Paderewski Pond Assessment and Alternatives Analysis

Paderewski Pond
Plainville, Connecticut

November 2016

Prepared for

Plainville Municipal Center

One Central Square

Plainville, Connecticut 06062

Loureiro

Engineering • Construction • EH&S • Energy
Waste • Facility Services • Laboratory

Loureiro Engineering Associates, Inc.

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An Employee-Owned Company

Comm. No. 67PV604

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1. INTRODUCTION

Loureiro Engineering Associates, Inc. (Loureiro) was retained by the Town of Plainville (Town) for an assessment of the environmental conditions at Paderewski Pond (hereafter referred to as the "Site").

The Site is a 15.8 acre pond located on Cooke Street in Plainville, Connecticut, as shown in Figure 1. Paderewski Pond is a shallow pond, ranging three to seven feet in depth, with extensive aquatic plant growth and ample supply of nutrients. The pond is surrounded by a residential area and has two point-source stormwater discharges located on the northwest and southwest corners of the waterbody.

The purpose of the investigation at the Site was in response to a fish kill which occurred in September 2015. The objective of the investigation was to assess the chemistry of the water column and sediment in the pond, determine if any undesirable conditions exist, and review potential alternatives to mitigating future algae blooms and potential fish kills.

2. BACKGROUND

In September 2015 a fish kill occurred in Paderewski Pond. It was reported that more than 1,000 fish died. Representatives from the Connecticut Department of Energy and Environmental Protection (DEEP) attributed the loss due to low dissolved oxygen (DO) levels caused by an algae bloom triggered by significant lack of rainfall and high temperatures.

Shallow ponds, such as Paderewski Pond, tend to have high temperatures during the summer which allows the entire waterbody to support weed and algae growth. As the temperature in the pond increases, the water's ability to hold oxygen decreases since warm water has a lower capacity to hold oxygen. An absence of oxygen, also referred to as anoxia, can lead to fish kills, production of hydrogen sulfide and accumulation of organic matter in the pond.

Additional demands on available oxygen in the pond are due to both outside nutrients sources, such as stormwater discharge, and internal nutrient sources. As internal plants and algae die they accumulate in the pond bottom sediment and act as nutrient sources for future algae and aquatic weed blooms.

Since April 2016, the Town's Water Pollution Control Facility (WPCF) has been monitoring the DO and temperature levels at select locations within the pond at depths of one foot from the bottom. Additionally, the Connecticut Agricultural Experiment Station (CAES) collected samples in August 2005 which included DO, temperature, conductivity, pH, alkalinity and phosphorus data. This data suggested typical levels expected within a healthy pond with depressed, but not distressed DO levels. Further, an aquatic plant survey performed concurrent with the 2005 sampling revealed that a native waterweed (Elodea nuttallii) commonly called western waterweed was extremely abundantly throughout the entire pond with dense mats growing in water as deep at 7-feet. The observations from the WPCF and CAES are included as Attachment A.

3. SAMPLING APPROACH

On August 23, 2016, Loureiro personnel completed water column and sediment sampling at Paderewski Pond. Photographs taken during the sampling event are included as Attachment B. The pond was divided into quadrants. Quadrants 1 through 4 are located in the southwest, northwest, northeast, and southeast respectively. Four strategic locations were chosen within the quadrants to perform the previously mentioned sampling. The four sampling locations are illustrated in Figure 2. Field parameters including DO, pH, specific conductivity and temperature were monitored and recorded throughout the water column from the surface to the sediment at each of the four locations. Secchi transparency depths were also monitored at each location through the water column to assist in potential eutrophication condition determinations.

Grab samples of water were acquired from the water column at each sampling location using a peristaltic pump. Water samples were analyzed for metals (copper, iron, zinc, lead, nickel, and manganese), total and ortho phosphorus, chlorophyll-a, total Kjeldahl and nitrate nitrogen, conductance, pH and alkalinity (as calcium carbonate).

Sediment samples were collected via an Eckman grab sampler with extension handle. Sediment samples were analyzed for metals (copper, iron, zinc, lead, nickel, and manganese), chemical oxygen demand (COD) and organic content.

4. SAMPLING RESULTS

To determine if Paderewski Pond is a stratified pond, field parameters including DO, pH, specific conductivity, and temperature were monitored and recorded throughout the water column from the surface to the sediment at each of the four locations.

A difference of 1 degree Celsius can indicate a stratified pond. Quadrants 1, 2, and 4 did not vary greatly in temperature throughout the water column. Quadrant 3 varied slightly in temperature; however, DO levels did not suggest such a condition.

Specific conductivity and pH readings did not follow a trend within the water column. Specific conductivity values ranged from 278.9 ms/cm to 311.7 ms/cm which is well within the acceptable limit for a healthy pond. The pH readings ranged from 7.77 to 9.23. The average pH value throughout the pond was 8.48 which is on the high end of the acceptable range for a healthy pond which is between 6.0 and 9.0. The DO, pH, specific conductivity, and temperature profiles are included at Attachment C.

The four water column samples and four sediment samples collected on August 23, 2016 were sent to Tunxis Laboratories, LLC in Plainville, Connecticut for analysis. Tables summarizing all sampling information and all analytical results are included in Tables 1 and 2 respectively.

The majority of the data fell within the healthy pond range. DO is the most critical indicator of pond heath and should range between 6-10 mg/L with a minimum required concentration of 5 mg/L to maintain a healthy fisheries program. The DO levels observed in Paderewski Pond were slightly below the optimal range but were still measured above the 5 mg/L.

The ideal pH range for supporting freshwater aquatic life is 6.0 to 9.0. Laboratory and field pH values were slightly high but not of significance since most species can tolerate pH levels outside of the ideal range.

The alkalinity was lower than anticipated, however, highly variable ranges for healthy waterbodies have been published and the values measured are not of concern. Ponds with an alkalinity of 5 mg/L as calcium carbonate or less are considered to be susceptible to acidification. The alkalinity measured in Paderewski Pond ranged between 25 mg/L and 28 mg/L which is significantly above the concerning levels.

The metals analyzed (copper, iron, zinc, lead, nickel, and manganese) were all measured within the acceptable range for a healthy pond with the exception of the manganese and iron in Quadrant 1 which were slightly elevated.

The four sediment samples were analyzed and reported on a "dry weight" basis, which is customary for all solid samples analyzed. After further review, it was determined that the samples should be calculated on an "as received" basis since this is their most representative state. This calculation was done by multiplying the results by the percent solids. A comparison between the "dry weight" values versus the "as received" values is included as Attachment D.

Based on the calculated "as received" values, all constituents evaluated, except for COD, were relatively consistent between each sample. COD in Quadrants 1 and 2 were significantly higher than in Quadrants 3 and 4. The inconsistency between the samples could be due to the amount of vegetation within each sample. COD levels are directly related to the amount of organic compounds in water so if there were more nutrients within the sediment samples for Quadrants 1 and 2, this could increase the COD reported.

Copper, lead, nickel and zinc levels were slightly higher in Quadrants 1 and 2 but not of significance since the values reported were all below a concentration which adverse biological effects are likely to occur.

5. ALTERNATIVES ASSESSMENT

Loureiro retained Landtech, to assess three alternatives to mitigate future algae blooms in Paderewski Pond. The three alternatives evaluated were pond dredging, aeration or pond mixing, and vegetation and algae management. The following section is their assessment.

5.1 Pond Dredging

Several management options are available to improve the pond's condition to reduce or eliminate seasonal algae blooms and anoxic conditions. The most effective management option is pond dredging to remove accumulated nutrient rich sediments, pond weeds and organic matter. Deepening of the pond would also provide benefits associated with thermal stratification, where warm waters "float" above the lower cooler waters. Thermal stratification would limit the movement of nutrients in deep water areas to upper waters through the development of a thermocline barrier between the upper warm waters and lower cooler waters and result in higher summer dissolved oxygen concentrations above the thermocline. Increasing water depths through dredging has the added benefit of reducing aquatic weed growth in deep water areas where sunlight does not reach.

Pond dredging can be done using either mechanical or hydraulic dredging. For a waterbody the size of Paderewski Pond, hydraulic dredging would likely be a more cost effective approach and less damaging to the pond ecosystem when compared to mechanical dredging.

Mechanical dredging would require the use of conventional earthmoving equipment and dump trucks to remove the sediment. Mechanical dredging would require pond dewatering or the use long reach equipment working from the shoreline and a floating barge.

Unless the pond can be fully drained, mechanical excavators must access the targeted work zone from upland areas or from a barge, requiring the installation of temporary access roads for the excavators and disposal trucks in fragile shoreline and riparian areas. Use of an excavator also requires the creation of stockpiling areas along the shore where the dredged material can be dewatered and stored until it can be loaded into trucks and hauled offsite. The use of mechanical excavators typically results in extensive damage to a pond's sensitive shoreline and near-upland areas, which needs to be stabilized and restored at the project's conclusion. Wet mechanical dredging (dredging the pond without removing the water) is also limited in its ability to remove loose-watery sediments from the pond bottom.

Hydraulic dredging is often faster and more cost effective than mechanical dredging, creates less turbidity than wet mechanical dredging, and can effectively remove loose, watery sediments. Hydraulic dredging consists of an auger or cutterhead dredge attached to a small boat that dislodges bottom sediments and a centrifugal pump that sucks up the slurry which is piped to a shoreline dewatering area.

The availability of Paderewski Park on the southern shoreline of the pond appears to provide a suitable dewatering area. Dewatering of the slurry can be accomplished using a constructed settling basin or use of geotextile tubes or other mechanical dewatering devices. Flocculants and coagulants are typically used to assist in sediment consolidation during the dewatering process.

Regardless of whether mechanical or hydraulic dredging is employed, disposal sites for the dredged sediment and associated costs must also be identified to determine if dredging is a cost effective option. The closer the disposal site is to the pond, the lower the transportation costs.

Pond dredging typically requires a permit from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and associated Section 401 Water Quality Certification from the Connecticut DEEP. A local Inland Wetlands permit would also be needed.

5.2 Aeration, Pond Mixing

Pond aeration involves the addition and circulation of oxygen into the water to prevent anoxia. Aeration also tends to encourage the growth of aerobic bacteria which enhances the breakdown of accumulated organic matter.

Pond aerators can consist of surface spray (fountains), horizontal aspirators and air diffusion systems. Horizontal aspirators are typically used in moderately deep water bodies that are long and narrow (such as canals). Air diffusion systems (bubblers) are most effective in deep water ponds (>15 feet). In shallow water ponds their efficiency at transferring oxygen into the water is greatly reduced.

Surface spray aerators provide the best circulation in shallow water ponds. They lift bottom water up to the top and spread it out over the surface waters to aerate it and create convection currents. The wave action caused by the spray pattern also breaks up algae mats and discourages mosquito breeding. Proper sizing and placement of surface spray aerators is critical to its success. A general rule of thumb is use of one 2hp aerator per surface acre.

5.3 Vegetation and Algae Management

Pond weed and algae management can consist of herbicide treatment or weed harvesting. Herbicide treatment to kill aquatic weeds and algae is a short term fix that needs continued application to control unwanted plants. An additional drawback is that the dead plant material and associated nutrients remain and accumulate in the pond bottom and can exacerbate future algae blooms and anoxia. Herbicide treatment is also non-selective and can result in impacts to beneficial plants, bacteria and protozoa.

Weed harvesting removes the plants and associated nutrients from pond. Floating mechanical weed harvesters are effective at removing submerged, emergent and free floating aquatic vegetation. The harvester cuts the vegetation, collects it and stores in on-board for transfer to a shoreline unloading area. Weed harvesting is an effective tool but it is also a short term fix that needs repeated application.

Other low cost, long term management actions should be considered to improve the water quality of Paderewski pond. These could include shoreline buffer plantings to filter runoff and to discourage geese, which can be a significant source of nutrients. Stormwater drainage discharges could also be evaluated to see if there are opportunities to remove sediments and improve the quality of stormwater discharges to the pond.

6. SUMMARY AND CONCLUSION

Paderewski Pond is a shallow pond with extensive plant growth and nutrients which make it susceptible to algae blooms and anoxic conditions. In September 2015 over 1,000 fish were killed due to low DO levels caused by an algae bloom triggered by significant lack of rainfall and high temperatures.

To reduce or eliminate future algae blooms and anoxic conditions three alternative were assessed based on the physical and chemical conditions within the pond. Pond dredging was recommended as the most effective management option to remove accumulated nutrients within the sediment of the pond, pond weeds, and organic matter. The second option suggested was aeration or pond mixing. The pond aerator adds and circulates oxygen into the water to prevent anoxia and would consist of surface sprayers, horizontal aspirators, or air diffusion systems. The last alternative evaluated for Paderewski Pond was vegetation and algae management. This option includes herbicide treatment or weed harvesting which would kill aquatic weeds and remove the plants and associated nutrients from the pond.

In summary, the proposed management options will reduce or eliminate seasonal algae blooms and anoxic conditions within Paderewski Pond. By decreasing the potential for algae blooms and anoxia, DO levels will improve and the likelihood of a fish kill will be significantly lowered.

TABLES

Table 1
SUMMARY OF SAMPLING AND ANALYTICAL INFORMATION
Plainville Paderewski Pond, Plainville, Connecticut

Loureiro
Engineering • Construction • EH&S • Energy
Waste • Facility Services • Laboratory

Sample Information					Analysis Information							
Location ID	Sample ID	Sample Date	Sampled Interval (ft)	Sample Class	Analyt. Lab.	Volatile Organics	Semivolatile Organics	Herbicides	Pesticides/ PCBs	Fuels/Oils	Metals	Miscellaneous Analyses
SS-1	1360795	08/23/2016	0 - 6.17	SD							X	X
SS-2	1360796	08/23/2016	0 - 3.17	SD							X	X
SS-3	1360797	08/23/2016	0 - 2.83	SD							X	X
SS-4	1360798	08/23/2016	0 - 4.08	SD							X	X
WS-1	1360777	08/23/2016	0	SW			X				X	X
WS-2	1360778	08/23/2016	0	SW			X				X	X
WS-3	1360779	08/23/2016	0	SW			X				X	X
WS-4	1360780	08/23/2016	0	SW			X				X	X

Printed on 11/15/2016

Table 2
SUMMARY OF ANALYTICAL RESULTS
Plainville Paderewski Pond, Plainville, Connecticut

Loureiro
Engineering • Construction • EH&S • Energy
Waste • Facility Services • Laboratory

	Location ID	SS-1	SS-2	SS-3	SS-4	WS-1	WS-2	WS-3
	Sample ID	1360795	1360796	1360797	1360798	1360777	1360778	1360779
	Sample Date	08/23/2016	08/23/2016	08/23/2016	08/23/2016	08/23/2016	08/23/2016	08/23/2016
	Sample Time	10:03	11:40	13:05	13:35	09:53	10:35	13:00
	Sample Depth	0' - 6.17'	0' - 3.17'	0' - 2.83'	0' - 4.08'	0'	0'	0'
	Laboratory	TUNX	TUNX	TUNX	TUNX	TUNX	TUNX	TUNX
	Lab. Number	16082308-005	16082308-006	16082308-007	16082308-008	16082308-001	16082308-002	16082308-003
Constituent	Units							
Depth to Water	Ft					3	1.5	1
Date Metals Analyzed	-	08/30/2016	08/30/2016	08/30/2016	08/30/2016	08/26/2016	08/26/2016	08/26/2016
Date Physical Analyzed	-	08/30/2016	08/30/2016	08/30/2016	08/30/2016	08/24/2016	08/24/2016	08/24/2016
Date Semivolatile Organics Analyzed	-					08/24/2016	08/24/2016	08/24/2016
Copper	mg/L	52.0	11.1	4.43	6.22	<0.005	<0.005	<0.005
Iron	mg/L	37600	9210	5320	6000	1.50	0.250	0.345
Lead	mg/L	171	13.4	2.23	3.30	<0.010	<0.010	<0.010
Manganese	mg/L	395	117	95.8	80.8	0.208	<0.010	0.026
Nickel	mg/L	31.5	7.70	3.94	4.01	<0.010	<0.010	<0.010
Zinc	mg/L	226	36.0	15.0	15.6	<0.010	<0.010	<0.010
Alkalinity, Total (as CaCO3)	mg/L					27	26	28
COD - Chemical Oxygen Demand	mg/kg	290000	53000	6200	7600			
Nitrogen, Total Kjeldahl	mg/L					4.3	<1.3	1.6
Phosphate, ortho-, (as PO4)	mg/L					<0.031	<0.031	<0.031
Phosphorus, Total	mg/L					0.090	0.017	0.026
Specific Conductance	-					280	280	300
pH	-					8.2	7.7	8.8

Table 2
SUMMARY OF ANALYTICAL RESULTS
Plainville Paderewski Pond, Plainville, Connecticut

Loureiro
Engineering • Construction • EH&S • Energy
Waste • Facility Services • Laboratory

	Location ID	WS-4						
	Sample ID	1360780						
	Sample Date	08/23/2016						
	Sample Time	13:30						
	Sample Depth	0'						
	Laboratory	TUNX						
	Lab. Number	16082308-004						
Constituent	Units							
Depth to Water	Ft	2						
Date Metals Analyzed	-	08/26/2016						
Date Physical Analyzed	-	08/24/2016						
Date Semivolatile Organics Analyzed	-	08/24/2016						
Copper	mg/L	<0.005						
Iron	mg/L	0.206						
Lead	mg/L	<0.010						
Manganese	mg/L	0.012						
Nickel	mg/L	<0.010						
Zinc	mg/L	<0.010						
Alkalinity, Total (as CaCO3)	mg/L	25						
COD - Chemical Oxygen Demand	mg/kg							
Nitrogen, Total Kjeldahl	mg/L	1.5						
Phosphate, ortho-, (as PO4)	mg/L	<0.031						
Phosphorus, Total	mg/L	0.019						
Specific Conductance	-	290						
pH	-	9.4						
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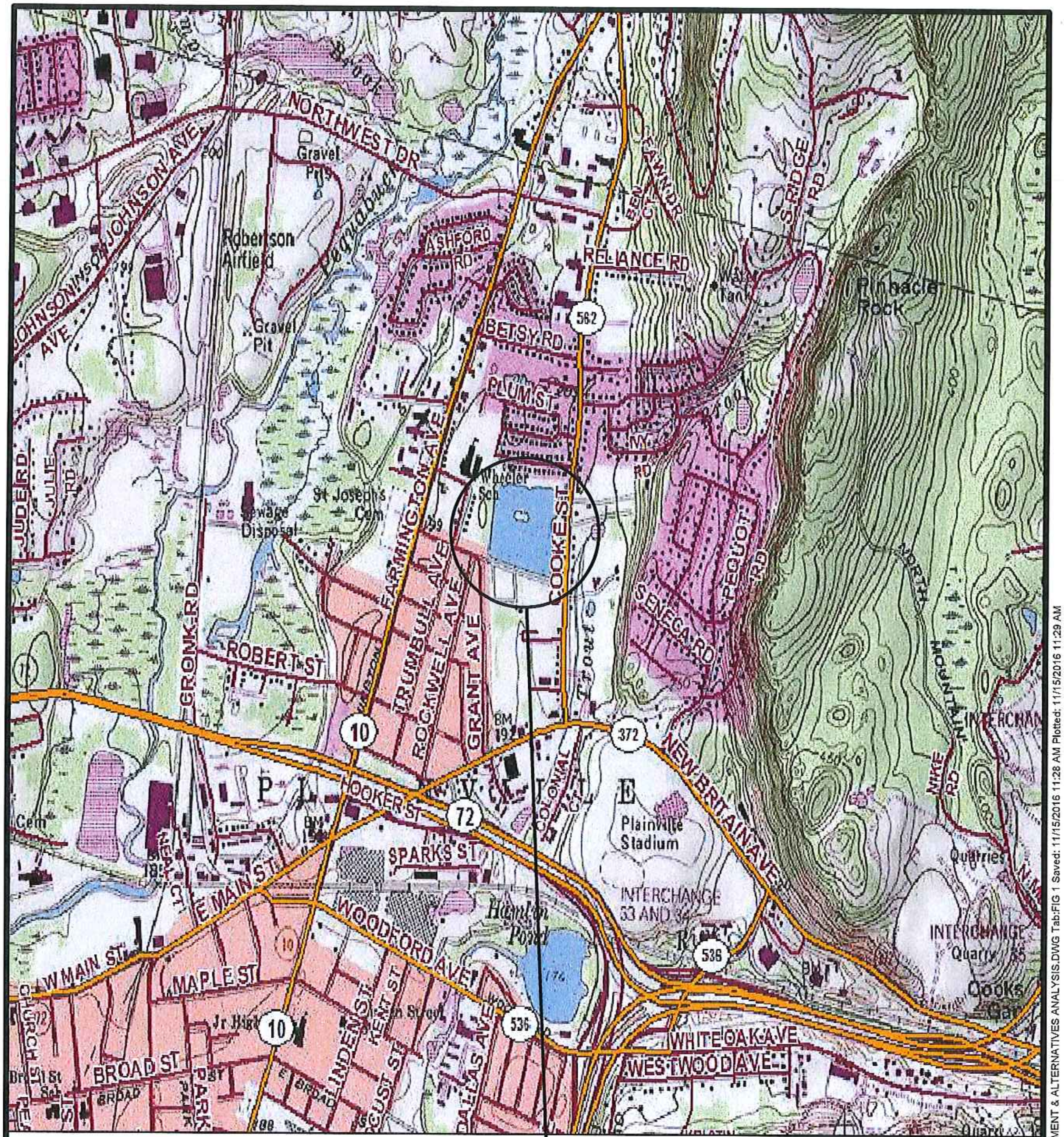
FIGURES



SITE LOCATION

1000 0 1000 2000 3000

APPROXIMATE SCALE IN FEET

N

MAP REFERENCE:

SECTION OF THE USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP FOR BRISTOL & NEW BRITAIN, CT. MAP VERSION DATE 1991 & 1992, MAP CREATED WITH TOPO! © 2006 NATIONAL GEOGRAPHIC & © 2005 TELE ATLAS, NORTH AMERICA, INC., RELEASE 08/2005.

Paderewski Pond Assessment & Alternatives Analysis
Plainville, Connecticut

SITE LOCATION MAP

Comm.No.		
67PV6.04.001	FIGURE 1	Loureiro

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LEGEND

APPROXIMATE SAMPLE LOCATION

APPROXIMATE STORMWATER DISCHARGE LOCATION

100 0 100 200 300

APPROXIMATE SCALE IN FEET

N

MAP REFERENCE:

AERIAL OBTAINED FROM GOOGLE EARTH PRO, DATE OF FLIGHT APRIL 20, 2016.

Paderewski Pond Assessment & Alternatives Analysis
Plainville, Connecticut

SAMPLING LOCATIONS

Comm.No.	FIGURE 2	Loureiro
67PV6.04.001		

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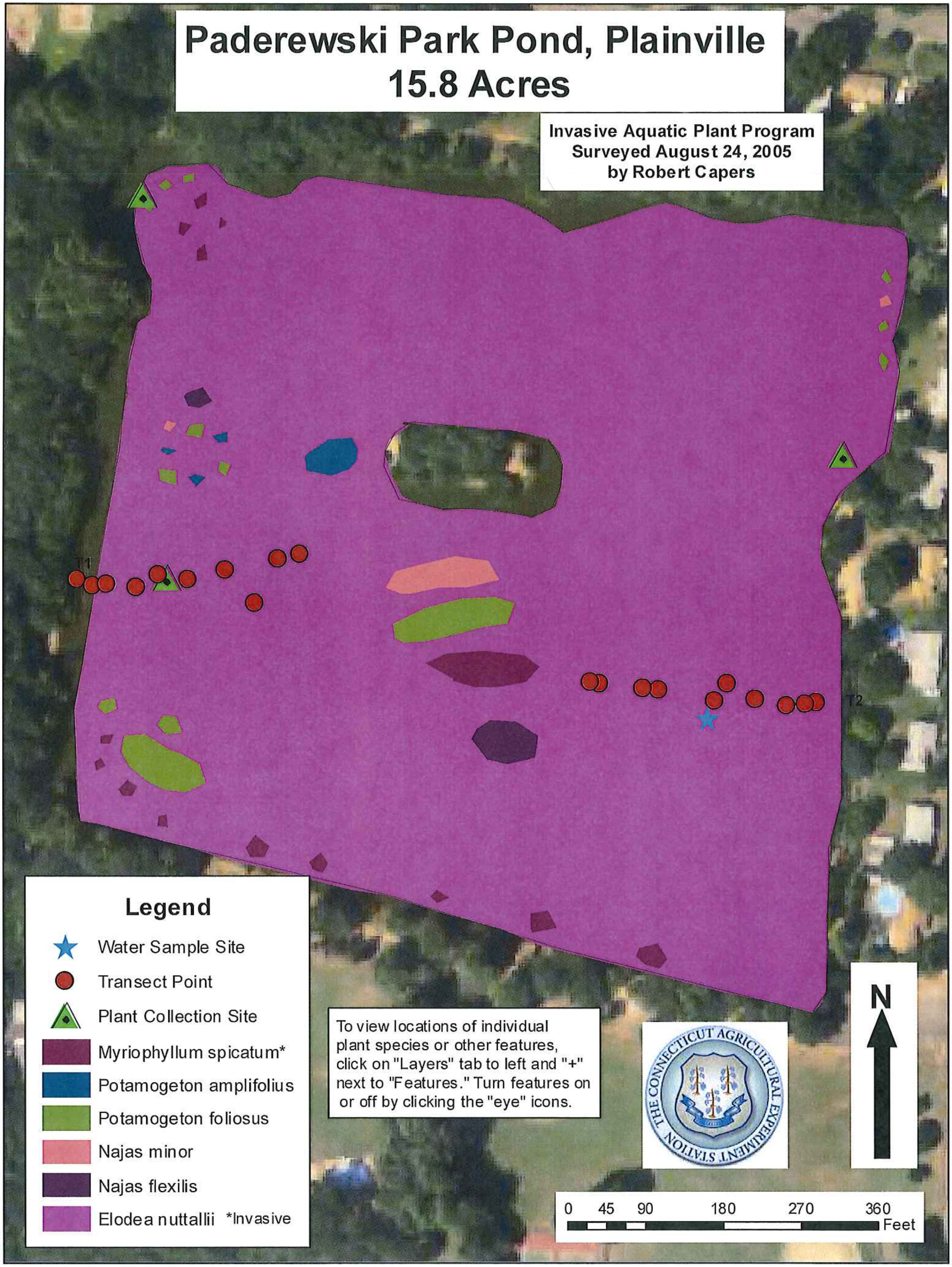
ATTACHMENT A

Connecticut Agricultural Experiment Station & Water Pollution Control Facility Data

Connecticut Agricultural Experiment Station Data



Paderewski Park Pond, Plainville
15.8 Acres
Invasive Aquatic Plant Program
Surveyed August 24, 2005
by Robert Capers
T1
T2
Legend
Water Sample Site
Transect Point
Plant Collection Site
Myriophyllum spicatum*
Potamogeton amplifolius
Potamogeton foliosus
Najas minor
Najas flexilis
Elodea nuttallii *Invasive
To view locations of individual plant species or other features, click on "Layers" tab to left and "+" next to "Features." Turn features on or off by clicking the "eye" icons.
THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION
N
0 45 90 180 270 360
Feet

*Plant abundance is on scale of 1 – 5: 1 = present but rare (1 plant), 2 = occasional (a few plants), 3 = common (more than a few plants), 4 = abundant, 5 = extremely abundant or dominant

**Follow this link to convert decimal degrees to degrees minutes seconds http://www.fcc.gov/mb/audio/bickel/DDDMMSS-decimal.html

Surveyor	Depth	Substrate	Weather	Transect number	Points	Meters from shore	Notes	*Elodea nuttallii*	*Najas minor*	*Polygonum amphibium*	*Potamogeton amplifolius*	*Potamogeton pusillus*	Date	Latitude**	Longitude
Robert Capers	0.1	Sand	Cloudy	1	1	0		3	0	0	0	2	8/24/2005	41.68308	-72.85064
	0.2			1	2	5		2	0	0	0	2	8/24/2005	41.68306	-72.85058
	0.3			1	3	10		3	0	0	0	0	8/24/2005	41.68307	-72.85052
	0.3			1	4	20		4	0	0	0	0	8/24/2005	41.68306	-72.85039
	0.9			1	5	30		3	0	0	0	3	8/24/2005	41.68310	-72.85030
	1.2			1	6	40		4	2	0	0	0	8/24/2005	41.68309	-72.85017
	1.7			1	7	50		4	0	2	0	0	8/24/2005	41.68311	-72.85002
	1.4			1	8	60		4	0	0	3	0	8/24/2005	41.68301	-72.84990
	1.7			1	9	70		5	0	0	4	0	8/24/2005	41.68315	-72.84980
	2			1	10	80		5	0	0	0	0	8/24/2005	41.68316	-72.84970
Robert Capers	0.1	Sand		2	1	0		3	0	0	0	0	8/24/2005	41.68270	-72.84753
	1.5	Sand		1	2	0		2	0	0	0	0	8/24/2005	41.68270	-72.84757
	2	Sand		1	3	10		5	0	0	0	0	8/24/2005	41.68269	-72.84765
	3			1	4	20		5	0	0	0	0	8/24/2005	41.68271	-72.84778
	3			1	5	30		2	0	0	0	0	8/24/2005	41.68276	-72.84790
	2.5			1	6	40		5	0	0	0	0	8/24/2005	41.68271	-72.84795
	1.8			1	7	50		4	0	0	0	2	8/24/2005	41.68274	-72.84819
	1.8			1	8	60		5	0	0	2	0	8/24/2005	41.68275	-72.84826

Surveyor	Depth	Substrate	Weather	Transect number	Points	Meters from shore	Notes	*Elodea nuttallii*	*Najas minor*	*Polygonum amphibium*	*Potamogeton amplifolius*	*Potamogeton pusillus*	Date	Latitude**	Longitude
	1.5			1	9	70		5	0	0	0	0	8/24/2005	41.68276	-72.84844
	1.8			1	10	80		5	0	0	0	0	8/24/2005	41.68277	-72.84848

The Connecticut Agricultural Experiment Station

Paderewski Park Pond, Plainville

Map | Transect Data (15 KB, .pdf format*)

Water data for Paderewski Park Pond, August 24, 2005.

Table 1. Dissolved oxygen and temperature. The transparency (Secchi) was 0.9 meters.

Weather	Latitude*	Longitude	Depth (m)	Dissolved Oxygen (mg/L)	Temperature (°C)
cloudy	41.68265	-72.84798	0.5	9	25.3
			1	8.8	25.3
			2	4.7	24.9

*Convert to degrees minutes seconds

Table 2. Water chemistry.

Depth (m)	Conductivity (µs/cm)	pH	Alkalinity expressed as Calcium carbonate (mg/L)	Phosphorus (parts per billion)
0.5	144	6.3	31.5	38
1.5	144	6.4	30	48

Content Last Modified on 2/18/2010 11:59:56 AM

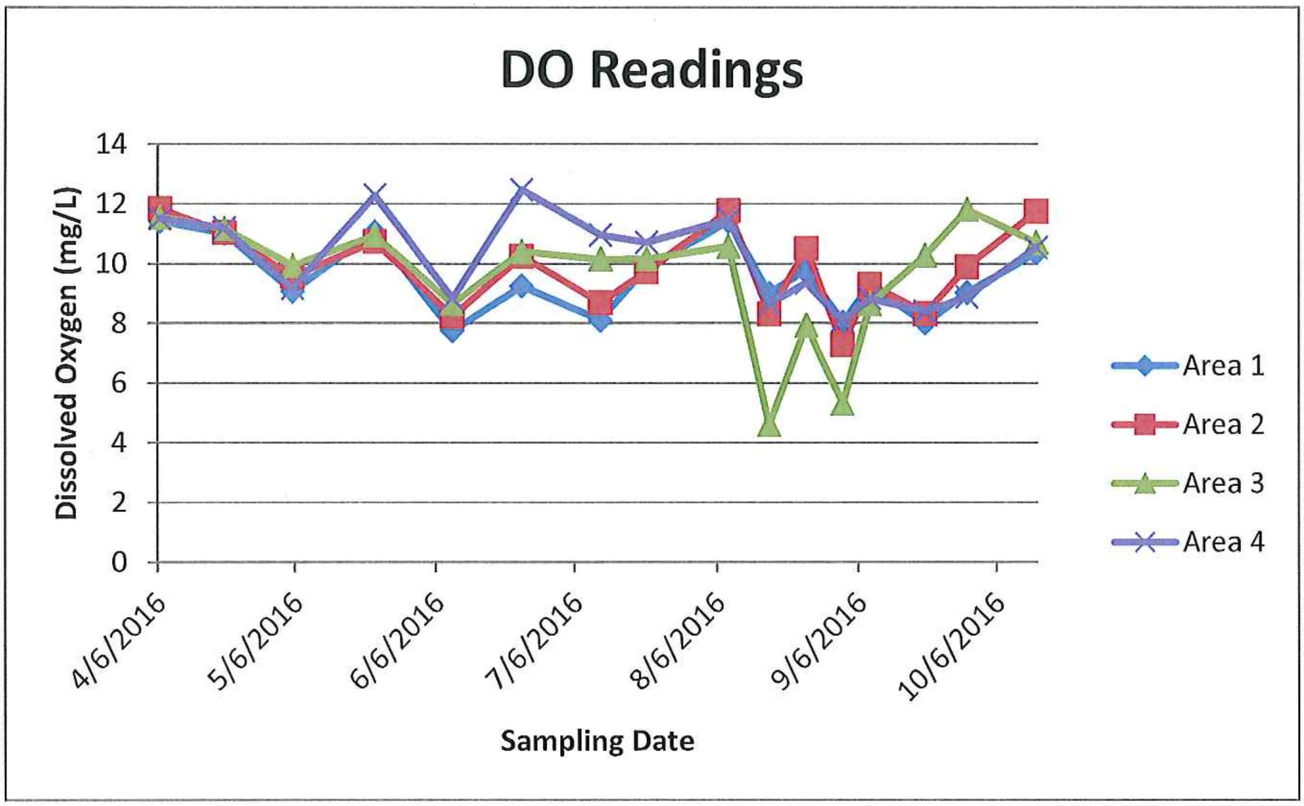
Town of Plainville Water Pollution Control Facility Data

Paderewski Park Pond dissolved oxygen readings and schedule

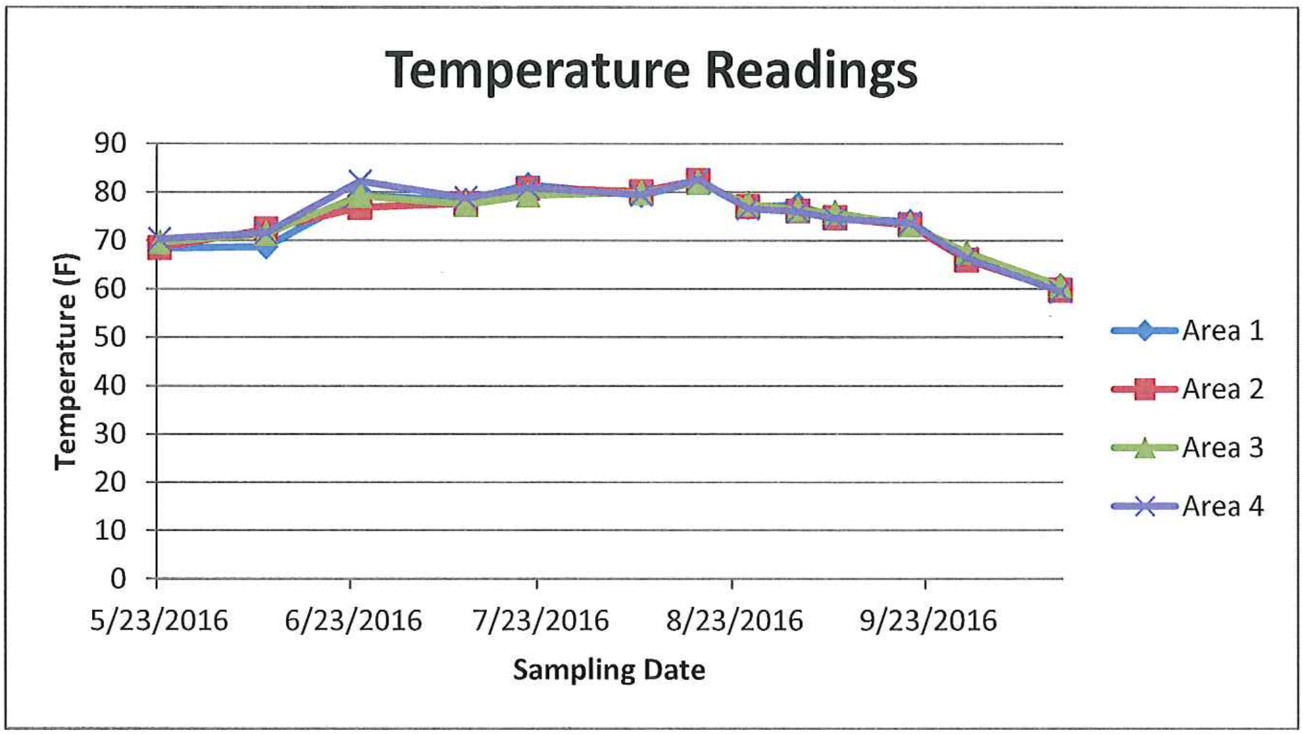
*All D.O. readings and temperature reading are performed approximately 1 ft above the bottom. Also D.O. and temperature readings are periodically checked at other depths to insure no major variations. If so they will be noted.

Month and dates	Sample Date	Area 1	Temp F	Area 2	Temp F	Area 3	Temp F	Area 4	Temp F
April, 4-8 18-22	4-6-16	11.42	N/A	11.83	N/A	11.55	N/A	11.51	N/A
	4-20-19	11.01	N/A	11.03	N/A	11.16	N/A	11.19	N/A
May 2-6 16-20	5-5-16	9.08	N/A	9.57	N/A	9.93	N/A	9.17	N/A
	5-23-16	11.05	68.4	10.74	68.5	10.94	69.6	12.29	70.3
June 6-10 20-24	6-9-16	7.75	68.7	8.23	72.3	8.65	71.4	8.83	71.6
	6-24-16	9.24	79.3	10.24	76.8	10.40	79.2	12.47	82.2
July 4-8 18-22	7-11-16	8.11	78.3	8.68	77.7	10.14	77.4	10.95	78.8
	7-21-16	9.87	81.5	9.73	80.8	10.15	79.3	10.71	80.9
August 1-5 15-19 22-26 29-31	8-8-16	11.42	79.3	11.77	80.1	10.57	79.9	11.48	79.5
	8-17-16	8.99	82.2	8.32	82.4	4.60	82	8.64	82.6
	8-25-16	9.80	76.8	10.50	77	7.93	77.5	9.34	76.6
	9-2-16	8.03	77.4	7.28	76.1	5.31	76.3	8.10	75.9
September 5-9 12-16 19-23 26-30 October 14	9-8-16	9.25	74.8	9.29	74.7	8.64	75.7	8.82	74.5
	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	9-20-16	8.01	73.9	8.32	73.2	10.27	73.2	8.40	73.6
	9-29-16	9.02	66.4	9.88	66	11.80	67.6	8.88	66.4
	10-14-16	10.36	60.6	11.74	59.7	10.70	60.6	10.53	59.4

Plainville Water Pollution Control Facility
Paderewski Pond Dissolved Oxygen Readings

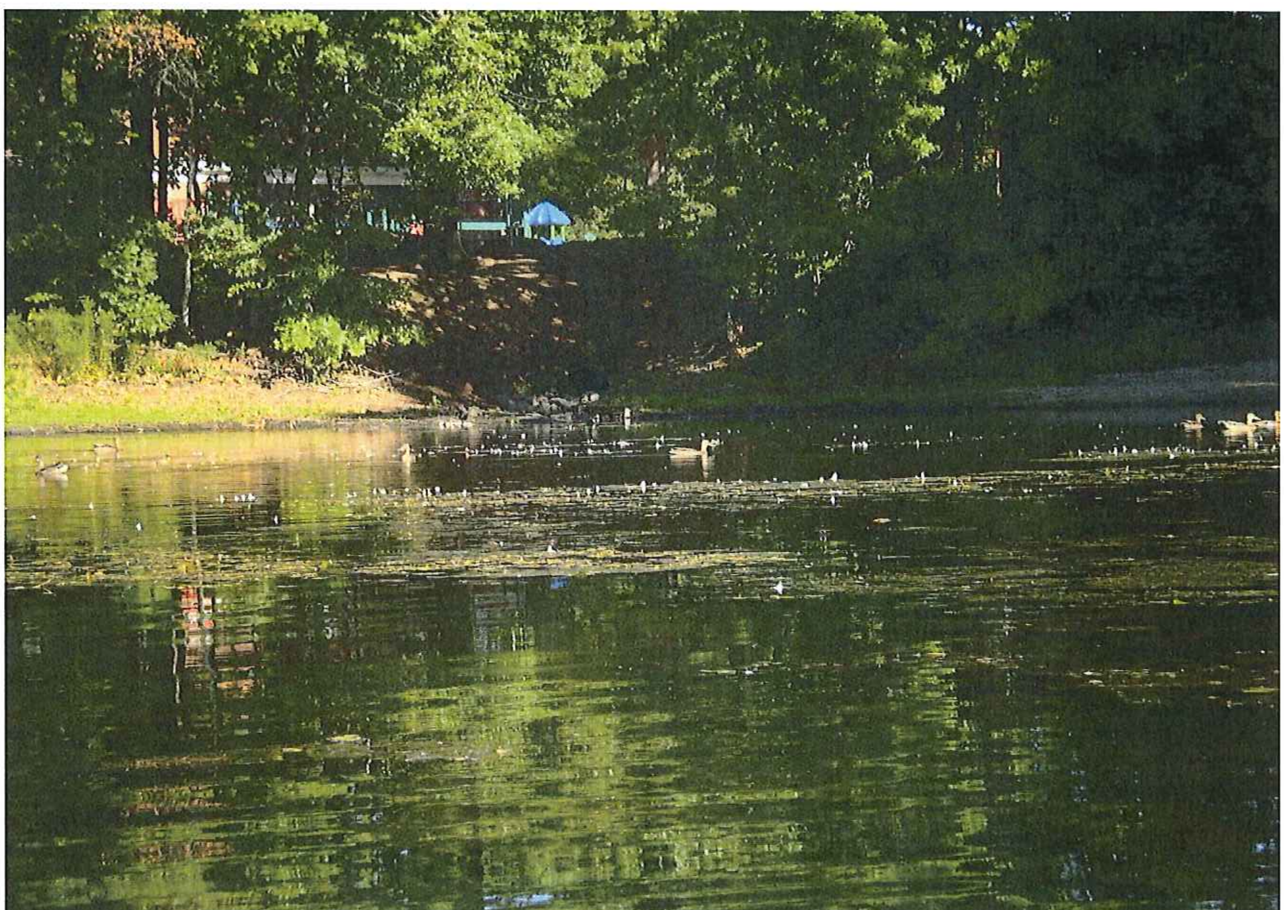


Plainville Water Pollution Control Facility
Paderewski Pond Temperature Readings



ATTACHMENT B

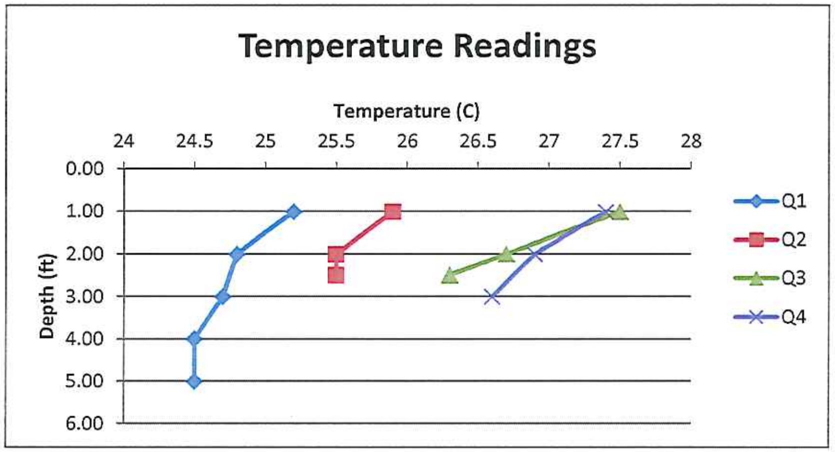
Site Photographs

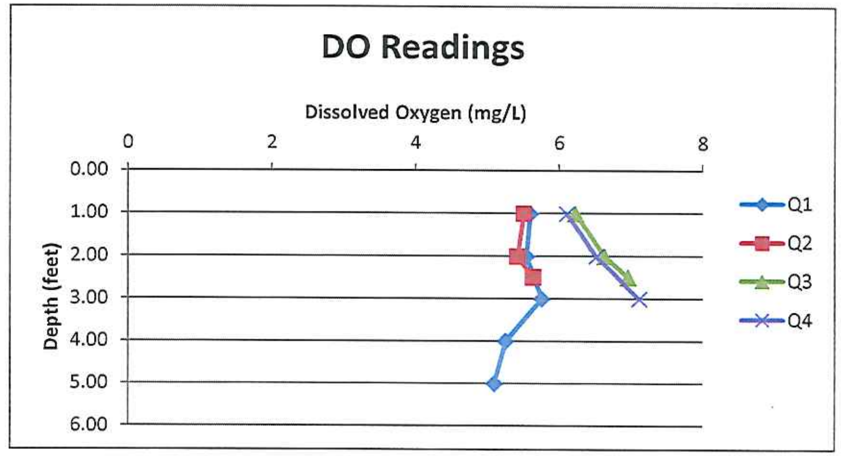



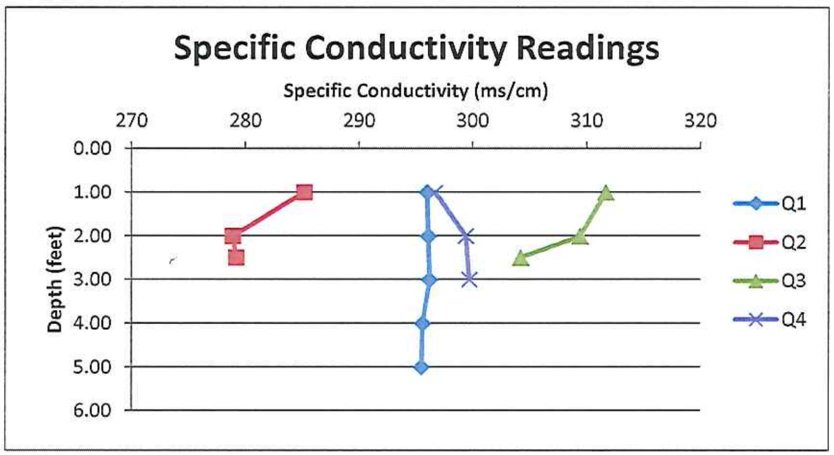
ATTACHMENT C

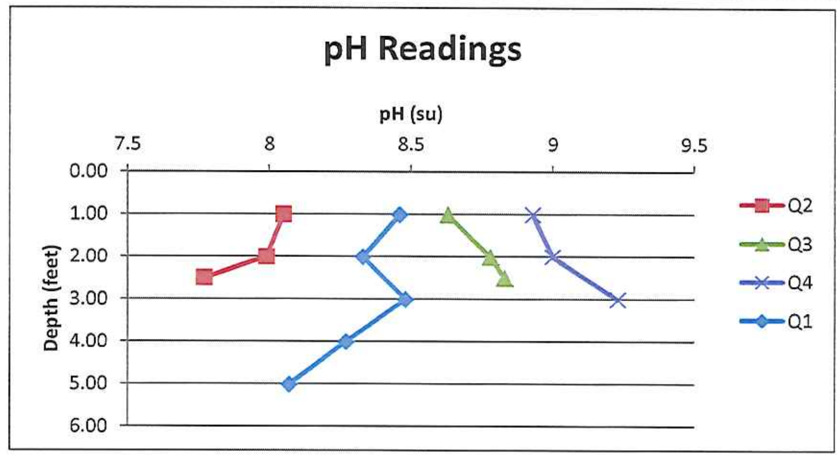
Water Column Profiles

Paderewski Pond Temperature, Dissolved Oxygen, Specific Conductivity, and pH Profiles





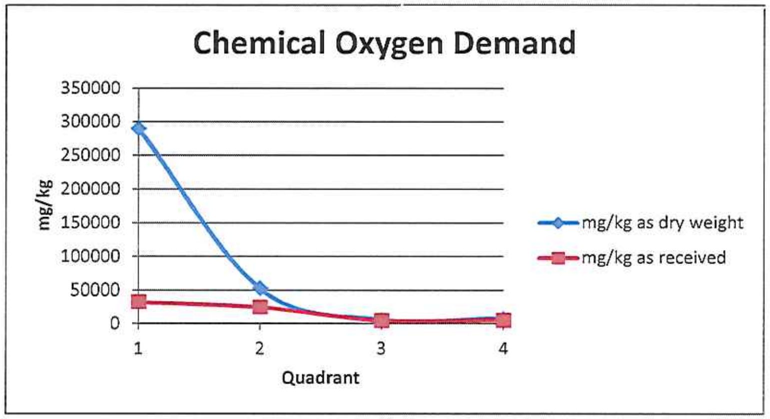


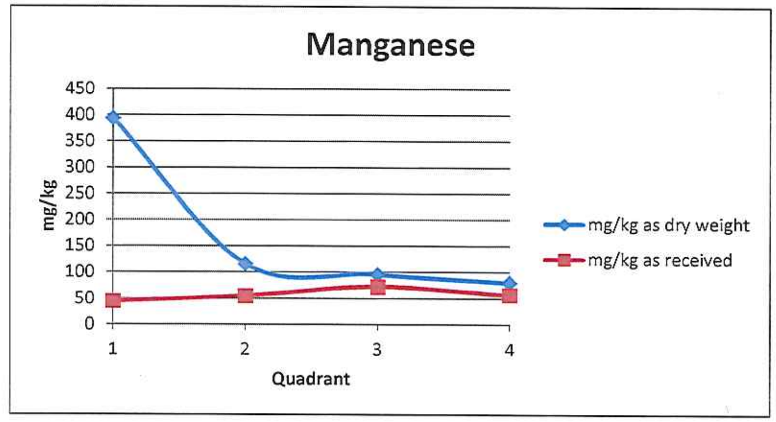


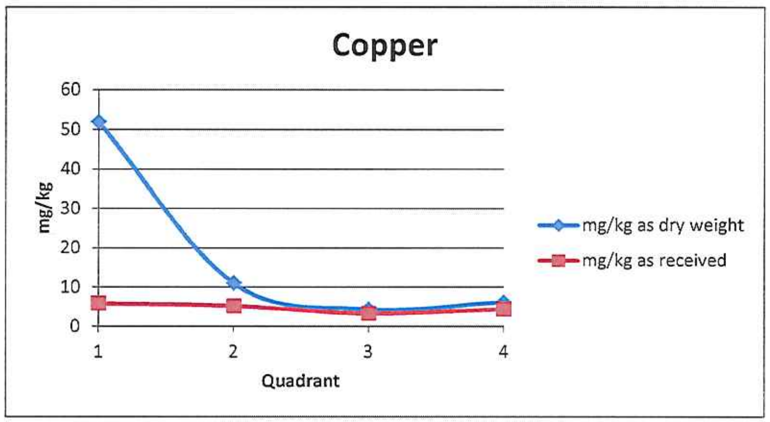
ATTACHMENT D

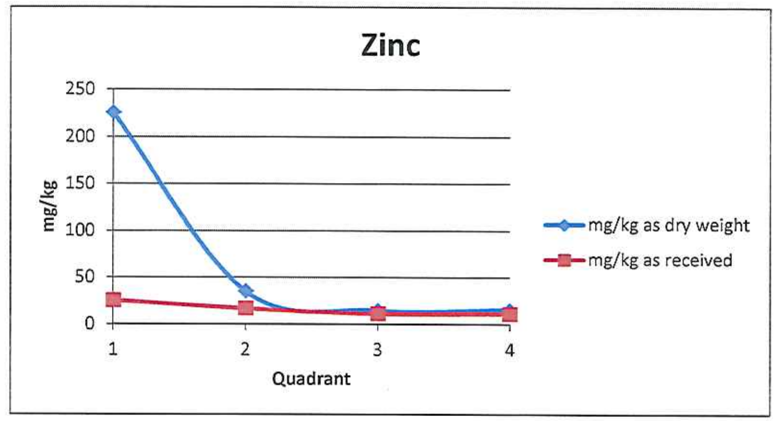
Dry Weight Versus As Received Graphs

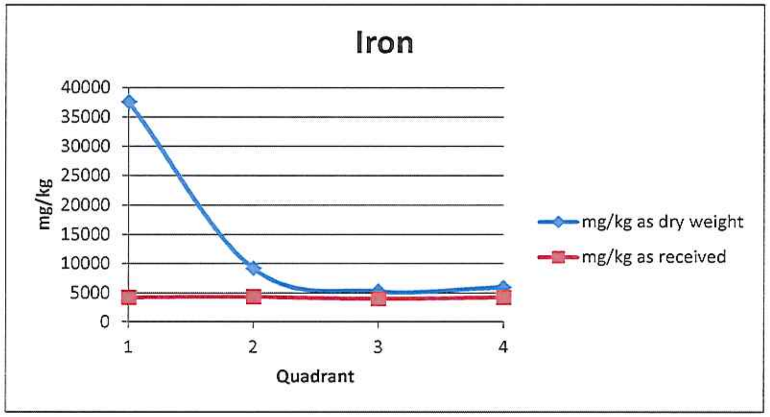
Paderewski Pond Sediment Sample Results
Dry Weight vs. As Received

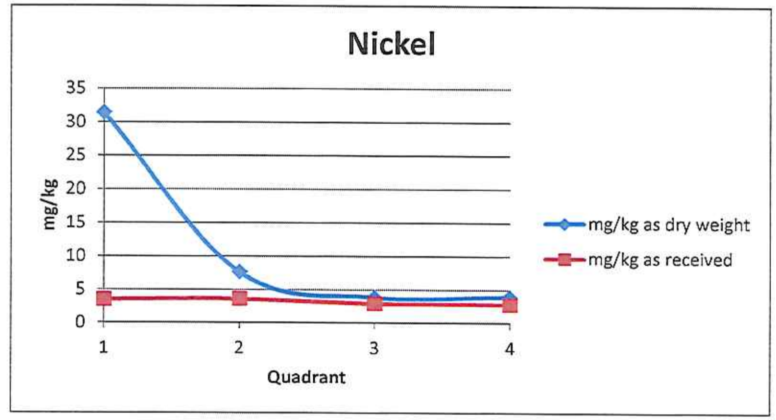


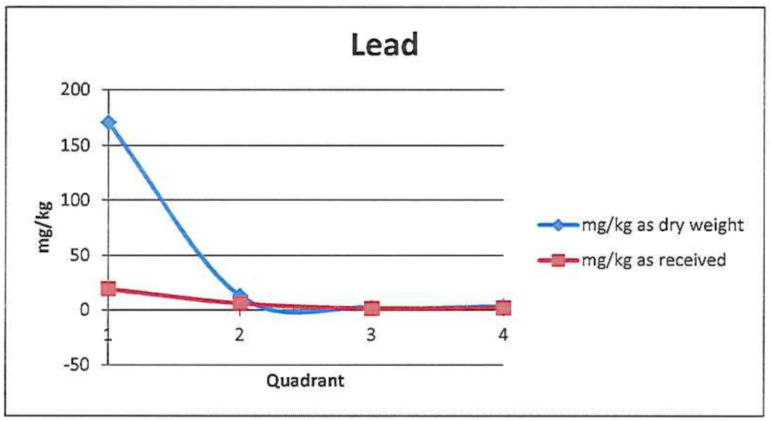







Iron
40000
35000
30000
25000
20000
15000
10000
5000
0
mg/kg
1
2
3
4
Quadrant
mg/kg as dry weight
mg/kg as received


Nickel
35
30
25
20
15
10
5
0
mg/kg
1
2
3
4
Quadrant
mg/kg as dry weight
mg/kg as received


Lead
200
150
100
50
0
-50
mg/kg
1
2
3
4
Quadrant
mg/kg as dry weight
mg/kg as received