Rhonda Haag
Chief Resilience Officer
Monroe County

Monroe County
Roadway Vulnerability Case Study – Key Largo

June 25, 2020
I. Overview of Countywide Project
II. Sea Level Rise Projections
III. Stillwright Point Analysis
IV. Policy Discussion
V. Next Steps
Purpose: Develop a long-term roads adaptation plan to mitigate projected Sea Level Rise (SLR) conditions.

<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>
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</tbody>
</table>

www.keysroadsplan.com
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)
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
Existing Conditions in Stillwright Point

King Tide Flooding today vs consistent impacts from projected SLR (NOAA Intermediate-High)

- **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)*
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)
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 Raising the road with curb &amp; gutter with Pump/Injection Well System</th>
<th>Alternative 2 Raising the road with flush shoulders above natural ground and Pump/Injection Well System</th>
<th>Alternative 3 Raising the road with flush shoulders at natural ground level and Pump/Injection Well System</th>
<th>Alternative 4 Raising the road with French Drain System</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>
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<td>Initial Investment</td>
<td>$20,195,708.31</td>
<td>$20,077,976.56</td>
<td>$21,060,147.60</td>
<td>$2,697,283.3</td>
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<td>Annual O&amp;M Cost</td>
<td>$ 17,662.00</td>
<td>$ 9,600.00 - 17,662.00</td>
<td>$ 180,000.00</td>
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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!