Lake Agawam Algae Harvesting Project Fact Sheet

- **Project:** Lake Agawam Algae Harvesting Project
- **Applicant:** Southampton Village
- **Facility:** Lake Agawam Algae Harvesters, 43 South Main Street, Southampton, New York, 11968
- **NYSDEC Application Number:** 1-4736-08860/00009 & 11
- **A Public Participation Plan (PPP) has been developed in accordance with NYSDEC Commissioner Policy 29, Environmental Justice and Permitting (CP-29)**

What is the Proposed Project?

The Proposed Project will use innovative algae harvesting technology to mitigate harmful algal blooms (HABs) and improve water quality in Lake Agawam. To implement the proposed project, Southampton Village has submitted an application for Freshwater Wetland and State Pollutant Elimination Discharge System (SPDES) permits to the New York State Department of Environmental Conservation (NYSDEC) to install and operate the algae harvesting system at Lake Agawam. The system is designed to remove algae along with the nutrients (nitrogen and phosphorus) contained in algae cells. By reducing nutrient levels, the project aims to improve water quality and decrease the frequency, intensity, and duration of HABs.

The facility will treat up to three million gallons of lake water per day. Surface water will be pumped from the north end of the lake, where algae concentrations are highest, to the algae harvesting facility for treatment. The treated water that is clear, low in nutrients, and well-oxygenated will then be discharged toward the south end of the lake through a submerged pipe, enhancing circulation and improving overall water quality. The algae slurry that is recovered in the process will be transported offsite for disposal at an approved waste facility. The system is expected to operate for at least six months each year, from spring through fall, depending on lake and weather conditions, and is planned to remain in operation for a total of three to five years. The purpose of this fact sheet is to inform the public about this proposed project and to involve the community during the NYSDEC permit application review process.

Why does Southampton Village need to implement algae harvesting at Lake Agawam?

Lake Agawam has experienced recurring HABs caused by decades of nutrient pollution, resulting in significant water quality issues and rendering the lake unsafe for recreational activities such as boating, fishing, and ice skating. Listed as an impaired water body under the Clean Water Act, the lake suffers from frequent cyanobacteria blooms, hypoxic conditions, and past fish kills due to elevated phosphorus and nitrogen levels from land runoff, groundwater, and sediments. Algae harvesting has been selected as a viable solution to remove algae and nutrients, based on the demonstrated success of a pilot study, to restore the lake's ecological balance and support safe recreational use.

How might the project affect the surrounding community?

The project may have minor visual, noise and traffic impacts on the community during construction and operation.

Potential Visual Impacts: The algae harvesting system will be housed in a decorative, fenced enclosure that blends with the environment and includes an educational kiosk. Any temporary visual impacts during construction will be addressed, and the site will be fully restored upon project completion, ensuring no long-term visual changes.

Potential Noise Impacts: The system is designed to operate quietly, with noise levels below thresholds for disturbances to people or wildlife within 20 feet of the facility. Noise attenuation measures, such as decorative fencing, will further minimize noise.

Potential Traffic Impacts: The project will not increase traffic in the surrounding area. A single waste hauler truck will remove algae slurry during weekdays, with operations scheduled during off-peak hours to avoid disruptions.

Together, the carefully managed visual, noise, and traffic impacts ensure that the project will integrate seamlessly into the community, preserving the character of the area while delivering long-term environmental and recreational benefits.

How can I participate in the permit review process?

- Ask questions, express concerns, provide input or submit by comments in writing, by phone or email to the project contact person identified below.

Where can I get more information about the proposed project?

- Visit the online document repository at: https://southamptonvillage.org/DocumentCenter/View/2085/LAKE-AGAWAM-ALGAE-HARVESTING-PROJECT-2025 to obtain application materials, relevant documents, and information about the project.

- **Contact Scott Russell by phone at: 631 283-0247 ext 224, by email at: srussell@southamptonvillage.org or in writing at:** Southampton Village, 23 Main Street, Southampton, NY 11968 for information on the project, or to find out about the status of the permit application and public comment period.

Who is responsible for reviewing the Permit Application?

- NYSDEC Region 1, SUNY @ Stony Brook, 50 Circle Road, Stony Brook, NY 11790-3409, is responsible for reviewing and issuing the required permits. Tel: (631) 444-0200; email: DEP.R1@dec.ny.gov

AECOM

Preliminary Engineering Report

Lake Agawam Algae Harvesting Project
Village of Southhampton, New York

Submitted by:
AECOM Technical Services, Inc.
1625 Summit Lake Drive, Suite 300
Tallahassee, Florida 32317

November 2024

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Acronym List

Acronym	Explanation
%	Percent
ACH	Aluminum chlorohydrate
CAS	Chemical Abstracts Service
CY	Cubic yards
DAF	Dissolved Air Flotation
DO	Dissolved oxygen
HAB	Harmful Algal Bloom
HDPE	High-density polyethylene
HFT	Hydronucleation Flotation Technology
kHz	Kilohertz
kWh	Kilowatt hours
lbs/d	Pounds per day
lbs/kg	Pounds per kilogram
lbs/yr	Pounds per year
m^3/yr	Cubic meters per year
MGD	Million gallons per day
No.	Number
NPV	Nelson Pope Voorhis, LLC
NSF	National Science Foundation
NY	New York
NYSDEC	New York State Department of Environmental Conservation
OGS	Office of General Services
mg/L	Milligrams per liter
µg/L	Micrograms per liter
PFD	Process flow diagram
PSEG	Public Service Enterprise Group
STAG	State and Tribal Assistance Grant
TN	Total nitrogen
TP	Total phosphorus
SESCs	Soil Erosion and Sediment Controls
USEPA	United States Environmental Protection Agency
Village	Village of Southampton

1.0 Introduction

This Preliminary Engineering Report has been prepared for the Village of Southampton (Village) to present the preliminary engineering considerations for the design of the algae harvester system selected to address harmful algal blooms (HABs). Lake Agawam has experienced a long history of water quality issues associated with excess nutrients, phosphorus and nitrogen, and low dissolved oxygen (DO) that have historically resulted in frequent toxic HABs that have impeded the community's use of the lake for recreational purposes.

1.1 Site/Project Background

Lake Agawam is a 64-acre freshwater body located in the Village, Suffolk County, New York (see Figure 1 in Appendix A). The lake lies within the Village centrally and is bound on the north by the western portion of the downtown business district and Agawam Park, on the east and west by residential properties, and on the south by the Atlantic Ocean with which there is connectivity via a water control structure.

Historically the lake has been used for recreation including sailing, boating, fishing, and ice skating, and has been a source of enjoyment for Village residents since Village incorporation in 1894. Due to toxic HABs, however, Lake Agawam is often no longer safe for recreational purposes.

The HABs issues in the lake are well documented. Lake Agawam was listed as an impaired water body under Section 303(d) of the Federal Clean Water Act in 2008 due to elevated phosphorus and low DO that have restricted beneficial uses of the lake. The migration of nutrients (phosphorus and nitrogen) from land surface runoff, groundwater discharge, and sediments into Lake Agawam has led to frequent and extensive HABs, which in turn have resulted in hypoxic zones, habitat loss, and past fish kills. Dense, cyanobacteria blooms generally persist from May through November with high concentrations of microcystins that regularly exceed recreational guidelines.

The New York State Department of Environmental Conservation (NYSDEC) prepared a HAB Action Plan for Lake Agawam in April 2020 in accordance with the goals and objectives of New York (NY) State's United States Environmental Protection Agency (USEPA) approved 2020-2025 Nonpoint Source Management Program. The plan outlined the issues and concerns and identified emerging HABs reduction treatments including hydrogen peroxide, ultrasound and algae harvesting as candidate Priority 1 projects. Hydrogen peroxide and ultrasound technologies were evaluated at Lake Agawam in the summer of 2021, but these did not successfully control HABs and are no longer being considered for full scale implementation. An algae harvesting pilot study conducted in October 2019 did provide HABs reduction and other positive benefits for the lake.

The Village and concerned citizen action groups such as the Lake Agawam Conservation Association and Lake Agawam Conservancy Group have taken significant measures to mitigate adverse environmental effects of nutrient enrichment on Lake Agawam. Notwithstanding these efforts, Lake Agawam remains impaired, and algae harvesting has been selected for full-scale implementation.

1.2 2019 Algae Harvesting Pilot Study

AECOM's Lake Agawam Innovative Algae Harvesting Demonstration Project (pilot study) was completed in October 2019 for the NY State Office of General Services (OGS) and NYSDEC (AECOM, 2020). The pilot study evaluated the use of the Hydronucleation Flotation Technology (HFT) to treat algae harvested from Lake Agawam and remove nutrients to improve water quality in the lake. The 10-day pilot study showed that the HFT was able to effectively separate intact algae cells from lake water, consolidate the algae biomass into a dense algae slurry, remove the microcystin toxin from the lake water to below the USEPA recommended human health recreational ambient water quality criterion of eight (8) micrograms per liter (µg/L), all while returning clarified, low-nutrient water directly back to Lake Agawam. The water returned to Lake Agawam following treatment had low algal biomass (average chlorophyll a = 0.501 µg/L), total suspended solids (8.5 milligrams per liter [mg/L]) and nutrient levels (average total phosphorus = 0.01 mg/L; average total nitrogen = 0.62 mg/L) that are characteristic of low productivity (oligotrophic) to moderate productivity (mesotrophic) lakes with good water clarity to support aquatic life. The treatment exceeded expectations for algae, algal toxin, and nutrient removal with average removal efficiencies of:

- >99 percent (%) for chlorophyll-a
- >90% for total microcystins

- >90% for total phosphorus
- >80% for total nitrogen

Since that time, use of the algae harvesting HFT has been implemented in additional projects in Florida and Ohio. These tests have continued to prove that the technology is safe and effective for HAB mitigation, physically removing nutrients and algal toxins to very low levels across a range of lake types and variable water quality conditions.

1.3 Proposed Treatment System

Based on the documented success of the algae harvesting with HFT treatment and the evaluation of additional alternatives, the Village has entered into an agreement with AECOM to design, install, and operate an HFT algae harvesting system. The proposed system has a treatment capacity of up to 3 million gallons per day (MGD). The system will be comprised of three 1-MGD algae harvesters, each with its own dedicated intake to provide operational flexibility and to facilitate relocation of one or more of the harvesters if desired in the future. Surface water from Lake Agawam will be pumped from the north end of the lake to the algae harvesting system and the treated water will be discharged at the south end of the lake. This design takes advantage of the higher algae levels typically observed at the north end of the lake to maximize the rate of nutrient removal.

1.4 Project Costs and Funding Sources

Costs for construction and the first year of operation of the project is estimated at $10.3 million (see Appendix B). The Village was awarded a total of $5.3 million from the Southampton Town Community Preservation Fund's water quality program for planning, construction, and operation of the HFT algae harvesting system. An additional $5 million was awarded through an USEPA State and Tribal Assistance Grant (STAG) for the capital purchases of the harvesters and support equipment. No additional funding is being sought by the Village for implementation of the project.

2.0 Analysis of Alternatives

To address the HABs in Lake Agawam, the Village has proposed the installation of a bio-retention system and rain garden to filter storm water runoff on the southern end of Lake Agawam (Town of Southampton, 2022). This installation would help to reduce excess nutrients from flowing into Lake Agawam.

In addition, the Village of Southampton has installed bioswale infrastructure at various locations including 71 Nugent Street, West Main Street, and Gin Lane. These bioswales have been designed to reduce discharge of pollutants from stormwater runoff into Lake Agawam (Town of Southampton, 2021).

Additional new construction measures have also been deemed necessary.

2.1 Development of Alternatives

Several alternatives included in the 2020 NYSDEC Harmful Algal Blooms Action Plan (NYSDEC, 2020) have been evaluated as part of the *Environmental Information Document, Lake Agawam Algae Harvesting Project* (AECOM, 2024) prepared for National Environmental Policy Act compliance.

2.1.1 Dredging

Dredging was considered in the 2020 NYSDEC Harmful Algal Blooms Action Plan as a potential strategy to improve lake water quality and conditions (NYSDEC 2020). Over time, Lake Agawam has accumulated sediment from the runoff of the surrounding watershed (Nelson Pope Voorhis, LLC [NPV], 2022) and while sediment deposition is a natural process, the surrounding impervious surfaces and residential and commercial development of the surrounding area has accelerated this process. This accumulation has caused the once sandy and gravelly bottom of Lake Agawam to become shallow and covered in fine silt and organic matter (NPV, 2022). Dredging would remove the nutrient rich sediment on the bottom of the lake to restore the original sandy bottom and reduce nutrient benthic flux (NPV 2022).

Major challenges related to dredging include the dewatering and disposition of dredged materials and the overall cost of dredging (NPV 2022). Finding a suitable dewatering site presents a significant challenge as there are limited options within the Village. Spatial analysis determined that there are no feasible dewatering areas of the size needed to contain all the dredged material from one dredging event. Therefore, it may be necessary to utilize one or more smaller areas (NPV 2022).

Cost estimates ranged from $52 million to $73 million dependent on dredging, dewatering, and disposal costs (NPV 2022). The cost estimates of dredging are displayed in **Table 1 and Table 2** below.

Table 1: Cost of Dredging the North Part of Lake (65,000 Cubic Yards)

Parameter	Cost	Volume (cubic yards [CY])	Cost/CY
Conservative	$14,054,028	65,000	$216.22
Moderate	$11,698,018	65,000	$179.97
Low	$9,981,028	65,000	$153.33

Notes: Estimates in 2019 Dollars

Table 2: Cost of Dredging Total Lake (336,424 Cubic Yards)

Parameter	Cost	Volume (CY)	Cost/CY
Conservative	$72,740,189	336,424	$216.22
Moderate	$60,546,242	336,424	$179.97
Low	$51,659,498	336,424	$153.33

In addition to the limited space that would result in difficulties performing a dredging operation as well as the prohibitive costs (**Table 2**), the potential impacts resulting from the dredging of Lake Agawam were also considered. These effects include impacts from equipment operations, dewatering, dredged material transport and related aspects of the project. These possible effects include (NPV, 2022):

- Disturbance and disruption within the Village during period of dredging/ dewatering/ removal.
- Loss of use of dewatering site(s) for period of dredging and dewatering/drying.
- Minimum alteration of soils at the dewatering site which can be limited through equipment operation and use of a liner, and land surfaces would be restored after removal
- Potential minor odors at dewatering site which may be controlled through odor controls.
- Noise associated with equipment operation at the dewatering location, on the lake and in any areas of pipe conveyance in the Village.
- Use and activity at the dewatering site(s) related to setting up the laydown area for geotextile tubes, which includes excavation, berming, installation of liner, installation of piping, and all construction activities related to this setup. During dredging operations, it is expected that activity would take place as related to placement of the discharge pipe in manifolds and Geotubes® and continued activity of personnel involved with the filling of tubes and polymer injection.
- Potential impact of dewatering liquid being reintroduced to the lake, which will be subject to sampling.
- Increased turbidity in area of anchor/cable use for movement of the hydraulic dredge
- Trucking equipment/materials, to/from the Village using Village roads and large trucks.

The cost, difficulty in finding a suitable dewatering location, and greater potential impacts linked to dredging, resulted in the need to evaluate additional options.

2.1.2 Hydrogen Peroxide Treatment

Dilute hydrogen peroxide has been proposed to treat harmful cyanobacteria blooms within lakes. This method has been shown to reduce cyanobacteria populations by up to 99% with minimal effects to eukaryotic phytoplankton, zooplankton and macrofauna (Matthijs et al., 2012). This method does not result in long-term chemical traces, as hydrogen peroxide degrades within a few days (Matthijs et al., 2012).

2.1.3 Ultrasound Radiation Treatment

Ultrasound (sound waves of a frequency higher than 20 kilohertz [kHz]) can lead to structural and functional disruption of cyanobacterial cells, making it a viable option to manage waterbodies (Rajasekhar et al., 2012). Research indicates that sonication impedes growth rates of cyanobacteria by breaching the gas vesicle, which then causes disruptions in the cell wall and membrane, suspension of photosynthesis, and inhibition of the cell cycle (Rajasekhar et al., 2012). Sonication also appears to be an environmentally friendly control method as it does not introduce chemical contaminants for the induction of cell lysis.

2.1.4 Hydronucleation Flotation Technology Algae Harvesting Project (Proposed Action)

The proposed action, algae harvesting using the HFT physically extracts algae and associated nutrients from water bodies and is an effective method and solution to restoring nutrient and HAB-impaired waterbodies. The proposed action attributes are the following (AECOM, 2024):

- Would only require a small temporary footprint for equipment,
- The proposed cost of ~$10 million, is 80% less than the conservative dredging costs, without the impacts
- Would allow for secondary reuse of the harvested algae
- Has been demonstrated to be effective in the Lake Agawam Pilot Study and at multiple other locations across the United States.

2.1.5 No Action

Without action, current water quality issues will continue and may worsen over time, and the lake's recreational and ecological value will continue to diminish.

The presence of toxic HABs currently restricts recreational opportunities on the lake (NYSDEC, 2020). As a Class C waterbody, fishing is allowed in Lake Agawam, however fish consumption is dangerous due to toxins (NYSDEC, 2020). The lake is an unsightly green color, reducing its aesthetic quality and further diminishing recreational appeal (NPV, 2009).

Fish kills have been observed in the years 1954, 1981, 2000, 2005 (NPV, 2009), and 2006 (Gobler, 2017), indicating a recurring problem with the lake's health. Without intervention, further ecological disturbance will occur, including continued fish kills and loss of biodiversity.

The No-Action Alternative fails to address public health issues associated with exposure to toxins produced by algal blooms, which are known to cause serious health issues ranging from skin irritation to severe neurological effects. The persistence of these hazardous blooms can lead to declines in property values and deter tourism, impacting the local economy and community well-being.

2.2 Alternative Screening

The new construction alternatives for in-lake treatment of HABs in Lake Agawam were evaluated based on criteria such as cost, feasibility, environmental impact, and operational efficiency (AECOM, 2024).

2.2.1 Dredging

Dredging was considered but was deemed as a costly option, with estimates ranging from $52 million to $73 million. This method was further complicated by the challenge of finding a feasible dewatering site within the Village. The impacts associated with dredging were the most severe as there would be disturbance and disruption within the Village during the period of dredging, dewatering, and removal (NPV, 2022). These factors collectively established dredging as an impractical solution for Lake Agawam.

2.2.2 Hydrogen Peroxide Treatment

Hydrogen peroxide has been used as a relatively cheap and effective management method for controlling HABs within various waterbodies. It has been proven to be most effective when cyanobacterial blooms are at an early stage and low doses of hydrogen peroxide are needed (Chen et al., 2021). Hydrogen peroxide dosed at a moderate level has not been shown to reduce cyanobacteria levels below detection or guidance levels (Lusty and Gobler, 2020). Studies have found that using hydrogen peroxide in a lake with high algal density, requiring high doses of hydrogen peroxide to treat, results in a considerable increase in both nutrients and microcystins within the water column (Chen et al., 2021). As Lake Agawam has a high density of algal blooms and would likely require a large dose of hydrogen peroxide to treat, the byproduct of cell lysing would release nutrients into the water column and result in increased algae growth. Hydrogen peroxide is therefore not a feasible solution for controlling cyanobacteria within Lake Agawam.

2.2.3 Ultrasound Radiation Treatment

Ultrasonic radiation treatment for impaired waterbodies is a relatively new approach to the management of cyanobacteria. As such, there is limited information on the use of sonification devices for larger waterbodies, indicating that further research needs to be done to determine the efficacy for field-scale control of cyanobacteria (Park et al,. 2017; Kibuye et al., 2021). Similar to hydrogen peroxide, ultrasonic radiation would lyse cyanobacteria cells, causing the intracellular organic matter to leach into the surrounding water (Dang et al., 2023). This would then release nutrients into the water column, providing opportunity for cyanobacteria population levels to return to or surpass their previous quantity. Therefore, the ultrasonic radiation treatment alternative is not plausible for treating Lake Agawam.

2.2.4 Hydronucleation Flotation Technology Algae Harvesting Project (Proposed Action)

Algae harvesting with HFT was identified as the most practical new construction alternative option. This method is more cost-effective, while requiring minimal space. In addition, the treatment has the capability to physically remove nutrients from the lake at a rate that can significantly reduce lake water nutrient concentrations, rendering it the optimal solution for mitigating harmful algal blooms over time.

2.3 Assigning weights for criteria

2.3.1 Dredging

Present Worth or Equivalent Annual Cost. Dredging had a high upfront cost ranging from $52 million to $73 million. This cost significantly impacts its evaluation criteria, making it the least economically tenable option.

Reliability. Dredging is a reliable method for sediment removal within a waterbody. Utilizing the dredging method would reduce nutrient levels that contribute to HABs. While dredging is effective, dredging may have potential operational difficulties or challenges.

Complexity. Dredging is a high complexity solution that involves sediment removal, dewatering, and disposal. All of these steps would require considerable planning to manage environmental impacts and logistical constraints.

Environmental factors. The environmental impacts of dredging at Lake Agawam include potential noise pollution, increased turbidity from anchor use, substantial habitat impacts, and disruption within the village in part due to the movement of trucks and equipment. Additional challenges include the potential reintroduction of dewatered liquid to Lake Agawam, which may carry contaminants. The project also faces constraints related to the disposal of dredged sediments (NPV, 2022).

Feasibility. Dredging is limited by high cost and logistical constraints like space. The extensive requirements that need to be met to successfully dredge Lake Agawam reduce this method's feasibility.

Flexibility. Dredging offers limited flexibility as it involves large-scale operations and fixed infrastructure for sediment removal and dewatering.

Water/Energy Use Comparison. Dredging would likely involve heavy energy consumption due to its use of heavy machinery. The process does not require additional water input.

2.3.2 Hydrogen Peroxide Treatment

Present Worth or Equivalent Annual Cost. Treating algal blooms with hydrogen peroxide may be cost efficient for cases involving low algal density or early-stage blooms. For a waterbody, the size of Lake Agawam, the volume of chemicals needed to treat the dense blooms throughout the entire lake would not be cost effective.

Reliability. Hydrogen peroxide treatment is effective for treating early stages of cyanobacteria blooms. As the density of algal blooms and the size of the waterbody increase, this method appears to be less reliable.

Complexity. Using hydrogen peroxide to treat cyanobacterial blooms within a lake would require careful planning and preparation to ensure proper dosing and minimal environmental impacts.

Environmental Factors. While studies have shown that hydrogen peroxide degrades quickly and has minimal environmental impacts on surrounding aquatic life, careful monitoring would need to be done to ensure no adverse effects resulted from this method. The use of hydrogen peroxide in high doses risks nutrient release and potential algal bloom resurgence, which would negatively impact the environment.

Feasibility. The use of hydrogen peroxide appears to be most feasible for smaller applications involving a low density of algal blooms.

Flexibility. As hydrogen peroxide is most effective for early-stage algal blooms, its flexibility is contingent on bloom growth and density.

Water/Energy Use Comparison. The hydrogen peroxide method would not require a large amount of energy and would not require additional water input.

2.3.3 Ultrasonic Radiation Treatment

Present Worth or Equivalent Annual Cost. As Lake Agawam is a large waterbody with a high algal density, the equipment needed to perform ultrasonic radiation treatment would likely be costly and require maintenance and energy fees.

Reliability. While ultrasonic radiation has been successful in disrupting cyanobacterial cells in previous studies, the efficacy on a large-scale operation remains under-researched. Therefore, this would not be a reliable treatment method for Lake Agawam.

Complexity. The ultrasonic radiation treatment method would require the installation and operation of equipment. As such, this method would not be excessively complex.

Environmental Factors. Ultrasonic radiation would not introduce chemicals into the environment, making it a relatively environmentally friendly process. However, cell lysis caused from the treatment method may increase nutrient levels within a waterbody like Lake Agawam, potentially exacerbating bloom conditions.

Feasibility. The limited amount of available information on ultrasonic treatment for a large waterbody like Lake Agawam makes this an uncertain method. Furthermore, the potential of worsening hypoxic conditions within Lake Agawam due to increased nutrient levels reduced the feasibility of this method.

Flexibility. Ultrasonic treatment has a degree of flexibility as the machine could be used as needed and with differing levels of intensity.

Water/Energy Use Comparison. The ultrasonic radiation treatment method would require moderate energy use for continuous operation. No additional water inputs would be needed.

2.3.4 Hydronucleation Flotation Algae Harvesting Treatment

Present Worth or Equivalent Annual Cost. The HFT method appears to be the most cost-effective method overall. Costs associated with installation, operation, and maintenance are anticipated to be considerably lower than dredging, while achieving effective results in removing nutrients that fuel HABs.

Reliability. HFT is a reliable method for controlling harmful algal blooms within Lake Agawam. The method has been evaluated at Lake Agawam and several other waterbodies in the United States, and was proven to remove algae, nutrients and intracellular toxins while increasing DO efficiently and consistently in the treated water.

Complexity. While it does not require as much space and logistical coordination as dredging, HFT algae harvesting is still complex and requires both aquatic and terrestrial elements. Once installed, the process requires minimal routine maintenance and oversight by a system operator.

Environmental Factors. The HFT algae harvesting method will clear less than 0.5 acres of habitat, specifically a manicured grass area, and has no anticipated chemical impacts. While the method may impact the existing zooplankton community by potential entrainment with water withdrawn from the lake for treatment, the overall treatment is anticipated to have net positive effects on zooplankton abundance and diversity. This would be achieved by improving aquatic habitat by increasing light penetration and reducing nutrients, thus promoting a more diverse and balanced algal and aquatic plant community.

Feasibility. Algae harvesting with HFT offers a feasible solution with practical cost, efficient nutrient removal, and low space requirements. This makes HFT feasible within the constraints of Lake Agawam and its surrounding environment.

Flexibility. The algae harvesting HFT process proposed will have a reasonable amount of flexibility as all water and land-based system components would be temporary in nature. Furthermore, the system will comprise three independent algae harvesting units, minimizing downtime for maintenance and repairs, thus offering treatment flexibility. As the treatment progresses and nutrient concentrations are reduced in the lake, one or more of the units can be relocated and used elsewhere. The HFT system would not impact any permanent municipal features.

Water/Energy Use Comparison. The treatment system will be powered by a local utility. Energy use is anticipated as approximately 272,000 kilowatt hours (kWh) for continuous operation over six months (May through October) (AECOM, 2024). This process will not involve any additional water input from municipal sources.

2.3.5 Comparative Evaluation of Alternatives

Comparing the alternatives (**Table 3**), algae harvesting with HFT outperforms dredging across all criteria. Algae harvesting is preferred over both the hydrogen peroxide method and ultrasonic radiation in four of the seven criteria. Therefore, algae harvesting with HFT is the preferred alternative based on the criteria evaluated.

Table 3: Comparative Evaluation of Algal Management Methods for Lake Agawam

Criteria	Dredging	Hydrogen Peroxide	Ultrasonic Radiation	HFT Algae Harvesting
Cost	High	Medium	Medium	Low
Reliability	Medium	Low	Low	High
Complexity	High	Medium	Medium	Medium
Environmental Factors	High	Medium	Medium	Low
Feasibility	Medium	Low	Low	High
Flexibility	Low	Medium	Medium	Medium
Water/energy use comparison	High	Low	Medium	Medium

3.0 Algae Harvesting System Design

Design of the algae harvesting system is underway. This section will describe preliminary design of the components of the algae harvesting system and the basis for sizing and treatment requirements.

3.1 HFT Treatment Sizing

The algae harvester is not intended for use to directly kill, destroy, repel, or mitigate algae in a water body. While algae are physically removed from water that passes through the system, the intent of this process is to remove the nutrients that they contain therefore reducing nutrient pollution stored in the water body that contributes to HABs.

The algae harvester HFT uses an advanced form of Dissolved Air Flotation (DAF), a liquid-solid separation process commonly used in the water and wastewater treatment industry to separate algae and other solids from water. This process utilizes microbubbles to gently separate and remove nutrient-rich algae and other solids from the water, producing clear, low-nutrient, and highly oxygenated water that is returned to the lake. A harvester treatment schematic is included as Figure 2 in Appendix A.

Water treatment products (coagulant and flocculant) are used in the operation of the algae harvester. The products used are certified for water treatment by the National Science Foundation (NSF). Aluminum chlorohydrate (ACH, Chemical Abstracts Services [CAS] Number [No.] 12042-91-0) is the commonly used coagulant. Polysep 1290 (mixture including sulfamic acid [CAS No. 532-14-16] and adipic acid [CAS No. 124-04-9] is the commonly used flocculant. Safety data sheets for these products are included in Appendix C.

Based on average historical water quality conditions and average annual nutrient loads to Lake Agawam (Gobler, 2017), the proposed 3-MGD algae harvesting system is estimated to be able to remove the equivalent of 23% of the total phosphorus (TP) load and 52% of the total nitrogen (TN) load to the lake in the first year of operation if operated at the design flow for six months (Table 4 and Table 5). This level of treatment is anticipated to significantly reduce nutrient concentrations in the lake and thus the risk of HABs over time. Based on 2016 algae levels, Gobler (2017) estimated that a 50% reduction in nitrogen loads to the lake would reduce cyanobacteria (blue-green algae) biomass by up to 55% and the toxicity of the blooms by 75%. A similar estimate of the impact of phosphorus load reduction on HABs has not been developed for Lake Agawam. The concentration of phosphorus in lakes is directly related to algae abundance, therefore, the removal of phosphorus is expected to significantly reduce the overall algae levels in Lake Agawam.

Table 4: Total Phosphorus and Total Nitrogen Loads to Lake Agawam

	Total Phosphorus (1)			Total Nitrogen (2)		
Source	Pounds per day (lbs/d)	Pounds per year (lbs/yr)	% Contribution	lbs/d	lbs/yr	% Contribution
Surface Runoff	0.07	26	1%	11	4,074	16%
Benthic Flux (from lake sediments)	3.70	1,349	59%	17	6,358	25%
Stormwater Drains	1.78	650	29%	6	2,046	8%
Groundwater (incl. Septic Systems)	0.48	175	8%	35	12,672	50%
Atmospheric Deposition to Lake	0.21	77	3%	1	295	1%
Total	6.24	2,276	100%	70	25,446	100%

Notes:

(1) From Gobler (2007) and modified to assume a shorter anoxic period of 90 days (instead of 365 days) for benthic flux

(2) From Gobler (2017)

Table 5: Nutrient Load Reduction Estimates for a 3-MGD Algae Harvester at Lake Agawam

Parameter	Total Phosphorus	Total Nitrogen
Existing Load to Lake Agawam (lbs/yr)	2,276 (1)	25,450 (2)
Potential Reduction by Algae Harvesting (lbs/yr) (3)	514	13,287
% Load Reduction	23%	52%

Notes:

(1) From Gobler (2007) and modified to assume a shorter anoxic period of 90 days (instead of 365 days) for benthic flux

(2) From Gobler (2017)

(3) Calculated as Lake Surface Water Concentration (mg/L) x Volume Treated (cubic meters per year [m^3/yr]) x % Removal x 2.205 pounds per kilogram (lbs/kg), and assuming:

- Average surface water concentrations in Lake Agawam over the open water season of 120 mg/L for total phosphorus (Gobler 2017) and 3.64 mg/L for total nitrogen (AECOM 2020)
- A maximum treatment volume of 3 MGD and 180 days of treatment per year for a total treatment volume of 360 million gallons (1.4 x 10^6 m^3/year) (approximately 2.6 lake volumes)
- % removal for total phosphorus (95%) and total nitrogen (82%) documented in the 2019 Lake Agawam Algae Harvesting Demonstration Project (AECOM 2020). These removal rates are consistent with results of multiple other field demonstration studies (Page et al., 2020, 2021; TetraTech, 2022; AECOM, 2022a, 2022b, 2023).

The mass of nutrients that will be removed in the first and subsequent years of algae harvesting will ultimately depend on the concentration of algae and nutrients in Lake Agawam, which can vary from year to year, as well as the volume of water that is treated.

Algae harvesting directly removes nutrients from water, but the discharge of large volumes of highly clarified (low turbidity), oxygenated water will provide additional water quality benefits that will further reduce nutrient concentrations and improve overall aquatic habitat in the lake. Lake Agawam receives approximately 910 million gallons of stormwater per year, representing approximately 84% of the lake's total water load. The 3-MGD system can therefore treat an equivalent of more than 50% of the stormwater entering the lake in six months (540 million gallons per year), if operated continuously. The amount of water that can be treated is equivalent to 2.6 times the volume of the lake (Lake Agawam volume = 208 million gallons). However, the Village periodically discharges water from the lake to the ocean to prevent flooding and septic system backups of surrounding homes. The discharge of this water could potentially delay the expected lake response to lake restoration, however the clean discharge water from the harvesting operations will reduce the nutrients and toxins that are currently being discharged to the ocean, thus providing a safer environment for the beach users.

3.2 Site Selection

The algae harvesting system will be located at Doscher Park at 43 South Main Street, Southampton, New York, 11968. Use of the vacant property was approved by the Village in a Proposition vote on November 5, 2024. The location is ideally suited for the algae harvester system staging due to its lake access since the property is located directly on the northeast corner of Lake Agawam.

3.3 Landside Process Flow Equipment

An electric pump will be utilized to pump lake water into the algae harvesters through 6-inch diameter high-density polyethylene (HDPE) piping from the lake. The harvesters will sit on concrete pads above grade from the shoreline. Following treatment, discharge water from the algae harvester will gravity flow into a centralized collection tank and then pumped from the tank back into the Lake. A proposed piping and instrument diagram and preliminary site plan are provided in Figure 3 and Figure 4 of Appendix A, respectively.

3.4 Lake Agawam Intake and Discharge Systems

The intake structures and discharge piping will be placed in the Lake via flat-deck work boats utilizing cranes. The intake structures consist of three individual concrete vaults that will allow the top 6 inches of water to flow into the structures through mesh screening to prevent incidental uptake of aquatic organisms. The vaults will be connected to 6-inch diameter HDPE piping running to an electric pump onshore. The discharge piping will consist of 12-inch diameter HDPE piping running from an onshore collection tank, and discharge water will be pumped approximately

3,000 feet to the southern end of the Lake via an electric pump. The discharge piping will be submerged and anchored to the lake bottom with concrete weights. The discharge water will be dispersed in a manner as to reduce any scouring of the lakebed sediments. Preliminary routings of the intake and discharge piping are provided on Figure 5 and Figure 6 in Appendix A.

3.5 Slurry Management

Slurry produced by the algae harvesting units will be collected in onshore polyethylene tanks. The slurry will be recirculated within the tanks to reduce water-algae separation. Slurry production will be limited to 3,000 gallons per day to reduce the frequency of hauling the slurry off-site. Once capacity is reached, the slurry will be transferred to a waste-hauling vac-truck and transported to an offsite waste processing facility.

A licensed waste-hauler will be used to transport the slurry via vac-truck to a waste processing facility. Disposal of the slurry will depend on the facility to which the slurry is hauled. Waste processing options include land application, incineration, waste-to-fuel conversion, or landfill.

4.0 Site Access, Preparation, and Control

The proposed landside site layout is presented Figure 4 in Appendix A.

4.1 Site Access

The algae harvesting system will be located at Doscher Park at 43 South Main Street, Southampton, New York, 11968. Access to the areas will be required for mobilization, demobilization, operations, inspections, and maintenance.

4.1.1 Landside

Landside access to construction areas will be required for the project, and traffic is expected to utilize Jobs Lane to access the site. Access points will be stable enough to support equipment and supply delivery trucks. A site traffic plan will be developed in cooperation with the Village prior to the start of site activities.

4.1.2 Waterside Access and Launch Areas

For in-water construction activities and maintenance, flat-deck boats with cranes will be utilized to placed infrastructure in the lake. Boats will be launched at the existing boat ramp on the southeastern corner of the lake. Following construction, periodic water access will be required for sampling and maintenance activities.

4.2 Site Preparation

4.2.1 Utilities

Operation of the system will require both single phase and 3-phase power be run to the site location. The electrical contractor, Ocean Electric, is working with Public Service Enterprise Group (PSEG) to secure the power required. Power is expected to be run off existing single phase and 3-phase power poles located on Pond Lane.

Potable water for cleaning will be secured by running a water line from the existing Doscher Park infrastructure.

If needed, process water will be drawn from the effluent of the algae harvesting system.

4.2.2 Grading and Pad Construction

The site area will be approximately 7,500 square feet (sq ft) (60 feet [ft] x 125 ft) in total. Grading will be a sitewide 2-3% grade northwest towards the existing parking lot and drainage infrastructure. Three (3) concrete pads will be poured near the site center (10 ft x 50 ft each) for a total of 1,500 sq ft that will be set at a 1% grade northwest. The open-top algae harvesters will be placed on these concrete pads. The remainder of the site will consist of permeable pavers at a 2-3% grade to allow for shedding of any excess stormwater. There will be four (4) drop in place buildings placed on site consisting of approximately 1,500 sq ft total of covered space for coagulant and flocculant storage and mixing, material storage, pump and electrical housing, and office space. Gutters will be placed on the buildings with the downspouts following the northwest site grading. Plans for stormwater management will be coordinated through the Village.

4.2.3 Soil Erosion and Sediment Controls During Construction

Soil Erosion and Sediment Controls (SESCs) will be installed prior to intrusive activities and be maintained through construction until restoration and demobilization are completed. Dense graded or recycled concrete aggregate will be imported and placed as needed to create stable roadways and ground conditions for construction traffic and laydown areas. Silt fencing, straw wattles, and compost filter socks will be installed downgradient of any disturbance work as needed to minimize runoff. Any storm drains found during the utility survey will be protected via drain covers and/or compost filter socks.

A water truck may be kept on site to mitigate dust onsite and limit dust from leaving the site. A municipal location to refill the truck has yet to be determined.

4.2.4 Temporary Staging Areas for Equipment and Materials During Construction

An equipment and materials laydown area will be identified in cooperation with the project stakeholders near the construction area prior to mobilization. This area will stage equipment, materials and supplies, fuel, etc. during the construction activities. As much as practical, staging will occur within the site boundaries.

Secondary containment will be constructed or installed for all stationary diesel equipment, chemicals, and fuel storage containers. Spill kits will be available at each secondary containment location.

4.2.5 Water Quality Control Best Management Practices

The primary water quality controls during installation activities may include secondary containment, turbidity curtains around the installation working area. During installation and demobilization activities, turbidity of the Lake water will be monitored, and activities may be halted to mitigate suspended sediments in the water. During grading of the landside site and installation of equipment, silt-fence or similar erosion control devices may be used to mitigate potential runoff to the lake.

4.3 Security

Site areas will be protected both during construction and during system operation.

4.3.1 Temporary Controls During Construction

Security and public access controls will be implemented to protect the public and deter vandalism. If needed during construction, a temporary construction fence, high visibility fence, concrete barriers, and other controls will be installed as needed laydown/staging areas and the Site to delineate the work area from other areas of the property. Additionally, signs will be used to demarcate areas with restricted access. Signs will be posted for public safety at land and water side access points. Lighting and security cameras as well as uniformed security personnel can be used as an added means of security, if needed.

4.3.2 Site Fencing and Additional Features

The entire 7,500 sq ft site will be fenced by 430 linear ft of 12-ft high wooden fencing. The fence posts will be no more than 6 ft apart, and the enclosure will include a total of four gates. Three of the gates will be in line with the concrete pads installed on the east side of the site, and each gated opening will be 12 ft wide. There will be one 6-ft wide gate located on the west side of the site to serve as a primary entrance.

An education kiosk with a pergola will be installed near the east side entrance to present educational materials including project specific goals and lake management practices.

4.4 Traffic Control and Off-Site Slurry Transportation

There are two types of traffic associated with the project. On-site construction traffic includes construction equipment, and personnel vehicles. Signage and fencing will be installed to direct pedestrians and the public away from the work area and facilitate the flow of construction traffic. Flaggers and spotters may be required to direct traffic on-site and manage traffic at the construction entrance as needed.

Off-site traffic will be limited to personnel traffic, off-site transportation trucks used for equipment and supply delivery, and mobilization/demobilization operations. During daily operations, the contractor will use Village of Southampton approved traffic routes to and from the Site.

A traffic plan will be prepared in coordination with the Village prior to mobilization.

5.0 Stakeholder Coordination, Work Restrictions, and Permitting Requirements

AECOM and its subcontractors will work within the restrictions imposed by the contract, the Village, permits, and other regulatory requirements. This section includes some, but not all, of these restrictions and requirements.

5.1 Stakeholder Coordination

All site work will be coordinated closely with the Village. AECOM will work with the Village to mitigate traffic during construction, to minimize noise from construction, and to minimize disruptions to public use of the areas of Doscher Park not used by the project.

5.2 Work Hours

Work hours are to be established with the Village in accordance with local requirements. Typical work hours for construction will be 7:00 am through 6:00 pm, Monday through Friday.

5.3 Environmental Restrictions and Permitting

AECOM and its subcontractors will operate under applicable laws, rules, and regulations during construction and system operation. Permits identified and obtained for construction and operation shall be enforced and abided by until closed.

The following permits or approvals have been identified as potentially needed for this project:

1) NYSDEC Article 24 Freshwater Wetland Permit (Application ID# 1-4736-08860/00009, in review)
2) NY State Pollutant Discharge Elimination System (SPDES) permit (Application ID# 1-4736-08860/00009, in review)
3) USEPA Pesticidal Device Determination (Application submitted, in review)
4) U.S. Army Corps of Engineers Nationwide Permit #18 (Permit Number NAN-2024-00340-EMI, issued October 28, 2024)
5) NY Department of State Coastal Zone Consistency Determination
6) National Environmental Policy Act required Environmental Information Document (EID) (EID submitted, September 2024, EA prepared with Preliminary Finding of No Significant Impact (FONSI) by EPA, October 7, 2024; public notice to be advertised November 2024)
7) Town of Southampton Board of Trustees General Permit
8) Village of Southampton Road Excavation or Repair Permit
9) Village of Southampton Building Permit

6.0 Construction Sequence

A list of major work activities is presented below in general chronological order; some activities may be performed simultaneously:

- Perform pre-mobilization activities, prepare submittals, and secure permits and approvals
- Perform existing conditions inspection and site topographic survey
- Install temporary construction fencing, signage, and erosion control measures, as needed
- Prepare laydown yard as needed
- Perform subsurface utility locate in project
- Establish temporary facilities, field offices, and power.
- Mobilize upland equipment, material, supplies, and personnel
- Grade site as needed to control drainage
- Install permeable pavers and concrete pads
- Perform directional drilling and install electrical lines, system intake and discharge piping
- Complete electrical system construction and panels
- Install algae harvesters and associated onsite equipment and piping, temporary site buildings, and perimeter fencing
- Mobilize in-water equipment, material, supplies, and personnel
- Install turbidity curtain(s), oil boom(s), light markers, and signage
- Install intake pump structures and pumps
- Install in-water discharge piping and anchors
- Complete electrical hook-ups
- Inspect and test in-water equipment
- Remove turbidity curtain(s), oil boom(s), light markers, and signage
- Remove temporary construction fencing and signage from the laydown yard and restore area to previous conditions
- Perform final site inspection and construction closeout checklist
- Perform start-up and shakedown
- Maintain operation and required sampling and analysis and monitoring during treatment period

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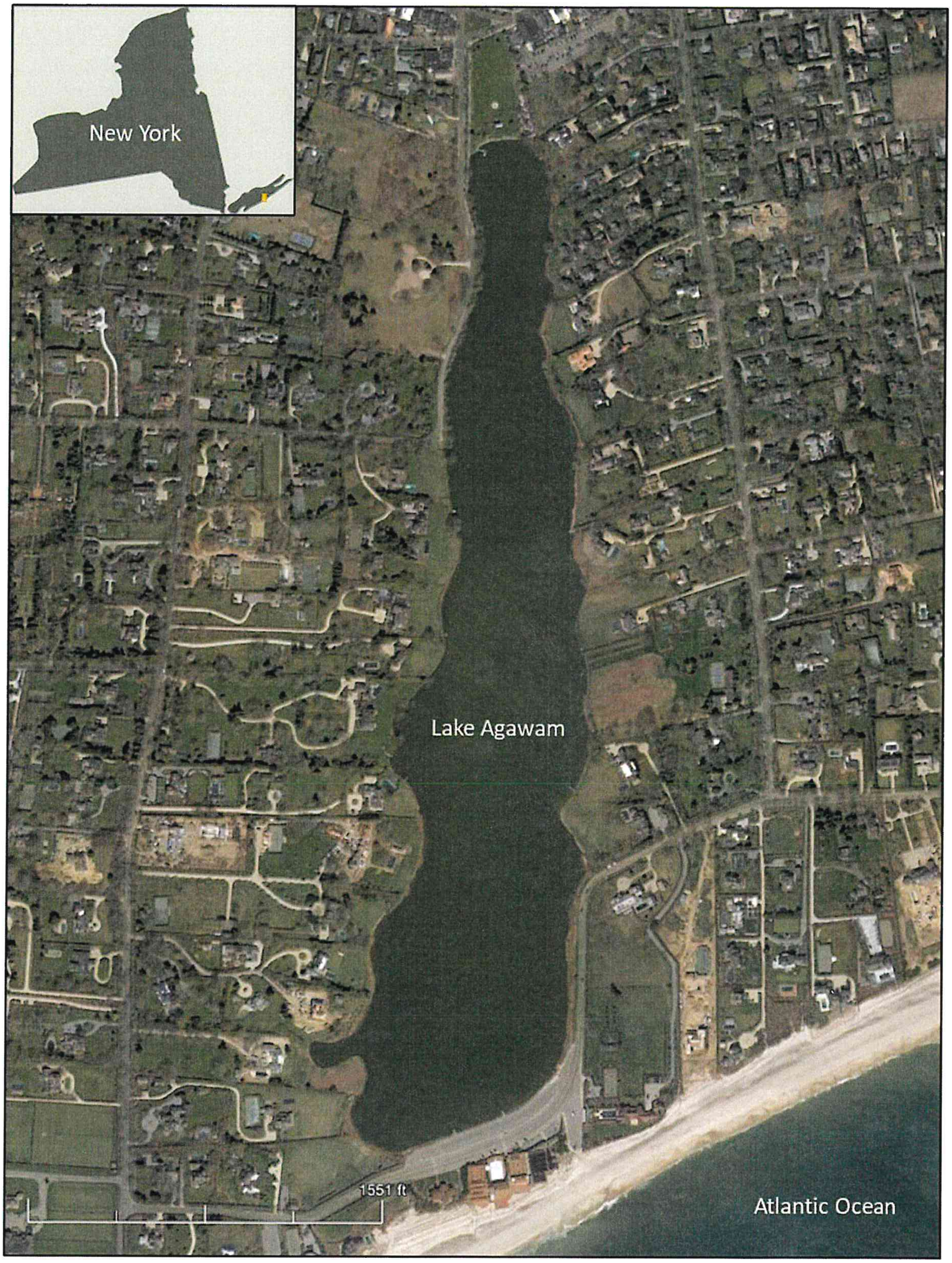
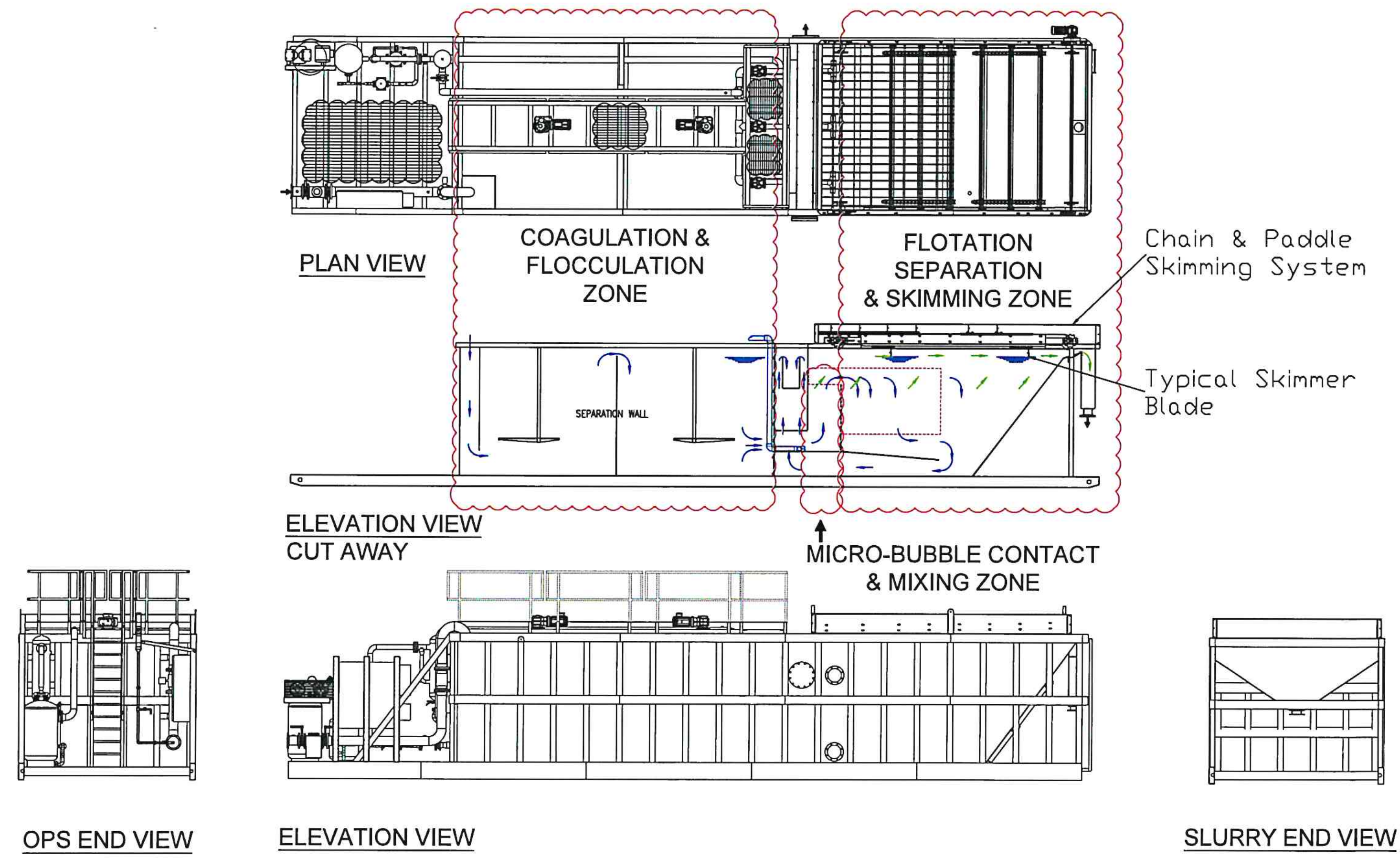
Appendix A

Figures

Figure 1 Lake Agawam Location Map





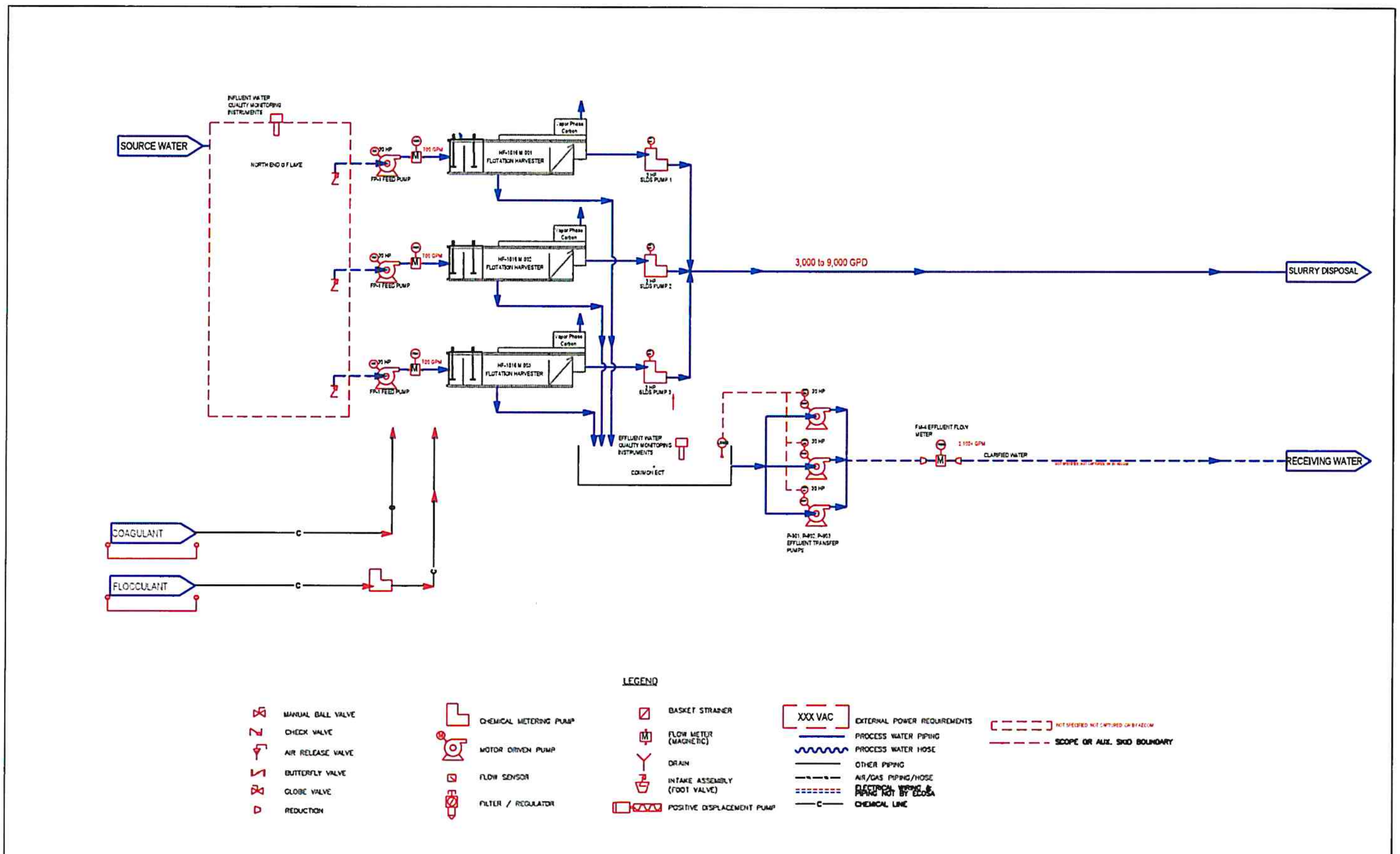
PROPRIETARY and CONFIDENTIAL

ECOSA PROCESS TECHNOLOGIES
ASHEVILLE, NC USA

WASTEWATER TREATMENT
PRODUCT RECOVERY
WATER RECOVERY
WATER REUSE
NUTRIENT & CARBON CAPTURE

Figure 2
HFS 1016 Hydronucleation Flotation System Plan & Elevation Views
Showing Process Zones

REV	BY	DESCRIPTION	DATE			
REV	BY	DESCRIPTION	DATE		DATE: 7-30-24	0100-HFS-1016(S)
REV	BY	DESCRIPTION	DATE		DATE:	0
REV	BY	DESCRIPTION	DATE		DATE:	1016(s) Zones
REV	BY	DESCRIPTION	DATE		DATE:	
REV	BY	DESCRIPTION	DATE		DATE:	



PROPRIETARY and CONFIDENTIAL

AECOM

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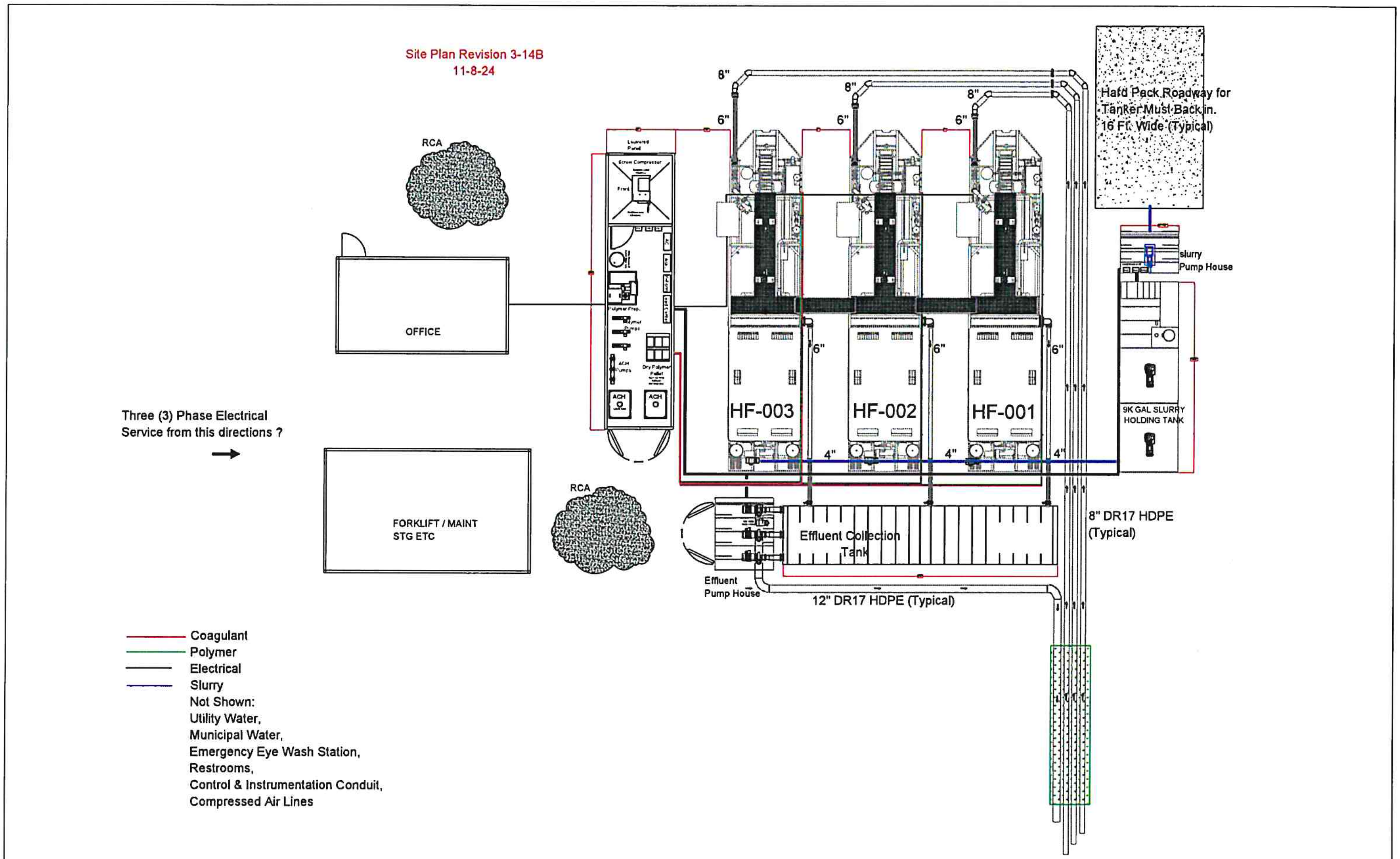
Figure 3
HF-1016 M Hydronucleation Flotation Technology (HFT)
Process Flow Diagram

B-101 PFD

NTS

1



PROPRIETARY and CONFIDENTIAL	ECOSA PROCESS TECHNOLOGIES ASHEVILLE, NC USA	WASTEWATER TREATMENT PRODUCT RECOVERY WATER RECOVERY WATER REUSE	Figure 4 Lake Agawam Preliminary Site Plan	NTS D-112 3-14B Site Plan

REV	BY	DESCRIPTION	DATE
14B	DJP	Increase Harvester Spacing, Reorient Buildings	11-8-24
14	DJP	Rotate and Relocate Chem / Electrical Structure	11-7-24

FIGURE 5 PRELIMINARY SITE LAYOUT

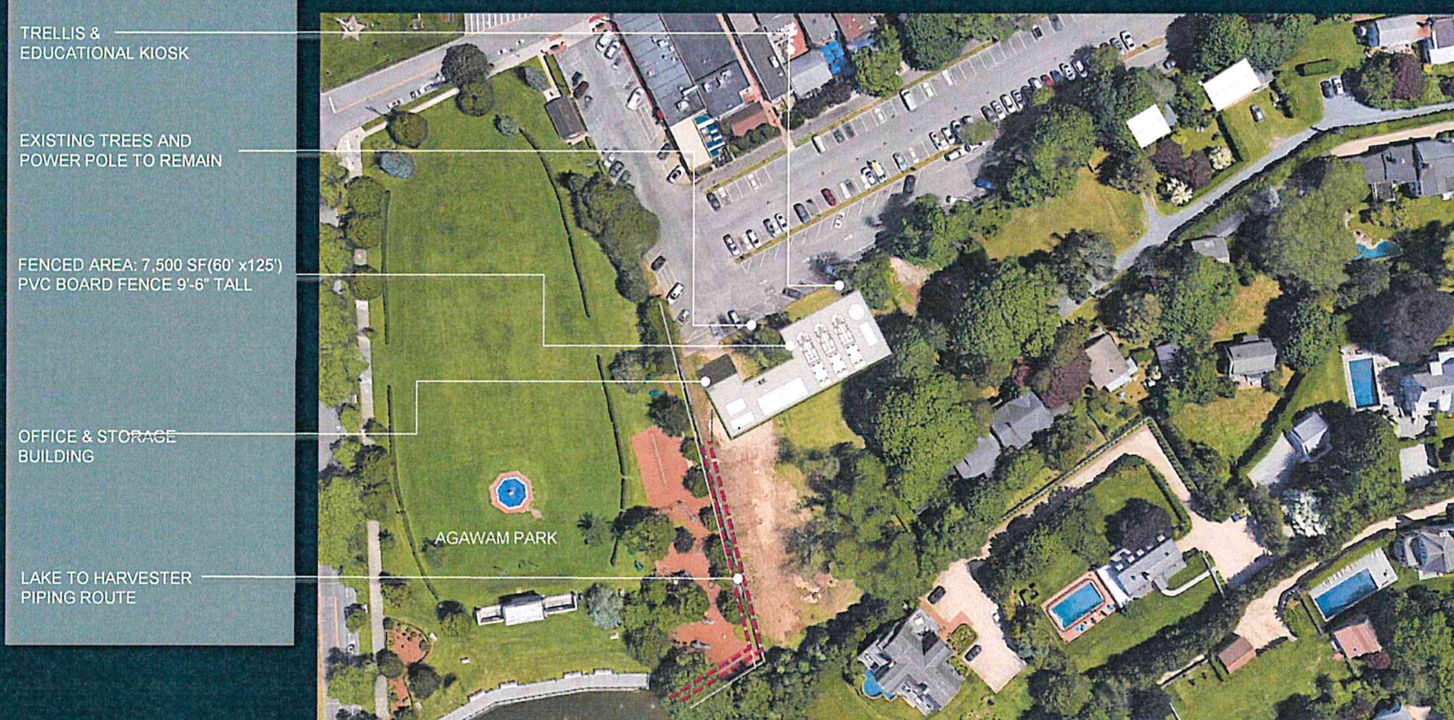
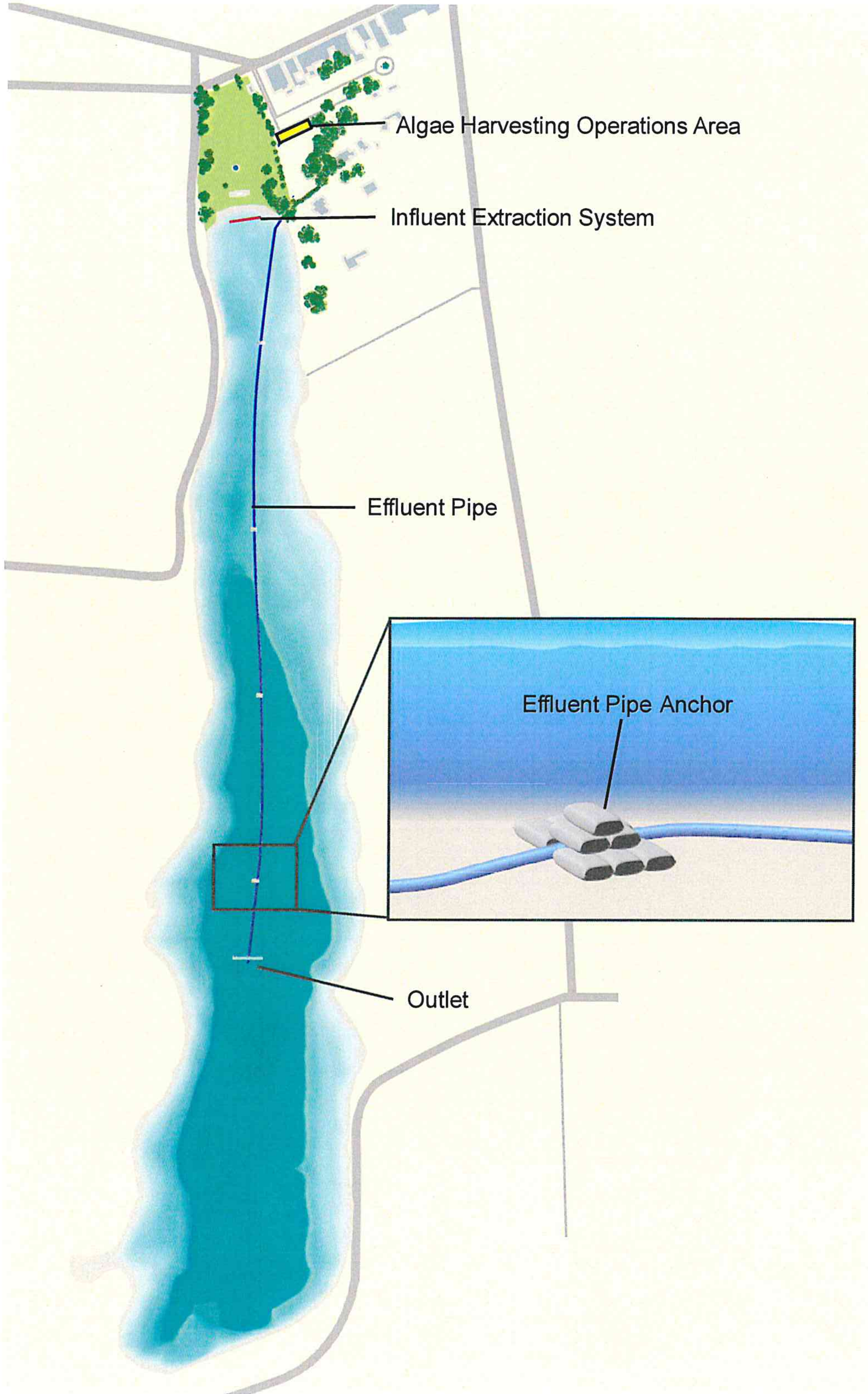


Figure 6 Preliminary Intake Extraction and Effluent Discharge Systems Layout – Plan View



Note: Layout and outlet structure (diffuser) are subject to change based on detailed design and permit requirements

Appendix B

Cost Estimate

Appendix C

Coagulant and Flocculant Safety Data Sheets

Appendix 4

SAFETY DATA SHEET

According to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication.

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name: **POLYSEP 1290**
POLYSEP 1290

Type of product: Mixture.

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Processing aid for industrial applications.

Uses advised against: None.

1.3. Details of the supplier of the safety data sheet

Company:
Polymer Separations, Inc.
P.O. Box 6449
Marietta, GA 30065

Telephone: 770-380-6450

Telefax:

E-mail address holtkj49@gmail.com

1.4. Emergency telephone numb770-380-6450
1.5.

24-hour emergency number:

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to paragraph (d) of 29 CFR 1910.1200:

Not classified.

2.2. Label elements

Labelling according to paragraph (f) of 29 CFR 1910.1200:

Hazard symbol(s): None.

Signal word: None.

Hazard statement(s): None.

Precautionary statement(s): None.

2.3. Other hazards

Aqueous solutions or powders that become wet render surfaces extremely slippery.

For explanation of abbreviations see Section 16.

SECTION 3: Composition/information on ingredients

3.1. Substances

Not applicable, this product is a mixture.

3.2. Mixtures

Adipic acid

Concentration/ -range: <= 2.5%

CAS Number: 124-04-9

Classification according to paragraph (d) of 29 CFR 1910.1200: Eye Irrit. 2A;H319

Sulfamic acid

Concentration/ -range: <= 2.5%

CAS Number: 5329-14-6

Classification according to paragraph (d) of 29 CFR 1910.1200: Skin Irrit. 2;H315, Eye Irrit. 2A;H319

For explanation of abbreviations see section 16

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation:
Move to fresh air. Get medical attention if symptoms occur.

Skin contact:
Wash off with soap and plenty of water. Get medical attention if irritation develops and persists.

Eye contact:
Rinse immediately with plenty of water, also under the eyelids. Get medical attention.

Ingestion:
Rinse mouth. If conscious, give the victim plenty of water to drink. Induce vomiting, but only if victim is fully conscious.

4.2. Most important symptoms and effects, both acute and delayed

Powder can cause localised skin irritation in folds of the skin or under tight clothing. Contact with dust can cause mechanical irritation or drying of the skin.

4.3. Indication of any immediate medical attention and special treatment needed

None.

Other information:
No information available.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media:
Water. Water spray. Foam. Carbon dioxide (CO_2). Dry powder.
Warning! Aqueous solutions or powders that become wet render surfaces extremely slippery.

Unsuitable extinguishing media:
None known.

5.2. Special hazards arising from the substance or mixture

Hazardous decomposition products:
Thermal decomposition may produce: hydrogen chloride gas, nitrogen oxides (NOx), carbon oxides (COx). Ammonia (NH_3). Hydrogen cyanide (hydrocyanic acid) may be produced in the event of combustion in an oxygen deficient atmosphere.

5.3. Advice for firefighters

Protective measures:
Wear self contained breathing apparatus for fire fighting if necessary.

Other information:
Aqueous solutions or powders that become wet render surfaces extremely slippery.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions:
Avoid contact with skin and eyes. Avoid dust formation. Avoid breathing dust. Aqueous solutions or powders that become wet render surfaces extremely slippery.

Protective equipment:
Wear adequate personal protective equipment (see Section 8 Exposure Controls/Personal Protection).

Emergency procedures:
Keep people away from spill/leak. Prevent further leakage or spillage if safe to do so.

6.2. Environmental precautions

As with all chemical products, do not flush into surface water.

6.3. Methods and material for containment and cleaning up

Small spills:
Do not flush with water.Clean up promptly by sweeping or vacuum.

Large spills:
Do not flush with water.Prevent unauthorized access. Sweep up and shovel into suitable containers for disposal.

Residues:
Sweep up to prevent slip hazard. After cleaning, flush away traces with water.

6.4. Reference to other sections

SECTION 7: Handling and storage; SECTION 8: Exposure controls/personal protection; SECTION 13: Disposal considerations;

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Avoid contact with skin and eyes. Avoid dust formation. Avoid breathing dust. Wash hands before breaks and at the end of workday.

7.2. Conditions for safe storage, including any incompatibilities

Keep in a dry place.
Incompatible with oxidizing agents.

7.3. Specific end use(s)

This information is not available.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits:

Adipic acid
ACGIH: 5 mg/m³ (8 hours)

8.2. Exposure controls

Appropriate engineering controls:

Use local exhaust if dusting occurs. Natural ventilation is adequate in absence of dusts.

Individual protection measures, such as personal protective equipment:

a) Eye/face protection:
Safety glasses with side-shields. Do not wear contact lenses where this product is used. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166 (EU).

b) Skin protection:
i) Hand protection: PVC or other plastic material gloves. The selected protective gloves have to satisfy the specifications of EU Directive 89/689/EEC and the standard EN 374 derived from it.
ii) Other: Chemical resistant apron or protective suit if splashing or repeated contact with solution is likely. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

c) Respiratory protection:
Dust safety masks recommended where working powder concentration is more than 10 mg/m³. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

d) Additional advice:
Wash hands before breaks and at the end of workday. Wash hands before breaks and immediately after handling the product. Handle in accordance with good industrial hygiene and safety practice.

Environmental exposure controls:

Do not allow uncontrolled discharge of product into the environment.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

a) Appearance:	Granular solid, White.
b) Odour:	None.
c) Odour Threshold:	Not applicable.
d) pH:	2.5 - 4.5 @ 5 g/L (See Technical Bulletin or Product Specifications for a more precise value, if available)
e) Melting point/freezing point:	> 100°C
f) Initial boiling point and boiling range:	Not applicable.
g) Flash point:	Not applicable.

h) Evaporation rate:	Not applicable.
i) Flammability (solid, gas):	Not combustible.
j) Upper/lower flammability or explosive limits:	Not expected to create explosive atmospheres.
k) Vapour pressure:	Not applicable.
l) Vapour density:	Not applicable.
m) Relative density:	0.6 - 0.9 (See Technical Bulletin or Product Specifications for a more precise value, if available)
n) Solubility(ies):	Soluble in water.
o) Partition coefficient n-octanol/water (log value):	< 0
p) Autoignition temperature:	Not applicable.
q) Decomposition temperature:	> 200°C
r) Viscosity:	See Technical Bulletin.
s) Kinematic viscosity:	No data available.
t) Explosive properties:	Not expected to be explosive based on the chemical structure.
u) Oxidizing properties:	Not expected to be oxidising based on the chemical structure.
v) Particle characteristics:	No data available.

9.2. Other information

None.

SECTION 10: Stability and reactivity

10.1. Reactivity

Hazardous polymerisation does not occur.

10.2. Chemical stability

Stable.

10.3. Possibility of hazardous reactions

Oxidizing agents may cause exothermic reactions.

10.4. Conditions to avoid

None known.

10.5. Incompatible materials

Oxidizing agents.

10.6. Hazardous decomposition products

Thermal decomposition may produce: hydrogen chloride gas, nitrogen oxides (NOx), carbon oxides (COx). Ammonia (NH3). Hydrogen cyanide (hydrocyanic acid) may be produced in the event of combustion in an oxygen deficient atmosphere.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Information on the product as supplied:

Acute oral toxicity:	LD50/oral/rat > 5000 mg/kg
Acute dermal toxicity:	LD50/dermal/rat > 5000 mg/kg.
Acute inhalation toxicity:	The product is not expected to be toxic by inhalation.
Skin corrosion/irritation:	Not irritating.
Serious eye damage/eye irritation:	Testing conducted according to the Draize technique showed the material produces no corneal or iridial effects and only slight transitory conjuctival effects similar to those which all granular materials have on conjuctivae.
Respiratory/skin sensitisation:	The results of testing on guinea pigs showed this material to be non-sensitizing.
Mutagenicity:	Not mutagenic.
Carcinogenicity:	Not carcinogenic.
Reproductive toxicity:	Not toxic for reproduction.
STOT - Single exposure:	No known effects.
STOT - Repeated exposure:	No known effect.
Aspiration hazard:	No hazards resulting from the material as supplied.

Relevant information on the hazardous components:

Adipic acid

Acute oral toxicity:	LD50/oral/rat = 5560 mg/kg (OECD 401)
Acute dermal toxicity:	LD0/dermal/rabbit >= 3176 mg/kg
Acute inhalation toxicity:	LC0/inhalation/4 hours/rat > 7.7 mg/L (OECD 403)
Skin corrosion/irritation:	Slightly irritating.

Serious eye damage/eye irritation:	Not irritating. (OECD 405) (SNF)
Respiratory/skin sensitisation:	Not sensitizing.
Mutagenicity:	Negative in the Ames Test (OECD 471). Negative in the In vitro Mammalian Cell Gene Mutation Test (OECD 476).
Carcinogenicity:	Based on available data, product is not expected to be carcinogenic. Carcinogenicity study in rat: NOAEL > 750 mg/kg/day
Reproductive toxicity:	Based on available data, product is not expected to be toxic for reproduction. NOAEL/Maternal toxicity/rat >= 288 mg/kg/day NOAEL/Developmental toxicity/rat >= 288 mg/kg/day
STOT - Single exposure:	No known effects.
STOT - Repeated exposure:	No known effect.
Aspiration hazard:	No known effects.

Sulfamic acid

Acute oral toxicity:	LD50/oral/rat = 2065 - 2140 mg/kg
Acute dermal toxicity:	NOAEL/dermal/rat = 2000 mg/kg (OECD 402)
Acute inhalation toxicity:	The product is not expected to be toxic by inhalation.
Skin corrosion/irritation:	Not irritating. (OECD 404) (SNF)
Serious eye damage/eye irritation:	Moderately irritating to the eyes. (EPA OPPTS 870.2400)
Respiratory/skin sensitisation:	The product is not expected to be sensitizing.
Mutagenicity:	Negative in the Ames Test (OECD 471). Negative in the In vitro Mammalian Cell Gene Mutation Test (OECD 476). Not mutagenic. (OECD 472, 487)
Carcinogenicity:	Based on the absence of mutagenicity, it is unlikely that the substance is carcinogenic.
Reproductive toxicity:	Based on available data, product is not expected to be toxic for reproduction. Prenatal Development Toxicity Study (OECD 414) - NOAEL/Maternal toxicity/rat = 200 mg/kg/day - NOAEL/Developmental toxicity/rat = 200 mg/kg/day

STOT - Single exposure:	No known effects.
STOT - Repeated exposure:	No known effect.
Aspiration hazard:	No known effects.

SECTION 12: Ecological information

12.1. Toxicity

Information on the product as supplied:

Acute toxicity to fish:	LC50/Danio rerio/96 hours = 5 - 10 mg/L (OECD 203)
Acute toxicity to invertebrates:	EC50/Daphnia magna/48 hours = 20 - 50 mg/L (OECD 202)
Acute toxicity to algae:	Algal inhibition tests are not appropriate. The flocculation characteristics of the product interfere directly in the test medium preventing homogenous distribution which invalidates the test.
Chronic toxicity to fish:	No data available.
Chronic toxicity to invertebrates:	No data available.
Toxicity to microorganisms:	No data available.
Effects on terrestrial organisms:	No data available. Readily biodegradable, exposure to soil is unlikely.
Sediment toxicity:	No data available. Readily biodegradable, exposure to sediment is unlikely.

Relevant information on the hazardous components:

Adipic acid

Acute toxicity to fish:	LC0/Danio rerio/96 hours >= 1000 mg/L
Acute toxicity to invertebrates:	EC50/Daphnia magna/48 hours = 46 mg/L (OECD 202)
Acute toxicity to algae:	IC50/Selenastrum capricornutum/72 hours = 59 mg/L (OECD 201)
Chronic toxicity to fish:	No data available.
Chronic toxicity to invertebrates:	NOEC/Daphnia magna/21 days = 6.3 mg/L (OECD 211)
Toxicity to microorganisms:	EC50/activated sludge/3 hours = 4747 mg/L (OECD 209)

Effects on terrestrial organisms:	No data available.
Sediment toxicity:	No data available.

Sulfamic acid

Acute toxicity to fish:	LC50/Pimephales promelas/96 hours = 70.3 mg/L (OECD 203)
Acute toxicity to invertebrates:	EC50/Daphnia magna/48 hours = 71.6 mg/L (OECD 202)
Acute toxicity to algae:	IC50/Scenedesmus subspicatus/72 hours = 48 mg/L (OECD 201)
Chronic toxicity to fish:	NOEC/Danio rerio/34 days >= 60 mg/L (OECD 210)
Chronic toxicity to invertebrates:	NOEC/Daphnia magna/21 days = 19 mg/L (OECD 211)
Toxicity to microorganisms:	EC50/activated sludge/3 hours > 200 mg/L (OECD 209)
Effects on terrestrial organisms:	No data available.
Sediment toxicity:	No data available.

12.2. Persistence and degradability

Information on the product as supplied:

Degradation:	Based on the degradability data of the components, this product is expected to be readily (bio)degradable according to OECD criteria.
Hydrolysis:	At natural pHs (>6) the polymer degrades due to hydrolysis to more than 70% in 28 days. The hydrolysis products are not harmful to aquatic organisms.
Photolysis:	No data available.

Relevant information on the hazardous components:

Adipic acid

Degradation:	Readily biodegradable. > 70% / 28 days (OECD 301 D)
Hydrolysis:	Does not hydrolyse.
Photolysis:	Half-life (indirect photolysis): = 2.9 days

Sulfamic acid

Degradation: Not relevant (inorganic).

Hydrolysis: Does not hydrolyse.

Photolysis: No data available.

12.3. Bioaccumulative potential

Information on the product as supplied:

The product is not expected to bioaccumulate.

Partition co-efficient (Log Pow): < 0

Bioconcentration factor (BCF): ~0

Relevant information on the hazardous components:

Adipic acid

Partition co-efficient (Log Pow): 0.093 @ 25°C, pH 3.3

Bioconcentration factor (BCF): ~ 0

Sulfamic acid

Partition co-efficient (Log Pow): -4.34 @ 20°C

Bioconcentration factor (BCF): ~ 0

12.4. Mobility in soil

Information on the product as supplied:

No data available.

Relevant information on the hazardous components:

Adipic acid

Koc: No data available.

Sulfamic acid

Koc: No data available.

12.5. Other adverse effects

None known.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste from residues/unused products:

Dispose in accordance with local and national regulations. Can be landfilled or incinerated, when in compliance with local regulations.

Contaminated packaging:

Rinse empty containers with water and use the rinse-water to prepare the working solution. If recycling is not practicable, dispose of in compliance with local regulations. Can be landfilled or incinerated, when in compliance with local regulations.

Recycling:

In accordance with local and national regulations.

SECTION 14: Transport information

Land transport (DOT)

Not classified.

Sea transport (IMDG)

Not classified.

Air transport (IATA)

Not classified.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Information on the product as supplied:

TSCA Chemical Substances Inventory:

All components of this product are either listed as active on the inventory or are exempt from listing.

US SARA Reporting Requirements:

SARA (Section 311/312) hazard class:
Not concerned.

<u>SARA Title III Sections:</u>

Section 302 (TPQ) - Reportable Quantity:
Not concerned.

Section 304 - Reportable Quantity:
Not concerned.

Section 313 (De minimis concentration):
Not concerned.

<u>Clean Water Act</u>

Section 311 Hazardous Substances (40 CFR 117.3) - Reportable Quantity:
Contains one or more of the listed substances.

<u>Clean Air Act</u>

Section 112(r) Accidental release prevention requirements (40 CFR 68) - Reportable Quantity:
Not concerned.

<u>CERCLA</u>

Hazardous Substances List (40 CFR 302.4) - Reportable Quantity:
Contains one or more of the listed substances.

<u>RCRA status :</u>

Not RCRA hazardous.

<u>California Proposition 65 Information:</u>

WARNING! This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm, Acrylamide

<u>Relevant information on the hazardous components:</u>

<u>Adipic acid</u>

Clean Water Act *Section 311 Hazardous Substances (40 CFR 117.3) - Reportable Quantity:*	5000 lbs
CERCLA *Hazardous Substances List (40 CFR 302.4) - Reportable Quantity:*	5000 lbs

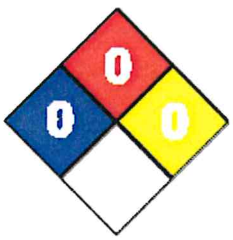
DOT RQ (lbs): 5000 lbs

SECTION 16: Other information

NFPA and HMIS Ratings:

NFPA:

Health:	0
Flammability:	0
Instability:	0



HMIS:

Health:	0
Flammability:	0
Physical Hazard:	0
PPE Code:	B

This data sheet contains changes from the previous version in section(s):

SECTION 3. Composition/information on ingredients, SECTION 5. Fire-fighting measures, SECTION 8. Exposure controls/personal protection, SECTION 16. Other Information.

Key or legend to abbreviations and acronyms used in the safety data sheet:

Acronyms
STOT = Specific target organ toxicity

Abbreviations
Eye Irrit. 2A = Serious eye damage/eye irritation Category Code 2A
Skin Irrit. 2 = Skin corrosion/irritation Category Code 2

Hazard statements
H315 - Causes skin irritation
H319 - Causes serious eye irritation

Training advice:

Do not handle until all safety precautions have been read and understood.

This SDS was prepared in accordance with the following:

U.S. Code of Federal Regulations 29 CFR 1910.1200

Version: 20.01.a

PRCC003

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.