

# Research Need Statement 639

## I. Need Statement Champions and Information

### I.A. Need Statement Champion Information

- I.A.1. First and Last Name of Research Champion: **Dwayne Stenlund**
- I.A.2. Research Champion's Office: **MnDOT Environmental Stewardship**
- I.A.3. Research Champion's Phone Number: 612-810-9409
- I.A.4. Research Champion's Email: [dwayne.stenlund@state.mn.us](mailto:dwayne.stenlund@state.mn.us)

### I.B. Research Co-Champion

- I.A.1. First and Last Name of Research Co-Champion:
- I.A.2. Research Co-Champion's Office:
- I.A.3. Research Co-Champion's Phone Number:
- I.A.4. Research Co-Champion's Email:

### I.C. Research Needs Title (115 Characters):

**Re-use of Minnesota waste material in sustainably designed soils. Part 2.**

### I.D. Project Sponsor: **MnDOT Research Program**

## II. Research Need Background and Description

### II.A. Research Need Background

#### II.A.1. Describe the problem or opportunity.

This project would identify, select, and characterize waste material, by-products, and commercially available materials available across Minnesota to create engineered and designed soils capable of meeting stormwater retention and pollutant load reduction requirements and supporting native plant establishment. Patelke et al. (2021) provided a framework for the current project using regional materials from northeast Minnesota. Potential materials of interest include by-products and waste materials generated by mineral, forestry, agricultural, and industrial sectors. Materials will be characterized with beneficial use determination process recognizing that not every potential waste reuse material is suitable for every location. Current gaps in life cycle assessment, climate resiliency enhancement, cost estimates, standard specifications and appropriate details for mixing and options for application need to be created for construction program delivery.

#### II.A.2. If applicable, describe how this project will build on previous research.

The previous research partnered with industry, federal and state entities to identify, characterize and combine sources of organic and inorganic materials generated from dredging, mining, agriculture, forestry, paper, peat compost, sanitary sludge, and city/road construction

in one specific region of Minnesota (MnDOT District 1 area). The primary focus locating and surveying partners that generate quantities of suitable waste materials, laboratory testing to analyze leachable constituents alone or in combination, and characterization of potential reuse materials indicating ability to solve stormwater volume and pollutant load reduction. An older study looked at alternatives to compost used in MnDOT 3878 filter Topsoil Borrow material due to non-sustainable transport costs from centers of production to where needed. The research showed that peat and muck salvaged from project excavations could be cost effectively incorporated into sand media or used alone to treat and reduce stormwater runoff from slopes and conveyance systems. This sustainably reduced the need to dispose of peat/muck materials, and shipping costs to utilized other organic inputs. In addition, the researcher examined iron taconite for potential ability to bind to soluble phosphorus for receiving water quality improvement.

II.A.3. If applicable, include the title/s or previous research.

Re-use of Minnesota waste material in sustainably designed soils.

Comparing properties of water absorbing/filtering media for bioslope/bioswale design.

Development and regionalization of in-situ bioslopes and bioswales.

Continued monitoring of stormwater effluents from filter media in two bioslope sites.

II.A.4. What is the **objective** of the proposed research?

The objective of the project is to create statewide, resilient, and sustainable engineered soil mixes to provide volume and pollutant load reduction capable of supporting native plant growth.

### III. Strategic Priorities, Benefits, and Expected Outcomes

**Section III. is for MnDOT sponsored and co-sponsored projects only; all LRRB projects proceed to section IV.**

#### III.A. MnDOT Strategic Priorities

*Instructions:* Briefly describe how the project aligns with the following MnDOT Research Strategic Priorities. Complete all that apply.

III.A.1. Innovation & Future Needs: This research would reduce transportation costs by using project and regionally sourced organic and mineral wastes, sequester carbon, provide local, less expensive, alternate soil mix materials for stormwater or vegetative establishment, and provide a mechanism for beneficial reuse designation.

III.A.2. Advancing Equity: This research has the potential to identify opportunities for small, regional business to create new topsoils that solve regional problems with low capital costs to begin. The research group will estimate the costs to generate soil mixtures and disseminate the information to DBEs.

III.A.3. Asset Management: There generally is no manual, estimated cost, or budget for long term operations and maintenance of stormwater facilities. The research intends to demonstrate that stormwater facilities can be distributed over the landscape with enhanced vegetated slopes and conveyance systems that are designed to retain sediment buildup on the slope and require no removal.

III.A.4. Safety:

III.A.5 Climate Change & Environment: While MnDOT's current method of meeting stormwater runoff regulations is effective, the consequences of not addressing the issues raised in this research is limiting design engineers' options and increasing post-construction maintenance costs. Current practice is to mix sand and commercial compost to capture the first inch of run off and filter pollutants in designated low points rather than enhanced soil capture on engineered side slopes.

#### III.B. Expected Outcomes

*Instructions:* Check all expected direct outcomes of this research.

- New or improved technical standard, plan, or specification
- New or improved manual, handbook, guidelines, or training
- New or improved policy, rules, or regulations
- New or improved business practices, procedure, or process
- New or improved tool or equipment

- New or improved decision support tool, simulation, or model/algorithm (software)
- Evaluation of a new commercial product
- New or improved technical standard, plan, or specification
- Other. Please specify below:

### III.C. Expected Benefits

*Instructions:* Select all expected benefits that may be realized if the findings and recommendations from this research is adopted or implemented

III.C.1. Construction Savings **Cost savings from alternate materials**

III.C.2. Decrease Engineering/Administrative Costs **Reduced planning/design costs**

III.C.3. Environmental Aspects **Recycling**

Analysis of by-product and waste materials generated by mineral, forestry, agricultural, and industrial sectors. Use of regional materials, more sustainable shipping, and pollutant reduction from local sources.

III.C.4. MnDOT Policy **Changed or inform a policy**

Use of waste organics, landfill reduction, carbon sequestration, better topsoils

III.C.5. Lifecycle **Reduce maintenance cost**

III.C.6. Operations and Maintenance Savings **Other operations and maintenance savings. Please describe below.**

Designed topsoils for retaining water where it falls is more cost effective than building ponds and basins.

III.C.7. Reduce Risk **Choose an item.**

III.C.8. Reduce Road User Cost **Choose an item.**

III.C.9. Safety **Choose an item.**

III.C.10. Technology **New method of using technology**

III.C.11. Other, please describe below: **Research is a partnering endeavor to match organic and mineral waste producers to addressing needs of construction. Private/public cooperation and mutual benefits.**

## IV. Technical Advisory Panel

*Instructions:* Please list the name and affiliation of individuals to consider for the Technical Advisory Panel.

Kerry Glader, Plaisted Co., [kglader@plaistedcompanies.com](mailto:kglader@plaistedcompanies.com),

Todd Smith, MPCA. [Todd.smith@state.mn.us](mailto:Todd.smith@state.mn.us)

Warren Tuel, MnDOT (OES). [Warren.tuel@state.mn.us](mailto:Warren.tuel@state.mn.us)

Carolyn Boben, MnDOT (Contaminated Materials). [Carolyn.boben@state.mn.us](mailto:Carolyn.boben@state.mn.us)

Laura Lyle MnDOT (Chief Toxicologist). [Laura.lyle@state.mn.us](mailto:Laura.lyle@state.mn.us)

Steve Adamsky, MnDOT (Soils Engineer): [steve.adamsky@state.mn.us](mailto:steve.adamsky@state.mn.us)

David Bauer, Alliant Engineering, Inc., 733 Marquette Ave, Ste 700, Mpls, 55402. [dbauer@alliance-inc.com](mailto:dbauer@alliance-inc.com). 651-442-4512

Keri Aufdencamp, [kaufdencamp@sehinc.com](mailto:kaufdencamp@sehinc.com)

Your assigned Project Advisor is available to answer questions and provide guidance (assigned by the Office of Research & Innovation).

Your Project Advisor is: Marcus Bekele, (651)366-3903, [marcus.bekele@state.mn.us](mailto:marcus.bekele@state.mn.us)