



Western Washington University  
**Western CEDAR**

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Salish Sea Ecosystem Conference

2018 Salish Sea Ecosystem Conference  
(Seattle, Wash.)

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Apr 5th, 4:45 PM - 5:00 PM

## **Blue carbon: Port of Seattle's kelp, eelgrass and shellfish enhancement pilot project**

Jon Sloan  
*Port of Seattle, United States*, [sloan.j@portseattle.org](mailto:sloan.j@portseattle.org)

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Sloan, Jon, "Blue carbon: Port of Seattle's kelp, eelgrass and shellfish enhancement pilot project" (2018). *Salish Sea Ecosystem Conference*. 426.  
<https://cedar.wwu.edu/ssec/2018ssec/allsessions/426>

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# Smith Cove Blue Carbon Pilot Project



# Blue Carbon?

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- ❖ Carbon captured by oceans and coastal ecosystems
- ❖ Stored in biomass and sediments
- ❖ Marsh, seagrass and algae





# Why build habitat projects?

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- Stewardship
- Compensatory mitigation
- Revenue
- Climate Adaptation/Resilience
  - Carbon sequestration
  - Ocean acidification (OA) refugia
  - Shoreline stabilization



# PORTfolio

- Nineteen habitat restoration & public shoreline access sites
- Over 100 acres
- One-third already restored
- Mostly estuarine and marine



Terminal 108



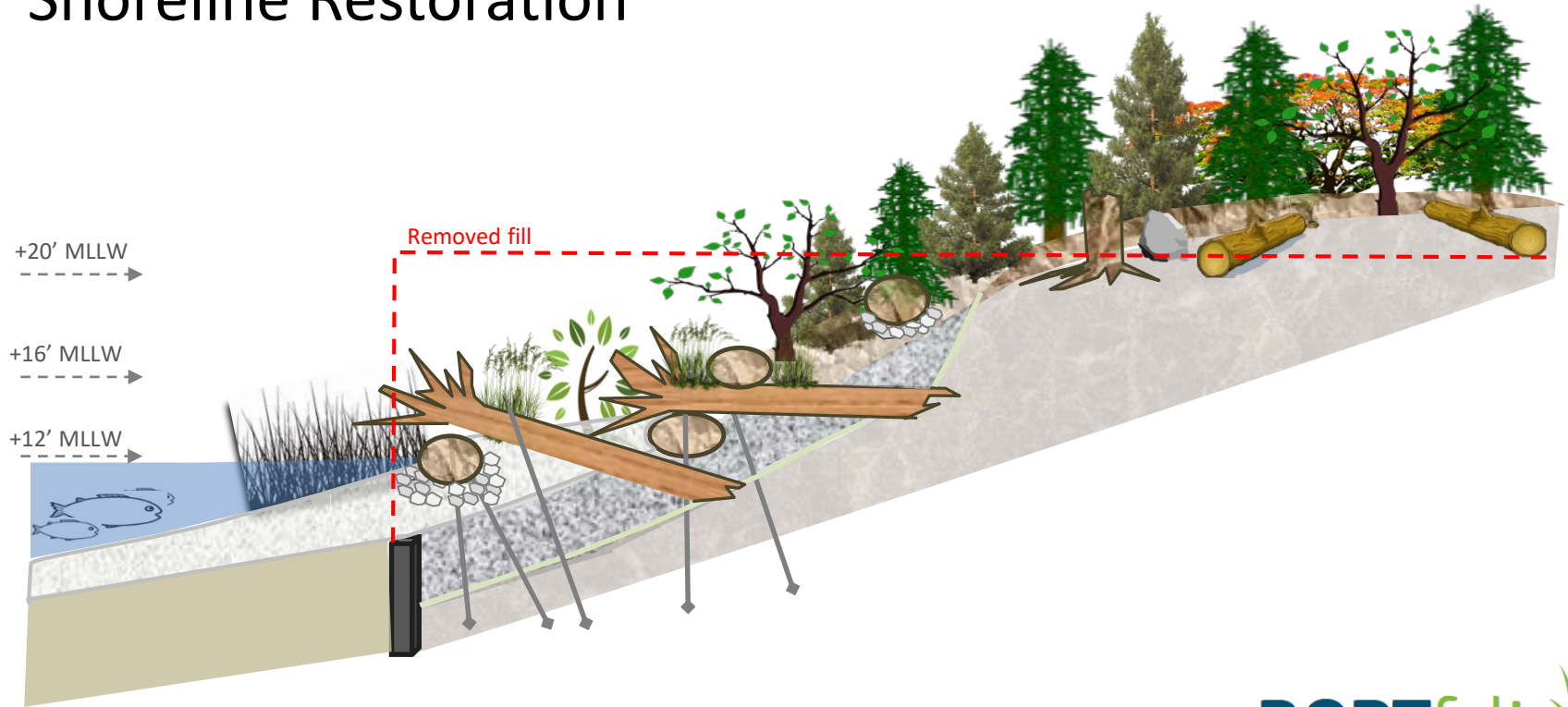
Terminal 105



Turning Basin 3



# Typical Port of Seattle Shoreline Restoration



SHALLOW SUBTIDAL HABITAT

INTERTIDAL HABITAT

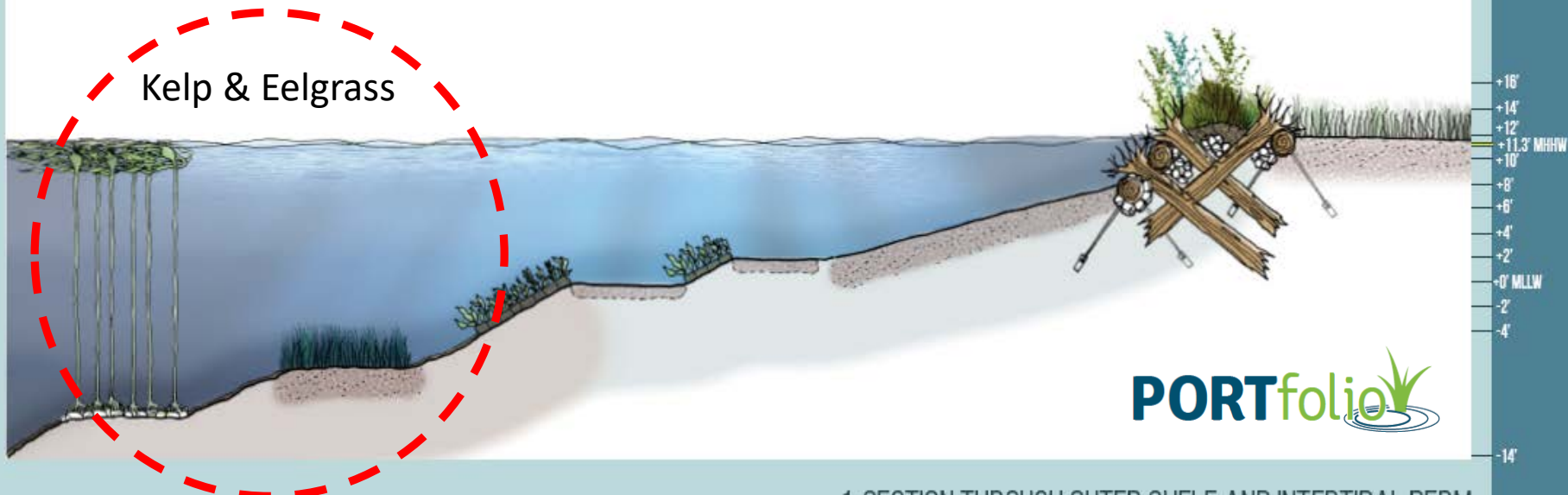
INTERTIDAL BERM

HIGH MARSH HABITAT

LOWER DUWAMISH  
RIVER CHANNEL

OFF-CHANNEL HABITAT AREA

Kelp & Eelgrass



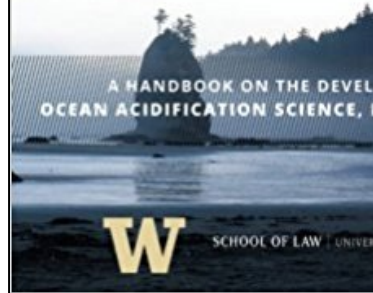
**PORTfolio** 

1. SECTION THROUGH OUTER SHELF AND INTERTIDAL BERM



WASHINGTON JOURNAL OF  
ENVIRONMENTAL LAW & POLICY

# OCEAN ACIDIFICATION: UNDERSTANDING THE OTHER CLIMATE CRISIS



W

SCHOOL OF LAW | UNIVERSITY OF WASHINGTON



# EMERGING UNDERSTANDING OF **SEAGRASS AND KELP** AS AN OCEAN ACIDIFICATION MANAGEMENT TOOL IN CALIFORNIA

Developed by a Working Group of the Ocean Protection Council Science Advisory Team  
and California Ocean Science Trust

### AUTHORS

Nielsen, K., Stachowicz, J., Carter, H., Boyer, K., Bracken, M., Chan, F., Chavez, F.,  
Coffey, K., Ruesink, J., Tyburczy, J., and Wheeler, S.

## Can Kelp Save The Pacific Ocean?



CREDIT: AP PHOTO/MANUEL VALDES



# Carbon sequestration

## Habitat Categories:

- Unvegetated Uplands
- Upland greenbelt
- Riparian
- Emergent marsh
- Mudflat
- Intertidal
- Shallow subtidal
- Deep subtidal



## PORTfolio Carbon Sequestration Assessment

Attorney-Client Privileged Work Product

Prepared on behalf of:



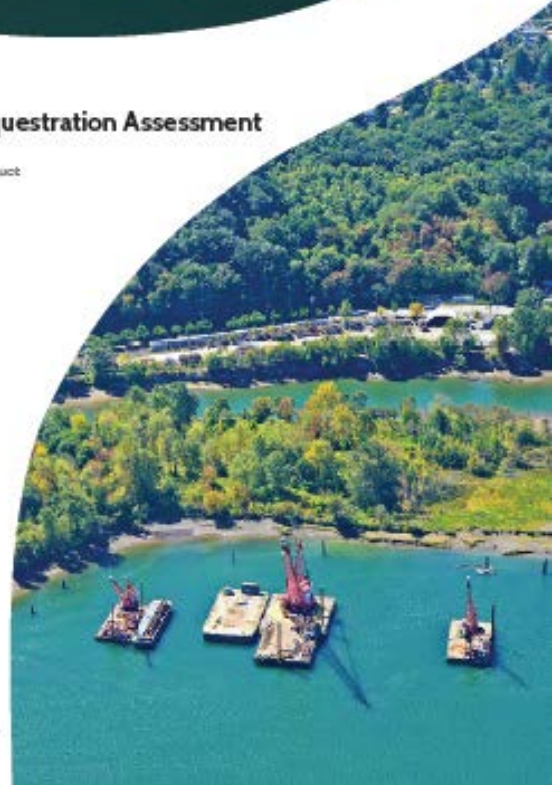
2711 Alaskan Way  
Seattle, WA 98121

Prepared by:

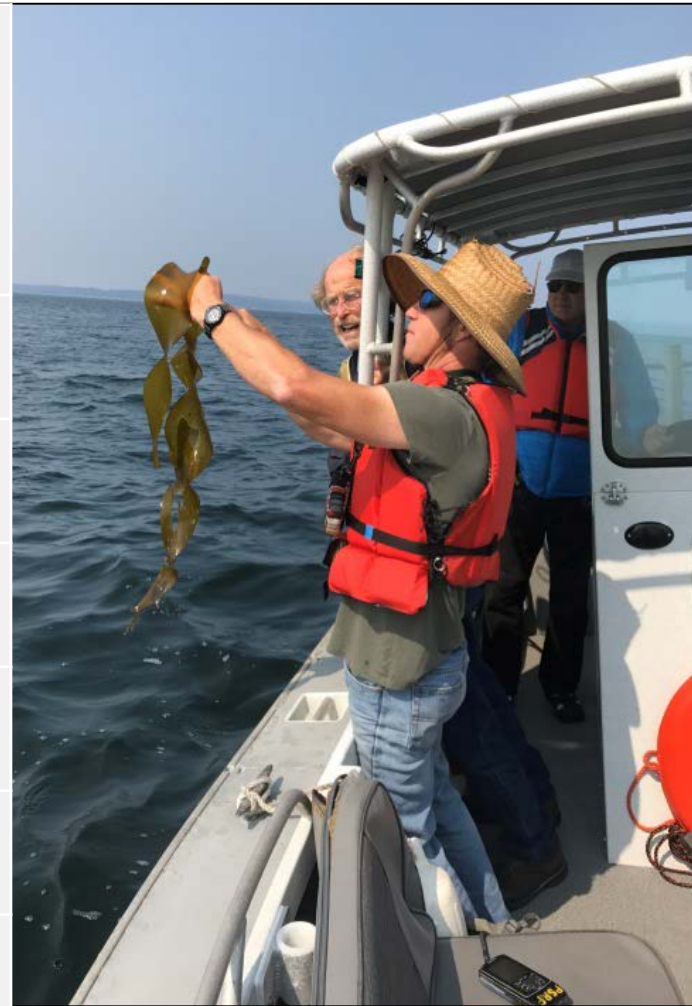


750 Sixth Street South  
Kirkland, WA 98033  
425.822.5242  
watershedco.com

Photo Credit: Washington State Department of Ecology



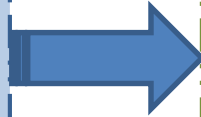
<b>Habitat Type</b>	<b>Carbon (tC/ac/yr)</b>
Riparian	1.08
Intertidal marsh	0.98
Intertidal mudflat	0.19
Shallow subtidal (eelgrass)	0.28
Deep subtidal (kelp)	0.36



# Smith Cove Pilot Project

## Install “blue carbon”:

- Riparian (2 acres)
- Marsh (1 acre)
- Shellfish (2 acres)
- Eelgrass (12 acres)
- Bull kelp (8 acres)
- Mussel collectors (100)



## Evaluate changes:

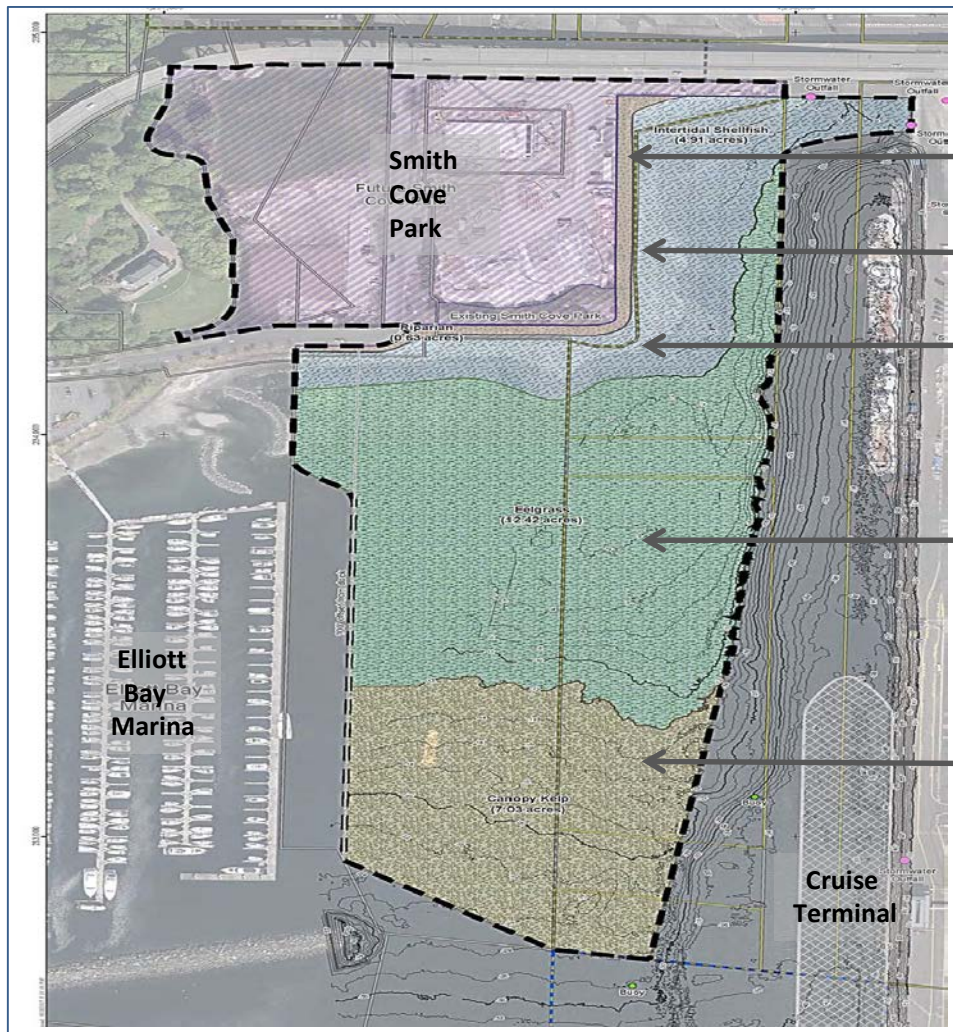
- Water chemistry (pH)
- Biomass
- Habitat functions



**SCALE IT UP!**



Smith Cove



Riparian vegetation (> +12' MLLW)

Olympia oysters (+1' to -5' MLLW)

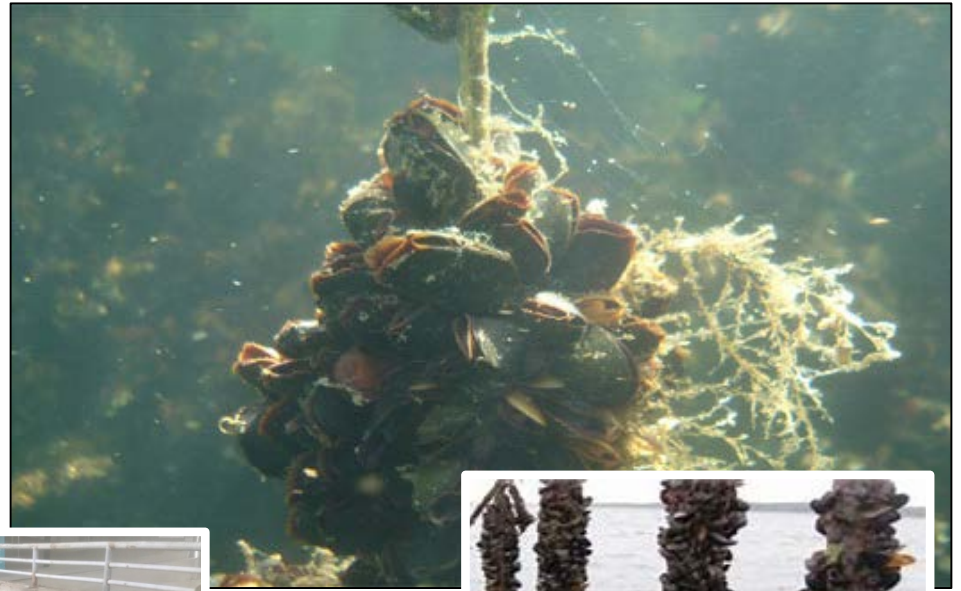
Emergent marsh (+12' to +8' MLLW)

Eelgrass (-1' to -12' MLLW)

Bull kelp (-12' to -24' MLLW)



# Under-Pier Collectors



Photos: Pacific Shellfish Institute

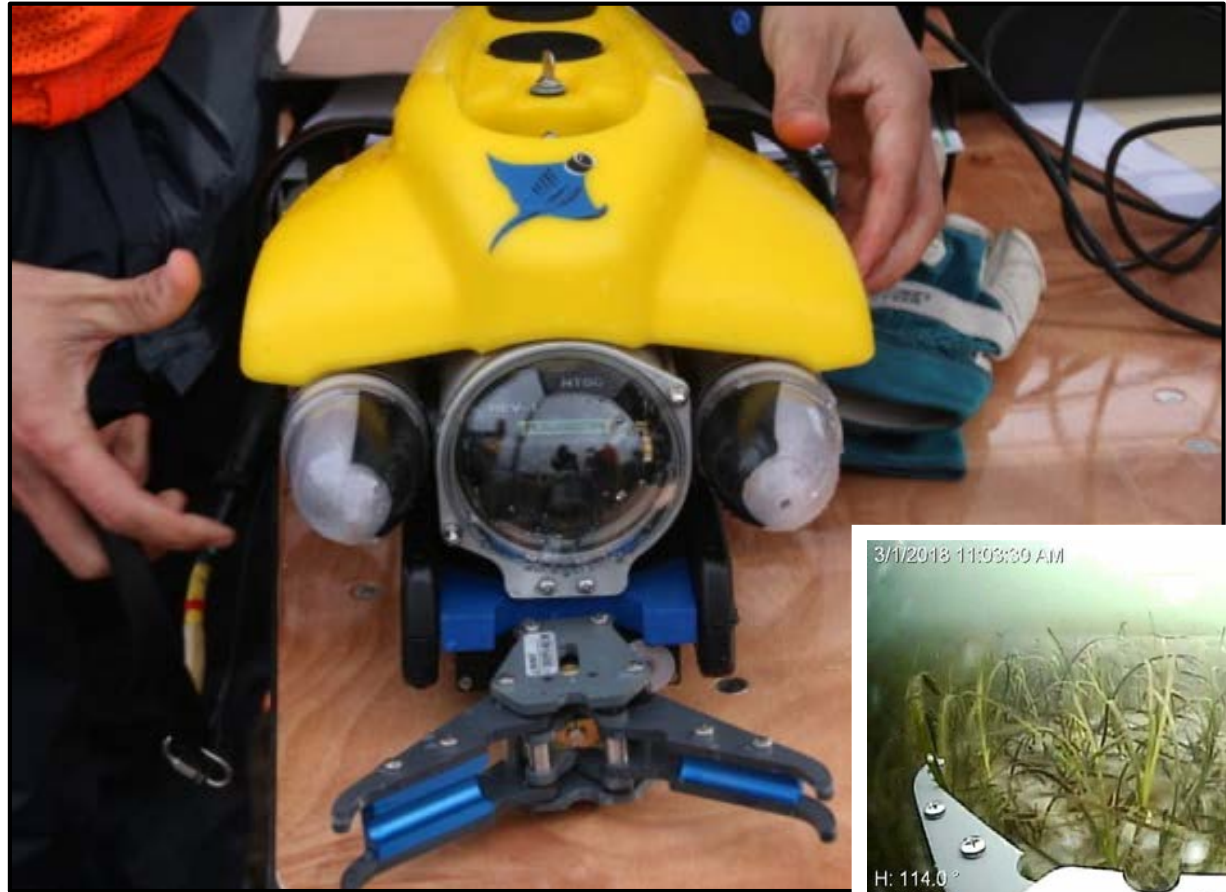
# Estimated Costs

	Plots	Size	Cost
Baseline survey	NA	Sitewide	\$35,000
Eelgrass transplant	15	20'x20'	\$100,000
Kelp substrate/seeding	15	variable	\$100,000
Olympia oyster beds	10	10'x20'	\$115,000
Mussel collectors	NA	NA	\$75,000
Long-term study	NA	NA	\$150,000
<b>Gear</b>	<b>NA</b>	<b>NA</b>	<b>\$175,000</b>
		Total	<b>\$750,000</b>

# Ringo

## VideoRay Pro4+

- Rotating arm
- BlueView Sonar
- LynnVision Filter
- 720p int. camera
- 4K GoPro
- GPS tether
- LED lighting
- Sediment sampler
- Multi-parameter water quality probe



3/1/2018 11:03:30 AM



H: 114.0°  
D: 8.00 ft  
Temp: 54.8 °F

# Maverick

DJI Mavic Pro

- Full HD 1080p camera
- 4.3 mile range
- 25 min. flight time



# SGT. Pepper

## Upgrades:

- Garmin GPS
- Garmin Depth Sounder
- Sidescan sonar
- Worktable for ROV
- 1000w Inverter
- ROV tether rollers
- Side work lights
- Paint and logos



# Milestones 2018

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- Kelp test plots (Jan-Apr)
- Baseline survey (May)
- Eelgrass test plots (June)
- Shellfish test plots (July)
- Kelp substrate install (Dec)



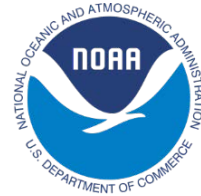
# Milestones 2019-2023

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- Select preferred methods
- Install kelp, eelgrass, shellfish
- Restore 1,100' of shoreline
- Interpretive signage
- Monitoring, maintenance, long term study w/ UW



# Acknowledgements:



Port Interns:  
**Victoria Knorr**  
**Tori Niewohner**