



# CITY OF KEY COLONY BEACH VULNERABILITY ASSESSMENT

VULNERABILITY ASSESSMENT

APRIL 15, 2024

# OUTLINE

- Brief Project Overview
- Vulnerability Assessment Modeling Output
- Prioritization of Assets (Scoring/Ranking)
- Example adaptation recommendations
- Conclusions



# RESILIENCY PLANNING GRANT 22PLN97

Task	Work Products:
1- Outreach and Stakeholder input	<ul style="list-style-type: none"> <li>• (2) Public Workshops to present results of Preliminary Vulnerability Assessment</li> <li>• (2) City Council Briefings to present project status and outcomes</li> <li>• Agenda and presentation materials. Minutes, agenda and presentation materials will be included.</li> <li>• Story map update to incorporate new modeling output</li> </ul>
2- Acquire Background Data	<ul style="list-style-type: none"> <li>• Report of data compiled</li> <li>• Report of recommendations to bridge data “gaps”</li> <li>• GIS files of data</li> </ul>
3- Exposure & Sensitivity Analysis	<ul style="list-style-type: none"> <li>• Draft Vulnerability Assessment regarding modeling and resulting tables/maps</li> <li>• Critical Asset / Regionally Significant Asset List identifying flood scenario of impact</li> <li>• GIS files</li> </ul>
4- Vulnerability Assessment Report/Tables and Maps	<ul style="list-style-type: none"> <li>• Final VA Report that provides details on the results and conclusions, including illustrations via maps and tables, based on the statutorily-required scenarios and standards in s. 380.093, F.S. The Final VA Report should also include the following: outline the data compiled and the findings of the gap analysis with recommendations to address the identified data gaps and any actions taken to rectify them, if applicable; and provide details on the modeling process, type of models utilized, and resulting tables and maps illustrating flood depths for each flood scenario</li> <li>• A final list of critical and regionally significant assets that are impacted by flooding, which must be prioritized by area or immediate need and must identify which flood scenario(s) impacts each asset</li> <li>• Flooding inundation maps, GIS data</li> </ul>
5- Peril of Flood Comp Plan Amendments	<ul style="list-style-type: none"> <li>• Coastal Element – 2015 Statutory updates</li> </ul>

# WHY CONDUCT A VULNERABILITY ASSESSMENT?

1. Position the City for future grant opportunities by having a plan of action (and its required in Section 380.093(5), F.S. to qualify for capital project funding after 2024)

2. Establish adaptation project priorities, examples:

- Road elevation, drainage and infrastructure
- Protection of shorelines and policies (natural and hardening)

3. Establish other implementing policies, examples:

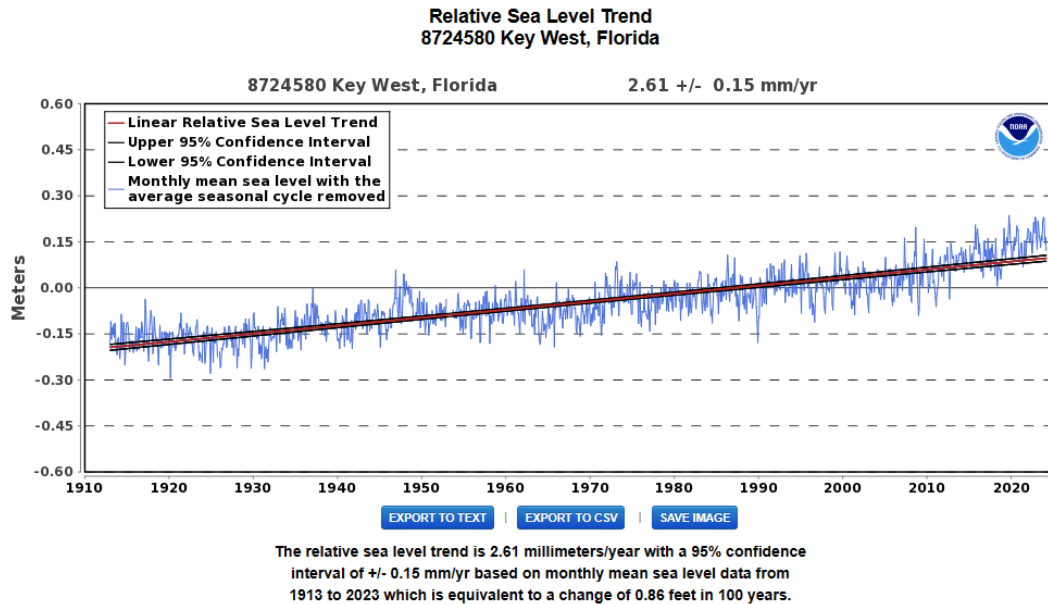
- Linking recovery and rebuilding more resiliently
  - Addressing vulnerable neighborhoods
  - Framing infrastructure commitments (deficiencies, maintenance and enhancements/upgrades)

4. Priorities for land acquisition

5. Maintaining access for recreation and open space

6. Integration of adaptation response fully into Comprehensive Plan / Code (example infrastructure design criteria)

# PROJECT OBJECTIVES: IDENTIFY OPPORTUNITIES TO BECOME MORE RESILIENT

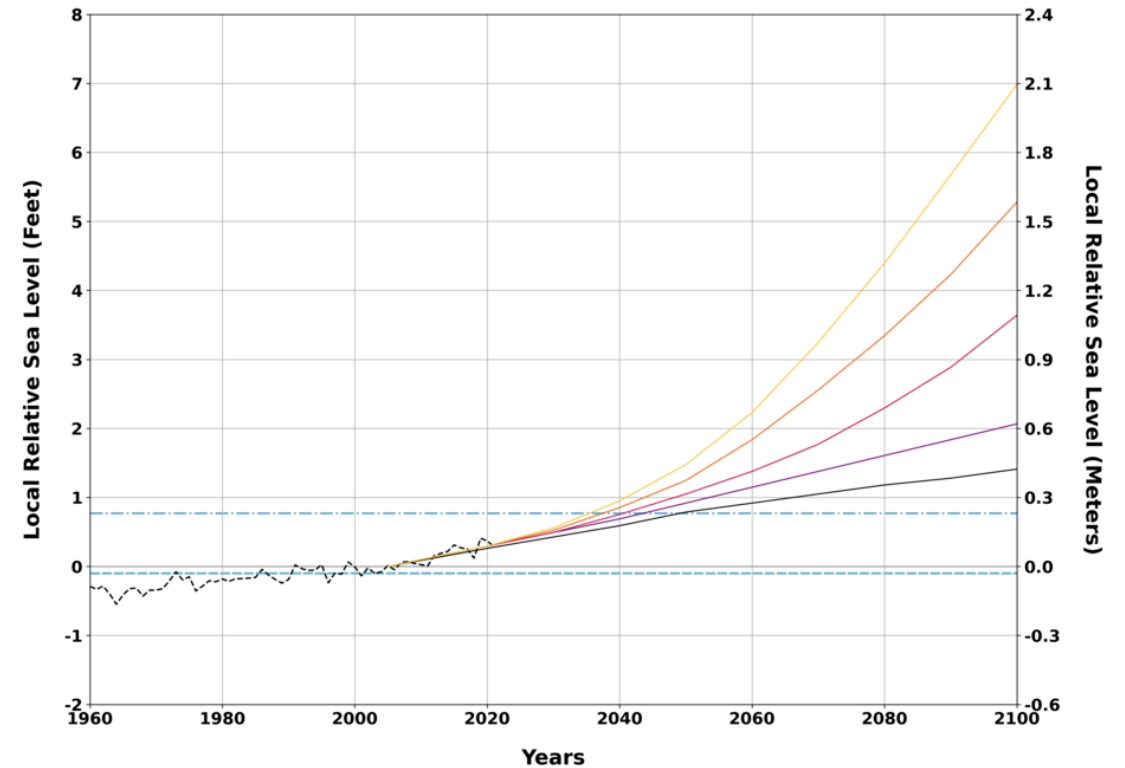


- Evaluate risks to assets owned or maintained by the City of Key Colony Beach and community resources
- Measure the impacts of potential climate threats on the area and identify the level at which selected assets may be affected
- Understand the potential magnitude, severity and extent of rainfall flooding, tidal flooding, current and future storm surge flooding in combination with various sea level rise projection scenarios
- Identify future State and Federal grant funding

# CLIMATE VULNERABILITY ASSESSMENT REQUIREMENTS SECTION 380.093(3) F.S

- Assessment to encompass entire City boundaries
- Most recent elevation data
- Sea level rise NOAA Intermediate Low and High projections for 2040 and 2070
- Storm surge
- Rainfall and Compound flooding
- Rainfall + SLR + Tides for 100- and 500- Year Event

Annual Relative Sea Level Since 1960 and Projections  
8724580 Key West



High Intermediate Low MSL Datum: -0.101ft  
Intermediate High Intermediate Low Observed NAVD88: 0.769ft

# FLOODING THREAT ANALYSIS

## Sea Level Rise

- An increase in the level of the world's oceans from the effects of climate change

## High Tide Flooding

- Characterized by high tide occurrences, leading to the temporary inundation of low-lying areas

## Storm Surge Flooding

- An event driven rise of ocean water generated by elevated water levels associated with a storm or wind event

## Rainfall-Induced Flooding

- Occurs when rainfall overwhelms drainage/stormwater systems and natural waterways, leading to the inundation of normally non-flood-prone land

## Compound Flooding

- The combination of tidal, storm surge, and rainfall-induced flooding



EXAMPLE ANALYSIS TO DATE



# **ASSET CLASSES (REQUIRED FOR EVALUATION BY THE STATE)**

## **1. Transportation**

- **Roads, bridges, rail, and marina**

## **2. Critical Infrastructure**

- **Non-buildings, all utilities**

## **3. Critical Community and Emergency Facilities**

- **Buildings, schools, health care services**

## **4. Natural, Cultural, and Historical Resources**



# HOW WE DETERMINE WHAT IS VULNERABLE

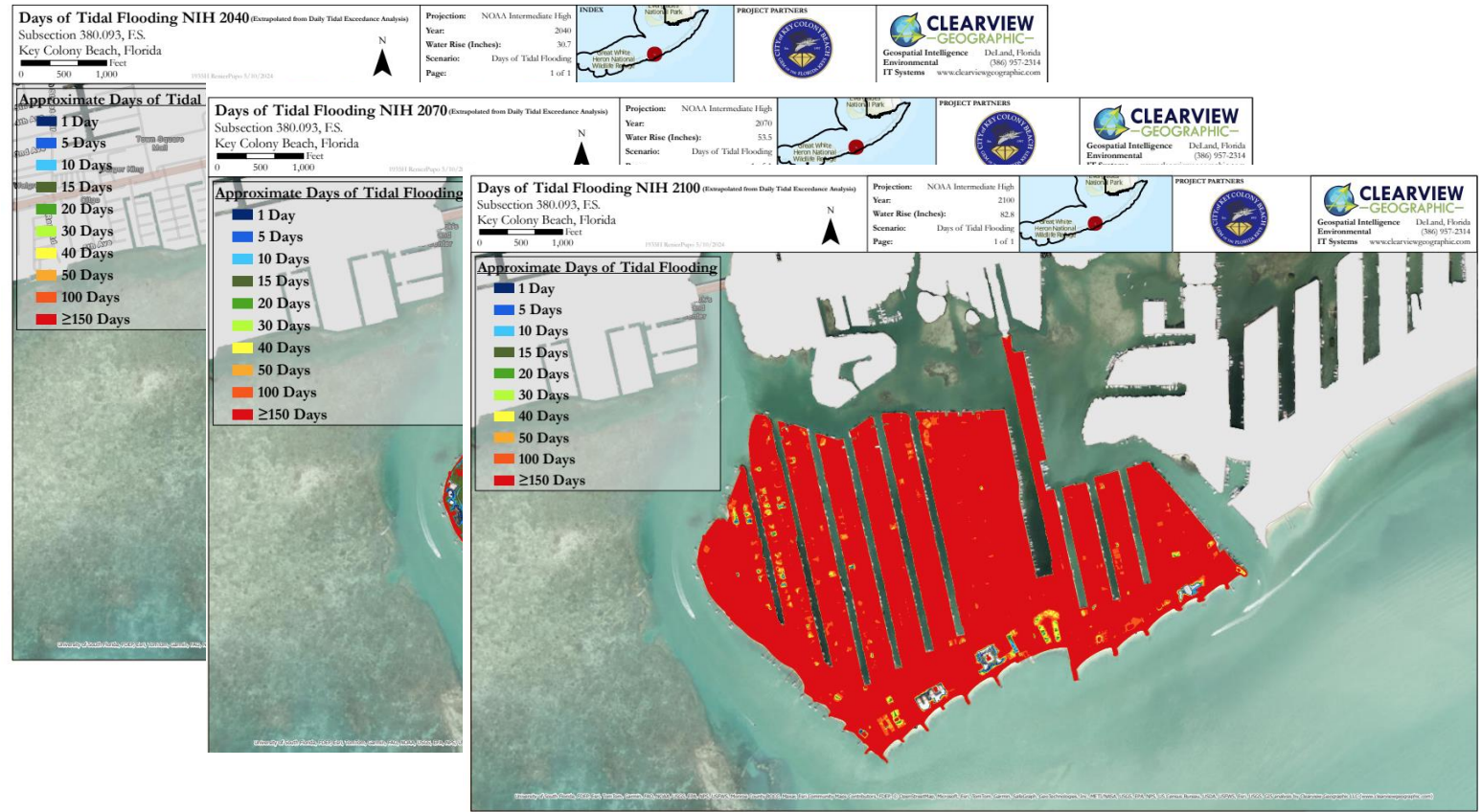
- **Determine level of exposure from specific flood scenarios**
- **Identify Critical Assets at risk**
- **Prioritize the assets to identify future project needs**
- **Identify adaptation strategies**
- **Obtain and incorporate public/stakeholder feedback**
- **Identify priority projects to fund and implement**



# DAYS OF TIDAL FLOODING

Identifies flooding scenario from sea level rise and shows project number of days that flooding will occur (based on daily tide cycle- highest tide in a year +NOAA Intermediate High sea level rise):

- 2040 = 30.7" Max Tide Height
- 2070 = 53.5" Max Tide Height
- 2100 = 82.8" ft Max Tide Height



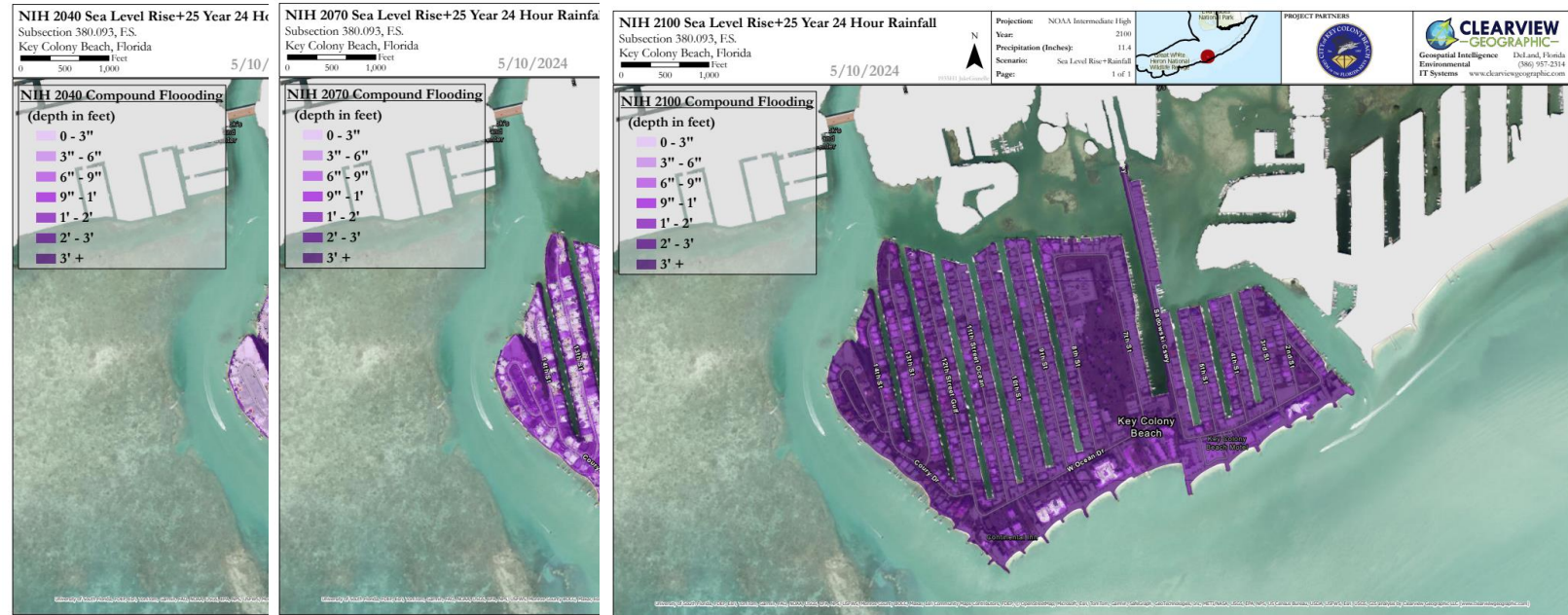
Note: Model only evaluates land and water elevations and does not include specific projects or structures



# RAINFALL PRESENT DAY/ FUTURE WITH SEA LEVEL RISE

Identifies flooding scenario from sea level rise and high tide flooding (predicted average sea level for these year + 2 feet of high tide threshold required by statute). NOAA Intermediate Low & High modeled as required by statute. Results presented today are the 25-year rainfall events with NOAA Intermediate High scenarios. Present day rainfall of XXX" is modified for future boundary conditions for 2040, 2070 and 2100. Identifies year and scenario from 2000 baseline:

- 2040 NIH SLR (31.2") + 25-yr/24-hr rainfall (11.4")
- 2070 NIH SLR (54.3") + 25-yr/24-hr rainfall (11.4")
- 2100 NIH SLR (88.2") + 25-yr/24-hr rainfall (11.4")



Note: Model only evaluates land and water elevations and does not include specific projects or structures

# SEA LEVEL RISE + 100-YEAR STORM SURGE

Identifies flooding scenario from sea level rise and storm surge (predicted average sea level for these year + 100 year/500-year storm surge). NOAA Intermediate Low & High modeled as required by statute. Results presented today are the NOAA Intermediate High scenarios. Identifies year and scenario from 2000 baseline:

- 2040 NIH SLR + surge = 129.2" of rise
- 2070 NIH SLR + surge = 152.4" of rise
- 2100 NIH SLR + surge = 186.2" of rise

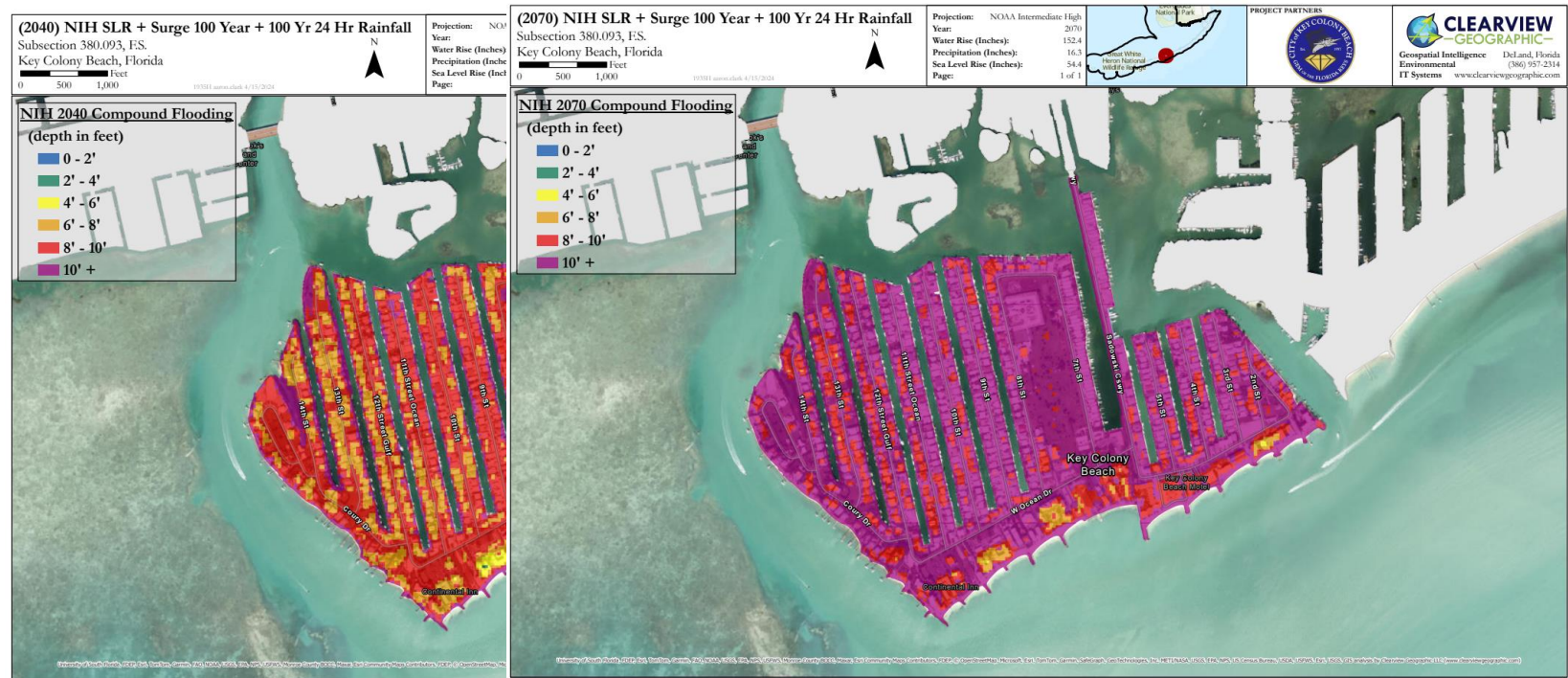


Note: Model only evaluates land and water elevations and does not include specific projects or structures

# COMBINED: SLR + HTF + SURGE + RAINFALL

Identifies flooding scenario from sea level rise and storm surge (predicted average sea level for these year + 100 year/500-year storm surge). NOAA Intermediate Low & High modeled as required by statute. Results presented today are the NOAA Intermediate High scenarios. Identifies year and scenario from 2000 Baseline:

- 2040 NIH SLR (31.2") + 16.3" 100-yr / 24-hr rainfall + 129.2" of 100-yr storm surge)
- 2070 NIH SLR (54.4") + 16.3" 100-yr / 24-hr rainfall + 152.4" of 100-yr storm surge)



Note: Model only evaluates land and water elevations and does not include specific projects or structures



**SENSITIVITY ANALYSIS / STEP 1: ESTABLISH FLOODING HOT SPOTS (INCLUDED ENTIRE CITY)**



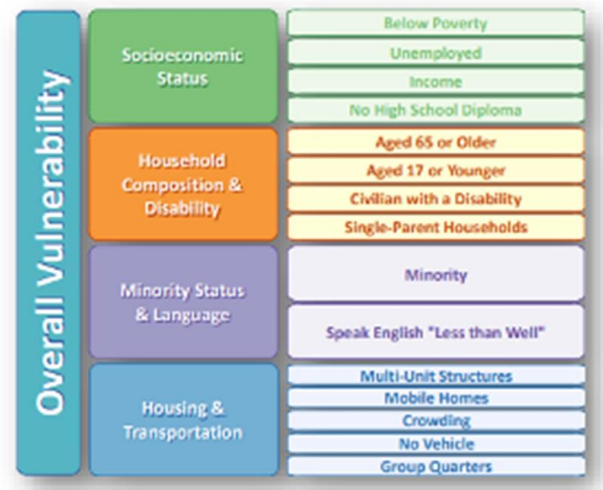
**Final Metric:**

Horizon Index (Sum of Flood Depths \* Multiplier)

- Present Day (Multiplier: 15)
- 2040 Exposure (Multiplier: 10)
- 2070 Exposure (Multiplier: 5)
- 2100 Exposure (Multiplier: 1)



Risk Factor	Weight
Sea Level Rise Effect	0.35
Rain And Sea Level Combo	0.25
Flood Impact Score – sum of flood depths multiplied by “scenario count”	0.15
Flood Scenarios Count – number of floods projected at location	0.1
Avg Flood Depth	0.1
Flood Depth Rank	0.05



**Composite Flood Vulnerability Scores:**

1. Horizon Index
  - Planning horizon/nearest timeline to impact (weight: 0.5)
2. Flood Risk Index
  - Exposure Ranking/overall depth of impacts (weight: 0.3)
3. Social Index
  - Socioeconomic considerations (weight 0.2)

**SENSITIVITY ANALYSIS / STEP 2: SCORING THE ASSETS**

## Asset Ranking based on scores:

- **Top 5%** Highest of all Values = Priority **1**
- **5-10%** of All Values = Priority **2**
- **10-15%** of All Values = Priority **3**
- **15-25%** of All Values = Priority **4**
- **25-50%** of All Values = Priority **5**
- **Less than 50%/Median Value** = Not Prioritized



## Example Assets evaluated:

- Childcare centers
- Evacuation routes
- Local law enforcement
- Conservation lands
- Disaster management facilities
- Shorelines
- Electrical infrastructure (FKEC)
- Water / Wastewater (FKAA)
  - Tanks, pumps, lines, networks, hydrants,
- Gas stations
- City Hall
- Solid Waste debris sites
- Transportation bridges/public access sites
- Cultural and historical facilities
- Marinas and canals
- Local streets

**SENSITIVITY ANALYSIS / STEP 3: ANALYZE  
PRIORITY ASSETS**

# ASSET PRIORITIZATION



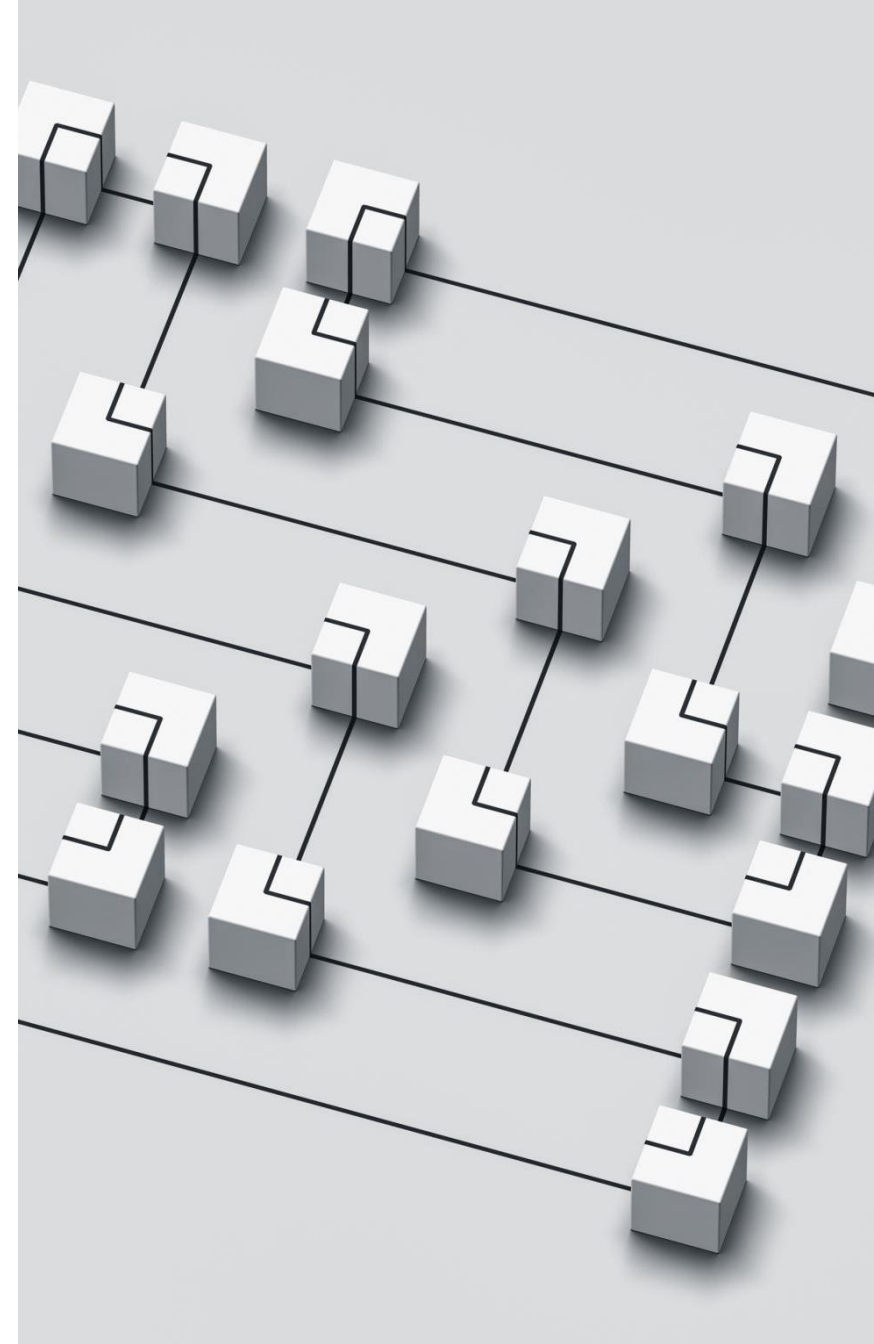
## Example Adaptation Recommendations

- 1) Reinforce critical facilities and utilities to ensure continuous operations during flood events. Provide information to FCAA and FKEC about facilities they own and maintain within the City so that they are aware and can prioritize those assets for resiliency.
- 2) Analyze opportunities to implement flood resiliency measures (water barriers, etc.) for City buildings.
- 3) Work with San Pablo Church to research opportunities to make it more resilient given its dual role both as a place of worship and a resilient emergency shelter, including provisions for food and water storage, emergency power sources, and medical supplies.
- 4) Enhance public outreach on flood awareness for all types of flood events beyond just hurricanes (such as seasonal tides) and determine if flood hazard signage is necessary where roads flood.
- 5) Examine seawall / shorelines and fill policies of the City to incorporate a future elevation requirement upon major rebuilds and retrofits.
- 6) Determine opportunities to enhance stormwater management at low points throughout the City to determine if passive or active drainage projects are needed. (Some of this will be informed by the Watershed Management Plan also).
- 7) Continue participation in partnerships with the County such as the compilation of elevation data and the roads prioritization planning process that are ongoing.
- 8) Explore partnership with municipalities and County for an Adaptation Planning grant to be submitted this summer for the Resilient Florida program (which will provide more detailed information about projects to pursue for grants)

SENSITIVITY ANALYSIS / STEP 4: IDENTIFY  
EXAMPLE ADAPTATION PROJECTS

# DEVELOP MENU OF ADAPTATION STRATEGIES/ RECOMMENDATIONS

- Obtain additional data (more advanced modeling of stormwater system) (*This process has already launched through a FDEM grant fund matched by State funds for this Vulnerability Assessment*)
- Include sea level rise in capital project design through Code or Policy
- Policy updates by linking results into Comprehensive Plan Elements
- Regulatory updates (Design Standards, Floodplain Ordinance)
- Develop project ideas for capital projects (ex: stormwater or floodproof buildings)
- Identify public areas for stormwater management
- Secure funding for Adaptation Plan (Budget and Conceptual costs for design of priority projects to position for future grant applications) through a future planning grant (Apply Summer 2024)
- Link Vulnerability Assessment to emergency and floodplain planning processes (LMS)



**HOW THIS  
ALIGNS  
WITH  
OTHER  
RESILIENCY  
EFFORTS/  
INITIATIVES**



# OTHER RESILIENCY EFFORTS



**CRS Watershed  
Management Plan  
to maintain or  
increase CRS score**



## **Other efforts:**

**Regional collaboration and  
outreach (elevation data  
and roads planning)**

**Cross-jurisdictional  
partnerships**

**SCHEDULE/  
TASKS/  
BUDGET**

**1**

7

8

9

10

11

12

13

**2**

7

8

9

10

11

12

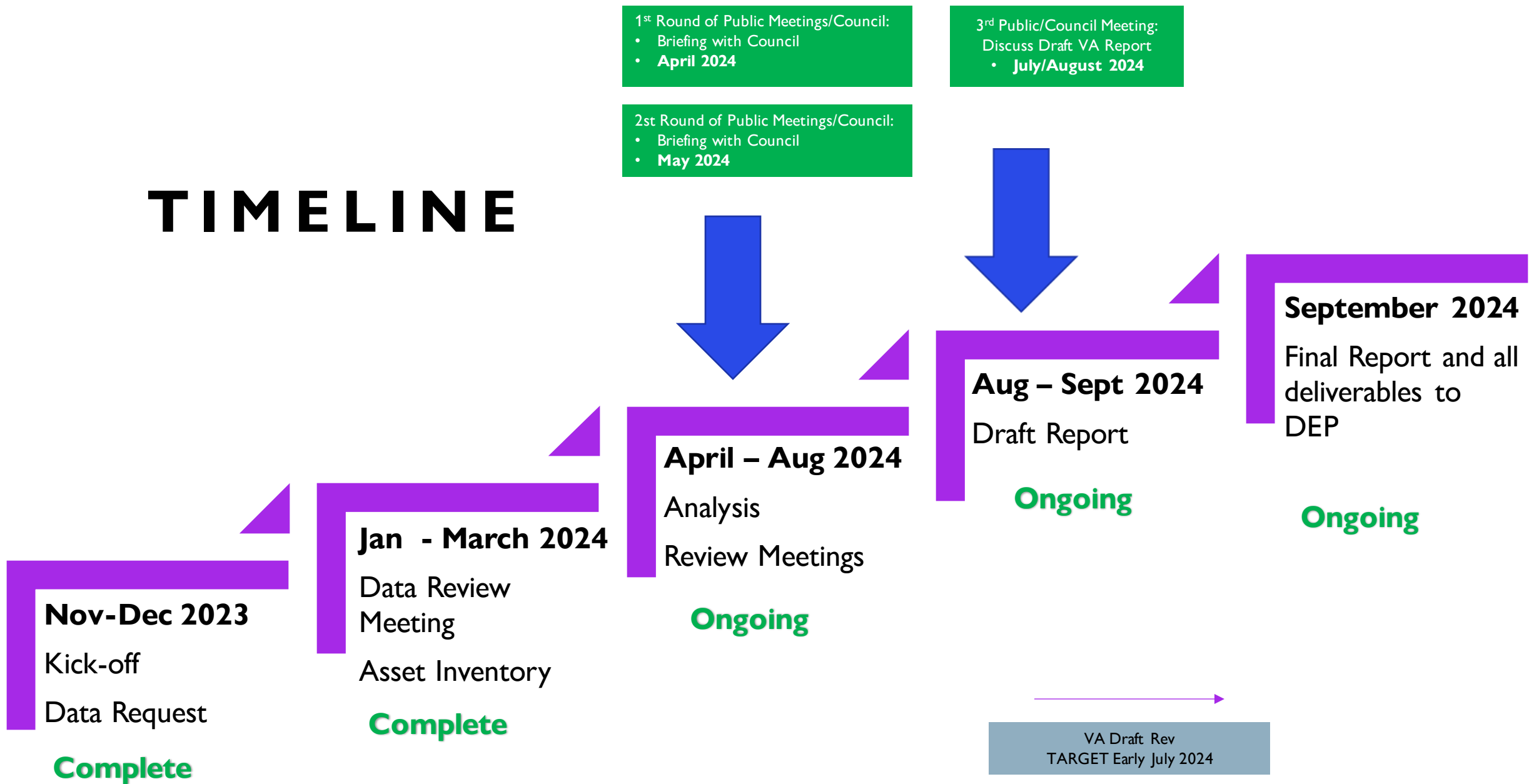
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# NEXT STEPS:

- Finalize QA/QC on assets and inundation maps
- Further develop identified projects
- Draft Comprehensive Plan Coastal Element revisions and provide resiliency recommendations for other elements for coordination with Jim LaRue @ LaRue Planning
- Develop Draft Vulnerability Assessment Report for Review by KCB
- Finalize Vulnerability Assessment Report and produce final deliverables for the State's Grant process for submittal

# TIMELINE



**QUESTIONS?**

