Executive Summary, Research Readiness Level Assessment, and Technology Transfer

Evaluation of NDOT's Construction Stormwater Detention Measures Using Full-Scale Testing Techniques

Research Objectives

The objective of this proposed research is to evaluate NDOT's standard silt trap and sediment trap used to facilitate impoundment and capture sediment. This study is divided into three primary objectives:

1. Develop a full-scale testing methodology that allows for the performance comparison of construction stormwater detention practices,
2. Evaluate construction stormwater detention practices and modified installations through full-scale testing at the AU-SRF that mimics conditions found on a NDOT highway construction project, and
3. Develop implementable design guidance and comparisons on the use of detention practices on construction projects, including performance, costs, installation, maintenance requirements, etc.

Research Benefits

This study is expected to provide immediate implementable results for NDOT. A complete report containing an executive summary and complete record of the project, including methods, data collection and analysis will be provided. In addition, a technology transfer brief will be created to summarize key findings. Design recommendations for evaluated stormwater detention practices will be developed for NDOT implementation consideration. This guidance will include clear specifications, drawings, and language for stormwater detention practices that may be considered for future stormwater management plans.

Principal Investigator

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NDOT Lead TAC Member

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Interested in finding out more?
Final report is available:
HERE

Background

Earthmoving activities associated with highway construction create increased risk of downstream pollution from stormwater runoff. Rainfall dislodges sediment and runoff mobilizes soil particles and other pollutants that can cause significant risk to receiving water bodies. Excessive sediment in waterways can harm aquatic life by increasing turbidity, reducing fish habitats, as well as increasing the risk of flooding by reducing the flow capacity of rivers and streams. The cost of sediment in surface waters is drastic, with the cost of sediment pollution being estimated at $16 billion in 1998, including the physical, biological, and chemical damages caused by unmanaged or improperly managed stormwater discharges.

Conclusion

Sediment is a leading pollutant in waterbodies, contributing to turbidity, pollutant transport, ecological degradation, and reduced flow capacity. Construction activities are major sources of sediment-laden runoff, necessitating regulatory compliance through Stormwater Pollution Prevention Plans. This study developed a full-scale testing methodology simulating Nebraska hydrologic conditions to evaluate the performance of Nebraska Department of Transportation silt traps and sediment traps at the Auburn University Stormwater Research Facility. Results showed that standard installations can be significantly improved through design modifications. For silt traps, pairing with a modified V-shaped, wire-backed silt fence with a central weir achieved the highest sediment retention (95.9%), substantial total suspended solids (TSS) reduction (89.1%), and turbidity reduction (67.7%). A slash mulch berm also performed well but may be limited by material availability. Structural testing of the low porosity silt fence indicated that reduced post spacing and fence height improved durability. For sediment traps, the use of coir baffles and a surface skimmer enhanced flow control, reduced turbulence, lowered downstream TSS and turbidity, and retained sediment (91.1%). Overall, optimized configurations significantly improved sediment capture and downstream water quality, supporting refined design recommendations for effective sediment control practices.

Figure 1: Modified silt fence design (nonwoven, wire backed, 18" weir, V-shape in channel).

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NDOT Recommendations Based Off Research Project – 2026 – RRL4

This research provided the NDOT with optimized configurations of NDOT's silt and sediment traps with the goal of improving water quality leaving construction sites. The new design will allow for the incremental discharge of cleaner water compared to the previous design, which often had water pool in basins for extended periods of time. With the viability having been shown in a full-scale testing environment, the NDOT would like to select some pilot projects for field evaluation prior to pushing it to standard practice. Due to additional complexity from new materials and grading efforts, these pilot projects will be done through the bidding process. Additionally, pilot projects must be carefully selected to ensure proper space and grade for the optimized installations for the sediment basins. The NDOT's Roadside Development and Compliance Unit will visually inspect water quality at the installations as part of their standard practices.

- *As provided by Jason Jurgens and Ronald Poe, Lead TAC Members*

Research Readiness Level (RRL) Assessment

RRL 4

Level 4: Implementation with Follow Up

Benefits of implementation will be evaluated in 3 years.

Technology Transfer

Transportation Research Board (TRB) papers and Publications

- Williams, L. R., Perez, M. A., and W. N. Donald. Sediment Traps: Full-Scale Evaluation Under Nebraska Highway Conditions. Transportation Research Record: Journal of the Transportation Research Board.
- Williams, L. R., Perez, M. A., and W. N. Donald. Improving Silt Traps Using Full-Scale Techniques Under Regional Conditions. Transportation Research Record: Journal of the Transportation Research Board.

Webinars/Presentations

- Improving Silt Traps: Full-Scale Performance Evaluation Under Nebraska Highway Conditions (Poster at IECA 2025 conference in Richmond, VA)
- Krueger, L. R. (September 2025). Improving Silt Traps Using Full-Scale Techniques Under Regional Conditions. [Conference presentation]. Alabama Water Resources Conference, Orange Beach, AL.
- Williams, L. R. (March 2026). Silt Happens: Improving Silt Traps Using Full-Scale Techniques Under Regional Conditions. [Conference presentation]. International Erosion Control Association, Fort Worth, TX.
- Iowa Stormwater Education Partnership (ISWEP) webinar on 11/18/2025
- TigerStream Stormwater Webinar Series Episode No. 21 on 5/27/26

Journal Papers Submitted for Review and In Progress Journal Papers and Theses

- Williams, L. R. K. (2026). Improving Silt Traps Using Full-Scale Techniques Under Regional Conditions. [Conference presentation paper]. International Erosion Control Association, Fort Worth, TX.

This brief summarizes Project SPR-FY25(043)
"Evaluation of NDOT's Construction Stormwater Detention Measures Using Full-Scale Testing Techniques"
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