Drainage Investigation and Flood Analysis

Wellington Avenue and Bridge Street

Project No. 15-037

Please visit our project website at:

http://www.newportdrainageinvestigation.com/index.php

Public Informational Meeting #2

Mid-project Update

Presented by:

ch2m

September 17, 2015

Introductions

- City of Newport
  - » Julia Forgue, PE – Director of Utilities
  - » Rob Schultz, PE – Deputy Director of Engineering
  - » JR Frey, PE – Water Pollution Control
- CH2M
  - » Peter von Zweck, PE – Project Manager
  - » Becky Weig – Public Involvement
  - » Bill McMillin, PE – Senior Technologist, Climate Change & Sea Level Rise
  - » Greg Brenner – Hydraulic Modeling Engineer

Agenda

- Introductions & Agenda Overview
- Review of Stakeholder Comments from Meeting #1
- Model Development & Calibration
- Example Mitigation Measures being Considered
- Review of the Alternatives Evaluation Process
- Next Steps

Review of Stakeholder Comments from Meeting #1

Wellington Ave. Study Area Comments

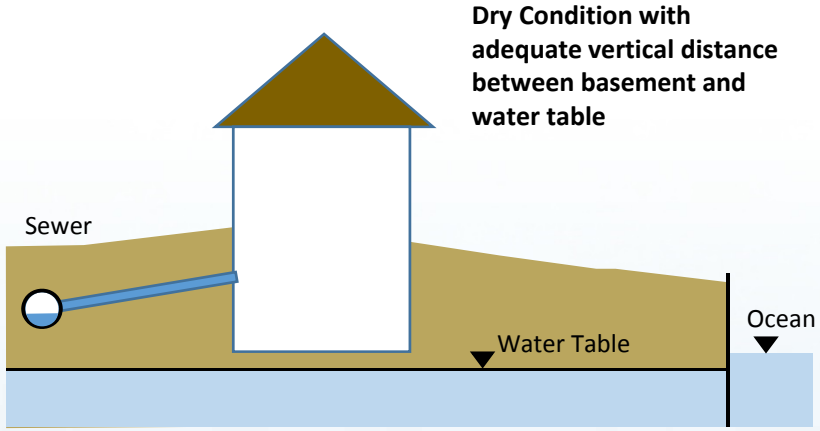
- Magnitude of future flooding events
  - » Will be addressed in this study
- Flooding and seepage from groundwater into basements
  - » Information on basements is included in this presentation
- Identifying natural springs and any influence on flooding
  - » The hydrologic analysis being completed for the project address the unique characteristics of each watershed

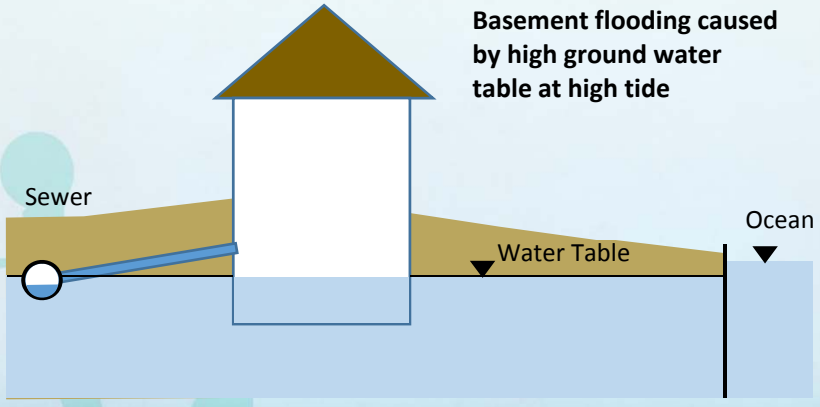
Bridge St. Study Area Comments

- Water quality of the stormwater
  - » Stormwater in Newport contains pollutants typical of urban drainage systems
- Traffic in flooded areas
  - » Study will address street level flooding
- What are the groundwater impacts?
  - » Basement flooding information is included in this presentation
- How to coordinate with FEMA?
  - » Study will not address FEMA coordination, but will be available for stakeholders to use when working with FEMA
- Will adaptation be addressed?
  - » Both adaptation and mitigation measures will be considered
- Will there be long-term solutions?
  - » The project will develop both short-term and long-term recommendations
- What are the pavement and permeability issues?
  - » These will be addressed when evaluating green infrastructure

Information on Groundwater Levels and Basement Flooding

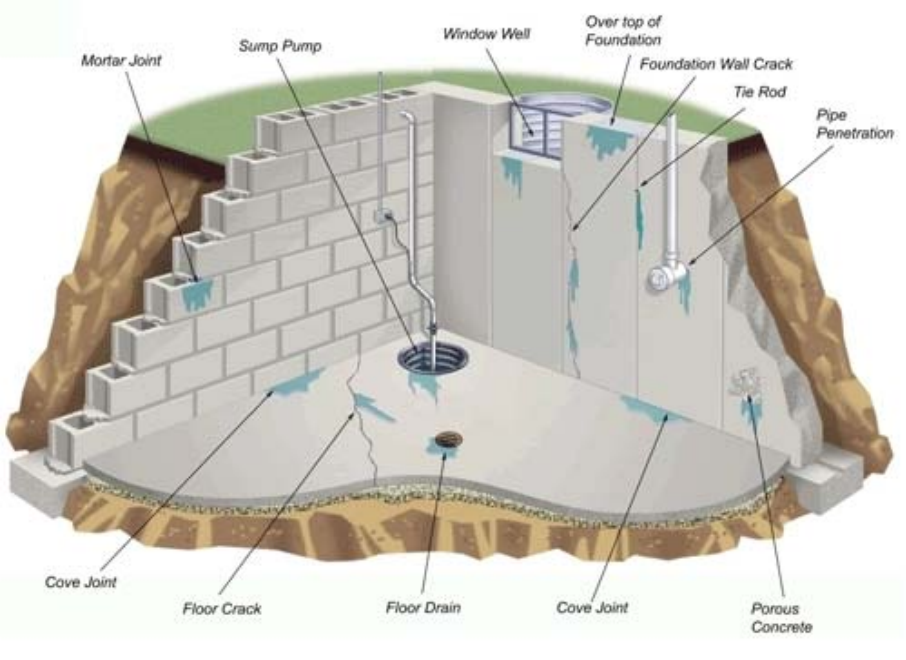
Basement Flooding by High Water Tables





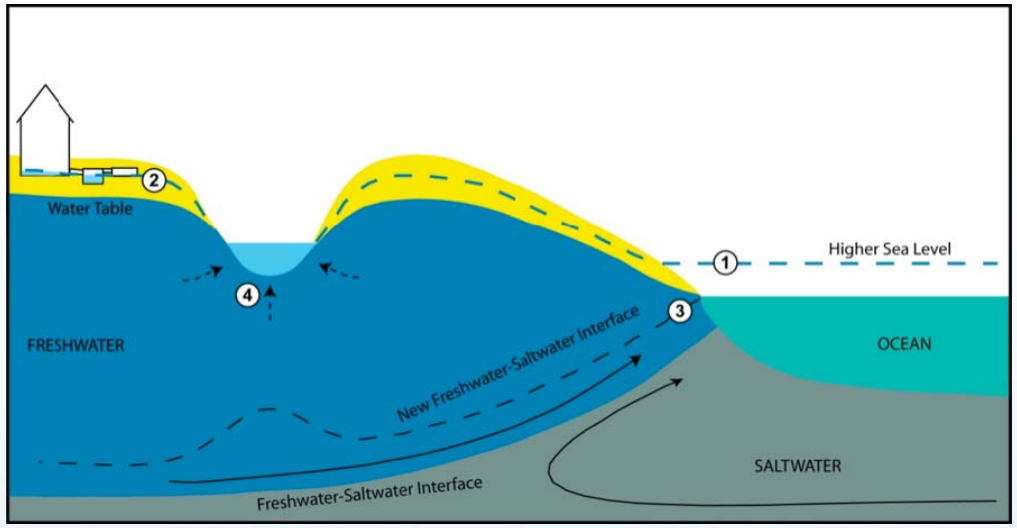
- Basements of structures with adequate drainage above the water table are at low risk to groundwater flooding
- Water tables normally rise due to rainfall
- Coastal water tables are also tidally influenced depending on the soils

Basements may Flood via Multiple Pathways



- Basement windows
- Cracks in walls and floors
- Porous concrete
- At pipe and utility penetrations
- Concrete seams
- Wall/floor
- Basement drains
- Failing drainage systems

Sea Level Rise will Worsen the Situation



- *A rise in sea-level will affect ground-water flow in coastal aquifers.*
- *An increase in the elevation of the water table (dashed–blue line) may result in basement flooding and compromise septic systems*
- *A rise in sea level may also result in an upward and landward shift in the position of the freshwater-saltwater interface*
- *Where streams are present, an increase in the water-table elevation also may increase ground-water discharge to streams and result in local changes in the underlying freshwater-saltwater interface.*

U.S. Geological Survey
http://wh.er.usgs.gov/slr/coastalgroundwater.html

Typical Measures for Preventing Basement Flooding

- Gutters and downspouts
  - » drain storm water at least three feet away
  - » consider running extensions or troughs
  - » discharge to a splash pad
  - » clean/clear gutters and downspouts regularly of leaves and debris
- Seal foundation cracks and gaps around pipes in basement walls and floors
- Sump Pumps
  - » check to make sure its well is free of debris
  - » position it in the lowest part of the basement
  - » Pump to exterior ground surface NOT sanitary sewer system
- Basement window wells & covers
  - » drain water away from at- or below-grade windows
  - » fasten covers securely
- Landscape downslope away from house

Property owners are responsible for the implementation of structural and non-structural measures to prevent basement flooding.

Structural Systems to Prevent Basement Flooding

- Basement interior perimeter trough or edge drain to sump pump that pumps to exterior ground surface
- Drain tile system to sump pump
  - » Around the house's exterior foundation
  - » Below or interior of the foundation footings
  - » Pump to exterior ground surface
- French drains outside the foundation
- Permanent concrete barriers constructed around basement entrances and windows

Model Development & Calibration

Field Investigation:

Objectives at both Study Areas

- Inspect Drainage Manholes
  - » Collect invert elevations
  - » Record pipe sizes
  - » Check pipe conditions/ sediment levels
  - » Check connectivity to neighboring systems
  - » Update GIS
- Observe High Tide Event
  - » Check tidal influence/tide gate effectiveness
  - » Record water stage for model calibration

Catch Basin in King Park at High Tide

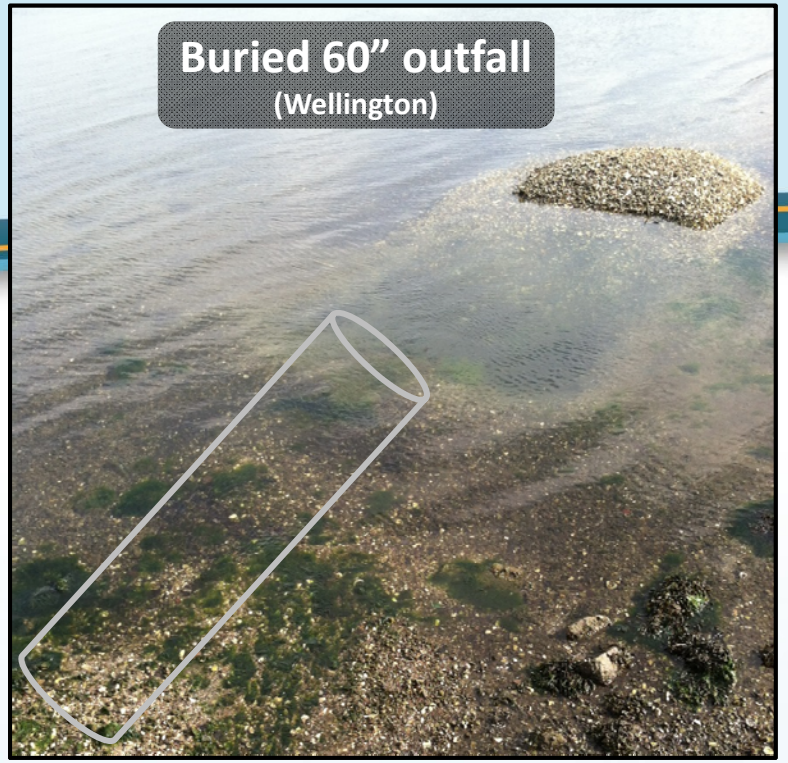
Manhole at intersection of Thames and Webster St.

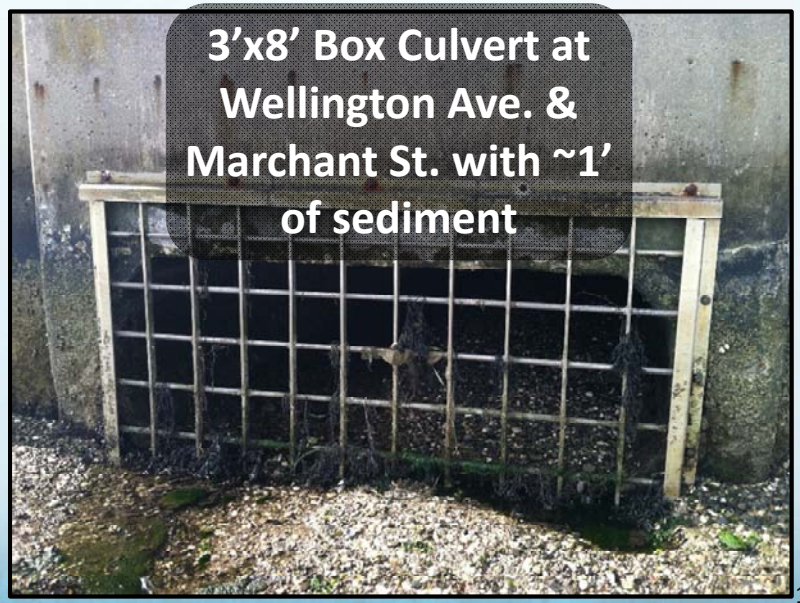
2nd St. Tide gate

Field Investigation:

Findings at both study areas

- 80+ drainage manholes inspected
- Major connectivity in GIS is correct
- Both study areas heavily influenced by the tide
- 2nd St. and 3rd St. tide gates functioning but occasionally impacted by debris
- Some catch basins in need of cleaning
- 4 outfall pipes (3 Wellington, 1 Bridge) each has some sedimentation





Model Construction

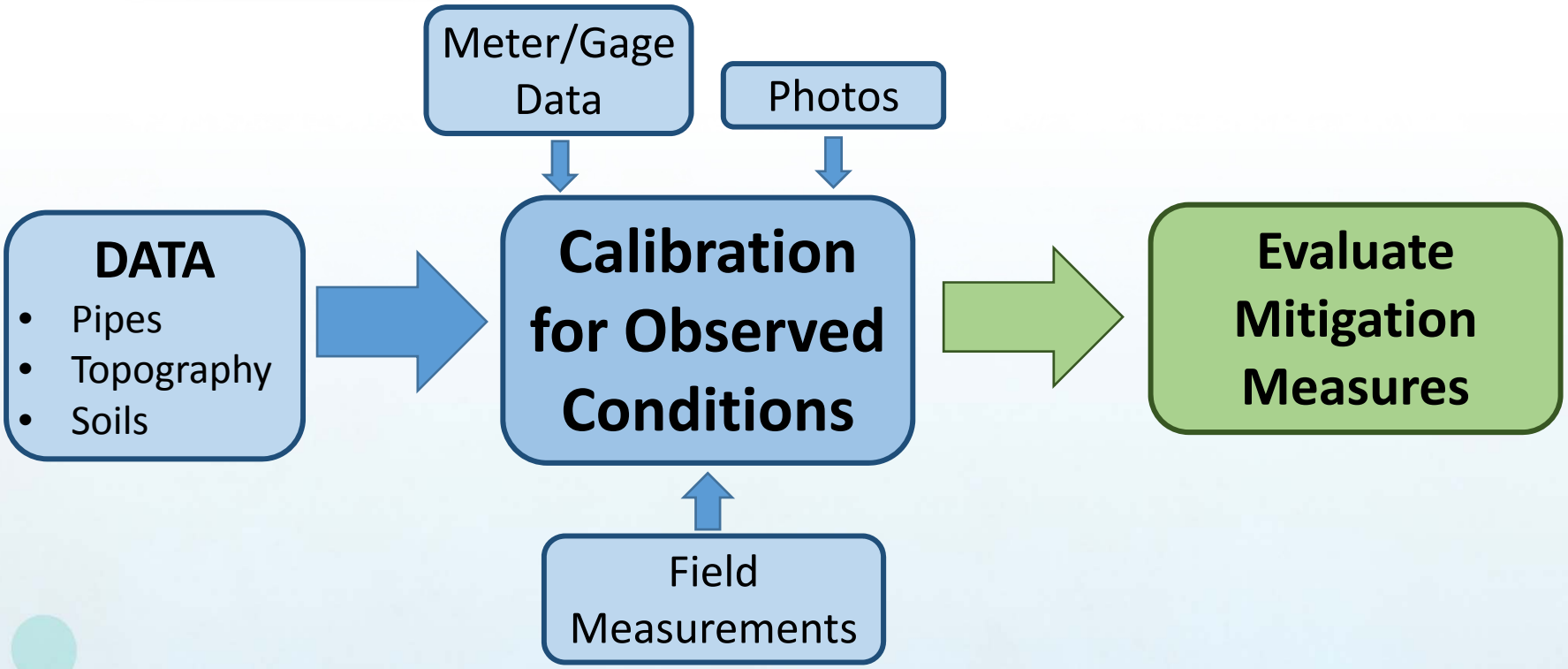
Hydrology

- Digital Elevation Model (DEM)
  - » 1 meter resolution
  - » University of Rhode Island Spring 2011 Northeast LiDAR Project
- Subcatchment Delineation
  - » PCSWMMs Automated Watershed Delineation Tool
  - » Subcatchments sized to fit catch basin watersheds

Subcatchment Delineation and Flow Paths
(Wellington Study Area)

Bridge St. Contributing Area:
90 acres
Wellington Ave. Contributing Area:
240 acres

Model Calibration

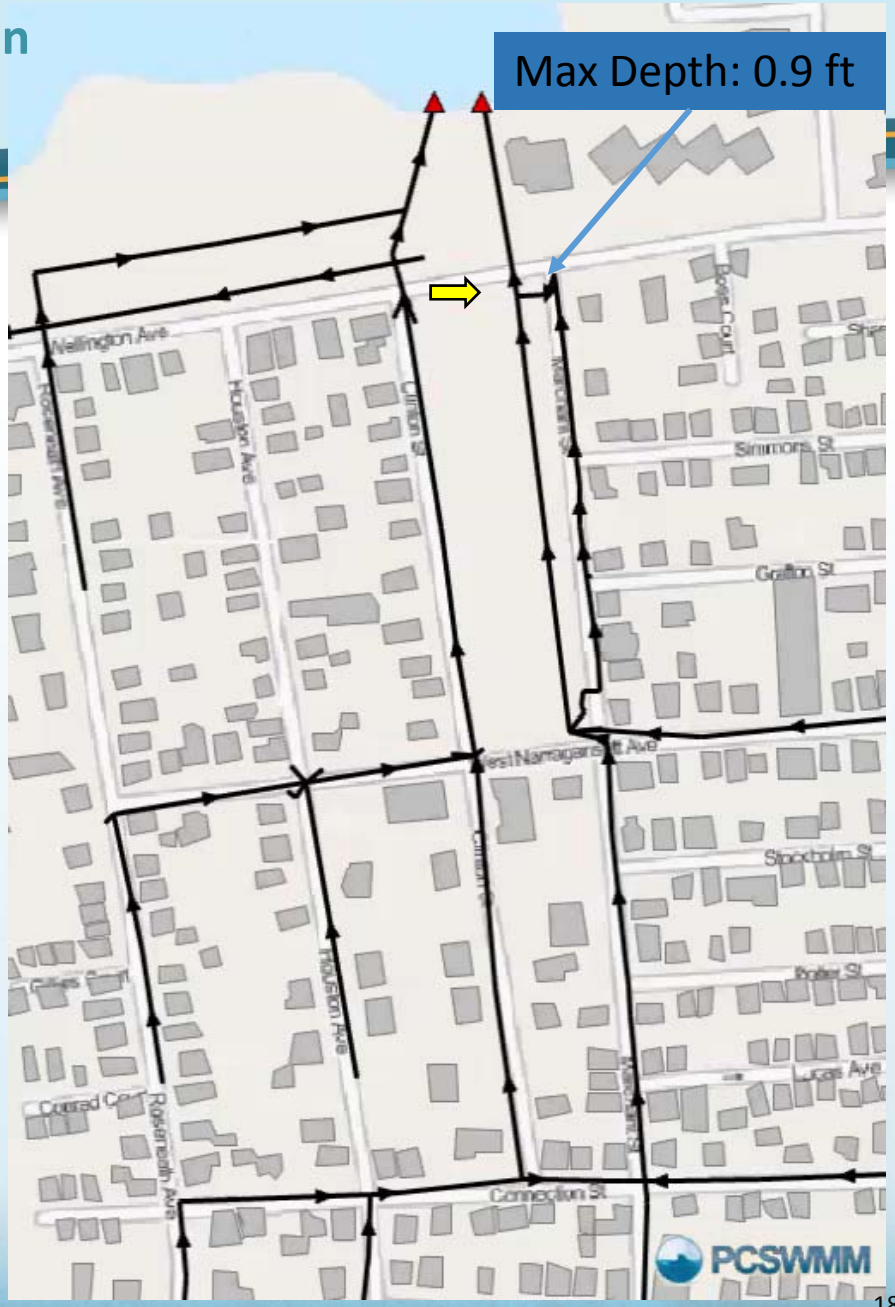


Calibration is the fine-tuning of parameters to increase the models **accuracy** in reflecting observed events.

CALIBRATION: Wellington Ave.

10/7/2010 Lunar High Tide of 5.8 ft - No rain

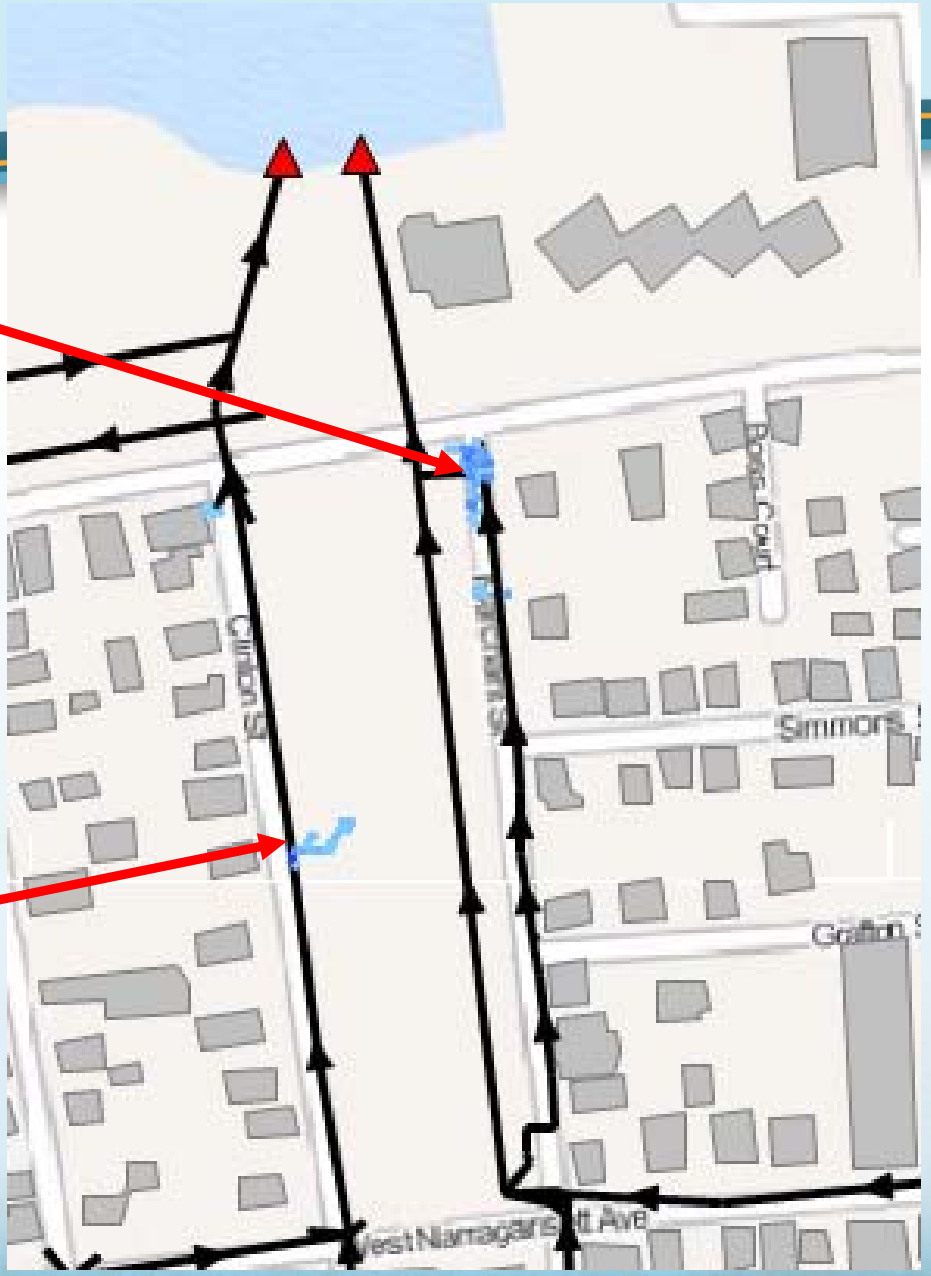
Datum: NOAA



CALIBRATION: Wellington Ave.

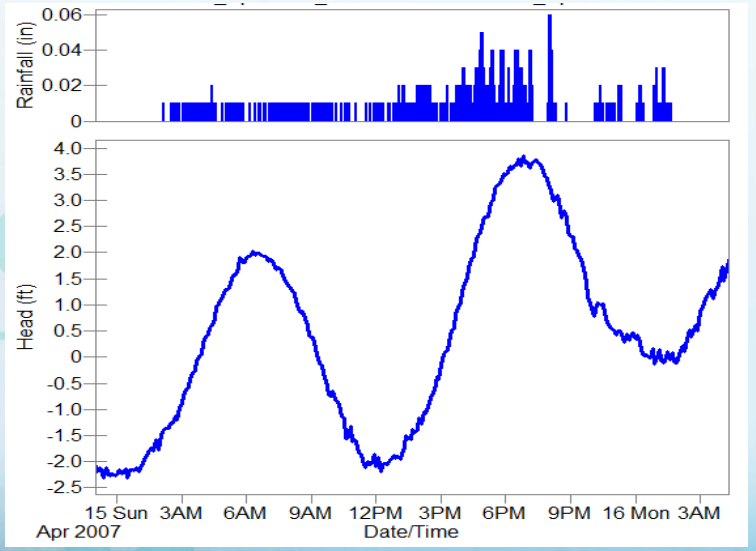
9/1/2015 High Tide of 5.0 ft - No rain

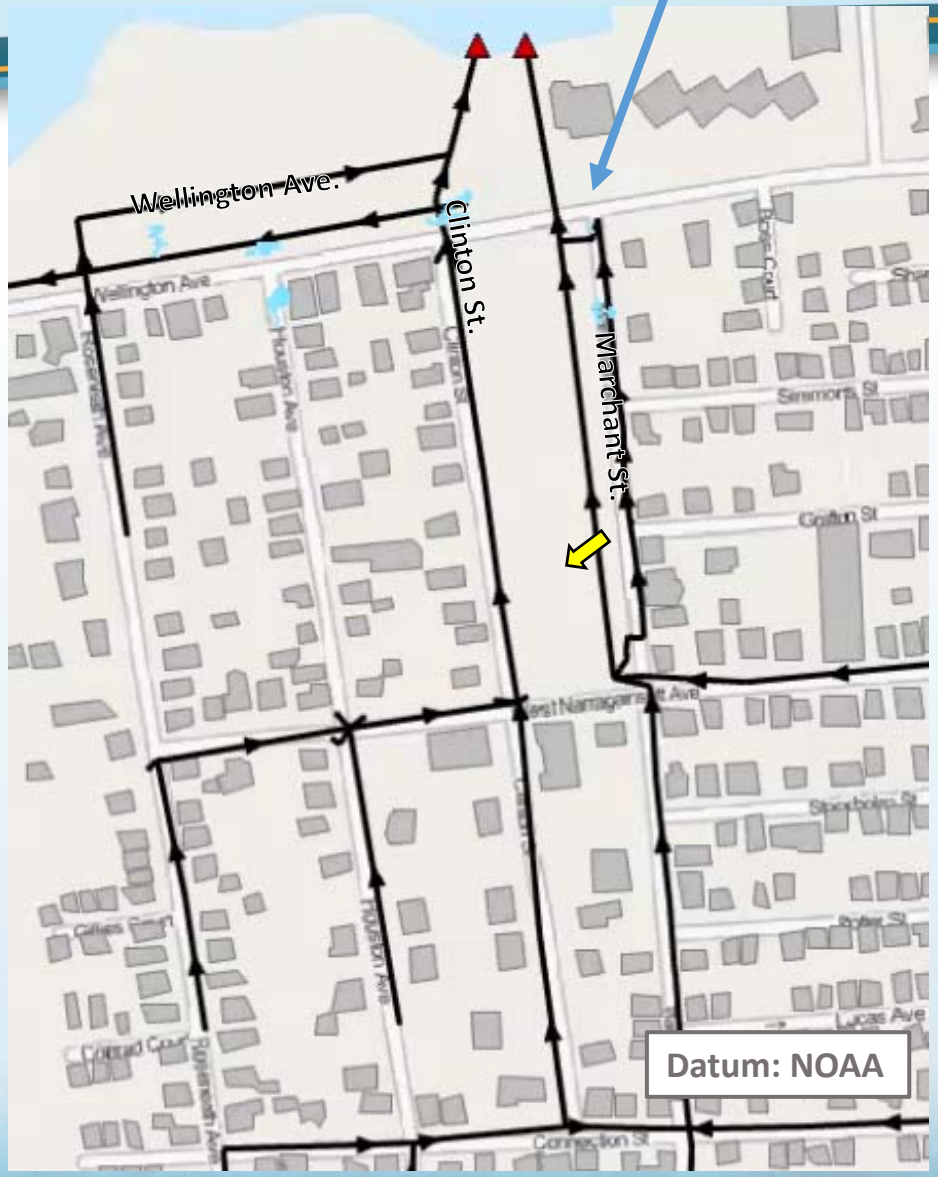
Datum: NOAA



CALIBRATION: Wellington Ave.

4/15/2007 High Tide of 5.8 ft and Rain Event of 3.6 inches





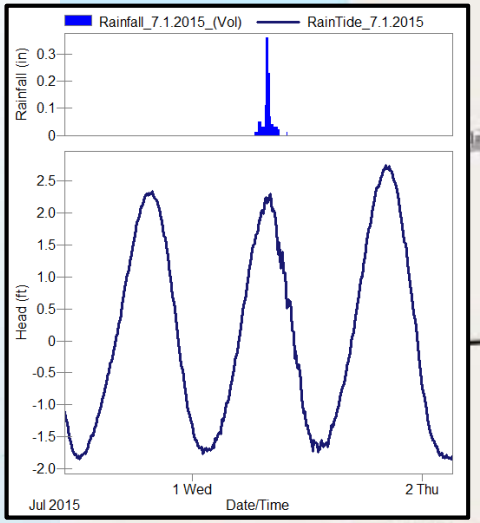
CALIBRATION: Bridge St.

10/27/2011 Lunar High Tide of 5.9 ft - No rain
Prior to installation of tide gates on 2nd and 3rd Streets

CALIBRATION: Bridge St.

7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 inch

Tide Gates on 2nd and 3rd Street In-place



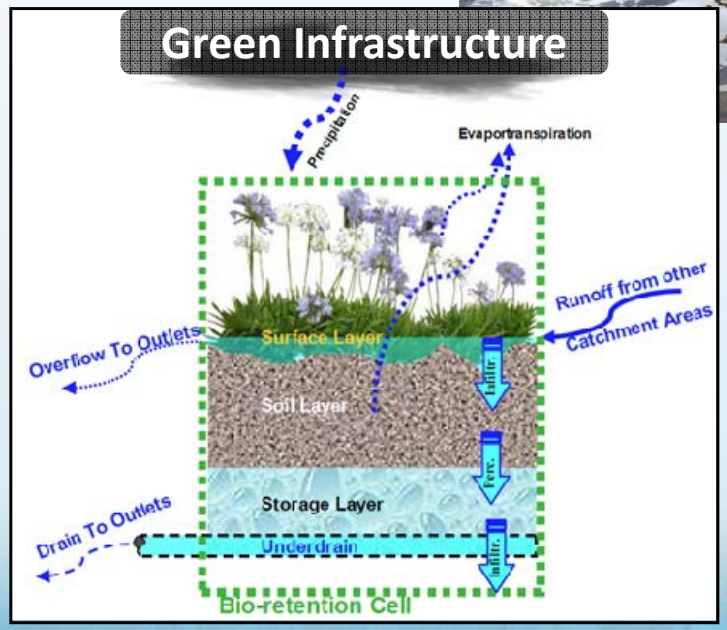
Max Depth: 0.8 ft

Datum: NOAA

Examples of Mitigation Measures being Considered

Example Mitigation Measures

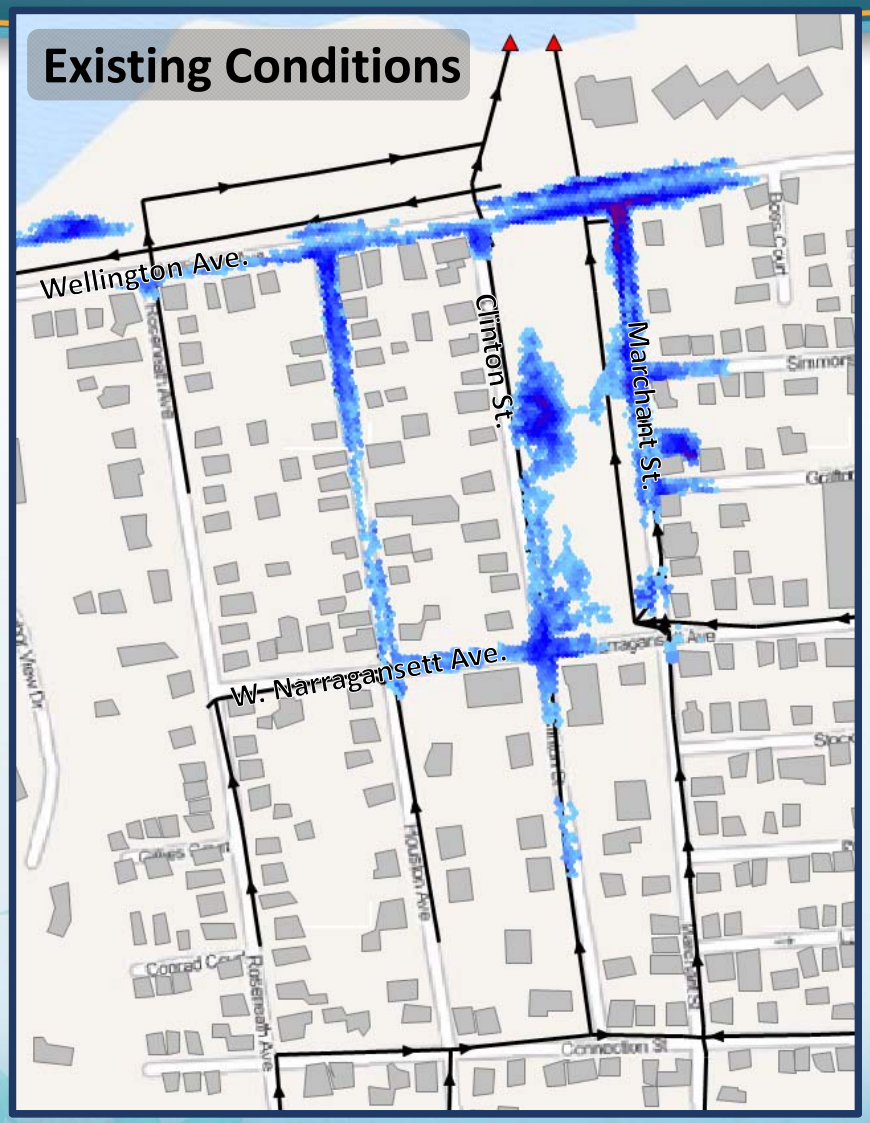
- Tide Gates
  - » Prevent sunshine flooding
  - » May prolong rain event flooding
  - » Many types
- Larger Pipes
  - » Increased conveyance
  - » Space constraints with other utilities (gas, water, etc.)
- Catch Basin Sumps
  - » Collect debris in manhole to avoid clogging pipes
- Green Infrastructure
  - » Provides storage
  - » Can increase basement flooding
- Pump Station
  - » Complete solution
  - » Expensive, large facility

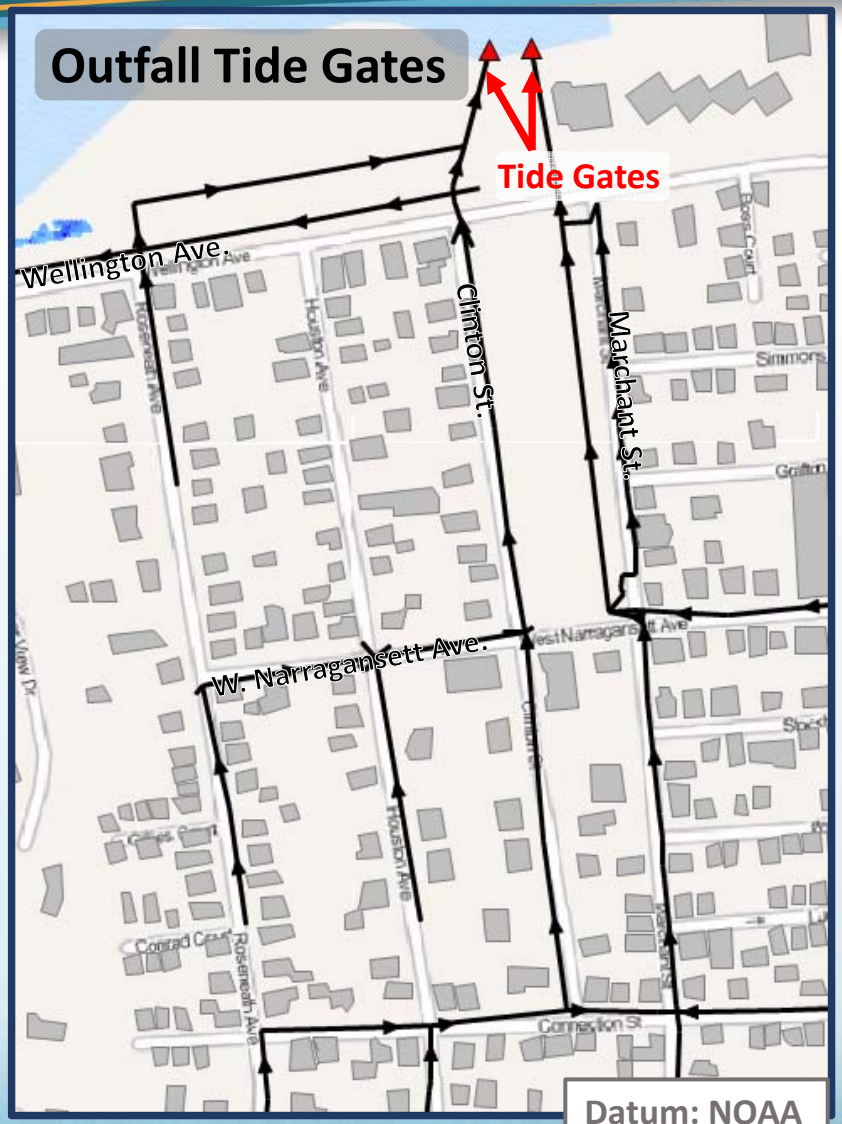


Wellington Ave. - Outfall Tide Gates

10/7/2010 Lunar High Tide of 5.8 ft – No rain

Tide gates can prevent tidal flooding

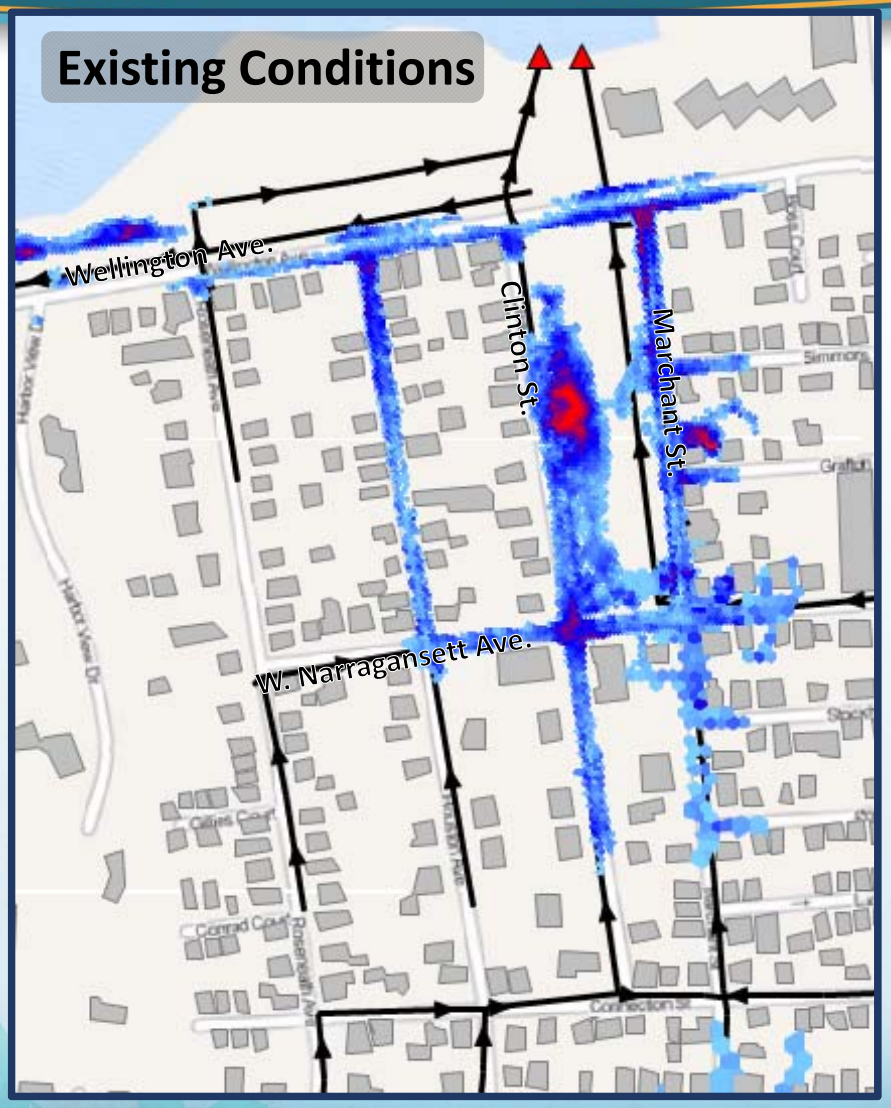


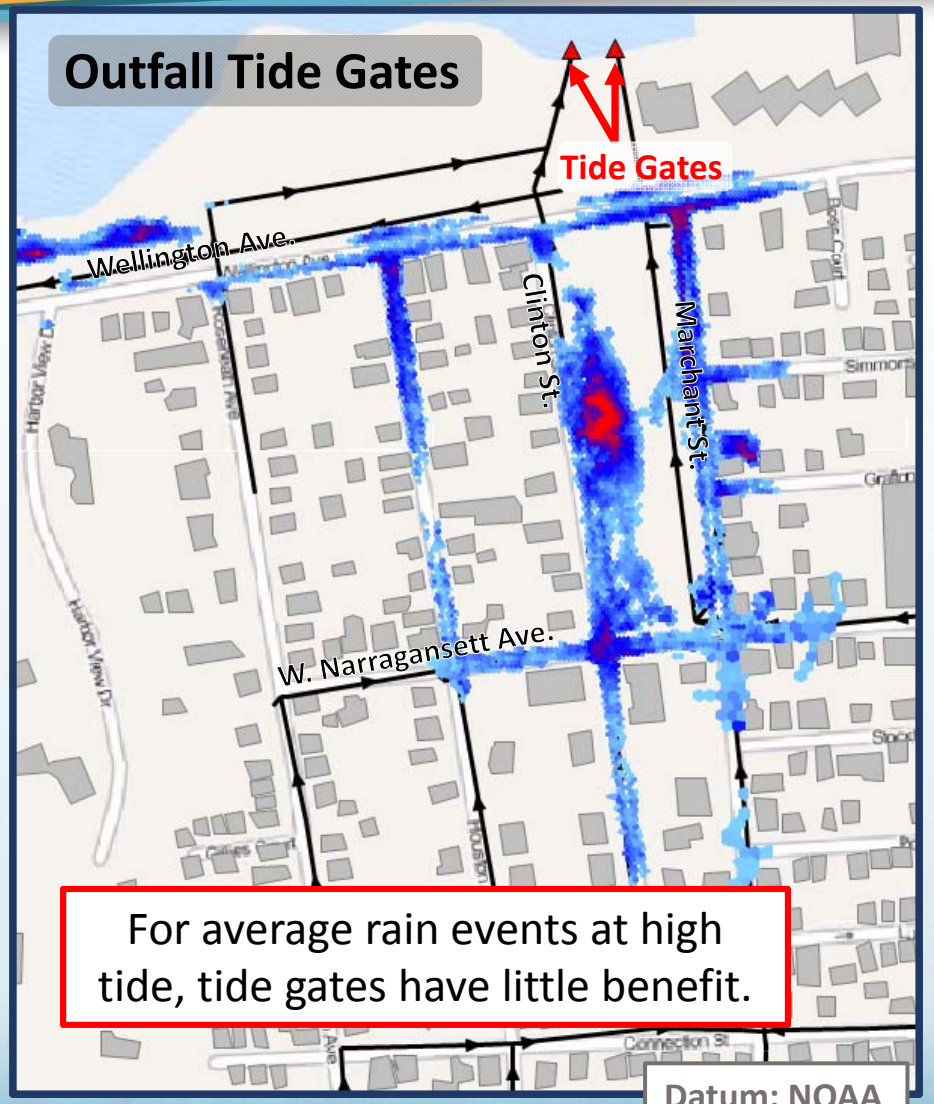


Datum: NOAA

Wellington Ave. - Outfall Tide Gates

7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 inches





Wellington Ave. – Sediment Removal

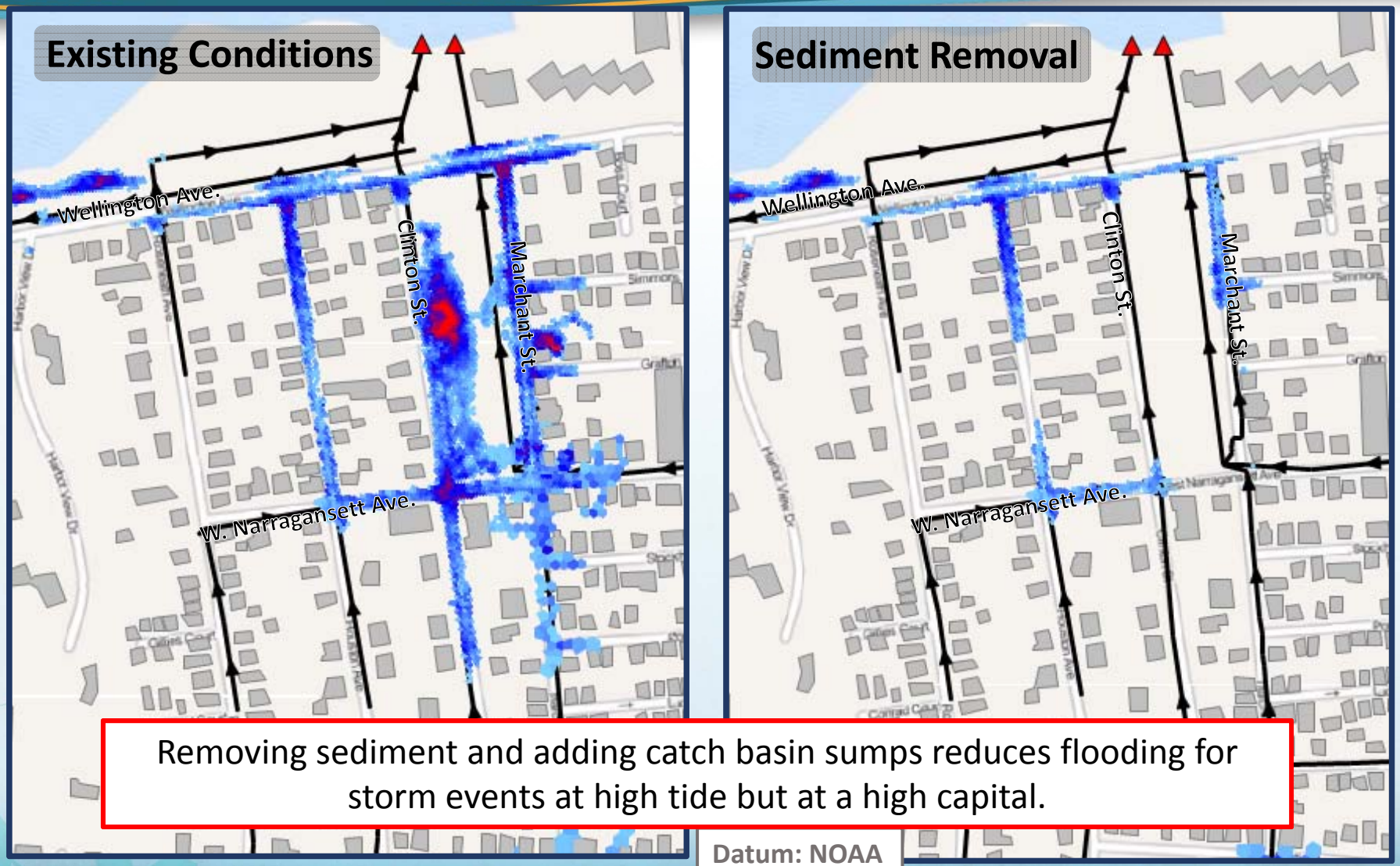
7/1/2015 Low Tide (theoretical) and Rain Event of 1.2 inches

Removing sediment and adding catch basin sumps reduces flooding for storm events at low tide but at a high capital cost.

Datum: NOAA

Wellington Ave. – Sediment Removal

7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 inches

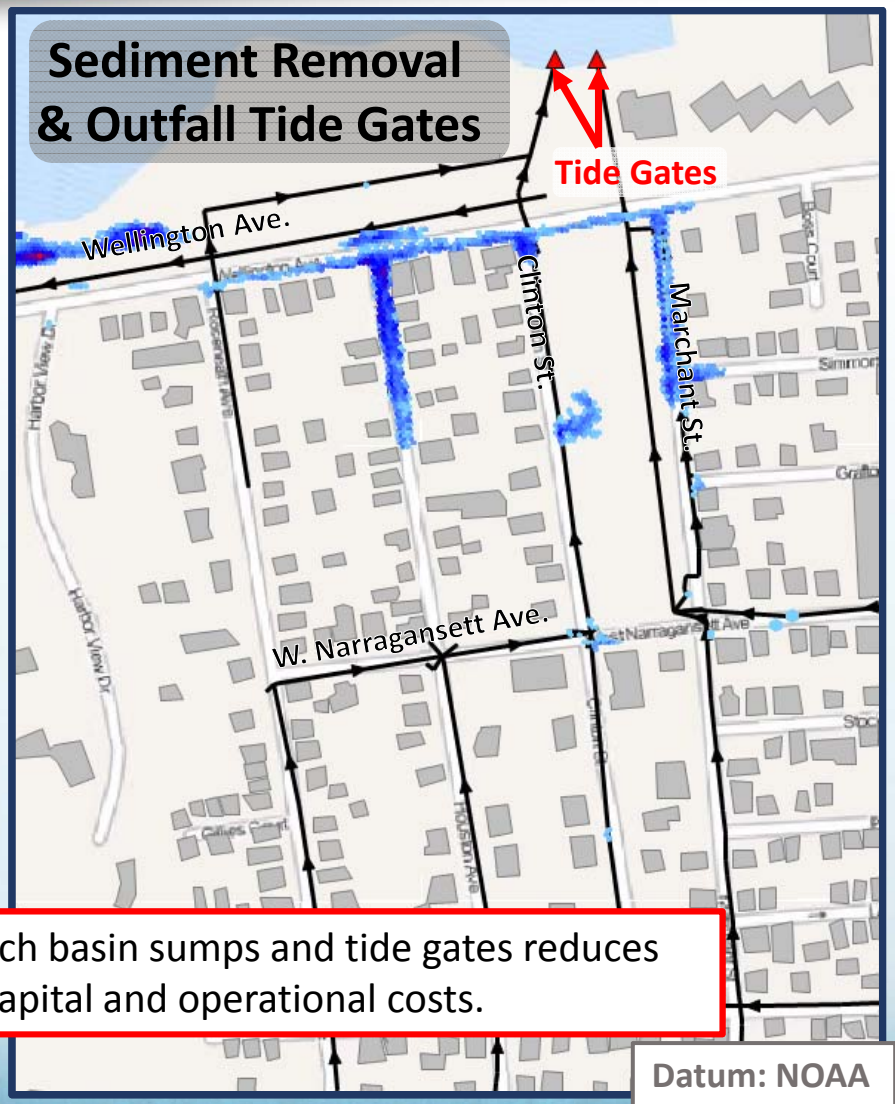


Removing sediment and adding catch basin sumps reduces flooding for storm events at high tide but at a high capital.

Datum: NOAA

Wellington Ave. – Sediment Removal & Tide Gates

7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 inches



Removing sediment, adding catch basin sumps and tide gates reduces flooding but at high capital and operational costs.

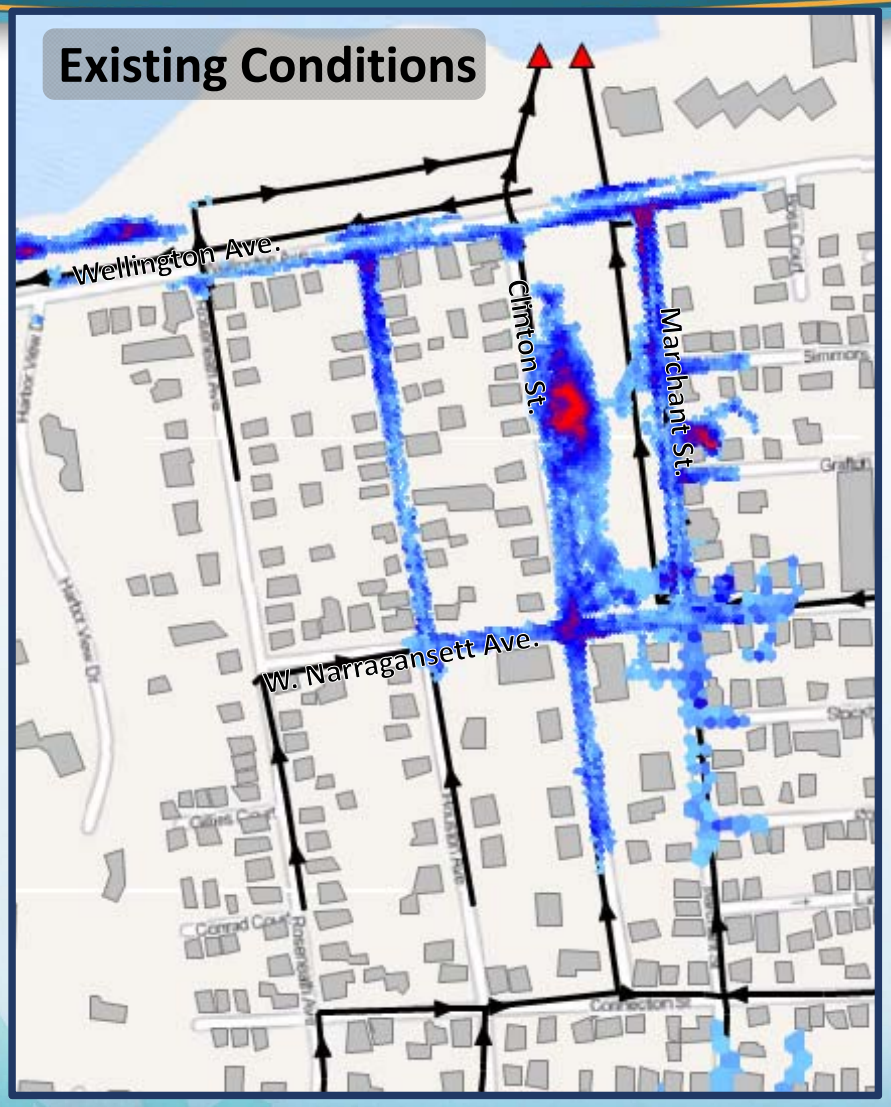
Datum: NOAA

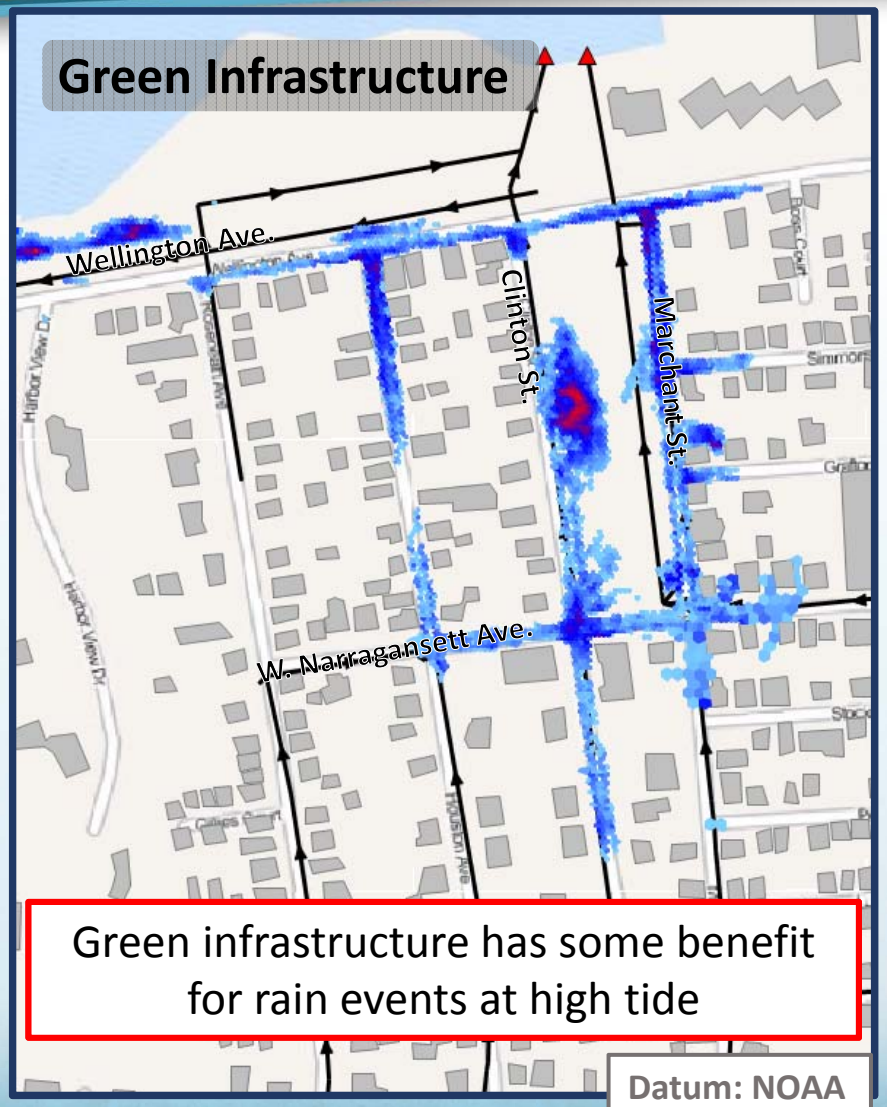
Wellington Ave. – Green Infrastructure

- Modeled Assumptions
  - » Capture 15% of runoff primarily through infiltration
  - » Only applied in areas at low risk for basement flooding
- Available Options
  - » Permeable Pavement
  - » Bio-Retention Cells
  - » Rain Garden
  - » Green Roof
  - » Rain Barrels

Wellington Ave. - Green Infrastructure

7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 inches



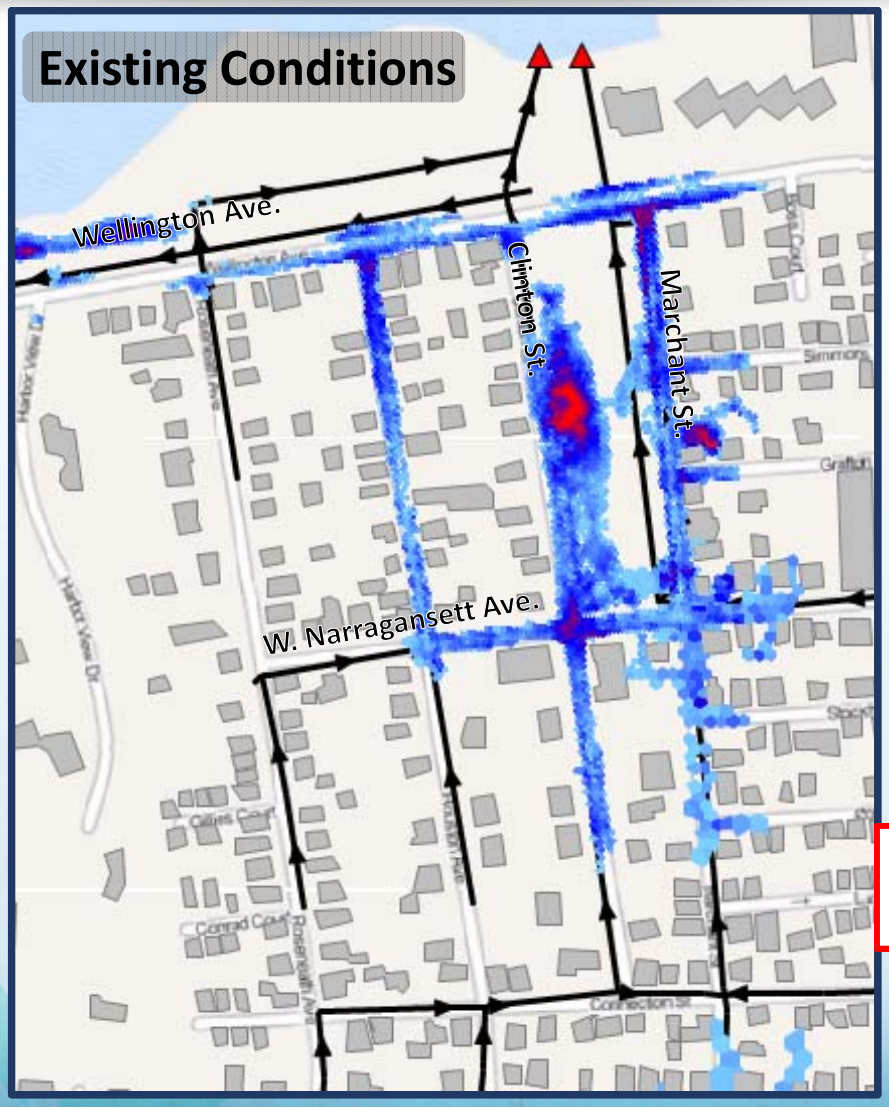


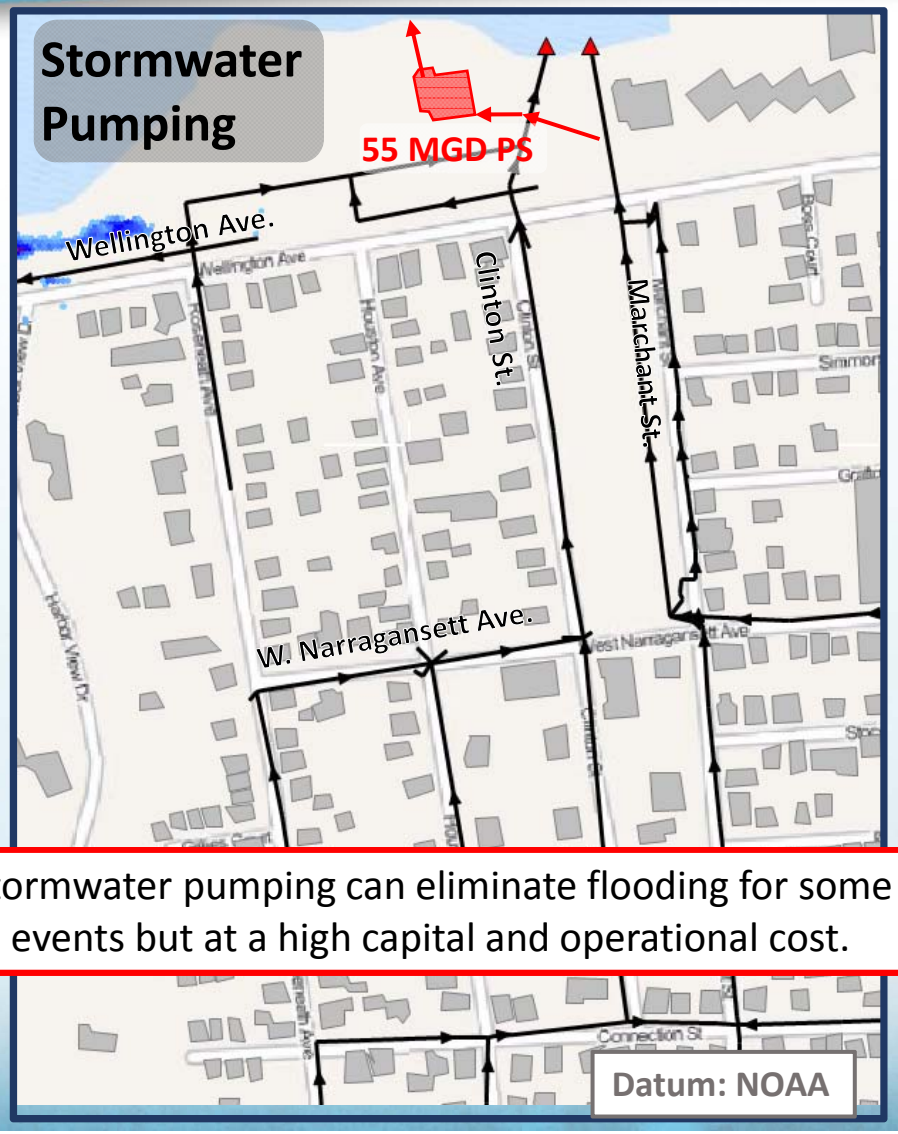
Green infrastructure has some benefit for rain events at high tide

Datum: NOAA

Wellington Ave. – Stormwater Pumping

7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 in



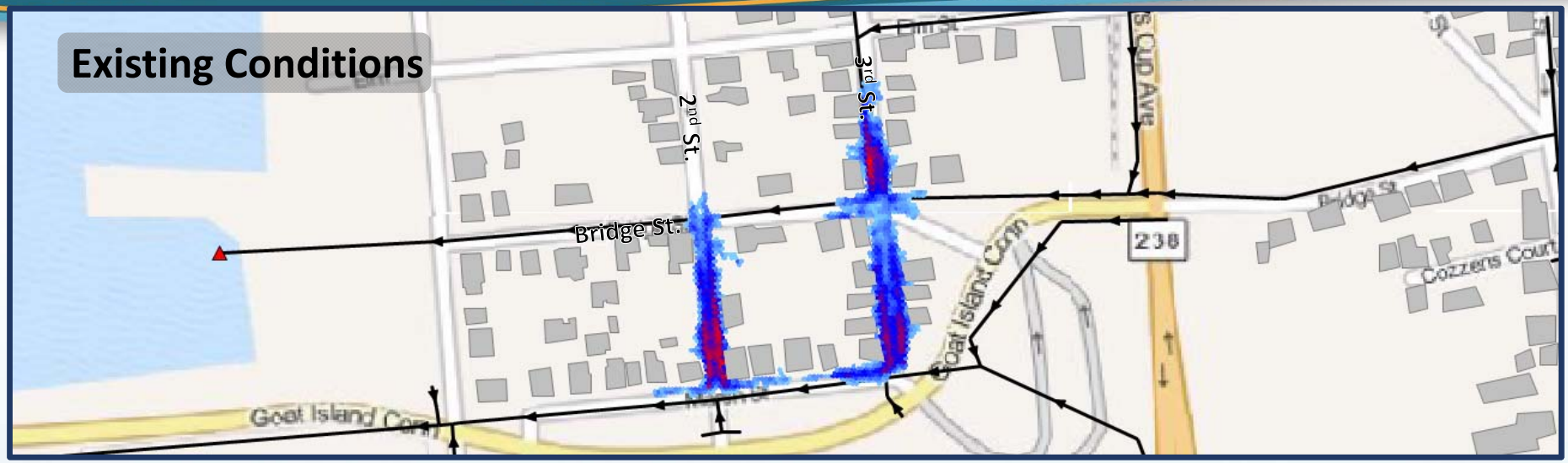


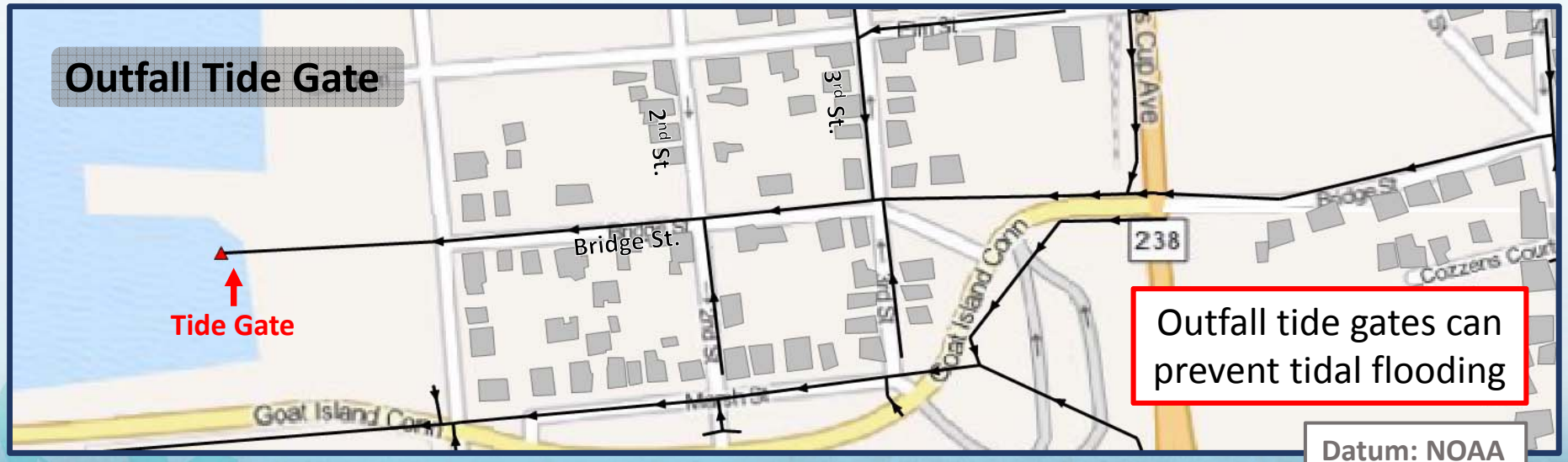
Stormwater pumping can eliminate flooding for some events but at a high capital and operational cost.

Wellington Ave. Mitigation Measures Discussion

Bridge St. - Outfall Tide Gate

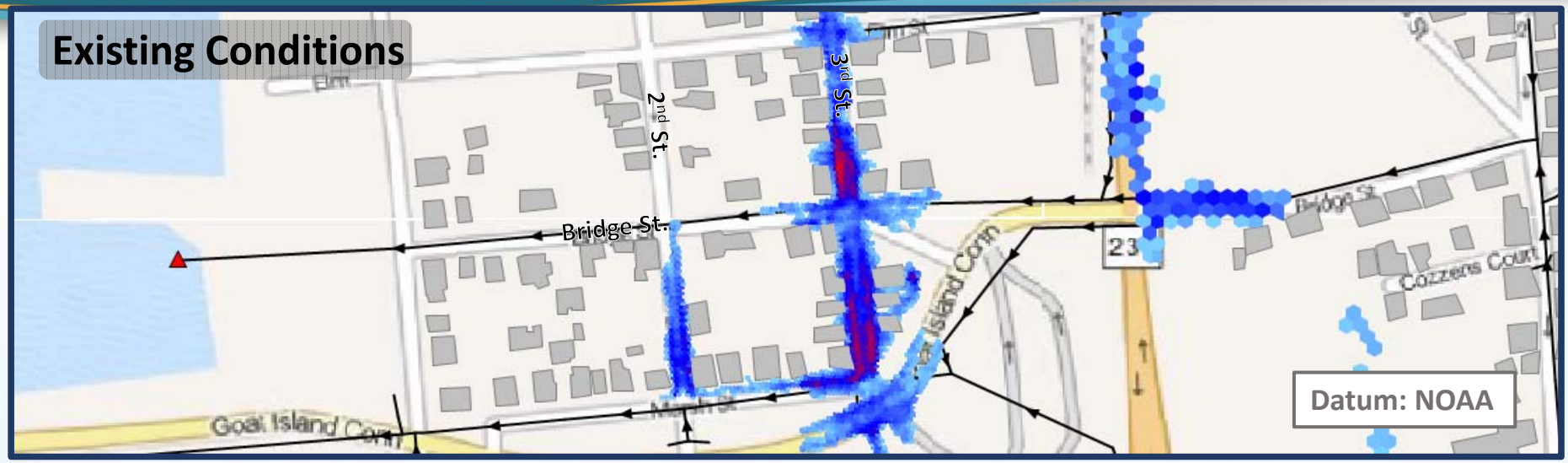
10/27/2011 Lunar High Tide 5.9 ft – No tide gates at 2nd St. & 3rd Streets

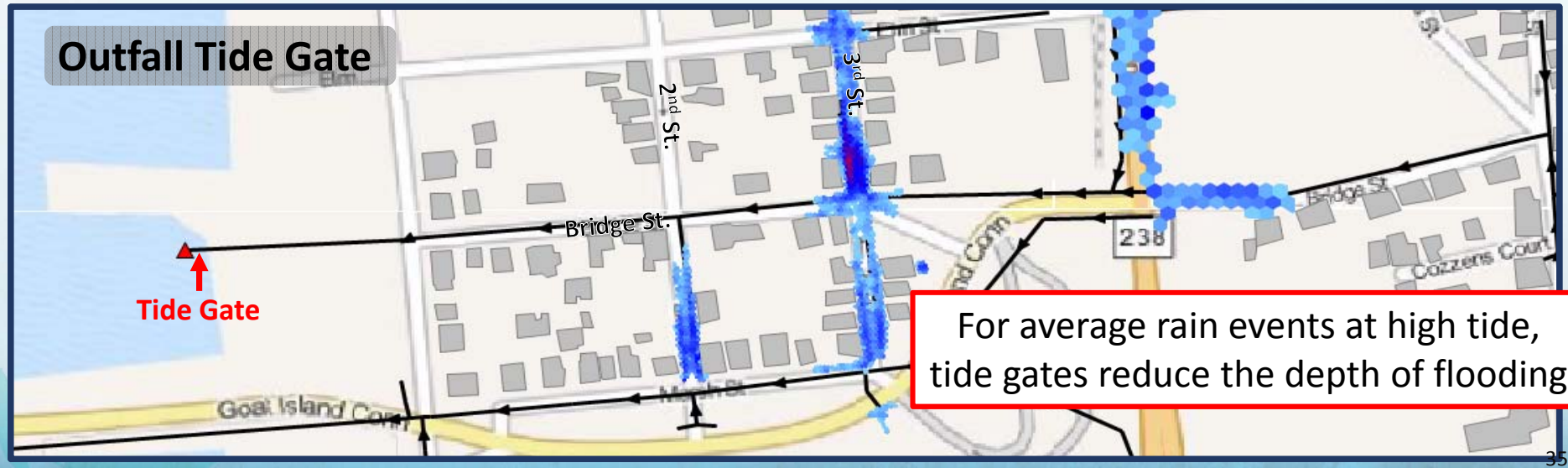




Bridge St. Outfall Tide Gate

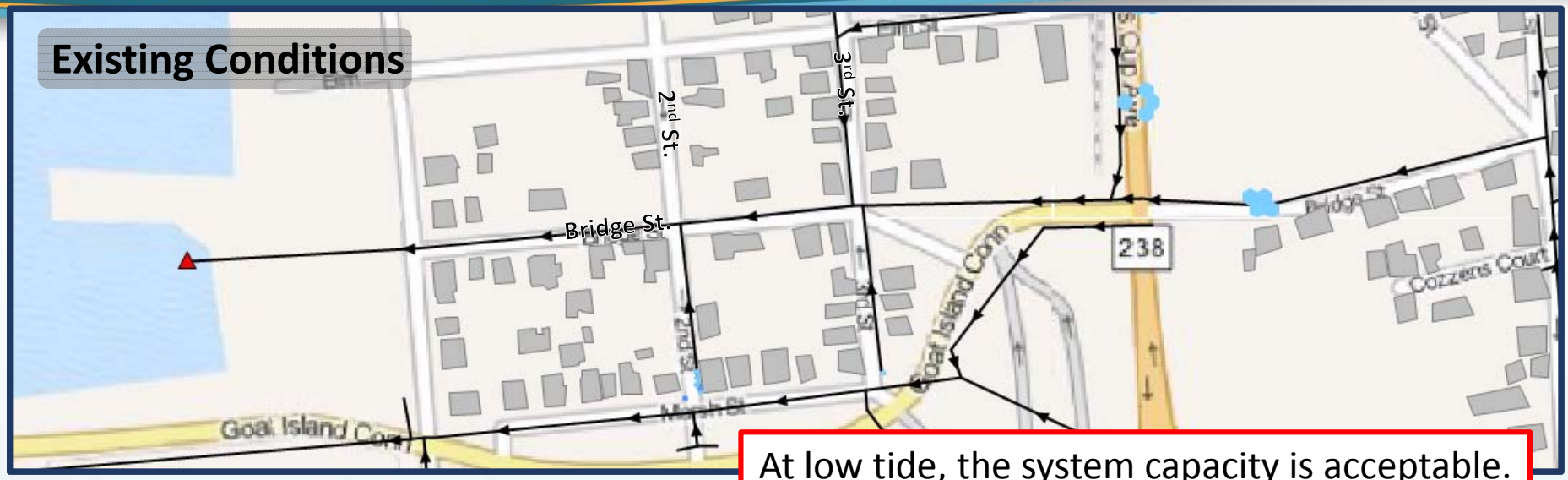
7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 inches



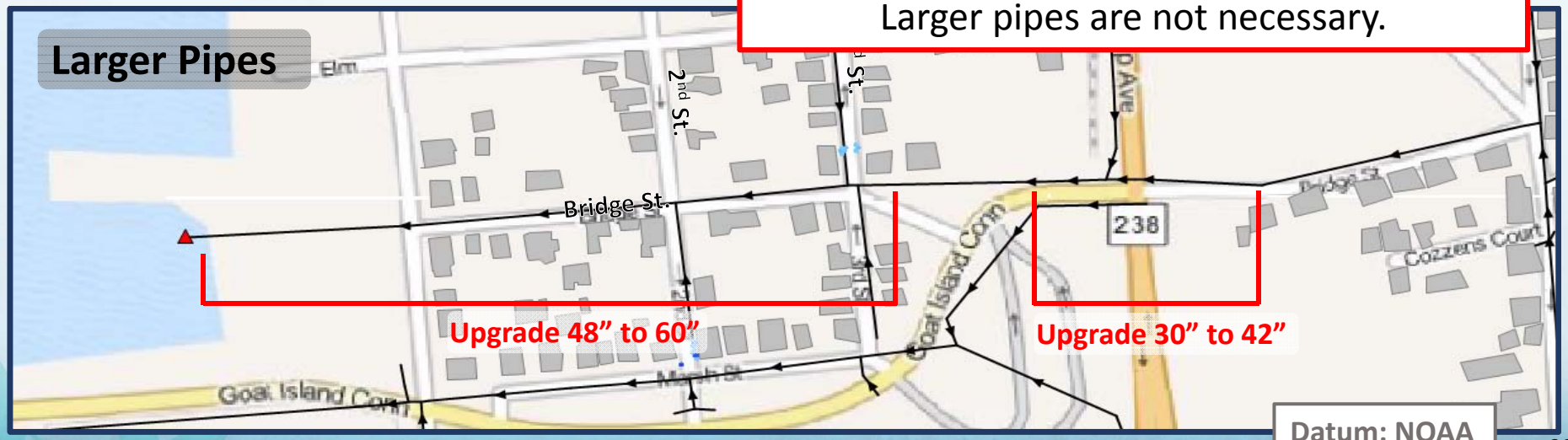


Bridge St. – Larger Pipes

7/1/2015 Low Tide (theoretical) and a Rain Event of 1.2 inches



At low tide, the system capacity is acceptable. Larger pipes are not necessary.



Bridge St. – Larger Pipes

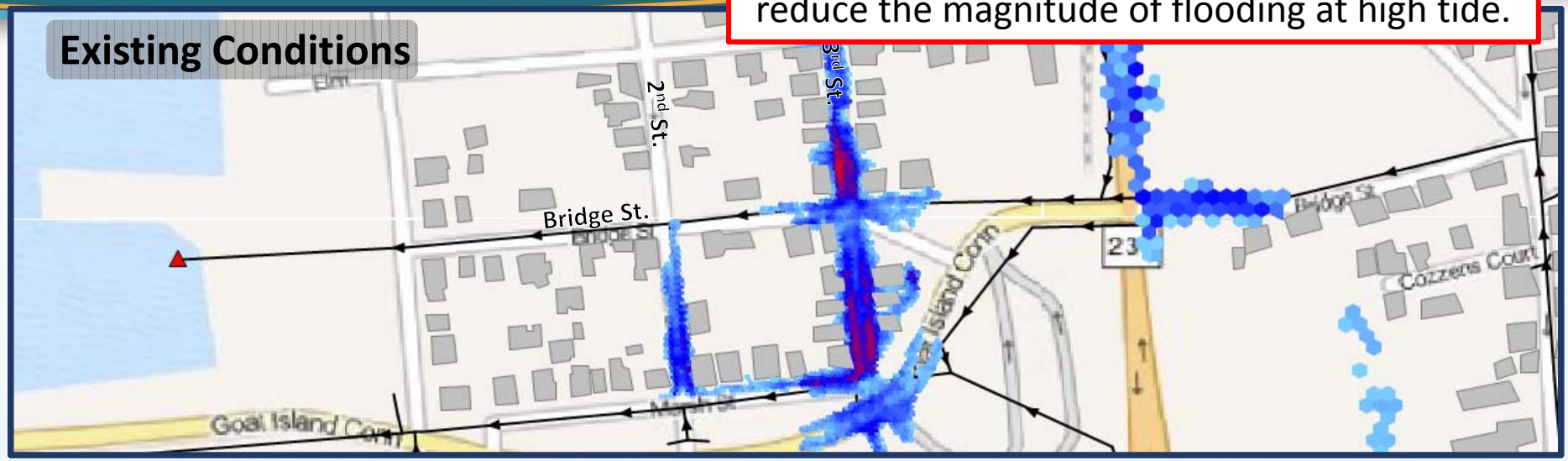
7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 inches

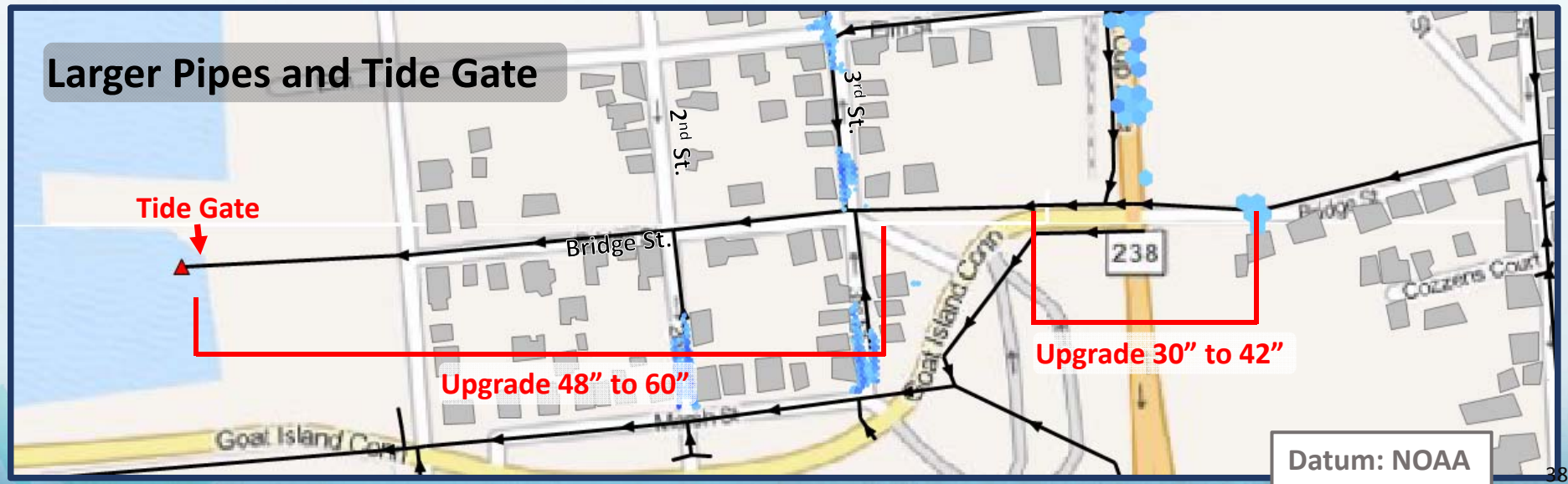
Larger pipes can reduce the magnitude of flooding for rain events at high tide.

Bridge St. – Larger Pipes & Outfall Tide Gate

7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 inches

Larger pipes with an outfall tide gate can reduce the magnitude of flooding at high tide.





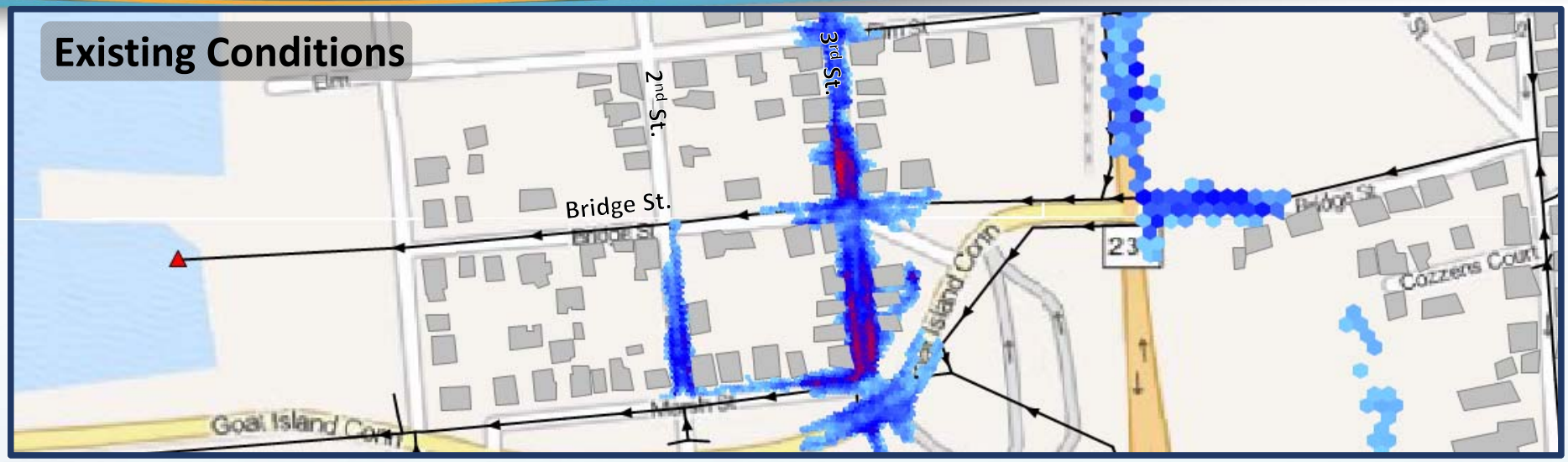
Bridge St. – Green Infrastructure

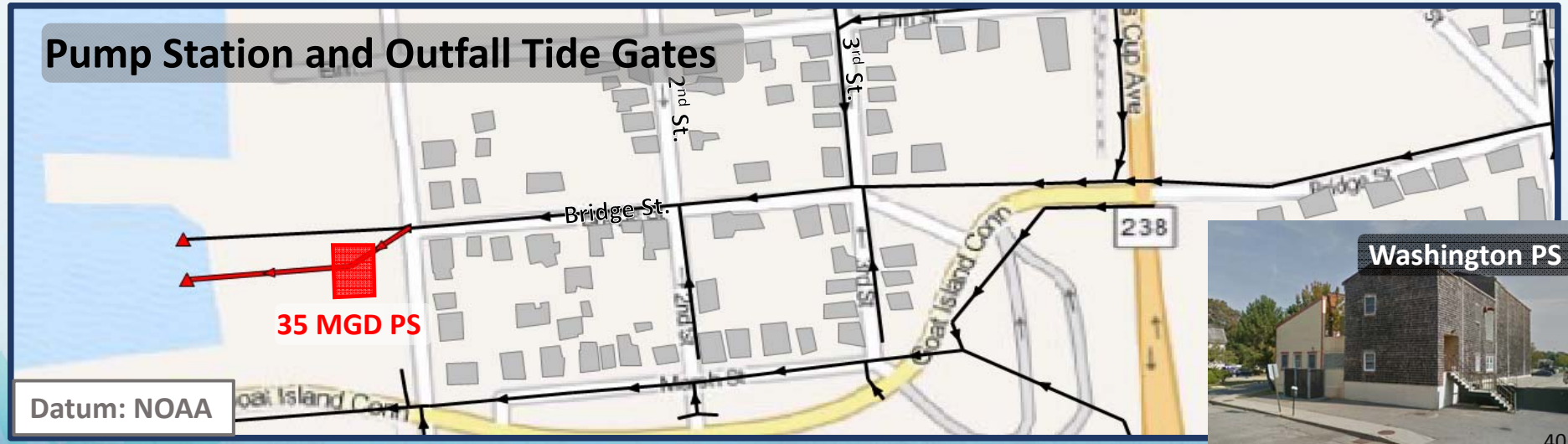
7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 inches

Bridge St. – Stormwater Pumping

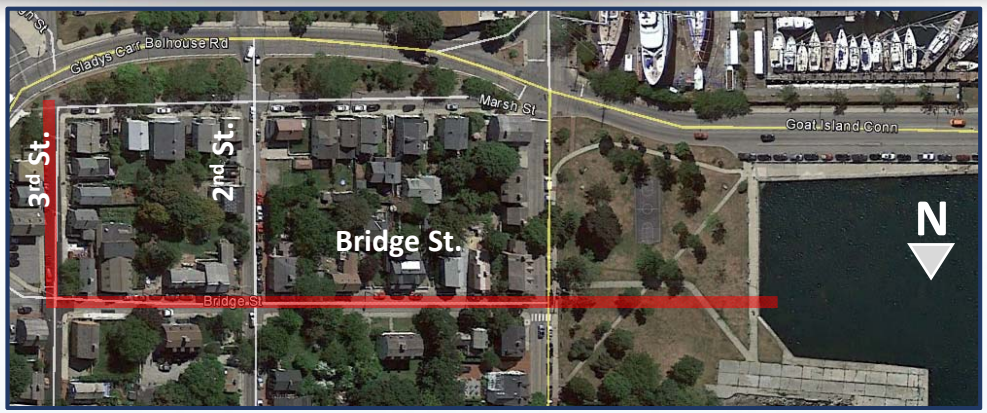
7/1/2015 High Tide of 4.3 ft and Rain Event of 1.2 inches

Stormwater pumping can eliminate flooding for some events but at a high capital and operational cost.

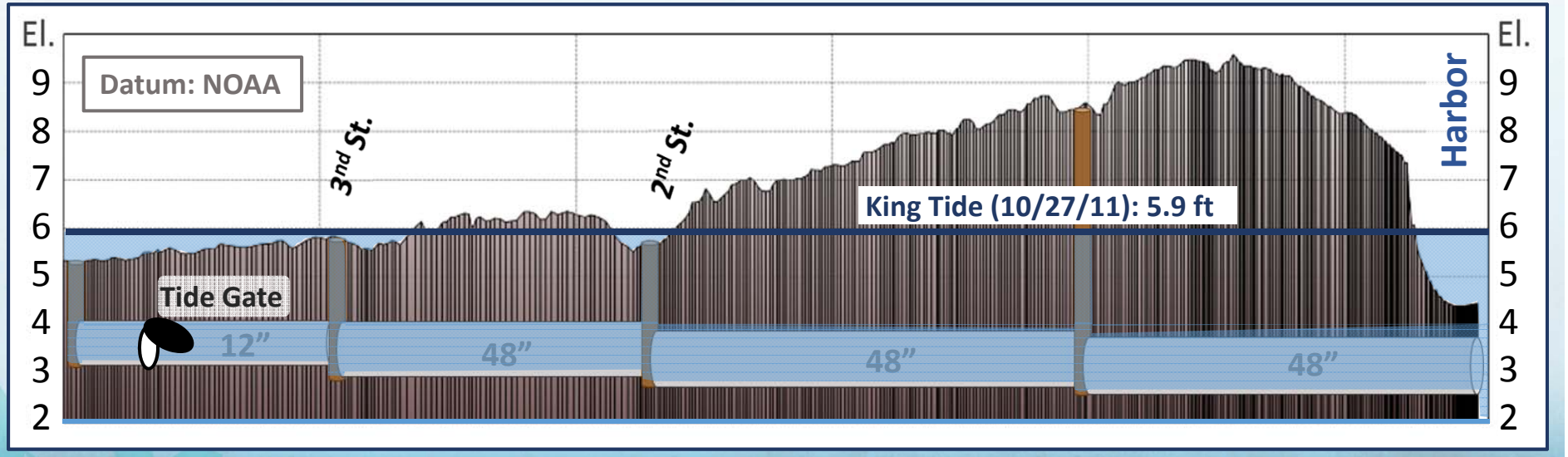




Bridge Street – Flood Protection Levees



- Levees are tall embankments designed to block overland flow from a water body
- At Bridge Street a natural Levee already exists
- Most flooding issues are caused by backwater from tides



Bridge St. Mitigation Measures Discussion

Next Steps

Next Steps for Both Study Areas

- Evaluate combinations of technologies as potential mitigation options using the model
- Develop conceptual cost estimates
- Rate alternatives using MODA
- Hold third public informational meeting in November 2015 to review modeling results and recommendations

The project team is continuing to solicit input.

To contribute or review more information:

Engage Newport:

http://engagenewport.com/projects/drainage-investigation-and-flood-analysis-for-wellington-avenue-and-bridge-street

Project website:

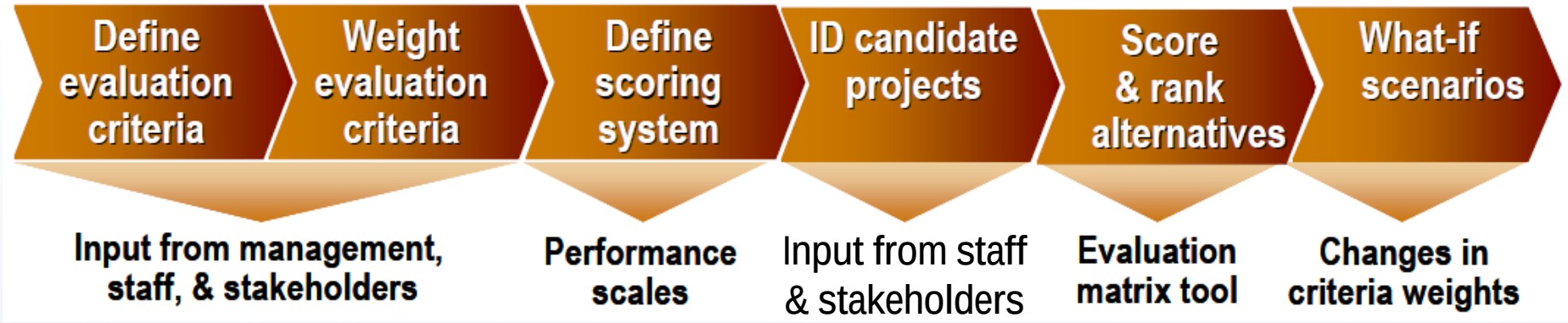
http://www.newportdrainageinvestigation.com/index.php

Determining the Best Recommendation Requires Consideration of Many Factors

- Combinations of mitigation measures
- Performance
  - » Depth of flooding
  - » Extent of flooding
  - » Duration of flooding
- Cost considerations
- Operability of system
- Impacts to community & residents

- Utilizing multi-objective decision analysis (MODA) allows for evaluation of all factors

Multi Objective Decision Analysis



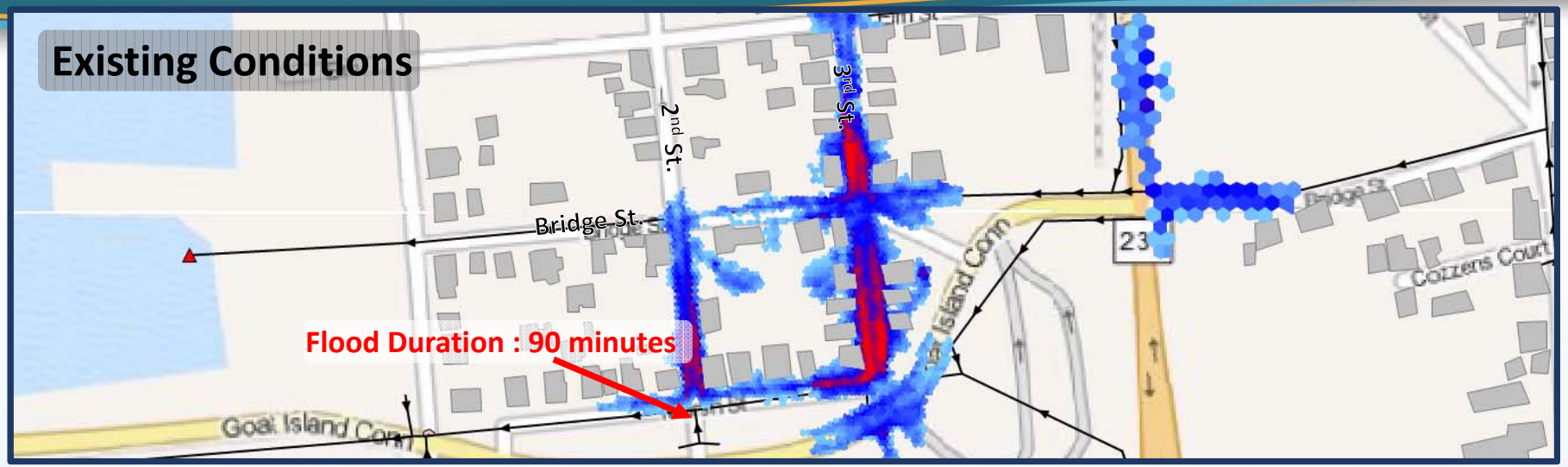
Thank You

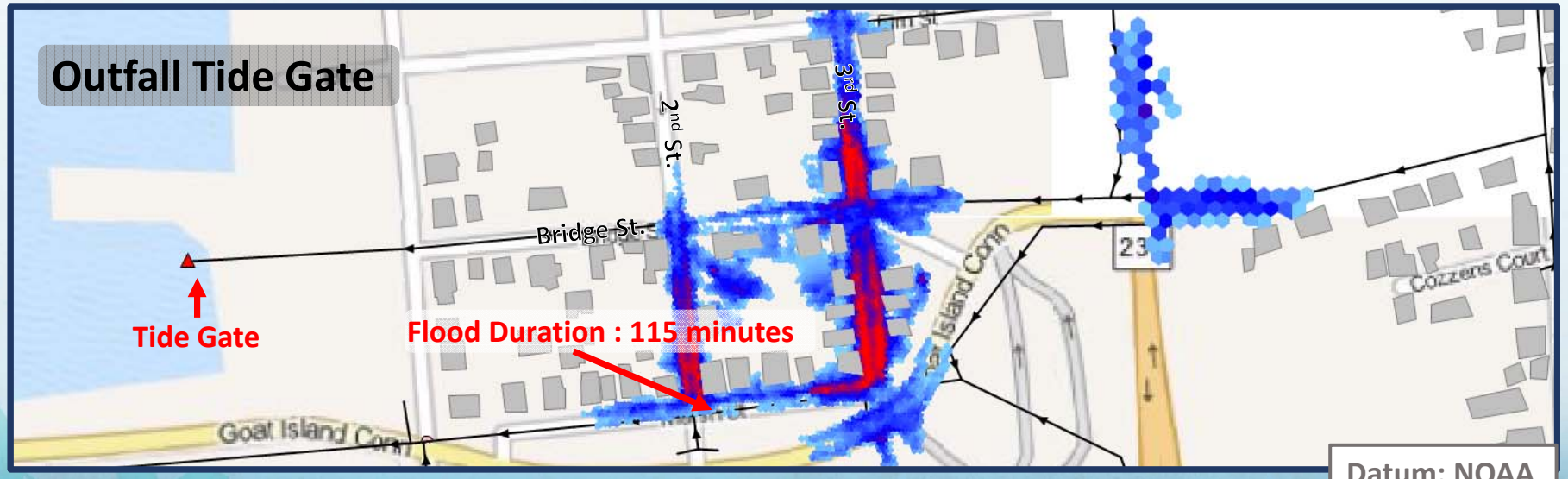
Please visit our project website at:

http://www.newportdrainageinvestigation.com/index.php

Bridge Street - Outfall Tide Gate

5-year, 6-hour Design Storm (2.64 inches) at High Tide: 5.0 ft





Example MODA Results for Thames Street Interceptor Rehabilitation