# Monitoring of Municipal Salt Management Plans In the District of Muskoka

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Muskoka
WATERSHED COUNCIL

## INTRODUCTION

The mission of the Muskoka Watershed Council (MWC) is to **Champion Watershed Health.** In pursuing this mission, MWC evaluates the watershed through research on, and analysis of, issues impacting the health of the watersheds. The Muskoka Watershed Report Card is the primary tool used to communicate the results of this work. MWC also prepares position papers on issues of concern.

## PURPOSE AND RECOMMENDATIONS

The purpose of this paper is to report on the implementation of municipal salt management plans across Muskoka. The Province also uses salt on provincial highways and private shopping centres use salt on their parking lots to ensure safe conditions. These applications will not be addressed in any detail in this report.

In general, municipalities have methodically implemented their respective plans over the last four years. In particular, significant capital investment has been made in the construction of new salt domes with impervious floor surfaces, the installation of proper facilities to store pre-wetting material (water or a de-icing solution added to road salt or sand before, or during, application to the road ), and the acquisition of trucks and computers with pre-wetting capability. This effort should be commended.

Not all actions can be implemented at the same time, and additional work is required to completely implement the salt management plans. In particular, the following activities, recommended in the salt management plan, are outstanding:

1. Monitoring of snow storage areas to determine the levels of salt, oil/grease and heavy metals present in the snow melt that are released to the environment. The results of this monitoring program are to be used to initiate the mitigation of any adverse environmental impacts.

2. The treatment of waste water that is high in salt from vehicle washing sites before it is released to the environment.

3. Development of a program to monitor salt levels in area lakes. Monitoring programs that address groundwater or terrestrial concerns should also be considered.

## BACKGROUND

The use of salt as a de-icer in winter road conditions has both immediate benefits for road conditions and significant potential environmental impacts.

The de-icer used by municipalities in Muskoka is sodium chloride (NaCl), as it is relatively inexpensive and is an effective mechanism to address icy winter road conditions. The use of road salt, as well as the ensuing runoff from roadways, salt storage yards and snow disposal sites, has contributed to elevated chloride levels in surface water in various parts of Ontario. Figure 1 illustrates that surface water chloride levels in local lakes have also increased slightly over the last 10 years (Somers, 2009). Salt management plans have been developed to help manage this risk.

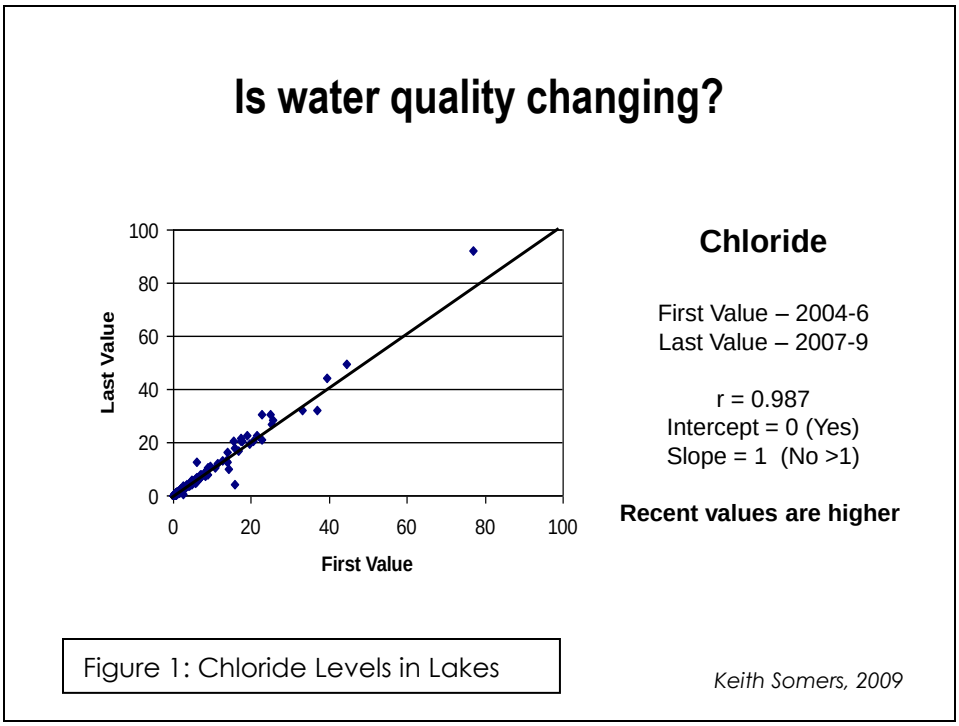


Figure 1: Chloride Levels in Lakes

The use of road salt is always contentious, with the proper balance between safe winter road conditions and environmental protection hard to define and achieve. In response to concerns over the impact of road salt on the environment, Environment Canada published the Code of Practice for the Environmental Management of Road Salt in April 2004.

The code applies to organizations that:

a) Use more that 500 tonnes of road salt per year, and
b) Have vulnerable areas that could be potentially impacted by road salt.

Any organization that met these criteria was required to prepare a Salt Management Plan by June 30, 2005. The District Municipality of Muskoka and its member municipalities, with the exception of the Townships of Lake of Bays and Georgian Bay, meet the criteria in the Code. However, to ensure a comprehensive approach the District and all six Area Municipalities undertook to prepare Salt Management Plans. These Plans were completed and adopted by Councils in 2006.

The expressed objective of winter maintenance by municipalities is to provide a safe and efficient transportation system. The values of such a system include:

- Lower accident rates with associated reductions in injury and loss of life;
- Lower associated insurance and liability claims;
- Time savings from faster travel;
- Fuel savings from better traction and less congestion;
- Reduced productivity losses due to late days and absenteeism;
- Avoidance of lost sales due to inaccessibility or unavailability;
- Reduced cost of commodities by reducing the transportation costs;
- Ensuring that emergency services can operate efficiently and effectively; and
- Ensuring the mobility of residents to engage in social activities.

On the other hand, the associated environmental costs of using road salt include:

- Ground and surface drinking water contamination;
- Altered timing of lake stratification with resultant changes to deep-water oxygenation;
- Reduced diversity in plants and animals;
- Injury and mortality of a variety of aquatic and terrestrial species including lake trout, deer, and many birds;
- Dieback of white pine;
- Increase in salt-tolerant invasive species;
- Automobile damage; and
- Building damage.

Salt Management Plans are designed to balance the costs and benefits of using road salt.

**REVIEW OF SALT MANAGEMENT PLANS**

Provincial regulation recommends that in order to reduce municipal liability, roads that carry an average of more than 800 vehicles per day during the winter months should not be allowed to exceed 4 cm of snow cover and that a bare pavement condition with minimum centre bare condition be achieved within 24 hours after the end of a storm. These are called Level One roads. With current technology, this level of service is possible only with the use of salt. District roads that are required to meet these criteria are detailed in Appendix A.

As noted above, depending on the volume of traffic on a roadway, winter maintenance can involve either the application of pure salt to achieve a bare surface standard, or the application of a sand/salt mixture. Secondary roads carry lower volumes of traffic and can tolerate snow-packed conditions. The sand/salt mixture contains 3% salt, which is necessary to ensure that the sand does not freeze and clump in cold conditions.

Salt Management Plans address the use of salt in both these situations; however, significantly more care is required with the storage and application of pure salt. Appendix B compares the distance of roads salted to the distance where only a sand/salt mixture is used. In general it is the District Roads that require salt while only a few Area Roads experience the traffic volume to warrant salt application. In particular, it should be noted that no roads in the Township of Lake of Bays require a pure salt application.

Salt Management Plans are intended to manage the impact of the use of salt and mitigate any negative impacts by reducing the amount of salt used on roads or dispersed into the environment from storage areas. Given the public's desire to use roads regardless of winter conditions, particularly in regions like Muskoka, the ability of roads managers to reduce the use of salt is particularly limited. However, steps to reduce the environmental impact of salt have been taken. Since 2007, the Muskoka Watershed Council has monitored the implementation of the Salt Management Plans of the District Municipality of Muskoka and the Area Municipalities with annual interviews with the Directors of Public Works (Roads).

Even with the implementation of Salt Management Plans, it is unlikely that the overall use of salt will decrease. The use of salt is dependent on weather and road conditions. As more people move to Muskoka it is likely that more roads will experience winter traffic volumes over 800 vehicles per day. At that volume a road will be classified as a Level One road and require the use of salt to maintain the bare pavement condition. In addition, as the climate changes, it is predicted that Muskoka will experience more temperatures closer to the freezing point, resulting

in the likelihood of more ice. Both these conditions would suggest that the use of salt on roads will increase, making sound environmental management and use of salt critical.

## CONFORMITY TO SALT MANAGEMENT PLANS

Salt Management Plans focus on procedures and operational practices, as well as capital projects that will mitigate the environmental impact of road salt. While each of these activities can have environmental impacts, procedural practices are less expensive to implement and have generally been accepted as 'standard practice' across Muskoka, in particular:

- Winter maintenance policies – Each municipal council has adopted maintenance policies that implement Ontario Regulation 239/02 (Municipal Act).

- Equipment calibration – Equipment is calibrated annually before the snow season and as required throughout the winter.

- Equipment washing
  - The District Municipality of Muskoka washes vehicles inside at Glen Orchard, which is equipped with an oil/water/grit separator. Water is disposed of into the ground.
  - The contractor to The District Municipality of Muskoka washes vehicles inside at their private facility on Rosewarne Drive, which is equipped with an oil/grit separator. Water is disposed of into the ground.
  - The Towns of Bracebridge and Huntsville wash vehicles inside and use oil/water/grit separators. Water is disposed of into the ground.
  - The Township of Muskoka Lakes washes vehicles inside. Water is disposed of into the ground.
  - The Town of Gravenhurst washes vehicles outside and allows water to soak into the ground.
  - The Township of Georgian Bay washes vehicles inside and uses an oil/water/grit separator. Water is disposed of into the ground.
  - The Township of Lake of Bays does not use salt and washing is not an issue.

- Material ordering and delivery – All salt is ordered and delivered in the fall to covered facilities. The Town of Bracebridge is constructing a new salt dome this year to replace the current shed-type storage.

- Material storage and handling – Salt can either be 100% salt on Level One roads or it can be a 3% sand-salt mixture used on roads with lower traffic counts. Most Area roads use a sand-salt mixture, while the pure salt mixture is used on high volume District Roads and Provincial Highways.

  All municipalities store salt inside, and new domes have been built in Glen Orchard (DMM) Mactier (GB), Port Severn (GB), and Dwight (LOB). District is planning a dome for the eastern portion of the District at Baysville to replace the Rosewarne site owned by the current District contractor. Muskoka Lakes, Gravenhurst and Huntsville had salt domes prior to the development of the Salt Management Plans. Most municipalities also store their sand/salt mixture inside, although the Town of Huntsville does not yet have an indoor facility.

- Snow Disposal – No snow disposal sites are located on impervious surfaces and snow melt is discharged directly into the environment.

- Weather forecasting – Muskoka has 24-hour patrol vehicles with infrared thermometers (IRTs) that monitor road conditions. All municipalities monitor weather through the Environment Canada website and MTO's ARWIS.

- Storm response – Storm plans are in place and reviewed on an ongoing basis.

- Winter Patrol – Patrol policy is in place with trained people.

- Snow and ice control training – New staff attend the provincial 'snow school' and there is annual refresher training.

- Technology review – The District Municipality of Muskoka, in conjunction with Area Municipalities, tests new equipment as appropriate.

- Material Record Keeping – Although there is a mix of manual and electronic record-keeping depending on the size of the municipality, all municipalities meet provincial standards.

**CAPITAL COMPONENTS OF SALT MANAGEMENT PLANS**

The upgrading of capital equipment is critical in achieving a reduction in the impact of road salt on the environment. On high-volume roads, the use of pre-wetting technology is a key capital upgrade. Used properly, it can reduce the amount of salt used and improve the efficiency of its application. Pre-wetting is the addition of water or a de-icing solution to road salt or sand before, or during, application to the road. In solution, the salt will adhere to the road surface better and reduce salt waste. Salt Management Plans identified several key improvements, including:

- Covered storage with impervious floor surfaces for all salt supplies – The District Municipality of Muskoka and the Townships of Lake of Bays and Georgian Bay have constructed new domes to house their salt. The Town of Bracebridge plans to construct a new dome this year. The Towns of Gravenhurst and Huntsville and the Township of Muskoka Lakes previously had adequate facilities. The Town of Huntsville does not have covered storage for its sand/salt mixture.

- Pre-wetting capability on trucks – Pre-wetting requires both onboard computers to regulate use and the proper mixing and spreading mechanisms. In most cases new trucks are required to satisfy this requirement.

  Currently, the District contractor (Fowler) and the Towns of Huntsville and Bracebridge have pre-wetting capability. The Town of Gravenhurst has acquired the onboard computers and required pumps but do not yet have complete pre-wetting capability. It will continue to be a budget item. The Township of Georgian Bay has recently acquired a new truck with pre-wetting capabilities. They are exploring options with the MTO to implement a pre-wetting program.

  The Township of Muskoka Lakes has not acquired pre-wetting capability due to other budget priorities.

The Township of Lake of Bays does not salt any of its roads and does not require pre-wetting capability.

The final two components of the Salt Management Plans are:

- Communications strategy – The District Municipality of Muskoka has developed a brochure for general distribution on regulations governing District roadways. The brochure explains the different maintenance regimes for Level One and Level Two priority roads, as well as a brief explanation of the value of pre-wetting. The District website also provides information on winter road maintenance and policies.

  Information on the winter policies and practices applicable to Area Municipality roads is not readily available.

- Environmentally sensitive areas – All of Muskoka is considered to be environmentally sensitive due to the number of lakes and wetlands in close proximity to roads. Monitoring of salt impacts on surface water is recommended in the Salt Management Plans. There have been initial discussions at the District of Muskoka to analyze the impact of road salt on area lakes.

  The long-term cumulative effects of salt on both terrestrial and aquatic environments have not been well studied or considered in the development of local Salt Management Plans.

**PROVINCIAL SALT MANAGEMENT PLAN**

No monitoring of the Ministry of Transportation's (MTO) Salt Management Plan has been done. Given the higher traffic volumes on provincial highways, environmental impacts are likely greater than on District or Area roads. All provincial highways in Muskoka are required to meet the Level One standard, which states that a roadway will not exceed 4 cm of snow cover and that a bare pavement condition with minimum centre bare condition will be achieved within 24 hours after the end of a storm. As stated previously, this can only be achieved with the use of salt.

Similar to municipalities, the province has taken steps to reduce the environmental impact of road salt. The following list of actions is taken directly from the MTO website http://www.mto.gov.on.ca/english/engineering/roadsalt.shtml:

- All salt-spreading trucks are equipped with Electronic Spreader Controls (ESC). These instruments allow the operator to control the amount and location of salt placed, resulting in efficient salt usage.
- The ministry continues to expand the use of 'pre-wetted' salt. This practice involves adding a small amount of liquid de-icer to road salt as it is placed on the road. Pre-wetted salt stays on the road better and works faster than dry salt. Pre-wetting equipment was installed on 140 salt and sand spreaders this past winter.
- Infrared thermometers are installed in over 200 winter maintenance vehicles to provide fast, accurate road and air temperature readings. This information assists in planning where and when salt application will be most effective.

- MTO recently completed trials using high-speed spreaders. These spreaders place salt on the road in a controlled manner, resulting in less scatter, bounce and waste.
- Trials are underway using rubber snowplough blades. These blades are more flexible and clean the snow from the road surface better than traditional metal blades, resulting in less need for salt.
- The ministry is expanding the use of snow hedge innovations that prevent snow from drifting onto highways, resulting in less need for salt.
- Automated Vehicle Location (AVL) systems, using Global Positioning System (GPS) technology, allow maintenance managers to monitor salt usage to ensure application rates conform to ministry standards. These systems are installed on approximately 240 vehicles.
- MTO uses Advanced Road Weather Information Systems (ARWIS) to monitor and forecast road and weather conditions to schedule winter maintenance operations and eliminate unnecessary salt applications. MTO owns 82 ARWIS stations and has access to information from an additional 18 sites, for a total of 100 ARWIS stations, more than any other Canadian province. MTO is currently installing 30 new stations across Ontario.
- Two automatic bridge de-icing systems have been installed: one at Highway 401 and 416, one on Highway 17 in Ottawa, with three under construction. These systems automatically spray liquid de-icing chemicals on the bridge surface when ice or snow is anticipated. Also, the ministry has initiated trials to evaluate mobile liquid anti-icing techniques to prevent black ice from forming and snow from packing on the road surface.
- MTO's Maintenance Technology Project is piloting a variety of new winter maintenance technologies designed to ensure efficiency and enhanced environmental protection.

The ministry's actual salt usage is highly dependent upon weather conditions, varying from 500,000 to 600,000 tonnes of salt annually. Combining safe road salt use with new and existing MTO technologies is estimated to reduce road salt use by up to 20 percent.

MTO is also a member of a national Road Salt Management working group assigned by the Council of Deputy Ministers responsible for transportation and highway safety. Consisting of both Canadian road maintenance agencies and Environment Canada, this group ensures that state-of-the-art salt management practices are identified. MTO will continue to explore new and emerging technologies to further enhance road salt management practices.

**PRIVATE SALT USE AND MANAGEMENT**

The use of salt by private companies to ensure safe parking lots, private roads and walkways has not been investigated.

## CONCLUSIONS AND RECOMMENDATIONS

Since the development of local Salt Management Plans in 2006, considerable advancements have been made by municipalities to reduce the impact of salt in the watersheds of Muskoka. As with any new program with a considerable capital component, implementation has been dictated by the budget process. However, in the last five years, the following capital improvements have been made:

1. New salt domes have been constructed in Glen Orchard by the District Municipality of Muskoka, in Port Severn and Mactier by the Township of Georgian Bay, in Dwight by the Township of Lake of Bays, and this year the Town of Bracebridge will construct a new dome.

2. Pre-wetting capability has been improved with full capability in the Towns of Bracebridge and Huntsville, and by the District contractor. The Town of Gravenhurst and Township of Georgian Bay have acquired equipment that will become operational as budgets allow.

Additional work is required to completely implement the Salt Management Plans. In particular, the major areas of improvement include:

1. Monitoring of snow storage areas to determine the levels of salt, oil/grease and heavy metals present in the snow melt that are released to the environment. The results of the monitoring program are to be used to initiate the mitigation of any adverse environmental impacts.

2. The treatment of waste water that is high in salt from vehicle washing before it is released to the environment;

3. Development of a program to monitor salt levels in area lakes. Monitoring programs that address groundwater or terrestrial concerns should also be considered.

The management of salt by the District and Area Municipalities in Muskoka has improved in the last four years since the approval of municipal Salt Management Plans. Additional measures to reduce the impact of salt on the environment should be considered in order to protect the health of the watershed and lake water quality. In particular, disposal of water from washing vehicles and improved salt storage should be addressed along with better monitoring of sensitive areas.

The Muskoka Watershed Council will continue to monitor the implementation of the Salt Management Plans.

**APPENDIX A**
**Level One – Winter Maintained Roads**

| Level ONE - DISTRICT ROADS | | |
|---|---|---|
| **ROAD No. & AREA MUN.** | **ROAD DESCRIPTION** | **Length (Km)** |
| M.R. 1 G/H | Highway 118E. to Muskoka Road 6 at Highway 11. | 7.9 |
| M.R. 2 H/V | Muskoka Rd. 45 (Hoodstown Rd.) to Locks Bridge. | 18.6 |
| M.R. 3 H/V | Hwy. 11 at Big East River to Huntsville/Muskoka Lakes Bdry. | 28.6 |
| M.R. 3 M/L | Rosseau Village Limit to Muskoka Lakes/Huntsville Boundary. | 15.9 |
| M.R. 4 B/B | Muskoka Rd. 118W. (Wellington St.) to Muskoka Rd. 35. | 17.0 |
| M.R. 5 G/B | Muskoka/Simcoe Bdry. in Port Severn to Honey Harbour Rd. | 13.3 |
| M.R. 6 G/H | Muskoka Road 1 at Highway 11 to Muskoka Road 20. | 8.4 |
| M.R. 7 M/L | Muskoka Road 118W. to Muskoka Road 28 at Minett. | 10.9 |
| M.R. 10 H/V | Highway 11 to Muskoka Road 2. | 14.7 |
| M.R. 11 G/B | Highway 69 to Highway 612 at Healey Lake Road. | 6.1 |
| M.R. 14 B/B | Muskoka Rd. 37 to East Limit of Highway 11 Overpass. | 1.2 |
| M.R. 15 B/B | Muskoka Road 118W. to Brobst Lane. | 0.7 |
| M.R. 16 B/B | Muskoka Rd. 37 at Ontario Street to Beaumont's Road. | 6.6 |
| M.R. 17 G/H | Muskoka Road 18 to Muskoka Road 41. | 0.4 |
| M.R. 17 G/H | Winewood Ave. to Muskoka Sands Resort (North Entrance). | 5.0 |
| M.R. 18 G/H | Muskoka Road 169 at Hwy. 11 to End of Muskoka Road 18. | 4.6 |
| M.R. 23 H/V | Highway 60 to Canal Bridge. | 1.6 |
| M.R. 35 B/B | Muskoka Road 4 to Highway 141. | 0.8 |
| M.R. 36 G/H | Muskoka Road 1 to Beaver Creek Institution Entrance. | 1.5 |
| M.R. 37 B/B | Hugh Campbell Drive to Muskoka Road 4 at MacDonald Street. | 4.9 |
| M.R. 41 G/H | Muskoka Road 169 (Brock St.) to Muskoka Road 6. | 3.4 |
| M.R. 42 B/B | Muskoka Road 37 (Manitoba St.) to Highway 11 North Exit. | 2.6 |
| M.R. 44 H/V | Muskoka Road 10 at Muskoka River Bridge to Highway 11. | 3.9 |
| M.R. 118W. B/B | Highway 11 to West Mall Road. | 6.7 |
| M.R. 169 G/H | North Muldrew Lk Rd to Muskoka Road 18 at Highway 11. | 3.1 |
| M.R. 2 Fowler | Muskoka Road 117(Baysville) to Locks bridge. | 20.5 |
| M.R. 117 Fowler | Highway 11 to Highway 35 | 43.0 |
| M.R. 118 Fowler | Muskoka Road 169 to West mall Road in Bracebridge. | 31.4 |
| M.R. 169 Fowler | Highway 69 at Foote's Bay to North Muldrew Lk. Road | 44.0 |
| M.R. 38 Fowler | Highway 69 to Muskoka Road 169 | 17.6 |
| | | |
| | **TOTAL LEVEL I BARE PAVEMENT** | **344.9** |

M.R. – Muskoka Road B/B – Bracebridge H/V – Huntsville G/H – Gravenhurst
G/B – Georgian Bay M/L – Muskoka Lakes

**APPENDIX B**
**Level of Service by Municipality**

| Municipality | Level of Service | | | | | | |
|---|---|---|---|---|---|---|---|
| | Road Category | | | | Total | | |
| | District Rd by Area Maintenance | | Area Roads | | | | |
| | Salted (km) | Sanded (km) | Salted (km) | Sanded (km) | Salted (km) | Sanded (km) | Salted (%) |
| Bracebridge | 36.5 | 60.7 | 24.28 | 243.5 | 60.78 | 304.2 | 16.65 |
| Gravenhurst | 36.3 | 72.1 | 1.3 | 252.7 | 37.6 | 324.8 | 10.37 |
| Georgian Bay | 20.4 | 42.2 | 0 | 85.0 | 20.4 | 127.2 | 13.82 |
| Huntsville | 68.4 | 55.0 | ~1 | 391.2 | 69.4 | 446.2 | 13.46 |
| Lake of Bays | 0 | 72.4 | 0 | 268.0 | 0 | 340.4 | 0 |
| Muskoka Lakes | 26.8 | 84.6 | 0 | 383.6 | 26.8 | 468.2 | 5.4 |
| Fowlers | 156.5 | N/A | N/A | N/A | 156.5 | N/A | 100 |
| **Total** | **344.9** | **387** | **26.58** | **1624.0** | **371.48** | **2,011.0** | **18.47** |