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# Utility Considerations with the Proposed NJ Back Bays Storm Surge Barrier Systems

NJWEA AAEES Workshop

9th May 2022

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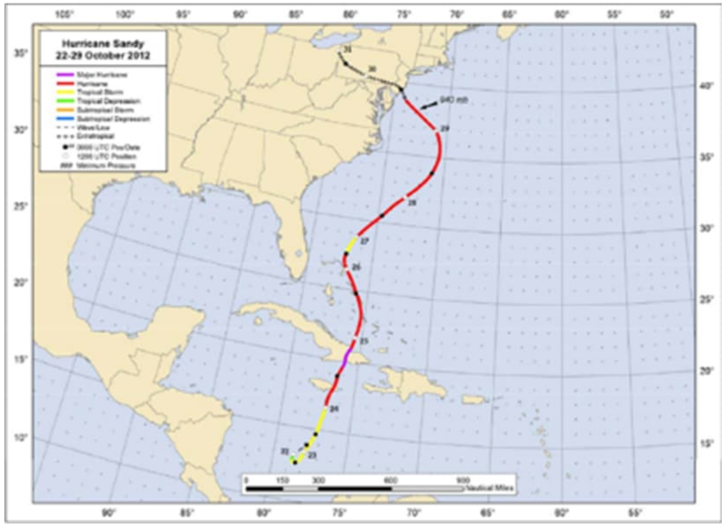
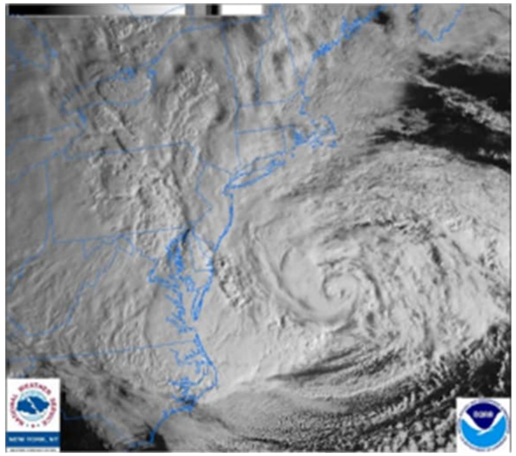
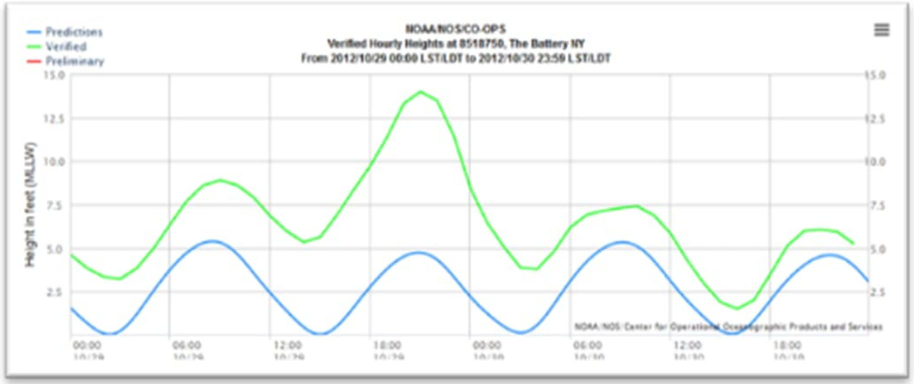
# Lessons Learned - Multiple Threats Occur Simultaneously






Water Elevation at Tip of Manhattan

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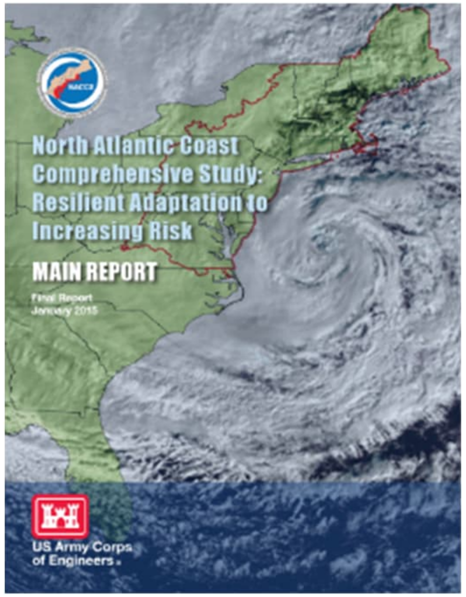
# USACE North Atlantic Coast Comprehensive Study (NACCS)




NACCS:

- Addresses the legislative direction for a <u>comprehensive plan</u> to address vulnerable coastal communities
- Formalized and <u>consistent approach/framework</u> for more detailed, site-specific coastal evaluations
- <u>Integrates</u> state-of-the-science techniques and collaboration
- Equips and links a broad audience and all levels of government with data, tools, and other stakeholders to make <u>INFORMED coastal risk management decisions</u>

NACCS is Not:

- A decision document authorizing design and construction
- A NEPA document evaluating impacts of any specific solution
- A USACE-only application

Reference: www.nad.usace.army.mil/CompStudy



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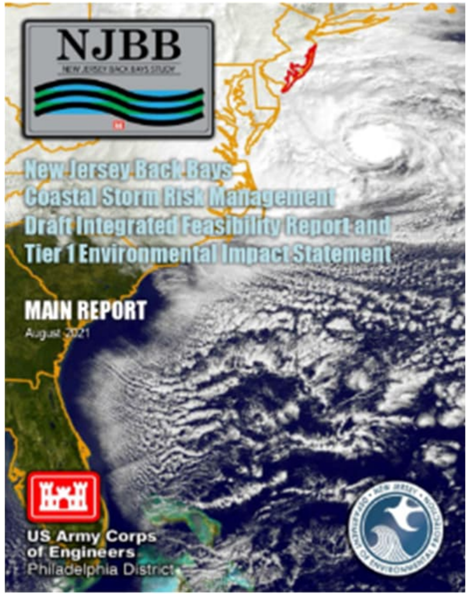
# USACE New Jersey Back Bays Study - Tentatively Selected Plan




**Tentatively Selected Plan Includes:**

- Storm surge barriers (SSB) or inlet closures at Manasquan Inlet, Barnegat Inlet, and Great Egg Harbor Inlet
- Cross-bay barriers (CBB) or interior bay closures at Absecon Boulevard, and southern Ocean City; and
- Elevation and floodproofing of 18,800 structures.
- Perimeter measures including floodwalls, levees and seawalls which tie SSBs and CBBs into adjacent higher ground.

**Projected Costs:**

- Construction cost = $16.07B
- Annual Operation, Maintenance, Repair, Replacement and Rehabilitation = $196M

**Schedule:**

- Construction start ~2030

Reference: https://www.nap.usace.army.mil/Missions/Civil-Works/New-Jersey-Back-Bays-Study/

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# What Does This Mean To Utilities in the Back Bays Planning Area?

What are the threats and risks, where, and when?

How much risk tolerance is acceptable?

What has been done and what remains to be done to address the risks?

<u>To do?</u>

Assess likelihood and consequences of impacts over time w/o and w/ the Back Bays plan implementation in mind

Consequence categories based on types of loss that utilities may experience

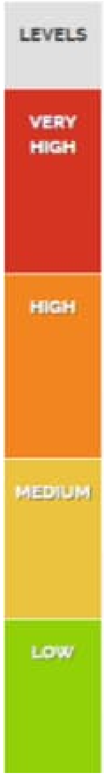
- Business Impacts
- Equipment Damage
- Source/Receiving Water Impacts
- Environmental Impacts

Monetize Levels of Consequence

Consider Time to Implementation – what may happen from now to then?

What's the Backup Plan?

RISK

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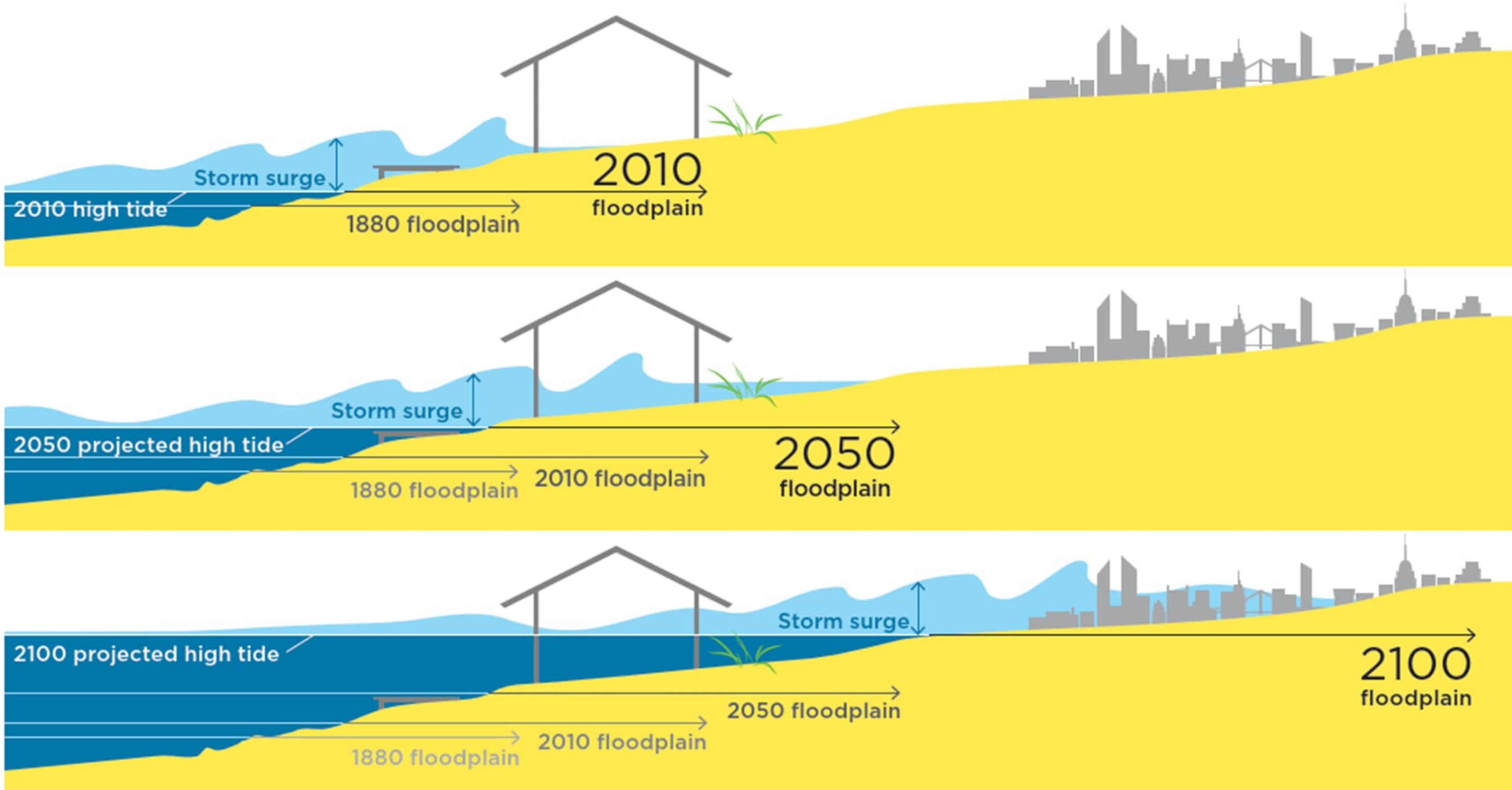
# Storm Surge Increasing in Height and Space with Sea Level Rise




*Source: Union of Concerned Scientists:*
*https://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/Causes-of-Sea-Level-Rise.pdf*

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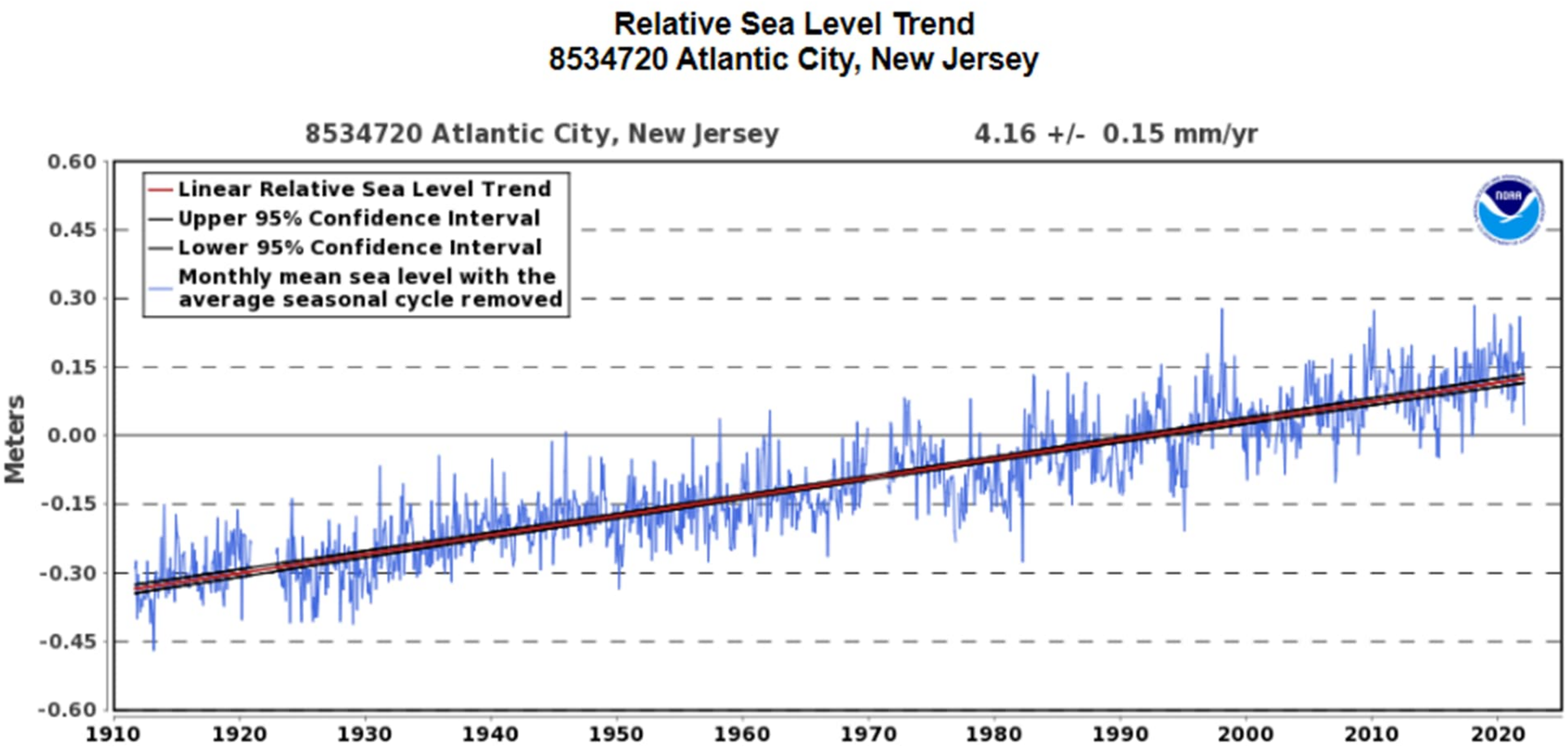
# Sea Level Trends at Atlantic City




Source: https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8534720

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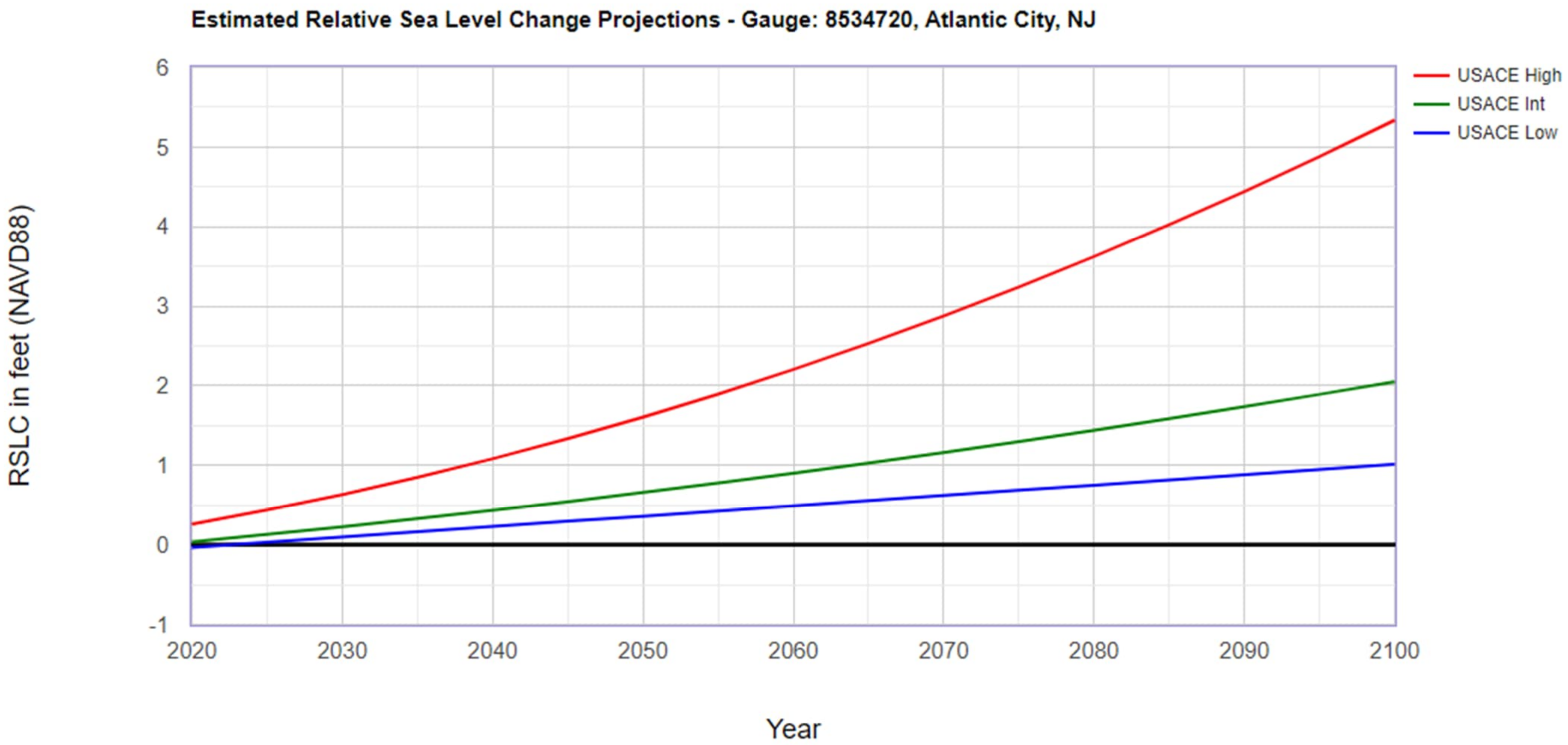
# Projected Sea Level Rise at Atlantic City




Source: USACE SLR Calculator, https://cwbi-app.sec.usace.army.mil/rccslc/slcc_calc.html

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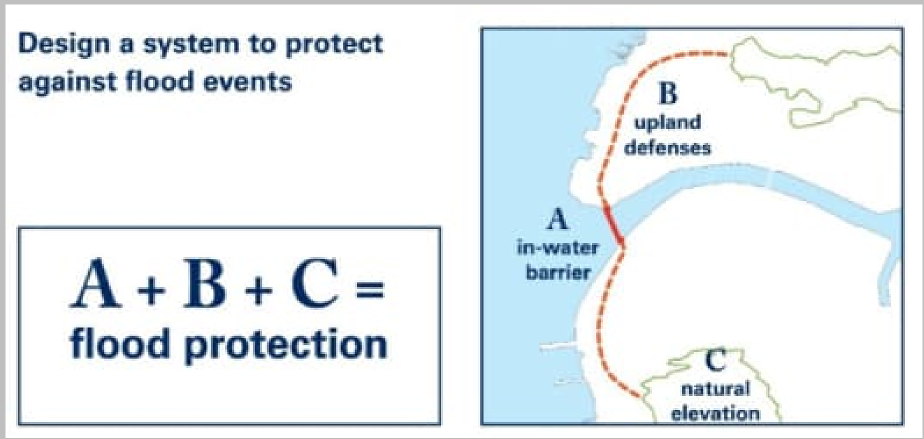
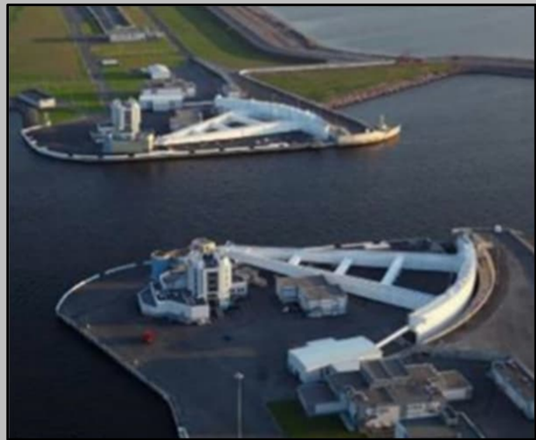
# NJ Storm Surge Barrier System Considerations

# What is a Storm Surge Barrier System?





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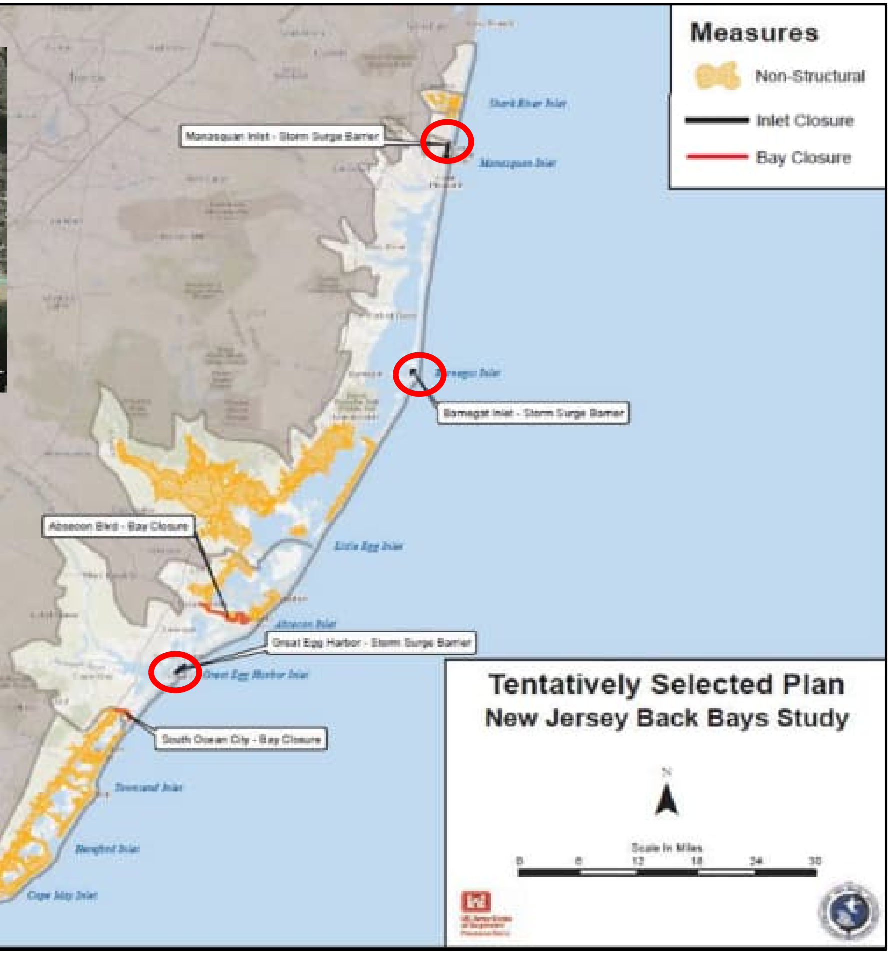
# Where are the Proposed Storm Surge Barriers in New Jersey?

- Manasquan Inlet
- Barnegat Inlet
- Great Egg Harbor Inlet



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# What Utility Infrastructure Could be Affected?

- Water & wastewater treatment plants
- Pump stations
- Sewer collection systems
- Water distribution systems
- Stormwater systems
- Power stations, sub-stations
- Access routes
- Evacuation routes




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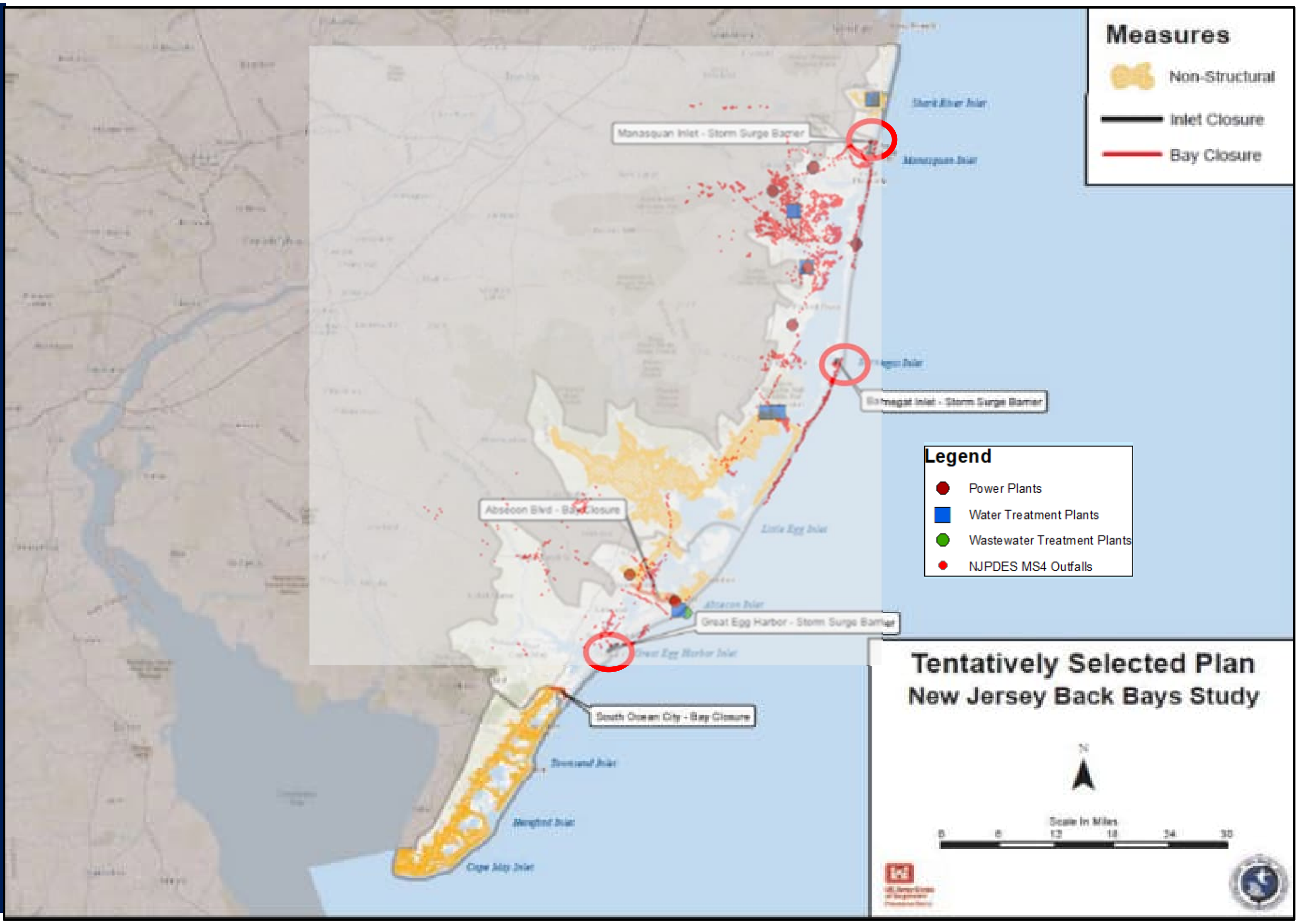
# What Utilities Will Be Behind the Barriers?



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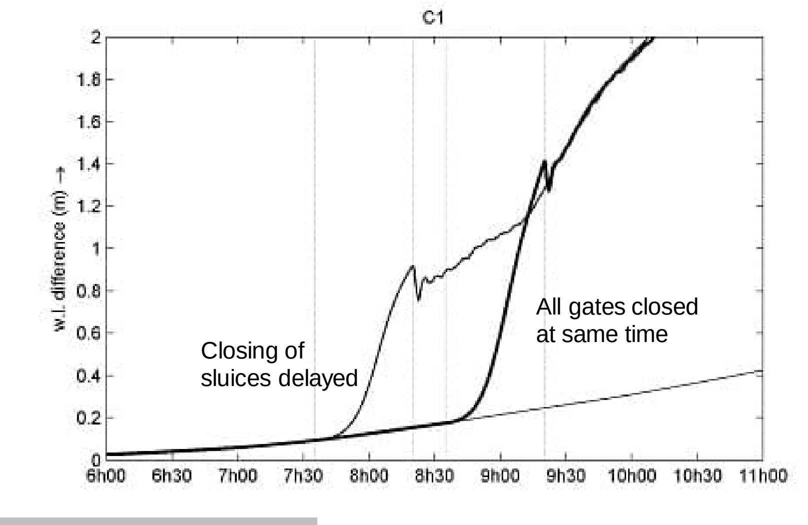
# What Do Utilities Need to Consider?

- Closure level of the system
- Frequency of closure
- Navigation requirements
- Environmental requirements
- Climate change/ sea level rise
- Time for a barrier system implementation
- Water quality
- Secondary surge
- Upstream flood storage
- Opportunities – service crossings



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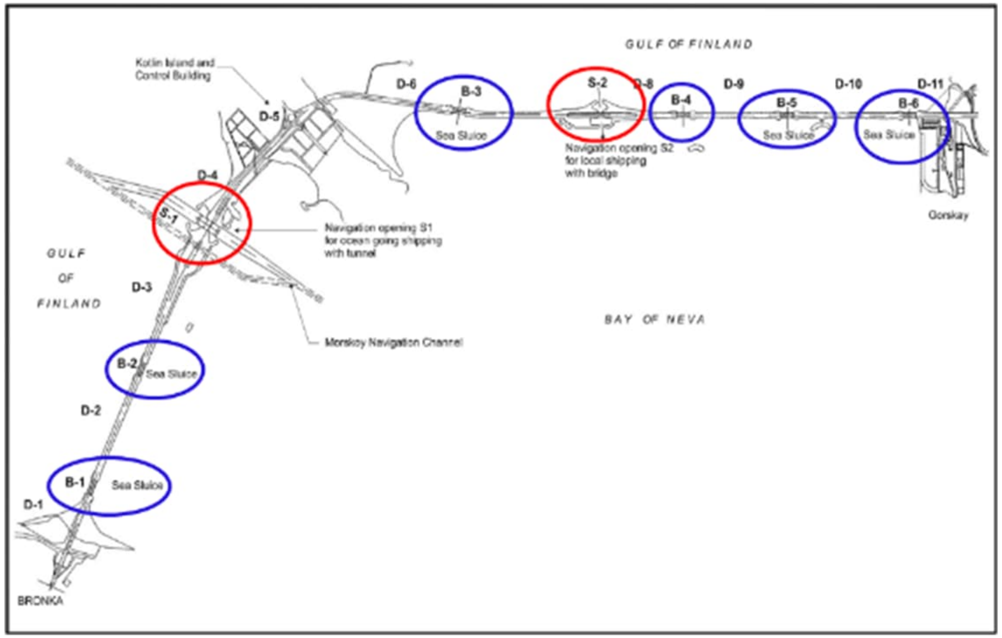
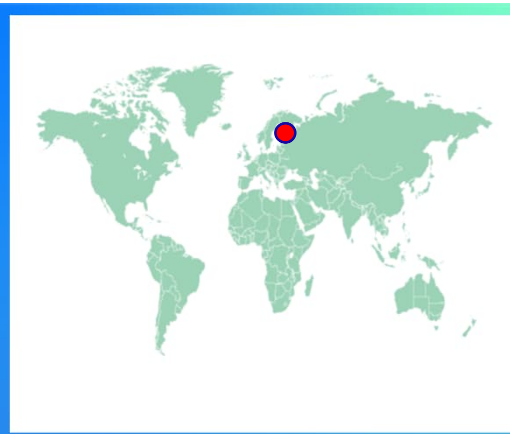
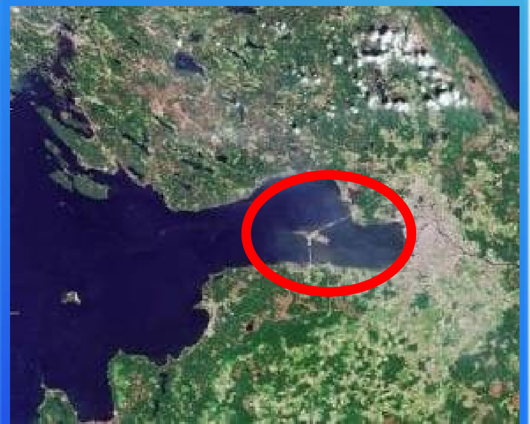
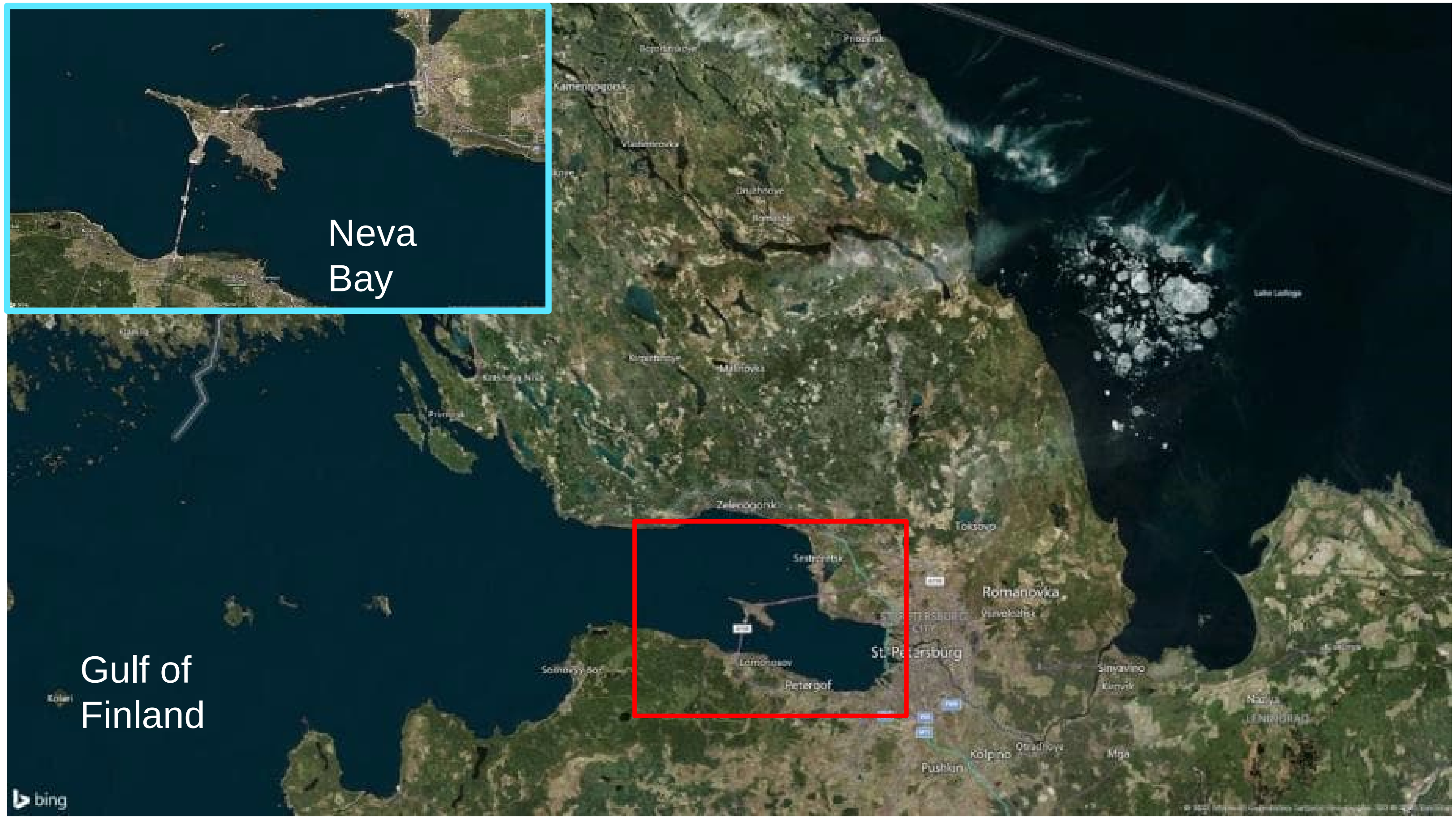
# Case Study:
# St. Petersburg Barrier System





# Location

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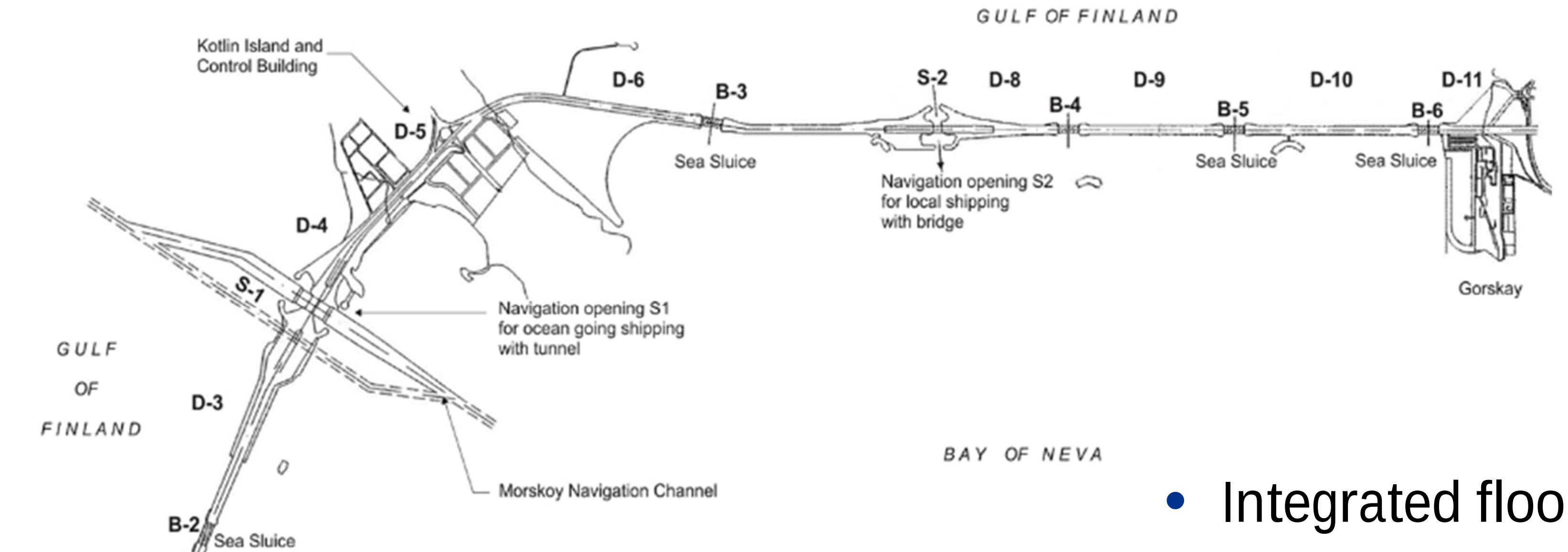
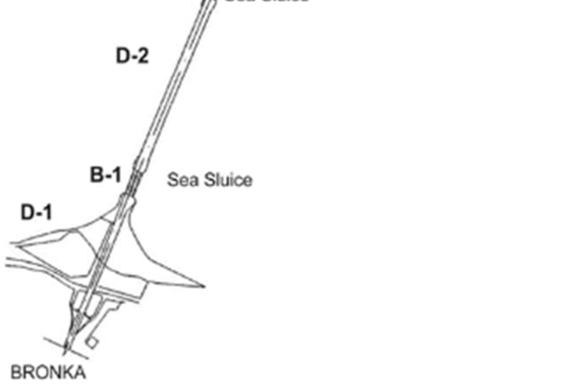
# The Barrier System



- Integrated flood protection system
  - Barrier embankment
  - Main navigation opening (C1)
  - Secondary navigation opening (C2)
  - Sea sluice structures (B1-6)
  - Control center building

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# Main Navigation Opening (C1)

- Length: 273 m
- Navigation width 200 m (660 ft)
- Depth : 16 m (0 ft)
- 2 Floating sector gates
- Tunnel under the structure
- Floating sector gate leaf: weight 2938 tons, length 120 m, height 22 m
- Gate arms: weight 1800 tons, length 115.5 m,  max. width 58.7 m, height: 3.1 to 7.7m

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# Secondary Navigation Opening (C2) - Design Aspects

- Navigation width 117.3m (391 ft)
- Navigation depth : 7m (23 ft)
- Height: 11.6m (39 ft)
- Gate Weight: 2377t
- Steel gate stored below concrete floor
- Draw bridge (16m above water, can be raised by additional 9m in 3 minutes)




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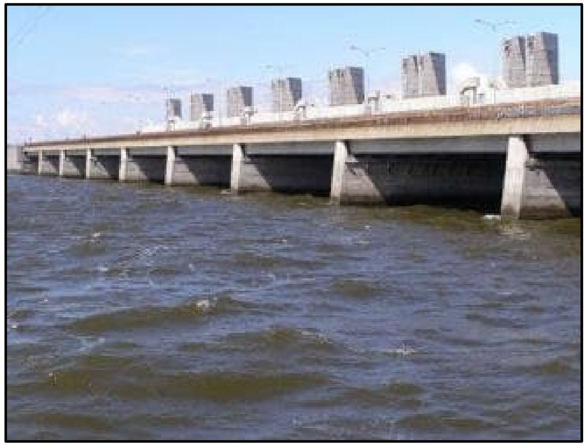
# Sluice Gate - Design Aspects

- 6 complexes of radial gates (64 gates, 24m (80 ft) wide)
- Each complex about 250m wide with 10 gates (deep and shallow water complexes)
- Threshold depth: 2.5 / 5m
- Gate height: 4.5 / 6.5m
- Gate weight: 280 – 305t
- Road bridge on top
- Weight to penetrate ice



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# Embankment - Design Aspects

- Earth embankments (top level 6.8m BC)
- 23.4km (14.5 miles)
- Crest width 36m
- Base width 100 – 160m
- Rock Armor (dynamic loading design based on accepting certain level of maintenance)

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# Closure Scenarios

Closure scenarios for whole barrier system to get insight into hydraulic design conditions


Figure 2: Closing sequence I

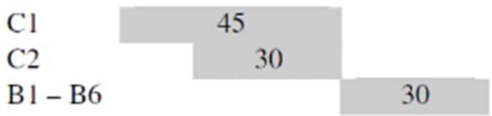
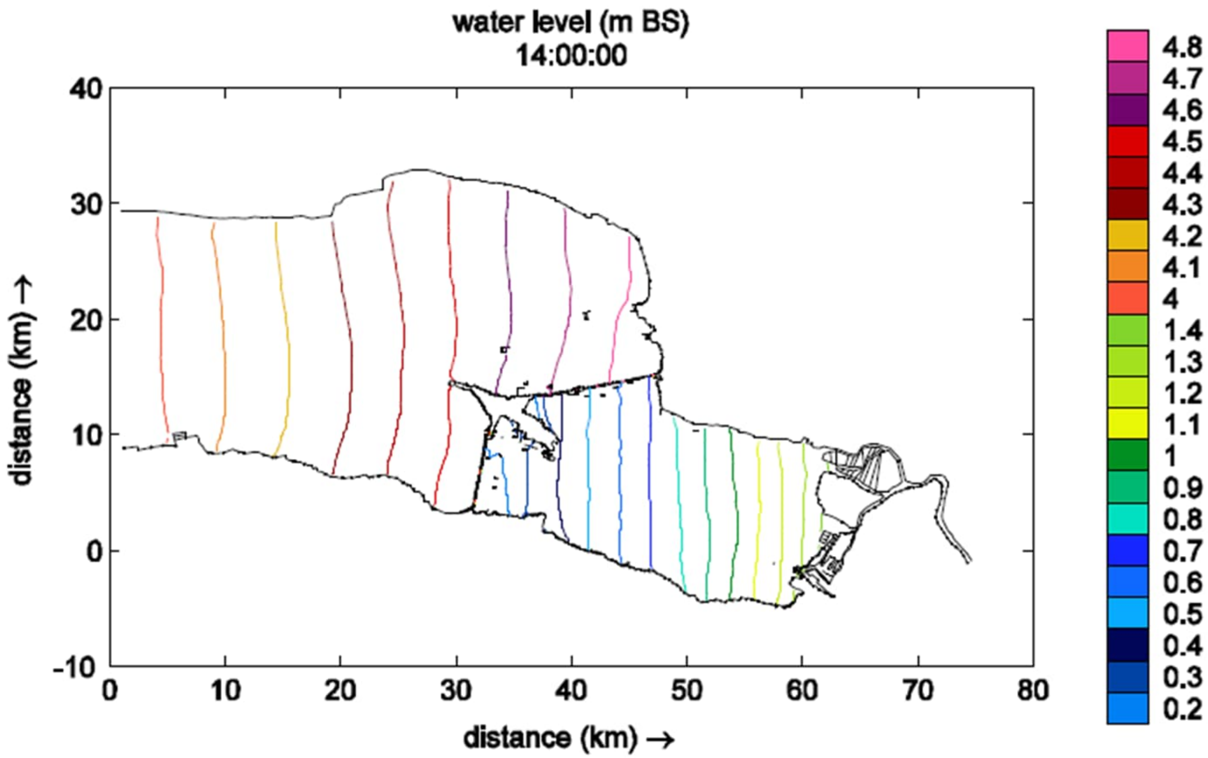



Figure 3: Closing sequence II


Figure 4: Closing sequence III



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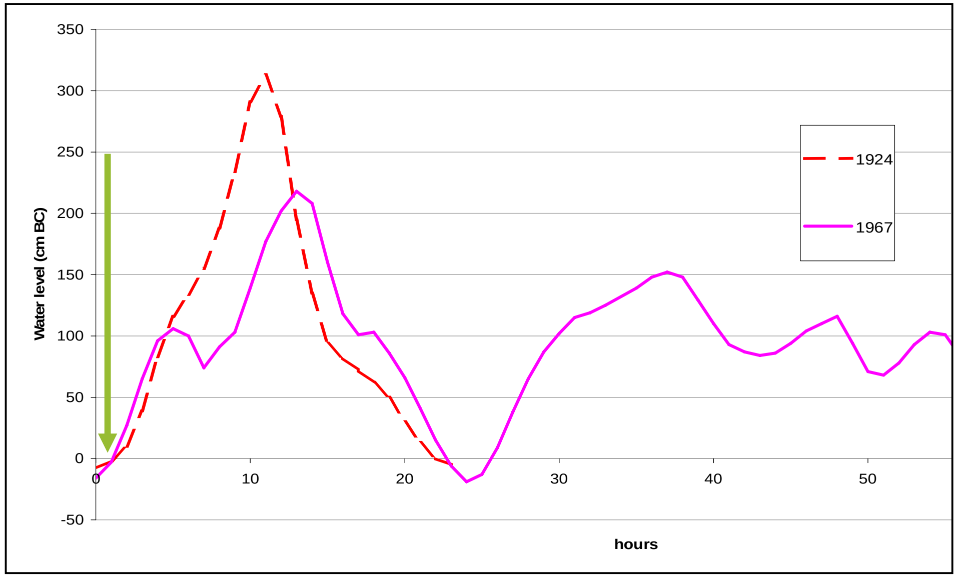
# Operational Closure

Requirements Set by the Designer:

- *pre-warning*: 1 day before flood waves arrives in Kronstadt → alert responsible organisations
- *early warning*: 8 hours ahead →announce Alert State 1, start preparations for closing (pre-heating, clearing ice, testing systems)
- *final warning*: 2 hours ahead →decision to close, announce Alert State 0, stop navigation, start closing procedure (press the button)





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# Operational Closure

## Operational Forecast System:

- Use of accurate and most recent meteorological data and predictions
- Regular refreshment of predictions with measurements (6-hour cycle)
- Reliable also in winter (ice cover)
- Prediction of water levels (accuracy of final prediction: 10 – 20 cm)
- Prediction of wave heights
- Detailed prediction of effects of closing the gates, and effects of wind on water levels in Neva Bay

## Decision Support System:

- Built around the forecast system
- Objectives:
  - to determine optimum timing and sequence of closing and opening the gates
  - to keep water levels in SPB below critical level (1.60 m BC)
  - to keep water levels in the Neva Bay near the Barrier sufficiently high (not to exceed the design head difference: 3.55 m)


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# Thank You

## Utility Considerations with the Proposed NJ Back Bays Storm Surge Barrier Systems

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