Town of Derry, NH

Chloride Reduction Plan For:

Beaver Brook Watershed
Within the Boundary of the Town of Derry

Original Approved by Council: 2010
Revision 1: *8/11/2011*
Revision 2: *3/9/2016*
Revision 3: *9/1/2018*
Revision 4: 9/13/2022

Legal Notices:

These are General guidelines used by the Derry, NH Public Works Dept. 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

Beaver Brook has been identified as impaired by the New Hampshire Department of Environmental Services (DES) and the US Environmental Protection Agency (EPA) for chloride concentrations that exceed state and federal water quality standards. NH DES has completed a Total Maximum Daily Load (TMDL) analysis (April 2008) to quantify pollutant reductions needed to meet the state water quality standards for chlorides. The goal of the TMDL is to reduce chloride loads from all sources (municipal, state and private/commercial sources) so that water quality standards for all the designated uses affected by chloride pollution are met in all areas of the Beaver Brook watershed.

The TMDL is expressed as a load duration curve and is based on a 4-day average concentration. The units for the TMDL are expressed as tons of chloride per day. The TMDL was set at the level necessary to achieve the EPA and DES standard of 230 mg Cl/L standard which includes a 10% margin of safety in order to address impacts associated with chlorides on the instream, benthic, and riparian communities. In order to meet water quality standards, significant reductions from current chloride loading from all sources are required. The Town of Derry has agreed to implement reduction measures and improve storage, handling and application operations in order to reduce the amount of chlorides applied during snow and ice removal operations while maintaining an acceptable level of service (LOS) on roadways. See Appendix A for a copy of the approved Municipal Resolution stating same.

The Chloride Reduction Plan, formerly called the Salt Reduction Plan, was originally prepared in 2010 to serve as a general scope of work for implementation of salt reduction efforts. The Federal Highway Administration (FHWA) had allocated funds to assist municipalities with salt source reductions to implement the chloride TMDL in the I-93 corridor. Preparation of the Salt Reduction Plan was a prerequisite to eligibility for these funds. At this time all available funds have been dispersed and significant equipment upgrades have been completed and best management practices implemented. A memorandum documenting the review and approval of the first Salt Reduction Plan by NHDES, USEPA, FHWA, and NH Department of Transportation (NHDOT) is included in Appendix A.

For purposes of this plan, salt or chloride reduction efforts not only include simply applying less de-icing materials that contain chloride, but a series of actions that include operational changes and improvements, mechanical upgrades, outreach and awareness activities, regulatory changes, and monitoring, all of which are designed and implemented with the result being a net decrease in chloride loading to the watershed.

Since the development of the TMDL and prior to development of this plan, the Town of Derry already started taking chloride reduction measures including construction of a new salt/sand storage facility and loading procedures, calibration of spreaders, preparation of a draft outreach brochure targeted at the private/commercial sectors, and periodic conductivity monitoring of select tributaries to Beaver Brook separate from monitoring conducted by NHDES.

Beaver Brook is a 4.86 mile stream segment located in Auburn, Derry, Chester, and Londonderry, NH. The associated watershed is 30.33 square miles (NHDES, Total Maximum Daily Load (TMDL) Study for Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Beaver Brook in Auburn, Chester, Derry, and Londonderry 2008) (see figure 1).

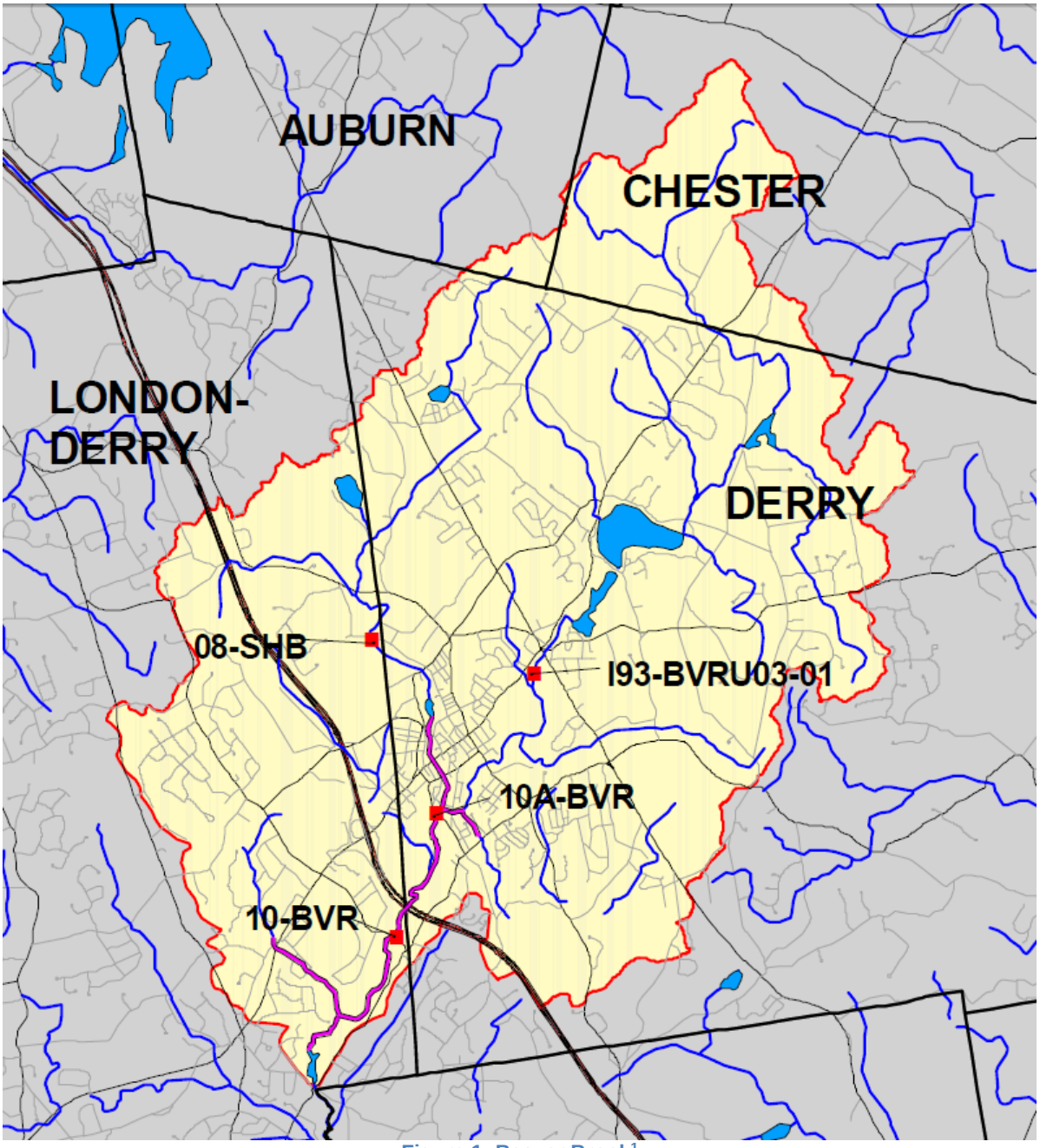


Figure 1: Beaver Brook[1]

[1] Photo Credit: NHDES TMDL 2008

Derry is responsible for winter maintenance on 212.78[2] lane miles (106.39 road miles) of road within the watershed. Derry maintains 29[4] parking lots (14.4 Acres – 627,483 Sq. Ft.) within the watershed. These parking lots include paved (impervious) lots associated with municipal operations (employee lots, highway and waste water facilities, fire and police stations, etc), general public use parking (town parks, municipal lots, library, cemetery, etc.) and the associated parking lot driveways

NHDOT is responsible for winter maintenance operations on approximately 53[2] lane miles within the entire Beaver Brook Watershed. Within the municipal boundaries of Derry (within the watershed) NHDOT maintains approximately 8.8 lane miles of Interstate I-93 with the completion of the I-93 widening project, and approximately 17.6 miles of other state routes.

Roadways and parking lots which are not maintained by Derry or NHDOT are classified as private. These paved surfaces are maintained each winter season by a private snow and ice removal company hired by the respective landowner. Within the watershed and within the municipal boundaries of Derry there are approximately 31.5[2] lane miles (15.75 road miles) of private roads, 270.5[3] acres of parking lots, and 9.18[3] miles of parking lot driveways as of the original date of this plan. The area of parking lots and parking lot driveways is expected to increase as additional development occurs in areas approved as commercial and industrial.

2.0 Plan Development

The goal for the Chloride Reduction Plan (CRP) is to set a policy and procedural framework to demonstrate how the Town of Derry will continuously work to improve 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 by the Town thus working towards meeting the Town's allocation of the required TMDL load reductions while continuing to meet town level of service (LOS).

Derry 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 Chloride Reduction Plan;
- Committing to ongoing winter maintenance staff training and education;
- Reporting fiscal year salt use data to the NH DES
- Re-evaluating the effectiveness of the Salt Reduction Plan as needed to incorporate new cost-effective technologies or changes in procedures.

[2] NHDOT 2010 GIS Road Centerline File
[3] PSU Parking Lot Study
[4] Derry GIS 2010

The CRP is meant to be dynamic to allow the municipality 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 on municipal taxpayers the town participated in the I-93 Watersheds municipal salt reduction program developed in 2008 by the NH DOT in cooperation with the Federal Highway Administration. The program administered a reimbursement process to assist towns with implementing TMDL load reductions. This CRP was initially prepared in partial fulfillment of program requirements to address TMDL chloride load reductions.

3.0 Winter Maintenance Overview

Derry is responsible for winter maintenance on various roads and parking lots within the watershed and winter maintenance involves numerous activities, not all of which involve snow clearing or deicing. 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 1: Winter Maintenance Activities

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

The Town of Derry currently maintains 160.81[4] miles of public roads town-wide, and 14.4 acres of parking lots. Town-maintained parking lots include: town municipal offices, Derry Library, Derry Fire Dept., Derry Police Dept. Derry Transfer Station, Derry recreational parks, and a few municipal lots. All of the parking lots are located within the watershed, however approximately 66% of roads are within the watershed.

Table 2: Town-Wide Road Mileage Summary

Road Classification	Average Daily Traffic	Typical Road Width	Number of Lane Miles
Arterial	3,000 +	24’ – 36’	56.6
Collector	1,000 – 3,000	22’ – 24’	63.2
Access Street	< 500	18’ – 20’	210

Note: Road classifications per NHOEP (http://www.nh.gov/oep/resourcelibrary/documents/12-roads.pdf)

Derry roads have been classified based on the average daily traffic and maintainer in order that LOS can be set for each classification of road. It should be noted that the LOS policy has remained consistent throughout the TMDL process. During snow and ice events, the LOS and operating procedures (OP) constantly change depending on numerous factors, all of which change depending on forecasts, projected road conditions, and the actual conditions observed. Some of the factors that affect the Town’s LOS and OP include but are not limited to observed and anticipated precipitation rates, regular forecasts of snowfall and temperature changes throughout the storm, projected post-storm forecast (warm-up or deep freeze), time of day (solar assistance), and locality (hills or high traffic intersections). Derry also does not apply salt each time that plows are out and does not apply salt on unpaved roads. The Town’s Snow and Ice Control Policy is included in Appendix B. Also included are select pages to the Town of Derry Winter Operations Booklet which is updated annually. Some

[5] per 10 year average from Round 1

pages are omitted as they include operators' personal information (names and home and/or cell phone numbers) which are private and subject to change.

Table 3: Summarized Level of Service Policy

Arterial Roads	Full width bare pavement as soon as practical after storm event terminates.
Collector Streets	Full width bare pavement as soon as practical after storm event terminates.
Access Streets	Full width bare pavement as soon as practical after storm event terminates.

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. A detailed 10-year average is provided within Appendix C. The 10-year average is used to evaluate salt usage to normalize the effects of more and less severe winters. NHDOT analysis has found that a 10-year average is approximately equal to the Weather Severity Index (WSI) normalized average.

Watershed salt use was compared to the WSI as reported by NHDOT. Figure 2 shows the close correlation of salt applied by the Town in the watershed with WSI.

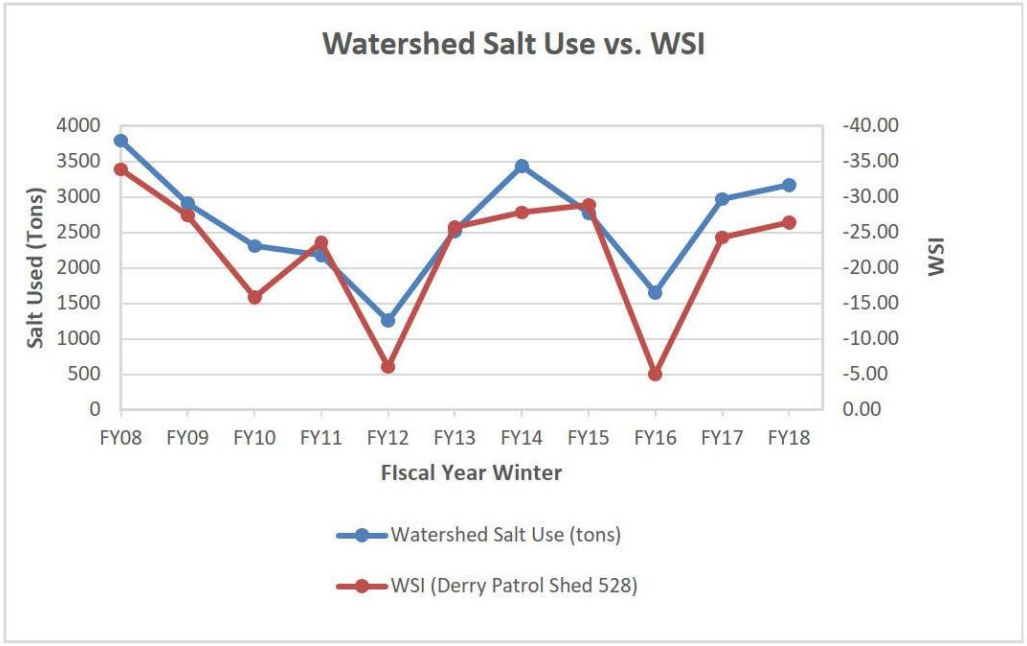


Figure 2: Watershed Salt Use Vs Weather Severity Index

Table 4: Annual Town Wide Material Usage Summary

Material	2008/2009	2009/2010	10 Year Average
Solids			
Rock Salt (NaCl)	4407 Tons	3500 Tons	4211 Tons

Table 5: Beaver Brook Watershed Usage

Material	2008/2009	2009/2010	10 Year Average
Solids			
Rock Salt (NaCl)	2909 Tons	2310 Tons	2779 Tons

Current application rates town-wide are set at approximately 300 lb/lane mile (±50lb). The material applied consists of 100% salt application. The Town no longer uses Salt/Sand Mix. Town-wide plow route maps are included in Appendix D.

4.0 Best Management Practices (BMPs)

Derry has demonstrated an ongoing commitment to salt reduction in several key areas.

Equipment: Derry has participated in three rounds of federal funding for salt reduction. It has purchased a total of five (5) salt reducing plow trucks with pre-wetting sprayers, groundspeed controls, pavement temperature sensors, underbelly scrapers (on 3 trucks), and instituted a calibration program to ensure accurate application.

Training: All Derry municipal operators have been trained in the Green Snow Pro Program offered by the UNH Technology Transfer Center, and the municipality regularly hosts the training at the Derry Municipal Center on Manning Street. Derry Officials also supported the passage of the Voluntary Certified Salt Applicator law each time it was presented to the legislature.

Public Outreach: The town has filmed and broadcasted plow truck ride-alongs on its public access television station. It has also provided ride-alongs for the DES Salt Reduction Coordinator. Additionally Derry public television also interviewed DES and UNH salt reduction experts during a segment about the chloride contamination issues in Beaver Brook and broadcast on Derry Cable Access television.

Total Estimated Planned reductions from rounds 1-3 are summarized below:

Table 6: Summarized Estimated Reductions from rounds 1-3

Watershed	Existing Imports[5]	Estimated Reduction	Estimated Reduction	Estimated Reduced Imports	TMDL Allocation
	Tons/Year	*Percent*	*Tons/Year*	*Tons/Year*	*Tons/Year*
Beaver Brook	2705.05	18%	486.9	2,218.14	2,264.4

4.1 Equipment Upgrades

4.1.1 Round 1: Truck with Underbelly Plow, Prewetting & Air/Pavement Temperature Sensors

Pre-TMDL: Derry had not used underbelly plows or prewetting prior to TMDL. The town was applying chemical (sand/salt mix, or straight salt) prior to some storm events to reduce the potential for ice/pavement bonding.

[5] per 10 year average from Round 1

Post-TMDL: Derry did not adopt prewetting after the TMDL reports were published.

Implementation: Derry conducted a prewetting pilot to evaluate its use for salt reduction on municipally maintained roads and parking lots within the watershed. This gave the town the ability to evaluate effectiveness and refine application rates and usage on a limited scale to determine if prewetting is appropriate for town wide usage. The town used DOT recommended application rates and timetables in conjunction with prevailing industry documentation as a baseline for evaluation. The trial was primarily focused on municipally maintained roads within the Beaver Brook watershed. In addition to the prewetting equipment, the town equipped trucks with pavement temperature sensors with in-cab readout. The town maintained a log of salt usage for routes within the watersheds to tabulate salt usage and determine achieved reductions.

Derry conducted field trials with this equipment throughout the winter season. During the trials, each element was evaluated for potential use in all town trucks. Key factors include salt reduction potential, ease of use, reliability, routine and unanticipated maintenance, maintenance and lifecycle costs, and driver adoption.

Equipment/Materials Purchased: Derry purchased a new 6-wheeled dump truck with underbelly plow, spreader control unit and air/pavement temperature sensors. New prewetting equipment was purchased and installed on four (4) existing six-wheel dump trucks. This new equipment included: spreader control units Including v-box tanks/frame mounted tanks brine tanks, pumps, hoses, sprayers, cab mounted on-off switch, and in-cab air/pavement temperature sensors.

To facilitate the pilot, Derry purchased Salt Brine from NHDOT at a price determined prior to the winter season. The town worked with NHDOT to ensure that brine was purchased and transported on a schedule that did not present a burden to either organization. Derry also took advantage of NHDOT knowledge base relative to application rates and best practices to aid in the success of the trial.

Estimated Reduction: The reductions estimated in the table below are conservatively estimated at 6%. These reductions are only resulting from equipment upgrades under the pilot program. Given that these measures are only designed to address the Town's allocations, Derry acknowledged that these reductions alone may be insufficient by themselves to consistently meet TMDL requirements and that this is also acknowledged by NHDES, NHDOT, and USEPA.

Table 7: Estimated Reductions for Round 1

Watershed	Existing Imports[6]	Estimated Reduction	Estimated Reduction	Estimated Reduced Imports	TMDL Allocation
	Tons/Year	*Percent*	*Tons/Year*	*Tons/Year*	*Tons/Year*
Beaver Brook	2705.05	6%	162.3	2542.75	2264.4

4.1.2 Round 2: Trucks with Underbelly Plows, Prewetting, & Air/Pavement Temperature Sensors

The town purchased two (2) new 6-wheel dump trucks with underbelly plows, equipped with sprayers to prewet salt and ground-speed oriented spreaders. Derry continued to evaluate the prewetting upgrades to determine its effect on salt reduction on municipally maintained roads within the watershed. This gives the town the ability to refine application rates and usage on a limited scale to capitalize on prewetting knowledge gained in round 1. The DOT recommended application rates in conjunction with prevailing industry documentation, and experience from round one will be used as a baseline for evaluation. In addition to the prewetting equipment, the trucks will be equipped with pavement temperature sensors with in-cab readout. In addition, the town will continue to maintain a log of salt usage for routes within the watershed to tabulate salt usage and determine achieved reductions.

Equipment/Materials Needs: To facilitate the implementation of the Round 2 BMP, Derry is anticipating purchasing Salt Brine from NHDOT at a price to be determined prior to the winter season. The town worked with NHDOT to ensure that brine can be purchased on a schedule which would not present a burden to either organization. Derry also took advantage of NHDOT's knowledge base relative to application rates and best practices to aid in the success of the trial.

Two (2) new underbelly discharge 6-wheeled dump trucks purchased were used as a platform for new equipment. New prewetting, and groundspeed-oriented spreading equipment were purchased and installed on the new 6-wheeled dump trucks. This new equipment will included:

- **Two (2) new 6-Wheel Dump Trucks:** 6-wheel dump trucks with underbelly plows. Specifications were similar to existing Derry trucks.

- **Two (2) Spreader Control Units:** Controllers with the ability to calibrate and accurately dispense material regardless of vehicle speed. The controllers included the ability to control pre-wetting equipment, ground speed oriented spreaders, and temperature sensor data. The units allow management to set application rates which will automatically change with

[6] per 10 year average

vehicle speed and ground temperature. Prescribed application rates may only be changed with an administrative password.

- **Two (2) Brine Tanks & Sprayers:** Truck mounted brine tanks, pumps, and sprayers with the ability to be calibrated and operate with the spreader control units. Units may vary as appropriate to fit truck configurations (i.e. saddle tanks, top mounted tanks, etc.).

- **Two (2) In-Cab Air/Pavement Temperature Sensors:** Units will provide air and pavement temperature readings on an in-cab display and integrate into the spreader control units.

- **Two (2) Electronically Controllable Hydraulic Valves:** Necessary to allow the controller to adjust auger and spinner speeds.

Estimated Reduction: The second year (combined first and second round) reductions estimated in table below are conservatively estimated at 10%. These reductions are only resulting from equipment upgrades.

Table 8: Estimated Cumulative Reductions for Round 2

Watershed	Existing Imports[7]	Estimated Reduction	Estimated Reduction	Estimated Reduced Imports	TMDL Allocation
	Tons/Year	*Percent*	*Tons/Year*	*Tons/Year*	*Tons/Year*
Beaver Brook	2705.05	10%	270.55	2434.5	2264.4

4.1.3 Round 3: Plow Trucks, Prewetting & Pavement Temperature Sensors

The town purchased two (2) new F-550, 6 wheeled dump trucks equipped with ground speed control, pre-wet systems, bull plow, wing plow (Smaller trucks for use on narrow urban streets and around the lakes.)
Derry continues to evaluate the prewetting upgrades to determine its effect on salt reduction on municipally maintained roads within the watershed. In addition to the prewetting equipment, the trucks will be equipped with pavement temperature sensors with in-cab readout. The town will continue to maintain a log of salt usage for routes within the watershed to tabulate salt usage and determine achieved reductions.

[7] per 10 year average

Table 9: Estimated Cumulative Reductions for Round 3

Watershed	Existing Imports[8]	Estimated Reduction	Estimated Reduction	Estimated Reduced Imports	TMDL Allocation
	Tons/Year	*Percent*	*Tons/Year*	*Tons/Year*	*Tons/Year*
Beaver Brook	2705.05	16%	432.81	2272.24	2264.4

4.2 Improved Calibration Procedures

Pre-TMDL: Derry has performed routine periodic calibrations of municipal spreaders in the past.

Post-TMDL: Derry continued with its routine periodic calibration procedures.

Round 1 BMP: Derry calibrated each spreader unit prior to the winter season using manufacturer information supplemented with T^2 supplied calibration procedures. Calibrated settings were logged in a master sheet and stored inside the vehicle. Prior to each storm, each truck was checked to verify that settings were calibrated to dispense the proper amount of chemical for the specific situation. Each unit was re-calibrated at least once during the season, and hydraulically controlled units were re-calibrated whenever the hydraulic system was altered or maintained.

Properly calibrated equipment ensures that each spreader is dispensing the appropriate amount of material which is determined for each storm. This practice reduces waste and improves efficiency of chemical dispensation.

Equipment/Materials Needs: The town will not require any additional equipment or materials to perform calibrations.

Estimated Reduction: The reductions estimated in table below are conservatively estimated at 2%. These reductions are only resulting from improved calibration procedures. Derry acknowledges that these reductions alone are insufficient to meet TMDL requirements.

[8] per 10 year average

Table 10: Equipment Calibration Estimated Reductions for Year 1

Watershed	Existing Imports	Estimated Reduction	Estimated Reduction	Estimated Reduced Imports	TMDL Allocation
	Tons/Year	*Percent*	*Tons/Year*	*Tons/Year*	*Tons/Year*
Beaver Brook	2705.05	2%	54.1	2650.95	2264.4

4.3 Public/Private Sector Outreach Program & Training

Pre-TMDL: Prior to the TMDL completion Derry had not actively encouraged owners or local contractors to reduce their chloride usage. There were no regulatory requirements mandating the use of BMPs to reduce

Post-TMDL:

Outreach

After the TMDL Derry did actively encourage local contractors to reduce their chloride usage and required one commercial property to address poor management and storage with one commercial property within the watershed. The Town also reached out to private contractors and local property management companies and encouraged them to attend training and become involved in the Green SnowPro Certification legislation. Derry strongly supported HB 1679 requiring the certification of private sector salt applicators. The town supported a master certification for supervisors or owners which will provide liability protection for owners and applicators.

The Town began working on a Salt Reduction brochure to be distributed to local contractors and businesses to encourage the implementation of best management practices to reduce chloride usage. The brochure combined with Green SnowPro Certification program outreach will be used for outreach to local businesses.

Derry will continue to engage in a public outreach program including sending mailers to local business owners encouraging them to require their winter maintenance contractors to attend training. The town may also investigate other avenues such as posting winter driving tips in the town high school, speaking to new drivers about safe winter driving, and communicating with the local bus company. Derry will also post Best Management Practices and informational brochures on their website and salt reduction and awareness videos on public access TV.

Training
Derry requires that all town staff involved in plowing/salting operations and private contractors hired by the town, attend salt reduction trainings.

Regulatory Changes
The Town amended its Stormwater Ordinance to reflect requirements of the MS4GP that all commercial properties with 10 or more parking spaces located within watersheds with a chloride TMDL use a Certified Green SnowPro Contractor for winter de-icing operations.

Equipment/Materials/Staffing Needs: Stationary supplies, postage, printing/publication, advertising fees, staffing time to participate in the behaviour change initiatives.

Estimated Reduction: The goal of the outreach program is to increase awareness and encourage private sector applicators to become trained and implement best practices. Outreach to new drivers and local bus companies is the first step in changing driver expectation within town and could result in less long-term salt use. Training of town operators will encourage participation in salt reduction efforts. Derry is unable to quantify actual reductions possible because it has no control over the actual behaviour of private contractors or citizens expectations.

4.4 Weather Monitoring System

Pre-TMDL: Derry uses Precision Weather Forecast to monitor current and future weather conditions

Post-TMDL: The Town has not changed its weather monitoring practices subsequent to the TMDL reports.

Proposed BMP: Derry will continue to use Precision Weather Forecast to monitor current and future weather conditions. This helps to determine the need to salt and how heavily or lightly. It also ensures that that the Town does not treat prematurely. If roads are treated and then get hit with another plowable accumulation the Town will plow off the salt applied and must treat the roads again. It is anticipated that this more accurate information will result in more efficient salt use and applications at key points during the storm

Equipment/Materials Needs: The town will need computer workstation and peripherals including monitor, keyboard, mouse, and printer as well as a subscription to a custom meteorological service.

Estimated Reduction: The goal of the improved weather monitoring is to time chloride applications for maximum efficiency. While it is difficult to quantify reductions based on improved weather monitoring, Londonderry anticipates at

least several storms each season during which improved weather monitoring will reduce the need to reapply resulting in less chloride use.

4.5 BMP Overview Matrix

The town intends to continually evaluate and improve salt use efficiency and management to achieve maximum reductions feasible (economically and physically) through ongoing training and experience and take advantage of annual federal funding opportunities through the I-93 salt reduction program with the ultimate goal of meeting TMDL allocations. The Town's reduction goals based on equipment upgrades are: 8% for year 1, an additional 4% (12% total) for year 2 and an additional 4% (16% total) for year 3. The reduction goal based on spreader calibration is an additional 2% in year 1.

Table 11: Total BMP Reduction Overview Matrix for Rounds 1, 2, and 3

BMP	Watersheds	Reduction	
4.1 Equipment Upgrade Pilot	Beaver Brook	432.8	Tons/Yr
4.2 Improved Calibrations	Beaver Brook	54.1	Tons/Yr
4.3 Private Sector Outreach	Beaver Brook	0.0	Tons/Yr
4.3 Weather Monitoring System	Beaver Brook	0.0	Tons/Yr
Total Estimated Reduction:		**486.9**	**Tons/Yr**
Total Estimated Salt Imports After Improvements:		**2205**	**Tons/Yr**
TMDL Allocation:		**2264.4**	**Tons/Yr**

5.0 Implementation Timeline

The purchase and implementation have been completed and further purchase is on hold due to observed improvements in chloride concentrations in Beaver Brook and realized reductions in salt imports to the watershed.

Table 12: Project Timeline

Time Period	Action
July 2010 – August 2010	Municipal Plan Review
December 2010 – March 2011	Municipal Budgeting
May 2011	Budget Approval
April 2011-June 2011	Bid document Prep & Bidding
June 2011 – September 2011	Outreach Program
September 2011	Equipment Install & Training
Winter Season 2011-2012	Salt Reduction Ops. & Documentation
April 2012 – May 2012	Data Processing & Evaluation
February 2012 – May 2012	Plan Preparation for Funding Round 2
June 30, 2012	Submit Plan for funding Round 2
December - May 2013	Plan Preparation for Funding of Round 3
June 2013	Submit Plan for funding Round 3

6.0 BMP Evaluation

Underbelly plows - The town used underbelly scraper plows for 3 years. During this time the Town encountered significant maintenance problems including frozen hydraulics and truck frame damage. The Town ceased using these trucks in 2016 and returned to only using front mounted plows.

Prewetting brine system – The Town used prewetting system to prewet salt as it was being applied for 3 years. During this time, the Town encountered significant problems with sprayers nozzles frequently blocking and accelerated corrosion of brine spraying equipment and trucks. The Town ceased using prewetting in 2016 and no longer uses a brine prewetting system.

Magnesium Chloride - Magnesium Chloride was evaluated by the Salt Reduction Workgroup as a salt alternative. The Workgroup agreed to magnesium chloride is extremely corrosive to would cause more detriment to snow plowing and deicing equipment that benefit to be gained. Magnesium chloride could also be detrimental to existing infrastructure including utilities and bridges as well as public vehicles.

ICB Magic - ICB Magic is a distillery bottoms and magnesium chloride liquid which is added to salt and is reportedly much less corrosive than magnesium chloride alone. The ICB magic purportedly lowers the freezing temperature and acts as a deicer. The Town used ICB Magic one year. The Town did not observe a noticeable difference when using the ICB Magic-treated salt. In addition, personnel observed frequent caking or clumping of the ICB Magic treated salt which resulted in difficulty being applied and distributed by the truck-mounted spreaders.

7.0 Salt Usage Evaluation & Monitoring

Derry continues to monitor its salt usage with respect to TMDL compliance. Derry is committed to a multi-year program of efforts and operational modifications that would result in salt reduction with the goal of meeting TMDL load allocation requirements. Salt usage data is compiled throughout the winter and summarized and analyzed during the spring. Data is provided to state agencies on an annual basis and will be used in future salt reduction plans. Salt usage data will be substantiated with documentation such as invoices, cancelled checks, purchase orders, and or delivery receipts and be provided in total annual usage format based on fiscal/seasonal year.

DES proposed TMDL compliance will be measured using a 10-year average and confidence intervals as currently described in a DRAFT document titled "TMDL IMPLEMENTATION PLAN CONSIDERATIONS" dated April 15, 2010 prepared by NHDES and is included in Appendix F. This document is subject to change following additional Salt Reduction Workgroup discussions.

It is noted that determination of TMDL compliance hinges upon 1) monitoring conducted by DES at the compliance points and 2) DES having compliance point monitoring data publicly available in a timely manner.

Figure 3 compares the annual and 10-year running average salt use by the Town within the watershed. A best-fit polynomial trendline indicates a decreasing trend in the 10-year running average.

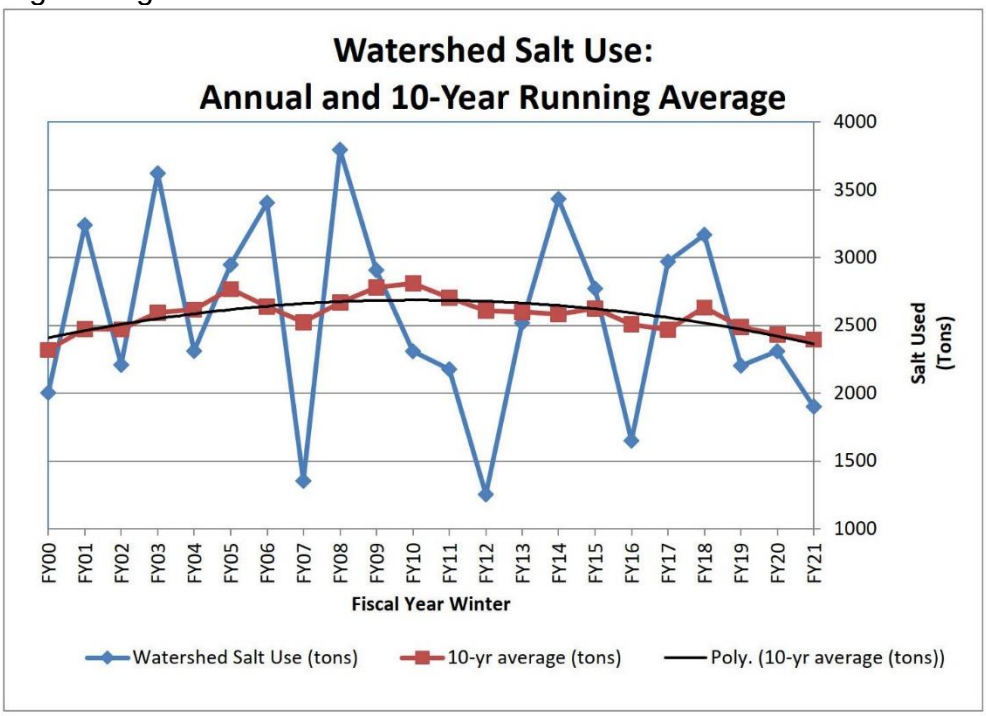


Figure 3: Watershed Salt Use – 10 Year Running Average

8.0 Summary

The town committed to and provided a written report and oral presentation to the salt reduction workgroup. The town is committed to reducing is chloride imports into the Beaver Brook Watershed by implementing the BMP's contained herein.

Appendix A

Municipal Resolution

And

Salt Reduction Plan Approval Memorandum

TOWN OF DERRY

Certificate

The Derry Town Council, after a duly noticed public hearing held on Tuesday, January 5, 2010, approved by a vote of 7-0-0, that the Derry Town Council authorize the Town Administrator to generate the Salt Management Plan for the purpose of supporting chloride reduction in the 1-93 Corridor.

See attached Resolution

Richard Metts, Chair
Derry Town Council

Denise E. Neale
Town Clerk

Received and Recorded Jan 7, 2010

RESOLUTION

The Town Council of Derry, New Hampshire

A resolution expressing the Town Council's commitment to reduce salt loading in impaired watersheds in the Interstate 93 Corridor

WHEREAS: Beaver Brook does not meet water quality standards for chloride; and,

WHEREAS: The Total Maximum Daily Load (TMDL) studies show that municipal road salt application must be reduced to meet water quality standards; and,

WHEREAS: The I-93 Corridor municipalities, private transportation facility managers, and the Department of Transportation are working together as the I-93 Salt Reduction Work Group to collectively reduce road salt application to Impaired watersheds

THEREFORE, BE IT RESOLVED BY THE TOWN COUNCIL OF THE TOWN OF DERRY, that the Town commits to reduce municipal application of road salt and to work with the New Hampshire Department of Transportation, the New Hampshire Department of Environmental Services and private salt applicators to reduce chloride loading to impaired watershed in the I-93 Corridor.

This resolution does not bind the town to any specific salt reduction technique.

The foregoing resolution was duly passed and adopted by the Derry Town Council this 5 day of January, 2010

Richard M. Metts, Chair
Town Council

ATTEST:

Town Clerk

Jeffrey H. Taylor & Associates
136 North Main Street, Suite 4
Concord, NH 03301
603-224-6555

December 6, 2010

TO: Salt Reduction Steering Committee Members

FROM: Steve Whitman

RE: Derry, Londonderry, and Windham Salt Reduction Plans

On Friday December 3, 2010 I circulated three local Salt Reduction Plans (Derry, Londonderry, and Windham, NH) by email to the New Hampshire Salt Reduction Steering Committee. A representative of each of the four agencies represented on the Steering Committee was asked to respond and indicate their support of these plans. Below is a record of the responses:

NH Department of Environmental Services – Eric Williams
Approved the Derry, Londonderry, and Windham Plans on 12/3/2010

NH Department of Transportation – Mark Hemmerlein
Approved the Derry, Londonderry, and Windham Plans on 12/3/2010

Federal Highway Administration – Jamie Sikora
Approved the Derry, Londonderry, and Windham Plans on 12/3/2010

Environmental Protection Agency – Carl DeLoi
Approved Windam plan on 12/3/2010, Derry and Londonderry on 12/6/2010

SECTION ALLOCATION AGREEMENT

Date: April 4, 2011

Re: Revised Beaver Brook Sector Allocation

Summary:

Pursuant to the sector allocation meeting of October 15, 2010 this agreement has been drafted to define the commitments of each party specifically with respect to private sector outreach.

Municipal Commitment: Derry and Londonderry (TOWNS) did not alter their TMDL sector allocations. The TOWNS reaffirm the private sector outreach efforts detailed in their salt reduction plans, including directly contacting private parking lot owners in the respective towns to inform them about certification and training opportunities provided through the University of New Hampshire Technology Transfer Center. Such communication will be provided annually.

DOT Commitment: An additional 244.7 tons was reallocated from the private sector to the State maintained (NHDOT) sector. It is agreed that this redistribution is reasonable as there is the potential for significant reductions within the private sector with a concerted team effort. NHDOT will continue to provide outreach to private parking lot owners and maintainers on the use of liquids for winter maintenance. Such outreach will include demonstrations at NHDOT park and ride lots in the southern I-93 corridor and reporting of the results of such demonstrations. NHDOT will co-sign letters to the local chambers of commerce promoting private sector certification and training on an annual basis.

Resulting Allocation: The following table details the agreed upon allocations per the sector allocation on October 15, 2010.

Beaver Brook NEW** TMDL Allocations

Source	Agency	FY08 Salt Imports (tons salt/yr)	Allocation of Loads (tons salt/yr)	Total Allocation
State Roads	NHDOT PS 508	126.7	97.92	1145.3
	NHDOT PS 512	375.4	290.33	
	NHDOT PS 513	124.3	96.14	
	NHDOT PS 514	187.4	144.97	
	NHDOT PS 528	667.2	515.93	
Municipal Roads	Auburn	12.0	7.3	2,983.6
	Chester	67.6	41.1	
	Derry	3,643.6	2,215.8	
	Londonderry	1,183.0	719.4	
Private Roads	Chester	23.9	14.5	316.4
	Derry	349.3	212.4	
	Londonderry	147.1	89.5	
Parking Lots	Derry	3,617.8	2,043.8	3,200
	Londonderry	2,046.6	1,156.2	
Salt Piles	Derry	0.3	0.0	0.0
	Londonderry	1.3	0.0	0.0
Water Softeners	NA	272.3	272.3	272.3
Food Waste	NA	149.5	149.5	149.5
Atmospheric Deposition	NA	95.1	95.1	95.1
Margin of Safety	NA		906.9	906.9
Total		13,090.3	**9,069.2**	**9,069.2**

Acceptance:

By signing this Sector Allocation Agreement the parties agree to perform the outlined outreach efforts, and agree to accept the revised sector allocations until such a time as they are amended with consent of all parties and approval of the Salt Reduction Work Group.

For NHDOT:

William J. Cass, P.E.
Director of Project Development
NHDOT

Date: 4/15/11

For NHDES:

Date: 4/20/11

For Derry, NH:

Date: 4/27/11

For Londonderry, NH:

Date: 5-10-2011

Appendix B
Derry Snow and Ice Policy
And
Winter Operations Booklet

TOWN OF DERRY
DEPARTMENT OF PUBLIC WORKS
WINTER MAINTENANCE
SNOW AND ICE CONTROL POLICY

MARCH 1999
(Revised October 2007)

Michael Fowler, P.E.
Director

Alan R. Cote
Supt. of Operations

TABLE OF CONTENTS

RESOLUTION

BE IT RESOLVED that the Town Council of the Town of Derry adopt the following statement of policy regarding winter snow and ice operations:

1) NOT WITHSTANDING the circumstances involved with changing climatic conditions, the Town will endeavor to keep Town roads and designated walkways in a reasonably safe condition for travelers and
2) Town employees will endeavor to exercise reasonable care and diligence in the performance of their duties, consistent with the intent of the current Town of Derry Department of Public Works Snow and Ice Manual and Procedures and
3) Travelers who use Town roads and designated walkways are expected to demonstrate due care and reasonable caution, especially under adverse winter conditions.

Executed at Derry, this _____ day of _____ 1999.

_____

Carol M. Granfield, Town Administrator

_____

Alan G. Swan P.E., Director

_____

Craig Bulkley , Council Chairperson

II. RESOURCES AVAILABLE

The Town of Derry has the following resources available to it in its winter operations: (See appendices for detailed listing.)

A. Weather information

Local Radio: WOKQ 97.5 FM
WZID 95.7 FM
Local T.V. WMUR CH 9
Cable T.V. NECN
Weather Channel

B. Personnel (see appendix A)

The Town D.P.W. has ten truck drivers, two equipment operators and three mechanics, and a road foreman available for normal storm responses. This includes personnel from Highway, Water, and Wastewater divisions. Additional manpower is available in the Parks, Buildings and Grounds and Solid Waste divisions.

Personnel are called in and assigned to work by the Supt. of Operations or "on call" foreman. Normally the truck drivers are assigned to their specific routes. An equipment operator loads trucks and the drivers not holding a commercial drivers license (C.D.L.) drive small trucks on assigned routes. Supervision is provided by the Director and/or Supt. of Operations during normal working hours and by the Supt. of Operations and/or "on-call" foreman during off hours. The Director provides supervision during off duty storms as needed depending on the severity of the storm.

C. Equipment:

The Town has available 7 "front line" dump trucks (3 ten wheelers, and 4 six wheelers equipped with hydraulic sanders, eleven foot bull plows, and eight foot

wing plows; one "low profile" dump truck, two one tons with wing plows, and several one tons and pickup trucks. The Town supplements its forces with contracted equipment including 33,000 GVW six wheelers with sanders and plows, one tons, pickup trucks, and loader/back hoes with plows from private contractors. Three pickup trucks are also available from the parks department to plow parking lots.

One 3 C.Y. loader is garaged at the Town Garage and is used to load trucks and plow the garage area. Another 3 C.Y. loader used at the transfer station is used as a backup to load trucks. This piece of equipment is also used to pull out trucks that are stuck and to plow parking lots.

The Town has three Trackless (articulated) sidewalk machines equipped with plows and snow blowers for large accumulations of snow. These machines are used to clear sidewalks.

D. Materials

Sand is purchased from a Town bid sand supplier and is stockpiled at the Town Garage. Approximately 1000 C.Y. are used each year. Sand is used as an abrasive for immediate traction but is not effective in melting ice.

Sodium Chloride (Salt) is purchased through a consortium bid. The Town will use approximately 3800 tons of salt in a normal winter. The Town strives to keep the salt shed as close to full as possible. The salt stock is replenished after each storm when possible. This is done to ensure a continuous supply of salt in the event of long duration storms or an inability to get salt for an extended period of time. Salt is most effective for melting purposes at temperatures above 20 degrees Fahrenheit, becoming slower acting as the temperature drops.

Calcium chloride flake is purchased in 100# Bags to mix with salt in trucks when temperatures drop below 6 degrees Fahrenheit and is expected to stay that cold for more than two days. This material is mixed manually adding about 200# to a six ton load of salt. Calcium chloride is used to activate the rock salt. If it is

judged to be excessively cold and salt will be ineffective straight sand may be applied to try to offer traction with grit.

III. OPERATIONS:

A. General:

Winter weather in northern New England is difficult to predict. There are many variables affecting winter maintenance operations such as type of precipitation, air temperature and pavement temperature, traffic, wind, time of day, and day of week.

The Public Works Department's snow removal and ice control policy has been based for many years on the goal of obtaining bare and dry pavements at the earliest practical time following the cessation of a storm. It is virtually impossible to provide bare pavement during a winter storm and the Public Works Department does not attempt to do so.

Traffic volume and speed are the primary factors in determining the level of winter maintenance service (effort) with gradient also being an important factor. Therefore, the principal arterials including West Broadway, East Broadway, North Main Street, South Main Street, Chester Road, East Derry Road, Crystal Ave., Birch Street, Rockingham Road, Tsienneto Road, and Pinkerton Street as well as other heavily traveled roadways are maintained in such a manner that bare pavement in produced as soon as possible after termination of a storm. On other town roadways, the Public Works Department attempts to provide some bare pavement, but not necessarily shoulder to shoulder, within a day or two of the storms end.

It is impractical to develop specific rules on winter maintenance operations. Due to numerous variables involved in winter storms, the judgement of the on-call foreman, the Supt. of Operations, or the Public Works Director governs the

quantities and type of material used to control snow and ice. In general, the purpose of salt is to (1) reduce adherence of snow to the pavement, (2) keep snow in a "mealy" condition and thereby permit nearly full removal by plowing, and, (3) prevent the formation of ice or snow ice (hardpack). Salt is not intended to eliminate the need for snow plows. Sand treated with chlorides to prevent freezing in stock piles is used when temperatures become to cold for salt to activate, around Beaver Lake and Island Pond, and on gravel roads.

The Derry Public Works Department has the responsibility for maintaining essential services on over 160 miles of Town roadways, of which 2% are gravel and 98% are paved. A significant portion of the Department's overall efforts is directed towards maintaining the essential transportation services during periods of high precipitation, low temperatures, and heavy winds.
The Public Works Director has direct responsibility for daily operation of the Department, acting under the general direction of the Town Administrator. The Supt. of Operations supervises the day to day operations of the highway department. Appendix A contains an organizational chart identifying Department positions and individuals.

B. Applications

1. Application of De-Icing Materials

The use of chemicals, abrasives, or chemical-abrasive mixtures is dependent not only on present roadway and weather conditions, but also on anticipated changes in these conditions and fiscal constraints experienced by the Public Works Department. The effects of peak traffic periods, approaching nightfall or

daybreak, predicted temperature changes, and end of storm, are considered and evaluated prior to selecting the proper materials or rate of application.

Adverse roadway conditions existing during periods of low temperatures which are predicted to rise would generally be treated in accordance with the recommendations for the higher temperature. If the time of day, trend and weather forecast is such that a drop in temperature may reasonably be expected, treatment would generally be for the lower temperature. Neither chemicals nor abrasives should be used at low temperatures if the pavement is dry and snow is blowing off the pavement.

Generally straight sodium chloride is the chemical of choice for most storm situations. Sodium Chloride is used to prevent snow and ice build-up on the pavement and to aid removal of any build-up that occurs.

The recommended guideline to adequately maintain highways is 300 lbs. per lane mile.

For exceptionally high volume roads where traffic will enhance the action of salt, this rate may be decreased to 200 lbs. per lane mile.

Abrasive –chemical mix may be needed at extremely low temperatures or on very lightly traveled roadways.

Chemicals are generally applied to the middle 1/3 of pavement width and on high side of bank curves. Spread width may be increased or decreased depending on action of traffic. Materials are applied early in the storm s that brine develops on the pavement and prevents build-up of packed snow. If snow continues and accumulates on the pavement plowing should continue. At the end of the storm when all roadways have been plowed, an additional treatment of salt and /or abrasives may be applied if deemed necessary.

There are many additional circumstances which will necessitate modifications to these treatments. Some circumstances are:

- Rising or Falling temperatures
- When pavement is cold and dry and dry snow is falling, chemicals may not be applied. Plowing and treatment of icy spots, if they develop is recommended.
- An abrasive and chemical mix may be needed at extremely low temperatures or on very lightly travelled roadways. Under these conditions the effectiveness of salt is reduced and abrasives may be needed for traction.

Spreading Practices

Each spreading unit should be calibrated each year prior to the winter season to insure that selected rates of application are attained. Timing of the initial application during each storm is very critical. It should be delayed until there is sufficient accumulation on the pavement to hold and contain the material spread. However, the pavement may become glazed prior to this time and may require an earlier treatment.

Portions of the town are peculiar due to various physical conditions and will require a greater application rate or an additional application during some storms. However, these areas should be judged and treated separately and not used as a barometer to evaluate and subsequently direct complete applications over the entire town. In order to conduct efficient operation, periodic observation of the pavement surface conditions must be performed.

Width of material spread (throw plus roll) should be restricted. Reduction of the spread width by windrowing chlorides will increase the concentration of the

chemical where it is needed and therefore increase the effectiveness of the application. Spreading operations should generally be conducted at speeds less than 25 mph. Air turbulence created at speeds in excess of 25 mph makes it difficult to retain all the material discharged within the desired width. Spinner and belt speeds and spread pattern must be adjusted to obtain the correct spread rate and to retain the material within the lane(s) where additional material is required.

Plowing Operations

Plowing operations are generally initiated after two inches of snow has fallen and continues until the storm has ended. In some cases of long duration storms plowing may be suspended in order to allow drivers to go home and get some sleep. Widening and intersection view clearing is performed following the storm and generally during daylight hours when best visibility prevails.

For snowstorms with a predicted accumulation in excess of two inches, plowing usually begins after the initial salt application has formed a brine and after two inches of snow has fallen (dependent on the intensity of the snowfall) and continues for the duration of the storm. Following plowing operations a light salt application to remove remaining residue may be appropriate.

For light accumulation snowfalls, snow squalls, and so-called "Alberta Clippers" of short duration, plowing may begin immediately and may include simultaneous salting and /or sanding to provide desire results quickly and efficiently.

Truck mounted front plows and in some cases wing plows are utilized to clear roadways of frozen precipitant. Storm intensity generally measured in inches per hour varies considerably in New Hampshire but average major snow storms are approximately one inch per hour. This one inch per hour intensity rate and the allowable snow accumulation is used in planning the availability of equipment

necessary for snow plow operations. The planned allowable snow accumulation on most roads in town is 3 ½ inches with a maximum allowable accumulation of 6 inches and a planned plowing frequency of 3 ½ hours. On some of the principal arterials the planned allowable snow accumulation is 2 ½ inches with a maximum allowable accumulation of 5 inches and a planned plowing frequency of 2 ½ hours. These above mentioned figures are based on an average of 1" per hour under optimum conditions (i.e., no traffic tie ups due to accidents or stuck vehicles and no equipment breakdowns. The maximum allowable depth of snow that a motorist may encounter on highway pavements does not include blizzard conditions or heavy wind and drifting conditions.

Frozen precipitation including sleet and the build up of ice caused by freezing rain are special situations and are not subject to the procedures indicated above. When a changeover from snow or sleet to freezing rain is predicted or anticipated, snow and/or sleet is left on the pavement to capture the freezing thereby preventing a glare ice situation, which without question is the most treacherous condition that occurs on highways.

Judgment based on experience is essential in conducting and timing remedial work to overcome ice and snow hazards. Each storm situation varies, so therefore it must be emphasized that these (general) guidelines are strictly advisory which in no way restricts the freedom of judgement exercised by the On-call Foreman, Supt. of Operations, or Public Works Director.

C. Communications:

1.) Prior to Storm

The Director, Supt. of Operations, On-call Foreman, and Chief Mechanic communicate prior to the storm to determine the level of readiness and probable initiation of snow and ice control operations. The Director and Supt. of Operations utilize the various weather forecasting sources available, as well as

communications from Local Police and School Officials. Normally, the Supt. of Operations monitors the onset of the storm or ice conditions via telephone and Town radio with the Director, Foreman, and Police personnel as appropriate.

2.) Onset of Storm:

Phone or Town radio communications are utilized as the Director and Supt. of Operations make the decision to initiate the Department's response or receive word from the Police Dept. or Fire Dept. that a response may be necessary. Calls to the Director, "On-call Foreman", Police, School Officials, or other highway departments are made as required. Normally the Director and the Supt. of Operations communicate at the storm onset to verify the initial Department response.

The Director, Supt. of Operations, Foreman, or their designee then calls in the response team as required according to procedures.

3.) During Storm Operations

Radio communication is maintained with all response vehicles at least every hour. Special instructions and requests for service are taken via telephone or radio at the Highway garage or D.P.W. office and relayed via radio to appropriate responding personnel. All such requests are logged and transmitted by radio to the Supt. of Operations or Foreman as required. The Supt. of Operations or Foreman will dispatch personnel and equipment when they become available or immediately if it is deemed to be an emergency. The Director or Supt. of Operations or designee will determine the extent of the emergency.

All communications, telephone or radio, with the Director, Supt. of Operations, School Administrators, Bus Managers, Police, and Fire continue at appropriate intervals during the storm.

A log of all incoming calls and response actions is maintained in the Public Works office or garage. Any problems with communications or communications equipment should be noted in the log.

4.) Wrap Up After The Storm

At the close of the snow/ice operations the Supt. of Operations, Director, and On-call Foreman notify each other via telephone or radio that operations are ended and:

a. Where each supervisor will be for follow up communications.
b. Who is available for follow up actions and investigations.
c. The status of equipment, i.e., any major equipment that is down, whether trucks are loaded or not etc.
d. The status of responding personnel i.e., who is next for call-in, supervision, etc.
e. Any potential weather related problems to monitor, i.e., drifting snow, icing conditions, etc.

Following the storm-generally on the following day, the storm log is reviewed by the Director, Supt. of Operations, Foreman, and Lead Mechanic as appropriate and required actions or repairs are initiated. Following this, a meeting with the response team should be held to review the storm log and any problems that have occurred.

D. Storm Log

Beginning with the arrival of the Supt. of Operations or responding supervisor at the town garage, a storm log is initiated and kept through the storm event to note all communications, conditions, major events, and requests for service received.

At a minimum, the following information is noted on the log with the time of occurrence:

a. Time each responding piece of equipment begins operation.

b. Weather conditions, snow accumulations and temperature on an hourly basis.
c. Radio checks with responding vehicles on an hourly basis.
d. Driver rest periods (on and off air) .
e. Any reported problems from drivers or operators including equipment failure.
f. Time equipment is down and time that equipment is back in service.
g. Supervisors' comments on storm progress and progress of department operations.
h. Report on accidents and special situations, especially Police calls.

E. Response Teams

Department responses will vary with the conditions encountered, personnel, who are available for work, the time of day and day of week, the temperatures, overall road conditions, preceding weather, anticipated weather, etc.

All things being equal, the Department response teams are as follows:

1.) Spot Salting

The on-call team (three men) will be called in. The on-call foreman will determine whether additional help is needed to cover the icy spots than his team. If necessary he can contact the Highway Coordinator for advice as to whether or not to call in additional help. If additional help is needed, the overtime rotation list is utilized to determine who will be called in to duty.

2.) Salting

When conditions warrant all routes will be salted, all town sanders and all contractors' sanders will be called in to duty. The on-call foreman will run the

operation at this time from the Garage and will only go out on a truck if sufficient drivers can not be located.

3.) Normal Winter Storms

Response to normal winter storms will vary with the storm. Generally, a storm will progress from salting operation to plowing when snow accumulations reach about 2 inches. Response teams will vary from minimum manning to full crew depending on the rate of snow, anticipated conditions, equipment breakdowns, time of day, etc. The Supt. of Operations will be called in to determine when to start plowing and supervise operations.

4.) Blizzard Conditions

Generally, blizzards develop rather than being predicted. When heavy snow and high winds are encountered, all Department personnel may be called to assist in clearing snow from roads and town facilities. A secretary will usually be asked to work answering phone calls and act as a facilitator. All Town personnel must be available if the Director declares an emergency.

F.) Blowing and Drifting Snow

Quite often after a cold, dry snowstorm, blowing and drifting snow will begin to drift across roadways creating hazardous travel conditions.

Areas that are generally prone to drifting include:

Tsienneto Road	Humphrey Road
Folsom Road (near the police dept.)	West View Drive
Old Auburn Road	Kilrea Road
Island Pond Road (near Warner Hill Road)	Damren Road
Pingree Hill Road (near Ledgewood Drive)	Walnut Hill Road
A Street	B Street
English Range Road	Adams Pond Road

G. Towing

Often during snow removal operations, stranded vehicles will be encountered on Town roads. When a car is on a Town road in such a condition, it may be towed under the Town's winter parking ban/ordinance. (See appendix E)

Procedures for having a car towed are as follows:

- Operating personnel call the garage base station who notify the Derry Police at 432-6111. The make of the car, the plate number, and location are given.
- Persons contacting the Public Works Department to retrieve their car after a storm are referred to the Derry Police Department at 432-6111.

H. Post Storm Operations

After a storm event or during periods of lessened storm activity, a number of operations take place to ensure readiness for subsequent winter operations.

1. Equipment inspected using preventative maintenance techniques and repairs made as necessary. Special attention is given to tires, brakes, snowplows and sanders including shoes, bearings, spinners, and hydraulic feed systems.
2. Materials, especially salt, are reordered in order to insure adequate stockpile.
3. Plow routes are driven and checked for identification of problems, especially illegal plowing by driveway contractors, problem mailboxes, snow castles, etc. It is the responsibility of the route driver to identify these problems and report them to their supervisor.
4. It is important to push back snow on road shoulders following each major storm and to clear critical areas to make room for future storage. If the snow

bank height becomes excessive, the top of banks are cut down for proper visibility or future snow storage. If the snow is allowed to melt in place and refreeze, the result is a heavily compacted mass which can not be moved without considerable efforts by snow plows. Therefore, pushing back is an ongoing function which is addressed as soon as the storm subsides and the amount of stockpiled snow dictates that pushing back is needed.

5. The Town begins snow removal (hauling away) when there becomes a need to create storage space for snow and will be done under the following priority list:

Major intersections where sight distance is impaired.

West Broadway from Horne Brook to Merchants Row.

East Broadway from Merchants Row to Derry Public Library.

Crystal Ave. from East Broadway to Ross's Corner.

Birch Street from East Broadway to Beaver Brook.

Folsom Road

Central Street

South Ave.

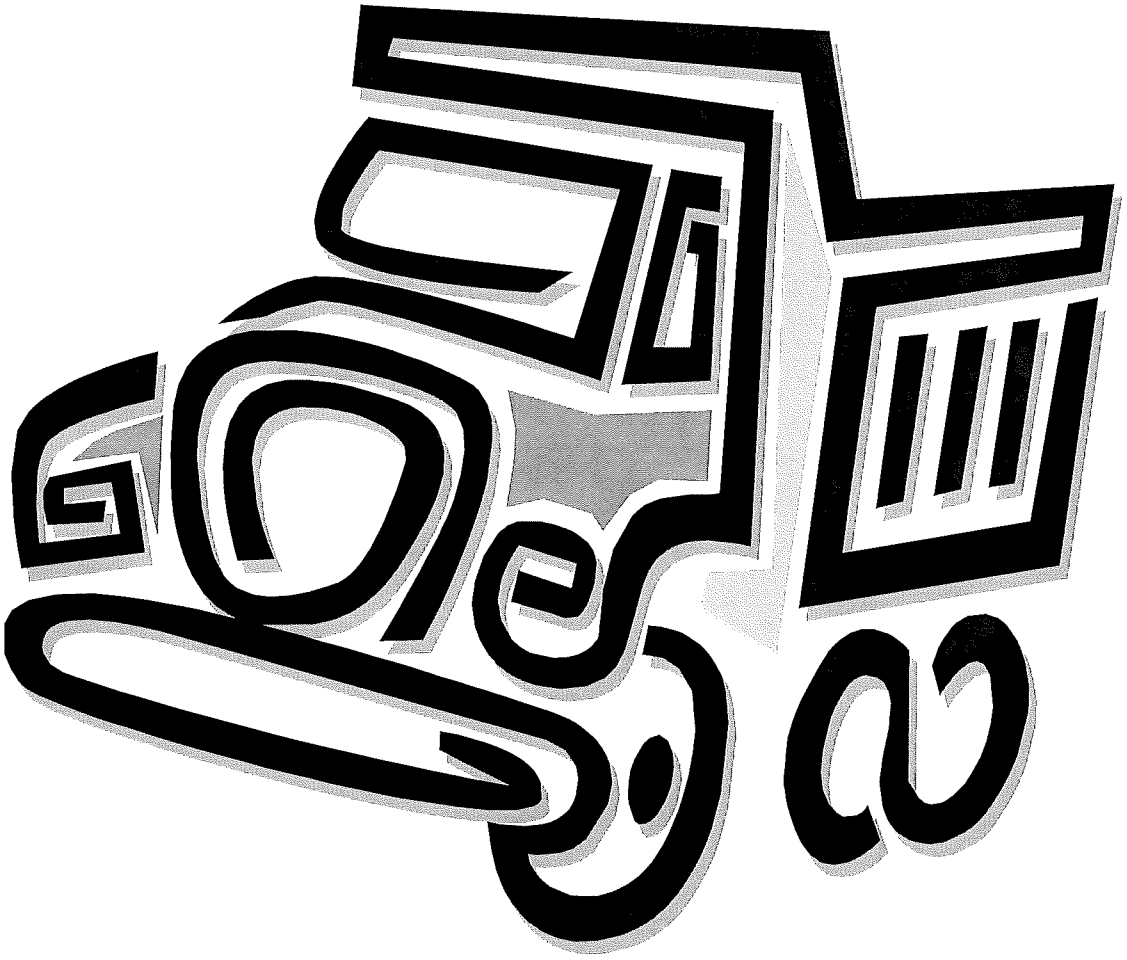
IV. Public Information

Town residents are advised prior to each winter season of the Town's overnight parking ordinance, mailbox policy, winter safety tips, etc.

In addition, the local media is used to inform residents of particular problems encountered during the winter such as ice pack, drifts, and other unusual circumstances encountered from time to time during the winter.

Finally, the Town's Emergency Management System may be utilized during the winter emergencies.

TOWN OF DERRY



WINTER OPERATIONS BOOKLET

2017-2018

Revised as of December 8, 2017

CONTRACTORS SNOW PLOW LIST
2017-2018

COMPANY	PHONE #	EQUIPMENT
[redacted]	[redacted] Office 9-4pm [redacted] Home ([redacted]) [redacted] Cell [redacted] Cell [redacted] Cell [redacted] (Salter) [redacted] (Salter)	1 – 5 Ton Plow w/salter 2 – Dodge Rams - ¾ ton Trks 1 – JD Backhoe 310 1 –Hyundai Loader HL760-9 1 – Chevy - ¾ ton Trk
[redacted]S ([redacted]s)	[redacted] Home (1) [redacted] Office (2) [redacted]	1 – Ford F250
[redacted]	[redacted] Home [redacted] Office [redacted] Cell #	1 - Chevy Pickup 3 – International 5 Ton DT466E
[redacted]T.	[redacted] H [redacted] C	3 – 6 Wheeler Intl
[redacted]	[redacted] C	1 – Dodge RAM
[redacted]G	[redacted]	1 Chevy Pkup

PLOW VEHICLE CALL NUMBERS 2017/2018

Plow Route Assignment	Veh #/ Vehicle	Driver	Salter
1 - Overledge, Hemlock Springs	575	[redacted]	Y
2 - Scobie Pond, By-Pass West	Rich Brown #2		Y
4 – Barkland Acres, Linlew Dr	606	[redacted]	Y
5 – Hillside Ave, Folsom Rd	Remi 1 Ton/590	[redacted]	
6 – Derry Village, Hood, Lenox	624/618/Todd Tree	[redacted]	
7 – Aiken, South Ave, Highland	629/B Searles 1 ton & PU	[redacted]	
8 – Nortonville, Franklin St	624/AEC Backhoe	[redacted]	
9 – Quail Hill, Bowers, Kendall Pd	Remi Loader		
10 – Montgomery Farms	Remi-5 Ton/Pick Up	[redacted]	Y
11 – Conley/Escumbuit/Collette's	634	[redacted]	
12 – Windham Depot, Frost Rd	Rob Brown 5 ton #2		Y
13 – Sunset Acres, Maple Hills	Rob Brown 5 ton #3		Y
14 – Fairways, Lane Rd, Cemetery	625	[redacted]	Y
15 – Kilrea Rd, Goodhue Rd	607	[redacted]	Y
16 – Island Pond Rd, Drew Rd	574	[redacted]	Y
17 – Meadowbrook, Spollette Dr	Rob Brown 5 ton #1	[redacted]	Y
18 – Warner Hill Rd, Village Brk	605	[redacted]	Y
19 – Walnut Hill, Damren, Back Chester	Rich Brown 5 ton	[redacted]	Y
20 – Old Auburn, English Range Rd	577	[redacted]	Y
21 – Rainbow Lake	622	[redacted]	
22 – Beaver Lake	Remi-1 ton/Backhoe	[redacted]	
23 – Downtown	535	[redacted]	Y
24 – Stark Rd, Woodlands	651	[redacted]	Y

Spare Trucks 622 – Wastewater
Spare Trucks 594 & 621 – Vehicle Maint.

* - One ton cleanup of corner Routes 17 & 19 –Veh 554
** - One ton cleanup of corners Routes 9 & 13 – Veh 532

Parking Lots	548	[redacted]
	Backhoe w/push box	[redacted]
Gerrish CC, DPL, Taylor Lib and AC	532	[redacted]

Wall St, DMC, Abbott Cr, Merchants Row - Downtown Clean Up – Trucks 601/557A – [redacted]

Police Dept & Central Fire Station 628 [redacted]

Revised as of December 8, 2017

CONTRACTORS SALTER LIST
2017-2018

COMPANY	PHONE #	EQUIPMENT
[redacted]	[redacted] Office 9-4pm [redacted] Home (Bryan) [redacted] Andy (Salter)	2 – 5 Ton Plow w/Salter
[redacted]	[redacted] H [redacted] C	1 – 6 Wheeler Intl
[redacted]	[redacted] Home [redacted] Office [redacted] Cell	1 - Chevy Pickup 1 – International 5 Ton DT466E

SALT VEHICLE CALL NUMBERS 2017/2018

Salt Route Assignment	Veh #/Vehicle	Driver
1 – Old Auburn, English Range, Off Chester RD	577	[redacted]
2 – Montgomery Farms & Derryfield Rd	[redacted]	[redacted]
3 – Windham Depot, Frost Rd	[redacted] #2	Contractor
4 – Warner Hill Rd, Village Brook	605	[redacted]
5 – Rainbow Lake, Beaver Lake, Collette's (SAND)	626	[redacted]
6 – Kilrea & Gulf Rd	607	[redacted]
7 – Upper By-Pass 28, Pingree Hill Rd	575	[redacted]
8 – Downtown West, Sunset Aceas	[redacted] #3	[redacted]
9 – Walnut Hill, Damren, Back Chester Rd	[redacted] #1	[redacted]
10 – Island Pond Rd, Drew Rd	574	[redacted]
11 – Derry Village & off Hampstead Rd	[redacted] #1	Contractor
12 – Broadway, Crystal Ave, No. Main St	535	[redacted]
13 – Lower By-Pass 28, Barkland Acrea	606	[redacted]
14 – A St, Hillside Ave, Franklin St, Lenox Rd	[redacted] #2/625	Contractor/[redacted]

SNOW PLOW TEAMS 2017/2018

TEAM #1

TEAM #2

TEAM #3

TEAM #4

Highway Numbers - On Call phone –
Beeper
Beeper

Vehicle Maintenance On-Call Phone –

Building & Grounds Beeper –

Highway On-Call Nextel phone #
Bill Buxton-Hwy Crew Chief Cellphone #

TOWN OF DERRY
SNOW PLOW PERSONNEL - PHONE NUMBERS
WINTER SEASON 2017-2018

[redacted]..... [redacted]c
[redacted]D..... [redacted]c
[redacted]N..... [redacted]c
[redacted]..... [redacted]c
[redacted]..... [redacted]c
[redacted]..... [redacted]8
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[redacted]..... [redacted]
[redacted]..... [redacted]
[redacted]..... [redacted]

ALTERNATES

[redacted]..... [redacted]c
[redacted]..... [redacted]1
[redacted]..... [redacted]c / [redacted]h
[redacted]..... [redacted]c
[redacted]..... [redacted]
[redacted]..... [redacted]c

[redacted]	[redacted] VERIZON		
[redacted]	[redacted] VERIZON	[redacted] HOME	
BLDG MAINT. BEEPER	[redacted] VERIZON	[redacted] HOME	
HIGHWAY ON CALL PHONE	[redacted] FOREMAN		
HIGHWAY BEEPER	[redacted]	[redacted] BEEPER	[redacted] BEEPER
STATE SHED (Div #5)	666-3336		
[redacted]	[redacted]		
WASTEWATER BEEPER	[redacted]		
WATER BEEPER	[redacted]		
VEHICLE MAINT	[redacted]		

[redacted]..... [redacted] [redacted]T ..... [redacted]
[redacted]..... [redacted] [redacted]X ..... [redacted]

Revised as of December 8, 2017

STORM LOG **DATE OF STORM____/____/____** **TIME RESPONDING____________**

EMPLOYEES CALLED AND/OR RESPONDING				IN	OUT	CALL BACK
[redacted]	Y	N	[redacted](c)			
[redacted]	Y	N	[redacted](c)			
[redacted]	Y	N	[redacted](C)			
[redacted]	Y	N	[redacted](C)			
[redacted]	Y	N	[redacted](C)			
[redacted]	Y	N	[redacted] C			
[redacted]	Y	N	[redacted]	--------	--------	----------------
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted]			

[redacted]	Y	N	[redacted](C)			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted](C) [redacted](H)			
[redacted]	Y	N	[redacted] (C)			
[redacted]	Y	N	[redacted]			
[redacted]	Y	N	[redacted](C)			
[redacted]	Y	N	[redacted]			

STORM LOG cont.

DATE OF STORM_____/_____/_____

TIME_____

Road conditions: DRY _____ WET _____ ICY _____

SNOW COVERED _____ SNOW PACKED _____

Weather conditions: CLEAR ____ CLOUDY _____ WINDY _____(MPH)

RAINING _____ FREEZING RAIN _____ SLEET _____

SNOWING Light_____ Moderate _____ Heavy_____

TEMPERATURE _____

Actions being taken: SANDING/SALTING_____ PLOWING_____

Comments on current operations:

_____

_____

_____

_____

_____

_____

TIME_____

Road conditions: DRY _____ WET _____ ICY _____

SNOW COVERED _____ SNOW PACKED _____

Weather conditions: CLEAR ____ CLOUDY _____ WINDY _____(MPH)

RAINING _____ FREEZING RAIN _____ SLEET _____

SNOWING Light_____ Moderate _____ Heavy_____

TEMPERATURE _____

Actions being taken: SANDING/SALTING_____ PLOWING_____

Comments on current operations:

_____

_____

_____

_____

_____

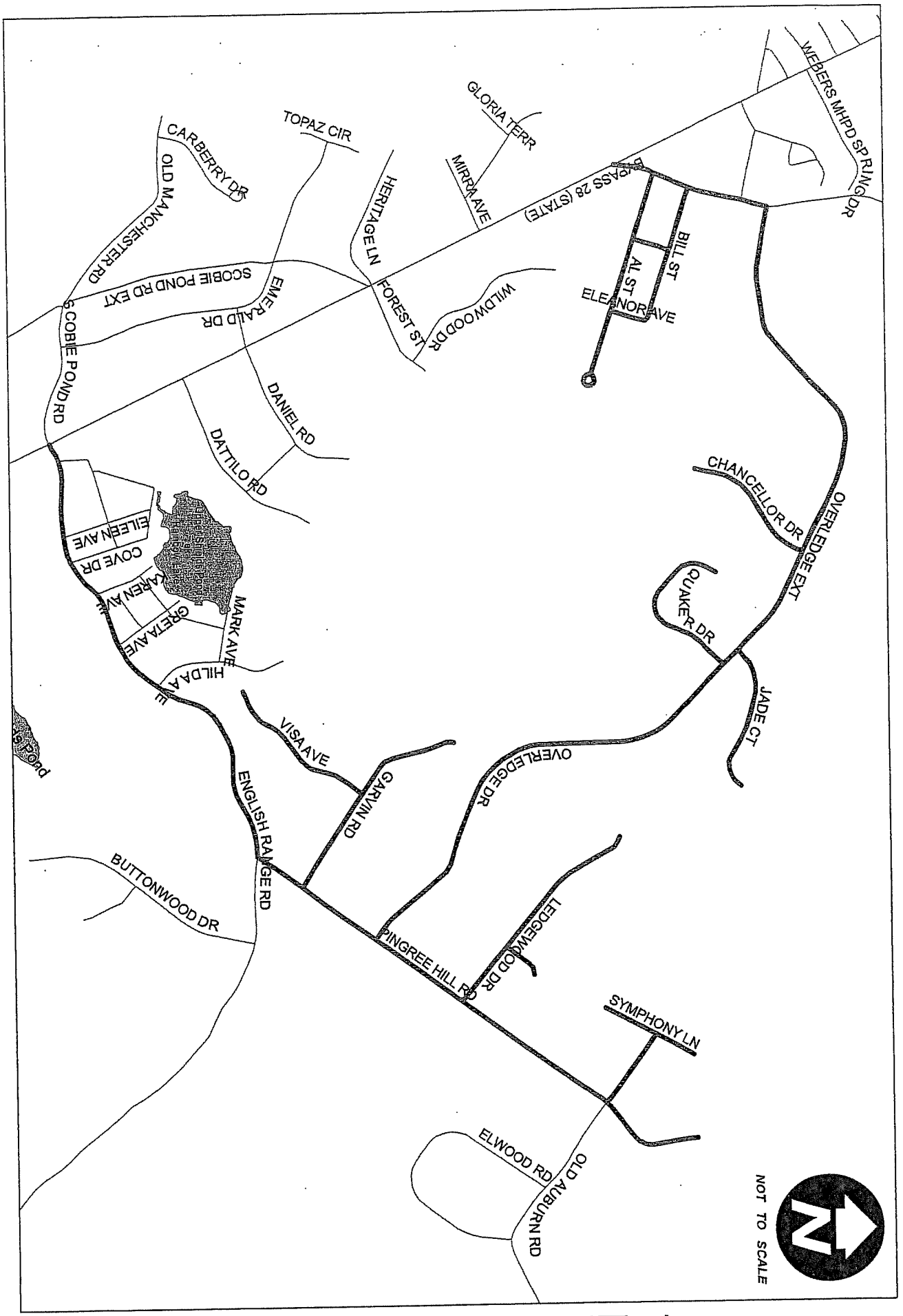
Appendix C Derry Town-Wide Municipal Salt Usage Summary

FY1991 through FY2019

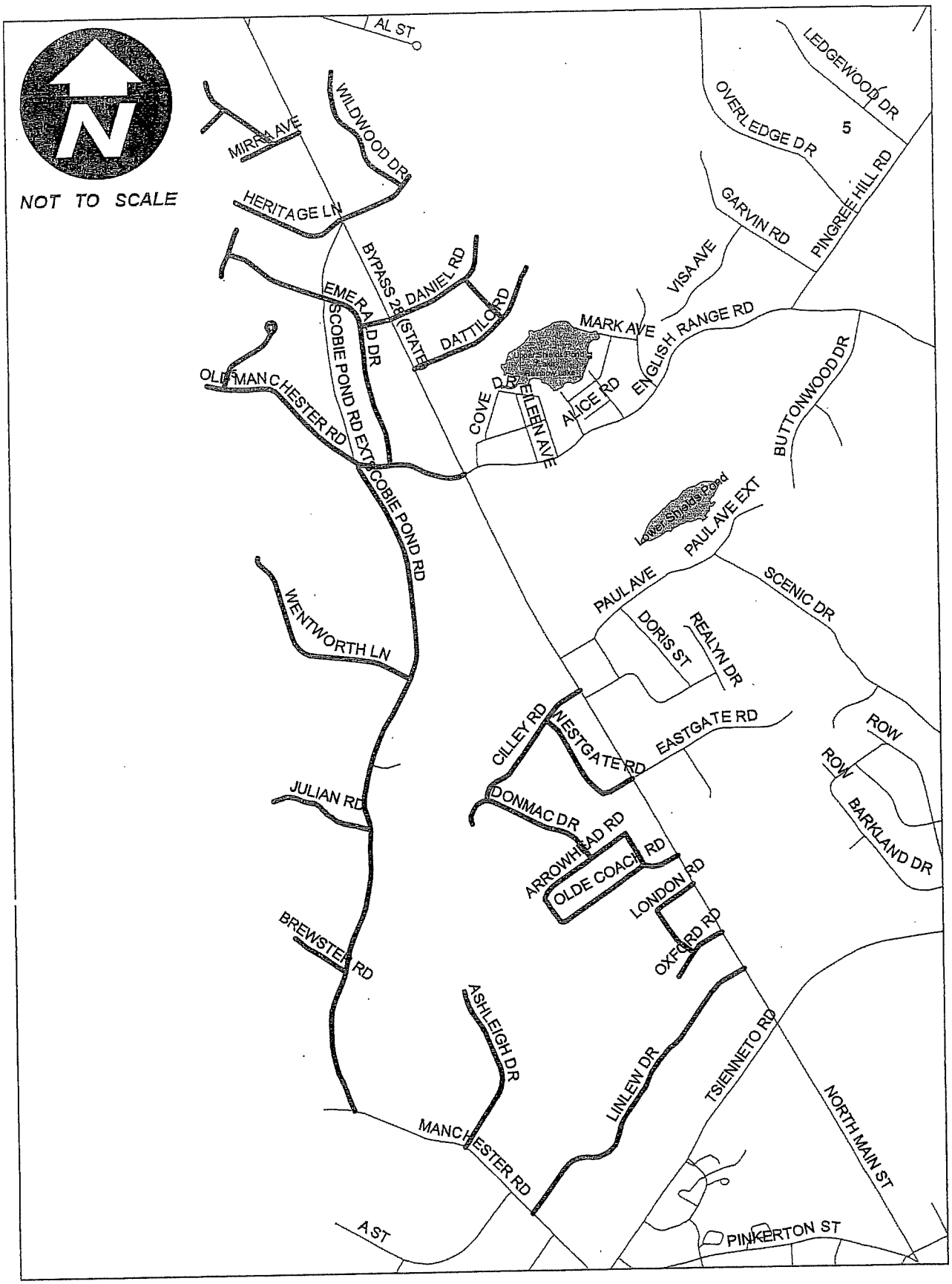
Fiscal Year	Town-Wide Salt Use (tons)	10-yr average (tons)	5-yr average (tons)	Watershed Salt Use (tons)	10-yr average (tons)	5-yr average (tons)
FY19	3340	3770	4090	2204	2488	2699
FY18	4800	3989	4170	3168	2633	2752
FY17	4500	3739	3686	2970	2468	2433
FY16	2500	3799	3486	1650	2507	2301
FY15	4200	3977	3653	2772	2625	2411
FY14	5200	3914	3688	3432	2583	2434
FY13	3818	3940	3779	2520	2600	2494
FY12	1900	3952	3771	1254	2608	2489
FY11	3300	4097	3802	2178	2704	2509
FY10	3500	4258	4173	2310	2810	2754
FY09	4407	4211	4366	2909	2779	2882
FY08	5750	4041	4185	3795	2667	2762
FY07	2051	3825	4133	1354	2525	2728
FY06	5158	4000	4392	3404	2640	2899
FY05	4465	4195	4342	2947	2769	2866
FY04	3503	3965	4056	2312	2617	2677
FY03	5486	3931	3897	3621	2595	2572
FY02	3347	3745	3518	2209	2472	2322
FY01	4910	3747	3608	3241	2473	2381
FY00	3035	3516	4048	2003	2321	2672
FY99	2708		3873	1787		2556
FY 98	3590		3965	2369		2617
FY 97	3796		3972	2505		2622
FY 96	7110		3886	4693		2565
FY 95	2160		2984	1426		1970
FY 94	3171			2093		
FY 93	3625			2393		
FY 92	3365			2221		
FY 91	2600			1716		

Note: Fiscal Year runs July 1 through June 30
i.e., FY10 is July 1, 2009 through June 30, 2010

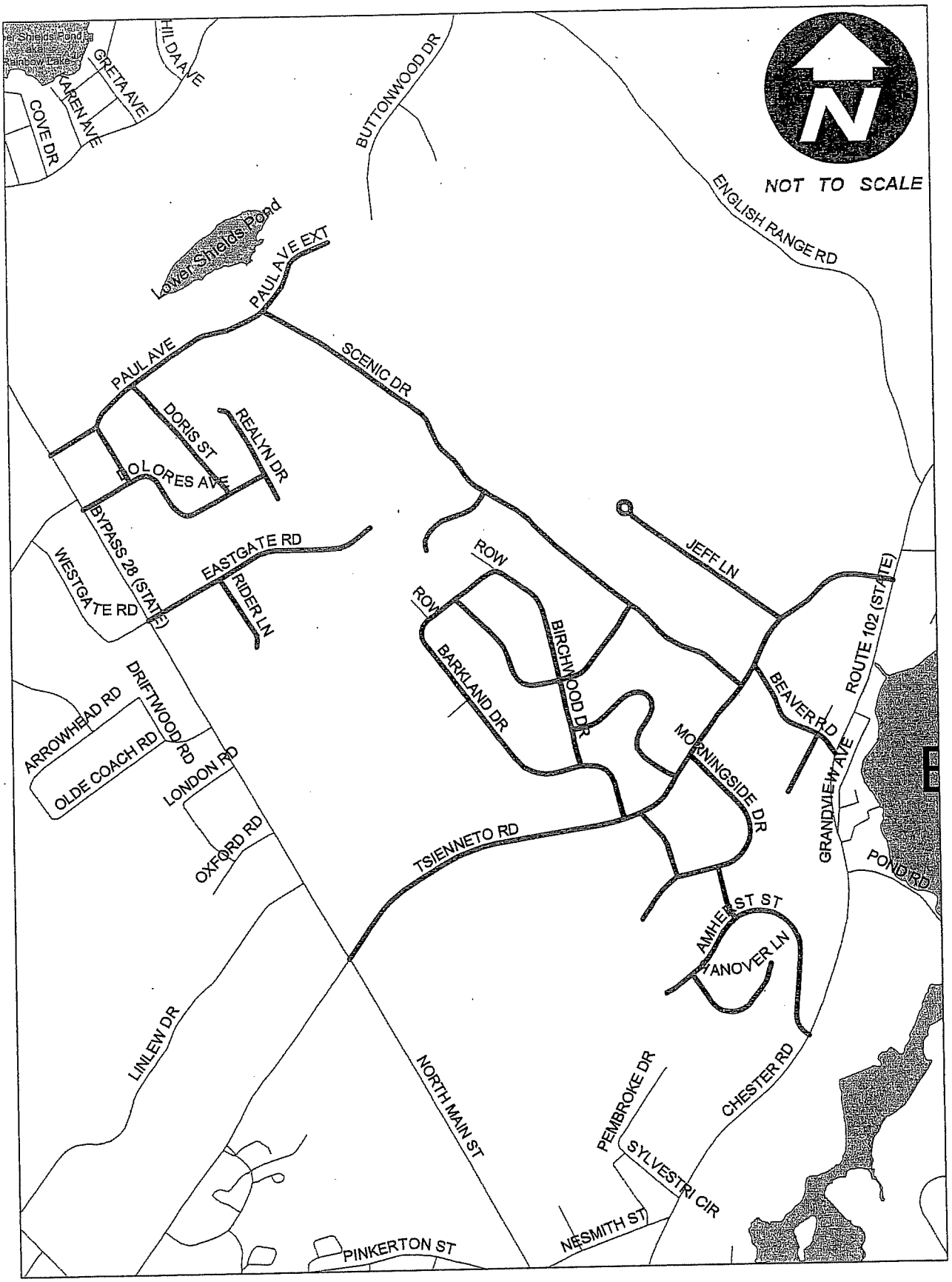
Appendix D Derry Town-Wide Plow Route Maps


WEBERS MHPD SPRING DR
BYPASS 28 (STATE)
GLORIA TERR
TOPAZ CIR
MIRRA AVE
CARBERRY DR
OLD MANCHESTER RD
HERITAGE LN
SCOBIE POND RD EXT
EMERALD DR
FOREST ST
WILDWOOD DR
BILL ST
ALST
ELEANOR AVE
SCOBIE POND RD
DANIEL RD
DATTILO RD
CHANCELLOR DR
OVERLEDGE EXT
EILEEN AVE
COVE DR
KAREN AVE
GRETA AVE
MARK AVE
HILDA AVE
QUAKER DR
JADE CT
VISA AVE
GARVIN RD
OVERLEDGE DR
ENGLISH RANGE RD
BUTTONWOOD DR
LEDGEWOOD DR
PINGREE HILL RD
SYMPHONY LN
ELWOOD RD
OLD AUBURN RD
NOT TO SCALE
N

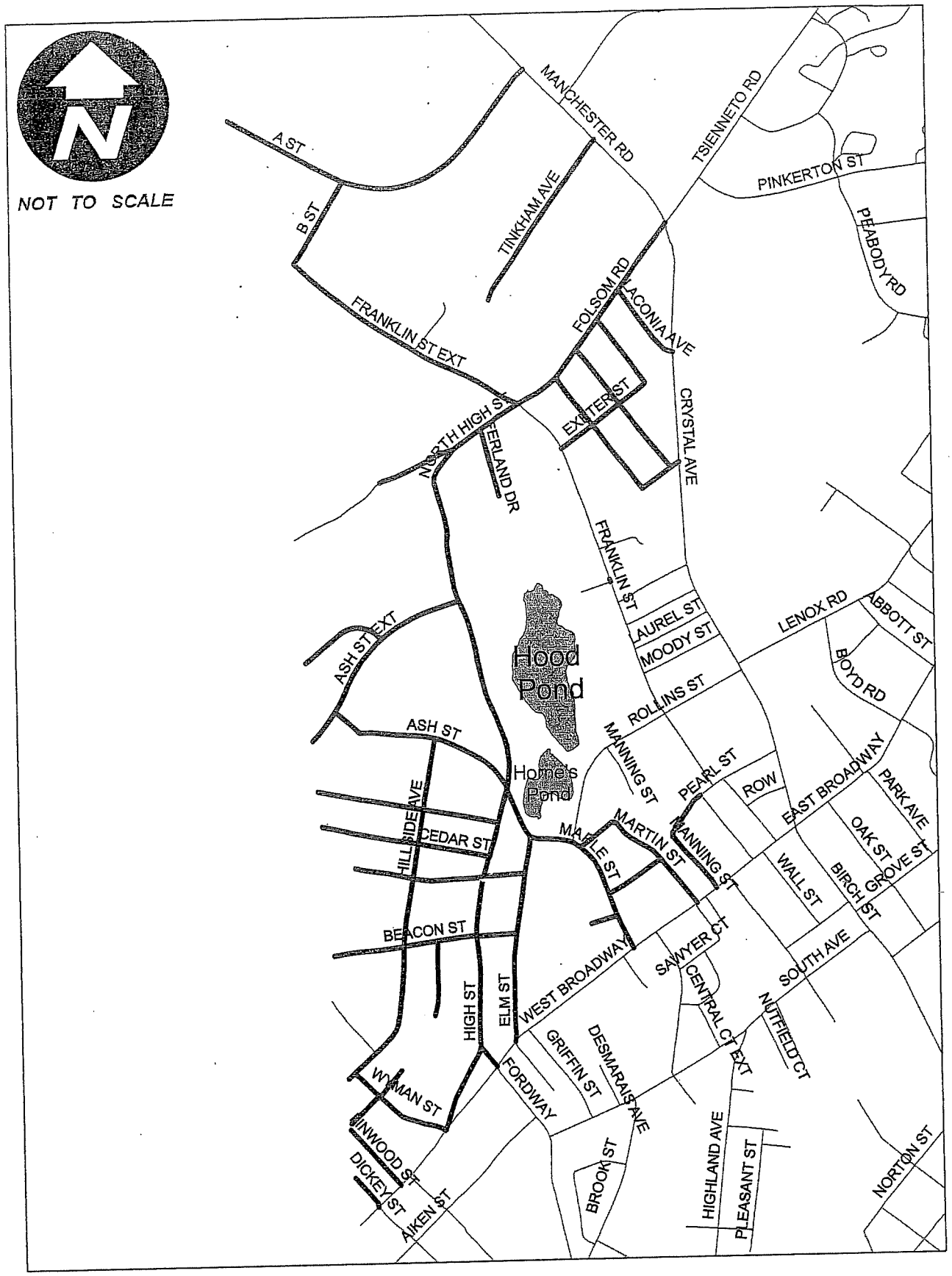
PLOW ROUTE 1


N
NOT TO SCALE
AL ST
MIRROR AVE
WILDWOOD DR
HERITAGE LN
BYPASS 28 (STATE)
DANIEL RD
DATTILO RD
EMERALD DR
SCOBIE POND RD EXT
OLD MANCHESTER RD
SCOBIE POND RD
WENTWORTH LN
JULIAN RD
BREWSTER RD
ASHLEIGH DR
MANCHESTER RD
AST
LEDGEWOOD DR
5
OVERLEDGE DR
GARVIN RD
PINGREE HILL RD
VISA AVE
MARK AVE
ENGLISH RANGE RD
COVE DR
EILEEN AVE
ALICE RD
BUTTONWOOD DR
Lower Shed Pond
PAUL AVE EXT
PAUL AVE
SCENIC DR
DORIS ST
REALYN DR
CILLEY RD
WESTGATE RD
EASTGATE RD
ROW
ROW
BARKLAND DR
DONMAC DR
ARROWHEAD RD
OLDE COACH RD
LONDON RD
OXFORD RD
LINLEW DR
TSIENNETO RD
NORTH MAIN ST
PINKERTON ST

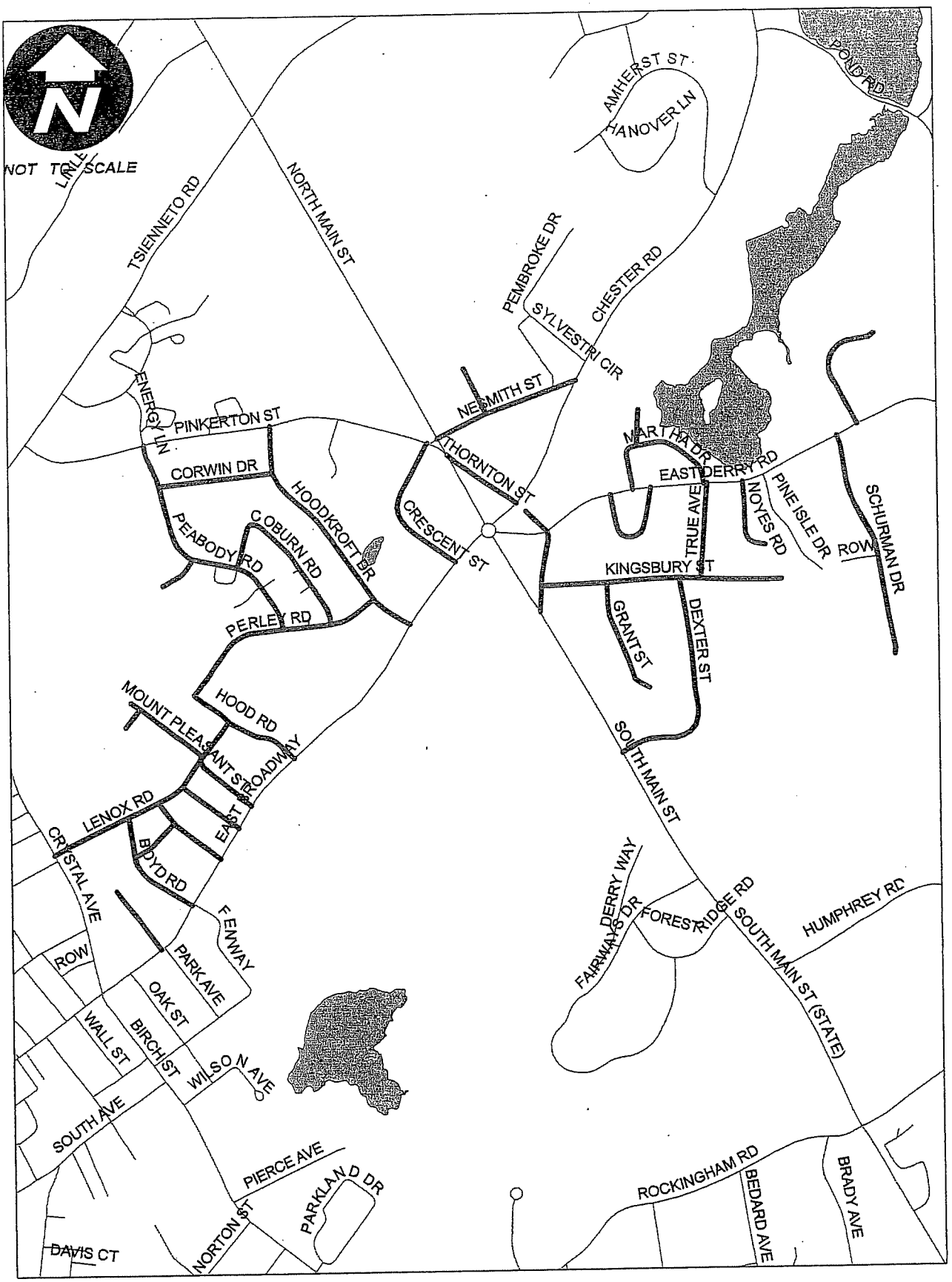
PLOW ROUTE 2


NOT TO SCALE
Lower Shields Pond
Rainbow Lake
COVE DR
KAREN AVE
GRETA AVE
HILDA AVE
BUTTONWOOD DR
ENGLISH RANGE RD
PAUL AVE EXT
PAUL AVE
SCENIC DR
DORIS ST
REALYN DR
DOLORES AVE
BYPASS 28 (STATE)
WESTGATE RD
EASTGATE RD
RIDER LN
ROW
ROW
JEFF LN
BIRCHWOOD DR
BARKLAND DR
BEAVER RD
ROUTE 102 (STATE)
MORNINGSIDE DR
GRANDVIEW AVE
POND RD
ARROWHEAD RD
DRIFTWOOD RD
OLDE COACH RD
LONDON RD
OXFORD RD
TSIENNETO RD
AMHERST ST
HANOVER LN
LINLEW DR
NORTH MAIN ST
PEMBROKE DR
CHESTER RD
SYLVESTRI CIR
NESMITH ST
PINKERTON ST

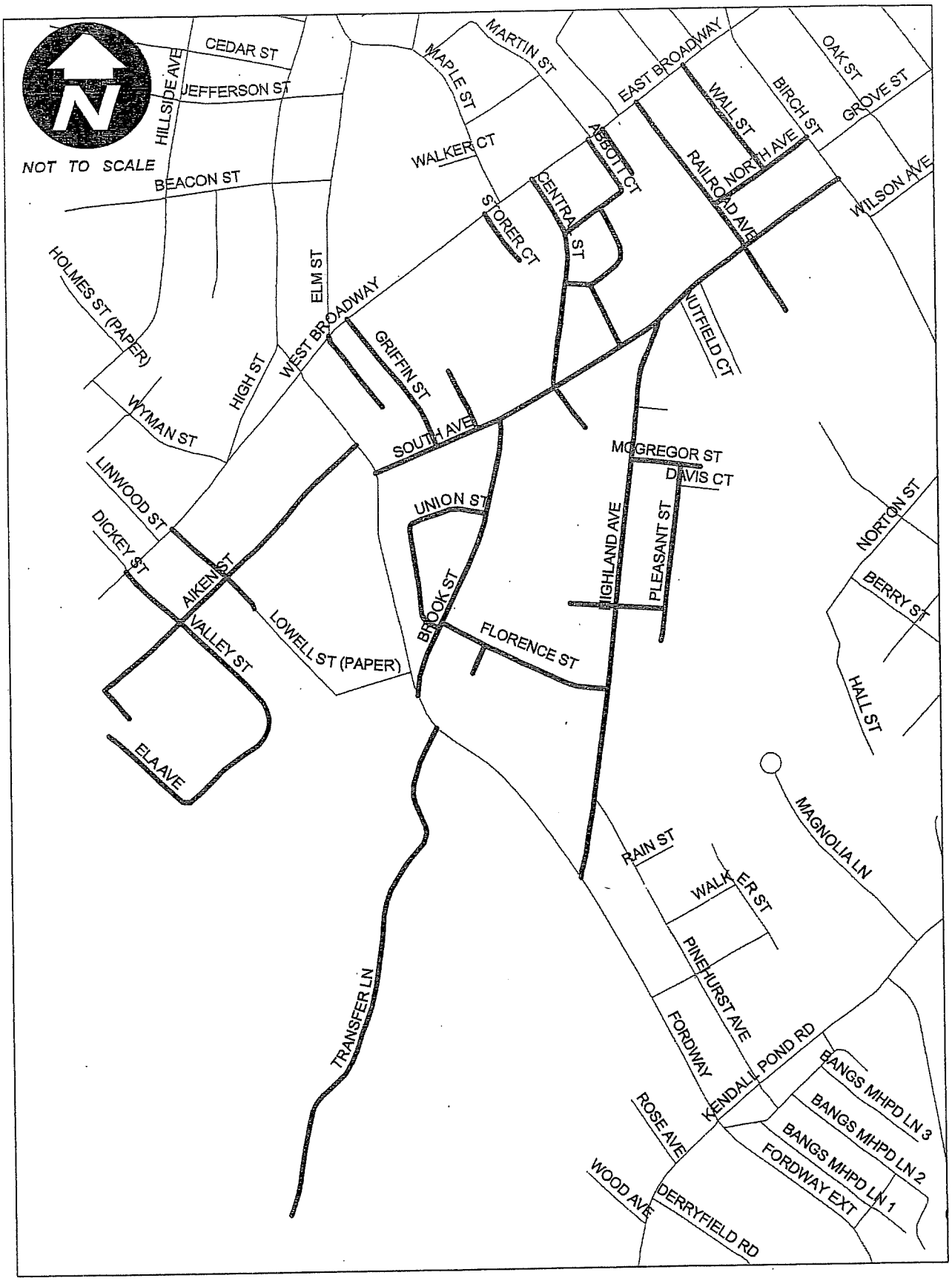
PLOW ROUTE 4


N
NOT TO SCALE
A ST
B ST
MANCHESTER RD
TINKHAM AVE
TSIENNETO RD
PINKERTON ST
PEABODY RD
FRANKLIN ST EXT
FOLSOM RD
LACONIA AVE
EXETER ST
CRYSTAL AVE
NORTH HIGH ST
ERLAND DR
FRANKLIN ST
LAUREL ST
MOODY ST
LENOX RD
ABBOTT ST
BOYD RD
ROLLINS ST
ASH ST EXT
ASH ST
Hood Pond
Home's Pond
MANNING ST
PEARL ST
ROW
EAST BROADWAY
PARK AVE
OAK ST
GROVE ST
BIRCH ST
WALL ST
MAPLE ST
MARTIN ST
MANNING ST
HILLSIDE AVE
CEDAR ST
BEACON ST
SAWYER CT
CENTRAL CT
SOUTH AVE
NUTFIELD CT
CENTRAL CT EXT
WEST BROADWAY
HIGH ST
ELM ST
GRIFFIN ST
DESMARAIS AVE
FORDWAY
WYMAN ST
WINWOOD ST
DICKEY ST
AIKEN ST
BROOK ST
HIGHLAND AVE
PLEASANT ST
NORTON ST

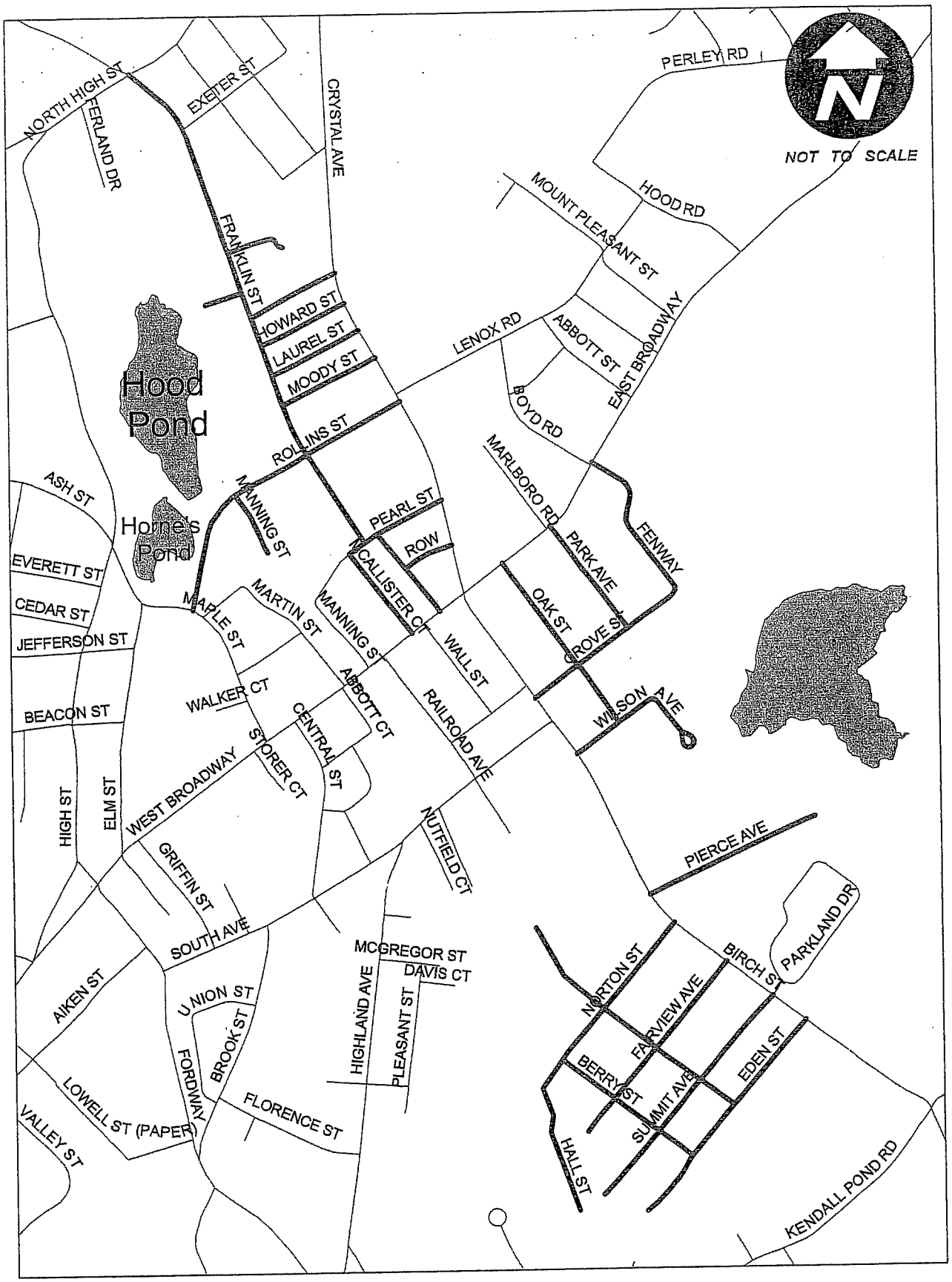
PLOW ROUTE 5


N
NOT TRUE SCALE
TSIENNETO RD
NORTH MAIN ST
AMHERST ST
HANOVER LN
POND RD
PEMBROKE DR
SYLVESTRI CIR
CHESTER RD
NESMITH ST
ENERGY LN
PINKERTON ST
CORWIN DR
HOODKROFT DR
PEABODY RD
COBURN RD
PERLEY RD
THORNTON ST
CRESCENT ST
MARTHA DR
EAST DERRY RD
TRUE AVE
NOYES RD
PINE ISLE DR
ROW
SCHURMAN DR
KINGSBURY ST
GRANT ST
DEXTER ST
SOUTH MAIN ST
MOUNT PLEASANT ST
HOOD RD
BROADWAY
LENOX RD
EAST
BOYD RD
CRYSTAL AVE
ROW
PARK AVE
FENWAY
OAK ST
WALL ST
BIRCH ST
WILSON AVE
SOUTH AVE
DAVIS CT
PIERCE AVE
NORTON ST
PARKLAND DR
FAIRWAYS DR
DERRY WAY
FORESTRIDGE RD
HUMPHREY RD
SOUTH MAIN ST (STATE)
ROCKINGHAM RD
BEDARD AVE
BRADY AVE

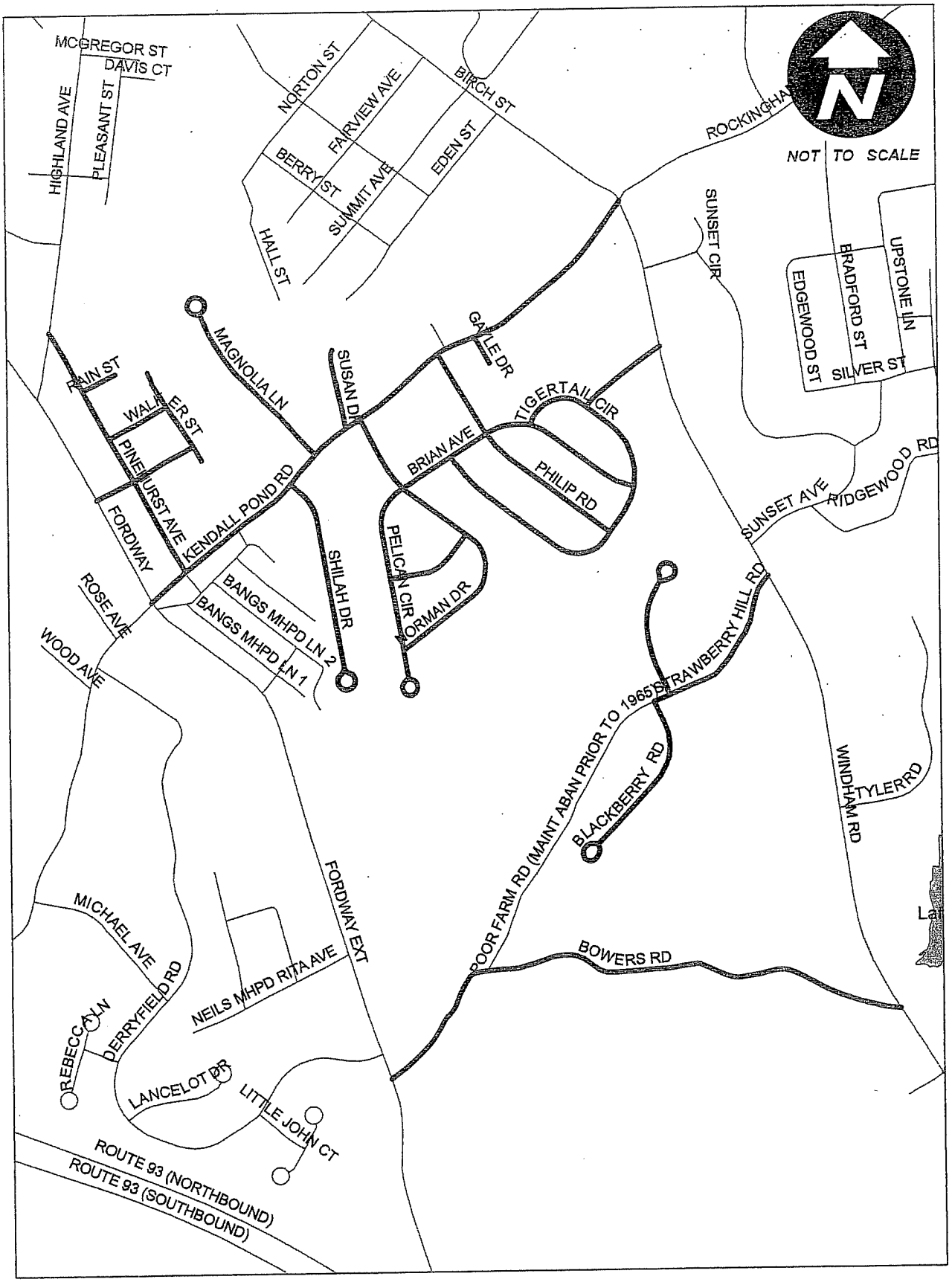
PLOW ROUTE 6


N
NOT TO SCALE
CEDAR ST
HILLSIDE AVE
JEFFERSON ST
BEACON ST
MAPLE ST
MARTIN ST
EAST BROADWAY
WALL ST
BIRCH ST
OAK ST
GROVE ST
WALKER CT
ABBOTT CT
RAILROAD AVE
NORTH AVE
WILSON AVE
STORER CT
CENTRAL ST
HOLMES ST (PAPER)
ELM ST
WEST BROADWAY
GRIFFIN ST
OUTFIELD CT
HIGH ST
WYMAN ST
SOUTH AVE
MCGREGOR ST
DAVIS CT
LINWOOD ST
UNION ST
HIGHLAND AVE
PLEASANT ST
NORTON ST
DICKEY ST
AIKEN ST
BROOK ST
BERRY ST
VALLEY ST
LOWELL ST (PAPER)
FLORENCE ST
HALL ST
ELA AVE
MAGNOLIA LN
RAIN ST
WALKER ST
PINEHURST AVE
TRANSFER LN
FORDWAY
KENDALL POND RD
BANGS MHPD LN 3
BANGS MHPD LN 2
BANGS MHPD LN 1
FORDWAY EXT
ROSE AVE
WOOD AVE
DERRYFIELD RD

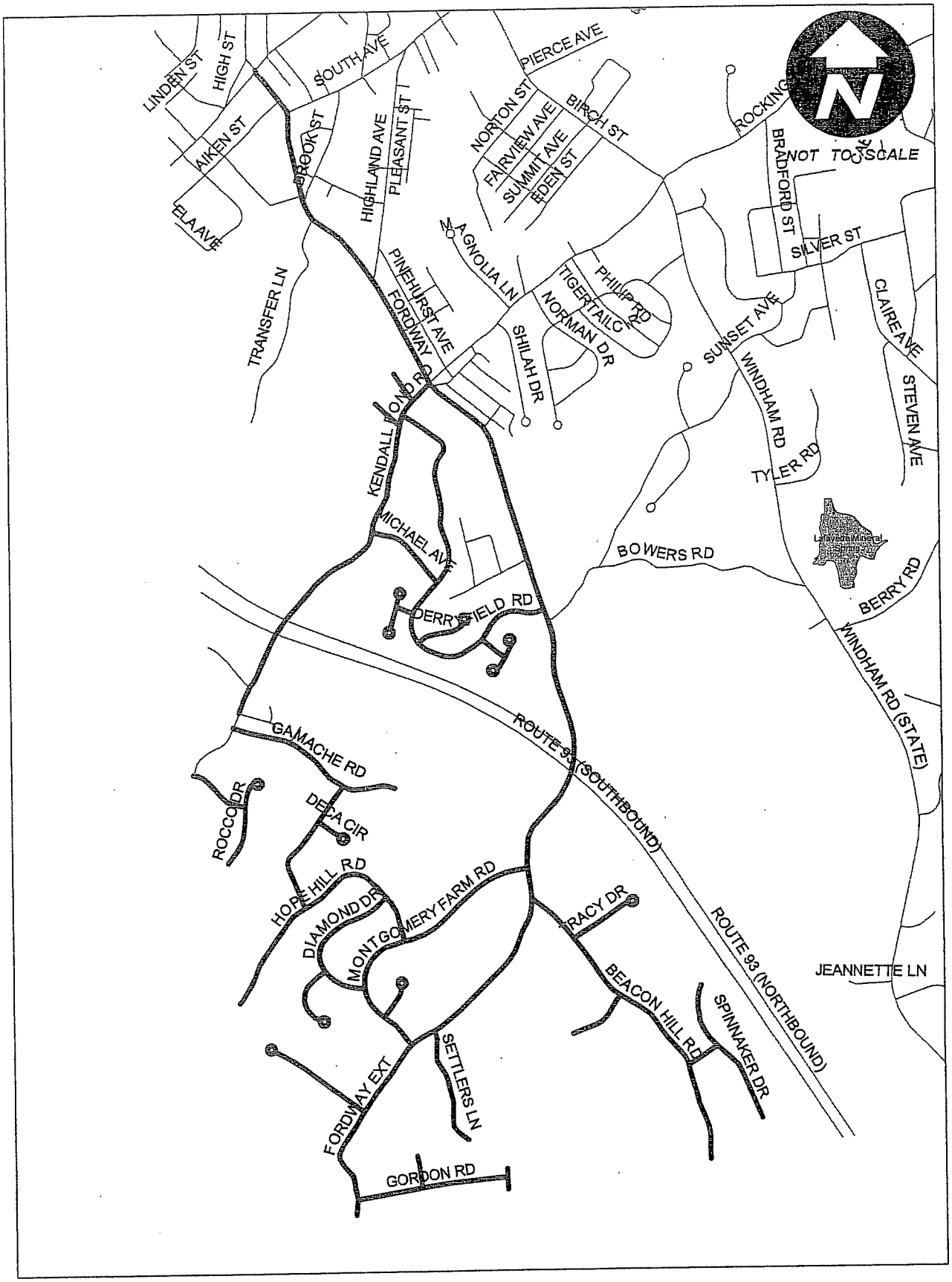
PLOW ROUTE 7


NOT TO SCALE
PERLEY RD
NORTH HIGH ST
FERLAND DR
EXETER ST
CRYSTAL AVE
HOOD RD
MOUNT PLEASANT ST
FRANKLIN ST
HOWARD ST
LAUREL ST
MOODY ST
ROLLINS ST
LENOX RD
ABBOTT ST
EAST BROADWAY
BOYD RD
Hood Pond
Horne's Pond
ASH ST
MANNING ST
PEARL ST
ROW
MARLBORO RD
PARK AVE
FENWAY
EVERETT ST
CEDAR ST
JEFFERSON ST
MAPLE ST
MARTIN ST
MANNING ST
CALLISTER CT
WALL ST
OAK ST
GROVE ST
WILSON AVE
BEACON ST
WALKER CT
ABBOTT CT
CENTRAL ST
RAILROAD AVE
STORER CT
HIGH ST
ELM ST
WEST BROADWAY
GRIFFIN ST
NUTFIELD CT
PIERCE AVE
SOUTH AVE
MCGREGOR ST
DAVIS CT
PARKLAND DR
NORTON ST
BIRCH ST
AIKEN ST
UNION ST
HIGHLAND AVE
PLEASANT ST
FAIRVIEW AVE
EDEN ST
BROOK ST
FORDWAY
BERRY ST
SUMMIT AVE
LOWELL ST (PAPER)
FLORENCE ST
VALLEY ST
HALL ST
KENDALL POND RD

PLOW ROUTE 8


MCGREGOR ST
DAVIS CT
HIGHLAND AVE
PLEASANT ST
NORTON ST
FAIRVIEW AVE
BIRCH ST
BERRY ST
SUMMIT AVE
EDEN ST
HALL ST
ROCKINGHAM
NOT TO SCALE
SUNSET CIR
UPSTONE LN
BRADFORD ST
EDGEWOOD ST
SILVER ST
MAGNOLIA LN
SUSAN DR
GAYLE DR
TIGERTAIL CIR
BRIAN AVE
PHILIP RD
PINEHURST AVE
KENDALL POND RD
FORDWAY
SUNSET AVE
RIDGEWOOD RD
SHILAH DR
PELICAN CIR
ORMAN DR
BANGS MHPD LN 2
BANGS MHPD LN 1
ROSE AVE
WOOD AVE
STRAWBERRY HILL RD
BLACKBERRY RD
POOR FARM RD (MAINT ABAN PRIOR TO 1965)
WINDHAM RD
TYLER RD
FORDWAY EXT
MICHAEL AVE
DERRYFIELD RD
NEILS MHPD RITA AVE
BOWERS RD
REBECCA LN
LANCELOT DR
LITTLE JOHN CT
ROUTE 93 (NORTHBOUND)
ROUTE 93 (SOUTHBOUND)

PLOW ROUTE 9



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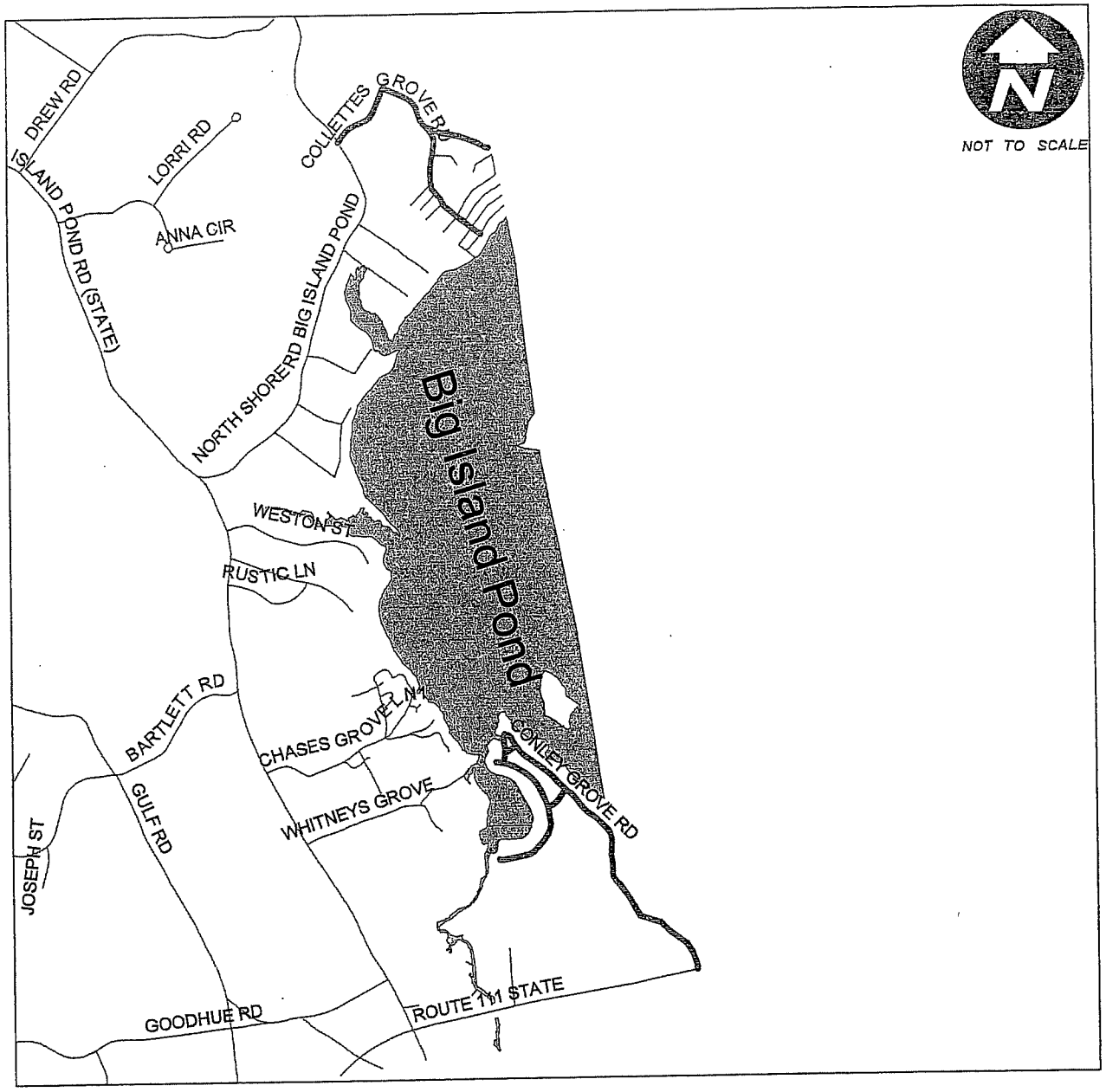

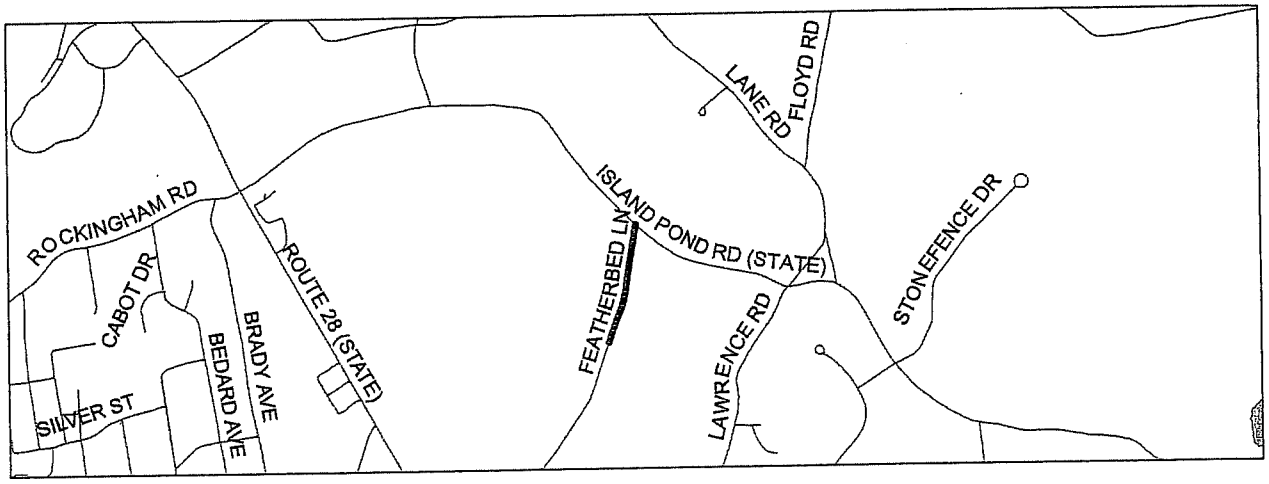

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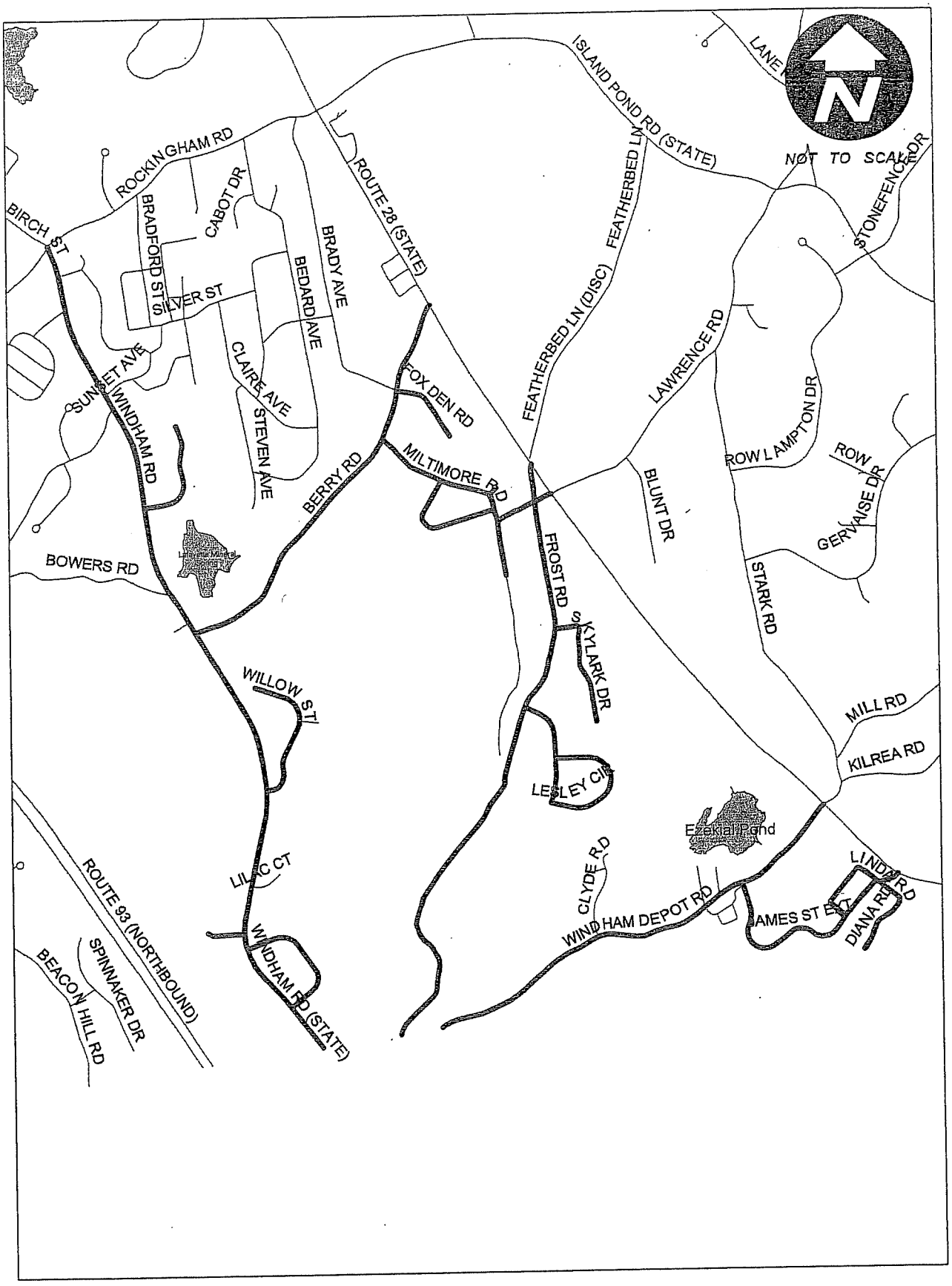
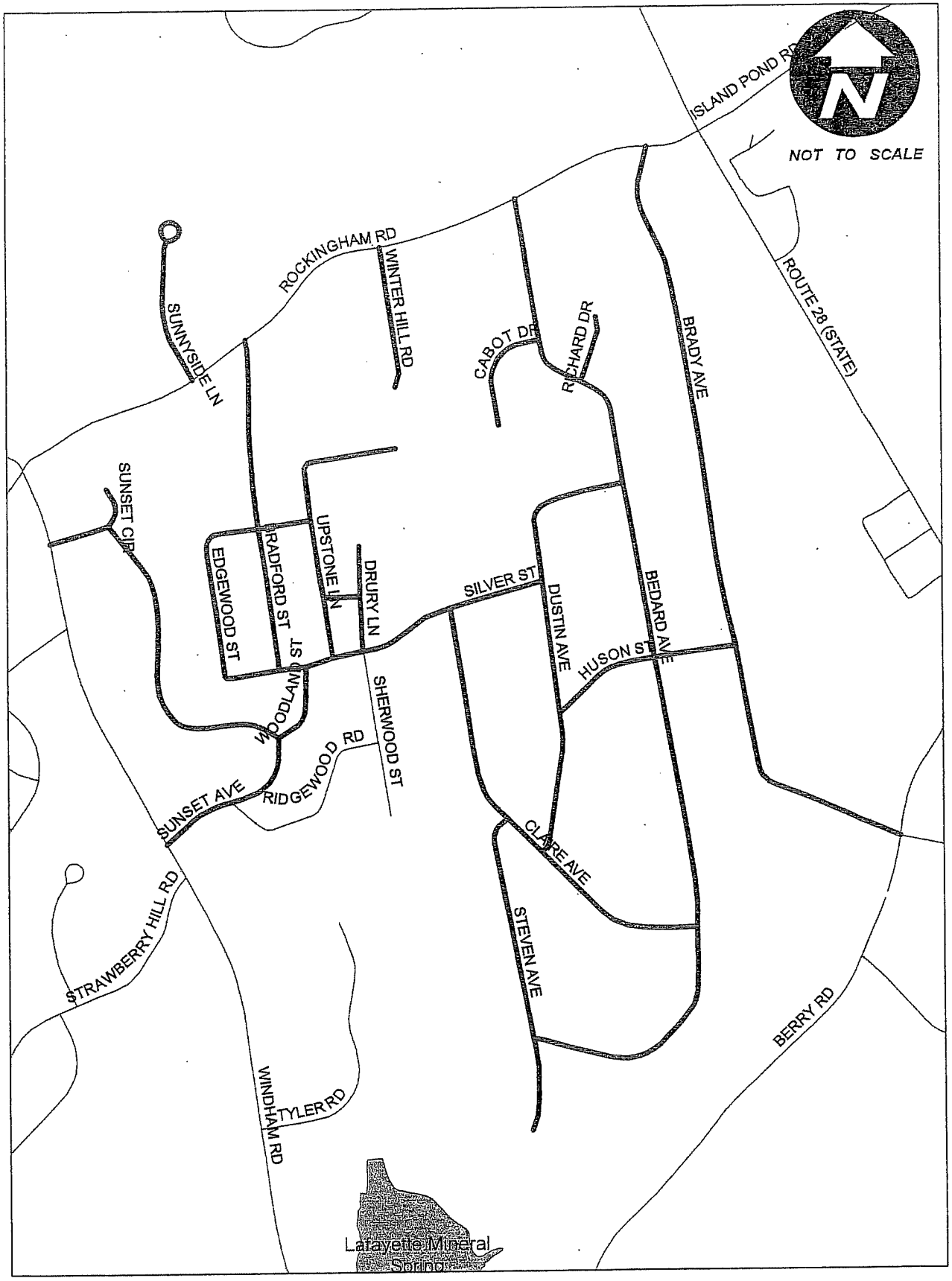
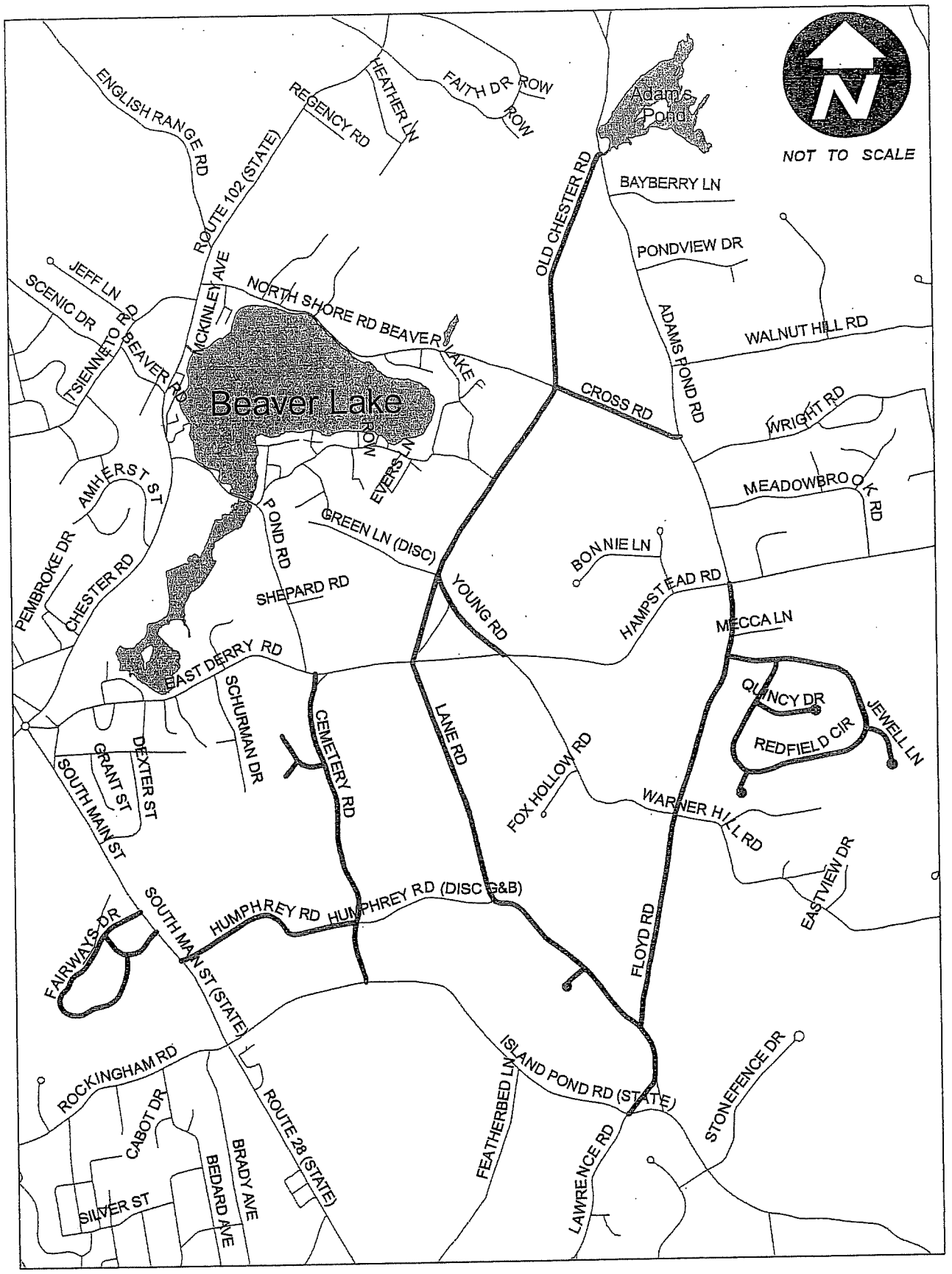


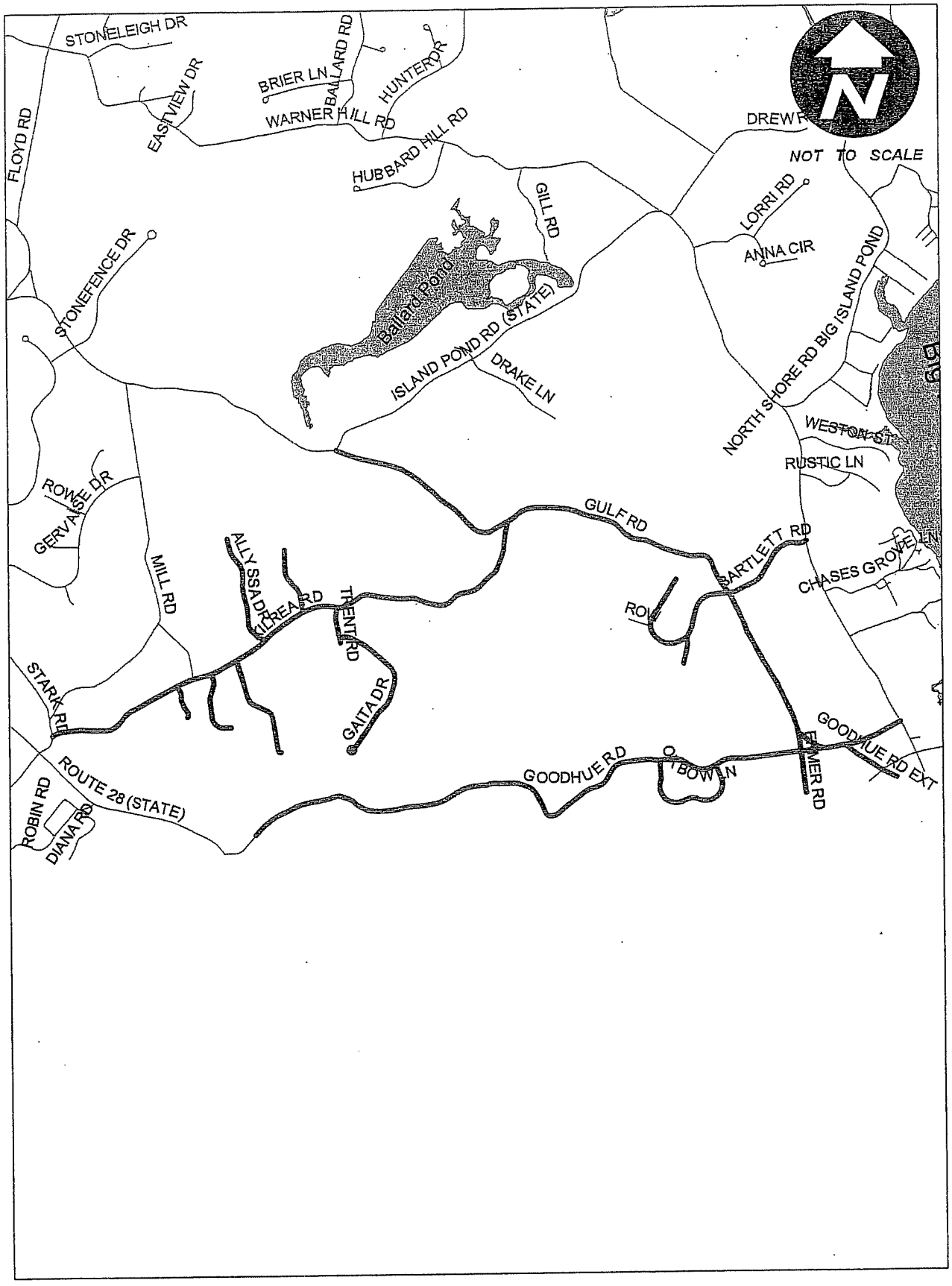
PLOW ROUTE 12



PLOW ROUTE 13



PLOW ROUTE 14



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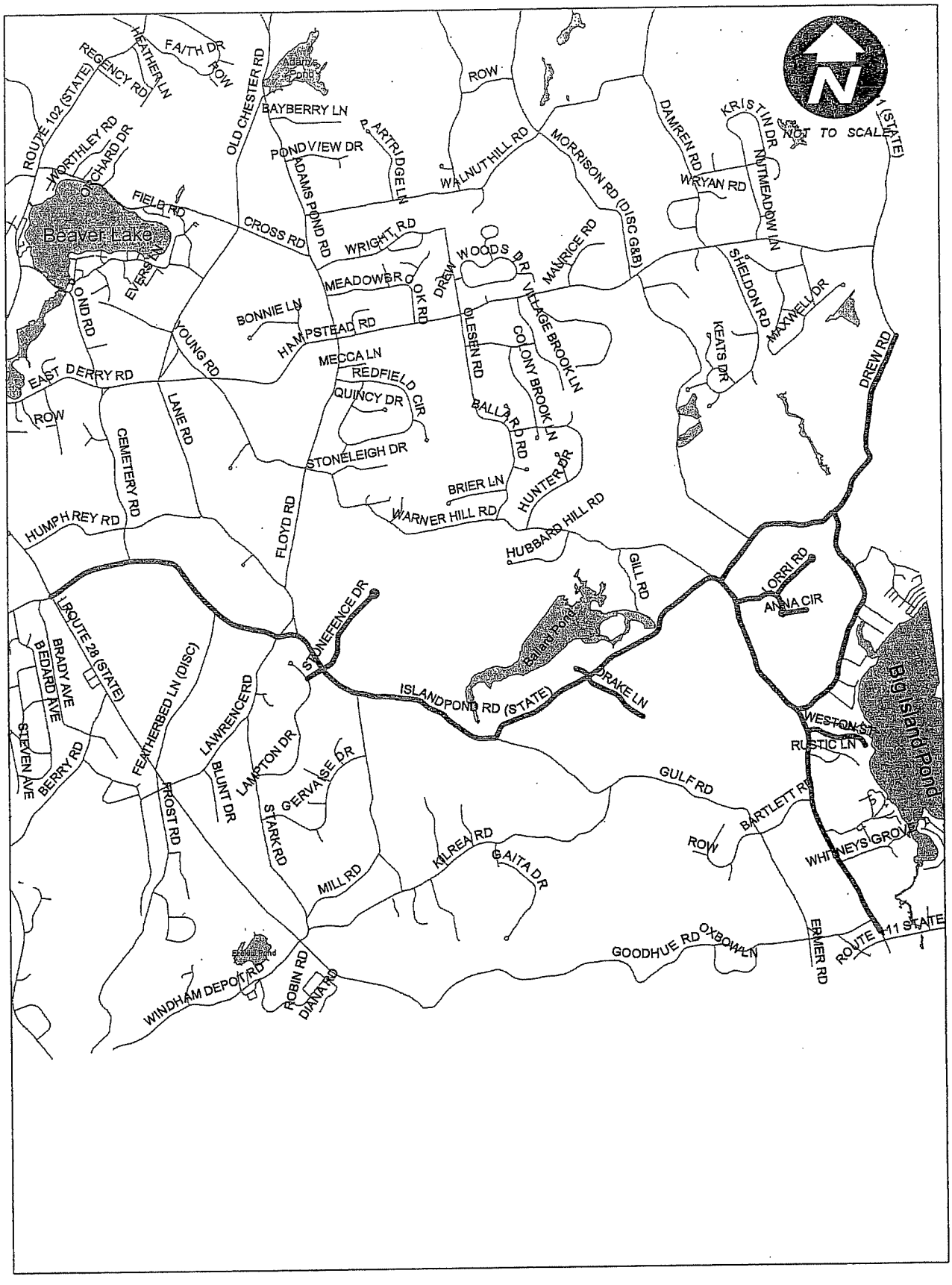
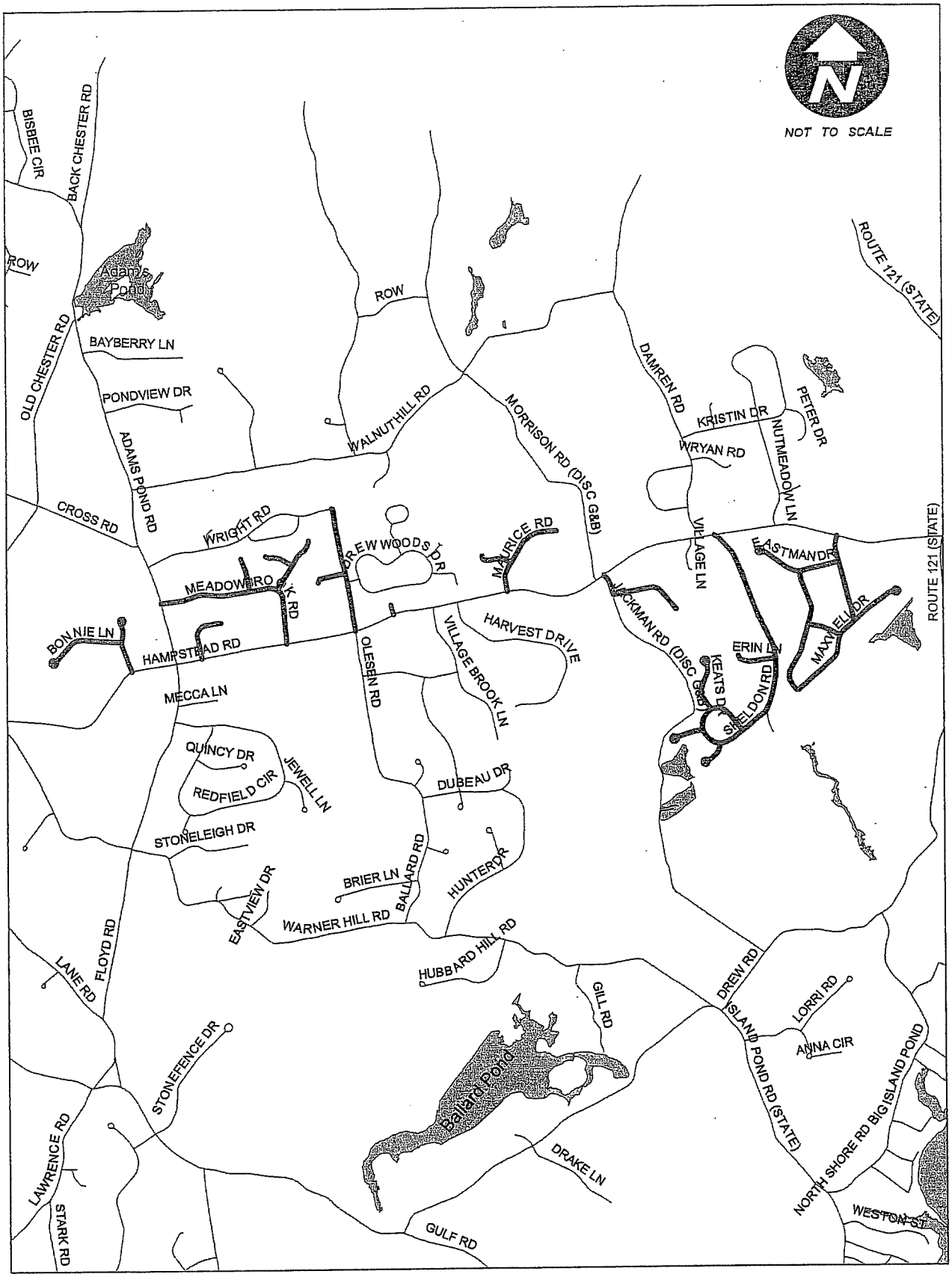
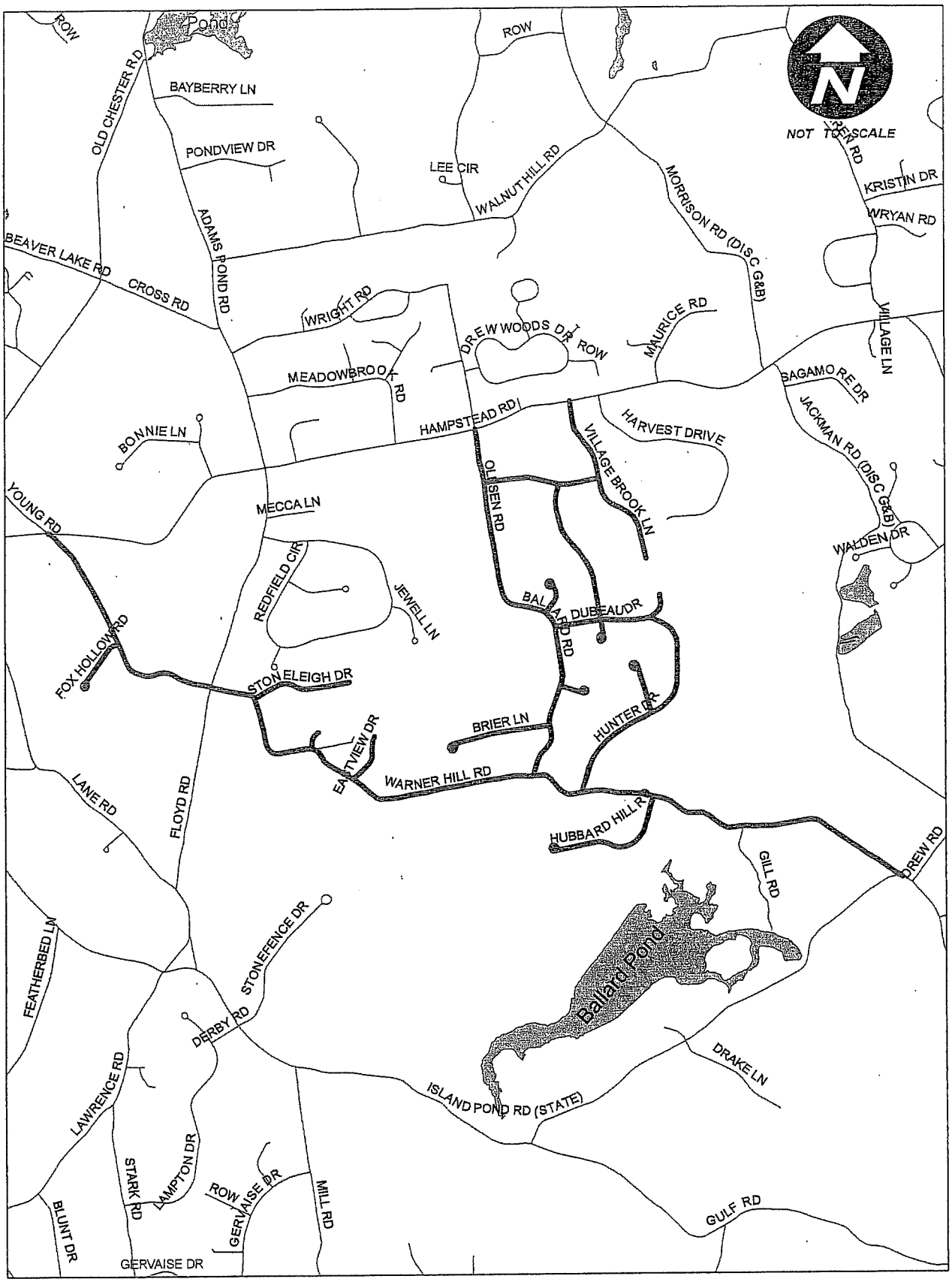


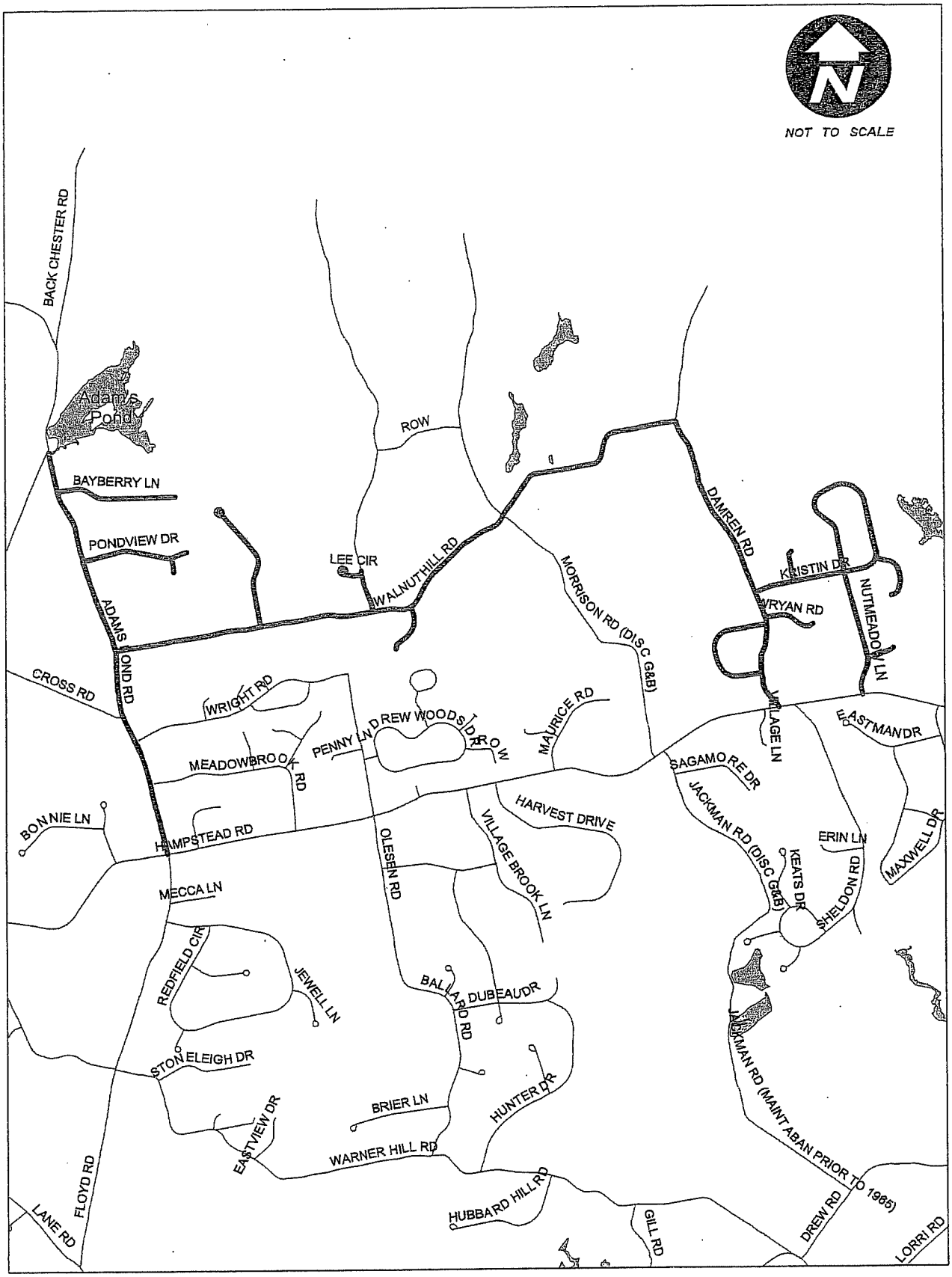
PLOW ROUTE 16



PLOW ROUTE 17



PLOW ROUTE 18



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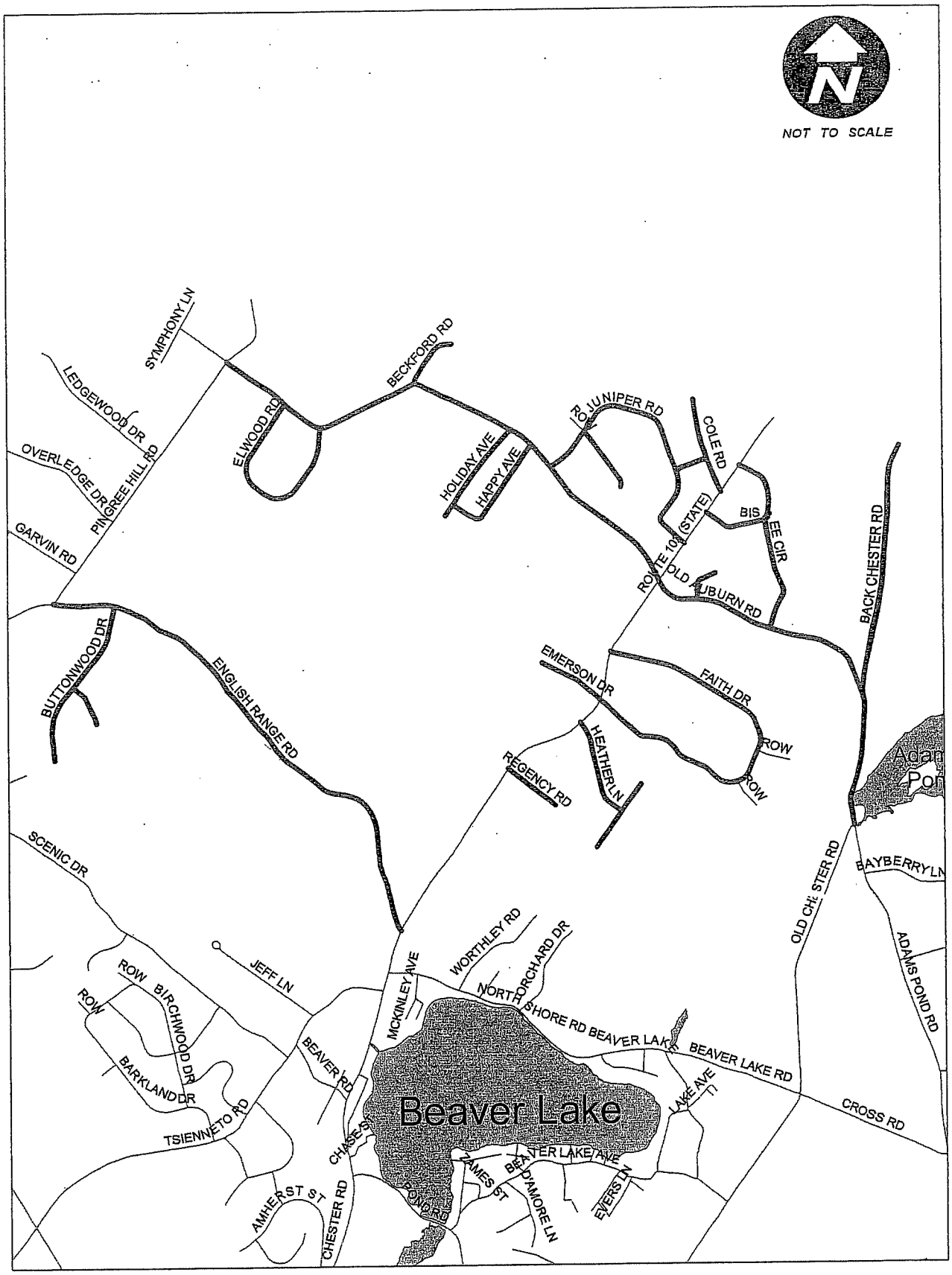
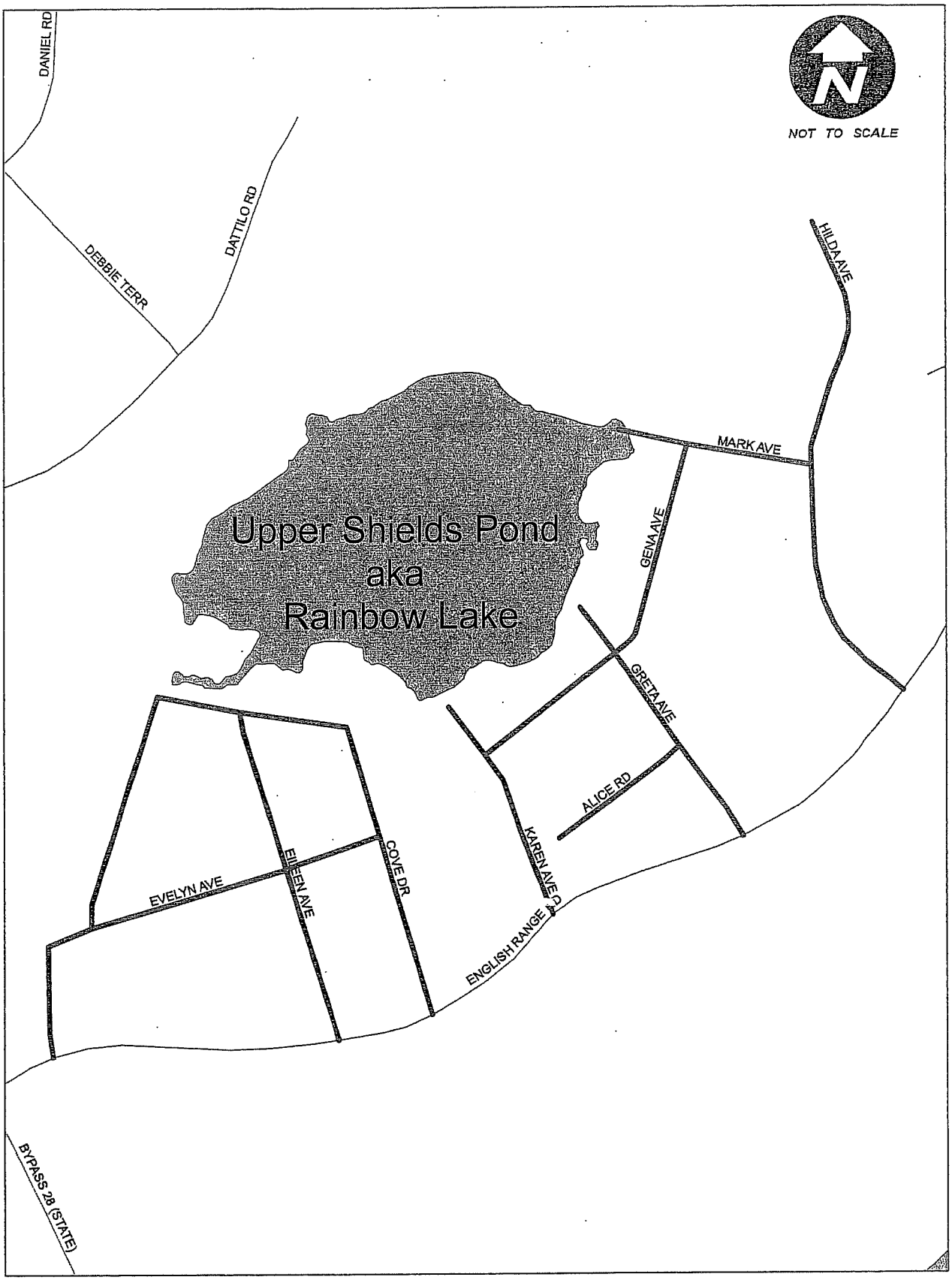
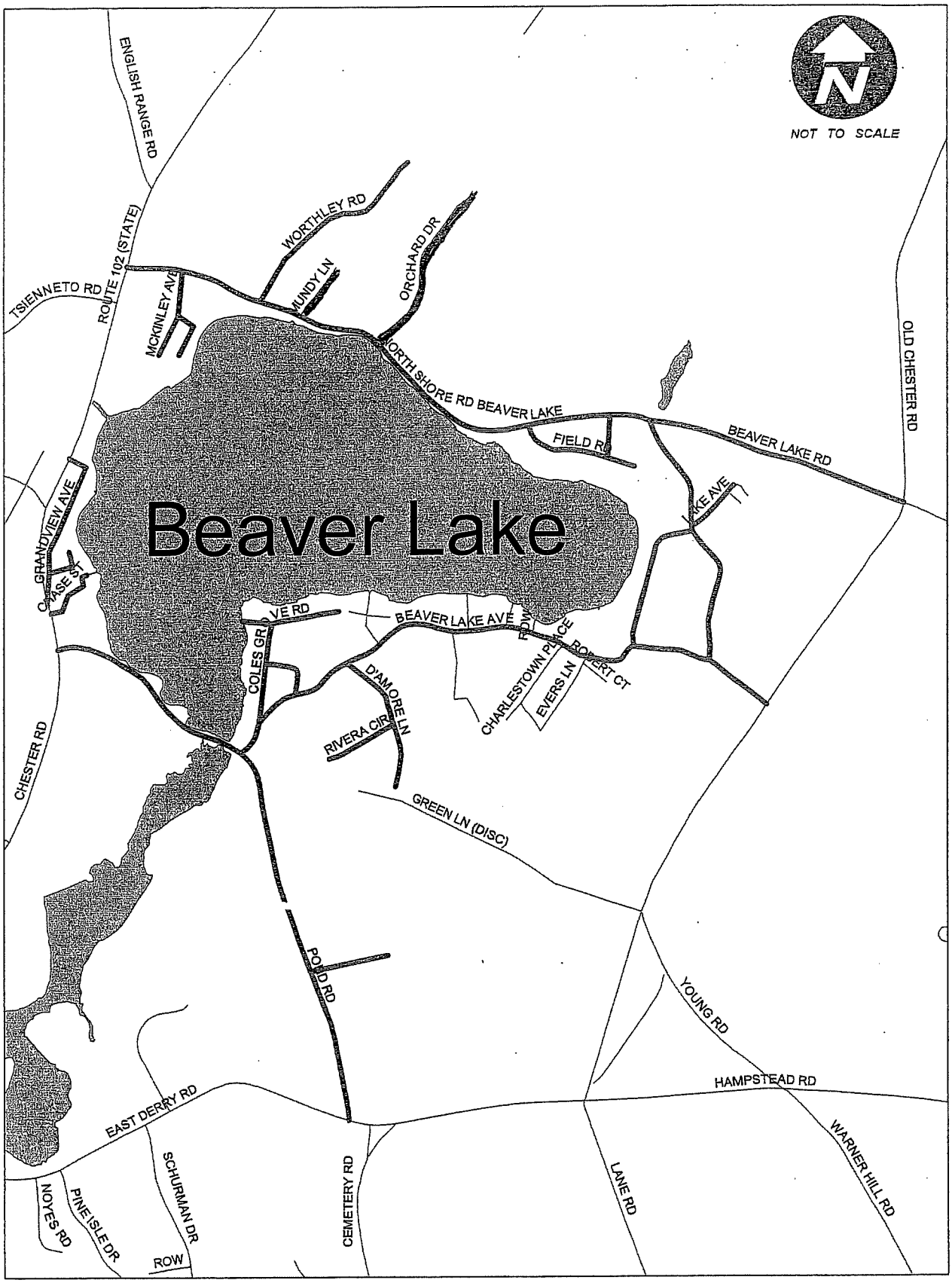


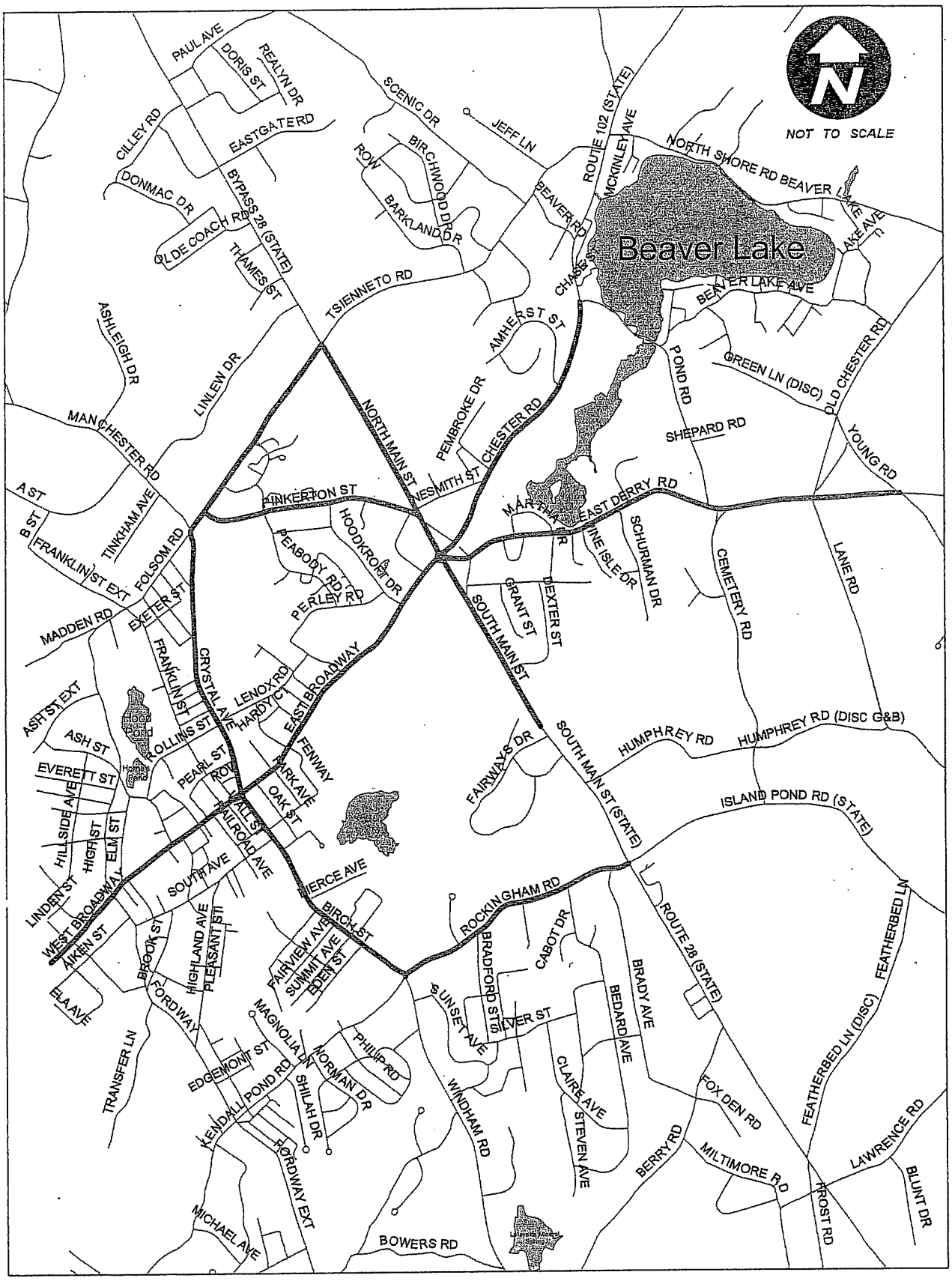
PLOW ROUTE 20



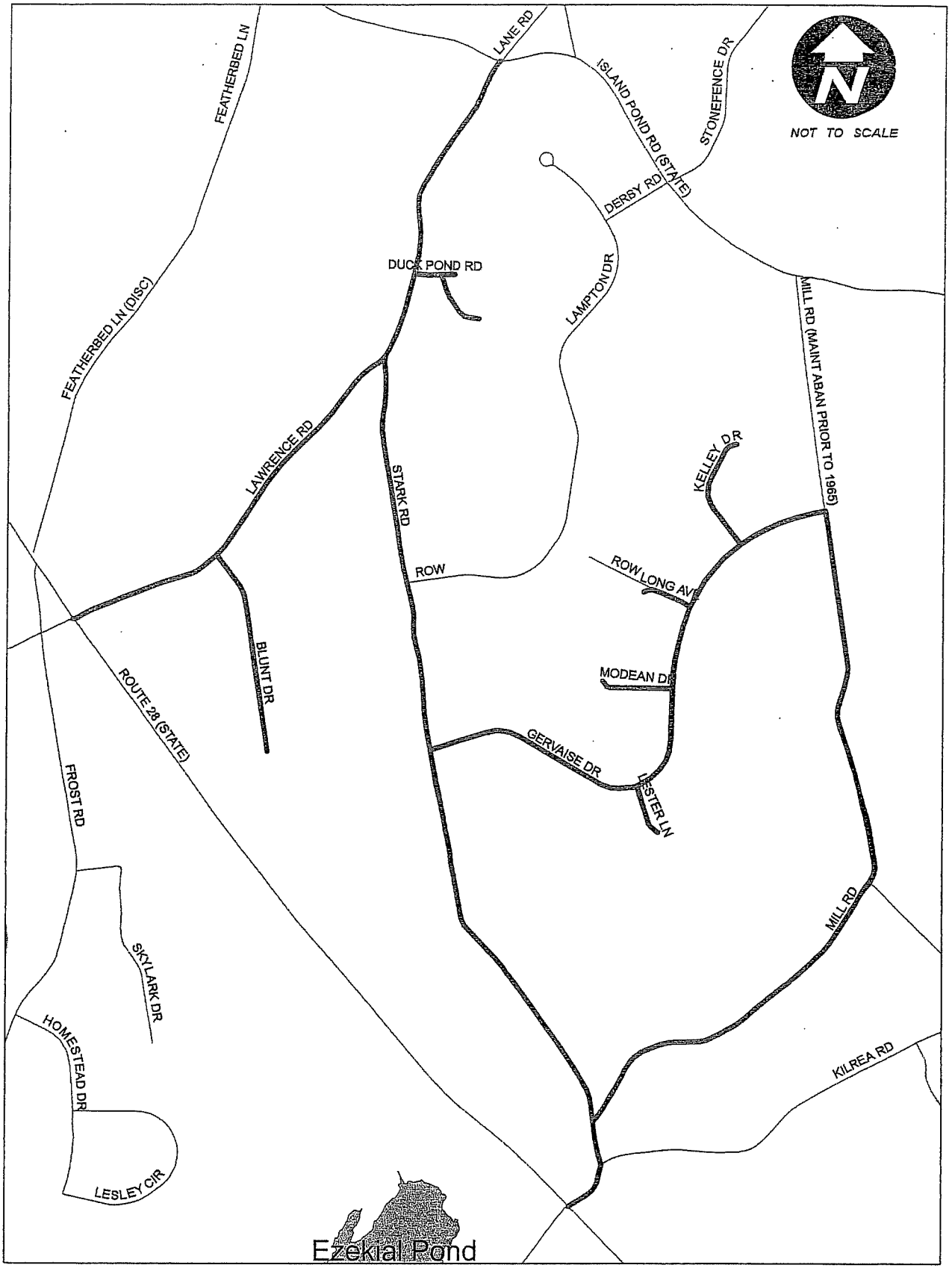
PLOW ROUTE 21



PLOW ROUTE 22



PLOW ROUTE 23



PLOW ROUTE 24

Appendix E TMDL Implementation Plan Considerations - NHDES April 15, 2010

TMDL IMPLEMENTATION PLAN CONSIDERATIONS
Paul M. Currier, DES Watershed Management Bureau April 15, 2010

I. There are Four TMDL watersheds for which salt reduction implementation plans are needed. For DOT, I-93 should get a separate allocation from other DOT roads that includes the planned expansion. There would be a separate allocation for municipal and private salt use for each town in a TMDL watershed

Table 1

DINSMORE BK.	N. TRIB. CANOBIE LAKE	BEAVER BK	POLICY – PORCUPINE BK
DOT I-93	DOT I-93	DOT I-93	DOT I-93
DOT other roads	DOT other roads	DOT other roads	DOT other roads
Windham municipal	Windham municipal	Londonderry muni.	Salem municipal
Windham Private	Windham Private	Derry municipal	Windham municipal
Windham Future	Windham Future	*Chester&Auburn	Salem private
		Londonderry private	Windham private
		Derry private	Salem future
		Londonderry future	Windham future
		Derry future	
123.1 tons salt/yr	26.9 tons salt/yr	5863.4 tons salt/yr	3,449 tons salt/yr

II. The measure of salt reduction success should be a rolling 10-year average of salt use. An interim measure of success for any given year would be the year's salt use weighted by the Winter Severity Index for I-93.

II. The starting point for all implementation plans is the "equally shared reduction" scenario presented in the approved TMDLs. The final implementation plans may contain different allocations for sectors, and a future growth allocation. These must be negotiated among DOT and municipalities.

A. Municipalities MAY negotiate on behalf of private sector salt users. Private sector allocations should be different from the initial TMDL allocation ONLY if there is a municipally-based plan for how private salt use will be tracked and a municipal commitment to help implement it.

III. In the absence of negotiated agreement among municipalities and DOT, sector allocations for municipalities and DOT should remain as in the TMDLs.

IV. In the absence of a municipally-based plan for how private salt use will be tracked and a municipal commitment to help implement it, private sector salt allocations should remain as in the TMDLs.

V. In the event that municipal salt reduction plans, DOT salt reduction plans, and discussions and negotiations among DOT, municipalities, and private sector salt users do not result in consensus-based sector allocations and plans for each sector that are expected to meet the overall watershed allocation, DES may either:

A. Prepare and publish an implementation plan, and use state law authorities to implement it as necessary; OR

B. Defer to EPA to implement the needed salt use reductions by using their NPDES permit authority. This might involve NPDES small MS4 stormwater general permits, issuing individual permits, and issuing general stormwater permits to categories of salt users (property owners and municipalities) under residual designation authority.

VI. The best scenario is one in which DOT, DES, and municipalities work together, leverage the FHWA earmark $$, and develop a long-term (probably a decade or more) strategic plan for overall salt use reduction.

Appendix F

Best Management Practices

Anti-Icing

NH Best Management Practices

GET OUT EARLY

Typically anti-icing is most effective if applied 1-2 hours before the precipitation begins however it can be applied up to 24 hours in advance.

TRY IT FIRST

Trying anti-icing for the first time? Make a 23.3% brine solution and before a storm spray pavement on your own property using a masonry/ plant sprayer. Use this experiment to determine how best to use it with your clients.

LEAVE SOME PAVEMENT BARE

It's always best to use stream nozzles instead of fan tip to avoid creating a slippery condition. If the anti-icing liquid freezes the bare pavement will still provide a traction surface.

USE A FILTER

Having a filter in your liquid dispensing system will reduce clogs in your nozzle. Automotive in line fuel filters work quiet well. If your liquid dispenser is not functioning properly be sure to check the filter first.

A Proactive Treatment

Anti-Icing before a storm is very similar to using a non-stick spray on a pan before cooking. Just like a non-stick spray prevents food from bonding to the pan, anti-icing prevents snow and ice from bonding to the pavement so that it can be plowed away. Anti-icing can save you money as it costs 50% less than reactive deicing.

Make Your Own Salt Brine

When making brine it is important to add enough salt to produce a 23.3% solution which freezes around 0°F. Roughly 2.5lb per gallon of water will produce a 23.3% solution. You can verify using a salometer (~$20) a 23.3% solution will have a specific gravity of 1.176, or 85% salinity. Consult the Brine Making BMP sheet for more info.

How Much Should I Use and When?

You can apply brine up to 24 hours in advance of the storm. Typical application rates range from 0.5 to 0.75 gallon per 1000 sq.ft. (10' x 100' area). Other chemicals such as magnesium are also available—consult your supplier for application rates. Anti-icing is not advised prior to freezing rain events.

Getting Started

Try making your own salt brine by putting 13 lb of salt in 5 gallons of water to get a 23.3% salt brine solution. Mix the brine until all of the salt is dissolved. Using a masonry sprayer apply the liquid several hours before a storm. Start by applying about 0.25—0.5 gallons to a 10' x 50' area. Adjust the application rates based on your experience. Being careful not to over apply and cause a slippery condition.

Produced in partnership with:

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

New Hampshire DOT

New Hampshire Technology Transfer Center

Brine Making

NH Best Management Practices

GET THE LOWEST FREEZE POINT

When salt brine is 23% salt (measured with a hydrometer: 1.176, or with a salimeter: 85%) it has the lowest freeze point possible (about 0°F).

BRINE STORAGE

23% brine solution may be stored outside, however if temperatures get below 0°F the brine may freeze. A circulator pump will reduce the risk of freezing. If possible store brine indoors to eliminate risk of freezing.

COST OF BRINE

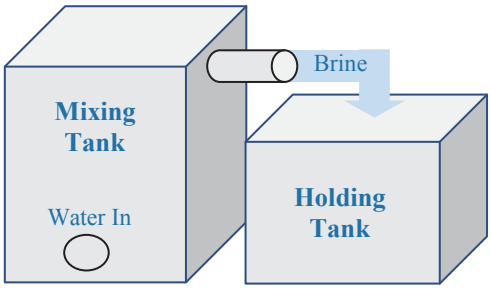
Calcium chloride brine costs about 7¢ / gallon (assuming $58/ton for salt) after you have your equipment setup.

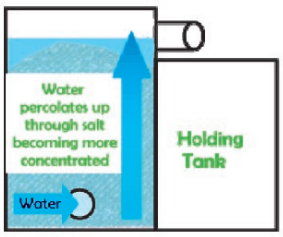
MULTIPLE USES

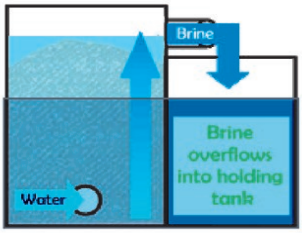
Brine can be used directly for anti-icing, for prewetting salt as it is dispensed from your truck, or to pretreat salt before it is loaded into your truck. Brine can be safely stored for up to a year, however, the concentration should be tested before use.

What Do You Need?

Brine making is a fairly simple process—the only ingredients are salt and water, and the only equipment you'll need is an open top mixing tank, a holding tank, a small pump, and a salimeter.





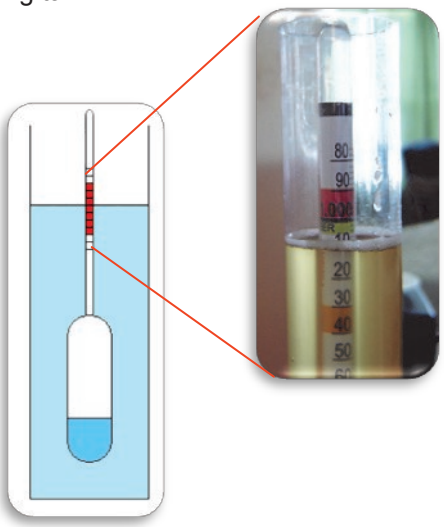


Images courtesy of Iowa DOT

Step 1: Fill Mixing Tank

Add Salt: Add about 2.5 lb of salt per gallon of water you plan to add. Make sure your mixing tank has a large opening to make adding salt easy.

Add Water: Slowly add water from the bottom of your brine mixing tank. This will allow it to percolate up through the salt and overflow into the holding tank.



Step 2: Check Concentration

Float a hydrometer or salimeter directly in your holding tank and read the value at the surface of the water. The number should be either 85% or 1.176 depending on the units of your device.

If the values are too low, pump some brine from your holding tank back into the mixing tank and allow it to overflow. If values are too high simply add some fresh water

Quality Control & Documentation

Make sure that you record the date when you create each batch of brine and document who mixed it and checked the concentration. It is also a good idea to note the final concentration. These records should be kept for at least two years to protect your group in the event of litigation.

Produced in partnership with:

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

New Hampshire DOT

New Hampshire Technology Transfer Center

9 ANTI-ICING

A relatively new weapon in the sustainable snowfighting arsenal in North America is anti-icing. But it has a long history of keeping European roads safe and passable.

Anti-icing differs significantly from deicing because brine is applied before precipitation to prevent the formation or development of bonded snow and ice on the road surface. It is a proactive approach to snowfighting and is often the first in a series of strategies employed for a winter storm. By applying freezing point depressant materials before a storm it is possible to prevent the bond from forming between the pavement and snow or ice. Research has shown that timely applications of anti-icing materials can cut the cost of maintaining a safe road surface by 90% compared to traditional deicing. Liquid sodium chloride (NaCl) is the most effective choice for anti-icing above 15°F.

Anti-icing has many advantages.

- Anti-icing returns road surfaces to normal faster, resulting in fewer accidents and delays.
- Anti-icing can reduce airborne dust and salt particulates.
- Salt needs moisture to be effective. Applying brine jumpstarts the melting process.
- Brine sticks to the road surface. It will not be as easily blown off the road by wind or traffic, so material is more efficiently used.
- If the storm is delayed, salt residue remains on the road ready to begin work when precipitation begins.
- Crews can begin treatment in advance of a storm. Because anti-icing prevents the bonding of snow and ice to pavement, snowfighters have less work to maintain safe roadways as the storm progresses.
- Increased efficiency results in use of less deicer and manpower, therefore lowering the cost of maintaining safe road conditions. The use of less deicing materials also minimizes environmental concerns.

Products available for use in an anti-icing program are sodium chloride, calcium chloride, magnesium chloride, potassium acetate, and calcium magnesium acetate.

Each product has its own advantages and disadvantages. The most common material in use is sodium chloride (salt) in the form of a brine made from a mixture of rock salt and water. Salt brine is effective to -6°F and is a proven anti-icing agent in use throughout the snowbelt.

Some agencies use calcium or magnesium chloride in a brine solution which is effective down to -6° F, but is more than six times more expensive than salt, and is more difficult to handle. Also, calcium and magnesium chloride residue on road surfaces can attract moisture at lower relative humidity than salt resulting in dangerous, slippery conditions under certain circumstances.

Salt Brine Manufacture

Salt brine is made by mixing rock salt or solar salt with water. The process is simple: the resulting brine should be approximately 23% NaCl.

The proportion of salt to water is critical to the effectiveness of the brine. Too much or too little salt affects the freeze point depressing qualities of the brine. The proper brine mixture is 23.3% salt content by weight. This is the concentration at which salt brine has the lowest freezing point, -6° F. Can we keep adding salt to water until the freezing point goes down much further? No. The solubility of salt in water decreases with decreasing temperature. We eventually reach what is called the eutectic point. This is the point at which a solution achieves a maximum salt concentration. Any colder and salt will begin to leave the solution and raise the freezing point. At the eutectic temperature, ice, saltwater, and solid salt exist in equilibrium. For water, the eutectic temperature is -6° F. The percentage of salt is measured with a salometer, a specialized hydrometer, until a 88.3% measurement on the salometer is obtained. This results in the proper 23.3% salt content.

Commercial brine makers are available at a cost of approximately $5,000. Many agencies have made their own brine makers using water tanks and PVC pipe for substantially lower cost. Brine is usually made at the local maintenance facility sites and stored in large tanks in locations convenient for loading into saddle tanks on the sides of the V-box or anti-icing equipment. It is essential to clean out brine makers after brine is prepared to reduce the potential for corrosion.

Application Equipment

Brine applicators are commercially available for about $1,500. Some agencies have manufactured their own application equipment using large tanks and PVC piping. Some equipment is designed to be

Hydrometer/Salometer Chart for Salt Brine

% Salt	Hydrometer Specific Gravity	Salometer Using 0-100%
0	1.000	0
1	1.007	4
2	1.014	7
3	1.021	11
4	1.028	15
5	1.036	19
6	1.043	22
7	1.051	26
8	1.059	30
9	1.067	33
10	1.074	37
11	1.082	41
12	1.089	44
13	1.097	48
14	1.104	52
15	1.112	56
16	1.119	59
17	1.127	63
18	1.135	67
19	1.143	70
20	1.152	74
21	1.159	78
22	1.168	81
23	1.176	85
24	1.184	89
25	1.193	93
26	1.201	96
27	-	100

loaded onto the bed of spreading trucks, towed behind maintenance equipment or permanently mounted on truck beds. It can be as simple as a gravity fed spraying system with a operator controlled cut-off valve or a more complex (and more controllable) pump driven sprayer system. Fan sprayers are not recommended. Control should be available to vary spreading rates from 25 to 60 gallons per lane mile.

If large, horizontal tanks are used in the design, consider installing baffles inside the tanks to help prevent the liquid from suddenly shifting in the tank, creating a hazardous control situation for the operator.

Application

Accurate weather and road surface information are critical for the efficient use of anti-icing materials. Road surface temperatures, precipitation amounts and form, wind conditions, and road environment (sunlight exposure, surface condition, bridges, etc.) all affect the use and application of anti-icing measures.

Understanding the freeze point depressing qualities of brine is important to its use and application as an anti-icing agent. (See the Phase diagram below.) As you can see from the chart, the minimum freeze point of salt brine is -6°F at a concentration of 23.3%. Road surface temperatures are indicated on the side of the chart, solution concentrations along the bottom. The line represents the freeze point of the solution at a given temperature. The colored portion in the center of the chart shows the melting range of brine solutions. The area to the left shows the results of a solution with too little salt, the road surface will refreeze unless more salt brine or deicing salt is applied. The area to the right shows the results with too much salt, with a resultant non-functional loss of material to the environment. As you can see, additional precipitation and heavy traffic can dilute the brine solution allowing the road to refreeze.

ADDITIONAL PRECIPITATION ALWAYS RESULTS IN A DILUTION OF BRINE AT THE ROAD SURFACE.

Weather information is getting better with everything from air temperature, dew point, optical weather identifiers, to pavement temperature, surface status, and compound information being available. Some agencies utilize remote television cameras to monitor traffic and bridge conditions. This information will help agencies accurately determine the appropriate application of anti-icers.

Do not apply anti-icer under blowing conditions, particularly in areas prone to drifting and anywhere else that might be problematic for salt, such as all areas subject to wind issues.

Don't apply too much or the roadway may become slippery. Always follow application recommendations.

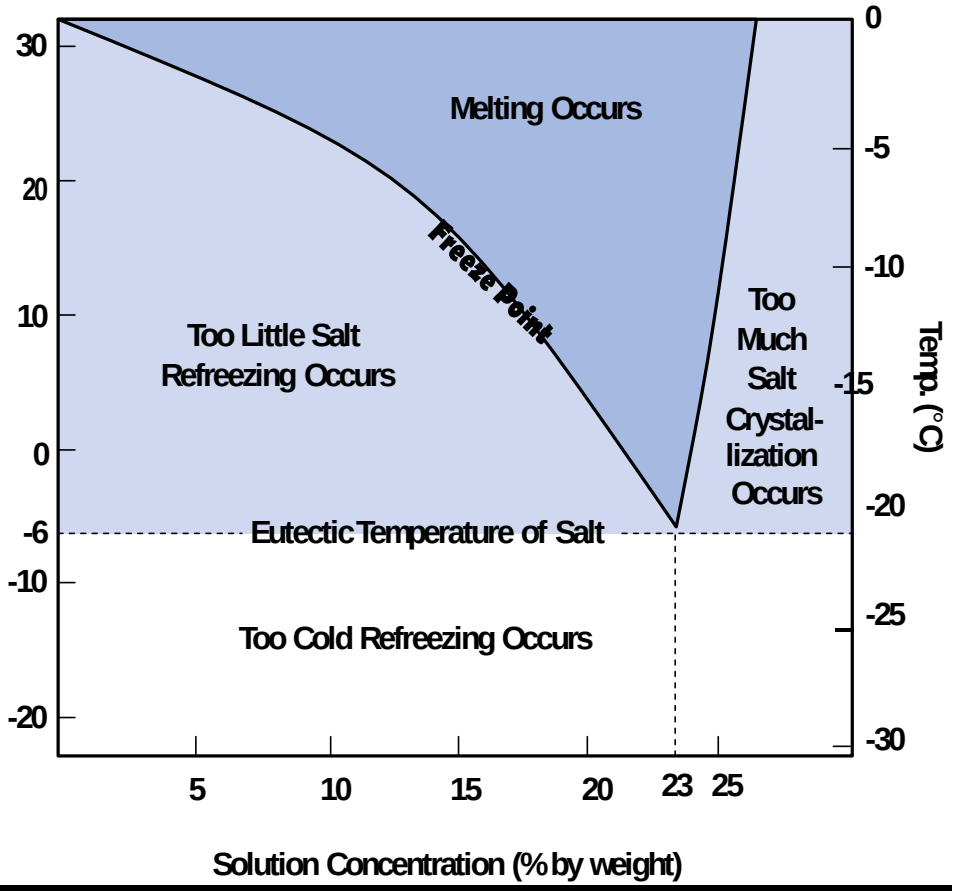
Don't apply CaCl2 or MgCl2 to a warm road (above 28°F pavement temperature). It can become very slippery and cause crashes!

Summary

Anti-icing measures are an important weapon in the snowfighter's arsenal. The appropriate use of anti-icing techniques results in:

- Returning to bare pavement conditions more quickly, saving lives and reducing property damage due to fewer accidents, as well as the reduction of traffic delays and the resulting reduction of losses to local economies;
- Reduction in the quantity of deicer use, resulting in cost savings and less environmental concerns; and
- Reduction in the manpower necessary to maintain safe road conditions, resulting in less overtime costs, less operator fatigue and safer working conditions. ❄

Phase Diagram for Salt



5.4 Action: Application Rates and Practices

The goal of winter operations is to maintain the specified Level of Service while using the minimum practical amount of chemical. Spreading rates and the timing of application are decisions that need to be made based on variables in weather conditions.

Although there are no firmly set application rates due to these variables, it is feasible for guidelines to be established based on known data. With continued data collection and by performing application rate studies these recommendations can be modified based on experience.

The approach to snow and ice control should be proactive. Therefore, it is recommended that anti-icing be the preferred method of operations when conditions permit. Mechanical removal of snow with proper plow types and cutting edges should be used to ensure adequate cleaning of the roadway prior to secondary chemical application. When applying chemical it is best managed by the use of ground speed oriented spreaders.

Appendix I contains application rate guidelines established by for roads and Appendix J contains application rate guidelines established for parking lots. The recommendations are based on data issued in Appendix B of the New Hampshire DOT Salt Management Plan and are derived from recommendations set by New York State Department of Transportation (NYDOT). They are in chart form with various winter conditions, temperatures, and treatment options for dry rock salt and pre-wet rock salt.

Application rate guidelines for straight liquid salt brine (23 percent concentration of NaCl) chemical are provided in Appendix M. They are based on data issued by the City of Hamilton, New Jersey and are recommended as a starting point, to be adjusted as experience dictates. Caution should be used as over-application of salt brine may cause slippery road conditions.

The following chart is a range of application rates for a variety of treatment options. Data sources are identified next to the recommended rates. The rates should be adjusted depending on various weather conditions and temperatures. In general lower rates are used at warmer temperatures around 28° F - 32° F and higher application rates are used at temperatures below 28° F. For temperatures below 15°F liquid chemical, salt, and prewet may not be beneficial due to chemical inactivity, increased chance of rapid freeze, and application rates that would be too high to be cost effective. Verify your products effective melting temperature prior to application and as a general rule use less chemical if the temperature is rising and more chemical if the temperature is falling.

Table 8. General Application Rates

	Dry Salt (lb.)	Salt prewet with Brine (lb.)	23% Salt Brine NaCl (gal.)	27% Mg Chloride MgCl (gal.)	32% Ca Chloride Mg/Cl (gal.)	Potassium Acetate (Ka)	Calcium magnesium Acetate (CMA) (gal.) / (lb.)	Sand (lb.)
Roads (per/lane mile)	100-450 NYDOT 250-300 NHDOT 100-400 MN05/ UNH T2 100 WI up to 250 FHWA	80-350 NYDOT 80-320 MN05 up to 250 FHWA	30-40 NYDOT 40-60 NHDOT/ UNH T2 20-50 MN05 44 WI 25-80 NJ 25 FHWA	28-30 NYDOT 15-25 MN05 15-35 UNH T2 26-33 WI (74-94 dry per lb.) WI	33-36 NYDOT 15-60 UNH T2 25-32 WI (89-111 dry per lb.) WI	10-30 UNH T2	15-25 / 200-400 UNH T2	500-800 NH DOT 400-800 UNH T2
Parking lots (per/1000 sq.ft.)	3-14 T2 0.75-3 MN06	3-11 T2 0.75-2.5 MN06	0.5-0.75 T2 0.2-0.4 MN06	0.1-0.2 MN06				

NYDOT- Highway Maintenance Guidelines Snow and Ice Control 2006
NHDOT – Winter Maintenance Snow Removal and Ice Control Policy 2001
MN05- Minnesota Snow and Ice Control Field Handbook for Snowplow Operators 2005
MN06- Minnesota Winter Parking Lot and Sidewalk Maintenance Manual 2006
NJ- Hamilton, New Jersey- Implementing an Anti-Icing Policy at the Municipal Level 2007
T2- University of New Hampshire Technology Transfer Center, Guidelines for Parking Lots 2010
UNH T2 – Technology Transfer Center Salt Reduction Workshop for Supervisors 2010
WI- Wisconsin Transportation Bulletin, Pre-Wetting and Anti-Icing, No. 22
FHWA – Federal Highway Administration, Manual of Practices for an Effective Anti-Icing Program

The most efficient and effective tool for reducing chloride levels without decreasing the level of service is selecting the appropriate time and method of snow and ice removal for each storm.

NH Road Salt Application Rates for Deicing Parking Lots
(Pounds per 1000 sq.ft.)

Pavement Temp. (°F) and Trend (↑ ↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per 1000 sq.ft.)			
			Salt Prewet/ Pretreated with salt brine	Salt Prewet/ Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only	4.5	4	4.5	Not recommended
	Frz. Rain	Apply chemical	5.75	5.25	6.5	Not recommended
30 ↓	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	6.5	5.75	7	Not recommended
25 - 30 ↑	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	6.5	5.75	7	Not recommended
25 - 30 ↓	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	7	6.5	8.25	10.5
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	7	6.5	8.25	10.5 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	5.75	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	7	7.5	10	10.5
15 - 20 ↑	Snow	Plow and apply chemical	7.5	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	8.75	7.5	10	10.5
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	8.25	7.5	10	10.5 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	10	Not recommended	13 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	23	Not recommended	13 and spot-treat as needed

Table 19. Application Rates for Deicing

These rates are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

NH Road Salt Application Rates for Deicing Roads
(Pounds per Lane Mile)

Pavement Temp. (°F) and Trend (↑ ↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per lane mile)			
			Salt Prewet/ Pretreated with salt brine	Salt Prewet/ Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only	150	125	150	Not recommended
	Frz. Rain	Apply chemical	175	150	200	Not recommended
30 ↓	Snow	Plow and apply chemical	175	150	200	Not recommended
	Frz. Rain	Apply chemical	200	175	225	Not recommended
25 - 30 ↑	Snow	Plow and apply chemical	200	175	225	Not recommended
	Frz. Rain	Apply chemical	225	200	225-275	Not recommended
25 - 30 ↓	Snow	Plow and apply chemical	250	200	275	Not recommended
	Frz. Rain	Apply chemical	275	250	275-300	450
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	275	275	275-300	450 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	275	250	300-325	Not recommended
	Frz. Rain	Apply chemical	300	275	325-400	450
15 - 20 ↑	Snow	Plow and apply chemical	300	275	325	Not recommended
	Frz. Rain	Apply chemical	300-375	275-350	325-400	450
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	325	300	350	450 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	300-350	Not recommended	600 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	350-500	Not recommended	600 and spot-treat as needed

Table 19. Application Rates for Deicing

These rates are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

Pony Motor-Run Spreader Calibration

NH Best Management Practices

WHY CALIBRATE?

You can't reduce your salt use if you don't know how much salt you actually use! The goal of calibrating is to know how much material you are putting down on a roadway or parking lot for every setting on your truck that you use. This is why calibrating your equipment is the first step to reducing salt use and saving money!

REMEMBER:

Each truck must be independently calibrated for each material it will be used to spread (the salt calibration card *will* be different than the sand calibration card).

Calibrations should be preformed annually, or after a spreader is serviced.

CALCULATIONS:

There are a few simple calculations you must perform in order to complete the calibration. Once all of the necessary data is recorded, head back inside and warm up! Refer to the reverse side of this fact sheet for calculation instructions.

Step 1: Load the Truck

Partially load the truck. Half of a full load should be more than adequate for calibration purposes.

Step 2: Set Your Controls

Gate Height: Set the gate height to its lowest practical setting to start (approximately 1" to 1.5"). After the truck is calibrated for the lowest gate setting, calibrate for each 1/2" increment greater than the lowest setting. Continue until all gate settings you use are calibrated.

Engine Speed: Set the pony motor speed to the maximum setting, or to the setting you would normally use.

Step 3: Measure Spread Width

Measure the width that the material covers during spreading. Do this for each gate setting you are calibrating. Round your numbers to the nearest half foot and record them in column "**W**" of the calibration chart (see reverse side).

Step 4: Collect & Weigh Material

You will need either a sheet of canvas, a tarp, or a bucket to collect the material that is dispensed from the spreader, as well as a scale. Weight the object you are using to collect the material in, and record that value in the purple box above the discharge rate column. Collect material for 1 minute. Weigh the collected material and subtract the weight of the tarp/canvas/bucket. Record this value in the first purple column of the calibration chart. Do this 3 times for each gate opening that is typically used. Average these three values together and record in the orange column in the calibration chart.

Step 5: Perform Calculations

Go inside and calculate your discharge rate using the calibration chart for each truck speed and gate setting you normally use. Refer to the reverse side of this fact sheet for calculation instructions. The formula you will be using is shown below:

$$D = \frac{B \times C}{A}$$

Step 6: Distribute Completed Calibration Cards!

Put a copy of the calibration card in the truck you just calibrated. Also, leave a copy of the calibration card in the office so you have a copy incase the original is damaged.

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

New Hampshire DOT

T2 New Hampshire Technology Transfer Center

Hydraulic-Run Spreader Calibration

NH Best Management Practices

WHY CALIBRATE?

You can't reduce your salt use if you don't know how much salt you actually use! The goal of calibrating is to know how much material you are putting down on a roadway or parking lot for every setting on your truck that you use. This is why calibrating your equipment is the first step to reducing salt use and saving money!

REMEMBER:

Each truck must be independently calibrated for each material it will be used to spread (the salt calibration chart *will* be different than the sand calibration chart).

Calibrations should be preformed annually, or after a spreader is serviced.

CALCULATIONS:

There are a few simple calculations you must perform in order to complete the calibration. Once all of the necessary data is recorded, head back inside and warm up! Refer to the reverse side of this fact sheet for calculation instructions.

Step 1: Load the Truck

Partially load the truck. Half of a full load should be more than adequate for calibration purposes.

Step 2: Set Your Controls

Gate Height: Set the gate height to its lowest practical setting (~ 2"). This should be kept constant throughout the calibration process. If you find that not enough material is dispensed with this setting, try 2.5" to 3".

Engine Speed: Warm the truck up and run the engine at the typical rate seen during spreading (approximately 2000 rpm).

Step 3: Measure Spread Width

Measure the width that the material covers during spreading. Do this for each conveyor/auger setting you are calibrating. Round your numbers to the nearest half foot and record them in column "**W**" of the calibration chart (see reverse side).

Step 4: Collect & Weigh Material

You will need either a sheet of canvas, a tarp, or a bucket to collect the material that is dispensed from the spreader, as well as a scale. Weight the object you are using to collect the material in, and record that value in the purple box above the discharge rate column. Collect material for 1 minute. Weigh the collected material and subtract the weight of the tarp/canvas/bucket. Record this value in the first purple column of the calibration chart. Do this 3 times for each conveyor/auger setting that is typically used. Average these three values together and record in the orange column in the calibration chart.

Step 5: Perform Calculations

Go inside and calculate your discharge rate using the calibration chart for each truck speed and conveyor/auger setting you normally use. Refer to the reverse side of this fact sheet for calculation instructions. The formula you will be using is shown below:

$$D = \frac{B \times C}{A}$$

Step 6: Distribute Completed Calibration Cards!

Put a copy of the calibration chart in the truck you just calibrated. Also, leave a copy of the calibration chart in the office so you have a copy incase the original is damaged.

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New Hampshire DOT

New Hampshire Technology Transfer Center

Calibration Chart (Hydraulic Type)

Material: _____ Truck/Spreader ID: _____

Date: _____ Performed by: _____

Tarp/Canvas/Bucket Weight: _____

Conveyor or Auger Setting	W	A	Discharge Rate (lb/min.)			B	D					
	Spread Width (ft.)	5.28 × W	Run 1	Run 2	Run 3	Average Discharge Rate *((Run1 + Run2 + Run3)/3)*	Pounds of Material Discharged per 1000 square ft. *(D = B × C ÷ A)*					
							5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1												
2												
3												
4												
5												
EX	14	5.28 × 14= **73.92**	87	92	93	(87+92+93)÷3= **90.67**	12 × 90.67 ÷ 73.92= **14.72**	6 × 90.67 ÷ 73.92= **7.36**	4 × 90.67 ÷ 73.92= **4.91**	3 × 90.67 ÷ 73.92= **3.68**	2.4 × 90.67 ÷ 73.92= **2.94**	2 × 90.67 ÷ 73.92= **2.45**

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each conveyor/auger setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable "**C**". The "**C**" value for each travel speed is shown in red under that given speed. Multiply column **B** by the "**C**" value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$

Calibration Chart (Pony Motor Type)

Material: _____ Truck/Spreader ID: _____

Date: _____ Performed by: _____

Tarp/Canvas/Bucket Weight: _____

Gate Opening	W	A	Discharge Rate (lb/min.)			B	D					
	Spread Width (ft.)	5.28 × W	Run 1	Run 2	Run 3	Average Discharge Rate *((Run1 + Run2 + Run3)/3)*	Pounds of Material Discharged per 1000 square ft. *(D = B × C ÷ A)*					
							5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1”												
1.5”												
2”												
2.5”												
3”												
EX	14	5.28 × 14= **73.92**	87	92	93	(87+92+93)÷3= **90.67**	12 × 90.67 ÷ 73.92= **14.72**	6 × 90.67 ÷ 73.92= **7.36**	4 × 90.67 ÷ 73.92= **4.91**	3 × 90.67 ÷ 73.92= **3.68**	2.4 × 90.67 ÷ 73.92= **2.94**	2 × 90.67 ÷ 73.92= **2.45**

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each gate setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable “**C**”. The “**C**” value for each travel speed is shown in red under that given speed. Multiply column **B** by the “**C**” value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$

Pre-wetting

NH Best Management Practices

PRE-WETTING?

Pre wetting is the process of coating a solid de icer with a liquid before it is spread on a roadway.

WHY PRE-WET?

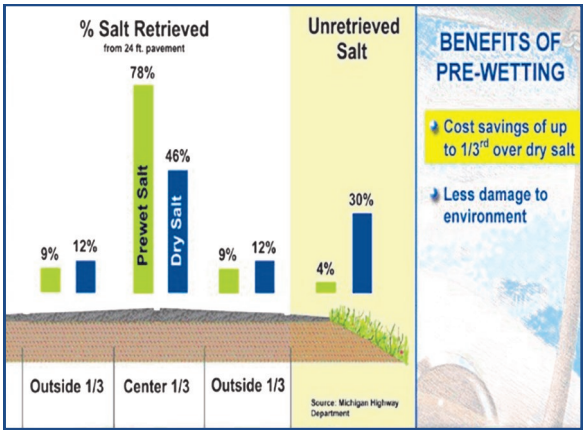
De icing chemicals must form a brine before they can begin melting ice. Pre wetting your chemicals accelerates the brine making process, which improves the melting action of the material. Pre wetting also reduces bounce and scatter of material during spreading, and reduces the total amount of de icer needed to obtain the desired results.

REDUCED RATES

If you are pre wetting, don t forget to reduce your application rates accordingly. Reduc tions in the range of 15 20% are typical.

HOW MUCH LIQUID?

A good rule of thumb is to use 8 10 gallons of pre wetting liquid for every ton of de icer. For other chemicals, such as magnesium chloride, consult your supplier for application rates

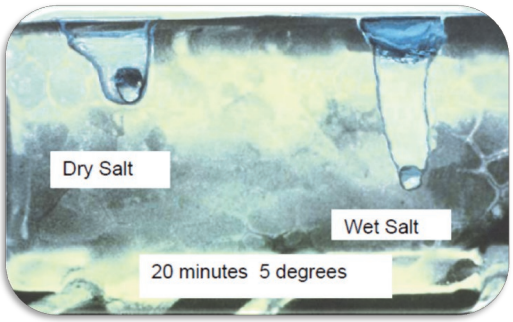


Pre-wetting Liquids

You have a few options for pre-wetting liquids. The most commonly used is a 23% sodium chloride brine solution. Calcium chloride at 32% solution is also used, as well as Magic Minus Zero™ and other patented products.

Getting Started

Wet the pile! There are two ways to pre-wet your de-icing chemicals. The easiest way to get started with pre-wetting is to spread your salt pile, spray it with pre-wetting liquid, mix it around, and re-pile it. More advanced truck mounted pre-wet systems can be installed on your trucks if you decide to make the investment.



Source: Wisconsin DOT Transportation Bulletin

Spraying the Pile

This is the easiest and most cost effective way to get started in pre-wetting. The first step is to spread your salt pile on a flat, impermeable surface. Next, spray the salt while it is spread out, and mix it around to ensure adequate and consistent liquid coverage. After the salt is sufficiently covered, re-stack the salt in your storage shed for later use.

Truck Mounted Systems

These systems are mounted in the truck bed and coat the de-icer with liquid as it comes off the conveyor/auger onto the spinner. These systems have the benefit of applying liquid only to the material you use as you use it. However, these systems must be installed on every truck that will be used to spread pre-wetted material.

Produced in partnership with:

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

New Hampshire DOT

New Hampshire Technology Transfer Center

The basic equipment used in brine making is a mixing tank, a holding tank, a pump, and a salometer. It is recommended that brine mixing and storage be indoors to reduce the risk of freezing when temperatures are below 0^{o} F; a circulatory pump may be used to reduce this risk if outdoor storage is the only option. If a mixing facility is not available or desired brine may be purchased from an independent vendor. DOT is currently willing to sell brine to the town of Windham for a pre-wetting trial period.

Figure 35. Salometer

Use the following guidelines for working with brine:

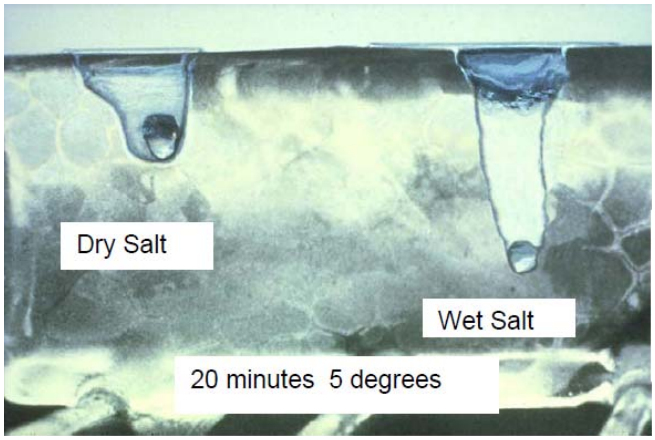
- Salometer reading should be 88.3 for 23% solution
- Specific gravity of 1.179 at 60° F
- Freeze point of -5.8° F for 23% solution
- One gallon of saturated brine contains 2.647 pounds of salt and weighs 10.027 poumds.
- One gallon of water dissolves 2.991 pounds of salt to produce 1.13 gallons of saturated brine.
- One ton of salt will produce 755.5 gallons of saturated brine.
- Chemical additives can be mixed with brine to further lower the freeze point.

For information about the proper storage of brine, see the Brine Storage and Management section. Refer to Appendix G for the New Hampshire Best Management Practices fact sheet on making brine**.**

Pre-Wetting

Pre-wetting is a term referred to a liquid deicer that is applied to a solid-based deicer in order to create a quicker reaction time for the solid deicer to begin melting snow and ice. Salt doesn't work until it is in solution, so it is recommended that all dry salt be pre-wetted regardless of the temperature. By introducing moisture into salt prior to application, the results are a quicker melting action, reduced bounce and scatter of material, and a reduced application rate.

Figure 36. Ice Melting



With a quicker melting action the application rate of pre-wet salt can be decreased by approximately 20 percent over dry salt, which saves money, increases level of service, and reduces chloride in the environment.

Pre-wetting decreases the amount of material that resides outside the target application area due to bounce and scatter. In a Michigan Highway Department study it was found that 20 percent to 30 percent of dry salt applied was immediately removed from the target pavement area. With pre-wet salt already beginning to produce a brine it tends to "stick" to the pavement surface and is worked in by vehicle and pedestrian traffic. Pre-wetting has shown to increase the performance of solid chemicals and their longevity on the roadway surface, thereby reducing the amount of materials required. (O'Keefe and Shi, 2005)

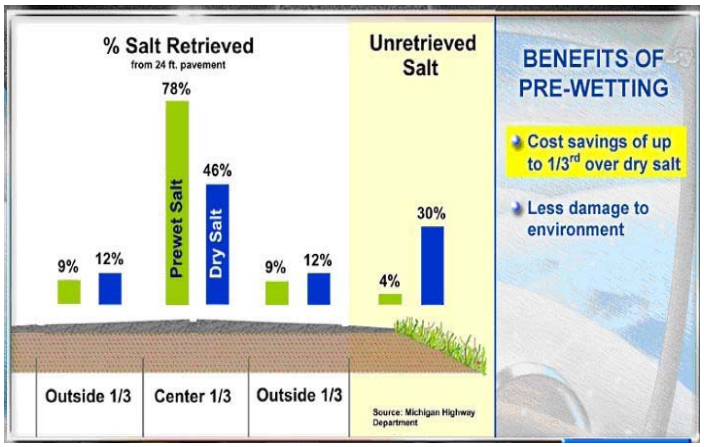


Figure 37. Bounce and Scatter of Salt

Pre-wetting can be accomplished at the stockpile, in the body of a truck, at the spinner, and at the auger.

Wetting stockpiles can be done with a liquid injector that uses special nozzles that inject deep into the pile, but this method is not readily used due to the level of management required. The degree of coating on dry salt is highly dependant on the skill of the operator

and frequent reworking of the pile is needed. Because of leaching risks, all stockpiles should be covered and on an impervious pad.

Another method of pre-wetting at the pile is to move the needed amount of dry salt into an area for mixing. Spray liquid deicer onto the smaller pile at the desired rate, mix, and then load into the truck.

Figure 38. Overhead Pre-Wet Spray System

Spraying truckloads is accomplished by spraying liquid chemical onto a loaded truck, or while material is being loaded to the truck with an overhead spray-bar system. Spraying stockpiles and truck loads is not as practical since granules are not uniformly coated and liquid may drain out of the solid material. Performance on the road may not be consistent throughout the route.

The most efficient method is to pre-wet while salt is being discharged from the chute or at the spinner.

Solutions for pre-wetting can include sodium chloride brine, calcium chloride, magnesium chloride, potassium acetate, calcium magnesium acetate and various agricultural products.

For the UNH T2 best management practices fact sheet on Pre-wetting please refer to Appendix H.

If pre-wetting salt is not an option then pretreated salt may be available for purchase from your local supplier. It is important that the pre-wetted salt be stored in a covered area or within a building to reduce leachate and material waste.

Abrasives

Abrasives (sand and fine mineral aggregates) provide temporary traction on roads, hills, intersections or other problem areas. Abrasives do not melt ice or snow. They are generally used in very cold temperatures when other materials are not as effective. Abrasives, once applied, are quickly dispersed off the road surface by traffic, therefore they are most beneficial in very low traffic areas.

upcoming weather conditions and storms. For additional information regarding station locations within New Hampshire please visit the DOT informational poster on RWIS at: http://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/documents/12323i_poster.pdf

5.2.2 Pavement Temperature

The two most critical factors that can produce a winter road hazards are pavement temperature and the dew point/precipitation rate. Pavement temperature, not air temperature, is the deciding factor for treatment type and duration. The pavement temperature directly effects the formation, development, and breaking of a bond between fallen or compacted precipitation and the road surface. The pavement temperature also determines the effectiveness of any applied chemicals. Pavement temperatures can be significantly affected by the following:

- Air temperature trends - may indicate what the pavement temperatures are likely to do.
- Subsurface temperatures - warm subsurface temperatures (typically in the fall) will help pavement hold heat and keep the pavement temperature from dropping. During the winter and spring, pavement temperatures will drop quickly because the ground is still cold. Pavement temperatures can be considerably colder then the air temperature in the spring, creating frost and ice conditions.
- Time of day - The amount of sunlight and the angle at which the sunlight hits the road will influence the pavement temperature and the melting effectiveness of any chemical that has been applied.
- Cloud cover - Daytime cloud cover can cause pavement temperatures to cool. During the night, lack of cloud cover causes heat to escape and cooling to occur.
- Wind speed and direction - can have either a warming or cooling effect.
- Precipitation rate - the amount of precipitation; whether it is snow, freezing rain, or sleet that falls within a given time will affect the temperature of the pavement.

Black ice or frost will form on a very cold pavement surface when air has cooled to its dew point. The dew point is the saturation temperature of the air. The higher the dew point, the greater the moisture in the air. The lower the dew point, the drier the air. When the air temperature is cooled to the dew point, water vapor in the air will condense into either a liquid or a solid.

It is essential to know the current pavement temperature, dew point, and weather forecast to accurately treat snow and ice problems.

5.2.3 Traffic, Road Surface, Beat

Vehicles can affect the pavement surface in many ways. Vehicles can compact the snow, abrade it, displace it or disperse. Heat from tire friction, engines, and exhaust can add measurable heat to the pavement surface. Vehicle action and road surface can influence, both positively and negatively, the effectiveness of snow and ice control. The volume of vehicle traffic should be considered when establishing levels of response.

Road surfaces such as asphalt, porous pavement, or gravel and locations such as intersections, bridges, shaded areas, steep grades, sharp curves, on/off ramps, and areas near high traffic facilities should be given special consideration along with areas prone to snow drifting or that experience sudden icing.

Have efficient and effective beats planned for your staff and prepare procedures for call outs and call backs. Have a description of beat length, the average time to run the beat along with the amount of chemical needed to complete it.

Road variables to take into consideration include:

- Geometrics – bridge decks, steep grades or sharp curves will influence the application rate required.
- Cold Spots – Cold spots at higher elevations or in shaded areas may require application and treatment techniques that are different from the rest of the route.
- Pavement Surface – surface consistency and variation will affect the types of equipment and techniques used.
- Lanes – the number of lanes being treated will effect the cycle time of the beat.
- Speed – truck speed will vary considerably due to traffic, buildings, pedestrians, and road type.
- Time of day – The amount of sunlight and the angle at which the sunlight hits the road.

NH Road Salt Application Rates for Deicing Parking Lots
(Pounds per 1000 sq.ft.)

Pavement Temp. (°F) and Trend (↑ ↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per 1000 sq.ft.)			
			Salt Prewet/ Pretreated with salt brine	Salt Prewet/ Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only	4.5	4	4.5	Not recommended
	Frz. Rain	Apply chemical	5.75	5.25	6.5	Not recommended
30 ↓	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	6.5	5.75	7	Not recommended
25 - 30 ↑	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	6.5	5.75	7	Not recommended
25 - 30 ↓	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	7	6.5	8.25	10.5
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	7	6.5	8.25	10.5 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	5.75	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	7	7.5	10	10.5
15 - 20 ↑	Snow	Plow and apply chemical	7.5	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	8.75	7.5	10	10.5
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	8.25	7.5	10	10.5 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	10	Not recommended	13 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	23	Not recommended	13 and spot-treat as needed

Table 19. Application Rates for Deicing

These rates are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

NH Road Salt Application Rates for Deicing Roads
(Pounds per Lane Mile)

Pavement Temp. (°F) and Trend (↑ ↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per lane mile)			
			Salt Prewet/ Pretreated with salt brine	Salt Prewet/ Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only	150	125	150	Not recommended
	Frz. Rain	Apply chemical	175	150	200	Not recommended
30 ↓	Snow	Plow and apply chemical	175	150	200	Not recommended
	Frz. Rain	Apply chemical	200	175	225	Not recommended
25 - 30 ↑	Snow	Plow and apply chemical	200	175	225	Not recommended
	Frz. Rain	Apply chemical	225	200	225-275	Not recommended
25 - 30 ↓	Snow	Plow and apply chemical	250	200	275	Not recommended
	Frz. Rain	Apply chemical	275	250	275-300	450
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	275	275	275-300	450 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	275	250	300-325	Not recommended
	Frz. Rain	Apply chemical	300	275	325-400	450
15 - 20 ↑	Snow	Plow and apply chemical	300	275	325	Not recommended
	Frz. Rain	Apply chemical	300-375	275-350	325-400	450
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	325	300	350	450 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	300-350	Not recommended	600 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	350-500	Not recommended	600 and spot-treat as needed

Table 19. Application Rates for Deicing

These rates are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

means that when mixed with water, depending on the concentration, it will lower the temperature at which the solution freezes. Solid sodium chloride loses it effectiveness (has difficulty going into solution) when temperatures fall below 15° F. Applications of dry salt below this temperature, even at high rates, will not result in snow or ice melting; therefore, it is critical that salt is applied at the appropriate pavement temperature. The average cost of NaCl is $58/ton or about $0.07 a gallon for 23.3 percent brine solution.

Dry salt that is applied directly to roads does not all remain in the targeted application area. The salt grains bounce and scatter after being applied and are blown off the pavement surface. With less salt retained on the road additional treatments or higher than needed application rates are required. For best effect with the least environmental impact salt should be pre-wetted with brine rather than applied in dry form. Refer to Appendix F for additional information regarding how salt works and Appendix H on pre-wetting salt.

Other Chlorides

Calcium(CaCl) and magnesium chloride(MgCl) are often used as salt alternatives; however, they have the same impact on water quality since they both contain chlorides. These chemicals work differently than salt in that they do not require heat energy to go into a solution; instead they give off heat when they go from a solid into a solution. Their main benefit is having lower eutectic temperatures, providing more melting power at lower temperatures. They are more effective in dry, cold conditions as compared with salt. It is not recommended that they be applied at high application rates or when pavement temperatures are above 28 degrees Fahrenheit due to an increase in slippery road conditions. They are both corrosive and may contain corrosive inhibitors. The cost associated with making brine using Mg chloride averages between $0.45-$0.75/gal and for Ca chloride the cost of brine is around $0.82/gal and $250/ton for flake.

Alternative De-Icers

Environmental impacts associated with the selection of alternative deicers should be considered. Road salt alternatives are primarily proprietary and are not well documented in scientific literature. Available data is limited, particularly regarding long-term environmental impacts.

Most agricultural by-products are not as good at melting ice; however, they do slow the formation of ice crystals, making them good for anti-icing and pre-treating. Some agricultural byproducts

have freezing points near -30° F. They are less corrosive than many conventional materials. Most products are derived from the processing of grains or other agricultural products. They have a higher cost associated with them and most often are mixed with products such as magnesium chloride.

Table 7. Generalized Environmental Concerns for Chloride Alternatives

Product	Chemical Formula	General Information	Environmental Concern
Calcium Magnesium Acetate (CMA)	CaMgAc	powder, crystal, pellet or liquid, non-corrosive, cost around $1,000/ton or $1.30/gal	Organic content leading to BOD
Potassium Acetate (KA)	KAc	liquid, non-corrosive, 50% concentration cost around $3.00/gal	Organic content leading to BOD
Agricultural By-Products	N/A	mostly proprietary, can be derived from corn, beet, alfalfa, alcohol, grains, or molasses. Less corrosive, lowers freeze point, generally not good at melting alone. Avg cost $1.00/gal	Organic content leading to BOD, Heavy Metals, nutrient enrichment by phosphorus, nitrogen
Urea (Urea, Ammonia)	Urea, Ammonia	fertilizer with high nitrogen content, corrosive, cost around $350.00/ton	Rapid break down and release of Ammonia, Fertilizer leading to nutrient enrichment, algae blooms and BOD

Since Dinsmore Brook flows into Cobbetts Pond and Cobbetts Pond is impaired for dissolved oxygen saturation and total phosphorus, agricultural by-products are not recommended, except in small quantities to pre-wet salt.

Addition of organic compounds (e.g., acetate or mixed organic matter from biomass) may cause deoxygenation in the water, which in turn could cause the release of potentially harmful substances such as heavy metals into the groundwater and could be a cause of taste and odor problems (NCHRP, 2004).

Brine

Using brine is the most cost effective way to anti-ice or pre-wet. Brine is widely used in other states because it is easy to produce, economical and effective for events occurring at moderate or subfreezing temperatures. There are many types of products that are used to make brine such as sodium chloride (NaCl), magnesium chloride (MgCl), potassium acetate(KA), calcium magnesium acetate(CMA) as well as proprietary blends. Each product has its

ENVIRONMENTAL
Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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WD-DWGB-22-30 2019

Storage and Management of Deicing Materials

Storage and management of deicing material can be a source of contamination of surface water and groundwater, causing a violation of state water quality standards. These salt-based products dissolve in precipitation and either infiltrate though the ground surface to groundwater, or run off into surface water. Salt that infiltrates the subsurface at significant concentrations can also react with the soils and release metals into groundwater and surface water at concentrations that exceed water quality standards.

The term "deicing material" used here refers to deicing salts, and may include any of the following in either solid or liquid form: sodium chloride (often called rock salt), potassium chloride, calcium chloride, magnesium chloride, and other mixtures that contain salts (chlorides) including mixtures with abrasives, such as sand, cinder, slag, etc.

Need for Proper Management

Due to their high potential for causing groundwater and surface water pollution, salt storage facilities should not be placed in environmentally sensitive areas. The best strategy to prevent pollution from deicing materials and the associated liability is to use and store these materials responsibly. Facilities should develop good housekeeping practices to minimize loss and waste during the delivery, storage, loading and management of deicing materials.

Existing and new facilities that operate without impermeable surfaces and infiltrate brine to the ground or groundwater need to register with the New Hampshire Department of Environmental Services (NHDES) under Env-Wq 402, Groundwater Discharge Permit and Registration Rules. This is a free registration and is a method of tracking potential contaminant sources. If there are sensitive receptors nearby, some sites may be required to monitor drinking water wells and/or the groundwater. The registration form can be found at the Groundwater Discharge Permitting and Registration program page.

Best management practices (BMPs) for locating a new deicing materials storage facility should include the following:

- The facility should be located in an area that is not environmentally sensitive. Avoid areas where there are wells, reservoirs, or within the footprint of stratified-drift aquifers.
- The facility should be located on a flat site away from surface water and wetlands.
- Site drainage should be designed to direct clean stormwater away from the operations and storage areas in order to keep the stockpiles as dry as possible.
- Drainage that is contaminated with salt should be directed to a sewage treatment plant (subject to municipal approval), collected for use in pre-wetting activities or sent for proper disposal.

Structures and Work Areas

Ideally deicing material storage facilities should be completely enclosed, with storage and working areas on impervious surfaces such as asphalt or coated concrete. There should be stormwater drainage controls to prevent runoff water and snow melt from contacting or running through loading and material storage areas. Overhead cover to protect material from exposure to snow and rain should be installed to minimize runoff and inventory loss. A fixed roof is preferred over a tarp, because it is very difficult to keep storage piles completely covered with tarps during winter months and storm events.

Buildings should have concrete foundations and can be designed using dome, barn, or fabric style structures. For more information on constructing salt storage units, calculating how much space is needed for storage, and salting practices, see the Salt Institute's publications at www.saltinstitute.org. *The Salt Storage Handbook* contains tables that indicate how much space is required to cover different height piles, and provides surface areas of exposed salt piles, to help in calculating number and size of tarps for *temporarily* covering salt piles.

The following BMPs should be considered when storing and managing deicing materials.

Storage Structures

- All salt and sand/salt mixtures should be stored on pads of impermeable asphalt or concrete. Storage and loading areas should have an impermeable floor constructed of asphalt, concrete or other suitable material that extends around the buildings and work area exterior. The area should be sloped away to prevent stormwater from entering the loading areas or structure.
- Concrete pads and walls should be treated to prevent concrete deterioration (spalling).
- Structure hardware should be galvanized and concrete block buildings should be waterproofed inside.
- If using a three-sided building, the exposed salt at the open end should be covered.
- Stormwater and snowmelt runoff should be properly controlled. Building floors and storage pads should be sloped to prevent ponding and allow any water to drain away from the storage piles.

On-Site Management: Delivery/Handling/Loading

- All sand and sand/salt mixtures temporarily out in the open should be covered to prevent salt from being washed or blown from the pile.
- If a permanent under-roof work area is not possible, then storage and handling activities should be conducted on impermeable (bituminous) pads. Any deicing materials left outdoors should be completely covered with waterproof tarpaulins.
- All surplus materials must be removed from the site when winter activity is finished.
- Working areas should be bermed and sloped to allow snow melt and stormwater to drain away from the area. In some cases, it may be necessary to channel water to a collection point, such as a sump, holding tank, or lined basin for collection.
- Storage and distribution should only be conducted during the fall/winter season.
- Spreaders should not be overloaded such that material spills off the vehicle. A plan for loading operations to prevent overfilling vehicles and eliminating material spillage during transportation should be developed and implemented.
- Salt spilled at the storage yard and loading areas should be collected and returned to the storage pile.
- Annual inspection and repairs should be carried out prior to the start of each season. Ongoing inspection of storage structures, work areas, and deicing liquid storage tanks should be carried out during the season.
- Solid bagged materials should be stored securely, indoors if possible.

- Spreaders should only be washed at a location where the wash water is properly managed. (See NHDES fact sheet WD-DWGB-22-10 Management of Vehicle Wash Water.)
- Liquid storage tanks should be designed such that a plumbing failure will not result in release of the contents. Backflow prevention may be necessary on some plumbing applications.
- Liquid storage tanks should be protected from impact from vehicles moving about the yard and be located such that spilled material can be contained and retrieved in the event of a tank or piping failure. Secondary containment should be provided around large liquid storage tanks.

Brine Storage and Management

In recent years, brine has been used on roads prior to storms as an effective ice preventative, reducing the amount of deicing materials needed during a storm event. The water that runs off storage and loading areas can be collected into watertight tanks or lined basin(s) and re-used in pre-storm wetting of roads. Any brine storage should be designed with inert materials that are compatible with salt.

Brine stored using holding tanks must be managed so that there are no releases to drains, groundwater or surface waters. If there is a floor drain in a building where brine is stored, it must be connected to a municipal sewer system (with the approval of the local authority), routed to a registered holding tank or permanently sealed. (see fact sheet WD-DWGB-22-8 Holding Tanks for Floor Drains)

Storage ponds or collection basins used for brine storage must be lined and must not receive runoff from areas other than the storage and operations areas. The basin itself must be impermeable to prevent infiltration of the collected water into the ground. The basin may need a roof or cover to reduce the accumulation of snow and rain water. The collection of this runoff water would only be necessary during the winter maintenance months (November through March). During the remaining seven months of the year, the non-brine stormwater can be redirected from the brine storage to a natural discharge point.

The preferred management option for any brine collected is for use as a pre-wetting agent for roads prior to winter storms. The release of this collected water to the ground, groundwater, or a stormwater system during operation or at season's end is not permissible and as a consequence, this type of runoff management may require disposal of the brine by one of the following methods: (1) discharge directly to a publicly owned treatment works (POTW) with local approval; (2) pumping and transporting the salt water to a POTW system by tank truck; (3) evaporation; or (4) treatment to remove salt and on-site discharge under a Nondomestic Wastewater Registration.

References:

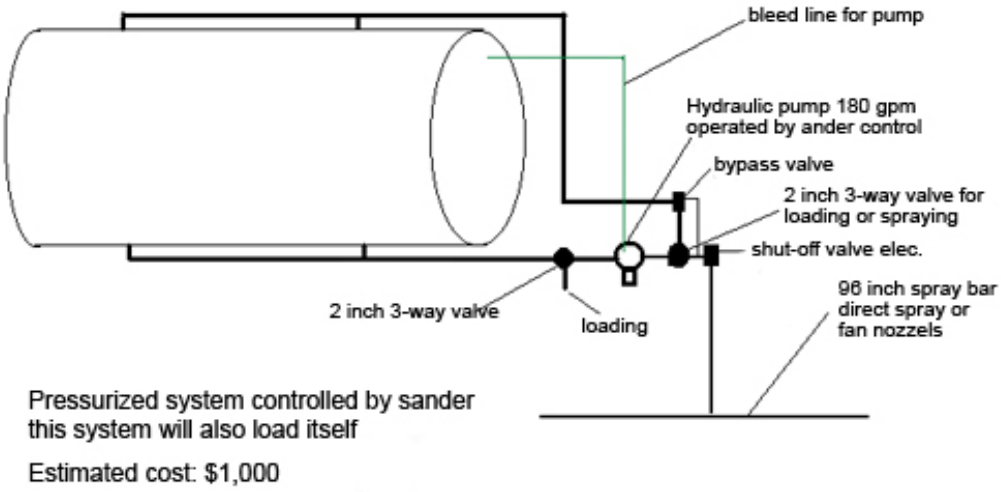
Salt Institute
Michigan Department of Environmental Quality Salt and Brine Storage Guidance
Guide to Salt Storage Requirements for Small Commercial Snow Removal Services
Environnent Canada
Best Management Practices for Salt Use on Private Roads, Parking Lots & Sidewalks
SIMA (Snow & Ice Management Assoc.)

For More Information

Please contact the Drinking Water and Groundwater Bureau at (603) 271-2513 or by email at dwgbinfo@des.nh.gov

Note: This fact sheet is accurate as of June 2019. Statutory or regulatory changes, or the availability of additional information after this date may render this information inaccurate or incomplete.

Figure 25: Graphic of Home-Made Brine Unit



http://www.iowadot.gov/maintenance/images/equipment/truck_back.jpg

5.1.4 Calibration

During winter operations, changes may occur in mechanical linkages, hydraulic systems and other components. Yearly calibration of equipment allows for better control of application rates for various gate height/openings. Gate height or gate openings should be adjusted to spread the desired chemical application rate for each set of unique conditions. Re-calibration should be done if any changes are made to the equipment or if a different deicing material is used. In addition to manufacturer specifications, see Appendix B for Hydraulic-Run Spreader Calibration and Appendix C for Pony Motor-Run Spreader Calibration. Keep a record of the calibration results with the vehicle and refer to it for the application settings recommended for the various weather conditions.

5.1.5 Storage and Site Management

In addition to managing how salt is applied to parking lots and roadways, it is also important to manage how dry salt, pre-wet salt, salt brine, salt/sand mixtures, and snow piles are stored and handled. This section was adapted from DES Fact Sheet WD-DWGB-22-30.

Chloride storage facilities can contribute to both surface and ground water contamination. The location of a storage facility should not be in an area that is environmentally sensitive. Avoid areas where there are wells, reservoirs, or within the footprint of stratified drift aquifers.

Ideally deicing material storage facilities should be completely enclosed, with storage and working areas on impervious surfaces such as asphalt or

coated concrete. Buildings should have concrete foundations and can be designed using dome, barn, or fabric style structures.

Figure 26. Improper Site Management

There should be storm water drainage controls to prevent runoff water and snow melt from contacting or running through loading and material storage areas. Overhead cover to protect material from exposure to snow and rain should be installed to minimize runoff and inventory loss. A fixed roof is preferred over a tarp, because it is difficult to keep storage piles completely covered with tarps during winter months and storm events.

As a general practice, site drainage should direct clean storm water away from the operations and storage areas in order to keep the stockpiles as dry as possible. In new facilities or facilities that are being retrofitted drainage that is contaminated with salt should be directed to a sewage treatment plant (subject to municipal approval), collected for use in pre-wetting activities or sent for proper disposal.

Salt Storage Structures

- All salt and sand/salt mixtures should be stored on pads of impermeable asphalt or concrete. Storage and loading areas should have an impermeable floor constructed of asphalt, concrete or other suitable material that extends around the buildings and work area exterior. The area should be sloped away from the structure to prevent storm water from entering the loading areas or structure.
- Concrete pads and walls should be treated to prevent concrete deterioration.
- Structure hardware should be galvanized and concrete block buildings should be waterproofed inside.
- If using a three sided building, the exposed salt at the open end should be covered.
- Storm water and snowmelt runoff should be properly controlled. Building floors and storage pads should be sloped to prevent ponding and allow any water to drain away from the storage piles.

Figure 27.
Town of Derry NH Salt Storage

Brine Storage and Management

In recent years brine has been used on roads prior to storms as an effective ice preventative, reducing the amount of deicing materials needed during a storm event. The water that runs off storage and loading areas can be collected into watertight tanks or lined basin(s) and reused. Any brine storage should be designed with inert materials that are compatible with salt.

Brine stored in holding tanks must be managed so that there are no releases to drains, groundwater or surface waters. If there is a floor drain in a building where brine is stored, it must be connected to a municipal sewer, routed to a registered holding tank or permanently sealed. For the NHDES fact sheet on floor drains refer to Appendix D.

Storage ponds or collection basins used for brine storage must be lined and must not receive runoff from areas other than the storage and operations areas. The basin itself must be impermeable to prevent infiltration of the collected water into the ground. The basin may need a roof or cover to reduce the accumulation of snow and rain water. The collection of this runoff water would only be necessary during the winter maintenance months (November through March). During the remaining seven months of the year, the non-brine stormwater can be redirected from the brine storage to a natural discharge point.

The preferred management option for any brine collected is for use as a pre-wetting agent for roads prior to winter storms. The release of this collected water to the ground, groundwater, or a stormwater system during operation or at season's end is not permissible and as a consequence, this type of runoff management may require disposal of the brine by one of the following methods:

1) Discharge directly to a publicly owned treatment works (POTW) with local approval;

2) Pumping and transporting the salt water to a POTW system by tank truck;
3) Evaporation; or
4) Treatment to remove salt and onsite discharge under a Nondomestic Wastewater Registration.

Figure 28. Proper Brine Storage

All liquid storage tanks should be protected from impact by vehicles moving about the yard and be located such that spilled material can be contained and retrieved in the event of a tank or piping failure. Secondary containment should be provided around large liquid storage tanks.

<u>Snow Storage and Disposal</u>

The environmental effects of disposed snow result from high levels of sodium chloride, sand, debris and contaminants from automobile exhaust. It is the debris contained in plowed snow that makes it illegal to dump snow directly in water bodies. RSA 485-A:13,I(a) prohibits discharging wastes to surface waters without a permit. Groundwater is sensitive to snow dumping due to the high levels of sodium chloride in plowed snow. RSA 485-C:12 prohibits the sitting or operation of snow dumps within classified wellhead protection areas.

Figure 29. Snow Storage and Disposal

The following guidelines are designed to select safe places to dump plowed snow. Snow dumps are kept out of water bodies due to the litter and debris content. Litter and debris do not belong on the land surface either; after the snow melts, all litter and debris must be collected and disposed of properly.

- Disposed snow should be stored near flowing surface waters, but at least 25 feet from the high water mark of the surface water.

- A silt fence or equivalent barrier should be securely placed between the snow storage area and the high water mark.
- The snow storage area should be at least 75 feet from any private water supply wells, at least 200 feet from any community water supply wells, and at least 400 feet from any municipal wells. (Note: Snow storage areas are prohibited in wellhead protection areas [class GAA groundwater].)
- All debris in the snow storage area should be cleared from the site prior to snow storage.
- All debris in the snow storage area should be cleared from the site and properly disposed of no later than May 15 of each year the area is used for snow storage.

Onsite Management: Delivery/Handling/Loading

- All sand and sand/salt mixtures temporarily out in the open should be covered to prevent salt from being washed or blown from the pile.
- If a permanent covered work area is not possible, then storage and handling activities should be conducted on impermeable (bituminous) pads. Any deicing materials left outdoors should be completely covered with waterproof tarpaulins.
- All surplus materials must be removed from the site when winter activity is finished.
- Working areas should be bermed and sloped to allow snow melt and stormwater to drain away from the area. In some cases, it may be necessary to channel water to a collection point, such as a sump, holding tank, or lined basin for collection.
- Storage and distribution should only be conducted during the fall/winter season.
- Spreaders should not be overloaded such that material spills off the vehicle. A plan for loading operations to prevent overfilling vehicles and eliminating material spillage during transportation should be developed and implemented.
- Salt spilled at the storage yard and loading areas should be collected and returned to the storage pile.
- Annual inspection and repairs should be carried out prior to the start of each season.
- Ongoing inspection of storage structures, work areas, and deicing liquid storage tanks should be carried out during the season.
- Solid bagged materials should be stored securely, indoors if possible.
- Spreaders should only be washed at a location where the wash water is properly managed. Please refer to Appendix L for The DES fact sheet on the Management of Vehicle Wash Water.

- Liquid storage tanks should be designed such that a plumbing failure will not result in release of the contents. Backflow prevention may be necessary on some plumbing applications.

5.2 Information: Evaluate and Monitor Conditions

Knowing current and expected conditions is essential for planning snow and ice control operations. Weather and road conditions change constantly and must be monitored. The decision to initiate treatment can only be made if accurate information is available. Treatment options chosen should be modified as necessary to address road conditions as they develop.

Monitor and evaluate the following information to assist in making the right treatment decision:

- Start and end times of precipitation
- Type of storm, precipitation type and amount expected, wind, intensity
- Pavement, ambient and dew point temperatures and trends
- Road conditions and surfaces
- Post-storm forecast
- Traffic and accident information

Information can be obtained from local, state, and national weather and road services. Access to information can be obtained by phone, radio, internet radar forecasting services, RWIS data, and by truck mounted or hand-held pavement temperature sensors. Private weather and road condition forecasting services are also available by contract at a cost to the subscriber.

Truck mounted and hand-held infrared pavement temperature sensors are critical tools for operators because they provide real-time data and allow for application rate adjustments to be made accordingly.

Communication among operators and law enforcement officials can assist in making snow and ice management decisions.