Chapter 11: Township of Springwater

Table of Contents

List of Tables

List of Figures

Cassell Drive Well Supply

Elmvale Well Supply

Hillsdale Well Supply

11 Township of Springwater

11.1 Introduction

This chapter contains information on three drinking water systems for the Township of Springwater. Various consultants have completed the work presented, all of which was reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff and members of the Technical Work Group or the Source Protection Committee. In this chapter, each of the groundwater systems and surface water systems is discussed separately for easier readability.

Each municipal system section begins with an introduction of the characteristics of the drinking water system. This includes an overview of the location, number of people served, and source of the water supply. The sections following the system introductions are comprised of a Vulnerability Assessment and Issues and Threats evaluation of the system. The Vulnerability assessment includes the delineation of the Vulnerable Area(s) (Wellhead Protection Area or Intake Protection Zone), and the assignment of Vulnerability Score for the delineated area. An Uncertainty Rating is also provided for the Vulnerable Area delineation and the Vulnerability Assessment as per Technical Rules 13-15 [Part I.4 – Uncertainty Analysis – Water Quality (MOE, 2008a)] to express the level of confidence in the results based on the information that was available for the study.

The Issues evaluation is intended to identify chemical parameters or pathogens in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. Any Issues identified for the systems will be listed in this section, along with a map illustrating the Issues Contributing Area if an Issue is known. The Threats evaluation identifies potential Significant Drinking Water Threats within the delineated Vulnerable Areas. This process includes creating lists for Drinking Water Threats for Activities and Conditions, generating maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats, and a final enumeration of Significant Drinking Water Threats.

For more information, readers are encouraged to read Chapter 5: Methods Overview as well as, the responsible consultant reports and memos (found in Appendix MO and S) for a more in depth description of the methods used, as well as the Glossary for any unfamiliar terms.

11.2 Drinking Water Systems

The Township of Springwater, located north of the City of Barrie within Simcoe County, operates groundwater based water supplies in nine (9) communities and has no surface water intakes. As shown in Table 11-1 and Figure 11-1 all of the groundwater supplies are within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR). Table 11-1 also indicates the Source Protection Region and corresponding lead Source Protection Authority (SPA) for the municipal water supplies.

Table 11-1: Municipal Groundwater Supplies in the Township of Springwater

Local Municipality	Community Water Supply	Drinking Water Information System (DWIS) Number	Source Water Body/ Aquifer	Number of Intakes/ Wells	Source Protection Region & Source Protection Authority (SPA)	Location where entire Assessment can be obtained
Township of Springwater	Cassell Drive (Hillsdale)	TBD	Confined overburden and bedrock aquifer (A2, A3)	2	SGBLS SPR & Severn Sound SPA	This chapter
Township of Springwater	Elmvale	220000700	Confined overburden and bedrock aquifer (A3)	2	SGBLS SPR & Severn Sound SPA	This chapter
Township of Springwater	Hillsdale	220003911	Confined overburden and bedrock aquifer (A2, A3, A4)	3	SGBLS SPR & Severn Sound SPA	This chapter
Township of Springwater	Anten Mills	220005447	Confined overburden aquifer (A3)	3	SGBLS SPR & Nottawasaga Valley SPA	Nottawasaga Valley Assessment Report (Chapter 16)
Township of Springwater	Del Trend	220009149	Confined overburden aquifer (A3)	3	SGBLS SPR & Nottawasaga Valley SPA	Nottawasaga Valley Assessment Report (Chapter 16)
Township of Springwater	Midhurst	220005474	Semi-unconfined aquifer (A3)	6	SGBLS SPR & Nottawasaga Valley SPA	Nottawasaga Valley Assessment Report (Chapter 16)
Township of Springwater	Minesing	220005465	Confined overburden aquifer (A2, A3)	4	SGBLS SPR & Nottawasaga Valley SPA	Nottawasaga Valley Assessment Report (Chapter 16)
Township of Springwater	Phelpston	260048282	Confined overburden aquifer (A2)	2	SGBLS SPR & Nottawasaga Valley SPA	Nottawasaga Valley Assessment Report (Chapter 16)
Township of Springwater	Snow Valley Highlands	260048204	Confined overburden aquifer (A3)	4	SGBLS SPR & Nottawasaga Valley SPA	Nottawasaga Valley Assessment Report (Chapter 16)
Township of Springwater	Vespra Downs	210001786	Confined overburden aquifer (A3)	2	SGBLS SPR & Nottawasaga Valley SPA	Nottawasaga Valley Assessment Report (Chapter 16)

While still in Springwater and in the SGBLS SPR, the majority of the water supply systems are located outside of the Severn Sound watershed. Information on the Anten Mills, Del Trend, Midhurst, Minesing, Phelpston, Snow valley Highlands and Vespra Downs Water Supplies (located in the Nottawasaga Valley watershed) can be found in the Nottawasaga Valley Assessment Report, Chapter 16.

In addition to the groundwater systems within Springwater, a number of vulnerable areas from surrounding municipalities extend into the Township (Table 11-2). This includes WHPAs from the Barrie and Angus water supplies. Information on these systems can be found in Chapters 9, and 12 respectively of the Nottawasaga Valley Assessment Report. Also, the Hillsdale Water Supply has been found to extend out of the Springwater and into the Township of Oro-Medonte (Table 11-2).

Table 11-2: WHPA that cross into and out of the Township of Springwater in the SGBLS SPR.

Local Municipality that WHPA extends into	Municipality where wellhead is located	Name of Water Supply	Source Protection Region / Lead Source Protection Authority (SPA)	Location where entire Assessment can be obtained
Township of Springwater	City of Barrie	Barrie	SGBLS SPR Lake Simcoe CA	Lake Simcoe Assessment Report (Part 1: Chapter 8)
Township of Springwater	Township of Essa	Angus	SGBLS SPR Nottawasaga Valley CA	Nottawasaga Valley Assessment Report (Chapter 12)
Township of Oro-Medonte	Township of Springwater	Hillsdale	SGBLS SPR & Severn Sound SPA	This Chapter

11.3 Cassell Drive Well Supply

The Cassell Drive Water Supply is located north of Highway 400 and east of County Road 93, approximately 3 km south of the community of Hillsdale, in the Township of Springwater and services an anticipated population of 4,584 in the Heritage Village Development in the Community of Hillsdale. The Cassell Drive Water Supply consists of two wells: Well 1 and Well 2.

The system will be designed for an average day demand of 1,432.8 L/min (2063 m^3/day) and a maximum day demand of 2,865 L/min (4126 m^3/day). A long term, Category 3 permit to take water is anticipated to be applied for in 2023.

Wells 1 and 2 were constructed in 2007. The two wells were drilled into a confined sand and gravel aquifer encountered at an approximate depth of 26 m below ground level (bgl). Well 1 was drilled to a depth of approximately (Well 1 grouted into place at 40m) mbgl and screened from 48.8 mbgl to 53.3 mbgl. Well 2 was drilled to a depth of approximately (Well 2 grouted into place at 27m) mbgl and screened from 59.4 mbgl to 64.0 mbgl.

At the Cassell Drive Water Supply, three aquifers have been identified (A1, A2, and A3). Aquifer A1 is the uppermost aquifer in the area and is mainly under unconfined, or partially confined, water table conditions. Aquifer A2 and A3 are combined in the area and is under confined artesian conditions, overlain by a lacustrine silt and clay confining layer of varying thickness, and is separated from direct hydraulic connection to overlaying surface water features. The A2/A3 aquifer is the target water supply aquifer and is part of a tunnel channel aquifer complex.

Information presented for the Cassell Drive section of this Chapter is based on the Source Protection Vulnerability, Issues, and Threats Assessment in Support of Draft Plan Condition 12, WSP Canada Inc., 2023 report (WSP, 2023).

11.3.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply. The Vulnerability Analysis considers the WHPA and the Groundwater Vulnerability, as well as the potential for the vulnerability to be increased by man-made (anthropogenic) structures, through Transport Pathways, by developing a “Vulnerability Score” within the WHPA. Conversion of Vulnerability categories (High, Medium and Low) to Vulnerability Scores (10, 8, 6, 4 and 2) results in a new map for each WHPA that expresses the relative degree to which a Threat could affect the drinking water supply. A higher value Vulnerability Score will always be assigned to the immediate vicinity of the well and to any areas that are shown to be vulnerable.

The Groundwater Vulnerability for the Cassell Drive Water Supply has been delineated in accordance with the Technical Rules (MECP, 2021). The areas that are determined to contribute

groundwater to the wells within 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the Vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules (MECP, 2021) to determine a Vulnerability Score for the Cassell Drive WHPA.

11.3.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Cassell Drive Water Supply were delineated in 2023 by WSP using the USEPA's Wellhead Analytic Element Model. The well locations and the Cassell Drive WHPA are shown in Figure 11a-1. WHPA delineation methods are documented in WSP, 2023.

WHPA-A has been added to include the 100 m radius from each municipal well. The WSP (2023) study delineated time-of-travel zones (TOT) for 2 years, 5 years and 25 years. The WHPA reflect a northwest groundwater flow direction. This is reasonable based on available data describing regional groundwater flow patterns.

11.3.1.2 Groundwater Vulnerability

The Cassell Drive Water Supply draws water from combined aquifer A2/A3 under confined artesian conditions. The Groundwater Vulnerability for the aquifer in the area was determined using the regional Aquifer Vulnerability Index in accordance with the Technical Rules (MECP, 2021).

The Groundwater Vulnerability within the WHPA of the two municipal wells in the Cassell Drive Water Supply is shown in Figure 11a-2. The Groundwater Vulnerability for the municipal water supply aquifers within the WHPA-A and WHPA-B is considered to be Medium, and within WHPA-C and WHPA-D is considered to be Low.

11.3.1.3 Transport Pathway Increase

Transport Pathways were considered in the Vulnerability Rating as per Technical Rules (MECP, 2021), specifically Part IV.1, rules 39-41. The Vulnerability Rating can be increased from Medium to High, Low to Medium, or from Low to High in accordance with the potential for artificial Transport Pathways to increase the observed vulnerability.

Private wells, and particularly wells that either do not contain seals that will prevent water from moving down around the outside of the well pipe, and wells that are no longer used and/or that have not been sealed present the greatest potential for increasing the rated Vulnerability. The available data from the Provincial Water Database was screened to identify wells that penetrate to the water supply aquifers and have potential to increase the Vulnerability of the natural stratigraphic profile. There is potential that other wells may exist that are not included

in the database, particularly in areas now serviced by municipal water that formerly obtained water supply from private wells.

No wells were identified within the Cassell Drive WHPA that are considered to have the potential to be a Transport Pathway. The Groundwater Vulnerability map (Figure 11a-2) is therefore proposed to be used to generate the Vulnerability Scores.

11.3.1.4 WHPA-E

None of the wells in this study have been identified as Groundwater Under the Direct Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required.

11.3.1.5 Vulnerability Score

The WHPA zones for the Cassell Drive Water Supply, as shown in Figure 11a-1, and the Groundwater Vulnerability, as shown in Figure 11a-2, were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 11a-3 illustrates the Vulnerability Scores for the Cassell Drive WHPA. Figure 11a-3 will be used to assess Drinking Water Threats in Section 11.3.3.

11.3.1.6 Uncertainty Rating

An Uncertainty Rating of either High or Low be assigned with each Vulnerable Area as outlined in the Technical Rules 13-15 (Part I.4 – Uncertainty Analysis (MECP, 2021).

The uncertainty delineation of the Cassell Drive WHPAs was determined by WSP (2023), with the Uncertainty Rating assigned for the Cassell Drive WHPAs as Low.

The assessment of the uncertainty for the Vulnerability Assessment considers the type, quantity and quality of available data, the methods used to determine the Groundwater Vulnerability, and the nature of the groundwater flow system.

The Vulnerability Rating for the Cassell Drive Water Supply has been determined using decisions and assumptions that would err on the conservative side. "There is little borehole information available in the WHPA-B, however, since the boreholes located within the WHPA-A indicate a medium vulnerability the WHPA-B is also given a medium vulnerability, and therefore a vulnerability of 8, as a conservative assumption (WSP, 2023)."

11.3.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a

source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114(1)(a-b)(MECP, 2021)). However, a parameter may not be considered an Issue in cases where it is naturally occurring, or effective treatment is in place.

WSP, 2023 reviewed available data describing raw water quality and for the Cassell Drive Water Supply to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water.

No Drinking Water Issues were identified for the Cassell Drive Water Supply.

11.3.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Cassell Drive Water Supply was completed in accordance with the Technical Rules (MECP, 2021). A Drinking Water Threat is defined as "an Activity, or Condition that adversely affects or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water and includes any Activity or Condition that is prescribed by the regulations as a drinking water threat." An Activity is one, or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the Cassell Drive Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

- A list of Drinking Water Threats for Activities,
- A list of Drinking Water Threats for Conditions,
- Maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Activities,
- Maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Conditions, and
- An enumeration of Drinking Water Threats.

11.3.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Cassell Drive Drinking Water Supply is provided in Chapter 5, section 5.5.1.

No additional Drinking Water Threats were identified for consideration. No local circumstances for prescribed Threats were identified.

11.3.3.2 List of Drinking Water Threats – Conditions

Methods used to assess Conditions are in accordance with the Technical Rules (MECP, 2021). The following information sources were consulted to identify existing Conditions that could affect the Cassell Drive Water Supply system:

- Records from available technical studies and previous contaminant source inventories that identified situations that may qualify as conditions.
- Municipal planning documents and completing and completing windshield surveys.

No confirmed Conditions have been identified for the Cassell Drive Water Supply. No potential Conditions have been identified for consideration at this time.

11.3.3.3 Identifying Areas of Significant/Moderate/Low Threats – Activities

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps combined with the Technical Rules can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The circumstances can be found at: https://threats.swpip.ca/.

11.3.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 11a-4 to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Cassell Drive Supply. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

11.3.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 11a-5 to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Cassell Drive Water Supply, Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than 8.

11.3.3.3.3 DNAPL Chemical Parameters

Figure 11a-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to

be a Significant Drinking Water Threat for the Cassell Drive Water Supply. The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 11a-6 to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

11.3.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions

Further to Section 11.3.3.2, no Conditions have been confirmed within the WHPA for the Cassell Drive Water Supply.

A Condition or potential Condition that has not been identified would potentially be a Significant, Moderate, or Low Threat to Drinking Water based on the combination of Hazard Rating and Vulnerability Rating. The Hazard Rating is dependent on whether there is evidence the Condition is causing off-site contamination, and whether the Condition is located on the same property as the supply well.

A Condition would be a threat to municipal drinking water in the following situations:

- **Significant**: where the Vulnerability Score is ≥ 8 and there is evidence that the Condition is causing off-site contamination, and/or that the Condition is located on the same property as the supply well.
- **Moderate**: (1) where the Vulnerability Score ≥ 6 and < 8, and there is evidence that the Condition is causing off-site contamination, and/or that the Condition is located on the same property as the supply well; or (2) Where the Vulnerability Score is 10, and there is no evidence of off-site contamination.
- **Low**: Where the Vulnerability Score ≥ 8 and < 10 and there is no evidence of off-site contamination.

Figure 11a-3 illustrates the Vulnerability Score map for Cassell Drive well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

11.3.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Cassell Drive Water Supply has been determined using the Technical Rules (MECP, 2021). There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 11-3 documents the refined enumeration of existing activities that are considered to be potential Significant Drinking Water Threats within the WHPA for the Cassell Drive Water Supply. Potential Significant Drinking Water Threats were identified in WHPA A and B where the Vulnerability Score is 8-10.

Five (5) activities that are considered to be potential Significant Drinking Water Threats were identified in association with ten (10) land parcels in the WHPA for the Cassell Drive Water Supply. Four (4) activities across eight (8) parcels in WHPA A, and one (1) activity across two (2) parcels in WHPA B.

Table 11-3: Number of Significant Drinking Water Threats for the Cassell Drive Drinking Water Supply.

Threat Number	Threat	Significant threat counts Number of threats
1.	The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act.	0
2.	The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.	1
3.	The application of agricultural source material to land.	0
4.	The storage of agricultural source material to land.	0
5.	The management of agricultural source material.	0
6.	The application of non-agricultural source material to land.	0
7.	The handling and storage of non-agricultural source material.	0
8.	The application of commercial fertilizer to land.	0
9.	The handling and storage of commercial fertilizer to land.	0
10.	The application of pesticide to land.	0
11.	The handling and storage of pesticide.	0
12.	The application of road salt.	0
13.	The handling and storage of road salt.	0
14.	The storage of snow.	0
15.	The handling and storage of fuel.	1

Threat Number	Threat	Significant threat counts Number of threats
16.	The handling and storage of dense non-aqueous phase liquid.	2
17.	The handling and storage of an organic solvent.	1
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0
-	**Totals:**	**5** significant threats (on **2** properties)

11.3.3.5.1 Managed Lands

Technical Rule 16(9) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Technical Rules.

Managed Lands were assessed, and the managed lands proportions were determined for the WHPA of the Cassell Drive Water Supply, following the Technical Rules, and using a GIS based approach by reviewing aerial photos and Natural Resources and Values Information vector data from the Ministry of Natural Resources. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.3.5). The Managed Lands are used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 11a-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Cassell Drive Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

11.3.3.5.2 Livestock Density

Technical Rule 16(10) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Technical Rules.

The Livestock Density was calculated for the delineated WHPA zones of the Cassell Drive Water Supply, following the Technical Rules (MECP, 2021), and through identifying agricultural properties within the WHPA by reviewing ariel imagery for suspected livestock barns. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.3.5). Nutrient units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 11a-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Cassell Drive Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with the Technical Rules (MECP, 2021).

11.3.3.5.3 Impervious Surfaces

Technical Rule 16(11) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within a WHPA. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Technical Rules.

The proportion of impervious surfaces within the delineated WHPA zones for the Cassell Drive Water Supply was determined in accordance with the methodology in the Technical Rules. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules.. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 11a-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Cassell Drive Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

11.4 Elmvale Well Supply

The Elmvale Water Supply is located at 6 Shaw Street (Lot 5, Concession 9), in the Township of Springwater and services an estimated population of 1,712 (955 units) in the Community of Elmvale. The Elmvale Water Supply consists of two wells: Well 1 and Well 2.

The two wells operate under Permit to Take Water 91-P-3104 dated April 4, 2001 and expires April 15, 2011. Wells 1 and 2 are permitted to pump at maximum rates of 1,600 L/min (2,273 m^3/day). The wells can operate up to a maximum combined taking of 4,546 m^3/day from the system.

Wells 1 and 2 were constructed in 1960 and 1989, respectively. The two wells were drilled into a confined sand and gravel aquifer encountered at an approximate depth of 26 m below ground level (bgl). Well 1 was drilled to a depth of approximately 51.8 mbgl and screened from 46.6 mbgl to 49.9 mbgl. Well 2 was drilled to a depth of approximately 58.8 mbgl and screened from 48.8 mbgl to 57.0 mbgl.

At the Elmvale Water Supply, one aquifer was encountered. A layer of confining till and lacustrine materials extends from ground level to a depth of approximately 25 mbgl. This material extends to north and south of the Community of Elmvale and thins to the east and west of the Community of Elmvale. An artesian sand and gravel aquifer, underlines the confining layer and is approximately 28 m thick and also underlain by an aquitard. The confined aquifer is under artesian conditions and is regionally extensive to the east, west, and north. Limestone bedrock is found at a depth of approximately 100 mbgl. The static water levels at the wells are approximately 5 mbgl (2005).

The screen intervals for Well 1 and Well 2 has been assigned to the A3 Aquifer in the draft regional hydrostratigraphic model prepared by AquaResource and Golder (2009). The groundwater vulnerability rating will be determined for the A3 Aquifer.

Information presented for the Elmvale section of this Chapter is based on Genivar 2010a report.

11.4.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply. The Vulnerability Analysis considers the WHPA and the Groundwater Vulnerability, as well as the potential for the vulnerability to be increased by man-made (anthropogenic) structures, through Transport Pathways, by developing a “Vulnerability Score” within the WHPA. Conversion of Vulnerability categories (High, Medium and Low) to Vulnerability Scores (10, 8, 6, 4 and 2) results in a new map for each WHPA that expresses the relative degree to which a Threat could affect the

drinking water supply. A higher value Vulnerability Score will always be assigned to the immediate vicinity of the well and to any areas that are shown to be vulnerable.

The Groundwater Vulnerability for the Elmvale Water Supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that determined to contribute groundwater to the wells within 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the Vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Elmvale WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

11.4.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Elmvale Water Supply were delineated in 2005 by Golder using a 2-dimensional analytical groundwater flow model. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. A minor translation was required to adjust the Elmvale Water Supply and the WHPA. The updated well locations and the WHPA are shown in Figure 11b-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2005) study delineated time-of-travel zones (TOT) for 50 days, 2 years, 10 years and 25 years. WHPA-C, representing the 5 year TOT zone, was estimated under this study as per Technical Memorandum A2 – 5 year Time-of-Travel Estimation Methods (Appendix MO).

The WHPA reflect groundwater flow from east to west. This is reasonable based on available data describing regional groundwater flow patterns.

11.4.1.2 Groundwater Vulnerability

The Elmvale Water Supply draws water from a confined overburden aquifer layer (regional aquifer system A3). The Groundwater Vulnerability for the aquifer in the area was determined using the regional Aquifer Vulnerability Index (AVI methods outlined in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO). The regional Groundwater Vulnerability is illustrated in Technical Memorandum B1 – Regional Groundwater Vulnerability Mapping.

The Groundwater Vulnerability within the WHPA of the two municipal wells in the Elmvale Water Supply is shown in Figure 11b-2. The Groundwater Vulnerability for the municipal water supply aquifers within the WHPA is considered to be Low.

11.4.1.3 Transport Pathway Increase

Technical Memorandum A3 (Appendix MO) documents the consideration of Transport Pathways to increase the Vulnerability Rating as per the Technical Rules. The Vulnerability Rating can be increased from Medium to High, Low to Medium, or from Low to High in accordance with the potential for artificial Transport Pathways to increase the observed vulnerability.

Private wells, and particularly wells that either do not contain seals that will prevent water from moving down around the outside of the well pipe, and wells that are no longer used and/or that have not been sealed present the greatest potential for increasing the rated Vulnerability. The available data from the Provincial Water Well Information System (WWIS) database was screened to identify wells that penetrate to the water supply aquifers and have potential to increase the Vulnerability of the natural stratigraphic profile. There is potential that other wells may exist that are not included in the database, particularly in areas now serviced by municipal water that formerly obtained water supply from private wells.

No wells were identified within the Elmvale WHPA that are considered to have the potential to be a Transport Pathway. The Groundwater Vulnerability map (Figure 11b-2) is therefore proposed to be used to generate the Vulnerability Scores.

11.4.1.4 WHPA-E

None of the wells in this study have been identified as Groundwater Under the Direct Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required.

11.4.1.5 Vulnerability Score

The WHPA zones for the Elmvale Water Supply, as shown in Figure 11b-1, and the Groundwater Vulnerability, as shown in Figure 11b-2, were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 11b-3 illustrates the Vulnerability Scores for the Elmvale WHPA. Figure 11a-3 will be used to assess Drinking Water Threats in Section 11.3.3.

11.4.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating of either High or Low be assigned with each Vulnerable Area as outlined in Technical Rules 13-15 (Part I.4 – Uncertainty Analysis – Water Quality (MOE, 2008a)). A component of the Uncertainty Rating is to be provided for the WHPA delineation by the technical peer review consultant. A second component of the Uncertainty Rating is to be provided in association with the Vulnerability Assessment.

The uncertainty delineation of the Elmvale WHPAs was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Elmvale WHPAs is High. The full results of the WHPA delineation Peer Review process, for Elmvale is available in Appendix S and discussed in Chapter 5 (Methods Overview).

The assessment of the uncertainty for the Vulnerability Assessment considers the type, quantity and quality of available data, the methods used to determine the Groundwater Vulnerability, and the nature of the groundwater flow system.

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Elmvale WHPA is High. The Vulnerability Rating for the Elmvale Water Supply has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). In this case, the High Uncertainty Rating reflects that additional data to describe the continuity, thickness and types of soils within the delineated WHPA could potentially be used to improve the understanding of local hydrostratigraphy and to increase the confidence in the Vulnerability Analysis. For further information, refer to Technical Memorandum A1 (Appendix MO).

11.4.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114(1)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.

Available data describing raw water quality and treated water quality for the Elmvale Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the

Drinking Water Issues Evaluation for the Township of Springwater Groundwater are provided in Technical Memorandum O1 – Drinking Water Issues Evaluation – Springwater (Appendix S).

No Drinking Water Issues were identified for the Elmvale Water Supply.

Some organic parameters, such as 1,2-dichloroethane, alachlor, aldrin + dieldrin, benzene, bromoxynil, carbaryl, carbofuran, cyanazine, monochlorobenzene, prometryn, temephos and vinyl chloride, were detected in trace concentrations in the treated water on very rare occasions. Detections are not persistent and concentrations are typically well below Ontario drinking Water Quality Standards (ODWQS) objectives.

Trihalomethanes are present in trace concentrations in the treated water as by-products of disinfection by chlorination. Trihalomethane concentrations are typically well below ODWQS values and do not display increasing trends.

Bacteria have occasionally been detected in low numbers in the raw and treated water under conditions that are rare and not consistent. Coliform or *E. coli* pathogens were not reported in the provided water quality data. Treatment consisting of disinfection is in place and maintained in accordance with Provincial standards set under the Safe Drinking Water Act. As this treatment is effective and detections are rare, pathogens are not considered to be Drinking Water Issues.

11.4.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Elmvale Water Supply was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). A Drinking Water Threat is defined as “an Activity, or Condition that adversely affects or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water, and includes any Activity or Condition that is prescribed by the regulations as a drinking water threat.” An Activity is one or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the Elmvale Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

- A list of Drinking Water Threats for Activities,
- A list of Drinking Water Threats for Conditions,
- Maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Activities,

- Maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Conditions, and
- An enumeration of Drinking Water Threats.

11.4.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Elmvale Drinking Water Supply is provided in Chapter 5, section 5.5.1.

No additional Drinking Water Threats were identified for consideration. No local circumstances for prescribed Threats were identified.

11.4.3.2 List of Drinking Water Threats – Conditions

Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO).The following information sources were consulted to identify existing Conditions that could affect the Elmvale Water Supply system:

- Files provided by the Ministry of the Environment, Conservation and Parks local offices pertaining to licenses, and records of spills in the area of the delineated WHPA.
- Records available from the Ministry of the Environment, Conservation and Parks website containing registry of Brownfield Sites.
- Records from available technical studies and previous contaminant source inventories that identified situations that may qualify as conditions.
- Interviews of Township of Springwater staff to identify potential conditions within the identified WHPA for the drinking water supply.

No confirmed Conditions have been identified for the Elmvale Water Supply. No potential Conditions have been identified for consideration at this time.

11.4.3.3 Identifying Areas of Significant/Moderate/Low Threats – Activities

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps combined with the Technical Rules can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The circumstances can be found at: https://threats.swpip.ca/.

11.4.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 11b-4 to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Elmvale Water Supply. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

11.4.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 11b-5 to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Elmvale Water Supply, Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than 8.

11.4.3.3.3 DNAPL Chemical Parameters

Figure 11b-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Elmvale Water Supply. The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 11b-6 to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

11.4.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions

Further to Section 11.3.3.2, no Conditions have been confirmed within the WHPA for the Elmvale Water Supply.

A Condition or potential Condition that has not been identified would potentially be a Significant, Moderate, or Low Threat to Drinking Water based on the combination of Hazard Rating and Vulnerability Rating as described in Section 5.5.5 (Chapter 5: Methods Overview) and Technical Memorandum A5 (Appendix MO). The Hazard Rating is dependent on whether there is evidence the Condition is causing off-site contamination, and whether the Condition is located on the same property as the supply well.

A Condition would be a threat to municipal drinking water in the following situations:

- **Significant**: where the Vulnerability Score is ≥ 8 and there is evidence that the Condition is causing off-site contamination, and/or that the Condition is located on the same property as the supply well.
- **Moderate**: (1) where the Vulnerability Score ≥ 6 and < 8, and there is evidence that the Condition is causing off-site contamination, and/or that the Condition is located on the same property as the supply well; or (2) Where the Vulnerability Score is 10, and there is no evidence of off-site contamination.
- **Low**: Where the Vulnerability Score ≥ 8 and < 10 and there is no evidence of off-site contamination.

Figure 11b-3 illustrates the Vulnerability Score map for Elmvale well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

11.4.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Elmvale Water Supply has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO). There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 11-3 documents the refined enumeration of existing activities that are considered to be potential Significant Drinking Water Threats within the WHPA for the Elmvale Water Supply. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

Two (2) activities that are considered to be potential Significant Drinking Water Threats were identified in association with two (2) land parcels in the WHPA for the Elmvale Water Supply. One (1) activity/parcel was assigned to represent the municipal sanitary sewer connections within WHPA-A. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are two (2) residential parcels within this area.

Table 11-4: Number of Significant Drinking Water Threats for the Elmvale Drinking Water Supply.

Threat Number	Threat	Significant threat counts Number of threats
1.	The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act.	0
2.	The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.	1
3.	The application of agricultural source material to land.	0
4.	The storage of agricultural source material to land.	0
5.	The management of agricultural source material.	0
6.	The application of non-agricultural source material to land.	0
7.	The handling and storage of non-agricultural source material.	0
8.	The application of commercial fertilizer to land.	0
9.	The handling and storage of commercial fertilizer to land.	0
10.	The application of pesticide to land.	0
11.	The handling and storage of pesticide.	0
12.	The application of road salt.	0
13.	The handling and storage of road salt.	0
14.	The storage of snow.	0

Threat Number	Threat	Significant threat counts Number of threats
15.	The handling and storage of fuel.	1
16.	The handling and storage of dense non-aqueous phase liquid.	0
17.	The handling and storage of an organic solvent.	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0
-	**Totals:**	**2*** significant threats (on **2** properties)

*2 potential Threats that require further verification (2015)

11.4.3.5.1 Managed Lands

Technical Rule 16(9) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and –E . This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Technical Rules.

Managed Lands were identified and the managed lands proportions were determined for the WHPA of the Elmvale Water Supply as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.3.5). The Managed Lands are used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 11b-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Elmvale Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

11.4.3.5.2 Livestock Density

Technical Rule 16(10) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Technical Rules.

The Livestock Density was determined for the delineated WHPA zones of the Elmvale Water Supply as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.3.5). Nutrient units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 11b-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Elmvale Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

11.4.3.5.3 Impervious Surfaces

Technical Rule 16(11) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and -E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Technical Rules.

The proportion of impervious surfaces within the delineated WHPA zones for the Elmvale Water Supply was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 11b-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Elmvale Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

11.5 Hillsdale Well Supply

The Hillsdale Water Supply is located at 140 Scarlett Line (Lot 57, Concession 1), in the Township of Springwater and services an estimated population of 1,126 (333 units) in the Community of Hillsdale. The Hillsdale Water Supply consists of three productions wells: Well 1, Well 2, and Well 3.

The three wells operate under Permit to Take Water 4031-5YEMY2 dated May 26, 2004 and expires April 30, 2014. Well 1 is permitted to pump at a maximum rate of 654 L/min (285 m^3/day), Well 2 is permitted to pump at a maximum rate of 342 L/min (493 m^3/day) and Well 3 is permitted to pump at a maximum rate of 456 L/min (657 m^3/day). The wells can operate up to a maximum combined taking of 1,434 m^3/day from the system.

Wells 1 and 2 were constructed in 1995. The three wells were drilled into three separate aquifers: Well 1 was drilled into a bedrock aquifer encountered at 96 m below ground level (bgl), Well 2 was drilled into a confined sand aquifer encountered at 23 mbgl, and Well 3 was drilled into a confined sand/gravel aquifer. Well 1 was drilled to a depth of 97.5 mbgl and screened from 91.4 mbgl to 94.5 mbgl. Well 2 was drilled to a depth of 26.5 mbgl and screened from 22.6 mbgl to 23.8 mbgl. Well 3 was drilled to a depth of 27.4 mbgl.

At the Hillsdale wells, three aquifers were encountered. A layer of confining silt exists from ground level to a depth ranging from 5 mbgl to 10 mbgl. This silt aquitard confines a sand aquifer 3 m to 5 m thick. This confined sand aquifer is underlain by a sandy silt aquitard which confines a sand/gravel aquifer 4 m to 5 m thick. Below the confined sand/gravel aquifer lies a 69 m thick layer of till which confines a bedrock aquifer, encountered at 96 mbgl. The upper two aquifers form a combined aquifer to the east, west, and south of the Community of Hillsdale. The bedrock aquifer and the confining units are regionally extensive. The static water levels at the wells are approximately at ground level (2005).

The screen intervals for Wells 1, 2 and 3 have been assigned to the A4, A2 and A3 Aquifers respectively, in the draft regional hydrostratigraphic model prepared by AquaResource and Golder (2009). The Groundwater Vulnerability rating will be determined for the A2, A3 and A4 Aquifers.

Information presented for the Hillsdale section of this Chapter is based on Genivar 2010a report.

11.5.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply. The Vulnerability Analysis considers the WHPA and the Groundwater Vulnerability, as well as the potential for the vulnerability to be increased by man-made (anthropogenic) structures, through Transport Pathways, by developing a “Vulnerability Score” within the WHPA. Conversion of Vulnerability

categories (High, Medium and Low) to Vulnerability Scores (10, 8, 6, 4 and 2) results in a new map for each WHPA that expresses the relative degree to which a Threat could affect the drinking water supply. A higher value Vulnerability Score will always be assigned to the immediate vicinity of the well and to any areas that are shown to be vulnerable.

The Groundwater Vulnerability for the Hillsdale Water Supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that determined to contribute groundwater to the wells within 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the Vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Hillsdale WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

11.5.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Hillsdale Water Supply were delineated in 2005 by Golder using a fixed radius method. This method was determined to be most appropriate for the lack of available hydrogeological data at the time. The availability of the regional groundwater flow model being constructed to assist in may provide an opportunity to update the WHPA for the Hillsdale Water Supply, although the availability of local data will still determine the overall confidence in the model results. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. A minor translation was required to adjust the Hillsdale well locations and the WHPA. Wells 1 and 2 are located so close to each other that they cannot be discerned on the map and appear to be only one well. WHPA delineation and adjustment details are documented in Genivar, 2010a.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2005) study delineated time-of-travel zones (TOT) for 50 days, 2 years, 10 years and 25 years. WHPA-C, representing the 5 year TOT zone, was estimated under this study as per Technical Memorandum A2 – 5 year Time-of-Travel Estimation Methods (Appendix MO).

The updated WHPA for Well 2 is shown in Figure 11c-1. The updated WHPA for Well 1 is shown in Figure 11c-2. The extent of the delineated WHPA for the Hillsdale Water Supply is a function of the pumping rates used and the aquifer properties. The WHPA for Well 1 completely covers the Well 2 WHPA as it is larger due to a combination of higher pumping rate, lower aquifer thickness, lower effective porosity and reduced recharge to the water supply aquifer. A specific pumping scenario was not provided to delineate the WHPA for Well 3. Both Wells 2 and 3 are located within the same aquifer and are not pumped at the same time and therefore it was determined that the WHPA delineated for Well 2 also represents the WHPA for Well 3.

11.5.1.2 Groundwater Vulnerability

The Hillsdale Water Supply draws water from confined overburden and bedrock aquifer layers (regional aquifers system A2, A3 and A4). The Groundwater Vulnerability for the municipal aquifers in the area was determined using the regional Aquifer Vulnerability Index (AVI methods outlined in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO). The regional Groundwater Vulnerability is illustrated in Technical Memorandum B1 – Regional Groundwater Vulnerability Mapping.

The Groundwater Vulnerability within the WHPA of Well 2 in the Hillsdale Water Supply is shown in Figure 11c-3. The Groundwater Vulnerability for Well 2 reflects the relatively shallow aquifer layer A2. The Groundwater Vulnerability Rating is Low beneath much of the WHPA but Medium to the west of the wells. The actual Vulnerability of aquifer that supplies water to Well 1 will be lower than for the A2 aquifer.

As the aquifer that supplies Well 3 is stratigraphically above the bedrock layer that supplies Well 1, using the Groundwater Vulnerability for the A3 aquifer layer will be a conservative estimate of the Groundwater Vulnerability for both wells. The groundwater vulnerability within the WHPA of Well 1 and 3 in the Hillsdale Water Supply is shown in Figure 11c-4. The Groundwater Vulnerability Rating for the A3 aquifer beneath the WHPA for Well 1 and Well 3 is consistently Low. As a bedrock well, Well 1 will be better protected than Well 3.

11.5.1.3 Transport Pathway Increase

Technical Memorandum A3 (Appendix MO) documents the consideration of Transport Pathways to increase the Vulnerability Rating as per the Technical Rules. The Vulnerability Rating can be increased from Medium to High, Low to Medium, or from Low to High in accordance with the potential for artificial Transport Pathways to increase the observed vulnerability.

Private wells, and particularly wells that either do not contain seals that will prevent water from moving down around the outside of the well pipe, and wells that are no longer used and/or that have not been sealed present the greatest potential for increasing the rated Vulnerability. The available data from the Provincial Water Well Information System (WWIS) database was screened to identify wells that penetrate to the water supply aquifers and have potential to increase the Vulnerability of the natural stratigraphic profile. There is potential that other wells may exist that are not included in the database, particularly in areas now serviced by municipal water that formerly obtained water supply from private wells.

No wells were identified to be potential Transport Pathways within the Hillsdale WHPA. The Groundwater Vulnerability maps (Figure 11c-3 and Figure 11c-4) are therefore proposed to be used to generate the Vulnerability Scores.

11.5.1.4 WHPA-E

None of the wells in this study have been identified as Groundwater Under the Direct Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required.

11.5.1.5 Vulnerability Score

The WHPA zones for the Hillsdale Water Supply, as shown in Figure 11c-1, and the Groundwater Vulnerability, as shown in Figure 11c-3 and Figure 11c-4, were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 11c-5 illustrates the Vulnerability Scores for the Hillsdale Water Supply. Figure 11c-5 will be used to assess Drinking Water Threats in Section 11.3.3. Note that while parts of well 2 were found to have a Medium Areas where Pathogens are or would be Significant, Moderate or Low Threats - Hillsdale. Vulnerability, these were largely within WHPA-D whereby a Vulnerability Score of 4 would result when using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). For this reason the higher Vulnerability Scores for Well 1 and 3 (Figure 11c-5) are used for the assessment of Drinking Water Threats.

11.5.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating of either High or Low be assigned with each Vulnerable Area as outlined in Technical Rules 13-15 (Part I.4 – Uncertainty Analysis – Water Quality (MOE, 2008a)). A component of the Uncertainty Rating is to be provided for the WHPA delineation by the technical peer review consultant. A second component of the Uncertainty Rating is to be provided in association with the Vulnerability Assessment.

The uncertainty delineation of the Hillsdale WHPAs was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Hillsdale WHPAs is High. The full results of the WHPA delineation Peer Review process, for Hillsdale is available in Appendix S and discussed in Chapter 5 (Methods Overview).

The assessment of the uncertainty for the Vulnerability Assessment considers the type, quantity and quality of available data, the methods used to determine the Groundwater Vulnerability, and the nature of the groundwater flow system.

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Hillsdale WHPA is High. The Vulnerability Rating for the Hillsdale Water Supply has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). In this case, the High Uncertainty Rating reflects that additional data to describe the continuity, thickness and types of soils within the delineated WHPA could potentially be used to improve the understanding of local hydrostratigraphy and to increase the confidence in the Vulnerability Analysis. For further information, refer to Technical Memorandum A1.

11.5.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114(1)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.

Available data describing raw water quality and treated water quality for the Hillsdale Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for the Township of Springwater water supplies are provided in Technical Memorandum O1 – Drinking Water Issues Evaluation – Springwater (Appendix S).

No Drinking Water Issues were identified for the Hillsdale Water Supply.

Some organic parameters, such as 1,1-dichloroethylene, 1,2-dichloroethane, alachlor, aldrin + dieldrin, bromoxynil, carbofuran, cyanazine, monochlorobenzene and vinyl chloride, were detected in trace concentrations in the treated water on very rare occasions. Detections are not persistent and concentrations are typically well below ODWQS objectives.

Trihalomethanes are present in trace concentrations in the treated water as by-products of disinfection by chlorination. Trihalomethane concentrations are typically well below ODWQS values and do not display increasing trends.

Coliforms have been detected in the raw water under conditions that are rare and not consistent. Treatment consisting of adequate filtration and disinfection is in place and maintained in accordance with Provincial standards set under the Safe Drinking Water Act. As this treatment is effective and detections are rare, the coliform bacteria are not considered to be Drinking Water Issues.

11.5.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Hillsdale Water Supply was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). A Drinking Water Threat is defined as “an activity, or condition that adversely affects or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water, and includes any activity or condition that is prescribed by the regulations as a drinking water threat.” An Activity is one or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the Hillsdale Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

- A list of Drinking Water Threats for Activities,
- A list of Drinking Water Threats for Conditions,
- Maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Activities,
- Maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Conditions, and
- An enumeration of Drinking Water Threats.

11.5.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Hillsdale Drinking Water Supply is provided in Chapter 5, section 5.5.1.

No additional Drinking Water Threats were identified for consideration. No local circumstances for prescribed Threats were identified.

11.5.3.2 List of Drinking Water Threats – Conditions

Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO). The following information sources were consulted to identify existing Conditions that could affect the Hillsdale Water Supply system:

- Files provided by the Ministry of the Environment, Conservation and Parks local offices pertaining to licenses, and records of spills in the area of the delineated WHPA.
- Records available from the Ministry of the Environment, Conservation and Parks website containing registry of Brownfield Sites.
- Records from available technical studies and previous contaminant source inventories that identified situations that may qualify as conditions.
- Interviews of Township of Springwater staff to identify potential conditions within the identified WHPA for the drinking water supply.

No confirmed Conditions have been identified for the Hillsdale Water Supply. No potential Conditions have been identified for consideration at this time.

11.5.3.3 Identifying Areas of Significant/Moderate/Low Threats – Activities

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps combined

with Technical Rules can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The circumstances can be found at: https://threats.swpip.ca/.

11.5.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 11c-6 to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Hillsdale Water Supply. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

11.5.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 11c-7 to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Hillsdale Water Supply, Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than 8.

11.5.3.3.3 DNAPL Chemical Parameters

Figure 11c-8 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Hillsdale Water Supply. The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 11c-8 to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

11.5.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions

Further to Section 11.4.3.2, no Conditions have been confirmed within the WHPA for the Hillsdale Water Supply.

A Condition or potential Condition that has not been identified would potentially be a Significant, Moderate, or Low Threat to Drinking Water based on the combination of Hazard Rating and Vulnerability Rating as described in Section 5.5.5 (Chapter 5: Methods Overview) and Technical Memorandum A5 (Appendix MO). The Hazard Rating is dependent on whether there is evidence the Condition is causing off-site contamination, and whether the Condition is located on the same property as the supply well.

A Condition would be a threat to municipal drinking water in the following situations:

- **Significant**: where the Vulnerability Score is ≥ 8 and there is evidence that the Condition is causing off-site contamination, and/or that the Condition is located on the same property as the supply well.
- **Moderate**: (1) where the Vulnerability Score ≥ 6 and < 8, and there is evidence that the Condition is causing off-site contamination, and/or that the Condition is located on the same property as the supply well; or (2) Where the Vulnerability Score is 10, and there is no evidence of off-site contamination.
- **Low**: Where the Vulnerability Score ≥ 8 and < 10 and there is no evidence of off-site contamination.

Figure 11c-5 illustrates the Vulnerability Score map for Hillsdale well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

11.5.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Hillsdale Water Supply has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO) and refined using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report. There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 11-4 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Hillsdale Water Supply. Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

Four (4) activities that are considered to be Significant Drinking Water Threats were identified in association with four (4) land parcels for the Hillsdale WHPA. Three (3) parcels were identified as having potential significant threats related to residential landuse via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are three (3) residential parcels within this area.

Table 11-5: Number of Significant Drinking Water Threats for the Hillsdale Drinking Water Supply.

Threat Number	Threat	Significant threat counts Number of threats
1.	The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act.	0
2.	The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.	3
3.	The application of agricultural source material to land.	0
4.	The storage of agricultural source material to land.	0
5.	The management of agricultural source material.	0
6.	The application of non-agricultural source material to land.	0
7.	The handling and storage of non-agricultural source material.	0
8.	The application of commercial fertilizer to land.	0
9.	The handling and storage of commercial fertilizer to land.	0
10.	The application of pesticide to land.	0
11.	The handling and storage of pesticide.	0
12.	The application of road salt.	0
13.	The handling and storage of road salt.	0
14.	The storage of snow.	0
15.	The handling and storage of fuel.	1

Threat Number	Threat	Significant threat counts Number of threats
16.	The handling and storage of dense non-aqueous phase liquid.	0
17.	The handling and storage of an organic solvent.	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0
-	**Totals:**	**4*** significant threats (on **4** properties)

*1 verified existing Threat and 3 potential Threats that require furtherverification (2015)

11.5.3.5.1 Managed Lands

Technical Rule 16(9)requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and –E . This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Technical Rules.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Hillsdale Water Supply as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.4.3.5). The Managed Lands is used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 11c-9 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Hillsdale Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

11.5.3.5.2 Livestock Density

Technical Rule 16(10) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Technical Rules.

The Livestock Density was determined for the delineated WHPA zones of the Hillsdale Water Supply as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.4.3.5). Nutrient units per farm are used in the identification of threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 11c-10 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Hillsdale Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

11.5.3.5.3 Impervious Surfaces

Technical Rule 16(11) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and -E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Technical Rules.

The proportion of impervious surfaces within the delineated WHPA zones for the Hillsdale Water Supply was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.4.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 11c-11 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Hillsdale Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

Figure 11-1: Vulnerable Areas in the Township of Springwater.

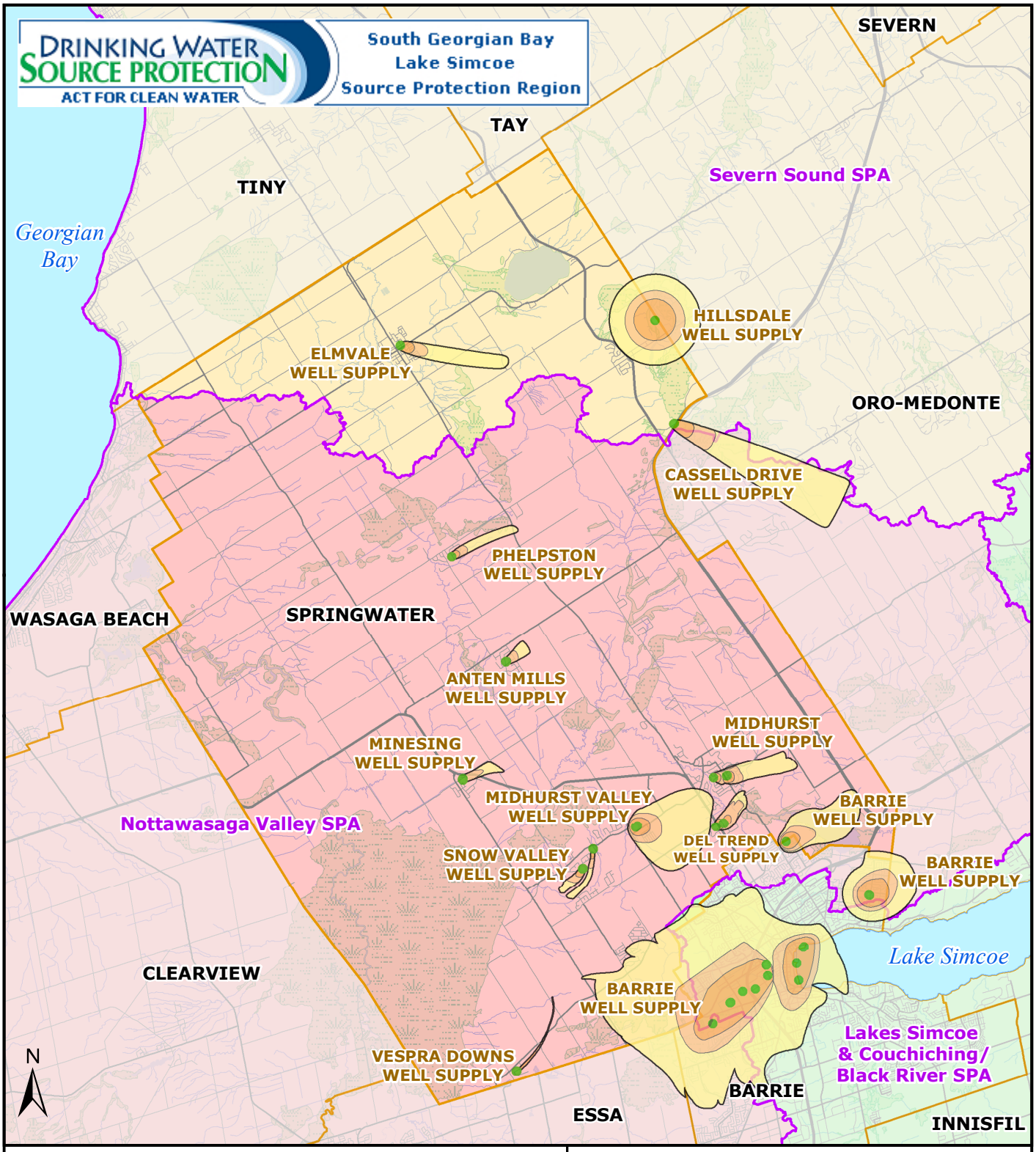
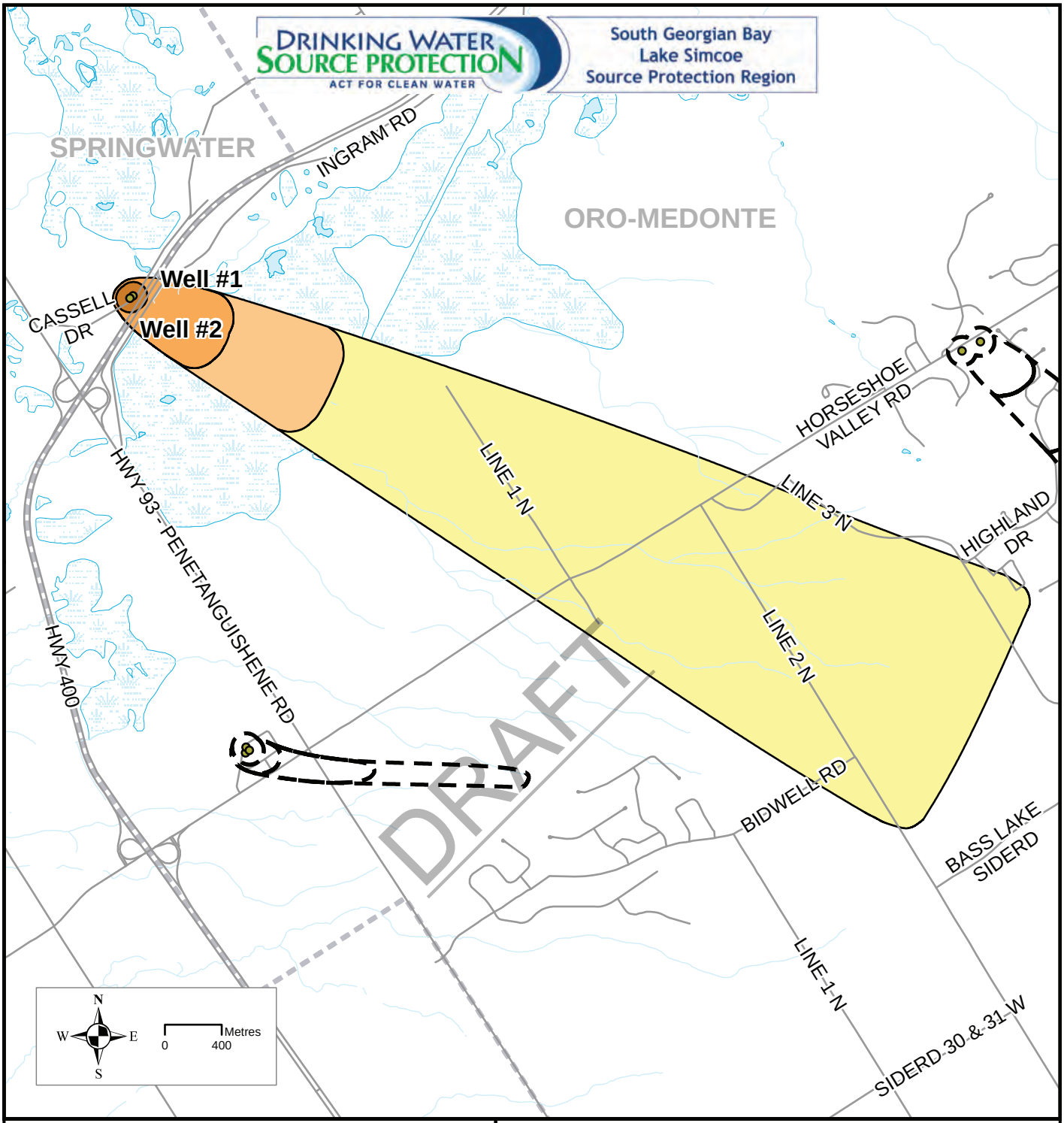


Figure 11a-1: Wellhead Protection Areas – Cassell Drive.



Legend

- Municipal Wells
- WHPA Boundary
- WHPA-A: 100 m Radius
- WHPA-B: 2-Year Time-of-Travel
- WHPA-C: 5-Year Time-of-Travel
- WHPA-D: 25-Year Time-of-Travel
- Road
- Watercourse
- Water Area
- Wetland
- Municipal Boundary
- Adjacent WHPA

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

WELLHEAD PROTECTION AREAS - CASSELL DRIVE, SPRINGWATER

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

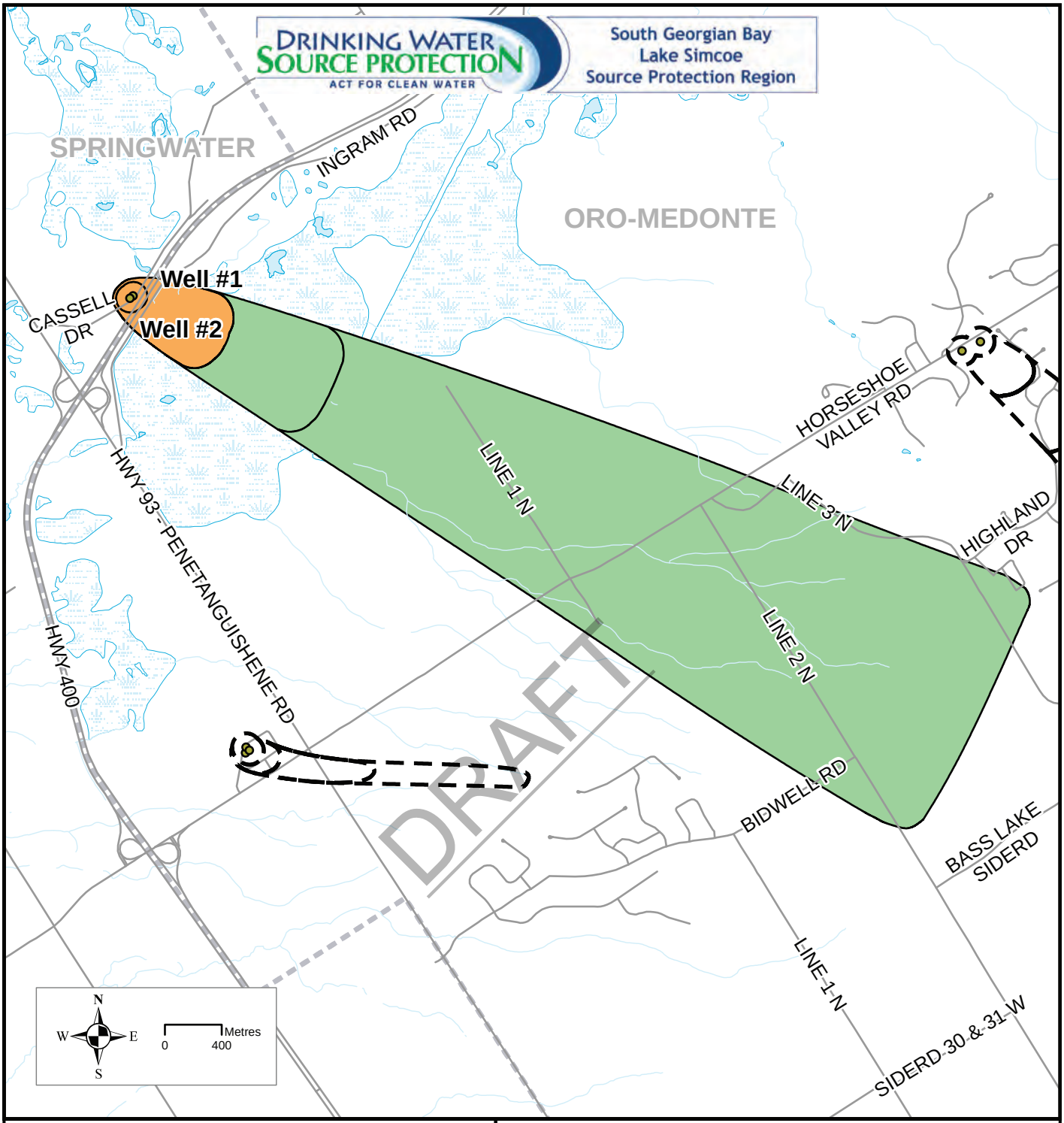
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: FEBRUARY 2024	SCALE: 1:40,000

WSP GOLDER Ontario

FIGURE **11a-1**

Figure 11a-2: Groundwater Vulnerability – Cassell Drive.



Legend

- Municipal Wells

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

- Road
- Watercourse
- Water Area
- Wetland
- Municipal Boundary
- Adjacent WHPA

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GROUNDWATER VULNERABILITY - CASSELL DRIVE, SPRINGWATER

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

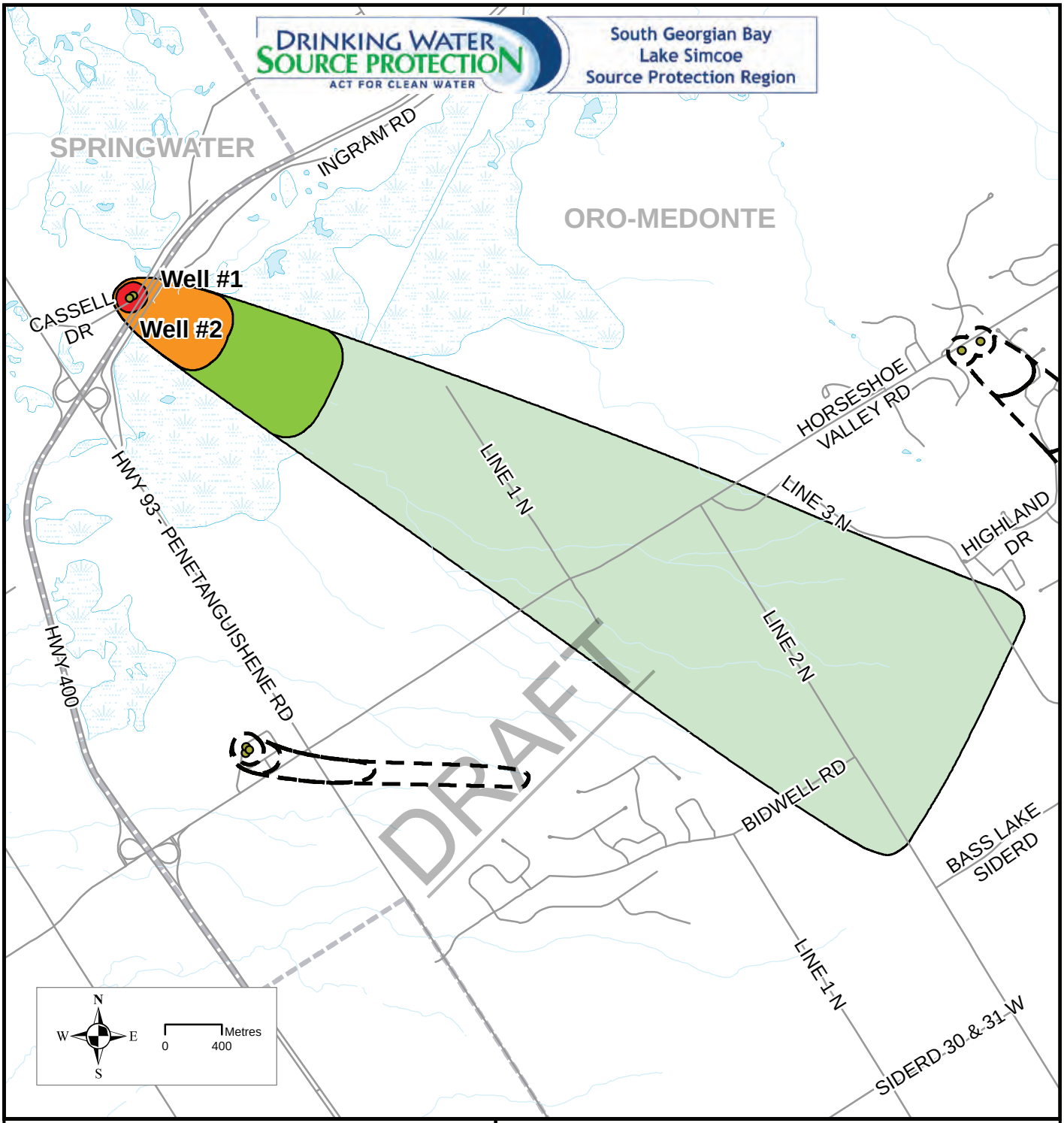
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: FEBRUARY 2024	SCALE: 1:40,000

WSP GOLDER Ontario

FIGURE **11a-2**

Figure 11a-3: Vulnerability Scores – Cassell Drive.



Legend

- Municipal Wells

VULNERABILITY SCORING

- 10
- 8
- 6
- 4
- 2

- Road
- Watercourse
- Water Area
- Wetland
- Municipal Boundary
- Adjacent WHPA

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

VULNERABILITY SCORES - CASSELL DRIVE, SPRINGWATER

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

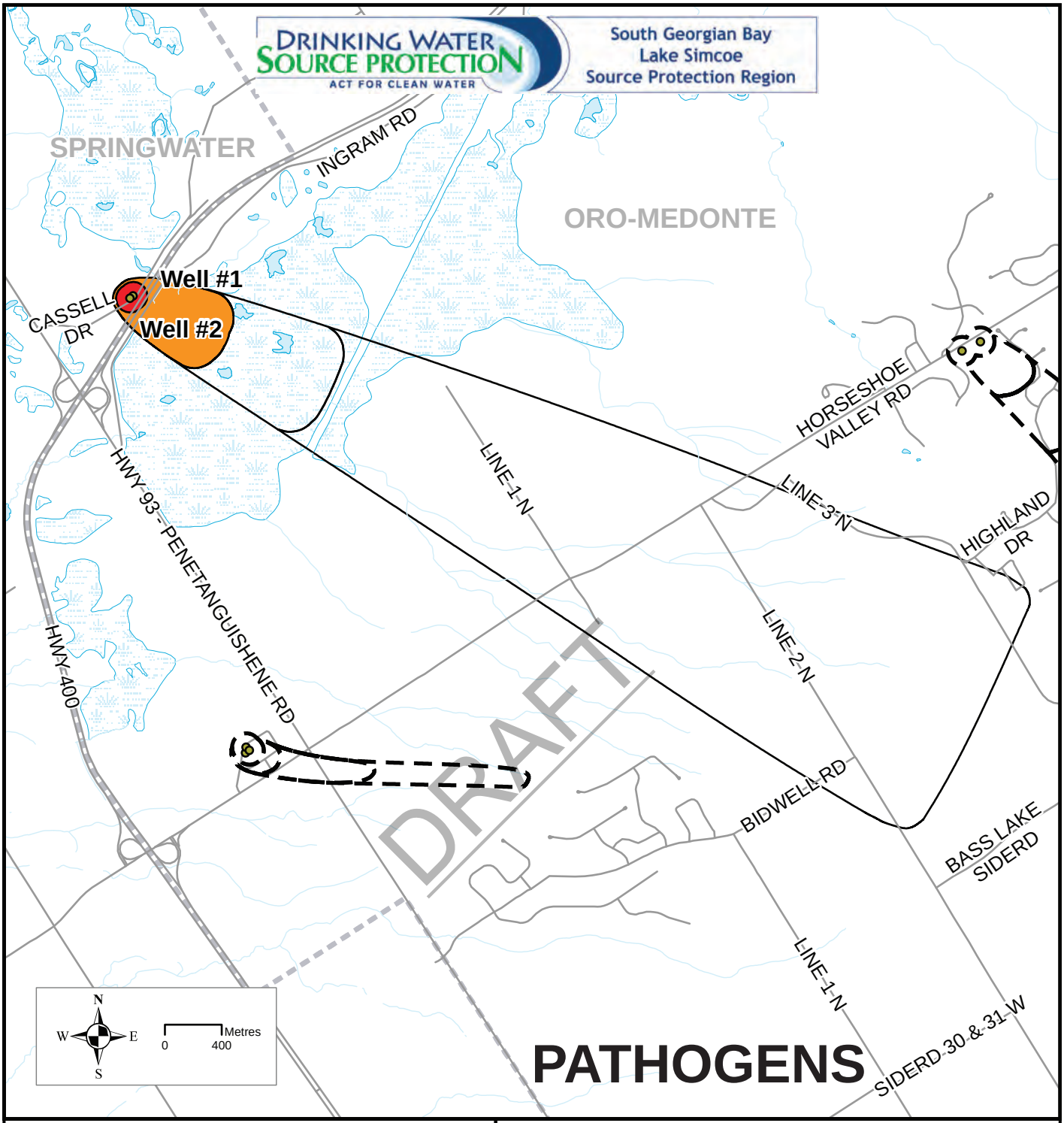
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: FEBRUARY 2024	SCALE: 1:40,000

WSP GOLDER Ontario

FIGURE **11a-3**

Figure 11a-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats – Cassell Drive.



Legend

- Municipal Wells

VULNERABILITY SCORING

- 10
- 8
- 6

- Road
- Watercourse
- Water Area
- Wetland
- Municipal Boundary
- Adjacent WHPA

AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW CASSELL DRIVE, SPRINGWATER

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

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules.

DATE: FEBRUARY 2024

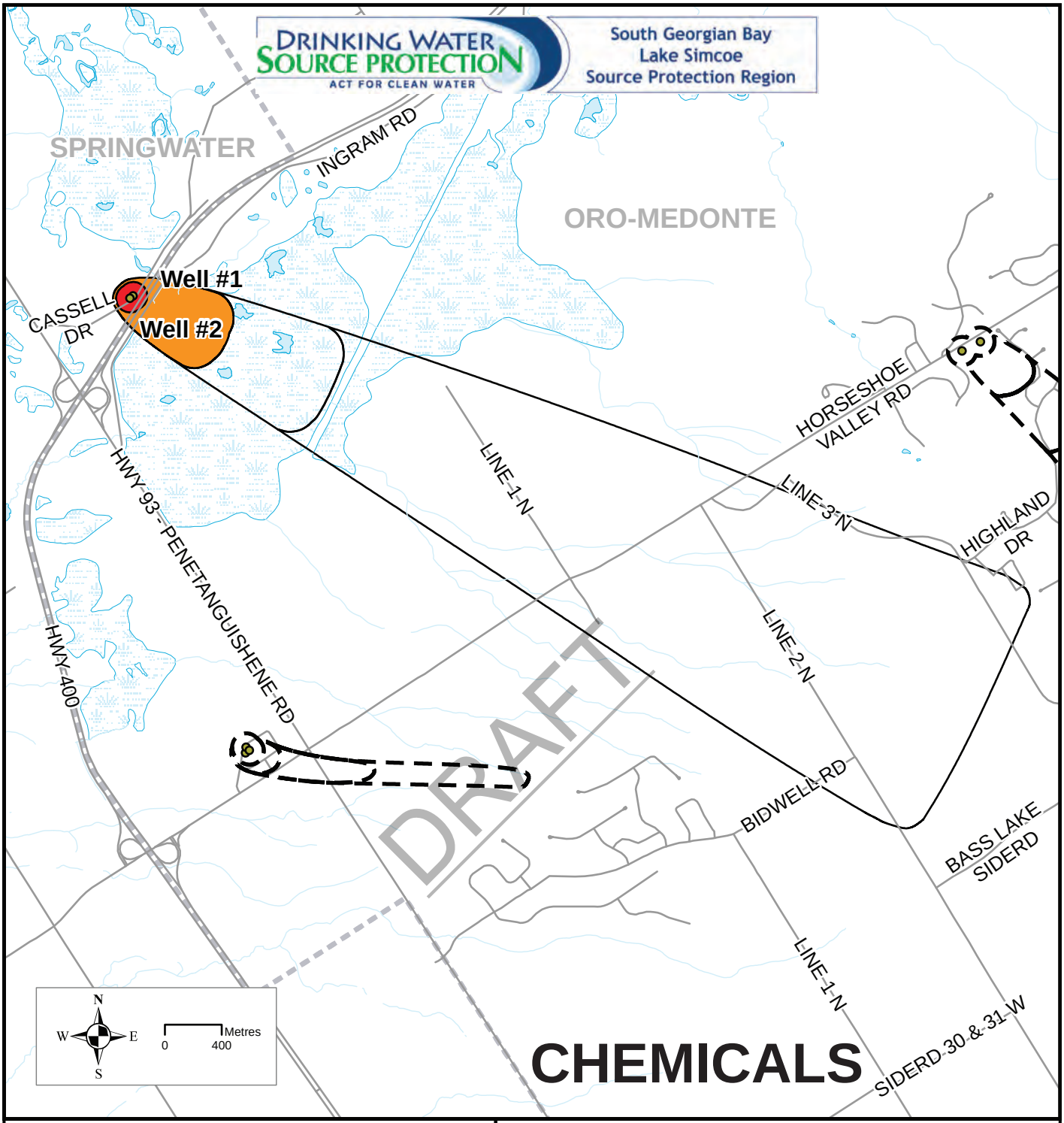
SCALE: 1:40,000

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

WSP GOLDER Ontario

FIGURE **11a-4**

Figure 11a-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats – Cassell Drive.



Legend

- Municipal Wells

VULNERABILITY SCORING

- 10
- 8
- 6

- Road
- Watercourse
- Water Area
- Wetland
- Municipal Boundary
- Adjacent WHPA

AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW CASSELL DRIVE, SPRINGWATER

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

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules.

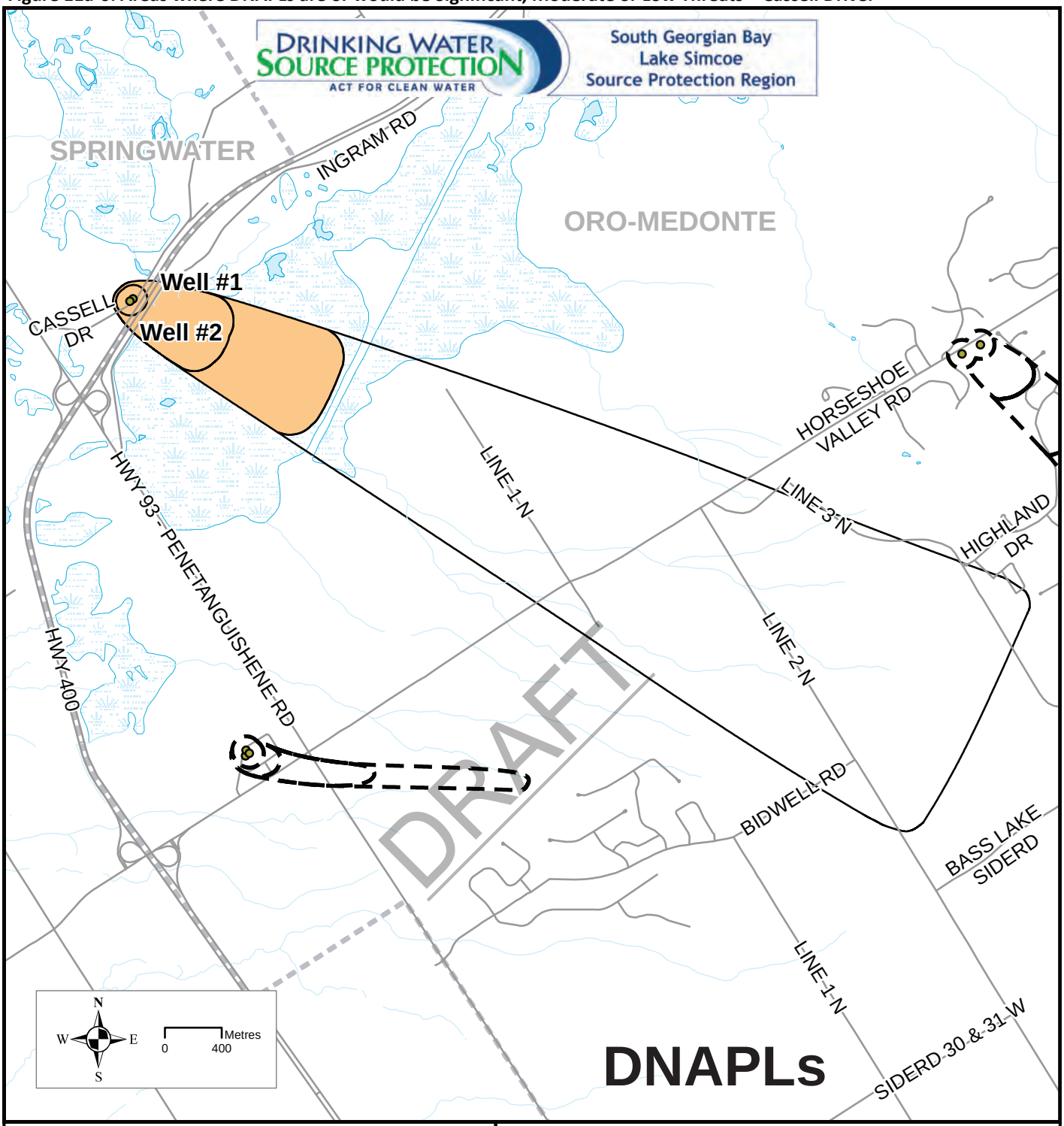
DATE: FEBRUARY 2024

SCALE: 1:40,000

WSP GOLDER Ontario

FIGURE 11a-5

Figure 11a-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats – Cassell Drive.



Legend

- Municipal Wells
- WHPA-C 5 YEAR TIME-OF-TRAVEL
- Road
- Watercourse
- Water Area
- Wetland
- Municipal Boundary
- Adjacent WHPA

AREAS WHERE DNAPLs ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW CASSELL DRIVE, SPRINGWATER

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

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules.

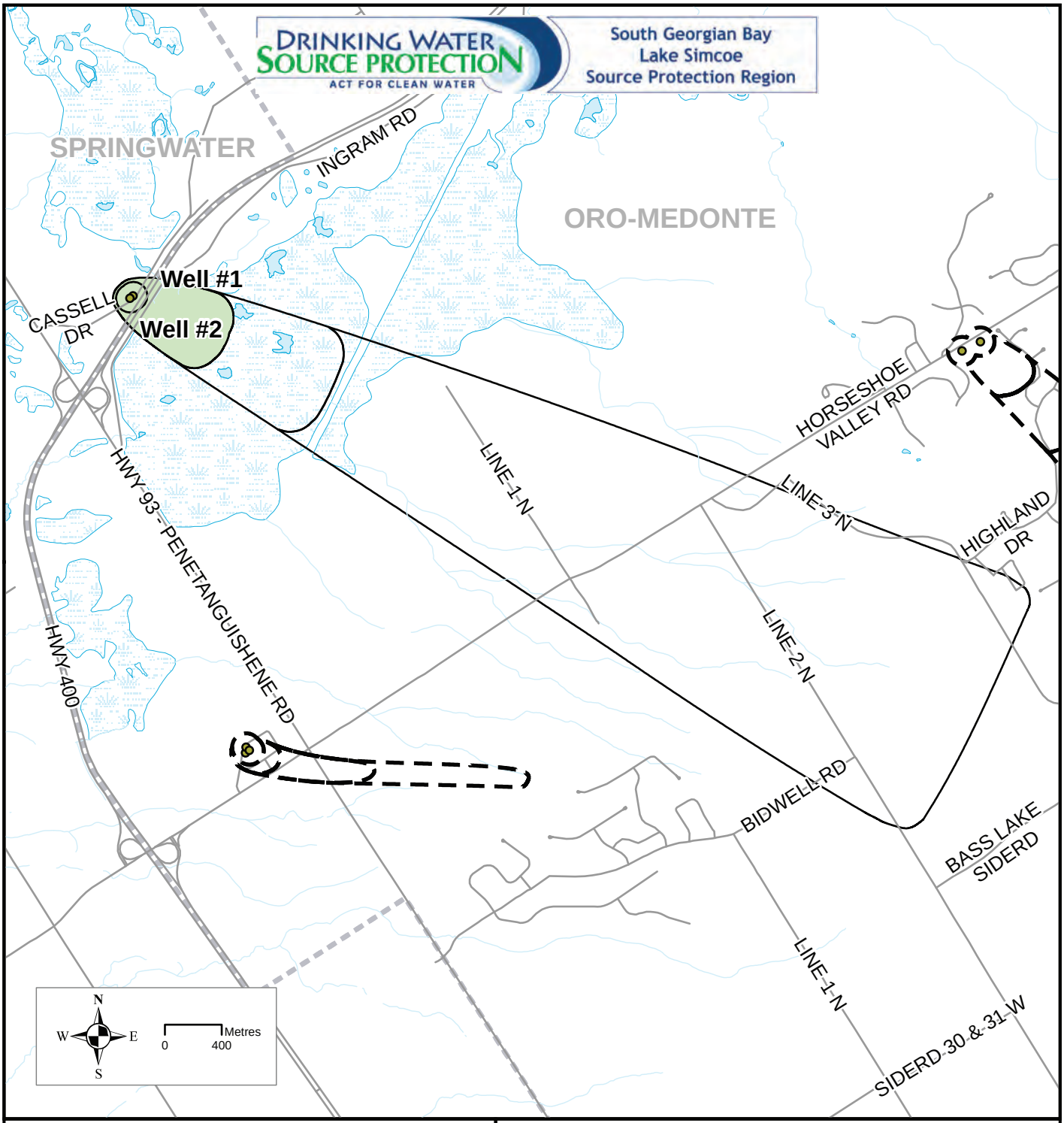
DATE: FEBRUARY 2024

SCALE: 1:40,000

WSP GOLDER Ontario

FIGURE 11a-6

Figure 11a-7: Managed Lands – Cassell Drive.



Legend

- Municipal Wells

Percent Total Managed Lands

- < 40%
- = 40% - < 80%
- => 80%

- Road
- Watercourse
- Water Area
- Wetland
- Municipal Boundary
- Adjacent WHPA

MANAGED LANDS - CASSELL DRIVE, SPRINGWATER

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

The Managed Land proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

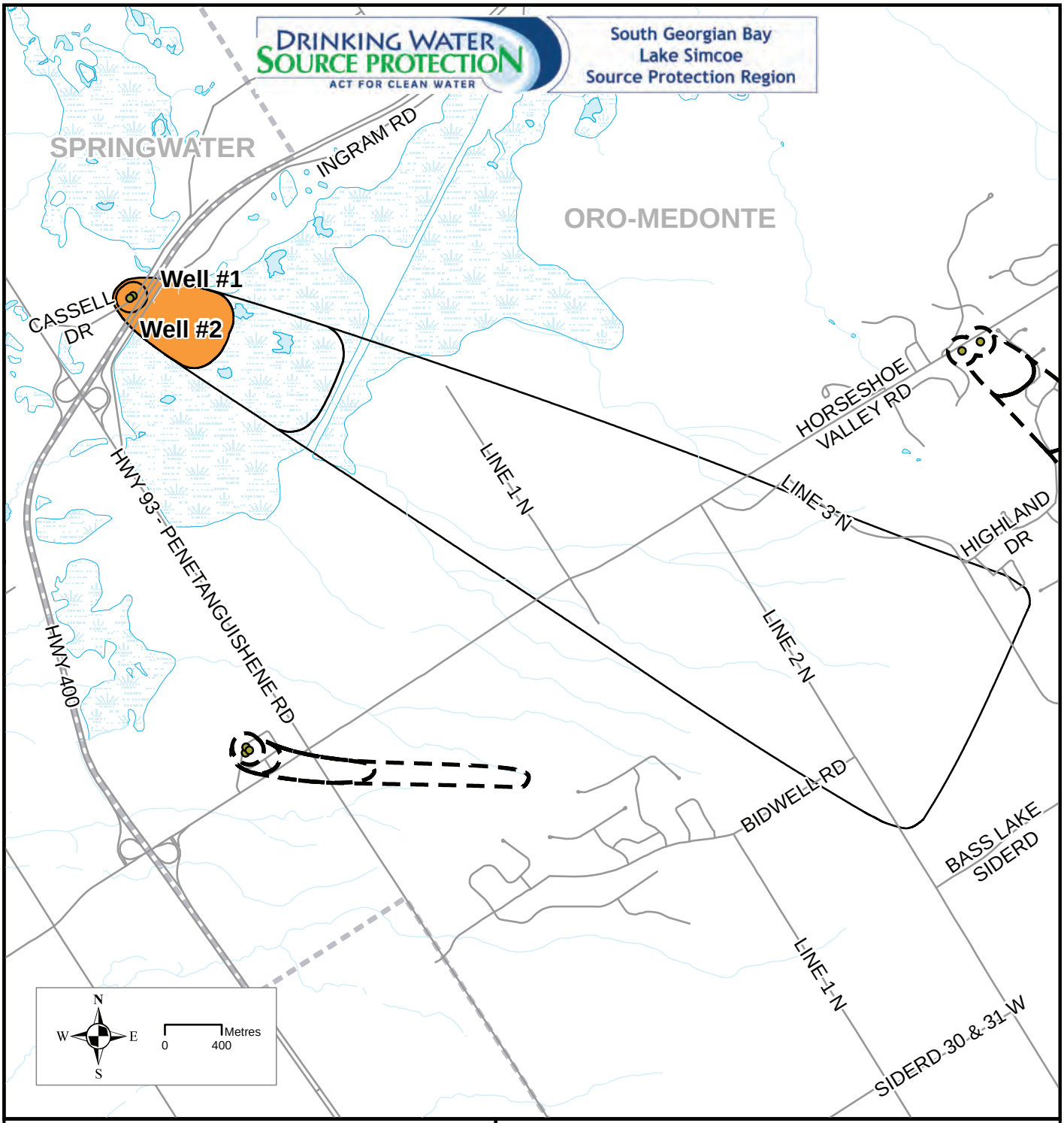
DATE: FEBRUARY 2024

SCALE: 1:40,000

WSP GOLDER Ontario

FIGURE 11a-7

Figure 11a-8: Livestock Density – Cassell Drive.



Legend

- Municipal Wells

LIVESTOCK DENSITY

- < 0.5 NU/AC*
- = 0.5 - < 1.0 NU/AC*
- => 1.0 NU/AC*

*NUTRIENT UNITS/ ACRE

- Road
- Watercourse
- Water Area
- Wetland
- Municipal Boundary
- Adjacent WHPA

LIVESTOCK DENSITY- CASSELL DRIVE, SPRINGWATER

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

The Livestock Density proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

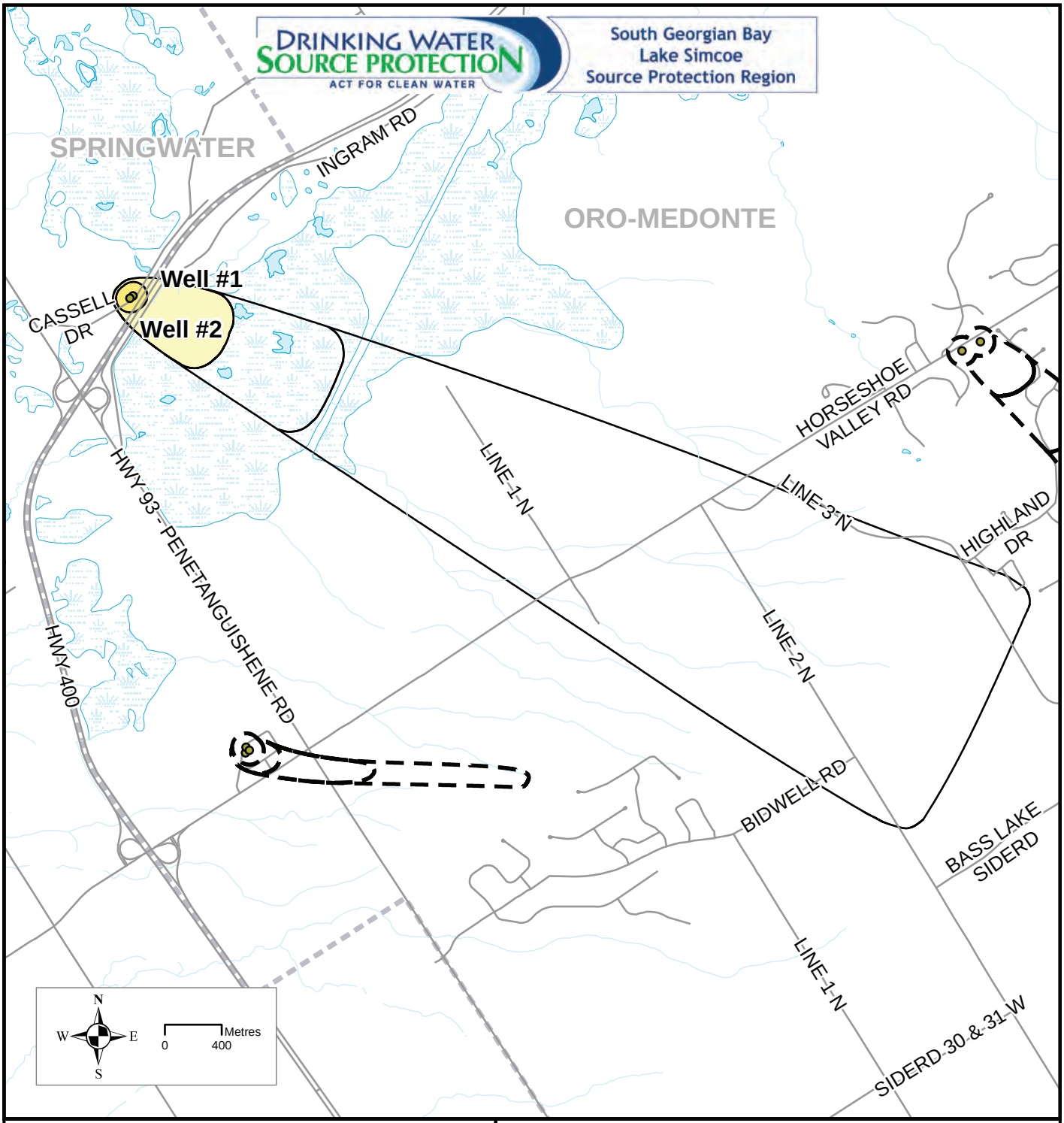
DATE: FEBRUARY 2024

SCALE: 1:40,000

WSP GOLDER Ontario

FIGURE **11a-8**

Figure 11a-9: Impervious Surfaces – Cassell Drive.



Legend

- Municipal Wells

IMPERVIOUS SURFACE

- < 1%
- = 1% - < 6%
- = 6% - < 8%
- = 8% - < 30%
- => 30%

- Road
- Watercourse
- Water Area
- Wetland
- Municipal Boundary
- Adjacent WHPA

IMPERVIOUS SURFACES- CASSELL DRIVE, SPRINGWATER

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

The Impervious Surfaces proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

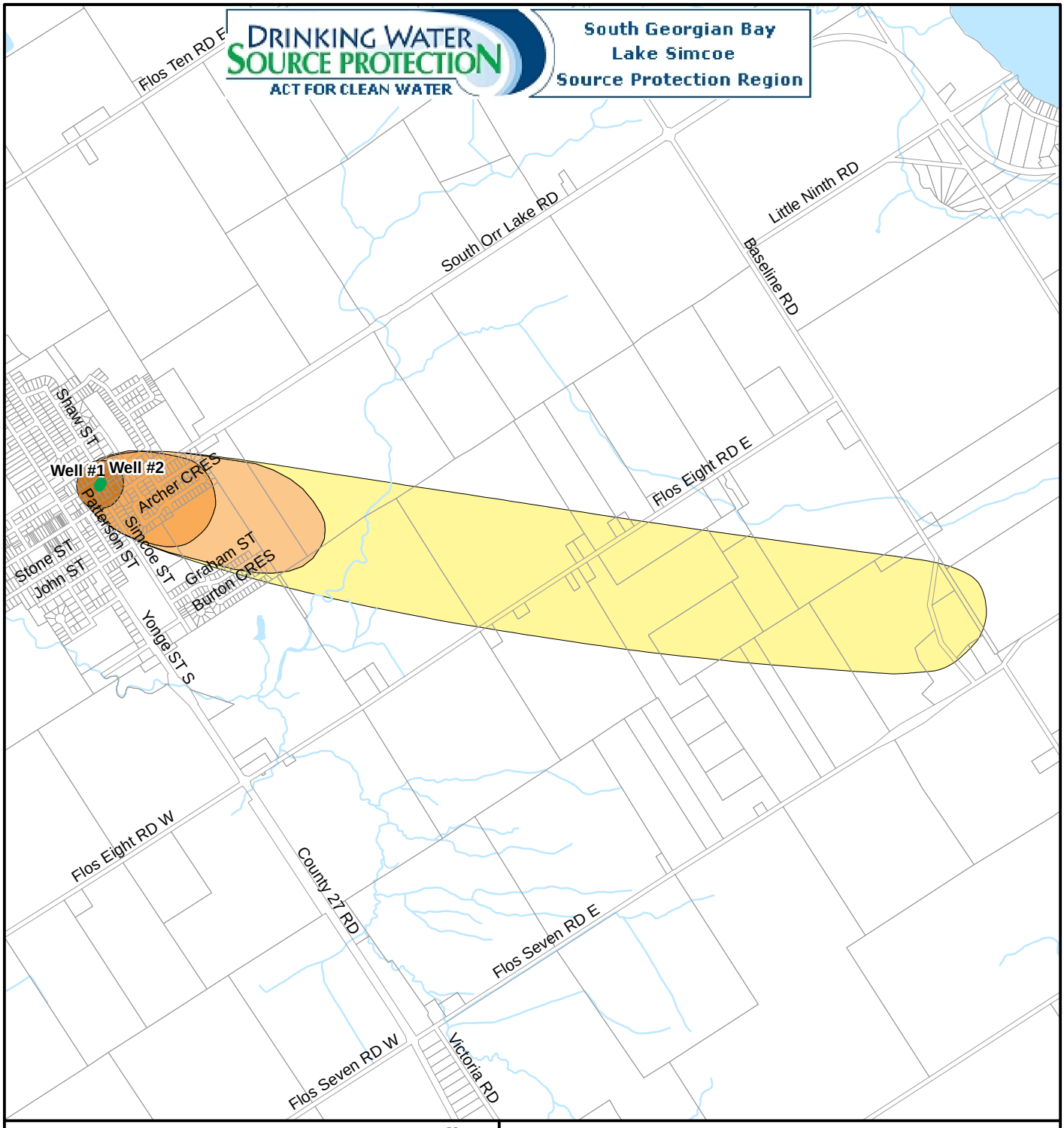
DATE: FEBRUARY 2024

SCALE: 1:40,000

WSP GOLDER Ontario

FIGURE **11a-9**

Figure 11b-1: Wellhead Protection Areas - Elmvale.



WELLHEAD PROTECTION AREAS - ELMVALE, SPRINGWATER

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

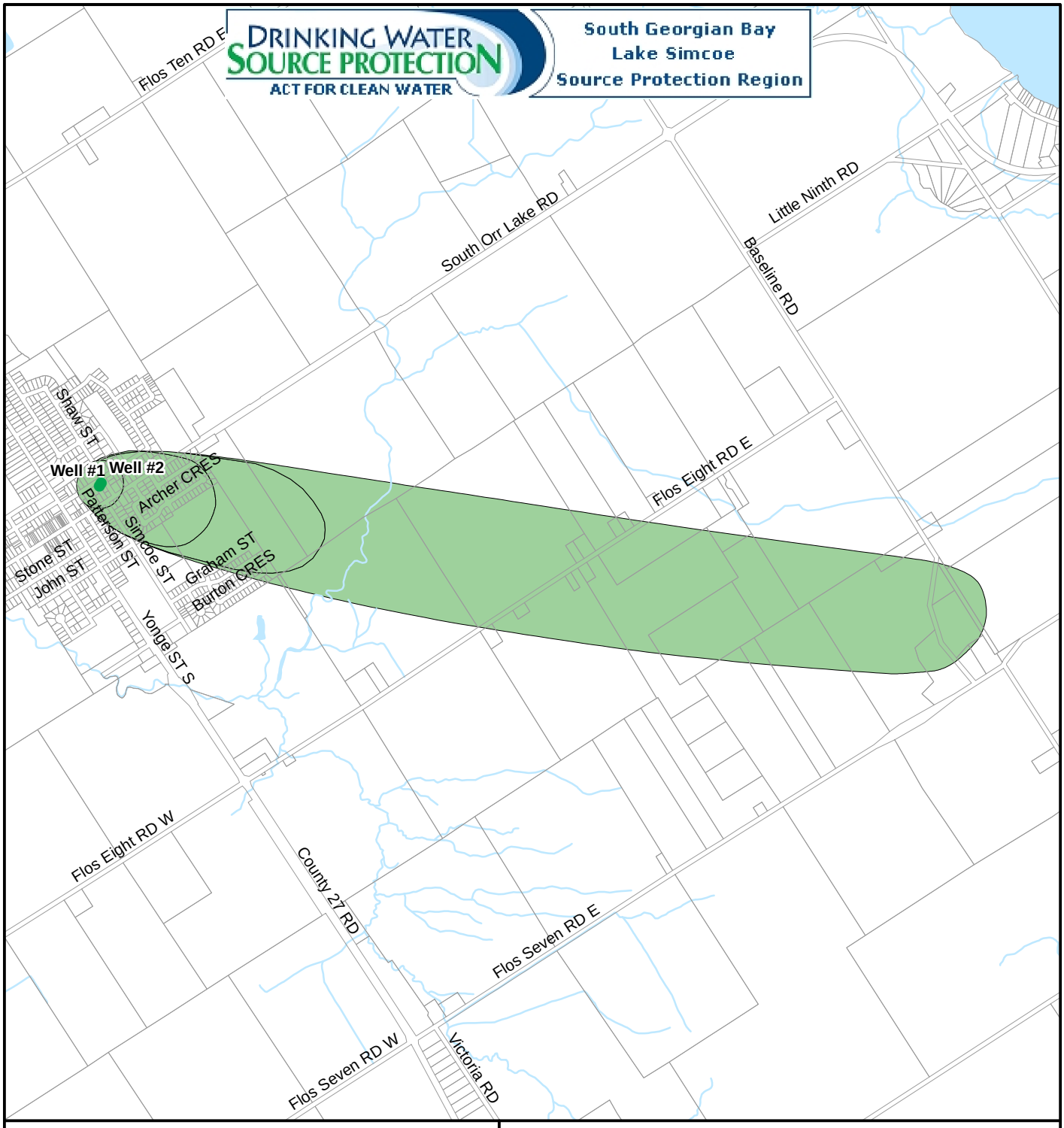
DATE: JULY 2010	SCALE: 1:25000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.3-1

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11b-1**

Figure 11b-2: Groundwater Vulnerability - Elmvale.



GROUNDWATER VULNERABILITY - ELMVALE

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

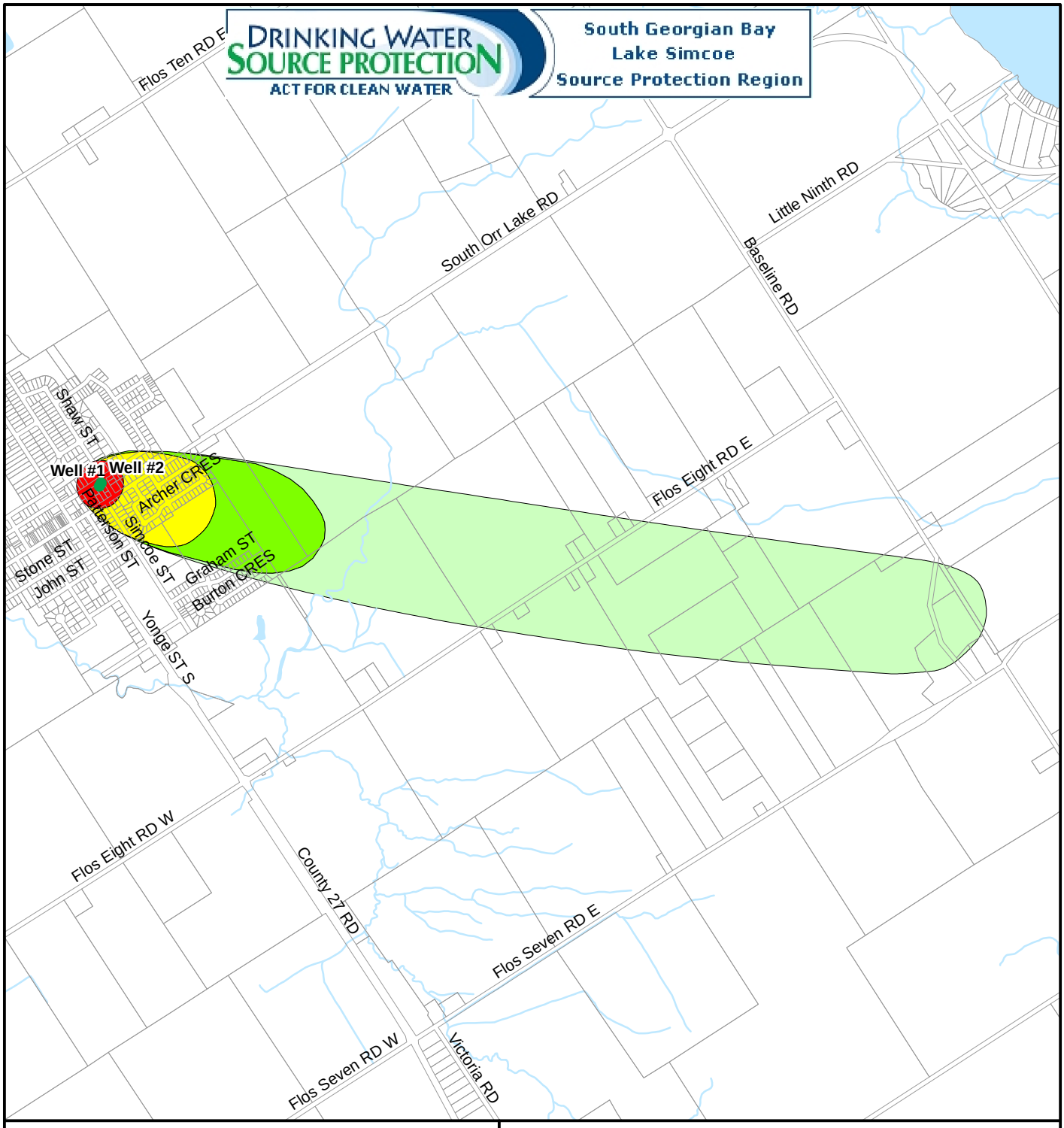
DATE: JULY 2010	SCALE: 1:25000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.3-2

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11b-2**

Figure 11b-3: Vulnerability Scores - Elmvale.



VULNERABILITY SCORES - ELMVALE

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

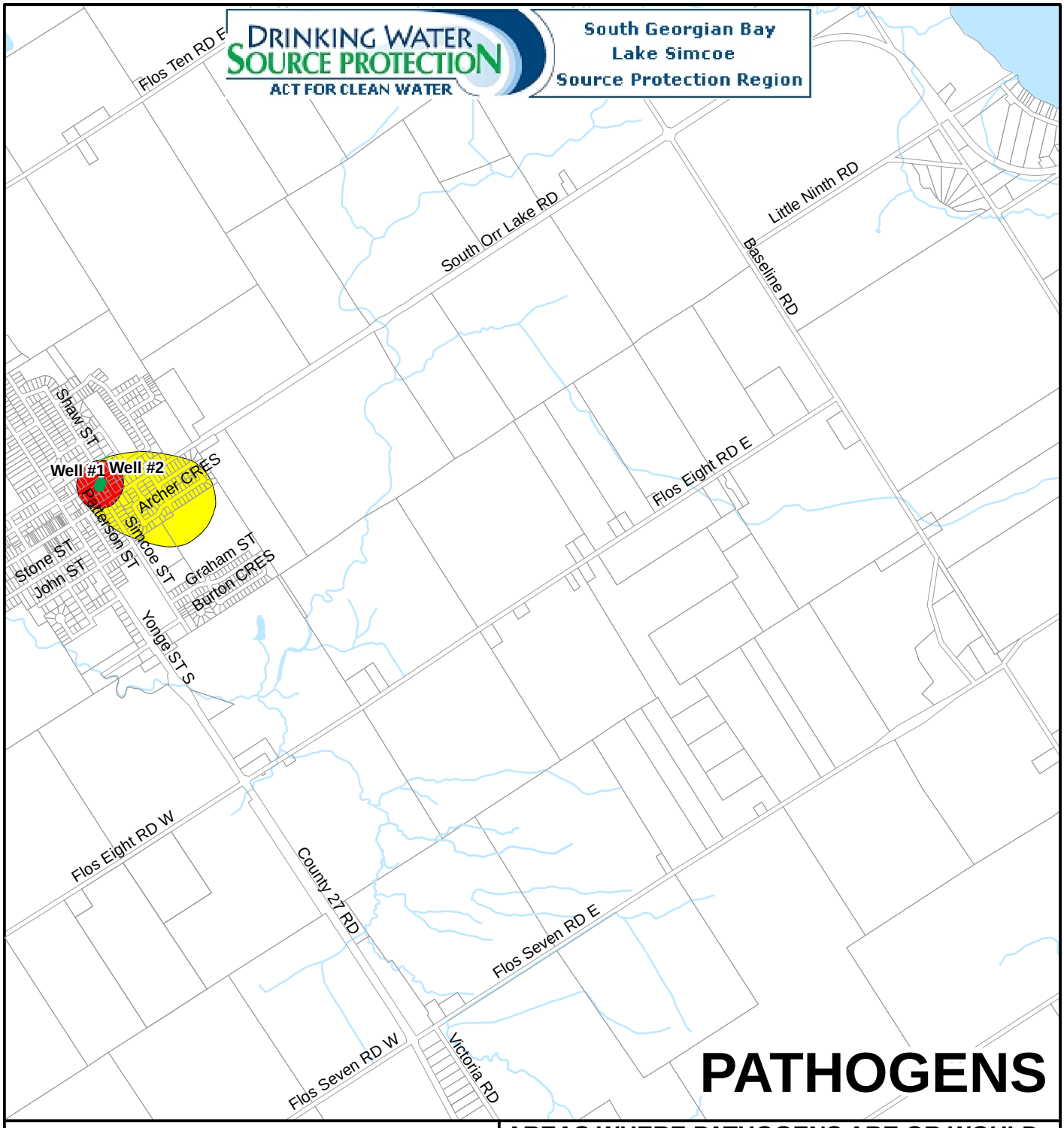
DATE: JULY 2010	SCALE: 1:25000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.3-3

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11b-3**

Figure 11b-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats - Elmvale.



LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6

N W E S

250 125 0 250 Metres

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - ELMVALE

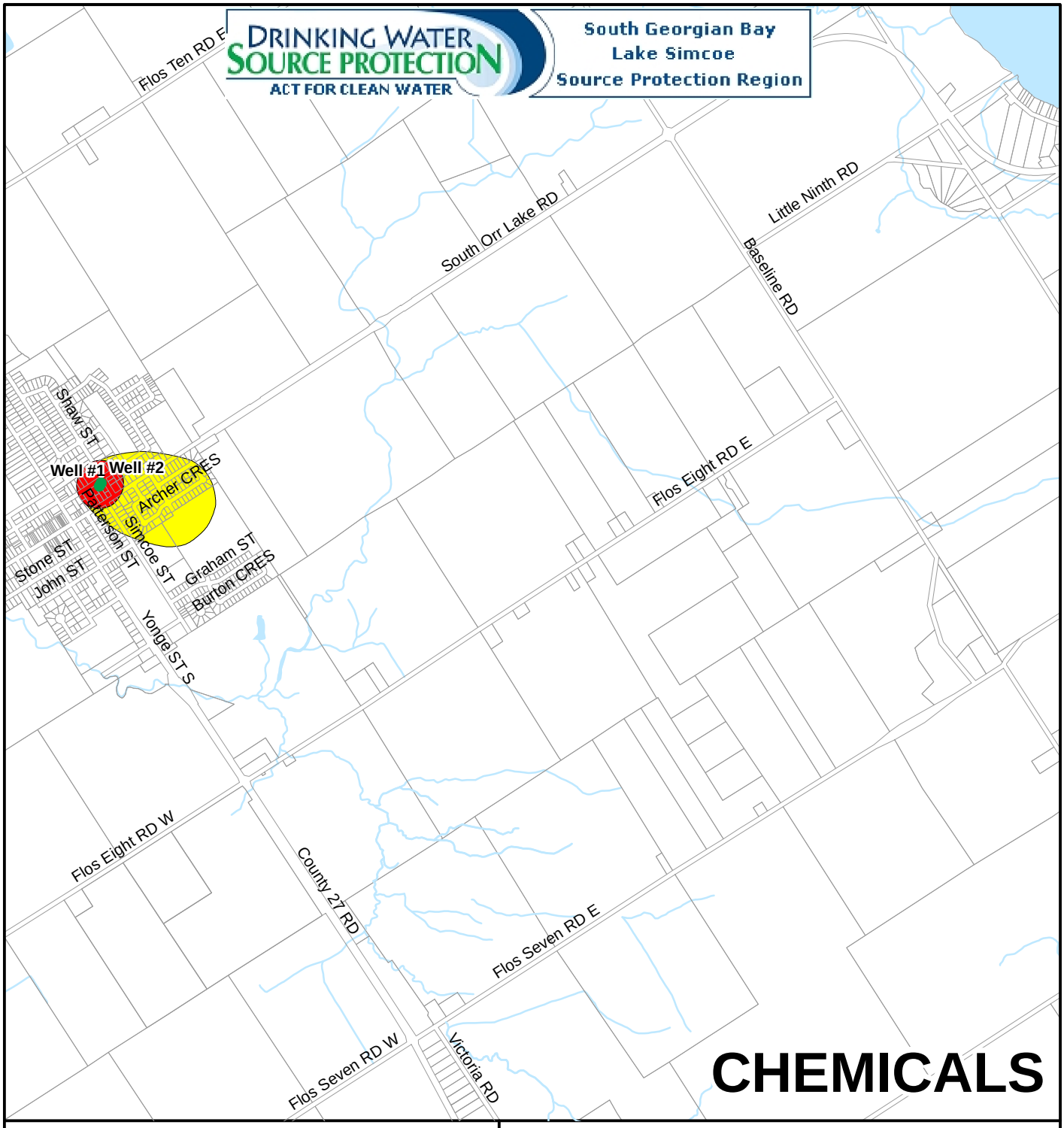
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010	SCALE: 1:25000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.3-4

GENIVAR Ontario

FIGURE **11b-4**

Figure 11b-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats - Elmvale.



LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6

N W E S

250 125 0 250 Metres

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

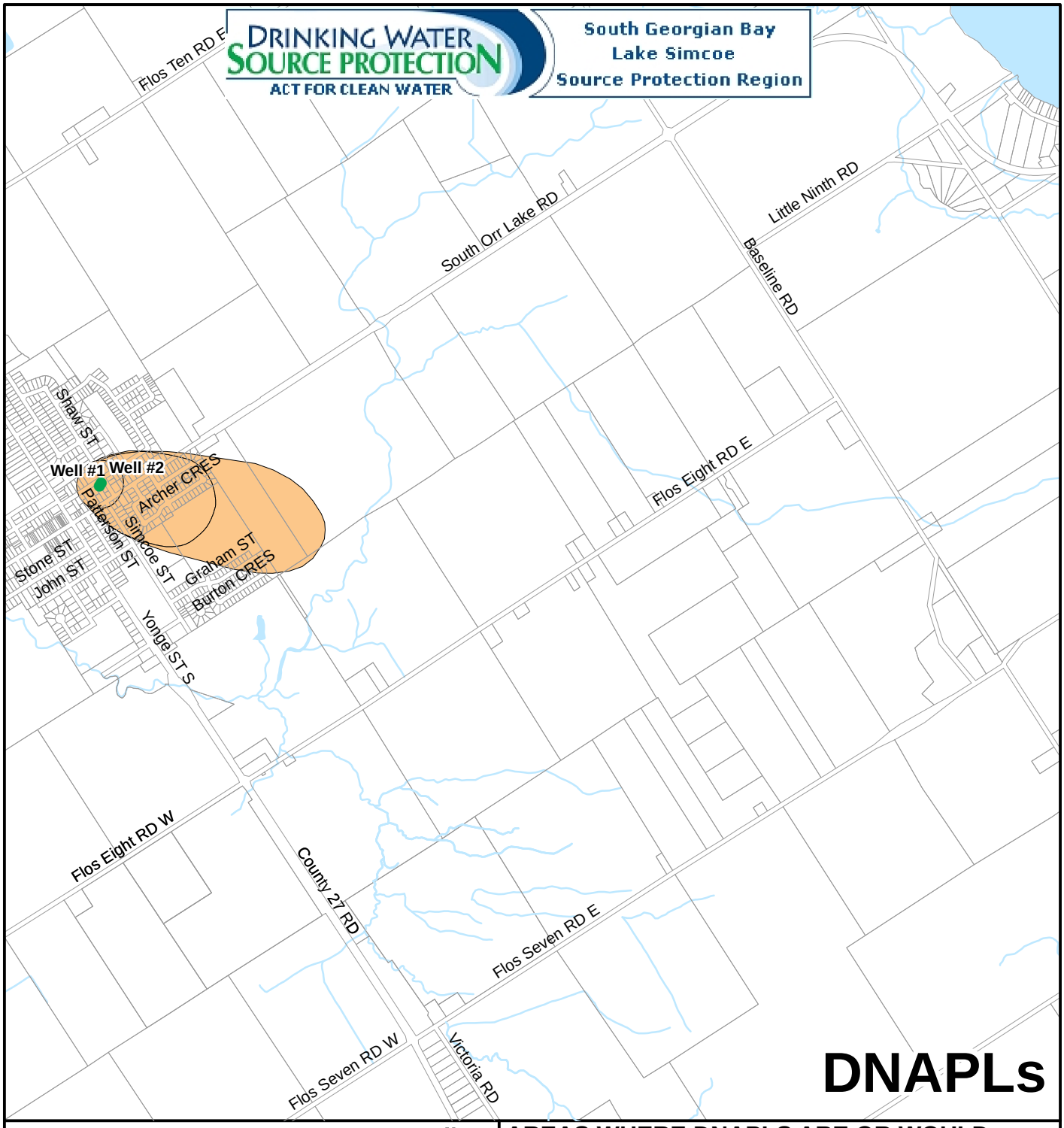
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010	SCALE: 1:25000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.3-5

GENIVAR Ontario

FIGURE **11b-5**

Figure 11b-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats - Elmvale.



LEGEND

- MUNICIPAL WELL LOCATION
- WHPA-C: 5 YEAR TIME-OF-TRAVEL

N W E S

250 125 0 250 Metres

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

AREAS WHERE DNAPLS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - ELMVALE

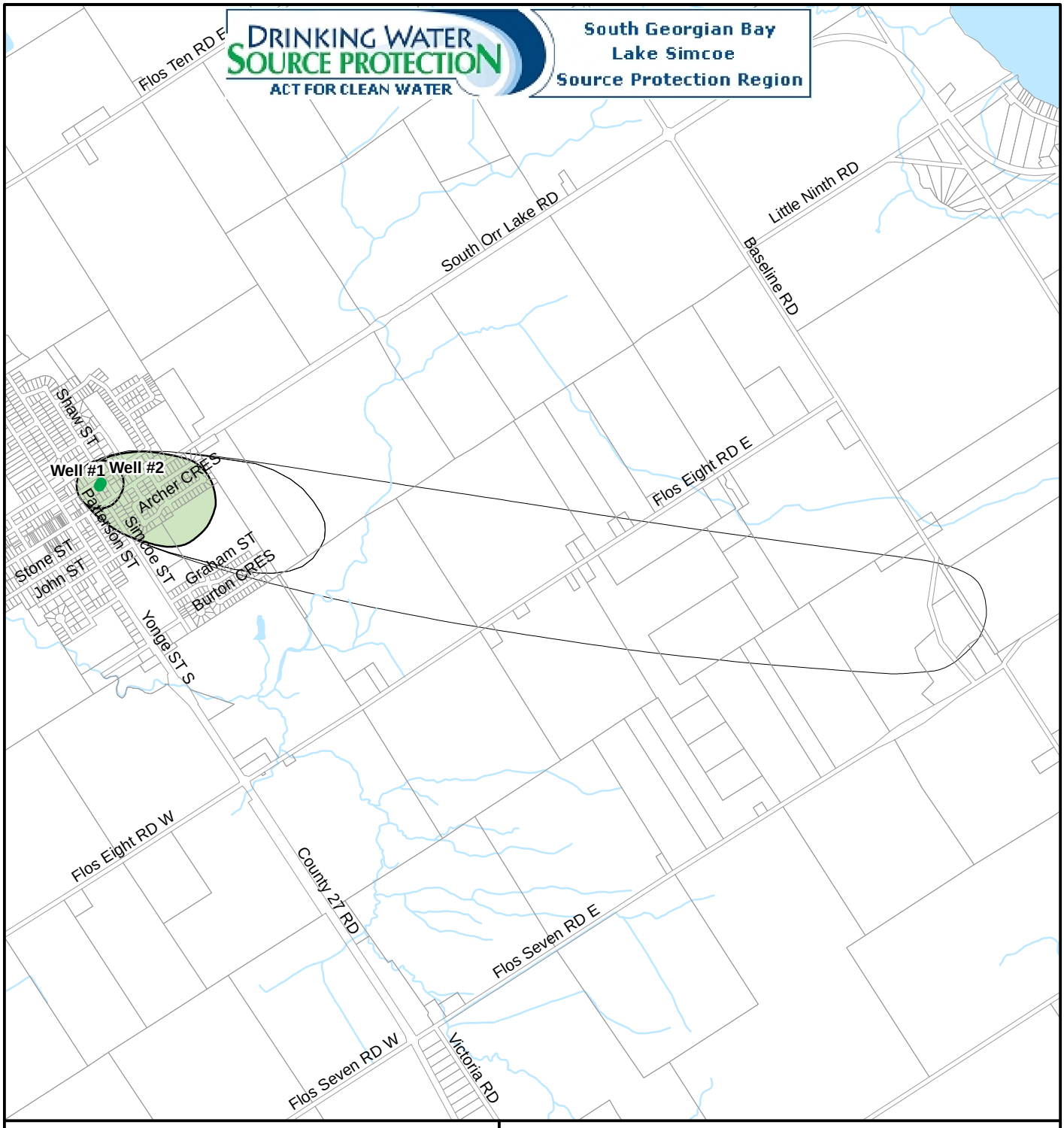
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010	SCALE: 1:25000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.3-6

GENIVAR Ontario

FIGURE **11b-6**

Figure 11b-7: Managed Lands - Elmvale.



Legend

- MUNICIPAL WELL LOCATION
- MANAGED LANDS (<40%)
- MANAGED LANDS (40-80%)
- MANAGED LANDS (>80%)

N W E S

250 125 0 250 Metres

MANAGED LANDS - ELMVALE

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

The Managed Land proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

DATE: JULY 2010 | SCALE: 1:25000

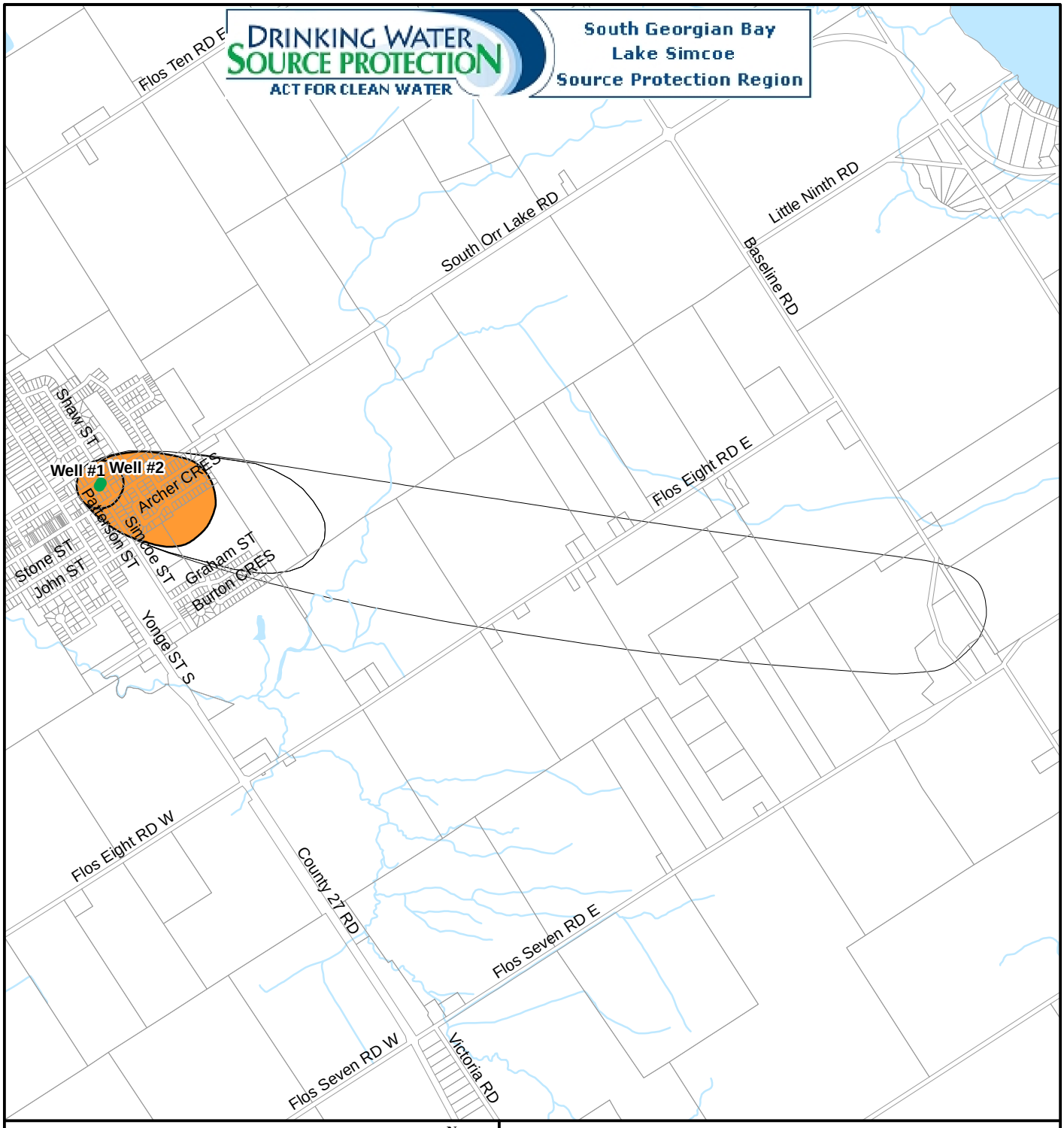
PROJECT: 0-071948.10 | FILE. NO.:0-07194810F16.3-7

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11b-7**

Figure 11b-8: Livestock Density - Elmvale.



Legend

- MUNICIPAL WELL LOCATION
- LIVESTOCK DENSITY (<0.5 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (0.5-1.0 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (>1.0 NUTRIENT UNITS/ACRE)

N W E S

250 125 0 250 Metres

LIVESTOCK DENSITY - ELMVALE

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

The Livestock Density proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

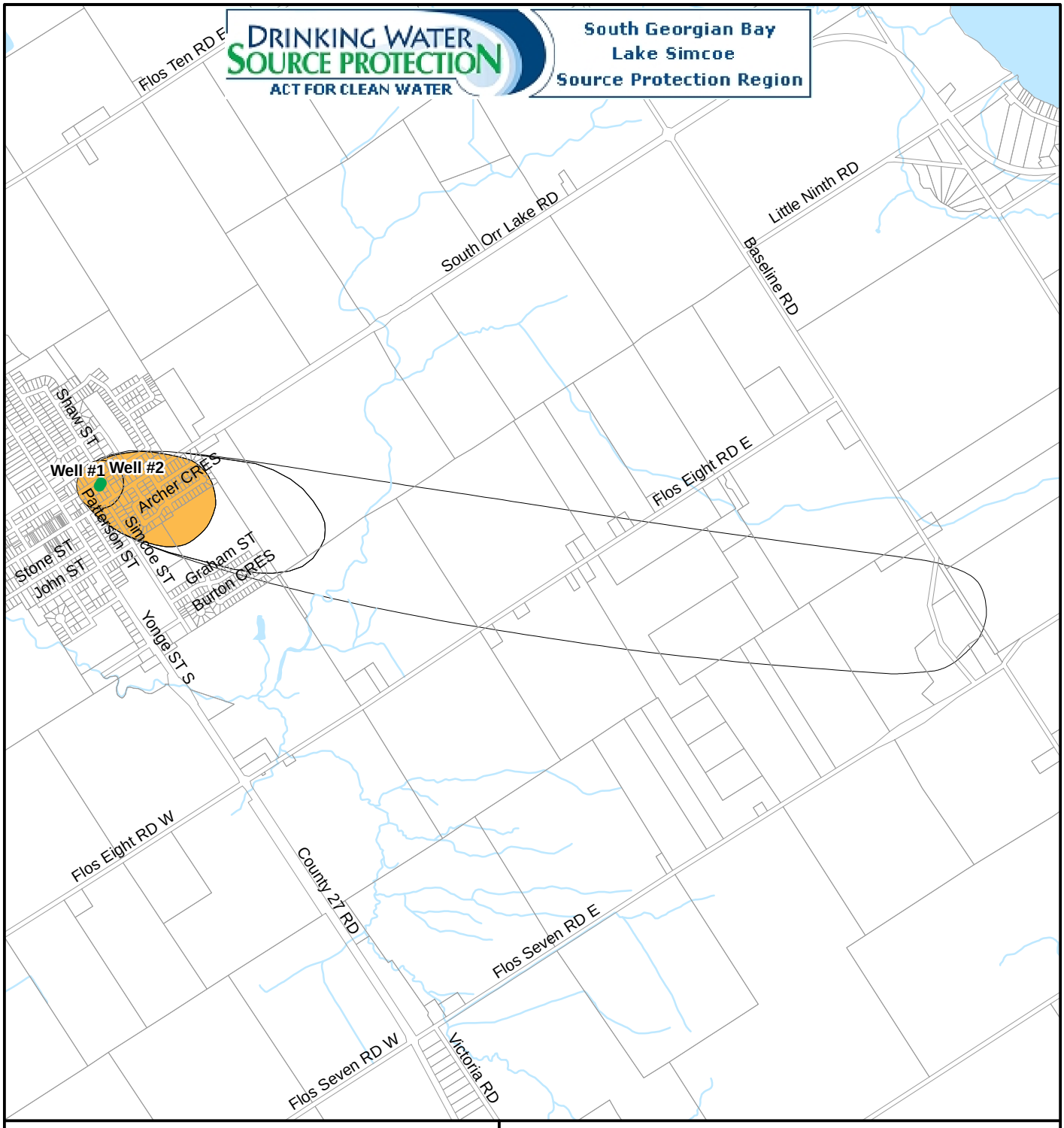
DATE: JULY 2010	SCALE: 1:25000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.3-8

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11b-8**

Figure 11b-9: Impervious Surfaces - Elmvale.



IMPERVIOUS SURFACES - ELMVALE

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

The Impervious Surfaces proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

DATE: JULY 2010 | SCALE: 1:25000

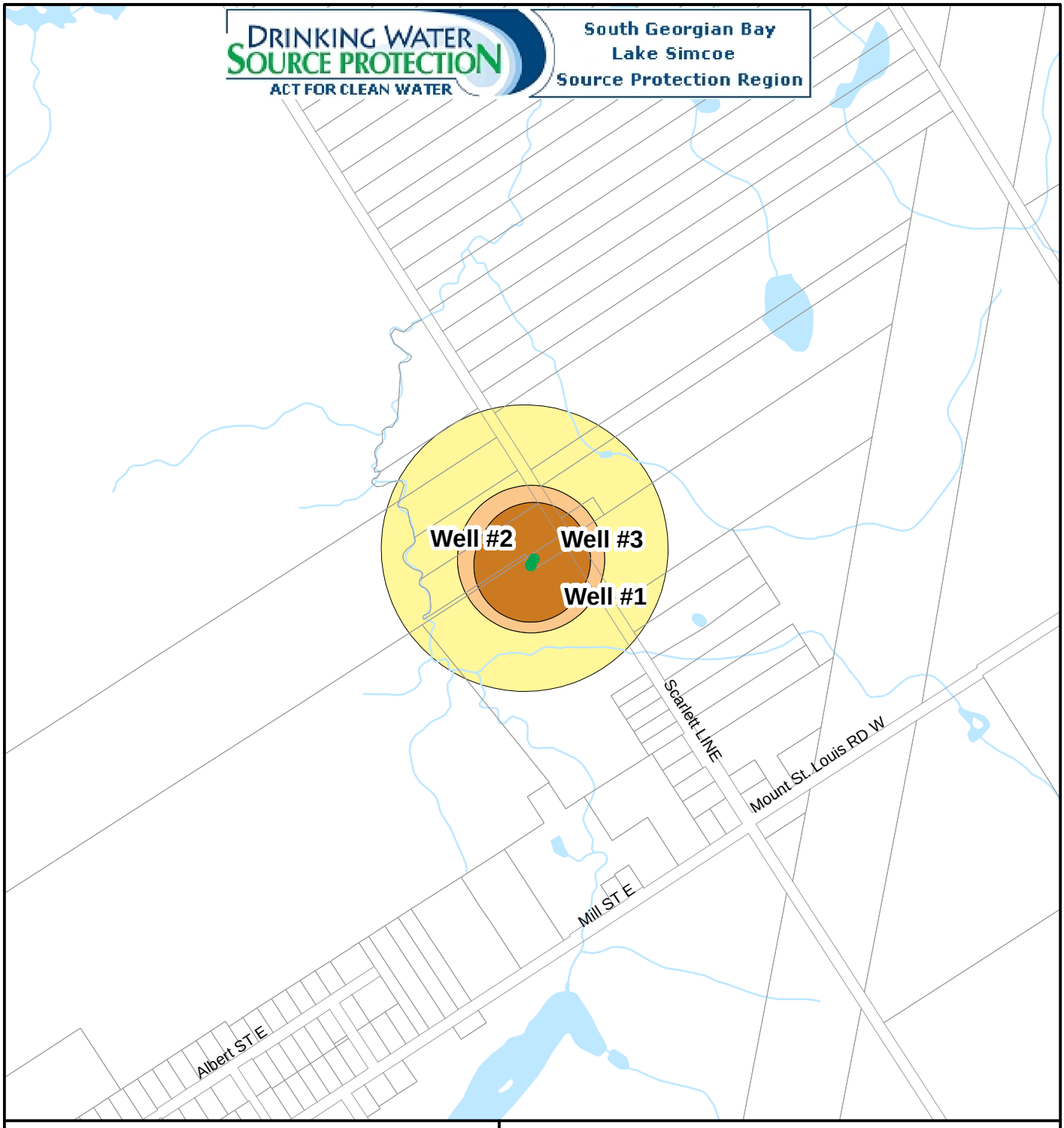
PROJECT: 0-071948.10 | FILE. NO.:0-07194810F16.3-9

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE 11b-9

Figure 11c-1: Wellhead Protection Areas - Hillsdale (Well 2).



Legend

- MUNICIPAL WELL LOCATION
- WHPA-A: 100 m RADIUS
- WHPA-C: 5-YEAR TIME-OF-TRAVEL
- WHPA-D: 25-YEAR TIME-OF-TRAVEL

N W E S

90 45 0 90 Metres

WELLHEAD PROTECTION AREAS (WELL 2) - HILLSDALE, SPRINGWATER

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

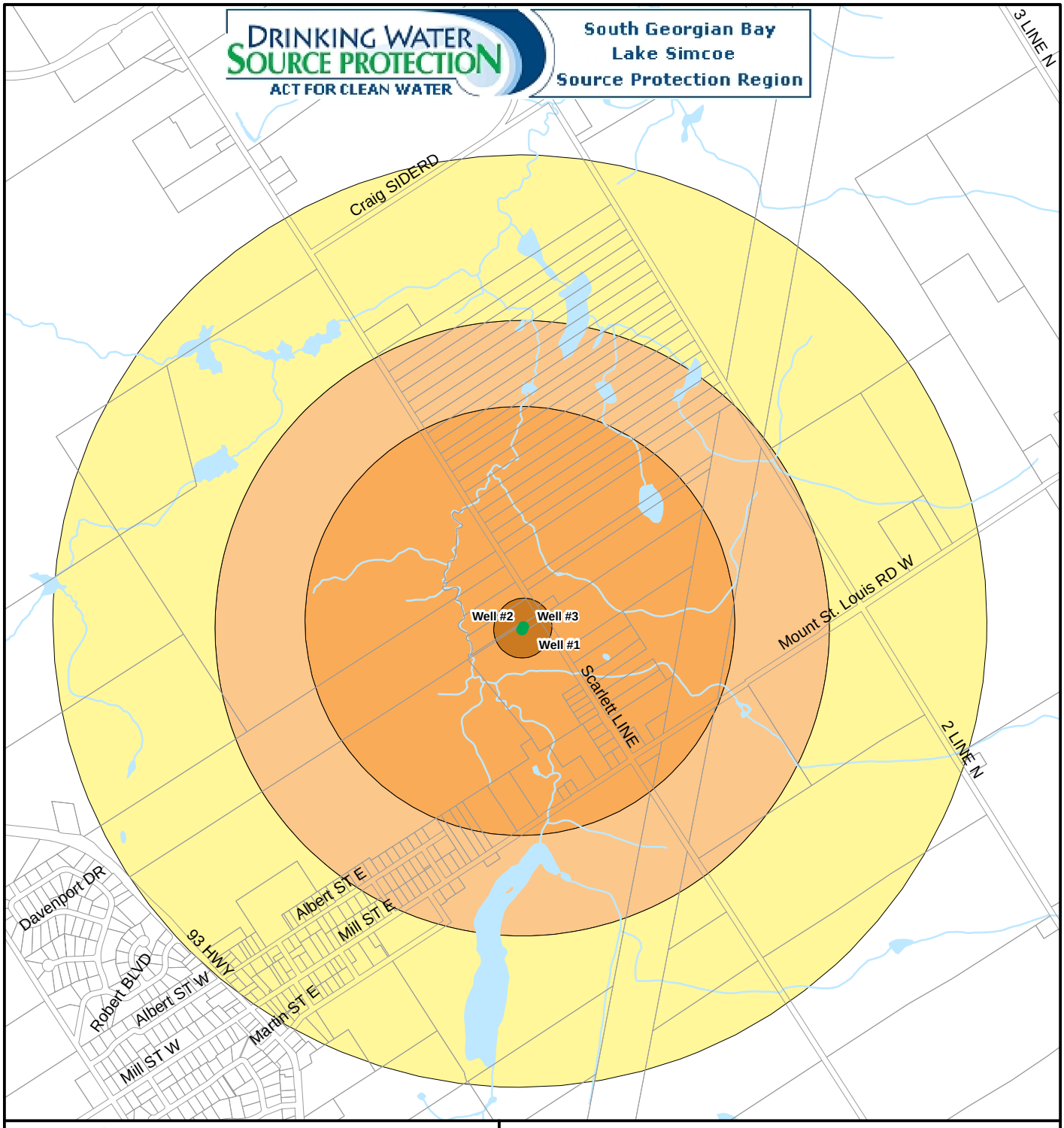
DATE: JULY 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-1

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11c-1**

Figure 11c-2: Wellhead Protection Areas - Hillsdale (Wells 1 & 3).



Legend

- MUNICIPAL WELL LOCATION
- WHPA-A: 100 m RADIUS
- WHPA-B: 2-YEAR TIME-OF-TRAVEL
- WHPA-C: 5-YEAR TIME-OF-TRAVEL
- WHPA-D: 25-YEAR TIME-OF-TRAVEL

N W E S

190 95 0 190 Metres

WELLHEAD PROTECTION AREAS (WELLS 1 & 3) - HILLSDALE, SPRINGWATER

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

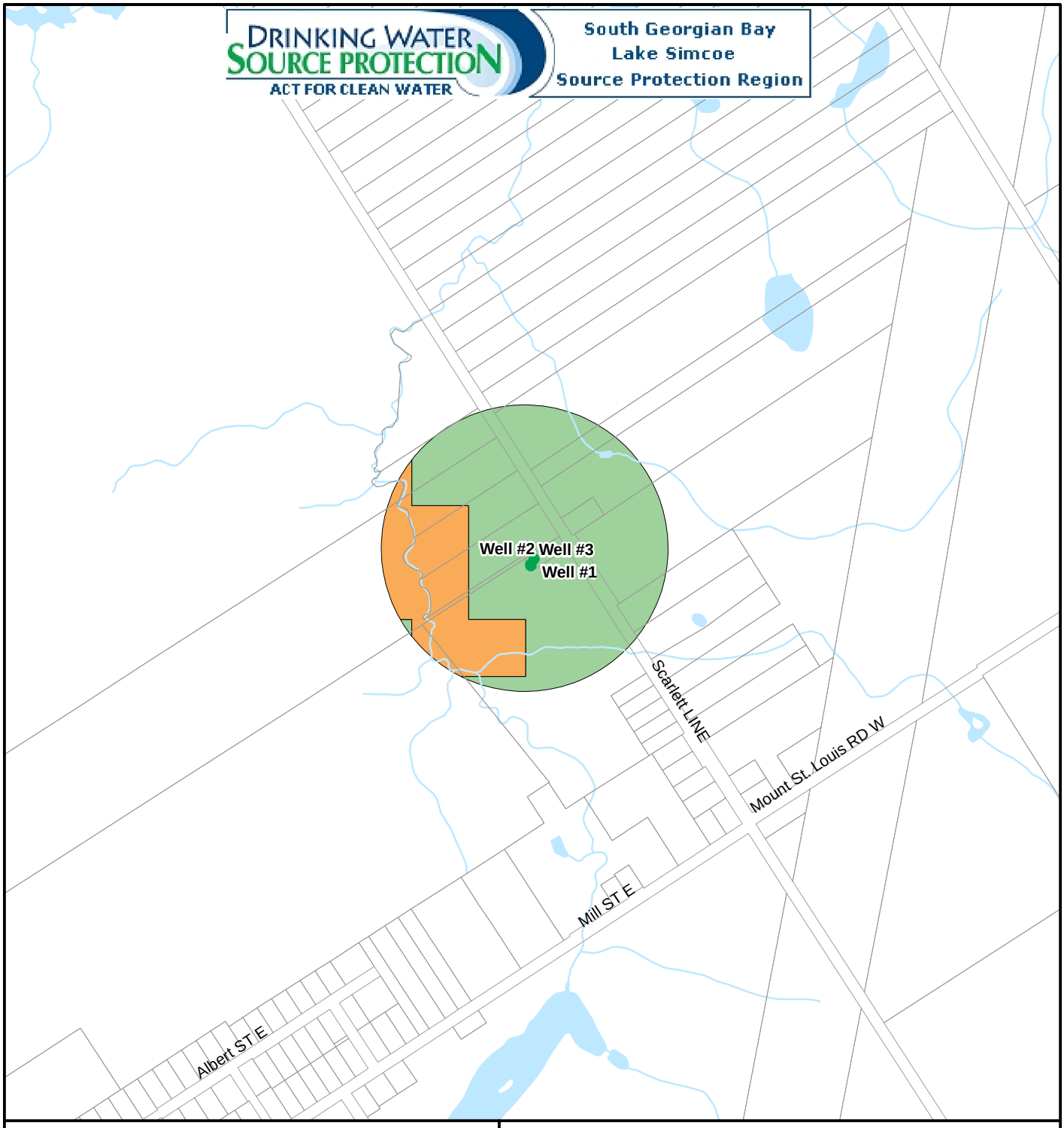
DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-2

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11c-2**

Figure 11c-3: Groundwater Vulnerability - Hillsdale (Well 2).



LEGEND

- MUNICIPAL WELL LOCATION

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

N
W E
S

90 45 0 90 Metres

GROUNDWATER VULNERABILITY - WELL 2 - HILLSDALE

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

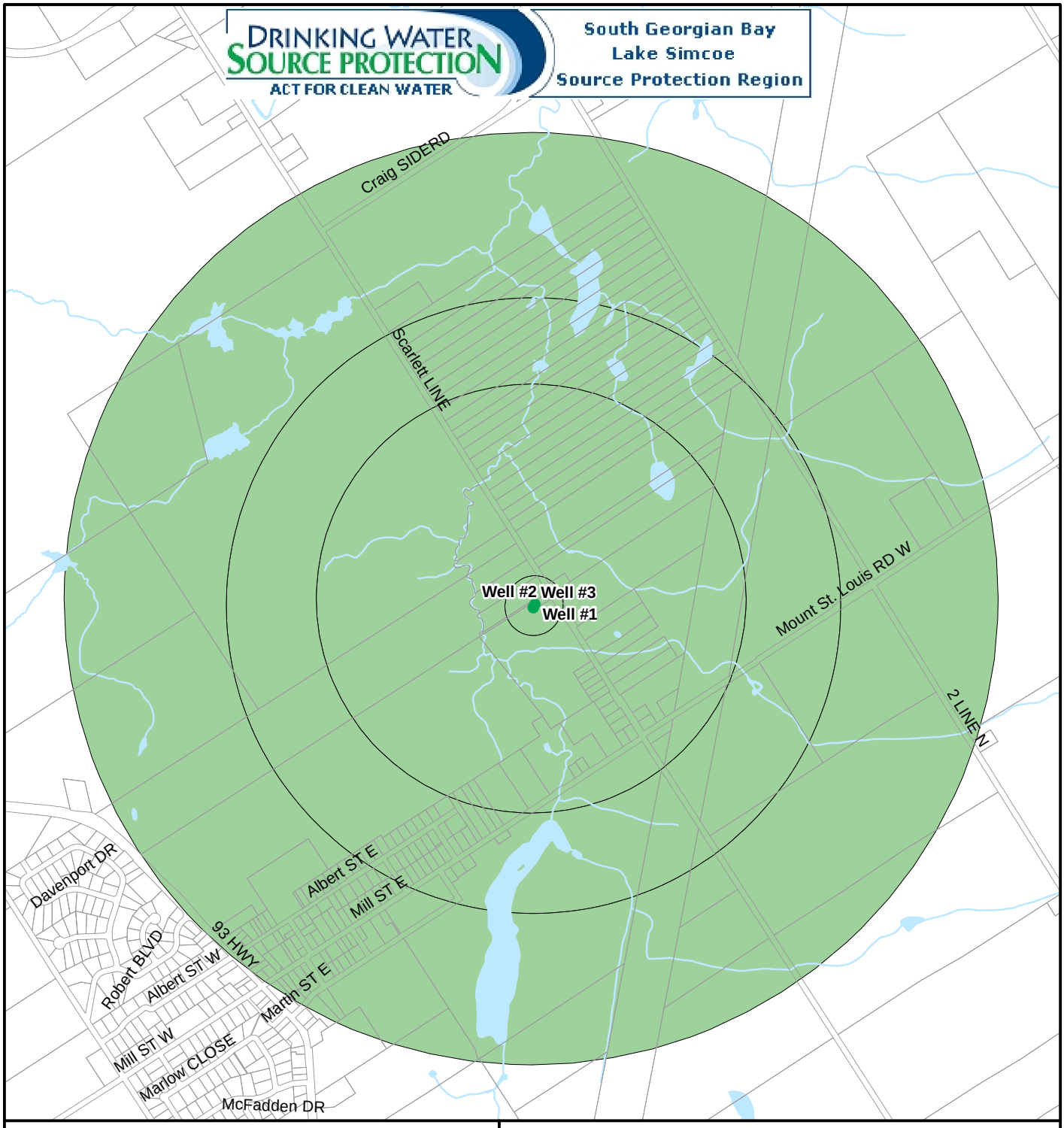
DATE: JULY 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-3

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11c-3**

Figure 11c-4: Groundwater Vulnerability - Hillsdale (Wells1 & 3).



LEGEND

- MUNICIPAL WELL LOCATION

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

N W E S

200 100 0 200 Metres

GROUNDWATER VULNERABILITY - WELLS 1 & 3 - HILLSDALE

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

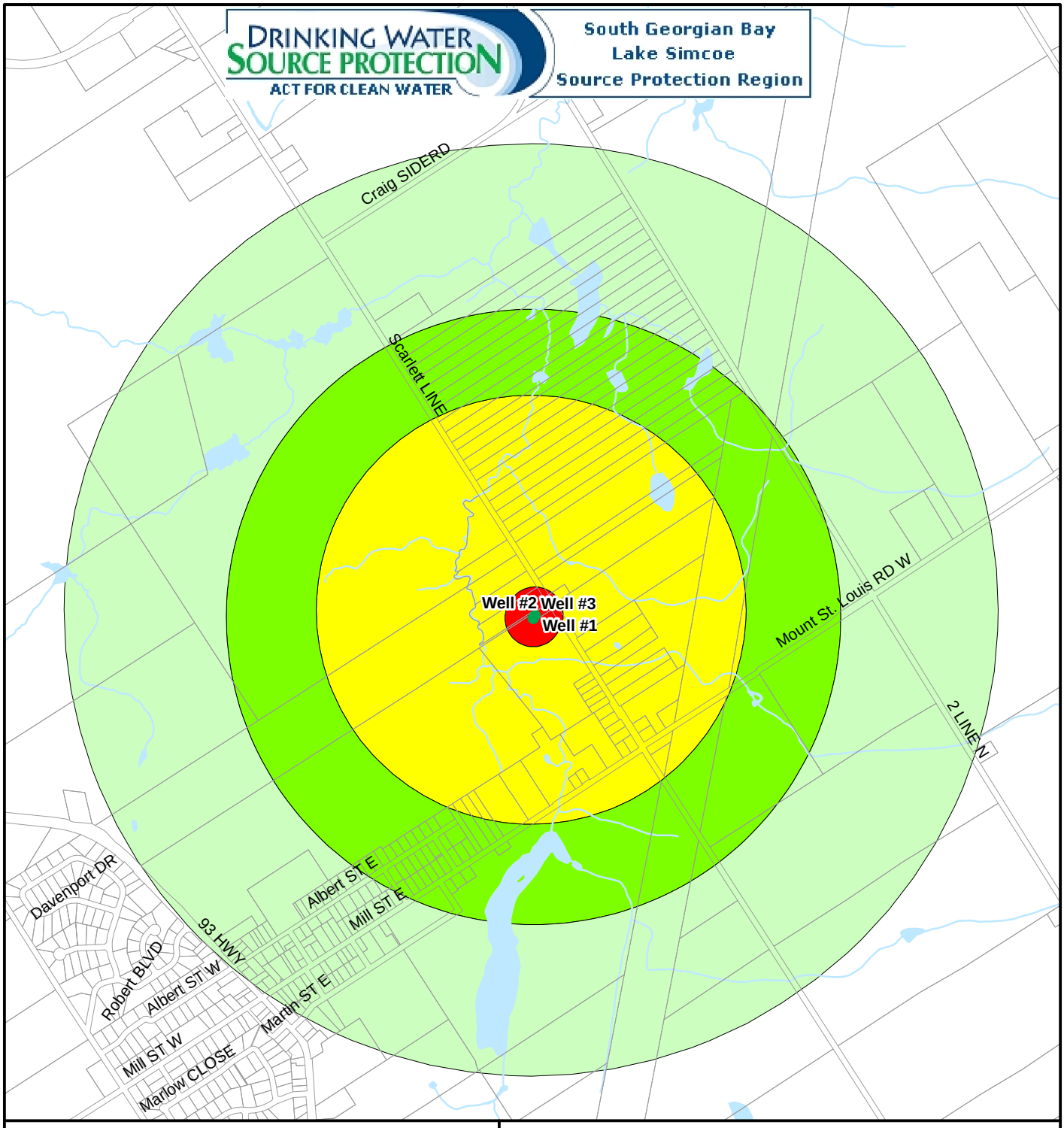
DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-4

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11c-4**

Figure 11c-5: Vulnerability Scores - Hillsdale.



LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6
- 4
- 2

N W E S

200 100 0 200 Metres

VULNERABILITY SCORES - HILLSDALE

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

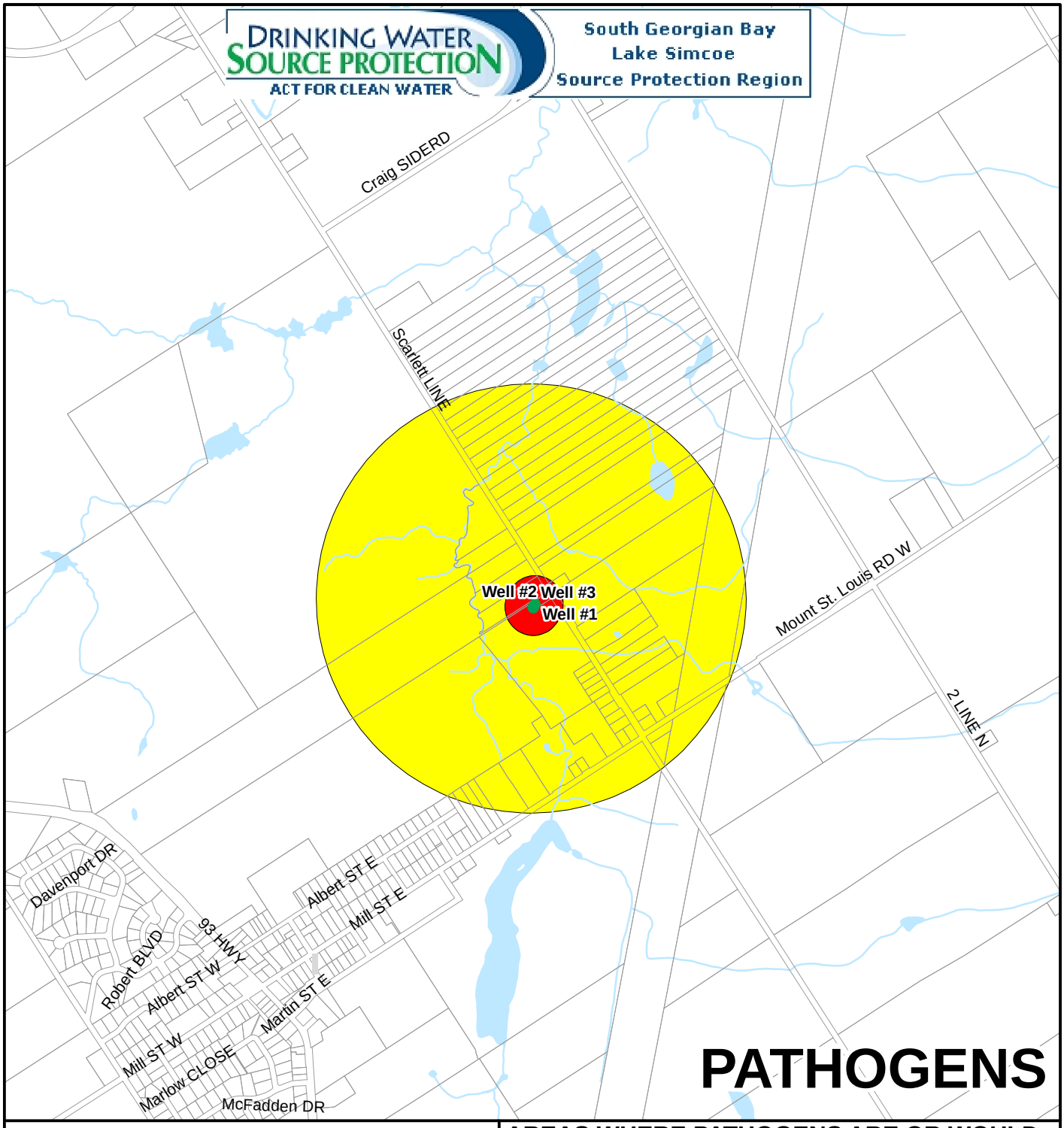
DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-5

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE 11c-5

Figure 11c-6: Areas where Pathogens are or would be Significant, Moderate or Low Threats - Hillsdale.



LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6

N W E S

200 100 0 200 Metres

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - HILLSDALE

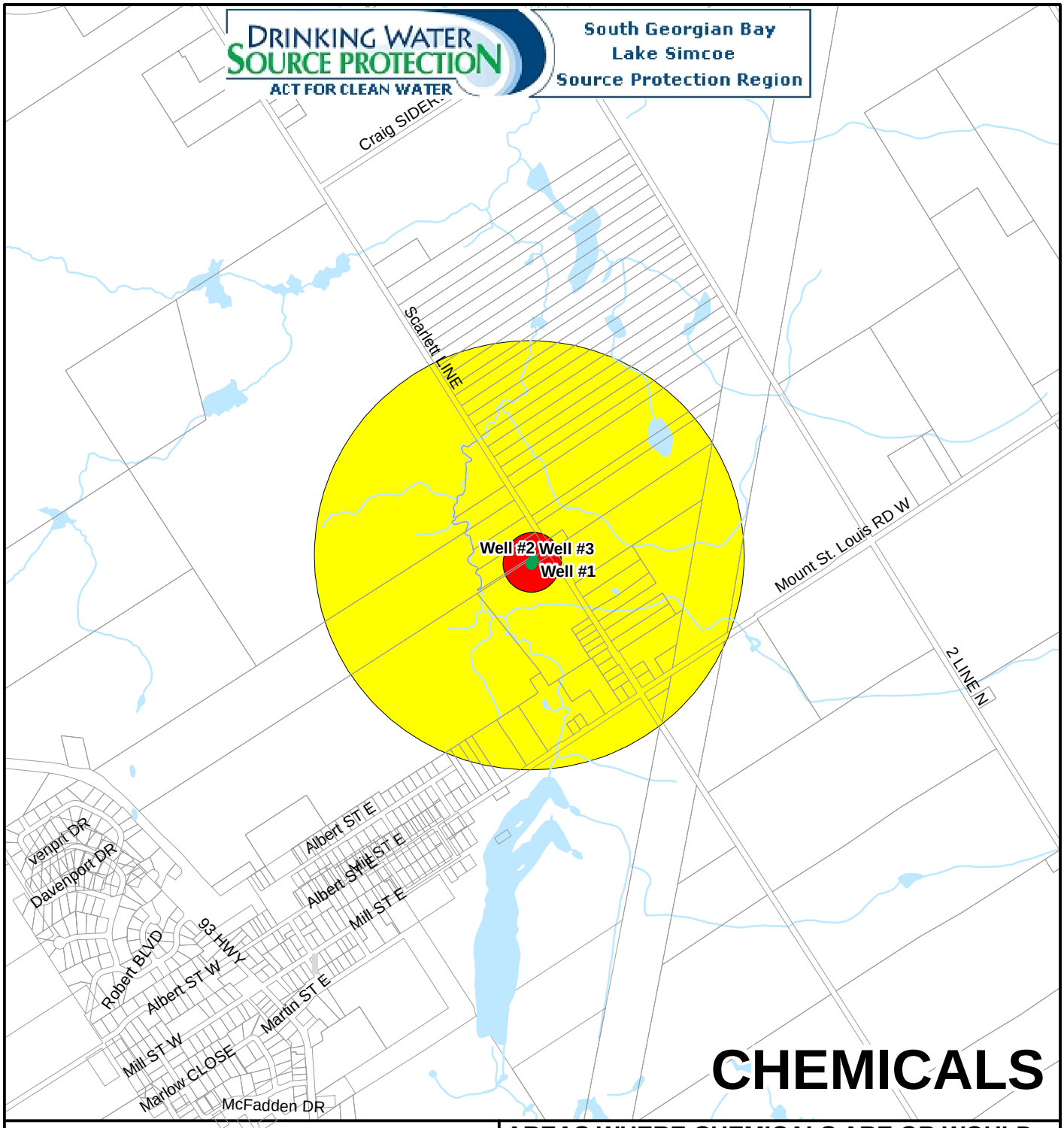
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-6

GENIVAR Ontario

FIGURE **11c-6**

Figure 11c-7: Areas where Chemicals are or would be Significant, Moderate or Low Threats - Hillsdale.



LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6

N W E S

200 100 0 200 Metres

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - HILLSDALE

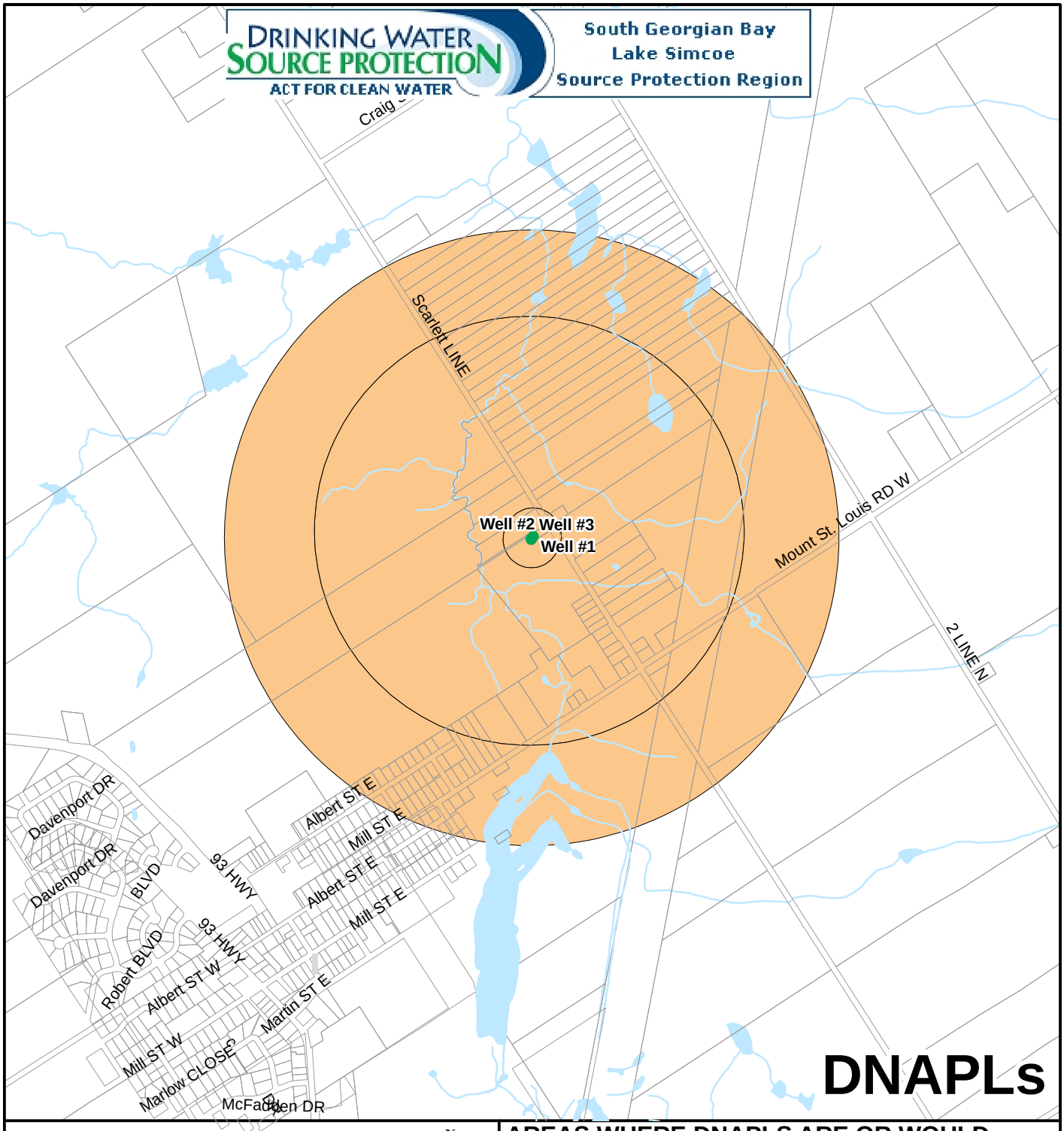
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-7

GENIVAR Ontario

FIGURE **11c-7**

Figure 11c-8: Areas where DNAPLs are or would be Significant, Moderate or Low Threats - Hillsdale.



LEGEND

- MUNICIPAL WELL LOCATION
- WHPA-C: 5 YEAR TIME-OF-TRAVEL

N W E S

200 100 0 200 Metres

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

AREAS WHERE DNAPLS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - HILLSDALE

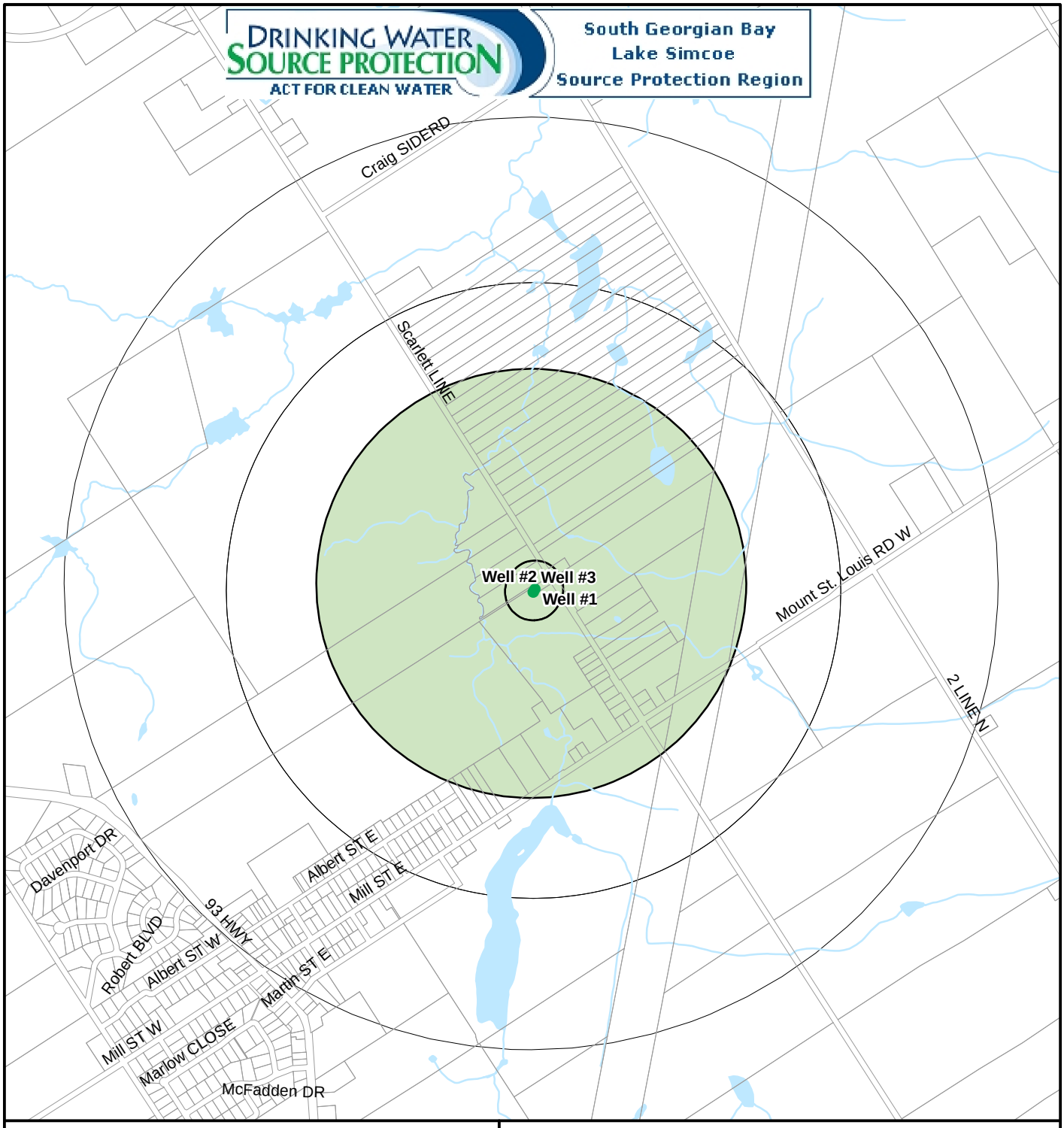
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-8

GENIVAR Ontario

FIGURE **11c-8**

Figure 11c-9: Managed Lands - Hillsdale.



Legend

- MUNICIPAL WELL LOCATION
- MANAGED LANDS (<40%)
- MANAGED LANDS (40-80%)
- MANAGED LANDS (>80%)

N W E S

200 100 0 200 Metres

MANAGED LANDS - HILLSDALE

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

The Managed Land proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

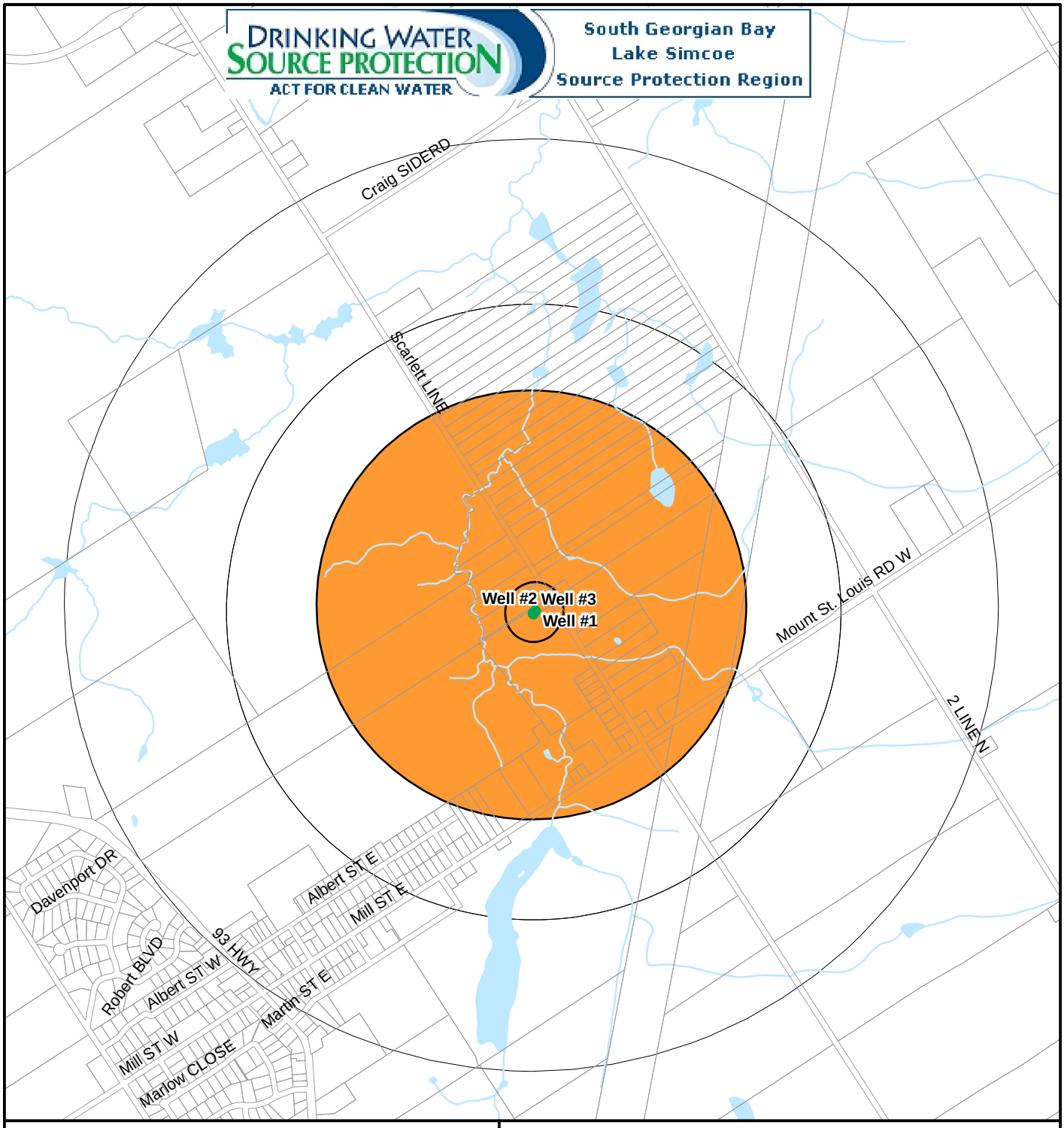
DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-9

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11c-9**

Figure 11c-10: Livestock Density - Hillsdale.



LIVESTOCK DENSITY - HILLSDALE

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

The Livestock Density proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6, and for WHPA-E where the score is greater than 4.

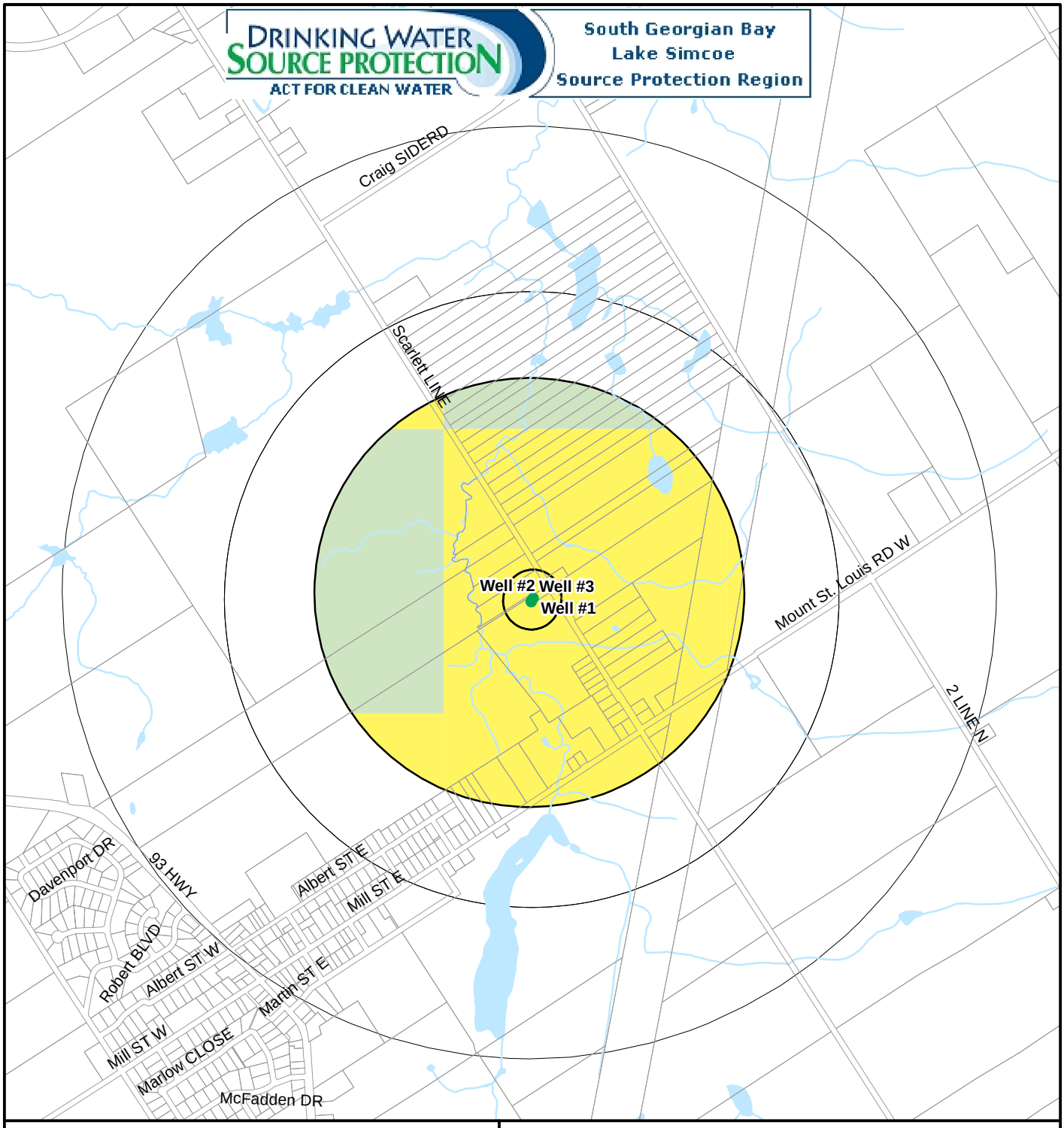
DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-10

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. 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.

GENIVAR Ontario

FIGURE **11c-10**

Figure 11c-11: Impervious Surfaces - Hillsdale.



IMPERVIOUS SURFACES - HILLSDALE

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

The Impervious Surfaces proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.4-11

GENIVAR Ontario

FIGURE 11c-11