



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2018 ENRTF Work Plan (Main Document)

Today's Date: June 12, 2021

Date of Next Status Update Report:

Date of Work Plan Approval: 06/05/2018 and 6/17/2019

Project Completion Date: June 30, 2020 (\$700,000) June 30, 2021 (\$500,000)

Does this submission include an amendment request? No

PROJECT TITLE: Pilot Program to Optimize Local Mechanical and Pond Wastewater-Treatment Plants

Project Manager: Joel Peck

Organization: Minnesota Pollution Control Agency

College/Department/Division: Municipal Wastewater Division

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Location: Multiple locations throughout the state of Minnesota

Total Project Budget: \$1,200,000

Amount Spent: \$116,869

Balance: \$1,033,131

Legal Citation: M.L. 2018, Chp. 214, Art. 4, Sec. 02, Subd. 04a

Appropriation Language:

\$89,000 the first year and \$611,000 the second year are from the trust fund to the commissioner of the Minnesota Pollution Control Agency, in partnership with the Minnesota Rural Water Association and the University of Minnesota's Technical Assistance Program, to implement a pilot program to optimize existing local mechanical and pond wastewater-treatment systems to increase nutrient removal and improve efficiency without requiring costly upgrades.

Legal Citation: M.L. 2019, First Special Session, Chapter 4, Article 2, Subd. 11b

Appropriation Language:

\$500,000 the first year is from the trust fund to the commissioner of the Pollution Control Agency for the pilot program created under Laws 2018, chapter 214, article 4, section 2, subdivision 4, paragraph (a). This appropriation is available until June 30, 2021, by which time projects must be completed and final products delivered.

I. PROJECT STATEMENT:

Effective wastewater treatment systems are critical infrastructure to manage waste effluent within hundreds of communities throughout Minnesota. Optimization, in general, means getting better results through existing infrastructure. This proposal will determine how both mechanical and pond wastewater treatment systems can be optimized, and the new effluent limits met, without adding substantial new infrastructure. Infrastructure improvements should be the last resort when new, or more restrictive effluent limitations are required to meet water quality standards. The goal is to optimize existing wastewater treatment processes to improve nutrient (phosphorus and nitrogen) removal.

The primary purpose of wastewater treatment is to protect the environment from contamination and preserve water sources for residential, industrial and recreational use as well as minimizing impact on wildlife and aquatic species. Cities throughout the state are responsible for providing effective, affordable wastewater treatment services for residents and businesses within their communities. Effective operation of wastewater services is vital to preserve the environment, maintain public health, and support regional economic development.

To ensure communities manage their environmental impact, wastewater effluent discharged to Minnesota waterways are subject to federal and state regulation. These regulations continue to become more stringent over time as treatment demands increase and as negative environmental impacts to receiving waters are better understood. This proposal would add a new option for municipalities – wastewater facility optimization – that may help many communities meet new pollutant limits without requiring expensive new infrastructure. This will result in lower costs for communities and cleaner water for all Minnesotans.

The outcomes of these projects will be:

- Increased nutrient removal and improved operational efficiencies at mechanical and pond wastewater treatment plants,
- Ability of at least some cities to comply with new water quality standards without needing expensive new construction,
- Cost savings to cities and to the state, as the useful life of optimized wastewater systems is extended.
- This project will allow MNTAP, Minnesota Rural Waters, MCES, City of St. Cloud and the MPCA to collaboratively work together to help rural communities save money and resources to assure that wastewater effluent limitations are met and maintained.
- This project will establish mentoring relationships that will foster learning and the exchange of knowledge for years to come.

II. OVERALL PROJECT STATUS UPDATES:

First Update January 31, 2019

The project started slow, due primarily to MPCA's internal contracting process. So, while the money for this project became available on July 1, 2018, actual work was not possible until November 1, 2018. The long delay was caused by available staff time in MPCA's Contracts Unit, their fiscal-year-end workload, and lack of consensus on the structure of the contracts. This was a significant challenge. Even through the long project delay, however, MPCA was able to communicate well with project partners, so that when signatures were signed, they could proceed under full momentum.

A short list of facilities were all selected from the 2017 DMR data on the basis of Nitrogen and Phosphorus effluent. All 239 mechanical plants within the scope of the study were ranked based on Total Nitrogen Effluent Concentration, Total Annual Nitrogen Discharge, Total Phosphorus Effluent Concentration, and Total Phosphorus Effluent Discharge. Plants that ranked in the top 20% of each of these categories were given a score of 1 for each specific criteria, for a maximum of 4. Plants were also evaluated for simultaneous Biological and Chemical methods for Phosphorus Removal, and if they were found to possess both of these capabilities, the plant was given an additional 1 point, bringing the maximum score to 5. Plants that aggregated a total score of 2 or more were placed on a short list to target for inclusion in to the optimization program.

Project partners then began to promote the Optimization Pilot Program by calling facility operators and providing a description of the program. If the municipality elected to participate, a site visit was scheduled, and an initial facility assessment was conducted. Using that initial assessment, University of Minnesota engineering students built theoretical models of the facilities used modeling software that can be used to predict effluent concentrations under different treatment process scenarios. To date, one wastewater treatment plant (New Ulm) and one wastewater treatment pond (Gaylord), are under development using the modeling software.

Amendment Request May 30, 2019:

We seek an amendment to the work plan to add an additional \$500,000 that was appropriated through laws of 2019. With this new funding, substantially more operator training, instruction, and development will be accomplished. The following outcomes were updated accordingly:

- Learn if the municipality has completed an adequate phosphorous management plan, and an inflow and infiltration (I & I) plan. And if not, to assist them in doing so.
- Complete an assessment of the integrity of the systems structures, gates, and assets to make sure we have the ability to use optimization strategies.
- Gain better understanding of the current influent flow using composite sampling for accurate data: What businesses served by the collection system have a reasonable potential to impact the system's ability to treat as industrial and commercial contributions such as, high-strength septage, B.O.D., salts, and metals can have significant impact on treatment system.
- Increase sampling events in the spring or fall, prior to discharges, for two- and three-cell pond systems. We can measure how algae, macrophytes, and the conditions of "old water" to implement a time schedule to determine when optimal treatment has been met or ready to discharge. This can be weather dependent and onsite operations may be a factor. But this activity will inform operators who discharge the same time, year-after-year, because this is "when we always discharge." Conditions should drive discharge events, not habit.

Second Update June 30, 2019

Third Update January 31, 2020

Final Update June 30, 2020

III. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Instruction and Selection of Pilot Participants

Description:

To pique the interest of prospective facilities, we need to tell those who operate them what we want to do, what optimization is, and what it has done elsewhere. To that end, two seminars that describe the activities and possible benefits – one for wastewater treatment plants, and one for wastewater treatment ponds – will be conducted.

The seminar for *mechanical systems* will cover what WWTP Optimization is and why it may be a viable alternative to infrastructure improvements to meet nutrient effluent limitations. We will select three to five candidate-WWTP from seminar attendees to participate in the pilot program.

A seminar for *pond systems* with project partners Minnesota Rural Water Association and Minnesota Technical Assistance Program will show what is already being done well by ponds, but also what opportunities exist for further nutrient reductions. In addition, asset management protocols and Minnesota Water/Wastewater Utilities Agency Response Network (MnWARN) training will be offered to participating facilities. We will select approximately 30 candidate pond facilities from seminar attendees to participate in the pilot program.

The objective is to help wastewater operators who say, “I operate the plant this way because I was trained to operate the plant this way,” to a position of confidence where they can say, “I operate the plant this way because this is what the effluent data indicates.”

ENRTF BUDGET: \$7584

Outcome	Completion Date
1. Provide a seminar to transfer knowledge from experts to interested parties about wastewater treatment plant optimization.	12/01/2018
2. Provide a seminar to transfer knowledge on pond system optimization. Seminar to include also demonstration of Rural Water Association’s asset management tool.	12/30/2018
3. Identify facilities that express an interest in optimizing their operations, after hearing from seminar presenters, what those activities might involve. 4 or 5 treatment plants, and as many as 30 pond facilities will be selected.	12/30/2018

ACTIVITY 2: Operator Mentorship and Technical Assistance

Description:

Technical assistance will commence with a site visit to the participating WWTP and pond systems to understand the plants process, existing components, and general capability of both the facility and the operator. Additional instruction will likely occur at program partner facilities.

The *mechanical system* pilot facilities will enter into an agreement under which program partners, namely wastewater operators from the Met Council’s and City of St. Cloud’s wastewater systems, will act as mentors for pilot cities undertaking optimization. Mentors will provide technical assistance such as: evaluating each pilot plant’s treatment processes, making adjustments through process control, training and mentoring operators, and increasing or decreasing wastewater detention time.

Optimization in *pond systems* is by definition more labor intensive, due to complex biological processes occurring within ponds and because most pond system operators have multiple jobs within the government of a

small city. This activity will provide “one on one” optimization tailored to each pond facility, so that municipalities can operate pond systems ongoing with low-level labor input. Optimization will entail detailed analysis of a given pond system, followed by developing and establishing an ongoing protocol to achieve maximum pollution reduction in pond system effluent. This work will be provided by subcontract with Minnesota Rural Water Association and will include enhanced coagulation and flocculation, and discharge window optimization

Technical assistance will also include upstream pollution prevention activities, asset management training, and emergency preparedness training and will include connecting site staff with external resources as needed to assist with implementation of recommendations.

Data will be collected for each of the pilot systems for analysis and compilation into a report as part of Activity 3.

ENRTF BUDGET: \$585,550, June 30, 2021: \$388,000

Outcome	Completion Date
1. Develop protocol for facility assessment including treatment process and inputs	12/31/2018
2. Learn if the municipality has completed a phosphorous management plan, and an inflow and infiltration (I & I) plan. And if not, to assist them in doing so.	08/30/2021
3. Assessment of the integrity of the systems structures, gates, and assets to make sure we have the ability to use optimization strategies.	11/30/2020
4. Assess impact of commercial and industrial S.I.U.s and develop strategies for upstream pollution prevention	07/30/2021*
5. Increase sampling events in the spring or fall, prior to discharges, for two- and three-cell pond systems.	07/30/2021*
6. Work with partners to make low cost recommendations to optimize treatment process at both mechanical and pond pilot locations	06/30/2019
7. Additional training and technical assistance completed, including conducting upstream pollution prevention assessments to reduce load coming to each facility	06/30/2020
8. Generate report outlining operational actions to reduce effluent contamination.	08/30/2020
9. All project results fully analyzed for efficacy and detailed reports published, and made available for further academic and technical applications.	08/30/2021

*denotes activities made possible by 2019 appropriation which can now begin in the sequence order, but be completed in 2021.

First Update January 31, 2019

On July 27, 2019, Jon Vanyo with MnTAP and Joel Peck, and Brian Fitzpatrick with MPCA, gave a presentation to the Minnesota Wastewater Operators Association general conference in Grand Rapids, MN, on the topic of wastewater optimization for both ponds and for mechanical plants. The intent was to generate interest in the pilot program. However, presentations were made on the last day of the conference, and many attendees had already left. Further, because contracts were not available for signatures, official work could not begin, and some opportunity was lost until November 1, 2018, when both project partners were able to fully engage in outreach and engagement. So, while we met the completion date identified in Activity 1, Outcome 1, we believe a second opportunity to better fulfill the objective to transfer knowledge is available. A nationally recognized

expert in optimization techniques, Grant Weaver of Clean Water Ops, has been engaged for MPCA’s Wastewater Annual Conference over March 27 and 28, 2019. Weaver has worked in Montana, Tennessee, and Massachusetts optimizing wastewater plants, and will be giving the plenary address, and a half-day session on optimization. We believe this will also boost the interest among wastewater treatment plant operators to participate in the pilot program.

MPCA and project partners identified a set of criteria on which to objectively score interested permittees to avoid any selection disputes, meeting the objective of Activity 2, Outcome 1. These criteria included a five-point system comprised of a sum of 5 Boolean values each indicating whether or not the plant fell into one of these five categories:

1. The plant has Biological-Phosphorous removal capability, but is using chemical removal instead.
2. The plant is in the top 20% in regards to P effluent concentration.
3. The plant is in the top 20% in regards to N effluent concentration.
4. The plant is in the top 20% in regards to total P effluent mass.
5. The plant is in the top 20% in regards to total N effluent mass.

All of these values are averaged for the year of 2017. Criteria Score was calculated by adding the rank for each plant in regards to the categories 2-5 used in the 5-point system as described above. Maximum possible score is 857, Minimum possible score is 4. Average would be 428.

Pond Facilities Selected for the Optimization Pilot Program include:

- | | | |
|------------------|------------------|-----------------|
| 1. Taylors Falls | 11. Deer River | 21. Bird Island |
| 2. Winthrop | 12. Wheaton | 22. Morton |
| 3. Gaylord | 13. Edgerton | 23. Butterfield |
| 4. Nicollet | 14. Beaver Creek | 24. Evansville |
| 5. Sandstone | 15. Round Lake | 25. Lynd |
| 6. Moose Lake | 16. Adrian | 26. Balaton |
| 7. Osakis | 17. Warroad | 27. Minneota |
| 8. Clearbrook | 18. Good Thunder | 28. Wahkon |
| 9. Newfolden | 19. Stockton | 29. Belview |
| 10. Littlefork | 20. Geneva | 30. Rice |

Second Update June 30, 2019

Third Update January 31, 2020

Final Update June 30, 2020

ACTIVITY 3: Academic Analysis, Assessment and Knowledge Transfer

Description:

Academic analysis and assessment is necessary to both quantify the data gathered of the project duration, and to understand the results of the data. We will work with students supervised by the University of Minnesota’s MN TAP program engineers to collect data, analyze datasets, draw conclusions, and publish findings. The additional appropriation authorized under M.L. 2019, First Special Session, Chapter 4, Article 2, will make possible an additional cohort of four engineering students, supervised by staff at University of Minnesota, to work hand-in-hand with project partners to quantify baseline conditions, and evaluation of treatment alternatives, with a goal of more pilot facilities enrolled in the program.

ENRTF BUDGET: \$106,866, December 31, 2021: \$60,000

Outcome	Completion Date
1. “Before” data collected from each pilot system (3-5 mechanical, ~30 ponds)	Beginning 7//30/2018
2. “After” data collected from each pilot system (3-5 mechanical, ~30 ponds)	Beginning 7/30/2019
3. Evaluation of datasets, assessment of results, and final recommendations	6/30/2020
4. Additional student workers hired to continue site assessments	9/30/2019
5. Final reports published as field guides to optimization practices and processes, transfer of knowledge completed through publication on MPCA web site and shared broadly with other facilities across the state	6/30/2020
1.	

First Update January 31, 2019

Because of MPCA contracting developments, Initial site assessments began on November 1, 2018, missing the date identified in the Activity 3, Outcome 1. Minnesota Rural Water’s (MRWA) pond expert went on site to explain the program. If the municipality was willing to be part of the project, MRWA obtained general information, including primary contact person name and number, size and number of ponds, operation depth, sludge depth in the ponds if that was reliably known. If not, MRWA drilled holes in the pond ice to “sludge judge” the depth of the sludge blanket, and to assess the dissolved oxygen levels in the pond systems. The information that was gathered was then transferred to University of Minnesota where students began the process of building the model of the ponds in modeling software.

The site assessment for the first wastewater treatment plant began on November 1, 2018, when MnTAP staff and student workers visited New Ulm Wastewater Treatment Plant. The site assessment was completed on December 1, 2019 with full complement of data acquired to begin modeling the wastewater treatment plant and operations.

Second Update June 30, 2019

Third Update January 31, 2020

Final Update June 30, 2020

IV. DISSEMINATION:

Description: The raw data and results of optimization activities will be available for all interested parties. The final report, comprising of academic data analysis and evaluation of optimization activities should have some rigor applied to it.

As many as three upper-class engineering students will be working on this project to evaluate the results of the treatment-plant and the treatment-pond tracks. Their work products should be in a format that is capable of serving as a field guide for any future operator who has an interest in improving treatment without adding infrastructure costs. These field guides will be available for down load on the MPCA wastewater web pages at <https://www.pca.state.mn.us/water/municipal-wastewater>.

The Minnesota Environment and Natural Resources Trust Fund (ENRTF) will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the [ENRTF Acknowledgement Guidelines](#).

First Update January 31, 2019

No activity during this reporting period.

Second Update June 30, 2019

Third Update January 31, 2020

Final Update June 30, 2020

V. PROJECT BUDGET SUMMARY:

A. Preliminary ENRTF Budget Overview:

See attached spreadsheet

Explanation of Capital Expenditures Greater Than \$5,000: N/A

Explanation of Use of Classified Staff: N/A

Total Number of Full-time Equivalent (FTE) Directly Funded with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours:	Divide by 2,080 = TOTAL FTE: 0
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Total Number of Full-time Equivalent (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours: 5450	Divide by 2,080 = TOTAL FTE: 2.6
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B. Other Funds:

SOURCE OF AND USE OF OTHER FUNDS	Amount Proposed	Amount Spent	Status and Timeframe
Other Non-State \$ To Be Applied To Project During Project Period:			
MPCA Municipal Liaison labor expected over a period of 180 hours.	\$ 9448	\$	
Other State \$ To Be Applied To Project During Project Period:			
	\$	\$	
Past and Current ENRTF Appropriation:			
	\$	\$	
Other Funding History:			
	\$	\$	

VI. PROJECT PARTNERS:

A. Partners receiving ENRTF funding

Name	Title	Affiliation	Role
Ruth Hubbard	Executive Director	Minnesota Rural Water	Pond Expert
Laura Babcock	Executive Director	MnTAP	Plant-Expert
Tracy Hodel	Assistant Public Utilities Director	St. Cloud WWTP	Plant-Expert
Larry Rogacki	Assistant General Manager, Support Services	Met Council Environmental Service	Plant-Expert

B. Partners NOT receiving ENRTF funding

Name	Title	Affiliation	Role
Joel Peck	Municipal Liaison	MPCA	Project Manager
Brian Fitzpatrick	Wastewater Engineer	MPCA	Technical Supervision

VII. LONG-TERM- IMPLEMENTATION AND FUNDING: The project will have an immediate impact on the pilot projects selected by reducing nutrient levels into waters and by extending the use of treatments systems without having to pay for additional capital improvements. The results and protocols will also be shared with other operators throughout the state. This proposal also sets the table for future research on denitrification in wastewater pond systems, to define the biological processes by which nitrogen is removed from pond water and evaporates into the air. Anammox and ammonia volatilization, as well as biological indicators in ponds are also worthy areas of study that will lead to better pond performance. While sufficient time to develop and plan this study is not available at this time, we fully believe the activities outlined here will facilitate the next phase of understanding the microbiology of denitrification within these ponds.

VIII. REPORTING REQUIREMENTS:

- The project is for two years, will begin on 7/1/19. The activities funded with ML 2018 funds will end on 6/30/20; activities funded with ML 2019 funds will end on 6/30/21.
- Periodic project status update reports will be submitted 1/31 and 6/30 of each year.
- A final report and associated products will be submitted between June 30 and August 15, 2021.

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

- A. Budget Spreadsheet
- B. Visual Component or Map
- C. Parcel List Spreadsheet N/A
- D. Acquisition, Easements, and Restoration Requirements N/A
- E. Research Addendum N/A

Attachment A:
 Environment and Natural Resources Trust Fund
 M.L. 2018 Budget Spreadsheet



Project Title: Pilot Program to Optimize Local Mechanical and Pond Wastewater-Treatment Plants
 Legal Citation: M.L. 2018, Chp. 214, Art. 4, Sec. 02, Subd. 04a; M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 11b
 Project Manager: Joel Peck
 Organization: MPCA
 College/Department/Division: Municipal Wastewater
 M.L. 2018 ENRTF Appropriation: \$700,000
 Project Length and Completion Date: 6/30/2020, 6/30/21
 Date of Report: 6/13/19

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	ML 2018 BUDGET	ML 2018 SPENT	ML 2018 BALANCE	ML 2019 BUDGET	REVISED ML 2019 BUDGET 6-XX-19	ML 2019 SPENT	ML 2019 BALANCE	TOTAL BUDGET	TOTAL SPENT	TOTAL BALANCE
BUDGET ITEM										
Professional/Technical/Service Contracts										
<i>Mechanical Plant Technical Assistance: MnTAP, MCES, and St. Cloud staff through Sole-source contract, which their technical and operational experience affords.</i>	\$179,200	\$21,401	\$157,799	\$0	\$128,000	\$0	\$128,000	\$307,200	\$21,401	\$285,799
<i>MRWA Pond Expert through sole-source contract, which MRWA's technical and operational experience affords.</i>	\$390,000	\$85,677	\$304,323	\$0	\$260,000	\$0	\$260,000	\$650,000	\$85,677	\$564,323
<i>Optimization Venue, Presentations, and Materials</i>	\$7,584	\$5,000	\$2,584	\$0		\$0	\$0	\$7,584	\$5,000	\$2,584
<i>Civil Engineering Students</i>	\$106,866	\$4,791	\$102,075	\$0	\$60,000	\$0	\$60,000	\$166,866	\$4,791	\$162,075
Equipment/Tools/Supplies										
<i>Five portable lab spectrophotometers for rapid wastewater analysis</i>	\$16,350		\$16,350	\$0	\$2,000	\$0	\$2,000	\$18,350	\$0	\$18,350
Capital Expenditures Over \$5,000										
<i>MRWA Vehicle</i>					\$50,000			\$50,000		
COLUMN TOTAL	\$700,000	\$116,869	\$583,131	\$0	\$500,000	\$0	\$450,000	\$1,200,000	\$116,869	\$1,033,131

