

May 15, 2023

**RE: Example A-Pod Evaluation for Phytoplankton-Cyanobacteria Harvesting and Removal
HEA Proposal No. 0122X**

XXXX

XX:

This Proposal from Higgins Environmental Associates, Inc. (HEA) pertains to completion of supporting evaluations of XXX water body(s) for optimization and use of a harvesting technology (the A-Pod technology) to actively and/or passively target, harvest and permanently remove excess phytoplankton-cyanobacteria and their nutrients and cyanotoxins from XXX. HEA understands from reviewing recent water quality assessment information for XXXX that

Given our initial review of existing information for XXX, use of the A-Pod(s) for harvesting and removal of phytoplankton-cyanobacteria can be timed to occur when cyanobacteria are the dominant phytoplankton species and when herring fry have matured and increased in size - thus minimizing the potential to impact more beneficial forms of phytoplankton, as forage for herring fry, the herring themselves or to other beneficial native aquatic species such as mussels. The A-Pod(s) can also be used to target and remove excessive/nuisance amounts of non-cyanobacteria forms of phytoplankton and their excess nutrients from XXX. When the A-Pods are setup and ready, they are easy to deploy and retrieve as needed as XXX conditions change and to adhere to any regulatory concerns or limits on use.

Removal of excessive amounts of phytoplankton-cyanobacteria and their nutrients is a sustainable, timely and ecologically-sensitive way to improve the health and water clarity of water bodies and to limit risks to water body users, pets and wildlife posed by cyanotoxins.

For the duration of this proposal, HEA will refer to phytoplankton-cyanobacteria as “cyanobacteria” as cyanobacteria also commonly contain cyanotoxins which are also regulated to limit health risks.

Intent of Service: To gather and assess XXX seasonally-variable cyanobacteria biomass, biovolume, nutrient concentrations, the patterns and strengths of naturally-occurring water currents, to optimize construction of the A-Pod(s) for harvesting (actively or passively), and to document biodegradation of cyanobacteria and cyanotoxins removed using the A-Pods. Additionally, HEA would collect sediment samples, as both one vertical profile gravity-core sample from the deepest basin and as top 2-inch soft sediment samples to evaluate historical and ongoing changes in nutrient concentrations prior to, during and following use of the A-Pod(s) to remove cyanobacteria and excess nutrients from XXX.

Timeline for Services: Pending approval to proceed, May to October 2023. Use of an A-Pod to demonstrate harvestability of cyanobacteria and to evaluate biodegradation of cyanobacteria and cyanotoxins removed from XXX would not take place until applicable permits and approvals from Federal, State and local agencies have been obtained including possible field coordination with or conditions by these agencies, if requested or required. Other Services are assessment related (water quality surveys, sediment sampling, hydrologic surveys) and could begin upon approval of our Proposal by XXX. A minimum of two full seasons of cyanobacteria harvesting and removal using the A-Pods are ultimately recommended. Related costs and services beyond 2023 would be estimated by HEA and provided in a Proposal Addendum to XXX based on findings and performance evaluations from 2023.

One full season of optimized A-Pod harvesting and removal of cyanobacteria should have a notable reduction in cyanobacteria biomass, biovolume and nutrient content. A second and subsequent year would allow cyanobacteria that have accessed and accumulated additionally available nutrients from the sediment over the winter to be harvested and removed.

SCOPE OF SERVICES:

The following sections detail services and costs by task for this Proposal for one calendar year (2023). If requested, we would prepare a Proposal Addendum for XXXX's prior authorization for additional services or time frames not detailed in the following tasks.

TASK 1 - Supporting Assessments and Performance Evaluations

Record Review and Interviews: HEA would review available environmental documentation for XXX and surrounding watershed and water bodies as it may pertain to water quality and knowledge of XXX. HEA would be available to meet, interview or discuss conditions at XXX with XXXX, yourself and others.

Bathymetry and Cyanobacteria Biomass and Biovolume Surveys: HEA would complete initial and ongoing (minimum of monthly) field surveys of XXX to supplement available information including for XXX bathymetry, physical assessment of sediment quality, and water quality. HEA would utilize a multi-frequency, dual channel sonar and chart plotter surveys to characterize and map water body bathymetry, bottom-habitats and water body volume. HEA would also complete monthly water body surveys using a multiparameter sonde fitted with a global positioning system (gps) and various water quality probes (pH, temperature, turbidity, and others including chlorophyll-a (CHLa) and phycocyanin (PC)) to evaluate water quality conditions and with CHLa and PC measurements to estimate the biomass and biovolume of cyanobacteria seasonal variations in XXX. Water clarity (secchi) depth measurements will be completed at the deep hole during each monthly sonde survey. The sonde also records turbidity as another measure of water clarity.

Sediment and Cyanobacteria solid Sampling and Laboratory Analysis: An in-place soft sediment gravity core sample will be collected early in the 2023 season from XXX deep hole or shallow littoral areas, as appropriate, retrieved and sampled (top 2-inches, mid-point and base) for nutrient analysis (carbon, iron, nitrogen, phosphorus and sulfur). A second, top 2-inches sample of soft sediment would be collected from the same or location at the end of the season (approximately October to November 2023).

Cyanobacteria solid samples removed during use of the A-Pod will be sampled for nutrients (same as sediment), cyanobacteria type and cyanotoxin content.

If requested or desired, HEA can collect surface water samples for laboratory analysis for these same nutrients, PC and cyanotoxins. HEA can prepare a proposal addendum for this additional service and related costs.

Characterization of Water Flow Regime: HEA would utilize hydrologic drogues to evaluate surface water current strengths and patterns at varying depths in XXX. Correlating water flows with cyanobacteria biomass patterns assists with optimizing targeted removal of cyanobacteria using the A-Pod technology. This Proposal for Services assumes that sufficient naturally-occurring water currents are present to use the A-Pods in passive mode. Given the size and configuration of XXX it would be surprising if sufficient natural water currents were not present. However, HEA could complete our 2023 season using an A-Pod in active mode (extension and retraction of collection members to force

cyanobacteria into the A-Pod trap area). If insufficient natural water currents were present, HEA would confer with you and XXXX before deploying and completing A-Pod removal performance evaluations (passive or active modes).

Deployment of one Temporary (Stock-version) A-Pod: Based on previous Task 1 activity findings, after obtaining approval for use from XXXX and other applicable Federal, State or local agencies, HEA would deploy a stock-version of an A-Pod to start the harvesting, performance evaluation process and to obtain cyanobacteria solid samples for composting/biodegradation assessments. This information would in turn be used under **Task 3** to design an optimized configuration of one or more larger A-Pod(s) to harvest cyanobacteria over time from XXX. Optimization is intended to target and maximize concentration and recovery (trap and removal) of cyanobacteria in XXX.

HEA would confer with you and XXXX on proposed locations of the temporary A-Pod for approval prior to deployment and use.

Note, given the need for supporting assessments, review and approvals and consideration of sensitive biologic species (alewife spawning habitat), deployment of a temporary, stock-version A-Pod may not take place until later in the fall of 2023.

Task 1 is designed to provide an in-depth understanding of the biologic, chemical and physical nature and features of XXX in Year 2023 with particular emphasis on the occurrence, type(s) and movement of pelagic (water-suspended) cyanobacteria. Performance evaluations include sediment and cyanobacteria solids sampling and laboratory analysis over time correlated to monthly field sonde water quality and clarity measurements for pH, PC, CHLa, turbidity, etc. Permanently removed cyanobacteria collected with the temporary A-Pod would be dried out, weighed and composted in controlled manner with confirmatory laboratory testing to document biodegradation of cyanotoxins.

Estimated Year 2023 Costs for Task 1 \$ 20,000

TASK 2 - Federal, State and Local Approvals, Coordination and Permitting

The A-Pod was designed to be ecologically-sensitive and used in coordination with local municipalities having jurisdiction over each particular water body work area and in consultation or coordination with other Federal and State agencies or programs as may be applicable or appropriate given each water bodies' and related biota regulatory status or environmental sensitivity. Each water body is different and the following sections are meant as a guide for XXXX and others to consider for use of A-Pod(s) at XXX.

Wetlands Protection Act (310 CMR 10.00): Based on HEA's understanding, discussions and meetings with other municipalities, use of the A-Pod and components to target and remove cyanobacteria suspended in water is not a jurisdictional activity under the Wetlands Protection Act and similar local implementing ordinances. However, each municipality differs in their application and permitting process so HEA remains available to assist with applicable approvals, meetings and permitting that may be required or recommended.

Threatened or Endangered Species Protection (Guidance and 321 CMR 10.00): The Massachusetts Natural Heritage and Endangered Species Program (NHESP) and publicly-available records should be consulted to determine whether any listed Threatened or Endangered Species (including species of Special Concern) may be present that could be impacted by use of the A-Pods. This may require coordination with NHESP and others that may affect the scope or timing of work using the A-Pods and

require approval by XXXX of a Proposal Addendum for any additional time and material costs.

The floating A-Pod and components are specifically designed to not “take” non-targeted biota or damage their habitats other than removal of targeted cyanobacteria. The A-Pod and components do not alter benthic habitat or “take” animal species such as dragon fly nymphs, fisheries, molluscs or vascular plants. HEA understands that XXX is a sensitive fishery habitat. The A-Pod is a live trap and does not even kill or “take” the targeted cyanobacteria, unless some direct and intentional action is taken by people after inspecting the A-Pod’s Trap contents. HEA also has an A-Pod component called a Zoop Farm that can assist with limiting harm to bycatch of non-target zooplankton prior to cyanobacteria removal activities from the A-Pod Trap.

Chapter 91 Waterways Permit (310 CMR 9.00):

The A-Pod and components are temporary, floating structures that would likely be secured by anchors and wood staking (if in shallow water). They would not be constructed or placed to restrict open access or use of water ways by others. XXX is listed as a Massachusetts Great Pond and as such use of the A-Pod and components requires either a Chapter 91 Permit (likely a Limited Project Permit) or specific approval for use by a jurisdictional municipal official, including a Harbormaster or similar. Chapter 91 has allowance and procedures for officials (towns usually) with control and oversight of structures or activities in water ways completely contained in said Town or City, to approve or permit temporary structures like the A-Pod and components. We have spoken with MassDEP Water Ways Program about the A-Pod, it’s basic construction and use (which can vary depending upon water body and cyanobacteria characteristics). They consider it as needing a permit but also recognize that this can be done (permitted for use) by appropriate local officials as well.

At XXXX discretion, HEA can pursue either local approval for use of the A-Pod and related components or a Chapter 91 Permit from MassDEP, if desired. Please let us know but this later (MassDEP Ch.91 Permit) process for approval would take time and additional costs beyond that estimated in our Proposal. Additional costs to pursue a Chapter 91 permit would be detailed in a Proposal Addendum for prior authorization by XXXX.

Massachusetts Division of Marine Fisheries:

HEA understands that XXX is a spawning area for herring in particular. There may be other marine or sensitive fisheries that should be evaluated in consultation with Massachusetts’ Division of Marine Fisheries. Any of Marine Fisheries conditions or requirements for use of the A-Pods would need to be incorporated into the design and use of A-Pods at XXX.

Massachusetts Solid Waste Disposal and Management (regulations, guidance and policies):

In the 1990s, to conserve landfill space, Massachusetts banned many types of organic solid waste (grass clippings, leaves, etc.) from disposal at solid waste landfill facilities. Composting is now a vital part of Massachusetts’s waste reduction and recycling strategy and they have provided guidance for composting common organic wastes (grass clippings, leaf litter, food industry wastes, etc.). While there is no specific guidance for composting of cyanobacteria (and their toxins if present) they are biologically-produced organic matter that readily and rapidly biodegrade into beneficial endproducts, high carbon and nutrient-rich organic matter. HEA can provide a separate HEA document on the management of cyanobacteria including a discussion on composting/biodegradation.

Cyanobacteria are essentially like plants and readily biodegrade. Unlike plants though, cyanobacteria

are approximately 85% liquid (water and carbohydrates) and lack the fibrous plant matter (lignin) which does not readily decompose. As such, cyanobacteria biomass and volume rapidly decreases with drying and biodegradation and approaches 15% residual solids. Biodegradation of cyanotoxins, a biological substance, is also rapid, with documented reduction in cyanotoxin content of 90 percent within one week. HEA or others can manage the composting/biodegradation process in a controlled and secure manner, including confirmatory laboratory testing for cyanotoxins. These composted solids would be returned to XXXX and could be used as a soil amendment in non-agricultural areas such as landscaped areas along roadways. The volume and pounds of cyanoHABs that may be removed and composted over time can be estimated during **Task 1** but given our current knowledge and the area/volume of XXX it will likely exceed what one A-Pod could remove in one full year of use. Based on **Task 1's** findings, HEA may recommend as part of **Task 3** that XXXX consider the use of additional A-Pods over two or more cyanobacteria seasons. In any event, removal of the cyanobacteria and their excess nutrients and cyanotoxins is a sustainable way to improve water quality, water clarity and habitat at XXX.

Based on past discussions, MassDEP has offered to assist with other disposal options including at incineration facilities as they recognize cyanobacteria is a waste stream that acceptance facilities are not accustomed to.

HEA will continue to reach out and coordinate work with MassDEP for reuse and disposal options for cyanobacteria. HEA would seek a Waiver for disposal or incineration of “biomass” from MassDEP if composting is for any reason not accepted or suitable. MassDEP has previously relayed to us that this Waiver process would be timely and straightforward

Summary: To HEA’s knowledge, there are no other Federal, state or local permits or regulations applicable to the temporary use of A-Pods and components for removal of cyanobacteria, their toxins, carbon and excess nutrients from water bodies. There may be some regulations, policies or guidance that HEA is not aware of or that may be developed or modified over time, but being able to proactively and sustainably improve surface water quality, habitats and reduce health risks posed by cyanobacteria to people, pets, wildlife and the environment is an area of concern and interest faced by many communities and regulators and one that the A-Pod technology is well suited to address.

Based on our discussion with XXXX, **Task 2** estimated costs are for HEA’s assistance in meeting, coordination and obtaining a Notice of Intent or equivalent with conditions under the Wetlands Protection Act through XXXX. HEA recommends that Massachusetts Marine Fisheries be consulted and included as part of that process. HEA would prepare a Proposal Addendum to complete any additional work or permitting assistance beyond our estimated costs.

Estimated Costs for Task 2 - \$ 3,000

TASK 3 - Optimized A-Pod Configuration Design for XXXX

Using information gained from **Task 1** and **2**, HEA will design one or more A-Pod configurations for longer term use at XXX beginning next year (2024) - to allow for sufficient time in year 2023 to complete **Task 1** and **2**. The size, configuration and location(s) of the A-Pod(s) will be designed in consultation with XXXX and other **Task 2** approvals or conditions to optimize cyanobacteria targeting and removal while minimizing impact to non-target biota such as fish, sensitive shoreline vegetation, nesting bird areas, etc. HEA may recommend utilizing a smaller A-Pod in combination with one large A-Pod or have use of an active use A-Pod collection member available.

A-Pod design for longer term use are flexible depending upon water body conditions, uses and sensitive receptors. While not significant given materials of construction (mostly fabric), build-out costs for optimized design and configuration of A-Pod(s) for longer term deployment at XXX will be provided in a separate Proposal Addendum for review and approval by XXXX. This Proposal Addendum would also include an estimate of year 2024 assessment and A-Pod operation costs, including removal and composting of cyanobacteria as additional operational and performance information is gathered in 2023 as part of this Proposal for Services. HEA is amenable to modifying costs based on suitable assistance available from XXXX and others (assessment, composting, etc.).

All A-Pod components float on the water surface and can be anchored and/or staked in place to maintain their function and security during use. A placard or similar can be attached to each A-Pod to provide contact information, a URL for more information, and to thank XXX users for their interest in HEA's work products (A-Pod, C-Pod, Zoop Farm and any related equipment).

The Town of XXXX, Natural Resource Advisory Committee and XXXX Coalition and others with an organized presence relative to XXX - should inform residents and users at and around XXX prior to long term use and deployment of A-Pod(s) at XXX.

Note: The A-Pods and components are patented (U.S. Patent No. 10,745,879) work products constructed and used to serve a public benefit - water quality improvements and reduction of environmental impacts/health risks posed by cyanobacteria and their excess nutrients and cyanotoxins in water bodies.

Estimated Design Costs for Task 3 \$ 2,000

TASK 4 - Correspondence and Documentation of Findings

During the 2023 field season, HEA will provide brief emails summarizing ongoing Services to XXXX. From November to December 2023 (after the 2023 field season is complete), HEA will prepare a summary report documenting our assessment and performance evaluation findings, including recommended configuration design for long term use of the A-Pod(s) and related operational activities at XXX.

Estimated Year 2022 Costs for Task 4 \$ 5,000

TOTAL ESTIMATED COST FOR HEA PROPOSAL NO. 0122X = \$30,000

FEE SCHEDULE:

HEA's Services are limited to those activities, assessments and testing described in Tasks 1 through 4 of Proposal No. 0122X dated May 15, 2023. The scope of work described in this Proposal will be completed by HEA on a Fixed Price basis for a cost of **\$30,000** and in accordance with the HEA's attached May 15, 2023 Standard Terms and Conditions. This Fixed Price was developed based on HEA's current understanding of work and effort needed to complete Proposed Tasks described in this Proposal for XXXX. Proposal Addendums would be provided to XXXX approval for additional time and material cost estimates as noted in Tasks in this Proposal.

Any additional services beyond those specifically described in this Proposal, including additional Federal, State or local permitting effort or fees will be provided by HEA on a Time and Materials basis as incurred at the rates specified on the current HEA Fee Schedule.

Any time or costs associated with compliance with COVID-19 related protocols or orders will be

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invoiced as an additional service on a Time and Materials basis

HEA would need physical and unrestricted access (key or code to boat launch gate or equivalent) to XXX to complete our Proposed Services including if possible, access to a composting location on land (XXXX compost facility) or near XXX for handling, placement and use of rotary compost bins for biodegrading cyanoHABs in a controlled manner. Alternatively, HEA can transport small volumes of cyanobacteria back and forth from our office with composting there but overall volumes should be minimal in 2023 and preferably, managed within XXXX or adjacent to XXX and A-Pod area performance evaluation area. Authorization of this Proposal would serve as our confirmation that access to XXX for proposed work is approved by XXXX.

Authorization to Proceed

If acceptable, please sign and return one full copy of the attached Proposal Authorization Form (No. 0122X) and separately, our attached Standard Terms and Conditions. We anticipate that this Proposal can be completed from May to October 2023 (Tasks 1 through 3) and by December 2023 for the final report (Task 4) but is ultimately dependent upon authorization to proceed with this Proposal (by the Proposal Authorization/Addendum Forms), approvals and access to XXX.

We look forward to being able to provide environmental assistance to XXXX for XXX. If you have any questions, please give me a call at (978) 834-9000.

Sincerely,

Higgins Environmental Associates, Inc.

Jonathan B. Higgins, C.P.G., LSP
Principal Earth Scientist

Attachments:

Proposal Authorization/Addendum Form (Nos. 0122X)
Standard Terms and Conditions
Year 2023 Standard Fee Schedule