Prepared by: EOR

Date: June 27, 2025

Update on developing a clear process for implementing stormwater capture and use in Minnesota

Cover Image –Campus for Organic Valley Co-op Headquarters.

Prepared for: For the Minnesota Department of Health

Table of Contents

EXECUTIVE SUMMARY

The objective of this report is to provide an overview of the current efforts, challenges, and future directions for stormwater capture and use (SCU) in Minnesota. SCU, or stormwater reuse, involves collecting, storing, treating, and reusing stormwater for non-potable purposes such as irrigation, toilet flushing, and laundry. In Minnesota, the growing interest in stormwater reuse is driven by its potential to reduce reliance on clean groundwater and treated surface water. This report details the work undertaken by state agencies and interested parties to develop guidance and best practices for SCU, highlighting the importance of safe and sustainable water management in light of increasing droughts and heavy rainfall events.

Background and Current Efforts

In 2018, an Interagency Work Group published a foundational report, "Advancing Safe and Sustainable Water Reuse in Minnesota," which recommended a risk-based management system, an information hub, and defined roles for overseeing water reuse initiatives. Following this effort, in 2021, the Minnesota Legislature called for a road map for water reuse implementation, aiming to establish a robust framework for SCU as a viable water management strategy. Subsequent reports, including the 2022 "Reuse of Stormwater and Rainwater in Minnesota: A Public Health Perspective," have further evaluated the risks and potential of SCU, using locally sourced data to assess microbial contents in stormwater systems.

Key Discussions and Findings

The Interagency Work Group and Engagement Core, which are two groups that are further described in Section 1 of the report, held a series of meetings that have been important in addressing the need for consistent guidelines to streamline SCU design, implementation, and maintenance. The discussions highlighted several core areas and the need for further consideration:

Roles and Responsibilities: Clear delineation of responsibilities across different stages of SCU systems is needed. A survey conducted among interested parties mapped out areas of need. Many of those involved indicated a preference for starting with guidance rather than regulation to manage SCU and focusing primarily on **irrigation** as the most popular end-use.

Risk-Based Management: A proposed risk-based management system categorizes applications into low, moderate, and high risk, with corresponding management levels from guidance to regulation. However, the group prioritized developing guidelines for low-risk applications like irrigation first, while complex, high-risk uses, such as potable water supply, require further consideration.

Information Hub: Developing a centralized repository for SCU information, potentially hosted within the MN Stormwater Manual, was also recommended. Information should include optimized design, management, operation and maintenance protocols and best practices learned from national experience and local case studies.

Governance and Guidance: The meetings emphasized the need for a unified set of recommendations and the potential use of restricted access as a risk management tool. There was

agreement on the need for ongoing review and refinement of the risk management framework, aligned with both national and local data.

Research/Investigation and Implementation Needs: To advance Minnesota's water reuse initiatives, several critical study areas have been identified.

System Design and Operation Optimization: Improving stormwater reuse system design, operation, and maintenance through lessons from case studies to reduce costs and enhance reliability.

Pathogen and Exposure Assessment: Researching pathogen presence and transmission routes in irrigation systems using stormwater to guide risk mitigation strategies.

Stakeholder Perspectives and Acceptance: Understanding public health perspectives and enhancing community acceptance through targeted education and risk communication.

Effectiveness of Treatment Methods: Evaluating treatment methods like UV treatment, filtration, and disinfection under various conditions to identify cost-effective solutions.

Role of Ponds/Cisterns and Pathogen Sources: Investigating the treatment efficacy of ponds and cisterns and identifying pathogen sources in rooftop rainwater to inform system improvements.

Additional Research/Investigation Needs: Developing monitoring guidelines, cost benefit analyses, evaluating reuse effectiveness as a stormwater management practice, and assessing health risks from exposure to treated stormwater.

Recommendations and Next Steps

While significant progress has been made in developing a framework for SCU in Minnesota, several challenges and disagreements remain among interested parties. To achieve broader consensus and effectively implement SCU practices, the following steps are recommended:

Clarify Decision-Making Framework: Ensure all parties understand and support the decision-making framework, such as the RAPID Decision Process, and revisit baseline understandings to achieve alignment.

Complete Cost-Benefit Analyses and Case Studies: Provide interested parties with comprehensive case studies to better understand the costs and benefits of meeting agreed-upon log reduction targets.

Define Access and Implementation Roles: Clearly define restricted versus unrestricted access and identify specific roles for design, implementation, and oversight of SCU systems.

Establish a Information Hub: Create a centralized information repository potentially within the Minnesota Stormwater Manual to facilitate knowledge sharing, best practices, and guidance on SCU, support ongoing research and foster interagency collaboration.

Engage Community Perspectives: Continue the use of a diverse working group, such as the Engagement Core, to accomplish a clear process for implementing stormwater capture and use.

Involve the broader community and public in determining acceptable risk for stormwater reuse, and associated water quality standards, and develop robust communication strategies to address concerns and update expectations that not all water systems should be assumed to be drinking water quality.

Conclusion

Stormwater capture and use presents a promising opportunity for sustainable water management in Minnesota, but key challenges remain in collecting comprehensive cost data and evaluating the effectiveness and level of need for various treatment options. As the state and involved parties continue to refine its policies and practices, a more thorough survey of existing, simpler systems that use stormwater pond water for irrigation is a good starting point to better understand cost implications and improve decision-making. Collaboration among state agencies, local governments, and other interested parties will be crucial in advancing safe, effective, and sustainable stormwater reuse initiatives. Addressing research gaps, optimizing system design, and fostering community engagement are essential steps toward building a resilient urban water management system that protects public health, enhances environmental protection, and realizes cost efficiency.

1. PROJECT BACKGROUND AND OBJECTIVES OF FACILITATED PROCESS

Water reuse is the collection, storage, treatment and use of various types of water, such as stormwater (which includes rainwater), wastewater, and subsurface water. In Minnesota, there has been an increasing level of interest in stormwater reuse (also known as stormwater capture and use or SCU) in recent years. Stormwater runoff is rain and snowmelt that flows over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground. Rainwater from roofs is considered a subset of stormwater.

Given the current interest in stormwater reuse, to facilitate progress in the short term, this effort focused on stormwater instead of wastewater or graywater. The other areas are important and worthy of consideration in the future. There is an existing framework already in place for municipal wastewater reuse, which is overseen by the Minnesota Pollution Control Agency (MPCA). There are several benefits to stormwater reuse in comparison to other sources of reuse water (such as wastewater or graywater). Those benefits include less extensive treatment needed compared to wastewater or greywater and fewer regulatory requirements since it is not wastewater-based. Reuse of stormwater can save water by decreasing our need to use clean groundwater or treated surface water, so that these sources can be saved for drinking water purposes. Reuse can also help make the consequences of dry periods and droughts less severe and help manage stormwater volume in wet periods. There are several entities, such as stormwater/water system managers, designers/engineers, and the construction community, with interest in SCU. They have expressed interest in standardization of design, defined protocols that can be referenced, and guidance on best practices, and see a lack of standardization as a hurdle to SCU success.

This growing interest led to the formation of an Interagency Work Group and the development of reports in 2018 and 2022, with the latter providing Minnesota-specific data. These reports laid the foundation for broader engagement, gathering input from partners and offering actionable recommendations for safe, sustainable reuse practices. The current report documents this facilitated process, aiming for transparency in the development of a SCU program in Minnesota while addressing additional data requests.

These requests led to the compilation of new supporting information, including case studies, to better understand the practical implications of a log reduction target (LRT)-based SCU program. These case studies provide some insights into costs, facility needs, and operations and maintenance, ensuring that future SCU programs are grounded in real-world scenarios. The concern over costs is an important aspect that is frequently raised by practitioners and communities.

The State of Minnesota Interagency Work Group completed a 2018 report called “Advancing Safe and Sustainable Water Reuse in Minnesota,” which put forward eight recommendations (**Appendix B**). Subsequent interests led to the Minnesota Legislature directing state agencies “to create a road map for water reuse implementation in Minnesota …” as required in Session Law 2021, First Special Session, Chapter 1, Article 2, Section 8. This current effort is the follow-up to the 2018 report recommendations and the legislative directive.

1.1. Project Overview

Building on the base of work summarized in the following two reports, goals were established to further the use of SCU as an effective water management strategy.

A. Advancing Safe and Sustainable Water Reuse in Minnesota - 2018 REPORT OF THE INTERAGENCY WORK GROUP ON WATER REUSE

B. Reuse of Stormwater and Rainwater in Minnesota - A PUBLIC HEALTH PERSPECTIVE, January 2022

It is worth noting the contents of these reports again (see Appendix B), since there is strong background work and information reflected in those reports that is sometimes overlooked or not fully understood. The recommendations from the 2018 Report formed the basis for the 2024 work and were translated into the following objectives:

- A list of **roles and responsibilities** to oversee and monitor stormwater capture and use that considers the involved workgroups feedback and agency leadership concurrence.
- A defined **risk-based management system** for stormwater captures and use that considers the Engagement Core's feedback and agency leadership concurrence.
- A **prioritized list** of stormwaters captures and use **investigation/study needs**.
- Written **recommendations** and proposed action plan for developing a **collaboration hub** and how information, training, and education needs will be met.
- Clear documentation of **processes** and meeting agendas, notes, and action items.
- Ensure that the **Interagency Work Group and Engagement Core** have the leadership support, organizational structures, and tools they need so that they continue to function at a high level into the future.

The research, report, and recommendations are to help assist decision makers and interested parties in setting a course of action to advance safe and sustainable water reuse in Minnesota.

A key goal of this phase of work is to focus on facilitating input and recommendations with a broader group involved in stormwater capture and use/reuse. Since this was primarily a facilitation process, the formation of the various work groups is an important part of the work. The following section reviews formation and roles of the various groups involved in this effort.

1.2. Involved Interested Parties

As part of the initial process design, involvement by several groups was necessary to represent the diverse range of participants who would be involved. To identify engagement needs and clarify roles and responsibilities in the participation process, the RAPID (Recommend, Approve (previously called Agree), Perform, Input and Decide) decision-making process was adapted and utilized (see **Figure 1**). In the context of this flow chart, this project has advanced the effort to the Recommend and Approve phase.

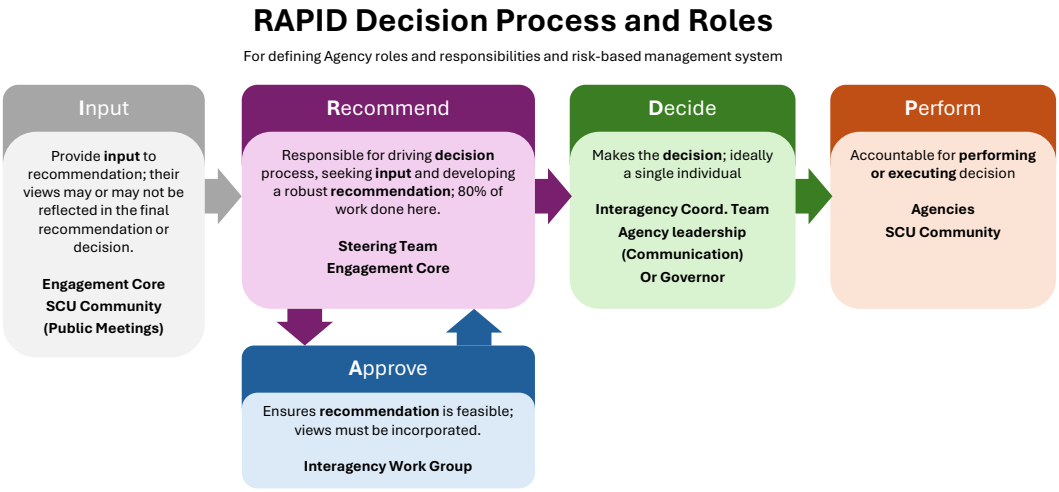


Figure 1. The RAPID Decision Process and Roles Flow Chart.

The RAPID process, adapted from the Metropolitan Council and Bain & Company, divides public participation roles into five categories: Recommend, Approve, Perform, Input, and Decide. In this flow chart, the Recommend group (Steering Team and Engagement Core) were intended for developing recommendations and performing a significant portion of the work. As the project evolved, the Steering Team's role was small, and issues were primarily brought to the broader Engagement Core. The Engagement Core spent much of its time on the Input role, providing feedback rather than generating content, as well as some preliminary recommendations. The Input group (including the Engagement Core and some additional SCU Community attendees/observers) provided valuable perspectives, while the Approve group (the Interagency Work Group) ensured that the recommendations were feasible. As an implementation framework and recommendations are developed in the future, this information should be taken to a forum open to all interested entities, such as an open house. Final decisions are to be made by the Decide group (Interagency Coordination Team and Agency Leadership), who will review the recommendations for alignment with policy objectives. The Perform group (Agencies, SCU Community) are then tasked with executing the process.

This RAPID Decision process was shared with members of the Steering Team, Engagement Core and Interagency Work Group at the beginning of the project as our accepted process for moving forward. Additionally, a work group charter was developed for the larger, more diverse Engagement Core group to facilitate a smooth and orderly process. That charter (**Appendix C**) was also shared with and approved by the groups.

1.2.1. Involved Partners/Stakeholder Details

The need for an expanded workgroup with practitioners, advisors and interested parties was identified in the 2018 Report. The first phase of the project involved forming a Steering Team, Engagement Core, and Interagency Work Group based on participants that had been active in the past, such as those asking to be informed during the 2018 report development, along with entities known to be active with reuse projects and reuse work. While the groups were largely comprised of Minnesota representatives, there were also a few national representatives invited for broader perspective. The following section discusses the membership of the various groups.

Engagement Core (Input and Recommend)

The Engagement Core is a group of representatives from local governments, designers, academia, and state agency staff, who have an interest in promoting safe stormwater capture and use. The role of this group is to provide input and recommendations to the Interagency Coordination Team and Agency Leadership to develop statewide guidance or policy on stormwater capture and use systems that ensures projects protect the public's health, environment, and eco-systems; balance risks and benefits; support water sustainability; are feasible; and reflect the realities of the industry. Given strong interest from the SCU Community in participating, additional observers were allowed to participate in the Engagement Core meetings, with the understanding their input should be routed through one of their representatives on the group. All those attending was able to share their input freely. The Engagement Core met five times during the project. A draft charter for the MN Stormwater Capture & Use Engagement Core Group was shared with the group, allowing members to propose questions and modifications to decision rules and operating agreements. After review, the group voted on the changes, and the charter was updated accordingly. The final version includes the date of acceptance once it had been finalized.

Engagement Core Members

- Scott Anderson, City of Hugo
- Lisa Vollbrecht, City of St. Cloud / City of Sartell
- Kristin Seaman, City of Woodbury
- Bob Bean / Nico Cantarero (1st portion) / Kelly Perrine (middle portion), Minnesota Cities Stormwater Coalition
- Karen Kill, Brown's Creek Watershed District
- Forrest Kelley, Capitol Regional Watershed District
- Tina Carstens, Ramsey-Washington Metro Watershed District
- Bridget Osborn, HR Green, Inc.
- Michelle Stockness, Freshwater
- Lydia Silber, Water Reuse Association
- Jim Caulkins, MNLA Foundation
- Benjamin Sojka, / Dave Stark (alternate), Rainwater Management Solutions
- Tim Malooly, Water in Motion
- John Bilotta, U of M Water Resources Center
- Larry Baker, University of Minnesota (retired)
- Anita Anderson, MN Dept. of Health
- Nancy Rice, MN Dept. of Health
- Joanne Boettcher, MN Pollution Control Agency
- Paula Kalinosky / Brandon Smith (alternate), MN Pollution Control Agency
- Mike Westemeier, MN Dept. of Labor and Industry
- Brad Wozney, MN Board of Water and Soil Resources
- Larry Gunderson, MN Dept. of Agriculture
- Jen Kader / Jennifer Kostrzewski (alternate), Metropolitan Council
- Maureen Hoffman, Metropolitan Council

Interagency Work Group (Approve)

The Interagency Work Group, in the "Approve" group in the RAPID decision-making process, is a group of state agency subject matter experts in areas related to stormwater capture and use. The role of this group is to ensure recommendations for stormwater capture and use in Minnesota are feasible. The Interagency Work Group met three times over the project, while a subset of the Interagency Work Group (Minnesota Department of Health (MDH), MPCA and the Metropolitan Council) met separately three more times. More details on the need for these additional meetings are provided in section 2.7 below.

Interagency Work Group Members

- Anita Anderson, MN Dept. of Health
- Nancy Rice, MN Dept. of Health
- Brandon Smith, MN Pollution Control Agency
- Joanne Boettcher, MN Pollution Control Agency
- Paula Kalinosky, MN Pollution Control Agency
- Mike Westemeier, MN Dept. of Labor, and Industry
- Dan Miller, MN Dept. of Natural Resources
- Brad Wozney, MN Board of Water and Soil Resources
- Udai Sing, MN Board of Water and Soil Resources
- Larry Gunderson, MN Dept. of Agriculture
- Jen Kader, Metropolitan Council
- Jennifer Kostrzewski, Metropolitan Council
- Maureen Hoffman, Metropolitan Council

Steering Team (Input and Recommend)

The Steering Team was one of the several groups of the process and made up of members from other groups. The Steering Team met once during the introductory phase of the project meeting on September 29, 2023.

Steering Team Members

- Nico Canterero, Minnesota Cities Stormwater Coalition (left/changed positions)
- Forrest Kelley, Capitol Regional Watershed District
- Michelle Stockness, Freshwater
- Mike Westemeier, DLI
- Anita Anderson, MDH
- Brandon Smith, MPCA or designee
- Jen Kostrzewski, Metropolitan Council

Interagency Coordination Team / Agency Leadership (Decide)

The Interagency Coordination Team and Agency Leadership, as the "Decide" in the RAPID decision-making process, are responsible for making final decisions on recommendations developed by the Steering Team and Engagement Core. Comprising high-level representatives from various state agencies, this group ensures that the recommendations are feasible, align with policy objectives, and are ready for implementation, deciding when they meet to review recommendations.

2. STORMWATER CAPTURE AND USE PROJECT OUTCOMES

During the initial phase of the project, ambitions were high, with a comprehensive set of goals aimed at advancing stormwater capture and use (SCU) practices in Minnesota as described in Section 1.1. However, the gap in the effort between the 2018 report and this phase of the work, due to the impacts of the COVID-19 pandemic, meant revisiting the past work with new agency and interested party representatives. The delay also shortened the available timeline for the facilitated process. So, while the goals had to be shifted, progress was made on each of the key objectives.

2.1. Key Objectives and Current Status

Below is a summary table outlining the project's key objectives, their current status (achieved/not achieved), and a brief description of further work needed to achieve each objective. Further detail is provided below in the summary table.

Table 1. Summary of Project Objectives and Status

Objective	Status	Notes, Further Work Needed
Elaboration of roles and responsibilities for overseeing stormwater capture and use.	Partially Achieved	Need to finalize roles and assign responsible parties for ongoing management and oversight.
Approval of a risk-based management system.	Begun, Not Achieved	Proposed 3-tiered system is not ready; requires resolution of log reduction target standards, risk targets, and exposure mitigation guidelines.
Development of a prioritized list of research needs.	Achieved	Further prioritization required based on new criteria and interested party input to address gaps in understanding of pathogen presence, environmental impacts, and risks.
Recommendations for developing a collaboration hub and meeting educational needs.	Achieved	Confirmed need for resources; location and structure for information dissemination (MN Stormwater Manual).
Support for continued high-level function of the Interagency Work Group and Engagement Core.	Mostly Achieved	Membership and group formed, consensus on interest to continue. Further definition of lead entity/ agency and establishing a convenor are needed.
Documentation of processes, meeting agendas, notes, and follow up items.	Achieved	Maintain ongoing documentation efforts to support future reviews and decision-making processes.

- **Elaboration of Roles and Responsibilities:** Initially, the project sought to clearly define roles and responsibilities for overseeing SCU. Although needed roles were identified and preliminary feedback obtained, the allocation of responsibilities remains incomplete.
- **Approval of a Risk-Based Management System:** A proposed 3-tiered risk-based management system was considered; it became apparent that the system could not be finalized until key elements—such as log reduction targets and exposure mitigation guidelines—were fully developed and agreed upon.
- **Development of a Prioritized List of Investigation/Study Needs:** A prioritized list of additional investigation/study needs was developed, focusing on understanding pathogen presence, environmental impacts, and other risks associated with SCU. The prioritization process was not formally documented, and further refinement is required to address additional stakeholder concerns.
- **Recommendations for a Collaboration Hub:** The need for a central hub to meet information, training, and education needs was confirmed, with a potential location identified in the Minnesota Stormwater Manual. Further steps are required to establish this hub and ensure it meets the diverse needs of interested parties.
- **Support for High-Level Function of Groups:** While there was consensus on the need for the continued function of the Interagency Work Group and Engagement Core, identifying a lead entity or agency remains an outstanding task.
- **Documentation of Processes:** Comprehensive documentation of processes, meeting agendas, notes, and action items was successfully completed, providing a robust foundation for future work and continuity in SCU initiatives.

This report summarizes the collaborative discussions and identifies the need for follow up on a comprehensive list of essential tools and resources for effective stormwater management. These include Operations and Maintenance (O&M) manuals, design guidelines, and institutional controls to mitigate exposure risks. It also underscores the necessity for cost references and templates for third-party agreements, crucial for the successful implementation and oversight of stormwater capture and reuse systems, ensuring both efficiency and compliance. The section on Roles and

Responsibilities was developed to map out future steps and included input from the Engagement Core in terms of future needs for smooth implementation.

2.2. Engagement Core and Interagency Work Group Meetings

This section summarizes the meetings and outcomes from the Interagency Work Group meetings, Engagement Core meetings and meetings with a subset of the Interagency Work Group which included MDH, MPCA and the Metropolitan Council (detailed meeting agendas, minutes, and summery provided in **Appendix-C, D, & E**). Table 2 provides a brief summary of the meetings.

Table 2. Discussion summary from various meetings during the project period.

Date	Party	Discussion Summary
Sep 29, 2023	***Steering Team***	- Discussed project purpose, team roles, and participant experiences with water reuse; outlined goals for the process. - Reviewed the RAPID process (Recommend, Approve, Perform, Input, Decide) and clarified roles; emphasized independent facilitation and public health focus. - Provided overviews of past reports and discussed the regulatory framework; conducted a Jam Board exercise for Phase II goals and aspirations.
Oct 26, 2023	***Engagement Core***	- Introduction to the project and the upcoming workshop. - Review of the RAPID Process & Roles. - Draft Charter review. - Analysis of Pre-meeting Feedback Questionnaire results.
Oct 31, 2023	***Engagement Core***	- Workshop on stormwater capture and use experiences. - Review of the 2018 State of Minnesota Report on water reuse.
Nov 13, 2023	***Engagement Core***	- Discussion on a risk-based management system for stormwater capture and use. - Review of MDH report on stormwater and rainwater reuse from a public health perspective. - Breakout sessions on risk assessment and management for various stormwater reuse examples.
Dec 8, 2023	***Interagency Work Group***	- Review of areas of agreement from MPCA-MDH-Metropolitan Council meeting. - Acknowledgment of the value of completing case studies in the decision-making process.
Jan 5, 2024	***Interagency Work Group***	- Continued review and discussion on areas of agreement from previous meetings.
Feb 28, 2024	***Interagency Work Group***	- Discussed project goals and meeting objectives. - Reviewed progress on the Risk Based Management Framework. - Analyzed survey results regarding environmental, health, and operational concerns. - Identified actions for refining the framework and assigning risk categories.

Date	Party	Discussion Summary
Mar 4, 2024	***Interagency Work Group***	- General agreement on supporting stormwater capture and use. - Discussion on environmental concerns and potential impacts. - Emphasis on balanced approach and consideration of guidelines for implementers. - Presentation on health risk analysis related to stormwater runoff. - Agreement on the importance of case studies and need for governance. - Discussion on using log reduction targets and establishment of treatment requirements.
Mar 13, 2024	***Interagency Work Group***	- Review of group agreements from previous meetings. - Agreement on consistency of Minnesota data with national data. - Consensus on adopting national data where applicable. - Confirmation of terminology and agreement on the need for case studies. - Exploration of restricted access as a risk management tool. - Discussion on governance and unified recommendations. - Agreement on periodic review of science and consensus on review frequency.
Mar 26, 2024	***Interagency Work Group***	- MDH clarified that the values in the table represent the required LRTs, not concentration targets, indicating the necessary pathogen reduction. - Discussion on exposure levels revealed that stormwater irrigation and drinking water have different ingestion rates, impacting the required treatment levels. - A draft log credit table from Washington was presented, showing how LRTs translate into treatment methods and highlighting policy implications. - The team discussed the relevance of the 10^{-4} risk benchmark for voluntary vs. involuntary exposure, with further discussions needed. - The potential for *Legionella* in stormwater systems was noted, emphasizing the need for further study and considering chlorine for control.
Apr 16, 2024	***Engagement Core***	- Attendees introduced themselves; Brett Emmons presented the agenda and project overview. - Meeting goals: update work, gather feedback on risk assessment and log reduction targets, and review process timeline. - Project review included health risks, risk-management framework, and consensus on key baseline understandings. - Nancy Rice and Anita Anderson presented health risk data, focusing on stormwater reuse and pathogen variability. - Preliminary points of understanding: national and local data alignment, need for guidance, evolving risk-management framework, and case studies.

Date	Party	Discussion Summary
May 13, 2024	***Engagement Core***	- Review of Project Progress and Engagement: Attendees emphasized ongoing feedback and discussed project goals. - Concerns and Clarifications: Participants questioned the possibility of additional Engagement Core meetings. - Case Studies Presentation: Six case studies evaluated stormwater systems' costs, effectiveness, and treatment methods. - Risk Management and Health Considerations: Discussions focused on health risk benchmarks and effective risk communication. - Recommendations and Next Steps: Recommendations included revising log reduction targets and exploring more case studies. - Future Collaboration and Funding: Ongoing collaboration and funding needs were highlighted for future projects.

Overall Outcomes

Roles and Responsibilities

- *General agreement on the need for consistent and streamlined guidance for stormwater capture and use design, implementation, monitoring, and maintenance.*
- *Provide guidance that helps designers be assured they are following a vetted and appropriate industry standard.*
- *Desire to streamline who is responsible, while also noting that it can be different organizations throughout lifecycle of the practices (design, reviews, capable/active owner, tracking, O&M).*

Risk-Based Management System

- *General understanding on supporting stormwater capture and use.*
- *The 3-Tiered Risk Management Categories Framework is not ready currently.*
- *Guidance as our targeted outcome, not Regulation currently.*
- *Identification of environmental concerns and consideration of balanced approaches.*

Research Needs

- *Agreement on the importance of case studies for clarifying costs and treatment requirements.*
- *Discussion on the use of log reduction targets and treatment requirements.*

Collaboration Hub

- *Agreement on the importance of central location for materials.*
- *It is suggested that the MN Stormwater Manual (wiki-based) would be a good host for information.*

On-going involvement of Interagency Work Group and Engagement Core

- *Irrigation as the focus of end use, in the short term.*
- *Exploration of governance needs and unified recommendations.*
- *Identified actions for refining the framework and assigning risk categories.*
- *Exploration of restricted access as a risk management tool.*
- *Emphasis on balanced approach and guidelines for implementers.*
- *Agreement of national and local data alignment, need for guidance, evolving risk-management framework, and case studies.*
- *Agreement on periodic review of science to ensure ongoing effectiveness.*

2.3. Roles and Responsibilities

A list of roles or items important in the design, implementation, and on-going operation of reuse systems was developed by the authors using the input from the various meetings and inventory of other reuse frameworks around North America. Other reports and literature (see section 4:

additional resources) on management guidance were also consulted to assemble the list. To develop resources around each one of these items – and to delegate who might be responsible for these activities in the long term – this list was reviewed with the Engagement Core and Interagency Work Group. A survey was sent to the Engagement Core members requesting feedback on the potential roles and responsibilities for overseeing, monitoring, and implementing these various elements of a stormwater capture and use system. Table 3 summarizes preliminary ideas on roles and relevant comments, including those received from the Engagement Core (**Appendix E**). Responsible parties were not yet agreed upon.

Table 3. Potential Responsibilities/Roles for Reuse Implementation Program

POTENTIAL RESPONSIBLE PARTY(IES)	COMMENTS
a. Design Considerations & How-To Guidance	
Lead: TBD **Support: TBD**	MN SW Manual (MPCA) is a primary resource. Identify essential tools for effective stormwater management, including O&M manuals and design guidelines, and institutional controls to mitigate exposure risks. Other entities should address local context issues & outreach: BWSR, WDs, Counties, MDA (rural/agriculture).
a1. Determine Appropriate LRTs for situation	
Lead: TBD **Support: TBD**	Develop framework for applying LRTs in various settings. • Determine appropriate risk benchmark – 1:10,000, 1:100, or other. • Develop criteria for restricted access to mitigate risk and potentially lower recommended LRTs • Develop Risk-Based, Tiered Management Framework
a2. Typical System Components	
Lead: TBD **Support: TBD**	SW Manual update with input from Technical Advisory Committee or Engagement Core including industry experts, agencies currently overseeing reuse project. • On MPCA's list of priority topics for SW Manual Update. • Includes Storage, pumping, pipe, nozzles, valves, meter, treatment, backup connection, controls, etc. • End uses: How to lower risk by restricting use and creating awareness to lower chance of exposure and reduce complexity and cost of construction and O&M.
a3. Backflow Preventer Valve / System Separation Guidance	
Lead: TBD	DLI with input from industry experts (irrigation, water harvesting industries, water suppliers).
a4. Vet other Source Waters (greywater/WW) and End Uses (beyond irrigation) for Management Framework	
Lead: TBD **Support: TBD**	As part of regional water supply conservation, consider other sources of reuse and extend SCU to broader end use applications.
b. Owner/ Operator Requirements	
Guidelines Lead: Interagency Work Group **Enforcement Lead: TBD**	Guidelines - training/certification for operation of components/ contexts typical in MN. Partnership agreements/contacts for 3rd parties including HOAs or maintenance contractors. Enforcement - when requirements adopted through local ordinance, local authority could be enforcement lead.

<table>
<tr><th>POTENTIAL RESPONSIBLE PARTY(IES)</th><th>COMMENTS</th></tr>
<tr><td colspan="2">c. Submittal Standardization</td></tr>
<tr><td>Lead: Engagement Core (Task Force)

Support: TBD</td><td>Within Agencies, use Site Plan Review & Permit Staff to develop – Task Force.
Incorporate into the MPCA SW Manual.
Example Dual-Objectives Framework:<table><tr><td>Objective</td><td>Submittal Considerations</td></tr><tr><td>2-yr Volume Control</td><td>TBD</td></tr><tr><td>Reduced dependence on other water sources, etc.</td><td>TBD</td></tr></table>Context dependent – customize.
Submittal recommendations vary based on project objectives/drivers: i.e., stormwater-driven or water supply source.</td></tr>
<tr><td colspan="2">d. Tracking Program</td></tr>
<tr><td>Lead: TBD</td><td>Need to address: Is it realistic to track all reuse systems?
MPCA does not have the capability to track all BMPs.</td></tr>
<tr><td colspan="2">e. Operation & Maintenance (O&M)</td></tr>
<tr><td>Lead: TBD - Develop Guidelines/Templates
Support: Local permitting authority – Require Submittals, Enforcement</td><td>Stormwater manual update, with input from the practitioners including industry experts and agencies currently overseeing reuse projects.
Reuse is on a list of priority topics for the MPCA stormwater manual update.
Include decommissioning contingency and how stormwater requirements are met.</td></tr>
<tr><td colspan="2">e1. Inspection / Reporting</td></tr>
<tr><td>Lead: Local permitting authority</td><td>Local permitting authority could determine submittal requirements consistent with state input/guidelines.</td></tr>
<tr><td colspan="2">e2. Monitoring</td></tr>
<tr><td>Lead: TBD – Develop guidelines</td><td>Guidelines - What level of system monitoring is robust enough given context?
Local permitting authority could require submittals, need to determine tie-in to enforcement.</td></tr>
<tr><td colspan="2">e3. Operator Training / Certification Requirements</td></tr>
<tr><td>Lead: TBD in the future.</td><td>Future need once there is demand through local rules or ordinances or state statute.</td></tr>
<tr><td colspan="2">f. Public Notice & Signage</td></tr>
<tr><td>Guidance Lead: TBD
Requirement Lead: TBD</td><td>MPCA or MDH could develop a signage template or standard graphic to be incorporated on signs for the purpose of consistency /public awareness.
System Owner – Implement (per local rule/ordinance)
MN SW Manual provides guidance to ensure consistency across the state.</td></tr>
<tr><td colspan="2">g. Leadership support and organizational structures to sustain Interagency Work Group and Engagement Core</td></tr>
<tr><td>Lead: TBD</td><td>Could incorporate Agencies/Engagement Core into the MN SW Manual Reuse/SCU Chapter Update process and establish an on-going committee.</td></tr>
</table>

2.4. Risk-Based Management System

One role of MDH is to determine the risk that water practices might pose in a community. In the 2022 report, MDH identified and quantified the microbial risk associated with SCU using Minnesota data and current risk assessment methods. From there, an approach to managing risk needs to be developed. A risk-based management system for stormwater captures and use, to facilitate easier implementation, could be developed with feedback from the Engagement Core and Interagency Work Group.

The 2018 report provided background on the relevance of this type of approach, which is also proposed elsewhere nationally: "Minnesota could manage the risks of water reuse through a risk-based management system which uses a spectrum of strategies ranging from education and guidance to regulation. Risk-based management systems consider factors such as contaminant concentrations of the source water, the number of people likely to be exposed to the contaminant and the complexity of the system. In general, the more people are likely to be exposed to a contaminant, the higher the level of risk and the greater the need for regulation. Lower risk categories can rely on guidance more than regulation."

Discussions started with examples of how a risk-based management system could work in Minnesota (provided in the report). The provided reuse scenarios were divided into three categories, along with suggested management approaches for each: Category 1 (low risk): Primarily guidance; Category 2 (moderate risk): Mix of guidance and regulation; and Category 3 (high-risk): Primarily regulation and licensing.

The involved interested parties reviewed the risk-based management categories and systems as presented in Table 4 and 5 (*Report 2018: Advancing safe and sustainable water reuse in Minnesota)* and began providing (*and supplemented the existing content with)* examples of the kinds of projects that might fit into the various categories. However, various comments and scenarios on water use and risk led to many iterations and combinations, distracting from advancing a management framework. To stay on track, the group agreed to focus on guidance (rather than regulation) for irrigation using stormwater and rainwater. They also concurred that more discussion is needed on who should develop the guidance content, the appropriate risk framework, and how the guidance should be housed, maintained, and implemented. Despite the challenges, a future risk-based category system, possibly similar to the one outlined above, remains a potential goal.

There were several elements of the management framework that the various interested parties requested be discussed and subject to further review. Questions for further consideration are discussed below. Those include setting a risk benchmark that reduction calculations are built upon, along with the associated LRTs that would define the level of treatment and disinfection needed. The use of LRTs and literature and industry standards are easier for implementation since it is a compliance method that does not require intensive end of pipe/sprinkler on-going monitoring and reporting, but rather a calculated removal expectancy used in the design. As the LRTs become more stringent, the amount of treatment and associated costs could increase, raising concerns about the conservativeness of these standards. It is important to note that these standards are not intended for drinking water quality but are more relaxed for non-potable purposes, such as irrigation, which do not require the same level of treatment and, therefore, would not be as expensive. The following summarizes the elements suggested for further review and the relevant issues.

2.4.1. Various Perspectives on Risk

All members of the Engagement Core and the Interagency Work Group want water reuse systems to be safe. However, consensus was not reached on how much risk the systems pose to the public, what level of risk is acceptable (e.g., what risk benchmark to use), and what practices need to be in place to ensure safety.

Both the 2017 expert panel report from the Water Environment and Reuse Foundation (WERF, 2017) and MDH's 2022 report discuss risk benchmarks that can be applied to water reuse. The reports suggest that a benchmark of 1:10,000 for infection be used for involuntary exposures. Exposure to water used in irrigation is usually involuntary. The public expects that water used in such settings is treated to be safe, regardless of its source.

In comparison, a 1:100 risk benchmark for illness, reflects a different context—voluntary risks associated with recreational activities. People typically understand the risks of swimming in a lake, for example, and make a voluntary choice to accept them, often factoring in their own health profile. Beaches frequently post warnings or closures, allowing individuals to make informed decisions about participation.

Group members looking to implement SCU are understandably concerned about the cost of any treatment components that would be required and favored options viewed as lower cost such as using the 1:100 risk benchmark or minimizing exposure through restricted access as discussed in the next section. The group hoped that the case studies would provide some information on the costs involved in providing treatment to meet the different benchmarks, but not enough details were available on those past projects to provide cost-treatment results, and perhaps "desktop" engineering estimates would be a better tool for this type of assessment.

The group wondered if signage and educational efforts might address the risk issue, but further discussions are needed on the content, languages, and placement of such signs to ensure effective communication about voluntary and involuntary risks. MDH felt signage and education alone are unlikely to completely address risk in most scenarios.

Despite the general agreement between the risk assessment conducted using Minnesota data (MDH, 2022) and the national framework report (WERF, 2017), group members still questioned whether enough local information was available and if pathogens in stormwater can cause infection or illness and how much the public is exposed to stormwater in irrigation scenarios. As the public health authority, MDH did not feel any new data were presented that warranted a new risk assessment at this time. If new data are obtained through future research efforts, MDH could reevaluate the risk.

2.4.2. LRTs recommendations and "Restricted Access" Approach

No clear consensus was reached on use of an LRT approach for the various reuse scenarios. From the health risk perspective, there are concerns of setting a target that is not restrictive enough to protect public health in the various forms of exposure that might occur and the "what ifs" of applying SCU. From the practitioner's perspective, the concern becomes too conservative of a standard that makes it cost prohibitive. The Engagement Core and the Interagency Work Group discussed the option of developing a "restricted access" approach to irrigation, and the potential for this approach to be a cost-effective way to implement SCU. MDH's risk assessment indicates that in some cases, restricted access will be insufficient to protect public health and LRT implementation will still be needed.

A **restricted access** approach would involve either limiting the location of the irrigation to non-populated and/or non-public areas or limiting the timing of application to prevent droplet inhalation or direct human contact, or variations on the two. For example, if irrigation is applied during off hours (i.e., at night in a park or golf course), would exposure to droplets be minimized and direct contact with the grass or objects be safe the next day? The group discussed restricted access as a way of irrigating that could be safer and more cost effective.

At the same time, group members acknowledged that there could be ambiguity in how it would be applied and reviewed in various situations, leaving some concerns about whether restricted access sufficiently reduces risk to humans. The topic of restricted access should be a high priority for further discussion (see Section 3.0 Recommendations and Next Steps).

2.5. Investigation/Study Needs

As Minnesota advances its water reuse initiatives, a thorough understanding of pathogen presence, exposure risks, and treatment effectiveness is essential for developing safe and efficient (storm)water reuse systems. It is important to note that there was not unanimous agreement among interested parties regarding the alignment of national and local data with recommendations. Specifically, multiple interested parties expressed discomfort with the reliance on national reports that assume significant concentrations of human sanitary sewage in stormwater ponds., even though Minnesota data also supported the presence of human pathogens in stormwater. These interested parties were hesitant to proceed with LRTs and treatment recommendations without more robust data on stormwater quality and pathogen presence.

Discussions and input from the Engagement Core and Interagency Work Group identified several research gaps that will help optimize water reuse practices and ensure public health and safety. By addressing the following research needs, Minnesota can establish a scientifically grounded framework for water reuse that ensures public health and safety, environmental protection, and practical implementation. The following research gaps are ranked from high to low with feedback from the Engagement Core on order of importance.

- **Optimization of System Design and Operation:** Refining and enhancing the design, operation, and maintenance protocols of stormwater reuse systems by drawing insights from practical experiences and case studies. This approach aims to gain a deeper understanding, mitigate costs, and enhance the reliability and consistency of reuse systems. Furthermore, it involves evaluating existing stormwater reuse systems to identify best practices, challenges, and opportunities. Subsequently, guidelines will be developed to optimize the design, operation, and maintenance practices, ensuring the efficiency and effectiveness of water reuse systems.
- **Pathogen Presence and Exposure Assessment in Irrigation:** Study the existence/presence, degradation patterns, and transmission routes of pathogens during irrigation practices to craft appropriate and customized risk mitigation approaches for irrigation systems employing reclaimed water. This research should include a comparative analysis with non-reuse (potable) water systems to identify key differences and develop tailored risk mitigation strategies. Additionally, the research may encompass (1) identifying and quantifying pathogens present in irrigation water and runoff from rooftops, and (2) evaluating the degradation rates and behaviors of pathogens across diverse environmental

conditions. Understanding these differences is crucial for creating targeted guidelines to protect public health.

- **Environmental Risks and Benefits of Stormwater Capture and Use (SCU):** Research is needed to assess the environmental risks and benefits of SCU, especially in light of interest driven by environmental regulations. This research should include evaluating both positive impacts, such as improved groundwater recharge and reduced urban flooding, and negative impacts, like potential contamination of water supplies or altered natural flow regimes in ecosystems. Additionally, the research should aim to develop necessary guidance for sustainable SCU practices.
- **Interested Parties Perspectives and Acceptance:** Capture public health perspectives and acceptance of stormwater reuse for irrigation through comprehensive public education campaigns and targeted risk communication strategies. Conduct surveys and focus groups to assess both public and interested party viewpoints on stormwater reuse. Utilize findings from these assessments to develop educational materials and tailor risk communication strategies effectively.
- **Role of Ponds/Cisterns as Treatment or Sources:** Assess the impact of ponding and residence time on pathogen treatment in ponds and cisterns to enhance system design, maximizing treatment efficiency while minimizing detrimental factors.
- **Pathogen Sources in Rooftop Rainwater:** Identify and analyze sources of pathogens in rooftop rainwater to inform improved design and prevention strategies. This, in turn, will enhance the quality of captured rainwater through refined design and source control measures.
- **Sources of Norovirus:** Identify human-associated norovirus sources and pathways to pinpoint high-risk settings and mitigate the use of water from these areas, effectively reducing the potential for norovirus contamination. Additionally, investigate potential sources of pathogens, especially norovirus, in rooftop rainwater and stormwater systems to develop recommendations for minimizing contamination from these sources.
- **Restricted Access Guidelines:** Research is needed to address "restricted access" questions to determine when treatment may not be necessary for certain reuse applications. This will help refine treatment requirements and ensure that guidelines are based on a realistic assessment of risks.
- **Case Studies on Smaller and Privately-Owned Systems:** Compile information and insights from case studies involving smaller and privately-owned and operated stormwater reuse systems. This research will provide a more diverse understanding of system performance, and the unique challenges faced by these types of installations.
- **Case Studies to Inform Costs and Impacts of System Requirements:** Conduct a broad survey of existing systems that use stormwater pond water for irrigation, many of which are simpler and less expensive, to compile cost trends for impact assessment of various requirements. Case studies could be supplemented by an engineering assessment.

Additional research gaps identified by individuals of the Engagement Core in the final rounds of review are listed below. These are listed separately since these topics were not prioritized and not able to be reviewed by the full Engagement Core since they were obtained late in the process.

- ***Monitoring Guidelines:*** Develop monitoring guidelines that consider runoff sources, seasons, end use, and treatment system components. These guidelines should specifically include monitoring for pesticides in stormwater systems, particularly in residential areas where lawn care products are frequently used to control weeds. Collecting such detailed monitoring data can enhance decision-making by providing a clearer understanding of acceptable risk levels associated with different stormwater reuse applications.
- ***Efficacy of Reuse as a Stormwater BMP:*** Evaluate if reuse systems meet their intended objectives and identify contexts where they are most cost-effective. Additionally, assessing the Microbial Risks and Impacts from Stormwater Capture and Use to Establish Appropriate Best Management Practices | The Water Research Foundation (waterrf.org)
- ***Exposure and Human Illness:*** Investigation and documentation of human illness caused by exposure to broadcast (sprinkler) irrigation using stormwater in landscape settings, including situational and data specifics.
- ***Chloride concentrations:*** Concerns exist regarding high chloride concentrations in meltwater, posing risks to vegetation and groundwater quality.
- ***Toxin accumulation:*** Study the potential for toxin accumulation in surface soils, especially metals like lead, which could be mobilized by irrigation, particularly in the presence of high chloride concentrations. It is also important to consider previous land use, as former industrial sites, agricultural chemical facilities, and golf courses may have contributed undesirable substances, including heavy metals and fungicides, to stormwater. Additionally, examine the risks of cyanotoxin contamination from algal blooms that could be dispersed through irrigation systems.
- **Cross-Contamination Prevention**: Investigate the potential for cross-contamination in stormwater reuse systems and develop guidelines for design, operation, and management practices that minimize these risks.
- **Pathogen Viability in Stormwater Ponds:** Investigate whether pathogens present in stormwater ponds are alive, active, and capable of posing a risk to human health.
- **Health Risk Assessment from SCU:** Assess the available data from Minnesota research to determine the health risks associated with stormwater capture and use (SCU) from constructed stormwater ponds.
- **Pathogen Source and Risk in Stormwater Ponds:** Examine whether pathogens found in stormwater ponds are of human origin and assess their potential impact on human health.
- **Pathogen Load Comparison:** Compare the pathogen loads in irrigation systems sourced from stormwater ponds with those in systems using potable water, evaluating the relative risks to human health.

2.6. Collaboration Hub for SCU Information

The Engagement Core and the Interagency Work Group discussed the need to have a centralized place where practitioners can find consistent and high-quality information on the latest recommended practices and methods for SCU. The participants pointed to the success of the MN Stormwater Manual in being a frequently updated and authoritative source for stormwater management. The MN Stormwater Manual has a section on the stormwater reuse, but it is already several years old and would benefit from updates and expanding to the wide list of elements of SCU.

The group recommended updating the MN Stormwater Manual to serve as a robust resource for SCU information and guidance. However, a final decision on designating the MN Stormwater Manual as the primary collaboration hub for SCU remains pending.

2.7. Interagency Work Group and Engagement Core / Expanded Workgroup

The earlier section on interested parties involved describes the significant effort spent developing the robust and expanded working group of professionals from across different organizations. The group was called the Engagement Core. See above for more details on the Engagement Core membership. It is the intent that this group, or some variation on this group, would continue to convene periodically and work collaboratively to accomplish the goals and vision of a clear process for promoting stormwater capture and use. More information about this expanded workgroup can be found in Section 3.0 Recommendations and Next Steps.

Given that many of the participants in the Engagement Core are practitioners seeking clear guidance on stormwater capture and use in Minnesota, their continued involvement is important to maintaining the momentum built during this engagement process. The Engagement Core, or their successor, should actively participate in ongoing discussions to refine the process and establish agreed-upon goals for promoting SCU. Their involvement is not only important for developing the guidance they seek but also for supporting continuous efforts such as information dissemination through the collaboration hub, monitoring and data collection, and evaluating the effectiveness of the guidance materials.

The Engagement Core should be actively involved in developing the charter under which they will operate moving forward, ensuring that the process remains dynamic and focused on the interested parties' objectives. Additionally, it is good to clarify their role in decision-making and ensure full commitment to the process. To foster continued engagement and broad-based support, it is recommended to review the current composition of the Engagement Core to ensure it includes representatives from a wide range of groups who are representative and appropriate to make recommendations on behalf of the broader community.

2.7.1. Preliminary Case Studies to Understand Scale/Scope/Feasibility

The case studies examine various stormwater reuse systems for irrigation, showcasing different approaches to treatment and risk mitigation. The 1st Street system in Waconia uses sedimentation and periodic shock chlorination for treatment, prior to use for irrigating athletic fields, while also addressing risks with signage and operational timing. Hunters Crossing, also in Waconia, employs a retrofit system with UV treatment for residential turf irrigation, reducing city water demand. Similarly, the 10th Street retrofit project utilizes treatment by chlorination for irrigation use, showing cost-effectiveness compared to potable water use. The Mississippi Watershed Management Organization focuses on flood mitigation with a cistern system that irrigates tree trenches and nurseries without disinfection. The Tower Side District Reuse System in Minneapolis, a comprehensive urban project, includes underground storage and various irrigation methods, with a high installation cost of $1.5 million. Allianz Field in Saint Paul integrates multiple risk management strategies, including UV disinfection, with water used primarily for lawn irrigation. In the case of the Allianz Field reuse and fairly rigorous treatment and monitoring system, the facility has faced operational challenges in this ultra-urban setting.

A common issue across these projects is the lack of centralized information and the challenges posed by personnel changes, as well as varying effectiveness in risk mitigation strategies. Despite these challenges, the case studies provide valuable insights into the practical benefits and obstacles of implementing stormwater reuse systems in Minnesota. However, they also highlight significant limitations, particularly in drawing definitive conclusions about the relative costs of treatment options. Key Findings include:

- **Diverse Treatment Systems:** The systems vary significantly, employing methods such as sedimentation, UV treatment, and chlorination. However, not all systems meet the MDH recommended LRTs, indicating a need for standardization in treatment efficacy.
- **Cost Implications:** Implementation and operational costs of disinfection systems are notable, impacting overall project budgets. However, the case studies show that implementing some form of disinfection treatment has been feasible for Minnesota projects. Costs also vary widely depending on the complexity and scale of the project. The lack of comprehensive cost data makes it difficult to draw useful conclusions about the most cost-effective treatment options.
- **Risk Mitigation Practices:** Common practices include using purple pipes, posting signage, and scheduling irrigation to minimize exposure. However, the effectiveness of these measures in consistently reducing exposure risk needs further validation.
- **Data and Knowledge Gaps:** There are significant gaps in information, including system operation details, maintenance costs, and long-term effectiveness. These gaps are exacerbated by decentralized project information and staff turnover.
- **Project Motivations:** While not always quantifiable, broader considerations such as reducing potable water use and improving downstream water quality are important motivators for implementing stormwater reuse systems.

2.7.2. Baseline Understandings

As part of grounding the group again after a multi-year break following the 2018 report, in part due to the COVID-19 pandemic, and with new agency and local government staff members involved, some basic points of understanding to build from were developed. After additional agency meetings to review MN stormwater and rainfall reuse system data and calculated health risks reported in the MDH 2022 report, the following understandings were accepted by the agency technical staff on the Interagency Work Group.

1. National Data Compared to Local Data - The local studies and national data on health risks and LRTs are generally comparable. More detailed guidance and comparable recommendations can be found in the “Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems (WERF, 2017)” published by the Water Environment & Reuse Foundation. It is important to distinguish between the science-based risk assessment conducted by the MDH and the perceptions of other state agencies and interested parties. Further, ongoing education is needed for interested parties to align their perceptions with the scientific risk assessments.
2. Health Risks Balanced with Implementation - Uncontrolled Stormwater reuse may pose a health risk. Guidance and/or regulation are needed to manage the risk, but it must be balanced with clearly defined and reasonable expectations of what can be implemented and monitored.

3. Consensus Among Agencies - The water agencies involved will continue to work to reach consensus on reuse recommendations to limit confusion and barriers for implementing parties. However, achieving complete consensus may be challenging and not always possible. The LRT Table and Case Studies will continue to inform these recommendations.
4. Start with Rain/Stormwater Used for Irrigation - The risk-management framework will be an evolving document initially focusing on the use of rainwater and stormwater for irrigation purposes. This clear and limited focus allows for the development of well-supported guidelines and best practices for design, installation, maintenance, and operation. In the future, the framework can be expanded to include other end uses (e.g., splash pads, wash water) and potentially treated greywater as source waters, aligning with stakeholder consensus and further research.
5. Framework Needs Regular Review - The risk-management framework will be revisited regularly to ensure that the most recent scientific data and best management practices are incorporated. The Review will follow a cycle of 5 years, with the timeframe being evaluated and adjusted as necessary to remain current with ongoing research and developments.

The agency staff brought these to their leadership for review and confirmation. There was general support for these points, however the MPCA, Metropolitan Council, and MDH leadership asked to receive and consider the various implementers' input before full endorsement.

This same list of baseline understandings was also brought to the broader Engagement Core for review and input. A Fist-to-Five exercise was planned for an Engagement Core meeting, however there was a lack of time at the meeting due to extensive discussion and questions on other topics. Feedback was instead collected via an online survey.

Summary of Survey Feedback:

- Survey results indicated diverse perceptions of health risks, highlighting the need for further outreach, discussions, and education on collected data.
- Some respondents were uncomfortable with the five statements listed above, suggesting follow-up in a future phase.
- There are still concerns around implementing regulation and some have a preference for guidance only. However, earlier concerns were expressed that having different standards in every jurisdiction is a barrier to stormwater capture and use. In that context it was discussed previously that practitioners would prefer consistent guidelines or standards statewide.
- A summary of survey results and feedback from participants is included in the appendices.

3. RECOMMENDATIONS AND NEXT STEPS

The series of meetings conducted for this effort provided valuable insights on SCU issues, from understanding the risk analysis and water quality requirements to the design, operation, and long-term maintenance considerations. It also showed that there remain different perspectives on how best to remove uncertainties related to health risks. This phase of the work did not allow the time and opportunity for the in-depth discussions needed to achieve broader consensus among all interested parties. Consequently, there remains disagreement on decision points and the form of a management framework among agencies and other interested parties. There was consensus that the broad stakeholder process should be continued in future phases of this work, and continuity of those discussions without major delays is important. The participants suggested that there

continues to be a need for clear guidance, resources, and a standardized process, and that continued discussions will foster greater alignment and understanding. The structure of these recommendations follows the main elements of the project.

3.1. Potential Roles and Responsible Parties

One important element of streamlining stormwater captures and use implementation is defining which roles need to be formalized, and the associated responsible parties to lead and/or support each role. Significant progress was made towards the development of a comprehensive list of roles and elements, such as: design, implementation, and operational elements related to stormwater capture and use. This content was informed by national and international guidance documents and the insights of the Engagement Core members. The identification of responsible parties for the various roles to support implementation of stormwater capture and use was discussed but was not completed during the course of this project,

Once the roles are more fully detailed out and defined, the next step will be to identify which entities should be responsible for these roles and obtain their concurrence and supported funding. The preliminary list of possible roles identified during this project is a starting point (Table 3).

3.2. Design Guidance for Consistent Implementation

To advance SCU and address barriers identified by interested parties, it is recommended to prioritize the development of a menu of tools outlining best practices for stormwater capture and reuse. This menu should include design guidelines, permitting processes, risk management decision-making, institutional control options, treatment strategies, cost estimation, funding mechanisms, third-party agreements, and O&M manuals. Establishing this toolkit will provide a clear foundation for the roles needed in the design and implementation process, facilitating smoother project execution and compliance.

3.3. Support for Continuation of Engagement Core

Given that many of the participants on the Engagement Core are the practitioners (in some form or fashion) requesting clear guidance on the use of stormwater capture and use in Minnesota, it will be important to continue engaging them in the SCU work moving forward. Not only will they be critical in establishing the guidance they are seeking, but it will also be important to engage them in on-going efforts such as making information available on the collaboration hub, monitoring and data collection, and evaluating the effectiveness of the guidance materials moving forward.

The Engagement Core should also be involved in developing the charter under which they will operate moving forward. In developing this charter, it will be important to ensure that everyone involved in the process understands and supports the RAPID decision-making framework. While this framework was introduced at the beginning of this effort, people didn't understand how it should be used. Moving forward, the framework should be revisited throughout the process and greater emphasis should be placed on community input and co-creation.

The list of who is included on the Engagement Core should also be revisited to make sure that participants representing the broader groups of interested parties are appropriate and people are comfortable with them making recommendations on behalf of their groups. The following groups were represented on the Engagement Core during this phase of the work:

- Cities
    - Metro

    - Outstate
- Minnesota Cities Stormwater Coalition
- Watershed Districts
- Water-Related Non-Profit Organizations
    - MN
    - National
- Design/Engineering Consultants
- Industry Equipment Providers
- Irrigation Industry
- Landscape and Irrigation Trade Groups
- Academia/Universities
- State Agencies
    - Dept. of Health
    - Pollution Control Agency
    - Dept. of Labor and Industry
    - Dept. of Natural Resources
    - Board of Water and Soil Resources
    - Dept. of Agriculture
- Regional Agencies – Metropolitan Council

When the Engagement Core reconvenes, they should revisit the following discussion points which is where they left off at the end of this effort.

- Revisit the five baseline understandings with local implementers to make sure everyone is engaged, informed, understands, and agrees with an updated framework.
- Identify which entities will assume responsibility for the various roles identified.
- Define restricted versus unrestricted access.
- Research new water reuse frameworks subsequent to the 2018 Report and include any new insights or options for use in MN's approach.
    - Example: Rainwater harvesting systems, 2022, ICC 805:2022 - Canadian Standards Association (operating as "CSA Group"), International Code Council, Inc. ("ICC"), Standards Council of Canada ("SCC"), and the American National Standards Institute ("ANSI").
- Develop the framework for stormwater capture and use that clarifies the process of implementing this stormwater management practice throughout the state of Minnesota.
- Correlate cost impacts of log reduction targets, conduct an engineering assessment and/or complete the Case Studies initiated here so interested parties can better understand the cost-benefit of meeting the agreed upon log reduction targets.
- Revisit the implementation framework and the need to include adaptive management moving forward.

In addition to the Engagement Core continuing, it is also recommended that a smaller, technical group or subcommittee be established as the process continues with the interested parties. Given the number of highly technical issues, it was challenging to have a large, interested parties group (Engagement Core) of 25-30 people to work through a long list of technical details. A lead entity, such as the MPCA, Met Council or non-profit such as Freshwater, should be identified to serve as

convenor for the group and representatives of the technical group/subcommittee. The technical group should be reviewed and approved by the Engagement Core to ensure they are operating as trusted messengers.

3.4. Collaboration Hub and Information Sharing

To advance safe water reuse in Minnesota, it is recommended that the technical guidance and resources be brought into the existing Minnesota Stormwater Manual. The Manual will provide a central location for practitioners to find current information, best practices, and guidance on SCU. It should also address training and education needs, ensuring practitioners have access to consistent, authoritative resources. Additionally, this hub should serve as a repository for best practices, case studies, research findings, and regulatory updates to support ongoing and future SCU initiatives. By fostering Interagency collaboration and stakeholder engagement, this can serve as common location and hub that will enhance information sharing, streamline processes, and support ongoing research and implementation efforts. Through input from the Engagement Core group, on-going learning and insights could be included in future updates of the MN Stormwater Manual, if MPCA has resources and were amenable, ensuring it remains a living document that evolves with advancements in the field.

3.5. Engaging Community Perspectives

The development of water quality standards and the framework should actively engage community members to understand their perspectives on acceptable water quality standards. Evidence from the study by Hwang, Valeo, and Draper (2006) suggests that with proper communication, there may be a higher acceptance of using higher-risk water for purposes such as irrigation. However, it is essential to recognize that effectively communicating the associated risks can be challenging. In the U.S., there is a strong expectation that any permitted use of water will be safe. Therefore, future work should focus on developing robust communication strategies to convey the safety and benefits of using recycled stormwater for irrigation, while also addressing community concerns and expectations. Strengthened engagement with local communities, interested parties, and the public is essential to advancing SCU projects. This includes developing targeted educational campaigns, gathering feedback, and fostering a comprehensive understanding of the benefits and risks associated with water reuse practices. Such collaborative efforts can build trust, increase acceptance, and ensure the successful implementation of water reuse initiatives.

3.6. Investigation/Study Needs

The continuation of investigating SCU methods, applications, and risks remains a long-term need. However, guidance development can proceed without exhaustive research in all areas. An extensive list of research areas should not be interpreted as a barrier to creating actionable guidance. Instead, these efforts will serve to refine and strengthen water reuse practices over time.

To further advance Minnesota's water reuse initiatives, addressing key research gaps is essential to enhance safety, efficiency, public trust, and cost-effectiveness. Focus areas include optimizing system design and operations, assessing pathogen presence in stormwater used for irrigation, understanding stakeholder perspectives, evaluating treatment methods, and identifying pathogen sources. Additional priorities involve developing monitoring guidelines, evaluating reuse efficacy, assessing human illness risks, and managing chloride and toxin accumulation, and evaluating reuse efficacy. Addressing these gaps will enhance safety, efficiency, public trust, and cost-effectiveness

of water reuse systems through informed design and policy development. One funding source recommended is developing a proposal to the MN Stormwater Research Council as a potential avenue to complete this much needed work.

3.7. Road map for Next Steps

This section compiles the key considerations discussed above and presents them as a concise list to facilitate the next phase of this work. These considerations emerged from the development of a streamlined framework and discussions with the Engagement Core about outstanding needs. It serves as a road map for necessary actions once the agency (e.g., MPCA) responsible for advancing this effort is selected. The order of these next steps reflects the priorities informed by the stakeholder process.

- *Leadership:* Select the agency responsible for advancing this work, ensuring consistent leadership, accountability, and strategic direction. The chosen agency will coordinate efforts, secure funding, engage interested parties, and align initiatives with broader policy objectives for successful execution.
- *Centralized Information Repository:* Establish a centralized database for recording project information, ensuring continuity despite staff changes and improving data accessibility for future evaluations.
- *Standardized LRT Guidelines*: Develop and disseminate standardized LRTs tailored to different source-use scenarios. These guidelines, informed by entities like MDH, WRF, other states and cities and international standards, will provide clearer targets for treatment systems.
- *Cost-Benefit Analysis:* Incorporate comprehensive cost-benefit analyses in future projects, including the long-term savings from reduced potable water use and environmental benefits. This should extend beyond installation and operational costs to cover broader economic and ecological impacts.
- *Project Registration and Monitoring:* Develop a system to assure proper long-term maintenance and operation of SCU systems, including maintenance schedules and a framework for appropriate monitoring. Develop and implement a system and set of protocols to provide such assurance through a training and/or certification program for contracted operators, with cities providing oversight for system owners.
- *Financial Incentives:* Encourage municipalities to provide financial incentives, such as credits or subsidies, for projects that meet or exceed LRTs and demonstrate significant public health and environmental benefits.
- *Case Studies and/or Engineering Assessment:* Further research is required to develop a more comprehensive understanding of stormwater reuse systems that utilize stormwater ponds for irrigation. This should involve a detailed survey of existing systems, particularly those that are simpler and less expensive, to evaluate their costs and treatment effectiveness in meeting LRTs. The research should also focus on identifying and analyzing the roles of various interested parties, including cities, watershed management organizations, landscapers, and golf course managers, in managing these systems. This data will help in developing informed recommendations for future project planning, ensuring that stormwater reuse practices are both cost-effective and effectively protecting public health.

Additional case studies should include systems supplying irrigation from stormwater ponds without treatment across the nation and in the state to better understand the risk management and cost-benefits of this common BMP.

- *Educational Outreach:* Strengthen educational outreach programs to inform the public and interested parties about the benefits, risks, and operational details of stormwater reuse systems, fostering greater community support and understanding.
- *Policy Integration:* Advocate for the integration of stormwater reuse standards into municipal and state policies, ensuring that new developments align with the best practices identified through these case studies.
- *Institutional Controls for SCU Risk-based Management System:* Further research is needed to assess institutional controls for managing stormwater capture and reuse systems. This includes evaluating strategies for access restrictions, such as time-of-day watering schedules, and the effectiveness of signage in conveying risks. Additionally, studying proximity controls to mitigate exposure and developing institutional frameworks for enforcing these controls is crucial. This research will provide recommendations for implementing guidelines that balance stormwater reuse benefits with public health and safety.

By addressing these recommendations, future stormwater reuse projects can achieve better health outcomes, cost efficiency, and environmental sustainability, contributing to more resilient urban water management systems.

4. REFERENCES AND ADDITIONAL RESOURCES

1. Minnesota Department of Health (MDH), 2018. Advancing Safe and Sustainable Water Reuse in Minnesota
2. Minnesota Department of Health (MDH), 2022. Reuse of Stormwater and Rainwater in Minnesota - A public health perspective
3. Hunter, P. R., & Fewtrell, L. (2001). Acceptable risk (pp. 207-227). IWA Publishing, London.
4. Hwang, A. S., Valeo, C., & Draper, D. (2006). Public perceptions and attitudes toward stormwater recycling for irrigation. Canadian Water Resources Journal, 31(3), 185-196.
5. Pure Potential: The Case for Stormwater Capture and Use
6. BARR, 2014. Public and Private Partnerships for Water Reuse: Wastewater, Stormwater, Rainwater, or Industrial Water Reuse
7. Canadian Standards Association (CSA), 2022. Rainwater Harvesting Systems- Standards update service.
8. Kyle et al., 2022. Water Reuse: Executive Summery.
9. Schoen et al (2023) _Onsite Nonpotable Water Systems Pathogen Treatment Targets - A comparison of infection and DALYs) risk benchmark approaches.
10. Schoen et al. (2017) _ Risk-based framework for the development of public health guidance for DNPW system.
11. Carina Eisfeld, Boris M. van Breukelen, Gertjan Medema, Jan M. van der Wolf, Jouke Velstra, Jack F. Schijven, QMRA of Ralstonia solanacearum in potato cultivation: Risks associated with irrigation water recycled through managed aquifer recharge, Science of The Total Environment, Volume 901, 2023, 166181, ISSN 0048-9697, doi: doi.org/10.1016/j.scitotenv.2023.166181.

12. L. Alcalde-Sanz, B. M. Gawlik, Minimum quality requirements for water reuse in agricultural irrigation and aquifer recharge - Towards a legal instrument on water reuse at EU level, EUR 28962 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-77175-0, doi:10.2760/804116, JRC109291
13. Sharvelle, S.; Ashbolt, N.; Clerico, E.; Hultquist, R.; Leverenz, H.; and A. Olivieri. (2017). Risk Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems. Prepared by the National Water Research Institute for the Water Environment & Reuse Foundation. Alexandria, VA. WE&RF Project No. SIWM10C15.

APPENDIX A

Definition of Various Terms Used

Stormwater and Water Reuse

Stormwater: Water generated by rainfall or snowmelt that causes runoff and that reaches the ground.

Rainwater (subset of stormwater): Water generated by rainfall or snowmelt that can be collected directly from roof surfaces.

Wastewater: Used or discharged water from homes, institutional or public buildings, commercial establishments, farms or industries.

Graywater (subset of wastewater): Wastewater segregated from a domestic wastewater collection system, typically from laundry and bathing water.

Stormwater Capture and Use (SCU): The capture and use of stormwater, wastewater and subsurface water to meet water demands for intentional and beneficial uses.

Water Reuse: Virtually the same as SCU; the capture and use of stormwater, wastewater and subsurface water to meet water demands for intentional and beneficial uses.

Irrigation: Artificial application of water to soil to grow crops or maintain landscapes.

Nonpotable End Uses: Flushing, irrigation, cooling, washing, and industrial processes waters.

Potable End Uses: Drinking, culinary, and bathing waters.

Filtration: Removing particles and associated contaminants from stormwater.

Disinfection: Treatment method to kill harmful microorganisms in stormwater.

Ponds/Cisterns: Structures used to collect and store stormwater for reuse.

Risk Management

Risk-Based Management System: Framework for categorizing and managing risks to determine appropriate levels of guidance or regulation.

Log Reduction Targets (LRTs): Numbers that represent the difference between the level of microbes in the water before and after treatment on a Log10 scale (.

Design and Implementation

Design: Planning and creating systems for capturing, treating, and reusing stormwater.

Implementation: The process of executing and applying designed systems and practices.

Operation: Ongoing management and functioning of stormwater capture and reuse systems.

System Optimization: Improving design and operation of water reuse systems for efficiency and effectiveness.

Operational Guidelines: Instructions for managing and maintaining stormwater reuse systems.

Case Studies: Detailed analyses of specific stormwater reuse projects to understand costs and benefits.

Cost-Benefit: Evaluating financial and environmental impacts of stormwater reuse projects.

Tools and Resources

Minnesota Stormwater Manual: Comprehensive guide with best practices and guidelines for managing stormwater in Minnesota hosted by the MN Pollution Control Agency.

Collaboration Platform: Tool for facilitating cooperation among interested parties and sharing stormwater management resources.

APPENDIX B:

2018 and 2022 Report Summary

2018 Report – Advancing Safe and Sustainable Water Reuse in Minnesota

The first, 2018 Report (MDH, 2018), sought to understand the state of the science and management approaches being developed and considered throughout North America, and compile the research into a management framework that Minnesota could use to streamline and facilitate safe water capture and use.

From the Executive Summary of the report, the outcomes of that effort are summarized here:

Executive Summary

Water reuse will be an increasingly important part of managing Minnesota's water resources as demands on our water supplies continue to grow due to population increases, urbanization, climate change, increased irrigation, and industry growth. Water reuse is happening across Minnesota. Despite increasing interest in water reuse, there is no comprehensive statewide guidance or policy on water reuse. In 2015, the Minnesota Legislature directed the Minnesota Department of Health to:

"Prepare a comprehensive study of and recommendations for regulatory and non-regulatory approaches to water reuse for use in the development of state policy for water reuse in Minnesota" (Session Law 2015, 1st special session, Chapter 2, Article 2, Section 8).

The Clean Water, Land and Legacy Amendment provided funding for this project. In response to the Legislature's directive and funding, the Water Reuse Interagency Work Group ("Workgroup") formed including representatives from the Departments of Agriculture, Health, Labor and Industry, and Natural Resources, the Minnesota Pollution Control Agency, Board of Water and Soil Resources, Metropolitan Council and the University of Minnesota Water Resources Center.

The Workgroup:

- *Defined successful water reuse.*
- *Collected and assessed information on 1) water reuse in Minnesota, 2) water reuse in other states and nations and 3) ways to manage human health risks posed by water reuse.*
- *Sought stakeholder perspectives through surveys and meetings.*

The Workgroup used the information to develop Minnesota-specific recommendations for state and local governments, non-governmental organizations, businesses, and industries to consider in developing regulations and guidance for water reuse. The recommendations are:

a. *Create an expanded workgroup with practitioners, advisors, and interested parties to continue development of standards and programs.*
b. *Prioritize investigation/study needs and integrate ongoing research to address questions about reuse.*
c. *Define roles and responsibilities to oversee and monitor water reuse.*
d. *Establish an information and collaboration hub on the web to share information and resources.*
e. *Develop a risk-based management system to determine if regulation or guidance is needed.*
f. *Develop water quality criteria for a variety of reuse systems based on the log reduction target approach for pathogens to manage human health risks.*
g. *Resolve unique issues related to graywater reuse to determine the feasibility of expanding graywater reuse.*

h. *Provide education and training to support water reuse.*

This research, report and recommendations can help assist decision makers and interested parties in setting a course of action to advance safe and sustainable water reuse in Minnesota.

2022 Report - Reuse of Stormwater and Rainwater in Minnesota

The 2022 Report (MDH, 2022) delved deeper into the health risk aspects of reuse and drew from new, locally collected data on stormwater collected for reuse and the contaminants of health concern.

From the Executive Summary of the report, the outcomes of that effort are summarized here:

Executive Summary

There has been an increasing level of interest in water reuse in Minnesota in recent years. Water reuse is the collection, storage, treatment, and use of stormwater, wastewater, and subsurface water. Rainwater from roofs is considered a subset of stormwater. Stormwater can also fall and travel on land surfaces. Stormwater reuse for non-potable uses such as irrigation, toilet flushing, or doing laundry are the main topic of this paper.

There are many benefits to stormwater reuse. Stormwater reuse can save water by decreasing our need to use clean groundwater or treated surface water for everything, so that these sources can be saved for drinking water. Reuse can also help make the consequences of dry periods and droughts less severe and help manage stormwater in wet periods.

However, there are some potential threats to public health that need to be considered. We know very little about what (such as pathogens or chemicals) is in the source water of some stormwater reuse systems, how people could be exposed to reused water, and how easily people could get sick if there are pathogens or chemicals in the water they may be exposed to. We need to learn more and make sure stormwater reuse is safe for people.

The Minnesota Department of Health's (MDH) mission is to protect, maintain, and improve the health of all Minnesotans. Under this mission, we are required to identify and assess potential threats to public health. The questions we ask to evaluate the safety of stormwater reuse from a public health perspective include:

- *What is in stormwater and rainwater that could be harmful to people?*
- *How likely are people to get sick from stormwater reuse?*
- *Who could be affected?*
- *Is there a way to reduce the hazard or the exposure of reused water to prevent potential illness or injury?*

This paper is focused on stormwater and rainwater reuse. To prepare this paper we:

- *Studied reports that have explored the risks and benefits of stormwater reuse.*
- *Partnered with the University of Minnesota and the Minnesota Public Health Laboratory to collect data about the microbial and chemical content in stormwater reuse systems in Minnesota.*
- *Reviewed stormwater reuse guidelines and risk-based frameworks from other states and countries to see how they handled concerns about human pathogens.*
- *Assessed the potential human health risk from Minnesota stormwater reuse systems.*

- *Made recommendations to inform policymakers, regulators, and stormwater reuse implementers.*

This white paper provides guidance on what to consider from a public health perspective when approaching stormwater reuse in Minnesota. It gives an overview of potential health risks from stormwater reuse, presents a quantitative assessment of microbial risk with Minnesota data, and describes a risk-based framework that could be one approach to managing risks.

After reviewing the data, we have determined that stormwater and rainwater used in water reuse systems contain some microbes. Many of the microbes come from human sewage or animal waste. This could lead to potential health risks and possible illness for people exposed to the water.

People who are designing and operating stormwater reuse systems can reduce these risks. The recommendations at the end of this document were developed based on the quantitative microbial risk assessment described in this paper and are ways to reduce potential human health risks.

Next, an expanded workgroup will convene to decide on actionable steps for stormwater reuse in Minnesota.

APPENDIX C

Charter: MN Stormwater Capture & Use - Engagement Core Group

Charter: MN Stormwater Capture & Use - Engagement Core Group

Background

In 2019, the Minnesota Legislature directed the Department of Health to "…create a road map for water reuse implementation in Minnesota and to address research gaps by studying Minnesota water reuse systems." The purpose of the 2024 work is to advance the recommendations from the 2018 State of Minnesota report: Advancing Safe and Sustainable Water Reuse in Minnesota, and subsequent 2022 Report: Reuse of Stormwater and Rainwater in Minnesota, A Public Health Perspective. The process is a facilitation of various groups involved in water management and interested parties working with stormwater capture and use/reuse.

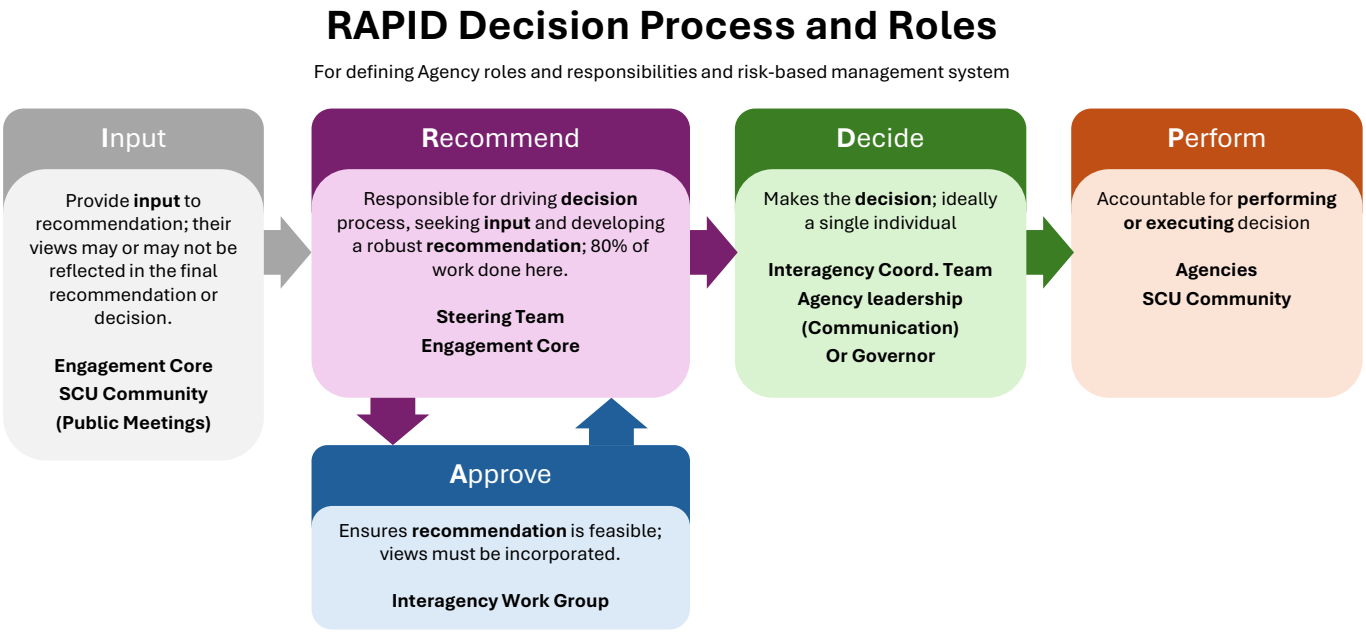
The Engagement Core is a group of representatives from local governments, designers, academia, and state agency staff, who have an interest in promoting safe stormwater capture and use. The role of this group will be to provide input and recommendations to the Steering Team to develop statewide guidance or policy on stormwater capture and use systems that ensure projects protect the public's health, environment, and eco-systems; balance risks and benefits; support water sustainability; are feasible; and reflect the realities of the industry. The Engagement Core is expected to meet 6 times over the next 10 months.

Background Materials

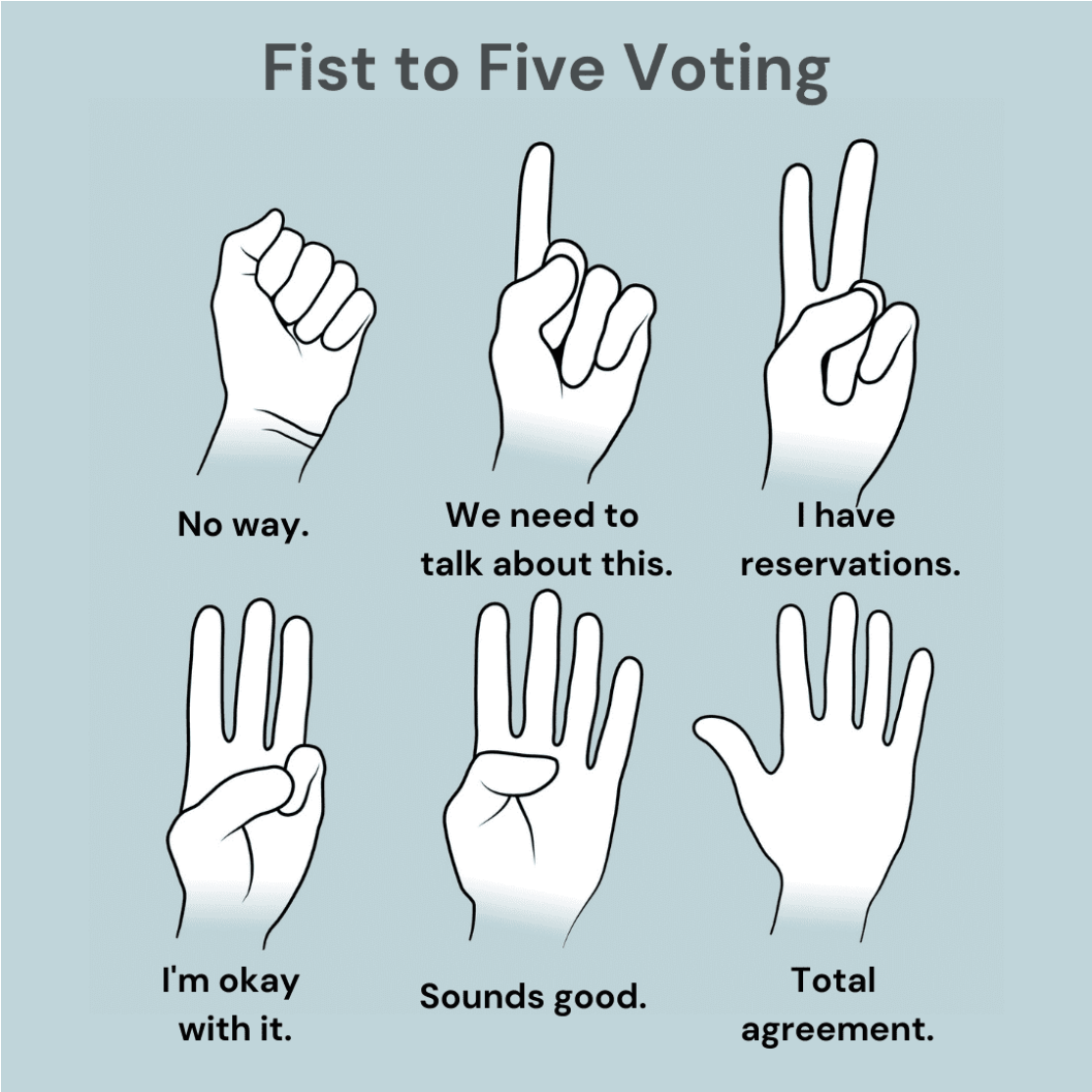
Background materials will be available on project Teams site

- 2018 State of Minnesota report: Advancing Safe and Sustainable Water Reuse in Minnesota (https://www.health.state.mn.us/communities/environment/water/docs/cwf/2018report.pdf)(PDF)
- 2022 MDH Report, Reuse of Stormwater and Rainwater in Minnesota, A Public Health Perspective (https://www.health.state.mn.us/communities/environment/water/docs/cwf/wpwaterreuse.pdf)(PDF)

Roles and Responsibilities



Decision Rules



Note: While this decision rule process was established in the Charter, it was not needed or used in the meetings.

- Both straw polls and votes will use a gradient of agreement, fist to five.
- Decisions are made by those in attendance. We invite input ahead of those unable to attend and will only schedule meetings when at least 75% can attend.
- Approval requires 75% of those in attendance to vote "Sounds good" or "Total agreement" and no more than one to vote "No way".
- All decisions will be recorded. We will only revisit decisions if the group votes that it is necessary.
- Engagement Core Group votes on recommendations to submit to the Agency Leadership / Governor, who votes on acceptance of the recommendations.

Operating Agreements

- Start on time. End on time.
- Be present. Give this work and your fellow participants your full attention. Limit use of electronic devices.
- Cameras on for virtual meetings.
- Encourage understanding. Speak plainly, ask questions, listen for understanding, allow some silence.

- Share your perspective.
- Be responsible for your own needs.

Engagement Core Members

The Engagement Core is a group of over 20 representatives from local governments, designers, academia, and state agency staff, who have an interest in and experience with stormwater capture and use (SCU). The role of this group will be to provide practical input and recommendations to the Steering Team to develop statewide guidance or policy on stormwater capture and use systems that ensures projects protect the public's health, environment, and eco-systems; balance risks and benefits; support water sustainability; are feasible; and reflect the realities of the industry. The list below is the original invited list, and as the work proceeded, additional interested parties joined the meetings and were involved, receiving materials, commenting, and/or regularly attending meetings.

Name	Organization	Designation
Anita Anderson	MDH	Agency
Benjamin Sojka or Dave Stark[1]	Rainwater Management Solutions	Reuse Industry
Brad Wozney	BWSR	Agency
Brandon Smith or Paula Kalinosky[1]	MPCA	Agency
Bridget Osborn	HR Green, Inc.	Consultant
Forrest Kelley	Capitol Region Watershed District	Watershed District
Jen Kader	Metropolitan Council	Agency
Joanne Boettcher	MPCA	Agency
John Bilotta	U of M Water Resources Center	University
Karen Kill	Brown's Creek Watershed District	Watershed District
Kristin Seaman	City of Woodbury	City
Larry Baker	University of Minnesota (retired)	University
Larry Gunderson	MDA	Agency
Lisa Vollbrecht	City of St. Cloud	City
Lydia Silber	Wate Reuse (VA)	Nonprofit, National
Maureen Hoffman	Metropolitan Council	Agency
Michelle Stockness	Freshwater	Nonprofit
Mike Westemeier	DLI	Agency
Nancy Rice	MDH	Agency
Nico Canterero or Bob Bean[1]	Minnesota Cities Stormwater Coalition	Cities
Scott Anderson	City of Hugo	City
Tina Carstens	Ramsey-Washington Metro Watershed District	Watershed District

[1] Backup, if primary representative cannot attend

Schedule & Milestones

Materials for each event were available on project Teams Site

Event Number	Event	Date	Discussion Topics
1a	Online meeting Engagement Core Workshop (Part 1)	Oct. 26 2023	Introductions and background
1b	In Person Engagement Core Workshop (Part 2)	Oct. 31 2023	Engagement activities to identify gaps and entities involved in stormwater reuse and to define roles and responsibilities.
2	Online meeting	Nov. 13 2023	Input on a risk-based management system for stormwater capture and use in Minnesota
3	Online meeting	Jan. 8 2023	Engagement Core Feedback on Roles & Responsibilities
4	Online meeting	Jan. 24 2023	Engagement Core Feedback on Risk Based Management
5	Online meeting	Mar. __ 2024	Draft a proposed action plan for developing a collaboration hub and how information, training, and education needs will be met.
6	Online meeting	Apr.__ 2024	Prioritized list of investigation/study needs and identify next steps related to the establishment of a realistic organizational structure for future work.

APPENDIX D

Steering Team Meeting

agenda

MN Stormwater Capture & Use - Steering Team Meeting #1
September 29, 2023, 1:00 p.m. – 3:00 p.m.
Microsoft Teams meeting
Join on your computer, mobile app or room device
Click here to join the meeting

Meeting ID: 255 238 767 21
Passcode: WGUHVU

Meeting purpose: Project Kick-off meeting with Minnesota Department of Health project management team, Steering Team, and EOR.

Attendees:

- Anita Anderson, MDH
- Forrest Kelley, Capitol Regional Watershed District
- Michelle Stockness, Freshwater
- Nico Canterero, Minnesota Cities Stormwater Coalition
- Anne Nelson, MDH
- Camilla Correll, EOR
- Brandon Smith, MPCA or designee
- Jen Kostrzewski, Metropolitan Council
- Mike Westemeier, DLI
- Tannie Eshenaur, MDH
- Brett Emmons, EOR
- Mike Rupiper, EOR

Time	Agenda Item	Lead
1:00 25 min	**Welcome and Introductions** ▪ Welcome and purpose of the project ▪ Introductions and experience with reuse ○ What are you hoping to get out of this process? ▪ Role of the Steering Team	Eshenaur
1:25 15 min	**RAPID Decision Process** ▪ Review RAPID (Recommend, Approve, Perform, Input, and Decide) Process & Roles	Eshenaur
1:40 20 min	**Background on Stormwater Capture and Use in MN** ▪ Overview of previous reports ○ 2018 State of Minnesota Report, Advancing Safe and Sustainable Water Reuse in Minnesota ○ 2022 MDH Report, Reuse of Stormwater and Rainwater in Minnesota, A Public Health Perspective	Anderson / Rice
2:00 15 min	**Goals and aspirations for Phase II of stormwater capture and use in MN** ▪ Jam Board exercise	Rupiper / Emmons
2:15 15 min	**Project Overview** ▪ Review scope of work ▪ Review meeting schedule ▪ Teams Site	Emmons / Rupiper
2:30 15 min	**Engagement Core** ▪ Review of Engagement Core membership ○ Anyone missing? ▪ Review draft charter	Emmons / Rupiper

2:45 15 min	**Closing** ▪ Follow up items ▪ Engagement Core workshop (Part 1) Oct. 26th at 10:30 AM ▪ Engagement Core workshop (Part 2) TBD	Eshenaur
3:00	*Adjourn*	

minutes

MN Stormwater Capture & Use Steering Team Meeting #1

September 29, 2023, 1:00 p.m. – 3:00 p.m.

Microsoft Teams meeting

Join on your computer, mobile app or room device

Click here to join the meeting

Meeting ID: 255 238 767 21
Passcode: WGUHVU

Meeting purpose: Project Kick-off meeting with Minnesota Department of Health project management team, Steering Team, and EOR.

Attendees:

- Anita Anderson, MDH
- Forrest Kelley, Capitol Regional Watershed District
- Michelle Stockness, Freshwater
- Nico Canterero, Minnesota Cities Stormwater Coalition
- Anne Nelson, MDH
- Mike Rupiper, EOR
- Paula Kalinosky, MPCA
- Jen Kostrzewski, Metropolitan Council
- Mike Westemeier, DLI
- Tannie Eshenaur, MDH
- Brett Emmons, EOR
- Nancy Rice, MDH

Time	Agenda Item	Lead
1:00 25 min	**Welcome and Introductions** ▪ Welcome and purpose of the project ▪ Introductions and experience with reuse o What are you hoping to get out of this process? ▪ Role of the Steering Team	Eshenaur
1:25 15 min	**RAPID Decision Process** ▪ Review RAPID (Recommend, Approve, Perform, Input, and Decide) Process & Roles **EOR is an independent facilitator. MDH is public health voice** **SCU Community part of Steering Team**	Eshenaur

1:40 20 min	**Background on Stormwater Capture and Use in MN** ▪ Overview of previous reports o 2018 State of Minnesota Report, Advancing Safe and Sustainable Water Reuse in Minnesota o 2022 MDH Report, Reuse of Stormwater and Rainwater in Minnesota, A Public Health Perspective **Link to slides** **Nancy Rice – Risk Assessment** MS - We tried to develop a list of projects here: Minnesota reuse projects (https://stormwater.pca.state.mn.us/index.php?title=Minnesota_reuse_projects) NC – Current regulatory framework Anita – See 2018 report Cities – Stormwater maintenance agreements	Anderson
2:00 15 min	**Goals and aspirations for Phase II of stormwater capture and use in MN** ▪ Jam Board exercise	Rupiper / Emmons
2:15 15 min	**Project Overview** ▪ Review scope of work ▪ Review meeting schedule ▪ Teams Site **MPCA to send out update through Gov delivery**	Emmons / Rupiper
2:30 15 min	**Engagement Core** ▪ Review of Engagement Core membership o Anyone missing? ▪ Review draft charter **MS - I forgot to mention I'm on the WateReuse research committee too. That committee just started up.** **Industry / Technology** **Dave Stark, RMS** **https://www.linkedin.com/in/dave-stark-605512b/** **Jen Kater for Jen Kostrzewski** **Jen.Kader@metc.state.mn.us** **Prof. Satoshi UWM - SRC** **Larger Org. representing HOAs? (I.e. maintenance)** **Ex. City Management?** **Woodbury, MN - 15 private systems**	Emmons / Rupiper

2:45 15 min	**Closing** ▪ Follow up items ▪ Engagement Core workshop (Part 1) Oct. 26th at 10:30 AM ▪ Engagement Core workshop (Part 2) TBD I'd like to send out meeting appointments for all the rest of the meetings now- if possible!	Eshenaur
3:00	*Adjourn*	

APPENDIX E

Engagement Core Meetings

agenda

MN Stormwater Capture & Use - Engagement Core Meeting #1A

October 26, 2023, 10:30 a.m. – 11:30 p.m.

Microsoft Teams meeting

Join on your computer, mobile app or room device

Click here to join the meeting

Meeting ID: 220 039 857 573
Passcode: JeRxDG

Meeting purpose: Convene Engagement Core for introduction to the project and the Oct. 31st workshop.

Attendees:

- Anita Anderson, MDH
- Benjamin Sojka, Rainwater Management Solutions
- Brad Wozney, BWSR
- Brandon Smith / Paula Kalinosky, MPCA
- Bridget Osborn, HR Green, Inc.
- Forrest Kelley, Capitol Regional Watershed District
- Jen Kostrzewski / Jen Kader, Metropolitan Council
- Joanne Boettcher, MPCA
- John Bilotta, U of M Water Resources Center
- Karen Kill, Brown's Creek Watershed District
- Kristin Seaman, City of Woodbury
- Larry Baker, University of Minnesota (retired)
- Larry Gunderson, MDA
- Lisa Vollbrecht, City of St. Cloud
- Lydia Silber, WateReuse
- Maureen Hoffman, Metropolitan Council
- Michelle Stockness, Freshwater
- Mike Westemeier, DLI
- Nancy Rice, MDH
- Nico Canterero / Bob Bean, Minnesota Cities Stormwater Coalition
- Scott Anderson, City of Hugo
- Tina Carstens, Ramsey-Washington Metro Watershed District
- Tannie Eshenaur, MDH
- Anne Nelson, MDH
- Brett Emmons, EOR
- Camilla Correll, EOR
- Mike Rupiper, EOR

Time	Agenda Item	Lead
10:30 30 min	**Welcome and Introductions** ▪ Welcome and purpose of the project ▪ Introductions & ice breaker ○ Memorable stormwater capture and use project ▪ Review RAPID (Recommend, Approve, Perform, Input, and Decide) Process & Roles	EOR, Eshenaur
11:00 10 min	**Role of the Engagement Core** ▪ Review Draft Charter	EOR

11:10 15 min	**Pre-meeting Feedback Questionnaire** ▪ Review Results	EOR
11:25 5 min	**Closing** ▪ Follow up items: Prepare for the Engagement Core workshop (Part 2) Oct. 31st. ○ Review previous reports and think about: ▪ What changes have occurred in stormwater reuse since 2018? ▪ What are the roles and responsibilities of your organization and others actively working in the stormwater capture and use space? ▪ What are the risk assessment and risk management systems currently in place for stormwater capture and use?	EOR
11:30	*Adjourn*	

minutes

MN Stormwater Capture & Use - **Engagement Core Meeting #1A**
Meeting purpose: Convene Engagement Core for introduction to the project and the Oct. 31st workshop.
Attendees:

- Anita Anderson, MDH – St. Louis Co garage vehicle washing
- Benjamin Sojka/DaveStark, Rainwater Management Solutions - – Allianz Field (sp?)
- Boettcher Joan (MPCA)
- Brett Emmons (EOR)
- Dave Stark
- Tannie, Eshenaur
- Paula Kalinosky, MPCA – Stillwater Golf Course
- Forrest Kelley, Capitol Regional Watershed District – Allianz Field (sp?)
- Jim Calkins
- Osborn Bridget
- Jen Kader, Metropolitan Council – Freshwater reuse workshop
- Joanne Boettcher, MPCA
- John Bilotta, U of M Water Resources Center
- Karen Kill, Brown's Creek Watershed District – Golf course projects
- Kelly Perrine, City of Lakeville
- Kristin Seaman, City of Woodbury – 20 systems in City, golf courses & others
- Larry Baker, University of Minnesota (retired) – Reuse in Phoenix ASU
- Larry Gunderson, MDA
- Lydia Silber, WateReuse
- Maureen Hoffman, Metropolitan Council, - CSH Fields
- Michelle Stockness, Freshwater -
- Mike Westemeier, DLI (plumbing plan review) – Irrigation use in St. Cloud
- Nancy Rice, MDH
- Nico Canterero / Bob Bean/Randy Neprash, Minnesota Cities Stormwater Coalition
- Scott Anderson, City of Hugo – 11 projects
- Tina Carstens, Ramsey-Washington Metro Watershed District
- Tannie Eshenaur, MDH
- Frieda vonQualen, MDH
- Brett Emmons, EOR
- Mike Rupiper, EOR

Appendix E: Engagement Core Meeting

Time	Agenda Item	Lead
10:30 30 min	**Welcome and Introductions** ▪ Welcome and purpose of the project ▪ Introductions & ice breaker o Memorable stormwater capture and use project ▪ Review RAPID (Recommend, Approve, Perform, Input, and Decide) Process & Roles	EOR, Eshenaur
11:00 10 min	**Role of the Engagement Core** ▪ Review Draft Charter	EOR
11:10 15 min	**Pre-meeting Feedback Questionnaire** ▪ Review Results	EOR
11:25 5 min	**Closing** ▪ Follow up items: Prepare for the Engagement Core workshop (Part 2) Oct. 31st. ▪ Review previous reports and think about: • What changes have occurred in stormwater reuse since 2018? • What are the roles and responsibilities of your organization and others actively working in the stormwater capture and use space? • What are the risk assessment and risk management systems currently in place for stormwater capture and use?	EOR
11:30	*Adjourn*	

summary

Convened the Engagement Core for introduction to the project and the Oct. 31st workshop.

- Reviewed RAPID (Recommend, Approve, Perform, Input, and Decide) Process & Roles
- Reviewed Draft Charter
- Reviewed Results of Pre-meeting Feedback Questionnaire (see EOR Technical Memo: Engagement Core Survey Summary in Appendix A.3)

agenda

MN Stormwater Capture & Use - Engagement Core Meeting #1B
October 31, 2023, 1:00 p.m. – 3:00 p.m.
In Person at:
Freeman Building, Room B107
625 Robert St. N
St. Paul, MN 55164-0975
Please attend in person if possible
Join on your computer, mobile app or room device
Click here to join the meeting
Meeting ID: 218 929 075 660
Passcode: wJjy6J
Download Teams | Join on the web
Join with a video conferencing device

mn@m.webex.com

Video Conference ID: 116 051 679 9

Alternate VTC instructions

Or call in (audio only)

+1 651-395-7448,,369338176# United States, St. Paul

Phone Conference ID: 369 338 176#

Find a local number | Reset PIN

Meeting purpose: Convene Engagement Core for workshop

Attendees:

- Anita Anderson, MDH
- Benjamin Sojka, Rainwater Management Solutions
- Brad Wozney, BWSR
- Brandon Smith or Paula Kalinosky, MPCA
- Bridget Osborn, HR Green, Inc.
- Forrest Kelley, Capitol Regional Watershed District
- Jen Kader, Metropolitan Council
- Joanne Boettcher, MPCA
- John Bilotta, U of M Water Resources Center
- Karen Kill, Brown's Creek Watershed District
- Kristin Seaman, City of Woodbury
- Larry Baker, University of Minnesota (retired)
- Larry Gunderson, MDA
- Lisa Vollbrecht, City of St. Cloud
- Lydia Silber, WateReuse
- Maureen Hoffman, Metropolitan Council
- Michelle Stockness, Freshwater
- Mike Westemeier, DLI
- Nancy Rice, MDH
- Nico Canterero or Bob Bean, Minnesota Cities Stormwater Coalition
- Scott Anderson, City of Hugo
- Tina Carstens, Ramsey-Washington Metro Watershed District
- Tannie Eshenaur, MDH
- Frieda von Qualen, MDH
- Brett Emmons, EOR
- Camilla Correll, EOR

Appendix E.2: Engagement Core Meeting #1B

Time	Agenda Item	Lead
1:00 10 min	**Welcome and Overview of the Day** ▪ World Café – 3 tables, 7-8 people per table	EOR
1:10 10 min	**Overview of 2018 report** ▪ 2018 State of Minnesota Report, Advancing Safe and Sustainable Water Reuse in Minnesota	Anderson
1:20 35 min	**Stormwater Capture and Use Experiences - Round 1** ▪ Group selects 2 example projects from their experiences o What type of project was it (goals / driver / source water / end use)? o Who was involved (roles & responsibilities)? o What policies/regulations were in place? o What risk assessment/risk management systems were involved? o What worked / didn't work / why?	EOR
1:55 25 min 5 min	**Stormwater Capture and Use Experiences - Round 2** ▪ 2 people most familiar with the projects stay, the rest rotate. Pick one project and discuss: o What would you do differently to improve the outcome? o Who else could have been involved (roles & responsibilities)? o What additional policies/regulations would have been helpful? o What additional risk assessment/risk management systems would have been helpful? ▪ Report Out	EOR
2:25 25 min 5 min	**Stormwater Capture and Use Experiences - Round 3** ▪ 2 people most familiar with the projects stay, the rest rotate. Discuss the second project: o What would you do differently to improve the outcome? o Who else could have been involved (roles & responsibilities)? o What additional policies/regulations would have been helpful? o What additional risk assessment/risk management systems would have been helpful? ▪ Report Out	EOR
2:55 5 min	**Closing** ▪ Follow up items	EOR
3:00	*Adjourn*	

summary

- Convened the Engagement Core for workshop on their experiences with stormwater capture and use (see EOR Technical Memo: Engagement Core Workshop – Roles and Responsibilities in Appendix A.4)
- Reviewed 2018 State of Minnesota Report, Advancing Safe and Sustainable Water Reuse in Minnesota

agenda

MN Stormwater Capture & Use - Engagement Core Meeting #3
April 16th, 2024, 2:05pm – 4:00pm
Teams Meeting Information
Click here to join the meeting
Meeting ID: 258 008 991 584
Passcode: gBUeQ7
Download Teams | Join on the web
In-Person Meeting Information
Freeman Building - B107

Attendees:

- Karen Kill
- Brad Wozney
- Forrest Kelley
- Scott Anderson
- Lisa Vollbrecht
- Kristin Seaman
- Mike Westemeier
- Michelle Stockness
- Bridget Osborn
- Larry Gunderson
- Anita Anderson
- Nancy Rice
- Jen Kader Jennifer Kostrzewski (alternate)
- Maureen Hoffman
- Bob Bean, Kelly Perrine (alternate)
- Paula Kalinosky Brandon Smith (alternate)
- Joanne Boettcher
- Benjamin Sojka Dave Stark (alternate)
- Tina Carstens
- John Bilotta
- Larry Baker
- Lydia Silber
- Tim Malooly
- Jim Caulkins
- Tannie Eschenaur
- Freida vonQualen

Time	Agenda Item	Lead
2:05 10 min	**Welcome and Overview of the Agenda** ▪ Introduction ▪ GOALS for the Meeting ▪ Process Timeline Review	EOR
2:15 40 min	**Project Review** ▪ What has been happening since we last met? ▪ How was information from the last Engagement Core meeting been incorporated? ▪ Risk Assessment Data Review	EOR/ MDH - Rice / Anderson
2:55 10 min	**Preliminary Points of Agreement – Review and Discussion** ▪ Presentation of Points of Agreements	All w/ EOR facilitation
3:05 10 min	**Status of Risk Based Management Strategy** ▪ Current thinking is to provide and start with guidance, with regulatory options TBD in the future	All w/ EOR facilitation
3:15 25 min	**Evolving Guidance Discussion** ▪ Case Studies ▪ Restricted vs Unrestricted Discussion ○ Create a list of scenarios which would fall into each category	MPCA, EOR, MDH

3:40 15 min	**Guidance in Other Elements Beyond Design Targets Discussion** ▪ What else do implementers need guidance on, to successfully install, operate, and maintain a system? ▪ Format: MN Stormwater Manual or Other?	All w/ EOR facilitation
3:55 5 min	**Closing** Outline next steps	EOR
4:00	*Adjourn*	

minutes

Meeting Notes

Welcome and Overview of the Agenda

- All attendees introduced themselves
- Brett Emmons presented an overview of the Agenda and Project Review (see presentation slides 1 to 7)
- GOALS for the Meeting
  - Update group on work done
  - Present and gather feedback on Risk Assessment and Log Reduction Targets
  - Introducing 'Preliminary Agreements' discussed
  - Gather feedback on the Guidance Approach and any additional guidance needed
- Process Timeline Review
  - Reviewed project schedule. We're about halfway through the process. Engagement Core and public meetings remain.

Project Review

- What has been happening since we last met?
  - Interagency Work Group met 3 times (Feb. 28th, March 4th, & March 13th, 2024)
    - Discussed results of a survey sent to MDH, MPCA, & Metropolitan Council on proposed risk-management categories and where different reuse systems would fit.
    - Health Risks presented by MDH
    - Risk- management framework options (Restricted vs Unrestricted, Log Reduction Targets/(LRT), Case Studies)
    - Preliminary consensus (technical level) summarized on the 'Preliminary Key Agreement' slide
- Q&A: Clean Water Fund funding for this project on June 30, 2024.
- Risk Assessment Data Review
  - Nancy Rice presented Univ. MN / MDH health risk assessment data (see presentation slides 8 to 16)
    - Q&A: As a benchmark, the accepted risk is generally 1 in 10,000 or 10^{-4} for microbial infection in drinking water. Note that using this benchmark for stormwater reuse does not mean the irrigation water is drinking water quality (because the exposure volume for irrigation is much lower).
    - Q&A: Sources of norovirus? We don't know for sure but have educated guesses including soiled diapers in leaking garbage cans, leaking wastewater collection system, leaking Porta Potty, etc. Norovirus is a human norovirus, so we're pretty sure of that source, but some of the bacteria that we find could come

from birds or dogs, etc. We can't know without microbial source tracking. Interest was expressed in epidemiological data / studies.

- Anita Anderson presented slides on risk management – (see slides 17 to 24)
  - Different people can have different levels of acceptable risk, but 10^{-4} is a commonly acceptable risk level benchmark for stormwater.
  - WE&RF report was compared to MN QMRA data
  - Health Risk Summary:
    - Pathogen detections are sporadic, but all systems had detections
    - Stormwater is heterogeneous
    - System to system variability
    - Several national reports and expert panels indicate health risk concern with the use of untreated stormwater when there is potential for human exposure
    - Minnesota analysis based on local data came to similar conclusions
    - Minnesota could choose to use a different risk benchmark
  - Q&A: What do we know about whether the pathogens we find are alive and viable, human, and how that how that affects all the calculations? Though some of the samples that were collected were cultured and shown to be viable, we don't have comprehensive—data. Most pathogens detected could cause illness regardless of the source.
  - It was commented/noted that variation in source water could be an important factor in virus / bacteria levels.
  - In general, the questions and discussion focused on Engagement Core members who implement stormwater capture and use systems wanting to know how the proposed log reduction targets would affect the way systems are currently being implemented. Are existing systems meeting the proposed log reduction targets? If not, what additional treatment or management practices are needed? What is the cost?

Preliminary Points of Agreement – Review and Discussion

- Brett Emmons presented Key Points of Agreements by the Interagency Work Group (see slides 25 – 28):

1. The local studies presented and national data available on the health risks and Log Reduction Targets (LRTs) can be considered close enough to be comparable. Therefore, the agencies will align their recommendations (where possible) with this data for consistency in their treatment and management recommendations. National Data and comparable recommendations can be found in the "Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems" published by the Water Environment & Reuse Foundation.
2. Uncontrolled Stormwater reuse does pose a health risk. Guidance and/or regulation is needed to manage the risk, but it must be balanced with reasonable expectations of what can be implemented and monitored.
3. The involved water agencies will continue to work to reach consensus on reuse recommendations in order to limit confusion and barriers for implementing parties. The LRT Table and Case Studies will inform you of these recommendations.
4. The risk-management framework will be an evolving document which will initially focus on only the source waters of rainfall and stormwater and the end use of irrigation. Later, the framework can be expanded to other, more diverse end uses (splash pads, wash water, etc.) and potentially treated greywater as source water.

5. The risk-management framework will be revisited regularly to ensure that the most recent scientific data and best management practices are incorporated. The review will follow a 5-year cycle.

- Comment: Concern was raised that even though this will be called guidance, the fear of liability will result in practitioners following it as a matter of fact.
- Q/A: Was assumption in national report (based on an assumed wastewater % in stormwater) accurate? – Anita will review
- Comment: Additional discussion is desired on the acceptable level of risk.

Status of Risk Based Management Strategy

- Current thinking is to provide and start with guidance, with regulatory options TBD in the future
  - The 1 to 3 Risk Management Categories can be developed at a later time as guidance is refined and situations expanded.
  - Expanded uses can be included at a later time – water play features, wash waters, industrial/cooling waters, etc.
  - Discuss when and where regulations are needed at a later time.

Evolving Guidance Discussion

- Case Studies
  - Paula Kalinosky presented the case study information she's been compiling (see slides 37 to 39)
    - City of Waconia First Street System
    - City of Waconia Hunters Crossing
    - City of Waconia 10th Street System
    - Mississippi WMO Cistern
    - MWMO Towerside District Stormwater System
  - Bob Bean can provide updated information
  - Next step is to apply Log Reduction Targets
  - Comment: Cost of treatment is important
  - Comment: Would like to see some examples of privately operated systems like in Woodbury.

The following agenda items were not covered due to lack of time:

- Restricted vs Unrestricted Discussion
  - Create a list of scenarios which would fall into each category

Guidance in Other Elements Beyond Design Targets Discussion

- What else do implementers need guidance on, to successfully install, operate, and maintain a system?
- Format: MN Stormwater Manual or Other?

Closing

- Outline next steps
  - Continued work on Case Studies
  - Funding ends in June
  - Looking for a new agency lead
  - Defining what we accomplish during this phase of the work:

Being Done:

- Create an expanded workgroup with practitioners, advisors, and interested parties to continue development of guidance and programs.
- Prioritize Investigation/study needs to address questions about reuse.
- Define roles and responsibilities to oversee and monitor water reuse.

- Develop a risk-based management system to determine if regulation or guidance is needed. – WQ Targets – Log Reduction Targets

- May be Done:
  - Establish an information and collaboration hub on the web to share information and resources. – MN Stormwater Manual?
- Future Work:
  - Provide education and training to support water reuse.
  - Greywater risk-based management.

Closing Comments / Requests by Engagement Core Members:

- Provide information (slides & notes) for closer review & schedule for feedback.
- Schedule the next meeting for ~ 3 to 5 weeks.
- Engagement Core would like to draft guidance 2 weeks ahead of the next meeting.
- Guidance should include how and what to consider, not just treatment goals.

Meeting Adjourned at 4:25

summary

Group Agreement that Minnesota Data is consistent with national data.

Group agreement that 'In Theory' the adoption/alignment of National Data (where it aligns with Minnesota data) should be done and it is okay to move forward in the process with this assumption. Though, the Metropolitan Council and MPCA will need to wait to provide an official answer until it has reviewed this information with higher level decision makers.

Group agreement with the terminology used in the statement addressing the points related to Health Risks Balanced with Practicality.

Group agreement on the need to create Case Studies

Group agreement that 'Restricted Access' could be a useful tool and needs to be explored.

Group discussion around the question of "What does Restricted Access actually mean?". It could mean a physical boundary but could also be a temporal boundary (timing). Whether or not several types of restrictions need different LRTs can get teased out with the creation of the Case studies. Some places are so urban that restriction may not be possible, but they see potential in Minnesota.

While there could be some differences in the LRT required for restricted access irrigation, Anita Anderson noted that it does not appear that other states have allowed for these differences. She did note that the Australians tried to assign LRTs for various restricted uses but that the numbers were not vetted by the scientific community. Paula Kalinosky noted that this may be an area for additional research.

Group agreement on the need for governance. The group decided that it would be easier to work through what the guidance looks like before the assignment of risk management categories. It will be important to lay a firm foundation of mutual understanding and make sure there is agreement on the approach before looking at other applications such as indoor reuse.

- Group agreement that a consensus and unified recommendations need to be completed. Though no agency is ready to start regulating this without clear guidance to follow. The focus should be on understanding the guidance needed and on the management categories later.

Group agreement that various sources will be looked at later and will be kept in mind during the creation of guidance and management strategies.

The group agreed that science should be reviewed on a periodic basis. The group agreed that a 5-year review period made sense.

agenda

MN Stormwater Capture & Use - Engagement Core Meeting #4
May 13th, 2024, 2:00pm – 4:00pm
Freeman Building B107, 625 Robert St. N., St. Paul, MN
Teams Meeting Information
Join the meeting now
Meeting ID: 215 345 032 535
Passcode: nnfbyc
Download Teams | Join on the web

Past Attendees/Invitees:

- Anita Anderson, MDH
- Benjamin Sojka, Rainwater Management Solutions
- Brad Wozney, BWSR
- Brandon Smith or Paula Kalinosky, MPCA
- Bridget Osborn, HR Green, Inc.
- Forrest Kelley, Capitol Regional Watershed District
- Jen Kader, Metropolitan Council
- Joanne Boettcher, MPCA
- John Bilotta, U of M Water Resources Center
- Karen Kill, Brown's Creek Watershed District
- Kristin Seaman, City of Woodbury
- Larry Baker, University of Minnesota (retired)
- Larry Gunderson, MDA
- Lisa Vollbrecht, City of Sartell
- Lydia Silber, WateReuse Maureen Hoffman, Metropolitan Council
- Michelle Stockness, Freshwater
- Mike Westemeier, DLI
- Nancy Rice, MDH
- Bob Bean, Minnesota Cities Stormwater Coalition
- Scott Anderson, City of Hugo
- Tina Carstens, Ramsey-Washington Metro Watershed District
- Tannie Eshenaur, MDH
- Frieda von Qualen, MDH
- Brett Emmons, EOR
- Camilla Correll, EOR
- Mike Rupiper, EOR
- Kajol Annaduzzaman, EOR

Time	Agenda Item	Lead

2:00
10 min
	Welcome and Overview of the Agenda
	• Introduction
	• Meeting #4 of 4 of the Engagement Core, but not the last opportunity for your feedback.
	• Review Project Goals, what's been accomplished, and what remains to be accomplished. How have things changed?
	• GOALS for this final Meeting
	  ○ Review Case Studies (1st hour)
	  ○ Revisit Log Reduction Targets (1st hour)
	  ○ Consensus on key points of agreement (2nd hour)
		EOR

2:10 10 min	**Addressing Points of Confusion** 1. **Cultural Expectations** People expect that any water they come into contact with is "safe" (i.e., treated to drinking water standards). Examples include tap water, pools, sprinklers, fountains, etc. 2. **Voluntary/Involuntary Risk** Since the public has a better understanding of pollution and impacts to our natural systems (waterbodies), they understand the risk of recreating in waters that are not pure or clean. They are making a conscious decision to swim, fish, and recreate (recreational water quality standards). 3. **Benchmarks for Health Risks** Neither Benchmark (1:10,000 or 1:100) proposed are treating stormwater to Drinking Water quality. 4. **Case Studies Inform Implementation Realities** Provide concrete examples, including how to achieve the LRTs, via case studies. 5. ***Address Feedback Received*** *Before we move into a discussion about the Risk Based Management Strategy, does anyone have any questions about these points?*	MDH-Tannie E.
2:20 10 min	**Recent Feedback from Engagement Core & Review Stakeholder Process** • What did we ask people to do at the last meeting? • Who did we get feedback from/what type of feedback did we get? *Much of the feedback/questions are addressed in the agenda items. • Referenced reports (Engagement Core meeting #3) **Stakeholder Engagement Process** *We are revisiting the stakeholder engagement process as a reminder of what has been done, the roles of each group, and how the information collected during the engagement process informs the work completed to date.* ***How have people been involved to date?*** • Review slide from Mtg 1 of Process Diagram and Review • Presentations of the reports (2018, 2022) at initial meetings – not all were tracking the content. Led to the meetings with MDH, MPCA, and Metropolitan Council. • The survey revisited decisions made in the 2018 report with MDH, MPCA and Metropolitan Council. • Led to preliminary agreement on five points (shared last mtg) ***How is the information being taken into consideration?*** • Adjusted project outcomes as summarized in the May 6th Memorandum (Overlap of 1a., 1b. with Points of Agreement #4).	EOR – Brett E.
2:30 30 min	**Case Studies** • Show if existing systems would meet the proposed Log Reduction Targets and/or what else needed. • Reminder - Costs are highly variable - normalize ($/ flow rate or treatment costs per flow rate) *Is this a next step?* • Case Studies Results • Draft Log Reduction Table Review ○ Does the Engagement Core want to provide feedback for the Interagency Work Group to consider in drafting recommendations for the next steps?	All w/MPCA, EOR facilitation

3:00 45 min	**Key Points of Agreement – Review and Discussion** *Structure of this discussion item:* • *Can we get consensus on these five points? Review and discuss each point concluding with the fist-to-five exercise.* Agreements: 1. National Data Compared to Local Data 2. Health Risk, Balanced with Implementation 3. Consensus Among Agencies 4. Start with Rain/Stormwater Used for Irrigation 5. Framework Needs Regular Review with New Data	EOR – Camilla C.
3:45 15 min	**Next Steps** ▪ Deadline for the Project is June 30th ▪ Project Goals (2018 Report): 1. Create an expanded workgroup with practitioners, advisors, and interested parties to continue development of guidance and programs. ***Done – Engagement Core*** 2. Prioritize investigation/study needs to address questions about reuse. ***In-Process – May 6, 2024, Memo & Feedback*** 3. Define roles and responsibilities to oversee and monitor water reuse. ***Partially – May 6 Memo Feedback*** 4. Establish an information and collaboration hub on the web to share information and resources. ***In-Process – MN SW Manual?*** 5. Develop a risk-based management system to determine if regulation or guidance is needed. ***Partially – Meeting Feedback*** 6. Provide education and training to support water reuse. ***Future – Expand beyond Hub/MN SW Manual?*** ▪ What remains to be accomplished? *Recommendation for the next steps* ▪ Complete the case studies. ▪ Need to define Restricted versus Unrestricted Use. ▪ What else do implementers need guidance on, to successfully install, operate, and maintain a system? ▪ Feedback on Hub (“information and collaboration hub on the web”) – MN Stormwater Manual? ▪ Draft Documents as they are Developed/Shared ▪ Role of the Engagement Core Team moving forward ○ Further developing the Case Studies ○ Passing the Engagement Core’s concerns about engagement on to the next agency taking the lead on thie SCU work.	EOR – Brett E.
4:00	*Adjourn*	

minutes

Project Name: Stormwater Capture & Use in Minnesota
Date: 13 May 2024/Reissued 14 June 2024
Meeting Location: Department of Health – Freeman Building & Virtually
Regarding: Engagement Core Meeting #4

Attendees (virtually)

- Tannie Eshenaur, MDH
- Benjamin Sojka, RMS
- Brandon Smith, MPCA
- Bridget Osborn, HR Green Inc
- Forrest Kelley, CRWD
- Joanne Boettcher, MPCA
- Udai Singh, BWSR
- Tim Malooy, Water in Motion
- Scott Anderson, City of Hugo
- Jim Calkins, MNLA Foundation
- Cassie Larson, MNLA Foundation
- Jeff Latterell, (Unknown)
- Tina Carstens, RWMWD
- Dave Stark, RMS
- Kajol Annaduzzaman, EOR

Attendees (in person)

- Anita Anderson, MDH
- Nancy Rice, MDH
- Frieda von Qualen, MDH
- Michelle Stockness, Freshwater
- Mike Westemeier, DOLI
- Paula Kalinosky, MPCA
- Jen Kader, Metropolitan Council
- Karen Kill, BCWD
- Brett Emmons, EOR
- Camilla Correll, EOR
- Randy Neprash, MCSWC
- Larry Baker, UMN (retired)
- Kristin Seaman, City of Woodbury
- Bob Bean, Minnesota Cities Stormwater Coalition

Recorded By: Kajol Annaduzzaman, EOR

Meeting Purpose and overall summery of the meeting

The **Engagement Core meeting #4 was held on 13 May 2024** and led by Brett Emmons from EOR with an introduction and overview of the agenda, emphasizing that it is the fourth Engagement Core meeting but not the final opportunity for feedback. The project goals are reviewed, highlighting accomplishments and remaining tasks. Goals for the meeting include reviewing case studies, log reduction targets, and achieving consensus on key points. Addressing points of confusion, such as cultural expectations and health risk benchmarks, sets the stage for informed discussion.

Recent feedback from the Engagement Core and stakeholder process is discussed, with an emphasis on understanding what was asked of participants and how their input informs the project. The stakeholder engagement process is revisited to clarify roles and the collection of information. Case studies are presented to evaluate existing systems against proposed targets and to discuss costs and potential next steps.

Key points of agreement are reviewed and discussed, focusing on areas such as national versus local data, health risk considerations, and the need for ongoing review. The meeting concludes with a discussion of next steps, including project deadlines, remaining tasks, and the role of the engagement core team moving forward. Recommendations are made for completing case studies, defining use categories, providing guidance to implementers, and developing draft documents.

MEETING NOTES:

Welcome and Overview of the Meeting

Brett Emmons opened the meeting by welcoming everybody, who also introduced themselves prior to the meeting's start.

- The meeting agenda included reviewing the scope of work derived from the 2018 report and discussing key recommendations to advance stormwater capture and reuse. It was also welcomed to comment or suggest in the later stage despite this is the last Engagement Core meeting.
- B. Emmons also directed the audience to ask any clarification or questions via emails, phone calls to himself with CC to everyone to keep the conversation transparent.
- He also reminded the work scope for the discussion which stems directly from the 2018 report, which highlighted several key recommendations essential for moving forward. B. Emmons also provided a brief update on the project progress regarding these recommendations.

One major goal was to form an expanded work group, including practitioners, advisors, and interested parties, to continue developing guidance and programs. This group, known as the Engagement Core, is that expanded work group, which aims to reach a broader audience with an expectation of 18 to 20 participants, but has grown to nearly 30!

Questions/Clarifications Discussed

- There was a mention that this is the last meeting for the group, which raised some concerns. It was asked if additional Engagement Core meetings might be possible.
- According to the original schedule, two additional open meetings were planned.
- The speaker inquired if these additional open meetings are still scheduled.
- Turned to MDH for clarification on whether these additional meetings are still planned or if any changes are anticipated based on the current discussions. With the funding deadline soon, it is doubtful there is time for additional meetings at this stage, but a future process can take up remaining items and continue discussions. The Engagement Core intends to continue to be involved in these topics.

Discussion on Points of Confusion (Slides 11-17)

From MDH, Tannie Eshenaur shared a personal story to illustrate cultural and social norms about expectations around water safety, highlighting the implications that water we are exposed to is drinking water quality and the importance of risk management in daily life.

Cultural Expectations: Later, T. Eshenaur discussed her uncertainty about water reuse sources at a local park, highlighting that if she, as an informed person, is unsure about water safety, the average person shares this uncertainty.

Voluntary/Involuntary Risk:

Benchmarks for Health Risks: In the discussion, the group considered using a standard for involuntary outdoor exposures and noted that while voluntary outdoor exposures pose a significant risk, focusing on involuntary exposures could involve measures like restricting use in public areas to reduce accidental exposure, rather than solely improving water quality. The discussion also focused on acceptable risk levels for drinking and recreational water, with experts setting the acceptable risk at 1 in 10,000 for drinking water and up to 3 in 100 for recreational water. This is **different from** saying this water would be treated to drinking water level of purity, and that seems to be misunderstood and misquoted.

Risk Analysis Process: Risk analysis involves three components: Risk Assessment, conducted by experts and documented in the 2022 paper; Risk Management, which considers several factors beyond acceptable risk; and Risk Communication, a crucial part of managing risk.

Stakeholder Input: Stakeholder engagement is essential for risk management decisions, which must balance health and environmental benefits while considering various options without the illusion of eliminating all risks.

***Question**: How much does it cost to meet this log reduction target or that log reduction target, and how much will we need to do in order to protect Minnesota without a cost that would prevent water reuse from happening in the state?*

Answer: Later in the meeting we will be discussing costs and feasibility in the review of Case Studies since we anticipated this specific question. Putting the discussion into perspective, the focus is on assessing risks, such as a one in 100 chance of contracting diarrhea for a week, which may not be life threatening but is still significant. Pathogens like *E. coli* can lead to serious illnesses, as evidenced by past outbreaks causing fatalities, notably in Milwaukee and Grand Rapids. While the threat may not evoke the same fear as cancer, it remains a concern, especially for those with weakened immune systems. Despite fortunate outcomes so far, the potential severity of outbreaks, such as Legionella, underscores the importance of vigilance in managing water-related risks.

***Question 2 (R. Neprash*):** *How does the selection of benchmarks impact the determination of log reduction targets (LRTs), and what factors influence the decision-making process?*

Answer: The selection of benchmarks plays a crucial role in establishing log reduction targets and subsequent treatment recommendations. While the choice between benchmarks like one in 10,000 versus one in 100 or three in 100 may seem subtle, it affects the outcomes and associated costs. The decision-making process regarding which benchmark to use is not rigid and involves considerations of practicality, cost-effectiveness, and stakeholder input. Currently, the Minnesota Department of Health (MDH) favors the one in 10,000 benchmarks, given voluntary/involuntary and public expectations reviewed earlier, but this may be subject to revision pending further analysis of costs and uncertainties. Ultimately, the choice of benchmark could impact the viability of stormwater reuse projects and requires balancing stakeholder interests with public health considerations. While the potential economic value of preventing fatalities can be estimated, determining the value of mitigating less severe outcomes, like a week of diarrhea, presents challenges and may not be quantified to the same extent.

Question 3 (T. Malooly): *What steps can be taken to effectively collect data on pathogen and other concerns within reuse systems, and what is the timeframe for this data collection process?*

Answer: The process involves analyzing case studies of installed equipment to assess effectiveness and cost. Owners' insights inform decisions. Identifying where systems succeed guides cost-effective solutions. Large-scale systems may require alternate approaches due to cost. Continuous monitoring is crucial for insights. Discussion includes limiting exposure to untreated water, possibly through usage restrictions or protective measures, offering cost-effective alternatives. Addressing behavioral aspects, like waste management, is considered. Overall, the aim is to provide guidance ensuring reused water safety. We should note that this has already been started, and data collected after 2018 is summarized in the 2022 report and was presented at the last Engagement Core meeting.

B. Emmons reminded the group that last week there were emails sent out to the group soliciting feedback, since we have a finite meeting time.

The overall stakeholder involvement process and means for feedback/input was reviewed again. The Engagement Core initiates feedback loops, which involve an Interagency Work Group and agency leadership. The process was presented in their first meeting, using the RAPID decision process (Slide 24). The project team has used a flexible approach due to evolving project scopes and we have reset several benchmarks. Recent updates include a shift towards irrigation focus and developing consensus-based guidelines vs. regulation. Key goals include addressing health risks and optimizing water reuse management plans. This process will culminate in what was discussed, where agreement has been found, desire to have ongoing engagement, and case study analysis to inform future recommendations and ensure systems are sustainable.

Case Studies by MPCA and MDH, with EOR facilitation and follow up discussions (Slides 32-69)

Case studies were developed to inform the Interagency Work Group discussion of exposure risk assessment, and risk mitigation through treatment (disinfection); physical impediments such as fencing, use of drip irrigation or irrigation during periods of no/low use; and other risk mitigation practices like signage or other

education and outreach efforts. The Interagency Work Group also hopes to better understand the costs of meeting recommended LRTs.

Case studies were developed to address the following questions:

- What do existing treatment systems look like?
    - Do existing treatment systems provide treatment consistent with MDH recommendations for source-use LRTs or LRTs developed by others (WERF, Australia).
    - How does implementation of disinfection increase overall project costs?
- What risk mitigation practices have been implemented in existing projects?
    - Which mitigation practices function to decrease LRTs for source-use and thereby reduce the level of treatment needed to meet MDH recommendations?
- The Interagency Work Group tried to include a representative cross-section of projects from existing harvest and use for irrigation projects in Minnesota. Due to time constraints, only projects where relevant data were readily available could be selected. Cost information was limited to the cost of implementation and operation. Broader considerations such as cost saving associated with reduced use of potable water or water quality benefits to downstream surface water were not included, though in practice, these factors may be significant motivators for implementing harvest and use for irrigation. Hypothetical scenarios were not included as case studies. The Tables 1 and 2 in Appendix XXX summarizes the various relevant information on discussed case studies.

Common hurdles in case study development:

- Projects were implemented under staff who no longer work for the organization, first-hand knowledge is not readily available.
- Project information is not centralized; the time investment needed to pull data from various records was greater than time available/allotted under project scope.
- Project does not add breadth to cross-section of reuse systems included in the case studies (e.g., use of a stormwater pond to irrigate green space).
- Reuse applications fall outside current focus reuse for irrigation (e.g., case studies on indoor use were not pursued).

Case study 1: The case study examines the 1st Street system in Waconia, implemented in 2013 with three phases. Treatment involves sedimentation in underground units, and shock chlorination is used periodically/seasonally. Irrigation is primarily for athletic fields and green spaces at 1st Street Elementary School, using rotary spray heads. Risk mitigation actions include posting signage and using purple pipes to indicate a non-potable water source and operating the irrigation system at time when potential exposure risk is minimized (nighttime, early morning). Discussion included if chlorine levels after shock treatments were damaging to turf, risk mitigation, and target benchmarks for treatment requirements. The study raises questions about exposure reduction, educational efforts, and decision-making on treatment standards. Concerns include buffer areas (which are present in most adjoining areas), access during irrigation, and target credit allocation for treatments.

Case Study 2: Hunters Crossing in Waconia is a retrofit project in a larger residential area with an adjacent park, utilizing an existing pond and a new development pond for stormwater management. The system includes a UV treatment component. Irrigation is provided to the neighborhood park and in the new residential developments for turf irrigation, offsetting city water demand, and reducing stormwater management costs.

Case Study 3: It was a similar retrofit project in an area of Waconia (10th St.), which utilizes an existing pond with a focus on irrigation. The system includes a chlorination unit at the pump station. The chlorine dose was provided, but the flowrate and system detention time were not. Operational costs are comparatively lower.

It was noted that in Waconia's experience, using non-potable water was more cost effective for irrigation users than using potable water.

Case study 4: The Mississippi Watershed Management Organization employs an external cistern for flood mitigation and as a harvest and use demonstration project. The system does not include disinfection and is primarily as detention for localized flood mitigation but can be used to water tree trenches and a gravel bed tree nursery using ground level irrigation (hose or via tree trench drain tile). Installation costs were around $40,000 with minimal ongoing maintenance.

Case Study 5: The Tower Side District Reuse System in Minneapolis is a more comprehensive project collecting stormwater from an 8-acre redevelopment area in an ultra-urban setting. Components include underground storage, drip, and spray irrigation systems. Total project installation cost was approximately $1.5 million.

Case Study 6: The Allianz Field project in Saint Paul integrates multiple stormwater management approaches, including underground rainwater storage. The system includes UV disinfection, with ongoing challenges in system operation and maintenance. The system primarily irrigates lawn areas rather than the soccer field itself. This is also a large redevelopment project in an ultra-urban setting which can increase project costs significantly if compared to new developed in suburban or rural settings.

In summary, the case studies examined various stormwater reuse systems for irrigation, highlighting different approaches to treatment and risk mitigation. Common issues included the absence of centralized information, changes in project personnel, and varied effectiveness of risk mitigation strategies. Notably, treatment systems ranged from no disinfection (First Street, Rainwater Cistern) to advanced UV and chlorination treatments (Hunters Crossing, Allianz Field), impacting both project costs and risk reduction. Furthermore, exposure risk was managed through physical barriers, operational strategies, and public education, though not uniformly across all projects. Despite limitations, the case studies provided valuable insights into the practical challenges and benefits of stormwater reuse systems in Minnesota.

Follow up discussion on case studies

- The team discussed the time of application to the time of access/contact, questioning if there were ways to limit access to irrigated areas. This aspect requires further quantification to ensure effective stormwater management.
- The summary included rough estimates of the treated area, watershed size, impervious cover, and irrigation demand. Costs and annual maintenance were also considered, albeit with some missing data and uncertainty, necessitating validation from data sources.
- Retrofit projects with storage components already available tended to have lower costs, while ultra-urban projects incurred higher expenses. Patterns suggested that projects requiring new or more storage were costlier, but the correlation between cost and the reduction of log reduction targets (LRTs) required further investigation to quantify.
- Comparing stormwater treatment costs to those of potable water or well construction presents challenges due to differing variables. While it may seem straightforward, the context, such as treatment method and water source/quality, significantly influences cost comparisons.
- Participants acknowledged the importance of including privately-owned site owners, like golf courses, in future evaluations, as they represent significant yet relatively unexplored aspects of stormwater reuse management. These sites could provide valuable insights into costs and practices beyond those discussed in the current evaluation.

Preliminary recommendation based on case studies.

The recommendation for the next phase of stormwater management evaluation is to carefully review and possibly revise the reduction targets. It seems prudent to consider different benchmarks for diverse types of stormwater systems rather than applying a one-size-fits-all approach. For instance, treating agricultural

fields differently from industrial or commercial areas could lead to more tailored and effective stormwater reuse management strategies. This nuanced approach requires further consideration and should be included as part of the recommendation for moving forward.

Concluding Remarks by EOR facilitator and teams

B. Emmons concluded the meeting with some next steps and highlights from the audience, which were:

- The five points of agreement previously introduced may include follow-up by conducting an online survey to gather feedback since there was not sufficient time at the meeting to cover the topic.
- A request was made to consolidate past emails asking for feedback into one new request to make sure members are not missing anything.
- Recommendations included the need for nuanced reduction targets based on several types of stormwater systems rather than a one-size-fits-all approach.
- Future steps involve further exploration of case studies, consideration of different benchmarks and revisiting log reduction targets suggested by the Department of Health.
- The Minnesota Stormwater Manual generally was supported as an appropriate place for an information and collaboration hub and for inclusion of future guidance or requirements for reuse.
- Participants were encouraged to provide feedback on the group's continuation and potential governance structures, emphasizing the importance of ongoing collaboration.
- Funding for continued work was identified as a need, with suggestions to engage with the Clean Water Council and other relevant agencies.
- The meeting concluded with expressions of gratitude for the participants' time and efforts, with plans for future correspondence and updates.

summary

- **Review of Project Progress and Engagement**: The meeting focused on reviewing project goals, recent feedback, and the stakeholder engagement process. Attendees discussed key recommendations from the 2018 report and emphasized the need for ongoing feedback and involvement from the expanded work group.
- **Concerns and Clarifications**: Participants raised concern about whether this was the last Engagement Core meeting and the possibility of additional meetings. MDH clarified the future of the Engagement Core and the importance of continuing discussions despite the funding deadline.
- **Case Studies Presentation**: Six case studies were presented to evaluate existing stormwater reuse systems, their treatment methods, costs, and effectiveness. The discussion highlighted differences in costs and treatment approaches, with a focus on the practical implications of log reduction targets and the need for context-specific benchmarks.
- **Risk Management and Health Considerations**: Discussions centered on cultural expectations, acceptable health risk benchmarks, and the need for clear communication about risk management. The group considered the costs and feasibility of meeting log reduction targets and the implications for public health and safety.
- **Recommendations and Next Steps**: Preliminary recommendations included revisiting and possibly revising log reduction targets based on different stormwater systems, considering various benchmarks, and exploring further case studies. The Minnesota Stormwater Manual was suggested as a hub for information and collaboration.
- **Future Collaboration and Funding**: The meeting concluded with a call for ongoing collaboration, specific feedback on governance structures, and the need for continued funding. Participants were encouraged to stay involved, with plans for future updates and correspondence.

APPENDIX F

Interagency Work Group Meetings

agenda

MN Stormwater Capture & Use - Interagency Work Group Meeting #1
December 8, 2023, 1:00 pm. – 3:00 p.m.
Microsoft Teams meeting
Join on your computer, mobile app or room device
Click here to join the meeting
Meeting ID: 241 000 140 42
Passcode: Rh56Ub
Download Teams | Join on the web
Meeting purpose: Convene Interagency Work Group and Engagement Core to discuss roles & responsibilities for stormwater capture and use in Minnesota
Attendees:

- Anita Anderson, MDH
- Brad Wozney, BWSR
- Brandon Smith, MPCA
- Dan Miller, DNR
- Jen Kader, Metropolitan Council
- Jennifer Kostrzewski, Metropolitan Council
- Joanne Boettcher, MPCA
- Larry Gunderson, MDA
- Mike Westemeier, DLI
- Nancy Rice, MDH
- Tannie Eshenaur, MDH
- Frieda von Qualen, MDH
- Brett Emmons, EOR
- Camilla Correll, EOR
- Mike Rupiper, EOR

Agenda:

Time	Agenda Item	Lead
9:00 10 min	**Welcome and Overview of the Meeting** ▪ RAPID Framework ▪ Schedule	EOR
9:10 20 min	**Overview of Engagement Core Input** ▪ Survey Results ▪ Roles & Responsibilities	EOR
9:30 80 min	**Round Robin – Interagency Work Group Input on Roles & Responsibilities** ▪ Does the Draft Table Reflect the Roles & Responsibilities you think are Appropriate for your Agency? ▪ For Other Entities? ▪ What would you Change?	All
10:50 10 min	**Closing** Follow up items ▪ Next Meeting: 12/15 – Risk Assessment & Management	
11:00	*Adjourn*	

summary

- An overview of Engagement Core meeting input was presented through 3 Technical Memos which summarized those meetings (see Appendices A.3 through A.5)
- The Interagency Work Group reviewed and provided feedback on a draft table of roles and responsibilities. The table was based on Table 5 and page 25 of the 2018 report with recommended deletions for information pertaining to greywater and indoor reuse systems which are to be addressed at a future point in time, and recommended additions based on Engagement Core and Agency input (see Appendix C.?).

agenda

MN Stormwater Capture & Use - Interagency Work Group Meeting #2
January 5, 2024, 2:30 pm. – 4:30 p.m.
Microsoft Teams meeting
Microsoft Teams meeting
Join on your computer, mobile app or room device
Click here to join the meeting
Meeting ID: 296 044 887 511
Passcode: KS2CNY
Download Teams | Join on the web
Meeting purpose: Convene Interagency Work Group Engagement Core to discuss roles & responsibilities for stormwater capture and use in Minnesota
Attendees:

- Anita Anderson, MDH
- Brad Wozney, BWSR
- Brandon Smith, MPCA
- Dan Miller, DNR
- Jen Kader, Metropolitan Council
- Jennifer Kostrzewski, Metropolitan Council
- Joanne Boettcher, MPCA
- Larry Gunderson, MDA
- Mike Westemeier, DLI
- Nancy Rice, MDH
- Tannie Eshenaur, MDH
- Frieda von Qualen, MDH
- Brett Emmons, EOR
- Camilla Correll, EOR
- Karli McCawley, EOR

Time	Agenda Item	Lead
2:30 10 min	**Welcome and Overview of the Meeting** ▪ RAPID Framework ▪ Schedule	EOR
2:40 15 min	**Risk Management** ▪ Review of Risk Categories and Risk Management Framework recommended in the 2018 and 2022 reports	MDH
2:55 20 min	**Agency Leadership Feedback** ▪ Agency Reports	All
3:15 60 min	**Visioning Exercise** ▪ What's the ideal institutional structure for stormwater capture and use in MN and how do we get there?	All
4:15 10 min	**Examples in Other States** ▪ Examples of Roles & Standards	EOR
4:25 5 min	**Closing** ▪ Follow up items ▪ Next Steps	EOR / MDH
4:30	*Adjourn*	

summary

- The Interagency Work Group was convened to discuss roles & responsibilities for stormwater capture and use in Minnesota
- An overview of Engagement Core meeting input was presented through 3 Technical Memos which summarized those meetings (see Appendices A.3 through A.5)
- The Interagency Work Group reviewed and provided feedback on a draft table of roles and responsibilities. The table was based on Table 5 and page 25 of the 2018 report with recommended deletions for information

pertaining to greywater and indoor reuse systems which are to be addressed at a future point in time, and recommended additions based on Engagement Core and Agency input (see Appendix A.?).

agenda

MN Stormwater Capture & Use – Joint MDH, MPCA and Metropolitan Council Meeting #1
Wednesday February 28 2024, 8:00 a.m. – 10:00 a.m.
Meeting location: Freeman Building (MDH) – Conference Room4 44
Meeting purpose: To review the results of the survey taken by MDH, MPCA and the Metropolitan. Council to determine how to achieve alignment and common understanding on the following:
The risk-based management approach/framework being proposed.
The path that should be taken to establish recommendations for "regulatory and non-regulatory approaches to water reuse for development of state policy".

Attendees:

- Tannie Eshenaur, MDH
- Anita Anderson, MDH
- Nancy Rice, MDH
- Frieda von Qualen, MDH
- Brandon Smith, MPCA
- Joanne Boettcher, MPCA 0
- Jennifer Kostrzewski, Metropolitan Council
- Jen Kader, Metropolitan Council
- Brett Emmons, EOR
- Camilla Correll, EOR
- Karli McCawley, EOR (remote)
- Mike Rupiper, EOR (remote)

Time	Agenda Item	Lead

8:00 am
10 min
	Welcome and Overview of the Meeting
	• Goals for the project and goals for the meeting (Slide 4)
	• Revisit the goals for the Framework (Slide 5)
	• Where are we to date with the Risk Based Management Framework?
	  ○ Definition of Risk (Health) (Slide 6)
	  ○ What has been completed to date (Slide 7)
	  ○ Table 4 and Table 5 (Slide 8,9)
		EOR - Brett

8:10
5 min
	Survey Results Introduction (Slide 11)
	• Reviewing the survey results through question 13
	  ○ Management Approaches for Risk Categories
	  ○ Assignment of risk management categories
	• Only talking about
	  ○ Sources = rainwater and stormwater
	  ○ End Use = Irrigation
	• Goal is to identify where your organizations are *in alignment* and where your organizations are *not in alignment*.
	• Review each survey question and discuss the comments so we can better understand differences in the responses.
	• At the end, we will identify what steps need to be taken to move forward with the Risk Based Management Framework.
		EOR - Camilla

8:15 2 min	**Survey Results – Question 2 (Slide 13)** • All of you support reuse in Minnesota	EOR - Camilla

8:17
15 min
	Survey Results – Question 4 (Slide 13)
	• All of you support the need for Environmental and Health Policy
	• Environmental Concerns (Slide 14)
	  ○ *Captured stormwater does not transport or mobilize pollutants to our landscape.*
	  ○ Can we infer that rainwater is okay?
	  ○ Is there a concern about stormwater runoff from ponds?
	  ○ What are the concerns?
	  ○ Are there other concerns?
	  ○ Does the framework need to include environmental risk?
	  ○ What would this look like?
		EOR – Camilla

8:32 20 min	**Survey Results – Question 4 (Slides 15 – 36)** • Health Concerns • What are people's thoughts about the data (Slide 31)	MDH - Anita
8:52 5 min	**Survey Results – Question 4 (Slide 38)** • Operational Concerns/Risk • What is Operational Risk (i.e. "System Complexity" in Table 5)? • Does the framework need to include operational risk (why)? • What would this look like?	EOR – Brett
8:57 15 min	**Survey Results – Question 6 (Slide 39 - 43)** • Review Terminology • Do the Management Approaches make sense for Category 1 (Low Risk) scenario?	EOR - Camilla
9:12 10 min	**Survey Results – Question 8 (Slide 44 - 46)** • Do the Management Approaches make sense for Category 2 (Moderate Risk) scenario?	EOR - Camilla
9:22 10 min	**Survey Results – Question 10 (Slide 47 - 49)** • Do the Management Approaches make sense for Category 1 (low risk) scenario?	EOR - Camilla
9:32 10 min	**Survey Results – Did some of the responses change?** • *Karli to track which of the responses may have changed as a result of the discussion.* • *Karli to track next steps.*	EOR - Camilla

9:42
15 min
	Survey Results – Question 12 (Slides 52 - 58)
	• Which Risk Category is most appropriate for each potential reuse scenario?
	• Questions about Risk Category assignment and the need to be based on *How*, *When* and *Where* the system is operated
	• What's missing from the framework developed based on Tables 4 and 5?
	  ○ Table with 3 variables
	  ○ Table with 4 variables
	  ○ Table with 5 variables if we add environmental
	• How does the group want to proceed with the Risk Management Framework?
	  ○ Do we need to assign existing example projects to the expanded table in order to identify risk categories?
	  ○ Would this help people assign management approaches?
	  ○ Would this help with the assignment of roles and responsibilities?
	  ○ Who should participate in this exercise?
	  ○ Does a similar Risk Matrix need to be developed for Environmental Risk? Who should take the lead on this?
	  ○ Does a similar Risk Matrix need to be developed for Operational Risk? Who should take the lead on this?
		EOR - Camilla

9:58 2 min	**Review Next Steps** • *Karli to keep track of next steps so we can share these at the end of the meeting.*	EOR
10:00	*Adjourn*	

minutes

Project Name: Stormwater Capture & Use in Minnesota
Date: 28 Feb. 2024\Reissued 1 April 2024
Meeting Location: MN Department of Health – Freeman Building & Virtual
Regarding: Joint MDH, MPCA, and Metropolitan Council Meeting - 1
Attendees:

- Tannie Eshenaur, MDH (remote)
- Anita Anderson, MDH
- Nancy Rice, MDH
- Frieda von Qualen, MDH
- Brandon Smith, MPCA (remote)
- Paula Kalinosky, MPCA (remote)
- Jennifer Kostrzewski, Metropolitan Council (remote)
- Jen Kader, Metropolitan Council (remote)
- Brett Emmons, EOR
- Camilla Correll, EOR
- Karli McCawley, EOR (remote)
- Mike Rupiper, EOR (remote)

Recorded By: Karli McCawley, EOR

Meeting Purpose

On Wednesday February 28th, MDH, MPCA and the Metropolitan Council met to review the results of a survey taken by these three organizations earlier in the month. The goal of the survey was to evaluate each agency's understanding and support for the risk-based management framework developed by the Interagency Work Group on Water Reuse in 2018. Given the differences in the survey responses, it was decided that MDH, MPCA, and the Metropolitan Council should meet to review the survey results and discuss any questions or concerns with the risk-based management framework.

The purpose of the meeting was to determine how to achieve alignment and common understanding on the following:

- The risk-based management approach/framework was established in 2018.
- The path that should be taken to create a road map for water reuse implementation in Minnesota.

This meeting summary covers the content discussed at the February 28th meeting. Given that the group didn't get to all the agenda items, they will be reconvening on Monday March 4th and March 13th.

Meeting Summary

Welcome and Overview of the Meeting

EOR presented a reconfigured example of Table 4 and Table 5 from the 2018 Report to illustrate how the content developed for the risk-based management framework is organized by risk (Low, Medium, and High), likelihood of exposure (end use type, of potential users) and hazard/consequence (level of pathogens/contaminants in the source).

- The Team would like time with this reconfigured table and a picture of it was sent via the meeting chat.

Survey Results

Question 2 (Slide 13): Do you support onsite stormwater capture and use in Minnesota in general?

- General agreement on supporting onsite stormwater capture and use in Minnesota.

Question 4 (Slide 13): Should there be any environmental or health policy related to stormwater reuse at any level of government?

Slide Questions:

- All of you support the need for Environmental and Health Policy
- Environmental Concerns (Slide 14)
- *Captured stormwater does not transport or mobilize pollutants to our landscape.*
- Can we infer that rainwater is, okay?
- Is there a concern about stormwater runoff from ponds?
- What are the concerns?
- Are there other concerns?
- Does the framework need to include environmental risk?
- What would this look like?

Discussion on Environmental Risks:

- ***Pollutant Mobilization*** – Metropolitan Council clarified that the comment was made as a general cautionary statement, as there is potential for pollutants to become concentrated in the source water. The Metropolitan Council is concerned with nutrients, chloride, metals associated with residue from cars within parking lots and PFAS.
- ***MIDS Treatment*** – Is the environmental concern impacts to downstream waterbodies or impacts to public health?
    - Since stormwater ponds are designed to meet MIDS requirements (water quality and volume control), downstream resources should benefit from additional treatment due to reuse.
        - Ponds are designed to provide water quality treatment for stormwater runoff (sediment and phosphorous removal). Unless there is a specific hot spot for pollutants then it should be okay for use.
        - Need to evaluate impacts to the irrigation system. Stormwater ponds may need to be designed to provide additional storage (i.e., ensure a permanent pool) so sediment isn't being pulled into the irrigation system.
    - The group did not raise concerns with impacts to downstream waterbodies. MPCA mentioned that nitrate loading to groundwater would be a concern but that this is probably not an issue in an urban setting.
- ***Potential Benefits*** – There are environmental benefits of using stormwater runoff for irrigation.
    - Keeping nutrients on the vegetation will help them grow and keep them out of downstream water sources.
    - Chloride is a more difficult pollutant to address – irrigation could keep it out of downstream waterbodies, but higher concentration could kill vegetation.
- ***Local Hydrology*** – No discussion/comments from group. It was noted that MNDNR would be concerned with quantity issues and potential hydrologic impacts and should be engaged at a later date.
- ***Overall Comments*** - Want to ensure that there are not too many barriers (i.e., RO system on every pond) to stormwater reuse and that the benefits are considered in establishing the framework. The group wants to see a balanced approach to promoting stormwater reuse based on the source, understanding that tradeoffs will be involved in the application of this practice. The group wants to see guidelines for implementers so they know what they are taking on and what potential problems can be (understanding of risk).
- ***Goal of Process*** - Determine what tradeoffs are acceptable (acceptable level of risk).

Question 4 (Slides 15 – 36): MDH Health Risks Presentation

Discussion on Health Risks:

- ***Data Presented*** – MDH presented data from the 2022 white paper Reuse of Stormwater and Rainwater in Minnesota (https://www.health.state.mn.us/communities/environment/water/docs/cwf/wpwaterreuse.pdf)(PDF).The water quality data used for the risk analysis for stormwater (rooftop water data was not discussed) was collected at 22 sites throughout the TCMA. All of the water was considered to be source water to a reuse facility. There is an additional (more recent) study conducted by UMN, but MDH has not had the opportunity to process the data yet. MDH noted that national studies support the findings of this local risk analysis.

Benchmark for acceptable risk of 1/10,000 (10^{-4}) ppy is used by EPA for drinking water and is used by other entities nationally for reuse. At the meeting, it was stated that this standard is fairly protective of a large, more vulnerable portion of the population (i.e., the elderly and children). *Following the meeting, a review of the WERF report demonstrates that the LRT table is for healthy adults. This correction will be noted at the next meeting with MDH, MPCA and the Metropolitan Council.*

Comparison of Exposure Rates to Recreational Standards – The Metropolitan Council asked how the exposure rates presented by MDH compare to swimming in a lake (recreational exposure).

  - The 10^{-4} benchmark for acceptable risk used in the white paper is higher (or more protective) than the recreational standard for *E. coli*.
  - MDH reminded the group that the standards will vary due to voluntary exposure considerations. If someone chooses to swim in a waterbody that is prone to beach closures, they are knowingly assuming a certain level of risk. Someone who comes into contact with stormwater runoff is not volunteering to be exposed to risk of infection. Need to consider that the public doesn't have a good understanding about the quality of stormwater runoff. People assume that everything coming out of a spigot is clean, potable water.

- ***Treatment Options*** - MDH presented treatment-train approaches that would reduce the risk (filter, UV light, etc.)
  - Based on Log reduction targets
  - Concern was raised over whether these devices would be cost prohibitive to implementers.
  - MPCA suggested that we work through some example systems to demonstrate the level of treatment required for various risk categories and the associated costs.
  - Balance of mitigating risks and promoting use – no need to design and mandate a 'perfect' system that no one will actually implement.
- ***Risk Management*** -
  - MPCA asked how long pathogens last once they are applied to vegetation and brought up the issue of restricted versus unrestricted access.
  - Drip irrigation would mitigate a lot of risks.
- ***Decisions/Next Steps*** -
  - If MDH establishes the treatment requirement (WQ Criteria based on source, use, level of treatment), does MPCA make sure that reuse systems are being designed and installed in accordance with MDH's requirements? This is the main question.
  - What are all of the other sources that have been evaluated and what are the exposure pathways (stormwater, ponds, cisterns, and roof tops)?
  - MDH made the point that using log reduction targets is an alternative to constantly monitoring the microbial water quality coming out of the system, although operational

parameters will need to be monitored to ensure the treatment system is working properly.

ACTION ITEMS

- Reconvening on Monday March 4th and on March 13th to continue discussing the rest of the survey's questions.

summary

- Discussed project goals and meeting objectives.
- Reviewed progress on the Risk Based Management Framework.
- Analyzed survey results regarding environmental, health, and operational concerns.
- Identified actions for refining the framework and assigning risk categories.

summary

Project Name: Stormwater Capture & Use in Minnesota

Date: 04 March 2024\Reissued 1 April 2024

Meeting Location: Department of Health – Freeman Building & Virtual

Regarding: Joint MDH, MPCA, and Metropolitan Council Meeting - #2

Attendees:

- Tannie Eshenaur, MDH
- Anita Anderson, MDH (remote)
- Nancy Rice, MDH
- Frieda von Qualen, MDH
- Brandon Smith, MPCA
- Paula Kalinosky, MPCA
- Joanne Boettcher, MPCA (remote)
- Jennifer Kostrzewski, Metropolitan Council
- Jen Kader, Metropolitan Council
- Brett Emmons, EOR
- Camilla Correll, EOR
- Karli McCawley, EOR (remote)
- Mike Rupiper, EOR (remote)

Recorded By: Karli McCawley, EOR

Meeting Purpose (Same as Meeting #1)

On Wednesday February 28th, MDH, MPCA and the Metropolitan Council met to review the results of a survey taken by these three organizations earlier in the month. The goal of the survey was to evaluate each agency's understanding and support for the risk-based management framework developed by the Interagency Work Group on Water Reuse in 2018. Given the differences in the survey responses, it was decided that MDH, MPCA and the Metropolitan Council should meet to review the survey results and discuss any questions or concerns with the risk-based management framework.

The purpose of the meeting was to determine how to achieve alignment and common understanding on the following:

- The risk-based management approach/framework established in 2018.
- The path that should be taken to create a road map for water reuse implementation in Minnesota.

This meeting summary covers the content discussed at the second meeting which was held on Monday March 4th. Given that the group did not get through all of the survey questions, we will be reconvening on March 13th.

MEETING NOTES:

Welcome and Overview of the Meeting

The meeting began with a review of the February 28th meeting summary, re-introduced the existing Risk Based framework (reworked Table 4 & 5 on slide 7), and outlined the content that would be discussed today. The following clarifications were made:

- Jen Kader, Metropolitan. Council suggested that options other than treatment (i.e., restricted use) be considered in the development of the case studies for low, moderate and high-risk scenarios. This will highlight additional lower-cost options for protecting public health.
- Paula Kalinosky clarified that the Stormwater Coalition, not the Pathogen Lateral Team, is interested in the topic of an evaluation of pathogens applied to the landscape but is not currently working on it.

At the beginning of the meeting, MPCA requested access to the slides in order to review what had been presented previously.

Discussion on additional MDH WQ Slides (Slides 39 – 48)

In response to Meeting #1, MDH prepared and added additional slides with data on the exposure rates from rainwater sources, as stormwater was the only source water presented during MDH slides for Meeting #1.

- ***Rainwater Data*** – MDH presented the data analysis for systems using rainwater as the source. Overall, rainwater source systems have lower risk than stormwater sourced systems.
    - Example: Salmonella – 50 exposures during the year = 4 infections / 1000 people (compared with 7 /100 people for stormwater or 70 infections/1000 people)
    - One of the assumptions of this analysis is that people are around when irrigation is happening. No input variable is included for considering 'Restricted Use'.
- ***Comparison of MN Data to National Trends*** – MDH noted that the analysis conducted using local (TCMA) data for stormwater and rainwater aligns with what has been reported to date by the Water Environment and Reuse Foundation (WE&RF) (Now Water Research Foundation – WRF). This was illustrated in Tables 1 & 2 from the MDH 2022 White Paper (Slide 46).

MDH also demonstrated how Chloride, Nitrate, and Phosphorus compares to benchmarks from Water Reuse Irrigation Guidelines (Slide 47). This data was from the Regional Applied Research Effort (RARE) - EPA and showed that most sampled values were lower than the Reuse Guidelines for Chloride and nutrients applied for irrigation, but it was unclear where and what land these samples used had been taken from.

- Metropolitan Council expressed concern with the use of chloride laden stormwater runoff as a source of water for irrigation in terms of being toxic to plants and corrosive to industrial process. MDH asked if there were a chloride level that would preclude the use of stormwater runoff for irrigation? The Metropolitan Council noted that they were unsure about numbers.
    - Suggestion to provide guidance on how to clean stormwater ponds – including chloride laden bottom waters.

- ***Risk of Exposure*** – The group discussed the following related to risk exposure:
    - Are there restrictions required for manure spraying? The group did not have a good response to this question.
    - What is the risk of just being outside or in a lake where we are already exposed to pollutants? The difference we are making with stormwater capture and use is that we are adding risk by introducing the pollutants in the reused water (i.e., rainwater and/or stormwater).
        - Nancy Rice – Not sure if they have a study, maybe a golf course, but there is always some level of risk.
        - Anita Anderson – comparison they are making is between Drinking Water source for irrigation vs Stormwater/rainwater for irrigation because other things will exist in either case.
    - MDH summarized the discussion on risk of exposure by noting that there are three layers that need to be considered: (1) is the public making a voluntary choice to be exposed (to the risk)? (2) is the public making an assumption about the quality of the water? And (3) what is the exposure pathway (risk to exposure and/or infection)?
    - Collecting and storing water itself can create conditions for breeding bacteria so this can actually increase risk.

- ***Risk Management*** – The following discussion points were addressed after MDH's presentation of the exposure assessment and risk analysis for rainwater and benchmark for acceptable risk.
    - Metropolitan Council suggested developing a table which will guide implementers as they build their own system.
        - What is the target/water quality criteria?
        - How could partially restricted systems reduce treatment demands?
        - Provide credits or points for UV, Filtering Treatment and people add up what they need based on provided guidance to meet Log Reduction Targets.
        - How do monitoring costs factor into the design process?
        - If guidelines were not provided around treatment levels for Source and End Use, what kind of monitoring would be needed of a system? Meeting log reduction targets and monitoring treatment processes could replace expensive end-point microbial monitoring.
        - Need to ensure that all choices are clear, and implementers understand the tradeoffs to make informed choices.
    - MPCA would like to better understand the inherent tradeoffs and overall risk to human health by conducting something akin to a cost – benefit analysis:
        - How will guidance and restricted access fit into this analysis?
        - Issues with many variables and potentially changing exposure rates.
        - Case Studies – Metropolitan Council has a variety of systems that do and don't have treatment systems in place – it was suggested that someone could utilize data from these systems and see if people got sick from them? Word of mouth analysis.

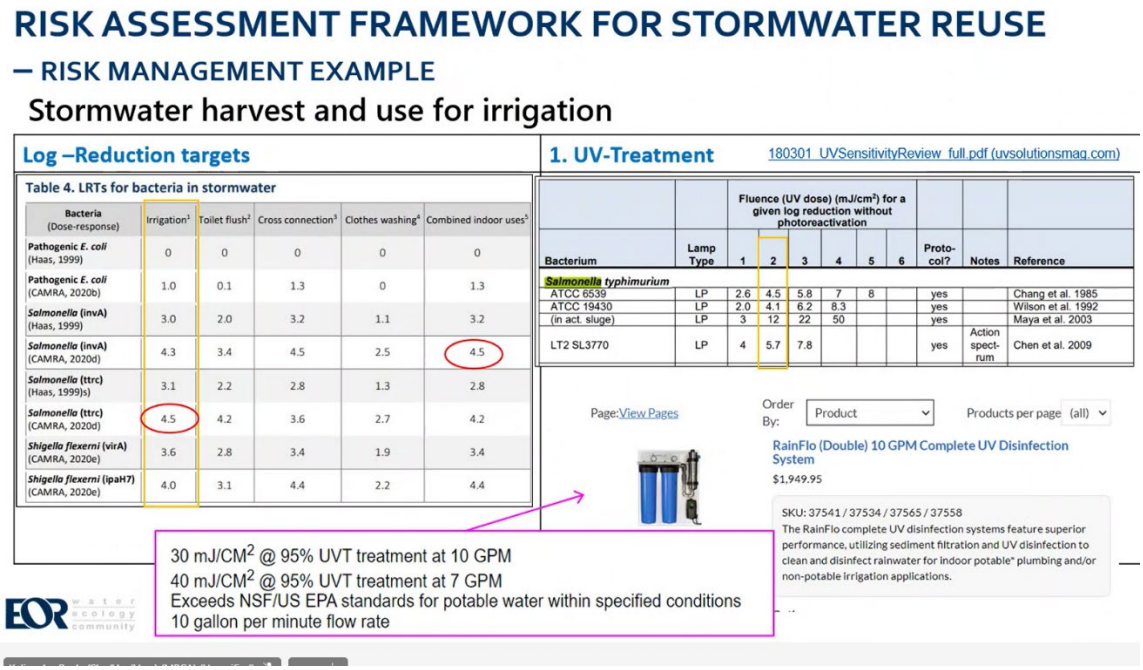
Revisit of Survey Questions (Slide 15)

At the end of the discussion, EOR asked the group to revisit the following comments from question 4 of the survey. Camilla Correll asked the group if they had the same concerns as was originally noted in the Survey or if they had additional concerns to add and she asked if there was a need for additional information related to health risks.

QUESTIONS/DISCUSSION POINTS:

- **Health Concern - Water quality needs to match the use/need**
    - Log reduction approach - log reduction targets that need to be met to protect human health for each source and end use
- **Health Concern - Health related policy based on limited data**
    - MDH to share available data
- **Is there a need for additional information related to health risks?**
    - Discussion

- ***Case Studies*** – The group revisited the idea of developing case studies for each risk management scenario (low, medium, high) in an effort to clarify the range of costs given the treatment requirements and the applications.
    - Paula Kalinosky shared the following slide on potential LRT and cost of products for Stormwater treatment. This slide came from a presentation that Paula gave for the Central States Water Environment Association (CSWEA). She showed this as an example of what the case studies could summarize.



Products are described by LRT and the flow rate of the irrigation system.

- Metropolitan Council asked if it would help to conduct a real-world golf course based on this information (i.e., for this flow rate, how many filters would be needed to meet the water quality treatment criteria?)
- Paul Kalinosky requested that MDH provide the LRTs for each combination of Source Water and End use (Risk Management Scenario) and any guidance that may have been developed regarding how restricted access may reduce the LRT.

- MDH noted that there is a significant need for guidance and has the impression that some systems are way overdesigned because they are unsure about the risk and trying to design to some unknown future regulation and others are under designed. "Wild west."
- ***Additional Information*** – MPCA requested that MDH add information to the Revised Table 4-5. It was requested that exposure rates and Log Reductions Targets be added to the table to illustrate the criteria that would need to be met. To some degree that is reflected in an existing table.
- ***Management Approaches*** – The following discussion points identify some additional needs related to management approaches.
    - Suggestion for a threshold for regulation (comparable with drinking water systems only being regulated for systems serving over 25 people), as they can't regulate all reuse applications and need to draw a line somewhere.
    - All agencies agree they are trying to find a good balance between minimizing risk and reasonable expectations of what can be implemented and monitored. Attaining zero is not realistic or reasonable, and this is inherent in public health work.

- First step would have guidance. Then see if there are situations where consequences would be so great that regulation would be required. We do not want a situation like Legionella Outbreaks, for example.

Summary of Tentative Agreement – The group appeared to be coming toward some consensus on the following points and appropriate next steps:

- MN Data Consistency with National Data - The more recent MN-based monitoring data and risk analysis provides results that bracket and have averages that agree with the National data referenced in the 2018 study, and the 2018 and 2022 Risk Assessments are reasonable.
- Consistency with National Recommendations - If there are only small differences between local and national data, like those discussed above, the agencies prefer being consistent with reuse treatment and management recommendations provided by national organizations such as the recommendations made in the following Final Report: Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems (published by the Water Environment & Reuse Foundation).
- Health Risks Balanced with Practicality - The agencies agree that uncontrolled stormwater reuse does pose a health risk. Guidance and/or regulation are prudent to manage the risk but it must be balanced with reasonable expectations of what can be implemented and monitored.
    - Case Studies to Resolve the Details - Developing some representative case studies, defining needed treatment regimes, and associated costs will be a major step forward to allow the agencies to find common ground on what is reasonable for a risk-based stormwater reuse management framework.
    - Restricted Access – Restricting access to application areas can be a Risk Management option and provides a useful tool to minimize risk, which could replace treatment systems under certain scenarios. New Table with resynthesis of Tables 4 and 5 to map out scenarios and log reduction requirements.
- Consensus and Unified Recommendations - The involved water agencies will work to come to a consensus on reuse recommendations in order to limit confusion and barriers for implementing parties, who often struggle to improve water management when there are differing or conflicting agency directives.
- Incremental Progress on Applications - The framework will begin with source waters of rainfall and stormwater and end uses of irrigation. Later, the framework can be expanded to other, more diverse end uses (splash pads, wash water, etc.). Further, treated greywater and/or wastewater as source waters could be considered beyond that.
- Evolving Science Needs Periodic Updates – the reuse databases are growing and the local experience of how well reuse is working (in MN and in North America) continues to expand quickly, and decisions and framework made now should be revisited and amended if needed on a 2–5-year interval.
- Reporting Back Out – The group is nearing consensus on a risk–based framework recommendation and plans to report back to the rest of the Interagency Work Group and the Engagement Core Group in the near future.

ACTION ITEMS

- Reconvening on March 13th to continue discussing the rest of the survey's questions.

Summary:

- General agreement on supporting onsite stormwater capture and use in Minnesota.

- The group is not concerned with impacts to downstream waterbodies since the source of stormwater runoff will have been treated at least to MIDS requirements. MPCA mentioned that nitrate loading to groundwater would be a concern but that this is probably not an issue in an urban setting. The Metropolitan Council is concerned with nutrients, chloride, metals associated with residue from cars within parking lots and PFAS.
- The group wants to ensure that there are not too many barriers (i.e., RO system on every pond) to stormwater reuse and that the benefits are considered in establishing the framework. The group wants to see a balanced approach to promoting stormwater reuse based on the source, understanding that tradeoffs will be involved in the application of this practice. The group wants to see guidelines for implementers so they know what they are taking on and what potential problems can be (understanding of risk). Determine what trade-offs are acceptable (acceptable level of risk).
- MDH presented its analysis on health risk as it relates to stormwater runoff. Following the presentation, there were questions about other sources of stormwater runoff (i.e., rainwater) and the exposure pathways (stormwater, ponds, cisterns, and roof tops) that have been evaluated.
- MDH made the point that using log reduction targets is an alternative to constantly monitoring the microbial water quality coming out of the system, although operational parameters will need to be monitored to ensure the treatment system is working properly.
- There was discussion on the process. If MDH establishes the treatment requirement (WQ Criteria based on source, use, level of treatment), does MPCA make sure that reuse systems are being designed and installed in accordance with MDH's requirements?

summary

Project Name: Stormwater Capture & Use in Minnesota

Date: 13 March 2024\Reissued 1 April 2024

Meeting Location: Department of Health – Freeman Building & Virtual

Regarding: **Joint MDH, MPCA, and Metropolitan Council Meeting - #3**

Attendees:

- Tannie Eshenaur, MDH
- Anita Anderson, MDH (remote)
- Nancy Rice, MDH
- Frieda von Qualen, MDH
- Brandon Smith, MPCA (remote)
- Paula Kalinosky, MPCA (remote)
- Joanne Boettcher, MPCA (remote)
- Jennifer Kostrzewski, Metropolitan Council
- Maureen Hoffman, Metropolitan Council
- Brett Emmons, EOR
- Camilla Correll, EOR
- Karli McCawley, EOR (remote)
- Mike Rupiper, EOR (remote)

Recorded By: Karli McCawley, EOR

Meeting Purpose (Same as Meeting #1)

- O On Wednesday February 28th, MDH, MPCA and the Metropolitan Council met to review the results of a survey taken by these three organizations earlier in the month. The goal of the survey was to evaluate each agency's understanding and support for the risk-based management framework developed by the Interagency Work Group on Water Reuse in 2018. Given the differences in the survey responses, it was decided that MDH, MPCA and the Metropolitan Council should meet to review the survey results and discuss any questions or concerns with the risk-based management framework.
- The purpose of the meeting was to determine how to achieve alignment and common understanding on the following:
- The risk-based management approach/framework established in 2018.
- The path that should be taken to create a road map for water reuse implementation in Minnesota.
- This meeting summary covers the content discussed at the second meeting which was held on Monday March 4th. Given that the group did not get through all of the survey questions, we will be reconvening on March 13th.

MEETING NOTES:

- **Welcome and Overview of the Meeting**
- The meeting began with a review of the February 28th meeting summary, re-introduced the existing Risk Based framework (reworked Table 4 & 5 on slide 7), and outlined the content that would be discussed today. The following clarifications were made:
- Jen Kader, Metropolitan. Council suggested that options other than treatment (i.e., restricted use) be considered in the development of the case studies for low, moderate and high-risk scenarios. This will highlight additional lower-cost options for protecting public health.
- Paula Kalinosky clarified that the Stormwater Coalition, not the Pathogen Lateral Team, is interested in the topic of an evaluation of pathogens applied to the landscape but is not currently working on it.

- At the beginning of the meeting, MPCA requested access to the slides in order to review what had been presented previously.
- **Discussion on additional MDH WQ Slides (Slides 39 – 48)**
- In response to Meeting #1, MDH prepared and added additional slides with data on the exposure rates from rainwater sources, as stormwater was the only source water presented during MDH slides for Meeting #1.
- ***Rainwater Data*** – MDH presented the data analysis for systems using rainwater as the source. Overall, rainwater source systems have lower risk than stormwater sourced systems.
    - Example: Salmonella – 50 exposures during the year = 4 infections / 1000 people (compared with 7 /100 people for stormwater or 70 infections/1000 people)
    - One of the assumptions of this analysis is that people are around when irrigation is happening. No input variable is included for considering 'Restricted Use'.

- ***Comparison of MN Data to National Trends*** – MDH noted that the analysis conducted using local (TCMA) data for stormwater and rainwater aligns with what has been reported to date by the Water Environment and Reuse Foundation (WE&RF) (Now Water Research Foundation – WRF). This was illustrated in Tables 1 & 2 from the MDH 2022 White Paper (Slide 46).
- MDH also demonstrated how Chloride, Nitrate, and Phosphorus compares to benchmarks from Water Reuse Irrigation Guidelines (Slide 47). This data was from the Regional Applied Research Effort (RARE) - EPA and showed that most sampled values were lower than the Reuse Guidelines for Chloride and nutrients applied for irrigation, but it was unclear where and what land these samples used had been taken from.
    - Metropolitan Council expressed concern with the use of chloride laden stormwater runoff as a source of water for irrigation in terms of being toxic to plants and corrosive to industrial process. MDH asked if there were a chloride level that would preclude the use of stormwater runoff for irrigation? The Metropolitan Council noted that they were unsure about numbers.
        - Suggestion to provide guidance on how to clean stormwater ponds – including chloride laden bottom waters.

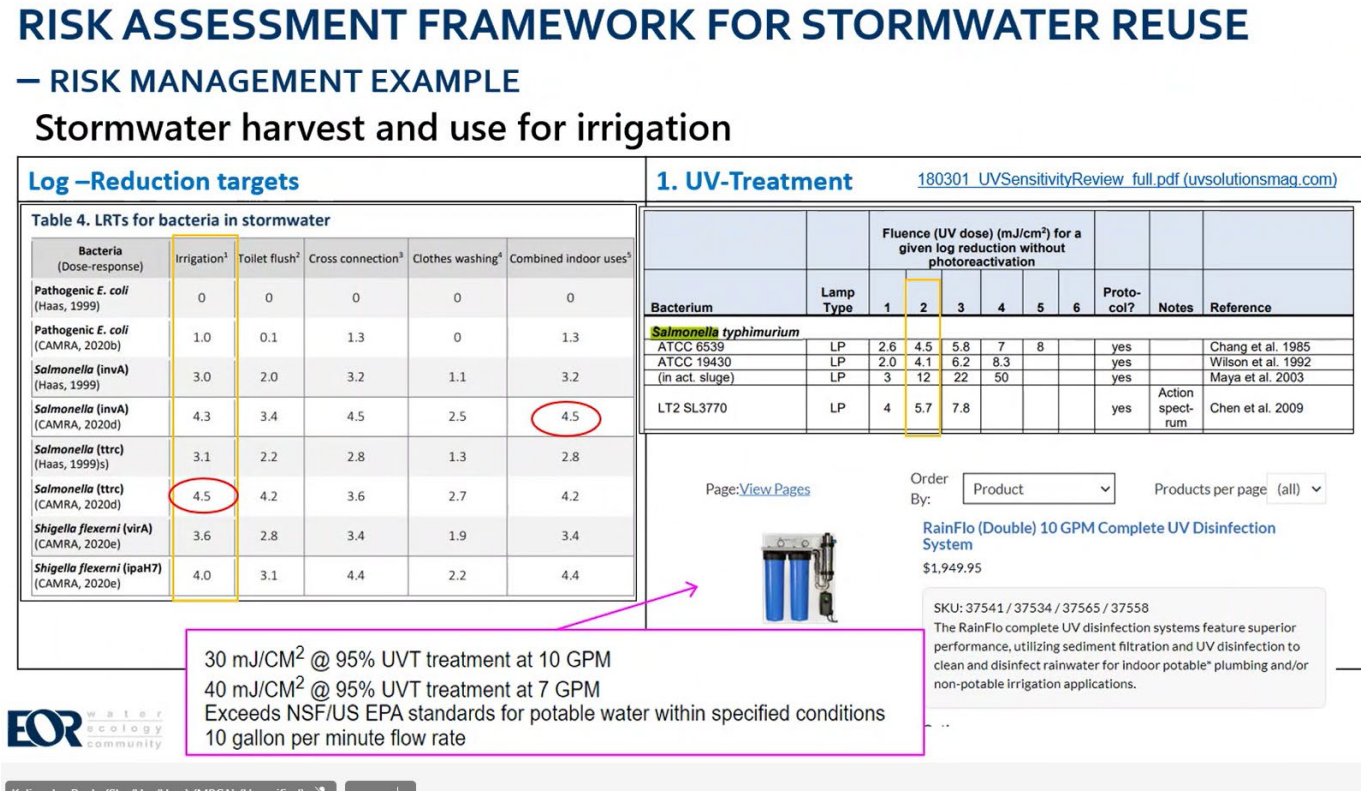
- ***Risk of Exposure*** – The group discussed the following related to risk exposure:
    - Are there restrictions required for manure spraying? The group did not have a good response to this question.
    - What is the risk of just being outside or in a lake where we are already exposed to pollutants? The difference we are making with stormwater capture and use is that we are adding risk by introducing the pollutants in the reused water (i.e., rainwater and/or stormwater).
        - Nancy Rice – Not sure if they have a study, maybe a golf course, but there is always some level of risk.
        - Anita Anderson – comparison they are making is between Drinking Water source for irrigation vs Stormwater/rainwater for irrigation because other things will exist in either case.
    - MDH summarized the discussion on risk of exposure by noting that there are three layers that need to be considered: (1) is the public making a voluntary choice to be exposed (to the risk)? (2) is the public making an assumption about the quality of the water? And (3) what is the exposure pathway (risk to exposure and/or infection)?
    - Collecting and storing water itself can create conditions for breeding bacteria so this can actually increase risk.

- ***Risk Management*** – The following discussion points were addressed after MDH's presentation of the exposure assessment and risk analysis for rainwater and benchmark for acceptable risk.
    - Metropolitan Council suggested developing a table which will guide implementers as they build their own system.
        - What is the target/water quality criteria?
        - How could partially restricted systems reduce treatment demands?
        - Provide credits or points for UV, Filtering Treatment and people add up what they need based on provided guidance to meet Log Reduction Targets.
        - How do monitoring costs factor into the design process?
        - If guidelines were not provided around treatment levels for Source and End Use, what kind of monitoring would be needed of a system? Meeting log reduction targets and monitoring treatment processes could replace expensive end-point microbial monitoring.
        - Need to ensure that all choices are clear, and implementers understand the tradeoffs to make informed choices.
    - MPCA would like to better understand the inherent tradeoffs and overall risk to human health by conducting something akin to a cost – benefit analysis:
        - How will guidance and restricted access fit into this analysis?
        - Issues with many variables and potentially changing exposure rates.
        - Case Studies – Metropolitan Council has a variety of systems that do and don't have treatment systems in place – it was suggested that someone could utilize data from these systems and see if people got sick from them? Word of mouth analysis.
- **Revisit of Survey Questions (Slide 15)**
- At the end of the discussion, EOR asked the group to revisit the following comments from question 4 of the survey. Camilla Correll asked the group if they had the same concerns as was originally noted in the Survey or if they had additional concerns to add and she asked if there was a need for additional information related to health risks.

QUESTIONS/DISCUSSION POINTS:

- **Health Concern - Water quality needs to match the use/need**
    - Log reduction approach - log reduction targets that need to be met to protect human health for each source and end use
- **Health Concern - Health related policy based on limited data**
    - MDH to share available data
- **Is there a need for additional information related to health risks?**
    - Discussion

- ***Case Studies*** – The group revisited the idea of developing case studies for each risk management scenario (low, medium, high) in an effort to clarify the range of costs given the treatment requirements and the applications.
    - Paula Kalinosky shared the following slide on potential LRT and cost of products for Stormwater treatment. This slide came from a presentation that Paula gave for the Central States Water Environment Association (CSWEA). She showed this as an example of what the case studies could summarize.



Products are described by LRT and the flow rate of the irrigation system.

- Metropolitan Council asked if it would help to conduct a real-world golf course based on this information (i.e., for this flow rate, how many filters would be needed to meet the water quality treatment criteria?)
- Paul Kalinosky requested that MDH provide the LRTs for each combination of Source Water and End use (Risk Management Scenario) and any guidance that may have been developed regarding how restricted access may reduce the LRT.

- MDH noted that there is a significant need for guidance and has the impression that some systems are way overdesigned because they are unsure about the risk and trying to design to some unknown future regulation and others are under designed. "Wild west."
- ***Additional Information*** – MPCA requested that MDH add information to the Revised Table 4-5. It was requested that exposure rates and Log Reductions Targets be added to the table to illustrate the criteria that would need to be met. To some degree that is reflected in an existing table.
- ***Management Approaches*** – The following discussion points identify some additional needs related to management approaches.
  - Suggestion for a threshold for regulation (comparable with drinking water systems only being regulated for systems serving over 25 people), as they can't regulate all reuse applications and need to draw a line somewhere.
  - All agencies agree they are trying to find a good balance between minimizing risk and reasonable expectations of what can be implemented and monitored. Attaining zero is not realistic or reasonable, and this is inherent in public health work.
  - The first step would be guidance. Then see if there are situations where consequences would be so great that regulation would be required. We do not want a situation like Legionella Outbreaks, for example.

Summary of Tentative Agreement – The group appeared to be coming toward some consensus on the following points and appropriate next steps:

- MN Data Consistency with National Data - The more recent MN-based monitoring data and risk analysis provides results that bracket and have averages that agree with the National data referenced in the 2018 study, and the 2018 and 2022 Risk Assessments are reasonable.
- Consistency with National Recommendations - If there are only small differences between local and national data, like those discussed above, the agencies prefer being consistent with reuse treatment and management recommendations provided by national organizations such as the recommendations made in the following Final Report: Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems (published by the Water Environment & Reuse Foundation).
- Health Risks Balanced with Practicality - The agencies agree that uncontrolled stormwater reuse does pose a health risk. Guidance and/or regulation are prudent to manage the risk but it must be balanced with reasonable expectations of what can be implemented and monitored.
    - Case Studies to Resolve the Details - Developing some representative case studies, defining needed treatment regimes, and associated costs will be a major step forward to allow the agencies to find common ground on what is reasonable for a risk-based stormwater reuse management framework.
    - Restricted Access – Restricting access to application areas can be a Risk Management option and provides a useful tool to minimize risk, which could replace treatment systems under certain scenarios. New Table with resynthesis of Tables 4 and 5 to map out scenarios and log reduction requirements.
- Consensus and Unified Recommendations - The involved water agencies will work to come to a consensus on reuse recommendations in order to limit confusion and barriers for implementing parties, who often struggle to improve water management when there are differing or conflicting agency directives.
- Incremental Progress on Applications - The framework will begin with source waters of rainfall and stormwater and end uses of irrigation. Later, the framework can be expanded to other, more diverse end uses (splash pads, wash water, etc.). Further, treated greywater and/or wastewater as source waters could be considered beyond that.
- Evolving Science Needs Periodic Updates – the reuse databases are growing and the local experience of how well reuse is working (in MN and in North America) continues to expand quickly, and decisions and framework made now should be revisited and amended if needed on a 2–5-year interval.
- Reporting Back Out – The group is nearing consensus on a risk–based framework recommendation and plans to report back to the rest of the Interagency Work Group and the Engagement Core Group soon.

APPENDIX G

Case Studies for Preliminary Assessment

Case Studies for Preliminary Assessment of Current Practices

Case studies were developed to inform the Interagency Work Group discussion of exposure risk assessment, and risk mitigation through treatment (disinfection); physical impediments such as fencing, use of drip irrigation or irrigating during periods of no/low use; and other risk mitigation practices like signage or other education and outreach efforts. The group wanted to better understand how current practices in Minnesota address exposure risk and whether providing treatment to meet preliminary LRT targets would require a significant shift if practices or increase in project costs.

What do existing treatment systems look like?

- Do existing treatment systems provide treatment consistent with MDH recommendations for source-use LRTs or LRTs developed by others (WERF, Australia).
- How does implementation of disinfection increase overall project costs?

What risk mitigation practices have been implemented in existing projects?

- Which mitigation practices function to decrease LRTs for source-use and thereby reduce the level of treatment needed to meet MDH recommendations?

The Interagency Work Group tried to include a representative cross-section of examples from existing harvest and use projects in Minnesota. Due to time constraints, only projects where relevant data were readily available could be selected. Cost information was limited to project implementation and annual operation costs. Broader considerations such as cost saving associated with reduced use of potable water or water quality benefits to downstream surface water were not included, though in practice, these factors may be significant motivators for implementing. Select case study details and information are summarized in Table 1 and Table 2.

Common hurdles in case study development:

- Projects were implemented under staff who no longer work for the organization, first-hand knowledge is not readily available.
- Project information is not centralized; the time investment needed to pull data from various records was greater than time available/allotted under project scope.
- Project does not add breadth to cross-section of reuse systems included in the case studies (e.g., use of a stormwater pond to irrigation green space).
- Reuse applications fall outside current focus reuse for irrigation (e.g., case studies on indoor use were not pursued).

Case study 1: The case study examines the 1st Street system in Waconia, implemented in 2013 with three phases. Treatment involves sedimentation in underground units, and shock chlorination is used periodically/seasonally. Irrigation is primarily for athletic fields and green spaces at 1st Street Elementary School, using rotary spray heads. Risk mitigation actions include posting signage and using purple pipes to indicate a non-potable water source and operating the irrigation system at time when potential exposure risk is minimized (nighttime, early morning). Discussion included if chlorine levels after shock treatments were damaging to turf, risk mitigation, and target benchmarks

for treatment requirements. The study raises questions about exposure reduction, educational efforts, and decision-making on treatment standards. Concerns include buffer areas (which are present in most adjoining areas), access during irrigation, and target credit allocation for treatments.

Case Study 2: Hunters Crossing in Waconia is a retrofit project in a larger residential area with an adjacent park, utilizing an existing pond and a new development pond for stormwater management. The system includes a UV treatment component Irrigation is provided to the neighborhood park, and in the new residential developments for turf irrigation, offsetting city water demand, as well as reducing stormwater management costs.

Case Study 3 was a similar retrofit project in an area of Waconia (10th St.), which utilizes an existing pond with a focus on irrigation. The system includes a chlorination unit at the pump station. The chlorine dose was provided, but the flowrate and system detention time were not. Operational costs are comparatively lower. It was noted that in Waconia's experience, using non-potable water was more cost effective for irrigation users than using potable water.

Case study 4: The Mississippi Watershed Management Organization employs an external cistern for flood mitigation and as a harvest and use demonstration project. The system does not include disinfection and is primarily as detention for localized flood mitigation but can be used to water tree trenches and a gravel bed tree nursery using ground level irrigation (hose or via tree trench drainage). Installation costs were around $40,000 with minimal ongoing maintenance.

Case Study 5: The Tower Side District Reuse System in Minneapolis is a more comprehensive project collecting stormwater from an 8-acre redevelopment area in an ultra-urban setting. Components include underground storage, drip, and spray irrigation systems. Total project installation cost was approximately $1.5 million.

Case Study 6: The Allianz Field project in Saint Paul integrates multiple stormwater management approaches, including underground rainwater storage. The system includes UV disinfection, with ongoing challenges in system operation and maintenance. The system primarily irrigates lawn areas rather than the soccer field itself. This is also a large redevelopment project in an ultra-urban setting which can increase project costs significantly if compared to new developed in suburban or rural settings.

Table AE.1. Stormwater Reuse for Irrigation Case Studies.

Case Study/ Location	Project Objectives	Ownership	Project Partners	Storage Type & Capacity	Source Areas of Harvested Water	Preliminary LRT based on source water[1]	Pretreatment and Stormwater Treatment Components	Disinfection Components	Exposure Risk Mitigation Strategies	LRT Credits
1. First Street, Waconia	• Volume control credit for new development impervious • Reduced use of drinking water for irrigation	Public Utility – City of Waconia, MN	Waconia County	Underground Tank >30,000 gallons [2]	8-acre residential land use area	Virus: 3 (1) Protozoa: 2.5 (0.5) Bacteria: 2 (0)	• Sedimentation/isolator tanks • 20-micron screen/filter • Periodic chlorine shock treatment	None	• Purple pipe to indicate non-potable supply • Signage indicating use of non-potable water for irrigation • Irrigation at night only to reduce risk	No LRT Credit
2. Hunters Crossing, Waconia			unknown	Pond 179,000 CF (1.3 MG)	82-acre watershed, 51% impervious, mix of residential and commercial/industrial land use.		• Sedimentation within pond and upstream pretreatment BMPs • 20-micron screen/filter • (Hunter's Crossing) • 80-micron screen/filter (10th Street)	**UV Treatment Dose**: 100 mJ/cm^2 220 gpm		**Full credit -** LRTs exceeded Virus: 4.25 Protozoa: 6 Bacteria: 4.25
3. 10th Street, Waconia				Pond 233,000 CF (1.7 MG)	174-acre watershed, 58% impervious, primarily commercial/industrial, and institutional			**Chlorination Dose**: 0.5 ppm NaClO dose, flow rate unconfirmed		• **Undetermined Credit** for bacteria & viruses (system detention time unknown) • Protozoa credit = 0[4]
4. Rainwater Cistern, MWMO HQ, Minneapolis	• Local flood control benefit • Harvest & use demonstration project • Backup irrigation for gravel tree bed	Public - MWMO	n/a	External Cistern 4,000 gallons	0.08-acre (3,400 sf) Building rooftop area	Virus: N/A - 0.3 Protozoa: (no data) Bacteria: 3.5 (1.5)	• Screen (size unknown)	None	• Drip/ground level irrigation only	N/A Exposure risk mitigates through use of drip irrigation.
5. Towerside District (MWMO), Minneapolis	• Stormwater management for special stormwater district • Irrigation for community garden and commercial green space	Privately owned	Planning, O&M oversight in partnership with MWMO	Underground Tank 207,000 gallons	7.9-acre watershed, 74% impervious, mix of commercial and multi-family residential.	• Community Garden: No *LRTs Developed*[3] • Green Space LRTs: Virus: 3 (1) Protozoa: 2.5 (0.5) Bacteria: 2 (0)	• Pretreatment sumps with SAFL Baffle • Bioretention basin with draintile • 25-micron screen/filter	**UV Treatment Dose**: 32 mJ/cm^2 @ ≤83 GPM	• Drip irrigation in some areas (spray irrigation in others).	**Partial Credit** Virus: 1.5 Protozoa: 2.5 Bacteria: 1.5
6. Allianz Field, (CRWD), St. Paul	• Stormwater management for a large commercial redevelopment site • Harvest & use demonstration project	Privately owned,	Planning, O&M oversight in partnership with CRWD	Underground Tank 675,000 gallons	13.5-acres of impervious surface including stadium rooftop areas	Virus: 3 (1) Protozoa: 2.5 (0.5) Bacteria: 2 (0)	• Upstream BMPs (tree trenches, other?) • Sedimentation /isolator tanks • 120-micron screen & 5-micron filters	**UV Treatment Dose**: 30 mJ/cm^2 @ 80 gpm	• Drip irrigation for tree trenches (spray irrigation for other green space)	**Partial Credit** Virus: 1.5 Protozoa: 2.5 Bacteria: 1.5

[1] Table 1 and Table 2, Stormwater and Rainwater in Minnesota, A Public Health Perspective, 2022.

[2] This system has been expanded, and current storage exceeds the initial installation of 6 x 5 – 1,000-gallon tanks.

[3] Irrigation of food crops generally not recommended/no LRTs developed.

[4] Chlorination is not an effective treatment for protozoa.

Table AE.2. Stormwater Reuse for Irrigation Case Studies.

Case Study/ Location	Source of Harvested Water	Preliminary Log Reduction Targets based on source water[1]	Disinfection System			Log Reduction Target Credits	
			Method/ Treatment Capacity	Approximate Costs[2]		Credit	Comment
				Installation	Operation		
1. First Street, Waconia	Stormwater residential land use area	Virus: 3 (1) Protozoa: 2.5 (0.5) Bacteria: 2 (0)	None	N/A	N/A	No LRT Credit	• System does not include a disinfection component • Spray irrigation exposure risk not adequately mitigated by strategies described in Table 1.
2. Hunters Crossing, Waconia	Stormwater Land use mix of residential and commercial/industrial		**UV Treatment**: Wedeco 1xLBX850e UV Reactor **Dose**: 100 mJ/cm^2 @ 220 gpm ➢ Per manufacturer guidance for treatment to 2.2 MPN for Fecal Coliform	$117,000	?	Full Credit	• LRTs exceeded through disinfection • **Credits** - Virus: 4.25, Protozoa: 6, Bacteria: 4.25
3. 10th Street, Waconia	Stormwater Land use mix of commercial, industrial, and institutional		**Chlorination**: Watson Marlo peristatic pump **Dose**: 0.5 ppm NaClO dose, flow rate unconfirmed	$89,000	?	Undetermined Credit	• Credit cannot be determined for viruses and bacteria without system detention time or monitoring of chloride residuals. • Chlorination is not an effective treatment for protozoa • Spray irrigation exposure risk not adequately mitigated by strategies described in Table 1.
4. Rainwater Cistern, MWMO HQ, Minneapolis	Rainwater (rooftop areas only)	Virus: N/A - 0.3 Protozoa: (no data) Bacteria: 3.5 (1.5)	None	N/A	N/A	Full Credit	• Risk of exposure fully mitigated through use of drip irrigation
5. Towerside District (MWMO), Minneapolis	Stormwater Land use mix of commercial and multi-family residential.	No LRT's Developed[2] *Virus: 3 (1)* *Protozoa: 2.5 (0.5)* *Bacteria: 2 (0)*	**UV Treatment**: 435-Pureline PQ-0016 with Auto Wiper **Dose**: 32 mJ/cm^2 @ ≤ 83 gpm	$100,000	$2,500	Partial Credit	• LRT for Protozoa 2.5 (0.5) met by disinfection dose. • LRTs for viruses and bacteria partially met • **Credits** - Virus: 1.5, Protozoa: 2.5, Bacteria: 1.5 • Mitigation of exposure risk through use drip irrigation is some areas could not be quantified
6. Allianz Field, (CRWD), St. Paul	Stormwater Mix of pavement and rooftop areas	Virus: 3 (1) Protozoa: 2.5 (0.5) Bacteria: 2 (0)	**UV Treatment**: 2 x Viqua K+660002-R UV lamps **Dose**: 30 mJ/cm^2 @ 80 gpm	?	?		

[1] Table 1 and Table 2, Stormwater and Rainwater in Minnesota, A Public Health Perspective, 2022.

[3] Includes Disinfection system components only.

[2] Irrigation of food crops generally not recommended/no LRTs developed.

APPENDIX H

Areas of Baseline Understanding and Feedback

memo

Project Name: Stormwater Capture and Use
Date: 03-21-2024 Edited 04-05-2024
To / Contact info: MDH, MPCA, and Metropolitan Council Representatives
Cc / Contact info:
From / Contact info: Brett Emmons, EOR
Regarding: MDH, MPCA, and Metropolitan Council - Areas of Agreement (Technical Staff)

This memo is to summarize the areas of agreement reached after three meetings between MDH, MPCA, and Metropolitan Council technical staff regarding the stormwater capture and use risk-based management strategy and treatment recommendations made to date. These meetings were held to ensure that alignment was reached with technical staff on the basis and foundation for a risk-based management framework based on existing and known health risks. These agreements are not official policy of the agencies and are still subject to policy review in each agency. The meetings were held on February 28th, March 4th, and March 13th, 2024.

Discussions included reviewing the results of a survey that were sent to the agencies to solicit feedback on the current risk-based management categories (Categories 1-3), what reuse scenarios might fit within those, and what level of guidance or regulation each of those categories should follow. The discussions have also been focused primarily on irrigation reuse applications at this stage, until some basic risk frameworks are developed. This was done in an effort to limit the large number of combinations and variables that affect reviewing risks. The reuse applications can be expanded in the future.

Health based risk studies were presented with the risk percentile and number of potential infections for Salmonella, E. coli, and Norovirus for both Stormwater and Rainwater (rooftop) sources. The studies included local, MN-based data that was collected after the 2018 report was concluded. The proposed Log Reduction Targets (LRTs) were presented to mitigate those risks and discussions were held on the risk management strategy of Restricted vs Unrestricted Irrigation. The desire for Case Studies to help understand and support the LRTs was discussed and started, as it was seen that the Case Studies were essential to communicating these goals to the wider Engagement Core group and eventually the public. Case studies are also essential for ensuring that any proposed treatment requirements do not prove extraneous or cost-prohibitive to the implementer.

The agreements made to date include:

1. MN and National Consistency on Data and Recommendations - The local studies presented and national data available on the health risks and Log Reduction Targets (LRTs) of stormwater and rainwater can be considered close enough to be comparable. Therefore, the agencies will align their recommendations, where possible, with national guidance on treatment approaches for consistency in their management recommendations. National Data and comparable management recommendations can be found in the "*Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems*" published by the Water Environment & Reuse Foundation.
2. Health Risks Balanced with Practicality -The risk-assessment work to date has identified potential health risks associated with reuse of untreated stormwater. Guidance and/or regulation is needed to manage the risk, but it must be balanced with reasonable expectations of what can be implemented and monitored. These reasonable expectations will be explored further within Case Studies.
3. Consensus and Unified Recommendations - The water agencies involved will continue to work to reach consensus and consistent recommendations on reuse in order to limit confusion and barriers for implementing parties.

4. Expanding Applications - The risk-management framework should be an evolving document which is initially focused on the source waters of rainfall and stormwater and the end use of irrigation. Later, the framework can be expanded to other, more diverse end uses (splash pads, wash water, etc.). Source waters could also potentially expand to treated greywater and/or wastewater.
5. Evolving Science Needing Updates - The risk-management framework should be revisited regularly to ensure that the most recent scientific data and best management practices are incorporated. Review ideally could follow a 5-year cycle.

Other follow up items were also noted:

- Reengage and update the other groups, which should happen in near term:
    - Full Interagency Work Group
    - Engagement Core Group
- Identify another Agency or Agencies to bring forward funding requests to continue developing the Reuse guidance and framework.

Table AH.1. Guidance for voting and the feedback on the primary baseline understanding

Surveyed Scale	Description	Reporting Scale
1 *Thumps up (Fist) =*	*No way. I don't support this decision, and I am vetoing.*	**0**
2 *Thumps up =*	*I have strong reservations but will support the decision and will not veto.*	**1**
3 *Thumps up =*	*I am uncomfortable with the decision but can live with it.*	**2**
4 *Thumps up =*	*This decision is okay with me.*	**3**
5 *Thumps up =*	*I support this decision.*	**4**
6 *Thumps up (Five) =*	I strongly support this decision.	**5**

Understanding#	Text	Score (0-5)	Specific Comments	General Comments
1	**Health Risk, Balanced with Implementation** *Uncontrolled Stormwater reuse does pose a health risk. Guidance and/or regulation is needed to manage the risk, but it must be balanced with reasonable expectations of what can be implemented and monitored.*	2.25	•Question 1) While we agree with the general concept of this statement, the "reasonable expectations" can be very broad. Who defines them? On what is "reasonable" based? •Although it seems to reflect the perspective of the MDH, the statement that "Uncontrolled Stormwater reuse does pose a health risk" (and, specifically, use of the word "does") is too absolute; depending on source, stormwater may or may not pose a health risk. •Q1 - 1 thumb - strongly oppose due to the statement that stormwater reuse "does" pose a health risk vs the more acceptable word "may".	•This doesn't seem like we've made much progress beyond from the 2018 agreement. •I believe far more research is needed on the health risks posed by stormwater usage in irrigation. There has not yet enough evidence that stormwater would need to be treated to the high standards being discussed. •Additional study is needed, leadership needs to be able to provide technical and financial assistance beyond guidance in the form of unfunded mandates. What systems in existence are a concern now, MDH staff referenced the MWMO site that uses UV-treated water for a community garden in a negative connotation - MDH or another state-agency should be communicating that directly while projects are being proposed or prior to that, not making side comments after (costly) implementation
2	**National Data Compared to Local Data** *The local studies **presented** and national data **available** on **the** health risks and Log Reduction Targets (LRTs) **can be considered close enough to be** comparable. Therefore, **the** agencies **will** align their recommendations **(where possible)** with **this** data **for consistency** in their treatment and management recommendations. **National Data** and comparable recommendations can be found in the "Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems (Reuse of Stormwater and Rainwater in Minnesota, 2022)" published by the Water Environment & Reuse Foundation.*	2.58	•Question 2) References to the WERF report and MDH paper in the same quotation is confusing. •2 - Quantitative evidence is needed to support this statement as the data available is limited and the justification for the treatments applied to achieve the LRT's is unclear. •Q2 - 1 thumb - MN "data" presented was at best, qualitative. Further, Page 88 of the reference WERF report illustrates a non-workable treatment train for irrigation-based stormwater reuse.	
3	**Consensus Among Agencies** *The **involved** water agencies will continue to work to reach consensus on reuse recommendations **in order** to limit confusion and barriers for implementing parties. The LRT Table and Case Studies will inform these recommendations.*	3.58	•3 - Depending on the definition of consensus, achieving consensus would be great but getting there is difficult and often not possible. •Q3 - 2 thumbs because this workgroup output related to health risk for stormwater-based irrigation does not include consensus.	
4	**Start with Rain/Stormwater Used for Irrigation**	3.83		

	*The risk-management framework will be an evolving document **which will** initially **focus** on only the source waters of rainfall and stormwater **and the end use of** irrigation. **Later,** the framework can be expanded to other**, more diverse** end uses (splash pads, wash water**, etc.)** and potentially treated greywater as source waters.*		• 4 - While it singles out the use of rainwater/stormwater for irrigation purposes which may be a concern for irrigators, the development of a framework based on a clear and limited focus that might be expanded to other sources and uses in the future seem reasonable. • Q4 - 1 thumb - indoor reuse guidance may more readily result in stakeholder consensus while process(es) to collect research and supportable best practices (design, installation, maintenance, operation) can be put forward to stormwater-based irrigation.
5	**Framework Needs Regular Review** *The risk-management framework will be revisited regularly to ensure that the most recent scientific data and best management practices are incorporated. Review will follow a **5-year cycle.***	4.67	• Question 5) Regular review is useful. The timeframe of 5-year cycle for review might need to be evaluated over time. • 5 - Keeping up to date with the latest research is always a good idea. • Q5 - 5 thumbs - regular, periodic updates of guidance is a welcomed best practice.

NOTE: *> The average score (in the table below) was recalculated to meet the FIST-TO-FIVE concept/scale of 0 to 5 instead of 1 to 6; number of survey participants were 12. > Red marked words are changed in the proposed statement (in green).*

APPENDIX I

Meeting Presentations and Other Resources

(Please contact MDH to access these presentations and other relevant information)