Department of Public Works

Commerce Road Flooding

September 12, 2018
Outline

• Background
• Existing Conditions
• What Have We Done
• What Are We Doing
• What Do We Expect To Do
• Discussion
Background – Commerce Road Development

Aerial Photo: 1938/1941

Aerial Photo: 1968

Town of Barnstable, Department of Public Works
Background – Commerce Road Development

Aerial Photo: 1989

Aerial Photo: 2014
Background – Sea Level

Past and Projected Changes in Global Sea Level

Figure 7: Estimated, observed, and possible future amounts of global sea level rise from 1800 to 2100, relative to the year 2000. The orange line at right shows the currently most likely range of sea level rise of 1 to 4 feet by 2100 based on an assessment of scientific studies, which falls within a larger possible range of 0.66 feet to 6.6 feet. Source: Melillo et al. 2014 and Parris et al. 2012.

Source: NOAA National Centers for Environmental Information | State Summaries 149-MA
Background - Precipitation

Observed Number of Extreme Precipitation Events

Source: Northeast Regional Climate Center at Cornell University

https://statesummaries.nci.cs.org/ma

Town of Barnstable, Department of Public Works
Background – Storm Recurrence Interval

Massachusetts - Statewide Average
Change in 100-Year 24-hour Duration Storm (NOAA 14 vs TP40)

The TP40 (1961) 100-year storm is now approximately a 30-year storm.

Massachusetts Department of Environmental Protection (May 2017)

Town of Barnstable, Department of Public Works
Background – FEMA Flooding

FEMA Flood Zones: 1992 vs. 2014
Background – Storm Surge

Storm Surge Model:
3 feet above High Tide
Background – Storm Surge

Storm Surge Model:
7 feet above High Tide
Background – Storm Surge

Storm Surge Model:
10 feet above High Tide
Background – Storm Surge
Town Wide
Exiting Conditions – Road Storm Drain System

Drainage Infrastructure

Town of Barnstable, Department of Public Works
What Have We Done?

• Cleaned and Inspected all drainage basins
• Inspected the Maraspin Creek culvert including an internal video inspection
• Evaluated the drainage system capacity
• Begun a Hydrologic & Hydraulic study for the Maraspin Creek System
What Are We Expecting To Do?

• With modeling results, investigate engineering solutions that could mitigate some storm surge issues
  – Enlarging the culvert
  – Gating the end of the creek and extending the bulkhead
  – Raising the road/Installing a berm
Discussion?
Elevation:
Feet above Sea Level

Town of Barnstable, Department of Public Works
Predicted Hurricane Flooding

By Aerial Photography, one of the first areas to be developed.

SLOSH Storm Surge by Hurricane Category

Town of Barnstable, Department of Public Works
Observed Annual Precipitation

Total Annual Precipitation (inches)

Massachusetts

5-year Period


Source: NOAA National Centers for Environmental Information | State Summaries 149-MA
Observed and Projected Annual Number of Tidal Floods for Boston, MA

- Higher Emissions
- Lower Emissions
- Observed

Tidal Floods (Days/Year)

- Vertical axis: 0 to 400
- Horizontal axis: 1920 to 2100

Bar graph showing the increase in tidal floods with time, with projected higher and lower emissions compared to observed data.
# Extreme Precipitation Tables

**Northeast Regional Climate Center**

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

<table>
<thead>
<tr>
<th>Smoothing</th>
<th>Yes</th>
</tr>
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<tbody>
<tr>
<td>State</td>
<td>Massachusetts</td>
</tr>
<tr>
<td>Location</td>
<td></td>
</tr>
<tr>
<td>Longitude</td>
<td>70.321 degrees West</td>
</tr>
<tr>
<td>Latitude</td>
<td>41.699 degrees North</td>
</tr>
<tr>
<td>Elevation</td>
<td>0 feet</td>
</tr>
<tr>
<td>Date/Time</td>
<td>Tue, 11 Sep 2018 10:55:43 -0400</td>
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</table>

## Extreme Precipitation Estimates

|      | 5min | 10min | 15min | 30min | 60min | 120min | 1hr   | 2hr   | 3hr   | 6hr   | 12hr  | 24hr  | 48hr  | 1day  | 2day  | 4day  | 7day  | 10day |
|------|------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1yr  | 0.29 | 0.45  | 0.56  | 0.73  | 0.92  | 1.16   | 0.79  | 1.16  | 1.34  | 1.70  | 2.17  | 2.78  | 3.15  | 2.46  | 3.03  | 3.48  | 4.01  | 4.62  |
| 2yr  | 0.37 | 0.57  | 0.71  | 0.93  | 1.17  | 1.47   | 1.01  | 1.39  | 1.70  | 2.12  | 2.64  | 3.28  | 3.67  | 2.90  | 3.53  | 4.01  | 4.74  | 5.37  |
| 5yr  | 0.44 | 0.69  | 0.86  | 1.16  | 1.48  | 1.87   | 1.28  | 1.79  | 2.16  | 2.69  | 3.32  | 4.08  | 4.60  | 3.61  | 4.42  | 4.98  | 5.81  | 6.52  |
| 10yr | 0.51 | 0.80  | 1.01  | 1.36  | 1.77  | 2.26   | 1.53  | 2.17  | 2.61  | 3.23  | 3.95  | 4.81  | 5.46  | 4.26  | 5.25  | 5.86  | 6.77  | 7.55  |
| 25yr | 0.60 | 0.96  | 1.22  | 1.69  | 2.25  | 2.88   | 1.94  | 2.80  | 3.33  | 4.11  | 4.99  | 5.99  | 6.83  | 5.30  | 6.58  | 7.27  | 8.30  | 9.18  |
| 50yr | 0.70 | 1.12  | 1.43  | 2.01  | 2.70  | 3.47   | 2.33  | 3.39  | 4.02  | 4.93  | 5.94  | 7.07  | 8.13  | 6.26  | 7.82  | 8.56  | 9.69  | 10.64 |
| 100yr| 0.80 | 1.30  | 1.68  | 2.37  | 3.23  | 4.17   | 2.79  | 4.12  | 4.83  | 5.90  | 7.07  | 8.35  | 9.66  | 7.39  | 9.29  | 10.09 | 11.32 | 12.35 |
| 200yr| 0.93 | 1.51  | 1.96  | 2.81  | 3.88  | 5.02   | 3.35  | 5.00  | 5.81  | 7.07  | 8.42  | 9.86  | 11.49 | 8.73  | 11.05 | 11.90 | 13.23 | 14.33 |

*Town of Barnstable, Department of Public Works*
PRECAST CONCRETE CATCH BASIN (CB) WITH HOOD
NOT TO SCALE
## 2018 Tidal Flooding Events at Barnstable Harbor

<table>
<thead>
<tr>
<th>Dates</th>
<th>Storm Name</th>
<th>Maximum High Tide (MLLW)*</th>
<th>Maximum High Tide (NAVD88)**</th>
<th>Estimated Storm Surge (feet)***</th>
<th>Estimated Stillwater Elevation (NAVD88)</th>
<th>Estimated Stillwater Elevation (MLLW)</th>
<th>Recurrence (per table below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 2-3, 2018</td>
<td>Winter Storm Grayson</td>
<td>12.3</td>
<td>6.6</td>
<td>3</td>
<td>9.6</td>
<td>15.3</td>
<td>~50-year</td>
</tr>
<tr>
<td>March 2-3, 2018</td>
<td>Winter Storm Riley</td>
<td>11.7</td>
<td>6.0</td>
<td>4</td>
<td>10.0</td>
<td>15.7</td>
<td>~100-year</td>
</tr>
<tr>
<td>March 7-8, 2018</td>
<td>Winter Storm Quinn</td>
<td>10.1</td>
<td>4.4</td>
<td>3</td>
<td>7.4</td>
<td>13.1</td>
<td>&lt;10-year</td>
</tr>
<tr>
<td>March 12-13, 2018</td>
<td>Winter Storm Skylar</td>
<td>9.2</td>
<td>3.5</td>
<td>3.5</td>
<td>7.0</td>
<td>12.7</td>
<td>&lt;10-year</td>
</tr>
<tr>
<td>March 21-22, 2018</td>
<td>Winter Storm Toby</td>
<td>10.7</td>
<td>5.0</td>
<td>2.2</td>
<td>7.2</td>
<td>12.9</td>
<td>&lt;10-year</td>
</tr>
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### Average High Tides

<table>
<thead>
<tr>
<th>Dates</th>
<th>MLLW / NAVD88</th>
<th>Flood Elevation (NAVD88)</th>
<th>Flood Elevation (MLLW)</th>
<th>Recurrence****</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>8.5 to 10.4 / 2.8 to 4.7</td>
<td>10% chance (10-year)</td>
<td>8.8</td>
<td>14.5</td>
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<tr>
<td>March</td>
<td>8.5 to 10.6 / 2.8 to 4.9</td>
<td>2% chance (50-year)</td>
<td>9.8</td>
<td>15.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1% chance (100-year)</td>
<td>10.1</td>
<td>15.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2% chance (500-year)</td>
<td>11.1</td>
<td>16.8</td>
</tr>
</tbody>
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