

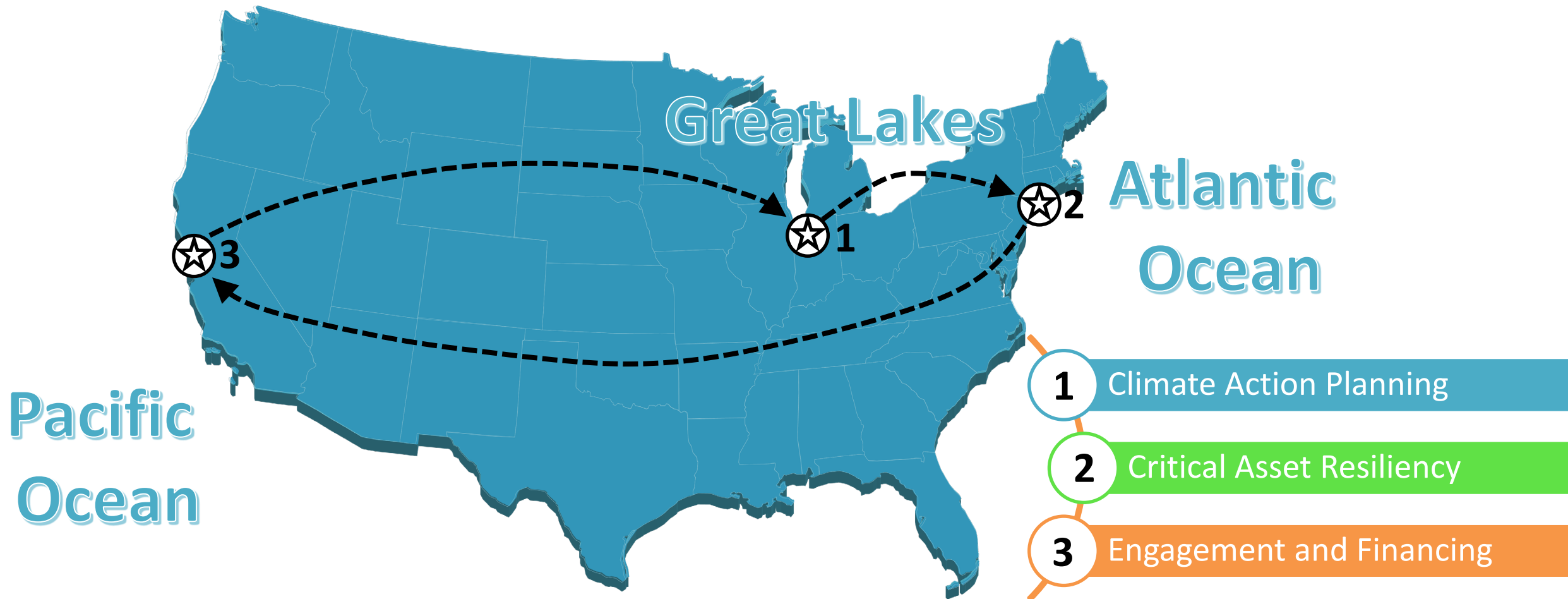


# National Perspectives on Efforts to Enhance System Resiliency

Nicole Stellaccio, PE  
Walt Walker, PE, ENV SP

May 9, 2022

# Coast-to-Coast-to-Coast Experience



# Presentation Background

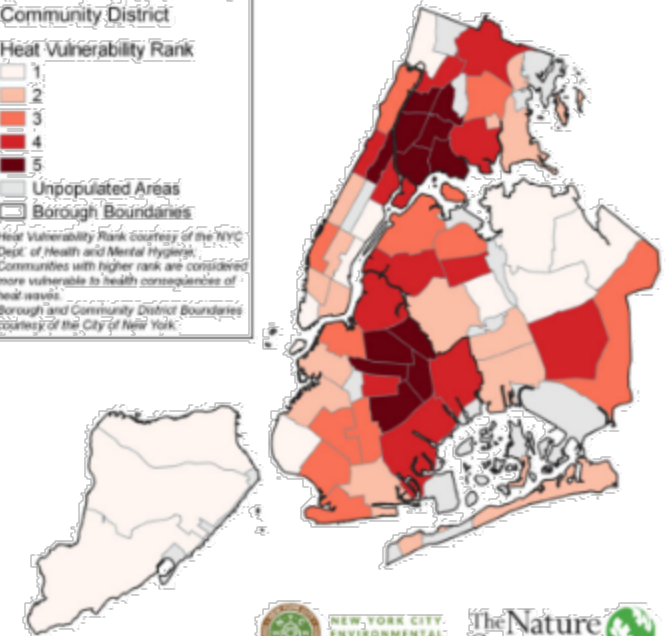
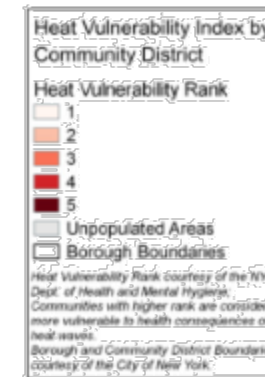
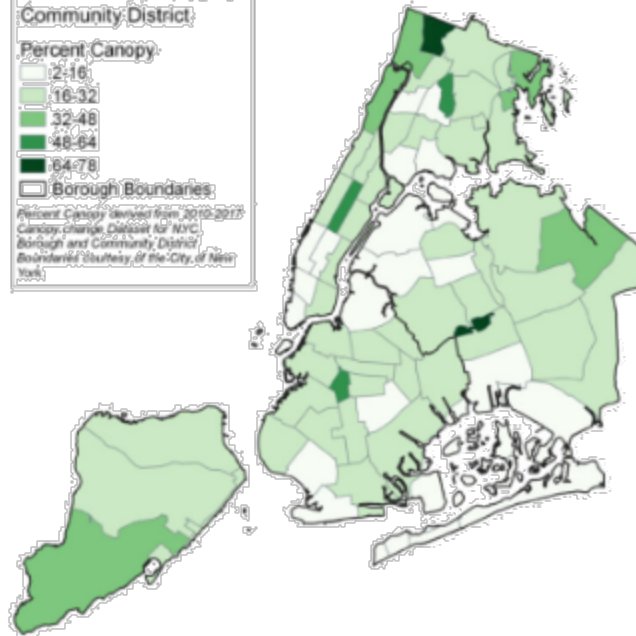
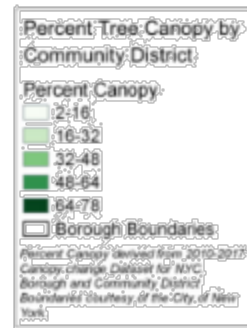
# Drivers for Resiliency Efforts

- Scientists are predicting 13-20 “named” storms, along with as many as 10 hurricanes (2021)
  - In an average hurricane season, there 12 “named” storms and as many as 3 hurricanes
- Last summer, hurricane season took 119 lives and over \$11.5 billion in property damage



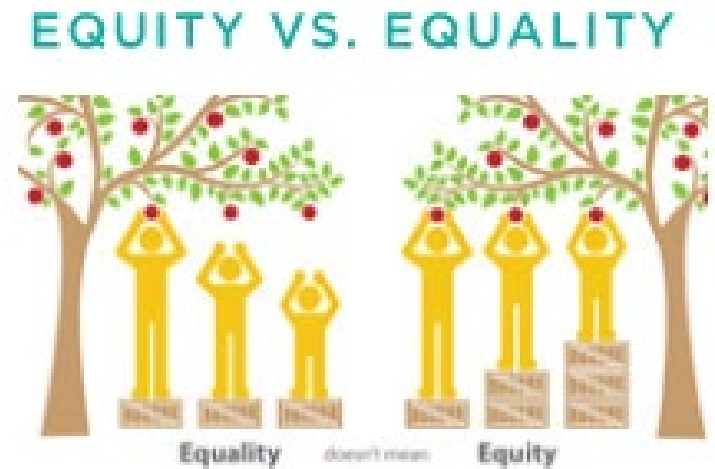
# Intersection of Climate Issues and Equity Action

- Redlining
- Preparedness for heat vulnerable communities
- Green infrastructure to improve health and quality of life
  - Land use
  - Health
  - Public space
- Affordable housing for all
- Transportation
- Energy efficiency & GHGs
- Infrastructure development
- Workforce development
- Local supplier diversity
- Intersectional approaches = multiple benefits



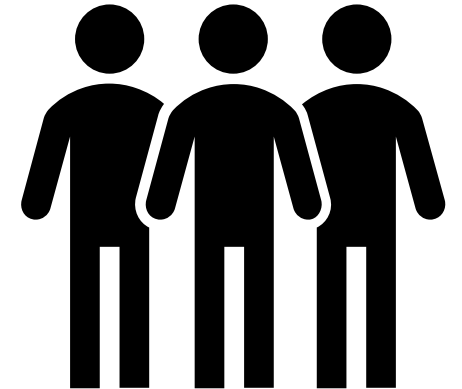
# Defining Terminology

- Equity refers to just and fair inclusion—a condition in which everyone has an opportunity to participate and prosper
- **Water equity** occurs when all communities:
  - have access to safe, clean, affordable drinking water and wastewater services
  - are resilient in the face of floods, drought, and other climate risks
  - have a role in decision-making processes related to water management in their communities;
  - share in the economic, social, and environmental benefits of water systems.
- Equity is not the same as equality



# Defining Terminology

- Community:
  - Frontline communities
  - Residents
  - Community-based organizations
  - Local non-profits and advocacy groups
  - Community organizing and environmental justice groups
  - Local businesses
  - Other Stakeholders (utility workers, treatment plant operators)



# Implementing Resiliency and Climate Action

- Flood Map Service Center
- National Flood Insurance Program
- Make a Plan – Be Ready for Disaster
- Community Resiliency Toolkit (published New Jersey Report, March 2017)
- Utilize FEMA’s variety of resources
- Climate Design Guidelines
- Climate Justice
- Climate Action Planning
- **Water’s Net Zero Plus: A Call to Action for Climate Mitigation (NEW)**

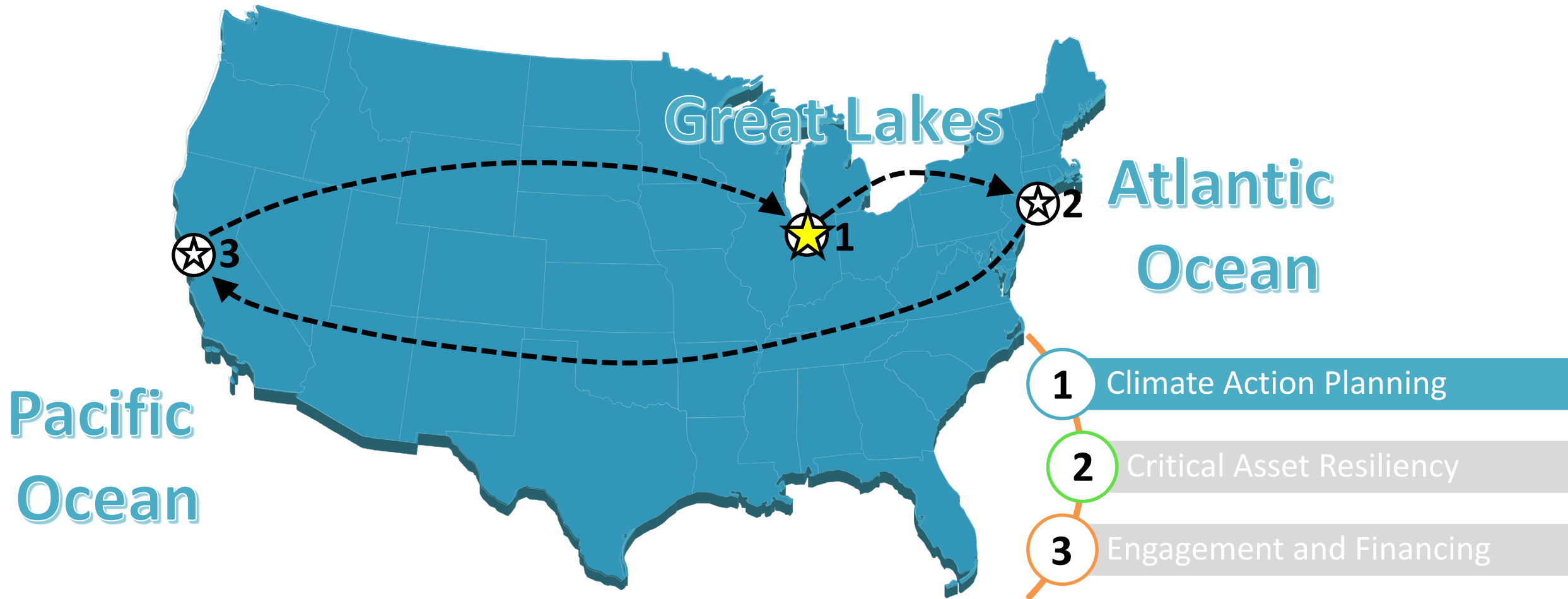
The collage features several key documents and a website interface:

- OneNYC 2050 BUILDING A STRONG AND FAIR CITY**: A LIVABLE CLIMATE, VOLUME 7 OF 9.
- NYC Mayor's Office of Resiliency**: Climate Resiliency Design Guidelines.
- NYC CLIMATE JUSTICE AGENDA 2020**: A CRITICAL DECADE FOR CLIMATE, EQUITY, & HEALTH.
- Manual of Water Supply Practices M71**: Climate Action Plans—Adaptive Management Strategies for Utilities.
- NEW YORK CITY**: September 2020 Version 4.0.
- American Water Works Association**: WATER'S NET ZERO PLUS: A Call to Action for Climate Mitigation.
- Coastal Flood Risk Resources** website screenshot showing a navigation menu with categories like "Hurricane Sandy Webpages/Resources", "Brochures/Fact Sheets", "Calendars", "Case Studies", and "Catalogs". A sub-menu for "Guidance (Technical & Non-Technical)" is expanded, listing resources such as "Adapting to Climate Change: A Planning Guide for State Coastal Managers (NOAA)", "Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update Report (FEMA)", "Best Practices Manual for Development in Coastal Louisiana (Center for Planning Excellence)", "Building Code Resources (FEMA)", "Building Performance Assessment Team (BPAT) Report - Hurricane Georges in the Gulf Coast (FEMA)", "Building Performance Assessment Team (BPAT) Report - Hurricane Charley in the Gulf Coast (FEMA)", "Building Science Publication", "Coastal Construction Manual", "Coastal Engineering Manual", "Coastal Permitting in New York", "CodeMaster - Flood Resistant", "Cooperating Technical Partners", "Design and Construction Guide", "Design Guide for Improving", "Elevation Certificate Guidelines", and "Engineering Principles and". A "Flood" sub-section is also visible, providing information on flood resistant provisions of the 2018, 2015, 2012, and 2009 International Codes (I-Codes), the referenced standard American Society of Civil Engineers (ASCE) 24 Flood Resistant Design and Construction, and the National Flood Insurance Program (NFIP) requirements. It includes a link to "Highlights of ASCE 24 Flood Resistant Design and Construction" and a note that these documents are compilations of flood resistant provisions prepared by FEMA and the I-Codes.

Source: FEMA Coastal Flood Risk Resources > Guidance (Technical & Non-Technical) > Building Code Resources > Highlights of ASCE 24



# Coast-to-Coast-to-Coast Experience





# Climate Action Planning

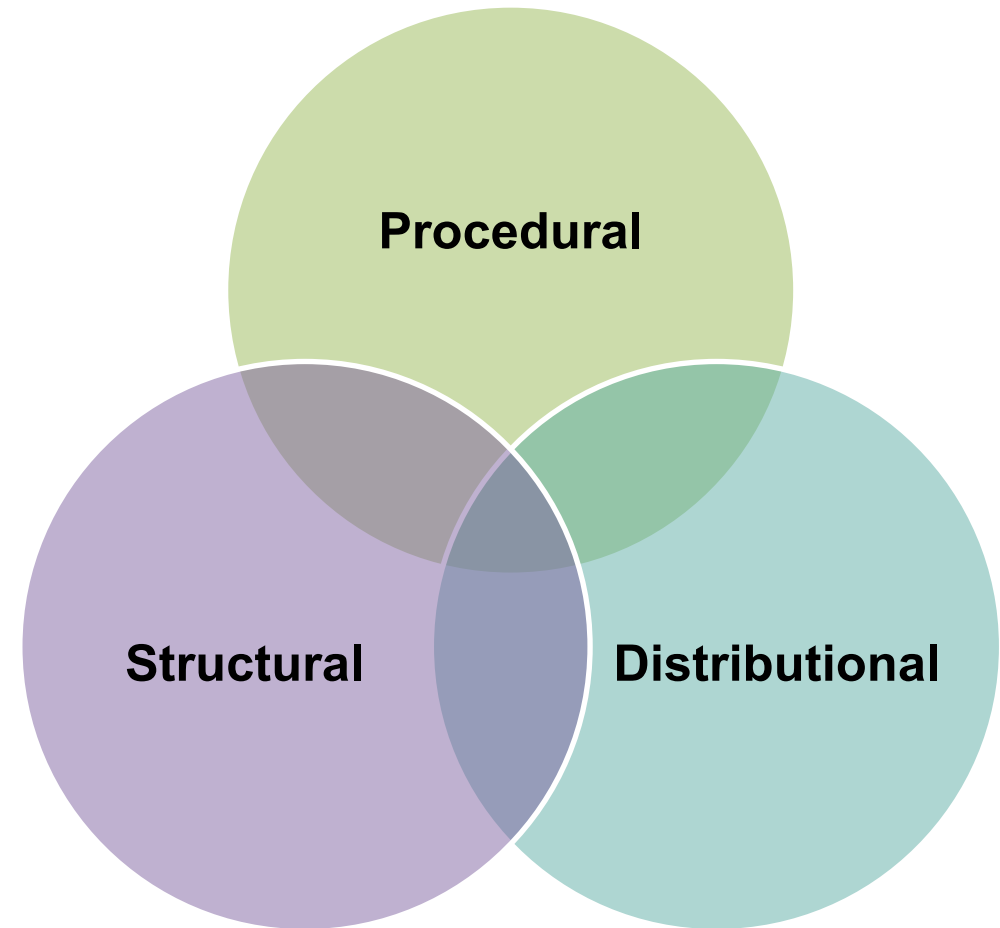
# The What – Climate Action Plans (CAPs)

- Detailed strategies on how to reduce GHGs and adapt to changes in climate
- At a minimum, a CAP includes:
  - An inventory of existing GHG emissions, reduction goals or targets, and analyzed and prioritized reduction actions.
- Ideally, a CAP also includes:
  - An implementation strategy that identifies resources and funding mechanisms to achieve set goals and targets.



# Equitable Community-Driven Climate Action Planning

- Community partnership and collaboration are at the core of equitable climate resiliency planning
- Understanding the historical context of harm
  - low-income communities, racism, gender inequality, displacement from land/property, resource extraction, lack of investment in our communities and our infrastructure



Source: Urban Sustainability Directors Network

# CAPs through a Social Equity Framework



- A tailored solution which incorporates frameworks of environmental justice and water equity to guide its recommendations.
- Emphasizes the needs of those most disadvantaged so that they are not the most financially and environmentally burdened
- Explores creative funding options that minimize/avoid financial burdens to ratepayers
- Should take intersectional factors into consideration
- Promotes transparency with community residents to build relationships and trust

# The Who – Advisory Committee

## Areas of Expertise

Climate Expert

Communities of Color

Building/Construction

PK-12

Development/Fundraising

State Policy

Energy

Religious Institutions

Equity

Residents

Food and Agriculture

Senior Citizens/Elderly

Healthcare

Small Business

Higher Education/Research

Social Services, i.e., low income, homeless

Industry/Manufacturing

Financial/Commerce

Laborers, i.e., electrical or carpenter unions

Transportation

Natural Resources/Environmental

Youth

# The Who – Community-Led CAP



# The How – Phased Approach

## THE PLAN



### PHASE 1

#### PROGRAM INITIATION

- Conduct Chartering Session
- Establish Leadership Framework
- Develop Interagency Agreement
- Draft Vision and Mission Statements



### PHASE 2

#### PROGRAM DEVELOPMENT

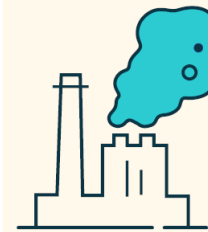
- Develop Communication Plan
- Identify Key Stakeholders
- Facilitate Action Plan Review Workshops
- Develop Resource Catalogue
- Prepare Schedule



### PHASE 3

#### PROGRAM EXECUTION

- Perform Baseline Assessment
- Identify Key Performance Indicators (KPIs)
- Integrate Approach with Existing Plans
- Identify and Prioritize Potential Program Initiatives



### PHASE 4

#### REPORT DEVELOPMENT

- Synthesize Data and Organize Initiatives
- Focus on Sustainability and Resilience
- Clean and Renewable Energy Alternatives
- Improved Transportation Options
- Reduced Waste Strategies



### PHASE 5

#### PROGRAM IMPLEMENTATION

- Measurement and Verification of Metrics
- Development of New Policies
- Engaging with Local Businesses and Industries
- Public Outreach



CURRENT PHASE

CURRENT PHASE



# Public Outreach Strategies – Examples

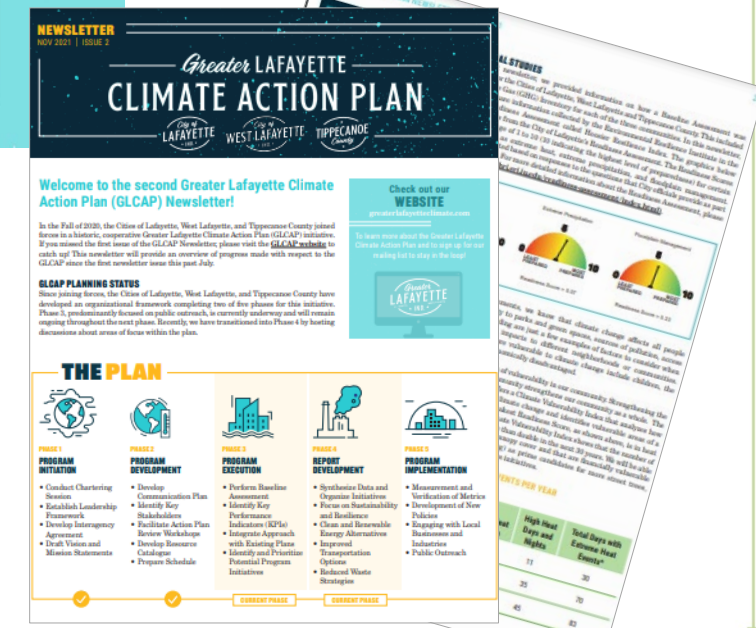
## FAQS

What is the Greater Lafayette Climate Action Plan?	+	How can we reduce the risks we face from climate change?	+
What is climate?	+	What are the benefits of acting on climate change now?	+
What is climate change?	+	Can I make a difference?	+
What is the evidence that shows the climate is changing?	+	Where can I learn more?	+
How do we know humans are causing climate change?	+	How will our region specifically be impacted by climate change?	+
How does climate change affect my health?	+	How do I get involved?	+

## Check out our WEBSITE

[greaterlafayetteclimate.com](http://greaterlafayetteclimate.com)

To learn more about the Greater Lafayette Climate Action Plan and to sign up for our mailing list to stay in the loop!

**CLIMATE ACTION PLAN NEWSLETTER | JULY 2021**

**TAKE OUR SURVEY**

**We want to hear what YOU think!**

**Check out our WEBSITE**  
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**THE PLAN**

PHASE 1: PROGRAM INITIATION	PHASE 2: PROGRAM DEVELOPMENT	PHASE 3: PROGRAM EXECUTION	PHASE 4: REPORT DEVELOPMENT	PHASE 5: PROGRAM IMPLEMENTATION
<ul style="list-style-type: none"> <li>Conduct Chartering Session</li> <li>Establish Leadership Framework</li> <li>Develop Interagency Agreement</li> <li>Draft Vision and Mission Statements</li> </ul>	<ul style="list-style-type: none"> <li>Develop Communication Plan</li> <li>Identify Key Stakeholders</li> <li>Facilitate Action Plan Review Workshop</li> <li>Develop Resource Catalogue</li> <li>Prepare Schedule</li> </ul>	<ul style="list-style-type: none"> <li>Perform Baseline Assessment</li> <li>Identify Key Performance Indicators (KPIs)</li> <li>Integrate Approach with Existing Plans</li> <li>Identify and Prioritize Potential Program Initiatives</li> </ul>	<ul style="list-style-type: none"> <li>Synthesize Data and Organize Initiatives</li> <li>Focus on Sustainability and Resilience</li> <li>Clear and Renewable Energy Alternatives</li> <li>Improved Transportation Options</li> <li>Revised Waste Strategies</li> </ul>	<ul style="list-style-type: none"> <li>Measurement and Verification of Metrics</li> <li>Development of New Policies</li> <li>Engaging with Local Businesses and Industries</li> <li>Public Outreach</li> </ul>

**ENTER 2024 YEAR**

High Heat Days and Nights	Total Days with Extreme Heat Events*
11	30
32	70
45	82

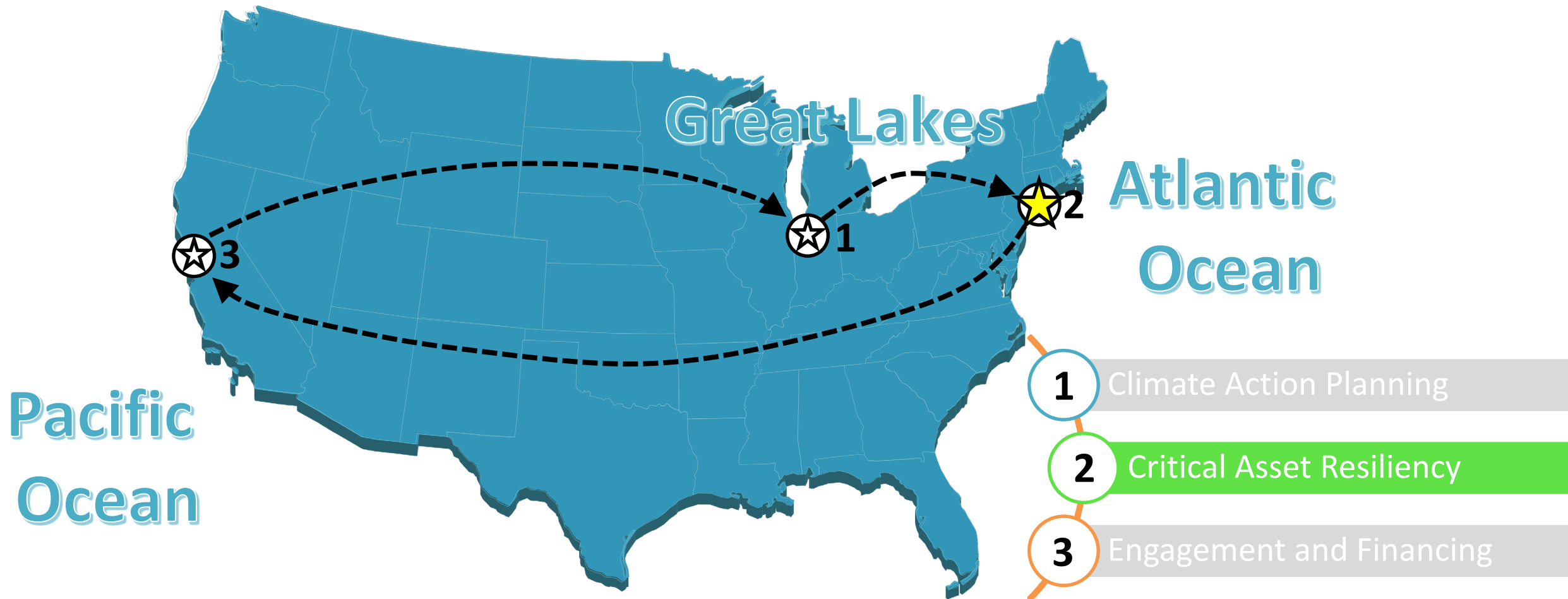
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**TAKE OUR SURVEY**

**We want to hear what YOU think!**



# Coast-to-Coast-to-Coast Experience





# Critical Asset Resiliency

# Design with Resiliency and Sustainability in Mind

- Flood pathways, vulnerable areas, and storm events
- Design Flood Elevation
- Flood emergency and flood protection deployment plans
- Protect communities and restore adjacent natural habitat
- Opportunities to Achieve Sustainability Goals
- Green infrastructure & Land Use
- Community Engagement through facilitated workshops
- Achieving Equity through Multiple Benefits
- Metrics Resource: ISI ENVISION® Pre-Assessment Checklist



*Flood protection assembly  
(Image Credit: Greeley and Hansen)*



*Image credits: ISI / Envision*

# Establish Design Criteria

## Mitigation Strategies

- Design Flood Elevation
- Environmental Health & Safety
- Sustainability KPIs
  - Emissions / Energy
  - Climate Resiliency
  - Waste Reduction
  - Recycled Material
  - Regional Material
  - Stormwater Management
- Impact to Normal Facility Operations
  - During construction
  - After project to execute resiliency initiatives

# Design Flood Elevation (DFE)

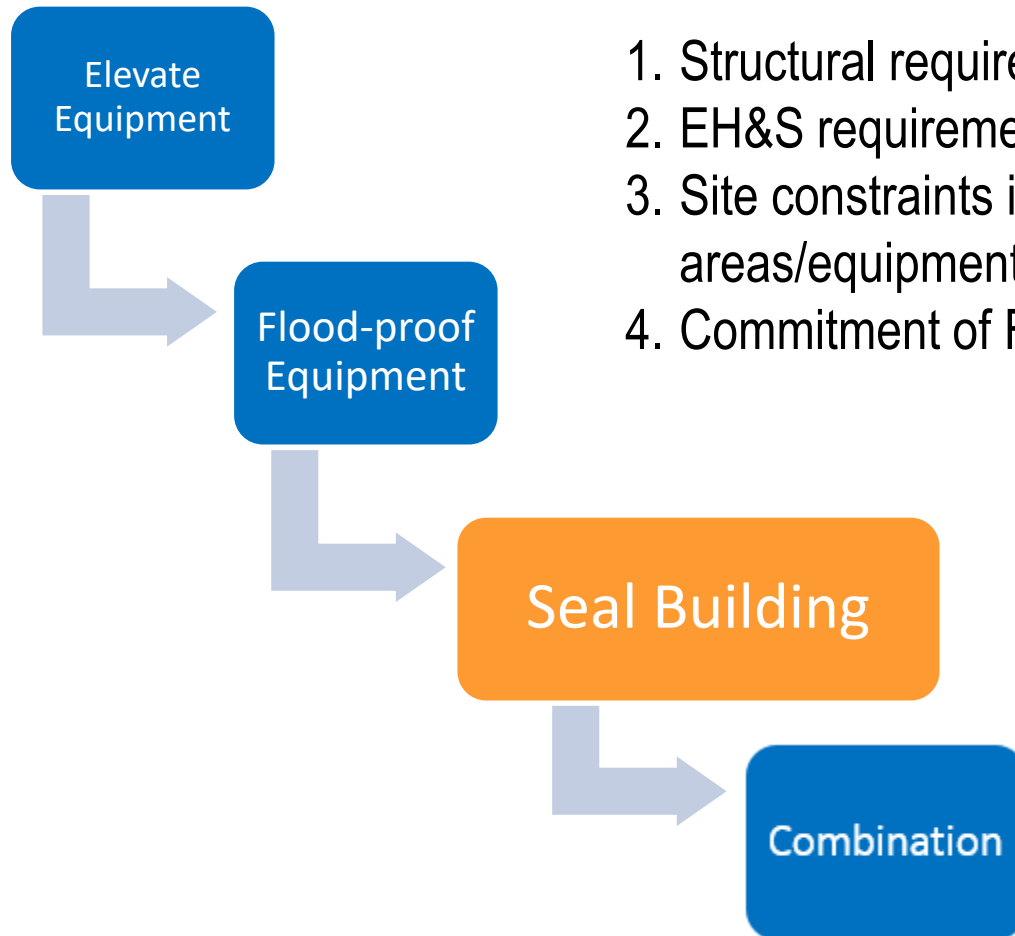
## Guiding Documents

- ASCE 24 – Flood Resistant Design and Construction
- FEMA Flood Insurance Rate Maps (FIRM or PFIRM)
- Local Construction Codes
- $DFE = BFE + X$

**Example: End of useful life in 2050s,  $X = 40$  and is comprised of:**

End of useful life	Base Flood Elevation (BFE)	+ Freeboard	+ Sea Level Rise Adjustment	= Design Flood Elevation (DFE)
Through 2039	FEMA 1% (PFIRMs)	24"	6"	= FEMA 1% + 30"
2040 -2069	FEMA 1% (PFIRMs)	24"	16"	= FEMA 1% + 40"
2070 – 2099	FEMA 1% (PFIRMs)	24"	28"	= FEMA 1% +52"
2100+	FEMA 1% (PFIRMs)	24"	36"	= FEMA 1% + 60"

# Toolbox Selection Process



1. Structural requirements and toolbox options
2. EH&S requirements – egress, OSHA
3. Site constraints including space limitations and critical process areas/equipment
4. Commitment of Facility Staff to maintain, store, and deploy (as needed)

# Flood Protection Strategies Toolbox

## ASSET / BUILDING LEVEL

### NO ACTION

- Sacrificial

## ASSET LEVEL

### ELEVATE

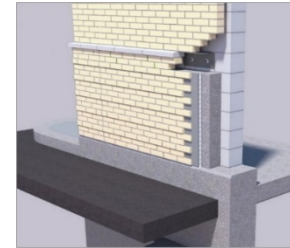
- Elevate in place
- Relocate and elevate

### SUBMERSIBLE

- Provide enclosure
- Replace equipment

## BUILDING LEVEL

### SEAL / WATERTIGHT



**Reinforce exterior walls and/or basement floor slab**

Rock anchors



Flood-proof doors

**Hinged flood barriers**

Sump pump



**Flexible membrane barriers**

Raise louver and/or windowsill height



**Vehicle gate**



# Flood Protection Strategies Toolbox

## BUILDING LEVEL

### WET FLOOD-PROOF



- Controlled flooding
- Equalize loads

- Protect critical equipment that is currently below the Design Flood Elevation
- Install flood openings, e.g., flood vents
- Install/upgrade pumps to remove accumulated floodwaters

## FACILITY LEVEL

### SEA WALL



- Protect Facility, but what else?
- Assess need for belt and suspenders for critical assets

- Coastal defense constructed on the inland part of a coast to reduce effects of strong waves
- “Harden the shoreline”
- May accelerate coastal erosion

# Toolbox Selection Case Study

CHLORINATION  
BUILDING

Elevate Equipment --> Seal Building



Elevate Equipment

CHLORINE  
CONTACT TANKS

# Flood Protection Strategies Toolbox

## Green Infrastructure for Climate Resiliency

Climate change is impacting urban areas in many ways, from exacerbating the urban heat island effect to elevating flood risk. Build green infrastructure to help improve community resilience.

### FLOODING



By the end of the century, annual damages from flooding in the U.S. are projected to **increase by 30%**.<sup>1</sup>

### DROUGHT



**1 out of 3** U.S. counties in the lower 48 states face higher risks of water shortages by mid-century.<sup>2</sup>

### COASTAL DAMAGE



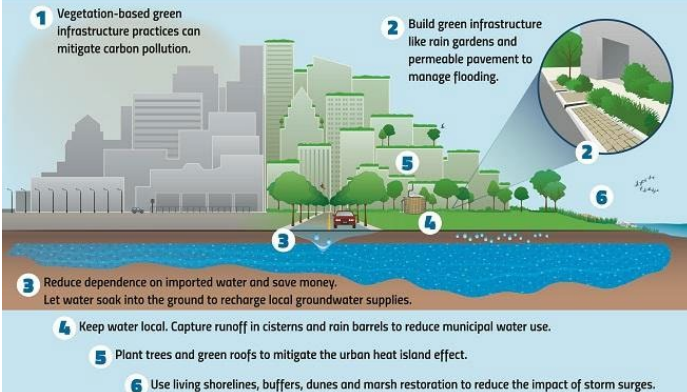
**50%** of Americans live in coastal counties, where water and energy infrastructure are increasingly vulnerable to higher sea levels.<sup>3</sup>

### URBAN HEAT



Climate change will likely lead to **more frequent and severe** heat waves during summer months.<sup>4</sup>

## Green Infrastructure Builds Resiliency



**Lower building energy demands** by reducing indoor temperatures and shading building surfaces.



**Spend less energy managing water** by reducing rainwater flows into sewer systems. Green infrastructure can reduce pumping and treatment demands for municipalities.



**Protect coastal areas** with living shorelines, buffers, wetlands, and dunes to help reduce coastal erosion and storm impacts.



**Manage flooding** with infiltration-based practices, floodplain management, and open space preservation to complement other measures to lower flood risk.

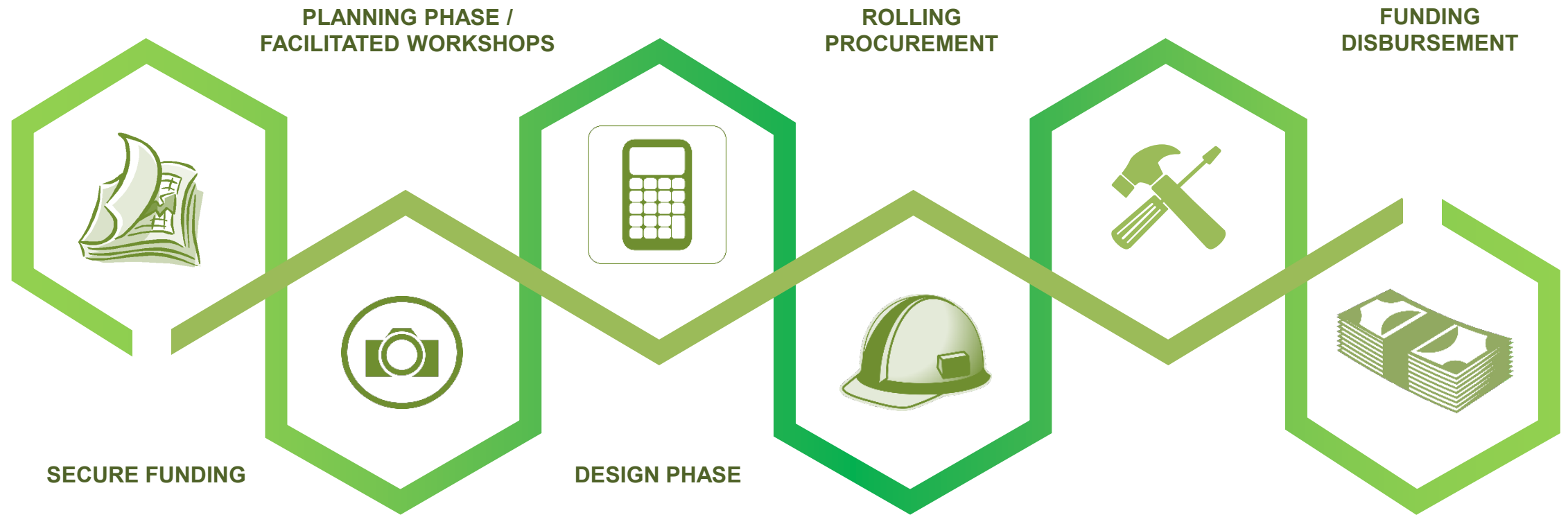


**Prepare for drought** by infiltrating water where it falls. Green infrastructure can help replenish groundwater reserves, relieving stress on local water supplies and reducing the need to import potable water.

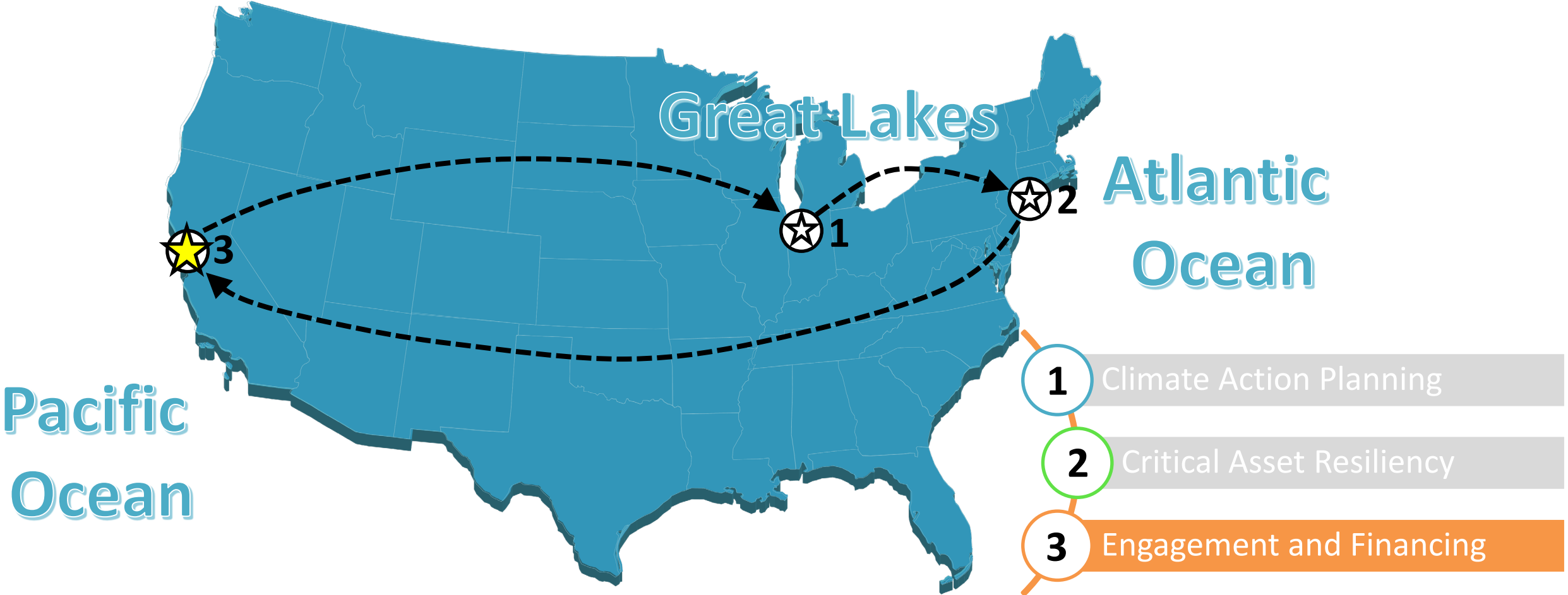


**Reduce urban heat island** effect by planting trees and building green roofs.

# Executing Resiliency



# Coast-to-Coast-to-Coast Experience



# Stakeholder Engagement and Financing



# The Facilitated Workshop Approach



- Goals & Vision Setting
  - Specific to your Organization and Community Needs
- Identification of Success Measurements
- Assessing Existing Dynamics
  - Identification of Facilitators and Resources to Achieving Goals
  - Identification of Obstacles to Achieving Goals
- Development of Approach, Scope, and Schedule of Master Plan
- Agreement on Decision Making
  - How to engage stakeholders for input and participation that results in a shared strategic vision
- Execution of Master Plan Development through Workshops

# Setting Goals and Visions

Define Goals

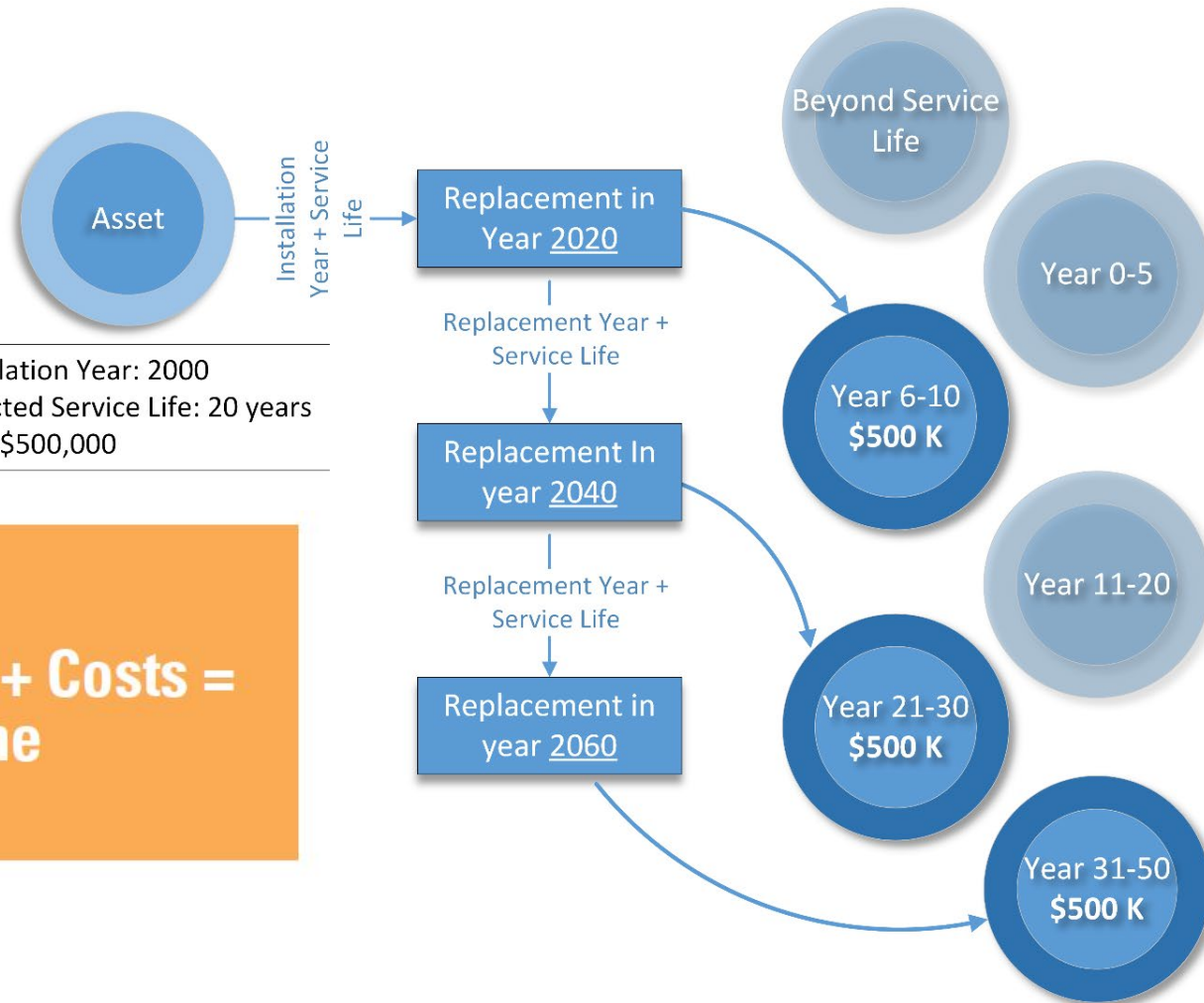
Define Project Constraints

Define Planning Horizon

- Collaborative – Decision making on needs
- Alignment – Mission and goals
- Scenario Based Planning – Triggers identifying future needs
- Clarity – Staffing needs and skills
- Documentation and Knowledge Transfer – Workforce Management
- Capital Investment Timeline – Within Planning Horizon



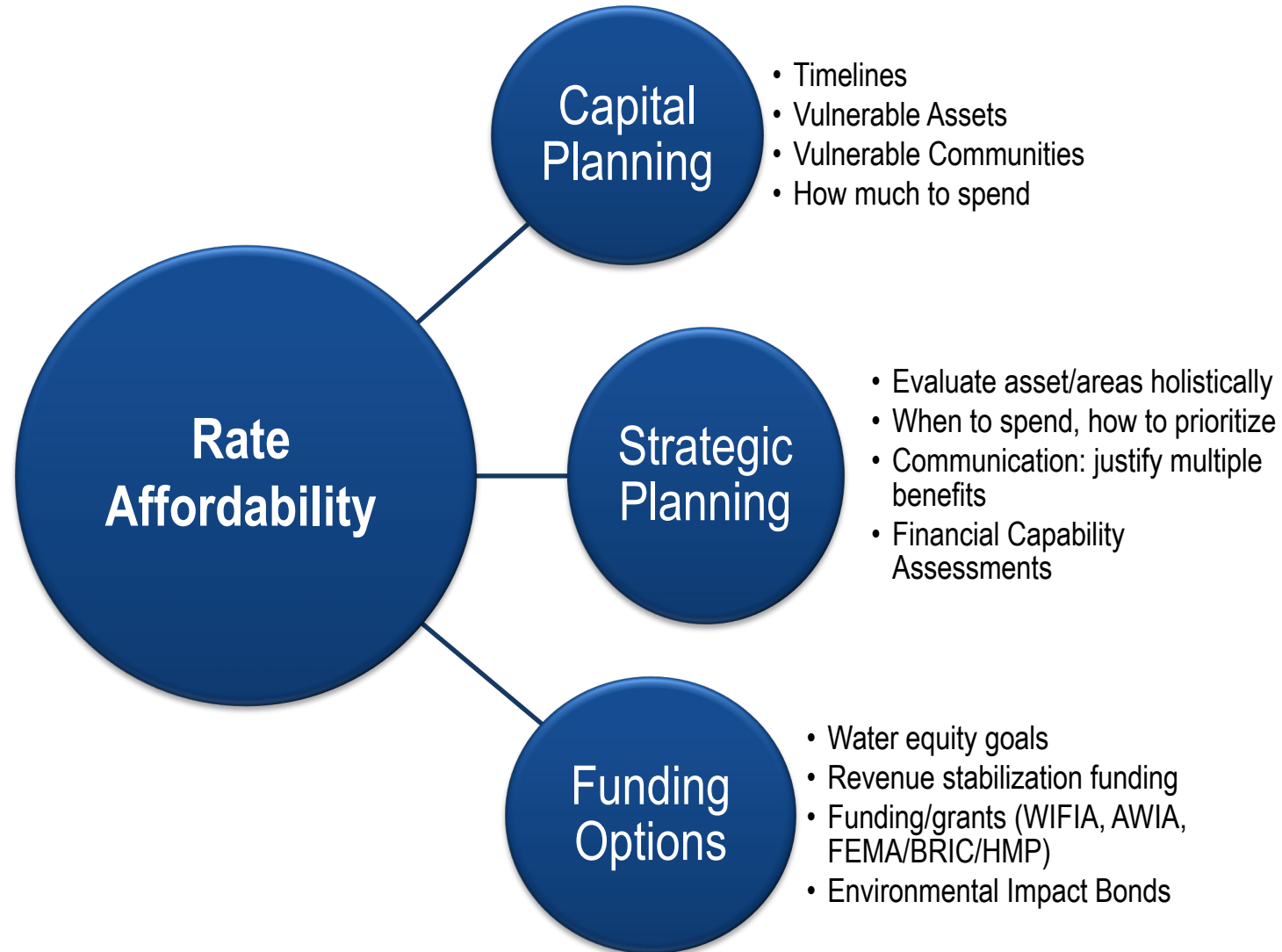
# Create a Timeline



Installation Year: 2000  
Expected Service Life: 20 years  
Cost: \$500,000

**Replacement Schedule + Costs =  
Capital \$ Timeline**

# Rate Affordability – Integrated Planning Approach



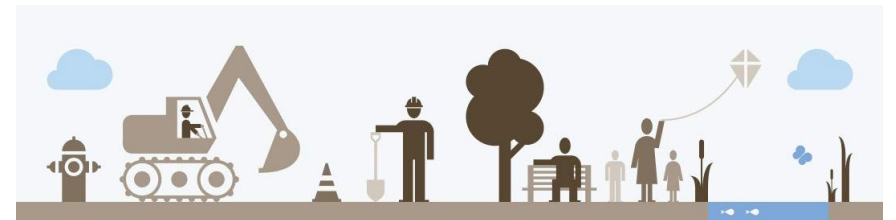
# Summary / Lessons Learned

- Provide representation from vulnerable/priority communities
  - Learned vs. Lived experience
- What works for one community/neighborhood will not necessarily work for another
- Emphasize the needs of those most disadvantaged so that they are not the most financially and environmentally burdened.
- Explore creative funding options that minimize/avoid financial burdens to ratepayers
- Take intersectional factors into consideration: such as access to quality jobs and housing, climate vulnerabilities (heat, flooding), disparities in neighborhood infrastructure access (transportation, GI, food)
- Be clear. Avoid equity language and the specific policy proposals in plans generally not closely tied to actual inequalities in a given service area.
- Promote transparency with community residents to build relationships and trust. Meet them where they are. That takes time and authenticity.



# What We Can Do Now – Resilient and Equitable Approaches and Actions

- Community Engagement and Collaboration
- Regional Collaboration and Shared Services
- Contracting and Procurement
- Local Workforce Development
- Affordability and Funding



# Thank You for Attending!

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