Monroe County Municipalities Roadway Vulnerability Analysis

MONROE COUNTY FLORIDA

Agenda Item No. 3c
City of Key Colony Beach

May 21, 2026

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Agenda

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1. Background on County's Resiliency and Climate Program
2. Present overview on Sea Level Rise Roads Vulnerability Project and receive direction on proposed approach for final Plan to be approved by City Commission
   a. Project approach and status
   b. Vulnerability and Criticality approach used to identify the vulnerable roadway segments
   c. Adaptation Plan and Cost
   d. Engineering concept design evaluation
3. Policy and Implementation
4. Next Steps

Monroe County Municipalities Roadway Vulnerability Analysis

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- What is this Study?
  - A Report outlining a methodology to evaluate what roads are vulnerable to various types of flooding and when they will be impacted
  - It evaluates various types of flood risk and when those risks may impact the City's roads based on their condition, elevation and other factors
  - It provides conceptual designs to address flood risk with cost estimates including drainage features to avoid flooding adjacent properties
  - It provides a prioritized list of projects based on the projected flood risk of the roads that are discretionary to implement
  - It provides policy recommendations for the City to implement the projects and start the discussion about flooding impacts on roads

Monroe County Municipalities Roadway Vulnerability Analysis

- What this Study is not….
  - A required capital program the City must undertake
  - A Plan that the City must take action upon, it is an entirely discretionary list of prioritized road elevation projects
  - A final permitted design for the projects
  - A funding strategy

Sea Level Rise Related Planning Efforts

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Roads Adaptation Plan

- Monroe County Pilot Roads Project, The Sands and Twin Lakes Community (January 2017)
- Un-incorporated County Roadway Vulnerability Study and Implementation Plan (May 2019 – February 2023)

Vulnerability Assessment for County non-Road Assets

- Assessment is being updated separately for habitat, buildings, and infrastructure.
- This has been funded by Resilience Grants in 2020 & 2022

Comprehensive Plan

- Climate and Resiliency Element
- Other amendments as necessary

Grants and Projects awarded

- Numerous Planning and implementation grants awarded since 2021 Resilient Florida program inception

Monroe County Municipalities Roadway Vulnerability Analysis

Scope of Work

Purpose: Develop a long-term roads adaptation plan to mitigate projected Sea Level Rise (SLR) conditions.

In progress

Changing Flooding Conditions That Impact Roads: Sea Level Rise

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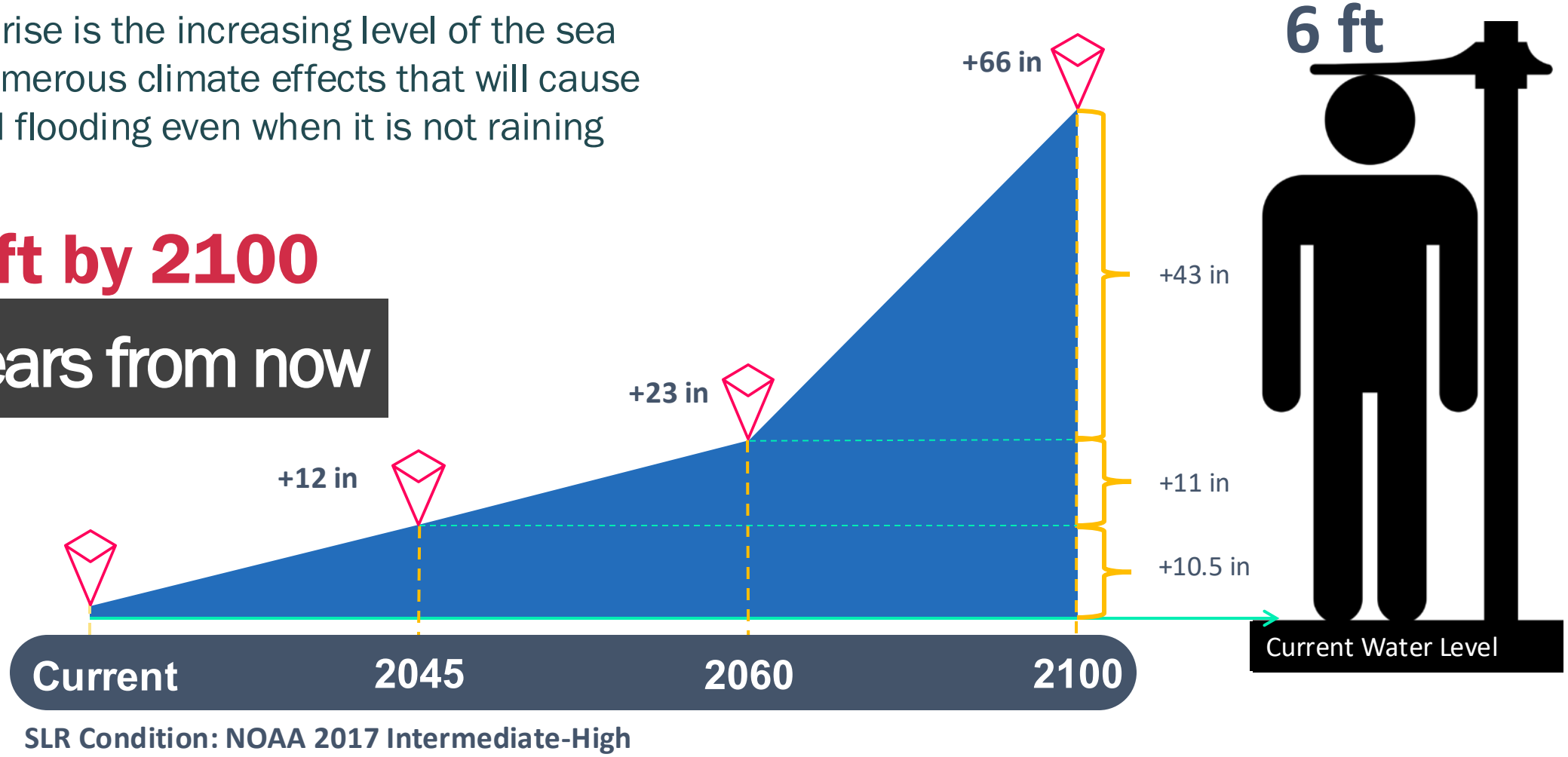
Sea level rise is the increasing level of the sea due to numerous climate effects that will cause increased flooding even when it is not raining

+5.5 ft by 2100

74 years from now



SLR Condition: NOAA 2017 Intermediate-High

Changing Flooding Conditions That Impact Roads: Increasing Groundwater and Reduced Ability to Drain

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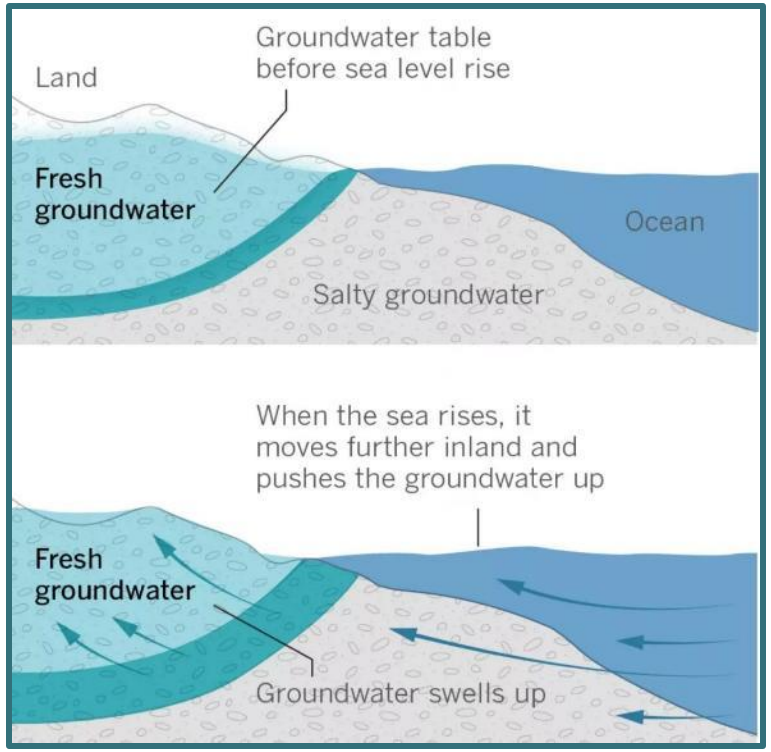
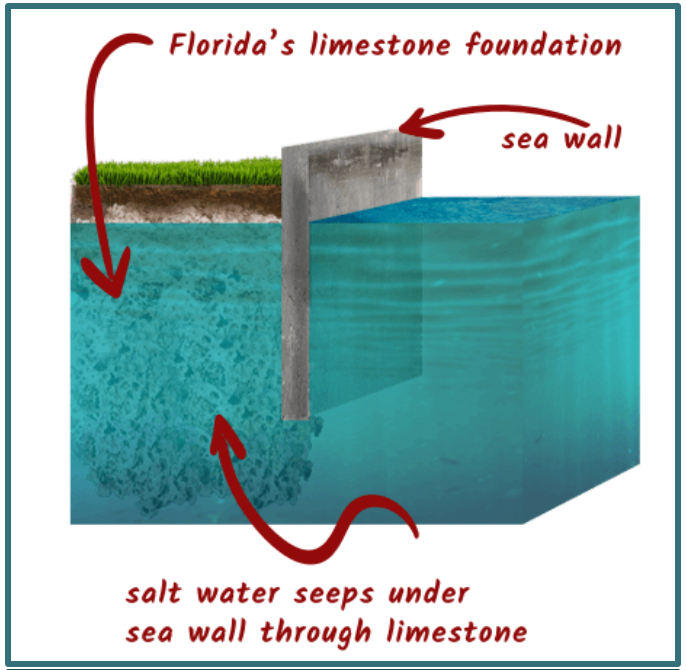
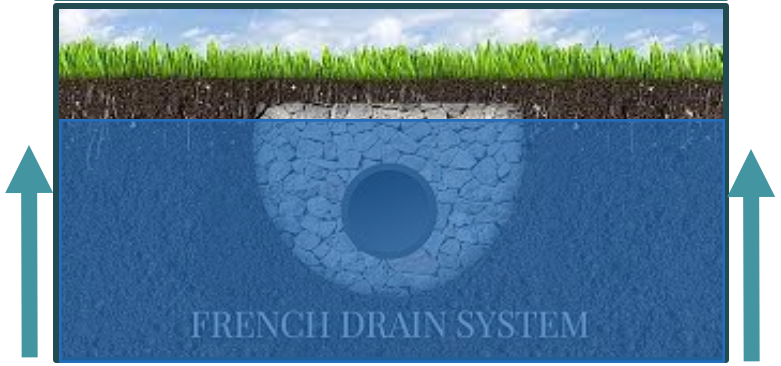
When the sea levels push groundwater up, the ground stays saturated → current gravity drainage systems (such as exfiltration trenches) can't absorb and manage the water.







Roadway Vulnerability and Criticality Analysis

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2 Step Modeling Process using ArcGIS (Vulnerability and Criticality)

- **Vulnerability to Climate Change:** influenced by environmental factors
- **Criticality:** influenced by human and community factors – The people factors

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- Good quality data was used for all roadway segments
- Initial modeling was completed for sea level rise (NOAA 2017 Intermediate-High) to identify roadway segments impacted by still water levels.
- King Tide predictions were evaluated to define those areas impacted beyond the SLR vulnerable areas.
- 2050 Design Year (standard “useful life” of a road project)

Step 1: Vulnerability Assessment - the Technical Considerations

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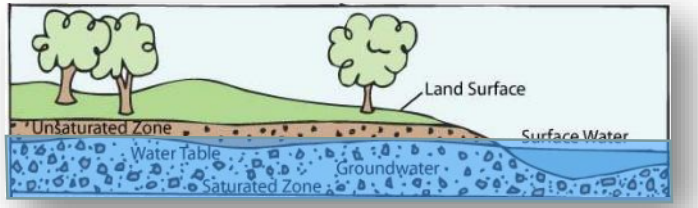
Influenced by Environmental Factors

Vulnerability Evaluation Factors	Weighting Percentages
Roadway Surface Inundation Depth	60%
Roadway Groundwater Clearance	25%
Roadway Inundation Due to Storm Surge	5%
Roadway Surface Wave Impact Potential	5%
Roadway Existing Pavement Condition	5%

1. Surface Inundation Depth (SLR)



2. Groundwater Clearance

4. Surface Wave Impact Potential

3. Storm Surge

5. Roadway Existing Pavement Condition

Vulnerability Assessment Results

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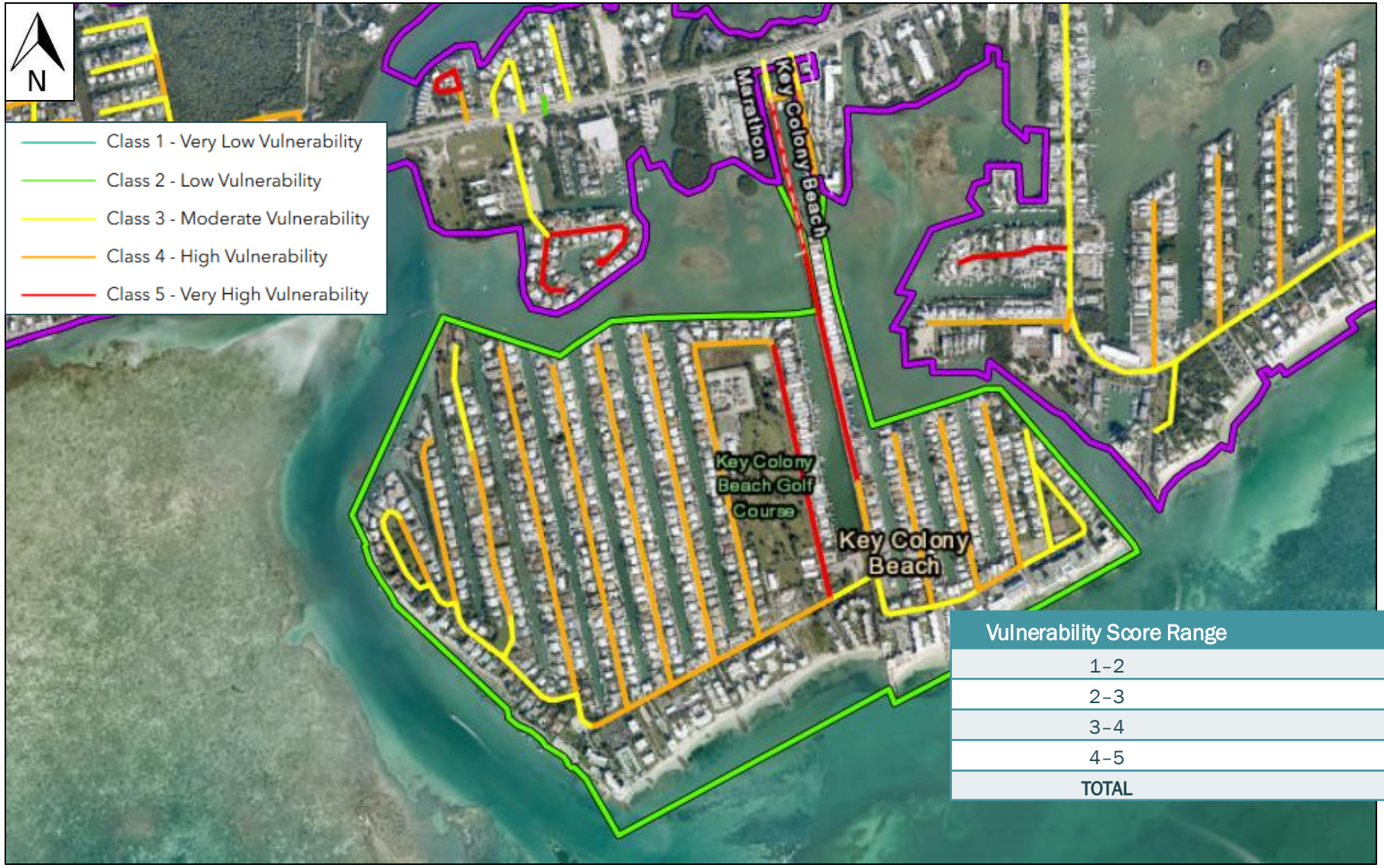

The vulnerability scores become a factor of the Criticality Assessment, and those results become a tool during prioritization to identify an implementation timeline for the recommended project areas to address the vulnerable roadways.

Vulnerability Score Range	Miles	Percent of Overall Study Area
1–2	0.115	1.59%
2–3	2.493	21.81%
3–4	1.325	25.77%
4–5	3.297	50.83%
TOTAL	7.230	100%

Step 2: Criticality Assessment - the Human Considerations

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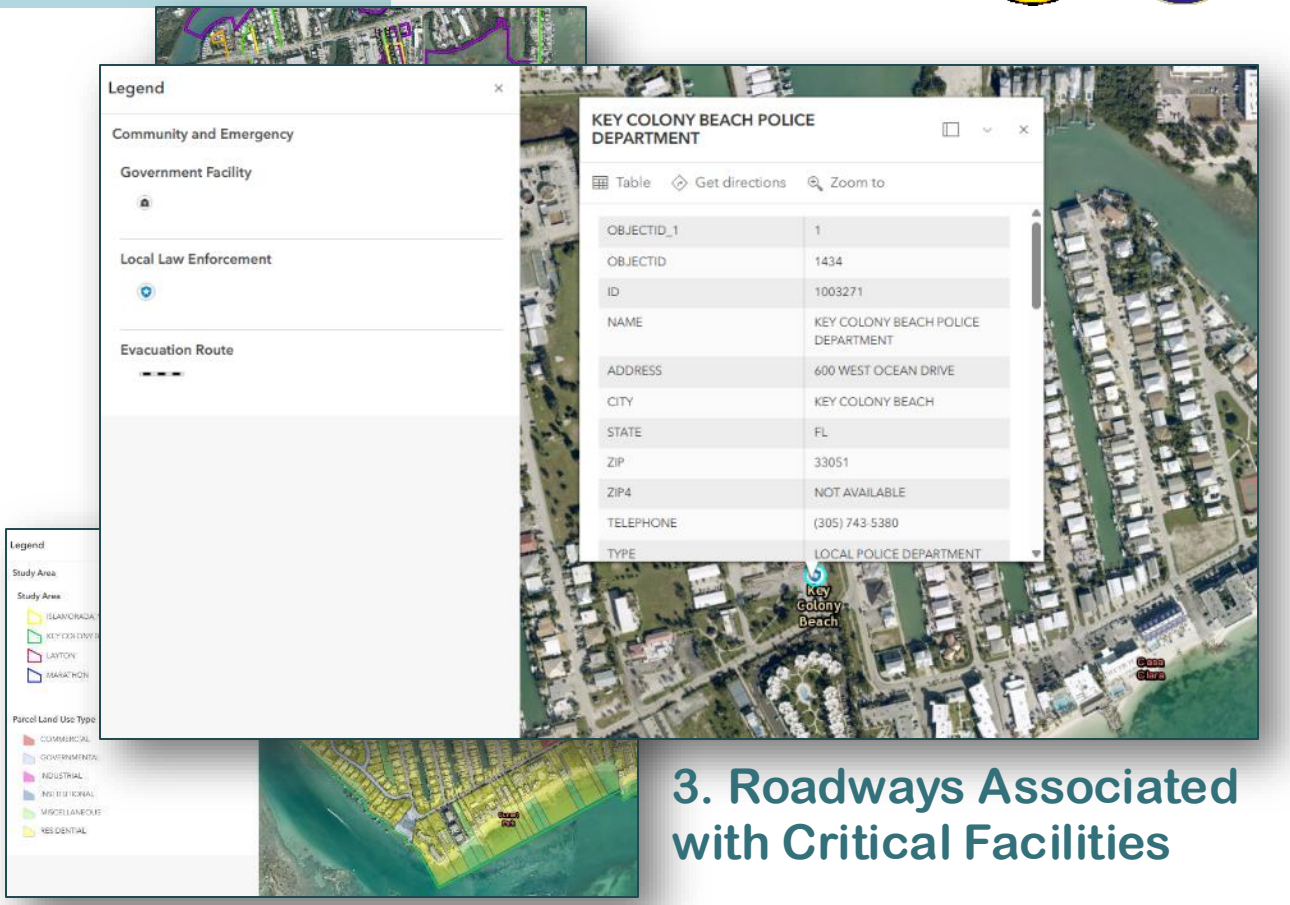
Criticality Score

Step 2

Influenced by Human Factors

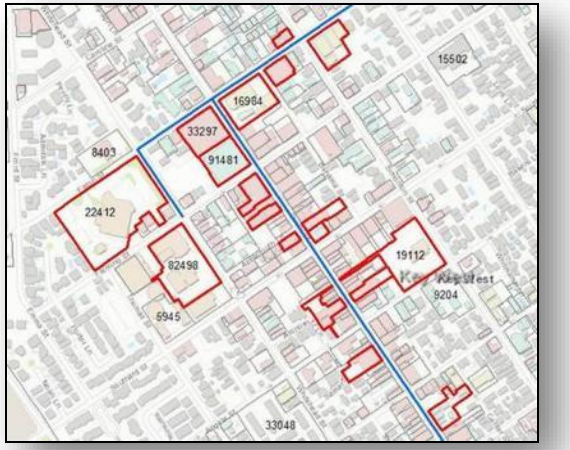
Criticality Evaluations Factors	Weighting Percentages
Vulnerability Score	50%
Number of Residential Units	25%
Roadways Associated with Critical Facilities (Police, Fire, etc.)	10%
Wetlands/Natural Habitats associated with Road Segment	5%
Roadway Functional Classification and Evacuations Routes	5%
Non-Residential Parcel (Commercial Buildings)	3%
T&E and Focus Species Associated with Road Segment	2%



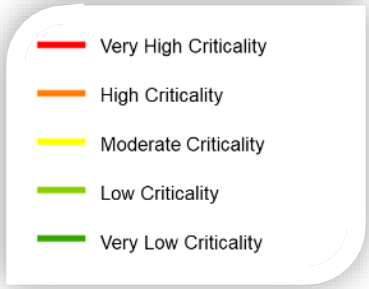
3. Roadways Associated with Critical Facilities

2. Number of Residential Units

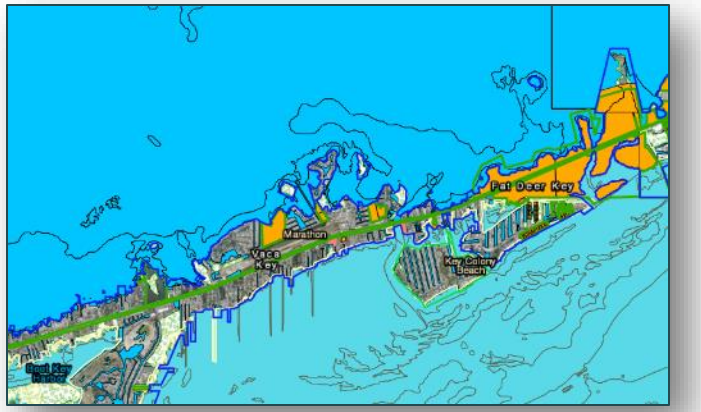
Step 2: Criticality Assessment (Cont.)



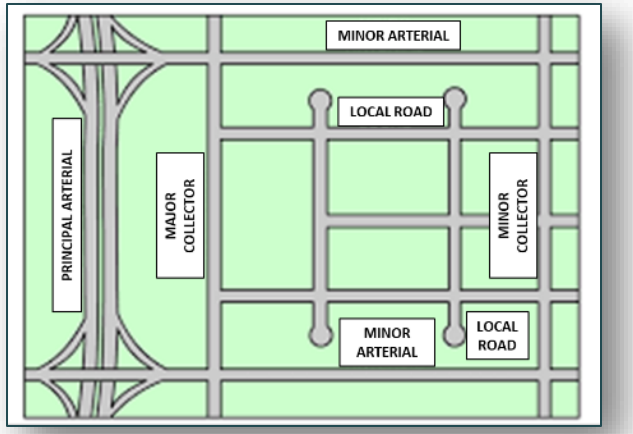
4. Commercial Buildings



5. Threatened, Endangered and Focus Species

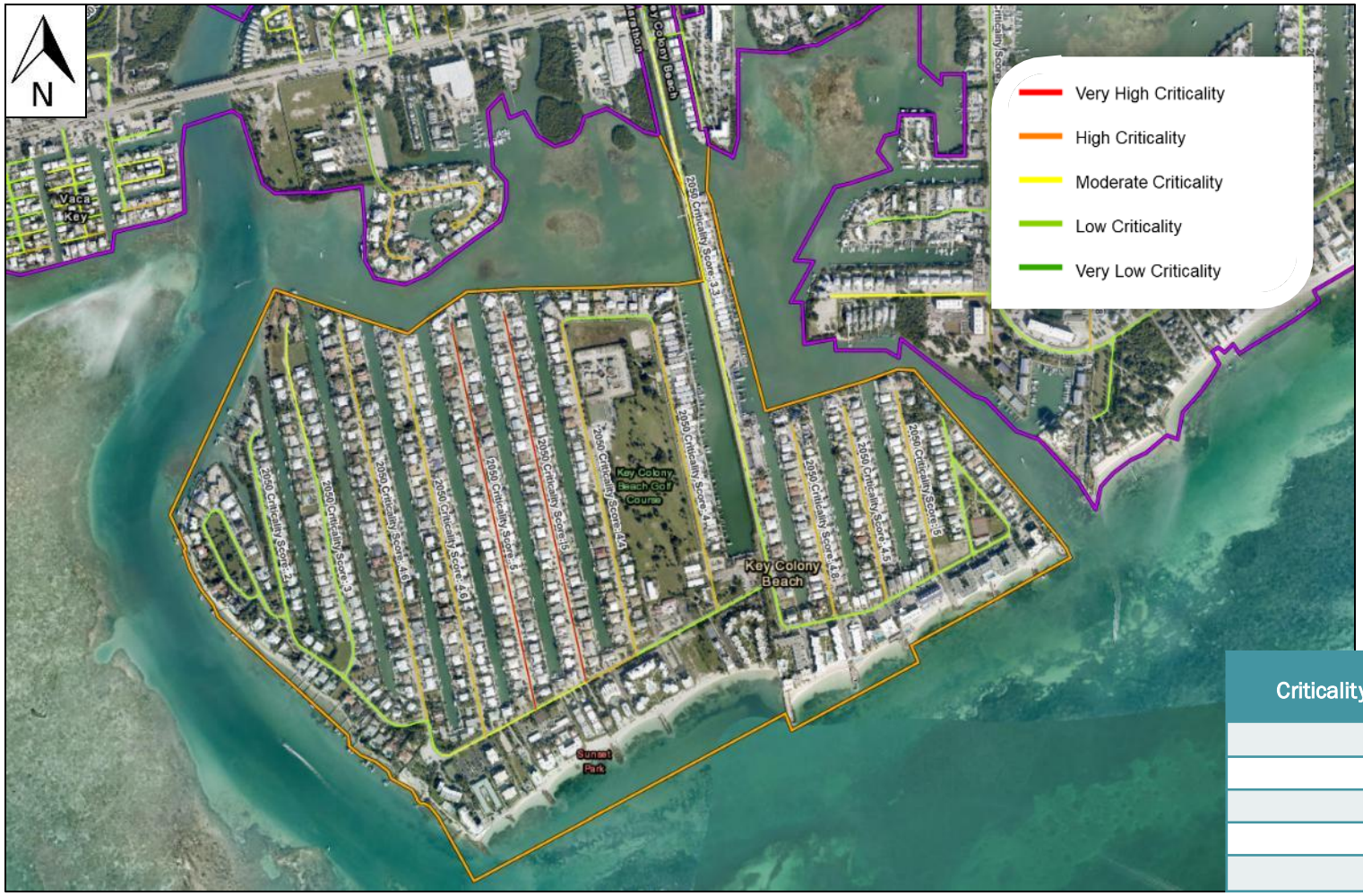


6. Wetlands/Natural Habitats



7. Roadway Functional Classification and Evacuation Route

Criticality Assessment Results



Criticality Score Range	Miles	Percent of Overall Study Area
1-2	0.12	1.59%
2-3	1.58	21.81%
3-4	1.86	25.77%
4-5	3.68	50.83%
Sum:	7.230	100%

Neighborhood Project Areas Summary

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Areas Affected after 2035KT

Areas affected after 2040

Adaptation Plan and Cost

1 Neighborhood area

Areas for 2035

$74,066,602

2 Neighborhood area

Areas for 2040

$ $76,291,587

$153 Million *
(Avg $21 Million / Mile)

Cost does not include Annual Operation & Maintenance

Projected **SLR + King Tides** will affect the following:

(SLR Condition: NOAA 2017 Intermediate-High + King Tides)

2050

*Cost estimate is conceptual and does not include design, right-of-way acquisition, harmonization/cost to cure, and legal fees. Cost estimates are preliminary and subject to change. Cost Estimate is based on 2026 Dollars.

Miles of Vulnerable and Critical City Maintained Roadways	7 MI
Approx. # of Residential Units along City Maintained Roadways	911 Res. Units/Bldgs

Design Considerations

- Future water levels considered in design alternatives
- FDOT (Florida Department of Transportation)
  Florida Greenbook
  - Lane Widths
  - Drop-off conditions
  - Horizontal clearance
  - Front Slopes
- SFWMD (South Florida Water Management District)
  - Project design must demonstrate that changes to rainfall flow patterns do not create adverse impacts to adjacent properties.
- FDEP (Florida Department of Environmental Protection)

Target Elevations
Design Year: 2050
SLR: 2.54’
SLR + KT: 3.68’

Roadway Typical Sections

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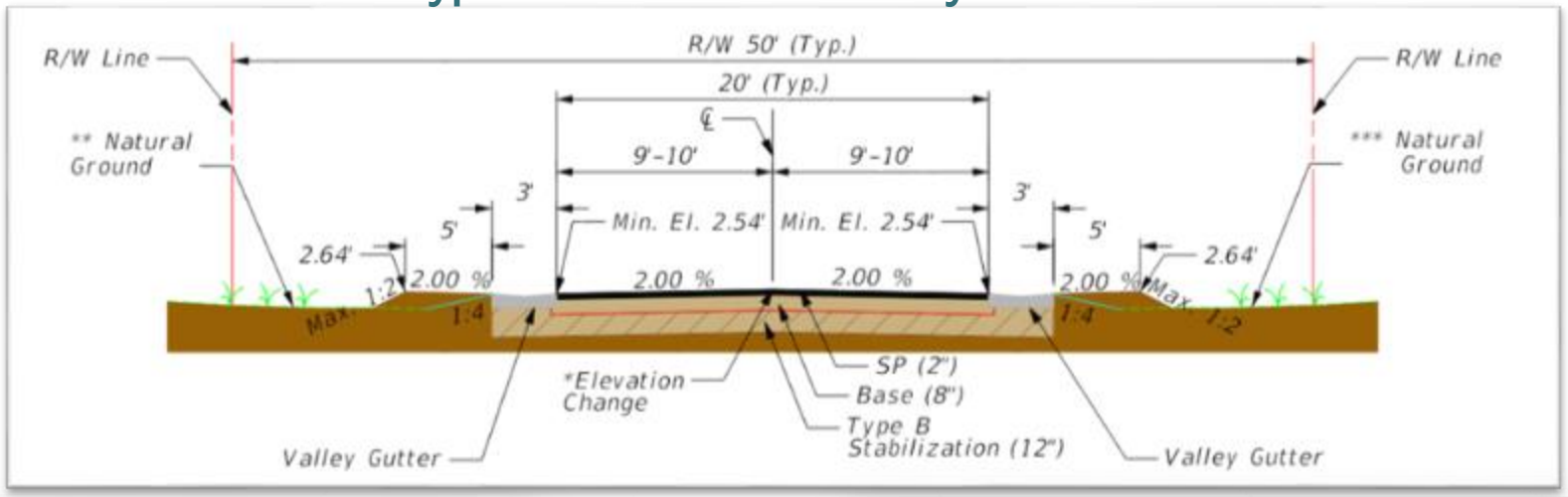
Typical Section 1 – Valley Gutter



Typical Section Example

5th Street

Roadway Typical Sections

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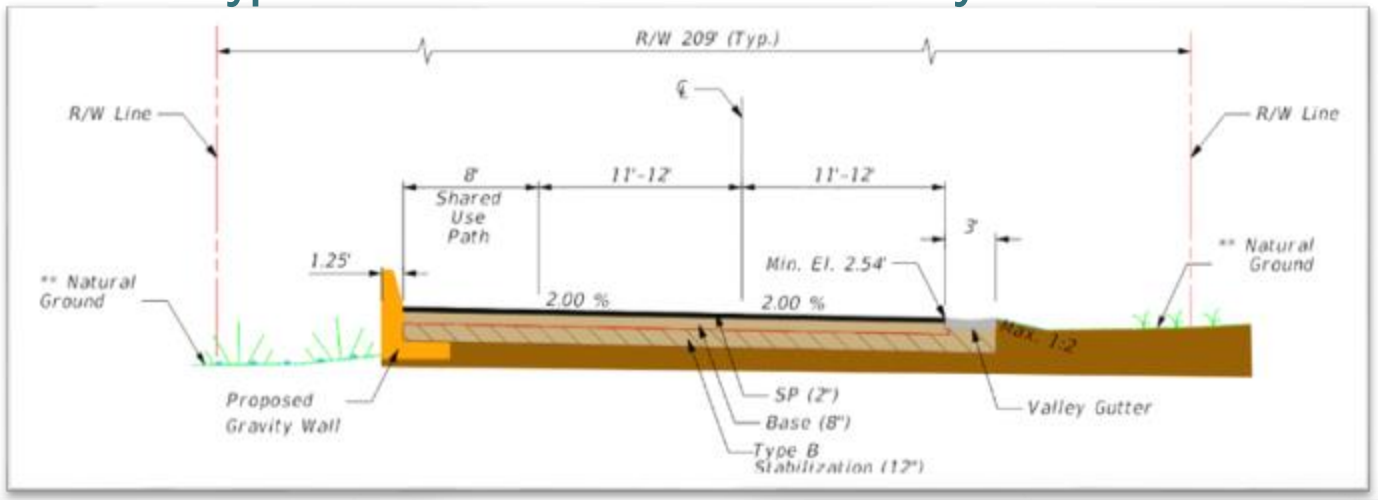
Typical Section 2 – Wall and Valley Gutter

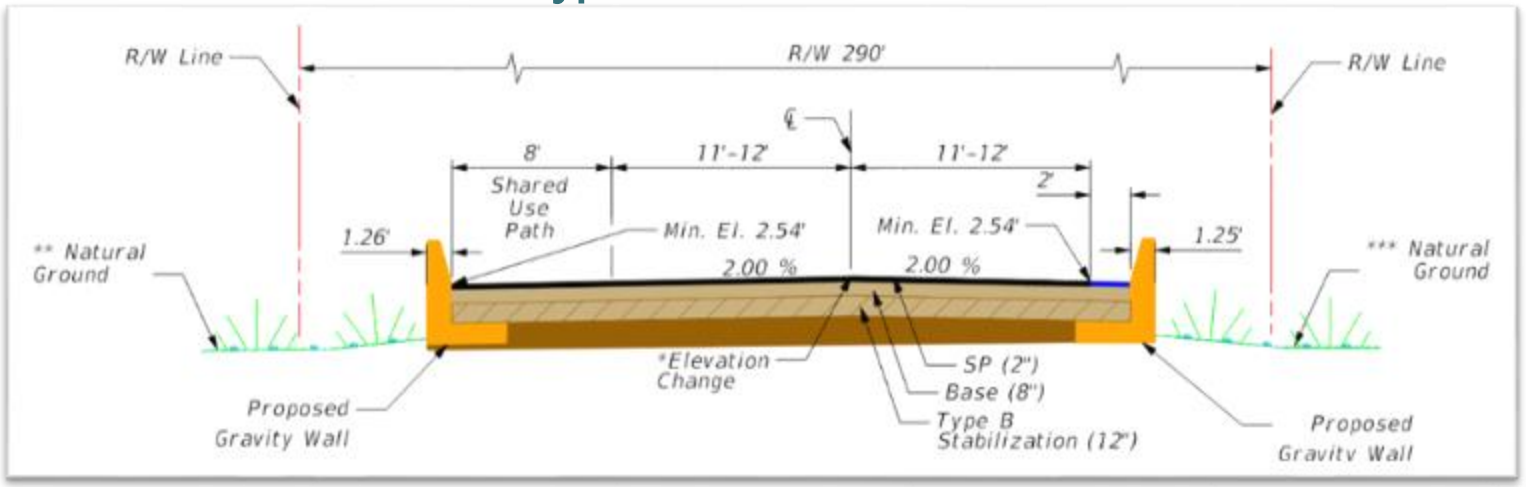


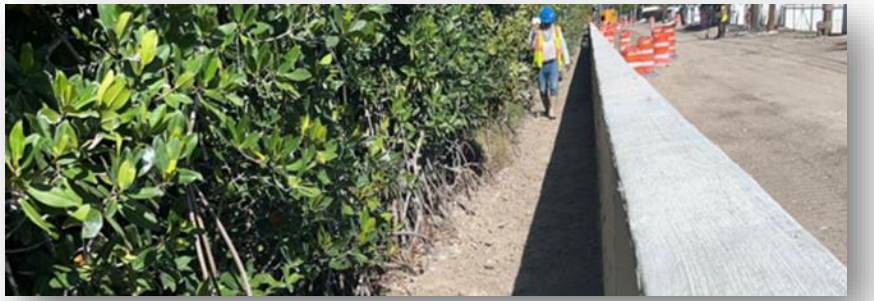
Typical Section Example

Sadowski Cwy

Roadway Typical Sections

Typical Section 3 – Wall





Barrier Wall

Sadowski Cwy

Engineering Stormwater Management System

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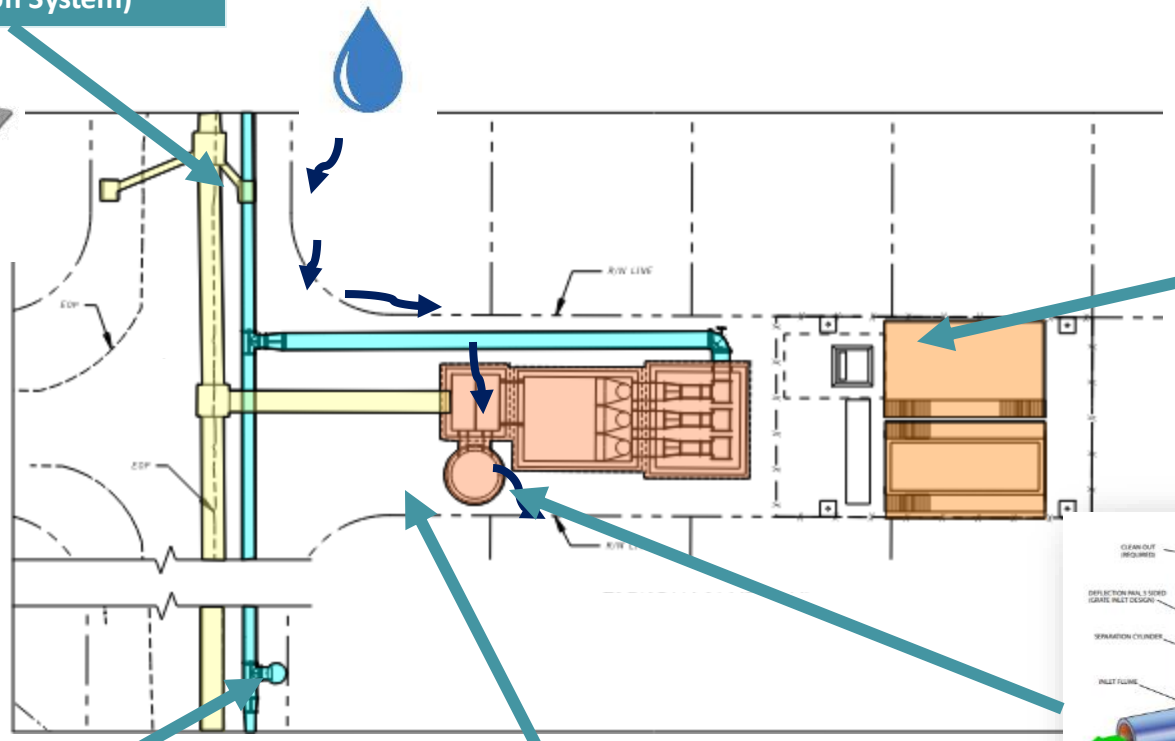
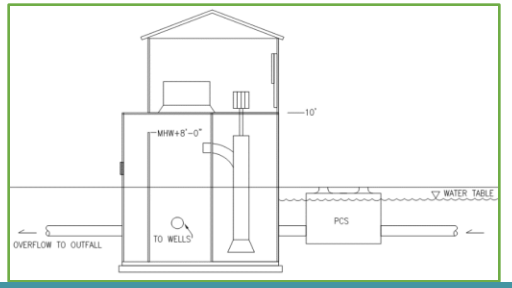
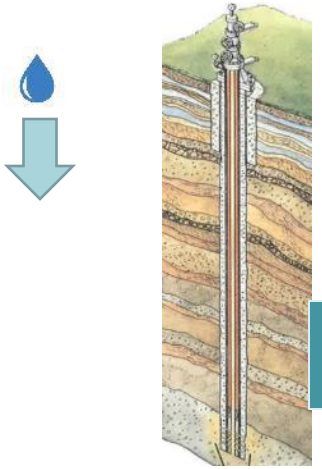
Catch Basins / Inlets (Gravity Collection System)



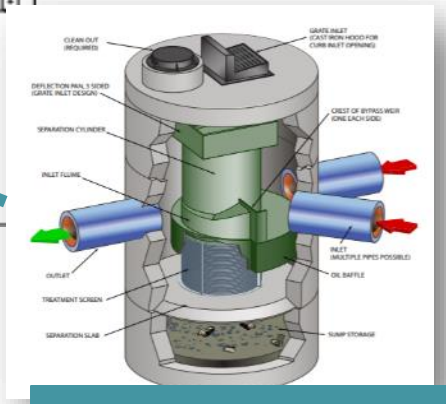


Pump Station and Backup Generator



Injection Wells

Pump Station Area



Hydrodynamic Separator

Policy and Implementation

- *Comprehensive Plan:*
- Capital Improvements Element
- **Objective 1.3 Infrastructure in Coastal High Hazard Area**
- *No funds will be spent by the City for sewer main or street extensions (or capacity increases) in order to avoid subsidizing new development in the coastal high hazard area.*
- Policy 1.3.1 The City's five-year capital improvement schedule shall not include road or sewer line projects that serve to increase land use intensity beyond what is now platted or shown on the Land Use Plan. This limitation shall not include road or other infrastructure adaptation projects to address current and future flood risk. Road elevation feasibility shall be determined considering available right-of-way, adjacent property elevation, community support and cost.

Policy and Implementation

- *Code (relevant provisions):*
- Sec. 101-116. – Public facility improvements.
- (3) Grading. All streets shall be graded and ditched to the full width of the street right-of-way according to specifications established by the city commission.
- (4) Street paving.
  - (a) Width: All streets shall be paved to a width of not less than twenty (20) feet according to the county specifications for subdivision roads.
  - (b) Height: All streets shall be paved to a minimum height of five and one-half (5½) feet above mean sea level as established by United States Coast and Geodetic Mean Sea Level Datum.
- Sec. 101-118. - Street and canal design standards.
- Adjoining street system. Streets in a new subdivision shall make provision for the continuation of existing streets and in adjoining subdivisions.
- Street width. The minimum right-of-way shall be fifty (50) feet.
- (3) Access. Every lot or parcel in a subdivision shall have access to a public street.
- (4) Corner radii. Minimum radii at street intersections shall be twenty-five (25) feet.
- (5) Dead-end streets. Dead-end streets shall terminate in a circle having a diameter of not less than one hundred (100) feet to the property line. The right-of-way around the curve shall be joined to the right-of-way along the street by a curve having at least a fifteen (15) foot radius.
- (6) Other design standards. Meet or exceed the FDOT, Manual of Uniform Minimum Standards for Design, Construction, and Maintenance of Streets and Highways (the "Florida Greenbook"). Road elevation and adaptation projects may meet or exceed FDOT road standards to the extent practicable based on available right-of-way, stormwater improvements, elevations and other factors that may influence design.

Policy and Implementation

- ***Recommendations:***
- *Modify Comprehensive Plan policies as suggested above.*
- *Add a policy to the Transportation and Capital Improvements Elements that the City is pursuing road elevation projects to address current and increasing flood risk considering right-of-way, stormwater and surrounding property elevation issues on a project by project basis. In some instances, roads may be elevated to address that risk, in some instances the City may choose to only perform continued maintenance and not adapt the road to current and future flood risk.*
- *Modify Code language in Article 101-18 to acknowledge that the Greenbook standards shall be adhered to the extent practicable, depending on right-of-way and road elevation design goals.*

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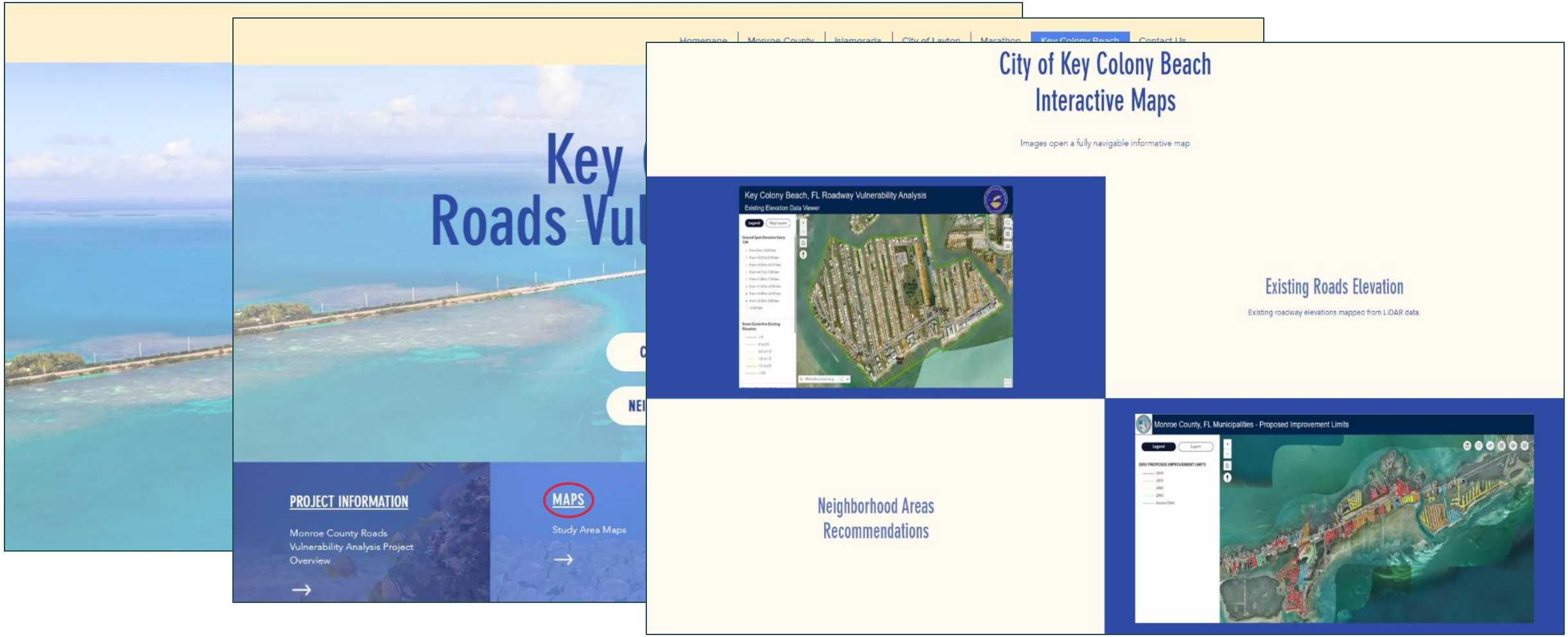

Next Steps

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PROJECT GOALS:

1. Help make the City more resilient by developing a long-term roads adaptation plan to mitigate projected Sea Level Rise impacts on roadways.
2. Develop planning level cost estimate for Citywide roadway adaptation.
3. Provide supporting technical information to facilitate roadway adaptation projects.

Yet to come...

Task 6:
Final Report and Implementation Plan

Final Report and Implementation Plan (June 2026)