

**University of New Hampshire
Grounds & Roads**



Salt Reduction Plan For:

College & Reservoir Brooks

Original Adoption Date: *9/28/2013*

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Revision 2:

Legal Notices:

These are General guidelines used by the University of New Hampshire Grounds & Roads Division. Each decision to mobilize crews, extend operation hours, and to apply de-icing, anti-icing, and pre-treatment materials is made based on particular weather conditions, past experience, and the availability of resources and therefore may not adhere strictly to this policy.

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1.0 Introduction & Background

The New Hampshire Department of Environmental Services (DES) and the US Environmental Protection Agency (EPA) have classified College Brook as impaired for chloride concentrations that exceed state water quality standards.

In order to meet water quality standards, significant reductions from current chloride loading are required. The University of New Hampshire Grounds and Roads Division (UNH) has agreed to reduce the amount of chlorides applied during snow and ice removal operations while maintaining an acceptable level of service (LOS) on roadways, sidewalks, and parking lots. This salt reduction plan will serve as a scope of work for implementation of ongoing salt reduction efforts.

College Brook Watershed: The watershed consists of an approximately 0.88 square mile drainage area located entirely in Durham, NH on the University of New Hampshire Campus. With a TMDL estimated *Chloride loading threshold of 226 Tons of NaCl per year* the watershed is experiencing an *approximated loading of 576 tons per year of Chloride*. In order to meet water quality standards the College Brook watershed will need approximately 61% load reduction.

UNH is responsible for winter maintenance of 28.21 acres of parking lot, 5.44 miles of roadway, and 9.73 miles of sidewalk within College Brook. The Town of Durham is responsible for 3.01 Miles of roadway within the watershed and the NHDOT has 2.24 miles of roadway.

Reservoir Brook Watershed: The watershed consists of an approximately 1 square mile drainage area located entirely in Durham, NH on the University of New Hampshire Campus. With a TMDL estimated *Chloride loading threshold of 256 Tons of NaCl per year* the watershed is experiencing an *approximated loading of 493 tons per year of Chloride*. In order to meet water quality standards the Reservoir Brook watershed will need approximately 48% load reduction.

UNH is responsible for winter maintenance of 30.24 Acres of parking lot, 1.35 Miles of roadway, and 8.73 miles of sidewalk within Reservoir Brook. The Town of Durham is responsible for 1.79 miles of roadway within the watershed and 0.77 miles of roadway classified as unmaintained.

Salt Sources College and Reservoir Brook Watersheds

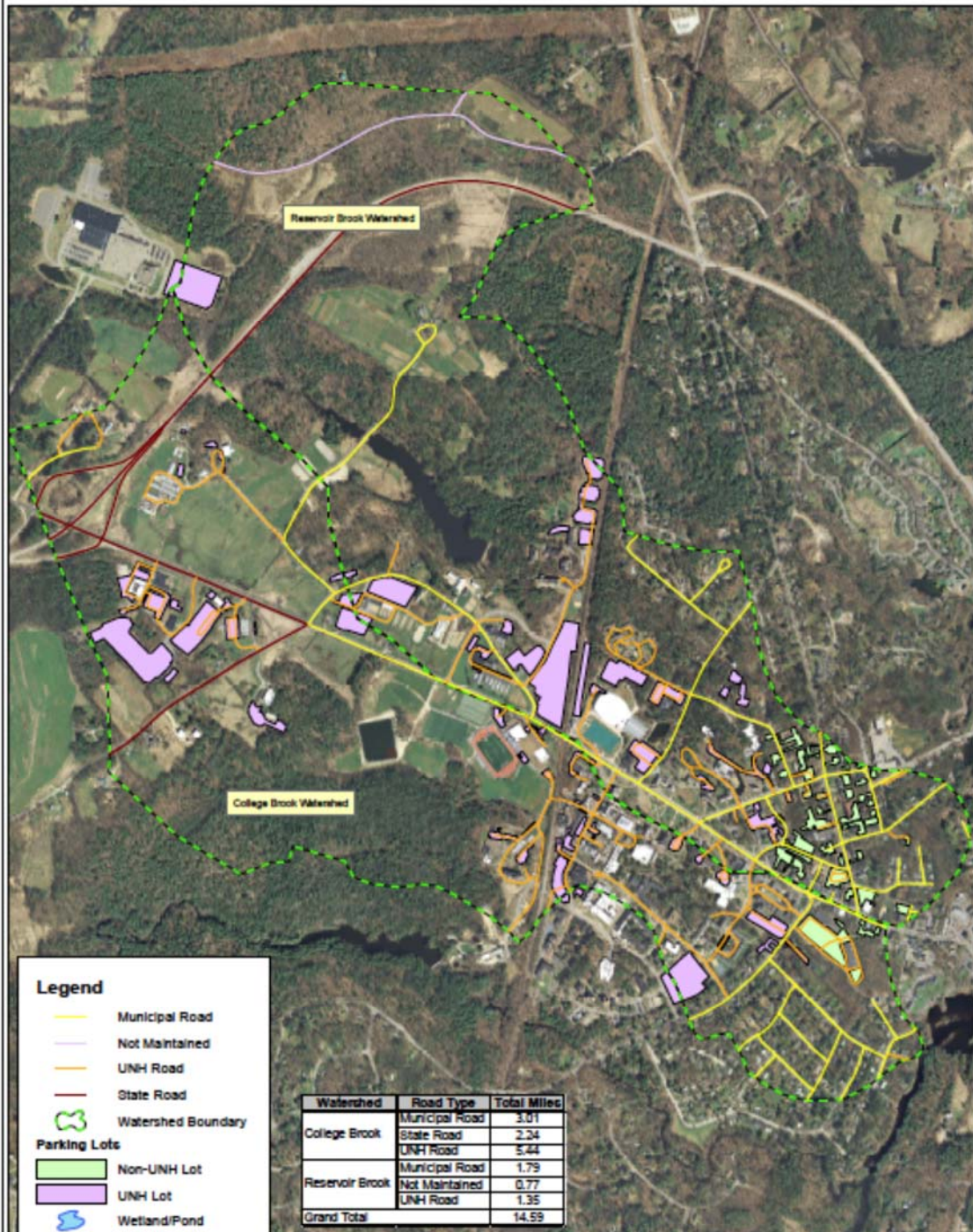


Figure 1: College & Reservoir Brooks, Durham, NH¹

¹ Image Source: NHDES GIS

Chloride Loading Sources: As evidenced by studies performed on watersheds within the I-93 Corridor from Salem to Manchester, NH as well as numerous other studies within the northern states the primary source of chloride contamination of surface waters is road salt used in winter maintenance. The tables below summarize the paved surfaces within the watershed, the parties responsible for winter maintenance, the estimated chloride loading as well as the predicted Chloride Loading Threshold as calculated by NHDES.

Table 1: Road Miles by Winter Maintainer (Source: NHDES)

Watershed	Road Type	Total Miles
College Brook	Municipal Road	3.01
	State Road	2.24
	UNH Road	5.44
Reservoir Brook	Municipal Road	1.79
	Not Maintained	0.77
	UNH Road	1.35
Grand Total		14.59

Table 2: Parking Lot Area by Maintainer (Source: NHDES)

Watershed	Lot Type	Total Acres
College Brook	UNH Lot	27.98
Reservoir Brook	Non-UNH Lot	15.00
	UNH Lot	30.24
Grand Total		73.21

Table 3: Sidewalk Length by Maintainer

Watershed	Sidewalk Type	Total Miles
College Brook	UNH Sidewalk	9.73
Reservoir Brook	UNH Sidewalk	8.73
Grand Total		18.46

Table 4: College Brook Calculated Salt Loading (Source: NHDES)

College Brook Salt Loading		Annual Loading Rate	Total Annual Salt Load
Roads	State roads	18 tons/lane mi	40.26
	Municipal roads	13 tons/ lane mi	39.08
	UNH roads	13 tons/ lane mi	70.75
Parking Lots	UNH lots	9.46 tons/acre	264.66
	Non-UNH lots	6.4 tons/acre	0.00
Sidewalks	UNH Sidewalks	8 Tons/Mile ²	77.84
Total Salt Load			575.75

² Estimated annual loading rate for report only. Rate has not been empirically validated.

Table 5: Reservoir Brook Calculated Salt Loading (Source: NHDES)

Reservoir Brook Salt Loading		Annual Loading Rate	Total Annual Salt Load
Roads	State roads	18 tons/lane mi	0.00
	Municipal roads	13 tons/ lane mi	23.32
	UNH roads	13 tons/ lane mi	17.51
Parking Lots	UNH lots	9.46 tons/acre	286.04
	Non-UNH lots	6.4 tons/acre	96.00
Sidewalks	UNH Sidewalks	8 Tons/Mile ³	69.84
Total Salt Load			492.71

Table 6: Predicted Chloride TMDL For College & Reservoir Brooks (Source: NHDES)

Parameter	Units	College	Reservoir
Drainage Area	mi ²	0.88	1.00
	km ²	2.28	2.59
Runoff Coefficient (Note 1)	cfs/mi ²	1.55	1.55
	m ³ /s/km ²	0.0170	0.0170
Conversion Factor	mg m ³ yr / Mg L s	0.0317	0.0317
Predicted Cl Loading Threshold	Mg Cl / km ² / yr	54.60	54.60
	Mg NaCl / km ² /yr	90.02	90.02
	Mg NaCl / yr	205	233
	tons NaCl / yr	226	256
Estimated Actual Loading	tons NaCl / yr	575.75	492.71
Reduction Needed	%	-60.7%	-48%

2.0 Plan Development

The goal for the Salt Reduction Plan (SRP) is to set a policy and procedural framework to ensure that the University of New Hampshire continuously improves winter maintenance operations while effectively and efficiently using road salt during snow and ice removal operations. New practices contained within this plan are intended to reduce the amount of road salt applied thus working towards meeting the required TMDL load reductions while continuing to meet University level of service (LOS) requirements.

UNH will provide winter maintenance to ensure the designated LOS to roadways, parking lots and sidewalks is maintained according to applicable state and local legislation while striving to minimize adverse impacts to the environment. These commitments will be met by adhering to the procedures contained within this Salt Reduction Plan:

- Committing to ongoing winter maintenance staff training and education;
- Reporting annual winter salt use data to the NHDES;

³ Estimated annual loading rate for report only. Rate has not been empirically validated.

- Re-evaluating the effectiveness of the Salt Reduction Plan as needed to incorporate new technologies or changes in procedures.

The SRP is meant to be dynamic to allow the University to evaluate and phase-in any changes, new approaches and technologies in winter maintenance activities in a fiscally sound manner.

To reduce the financial burden the University will participate in the 319 Grant Salt Reduction Program in partnership with the Town of Durham, and the UNH Technology Transfer Center. The program will provide limited funding to assist The University with implementing pilot level best practices to achieve TMDL load reductions. This SRP has been prepared in partial fulfillment of program requirements to address chloride load reductions and affect environmental improvements on College and Reservoir Brooks.

3.0 Winter Maintenance Overview

Documenting the current winter maintenance program at UNH is essential to understanding mechanisms in which actions for chloride reduction can take place. The summary below provides detail on paved surface maintained, material usage, application rates, and level of service policy. The major activities related to winter maintenance are:

Table 7: Winter Maintenance Activities

Snow Plowing	Snow Storage
Salt/Sand Spreading	Sidewalk Plowing & De-icing
Salt & Sand Storage	Install Fire Hydrant Flags
Snow & Ice Removal	Drainage Clearing

UNH currently maintains approximately 11 miles of roads⁴, 21 miles of sidewalks and 70 acres of parking lots. This includes faculty, staff, student, and visitor parking as well as utility lots such as the bus depot and grounds and roads facility.

Materials used in winter maintenance vary annually and are a function of winter weather severity. The table below provides an overview of average material usage.

Table 8: Annual UNH Material Usage Summary

Material	20012/2013		Annual Average	
Solids				
Rock Salt (NaCl)	790	Tons	None	Tons
Sand		Tons	None	Tons
Liquids				
N/A				

Current salt application rates vary based on equipment limitations for sidewalks. Application rates are approximated using annual loading rates

⁴ Source: UNH Records

Winter maintenance zones are outlined in Appendix A

4.0 Proposed Best Management Practices (BMPs)

4.1 Sidewalk Equipment Upgrade Pilot

Pre 319 Grant Salt Reduction Project: UNH has historically upgraded equipment as necessary and when funding was available. UNH has always been focused on operational efficiency with respect to material usage and equipment replacement and maintenance costs.

Proposed BMP: UNH will purchase One (1) new salt dispersion system for use on sidewalks within college brook. UNH has already piloted the use of this piece of equipment and documented reductions of 69% through a calibration exercise with the Technology Transfer Center.

Equipment/Materials Needs: One new Fisher Poly-Caster variable salt/sander which will be purchased and installed on an existing 6 wheel dump truck

Estimated Reduction: The reductions in table 9 below are conservatively estimated at 17.5% in UNH chloride imports to the College Brook Watershed. This is based on an estimated 79% reduction on one of the four pieces of equipment used in the watershed. The new equipment will be used for sidewalk plowing within that watershed only. These reductions are only resulting from equipment upgrades. UNH acknowledges that these reductions are insufficient to meet acceptable watershed loading. The University intends to continually improve salt reductions through ongoing training and experience with the ultimate goal of meeting acceptable chloride loading.

Table 9: Equipment Upgrade Estimated Reductions

Watershed	Existing Imports	Estimated Reduction	Estimated Reduction	Estimated Reduced Imports
	<i>Tons/Year</i>	<i>Percent</i>	<i>Tons/Year</i>	<i>Tons/Year</i>
College Brook	413.25	17.5%	72.32	340.93

4.2 Equipment Calibrations

Proposed BMP: UNH will calibrate each spreader unit prior to the winter season using manufacturer information supplemented with T² supplied calibration procedures. Calibrated settings will be logged in a master sheet, and stored inside the

vehicle. Prior to each storm each truck will be checked to verify that settings are calibrated to dispense the proper amount of chemical for the specific situation. Hydraulically controlled units will be re-calibrated whenever the hydraulic system is altered or maintained.

Properly calibrated equipment will ensure that each spreader is dispensing the appropriate amount of material which will be determined for each storm. It is anticipated that this practice will reduce waste and improve efficiency of chemical dispersion.

Equipment/Materials Needs: UNH will not require any additional equipment.

Estimated Reduction: The reductions in table 10 below are conservatively estimated at 10%. These reductions are only resulting from improved calibration procedures.

Table 10: Calibration Estimated Reductions

Watershed	Existing Imports	Estimated Reduction	Estimated Reduction	Estimated Reduced Imports
	<i>Tons/Year</i>	<i>Percent</i>	<i>Tons/Year</i>	<i>Tons/Year</i>
College Brook	413.25	10%	41.325	371.93
Reservoir Brook	373.39	10%	37.34	336.05

4.3 BMP Overview Matrix

Table 11: BMP Reduction Overview Matrix for Year 1

BMP	Watersheds	Reduction
4.1 Equipment Upgrade	College Brook	72.32 Tons/Yr
4.2 Equipment Calibration	College Brook	41.33 Tons/Yr
	Reservoir Brook	37.3 Tons/Yr
Total Estimated Reduction:		150.95 Tons/Yr
Total Estimated UNH Salt Imports after BMPs:		635.69 Tons/Yr

5.0 Implementation Cost & Timeline

Equipment costs reflect UNH’s best estimate at this time. Costs may change due to factors beyond the town’s control. The table below summarizes BMP and the associated estimated costs. It should be noted that matching funds will be compliant with 49 CFR18.24 and 49 CFR19.23.

Table 12: Estimated Cost Table

BMP	Equipment	Estimated Cost
4.1 Equipment Upgrade Pilot	Poly Caster Spreader	\$9,370
4.2 Improved Calibrations	<i>No Equipment Required</i>	\$0.00
	Total Project Cost:	\$9,370
	Total 319 Grant Funds:	\$9,370

6.0 Reduction Summary

Reductions are estimated uniformly among the sectors (UNH, Town of Durham, State, and Private Sector) at 60.7% for College Brook and 48% for Reservoir Brook. The measure in this salt reduction plan do not reduce loading to a level sufficient to eliminate impairment as illustrated in table 13 below. Potential future salt reduction measures are outlined in section 7.

Table 13: Estimated Total Reductions Needed for UNH

Watershed	Existing UNH Imports	Estimated Total Reduced UNH Imports	Total Estimated UNH Reduction	UNH Chloride Load Target	Remaining % Reduction Needed⁵	Remaining Reduction Needed
	<i>Tons/Year</i>	<i>Tons/Year</i>	<i>Percent</i>	<i>Tons/Year</i>	<i>Percent</i>	<i>Tons/Year</i>
College Brook	413.25	299.6	27.5%	162.21	33.2%	137.39
Reservoir Brook	373.39	336.05	10%	179.22	38.0%	156.83

It should be noted that the town of Durham, NHDOT, and private sector contractors also contribute chlorides through their winter maintenance activity. A summary of the estimated state and municipal reductions are provided in tables 14 and 15 below.

Table 14: Estimated State of NH Reductions

Watershed	Existing Imports State Imports	% Reduction Needed	Reduction Needed	Import Allocation
	<i>Tons/Year</i>	<i>Percent</i>	<i>Tons/Year</i>	<i>Tons/Year</i>
College Brook	40.26	60.7%	24.43	15.82
Reservoir Brook	0.00	48%	N/A	N/A

⁵ Based on original estimated loading

Table 15: Estimated Town of Durham Reductions

Watershed	Existing Imports Town Imports	% Reduction Needed	Reduction Needed	Import Allocation
	<i>Tons/Year</i>	<i>Percent</i>	<i>Tons/Year</i>	<i>Tons/Year</i>
College Brook	39.08	60.7%	23.72	15.35
Reservoir Brook	23.32	48%	11.19	12.13

7.0 Potential Future Reductions

It is acknowledged that the salt reductions outlined in this plan are not sufficient to meet predicted TMDL targets. UNH is considering additional salt reduction alternatives for future implementation as funding becomes available. Potential salt reduction techniques are outlined below.

Salt Reclamation: UNH is considering purchasing a sweeper to be used on sidewalks after a storm event. Once winter operations have ceased the sweeper will be deployed on the sidewalks to reclaim residual de-icing chemicals. Potential chloride reductions from this technique are unclear as to date this technology has not been deployed at any facilities nationwide. This pioneering technique could potentially reduce salt loading by up to 30%. UNH will be performing a salt reclamation pilot during the winter of 2013-2014 to quantify potential load reductions.

Equipment Upgrades: As funding becomes available UNH plans to upgrade its remaining equipment to include groundspeed controlled with in cab controls. These upgrades have the potential for an additional 20-45% reduction of salt usage within the target watersheds.

Anti-Icing: Due to the high capital investment required in producing brine is it unlikely that UNH will begin the use of Anti-Icing in the near future. However collaboration with town and state winter maintenance professionals to purchase a communal brine maker may be a lower cost alternative to deploying the technology. Anti-Icing has the potential to reduce salt loading by up to 20%.

Appendix A: Maintenance Zones

