



PROJECT TITLE: Wastewater Facility Energy Conservation and Air Pollution Reduction

I. PROJECT STATEMENT

Delivering wastewater treatment services to a small town can be a high-cost effort with significant air pollution impacts due to the energy intensity of the operating equipment and increasing quality requirements of treated water. The Minnesota Technical Assistance Program (MnTAP) proposes to provide technical assistance to wastewater treatment facilities to identify significant energy savings and resulting air emissions reductions by improving the efficiency of aeration systems, providing strategies and assistance to minimize upstream effluent load intensity, and sharing current wastewater treatment best practices and sustainable solutions.

Aerated wastewater treatment is the most effective and flexible method of removing water contaminants from residential, commercial, and industrial sources. Aeration can remove high levels of organic loading that would otherwise contribute to eutrophication of waterways. With careful design and operation, aeration can also remove ammonia, nitrates, and phosphorus. While highly effective, the aeration treatment is energy intensive and typically accounts for half of a plant’s electrical consumption. Energy audits of wastewater facilities conducted under utility programs typically focus on building and lighting efficiency, not process energy use. Assessments at facilities with diffused aeration operations have identified conservation opportunities between 5-30% of a plant’s total electrical consumption.

The work proposed in this project will expand knowledge across other plant sizes/configurations in order to develop energy conservation resources applicable to wastewater facilities across Minnesota. Additional energy savings are anticipated by coupling assessments with upstream source reduction to decrease load to the facility. The goals of the project are:

- Provide fifteen energy assessments for wastewater facility aeration across a range of processes
- Provide training and assistance on source reduction opportunities to reduce facility wastewater load
- Motivate additional conservation through benchmarking, publications, meetings, and training activities

In addition to energy conservation, the proposed program activities are anticipated to contribute to improved regional air pollution levels through decreased emission from energy production and increased water quality.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Technical assistance assessments for energy conservation **Budget: \$146,366**

Provide fifteen technical assistance assessments, approximately five per year, to define energy conservation opportunities for the aeration operations at wastewater treatment facilities across the state. Assessments will include site engagement, data collection, opportunity identification, and site-specific reporting.

Outcome	Completion Date
<i>1. Identify and engage at least 15 facilities, approximately 5/year, for technical assistance</i>	<i>6/2017</i>
<i>2. Conduct site-based assessments of aeration systems and general energy utilization</i>	<i>6/2017</i>
<i>3. Analyze data and generate site-specific energy conservation recommendations</i>	<i>6/2017</i>
<i>4. Write a customized report on energy conservation opportunities for each site</i>	<i>6/2017</i>
<i>5. Present results to site and provide additional pre-engineering assistance as required</i>	<i>6/2017</i>
<i>6. Conduct at least one student intern project to collect data or assist with implementation</i>	<i>6/2016</i>



Environment and Natural Resources Trust Fund (ENRTF)

2014 Main Proposal

Project Title: Wastewater Facility Energy Conservation and Air Pollution Reduction

Activity 2: Technical assistance assessments for load source reduction **Budget: \$20,750**

Provide training and assistance on source reduction to the facilities identified in Activity 1 to reduce wastewater load from upstream customers. Assistance will include a review of client organizations, identification of potential effluent reduction opportunities at these facilities, and source reduction technical assistance assessments at these facilities as needed.

Outcome	Completion Date
<i>1. Evaluate clients for each of the 15 facilities to identify effluent source reduction sites</i>	<i>6/2017</i>
<i>2. Share source reduction strategy resources with facility staff to affect reductions</i>	<i>6/2017</i>
<i>3. Assist facility staff in conducting source reduction assessments as requested</i>	<i>6/2017</i>
<i>4. Evaluate impact of reduced load on wastewater facility operations including energy use</i>	<i>6/2017</i>

Activity 3: Technical assistance case studies and information sharing **Budget: \$41,500**

Informational materials and training will be developed to motivate additional energy conservation adoption. This will be accomplished through performance benchmarking, publications such as MnTAP *Source* newsletter, wastewater publications or local newspapers, and wastewater association meetings.

Outcome	Completion Date
<i>1. Generate materials to train facility operators on aeration operation best practices</i>	<i>12/2015</i>
<i>2. Generate assistance tools to enable facility assessments</i>	<i>12/2015</i>
<i>3. Compile successful case examples to present at POTW operators meetings/webinars</i>	<i>6/2017</i>
<i>4. Compile assessment results to generate benchmark energy performance data for MN</i>	<i>6/2017</i>

III. PROJECT STRATEGY

A. Project Team/Partners

Project partners include: Karl DeWahl UMN, project management and direct technical assistance; A.J. Van den Berghe UMN, technical assistance; Mark Powers, guidance on benchmark tool development; Linda Maleitzke UMN, communications and outreach; Professor William Toscano UMN, principle investigator; and Laura Babcock UMN, Director MnTAP, program oversight and technical input. All listed team members will be covered through ENRTF funding. No additional ENRTF funded partnerships are expected, however partnerships with municipalities and wastewater facilities will be critical for success.

B. Timeline Requirements

The project is scheduled over three years with approximately five of the aeration energy efficiency and upstream source reduction assessments occurring in each year. During year two, benchmarking summaries and case studies will begin to be published to encourage additional facilities through the remainder of the grant period. Generation of resources for publications, presentations, and training will also be developed during year two. Year three will complete the onsite work and finalize state wastewater aeration energy benchmarking.

C. Long-Term Strategy and Future Funding Needs

Energy conservation data specific for Minnesota wastewater facilities will serve as a basis to compare facility operations, provide performance targets for additional facilities, and serve as a guide for future facility investment across the state. The goal of analyzing facilities representing each of the three primary aeration technologies is to provide a benchmark for state-wide operational energy conservation and air emission reduction potential. Training in upstream effluent source reduction provides a basis for improving water quality. Additional facilities will be assessed more easily based on the procedures and targets established in this work.

2014 Detailed Project Budget

Project Title: Wastewater Facility Energy Conservation and Air Pollution Reduction

IV. TOTAL ENRTF REQUEST BUDGET 3 years

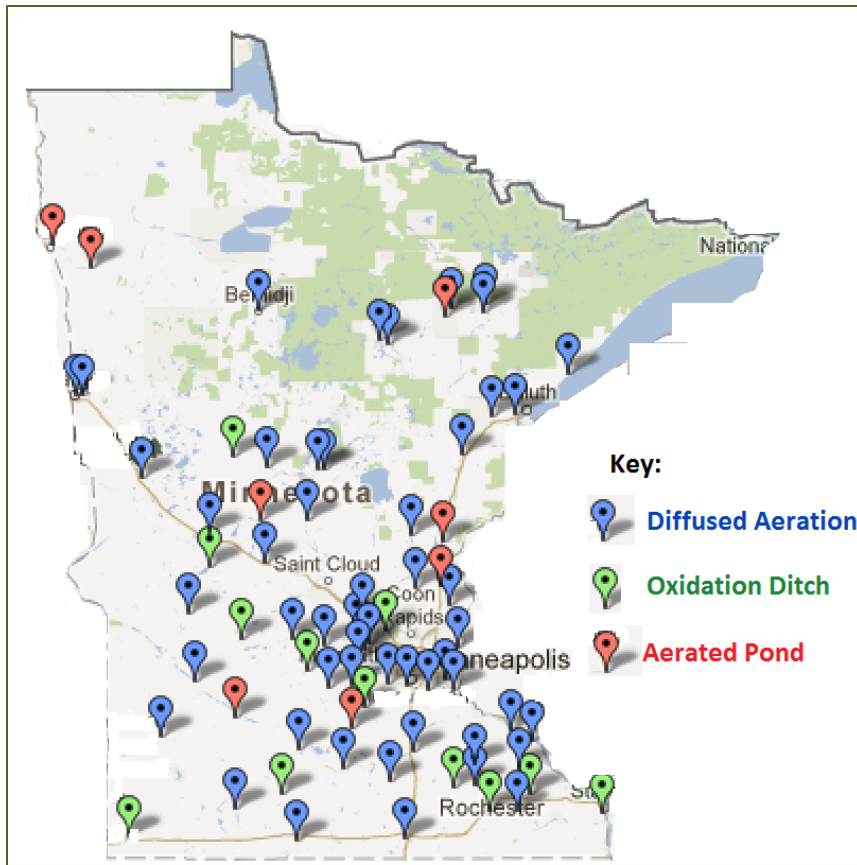
<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel: Project Manager and Technical Assistance Provider - 0.30 FTE per year of project; 66.4% salary, 33.6% fringe benefits	\$ 89,332
Personnel: Technical Assistance Provider - 0.25 FTE per year of project; 63.2% salary, 36.8% fringe benefits	\$ 54,575
Personnel: Principle Investigator all years - 0.01 FTE per year of project; 66.4% toward salary, 33.6% toward fringe benefits	\$ 9,280
Personnel: Director and Technical Expert all years - 0.05 FTE per year of project; 66.4% toward Salary, 33.6% toward fringe benefits	\$ 13,427
Personnel: Technical Expert all years - 0.05 FTE per year of project; 66.4% toward Salary, 33.6% toward fringe benefits	\$ 16,589
Personnel: Communications - 0.05 FTE per year of project, 63.2% salary, 36.8% fringe benefits	\$ 12,413
Personnel: Student Internship summer to assist with implementation and promote training of students in wastewater facility energy conservation	\$ 5,000
Contracts: N/A	\$ -
Equipment/Tools/Supplies: Dissolved Oxygen testing equipment	\$ 2,000
Supplies: Training materials and special issue publication for wastewater facility case studies and results.	\$ 3,000
Acquisition (Fee Title or Permanent Easements): N/A	\$ -
Travel: In state travel to wastewater treatment facilities for technical assistance and training. Some overnight stay may be required to service locations remote from Twin Cities.	\$ 3,000
Additional Budget Items: N/A	\$ -
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 208,616

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ Being Applied to Project During Project Period: Cost share for intern stipend from facility receiving intern assistance.	\$ 2,500	Pending
Other State \$ Being Applied to Project During Project Period: Rent allocation for MnTAP staff work area at McNamara Alumni Center on the University of Minnesota Twin Cities campus. Funding from annual MPCA grant to the University of Minnesota for partial support of MnTAP activities.	\$ 19,047	Secured
In-kind Services During Project Period: Wastewater treatment facility personnel will participate in site audit activities and review the final results of the audit analysis and any upstream analysis conducted. This will require dedication of at least 10 hours effort from on site staff at each facility choosing to participate in the program or 150 hours effort for the project. Value dependent on compensation rates. (estimate \$50/hr x 150 hr = \$7,500)	\$ 7,500	Pending
Remaining \$ from Current ENRTF Appropriation (if applicable):	\$ -	NA
Funding History: US EPA Region 5 Water Quality Cooperative Agreement, EPA-R5-WQCA-2010, "Energy Efficiency Demonstration Projects and Audits for Minnesota's Wastewater Treatment Plants" - 5/2011 to 7/2013. Work launched facility energy use assessment and benchmarking to identify major energy use processes in wastewater facilities practicing activated sludge operations. This work was the foundation for the efforts proposed in this application.	\$ 99,674	EPA Project concludes 7/31/2013



MN Wastewater Treatment Plants with Aeration Systems (excludes large facilities)



The map represents the 110 locations of wastewater treatment plants with the three common aeration processes in small to medium population cities.

Aeration Process Facts:

- Half the treatment plants in the state are included in this category.
- These facilities consume more than one third of the electricity associated with wastewater treatment across Minnesota.
- Aeration operations are the largest part of this energy consumption.

Energy Use and Air Pollution Contribution from MN Wastewater Facilities with Aeration

Aeration treatment facilities (excludes large facilities)	110
Electrical consumption (kWh/yr)	3.2 billion
Air pollution from electrical generation (lb/yr)	
CO ₂	5.2 billion
SO ₂	13 million
NO _x	7.3 million
Mercury (Hg)	100
CO ₂ equivalents	35,000 homes or 49,000 cars

Project Impact Opportunity

Consumption of electricity results in air pollution from the electricity generation process. Energy conservation efforts at wastewater treatment facilities have the potential to decrease a portion of local utility demand. This reduced demand decreases the associated regional air pollution contribution. Air pollutants impact climate change, acid rain, as well as human and environmental health.



Environment and Natural Resources Trust Fund (ENRTF)

2014 Main Proposal

Project Title: Wastewater Facility Energy Conservation and Air Pollution Reduction

#6 Project Manager Qualifications & Organization Description

Organization

MnTAP is an industrial and institutional outreach and assistance program at the University of Minnesota that provides industry-tailored solutions to prevent pollution at the source, maximize efficient use of resources, and reduce energy use and costs to improve public health and the environment. MnTAP has built a reputation for developing feasible solutions, building relationships with companies, and assisting with implementation including collecting data and documenting results. MnTAP’s technical staff members have engineering and science backgrounds including chemical, civil, and mechanical engineering, as well as chemistry.

Project Team

The lead staff member, Karl DeWahl (612-624-4645, dewah001@umn.edu), has extensive experience with a variety of industry areas. Karl’s expertise includes: conducting energy assessments at larger wastewater treatment plants; oversight of energy intern projects at wastewater treatment plants; well pump energy analysis for a city water distribution system; water reduction at a city water treatment facility; assisting metal finishing and metal fabricating companies with pollution prevention and addressing questions on industrial cleaning processes, industrial water use, and other energy efficiency issues related to compressed air, fan, and steam systems.

Staff / Title	Background	Experience	Responsibility
Karl DeWahl <i>Team Leader and Senior Engineer</i>	Chemical Engineer, Certified Energy Manager	Pollution prevention, hazardous materials, industrial cleaning processes, industrial water use, energy efficiency, air and water regulations	Serve as project lead and conduct trainings and assessments
AJ Van den Berghe <i>Associate Engineer</i>	Chemical Engineering, Environmental Science, Corporate Environmental Management	Pollution prevention, water conservation, energy use benchmarking, and process energy efficiency analysis for wastewater treatment, laundry, printing, hospitality, and healthcare	Serve as project team member, conduct trainings and assessments
Mark Powers <i>Engineering Coordinator</i>	Chemical Engineering	Industrial energy efficiency	Internal technical resource
Laura Babcock <i>Director</i>	Chemistry	Chemistry, industrial process technology	Programmatic oversight and input
Linda Maleitzke <i>Communications Specialist</i>	Marketing and communications	Technical writing, marketing, and outreach; intern program coordinator	Lead marketing and outreach efforts, coordinate partnerships and events
Dr. William Toscano <i>Division Head, Environ. Health Sciences</i>	Toxicologist	Public health	Principal Investigator, technical program oversight