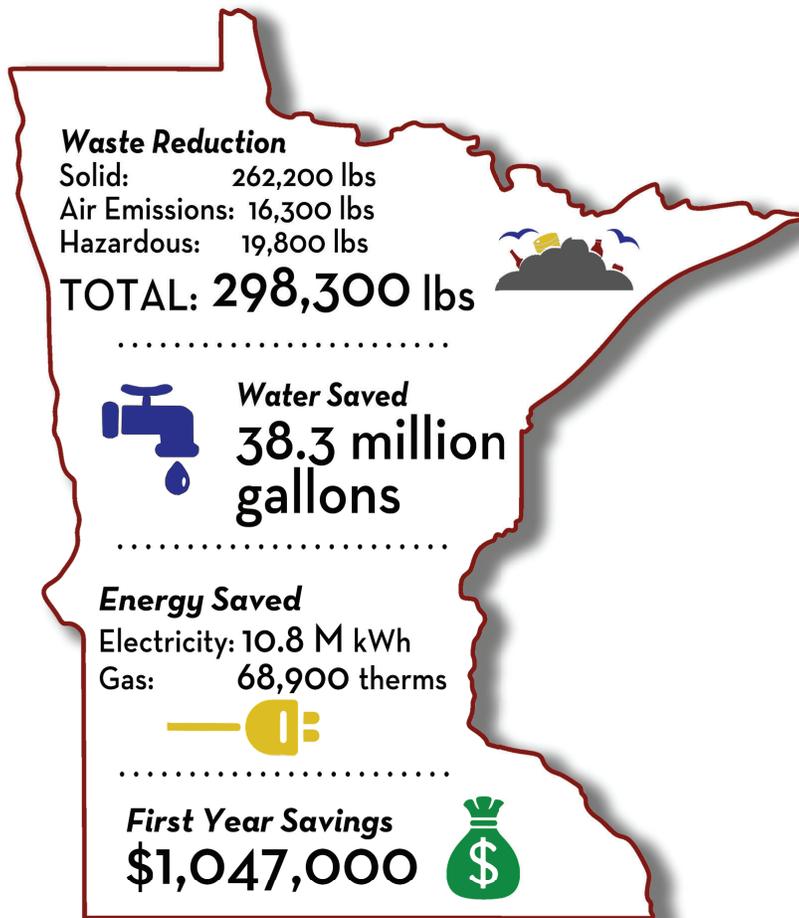


IMPACT

Minnesota Technical Assistance Program

2021 Annual Report



Strengthening Minnesota businesses by improving efficiency while saving money through energy, water, and waste reduction.



About MnTAP

The Minnesota Technical Assistance Program (MnTAP) is an outreach and assistance program at the University of Minnesota, School of Public Health, Division of Environmental Health Sciences. MnTAP helps Minnesota businesses and organizations develop and implement tailored solutions that prevent pollution at the source, maximize efficient use of resources - including water and energy - reduce costs, and improve public health and the environment.

Realizing a need for waste reduction and pollution prevention assistance, the Minnesota legislature amended the Waste Management Act in 1984 to “provide for the establishment of technical and research assistance for generators of hazardous and industrial waste in the state.” The Minnesota Toxic Pollution Prevention Act, enacted by the legislature in 1990, directed the Minnesota Office of Waste Management to “establish a pollution prevention assistance program” for all persons in the state using, generating, or releasing toxic pollutants, hazardous substances or hazardous wastes. Today, the Minnesota Pollution Control Agency (MPCA) supports this assistance with funding to the

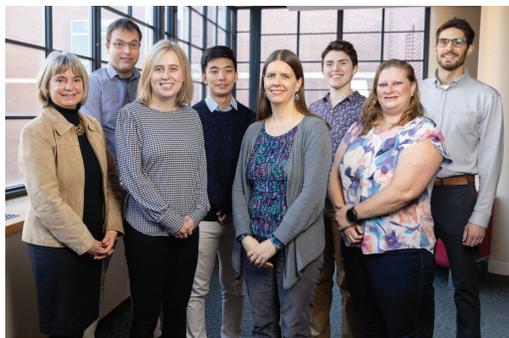
University of Minnesota, School of Public Health to support MnTAP efforts across the state. MnTAP has leveraged this funding to win additional competitive grant funding totaling 45% of the FY2021 budget.

Pollution prevention technical assistance is customized for businesses through site visits, student internships, the Minnesota Materials Exchange, workshops and website resources. Since MnTAP’s inception in 1984, staff members have

- Conducted over 4,968 site visits at facilities throughout the state
- Provided solutions to save businesses \$56.4 million in first year savings through avoided costs
- Helped businesses avoid regulatory burdens and reduce their environmental impact

Savings resulting from MnTAP assistance can be reinvested by businesses for improvements, expansions and new jobs while supporting local economies, preserving Minnesota’s natural resources and promoting regional public health.

MnTAP Staff Members



Front: Laura Babcock, Kira Peterson, Jane Paulson, Alaina Ryberg
Back: Jon Vanyo, Daniel Chang, Gabrielle Martin, Matt Domski

*Left MnTAP during 2021: Michelle Gage and Brent Vizanko

Not shown: Laura Sevcik

Laura Babcock, PhD

Director

Daniel Chang

Associate Engineer

Matt Domski

Intern Program Manager

Michelle Gage*, CEM

Engineer, Risk Assessment Specialist

Gabrielle Martin, CEWP

Associate Engineer

Jane Paulson

Senior Engineer

Kira Peterson, PE, CEM

Engineer

Alaina Ryberg

Website and Data Manager

Laura Sevcik, CWEP

Associate Engineer

Jon Vanyo, CEM

Engineer

Brent Vizanko*, EIT, CEM

Associate Engineer

Technical Assistance Delivered Across Minnesota

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Director's Note

A bright spot of the year was the opportunity to support 14 student internships over the summer and working with numerous undergraduate students on a variety of projects during the spring and fall terms of 2021. Outputs for the year include engagement with **360 organizations** across the state with **61 site visits** at 48 unique facilities. Forty-one facilities have implemented 64 MnTAP recommended process changes and realized reductions totaling over **38 million gallons of water, 298,300 pounds of waste, 10.8 million kWh** and **68,900 therms of fuel energy**. Combined, these reductions are **saving companies over \$1.0 million in first-year savings**.

Highlights of MnTAP's efforts in 2021 include:

- Providing technical assistance to businesses seeking to implement alternatives to TCE in advance of the Minnesota ban, effective June 1, 2022. Annual TCE reduction of 22,000 lbs. has been implemented, with an additional 18,000 lbs. in progress.
- Developing and posting several new resources designed to help businesses identify ways to conserve water, use less energy in small refrigeration systems and optimize water softener chloride use. www.mntap.umn.edu/resources/tools-calculators
- Launching a new project to train wastewater operators on basic operational energy efficiency measures. The first of 11 training cohorts was completed in 2021 with over 1 million kWh electric energy and \$87,000 saved.
- Providing four financial assistance awards totaling \$17,000 to facilities transitioning away from perchloroethylene (PERC) in dry cleaning businesses. A total of 2,860 lbs. of PERC has been eliminated.

MnTAP continues to contribute to Minnesota's economic well-being by reducing waste at the source and training the next generation of engineers through the MnTAP Intern Program and student projects. This report shares stories about the value found in the wide-ranging projects supported in 2021. The companies and organizations engaged in these projects are making their businesses more resilient by reducing waste, optimizing processes and saving money while helping to sustain Minnesota's environment. We thank our clients, partners and sponsors for the collaborations during 2021, and we look forward to serving YOUR business in 2022.

Laura Babcock

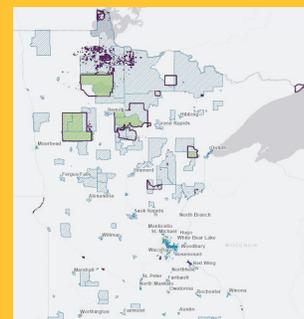
Director, Minnesota Technical Assistance Program

MPCA's Long Term Goals: Environmental Justice

MnTAP supports the Minnesota Pollution Control Agency's commitment to "ensuring that pollution does not have a disproportionate impact on any group of people. This means that all people—regardless of race, color, national origin or income—benefit from equal levels of environmental protection." In 2021, MnTAP conducted technical assistance activities at 25 facilities that are located in Minnesota areas of environmental justice concern. MPCA considers an area of concern for environmental justice if it meets one or more of the following criteria:

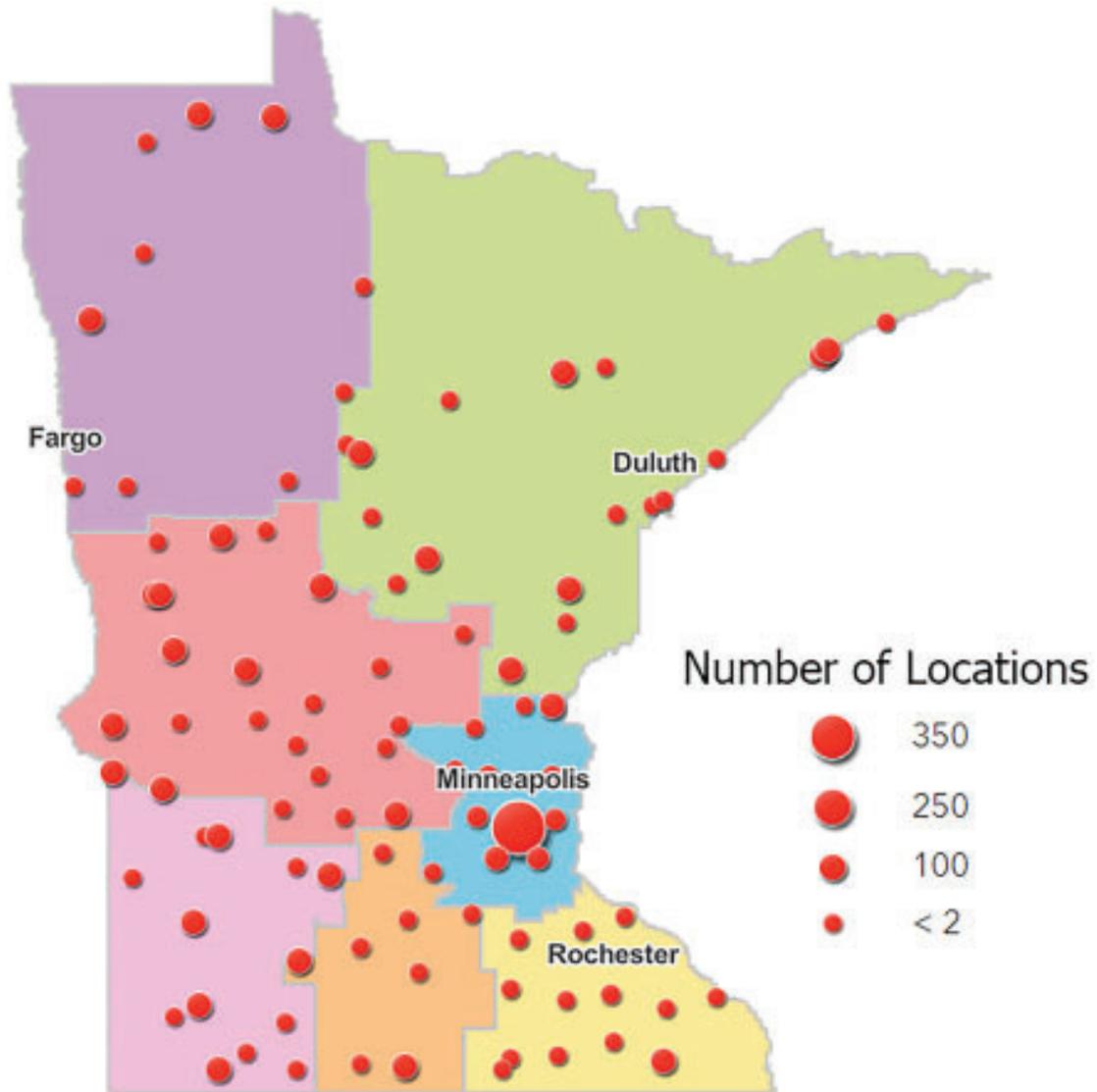
- 50% or more of residents are people of color
- >40% of the households have a household income <185% of the federal poverty level
- Federally recognized tribal areas

MnTAP will act on our commitment to provide pollution prevention technical assistance in environmental justice communities by responding quickly to requests for assistance, seeking outreach opportunities and promoting project activities that have the potential to positively impact environmental outcomes in these areas.



MnTAP Contributes to Minnesota's Economic Well-Being

MnTAP Impacts 2017-2021		
Number of Companies Assisted		1,724
Water Reduction (gal)	Recommended	550,000,000
	Implemented	161,000,000
Electric Energy Reduction (kWh)	Recommended	41,000,000
	Implemented	26,000,000
Waste Reduction (lbs)	Recommended	11,600,000
	Implemented	3,600,000
Gas Energy Reduction (therms)	Recommended	1,100,000
	Implemented	400,000
Cost Savings	Recommended	\$8,800,000
	Implemented	\$5,400,000





2021 Outcomes

Activity	Waste			Energy		Water	Savings
	Air Emissions (lbs)	Hazardous Waste (lbs)	Non-Hazardous/Solid Waste (lbs)	Electric (kWh)	Fuel (therms)	(Gallons)	(\$)
Site Visits	16,300	17,700	109,200	1,100,000	1,700	100,000	\$106,000
Interns	0	2,100	153,000	9,700,000	67,200	38,200,000	\$941,000
TOTALS	298,300 lbs			10,800,000	68,900	38,300,000	\$1,047,000

2021 Outputs

Technical Assistance Activity	2019 Results	2020 Results	2021 Results
Contacts (calls/emails/meetings)	1,198	1,290	1,146
Requests for Assistance	92	86	73
Total Staff Site Visits (unique facilities)	124 (78)	70 (57)	61 (48)
Student Interns	16	20	14
Events and Presentations	41	25	43
MnTAP Website Unique Visits	40,000	43,100	61,298

On-Site Assistance

2021 Outputs

61 on-site visits
48 unique facilities
73 requests for assistance
360 unique org interactions

2021 Outcomes

298,300 lbs waste
38.3 million gal water
10.8 million kWh
68,900 therms of fuel
\$1,047,000 annual savings

What they said...

“MnTAP’s first-rate staff of engineers, scientists and interns continue to deliver innovative solutions every year that lead to outstanding results in the face of an ongoing pandemic. We deeply appreciate the exceptional assistance they provide in helping MPCA achieve our goals of conserving resources, preventing pollution and strengthening Minnesota’s economy.”

- Mark Snyder,
Pollution Prevention Lead,
MPCA

2021 Goals

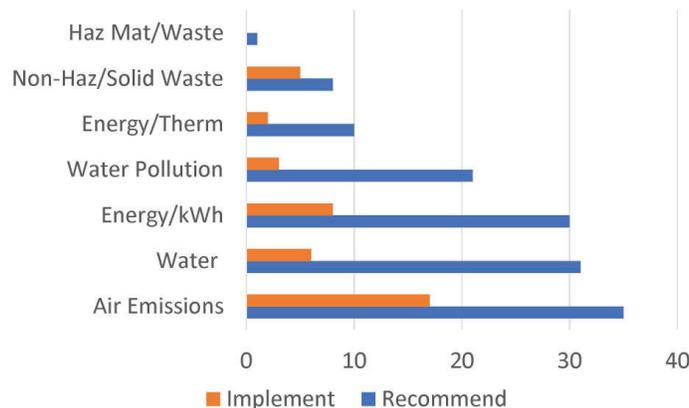
Conduct 125 site visits at 75 different facilities to identify opportunities for companies to prevent waste and pollution and conserve resources, including water and energy. Support Minnesota businesses by responding to questions on waste generation and resource utilization.

2021 Accomplishments

Site visit activities continued to be low during 2021 due to the Coronavirus pandemic, high MnTAP staff turnover and client staffing shortages. Even with these limitations, MnTAP staff members were able to interact with 360 facilities in person or via phone or email. MnTAP staff made **144 recommendations with a value of \$1.39 million** for resource conservation at Minnesota businesses in 2021 from all onsite services. Of the recommendations made during 2021 engagements, 42 have been implemented or 29% were recommended and implemented in the same year.

MnTAP received an unsolicited **73 requests for assistance** in 2021. Of the requests received, 47% were for technical assistance, 8% were for assistance with MPCA loan or grant applications, 26% were for general information about MnTAP program activities, and 19% requested information on regulatory issues.

2021 First Year Implemented Recommendations



Project Success: Industrial Chloride Reduction

At high levels, chloride is toxic to aquatic life and impacts biodiversity. Chloride levels in Minnesota lakes and rivers are rising. A common source of chloride in Minnesota is ion exchange water softeners, which typically use sodium chloride to regenerate. The sodium ions exchange with calcium and magnesium ions, but the chloride runs down the drain. MPCA funded a MnTAP intern project in 2021 to create a set of industrial water softening best management practices.

The intern identified best practices to optimize industrial water softeners and created an optimization flowchart that can be used to identify actions to reduce salt use. Additionally, the intern performed 5 site visits to companies with water softeners and provided recommendations to each company, with a total potential annual savings of 300,000 gallons of water, 60 tons of salt, and \$16,000. The most common recommendations were to change the hardness setting to match the incoming water hardness, lower the salt dosage, and replace the resin bed.

Water softeners are not the only source of chloride in industrial facilities. There may be product additives and process aids used in different industries that have chloride. For example, brine is used in the food processing industry for cheeses, meats, and pickles. MnTAP is continuing research into chloride sources and ways to reduce chloride effluent from Minnesota businesses.



On-Site Assistance: Intern Program

2021 Outputs

- 14 intern and student research projects serving 26 facilities
- 22 company applications processed
- 135 student applications

What they said...

“Working with the MnTAP internship program has been such a wonderful experience.

This valuable work has recommended ways to reduce chloride entering Minnesota’s water resources from the facilities engaged and provided a process that many more facilities can learn and benefit from.”

- Brooke Asleson,
Chloride Program Administrator
at MPCA

Funding Partners

- Minnesota Pollution Control Agency
- Metropolitan Council Environmental Services
- Clean Water Land and Legacy Amendment
- Xcel Energy
- Environment and Natural Resources Trust Fund



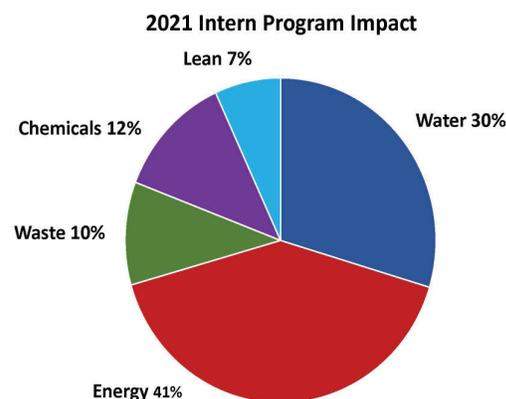
2021 Goals

Place students and interns with businesses to identify and implement pollution prevention, water conservation and energy efficiency solutions.

2021 Accomplishments

MnTAP guided 14 intern projects in 2021. MnTAP interns come from a variety of disciplines. In 2021, chemical, mechanical, bioproducts and biosystems engineering as well as environmental science, computer science and political science were represented. Most interns attended the University of Minnesota Twin Cities campus, one attended the University of Minnesota Duluth Campus, one attended the University of Wisconsin-Madison and one attended The University of St. Thomas. This summer’s projects focused on water conservation, energy efficiency, waste reduction and alternative chemical use.

Read more about MnTAP’s intern projects in our annual program summary, Solutions: www.mntap.umn.edu/resources/solutions.html



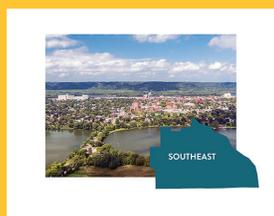
2021 Outcomes - Intern Program Implementation

Project Year(s)	Waste (lbs)			Energy		Water (gallons)	Savings
	Air Emissions (lbs)	Hazardous Waste (lbs)	Non-Haz/Solid Waste (lbs)	Electricity (kWh)	Gas (therms)		
2017	4,400	39,300	344,000	1.5 million	192,000	28.1 million	\$807,000
2018	12,000	44,500	268,000	4.5 million	59,000	17.5 million	\$731,000
2019	400	51,000	235,000	5.3 million	55,000	26 million	\$1,030,000
2020	--	121,250	738,900	1.1 million	23,400	7.9 million	\$1,100,000
2021	--	2,100	153,000	9.7 million	67,200	38.2 million	\$941,000

Partner Highlight: MN Department of Employment and Economic Development, Southeast Region

We like to say it takes a village to support the MnTAP Intern Program, from identifying and engaging company facilities to providing financial and technical resources. Sometimes the help we get from others can be as simple as an introduction. Business Development staff with the Minnesota Department of Employment and Economic Development (DEED), Southeast Region did just that in 2021. DEED is the state’s principal economic development agency and promotes business recruitment, expansion, and retention; international trade; and workforce and community development. In this function, regional offices are often on the front line to provide a variety of assistance and services to keep Minnesota businesses thriving.

In early 2021, DEED Southeast Business Development Manager Natalie Siderius introduced MnTAP to businesses in Rice County. The result of this connection was two highly successful intern projects that identified and implemented projects that will save 4.5 million gallons of water and up to \$73,000 in annual avoided costs for water, sewer, raw materials and energy.



General Outreach & Communications

2021 Outputs

8 Source newsletters
 5 P2 Week mini-webinars
 2020 Impact
 2021 Solutions
 43 presentations, booths
 and training events
 9 case studies

2021 Outcomes

4,400 Source newsletter
 subscribers
 29,298 new website users
 61,298 website page views

2021 Goals

Develop and disseminate technical information for Minnesota businesses to help them implement pollution prevention and energy efficiency practices and technologies. Promote MnTAP services and results through publications and presentations.

2021 Accomplishments

Communication methods included electronic newsletters, targeted email campaigns, project-specific printed materials, webinars, and many conversations. Highlights include:

- Presenting at 26 events on industry-specific topics, such as wastewater optimization
- Training on energy efficiency in wastewater treatment facilities
- Presenting on pollution prevention and intern program opportunities in classes
- Creating a series of 5 mini-webinars to highlight pollution prevention and other source reduction projects for P2 Week 2021.
- Participating on the planning committee for the 2021 Salt Symposium put on by Fortin Consulting, and presenting at the August virtual symposium on industrial salt use in Minnesota.



P2 Week Webinars

Pollution Prevention (P2) Week celebrates the practices that reduce or prevent pollution from being released into the environment using source reduction—that is, eliminating sources of waste BEFORE they are created. This year, to celebrate P2 Week from September 20 to September 25, MnTAP created and shared a series of mini-webinars that highlight success stories in aspects of pollution prevention or source reduction. Recordings of these mini-webinars can be viewed on the MnTAP website. www.mntap.umn.edu/resources/publications/p2/

- **Episode 1: DIY Solid Waste Reduction**
Learn about different approaches two local companies took to creatively use materials they already had on hand to improve efficiency and reduce waste.
- **Episode 2: Air Emission & Hazardous Materials**
MnTAP worked with auto shops and the Leech Lake Band of Ojibwe to improve air quality by eliminating the use of hazardous degreasing products.
- **Episode 3: Preventing Raw Material & Product Waste**
Learn about success stories from two Minnesota businesses demonstrating how companies can save money and reduce waste through raw material and product waste prevention.
- **Episode 4: Wastewater Energy Efficiency**
Highlights of wastewater treatment plants case studies demonstrating efforts to operate more efficiently. Introduces MnTAP's new energy efficiency training program for wastewater operators.
- **Episode 5: Water Best Management Practices Tool**
Introduction to a searchable database for users to find effective industry-specific water conservation suggestions.



2021 Goals

Target technical assistance services to new business sectors and clients while leveraging state investment to attract additional resources for focused projects.

Project & Funding Source	Highlighted Activities	Page
Industrial Water Conservation <i>Metropolitan Council Environmental Services Water Supply Planning Unit</i>	This project seeks to improve the efficiency of water use in industries throughout the Twin Cities area. This work is accomplished by MnTAP Interns.	10
TCE Alternatives Project <i>MPCA - Resource Management and Assistance Division/US EPA</i>	The TCE Alternatives Project focuses on helping Minnesota businesses replace trichloroethylene (TCE) with safer, yet effective alternatives while avoiding regrettable substitutions.	11
Nutrient Optimization in Wastewater Treatment <i>Legislative-Citizen Commission on Minnesota Resources (LCCMR)</i>	This project seeks to improve the removal efficiency of nitrogen and phosphorus (nutrients) from wastewater treatment plants and ponds throughout Minnesota through collaborative research, intern projects and technical assistance.	12-13
Upstream Nutrient Reduction in Wastewater Treatment <i>Legislative-Citizen Commission on Minnesota Resources (LCCMR)</i>	This project partners with communities to identify nutrient source reduction opportunities at facilities with high nutrient effluent discharged to municipal treatment facilities. Decreasing effluent load helps wastewater treatment operate more efficiently.	14
Energy Efficiency in Drinking Water <i>MN Department of Commerce, Division of Energy Resources - CARD Grant</i>	A study of municipal drinking water supply energy efficiency opportunities in a range of Minnesota facilities.	15
Pollution Prevention in the Metal Fabrication Industry <i>MPCA - Resource Management and Assistance Division</i>	Conduct informational interviews with industry stakeholders to define critical P2 and sustainability targets in the metal fabrication industry. Best practices will be shared and site assessments will support implementation of these best practices.	16
WWTP Cohort Energy Efficiency Training <i>MN Department of Commerce, Division of Energy Resources</i>	Implement a cohort-based energy efficiency training program targeting no and low-cost opportunities available at municipal, mechanical wastewater treatment facilities.	17
Industrial Water Conservation - Non-Metro <i>Legislative-Citizen Commission on Minnesota Resources (LCCMR)</i>	Support water efficiency training and technical assistance outreach to businesses in communities experiencing water stress	18

Industrial Water Conservation Initiatives

2021 Outputs

- 3 metro-area intern projects
- 1 resource development intern
- 16 proposed recommendations
- 13,800,000 gallons of proposed water savings
- \$85,800 recommended savings opportunities

2021 Outcomes*

- 5 implemented recommendations
- 4.3 million gallons of implemented water savings
- \$61,500 total implemented savings

**Implemented 2021 from recommendations all year*

Sponsors

Metropolitan Council
Environmental Services
Water Supply Planning Unit

Project Overview

MnTAP's strategic emphasis on water conservation and efficiency assistance in the Twin Cities Metro continued in 2021 with support and direction from the Metropolitan Council Environmental Services (MCES) Water Supply Planning Unit.

2021 Activities

Water conservation recommendation potential for the three metro interns assigned to sites totaled 13.8 million gallons of water carrying a cost savings opportunity of \$33,200 from 16 recommended actions. Implementation of 3 2021 recommendations totaled 1.7 million gallons of water and \$5,400.

Water efficiency projects often carry co-benefits to implementation in addition to gallons of water reduced. Recommendations made by the 2021 interns included 18,000 lb chemical, 31,000 therms of natural gas and 655,000 kWh electric energy reduction carrying an additional \$52,700 in cost savings when fully implemented. The cost savings from additional chemical or energy reduction associated with water efficiency can help justify project investment that may be needed for implementation.

Industrial Water Conservation Tool

In 2020 a MnTAP intern classified industrial water efficiency recommendations by type, volume and value. In 2021 this analysis was extended to create a tool to search MnTAP's internal data base of published industrial water efficiency recommendations from past intern projects. Users can search by NAICS code, implementation method, and key words. Each suggestion has a link to additional information about the intern project that generated the recommendations through a direct link to the project executive summary.

The tool can be accessed from the MnTAP website:

www.mntap.umn.edu/resources/tools-calculators/water-tool/

Project Success: Great Lakes Coca-Cola Bottling

One can of regular soft drink is 90% water. Given that fact, the MnTAP intern at Great Lakes Coca-Cola Bottling (GLCC) in Eagan, MN had their work cut out to identify opportunities to reduce water use at the facility. The intern developed recommendations that could help the facility eliminate over 3 million gallons of water use.

A two-part recommendation was made around bottle rinsing.

- Decrease rinse flow, saving 450,000 gallons of water per year and \$1,700.
- Remove rinse step saving an additional 350,000 gallons of water annually and \$1,200.

A second two-part opportunity was identified in the backwash for media filters used to remove iron and manganese from the water.

- Reduce backwash time, saving 1.25 million gallons of water per year and \$4,600.
- Add sensors to automate backwash saving an additional 1.3 million gallons of water and \$4,900.

These stepwise recommendations provide the company with actions that can be taken to capture savings immediately and provide a path for future improvement.



TCE Alternatives Project

Project Outputs

- 35 companies contacted
- 1 additional company engaged (10 total)
 - 1 TV news segment
 - 3 presentations
- 2 reports to sponsors

2021 Outcomes

- 1 additional company completed transition (6 total)
 - 15,000 lbs TCE reduced
 - 19 views of TCE webinars
- 180 interested parties reached through presentations

Project Partners

TURI (Toxics Use Reduction Institute), U Mass Lowell

Sponsors

- U.S. EPA, Region 5
- MPCA
- Water Gremlin Supplemental Environmental Project (SEP)

Project Overview

TCE is a hazardous air pollutant (HAP) that can contaminate soil, air, and water. TCE is a known human carcinogen, can affect the liver, kidneys, immune, reproductive, and central nervous systems, and may affect fetal development. The goal of the TCE Alternatives Project is to decrease air emissions of trichloroethylene (TCE) by working with Minnesota industries to replace TCE with safer, effective options while working to avoid regrettable substitutions such as n-propyl bromide (nPB) and trans-1,2-dichloroethylene (tDCE). On June 1, 2022, Minnesota implemented a first-in-the-nation ban on TCE use for all businesses requiring an air permit. MnTAP is committed to helping businesses adjust to this change by finding long term safer solutions through solvent testing and technical assistance.

2021 Projects Activities

In the early phases of this project, we observed that a lack of knowledge of equipment options and local suppliers left a gap between companies receiving their report of TCE alternatives from TURI and the implementation of these alternatives in their facilities. In 2021, MnTAP implemented a new approach of connecting the companies to vendor partners.

MnTAP reached out to three chemical vendors and explained our program and our goals of helping companies replace TCE with safer alternatives, especially water based cleaners, and avoid regrettable substitutions with other halogenated vapor degreaser chemicals. Each of the vendors agreed to work with MnTAP and test samples from our clients to determine which of their products would be the best option to meet their needs. MnTAP acts as a mediator to decrease the legwork needed from our client companies to engage with the vendors. We help work through the implementation process and use our knowledge of hazard analysis to promote safer alternatives.

We believe this new strategy of working directly with chemical and equipment vendors to engage their extensive industry experience will be a more efficient way of getting companies across the finish line to implement the safest cleaning choices.

MnTAP TCE Efforts Attract National Attention

MnTAP's TCE Alternative Project, the high profile TCE releases discovered in 2019, and Minnesota's subsequent ban on TCE use for all businesses subject to an air permit, have attracted the attention of regulators and technical assistance providers across the country. MnTAP has been invited to present about TCE hazards and alternatives, project background and status, and the MN TCE Ban.

Presentations have included the National Small Business Environmental Assistance Program (SBEAP) and the EPA Air Toxics Pollution in 2020. Interest in the project continued to build in 2021, with presentations to the national TCE Work Discussion Group, organized by EPA and PPRC in February and September, and the Iowa Strategic Goals Program in March.

A news segment featuring a MnTAP interview on the TCE Alternatives Project and eliminating TCE aired on local CBS affiliate WCCO August 2, 2021. Overall, an estimated 180 pollution prevention practitioners, business people, regulators, and community members were reached with information about MnTAP's TCE Efforts!

<https://minnesota.cbslocal.com/2021/08/02/companies-have-year-to-find-safer-alternative-after-minnesota-bans-toxic-chemical-tce/>



Nutrient Optimization in Wastewater Treatment - Page 1

Project Outputs*

- 6 intern projects
- 10 mechanical plant assessments
- 14 mechanical plant recommendations
- 14 wastewater pond assessments
- 47 pond system recommendations
- 11 student researchers
- 17 presentations completed

*All project years

Project Outcomes*

- 23 site Specific Reports
- 8 case studies
- 6 recorded video presentations/training
- 2 operator's guides for nutrient optimization

*All project years

Partners

- Minnesota Pollution Control Agency
- Minnesota Rural Water Association
- City of Saint Cloud Treatment Facility

Sponsors

- Minnesota Environment and Natural Resource Trust Fund
- Legislative-Citizen Commission on Minnesota Resources (LCCMR)



Project Overview (10/2018-6/2021)

The goal of this project was to identify and implement low and no cost strategies to reduce nutrient pollution in wastewater effluent throughout Minnesota. Nutrient pollution consists of nitrogen and phosphorus. These elements are key ingredients in fertilizer and have the effect of promoting the growth of aquatic plants. In excess, nutrients in the water will cause algae to outgrow the carrying capacity of the local ecosystem, resulting in an algal bloom. The algal bloom causes oxygen levels in the water body to fall to zero, choking out fish and other organisms that need oxygen to survive.

This project involved one-on-one assessments with Minnesota wastewater mechanical treatment plants and wastewater pond sites in order to identify opportunities associated with operational changes to promote biological nutrient removal, resulting in better nutrient treatment for a low cost investment.

Project Recommendations

Overall Project Results

A method called the 'steady state primary method' was developed for wastewater ponds to achieve better nutrient treatment. This strategy helps pond systems maximize hydraulic retention times in the first and last ponds of the system, creating good conditions for the growth of aquatic plants in the ponds which uptake nutrients.

The project team explored biological nutrient removal (BNR) for mechanical treatment plants. The team found that there are low-cost ways to modify operations in order to achieve some biological nutrient removal of nitrogen and phosphorus with Minnesota wastewater treatment plants.

Total Mechanical Plant Recommended Project Savings						
	Total N (lbs/yr)	Total P (lbs/yr)	Chemical Reduction (lbs/yr)	Energy Savings (kWh)	Additional Required Mix Energy (kWh)	Annual Savings (\$)
Total	680,100	91,300	4,976,600	4,348,700	(549,800)	\$830,00

Wastewater Pond Steady State Primary Method and Best Practices Recommended Savings						
Site	Total N (lbs/yr)	Total P (lbs/yr)	Chemical Needed (lbs/yr)	Chemical Cost	Chemical Savings versus Chemical Treatment Only Per Year (lb/yr)	Cost Savings versus Chemical Treatment Only Per Year
Total	49,470	29,050	27,000	\$8,100	772,100	\$225,900

Nutrient Optimization in Wastewater Treatment - Page 2

Project Success: City of Gaylord Pond Optimization

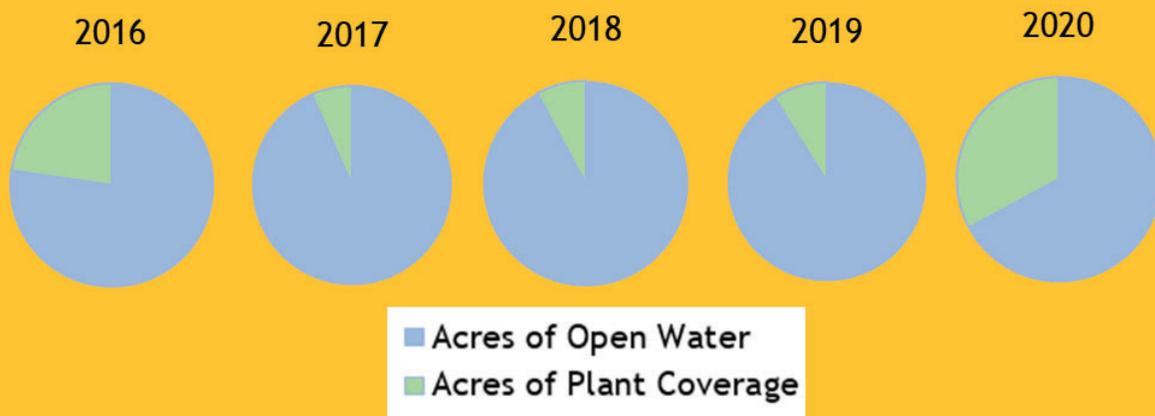
Wastewater nutrient optimization is a challenge faced by pond treatment systems throughout Minnesota. In the case of Gaylord MN, wastewater treatment has been enhanced significantly as a result of collaboration between the City of Gaylord's pond operator, Robert Kloeckl and the LCCMR wastewater nutrient optimization team.

During winter 2016 and spring 2017, the Gaylord team trialed parallel flow of water into ponds 1 and 2. Presumably as a result of this change, the coontail in the pond system was disrupted, resulting in a significant reduction of coontail. Between 2018 and 2020, the system was switched back to the 'steady state primary' operation. As a result, both phosphorus treatment and coontail growth improved significantly, resulting in the lowest effluent phosphorus the site had seen in years.

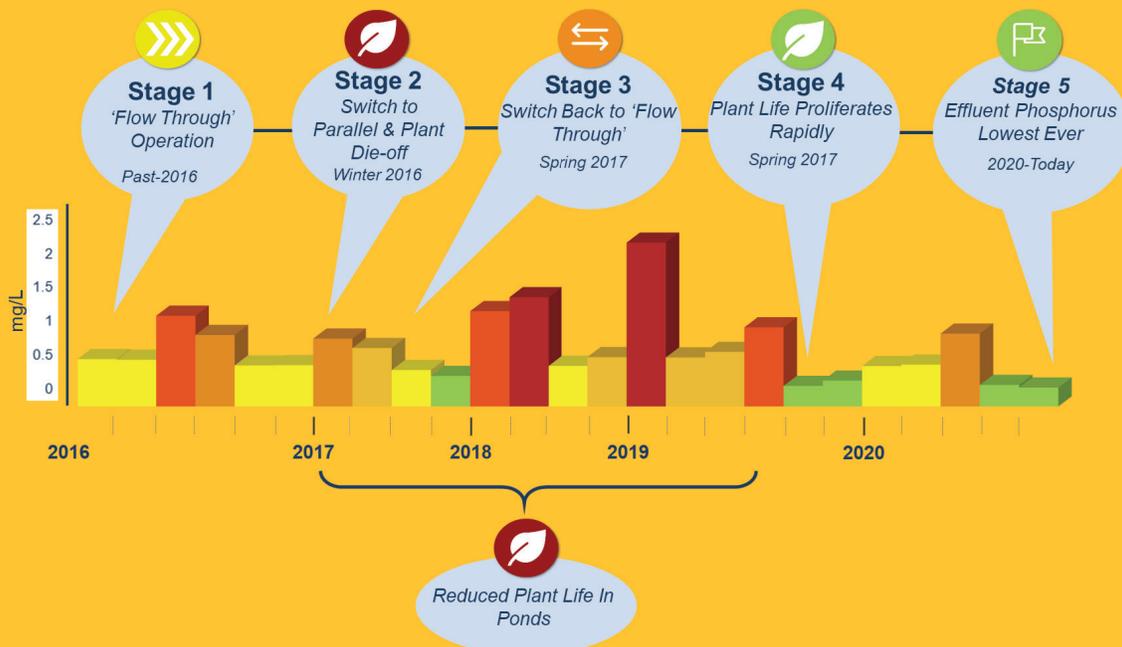
See the full case study:

www.mntap.umn.edu/wp-content/uploads/simple-file-list/POTW/Ponds/Gaylord-Case-Study.pdf

Coontail Coverage of Ponds Over Time



Timeline of Gaylord's Operation and Phosphorus Effluents



Upstream Nutrient Reduction

2021 Outputs

2 site assessments
1 student intern project

2021 Outcomes

30,000,000 gallons
water saved
18,000 kWh saved
\$302,000 implemented
savings

Project Partners

Minnesota Rural Water
Association (MRWA)

Sponsors

Legislative-Citizen
Commission on Minnesota
Resources (LCCMR)



Project Background

The primary goal of this project is to partner with MN communities and facilities in these communities that feed high-nutrient wastewater to treatment plants and ponds. Treatment plants and ponds can face great challenges in managing wastewater effluent, especially nitrogen and phosphorus. These nutrients support the growth of aquatic plants like algae. In normal amounts, this is a good thing; however, excess nutrients can result in algal blooms. These blooms can kill fish by consuming most of the dissolved oxygen in the water. The blooms can also produce toxins or promote bacterial growth that can make people sick.

Project Overview

Building on work with Minnesota's wastewater plants and ponds to achieve nutrient removal, MnTAP's technical staff have been engaging businesses and organizations in communities that discharge to these plants and ponds to reduce nutrient load sent to the wastewater facilities. The results for 2021 have included 2 additional business assessments, 1 additional summer intern projects and continued outreach to communities and businesses on the benefits of better wastewater effluent management.

2021 Activities

MnTAP continued to build strong connections with Minnesota communities and wastewater treatment systems to complete assessments. The following activities were accomplished in 2021:

- Two facility site assessments completed, identifying opportunities for nutrient reduction, water and energy conservation.
- One intern project completed resulting in over \$63,000 recommended savings and reductions opportunity of 600 lbs nitrogen effluent, 30 lbs phosphorus effluent, 14,000 lbs water pollution, 2.9 million gallons of water and 365,000 kWh electric energy when fully implemented.
- Two community upstream assessments conducted. One industrial source of phosphorus was identified, though it was deemed not to be a significant contributor to the community discharge concentration. Both community assessments indicated that non-industrial sources, that have yet to be identified, are potential contributors to elevated phosphorous levels.
- ProFood World, an international print and digital publication organization for the food and beverage industries, featured the 2020 LCCMR-supported MnTAP Intern Projects at August Schell Brewing Co. and Minnesota Specialty Yeast in early 2021. :

www.profoodworld.com/sustainability/article/21232614/mntap-identifies-sustainability-improvements-for-august-schell-brewing-co

www.profoodworld.com/sustainability/article/21259569/yeast-processor-decreases-phosphorous-and-cooling-water-usage

ProFood World presented a video spotlight that featured both LCCMR-supported MnTAP Intern Projects from 2020: www.profoodworld.com/TakeFive/video/21366384/facilities-optimize-costs-savings-sustainability-with-mntap-digital-innovation-production-amid-the-covid19-pandemic

Project Success: Branding Iron, Rochester Meat Co.

Branding Iron, Rochester Meat Co. in Rochester, MN, produces frozen beef patties and other beef products. The company was seeking to decrease high levels of total suspended solids (TSS) and biological oxygen demand (BOD) in their wastewater effluent. High loading of these parameters were contributing to high strength charges for the facility which were unsustainable for business operations. With the help of a MnTAP intern, the company reviewed sanitation procedures and developed training materials to reinstate best practices. The intern calculated that diversion of at least 50 lbs of meat per day was needed to avoid the high strength charges. Implementation of the intern recommendations resulted in 15,000 lbs per year of meat diverted from the sewer and an annual savings of \$13,500.

The facility was also interested in implementing best practices to improve water and energy use efficiency. The intern identified opportunities to reduce water consumption by installing recirculating water chillers, which would save 2.9 million gallons of water and \$13,400 annually. Three opportunities to save energy were identified: lighting upgrades to LED, fixing compressed air leaks, and repairing gaps in the doors to the freezer areas. In total, these energy savings measures are anticipated to save 365,000 kWh and \$36,500 annually.



Energy Efficiency in the Drinking Water Treatment Sector

2021 Outputs

5 site assessment reports
 Identified:
 648,000 kWh savings
 \$85,500 energy cost savings
 \$7,800 chemical cost savings

2021 Outcomes

1 Energy Savings Potential Study Complete

Sponsors

Conservation Applied
 Research and Development Grant

Minnesota Department of
 Commerce,
 Division of Energy Resources



Project Background

Minnesota drinking water treatment facilities produced 138 billion gallons of water in 2017, using an estimated 295 million kilowatt hours of energy. This project focused on identifying best practices for energy management in water treatment plants and defined the statewide energy efficiency opportunity potential for this sector.

Project Scope

Specific energy savings measures were not widely known at the outset of the project and information gathering included the following:

- **Literature review** to identify potential opportunities and summarize the base of knowledge.
- **Informational interviews** with water utilities (15), electric utilities (3), and industry experts (4), to generate a baseline for energy use in the sector.
- **Site assessments** with select water utilities to quantify savings.
- **Quantifying the savings potential** for the sector and identify the largest opportunities.

Key Findings

The key opportunities for energy efficiency at WTPs based on the number of facilities and the energy reduction potential are shown in the table. Combined these opportunities represent 42 million kWh/yr of electric energy use.

Opportunity	Percent of State WTPs with Opportunity	Estimated Savings	Estimated Sector Energy Savings (kWh/yr)
Pump Efficiency Optimization	87%	5%	25,000,000
Well/Pump Rehabilitation	53%	6%	9,300,000
Water Loss Reduction	95%	1-30% of losses	3,500,000
Customer Conservation	94%	--	2,700,000
VFD Optimization	60%	1.5%	1,900,000

For more information, refer to the webinar presented on 6/8/2021

- Slides - <http://mn.gov/commerce-stat/pdfs/mntap-ee-water-utilities-slide-deck.pdf>
- Recording - <https://www.youtube.com/watch?v=6knVuubg!NI>

Project Result: Minnesota Water Treatment Plant Energy Footprint

Energy footprints were calculated for each site that provided energy data. These footprints were calculated for each plant overall and for acquisition, treatment, and distribution. These footprints indicate that treatment is typically the least energy intensive operation and that acquisition and distribution use a similar amount of energy.

Size	Average (kWh/MGD)	Acquisition (kWh/MGD)	Treatment (kWh/ MGD)	Distribution (kWh/ MGD)
Small (5-50 MGD)	2,500	1,100	400	1,000
Medium (50-500 MGD)	1,600	700	300	600
Large (>500 MGD)	2,200	900	450	900
Overall	2,100	900	350	900

P2 in Metal Fabrication

2021 Outputs

- 1 industry survey
- 12 industry interviews
- 3 Site assessments
 - 3 case studies
- 1 industry-focused article for 2022 publication

2021 Outcomes

- 3,750 gallons of water savings
- \$13,000 of cost savings

Project Partner

Minnesota Precision Manufacturing Association

Sponsors

- U.S. EPA Region 5
- MPCA



Project Overview

This project seeks to identify pollution prevention priorities for the metal fabrication industries through informational interviews with practitioners, vendors and other industry stakeholders. Site assessments will support implementation of best practices and identify additional improvement opportunities. The P2 focus is on assessing industry use of Minnesota priority and TRI list chemicals, sources of chloride, cutting fluids and oils and developing source reduction options to reduce use of these materials. Follow up activities will seek to motivate implementation of recommendations, confirm actions and develop case studies to share key outcomes broadly for replication.

Fabricated metal processes generate various waste streams that may be hazardous, degrade to hazardous components or require extra expense for management or compliance. Some of these include: oily wastes from machining operations; metals from spent chemistry baths used in plating operations; solvents and alkaline- or acid-based solutions from metal cleaning. Chlorides in wastewater discharge may come from water softening operations, cutting fluids that contain halogenated paraffins and possibly from wastewater treatment chemistries applied on site. While the industry has shifted to using safer aqueous-based cleaners, some degreasing and cleaning activities for surface preparation may utilize hazardous solvents. Even aqueous-based cleaners have to be chosen carefully to avoid hazardous components. While PFAS was banned in chromium plating operations in 2015, there may be questions about how the alternatives are performing.

Activities

There were several observations from a survey and interview of 12 facilities.

- 60-70% of the fabricators use water softening
- All of the shops depend on compressed air and coolant/metalworking fluids
- All sites interviewed had engaged in lighting and compressed air energy efficiency actions

The survey results will be shared broadly to the industry and via MnTAP's newsletter. The survey will also serve as a discussion point for engaging with companies in future site assessments. In the second year of this project, MnTAP has begun the technical assistance portion of the project and has completed three site visits with manufacturers. The team is continuing to engage businesses in the sector for additional site assessments as well as focus and streamline the site assessment process.

Project Success: Sharing Best Practices Across the Industry

Part of the engagement process for our project partner and participating facilities was the promise to share information broadly across the industry. MnTAP was impressed with the innovative waste reduction strategies facilities had developed in-house and requested the opportunity to share these practices through case studies. Three case studies have been shared to improve overall industry sector environmental performance.

Coolant Recycling: Lou-Rich designed and implemented a centralized coolant recycling system to significantly reduce overall coolant usage and disposal costs.

www.mntap.umn.edu/wp-content/uploads/simple-file-list/Machine-Shops/Lou-Rich-Case-Study.pdf

Process Efficiency: Metal Services fabricated in-house carts and utilized facility and process mapping strategies to significantly reduce forklift usage and production lead times.

www.mntap.umn.edu/wp-content/uploads/simple-file-list/Machine-Shops/Metal-Services-Case-Study.pdf

Energy Efficiency: Jones Metal purchased a fiber laser cutter, achieving energy savings and improved throughput compared to conventional CO₂ lasers. www.mntap.umn.edu/wp-content/uploads/simple-file-list/Machine-Shops/Jones-Metal-Case-Study.pdf



Wastewater Cohort Energy Conservation Training Program

2021 Outputs

- 1 WWTP training cohort completed
- 7 operators trained
- 3 site assessments performed

2021 Outcomes

1,052,900 kWh
\$86,800

Sponsors

MN Department of Commerce, Division of Energy Resources

What They Said

“Water distribution accounts for a large portion of our municipal energy use. MnTAP helped us systematically identify opportunities for energy efficiency within this process. Their work helped us connect actions to measurable savings and provided useful recommendations going forward.”

—Rachel Workin,
City of Fridley,
Environmental Planner

Project Background

MnTAP has a long history of providing energy assistance to Minnesota wastewater treatment plants (WWTPs). The initial project completed in 2018 provided site assessments at eleven small to mid-sized mechanical facilities across the state. The average energy savings was 450,000 kWh per year per facility with a range from 70,000 to 1.2 million kWh/year with an estimated cost savings of \$423,000 across eleven assessed facilities. Approximately 70% of the recommended energy efficiency opportunities identified in this work could be achieved through operational changes requiring no or low capital investment. The following barriers to improving energy efficiency were identified for small to mid-sized mechanical WWTPs:

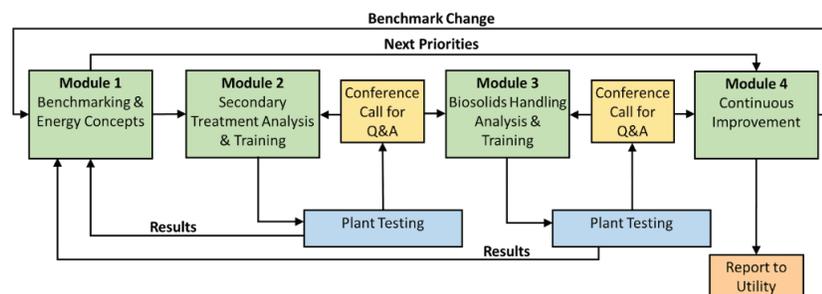
- knowledge of facility energy use is often unknown and limits motivation
- perception that energy efforts require large capital investment
- lack of familiarity with tailored energy efficiency solutions for customized plant operations
- risk of not meeting permit requirements if operating outside historical boundaries

Based on the success of the initial site assessment work and the need to overcome barriers experienced by wastewater plants, a cohort training program at a scale and level appropriate for small- to mid-size treatment facilities was developed by MnTAP through the State Energy Office CARD grant program. This project implements the training program for wastewater operations staff in regionally aligned cohorts for training, peer learning, identification and implementation of wastewater energy efficiency measures

Project Overview

MnTAP is using the previously developed cohort training curriculum to offer operator training focused on identifying and implementing low and no cost improvements that reduce energy consumption at WWTPs, without sacrificing plant effectiveness at meeting discharge limits. The target audience for this training program are lead wastewater treatment plant operators at municipal mechanical treatment WWTPs up to 10 MGD. Operators receive 16 direct wastewater contact hours by completing this MPCA accredited course.

Each training is conducted with a cohort of participants from five WWTPs that will attend all four modules and two conference calls (see figure below). MnTAP plans to provide training to 11 cohorts of five wastewater treatment plants each by the end of 2023.



Activities

- created a geographic information systems (GIS) mapping approach to locate cohorts
- contacted 20 wastewater treatment plants with invitations to join our first cohort
- completed of 1 cohort training for 7 wastewater operators from five treatment plants.

Project Success: Cohort 1 Results and Feedback

During the first cohort, 1,900,000 kWh of energy savings were identified, and 276,700 kWh of energy savings were implemented. Operators from the first cohort conducted in Fall 2021 reported the following aspects of the course would be most useful or valuable to them going forward:

- tips/Ideas to cut energy costs
- learning what to look for as we get into our plant upgrade
- being able to see potential savings.



Expanding Protection of Water through Industrial Conservation in Greater Minnesota

2021 Outputs

- 1 intern site identified
- 163 current non-metro industrial water users identified
- 1 interactive geographic information systems map created

Project Partners

Minnesota Rural Water Association (MRWA)



Sponsor

Legislative-Citizen Commission on Minnesota Resources (LCCMR)



Project Overview

The primary goal of this project is to identify and engage MN communities with water supply and/or water quality challenges. MnTAP, in collaboration with MRWA, will be offering water conservation training, outreach, and assessments. These services will be focused on identifying and implementing actionable industrial water conservation and efficiency measures through municipalities and businesses. Eligible participants include towns, cities, and other local units of government, as well as high water-using businesses.

Project Goals

- 3-4 regions receive directed outreach for water conservation technical assistance
- 3-4 education workshops on water conservation in participating regions
- 4-8 high water users identified
- 8 water conservation and source reduction site assessments completed
- 3 water conservation focused intern projects in the selected regions
- 10 million gallons of water reduced annually
- 3 intern success stories
- Presentations outlining the project outcomes
- 1 webinar recorded and archived for future viewing
- Water use assessment screening tool developed

Project Status

This project began in August 2021 and is expected to wrap up in 2023. MnTAP used data from both the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Natural Resources (DNR) to generate an interactive geographic information systems (GIS) map displaying the non-metro industrial wastewater dischargers and well water users throughout Minnesota.

6/8/22, 10:47 AM

Non-Metro Industrial Wastewater Dischargers (NPDES/SDS holders)

