# Sea Level Change:
## Sea Level Rise and Infrastructure Planning

December 11, 2020

APA Hazard Mitigation and Disaster Recovery Division

Matt Campo, Senior Research Specialist, Rutgers
Nicole Faghin, Coastal Management Specialist
Washington Sea Grant

Sea Grant Washington

RUTGERS
Edward J. Bloustein School of Planning and Public Policy

# Welcome to APA Hazard Division

apa.hmdr@gmail.com

# Sea Level Rise and Planning Series
# 2020 - 2021

**WEBINAR 1:** Sea Level Rise 101: How to Select and Use Sea Level Rise Data for Planning and Policy Decisions

**WEBINAR 2:** Integrating Sea Level Rise into Plans

**WEBINAR 3:** Coastal Hazard Zones, Best management practices, permitting and planning

**PLANNING WEBCAST SERIES YouTube Channel**

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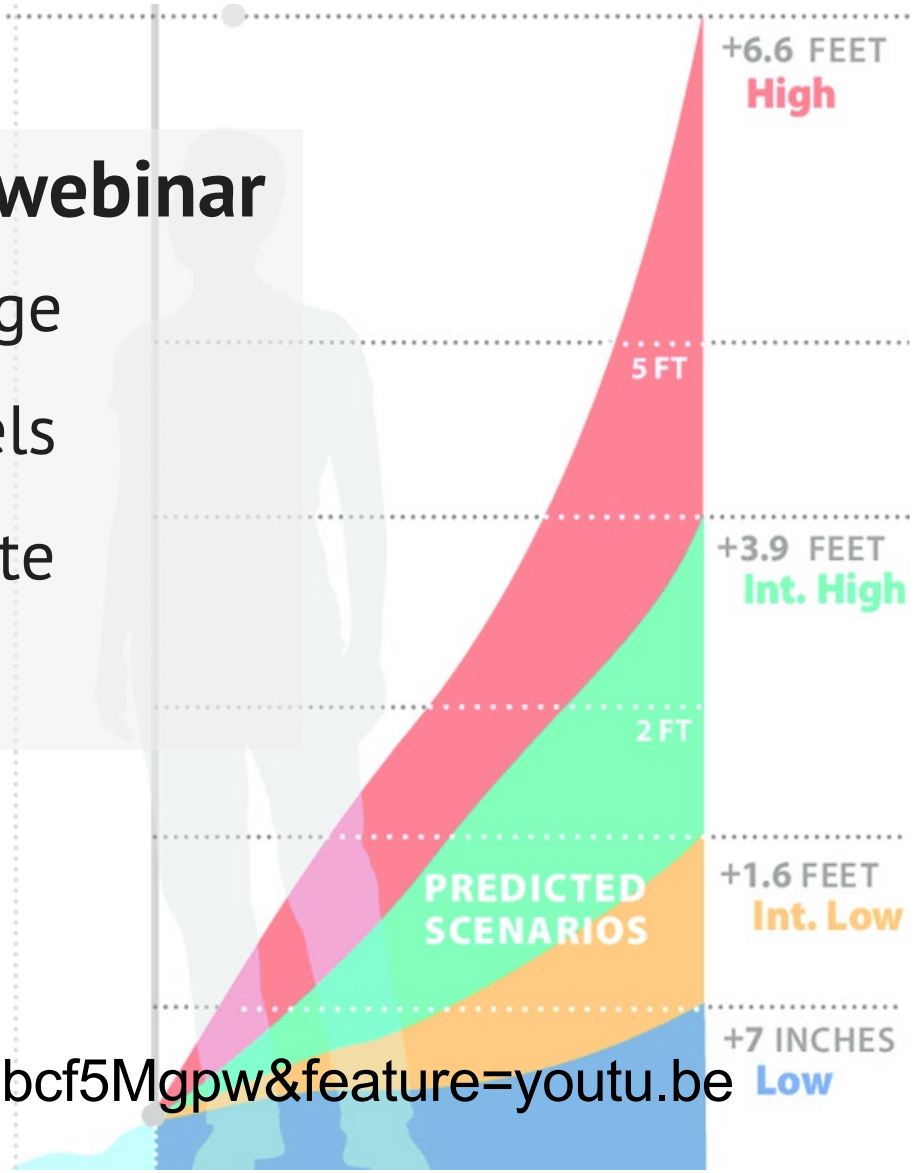
# An introduction

Nicole Faghin, Washington Sea Grant

Sea Grant
Washington

# What we covered in the first webinar

- Components of sea level change
- Scenario vs Probabilistic models
- Example from Washington State
- Tools




Link for our first webinar:
https://www.youtube.com/watch?v=qpFbcf5Mgpw&feature=youtu.be

# What we covered in the second webinar

Using sea level rise projections
in planning processes

Link for our second webinar:
https://www.youtube.com/watch?v=PdezO76Sbmg&t=1614s


# What we covered in the third webinar

Using Hazard Zones to address future conditions

Link for our third webinar:
https://www.youtube.com/watch?v=EqN2Coe3HZc

# WEBINAR 4:
# Sea Level Rise and Infrastructure Planning

PAS REPORT 596

# PLANNING FOR INFRASTRUCTURE RESILIENCE

Joseph DeAngelis, AICP, Haley Briel, and Michael Lauer, AICP

APA

American Planning Association

*Creating Great Communities for All*

# DEFINITIONS

# What is a CIP?

**Capital Improvement Plan** is a community planning and fiscal management plan used to coordinate the location, timing and financing of **multiple projects over a multi-year period**.

(Washington State Term: **Capital Facilities Plan**)

Contrast to **Capital Improvement Project** which is an individual Infrastructure project **considered annually**.

# What is Infrastructure?

**Publicly funded** projects including transportation investments, water and wastewater, and coastal defenses/hazard mitigation structures.

# The Capital Improvement Plan

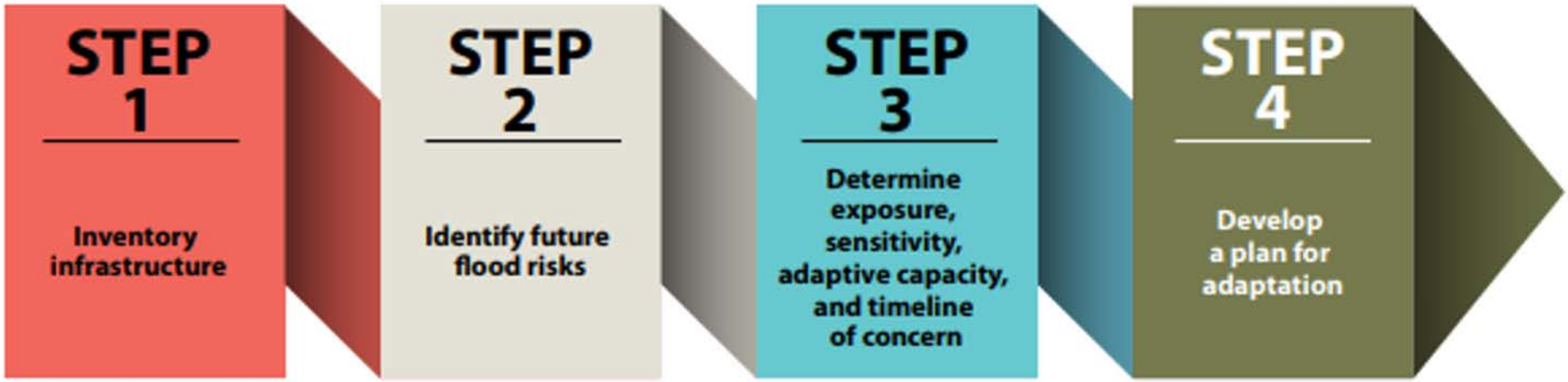
# 4 Big Disconnects…

# DISCONNECT #1

# DISCONNECT #2

## DISCONNECT #3 (not this webinar)

# DISCONNECT #4


STEP 1
Inventory infrastructure
STEP 2
Identify future flood risks
STEP 3
Determine exposure, sensitivity, adaptive capacity, and timeline of concern
STEP 4
Develop a plan for adaptation

# Issues for CIPs and SLR

Criteria

Funding Sources

Planning horizons and life cycles

Plan Coordination

Planning as driver or follower

# Introduction of our guest speakers

Susan Clark, Olympia, WA
Rhonda Haag, Monroe County, FLA


# Role of Planners in Sea Level Rise Response Planning

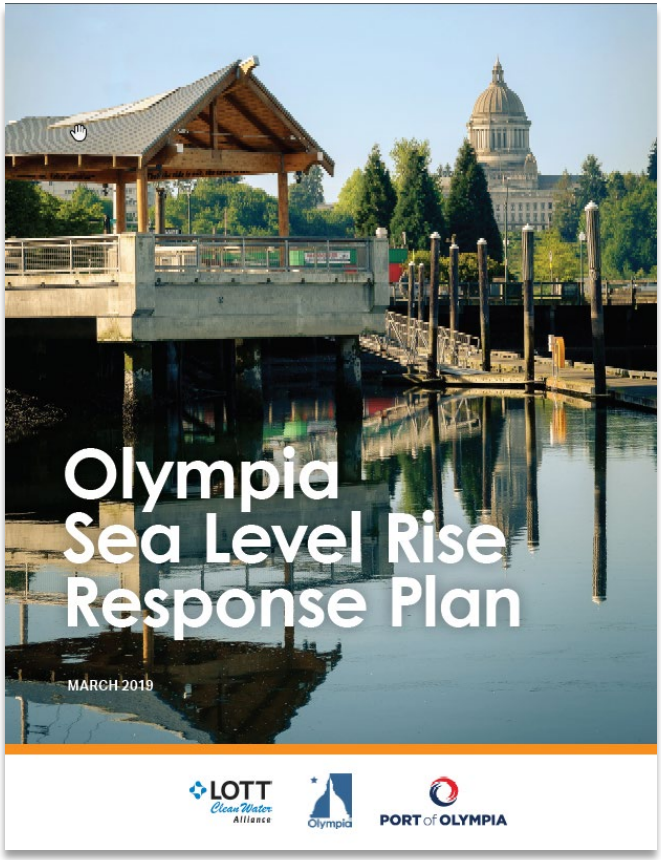
December 11, 2020

# Sea Level Rise Response Plan

## We Have A Plan!

The following is available on olympiawa.gov/slr:

- Final SLR Plan
- Story Maps
- Planning Framework
- Climate Science Review
- Vulnerability and Risk Assessment



# Today's Agenda

- Where's Olympia?
- Planning Context
- Planner's Role
- Implementation

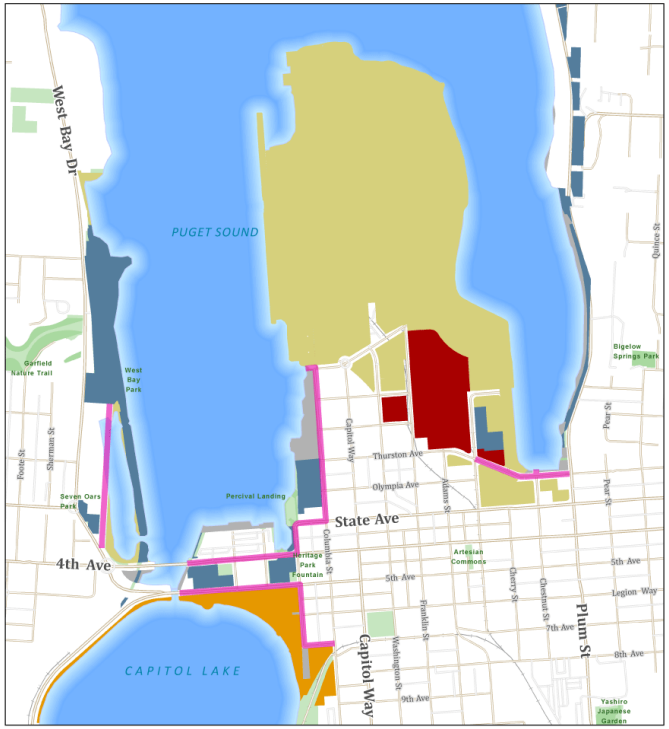

# Where is Olympia & What is Unique About it?

# Sea Level Rise Response Plan

## City of Olympia

# Sea Level Rise Response Plan

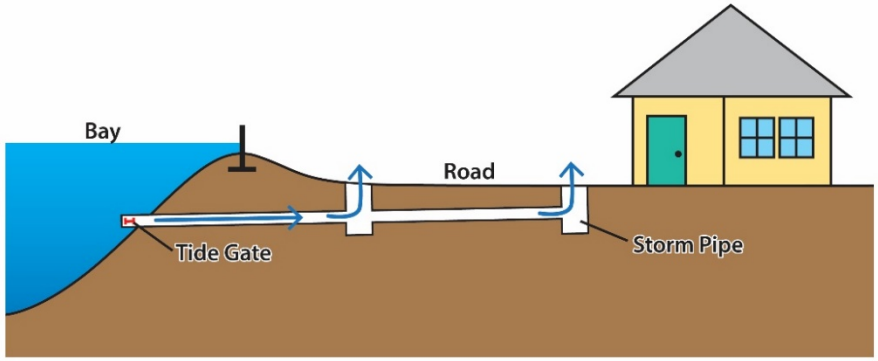
## Focused on Downtown Olympia

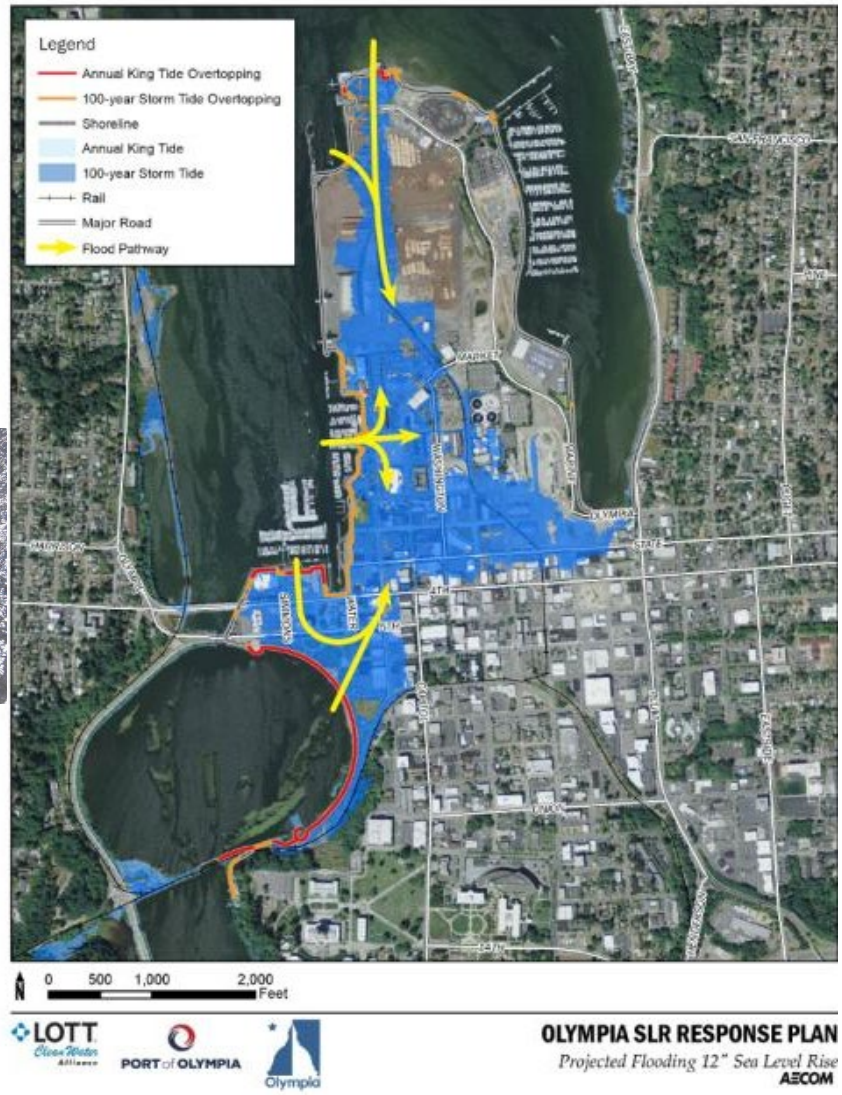



# Sea Level Rise Response Plan

## Olympia Flooding Dynamics

- High tides
- High river flows
- Backflow through stormwater system



# Phased Response

- Immediate (0-5 years): 2020-2025

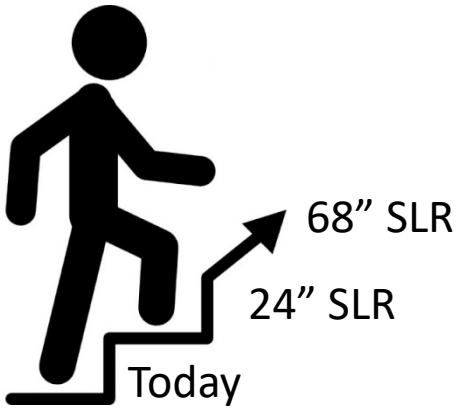
  [<6” SLR]

- Mid-Term (5-30 years): 2025-2050

  [13-25” SLR]

- Long-Term (30+ years): 2050 and beyond

  [36-68” SLR]




# Adaptation Strategies Types

**Physical / Infrastructure**
*(Addresses physical vulnerabilities)*

***Example:***
Raise Percival Landing Park to protect inland areas from flooding

**Operational**
*(Responds to physical vulnerabilities)*

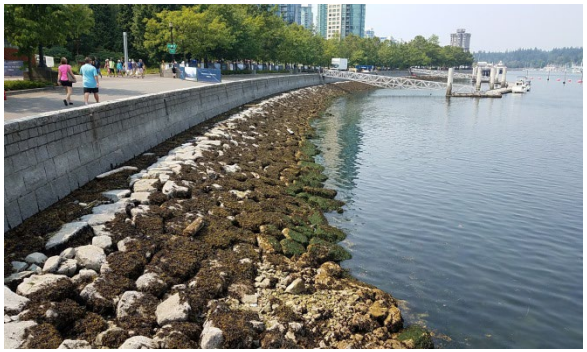
***Example:***
Traffic detour during flood event

**Governance**
*(Addresses policy, plans, overarching guidance documents)*

***Example:***
Update design standards to incorporate SLR considerations

**Informational**
*(Addresses initiatives, knowledge gaps)*

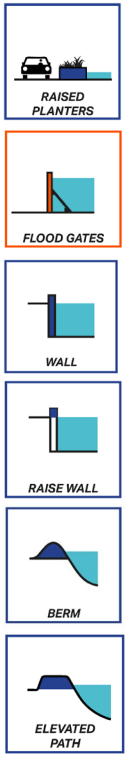
***Example: City, LOTT, Port***
Conduct study to better understand effect of elevated groundwater on stormwater and sewer system



# Sea Level Rise Response Plan

## Percival Landing Mid-Term Strategies for 24” SLR

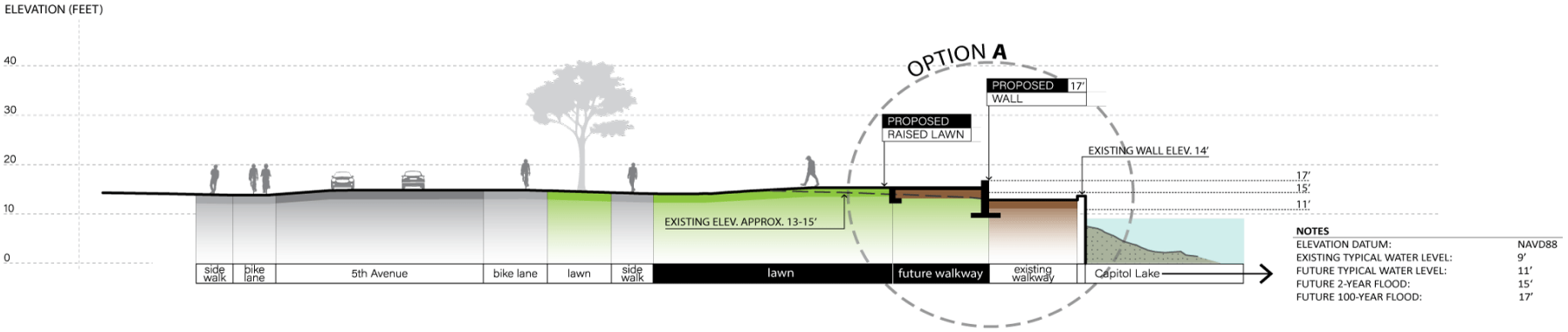
- Raised planters
- Flood gates
- Wall
- Raise wall
- Berm
- Elevated path




# Capitol Lake Strategies for 24” SLR

**CAPITOL LAKE**
MID-TERM SOLUTION FOR 24” OF SLR
*CONSTRUCT NEW WALL*

**5TH AVENUE PERSPECTIVE**




The proposed sea level rise adaption strategies are expected to be compatible with the long term management options for Capitol Lake/Lower Deschutes Watershed.


# Planning Context

# Washington State Growth Management Act

Washington State law that requires state and local governments to manage Washington's growth by identifying and protecting critical areas and natural resource lands, designating urban growth areas, **preparing comprehensive plans and implementing them through capital investments** and development regulations. This approach to growth management is unique among states.

Source: Wikipedia


# Policy & Planning Goals

**2010 Sea Level Rise Policy**

- The City is committed to protecting Downtown from the impacts of SLR
- The City will seek to understand the implications of potential 100-year sea rise of 50 inches
- Incorporate adaptation and flexibility into both public and private infrastructure projects
- Seek opportunities to maintain control of valuable shoreline

**2014 Comprehensive Plan Goal**

The City uses best available information to implement a sea level rise management plan that will protect Olympia's downtown.

**2016 Sea Level Rise Development Code**

Elevate or floodproof 2 feet above 100-year flood

**2017 Downtown Strategy**

- A vibrant, attractive regional destination
- Full of distinctive pedestrian-oriented places and spaces
- A mixture of urban housing options
- A home for a variety of businesses
- A place to connect with out culture and historic fabric, and
- **Protected from the effects of sea level rise**

# How Was The Plan Developed?

# Sea Level Rise Response Plan

**City of Olympia Storm and Surface Water Utility's** mission is to reduce flooding, improve water quality, and protect and enhance aquatic habitat in Olympia.

# Sea Level Rise Response Plan

## What is Impacted?

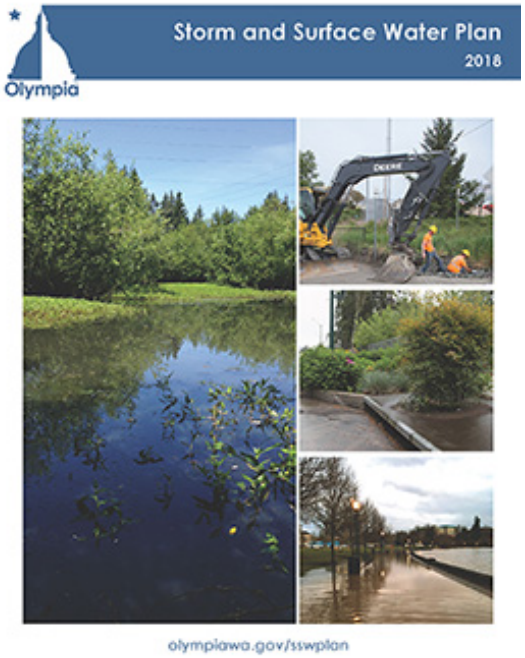


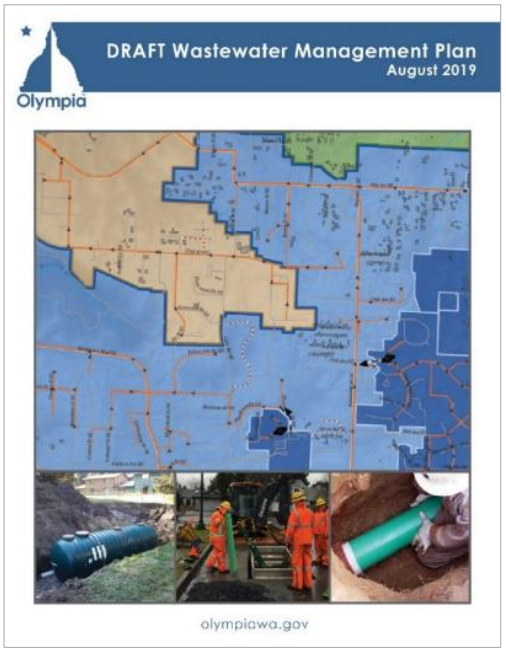






# Utility Planning



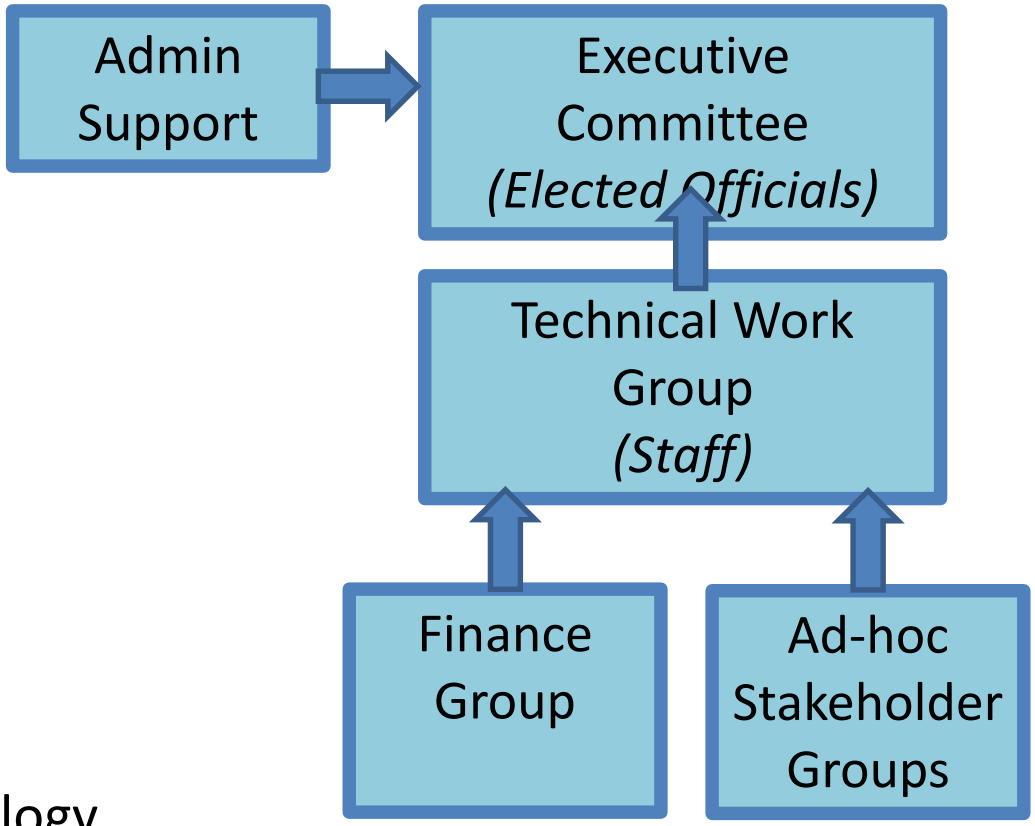




# Next Steps - Implementation


# Potential Total Costs and Phasing

| Area / Strategy | Near-Term (0-5 years) Sea Level Rise: up to 6 inches | Mid-Term (5-30 years) Sea Level Rise: up to 24 inches | Long-term (30+ years) Sea Level Rise: up to 68 inches |
|---|---|---|---|
| Capitol Lake / Lower Deschutes Watershed | $0.2M | $3M to $6M | $3M to $118M |
| Percival Landing and Isthmus | - | $11M to $13.5M | $85M to $105M |
| Budd Inlet Treatment Plant | - | $1M to $6M | $12.5 to $15M |
| Port of Olympia Peninsula | $20K | $0.5M to $1M | $8M to $9.5M |
| Stormwater System | $1M | - | $82.5M to $100.5M |
| **Total** | **$1.25M** | **$16M to $26M** | **$190M to $350M** |

# Olympia Sea Level Rise Response Collaborative




Initial Members
- City of Olympia
- LOTT Clean Water Alliance
- Port of Olympia

Invitees
- Squaxin Island Tribe
- WA State Department of Ecology
- WA State Department of Enterprise Services

# Sea Level Rise Response Plan


## Olympia Sea Level Rise Response Collaborative

**Work Plan**

- Adopt a strategic plan
- Prioritize projects and studies
- Identify funding opportunities
  - FEMA
  - NOAA
  - Bloomberg

# Climate Change & Sea Level Rise in the Florida Keys:
# Monroe County Begins to Bridge the Gap with Roads Elevation

**Sea Level Rise and Infrastructure**
**Capital Facilities Planning**
**Friday December 11, 2020,**
**10:00 AM - 11:30 AM PST**
**1:00 PM - 2:30 PM EST.**


**Presented by Rhonda Haag**
**Chief Resilience Officer**
**Monroe County, FL**

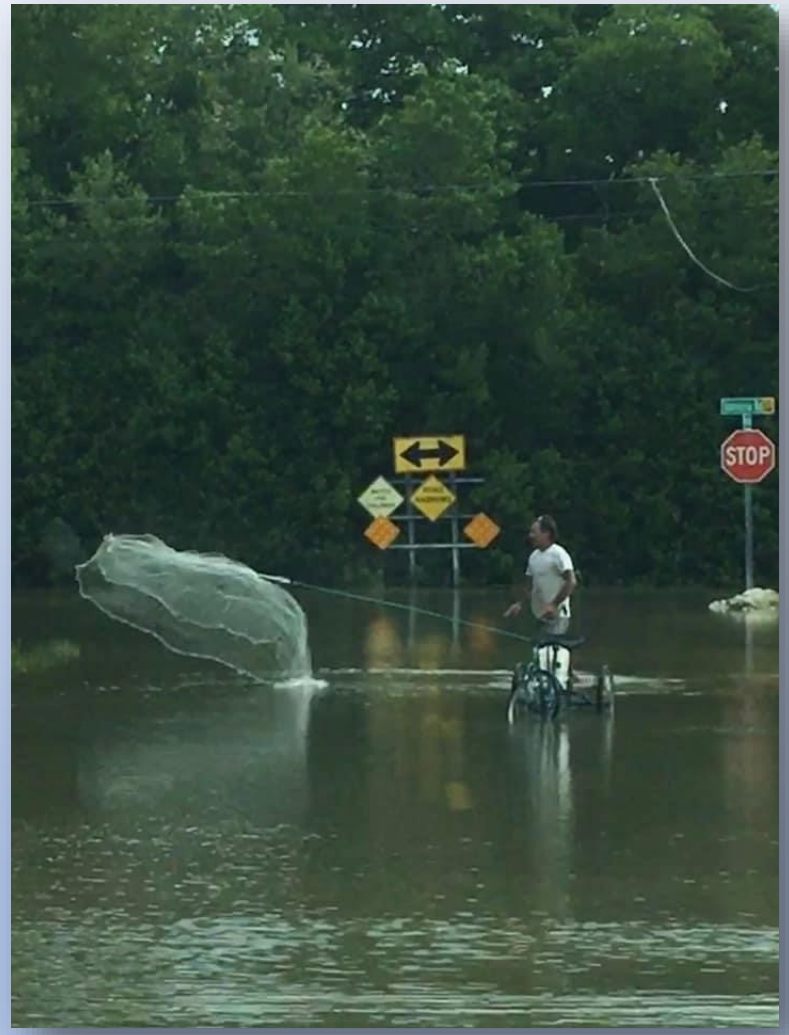

HDR wood.

ERIN L. DEADY, P.A.

# Monroe County Roadway Vulnerability Study and how Planners are Assisting

*Agenda*

1. Location of Project
2. Background on County's Resiliency and Climate Program and Key Issues related to Sea Level Rise
3. Local Infrastructure Adaptations and How Sea Level Rise is Being Addressed
4. Role of planners in the planning process as it relates to Sea Level Rise adaptation efforts




Kristen Key Szpak, 10/19/20

# Location:
# Monroe County, Florida
# “Florida Keys”

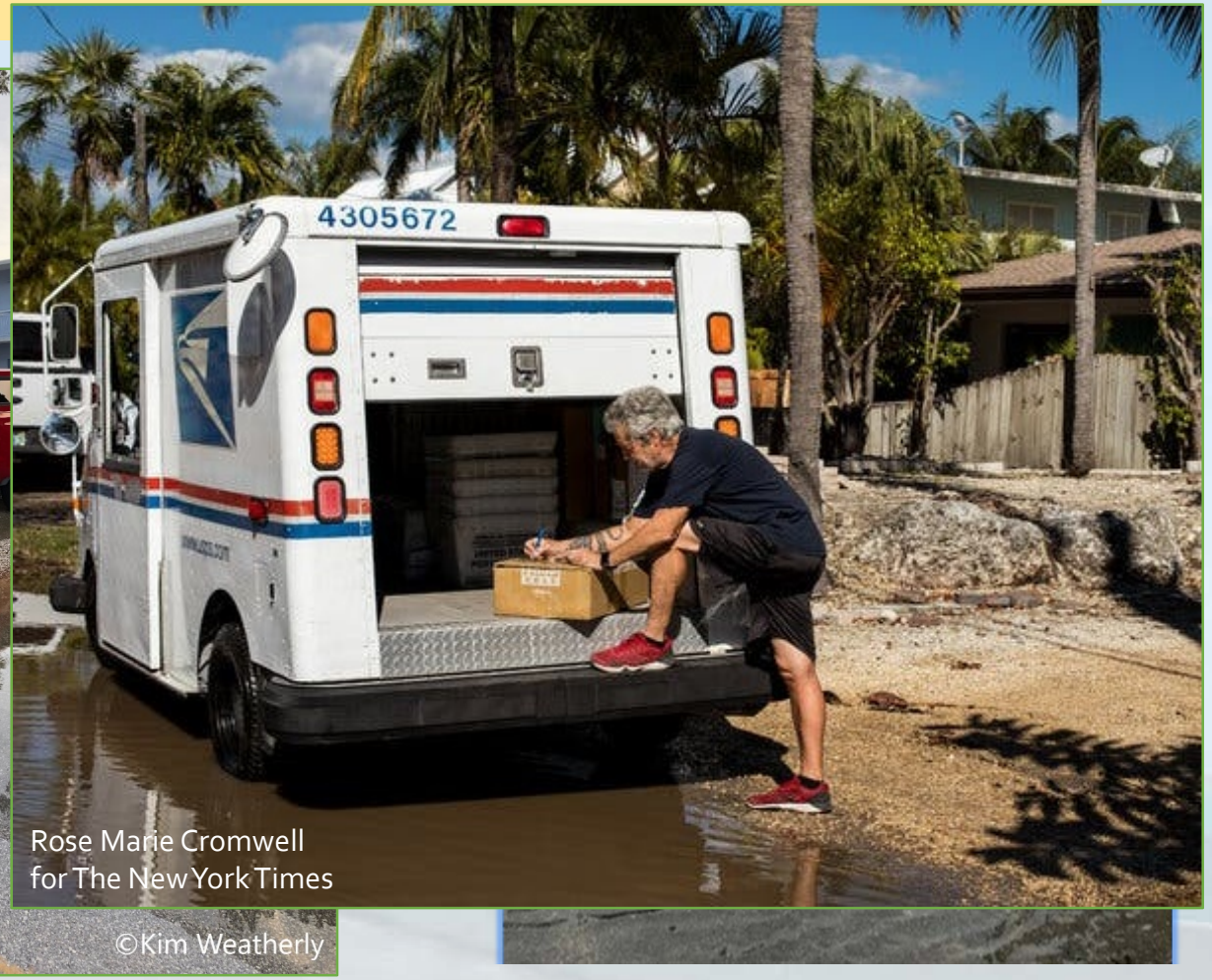
## Roadway Vulnerability Study

**Help make the Florida Keys island chain more resilient to sea level rise.**

# Why the Urgency? Key Issues


Key Largo – Stillwright Point
(85 days)


Key Largo – Twin Lakes



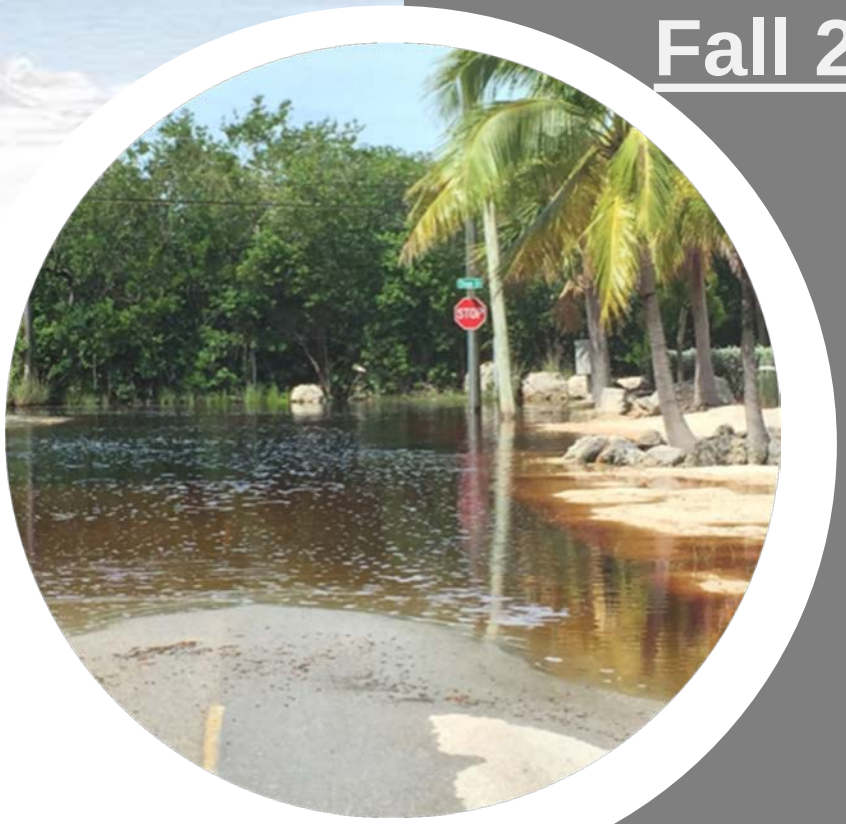

Big Pine

# Monroe County, Florida Among Most Vulnerable Counties in Nation

| Rank | County | Population Displaced |
|---|---|---|
| 1. | Tyrell, NC | 45% |
| 2. | Hyde, NC | 42% |
| **3.** | **Monroe, FL** | **36%** |
| 4. | Dare, NC | 21% |
| 5. | Currituck, NC | 20% |
| * | Miami-Dade, FL | 3% |
| * | Broward, FL | 1% |

**Land that's dry now that will go under water by 2060 in relation to the number of people living there**

**National-scale analysis of over 300 coastal counties Matthew Hauer, Applied Demography Program, University of Georgia*



# King Tides
# Fall 2015 and 2016



# Fall 2019-2020 King Tides

# Sea Level Rise Planning Process to Date

1. County's sea level rise planning launched in 2016: GreenKeys
   - 5-year work plan, 165 recommendations
   - Recommendations included:
     - Amendments to Comprehensive Plan
     - Pilot Roads Projects
     - Improve elevation data
     - Engineering level analysis of transportation impacts countywide

2. Energy and Climate Element of Comprehensive Plan (2016)

3. Pilot Road Elevation Projects (Big Pine and Twin Lakes) initiated in 2016 and design/permits completed 2020

4. New Roads Mobile LiDAR elevation data (2019 completed)

5. Grants for SLR planning

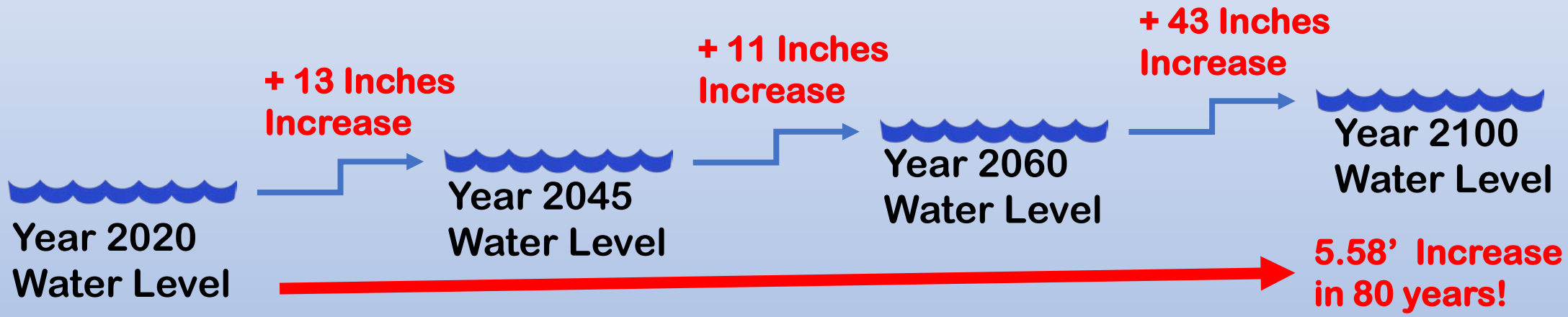
# Sea Level Rise Planning In Process

1. Roads Adaptation Plan (launched 2019)
   - Identify sea level rise impacts to roads and drainage comprehensively
   - Develop Ranking Criteria –with Planners assistance
   - Identify policy options –with Planners assistance
   - Develop engineering alternatives and Implementation Plan
2. Vulnerability Assessment for other County non-road assets being updated separately for habitat, buildings, and infrastructure
3. Comprehensive Plan (2021 initiate update)
   - Peril of Flood amendments to address State requirements (drafted, RPG 2019)
   - Adaptation Action Areas (in process RPG 2020)
   - Other amendments as necessary

# Monroe County Roadway Vulnerability Study

## Increasing Projected Water Levels Throughout County…

*SLR Condition: NOAA 2017 Intermediate-High*



# Monroe County Roadway Vulnerability Study

## Increasing Projected Water Levels Throughout County…

***SLR Condition: NOAA 2017 Intermediate-High + King Tides***



# Monroe County Roadway Vulnerability Study
# How Sea Level Rise is Being Addressed

## Increasing Projected Water Levels Throughout County…
***SLR Condition: NOAA 2017 Intermediate-High + King Tides***

$1.8 Billion*

| Projected SLR + King Tides will affect the following: | 2045 | Unincorporated Countywide % | 2060 | Unincorporated Countywide % | 2100 | Unincorporated Countywide % |
|---|---|---|---|---|---|---|
| Miles of Vulnerable and Critical County Maintained Roadways | **152 MI** | **49%** | **206 MI** | **66%** | **252 MI** | **81%** |
| # of Residential Units along County Maintained Roadways | **12,585 Res. Units** | **71%** | **14,501 Res. Units** | **82%** | **16,370 Res. Units** | **92%** |

**311 Total Road Miles County Wide**

* Cost estimate is conceptual and assumes reconstruction of the roadway and use of an injection well system. Cost estimates do not include design, right-of-way acquisition, harmonization/cost to cure, and legal fees. Cost estimates are preliminary and subject to change.

# Monroe County Roadway Vulnerability Study

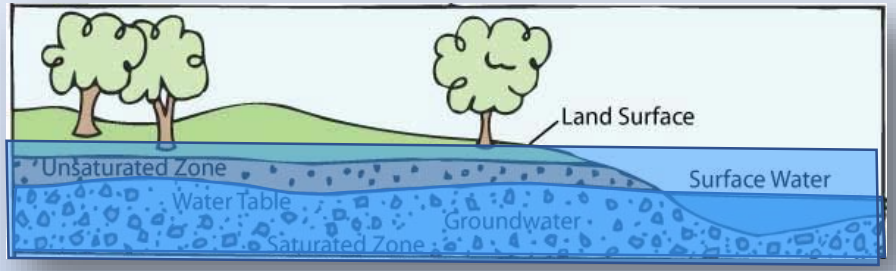
**What is vulnerability?**


**What is criticality?**

# Monroe County Roadway Vulnerability Study

## Step 1: Vulnerability Assessment

- Very High Vulnerability
- High Vulnerability
- Moderate Vulnerability
- Low Vulnerability
- Very Low Vulnerability




1. Groundwater Clearance


2. Surface Inundation Depth (SLR)

3. Storm Surge

4. Surface Wave Impact Potential


5. Roadway Existing Pavement Condition

# Monroe County Roadway Vulnerability Study

## Step 1: Vulnerability Assessment – What did it reveal?

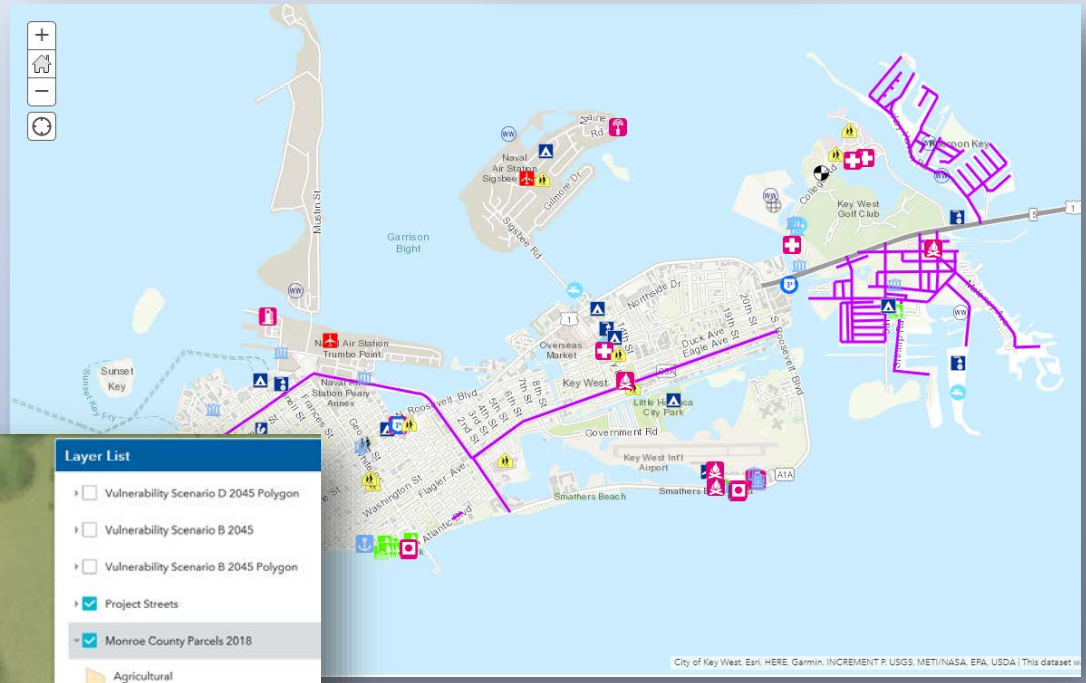
## Old State Rd 4A (SLR Projection + King Tide measured from Roadway Surface Elevation)

# Monroe County Roadway Vulnerability Study

## Step 2: Criticality Assessment


1. Vulnerability Score

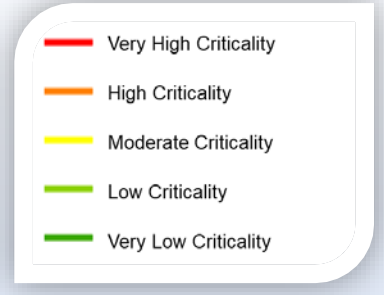

2. Number of Residential Units

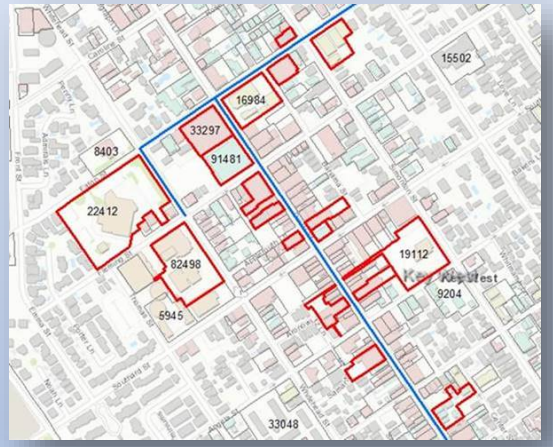



3. Roadways Associated with Critical Facilities

# Monroe County Roadway Vulnerability Study

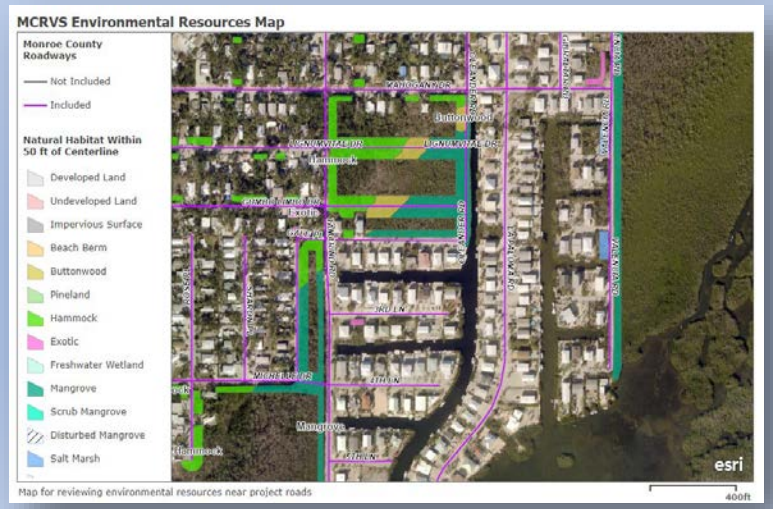
## Step 2: Criticality Assessment (Cont.)



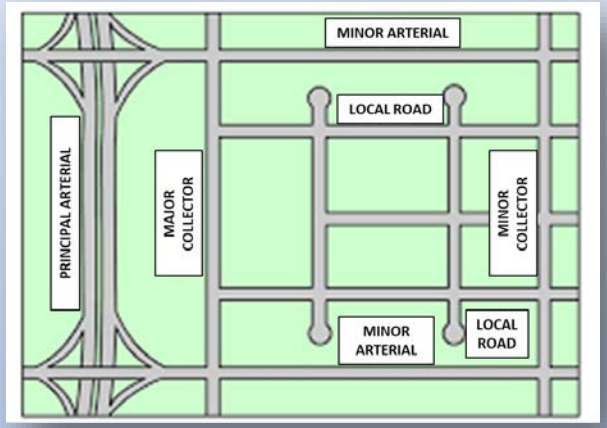




4. Commercial Buildings


5. Threatened, Endangered and Focus Species




6. Wetlands/Natural Habitats




7. Roadway Functional Classification and Evacuation Route

# Monroe County Roadway Vulnerability Study

## Planners Recommended Criteria and Weight Factors to Rank Roads for Vulnerability

### STEP 1

| Vulnerability Evaluation Factors | Weighting Percentages |
|---|---|
| Roadway Surface Inundation Depth | 60% |
| Roadway Groundwater Clearance | 25% |
| Roadway Inundation Duration | 5% |
| Evidence Storm Surge | 5% |
| Roadway Elevation | 5% |
| Roadway Drainage | 5% |
| Pavement Condition | 5% |

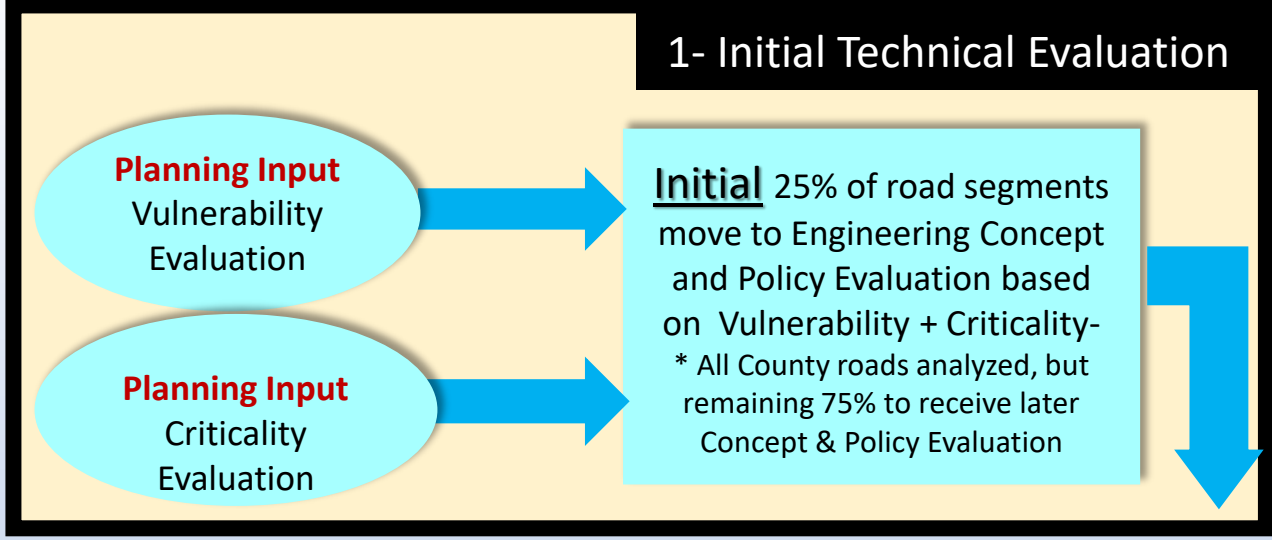
Criteria and Weights will Affect How Roads Are Ranked for Elevation

### STEP 2

| Criticality Evaluation Factors | Weighting Percentages |
|---|---|
| Vulnerability Score | 50% |
| Number of Residential Units | 25% |
| Number of Commercial Units | 5% |
| Number of Critical Facilities | 5% |
| Number of Evacuation Routes | 5% |
| Number of Transportation Routes | 5% |
| Number of Utilities | 5% |

# Planning Process for Roads Adaptation

**Data collection**
Review Compact's 25 year SLR (useful life) projections & King Tide predictions for future impacts



# Planning Process for Roads Adaptation

**Data collection**
Review Compact's 25 year SLR (useful life) projections & King Tide predictions for future impacts

## 1- Initial Technical Evaluation

**Planning Input**
Vulnerability Evaluation

**Planning Input**
Criticality Evaluation

**Initial** 25% of road segments move to Engineering Concept and Policy Evaluation based on Vulnerability + Criticality-
* All County roads analyzed, but remaining 75% to receive later Concept & Policy Evaluation

## 2- Policy and Economic Evaluation

**Board Presentation**
November 2020

**Engineering Concept**
Evaluation = Preliminary Design & Conceptual $$$

**Further Evaluation with Planning Input** Considerations *could* include: Level of Service, cost effectiveness, affordable housing issues, access, staging efficiency + other factors depending on road project

# Planning Process for Roads Adaptation

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## 3- Plan & Implementation

**Board Review and Public Engagement**
Review results of full roads evaluation process and results

**Draft Roads Adaptation Plan & Implementation Strategy With Planning Input**
* New projects in remaining 75% added as reviews completed

**Board Approval (Fall 2021)**
Roads Adaptation Plan and Implementation Strategy

**After Fall 2021 = Implementation**
Detailed design, project permitting/ implementation and funding

# Aligning Comprehensive Plan Policy Initiatives: EAR 5/1/21

| Initiatives | Timeframe |
|---|---|
| **Energy and Climate Element**<br>Updating now to incorporate all climate planning initiatives<br>To be finalized in Evaluation and Appraisal Report based Comp Plan amendments | 2013 Completed<br>In process (RPG)<br>2020-2021 |
| **Peril of Flood Amendments**<br>To be finalized in Evaluation and Appraisal Report based Comp Plan amendments | Drafted (RPG)<br>2020-2021 |
| Overall Integration of Sea Level Rise into other Comp Plan Elements<br>To be finalized in Evaluation and Appraisal Report based Comp Plan amendments | Drafted (RPG)<br>2020-2021 |
| **Stormwater Policy Implementation**<br>Policy 1001.1.3 & 1001.1.6: Updating stormwater management regulations & inventory and analysis of existing public drainage facilities | In process (DEO Grant) |

# Identifying the Issues for Future Comprehensive Plan Updates

1) Integration of Countywide Roads Study into capital improvements planning process
2) Updating other vulnerability work beyond roads/stormwater to form the basis for establishing adaptation action areas
3) Assessment of shorelines and policies (natural and hardening)
4) Remaining growth in the Keys (2026) and vulnerable neighborhoods
5) ROGO and transfer of development rights (evaluation of sea level rise vulnerability)
6) Framing infrastructure commitments (deficiencies, maintenance and growth/expansion)
7) Land acquisition and evaluation of sea level rise
8) Maintaining access for recreation and open space
9) Disaster recovery and rebuilding more resiliently

# Planning Decisions to Develop Roads and Flood Mitigation Implementation Strategy

- **Planning Decision** Framework of Adaptation Approaches
  - Analysis of Future Growth
    - Where is the remaining growth (and demand for services) going to go?
  - Level of Service issues
    - Differing levels of service across neighborhoods
    - Case studies related to "natural hazards" and government providing services (ie; flooding, snow plowing, fire management, etc.)
  - "Road Maintenance"
    - County obligations to maintain roads and authority to upgrade
- Implementation strategies:
  - Comprehensive Plan, Ordinances, Code, Special Districts/MSBU, etc.

Twin Lakes

# County Adaptation + Parcel Adaptation

***Countywide Adaptation***

- Roads
- Habitat/Resources
- Elevate or mitigate County buildings
- Infrastructure

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***Private Property Response***

- Elevate or mitigate private structures
- Lot fill and driveways
- Shorelines
- **Comp Plan Amendments Required**

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***Achieving Resilience***

- County
- People
- Habitat
- Economy

# How Communities Are Implementing Resilience for Infrastructure or Allowing Private Property Adaptation

| *Sample* Adaptation Implementation Strategies for Communities | Comprehensive Plan | LDRs & Other Code provisions | Local Govt. Capital Improvement Funding | Private Property Owner Funding (assessments or other sources) |
|---|---|---|---|---|
| Public- Road elevation & flood mitigation | X | X (Design standards) | X | X |

# How Are Other Communities Implementing Resilience for Infrastructure or Allowing Private Property Adaptation?

| ***Sample*** **Adaptation Implementation Strategies for Communities** | **Comprehensive Plan** | **LDRs & Other Code provisions** | **Local Govt. Capital Improvement Funding** | **Private Property Owner Funding (assessments or other sources)** |
|---|---|---|---|---|
| Public- Road elevation & flood mitigation | X | X (Design standards) | X | X |
| Private property- Shoreline, fill & driveways, etc. | X | X (Site development) | | X |

# How Communities Are Implementing Resilience for Infrastructure or Allowing Private Property Adaptation

| ***Sample*** **Adaptation Implementation Strategies for Communities** | **Comprehensive Plan** | **LDRs & Other Code provisions** | **Local Govt. Capital Improvement Funding** | **Private Property Owner Funding (assessments or other sources)** |
|---|---|---|---|---|
| Public- Road elevation & flood mitigation | X | X (Design standards) | X | X |
| Private property- Shoreline, fill & driveways, etc. | X | X (Site development) | | X |
| Public or private property- Available lands for road adaptation, management of acquired lands and vacant parcels where flooding crosses onto roads | X | X (Uses/Mgmt. of lands) | X | X |

# Thank You

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# QUESTIONS?
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# THANK YOU FOR JOINING US!

Matt and Nicole