Managing and Measuring Change

A Local Perspective
Jeremy Hardison
Planning & Development Director
How did we get here?

[Map with markers for Cape Fear River, Snow’s Cut, and Carolina Beach]

[Image: Historical photo of inland waterway]
Issue
Shoreline Protection
Problem
Monitored & Data Collection

North Carolina KING TIDES PROJECT

Help us visualize future sea levels along Coastal North Carolina

Take a look at the gauge & note water level
Snap a photo
Submit photos & report water level at bit.ly/ncktides

Latitude 30.123456
Longitude -80.567890

Learn more at NCKingTides.web.unc.edu

UNC

Dead End

King Tide Gauge

Water level indicators

Flooded street
Tides
Warning Systems
Canal Drive Flooding Advisory Committee

• Promote awareness of and solve issues related to tidal and stormwater flooding

• To form a visible, vocal and effective coalition of residents, engineers, roadway and stormwater experts to be advocates for improving systems to limit the negative impacts of tidal and stormwater flooding.

• Recommend town ordinances that improve the community’s ability to deal with potential sea level rise.

• To develop and implement education program for citizens, visitors and drivers of motor vehicles about the hazards of traveling through flood waters.
Study

1. Create a Bulkhead Ord.

2. Study to recommend bulkhead elevation height to mitigate overtopping

3. Evaluate the elevations and conditions of the bulkheads.

4. To implement a long-term monitoring program aimed at better understanding tidal fluctuations and rainfall totals driving flooding events.

Goal: Develop practical recommendations to reduce the risks of flooding (public and private properties) within the project area

Aim to **REDUCE** flooding and **IMPROVE** resiliency over a 30-year planning horizon, the recommendations are **NOT** intended to **PREVENT** all flooding
WATER LEVEL PROJECTION

Sea level rise modeling and analyze return periods of extreme events to develop a recommendation for a minimum bulkhead height for the next 30-year horizon.
Water level projections

Recommend using water level elevations associated with 1-Year and 2-Year return periods to mitigate the flooding impacts to Canal Drive and Florida Avenue that occur during high tide events.

Summary of Design Planning Water Elevation Projections

<table>
<thead>
<tr>
<th></th>
<th>Low Range (1-year Return Period)</th>
<th>Mid Range (1-year Return Period)</th>
<th>Upper Range (2-year Return Period)</th>
</tr>
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<tbody>
<tr>
<td>SLR 1992-2018 (ft.)</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
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<tr>
<td>IPCC RCP 2.6 (ft.)</td>
<td>0.49</td>
<td>0.49</td>
<td>-</td>
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<tr>
<td>IPCC RCP 8.5 (ft.)</td>
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<td>-</td>
<td>0.58</td>
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<tr>
<td>Storm Effects (ft. NAVD)</td>
<td>4.0</td>
<td>4.0</td>
<td>4.4</td>
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<tr>
<td>Structure Freeboard (ft.)</td>
<td>0.0</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>2048 Design Elev. (ft. NAVD)</td>
<td>4.7</td>
<td>5.2</td>
<td>5.7</td>
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</table>
Surveys conducted

- Bulkhead Elevation Surveys
- Bulkhead Condition Survey
- Stormwater Outfall & Inlet Surveys
- Shoreline Video
### Bulkhead Condition Summary

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Satisfactory</th>
<th>Fair</th>
<th>Poor</th>
<th>Serious</th>
<th>Critical</th>
<th>No Structure</th>
<th>Not Rated</th>
<th>All</th>
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<tr>
<td>Public</td>
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<td>3</td>
<td>5</td>
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<td>0</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>15</td>
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<tr>
<td>Private</td>
<td>7</td>
<td>50</td>
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<td>4</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>7</td>
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<tr>
<td>Total</td>
<td>7</td>
<td>53</td>
<td>55</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>9</td>
<td>144</td>
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91% privately owned 91
83% of the private bulkheads in fair to good condition
3% poor condition.
Bulkhead Evaluations

Bulkhead Elevations:

TOTAL STRUCTURES/SHORELINES: 144

- 72% below Low Range 30-Year Planning Elevation
- 90% below Mid Range 30-Year Planning Elevation
- 97% below High Range 30-Year Planning Elevation

PUBLIC STRUCTURES/SHORELINES: 15

- 73% below Low Range 30-Year Planning Elevation
- 87% below Mid Range 30-Year Planning Elevation
- 93% below High Range 30-Year Planning Elevation
Duckbill backflow prevention devices were observed to be encrusted with oysters and barnacles that inhibit proper sealing of the valves.

Debris or trash can get caught in the opening and prevent the duckbill valve from sealing properly.

The WaStop® inline check valves that were observed appeared to be unobstructed with marine growth or debris and functioning properly at the time of the observations.
WATER LEVEL/RAIN GAUGE MONITORING STATION

Proposed Weather Station Site
Myrtle Grove Sound @ Canal Dr & Sandpiper Ln

Current Conditions (updated every 10 minutes)

- Air Temperature: 68.7 F
- Relative Humidity: 24 %
- Barometric Pressure: 939.30 mBars

- Wind Speed: 7 MPH
- Wind Direction: 292 DegsN
- Wind Gust: 8 MPH

Rainfall (since midnight & previous day): 0.011 In. 11.000 In.

Water Elevation

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<tr>
<th>Ft. (NAVD88)</th>
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<td>12.00</td>
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<td>10.00</td>
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01/30 10:15 01/30 10:30 01/30 10:45 01/30 11:00 01/30 11:15 01/30 11:30
Date & Time
Water level/Rain Monitoring
Recommendations

• A comprehensive cost estimate should be developed to include the completion of bulkhead improvements to the design elevation, Installation of bulkheads at locations currently without a structure

• Installation of WaStop® Inline Check Valves backflow prevention devices at the remaining outfall locations along the Carolina Beach Yacht Basin,

• Re-lining the stormwater pipe network, Repair leaks, and other structural improvements

• Evaluate the impacts of abandoned outfalls and seal if needed

• Routine maintenance of stormwater system, including check valves

• The Town should also consider promoting stormwater initiatives that can be implemented by local Private Property

  1) the improvement and/or installation of gutter systems on private homes,

  2) the use of permeable pavements for driveway aprons and any areas typically covered by impervious materials to reduce the amount of impervious surfaces and

  3) the use of private stormwater storage systems (above or below ground) to retain stormwater on the property during an event that is slowly released following the event.
Multi-year implementation cycle

Data Collection
(Water Level/Weather and Public Flood Info)

Data Analysis / Priority Recommendations

Implementation of FY 19/20 Recommendations

Implementation of FY 20/21 Recommendations

Implementation of FY 21/22 Recommendations

Set Budget

$\text{Improvements Needed}$

$\text{Improvements Needed}$

$\text{Improvements Needed}$
Carolina Beach Dune Infiltration Project

Collect stormwater along Canal Street and pump to dunes on north side of Freeman Park. Replace underground utilities and bury overhead utilities in project area along Canal St.
<table>
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<th>Lunar Perigee</th>
<th>Super Full Moon</th>
<th>Super New Moon</th>
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