

WASTEWATER RESOURCE OPTIMIZATION

AT CHATHAM WATER POLLUTION CONTROL PLANT

Emmanuelle Caws • Alison Cox • Nicole Crone • Mistaya Langridge



BACKGROUND

The Chatham Water Pollution Control Plant (CWPCP) is a typical activated sludge treatment plant that includes biogas collection and a CHP. It treats ~20,800 m³/day Phosphorus is removed through chemical precipitation with FeCl₂ and the sludge is hauled to landfill. WPCP optimization is a growing practice that improves operational efficiency to reduce costs and environmental impacts.

PROBLEM STATEMENT

The CWPCP requires an optimization strategy to increase profit and reduce GHGEs while maintaining effluent water quality. The design must optimize the net energy use and implement a nutrient recovery process. Phase I proposes operational modifications, while Phase II implements capital upgrades.

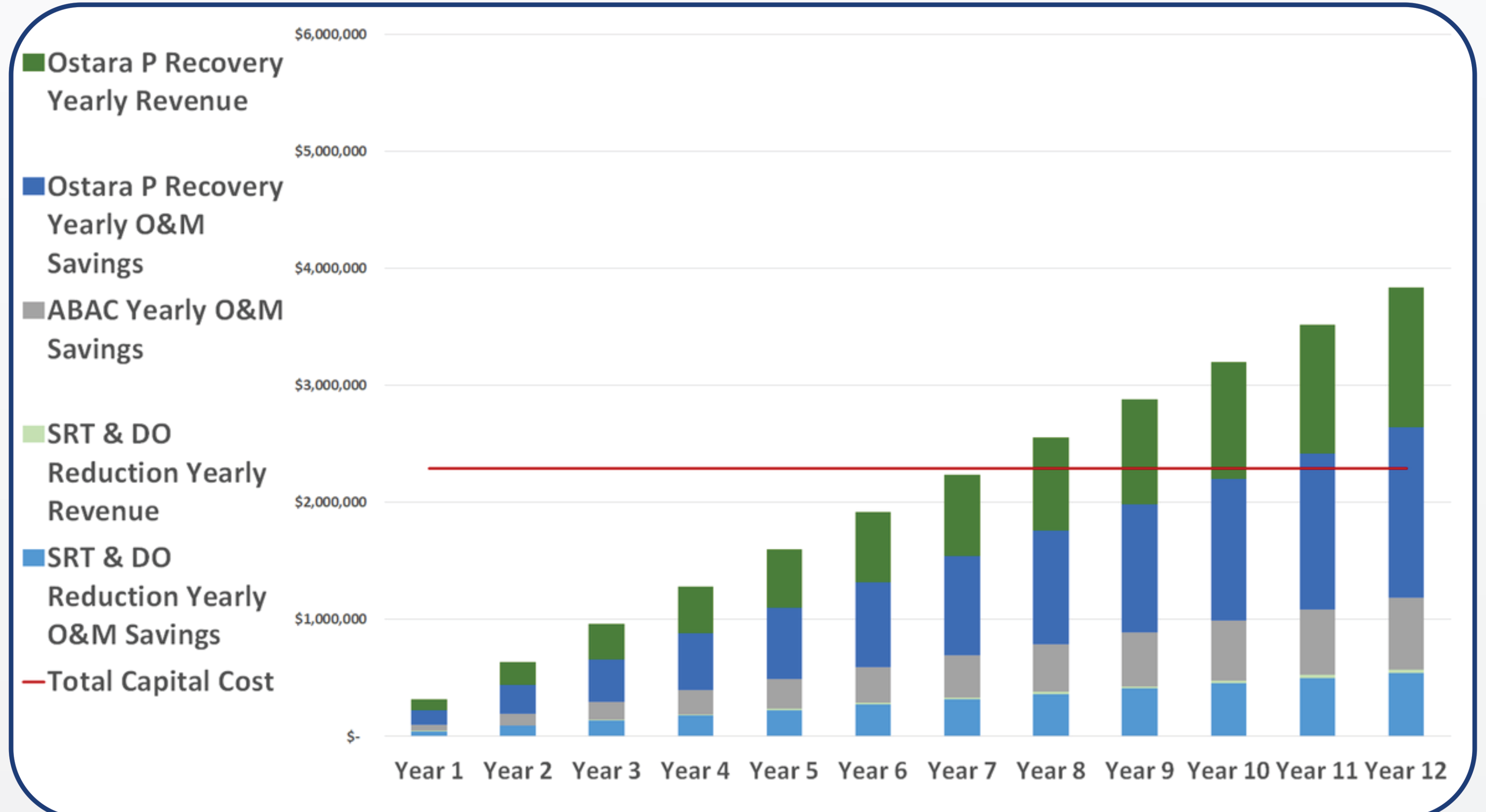


Figure 2: Expected Profit of Final Design over Time

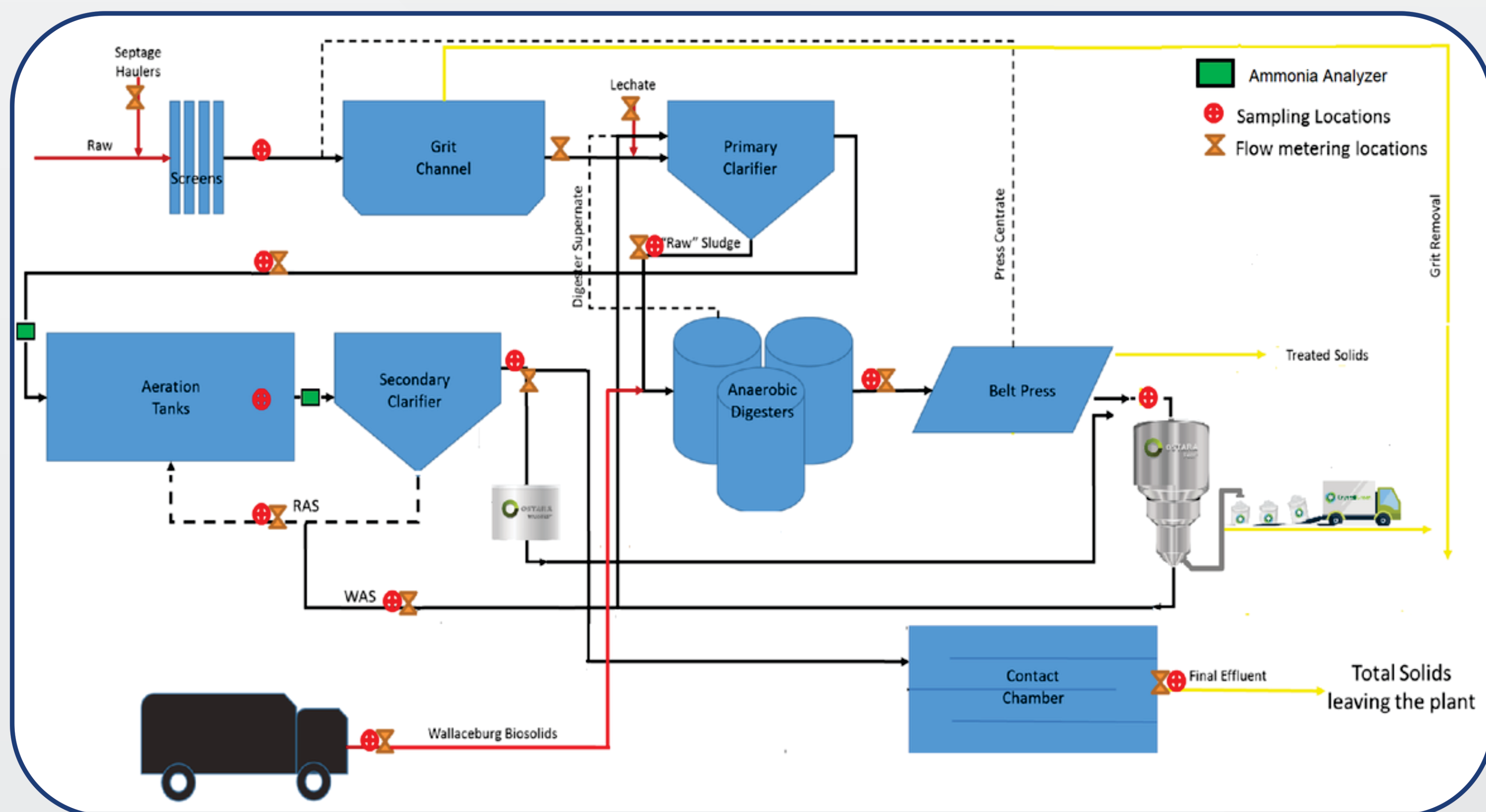


Figure 1: Process Flow Diagram of Phase II Plant Modifications

DESIGN SUMMARY

Phase I

- Reduce SRT to 14.8 days in winter and 10.9 days in summer
- Recommended DO setpoint of 2 mg/L
- Maintain digester temperature of 36-37 °C
- Schedule digester cleaning every 10 years
- Verify instrumentation calibration
- Perform volatile solids reduction study

Phase II

- Implement Ammonia Based Aeration Control (ABAC)
 - Control DO setpoint based on [NH₄] in plant
 - PID controller continuously adjusts blowers
- Enhanced biological phosphorus removal with Ostara struvite precipitation
 - Sell recovered phosphorus as high grade fertilizer
 - Reduce ferrous chloride consumption by 90%
 - Reduce sludge production by 23%

OPTIMIZATION RESULTS

	Capital Cost	Yearly O&M Savings	Yearly Revenue	Payback Period (y)	GHGE Reduction (tonne CO ₂ e/y)
SRT & DO Reduction	0	\$ 45,390	\$ 2,286	0	980
ABAC	\$ 140,000	\$ 51,242	0	2.7	1043
Ostara P Recovery	\$2,150,000	\$121,152	\$ 99,724	9.7	22

CONCLUSIONS

Phase I operational modifications have no cost and should be immediately implemented for energy, cost and GHGE reduction. Phase II recommendations will cost ~2.3 million and will require budgeting. The Phase II payback period of 8.4 years is justified by the benefits of increased revenue, decreased GHGEs, O&M costs and diversion of waste from landfills. Finally, the optimization plan ensures MECP regulations and future Lake Erie Action plan objectives.

Faculty Advisor: Dr. Erica Pensini, Ph.D., P.Eng.

Industry Advisors: Jim Nardi, Mike Green

Acknowledgments: Oliver Schraa, Josh Benoit, Brantford WWTP, CK-PUC

ENGINEERING

