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Date: July 5th, 2018

To: Sarah Porter, New Bedford Conservation Agent

From: James Lacasse, Environmental Scientist

Re: Buttonwood Pond Post-Management Water Quality Monitoring Data

Per your request, the following provides a brief overview of the Buttonwood Pond management program to date.

Following multiple inspections, an aquatic herbicide/algaecide treatment was conducted on June 18, 2018 to reduce unbalanced densities of submersed vegetation and algae. The dominant plant species, which included duckweed, elodea and thin-leaf pondweed were growing at moderate to dense levels throughout most of the pond. To minimize Biological Oxygen Demand (BOD) following management, less than half of the pond was targeted for treatment. As a result, the USEPA and MA DAR registered products Reward (diquat) and Captain (elemental copper) were applied as a surface spray to the southernmost 4 acres of the pond. The treatment was conducted without incident by SOLitude's MA licensed pesticide applicators. During the time of treatment, there was no observable inflow or outflow from the pond, in fact, the water level was approximately 5 inches below the crest of the spillway. The average depth within the treatment area was roughly 3 feet. Benthic and surface mats of filamentous algae were most abundant within the treatment area followed by thin-leaf pondweed and elodea. Duckweed was observed within the pond but the majority of the growth was located in the northern emergent/floating leaf plant dominated zone.

In compliance with the valid Order of Conditions and the Division of Marine Fisheries (DMF) determination letter, a series of post-management water quality monitoring visits were conducted at 1 day before treatment, 1 DAT, 3 DAT, and 5 DAT. Water quality tests were collected from three separate site locations per the DMF determination letter. Sites 1 & 2 were located within the treatment area and Site 3 was located at the north end of the pond outside of the treated area. See the map attached for the specific site locations. Below are the water quality results to date.

1 Day Before Treatment – June 17, 2018

Location	Depth (ft)	Temperature (°C)	Dissolved Oxygen (mg/l)
Site 1	Surface	25.2	5.56
	1	24.8	5.52
	2	24.5	3.72
	3	24.3	3.81
Site 2	Surface	25.4	5.61
	1	25.2	5.58
	2	24.8	4.11
	3	24.7	3.76
Site 3	Surface	24.9	5.48
	1	24.7	5.55
	2	24.5	5.28
	3	24.7	4.26
	4	24.3	4.23

1 DAT – June 19, 2018

Location	Depth (ft)	Temperature (°C)	Dissolved Oxygen (mg/l)	pH (SU)	Turbidity (NTU)
Site 1	Surface	24.9	2.01	10.2	1.8
	1	24.7	1.97		
	2	24.7	1.76		
	3	27.8	0.84		
Site 2	Surface	25.2	2.14	10.0	2.3
	1	25.2	2.02		
	2	25.1	1.54		
	3	24.7	1.10		
Site 3	Surface	25.3	2.18	10.1	1.6
	1	25.1	1.96		
	2	24.8	1.83		
	3	24.7	1.56		
	4	24.7	0.74		

3 DAT – June 21, 2018

Location	Depth (ft)	Temperature (°C)	Dissolved Oxygen (mg/l)	pH (SU)	Turbidity (NTU)
Site 1	Surface	25.4	1.15	6.6	2.6
	1	25.1	0.52		
	2	25.0	0.33		
	3	24.5	0.31		
Site 2	Surface	25.2	1.18	6.6	2.9
	1	25.5	1.08		
	2	24.9	0.60		
	3	25.0	0.40		
Site 3	Surface	26.0	1.01	6.5	3.2
	1	25.5	0.83		
	2	25.2	0.90		
	3	25.1	0.80		

5 DAT – June 23, 2018

Location	Depth (ft)	Temperature (°C)	Dissolved Oxygen (mg/l)	pH (SU)	Turbidity (NTU)
Site 1	Surface	25.7	1.51	6.8	4.4
	1	25.8	1.27		
	2	25.7	1.04		
	3	24.3	0.19		
Site 2	Surface	25.9	0.97	6.7	4.7
	1	25.8	0.85		
	2	24.5	0.21		
Site 3	Surface	26.1	1.13	6.7	4.8
	1	24.9	1.06		
	2	25.4	0.47		
	3	25.1	0.27		

14 DAT – July 2, 2018

Location	Depth (ft)	Temperature (°C)	Dissolved Oxygen (mg/l)
Site 1	Surface	31.8	2.45
	1	30.5	0.99
	2	27.2	0.20
	3	26.0	0.13
Site 2	Surface	32.0	2.28
	1	31.0	1.25
	2	26.2	0.21
Site 3	Surface	32.0	1.84
	1	31.8	1.70
	2	29.7	0.24

Dissolved oxygen levels were below saturation prior to conducting treatment, which is likely a function of the elevated plant growth, lower water levels, and high water temperatures. Given these conditions, less than half the pond was treated to protect against excessive BOD resulting from decaying vegetation. Despite these efforts, a significant drop in dissolved oxygen was observed post-treatment. Although the dissolved oxygen was low, no fish mortality or dissolved oxygen stress behaviors (gulping, fish at surface, shoreline crowding, etc.) were observed at any time during the monitoring period. In fact, it was not until ten days post-treatment, on Thursday June 28th, that fish mortality was reported. Although a SŌLitude biologist did not directly observe the extent of the fish kill it was reported to us by multiple sources as several dozens of fish of various species and size classes. A SŌLitude Biologist did visit the site the morning of June 29th and did not observe any additional dead fish. An abundant warm-water fish assemblage was observed at the time of this visit that did not appear overly stressed by low dissolved oxygen levels. No additional fish mortality has been observed or reported since Thursday June 28th.

As you are aware, the region experienced a significant rain event on the 28th, where in some areas more than an inch of rain fell in less than 24 hours. Given that fish mortality at Buttonwood Pond was confined to the 28th during the rain storm, we believe that the detrimental water quality impacts (increased organics, transport of fecal bacteria from resident geese, and other potential watershed based contaminants) resulting from the elevated storm water flow caused an already dissolved oxygen stressed sub-set of the fishery to succumb.

Although these events are unfortunate and require additional preventative measures in the future, we do not feel that this isolated and limited fish kill has negatively affected the overall fishery or the ecology of the system. We have already begun discussing the installation of a submersed aeration system with the swan boats owner to help stabilize naturally fluctuating dissolved oxygen levels and protect against excessive BOD resulting from vegetation control activities.

SŌLitude has collected some additional bacteria samples for analysis and will continue to monitor conditions throughout the remainder of the season. If you have any questions regarding this information, the management program, or next steps please do not hesitate to contact me (cell 774-276-6098) or Keith Gazaille (cell 508-954-8576) directly to discuss further.