Monroe County Roadway Vulnerability Case Study – Key Largo

June 25, 2020

Rhonda Haag
Chief Resilience Officer
Monroe County
Presentation Outline

I. Overview of Countywide Project
II. Sea Level Rise Projections
III. Stillwright Point Analysis
IV. Policy Discussion
V. Next Steps
**Countywide Roadway Vulnerability Study and Capital Plan**

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

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Data Collection</td>
</tr>
<tr>
<td>2</td>
<td>Engineering Analysis</td>
</tr>
<tr>
<td>3</td>
<td>Concept Development</td>
</tr>
<tr>
<td>4</td>
<td>Policy Review &amp; Regulations</td>
</tr>
<tr>
<td>5</td>
<td>Stakeholder &amp; Public Outreach</td>
</tr>
<tr>
<td>6</td>
<td>Implementation Plan</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Length of County Maintained Roads</th>
<th>1,658,221.0 Feet</th>
<th>314.06 Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>County Roads Spread Throughout 21 Different Keys, non-linear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total of 1202 Roadway Segments Throughout Project Limits</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[www.keysroadsplan.com](http://www.keysroadsplan.com)

6/25/2020
SE FL Climate Leadership Compact
Updated Projections Released December 2019

NOAA Intermediate-High SLR is projected to be the following:

- MHHW Elevation relative to 2000 MSL
  - Naples Tide Gauge
  - 7.2” (0.6’) NAVD88
- 9 inches by 2025 – up to 1.37’ NAVD88
- 17 inches by 2040 – up to 1.99’ NAVD88
- 31 inches by 2060 – up to 3.16’ NAVD88
How Sea Level Rise will impact Stillwright Point
How Sea Level Rise will impact Stillwright Point

Center lane
(NOAA Intermediate-High)

2035

2045

2060

3.0’ of depth
How Sea Level Rise will impact Stillwright Point

S. Blackwater lane
(NOAA Intermediate-High)

2035: 0.25’ of depth

2045: 0.7’ of depth

2060: 1.6’ of depth
**Existing Conditions in Stillwright Point**

**Existing Conditions / King Tide Flooding**

- All water front properties
- Low roadway and private property elevations
- 1/3 of roadway length abuts natural ground areas
- Blackwater Sound NOAA tidal BUOY sets **street flooding at approximately 0.40’ (4.8”) NAVD88**. On October 8, 2019 it reached 1.03’ NAVD88.
- Frequency of neighborhood flooding expected to increase with future sea level rise.

Pink highlighted areas denote areas susceptible to SLR flooding.
Engineering Analysis

Evaluation of:
- Years 2025, 2030, 2035, 2040, 2045, 2060, and 2100.
- Sea Level Rise and King Tide Predictions
- Roadway LiDAR
- Storm surge
- Wind waves
- Extreme events

Data allows us to:
- Projected Water Surface Elevations
- Conduct Vulnerability/Prioritization Evaluation
King Tide Flooding today vs consistent impacts from projected SLR (NOAA Intermediate-High)

**Perimeter Elevation Analysis**

- **2020** – King Tide conditions. Vacant parcels, natural areas, and b/w homes with EL. below ±1.5’ NAVD88.

- **2025** – Consistent inflow of sea water through Vacant parcels, natural areas, and b/w homes with EL. below 1.37’ NAVD88. (20 locations)

- **2035** - Consistent inflow of sea water through Vacant parcels, natural areas, and b/w homes with EL. below 1.79’ NAVD88. (66 locations)

- **2045** - Consistent inflow of sea water through Vacant parcels, natural areas, and b/w homes with EL. below 2.26’ NAVD88. (112 locations)
Stillwright Point Solution: Raising the road...

Installing curb & gutter with Pump/Injection Well System – Roadway Target EL. 1.87’ NAVD88 (0-1.75’ EL. Difference)

With flush shoulders above natural ground and Pump/Injection Well System - Roadway Target EL. 3.26’ NAVD88 (0.7’-3.15’ EL. Difference)

Alternative 1

Alternative 2
Flush shoulders at natural ground level and Pump/Injection Well System - Roadway Target EL. 2.26’ NAVD88 (0-2.15’ EL. Difference)

With French Drain System - Roadway Target EL. 0.9’ NAVD88 (0-0.88’ (10.5”) EL. Difference)
Alt. 4 - Would adding a couple of asphalt inches and installing an exfiltration drainage system work?

- How will it perform?
  - Minimum short term benefits
  - With or w/o drainage features, salt water flooding will still occur along the roadsides
  - With or w/o drainage features condition will be exacerbated by rain events
  - Flooding will accelerate roadway deterioration (By 2035 95% of roadways will be in Poor Conditions)
The solution to sea level rise
Accessibility Evaluation

• Driveway Connection
• Pedestrian Accessibility
Summary of Alternatives – What’s Next

- Evaluated Alternatives that enable transportation accessibility beyond 2045
- Work in partnership with private properties for long term resiliency
- Completion of the County wide study, including the Stillwright Point analysis, will enable a complete understanding of the areas of concern and overall adaptation improvements

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max elevation raising of the road</td>
<td>1.75'</td>
<td>3.15'</td>
<td>2.15'</td>
<td>0.88'</td>
</tr>
<tr>
<td>Front Yard Encroachment</td>
<td>0' to 8.5'</td>
<td>6' to 13'</td>
<td>0' to 7.5'</td>
<td>No Impact</td>
</tr>
<tr>
<td>Initial Investment</td>
<td>$20,195,708.31</td>
<td>$20,077,976.56</td>
<td>$21,060,147.60</td>
<td>$ 2,697,283.3</td>
</tr>
<tr>
<td>Annual O&amp;M Cost</td>
<td>$ 17,662.00</td>
<td>$ 9,600.00 - 17,662.00</td>
<td>$ 180,000.00</td>
<td>--</td>
</tr>
</tbody>
</table>
Summary of Stillwright Point

• Challenging Existing Conditions:
  • Low roadway and private property elevation
  • Limited Right-of-Way and number/location of Utilities
  • Increasing Sea Level Rise conditions

• Evaluated 4 Alternatives that address the roadway
  • Alt. 4 - does not provide extended benefit
  • Alt. 3 – concern with functionality and permitting requirements
  • Alt. 1-2 - Provision of long term accessibility

• Partnership with residents for long term resiliency goal
Thank You!