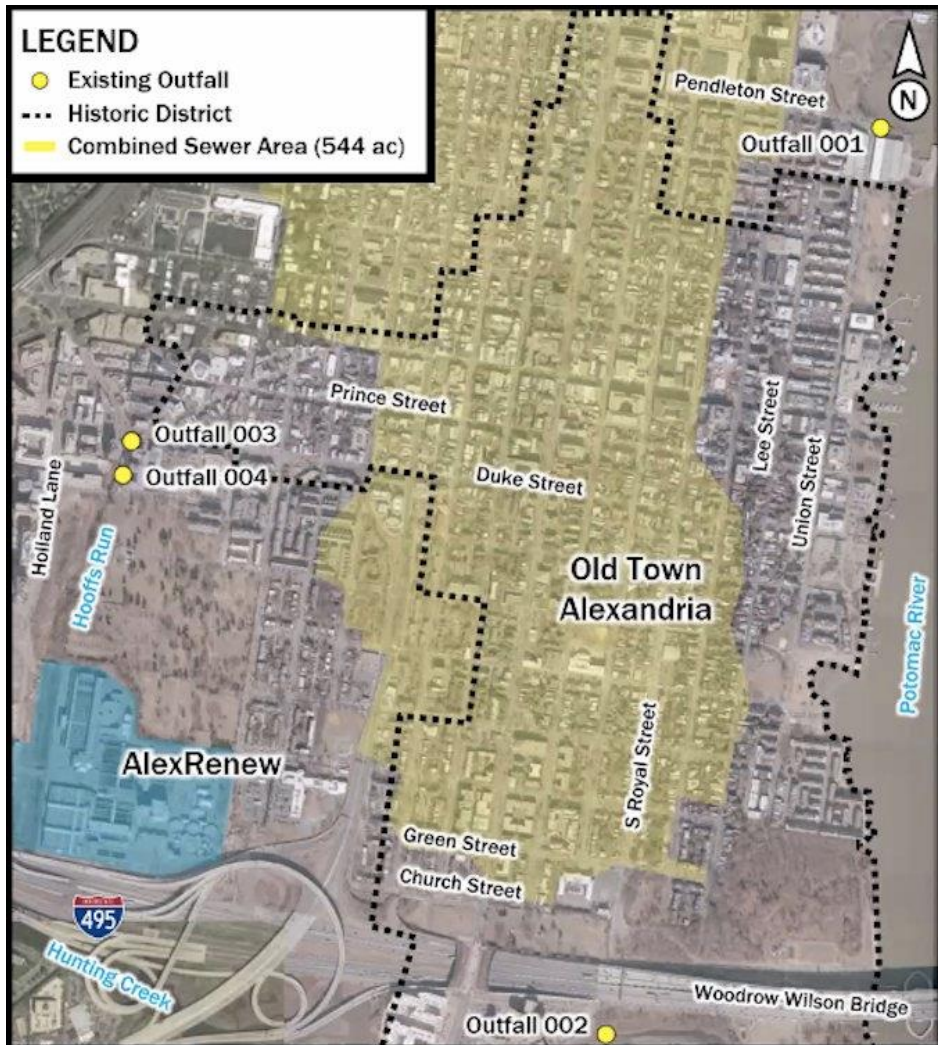
*Stormwater Management Projects, clockwise from top: Lucky Run, Lake Cook, Windmill Hill, Ben Brenman Pond, Four Mile Run, Eisenhower Pond*

# Where does all of the stormwater go?



←Check out Alexandria's Sewer Viewer!

# River Renew Overview



- Direct response to a 2017 state law requiring the remediation of the CSOs
- In 2018, ownership of four CSO outfalls to AlexRenew.
- RiverRenew is a \$615 million dollar project that includes tunnels and new pumping stations.

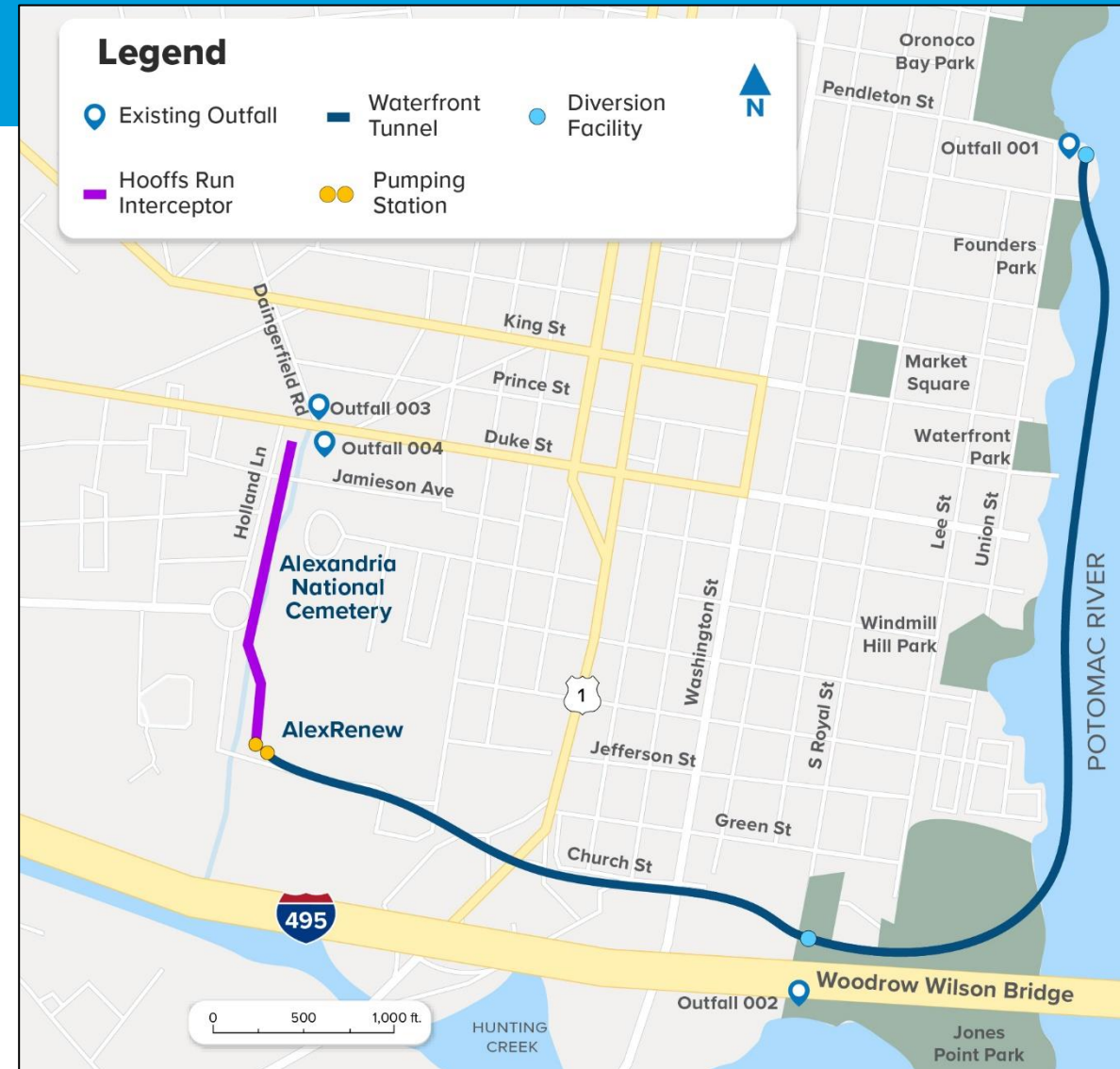
# River Renew Overview

**Project Components:** 2-mile-long, 12-foot-wide Waterfront Tunnel approximately 100 feet below ground; diversion facilities to direct 130 million gallons of combined sewage into the tunnel system; a half-mile-long, six-foot-wide Hooffs Run Interceptor; pumping stations housed in two large shafts; superstructure to house pumping station equipment.

**Timeline:** Construction began in December 2020 and is scheduled to be completed by July 2026.

**Cleaner Waterways:** Reduce the average volume of overflows from about 140 million gallons to less than 16 million gallons annually

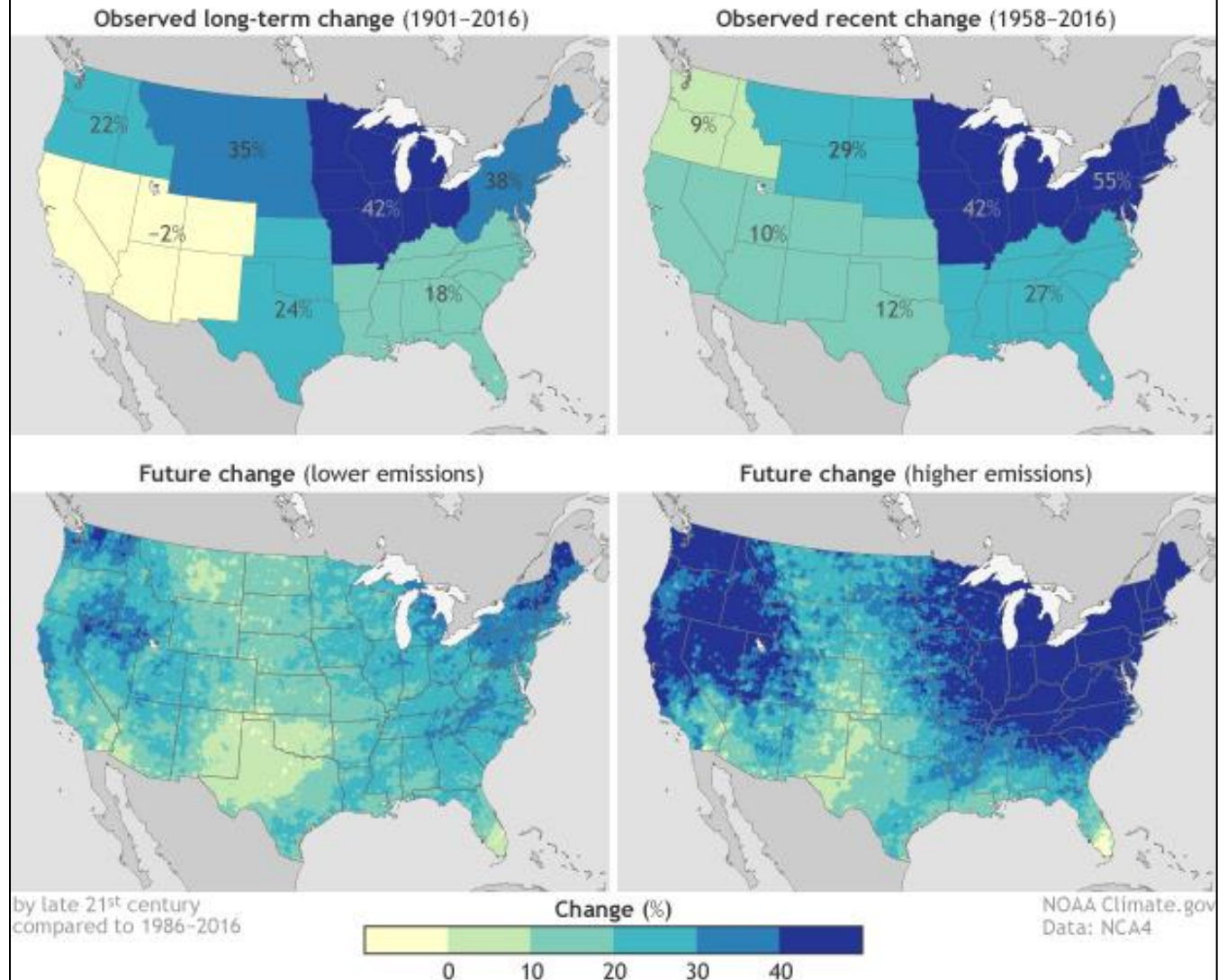
**Environmental Compliance:** The program is a direct response to a 2017 state law requiring the remediation of the CSOs



# More Frequent and Severe Flooding

- More frequent and intense rainfall events due to changing weather patterns
- Warmer air holds more moisture which leads to heavier rainfall

Change in extreme precipitation across the United States



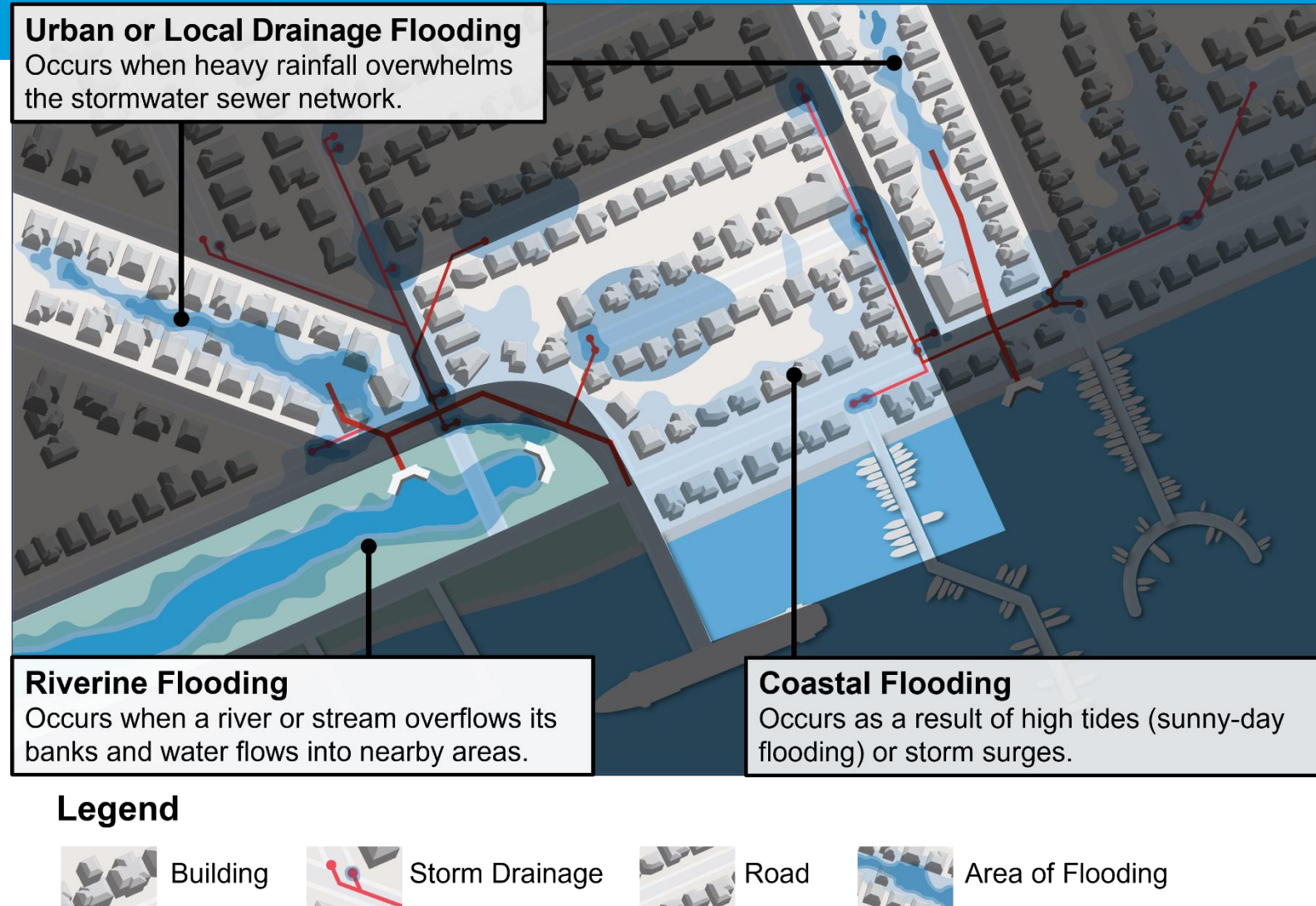
# Storms become more Frequent & Severe

- **2018:** Virginia's wettest year on record, 20"+ over normal
- **July 8, 2019:** Regional Flood
- **July 23, 2020:** Local Flash Flood
  - 60-80% of monthly avg in 30 minutes
- **Sept. 10, 2020:** Local Flash Flood
  - 2.5-4" with rates up to 3"/hr in 10 mins
  - Daily rainfall record at National Airport
- **August 15, 2021:** Local Flash Flood in Four Mile Run and Hooffs Run watersheds
  - 5.19-inches in 2-hours
- **August 14, 2023:** Most intense storm of Summer
  - 6.24-inches per hour



# What Types of Flooding Occur in Alexandria?

- Urban flooding
  - Flash flooding
  - Sewer/Sanitary backups
- Riverine flooding
- Coastal flooding (Potomac River)
  - High tides
  - Storm surges



# Flood Action Alexandria Program Launched in 2021

## City Leadership

- Provides guidance
- Appropriates funding (e.g., Stormwater Utility Fe)



## City Staff

- Maintain & operate stormwater + sanitary systems
- Investigate neighborhoods & identify projects
- Deliver CIP projects (large capacity + spot improvements)

## Community Members

- Report issues via Alex311
- Floodproof their property (grant available)
- Advisory Committee

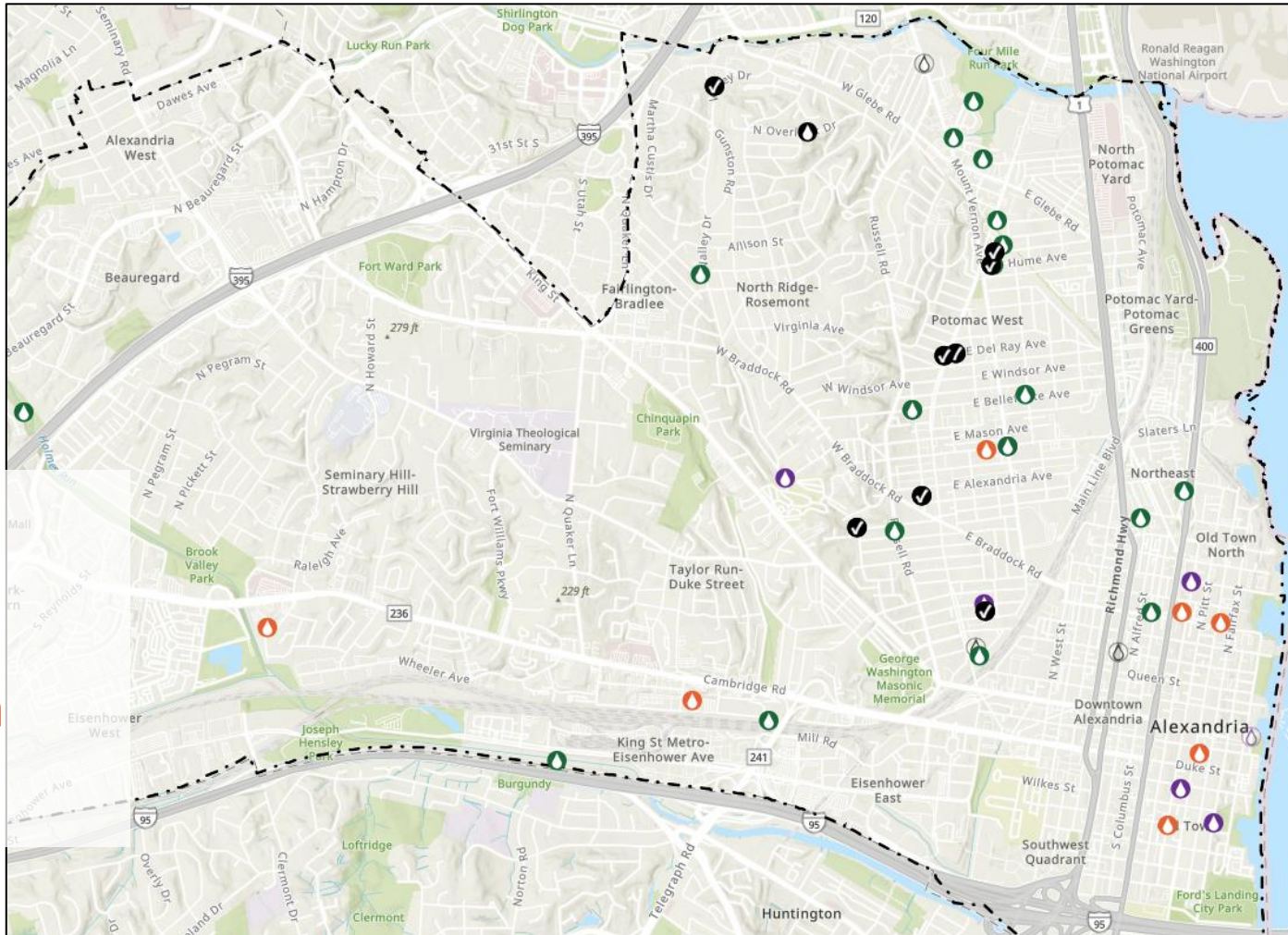


# Flood Action Alexandria Progress

- ✓ Diversified funding streams for large, expensive projects
- ✓ Ongoing maintenance of sewer system and stream channels
- ✓ Flood Action bi-monthly eNewsletter
- ✓ Stormwater Utility & Flood Mitigation Advisory Committee
- ✓ **Storm sewer system capacity improvement projects**
- ✓ **Flood Action Story Map**
- ✓ **Rain Gauge & Stream Flow Tool**
- ✓ **Flood Mitigation Grant Program & Updates to the Stormwater Utility Credit Fee Program**

# Flood Action Alexandria Progress

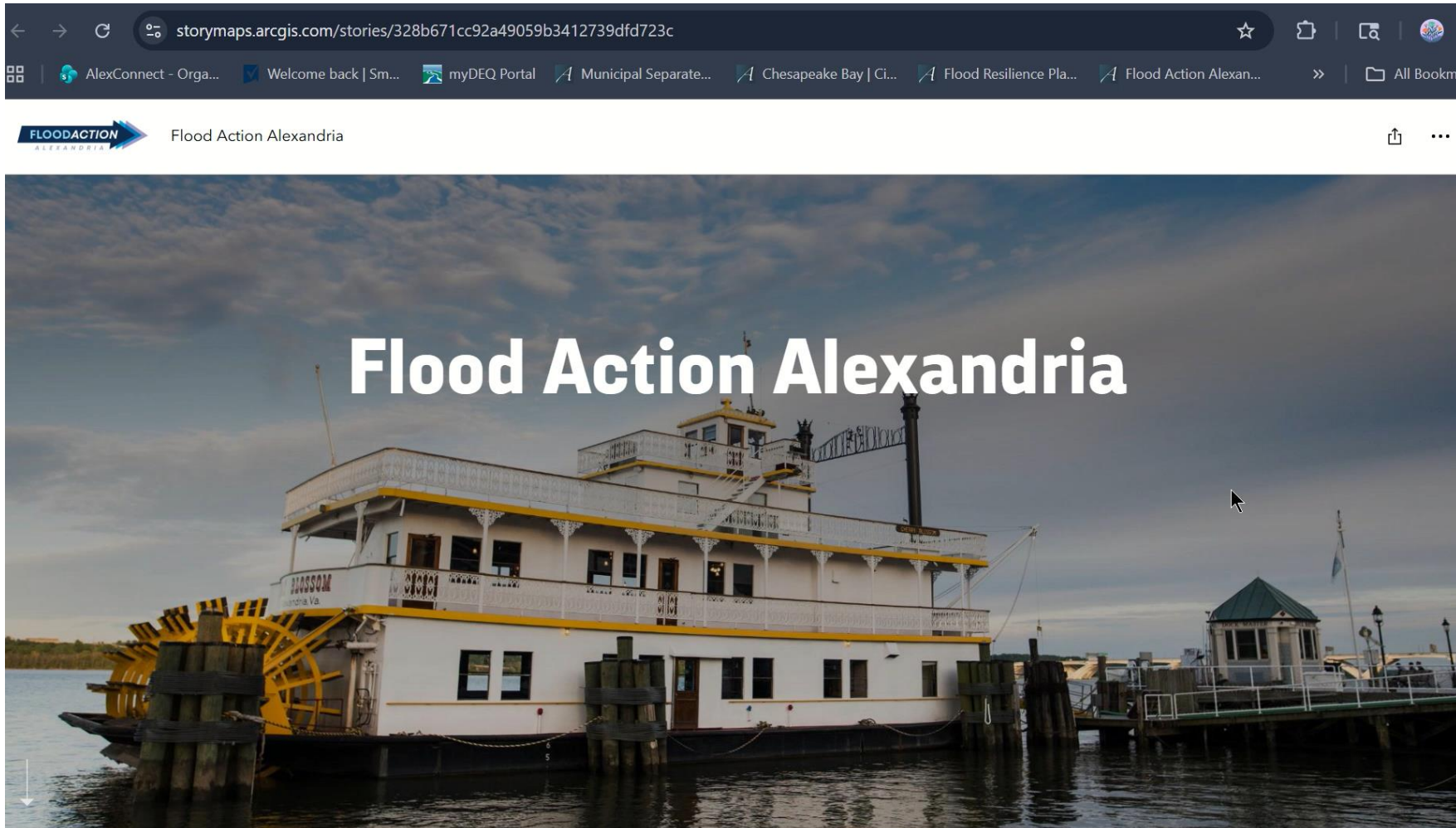
**7** Planning  
**19** Design  
**11** Construction  
**16** Completed



## Flood Action Alexandria Projects Dashboard



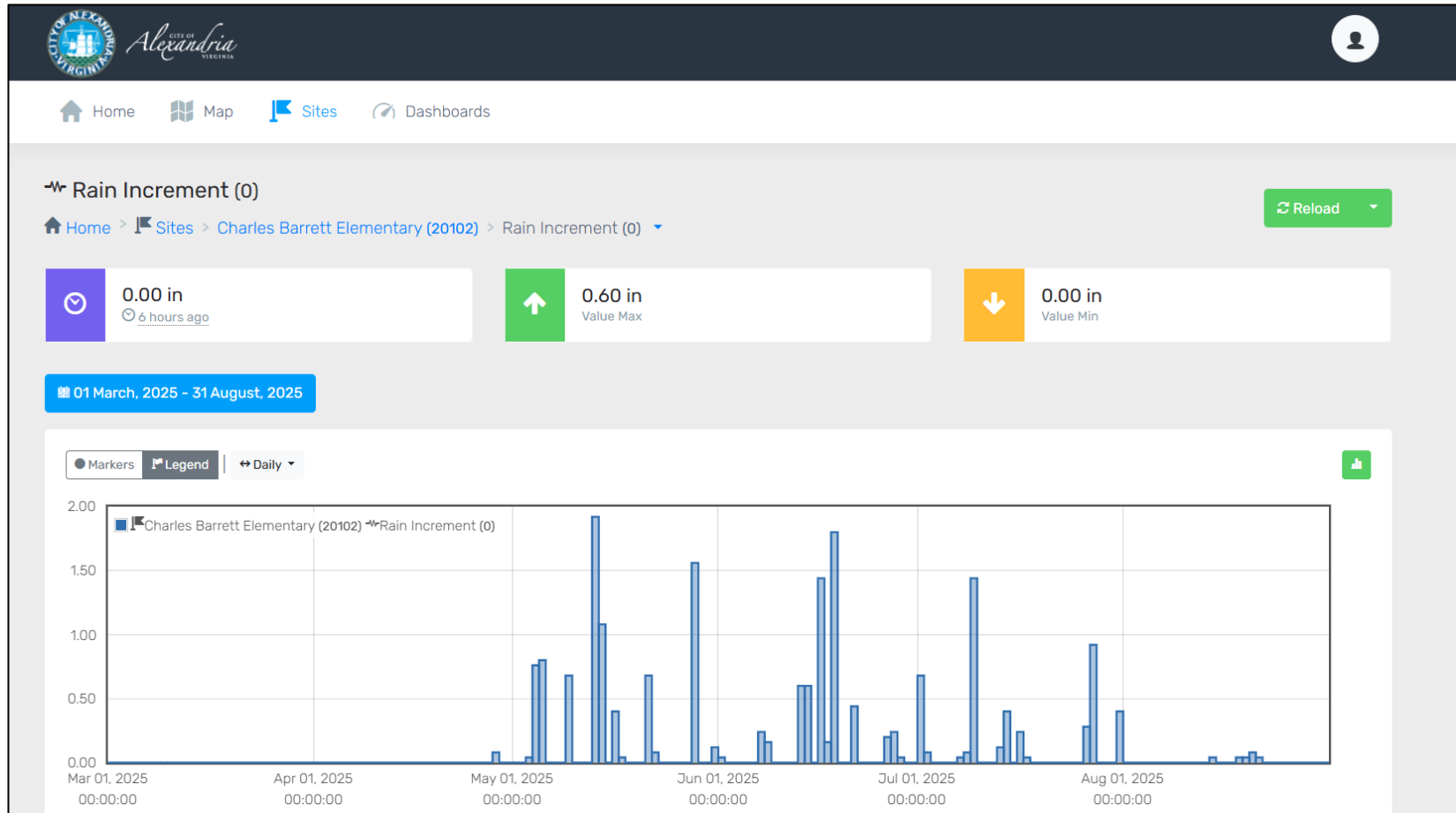
# Flood Action Alexandria Progress



## Flood Action Storymap



# Flood Action Alexandria Progress



## Rain Gauge & Stream Flow Tool

<https://alxfloodwatch.onerain.com/>



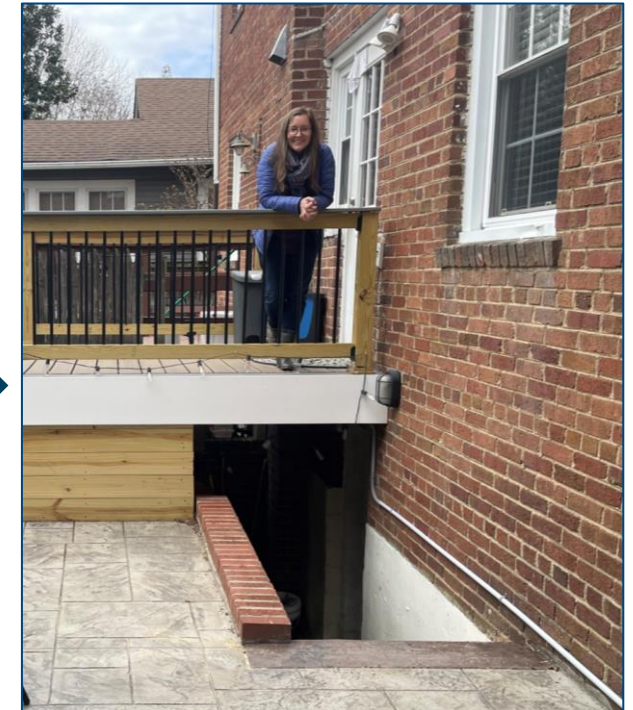
# Flood Mitigation Grant Program Objectives

- Financially reimburse homeowners for eligible floodproofing efforts
- Designed so both the City and homeowners achieve beneficial outcomes:
  - City delivers grant funds to homeowners who made efforts to help mitigate flooding
  - Homeowners are **reimbursed** for products and/or services that provide a return on their own investments

The “old” way



The “new” way



# Practices Covered by Flood Mitigation Grant Program



## Windows and Doors

- Permanent glass protection
- Basement window protection
- Ground floor or basement window wells and drains
- Temporary or permanent doorway flood gate or panel
- Flood socks
- Temporary quick dams

## Basement and Utilities

- Sump pump battery backups
- Drain tiles below basement floors
- Flood vents
- Utility flood covers
- Interior concrete or masonry walls
- Elevated electrical outlets and switches
- Quick Connect system
- Elevated utilities and service equipment



## Exterior and Topography

- Surface grading
- Protective walls
- Impermeable soil materials
- Flood walls
- French drain systems
- Earthen berm construction
- Sandless or traditional sandbags
- Flood resistant building materials



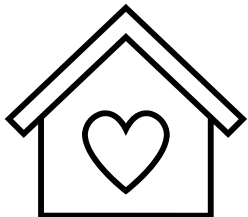
For questions about your flood mitigation efforts, contact City staff at [FloodGrant@alexandriava.gov](mailto:FloodGrant@alexandriava.gov)



# Flood Mitigation Grant (last modified in October 2023)

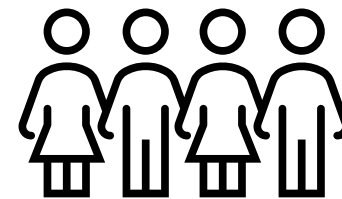
## Individual Homeowner

- Up to \$5K grant, 50/50 match
- Must be an eligible flood mitigation practice
- Use by owner within boundary of real estate property.



## Associations

- Up to \$25K grant, 50/50 match
- Must be an eligible flood mitigation practice
- Use by association to protect common area and/or exterior of multiple properties.



# Stormwater Utility Fee Credit Program



Application Window is  
December 1 – February 15

## RESIDENTIAL PROPERTIES CREDIT MENU

### STORMWATER MANAGEMENT PRACTICES

PRACTICE	CREDIT
RAIN BARRELS	5% EACH MAX 20% FOR 4
CISTERN	20%
DETENTION PRACTICES	20%
DRY WELL/ INFILTRATION	20%
RAIN GARDEN	20%
FLOW THRU PLANTER BOX	20%
PERMEABLE PAVEMENT	20%
VEGETATED GREEN ROOF	20%



### ELIGIBLE LANDSCAPING PRACTICES

PRACTICE	CREDIT
NO FERTILIZER PLEDGE	10%
CONSERVATION LANDSCAPING	10%
NEW TREE PLANTING	UP TO 30% ONE TIME CREDIT
MATURE TREE PRESERVATION	UP TO 20%



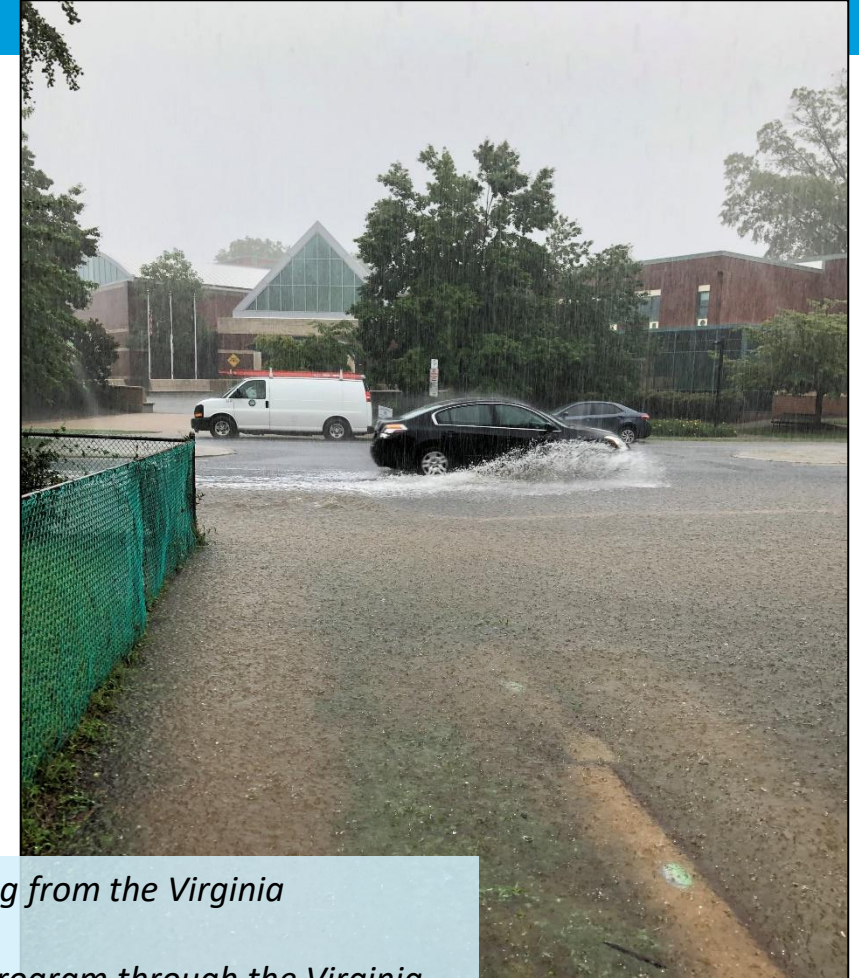
\*APPROVED STORMWATER PRACTICES IN THE BMP CLEARINGHOUSE MAY BE ELIGIBLE FOR CREDITS ON A CASE-BY-CASE BASES. SEE 2011 DESIGN SPECIFICATIONS FOR APPROVED PRACTICES AT [HTTPS://SWBMP.VWRRC.VT.EDU](https://swbmp.vwrrc.vt.edu)

### DRY FLOODPROOFING PRACTICES

PRACTICE	CREDIT
PROTECTIVE BARRIERS/ WALLS	10%
PROTECTIVE DOORWAY FLOOD GATE OR PANEL	10%
PASSIVE FLOOD GATES	10%
FLOODPROOF WINDOWS	10%
BASEMENT WINDOW PROTECTION	10%
GROUND FLOOR/ BASEMENT CUSTOM WINDOW WELLS	10%
FRENCH DRAIN AROUND BASEMENT	10%
IMPERMEABLE MATERIAL AROUND FOUNDATION	10%
CONCRETE SEALER	5%
CONSTRUCT WITH FLOOD RESISTENT BUILDING MATERIAL	5%
ELEVATE EXTERIOR UTILITIES/ SERVICE EQUIPMENT	5%

# Flood Resilience Plan Purpose and Goals

- The Flood Resilience Plan (FRP) will provide a roadmap to reduce current & future flood risk by:
  - Identifying flood hazards in areas not previously studied and updating previous studies
  - Identifying priority areas and future flood mitigation projects
  - Developing comprehensive strategies to reduce flood risk
    - Flood mitigation
    - Flood preparedness and response
    - Stormwater management regulations
    - Stormwater financing



*This project received funding from the Virginia Community Flood Preparedness Fund Grant Program through the Virginia Department of Conservation and Recreation (DCR), via CFPF-24-04-38.*

# Additional Goals of the FRP



Satisfy Virginia Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) requirements to remain eligible to apply for grants



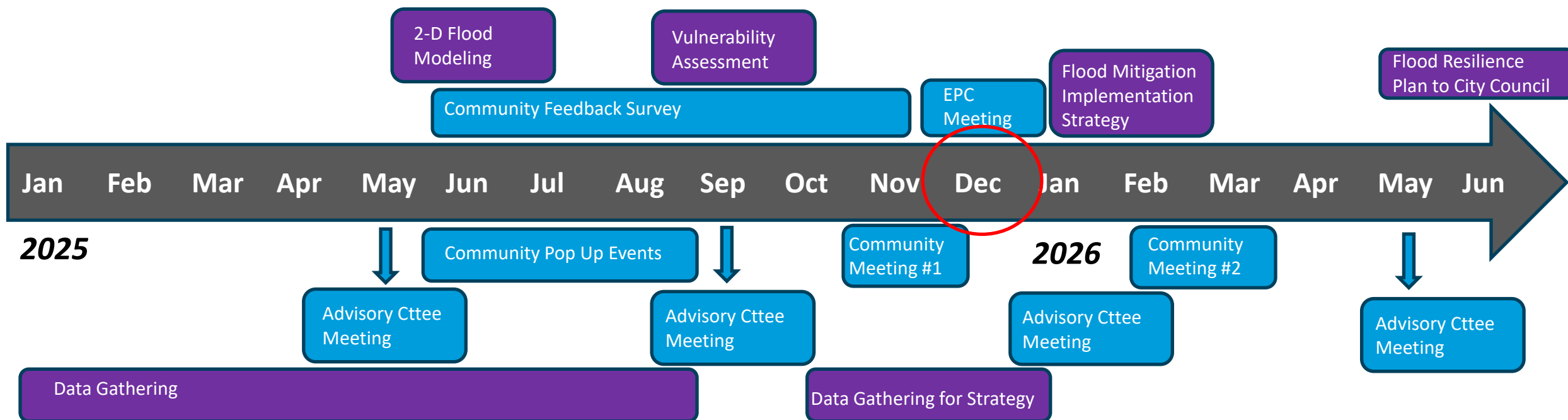
Coordinate with the FEMA Community Rating System (CRS) to reduce flood insurance premiums for property owners



Honor commitments in the City's Energy and Climate Change Action Plan and Long-Range Interdepartmental Work Plan



# FRP Project Timeline



## Legend

Purple – Project Team

Blue – Community Input Opportunity

# Data Gathering

- Compile data and identify information gaps to inform planning process
  - Previous studies, reports and analyses,
  - Projects completed, underway or planned
  - Relevant guidelines and standards
  - Flood and Emergency response plans
  - Geographic Information Systems (GIS) data

City of Alexandria, Virginia



Community Rating System (CRS)

Activity 510  
Floodplain Management Plan (FMP)

Annual Report

2023 - 2024 Recertification Cycle



Northern Virginia Hazard Mitigation Plan  
Annex 2: City of Alexandria

November 2022

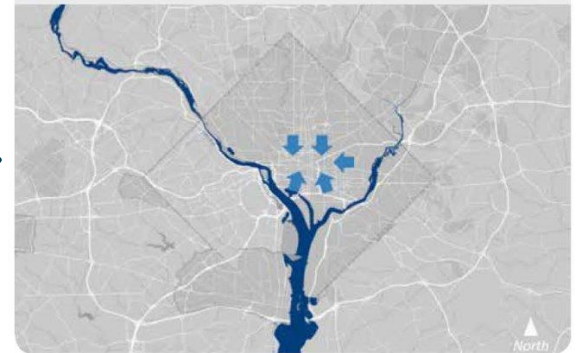


# City-Wide Screening-Level Flood Modeling

- Flood modeling is used to assess the scope and scale of flooding across the City
- Combined previous flood models with new flood analysis in areas not previously studied
- Generates maps that show where flooding might occur under different *future* climate scenarios

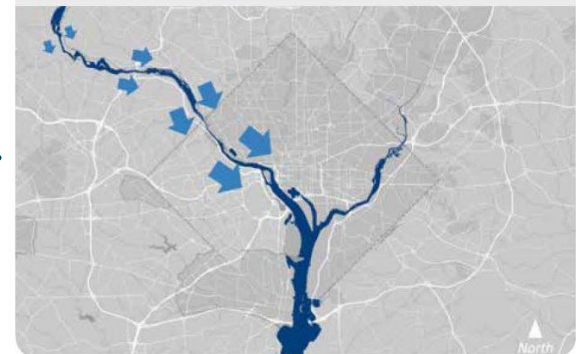
Urban overland drainage models simulate **rainfall on the land surface** to evaluate the **impact from surface runoff**

Interior Flooding



Riverine models simulate **flow in streams** and rivers to evaluate the impact from surface drainage during extreme storm events

Riverine Flooding



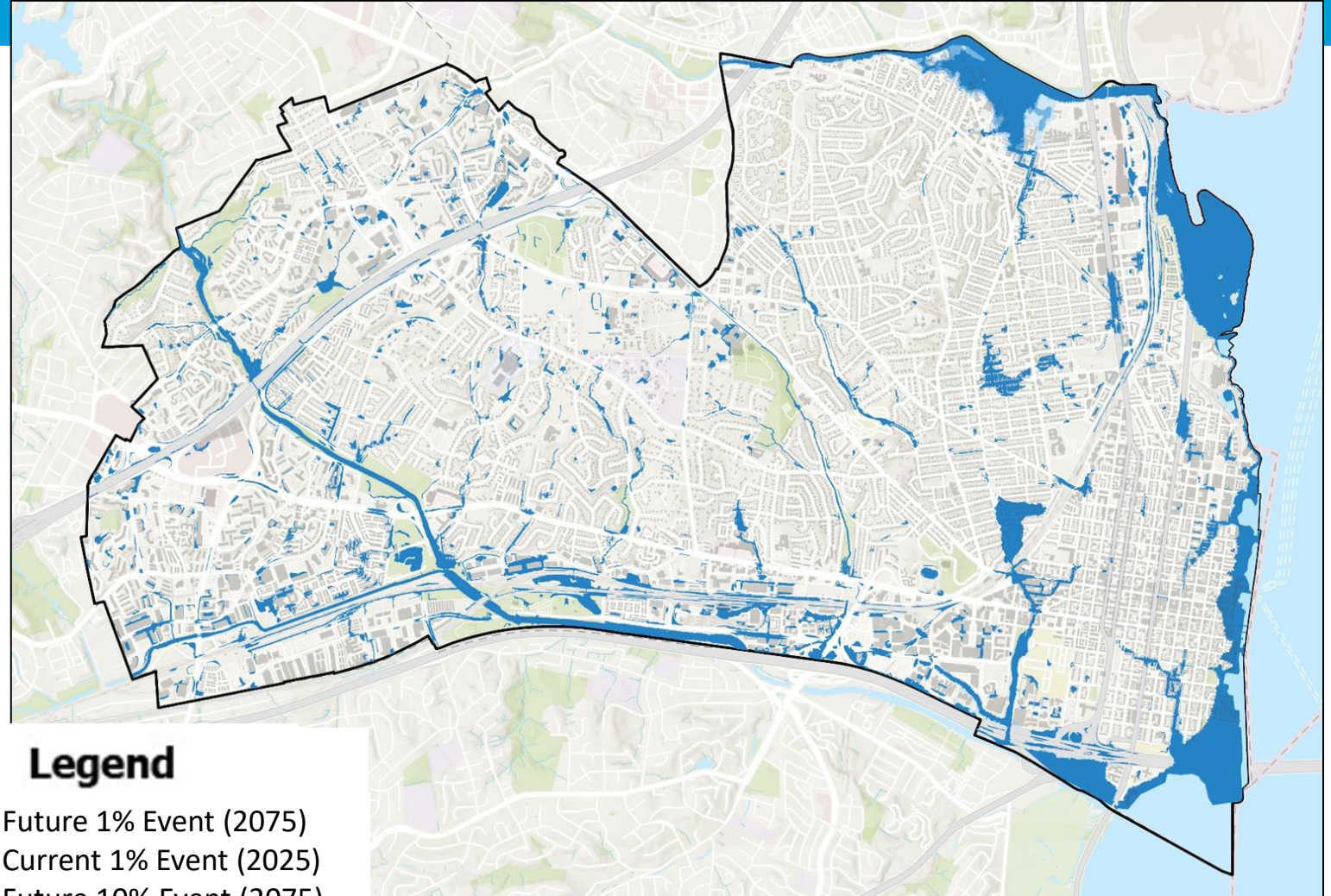
Coastal models simulate **storm surge and tide propagation** up the Potomac River from its mouth at the Chesapeake Bay

Coastal Flooding



# City-wide Screening-level Flood Modeling

- Urban/Interior Drainage, Riverine and Coastal Flood Extents Map
- Current and future (2075) climate conditions
  - 10% Probability event has a 10% chance of occurring in any given year
  - 1% Probability event has a 1% chance of occurring in any given year
- Three climate scenarios evaluated:
  - Future 10% Event
  - Current 1% Event
  - Future 1% Event

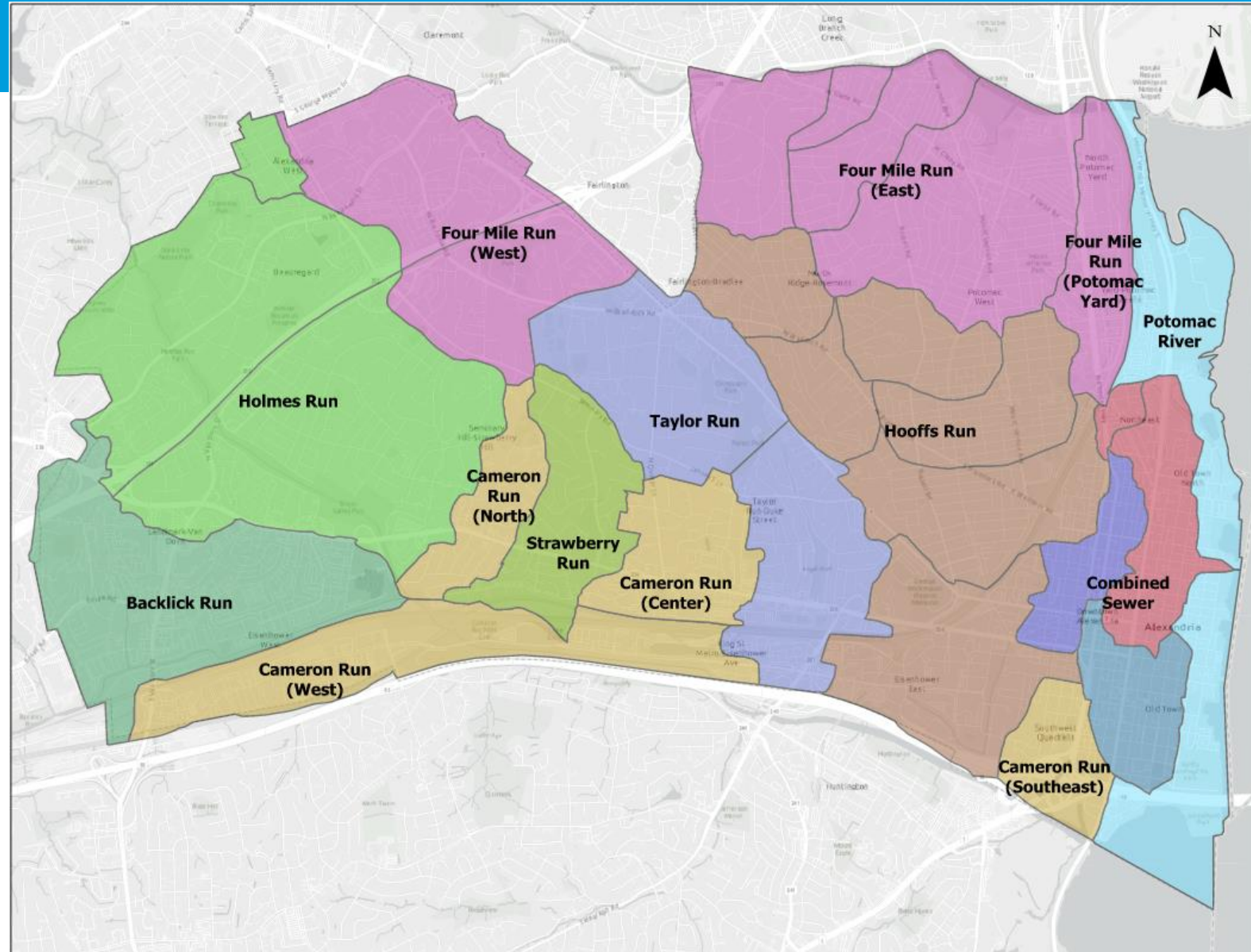


## Legend

- Future 1% Event (2075)
- Current 1% Event (2025)
- Future 10% Event (2075)
- Buildings
- Alexandria City Boundary

# Plan Analyses: Flood Modeling & Vulnerability Assessment

- Modeling and assessment of flood vulnerability for each of the City's sub-watersheds



# Flood Vulnerability Assessment

- ▶ Helps assess flood risk and vulnerability in the City to identify gaps and priorities for further study and new flood mitigation projects
- ▶ Identify the important assets & sensitive areas that may be exposed to flooding
- ▶ Use geospatial tools to overlay the community assets with inundation maps to quantify flood exposure for each asset within each watershed
- ▶ Calculate a total flood exposure score for each feature and combined them into a single Flood Vulnerability Score for each watershed

## Community features that may be exposed to flooding include...



Critical Facilities: Hospitals, Schools, Government Facilities, Utilities, Etc.



Single Family & Multi-family Residential Buildings



Non-Residential Buildings



Transportation: Road, Rail & Bus Routes



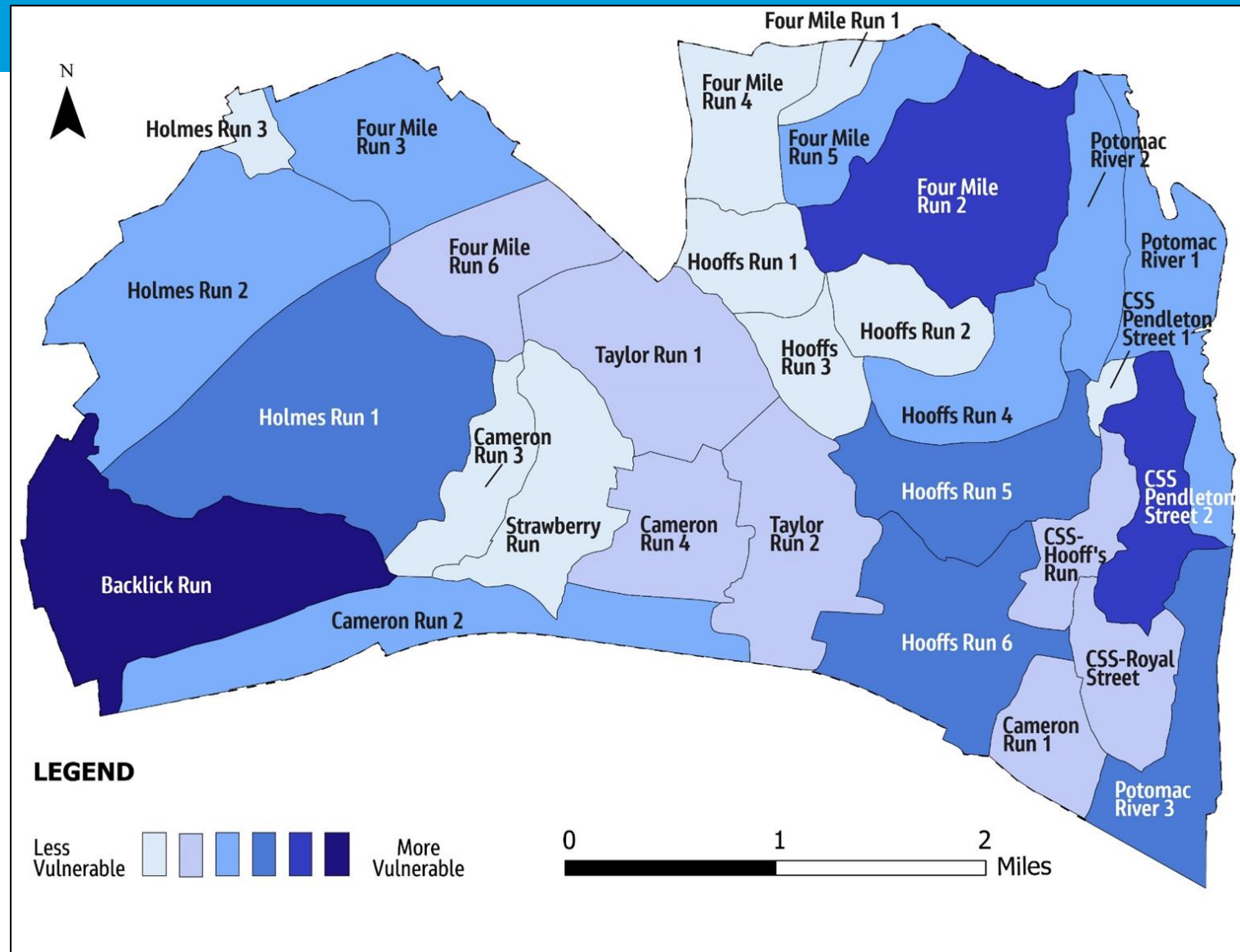
Historic Districts



Socially Vulnerable Communities

# Vulnerability Assessment Results

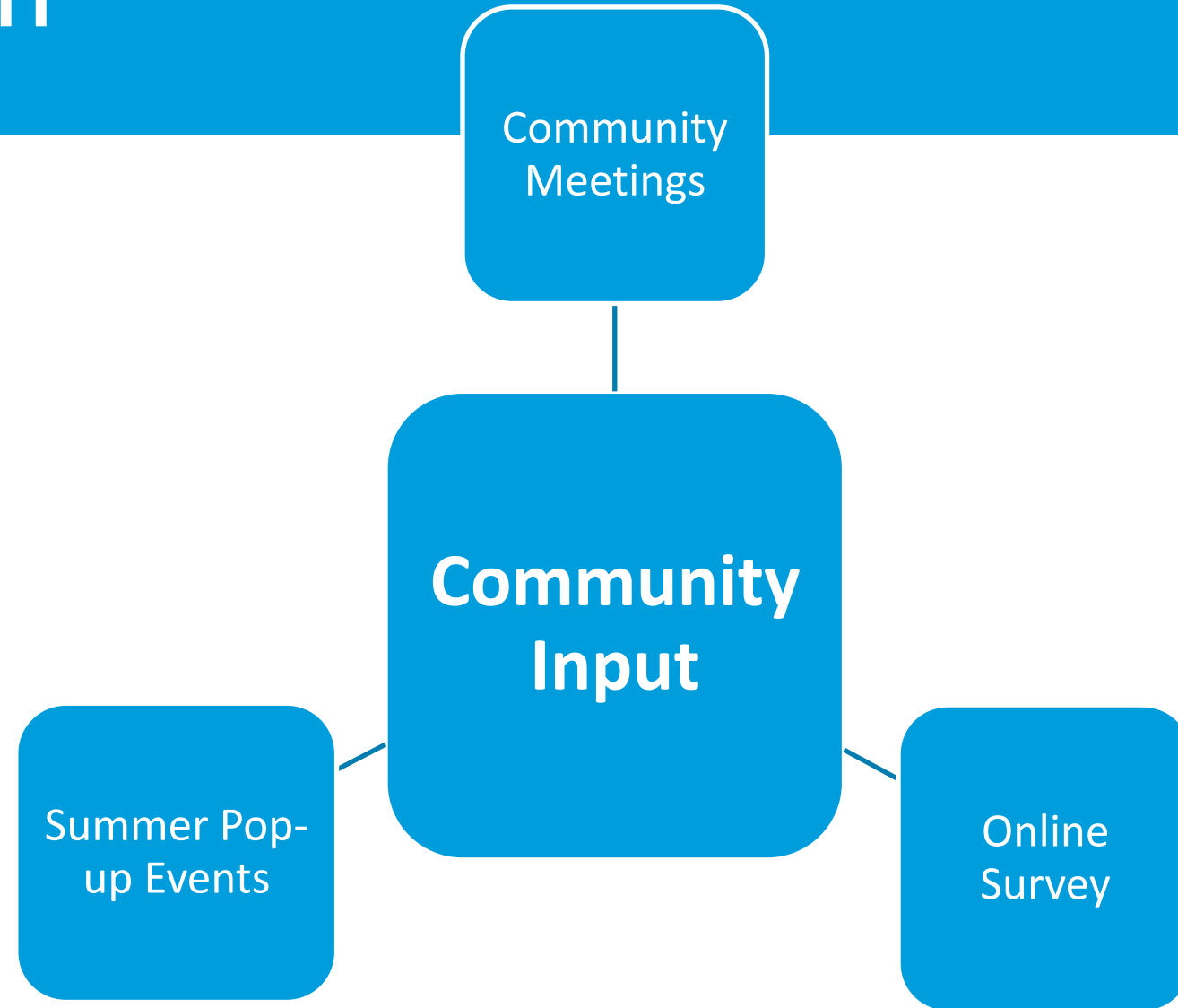
- Confirms that watersheds where the City has focused recently (Potomac River, Four Mile Run, and Hooffs Run) are highly vulnerable
- Highlights new areas where further study is needed (Holmes Run, Cameron Run, Backlick Run)



# Community Outreach

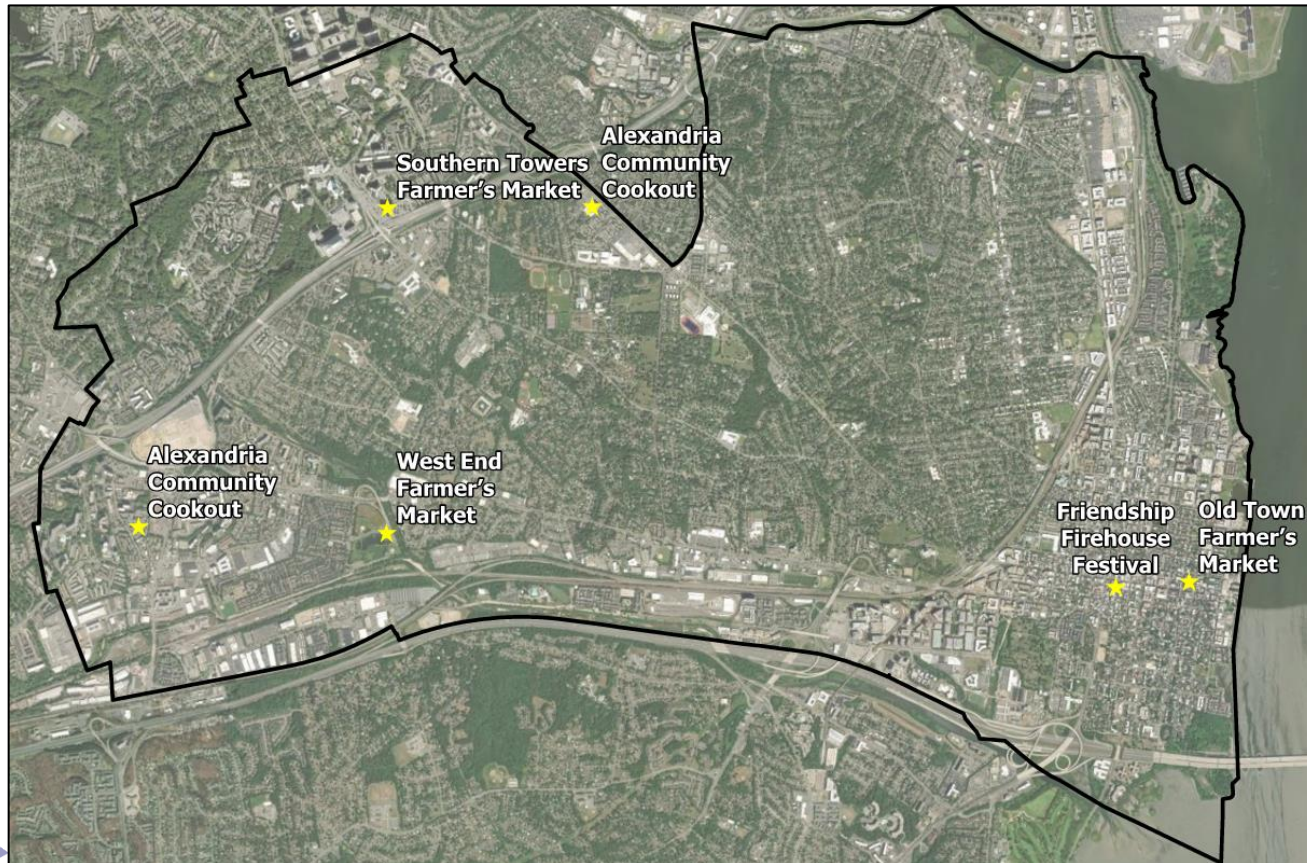
## Outreach Objectives

- Gather input on flood issues from a wide range of community members
- Obtain information on flooding locations, especially areas not reported previously
- Inform the community about the purpose and objectives for the plan
- Build support for flood mitigation efforts throughout the City



# Summer Outreach

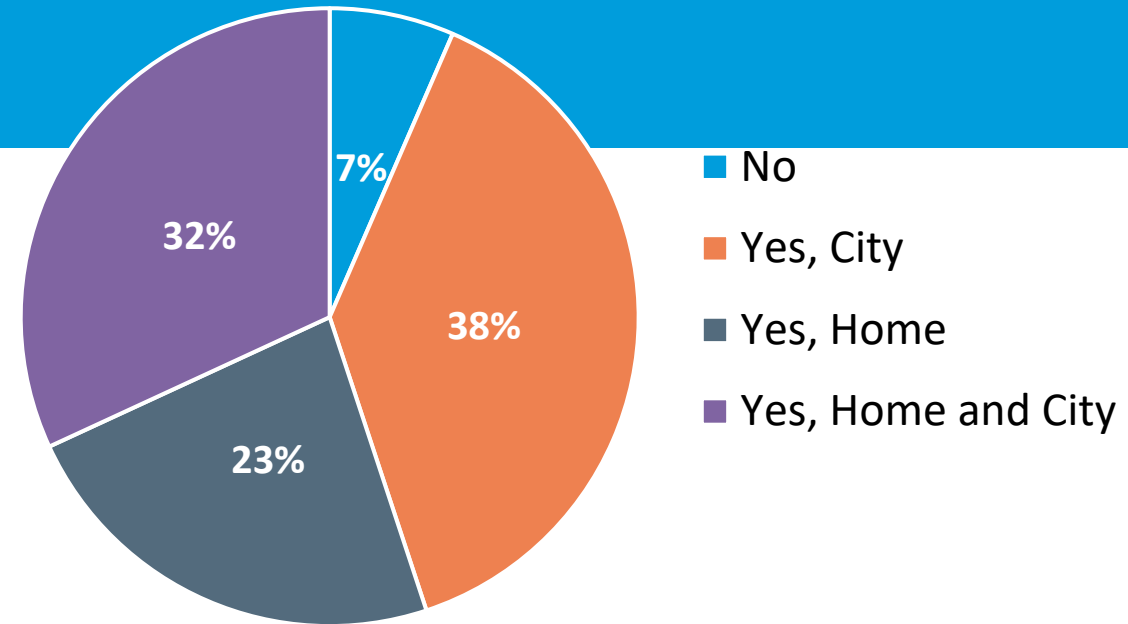
- Attended 6 community events this summer to share information about the FRP and gather input.
- Engaged with ~400 individual participants



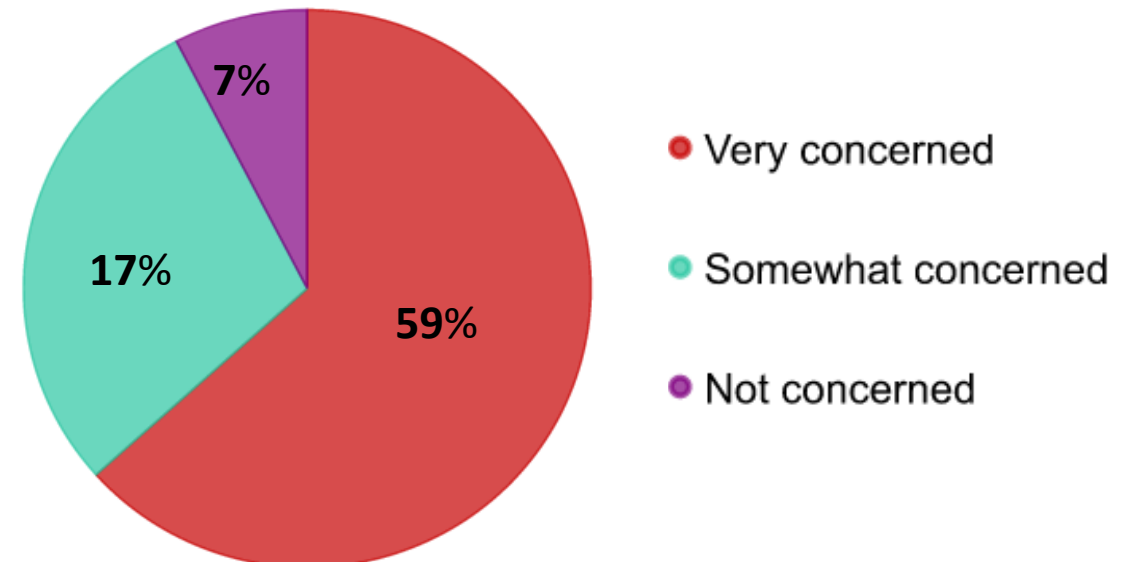
# Online Survey

- ▶ + 140 survey responses to date
- ▶ 93% respondents have experienced flooding in Alexandria, either at home or around the City
- ▶ 52% have experienced flooding often or very often
- ▶ 59% are very concerned about flood impacts in the future

Have you experienced flooding in the City of Alexandria?

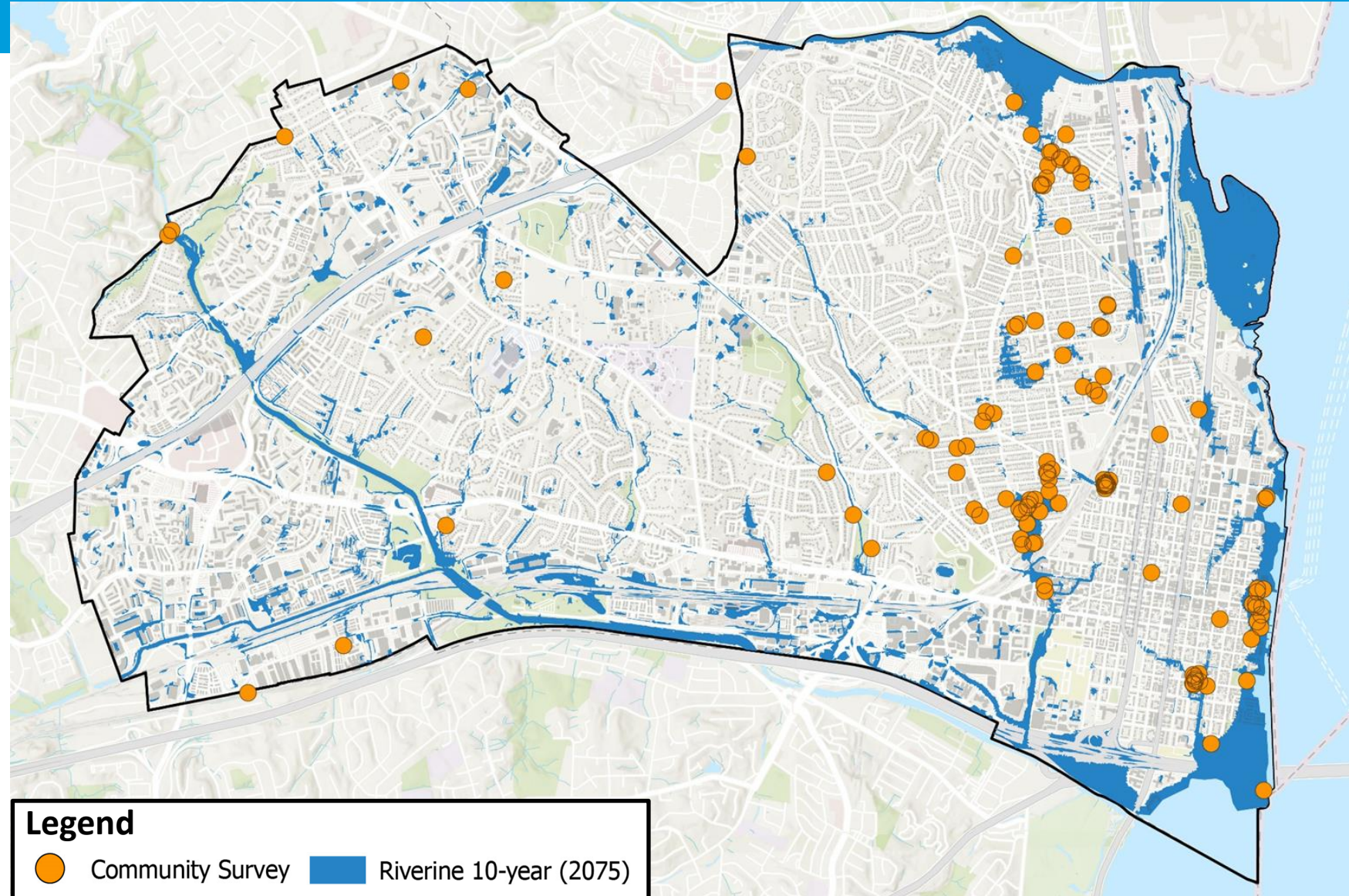


How concerned are you about flooding impacting you in the future?



# Online Survey

- ▶ 128 flood locations mapped
- ▶ Survey closed November 30



# How will the City use Community Input to Inform the Plan?

- Validate modeled flood locations and identify gaps for further study.
- Inform and justify flood resilience implementation strategies
- Understand community concerns and flood impacts including costs of flood damage and mitigation efforts
- Inform future outreach and education recommendations and initiatives



# What's Next? Developing a Flood Resilience Strategy

- Flood mitigation solutions
- Equity considerations
- Flood preparedness and response
- Policies and regulations
- Communications and outreach
- Funding strategies



# Connecting to Regional & State Resilience

- Membership with VA Municipal Stormwater Assn (VAMSA)
  - Flood Committee
- Resilient Virginia Participation
- Participation in NOVA Flood Mitigation and Resiliency Workgroup Follow-up
  - Resilience Expo
- Hazard Mitigation Planning



# Thank You!

