Paderewski Pond Assessment and Alternatives Analysis

Presented by:

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Agenda

- Introduction
- Background
- Sampling Approach and Results
- Alternatives Assessment
  - Pond Dredging
  - Aeration, Pond Mixing
  - Vegetation and Algae Management
- Summary And Conclusion

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Introduction

- Loureiro Engineering Associates, Inc. – Plainville, CT
- Tunxis Laboratories LLC – Plainville, CT
- LandTech Consultants – Westport, CT

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Background

- Paderewski Pond – 15.8 acre pond with depths varying from about 2-feet to 7-feet deep.
- Surrounded by residential properties and a town park
- Two point source discharges observed

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Documented Fish Kills

- **Fish Kill** - An event where large numbers of fish die, indicating a problem in the body of water. Fish kills can be caused by a variety of factors including dissolved oxygen depletion, extreme water temperatures, fish diseases or introduction of pollutants. Most fish kills are natural events.
- September 2015 fish kill - more than 1,000 fish lost
- Prior fish kill documented by DEEP in 2000
- DEEP attributed loss to low DO levels

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Prior Studies

- Previous Connecticut Agricultural Experiment Station studies
- Aquatic Plant Program Survey – August 24, 2005 –
  - Native Elodea nuttallii (waterweed) grew extremely abundantly
  - Potamogeton pusillus (Pondweed)
  - Potamogeton amplifolius (Native big leaf pondweed)
  - Invasive Najas minor
  - Najas flexilis (bushy pondweed)
  - Myriophyllum spicatum (Invasive Eurasian watermilfoil)

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Waterweed

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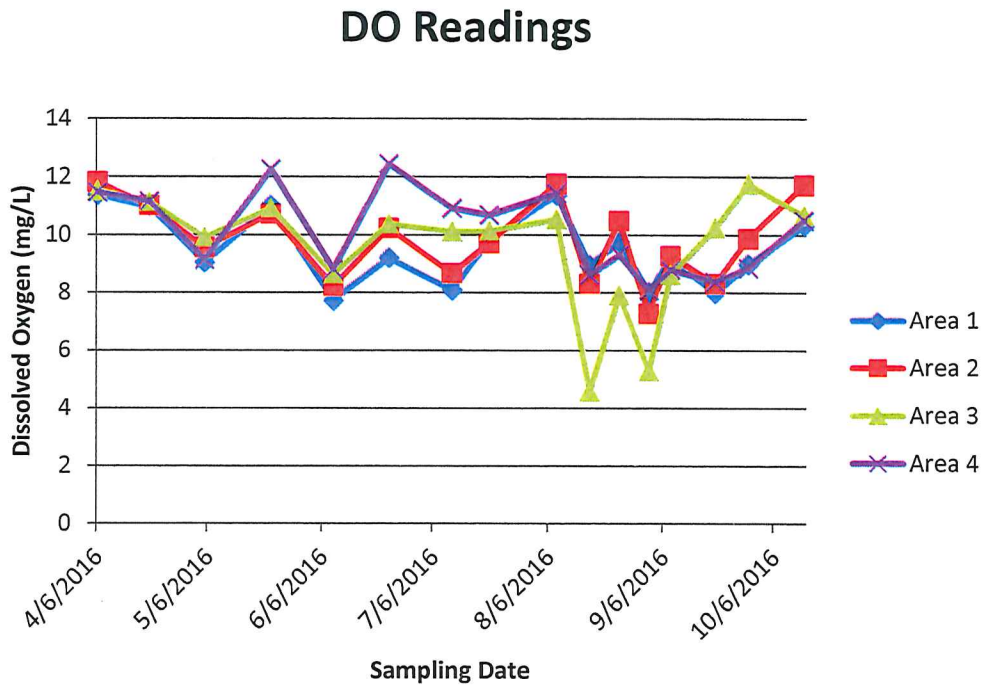
Plainville WPCF

- The Town of Plainville WPCF has been monitoring Paderewski Pond since April 2016
  (12" from bottom)



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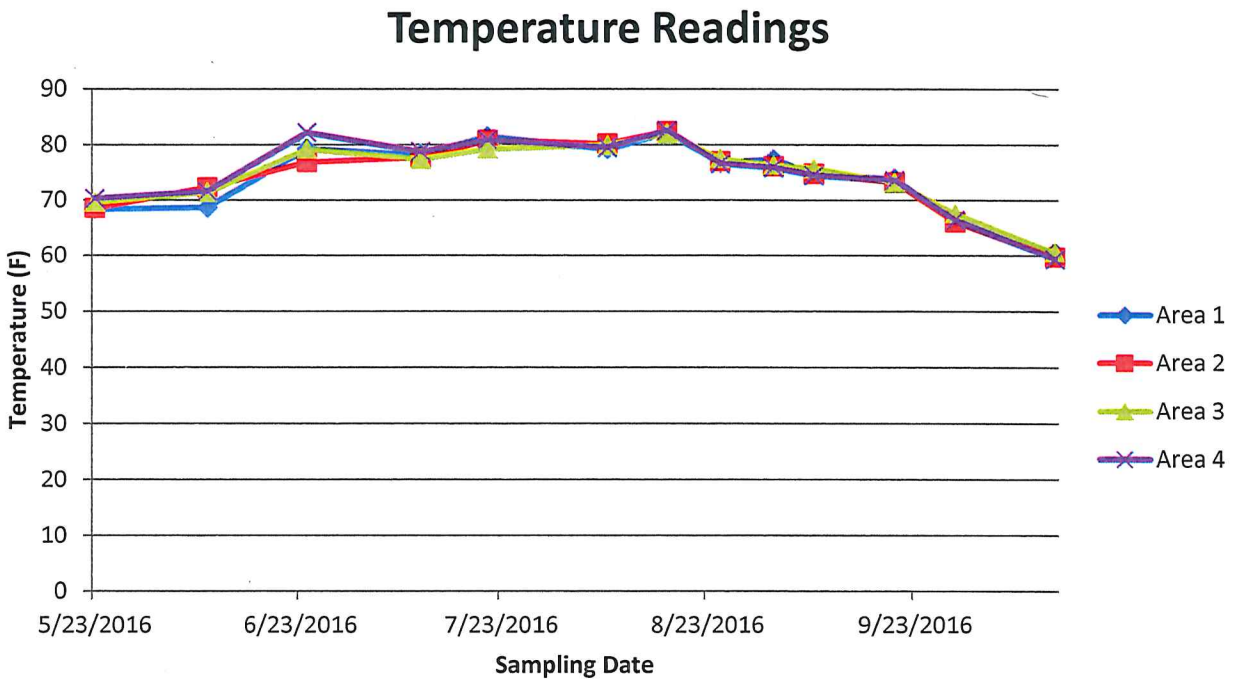
Plainville WPCF



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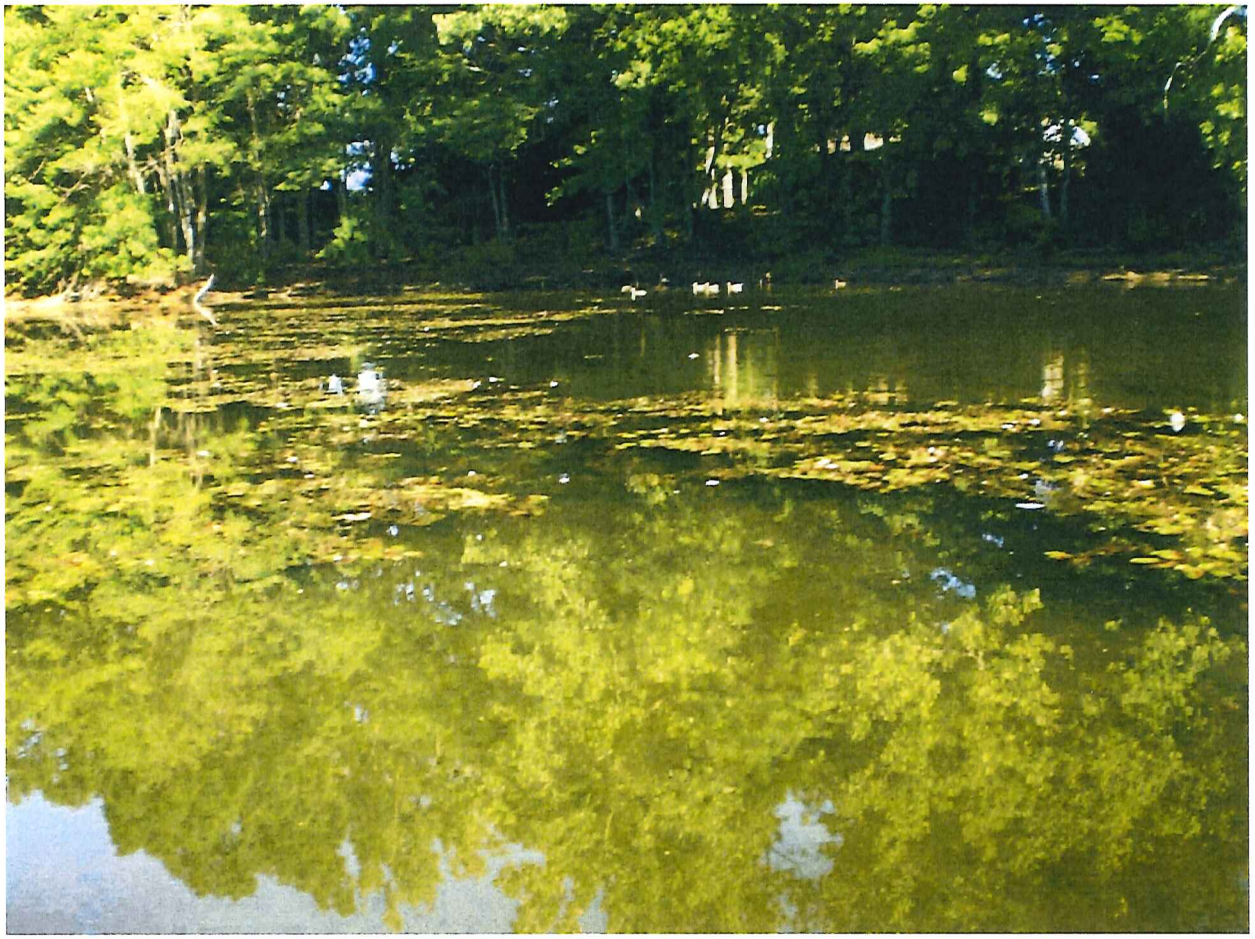
Loureiro Observations August 23, 2016



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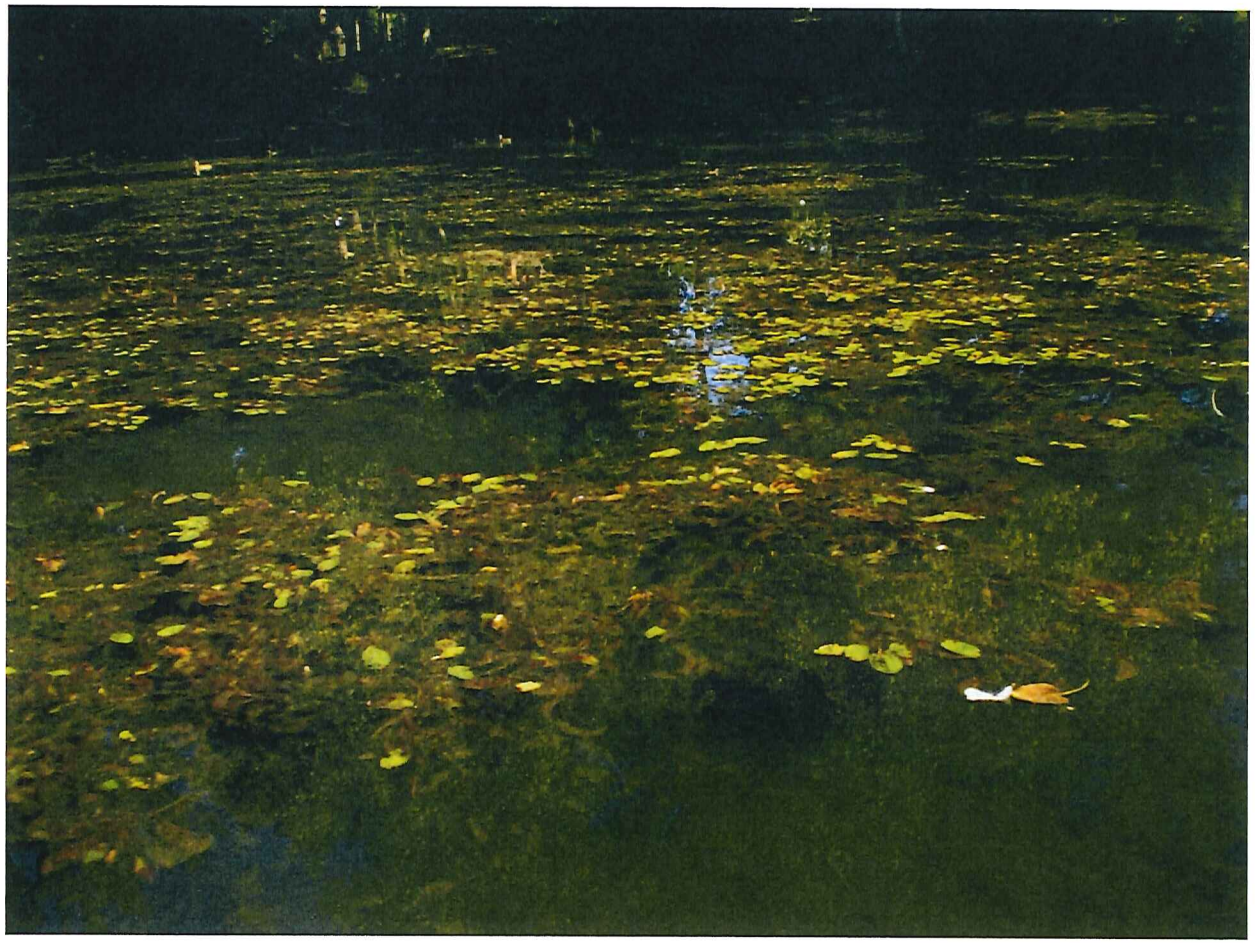
Loureiro Observations



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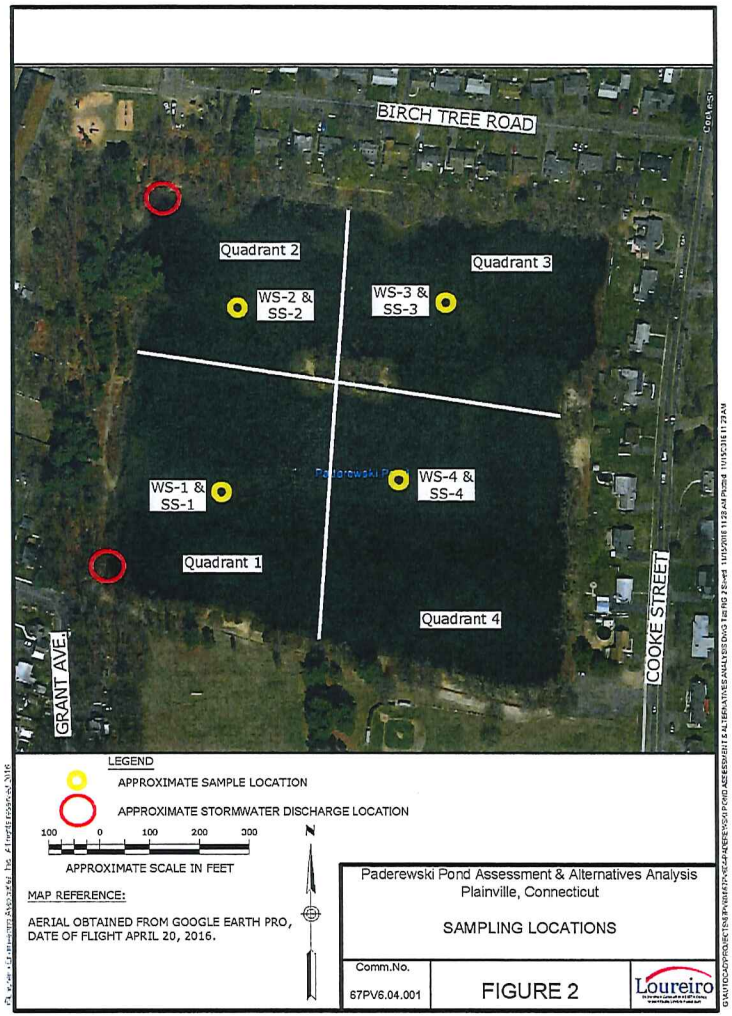
Loureiro Sampling and Analyses

- August 23, 2016 –
  - Four Quadrants Sampled, water and sediment
  - Water profiles observed for field Parameters:
    - Temp., DO, Specific Conductivity and pH



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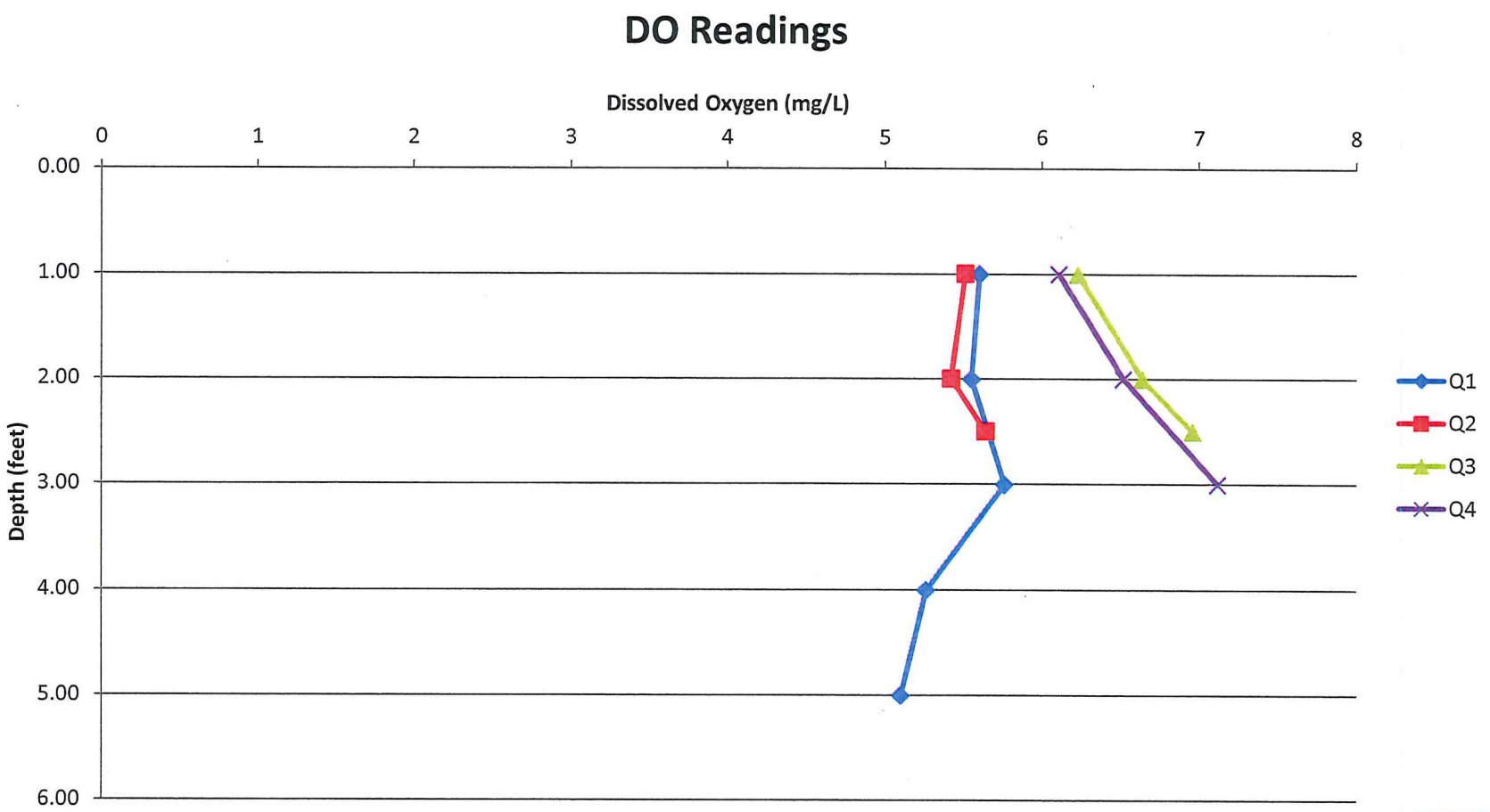
Field Sampling



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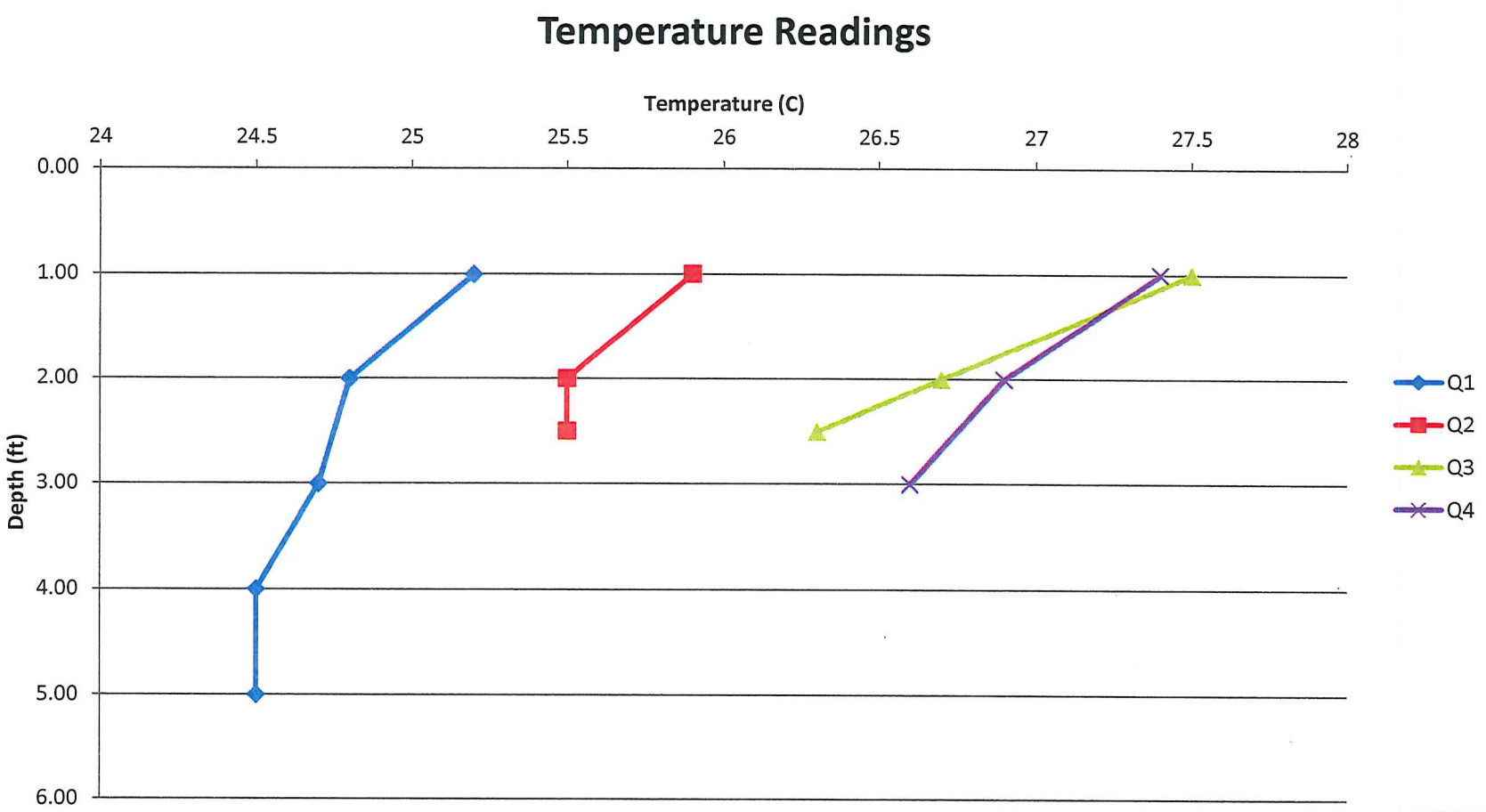
Field Sampling



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Laboratory Analyses – Water Samples

		Pond Water Sample				Healthy Pond
Test	Units	1	2	3	4	
Depth (ft)		3	1.5	1	2	
Quadrant		1	2	3	4	
pH	su	8.2	7.7	8.8	9.4	6.0-9.0
Orthophosphate	mg/L as PO4	<0.031	<0.031	<0.031	<0.031	0.005-0.5 mg/L
Specific Conductivity	umhos/cm	280	280	300	290	less than 1275 umhos/cm
Total Alkalinity	mg/L	27	26	28	25	50-150 mg/L **
Total Kjeldahl Nitrogen	mg/L	4.3	<1.3	1.6	1.5	1.2-3.0
Copper	mg/L	<0.005	<0.005	<0.005	<0.005	0.001-0.01 mg/L
Iron	mg/L	1.5	0.25	0.345	0.206	less than 0.3 mg/L
Lead	mg/L	<0.010	<0.010	<0.010	<0.010	less than 0.07 mg/L
Manganese	mg/L	0.208	<0.010	0.026	0.012	less than 0.05 mg/L
Nickel	mg/L	<0.010	<0.010	<0.010	<0.010	-
Total Phosphorus	mg/L as P	0.09	0.017	0.026	0.019	less than 0.025 mg/L
Zinc	mg/L	<0.010	<0.010	<0.010	<0.010	0.5-1.0 mg/L
Dissolved Oxygen	mg/L	5.45	5.52	6.61	6.58	6-10 mg/L **
Temperature	Celsius	24.74	25.63	26.83	26.97	26-32 Degrees C

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Laboratory Analyses – Sediment Samples

As Received Basis

		Bottom Sediment Sample			
Test	Units	1	2	3	4
Depth (ft)		6.17	3.17	2.83	4.08
Quadrant		1	2	3	4
Chemical Oxygen Demand	mg/kg as received	33350	25493	4761.6	5472
Copper	mg/kg as received	5.98	5.3391	3.40224	4.4784
Iron	mg/kg as received	4324	4430.01	4085.76	4320
Lead	mg/kg as received	19.665	6.4454	1.71264	2.376
Manganese	mg/kg as received	45.425	56.277	73.5744	58.176
Nickel	mg/kg as received	3.6225	3.7037	3.02592	2.8872
Zinc	mg/kg as received	25.99	17.316	11.52	11.232

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Summary of Analytical Findings

- Majority of parameters fell into Healthy Pond Range for water samples with minor excursions for pH, TKN, Fe, Mn and P.
- Variability in sediment samples due to the percent solids present. As received basis – much more consistent and below background.

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Alternatives Assessment

- Pond Dredging – effective at removal of nutrient rich sediments, base BOD load and pond weeds.
- Pond is very shallow, no beneficial thermal stratification observed.
- Depth and reduction in BOD associated with bottom sediments will improve overall pond health.

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Pond Dredging - Implementation

- Mechanical or Hydraulic
- Mechanical – Use excavator. Need to dewater and will affect fringe considerably. Lots of silt in water column.
- Hydraulic - Faster and cost effective. Cutter head and pump system with dewatering landward. Space in park and parking lot for dewatering.

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Pond Dredging - Permitting

- US Army Corps of Engineers Section 404 permit – may fall under a self verification under the new GP.
- Connecticut DEEP Water Quality Certification
- Local IWWC permit

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Aeration – Pond Mixing

- Aeration adds oxygen to the pond and circulates deeper, cooler waters from the bottom to the surface.
- Increases and stabilize the amount of dissolved oxygen in the entire water column
- Encourages growth of aerobic bacteria enhancing the breakdown of organic matter and nutrients, thereby reducing algae.

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Aeration - Implementation

- Fountains and diffusors are typically implemented.
- Diffusors ineffective in shallow ponds like Paderewski Pond.
- Electrically operated pumps supported by a float anchored to the bottom. Installed seasonally and removed in the winter.
- Need to be designed and sized to effectively facilitate complete mixing (usually 1-2 HP/acre)

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Aeration - Permitting

- Temporarily installed aerators – can be installed without US ACE or DEEP permits. Local permits may be required.
- Permanent installations would required US ACE or DEEP permits.

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Vegetation and Algae Management

- Paderewski Pond has significant vegetation primarily Elodea nuttallii (waterweed).
- Matting of the surface was observed on August 23, 2016 thereby reducing sunlight to the lower depths of water.
- This reduces photosynthesis (oxygen production) and enhances respiration (oxygen consumption).

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Vegetation and Algae Management - Implementation

- Can be accomplished by mechanical weed harvesting or herbicide treatment.
- Both are short-term fixes to a larger problem.
- Herbicide treatment leaves the plant material and nutrients within the water body and must be repeated at least annually and more likely twice per year.
- Weed harvesting removes the plant material but must be repeated annually.

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Vegetation and Algae Management - Permitting

- Permitting from the DEEP is required for herbicide application and the hired applicator must be licensed.
- Local permitting may be required, depending on specific IW requirements.
- Paderewski Pond is NOT located in a Aquifer Protection Zone or an NDDB area, so permitting should be straightforward.

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Conclusions and Recommendations

- Historic fish kills have resulted from reduced DO levels in the pond.
- Based upon field monitoring and laboratory analysis of collected samples, the health of the pond is satisfactory at the time of sampling.
  - Significant stratification was not present
  - Contaminants were not excessive
  - Excessive nutrients were not apparent
- Of the three alternatives evaluated, pond dredging offers the most effective long-term management technique to enhancing the ecosystem of the pond.

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Conclusions and Recommendations

- Aeration can provide enhanced mixing and DO distribution throughout the water column, but won't solve the overabundance of weed growth.
- Vegetation management can provide potential short-term improvements, but can also exacerbate the low DO levels by further amassing organic loads in the sediment from deadloss.

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Next Steps

- Study the pond further with a bathymetry survey to facilitate volume calculations and estimated costs and logistics associated with the implementation of a pond dredging solution.
- Further investigate the permitting requirements and applicability of the new US ACE General Permit.

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