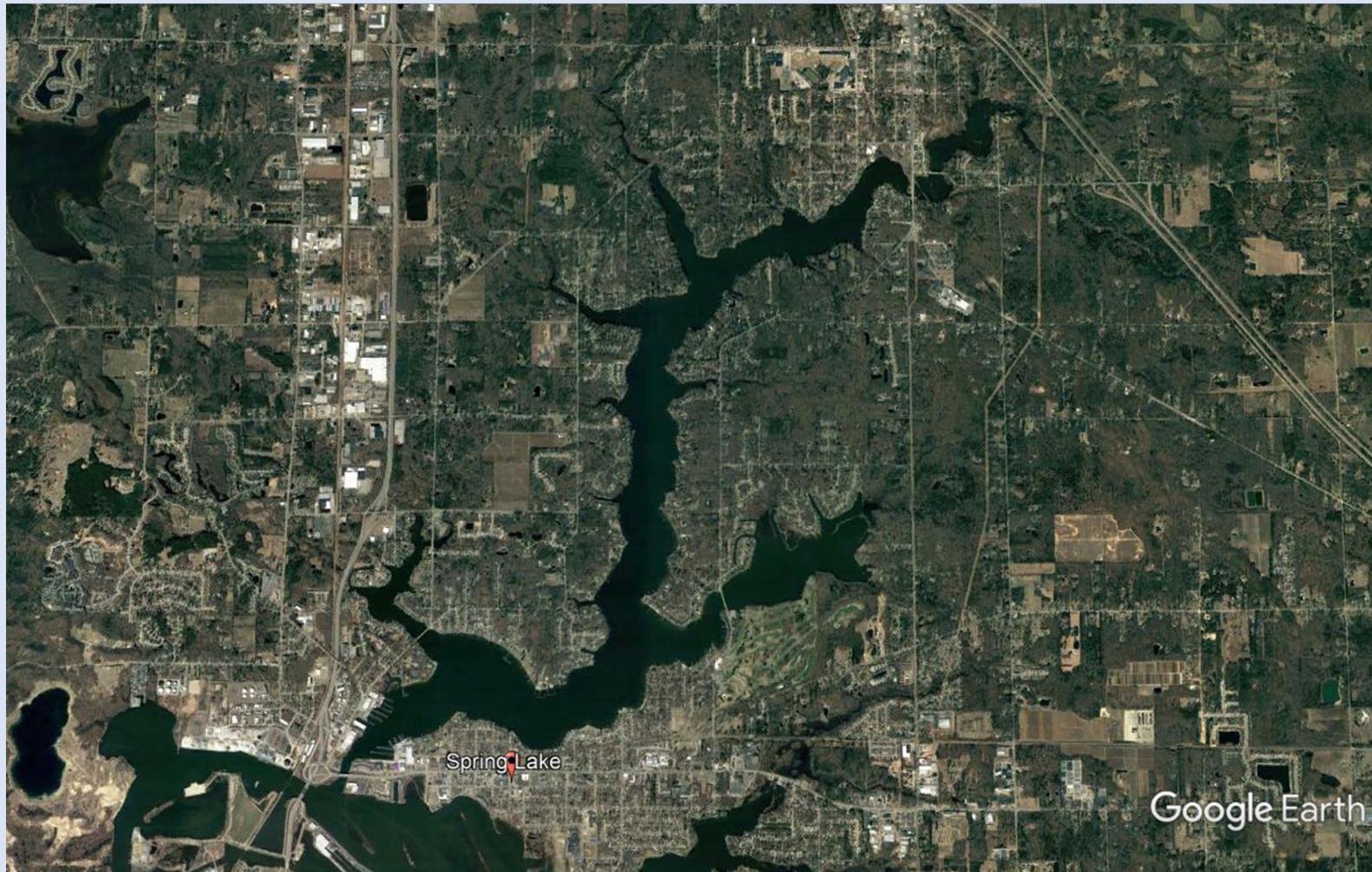


SPRING LAKE SEDIMENT ANALYSIS

FINAL REPORT ON SEDIMENT PHOSPHORUS AVAILABILITY & FLUX



Prepared by:

John Holz, PhD
Senior Limnologist
SOLitude Lake Management
john.holz@solitudelake.com



OCTOBER 21, 2022

1 Project Understanding & Overview

SOLitude Lake Management (SLM) understands that improving current water quality and protecting against future degradation is of importance to the Spring Lake community and lake users. In particular, phosphorus (P) management is important to limit nutrient availability to the algal community, which in turn reduces algae, increasing clarity and generally improves water quality.

SLM further understands that Spring Lake (1,091-ac) is a relatively deep lake (maximum depth = 40 ft, mean depth = 18 ft) and experiences thermal stratification and anoxic bottom water during summer. Anoxia occurs for approximately 91 d/yr (June 1 – August 31) at depths greater than 15 ft, which suggests internal loading of P from the lakebed is likely an important source of P to the lake.

This Spring Lake Sediment Analysis study has three objectives:

- (1) Determine the pool of P in the lake sediments that is available for release into the overlying water column
- (2) Measure the release rate of sediment P in a controlled lab environment
- (3) Determine the amount of alum required to inactivate sediment P and reduce internal P loading

This information is critical to understanding the sources P loads to the lake, the rates of P loading, and to design specific and focused approaches to controlling loads.

Total sediment P consists of multiple fractions (e.g., labile P, iron-bound P, aluminum-bound P, and biogenic P). These fractions define the pool of P available for release into the overlying water (internal loading) and measuring them reduces the uncertainty associated with estimating internal loading. We collected sediment samples and had them analyzed for separate P fractions.

We also conducted a phosphorus flux study of the Spring Lake sediments. This study provided information about how much P is released from the sediments under different environmental conditions. These results, combined with the P fractionation study data, provided an estimate of the sediment P release rate (how much and how fast).

2 Determination of Available Sediment Phosphorus Pool

2.1 Sediment Core Collection Methods

Sediment cores were collected from an anchored boat on July 19, 2022 from seven locations in Spring Lake. Undisturbed cores were collected using a Piston Interface Corer (www.aquaticresearch.com/piston_sediment_corer). The locations were representative of the basin conditions and captured spatial variation in sediment chemistry across the probable deepwater internal loading zone of Spring Lake. The coring locations are shown in Figure 1 and the exact site locations (latitude and longitude) are described in Table 1. Two cores were collected at all seven sites. All cores were left undisturbed and delivered to the University of Wisconsin-Stout where one core from each site was sectioned for P-fractionation and the other core from Sites 1-7 was used for the P release rate tests (see section 3).

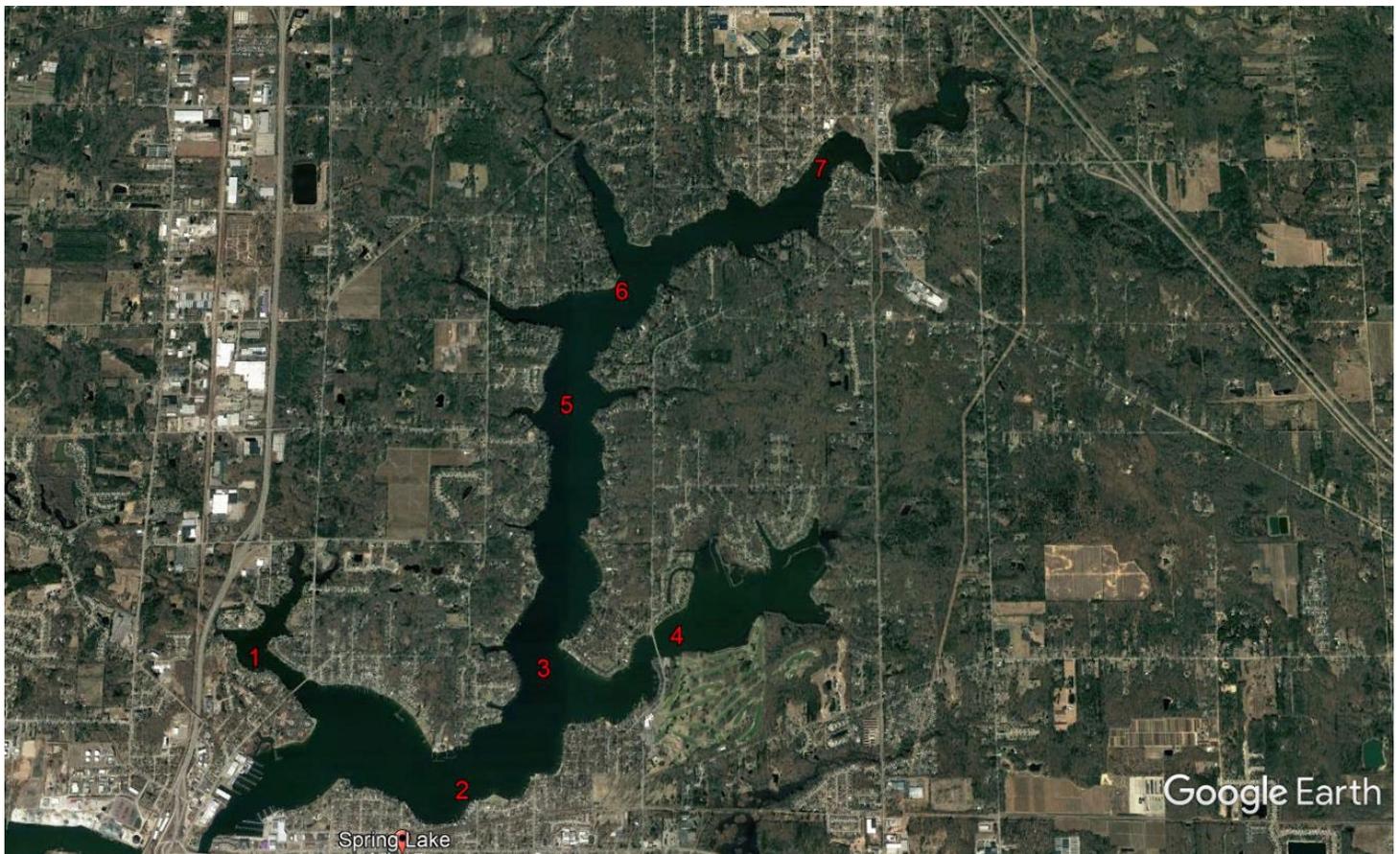


Figure 1. Spring Lake Sediment Coring Locations

Table 1. Description of the coring locations and core characteristics.

Site	Latitude/Longitude	Approx. Water Depth (ft)	Core Length (cm)
1	43°05.312'N/86°12.622'W	15	20+
2	43°04.821'N/86°11.520'W	38	20+
3	43°05.271'N/86°11.112'W	35	20+
4	43°05.394'N/86°10.415'W	12	20+
5	43°06.286'N/86°11.011'W	27	20+
6	43°06.742'N/86°10.719'W	24	20+
7	43°07.246'N/86°09.631'W	10	20+

At the UW-Stout Lab, each of the seven P -fractionation cores (Sites 1-7) were sectioned at 2-5 cm intervals down to 20 cm to determine the thickness of the elevated P layer (i.e. concentrations of P are typically greatest in the upper 4 to 10 cm layer, declining to background concentrations below this depth).

2.2 Laboratory Testing

The coring and subsequent sectioning resulted in 49 sediment samples for P-fractionation. UW-Stout Lab analyzed each sample for the following parameters:

- Percent Water & Percent Solids
- Phosphorus Fractions: Biogenic Phosphorus, Mobile Phosphorus (iron-bound phosphorus plus labile phosphorus), & Aluminum-bound Phosphorus

The labile and iron-bound P fractions are readily mobilized at the sediment-water interface as a result of anaerobic conditions that lead to desorption of P from sediment and diffusion into the overlying water column. The sum of the labile and iron-bound P fraction represents redox-sensitive P (i.e., the P fraction that is active in P release under anaerobic and reducing conditions; redox-P). In addition, biogenic organic P can be converted to soluble P via bacterial mineralization or hydrolysis of bacterial polyphosphates to soluble phosphate under anaerobic conditions. The sum of redox-sensitive P and biogenic P collectively represent the component of sediment P available for internal loading. This fraction is active in recycling pathways that result in exchanges of P from the sediment to the overlying water column and assimilation by algae. In contrast, aluminum-bound P is more chemically inert and subject to burial rather than recycling.

2.3 Results

The sediment phosphorus data are presented in Figure 2 on pages 10-11. The phosphorus fractions generally decreased with core depth until reaching background concentrations at sediment depths of 6 cm.

Redox P in the sediments is high and a large pool of P exists in the Spring Lake sediments that is available to contribute P to the water column via internal loading. The internal loading source of P from the sediments is twofold. The first internal loading source is the redox-sensitive P (sum of the labile and

iron-bound P fraction). This source is controlled by stoichiometric redox chemistry and internally loading from this source generally occurs when the sediments and sediment porewater are anoxic. There is a large amount of redox sensitive P (primarily in the form of iron bound-P) in the Spring Lake sediments and it is an internal loading source of concern.

The second source is biogenic-P. The biogenic-P represents the portion of organic-P that is most readily available for dissolution into the water column and is often controlled by biological activity in the sediments. Biogenic-P in Spring Lake is also high and represents an additional internal loading source of concern.

For Spring Lake, these two sediment sources of P (redox sensitive and biogenic) were added together to determine the amount of P available for internal loading events (i.e. the total sediment pool of available P). The depth integrated average across the seven sites is 6.04 g/m². Spring Lake has an area of 4,415,120 m² (1,091 acres). Therefore, 26,667,325 grams (or 58,791 pounds) of P exists in the sediments and is available for internal loading events (6.04 x 4,415,120).

3 Determination of Sediment Phosphorus Release Rates

3.1 Sediment Core Collection Methods

See section 2.1.

3.2 Laboratory Testing

Upon arrival at the University of Wisconsin-Stout laboratory, cores were drained of overlying water and the upper 10 cm of sediment was transferred intact to a smaller acrylic core liner using a core remover tool. Surface water collected from the lake was filtered through a glass fiber filter (Gelman A-E) and 300 mL was then siphoned onto the sediment contained in the small acrylic core liner without causing sediment resuspension. Sediment incubation systems consisted of the upper 10-cm of sediment and filtered overlying water contained in acrylic core liners that were sealed with rubber stoppers. They were placed in a darkened environmental chamber and incubated at a constant temperature (20 °C). The oxidation-reduction environment in the overlying water was controlled by gently bubbling nitrogen (anaerobic conditions for cores collected at sites 2, 3, 5 & 6) or air (aerobic conditions for cores collected at sites 1, 4 & 7) through an air stone placed just above the sediment surface in each system. Bubbling action insured complete mixing of the water column but did not disrupt the sediment.

Water samples for soluble reactive P were collected from the center of each system using an acid-washed syringe and filtered through a 0.45 µm membrane syringe filter. The water volume removed from each system during sampling was replaced by addition of filtered lake water preadjusted to the proper oxidation-reduction condition. These volumes were accurately measured for determination of dilution effects. Soluble reactive P was measured colorimetrically and the rates of P release from the sediment (mg/m² d) were calculated as the linear change in mass in the overlying water divided by time (days) and the area (m²) of the incubation core liner. Regression analysis was used to estimate rates over the linear portion of the data.

3.3 Results

P mass and concentration increased approximately linearly in the overlying water column of sites 2, 3, 5 & 6 sediment systems maintained under anaerobic conditions. The mean rate of P release under anaerobic conditions was very high at 9.42 mg/m² d and indicative of eutrophic conditions.

Although P accumulation in the overlying water column was much less under aerobic conditions for sites 1, 4 & 7, substantial P diffusion from sediment nevertheless occurred. A relatively high mean rate of P release of 0.98 mg/m² d was measured and, thus, represented an important internal source of P loading to Spring Lake.

Typically, rates of P release are higher under anaerobic versus aerobic conditions, due to binding of P onto iron-oxyhydroxides (Fe[~](OOH)) in the sediment oxidized microzone under the latter condition and suppression of diffusive flux into the overlying water column. Indeed, diffusional P flux from sediment can be negligible under aerobic conditions when Fe concentrations are sufficiently high in relation to P. In contrast, Spring Lake sediments appeared to act as a significant net P source even under aerobic conditions, a finding that was included in estimating annual sediment P release.

4 Interpretation of Results

4.1 Mass of Available Phosphorus in Basin Sediments

The sum of the two primary sediment sources of P (redox sensitive and biogenic) determined the amount of P available for internal loading events in Spring Lake (i.e. the total sediment pool of available P). The depth integrated average across the seven sites is 6.04 g/m². Spring Lake has an area of 4,415,120 m² (1,091 acres). Therefore, 26,667,325 grams (or 58,791 pounds) of P exists in the sediments and is available for internal loading events (6.04 x 4,415,120).

4.2 Release of Sediment Phosphorus

- 1) It was assumed that Spring Lake deep sediments (>15 ft) are anaerobic for 91 days/year in the summer months (June 1 – August 31). Annual anoxic P loading to Spring Lake was estimated by multiplying average anoxic release rate measured in the laboratory study (9.42 mg/m² d) by the area of the lake sediments that go anoxic (60% of total area = 2,630,457 m²) by the assumed days of anoxia (91 d). This yields an estimate of 2,255 kilograms (4,971 pounds) for annual anoxic deep sediment release.
- 2) It was assumed that Spring Lake deep sediments (>15 ft) are aerobic for the remaining 274 days/year (September 1 – May 31). Annual deep sediment oxic P loading was determined by multiplying estimated oxic release rate (0.98 mg/m² d) by the area of the basin greater than 15 ft (2,630,457 m²) by the assumed days of aerobic sediments (274 d). This yields an estimate of 706 kilograms (1,556 pounds) for annual deep sediment oxic release.
- 3) It was assumed that Spring Lake shallow sediments (<15 ft) are aerobic for 274 days/year during September 1 – May 31. Annual shallow sediment oxic P loading during this period was determined by multiplying estimated oxic release rate (0.98 mg/m² d) by the area of the basin

less than 15 ft (1,784,664 m²) by the assumed days of aerobic sediments (274 d). This yields an estimate of 479 kilograms (1,056 pounds) for annual shallow sediment oxic release during September 1 – May 31.

- 4) It was assumed that Spring Lake shallow sediments (<15 ft) are aerobic for 91 days/year during June 1 – August 31. Annual shallow sediment oxic P loading during this period was determined by multiplying estimated oxic release rate (0.98 mg/m² d) by the area of the basin less than 15 ft (1,784,664 m²) by the assumed days of aerobic sediments (91 d). This yields an estimate of 159 kilograms (351 pounds) for annual shallow sediment oxic release during June 1 – August 31.
- 5) Total annual sediment P release was estimated by the sum of the anoxic and oxic release rates calculated above. This result is 3,599 kilograms (7,934 pounds). During the summertime 91-d anoxic period, the total summer sediment P release is estimated to be 5,322 pounds (~67% of the annual total internal load).

4.3 External vs. Internal Phosphorus Loading

Lake management requires a comprehensive approach that first identifies the source(s) for the problem and then designs effective solutions for each source. Algae contribute to water quality issues at Spring Lake and the amount of algae is dependent on the amount of P available to fuel growth. Algae obtain P from a combination of external sources and internal sources.

4.3.1 External Loading

Steinman, S., M. Hassett and M. Oudsema 2018. Spring Lake Phosphorus Monitoring 2017-2018: External Loading and Spring Lake Microcystin Study estimate an annual external P load of 7,773 lb/yr.

4.3.2 Internal Loading

This study finds that there is a significant, uncontrolled internal load from Spring Lake sediments. The pool of available sediment P likely resulted from naturally occurring background concentrations and previous P deposition. It has likely increased with time (i.e. legacy P) and now appears to serve as an important source of P to the lake and the algae. If unaddressed, the benefits external P load control efforts will be compromised by the high internal loading. Thus, we are recommending a comprehensive P management plan that includes continued efforts to control external P loads, combined with novel internal load control strategies.

4.3.3 Annual P Budget

External and internal P loads were considered to construct a simple annual P budget for Spring Lake.

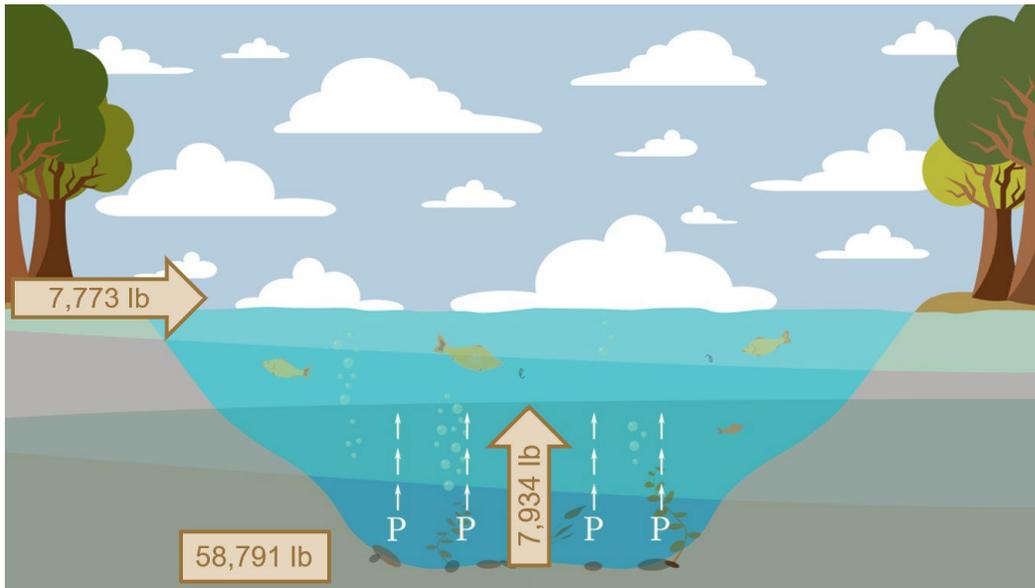


Figure 3. Spring Lake Annual P Budget

For the annual budget (Figure 3):

- 7,773 pounds of P enter Spring Lake from external sources
- The pool of sediment P is 58,791 pounds
- The internal P load is 7,934 pounds
- Internal P accounts for 50.5% of the total annual P load to the water column
- The relative contribution of internal P is presumably much higher during the summer growing season when external load is reduced (lower precipitation) and internal loading is at a maximum rate (anoxic conditions).

5 Internal Load Control Recommendations – Sediment P Inactivation

5.1 Overview

Testing has shown that a large pool of iron-bound P exists in Spring Lake. The iron to P chemical bond is unstable and breaks under the reducing conditions of anoxia. This is evident in the high P release rates found in lab study under anoxic conditions. In addition, iron can also release P under certain oxic conditions (typically at a lower rate). We recommend “inactivating” this iron bound P by the addition of aluminum to the sediments. P will preferentially bind to Al and, unlike the iron to P bond, the Al to P bond is very stable. Thus, P remains bound to the Al under both anoxic and oxic conditions. The Al addition effectively keeps the P in the sediments and also provides unfilled binding sites that intercept future P releases from both the redox sensitive and biogenic sediment P fractions.

We recommend applying aluminum sulfate combined with sodium aluminate (to buffer pH) using specialized equipment and a barge that ensure the precise placement of the material in Spring Lake. Upon mixing with the lake water, precipitate (floc) is formed and has active sites for P to bind. The resulting compound is insoluble in water and the bound phosphorus can no longer be used to fuel the algae. As the floc settles, phosphorus and particles are removed from the water column leaving the lake noticeably clearer. The floc then forms a thin layer on the bottom that binds the phosphorus as it leaches out of the bottom sediments during internal loading events. The floc layer keeps the phosphorus from entering the overlying water and makes it unavailable to the algae.

5.2 Aluminum Dose, Application Strategy & Estimated Costs

SLM specifically recommends:

- Lakebed sediments in areas greater than 15 ft in depth are experiencing summer anoxia and contribute P internally to the overlying water column. This area is 650-ac in size.
- Our study found that sediments in this 650-ac zone need to be supplemented with 102 g Al/m² via buffered alum application to inactivate available sediment P and reduce internal P release.
- One option would be to apply the total dose in one application in the spring of 2023.
 - This would require 526,448 gallons of alum and 263,224 gallons of sodium aluminate.
 - Cost estimate for this strategy is \$3,330,000
- The second strategy would be to split the total dose evenly into two separate applications. The first application would occur in the spring of 2023 and the second application in the spring of 2024.
 - Each application would require 263,224 gallons of alum and 131,612 gallons of sodium aluminate.
 - Cost estimate for Application 1 (2023) = \$1,685,000
 - Cost estimate for Application 2 (2024) = \$1,740,000
- Cost estimates are based on projected future chemical costs. Both estimates are lump sum and include all contractor costs associated with applying the alum and sodium aluminate (chemicals, delivery, labor, taxes, mobilization, demobilization, incidentals, etc.). Note that these are estimates, not quotes from SLM.

5.3 Project Specification Considerations

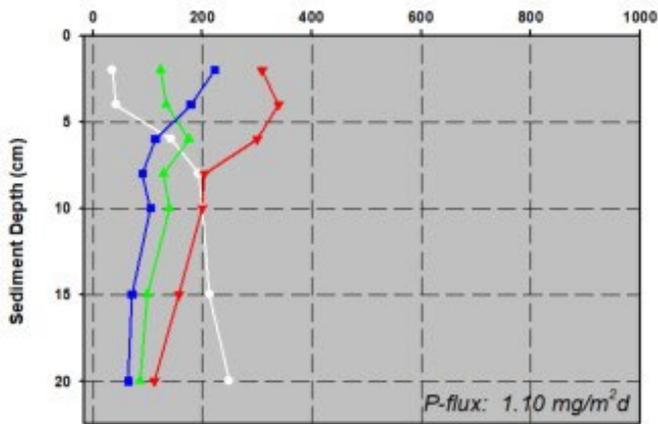
Many states have expanded the permit requirements for alum applications. While these requirements are not a restriction for the use of alum, they do require a greater level of performance and requirements from the contractor. Although SLM feels that high expectation from the contractor have always been important, we are now making even stronger project specification recommendations. In addition to standard alum project specifications (available upon request) we endorse the following requirements.

- Project Experience/Recommendations with large-scale alum applications and experience with the permitting and reporting processes.

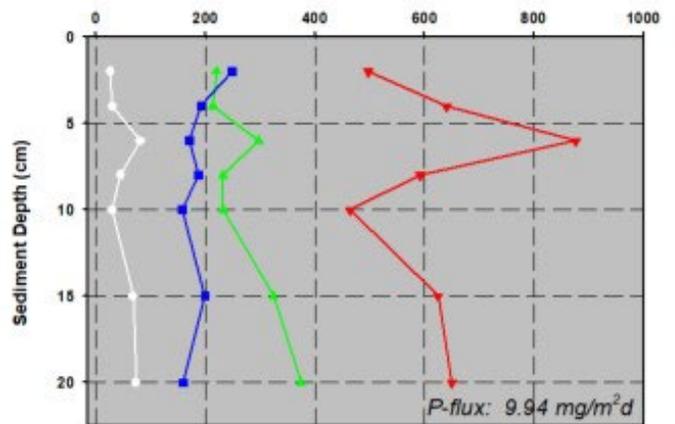
- The contractor must have conducted whole-lake alum treatments in a minimum of three lakes that are 500 surface acres or more in size, within the last five years. Chemical application experience on these projects should include application of alum and sodium aluminate as nutrient inactivants. Provide brief project descriptions and client contact information for a minimum of three, but not more than five, such projects. Detail contractor experience with current state alum permitting process.
- Strict insurance requirements, including pollution liability insurance (example specifications available upon request).
- Responsible bidder form. The form asks for experience on similar projects, references, etc. Requires contractor to sign verifying that they are qualified/meet the qualifications. Provides a definition of a responsible bidder (example specifications available upon request).
- Project supervision. Contractor provides a skilled and experienced superintendent who will be onsite during the application and will not have multiple project responsibilities at the same time (example specifications available upon request).
- Project duration. Limit on the number of days the contractor has to complete the project. The estimated duration limit for each Spring Lake application is 24 days (example specifications available upon request).
- Safety. Recommend requiring an OSHA compliant contractor (example specifications available upon request).
- Ability to calculate jar test doses, conduct jar testing, collect hourly pH measurements in the alum application zone throughout the project, evaluate wind speed and direction effects on the application process.

6 Figure 2: Sediment P-Fraction Profiles for the Seven Spring Lake Cores

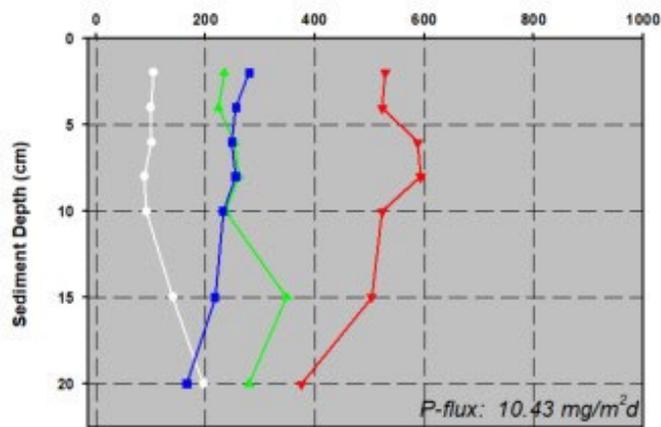
Site 1 (Z ~ 15 ft)
Phosphorus (mg/kg DW)



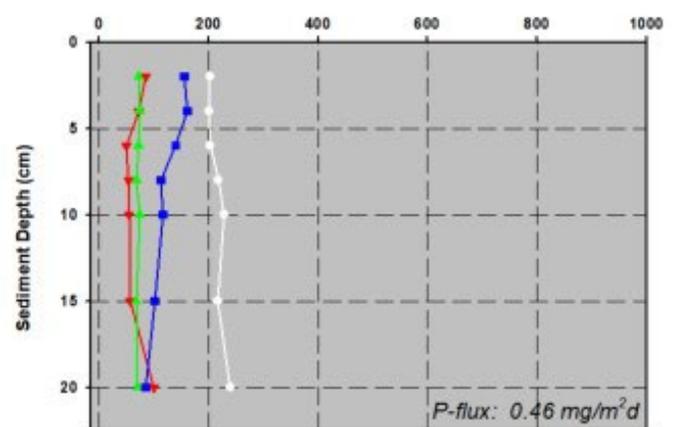
Site 2 (Z ~ 38 ft)
Phosphorus (mg/kg DW)



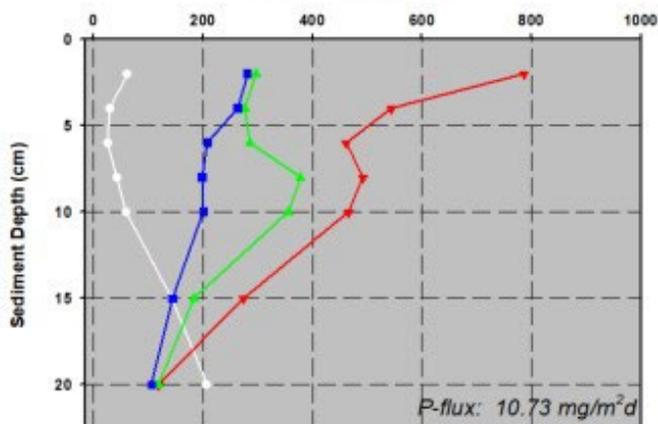
Site 3 (Z ~ 35 ft)
Phosphorus (mg/kg DW)



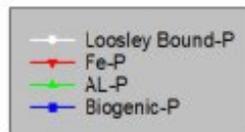
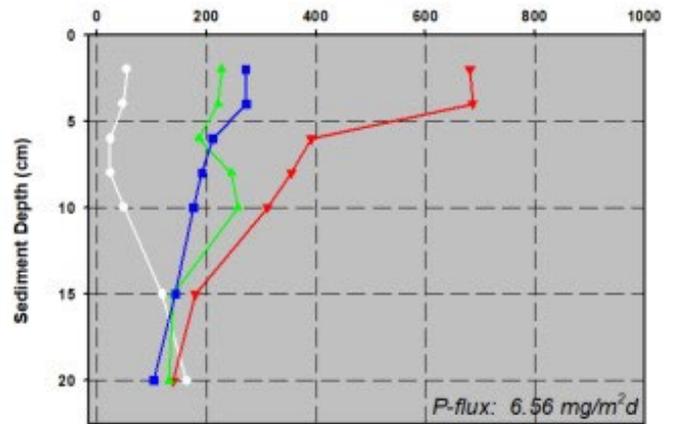
Site 4 (Z ~ 12 ft)
Phosphorus (mg/kg DW)



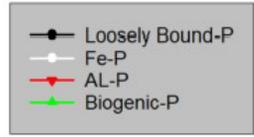
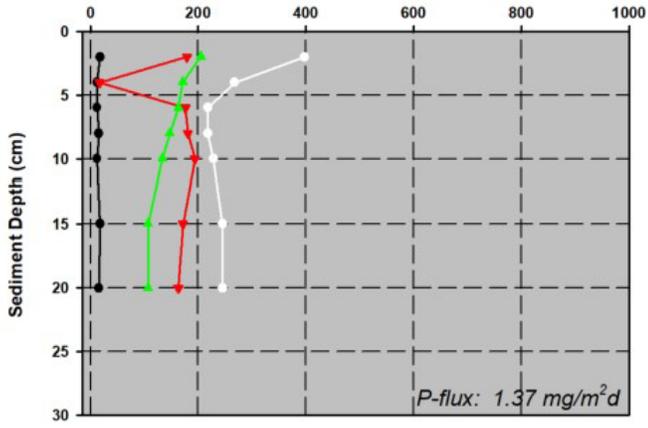
Site 5 (Z ~ 27 ft)
Phosphorus (mg/kg DW)



Site 6 (Z ~ 24 ft)
Phosphorus (mg/kg DW)



Site 7 (Z ~ 10 ft)
Phosphorus (mg/kg DW)



7 Appendix A. P-Fractionation & P-Flux Lab Results

Date	Lake	Station	Section		Depth	Moisture Content (%)	Wet Bulk Density (g/cm ³)	Dry Bulk Density (g/cm ³)	Organic Matter (%)	Loose-P (mg/g)	Fe-P (mg/g)	LOP (mg/g)	Al-P (mg/g)	Redox-P (mg/g)	Bio-labile P (mg/g)
7/22/2022	Spring	1	0	2	-1	88.8	1.059	0.120	19.3	0.035	0.309	0.222	0.124	0.344	0.566
7/22/2022	Spring	1	2	4	-3	86.3	1.075	0.150	17.5	0.042	0.339	0.179	0.134	0.381	0.560
7/22/2022	Spring	1	4	6	-5	82.0	1.103	0.202	15.7	0.143	0.300	0.114	0.175	0.443	0.557
7/22/2022	Spring	1	6	8	-7	80.0	1.116	0.227	15.2	0.193	0.204	0.090	0.129	0.397	0.487
7/22/2022	Spring	1	8	10	-9	79.1	1.122	0.239	15.3	0.200	0.200	0.105	0.139	0.400	0.505
7/22/2022	Spring	1	10	15	-12.5	77.4	1.133	0.262	15.6	0.213	0.157	0.071	0.099	0.370	0.441
7/22/2022	Spring	1	15	20	-17.5	75.5	1.147	0.287	15.1	0.249	0.112	0.064	0.086	0.361	0.425
7/22/2022	Spring	2	0	2	-1	90.5	1.051	0.101	16.6	0.026	0.497	0.248	0.220	0.523	0.771
7/22/2022	Spring	2	2	4	-3	89.0	1.061	0.118	14.8	0.030	0.640	0.191	0.213	0.670	0.861
7/22/2022	Spring	2	4	6	-5	86.6	1.077	0.146	13.9	0.081	0.876	0.170	0.297	0.957	1.127
7/22/2022	Spring	2	6	8	-7	85.9	1.081	0.154	13.7	0.044	0.592	0.187	0.232	0.636	0.823
7/22/2022	Spring	2	8	10	-9	85.6	1.084	0.158	12.8	0.030	0.464	0.157	0.222	0.494	0.651
7/22/2022	Spring	2	10	15	-12.5	84.1	1.094	0.176	12.1	0.068	0.625	0.199	0.324	0.693	0.892
7/22/2022	Spring	2	15	20	-17.5	82.7	1.103	0.194	12.3	0.073	0.650	0.159	0.374	0.723	0.882
7/22/2022	Spring	3	0	2	-1	92.1	1.041	0.083	18.1	0.105	0.529	0.280	0.234	0.634	0.914
7/22/2022	Spring	3	2	4	-3	91.4	1.046	0.090	16.7	0.100	0.523	0.256	0.224	0.623	0.879
7/22/2022	Spring	3	4	6	-5	91.0	1.048	0.095	17.2	0.101	0.588	0.248	0.253	0.689	0.937
7/22/2022	Spring	3	6	8	-7	89.9	1.055	0.107	16.1	0.088	0.593	0.255	0.261	0.681	0.936
7/22/2022	Spring	3	8	10	-9	89.0	1.060	0.118	15.8	0.092	0.523	0.232	0.237	0.615	0.847
7/22/2022	Spring	3	10	15	-12.5	86.7	1.075	0.144	14.4	0.140	0.503	0.217	0.348	0.643	0.860
7/22/2022	Spring	3	15	20	-17.5	84.6	1.089	0.169	13.8	0.196	0.375	0.166	0.279	0.571	0.737
7/22/2022	Spring	4	0	2	-1	86.1	1.075	0.151	18.7	0.203	0.092	0.156	0.073	0.295	0.451
7/22/2022	Spring	4	2	4	-3	85.0	1.081	0.165	18.7	0.201	0.085	0.161	0.074	0.286	0.447
7/22/2022	Spring	4	4	6	-5	84.3	1.085	0.173	18.6	0.204	0.072	0.140	0.072	0.276	0.416
7/22/2022	Spring	4	6	8	-7	82.7	1.094	0.193	18.9	0.218	0.050	0.113	0.069	0.268	0.381
7/22/2022	Spring	4	8	10	-9	82.8	1.094	0.192	18.9	0.229	0.054	0.117	0.075	0.283	0.400
7/22/2022	Spring	4	10	15	-12.5	80.7	1.107	0.217	18.1	0.217	0.055	0.102	0.068	0.272	0.374
7/22/2022	Spring	4	15	20	-17.5	78.5	1.123	0.247	17.4	0.240	0.057	0.085	0.071	0.297	0.382

7/22/2022	Spring	5	0	2	-1	92.0	1.041	0.084	20.4	0.062	0.786	0.281	0.297	0.848	1.129
7/22/2022	Spring	5	2	4	-3	89.9	1.053	0.107	19.0	0.030	0.544	0.263	0.277	0.574	0.837
7/22/2022	Spring	5	4	6	-5	88.8	1.060	0.120	18.0	0.026	0.461	0.208	0.286	0.487	0.695
7/22/2022	Spring	5	6	8	-7	87.6	1.068	0.134	17.0	0.043	0.492	0.198	0.378	0.535	0.733
7/22/2022	Spring	5	8	10	-9	86.9	1.073	0.143	16.4	0.059	0.466	0.201	0.356	0.525	0.726
7/22/2022	Spring	5	10	15	-12.5	85.8	1.079	0.156	16.2	0.143	0.274	0.144	0.184	0.417	0.561
7/22/2022	Spring	5	15	20	-17.5	81.7	1.092	0.205	25.1	0.207	0.119	0.106	0.118	0.326	0.432
7/22/2022	Spring	6	0	2	-1	88.9	1.059	0.119	19.4	0.055	0.681	0.271	0.227	0.736	1.007
7/22/2022	Spring	6	2	4	-3	87.6	1.067	0.134	18.0	0.047	0.686	0.272	0.221	0.733	1.005
7/22/2022	Spring	6	4	6	-5	86.7	1.072	0.144	18.0	0.024	0.391	0.211	0.185	0.415	0.626
7/22/2022	Spring	6	6	8	-7	85.4	1.081	0.160	17.1	0.024	0.355	0.191	0.245	0.379	0.570
7/22/2022	Spring	6	8	10	-9	84.4	1.086	0.171	16.9	0.049	0.311	0.176	0.257	0.360	0.536
7/22/2022	Spring	6	10	15	-12.5	82.4	1.099	0.196	16.6	0.119	0.179	0.143	0.139	0.298	0.441
7/22/2022	Spring	6	15	20	-17.5	81.1	1.109	0.213	15.8	0.163	0.139	0.103	0.132	0.302	0.405
7/22/2022	Spring	7	0	2	-1	85.6	1.075	0.158	20.9	0.018	0.398	0.205	0.179	0.416	0.621
7/22/2022	Spring	7	2	4	-3	84.3	1.081	0.173	22.0	0.012	0.268	0.171	0.170	0.280	0.451
7/22/2022	Spring	7	4	6	-5	83.6	1.084	0.181	23.4	0.012	0.218	0.163	0.176	0.230	0.393
7/22/2022	Spring	7	6	8	-7	81.9	1.094	0.203	22.7	0.016	0.218	0.147	0.181	0.234	0.381
7/22/2022	Spring	7	8	10	-9	81.9	1.095	0.202	21.7	0.012	0.228	0.133	0.194	0.240	0.373
7/22/2022	Spring	7	10	15	-12.5	78.8	1.117	0.242	19.9	0.018	0.245	0.107	0.172	0.263	0.370
7/22/2022	Spring	7	15	20	-17.5	78.1	1.120	0.252	20.3	0.016	0.245	0.107	0.163	0.261	0.368