



Spring Seminar April 26, 2019

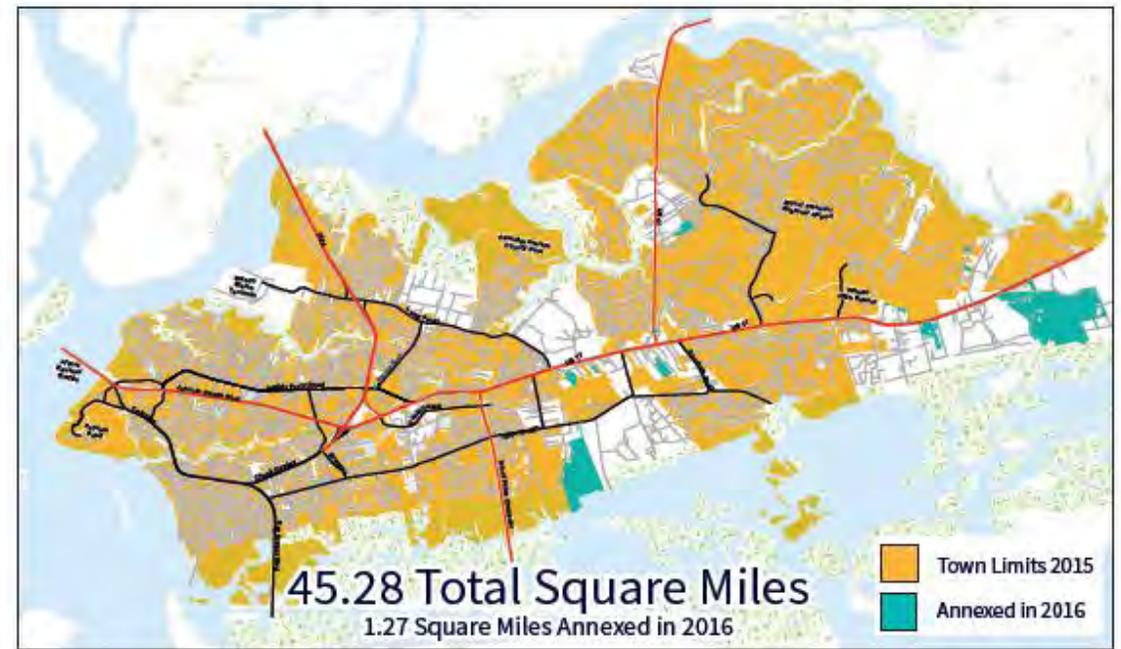
# STORMWATER OPERATIONS & MAINTENANCE

Reactive to Proactive  
Building resiliency into your every day

# Overview

- **Background**
  - **Mount Pleasant**
  - **Local Vulnerabilities**
- **Resiliency**
  - **Planning**
  - **SWOT Overview**
- **Hazard Mitigation**
- **Operations and Maintenance**
  - **Asset Management**
    - **Pollution Prevention**
  - **Public Resiliency**





### Average Yearly Climate



Average High  
75.2° F



Average Rainfall  
50.99 in.



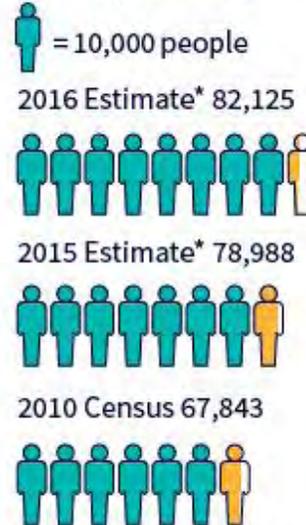
Average Days with Sun  
243 Days



Average Low  
56.1° F

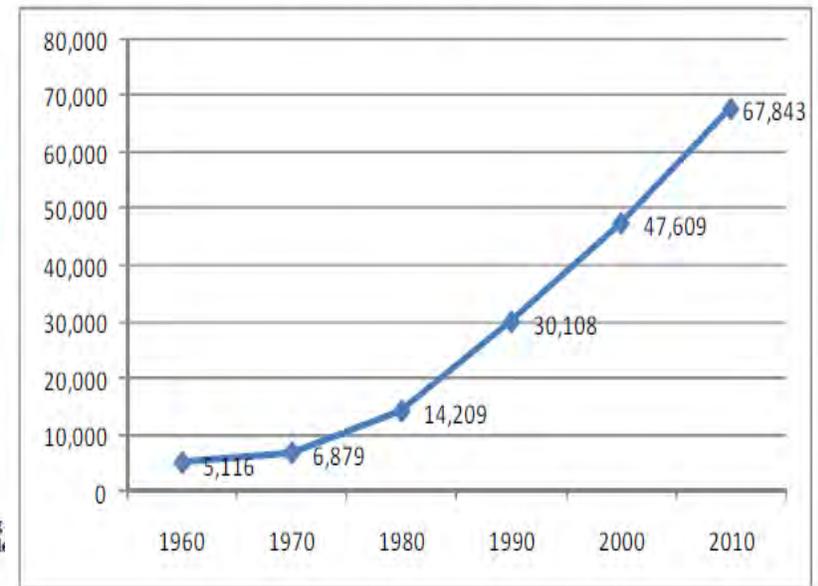
Source: National Oceanic and Atmospheric Administration

### Population



\*based on number of dwelling units receiving Certificate of Occupancy times average people household

### Population Change over the Past 50 Years



# LOCAL HAZARDS



# Regional Hazard Data

**Table 5-3**

2013 Top Five Most Hazardous Counties in South Carolina	
County	Ranking
Charleston	1
Spartanburg	2
Greenville	3
Berkeley	4
Orangeburg	5

Source: South Carolina Hazard Mitigation Plan, 2013

**Table 5-2**

2013 Risk Assessment by Hazard Type Based on Place "Vulnerability Score" Charleston County, SC		
Hazard Type	Vulnerability Score	State Ranking
Hurricane	0.92	5
Flood	1	1
Wildfire	0.24	17
Tornado	0.77	4
Earthquake	0.95	2
Hazardous Materials	1	1
Rip currents	Not studied	Not studied
Severe storms	0.41	12
Drought	0.56	17
Winter Storms	0.10	24
Avian Flu/Pandemics	Not studied	Not studied
Dam Failure	Not studied	Not studied
Terrorism	Not studied	Not studied
Tsunami	Not Studied	Not Studied
<b>Overall</b>	<b>8.64</b>	<b>1</b>

Source: South Carolina Hazard Mitigation Plan, 2013, pg 158



# DEFINING RESILIANCY

## Reasonable Resilience Definition

Infrastructure resilience is the ability to reduce the magnitude and/ or duration of disruptive events. The effectiveness of a resilient infrastructure or enterprise depends upon its ability to anticipate, absorb, adapt to, and/ or rapidly recover from a potentially disruptive event.

*(National Infrastructure Advisory Council (2009))*

## City Resilience

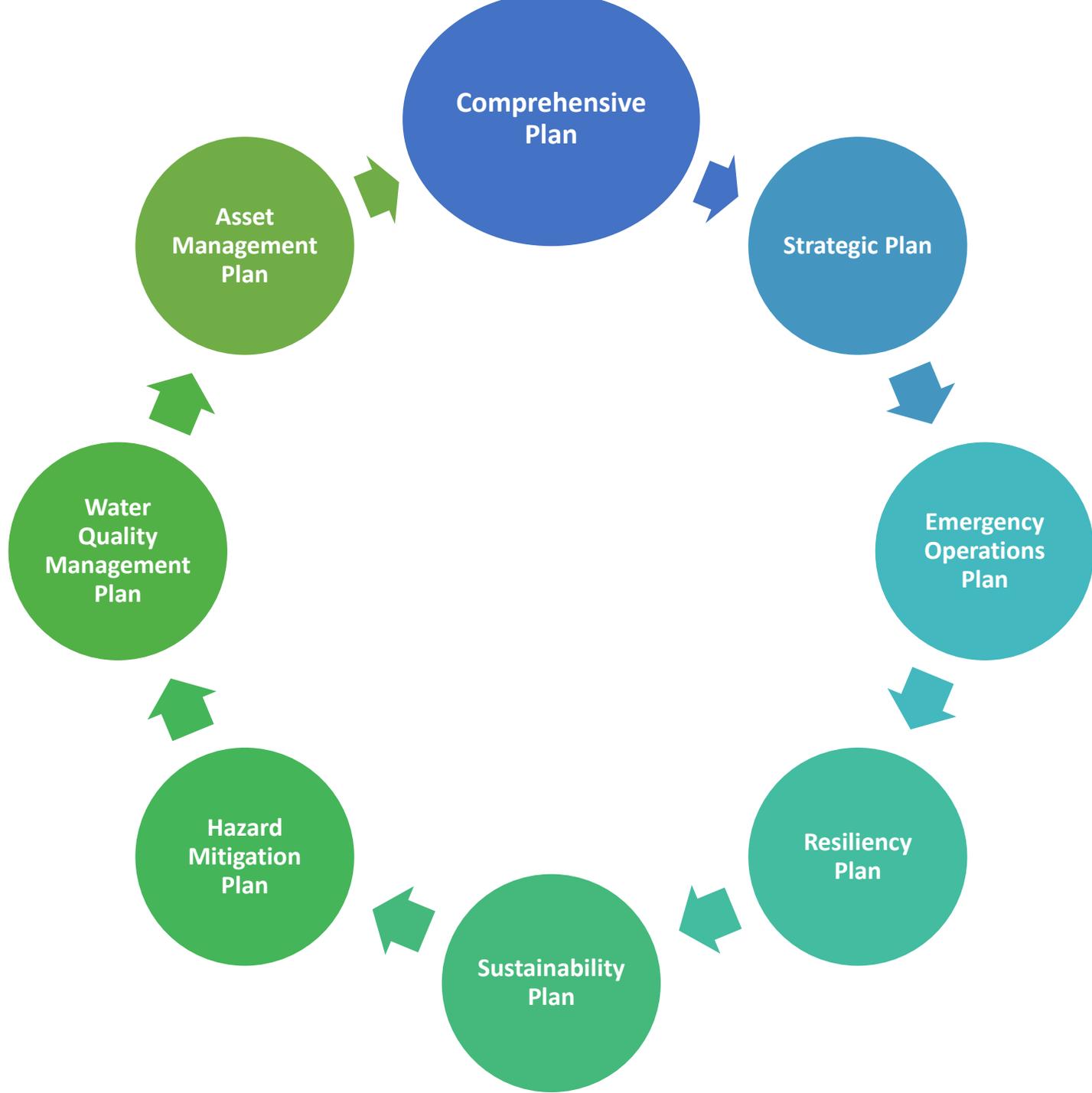
The capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stress and acute shocks they experience. *(www.100resilientcities.org)*

## Hazard Mitigation

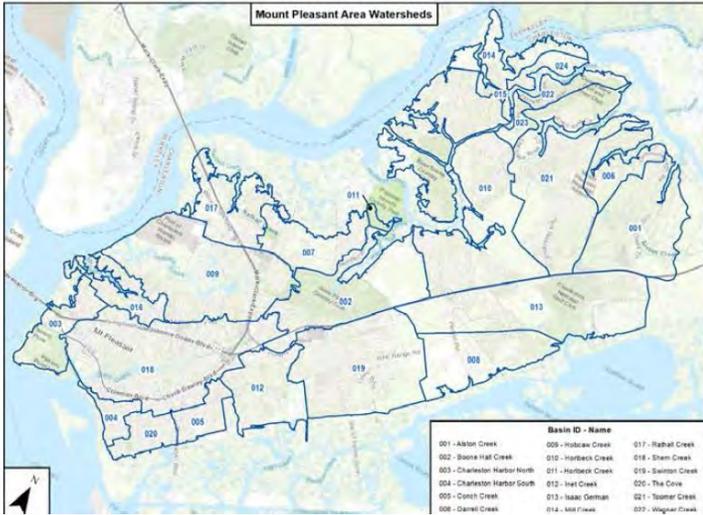
Sustained action taken to reduce or eliminate the long term risk to human life and property from hazards

*(Title 44 Code of Federal Regulations (CFR) §201.2, Definitions)*

# Planning



## Water Management Network



# Comprehensive Planning 2018-2028

- Added Hazard Planning Section
- Added Resiliency Section
- Added Water Management Network Section for Stormwater
  - Water quality
  - Flood control

1/2019 DRAFT

MOUNT PLEASANT, SC COMPREHENSIVE PLAN 2018-2028

## Green Network



Planning  
for  
Resiliency

O&M

Identify Disruptive Events



SWOT Analysis

Strengths

Weaknesses

Opportunities

Threats

## Long Range Events

- Rainfall fluctuations/ changes
- Hurricanes
- Sea Level Rise
- Other Hazards
- Economic forces
- Public perceptions

## Resiliency O&M Actions

- Design Standards
- Emergency Response
- Partner Studies
- Public Resiliency



## Short Term Events

- Construction Defects/ Issues
- Tidal Inundation
- Rain Bombs
- Environmental Discharges

## Resiliency O&M Program

- Infrastructure inspection/ acceptance program
- System Maintenance Programs
- Pollution Prevention Programs



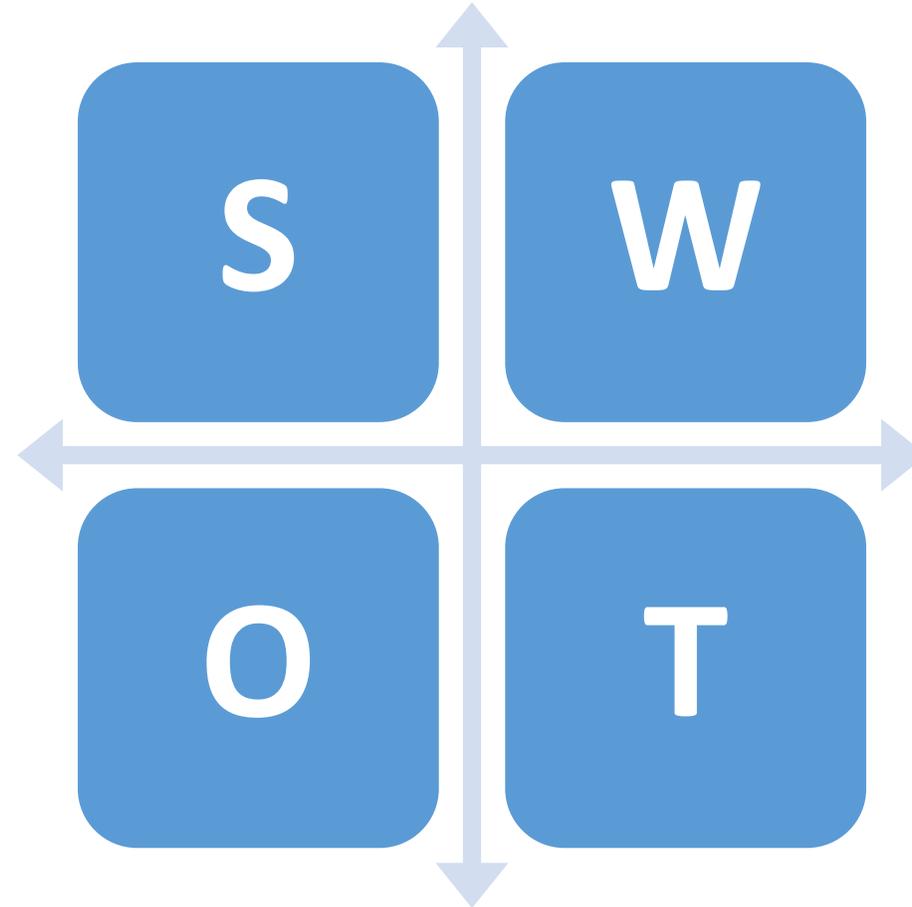
# Stormwater in Mount Pleasant - SWOT

## Strengths

- Awesome Staff
- Administrator Support
- Educated Citizens
- Economy allows for innovation

## Opportunities

- Awesome Neighbors
- Cross Training
- Multi Department connections
- Trust = Ability to grow



## Weaknesses

- Smallest Division
- Reactive
- Resources are in different departments
- Squirrel Principal

## Threats

- Cultural Environment
- Politics
- Adaptability
- Isolationism
- Desire to separate functions
- Growing population

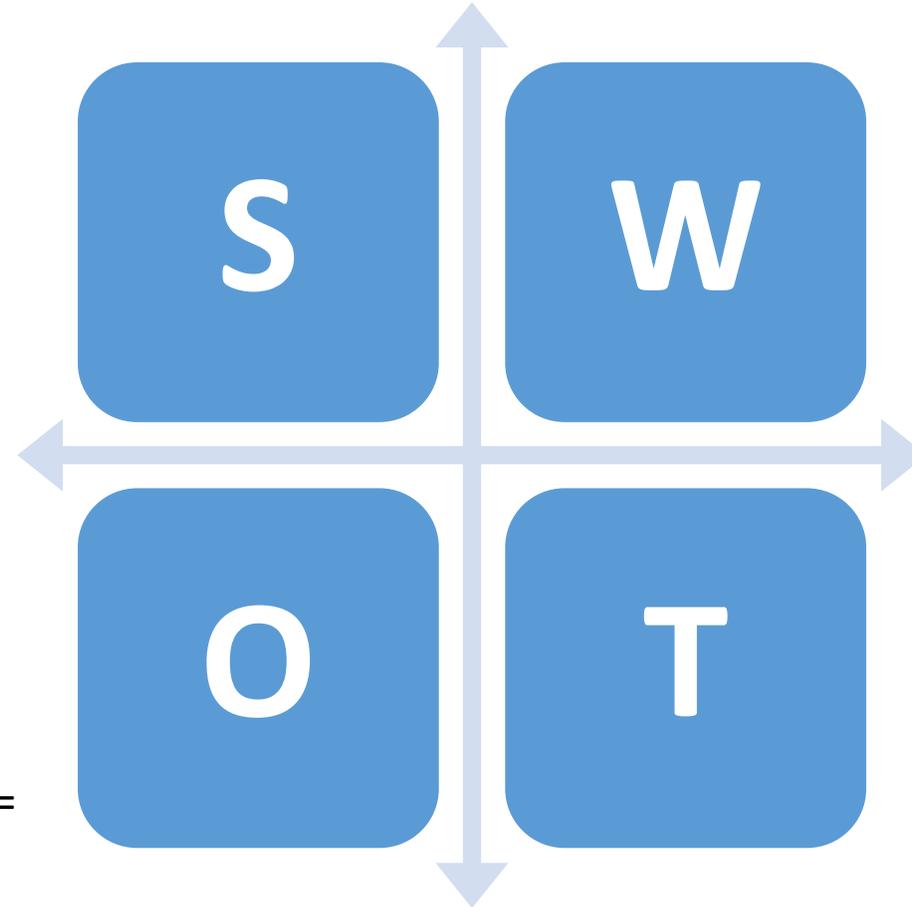
# Stormwater in Mount Pleasant - SWOT

## Strengths

- SW utility since 1996
- Use existing programs to drive methodology
- Look at outside for ideas & information
- Moving to proactive

## Opportunities

- Have Asset Management mindset
- Building teams
- Working on accreditation = sustainable processes & programs



## Weaknesses

- Reactive
- Squirrel Principal
- Resources are in different departments
- Low lying land

## Threats

- Short term visions
- SLR impact w/ rainfall
- Funding
- Limited Resources
- Changing regulations (FEMA/ EPA)

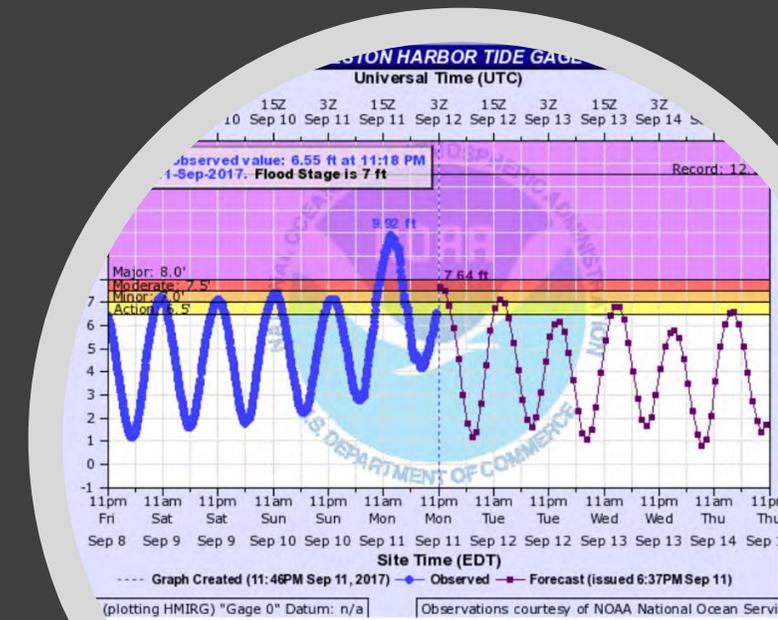
# Hazard Mitigation

Long range events

*“Ability to anticipate, absorb, adapt to, and/ or rapidly recover from a potentially disruptive event.”*

- Planning
- Response
- Recovery

- FEMA Community Rating System [CRS] program
- FEMA Disaster Guidelines
- Sea Level Rise Planning



# Hazard Mitigation Resources



OMB No. 1660-0022  
Expires: March 31, 2020

National Flood Insurance Program  
Community Rating System

## Coordinator's Manual

FIA-15/2017



## Damage Assessment Operations Manual

A Guide to Assessing Damage and Impact

April 5, 2016

# FEMA CRS Program

# O&M TOOL

Loss Statistics for Charleston County as of 3/31/2018		
Jurisdiction	Total Losses	Total Payments
City of Charleston	6,550	\$ 115,689,221.22
Unincorporated	4,501	\$ 41,514,268.74
City of Isle of Palms	2,561	\$ 63,324,936.22
Town of Mt. Pleasant	1,542	\$ 15,741,446.61
City of Folly Beach	1,243	\$ 17,379,472.35
Town of Sullivan's Island	848	\$ 20,995,713.54
City of North Charleston	467	\$ 9,633,876.18
Town of McClellanville	67	\$ 2,144,786.64
Town of Kiawah Island	114	\$ 374,872.91
Town of Seabrook Island	61	\$ 686,008.15
Town of Meggett	31	\$ 314,126.70
Town of Hollywood	16	\$ 194,427.11
Town of Awendaw	5	\$ 59,575.25
Town of Ravenel	1	\$ 5,066.66
Total Region	18,007	\$ 288,057,798.28

Source: FEMA Policy & Claims Statistics Database, 2018

- **Public Information**
- **Mapping and Regulations**
  - Flood Hazard Mapping*
  - Open Space Preservation
  - Building Codes
  - Stormwater Management*
  - Flood Protection
- **Flood Damage Reduction Activities**
  - Floodplain Management Planning
  - Flood Protection
  - Drainage System Maintenance*
- **Flood Warning and Response**
  - Levees
  - Dams

\*Since 1978

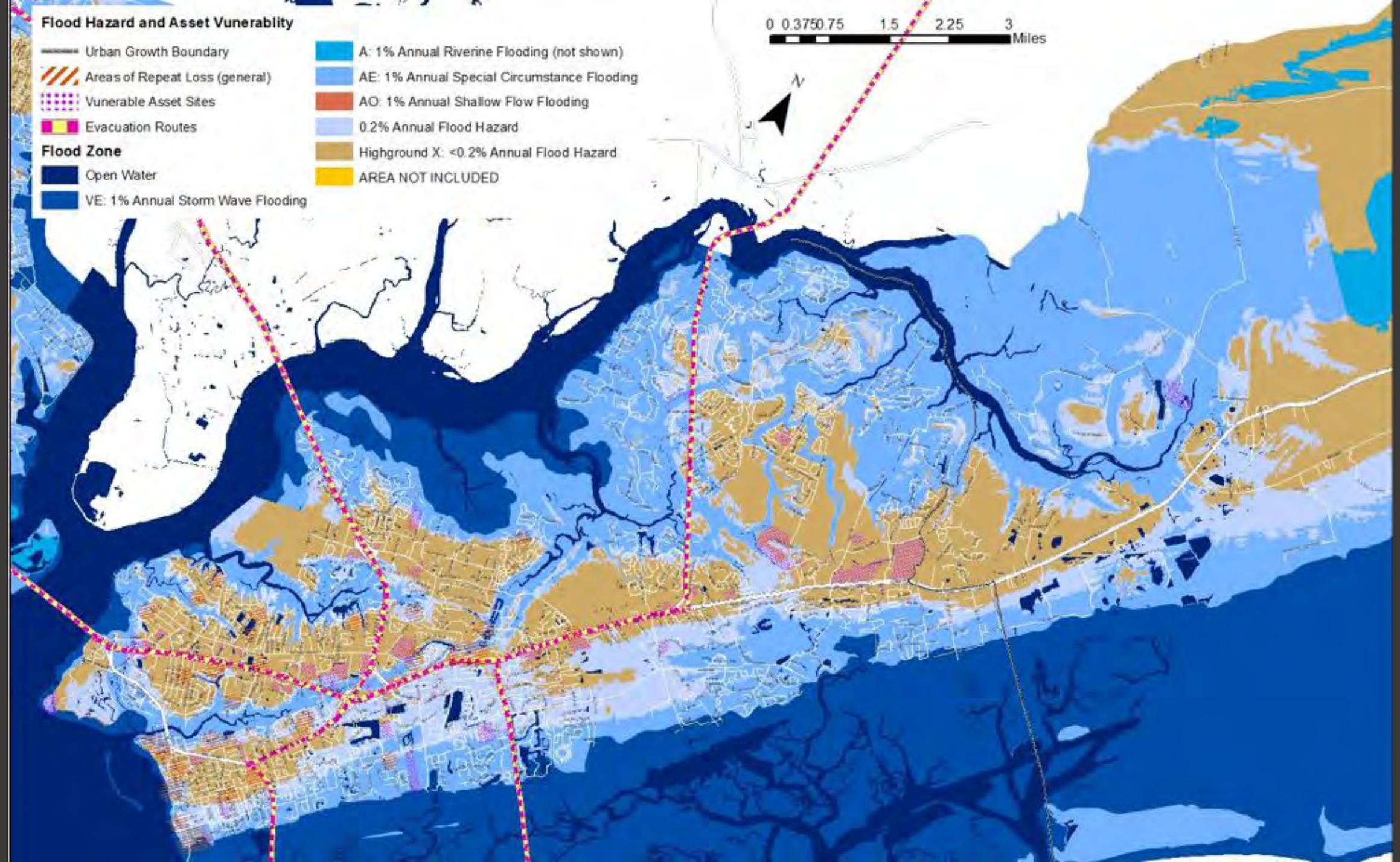
**Flood Hazard and Asset Vulnerability**

- Urban Growth Boundary
- Areas of Repeat Loss (general)
- Vulnerable Asset Sites
- Evacuation Routes

**Flood Zone**

- Open Water
- VE: 1% Annual Storm Wave Flooding

- A: 1% Annual Riverine Flooding (not shown)
- AE: 1% Annual Special Circumstance Flooding
- AO: 1% Annual Shallow Flow Flooding
- 0.2% Annual Flood Hazard
- Highground X: <0.2% Annual Flood Hazard
- AREA NOT INCLUDED



# Planning for Rise

## Activity 410 (Flood Hazard Mapping)

### Four Projections of Global Sea Level Rise

#### Lowest projection—0.7-foot average increase globally

A linear extrapolation of the historical sea level rise rate derived from tide gauge records beginning in 1900

#### Intermediate-Low Projection—1.6-foot average rise globally

Driven primarily by thermal expansion (water expands as its temperature increases)

#### Intermediate-High Projection—3.9-foot average rise globally

A result of both thermal expansion and limited ice sheet loss

#### Highest Projection—6.6-foot average rise globally

A result of thermal expansion plus maximum predicted ice sheet loss

See Coordinator's Manual pages 410-18-19

NFIP/Community Rating System



Visual 8.31



# Damage Assessment

# Recovery

## Evaluating Damage and Impact for FEMA Public Assistance Program

### Category C – Roads and Bridges

Permanent Work required to restore roads (paved, gravel, and dirt), bridges, and their components to their pre-disaster design and function is considered unless the restoration falls under the authority of an OFA. Permanent restoration of private roads, including homeowners' association roads, are not eligible for FEMA PA funding, and thus are not considered.

Road components include but may not be limited to:

- Surfaces
- Bases
- Shoulders
- Ditches
- Drainage structures, such as culverts
- Low water crossings
- Associated facilities, such as lighting, sidewalks, guardrails, and signs

Bridge components include but may not be limited to:

- Decking
- Guardrails
- Girders
- Pavement
- Abutments
- Pier
- Slope protection
- Approaches
- Associated facilities, such as lighting, sidewalks, and signs

Damage must be the result of the disaster to be considered. Work to repair potholes or fatigue cracking is generally not considered as this type of damage is rarely caused directly by a single incident.

When a system is damaged (e.g. road system), work and cost should be documented by site but may be combined into a single summary for evaluation. However, to simplify review by technical specialists, bridge restoration work should be separated from other roadwork. For large projects in which the pre-disaster condition may impact estimates, potential applicants will be asked to provide bridge inspection/safety reports to verify pre-disaster condition. If deficiencies identified in these reports were addressed, documentation supporting work performed should also be provided.

Work to repair scour or erosion damage to a channel or stream bank will be considered if the

### Category D – Water Facilities

## Evaluating Damage and Impact for FEMA Public Assistance Program

Restoring the pre-disaster carrying or storage capacity of engineered channels, debris and sediment basins, storm water detention and retention basins, and reservoirs may be considered, but only if the potential applicant can establish:

- The pre-disaster capacity of the facility; and
- The facility was maintained on a regular schedule.

Flood control works, such as levees, floodwalls, flood control channels, and water control structures generally fall under the authority of USACE or NRCS. For work to restore these facilities to be considered, it must first be confirmed that it does not fall under the authority of these OFA's. Secondary levees riverward of a primary levee are not considered, unless they protect human life.

Additional information related to the eligible repair or replacement of damaged water control facilities can be found in Chapter 2, Section VII (H)(2) of the PAPPG.

### Example - Category D

#### Fish Creek Debris Basin Restoration

- Basin dimensions: 300 ft x 200 ft x 10 ft
- Estimated depth of debris = 1.5 ft
- Amount of debris attributable to flood = 80% (basin last cleaned 3 mo earlier @ \$20.00/cy)
- FA labor and equipment
- Cost calculation =  $0.8 \times (300\text{ft} \times 200\text{ft} \times 1.5\text{ft}) \times (1\text{cy}/27\text{ cu ft}) \times \$20.00/\text{cy} = \$53,333$

Total estimated cost = \$53,333

# Emergency Response Planning & Operations

- Preparation
- Integration
- Education
- Training



# RECOVERY

- Timing
- Resources
- Community Preparedness

APRIL SINK HOLE OF THE MONTH 2016  
RCC



# Operations and Maintenance Programs

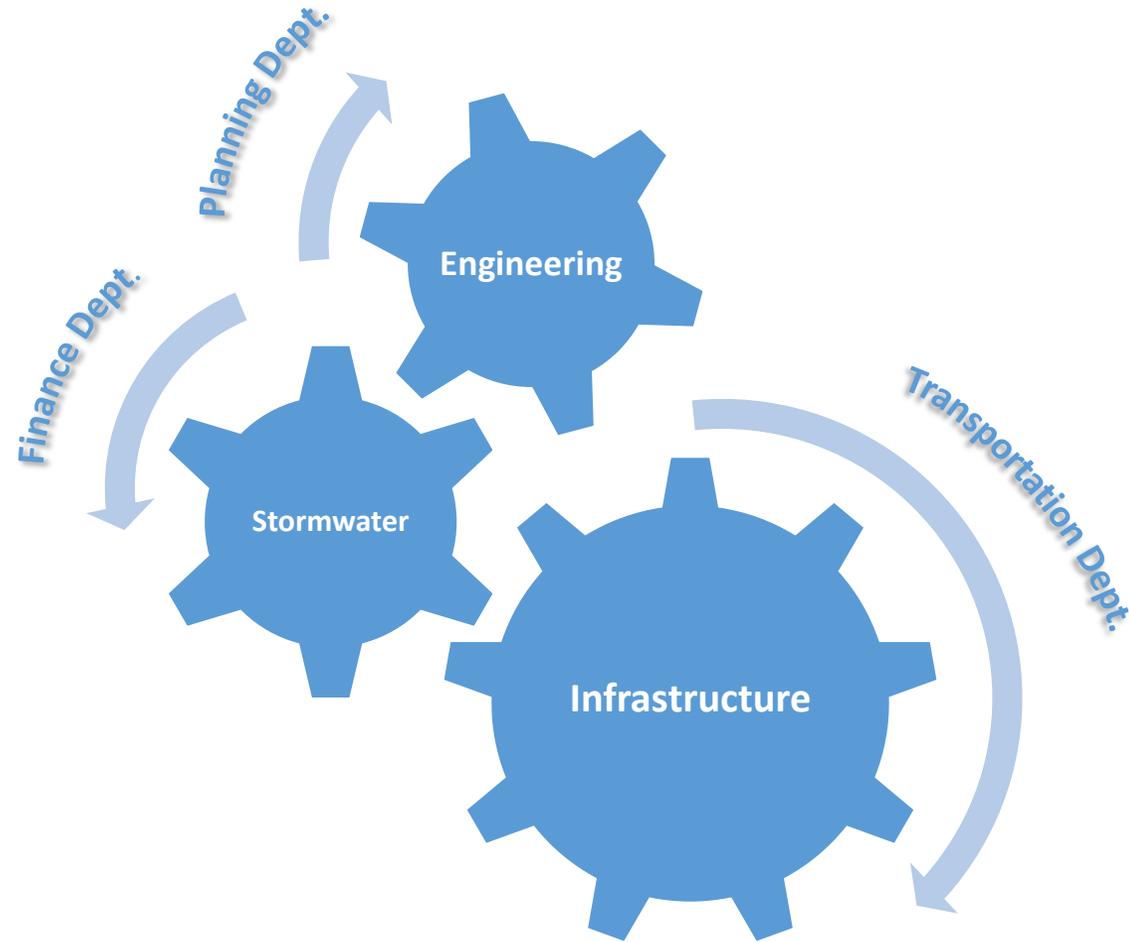
## Asset Management

- Operations
- Maintenance

## Pollution Prevention

## Public Resiliency

# Operations and Maintenance Team

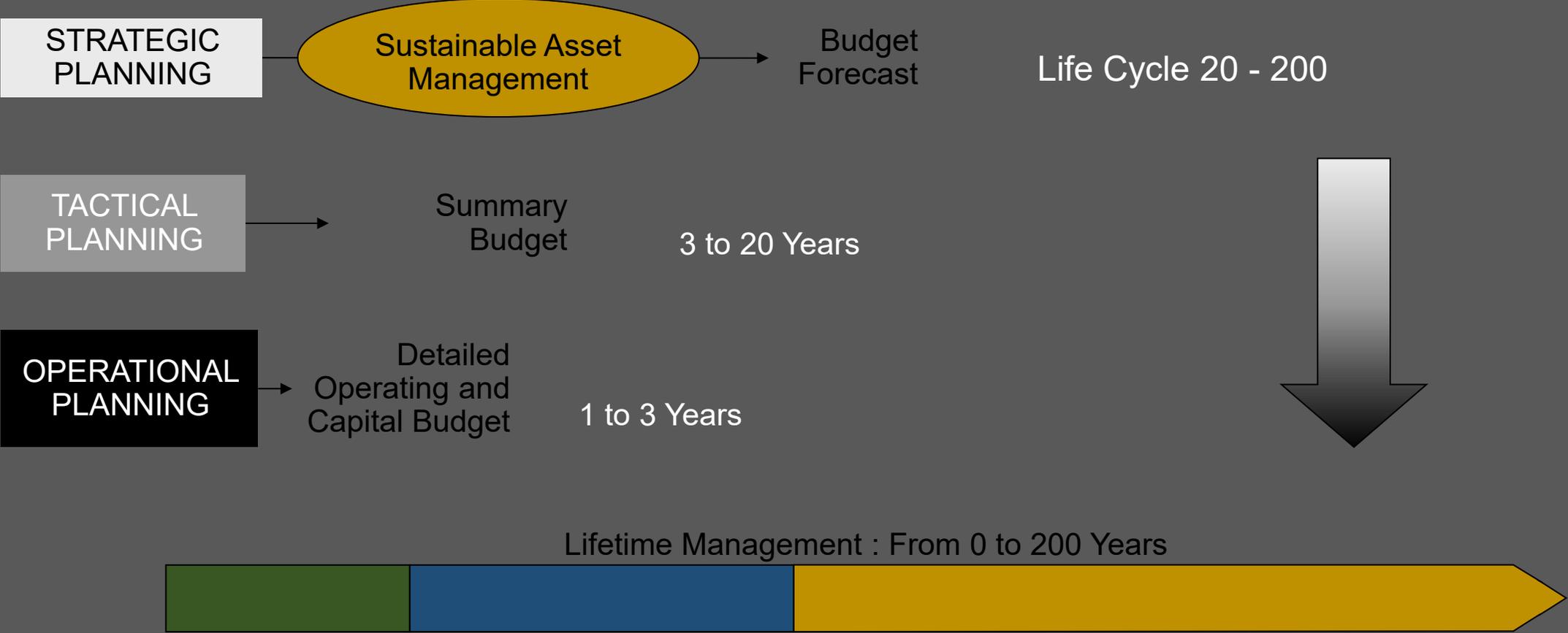


# Asset Management Programs

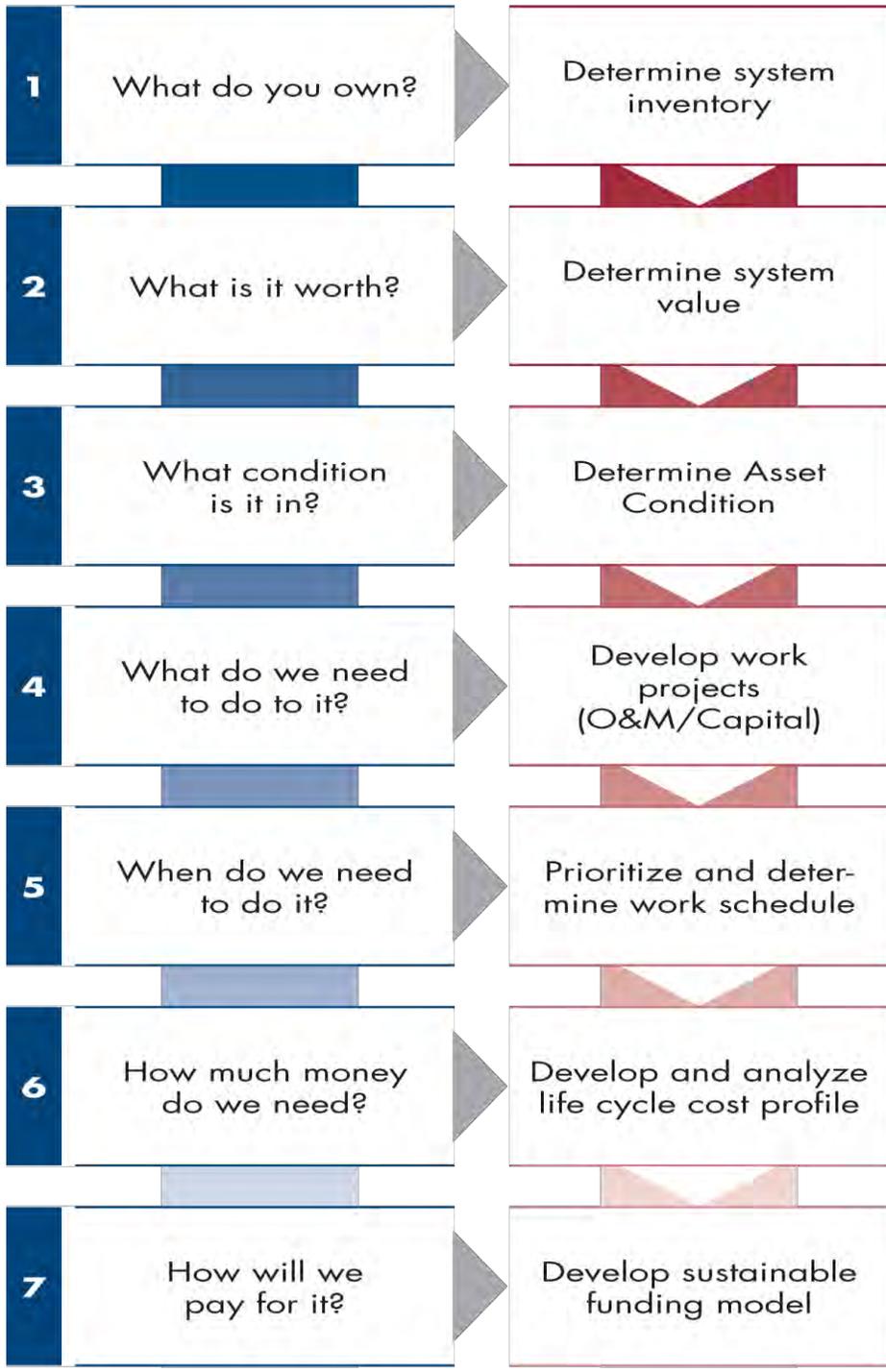
- Operations
- Maintenance
- Pollution Prevention



# Sustainable Asset Management Process



# Asset Management Operational Planning



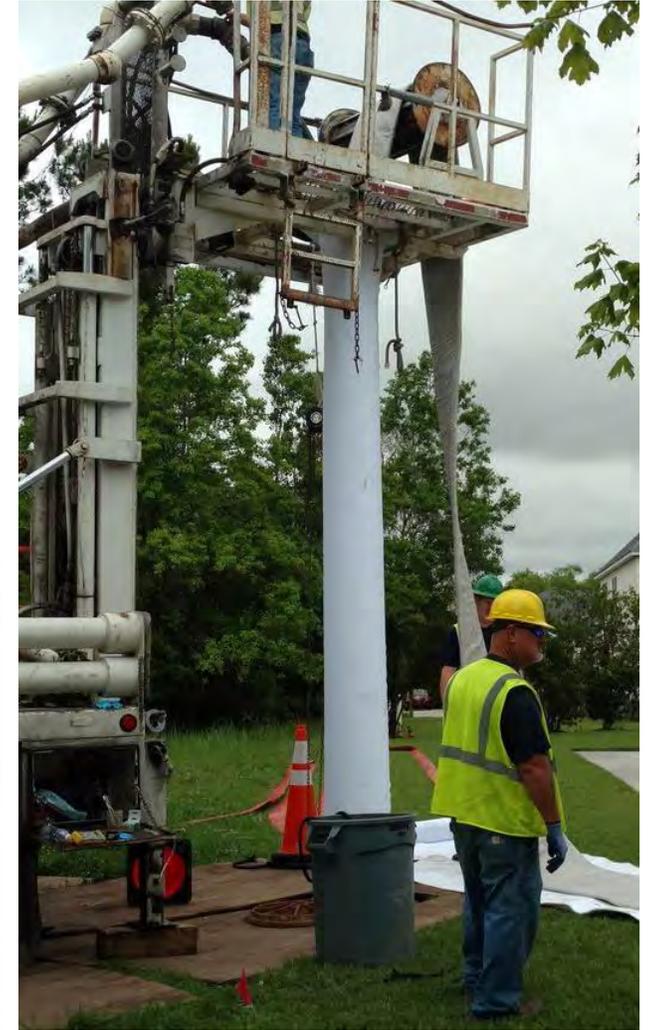
# Operational Programs

## Ensure its installed properly:

- New Pipe Inspections
- Final Plat Dedication
  - CCTV/ As-Builts
- End of Warranty
  - Bonds - CCTV

## Ensure its protected:

- Asset Inspection Program
- Encroachment Permits
- Rehabilitation Program
- Capital Improvements Program



# New Infrastructure Inspections

## REACTIVE – Structural Issues

- Respond to reports of Sinkholes/ pipe or other structure failures
- Utilize pole cameras and CCTV units to troubleshoot failures

## PROACTIVE

- **New Residential Construction Inspection Program**
  - New pipe installation
  - Compaction Testing
  - CCTV for fault identification
  - As-built
- **Warranty Acceptance Inspection Program**
  - Developer Driven
  - Clean System
  - New CCTV
  - Can ask for new As-built
  - Final Acceptance

# Inspection Program

## REACTIVE – Structural Issues

- Respond to reports of Sinkholes/ pipe or other structure failures
- Utilize pole cameras and CCTV units to troubleshoot failures

## PROACTIVE

- **New Residential Construction Inspection Program**
  - New pipe installation
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- **Warranty Acceptance Inspection Program**
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# Asset Management Inspections

## REACTIVE

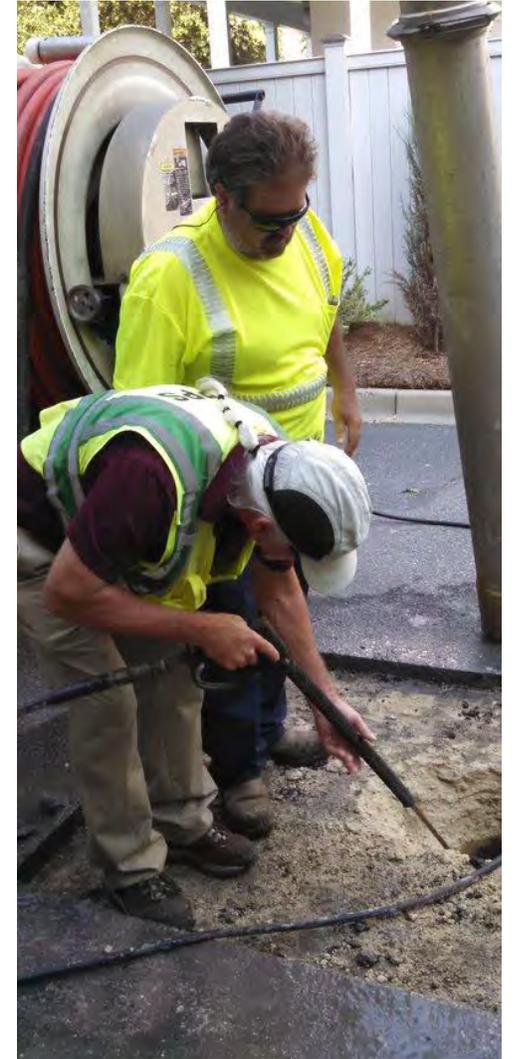
- **Service Requests = External Reports of issues**
  - Structural Issues
  - Pollution Issues
- **HOT Spots - Post Rain event**
- **Post – Event Damage Assessment**

## PROACTIVE

- **Routine = investigate current condition of infrastructure (CRS/  
Asset Management)**
  - Ditch/ Canals
  - Culverts/ Bridges
  - Pipes/ System
  - BMPs (SCMs)
- **Compliance = look for failures or issues to be corrected for  
Water Quality**
  - Outfalls
  - System
  - Construction
  - Post-Construction
  - Housekeeping

# Maintenance Programs

- Street Sweeping
- Pipe Cleaning Program
- Canal Inspection & Maintenance Program
- Small Repairs



# Closed System Cleaning Operations

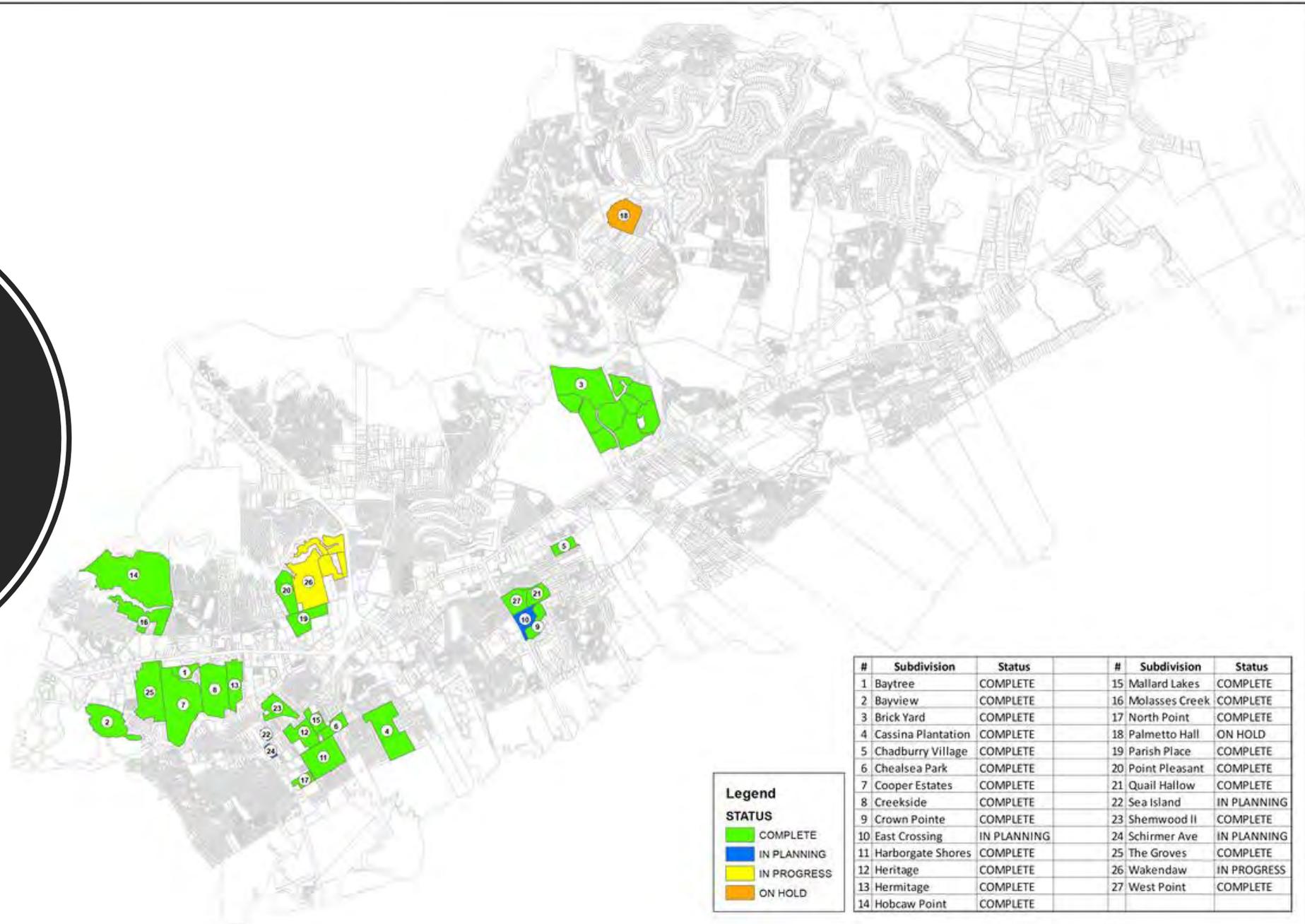
## REACTIVE

- **Service Requests = External Reports of issues**
  - Flooding Complaints
  - Debris Complaints
  - Inspection findings

## PROACTIVE

- **Whole System Cleaning Program**
  - Water Quality Priority areas
  - Asset Management/ Life Cycle Areas

# Closed System Cleaning



# Open System Cleaning Operations

## REACTIVE

- **Service Requests = External Reports of issues**
  - Flooding Complaints
  - Debris Complaints
  - Inspection findings

## PROACTIVE

- **Canal Inspection and Cleaning Program**
  - CRS Compliance & NPDES Compliance
    - Annual Inspection - clean as you go
    - Choke point - post rain inspections

# Comprehensive Maintenance Program (CMP)

- Pipe rehabilitation/ replacement
- Structure rehabilitation/ replacement
- Canal Reconstruction
- Ditch Regrading



# Recovery Programs

## Post-Event Inspections

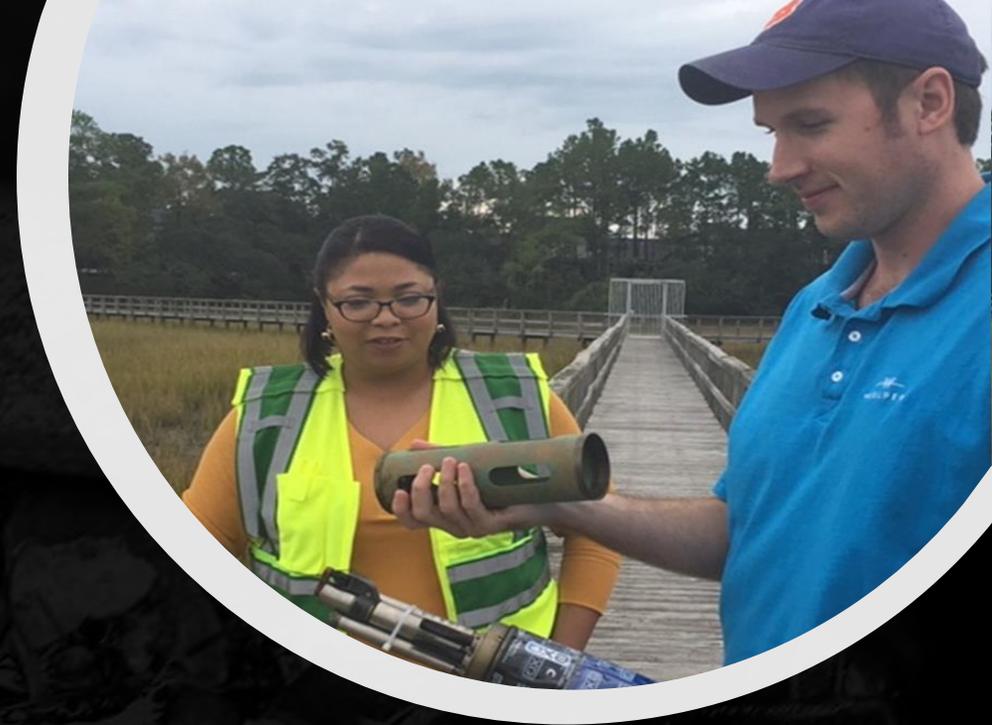
- Rapid Impact Assessments
- Clear minor obstructions
- Determine crew needs
- Identify contractor items



# Pollution Prevention Programs

Prevent pollution from flowing into our waterways

- Public Education
- Public Participation
- Illicit Discharge Detection
- Construction Management/ Controls
- Post-Construction Management/ Controls
- Municipal – Good Housekeeping

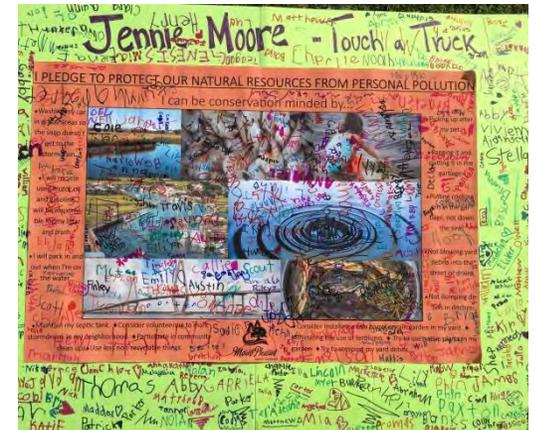




**SPILL RESPONSE**  
MOUNT PLEASANT PUBLIC SERVICES



# Outreach Programs



# BE. FLOOD. READY.



- ▶ Tell town staff about flooding problems
- ▶ Give researchers feedback on a new flood model for the Charleston region
- ▶ Talk to flood and weather experts
- ▶ Discuss FEMA flood maps
- ▶ Visit product and service vendors
- ▶ Refreshments provided

**Thursday, November 8, 2018**

Drop-in between  
4:30 p.m. and 7:30 p.m.

National Guard Armory  
245 Mathis Ferry Road  
Mount Pleasant, SC

Neighborhoods include:



## Don't Pitch in the Ditch

Stormwater ditches protect your property from flooding AND play an important role in water quality. Thousands of miles of ditches eventually drain into larger waterways, lakes or the ocean.

### Do:

- ✓ Keep ditches **free of trash** and yard debris preventing clogging and flooding
- ✓ Keep ditches **vegetated** with turf preventing erosion and property damage
- ✓ Keep sideslopes **gentle** and bottoms **flat** ensuring proper flow and reducing maintenance and erosion

### Don't:

- ∅ Restrict the **flow** of water
- ∅ **Dump** trash or yard waste
- ∅ **Dispose of waste** like chemicals, oil, or sewage, including pet waste
- ∅ **Burn** vegetation, trash or debris

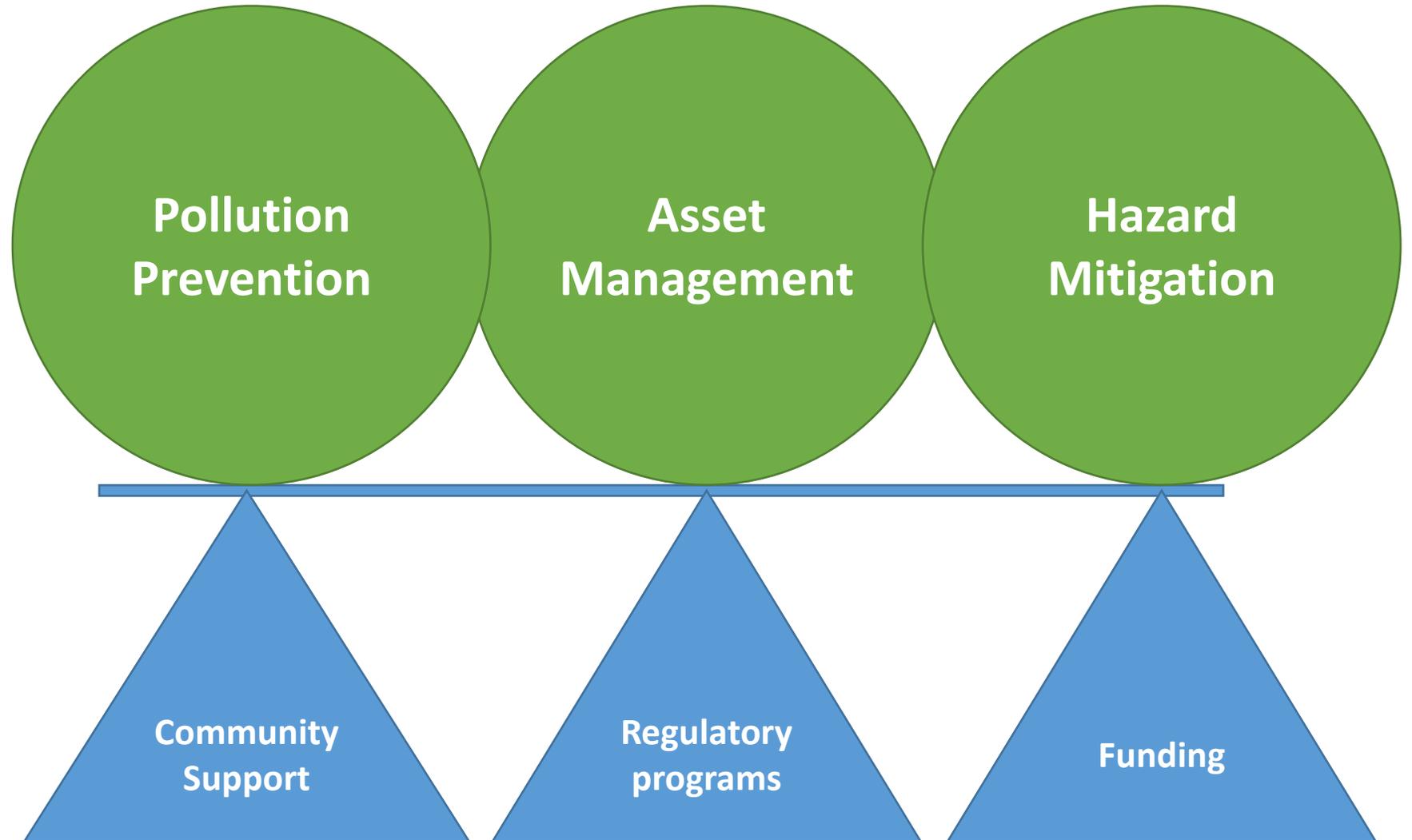


Public Resiliency  
Flood Mitigation



# Public Resiliency Pollution Prevention

Be Robust  
Be Resourceful  
Be Redundant  
Be able to Recover  
Be Resilient





**Hillary Repik**

**Stormwater Manager/ Division Chief**

**Town of Mount Pleasant, SC**

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