Executive Summary

Company Background

Founded in 1978, the Minnesota Rural Water Association (MRWA) is a non-profit organization that provides technical assistance to and trains personnel at small municipal and non-municipal systems, rural water districts, and wastewater districts with populations less than 10,000. They offer professional services in several areas, including state and federal regulations, fiscal management, system operation and maintenance, source water protections, and more. The Minnesota Pollution Control Agency (MPCA) is the leading organization that monitors environmental quality and enforces environment regulations in the state of Minnesota. Both MRWA and MPCA are partnered with MnTAP to identify nutrient removal solutions for wastewater ponds across Minnesota.

Project Background

Funded through a grant by the Legislative Citizen Commission on Minnesota Resources (LCCMR), the goal of the partnership of MnTAP, MRWA, and MPCA is to work with cities in optimizing the removal of nitrogen and phosphorus from their wastewater. Doing so involves analyzing current operations of their wastewater pond systems, researching best practices, calculating potential improvements, suggesting operational changes, and promoting the implementation of these low-cost solutions. The scope of this project encompasses the wastewater treatment ponds in the cities of Roseau and Warroad.

Incentives to Change

Nutrients in water, namely nitrogen and phosphorus, which come from agriculture, industry, or domestic households pose a serious threat to the health of aquatic environments. With an overabundance of these nutrients, algae are able to grow rapidly in local and international bodies of water. The excessive algal biomass consumes most of the oxygen in the water, leading to the depletion of oxygen and the subsequent death of aquatic animal and plant life in these ecosystems. In order to prevent these negative effects from occurring, the MPCA has placed limits on the phosphorus discharge in the effluents of wastewater ponds

Solutions
Flow Pattern.

Altering the way water flows through a wastewater pond can help immensely in increasing the hydraulic retention time (HRT) and maximizing the depth of water. As the amount of time water stays in the pond system increases, the treatment time increases, leading to better nutrient removal and cleaner discharge water. The overall goal is to keep the wastewater ponds as full as possible over the course of the year, ensuring that as much of the total pond volume as possible is actually being used for treatment time.

Inflow and Infiltration.

Inflow and infiltration (I&I) refers to the unintentional flow of storm water into the sanitary sewer system. It leads to ineffective use of the available volume in a pond, since storm water does not need to be treated but still takes up space, and reduces overall treatment time. Reducing inflow and infiltration by performing dye tests, resealing manhole covers, and inspecting private properties would serve to improve system hydraulic retention time.

Waterfowl Prevention.

Waterfowl, such as geese, contribute heavily to nutrient levels in these ponds in the form of fecal loading. Because waterfowl migration periods tend to align with wastewater pond discharge windows, and waterfowl like to use secondary, polishing ponds, slug loads of nutrients from waterfowl may have adverse impacts on effluent nutrient concentrations. Deterring geese from landing on the ponds during migration periods and deterring nesting at the ponds can lead to a direct decrease in nutrient levels. The use of mylar flags and coyote cutouts are suggested as options worth testing to reduce direct waterfowl nutrient loading into the ponds.

Chemical Phosphorus Removal.

Chemical addition is a common method of addressing phosphorus and is recommended only if lower effluent levels cannot be achieved using the other solutions provided in this report. A cost analysis for four chemicals, ferric chloride, aluminum sulfate, Phoslock, and RE300, was compiled. From this, ferric chloride, with a cost of $21 per lb of phosphorus removed, was recommended. In order to reduce costs associated with the use of a boat or mixer to add chemicals, gravitational addition of ferric chloride solution to the transfer structures between the primary and secondary ponds as water is being transferred was identified as an option worth trialing.

Recommendation	Waste reduced (per year)	Cost savings (per year)	Status
Increase Hydraulic Retention Time (Roseau)	160 lb P	$0	Recommended
Use Mylar Flags, Coyote Decoys, or Similar to Reduce Waterfowl Loading (Roseau)	1050 lb P 5700 lb N	$0	Recommended
Add Ferric Chloride as Chemical Phosphorus Treatment (Roseau)	600 lb P	$0	Recommended

Increase Hydraulic Retention Time by Reducing Inflow and Infiltration (Roseau)	180 lb P	$0	Recommended

Recommendation	Waste reduced (per year)	Cost savings (per year)	Status
Increase Hydraulic Retention Time (Warroad)	280 lb P	$0	Recommended
Use Mylar Flags, Coyote Decoys, or Similar to Reduce Waterfowl Loading (Warroad)	1400 lb P 5000 lb N	$0	Recommended
Add Ferric Chloride as Chemical Phosphorus Treatment (Warroad)	2600 lb P	$0	Recommended
Increase Hydraulic Retention Time by Reducing Inflow and Infiltration (Warroad)	370 lb P	$0	Recommended