SWCA
ENVIRONMENTAL CONSULTANTS
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MEMORANDUM

To: Karen Beattie
Vice President of Science & Stewardship
Nantucket Conservation Foundation, Inc.
P.O. Box 13
118 Cliff Road
Nantucket, MA 02554-0013

From: Naomi Valentine, Ecological Restoration Team Lead

Date: March 6, 2023

Re: **2022 Summary of Work – Capaum Pond / MassDEP File No. 48-3400**

REGULATORY SUMMARY

Nantucket Conservation Foundation, Inc. (NCF) received an Order of Conditions (OOC) on April 28, 2021 for pond management activities within Capaum Pond (Map/Plat 31/12) in Nantucket, Massachusetts. Capaum Pond is approximately 7.1 acres (309,276 square feet) and prior to active pond management has been overtaken by harmful algal blooms for many years. The scope of work associated with this OOC (MassDEP File No. 48-3400) includes the application of copper-based algaecide to manage harmful algae and the application of alum to manage excessive phosphorus concentrations within Capaum Pond as needed. The goal of this management program is to monitor and manage potentially dangerous algae species, improve water quality, and minimize the negative health impacts that they cause. The expiration date associated with MassDEP File No. 48-3400 is April 28, 2024.

In compliance with lake and pond management regulations in the Commonwealth of Massachusetts, SWCA submitted an application for a License to Apply Chemicals to Waters of the Commonwealth (license to apply) prior to the start of work in 2021. The license to apply for Capaum Pond was acquired by SWCA on May 11, 2022, under License No. WM04-0000906.

This memo is presented in accordance with Special Condition 22, which requires that a report be submitted to the Nantucket Conservation Commission following each growing season. This memo includes a summary of all pond management activities performed within the reporting year, approximate algae regrowth, representative photographs of all management activities, and a plan for the next (2023) growing season.

OVERVIEW

SWCA conducted algae and nutrient management during the peak growing season, and the Nantucket Land Council (NLC) continued their regular water quality and algae monitoring. NLC conducted five monitoring events during the 2022 growing season, in 4-week intervals, from May 25 to September 14, 2022. The results of those monitoring events as well as those from the 2019 and 2020 growing seasons (pre-management) are presented in Tables 1 and 2. The sampling event on May 25, 2022 was conducted prior to any pond management activities.

NLC notified Nantucket Conservation Foundation (NCF) and SWCA when conditions within Capaum Pond warranted algae management. No algaecide was applied unless it was necessary to directly target active algal blooms, and no more than half of the water column was treated during each application to allow adequate dissolved oxygen levels for aquatic life.

SUMMARY OF 2022 POND MANAGEMENT AND WATER QUALITY

The Nantucket Land Council has been monitoring water quality and algae species concentrations within Capaum Pond for more than 4 years. The two years immediately prior to management (2019 and 2020) are presented as the best measure of pre-management conditions within the pond. Management events took place in 2021 and 2022. The water quality results for 2021 are also included with this year's (2022) monitoring results for comparison.

SWCA conducted an alum treatment in Capaum Pond on May 31, 2022. The alum application was applied by broadcasting a pre-mixed slurry of PhosClear at a rate of 92.13 pounds per acre (7.3 grams per cubic meter or 7.3 ppm). This application was distributed evenly across the entirety of Capaum Pond. The pond required partial algaecide applications on June 14 and August 8, 2022. These treatments were responses to NLC monitoring and identification of microscopic algal growth during the field season.

As seen in Table 2, nutrient levels within Capaum Pond differed from those in 2021. Total phosphorus and total nitrogen were, on average, higher in 2022 than 2021. However, the soluble reactive phosphorus (SRP) and nitrate (NO3-N) were lower in 2022 than 2021. Nitrate and SRP are more readily available for uptake by algae/phytoplankton. Therefore, the reduction in these two nutrient concentrations is in improvement from past years; particularly as algal reduction is the primary goal of this management program. Furthermore, the 2021 year-end report stated that less fluctuation in SRP was anticipated for the 2022 season with additional alum applications, which is what was observed in 2022. While the reduction in SRP is very important to continue the unchecked growth of algae within Capaum Pond, the concentrations of total phosphorus (52 to 119 ug/L) as well as the average of 72 ug/L still designate Capaum Pond as eutrophic.

The range of phytoplankton community density in 2022 was 995 to 8,075 units (cells-colonies-fragments) per milliliter (mL), whereas in 2021 the range was 1,484 to 30,153 units per mL. The proportion of those phytoplankton groups that were Cyanophytes (potentially harmful Group) was also lower in 2022. Only 6.3% of those observed in May were Cyanophytes and 36.4% in September were identified as Cyanophytes. No other cyanophytes were detected in the other testing months. In 2021 Cyanophytes dominated the proportion of phytoplankton in the July and August testing and were present in every other month's samples.

These data would indicate that the SRP reductions observed from 2021 to 2022 resulted in a reduction of phytoplankton as well as Cyanophytes present within the water column of Capaum Pond. While other environmental conditions also affect algae development, the data are promising and indicate that the current management program is successfully reducing the prevalence of harmful algae in Capaum Pond.

These changes are still small in scale and further nutrient management (and potentially direct algal management) will be necessary to minimize nutrient loading to the extent practicable in 2023.

SWCA again anticipates less fluctuations of SRP in 2023 and a greater overall reduction in total phosphorus as well as SRP following the continued alum application regiment. See the *Conclusions and 2023 Management Plan* section of this memorandum for details on the proposed management method for Capaum Pond in 2023.

Table 1. Capaum Pond Water Clarity Sampling Details[1]

Sampling Dates				Total Depth (m)				Secchi Depth (m)				Avg Water Temp. (C)				TDS (ppm)				Color			
2019	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**
	6/2	6/1	5/25		2.13	2.21	2.5		1.55	1.32	1.5		20.3	16	18.1		169	181	217		clear	clear	green
	6/30	6/29	6/22		2.18	2.18	2		0.53	1.75	1.33		24.3	26.3	20.3		175	188	351		green	green	green
7/29	7/28	7/27	7/20	2.1	1.83	1.96	1.9	0.23	0.36	0.84	0.5	25.3	27.1	25.7	26.3	176	178	180	197	pale green	green	green	brown/ tannic
8/26	8/25	8/24	8/24	2.1	1.91	1.78	2	0.38	0.71	0.69	1	20.9	26.1	26	24.6	200	522	335	207	green	green	green	yellow/ brown
9/19	9/29	9/21	9/14	2.1	1.68	1.93	1.75	0.56	0.84	1.07	0.66	21.4	21.6	22.1	22.8	171	201	193	474	green	green	green	green
Average (no high/low)				**2.1**	**1.9**	**1.9**	**2.03**	**0.4**	**0.7**	**1.2**	**1.0**	**21.4**	**23**	**23.4**	**22.6**	**180**	**200**	**199**	**258.3**				

Table 2. Capaum Pond Water Quality Sampling Details[1]

Sampling Dates				Avg DO % saturation				TP (µg/L)				SRP (µg/L)				TN (mg/L)				NO3-N (mg/L)			
2019	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**
	6/2	6/1	6/5		98.6	114	89.7		36	46.9	64		5.0	0.5	1.0		0.77	0.79	0.95		0.01	0.03	0.02
	6/30	6/29	6/22		107.6	108	57.6		73	66.5	94		5.0	7.4	2.0		0.88	0.79	2.44		0.01	0.005	0.005
7/29	7/28	7/27	7/20	77.7	146.2	131	92.6	119	93	71.8	119	1.6	5.0	1.0	1.0	2.98	1.97	1.31	1.64	0.005	0.02	0.01	0.005
8/26	8/25	8/24	8/24	108.9	82.3	126	111.9	114	214	66.7	52	1.1	23.0	12.8	4.0	1.61	3.06	**218.00**	**0.97**	0.005	0.01	113	0.005
9/19	9/29	9/21	9/14	129.1	111.1	115	89.5	87.3	60	61.3	58	0.5	5.0	1.1	1.0	1.42	1.12	1.11	1.36	0.005	0.01	0.005	0.005
Averages (no high/low)				**104.8**	**116.1**	**116.7**	**90.6**	**100.7**	**83.9**	**69.3**	**72**	**0.9**	**5.0**	**3.9**	**1.3**	**1.70**	**1.30**	**1.00**	**1.32**	**0.005**	**0.01**	**0.014**	**0.005**

Sampling Dates				spC (µS/cm)				pH (s.u.)			
2019	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**
	6/2	6/1	6/5		254	270	328		6.4	7.08	7.57
	6/30	6/29	6/22		268	284	516		6.62	6.81	6.93
7/29	7/28	7/27	7/20	272	271	300	304	9.78	9.77	9.29	8.57
8/26	8/25	8/24	8/24	271	790	497	317	6.55	6.56	9.16	8.52
9/19	9/29	9/21	9/14	258	301	290	696	8.2	7.57	8.94	7.42
Averages (no high/low)				**267**	**299**	**300**	**383**	**8**	**7.5**	**8.2**	**7.84**

[1] Sutherland, J., Turcotte, R. J.. *Nantucket Island Ponds and 2022 Water Quality – Gibbs, Capaum, and Washing Ponds: A Summary of Physical, Chemical and Biological Monitoring.* Unpublished data prepared for the Nantucket Land Council, Inc.

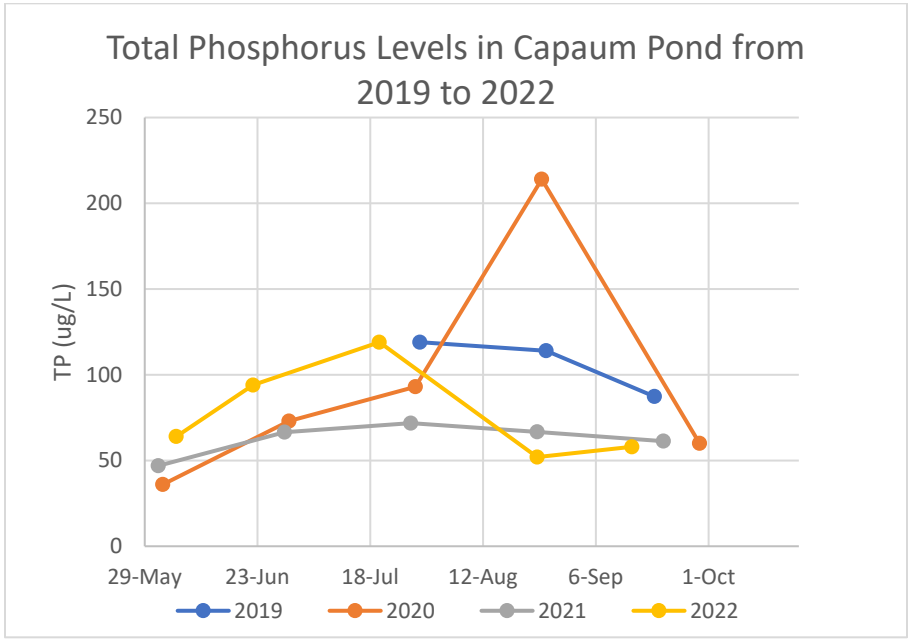

Figure 1. Total Phosphorus Levels in Capaum Pond (2019-2022)

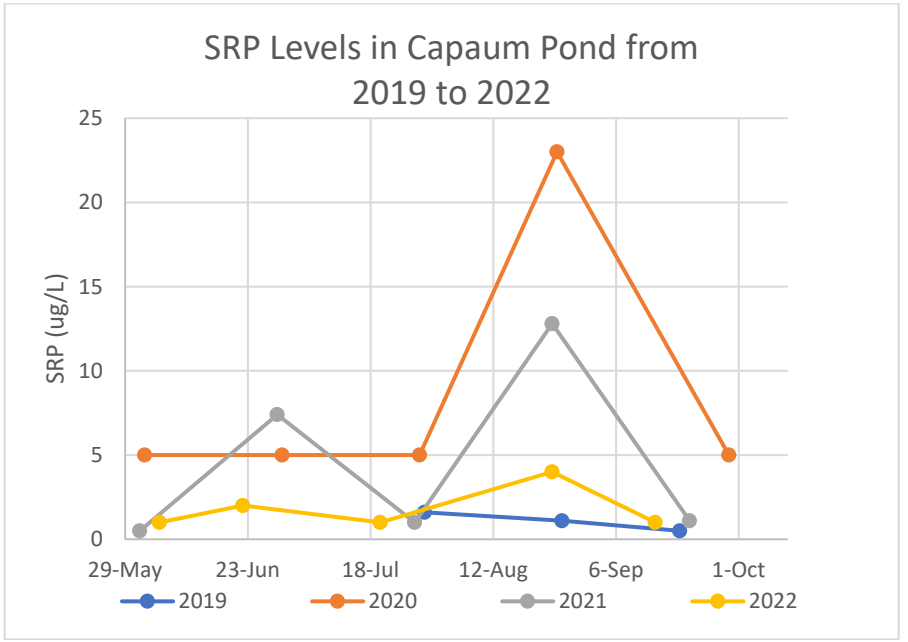

Figure 2. SRP Levels in Capaum Pond (2019-2022)

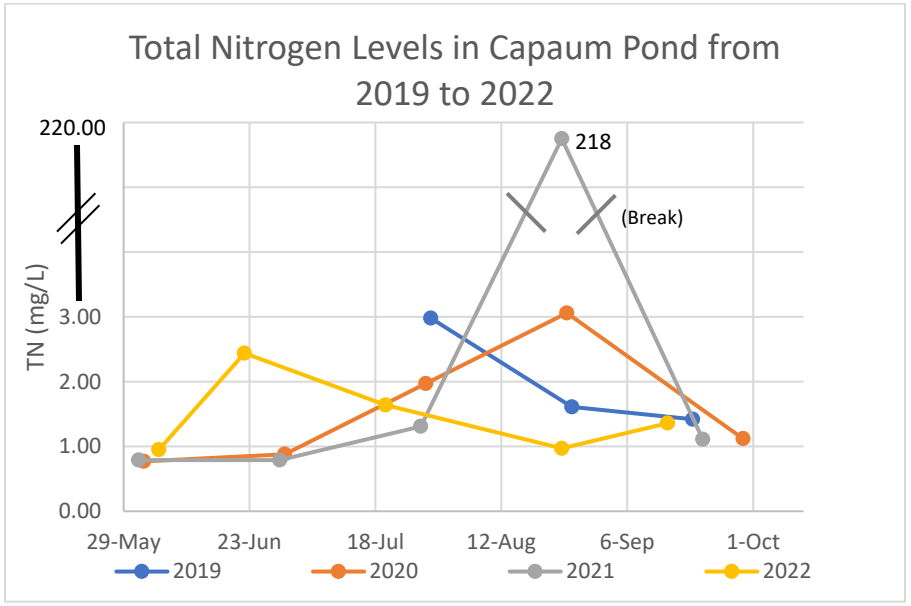

Figure 3. Total Nitrogen Levels in Capaum Pond (2019-2022)

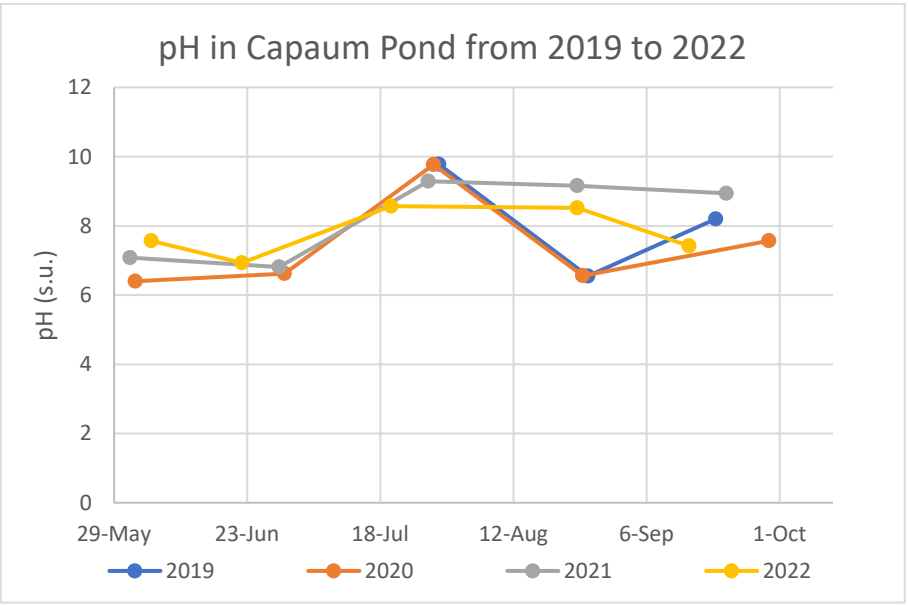

Figure 4. pH in Capaum Pond (2019-2022)

CONCLUSION AND 2023 MANAGEMENT PLAN

2022 was the second year of alum and algaecide application in Capaum Pond and the water quality testing suggests that while Capaum Pond is still categorized as eutrophic, the available nutrients and algaecide application methodology have reduced the total concentration of potentially harmful algae within the pond. While phosphorus inactivation was again not dramatic, as was seen in 2021, there were lower concentrations of SRP throughout the 2022 growing season than in past years.

The plan for the 2023 growing season is to increase the concentration and application method for alum within Capaum Pond. Alum (PAC) will be applied in April 2023 via injection at a rate of 3 parts per million (ppm). The injection will be conducted via a specially-designed spray boat equipped with a calibrated pumping system just below the surface of the water and into the prop wash of the outboard engine. This application method will provide flash mixing of the alum product.

With the data collected in 2021 and 2022, we now understand that this application method of alum (subsurface injection) is required to more significantly sequester in-water phosphorus and increase the barrier of phosphorus inactivation at the base of the pond. SWCA suggests conducting one or two more years of alum applications to reach the target level of total phosphorus in Capaum Pond (10 ug/L).

Continued collaboration is planned with the Nantucket Land Council, who will be conducting regular water quality and algae sampling, including the collection of a full suite of data prior to the spring Alum (PAC) treatment to document pre-treatment conditions.

ATTACHMENT A
Pesticide Use Reports

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Pesticide Application- Daily Use Report

Date: 5/31/2022

Time: 10:30am -6:30 pm

Applicator(s):	Matt Lewis							
License #(s):	34406							
Job #:	59305.02							
Client:	Nantucket Conservation Foundation							
Location:	Nantucket MA					**Weather:**	sunny, warm	
Product	**EPA Reg.#**	**Total Product Used**	**Application Rate**	**Total Solution Used (product + water)**	**Method: 1= Foliar 2=Cut-Stem 3= Aquatic 4= Injection**	**Amount treated & location (acreage/sq.ft.)**	**Target Species**	**Comments:**
PhosClear	n/a	2670 lbas	80 lbs/ac.ft.	n/a	3	~20.0 ac	Phosphorus; suspended solids	full pond, note 1600 lbs/permit

Signature(s): 

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Pesticide Application- Daily Use Report

Date: 6/14/2022

Time: 10:30am -3:30 pm

Applicator(s):	Matt Lewis							
License #(s):	34406							
Job #:	59305.02							
Client:	Nantucket Conservation Foundation							
Location:	Nantucket MA					**Weather:**	sunny, warm	
Product	**EPA Reg.#**	**Total Product Used**	**Application Rate**	**Total Solution Used (product + water)**	**Method: 1= Foliar 2=Cut-Stem 3= Aquatic 4= Injection**	**Amount treated & location (acreage/sq.ft.)**	**Target Species**	**Comments:**
Captain XTR	67690-9	15.0 gal	5.40 gal/ac max.	60	3	~10. ac	planktonic algae	perimeter

Signature(s): _____

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Pesticide Application- Daily Use Report

Date: 8/8/2022

Time: 12:30pm -3:30 pm

Applicator(s):	Matt Lewis							
License #(s):	34406							
Job #:	59305.02							
Client:	Nantucket Conservation Foundation							
Location:	Nantucket MA					**Weather:**	sunny, warm	
Product	**EPA Reg.#**	**Total Product Used**	**Application Rate**	**Total Solution Used (product + water)**	**Method: 1= Foliar 2=Cut-Stem 3= Aquatic 4= Injection**	**Amount treated & location (acreage/sq.ft.)**	**Target Species**	**Comments:**
Captain XTR	67690-9	17.50 gal	5.40 gal/ac max.	60	3	~5.0 ac	planktonic algae	the thumb alcove

Signature(s):