

Salt Optimization Plan

City of Greater Sudbury



Executive Summary

This Salt Optimization Plan is a multi-departmental collaborative effort that is striving to optimize the use of road salt within the City of Greater Sudbury (CGS/City) to maintain safe surfaces for pedestrian and vehicular traffic while minimizing the environmental impacts related to the storage, handling, and application of road salt. The Salt Optimization Plan was initially launched as part of a source water protection initiative to protect sources of drinking water from rising sodium and chloride concentrations as per policy number Sa2EF-SA within the Greater Sudbury Source Protection Area Source Protection Plan.¹ and in response to a Ministry of Environment and Climate Change (MOECC) request.

The Salt Optimization Plan assesses the potential risk to environmental receptors within vulnerable areas associated with the application of salt within the CGS. Vulnerable areas incorporated within the Salt Optimization Plan include the following: source water protection (SWP), wellhead protection areas (WHPAs), intake protection zones (IPZs), highly vulnerable aquifers, significant/sensitive groundwater recharge areas, lake trout and fish spawning areas, wetlands, and provincially tracked species sensitive to salt application. By combining and weighing each environmental receptor/vulnerable area cumulatively, areas and roadways within the CGS were rated as low to high receptor risk related to salt exposure (see Figure 11). Based on the identification of intersections of salt vulnerable areas and roadways within the CGS, recommendations are provided to minimize the impact of salt on these environmental receptors (see Table 1) and provide direction to the Working Group to maintain a safe road network while protecting the environment.

CGS developed this Salt Optimization Plan in an effort to remain proactive with its Salt Management Plan initiatives and as a requirement of the Ministry of the Environment and Climate Change (MOECC). By doing so, the City is demonstrating to the community that safe and environmentally conscious road salt management and winter maintenance practices are a priority for the municipality.

¹ "Greater Sudbury Source Protection Area Source Protection Plan", Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 19, 2014.



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Table 1 Salt Optimization Plan - Recommendations



1. Introduction

This Salt Optimization Plan is a multi-departmental collaborative effort that is striving to optimize the use of road salt within the City of Greater Sudbury (CGS/City) to maintain safe surfaces for pedestrian and vehicular traffic while minimizing the environmental impacts related to the storage, handling, and application of road salt. The Salt Optimization Plan was initially launched as part of a source water protection initiative to protect sources of drinking water from rising sodium and chloride concentrations as per policy number Sa2EF-SA within the Greater Sudbury Source Protection Area Source Protection Plan.² and in response to a Ministry of Environment and Climate Change (MOECC) request.

The Salt Optimization Plan assesses the potential risk/vulnerability to environmental receptors associated with the application of salt within the CGS road network. Environmental receptors incorporated within the Salt Optimization Plan include the following geographical information system (GIS) databases: source water protection (SWP), wellhead protection areas (WHPAs), intake protection zones (IPZs), highly vulnerable aquifers, significant/sensitive groundwater recharge areas, lake trout and fish spawning areas, wetlands, and provincially tracked species sensitive to salt application. By combining and weighing each environmental receptor/vulnerable area cumulatively, areas and roadways within the CGS can be rated as low to high receptor risk related to salt exposure. Based on the identification of the salt vulnerable areas and their intersection with roadways, recommendations are provided to minimize the impact of salt onto these environmental receptors and provide direction to the CGS Road Operations staff and Source water Protection Group (Working Group) to maintain a safe road network while protecting the environment.

CGS has developed this Salt Optimization Plan in an effort to remain proactive with its Salt Management Plan initiatives and as a requirement of the Ministry of the Environment and Climate Change (MOECC). By doing so, the City is demonstrating to the community that safe and environmentally conscious road salt management and winter maintenance practices are a priority for the municipality.

2. Project Overview

2.1 Vision

To minimize the environmental impact of road salt application, while maintaining safe surfaces for pedestrian and vehicular traffic.

2.2 Goals/Objectives

The City strives to minimize the impacts of road salt to the environment by encouraging reductions in the use of road salt in areas where this reduction will not impact pedestrian and vehicular safety.

² "Greater Sudbury Source Protection Area Source Protection Plan", Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 19, 2014.



It also strives to optimize current winter maintenance practices to achieve an overall reduction in the application of road salt while delivering the expected level of service to its customers. To achieve these goals, best management practices, education and outreach initiatives, and improvements to current technology are considered within this Salt Optimization Plan.

3. Background

3.1 Source Water Protection

Source water protection is a concept that gained status as a result of the Walkerton tragedy and the ensuing inquiry into the related events by Justice O'Connor. Following the inquiry, recommendations were made, and it was determined that the best way to manage our drinking water resources is through a multi-barrier approach; the first of these barriers being protection at the source. The Clean Water Act (2006).³ was instated to provide legislative guidance and authority to establish this barrier to protect drinking water sources from potential significant threats for current and future generations.

The City has six drinking water systems (listed below) including three surface water intakes and associated water treatment plants and 24 municipal groundwater water wells. Together these sources supply drinking water to 148,000 residents. An additional 12,000 residents are serviced by private drinking water systems. The City's drinking water systems (DWSs) are as follows:

- 1) Sudbury DWS:
 - Ramsey Lake (surface water intake)
 - Wanapitei River (surface water intake)
 - Garson (three wells)
- 2) Vermilion River DWS (surface water intake)
- 3) Valley DWS (13 wells)
- 4) Falconbridge DWS (three wells)
- 5) Onaping DWS (three wells)
- 6) Dowling DWS (two wells)

As a requirement under the Clean Water Act, an evaluation of existing water quality issues and potential water quality threats was conducted as part of the source water protection program as well as a delineation of vulnerable areas (i.e. protected zones around groundwater wells and surface water intakes where pollutants can reach the well or intake within a specific length of time). During the issues evaluation, review of the MOECC's Drinking Water Surveillance Program (DWSP) water quality data for 1991 to 2013 revealed elevated and rising sodium and chloride concentrations within Ramsey Lake. As such, sodium (primarily attributed to the application of road salt, but also the handling and storage of road salt as well as snow storage) was identified as a drinking water

³ "Clean Water Act, 2006, S.O. 2006, C.22", MOECC, Amendments June 20, 2012.



quality issue within Ramsey Lake vulnerable areas⁴. The application of road salt was also identified as a significant threat for the Wanapitei River DWS. Snow storage was identified as a significant threat to the Valley DWS.

Elevated sodium levels were also identified within the Dowling, Valley, and Garson DWSs, however sodium was not identified as a drinking water quality issue for these DWS due to insufficient available data to determine the presence of a significant increasing trend.

To start addressing the increasing sodium trend and the treats associated with the application, handling, and storage of road salt as well as snow storage, three specified actions are prescribed within the policies of the Greater Sudbury Source Protection Area Source Protection Plan, including:

- 1) **Policy Sa-6F SA:** Prohibit the establishment of large municipal or commercial snow melt (snow dump) facilities within vulnerable areas where they would be a significant threat.
- 2) **Policy Sa-5F s57:** Prohibit the handling and storage of road salt within vulnerable areas where this activity would be a significant threat. Within the Ramsey Lake Issues Contributing Area (ICA), this policy applies to road salt storage quantities of 0.5 tonnes and greater.
- 3) **Policy Sa-2EF-SA:**
 - Identify vulnerable areas where winter maintenance activities could be a significant threat.
 - Optimize the use and management of road salts.
 - Implement practices to minimize salt loss into the environment and impacts to drinking water sources.
 - Prioritize snow removal and street sweeping/cleaning on primary, arterial, and collector roads within vulnerable areas as soon as possible during/after snow melt.

As previously noted, this Salt Optimization Plan was initiated to meet the requirements of Policy Sa-2EF-SA and satisfy the MOECC.

3.2 Salt Management Plan

The Salt Optimization Plan is being established to complement the City's Salt Management Plan (SMP)⁵, which was developed in response to Environment Canada's Code of Practice on the Environmental Management of Road Salt. The Code of Practice outlines policies and a procedural framework that ensures the City's continuous improvement of an effective winter maintenance service.

The Salt Management Plan summarizes and provides an overview of the City's current road salt management practices. It speaks to all of the major activities related to winter maintenance,

⁴ "Greater Sudbury Source Protection Area Assessment Report", Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 2, 2014.

⁵ "2016 Salt Management Plan, City of Greater Sudbury", Prepared by GHD, May 19, 2017.



operational practices and strategies as well as monitoring and updating requirements stipulated within the plan.

The Salt Optimization Plan fits within the continual improvement framework of the SMP. By offering recommendations on new and innovative ways of best managing the handling, storing and applying road salt, the Salt Optimization Plan keeps in line with the policy statements within the SMP.

3.3 Frobisher Depot Risk Management Plan

The Greater Sudbury Source Protection Area Source Protection Plan prescribes the establishment of risk management plans (RMPs) for activities related to the handling, storage, and application of road salt as well as snow storage within the following areas:

- 1) **Policy Sa-4E RMP:** Existing road salt handling and storage areas where the activity is a significant threat. Within the Ramsey Lake ICA, this policy applies to road salt storage quantities of 0.5 tonnes and greater.
- 2) **Policy Sa-3EF RMP:** Existing and future road salt application and existing snow storage for properties with exterior parking lots that are equal to or greater than one hectare, where the activities could be a significant threat and where Policy SA6F-SA does not apply.

As such, significant drinking water threat activities related to the City's winter maintenance program, including those of salt handling and storage occurring at the Frobisher Depot, will be addressed through RMPs.

The Frobisher Depot has a covered salt storage dome with a relatively impermeable base that stores the salt needed for the winter maintenance season. Pickled sand (i.e. sand mixed with salt at approximately five percent by volume) is currently stored outside at the site within the footprint of the former pickled sand dome located beside the salt storage dome. Brine is prepared and stored in a separate building at the site. Application equipment used during the winter maintenance season is loaded at the site prior to deployment to respond to winter events. Portions of the site used for salt and pickled sand storage and handling are located within the Ramsey Lake vulnerable area further discussed in Section 4.3.

The Frobisher Depot RMP, which ensures that all best management practices related to the significant drinking water threat activities are or will be employed on site, is provided under separate cover.

4. Vulnerable Areas

This section of the report is dedicated to a presentation of mapped areas having a known high vulnerability to groundwater and surface water contamination. An understanding of these vulnerable areas and their spatial association will provide further insight into salt vulnerable areas and enable us to make targeted and informed decisions regarding salt reduction strategies.



The Assessment Report produced in response to legislative requirements under the Clean Water Act⁶ identified and mapped five (5) primary vulnerable areas for the Source Protection Region:

- 1) Well Head Protection Areas (WHPAs)
- 2) Intake Protection Zones (IPZs)
- 3) Issues Contributing Areas (ICAs)
- 4) Highly Vulnerable Aquifers (HVAs)
- 5) Significant/Sensitive Groundwater Recharge Areas (SGRAs)

Mapping for these areas was obtained from Conservation Sudbury.

Three additional vulnerable areas also considered within this document are as follows:

- 1) Fish Spawning Areas and Lake Trout Lakes/Proposed Lake Trout Lakes
- 2) Wetlands
- 3) Provincially Tracked Species

Mapping for these areas was obtained from the CGS GIS Department.

The CGS' boundary and road inventory/network are shown on Figures 1 and 2. CGS Surficial Drainage Areas, which show the tertiary watershed areas within the City limits (i.e. Vermillion, Upper and Lower Wanapitei, Killarney, as well as small portions of the Sturgeon, Spanish, and French watersheds), are shown on Figure 3.

4.1 Well Head Protection Areas (WHPAs)

Well Head Protection Areas (WHPAs) represent vulnerable areas that were delineated as part of the source water protection program, based on the presence of a municipal DWS. WHPAs are areas surrounding a municipal supply well where activities occurring at the surface may have the most impact on the quantity and quality of drinking water obtained from groundwater sources.

The WHPAs delineated for the City's wells include four areas: WHPA-A, WHPA-B, WHPA-C and WHPA-D. WHPA-A is the same for all wells and consists of a 100 meter radius, whereas WHPA-B, WHPA-C and WHPA-D are based on groundwater travel times to the wells and include two, five and 25 year categories. In addition, two of the wells within the Valley DWS (Wells M and J) in addition to both wells in the Dowling DWS are considered to be groundwater under the direct influence of surface water (GUDI) and as such a WHPA-E was established for these wells. The WHPA-E is delineated as an Intake Protection Zone-2 (IPZ-2) with the intake location at the point of interaction between groundwater supply and surface water or, if that is unknown, at the point in surface water that is closest to the well.

The WHPAs for the municipal wells are shown on Figure 4.

⁶ "Greater Sudbury Source Protection Area Assessment Report", Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 2, 2014.



4.2 Intake Protection Zones (IPZs)

Intake Protection Zones (IPZs), similarly to the WHPAs, were also delineated around each surfacewater supply source as part of the source water protection program, in this case around the surface water intake structures located within the Wanapitei River, the Vermilion River, and Ramsey Lake. There are three different zones outlined as part of the IPZ delineation process: IPZ-1, IPZ-2, and IPZ-3.

The **Wanapitei River** intake structure is located in the southeast section of the City and is classified as a Type C intake (i.e. located within in a river and flow direction and velocity are unaffected by a water impoundment structure). The Wanapitei River IPZ-1 consists of a 200 metre (m) semi-circle, with the intake at the center point of the semi-circle and a 10 m extension downstream of the intake. Where the zone abuts land, a 120 m setback from the high water mark is included.

The **Vermilion River** intake structure is located within the southwest section of the City and is classified as a Type C intake. The Vermilion River intake is located within a natural basin where water circulates before continuing downstream. The Vermilion River IPZ-1 was modified to reflect local hydrodynamic conditions and consists of a 400 m radius around the intake. Where the zone abuts land, a 120 m setback from the high water mark is included.

The **Ramsey Lake** intake structure is located within the south section of the City and is classified as a Type D intake (i.e. it does not fit into the description of a Type A, B or C intake). The Ramsey Lake IPZ-1 consists of a one kilometer (km) radius around the intake structure, and where the zone abuts land, a 120 m setback from the high water mark is included.

All three IPZ-1 (Wanapitei River, the Vermilion River, and Ramsey Lake) are shown on Figure 5.

The delineation of IPZ- 2 for each surface water intake was conducted based on a two-hour travel time, which is equal to or less than the amount of time it would take a surface water plant operator to shut down the surface water treatment plant in response to a spill event (see Figure 5).

The delineation of IPZ-3 includes the area within the surface water body that may contribute water to the intake and also includes a 120 metre (m) setback from the high water mark. Transport pathways may also be included. The IPZ-3 for Ramsey Lake includes a 120 m setback applied to all contributing tributaries and storm sewers within the watershed. In areas where road side ditches serve as storm drains the protection zone includes a 120 m setback from the road network. IPZ-3 for the Wanapitei and Vermilion Rivers include contributing tributaries extending northwards over 100 km each, to the Arctic Divide.

4.3 Issues Contributing Area (ICA)

As a result of elevated and rising sodium and chloride levels identified within Ramsey Lake, the Clean Water Act required that an additional vulnerable area be identified. This area is called the Issues Contributing Area (ICA). The ICA is outlined by including the total surface area where activities occurring within its boundaries may contribute to the issues identified, in this case the increasing sodium and chloride levels. Given that the application of road salt is a non-point source, the Ramsey Lake ICA was considered as being the entire Ramsey Lake IPZ-3 (Figure 5). No other ICAs were identified within the Greater Sudbury Source Protection Area Source Protection Plan.



4.4 Highly Vulnerable Aquifers

Highly Vulnerable Aquifers (HVAs) were delineated as part of source water protection program by considering characteristics that have an impact on increasing the aquifer's susceptibility to threat activities. According to these characteristics, HVAs are typically those consisting of materials that have high permeability (such as sands and gravels), have a water table level near the surface, and have little to no overlying confining layers. HVAs are found dispersed throughout the City as shown on Figure 6.

4.5 Significant/Sensitive Groundwater Recharge Areas

Significant/sensitive groundwater recharge areas (SGRAs) are those where water falling as precipitation can infiltrate easily into the ground, and become part of an aquifer system. The map of SGRAs was developed as part of the source water protection program using a model and includes areas where the annual recharge volume accounts for 55 percent or more of annual precipitation minus evapotranspiration over the entire recharge area. SGRAs are found dispersed throughout the central portion of the City mainly within Valley East, Dowling, and Onaping areas as shown on Figure 7.

4.6 Fish Spawning Areas

Fish Spawning Areas (FSA) for sensitive species (i.e. Brook Trout, Lake Trout and Walleye) are identified within the City's Official Plan, Natural Heritage Background Study⁷, and were delineated based on information gathered from the Ministry of Natural Resources and Forestry's (MNR's) Natural Resources and Values Information System (NRVIS) and the Laurentian University Cooperative Freshwater Ecology Unit (CFEU). As shown on Figure 8, there are no FSAs within the City limits.

4.7 Lake Trout Lakes/Proposed Lake Trout Lakes

Lake Trout Lakes (Existing and Proposed) are identified in the City's Official Plan and were identified based on information gathered from the MNR's NRVIS and the Laurentian University CFEU. Various Lake Trout Lakes/Proposed Lake Trout Lakes are located throughout the City as shown on Figure 8.

4.8 Wetlands

Wetland area are identified within the City's Official Plan and were delineated based on information provided in the MNR's NRVIS, as well as mapping prepared by City staff based on aerial photo review. There are multiple wetlands located throughout the City, as shown on Figure 9, including the provincially significant Vermilion River Wetland Complex.

⁷ "City of Greater Sudbury Official Plan, Natural Heritage Background Study", February 2005



4.9 Provincially Tracked Species Sensitive to Salt

Provincially tracked species areas were delineated based on information provided by the MNRF's Natural Heritage Information Centre (NHIC) under the City's MNRF Sensitive Data Use Licence Agreement. The NHIC manages data regarding the locations of species at risk (SAR), other tracked species, and natural areas within Ontario. The dataset for the City includes over 1,000 recorded observations of various birds, fish, snakes, turtles, insects, and plants, which were narrowed down by the application of the following criteria:

- Observations made prior to the year 2000 were excluded
- Observations with no information regarding the observer were excluded
- Species that were not directly affected by salt (i.e. do not live in aquatic or semi-aquatic habitat, or feed primarily on benthic species) were excluded
- Species that are not salt sensitive (i.e. they migrate to/live in salt water during part of the year)

The remaining species observations were mapped using the NHIC data. Figure 10 shows areas where provincially tracked species of interest were identified and is presented in one kilometer grid squares in compliance with the NHIC guidelines relating to data sensitivity.

5. Salt Vulnerability Index

The intent of the index is to provide a relative vulnerability to activities involving road salt application, storage and handling. It can be used to target specific salt reduction initiatives in areas of high salt vulnerability to help address surface and groundwater migration of sodium and chloride.

A multi-criteria analysis was performed on CGS managed plow routes proximate to various sodium-chloride sensitive receptor datasets provided by the MNRF, Conservation Sudbury, CFEU, and CGS. These receptor datasets were assigned weights to reflect their relative sensitivity to sodium-chloride exposure. CGS managed plow routes were buffered by 50 metres in all directions, then intersections were generated between the plow route buffered areas and the weighted receptors. These intersections were aggregated and their weights summed for spatially-common areas. These sums were subjected to a vulnerability classification ranging from negligible to highly vulnerable with the results from the entire CGS presented on an overview figure.

The index was calculated by assigning weighted values to each vulnerable area as follows:

Vulnerability Area/Criteria	Weight
WHPA-A	10
WHPA-B	8
WHPA-C	6
WHPA-D	4
WHPA-E	2
IPZ-1	10
IPZ-2	6



Vulnerability Area/Criteria	Weight
IPZ-3	2
Highly Vulnerable Aquifer	7
Significant/Sensitive Groundwater Recharge Areas	7
Fish Spawning/Lake Trout	2
Provincially Significant Wetlands	4
Non-Provincially Significant Wetlands	1
Salt Sensitive Provincially Tracked Species	5

By overlapping each of the mapped vulnerable areas along with their weighted values, we obtain a map covering the extent of the City by area and road which show a salt vulnerability index ranging from low to high risk (Figures 11a and 11b).

6. Recommendations

To achieve the project's vision of minimizing the environmental impact of road salt application while maintaining safe surfaces for pedestrian and vehicular traffic, recommendations are provided to improve the efficiency of winter maintenance practices. The recommendations are listed in Table 1 and divided into the following categories:

- Baseline understanding
- Level of Service
- Material Tracking and Monitoring
- Technology & Control Techniques
- Pilot Projects
- Education and Outreach
- Future Objectives

Each recommendation is categorized as either a short or long term goal, has an associated priority level (low, medium or high) and includes the group/department responsible for implementation. The implementation status of each recommendation is to be taken as its status at the time of the Salt Optimization Plan publication.

It is anticipated that a working group consisting of various City departments including members of the Source Water Protection Group, Road Operations and Traffic & Transportation staff, will continually review and assess these recommendations on an recurring basis, typically once every five years.



7. Monitoring and Updating

The purpose of monitoring and updating is to provide a basis for continuous improvement and to ensure efforts toward the implementation of the City's Salt Optimization Plan recommendations are ongoing. A review/revision of the status of the recommendations' implementation will therefore be completed at the end of each 5-year period by the working group, at which time, suggestions for new recommendations to be implemented can be added to the plan.

All of Which is Respectfully Submitted,

GHD

A handwritten signature in cursive script, appearing to read 'R. Bressan'.

Robert Bressan, P.Eng., FEC

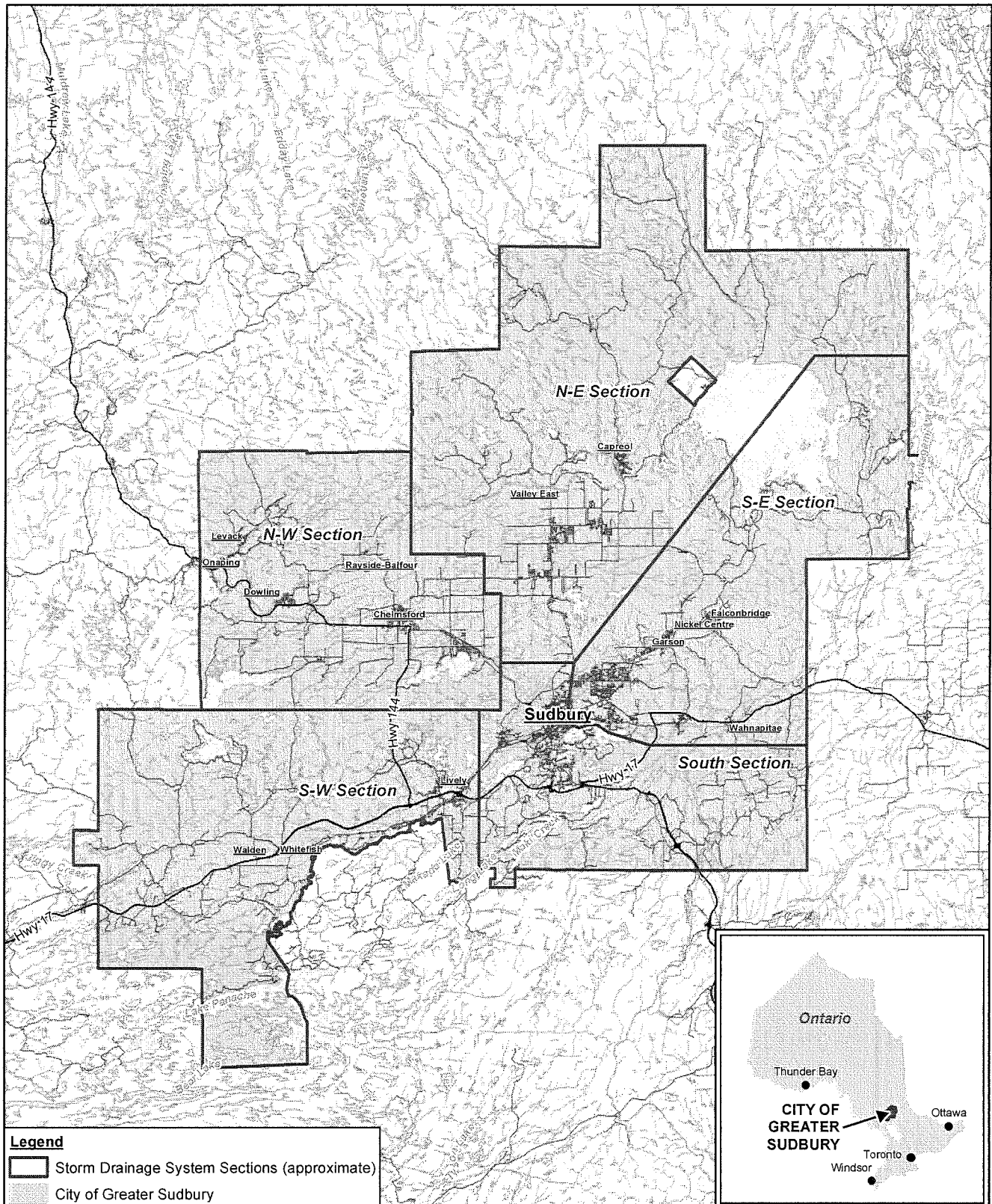
A handwritten signature in cursive script, appearing to read 'Sarah Ackert Ferguson'.

Sarah Ackert Ferguson, P.Eng.

A handwritten signature in cursive script, appearing to read 'Andrew Betts'.

Andrew Betts, M.A.Sc., P.Eng.

Figures



Source: MNRF NRVIS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017.
City of Greater Sudbury - Infrastructure - Needs Assessment - Storm Drainage System.

0 5 10 15
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

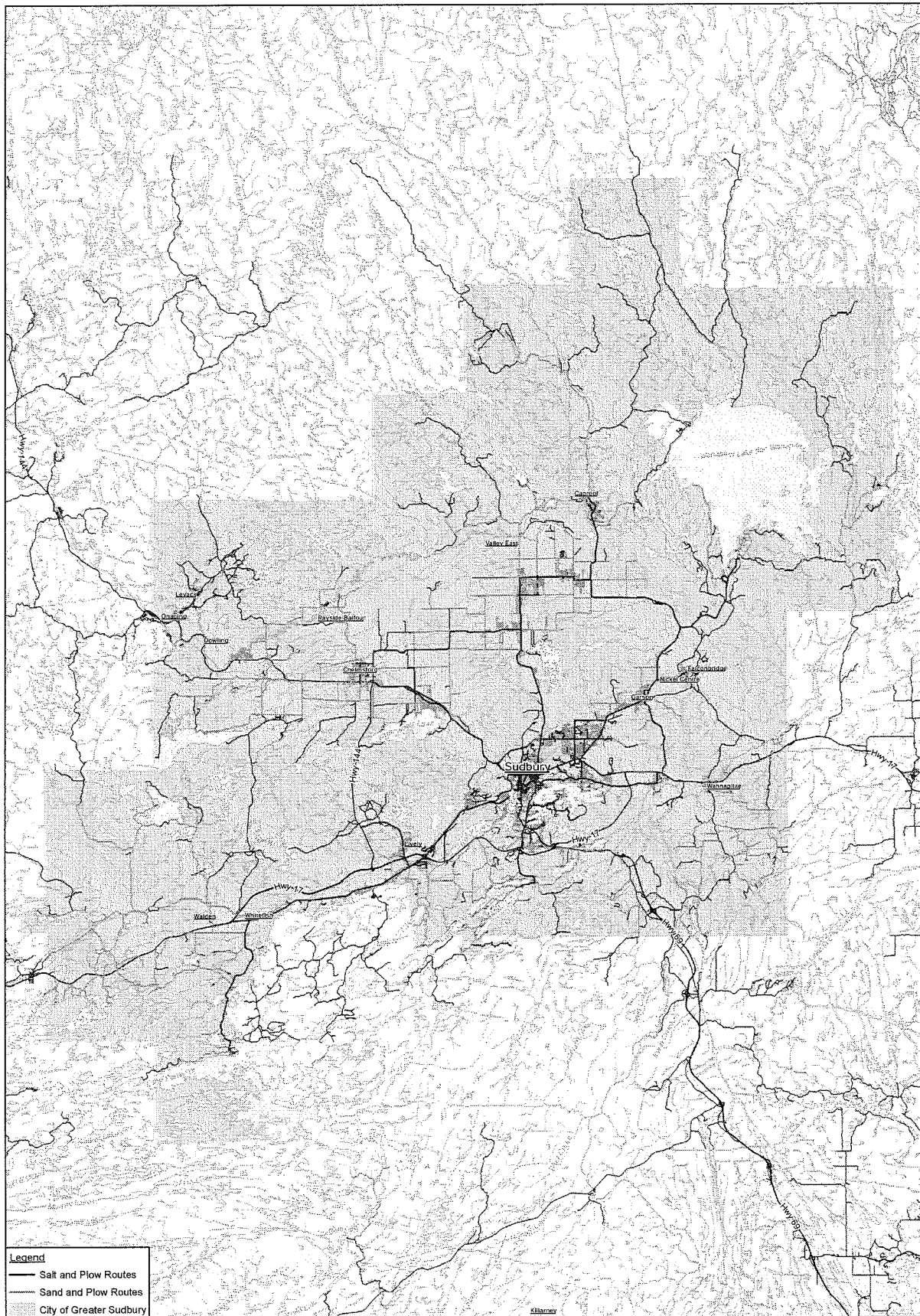


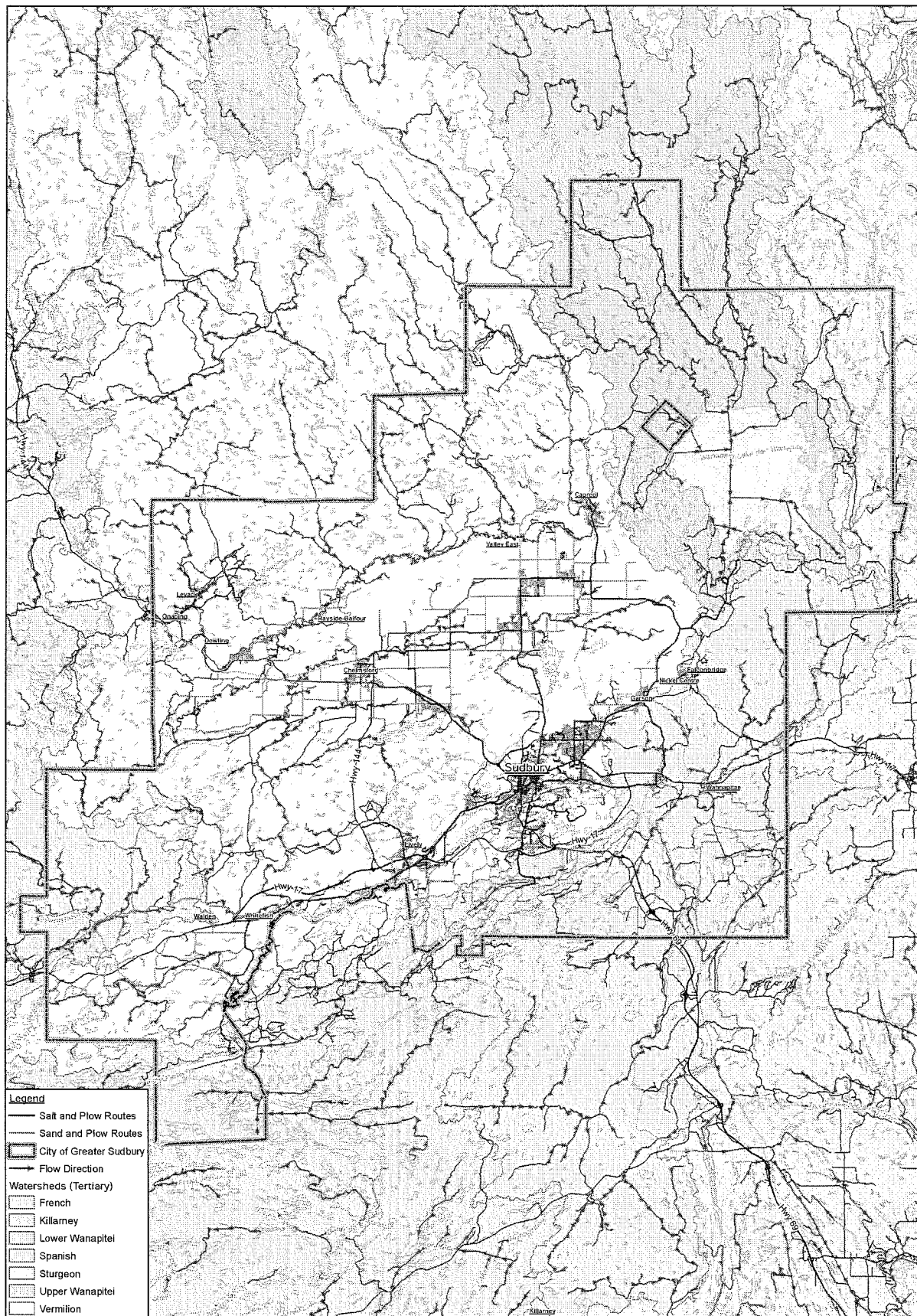
CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

39382-41
Oct 13, 2017

CITY OF GREATER
SUDBURY LIMITS

FIGURE 1





Source: MNRF NRVIS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry. © Queen's Printer 2017. City of Greater Sudbury, 2017.

0 3 6 9
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N



CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

SURFICIAL DRAINAGE

39382-41
Oct 13, 2017

FIGURE 3

CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

WELLHEAD PROTECTION AREAS

39382-41
Oct 16, 2017

FIGURE 4





Source: MNR/NRVS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017. City of Greater Sudbury, 2017.

0 3 6 9
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

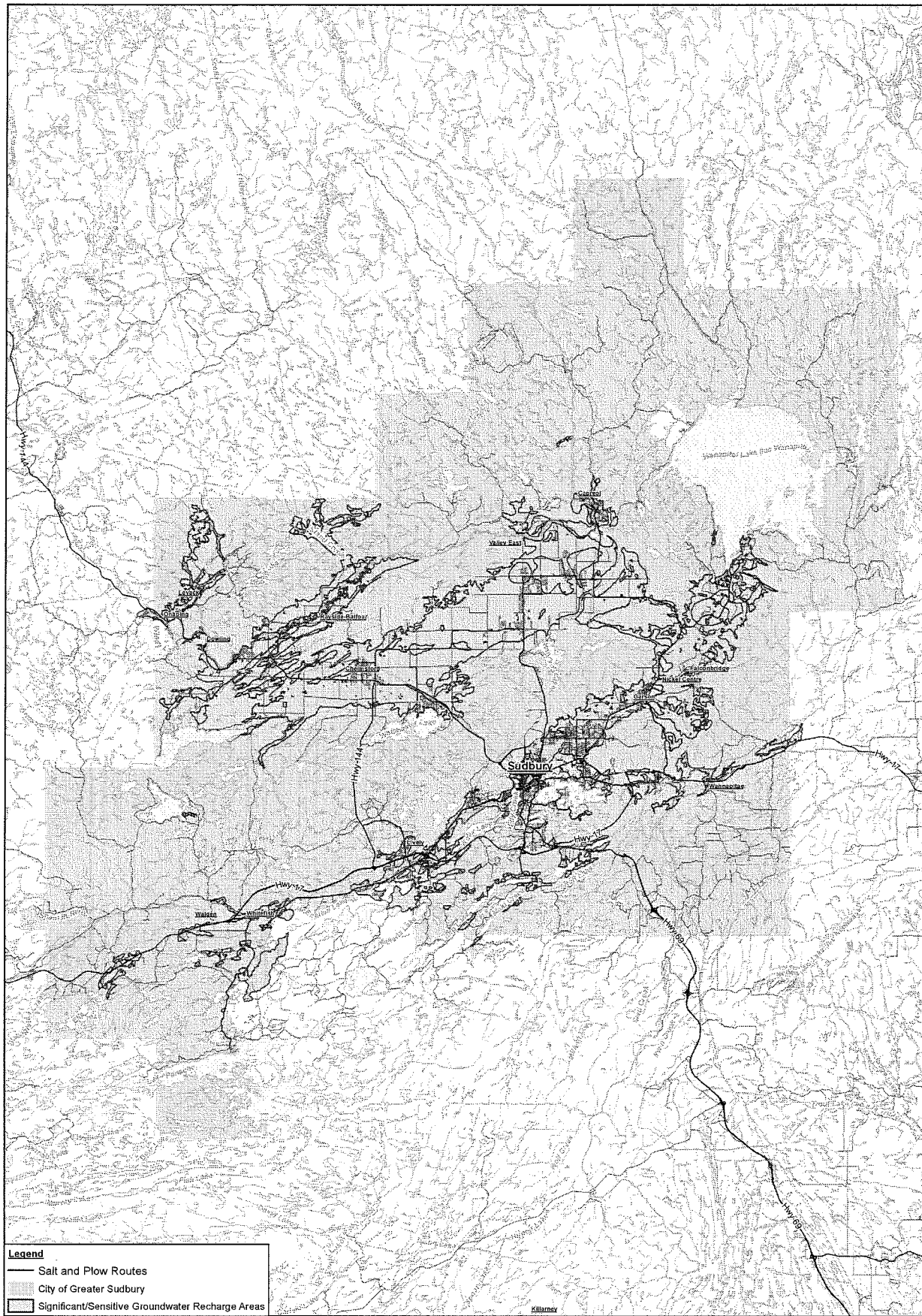


CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

HIGHLY VULNERABLE AQUIFERS

39382-41
Oct 16, 2017

FIGURE 6



Source: MNR NRVS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017, City of Greater Sudbury, 2017.

0 3 5 9
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

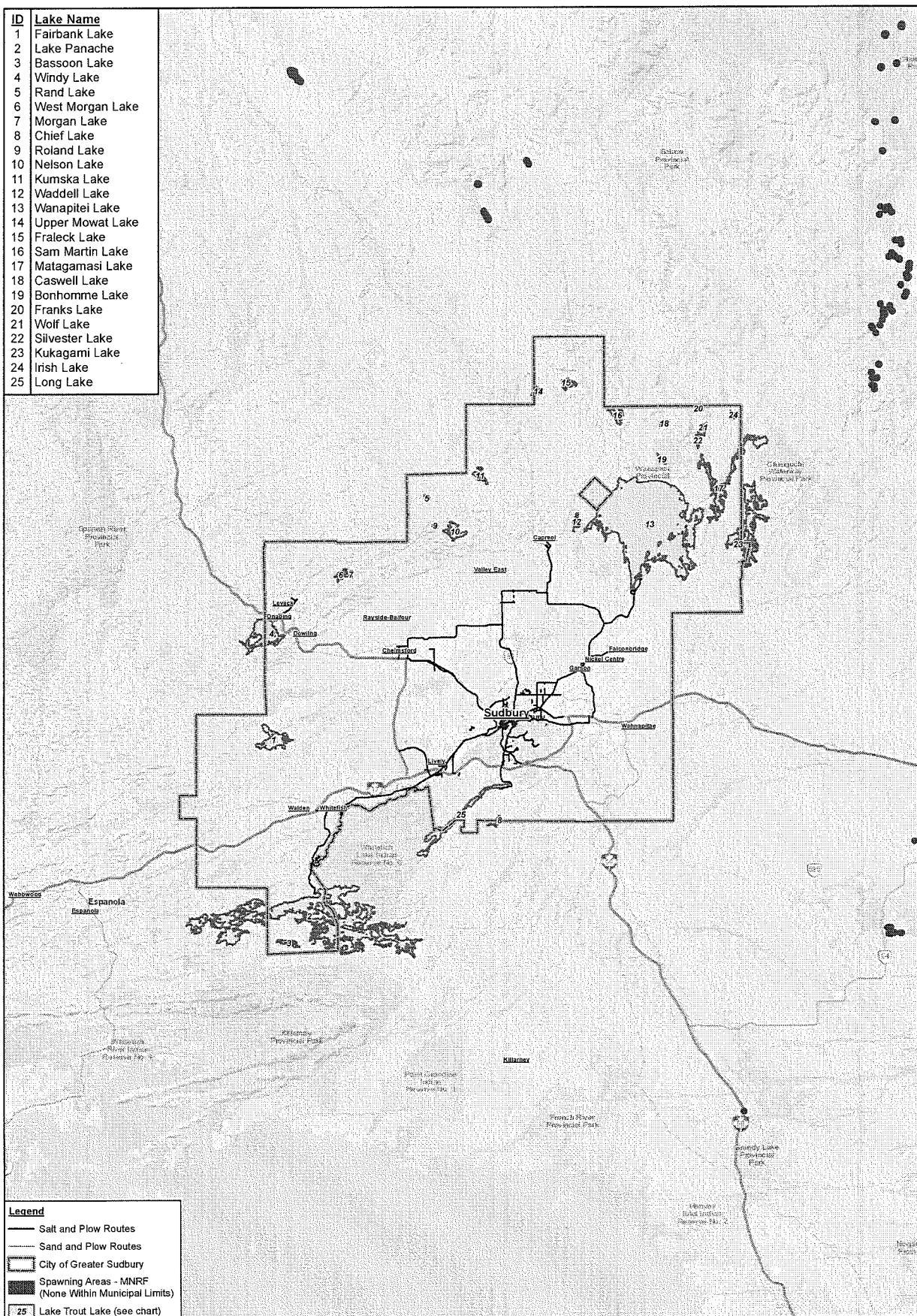


CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

SIGNIFICANT / SENSITIVE
GROUNDWATER RECHARGE AREAS

39382-41
Oct 16, 2017

FIGURE 7



Source: MNRF NRVIS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017. ESRI Streets Basemap.

0 5 10 15
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

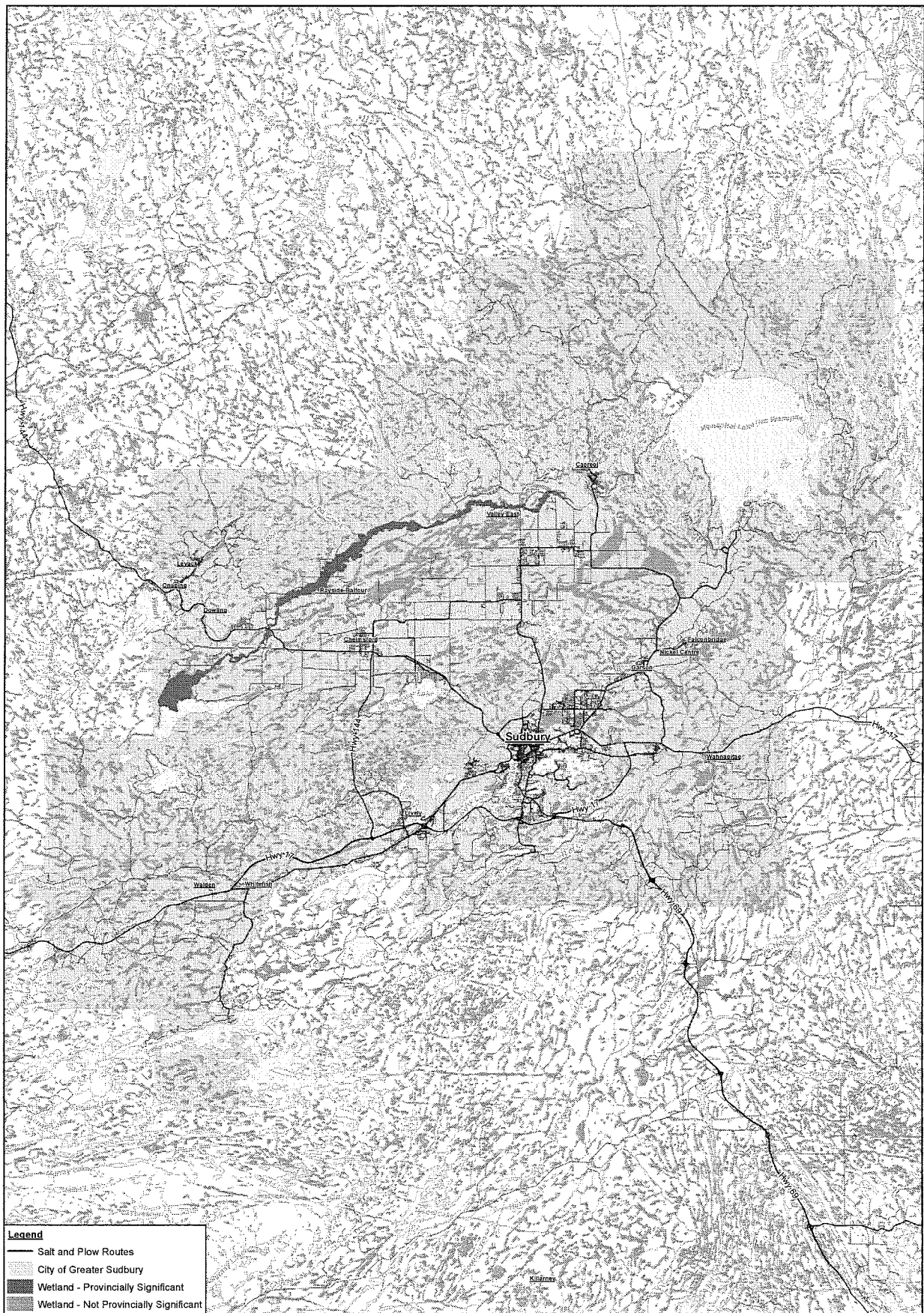


CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

LAKE TROUT LAKES AND
FISH SPAWNING AREAS

39382-41
Oct 17, 2017

FIGURE 8



Source: MNR/NRWS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry. © Queen's Printer, 2017. City of Greater Sudbury, 2017.

0 3 6 9
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

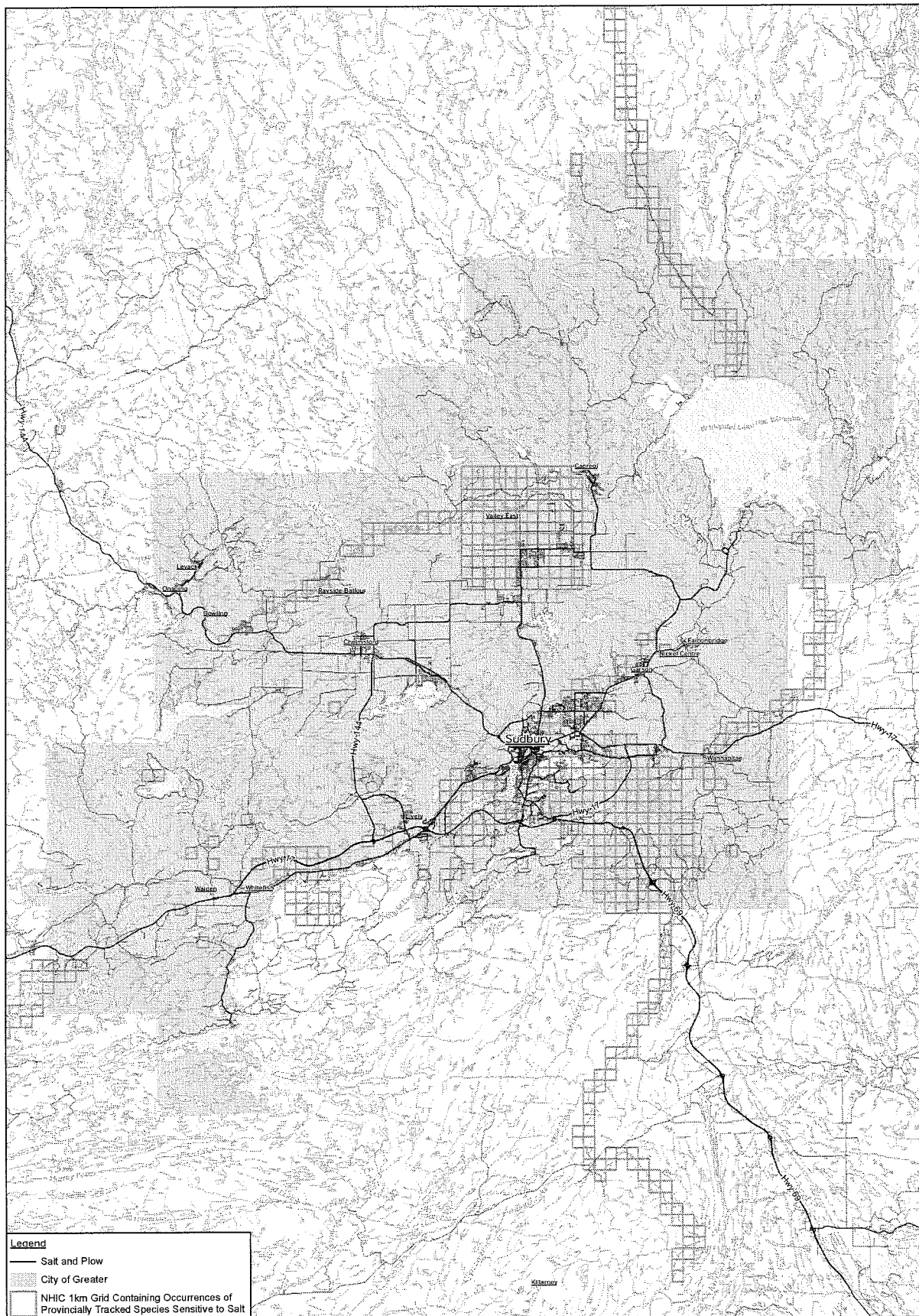


CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

WETLANDS

39382-41
Oct 17, 2017

FIGURE 9



Source: MNRF NRVIIS, 2017. NHIC, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017, City of Greater Sudbury, 2017.

0 3 6 9
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

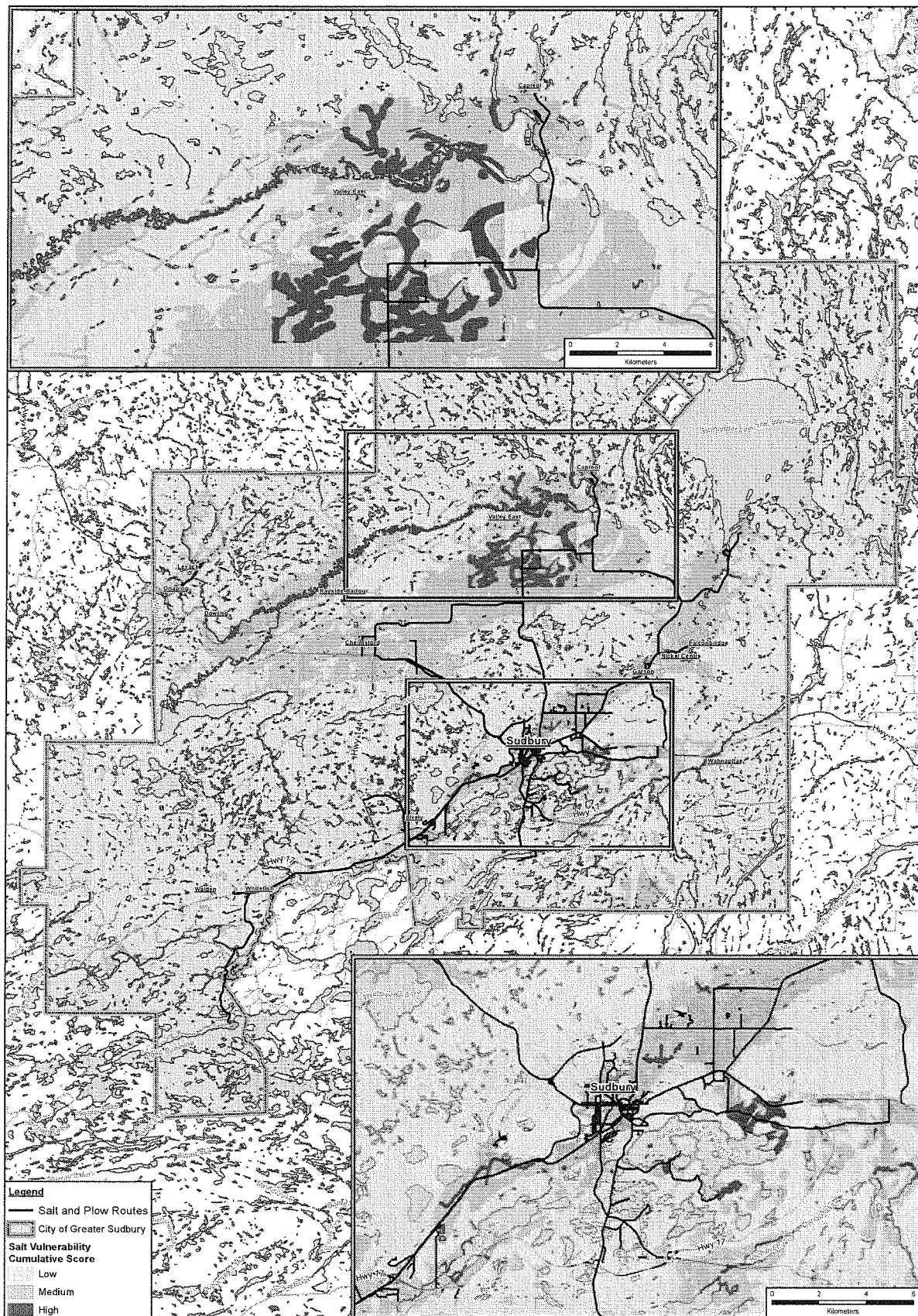


CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

DISTRIBUTION OF PROVINCIALLY TRACKED SPECIES
SENSITIVE TO SALT APPLICATION

39382-41
Oct 20, 2017

FIGURE 10



Source: MNR/NRVI, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017. City of Greater Sudbury, 2017.

0 3 6 9
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

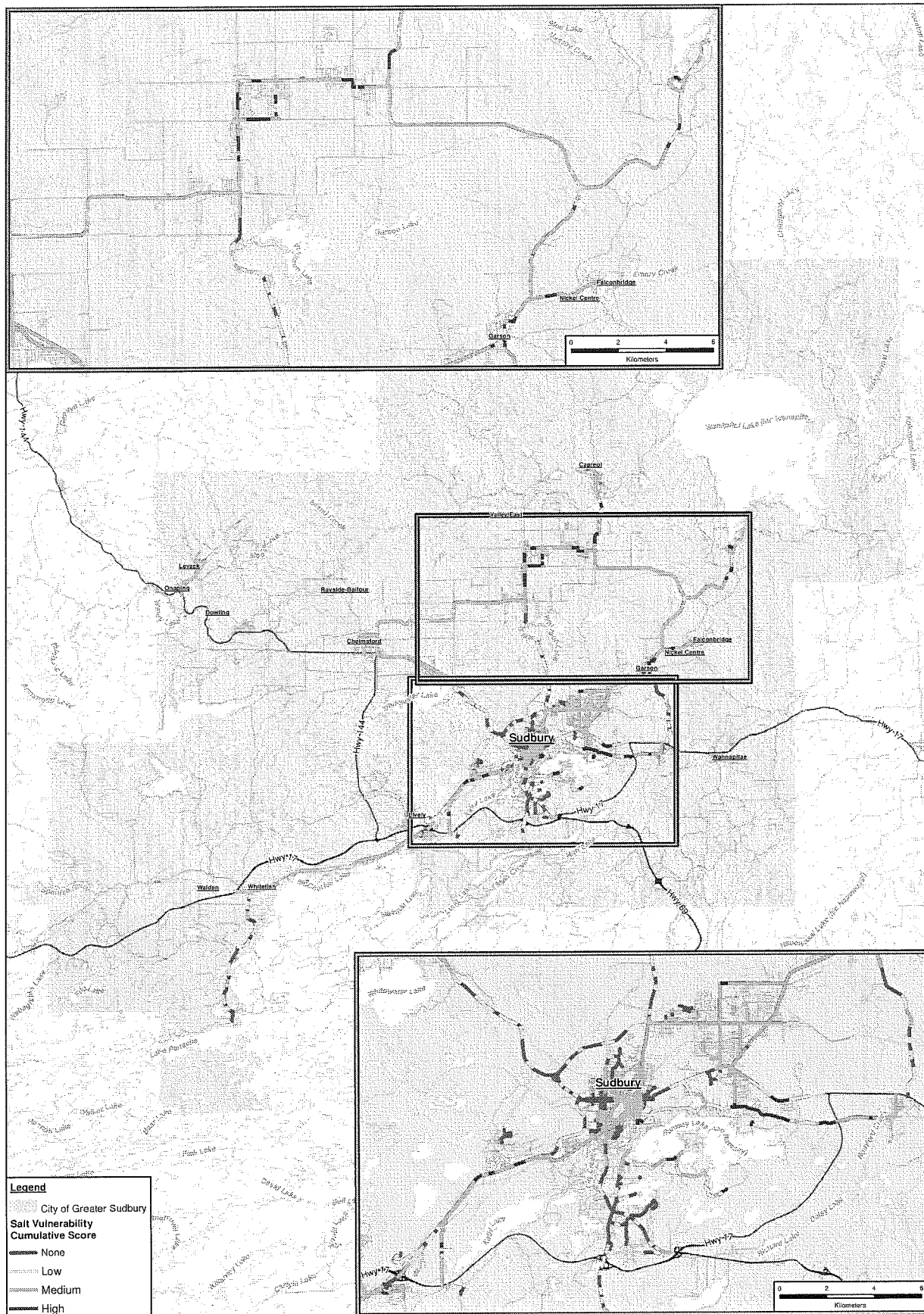


CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

SALT VULNERABILITY INDEX

39382-41
Nov 7, 2017

FIGURE 11a



Source: MHRF NRVS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017. City of Greater Sudbury, 2017.

0 3 6 9
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N



CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

SALT VULNERABILITY INDEX – ROAD NETWORK

39382-41
Oct 31, 2017

FIGURE 11b

Tables

Table 1
Salt Optimization Plan - Recommendations
City of Greater Sudbury

Recommendation	Timeframe	Recurrence	Priority	Responsible	Status
Establish a salt vulnerability index based on existing surface and groundwater vulnerable areas including WHPAs, IPZs, SGRAs, HVAs and ESGRAs. Create a salt vulnerability index map with the results to better understand salt sensitive areas to help in better decision-making.	Short Term	Initial with updates when major developments are planned	High	Road Operations with assistance from NDCA/SWPC/GIS	Complete
Review transportation infrastructure that receives winter maintenance services to better identify system users (i.e., vehicles, bicycles, e-bikes, pedestrians, etc.) and incorporate user data and winter maintenance considerations into the Transportation Master Plan (i.e., sidewalk priority index).	Short Term / Long Term	5 years	Medium	Road Operations and Traffic & Transportation	Future
Update available traffic count data, and posted speed limits.	Short Term	Annually	High	Traffic	Ongoing
Update Ontario Minimum Maintenance Standards road classification mapping.	Short Term	Annually	High	Traffic	Ongoing
Establish a level of service for municipal parking facilities that will be included within the Winter Maintenance Operations Plan.	Short Term	Annually	High	Building / Planning	Complete
Annually review transportation infrastructure that receives winter maintenance services, specifically priority plow (and salt/clear) routes to identify opportunities for improvement. Proposed changes in service will consider all road segments. Planning classification (arterial, collector, and local), OMS class, on-street, zoning and proximity to points of interest (schools, vulnerable sector community, churches and community buildings). Environmental vulnerability of the surrounding area must also be considered.	Short Term	Annually	High	Road Operations	Ongoing
Establish or look for areas to expand direct liquid application routes with the use of additives.	Long Term	Annually	High	Road Operations	Ongoing
Create a City-wide map of all surface water sampling locations for chlorides/sodium concentrations including historic data where available. Track any changes in chlorides/sodium loadings into receiving waters during the spring thaw and use this as a KPI.	Long Term	Annually	Medium/Low	Water/Wastewater Division / GIS / Environmental	Ongoing data collection
Create a City-wide map of all groundwater sampling locations for chlorides/sodium concentrations including historic data where available.	Long Term	Annually	Medium/Low	Water/Wastewater Division / GIS / Environmental	Ongoing data collection
Develop an institutional partnership with post-secondary institutions to perform ongoing analytics of data captured relating to transportation infrastructure winter maintenance services.	Long Term	As required	Low	Road Operations	Future Ongoing
Track the volume of anti-icing/de-icing materials used by CGS Fleet.	Short Term	Annually	High	Road Operations	Ongoing data collection
Develop a snow removal contract template for future Traffic & Transportation Services snow removal contractors.	Long Term	As required	High	Road Operations	Complete
Update Global Positioning System (GPS) devices used by City plows, sanders and contractor vehicles to incorporate Salt Vulnerable Area maps and track salt application within these areas.	Short Term	As required	High	Road Operations	Future
Establish a corporate policy to have all corporate vehicles, including transit vehicles, use snow tires during the winter maintenance season.	Long Term	As required	Low	Fleet	Future
Obtain additional Road Weather Information System (RWIS) within the City of Sudbury to better understand and respond to weather events.	Long Term	As required	Medium	Road Operations	Complete
Obtain anti-icing/de-icing material application equipment for City Fleet that is capable of being calibrated.	Long Term	As required	Medium	Road Operations / Fleet	Ongoing
Calibrate all equipment used for winter maintenance services as per manufacturer recommendations.	Short Term	Annually	High	Fleet	Ongoing
Obtain multi-purpose types of equipment that can be utilized to better perform winter maintenance services (e.g. sanders with plowing ability, rear-mounted spreader with GPS unit).	Long Term	As required	Medium	Road Operations / Fleet	Ongoing / Fleet Renewal
Establish a corporate standard to have cameras installed at strategic street signal installation locations to obtain better insight into weather conditions and traffic flow.	Long Term	As required	Low	Traffic and Transportation Services	Future
Develop storm water management plans at maintenance yards and snow disposal facilities that would also help to capture and control salt laden runoff.	Long Term	As required	High	Road Operations	Future

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Pilot Projects	Engage with post-secondary institutions that are currently performing research on winter maintenance practices. Contribute and participate in these research opportunities when able.	Short Term	As required	High / Medium	Communications and Community Engagement / Traffic and Transportation Services	Ongoing
	Have the Source Water Protection Group present annually at the Snow School held for operators at the beginning of each winter maintenance season.	Short Term	Annually	High	NCCAS/WPC	Future
	Require Smart About Salt Training for all City contractor hires	Short Term	As required	Medium	Road Operations	Future
Education & Outreach	Continue encouraging and offering learning opportunities for City staff involved in winter maintenance activities through professional development opportunities and knowledge sharing sessions.	Short Term	As required	High	All departments	Winter debriefs occurring annually
	Hold a promotional campaign to begin at the start of every winter maintenance season and continue throughout the season that will help educate the general public about salt application best management practices and the City's winter maintenance program. May include promotional materials in the local newspaper, informational pamphlets, ads through City-run social media outlets, etc.	Short Term	Annually	Medium	Road Operations / Communications and Community Engagement	Future
	Review and assess permissible truck routes through the City for potential changes to optimize the winter maintenance strategy.	Long Term	Annually	High	Road Operations	Ongoing
Future Objectives	Have future updates to the Transportation Master Plan consider ways to optimize winter maintenance activities of proposed road network changes.	Short Term	As required	Medium	Road Operations	Future
	Employ plowing as the primary technique to reduce amount of material applied to the surface.	Short Term / Long Term	Annually	High / Medium	Road Operations	Ongoing
	Review material application rates to identify successes and areas for improvement.	Short Term	Annually	High	Road Operations	Ongoing
	Establish definitions of hills, curves, intersections as ranges (ex. steep hill, very steep hill) within the Winter Operations Plan. Include a clause that winter maintenance within these areas is to be based on operator judgement.	Short Term	Initially	Low	Road Operations / Engineering	Future
	Provide recommendations and guidance to Planning and Engineering Policy and Standards on how winter maintenance can be better considered in site designs.	Long Term	As required	High	Road Operations / Traffic & Transportation / Engineering / Planning	Ongoing
	The City of Greater Sudbury to continue as an active member of Ontario's Road Salt Management Group (ORSMG). The ORSMG has municipal and Environment Canada membership and investigates state-of-the-art salt management practices and explores new technologies to further enhance road salt management.	Short Term	Annually	Medium	Road Operations	Ongoing

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