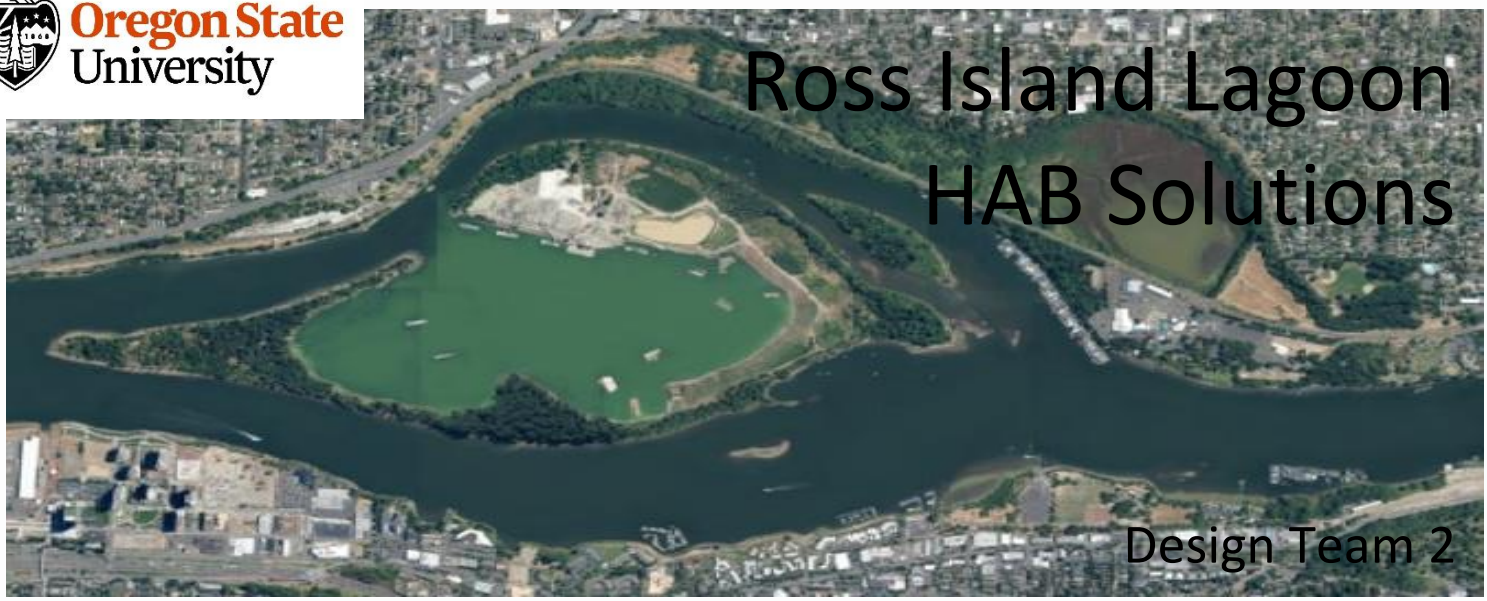
Oregon State University



Ross Island Lagoon HAB Solutions

Design Team 2

THE OBJECTIVE OF THIS ANALYSIS IS TO IDENTIFY PRACTICABLE SOLUTIONS TO REDUCE THE FREQUENCY & DURATION OF HABS AT ROSS ISLAND LAGOON.

Design team [2]

Contact:

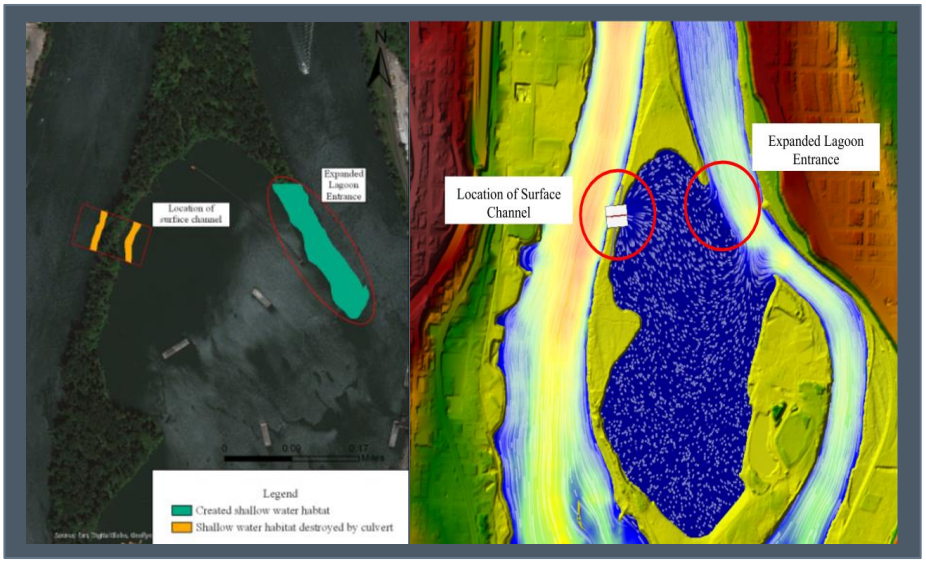
desiree.tullos@oregonstate.edu

Alternatives analyzed

1. **Hydraulic solution consisting of expanding the lagoon entrance and adding a surface channel to the northeast side of the island to increase flow and circulation.**
2. **Microbial solution using an alum coagulant to flocculate and settle the cyanobacteria.**
3. **No action**

KEY FINDINGS AND RECOMMENDATIONS

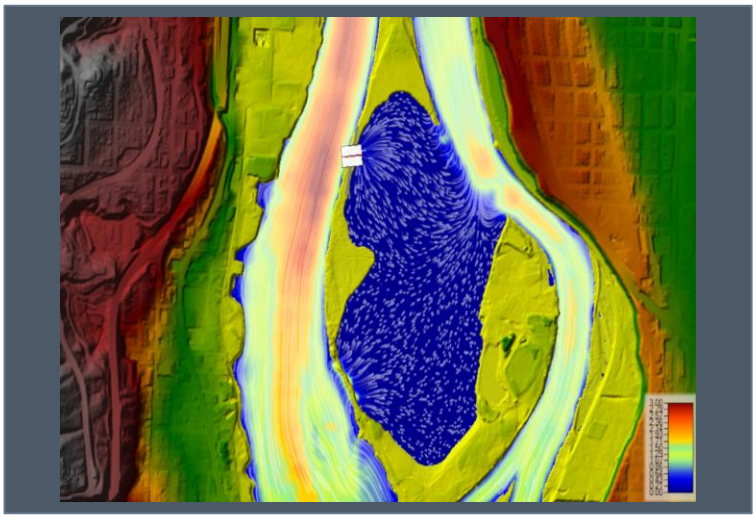
The hydraulic solution is not predicted to achieve sufficient mixing to control the HABS during the critical summer periods. This solution only resulted in a max velocity of 0.05 ft/s and a depth of complete mixing of 0.019 ft (0.22 in). However, these modifications did however reduce the Richardson number from 1069 to 42.8. This alternative has an estimated capital cost of $3,430,549.28 and an operation and maintenance cost of $116,418.50 per year. The PFMA for this alternative resulted in a value of 50. The microbial alternative has the risk of damaging aquatic species and has a large amount of uncertainty when choosing the proper dosing and mixing. This alternative has a capitol cost of $72,581.00 and an operation and maintenance cost of $72,581.00 per year. This alternative also had a score of 50 resulting from the PFMA. It was determined that neither of the proposed solutions are projected to control the HABs. The recommendation from this study is to investigate alternative hydraulic solutions that will be more successful in increasing flow through the lagoon.



For more information, see: http://blogs.oregonstate.edu/rivers/ross-island-harmful-algal-bloom/

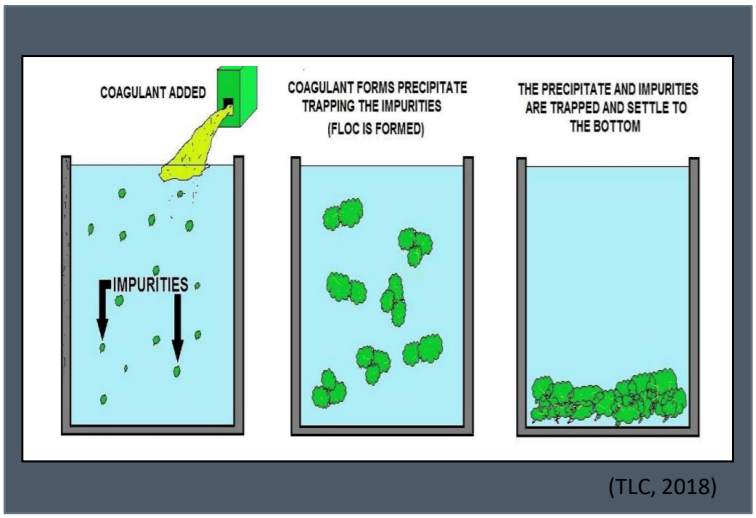
ALTERNATIVE 1

The hydraulic solution includes excavating a surface channel in the NW portion of the lagoon (cut: 4 x 10^6 ft^3) and expansion of the entrance (cut: 2.45 x 10^6 ft^3). These changes are intended to increase flow velocities to facilitate mixing and break up temperature stratification to impede algal blooms. These changes in terrain were modeled in GIS and implemented in HEC-RAS to model velocities. This model showed mixing depth of 0.09 ft, 1.02 ft, and 0.019 ft for March (0.11 ft/s), April (0.37 ft/s), and August (0.05 ft/s) velocities respectively.



ALTERNATIVE 2

The microbial solution proposed is adding alum as a coagulant to control the HAB through flocculating cells and letting them settle and bind to sediment (Herman, 2017). This requires adequate mixing and application to be successful. Ideal application can be difficult to determine so the uncertainty and likelihood of failure is moderate. This alternative can have a negative affect on aquatic species due to decreased dissolved oxygen if dosed inappropriately. Birds and waterfowl would benefit from increase in access to the water surface due to the absence of HABS.



(TLC, 2018)

ALTERNATIVES ANALYSIS RESULTS

Evaluation criteria	1. Hydraulic	2. Alum	3. No action
Capital cost ($)	3,430,549.28	72,581.00	0
O&M ($, frequency)	116,418.50	72,581.00	0
Loss and creation of shallow water habitats (acres)?	+4.02 (-0.73)	+0 (-0)	NA
Expected effectiveness at controlling HAB (unknown, low, med, high)?	moderate	moderate	None/low
Likelihood of failure during flood events (unknown, low, med, high)	low	moderate	high
Risk to CAD cells (USACE likelihood scale)	moderate	none	none
Likely benefit to widest range of aquatic taxa (Steelhead, chinook, lamprey, sturgeon, mussels)	Salmon, bird and waterfowl, and aquatic organisms	Birds and waterfowl	cyanobacteria
List any unintended impacts (List species, infrastructure, RISG operations, etc.)	Erosion	Impact on aquatic organisms through chemical reactions	Lower dissolved oxygen killing aquatic life

References: Herman, Brook, et al. Review and Evaluation of Reservoir Management Strategies for Harmful Algal Blooms. Environmental Laboratory (U.S.), 28 July 2017. Crossref, doi:10.21079/11681/22773.
TLC. "Flocculation Coagulation." Technical Learning College, TLC, 1 June 2018, www.abctlc.com/downloads/courses/Flocculation.pdf.