Salt Management Plan
Monitoring Report

Prepared by

Document Owner	Project/Organization Role
Corporation of the County of Essex	Engineering Department

SMP Monitoring and Updating Annual Report Version Control

Version	Date	Author
1.0	December 2011	Essex County Highways
1.1	December 2012	Essex County Highways
1.2	November 2014	Essex County Highways
1.3	December 2015	Essex County Highways

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Salt Management Plan Monitoring Report

Introduction

The County of Essex has prepared this annual report to provide an update on the Salt Management Plan and associated Winter Control activities. This report compares the submitted data against previous years in order to monitor the County's ability to effectively manage the use of road salt. The report also establishes time-oriented objectives, along with an update on new technologies and strategies that have the potential to be implemented for our winter maintenance program.

Environment Canada Annual Reporting

The County of Essex has actively participated in the annual reporting of road salt usage to Environment Canada since the program's implementation in 2004. As part of the program, Essex County Highways annually reports the quantity of de-icing chemicals used for each winter, along with various other best management practices such as the percentage of road salt stored indoors, the number of sites with water collection systems, etc. All of the data is reported to Environment Canada (EC). This year marks the first year that Environment Canada allowed salt usage reporting through the Environment Canada's Single Window web application in an attempt to streamline the process, alongside various other EC reporting requirements. All of the road salt data reported by the County of Essex is available through the County's Engineering Department.

Winter Severity Index

The Transportation Association of Canada and others developed the Winter Severity Index (wsi) to evaluate the relative harshness of a winter over a specified period of time (Stugget et. al, 2006). The indicator measures the relative impact the harshness of a winter has on the application of road salt for winter maintenance operations. The model made available to the public in October 2007 uses various meteorological inputs to determine a wsi, which in turn is used to predict a total quantity of salt usage for the specified length of road network. Winter Severity Indices range between 1 and 100, where 1 indicates a predicted salt usage below the model's chosen minimum salt usage threshold, and 100 indicates a predicted salt usage above the model's chosen maximum salt usage threshold.

Initially, the County calculated a wsi for the entire winter period; however, the predicted total road salt usage was abnormally low. The low quantity predictions were the direct result of one of the meteorological variables, namely the average temperature. Due to Essex County's geographical location, our average temperature between the months of November and April is typically a few degrees above 0°C, resulting in low model returns for the predicted road salt usage. The prediction did not reflect the harsh winter months

normally experienced between December and February, therefore an alternative approach was considered for calculating the wsi. A wsi was calculated for each individual winter month from November to April along with predicted salt usage for each corresponding month. The predicted salt usage for each month was totaled to provide a predicted value for the entire winter. Table B1 shows the averaged wsi for the winter, total predicted salt usage and the actual reported total salt usage for reporting years 2011 to 2015. Figure B1 shows all of the information from Table B1 in a graphical format along with the data back to the year 2005.

Table B1: Average wsi and Salt Usage for the Past 5 Reporting Years

Reporting Year	**2011**	**2012**	**2013**	**2014**	**2015**
Winter Severity Index	60	47	57	64	54
No. of Events	84	36	63	92	77
Predicted Total Road Salt Usage (tonnes)	14,265	7,226	13,627	18,077	13,415
Reported Total Road Salt Usage (tonnes)[1]	23,655	11,121	9,500	25,600	23,205
% Difference between Reported and Predicted	49.5%	42.5%	-35.5	34.6	72.7

[1]Includes salt mass from brine used for liquid application.

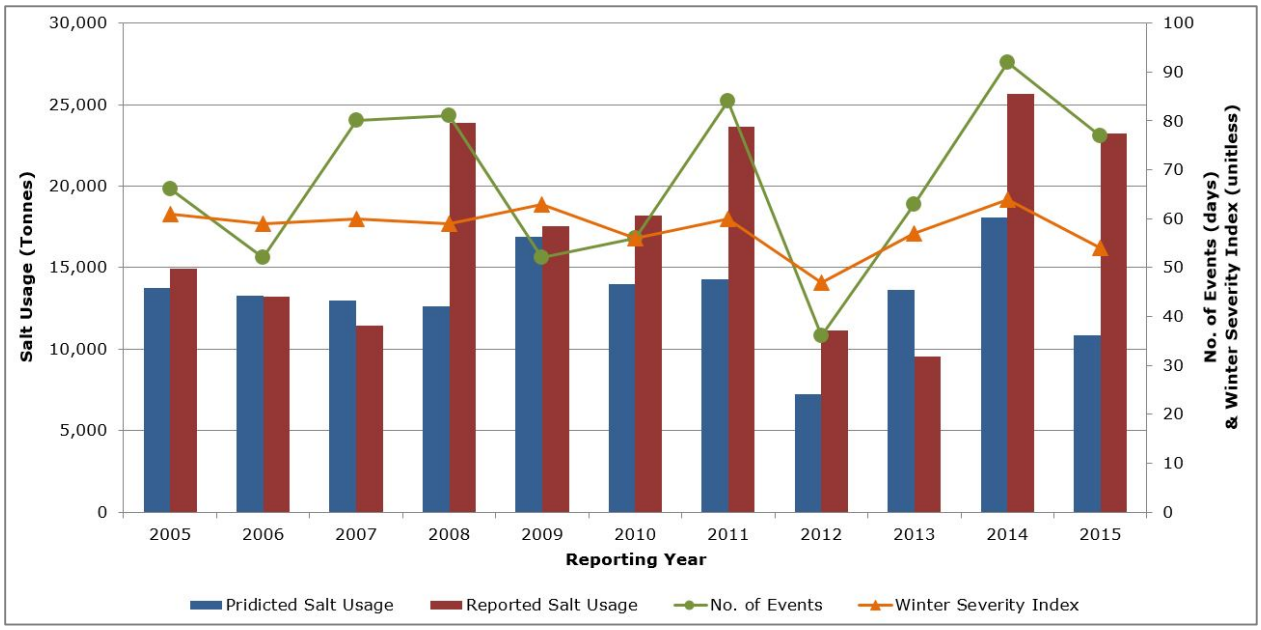

Figure B1: Predicted and Reported Salt Usage v. No. of Events and Winter Severity Index

As shown above in Figure B1, the winter severity was relatively consistent averaging at 58, with a slight dip in 2012.

Although the use of the wsi is encouraged from Environment Canada and Transportation Association of Canada, it should be noted that the model has a relatively low "goodness of fit" ranging from 0.54 to 0.66; the latter being the result of a relatively small sample size. Currently, the model does not include meteorological inputs such as wind speed and potential for snow drifts. Due to the inherent rural nature of the County Road Network, snow drifts can become problematic in certain areas, which are resolved by our Winter Maintenance staff. Other factors such as Minimum Maintenance Standards (MMS) Road Classifications are not incorporated into the model. Such standards have a profound impact on our winter maintenance operations. These factors may contribute to the large difference between predicted salt use and actual reported salt use.

As defined by Environment Canada, an event constitutes a precipitation event that requires deployment of winter maintenance crews; however, a single event may last for several days depending on the severity of the precipitation, temperature, wind, etc. It can be seen from Figure B1 that the number of events is random, as expected.

Active Transportation Facilities

Various Active Transportation (AT) facilities have been constructed over the past four (4) years across the County as part of the County Wide Active Transportation System (CWATS) Master Plan. Facility types vary from on-road facilities such as signed-only routes, paved shoulders, and off-road facilities. Year-round maintenance of these

facilities is necessary to ensure user safety for users and minimize the County's exposure to risk. Such maintenance also preserves and extends the life of the infrastructure.

The County has the intent to develop a maintenance strategy that will include facility classification system and establish service standard levels for each route classification. The intent is to build on the existing Minimum Maintenance Standards (MMS) outlined in Ontario Regulation 239/02 (as amended).

Winter Maintenance Management Review

Essex County Highways review winter maintenance best management practices annually. The review is broken down into ten (10) categories with each one having one (1) or more subcategories, best management practices, and performance measures. The categories are as follows:

Category No.	Category Name
1	Winter Maintenance Policies
2	Equipment Upgrading, Calibration, and Washing
3	Equipment Maintenance
4	Materials
5	Storm Response
6	Winter Patrol
7	Snow and Ice Control Training
8	Technology Review
9	Communications
10	Environmentally Sensitive/Vulnerable Areas

Below are a series of tables that describe performance measures for winter maintenance activities as well as current status and fiscal year (FY) targets for each of those performance measures

Category 1: Winter Maintenance Policies

Subcategory 1.1 Winter Maintenance Policy (ECH-R04-07)

Purpose / Description Outlines the strategies used for safe storage and effective use of snow and ice control products and Level of Service (LOS) for snow and ice on County Roads.

Environmental Consideration Prescribed LOS is the foundation of winter maintenance activities and has a significant impact on salt usage. There is also a need to demonstrate due diligence in the event of a claim against Essex County Highways.

Best Management Practice Review the winter maintenance program on an annual basis to determine whether revisions are required or warranted. The program is designed to meet or exceed the Minimum Maintenance Standards, O. Reg. 239/02 (as amended).

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Council approved winter maintenance policy	100%	100%	100%
PM 2	Develop an active transportation winter maintenance policy	50%	50%	10%

Subcategory 1.2 MMS Road Classification and Level of Service Policy (ECH-R06-07)

Purpose / Description Outlines the minimum maintenance standards and the level of service on all roads within the jurisdiction of the County of Essex

Environmental Consideration Prescribed LOS is the foundation of winter maintenance activities and has a significant impact on salt usage. There is also a need to demonstrate due diligence in the event of a claim against Essex County Highways.

Best Management Practice A documented and approved Level of Service policy (ECH-R06-07) exists and is followed by all snow and ice control personnel. The policy includes; response time, cycle times, end of storm conditions, etc.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Policy reviewed when traffic count data is available	100%	100%	100%

Category 2: Equipment Upgrading, Calibration and Washing

Subcategory 2.1 Pre-Wetting and Anti-Icing Equipment

Purpose / Description Pre-wetting is the process of spraying de-icing salt with a solution of liquid chemical (brine) before spreading the salt on the roadway. This process allows for better adhesion between the road salt and the road surface. It also ensures enough moisture is present to facilitate the snow melting process. As a result, pre-wetted road salt has the potential function faster and at lower temperatures than dry road salt.

Environmental Consideration Equipment upgrades such as “pre-wetting” has the potential to reduce the amount of rock salt applied to a road surface due to increased adhesion and efficiency in the snow melting process.

Best Management Practice Anti-icing is carried out when and where warranted. Staff is knowledgeable in the use and handling of solid and liquid anti-icing chemicals. Staff is knowledgeable in the use and handling of liquid fuels

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Percentage of vehicles equipped with pre-wetting capabilities	85%	85%	60%

Subcategory 2.2 Electronic Spreader Controls

Purpose / Description Electronic spreader controls can be accurately calibrated, regulated to ground speed, and generate pertinent salt-use data.

Environmental Consideration Electronic controllers ensure that the chosen and prescribed amount of salt is being placed on the roadway consistently, regardless of speed and provides data that permits salt use to be tracked.

Best Management Practice Material application data from each event, at the truck or route level, is logged. Data can be reviewed and archived.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Percentage of fleet vehicles with electronic spreader controls	100%	100%	100%

Category 3: Equipment Maintenance

Subcategory 3.1 Electronic Spreader Controls

Purpose / Description Calibrated equipment is important for the effective placement of de-icer material on Essex County roadways.

Environmental Consideration Effective quantity and placement of salt depends on accurate calibration of spreaders.

Best Management Practice All spreaders are calibrated before the start of each winter season. Spreaders are checked and recalibrated when required throughout the season.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Spreaders are calibrated annually	100%	100%	100%
PM 2	Verify contractor calibrations	100%	100%	100%
PM 3	Maintain calibration history	100%	100%	100%
PM 4	Review standardized application rates, which are related to precipitation and pavement temperature	100%	100%	100%

Subcategory 3.2 Equipment Washing

Purpose / Description Washing is intended to minimize chloride and oil and grease discharges to the environment.

Environmental Consideration Wash water contains salt, oil, grease, which have an adverse effect when discharged to soil and/or groundwater.

Best Management Practice All wash water is collected and sent for proper disposal where possible.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Percentage of patrol yards with oil/water separators	100%	100%	50%
PM 2	Investigate options for managing wash water	100%	25%	25%

Category 4: Materials

Subcategory 4.1 Ordering

Purpose / Description The quality of the snow and ice control materials should be sufficient for all winter maintenance needs.

Environmental Consideration Improper handling and storage of salt can increase loss to the environment. Excessive moisture creates salt clumps that are difficult to spread, and also interfere with the success of the pre-wetting operations.

Best Management Practice Materials are ordered, delivered, and stored in covered salt domes or sheds immediately upon delivery to reduce loss to the environment.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Percentage of orders covered / placed inside for storage	100%	100%	100%

Subcategory 4.2 Storage and Handling

Purpose / Description Appropriately sized storage facilities with large entrance ways can minimize salt handling upon delivery.

Environmental Consideration Improper handling and storage of salt can increase loss to the environment. Excessive moisture creates salt clumps that are difficult to spread, and also interfere with the success of the pre-wetting operations.

Best Management Practice Materials are ordered, delivered, and stored in covered salt domes or sheds immediately upon delivery to reduce loss to the environment.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Percentage of salt stored indoors on an impermeable surface	100%	100%	100%
PM 2	Percentage of salt storage facilities with drainage water management systems	100%	100%	100%

Subcategory 4.3 Recordkeeping

Purpose / Description Record keeping for quantity of material and the location of its use is necessary for effective salt management.

Environmental Consideration Effective salt management requires accurate knowledge of how much salt is being used and where. It is not sufficient to measure gross totals, which vary widely from year-to-year due to weather conditions.

Best Management Practice Material usage data is collected from the electronic spreader controllers to assess salt management practices.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Internally retrieve, review and archive spreader data from the electronic controllers	100%	0%	0%
PM 2	Implement material tracking system by vehicle, route, and storm and compare to benchmarks	100%	0%	0%
PM 3	Material usage data used to reconcile with material delivery and end-of-season	100%	0%	0%

Category 5: Storm Response

Subcategory 5.1 Weather Forecasting

Purpose / Description The intent is to provide timely and accurate weather information to assist in snow and ice control decision-making.

Environmental Consideration Effective use of de-icing chemicals is dependent upon good snow and ice control decision-making, which in turn depends on consistently accurate and timely weather information. Snow & Ice Control decisions that are not consistent with weather and road conditions will lead to material loss

Best Management Practice Decision-making staff makes appropriate Snow & Ice Control decisions based on accurate and timely weather forecasts. Decision-making staff is also knowledge in current weather forecasting technology [i.e. Road Weather Information System (RWIS)].

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Percentage of Operations staff knowledgeable in interpreting weather forecasts	100%	100%	100%
PM 2	Percentage of fleet vehicles with infrared temperature sensors	100%	100%	100%

Subcategory 5.2 Extreme Blizzard Response Approach

Purpose / Description To provide criteria and guidelines to standardize staff response for various combinations of precipitation events.

Environmental Consideration Snow and ice control decisions that are not consistent with weather and road conditions will lead to material loss

Best Management Practice Create the “Storm Response Plan” and review the plan annually.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	A documented “Extreme Blizzard Response Plan”	100%	100%	0%

Category 6: Winter Patrol

Subcategory 6.1 Level of Service

Purpose / Description It is intended that winter road conditions are monitored in an appropriate fashion to be able to react to changing weather and road conditions and to ensure that the levels of service (LOS) are maintained.

Environmental Consideration Accurate monitoring of winter maintenance activities will support appropriate and effective snow and ice control decisions, leading to efficient use of salt.

Best Management Practice Roads are patrolled regularly during the snow and ice control season and patrol logs are maintained. Meet or exceed the Minimum Maintenance Standards (MMS) outlined in Ontario Regulation 239/02 (as amended). Review the Level of Service Best Management Practice (ECH-R06-07).

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Review the MMS outlined in Ontario Regulation 239/02 (as amended) and Essex County Highways Best Management Practice ECH-R06-07	100%	100%	100%
PM 2	Train and inform staff, management, and the public on the intentions and expectations in level of service delivery	100%	100%	100%

Subcategory 6.2 Drift Control

Purpose / Description To reduce snow accumulation on roadways and problems associated with drifting or blowing snow.

Environmental Consideration A significant amount of winter maintenance activity is devoted to controlling drifting snow. If a roadway has a lower potential for snow and ice accumulation, then the winter maintenance demands will be correspondingly lower and the need for chemical application will be reduced.

Best Management Practice Controlled with snow fencing in areas known to be subject to frequent heavy snow drifting.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Percentage of winter maintenance staff trained	100%	100%	100%

Category 7: Snow and Ice Control Training

Purpose / Description Incorporate Salt Management Principles into training programs in accordance with TAC's Salt Management Synthesis of Best Management Practices for Training.

Environmental Consideration Through understanding of good housekeeping practices, the measures of snow & ice control and the expectations of program delivery will result in a greater probability of success with the Salt Management Plan.

Best Management Practice Annual training for winter maintenance staff, which includes a combination of in-house training and Ontario Good Roads Association (OGRA) training materials.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Percentage of winter maintenance staff trained	100%	100%	100%

Category 8: Technology Review

Purpose / Description To make Winter Maintenance Staff aware of current and emerging best practices that help provide more efficient use of snow control chemicals.

Environmental Consideration New techniques, procedure and technologies may provide more effective methods of monitoring and/or reducing the salt usage.

Best Management Practice Continually review existing & new technologies to determine their applicability in altering current practices Pilot studies incorporating relevant winter maintenance methodologies will be recommended when appropriate.

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Investigate new developments in snow and ice control through participation in conferences and forums geared to the development of salt best management practices	100%	100%	100%

Category 9: Communications

Purpose / Description An overall communications strategy with respect to Essex County's winter maintenance program is effectively communicated to staff & public sector.

Environmental Consideration An informed public and media are more likely to become effective partners in achieving the goals of the Salt Management Plan.

Best Management Practice Communicate with County Council annually on the Winter Control program including Fast Facts Sheets. Complete annual reporting to Environment Canada on salt usage

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Report annual road salt usage and Salt Management Plan update to Environment Canada	100%	100%	100%
PM 2	Release a media package annually to include "Fast Facts" of the Winter Maintenance program	100%	100%	100%
PM 3	Post a copy of the most recent Salt Management Plan on the County of Essex website (www.countyofessex.on.ca)	100%	100%	100%

Category 10: Environmentally Sensitive/Vulnerable Areas

Purpose / Description To determine if any salt vulnerable areas are potentially impacted by the use salt

Environmental Consideration Environmentally sensitive areas that are impacted by winter maintenance practices may require unique solutions and specific action plans to mitigate the impacts

Best Management Practice Salt Vulnerable Areas are identified and factored into salt-management decision-making

Performance Measure No.	Performance Measure Description	SMP Target	FY 2016 Target	FY 2015 Status
PM 1	Identification and ranking of environmentally sensitive and salt vulnerable areas	100%	100%	100%
PM 2	Identify strategies to reduce salt impacts to salt vulnerable areas	100%	50%	0%

Achievements

Comparing the 2015 Winter Maintenance Performance Measures with targets set one (1) year ago, Essex County Highways has performed well in most categories. Targets related to equipment and technology continue to be met. Future Initiatives from the 2014 report included the construction of a new West End Depot, the Development of a Storm Response Plan, and investigation into the management of wash water, onsite. The new West End Depot is currently under construction. This new depot will help improve fleet response to winter events. This new depot will yield the ability to improve the management of wash water runoff.

Future Initiatives

Essex County Highways has reviewed the performance measures and have identified actions to improve winter maintenance practices. The following areas for potential improvement for the year 2016 are being explored:

1) Complete the construction of the new West End Depot
2) Further investigation of Salt Vulnerable areas and compare to the recently approved Source Water Protection Plan and fully delineated Drinking Water Intake Protection Zones (IPZs).
3) Develop and implement an “Extreme Blizzard Response Plan”.
4) Complete a full Salt Management Plan Update in 2016 to replace the current 5 year plan adopted by County Council in 2011.

The County of Essex promotes continuous development of practices and procedures to improve winter maintenance activities while striving to reduce the effects of road salt on the environment. Improvements and refinements will be evaluated as new salt management techniques become available with the understanding that progress and changing salt management practices may be tempered by the County’s ability to invest in capital equipment upgrades and as new technologies become available.

References

Suggett, J., Hadayeghi, A., Mills, B., Andrey, J., & Leach, G. (2006). Development of Winter Severity Indicator Models for Canadian Winter Roads. Annual Conference of the Transportation Association of Canada. Charlottetown, Prince Edward Island.