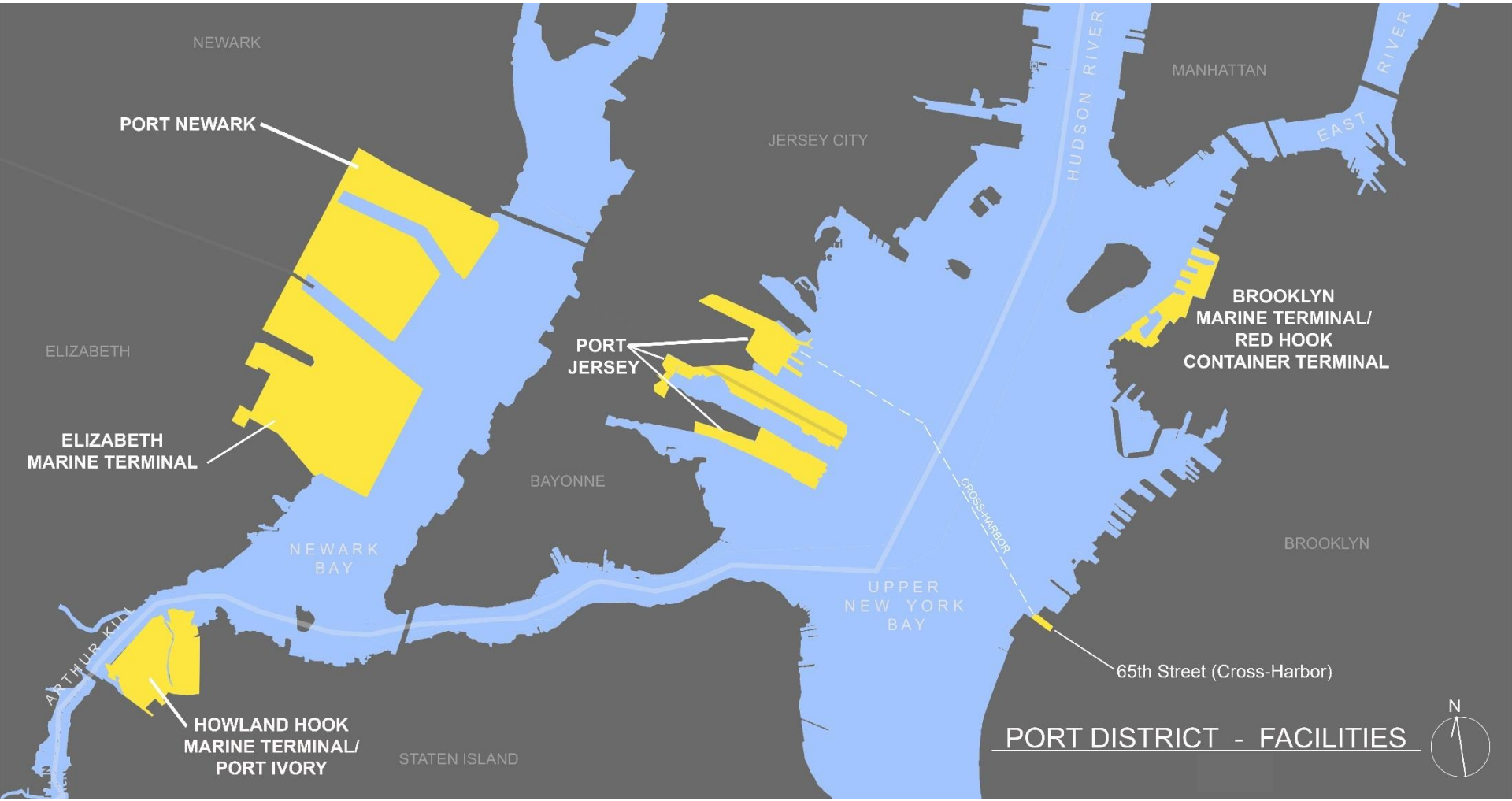
Port of New York and New Jersey

Post Sandy Approach to Resiliency

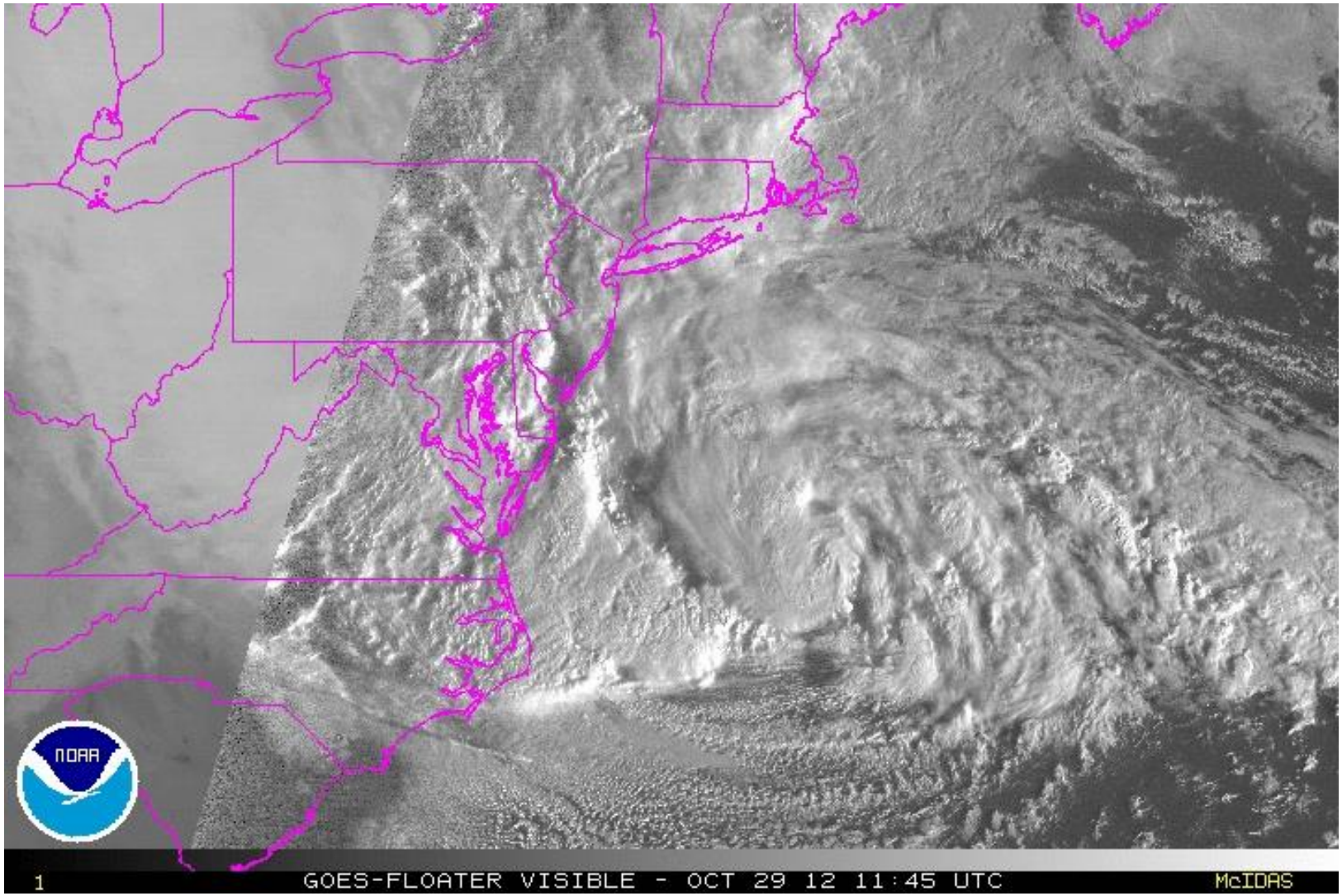
AAPA - Energy & Environment Seminar
September 12, 2018

Our Port Facilities

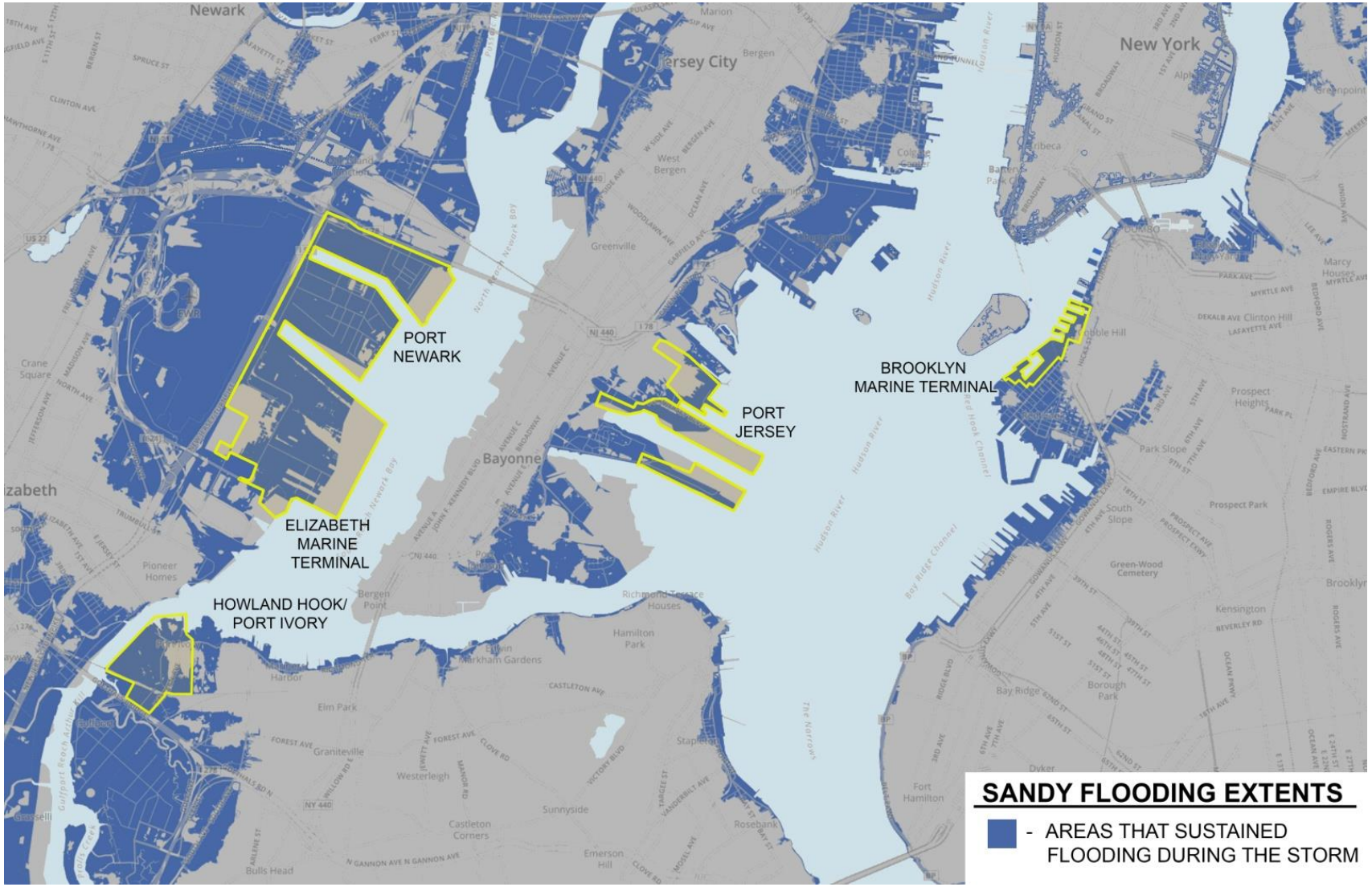


Sandy Re-Cap

Sandy



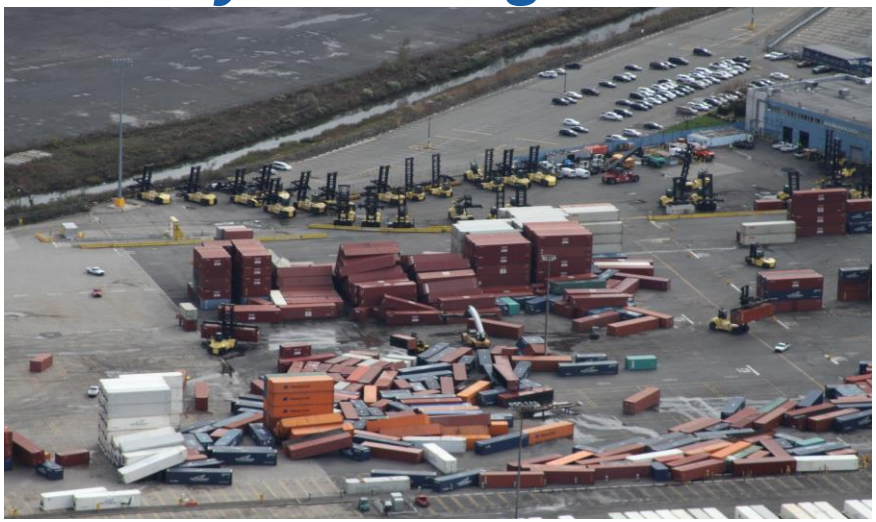
Sandy - Storm Surge Map



Map Source: WNYC - project.wnyc.org/flooding-sandy-new

Based on Nov. 11, 2012 interim data from the FEMA Modeling Task Force Hurricane Sandy Impact Analysis, which combines detailed elevation data with U.S. Geological Survey inspections of high water marks.

Sandy - Damages Incurred



Recent Storms Tropical Storms

2011 – Irene Mostly a rain event with large amount of precipitation swelling the streams and rivers. Brought +11” of rain to NJ, causing 3 days of flooding over much of NJ, Upstate NY, and VT.

2012 – Sandy Damage mainly caused by storm surge and to a lesser extent wind. Nominal amount of rain.

2013 - Remnants of Tropical Storm Andrea impact New York with 4+ inches of rain and wind gusts of 45 mph.

2015 - Hurricane Joaquin briefly threatens to approach or strike the New York metropolitan area, forcing New Jersey and New York to begin storm preparations. No US landfall.

2016 - Hurricane Hermine meanders off the coast of southeastern New York as an extratropical cyclone. Strong waves and minor coastal flooding occur along the coastline.

2016 - Hurricane Matthew – came ashore in the Carolinas but we still saw heavy rain and minor flooding.

Tackling the Short Term and the Mid-Range Issues

Identifying Critical Infrastructure

- Assets (Tools, Machinery, Equipment used to support port operations)
- Operations and preparedness for the next event.


PNCT
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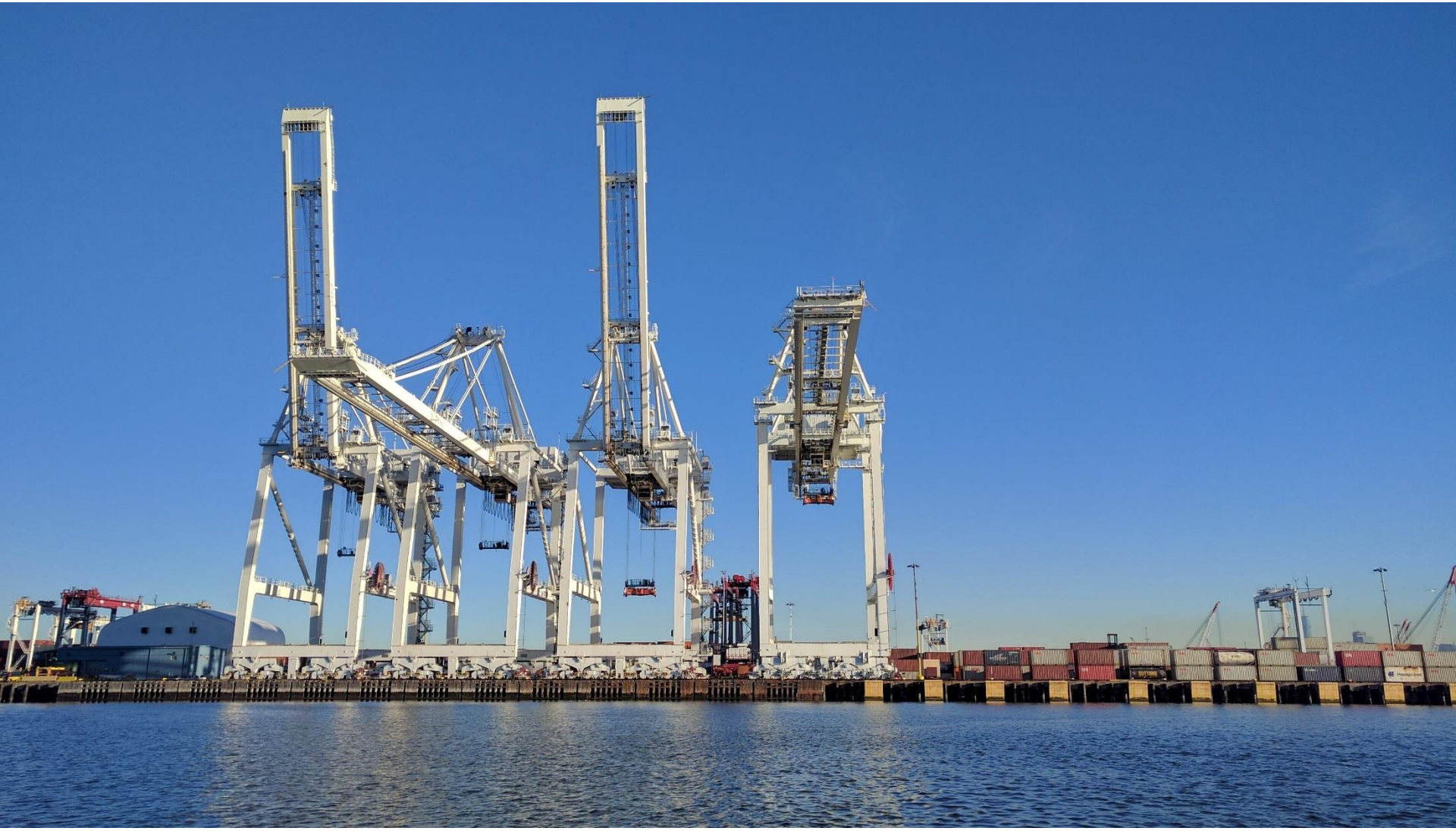
SAFETY

Long Term Planning



Design Guidelines Climate Resilience

- Used for all capital projects
- Addresses hazards:
  - Increased heat
  - Increased precipitation
  - Sea level rise
- Step-wise process for building flood resilience

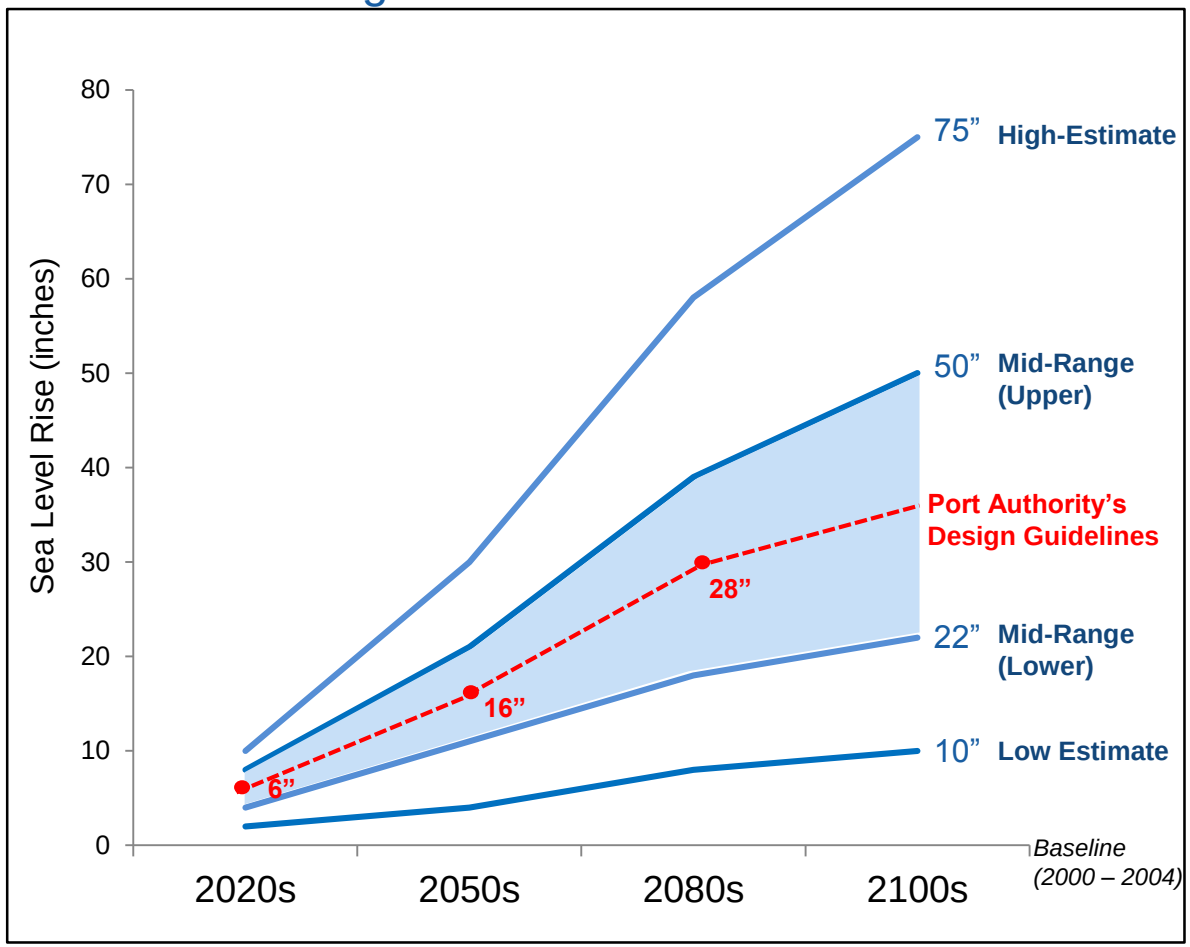
Table 2 – Flood Protection Levels

	Non Critical Assets			Critical Assets		
Asset Design Life	Code Requirement	Sea Level Rise Adjustment	Final Flood Protection Elevation	Code Requirement	Sea Level Rise Adjustment	Final Flood Protection Elevation
Up to 2020	12”	6”	FEMA 1% Elevation + 18”	24”	6”	FEMA 1% Elevation + 30”
2021-2050	12”	16”	FEMA1% Elevation + 28”	24”	16”	FEMA1% Elevation + 40”
2051-2080	12”	28”	FEMA1% Elevation + 40”	24”	28”	FEMA1% Elevation + 52”
2080+	12”	36”	FEMA1% Elevation + 48”	24”	36”	FEMA1% Elevation +60”

http://www.panynj.gov/business-opportunities/pdf/discipline-guidelines/climate-resilience.pdf

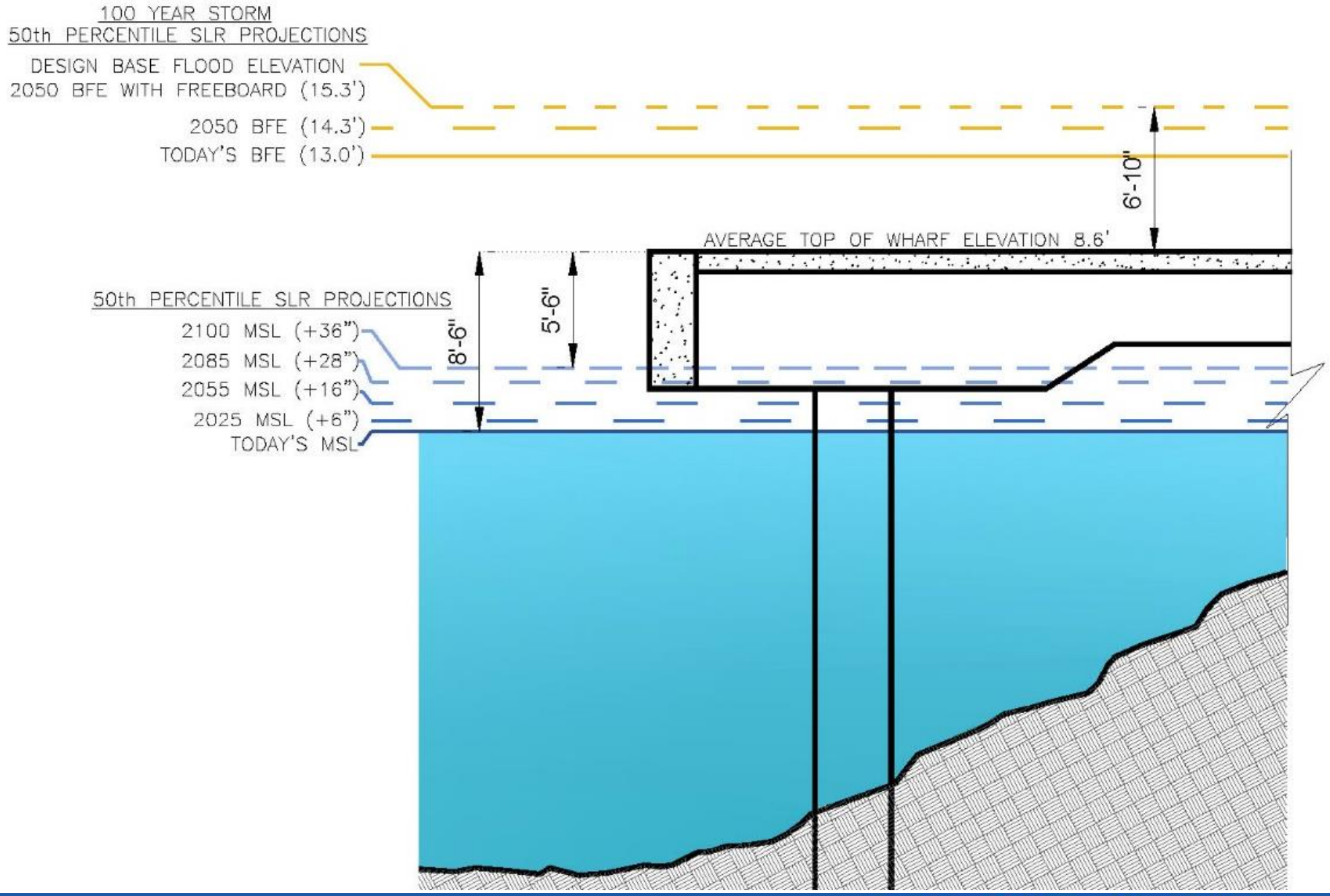
Climate Change - Sea Level Rise

New York City Panel on Climate Change 2015
Regional Mean Sea Level Rise

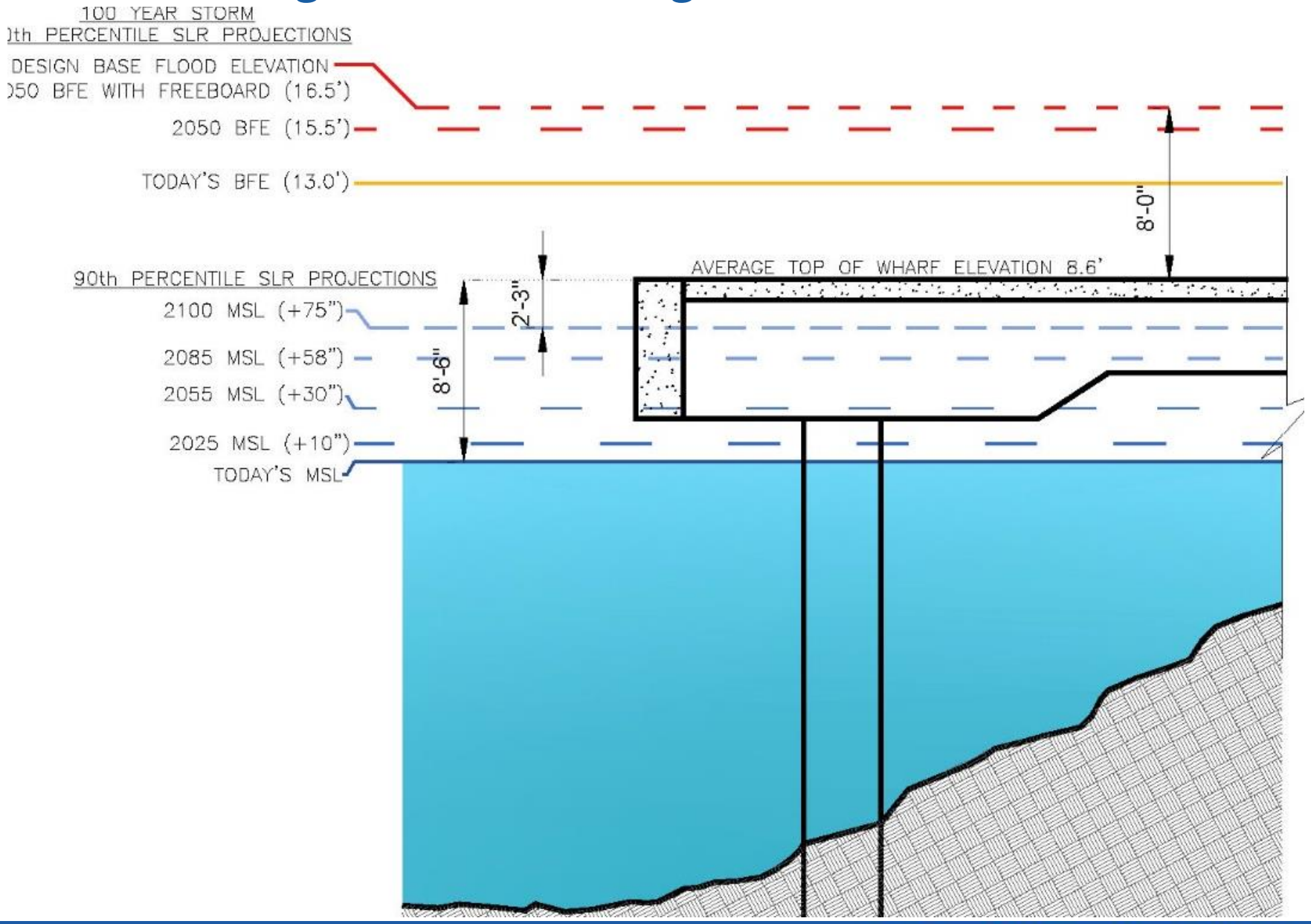


Source: NASA Goddard Institute, Columbia University (2015),
Applicable to Port District and Recommended for Port Authority adoption by OEEP

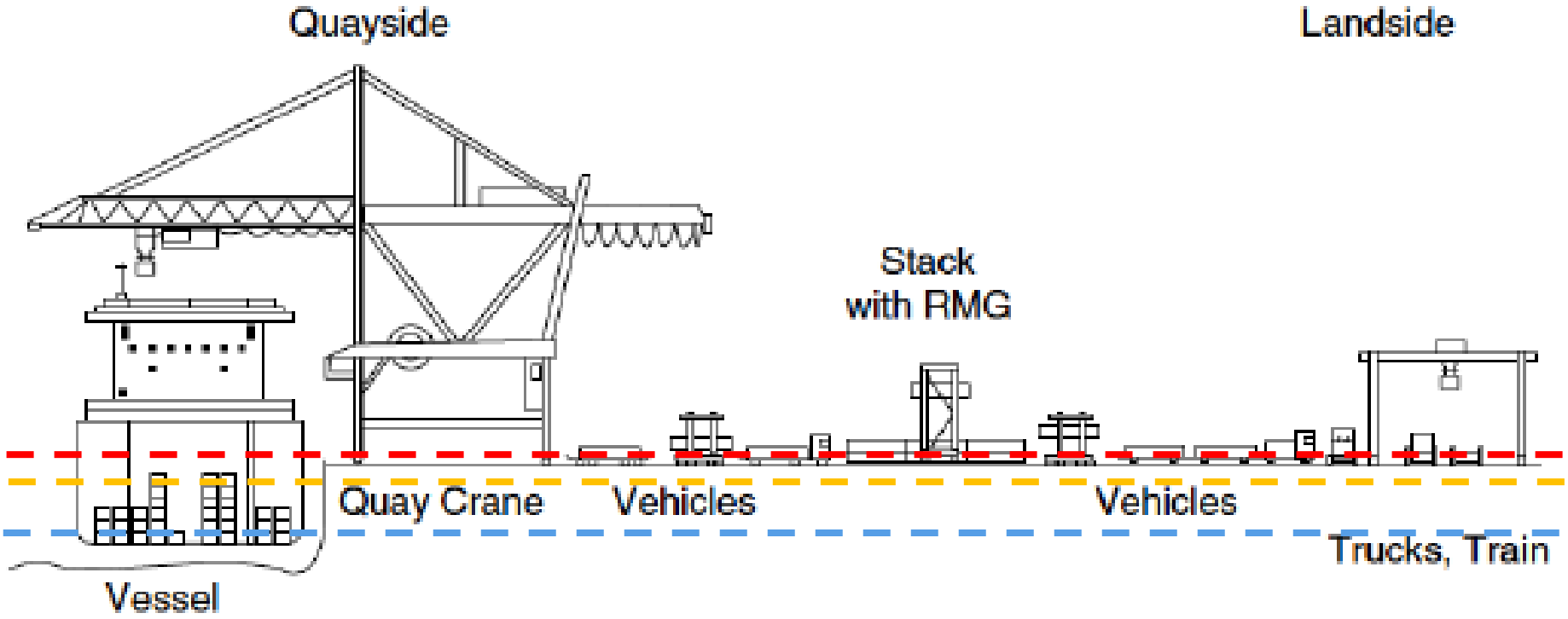
Understanding Climate Change Risk – 50th Percentile



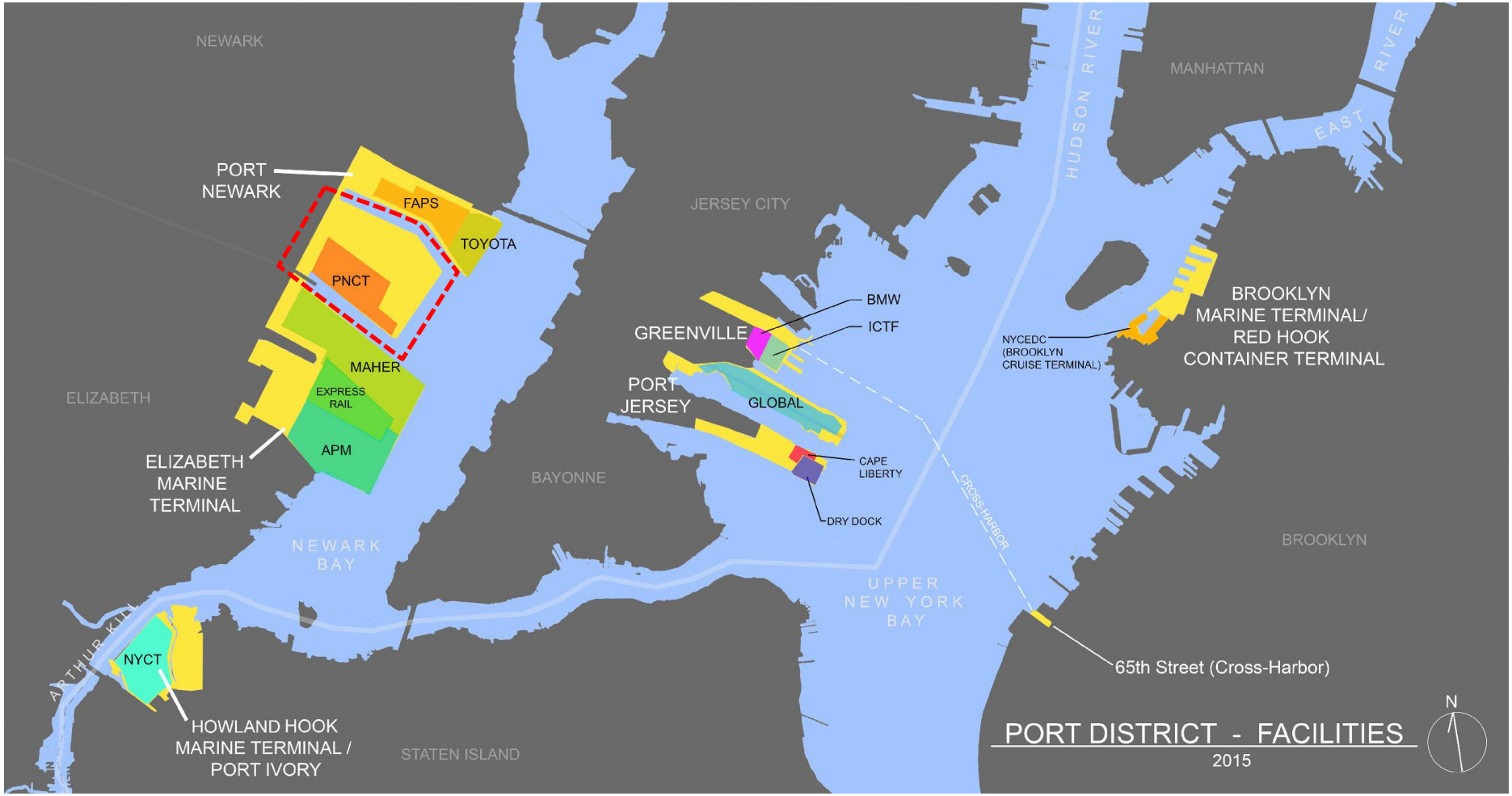
Understanding Climate Change Risk



Understanding Climate Change Impacts



Sea Level Rise Vulnerability and Risk Assessment - Port Newark South



Sea Level Rise and Flood Risk

- Port Authority Design Guidelines for Climate Resilience considers the following projections of SLR for resilient planning:

Table 1. Sea Level Rise Values for Risk Assessment Application		
Sea Level Rise Values (from NYC Panel on Climate Change Resilience Manual)		
Time Period	50th Percentile	90th Percentile
2025	6"	10"
2035*	9"	17"
2055	16"	30"

* 2035 values are interpolated, following Horton et al. 2015

- Study evaluated 4 coastal flood return periods with these future conditions:
  - 10-year: ~90% chance within a 20-year period
  - 50-year: ~30% chance within a 20-year period
  - 100-year: ~20% chance within a 20-year period
  - 500-year: ~3% chance within a 20-year period

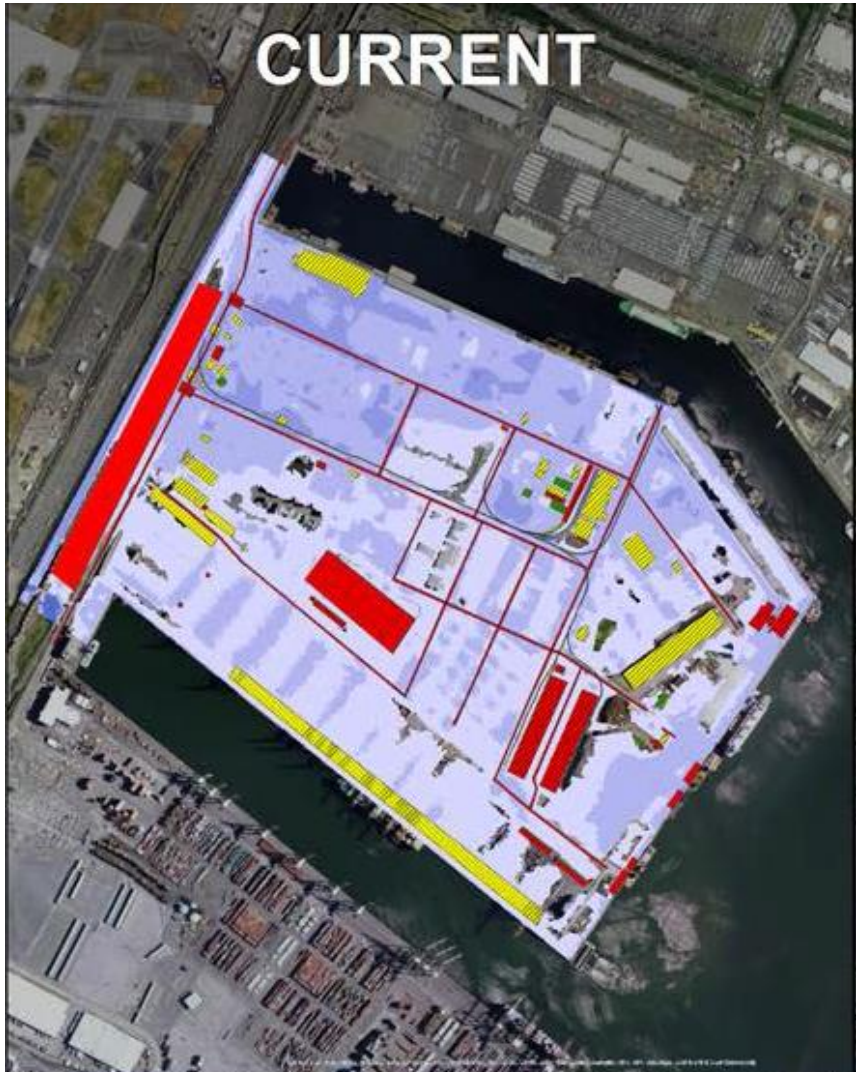
Identifying Critical Infrastructure

- Assets (Tools, Machinery, Equipment used to support port operations)
- Operations (Operational components used to carry out typical port function)
- What is a priority?
  - Discussion with port infrastructure and operations expert to determine assets and operations critical to tenant operations.
  - What is the purpose of this asset or operation?
  - Can the tenant function (and for how long?) with the asset or operation:
    - Impaired
    - Affected
    - Disabled

Example Hazard Results

Current Sea Level – Projected 10 Year Storm

- 12% of facility inundated
- 10% Annual Exceedance Probability
- Probability of storm event occurring in a given year.
- In 2025 - 23% of facility inundated

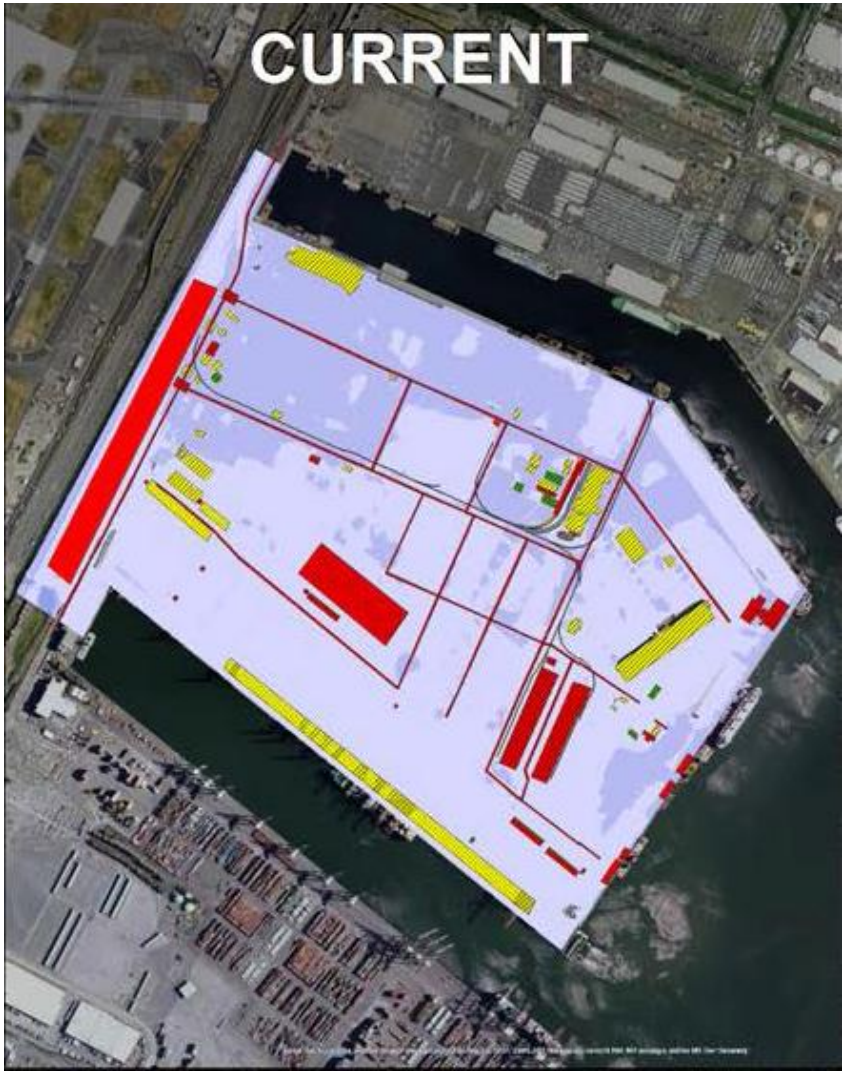


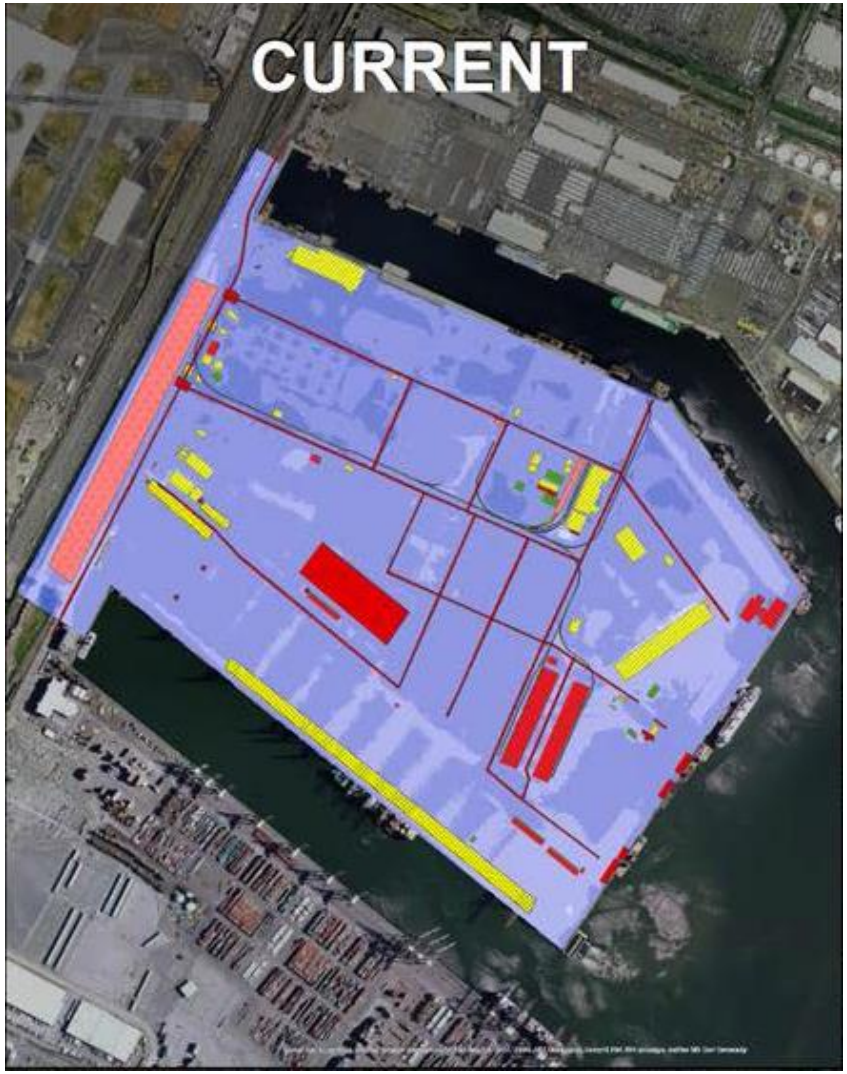
10-year Storm

50-year Storm

Flood Depth (feet)

0-2.0	4.1-6.0	8.1-10.0
2.1-4.0	6.1-8.0	10.1-12.0





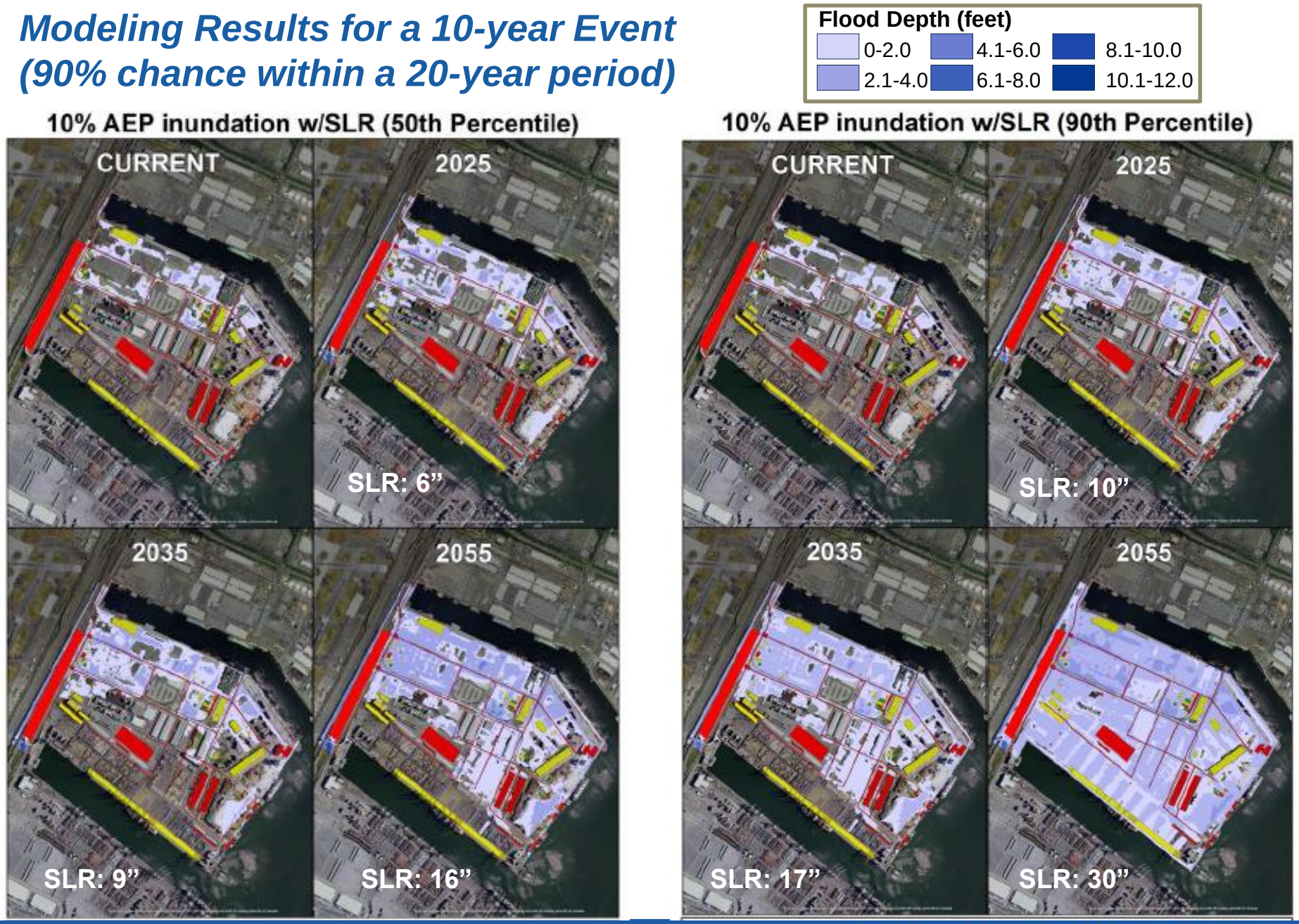
100-year Storm

500-year Storm

Flood Depth (feet)

0-2.0	4.1-6.0	8.1-10.0
2.1-4.0	6.1-8.0	10.1-12.0

Modeling Results for a 10-year Event (90% chance within a 20-year period)



How Do We Adapt?

Adaptation Options

Elevation

Relocation

Protection

Adaptation

What We Are Doing Differently

- Incorporate Design Resiliency Guidelines in all capital projects going forward
- Evaluate electrical substations, traffic and rail signals, pump stations and other fire protection systems for latent damage
- Evaluate localized power/electric stations fueled by natural gas and/or diesel to service key infrastructure
- We are performing a complete asset inventory, assets useful remaining life and replacement costs
- Check valves on our storm water out falls to prevent water backing up through our drainage systems.
- Working with Stevens Institute, USAC, and other academic/ scientific institutions to develop better modeling, prediction, and warning systems. As well as to develop better resilient strategies.

Thank You

Questions?

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