STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JANET T. MILLS
GOVERNOR

MELANIE LOYZIM
COMMISSIONER

May 5, 2022

Ms. Deb Hiney, President, Long Pond Association
21 Lloyd Watson Road
Parsonsfield, ME. 04047
debhiney@gmail.com

Mr. Rich Brereton, FB Environmental Associates
97A Exchange St., Suite 305
Portland, ME. 04101
richb@fbenvironmental.com

Sent via electronic mail
Delivery confirmation requested

RE: *Maine Pollutant Discharge Elimination System (MEPDES) Permit #ME0002836*
Maine Waste Discharge License (WDL) Application #W009245-5U-A-N
Long Pond Alum Treatment Proposed Draft MEPDES Permit *NEW*

Dear Ms. Hiney and Mr. Brereton,

Attached is a proposed draft MEPDES permit and Maine WDL which the Department proposes to issue for your discharge as a final document after opportunity for your review and comment. By transmittal of this letter, you are provided with an opportunity to comment on the proposed draft permit and its special and standard conditions. If it contains errors or does not accurately reflect present or proposed conditions, please respond to this Department so that changes can be considered.

By copy of this letter, the Department is requesting comments on the proposed draft permit from various state and federal agencies and from any other parties who have notified the Department of their interest in this matter.

The comment period begins on May 5, 2022 and ends on Monday June 6, 2022. All comments on the proposed draft permit must be received in the Department of Environmental Protection office on or before the close of business Monday, June 6, 2022. Failure to submit comments in a timely fashion will result in the proposed draft/license permit document being issued as drafted.

Comments in writing should be submitted to my attention at the following address:

Maine Department of Environmental Protection
Bureau of Water Quality
Division of Water Quality Management
17 State House Station
Augusta, ME 04333-0017
Cindy.L.Dionne@maine.gov

If you have any questions regarding the matter, please feel free to contact me.

Sincerely,

Cindy L. Dionne
Division of Water Quality Management
Bureau of Water Quality
ph: 207-446-3820

Enc.

ec: Linda Bacon, DEP
Pamela Parker, DEP
Stuart Rose, DEP
Lori Mitchell, DEP
Jim Pellerin, IFW
Shawn Mahaney, ACOE
Sean Mahoney, CLF
Environmental Review, DMR
Alex Rosenberg, USEPA
Nathian Chien, USEPA
Richard Carvalho, USEPA
Kirk F. Mohney, MHPC
Anna Harris, USFWS

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
17 STATE HOUSE STATION AUGUSTA, MAINE 04333-0017

DEPARTMENT ORDER

IN THE MATTER OF

LONG POND ASSOCIATION	)	MAINE POLLUTANT DISCHARGE
PARSONSFIELD, YORK COUNTY, MAINE	)	ELIMINATION SYSTEM PERMIT
CHEMICAL TREATMENT DISCHARGE	)	AND
ME0002836	)	WASTE DISCHARGE LICENSE
W009245-5U-A-N **APPROVAL**	)	**NEW**

In compliance with the applicable provisions of *Pollution Control*, 38 M.R.S. §§ 411 – 424-B, *Water Classification Program*, 38 M.R.S. §§ 464 – 470 and *Federal Water Pollution Control Act*, Title 33 U.S.C. § 1251, and applicable rules of the Department of Environmental Protection (Department), the Department has considered the application of LONG POND ASSOCIATION (permittee), with its supportive data, agency review comments, and other related materials on file and FINDS THE FOLLOWING FACTS:

APPLICATION SUMMARY

The permittee has submitted an application to the Department for a new combination Maine Pollutant Discharge Elimination System (MEPDES) permit /Maine Waste Discharge License (WDL). The Department has assigned a permit number of ME0002836/WDL W009245-5U-A-N. The permittee has applied for authorization to discharge aluminum sulfate (alum) and/or sodium aluminate to Long Pond in Parsonsfield, Maine, Class GPA, to control the growth of algae in the pond by inactivating iron-bound phosphorus in surficial sediments.

PERMIT SUMMARY

This permit requires the permittee to comply with technology based and water quality-based limitations, conduct visual and ambient water quality monitoring, recordkeeping and submit a report to the Department following each application or series of applications.

CONCLUSIONS

Based on the findings in the attached Fact Sheet, May 5, 2022, and subject to the terms and conditions of this permit, the Department makes the following **CONCLUSIONS**:

1. The discharge, either by itself or in combination with other discharges, will not lower the quality of any classified body of water below such classification.

2. The discharge, either by itself or in combination with other discharges, will not lower the quality of any unclassified body of water below the classification which the Department expects to adopt in accordance with state law.

3. The provisions of the State's antidegradation policy, *Classification of Maine Waters*, 38 M.R.S. § 464(4)(F), will be met, in that:

   (a) Existing in-stream water uses and the level of water quality necessary to protect and maintain those existing uses will be maintained and protected;

   (b) Where high quality waters of the State constitute an outstanding natural resource, that water quality will be maintained and protected;

   (c) Where the standards of classification of the receiving water body are not met, the discharge will not cause or contribute to the failure of the water body to meet the standards of classification;

   (d) Where the actual quality of any classified receiving water body exceeds the minimum standards of the next highest classification that higher water quality will be maintained and protected; and

   (e) Where a discharge will result in lowering the existing water quality of any water body, the Department has made the finding, following opportunity for public participation, that this action is necessary to achieve important economic or social benefits to the State.

4. The discharge will be subject to effluent limitations that require application of best practicable treatment as defined in 38 M.R.S. § 414-A(1)(D).

ACTION

Based on the findings and conclusions as stated above, the Department APPROVES the application of LONG POND ASSOCIATION to discharge aluminum sulfate (alum) and/or sodium aluminate to Long Pond in Parsonsfield, Maine, Class GPA, to control algal growth, SUBJECT TO THE ATTACHED CONDITIONS, including:

1. "*Maine Pollutant Discharge Elimination System Permit Standard Conditions Applicable To All Permits*," revised July 1, 2002, copy attached.

2. The attached Special Conditions, including any effluent limitations and monitoring requirements.

3. This permit becomes effective upon the date of signature below and expires five (5) years after that date. If a renewal application is timely submitted and accepted as complete for processing prior to the expiration of this permit, the terms and conditions of this permit and all subsequent modifications and minor revisions thereto remain in effect until a final Department decision on the renewal application becomes effective. [*Maine Administrative Procedure Act*, 5 M.R.S. § 10002 and *Rules Concerning the Processing of Applications and Other Administrative Matters*, 06-096 CMR 2(21)(A) (last amended June 9, 2018)]

DONE AND DATED AT AUGUSTA, MAINE, THIS _______DAY OF________________, 2022.

COMMISSIONER OF ENVIRONMENTAL PROTECTION

BY:____

For Melanie Loyzim, Commissioner

PLEASE NOTE ATTACHED SHEET FOR GUIDANCE ON APPEAL PROCEDURES

Date of initial receipt of application ___________April 22, 2022___ ______.

Date of application acceptance _______________April 29, 2022_________.

Date filed with Board of Environmental Protection

This Order prepared by Cindy Dionne, BUREAU OF WATER QUALITY

SPECIAL CONDITIONS

A. NARRATIVE EFFLUENT LIMITATIONS

1. The permittee must not discharge effluent that contains a visible oil sheen, foam or floating solids at any time which would impair the uses designated by the classification of the receiving waters.

2. The permittee must not discharge effluent that contains materials in concentrations or combinations which are hazardous or toxic to aquatic life, or which would impair the uses designated by the classification of the receiving waters.

3. The permittee must not discharge effluent that imparts color, taste, turbidity, toxicity, radioactivity or other properties which cause those waters to be unsafe for the designated uses and characteristics ascribed to their classification.

4. The permittee must not discharge effluent that lowers the quality of any classified body of water below such classification or lower the existing quality of any body of water if the existing quality is higher than the classification.

B. AUTHORIZED DISCHARGES

The permittee is authorized to discharge only in accordance with: 1) the permittee's General Application for Waste Discharge License (WDL)/Maine Pollutant Discharge Elimination System (MEPDES) permit, accepted for processing on April 29, 2022; and 2) the terms and conditions of this permit. Discharges of wastewater to a surface waterbody from any other point source are not authorized under this permit and must be reported in accordance with Standard Condition D(1)(f), *Twenty-four hour reporting*, of this permit.

C. NOTIFICATION REQUIREMENTS

At least three (3) days prior to the commencement of a discharge, the permittee is required to notify the Department's compliance inspector and the Department's Lake Assessment Section Leader to inform them of the discharge event(s). In accordance with Standard Condition D, the permittee must notify the Department of any substantial change (realized or anticipated) in the volume or character of pollutants being introduced into the receiving waters.

D. OPERATORS RESPONSIBLITIES

1. **Operator –** For the purpose of this permit, means any entity associated with the application of chemicals which results in a discharge to Long Pond that meets either of the following two criteria:

   (a) **Applicator –** For the purpose of this permit is defined as any entity who performs the application of chemicals or who has day-to-day control of the application (i.e., they are authorized to direct workers to carry out those activities); or

SPECIAL CONDITIONS

D. OPERATORS RESPONSIBLITIES (cont'd)

(b) Decision maker – For the purpose of this permit is defined as any entity with control over the decision to perform chemical applications including the ability to modify those decisions.

Operators must comply with all applicable statutes, regulations and other requirements including, but not limited to requirements contained in the labeling of the chemical products. If Operators are found to have applied a chemical in a manner inconsistent with any relevant water-quality related labeling requirements or the Chemical Discharge Management Plan (CDMP) required by Special Condition G of this permit, the Department will presume that the effluent limitation to minimize chemicals entering the waters of the State has been violated under the MEPDES permit. The Department considers many provisions of chemical labeling such as those relating to application sites, rates, frequency, and methods, as well as provisions concerning proper storage and disposal of chemical wastes and containers to be requirements that are necessary to protect water quality.

2. Applicator Responsibilities

a. To meet the effluent limitations of this permit, all Applicators must implement the following conditions to minimize the discharge of chemicals to Long Pond through the use of Chemical Management Measures (CMMs). For the purposes of this permit, CMMs are defined as any practice used to meet the effluent limitations that comply with manufacturer specifications, industry standards and recommended industry practices related to the application, relevant legal requirements and other provisions that a prudent Operator would implement to reduce and/or eliminate chemical discharges to Long Pond.

b. Use only the amount of chemical and frequency of chemical application necessary to control the target nutrient (in this case phosphorus to control algae), using equipment and application procedures appropriate for this task.

c. Maintain application equipment in proper operating condition, including requirement to calibrate, clean, and repair such equipment and prevent leaks, spills, or other unintended discharges.

d. Assess weather conditions (e.g. temperature, precipitation and wind speed) in the treatment area to ensure application is consistent with all applicable requirements.

SPECIAL CONDITIONS

D. OPERATORS RESPONSIBLITIES (cont'd)

3. **Decision Makers Responsibilities**

a. General

1. To meet the effluent limitations in this permit, all Decision-makers must minimize the discharge of chemicals to Long Pond through the use of CMMs.

2. To the extent the Decision-maker determines the amount of chemical or frequency of the application, the Decision-maker must use only the amount of chemical and frequency of chemical application necessary to control the target nutrient.

b. Identify the Problem

1. Identify areas with nutrient problems and characterize the extent of the problems, including, for example, water use goals not attained (e.g. human health, fisheries, recreation);

2. Identify target nutrient(s);

3. Identify possible factors causing or contributing to the nutrient problem;

4. Establish any nutrient and site-specific action threshold(s). Action threshold is defined as the point at which environmental conditions necessitate that chemical control action be taken based on economic, human health, aesthetic, or other effects. An action threshold may be based on current and/or past environmental factors that are or have been demonstrated to be conducive to emergence and/or growth of algae, as well as past and/or current algal presence. Action thresholds are those conditions that indicate both the need for control actions and the proper timing of such actions.

SPECIAL CONDITIONS

D. OPERATORS RESPONSIBLITIES (cont'd)

c. Chemical Management Options. Prior to the first chemical application that will result in a discharge to Long Pond, the Decision Maker must select and implement efficient and effective means of CMMs that minimize discharges resulting from the application of chemicals to control algae by way of sequestering internal phosphorus in the ponds' sediment. In developing the CMM for each chemical management area, the Decision-maker must evaluate the following management options, including a combination of these management options, considering impact to water quality, impact to non-target organisms, feasibility, and cost effectiveness:

1. No action
2. Prevention
3. Mechanical or physical methods
4. Cultural methods
5. Biological control agents
6. Chemical addition

d. Chemical Use. If a chemical addition to the pond is selected to manage internal recycling of phosphorus to control algae growth, the Decision-maker must:

1. Conduct surveillance in an area that is representative of the nutrient problem prior to each chemical application to assess the chemical management area and characterize pretreatment conditions; and

2. Reduce the impact on the environment and non-target organisms by applying the chemical only at a dosage rate that minimizes effects to non-target organisms while remaining effective for target species.

E. WATER QUALITY-BASED EFFLUENT LIMITATIONS

All Operators must control discharges as necessary to meet applicable numeric and narrative state water quality standards for any discharges authorized under this permit, with compliance required upon beginning such discharge.

If at any time an Operator becomes aware (e.g., through self-monitoring or by notification from the state or third party), or the State determines that the Operator's discharge causes or contributes to an excursion of any applicable water quality standard, the Operator must take appropriate corrective action(s) up to and including the ceasing of the discharge, if necessary.

SPECIAL CONDITIONS

F. MONITORING

a. **Visual Monitoring Requirements for Applicators** - During any chemical application with discharges authorized under this permit, all Applicators must, when considerations for safety and feasibility allow, visually assess the area to and around where chemicals were applied for possible and observable adverse incidents (defined in Special Condition G(4)(b) of this permit) caused by application of chemical, including the unanticipated death or distress of non-target organisms and disruption of wildlife habitat, recreational or municipal water use.

b. **Visual Monitoring Requirements for all Operators** - During any Operator post-application surveillance of any chemical application with discharges authorized under this permit, all Operators must visually assess the area to and around where chemicals were applied for possible and observable adverse incidents caused by application of chemicals, including the unanticipated death or distress of non-target organisms and disruption of wildlife habitat, recreational or municipal water use.

See Special Condition H, *Recordkeeping And Reporting*, (10) of this permit for recordkeeping requirements.

G. CHEMICAL DISCHARGE MANAGEMENT PLAN (CDMP)

Prior to the application of a chemical, the Decision maker must prepare a CDMP and submit it to the Department for review and comment.

The CDMP does not contain effluent limitations; the effluent limitations are specified in Special Conditions A, D and E of this permit. The CDMP documents how Decision-makers will implement the effluent limitations in Special Conditions A, D and E of this permit, including the evaluation and selection of CMMs to meet those effluent limitations in order to minimize discharges. In the CDMP, Decision-makers may incorporate by reference any procedures or plans in other documents that meet the requirements of this permit. If Decision-makers rely upon other documents to comply with the effluent limitations in this permit, such as a pre-existing chemical management plan, the Decision-maker must attach to the CDMP a copy of any portions of any documents that are used to document the implementation of the effluent limitations.

a. **Contents of the Chemical Discharge Management Plan.** The CDMP must include the following elements:
   1. **Chemical Discharge Management Team** - Decision-makers must identify all the persons (by name and contact information) that compose the team as well as each person's individual responsibilities, including:
      a. Person(s) responsible for managing chemicals in relation to the chemical management area.
      b. Person(s) responsible for developing and revising the CDMP; and
      c. Person(s) responsible for developing, revising, and implementing corrective actions and other effluent limitation requirements;

SPECIAL CONDITIONS

G. CHEMICAL DISCHARGE MANAGEMENT PLAN (cont'd)

2. **Problem Identification** - Decision-makers must document the following:

   a. **Nutrient problem description**. Document a description of the nutrient problem at the chemical management area, including identification of the target nutrients, source(s) of the nutrients problem, and source of data used to identify the problem.

   b. **Action Threshold(s).** Describe the action threshold(s) for the Chemical management area, including data used in developing the action threshold(s) and method(s) to determine when the action threshold(s) has been met.

   c. **General location map**. In the plan, include a general location map (e.g., USGS quadrangle map, a portion of a city or county map, or other map) that identifies the geographic boundaries of the area to which the plan applies and location of Long Pond and;

   d. **Water quality standards**. Document any water(s) identified as impaired by a substance which either is an active ingredient or a chemical that has degraded from an active ingredient.

3. **Chemical Management Options Evaluation** - Decision-makers must document the evaluation of the chemical management options, including combination of the chemical management options, to control the target nutrient(s). Chemical management options include the following: No action, prevention, mechanical/physical methods, cultural methods, biological control agents, and chemical addition. In the evaluation, Decision-makers must consider the impact to water quality, impact to non-target organisms, feasibility, cost effectiveness, and any relevant previous CMMs.

4. **Response Procedures**

   a. **Spill Response Procedures** - At a minimum, Decision-makers must have:

      1. Procedures for expeditiously stopping, containing, and cleaning up leaks, spills, and other releases to waters of the State. Employees who may cause, detect, or respond to a spill or leak must be trained in these procedures and have necessary spill response equipment available. If possible, one of these individuals should be a member of the CDMP team.

      2. Procedures for notification of appropriate facility personnel and emergency response agencies.

SPECIAL CONDITIONS

G. CHEMICAL DISCHARGE MANAGEMENT PLAN (cont'd)

b. **Adverse Incident Response Procedures** – For the purposes of this permit means an unusual or unexpected incident that an Operator has observed upon inspection or of which the Operator otherwise become aware, in which**:**

(1) There is evidence that a person or non-target organism has likely been exposed to a chemical residue, and

(2) The person or non-target organism suffered a toxic or adverse effect.

The phrase toxic or adverse effects includes effects that occur within waters of the State on non-target plants, fish or wildlife that are unusual or unexpected (e.g., effects are to organisms not otherwise described on the chemical product label or otherwise not expected to be present) as a result of exposure to a chemical residue, and may include:

• Distressed or dead juvenile and small fishes

• Washed up or floating fish

• Fish swimming abnormally or erratically

• Fish lying lethargically at water surface or in shallow water

• Fish that are listless or nonresponsive to disturbance

• Stunting, wilting, or desiccation of non-target submerged or emergent aquatic plants

• Other dead or visibly distressed non-target aquatic organisms (amphibians, turtles, invertebrates, etc.)

The phrase, toxic or adverse effects, also includes any adverse effects to humans (e.g., skin rashes) or domesticated animals that occur either from direct contact with or as a secondary effect from a discharge (e.g., sickness from consumption of plants or animals containing the applied chemicals) to waters of the State that are temporally and spatially related to exposure to a chemical residue (e.g., vomiting, lethargy). At a minimum, Decision-makers must have:

1. Procedures for responding to any adverse incident resulting from chemical applications;

2. Procedures for notification of the adverse incident, both internal to the Decision-maker's agency/organization and external. Contact information for state/federal permitting agency, nearest emergency medical facility, and nearest hazardous chemical responder must be in locations that are readily accessible and available.

SPECIAL CONDITIONS

G CHEMICAL DISCHARGE MANAGEMENT PLAN (cont'd)

5. **Signature Requirements –** Decision-makers must sign, date and certify the CDMP in accordance with Standard Conditions entitled, *Maine Pollutant Discharge Elimination System Permit Standard Conditions Applicable To All Permits*," revised July 1, 2002.

b. Chemical Discharge Management Plan Availability. Decision-makers must retain a copy of the current CDMP, along with all supporting maps and documents, at the address provided in the application for this permit. The CDMP and all supporting documents must be readily available, upon request, and copies of any of these documents provided, upon request, to the State, federal, or local agencies governing discharges or chemical applications within their respective jurisdictions.

H. RECORDKEEPING AND REPORTING

Decision-maker requirements:

1. Copy of the application submitted to the Department and any correspondence exchanged between the Decision-maker or Applicator and the Department specific to coverage under this permit;

2. Information on each chemical treatment area to which chemicals are discharged, including a description of treatment area, including location and size of treatment area and identification of any waters of the State, either by name or by location, to which chemicals are discharged;

3. Target nutrient(s) and explanation of need for control;

4. Description of chemical management measure(s) implemented prior to the first chemical application;

5. Company name and contact information for the chemical applicator and documentation of equipment calibration;

6. Name of each chemical product used including the U.S. Environmental Protection Agency (EPA) and State of Maine Department of Agriculture's Board of Pesticide registration number if applicable;

7. Quantity of each chemical product applied to each treatment area;

8. Chemical application start date;

9. Chemical application end date; and

SPECIAL CONDITIONS

H. RECORDKEEPING AND REPORTING (cont'd)

10. Whether or not visual monitoring and or ambient water quality monitoring was conducted during chemical application and/or post-application and if not, why not and whether monitoring identified any possible or observable adverse incidents caused by application of chemicals.

    Ambient water quality sampling and analysis must be conducted in accordance with; a) methods approved in 40 Code of Federal Regulations (CFR) Part 136, b) alternative methods approved by the Department in accordance with the procedures in 40 CFR Part 136, or c) as otherwise specified by the Department. Samples that are sent out for analysis must be analyzed by a laboratory certified by the State of Maine's Department of Human Services. Samples that are sent to a publicly owned treatment works licensed pursuant to *Waste discharge licenses*, 38 M.R.S. § 413 or laboratory facilities that analyze compliance samples in-house, are subject to the provisions and restrictions of *Maine Comprehensive and Limited Environmental Laboratory Certification Rules*, 10-144 CMR 263 (last amended December 19, 2018).

    Treatment monitoring protocol is outlined in **Attachment A** of this permit (CDMP).

    Within 90 days following the discharge of chemicals, the Decision maker must submit a report to the Department with documentation addressing items in Special Condition H (2)-H(10) of this permit including a summary of any analytical test results associated with ambient water quality monitoring. The report must be submitted to the Department's compliance inspector at the following address:

Department of Environmental Protection
Southern Maine Regional Office
Bureau of Water Quality
Division of Water Quality Management
312 Canco Road
Portland, Maine 04103

SPECIAL CONDITIONS

I. REOPENING OF PERMIT FOR MODIFICATIONS

In accordance with 38 M.R.S. § 414-A(5) and upon evaluation of the tests results or monitoring requirements specified in Special Conditions of this permitting action, new site specific information, or any other pertinent test results or information obtained during the term of this permit, the Department may, at any time and with notice to the permittee, modify this permit to: 1) include effluent limits necessary to control specific pollutants or whole effluent toxicity where there is a reasonable potential that the effluent may cause water quality criteria to be exceeded, (2) require additional monitoring if results on file are inconclusive; or (3) change monitoring requirements or limitations based on new information.

J. SEVERABILITY

In the event that any provision(s), or part thereof, of this permit is declared to be unlawful by a reviewing court, the remainder of the permit shall remain in full force and effect, and shall be construed and enforced in all aspects as if such unlawful provision, or part thereof, had been omitted, unless otherwise ordered by the court.

CONTENTS

A. GENERAL PROVISIONS

1. **General compliance**. All discharges shall be consistent with the terms and conditions of this permit; any changes in production capacity or process modifications which result in changes in the quantity or the characteristics of the discharge must be authorized by an additional license or by modifications of this permit; it shall be a violation of the terms and conditions of this permit to discharge any pollutant not identified and authorized herein or to discharge in excess of the rates or quantities authorized herein or to violate any other conditions of this permit.

2. Other materials. Other materials ordinarily produced or used in the operation of this facility, which have been specifically identified in the application, may be discharged at the maximum frequency and maximum level identified in the application, provided:

(a) They are not

(i) Designated as toxic or hazardous under the provisions of Sections 307 and 311, respectively, of the Federal Water Pollution Control Act; Title 38, Section 420, Maine Revised Statutes; or other applicable State Law; or

(ii) Known to be hazardous or toxic by the licensee.

(b) The discharge of such materials will not violate applicable water quality standards.

3. Duty to comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of State law and the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

(a) The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act, and 38 MRSA, §420 or Chapter 530.5 for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

(b) Any person who violates any provision of the laws administered by the Department, including without limitation, a violation of the terms of any order, rule license, permit, approval or decision of the Board or Commissioner is subject to the penalties set forth in 38 MRSA, §349.

4. Duty to provide information. The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.

5. Permit actions. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

6. Reopener clause. The Department reserves the right to make appropriate revisions to this permit in order to establish any appropriate effluent limitations, schedule of compliance or other provisions which may be authorized under 38 MRSA, §414-A(5).

7. Oil and hazardous substances. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities or penalties to which the permittee is or may be subject under section 311 of the Federal Clean Water Act; section 106 of the Federal Comprehensive Environmental Response, Compensation and Liability Act of 1980; or 38 MRSA §§ 1301, et. seq.

8. Property rights. This permit does not convey any property rights of any sort, or any exclusive privilege.

9. Confidentiality of records. 38 MRSA §414(6) reads as follows. "Any records, reports or information obtained under this subchapter is available to the public, except that upon a showing satisfactory to the department by any person that any records, reports or information, or particular part or any record, report or information, other than the names and addresses of applicants, license applications, licenses, and effluent data, to which the department has access under this subchapter would, if made public, divulge methods or processes that are entitled to protection as trade secrets, these records, reports or information must be confidential and not available for public inspection or examination. Any records, reports or information may be disclosed to employees or authorized representatives of the State or the United States concerned with carrying out this subchapter or any applicable federal law, and to any party to a hearing held under this section on terms the commissioner may prescribe in order to protect these confidential records, reports and information, as long as this disclosure is material and relevant to any issue under consideration by the department."

10. Duty to reapply. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit.

11. Other laws. The issuance of this permit does not authorize any injury to persons or property or invasion of other property rights, nor does it relieve the permittee if its obligation to comply with other applicable Federal, State or local laws and regulations.

12. Inspection and entry. The permittee shall allow the Department, or an authorized representative (including an authorized contractor acting as a representative of the EPA Administrator), upon presentation of credentials and other documents as may be required by law, to:

(a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
(b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
(c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
(d) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

B. OPERATION AND MAINTENACE OF FACILITIES

1. General facility requirements.

(a) The permittee shall collect all waste flows designated by the Department as requiring treatment and discharge them into an approved waste treatment facility in such a manner as to maximize removal of pollutants unless authorization to the contrary is obtained from the Department.

(b) The permittee shall at all times maintain in good working order and operate at maximum efficiency all waste water collection, treatment and/or control facilities.

(c) All necessary waste treatment facilities will be installed and operational prior to the discharge of any wastewaters.

(d) Final plans and specifications must be submitted to the Department for review prior to the construction or modification of any treatment facilities.

(e) The permittee shall install flow measuring facilities of a design approved by the Department.

(f) The permittee must provide an outfall of a design approved by the Department which is placed in the receiving waters in such a manner that the maximum mixing and dispersion of the wastewaters will be achieved as rapidly as possible.

2. Proper operation and maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

3. Need to halt or reduce activity not a defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

4. Duty to mitigate. The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

5. Bypasses.

(a) Definitions.

(i) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

(ii) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

(b) Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs (c) and (d) of this section.

(c) Notice.

(i) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

(ii) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in paragraph D(1)(f), below. (24-hour notice).

(d) Prohibition of bypass.

(i) Bypass is prohibited, and the Department may take enforcement action against a permittee for bypass, unless:

(A) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
(B) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
(C) The permittee submitted notices as required under paragraph (c) of this section.

(ii) The Department may approve an anticipated bypass, after considering its adverse effects, if the Department determines that it will meet the three conditions listed above in paragraph (d)(i) of this section.

6. Upsets.

(a) Definition. Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.
(b) Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph (c) of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.
(c) Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(i) An upset occurred and that the permittee can identify the cause(s) of the upset;
(ii) The permitted facility was at the time being properly operated; and
(iii) The permittee submitted notice of the upset as required in paragraph D(1)(f) , below. (24 hour notice).
(iv) The permittee complied with any remedial measures required under paragraph B(4).

(d) Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

C. MONITORING AND RECORDS

1. General Requirements. This permit shall be subject to such monitoring requirements as may be reasonably required by the Department including the installation, use and maintenance of monitoring equipment or methods (including, where appropriate, biological monitoring methods). The permittee shall provide the Department with periodic reports on the proper Department reporting form of monitoring results obtained pursuant to the monitoring requirements contained herein.

2. Representative sampling. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. If effluent limitations are based wholly or partially on quantities of a product processed, the permittee shall ensure samples are representative of times when production is taking place. Where discharge monitoring is required when production is less than 50%, the resulting data shall be reported as a daily measurement but not included in computation of averages, unless specifically authorized by the Department.

3. Monitoring and records.

(a) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

(b) Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years, the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Department at any time.

(c) Records of monitoring information shall include:

(i) The date, exact place, and time of sampling or measurements;
(ii) The individual(s) who performed the sampling or measurements;
(iii) The date(s) analyses were performed;
(iv) The individual(s) who performed the analyses;
(v) The analytical techniques or methods used; and
(vi) The results of such analyses.

(d) Monitoring results must be conducted according to test procedures approved under 40 CFR part 136, unless other test procedures have been specified in the permit.

(e) State law provides that any person who tampers with or renders inaccurate any monitoring devices or method required by any provision of law, or any order, rule license, permit approval or decision is subject to the penalties set forth in 38 MRSA, §349.

D. REPORTING REQUIREMENTS

1. Reporting requirements.

(a) Planned changes. The permittee shall give notice to the Department as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

(i) The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR 122.29(b); or

(ii) The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under Section D(4).

(iii) The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan;

(b) Anticipated noncompliance. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

(c) Transfers. This permit is not transferable to any person except upon application to and approval of the Department pursuant to 38 MRSA, § 344 and Chapters 2 and 522.

(d) Monitoring reports. Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(i) Monitoring results must be reported on a Discharge Monitoring Report (DMR) or forms provided or specified by the Department for reporting results of monitoring of sludge use or disposal practices.

(ii) If the permittee monitors any pollutant more frequently than required by the permit using test procedures approved under 40 CFR part 136 or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by the Department.

(iii) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Department in the permit.

(e) Compliance schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

(f) Twenty-four hour reporting.

(i) The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

(ii) The following shall be included as information which must be reported within 24 hours under this paragraph.

(A) Any unanticipated bypass which exceeds any effluent limitation in the permit.
(B) Any upset which exceeds any effluent limitation in the permit.
(C) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Department in the permit to be reported within 24 hours.

(iii) The Department may waive the written report on a case-by-case basis for reports under paragraph (f)(ii) of this section if the oral report has been received within 24 hours.

(g) Other noncompliance. The permittee shall report all instances of noncompliance not reported under paragraphs (d), (e), and (f) of this section, at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (f) of this section.
(h) Other information. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

2. Signatory requirement. All applications, reports, or information submitted to the Department shall be signed and certified as required by Chapter 521, Section 5 of the Department's rules. State law provides that any person who knowingly makes any false statement, representation or certification in any application, record, report, plan or other document filed or required to be maintained by any order, rule, permit, approval or decision of the Board or Commissioner is subject to the penalties set forth in 38 MRSA, §349.

3. Availability of reports. Except for data determined to be confidential under A(9), above, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department. As required by State law, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal sanctions as provided by law.

4. Existing manufacturing, commercial, mining, and silvicultural dischargers. In addition to the reporting requirements under this Section, all existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Department as soon as they know or have reason to believe:

(a) That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

(i) One hundred micrograms per liter (100 ug/l);
(ii) Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;
(iii) Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with Chapter 521 Section 4(g)(7); or
(iv) The level established by the Department in accordance with Chapter 523 Section 5(f).

(b) That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following ``notification levels":

(i) Five hundred micrograms per liter (500 ug/l);
(ii) One milligram per liter (1 mg/l) for antimony;
(iii) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with Chapter 521 Section 4(g)(7); or
(iv) The level established by the Department in accordance with Chapter 523 Section 5(f).

5. Publicly owned treatment works.

(a) All POTWs must provide adequate notice to the Department of the following:

(i) Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of CWA or Chapter 528 if it were directly discharging those pollutants.
(ii) Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.
(iii) For purposes of this paragraph, adequate notice shall include information on (A) the quality and quantity of effluent introduced into the POTW, and (B) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

(b) When the effluent discharged by a POTW for a period of three consecutive months exceeds 80 percent of the permitted flow, the permittee shall submit to the Department a projection of loadings up to the time when the design capacity of the treatment facility will be reached, and a program for maintaining satisfactory treatment levels consistent with approved water quality management plans.

E. OTHER REQUIREMENTS

1. Emergency action - power failure. Within thirty days after the effective date of this permit, the permittee shall notify the Department of facilities and plans to be used in the event the primary source of power to its wastewater pumping and treatment facilities fails as follows.

(a) For municipal sources. During power failure, all wastewaters which are normally treated shall receive a minimum of primary treatment and disinfection. Unless otherwise approved, alternate power supplies shall be provided for pumping stations and treatment facilities. Alternate power supplies shall be on-site generating units or an outside power source which is separate and independent from sources used for normal operation of the wastewater facilities.

(b) For industrial and commercial sources. The permittee shall either maintain an alternative power source sufficient to operate the wastewater pumping and treatment facilities or halt, reduce or otherwise control production and or all discharges upon reduction or loss of power to the wastewater pumping or treatment facilities.

2. Spill prevention. (applicable only to industrial sources) Within six months of the effective date of this permit, the permittee shall submit to the Department for review and approval, with or without conditions, a spill prevention plan. The plan shall delineate methods and measures to be taken to prevent and or contain any spills of pulp, chemicals, oils or other contaminates and shall specify means of disposal and or treatment to be used.

3. **Removed substances.** Solids, sludges trash rack cleanings, filter backwash, or other pollutants removed from or resulting from the treatment or control of waste waters shall be disposed of in a manner approved by the Department.

4. **Connection to municipal sewer.** (applicable only to industrial and commercial sources) All wastewaters designated by the Department as treatable in a municipal treatment system will be cosigned to that system when it is available. This permit will expire 90 days after the municipal treatment facility becomes available, unless this time is extended by the Department in writing.

F. DEFINITIONS. For the purposes of this permit, the following definitions shall apply. Other definitions applicable to this permit may be found in Chapters 520 through 529 of the Department's rules

Average means the arithmetic mean of values taken at the frequency required for each parameter over the specified period. For bacteria, the average shall be the geometric mean.

Average monthly discharge limitation means the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month. Except, however, bacteriological tests may be calculated as a geometric mean.

Average weekly discharge limitation means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

Best management practices ("BMPs") means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Composite sample means a sample consisting of a minimum of eight grab samples collected at equal intervals during a 24 hour period (or a lesser period as specified in the section on monitoring and reporting) and combined proportional to the flow over that same time period.

Continuous discharge means a discharge which occurs without interruption throughout the operating hours of the facility, except for infrequent shutdowns for maintenance, process changes, or other similar activities.

Daily discharge means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the daily discharge is calculated as the average measurement of the pollutant over the day.

Discharge Monitoring Report ("DMR'') means the EPA uniform national form, including any subsequent additions, revisions, or modifications for the reporting of self-monitoring results by permittees. DMRs must be used by approved States as well as by EPA. EPA will supply DMRs to any approved State upon request. The EPA national forms may be modified to substitute the State Agency name, address, logo, and other similar information, as appropriate, in place of EPA's.

Flow weighted composite sample means a composite sample consisting of a mixture of aliquots collected at a constant time interval, where the volume of each aliquot is proportional to the flow rate of the discharge.

Grab sample means an individual sample collected in a period of less than 15 minutes.

Interference means a Discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

(1) Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and
(2) Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Maximum daily discharge limitation means the highest allowable daily discharge.

New source means any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced:

(a) After promulgation of standards of performance under section 306 of CWA which are applicable to such source, or
(b) After proposal of standards of performance in accordance with section 306 of CWA which are applicable to such source, but only if the standards are promulgated in accordance with section 306 within 120 days of their proposal.

Pass through means a discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation).

Permit means an authorization, license, or equivalent control document issued by EPA or an approved State to implement the requirements of 40 CFR parts 122, 123 and 124. Permit includes an NPDES general permit (Chapter 529). Permit does not include any permit which has not yet been the subject of final agency action, such as a draft permit or a proposed permit.

Person means an individual, firm, corporation, municipality, quasi-municipal corporation, state agency, federal agency or other legal entity.

Point source means any discernible, confined and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation or vessel or other floating craft, from which pollutants are or may be discharged.

Pollutant means dredged spoil, solid waste, junk, incinerator residue, sewage, refuse, effluent, garbage, sewage sludge, munitions, chemicals, biological or radiological materials, oil, petroleum products or byproducts, heat, wrecked or discarded equipment, rock, sand, dirt and industrial, municipal, domestic, commercial or agricultural wastes of any kind.

Process wastewater means any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.

Publicly owned treatment works ("POTW'') means any facility for the treatment of pollutants owned by the State or any political subdivision thereof, any municipality, district, quasi-municipal corporation or other public entity.

Septage means, for the purposes of this permit, any waste, refuse, effluent sludge or other material removed from a septic tank, cesspool, vault privy or similar source which concentrates wastes or to which chemicals have been added. Septage does not include wastes from a holding tank.

Time weighted composite means a composite sample consisting of a mixture of equal volume aliquots collected over a constant time interval.

Toxic pollutant includes any pollutant listed as toxic under section 307(a)(1) or, in the case of sludge use or disposal practices, any pollutant identified in regulations implementing section 405(d) of the CWA. Toxic pollutant also includes those substances or combination of substances, including disease causing agents, which after discharge or upon exposure, ingestion, inhalation or assimilation into any organism, including humans either directly through the environment or indirectly through ingestion through food chains, will, on the basis of information available to the board either alone or in combination with other substances already in the receiving waters or the discharge, cause death, disease, abnormalities, cancer, genetic mutations, physiological malfunctions, including malfunctions in reproduction, or physical deformations in such organism or their offspring.

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Whole effluent toxicity means the aggregate toxic effect of an effluent measured directly by a toxicity test.

ATTACHMENT A

LONG POND

CHEMICAL DISCHARGE MANAGEMENT PLAN

Prepared by:
FB Environmental Associates
97A Exchange Street, Suite 305
Portland, ME 04101
www.fbenvironmental.com

Prepared for:
Long Pond Association
21 Lloyd Watson Road
Parsonsfield, ME 04047
www.longpondassociation.info

CHEMICAL DISCHARGE MANAGEMENT PLAN

LONG POND ALUM TREATMENT

PARSONSFIELD, MAINE

MARCH 2022

PREPARED BY:

FB ENVIRONMENTAL ASSOCIATES

97A Exchange Street, Suite 305
Portland, ME 04101
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. CHEMICAL DISCHARGE MANAGEMENT TEAM

Person(s) responsible for managing pests in relation to the chemical treatment area

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Attn: Deb Hiney, President
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(603) 770-0587
yakityakn@comcast.net

Applicator- *To be selected*

Person(s) responsible for developing and revising the Chemical Discharge Management Plan (CDMP)

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Long Pond Association
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Person(s) responsible for developing, revising, and implementing corrective actions and other effluent information

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Long Pond Association
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(603) 770-0587
yakityakn@comcast.net

Applicator- *To be selected*

2. PROBLEM IDENTIFICATION

Problem Background and Introduction

Located in the Town of Parsonsfield in western Maine, Long Pond is a 263-acre Great Pond (Class GPA) with a maximum depth of 33 feet. At 1,093 acres, the surrounding watershed is relatively small and steeply sloped. Long Pond has one primary inlet in the northern end of the lake, as well as many small direct drainages. The outlet of Long Pond is situated at the southeasterly end of the lake and discharges through a wetland complex and into Noah's Pond. The outlet flows for approximately 100 feet before flowing through four culverts underneath the Road Between the Ponds. Long Pond is hydrologically connected to West Pond by a cross-culvert under Road Between the Ponds near the West End House (WEH) Camp. The West Pond outlet enters the Long Pond outlet stream between Long Pond and Noah's Pond, however, a small tributary stream branches off the West Pond outlet and enters Long Pond through the aforementioned cross-culvert.

The pond is on the Maine Department of Environmental Protection (Maine DEP)'s Nonpoint Priority Watersheds List due to recent changes in water quality consistent with the expected effects of nonpoint source phosphorus enrichment. Cyanobacteria blooms were observed by Long Pond residents and water quality volunteers in the summers of 2006, 2017, and 2018. The most severe bloom was observed starting on July 4, 2017.

Secchi disk transparency (SDT) has been collected every year since 1983, with intermittent phosphorus and chlorophyll-a sampling, Maine DEP and volunteer lake monitors (at the deep hole monitoring station).

- Long Pond is moderately shallow, with a maximum depth of 33 feet and a steeply sloping lake bottom. In most areas of the shoreline, depth increases to 20 feet close to the shoreline.
- The flushing rate is estimated at 0.5 flushes per year.
- Long Pond experienced decades of good water quality, with >4 meter SDT and dissolved oxygen down to 8-9 m. This has changed in recent decades and is especially pronounced since 2017, with decreased SDT, frequent dissolved oxygen depletion at 8 meters depth, and P release from sediment.

Water clarity (measured via Secchi disk) was relatively consistent in Long Pond from 1983 to 2009, until a reduction in clarity in 2010 (5.27 m) and 2011 (5.04 m; Fig. 1). The summer of 2017 experienced the poorest water clarity on record, 0.8 meters, and the lowest average, 2.48 meters, across the sampling season (June-October). In 2018, water clarity continued to be low, with the second lowest average Secchi depth reading of 3.72 meters. Degraded water clarity in recent years generally corresponds with increased TP2 and increased chlorophyll-a in 2017 and 2018 (Fig. 1). Median total phosphorus (TP) was 16 parts per billion (ppb) in 2017 (n=6), the highest for any sampling season, and 13.5 ppb in 2018 (n=4). Average chlorophyll-a was 23.75 ppb in 2017 (n=4) and 12.75 ppb in 2018 (n=3).

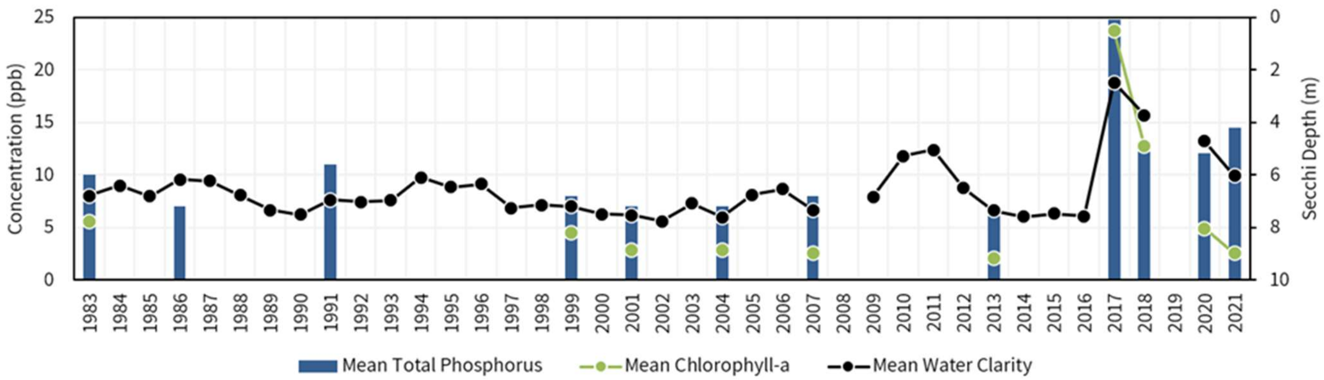


Figure 1. Mean total phosphorus (epilimnion core samples only), mean water clarity (Secchi depth), and mean chlorophyll-a measured at Long Pond from 1983-2021. Blooms were recorded in 2006, 2017, 2018, and 2020. 2019 data were not available from the MEDEP at the time of this plan. 2020-21 data were gathered from the LPA and were not quality assured by the MEDEP.

Watershed-Based Management Plan

The Long Pond Association raised local funding to complete a nine-element watershed-based plan (WBMP) to guide future lake restoration efforts. FB Environmental Associates (FBE) led the development of the plan with the assistance of a technical advisory committee including Maine DEP, LPA, St. Joseph's College of Standish, Maine, and Dr. Ken Wagner of Water Resource Services, Inc. The committee provided input on water quality analysis, modeling, and load reduction strategies throughout the planning process. The final plan, which is currently pending DEP approval, recommends continued external load reduction through watershed Best Management Practices (BMPs), non-structural BMPs, and internal load reduction through an alum treatment.

To limit the watershed load, the WBMP identified 19 residential properties with non-point source problems that could be addressed using BMPs. Nine private road and driveway sites, one town road site, and two summer camp sites were also identified in the WBMP. As part of the WBMP development, FBE conducted a lake loading analysis to inform load reduction goals and strategies, and this analysis was also used to evaluate the potential for alum treatment to reduce phosphorus loading into Long Pond (FBE, 2021).

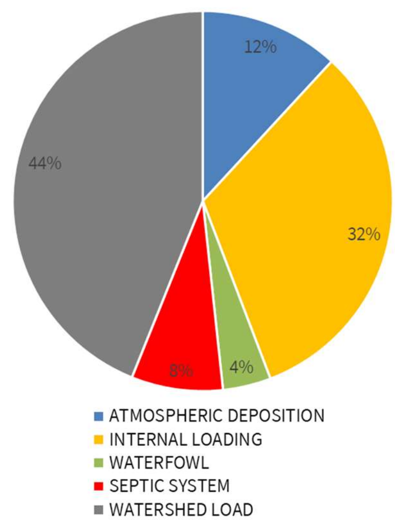
Education and Outreach Efforts

The Long Pond Association has conducted educational and outreach efforts to inform nearby residents about the alum treatment. The alum treatment recommendation has been developed in cooperation with the project technical advisory committee (TAC). The TAC is made up of stakeholders from the Long Pond Association, Maine DEP, York County Soil & Water Conservation District, FBE, and Dr. Ken Wagner of Water Resource Services, Inc. To date, two virtual TAC meetings have been held to discuss project and task updates. Additionally, the Long Pond Association has published information regarding the WBMP and alum treatment plan in their newsletter. See Appendix E for outreach materials on water quality, phosphorus, and alum treatment from the Spring and Fall 2021 Long Pond Association Newsletters.

Watershed Modeling & Loading Summary

During the development of the WBMP, a phosphorus loading analysis using the Lake Loading Response Model (LLRM) was completed by FBE (2021). The LLRM is an Excel-based model that uses environmental data to develop a water and phosphorus loading budget for lakes and their tributaries. Water and phosphorus loads (in the form of mass and concentration) are traced from various sources in the watershed through tributary basins and into the lake. The model incorporates data about watershed and sub-watershed boundaries, land cover, point sources (if applicable), septic systems, waterfowl, rainfall, volume and surface area, and internal phosphorus loading. These data are combined with coefficients, attenuation factors, and equations from scientific literature on lakes, rivers, and nutrient cycles. The model can be used to identify current and future pollutant sources, estimate pollutant limits and water quality goals, and guide watershed improvement projects.

FBE completed watershed and sub-watershed delineations, a land cover update, and desktop data collection to acquire the necessary LLRM inputs. Other input data included monthly precipitation data, lake volume and area estimates, septic system data, water quality data, waterfowl data, and internal loading estimates.



The LLRM separated phosphorus loading into five categories: atmospheric deposition, internal loading, wildlife (waterfowl), septic systems, and watershed load (surface runoff). Watershed runoff combined with baseflow (44%) was the largest phosphorus loading contribution across all sources to Long Pond, followed closely by internal loading (32%) and then atmospheric deposition (12%), septic systems (8%), and waterfowl (4%) (Figure 2; Table 1). Development in the watershed is most concentrated around the shoreline where septic systems or holding tanks are located within a short distance to the water, leaving little horizontal (and sometimes vertical) space for proper filtration of wastewater effluent. Improper maintenance or siting of these systems can cause failures, which then can leach untreated, nutrient-rich wastewater effluent to the lake. Additionally, the fluctuation of lake water levels can make poorly sited septic systems vulnerable to inundation.

The LLRM model was used to simulate the phosphorus loading in Long Pond under the proposed alum treatment scenario (Table 1). Based on the LLRM results, FBE recommended that an alum treatment be conducted at Long Pond to significantly reduce the internal load. The alum treatment would strip the water column of phosphorus in the immediate term and protect the lake from internal loading in the long-term as the alum blankets the bottom sediments and locks in phosphorus. To enhance the longevity of the alum treatment, it will be crucial to 1) maximize land conservation of intact forestland, 2) consider zoning ordinance amendments that encourage Low Impact Development techniques on existing and new development, and 3) improve and maintain stormwater control practices throughout the watershed. The Long Pond Association is currently improving several residential and road sites in the watershed under a

Section 319 Watershed Assistance Grant administered by the Maine DEP. This effort should be ongoing into the future to best protect the lake from existing and emerging threats, including development and climate change.

Table 1: Total phosphorus (TP) and water loading summary by source for Long Pond. Italicized sources sum to the watershed load. The Alum Treatment scenario simulates the result of an alum treatment on Long Pond.

SOURCE	CURRENT (2020)			ALUM TREATMENT		
	TP (KG/YR)	%	WATER (CU.M/YR)	TP (KG/YR)	%	WATER (CU.M/YR)
ATMOSPHERIC	11.6	12%	785,963	11.6	17%	785,963
INTERNAL	31.6	32%	0	3.2	5%	0
WATERFOWL	4.0	4%	0	4.0	6%	0
SEPTIC SYSTEM	7.6	8%	7,374	7.6	11%	7,374
WATERSHED LOAD	42.9	44%	2,384,362	42.9	62%	2,384,362
TOTAL LOAD TO LAKE	**97.6**	**100%**	**3,177,699**	**69.2**	**100%**	**3,177,699**

Addressing the Internal Load – Water Resource Services, Inc. Study

Internal loading is currently a major source of phosphorus to Long Pond whereby low dissolved oxygen in bottom waters is causing a release of phosphorus from bottom sediments. An internal loading study done by WRS, Inc. (2021) recommends that an alum treatment be conducted at Long Pond to reduce the internal loading of phosphorus. The study showed that internal phosphorus loading via release from sediments exposed to low oxygen is a major source of phosphorus to the pond, mainly later in summer as stratification breaks down, but also potentially via direct uptake by algae growing at the thermocline or deeper which then form gas pockets within cells and rise in the water column. The relatively shallow maximum depth (10 m) and generally desirable clarity (>4-5 m) translates into high growth potential for algae in the deeper water. The expected low ratio of nitrogen to phosphorus in that deeper water will favor cyanobacteria, a likely explanation for observed blooms. However, availability of P may be moderated by weather conditions and presence of other oxygen compounds, most notably nitrates, such that there will be substantial variation in algal abundance within and among years.

The pond appears to be trending toward a condition of more bottom area being exposed to low oxygen (<2 mg/L), leading to greater potential for phosphorus release from sediment and greater probability of blooms. The increase in low oxygen conditions in the 8-9 m water depth zone represents a major shift, as this zone contains a larger amount of available sediment phosphorus than other depth zones. Despite the increase in phosphorus concentration in Long Pond over the last couple of decades, conditions are acceptable most of the year, but cyanobacteria have become dominant and abundant several times in the last few years, mainly in late summer and early autumn. This trend can be expected to continue and to accelerate, but not necessarily in a continuous transition as a function of varying weather among years.

This trend can be countered by removing accumulated organic, phosphorus-rich sediment, by providing oxygen to counter the demand and limit reactions that release phosphorus, or by inactivating the phosphorus in surficial sediment to reduce release under low oxygen conditions.

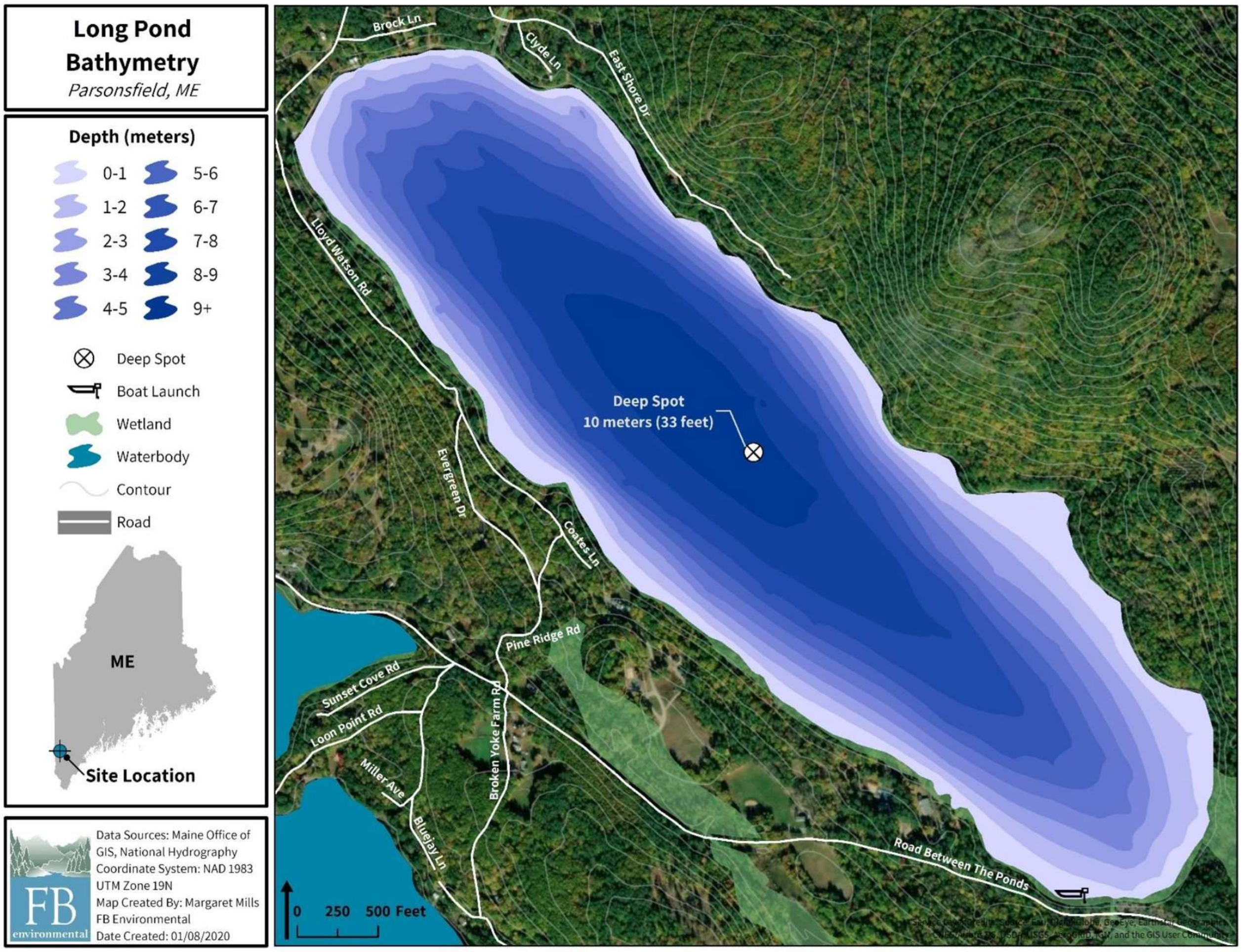


Figure 3: Detailed bathymetry of Long Pond, including the deep spot location.

Internal phosphorus loading estimated from water column data (change in phosphorus mass over time) is slightly lower than the load estimated from sediment features (10% of the phosphorus mass in the surficial sediment exposed to low oxygen), suggesting that much but not all the internally loaded phosphorus reaches the upper waters. Internal loading is estimated to represent about a third of total phosphorus loading to Long Pond, exceeded only by surface water inputs from the watershed at about 44% of the total load. Reducing the internal phosphorus load by 90% would result in achievement of desirable conditions according to the LLRM, with an average phosphorus concentration of 10 ppb and a low probability of algae blooms.

Assuming a 90% reduction efficiency, an alum treatment would reduce the internal load and thus the total phosphorus load to the lake by 28.4 kilograms per year (kg/yr), resulting in an average annual in-lake phosphorus concentration of 9.6 ppb. Average annual chlorophyll-a concentration and Secchi disk transparency would be significantly improved. The average annual bloom probability (percentage of time with a bloom) would reduce from 3.6% (13 days) to 0.3% (1 day) at year one after the alum application.

3. CHEMICAL TREATMENT OPTIONS EVALUATION

Review of Management Options – Water Resource Services Study

There are three basic approaches to preventing internal recycling-driven bloom occurrence that are known to work with an acceptable degree of reliability from past research and experience: dredging, oxygenation, and phosphorus inactivation. These are not mutually exclusive approaches, but rarely is more than one applied in a lake.

Dredging removes accumulated sediment and sets the lake back in time. While dredging does not affect ongoing watershed inputs, it can control internal loading and minimize oxygen demand. Dredging is very expensive, however, with a cost of $50,000 per acre-foot of sediment removed as a low-end estimate. Unless restoring lost depth is a major goal, dredging is rarely implemented to manage internal phosphorus loading, and dredging would likely be cost prohibitive in Long Pond. Additionally, dredging can cause suspension of sediments in the water column that must be carefully considered. Further, considerable additional study would be needed to plan a dredging project.

Hypolimnetic oxygenation would increase oxygen in deep waters, limiting the release of phosphorus from associated sediment while enhancing coldwater fish habitat. There are limited examples of this approach being applied to lower phosphorus levels; most often oxygenation is conducted to enhance water quality for potable supply or fish habitat (Wagner, 2015). Yet the theory is sound and where internal loading is a dominant component of phosphorus loading, oxygenating the hypolimnion should provide desirable results. Not all internal loading would be eliminated, and the extra oxygen would allow releases from decay to increase somewhat, but a 75% reduction in internal phosphorus loading is achievable and the benefits are clear. At the current oxygen demand of about 2 g/m^2/day over about 109 acres (436,000 m^2), a daily oxygen input of about 872 kg would be needed to counter the lakewide demand. As oxygen demand tends to rise in response to the movement of water that accompanies oxygen input, this estimate should be raised by at least 50% if pure oxygen is used, so a minimum oxygen supply of about 1300 kg/day should be planned. The need could be several times larger if air is used as the oxygen source.

There are several means to oxygenate a lake without destratifying it, but with a vertical run of only about 4 m in the hypolimnion of Long Pond, release of pure oxygen bubbles would not be effective (at least 6 m of vertical rise is needed for the oxygen to be absorbed). A Speece cone (within the lake) or sidestream supersaturation unit (on shore) could oxygenate water and return it to the hypolimnion at a rate that would counter oxygen demand. The capital cost from other projects is $1000-1500 per kg/day, or about $1.3-2.0 million for Long Pond. The operational cost would be on the order of $0.50 per kg/day, or about $650 per day. Just how long the system would have to run is a matter of adjustment to prevent oxygen depletion; low oxygen needs to be prevented but saturation level oxygen does not need to be achieved. It would be likely that an oxygenation system would have to be turned on in early June and run into mid-August, about 75 days, which suggests an annual operational cost of about $50,000.

If destratifying the lake is environmentally acceptable, water can be pumped upward, pumped downward, or moved via compressed air to mix the lake. Such mixing maintains oxygen from top to bottom if done well. Use of compressed air in hoses that either have perforations or lead to diffusers is the most common approach with the longest and most successful track record. An input of at least 1.3 cubic feet per minute per acre of target area would be needed. Working with the area associated with the 6 m depth (roughly the thermocline, an area of 147 ac), about 200 cfm will be needed. At a cost of about $1500 per acre, the capital expense for a destratification system would be about $220,000. Operational costs depend mostly on power expense, but a daily cost of about $1500 is likely. With operation from mid-May into September to prevent stratification from occurring, the annual operational cost would be about $180,000. There are solar versions of most equipment that might minimize operational costs, but the capital cost is still substantial and some operational costs are to be expected.

Phosphorus Inactivation

Phosphorus inactivation can be used three ways: to treat incoming water high in phosphorus, to strip phosphorus from the water column in a lake, or to bind phosphorus in surficial sediments and make reserves less susceptible to release under anoxia. All are applicable, but the most advantageous approach in a case like Long Pond would be a treatment of the sediment area subject to anoxia with a phosphorus binder such as aluminum. The track record for such treatments is favorable, including past efforts in Maine, and the empirical evidence that higher Al:Fe ratios in the sediment prevents phosphorus release also favors this approach. A reduction of about 90% of the internal load would be expected. Successful phosphorus inactivation of surficial sediment under water >8 m deep could reduce the average phosphorus concentration in Long Pond to about 10 ppb, a concentration that should minimize algal blooms. The duration of benefits should be about 20 years based on experience elsewhere.

The cost of phosphorus inactivation is a function of the necessary dose and area to be treated. Dose can be calculated stoichiometrically as a function of the amount of P to be inactivated (Table 2) and binding efficiency, that latter factor usually resulting in phosphorus binders being added at some multiplier of the phosphorus concentration. For the various sediment samples from Long Pond, the dose of aluminum that is expected to inactivate the Fe-P in the upper 10 cm of sediment in water 8-10 m deep ranges from 14 to 37 grams per square meter (g/m^2). When the phosphorus concentration is relatively low, as is the case in Long Pond, the binding efficiency of aluminum tends to be lower, as other compounds also bind with aluminum. Consequently, lab assays in which aluminum is added to a known mass of

Table 2: Sediment phosphorus mass in areas of Long Pond. (WRS, 2021)

Depth zone	Area	Est. Fe-P mass	Est. Fe-P + biogenic P mass
m	ac	kg	kg
6-7	19.4	100	599
7-8	18.8	106	368
8-9	46.3	345	1,220
9-10	62.5	181	615

sediment suspended in water are often conducted to determine the optimal dose of aluminum to be added.

For Long Pond sediment samples, the assay results (Figure 4) suggest that the point of diminishing returns is around 50 g/m^2 and that the efficiency of binding varies somewhat among samples representing different water depths and sediment zones. Given the differential phosphorus content between sediments at 8-9 and 9-10 meters (m) of water depth and the shape of the aluminum response curves, it is suggested that the 62.5 acres deeper than 9 m be treated at no less than 25 g/m^2 and the 46.3 acres at 8-9 m be treated at no less than 50 g/m^2. Additionally, there is a tendency for aluminum to migrate toward deeper water, so the deeper sediments will eventually be subjected to a higher aluminum dose. Shallower areas of the lake can be dosed with 40 g/m^2. Therefore, it is suggested that the 18.8 acres at 7-8 m be treated with no less than 40 g/m^2.

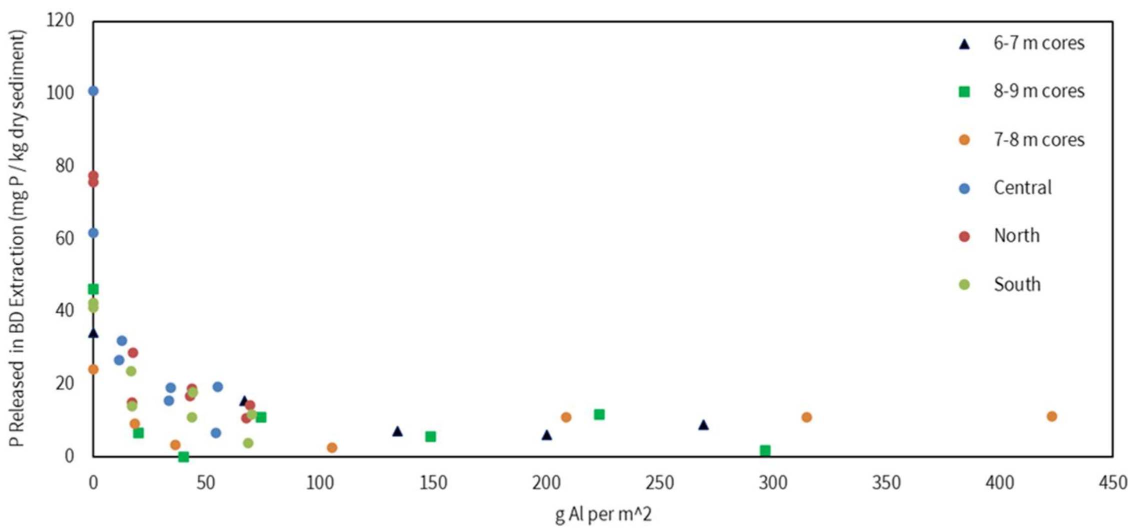


Figure 4: Sediment phosphorus inactivation assay results. (WRS, 2021)

The mass of phosphorus in each of four defined areas of Long Pond, the suggested aluminum dose, and the area to which it would be applied leads to cost estimates for possible treatment (Table 9). Treatment of areas deeper than 8 m is deemed necessary to sufficiently reduce the internal load to Long Pond; however, it may be advantageous to treat deeper than 7 m to protect the lake from occasional low oxygen conditions extending to 7 m depth and improve the treatment efficacy of deeper areas as the alum migrates to deeper areas of the lake. Treatment of surficial sediment under >9 m of water at 25 g/m^2 and surficial sediment under 8-9 m of water at 50 g/m^2 is estimated to cost about $174,000. Including some funds for permitting, planning, and monitoring a total cost of $210,000 is suggested. Treatment of areas deeper than 7 m would increase the total cost to $250,000. As noted in Table 6 (page 21), treatment of surficial sediments >7 m of water at 25 g/m^2 and surficial sediment under 8-9 m of water at 50 g/m^2 would result in a predicted mediant TP of 9.6 ppb.

There are other options for phosphorus inactivation, including calcium compounds where the pH is high, and a product called Phoslock that utilizes lanthanum attached to bentonite clay. The pH is not elevated enough in Long Pond to make calcium a viable option. Phoslock could be considered and has some desirable features but has no track record in Maine and tends to be more expensive than aluminum.

While addressing the internal load should put Long Pond into a desirable condition, watershed management is still an important component of long-term lake management. Watershed management should focus on inputs related to human actions, including residential practices, waste disposal, and agriculture, and is always appropriate as an element of lake management. Watershed management should indeed be pursued but is likely to be inadequate by itself to rehabilitate Long Pond, as the internal load from past watershed loading now represents a large source of phosphorus. However, effective watershed management is a very cost-effective means of extending the life of an alum treatment.

Table 3: Sediment iron-bound phosphorus (Fe-P) mass by depth zone, along with dose and treatment cost estimates for phosphorus inactivation by aluminum in Long Pond.

Depth zone (m)	Area (acres)	Est. Fe-P mass (kg)	Al Dose (g/m^2)	Cost for Alum Treatment
6-7	19.4	100	40	$34,578
7-8	18.8	106	40	$33,752
8-9	46.3	345	50	$104,246
9-10	62.5	181	25	$69,582
			Minimum dosage area (8m+)	$173,828
			Recommended dosage area (7m+)	$207,580
			Expanded dosage area (6m+)	$242,158

Proposed Aluminum Application Summary

The goal of this proposed treatment is to reduce the current internal phosphorus load (31.6 kg/yr) by 90% by applying 25 g/m^2 of liquid aluminum sulfate/sodium aluminate to the water column at water depths between 9 and 10 m and applying a treatment of 50 g/m^2 to depths of 8 and 9 m. An additional application of 40 g/m^2 at depths of 7-8 m was identified as a likely future need by the alternatives analysis, and the Long Pond Association's preference is to treat this 7-8 m depth increment at the same time if fundraising levels allow.

As discussed previously, the recommended dosage was determined by Dr. Ken Wagner using sediment core analysis conducted by Dr. Emily Lesher of St. Joseph's College. The sediment cores collected in Long Pond were analyzed for phosphorus fractions using sequential extractions to calculate concentrations of loosely sorbed (LS) P, iron-bound (Fe-) P, and NaOH extractable P, a mix of aluminum-bound P and organic P fractions. Dr. Wagner's analysis determined the dosages that would be required to achieve the desired reduction in internal load. An interesting and notable feature of the Long Pond sediment analysis is that the deepest depths (9-10 m) ha of 63 acres at 9-10 m treated at 25 g/m^2 and 46 acres at 8-9 m treated at a dose of 50 g/m^2, with the option of an additional 19 acres to of 7-8 m at a treatment of 40 g/m^2.

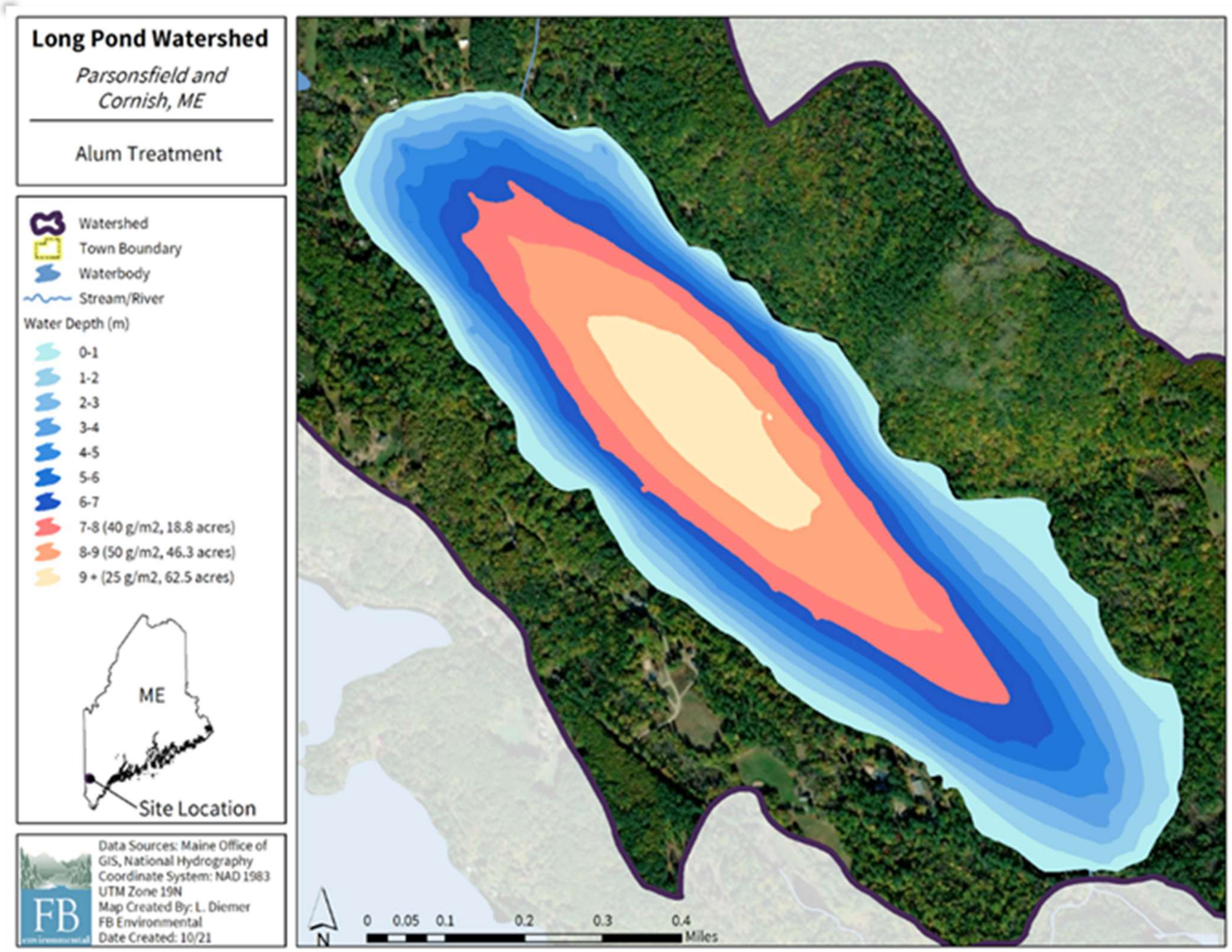


Figure 5: Map of Long Pond signifying the proposed aluminum treatment areas by depth increment. The total proposed area to be treated (yellow, orange, magenta) is 127.6 acres.

4. RESPONSE PROCEDURES

Spill Response Procedures

The company hired to conduct the chemical application (the Applicator) to Long Pond will be responsible for handling spill response procedures. The spill response procedures are presented below. Once the Applicator is selected, a copy of the Applicator's Standard Operating Procedure (SOP) for Chemical Spill Events will be provided to Maine DEP.

The selected Applicator will be trained and experienced with the application of the materials being used in Long Pond. They will have the necessary adsorptive materials in the event of a spill and will be familiar with the risks of exposure and required first aid procedures. Adsorptive materials may include kitty litter, clay, activated charcoal, or sawdust. The vehicle traveling to the application site will have hydrated lime and soap/detergent on-board.

In the event of a spill, the following protocols will be followed, at a minimum:

• Assess the situation: The following will be considered: Is there a fire, split or leak? What are the weather conditions? What is the terrain like? Who/what is at risk? What resources are required and are they readily available?

• Notifications: If the leak, spill, or other release into the water contains a hazardous substance or oil in an amount equal to or in excess of a reportable quantity occurs in any 24-hour period, an employee of the Applicant will notify the National Response Center immediately at (800) 424-8802.

• Contact Emergency Response: The emergency response number for Maine DEP (800) 482-0777 (Emergency Hotline) will be called. Help will be obtained if needed. If the spill is very large, then ChemTrec at 1-800-424-9300 will be contacted. The Town of Parsonsfield will also be notified.

• Personal Protective Equipment: All personnel aiding with the containment and clean-up of the spill will be wearing the necessary Personal Protective Equipment (PPE).

• Control the Spill: Necessary steps to end the leakage of additional material by righting punctured drums, placing them in new, oversized containers or other means will be taken.

• Contain the Spill: Absorbents, earthen dykes or other means will be used to limit the spread of the spilled chemical.

• Clean up the Spill: After the spill has been contained and liquid chemical absorbed on a solid material or special spill control gels, the contaminated absorbent will be picked up and bagged for proper disposal. The area must be further decontaminated through use of soapy water or alkaline material such as lye.

• Report the Spill: All necessary authorities and interested parties will be notified of the spill and the efforts made to control, contain and clean up the spill.

• Document the Spill: Documentation of the spill will be made in accordance with the SOP.

Adverse Incident Response Procedures

As with the spill response procedures, the adverse incident response procedures will be handled by the Applicator, the company hired to conduct the chemical application. The adverse incident response procedures are presented below. A copy of the Applicator's Standard Operating Procedure (SOP) for Adverse Incidents will be provided to Maine DEP before the Application commences. Following an adverse incident, the following will be done:

INVESTIGATE THE SITE AND ASSESS THE SITUATION IMMEDIATELY

Answers to the following questions will be documented:

- What has occurred?
- What chemicals have been applied and could they have contributed to the incident?
- Who/what else may still be at risk?
- What are the weather conditions?
- What is the terrain like?
- Can anything be done to mitigate further damage (example aeration)?
- What resources are required and are they readily available?

REPORT IMMEDIATELY

The following notifications will be made:

- The Maine Board of Chemical Control (207-287-2731)
- The Maine Department of Environmental Protection Eastern ME Regional Office (207-941-4570)
- The Maine Department of Inland Fisheries and Wildlife (207-287-8000)
- Environmental Protection Agency Region 1 (Boston, MA) (617-918-1579)

Any other department responsible for receiving reports of adverse incidents in Maine will be contacted, and assistance will be requested if necessary. Also, the incident will be reported to the Town of Parsonsfield and other interested parties. Incident notification will be performed in accordance with the SOP.

COLLECT WATER AND SOIL SAMPLES:

Samples will be collected in opaque glass jars and the samples will be frozen. The samples will be shipped overnight on ice to a designated laboratory for analysis of chemical content as soon as possible.

COLLECT DEAD ANIMAL/ FISH SAMPLES:

If the adverse incident is a wildlife and/or fish kill, samples of the dead animals/fish will be collected. The specimens will be wrapped in aluminum foil or placed inside a glass jar and frozen (for preservation purposes). Chemical testing of the samples may be requested.

ADVERSE INCIDENT REPORTING:

An Adverse Incident Report will be prepared in accordance with the selected contractor's existing SOP.

5. SIGNATURE REQUIREMENTS

The Decision maker(s) must sign, date and certify the CDMP by incorporating the following statement into the CDMP.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: Deb Hiney **Title:** President, Board of Directors **Organization:** Long Pond Association

Debra Hiney
Signature

March 29, 2022
Date

Richard Brereton
Signature

March 28, 2022
Date

6. APPENDICES

A. Minimizing Impacts to Non-Target Organisms
B. Monitoring Plan for Long Pond Alum Treatment
C. Proposed Bid Specifications
D. Application Protocol
E. Long Pond Association Outreach Materials
F. References

Appendix A. Minimizing Impacts to Non-Target Organisms

Literature Review

A review of the available literature on the effects of alum treatment on non-target organisms shows that some impacts have been noted in experimental studies and during whole-lake applications. The impacts noted in studies are varied and dependent on a wide variety of factors including focus species, total aluminum (Al) concentrations, dissolved Al concentrations, depth, pH, chemical composition of the water such as presence of organic ligands and hardness, and the impact metric studied. Most impacts on lake biota are short-to-moderate termed. Both short-term declines in zooplankton abundance and longer-term change in the relative composition of zooplankton communities following alum treatment have been observed (Shumaker *et al.* 1993). Additionally, benthic macroinvertebrate populations have been shown to decline at certain depths one-year post alum treatment, but populations recovered within two years and ultimately increased in density and species richness as a longer-term response (Smeltzer *et al.* 1999).

In experimental mesocosms, Freeman and Everhart (1971) found that Rainbow Trout mortality and growth were significantly impacted by total Al concentrations as low as 520 micrograms per liter (µg/L) at in water at a pH of 7 to 9. Based in part on this work, Cooke and Kennedy (1981) produced a US Environmental Protection Agency (EPA) study recommending a target safe level of 50 µg/L in water.

In an alum treatment in Lake Morey, Vermont in the late 1980s, Yellow Perch size quality was decreased following alum treatment and this impact was attributed to sublethal aluminum toxicity. Monitoring data from this study indicates that dissolved Al concentrations exceeded the 50 µg/L target safe level recommended by Cooke and Kennedy's 1981 EPA study due to equipment malfunction, and levels up to 200 µg/L were present at certain depth for a period of 30 days following treatment (Smeltzer *et al.* 1999).

Long Pond hosts a viable smelt fishery. The impacts of alum treatment on smelt are of particular concern because they comprise the base of the food chain for other fish species present in Long Pond and the ecology of smelt make them more susceptible to potential impacts from treatment. One specific concern is that smelt could be present in open waters at depths that coincide with the alum mixing zone before the alum is dispersed and diluted. The mixing zone during the initial dosing event is where research has indicated that Al concentrations tend to be highest and the short-lived intermediate products the most toxic, before aluminum hydroxides and flocs have fully formed (Gensemer and Playle 1999 and citations within). Smelt populations are neither common nor rare in Maine but, once lost or diminished, are very difficult to reestablish, and in the absence of extensive aluminum monitoring data there is justifiable concern that smelt could have been impacted by past alum treatments in Maine (J. Pellerin, pers. comm.).

A comprehensive synthesis by Cooke et al. (2005) (the same Cooke who coauthored the 1981 EPA study) places the earlier research in the context of decades of additional experience with real-world application using many advancements in safety. The authors point out that continuous exposure experiments in mesocosms are not realistic tests of the effect of alum treatment on fish in a lake, because in practice fish are only impacted in the active mixing zone of a treatment, or when floc falls through the water column, because fish are able to move and avoid toxic concentrations of aluminum (Cooke *et al.* 2005 and citations within). Additionally, lake chemistry has a blunting effect on any potential toxicity of Al on non-target organisms, as the presence of total organic carbon and hardness (particularly calcium ions) will form organic ligands with aluminum and reduce or eliminate aluminum toxicity (Cooke *et al.* 2005 and citations within).

In summary, despite demonstrated impacts to non-target organisms in certain experimental and real-world aluminum exposures, alum treatment is widely accepted as a beneficial water quality restoration and management tool with a track record of safe use for non-target organisms. The North American Lake Management Society (NALMS) holds the position that treating a lake with alum to control phosphorus is a “safe and effective” management tool as long as the treatment is designed and controlled to limit concerns with toxicity to aquatic life (NALMS 2004).In order to reduce the impact on the environment and non-target organisms, Alum (Aluminum, Al) will be applied at a dosage rate that minimizes effects to non-target organisms while remaining effective for target species. There are three alum treatment protective measures that have shown to prevent significant toxicity during applications in New England lakes and ponds for over 20 years. The three preventive measures are to 1) control pH levels, 2) keep the Al confined to the mixing zone, and 3) avoid treating areas with heavy dosage or more than one pass on consecutive days.

Application Method

For this project, the firm hired to conduct the chemical application (Contractor) shall conduct the aluminum sulfate/sodium aluminate application utilizing an appropriate vessel with a subsurface injection system that allows for controlled application and proper mixing of liquid aluminum sulfate and sodium aluminate at variable boat speeds. The barge position in the lake shall be managed by a global positioning system and a depth monitoring system that allows the operator to know where the vessel is and to direct application within the target area and only in the target area.

The treatment vessel will be loaded with aluminum compounds at a designated location set up properly to address any equipment issues, refueling, spills of fuel or aluminum compounds, and to minimize any environmental damage.

The Contractor shall apply the aluminum sulfate and sodium aluminate at a ratio that results in a pH between 6 and 8, with a preferred range of 6.5 to 7.5 and an average pH target of 7. It is assumed that a ratio of 2:1 (alum to aluminate by volume) will result in the desired conditions, but the Contractor will be responsible for ratio adjustment to maintain the pH within the range of 6-8 standard units. Chemicals must be simultaneously distributed by means of a dual manifold or other appropriate injection system that results in a mixing zone of suitable depth.

The Contractor will be responsible for application in a pattern that will lead to uniform distribution of aluminum floc on the bottom in the target area with minimum drift outside the target area. The application rate shall be such that the calculated concentration of aluminum in the active mixing zone (assumed to be five (5) vertical meters unless otherwise documented by the Contractor) will not exceed 5 milligrams Al per liter (mg/L), corresponding to a dose of 25 grams per square meter (g/m^2) unless approved by the Awarding Authority after consultation with the Maine DEP. Where an area must be treated more than once to achieve the target dose, at least 24 hours must elapse between treatments of the same area.

It is expected that the treatment will occur in the spring, with the month of May and completion by Memorial Day weekend strongly preferred to achieve phosphorus inactivation before the occurrence of the low-oxygen conditions that favor internal phosphorus release from the sediments in the deepest depths of Long Pond. Treatment later in the spring or summer will also be beneficial for future years but will be less likely to inactivate phosphorus and prevent algae blooms during the 2022 season.

Monitoring During Alum Treatment

Monitoring needs during the alum treatment will take place throughout the day at specific monitoring locations:

- Treatment area monitoring (each morning, before the treatment barge begins) – Both the proposed treatment area and the location treated the previous day will be sampled. Parameters collected include: Secchi disk transparency, dissolved oxygen, temperature, conductivity, pH, and alkalinity.
- Control monitoring (morning and late afternoon) will take place either at an established site not being treated but at least 4 m deep or in a site not treated for at least 2 days. Monitoring will occurin the morning before the barge begins, and again at the same location following treatment that day. Parameters collected include: Secchi disk transparency, dissolved oxygen, temperature, conductivity, pH and alkalinity.
- In-plume monitoring and floc evaluation will occur continuously during treatment and conducted within the aluminum plume (usually between 50’ and 200’ from the barge). Conductivity and pH data will be collected, with alkalinity checked if the pH drops below 6 standard units. Evaluation offloc will be completed via an underwater camera.

- **Fish and aquatic life surveys** on the downwind shoreline of Long Pond will occur daily during the aluminum treatment. Surveyors will observe shoreline areas for fish, shellfish, snail, amphibian, and bird fatalities or behavioral abnormalities and other signs of potential aluminum or pH toxicity.

See **Appendix B** for the complete **Monitoring Plan**.

Appendix B. Monitoring Plan

Water Quality and Environmental Monitoring Before, During, and After the Proposed Long Pond Alum Treatment

Monitoring will include daily pH and alkalinity testing in the treatment zone and in reference areas outside the treatment zone, daily surface and subsurface inspection for floc formation and settling and any distress to visible aquatic organisms.

Before, during, and after the proposed alum treatment, monthly water chemistry monitoring for features such as temperature, oxygen, phosphorus, and nitrogen will continue to be conducted at Long Pond.

During the treatment, an on-site third-party monitor will collect water quality and environmental data from a separate vessel. All data will be available to the Contractor as quickly as possible, with field measures available the same day as collected. The third-party monitor will communicate immediately with the Contractor if any problems are indicated, including high or low pH, fish kills, or other negative impacts that may require cessation and/or modification of the treatment protocol.

Aluminum concentrations will be monitored before the treatment, in the hours and days immediately following the treatment, and at time points weeks to months after the treatment.

Please refer to Table B1 on the following page for the detailed list of parameters to be measured, the timing of measurements, and the locations of measurements to be taken.

TABLE B1. Long Pond Monitoring Plan.

When	**Before/After Treatment - 2022**	**During Treatment - 2022**						**After Treatment - 2023+**
	Monthly to within a week before treatment starts, within a week of completion, monthly thereafter	Each morning before barge starts treatment			During treatment	Following treatment - late afternoon	Evening (or early the next morning)	Monthly from spring-fall
Where	Deep Spot	Treatment area	Control-treated on final day	Area treated previous day	In plume **	Control-treated on final day	Shoreline (esp. downwind shore)	Deep Spot
Secchi Disk Transparency ***	●	●	●	●		●		●
Profile (1-m intervals): Dissolved Oxygen/Temp ***	●	●	●	●		●		●
Profile (1-m intervals): Conductivity/pH	●	●	●	●	●	●		
Alkalinity (core and bottom grab)	●	●	●	●	●	●		
Phytoplankton (core) ^^	●							●
Zooplankton (min. 5 tows)	●							●
Total Phosphorus Grabs (1, 3, 5, 7, 9 m)	●							●
Total and dissolved aluminum (core and bottom grab) ^	●	● *		● *				
Chlorophyll-a (core)	●							●
Sediment (3, composited) ^^^	●							●
Fish & Aquatic Life [1]	●	●	●	●	●	●	●	
Floc evaluation with camera [2]					●			
Total Kjeldahl Nitrogen Grabs (1, 3, 5, 7, 9 m)	●							●
Nitrate-Nitrite Grabs (1, 3, 5, 7, 9 m)	●							●
Dissolved Organic Carbon Grabs (1, 3, 5, 7, 9 m)	●							●
Flow Monitoring at the Outlet Stream	●							●[3]
Total Phosphorus Grab at the Outlet Stream	●							●

** aluminum sampling will occur at the deep spot at all time points, with one additional station (location TBD) to be sampled at time points immediately following the conclusion of the treatment. See detailed narrative description of aluminum sampling on following page.*

*** continuously during the first days, less frequently thereafter; between 50' and 200' from the barge.*

**** aim for bi-weekly readings.*

^ collection of monthly aluminum samples may be discontinued once background levels are achieved following treatment.

^^ if blooms occur following alum treatment, weekly phytoplankton samples should be collected through the bloom period; in addition, at least one water sample should be tested for microcystin.

^^^ ideally collected within one week after the alum treatment, one year after treatment, and at 5-year intervals thereafter.

[1] surveyors observe shoreline areas for fish, shellfish, snail, amphibian, and bird fatalities, insect hatches, and other signs of potential aluminum or pH toxicity.

[2] test camera the day before treatment begins

[3]Recommend flow monitoring at six times per year under wet weather conditions

Aluminum Sampling Narrative

Upon project review by the Maine Department of Inland Fisheries and Wildlife (IF&W), Jim Pellerin (IF&W Regional Fisheries Biologist) relayed IF&W's concern about the need for more study of potential aluminum toxicity in alum treatments, which are becoming more frequent in Maine.

Following discussion between Mr. Pellerin, Linda Bacon (MEDEP Lakes Assessment section leader), and Rich Brereton (FB Environmental project manager on behalf of Long Pond Association), a plan for more aluminum monitoring effort was devised in order to determine 1) the maximum concentrations to which lake biota may be exposed due to the alum treatment; and 2) the duration of elevated concentrations.

To address #1, the project team will conduct sampling at additional depth increments during the alum treatment, to replace the typical epilimnetic core that allows measurement of an an average concentration across the entire epilimnion.

To address #2, for more information about the duration of elevated aluminum concentrations post-treatment, the project team will conduct sampling at 15 days post-treatment (in addition to the 30-day post-treatment sample that was already in the monitoring plan).

The following protocol will be observed:

Before treatment (1 day before alum treatment begins, or on the day alum treatment begins but before treatment starts):

Sample total aluminum in epilimnetic core and bottom grab (2 Tot Al samples). These samples will represent background aluminum levels.

Immediately following treatment (within 1 hour of completion of treatment):

Sample total at 2, 4, and 6 meters and a bottom grab (4 Tot Al samples). This will be done at two stations. There is no "control station" due to the small total lake area and small untreated area of Long Pond. As witnessed in the Georges Pond alum treatment monitoring, the "control" sampling station experienced elevated Al concentrations just as the treated sampling station did.

Repeat the above at 48 and 96 hours following the conclusion of the treatment.

15 days after treatment:

Sample total and dissolved aluminum epilimnetic core and bottom grab (2 Tot Al samples samples). By the 15-day mark and subsequent time points, it is assumed that the alum will be well-mixed in the epilimnion and no additional depth increment sampling will be needed.

30 days after treatment:

Just as with 15-day post-treatment sample, collect samples for total aluminum as epilimnetic core and bottom grab (2 Tot Al samples and 2 Diss Al samples).

Appendix C. Proposed Bid Specifications

The following bid specifications were sent out to qualified alum treatment contractors in a Request for Proposals dated January 3, 2022.

Sequence of Work

A. Aluminum treatment shall not begin until the chemical applicator (Contractor) is approved by Owner. The single treatment is to occur in the Spring of 2022.

B. The Contractor shall provide all equipment, labor, and materials necessary to perform the work including application equipment, and equipment necessary to mobilize and demobilize. This shall include:

a. GPS-linked computer system for barge (boat) guidance that is integrated with real-time bathymetric measurements and simultaneous chemical dosing control for both aluminum sulfate and sodium aluminate pumping rates,

b. treatment barge (boat) with on-board chemical storage tanks, and

c. boom applicator for even chemical distribution of chemicals.

C. Application is to occur after ice out but not until the lake is a minimum 40° F throughout the water column, weather permitting. Application is not permitted during Memorial Day Weekend to allow for recreational use. Once the alum application is started, the contractor has 30 calendar days to complete the treatment to ensure application effectiveness.

Submittals

A. The Contractor shall submit certificate(s) indicating all materials meet requirements of these Specifications before treatment occurs. The Contractor shall submit the item, applicable reference specification, class, type, manufacturer, and distributor. The Contractor shall also submit the results of aluminum sulfate lot testing of materials delivered to the site, including an analysis of the metals content of the material, before treatment.

B. The Contractor shall submit GPS coordinates and corresponding application rates and amounts of aluminum sulfate applied to the lake. These data shall be collected by the Contractor in real-time during the application and submitted to the project manager on a daily basis.

C. The Contractor shall submit a Plan of Work for approval by the project manager prior to the start of work. The Plan of work shall include, at a minimum, the following items:

a. Explanation of plans and schedule for the timely delivery, storage and transfer of chemicals. All piping, fittings, couplings and connectors for alum distribution lines, storage tank, pumps, and injector units must meet corrosion resistance standards for alum.

b. Description of the temporary lakeshore chemical storage facilities including a spill prevention, control and contingency plan (SPCC Plan). Manufacture's model number and material type for alum storage tank(s).

c. Method of chemical distribution documenting the computer control of chemical pumping rate into the lake based on application vessel speed, real-time GPS navigation, and bathymetric measurements to ensure an ultimate effective dose.

d. Explanation of navigational guidance system detailing real-time GPS linked computer system for barge (boat) guidance and chemical metering control to ensure complete and uniform chemical coverage during application.

e. Description of all backup systems to minimize down time.

f. Description of land-to-vessel chemical transfer method.

g. Anticipated treatment capacity (acre/hour or gallons/day). CONTRACTOR shall demonstrate an ability to apply approximately 15,000 gallons per day.

h. Plan for adjusting application procedures or taking other steps to respond to unfavorable lake pH change or other adverse occurrence during application.

i. The base bid shall include mobilization, all equipment, material, work and labor, and applicable taxes required to complete the application described.

__Chemicals__

A. Aluminum Sulfate (Alum)

a. Liquid aluminum sulfate supplied shall meet the requirements of AWWA B403-88. The liquid aluminum sulfate [Al2(SO4)3•14.3(H2O)] shall be of commercial grade appropriate for the application with an aluminum content of 4.4% Al+3 (Aluminum) by weight.

b. The aluminum sulfate supplied under this standard shall contain no soluble mineral or organic substances in quantities capable of producing deleterious or injurious effects on public health or water quality.

__Delivery, Storage, and Handling__

A. The Contractor shall provide the name and location of the proposed chemical supplier with the Bid and will be responsible for all coordination with the aluminum supplier necessary to ensure timely delivery to the project site. The Contractor shall confine all storage of equipment and materials within the Project Limits and otherwise in a safe, secure and environmentally sound manner. Conformance to these requirements shall be determined by the Contractor, subject to disapproval of the project manager, whose failure to disapprove does not, however, constitute any shift of responsibility to properly handle equipment and materials from Contractor to project manager. Tank Truck haul routes and site access shall be as directed by Owner. If gradual off-loading is required, the contractor shall be responsible for all demurrage charges.

B. The Contractor shall provide notice to Owner of delivery of equipment and materials seven days prior to the delivery date.

C. The Contractor shall maintain a copy of the spill prevention and spill contingency plan on site for the duration of the project.

Unfavorable Treatment Conditions

A. The project manager will be responsible to monitor wind and precipitation in order to make its judgments about whether conditions are suitable for application.

B. Application of aluminum shall not occur when wind speeds 6 feet above the lake surface exceed 15 miles per hour unless approved by the project manager. Application of aluminum shall not occur if it can be reasonably expected (forecast) that a significant precipitation event (greater than 0.5 inches in 24 hours) shall occur during treatment or begin within 24 hours after treatment completion.

Appendix D. Application Protocol

Mobilization and Staging Area Set Up

The Contractor shall get all necessary equipment to the site and establish an appropriate staging area from which the Contractor shall operate. Chemicals and sensitive equipment must be stored securely whenever the Contractor is not on site. The Awarding Authority will assist in locating the staging area and providing secure storage. Any overnight or off-time security personnel will be the responsibility of the Contractor.

Alum Transfer and Safe Handling

The Contractor shall plan and schedule the timely delivery, storage and transfer of aluminum sulfate and sodium aluminate. All piping shall be appropriate to the materials being transferred, corrosion resistant, with proper joint seals, and free of observable defects. All storage tanks, pipes, hoses, couplings, and connectors for aluminum compounds must meet corrosion resistance standards for those aluminum compounds.

The Contractor will have a spill prevention, control and contingency plan in place, a written copy of which will be accessible on site and will have adequate spill control materials to properly clean up after any spill.

Alum Application and Monitoring

See Appendix A and Appendix B for alum application and water monitoring protocols.

Demobilization and Site Restoration

The Contractor will remove all equipment related to the aluminum treatment at the end of the treatment process. All disturbed areas will be restored to their former conditions or better. The contractor is responsible for any snow removal required, and any repairs required from property damage due to snow removal. The Awarding Authority will inspect the staging area and certify that the Contractor has properly vacated and restored that area.

Reporting

The Contractor will maintain ongoing communication with the Awarding Authority and/or its field representative(s) and will advise all relevant parties on an ongoing basis as to application status, results, and all other conditions relevant to application. The Contractor shall keep daily records of the following:

- Hours of operation
- Quantities of aluminum sulfate and sodium aluminate applied
- Acreage of lake treated (daily and cumulative)
- Location (on map) of area treated each day

- Summary of chemical deliveries
- Explanation of any downtime, including weather conditions and equipment problems
- Any monitoring conducted by the Contractor

The Contractor shall also provide a completed coverage map at the end of the application, with any defined treatment sectors identified and the total quantities of aluminum sulfate and sodium aluminate applied to each. A concise summary report including all information relevant to the treatment is to be provided within 30 days of completion of the project.

Hazmat

Members of the crew will be available to respond to emergencies. They will maintain a trailer that is equipped with booms, absorbent pads, decontamination equipment, etc. This trailer will be parked at the deployment site and ready to go if needed.

Agency Notification

The following Agencies and Towns will be notified in advance of the chemical application:

- Maine Warden Service
- Maine Department of Inland Fisheries and Wildlife
- Maine Department of Environmental Protection
- Maine State Police
- Town of Parsonsfield

Police Patrol

Maine State Police will be notified about the project and will know the location of all chemical storage facilities that will be used during the chemical application. The Contractor will maintain security at the storage site.

Appendix E. Long Pond Outreach Materials

LONG POND ASSOCIATION

NEWSLETTER Parsonsfield, Maine FALL 2021

LONG POND ASSOCIATION ZOOM MEETING
THURSDAY, NOVEMBER 4TH, 7:00 P.M. EASTERN TIME

WHY IS THE LAKE SO CLEAR?

Laura Diemer, FB Environmental Associates

The LPA has been faced recently with a persistent, yet unsurprising, question – why is the lake so clear in 2021? Has the lake healed itself? The short answer is – no, the excellent water clarity that Long Pond experienced in 2021 reflects normal year-to-year variation in weather, which can either stymie or promote excessive growth of plants, algae, and cyanobacteria in lakes. The lake has not healed itself, and the problem has not gone away. Refer to Figure 1.
The LPA is currently gearing up for a large fundraising effort to pay for an alum treatment of the lake in 2022 because the modeling shows that a significant amount of phosphorus (a limiting nutrient for growth) is coming from bottom sediments during the summer months when bottom waters become devoid of oxygen. This phenomenon is known as internal loading and can trigger blooms. Internal loading has been occurring every year in Long Pond for many years and has been building over time. Sample results from 2021 show that internal loading was occurring in Long Pond all summer and for a longer amount of time than in 2020.
So why was the water quality so good in 2021? Because there is a trifecta of environmental conditions that need to be met for a nuisance bloom to occur – there needs to be plentiful nutrients (namely phosphorus), heat (consistent, warm water temperatures), and light (bright sunny days). Our review of sample results and weather records indicate that only one of these three conditions were satisfactorily met this summer – nutrients. Phosphorus in the water column was just as high if not higher than in 2020. The other two conditions – heat and light –

were dampened this summer due to the abnormal summer weather experienced by most of New England.

Local air temperature in early summer (April-June) 2021 was generally warmer than normal with less rainfall than normal compared to the previous 25 years (1995-2021) (Figures 2, 3). Spring rains would normally load up the lake with nutrients for use later in the summer. Then July 2021 experienced record rainfall levels but under cooler-than-usual air temperatures. Cloudy, rainy days over an extended period of time cooled water temperature, flushed out a large mass of nutrient load, and reduced light penetration, limiting any significant bloom growth in the lake. Conversely, July 2020 experienced normal rainfall amounts but under warmer-than-usual air temperatures, warming the water at a critical time of year for bloom growth. Profile data collected by an LPA volunteer, Justin Cook, show that water temperature in Long Pond was much warmer in late summer in 2020 compared to 2021.

Climate change will continue to make year-to-year weather more variable and thus harder to anticipate for bloom conditions. Even so, the science clearly shows that Maine's climate is becoming warmer and rainier, which is upsetting the ecological balance of many of our treasured lakes, including Long Pond. Without treatment, Long Pond will continue to suffer from blooms in future years, blooms which will likely become more severe and prolonged in the coming decades.

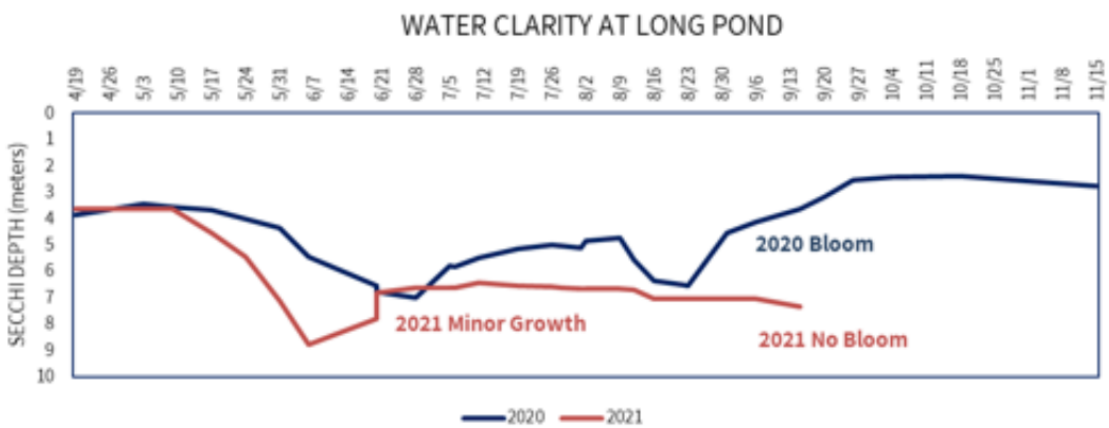


Figure 1. Water clarity (measured in meters below the surface using a Secchi disk and scope) of Long Pond in 2020 (blue) and 2021 (red). Water clarity in 2020 was generally shallower than in 2021 with algae and cyanobacteria growth building from July through October. A deepening of water clarity occurred at the end of August following a large storm event that mixed and flushed the lake. Water clarity in 2021 was generally deeper than in 2020 with minor growth apparent in June-July that did not build into bloom status by early fall. July was abnormally cool and cloudy, limiting the heat and light necessary to spur bloom growth.

Appendix F. References

Cooke, G.D., Welch, E.B., Peterson, S.A. and Nichols, S.A., 2005. Restoration and management of lakes and reservoirs. CRC Press: Boca Raton, FL.

FBE (2021). Long Pond Lake Loading Response Model. Prepared by FB Environmental Associates.

Freeman, Robert A. and W. Harry Everhart. 1971. Toxicity of aluminum hydroxide complexes in neural and basic media to Rainbow Trout. Trans. Amer. Fish. Soc. 4: 644-658.

Gensemer, Robert W. and Richard C. Playle (1999) The Bioavailability and Toxicity of Aluminum in Aquatic Environments, Critical Reviews in Environmental Science and Technology, 29:4, 315-450, DOI: 10.1080/10643389991259245

North American Lake Management Society. 2004. The Use of Alum for Lake Management.

Schumaker, Rick J., William H. Funk, and Barry C. Moore. 1993. Zooplankton Responses to Aluminum Sulfate Treatment of Newman Lake, Washington. Journal of Freshwater Ecology, 8:4, 375-387.

Smeltzer, Eric, Richard a. Kirn, and Steven Fiske. 1999. Long-term Water Quality and Biological Effects of Alum Treatment of Lake Morey, Vermont. Journal of Lake and Reservoir Management, 15 (3): 173-184.

Wagner, K. (2015). Oxygenation and Circulation as Aids to Water Supply Reservoir Management. Water Research Foundation, Denver, CO.

WRS, Inc. (2021). Internal loading to Long Pond and related implications. Prepared by Water Resource Services, Inc.

Rich Brereton <richb@fbenvironmental.com>

Long P Alum Treatment

Rich Brereton <richb@fbenvironmental.com> Thu, Apr 7, 2022 at 2:17 PM
To: "Pellerin, James" <james.pellerin@maine.gov>
Cc: "Bacon, Linda C" <linda.c.bacon@maine.gov>, "Dionne, Cindy L" <Cindy.L.Dionne@maine.gov>

Hi Jim, Linda, and Cindy,

Jim and Linda, thank you again for taking the time this morning to go through MDIFW's concerns in detail. I'm encouraged that we arrived at a plan to address concerns and collect additional data that will gain valuable information from this proposed treatment and hopefully future proposals can learn from this one.

I have attached meeting notes, please feel free to review and suggest any additions/changes. **I'm copying and pasting the tentative schedule and action items here:**
Tentative schedule:
(pending Long Pond Association's approval and contractor availability):

- May 1-30 – MDIFW conducts pre-alum juvenile smelt trawling and smallmouth bass/yellow perch collection
- May 31-June 3 – target week for alum treatment.
- June 6-30 – MDIFW conducts post-alum juvenile smelt trawling

Action items:

- Jim to reach out to Tim Obrey, MDIFW Greenville, re: timing of CPUE trawling, gear specs and cost from Tim's experience on Moosehead Lake smelt studies.
- Rich to update Cindy Dionne of DEP and the Long Pond Association (LPA) board on the meeting's results.
- Rich to work up additional aluminum sampling cost estimate.
- Rich to ask for authorization from LPA to write additional aluminum monitoring and smelt trawling gear into monitoring plan, with associated costs.
- Pending the results of the above action items, Rich to revise monitoring plan and submit to DEP.

Please let me know if you have any followup questions or concerns.

Best,
Rich

Rich Brereton, Ph.D.
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Meeting notes, Long Pond Alum Treatment discussion

April 7, 2022 10:00am – Zoom

Attendees:

Jim Pellerin – Regional Fisheries Biologist, Gray office, Maine Inland Fisheries & Wildlife

Linda Bacon – Lake Assessment section lead, Maine Department of Environmental Protection

Rich Brereton – Project Manager, FB Environmental Associates (on behalf of Long Pond Association)

Meeting notes:

The discussion proceeded to look in-depth at MDIFW's letter dated March 17, 2022 and examine each of the concerns numbered 1-5.

1. Literature review. All agreed that the Long Pond proposal and future proposals should include a literature review of the potential harmful impacts of alum treatments to nontarget organisms, particularly fisheries of note, so that stakeholders can be properly informed. Jim's references that he provided along with the March 17 letter (Freeman and Everhart 1971, Cooke and Kennedy 1981, Gensemer and Playle 1999, Smeltzer et al. 1999) provide a convenient starting point and Rich has started drafting this review, including notably Cooke et al.'s 2005 textbook Restoration and Management of Lakes and Reservoirs (3rd ed.) and references therein.

2. Potential long-term impacts of alum treatment on longer-lived fish. Jim would like to prioritize scale growth analysis from the 6-year class of smallmouth bass and yellow perch. Brown trout are shorter-lived and we would not be as likely to get a large enough sample size of that age cohort. These fish could be collected in late May before the alum treatment, with a follow-up collection of fish post-treatment.

3. Potential for aluminum toxicity to rainbow smelt. The group discussed previous alum treatments in Maine where the smelt had crashed after the treatment, Cochnewagon and Auburn Lakes. Cochnewagon Lake was treated with alum once in the early 1980s and then again in 2019. The smelt population crashed after the 2019 alum treatment. We aren't aware of any data on whether the population crashed after the earlier treatment. Lake Auburn was treated for the first time in 2019, no sign yet of recovery.

Jim had suggested in his letter two potential studies to assess the treatment's effect on smelt:

a) a bioassay where juvenile smelt are exposed to varying levels of aluminum in experimental enclosures, along with more extensive alum sampling data during the treatment, and/or

b) trawling for juvenile smelt to quantify catch per unit effort before and after the alum treatment.

Linda asked whether the smelt are at the southern end of their range in Long Pond. It is possible that smelt are impacted by trophic effects of an earlier ice-out due to climate warming, but we don't have any data on that.

Rich relayed his 4/1/22 phone conversation with Dr. Joe Zydlewski, fisheries professor at UMaine Orono, to Jim and Linda. Joe cautioned that the level of uncertainty in a single time point is very great, and good estimates of smelt populations are notoriously difficult in the best of circumstances over long time periods. To increase the level of inference from a single-time-point measurement, Joe recommended a paired lake study that would minimize the interference of other factors. The closest smelt fishery is Colcord Pond in Porter, on the New Hampshire border.

Jim relayed that the smelt have just started running in Long Pond. That means juvenile smelt will be hatching by the end of April, giving us about three weeks to get this study in place.

Jim provisionally agreed to put smelt trawling in his IF&W workplan (which is in process), which would mean IF&W could supply the boat and the staff needed to do weekly trawls, for approximately four weeks in May. Then, if the treatment is timed for the first week of June, post-treatment trawling would occur the remainder of June before the smelt change their behavior. IF&W would need a place to store the boat on the pond. Jim will follow up with Tim Obrey about this proposed timing, and about the trawling gear specification (the custom net and frame) and associated cost, at least as of the time the Moosehead Lake smelt trawling project was started.

The bioassay study could be completed at any time – it does not need to be before the Long Pond alum treatment. The group agreed that the more extensive aluminum sampling would be needed to determine the maximum concentrations of total and dissolved aluminum experienced during the treatment, and indeed would be valuable regardless of when/if the bioassay were to be carried out.

4. and 5. Both relating to the need to monitor aluminum concentrations more extensively. Jim's letter had expressed that maximum aluminum concentrations, rather than composite or average concentrations, should determine the acute toxicity encountered by fish and other biota, while the duration of elevated concentrations should determine the chronic toxicity. He suggested better aluminum sampling at discrete depth intervals in the epilimnion and over several time periods after the alum treatment (for comparison, the Georges Pond Association conducted one post-treatment sample at 30 days after their alum treatment in 2020).

Linda asked whether the contractor had been selected. Rich updated her that the two bidding contractors had merged, SOLitude acquiring HAB Aquatics. HAB will serve as SOLitude's in-house alum treatment unit. Linda added that SOLitude has treated lakes in geographic blocks in the past, applying alum in blocks as far away from one another as possible, while HAB has treated in a non-blocked fashion. The monitoring plan should be customized to the approach that the contractor will actually use.

<u>Tentative schedule:</u>

We agreed that a tentative schedule that would accommodate these additional studies is as follows (pending LPA's approval and contractor availability):

May 1-30 – MDIFW conducts pre-alum juvenile smelt trawling and smallmouth bass/yellow perch collection

May 31-June 3 – target week for alum treatment.

June 6-30 – MDIFW conducts post-alum juvenile smelt trawling

<u>Action items:</u>

Jim to reach out to Tim Obrey re: timing of CPUE trawling, gear specs and cost

Rich to update Cindy Dionne of DEP and the Long Pond Association (LPA) board on the meeting's results.

Rich to work up additional aluminum sampling cost estimate.

Rich to ask for authorization from LPA to write additional aluminum monitoring and smelt trawling gear into monitoring plan, with associated costs.

Pending the results of the above action items, Rich to revise monitoring plan and submit to DEP.

STATE OF MAINE
DEPARTMENT OF
INLAND FISHERIES & WILDLIFE
15 GAME FARM ROAD
GRAY, ME 04039

JANET T. MILLS
GOVERNOR

JUDITH CAMUSO
COMMISSIONER

March 17, 2022

Linda Bacon and Cindy Dionne
Maine Department of Environmental Protection (MDEP)
25 Tyson Drive SHS 17
Augusta, Maine 04333

RE: Alum Permit for Long Pond, Parsonsfield, Maine

Linda and Cindy,

As we have discussed, Rich Brereton of FB Environmental recently sent the Maine Department of Inland Fisheries and Wildlife (MDIFW) a proposal for the Alum Treatment on Long Pond in Parsonsfield and asked us to comment. This letter is a follow-up to our meeting on February 14th when we discussed this project and some MDIFW concerns. This letter recaps that discussion and in addition, I have included some of the literature you requested as additional attachments.

Long Pond supports popular and high-quality fisheries, particularly for Brown Trout and Smallmouth Bass. In addition, the pond supports a popular recreational dipnet fishery for Rainbow Smelt, and the smelt provide an important forage base for the Brown Trout and Smallmouth Bass, as well as other species.

Alum treatments are relatively new to us, this is only the second one I have seen in this region during my 26-year career here in Maine. The first being Auburn Lake, which I reviewed in 2019. After reviewing the Auburn proposal, we found there to be little to no discussion in the proposal regarding nontarget impacts, particularly impacts on fish. Consequently, we did a cursory literature search and found a couple items of concern. These items were discussed with MDEP and then later in more detail with the Auburn Water District (AWD) but were never adequately explored or resolved by the AWD.

Based on my review, alum treatments often improve water quality in terms of turbidity and phosphorus control if dosages and chemical application are appropriate and have rarely resulted in noticeable fish kills when properly dosed and buffered. MDIFW areas of concern:

(1) It appears short-to-moderate term impacts to the lake's biota should be expected. Shumaker et al. (1993) documented a short-term decline in zooplankton following an alum treatment in Newman Lake, Washington. In addition, they reported a longer-term post treatment change in the relative composition of the zooplankton community due to changes in food resources, and no long-term change in species diversity. Smeltzer et al. (1999) reported a 90% decrease in benthic macroinvertebrates at a specific depth one year following an alum treatment, but they recovered within 2 years. The longer-

term response to the treatment was a general increase in the density and species richness of the benthic invertebrate community, presumably due to improved water quality post treatment. These shorter-term impacts to the food chain are likely to result in similar short-term impacts on growth and possibly survival of certain fish species that rely on them as food. While longer-term improvements to water quality and health issues may certainly outweigh these short-term impacts, any impacts to nontargets should at least be discussed in future proposals so that all stakeholders are fully informed.

(2) Smeltzer et al. (1999) showed a moderate-term impact on Yellow Perch size quality (6-years) post treatment, which was attributed to sub-lethal aluminum toxicity that impacted those cohorts of fish until they were replaced by new recruits produced post treatment. In addition, monitoring data from this same study indicated dissolved aluminum (Al) concentrations exceeded the target safe level of (50 ug/L) recommended by Cook and Kennedy (1981) by up to 4x and for a period of more than 30 days at certain depths. Moderate-term, sublethal impacts are concerning as many alum treatments suggest about a 10-year life span. If these impacts occur because of alum treatments and they also occur in longer-lived species like bass, then these fisheries may not fully recover with on-going periodic treatments.

During the AWD proposal Mr. Wagner dismissed this research of moderate term impacts in fish growth potentially related to fish appetite reduction following exposures to aluminum. This effect has been documented by several researchers in scientific journals. MDIFW will continue to assume this research to be valid unless we have more evidence to suggest otherwise. It should certainly be explored or further evaluated in relation to this and/or future alum treatments in Maine. One may be able to do this on perch and/or other species with a shorter-term study via scale growth analyses pre/post-treatment. The proposed timing of the current proposal would likely be a couple weeks too early to allow for collection of any pre-treatment fish data.

(3) MDIFW staff are particularly concerned about the treatment impacts on smelt, as they are the base of the food chain for many of the other sport fish in the lake. We suspect <u>if</u> there were impacts to fish from an alum treatment smelt would likely be the most affected fish species due to their young life stage at the time of treatment (an ichthyoplankton); more limited swimming and avoidance ability; their reliance on plankton for food; and, due to their behavior, they are more likely to be in the mixing zone areas prior to chemical dispersion and dilution where Al concentrations will be highest. In addition, according to Gensemer and Playle (1999) several researchers have indicated that Al tends to be more toxic at initial dosing.

Anecdotal evidence from two recent alum treatments in Maine, Cochnewogan and Auburn Lakes, suggest smelt populations <u>may</u> have been impacted. Cochnewogan Lake has been a significant and relatively consistent source of smelt for commercial bait dealers for at least the past couple of decades, and that fishery collapsed post treatment. Auburn Lake smelt were recovering with some exceptional runs a year or two prior to 2019 alum treatment but have failed to meet expectations post treatment.

Smelt population are notorious for being volatile, so other explanations/causes other than alum could certainly be at play in these circumstances. Nonetheless, MDIFW believes the importance of smelt and the potential impacts of alum warrant further investigation. The proposed visual surveys are unlikely to capture impacts on smelt fry.

Two possible studies to be considered for this and/or future proposals: (1) bioassay work on juvenile smelt coupled with more extensive alum monitoring in the epilimnion; and/or (2) pre/post treatment smelt trawling to explore changes in CPUE. Smelt trawling work could be conducted like the work currently being done on Moosehead Lake. A large, unusual drop in CPUE post treatment would likely indicate a treatment impact.

(4) The monitoring plan for Al was poorly described in the current proposal. Monitoring is important to ensure that treatment levels are attained and that certain levels that are deemed detrimental are not exceeded. In addition, as noted above it would be appropriate to collect thorough sampling data in the epilimnion in case bioassay data is available at a later date, and it is important to get at maximum exposure concentrations rather than core or average values, as maximum values typically dictate acute or chronic impacts in biological systems.

(5) This project proposes total Al will not exceed 5 mg/L. It remains unclear what the anticipated maximum concentration might be in the 0-5', 5-10', or the 10-15' depth range where juvenile smelt are likely to be located, and how long those values will persist. Based on my limited research there is a vast array of data regarding lethal and sub lethal impacts to aquatic organisms from Aluminum, and the information is somewhat complicated to digest as researchers have measured different forms, under different water chemistry parameters, using many species, and with varying life stages. Gensemer and Playle (1999) provide a relatively thorough review of Al toxicity. Some of the more concerning literature encountered:

- Cooke and Kennedy (1981) reported a target safe level of 50 ug/L (0.05 mg/L) dissolved aluminum, which was largely based upon work by Freeman and Everhart.
- Freeman and Everhart (1971) examined the toxicity of Al on Rainbow Trout in neutral and basic media that would be more representative of the pH range in natural surface waters. Most studies have looked at aluminum toxicity at lower pH's where Al tends to be more reactive and toxic form. They examined total Al concentrations of 0.052 mg/L, 0.52 mg/L, and 5.2 mg/L at pH 7, 8, 8.5, and 9. This is important as alum treatments are typically buffered in the pH 6-8 range to minimize more toxic reactive forms of Al. Their conclusion, "If aluminum is present in [dissolved] anionic and neutral or near neutral precipitated forms, a condition that should hold for most natural water with a pH greater than 5.5, tolerable concentrations of either form probably should not exceed 0.10 ppm (0.1 mg/L, 100 ug/L) if trout are to survive and grow normally." For clarification, these researchers believed dissolved and precipitated forms of aluminum where responsible for the observed impacts (i.e. mortality, growth) in the tested pH

range. Regardless of the form, negative impacts were noted at pH's 7 and 8 with total Al values of 0.52 and 5.2 mg/L.

- EPA's Aquatic Life Criteria for Aluminum Calculator with parameters for a Long Pond alum treatment:

SiteName	DOC (mg/L)	Total Hardness (mg/L as $CaCO_3$)	pH	FAV	CMC	CCC	Flag
Long P	2.8	9.9	6	259.071	130	86	
Long P	2.8	9.9	6.5	697.37	350	190	
Long P	2.8	9.9	7	1466.67	730	360	
Long P	2.8	9.9	7.5	2664.4	1300	670	
Long P	2.8	9.9	8	4084.42	2000	1200	

ACUTE (Short-term) (Total Al in ug/l)							
Rank 1		Rank 2		Rank 3		Rank 4	
Genus	GMAV	Genus	GMAV	Genus	GMAV	Genus	GMAV
Daphnia	214.1	Ceriodaphnia	715.7	Stenocypris	736.9	Micropterus	738.6
Daphnia	623.4	Micropterus	1,373.3	Oncorhynchus	1,522.4	Ceriodaphnia	2,083.7
Daphnia	1,419.9	Micropterus	2,553.3	Oncorhynchus	2,830.6	Ceriodaphnia	4,745.8
Daphnia	2,529.9	Micropterus	4,747.4	Oncorhynchus	5,262.9	Ceriodaphnia	8,456.0
Daphnia	3,526.5	Micropterus	8,826.8	Oncorhynchus	9,785.3	Ceriodaphnia	11,786.8

CHRONIC (Long-term) (Total Al ug/L)							
Rank 1		Rank 2		Rank 3		Rank 4	
Genus	GMCV	Genus	GMCV	Genus	GMCV	Genus	GMCV
Daphnia	90.8	Lampsilis	94.5	Salmo	107.4	Ceriodaphnia	108.8
Salmo	199.7	Daphnia	264.2	Lampsilis	275.2	Salvelinus	293.3
Salmo	371.3	Salvelinus	545.4	Daphnia	601.7	Lampsilis	626.7
Salmo	690.3	Salvelinus	1,014.1	Daphnia	1,072.2	Lampsilis	1,116.6
Salmo	1,283.4	Daphnia	1,494.5	Lampsilis	1,556.5	Ceriodaphnia	1,792.2

Definitions:
FAV = Final Acute Value
CMC = Criterion Maximum Concentration
CCC = Criterion Continuous Concentration
GMAC = Genus Mean Acute Value
GMCV = Genus Mean Chronic Value
Note: The Genus rows in the Acute and Chronic Tables correspond w/ the pH values (6-8) in the 1st table.

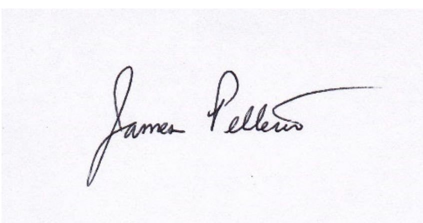
The maximum 5 mg/L (5000 ug/L) Al proposed certainly exceeds some of the acute and chronic values for some fish species at some pH values from the EPA calculator. It remains unknown if the exposure duration would be sufficient to result in any acute or chronic impacts to fish.

Note: Total aluminum monitoring data from the 2019 Auburn Lake alum treatment commonly and repeatedly exceeded 100 ug/L but was generally below 200 ug/L, particularly for the genus Salmo. For reference, Auburn Lake was treated at $18g/m^2$ for water >9m; Long Pond Treatment proposes $25g/m^2$ for water 8-9m and $50g/m^2$ for water < 7m, and the hypolimnion of Lake Morey in VT was treated at $44g/m^2$. This may suggest attainment of levels sufficient to cause chronic impacts to some fish species.

In conclusion, MDIFW would not anticipate acute toxicity resulting in a notable fish kill for most fish species but we still have concerns regarding smelt. The alum treatment may have short-to-moderate term direct and indirect impacts on the fish communities of Long Pond. Overall, we are supportive of efforts to improve the water quality of Long Pond including an alum treatment and offer the above concerns and considerations only as an effort to minimize impacts to the lakes fishery resources and to further investigate these potential impacts. In addition, we recognize that a successful alum treatment would likely benefit the lake water quality and its fisheries over the long-term by preventing algal blooms and their associated extreme anoxic conditions. We encourage ongoing consultation and discussion to further minimize any potential direct and indirect impacts to lake fisheries. Furthermore, we hope the applicant and the State resource agencies can explore our concerns via the requested additional information and by conducting additional monitoring that improves our understanding for future treatments on other Maine waters.

Please feel free to call me if you have any questions or concerns (287-5765).

Respectfully,



James Pellerin
Resource Management Supervisor - Fisheries
Sebago Lake Region

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LONG POND

CHEMICAL DISCHARGE MANAGEMENT PLAN

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CHEMICAL DISCHARGE MANAGEMENT PLAN

LONG POND ALUM TREATMENT

PARSONSFIELD, MAINE

MARCH 2022

PREPARED BY:

FB ENVIRONMENTAL ASSOCIATES

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. CHEMICAL DISCHARGE MANAGEMENT TEAM

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Applicator- *To be selected*

2. PROBLEM IDENTIFICATION

Problem Background and Introduction

Located in the Town of Parsonsfield in western Maine, Long Pond is a 263-acre Great Pond (Class GPA) with a maximum depth of 33 feet. At 1,093 acres, the surrounding watershed is relatively small and steeply sloped. Long Pond has one primary inlet in the northern end of the lake, as well as many small direct drainages. The outlet of Long Pond is situated at the southeasterly end of the lake and discharges through a wetland complex and into Noah's Pond. The outlet flows for approximately 100 feet before flowing through four culverts underneath the Road Between the Ponds. Long Pond is hydrologically connected to West Pond by a cross-culvert under Road Between the Ponds near the West End House (WEH) Camp. The West Pond outlet enters the Long Pond outlet stream between Long Pond and Noah's Pond, however, a small tributary stream branches off the West Pond outlet and enters Long Pond through the aforementioned cross-culvert.

The pond is on the Maine Department of Environmental Protection (Maine DEP)'s Nonpoint Priority Watersheds List due to recent changes in water quality consistent with the expected effects of nonpoint source phosphorus enrichment. Cyanobacteria blooms were observed by Long Pond residents and water quality volunteers in the summers of 2006, 2017, and 2018. The most severe bloom was observed starting on July 4, 2017.

Secchi disk transparency (SDT) has been collected every year since 1983, with intermittent phosphorus and chlorophyll-a sampling, Maine DEP and volunteer lake monitors (at the deep hole monitoring station).

- Long Pond is moderately shallow, with a maximum depth of 33 feet and a steeply sloping lake bottom. In most areas of the shoreline, depth increases to 20 feet close to the shoreline.
- The flushing rate is estimated at 0.5 flushes per year.
- Long Pond experienced decades of good water quality, with >4 meter SDT and dissolved oxygen down to 8-9 m. This has changed in recent decades and is especially pronounced since 2017, with decreased SDT, frequent dissolved oxygen depletion at 8 meters depth, and P release from sediment.

Water clarity (measured via Secchi disk) was relatively consistent in Long Pond from 1983 to 2009, until a reduction in clarity in 2010 (5.27 m) and 2011 (5.04 m; Fig. 1). The summer of 2017 experienced the poorest water clarity on record, 0.8 meters, and the lowest average, 2.48 meters, across the sampling season (June-October). In 2018, water clarity continued to be low, with the second lowest average Secchi depth reading of 3.72 meters. Degraded water clarity in recent years generally corresponds with increased TP2 and increased chlorophyll-a in 2017 and 2018 (Fig. 1). Median total phosphorus (TP) was 16 parts per billion (ppb) in 2017 (n=6), the highest for any sampling season, and 13.5 ppb in 2018 (n=4). Average chlorophyll-a was 23.75 ppb in 2017 (n=4) and 12.75 ppb in 2018 (n=3).

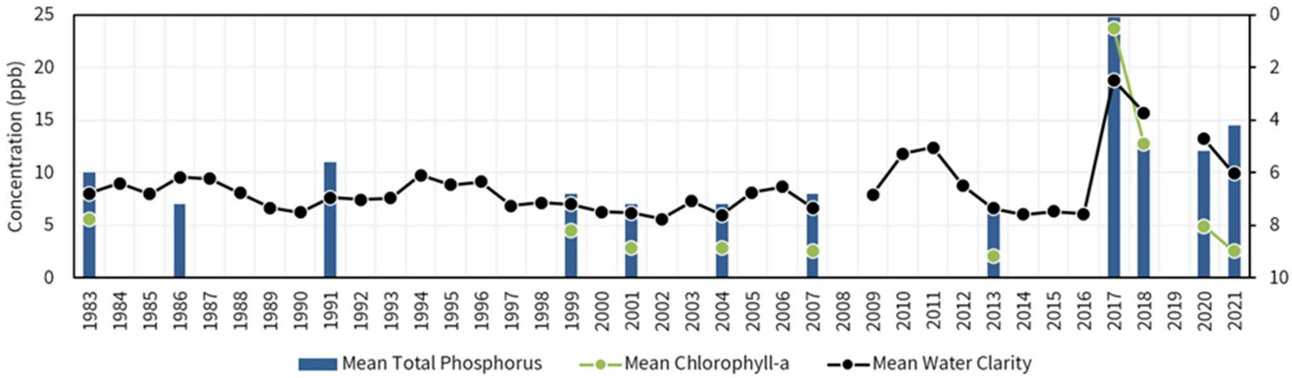


Figure 1. Mean total phosphorus (epilimnion core samples only), mean water clarity (Secchi depth), and mean chlorophyll-a measured at Long Pond from 1983-2021. Blooms were recorded in 2006, 2017, 2018, and 2020. 2019 data were not available from the MEDEP at the time of this plan. 2020-21 data were gathered from the LPA and were not quality assured by the MEDEP.

Watershed-Based Management Plan

The Long Pond Association raised local funding to complete a nine-element watershed-based plan (WBMP) to guide future lake restoration efforts. FB Environmental Associates (FBE) led the development of the plan with the assistance of a technical advisory committee including Maine DEP, LPA, St. Joseph's College of Standish, Maine, and Dr. Ken Wagner of Water Resource Services, Inc. The committee provided input on water quality analysis, modeling, and load reduction strategies throughout the planning process. The final plan, which is currently pending DEP approval, recommends continued external load reduction through watershed Best Management Practices (BMPs), non-structural BMPs, and internal load reduction through an alum treatment.

To limit the watershed load, the WBMP identified 19 residential properties with non-point source problems that could be addressed using BMPs. Nine private road and driveway sites, one town road site, and two summer camp sites were also identified in the WBMP. As part of the WBMP development, FBE conducted a lake loading analysis to inform load reduction goals and strategies, and this analysis was also used to evaluate the potential for alum treatment to reduce phosphorus loading into Long Pond (FBE, 2021).

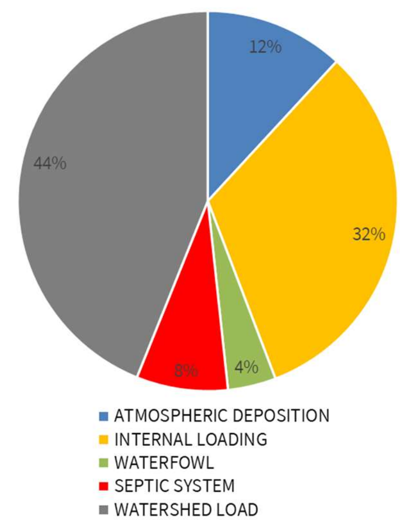
Education and Outreach Efforts

The Long Pond Association has conducted educational and outreach efforts to inform nearby residents about the alum treatment. The alum treatment recommendation has been developed in cooperation with the project technical advisory committee (TAC). The TAC is made up of stakeholders from the Long Pond Association, Maine DEP, York County Soil & Water Conservation District, FBE, and Dr. Ken Wagner of Water Resource Services, Inc. To date, two virtual TAC meetings have been held to discuss project and task updates. Additionally, the Long Pond Association has published information regarding the WBMP and alum treatment plan in their newsletter. See Appendix E for outreach materials on water quality, phosphorus, and alum treatment from the Spring and Fall 2021 Long Pond Association Newsletters.

Watershed Modeling & Loading Summary

During the development of the WBMP, a phosphorus loading analysis using the Lake Loading Response Model (LLRM) was completed by FBE (2021). The LLRM is an Excel-based model that uses environmental data to develop a water and phosphorus loading budget for lakes and their tributaries. Water and phosphorus loads (in the form of mass and concentration) are traced from various sources in the watershed through tributary basins and into the lake. The model incorporates data about watershed and sub-watershed boundaries, land cover, point sources (if applicable), septic systems, waterfowl, rainfall, volume and surface area, and internal phosphorus loading. These data are combined with coefficients, attenuation factors, and equations from scientific literature on lakes, rivers, and nutrient cycles. The model can be used to identify current and future pollutant sources, estimate pollutant limits and water quality goals, and guide watershed improvement projects.

FBE completed watershed and sub-watershed delineations, a land cover update, and desktop data collection to acquire the necessary LLRM inputs. Other input data included monthly precipitation data, lake volume and area estimates, septic system data, water quality data, waterfowl data, and internal loading estimates.



The LLRM separated phosphorus loading into five categories: atmospheric deposition, internal loading, wildlife (waterfowl), septic systems, and watershed load (surface runoff). Watershed runoff combined with baseflow (44%) was the largest phosphorus loading contribution across all sources to Long Pond, followed closely by internal loading (32%) and then atmospheric deposition (12%), septic systems (8%), and waterfowl (4%) (Figure 2; Table 1). Development in the watershed is most concentrated around the shoreline where septic systems or holding tanks are located within a short distance to the water, leaving little horizontal (and sometimes vertical) space for proper filtration of wastewater effluent. Improper maintenance or siting of these systems can cause failures, which then can leach untreated, nutrient-rich wastewater effluent to the lake. Additionally, the fluctuation of lake water levels can make poorly sited septic systems vulnerable to inundation.

The LLRM model was used to simulate the phosphorus loading in Long Pond under the proposed alum treatment scenario (Table 1). Based on the LLRM results, FBE recommended that an alum treatment be conducted at Long Pond to significantly reduce the internal load. The alum treatment would strip the water column of phosphorus in the immediate term and protect the lake from internal loading in the long-term as the alum blankets the bottom sediments and locks in phosphorus. To enhance the longevity of the alum treatment, it will be crucial to 1) maximize land conservation of intact forestland, 2) consider zoning ordinance amendments that encourage Low Impact Development techniques on existing and new development, and 3) improve and maintain stormwater control practices throughout the watershed. The Long Pond Association is currently improving several residential and road sites in the watershed under a

Section 319 Watershed Assistance Grant administered by the Maine DEP. This effort should be ongoing into the future to best protect the lake from existing and emerging threats, including development and climate change.

Table 1: Total phosphorus (TP) and water loading summary by source for Long Pond. Italicized sources sum to the watershed load. The Alum Treatment scenario simulates the result of an alum treatment on Long Pond.

SOURCE	CURRENT (2020)			ALUM TREATMENT		
	TP (KG/YR)	%	WATER (CU.M/YR)	TP (KG/YR)	%	WATER (CU.M/YR)
ATMOSPHERIC	11.6	12%	785,963	11.6	17%	785,963
INTERNAL	31.6	32%	0	3.2	5%	0
WATERFOWL	4.0	4%	0	4.0	6%	0
SEPTIC SYSTEM	7.6	8%	7,374	7.6	11%	7,374
WATERSHED LOAD	42.9	44%	2,384,362	42.9	62%	2,384,362
TOTAL LOAD TO LAKE	**97.6**	**100%**	**3,177,699**	**69.2**	**100%**	**3,177,699**

Addressing the Internal Load – Water Resource Services, Inc. Study

Internal loading is currently a major source of phosphorus to Long Pond whereby low dissolved oxygen in bottom waters is causing a release of phosphorus from bottom sediments. An internal loading study done by WRS, Inc. (2021) recommends that an alum treatment be conducted at Long Pond to reduce the internal loading of phosphorus. The study showed that internal phosphorus loading via release from sediments exposed to low oxygen is a major source of phosphorus to the pond, mainly later in summer as stratification breaks down, but also potentially via direct uptake by algae growing at the thermocline or deeper which then form gas pockets within cells and rise in the water column. The relatively shallow maximum depth (10 m) and generally desirable clarity (>4-5 m) translates into high growth potential for algae in the deeper water. The expected low ratio of nitrogen to phosphorus in that deeper water will favor cyanobacteria, a likely explanation for observed blooms. However, availability of P may be moderated by weather conditions and presence of other oxygen compounds, most notably nitrates, such that there will be substantial variation in algal abundance within and among years.

The pond appears to be trending toward a condition of more bottom area being exposed to low oxygen (<2 mg/L), leading to greater potential for phosphorus release from sediment and greater probability of blooms. The increase in low oxygen conditions in the 8-9 m water depth zone represents a major shift, as this zone contains a larger amount of available sediment phosphorus than other depth zones. Despite the increase in phosphorus concentration in Long Pond over the last couple of decades, conditions are acceptable most of the year, but cyanobacteria have become dominant and abundant several times in the last few years, mainly in late summer and early autumn. This trend can be expected to continue and to accelerate, but not necessarily in a continuous transition as a function of varying weather among years.

This trend can be countered by removing accumulated organic, phosphorus-rich sediment, by providing oxygen to counter the demand and limit reactions that release phosphorus, or by inactivating the phosphorus in surficial sediment to reduce release under low oxygen conditions.

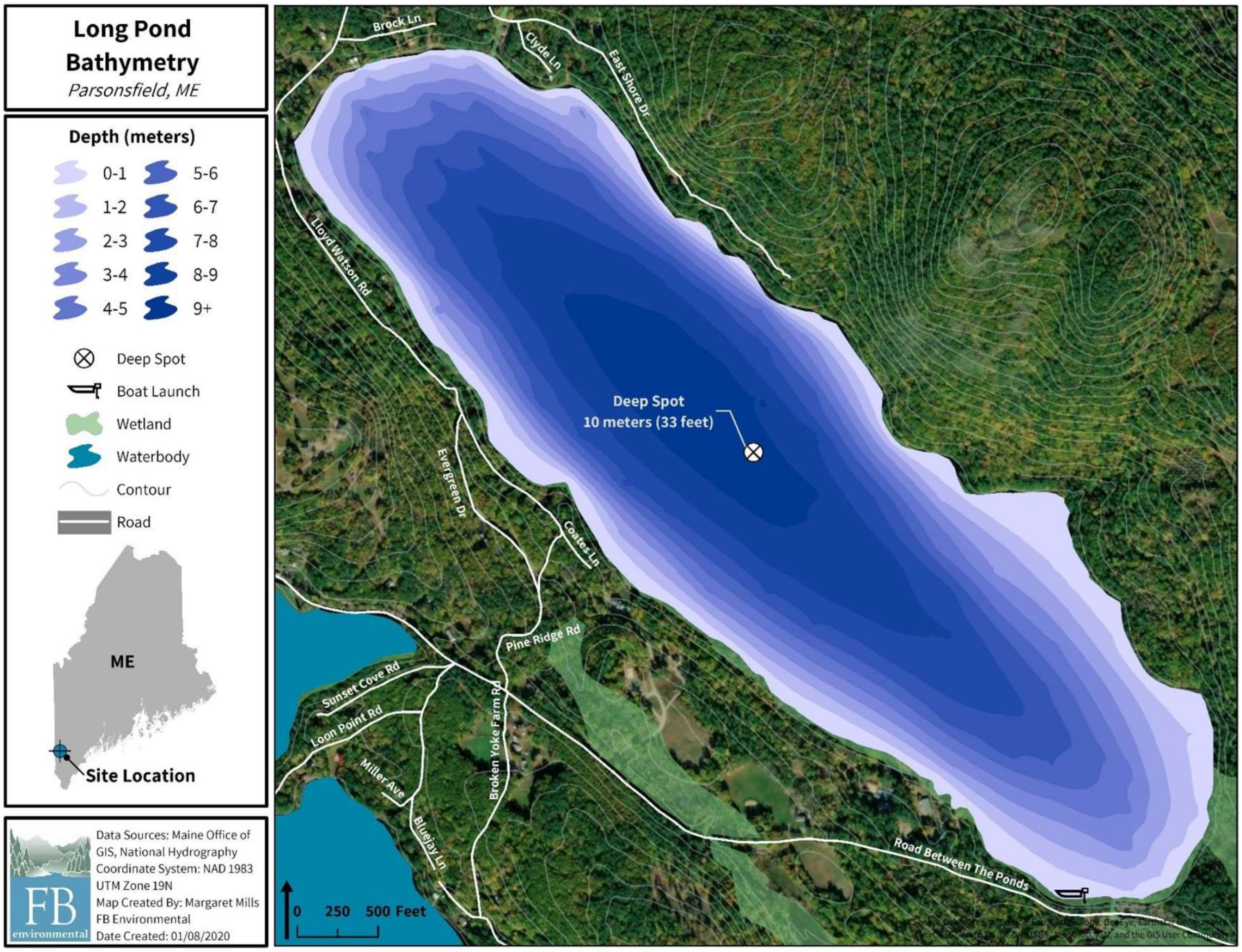


Figure 3: Detailed bathymetry of Long Pond, including the deep spot location.

Internal phosphorus loading estimated from water column data (change in phosphorus mass over time) is slightly lower than the load estimated from sediment features (10% of the phosphorus mass in the surficial sediment exposed to low oxygen), suggesting that much but not all the internally loaded phosphorus reaches the upper waters. Internal loading is estimated to represent about a third of total phosphorus loading to Long Pond, exceeded only by surface water inputs from the watershed at about 44% of the total load. Reducing the internal phosphorus load by 90% would result in achievement of desirable conditions according to the LLRM, with an average phosphorus concentration of 10 ppb and a low probability of algae blooms.

Assuming a 90% reduction efficiency, an alum treatment would reduce the internal load and thus the total phosphorus load to the lake by 28.4 kilograms per year (kg/yr), resulting in an average annual in-lake phosphorus concentration of 9.6 ppb. Average annual chlorophyll-a concentration and Secchi disk transparency would be significantly improved. The average annual bloom probability (percentage of time with a bloom) would reduce from 3.6% (13 days) to 0.3% (1 day) at year one after the alum application.

3. CHEMICAL TREATMENT OPTIONS EVALUATION

Review of Management Options – Water Resource Services Study

There are three basic approaches to preventing internal recycling-driven bloom occurrence that are known to work with an acceptable degree of reliability from past research and experience: dredging, oxygenation, and phosphorus inactivation. These are not mutually exclusive approaches, but rarely is more than one applied in a lake.

Dredging removes accumulated sediment and sets the lake back in time. While dredging does not affect ongoing watershed inputs, it can control internal loading and minimize oxygen demand. Dredging is very expensive, however, with a cost of $50,000 per acre-foot of sediment removed as a low-end estimate. Unless restoring lost depth is a major goal, dredging is rarely implemented to manage internal phosphorus loading, and dredging would likely be cost prohibitive in Long Pond. Additionally, dredging can cause suspension of sediments in the water column that must be carefully considered. Further, considerable additional study would be needed to plan a dredging project.

Hypolimnetic oxygenation would increase oxygen in deep waters, limiting the release of phosphorus from associated sediment while enhancing coldwater fish habitat. There are limited examples of this approach being applied to lower phosphorus levels; most often oxygenation is conducted to enhance water quality for potable supply or fish habitat (Wagner, 2015). Yet the theory is sound and where internal loading is a dominant component of phosphorus loading, oxygenating the hypolimnion should provide desirable results. Not all internal loading would be eliminated, and the extra oxygen would allow releases from decay to increase somewhat, but a 75% reduction in internal phosphorus loading is achievable and the benefits are clear. At the current oxygen demand of about 2 $g/m^2/day$ over about 109 acres (436,000 m^2), a daily oxygen input of about 872 kg would be needed to counter the lakewide demand. As oxygen demand tends to rise in response to the movement of water that accompanies oxygen input, this estimate should be raised by at least 50% if pure oxygen is used, so a minimum oxygen supply of about 1300 kg/day should be planned. The need could be several times larger if air is used as the oxygen source.

There are several means to oxygenate a lake without destratifying it, but with a vertical run of only about 4 m in the hypolimnion of Long Pond, release of pure oxygen bubbles would not be effective (at least 6 m of vertical rise is needed for the oxygen to be absorbed). A Speece cone (within the lake) or sidestream supersaturation unit (on shore) could oxygenate water and return it to the hypolimnion at a rate that would counter oxygen demand. The capital cost from other projects is $1000-1500 per kg/day, or about $1.3-2.0 million for Long Pond. The operational cost would be on the order of $0.50 per kg/day, or about $650 per day. Just how long the system would have to run is a matter of adjustment to prevent oxygen depletion; low oxygen needs to be prevented but saturation level oxygen does not need to be achieved. It would be likely that an oxygenation system would have to be turned on in early June and run into mid-August, about 75 days, which suggests an annual operational cost of about $50,000.

If destratifying the lake is environmentally acceptable, water can be pumped upward, pumped downward, or moved via compressed air to mix the lake. Such mixing maintains oxygen from top to bottom if done well. Use of compressed air in hoses that either have perforations or lead to diffusers is the most common approach with the longest and most successful track record. An input of at least 1.3 cubic feet per minute per acre of target area would be needed. Working with the area associated with the 6 m depth (roughly the thermocline, an area of 147 ac), about 200 cfm will be needed. At a cost of about $1500 per acre, the capital expense for a destratification system would be about $220,000. Operational costs depend mostly on power expense, but a daily cost of about $1500 is likely. With operation from mid-May into September to prevent stratification from occurring, the annual operational cost would be about $180,000. There are solar versions of most equipment that might minimize operational costs, but the capital cost is still substantial and some operational costs are to be expected.

Phosphorus Inactivation

Phosphorus inactivation can be used three ways: to treat incoming water high in phosphorus, to strip phosphorus from the water column in a lake, or to bind phosphorus in surficial sediments and make reserves less susceptible to release under anoxia. All are applicable, but the most advantageous approach in a case like Long Pond would be a treatment of the sediment area subject to anoxia with a phosphorus binder such as aluminum. The track record for such treatments is favorable, including past efforts in Maine, and the empirical evidence that higher Al:Fe ratios in the sediment prevents phosphorus release also favors this approach. A reduction of about 90% of the internal load would be expected. Successful phosphorus inactivation of surficial sediment under water >8 m deep could reduce the average phosphorus concentration in Long Pond to about 10 ppb, a concentration that should minimize algal blooms. The duration of benefits should be about 20 years based on experience elsewhere.

The cost of phosphorus inactivation is a function of the necessary dose and area to be treated. Dose can be calculated stoichiometrically as a function of the amount of P to be inactivated (Table 2) and binding efficiency, that latter factor usually resulting in phosphorus binders being added at some multiplier of the phosphorus concentration. For the various sediment samples from Long Pond, the dose of aluminum that is expected to inactivate the Fe-P in the upper 10 cm of sediment in water 8-10 m deep ranges from 14 to 37 grams per square meter (g/m^2). When the phosphorus concentration is relatively low, as is the case in Long Pond, the binding efficiency of aluminum tends to be lower, as other compounds also bind with aluminum. Consequently, lab assays in which aluminum is added to a known mass of

Depth zone	Area	Est. Fe-P mass	Est. Fe-P + biogenic P mass
m	ac	kg	kg
6-7	19.4	100	599
7-8	18.8	106	368
8-9	46.3	345	1,220
9-10	62.5	181	615

sediment suspended in water are often conducted to determine the optimal dose of aluminum to be added.

For Long Pond sediment samples, the assay results (Figure 4) suggest that the point of diminishing returns is around 50 g/m^2 and that the efficiency of binding varies somewhat among samples representing different water depths and sediment zones. Given the differential phosphorus content between sediments at 8-9 and 9-10 meters (m) of water depth and the shape of the aluminum response curves, it is suggested that the 62.5 acres deeper than 9 m be treated at no less than 25 g/m^2 and the 46.3 acres at 8-9 m be treated at no less than 50 g/m^2. Additionally, there is a tendency for aluminum to migrate toward deeper water, so the deeper sediments will eventually be subjected to a higher aluminum dose. Shallower areas of the lake can be dosed with 40 g/m^2. Therefore, it is suggested that the 18.8 acres at 7-8 m be treated with no less than 40 g/m^2.

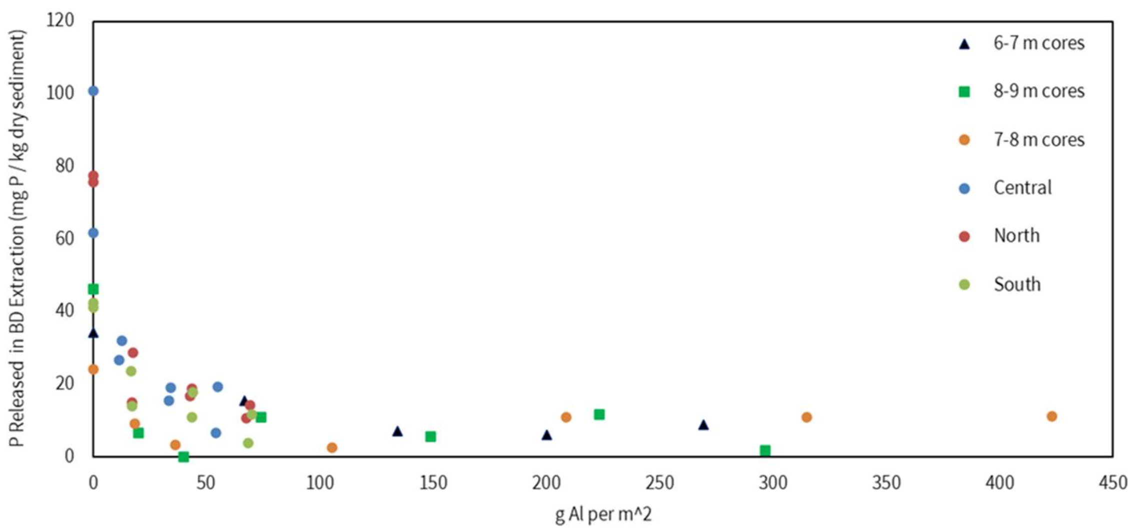


Figure 4: Sediment phosphorus inactivation assay results. (WRS, 2021)

The mass of phosphorus in each of four defined areas of Long Pond, the suggested aluminum dose, and the area to which it would be applied leads to cost estimates for possible treatment (Table 9). Treatment of areas deeper than 8 m is deemed necessary to sufficiently reduce the internal load to Long Pond; however, it may be advantageous to treat deeper than 7 m to protect the lake from occasional low oxygen conditions extending to 7 m depth and improve the treatment efficacy of deeper areas as the alum migrates to deeper areas of the lake. Treatment of surficial sediment under >9 m of water at 25 g/m^2 and surficial sediment under 8-9 m of water at 50 g/m^2 is estimated to cost about \$174,000. Including some funds for permitting, planning, and monitoring a total cost of \$210,000 is suggested. Treatment of areas deeper than 7 m would increase the total cost to \$250,000. As noted in Table 6 (page 21), treatment of surficial sediments >7 m of water at 25 g/m^2 and surficial sediment under 8-9 m of water at 50 g/m^2 would result in a predicted mediant TP of 9.6 ppb.

There are other options for phosphorus inactivation, including calcium compounds where the pH is high, and a product called Phoslock that utilizes lanthanum attached to bentonite clay. The pH is not elevated enough in Long Pond to make calcium a viable option. Phoslock could be considered and has some desirable features but has no track record in Maine and tends to be more expensive than aluminum.

While addressing the internal load should put Long Pond into a desirable condition, watershed management is still an important component of long-term lake management. Watershed management should focus on inputs related to human actions, including residential practices, waste disposal, and agriculture, and is always appropriate as an element of lake management. Watershed management should indeed be pursued but is likely to be inadequate by itself to rehabilitate Long Pond, as the internal load from past watershed loading now represents a large source of phosphorus. However, effective watershed management is a very cost-effective means of extending the life of an alum treatment.

Table 3: Sediment iron-bound phosphorus (Fe-P) mass by depth zone, along with dose and treatment cost estimates for phosphorus inactivation by aluminum in Long Pond.

Depth zone (m)	Area (acres)	Est. Fe-P mass (kg)	Al Dose (g/m^2)	Cost for Alum Treatment
6-7	19.4	100	40	$34,578
7-8	18.8	106	40	$33,752
8-9	46.3	345	50	$104,246
9-10	62.5	181	25	$69,582
			Minimum dosage area (8m+)	$173,828
			Recommended dosage area (7m+)	$207,580
			Expanded dosage area (6m+)	$242,158

Proposed Aluminum Application Summary

The goal of this proposed treatment is to reduce the current internal phosphorus load (31.6 kg/yr) by 90% by applying 25 g/m^2 of liquid aluminum sulfate/sodium aluminate to the water column at water depths between 9 and 10 m and applying a treatment of 50 g/ m^2 to depths of 8 and 9 m. An additional application of 40 g/m^2 at depths of 7-8 m was identified as a likely future need by the alternatives analysis, and the Long Pond Association's preference is to treat this 7-8 m depth increment at the same time if fundraising levels allow.

As discussed previously, the recommended dosage was determined by Dr. Ken Wagner using sediment core analysis conducted by Dr. Emily Lesher of St. Joseph's College. The sediment cores collected in Long Pond were analyzed for phosphorus fractions using sequential extractions to calculate concentrations of loosely sorbed (LS) P, iron-bound (Fe-) P, and NaOH extractable P, a mix of aluminum-bound P and organic P fractions. Dr. Wagner's analysis determined the dosages that would be required to achieve the desired reduction in internal load. An interesting and notable feature of the Long Pond sediment analysis is that the deepest depths (9-10 m) ha of 63 acres at 9-10 m treated at 25 g/ m^2 and 46 acres at 8-9 m treated at a dose of 50 g/m^2, with the option of an additional 19 acres to of 7-8 m at a treatment of 40 g/m^2.

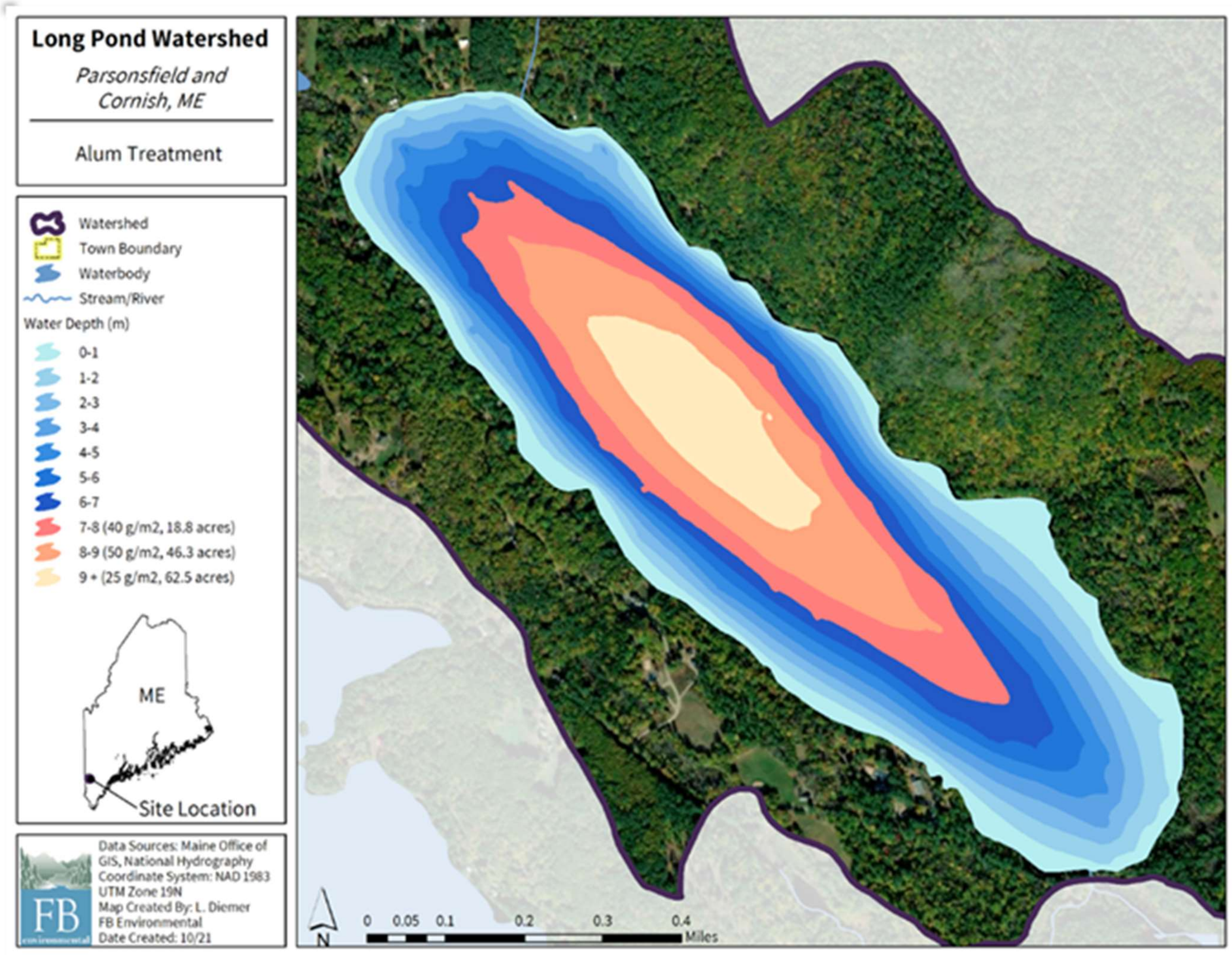


Figure 5: Map of Long Pond signifying the proposed aluminum treatment areas by depth increment. The total proposed area to be treated (yellow, orange, magenta) is 127.6 acres.

4. RESPONSE PROCEDURES

Spill Response Procedures

The company hired to conduct the chemical application (the Applicator) to Long Pond will be responsible for handling spill response procedures. The spill response procedures are presented below. Once the Applicator is selected, a copy of the Applicator's Standard Operating Procedure (SOP) for Chemical Spill Events will be provided to Maine DEP.

The selected Applicator will be trained and experienced with the application of the materials being used in Long Pond. They will have the necessary adsorptive materials in the event of a spill and will be familiar with the risks of exposure and required first aid procedures. Adsorptive materials may include kitty litter, clay, activated charcoal, or sawdust. The vehicle traveling to the application site will have hydrated lime and soap/detergent on-board.

In the event of a spill, the following protocols will be followed, at a minimum:

• Assess the situation: The following will be considered: Is there a fire, split or leak? What are the weather conditions? What is the terrain like? Who/what is at risk? What resources are required and are they readily available?

• Notifications: If the leak, spill, or other release into the water contains a hazardous substance or oil in an amount equal to or in excess of a reportable quantity occurs in any 24-hour period, an employee of the Applicant will notify the National Response Center immediately at (800) 424-8802.

• Contact Emergency Response: The emergency response number for Maine DEP (800) 482-0777 (Emergency Hotline) will be called. Help will be obtained if needed. If the spill is very large, then ChemTrec at 1-800-424-9300 will be contacted. The Town of Parsonsfield will also be notified.

• Personal Protective Equipment: All personnel aiding with the containment and clean-up of the spill will be wearing the necessary Personal Protective Equipment (PPE).

• Control the Spill: Necessary steps to end the leakage of additional material by righting punctured drums, placing them in new, oversized containers or other means will be taken.

• Contain the Spill: Absorbents, earthen dykes or other means will be used to limit the spread of the spilled chemical.

• Clean up the Spill: After the spill has been contained and liquid chemical absorbed on a solid material or special spill control gels, the contaminated absorbent will be picked up and bagged for proper disposal. The area must be further decontaminated through use of soapy water or alkaline material such as lye.

• Report the Spill: All necessary authorities and interested parties will be notified of the spill and the efforts made to control, contain and clean up the spill.

• Document the Spill: Documentation of the spill will be made in accordance with the SOP.

Adverse Incident Response Procedures

As with the spill response procedures, the adverse incident response procedures will be handled by the Applicator, the company hired to conduct the chemical application. The adverse incident response procedures are presented below. A copy of the Applicator's Standard Operating Procedure (SOP) for Adverse Incidents will be provided to Maine DEP before the Application commences. Following an adverse incident, the following will be done:

INVESTIGATE THE SITE AND ASSESS THE SITUATION IMMEDIATELY

Answers to the following questions will be documented:

- What has occurred?
- What chemicals have been applied and could they have contributed to the incident?
- Who/what else may still be at risk?
- What are the weather conditions?
- What is the terrain like?
- Can anything be done to mitigate further damage (example aeration)?
- What resources are required and are they readily available?

REPORT IMMEDIATELY

The following notifications will be made:

- The Maine Board of Chemical Control (207-287-2731)
- The Maine Department of Environmental Protection Eastern ME Regional Office (207-941-4570)
- The Maine Department of Inland Fisheries and Wildlife (207-287-8000)
- Environmental Protection Agency Region 1 (Boston, MA) (617-918-1579)

Any other department responsible for receiving reports of adverse incidents in Maine will be contacted, and assistance will be requested if necessary. Also, the incident will be reported to the Town of Parsonsfield and other interested parties. Incident notification will be performed in accordance with the SOP.

COLLECT WATER AND SOIL SAMPLES:

Samples will be collected in opaque glass jars and the samples will be frozen. The samples will be shipped overnight on ice to a designated laboratory for analysis of chemical content as soon as possible.

COLLECT DEAD ANIMAL/ FISH SAMPLES:

If the adverse incident is a wildlife and/or fish kill, samples of the dead animals/fish will be collected. The specimens will be wrapped in aluminum foil or placed inside a glass jar and frozen (for preservation purposes). Chemical testing of the samples may be requested.

ADVERSE INCIDENT REPORTING:

An Adverse Incident Report will be prepared in accordance with the selected contractor's existing SOP.

5. SIGNATURE REQUIREMENTS

The Decision maker(s) must sign, date and certify the CDMP by incorporating the following statement into the CDMP.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: Deb Hiney **Title:** President, Board of Directors **Organization:** Long Pond Association

Debra Hiney — March 29, 2022

Signature — Date

Name: Rich Brereton, Ph.D. **Title:** Project Manager **Organization:** FB Environmental Associates

Richard Brereton — March 28, 2022

Signature — Date

6. APPENDICES

A. Minimizing Impacts to Non-Target Organisms
B. Monitoring Plan for Long Pond Alum Treatment
C. Proposed Bid Specifications
D. Application Protocol
E. Long Pond Association Outreach Materials
F. References

Appendix A. Minimizing Impacts to Non-Target Organisms

Literature Review

A review of the available literature on the effects of alum treatment on non-target organisms shows that some impacts have been noted in experimental studies and during whole-lake applications. The impacts noted in studies are varied and dependent on a wide variety of factors including focus species, total aluminum (Al) concentrations, dissolved Al concentrations, depth, pH, chemical composition of the water such as presence of organic ligands and hardness, and the impact metric studied. Most impacts on lake biota are short-to-moderate termed. Both short-term declines in zooplankton abundance and longer-term change in the relative composition of zooplankton communities following alum treatment have been observed (Shumaker *et al.* 1993). Additionally, benthic macroinvertebrate populations have been shown to decline at certain depths one-year post alum treatment, but populations recovered within two years and ultimately increased in density and species richness as a longer-term response (Smeltzer *et al.* 1999).

In experimental mesocosms, Freeman and Everhart (1971) found that Rainbow Trout mortality and growth were significantly impacted by total Al concentrations as low as 520 micrograms per liter (µg/L) at in water at a pH of 7 to 9. Based in part on this work, Cooke and Kennedy (1981) produced a US Environmental Protection Agency (EPA) study recommending a target safe level of 50 µg/L in water.

In an alum treatment in Lake Morey, Vermont in the late 1980s, Yellow Perch size quality was decreased following alum treatment and this impact was attributed to sublethal aluminum toxicity. Monitoring data from this study indicates that dissolved Al concentrations exceeded the 50 µg/L target safe level recommended by Cooke and Kennedy's 1981 EPA study due to equipment malfunction, and levels up to 200 µg/L were present at certain depth for a period of 30 days following treatment (Smeltzer *et al.* 1999).

Long Pond hosts a viable smelt fishery. The impacts of alum treatment on smelt are of particular concern because they comprise the base of the food chain for other fish species present in Long Pond and the ecology of smelt make them more susceptible to potential impacts from treatment. One specific concern is that smelt could be present in open waters at depths that coincide with the alum mixing zone before the alum is dispersed and diluted. The mixing zone during the initial dosing event is where research has indicated that Al concentrations tend to be highest and the short-lived intermediate products the most toxic, before aluminum hydroxides and flocs have fully formed (Gensemer and Playle 1999 and citations within). Smelt populations are neither common nor rare in Maine but, once lost or diminished, are very difficult to reestablish, and in the absence of extensive aluminum monitoring data there is justifiable concern that smelt could have been impacted by past alum treatments in Maine (J. Pellerin, pers. comm.).

A comprehensive synthesis by Cooke et al. (2005) (the same Cooke who coauthored the 1981 EPA study) places the earlier research in the context of decades of additional experience with real-world application using many advancements in safety. The authors point out that continuous exposure experiments in mesocosms are not realistic tests of the effect of alum treatment on fish in a lake, because in practice fish are only impacted in the active mixing zone of a treatment, or when floc falls through the water column, because fish are able to move and avoid toxic concentrations of aluminum (Cooke *et al.* 2005 and citations within). Additionally, lake chemistry has a blunting effect on any potential toxicity of Al on non-target organisms, as the presence of total organic carbon and hardness (particularly calcium ions) will form organic ligands with aluminum and reduce or eliminate aluminum toxicity (Cooke *et al.* 2005 and citations within).

In summary, despite demonstrated impacts to non-target organisms in certain experimental and real-world aluminum exposures, alum treatment is widely accepted as a beneficial water quality restoration and management tool with a track record of safe use for non-target organisms. The North American Lake Management Society (NALMS) holds the position that treating a lake with alum to control phosphorus is a “safe and effective” management tool as long as the treatment is designed and controlled to limit concerns with toxicity to aquatic life (NALMS 2004).In order to reduce the impact on the environment and non-target organisms, Alum (Aluminum, Al) will be applied at a dosage rate that minimizes effects to non-target organisms while remaining effective for target species. There are three alum treatment protective measures that have shown to prevent significant toxicity during applications in New England lakes and ponds for over 20 years. The three preventive measures are to 1) control pH levels, 2) keep the Al confined to the mixing zone, and 3) avoid treating areas with heavy dosage or more than one pass on consecutive days.

Application Method

For this project, the firm hired to conduct the chemical application (Contractor) shall conduct the aluminum sulfate/sodium aluminate application utilizing an appropriate vessel with a subsurface injection system that allows for controlled application and proper mixing of liquid aluminum sulfate and sodium aluminate at variable boat speeds. The barge position in the lake shall be managed by a global positioning system and a depth monitoring system that allows the operator to know where the vessel is and to direct application within the target area and only in the target area.

The treatment vessel will be loaded with aluminum compounds at a designated location set up properly to address any equipment issues, refueling, spills of fuel or aluminum compounds, and to minimize any environmental damage.

The Contractor shall apply the aluminum sulfate and sodium aluminate at a ratio that results in a pH between 6 and 8, with a preferred range of 6.5 to 7.5 and an average pH target of 7. It is assumed that a ratio of 2:1 (alum to aluminate by volume) will result in the desired conditions, but the Contractor will be responsible for ratio adjustment to maintain the pH within the range of 6-8 standard units. Chemicals must be simultaneously distributed by means of a dual manifold or other appropriate injection system that results in a mixing zone of suitable depth.

The Contractor will be responsible for application in a pattern that will lead to uniform distribution of aluminum floc on the bottom in the target area with minimum drift outside the target area. The application rate shall be such that the calculated concentration of aluminum in the active mixing zone (assumed to be five (5) vertical meters unless otherwise documented by the Contractor) will not exceed 5 milligrams Al per liter (mg/L), corresponding to a dose of 25 grams per square meter (g/m^2) unless approved by the Awarding Authority after consultation with the Maine DEP. Where an area must be treated more than once to achieve the target dose, at least 24 hours must elapse between treatments of the same area.

It is expected that the treatment will occur in the spring, with the month of May and completion by Memorial Day weekend strongly preferred to achieve phosphorus inactivation before the occurrence of the low-oxygen conditions that favor internal phosphorus release from the sediments in the deepest depths of Long Pond. Treatment later in the spring or summer will also be beneficial for future years but will be less likely to inactivate phosphorus and prevent algae blooms during the 2022 season.

Monitoring During Alum Treatment

Monitoring needs during the alum treatment will take place throughout the day at specific monitoring locations:

- Treatment area monitoring (each morning, before the treatment barge begins) – Both the proposed treatment area and the location treated the previous day will be sampled. Parameters collected include: Secchi disk transparency, dissolved oxygen, temperature, conductivity, pH, and alkalinity.
- Control monitoring (morning and late afternoon) will take place either at an established site not being treated but at least 4 m deep or in a site not treated for at least 2 days. Monitoring will occurin the morning before the barge begins, and again at the same location following treatment that day. Parameters collected include: Secchi disk transparency, dissolved oxygen, temperature, conductivity, pH and alkalinity.
- In-plume monitoring and floc evaluation will occur continuously during treatment and conducted within the aluminum plume (usually between 50’ and 200’ from the barge). Conductivity and pH data will be collected, with alkalinity checked if the pH drops below 6 standard units. Evaluation offloc will be completed via an underwater camera.

- Fish and aquatic life surveys on the downwind shoreline of Long Pond will occur daily during the aluminum treatment. Surveyors will observe shoreline areas for fish, shellfish, snail, amphibian, and bird fatalities or behavioral abnormalities and other signs of potential aluminum or pH toxicity.

See Appendix B for the complete Monitoring Plan.

Appendix B. Monitoring Plan

Water Quality and Environmental Monitoring Before, During, and After the Proposed Long Pond Alum Treatment

Monitoring will include daily pH and alkalinity testing in the treatment zone and in reference areas outside the treatment zone, daily surface and subsurface inspection for floc formation and settling and any distress to visible aquatic organisms.

Before, during, and after the proposed alum treatment, monthly water chemistry monitoring for features such as temperature, oxygen, phosphorus, and nitrogen will continue to be conducted at Long Pond.

During the treatment, an on-site third-party monitor will collect water quality and environmental data from a separate vessel. All data will be available to the Contractor as quickly as possible, with field measures available the same day as collected. The third-party monitor will communicate immediately with the Contractor if any problems are indicated, including high or low pH, fish kills, or other negative impacts that may require cessation and/or modification of the treatment protocol.

Aluminum concentrations will be monitored before the treatment, in the hours and days immediately following the treatment, and at time points weeks to months after the treatment.

Please refer to Table B1 on the following page for the detailed list of parameters to be measured, the timing of measurements, and the locations of measurements to be taken.

TABLE B1. Long Pond Monitoring Plan.

	Before/After Treatment - 2022	During Treatment - 2022						After Treatment - 2023+
When	Monthly to within a week before treatment starts, within a week of completion, monthly thereafter	Each morning before barge starts treatment			During treatment	Following treatment - late afternoon	Evening (or early the next morning)	Monthly from spring-fall
Where	Deep Spot	Treatment area	Control-treated on final day	Area treated previous day	In plume **	Control-treated on final day	Shoreline (esp. downwind shore)	Deep Spot
Secchi Disk Transparency ***	●	●	●	●		●		●
Profile (1-m intervals): Dissolved Oxygen/Temp ***	●	●	●	●		●		●
Profile (1-m intervals): Conductivity/pH	●	●	●	●	●	●		
Alkalinity (core and bottom grab)	●	●	●	●	●	●		
Phytoplankton (core) ^^	●							●
Zooplankton (min. 5 tows)	●							●
Total Phosphorus Grabs (1, 3, 5, 7, 9 m)	●							●
Total and dissolved aluminum (core and bottom grab) ^	●	● *		● *				
Chlorophyll-a (core)	●							●
Sediment (3, composited) ^^^	●							●
Fish & Aquatic Life [1]	●	●	●	●	●	●	●	
Floc evaluation with camera [2]					●			
Total Kjeldahl Nitrogen Grabs (1, 3, 5, 7, 9 m)	●							●
Nitrate-Nitrite Grabs (1, 3, 5, 7, 9 m)	●							●
Dissolved Organic Carbon Grabs (1, 3, 5, 7, 9 m)	●							●
Flow Monitoring at the Outlet Stream	●							●[3]
Total Phosphorus Grab at the Outlet Stream	●							●

** aluminum sampling will occur at the deep spot at all time points, with one additional station (location TBD) to be sampled at time points immediately following the conclusion of the treatment. See detailed narrative description of aluminum sampling on following page.*

*** continuously during the first days, less frequently thereafter; between 50' and 200' from the barge.*

**** aim for bi-weekly readings.*

^ collection of monthly aluminum samples may be discontinued once background levels are achieved following treatment.

^^ if blooms occur following alum treatment, weekly phytoplankton samples should be collected through the bloom period; in addition, at least one water sample should be tested for microcystin.

^^^ ideally collected within one week after the alum treatment, one year after treatment, and at 5-year intervals thereafter.

[1] surveyors observe shoreline areas for fish, shellfish, snail, amphibian, and bird fatalities, insect hatches, and other signs of potential aluminum or pH toxicity.

[2] test camera the day before treatment begins

[3] Recommend flow monitoring at six times per year under wet weather conditions

Aluminum Sampling Narrative

Upon project review by the Maine Department of Inland Fisheries and Wildlife (IF&W), Jim Pellerin (IF&W Regional Fisheries Biologist) relayed IF&W's concern about the need for more study of potential aluminum toxicity in alum treatments, which are becoming more frequent in Maine.

Following discussion between Mr. Pellerin, Linda Bacon (MEDEP Lakes Assessment section leader), and Rich Brereton (FB Environmental project manager on behalf of Long Pond Association), a plan for more aluminum monitoring effort was devised in order to determine 1) the maximum concentrations to which lake biota may be exposed due to the alum treatment; and 2) the duration of elevated concentrations.

To address #1, the project team will conduct sampling at additional depth increments during the alum treatment, to replace the typical epilimnetic core that allows measurement of an an average concentration across the entire epilimnion.

To address #2, for more information about the duration of elevated aluminum concentrations post-treatment, the project team will conduct sampling at 15 days post-treatment (in addition to the 30-day post-treatment sample that was already in the monitoring plan).

The following protocol will be observed:

Before treatment (1 day before alum treatment begins, or on the day alum treatment begins but before treatment starts):

Sample total aluminum in epilimnetic core and bottom grab (2 Tot Al samples). These samples will represent background aluminum levels.

Immediately following treatment (within 1 hour of completion of treatment):

Sample total at 2, 4, and 6 meters and a bottom grab (4 Tot Al samples). This will be done at two stations. There is no "control station" due to the small total lake area and small untreated area of Long Pond. As witnessed in the Georges Pond alum treatment monitoring, the "control" sampling station experienced elevated Al concentrations just as the treated sampling station did.

Repeat the above at 48 and 96 hours following the conclusion of the treatment.

15 days after treatment:

Sample total and dissolved aluminum epilimnetic core and bottom grab (2 Tot Al samples samples). By the 15-day mark and subsequent time points, it is assumed that the alum will be well-mixed in the epilimnion and no additional depth increment sampling will be needed.

30 days after treatment:

Just as with 15-day post-treatment sample, collect samples for total aluminum as epilimnetic core and bottom grab (2 Tot Al samples and 2 Diss Al samples).

Appendix C. Proposed Bid Specifications

The following bid specifications were sent out to qualified alum treatment contractors in a Request for Proposals dated January 3, 2022.

Sequence of Work

A. Aluminum treatment shall not begin until the chemical applicator (Contractor) is approved by Owner. The single treatment is to occur in the Spring of 2022.

B. The Contractor shall provide all equipment, labor, and materials necessary to perform the work including application equipment, and equipment necessary to mobilize and demobilize. This shall include:

a. GPS-linked computer system for barge (boat) guidance that is integrated with real-time bathymetric measurements and simultaneous chemical dosing control for both aluminum sulfate and sodium aluminate pumping rates,

b. treatment barge (boat) with on-board chemical storage tanks, and

c. boom applicator for even chemical distribution of chemicals.

C. Application is to occur after ice out but not until the lake is a minimum 40° F throughout the water column, weather permitting. Application is not permitted during Memorial Day Weekend to allow for recreational use. Once the alum application is started, the contractor has 30 calendar days to complete the treatment to ensure application effectiveness.

Submittals

A. The Contractor shall submit certificate(s) indicating all materials meet requirements of these Specifications before treatment occurs. The Contractor shall submit the item, applicable reference specification, class, type, manufacturer, and distributor. The Contractor shall also submit the results of aluminum sulfate lot testing of materials delivered to the site, including an analysis of the metals content of the material, before treatment.

B. The Contractor shall submit GPS coordinates and corresponding application rates and amounts of aluminum sulfate applied to the lake. These data shall be collected by the Contractor in real-time during the application and submitted to the project manager on a daily basis.

C. The Contractor shall submit a Plan of Work for approval by the project manager prior to the start of work. The Plan of work shall include, at a minimum, the following items:

a. Explanation of plans and schedule for the timely delivery, storage and transfer of chemicals. All piping, fittings, couplings and connectors for alum distribution lines, storage tank, pumps, and injector units must meet corrosion resistance standards for alum.

b. Description of the temporary lakeshore chemical storage facilities including a spill prevention, control and contingency plan (SPCC Plan). Manufacture's model number and material type for alum storage tank(s).

c. Method of chemical distribution documenting the computer control of chemical pumping rate into the lake based on application vessel speed, real-time GPS navigation, and bathymetric measurements to ensure an ultimate effective dose.

d. Explanation of navigational guidance system detailing real-time GPS linked computer system for barge (boat) guidance and chemical metering control to ensure complete and uniform chemical coverage during application.

e. Description of all backup systems to minimize down time.

f. Description of land-to-vessel chemical transfer method.

g. Anticipated treatment capacity (acre/hour or gallons/day). CONTRACTOR shall demonstrate an ability to apply approximately 15,000 gallons per day.

h. Plan for adjusting application procedures or taking other steps to respond to unfavorable lake pH change or other adverse occurrence during application.

i. The base bid shall include mobilization, all equipment, material, work and labor, and applicable taxes required to complete the application described.

Chemicals

A. Aluminum Sulfate (Alum)

a. Liquid aluminum sulfate supplied shall meet the requirements of AWWA B403-88. The liquid aluminum sulfate [Al2(SO4)3•14.3(H2O)] shall be of commercial grade appropriate for the application with an aluminum content of 4.4% Al+3 (Aluminum) by weight.

b. The aluminum sulfate supplied under this standard shall contain no soluble mineral or organic substances in quantities capable of producing deleterious or injurious effects on public health or water quality.

Delivery, Storage, and Handling

A. The Contractor shall provide the name and location of the proposed chemical supplier with the Bid and will be responsible for all coordination with the aluminum supplier necessary to ensure timely delivery to the project site. The Contractor shall confine all storage of equipment and materials within the Project Limits and otherwise in a safe, secure and environmentally sound manner. Conformance to these requirements shall be determined by the Contractor, subject to disapproval of the project manager, whose failure to disapprove does not, however, constitute any shift of responsibility to properly handle equipment and materials from Contractor to project manager. Tank Truck haul routes and site access shall be as directed by Owner. If gradual off-loading is required, the contractor shall be responsible for all demurrage charges.

B. The Contractor shall provide notice to Owner of delivery of equipment and materials seven days prior to the delivery date.

C. The Contractor shall maintain a copy of the spill prevention and spill contingency plan on site for the duration of the project.

Unfavorable Treatment Conditions

A. The project manager will be responsible to monitor wind and precipitation in order to make its judgments about whether conditions are suitable for application.

B. Application of aluminum shall not occur when wind speeds 6 feet above the lake surface exceed 15 miles per hour unless approved by the project manager. Application of aluminum shall not occur if it can be reasonably expected (forecast) that a significant precipitation event (greater than 0.5 inches in 24 hours) shall occur during treatment or begin within 24 hours after treatment completion.

Appendix D. Application Protocol

Mobilization and Staging Area Set Up

The Contractor shall get all necessary equipment to the site and establish an appropriate staging area from which the Contractor shall operate. Chemicals and sensitive equipment must be stored securely whenever the Contractor is not on site. The Awarding Authority will assist in locating the staging area and providing secure storage. Any overnight or off-time security personnel will be the responsibility of the Contractor.

Alum Transfer and Safe Handling

The Contractor shall plan and schedule the timely delivery, storage and transfer of aluminum sulfate and sodium aluminate. All piping shall be appropriate to the materials being transferred, corrosion resistant, with proper joint seals, and free of observable defects. All storage tanks, pipes, hoses, couplings, and connectors for aluminum compounds must meet corrosion resistance standards for those aluminum compounds.

The Contractor will have a spill prevention, control and contingency plan in place, a written copy of which will be accessible on site and will have adequate spill control materials to properly clean up after any spill.

Alum Application and Monitoring

See Appendix A and Appendix B for alum application and water monitoring protocols.

Demobilization and Site Restoration

The Contractor will remove all equipment related to the aluminum treatment at the end of the treatment process. All disturbed areas will be restored to their former conditions or better. The contractor is responsible for any snow removal required, and any repairs required from property damage due to snow removal. The Awarding Authority will inspect the staging area and certify that the Contractor has properly vacated and restored that area.

Reporting

The Contractor will maintain ongoing communication with the Awarding Authority and/or its field representative(s) and will advise all relevant parties on an ongoing basis as to application status, results, and all other conditions relevant to application. The Contractor shall keep daily records of the following:

- Hours of operation
- Quantities of aluminum sulfate and sodium aluminate applied
- Acreage of lake treated (daily and cumulative)
- Location (on map) of area treated each day

- Summary of chemical deliveries
- Explanation of any downtime, including weather conditions and equipment problems
- Any monitoring conducted by the Contractor

The Contractor shall also provide a completed coverage map at the end of the application, with any defined treatment sectors identified and the total quantities of aluminum sulfate and sodium aluminate applied to each. A concise summary report including all information relevant to the treatment is to be provided within 30 days of completion of the project.

Hazmat

Members of the crew will be available to respond to emergencies. They will maintain a trailer that is equipped with booms, absorbent pads, decontamination equipment, etc. This trailer will be parked at the deployment site and ready to go if needed.

Agency Notification

The following Agencies and Towns will be notified in advance of the chemical application:

- Maine Warden Service
- Maine Department of Inland Fisheries and Wildlife
- Maine Department of Environmental Protection
- Maine State Police
- Town of Parsonsfield

Police Patrol

Maine State Police will be notified about the project and will know the location of all chemical storage facilities that will be used during the chemical application. The Contractor will maintain security at the storage site.

Appendix E. Long Pond Outreach Materials

LONG POND ASSOCIATION ZOOM MEETING
THURSDAY, NOVEMBER 4TH, 7:00 P.M. EASTERN TIME

WHY IS THE LAKE SO CLEAR?

Laura Diemer, FB Environmental Associates

The LPA has been faced recently with a persistent, yet unsurprising, question – why is the lake so clear in 2021? Has the lake healed itself? The short answer is – no, the excellent water clarity that Long Pond experienced in 2021 reflects normal year-to-year variation in weather, which can either stymie or promote excessive growth of plants, algae, and cyanobacteria in lakes. The lake has not healed itself, and the problem has not gone away. Refer to Figure 1.
The LPA is currently gearing up for a large fundraising effort to pay for an alum treatment of the lake in 2022 because the modeling shows that a significant amount of phosphorus (a limiting nutrient for growth) is coming from bottom sediments during the summer months when bottom waters become devoid of oxygen. This phenomenon is known as internal loading and can trigger blooms. Internal loading has been occurring every year in Long Pond for many years and has been building over time. Sample results from 2021 show that internal loading was occurring in Long Pond all summer and for a longer amount of time than in 2020.
So why was the water quality so good in 2021? Because there is a trifecta of environmental conditions that need to be met for a nuisance bloom to occur – there needs to be plentiful nutrients (namely phosphorus), heat (consistent, warm water temperatures), and light (bright sunny days). Our review of sample results and weather records indicate that only one of these three conditions were satisfactorily met this summer – nutrients. Phosphorus in the water column was just as high if not higher than in 2020. The other two conditions – heat and light –

were dampened this summer due to the abnormal summer weather experienced by most of New England.

Local air temperature in early summer (April-June) 2021 was generally warmer than normal with less rainfall than normal compared to the previous 25 years (1995-2021) (Figures 2, 3). Spring rains would normally load up the lake with nutrients for use later in the summer. Then July 2021 experienced record rainfall levels but under cooler-than-usual air temperatures. Cloudy, rainy days over an extended period of time cooled water temperature, flushed out a large mass of nutrient load, and reduced light penetration, limiting any significant bloom growth in the lake. Conversely, July 2020 experienced normal rainfall amounts but under warmer-than-usual air temperatures, warming the water at a critical time of year for bloom growth. Profile data collected by an LPA volunteer, Justin Cook, show that water temperature in Long Pond was much warmer in late summer in 2020 compared to 2021.

Climate change will continue to make year-to-year weather more variable and thus harder to anticipate for bloom conditions. Even so, the science clearly shows that Maine's climate is becoming warmer and rainier, which is upsetting the ecological balance of many of our treasured lakes, including Long Pond. Without treatment, Long Pond will continue to suffer from blooms in future years, blooms which will likely become more severe and prolonged in the coming decades.

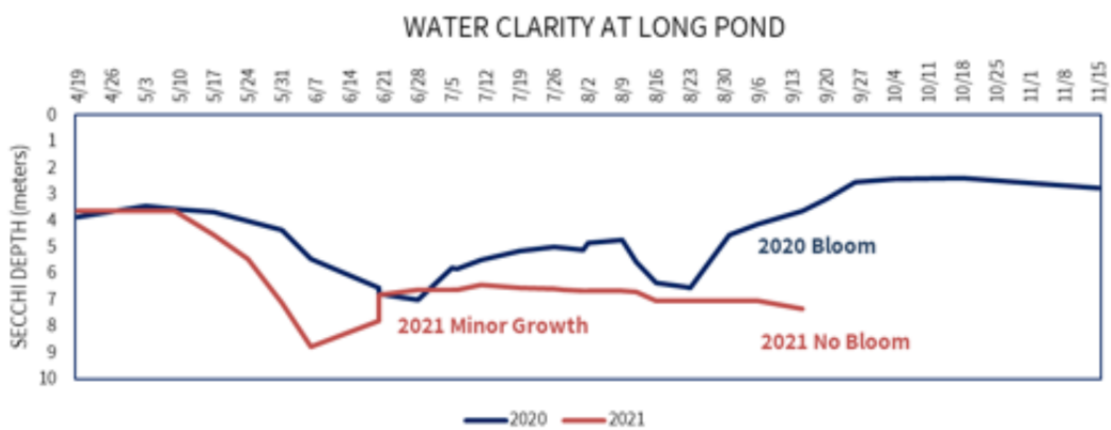


Figure 1. Water clarity (measured in meters below the surface using a Secchi disk and scope) of Long Pond in 2020 (blue) and 2021 (red). Water clarity in 2020 was generally shallower than in 2021 with algae and cyanobacteria growth building from July through October. A deepening of water clarity occurred at the end of August following a large storm event that mixed and flushed the lake. Water clarity in 2021 was generally deeper than in 2020 with minor growth apparent in June-July that did not build into bloom status by early fall. July was abnormally cool and cloudy, limiting the heat and light necessary to spur bloom growth.

Appendix F. References

Cooke, G.D., Welch, E.B., Peterson, S.A. and Nichols, S.A., 2005. Restoration and management of lakes and reservoirs. CRC Press: Boca Raton, FL.

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MAINE POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
AND
MAINE WASTE DISCHARGE LICENSE

DRAFT FACT SHEET

Date: **May 5, 2022**

PERMIT NUMBER: **ME0002836**
LICENSE NUMBER: **W009245-5U-A-N**

NAME AND ADDRESS OF APPLICANT:

LONG POND ASSOCIATION
Deb Hiney, President
21 Lloyd Watson Road
Parsonsfield, ME. 04047

COUNTY: **York County**

NAME AND ADDRESS WHERE DISCHARGE(S) OCCUR(S):

Long Pond
Parsonsfield, Maine

RECEIVING WATER(S)/CLASSIFICATION: **Long Pond/Class GPA**

COGNIZANT OFFICIAL AND TELEPHONE NUMBER:

Mr. Rich Brereton, FB Environmental Associates
97A Exchange St., Suite 305
Portland, ME. 04101
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1. APPLICATION SUMMARY

a. Application: The permittee has submitted an application to the Department of Environmental Protection (Department) for a new combination Maine Pollutant Discharge Elimination System (MEPDES) permit /Maine Waste Discharge License (WDL). The Department has assigned a permit number of ME0002836/WDL W009245-5U-A-N. The permittee has applied for authorization to discharge aluminum sulfate (alum) and/or sodium aluminate to Long Pond in Parsonsfield, Maine, Class GPA, to control the growth of algae in the pond by inactivating iron-bound phosphorus in surficial sediments.

1. APPLICATION SUMMARY (cont'd)

Parts of this summary are excerpts of the "Long Pond CDMP" submitted as part of this application.

Located in the Town of Parsonsfield in western Maine, Long Pond is a 263-acre Great Pond (Class GPA) with a maximum depth of 33 feet. At 1,093 acres, the surrounding watershed is relatively small and steeply sloped. Long Pond has one primary inlet in the northern end of the lake, as well as many small direct drainages. The outlet of Long Pond is situated at the southeasterly end of the lake and discharges through a wetland complex and into Noah's Pond. The outlet flows for approximately 100 feet before flowing through four culverts underneath the Road Between the Ponds. Long Pond is hydrologically connected to West Pond by a cross-culvert under Road Between the Ponds near the West End House (WEH) Camp. The West Pond outlet enters the Long Pond outlet stream between Long Pond and Noah's Pond, however, a small tributary stream branches off the West Pond outlet and enters Long Pond through the aforementioned cross-culvert.

Long Pond is moderately shallow, with a maximum depth of 33 feet and a steeply sloping lake bottom. In most areas of the shoreline, depth increases to 20 feet close to the shoreline. The flushing rate is estimated at 0.5 flushes per year.

The pond is on the Maine Department of Environmental Protection (Maine DEP)'s Nonpoint Priority Watersheds List due to recent changes in water quality consistent with the expected effects of nonpoint source phosphorus enrichment. Cyanobacteria blooms were observed by Long Pond residents and water quality volunteers in the summers of 2006, 2017, and 2018. The most severe bloom was observed starting on July 4, 2017.

Watershed-Based Management Plan The Long Pond Association raised local funding to complete a nine-element watershed-based plan (WBMP) to guide future lake restoration efforts. FB Environmental Associates (FBE) led the development of the plan with the assistance of a technical advisory committee including Maine DEP, LPA, St. Joseph's College of Standish, Maine, and Dr. Ken Wagner of Water Resource Services, Inc. The committee provided input on water quality analysis, modeling, and load reduction strategies throughout the planning process. The final plan, which is currently pending DEP approval, recommends continued external load reduction through watershed Best Management Practices (BMPs), non-structural BMPs, and internal load reduction through an alum treatment.

To limit the watershed load, the WBMP identified 19 residential properties with non-point source problems that could be addressed using BMPs. Nine private road and driveway sites, one town road site, and two summer camp sites were also identified in the WBMP. As part of the WBMP development, FBE conducted a lake loading analysis to inform load reduction goals and strategies, and this analysis was also used to evaluate the potential for alum treatment to reduce phosphorus loading into Long Pond (FBE, 2021).

1. APPLICATION SUMMARY (cont'd)

The Long Pond Association has conducted educational and outreach efforts to inform nearby residents about the alum treatment. The alum treatment recommendation has been developed in cooperation with the project technical advisory committee (TAC). The TAC is made up of stakeholders from the Long Pond Association, Maine DEP, York County Soil & Water Conservation District, FBE, and Dr. Ken Wagner of Water Resource Services, Inc. To date, two virtual TAC meetings have been held to discuss project and task updates. Additionally, the Long Pond Association has published information regarding the WBMP and alum treatment plan in their newsletter. See Appendix E for outreach materials on water quality, phosphorus, and alum treatment from the Spring and Fall 2021 Long Pond Association Newsletters.

The goal of this proposed treatment is to reduce the current internal phosphorus load (31.6 kg/yr) by 90% by applying 25 g/m2 of liquid aluminum sulfate/sodium aluminate to the water column at water depths between 9 and 10 m and applying a treatment of 50 g/ m2 to depths of 8 and 9 m. An additional application of 40 g/m2 at depths of 7-8 m was identified as a likely future need by the alternatives analysis, and the Long Pond Association's preference is to treat this 7-8 m depth increment at the same time if fundraising levels allow.

For this project, the firm hired to conduct the chemical application (Contractor) shall conduct the aluminum sulfate/sodium aluminate application utilizing an appropriate vessel with a subsurface injection system that allows for controlled application and proper mixing of liquid aluminum sulfate and sodium aluminate at variable boat speeds. The barge position in the lake shall be managed by a global positioning system and a depth monitoring system that allows the operator to know where the vessel is and to direct application within the target area and only in the target area.

The treatment vessel will be loaded with aluminum compounds at a designated location set up properly to address any equipment issues, refueling, spills of fuel or aluminum compounds, and to minimize any environmental damage.

The Contractor shall apply the aluminum sulfate and sodium aluminate at a ratio that results in a pH between 6 and 8, with a preferred range of 6.5 to 7.5 and an average pH target of 7. It is assumed that a ratio of 2:1 (alum to aluminate by volume) will result in the desired conditions, but the Contractor will be responsible for ratio adjustment to maintain the pH within the range of 6-8 standard units. Chemicals must be simultaneously distributed by means of a dual manifold or other appropriate injection system that results in a mixing zone of suitable depth.

The Contractor will be responsible for application in a pattern that will lead to uniform distribution of aluminum floc on the bottom in the target area with minimum drift outside the target area. The application rate shall be such that the calculated concentration of aluminum in the active mixing zone (assumed to be five (5) vertical meters unless otherwise documented by the Contractor) will not exceed 5 milligrams Al per liter (mg/L), corresponding to a dose of 25 grams per square meter (g/m2) unless approved by the Awarding Authority after consultation with the Maine DEP.

1. APPLICATION SUMMARY (cont'd)

Where an area must be treated more than once to achieve the target dose, at least 24 hours must elapse between treatments of the same area.

The permittee has submitted a CDMP to the Department as an exhibit to the application for this permit. The Department has reviewed the CDMP and finds it acceptable as written. In addition, the permit has included a letter dated March 17, 2022, from James Pellerin, the Fisheries Resource Management Supervisor that states the MDIFW "would not anticipate acute toxicity resulting a notable fish kill for most fish species but we still have concerns regarding smelt." Therefore, the CDMP contains a monitoring plan for this discharge that has been agreed upon by the permittee, DEP Lakes Division, as well as MDIFW to ensure that further investigations are undertaken for the smelt populations.

2. PERMIT SUMMARY

This permit requires the permittee to comply with technology based and water quality-based limitations, conduct visual and ambient water quality monitoring, recordkeeping and submit a report to the Department following each application or series of applications.

3. CONDITIONS OF PERMITS

Conditions of licenses, 38 M.R.S. Section 414-A, requires that the effluent limitations prescribed for discharges, including, but not limited to, effluent toxicity, require application of best practicable treatment (BPT), be consistent with the U.S. Clean Water Act, and ensure that the receiving waters attain the State water quality standards as described in Maine's Surface Water Classification System. In addition, 38 M.R.S. § 420 and 06-096 CMR 530 require the regulation of toxic substances not to exceed levels set forth in *Surface Water Quality Criteria for Toxic Pollutants*, 06-096 CMR 584 (last amended February 16, 2020), and that ensure safe levels for the discharge of toxic pollutants such that existing and designated uses of surface waters are maintained and protected.

4. RECEIVING WATER STANDARDS

Standards for classification of lakes and ponds 38 M.R.S., §465-A(1) classifies Long Pond as a Class GPA waterbody and describes the standards for classification of Class GPA waterbodies as follows;.

Class GPA shall be the sole classification of great ponds and natural ponds and lakes less than 10 acres in size.

A. *Class GPA waters must be of such quality that they are suitable for the designated uses of drinking water after disinfection, recreation in and on the water, fishing, agriculture, industrial process and cooling water supply, hydroelectric power generation, navigation and as habitat for fish and other aquatic life. The habitat must be characterized as natural.*

4. RECEIVING WATER STANDARDS (cont'd)

B. Class GPA waters must be described by their trophic state based on measures of the chlorophyll "a" content, Secchi disk transparency, total phosphorus content and other appropriate criteria. Class GPA waters must have a stable or decreasing trophic state, subject only to natural fluctuations and must be free of culturally induced algal blooms that impair their use and enjoyment. The number of Escherichia coli bacteria of human and domestic animal origin in these waters may not exceed a geometric mean of 29 per 100 milliliters or an instantaneous level of 194 per 100 milliliters.

C. There may be no new direct discharge of pollutants into Class GPA waters. The following are exempt from this provision:

(1) Chemical discharges for the purpose of restoring water quality approved by the department;

(2) Aquatic pesticide or chemical discharges approved by the department and conducted by the department, the Department of Inland Fisheries and Wildlife or an agent of either agency for the purpose of restoring biological communities affected by an invasive species;

(3) Storm water discharges that are in compliance with state and local requirements and

(4) Discharges of aquatic pesticides approved by the department for the control of mosquito-borne diseases in the interest of public health and safety using materials and methods that provide for protection of nontarget species. When the department issues a license for the discharge of aquatic pesticides authorized under this subparagraph, the department shall notify the municipality in which the application is licensed to occur and post the notice on the department's publicly accessible website.

Discharges into these waters licensed prior to January 1, 1986 are allowed to continue only until practical alternatives exist. Materials may not be placed on or removed from the shores or banks of a Class GPA water body in such a manner that materials may fall or be washed into the water or that contaminated drainage may flow or leach into those waters, except as permitted pursuant to section 480-C. A change of land use in the watershed of a Class GPA water body may not, by itself or in combination with other activities, cause water quality degradation that impairs the characteristics and designated uses of downstream GPA waters or causes an increase in the trophic state of those GPA waters.

5. TERMS AND CONDITIONS

A. **Applicators & Decision Makers** - In this permit, all Operators are classified as either "Applicators" or "Decision-makers" or both. An Applicator is an entity who performs the application of a chemical or who has day-to-day control of the application (i.e., they are authorized to direct workers to carry out those activities) that results in a discharge to waters of the State. A Decision-maker is an entity with control over the decision to perform applications, including the ability to modify those decisions that result in discharges to water of the State. As such, more than one Operator may be responsible for compliance with this permit for any single discharge from the application of chemicals.

This permit delineates the non-numeric effluent limitations into tasks that Department expects the Applicator to perform and tasks the Decision-maker to perform. In doing so, the permit assigns the Applicator and the Decision-maker different responsibilities.

1. **Applicators' Responsibilities -** Special Condition D(2) of this permit contains the general technology-based effluent limitations that all Applicators must perform. These effluent limitations are generally preventative in nature and are designed to minimize chemical discharges into waters of the State. All Applicators are required to minimize the discharge of chemicals to waters of the State by doing the following:

   a. **To the extent not determined by the Decision-maker, use only the amount of chemical and frequency of chemical application necessary to control the target nutrients, using equipment and application procedures appropriate for this task.**

   Use of chemicals must be consistent with any other applicable state or federal laws. To minimize the total amount of chemicals discharged, Operators must use only the amount of chemical and frequency of chemical application necessary to control the target nutrients. Using only the amount of chemical and frequency of chemical application needed ensures maximum efficiency in pest control with the minimum quantity of chemical. Using only the amount and frequency of applications necessary can result in cost and time savings to the user. To minimize discharges of chemical, Operators should base the rate and frequency of application on what is known to be effective against the target nutrients.

5. TERMS AND CONDITIONS (cont'd)

b. Maintain chemical application equipment in proper operating condition, including requirement to calibrate, clean, and repair such equipment and prevent leaks, spills, or other unintended discharges.

Common-sense and good housekeeping practices enable chemicals users to save time and money and reduce the potential for unintended discharge of chemicals to waters of the State. Regular maintenance activities should be practiced and improper chemical mixing and equipment loading should be avoided. When preparing the chemical for application be certain that they are mixed correctly and prepare only the amount of material that is needed. Carefully choose the chemical mixing and loading area and avoid places where a spill will discharge into Waters of the State. Some basic practices Operators should consider are:

- Inspect chemical containers at purchase to ensure proper containment;
- Maintain clean storage facilities for chemicals;
- Regularly monitor containers for leaks;
- Rotate chemical supplies to prevent leaks that may result from long term storage; and
- Promptly deal with spills following manufacturer recommendations.

To minimize discharges of chemicals, Applicators must ensure that the rate of application is calibrated (i.e. nozzle choice, droplet size, etc.) to deliver the appropriate quantity of chemicals needed to achieve greatest efficacy against the target nutrient. Improperly calibrated chemical equipment may cause either too little or too much chemical to be applied. This lack of precision can result in excess chemical being available or result in ineffective nutrient control. When done properly, equipment calibration can assure uniform application to the desired target and result in higher efficiency in terms of nutrient control and cost. It is important for Applicators to know that chemical application efficiency and precision can be adversely affected by a variety of mechanical problems that can be addressed through regular calibration. Sound maintenance practices to consider are:

- Choosing the right application equipment for the application.
- Ensuring proper regulation of pressure and discharge rate to ensure desired application rate.
- Calibrating application equipment prior to use to ensure the rate applied is that required for effective control of the target nutrient.
- Cleaning all equipment after each use and/or prior to using another chemical unless a tank mix is the desired objective and cross contamination is not an issue.
- Checking all equipment regularly (e.g., sprayers, hoses, nozzles, etc.) for signs of uneven wear (e.g., metal fatigue/shavings, cracked hoses, etc.) to prevent equipment failure that may result in inadvertent discharge into the environment.
- Replacing all worn components of chemical application equipment prior to application.

5. TERMS AND CONDITIONS (cont'd)

c. Assess weather conditions (e.g. temperature, precipitation, and wind speed) in the treatment area to ensure application is consistent with all applicable state and federal requirements.

Weather conditions may affect the results of chemical application. Applicators must assess the treatment area to determine whether weather conditions are suitable for chemical application.

2. Decision-makers' Responsibilities Special Condition D(3)of this permit contains the effluent limitations that Decision-makers must perform. The permit requires the Decision-makers, to the extent Decision-makers determine the amount of chemical or frequency of chemical application, to minimize the discharge of chemicals to waters of the State from the application of chemicals, through the use of Chemical Management Measure (CMMs), by using only the amount of chemical and frequency of chemical application necessary to control the target nuisance. For the purposes of this permit CMMs are defined as any practice used to meet the effluent limitations that comply with manufacturer specifications, industry standards and recommended industry practices related to the application of chemicals, relevant legal requirements and other provisions that a prudent Operator would implement to reduce and/or eliminate chemical discharges to waters of the State.

This permit is requiring certain Decision-makers to also comply with different technology-based effluent limitation than Applicators because they are considered the Best Available Technology Economically Achievable for these Operators. These requirements are aimed at reducing discharge of chemicals to waters of the State and lessening the adverse effects of chemicals that are applied. These requirements are divided into three different sections:

- Identify the problem,
- Chemical management options
- Chemical use.

Prior to each application or series of applications, Decision-makers must identify the problem prior to chemical application, consider using a combination of chemicals and non-chemical management measures, and perform surveillance before chemical application to reduce environmental impacts. This permit is requiring these additional technology-based effluent limitation requirements from Decision-makers and not the Applicators because the measures necessary to meet these requirements are within the control of the Decision-makers, not the Applicators.

5. TERMS AND CONDITIONS (cont'd)

B. Chemical Discharge Management Plan (CDMP)

Distinct from the technology-based or water quality-based effluent limitation provisions in the permit, Special Condition G of this permit requires Decision-makers to prepare a CDMP to document the implementation of CMMs being used to comply with the effluent limitations set forth in this permit. In general, Special Condition G of this permit requires that the following be documented in the CDMP:

- Chemical discharge management team information;
- Problem identification;
- Chemical management options evaluation;
- Response procedures pertaining to spills and adverse incidents;
- Documentation to support eligibility considerations under other federal laws, and

The CDMP must be kept up-to-date and modified whenever necessary to document any corrective actions as necessary to meet the effluent limitations in this permit.

The requirement to prepare a CDMP is not an effluent limitation because it does not restrict quantities, rates, and concentrations of constituents that are discharged. Instead, the requirement to develop a CDMP is a permit "term or condition" authorized under Sections 402(a)(2) and 308 of the Clean Water Act. The CDMP requirements set forth in the permit are terms or conditions because the Operator is documenting information on how it is complying with the effluent limitations (and inspection and evaluation requirements) contained elsewhere in the permit. Thus, the requirement to develop a CDMP and keep it updated is no different than other information collection conditions, as authorized by section 402(a)(2), in other permits. Failure to have a CDMP is a violation of the permit.

While Special Condition D of the permit requires the Operator to select CMMs to meet the effluent limitations in this permit, the CMMs themselves described in the CDMP are not effluent limitations because the permit does not impose on the Operator the obligation to comply with the CDMP; rather, the permit imposes on the Operator the obligation to meet the effluent limitations prescribed in Special Conditions A, D and E of this permit. Therefore, the Operator is free to change as appropriate the CMMs used to meet the effluent limitations contained in the permit. This flexibility helps ensure that the Operator is able to adjust its practices as necessary to ensure continued compliance with the permit's effluent limitations. However, the permit also contains a recordkeeping condition that requires that the CDMP be updated with any such changes in the Operator's practices. See Special Condition H of this permit. Thus, if an Operator's on-the-ground practices differ from what is in the CDMP, this would constitute a violation of the permit's recordkeeping requirement to keep the CDMP up-to-date, and not per se a violation of the permit's effluent limitations, which are distinct from the CDMP. The Department recognizes, however, that because the CDMP documents how the Operator is meeting the effluent limitations contained in the permit, not following through with actions identified by the Operator in the CDMP as the method of complying with the effluent limitations in the permit is relevant to evaluating whether the Operator is complying with the permit's effluent limitations.

5. TERMS AND CONDITIONS (cont'd)

Operators must comply with all applicable statutes, regulations and other requirements including, but not limited to requirements contained in the labeling of chemical products. If Operators are found to have applied a chemical in a manner inconsistent with any relevant water-quality related labeling requirements, the Department will presume that the effluent limitation to minimize chemical entering the waters of the State has been violated under the permit. The Department considers many provisions of labeling such as those relating to application sites, rates, frequency, and methods, as well as provisions concerning proper storage and disposal of chemical wastes and containers to be requirements that affect water quality.

If an Applicator applies a chemical at higher than the allowable rate, which results in excess product being discharged into waters of the State, the Department would find that this application was a misuse of the chemical and because of the misuse; the Department might also determine that the effluent limitation that requires the Operator to minimize discharges of chemical products to waters of the State was also violated, depending on the specific facts and circumstances. Therefore, chemical use inconsistent with certain labeling requirements could result in the Operator being held liable for permit or water quality violations.

1. **Contents of the CDMP** - The CDMP prepared under this permit must meet specific requirements in Special Condition G of this permit. Generally, Decision-makers must document the following:

   - A chemical discharge management team;
   - A description of the chemical management area and the pest problem;
   - A description of chemical management options evaluation;
   - Response procedures for spill response and adverse incident response; and
   - Any eligibility considerations under other federal laws.

a. **Chemical Discharge Management Team** - The permit requires that a qualified individual or team of individuals be identified to manage chemical discharges covered under the permit. Identification of a chemical discharge management team ensures that appropriate persons (or positions) are identified as necessary for developing and implementing the plan. Inclusion of the team in the plan provides notice to staff and management (i.e., those responsible for signing and certifying the plan) of the responsibilities of certain key staff for following through on compliance with the permit's conditions and limits.

   The chemical discharge management team is responsible for developing and revising the CDMP, implementing and maintaining the CMMs to meet effluent limitations, and taking corrective action where necessary. Team members should be chosen for their expertise in the relevant areas to ensure that all aspects of chemical management are considered in developing the plan. The CDMP must clearly describe the responsibilities of each team member to ensure that each aspect of the CDMP is addressed. The Department expects most Decision-makers will have more than one individual on the team, except for those with relatively simple plans and/or staff limitations. The permit requires that team members have ready access to any applicable portions of the CDMP and the permit.

5. TERMS AND CONDITIONS (cont'd)

b. Problem Identification - This section includes the pest problem description, action threshold(s), a general location map, and water quality standards.

1. **Nutrient Problem Description** - The permit requires that the CDMP include a description of the nutrient problem at the Chemical management area. A detailed chemical management area description assists Decision-makers in subsequent efforts to identify and set priorities for the evaluation and selection of CMMs taken to meet effluent limitations set forth in Special Conditions A, D and E and in identifying necessary changes in nutrient management. The description must include identification of the target nutrient(s), source of the nutrient problem, and source of data used to identify the problem. The permit allows use of historical data or other available data (e.g., from another similar site) to identify the problem at the site. If other site data is used, the permittee must document in this section why data from the site is not available or not taken within the past year and explain why the data is relevant to the site. Additionally, the chemical management area descriptions should include any sensitive resources in the area, such as unique habitat areas, rare or listed species, or other species of concern that may limit chemical management options.

2. **General Location Map** - The CDMP must also contain a general location map of the site that identifies the geographic boundaries of the area to which the plan applies and location of Long Pond.

c. Description of Chemical Management Measures Options Evaluation - The permit requires that the CDMP include a description of the CMMs implemented to meet the applicable technology-based or water quality-based effluent limitations. The description must include a brief explanation of the CMMs used at the site to reduce chemical discharge, including evaluation and implementation of the six management options (no action, prevention, mechanical/physical methods, cultural methods, biological control agents, and chemicals). Decision-makers must consider impact to non-target organisms, impact to water quality, feasibility, and cost effectiveness when evaluating and selecting the most efficient and effective means of CMMs to minimize chemical discharge to waters of the State.

1. No Action - No action is to be taken, although a nutrient problem has been identified. This may be appropriate in cases where, for example, available chemical management options may cause secondary or non-target impacts that are not justified, no available controls exist, or the algal levels are stable at a level that does not impair water body uses.

2. Prevention - Preventing introductions of possible nutrients is the most efficient way to reduce the threat of nuisance species. Identifying primary pathways of introduction and actions to cut off those pathways is essential to prevention. Through a better understanding of the transportation and introduction of nutrients, private entities and the public have the necessary knowledge to assist in reducing conditions that encourage the spread of nutrients in their immediate surroundings. Increasing public awareness of algal blooms, its impacts, and what individuals can do to prevent proliferation is critical for prevention.

5. TERMS AND CONDITIONS (cont'd)

3. **Mechanical or Physical Methods** - Mechanical control techniques will vary depending on the nutrients. Mechanical and biological controls will be the appropriate method in some cases, or a part of a combination of methods. In some instances, the need for chemical use in and adjacent to the affected habitat can be reduced or virtually eliminated with proper execution of CMMs.

4. **Cultural Methods** - Cultural techniques include water-level drawdown.

5. **Biological Control Agents** - Biological control of algae may be achieved through the introduction of grazers. While biological controls generally have limited application for control of weeds and algae, the Operator should fully consider this option in evaluating nutrient management options.

All five management options may not be available for the chemical treatment area. However, the CDMP must include documentation of how the five management options, including combination of these options, were evaluated prior to selecting a site-specific CMMs.

6. DISCHARGE IMPACT ON RECEIVING WATER QUALITY

As permitted, the Department has made a determination based on a best professional judgment that the existing water uses will be maintained and protected and the discharge will not cause or contribute to the failure of the waterbody to meet standards for Class GPA classification.

7. PUBLIC COMMENTS

Public notice of this application was made in the *Portland Press Herald* newspaper on or about February 26, 2022. The Department receives public comments on an application until the date a final agency action is taken on that application. Those persons receiving copies of draft permits have at least 30 days in which to submit comments on the draft or to request a public hearing, pursuant to *Application Processing Procedures for Waste Discharge Licenses,* 06-096 CMR 522 (effective January 12, 2001).

8. DEPARTMENT CONTACTS

Additional information concerning this permitting action may be obtained from and written comments should be sent to:

Cindy Dionne
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Bureau of Water Quality
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9. RESPONSE TO COMMENTS

Reserved until the end of the public comment period.