

Planning for Climate Change at Your Wastewater Treatment Facility

What You Should Be Doing Now

W 70°15'18"

An aerial photograph of a wastewater treatment plant. On the left side, there are several large, white, circular aeration tanks arranged in a row. To the right of the tanks are various industrial buildings and structures. Further to the right, there is a residential neighborhood with houses, streets, and trees. A white dashed line is drawn across the image, and the text 'W 70°15'18"' is overlaid on it. The background of the slide is a blue gradient with a white wavy shape at the bottom.

Presented by:
Jeffrey Pinnette, PE
David Cockburn, PE
January 27, 2015

Facility Plan Update – South Portland WWTF

- Assess equipment replacement needs over 20-year planning period – asset management
- Evaluate strategic process improvements to enhance overall facility performance
 - Grit removal
 - Screening
 - Dewatering
- Analyze longer term concerns
 - Potential future discharge parameters/limits - nitrogen
 - **Climate change**

Potential Climate Change Impacts

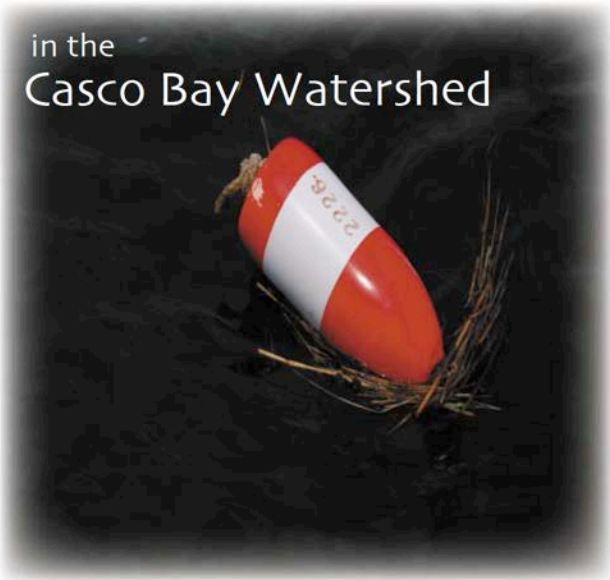
- Sea level rise
- Increasing storm intensities
- Increasing air temperatures
- Increasing wastewater temperatures



Key References for Climate Change Impacts

CLIMATE CHANGE

in the
Casco Bay Watershed



CLIMATE CHANGE IN THE CASCO BAY WATERSHED: PAST, PRESENT, AND FUTURE
DECEMBER 2009



University of Southern Maine · Muskie School of Public Service · www.cascobayestuary.org

Preparing South Portland for the Potential Impacts of Sea Level Rise

Peter Slovinsky, Marine Geologist
Maine Geological Survey, Department of Conservation

Stephanie Carver, Land Use Planner
Greater Portland Council of Governments

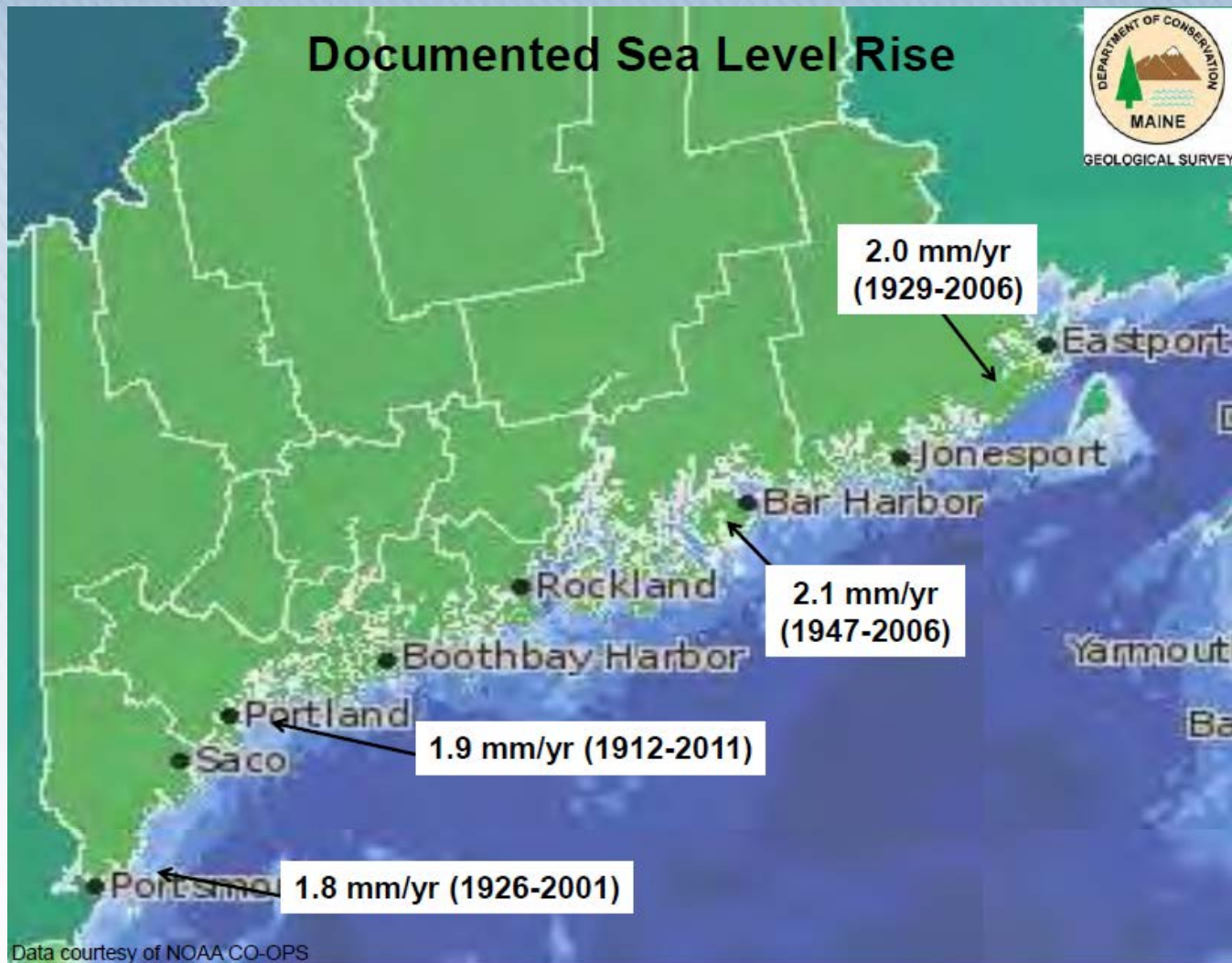
Project Partners:



Project Funding from:



Sea Level Rose 0.7' in Past Century

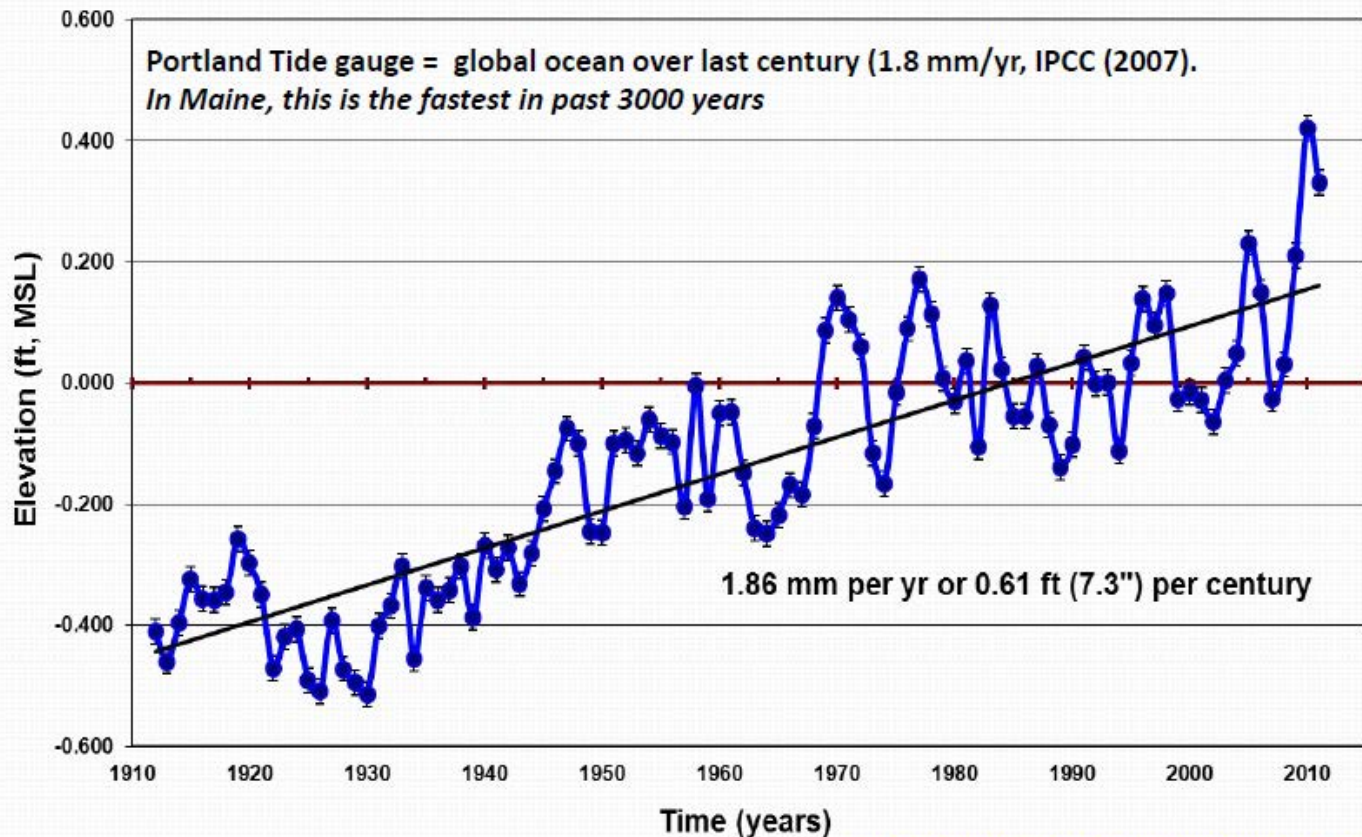


Portland Tide Gauge

Sea Level, Portland, Maine
1912-2011 (through June 2011)

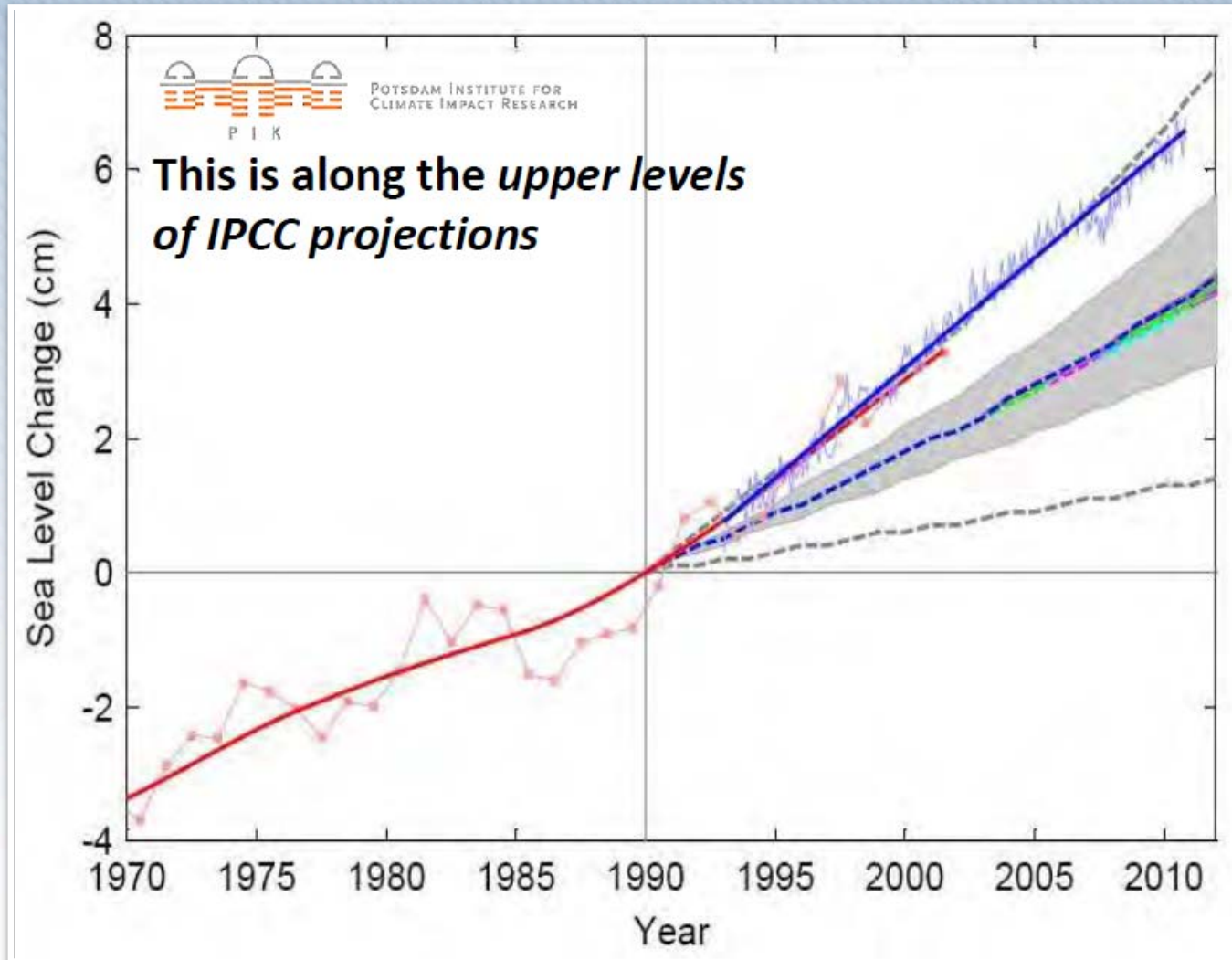


GEOLOGICAL SURVEY



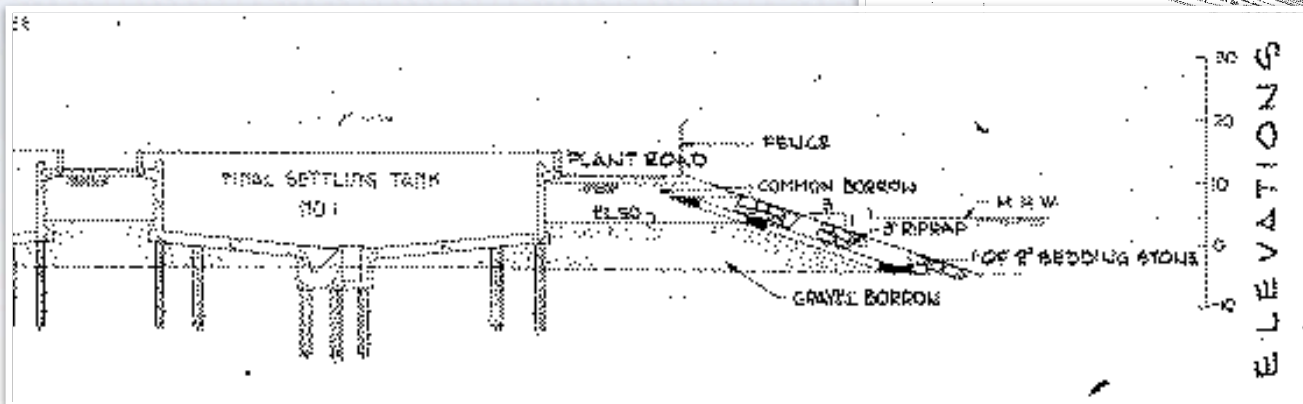
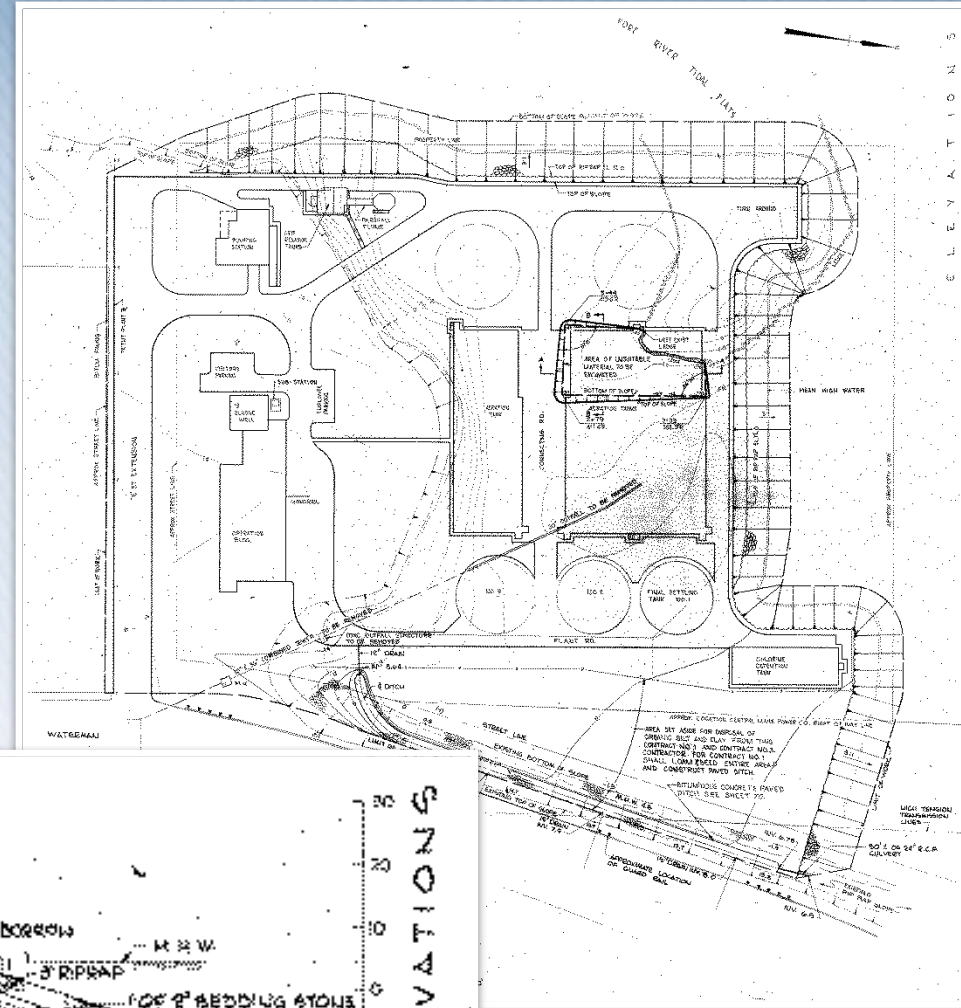
Actual Data

Consistent with Worse Case Scenario



Background

- Original WWTF operational in 1979
- Constructed partially in mud flats



Background

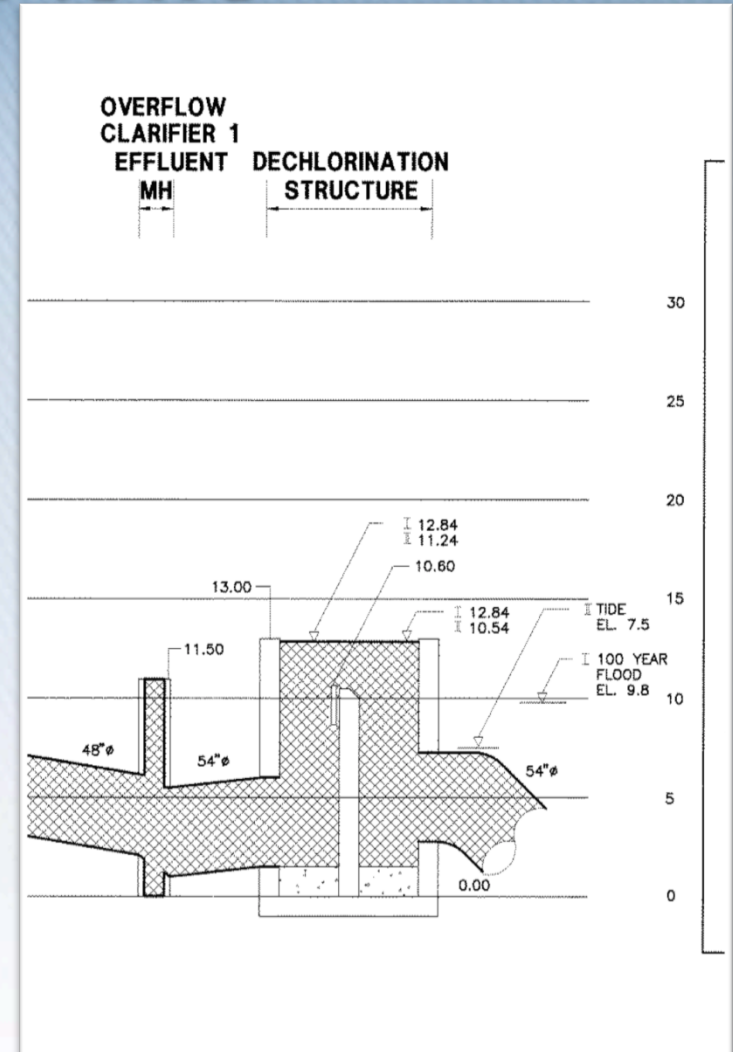
- Wet weather flows
 - 1990 Consent Decree to increase peak secondary capacity
 - CSO long-term control plan
 - ❖ first, maximize flows to WWTF
 - ❖ second, separate combined sewers
 - 1995 upgrade to WWTF
 - ❖ converted existing secondary clarifiers to wet weather treatment
 - ❖ constructed new larger secondary clarifier for main WWTF

Current South Portland WWTF



Current Design Peak Flows

- Main WWTF – 22.9 MGD
- Wet Weather – 33.1 MGD
- Total – 56.0 MGD



Current Flows

Condition	Main WWTF	Wet Weather Treatment	Total Flow
Average	6.6	0.13	6.7
Max Monthly	13.5	1.7	14.6
Peak Daily	24.4	18.4	40.6
Peak Hourly	31.2	33.1	~56.0^a

a. peak flows typically not concurrent

- Wet weather flows are decreasing due to combined sewer separation
- May increase in future due to:
 - higher groundwater levels due to sea level rise
 - more intense storms due to climate change

Projected 100-Year Flood Elevation – NAVD 1988

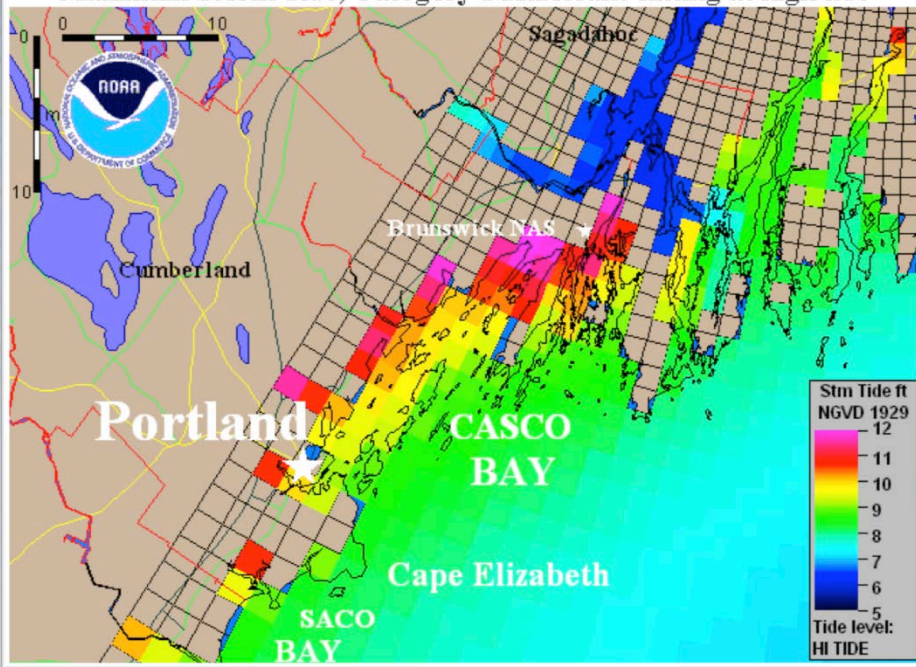
Scenario	Lower		Higher	
	2050	2100	2050	2100
Crust subsidence	0.024	0.043	0.024	0.043
Regional dynamic	NE	0.52	NE	0.79
Global eustatic	0.66	1.6	1.4	4.6
Total estimated sea level rise	0.68	2.17	1.42	5.43
Current (1998) FEMA 100-year flood w/storm surge	8.9	8.9	8.9	8.9
Future 100-year flood w/storm surge	9.5	11.1	10.3	14.3

Storm Surge vs. Typical Tidal Range

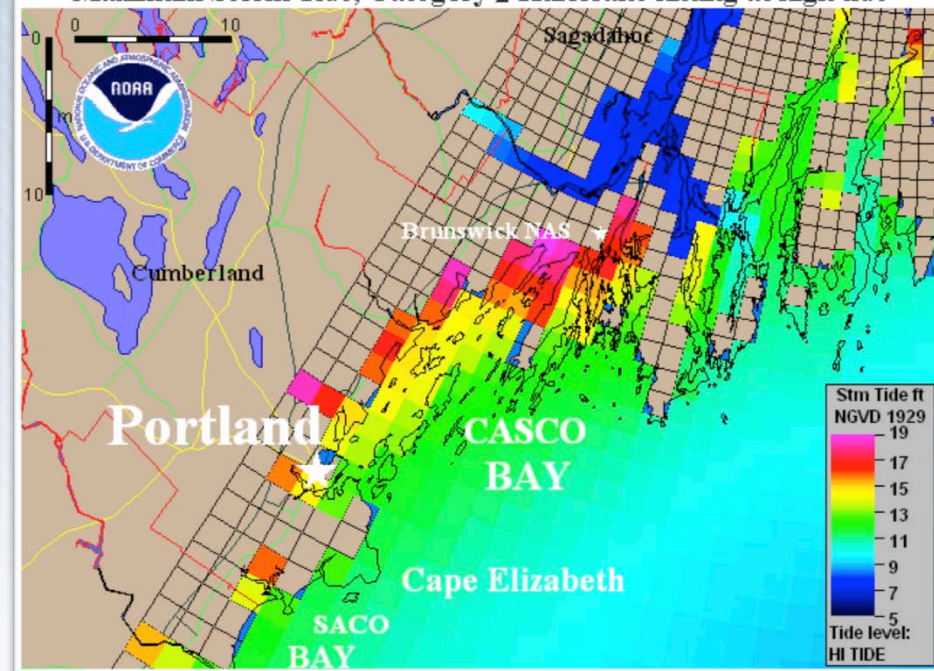
Item	Acronym	NAVD 1988
Highest observed water level w/storm surge (measured)	HOWL	8.87
Highest astronomical tide (predicted)	HAT	6.69
Mean higher-high water (measured)	MHHW	4.65
Mean high water (measured)	MHW	4.21
North American Vertical Datum of 1988	NAVD88	0.00
Mean diurnal tide level = (MHHW + MLLW)/2	DTL	-0.30
Mean sea level (DTL+MTL)/2	MSL	-0.32
Mean tide level = (MHW+MLW)/2	MTL	-0.35

Predicted Storm Surge – Level 1 vs. 2

Maximum Storm Tide, Category 1 Hurricane hitting at high tide



Maximum Storm Tide, Category 2 Hurricane hitting at high tide



Current Conditions



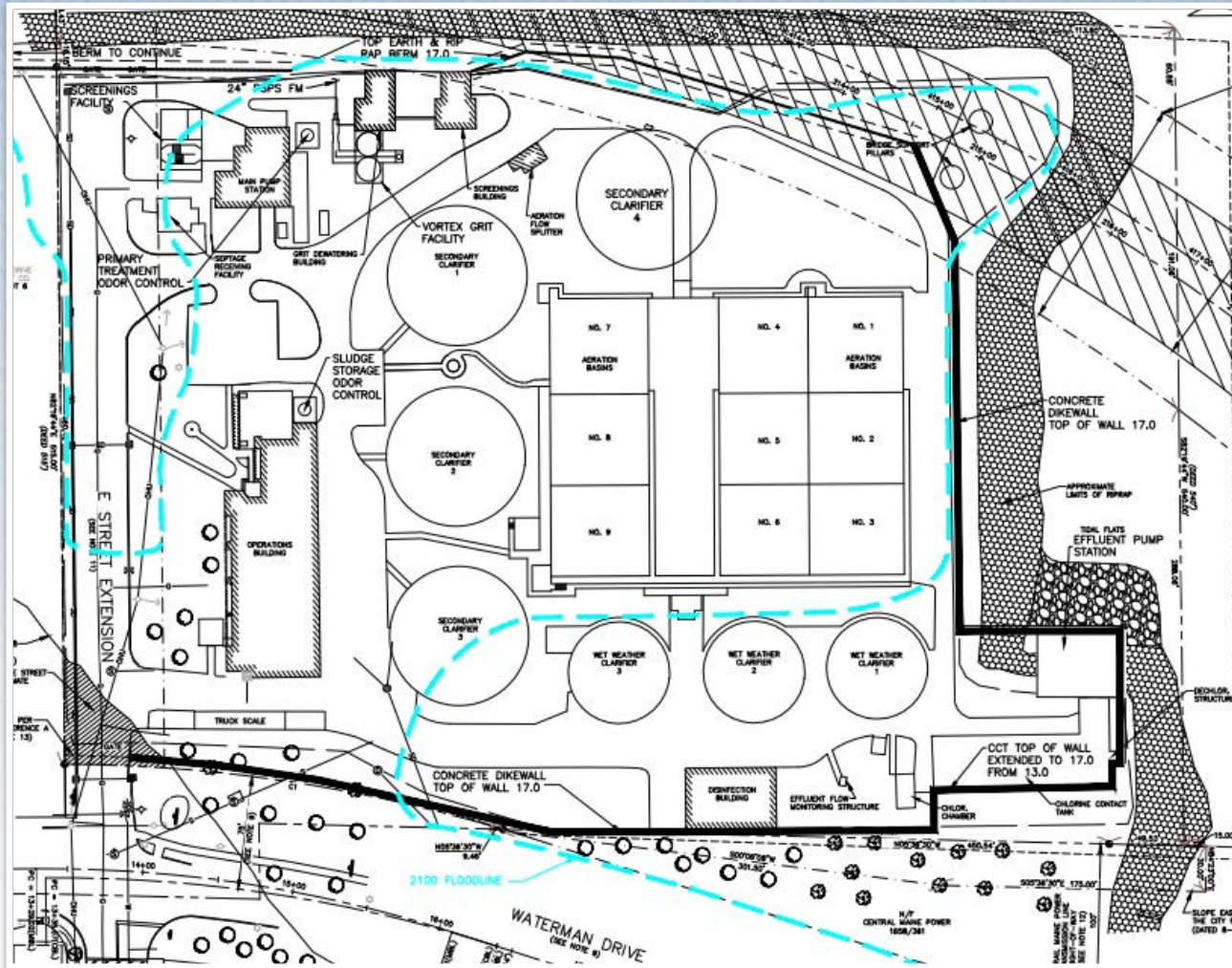
Future Sea Level Rise – Year 2100



Future Sea Level Rise w/100-Year Storm Surge



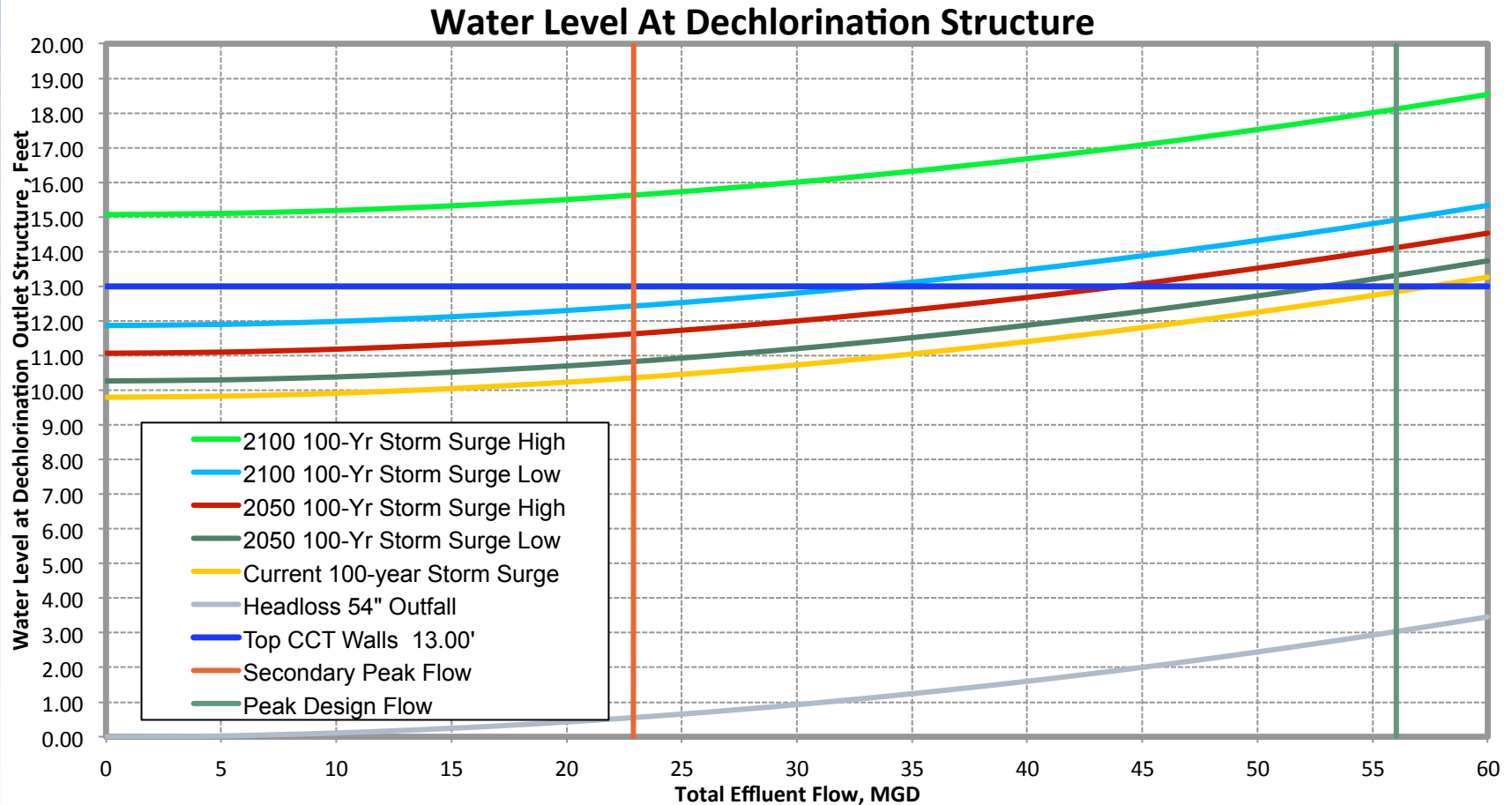
2100 Higher Scenario w/100 Year Storm Surge



Impacts of Sea Level Rise at WWTF

- Building Impacts
 - 2050 – limited flooding of grounds
 - 2100 – overtop ground floor of chlorination building and top of chlorine contact tank
- Hydraulic Impacts
 - Peak capacity with gravity flow decreases over time

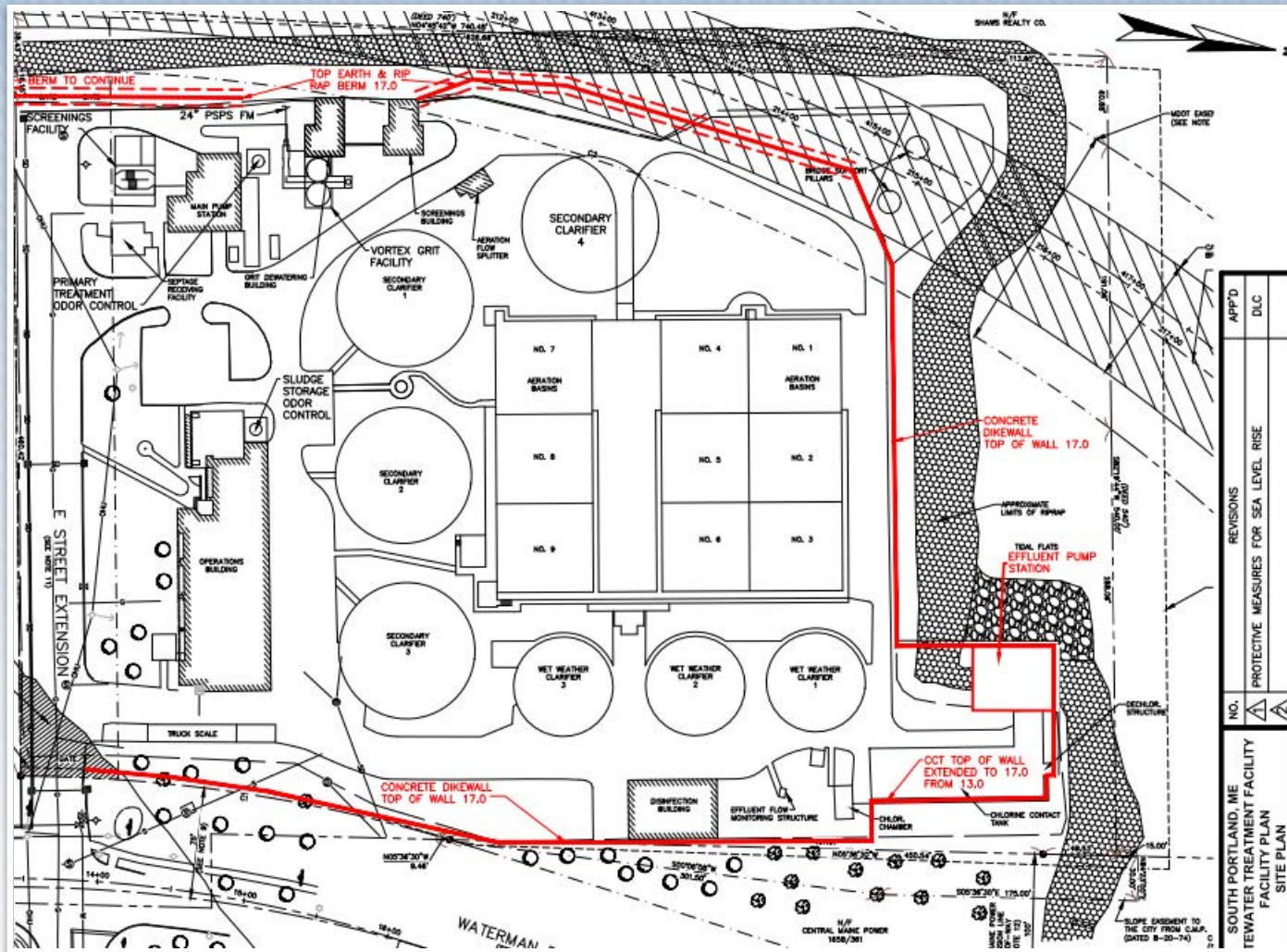
Gravity Flow Limitations with Sea Level Rise



Measures to Address Sea Level Rise at South Portland WTF

- Effluent pumping – 56 MGD capacity
 - potentially raise CCT walls to delay effluent pumping
- Protective berm
 - site is suitable for berm/dike at elevation 16.0 – NAVD88
 - provide ~ 1.7 feet of freeboard at 2100 high scenario with 100-year storm surge
 - also revisions to on-site storm drainage – prevent flooding from within – and direct to effluent pumping

Proposed Dike and Effluent Pump Station



Implementation

- Capital cost
 - Protective berm ~\$1,000,000
 - Effluent pump station ~\$15,000,000
- Timing
 - Depends on actual rate of sea level rise
 - Likely 20 to 35 year time horizon



Rising Air and Water Temperatures

Rising Air Temperature

- Requires greater aeration capacity for fine bubble diffused aeration system
- Not an immediate concern at South Portland WWTF due to excess aeration capacity

Rising Wastewater Temperature

- Contributes to higher aeration requirements
- Benefit for future nitrification

Summary

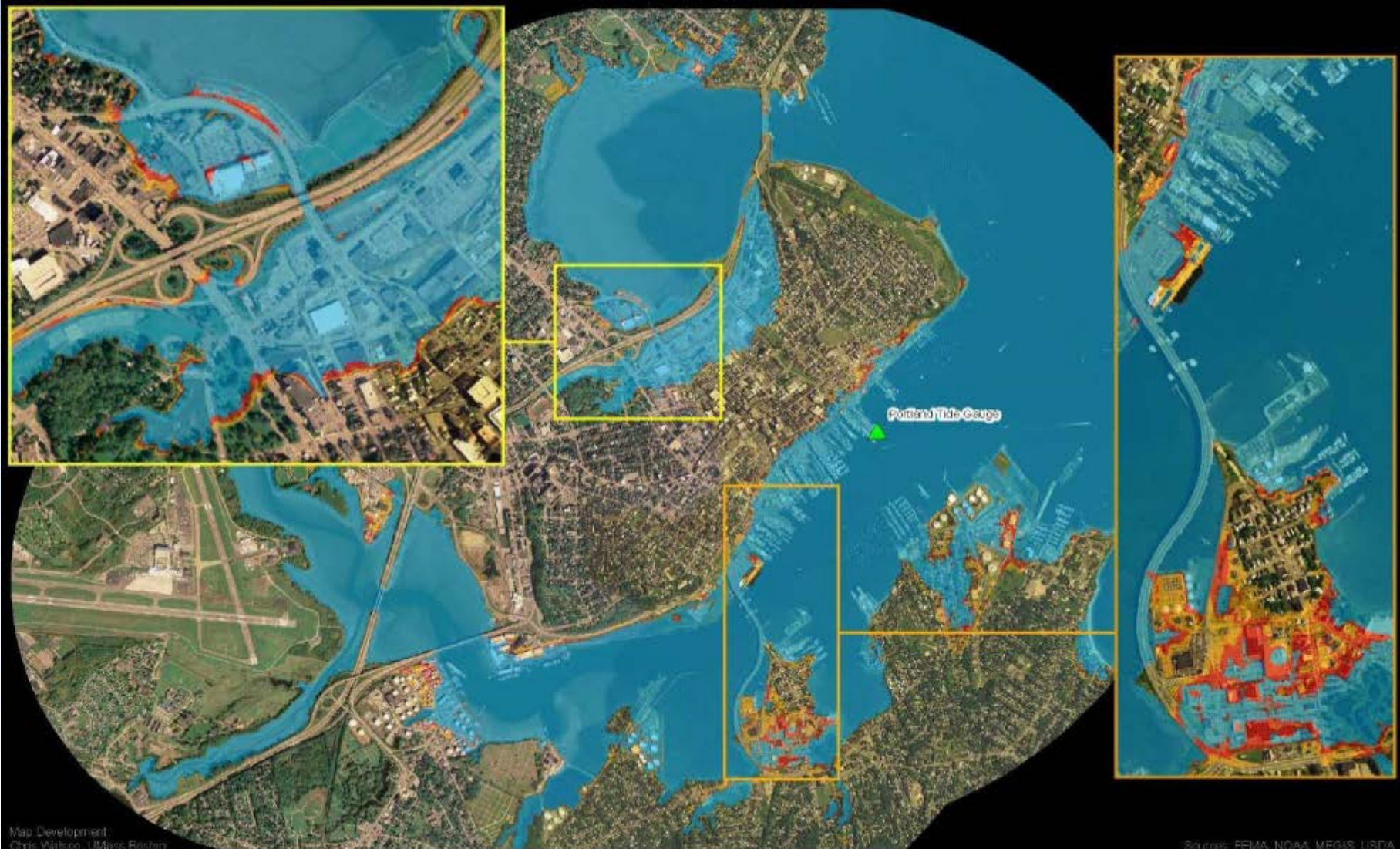
- Key impacts due to sea level rise
 - will need to be addressed within 20 to 35 year planning period
 - protective berm around WWTF
 - effluent pumping
 - possibly selective raising of tank walls to delay effluent pumping



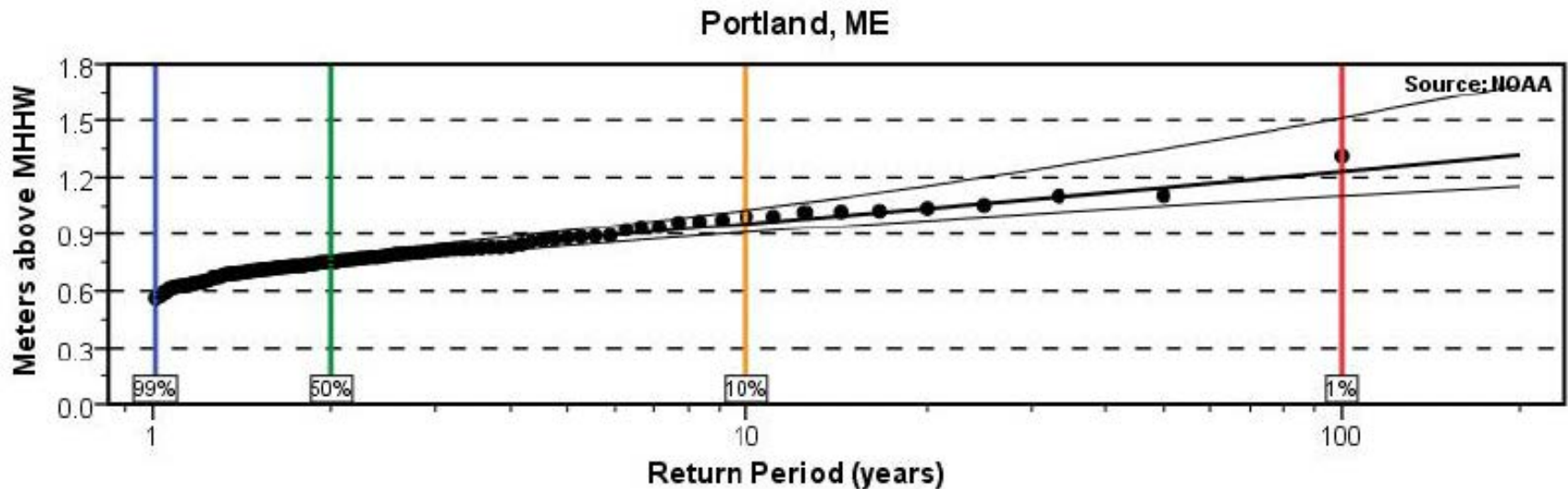
Questions / Discussions



2100 Higher Scenario w/100-Year Storm Surge



Storm Surge above MHHW



- 100-year event corresponds to 1978 storm of record
- Higher intensity storms predicted in future due to climate change
- Projections do not include increase in storm surge
- Comparable to Level 1 hurricane