Marshall Erickson

The comments presented in the attached document are from Clear Water Nitrate Reduction. We are a MN based environmental services company who designs and deploys engineered water quality solutions removing pollutants from ag/urban runoff and impaired waters. In addition to our Water Quality practice, we also have Wood Waste Utilization and Biochar practices.

Clear Water's comments on MN Nutrient Reduction Strategy – 2025 Update

9 September 2025

We think the report is comprehensive and communicates the need to deploy multiple solutions to meet 2040 nutrient reduction goals. Especially in TN reduction and treating tile drainage.

Our concern is the report's depiction of EoF Structural BMPs (Bioreactors, Saturated Buffers, and Constructed Wetlands for tile drainage). Specifically, nutrient reduction performance projections.

Below we share our perspective and an ask. We welcome a discussion on anything presented below.

Our Perspective

As a MN-based environmental services firm (Clear Water Nitrate Reduction) who design and deploy land and water based nutrient reduction solutions, we're well versed in the science of denitrification, BMP solutions, efficacy studies, and nutrient reduction projects and performance.

We're concerned about the report's low performance projections for bioreactors compared to saturated buffers and constructed wetlands (for tile drainage) numbers in the report.

This report will play a key role in watershed planning, funding, and project decisions across all stakeholders. We want to ensure nutrient reduction solutions are accurately and consistently presented, based on facts, and practical, real-world execution.

The report's BEET BMP (Efficiencies) table is using TN reduction input values for bioreactors that are less than 1/2 of what is used for saturated buffers and constructed wetlands (tile drainage). In table 5.4 (page 209) projected bioreactor TN reduced is less than ½ of saturated buffer and less than 1/3 of constructed wetland projections. **These examples and other instances in the report do not accurately reflect bioreactor performance compared to other EoF solutions.**

Factual data (formal and informal studies) show that nutrient reduction projections used in the report are:

- On the very low end of the range for bioreactors
- On the high end of the range for saturated buffers and constructed wetlands (tile drainage)

It seems like the approach here should be consistent across all tile drainage treatment solutions. **If saturated buffers and constructed wetlands are projected at 45% - 53% TN reduction efficacy, then bioreactors should be at least at that level.**

We understand you completed literature reviews as part of the report process. These reviews probably showed a wide range of efficacy outcomes for EoF projects. A common situation in engineered projects. Design/deployment quality and solution fit tend to be inconsistent, leading to widely variable performance data. **Do it right, and you get better, consistent results.**

When properly designed/deployed, studies show bioreactor projects deliver the following outcomes:

- Treat 85% or more of tile drainage, including at least 50% of maximum flow rate.
- 50% - 60% average annual TN reduction over 10 years with the following performance path.
    - Yrs. 0-2 (80%-90% TN reduction), Yrs. 3-10 (50%-65%), Yrs. 10+ (40% - 50%)
    - Replacing woodchips restarts the performance path.
- A lot of P removed. A study tracking P recorded average removal at 61% over 7 years. Like any retention basin, a bioreactor captures P if present.

A Clear Water designed/deployed bioreactor operating for one (1) year is treating most of the tile drainage, reducing an average of 85% TN, and removing P. **This is not an outlier, but the result of a properly designed and deployed bioreactor.**

Conclusion And Our Ask

For many reasons, in-field practices will not get Minnesota its TN and TP reduction goals or adequately protect our surface and ground waters. While this fact is acknowledged, along with the need for a multi-solution approach, actual execution does not show a consistent or strong commitment to non-in-field practices.

Landowners welcome engineered EoF solutions (if cost shared). Solution delivery stakeholders are hesitant to promote/fund solutions they don't know. Improperly designed and deployed solutions are also a problem.

We need an expanded approach, especially in addressing TN pollution. This report can play a key role in driving this change. In many cases, a bioreactor is the most viable solution and will outperform other solutions.

Each situation determines the best solution. Reflecting bioreactors as less favorable continues misperceptions and prematurely removes bioreactors from the solution discussion.

Let's use accurate and consistent projections across all BMP solutions. Increase bioreactor denitrification projections to 50%-60% average over 10 years. Reflect this throughout the report.

We're all striving for the same thing – Reduce nutrient pollution by creating an environment to:

- Expand solutions
- Evaluate options based on comprehensive, consistent, fact-based information
- Build the capacity of all parties to actively support this approach.

We welcome a discussion on anything presented here.

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