

2016

# Salt Optimization Strategy



*The City of*  
**BARRIE**

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## **1.0 Introduction**

### **1.1 Source Water Protection**

The Salt Optimization Strategy is a multi-departmental collaborative effort that is striving to optimize the use of road salt within the City of Barrie in order to maintain safe surfaces for pedestrian and vehicular traffic while minimizing the environmental impacts related to its storage, handling and application. The strategy was initially launched as part of a source water protection initiative to protect our sources of drinking water from rising sodium and chloride concentrations as per policy number SALT(ICA)-3 within the South Georgian Bay Lake Simcoe Source Protection Plan.

Source water protection is a concept that gained status as a result of the Walkerton tragedy and the ensuing inquiry into the 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) was instated to provide legislative guidance and authority to establish this barrier to protect our sources of drinking water from potential significant threats for current and future generations.

As a requirement under the Clean Water Act, an evaluation of drinking water issues was completed for the City of Barrie drinking water supply system. It was found that concentrations of sodium and chloride for certain municipal supply wells within the central portion of the City are trending to exceed Ontario Drinking Water Quality Standards within the next 50 years. To start addressing this increasing trend, risk management plans will need to be developed for activities related to the handling, storage and application of road salt as well as the storage of snow within the City's chloride and sodium Issues Contributing Areas.

As a community leader, the City of Barrie has opted to develop this City-wide Salt Optimization Strategy instead of the traditional Risk Management Plan. By doing so we are leading by example, demonstrating to the community that safe and environmentally conscious road salt management and winter maintenance practices are a priority for the municipality.

## **2.0 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. 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. A series of recommendations, which can be found in this document, has been established to meet these goals.

### **3.0 Additional Measures**

#### ***3.1 Salt Management Plan and Winter Operations Plan***

The Salt Optimization Strategy is being established to complement the City's Salt Management Plan and Winter Operations Plan. Both documents have been developed in response to Environment Canada's Code of Practice on the Environmental Management of Road Salt. The Code of Practices 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, operational practices and strategies as well as monitoring and updating requirements stipulated within the plan. The Winter Operations Plan focuses more specifically on winter maintenance services provided by the municipality. This includes a discussion on the level of winter maintenance service offered by the municipality, preparation procedures for the winter maintenance season, winter patrolling requirements, various operational components, decommissioning of equipment after the winter maintenance season and training of staff. Both the salt management plan and winter operations plan can be found on the Winter Control page of the City's website ([www.barrie.ca](http://www.barrie.ca)).

The Salt Optimization Strategy fits within the continual improvement framework of the Salt Management Plan and Winter Operations Plan. By offering recommendations on new and innovative ways of best managing the handling, storage and application of road salt the Salt Optimization Strategy keeps in line with the policy statements found within the plans.

#### ***3.2 Operations Centre Risk Management Plan***

Significant drinking water threat activities related to City of Barrie winter maintenance, including those of snow and salt handling and storage occurring at the City's R.A. Archer Operations Centre, will need to be addressed through a Risk Management Plan as per the policies within the South Georgian Bay Lake Simcoe Source Protection Plan (2015).

The R.A. Archer Operations Center (Operations Center) has a covered salt storage building with an impermeable base that stores the salt and brine needed for the winter maintenance season. The application equipment used during the winter maintenance season is loaded at the site prior to being deployed to respond to winter events. Once snow storage on the sides of road and sidewalks has reached its threshold within the municipality, the excess snow is removed and stored at the Operations Centre. More detail related to snow and salt handling and storage activities undertaken by the City can be found in the City's Salt Management Plan and Winter Operations Plan.

The Risk Management Plan for the Operations Center will be developed in the near future to ensure that all best management practices related to the significant drinking water threat activities mentioned above are or will be employed on site.

### **4.0 Baseline Vulnerability Assessment**

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 Act identified and mapped four primary vulnerable areas for the Source Protection Region: (1) Well Head Protection Areas (WHPAs), (2) Intake Protection Zones (IPZs) (3) Highly Vulnerable Aquifers (HVAs), and (4) Significant Groundwater Recharge Areas (SGRAs). These along with (5) Ecologically Significant Groundwater Recharge Areas (ESGRAs) and (6) Issues Contributing Areas (ICAs) are the six vulnerable areas considered in this document.

Well Head Protection Areas (WHPAs) and Intake Protection Zones (IPZs) are the two vulnerable areas that have been delineated based on the presence of a municipal drinking water system. 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 of Barrie 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 the times of travel of groundwater to the well and include a 2, 5 and 25 year category. The WHPAs for the municipal wells are located in the central and northern portions of the City (Figure 1).

IPZs, similarly to the WHPAs, have been delineated around a water supply source, in this case around the surface water intake structure located within Kempenfelt Bay. There are two different zones outlined as part of the IPZ delineation process: IPZ-1 and IPZ-2. IPZ-1 consists of a 1 km radius around the intake structure, and where land is intersected a 120 m setback is included. The delineation of IPZ- 2 was done based on a 2 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 (Figure 2).

As a result of rising sodium and chloride levels that have been identified for certain wells in the City, the Clean Water Act required that an additional vulnerable area be identified. This area is called the 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. The ICA for the City was considered as being the entire WHPA-D for the central wellfield (Figure 3).

HVAs have been delineated by considering the characteristics of aquifers that have an impact on increasing the susceptibility of the aquifer 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 little to no overlying confining layers. HVAs are found dispersed throughout the City (Figure 4).

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 using a model and included areas where recharge rates were greater than 15% of the average recharge rate for the watershed or where the recharge largely accounts for maintaining aquifer levels. Similarly to the HVAs, SGRAs are found dispersed throughout the City (Figure 5).

Finally ESGRAs are those areas which supplies groundwater recharge to sensitive features such as a cold water stream that is dependent on this recharge to maintain its ecological function. As such ESGRAs are found usually within proximity to surface water features and

tend to be concentrated within the central and south-eastern portion of the City (Figure 6). Due to the method of delineating ESGRAs and SGRAs certain areas may be considered both an ESGRA and SGRA.

#### **4.1 Salt Vulnerability Index**

All six vulnerable areas discussed previously were used to create a salt vulnerability index as a means to map relative salt vulnerable areas throughout the City. The index was calculated by assigning each of the vulnerable areas a specific value given its presence (1) or absence (0). By overlapping each of the mapped vulnerable areas and combining their values we obtain a map covering the extent of the City that shows a salt vulnerability index ranging from 1-5 (Figure 7). Given the presence of municipal supply wells and ICA within the central portion of the City, the areas having the highest salt vulnerability index is also found within the central portion of the City nearest Kempenfelt Bay.

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.

#### **5.0 Recommendations**

In order to achieve the project's vision of minimizing the environmental impact of road salt application, while maintaining safe surfaces for pedestrian and vehicular traffic, a working group was formed. This group, formed of various City departments including members of the Source Water Protection Group, Road and Technical Operations and Traffic & Parking Services, developed a series of recommendations. The recommendations are meant to improve the efficiency of winter maintenance practices to help optimize the use of road salt by the City of Barrie.

The recommendations obtained through the working group are listed in a table and divided into similar themes (Appendix 1). Each recommendation has been categorized as either a short term or a long term goal, has an associated priority level (low, medium or high) and the group/department responsible for implementation. The status of the listed recommendations implementation is to be taken as its status at the time of the Salt Optimization Strategy publication.

#### **6.0 Monitoring and Updating**

The purpose of monitoring and updating is to provide a basis for continuous improvement of the City's Salt Optimization Strategy, and to ensure the efforts towards the implementation of the recommendations are ongoing.

An annual revision on the status of the recommendations' implementation will therefore be completed at the end of each winter season. At which time suggestions for new recommendations to be implemented can be added to the strategy. Going forward, it is also the plan to expand the strategy to optimize collaboration efforts to include City facilities.

## **7.0 References**

City of Barrie, 2016, Salt Management Plan.

City of Barrie, 2016, Winter Operations Plan.

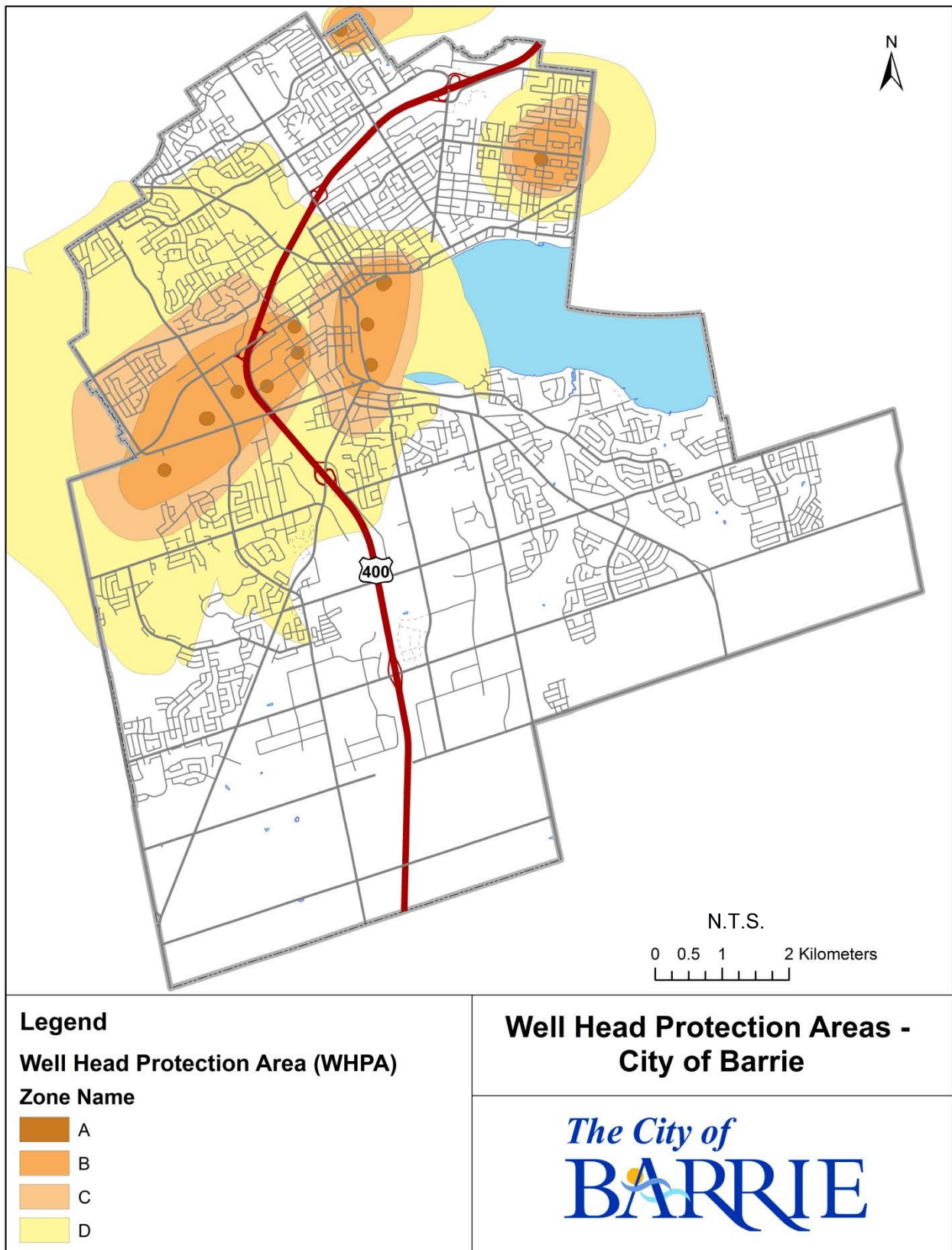
Ministry of the Environment, 2006, Clean Water Act. Amendments June 20, 2012.

South Georgian Bay-Lake Simcoe Source Protection Region, 2015, Approved South Georgian Bay Lake Simcoe Source Protection Plan.

South Georgian Bay-Lake Simcoe Source Protection Region, 2015, Approved Assessment Report: Lake Simcoe and Couchiching-Black River Source Protection Area.

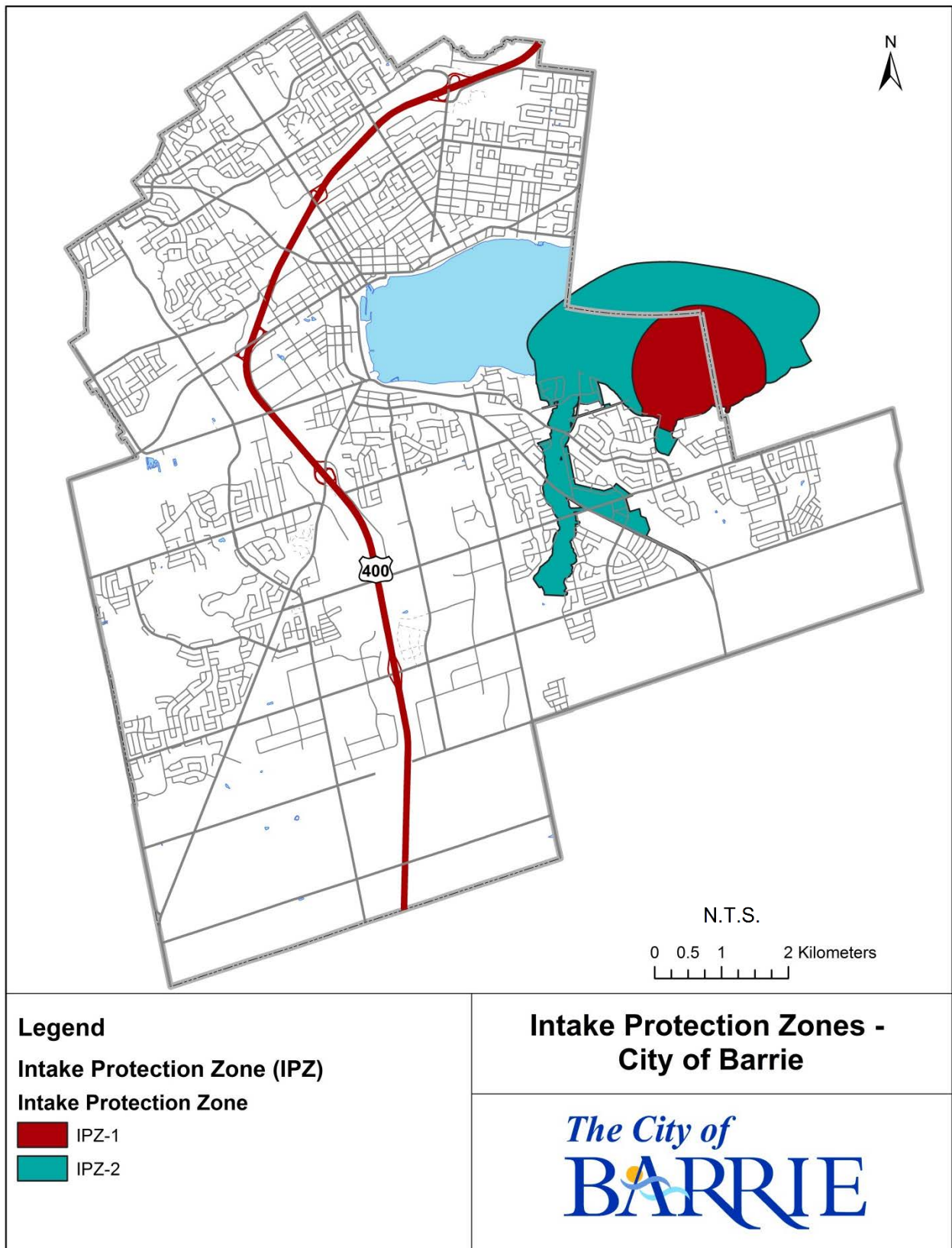


Figure 1 – Well Head Protection Areas





**Figure 2 – Intake Protection Zones**



**Figure 3 – Issues Contributing Areas**

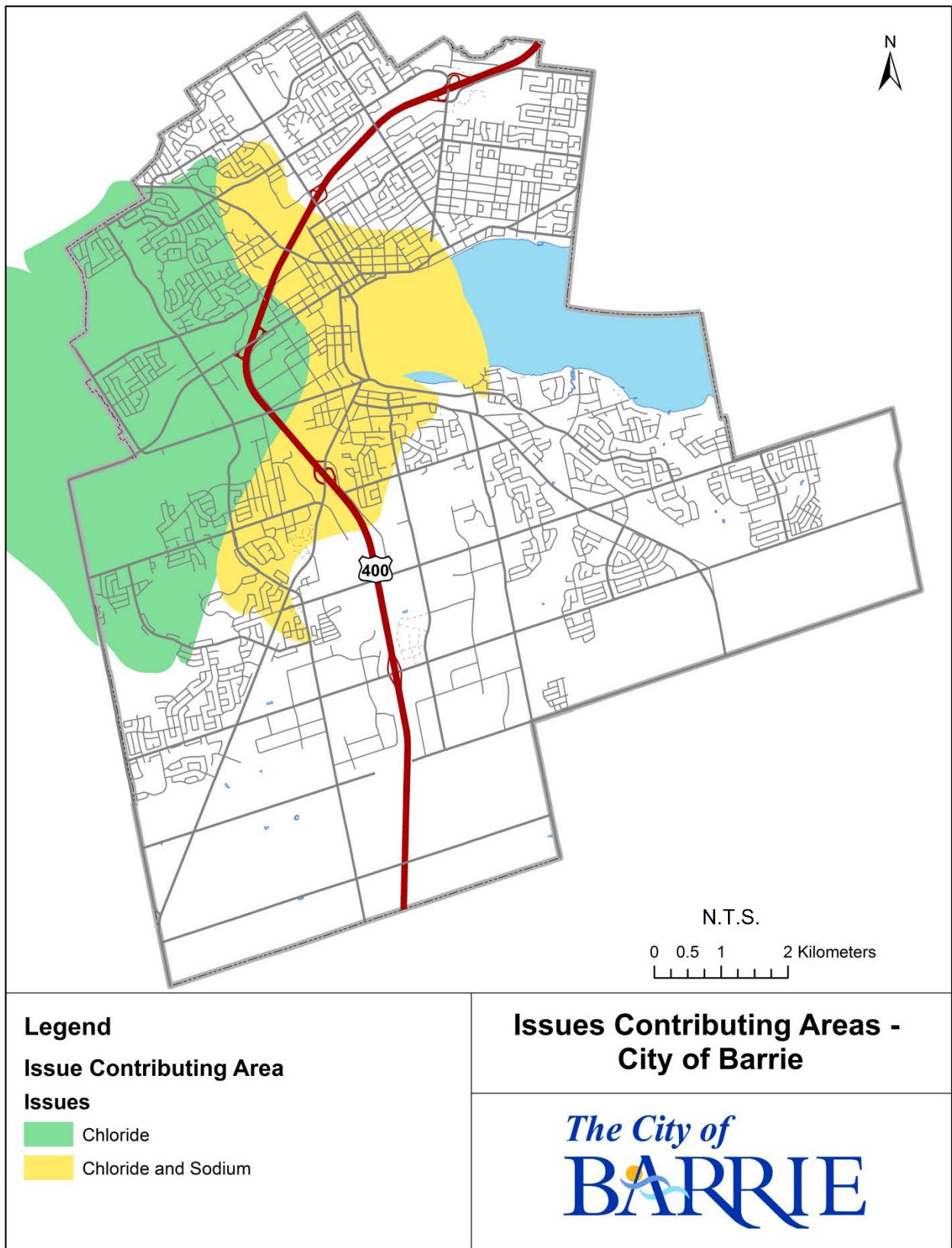
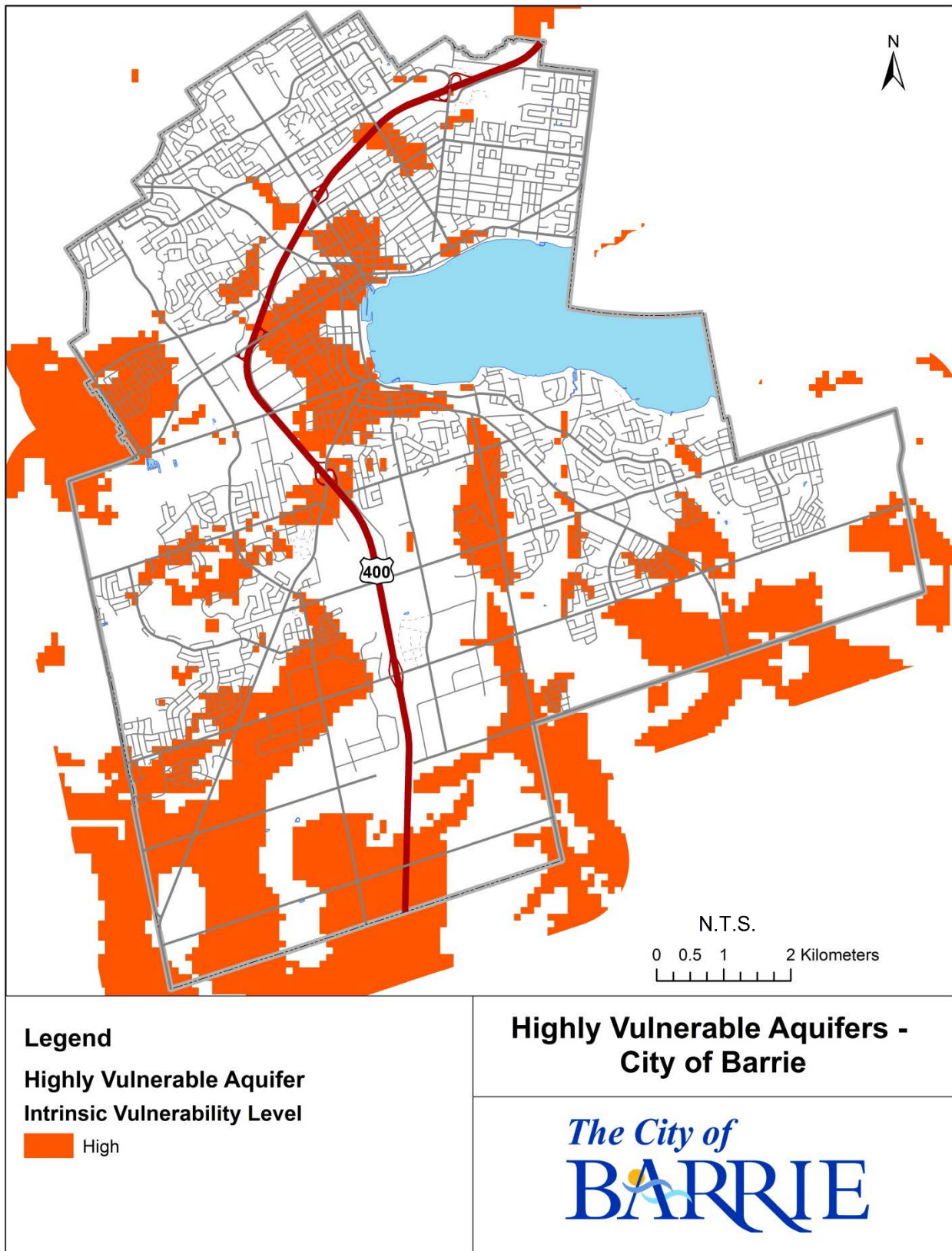


Figure 4 – Highly Vulnerable Aquifers





**Figure 5 – Significant Groundwater Recharge Areas**

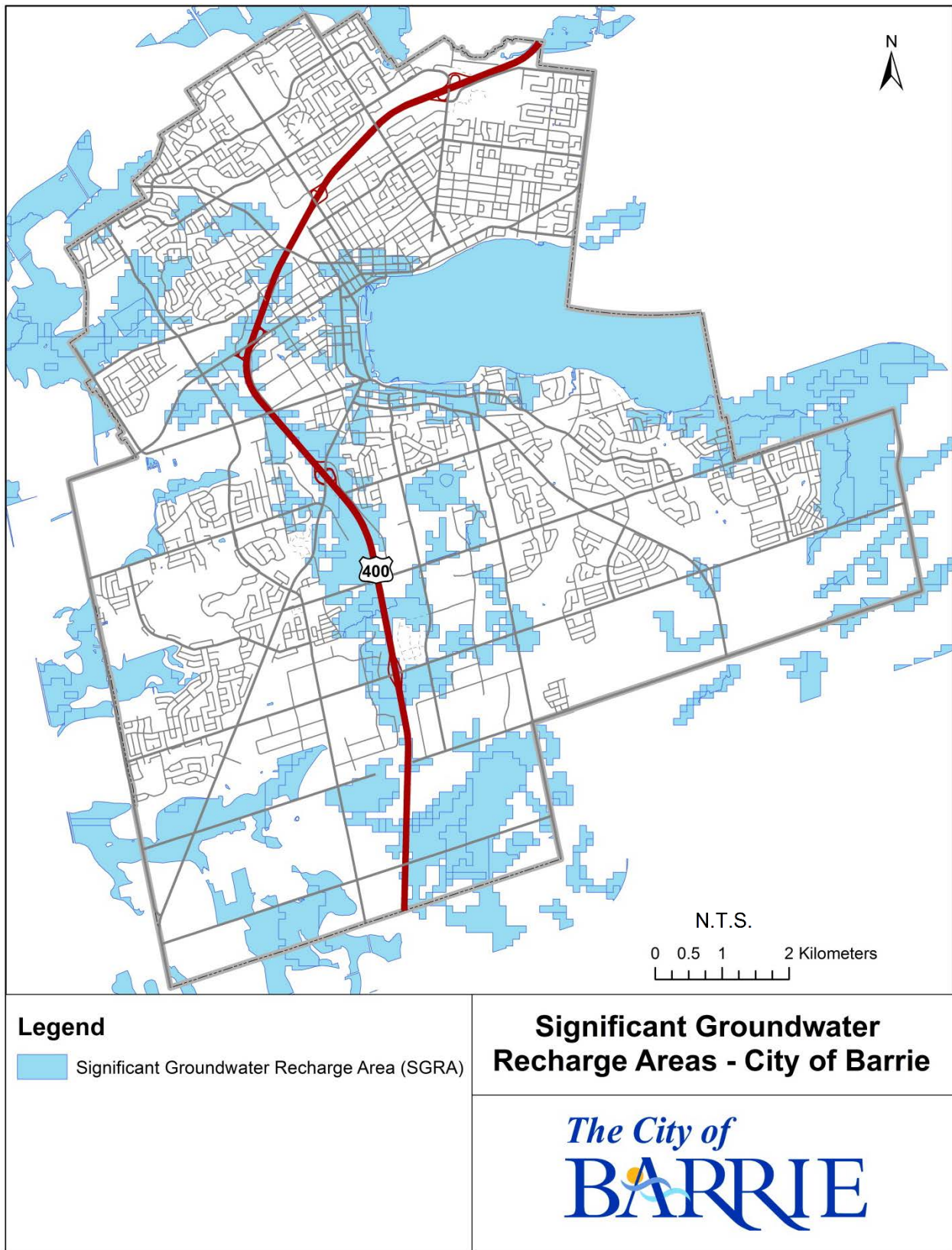


Figure 6 – Ecologically Significant Groundwater Recharge Areas

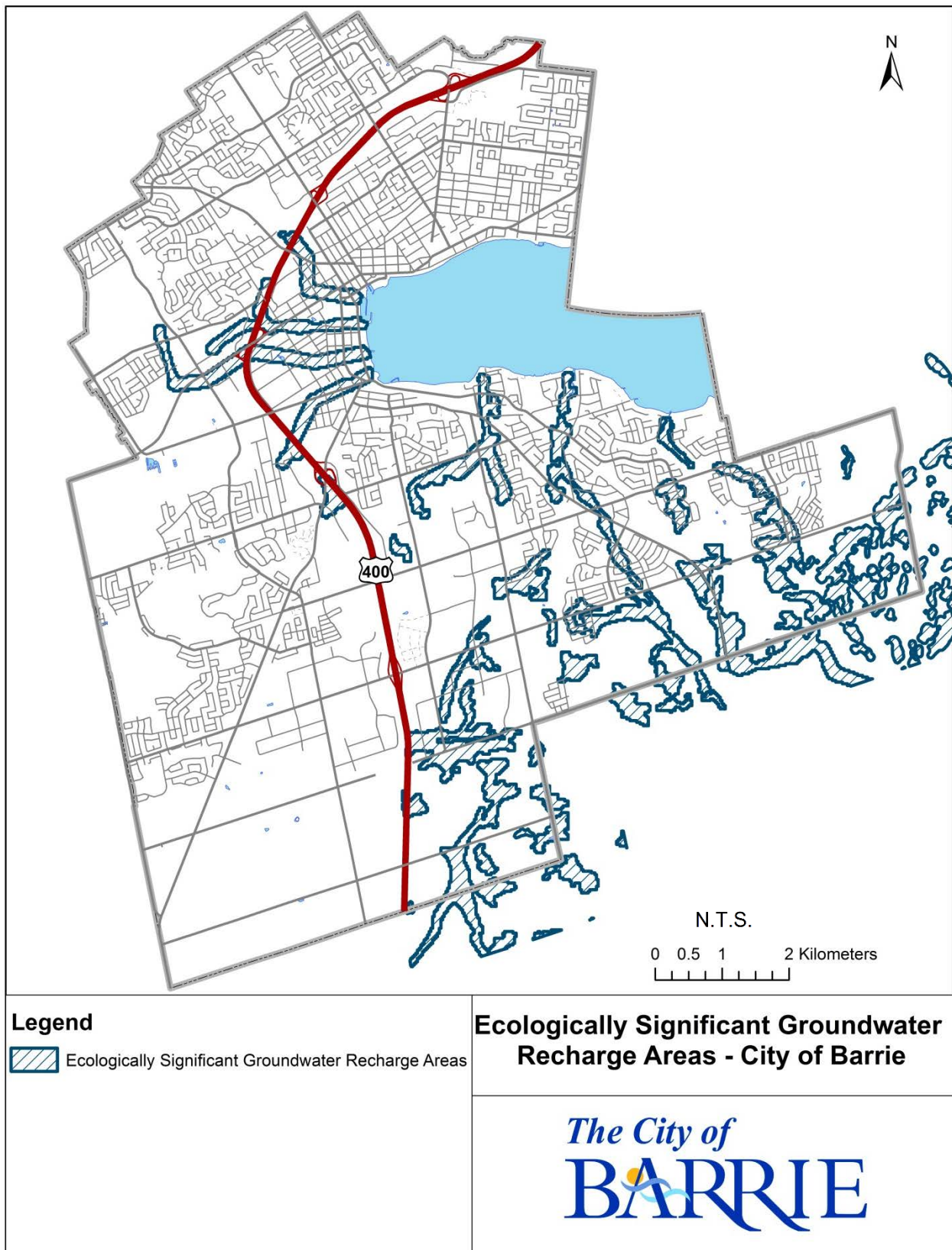
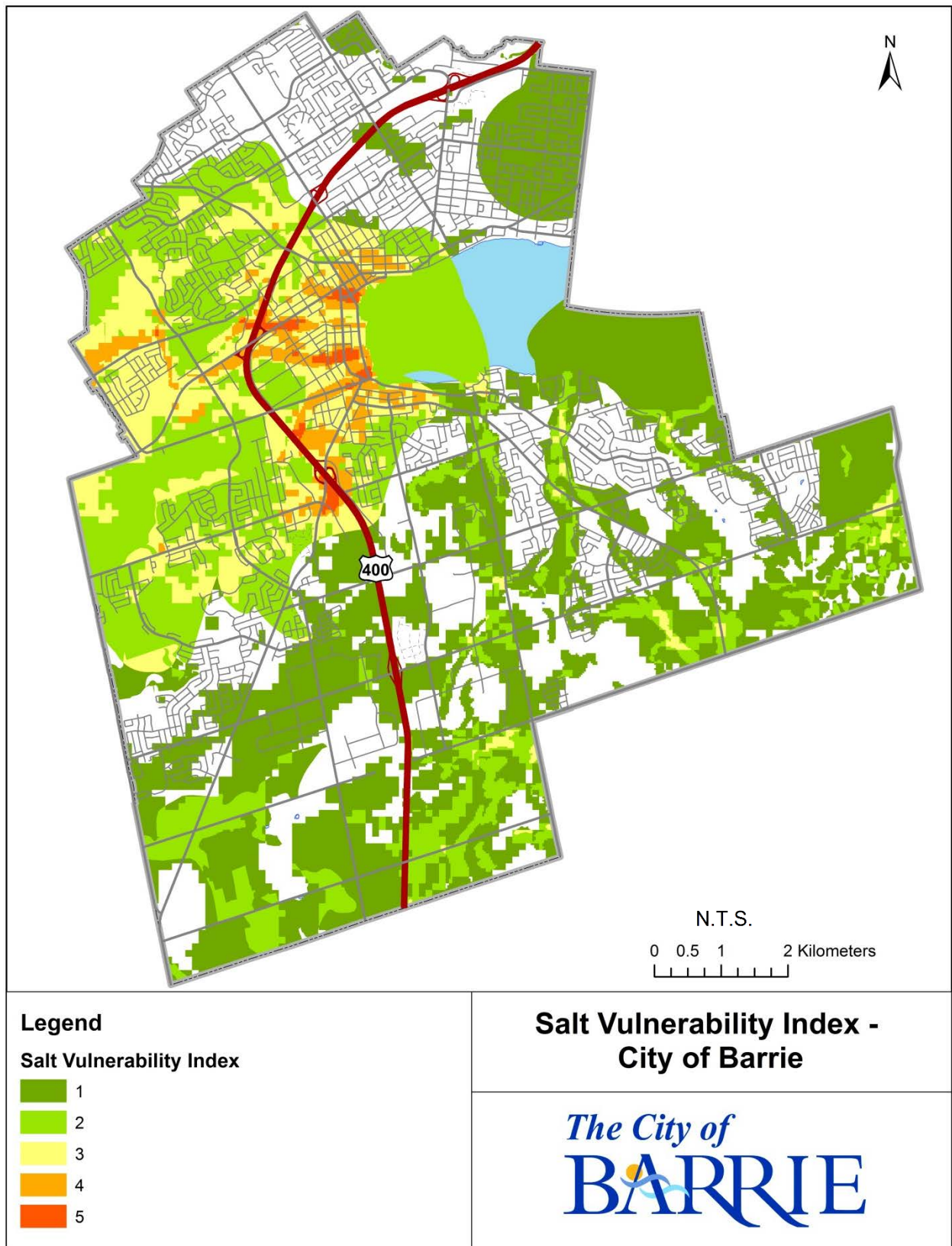




Figure 7 – Salt Vulnerability Index



## Appendix 1 – Salt Optimization Strategy Recommendations Table

Salt Optimization Strategy – Recommendations					
	<b><i>Recommendation</i></b>	<b><i>Timeframe</i></b>	<b><i>Priority</i></b>	<b><i>Responsible</i></b>	<b><i>Status</i></b>
Baseline Understanding	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	High	Source Water	Completed
	Complete a city-wide road gradient map for existing road infrastructure from the most current LiDAR data available. Update gradient mapping as new LiDAR data is available.	Short Term	High	Source Water / GIS	Completed
	Complete a city-wide map of road curvatures throughout the City.	Short Term	High	GIS	Future
	Develop a procedure to capture road gradients and curves from as-built drawings, and incorporate to appropriate GIS layer on the SDE.	Long Term	Medium	GIS / Engineering	Future
	Review transportation infrastructure that receives winter maintenance services in order to better identify users of the system (eg. vehicles, bicycles, e-bikes, pedestrians, etc.) at a minimum every five years and incorporate user data and winter maintenance considerations into the Transportation Master Plan.	Short Term / Long Term	Medium	Infrastructure Planning	Future
	Annually update available traffic count data, and posted speed limits on SDE.	Short Term	High	Traffic & Parking Services / GIS	Ongoing
	Annually update Ontario Minimum Maintenance Standards road classification mapping on SDE.	Short Term	High	Traffic & Parking Services / GIS	Ongoing



**Salt Optimization Strategy – Recommendations (cont.)**

<b>Salt Optimization Strategy – Recommendations (cont.)</b>					
<b>Recommendation</b>		<b>Timeframe</b>	<b>Priority</b>	<b>Responsible</b>	<b>Status</b>
<b>Level of Service</b>	Establish a level of service for municipal parking facilities that will be included within the Winter Maintenance Operations Plan.	Short Term	High	Traffic & Parking Services / Facility Services	Ongoing
	Establish a priority sand route level of service category for municipal roads within scope of the minimum maintenance standards. This route category would be ploughed like a priority route, and receive pickled sand as the treatment option as opposed to road salt.	Long Term	High	Road Operations	Proposal to be going forward Fall 2016
	Annually review transportation infrastructure that receives winter maintenance services, specifically priority plow (and salt/sand) routes to identify opportunities for improvement. Proposed changes in service will consider all road segments' planning classification (arterial, collector, and local), OMMS class, gradient, 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	High	Road Operations	Completed for 2016  Ongoing
	Establish or look for areas to expand direct liquid application routes with the use of additives.	Long Term	High	Road Operations	Ongoing

**Salt Optimization Strategy – Recommendations (cont.)**

<b>Recommendation</b>	<b>Timeframe</b>	<b>Priority</b>	<b>Responsible</b>	<b>Status</b>
Create a City-wide map of all surface water sampling locations for chloride/sodium concentrations including historic data where available. Track any changes in chloride/sodium loadings into receiving waters during the spring freshet and use this as a KPI.	Long Term	Medium / Low	Technical Operations / Environmental Services / Source Water Protection	Ongoing data collection
Create a City-wide map of all groundwater sampling locations for chloride/sodium concentrations including historic data where available.	Long Term	Medium / Low	Groundwater Services / Environmental Services / Source Water Protection	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	Low	Roads, Park & Fleet	Future Ongoing
Have at a minimum one Road Operations co-op student hired during the winter maintenance season. Incorporate the analysis of data collected relating to winter maintenance services as part of the job duties of this co-op student.	Short Term	High	Road Operations	Looking to hire student this winter season
Track the volume of anti-icing/de-icing materials used by Traffic Services fleet.	Short Term	High	Technical Operations / Traffic & Parking Services	To begin 2016 winter season
Develop a snow removal contract template for future Traffic & Parking Services snow removal contractors.	Long Term	High	Technical Operations / Traffic & Parking Services	Estimated time of completion: 2018
Track volume of anti-icing/de-icing materials used by Landfill Operations fleet.	Short Term	High	Technical Operations	To begin 2016 winter season
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	High	Road Operations	To begin 2016 winter season

Material Tracking & Monitoring

**Salt Optimization Strategy – Recommendations (cont.)**

<b>Salt Optimization Strategy – Recommendations (cont.)</b>					
	<b>Recommendation</b>	<b>Timeframe</b>	<b>Priority</b>	<b>Responsible</b>	<b>Status</b>
<b>Technology &amp; Control Techniques</b>	Establish a corporate policy to have all corporate vehicles, including transit vehicles, use snow tires during the winter maintenance season.	Short Term	High	Fleet Services	Pending Budget Approval
	Include the mandatory use of snow tires during the winter season for contracted waste collection trucks within the waste collection contract.	Long Term	Medium	Environmental Services	To be considered upon contract renewal
	Obtain a third Road Weather Information System within the City of Barrie to better understand and respond to weather events.	Short Term	High	Road Operations	Pending 2017 Budget Approval
	Obtain anti-icing/de-icing material application equipment for Traffic Services that is capable of being calibrated.	Long Term	Low	Fleet Services	Future
	Calibrate all equipment used for winter maintenance services as per manufacturer recommendations.	Short Term	High	Road Operations	Ongoing (Annually)
	Obtain more 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	Medium	Fleet Services with input from Road Operations	Ongoing: Annexed lands Future: replacement of fleet
	Establish a corporate standard to have cameras installed at strategic street signal installation locations to obtain better insight into weather conditions and traffic flow	Short Term	High	Traffic & Parking Services	Future
	Install road watch sensors at all bridges throughout the City to be able to better perform transportation infrastructure winter maintenance services.	Short Term	High	Road Operations	Future

**Salt Optimization Strategy – Recommendations (cont.)**

<b>Salt Optimization Strategy – Recommendations (cont.)</b>					
	<b><i>Recommendation</i></b>	<b><i>Timeframe</i></b>	<b><i>Priority</i></b>	<b><i>Responsible</i></b>	<b><i>Status</i></b>
Pilot Projects	Ensure continued endorsement by Council for staff to continue undertaking pilot projects to find innovative solutions to optimize our winter maintenance services.	Short Term / Long Term	High	Road Operations	Ongoing
	Establish a process for streamlining the purchasing process of anti-icing/de-icing product(s) to be used in winter maintenance pilot projects undertaken by the City. Include requirements for reporting within this process,	Long Term	High / Medium	Road Operations / Purchasing Branch	Future
	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	High / Medium	Road Operations	Ongoing
Education & Outreach	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	High	Source Water	Upcoming in October 2016
	Continue encouraging and offering learning opportunities for City of Barrie staff involved in winter maintenance activities through professional development opportunities and knowledge sharing sessions.	Short Term	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	Medium	Road Operations / Source Water Protection / Access Barrie	Future

**Salt Optimization Strategy – Recommendations (cont.)**

<b>Salt Optimization Strategy – Recommendations (cont.)</b>					
	<b>Recommendation</b>	<b>Timeframe</b>	<b>Priority</b>	<b>Responsible</b>	<b>Status</b>
<b>Big Picture Objectives</b>	Annually review and assess permissible truck routes through the City for potential changes to optimize the winter maintenance strategy.	Long Term	High	Traffic & Parking Services	Ongoing
	Have future updates to the Transportation Master Plan consider ways to optimize winter maintenance activities of proposed road network changes.	Short Term	Medium	Infrastructure Planning	Future
	Employ ploughing as the primary technique to reduce amount of material applied to the surface.	Short Term / Long Term	High / Medium	Road Operations	Ongoing
	Annually review material application rates to identify successes and areas for improvement.	Short Term	High	Roads Operations	Ongoing
	Write a letter to the province requesting that provincial legislation be enacted to require snow tires for all Ontario vehicles. Ask neighboring municipalities, AMO to follow suit.	Long Term	Low	Source Water	Future
	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	High	Engineering / Road Operations / GIS	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	High	Road Operations / Source Water Protection	Ongoing
	The City of Barrie to continue as an active member of Ontario's Road Salt Management Group (ORSMG). The ORSMG has municipal and Environment Canada membership and investigates/pilots state-of-the-art salt management practices and explores new technologies to further enhance road salt management.	Short Term	Medium	Road Operations	Ongoing