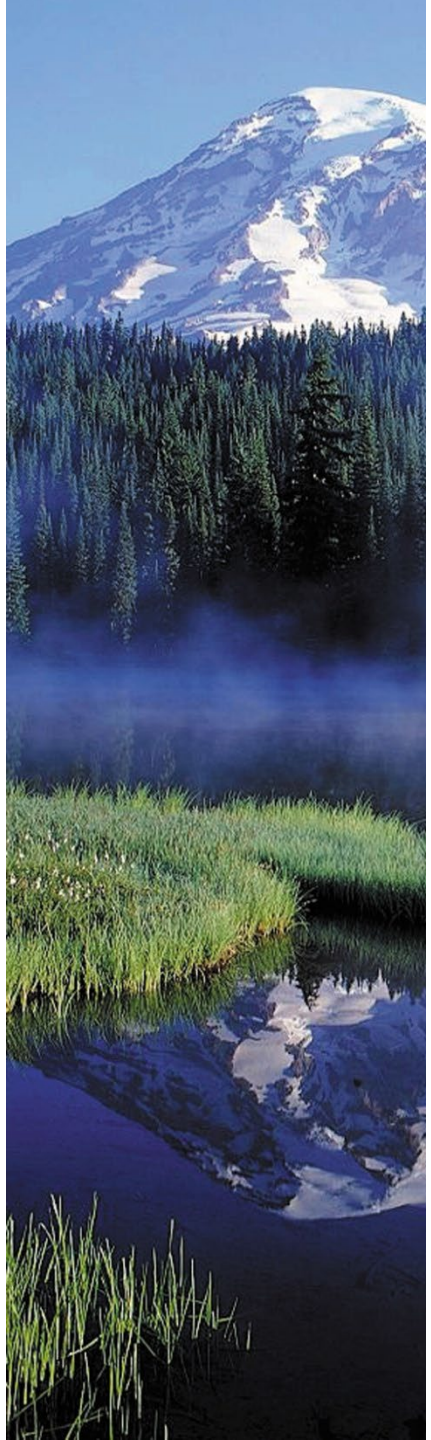


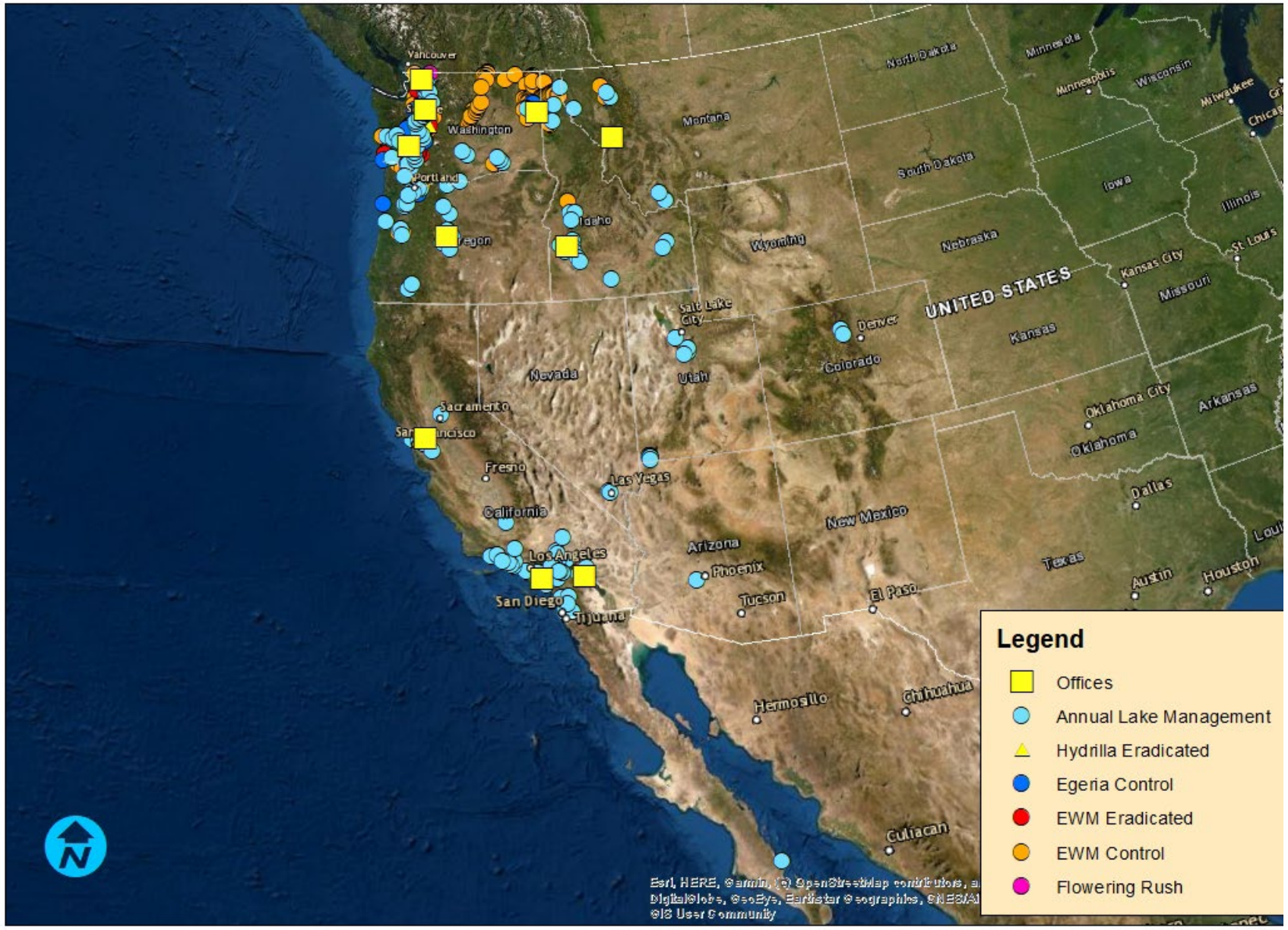
Alum Treatment Technology for Lake Lawrence

Terry McNabb, CLM

Aquatechnex, LLC

Terry McNabb

- Graduate Michigan State University, BS Water Resource Management 1979
- Have worked in this field since 1970
- Past President, Aquatic Plant Management Society (www.apms.org) and North American Lake Management Society (www.nalms.org)
- Certified Lake Manager, CLM
- California Pest Control Advisor, PCA
- GCSAA Lake Management Instructor
- UC Davis Aquatic Weed School Faculty



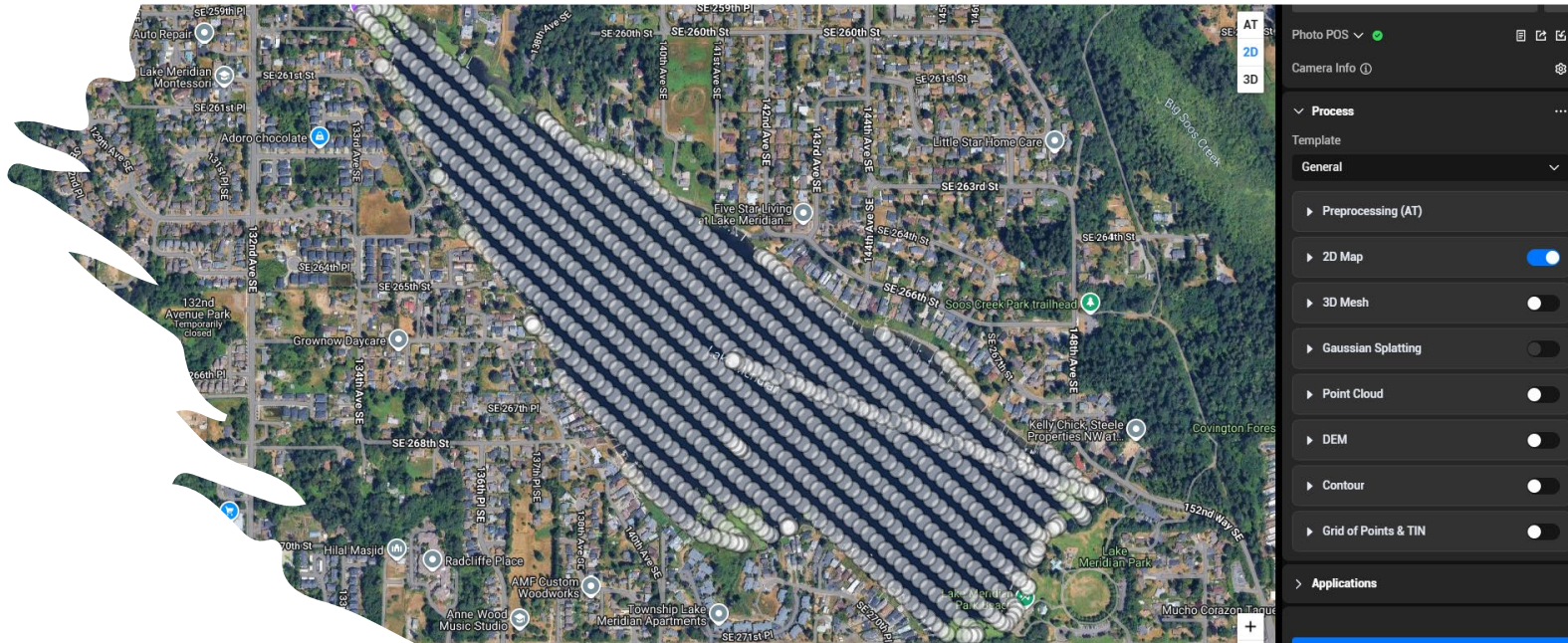
Aquatechnex Major Lake Management and Invasive Aquatic Weed Projects

Company Overview Over Four Decades of Lake Management Experience

- Expertise in management of invasive aquatic plants
- Expertise in management of HAB
- Research Contract Annually with WES/ERDC since 1987
- Snake River Quagga Mussel Treatments Last two years

A couple other things

- Aquatechnex operates both OST and nanobubble systems throughout our region
- Aquatechnex operates aerial drone technology for mapping and treatment
- Our multi spectral drone imaging system can map chlorophyll a and HAB Blooms
- We are starting daily satellite monitoring program next week on service contract accounts

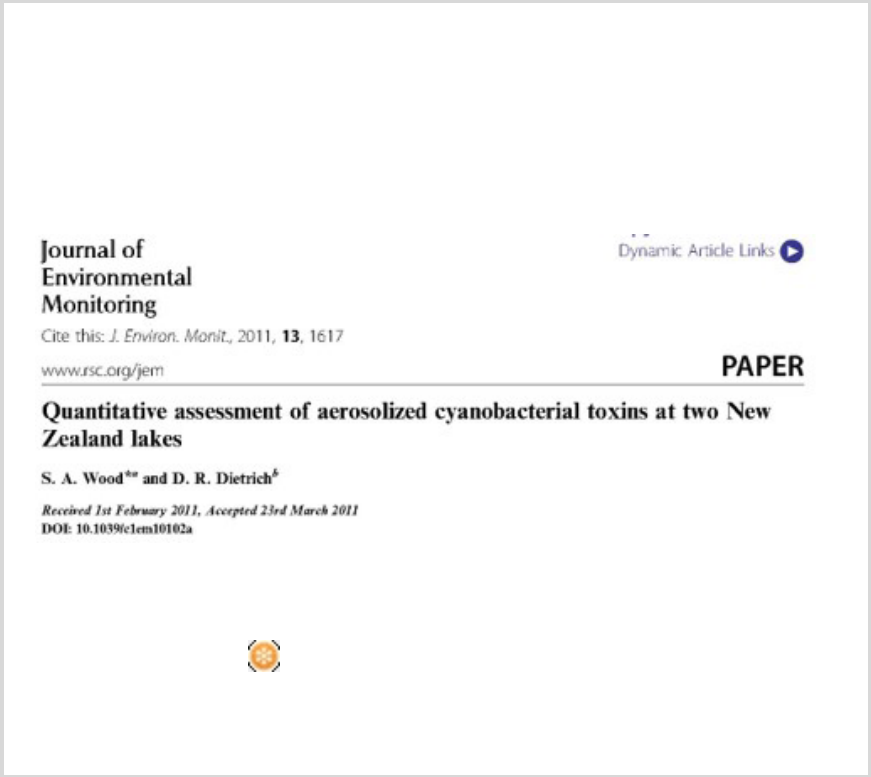


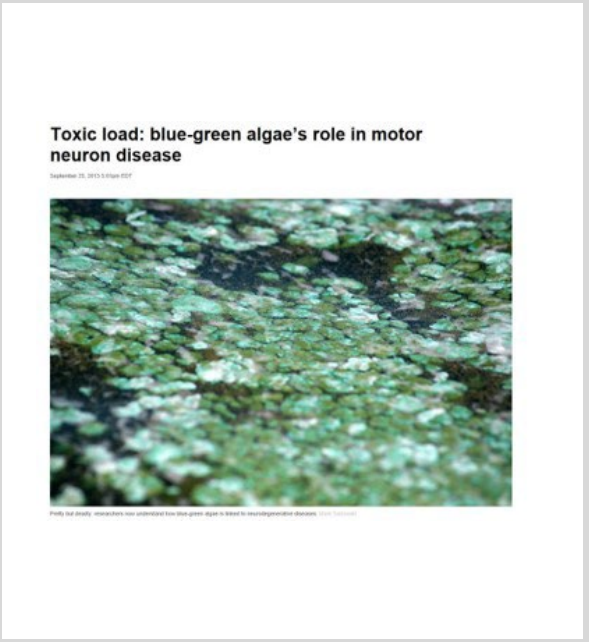
Harmful Algae Blooms

- Produce acute toxins
  - Liver toxins
  - Nervous system toxins
- Produce Chronic toxins to waterfowl
  - Avian vascular Myelinophathy
- Potentially have human health impact
  - Http://aquatechnex.com/2012/01/does-tap-water-cause-lou-gehrigs-als-disease/
  - This image is Lake Erie near Toledo Ohio Potable Water Intake

HAB and Long-Term Exposure

- Direct link to compounds produced and ALS
- Exposure can be from airborne toxins
- Exposure can be from potable water supply from impacted reservoir
- UF news 2020, “can travel 10 miles in light wind”





Home / Research News / Harmful Algal Blooms and ALS

Harmful Algal Blooms and ALS

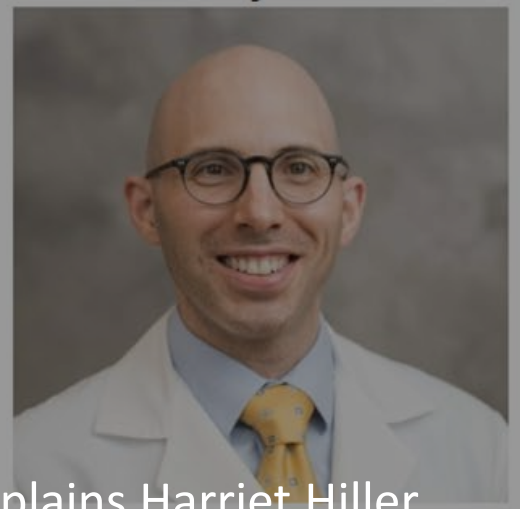
A new study points to a connection between cyanobacterial blooms and ALS survival.

May 29, 2025

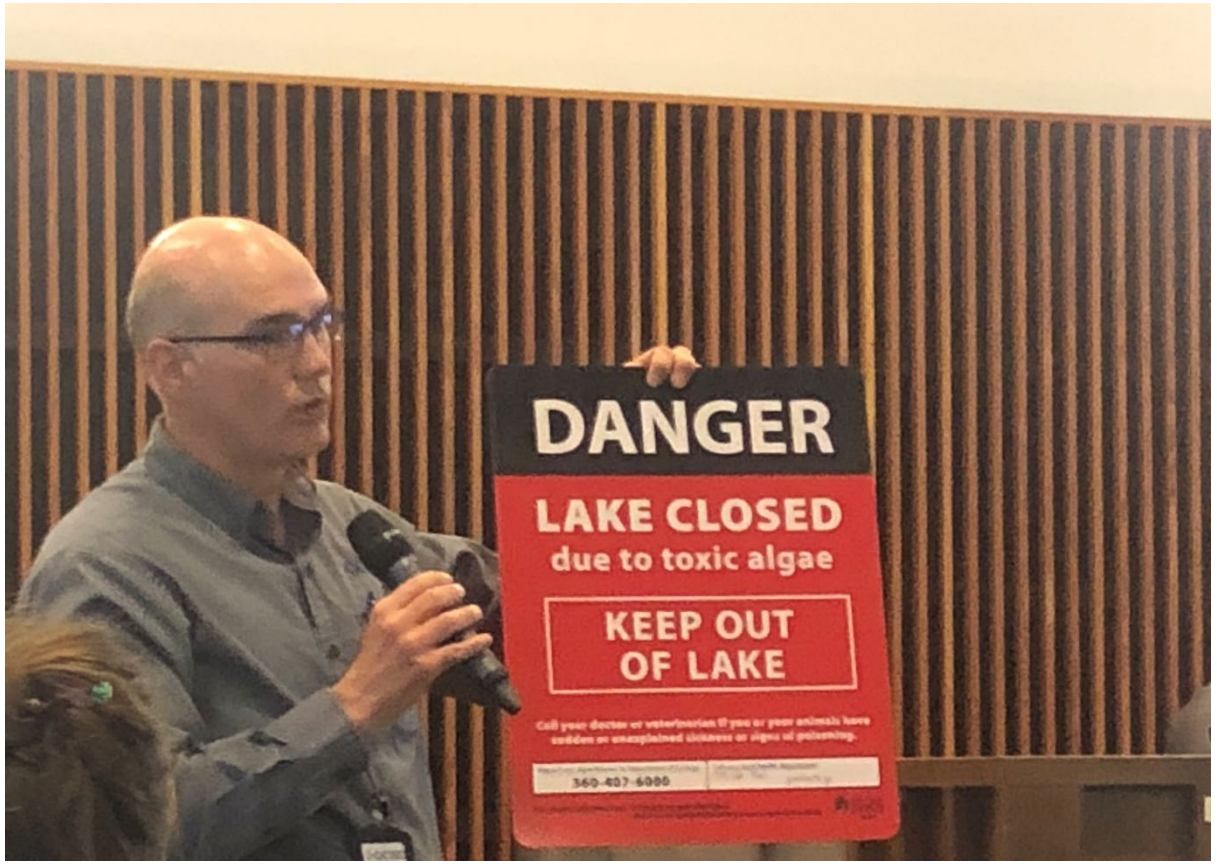
Author | Shoshanna Fischhoff >

- “These findings are important in our investigations into ALS risk factors,” explains Harriet Hiller Research Professor Stephen Goutman, M.D., M.S. “They suggest that cyanobacterial blooms may be a modifiable environmental risk factor influencing ALS progression. This means that by limiting exposure to these toxins can bring us one step closer to making ALS a preventable disease.”

In This Story



Stephen Goutman, MD, MS
Associate Professor



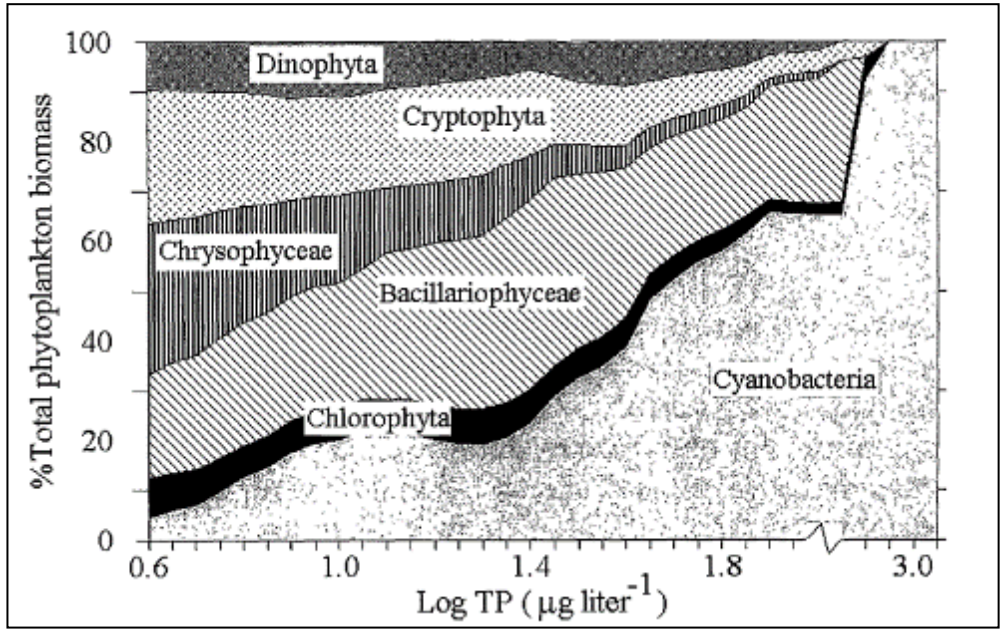
Most Common Result to this point Health Department measures Toxin, close the lake

Nutrient Inactivation

Why Phosphorus?

- Phosphorus control is critical to mitigating eutrophication.
  (Carpenter, S.R. 2008)

- Eutrophication of lakes cannot be controlled by reducing nitrogen input: results of a 37 year whole ecosystem experiment.
  (Schindler, D.W., et. al. 2008)



Watson SB, McCauley E, Downing JA 1997. Patterns in phytoplankton taxonomic composition across temperate lakes of different nutrient status.
Limnology and Oceanography 42: 487–495.

Our Experience with Phosphorus Sequestration

- 1970’s Lake Lansing (MI) and Skinner Lake (IN) US EPA Clean Lakes Studies, alum treatments
- Ongoing since then as necessary in our work, Big Bear Lake CA 750,000 Gallons applied 2015
- Orange County Parks RFP, primary issue was algae management in reclaimed water lakes
- Discovered Lanthanum technology in 2010

Canyon Lake

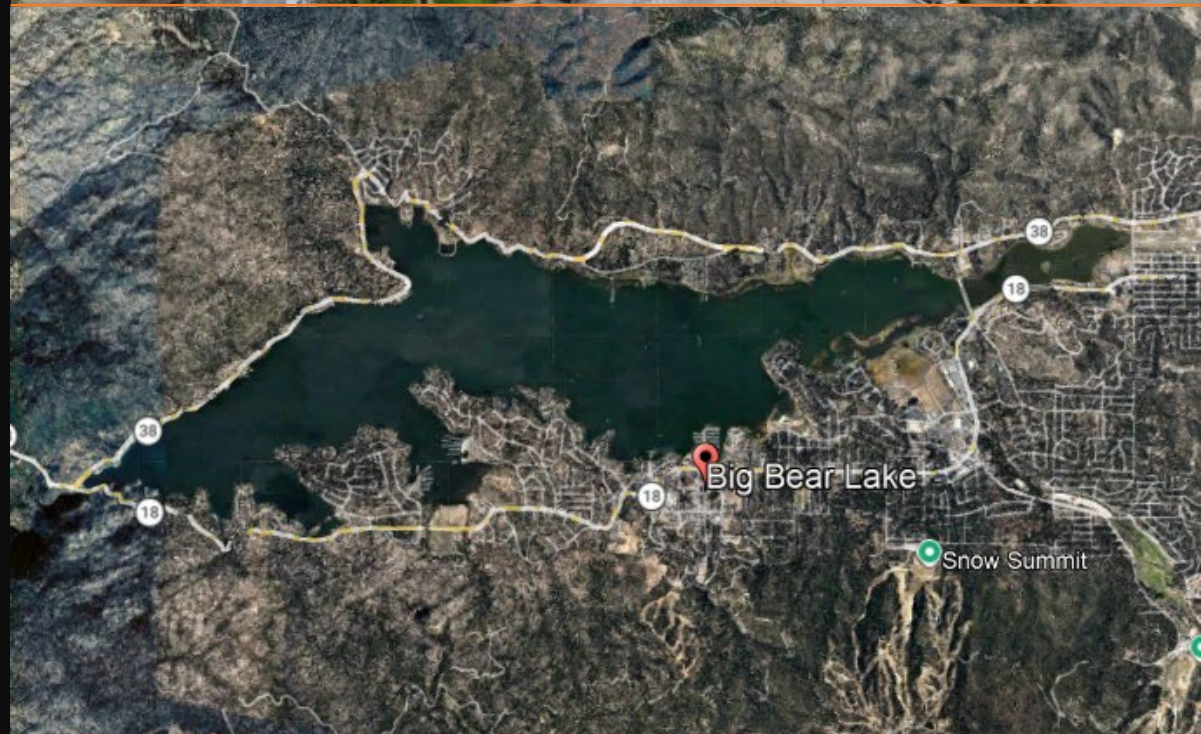
- 500 Acre potable water reservoir in Southern California
- TMDL set for Phosphorus about 2010 with numeric targets
- We have treated twice per year, spring to target inflows from 73 square mile watershed, just before turnover to target internal loading. Treatments annually since 2011
- **One of the few lakes in the Country that has met TMDL Target for Phosphorus, achieved in 2015**

Alum Operations

- We utilize the Canyon Lake Property Owners Association boat ramps for operations
- We generally receive and apply 4-5 truck loads per day
- Operations do not interfere with lake use or boat launching

Big Bear Lake, San Bernadino CO. CA

- 2,900 acre reservoir at 8,000-foot elevation in San Bernadino mountains.
- Won bid by approximately $300,000.00
- Applied 750,000 gallons of Alum in three weeks utilizing multiple application teams
- Delivery Logistics were complicated and we effectively managed just in time



Big Bear Lake Alum Application

- Our treatment vessels are optimized for alum treatments
- Treatment plan is developed and uploaded to boats
- Utilize precision application equipment including DGPS guidance and flow control technologies
- Using multiple boats removes the need for Shoreline Tanks and transfer

Long Lake , WA

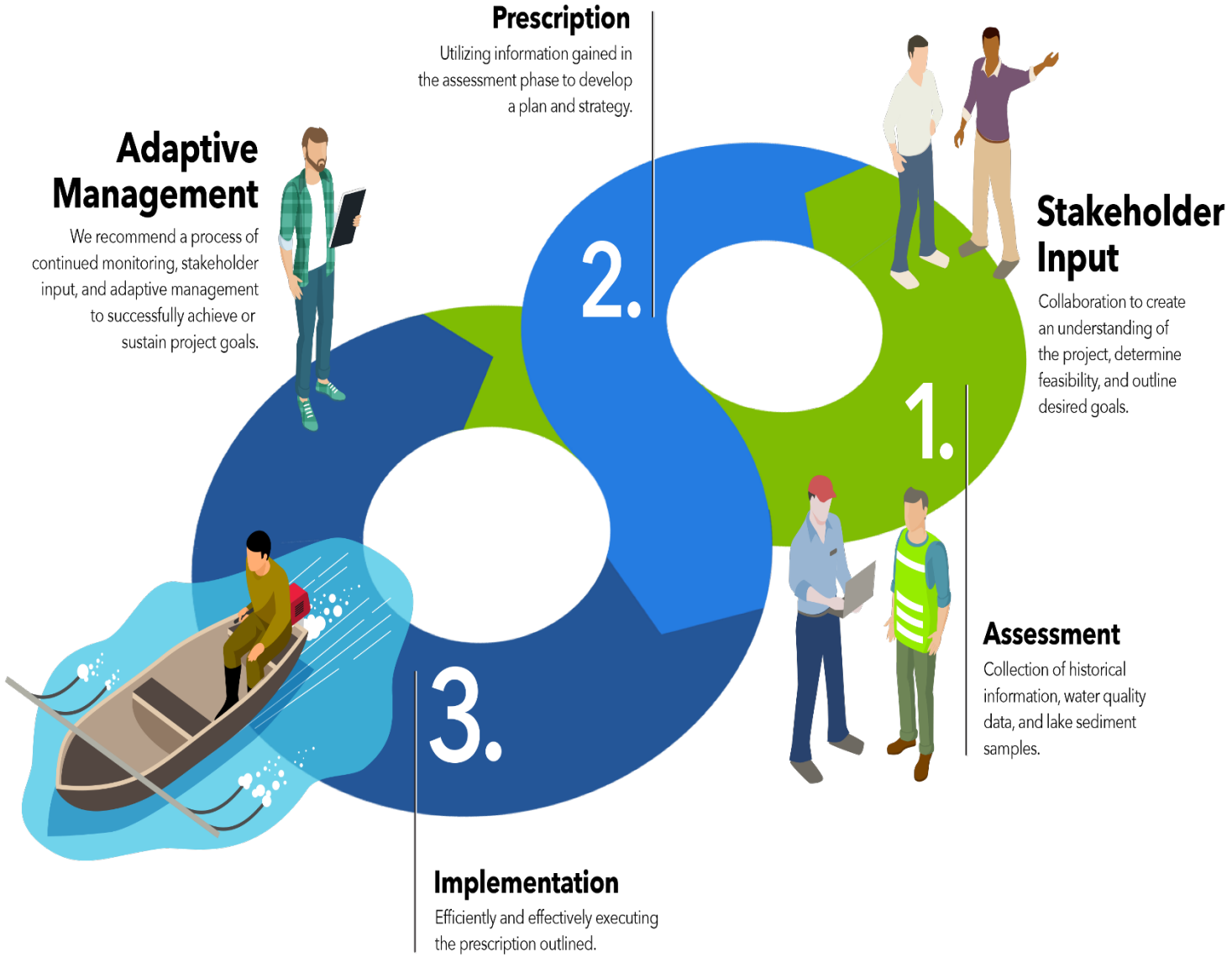
- Study by Tetra Tech suggested total reset using Alum treatment, cost $3 million USD
- 330-acre lake, 2 basins
- Internal P loading primary issue, on-going external loading
- Annual treatment budget from Lake Management District
- 2021 started Lanthanum Modified Bentonite and low dose Alum applications

Washington Experience with Alum

- Lake Stevens, Snohomish County 1,200 acre application, multiple years 2011 through present
- Long Lake, Thurston County, combo treatment Alum and Eutrosorb
- Moses Lake, subcontracted Alum to Solitude/performed 2,000 acre Eutrosorb treatment 2024
- Lake Ketchum, Snohomish County, 2014-2018, awarded 2026-2029 contract this past week
- Campbell Lake, Skagit County, 2025 started with Friends of Campbell Lake, added to the LMD project contract for this year.

Adaptive Management

- Many projects that forecast long term results do not deliver projected longevity
- Many lakes that have issues can not afford extensive study
- Adaptive Management is ongoing process that can be more cost effective



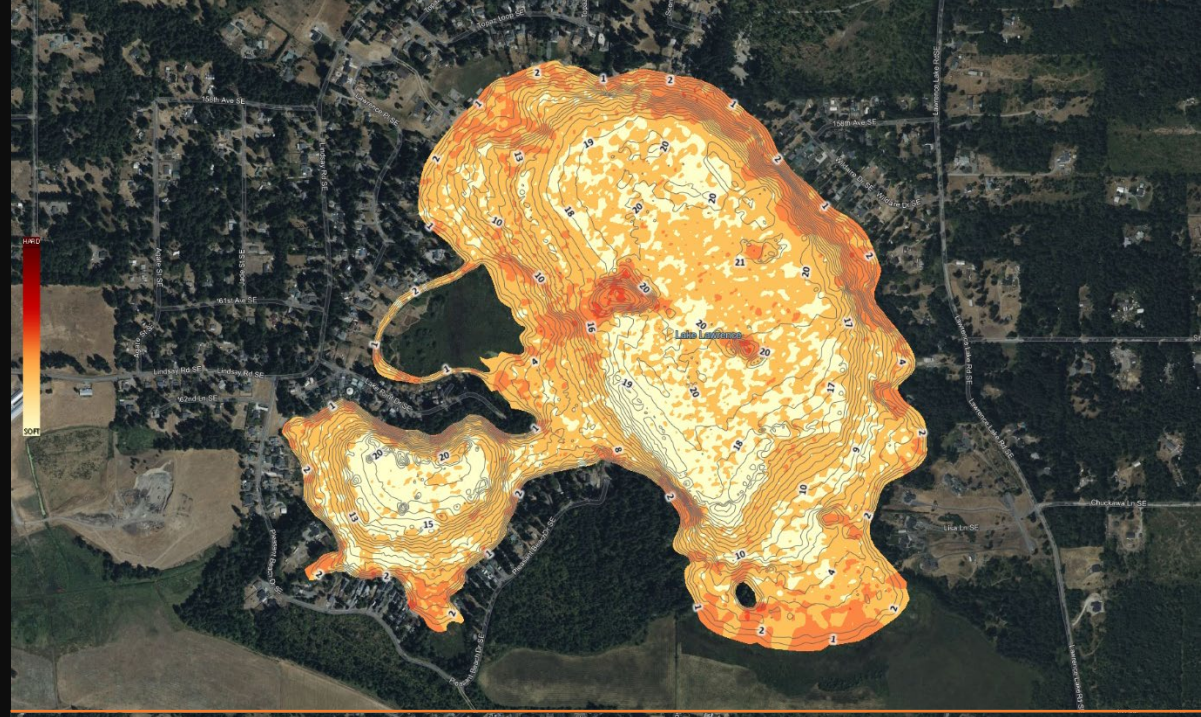
October 2022 HAB bloom

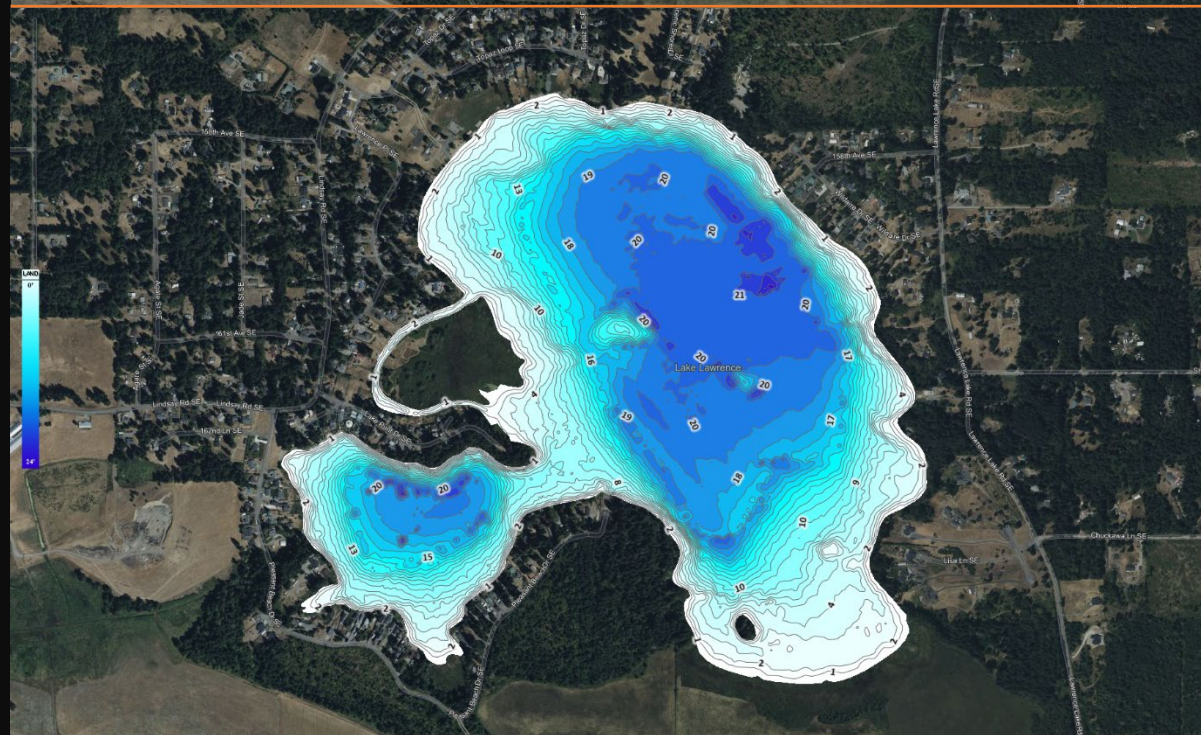
October 2024, post-treatment

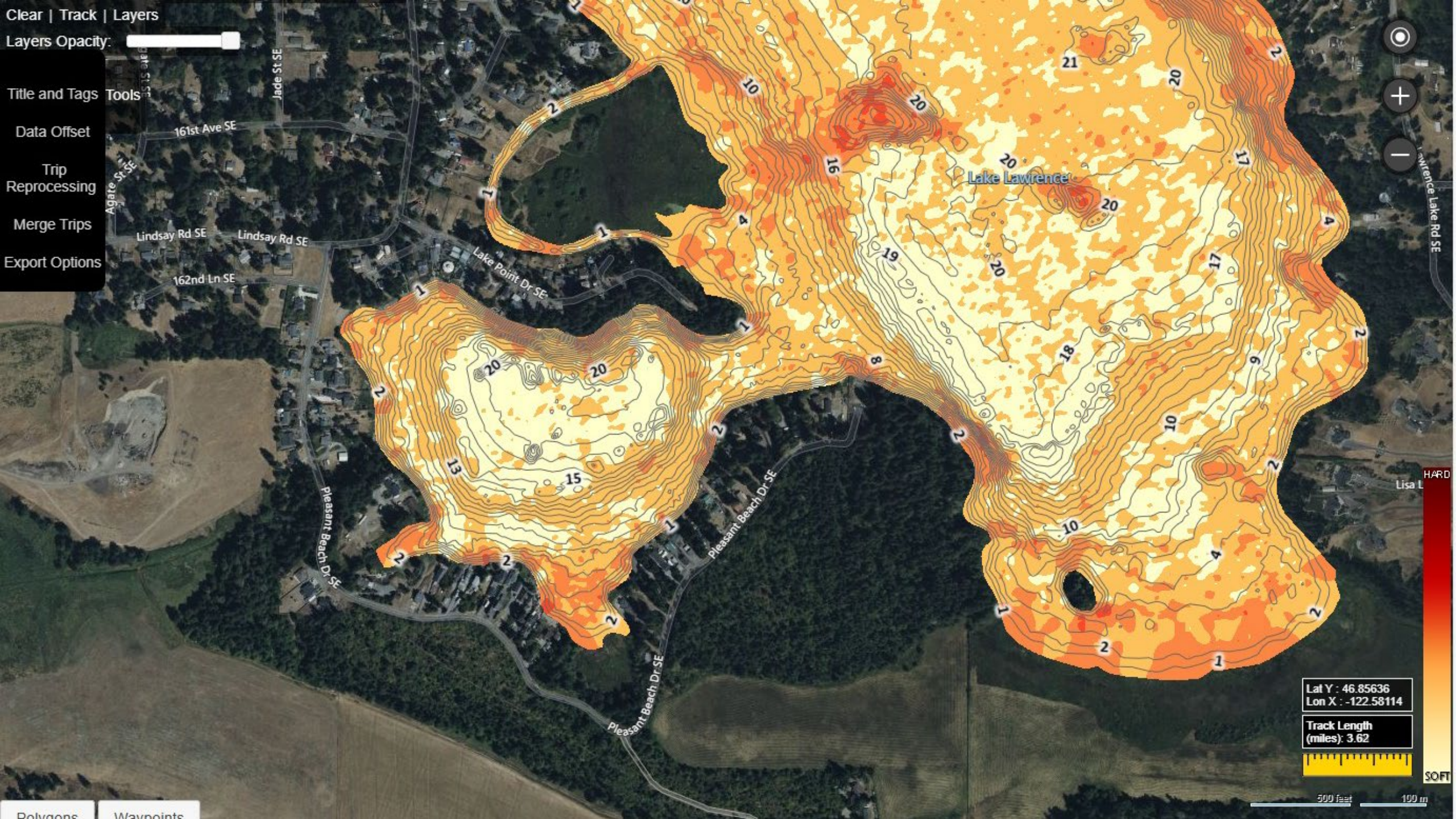
June 2025, post-treatment

Lake Lawrence

- Bathymetry and lake volume map used to calculate doses
- Sediment composition map can be used to target organic deposits

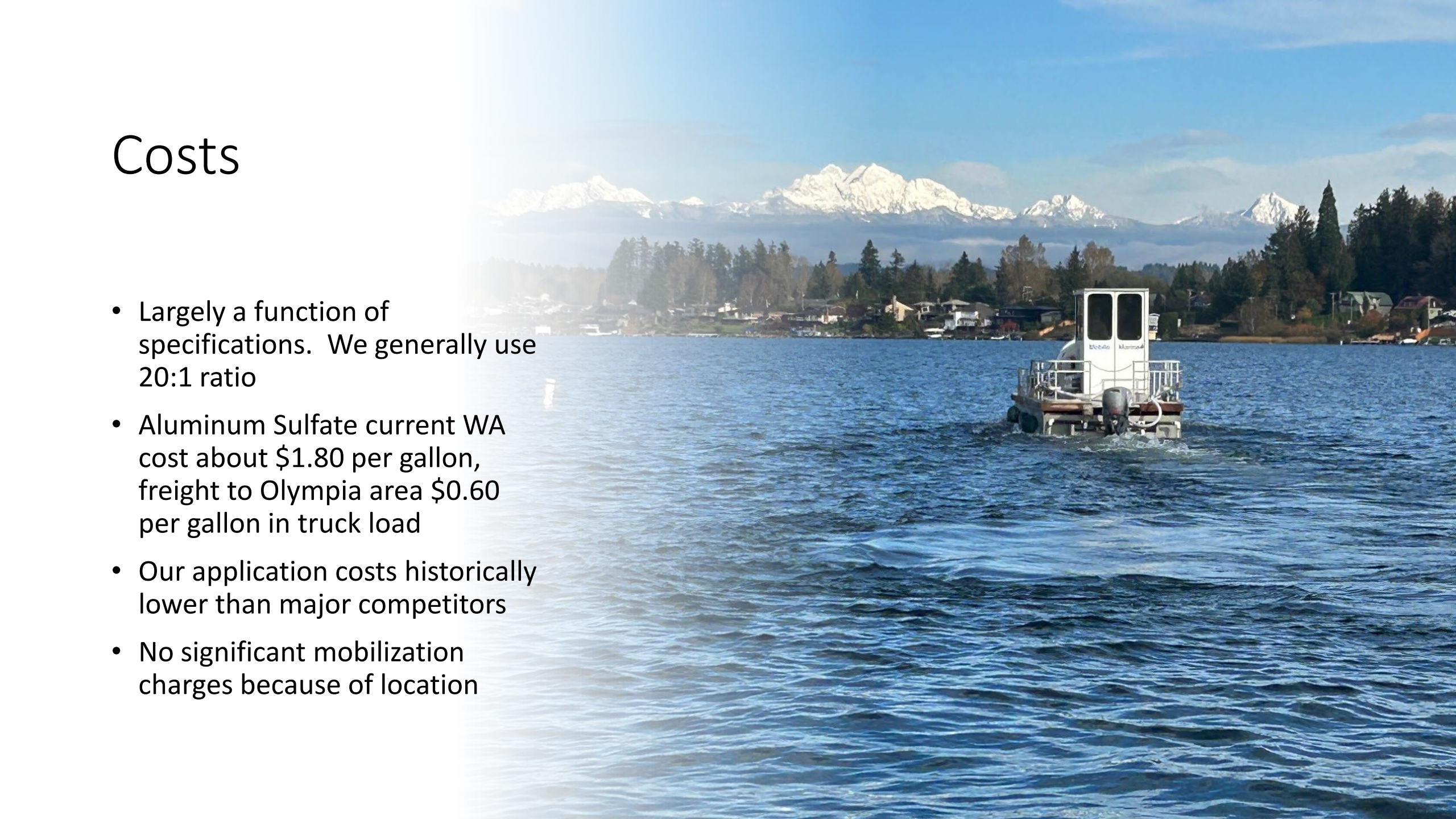





Clear | Track | Layers
Layers Opacity:
Title and Tags
Tools
Data Offset
Trip Reprocessing
Merge Trips
Export Options
Jade St SE
161st Ave SE
Agate St SE
Lindsay Rd SE
Lindsay Rd SE
162nd Ln SE
Lake Point Dr SE
Lake Lawrence
Lawrence Lake Rd SE
Pleasant Beach Dr SE
Pleasant Beach Dr SE
Pleasant Beach Dr SE
Pleasant Beach Dr SE
HARD
SOFT
Lat Y : 46.85636
Lon X : -122.58114
Track Length (miles): 3.62
500 feet
100 m
Polygons
Waypoints

Costs

- Largely a function of specifications. We generally use 20:1 ratio
- Aluminum Sulfate current WA cost about $1.80 per gallon, freight to Olympia area $0.60 per gallon in truck load
- Our application costs historically lower than major competitors
- No significant mobilization charges because of location



Monitoring Requirements

Table 5: Monitoring Schedule Summary

Frequency	pH (in situ)	Temperature, Conductivity, Dissolved Oxygen, % Saturation	Hardness (as CaCO3)	Total alkalinity (mg/L)	Dissolved organic carbon (mg/L)	Total aluminum (µg/L)	Sulfate (mg/L)
Pre-treatment (3 samples within 3 months of treatment)	✓	Added	✓	Added	✓	Added	Added
During	✓	Added	—	—	—	—	—
Day after treatment	✓	Added	✓	Added	✓	✓	Added
2 weeks	✓	Added	✓	Added	✓	✓	Added
1 month	✓	Added	✓	Added	✓	✓	Added
2 months	✓	Added	✓	Added	✓	✓	Added
6 months	✓	Added	✓	Added	✓	✓	Added
9 months	✓	Added	✓	Added	✓	✓	Added
~~12 months~~	~~✘~~		~~✘~~		~~✘~~	~~✘~~	

- New NPDES permit goes into effect this March
- Red are added parameters, sulfate toxicity to aquatic plants was discovered on Waughop Lake Treatment by University of Puget Sound

pH monitoring is critical during application

- We deploy buoys with sensors
- Sensors are connected to VuLink, a cellular system to “the Cloud”
- Viewable on laptops and smart phones in the field and in our treatment boats
- Can set alarms that broadcast immediately if conditions drop outside optimum levels.

There have been fish kills associated with Alum Treatments

- White Lake NC, fish kill How Did 115,000 Fish Die In White Lake? | WUNC News
- Lake Giles FL fish kill Aluminum sulfate water treatment in Orlando lake kills fish
- Heart Lake, WA fish kill
- Lake Ketchum fish kill
- Wapato Lake fish kill
- High dose and/or Buffer may be to blame

Contact
tmcnabb@aquatechnex.com
and 360-201-2612

- Aquatechnex is based in Centralia, mobilization charges are minimal compared to national groups
- We have 10 highly treated certified applicators in Washington
- We have consistently been the most cost effective Alum applicator in competitive situations
- We are expert in the use of other phosphorus mitigation technologies as well