Phosphorus Mitigation with EutroSORB G & EutroSORB SI

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A Division of SePRO Corporation

EutroPHIX division assembled 2020

SePRO - 31 Years of Environmental Stewardship and Water Resource Management

- Founded in 1994
- US based company
  - Headquartered in Carmel, IN
  - R&D in Whitakers, NC
  - Employees nationwide
- Water & Sediment Diagnostics Lab

SRTC SePRO Research & Technology Campus

EutroPHIX - A TECHNICAL RESOURCE team focused on water quality restoration and harmful algal bloom management

- Technical Support
- Water Quality Assessment
- Program Development
- Project Implementation
- Permitting and Monitoring
- Outreach and Education

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P Mitigation to Restore Lakes

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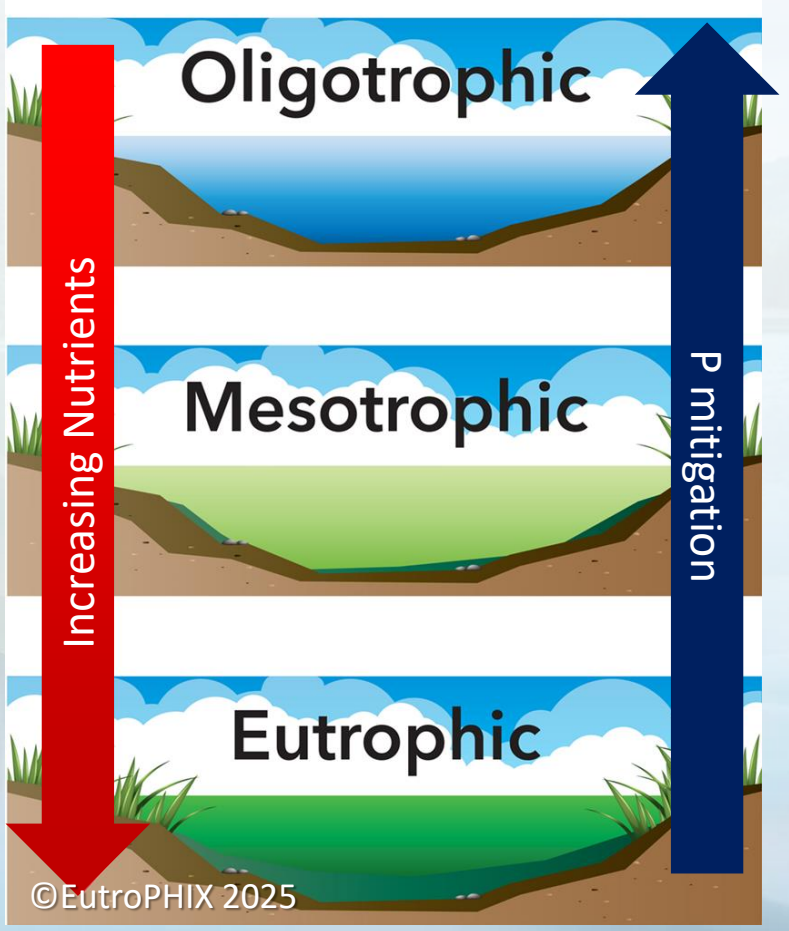
Presentation Agenda

- Phosphorus and Lanthanum
- EutroSORB G & EutroSORB SI
- Cost considerations
- Case Studies
- Lawrence Lake Specific Recommendations

Phosphorus (P) has strong impact on water quality and productivity



- P often limiting/co-limiting in freshwater systems
- Increased trophic state and productivity
- Cyanobacteria can dominate when phosphorus is more available
- Mitigating P improves water quality

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Lanthanum is an Efficient + Effective P binder

- Permanently binds phosphorus into mineral form
- Efficient 1:1 ratio
- Binding over wide pH range of 4-10, oxic/anoxic conditions
- Does not change water pH, alkalinity, Dissolved oxygen, etc.
- *Won't release P once bound in aquatic environments*

$La^{3+} + PO_4^{3-}$

$LaPO_4 * nH_2O$

Rhabdophane

$LaPO_4$

Monazite

Sources: Recht and Ghassemi 1970; Copetti et al. 2016; Mucci et al. 2018; Zhi et al. 2020; Kang et al. 2022)

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	EutroSORB® G	EutroSORB® SI
Formulation	Lanthanum modified bentonite (dry)	Iron-coated lanthanum Liquid - New 2024 Dry – *coming soon*
Approval in WA	Yes, general APAM permit	2026 general APAM permit (pending)
Targeted use	Sediments & some water column binding	Sediments only, Inert in water column
Lanthanum Content	10% La	20% La (liquid) 50% La (dry)
Dosing Ratio	50 lbs. per 1lb.P	2.5 gals. per 1lb.P (liquid) 10 lbs. per 1lb.P (dry)
Binding Ratio	1:1 La:P molar binding ratio	

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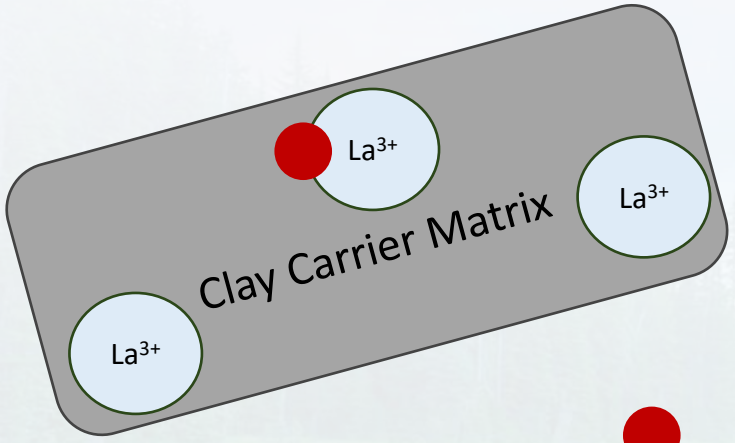
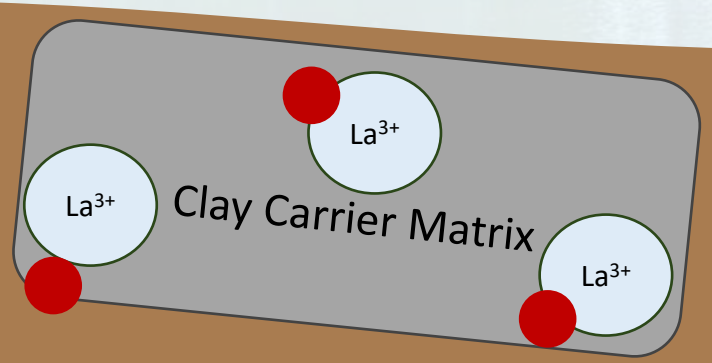
EutroSORB G



Water Column

- Matrix prevents La^{3+} release
- only phosphate binding, not TP
- No impacts to pH, DO, alkalinity

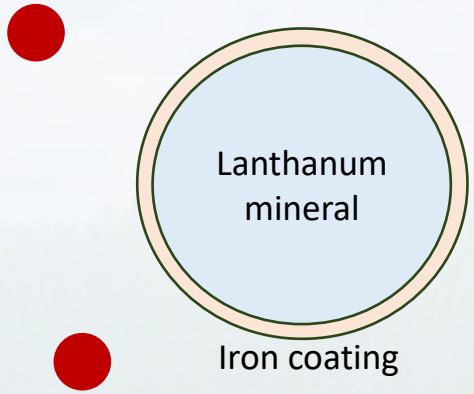
= Phosphate



Sediments

- Integrates into upper sediments
- La binds P
- Enhances sediment stability

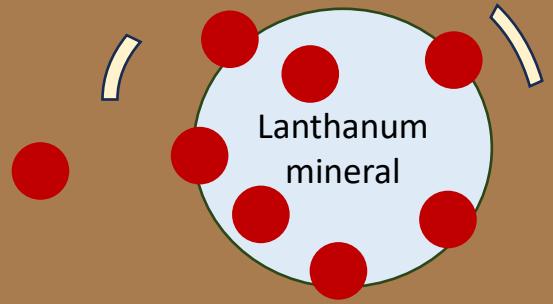
EutroSORB SI



Water Column

- Iron-coating protects La
- Inert in water column
- No phosphate binding
- No impacts to pH, DO, alkalinity

= Phosphate



Sediments

- Integrates into upper sediments
- Iron-coating releases in anoxic conditions
- La minerals active for P binding

Simplified diagram for EutroSORB G and EutroSORB SI

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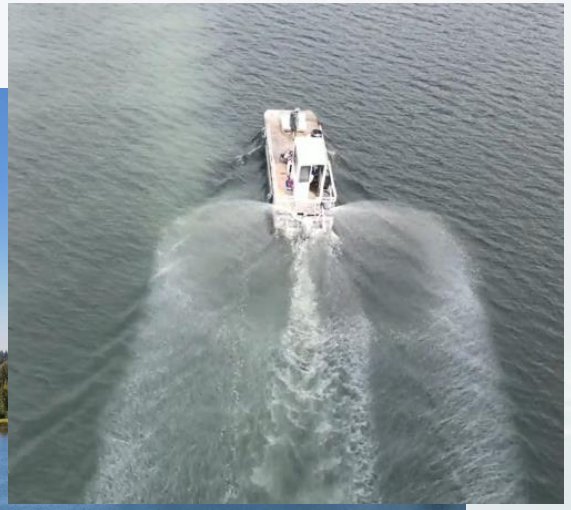
EutroSORB G/SI Applications



After application rapidly settles to the lake bottom

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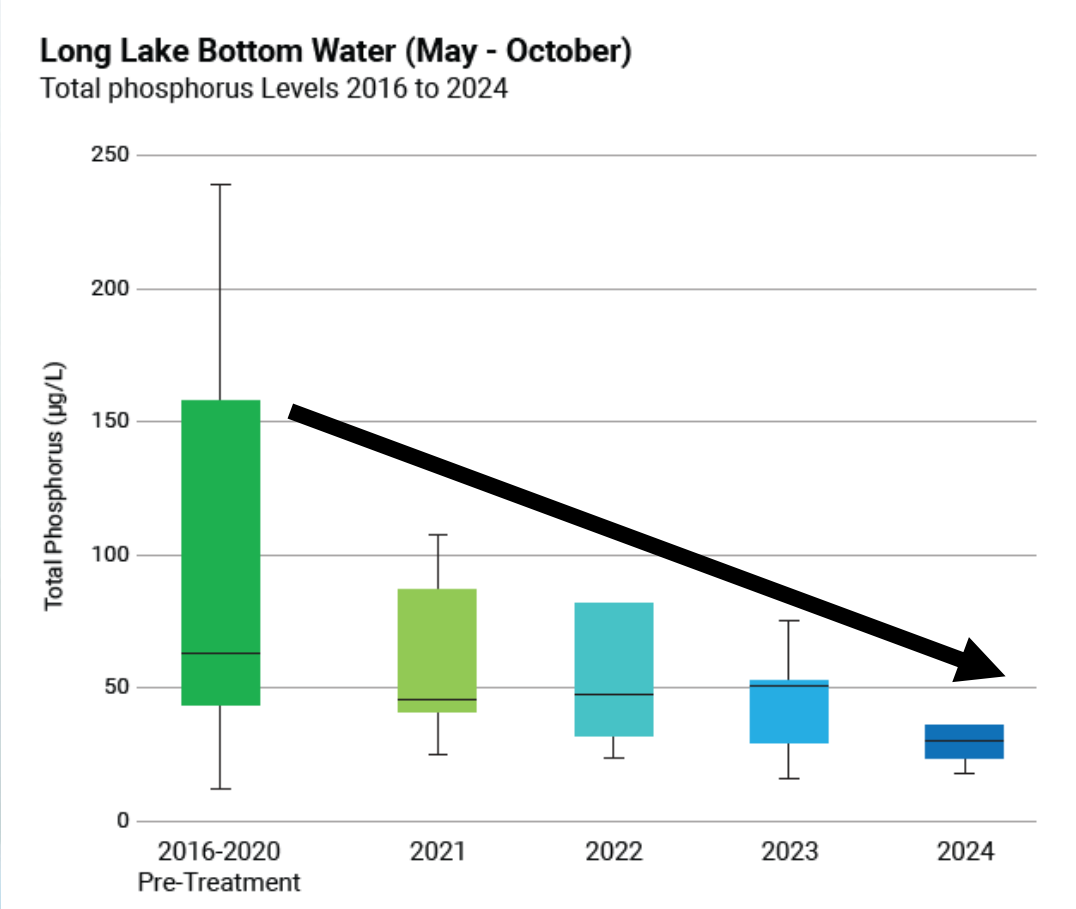
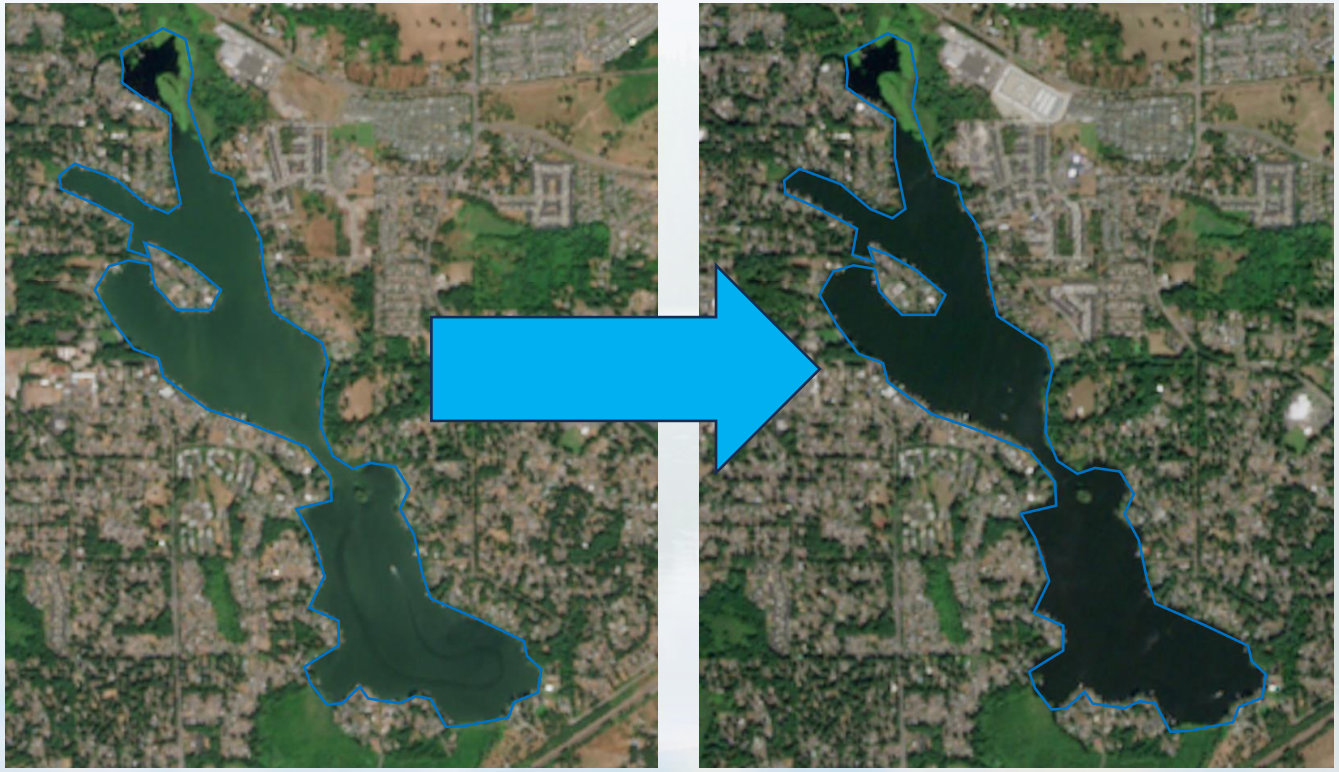
EutroSORB G & SI – Binds sediment P release, lowers lake phosphorus levels, water quality improves





Before

After

Source: EutroPHIX Case Studies 2025

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Outcomes of EutroSORB Applications

Sediments

- Intercepts the release of P from sediments into the lake
- Permanently binds Mobile P
- Reduces amount of Mobile P, thereby improving sediments

Lake

- Lower phosphorus levels
- Water clarity increases
- Better N:P nutrient ratios to support beneficial algae + food web
- Improved water quality = reduced HABS/cyanobacteria

Proven Performance of La

- Hundreds of waterbodies worldwide
- La chemistry well researched (>100 peer-reviewed publications)
- Peer-reviewed Meta-analyses of treatment outcomes

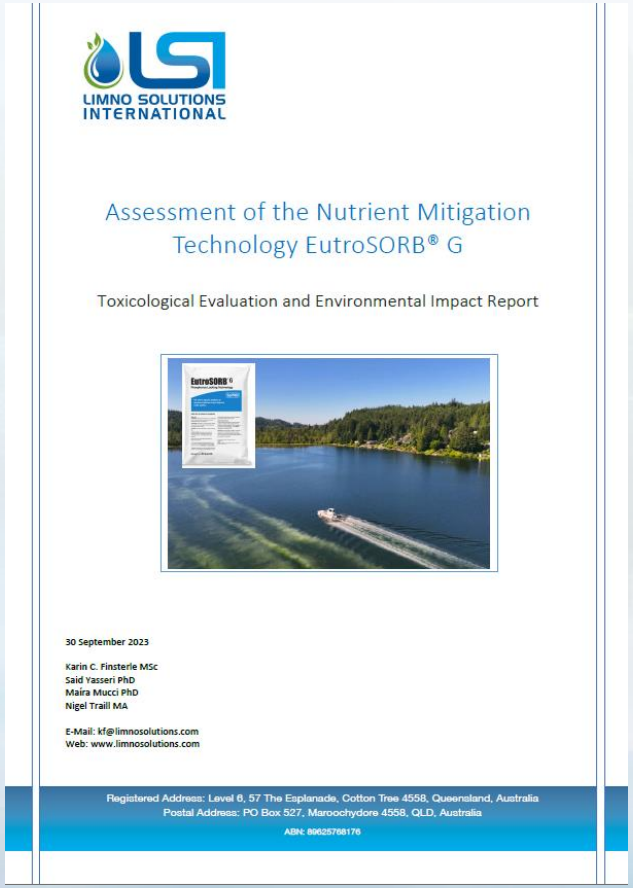
(Spears et al. 2013; Spears et al. 2015; Dithmer et al. 2016a;Dithmer et al. 2016b)

- Many lanthanum modified bentonite case studies
- Iron-coated lanthanum case studies limited at this time, but will rapidly increase

Environmental Safety Evaluations

Supportive of no risks with properly planned applications for humans, mammals, birds, and aquatic organisms

- Dosing - Water chemistry
- Bioavailability
- Ecotox tests on Aquatic Organisms
  - Lethal doses
  - No-observable Effects
- Risk Quotients Calculations



Finsterle et al. 2023; Finsterle 2025

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Treatment Monitoring

2026 Permit Requirements

Pre-treatment samples

- pH, hardness, alkalinity, DOC
- Total & Filterable Lanthanum

- Post-treatment up to 3-12 months
  - Total & Filterable Lanthanum

No expected toxicity impacts to aquatic organisms due to limited bioavailability of La when present

(Finsterle et al. 2023; Finsterle 2025)

Recommend Tracking Results

- Routine water quality data
- Satellite data
- Sediments every 3-5 years

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“How long will good water quality last?”

- If a small amount, a few months
- Applying 100% dose upfront, literature suggest 5-10 years for similar lakes

- We believe restored water quality is maintained longer with partial doses through time. Can extend longevity past 10 years for a similar cost

Technical Answer

Impacted by the following:

- Initial mobile P in sediment
- Dose applied
- Hydraulic residence time + External loading
- Lake morphology
- Benthic fish presence (carp)

Sources: Huser et al. 2016, Spears et al. 2013

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Partial dose targeting 400 lbs. P

Typical Application 4-10 boat hours, 1 day

EutroSORB SI -Dry
2 pallets

EutroSORB SI -Liquid
~4 totes

EutroSORB G
10 pallets

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Full treatment target 7,275 lbs. of P

EutroSORB SI - dry
2 trucks, 36.5 pallets

EutroSORB SI - liquid
5 trucks, 66 totes

EutroSORB G
9 trucks, 182 pallets

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Cost Considerations

	Material cost	Shipping & Handling	Application & Logistics Cost	Total Product Cost Applied	Total cost per lb. of P Sequestered
EutroSORB G	$3.6/lb.	None expected	$1.16/lb.	$4.76/lb.	$238.00
EutroSORB SI - liquid	$72/gallon	None expected	$18/gallon	$92/gallon	$225.00
EutroSORB SI - dry	$18/lb.	None expected	$3/lb.	$21/lb.	$210.00

Note: Costs are planning levels costs in 2026 USD

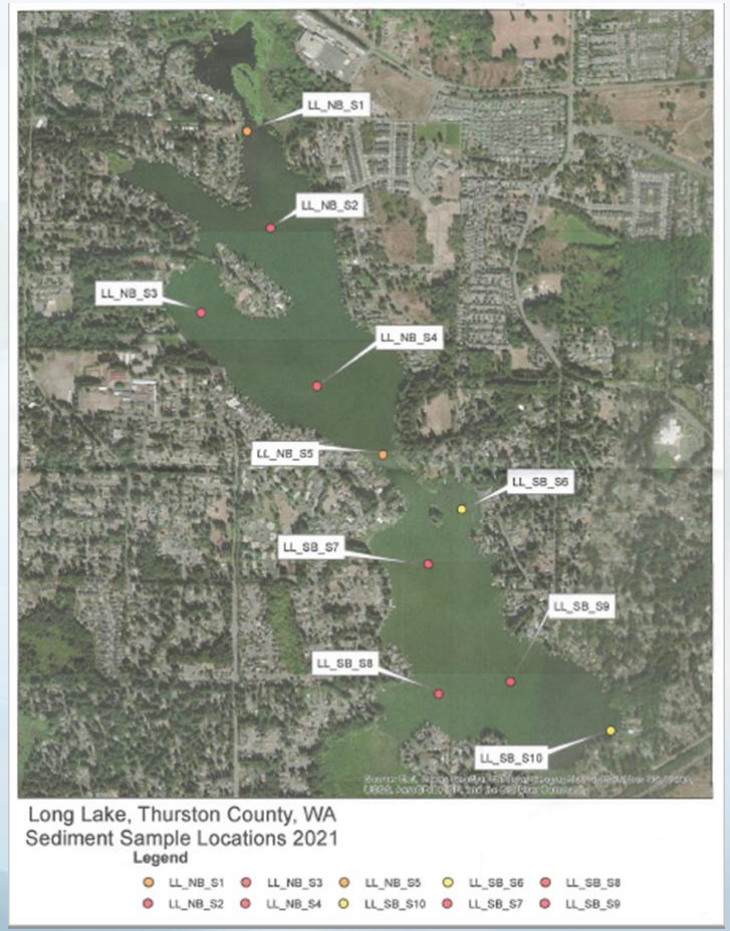
- Specific costs would be obtained via competitive bidding processes from qualified Lake Management Companies
- P mitigation Projects are generally between $200-300 per lb. of P mitigated including design and monitoring costs

Local Case Studies Available – Partial dosing

- **Long Lake, WA – EutroSORB G, some Alum**
- Kitsap Lake, WA – EutroSORB G
- Moses Lake, WA – EutroSORB G + inflow EutroSORB WC

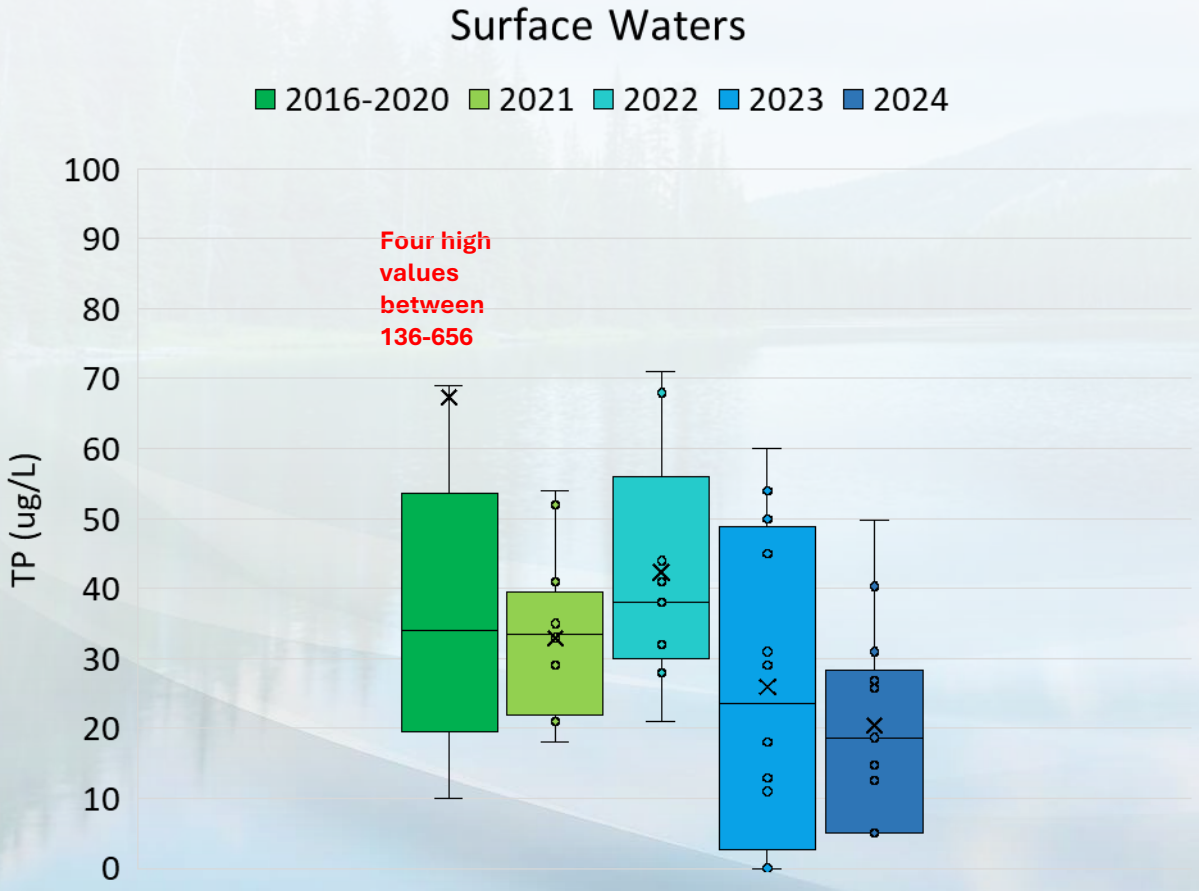
Long Lake Thurston Co., WA

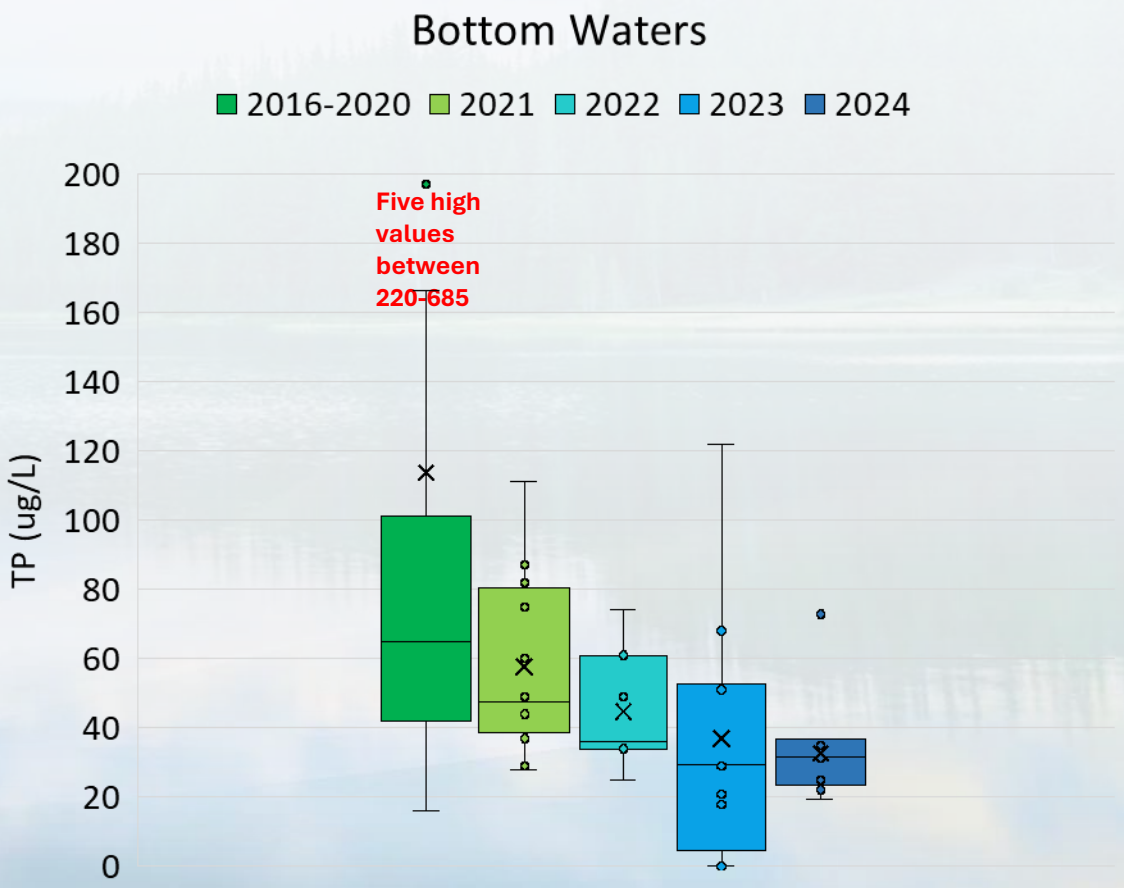
- 330-acre lake, 2 basins
- Internal P loading primary issue, external loading
- Annual treatment budget



Lake Region	Top 10cm Mobile Sediment P (lbs.)
North - Shallow	2,389
North - Deep	1,861
South - Shallow	2,597
South - Deep	1,890
Total lbs. P	**8,736**

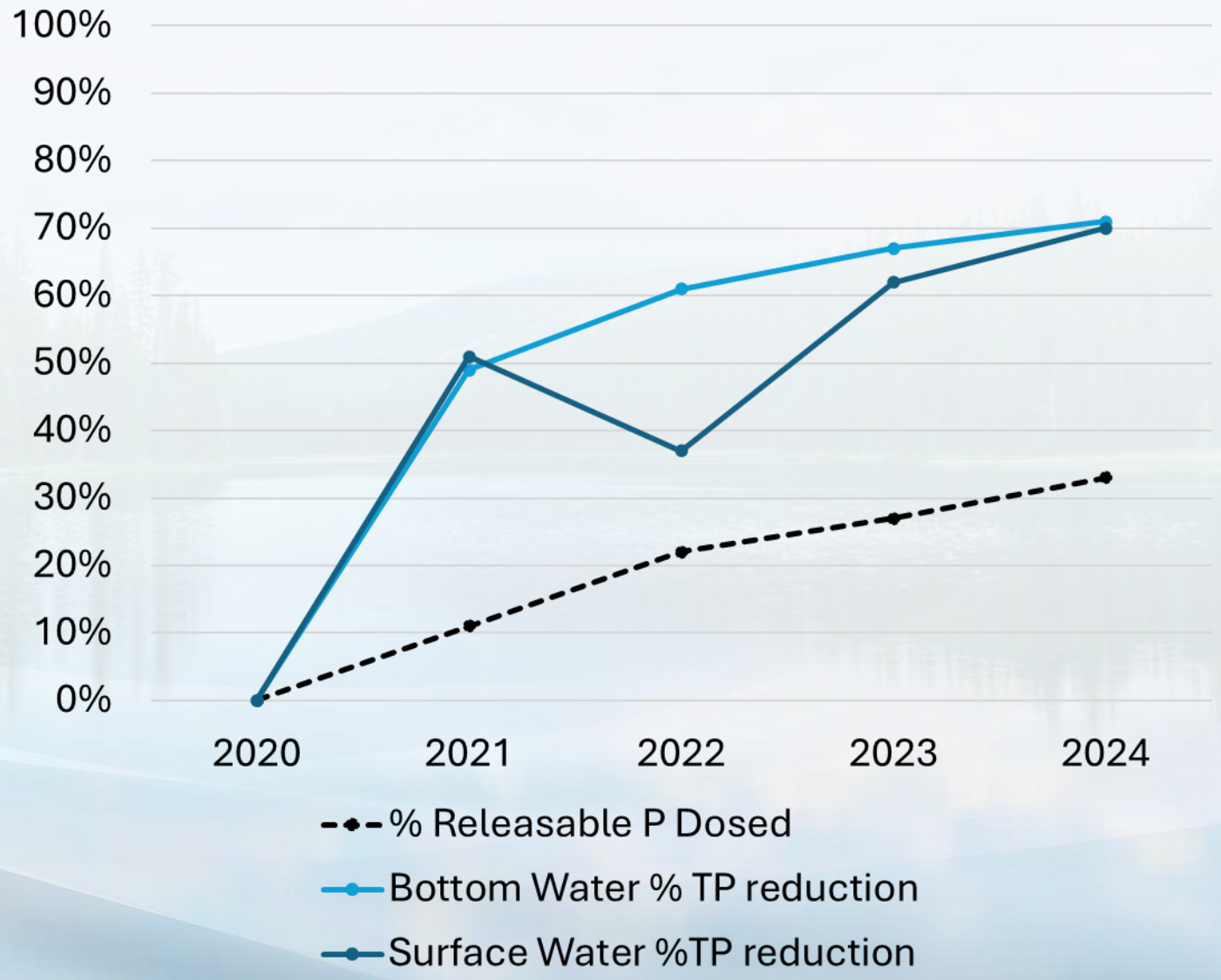
Water quality steadily improved with partial dosing. 2024 had great water quality, no HAB advisory.





Preliminary data not for citation

Multi-Year Dosing Response



Preliminary data not for citation

Before: August 2020 HAB bloom

After: August 2024

2025 Sediment Study

- Sediment cores collected across the lake
- Measured mobile P in sediment to estimate dosing needed into the future
- **Lanthanum binding well and as expected!** (1.14 molar La:P ratio, consistent recovery and peaks)
- Aluminum binding efficiency was moderate to low and floc was moving around the lake bottom. (16-28 molar Al-P ratios with variable recovery)

Report: Van Goethem & Langan 2026

Lawrence Lake

Utilizing EutroSORB G & SI

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Lake Lawrence

West Basin (53.3 ac)

Big Basin (~266 ac)

Lake residence time 2-4 years

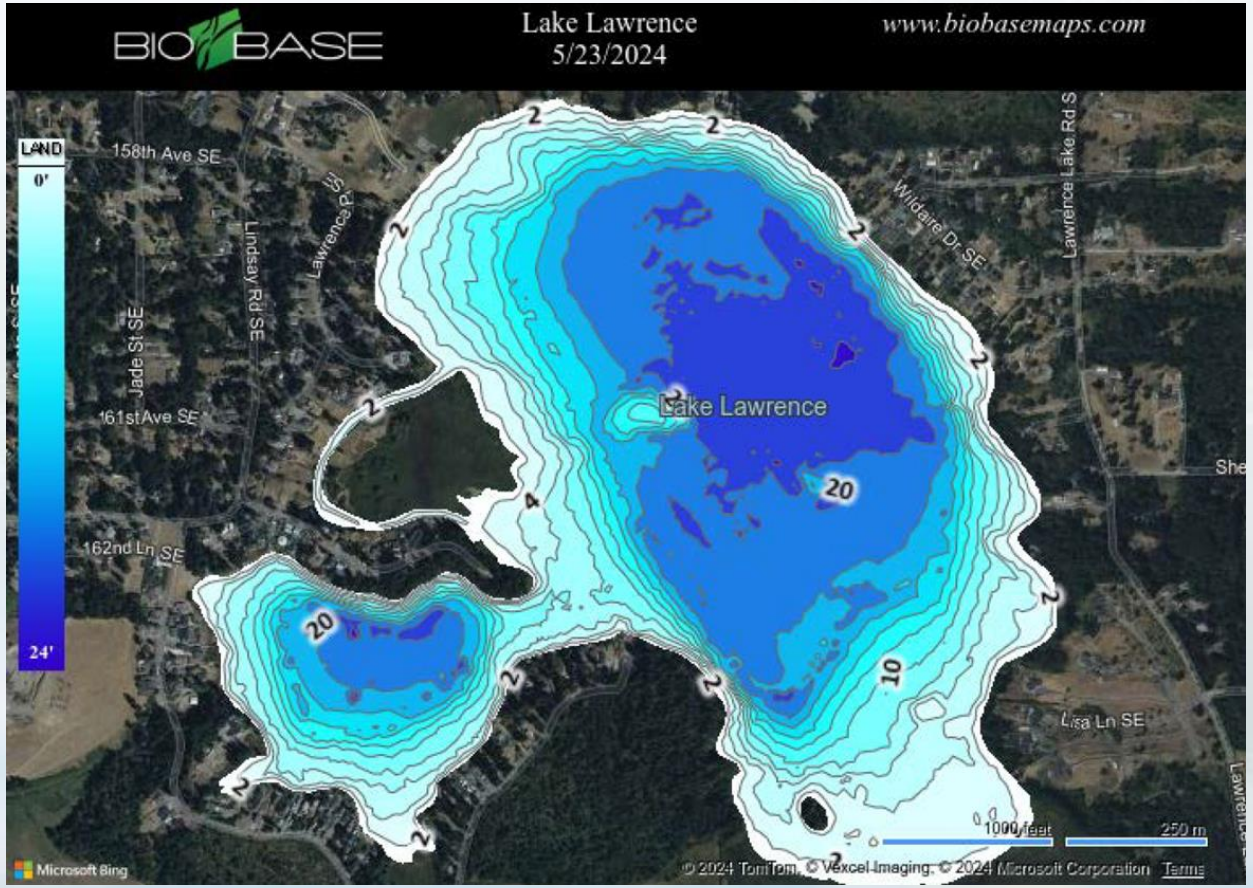
P budget = ~50% sediment release

“shallow” lake (max depth <30ft)

Osgood index = 3.5

Water chemistry

- pH 6-9
- Alkalinity = soft water expected
- DOC = low-medium expected



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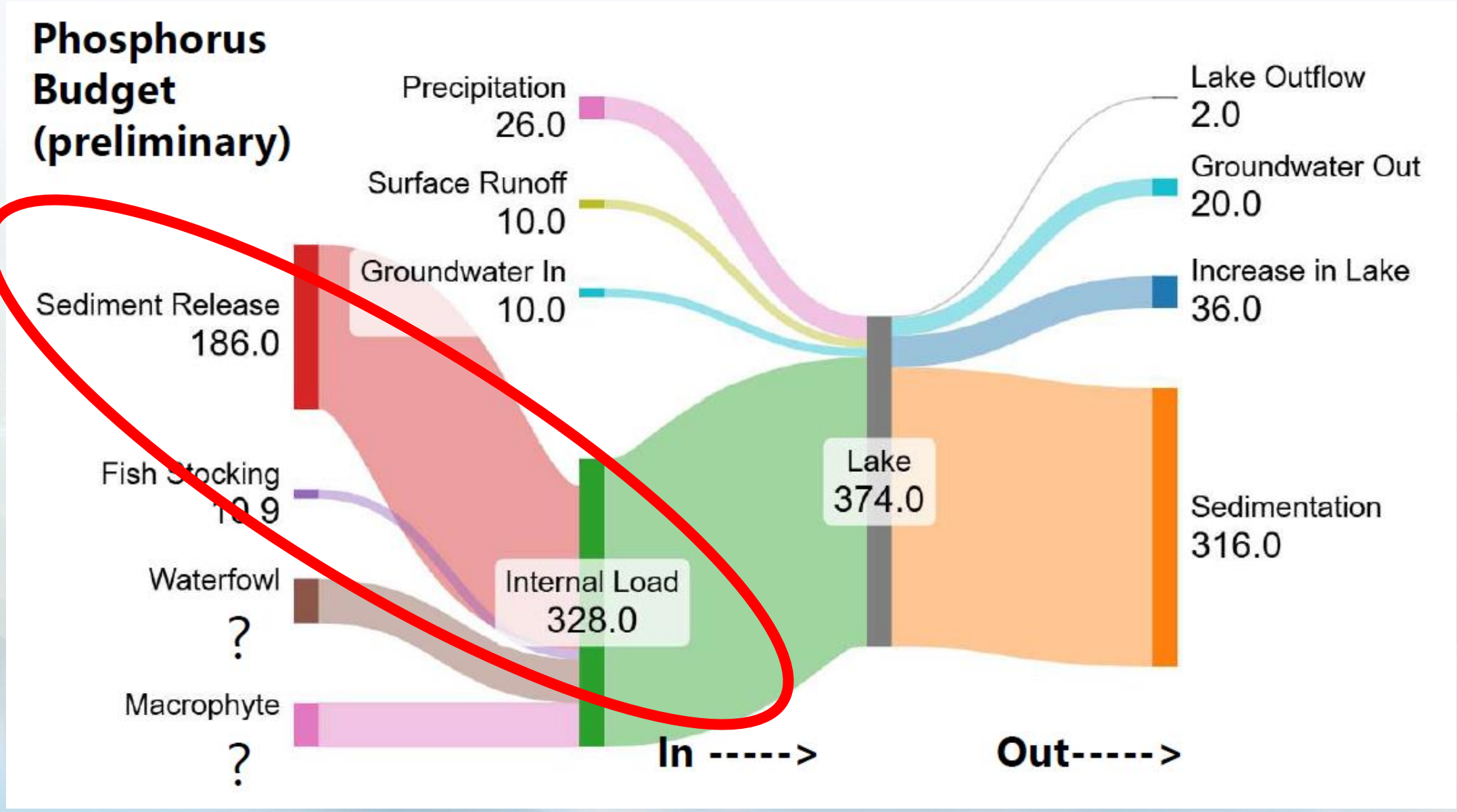
Phosphorus Budget (preliminary)
Precipitation
26.0
Surface Runoff
10.0
Groundwater In
10.0
Sediment Release
186.0
Fish Stocking
10.9
Waterfowl
?
Macrophyte
?
Internal Load
328.0
Lake
374.0
Lake Outflow
2.0
Groundwater Out
20.0
Increase in Lake
36.0
Sedimentation
316.0
In ----->
Out----->
Sources: Herrera 2025 LCMP presentation
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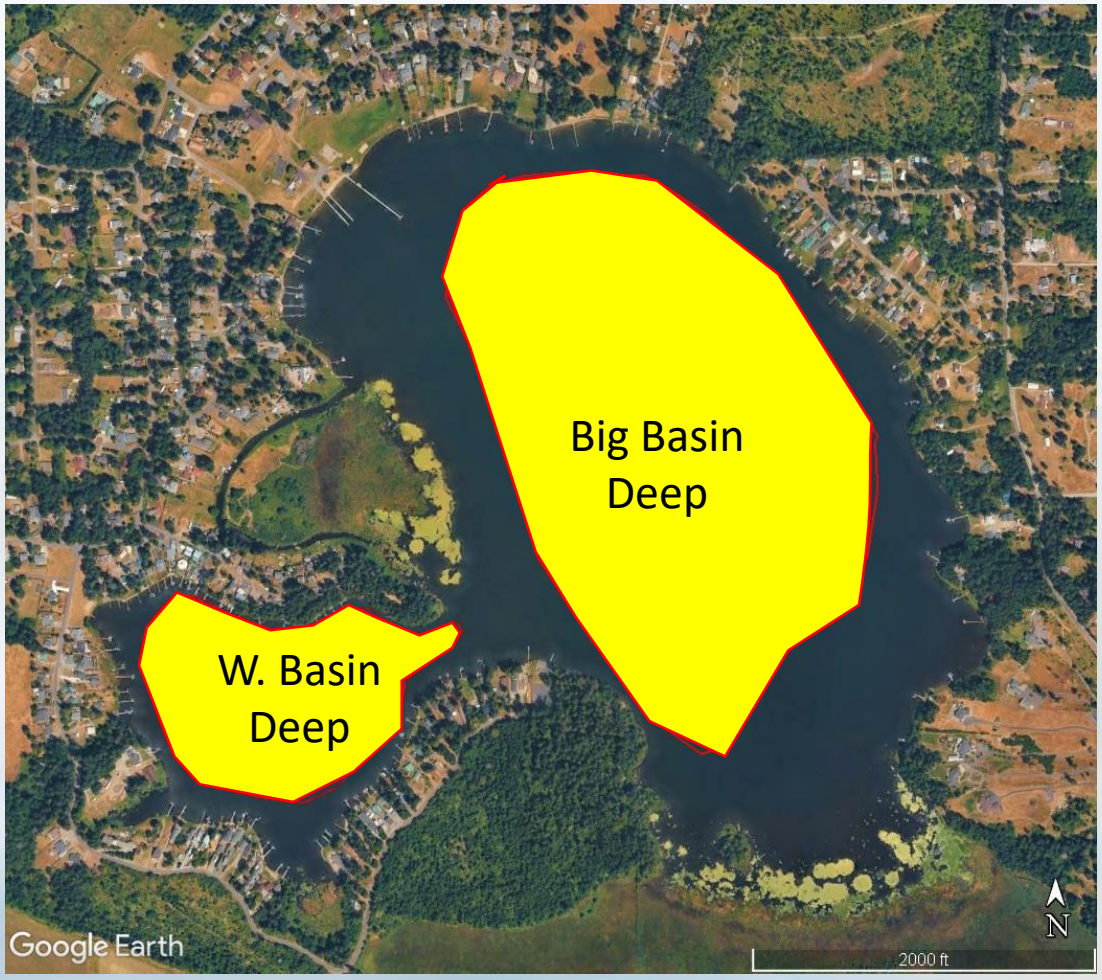
Lawrence Lake - Specific Recommendations

Product Choice: Either!

- EutroSORB SI dry with lowest cost and logistics

Potential Dosing Plan

1. Partial annual dosing with LMD budget, grants to increase treatment size.
2. Dose deeper (anoxic) sediments first, goal to get 50% dosed as fast as possible. ~2-5 year period
3. After that, increase treatment zone to include shallower sediments for treatments (due to biogenic P)
4. Shoot to address all Active P in deep sediments over ~ 3-10yr period, all Active P over 10-20yr period.



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Lawrence Lake – Expectations

- **Strong improvements in water quality when 20-30% of the sediment dose applied**
- Partial dosing through time will likely extend longevity of treatments beyond 10yrs
- Utilize Adaptive Management to optimize restoration

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Presentation Summary

- EutroSORB G & SI are safe, simple, effective P binders
- Well researched, successful, local expertise and case studies available
- EutroSORB SI new formulation for easier sediment treatments, dry formulation preferred when available
- Costs range expected $210-240/lb. P for mitigation
- Partial dosing of sediments through time will achieve water quality improvements you desire

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