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# MUNICIPAL STABILIZATION LAGOONS

- FIELD AND LAB DOCUMENTATION
- LAGOON PROGRAM PERFORMANCE
- COST SAVINGS

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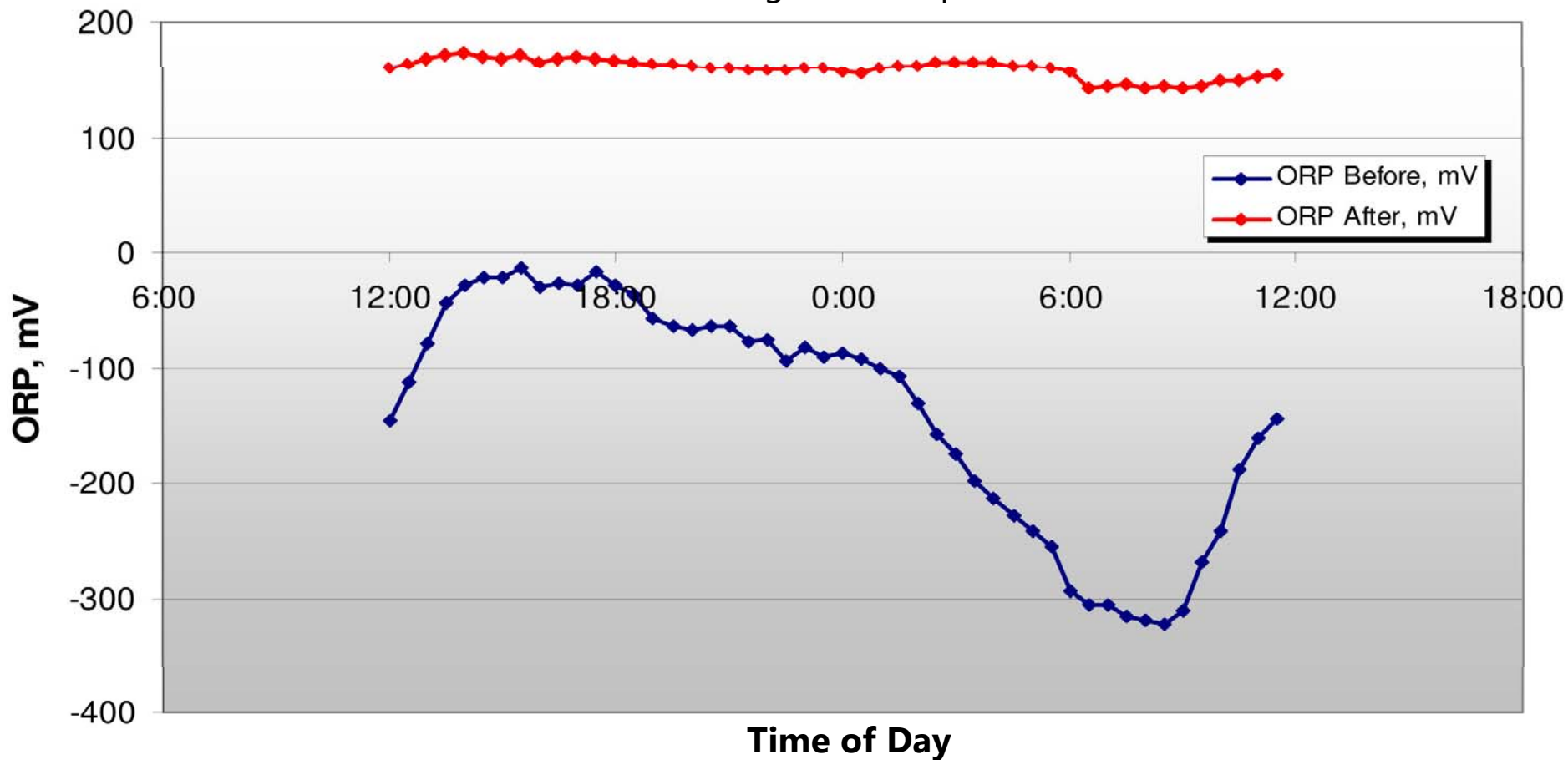
CLEARBROOKE<sup>®</sup>  
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# Northern Michigan Lagoon

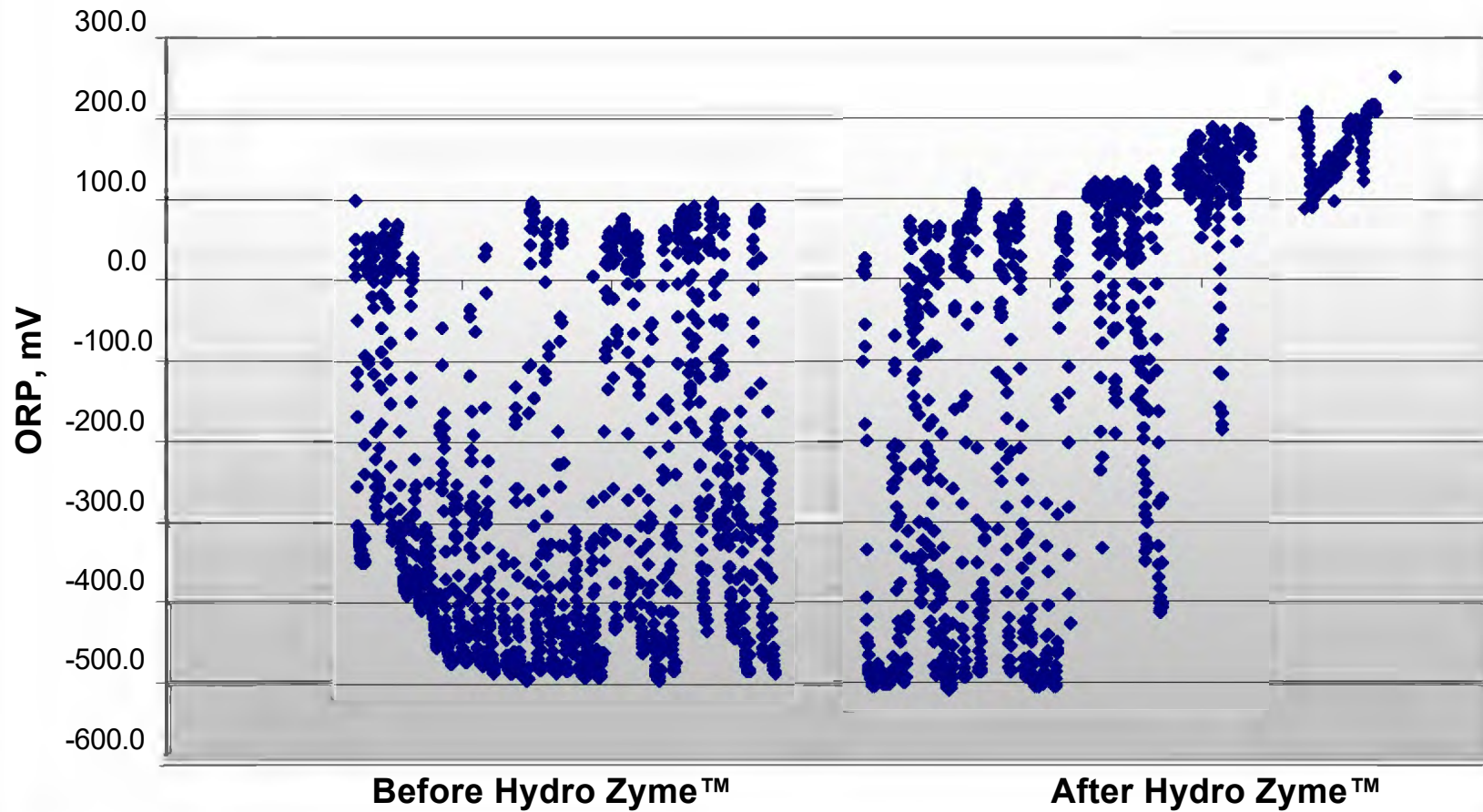
## Oxidation Reduction Potential\* Before and After 5 mg/l Hydro Zyme™ Application

Before Line is the average of all August data  
After Line is the average of all September data



\*Oxidation Reduction Potential is a measurement of waters ability to oxidize contaminants. The higher the ORP the greater the number of oxidizing agents.

## Northern Michigan Lagoon Oxidation Reduction Potential at One Foot

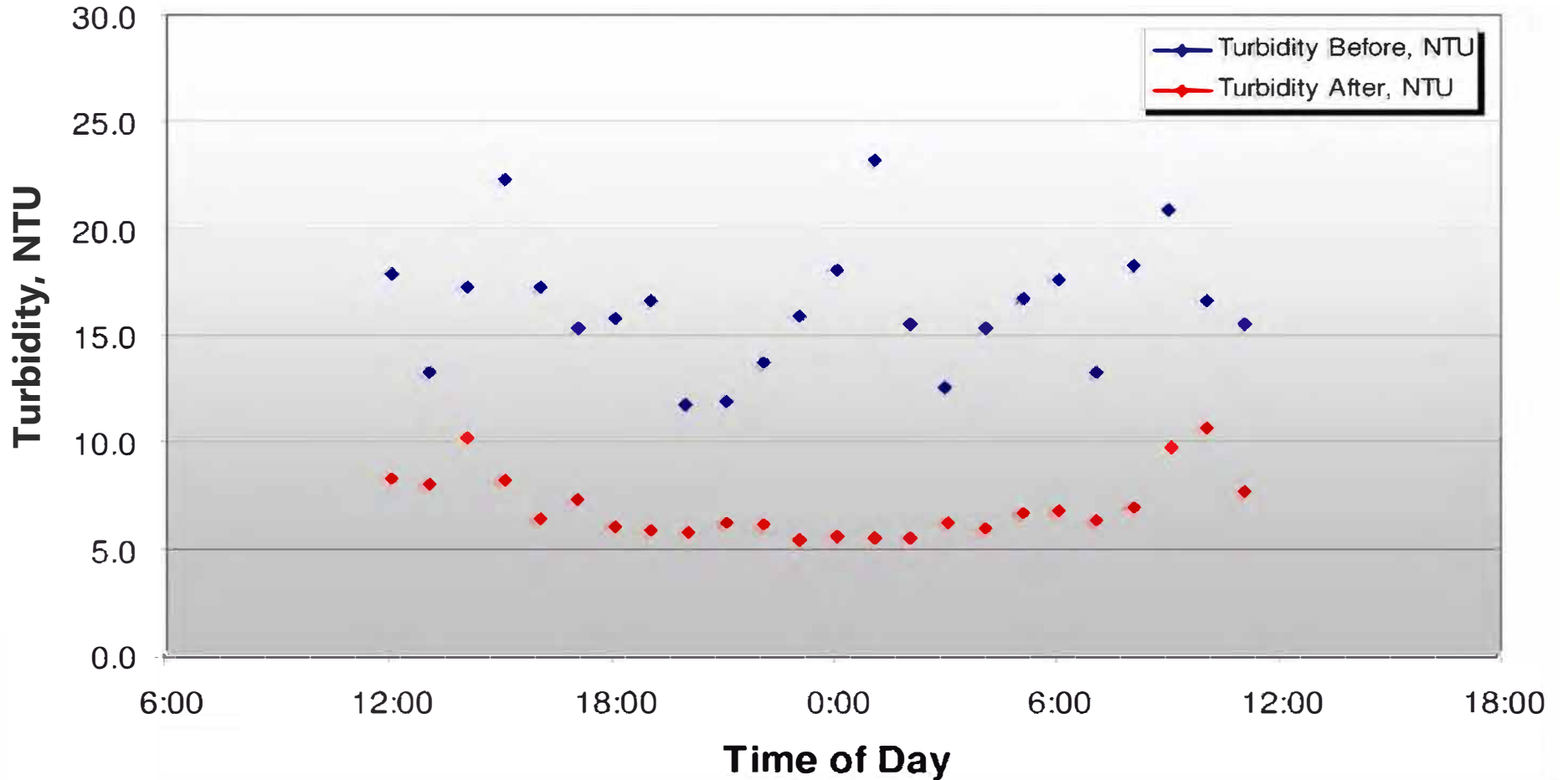




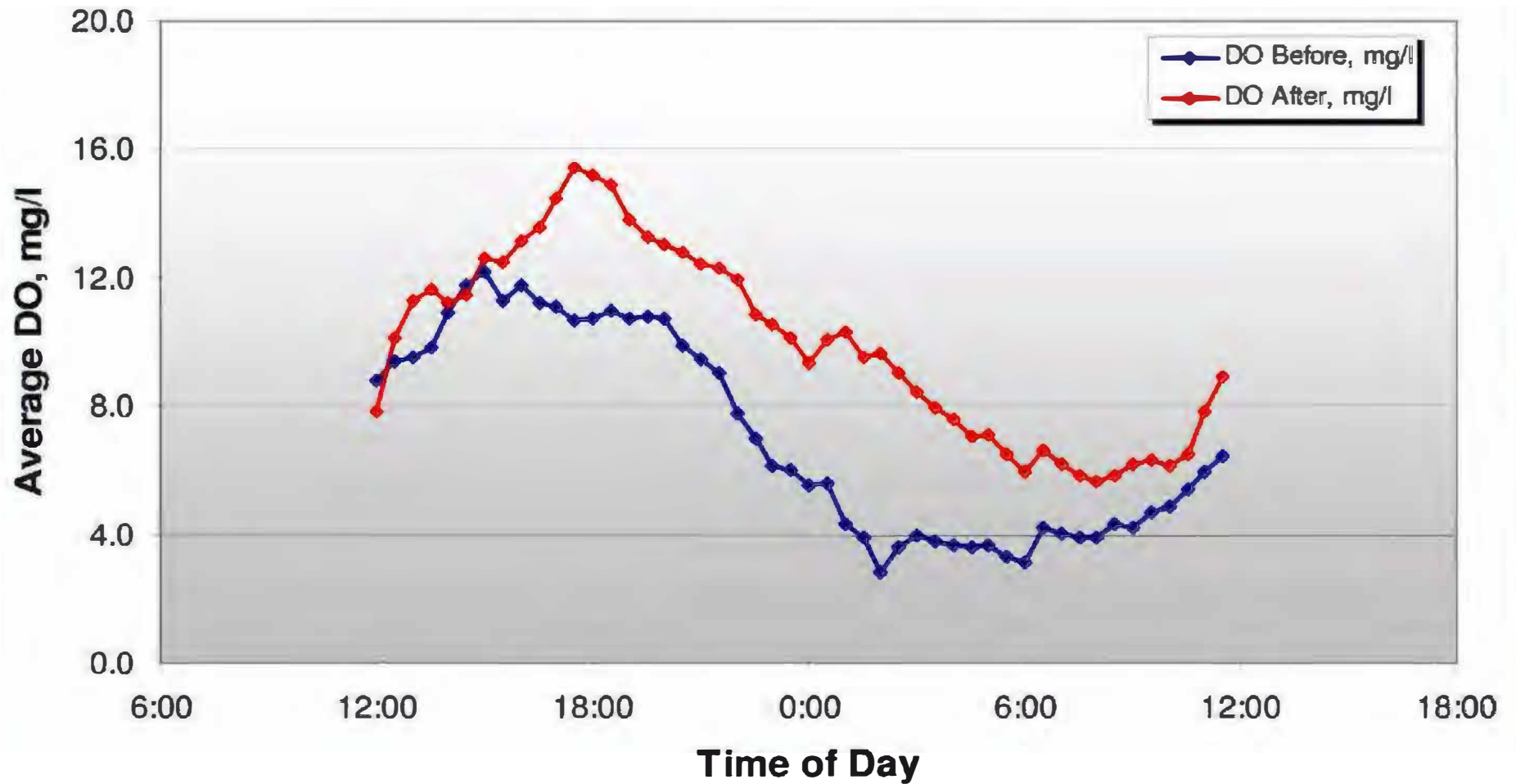
# Northern Michigan Lagoon

## Turbidity/Suspended Solids at One Foot Before and After 5mg/l Hydro Zyme™ Application

Before Line is the average of all August data  
After Line is the average of all September data



# NORTHERN MICHIGAN LAGOON DISSOLVED OXYGEN





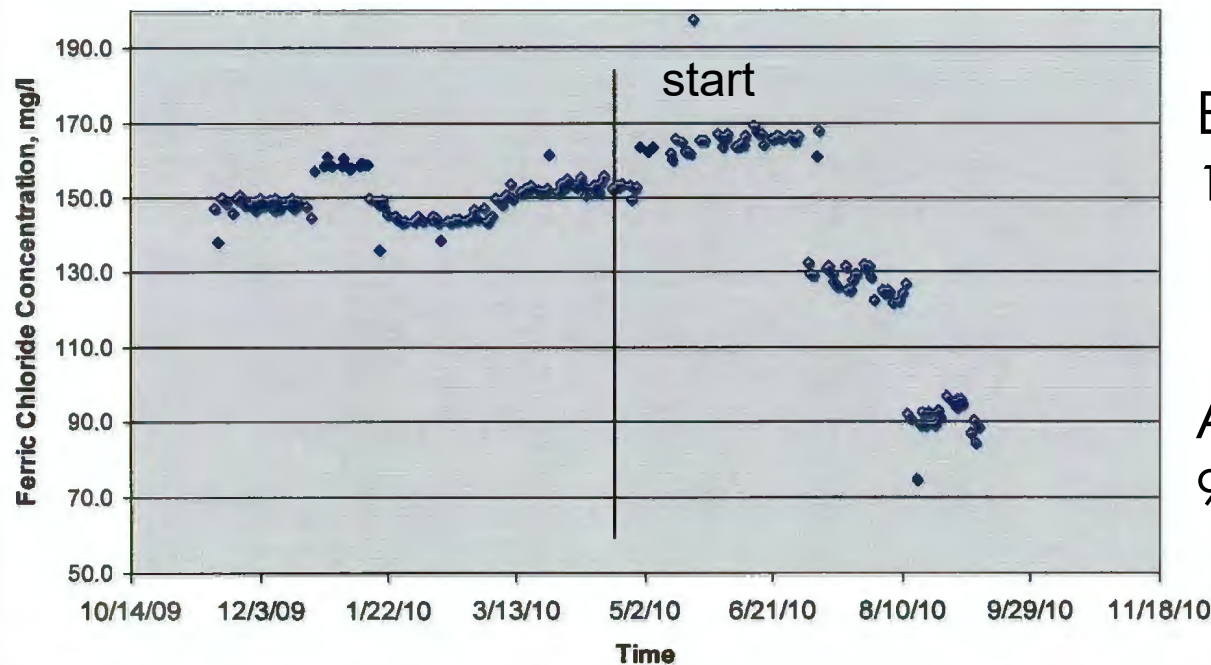
THIS TABLE SHOWS THE AVERAGE INFLUENT VALUES BEFORE AND AFTER THE 0.5 MG/L HYDRO ZYME™ DOSE. THE BEFORE VALUES AVERAGE 25 DAYS IN AUGUST. AFTER VALUES AVERAGE 5 DAYS IN SEPTEMBER.

	<b>DO, mg/l</b>	<b>ORP, mV</b>	<b>Temp, °F</b>	<b>Turbidity, NTU</b>
<b>Before</b>	<b>2.4</b>	<b>-123.9</b>	<b>77.5</b>	<b>13.6</b>
<b>After</b>	<b>7.5</b>	<b>28.0</b>	<b>74.2</b>	<b>8.1</b>

# CENTRAL INDIANA #2

## TOTAL COST TO OPERATE – TREATMENT CHEMICALS

Ferric Chloride Consumption



Before Hydro Zyme™  
158 mg/l → \$30,000/yr

After Hydro Zyme™  
91 mg/l → \$17,000/yr

Annual Savings = \$13,000



# NORTHERN OHIO

## ELECTRIC POWER COST DOCUMENTATION

Monthly Power Cost Before Hydro Zyme™	<b>\$2,166</b>
Monthly Power Cost After Hydro Zyme™	<b>\$436</b>
Annual Savings	<b>\$20,800</b>

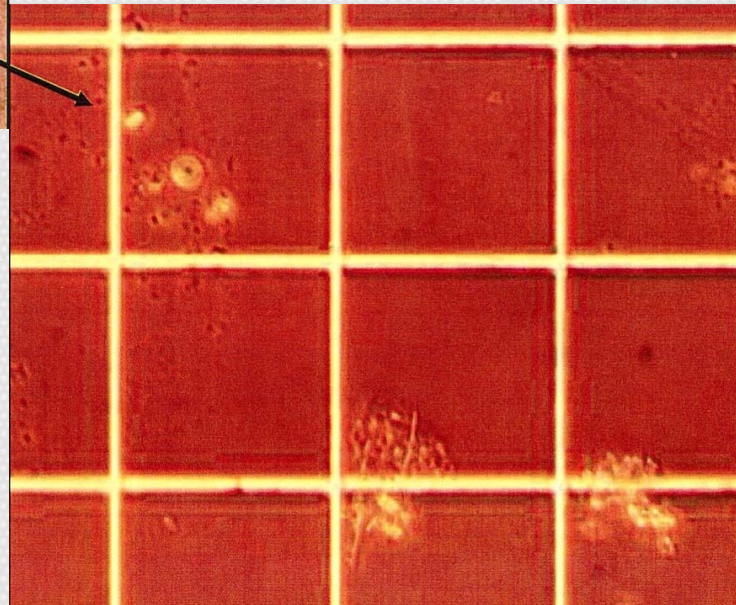
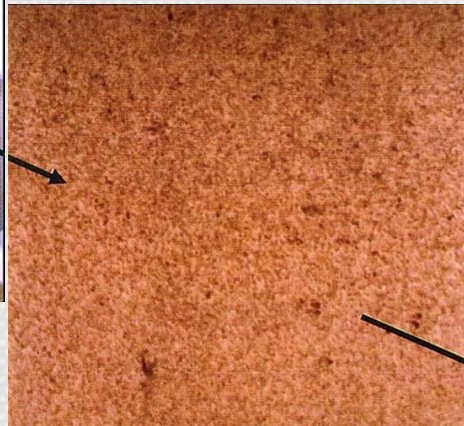
# LABORATORY BASED ALGAE AND BACTERIA STUDIES FOR THE SIMULATION OF STABILIZATION LAGOONS

- Lab-based studies allow for the algae and bacteria to be grown under conditions of controlled light, temperature and mixing.
- Chemical analyses including COD, TSS, Chlorophyll a, Total P, Nitrate, etc. can be performed at the start and end of the experiment.
- Probe-based parameters including pH, ORP and DO can be measured throughout the experiment to show changes as a result of bacterial and algal activity.
- Water samples from oxidation ponds in Indiana and Ohio are cultured in a sterile synthetic wastewater medium.

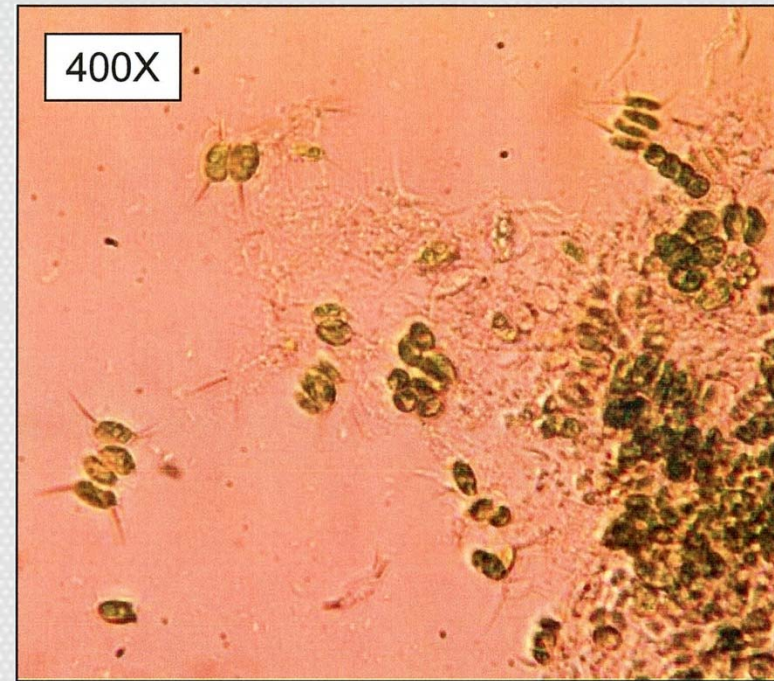
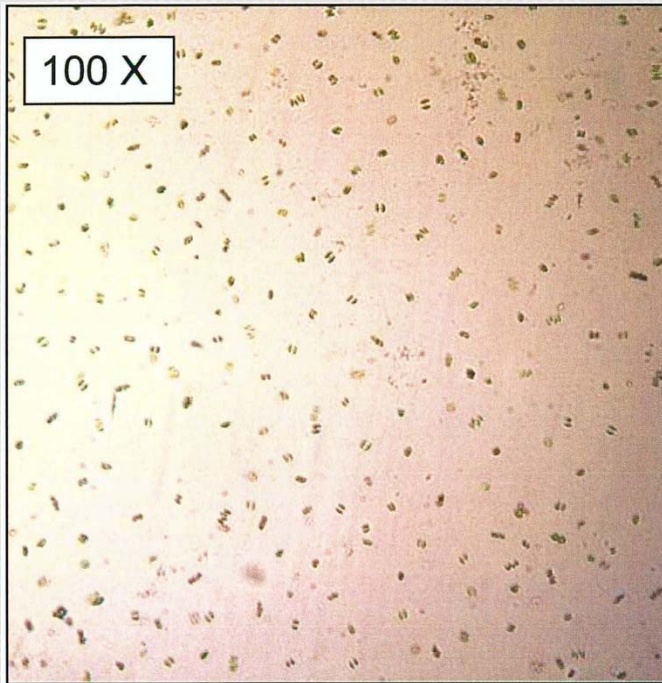




IN STABILIZATION LAGOONS, THERE IS A  
SUSPENDED FLOC COMPOSED OF ALGAL  
AND BACTERIAL BIOFILM





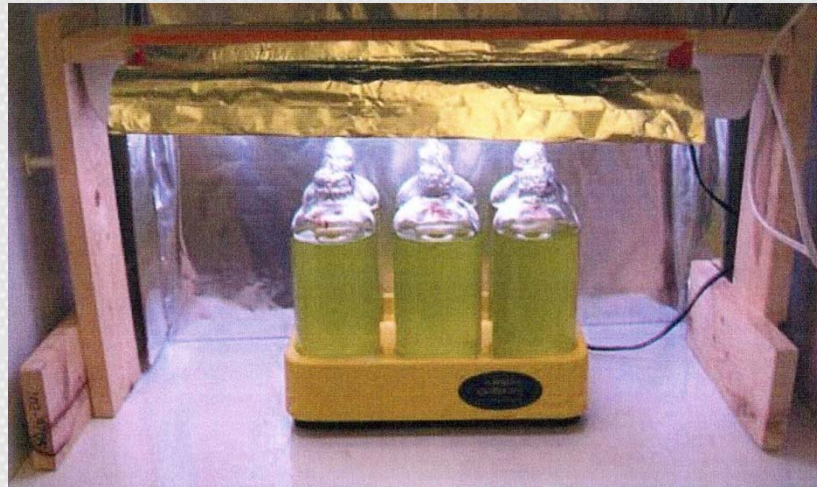


- The algal and bacterial mixture came from a stabilization lagoon and had been grown in the lab for months on a synthetic wastewater medium.
- There were several species of bacteria and algae, but the dominant alga was a green alga.

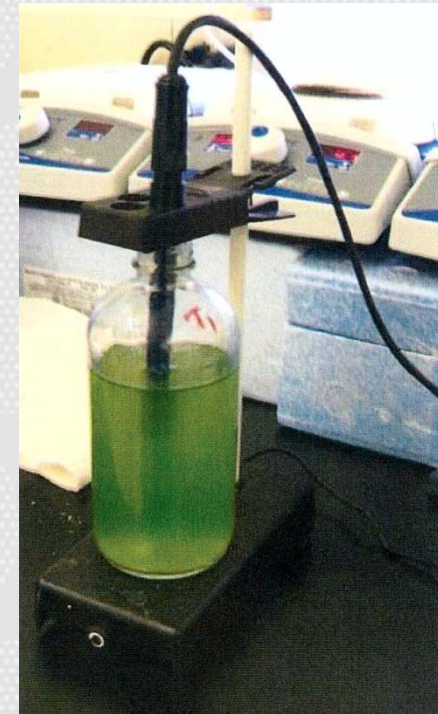




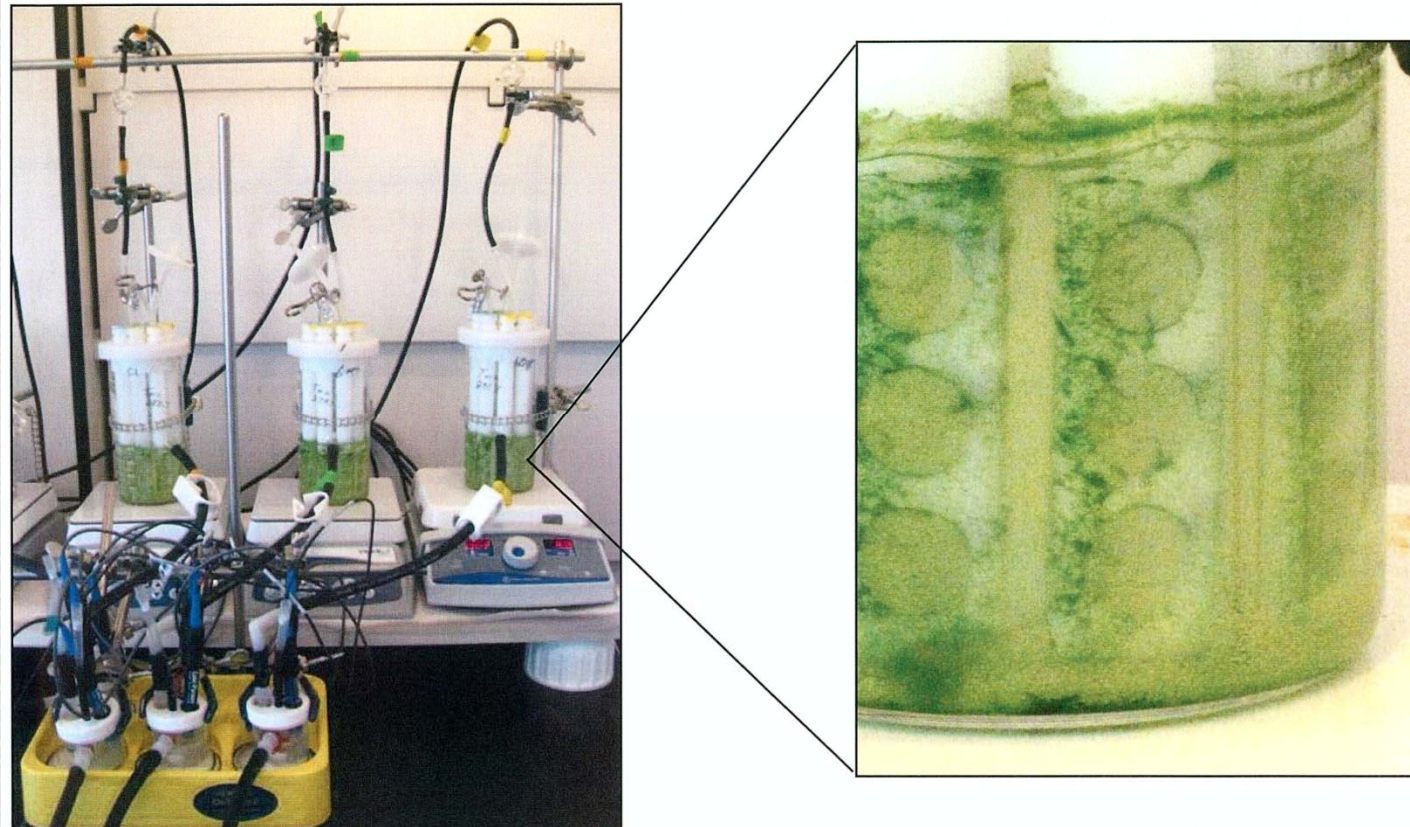
In the lab, we simulate the conditions in oxidation ponds where fixed volumes of mixed algae and bacteria are grown.



Under conditions of controlled light and temperature, dose responses to Hydro Zyme™ can be measured. The measurements include TSS, Oxygen, Chlorophyll, ORP, pH and direct counts of algae and bacteria.







Mixed populations of algae and bacteria can be grown under controlled conditions in the CDC bioreactors and tested for their response to Hydro Zyme™ as algal/bacterial biofilms.



# GROWTH/INHIBITION STUDIES RESULTS AND CONCLUSIONS

- Individual bacteria demonstrate a very positive sensitivity to Hydro Zyme™, resulting in lower systems TCO (Total Cost of Operation).
- The experimental method shows growth near filters that were spotted with appropriate concentrations of Hydro Zyme™.
- On a species by species basis, there is a positive concentration-based response due to the addition of Hydro Zyme™.