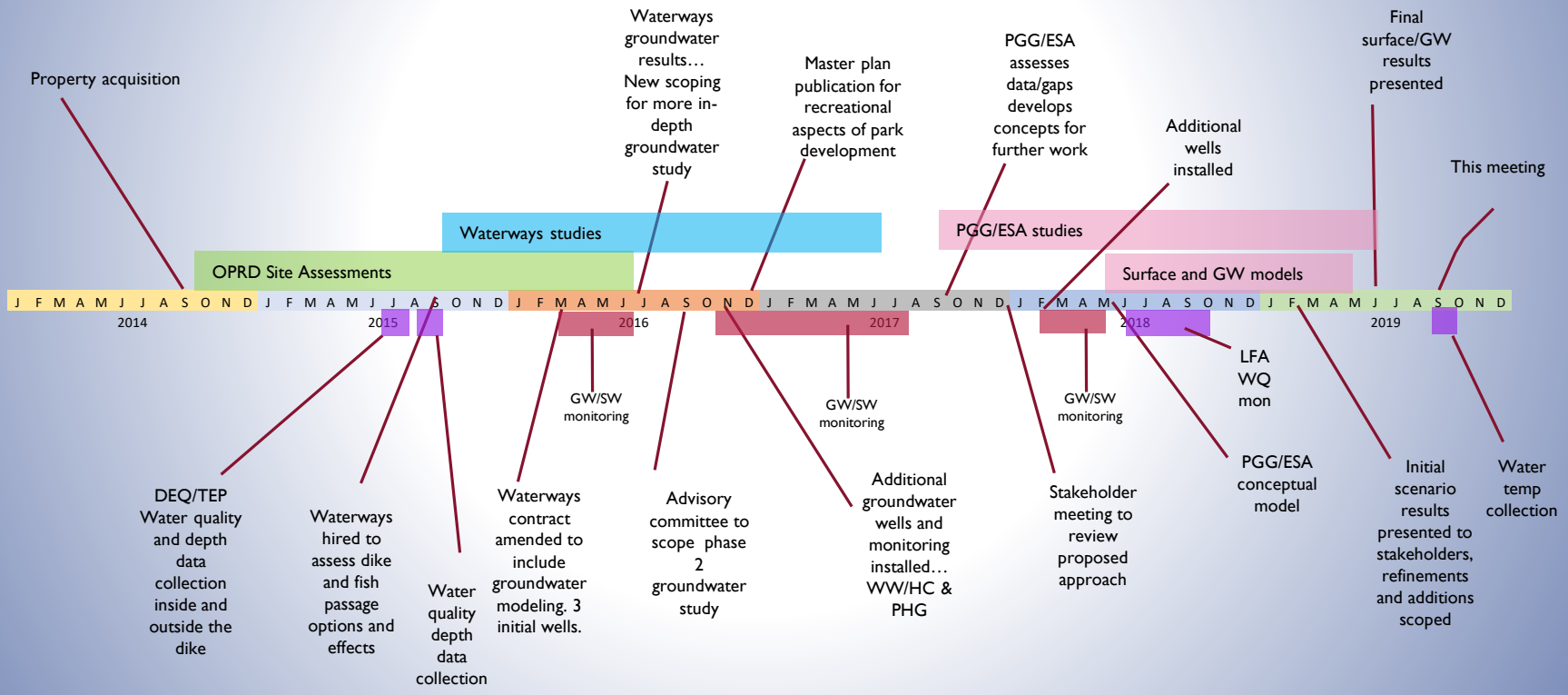
SITKA SEDGE SNA DIKE AND FISH PASSAGE ALTERATION SCOPING HISTORY AND RESULTS

Approximate timeline



What has been studied so far:

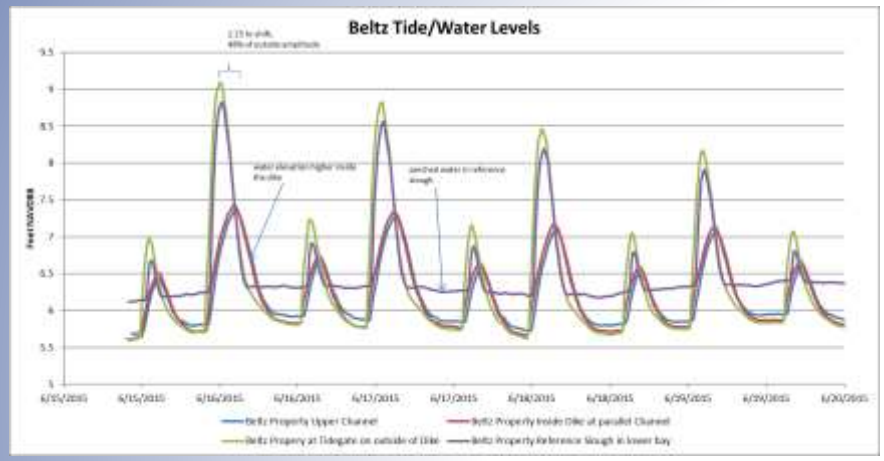
- Water quality characteristics – 2015 early and late summer. 2018 Limiting Factors Analysis summer-fall. 2019 temperature.
- Current vegetation and habitat composition, condition, conservation value assessment
- Recreational use and development concepts
- Surface water modeling for initial dike alteration scenarios – Waterways
- Preliminary assumptions for effects on habitat based on altered surface water from initial scenarios
- Preliminary TDM groundwater effects assessment (Waterways)
- Refined surface and groundwater modeling (PGG/ESA)

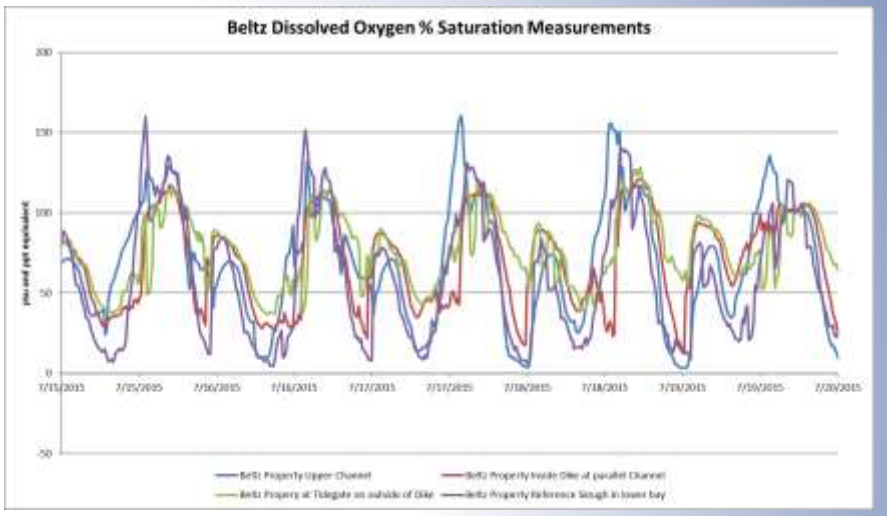
EXISTING WATER QUALITY DATA

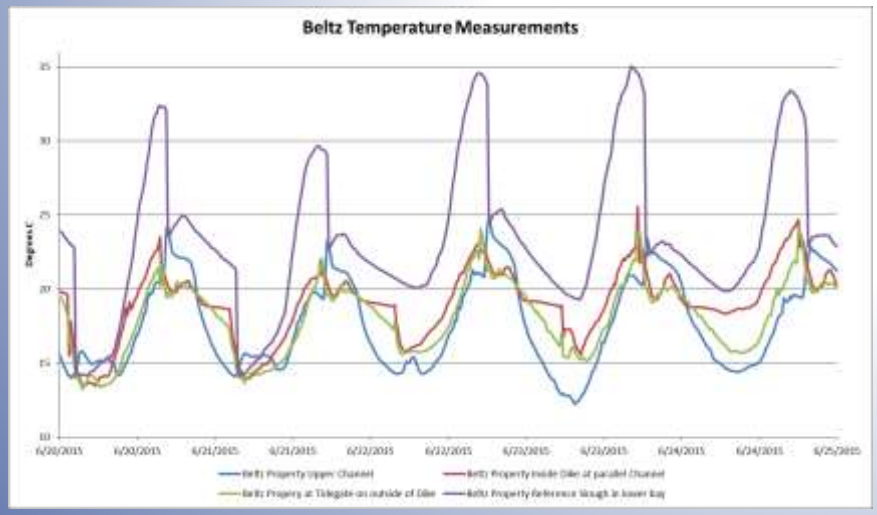
- DEQ/TEP 2015
- Watershed Council/River Design Group LFA 2018

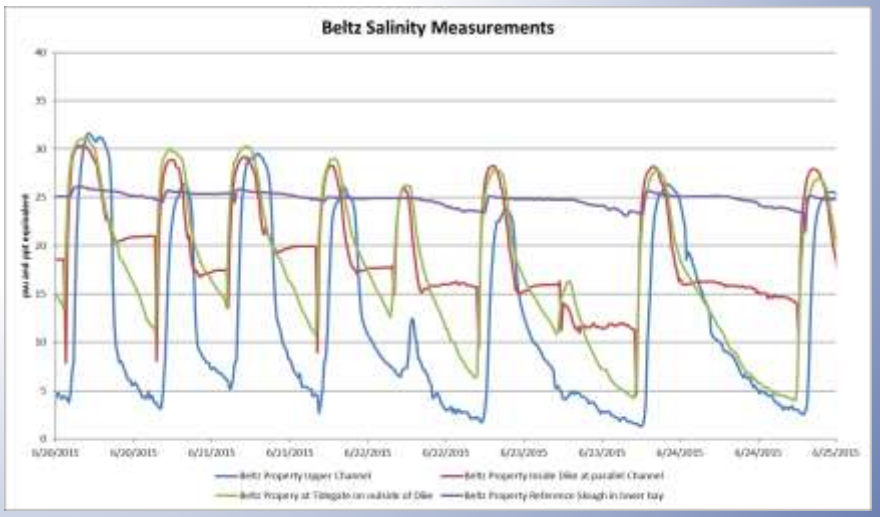
2015 EARLY SUMMER WATER QUALITY DATA

2015 EARLY SUMMER WATER QUALITY DATA



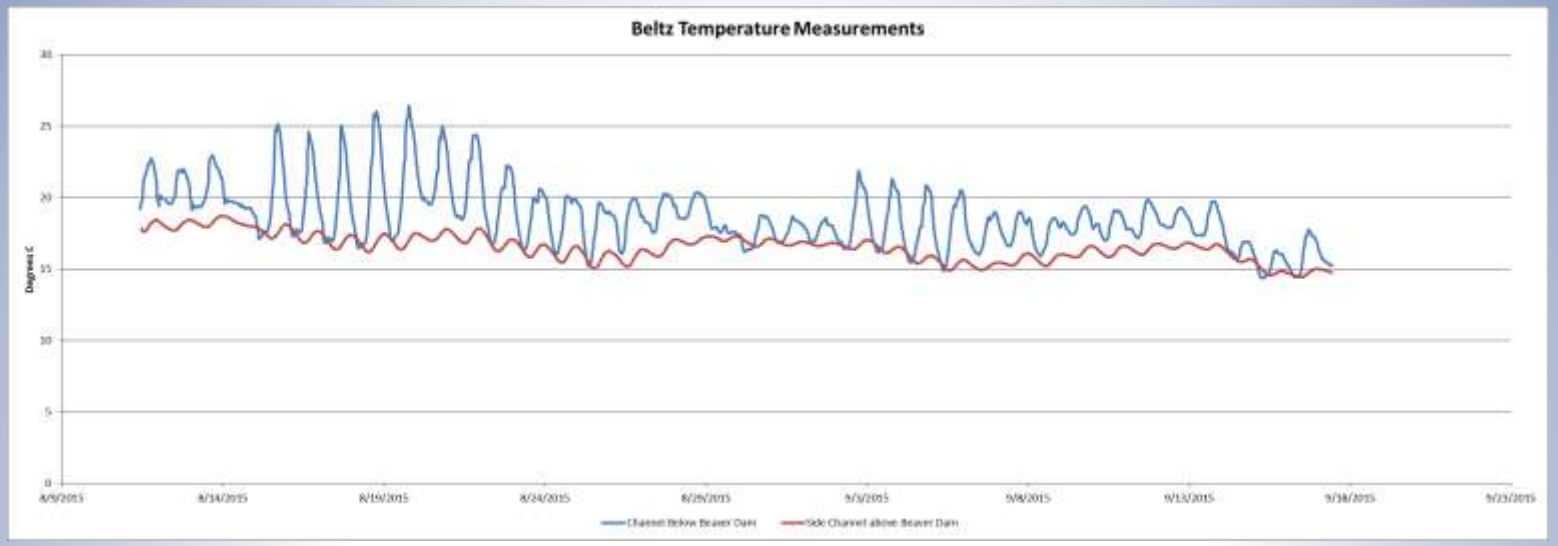


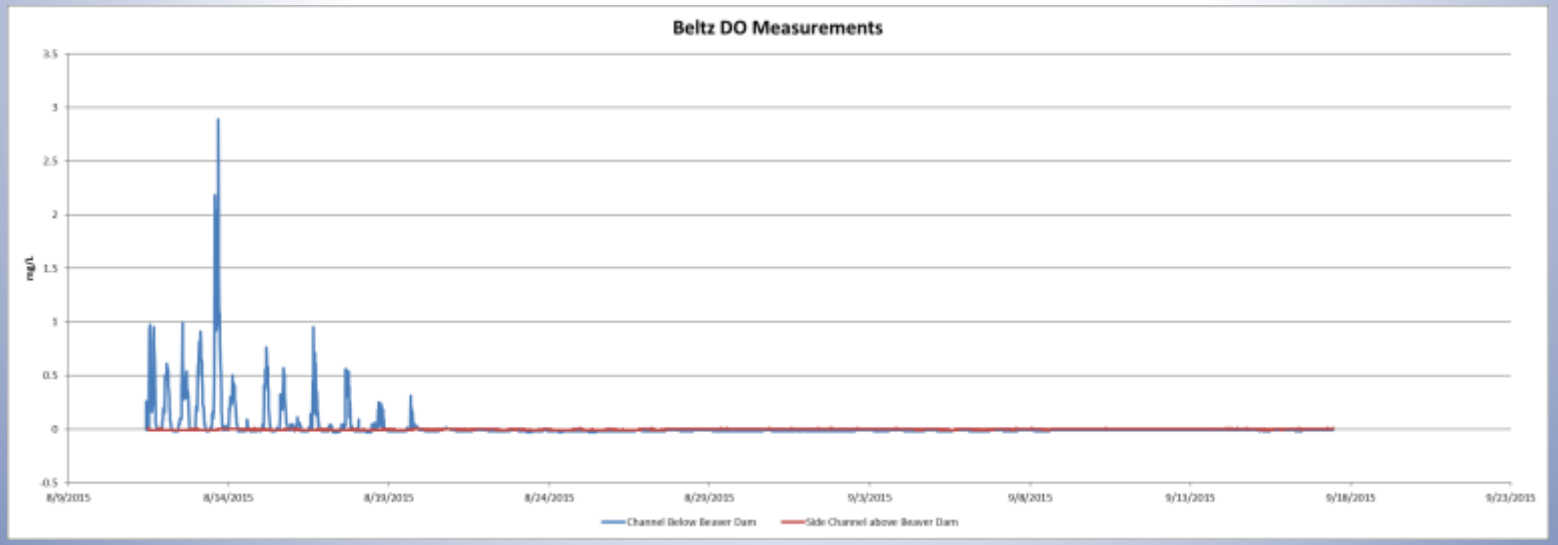




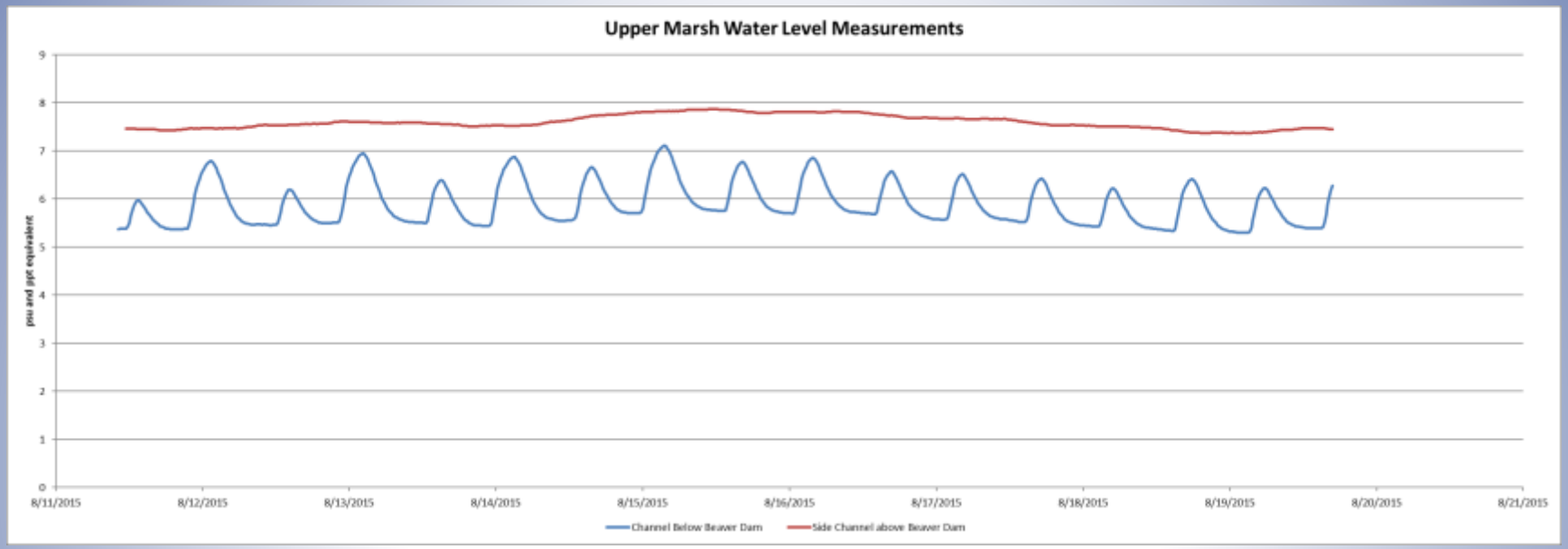
2015 LATE SUMMER WATER QUALITY DATA

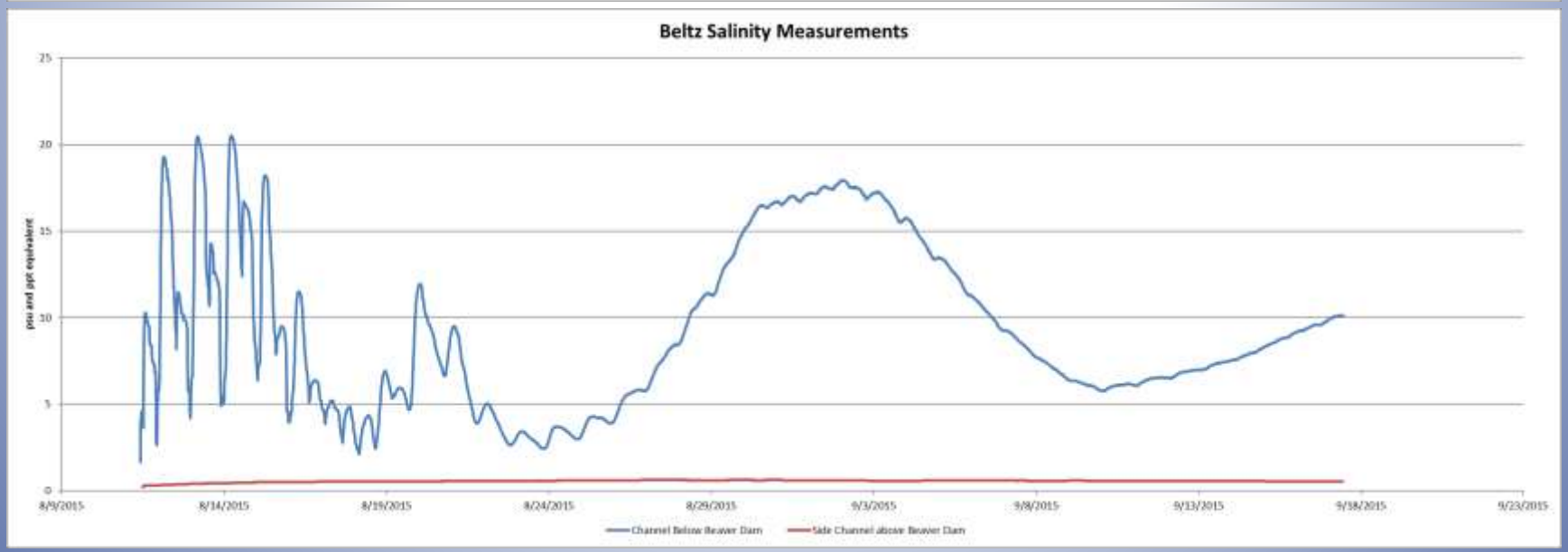
2015 LATE SUMMER WATER QUALITY DATA



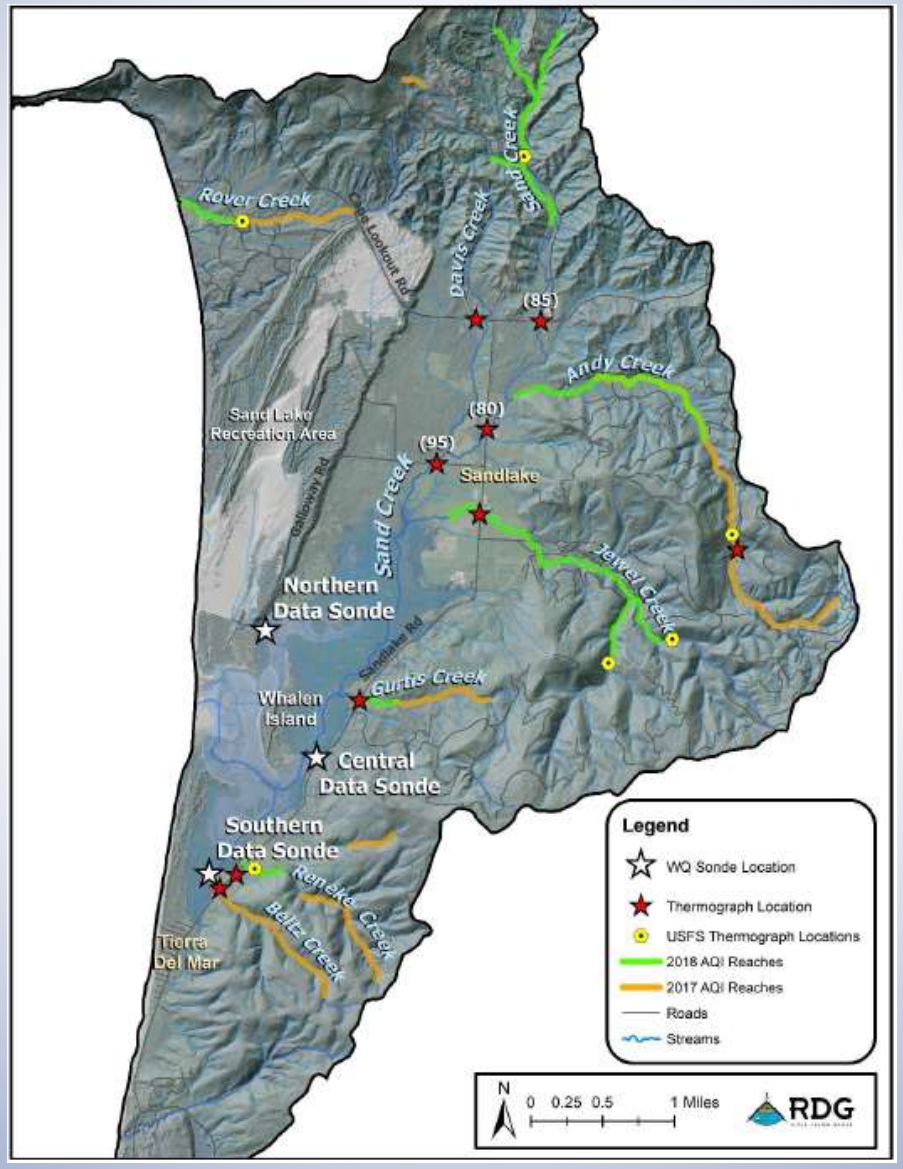


2015 LATE SUMMER WATER QUALITY DATA

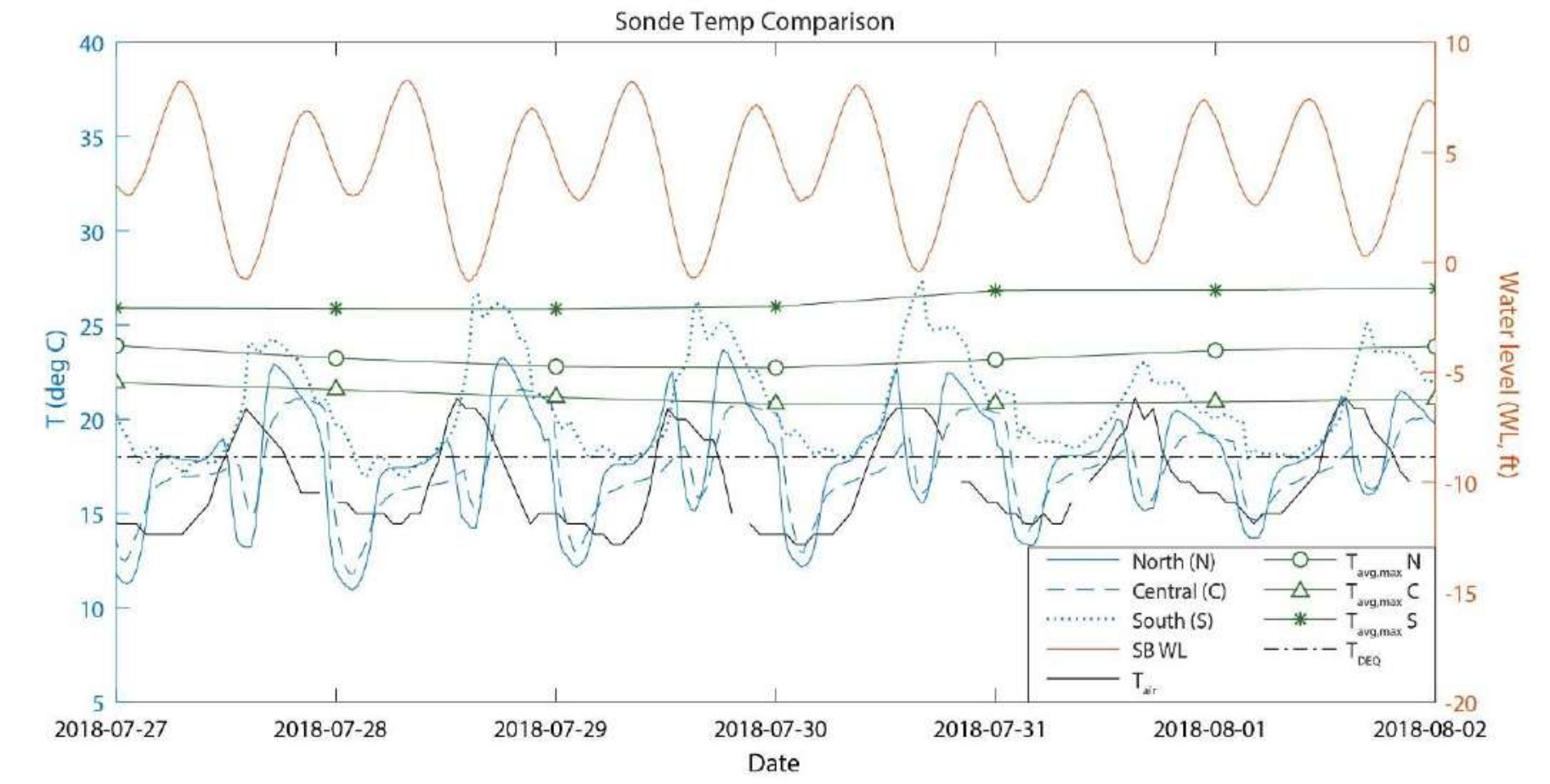




2018 LIMITING FACTORS ANALYSIS



2018 LIMITING FACTORS ANALYSIS



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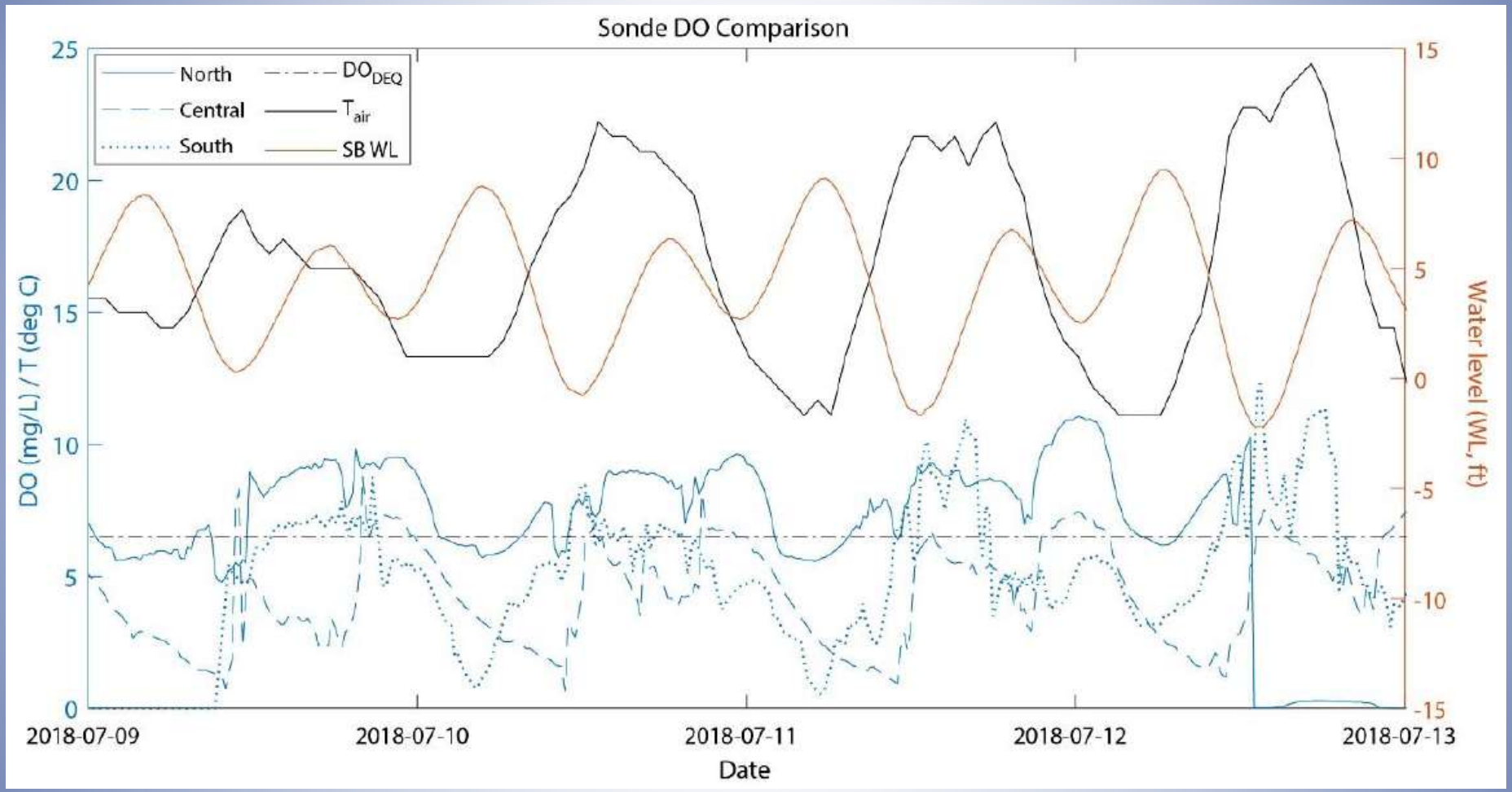
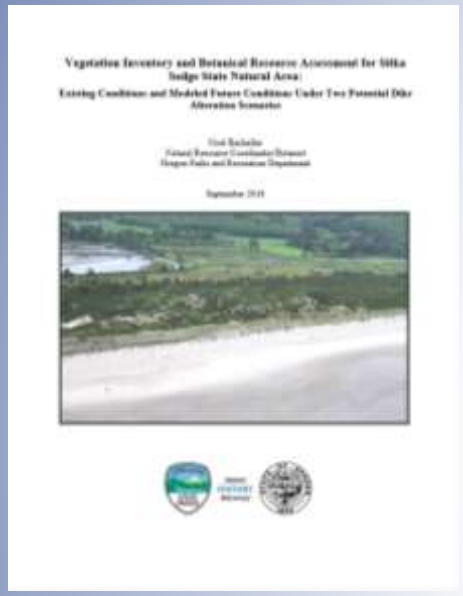
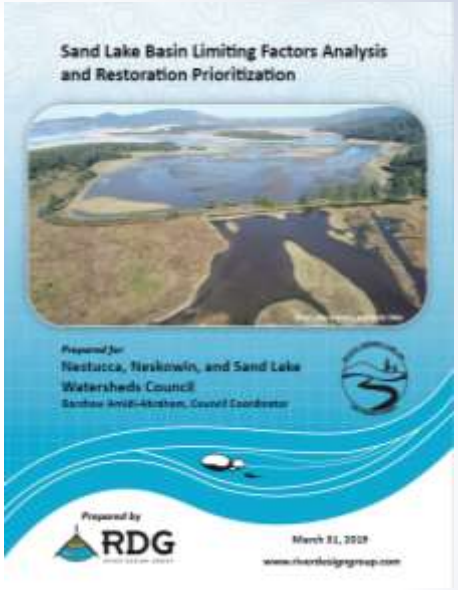


BIOTIC ASSESSMENTS



Botanical

Wildlife



LFA

Forestry

And some older assessments

OTHER ASSESSMENTS

Historic, archaeology, visitor experience/recreation, community, land use & permitting, …

Beltz Farm Plan

Assessments, Inventories, Surveys

Category	Lead	Dept	In-house / Contract	Cost Est.	Scale: General Park Area / Park
Natural Resources:					
1.0 Abiotic					
1.1 Geological Hazards	Brady	GIS		0	GPA & Park
1.2 Topography (LiDAR)	Brady	GIS		0	GPA & Park
1.3 Watersheds	Brady	GIS		0	GPA & Park
1.4 Floodplain	Brady	GIS		0	GPA & Park
1.5 Water features	Brady	GIS		0	GPA & Park
1.6 Soils	Noel	Stewardship		0	GPA & Park
1.7 Geology	Noel	Stewardship		0	Park Area
1.8 Hydrology				0	
1.9 Climate (temp, rainfall, wind, etc.)	Noel	Stewardship		0	Park Area
1.10 Climate Change Effects		Stewardship/IPS		0	Park Area
2.0 Biotic					
2.1 Existing plant communities	Noel	Stewardship		0	GPA & Park
2.2 Wetland species and NWI occurrences	Noel	Stewardship		0	GPA & Park
2.3 Sensitive plant species occurrences / habitats	Noel	Stewardship		0	GPA & Park
2.4 Historic vegetation	Noel	Stewardship		0	GPA & Park
2.5 Invasive plant occurrences	Noel	Stewardship		0	GPA & Park
2.6 Habitat types	Noel / Vanessa	Stewardship		0	GPA & Park
2.7 Wildlife use patterns and high value habitats	Vanessa	Stewardship		0	GPA & Park
2.8 Sensitive fish and wildlife occurrences / habitat	Vanessa	Stewardship		0	GPA & Park
2.9 Fire regime	Noel / Craig	Stewardship		0	Park Area
2.10 Forest conditions	Craig	Stewardship		0	GPA & Park
Cultural Resources:					
3.0 Archaeology					
3.1 Ethnographic Resources	Nancy	Heritage		0	GPA & Park
3.2 Tribal Interests - Consultation	Nancy	Heritage		0	GPA & Park
3.3 Archeological surveys and likely occurrence areas	Nancy	Heritage		0	GPA & Park
4.0 Historic					
4.1 Historic context	Julie	Heritage		0	GPA & Park
4.2 Listed sites / structures	Julie	Heritage		0	Park
Visitor Experience:					
5.0 Infrastructure					
5.1 Transport:					
5.1.1. Roads	Brady	GIS			
5.1.2. Land Trails		Loc/GIS	Cond/IPS		Park Area
5.1.4. Access Points		GIS			Park Area
5.1.5. Scenic Byeway		GIS			Park Area
5.2 Facilities:		GIS			
5.2.1. Buildings and Structures Assessment. (LiDAR)		GIS			Park Area
5.2.2. Site Furniture (seats/paths etc.)		GIS			Park
5.2.3. Signage		GIS			Park Area
5.3 Utilities:					
5.3.1. Sewage Assessment.		GIS			Park Area
5.3.2. Electric Assessment. (power lines/ground)		GIS			Park Area
5.3.3. Gas Assessment.		GIS			Park Area
5.3.4. Water		GIS			Park Area
5.3.5. Cable/Phone/Internet		GIS			Park Area
5.4 Mapping					
5.4.1 Historic Aerials		GIS			Park Area
5.4.2 Orthophoto.		GIS			Park Area
5.5 LiDAR		GIS			Park Area
5.6 Boundary		GIS			Park Area
5.7 Communications		GIS			Park Area
5.7.1. Web Map		GIS			Park Area
6.0 Recreation Context					
6.1 Land and Water Trails (incl. bikeways)		IPS/GIS			Park Area
6.2 Non-OPRD parks and recreation areas		IPS/GIS			Park Area
6.3 Usage patterns (i.e., Strava data, etc.)		IPS/GIS			Park Area
6.4 Regional / local Demographics		IPS/GIS			Park Area
7.0 Visitor Experience Assessment					
7.1 Visitor Experience Assessment		IPS		0	
7.1.1 Recreation		IPS			Park & Management Zone
7.1.2 Environmental Education	Brian	IPS			Park & Management Zone
7.1.3 Outdoor Skills	Brian	IPS			Park & Management Zone
7.1.4 Interpretation	Brian	IPS			Park & Management Zone
7.1.5 Park Events	Brian	IPS			Park & Management Zone
7.1.6 Volunteers and Partners	Brian	IPS			Park & Management Zone
7.17 Scenic Assessment		IPS			Park & Management Zone
7.2 SCORP Survey	Terry	CARD		0	
7.2.1. National Context		CARD			Regional
7.2.2. Regional Context: Region 1 Survey		CARD			Regional
7.2.3. Local Context: Tillamook County Survey		CARD			Regional
7.2.4. Traveling Public		CARD			Regional
7.2.5. OPRD's Regional Role		CARD			Regional
7.2.6. Regional Recreation		CARD			Regional
7.2.7. Regional Participation Estimates		CARD			Regional
7.2.8. Regional Trends		CARD			Regional
7.2.9. Regional Needs Assessment		CARD			Regional
7.3 Local Survey		IPS		0	
7.3.1. Park Values		IPS			Park
7.3.2. Park Trends		IPS			Park
7.3.3. Park Activities		IPS			Park
7.4. Park Needs Assessment		IPS		0	Park
7.5. Universal Access		IPS		0	Park
7.6 Safety & Risk Assessment (As designed)		IPS			Park
Park Management:					
8.0 Community					
8.1 Regional Economy:		IPS		0	Regional
Market		IPS		0	Regional
Local Goods (value added)		IPS		0	Regional
Services		IPS		0	Regional
8.2 Communities		IPS		0	Regional
8.3 Public Landowners		IPS		0	Regional
8.4 Easements & Land Use Agreements		Stewardship			Park
9.0 Acquisition					
9.1 Areas of Interest		IPS		0	Regional
9.2 Private Inholdings		IPS		0	Regional
9.3 Recent Acquisitions		Stewardship			Park
10.0 Operations					
10.1 Visitor Services		IPS		0	Park
10.2 Facilities		IPS		0	Park
10.3 Park Administration		IPS		0	Park
10.4 Budget		IPS		0	Park
10.5 Staffing		IPS		0	Park
10.6 HUB		IPS		0	Park
10.7 Operational Needs		IPS		0	Park
10.8 Revenue		IPS			
Land Use & Permitting:					
11.0 Local Development Codes		IPS			Regional
11.1 Zoning Designations		IPS			Park
11.2 State and Federal Agencies		IPS			GPA & Park
11.3 Related Plans		IPS			GPA & Park
11.4 Protected Designations		IPS			Regional

PARK MASTER PLAN

Guides recreational infrastructure development, but mostly defers natural resource management planning to a subsequent process (which is where we are now)

WATERWAYS FISH PASSAGE AND DIKE ALTERATION SCOPING

- Preliminary designs for Reneke, Beltz Creeks
- Modeling of surface water for 4 initial scenarios
  - Existing condition
  - Tide gate flap removed
  - Active Channel Width breach
  - Presumed historic condition (surface water inside dike= surface water outside)
- Scoping of velocity and fish passage considerations through the dike

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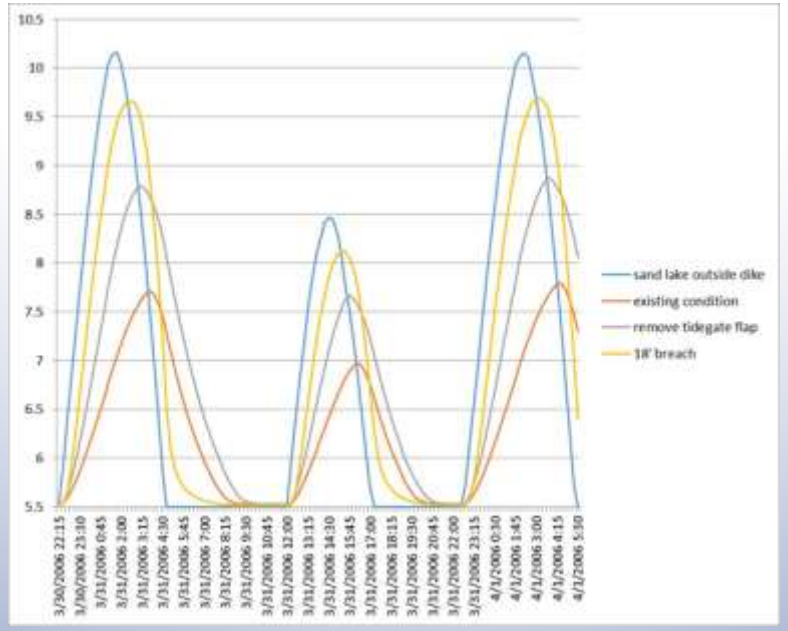
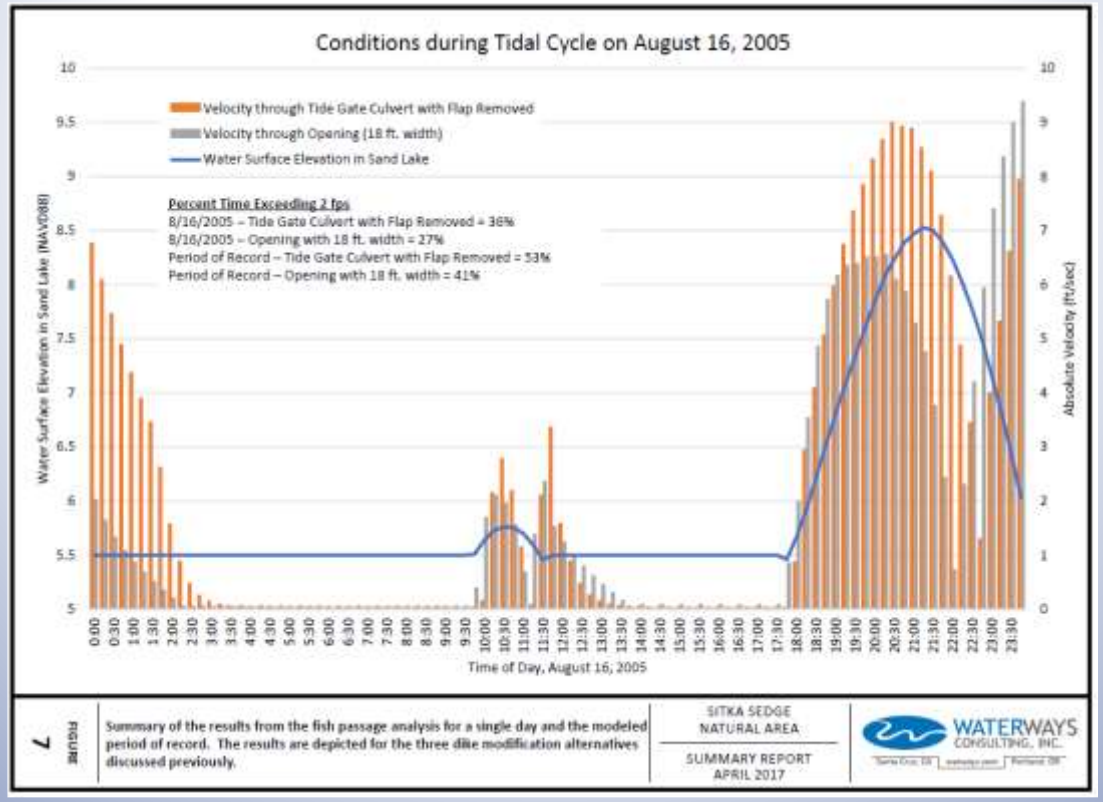


WATERWAYS FISH PASSAGE AND DIKE ALTERATION SCOPING

- Scoping of velocity and fish passage considerations through the dike



WATERWAYS GROUNDWATER EFFECTS SCOPING

WATERWAYS GROUNDWATER EFFECTS SCOPING

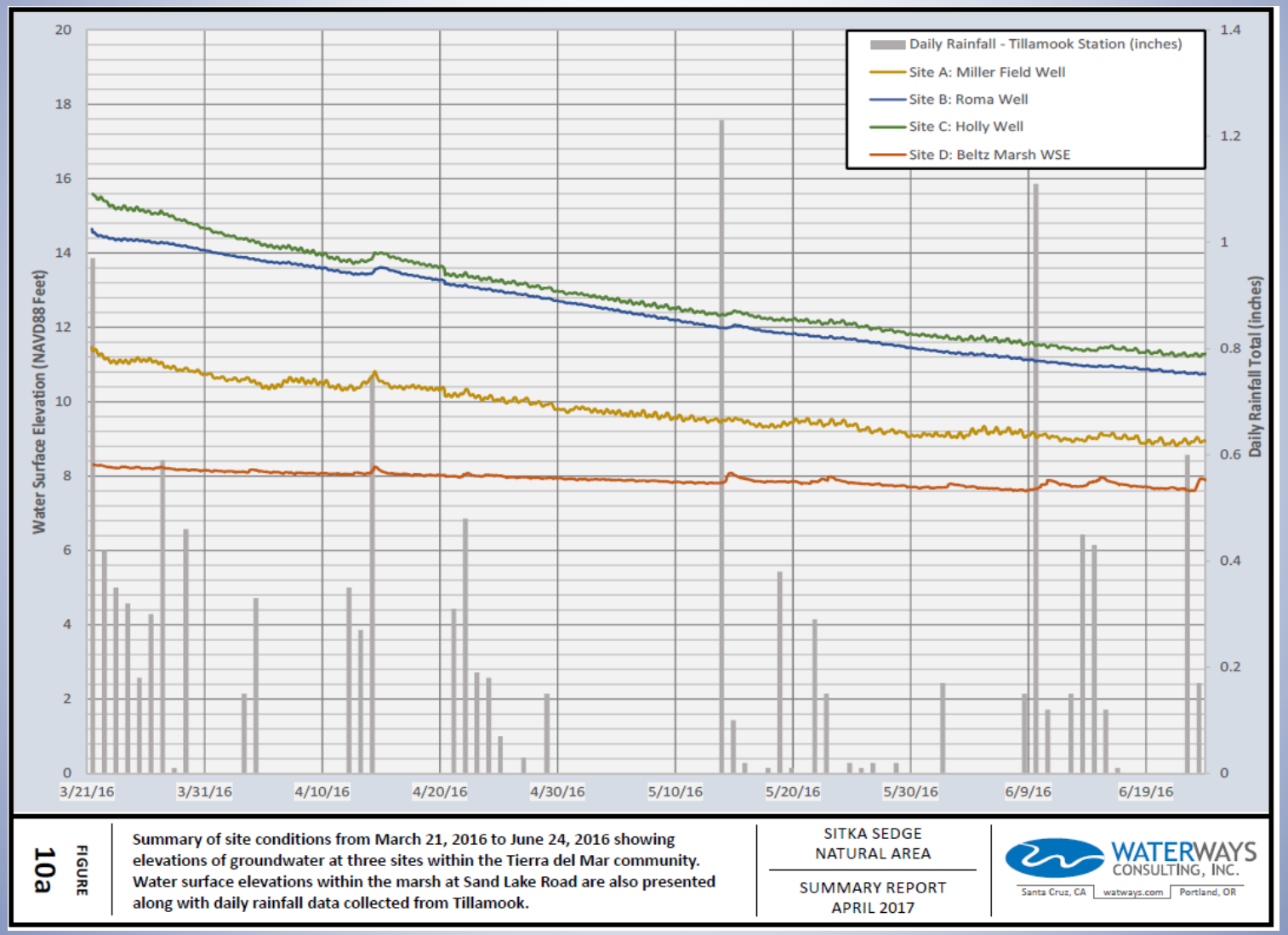


FIGURE 10a

Summary of site conditions from March 21, 2016 to June 24, 2016 showing elevations of groundwater at three sites within the Tierra del Mar community. Water surface elevations within the marsh at Sand Lake Road are also presented along with daily rainfall data collected from Tillamook.

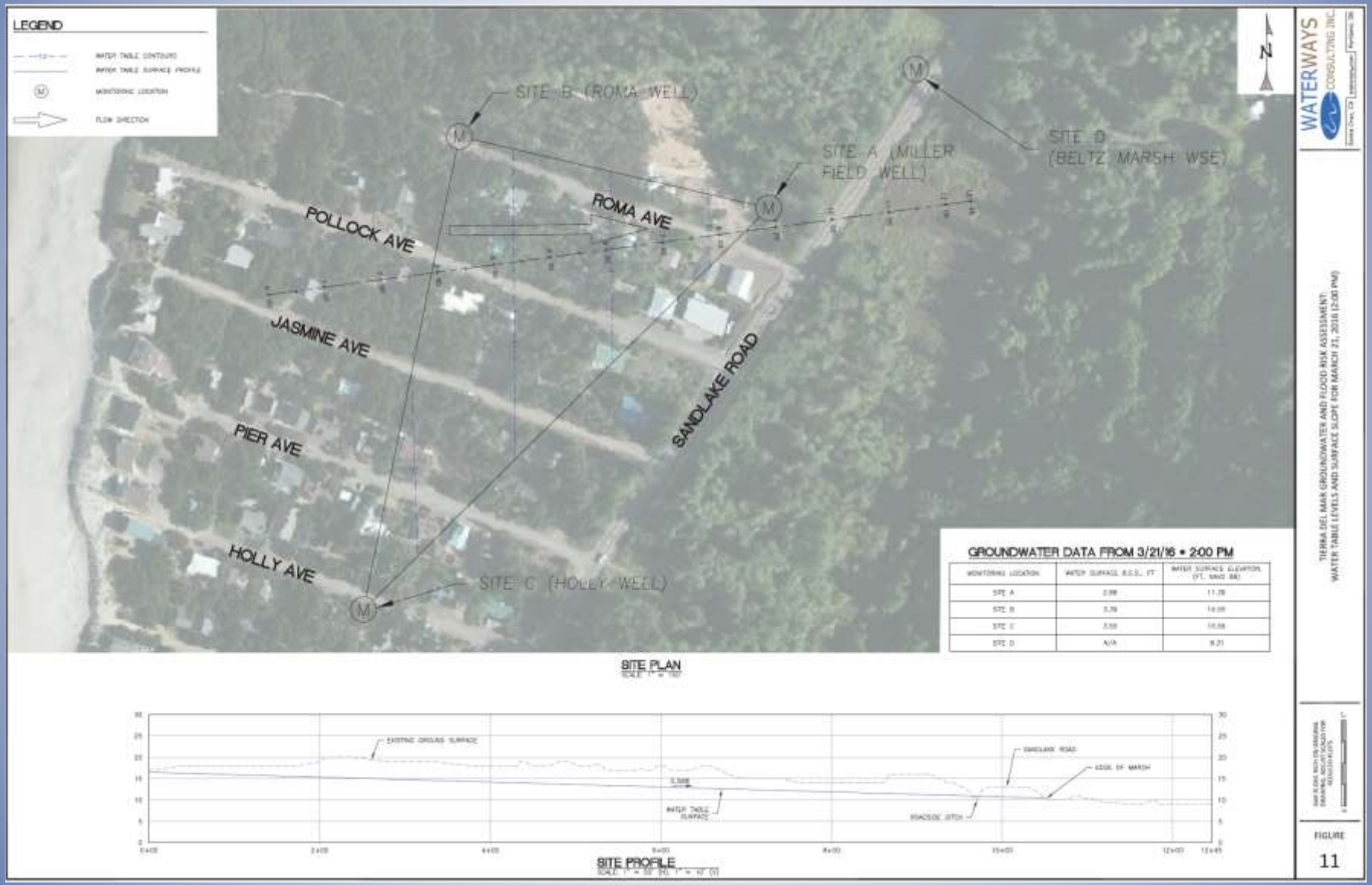
SITKA SEDGE NATURAL AREA

SUMMARY REPORT APRIL 2017

WATERWAYS CONSULTING, INC.

Santa Cruz, CA | watways.com | Portland, OR

WATERWAYS GROUNDWATER EFFECTS SCOPING

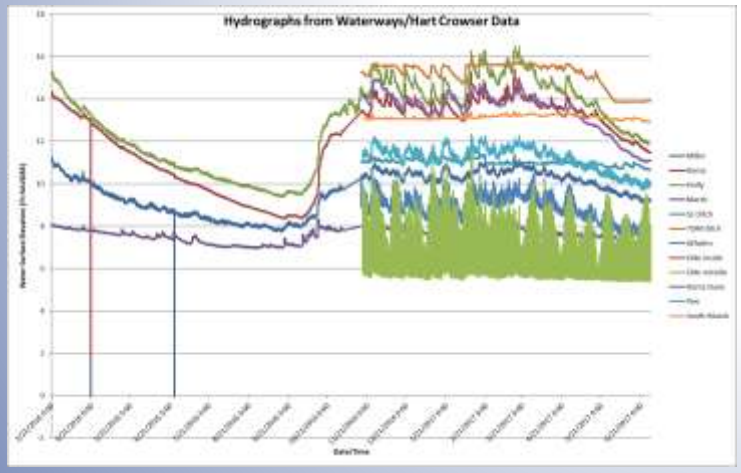


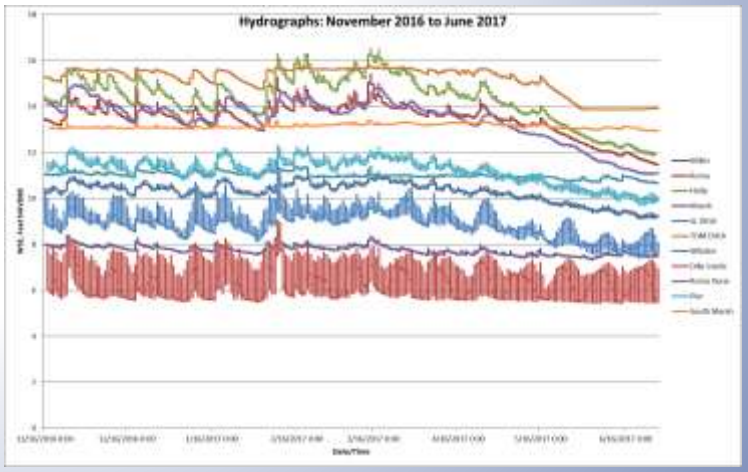
NEED FOR LARGER GROUNDWATER STUDY

- Preliminary study assessed current conditions only
- A model was needed that could predict groundwater response to altered tide inputs in the area behind the dike
- Creation of such a model required much more comprehensive subsurface hydrogeological characterization

PHASE 2 GROUNDWATER STUDY

- Initially planned by Waterways and Hart Crowser
- Advisory committee reviewed and edited scope of work
- A series of new wells and surface water monitoring locations were installed to gather data to be used in a future modeling effort
- Data collected in fall, winter, spring 2016-2017





PGG/ESA SURFACE WATER AND GROUNDWATER MODELING

- Reviewed and incorporated available data from previous studies
- Determined that new nested wells needed
- Installed 3 new nested wells, new surface water monitoring sites
- New surface water modelling process and inputs
- New dike alteration scenarios
- MODFLOW groundwater flow modeling

PGG/ESA SURFACE WATER AND GROUNDWATER MODELING

PGG/ESA MODELING SCENARIOS

Scenarios were chosen in 2 phases:

Initial scoping of extremes

- Existing tide gate
- Modern tide gates
- Breach

Follow-up testing and refinement scenarios

- Setback dike (not a fully developed scenario)
- Higher shutoff elevation variant for modern tidegate
- Exploration of beaver dam effect on storage capacity
- Exploration of effect of backed up water in ditches and culverts due to potential tidal surface water at outlet
- Exploration of altered marsh transmissivity on results

PGG/ESA MODELING SCENARIOS

Breached Dike

- Free flowing connection
  - Allows full tidal exchange
  - Sized based on Tidal Channel/Inlet Sizing Guidelines, based on tidal prism volume
  - Bottom Width = 40 ft
  - Top Width = 60 - 80 ft
  - Bottom Elev = 0.0’

PGG/ESA MODELING SCENARIOS

- Nehalem Marine Manufacturing

Modern Tide Gate

- "Muted Tidal Regulator"
  - Allows a 'muted' tidal exchange
  - Sets maximum water level upstream of tide gate, and gate closes when that elevation is reached.
- Preliminary Sizing
  - Two side-by-side gates
  - Each 8' tall x 10' wide
- Operation Parameters
  - Close when upstream water levels reach 7.0'
  - Also modeled 8' closure setting

PGG/ESA MODELING SCENARIOS

Setback dike preliminary scoping

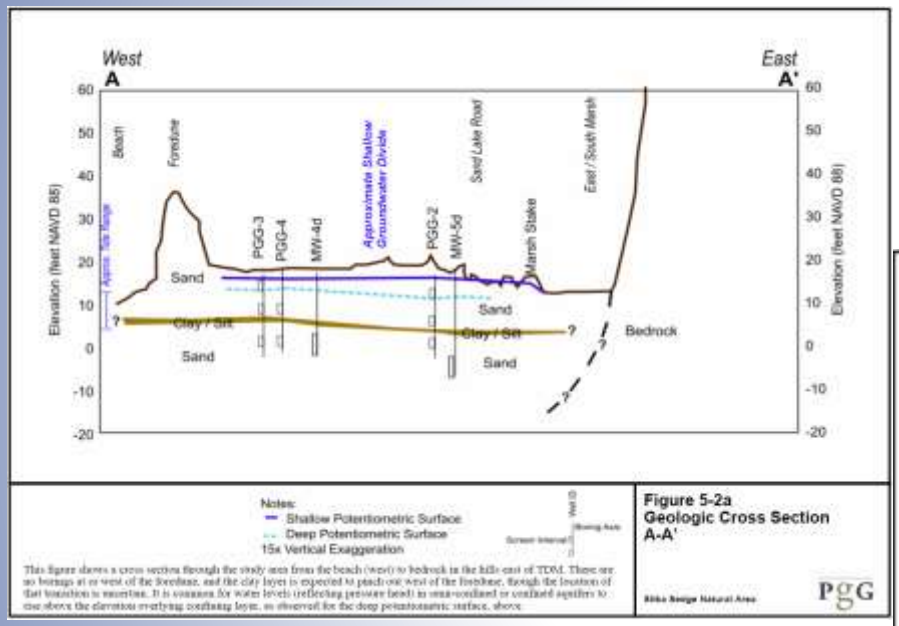
- Checked whether a setback dike located near the beaver dam would have enough storage capacity to hold stormwater without flooding during tide gate closure period
- Breach Beltz Dike to reconnect majority of marsh
- Reneke and Beltz Creeks drain to reconnected Marsh (outside/ downstream of setback dike)
- East Marsh (No Name Creek), TDM runoff, and direct precipitation drain in upstream of setback dike

PGG/ESA RESULTS

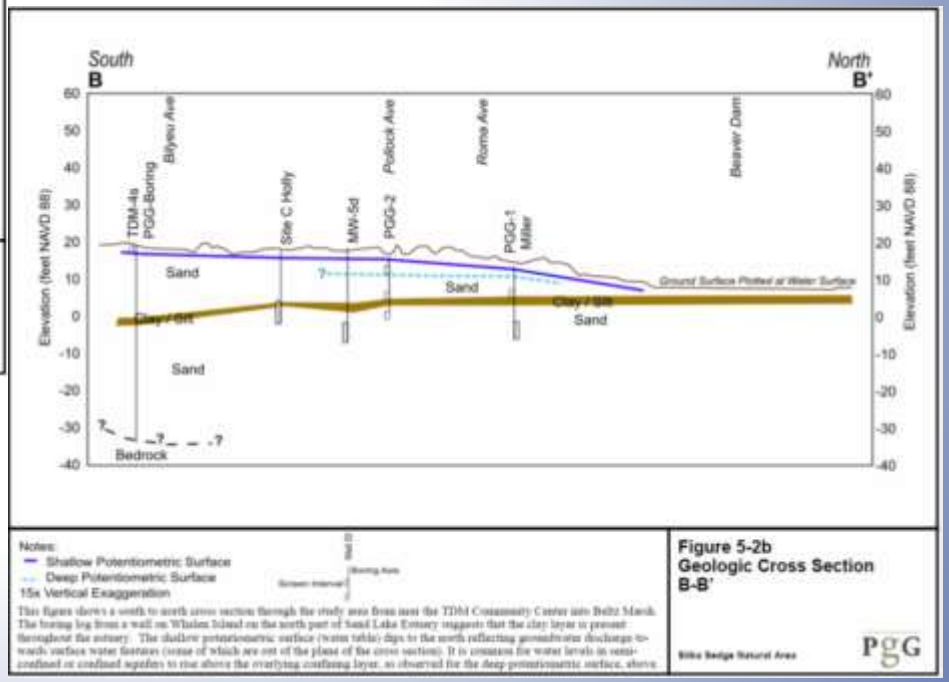
		Storm and Tide inputs		
		Shallow Aquifer Groundwater level change relative to existing tide gate: Average precipitation and tides	**Shallow Aquifer Groundwater level change relative to existing tide gate: 50-year storm and king tides**	**Surface water characteristics comparison**
Dike Configuration Scenario	Existing Leaky Tide Gate	NA	NA	Longest duration of inundation of upper elevations (7-12+ ft) in Beltz and East Marsh under significant storm conditions due to restricted outflow through dike. Lower frequency of inundation of upper marsh elevations under average conditions than Dike Breach, higher than Modern Tide Gate.
	Modern Tide Gate	Less than 1/8 inch decrease	Up to 2 inches decrease in well closest to Beltz Marsh, and no change evident in other wells to the south	Lowest Beltz Marsh water surface elevations. Rapid drainage. Lowest duration of inundation of upper marsh elevations under both average and extreme conditions.
	Dike Breach	Up to ¼ inch increase in well closest to Beltz Marsh. No effect in wells further from the Marsh.	Up to 1.7 inch decrease in well closest to Beltz Marsh. No effect in other wells.	Increased frequency of inundation of upper elevations of marsh (7'-12') relative to Existing Tide Gate and Modern Tide Gate under average conditions. Decreased duration of inundation of upper elevations of marsh relative to Existing Tide Gate under storm conditions due to rapid drainage.

PGG/ESA RESULTS

PGG/ESA RESULTS



East-west cross section



North-south cross section

PGG/ESA RESULTS

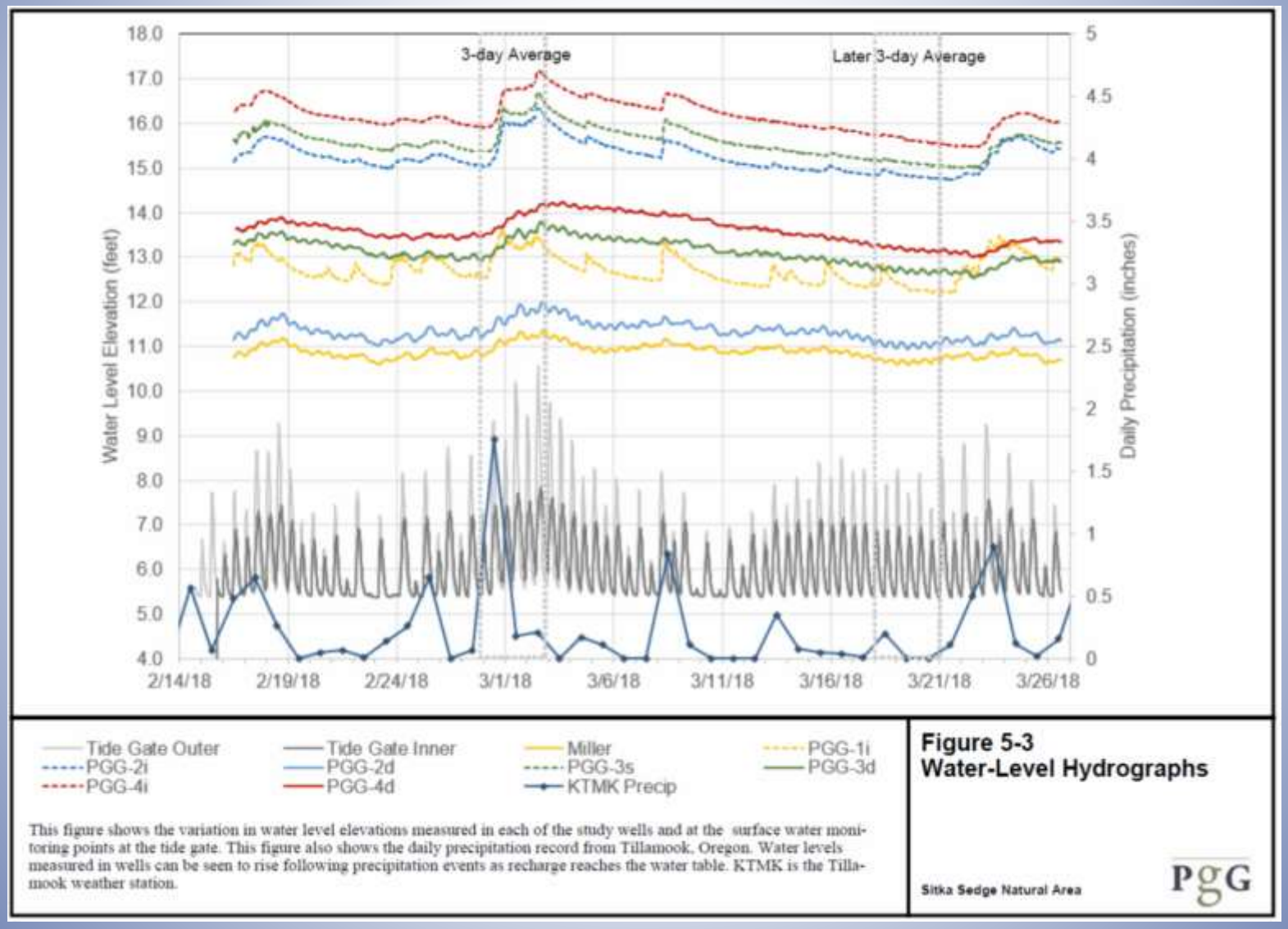


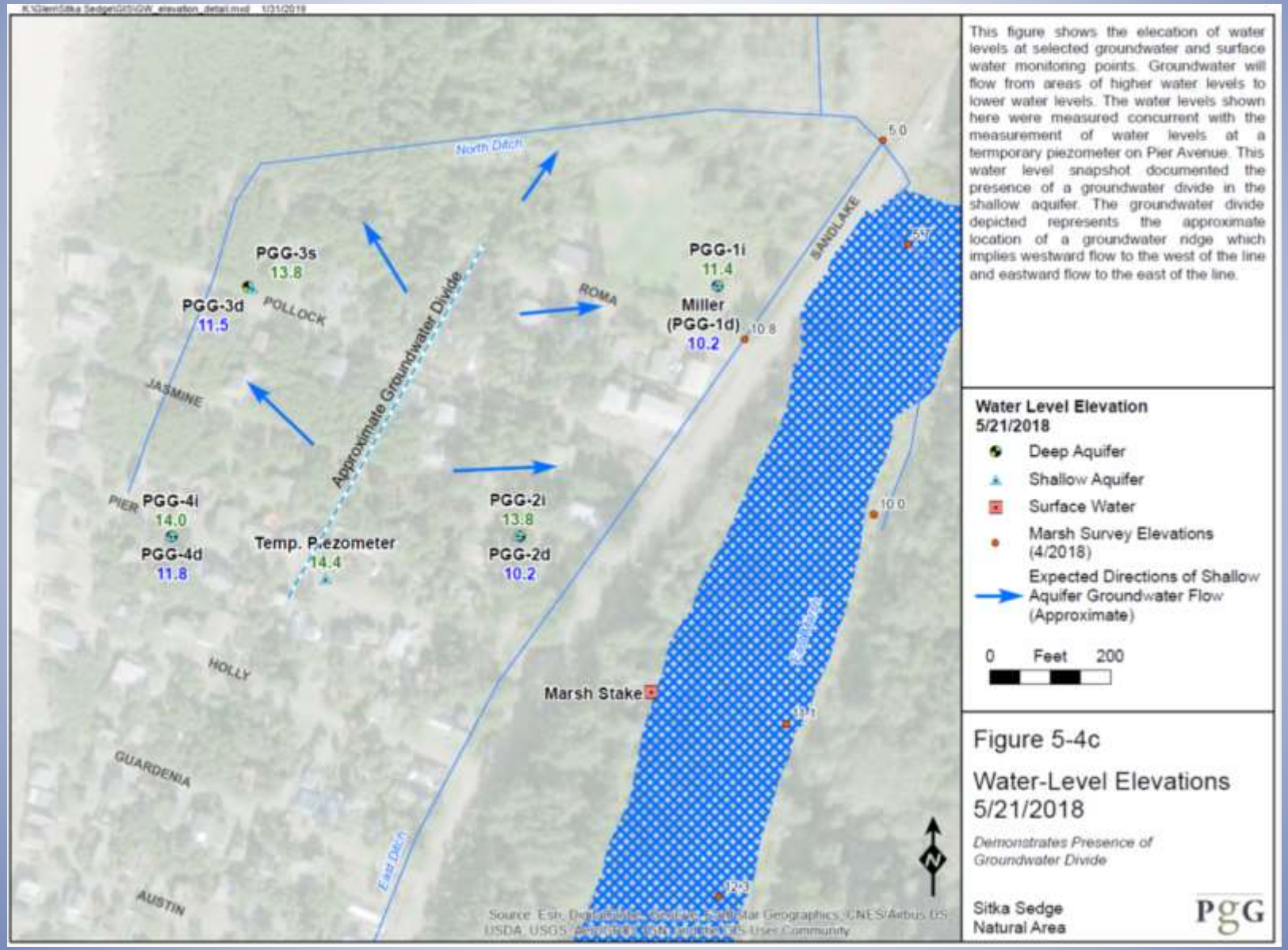
Figure 5-3
Water-Level Hydrographs

This figure shows the variation in water level elevations measured in each of the study wells and at the surface water monitoring points at the tide gate. This figure also shows the daily precipitation record from Tillamook, Oregon. Water levels measured in wells can be seen to rise following precipitation events as recharge reaches the water table. KTMK is the Tillamook weather station.

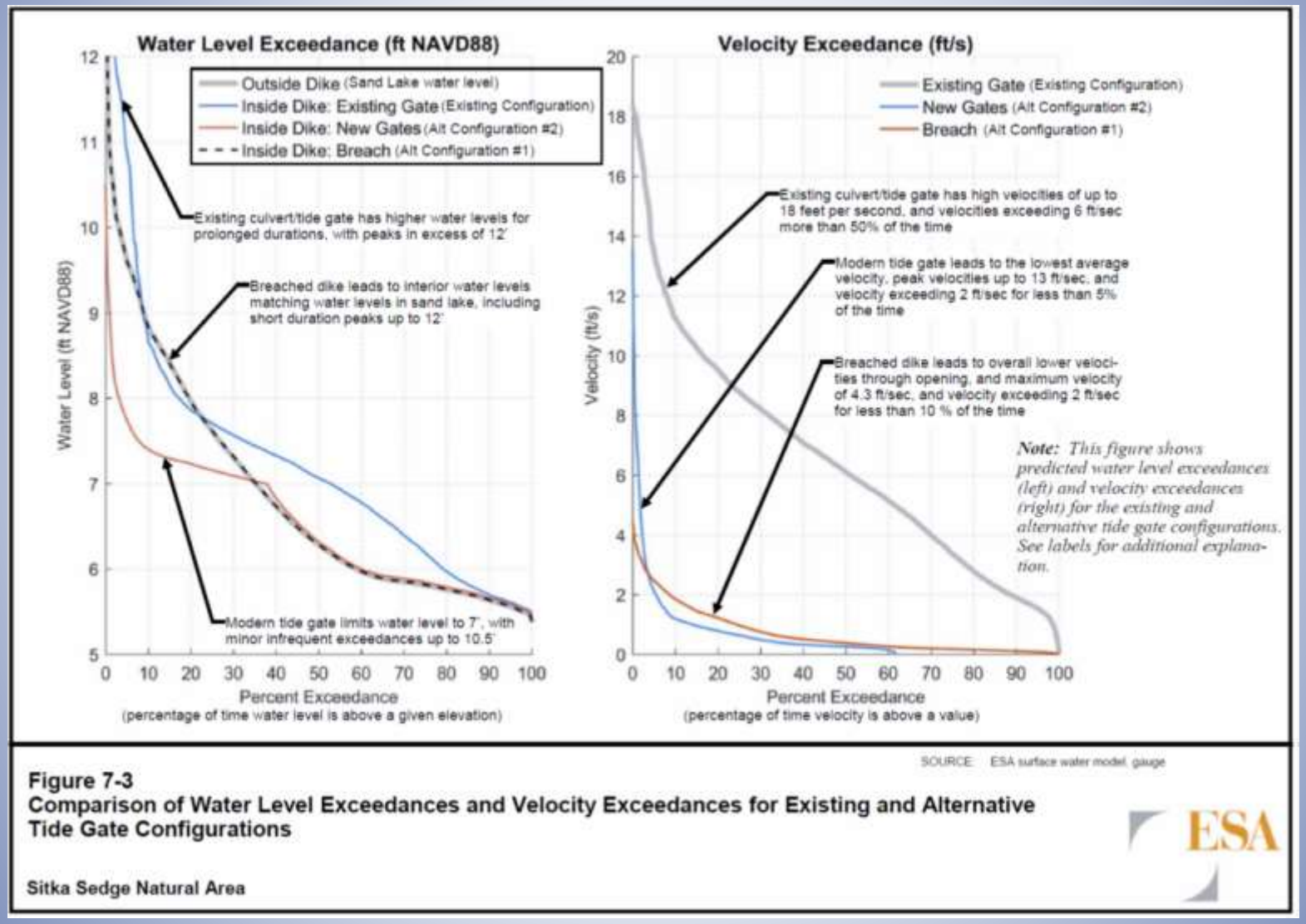
Sitka Sedge Natural Area

PgG

PGG/ESA RESULTS



PGG/ESA RESULTS



SOURCE: ESA surface water model, gauge

Figure 7-3
Comparison of Water Level Exceedances and Velocity Exceedances for Existing and Alternative Tide Gate Configurations

Sitka Sedge Natural Area

ESA

PGG/ESA RESULTS: SETBACK DIKE FEASIBILITY

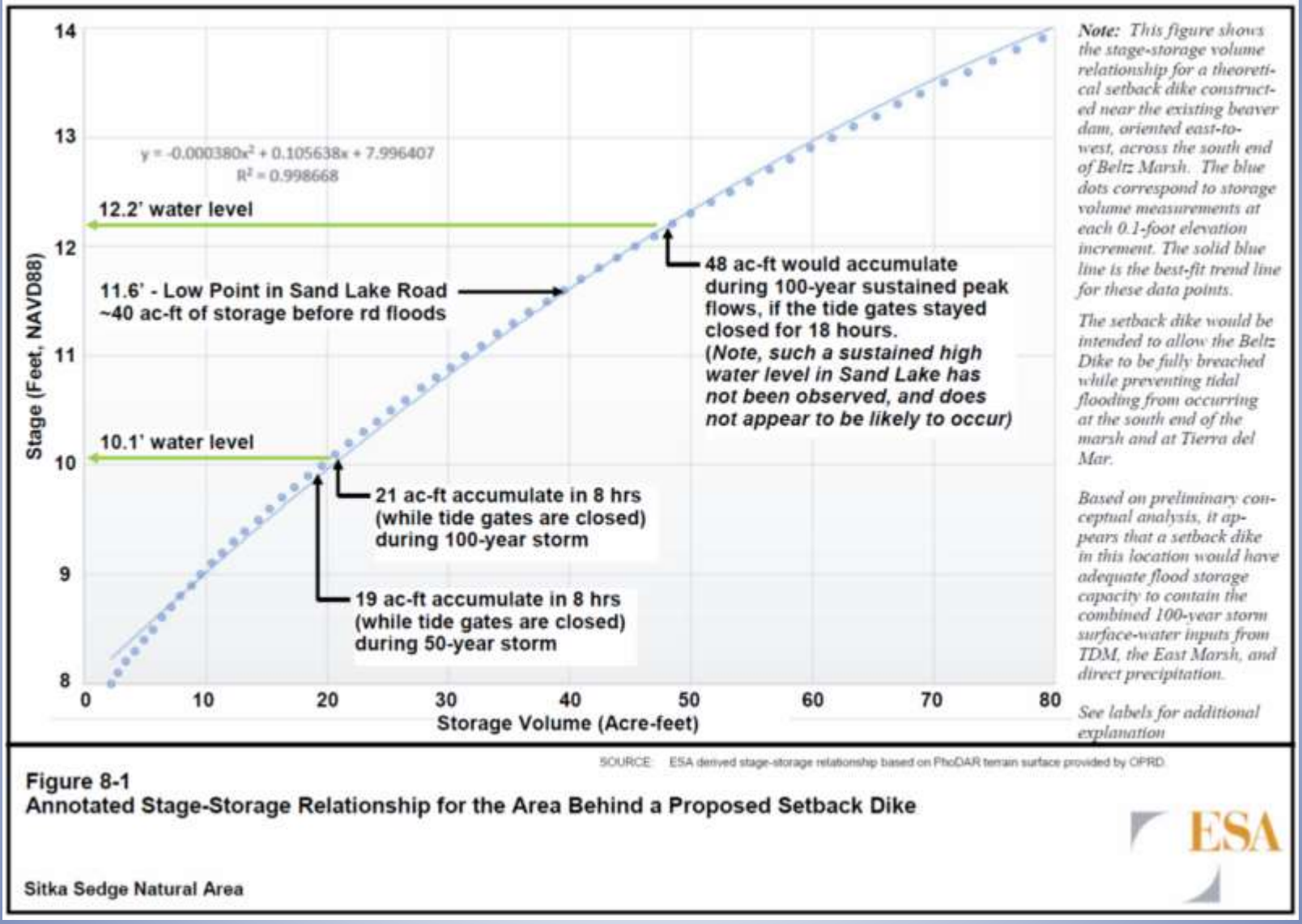
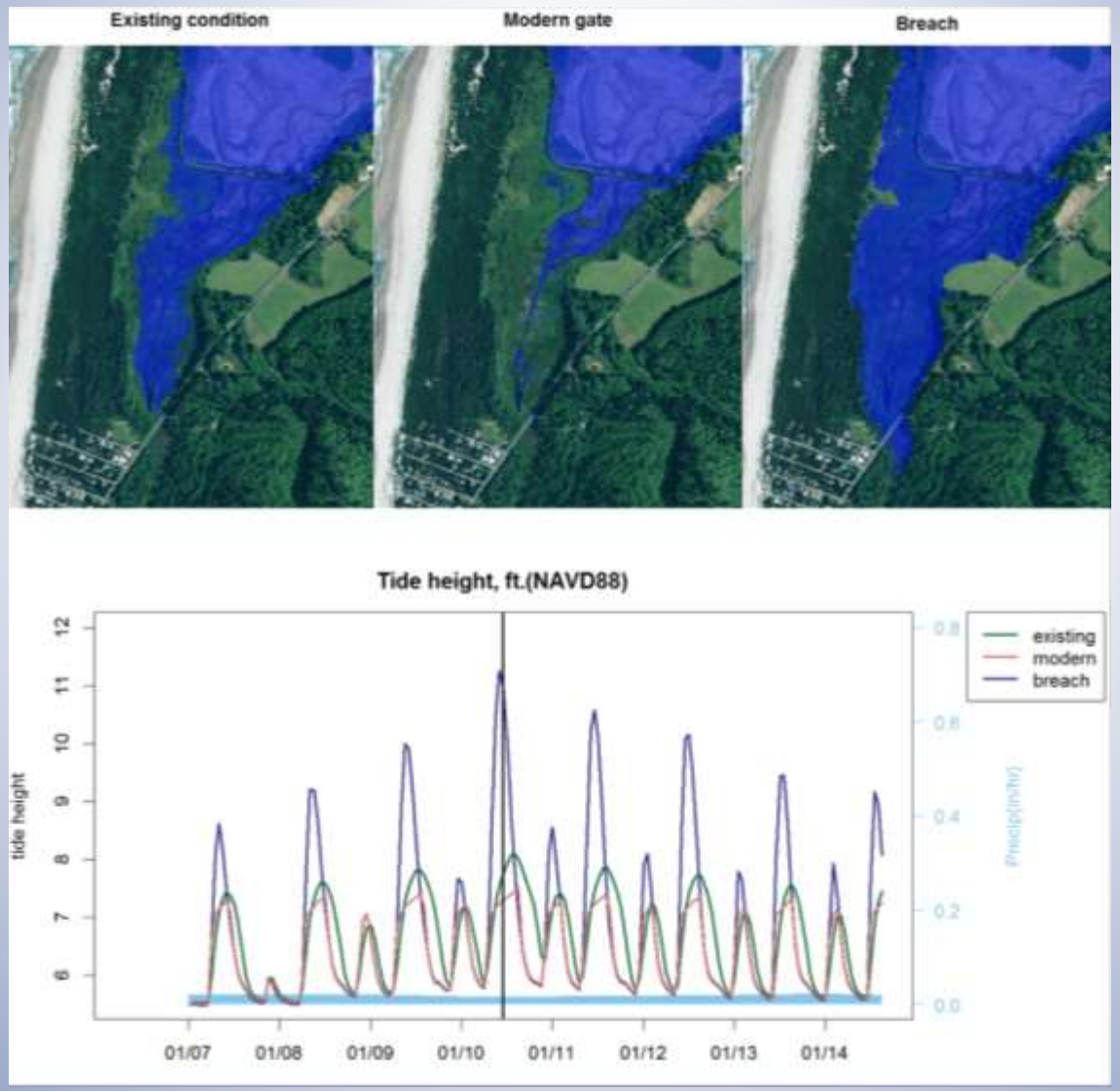


Figure 8-1
Annotated Stage-Storage Relationship for the Area Behind a Proposed Setback Dike

Sitka Sedge Natural Area

ESA

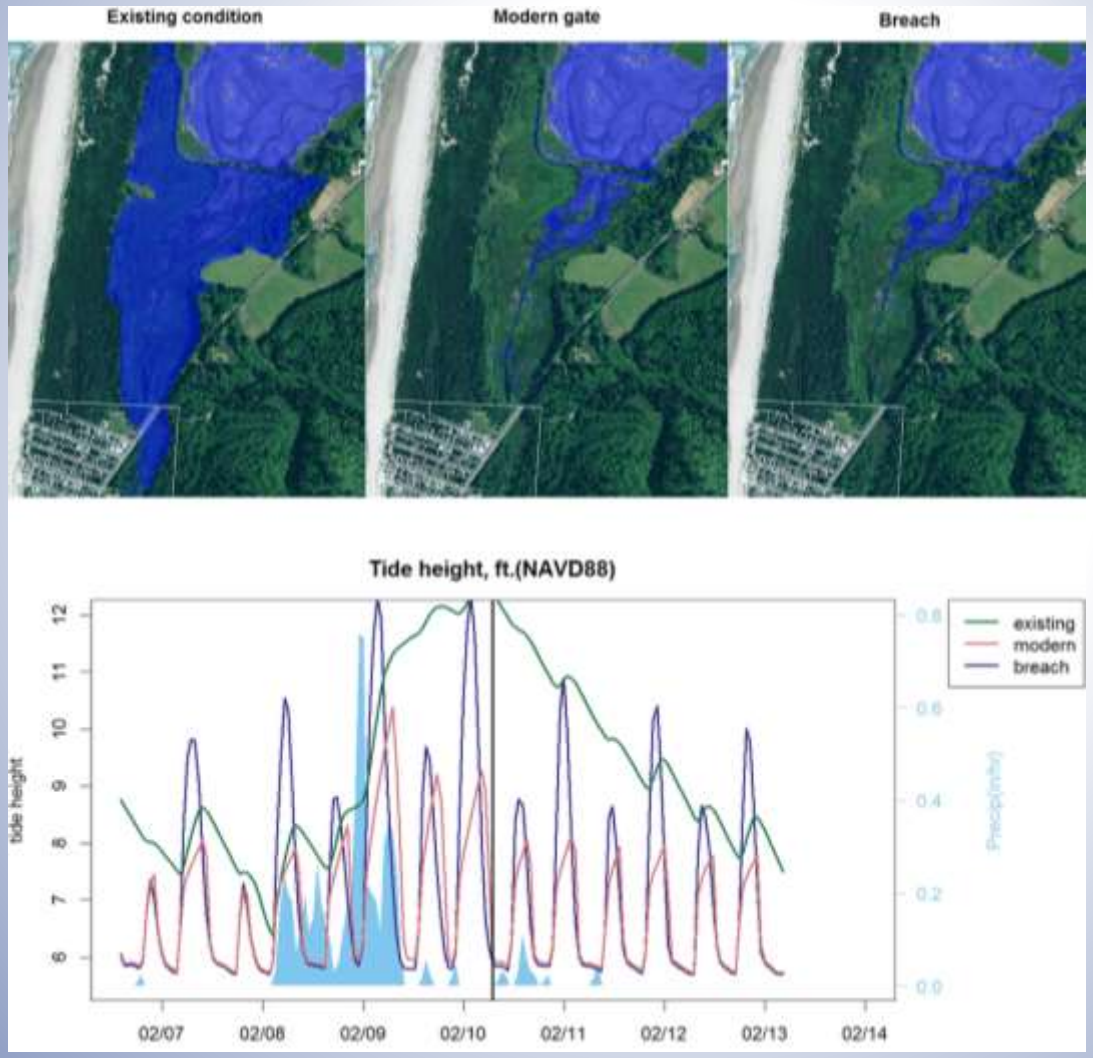
PGG/ESA RESULTS



Ave Storm/King

PGG/ESA RESULTS

- Private land effects from surface water alterations



Ave
Storm/King

WRAP UP

- This summary of what has been done is very basic, and doesn't cover the complexities and nuances.
- Future technical team meetings will cover some of this material in more detail.
- Original materials are all available for independent in-depth review. PGG/ESA reports and summaries are available here: https://www.oregon.gov/oprd/NATRES/Pages/SitkaSedgeHydrology.aspx
- I can make Waterways materials available to anyone that needs them.
- The Sand Lake Limiting Factors Analysis is available through the Nestucca, Neskowin, and Sand Lake Watersheds Council