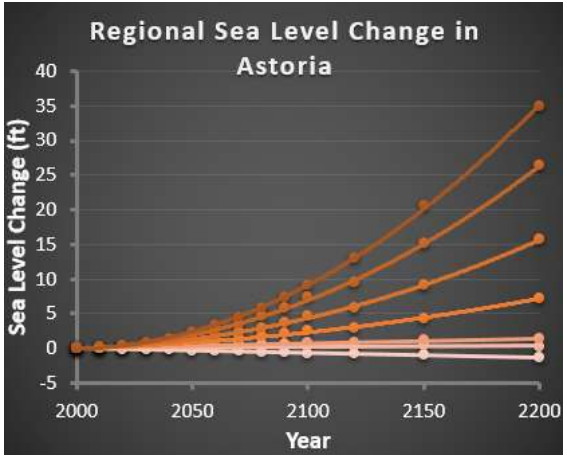
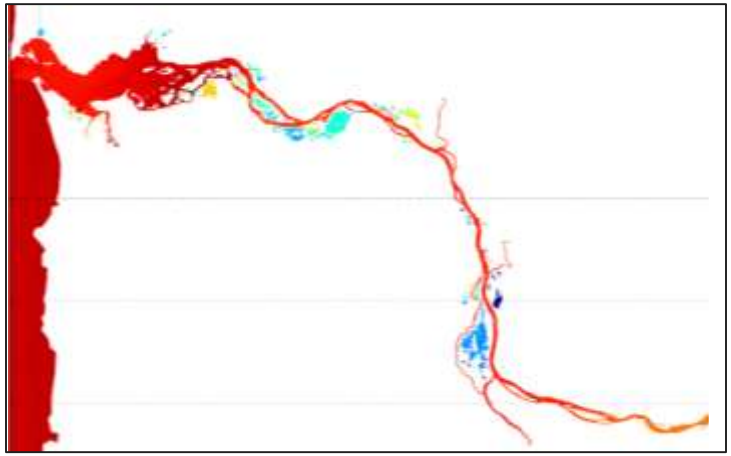
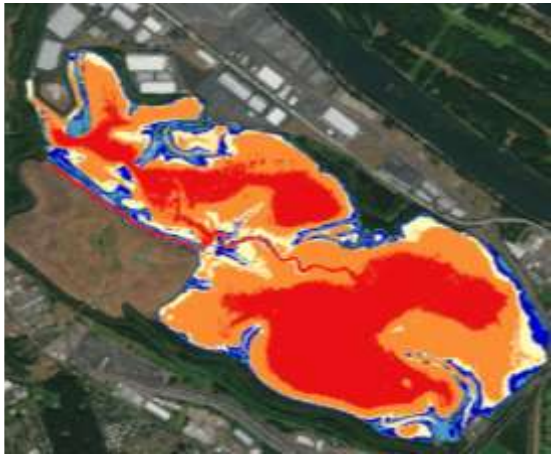


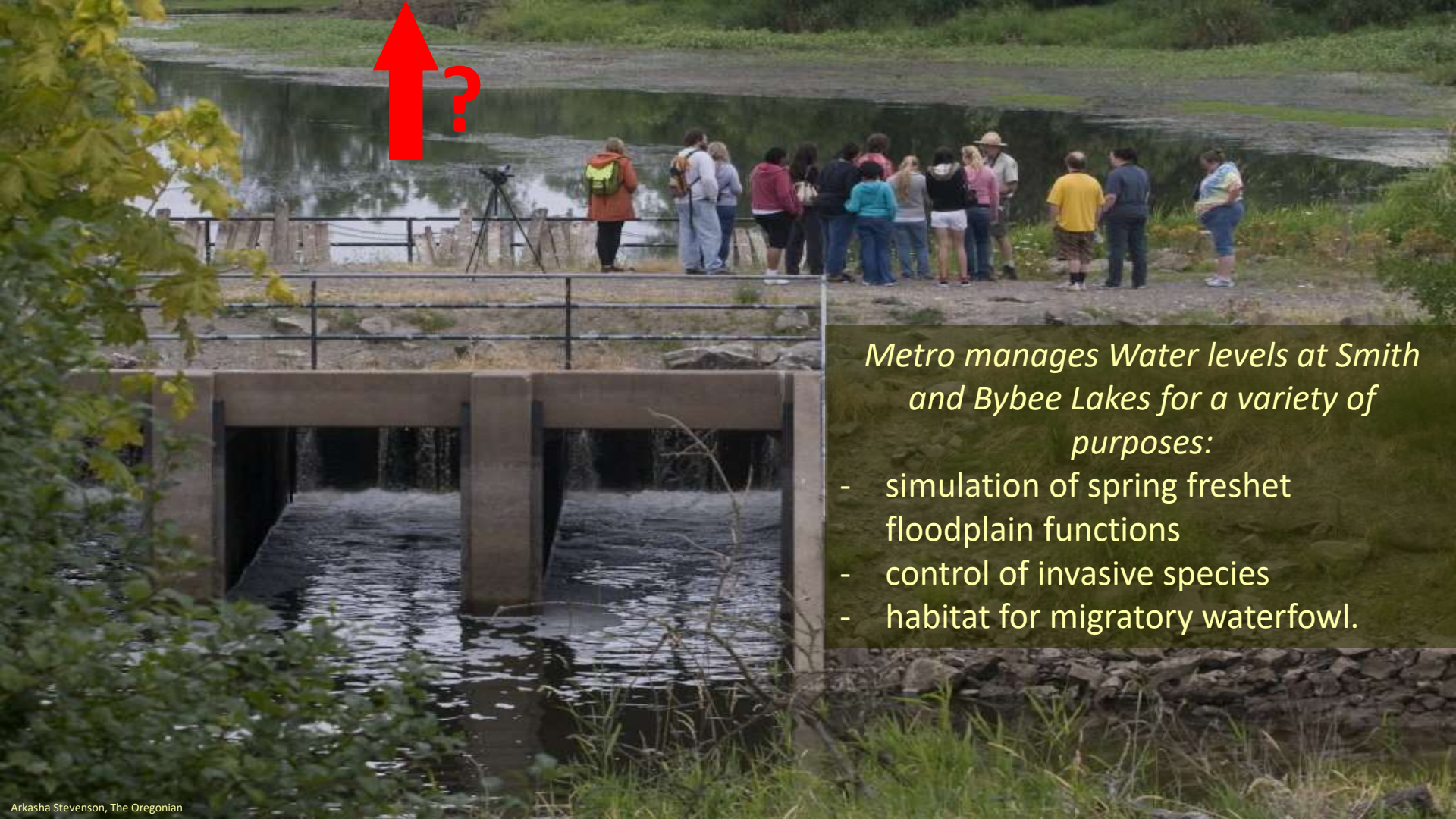




Sea Level Rise: Implications for Water Level Management

Mojy Rostaminia and Gary Wolff

Otak, Inc., Portland, OR



Metro manages Water levels at Smith and Bybee Lakes for a variety of purposes:

- simulation of spring freshet floodplain functions
- control of invasive species
- habitat for migratory waterfowl.

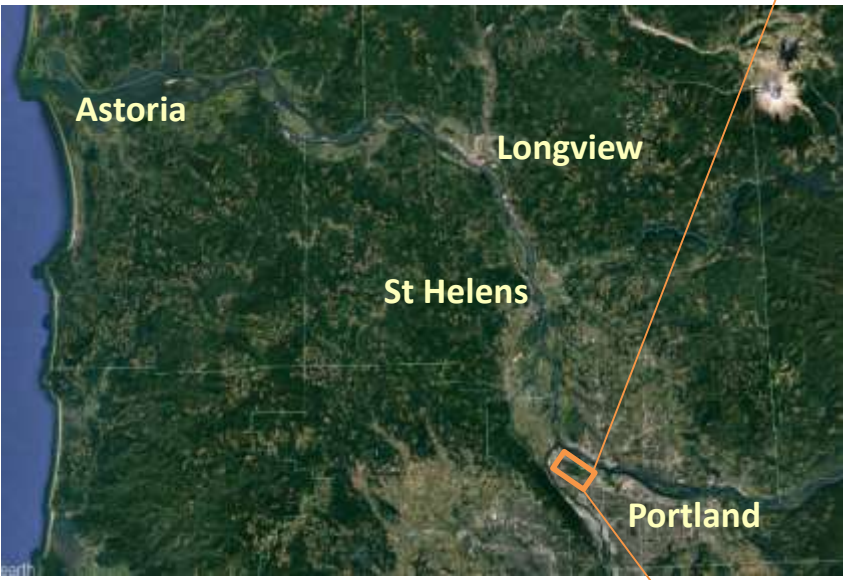
Arkasha Stevenson, The Oregonian

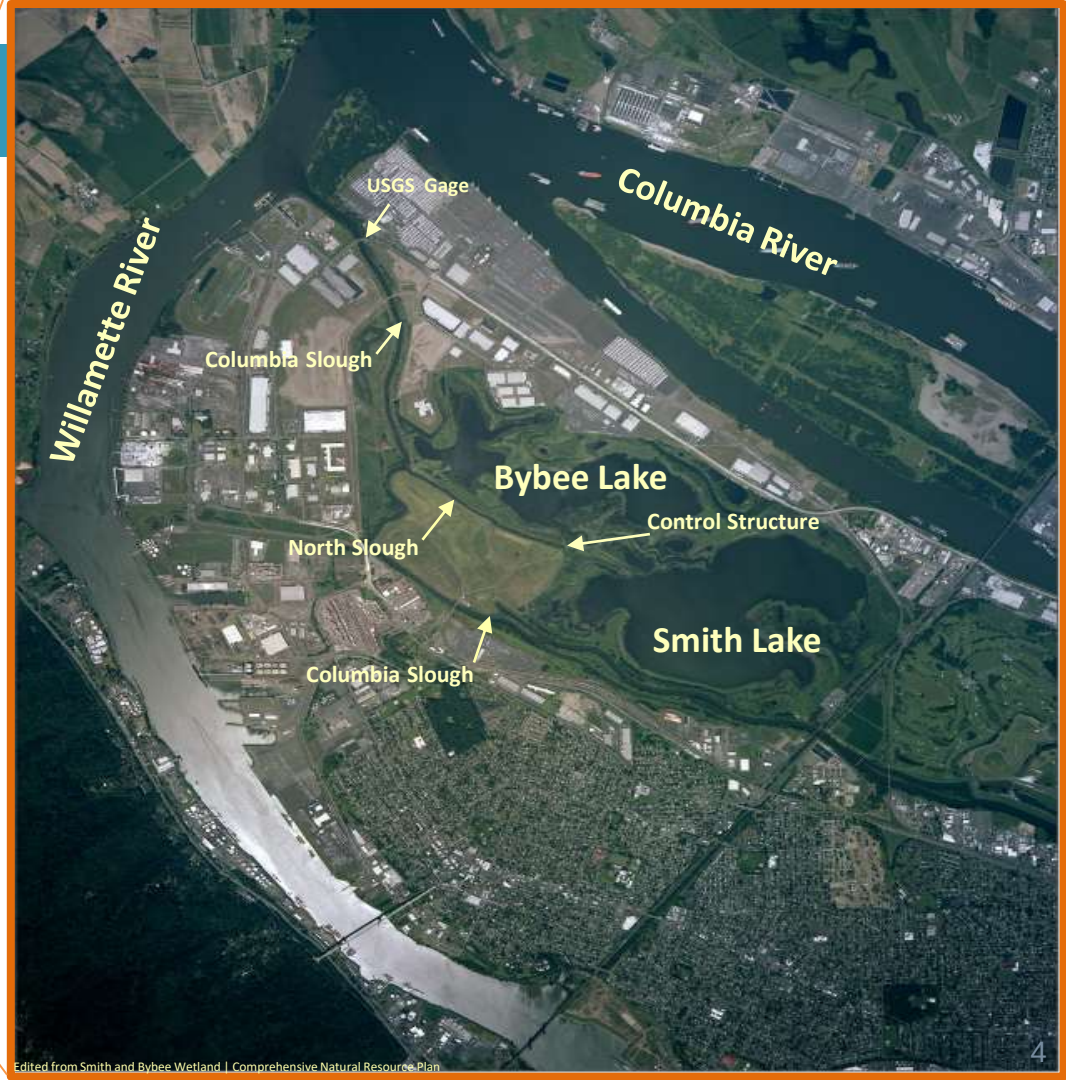
Questions:

- **What is the potential impact of sea level rise on water level at the Smith and Bybee Lakes?**

- **How the water level should be managed in the future?**

Site Location





Edited from Smith and Bybee Wetland | Comprehensive Natural Resource Plan

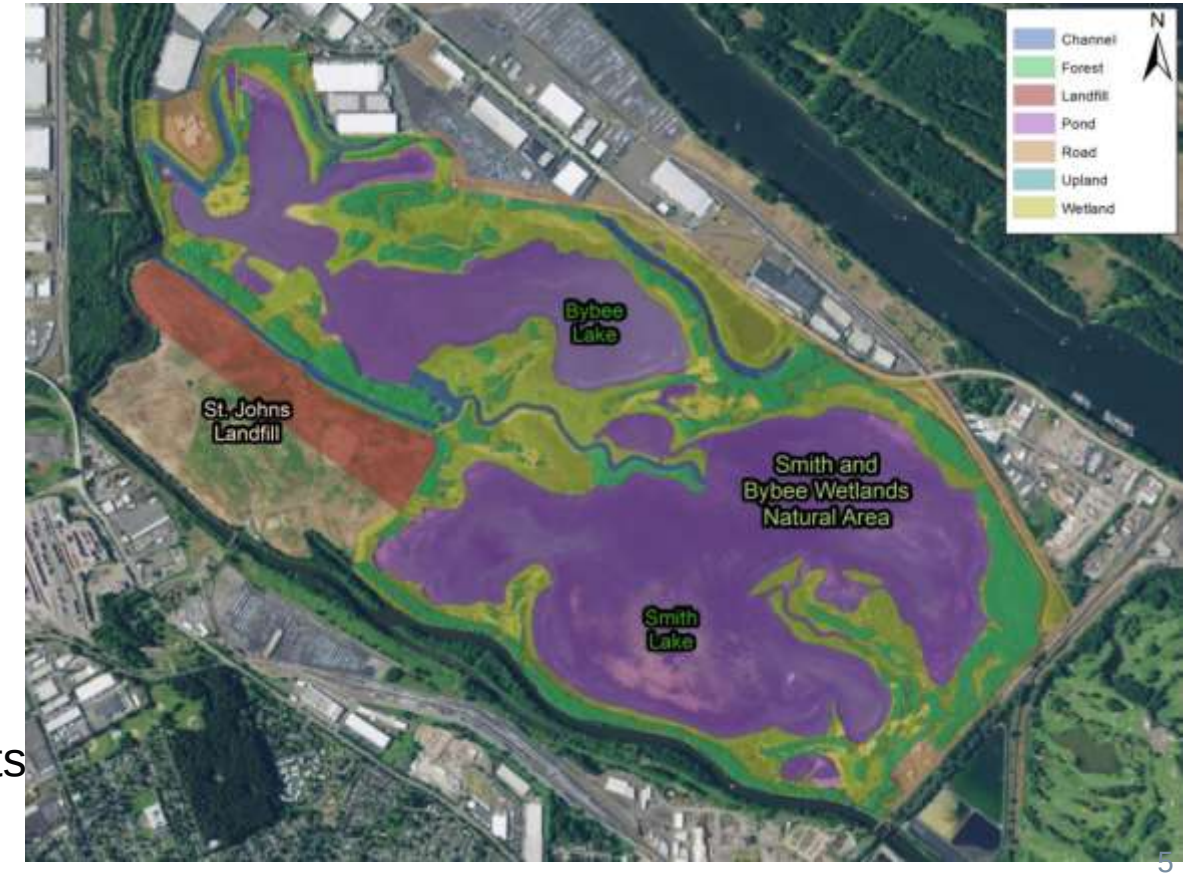
Smith & Bybee Wetland Site

Habitat

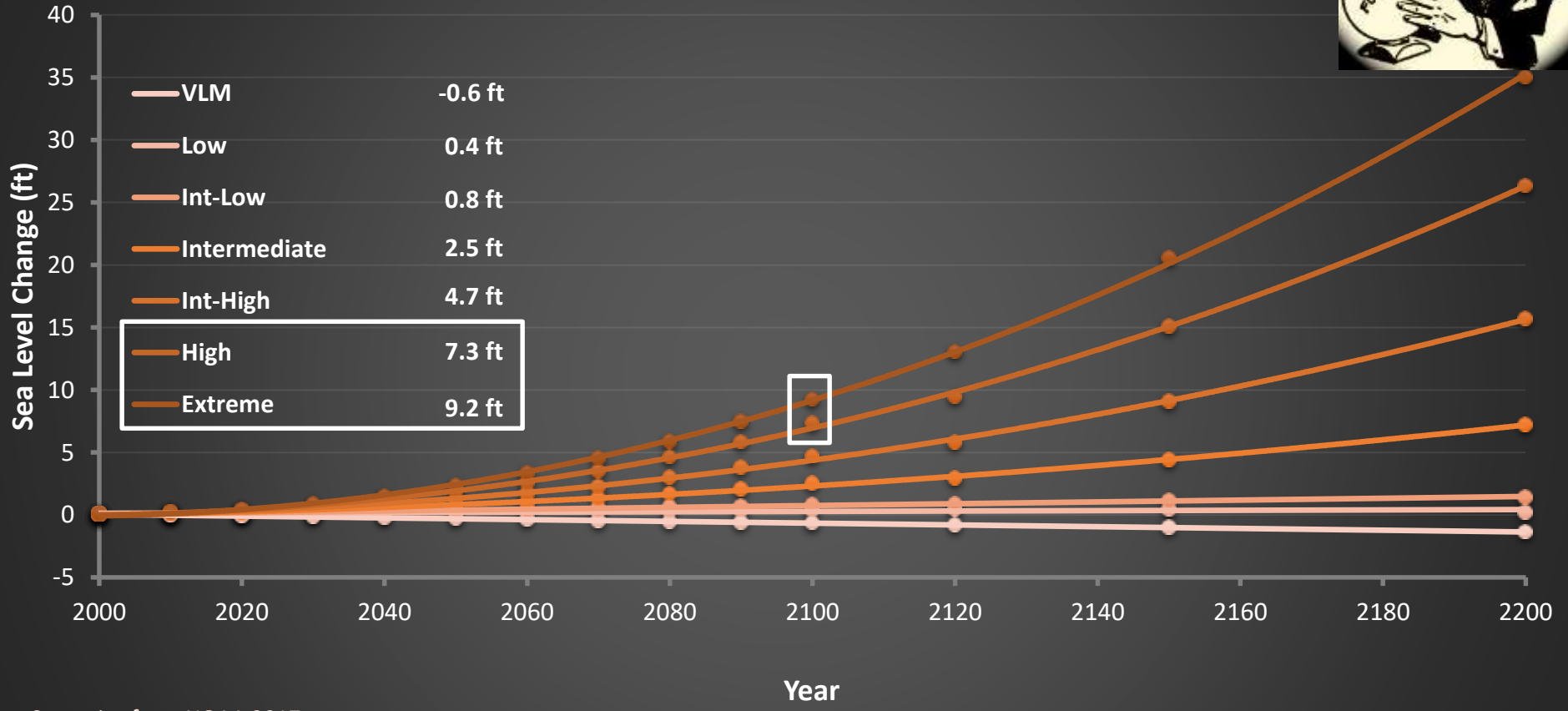
- Two Shallow Lakes
- Forested Wetland
- Sedge meadow wetlands
- Seasonal ponds
- Upland grassland

Fish and wildlife

- 17 species of fish
- > 150 bird species
- Reptiles, Amphibians, Insects



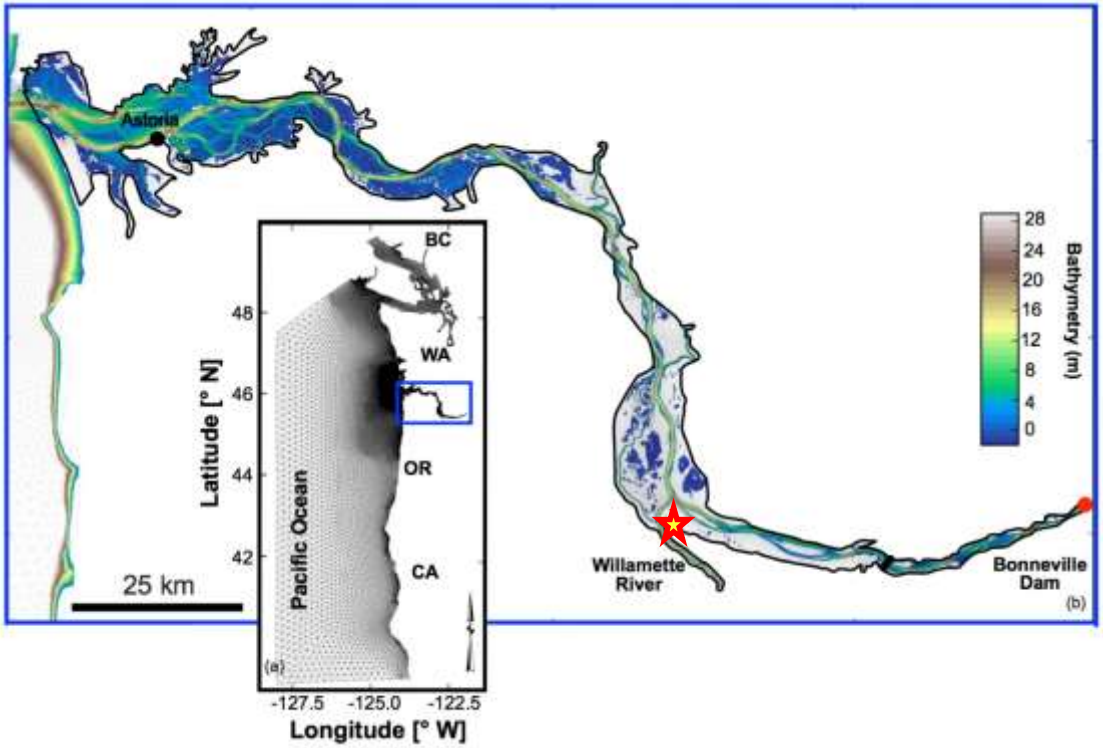
Scenarios of Sea Level Change in Astoria



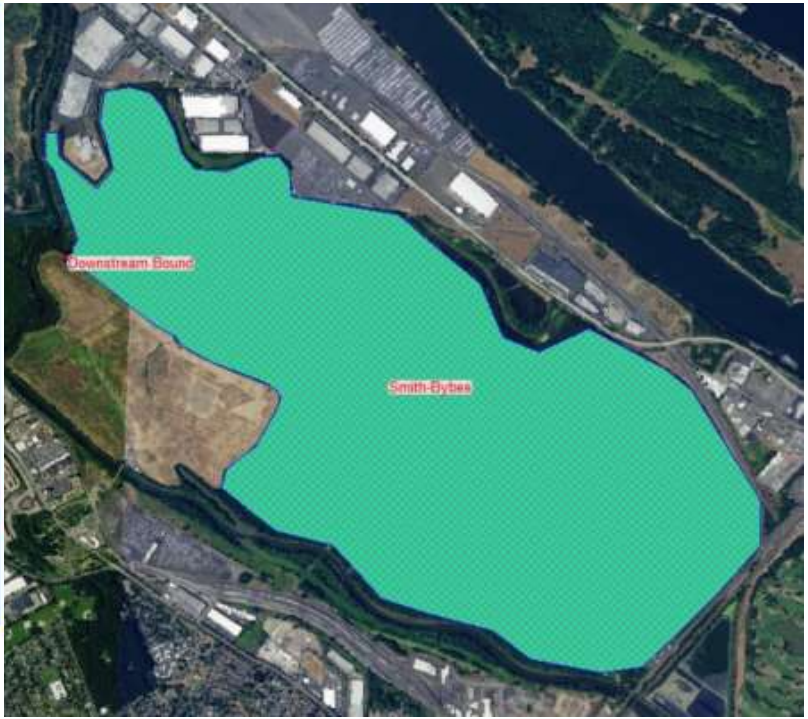
Scenarios from NOAA 2017

Modeling System

SELFE



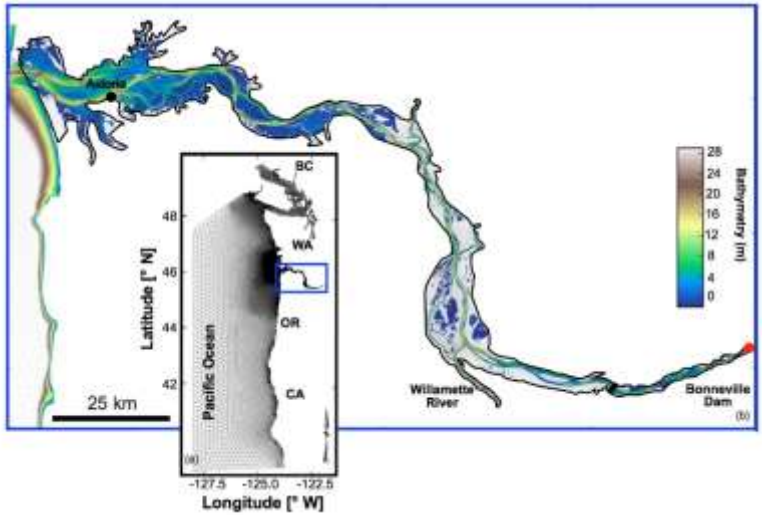
HEC-RAS



http://www.druckerinstitute.com/2011/08/cloudy-crystal-ball/

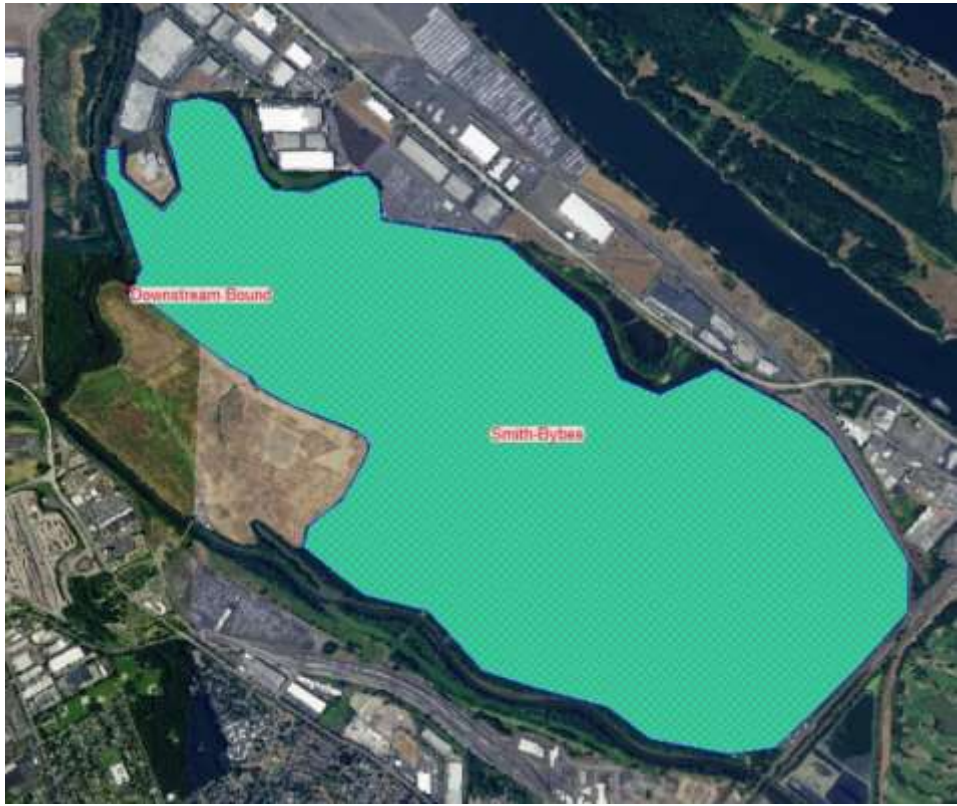
Modeling System, SELFE

- **3D hydrodynamic model, SELFE (Zhang & Baptista 2008)**
- **Calibrated (Kärnä et al. 2015) and skill assessed (Kärnä and Baptista 2016b) by observation networks (CMOP, NOAA, USGS)**
- **Domain: from Bonneville Dam to the Shelf**
- **Horizontal Grid resolution: tens of meters in estuary to 3 km in the ocean & Main channel ~180 m**
- **Model bias for elevation: 0.5 ft near the mouth to -0.7 ft at the Bonneville Dam (Kärnä and Baptista 2016a)**

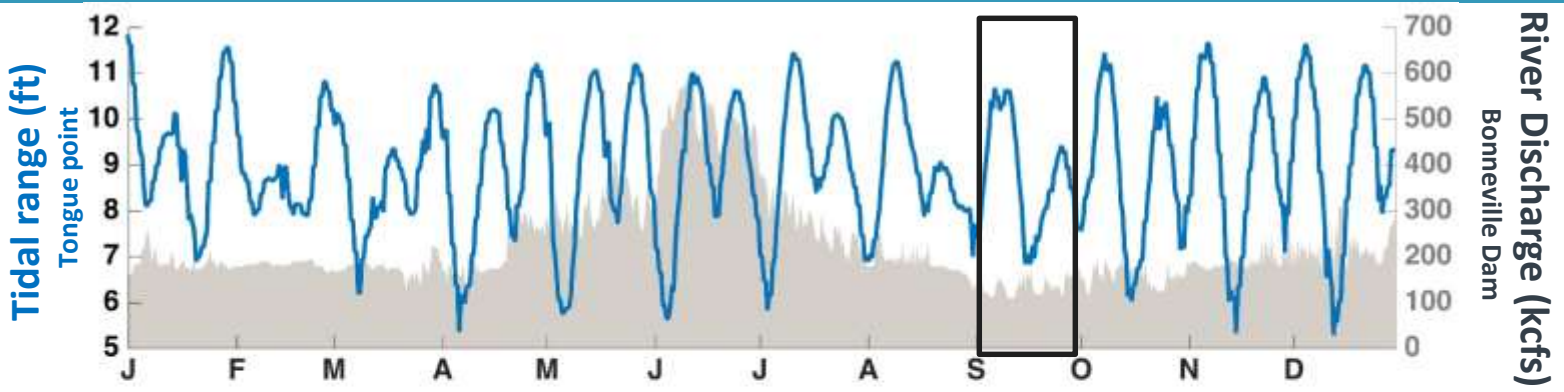


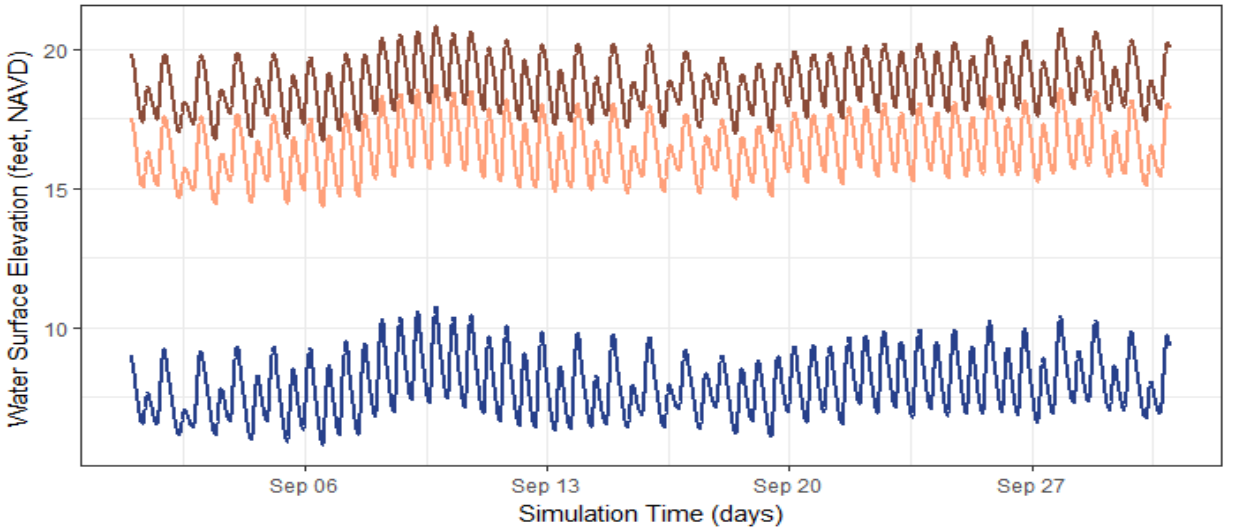
Modeling System, HEC-RAS

- **2D HEC-RAS model 5.0**
- **The mesh consists of 100ft x100ft cells**
- **The initial water-surface elevation in the wetland sets to 11.0 ft NAVD**
- **Rainfall, groundwater, and evapotranspiration are not included because these are small in comparison to flow in the north channel.**
- **The gates of the control structure are open.**



Boundary Condition



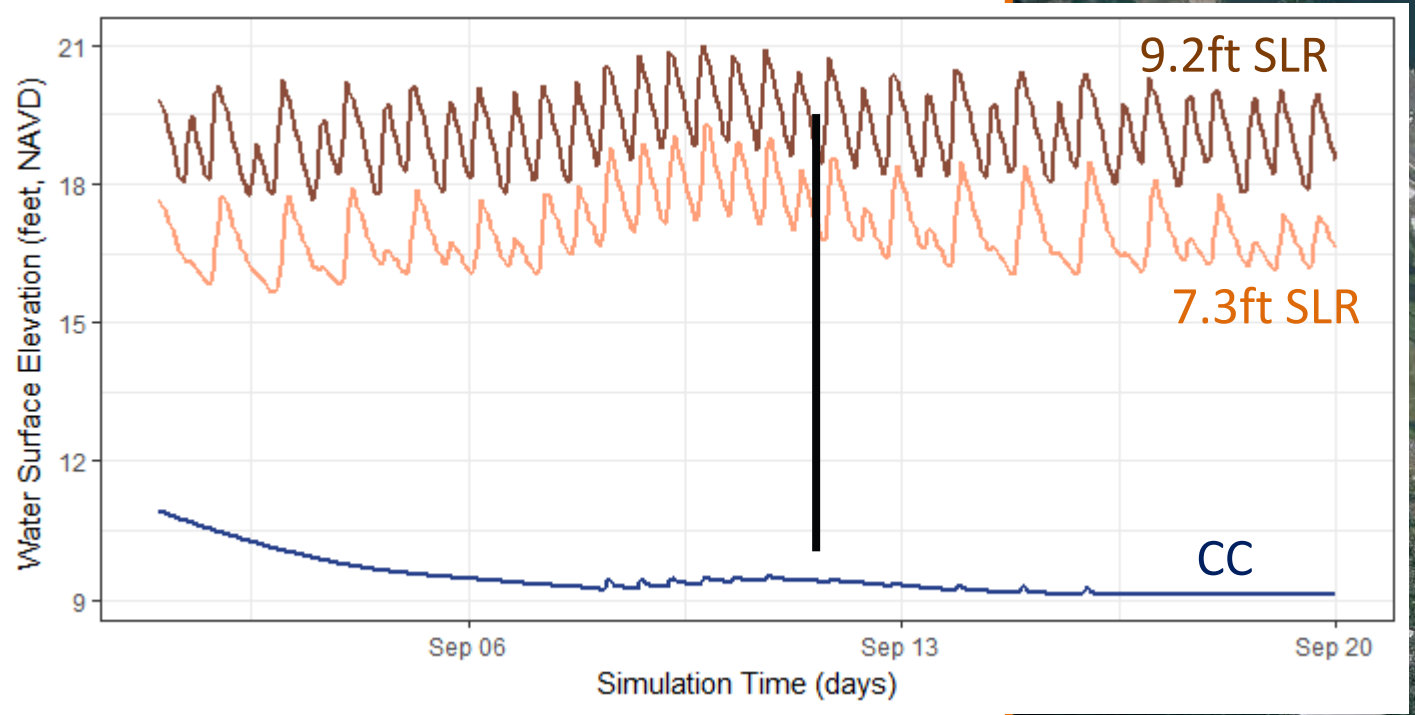


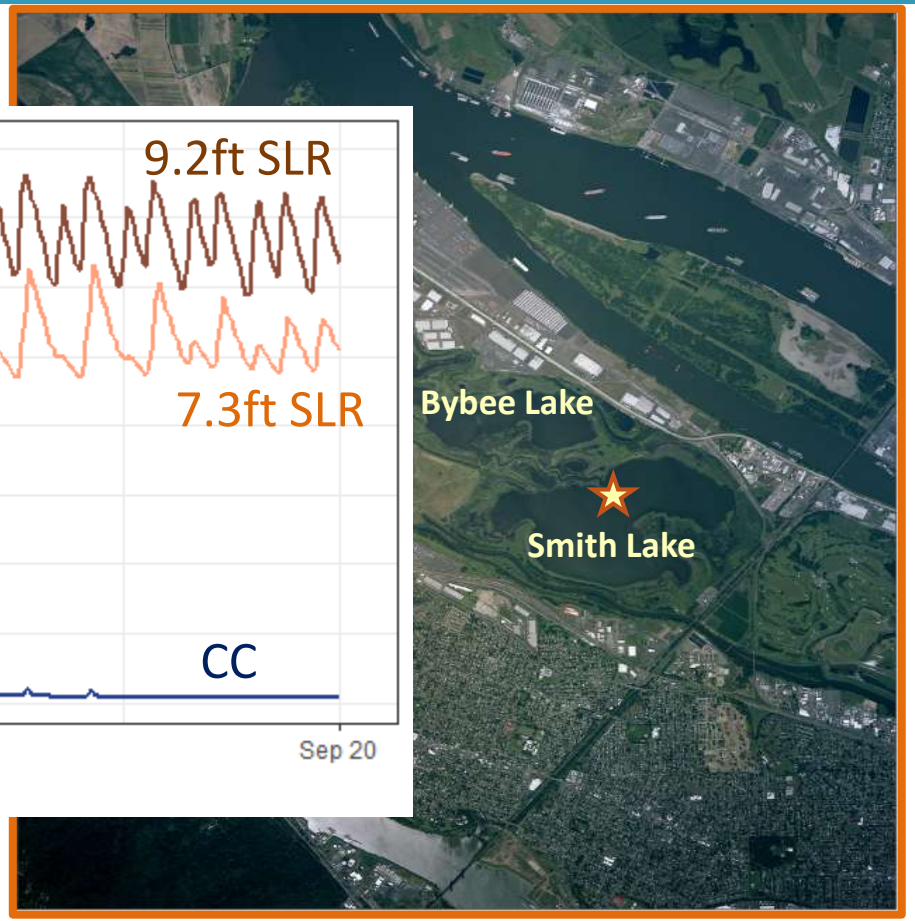
9.2ft SLR

7.3ft SLR

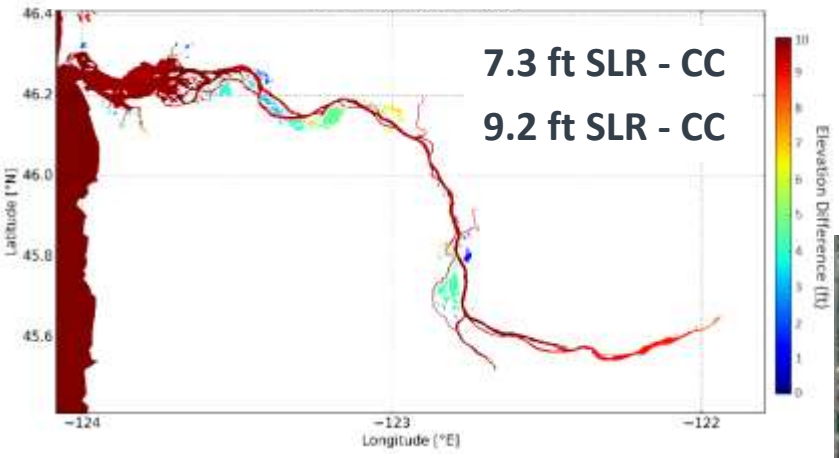
Current Condition (CC)

Results: Smith Channel Upstream

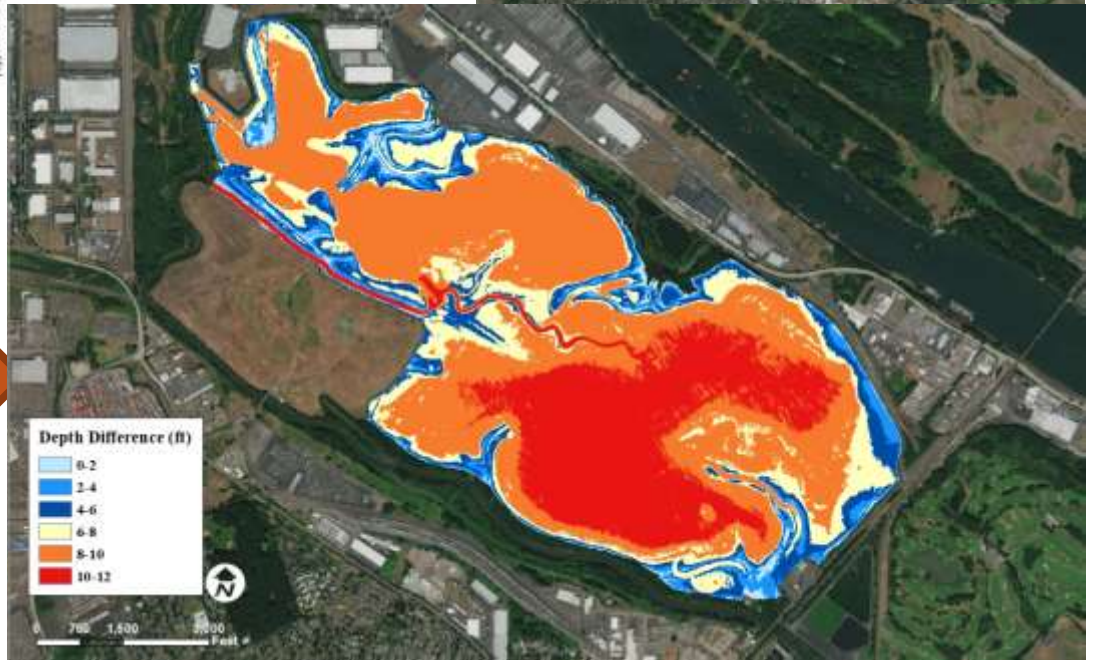




Results: 09/12/2010 00:00



Area with depth <6ft
Decreases by 30%



Lessons Learned

Using a regional infrastructure system, theVirtual Columbia River modeling system (CMOP, OHSU), HEC-RAS model, and sea level change scenarios (USACE) our results:

- Offer a methodology that can be used to quantify specific habitat based on the preferred water depth and velocity at the local stage.
- Suggests sea level rise will increase inundation in the Smith and Bybee lake wetland area.
- Provide guidance on the impacts of sea level change to design long-term plans for restoration and hatchery programs.

Uncertainty

- **There is a degree of uncertainty about how, when and where this system will experience the impact of sea level changes. There are some uncertainties:**
  - In the 3D hydrodynamic, HEC-RAS model, and downscaling method.
  - In considering sea level change in isolation of other regional changes
  - In Global and regional sea level change projections.
  - In the nature of sedimentary adjustments in sea level change.
- **An extensive and continuous system monitoring will help to track ongoing changes, which help to prevent the permanent system damages.**

Next steps

- **We can further investigate the impact of**
  - other scenarios of sea level change at the Smith and Bybee Lakes or other sites
  - sea level change at other seasons

- **We are also interested in using the available results of the future changes in temperature and river flow and apply that in the local scale.**

Acknowledgments

CMOP

Antonio Baptista

Paul Turner

Charles Seaton

Otak, Inc.

Kevin Timmins

Nick Cook

The mean sea level trend based on yearly mean sea level data from 1925-2016. The plot shows the yearly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents (removed seasonal variability)