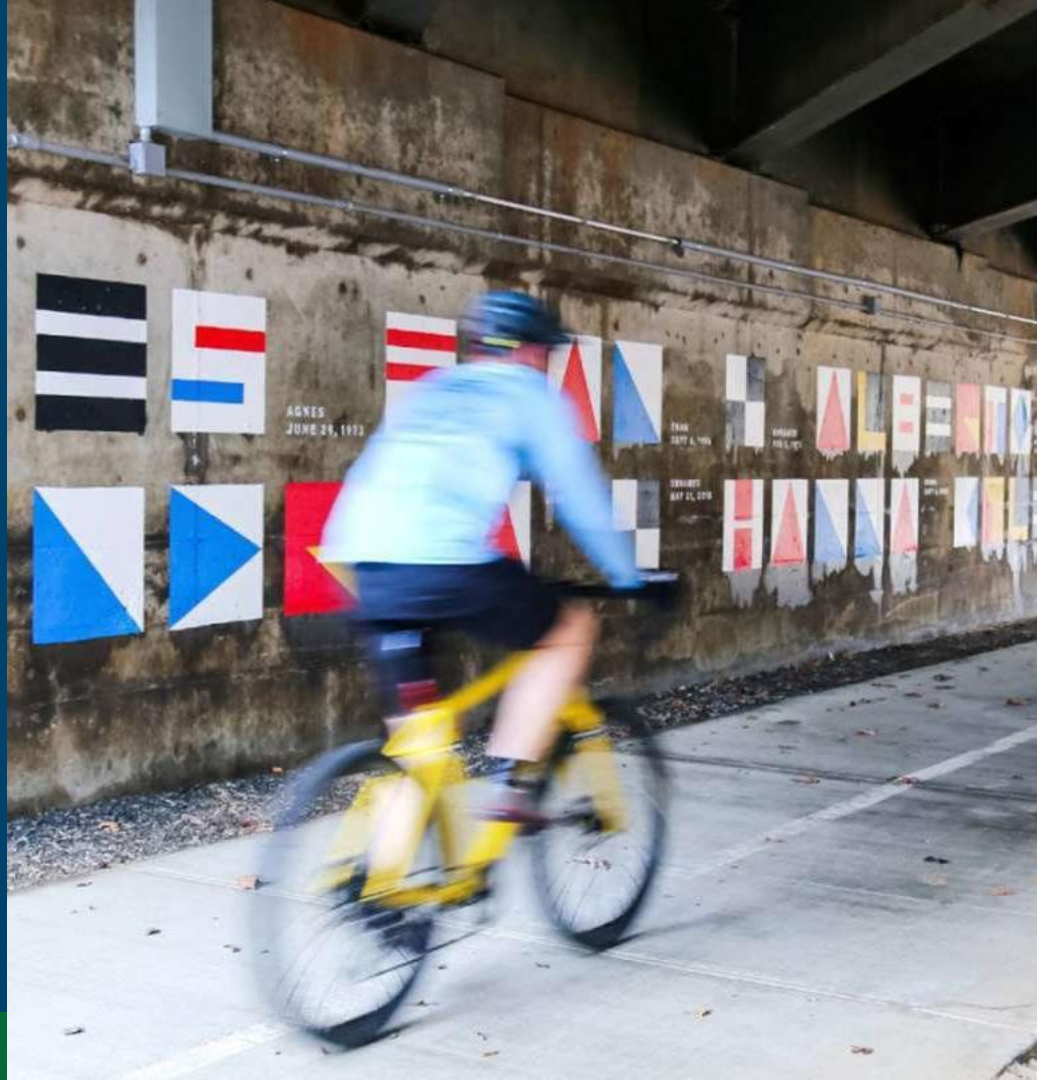
Raleigh Stormwater &
Planning and Development

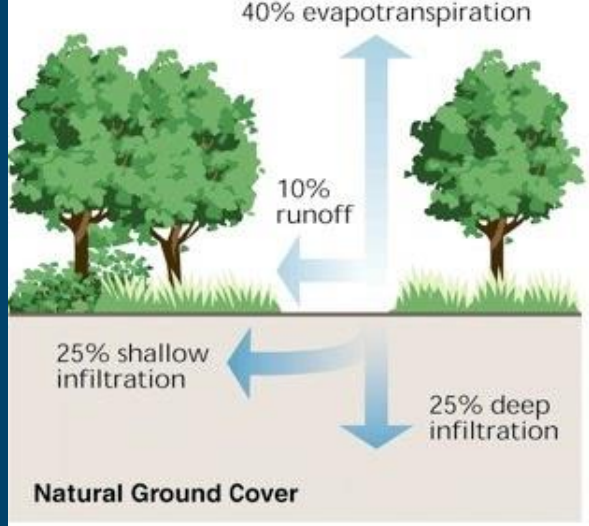
Stormwater:
State of the City

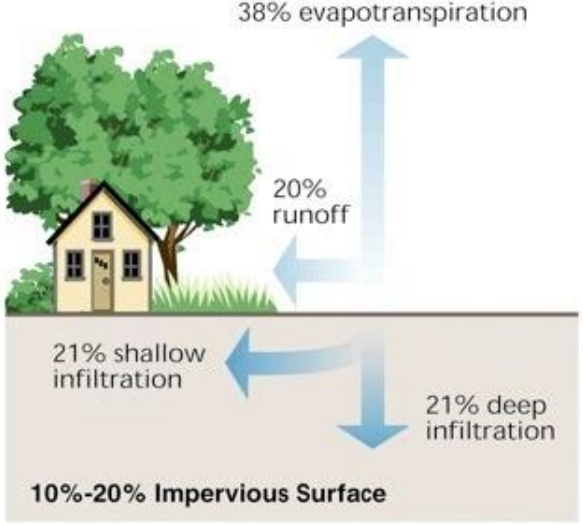
December 9, 2024

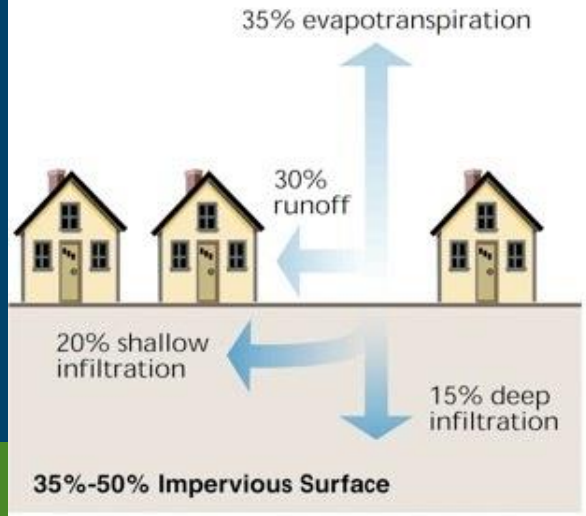
Raleigh



How Stormwater Runoff Changes with Development







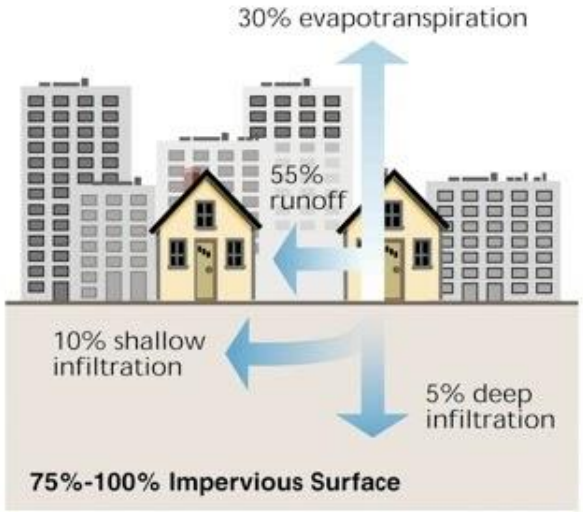


Photo: Environmental Protection Agency

Our Stormwater Challenges and Risks

Flooding

Aging Infrastructure

Water Quality

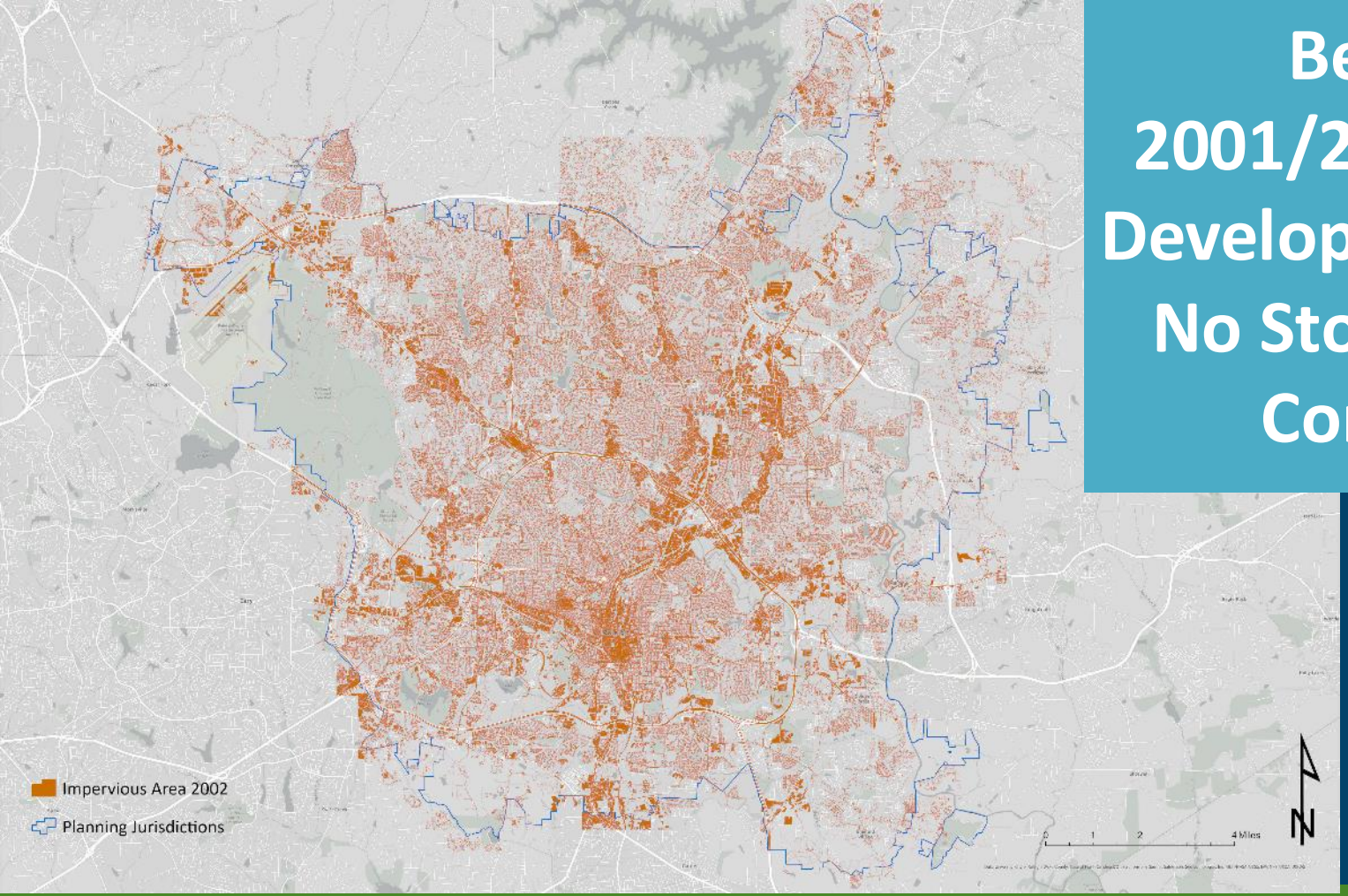
Our Stormwater Solutions

Floodplain Regulations and Warning Systems

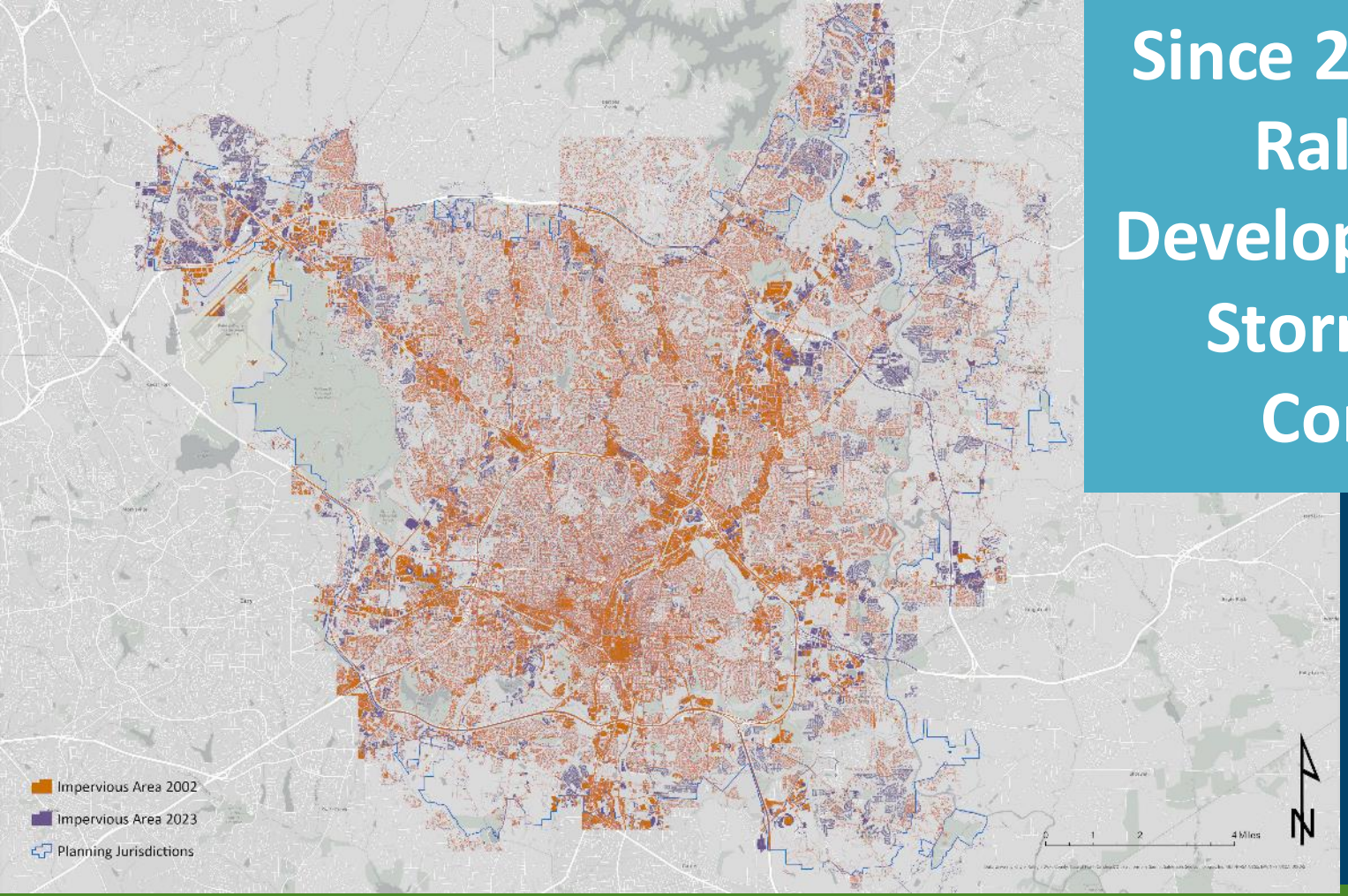
Capacity & Structural Improvements

Green Stormwater Infrastructure

Before 2001/2 Raleigh's Development Had No Stormwater Controls

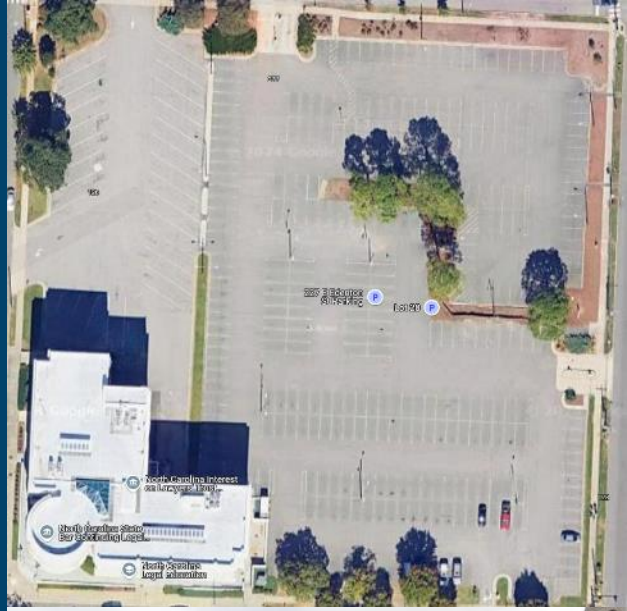


Since 2001/2002 Raleigh's Development Has Stormwater Controls



Wake County Justice Center

Denser development results in less impervious area per person and allows us to preserve open space.



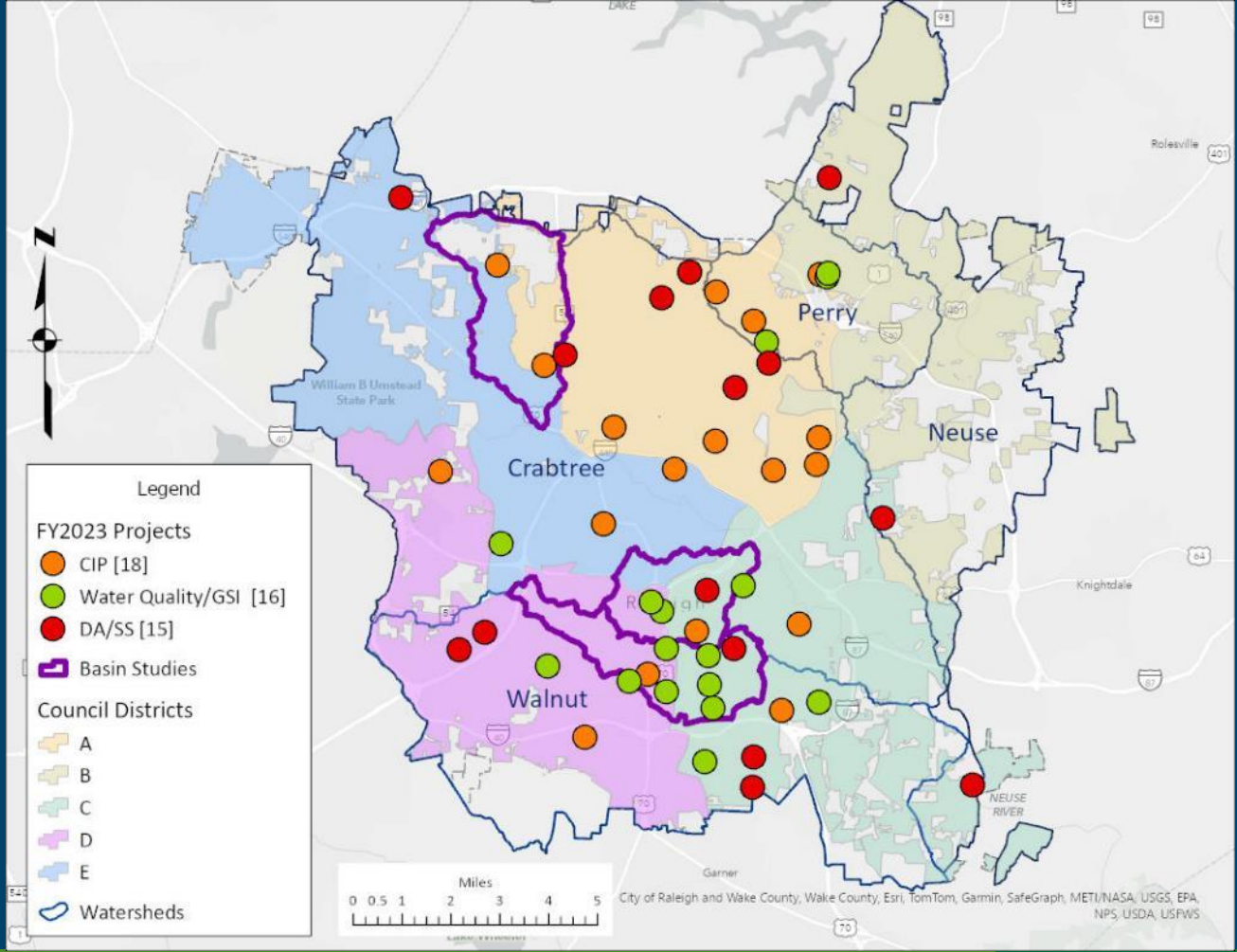
Downtown Raleigh Parking Lot

Development Review Items

What does Raleigh Stormwater review for submitted developments?

- Erosion & Sediment Control (for during construction)
- Stream Buffers
- Floodplains
- Active Stormwater Controls (for after construction)
- Stormwater Conveyance Systems

Stormwater Projects Make Raleigh More Resilient!



"Smarter" Stormwater Program Investments

Raleigh Rainwater Rewards (R3)

Cisterns at Marsh Creek Park Greenhouse

Watershed Studies

Inspections, Modeling, and Public Engagement

Operationalizing Equity

R3 Subsidy Program, Water Equity Network, and Equity Practices in Stormwater Programs

Drainage Assistance and Stream Stabilization Programs

Policy Updates, Team Expansion, New Program Initiatives and City Council Adoption

Green Stormwater Infrastructure (GSI) Investments Help Raleigh

"Lead by Example"

GSI Policy requires GSI be evaluated for all City-Funded Projects.

Green Stormwater Infrastructure Reduces Stormwater Runoff Volume, Thus Protecting Downstream Streams and Creeks

Raleigh Rose Garden

Glenwood Avenue

WCWP Subsurface Gravel Wetland

East Civic Tower - Gipson Play Plaza - Smoky Hollow Park - Baileywick Park - Worthdale Park - Durant Nature Preserve - Lion's Park - Biltmore Hills Park

Recent Major Stormwater System Projects

Capital Improvements

- Staff enhancing infrastructure across the city
- Converting Upper Durant Lake to a constructed wetland

Drainage Assistance Program

- Currently **26** projects in various stages totaling **$3.7 million**
- Relieves flooding and erosion on private properties

Stream Stabilization Program

- **$500k** for stream erosion projects over last year
- **15** small-scale stream bank repairs
- Over **2,000** live stakes installed

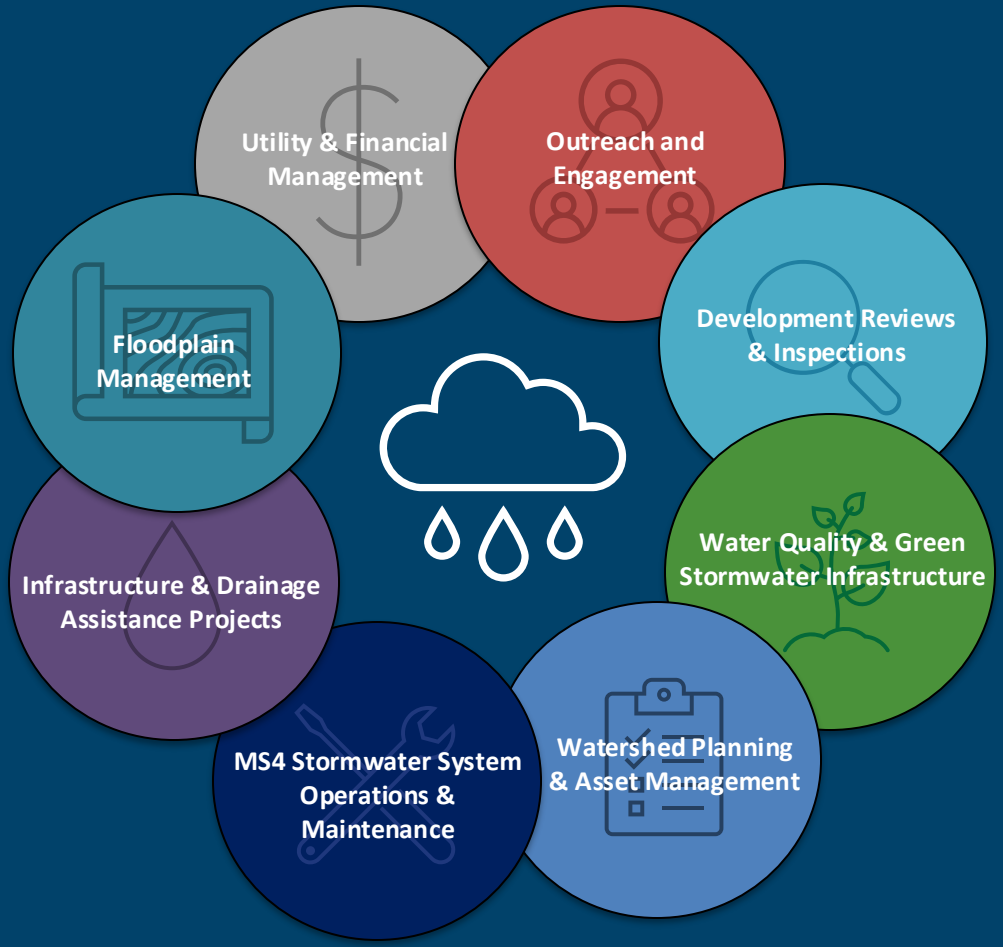
Mission Statement

Manage stormwater to preserve and protect life, support healthy natural resources, and complement sustainable growth for the community.

Vision Statement

Be the “smartest” stormwater program possible to economically and equitably achieve our mission.

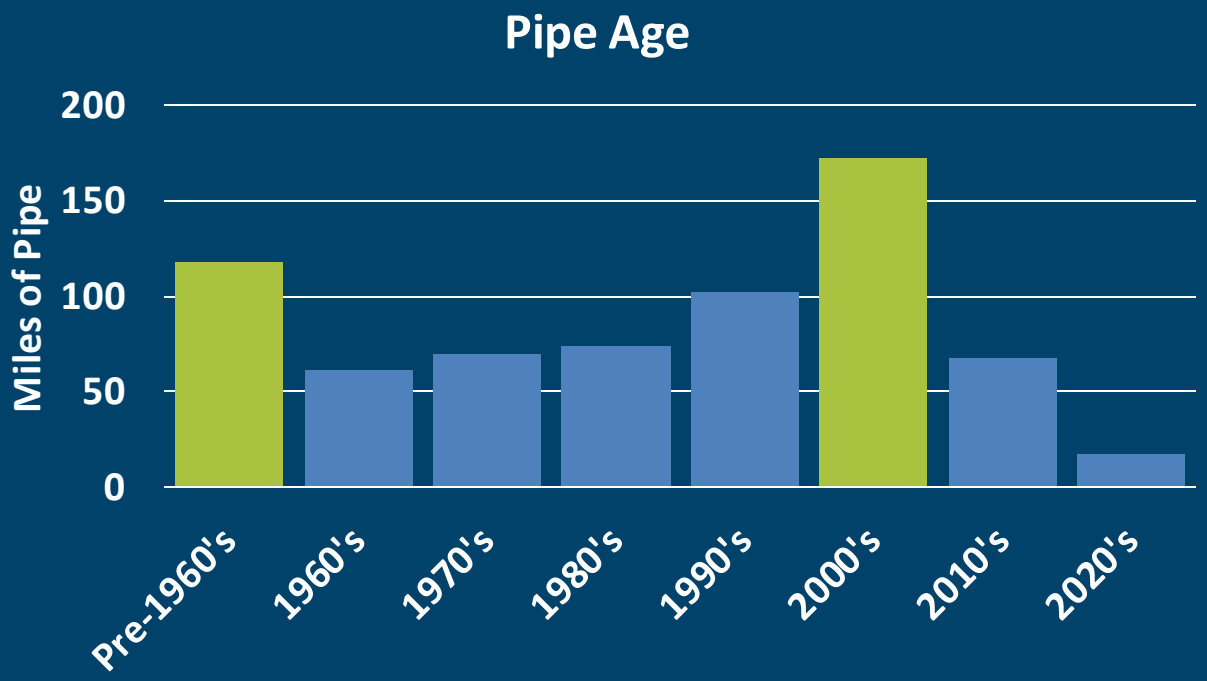
Be Stormwater Smart!



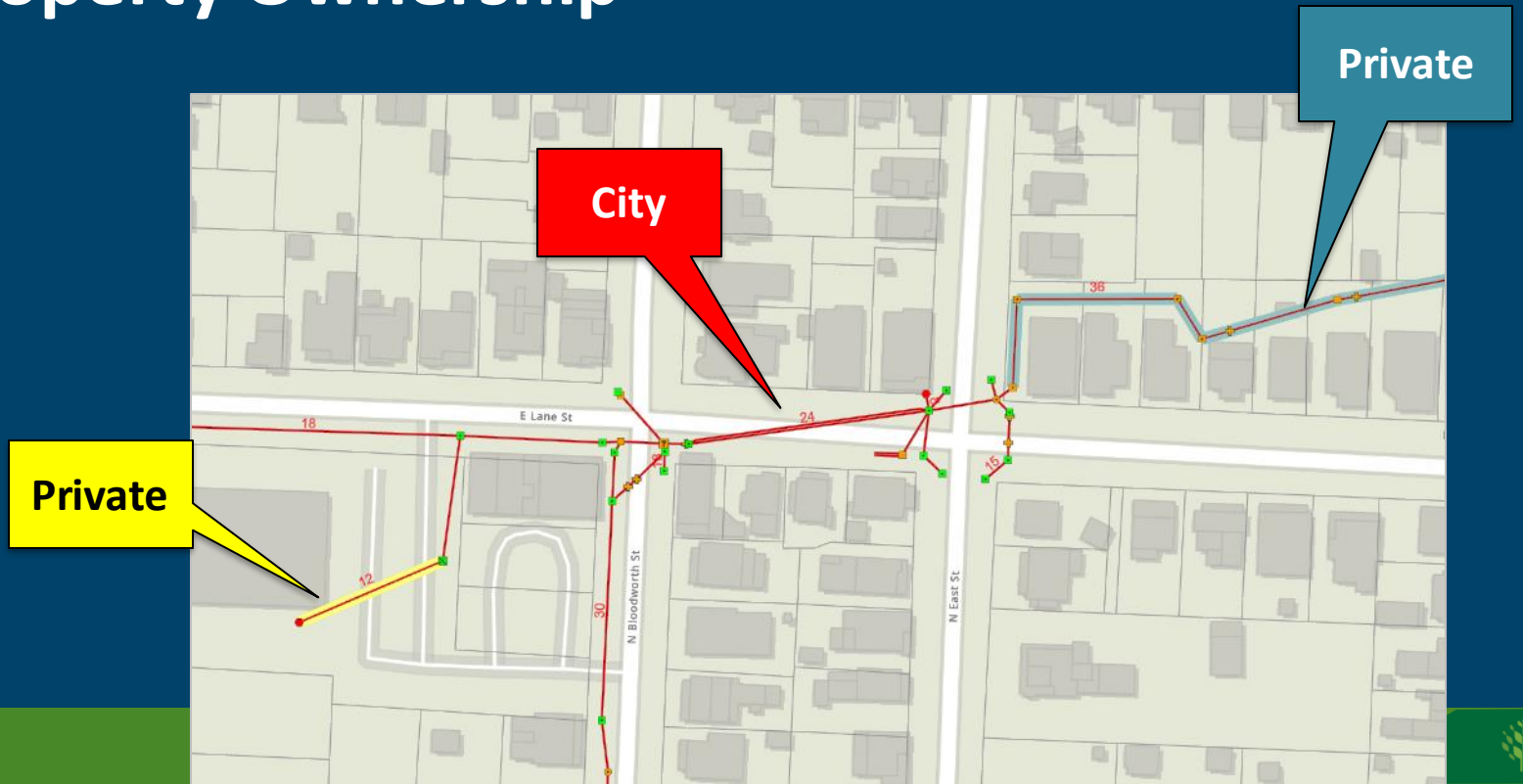
NPDES MS4 (Clean Water Act) Permit

- Public education & outreach
- Public involvement
- Illicit discharge detection & elimination
- Construction site controls
- Post-construction controls
- Pollution prevention & good housekeeping

Raleigh's Stormwater Assets Are Aging

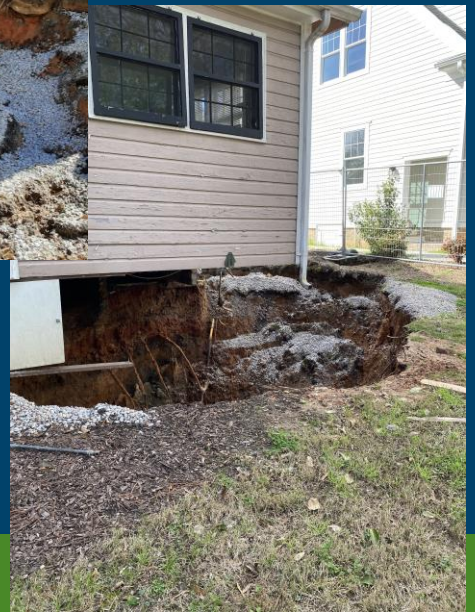


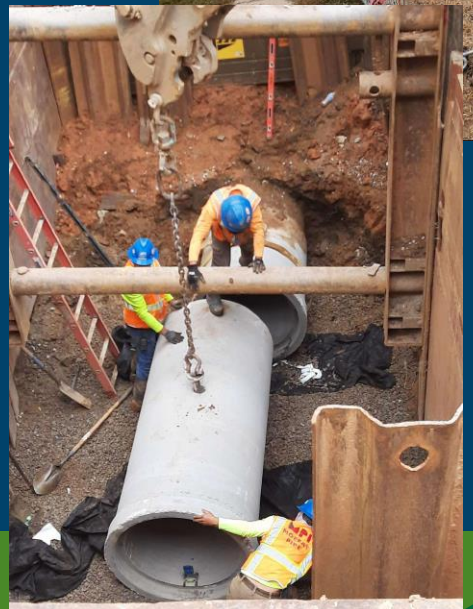
Stormwater Asset Responsibility Depends on Property Ownership



Stormwater Pipe Ownership Categories

When Private Stormwater Infrastructure is Ignored…



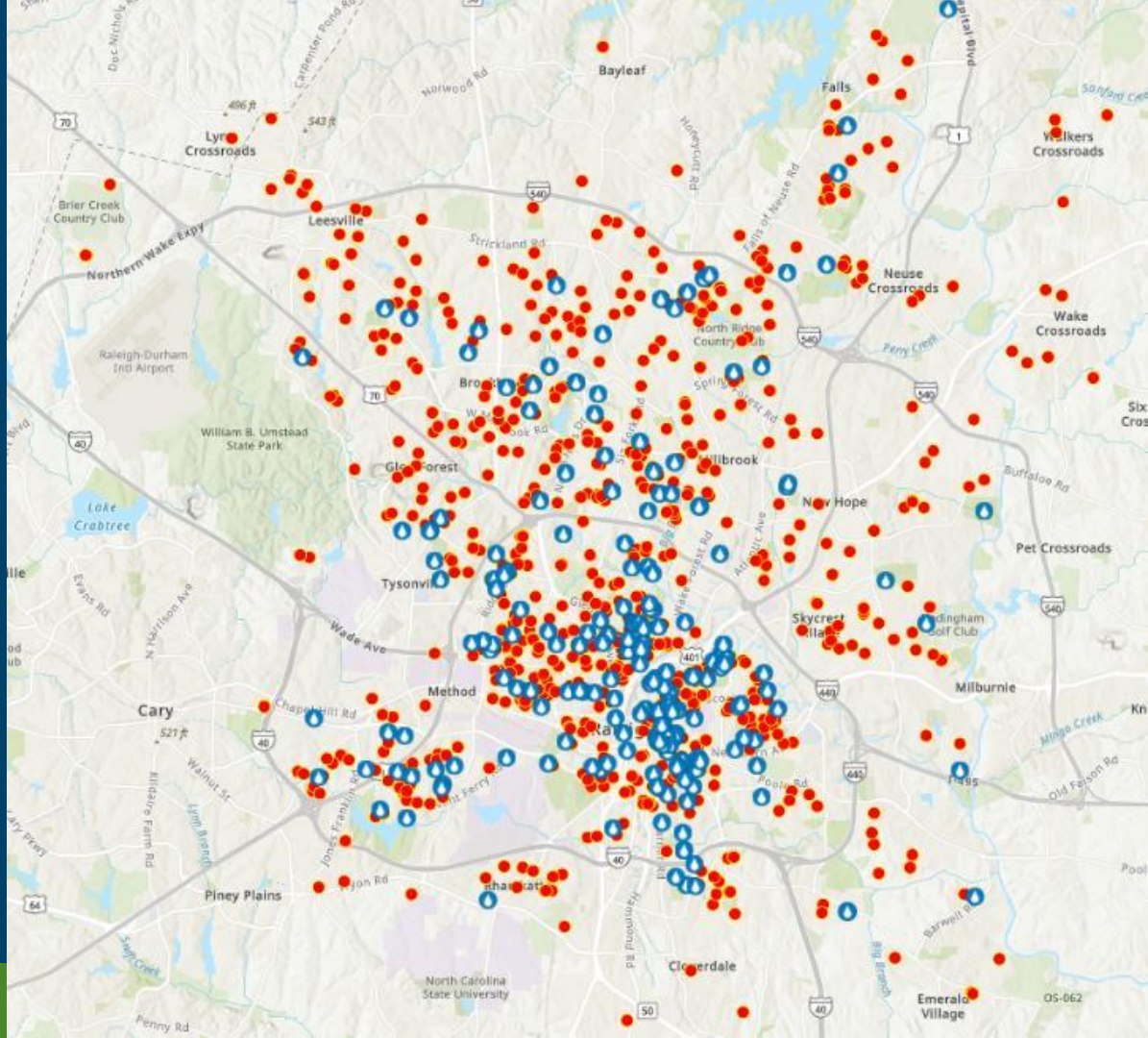


East Lane Street

Raleigh

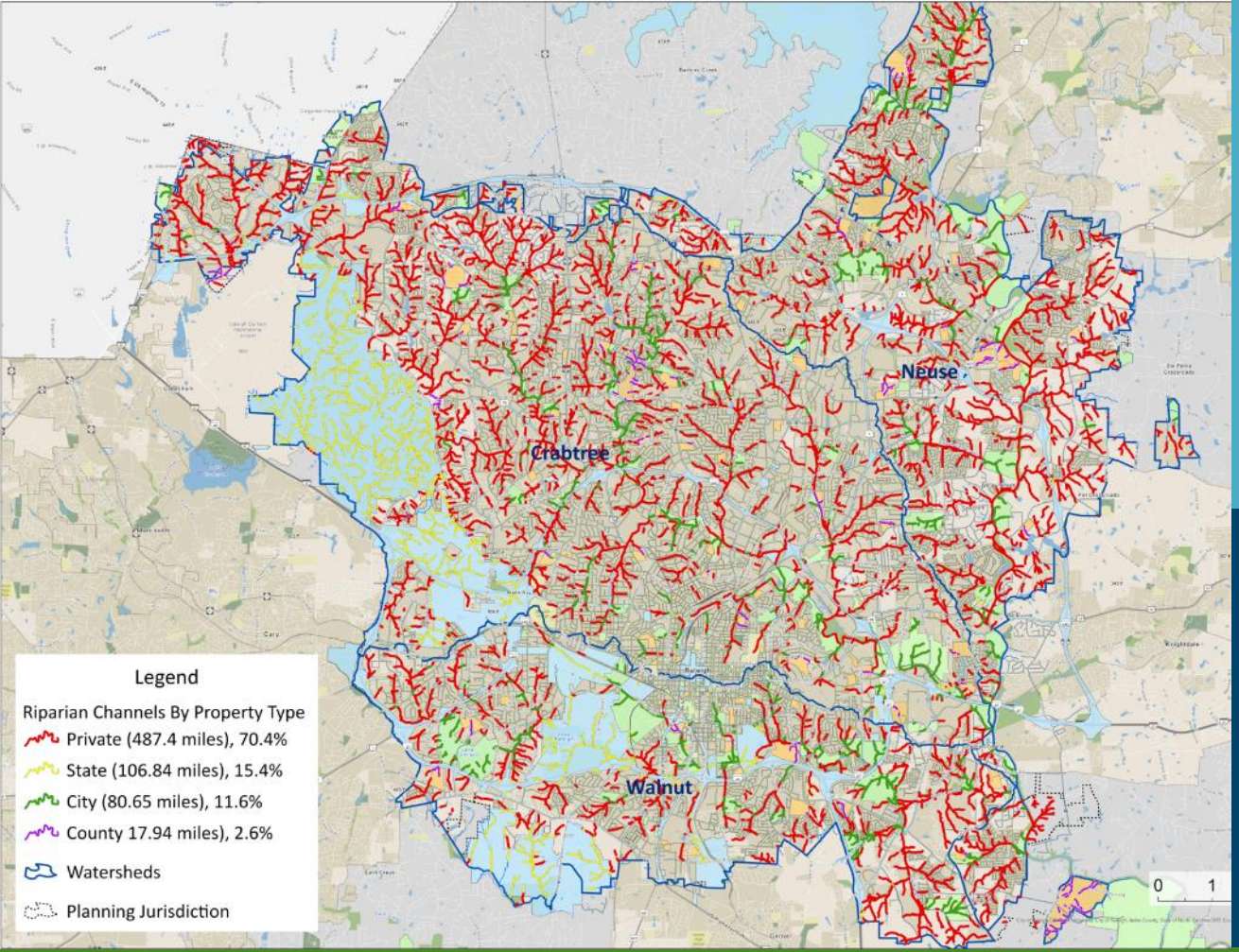
Raleigh Rainwater Rewards Funds GSI on Private Property

- Residential
- Commercial
- Institutional
- Places of Worship
- City Property



Raleigh

The Majority of Raleigh's 700 Miles of Creeks & Streams are Privately Owned



Stormwater Management Advisory Commission

Reverend
Jemonde Taylor
Chairperson

Graham Smith
Vice Chairperson

Josh
Dalton

Nicola
Hill

Barrett
Jenkins

Samantha
Krop

Ian
McMillan

Robert
Paschal

Lou Ann
Phillips

Melody
Whitford

Example Fee Calculation for the Median Residence in Raleigh

- Median single-family house in Raleigh = 2,260 square feet (sf) impervious area
- 2,260 sf = 1 Single Family Equivalent Unit (SFEU)

Monthly Bill

Current Residential Bill = $7.65

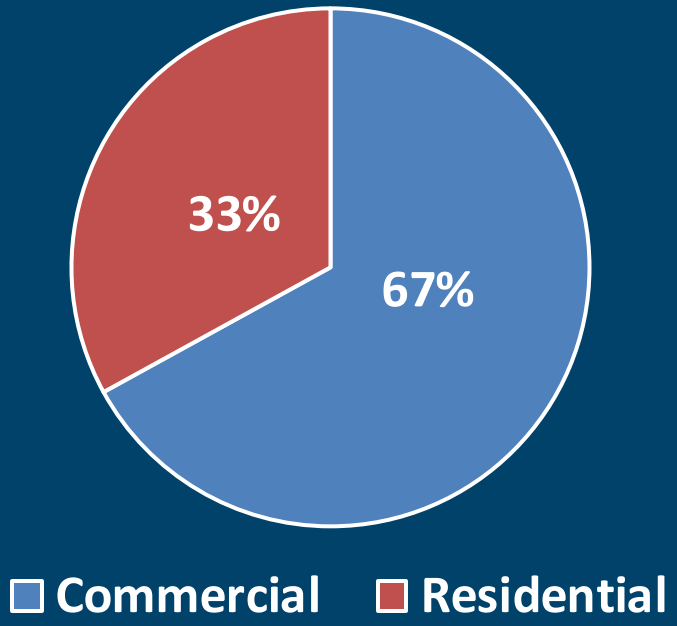
Example Calculation of Fee for Commercial Property in Raleigh

Commercial property (example)
47,303 sf impervious divided
by 2,260 sf/SFEU
Equals 20.93 SFEU

Monthly Bill

Currently: 20.93 x $7.65 = $160.11

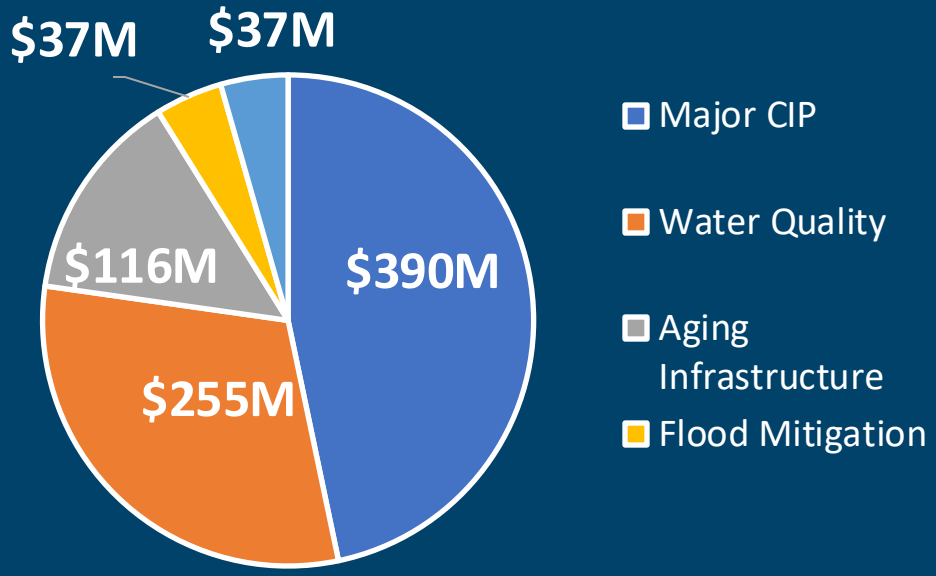
Stormwater Fee Revenues By Customer Type



Most stormwater revenue comes from commercial property utility fees.

- Multi-family properties
- Offices
- Institutions
- Industrial land uses
- Single-family properties larger than 9,500 square feet.

Raleigh Has **$835 million** of Known Stormwater Capital Improvement Needs



- Current FY24 pay-as-you-go CIP = $13.1M (64-year delivery)
- Proposed FY25 pay-as-you-go CIP = $13.9M (60-year delivery)
- Add ongoing Debt Finance & Grant strategy (40-year delivery)

Stormwater Outreach and Engagement Goals

- Build partnerships and trust with external stakeholders and community leaders
- Identify knowledge gaps in the community and effectively provide relevant information
- Create engaging methods to solicit resident feedback
    - Community flood resilience planning
    - Collaborate with residents vs. Inform
- Collaborate with Communications on severe weather preparedness, flood safety, and emergency communications planning

Rose Lane Safe Access

Commitment to Equity

- Outreach and engagement strategies targeted to reach all community demographic groups
- Rainwater Rewards Subsidy Program
- Partnerships with community groups
- Project priorities ranked objectively (complaints not considered)

Pursue world-class quality of life by actively collaborating with our community toward a fulfilling and inspired future for all.

Raleigh's Stormwater Vision

Keep Our Residents Safe & Informed

- Enhance our Flood Early Warning System
- Increase community notification strategies
- Educate residents on risks associated with flooding & storms

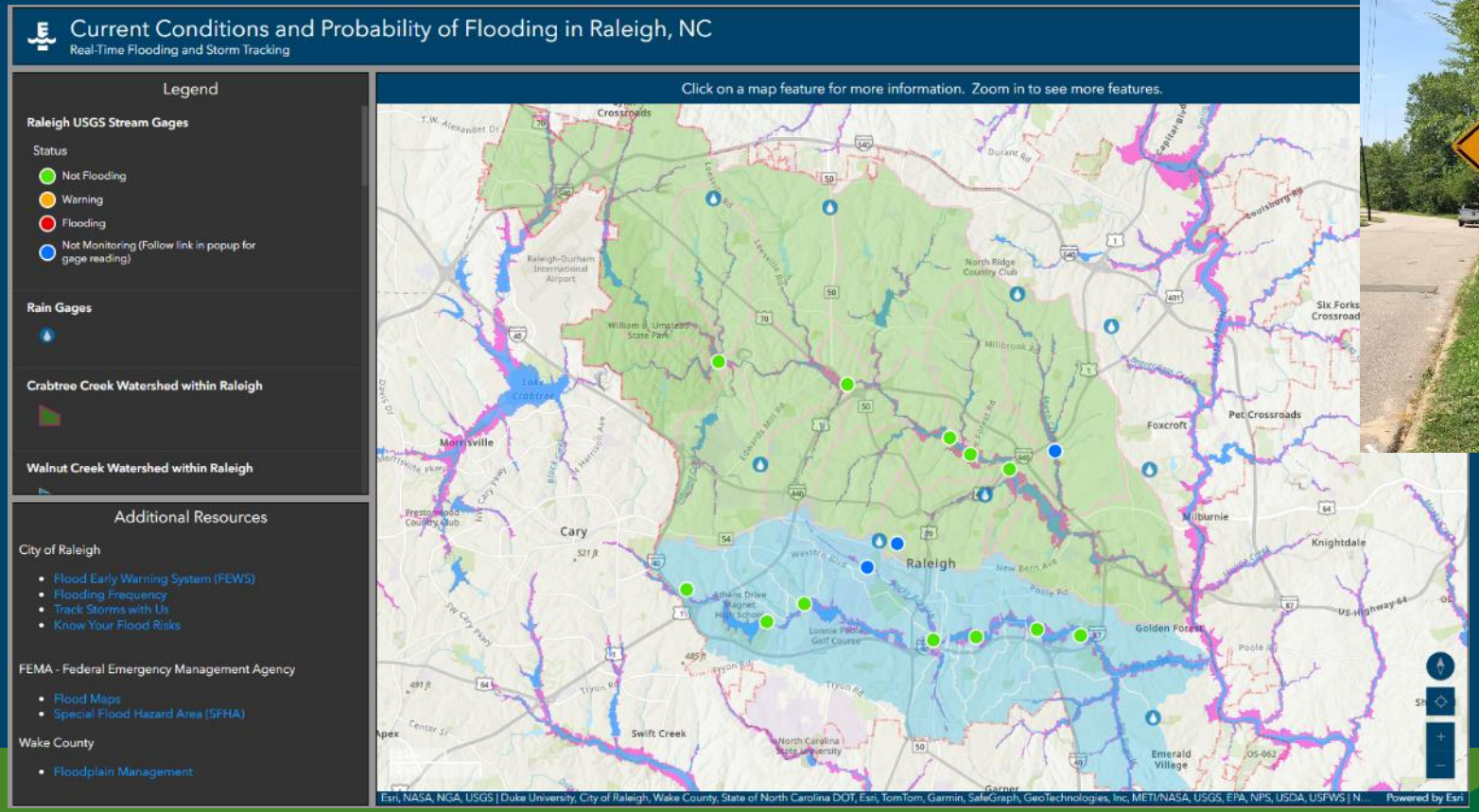
Make Our Community More Resilient

- Protect and enhance our floodplains
- Implement development mitigation strategies such as green stormwater infrastructure and nature-based systems

Implement Cost-Effective, Equitable, and Collaborative Strategies

- Improve program access to all residents
- Engage the community to better understand your stormwater concerns, needs, and challenges so we can better serve you

Online Tools and Flashing High-Water Signs Provide Flooding Information to Residents



Raleigh

How Can You Be Stormwater Smart?

- **Report and Stop Water Pollution**
- **Know Your Flood Risk**
- **Learn about City assistance**

Call: 919-996-3940

Email: RaleighStormwater@raleighnc.gov

Visit: raleighnc.gov/stormwater

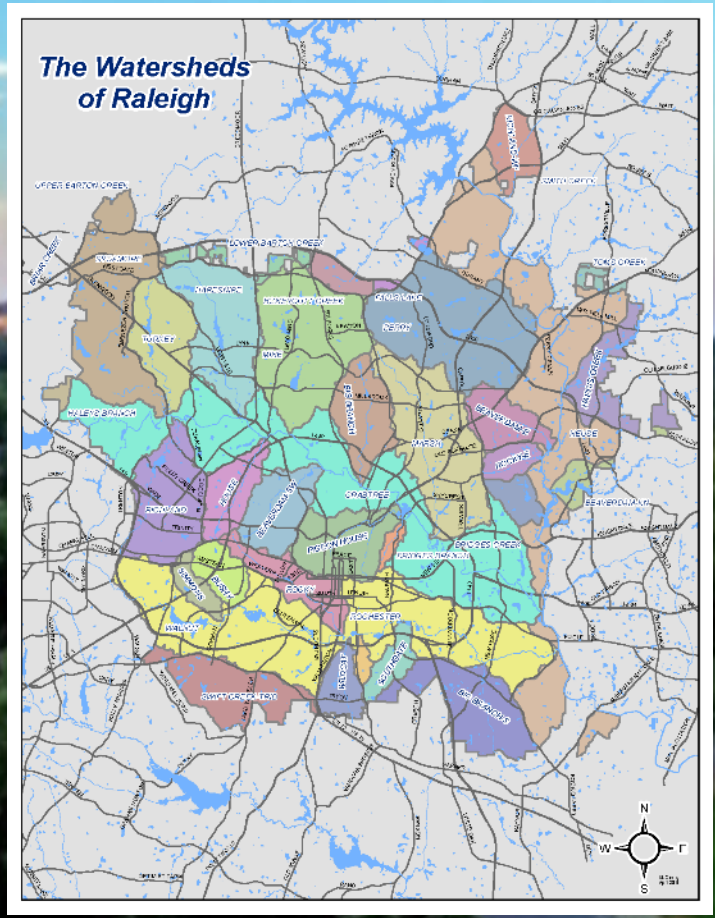

People Serving People

Bullpen slides after this – Do not display

101

Raleigh Stormwater

- City Capital of North Carolina
- ~ 480,000 residents and growing!
- 36 watersheds across the city
- Funded by impervious-surface based utility fee



Stormwater vs Wastewater

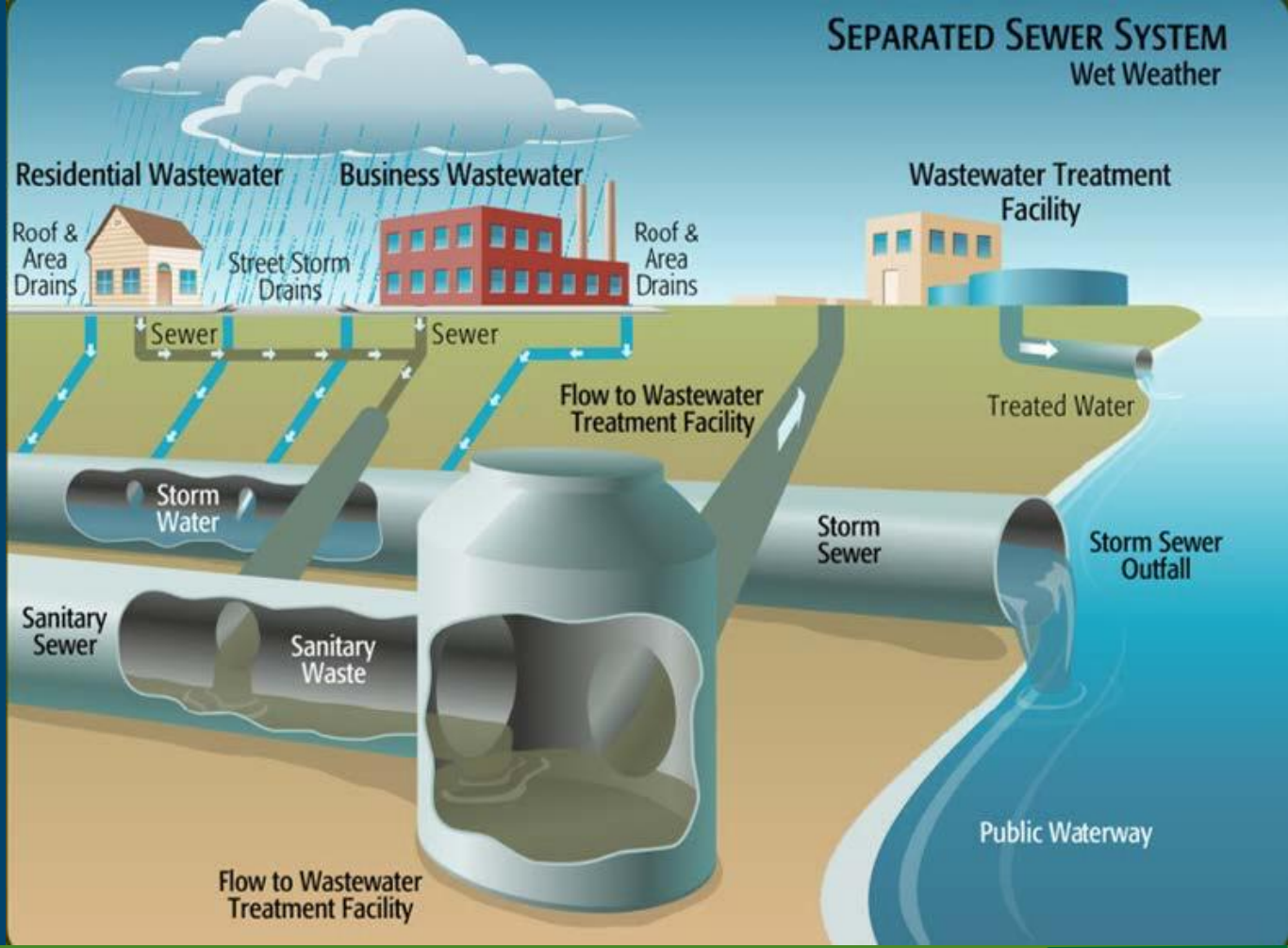


Photo: Pittsburgh Water & Sewer Authority

The Source of Pollution

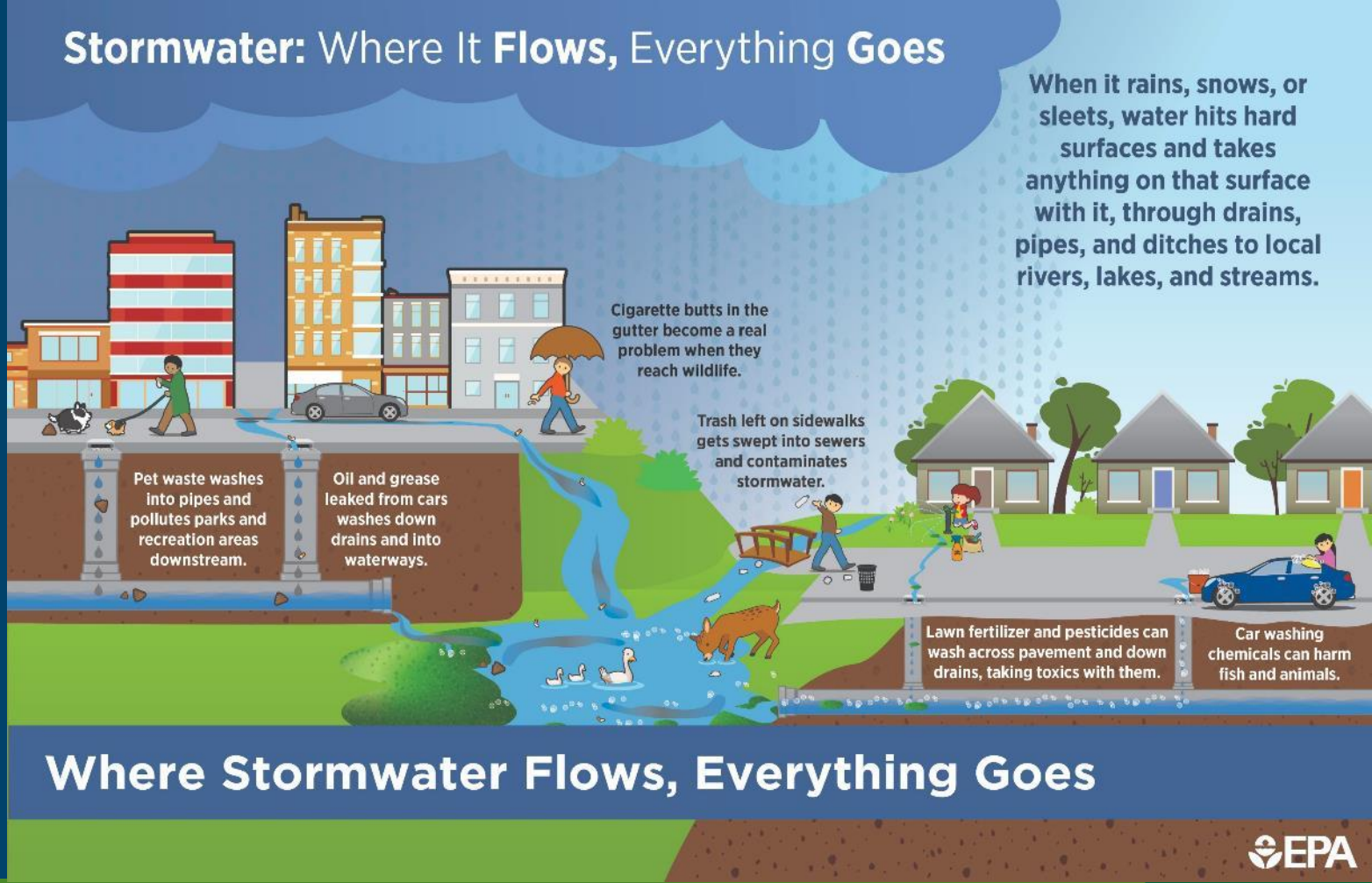
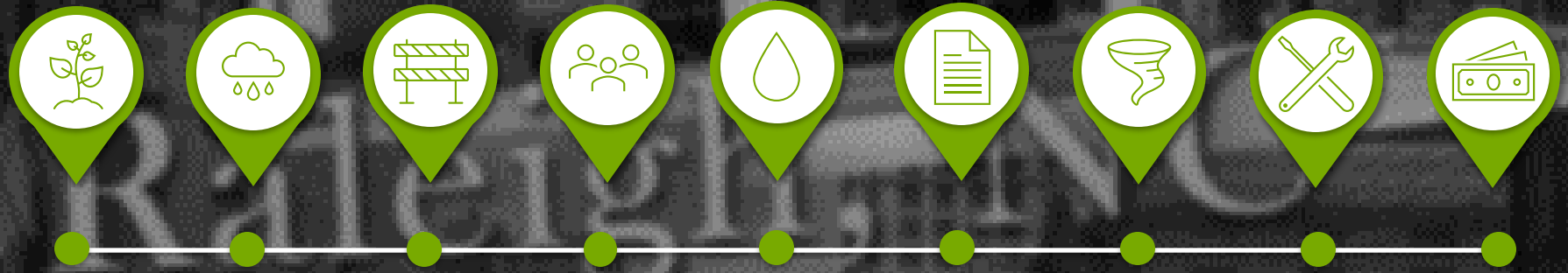


Photo: Environmental Protection Agency

History

History of Raleigh Stormwater



1974
Soil Erosion & Sediment Control Program began

1978
Raleigh Floodplain Management program began

1981
Falls Lake Dam construction completed

1985
Raleigh Stormwater Management Division formed

1992
NC Water Supply Watershed Rules adopted

1995
1st EPA NPDES Municipal Stormwater Permit

1996
Hurricane Fran hits Raleigh as Category 1

2001
Post-Construction Stormwater regulations

2004
Stormwater Utility Funding Begins

February 1973 Floods

Staff photo by Jim Strickland

CRABTREE BOATMEN — Three men on a raft at Crabtree Valley Shopping Center paddle an improvised raft in the parking lot during Friday's flooding. The theater marquee in background offers an appropriate movie — "The Poseidon Adventure," a story of an ocean liner overturned by a tidal wave.

Raleigh Stormwater System 1920

Development Review

Full Stormwater Requirements

For Stormwater Controls left in place after development:

- Control the rate of water flowing off the development site
- Limit the amount of nutrients (nitrogen and phosphorus) discharged to streams
- **If the flow fit in the pipe or stream before development, it will fit after.**

Larger Developments meet Full Stormwater Requirements

Parcel Size	One Detached House with ADU	Subdivision with Detached Houses	Cottage Court on 1 Parcel	Townhouse with Common Space	Small Apartment Building
					
< 0.5 acre	Exempt Property Requirements	Exempt Property Requirements	Exempt Property Requirements	Exempt Property Requirements	Exempt Property Requirements
0.5 acre to < 1 acre	Exempt Property Requirements	Exempt Property Requirements	Traditional Stormwater Requirements	Traditional Stormwater Requirements	Traditional Stormwater Requirements
> 1 acres	Exempt up to 5% impervious, then Traditional Stormwater Requirements.	Traditional Stormwater Requirements	Traditional Stormwater Requirements	Traditional Stormwater Requirements	Traditional Stormwater Requirements

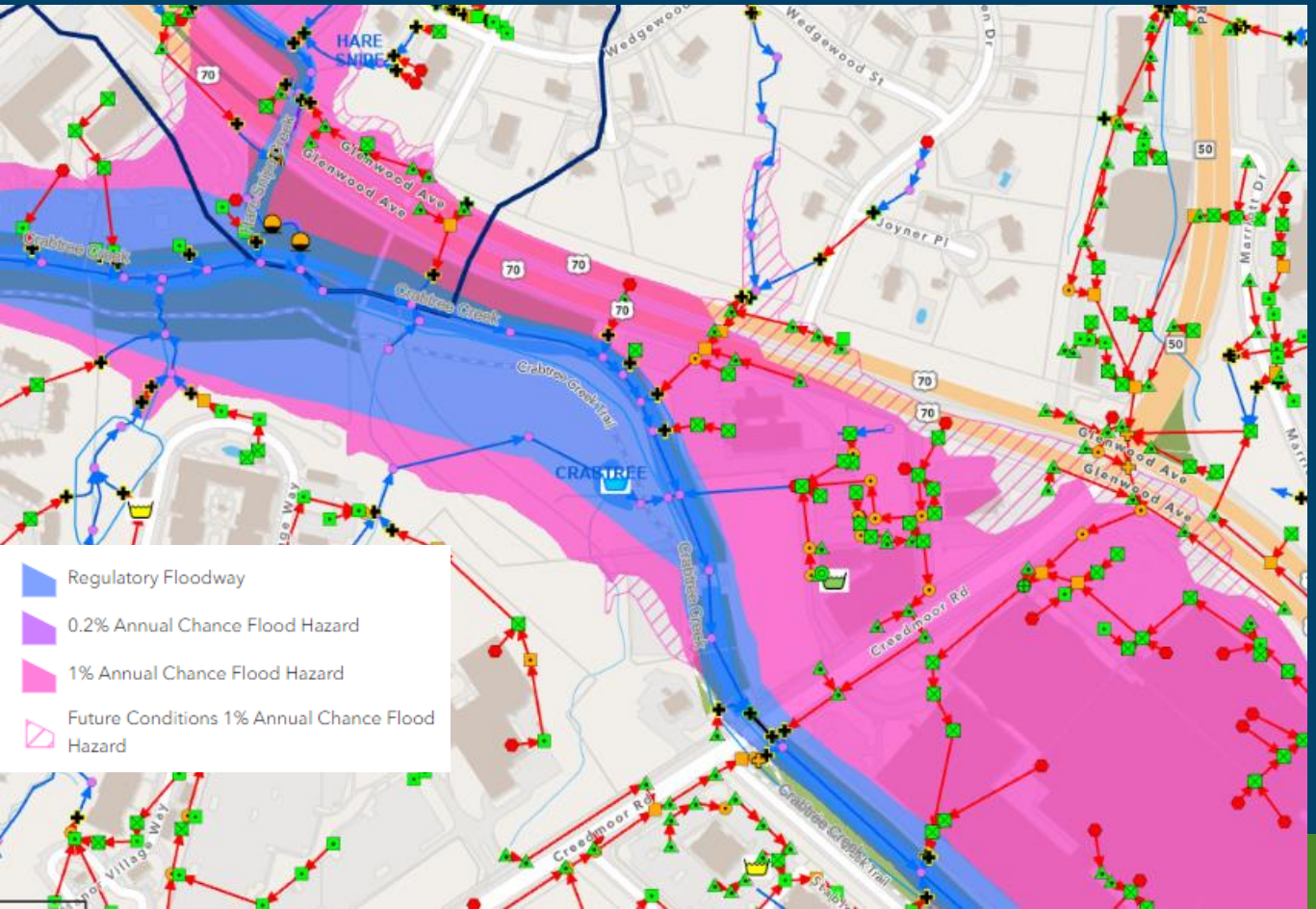
Photo Credit

NC Stormwater Law 101
The Rule of Reasonable Use

Obligates owners of lower land to receive the natural flow of surface water from higher lands, as long as the upper landowner is making a “reasonable use” of the land.

Liability is only when a **“harmful interference”** is found to be unreasonable and causing substantial damage.

Floodplain Regulations Restrict Development

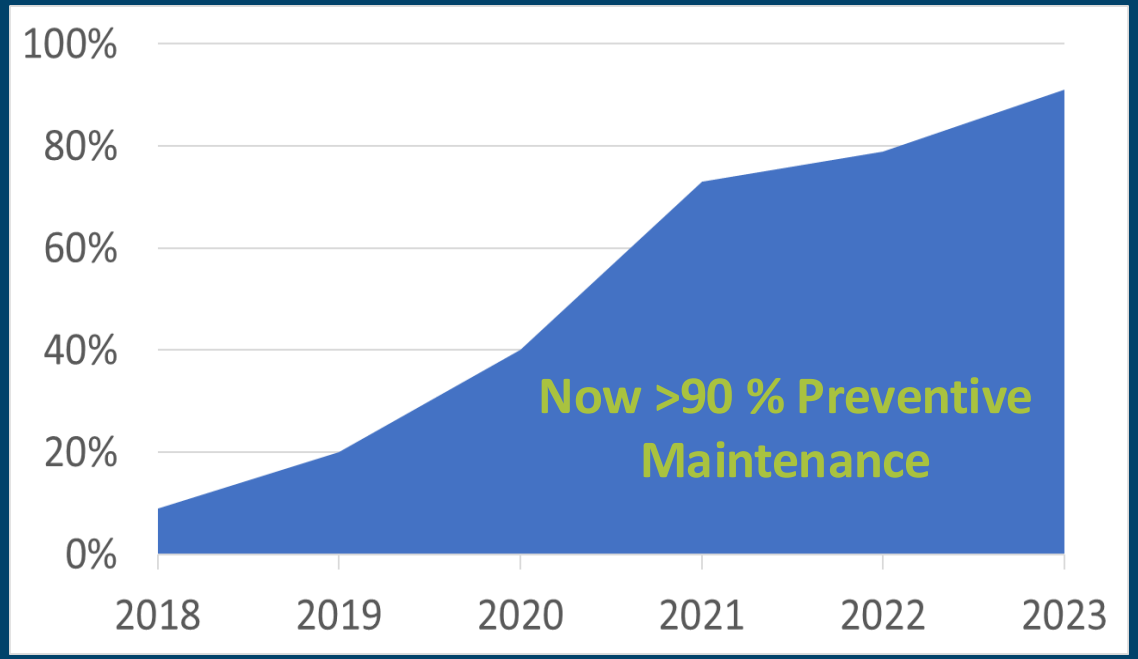


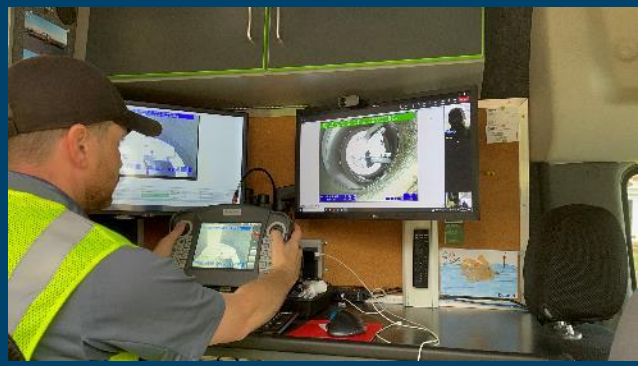
iMaps on RaleighNC.gov or mobile app.

Maintenance

"Smarter" Maintenance Reduces System Risk and Improves Performance

This Makes the Public Safer!





Recent Year At A Glance

&

FY 2024 Stormwater Projects

Our Raleigh Residents

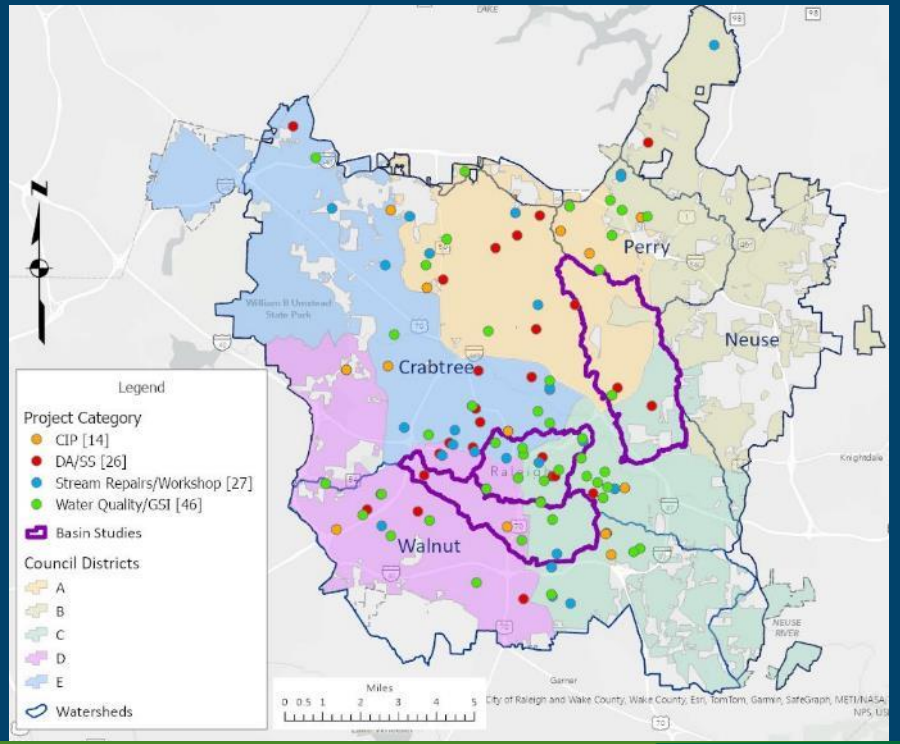
1,300 Volunteers

2,243 Hours Worked

27,800 lbs Trash Removed

Stormwater Maintenance Unit Summary Statistics

Task	Asset Quantity FY 2023	Asset Quantity FY 2024
Pipes Inspected	6,550 (481,101 LF)	7,058 (511,255 LF)
Pipes Flushed	12,822 LF	36,815 LF
Replaced or Repaired Pipes	669 LF	830 LF
Culverts Maintained	1,356	3,359
Catch Basins Repaired	215	196
Street Sweeping	7,007 miles	6,346 miles



Water Quality

Water Quality Initiatives

Raleigh Rainwater Rewards (R3)

- SMAC approved **37** projects totaling **$488,616**
- **38** projects installed and began maintenance terms

Water Quality Projects

- Completed Green Stormwater Infrastructure (GSI) at Biltmore Hills Park
- Repaired Millbrook Exchange Park Stream (led tour with Millbrook HS students)

Capture It! Art Contest

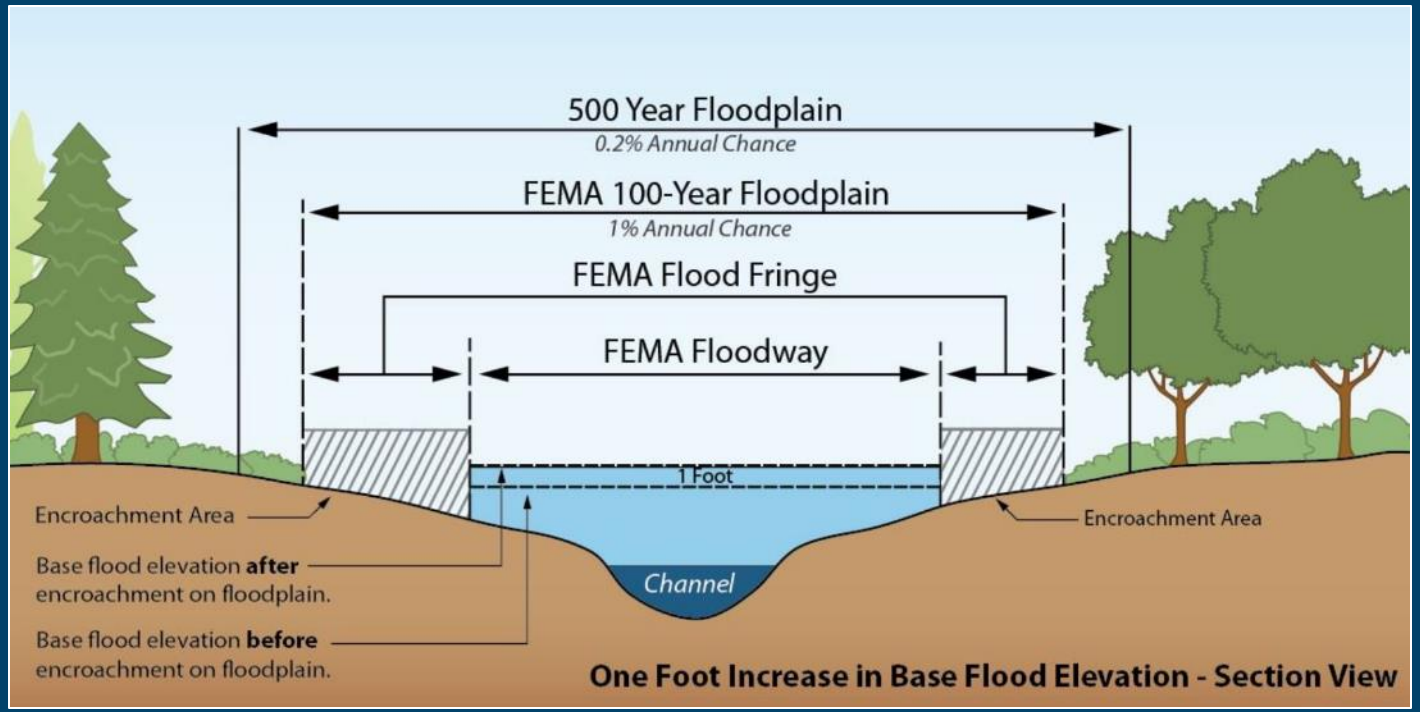
- 64 entries and awarded 3 finalists
- Collaborated with Raleigh Arts to host a gallery at Pullen Arts Center

Water Quality Initiatives

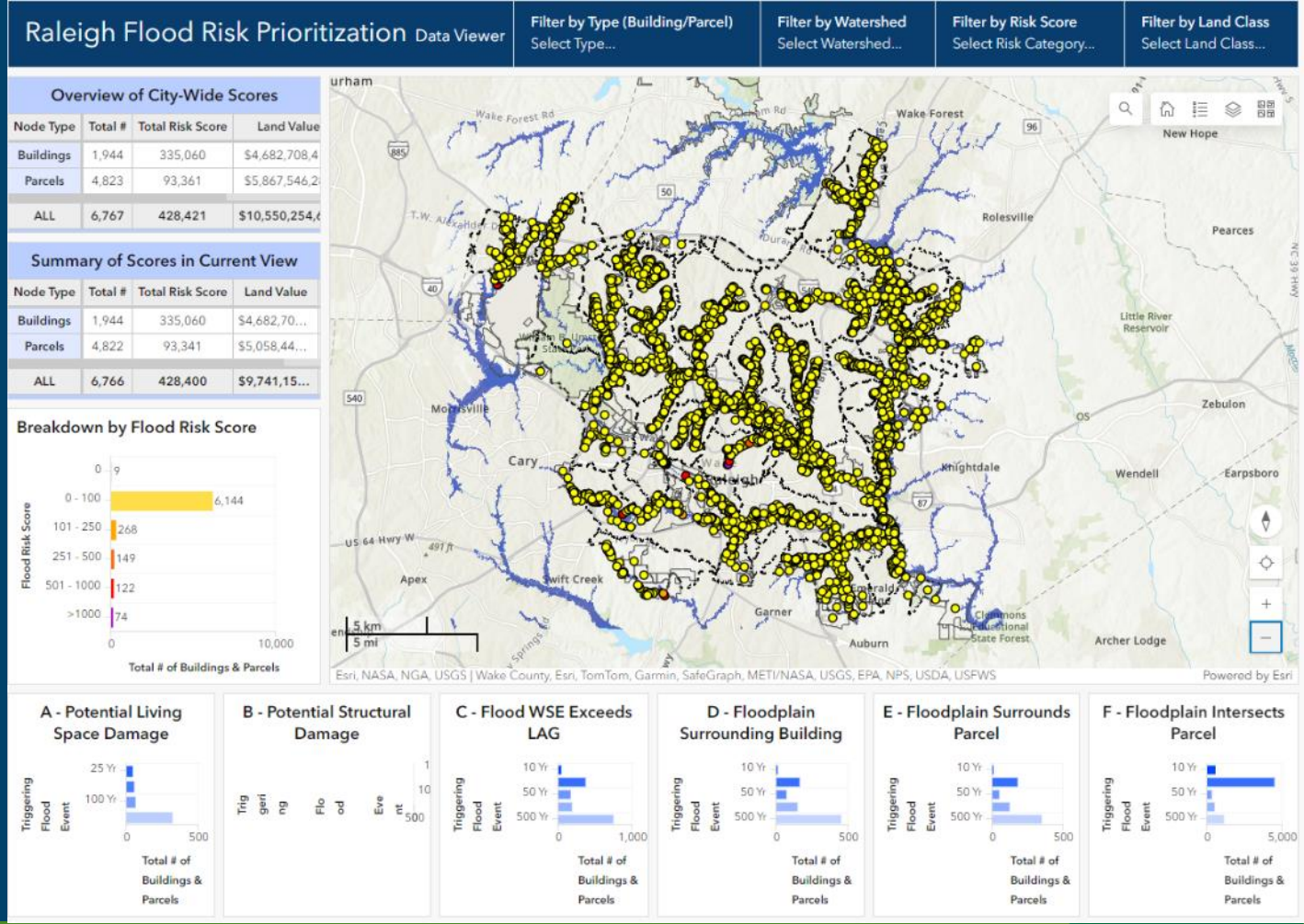
- Advised stormwater equity and inclusion initiatives, including **$3 million ARPA funding allocation.**
- Supported staff with enhancing storm and flood monitoring efforts, adding **20 new rain gauges.**
- Reviewed stormwater utility fee rates for FY 2025.
- Received and reviewed **Stormwater Design Manual** updates (approved by City Council September 3).
- Supported Asset Management, Floodplain Management and Development Management groups.
- Supported Stormwater Maintenance Unit (provided ride-a-long tour to council member).
- Reviewed and supported Watershed Public Engagement Plans.

Floodplain

Floodplain Management Standards



Flood Risk Tool



Awareness (Pre-Event)

Reverse 911 Calls

- GIS/Customer Billing System Info

Social Media

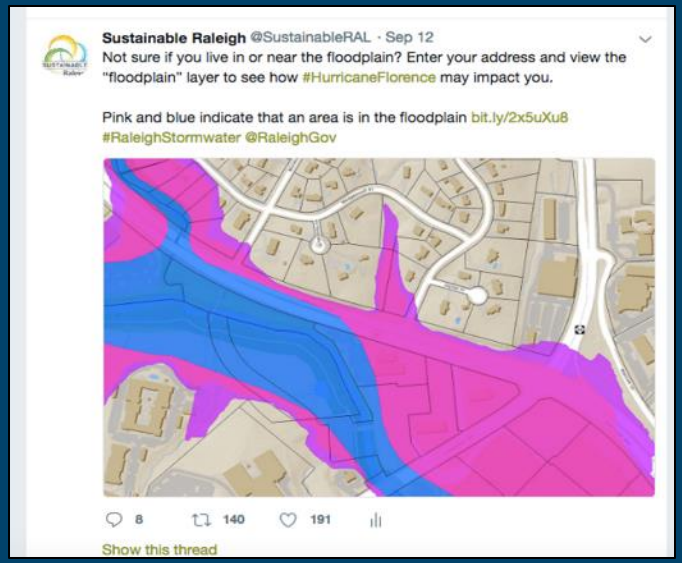
- Twitter/Facebook

Door to Door

- Police/Fire Dept

Website

- raleighnc.gov/stormwater



Reporting (In-Event)

Emails

- EOC/ECC/City Management

Calls

- 911 (roads or structure flooding)

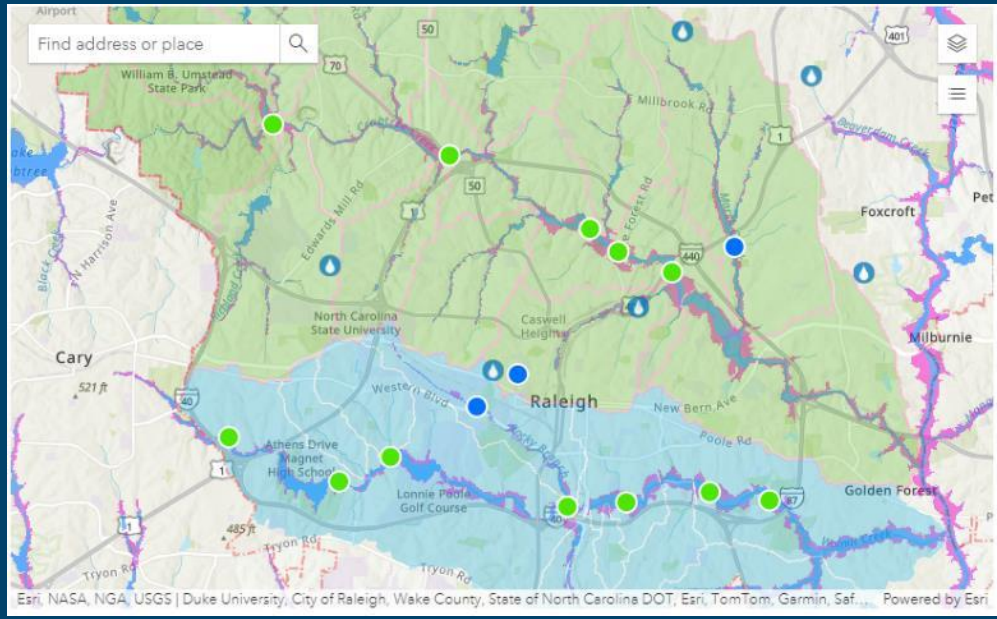
Wireless Emergency Alerts (WEA)

911/State Dam Safety

Social Media

- Twitter/Facebook

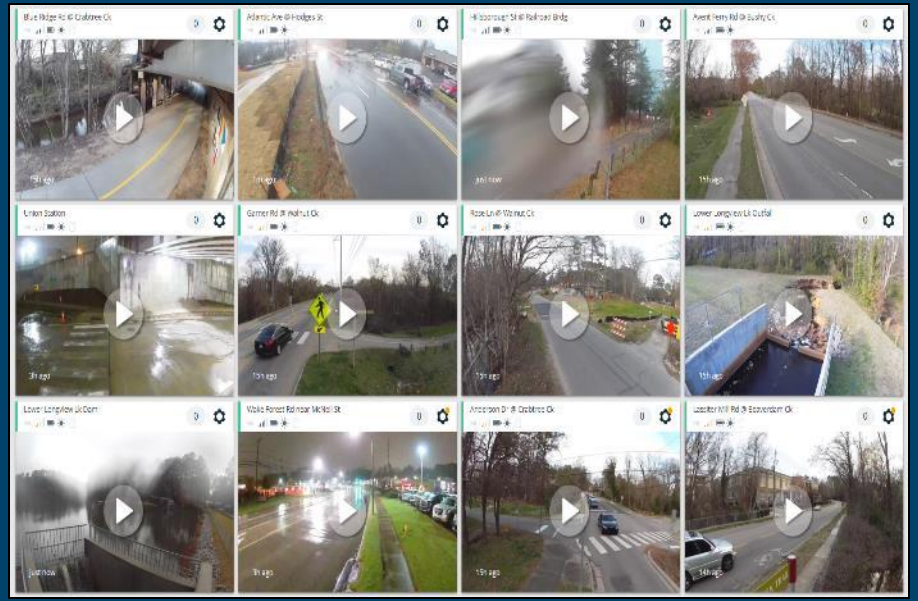
Public (coming soon)



Cameras Supporting Flood Monitoring

18 Flood / 180 Traffic Cameras

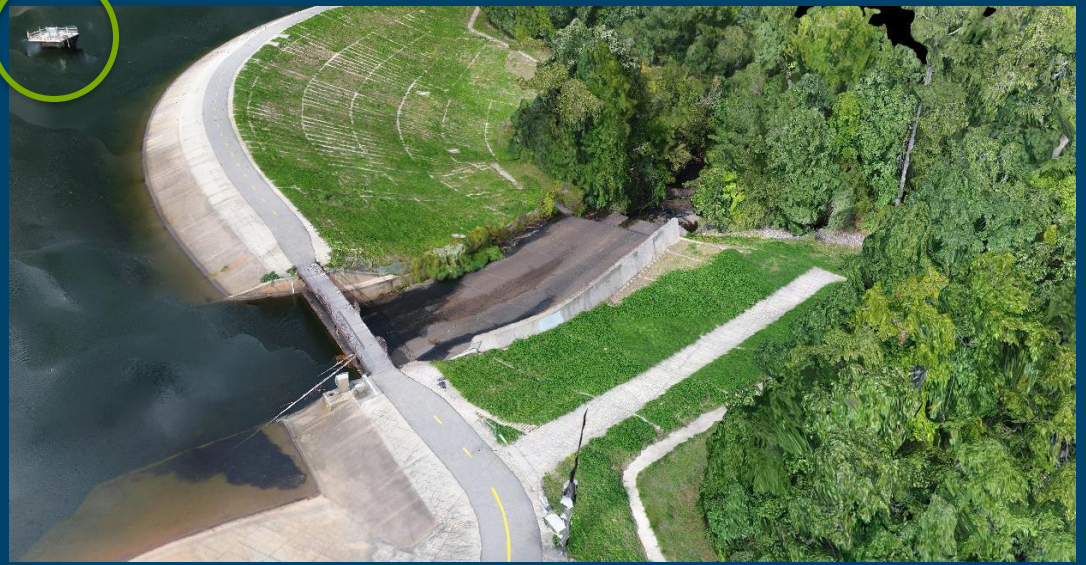
21 Cellular / Solar Flood Cameras



Flood Control through Active Lake Level Management

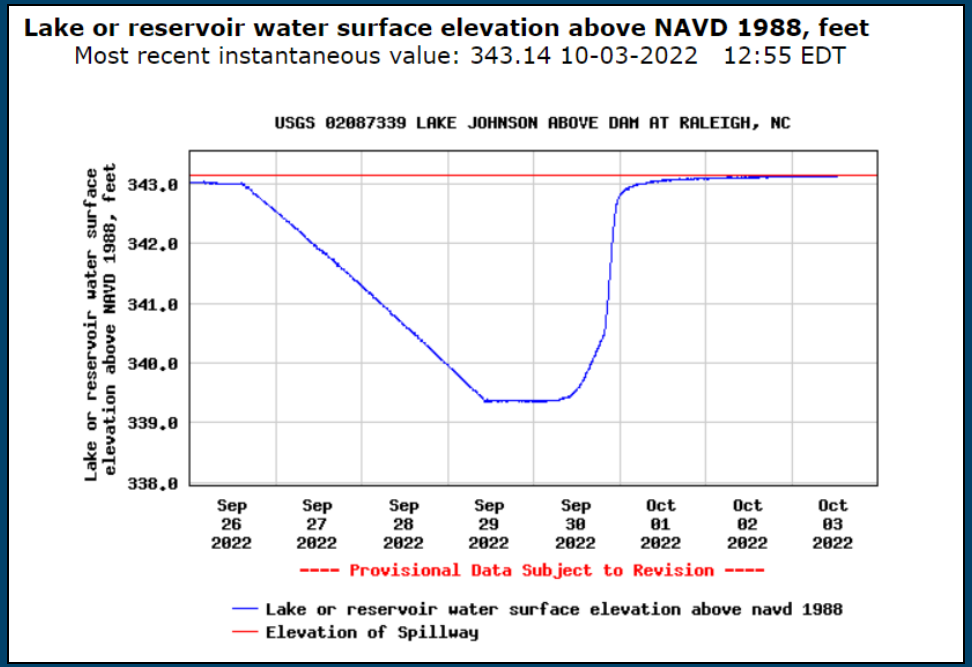
- Remote control of gate
- Tool for storm preparation
- Cellular or option of NOAA Weather alert activated
- Siren and flashing warning light for safety when valve is opened
- Connected to AC power but also solar capable
- Water level sensor

Lake Johnson Pilot Project

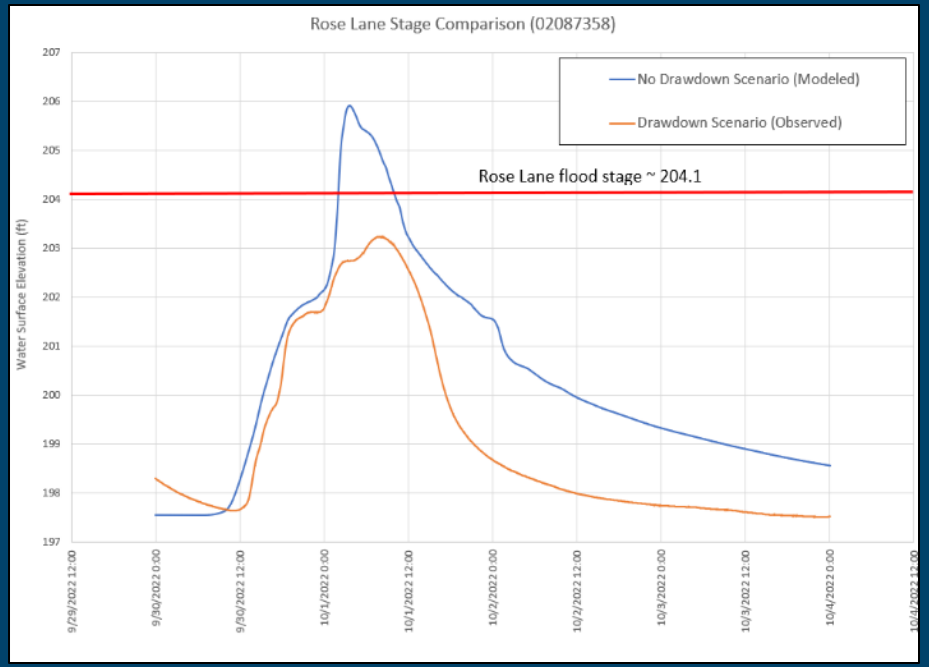


Lowering Lake Johnson (Hurricane Ian)

Lake Johnson



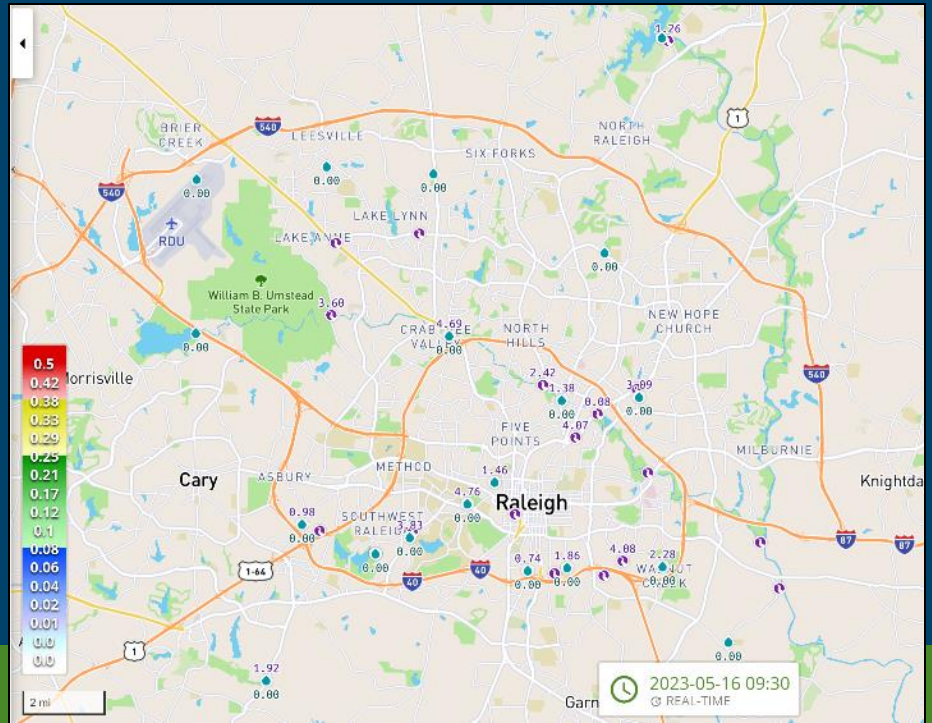
Rose Lane

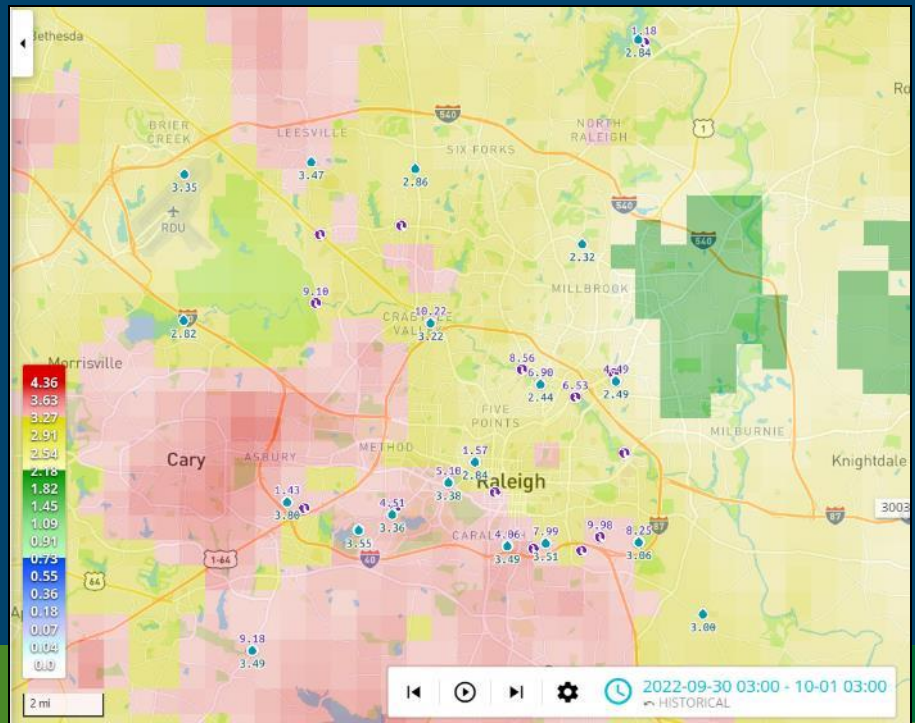


FEWS

Flood Early Warning System (FEWS) Software Provides Advanced Flood Predictions

Gauge Adjusted Radar Rainfall (GARR) and forecasts





Rehabilitation project bundles provide streamlined project delivery and cost savings

System Repairs

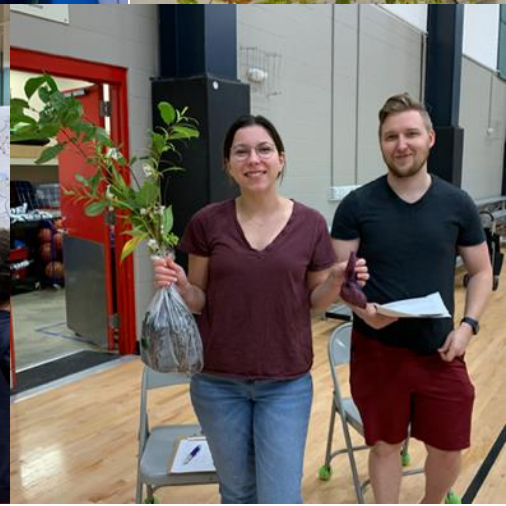
- Bundling projects based on construction type
- Rehabilitation of infrastructure to extend life of assets and minimize disturbance

Steams

Hadley Road Stream Repair

Buffer Builder Bags (B3)

- Free native shrub and tree seedlings provided.
- Helps prevent erosion and create a streamside buffer.
- First-come, first-served



Urbanization Leads to Streambank Erosion

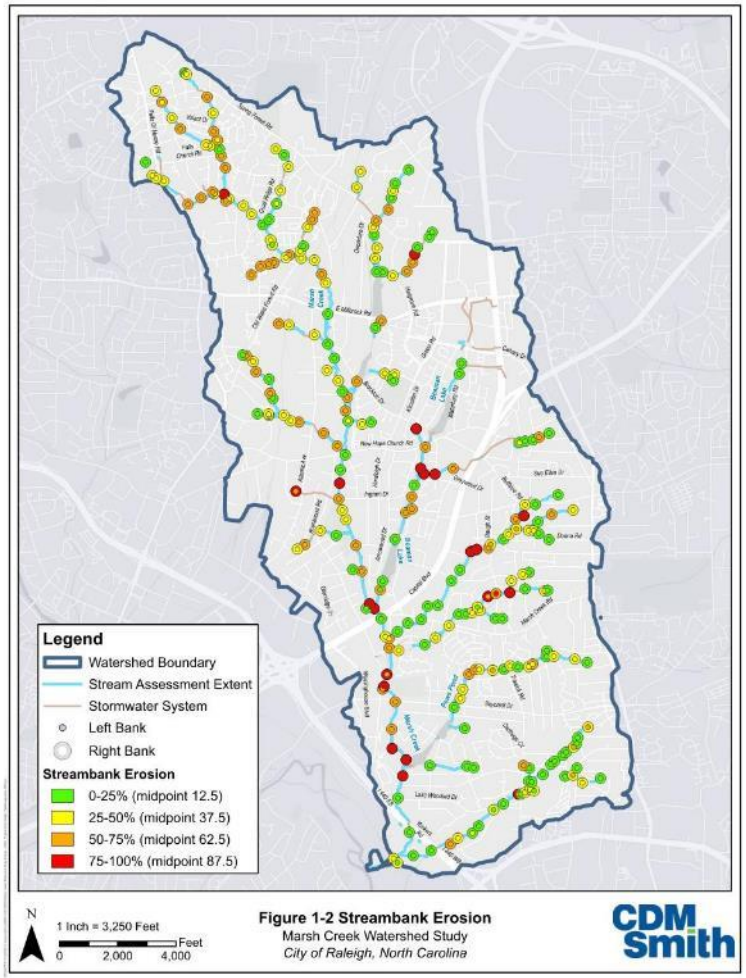
- Impervious surfaces – more stormwater runoff
- More stormwater volume leads to streams flowing full more frequently
- Higher velocities of flow leads to more sheer stress on streambanks and thus more erosion
- Streams will “restabilize” themselves over many decades
- Sediment is a major pollutant in NC streams – impacts aquatic habitat

Watershed Assessments Quantify Streambank Erosion

Bank erosion leads to high volumes of sediment moving down the systems.

High erosion near Oates Drive

Low erosion downstream of Oates Drive high erosion picture.



Most Stream Restorations Thus Far Have Been on City Property: Millbrook Exchange Park Stream Repair

Asset Management

Asset Management Program Goal

Make the best use of resources to extend the life of stormwater assets and protect public safety

Stormwater
A service unit of the Engineering Services Department

Stormwater Maintenance
A service unit of the Transportation Department

Public Safety Impacts of Aging Assets

Sinkhole

Park Drive Sinkhole

Stormwater Conveyance Inventory

	Culverts	Inlets	Junctions	Pipes
Total	~1,700	91,700	13,030	1,850 miles
City	839	35,500	3,780	680 miles

Pipe Condition Assessment Pro-Active Approach

Visual

Crossline Conveyances
Large Diameter Pipes
Inlets and Junctions

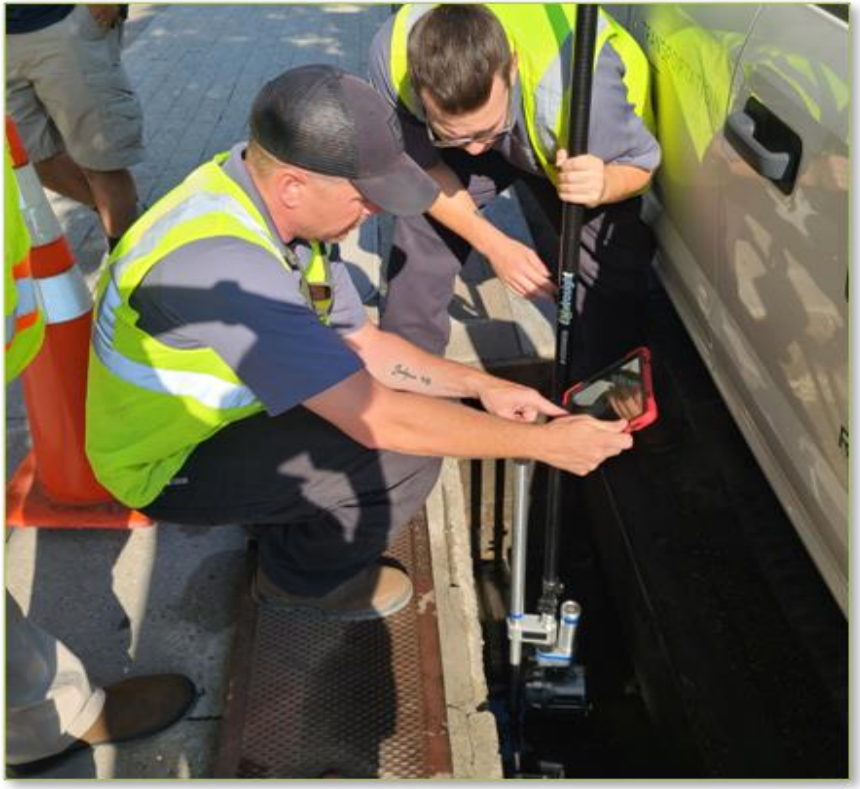
Pole Camera

Crossline Conveyances
and Pipes

Crawler

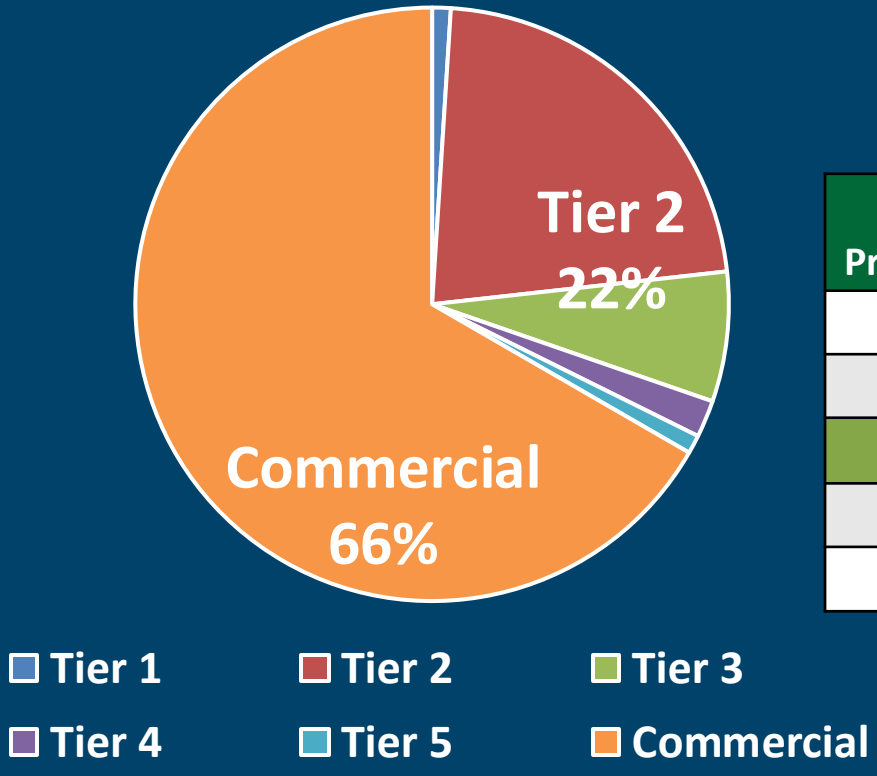
Crossline Conveyances
and Pipes

Pipe Condition Assessment Phased Screenings



Funding

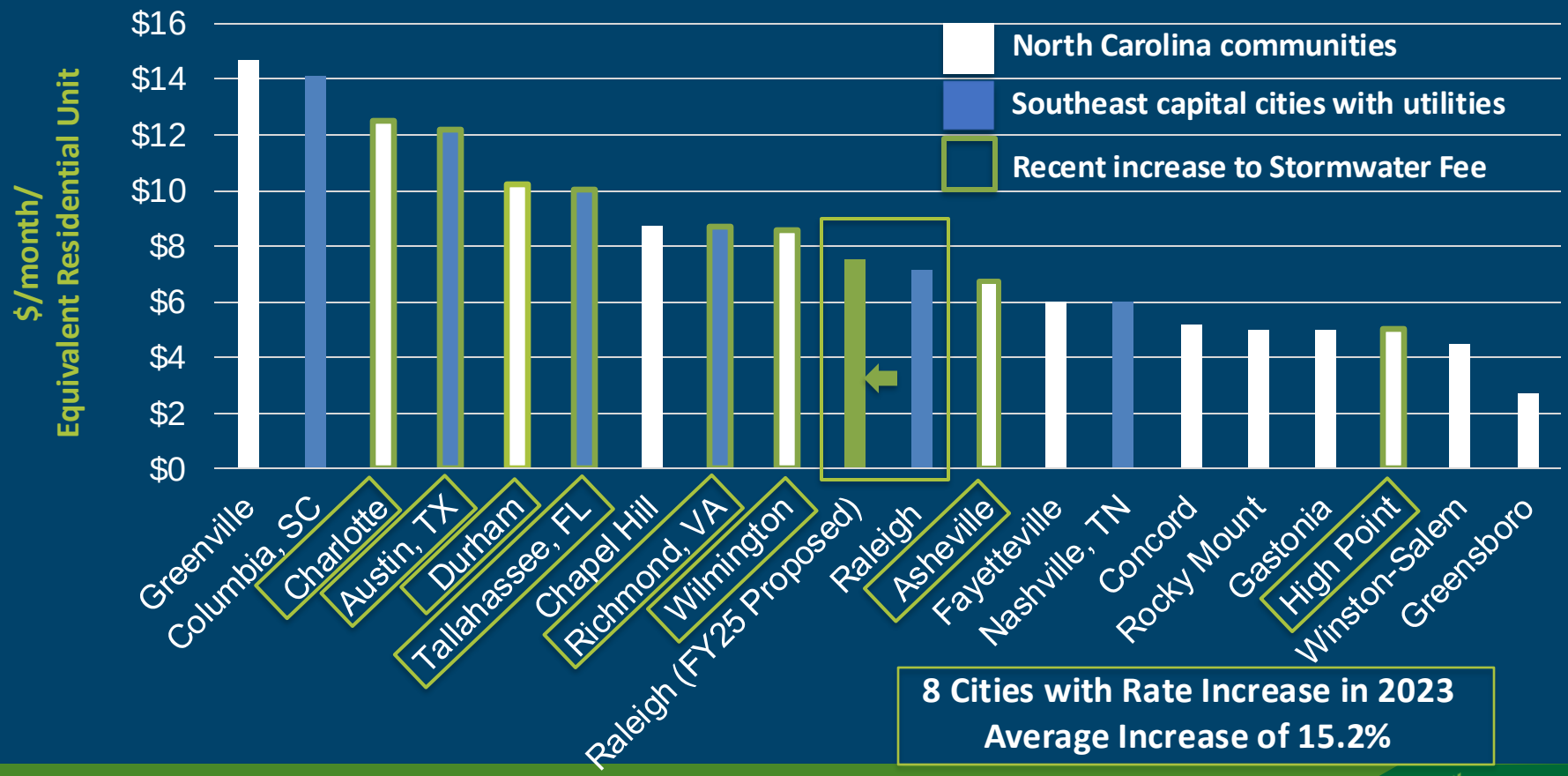
Stormwater Fees Are Proportionate to Downstream Impacts



Property Type	Impervious Area	Current FY24 Monthly Fee
-	0 – 399	No Fee
Tier 1	400 – 1,000	$3.06
Tier 2	**1,001 – 3,870**	**$7.65**
Tier 3	3,871 – 6,620	$13.01
Tier 4	6,621 – 9,500	$22.19

Raleigh Stormwater Fees Compared to Peers

As of Dec 2023



8 Cities with Rate Increase in 2023
Average Increase of 15.2%

Raleigh

Be the **“smartest”** stormwater program possible to economically and equitably achieve our mission.

Be Stormwater Smart!