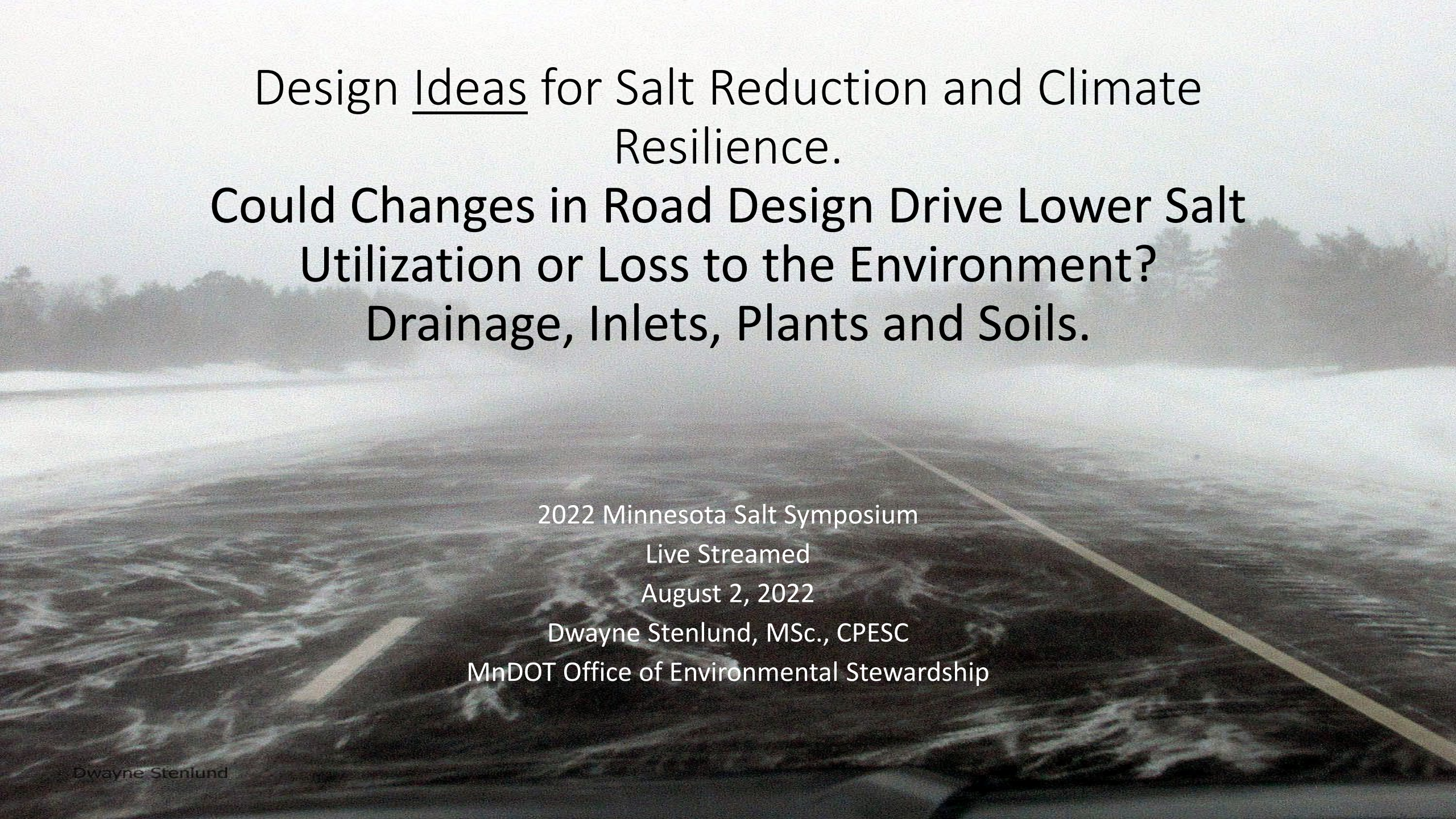
Dwayne Stenlund

Minnesota Department of Transportation

Afternoon Speaker

Could Changes in Road Design Drive Lower Salt Utilization or Loss to the Environment? Drainage, Inlets, Plants and Soils

Design Ideas for Salt Reduction and Climate Resilience.
Could Changes in Road Design Drive Lower Salt Utilization or Loss to the Environment?
Drainage, Inlets, Plants and Soils.



2022 Minnesota Salt Symposium

Live Streamed

August 2, 2022

Dwayne Stenlund, MSc., CPESC

MnDOT Office of Environmental Stewardship


Dwayne Stenlund

What is stormwater equity?

How critical is urban soil?

- Quality of life?
- Quality of water?
- Quality of air?
- Environmental justice?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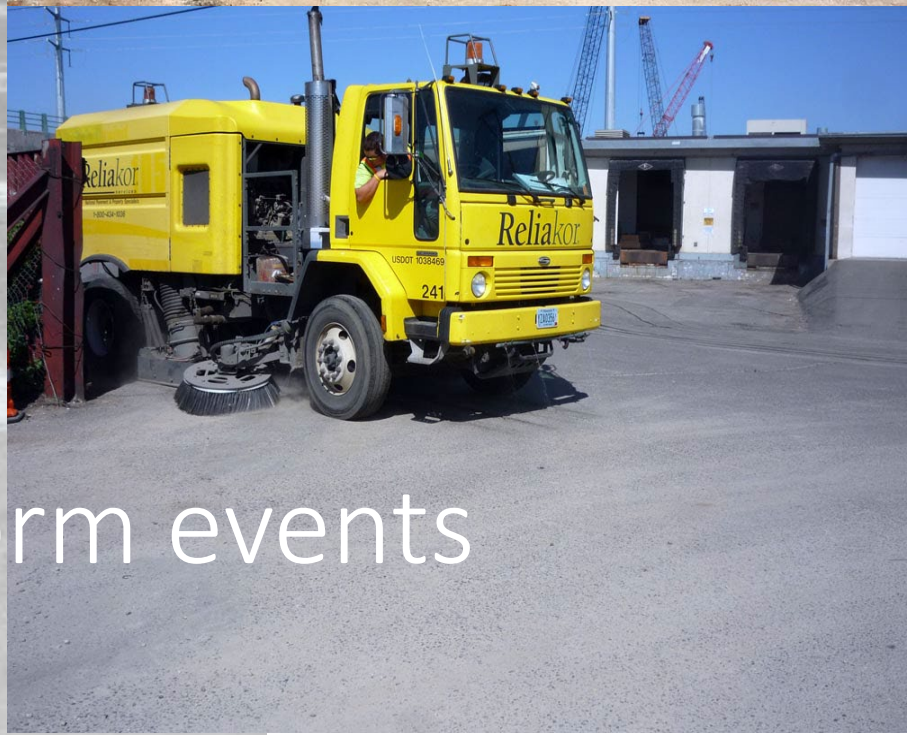
Reducing Salt

- Salt Capture and Reuse
- Using drainage and sunshine to reduce salt applications in safety critical areas
- Use Salt alternatives

Mitigating Salt

- Organic structural soils
- Salt tolerant vegetation
- Salt capturing plants and harvest

One Constant is Change



Idea 1. Sweep between snow storm events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Between Storm Salt Harvest and Reuse

https://stormwater.pca.state.mn.us/index.php?title=MS4_fact_sheet_-_Street_%26_Parking_Lot_Sweeping

WIKI

Minnesota Stormwater Manual

Search | Search Help | Log in

MS4 fact sheet - Street & Parking Lot Sweeping

Page Content

NAVIGATION
- Main page
- Table of contents
- Index (Categories)
- What's new
- Response to comments
- Future updates
- Events
- In the News
- Funding
- Recent changes
- Help
- Export to pdf

TOOLS
- What links here
- Related changes
- Special pages
- Printable version
- Permanent link
- Page information

MPCA LINKS
- MPCA Homepage
- Stormwater
- Policies / Disclaimers

Pollutants collect on surfaces in between storm events as a result of atmospheric deposition, vehicle emissions, winter road maintenance, construction site debris, trash, road wear and tear, and litter from adjacent lawn maintenance (grass clippings). Sweeping of materials such as sand, salt, leaves and debris from city streets, parking lots and sidewalks prevents them from being washed into storm sewers and surface waters. Timing, frequency and critical area targeting greatly influence the effectiveness of sweeping.

This fact sheet provides an overview of studies assessing the benefits of street and parking lot sweeping and guidance on improving the pollution reduction benefits of sweeping programs applicable to Municipal Separate Storm Sewer System (MS4) Stormwater Pollution Prevention Plans (SWPPPs). For more information, also link here.

Street sweepings can be filtered and recycled for sanding or filling Image Courtesy of Emmons & Olivier Resources, Inc.

Benefits and pollution reduction

Regular street sweeping reduces the amount of pollutants that get washed into the storm drain and ultimately discharge to lakes, rivers and wetlands. Targeted pollutants include sediment, trash and debris, leaves, organic matter and nutrients; metals and hydrocarbons. The following pollutant removal efficiencies for total solids (TS), total phosphorus (TP) and total nitrogen (TN) are from a conceptual model developed by the Center for Watershed Protection based on research findings from a variety of studies.

No parking for street sweeping sign

The lower removal efficiencies represent monthly street sweeping by a mechanical street sweeper. The upper efficiencies characterize the pollutant removal efficiencies using a regenerative air or vacuum street sweeper at weekly frequencies. Note that the relatively high frequencies of sweeping generate particularly low removal efficiencies, indicating that sweeping, although an effective aesthetic practice, does not necessarily translate into improved water quality. This is a similar finding of Selbig and Bannerman (2007) in their study of street sweeping in Madison, WI. Even so, every pound of trash and debris removed by sweeping is another pound not entering local waterbodies.

Pollutant removal efficiencies from street sweeping for total solids, total phosphorus, and total nitrogen. Source: Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin. Center for Watershed Protection. Link to this table

Frequency	Technology	TS %	TP %	TN %
Monthly	Mechanical	9	3	3
	Regenerative Air/Vacuum	22	4	4
Weekly	Mechanical	13	5	6
	Regenerative Air/Vacuum	31	8	7

MINNESOTA DEPARTMENT OF TRANSPORTATION

RESEARCH

2008 RIC06

Resource for Implementing a Street Sweeping Best Practice

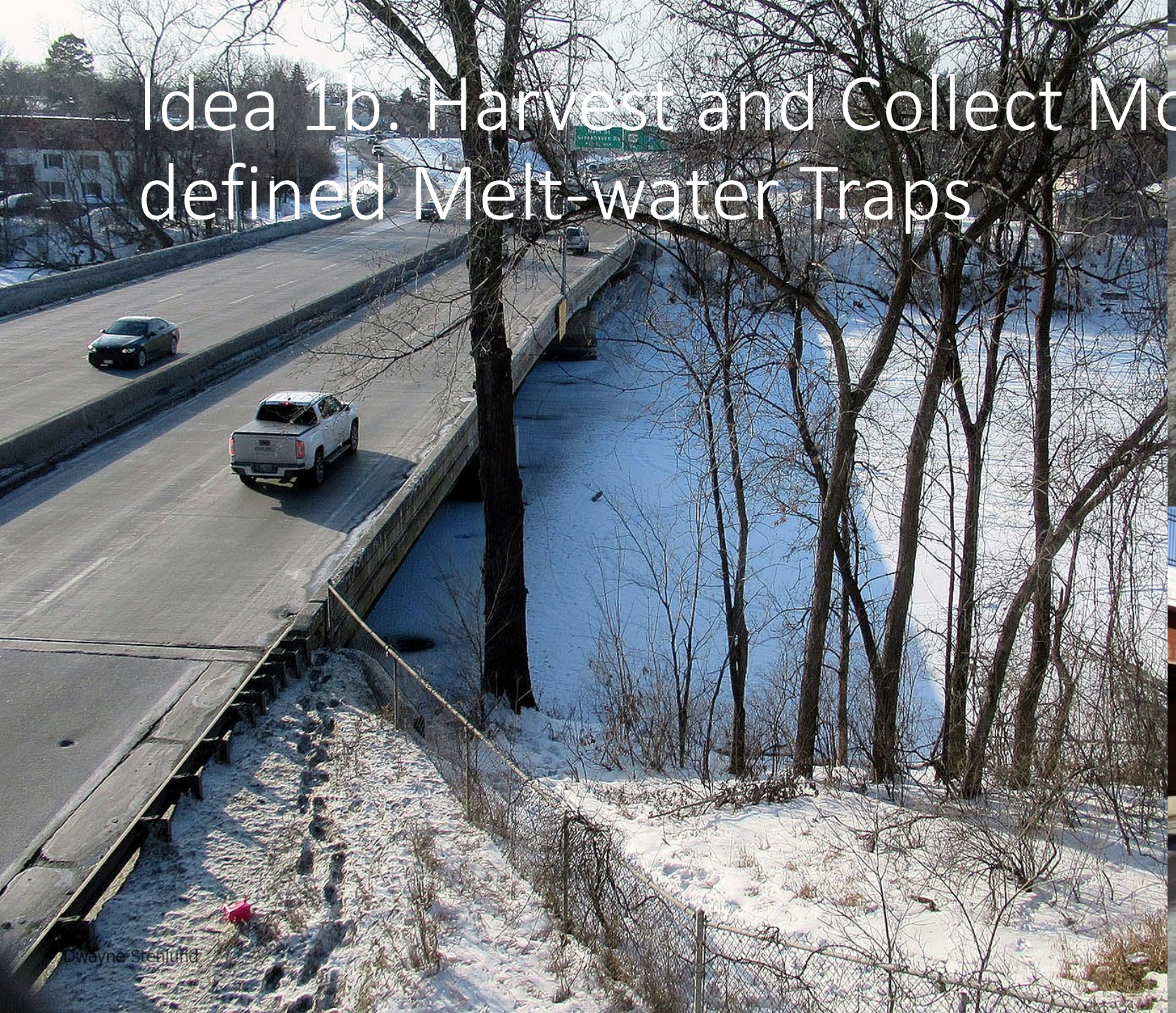
LRRB

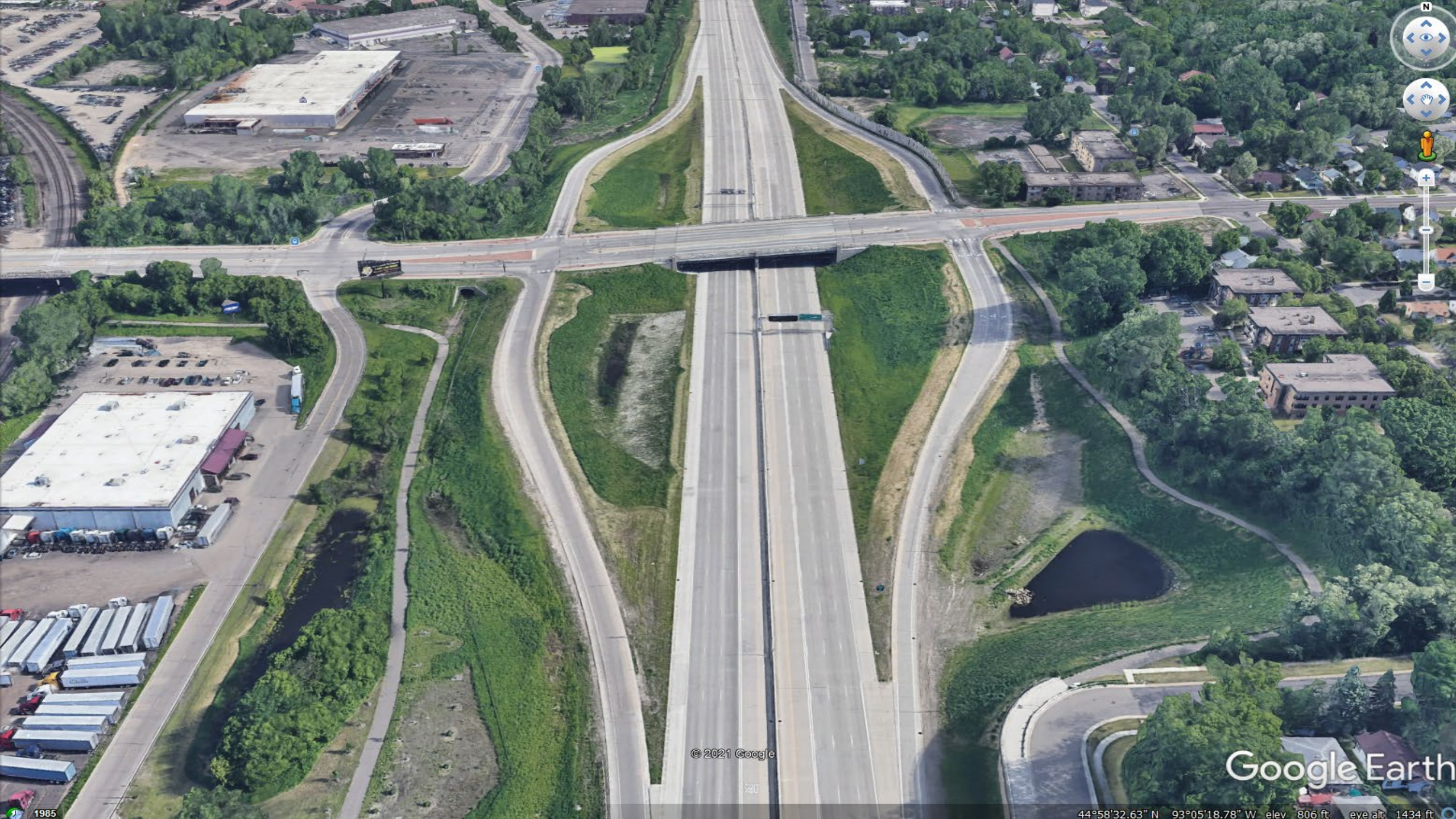
Take the steps... Research...Knowledge...Innovative Solutions!

Transportation Research


Add to stockpile and apply again

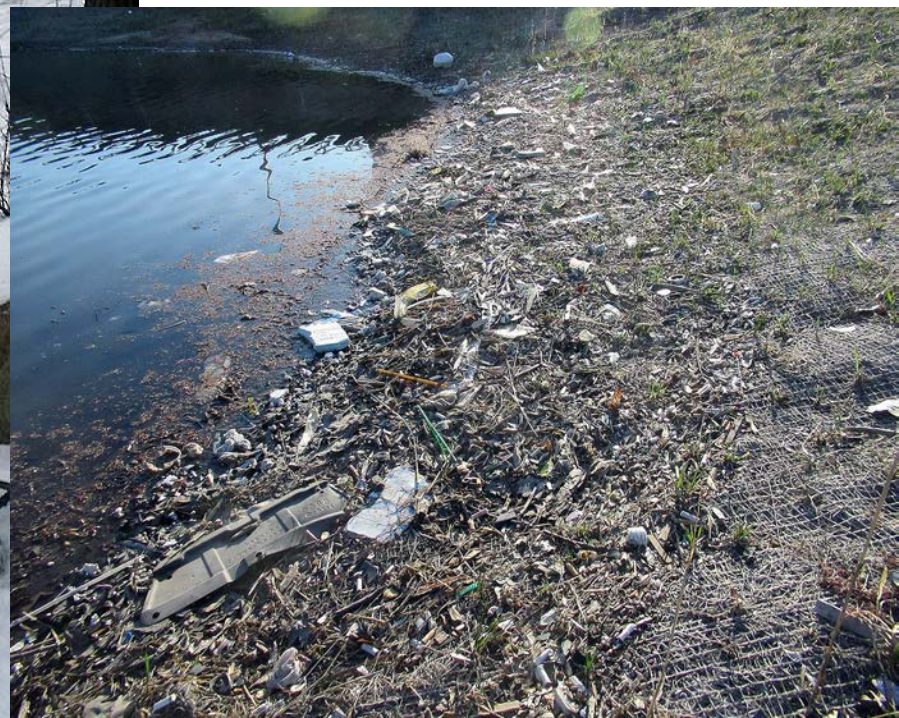
Idea 1b. Harvest and Collect More salt In defined Melt-water Traps




© 2021 Google
Google Earth
1985
44°58'32.63" N 93°05'18.78" W elev 806 ft eye alt 1434 ft


Bobcat

Salt Traps could look normal

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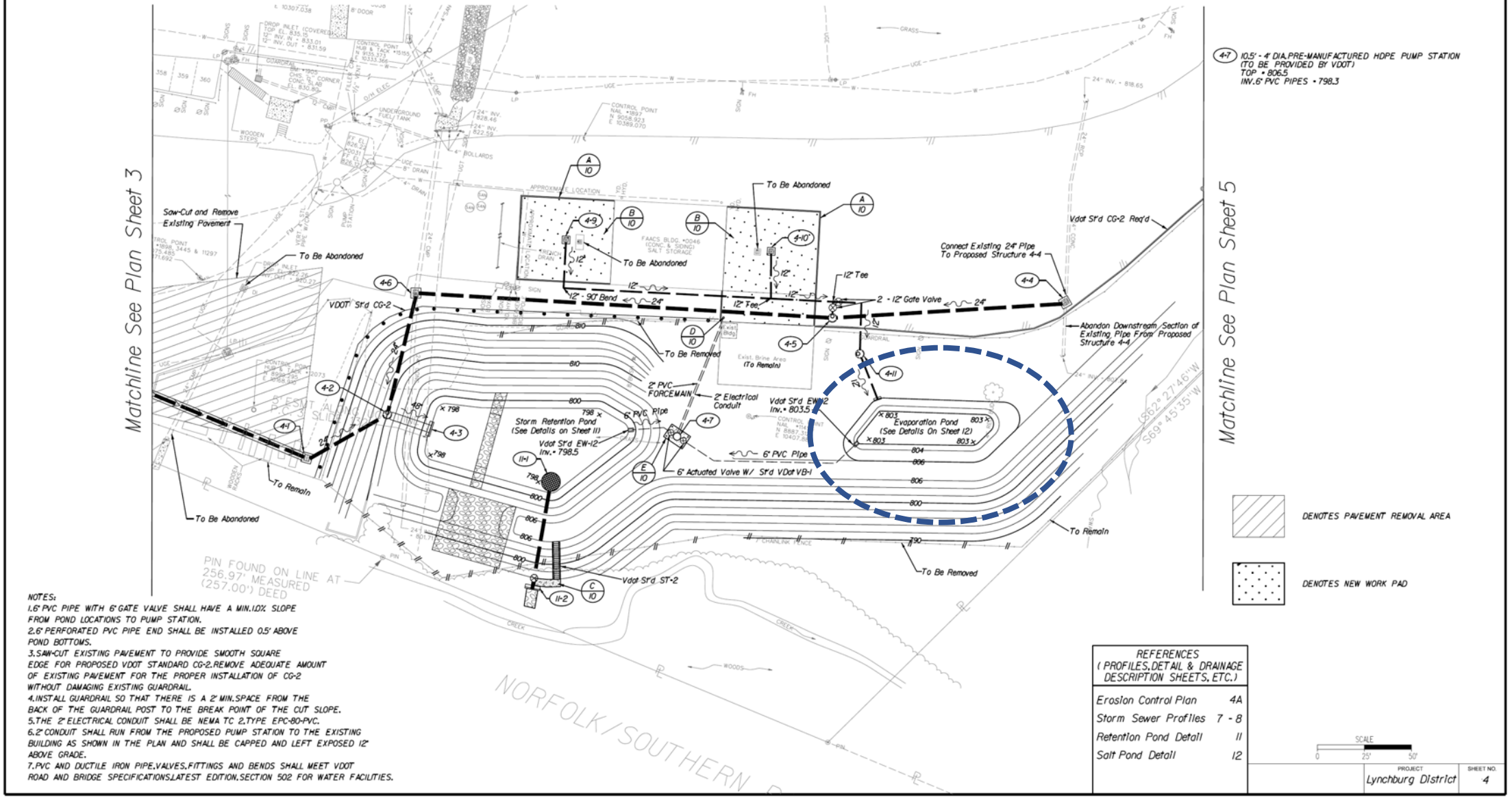
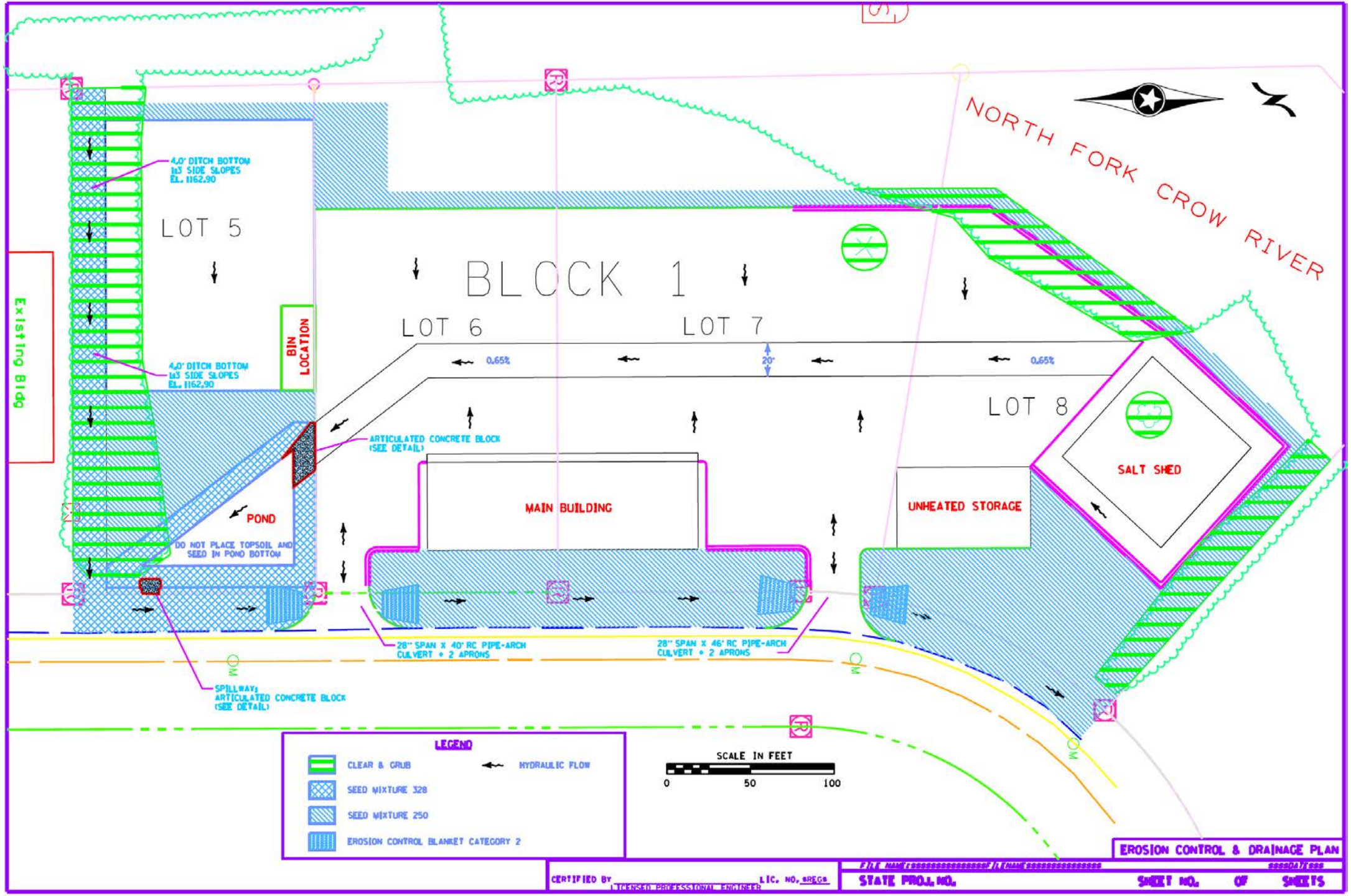
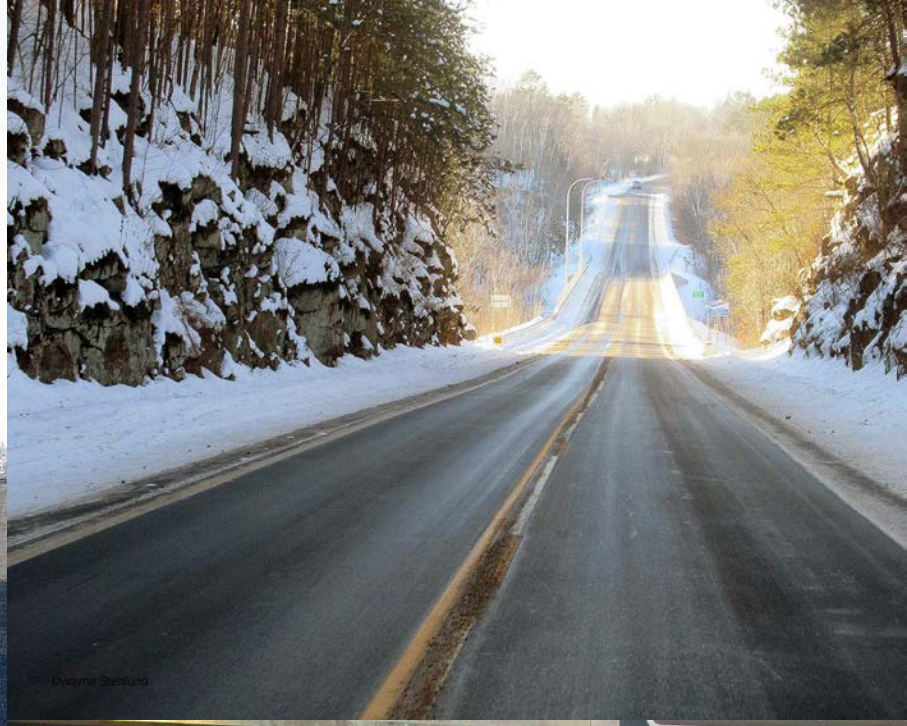
Or traps could be designed



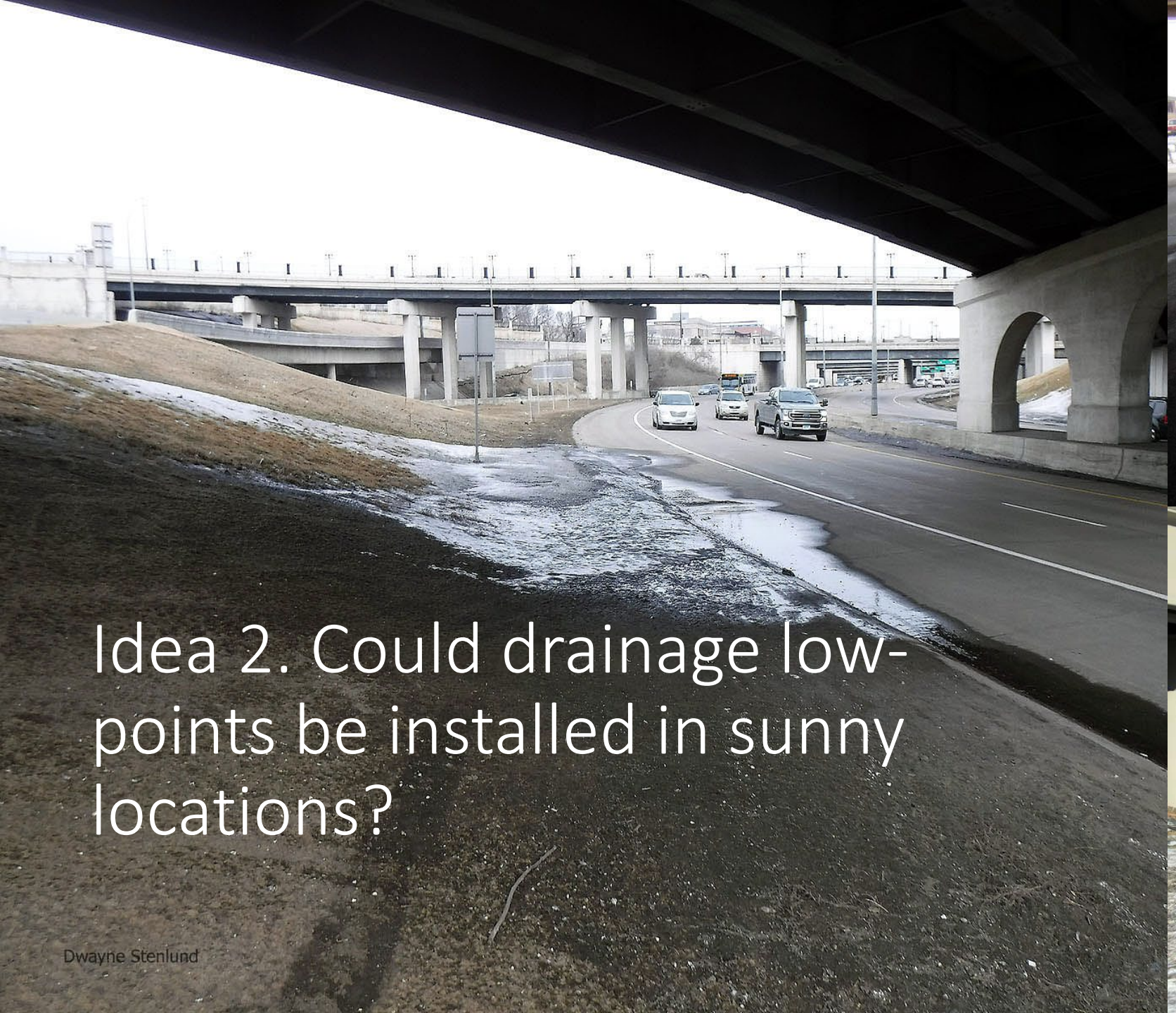

FedEx


NORTH FORK CROW RIVER
LOT 5
BLOCK 1
LOT 6
LOT 7
LOT 8
Existing Bldg
BIN LOCATION
4.0' DITCH BOTTOM
1:3 SIDE SLOPES
EL. 1162.90
4.0' DITCH BOTTOM
1:3 SIDE SLOPES
EL. 1162.90
0.65%
20'
0.65%
ARTICULATED CONCRETE BLOCK
(SEE DETAIL)
POND
DO NOT PLACE TOPSOIL AND
SEED IN POND BOTTOM
MAIN BUILDING
UNHEATED STORAGE
SALT SHED
28" SPAN X 40' RC PIPE-ARCH
CULVERT + 2 APRONS
28" SPAN X 46' RC PIPE-ARCH
CULVERT + 2 APRONS
SPILLWAY:
ARTICULATED CONCRETE BLOCK
(SEE DETAIL)
LEGEND
CLEAR & GRUB
HYDRAULIC FLOW
SEED MIXTURE 328
SEED MIXTURE 250
EROSION CONTROL BLANKET CATEGORY 2
SCALE IN FEET
0
50
100
EROSION CONTROL & DRAINAGE PLAN
CERTIFIED BY
LICENSED PROFESSIONAL ENGINEER
LIC. NO.
STATE PROJ. NO.
SHEET NO.
OF
SHEETS

Problem with Shade and increased need of deicing agents.



Idea 2. Could drainage low-points be installed in sunny locations?




Fairview Ave
EXIT 1/4 MI
MINNESOTA 51
SOUTH
Snelling Ave
EXIT
25
M.P.H.
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Idea 3. More Locations with NaCL Alternatives. K-Acetate. Construct Ponds with Aeration that receive direct runoff.


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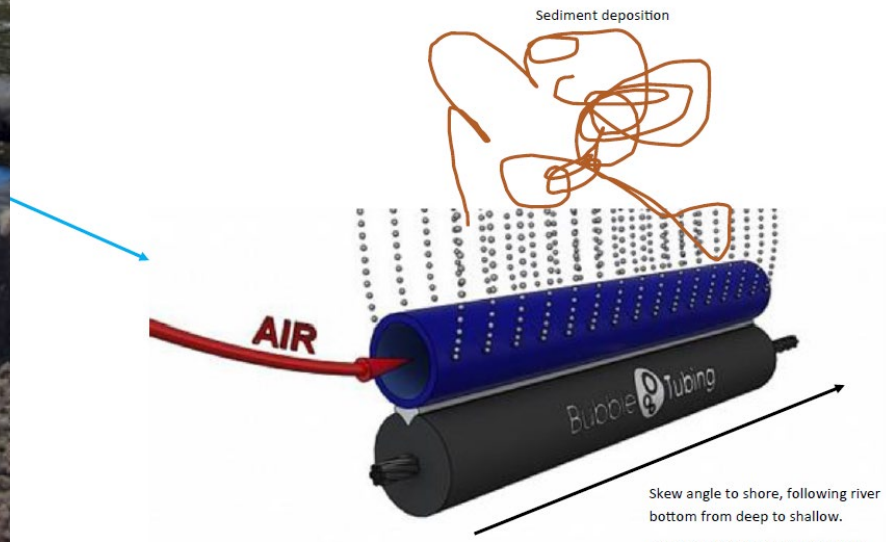
Pier or other work up-
stream of bubbler curtain.



Skew angle to shore, following river bottom from deep to shallow.

Suspended sediments lose buoy-
ance and follow the bubbles to
shore and deposit for later removal.

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Loss of soil structure, easy to displace soil under load due to breakdown of cohesive properties


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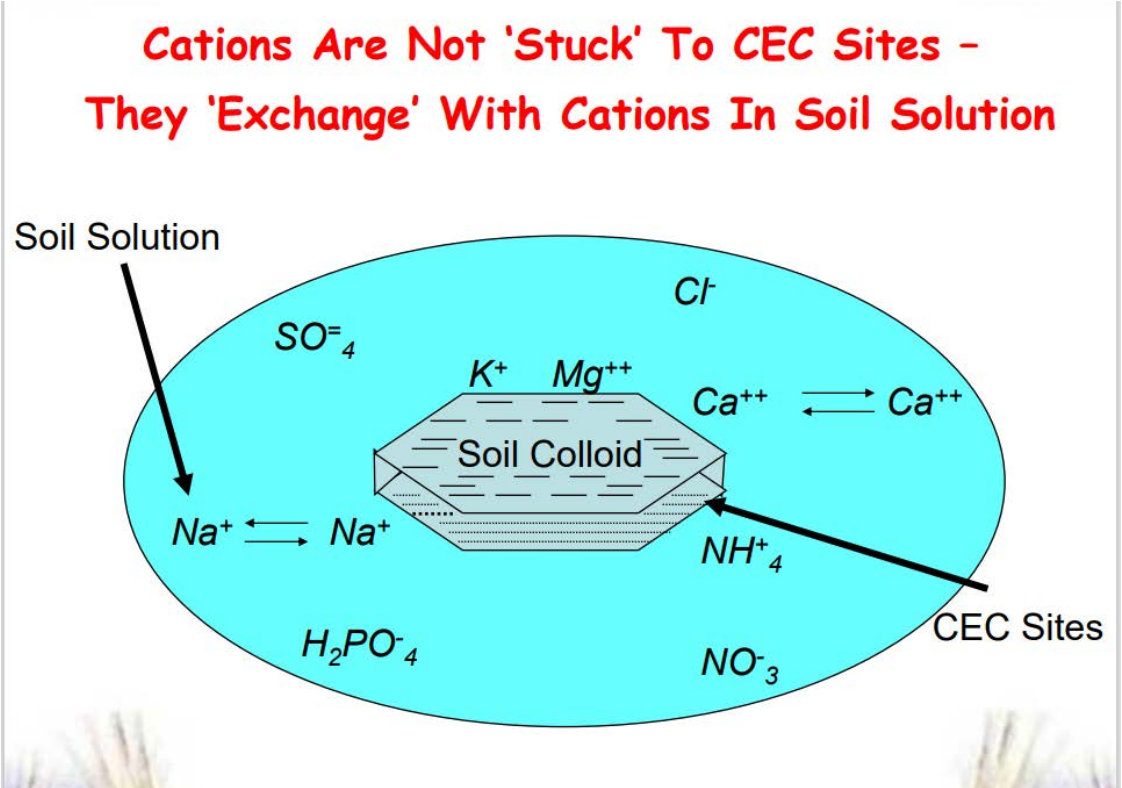
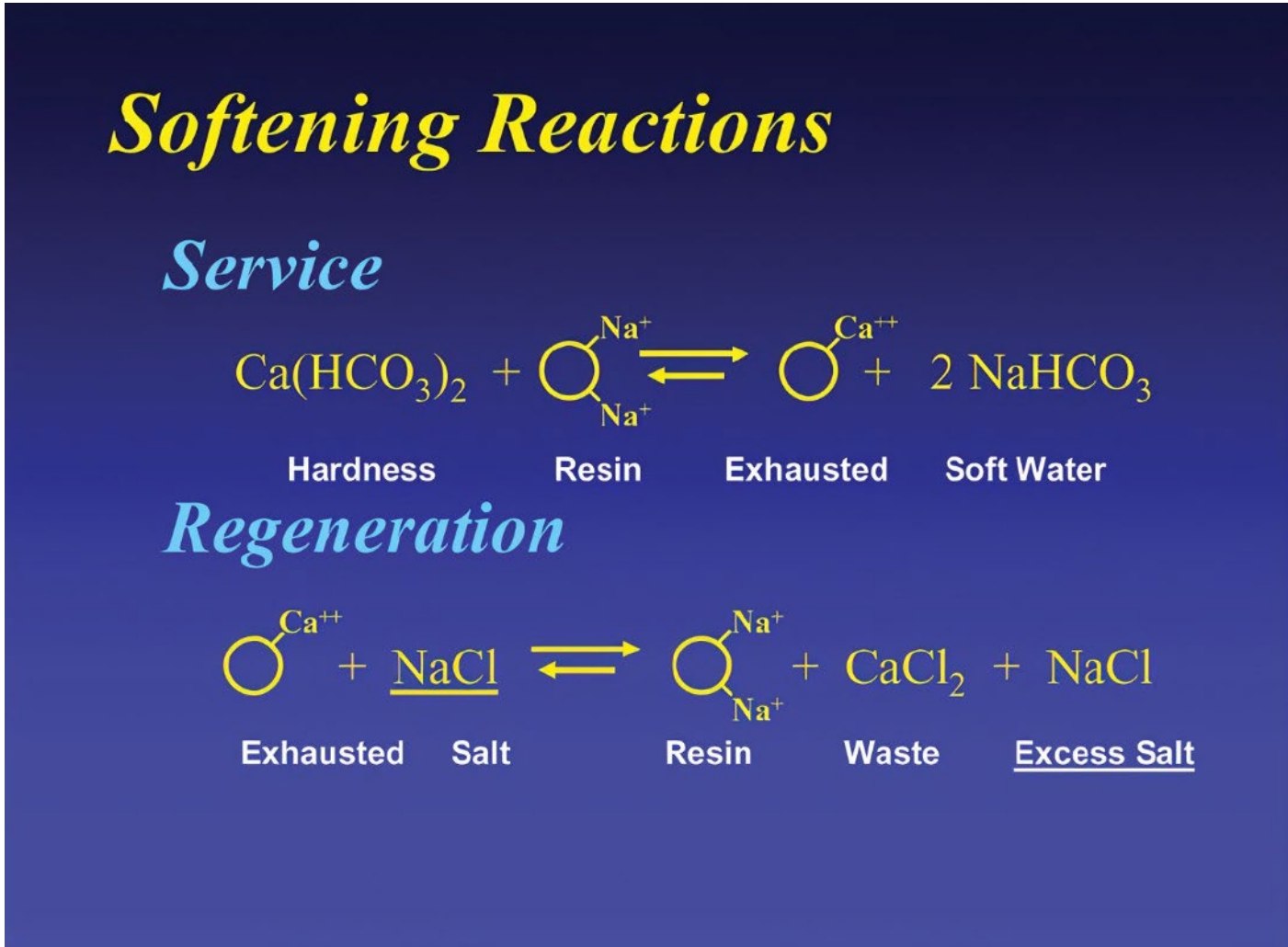
Soils compacted, but without soil structure erode easily

‘Softening’ of soil reduces soil and fertility structure

- How does NaCl change Mg and Ca concentration of soil?



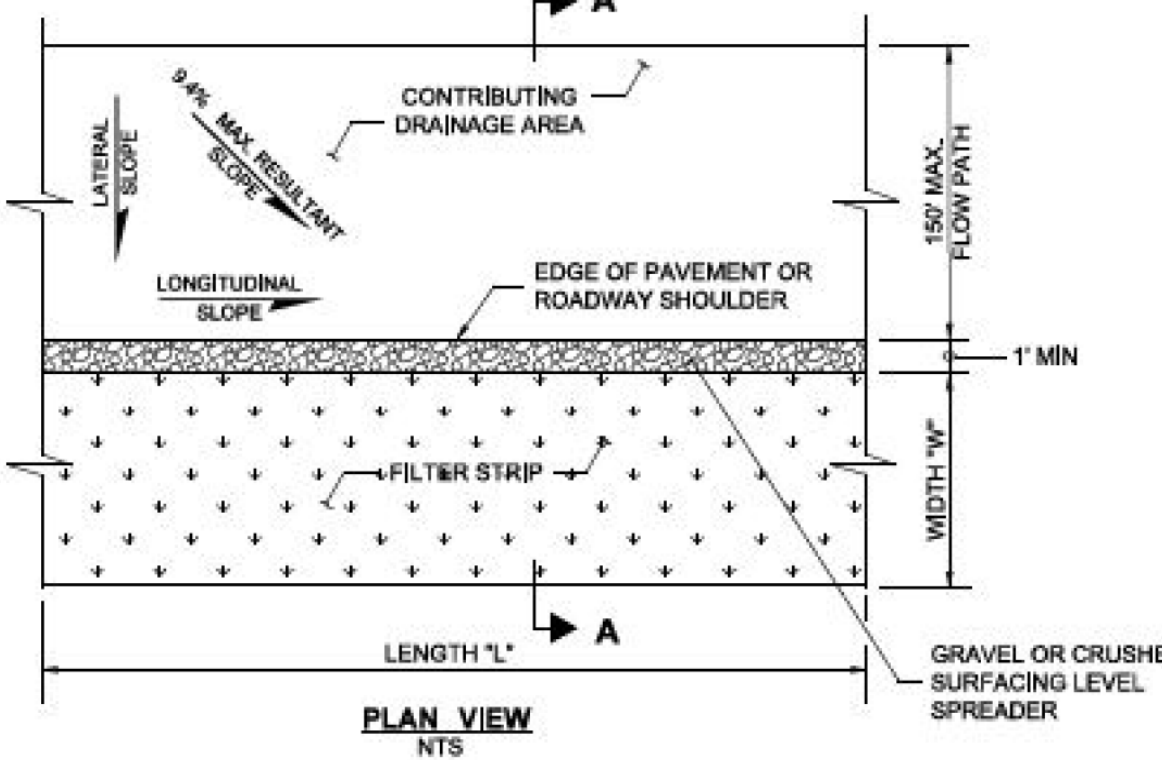


What happens

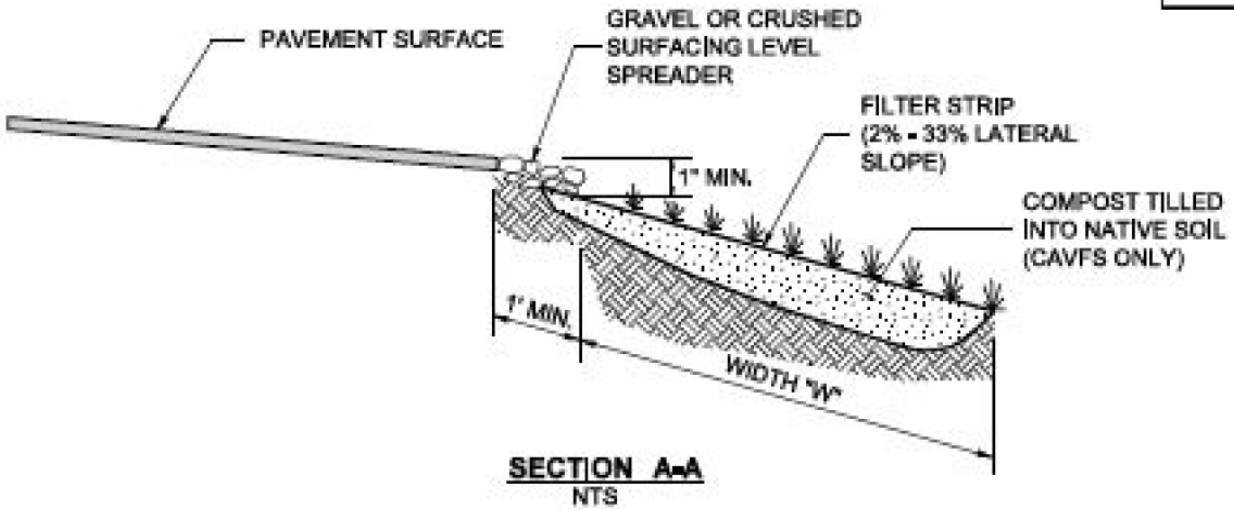
- Loss of soil structure by Ca/Mg displacement
  - Holds excessive water
    - Ruts easily
    - Increased runoff
  - When dry, becomes hard
    - Increased erosion
- Increased difficulty establishing perennial vegetation
  - Reduction in plant species diversity
  - Increased taproot-type weeds
- Increased loss of perennial vegetation over time
  - Native
  - Sod

Idea 4. Increase organic matter content to 5 to 9 %.

Salvage and Reuse all Topsoil

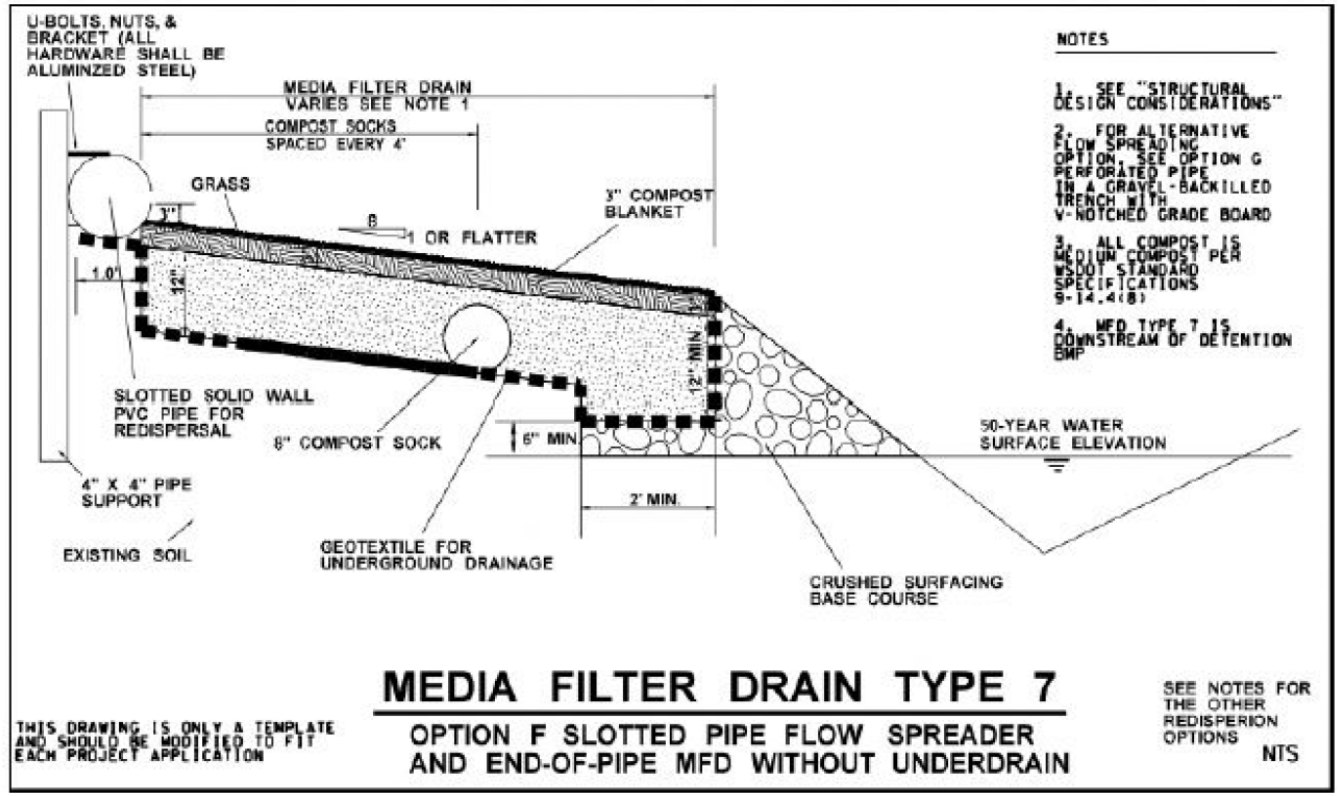


PLAN VIEW
NTS



SECTION A-A
NTS

TYPICAL FILTER STRIP DETAILS



THIS DRAWING IS ONLY A TEMPLATE AND SHOULD BE MODIFIED TO FIT EACH PROJECT APPLICATION

MEDIA FILTER DRAIN TYPE 7

OPTION F SLOTTED PIPE FLOW SPREADER AND END-OF-PIPE MFD WITHOUT UNDERDRAIN

SEE NOTES FOR THE OTHER REDISPERION OPTIONS

NTS


Compost topdressing (1 inch = 135 cu yd/ac)

Mimic nature, plant weeds

Idea 5. Crosstown Commons Landscape Boulevard Mixture for compacted, salt encrusted, poor topsoil areas.

Seed Mixture Special. **Mostly Annual Weeds**.

Common name	Scientific name	Pounds per acre
Squirreltail	*Elymus elymoides*	10
Rabbits foot clover	*Trifolium arvense*	5
Blue bunchgrass	*Festuca idahoensis*	5
Gum weed	*Grindelia spp.*	2
Red clover	*Trifolium pratense*	2
Boreal sweetvetch	*Hedysarum boreale*	2
Blue flax	*Linum lewisii*	1
Path rush	*Juncus tenuis*	0.75
Freeway sedge	*Carex praegracilis*	0.5
Baltic Rush	*Juncus balticus*	0.5
Carpetweed	*Mullugo verticillate*	0.5
Pineapple weed	*Matricaria discoidea*	0.5
Sedum, frosty morn	*Sedum erythrostictum* 'Frosty Morn'	0.25
Total		30







Idea 6. Establish and Harvest Halophytes

Environment and Natural Resources Trust Fund

2022 Request for Proposal

General Information

Proposal ID: 2022-214

Proposal Title: Phytoremediation for Extracting Deicing Salt

Project Manager Information

Name: Bo Hu

Organization: U of MN - College of Food, Agricultural and Nat

Office Telephone: (612) 625-4215

Email: bhu@umn.edu

Activity 1: Field study of halophyte mixed with roadside plants on different soils

Activity Budget: $166,000

Activity Description:
We are currently working with MNDOT to move some of our best plant species to the field testing stage in summer 2021. In the next step, we want to study different establishment and harvest methods to reach the optimized salt removal from roadside soil and water. We will plant single species, mixtures of halophytes, and mixtures of halophytes with non-halophytes at MnROAD Albertville roadside testing sites, representing at least 2 different soil types. We want to understand how competitive halophytes will be with other plant species and what harvest frequency is needed so that they will be able to remove salt in different growth environments. The selected specimen from the lab tests will be planted in the spring on this pilot testing lot and monitored for the entire growing season. We will measure the plant biomass, nitrogen (TN), phosphorus (TP and PO4-P), and the salt concentration in the shoots, roots, and soil. We will use this information to develop an implementation plan for how this species will be added into current regional seed mixtures for plantation diversity and how to maintain their growth.

Project Basic Information

Project Summary: We propose to develop application methods to apply native plants that can adsorb salts to be planted on the roadside to address the environmental concerns over deicing road salts.

Funds Requested: $507,000

Proposed Project Completion: June 30 2025

LCCMR Funding Category: Methods to Protect, Restore, and Enhance Land, Water, and Habitat (F)

Nothing is maintenance Free


CAT


CAT

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- 612-810-9409