HAB @ Ross Island Lagoon

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Existing conditions

- Embankment at upstream/south end creates stagnant water that establishes stratification
- Listed as impaired for nuisance algae

Data source: Kurt Carpenter
Existing conditions

- Summer HABs that move into mainstem with tide
- Many engaged stakeholders
- No single responsible party
Existing conditions

Added complexities: CAD cells, reclamation plan
Alternatives analysis by OSU students

Woods Hole Oceanographic Institute

Lgsonic.com
Recommendation 1

A short term solution is feasible and needed. Some are well established.

Most promising option: Mechanical mixing

- **Approximate cost:** $200,000 capital + $80,000 annually
- **Effectiveness uncertainty:** Careful design is needed
- **Regulatory uncertainty:** none?
- **Adverse environmental impacts:** minimal
Recommendation 1

A short term solution is feasible and needed. Some are experimental.

Range of experimental options: nanobubblers, barley straw floats, floating ultrasonic instruments, etc.

• Approximate cost: varies significantly
• Uncertainty in effectiveness: high
• Regulatory uncertainty: high
• Adverse environmental impacts: varies from probably none to unknown
Recommendation 1

A short term solution is feasible and needed. Some may have environmental impacts.

Non-feasible option: Alum

- **Approximate cost:** ~$80,000
- **Effectiveness uncertainty:** More data is needed on internal recycling of P
- **Regulatory uncertainty:** Aluminum will be a regulated water quality parameter in OR
- **Adverse environmental impacts:** expected
Recommendation 1

A short-term solution is needed. Aeration mixing is probably the most feasible. It needs to be implemented carefully.
Recommendation 1

Increased nutrient concentration

Decreased light dose phytoplankton

Increased suspended matter

Decreased stability of water column

Improved conditions for fish & zooplankton

Mixing

Cyanobacteria

Diatoms and green algae

Visser et al. (2016)
Recommendation 1

Mixing treatment mechanisms

• Decreased stability of euphotic zone
  • modifies competitive balance between buoyant cyanobacteria and sinking phytoplankton – competition for light
  • But to what depth? Epilimnion: ~12m; PAR: ~ 5m

• Nutrients
  • Oxidizes hypolimnion to reduce mobilization of P
  • But... can increase N and P availability by suspending sediments

  • Is mixing enough? Or do we also need management of N:P ratio?
    • Models (e.g. Klausmeier et al. 2001, Huisman et al. 2004) and field experiments should help understand this problem better
Recommendation 2

A long-term solution is feasible and needed, but more complicated.

The HAB is fundamentally a hydraulics problem.

The long-term solution ultimately addresses the hydraulics.

Viney et al. 2007
Recommendation 2

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Recommendation 2

A long-term solution is feasible and needed, but more complicated.

Why it is complicated
• The lagoon is BIG (~9600 ac-ft).
• Mixing likely requires both river flows and tidal pumping
• Uncertainty around mixing depths needed
• Over-constrained
Recommendation 3

Further data and modeling are needed.

• Short term: Better understanding of contributing factors and solution feasibility.
  • Depth of euphotic zone in spring and summer
  • Basic data on soil pH and P in soils.
  • N and P concentrations in fill materials (as recommended by ODEQ in 2001)

• Long-term: Better understanding of hydraulics.
  • 3D modeling needed for detailed design of hydraulic solution
Recommendation 4

Leadership and coordination are needed.

• Agencies have data and authority that aren’t being utilized to address this issue.

• Focus group of experts should prioritize activities in the lagoon
  • hydraulics and modeling of rivers, microbiology of cyanobacteria, water quality, aquatic habitat for T&E+ species, regulatory authority and flexibility, and facilitation

• Oregon Solutions process underway.
Recommendation 4

Key considerations for this dynamic system

• Avoid solutions that fix short-term problems but create longer term and potentially irreversible problems

• Ask hard questions:
  • Is the Reclamation Plan still the right vision?
  • Does the nexus with Portland Harbor inhibit long-term solutions at RIL?
Conclusions

Like nearly all HABs...

• A short-term solution is needed.
• A long-term solution is needed.
• More information is needed.
• Leadership & coordination are needed.

But all of these are feasible with the right team and resources.
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