

Edmonds Marsh Study Review

Presentation by Windward Environmental LLC to the Edmonds City Council

October 1, 2019





Presentation Overview

- ▶ Review of project tasks completed
 - ▶ Summary of baseline monitoring study goals, monitoring parameters, and field methods
 - ▶ Summary of results for physical monitoring parameters
 - ▶ Summary of results for biological monitoring parameters
 - ▶ Summary of the Evaluation of the Edmonds Marsh Estuary Restoration Project
- 



Overview of Tasks Completed

- ▶ Task 1: Baseline Monitoring Study
 - ▶ Task 2: Evaluation of Buffer Widths and Ecological Functions: A Review to Support the Edmonds Marsh Study and Initial Evaluation of Edmonds Marsh and Shellabarger Marsh Buffer Zones
 - ▶ Task 3: 2019 Shoreline Master Program update
 - ▶ Task 4: Edmonds Marsh Estuary Restoration project impacts
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Purpose of Baseline Monitoring Study

- ▶ Document current conditions within the Marsh and its buffer areas.
- ▶ Evaluate the ecological functions being provided by these habitats.
- ▶ Help identify restoration opportunities, such as vegetation enhancements.
- ▶ Coordinate with and provide an overview of data and information being collected by other groups.



Baseline Monitoring Study – a year of data collection

- ▶ Soil and sediment characteristics
 - ▶ Water quality and depths
 - ▶ Vegetation surveys
 - ▶ Invertebrate surveys
 - ▶ Wildlife surveys
 - ▶ Photographic surveys
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Water Quality with Hand-held Meters



Salinity and Depth Measurements with Deployed Data Loggers



Data Loggers (cont.)



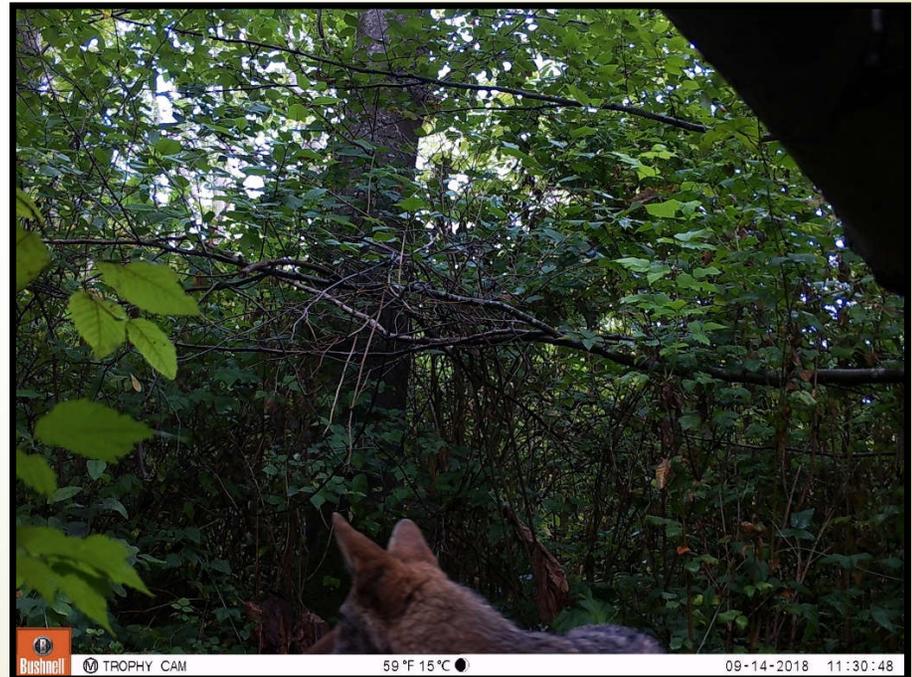
Vegetation Surveys (in Buffer Zones and Marsh Interior)



Invertebrate Surveys



Wildlife Surveys



Photographic Surveys – Photo Stations



Baseline Monitoring Study Community Involvement

The screenshot shows the Flickr group page for 'Edmonds Marsh Madness'. The page features a dark header with the Flickr logo, navigation links (Explore, Create, Get Pro), a search bar, and login/sign-up options. The main banner image shows silhouettes of birds in flight against a warm, orange sky. Below the banner, the group name 'Edmonds Marsh Madness' is displayed with a '+ Join Group' button. Statistics show 10 Members, 55 Photos, and 4 Discussions. The group was created on Sep 14, 2018. The 'Overview' tab is selected, showing a 'Photo pool' with four landscape photos of a marsh at sunset. A 'View 55 photos' link is available. A 'GROUPS BETA' notification is visible in the bottom right corner.

flickr Explore Create Get Pro

Photos, people, or groups Log In Sign Up

Edmonds Marsh Madness + Join Group

10 Members • 55 Photos • 4 Discussions Group Since Sep 14, 2018

Overview Discussions Photos Members Map

Photo pool View 55 photos

GROUPS BETA

https://www.flickr.com

Results of Physical Monitoring Parameters





Buffer Soils and Marsh Sediments

Buffer Soils

- ▶ Contain large percentages of sand and gravel
- ▶ High organic matter content in the North Buffer Zone and the North Shellabarger Marsh Buffer Zone
- ▶ Bulk density measurements below those known to restrict woody plant root growth and prevent water infiltration
- ▶ Acidic soil pH, consistent with the soil series in and around the Marsh

Marsh Sediments

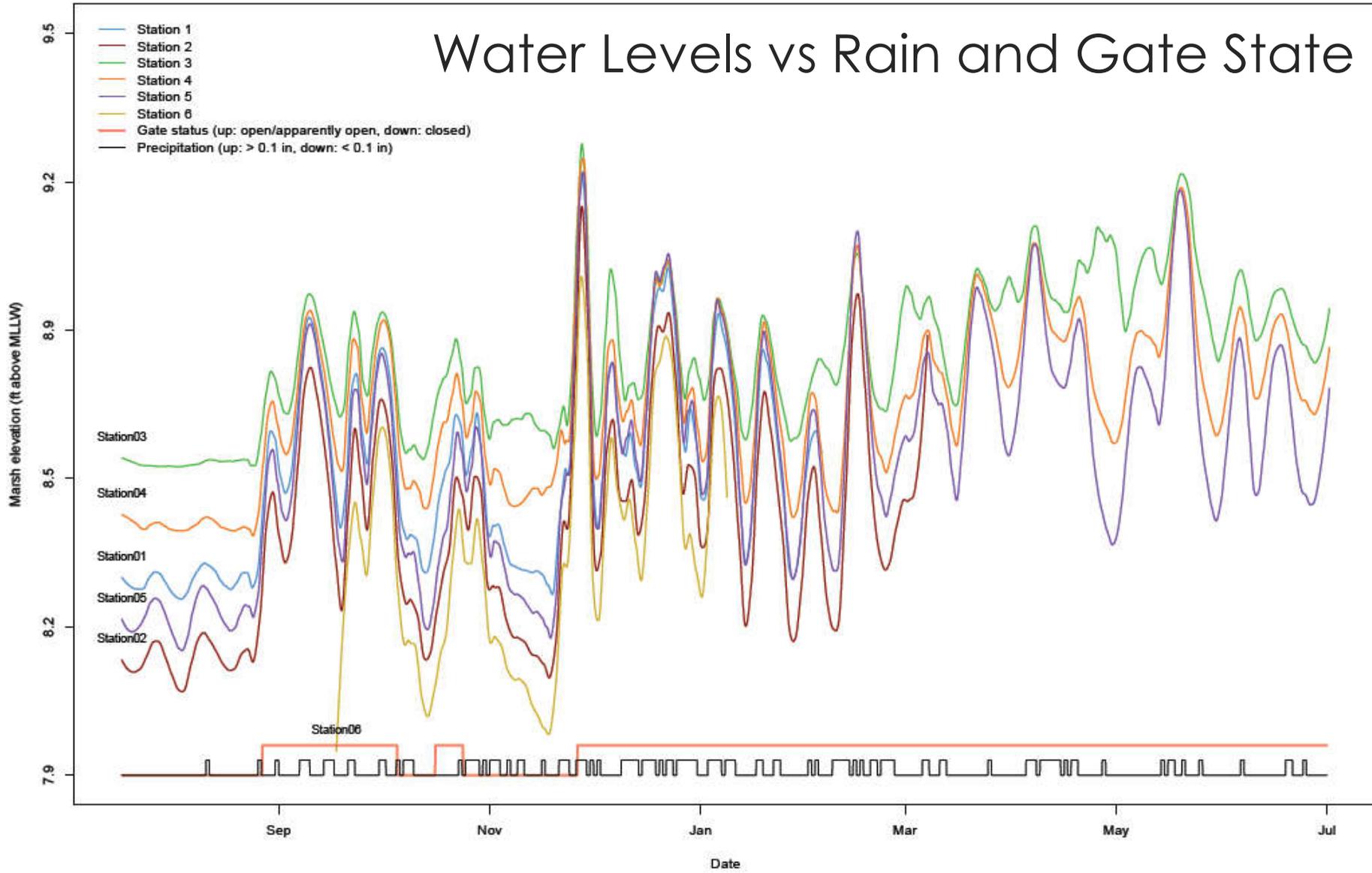
- ▶ Contain higher percentages of silt and clay compared to buffer soils
- ▶ Organic matter content ranged from 7 to 13%; large quantities of organic matter (plant detritus and small roots) also visually observed in sediments
- ▶ Acidic sediment pH, consistent with the Mukilteo muck soil series



Discrete Water Quality Monitoring

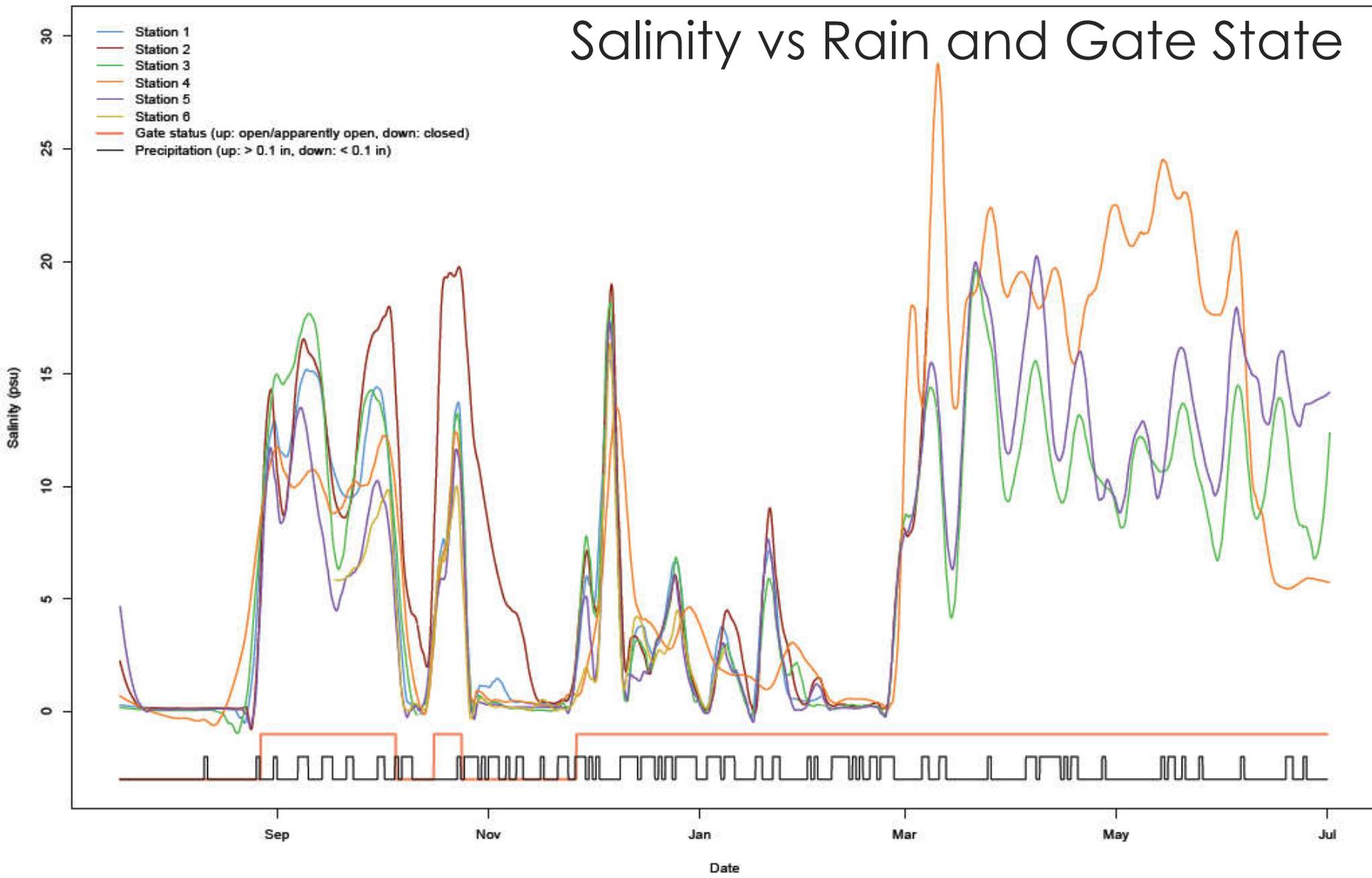
- ▶ Washington State WQC generally met, with some exceptions
- ▶ A few low pH (acidic) readings at Station 4 (along North Buffer Zone) and Station 7 (Marsh outlet basin)
- ▶ Turbidity readings generally low (meaning clear water)
- ▶ WQC for dissolved oxygen met at all stations except 5 and 6 (along North Buffer Zone)
- ▶ WQC for temperature usually met, except in summer
- ▶ The water quality benefit of preserving lower water temperatures during warmer weather observed in and near the South Buffer Zone

Water Levels vs Rain and Gate State

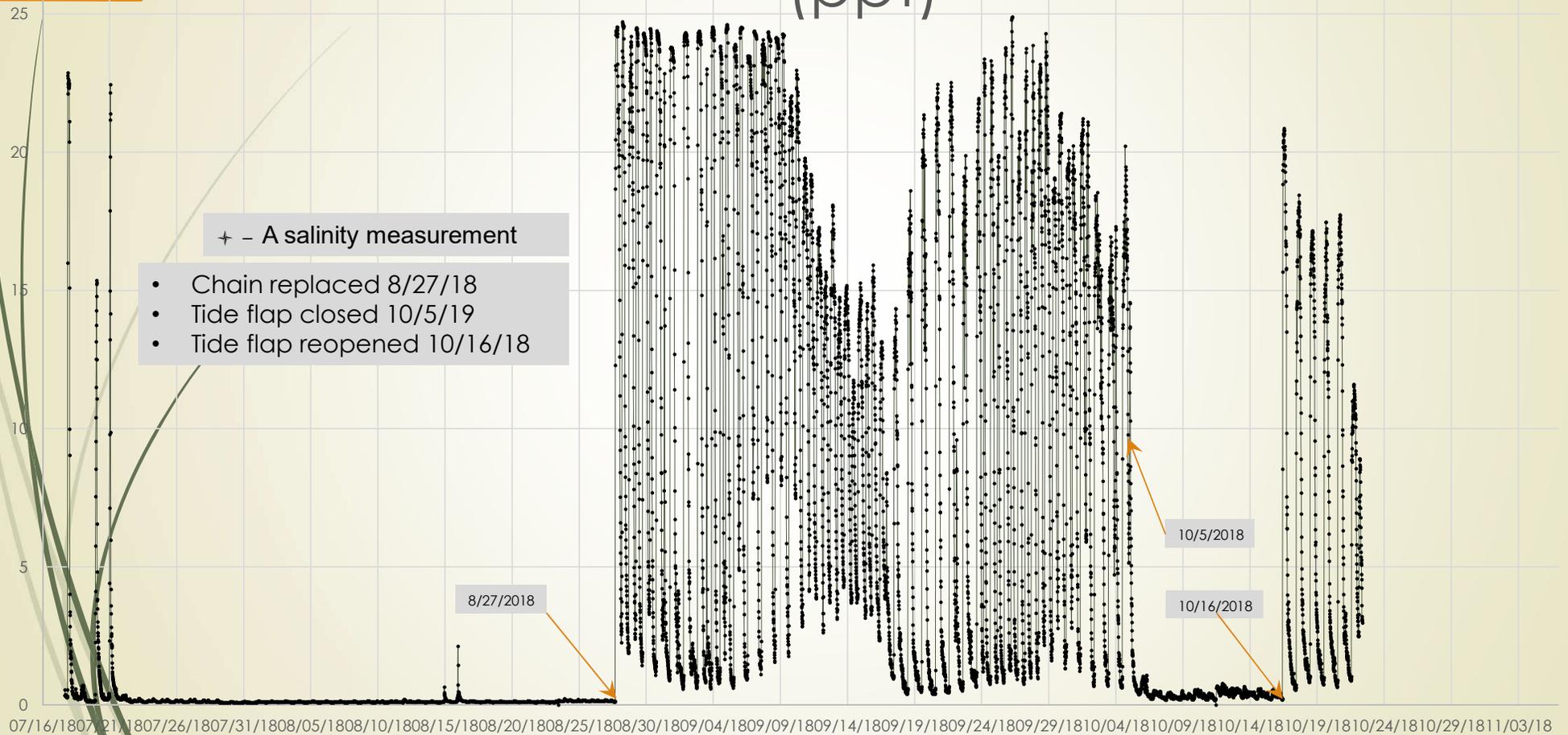




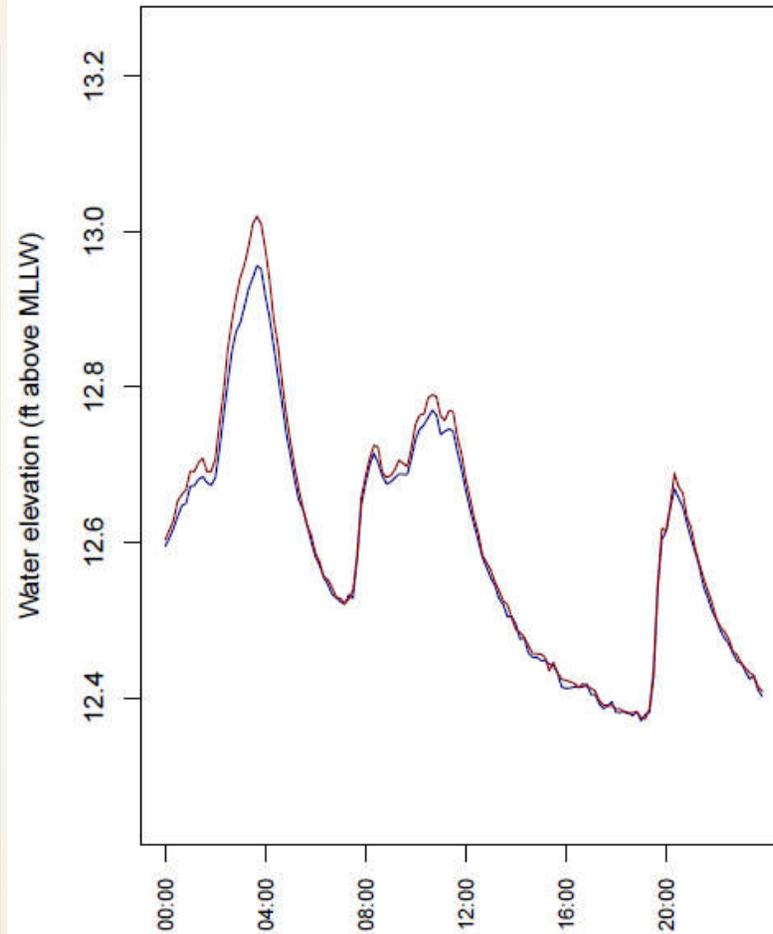
Salinity vs Rain and Gate State



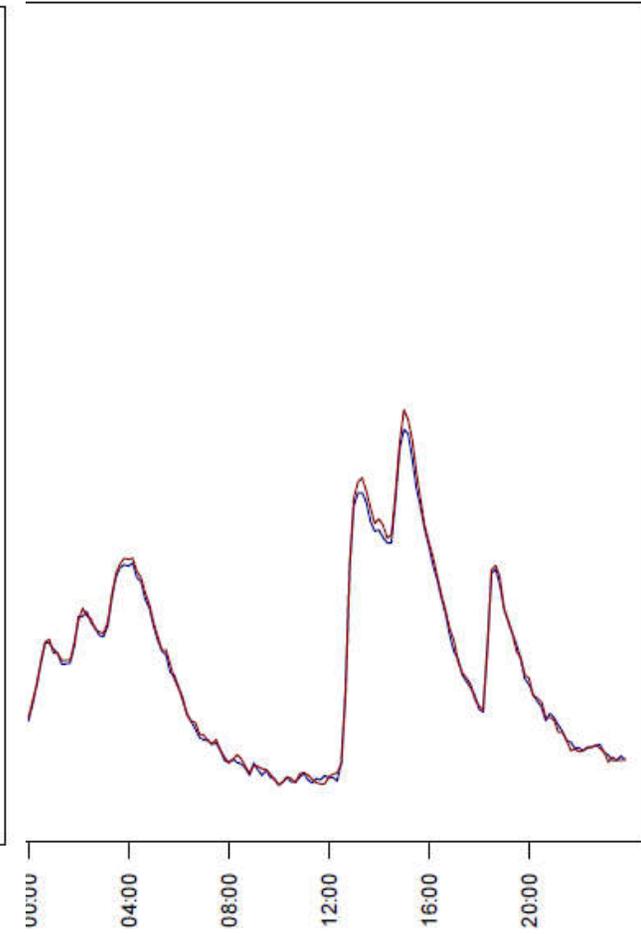
Station 5 (7/17/18 to 10/22/18) Salinity (ppt)



East and West Sides Hwy 104



March 12, 2019, 1.27 in. total rainfall



April 5, 2019, 0.81 in. total rainfall

Results of Biological Monitoring Parameters

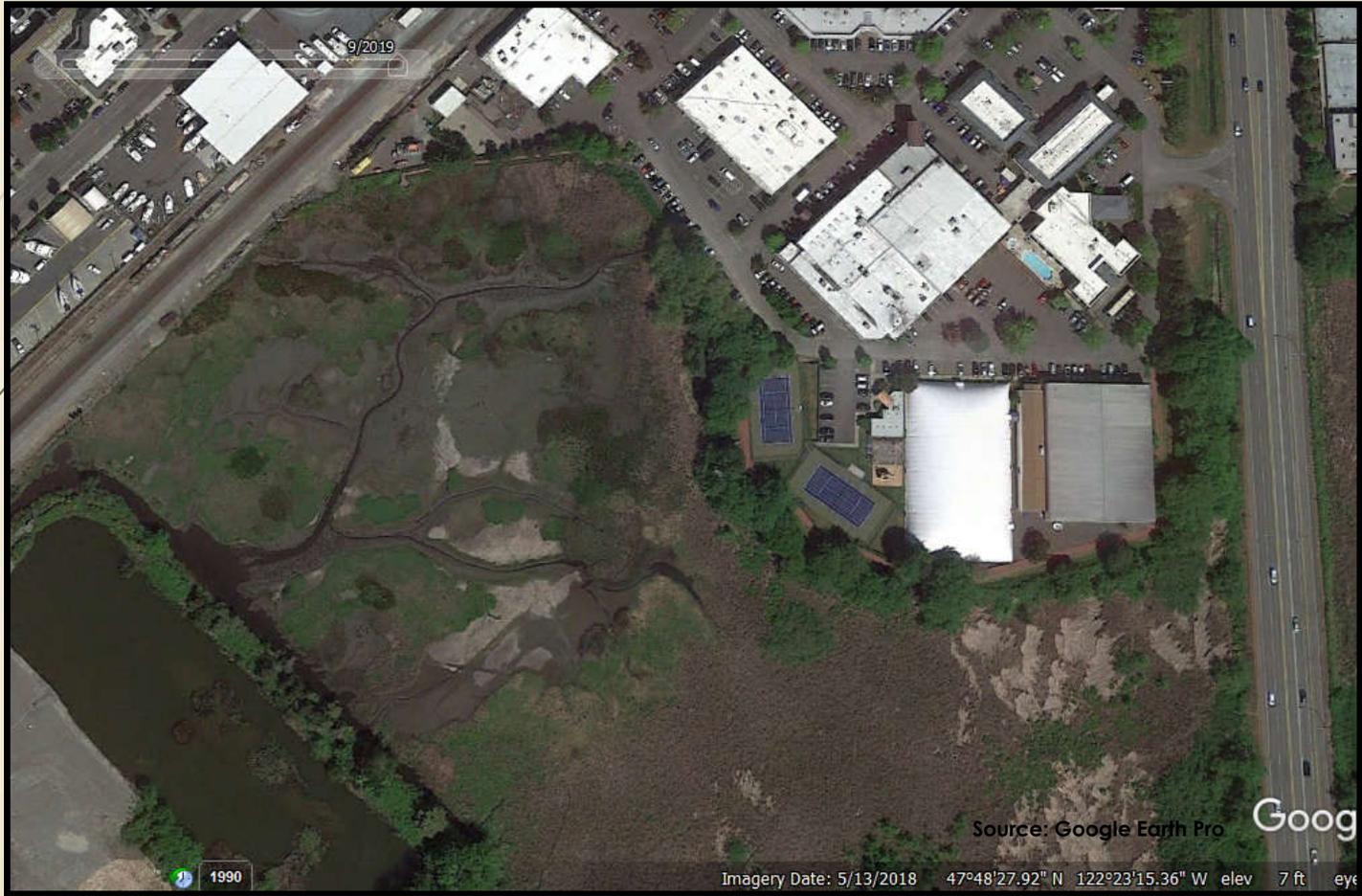




Overview of Marsh Buffer Zones Surveyed

- ▶ North Buffer Zone (along Harbor Square)
 - ▶ North Buffer Zone of Shellabarger Marsh
 - ▶ Southeast Buffer Zone (along SR-104)
 - ▶ South Buffer Zone (Willow Creek Fish Hatchery)
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North Buffer Zone



North Buffer Zone (cont.)





Vegetation and Invertebrates of the North Buffer Zone

Vegetation:

- ▶ Red alder and Scouler's willow dominant in the canopy (cover 82 to 85% during growing season)
- ▶ Scouler's willow, Himalayan blackberry, installed native shrub mixes in the understory
- ▶ Broadleaf cattail, water parsley dominant groundcover species

Invertebrates:

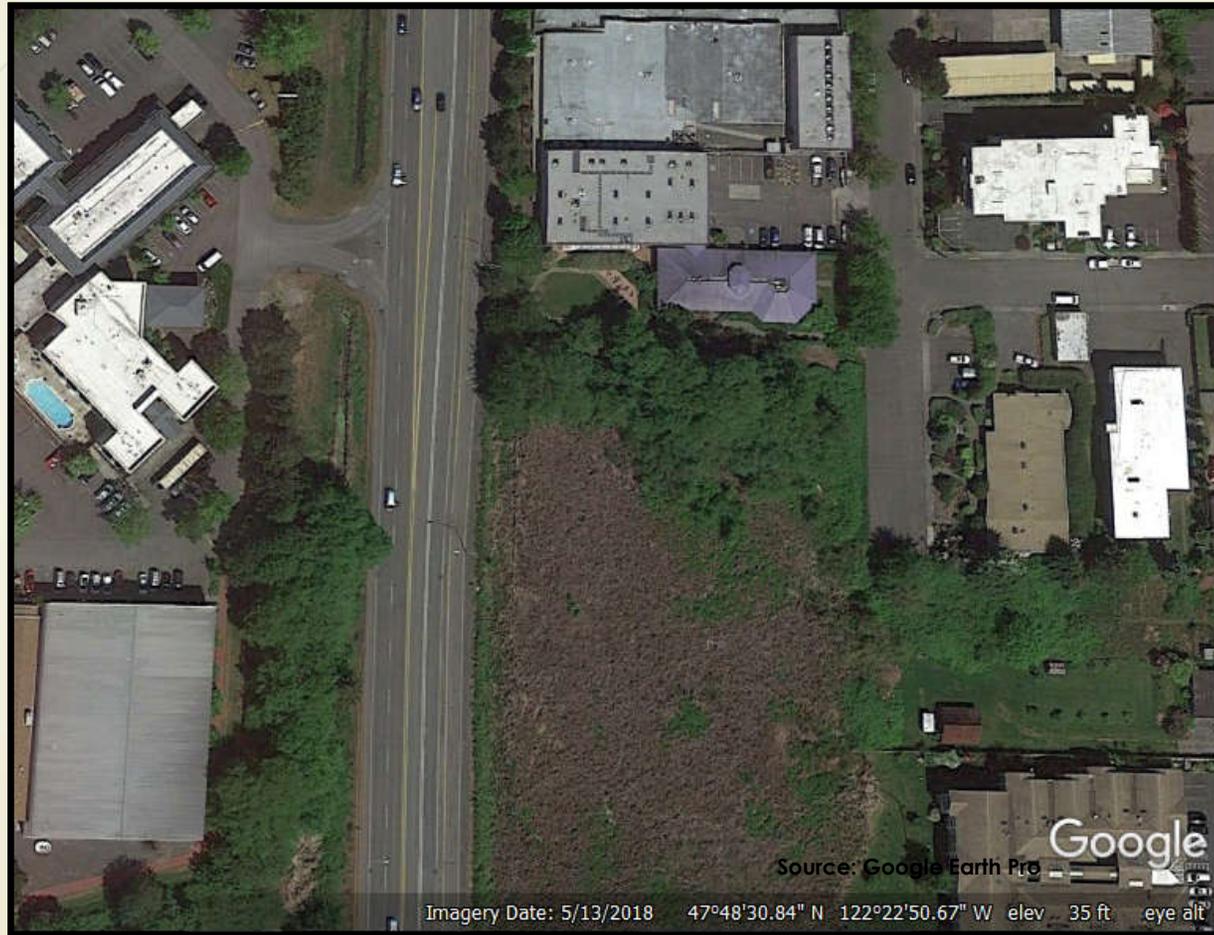
- ▶ Springtails
- ▶ Flies
- ▶ True bugs
- ▶ Spiders
- ▶ Bark lice
- ▶ Others



Birds of the North Buffer Zone and Adjacent Marsh Area

- ▶ American crow (summer)
- ▶ American robin (fall, winter, spring)
- ▶ Anna's hummingbird (summer, winter, spring)
- ▶ Bewick's wren (spring)
- ▶ Black-capped chickadee (fall, spring)
- ▶ Common yellowthroat (summer, spring)
- ▶ *Dark-eyed junco (various)*
- ▶ Golden-crowned sparrow (fall, winter, spring)
- ▶ Marsh wren (summer, winter, spring)
- ▶ Red-winged blackbird (winter, spring)
- ▶ Song sparrow (summer, fall, winter)
- ▶ Spotted towhee (spring)
- ▶ Yellow-rumped warbler (winter)

North Buffer Zone of Shellabarger Marsh



North Buffer Zone of Shellabarger Marsh (cont.)





Vegetation and Invertebrates of the North Buffer Zone of Shellabarger Marsh

Vegetation:

- ▶ Red alder dominant in the canopy (cover 81 to 95% during growing season)
- ▶ Himalayan blackberry dominant in the understory
- ▶ Purple loosestrife, bittersweet nightshade, and field bindweed (all invasive plants) dominant groundcover species

Invertebrates:

- ▶ Flies
- ▶ Springtails
- ▶ Beetles
- ▶ Spiders
- ▶ Snails
- ▶ Others

A Diversity of Flies

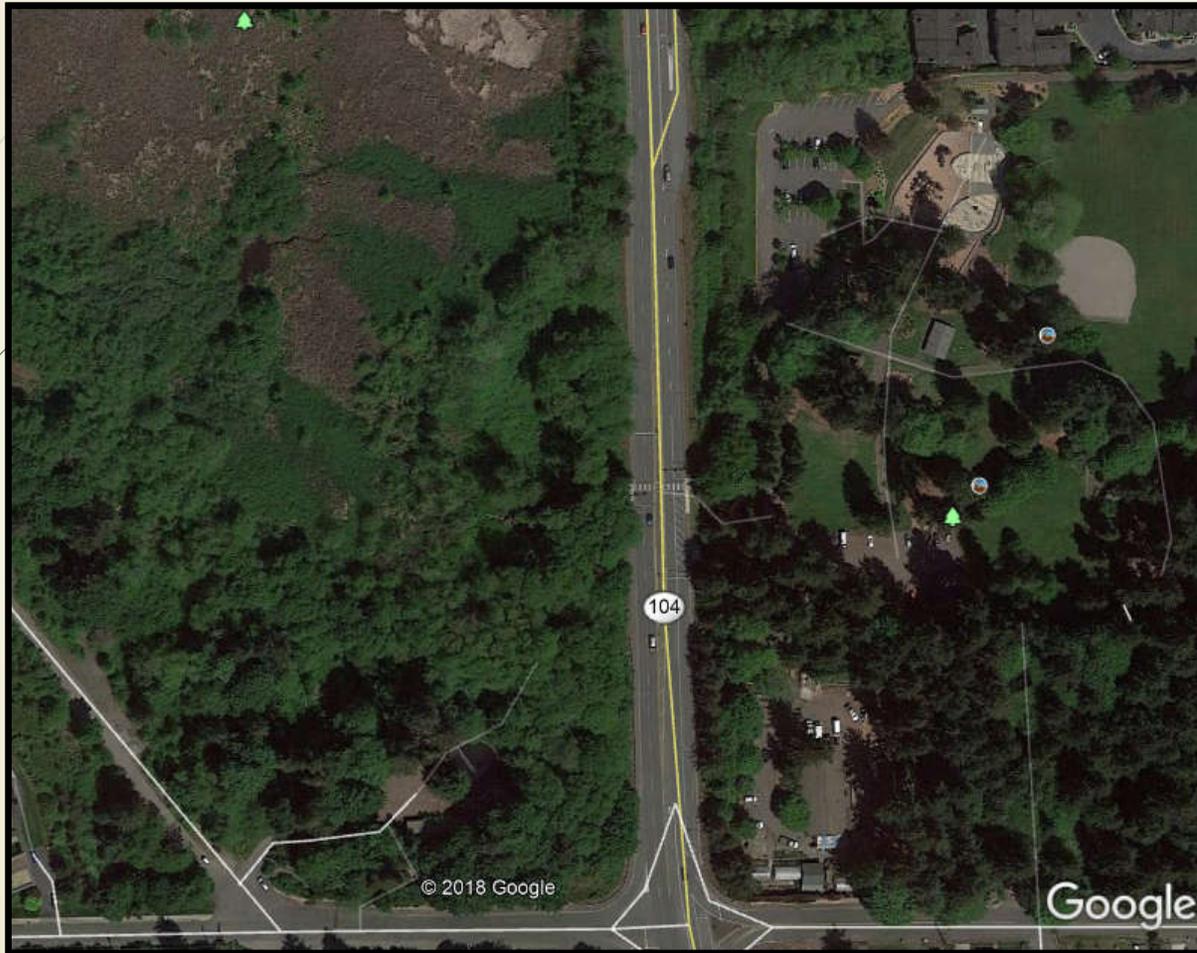




Birds of the North Buffer Zone of Shellabarger Marsh and Adjacent Marsh Area

- ▶ American crow (summer, winter, spring)
- ▶ American robin (winter, spring)
- ▶ Anna's hummingbird (summer, winter, spring)
- ▶ Bewick's wren (summer)
- ▶ Dark-eyed junco (winter)
- ▶ House finch (fall, spring)
- ▶ Marsh wren (summer, spring)
- ▶ Red-winged blackbird (summer, winter, spring)
- ▶ Song sparrow (fall, winter)
- ▶ Spotted towhee (winter, spring)
- ▶ White-crowned sparrow (winter, spring)
- ▶ Wilson's warbler (spring)

Southeast Buffer Zone



Southeast Buffer Zone (cont.)





Vegetation and Invertebrates of the Southeast Buffer Zone

Vegetation:

- ▶ Common hawthorn (canopy cover 80 to 95% during growing season)
- ▶ Himalayan blackberry dominant in the understory
- ▶ Himalayan blackberry and trailing blackberry dominant in groundcover stratum

Invertebrates:

- ▶ Spiders
- ▶ Springtails
- ▶ Flies
- ▶ Slugs
- ▶ Others

South Buffer Zone



South Buffer Zone (cont.)



South Buffer Zone (cont.)





Vegetation and Invertebrates of the South Buffer Zone

Vegetation:

- ▶ Red alder, bigleaf maple, Douglas fir, western red cedar, western hemlock in canopy (cover 77 to 94% during growing season)
- ▶ Salmonberry dominant in the understory, many other native shrub species present
- ▶ Skunk cabbage and youth-on-age predominant groundcover species

Invertebrates:

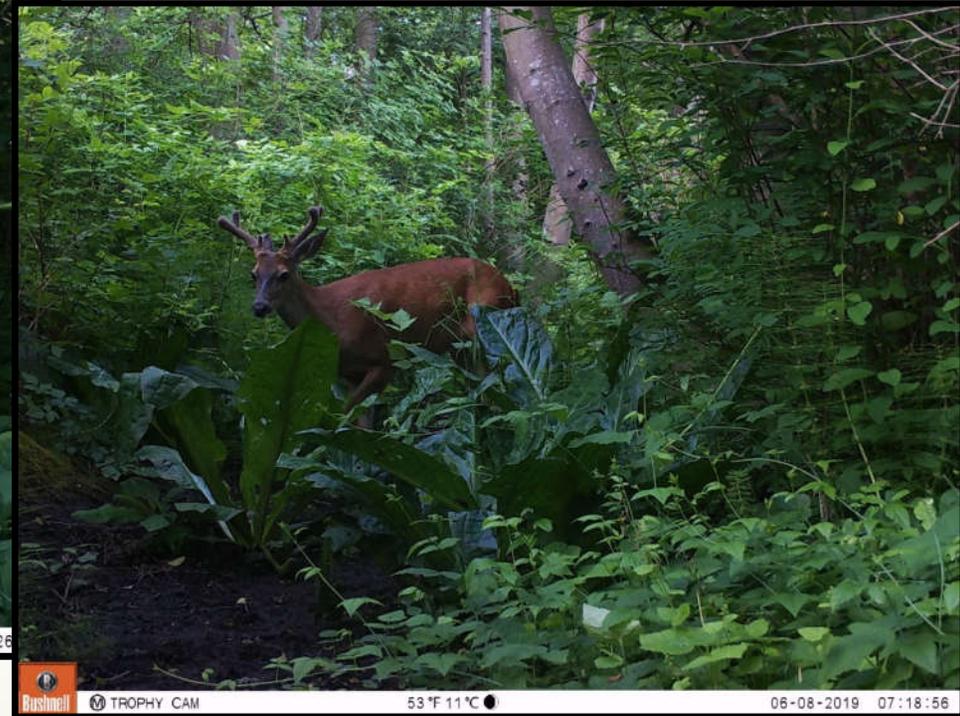
- ▶ Flies
- ▶ Spiders and harvestmen
- ▶ Stonefly
- ▶ Others



Birds of the South Buffer Zone

- ▶ American crow (summer, winter, spring)
- ▶ American robin (fall, winter)
- ▶ Bewick's wren (spring)
- ▶ Black-capped chickadee (summer, fall, winter)
- ▶ *Brown creeper (summer)*
- ▶ Downy woodpecker (spring)
- ▶ Golden-crowned kinglet (summer, winter)
- ▶ Northern flicker (fall)
- ▶ Pacific-slope flycatcher (summer)
- ▶ *Pileated woodpecker (spring)*
- ▶ *Red-tailed hawk (spring)*
- ▶ Song sparrow (all seasons)
- ▶ Spotted towhee (summer)
- ▶ *Swainson's thrush (spring)*
- ▶ *Varied thrush (winter)*

South Buffer Zone Wildlife Cameras



South Buffer Zone Wildlife Cameras

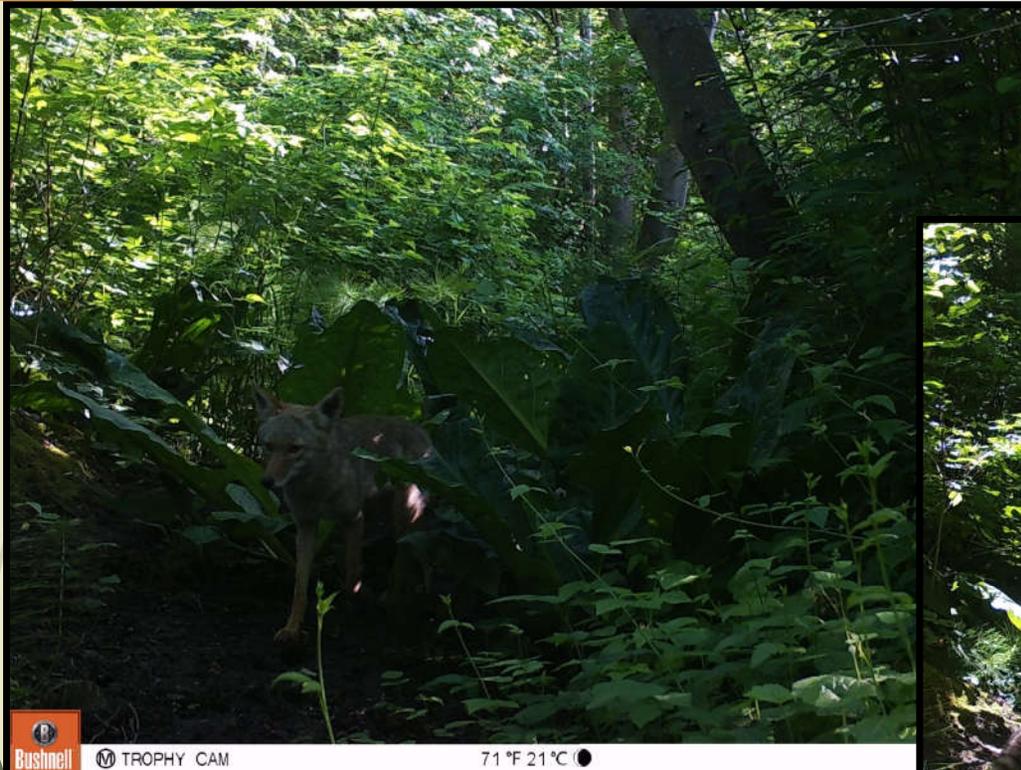
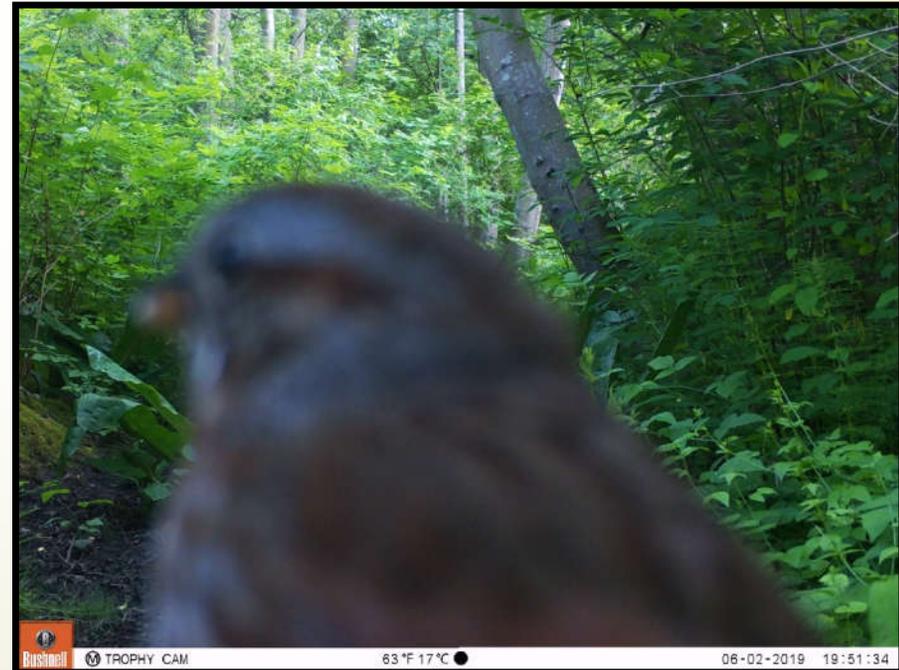
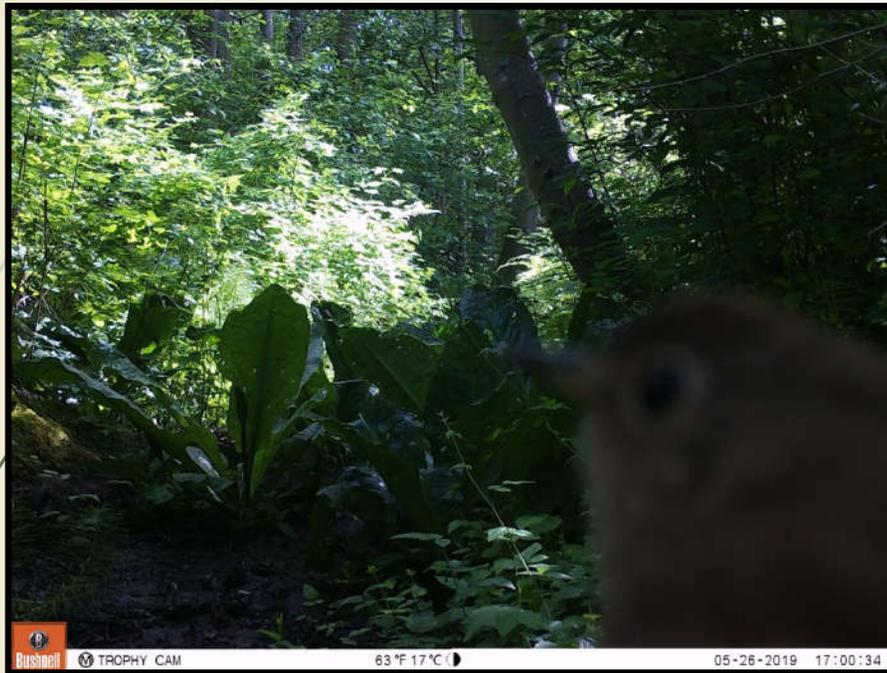


Photo-bombing Birds



The Marsh Interior





Vegetation of the Marsh Interior

Western Lobe of Main Marsh:

- ▶ Dominated by salt-tolerant vegetation
 - ▶ Saltgrass and Pacific silverweed
 - ▶ Hardstem and cosmopolitan bulrush
 - ▶ Lyngbye's sedge
 - ▶ Pickleweed and brass buttons
- ▶ Cattail
- ▶ Invasive species: common reed, bittersweet nightshade, reed canarygrass, Himalayan blackberry, Japanese knotweed, some purple loosestrife

Eastern Lobe of Main Marsh:

- ▶ Dominated by cattail
- ▶ Also "islands" of willow and alder
- ▶ Main invasive species: reed canarygrass, bittersweet nightshade, and Himalayan blackberry

View of the Eastern Marsh Interior



View of the Western Marsh Interior

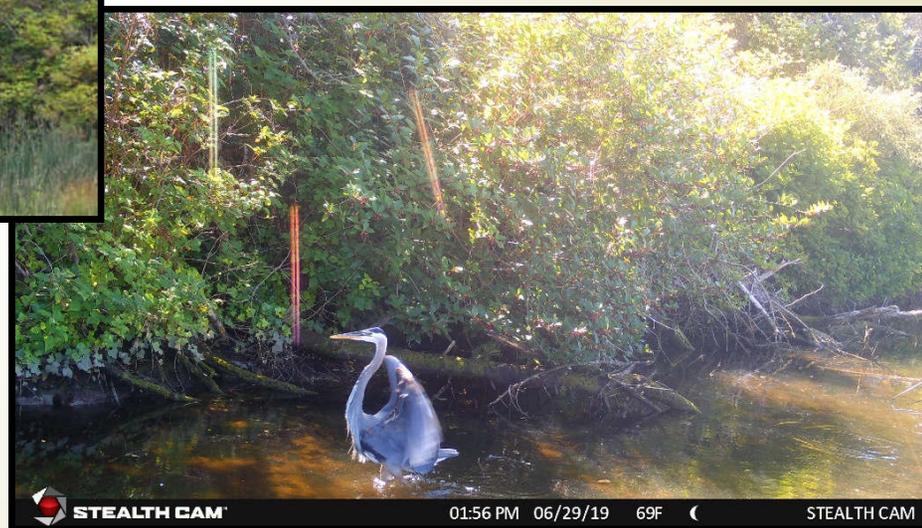




Diversity of Birds in the Marsh

- ▶ Raptors: bald eagles, red-tailed hawks, Cooper's hawk, northern harrier
- ▶ Canada geese, American wigeon, mallard ducks, gadwall ducks, other waterfowl
- ▶ Killdeer, spotted sandpiper, and other shorebirds
- ▶ Great blue heron during all seasons
- ▶ Swallows, sparrows, wrens, chickadees, nuthatches, kinglets, red-winged blackbirds, warblers, finches, crows, robins, and others
- ▶ Belted kingfisher near Unocal pond and Willow Creek

An Important Perching/Foraging Area in the Marsh



Birds of the Marsh – Foraging



Birds of the Marsh – Breeding



Birds of the Marsh – Breeding (cont.)



Predator-Prey Interactions





Summary of Literature Review (Task 2)

- ▶ Ecological functions of buffers:
 - ▶ Water quality improvements/microclimate maintenance
 - ▶ Inputs of large woody debris
 - ▶ Wildlife habitat
 - ▶ Protection from disturbance
- ▶ Recommended buffer widths vary by ecological function, as well as by many other factors.



Buffer Width Recommendations from Literature – Water Quality

- ▶ Buffers can best improve water quality when water flows slowly through a buffer zone in a non-channelized (i.e., spread out) flow path.
- ▶ **50 to 100 ft for shading to maintain natural water temperatures**
- ▶ 30 to 100 ft to remove majority of sediment load
- ▶ Wide variability in findings for nutrient removal (13 to 860 ft)
- ▶ 12.5 to 115 ft for fecal coliform reduction in most studies
- ▶ Approximately 50 ft for pesticide residue removal



Ability of Edmonds Marsh Buffers to Provide Cooling Shade

- ▶ South Buffer Zone was the only place where the water quality benefit of maintained cool water temperatures in the summer was observed; cooler temperatures were observed in both Willow Creek and the adjacent Marsh.
 - ▶ Water temperature readings collected within and adjacent to the North Buffer Zone (30 to 60 ft of canopy) were above WQC in the summer.
 - ▶ The highest summer water temperature reading was taken at the Marsh outlet basin, indicating that water is warming as it passes through the channelized portion of Willow Creek and the Marsh interior.
 - ▶ Wider bands of buffer vegetation around the channelized portion of Willow Creek and the Marsh, and possibly other features like large woody debris around mudflat perimeters, would provide more shade and help keep summer water temperatures cooler.
- 



Buffer Width Recommendations from Literature – Large Woody Debris

- ▶ Large woody debris can be defined as large pieces of dead wood present in a natural area (e.g., standing snags, pieces of a felled tree).
- ▶ Large woody debris provides:
 - ▶ Roosting, foraging, nesting, and denning habitat for birds and mammals
 - ▶ Habitat for invertebrates and plants
 - ▶ In-stream fish habitat and water temperature regulation (shading)
 - ▶ Organic matter inputs to soil and streams and other water bodies
- ▶ Large woody debris helps control erosion, trap sediment, and keep soils cool and moist.
- ▶ Buffer width recommendations for the provision of large woody debris typically ranged between 33 and 200 ft.



What do we see in Edmonds Marsh and its buffer zones?

- ▶ South Buffer Zone contained the most large woody debris, as well as lots of standing snags at the transition between forest and emergent marsh.
 - ▶ Shellabarger Marsh North Buffer Zone (~65 to 100 ft wide) contained the next greatest amount.
 - ▶ Fewer and smaller pieces of large woody debris were found in the North Buffer Zone (~25 to 50 ft wide where surveyed) and Southeast Buffer Zone (~60 to 115 ft wide where surveyed).
 - ▶ Few (3) pieces of large woody debris were identified in the western Marsh interior.
 - ▶ Large woody debris appears to be more prevalent in the southern portion of the eastern Marsh interior – contributions from surrounding forested buffer.
- 



Buffer Width Recommendations from Literature – Wildlife Habitat

- ▶ Recommendations for wildlife habitat vary depending on species, life cycle stage/season, and habitat component (e.g., nesting habitat vs. foraging habitat).
- ▶ Examples of buffer width recommendations for different animal groups:
 - ▶ 200 to 655 ft for birds
 - ▶ 230 to 590 ft for mammals
 - ▶ 240 to 950 ft for reptiles and amphibians
 - ▶ At least 100 ft for benthic invertebrates in streams



What do we see in Edmonds Marsh and its buffer zones?

- ▶ Birds:
 - ▶ Herons, shorebirds, raptors, and other species use the Marsh interior year-round.
 - ▶ Riparian trees and snags along the south side of the Marsh provide important perches and foraging habitat.
 - ▶ More forest-loving birds are in South Buffer Zone, particularly woodpeckers.
- ▶ Mammals:
 - ▶ Deer, coyote, rabbits, and raccoons are common in the South Buffer Zone.
 - ▶ Coyote common in the Marsh interior.
 - ▶ Deer rear young and possibly breed in the South Buffer Zone.



What do we see in Edmonds Marsh and its buffer zones? (Wildlife Habitat, cont.)

- ▶ Reptiles and amphibians: No formal surveys of these animals occurred, but an amphibian egg mass was observed in Shellabarger Creek, and garter snakes were observed in various buffer zones.
- ▶ Invertebrates:
 - ▶ Sample from Willow Creek within the Hatchery contained more than 500 individuals.
 - ▶ Sample from Shellabarger Creek (from an area east of SR-104 with little to no riparian vegetation) contained approximately 400 individuals.
 - ▶ Composition of the two samples was similar.
 - ▶ Summer 2018 fallout trap sample from the North Buffer Zone of Shellabarger Marsh was most diverse sample with the greatest number of specimens by far.



Summary of Buffer Width Recommendations from Literature – Reducing Disturbance

- ▶ Buffers help reduce disturbance/impacts from surrounding human uses.
- ▶ Buffers narrower than 50 ft have been found to be ineffective at protecting wetlands from disturbance, especially when adjacent land use intensity is high.
- ▶ Buffer width recommendations for reducing disturbance generally ranged from 100 to 164 ft.
- ▶ Greater widths (200 to 328 ft) were recommended to prevent flushing birds (great blue herons and waterfowl).



What about in Edmonds Marsh?

- ▶ Wildlife that uses the Marsh generally seems adapted to the surrounding human activities and noises (e.g., BNSF railroad tracks, ferry horn blasts, SR-104 traffic).
 - ▶ However, animals are distressed by people entering and traversing the Marsh.
 - ▶ Buffer vegetation enhancements should be done in such a way as to preserve wildlife viewing corridors to encourage people to stay on designated trails and lookout points.
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Evaluation of the Edmonds Marsh Estuary Restoration Project (Task 4)



Habitat Equivalency Analysis (HEA) Model

- ▶ Used to estimate the difference between habitat functions currently being provided and those that would be expected post-restoration
- ▶ Used to evaluate Alternative 6 in the *Draft Willow Creek Daylight Project, Expanded Marsh Concept Design and Hydraulic Modeling Report* (version dated March 11, 2019)





Model Inputs

- ▶ Baseline conditions and acreages of existing habitat types
- ▶ Estimated types and acreages of habitats that will be created/restored
- ▶ Pre- and post-restoration habitat value for each habitat type
- ▶ Start and completion dates of restoration activities
- ▶ Anticipated time it will take for the new/restored habitats to mature and become fully functional
- ▶ Anticipated lifespan of the restoration project
- ▶ A real discount rate (from the science of economics) to translate future value into present-day value: typically 3%



Habitat Type Change Estimates

- ▶ The HEA model delineated 13 different habitat polygons and described anticipated changes.
- ▶ Examples:
 - ▶ Freshwater, cattail-dominated portion of Marsh anticipated to change to salt marsh habitat post-restoration
 - ▶ Restored Willow Creek downstream from Marsh (3 polygons)
 - ▶ New tidal/stream channels to be excavated within freshwater portion of Marsh



Representative Species for Habitat Value Development

- ▶ For each habitat type change, used a unique assemblage of species based on those known to currently use the habitat type, or expected to use it post-restoration
- ▶ Included fish (e.g., juvenile Chinook salmon, chum salmon, three-spined stickleback), birds (e.g., great blue heron, killdeer, marsh wren), and mammals (deer and coyote)
- ▶ Examined general habitat requirements and diet/foraging information for each species to help develop existing and post-restoration habitat values



Temporal Inputs

- ▶ Used 2020 as the project start date
- ▶ Used a lifespan of 80 years (hydraulic modeling using assumptions about sea level conditions in the year 2100 has been conducted and shows Marsh habitats remaining intact)
- ▶ Maturation rates: used Lower Duwamish River and Commencement Bay HEA model maturation rates in many cases (e.g., 50% habitat function after 4 years for riparian vegetation, and 100% function after 8 years)

HEA Model Results

- ▶ Estimate that the project has the potential to increase the level of habitat function provided by the Marsh and creeks by approximately 60%.
- ▶ Project will also protect the current level of habitat functions being provided by these habitats.



Additional Information in Task 4 Report

- ▶ Recommendations for large woody debris installation in both the restored stream channel and Marsh interior
- ▶ Recommendations for riparian and flood berm plantings
- ▶ Recommendations for control of cattail and common reed
- ▶ Recommendations for post-restoration monitoring



Thank You! Questions?

