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DEPARTMENT OF TRANSPORTATION

OFFICE OF RESEARCH & INNOVATION

TECHNICAL SUMMARY

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PROJECT COST:
$150,301

At truck facilities connected to city sewers, researchers took wastewater samples from flammable waste traps while trucks were washed.

Investigating Wastewater Reuse at Rest Areas and Truck Stations

What Was the Need?

Despite Minnesota's abundance of water resources, 75 percent of the state's water comes from aquifers at increasingly unsustainable rates. The recycling of wastewater for other uses would allow potable groundwater aquifers to be used more conservatively. Gov. Tim Walz and former Gov. Mark Dayton issued executive orders directing state agencies to make efforts to save energy and water. Since every MnDOT building uses water, the potential for substantial water reuse exists.

MnDOT sought to learn the potential for on-site wastewater reuse as well as the barriers to implementing, operating and maintaining water reuse systems. Developing a system of water recycling at MnDOT facilities could create sustainable water resources for toilet flushing and vehicle washing. To that end, MnDOT initiated this project to evaluate when reuse would make sense from a regulatory, environmental, economic and management perspective at more than 50 rest areas and 137 truck-washing stations and storage facilities.

Researchers provided MnDOT with a comprehensive and practical evaluation of what the agency would need to do to develop wastewater reuse systems for its truck stations and rest areas. Two sites will install the project's recommended systems soon.

What Was Our Goal?

The objective of this project was to investigate and evaluate the potential for wastewater reuse within MnDOT. As part of the project, researchers would identify regulatory challenges, properties of wastewater streams, contaminants that would be difficult to remove or manage, potential treatment technologies and the MnDOT processes that would be suitable candidates for wastewater reuse. In addition, researchers intended to examine the possibility of recapturing salt-laden wastewater for further use in winter road maintenance.

What Did We Do?

The project's work progressed in three phases:

- **Review of current wastewater reuse policies and regulations** in Minnesota, wastewater reuse programs in other states, as well as international guidelines for water reuse. Researchers reviewed case studies about successful wastewater reuse systems implemented in Minnesota and examined potential regulatory barriers to wastewater reuse implementation.
- **Sampling and data collection from 11 MnDOT truck-washing facilities** to determine common contaminants. Samples were taken year-round from an equal number of facilities with holding tanks and from those served by city sewer systems. Researcher collected 37 winter samples. In addition, a nonwinter sample was collected from each site to compare the characteristics of winter versus nonwinter samples.
- **Evaluation of existing wastewater treatment technologies** to identify those meeting MnDOT's needs. Researchers investigated methods that could most effectively remove the identified contaminants from the wastewater while allowing chlorides to remain for brine production. Researchers also determined cost estimates over an assumed 25-year life span.

continued

"This innovative study's findings will result in the implementation of wastewater reuse technology at two MnDOT sites. The project promises to be a continuing success."

—Neile Reider,
Administrative Engineer,
MnDOT Office of
Maintenance

"The great success of this project arises from its close examination and evaluation of all aspects of industrial wastewater reuse in Minnesota, from regulation to the practical choice of technology MnDOT will be able to sustain into the future."

—Sara Heger,
Research Engineer,
Water Resources Center,
University of Minnesota

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A researcher collects a nonwinter wastewater sample from the holding tank at the Shakopee facility.

What Did We Learn?

Policies and regulation. Minnesota's current state and federal regulatory framework addressing wastewater reuse is dispersed over multiple agencies, and rules can be contradictory. Currently at least four agencies are involved in wastewater regulation. Wastewater reuse systems require a variance and in some cases additional permits from local agencies. Researchers reported that the regulatory framework for water reuse in Minnesota needs to be simplified and streamlined to create a more effective permitting process.

Researchers noted that California has been a pioneer in water reuse since 1929. Florida is a national leader, recycling more than 727 million gallons per day, while Arizona developed effective water reuse regulations in 1972 and has been a regulatory model for Texas, New Mexico and Montana. Investigators suggested that Minnesota could adopt water use standards modeled on Arizona's as the state clarifies its regulatory framework.

In addition, researchers reviewed four case studies in which wastewater reuse systems were successfully implemented.

Wastewater sample data. Researchers tested samples for volatile organic compounds, metals, fecal coliform, mercury, suspended solids, biochemical oxygen demand (BOD) and chlorides. They found excessive levels of only one chemical, ethylene dichloride, which is commonly used as a solvent; MnDOT could reduce its use of it. Across all samples, the critical contaminants to be removed for water reuse were organics (BODs) and suspended solids. Excessive chlorides were not considered a contaminant since chloride-rich water could be reused as brine in winter road maintenance operations.

Recommended technology. Researchers recommended that MnDOT use either a recirculating sand filter or a membrane bioreactor to treat wastewater. An economic evaluation comparing long-term costs of the two technologies indicated that the membrane bioreactor is the most economical system for MnDOT.

What's Next?

A pilot implementation is planned for the Granite Falls truck station, a facility that is already plumbed to separate and collect washdown water. Evaluation of the system's treatment effectiveness and maintenance requirements will inform the broader scale implementation of wastewater reuse systems for MnDOT.

This Technical Summary pertains to Report 2019-22, "Investigating Wastewater Reuse at MnDOT Truck Stations," published May 2019. The full report can be accessed at mndot.gov/research/reports/2019/201922.pdf.