

## Chapter 2: Watershed Characterization

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## Watershed Characterization

### 2.1 Introduction

This chapter provides a brief background on the characteristics of the Black-Severn River watershed including the natural, human, and physical features and their interactions. The chapter concludes by summarizing drinking water systems in the watershed, as a prelude to the more in-depth assessment presented in Chapters 6 to 10. Watershed characteristics related to hydrologic and hydrogeologic conditions are presented in the following chapter (Chapter 3; Conceptual water budget). Understanding the characteristics of the Black-Severn River watershed is essential in understanding how quality and quantity of drinking water is affected by both human and natural interactions in the watershed.

Relative to the other areas in the SGBLS Source Protection Region, the Black-Severn River watershed is sparsely populated (less than 54,000 residents [as of 2006](#)) with few large urban or agricultural areas. The land use tends to be a blend of rural residential and crown land settings where population dramatically increases for the summer months as a result of a vibrant tourism industry and seasonal residents.

The information presented in this chapter is drawn from a variety of sources, including reports and data made available by the Ministry of the Environment<sup>1</sup> (MOE, 2005 a & b) and Ministry of Natural Resources (MNR, 2008 a & b, 2009), personal correspondence with MOE and MNR staff, as well as a combination of land cover data sets. As such readers are directed to these reports and the websites provided for a more detailed assessment of the watershed characteristics. Due, however, to the relative remoteness of this area compared to other areas in the SGBLS SPR there is substantially less data available for watershed characterization. Part II of the MOE Assessment Report Technical Rules (MOE, 2008a) clearly states what information is required in this chapter, where the information is available - this chapter does not include all the information requested in the Technical Rules and as such a summary of the gaps is provided in Section 3.7.

In general, watershed characterization, and the Conceptual water budget (provided in the following chapter) are described as a 'drinking water focused' watershed plan, comprised of five main components as outlined in the [schematic-list](#) below. It must be noted however, that

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<sup>1</sup> [Now, the Ministry of the Environment, Conservation and Parks \(MECP\)](#)

the information provided in this watershed characterization is not used to determine Issues and Threats to specific municipal drinking water systems – see municipal chapters (chapter 6-10) for details on individual drinking water systems.

### **Characterization**

The five main components are:

**1. Watershed Boundaries**

Delineates the area within the watershed, encompassing both the natural and human features

**2. Water Budget**

Describes the movement of water through the hydrologic cycle and quantifies the amount of water flowing through the Source Protection Region

**3. Physical Geography**

Describes the natural features in the watershed, how they have changed over time and the interactions that occur

**4. Drinking Water Systems**

Details the location and population served by municipal and non-municipal wells, as well as the pumping rates

**5. Natural Geography and Ecology**

Depicts the flora and fauna present within the watershed, highlighting important details, such as the current status of habitats

## 2.2 Watershed and Subwatershed Boundaries

The Black-Severn River watershed is one of four watersheds with the South Georgian Bay- Lake Simcoe Source Protection Region. The three other watersheds within the Source Protection Region include the Nottawasaga Valley, the Severn Sound and the Lake Simcoe watersheds (Figure 2-1; figures are located at the end of the chapter). The Black-Severn River watershed lies within portions of Haliburton County, the District Municipality of Muskoka, Simcoe County and City of Kawartha Lakes. The Black-Severn River watershed has been divided into 8 subwatersheds, or hydrological units (Figure 2-2re 2.2), with a combined drainage areas of 2,770 km<sup>2</sup> (Table 2.1). The Black River is the main tributary of the Severn River and extends from the confluence at Washago northeastward into Haliburton County. The river originates at elevations of 366 m and 396 m above sea level and drains several small lakes before it enters Logan Lake. Here it is joined by Anson Creek before draining out and flowing south, converging with Head River just before it enters Lake St. John. It leaves Lake St. John and flows north to enter the Severn River at Washago. The Severn River flows into Little Lake and then into Georgina Bay via the Severn Sound. The Upper Talbot River subwatershed is also included in this Source Protection Area. The Talbot River flows into Lake Simcoe approximately 5 km north of Beaverton.

**Table 2-1: Drainage Area of the subwatersheds in the Black-Severn River watershed (Data Source: LSRCA).**

| Subwatershed              | Drainage Area (km <sup>2</sup> ) |
|---------------------------|----------------------------------|
| Lake St John              | 59.82                            |
| Lake Couchiching          | 88.97                            |
| Head River                | 611.14                           |
| Upper Talbot River        | 297.30                           |
| Black River               | 509.19                           |
| Upper Black River         | 392.24                           |
| Severn River              | 564.84                           |
| Kashe / Gartersnake River | 246.44                           |
| <b>Total</b>              | <b>2,769.93</b>                  |

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## 2.3 Physical and Natural Geography

### 2.3.1 Natural Vegetation – wetlands, woodlands and riparian areas.

Natural vegetated areas within the Black-Severn River watershed have been mapped using a combination of the 2006 Southern Ontario Interim Landcover (SIL) for the southern areas, and the 2000 Provincial Land Cover for the northern regions. The SIL is a composite of the best available datasets depicting land classes that have been merged to formulate an updated seamless landcover for southern Ontario. The Provincial land cover data was derived from digital, multispectral Landsat Thematic Mapper data based on images collected between 1998 and 2002. Land cover classes consist of vegetation types (forest, wetlands, crops, pasture) and non-vegetated surfaces (waterbodies, bedrock outcrops, settlements).

Overall, 1,682 km<sup>2</sup> of the Black-Severn River watershed is considered natural vegetative cover, or approximately 60% of the total area (Figure 2-3). Natural vegetative cover in this watershed is outlined below in Table 2.2. The percentage of natural vegetative cover within each subwatershed varies from as low as 22% within the Lake Couchiching subwatershed, to almost 69% in the Severn River subwatershed; the Upper Black River has the highest coverage at 84%. Wetlands occupy approximately 14% of the Black-Severn River watershed. They are scattered throughout the watershed, with the highest concentrations in the east and northwest of Lake Couchiching in the Lake ~~St. John~~St. John and Severn River subwatersheds. There are two wetlands within the Black-Severn River watershed that have been identified by the Natural Heritage Information Centre (NHIC). These total 616 ha in area and are both located within the District of Muskoka. There are several other wetlands considered to be provincially significant wetlands such as: Sparrow Lake Wetlands including McLean Bay, Morrison Lake Wetland, Loon Lake Wetlands, Potato Island in Severn Sound, Port Severn, Lewisham Wetland. While there are no Areas of Natural and Scientific Interest (ANSIs) identified within the Black-Severn River watershed, there are five candidate Life Science ANSIs, totaling 6,307 ha in area.<sup>2</sup>

Woodland cover percentage is lowest in the Lake St. John subwatershed (45%) and highest in the Upper Black River subwatershed with approximately 98% of the natural vegetative cover being designated as woodland cover. Woodlands reduce the speed of overland water flow and erosion, increase evapotranspiration, intercept rainfall, and increase water infiltration to shallow groundwater areas.

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<sup>2</sup> <https://geohub.lio.gov.on.ca/datasets/b88037cdb71e4daf9445afa6fb999194/explore?location=38.184240%2C-68.394900%2C3.00>

Both wetlands and woodlands fall into the 30-metre riparian area recommended for watercourses. Vegetated riparian areas control erosion from overland flow, limit the sedimentation of surface waters, and reduce the concentrations of nutrients, pesticides and some pathogens entering the watercourse. While there are many benefits of reduced contamination to the aquatic ecosystems, the reduction is also important for ensuring quality drinking water. There is currently no data summarizing the amount of riparian area in the Black-Severn River watershed. With a much smaller population and the majority of the watershed having natural vegetative cover, it is likely that there would be a high percentage of land along watercourses that would meet the 30-metre recommendation.

**Table 2-12: Natural Vegetative Cover in the Black-Severn River watershed.**

| Community Type            | Total Area (km <sup>2</sup> ) | % of Watershed Area | % of Natural Vegetative Cover |
|---------------------------|-------------------------------|---------------------|-------------------------------|
| Alvar                     | 8.36                          | 0.302               | 0.50                          |
| Bog - Treed               | 21.02                         | 0.760               | 1.25                          |
| Forest - Dense Coniferous | 67.53                         | 2.442               | 4.01                          |
| Forest - Dense Deciduous  | 330.15                        | 11.937              | 19.63                         |
| Forest - Dense Mixed      | 456.65                        | 16.511              | 27.15                         |
| Hedgerow                  | 1.37                          | 0.050               | 0.08                          |
| Plantation                | 4.80                          | 0.173               | 0.29                          |
| Wetland                   | 230.38                        | 8.330               | 13.70                         |
| Wooded Area               | 561.77                        | 20.311              | 33.40                         |
| <b>TOTALS:</b>            | <b>1,682</b>                  | <b>61</b>           | <b>100.00</b>                 |

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### 2.3.2 Surface Water Quality

The chemical, physical and microbiological characteristics of natural water make up an integrated index we define as “water quality”. Water quality is a function of both natural processes and anthropogenic impacts. For example, natural processes such as weathering of minerals and various kinds of erosion are two actions that can affect the quality of surface water. There are also several types of anthropogenic influences, including point source and non-point sources of pollution. Point sources of pollution are specific, identifiable sources of contaminants to the surface water or groundwater system. Examples include municipal and

industrial wastewater discharges, ruptured underground storage tanks, and landfills. Non-point sources are diffuse sources of pollution such as agricultural drainage, urban runoff, land clearing, construction activity or land application of waste that typically travel to waterways through surface runoff and infiltration. Contaminants delivered by point and non-point sources can travel in suspension and/or solution and concentrations are normally monitored at Provincial Water Quality Monitoring Network (PWQMN) Stations (like in the Lake Simcoe, Nottawasaga and Severn Sound watersheds).

While there are no PWQMN stations within the Black-Severn River watershed, some monitoring of the lakes is being conducted within the watershed. The Lake Partner Program is a volunteer-based monitoring program that consists of a partnership between the Ministry of the Environment, [Conservation and Parks](#) and residents and cottagers in Ontario. The goal of the program is to build up a long-term database on the clarity and total phosphorus (TP) levels in Ontario's inland lakes to identify change in water quality trends over time. Being aware of changing trends can aid in assessing the impacts of land use changes on water quality. The Lake Partner Program information does not relate to any specific drinking water system but rather provide ambient conditions and the ability to detect changes over time. Therefore, the water quality data presented here is not generally suitable for assessment of drinking water Issues — See Issues Evaluation sections of the municipal chapters for this information (chapters 6 to 10).

Collected samples are sent to the laboratory Ministry of the Environment, [Conservation and Parks's](#) Dorset Environmental Science Centre (DESC) to be analyzed. The data used in this report has eight years of total phosphorus data and eighteen years of Secchi disc depth measurements that have been collected by volunteers across the watershed and is available on the Lake Partner Program website<sup>3</sup>. Where there was less than five years of data, samples were not included in this analysis. One exception is for the total phosphorus (TP) concentration for Lake St. John. This was included because there were a number of samples taken within the three years of data and there is an interesting spike in average TP concentrations. While this is most likely an 'outlier', the samples taken during this year (2003) were all relatively high (>30 ug/L) compared to 2002 and 2005.

Table 2.3 provides the minimum, maximum and median values for average TP and Secchi disc depth, along with the number of years of data. Phosphorus, while necessary for everyday life, also promotes eutrophication of surface waters by stimulating nuisance algal and aquatic plant growth. This depletes oxygen levels as they decompose resulting in adverse impacts to aquatic fauna and restrictions on recreational use of waterways. Sources include lawn and garden

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<sup>3</sup> <http://www.ene.gov.on.ca/en/water/lakepartner/index.php>

fertilizers, animal wastes, eroded soil particles and sanitary sewage. For total phosphorus, the interim Provincial Water Quality Objectives (PWQO) for total phosphorus is 20 µg/L, to avoid nuisance concentrations of algae. Lakes that have exceeded this objective over the years include: Lakes [Baxter](#), [Prospect](#), Canal, Mitchell, Loon, [Brady](#), [Head](#), [Kashe](#), [South Muldrew](#), [Couchiching](#), St.John, Bass, Riley, ~~and~~ [Sparrow](#), [Raven](#), [Morrison](#), and [Turtle](#). [In the 2002 to 2009 data set, 7 lakes had exceeded the objective in at least one of their samples. In the 2010 to 2017 samples, an additional 10 lakes recorded total phosphorus readings above this objective, for a total of 17 lakes who have exceeded the objective since 2002.](#) The increased phosphorus levels in these lakes could cause an increase in algal growth, decreasing water clarity, and potentially causing taste or odor problems with the water (MOE, 2005a). To see the trends in average TP concentrations for each lake refer to graphs in Appendix WC.

One of the limitations of collecting data in this manner is the possibility of sample contamination. If not properly filtered, things such as zooplankton can alter the amount of phosphorus detected. In general, because of the kit and directions they provide to volunteers, the Lake Partner Program is confident that the percentage of outliers (present with almost any data set) is roughly the same (2-5%) whether volunteers or professionals collect the samples. Location of sampling sites is illustrated in Figure 2.4.

Secchi discs are used to measure the clarity of the water in a lake. Regular measurements will produce a trend of the clarity over time. While a fluctuation in clarity can indicate an increase or decrease in algal biomass of a lake, it can also indicate other changes that are taking place within a lake system that are independent of nutrient status. Examples include invasive species (such as zebra mussels) and climate (MOE, 2005b). Overall, when comparing median concentrations, Clear Lake in Oakley has the highest clarity (a median Secchi depth of 6.9 m [between 1992 and 2009](#)) and Bass Lake in Ryde has the least clear water with a median Secchi depth of only 1.7 m [between 1992 and 2009](#). To see the trend ~~over the years~~ for individual lakes [between 1992 and 2009](#), refer to Appendix WC. [In the 2017 to 2019 data set, Riley Lake also reported a low median value of 1.7 m.](#)

**Table 2-23: Surface water quality results in the Black-Severn River watershed.**

|                                      | Average Total Phosphorus (2002-2009): µg/L | Average Total Phosphorus (2010-2019): µg/L | Secchi Depth (1992-2009): m | Secchi Depth (2017-2019): m |
|--------------------------------------|--|--|-----------------------------|-----------------------------|
| <b>Baxter - Six Mile Lake (4978)</b> |  |  |                             |                             |
| Min                                  | 6.6  | 4.0  | 3.4                         | N/A                         |
| Max                                  | 12.2                                       | 22.6*                                      | 6.1                         | N/A                         |

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|  | Average Total Phosphorus (2002-2009): µg/L | Average Total Phosphorus (2010-2019): µg/L | Secchi Depth (1992-2009): m | Secchi Depth (2017-2019): m |
|--|--|--|-----------------------------|-----------------------------|
| Median   | 8.9  | 8.2  | 4.8                         | 4.6                         |
| Number of years with data                      | 8  | 10   | 16                          | 2                           |
| <b>Carden/Dalton - Dalrymple Lake (1905)</b>   |  |  |                             |                             |
| Min  | N/A  | N/A  | 1.4                         | N/A                         |
| Max  | N/A  | N/A  | 3.7                         | N/A                         |
| Median   | N/A  | N/A  | 2.3                         | 1.8                         |
| Number of years with data                      | N/A  | N/A  | 9                           | 2                           |
| <b>Draper - Prospect Lake (4468)</b>           |  |  |                             |                             |
| Min  | 6.1  | 5.6  | 3.0                         | N/A                         |
| Max  | 12.5                                       | 31.5*                                      | 3.5                         | N/A                         |
| Median   | 9.1  | 11.4                                       | 3.2                         | 2.3                         |
| Number of years with data                      | 6  | 9  | 6                           | 2                           |
| <b>Eldon - Canal Lake (7047)</b>               |  |  |                             |                             |
| Min  | 12.3                                       | 4.0  | 1.1                         | N/A                         |
| Max  | 36.8*                                      | 39*  | 3.1                         | N/A                         |
| Median   | 19.6                                       | 11.9                                       | 2.1                         | 2.5                         |
| Number of years with data                      | 8  | 10   | 5                           | 3                           |
| <b>Eldon - Mitchell Lake (7095)</b>            |  |  |                             |                             |
| Min  | 10.6                                       | N/A  | N/A                         | N/A                         |
| Max  | 31.5*                                      | N/A  | N/A                         | N/A                         |
| Median   | 19.9                                       | N/A  | N/A                         | N/A                         |
| Number of years with data                      | 6  | N/A  | N/A                         | N/A                         |
| <b>Gravenhurst - Loon Lake (2807)</b>          |  |  |                             |                             |
| Min  | 7.0  | 7.4  | 2.7                         | N/A                         |
| Max  | 25.8*                                      | 20.9*                                      | 4.6                         | N/A                         |
| Median   | 9.2  | 9.8  | 3.1                         | N/A                         |
| Number of years with data                      | Z  | Z  | Z                           | N/A                         |
| <b>Gravenhurst - North Muldrew Lake (4074)</b> |  |  |                             |                             |
| Min  | 6.1  | 6.3  | 2.0                         | N/A                         |
| Max  | 18.1                                       | 27.9*                                      | 3.7                         | N/A                         |
| Median   | 7.9  | 10.5                                       | 3.0                         | 2.9                         |
| Number of years with data                      | 8  | 10   | 16                          | 2                           |
| <b>Hindon - Brady Lake (560)</b>               |  |  |                             |                             |
| Min  | 8.2  | 4.5  | 2.2                         | N/A                         |
| Max  | 14.7                                       | 28.2*                                      | 3.7                         | N/A                         |

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|   | Average Total Phosphorus (2002-2009): µg/L | Average Total Phosphorus (2010-2019): µg/L | Secchi Depth (1992-2009): m | Secchi Depth (2017-2019): m |
|---|--|--|-----------------------------|-----------------------------|
| Median  | 11.7                                       | 9.3  | 3.1                         | 2.4                         |
| Number of years with data                       | 8  | 8  | 17                          | 1                           |
| <b>Laxton/Digby/Longford - Head Lake (1917)</b> |  |  |                             |                             |
| Min   | 5.8  | 4.2  | 2.0                         | N/A                         |
| Max   | 19.2                                       | 64.4*                                      | 6.0                         | N/A                         |
| Median  | 10.3                                       | 10.7                                       | 2.8                         | 3.1                         |
| Number of years with data                       | 6  | N/A  | 10                          | 1                           |
| <b>Matchedash - Tea Lake (5310)</b>             |  |  |                             |                             |
| Min   | N/A  | N/A  | 0.3                         | N/A                         |
| Max   | N/A  | N/A  | 3.7                         | N/A                         |
| Median  | N/A  | N/A  | 1.9                         | N/A                         |
| Number of years with data                       | N/A  | N/A  | 5                           | N/A                         |
| <b>Morrison - Clearwater Lake (901)</b>         |  |  |                             |                             |
| Min   | 8.0  | 3.2  | 4.1                         | N/A                         |
| Max   | 19.7                                       | 12.7                                       | 7.5                         | N/A                         |
| Median  | 11.5                                       | 9.6  | 5.7                         | 4.8                         |
| Number of years with data                       | 8  | 10   | 12                          | 3                           |
| <b>Morrison - Kashe Lake (2217)</b>             |  |  |                             |                             |
| Min   | 6.3  | 3.2  | 1.8                         | N/A                         |
| Max   | 11.8                                       | 21.8*                                      | 3.7                         | N/A                         |
| Median  | 7.9  | 9.2  | 2.7                         | 3.0                         |
| Number of years with data                       | 8  | 10   | 18                          | 3                           |
| <b>Morrison - South Muldrew Lake (5075)</b>     |  |  |                             |                             |
| Min   | 6.3  | 6.2  | 1.8                         | N/A                         |
| Max   | 11.8                                       | 22.4*                                      | 3.8                         | N/A                         |
| Median  | 7.9  | 10.8                                       | 3.2                         | 3.2                         |
| Number of years with data                       | 8  | 10   | 16                          | 2                           |
| <b>Oakley - Clear Lake (884)</b>                |  |  |                             |                             |
| Min   | 4.0  | 3.8  | 4.0                         | N/A                         |
| Max   | 9.5  | 17.0                                       | 7.5                         | N/A                         |
| Median  | 5.3  | 10.8                                       | 6.9                         | 6.5                         |
| Number of years with data                       | 8  | 9  | 14                          | 2                           |
| <b>Ramara - Couchiching Lake (2454)</b>         |  |  |                             |                             |
| Min   | 6.3  | 4.0  | 3.7                         | N/A                         |
| Max   | 17.3                                       | 62*  | 4.8                         | N/A                         |

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|  | Average Total Phosphorus (2002-2009): µg/L | Average Total Phosphorus (2010-2019): µg/L | Secchi Depth (1992-2009): m | Secchi Depth (2017-2019): m |
|--|--|--|-----------------------------|-----------------------------|
| Median   | 9.7  | 9.8  | 4.4                         | 3.6                         |
| Number of years with data                      | 5  | 9  | 4                           | 3                           |
| <b>Ramara - Lake St. John (5141)</b>           |  |  |                             |                             |
| Min  | 14.7                                       | 4.8  | 0.9                         | N/A                         |
| Max  | 99.9*                                      | 134*                                       | 4.0                         | N/A                         |
| Median   | 28.1*                                      | 15.3                                       | 3.0                         | N/A                         |
| Number of years with data                      | 3  | 2  | 10                          | N/A                         |
| <b>Ryde - Bass Lake (239)</b>                  |  |  |                             |                             |
| Min  | 14.8                                       | N/A  | 1.3                         | N/A                         |
| Max  | 31.4*                                      | N/A  | 1.9                         | N/A                         |
| Median   | 27.2*                                      | N/A  | 1.7                         | N/A                         |
| Number of years with data                      | 6  | N/A  | 10                          | N/A                         |
| <b>Ryde - Riley Lake (4628)</b>                |  |  |                             |                             |
| Min  | 11.3                                       | 6.0  | N/A                         | N/A                         |
| Max  | 25.0*                                      | 32.4*                                      | N/A                         | N/A                         |
| Median   | 13.2                                       | 8.5  | N/A                         | 1.7                         |
| Number of years with data                      | 6  | 10   | N/A                         | 3                           |
| <b>Severn/Matchedash - Sparrow Lake (5094)</b> |  |  |                             |                             |
| Min  | 9.6  | 5.0  | 3.8                         | N/A                         |
| Max  | 30.7*                                      | 18.0                                       | 5.5                         | N/A                         |
| Median   | 12.9                                       | 10.2                                       | 5.0                         | N/A                         |
| Number of years with data                      | 8  | 8  | 5                           | N/A                         |
| <b>Sherborne - Raven Lake (4555)</b>           |  |  |                             |                             |
| Min  | 3.2  | 4.0  | 2.7                         | N/A                         |
| Max  | 15.6                                       | 27.0*                                      | 5.7                         | N/A                         |
| Median   | 6.9  | 9.6  | 4.6                         | 4.1                         |
| Number of years with data                      | 8  | 10   | 12                          | 3                           |
| <b>Wood - Morrison Lake(3331)</b>              |  |  |                             |                             |
| Min  | 6.1  | 5.0  | 1.9                         | N/A                         |
| Max  | 13.7                                       | 49.4*                                      | 3.4                         | N/A                         |
| Median   | 8.8  | 10.3                                       | 2.8                         | 3.0                         |
| Number of years with data                      | 7  | 10   | 13                          | 3                           |
| <b>Wood - Turtle Lake (5485)</b>               |  |  |                             |                             |
| Min  | 5.9  | 7.0  | 2.8                         | N/A                         |
| Max  | 12.6                                       | 55.4*                                      | 3.5                         | N/A                         |

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|                           | Average Total Phosphorus (2002-2009): µg/L | Average Total Phosphorus (2010-2019): µg/L | Secchi Depth (1992-2009): m | Secchi Depth (2017-2019): m |
|---------------------------|--|--|-----------------------------|-----------------------------|
| Median                    | 7.3  | 13.1                                       | 3.2                         | N/A                         |
| Number of years with data | 6  | 10   | 6                           | N/A                         |

 = above interim PWQO of 20 µg/L for total phosphorus

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### 2.3.3 Groundwater Quality

There are no Provincial Groundwater Monitoring Network (PGMN) wells within the Black-Severn River watershed. However, in the City of Kawartha Lakes, Morrison Environmental Limited (2004) reported that wells located in the north-central portion of the municipality commonly produce sulfurous water. In addition, concentrations of iron, manganese and chloride measured in groundwater have been reported to exceed the ODWS at selected well locations. Maps illustrating the groundwater quality in the overburden and bedrock aquifers in the City of Kawartha Lakes are presented in Morrison Environmental Limited (2004). Groundwater quality related to specific municipal well supplies are presented in the Issues Evaluation Section of Chapters 6 to 10.

While not mentioned in the water quality sections above, there has been increased interest and concern of the levels of pharmaceuticals and personal care products accumulating in the environment through the movement of water (surface and ground) and what the possible impacts are on ecosystems and humans. Pharmaceuticals and Personal Care Products (PPCPs) are a group of chemicals commonly referred to as ‘emerging contaminants’ and ‘contaminants of emerging concern’. The **MOEMEC** defines these terms as the presence of chemicals that were previously, or are currently, unknown, unrecognized and/or unregulated in the environment.

PPCP compounds are typically found where people use personal care products (such as their homes) or where people and animals are being treated medicinally (i.e. hospitals, veterinary clinics, etc). PPCP enter the environment through a number of channels including:

- residual pharmaceutical compounds which pass through the body into sewers,
- topical medications and personal care products that get washed off; and
- any products that are unused or expired and are improperly disposed of.

The result is these compounds are frequently found in water that is influenced by sewage (streams, rivers, ground water) and are appearing in some sources of drinking water.

Recently the Ministry of the Environment<sup>4</sup> carried out a study that involved the collection and analysis of over 250 water samples (both surface and ground) from 17 drinking water systems (full results can be found in Survey of the Occurrence of Pharmaceuticals and Other Emerging Contaminants in Untreated Source and Finished Drinking Water in Ontario (MOE, 2010b). Samples were tested for 46 different pharmaceuticals, antibiotics, and hormones. Results showed that the concentration of these compounds was in the nanogram per litre (ng/L) or parts per trillion range (MOE, 2010b).

Currently there is no Canadian Drinking Water Quality Guidelines (CDWQG), Ontario Drinking Water Quality Standards (ODWQS) or Provincial Water Quality Objectives (PWQO) for pharmaceuticals, nor are there any standards in North America or Europe to go by. Since there is very little information and research on how PPCPs interact in the environment, the possible short- and long-term impacts they have on both ecosystems and humans are unknown. The Ministry of the Environment, [Conservation and Parks](#) has conducted studies in the past that show that current drinking water treatments being used can reduce the amount of some pharmaceuticals and other contaminants of emerging concern in raw water (MOE, 2010b).

In terms of Source Water Protection, many activities that are potential sources of these compounds (e.g. sewage treatment plants, landfills) have been identified as prescribed Drinking Water Threats in the Region and may therefore be indirectly managed under the *Clean Water Act, 2006*. That being said, the current circumstances for identifying Significant Threats do not identify PCPPs as a potential hazardous chemical and this is a shortcoming that may need to be addressed in the future as more information becomes available.

#### **2.3.4 Aquatic Habitats – fisheries and macroinvertebrate communities.**

Habitat can be described as a place where an animal or plant normally lives, often characterized by a dominant plant form or physical characteristic. All living things have a number of basic requirements in their habitats including space, shelter, food, and reproduction. In an aquatic system, good water quality is an additional requirement. In a river system, water affects all of these habitat factors. Its movement and quantity affect the usability of the space in the channels. It can provide shelter and refuge by creating an area of calm in a deep pool, it carries small organisms, organic debris and sediments downstream which can provide food for many organisms, and its currents incorporate air into the water column which provides oxygen for both living creatures and chemical processes in the water and sediments. Habitat features also frequently affect and are affected by other features and functions in a system. For instance, the

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<sup>4</sup> Now, the Ministry of the Environment, Conservation and Parks (MECP)

materials comprising a channel bed can affect the amount of erosion that will take place over time; this in turn affects the channel shape and the flow dynamics of the water. The coarseness of the channel's bed load can also affect the suitability for fish habitat – some species require coarse, gravelly deposits for spawning substrates, while finer sediments in the shallow fringes of slow moving watercourses often support wetland plants that are required by other species. These ideal habitats are not always available to organisms.

The communities impacted by anthropogenic factors tend to see a gradual and permanent change in the surrounding aquatic habitat. Normally, fish tend to be able to avoid getting diseases but when faced with situations such as rising temperatures, murky waters and loss of habitat, they become stressed, making them susceptible to pathogens and diseases. Similarly, benthic invertebrates have a ranging tolerance to different conditions, but when these are exceeded, they are unable to move to different habitats quickly, making them very vulnerable.

Degradation and loss of aquatic habitat can be attributed to numerous factors both within the watercourse and the surrounding subwatershed. Stressors to aquatic habitat include change in land use, discharge of pollutants (e.g. Wastewater treatment plants) and recreational activities. Impacts from recreational activities in these areas, for example, can include increased bank erosion and instability, loss of riparian area resulting in an increase in input of total suspended solids (TSS) and pollution. Results from recreational activities in these areas can include increased bank erosion and instability, loss of riparian area resulting in an increase in input of total suspended solids (TSS) and pollution. Silt in the water can get trapped in the gills of fish and cause permanent damage. The sediment that settles on the bottom can cover the eggs of organisms, reducing the future population of a species, and can smother the benthic invertebrates living on the streambed.

Removal of riparian vegetation can also impact the communities living within watercourses. Not only does the vegetation act as a filter for debris and runoff, but shrubs and their roots provide shelter and shade to the organisms living in the water. When removed, species become vulnerable to predation and the watercourse can experience an increase in temperature. Increased water temperatures further stress the aquatic communities as this causes the levels of dissolved oxygen to decrease and forces species with specific temperature tolerance levels to leave the area, if capable of doing so. Warmer waters also provide new growth habitat for algae, further decreasing oxygen levels.

### 2.3.4.1 Fish communities

The health of a fisheries community of an aquatic system can be very descriptive of its condition and health. Fish have very specific requirements for temperature regime, suspended sediment levels (turbidity), and nutrient levels.

#### 2.3.4.1.1 Coldwater

Cold water species are generally intolerant of increased temperatures, preferring a range between 10 and 18 degrees C. Coldwater temperatures are often maintained by groundwater discharge (i.e. baseflow, which is the portion of streamflow supplied by groundwater discharge). If baseflow levels decline, the temperature of the watercourses will increase, encouraging warmwater species to replace the coldwater species. Coldwater species also require high levels of dissolved oxygen (which is in higher concentration in coldwater) and cannot tolerate high turbidity levels, as the suspended sediment clogs the gills and impairs the ability of the fish to breathe. Suspended sediment can also impair the feeding ability of some species. Many of these species are also unable to survive in areas with high nutrient levels, as these areas have increased growth of vegetation, which will deplete the dissolved oxygen as it dies and decomposes. Many of these species will require clean gravel or rock over which to spawn. Though not seen in the 2005 survey, the coldwater brook trout (*Salvelinus fontinalis*) is known to inhabit various places.

#### 2.3.4.1.2 Warmwater

Warmwater fish species are more tolerant of higher temperatures, suspended sediment and nutrient levels. Water temperatures up to 30 degrees C can be tolerated by most, and they do not require high concentrations of dissolved oxygen. Inputs of nutrients are also tolerated well, as the resulting vegetative growth enhances the habitat that most of these species require. Examples of warmwater species found within the Black-Severn River watershed are largemouth bass (*Micropterus salmoides*) and brown bullhead (*Ameiurus nebulosus*).

Changes in water quality and aquatic habitat conditions can result in a shift in the aquatic community. Continued monitoring of fish communities over a long period of time can help to identify the occurrences that changed the habitat, and also to potential remedial strategies to help the affected community recover.

The majority of the upper portion of the Black-Severn River watershed flows through crown land, and has thus been left relatively undisturbed. As a result, tributaries in this area are able to support healthy populations of coldwater fish, including brook trout. Some sections flow

through privately owned land, but with very little development – there may be some disturbance, but there does not appear to be a significant impact.

While there has been little fisheries sampling completed in this watershed, it is believed that the lower portions contain populations of muskellunge (*Esox masquinongy*), and possibly species of bass. These fish likely originate from lakes with outflows into the Black – many of which support bass and muskellunge populations (MNR, Personal Correspondence).

Current fisheries data is not available at the time of this report. ~~MNR~~MNRF has not completed a comprehensive management plan in the watershed however, in 2008, a broad-scale fisheries monitoring program was implemented in Ontario. The data being collected includes water quality, invasive species and the numbers and condition of fish species (MNR, 2008a). Some of the fish species that have identified within the Black-Severn River watershed (in both lakes and water courses) include those listed in Table 2.4Table 2-4.

The Ministry of ~~Natural Resources~~Natural Resources and Forestry also conducts an annual fish stocking program in the Minden/Haliburton area. In 2008 a total of 101,550 fish, including 11,525 lake trout and 15,550 rainbow trout from the Haliburton Highlands Outdoors Association hatchery, were added to local lakes. This past year (2009) 65,425 fish, including 15,700 Lake Trout and 14,125 rainbow trout from the Haliburton Highlands Outdoors Association hatchery, were put into the local lakes (MNR, 2008b, 2009)

While there is minimal fisheries data available for the Black-Severn River watershed, historical data is available in hard copy at the Minden Area Office, Bancroft District of the ~~MNR~~MNRF and should be considered in future versions of this report.



upper reaches of the Black River is available in hard copy at the Minden Area Office, Bancroft District of the MNR and should be considered in future versions of this report.

As a result of the significant boating traffic, virtually all waterbodies that have direct access to the Severn River contain zebra mussels, including the Severn River proper and Six Mile Lake. Zebra mussels have been linked in other areas to increased clarity of water, and through this, the increased growth of aquatic macrophytes. The spiny water flea (*Bryotrepes longimanus*) is also present in the Muskoka area. The water flea feeds on zooplankton, also a food source of small and juvenile fish. Its impact has not yet been ascertained, but it could potentially change the ecosystem dynamics, as the water flea consumes organisms near the base of the food chain, and competes directly with some fish species for this food source.

## 2.4 Human Geography – Population and Land Use

### 2.4.1 Population and municipal boundaries

Within the Black-Severn River watershed there are three upper tier municipalities (Simcoe, Muskoka, and Haliburton), one separated city (Orillia), one single tier municipality (City of Kawartha Lakes) and nine lower tier municipalities (Ramara, Severn, Minden Hills, Dysart et al, Georgian Bay, Bracebridge, Gravenhurst, Georgian Bay Lake of Bays and Muskoka Lakes).

Municipal populations within the Black-Severn River watershed are relatively small, especially compared to some of the highly populated areas in the Source Protection Region such as Newmarket and Aurora (Table 2.5, Figure 2.5). Population in the entire District of Muskoka in 2001 was 53,106 (with the population increasing significantly during the summer months due to the influx of seasonal residents) and this increased to 57,563 in the 2006, surpassing the projected increase by over 600 people (Muskoka OP). By 2021 the population ~~was~~ projected to increase to 58,635 (Muskoka OP). It should be noted, that the majority of Muskoka's population is within the urban centres (e.g. Bracebridge and Gravenhurst) which are not located within the Black-Severn River Source Protection Area. The population of the City of Kawartha Lakes was 69,179 in 2001, ~~and~~ this increased to 74,561 in 2006, ~~and 79,247 in 2021~~. The population growth rate from 1996-2001 was lower in Kawartha Lakes (1.8%) than that of the province of Ontario (6.1%).

~~As many municipalities are only partially within the Source Protection Region, and Statistics Canada data was provided on a census-consolidated subdivision (CCS) scale<sup>6</sup>, it was necessary~~

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<sup>6</sup>Grouping of adjacent census municipalities

to estimate the actual municipal population within the Source Protection Region using GIS<sup>7</sup>. This calculation used a combination of several datasets, including assessment parcel fabric, municipal population figures from Statistics Canada<sup>8</sup> and the Source Water Protection boundary. The approach involved allocating municipal populations through an area-weighted proportioning for the municipalities that are not entirely within the SPR. This is intended to be a preliminary estimation of population, rather than a conclusive census, and should be treated accordingly.

The Rama First Nation Reserve is located along the eastern Shore of Lake Couchiching, this reserve had a population of 846 during the 2006 census, at a density of 79 people per km<sup>2</sup>. As of 2021, the population has increased to 998 residents, and a population density of 89.5 people per km<sup>2</sup>.

**Table 2-45: Municipal population and population density (Data Source: Statistics Canada, Census 2021<sup>6</sup>).**

| Upper Tier Municipality | Lower Tier Municipality         | Total municipal Population | % of CCS area within Watershed |
|-------------------------|---------------------------------|----------------------------|--------------------------------|
| County of Haliburton    | Township of Algonquin Highlands | 1,9762,588                 | 6                              |
| County of Haliburton    | Township of Minden Hills        | 5,5566,971                 | 28                             |
| City of Kawartha Lakes  | City of Kawartha Lakes          | 74,56179,247               | 30                             |
| District of Muskoka     | Town of Bracebridge             | 15,65217,305               | 29                             |
| District of Muskoka     | Township of Georgian Bay        | 2,3403,441                 | 14                             |
| District of Muskoka     | Town of Gravenhurst             | 11,04613,157               | 73                             |
| District of Muskoka     | Township of Lake of Bays        | 3,5703,759                 | 11                             |
| District of Muskoka     | Township of Muskoka Lakes       | 6,4677,652                 | 2                              |
| County of Simcoe        | Township of Ramara              | 9,42710,377                | 60                             |
| County of Simcoe        | Township of Severn              | 12,03014,576               | 47                             |
| City of Orillia         | City of Orillia                 | 30,25933,411               | 21                             |

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<sup>7</sup> Geographic Information System (GIS) is a computer system that can analyze and manipulate data to produce geographic representations (i.e. a map). Different information can be layered and depicted visually by using this method.

<sup>8</sup> <http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E>

### 2.4.2 Land use

It is important to consider land use when implementing Source Water Protection measures because land cover, and changes to it, will affect several aspects of the water budget including surface water runoff, evaporation and infiltration. Often, developed land will have higher proportion of impervious surfaces, such as roadways, parking lots and building roofs. This, in turn increases runoff rates, resulting in erosion and reduced infiltration to recharge groundwater reserves. The potential for the introduction of contaminants to both groundwater and surface water must be a consideration when a new land use is proposed.

Land use within the Black-Severn River watershed has been divided into 12 classes (Table 2.6). The largest land use within the Black-Severn River watershed is Wooded Area comprising of 51% of the area, followed by Rural Land Use covering 13%. These land uses are shown in Figure 2.6.

**Table 2-56: Land use in the Black-Severn River watershed (Data Source: LSRCA).**

| Land Use                   | Area (km2)  | % of total |
|----------------------------|-------------|------------|
| Bedrock                    | 71.00       | 2.57       |
| Built-up Areas Impervious  | 41.01       | 1.48       |
| Built-up Areas Pervious    | 4.60        | 0.17       |
| Cloud Error                | 9.45        | 0.34       |
| Licensed Pits and Quarries | 9.08        | 0.33       |
| Mixed Agriculture          | 122.41      | 4.43       |
| Monoculture                | 126.11      | 4.56       |
| Rural Land Use             | 363.77      | 13.15      |
| Transportation             | 18.97       | 0.69       |
| Unclassified               | 31.17       | 1.13       |
| Waterbody                  | 286.22      | 10.35      |
| Vegetative Cover           | 1682.03     | 60.81      |
| <b>TOTALS:</b>             | <b>2766</b> | <b>100</b> |

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#### 2.4.2.1 Areas of Settlement

Areas of settlement are defined in the *Places to Grow Act, 2005* as “area[s] of land designated in an official plan for urban uses, including urban areas, urban policy areas, towns, villages,

hamlets, rural clusters, rural settlement areas, urban systems, rural service centres or future urban use areas, or as otherwise prescribed.

Areas of settlement in the Black-Severn River watershed include portions of Simcoe County, The District of Muskoka, The City of Kawartha Lakes, The City of Orillia and Haliburton County and are shown in Figure 2.7, as well as the location of First Nation reserves.

In the District of Muskoka a number of municipalities, including Bracebridge, Gravenhurst, Hunstville, Hidden Valley, Bala, Port Carling, MacTier, Port Severn, and Baysville, are to be the focus of development in the region (Muskoka District OP). Of these, only Port Severn falls entirely within this watershed region. A large component of the industry in the District of Muskoka is recreation. Other sectors (particularly manufacturing, health and social services) have been rising. This is an indication of real, long-term economic growth that should result in a sustained increase in the work force (Muskoka District OP).

Forestry is a major economic activity in Muskoka, directly employing over 500 people and indirectly employing another 700 – this is four times greater than the provincial average. All crown land within the Muskoka District has been certified for forestry through Westwind Forest Inc. Tembec (the local major forestry-based company) also provides a land stewardship program that includes 3,294 ha of private owned lands that have been certified for forestry purposes<sup>9</sup>. The Ministry of Natural Resources oversees forestry regulation on crown land, and the District of Muskoka’s “Good Forestry Practices By-Law” was implemented in 2001 to ensure sustainable forestry practices on private land.

Because labor costs in the Kawartha Lakes are lower than in nearby metropolitan areas, the city has developed a very diverse industrial base. There are over 100 manufacturers, 25% of which actively export to global markets, and there is also a fast-growing high-tech sector (City of Kawartha Lakes OP).

In Haliburton County there is a very high unemployment rate, due to dependency on seasonally driven business. This rate often reaches 30 to 35% between December and February. Service and hospitality, retail trade, construction, and manufacturing are among the largest industries. A large influx of people over age 55 is expected over the next several years. This will contribute to an educated work force looking for challenge and interesting opportunities and may shift the distribution in the work force.

Cottaging is a significant land use in the Black-Severn River watershed, and of interest to water resource management efforts due to associated septic wastewater treatment, waterfront

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<sup>9</sup> [www.muskokaheritage.org](http://www.muskokaheritage.org)

property management, boating activities, and the like. The majority of residents within this watershed are on private septic systems although specific data on the condition, type and location of septic systems have not been found.

#### 2.4.2.2 Total Impervious Surface

The hardening of the land's surface through paving and the construction of buildings significantly alters the hydrologic properties or drainage characteristics of an area. The result is reduced groundwater recharge and increased surface runoff. For the purpose of characterizing the Black-Severn River watershed, we provide a map of impervious surfaces using the typical definition where all hardened surfaces are shown, including roads, parking lots and buildings. Figure 2.8 shows that the areas with the most impervious surface cover are the major urban areas such as Orillia. Rural areas typically have very little impervious surface cover.

In the context of identifying risks to municipal drinking water systems, a slightly different definition of impervious surface area is applied to than that described above. Source Water Protection defines total impervious surface area as “the surface area of all highways and other impervious land surfaces used for vehicular traffic and parking, and all pedestrian paths” (MOE, 2008a). This definition of total impervious surface is essentially used as a proxy for the application of road salt, a potential threat to municipal drinking water, as excess sodium is linked to a number of negative health issues (such as high blood pressure) and is of particular concern to those on low-sodium diets. The Technical Rules (MOE, 2008a) requires that the percentage of total impervious surface be calculated for each vulnerable area, including the Highly Vulnerable Aquifers (HVAs), ~~Significant Groundwater Recharge Areas (SGRAs)~~, Wellhead Protection Areas (WHPAs) and Intake Protection Zones (IPZs).

Total impervious surface calculations for WHPAs and IPZs were conducted as a component of the technical studies undertaken to investigate potential Drinking Water Threats to individual municipal drinking water supplies. The methods and results of the WHPA and IPZ impervious surface calculations can be found in each of the municipal vulnerability and threats chapters (Chapters 6 to 10). Similarly, methods and results for total impervious surface cover for the two broad scale vulnerable areas—HVAs and SGRAs—can be found in Chapter 4.

#### 2.4.2.3 Agriculture and the Raising of Livestock

Much of this watershed is situated on shallow till over bedrock or exposed bedrock (Muskoka OP) and is therefore not suitable for most agricultural practices. However, there are 201 farms within the Muskoka District jurisdiction and 69 in Haliburton, several of which are located in this watershed region (Statistics Canada, 2006).

Stock densities in all census consolidated subdivisions (CCS) areas are low, especially when compared to other CCS within the SPR. For example, four of the CCS areas have livestock densities less than 3 head/km<sup>2</sup>, while the highest livestock density in the area was 109 head/km<sup>2</sup>; compared to a high of 848 head/km<sup>2</sup> in the Lake Simcoe area. No data was reported for the areas of Algonquin highlands, Dysart and Others, Georgian Bay, Lake of Bays and Orillia. The location of livestock farms is presented in Figure 2.9 and the density of livestock within census consolidated subdivisions is presented in Table 2.7.

**Table 2-67: Livestock density (number/km<sup>2</sup>) within Black-Severn River watershed census consolidated subdivisions. Only those CCS regions with available data are presented (Data source: Statistics Canada, 2006 Census).**

| Census Consolidated subdivision | % of CCS area within watershed | Cattle and calves | Pigs | Sheep and lambs | Horses and ponies | Hens and chickens | Other livestock | All livestock |
|---------------------------------|--------------------------------|-------------------|------|-----------------|-------------------|-------------------|-----------------|---------------|
| Kawartha Lakes                  | 30                             | 16.6              | 2.6  | 3.4             | 0.9               | 82.2              | 3.3             | 109.0         |
| Severn                          | 47                             | 5.6               | 0.1  | 2.6             | 0.5               | 12.8              | 1.5             | 23.0          |
| Ramara                          | 60                             | 19.4              | 0.2  | 4.1             | 0.5               | 4.0               | 1.1             | 29.4          |
| Gravenhurst                     | 73                             | 0.3               | 0.0  | 0.0             | 0.3               | 0.8               | 0.4             | 1.8           |
| Bracebridge                     | 29                             | 0.5               | 0.1  | 0.7             | 0.2               | 1.4               | 0.1             | 2.9           |
| Muskoka Lakes                   | 2                              | 0.7               | 0.0  | 0.0             | 0.1               | 0.2               | 0.0             | 1.1           |
| Minden Hills                    | 28                             | 0.7               | 0.0  | 0.0             | 0.1               | 0.4               | 0.0             | 1.2           |

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Estimating the number of livestock being raised in vulnerable areas is an important task in determining risks to municipal drinking water supply. Livestock and associated activities, such as the storage or application of agricultural source material (i.e. manure spreading), have the potential to be a risk to drinking water due to both the pathogens (e.g. *Escherichia coli* [*E. coli*]) and chemicals (e.g. nitrogen) the material contains. The Technical Rules (MOE, 2008a) require that livestock density be calculated for each vulnerable area – Wellhead Protection Area (WHPA), Intake Protection Zone (IPZ), Significant Groundwater Recharge Area (SGRA) and Highly Vulnerable Aquifer (HVA). The methods used for these vulnerable areas is based on a Technical Bulletin provided by the Province (MOE, 2009b), and require interpretation of aerial photography to estimate capacity of a farm to house livestock. Methods and results of the WHPA and IPZ livestock density calculation, and whether these result in potential significant risks, can be found in Chapters 6 to 10. Similarly, livestock density for the broad scale vulnerable areas—HVAs and SGRAs—can be found in Chapter 4. To enable comparison of risk for different livestock types (e.g. hens versus cattle), livestock density estimates within these sections are presented as nutrient units per acre.

#### 2.4.2.4 Managed Lands

Managed Land means land to which agricultural source material, commercial fertilizer, or non-agricultural source material (i.e. sewage or meat plant effluent) is applied (MOE, 2008a). Managed lands include pasture, golf courses, residential areas, and areas where biosolids are applied. Managed Lands do not include areas such as forests, wetlands and commercial properties. The Technical Rules require that the percentage of managed lands within each vulnerable area (WHPA, IPZ, ~~SGRA~~ and HVA) be determined so that it can be established whether activities such as application of source material and fertilizer is a potential Significant, Moderate or Low Drinking Water Threat to the municipal water supply.

Methods and results of the WHPA and IPZ managed land calculation, and whether these result in potential Significant Threats, can be found in each of the municipal vulnerability and threats chapters (Chapters 6 to 10). Similarly, managed land information for the broad scale vulnerable areas ~~HVAs and SGRAs~~ can be found in Chapter 4.

For the purposes of characterizing the Black-Severn River watershed, Figure 2.10, provides a broad scale overview of managed lands in the area. This figure is based on the methods prescribed by the Province in a Technical Bulletin (MOE, 2009b) and shows the Municipal Property Assessment Corporation (MPAC) land use and property codes identified as having activities that have the potential to apply nutrients. Figure 2-10 illustrates that areas of the watershed are classified as being managed lands. These include both urban (e.g. residential lawns) and rural (farms) areas.

### 2.5 Drinking Water Systems

Drinking water systems in Ontario are classified under O.Reg 170/03 (Drinking Water Systems) made under the *Safe Drinking Water Act, 2002*. The drinking water system classifications are:

- (i) large municipal residential system;
- (ii) small municipal residential system;
- (iii) large municipal non-residential system;
- (iv) small municipal non-residential system;
- (v) non-municipal year-round residential system;
- (vi) non-municipal seasonal residential system;
- (vii) large non-municipal non-residential system; and
- (viii) small non-municipal non-residential system;

The *Safe Drinking Water Act (SDWA)*, 2002, came out of the recommendations from the Walkerton Inquiry to address the issues pertaining to the treatment and distribution of drinking water. The Act helps to protect drinking water through regulating the operation of drinking water systems and the testing of drinking water. The systems that are covered under O.Reg. 170/03 of the SDWA are listed below in Table 2-8 and include year-round municipal and private water systems that provide drinking water to residential developments and designated facilities that supply water to 'vulnerable populations' (elderly, children). These facilities consist of schools (both public and private), universities, colleges or institutions that grant degrees, health and social care facilities, children's camps, and child and youth care facilities.

The *Clean Water Act (CWA)*, 2006 differs from the SDWA in that it focuses more on protecting drinking water at the source rather than relying on the treatment system. In addition, the CWA focuses only on large and small municipal residential drinking water systems, where the SDWA focuses on municipal non-residential and non-municipal year round residential systems as well. Other drinking water systems (as previously mentioned) are regulated under the *Safe Drinking Water Act* and the *Health Protection and Promotion Act (HPPA)*, 1990. For more information on the CWA and the assessment report process, please refer to Chapter 1 of this report.

**Table 2-78: Drinking Water Systems and the legislation they are protected under.**

| Drinking Water System                       | Definition  | Legislative Protection |
|---|---|------------------------|
| Large Municipal Residential System          | <ul style="list-style-type: none"> <li>• Municipal</li> <li>• Serves major residential development &amp; more than 100 private residences</li> </ul>  | SDWA, CWA              |
| Small Municipal Residential System          | <ul style="list-style-type: none"> <li>• Municipal</li> <li>• Serves a major residential development &amp; fewer than 101 private residences</li> </ul>   | SDWA, CWA              |
| Large Municipal Non-Residential System      | <ul style="list-style-type: none"> <li>• Municipal</li> <li>• Non-residential</li> <li>• Capable of supplying drinking water at a rate of more than 2.9 L/s</li> </ul>  | SDWA, HPPA             |
| Small Municipal Non-Residential System      | <ul style="list-style-type: none"> <li>• Municipal</li> <li>• Non-residential</li> <li>• Not capable of supplying drinking water at a rate of more than 2.9 L/s</li> </ul>  | SDWA, HPPA             |
| Non-Municipal Year-Round Residential System | <ul style="list-style-type: none"> <li>• Non-municipal</li> <li>• Year-round</li> <li>• Serves a major residential development or trailer park or campground &amp; has more than 5 service connections</li> </ul>   | SDWA                   |
| Non-Municipal Seasonal Residential System   | <ul style="list-style-type: none"> <li>• Non-municipal</li> <li>• Seasonal</li> <li>• Serves a major residential development or trailer park or campground &amp; has more than 5 service connections</li> </ul>   | HPPA                   |
| Large Non-Municipal Non-Residential System  | <ul style="list-style-type: none"> <li>• Non-municipal</li> <li>• Does not serve major residential development/trailer park or campground that has more than 5 service connections</li> <li>• Capable of supplying drinking water at a rate of more than 2.9 L/s</li> </ul> | HPPA                   |

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| Drinking Water System                      | Definition   | Legislative Protection |
|--|--|------------------------|
| Small Non-Municipal Non-Residential System | <ul style="list-style-type: none"> <li>• Non-municipal</li> <li>• Serves a designated facility or public facility</li> <li>• Does not serve major residential development/trailer park or campground that has more than 5 service connections</li> <li>• Not capable of supplying drinking water at a rate of more than 2.9 L/s</li> </ul> | HPPA                   |

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The Terms of Reference (ToR) for the SGBLS Assessment Reports identifies all the drinking water systems and associated wells and surface intakes requiring analysis in this Assessment Report. In accordance with the ToR, only drinking water systems classified as large municipal residential, and small municipal residential have been included (Type i and ii) in this report. Within the entire SGBLS Source Protection Region there are 108 drinking water systems, serviced by 277 wells and 16 surface water intakes. Within the Black-Severn River area there are 10 drinking water systems, serviced by 10 municipal wells and 6 surface water intakes (Figure 2.11), with Orillia being serviced by both wells and a surface intake. Location of non-municipal and non-residential drinking water systems that are not included in this report are shown in Figure 2.12. Locations of these drinking water systems were provided by the [MOE/MECP](#) and represent those systems that are registered with the [MOE/MECP](#) under the former O.Reg 252 (now Reg 318 of the *Health Promotion and Protection Act*).

Information pertaining to each municipal drinking water system, such as the location, population served and pumping rates are presented in Table 2.9. The maximum annual and average monthly average pumping rates are available in Appendix WB-3B. A few of the drinking water systems in the South Georgian Bay-Lake Simcoe Source Protection Region are spread across more than one watershed. In the Black-Severn River watershed, the Orillia Water Supply System is in both the Black-Severn River and the Severn Sound watershed. Two of the wells (Well #1 and #2) show an annual pumping rate zero. The data used for this, and the Tier 1 water budget, are from 2006 MOE permit database and may need to be updated with current reported rates if changes in pumping rates have occurred. Well #3 is located in the Severn Sound watershed and reported rates can be found in the Severn Sound Assessment Report.

Information presented in these tables has been sourced either directly from the municipality, or obtained through previously published reports including North Simcoe Groundwater Study (Golder, 2005) and various other wellhead protection reports from across the source protection region. Specific details about each drinking water system are provided in Chapters 6 to 10.

**Table 2-89: Municipal Drinking Water Systems in the Black-Severn River Watershed.**

| Municipality                                | Subwatershed            | Drinking Water System (DWS) Name                | DWS Classification | Population served by DWS               | Well Name        | Easting         | Northing          | Average Pumping (m <sup>3</sup> /a) | Data current as of... |
|---|-------------------------|---|--------------------|--|------------------|-----------------|-------------------|-------------------------------------|-----------------------|
| The City of Kawartha Lakes                  | Upper Talbot River      | Western Trent/Palmina Well Supply               | 1                  | 280 combined (Western Trent wells [2]) | Well #1          | 653028          | 4933808           | 107,310                             | 2012                  |
| The City of Kawartha Lakes                  | Upper Talbot River      | Western Trent/Palmina Well Supply               | 1                  | 280 combined (Western Trent wells [2]) | Well #1          | 652952          | 4934003           | 143,080                             | 2012                  |
| <i>The District Municipality of Muskoka</i> | <i>N/A</i>              | <i>Port Severn Water Treatment Plant</i>        | 2                  | 250                                    | SW               | -               | -                 | 146,000                             | 2012                  |
| <i>The City of Orillia</i>                  | <i>Lake Couchiching</i> | <i>Orillia Water Treatment Plant</i>            | 1                  | 30,908                                 | SW               | -               | -                 | 3,353,452                           | 2012                  |
| The City of Orillia                         | Lake Couchiching        | Orillia Well Supply                             | 1                  | -                                      | Well #1          | 625757          | 4941830           | 0                                   | 2012                  |
| The City of Orillia                         | Lake Couchiching        | Orillia Well Supply                             | 1                  | -                                      | Well #2          | 625747          | 4941678           | 0                                   | 2012                  |
| The Township of Ramara                      | Severn River            | Davy Drive Subdivision Well Supply              | 2                  | 75                                     | Well #1 / Well 2 | 633698 / 633679 | 4954130 / 4954133 | 5,110                               | 2012                  |
| The Township of Ramara                      | Severn River            | Davy Drive Subdivision Well Supply              | 2                  | 47                                     | Well #3          | 633685          | 4954178           | 0                                   | 2012                  |
| The Township of Ramara                      | Severn River            | Park Lane Subdivision Well Supply               | 2                  | -                                      | Well #1 & #2     | 633295          | 4956374           | 4,928                               | 2012                  |
| <i>Chippewas of Rama First Nation</i>       | <i>Lake Couchiching</i> | <i>Rama First Nations Water Treatment Plant</i> | 2                  | 625                                    | SW               | -               | -                 | <i>Data Gap</i>                     | 2012                  |
| <i>The Township of Severn</i>               | <i>Severn River</i>     | <i>Sandcastle Estates Water Treatment Plant</i> | 2                  | 167                                    | SW               | -               | -                 | 14,810                              | 2012                  |
| The Township of Severn                      | Severn River            | Severn Estates Well Supply                      | 2                  | 62                                     | Well #1          | 631123          | 4958941           | 4,745                               | 2012                  |
| <i>The Township of Severn</i>               | <i>Severn River</i>     | <i>Washago Water Treatment Plant</i>            | 1                  | 300                                    | SW               | -               | -                 | 38,624                              | 2012                  |
| <i>The Township of Severn</i>               | <i>Severn River</i>     | <i>West Shore Water Treatment Plant</i>         | 1                  | 2,200                                  | SW               | -               | -                 | 5,000                               | 2012                  |

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1 – Large Municipal System, 2 – Small Municipal System

## 2.6 Interaction Between Physical and Human Geography

Humans are dependent on the environment in a number of ways and the manner in which they work the land is determined by the physical geography of the surrounding environment. As technology advances more of the landscape can be modified to accommodate the needs of a community. On one hand, newer technology and methods allow for more sophisticated measures to be used to extract resources (such as drinking water) while minimizing impacts on the local environment. On the other hand, it also provides ways to supply resources to more people, encouraging population growth. By increasing the demands and stress put on an ecological system, the natural balance is altered with resulting consequences that will need to be studied and addressed.

Interactions between human and physical geography within the Black-Severn River watershed, pertaining to drinking water and Source Protection, are moderate. As previously mentioned, populations within the watershed are relatively small, especially compared to some of the highly populated areas in the Source Protection Region, such as Aurora and Newmarket.

One of the cities that had the most dramatic increase between the 2001 and 2006 census is the Township of Lake of Bays with a 23% increase. While this would be increasing the stress on natural systems, approximately 86.7% of the population is located outside of the Black-Severn River Watershed. Other cities that had a large jump in population during this time period includes the Township of Georgian Bay (17.5%) and the Town of Bracebridge (13.8%) located in the Severn and Kashe/Gartersnake River subwatersheds respectively. Like the Township of Lake of Bays though, the majority of their populations lie outside the watershed region. As these areas continue to increase in population and more people move into the Black-Severn River watershed region, there is an associated loss of natural vegetative cover. By removing the natural vegetation, the water quality and quantity of available drinking water can be altered.

### *Natural Features*

Natural features in the environment generally serve to maintain water quality conditions. Naturally vegetated areas including grasslands, meadows, and woodland areas tend to improve the quality of water as it flows over land. The stems and roots of the vegetation slow the flow of water, enabling soil particles and other contaminants to be deposited and increase the amount of runoff that infiltrates into the soil. Water is filtered as it flows through the soil to the groundwater. Wetlands slow the flow of water, provide storage and can absorb some contaminants, including nutrients such as phosphorus and thus have a natural filtering ability.

With the removal of natural features there is increased access for people and contaminants to waterways. As the quality of water decreases, it is not only human populations that are impacted but fish and invertebrate species living within watercourse, as well as other wildlife in the area.

#### *Agriculture*

Although there is minimal agriculture within the Black-Severn River watershed, there are a number of water quality issues that it can cause. Runoff from pasture and cropland can contain high levels of nutrients, sediment, and bacteria. Wind can erode topsoil with its associated contaminants. All of these substances can end up in local watercourses if the appropriate Best Management Practices (BMPs) are not implemented. These BMPs can include conservation tillage, cover cropping, maintaining vegetated riparian buffers, cattle fencing, and the appropriate use of fertilizers and pesticides.

#### *Urbanization*

While there are relatively few urban areas in the Black-Severn River watershed, those areas such as Orillia that are urbanized can lead to specific impacts to the natural environment. An increase in urbanization results in an increase in impervious surface areas such as roads and rooftops. These have a significant effect on both water quality and quantity. Hardened or impervious surfaces reduce the amount of surface water infiltrating into the ground, causing an increase the volume and velocity of surface runoff, which leads to streambank erosion. This contributes more sediment to watercourses and can even contribute to flooding. Runoff from imperious surfaces, particularly those built prior to the requirement for stormwater management, can carry a host of pollutants to local watercourses. These pollutants build up on roads, driveways and parking lots and even lawns, and are washed to watercourses when it rains. There are many pollutants that can be carried by urban stormwater runoff. Some examples include nutrients and pesticides from lawns, parks and golf courses, road salts, tire residue, oil and gas, sediment, as well as nutrients and bacteria from pet and wild animal feces. The requirement for stormwater management facilities in all new developments will help to mitigate these issues in urban areas, however, the ongoing maintenance of these facilities is crucial to ensuring that they continue to reduce sediment and nutrient loads as designed, otherwise these new developments would be contributing additional phosphorus to the system.

By characterizing the watershed, and the different elements within it, a general overview of the health of the area can be demonstrated. The characterization puts into context the location of different features of the watershed and gives an understanding of the current pressures on

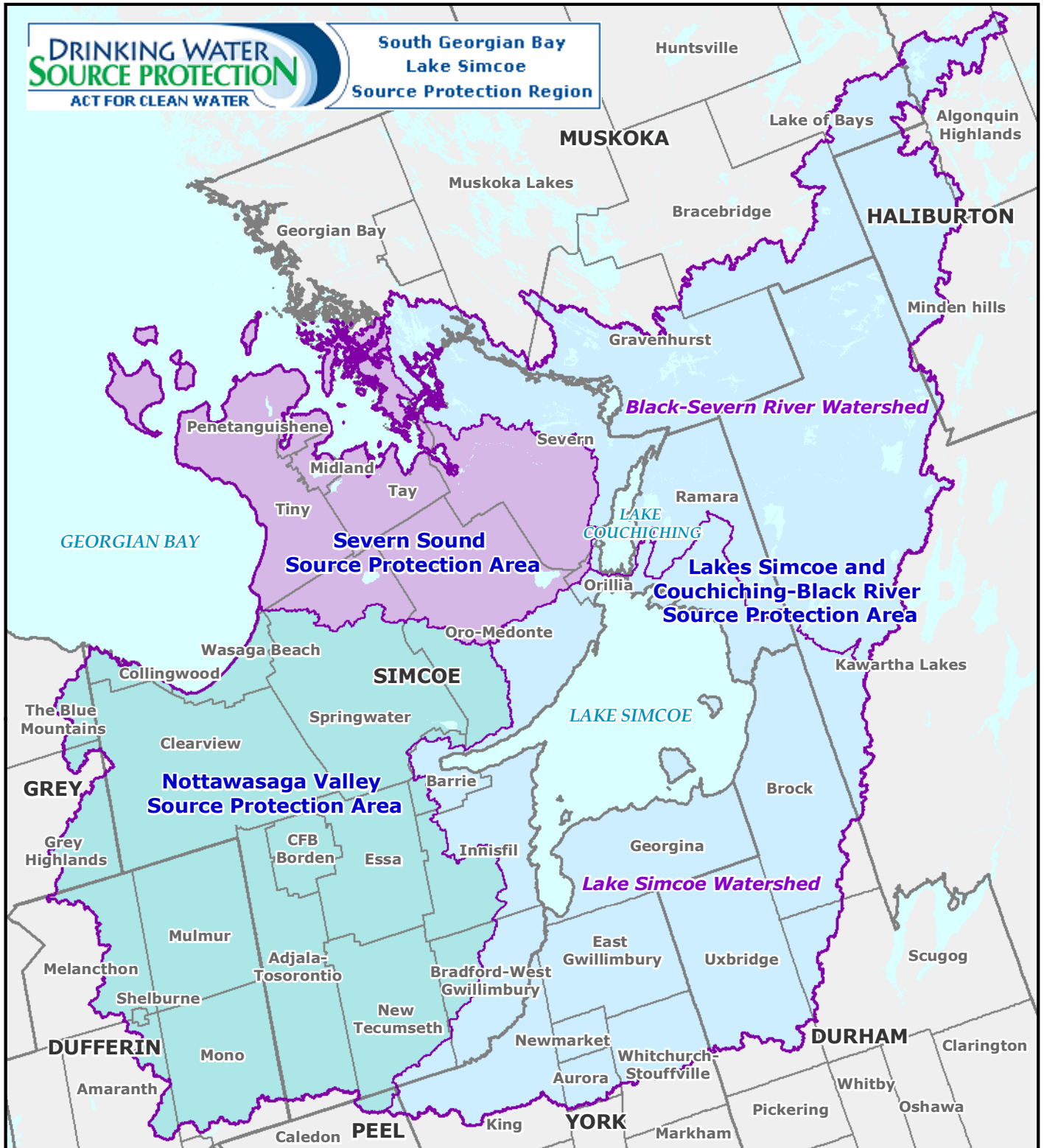
drinking water supplies. This broad analysis of the watershed sets the stage for further in-depth analysis of water quantity stressors (Chapter 3) and the details for specific municipal systems (Chapters 6-10).










## **2.7 Data and Knowledge Gaps**

Significant efforts have been made by all levels of government to collect and interpret environmental data for the watershed area. However, throughout the development of this report, data and knowledge gaps with respect to watershed characterization have been identified. These include:

- The location and aquatic habitats including coldwater and mixed water fisheries and macro invertebrate communities
- Surface water quality and ground water quality across the watershed

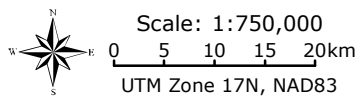
A key task for the technical team and the Source Protection Committee will be to fill these gaps for inclusion in future versions of the Assessment Report.



-  Source Water Protection Region
-  Source Protection Area (SPA)
-  Lakes Simcoe and Couchiching-Black River SPA
-  Nottawasaga Valley SPA
-  Severn Sound SPA
-  Watershed Boundaries
-  Upper Tier Municipality
-  Lower Tiers Municipality
-  Water Body

**Source Water Protection Region  
 Areas and Municipalities**

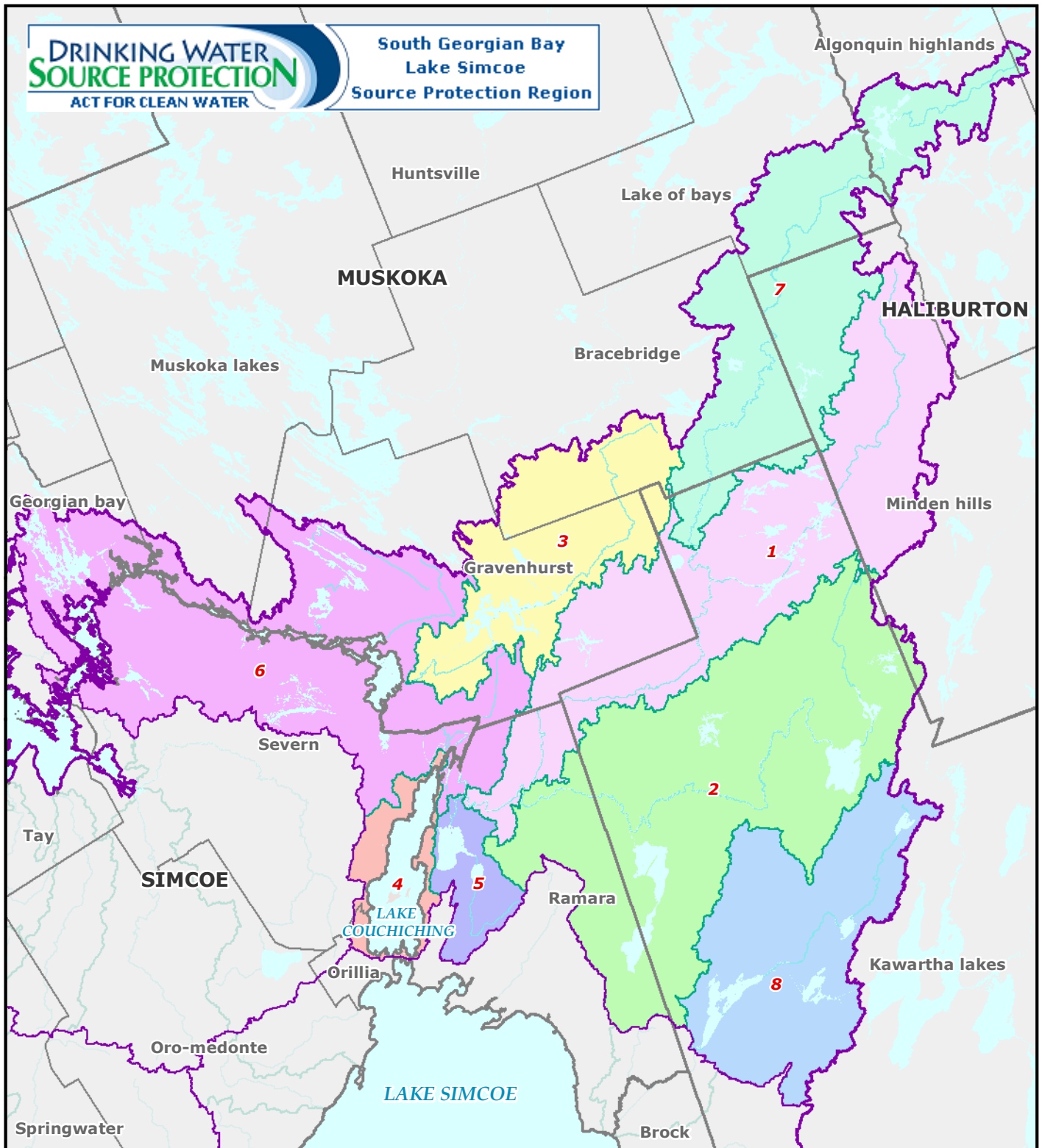
Created by: LSRCA  
 Date: 2010-01-21



This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



**Figure 2-1**



- |                         |                          |
|-------------------------|--------------------------|
| 1, Black River          | SWP Watershed Region     |
| 2, Head R.              | SWP Watershed Area       |
| 3, Kashe/Gartersnake R. | Upper Tier Municipality  |
| 4, Lake Couchiching     | Lower Tiers Municipality |
| 5, Lake St. John        | Water Body               |
| 6, Severn R.            | Main Water Courses       |
| 7, Upper Black R.       |                          |
| 8, Upper Talbot R.      |                          |

**Watershed and Subwatershed Boundaries and Municipality Boundaries**

Created by: LSRCA  
Date: 2010-01-12

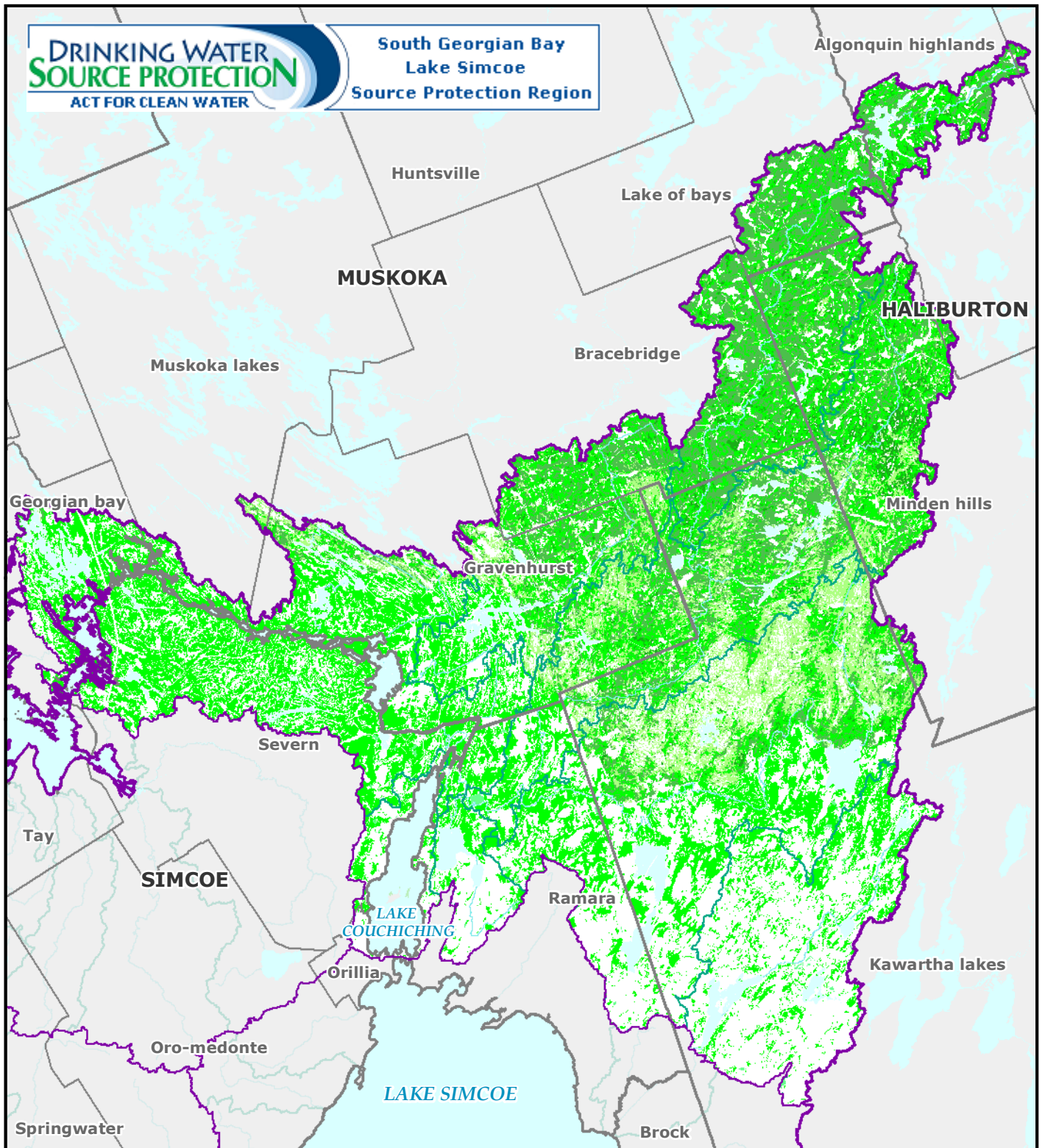


Scale: 1:460,000  
0 2 4 6 8 10km  
UTM Zone 17N, NAD83

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**Figure 2-2**



**Vegetation Area (%)**

- Forest - Dense Coniferous (2.442%)
- Forest - Dense Deciduous (11.937%)
- Forest - Dense Mixed (16.511%)
- Forest Sparse (9.338%)
- Plantation (0.173%)
- Wooded Area (20.311%)

**Location of Natural Vegetative Cover**

Created by: LSRCA  
Date: 2009-11-30

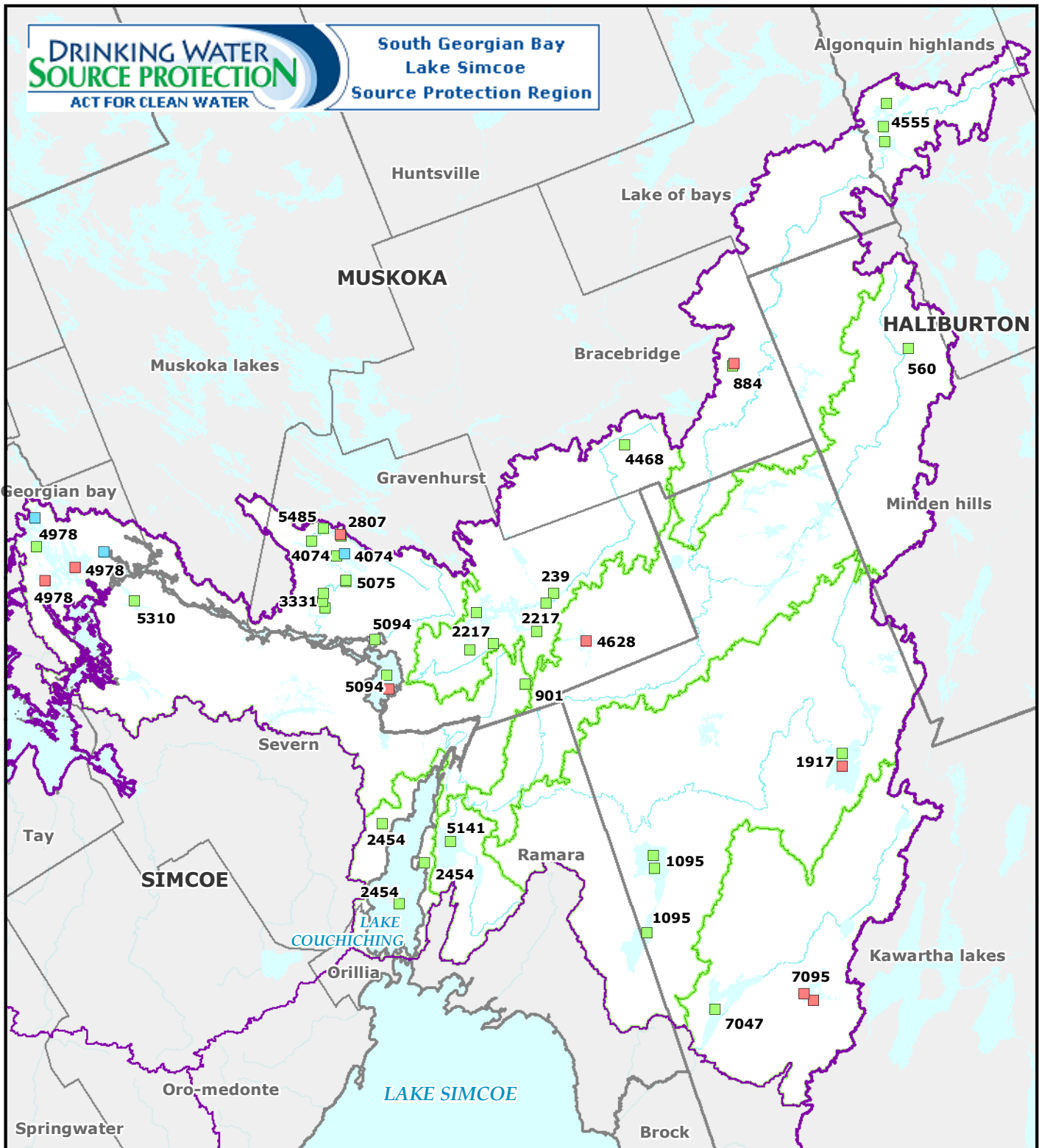


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**Figure 2-3**



- Water Quality Sampling Sites**
- 1 -- Secchi Sampling Sites
  - 2 -- TP Sampling Sites
  - 3 -- Both Sampling Sites
  - Subwatershed Boundary

**Surface Water Monitoring Stations**

Created by: LSRCA  
Date: 2010-02-03

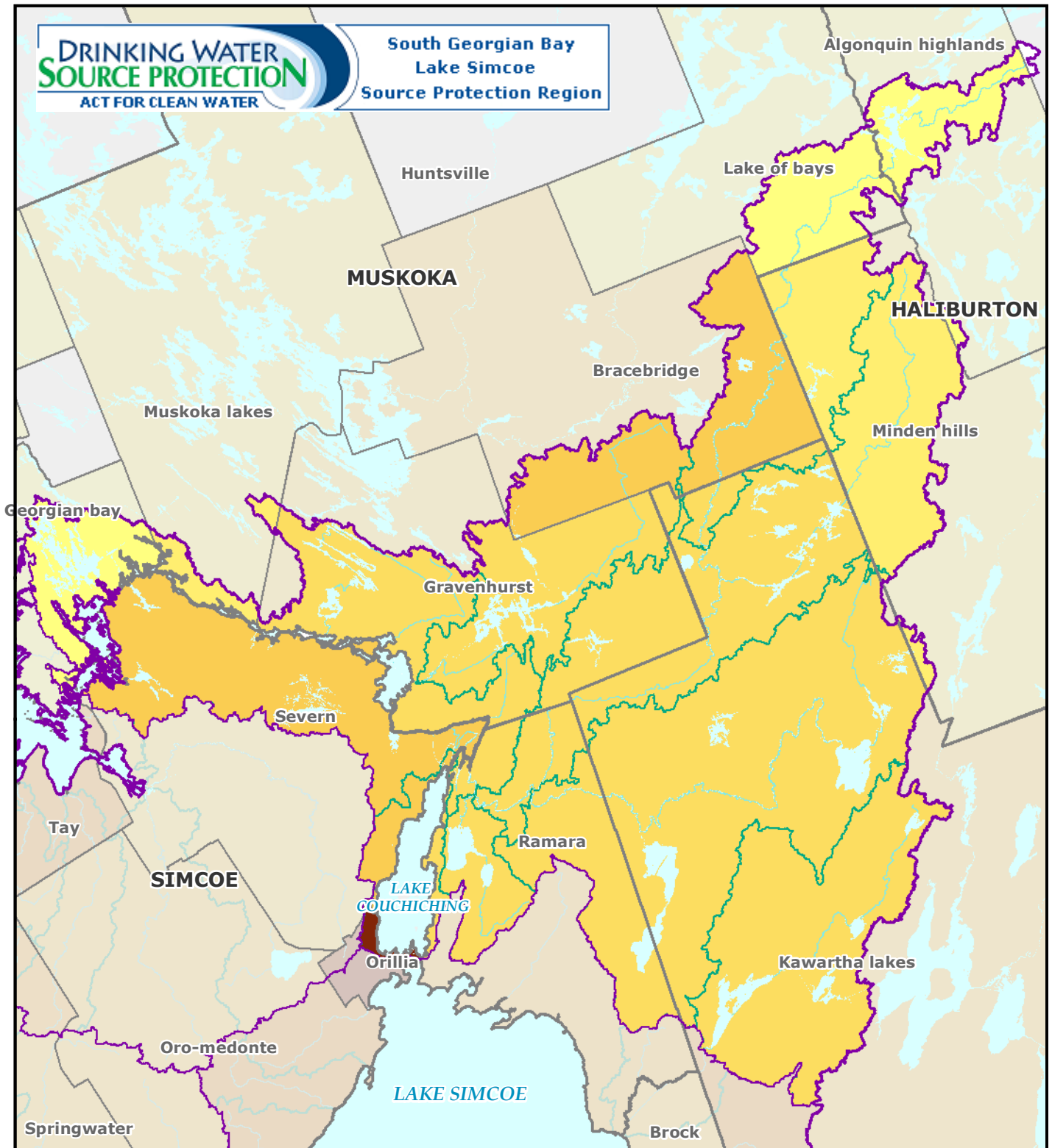


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**Figure 2-4**



Population Density (person/km<sup>2</sup>)  
(Based on 2006 Census)

- < 5.0
- 5.1 - 10.0
- 10.1 - 20.0
- 20.1 - 30.0
- 30.1 - 40.0
- 40.1 - 50.0

- 50.1 - 100.0
- 100.1 - 200.0
- 200.1 - 500.0
- 500.1 - 1000.0
- 1000.1 - 1500.0
- > 1500.1

No Data

**Municipal Population Density  
in the Black Severn River Watershed**

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Date: 2010-02-17

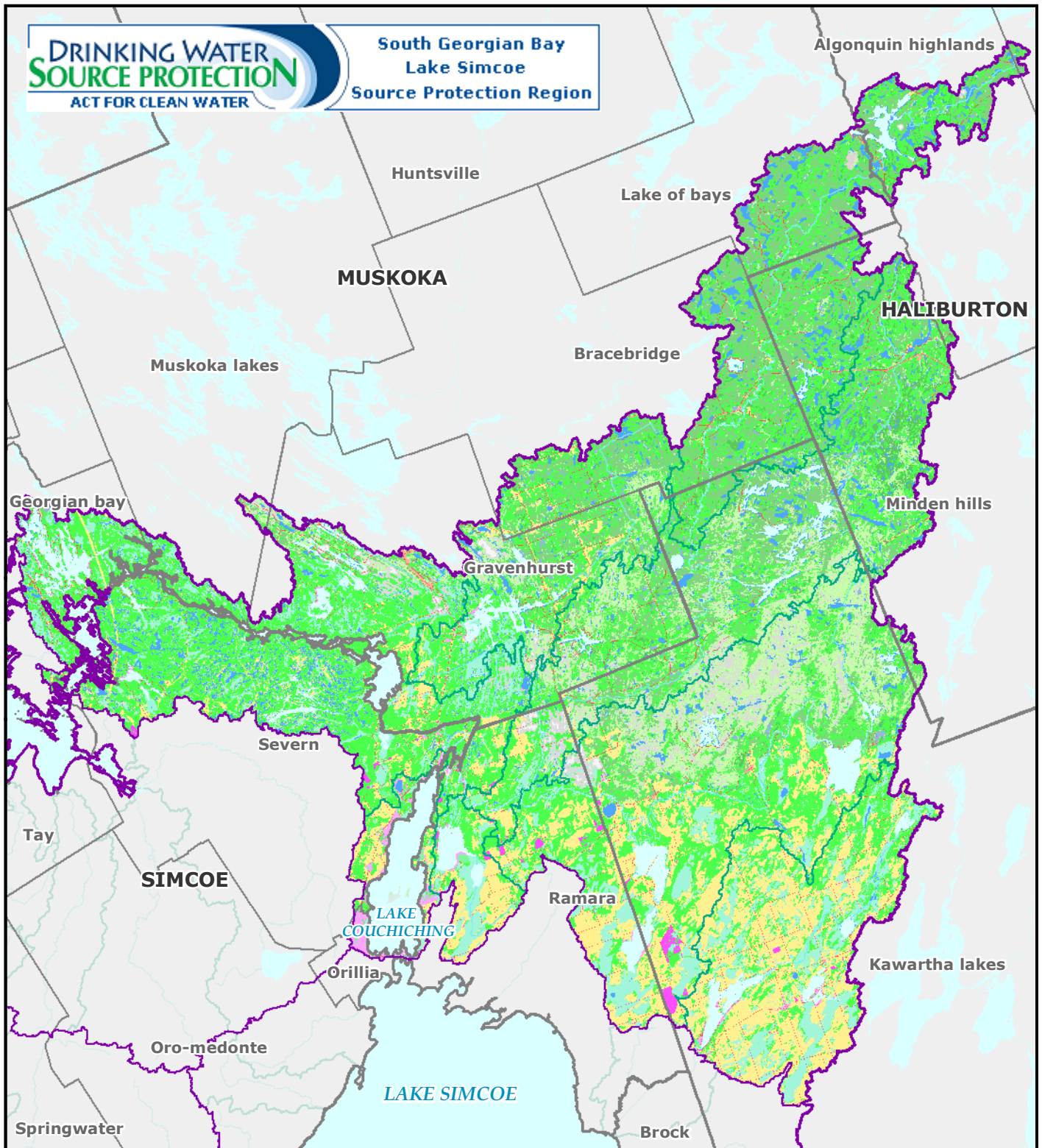


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0 2 4 6 8 10km  
UTM Zone 17N, NAD83

This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



**Figure 2-5**



- |                               |                             |
|-------------------------------|-----------------------------|
| Agriculture                   | Forest Sparse               |
| Bedrock                       | Licensed Pits and Quarries  |
| Bog                           | Plantation                  |
| Built-up Areas Impervious     | Rural Land Use              |
| Built-up Areas Pervious       | Settlement / Infrastructure |
| Cloud / Shadow / Unclassified | Transportation              |
| Forest - Dense Coniferous     | Waterbody                   |
| Forest - Dense Deciduous      | Wetland                     |
| Forest - Dense Mixed          | Wooded Area                 |
| Forest Depletion - Burns      |                             |

**Areas of Land Use**

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Date: 2010-02-17

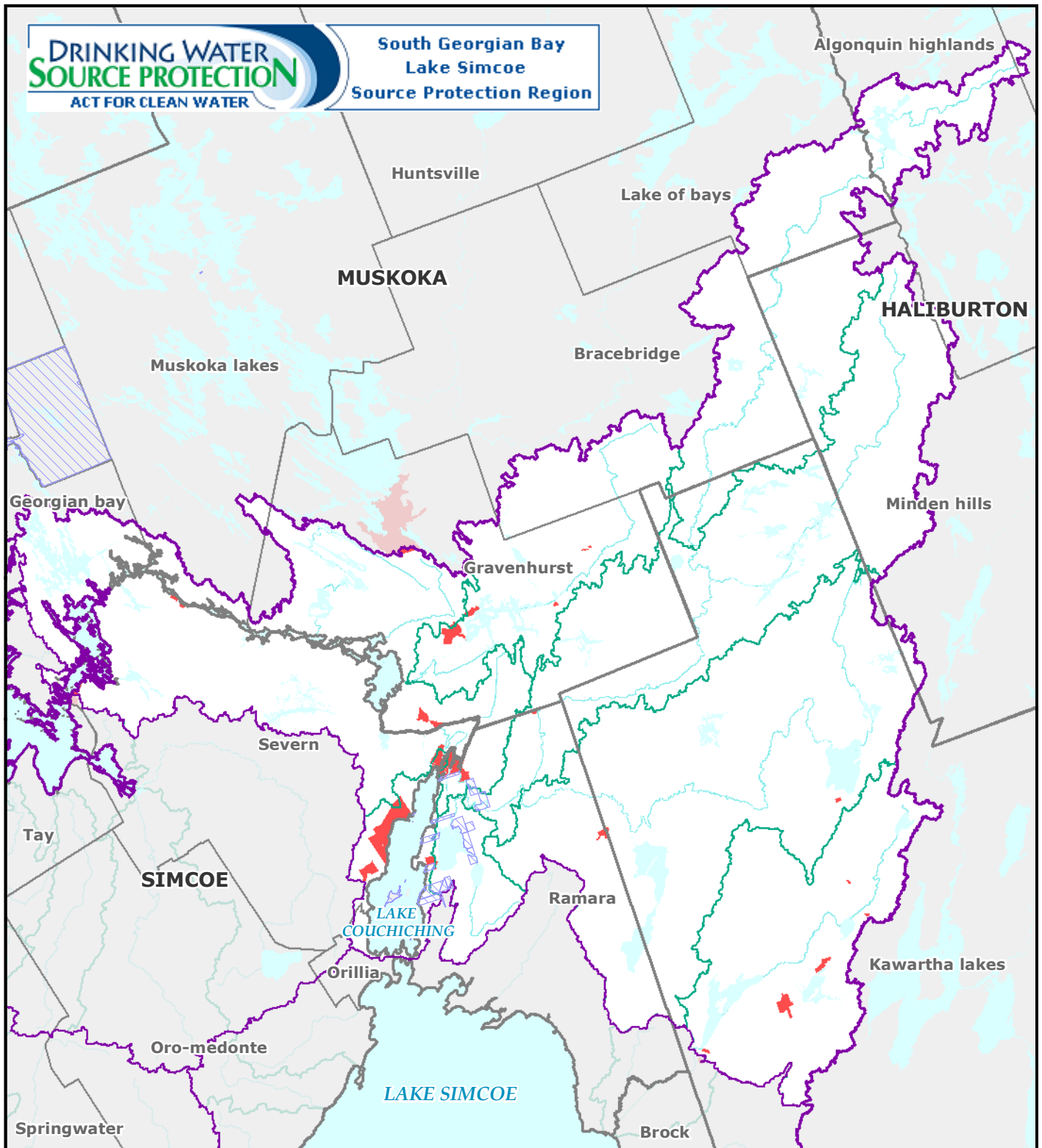









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UTM Zone 17N, NAD83

This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



**Figure 2-6**



-  Indian Reserve
-  Areas of Settlement
-  SWP Watershed Region
-  SWP Watershed Area
-  Upper Tier Municipality
-  Lower Tiers Municipality
-  Subwatershed Boundary

**Areas of Settlement and Land Owners  
as Defined in the *Places to Grow Act, 2005***

Created by: LSRCA  
Date: 2010-02-16

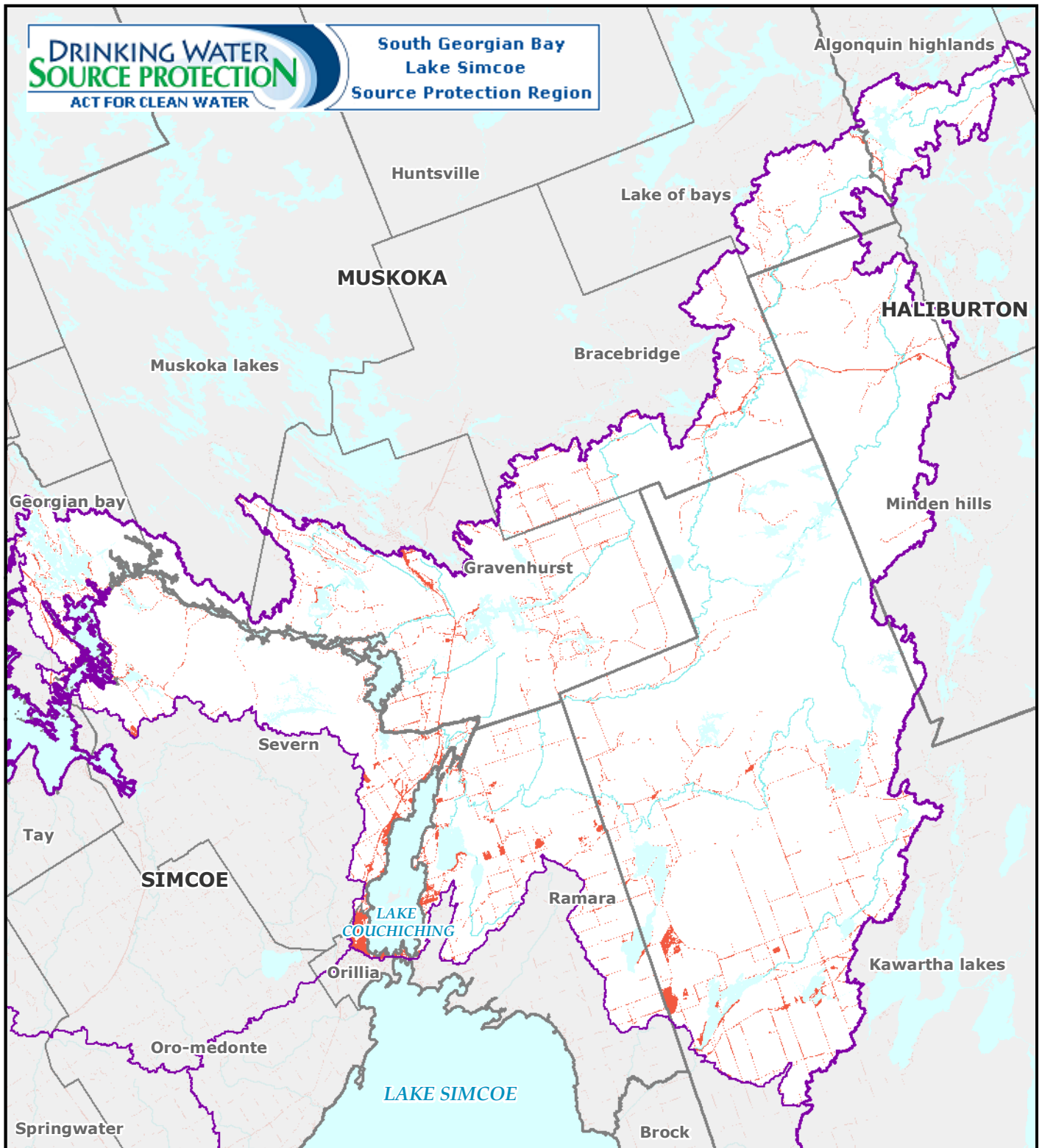


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UTM Zone 17N, NAD83

This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



**Figure 2-7**



- Impervious Areas  
(Hardened Surface such as roads and buildings)
- SWP Watershed Region
- SWP Watershed Area
- Upper Tier Municipality
- Lower Tiers Municipality
- Water Body
- Main Water Courses

**Impervious Areas  
in Black-Severn River Watershed**

Created by: LSRCA  
Date: 2010-02-17

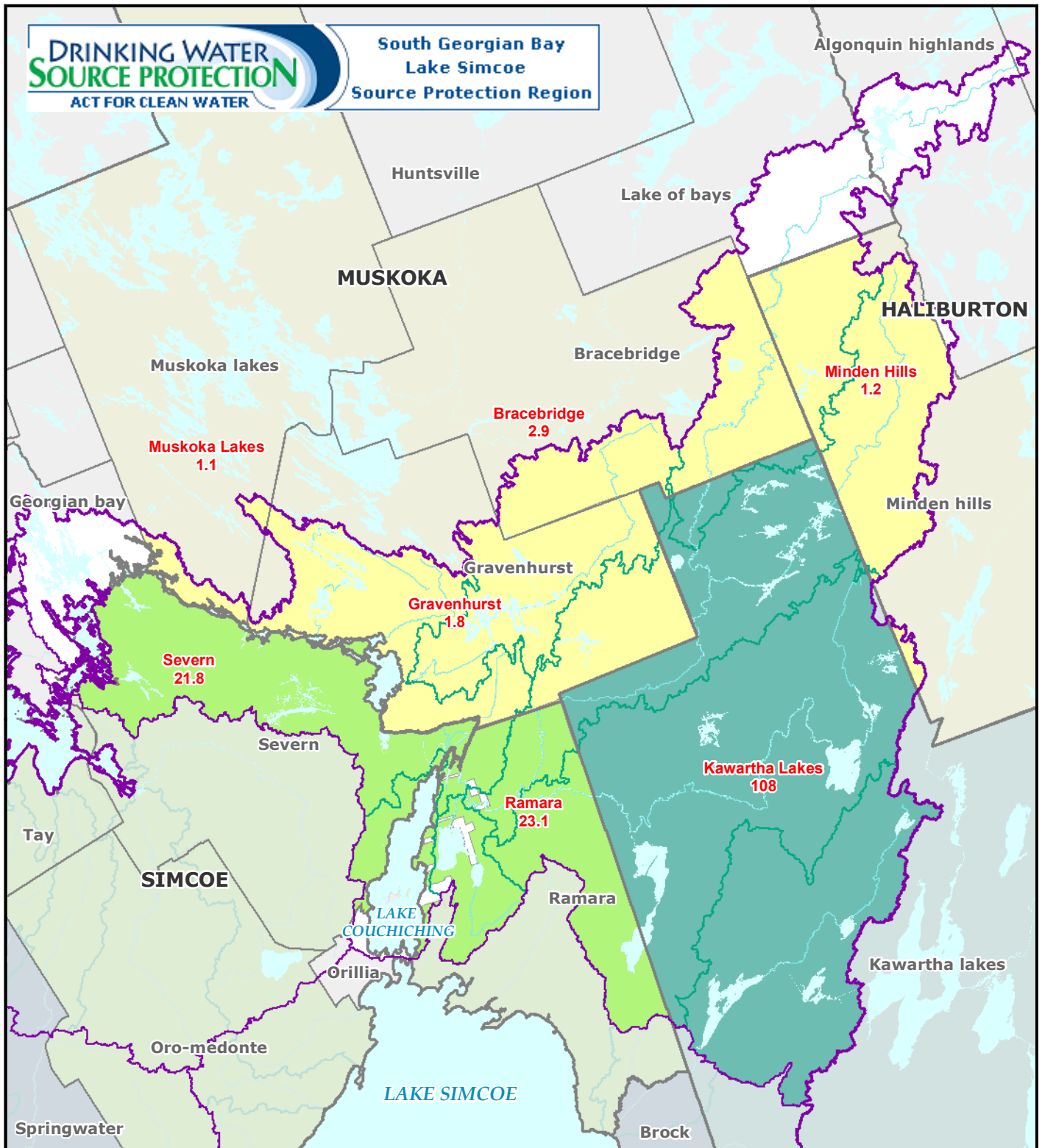


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**Figure 2-8**



- Livestock Density (heads/km<sup>2</sup>)
- 1 - 10
  - 11 - 50
  - 51 - 100
  - 101 - 200
  - 201 - 500
  - 501 - 1000

- SWP Watershed Region
- SWP Watershed Area
- Upper Tier Municipality
- Lower Tiers Municipality
- Water Body
- Main Water Courses

**Location and Density of Livestock**

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Date: 2010-02-17









Scale: 1:460,000  
0 2 4 6 8 10km  
UTM Zone 17N, NAD83

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**Figure 2-9**

**Legend**

-  MANAGED LANDS (<40%)
-  MANAGED LANDS (40-80%)
-  MANAGED LANDS (>80%)
-  UPPER TIER MUNICIPALITY
-  LOWER TIER MUNICIPALITY
-  SOURCE PROTECTION WATERSHED REGION



4,800 2,400 0 4,800 Metres

**Managed Lands in the Black-Severn River Watershed**

ASSESSMENT OF DRINKING WATER THREATS  
SELECTED MUNICIPAL GROUNDWATER SUPPLIES  
South Georgian Bay Lake Simcoe  
Source Protection Region

DATE: JUNE 2010

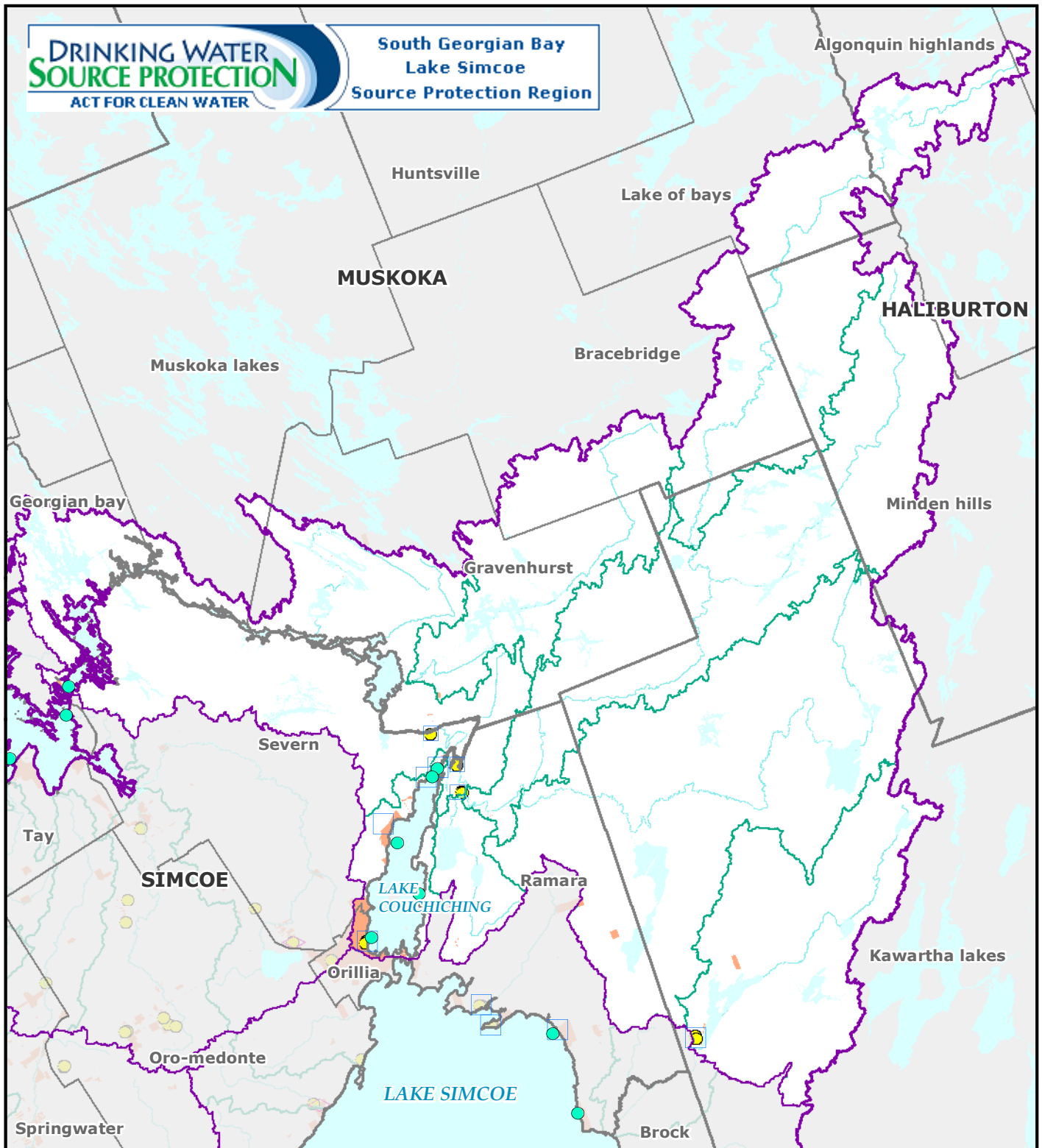
SCALE: 1:475000

PROJECT: 0-071948.00

FILE. NO.:0-07194800F2-10

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- Large Municipal Residential
- Small Municipal Residential
- Serviced Areas (Municipal and Non-Municipal)
- Municipal SW Intakes
- Municipal Supply Wells
- Monitoring Wells

**Drinking Water System - Intakes,  
Supply Wells, and Monitoring Wells  
in Term of Reference**

Created by: LSRCA  
Date: 2010-01-13

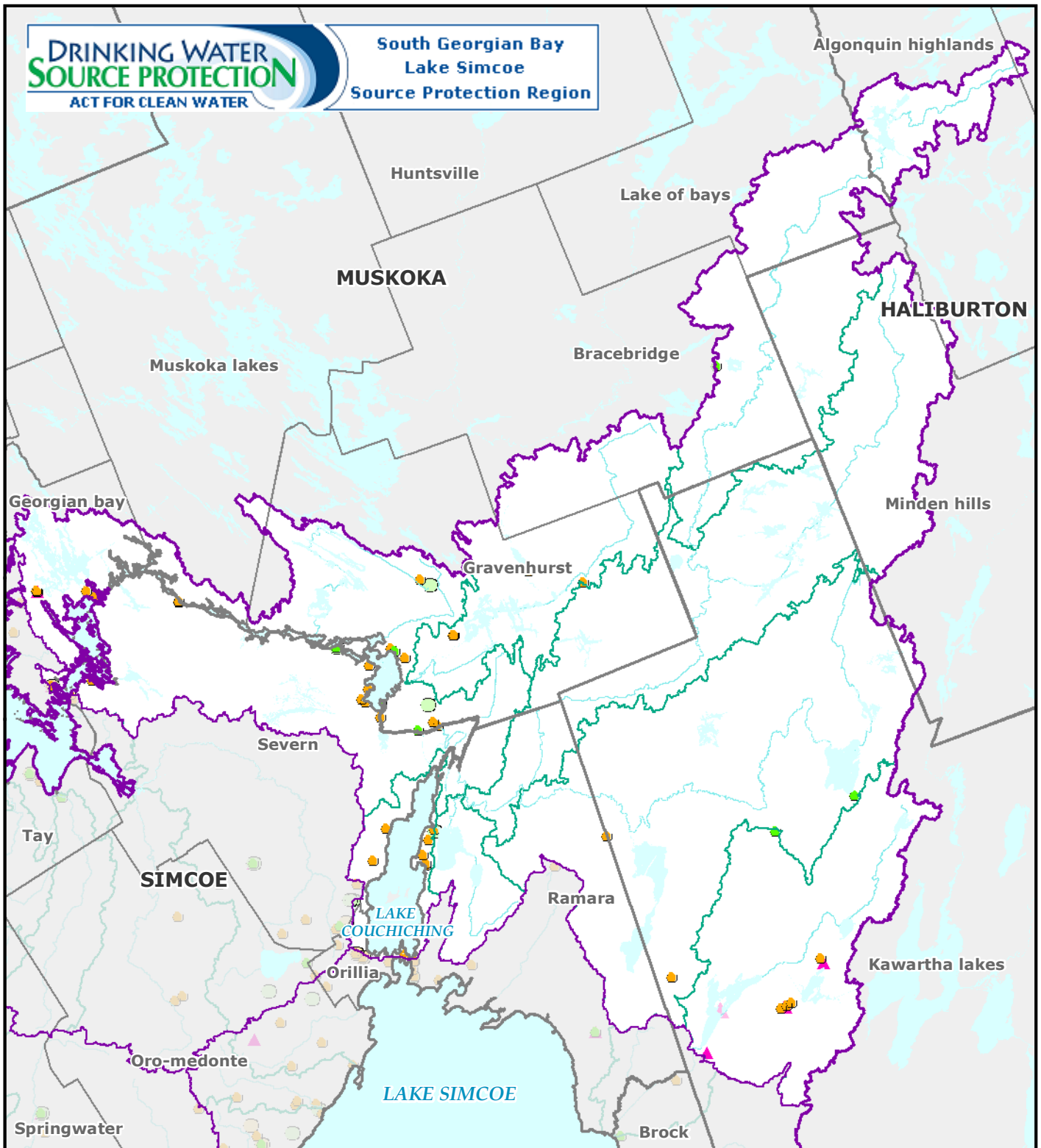


Scale: 1:460,000  
0 2 4 6 8 10km  
UTM Zone 17N, NAD83

This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



**Figure 2-11**



- Surface Water Intakes -- First Nation
- ▲ Large Municipal Non-Residential
- ▲ Small Municipal Non-Residential
- Large Non-Municipal Non-Residential
- Small Non-Municipal Non-Residential
- Non-Municipal Year-Round Residential
- Non-Municipal Seasonal Residential

**Drinking Water System  
(Non-Residential and  
Non-Municipal)**

Created by: LSRCA  
Date: 2010-01-13



Scale: 1:460,000  
0 2 4 6 8 10km  
UTM Zone 17N, NAD83

This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



**Figure 2-12**