Chapter 9: Township of Oro-Medonte

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9.1 Introduction

This chapter contains information on six drinking water systems for the Township of Oro-Medonte that are located within the Severn Sound Source Protection Area. Various consultants have completed the work presented, which has also been 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 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), 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. This report has been updated with information relating to changes to a number of drinking water systems and the addition of the Braestone Well Supply. The updates information is current up to and inclusive of September 21, 2021.

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 OM) for a more in depth description of the methods used, as well as the Glossary for any unfamiliar terms.

9.2 Drinking Water Systems

The Township of Oro-Medonte, located in the middle and northern portion of Simcoe County, operates groundwater based water supplies in twelve (12) communities and no surface water intakes. As shown below and in Figure 9-1 all of the groundwater supplies are within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR). Oro-Medonte Municipal Water Supplies within the Lake Simcoe and Couchiching Black River Source Protection Authority are:

- Canterbury Subdivision (drinking water information system number 220007454) with 2 wells screened in the A2 confined overburden aquifer
- Cedar Brook Subdivision (drinking water information system number 220006936) with 2 wells screened in the A2 confined overburden aquifer
- Harbourwood (drinking water information system number 220006703) with 2 wells screened in the A3 and A4 confined overburden aquifers
- Maplewood Estates (drinking water information system number 220004135) with 2 wells screened in the A4 confined overburden aquifer
- Shanty Bay (drinking water information system number 220005198) with 3 wells screened in the A2 and A3 confined overburden aquifers

Oro-Medonte Municipal Water Supply within the Nottawasaga Valley Source Protection Authority is:

- Craighurst (drinking water information system number 250001322) with 3 wells screened in the A1-SA4 and A2 confined overburden aquifers

Oro-Medonte Municipal Water Supplies within the Severn Sound Source Protection Authority are:

- Braestone (drinking water information system number 220005198) with 2 wells screened in the A2 confined overburden aquifer
- Horseshoe Highlands Subdivision (drinking water information system number 250001402) with 3 wells screened in the A1-SA4 and A2 confined overburden aquifers
- Medonte Hills (drinking water information system number 220003920) with 2 wells screened in the A1-SA4 confined overburden aquifer
- Robin Crest (drinking water information system number 220010752) with 2 wells screened in the A1-SA4 confined overburden aquifer
- Sugar Bush (drinking water information system number 220001518) with 3 wells screened in the A2 and A3 confined overburden aquifers
- Warminster (drinking water information system number 220005125) with 2 wells screened in the A1-SA3 confined overburden aquifer

The list below also indicates the Source Protection Region and corresponding lead Source Protection Authority (SPA) for all of the drinking water systems (or municipal water supply systems) in Oro-Medonte. This chapter discusses the 6 Oro-Medonte groundwater based supplies that are within the Severn Sound SPA.

Oro-Medonte Municipal Water Supplies within the Lakes Simcoe and Couchiching/Black River Source Protection Authority are:

- Canterbury Subdivision (drinking water information system number 220007454) with 2 wells screened in the A2 confined overburden aquifer
- Cedar Brook Subdivision (drinking water information system number 220006936) with 2 wells screened in the A2 confined overburden aquifer
- Harbourwood (drinking water information system number 220006703) with 2 wells screened in the A3 and A4 confined overburden aquifers
- Maplewood Estates (drinking water information system number 220004135) with 2 wells screened in the A4 confined overburden aquifer
- Shanty Bay (drinking water information system number 220005198) with 3 wells screened in the A2 and A3 confined overburden aquifers

Oro-Medonte Municipal Water Supply within the Nottawasaga Valley Source Protection Authority is:

- Craighurst (drinking water information system number 250001322) with 3 wells screened in the A1-SA4 and A2 confined overburden aquifers

Oro-Medonte Municipal Water Supplies within the Severn Sound Source Protection Authority are:

- Braestone (drinking water information system number 220005198) with 2 wells screened in the A2 confined overburden aquifer
- Horseshoe Highlands Subdivision (drinking water information system number 250001402) with 3 wells screened in the A1-SA4 and A2 confined overburden aquifers
- Medonte Hills (drinking water information system number 220003920) with 2 wells screened in the A1-SA4 confined overburden aquifer
- Robin Crest (drinking water information system number 220010752) with 2 wells screened in the A1-SA4 confined overburden aquifer
- Sugar Bush (drinking water information system number 220001518) with 3 wells screened in the A2 and A3 confined overburden aquifers
- Warminster (drinking water information system number 220005125) with 2 wells screened in the A1-SA3 confined overburden aquifer

While still in the Township of Oro-Medonte and within the SGBLS SPR, over half of the water supply systems are located outside of the Severn Sound watershed. Information on the Craighurst Water Supply can be found in the Nottawasaga Valley Assessment Report, Chapter 15. Information on the Canterbury Subdivision, Cedar Brook Subdivision, Harbourwood, Maplewood, Shanty Bay and Craighurst Water Supply systems can be found in the Lake Simcoe Assessment Report, Chapter 11.

Also, WHPAs from five systems, all within the SGBLS SPR, cross into the Township of Oro-Medonte (Table 9-1). WHPAs from the Orillia (City of Orillia), and Bass Lake Woodlands and Coldwater (Township of Severn) cross their municipality's borders into Oro-Medonte. For more

information on these three systems see Chapters 6 and 10 respectively. WHPAs from the Barrie (City of Barrie) and Hillsdale (Township of Springwater) water supplies extend east over the border into Oro-Medonte – for more information see the Lake Simcoe Assessment Report (Chapter 9) for Barrie and the Nottawasaga Valley Assessment Report (Chapter 16) for Springwater.

Table 9-1: WHPA that cross into the Township of Oro-Medonte in the SGBLS SPR.

Local Municipality that WHPA extends into	Municipality where wellhead is located	Name of Water Supply	Source Protection Region & Source Protection Authority (SPA)	Location where entire Assessment can be obtained
Township of Oro-Medonte	The City of Orillia	Orillia	SGBLS SPR & Severn Sound SPA	This report (Chapter 6)
Township of Oro-Medonte	The Township of Severn	Bass Lake Woodlands	SGBLS SPR & Severn Sound SPA	This report (Chapter 10)
Township of Oro-Medonte	Township of Severn	Coldwater	SGBLS SPR & Severn Sound SPA	This report (Chapter 10)
Township of Oro-Medonte	The City of Barrie	Barrie	SGBLS SPR & Lakes Simcoe and Couchiching/Black River SPA	Lake Simcoe Assessment Report (Chapter 9)
Township of Oro-Medonte	The Township of Springwater	Hillsdale	SGBLS SPR & Nottawasaga Valley SPA	Nottawasaga Valley Assessment Report (Chapter 16)

9.3 Braestone Well supply

The Braestone Water Supply is located in the central part of the Township of Oro-Medonte at 26 Georgian Grande Drive in Lot 2, Concession 9 of Oro-Medonte Township, Ontario, south of Horseshoe Valley Road. The Braestone Water Supply consists of two production wells (Wells PW1 and PW2) situated approximately 12 m apart. The wells will serve an estimated population of 802 (229 lots) once the subdivision is fully constructed. Well PW1 was installed and tested in 1990 and Well PW2 was installed in late 2007 and tested in 2008.

According to the Permit to Take Water (PTTW) # 1383-AZ4KXR, issued in June 2018 and which expires on June 13 2028, the rated capacities for Wells PW1 and PW2 are 1,011 m^3/day each.

Well PW1 was constructed with a nominal 200 mm diameter steel casing from surface to a depth of 84.4 m with a nominal 200 mm diameter, telescopic 18 and 10-slot stainless steel screen set from 84.4 to 92.0 mbgl. Well PW2 was constructed with a nominal 200 mm diameter steel casing from surface to a depth of 86.0 m, with a nominal 200 mm diameter 18-slot stainless steel screen set from 86.0 to 92.1 mbgl.

Both of the pumping wells are completed in the A2 sand and gravel aquifer at the same elevation of 216 masl (81 mbgl). The A2 aquifer is overlain and protected by the largely continuous, regional, C1 clayey confining layer (Golder, 2020). In the eastern portion of the Braestone model domain, in the vicinity of Bass Lake, the A2 aquifer is interpreted to have direct hydraulic connection with the A3 aquifer. Golder, (2020) demonstrated that the static water levels in the Braestone pumping wells are approximately 9 metres greater than the static water level at the closest well interpreted to be screened in the A3 aquifer and that the pumped water (at the modelled WHPA rate) arriving at the Braestone well travels within the A2 aquifer (i.e., is not sourced from within the A3 aquifer). The recharge area is believed to be located on the Oro Kame Moraine to the south of the Braestone pumping wells.

The screen interval for Wells PW1 and PW2 have been assigned to the A2 Aquifer in the Braestone groundwater flow model prepared by Golder (2020). The Groundwater Vulnerability rating will be determined for the A2 Aquifer.

9.3.1 Information presented for the Braestone section of this Chapter is based on the Golder 2020 report.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 Braestone Water Supply has been delineated following the process recommended in the Technical Rules (MOE, 2017). The areas that were 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 Braestone WHPA. Details of the methods for the Vulnerability Analysis are provided in Golder (2020).

9.3.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Braestone wells were delineated in 2020 by Golder using a 3-dimensional numerical groundwater flow model. The well locations and the Braestone WHPA are shown in Figure 9-1. WHPA delineation methods are documented in Golder, 2020.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2020) study delineated time-of-travel (TOT) zones for 2 years, 5 years and 25 years.

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

9.3.1.2 Groundwater Vulnerability

The Braestone wells draw water from the regional A2 confined overburden aquifer layer. The Groundwater Vulnerability for the municipal overburden aquifer was determined using the Intrinsic Susceptibility Index (ISI) method. This method is outlined in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO) as well as Golder (2020).

The Groundwater Vulnerability within the WHPA of the two municipal wells in the Braestone Water Supply is shown in Figure 9a-1. The Groundwater Vulnerability for the A2 municipal water supply aquifer within the WHPA is considered to be Low.

9.3.1.3 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 Braestone WHPA that are considered to have the potential to be Transport Pathways (JHL, 2008). The aggregate extraction operations located southwest (the Oro Pit operated by Sargeant Co.) and east (Oro Pit operated by Nelson Aggregates) of the Braestone WHPAs have been accounted for in the groundwater flow model and vulnerability assessment (Golder, 2020). Based on the available knowledge there is not sufficient potential for the aggregate operations to produce a preferential pathway and change the vulnerability rating. The Groundwater Vulnerability map (Figure 9a-1) is therefore proposed to be used to generate the Vulnerability Scores.

9.3.1.4 WHPA-E / WHPA-F

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

9.3.1.5 Vulnerability Score

The WHPA zones for the Braestone Water Supply, as shown in

Figure 9a-, and the Groundwater Vulnerability, as shown in Figure 9a-1, were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 9a-2 illustrates the Vulnerability Scores for the Braestone WHPA. Figure 9a-2 will be used to assess Drinking Water Threats in Section 9.7.3.

9.3.1.6 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)).

The uncertainty delineation of the Braestone WHPAs was determined by Golder (2020). Based on professional judgement the areas encompassed within the 2 year (TOT) WHPA were categorized as “low uncertainty”, where the remaining areas within the overall WHPA were categorized as “high uncertainty” (Golder, 2020).

9.3.1.7 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). 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 Braestone 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 Braestone are provided in JHL (2008) and Golder (2020).

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

9.3.2 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Braestone 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 Braestone 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

9.3.2.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Braestone 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.

9.3.2.2 List of Drinking Water Threats – Conditions

Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO).

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

9.3.2.3 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 table of drinking water threat circumstances can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at https://swpip.ca/

9.3.3.4 Pathogen Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9a-4 to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Braestone 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.

9.3.2.3.1 Chemical Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9a- to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Braestone 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.

9.3.2.3.2 DNAPL Chemical Parameters

Figure 9a-3 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of at least 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Braestone Water Supply. The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9a-3 to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 9.3.2.2, no Conditions have been confirmed within the WHPA for the Braestone 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. Conditions can only be identified as a significant risk if they are located in Issue Contributing Areas and may contribute to the Issue associated with these areas.

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 9a-2 illustrates the Vulnerability Score map for Braestone Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

9.3.2.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Braestone 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 9-2 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Braestone Water Supply. Significant Drinking Water Threats were identified within WHPA-A.

- Eight (8) activities that are considered to be Significant Drinking Water Threats were identified in association with seven (8) land parcels in the WHPA for the Braestone Water Supply, all relating to residential land use via the use of private individual sewage disposal systems.

Table 9-2: Number of Significant Drinking Water Threats for the Braestone Drinking Water Supply

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

Threat Number	Threat	Significant Threat Counts Number of threats	Significant Threat Counts Number of parcels
12	The application of road salt.	0	0
13	The handling and storage of road salt.	0	0
14	The storage of snow.	0	0
15	The handling and storage of fuel.	0	0
16	The handling and storage of dense non-aqueous phase liquid.	0	0
17	The handling and storage of an organic solvent.	0	0
18	The management of runoff that contains chemicals used in the de-icing of aircraft.	0	0
21	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0	0
22	The establishment and operation of a liquid hydrocarbon pipeline	0	0
-	Totals	8	8

9.4 Horseshoe Highlands Well Supply

The Horseshoe Highlands Water Supply is located in the central part of the Township of Oro-Medonte in the vicinity of the Horseshoe and Horseshoe Highlands ski and golf facilities. The Horseshoe Highlands Water Supply consists of three water supply wells: Well 1, Well 2 and Well 3. The wells are located on the south side of Horseshoe Valley Road between County Club Drive and Valley Crest Drive. The wells serve the Horseshoe Valley developments with an estimated population of 1,022 (362 lots) based on 2001 data. The wells were constructed in 1988, 1987, and 2014 respectively.

According to the Permit to Take Water (PTTW) 1827-ANXPWH issued on August 8, 2017 and which expires on December 31, 2023, the rated capacity for the maximum rated capacity for Well 1 is 3,371 m^3/day, no maximum rated capacity for Well 2, and the maximum rated capacity for Well 3 is 4,580 m3/day. Wells 1 and 3 provide the water on a day-to-day basis while Well 2 is a standby well.

All wells were drilled into a confined overburden aquifer system. Well 1 was constructed with a nominal 305 mm diameter steel casing to a depth of 73.2 m and a nominal 305 mm diameter 13.7 m long 25 and 15, 20-slot telescoping stainless steel screen. The well annulus was sealed with cement grout from surface to 18.3 mbgl. Well 2 was constructed with a nominal 152 mm diameter steel casing to a depth of 73.2 m and a nominal 152 mm 16-slot stainless steel screen set from 73.2 to 79.2 mbgl. Well 3 was constructed with a normal 300 mm steel casing to a depth of 85.3 m and a nominal 300 mm 30 slot stainless steel screen set at a depth of 67 to 84 mbgl.

The regional sand aquifer that supplies the municipal system is present between elevations from approximately 220 to 265 masl (approximately 50 to 95 mbgl). The aquifer may be unconfined more than 3 km west of the wellfield (towards Craighurst). The aquifer extends to the east beyond the Sugarbush subdivisions.

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

Information presented for the Horseshoe Highlands section of this Chapter is based on Golder 2022 report.

9.4.1 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 Horseshoe Highlands Water Supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that were 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 Horseshoe Highlands WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

9.4.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Horseshoe Highlands wells 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. Golder provided updated WHPA for this study through use of a 3-D numerical model (Golder 2010). Pumping by other water users with a permit to take water in the vicinity of the municipal wells was considered in delineation of the WHPA. In 2015 Golder completed a re-evaluation of the WHPA that included the use of Well 3 using the numerical groundwater flow model developed in 2009 (Golder 2022). The updated well locations and the WHPA are shown in

Figure 9a-. WHPA delineation and adjustment details are documented in Golder 2022.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2010) study delineated time-of-travel zones (TOT) for 2 years, 5 years and 25 years.

The WHPA reflect groundwater flow from southeast to northwest. This is reasonable based on topography and available data describing regional groundwater flow patterns.

9.4.1.2 Groundwater Vulnerability

The Horseshoe Highlands wells draw water from a confined overburden aquifer layer (regional aquifer A2). The Groundwater Vulnerability for the municipal overburden aquifer 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 intrinsic Groundwater Vulnerability within the WHPA of the three municipal wells in the Horseshoe Highlands Water Supply is shown in Figure 9a-1. The Groundwater Vulnerability for the A2 municipal water supply aquifer within the WHPA is considered to be Medium in the immediate vicinity of the wellheads and low beneath WHPA-B to WHPA-D.

9.4.1.3 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.

Two wells were identified within the Horseshoe Highlands WHPA that are considered to have the potential to be a Transport Pathway. They are both located within an area of Low Vulnerability. The Vulnerability Rating at the well locations and the 30 m radius around them has been increased from Low to Medium Vulnerability.

9.4.1.4 WHPA-E

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

9.4.1.5 Vulnerability Score

The WHPA zones for the Horseshoe Highlands Water Supply, as shown in

Figure 9a-, and Groundwater Vulnerability, as shown in Figure 9a-1, were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 9a-2 illustrates the Vulnerability Scores for the Horseshoe Highlands WHPA. Figure 9a-2 will be used to assess Drinking Water Threats in Section 9.4.3.

9.4.1.6 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 Rating of the Horseshoe Highlands WHPAs delineation was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Horseshoe Highlands WHPAs is High. The full results of the

WHPA delineation Peer Review process, for Horseshoe Highlands is available in Appendix OM 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 Horseshoe Highlands WHPA is High. The Vulnerability Rating for the Horseshoe Highlands 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.

The Uncertainty Rating for the Horseshoe Highlands WHPA was not changed as part of the 2022 update and was left as a High Uncertainty Rating. The quantity of available geological and hydrogeological data in the area of the WHPA has not changed significantly since the original uncertainty analysis was conducted by Dillon Consulting (2010) and therefore the Uncertainty Rating should not change.

9.4.2 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 Horseshoe Highlands 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 Horseshoe Highlands are provided in Technical Memorandum L1 – Drinking Water Issues Evaluation – Oro-Medonte (Appendix OM).

No Drinking Water Issues were identified for the Horseshoe Highlands Water Supply.

Several parameters were observed on occasion or in low concentrations that are consistently less than the Ontario Drinking Water Quality Standard (ODWQS) values, including turbidity. Trends of increasing concentrations that would exceed the ODWQS value within 50 years were not observed,

Trihalomethanes and other disinfection by-products 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.

The rare presence of coliform bacteria in raw or treated water is not considered to represent a specific Drinking Water Issue as these parameters have only been rarely observed under circumstances that are not considered to be persistent.

9.4.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Horseshoe Highlands Water Supply was originally completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). In 2022, following the update to the WHPA mapping and vulnerability scoring the assessment of drinking water threats for the Horseshoe Highlands Well Supply was also updated. 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 Horseshoe Highlands 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.

9.4.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Horseshoe Highlands 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.

9.4.3.2 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 Horseshoe Highlands 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 Oro-Medonte staff to identify potential conditions within the identified WHPA for the drinking water supply.

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

9.4.3.3 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 table of drinking water threat circumstances can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tab can be found at: https://swpip.ca/

9.4.3.3.1 Pathogen Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9a-4 to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Horseshoe Highlands 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.

9.4.3.3.2 Chemical Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9a- to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Horseshoe Highlands 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.

9.4.3.3.3 DNAPL Chemical Parameters

Figure 9a-3 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of at least 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Horseshoe Highlands Water Supply. The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9a-3 to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 9.4.3.2, no Conditions have been confirmed within the WHPA for the Horseshoe Highlands 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 9a-2 illustrates the Vulnerability Score map for Horseshoe Highlands Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

9.4.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Horseshoe Highlands Water Supply was originally 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. In 2022, following the update to the WHPA mapping and vulnerability

scoring the assessment of existing drinking water threats for the Horseshoe Highlands Well Supply was completed, resulting in no new Significant Drinking Water Threats. There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 9-3 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Horseshoe Highlands Water Supply. Significant Drinking Water Threats were identified within WHPA-A.

Seven (7) activities that are considered to be Significant Drinking Water Threats were identified in association with seven (7) land parcels in the WHPA for the Horseshoe Highlands Water Supply. Five (5) parcels are identified as having significant threat activities relating to residential land use 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 nine (9) residential parcels within this area. One (1) parcel was identified with the potential application of pesticide to land.

Table 9-3: Number of Significant Drinking Water Threats for the Horseshoe Highlands Drinking Water Supply.

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

Threat Number	Threat	Significant threat counts Number of threats	Significant threat counts Number of parcels
14.	The storage of snow.	0	0
15.	The handling and storage of fuel.	1	1
16.	The handling and storage of dense non-aqueous phase liquid.	0	0
17.	The handling and storage of an organic solvent.	0	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0	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	0
20.	Any activity that reduces the recharge of an aquifer.	0	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0	0
-	Totals:	7*	7

*5 verified existing Threats and 2 potential Threats that require further verification (2015)

9.4.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) 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 Table of Drinking Water Threats.

Managed Lands were identified and the managed lands proportions were determined for the WHPA of the Horseshoe Highlands 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 9.4.3.5). 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 9a- illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Horseshoe Highlands Water Supply.

9.4.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) 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 Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Horseshoe Highlands 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 9.4.3.5). 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 9a-4 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Horseshoe Highlands Water Supply. The Livestock Density was estimated for the identified Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

9.4.3.5.3 Impervious Surfaces

Technical Rule 16(11) (December 2021) 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 Part XII of the Technical Rules (December 2021).

The proportion of Impervious Surfaces within the delineated WHPA zones for the Horseshoe Highlands 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 9.4.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 9a-5 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Horseshoe Highlands Well Supply.

9.5 Medonte Hills Well Supply

The Medonte Hills and Robin Crest (Section 9.6) Water Supplies provide water for the community of Moonstone, located in the north part of the Township of Oro-Medonte, approximately 25 km north of Barrie. The Medonte Hills Water Supply consists of two water supply wells: Well 1 and Well 2, and they are located approximately 1,850 m south of Moonstone Rd. West and approximately 75 m east of the 7th Concession Line North. Along with the Robin Crest wells, the Medonte wells serve an estimated population of 505 persons based on 2001 data. The Medonte Hills wells were constructed in 1973 and 1974. The Robin Crest Water Supply is discussed in the following section (Section 13.8). One set of figures has been used to present the required map products for both systems.

According to the Permit to Take Water (PTTW) #92-P-3029 issued on December 18 2001 and which expires December 15 2011 for the Medonte Hills Water Supply, the rated capacity for Well 1 is of 327 m^3/day and for Well 2 is of 393 m^3/day. Medonte Wells 1 and 2 alternate to provide water to the subdivision on a day-to-day basis.

Medonte Well 1 was constructed with a nominal 152 mm diameter steel casing from surface to 62.2 mbgl, with a 4.88 m long 25-slot stainless steel screen. Medonte Well 2 was constructed with a nominal 152 mm diameter steel casing from surface to a depth of 68.6 m, with a 2.13 m long 152 mm diameter 25-slot stainless steel screen.

The two wellfields that service Moonstone extract water from a confined sand and gravel aquifer identified at approximately 205 to 215 masl (60 to 70 mbgl) at the Medonte Hills Water Supply and approximately 210 to 230 masl (52 to 72 mbgl) at the Robin Crest Water Supply. The minimum thickness of the overlying confining layer, approximately 15 m, is encountered at the Medonte Hill wellfield. The aquitard is reported to consist of clayey silt or clay till. At least two more aquifers were identified in the vicinity of the wellfields which are located above the municipal aquifer. An apparent fourth aquifer at the Robin Crest Water Supply may be a lower component of the municipal aquifer that is not identified at the Medonte Hills Water Supply because the upper contact of bedrock is locally elevated. The recharge area for the municipal aquifer is believed to be located southwest of the wellfields in the vicinity of Mount St.Louis.

The screen intervals for Medonte Wells 1 and 2 have been assigned to the A1-SA4 Aquifer in the draft regional hydrostratigraphic model prepared by AquaResource and Golder (2009). The Groundwater Vulnerability rating will be determined for the A1-SA4 Aquifer.

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

9.5.1 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 Medonte Hills 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 Medonte Hills WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

9.5.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Medonte Hills wells 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 Medonte Hills well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 9b-. 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 southwest to northeast. This is reasonable based on available data describing regional groundwater flow patterns.

9.5.1.2 Groundwater Vulnerability

The Medonte Hills wells draw water from a confined overburden aquifer layer (regional aquifer A1-SA4). The Groundwater Vulnerability for the municipal overburden aquifers 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 Medonte Hills Water Supply is shown in Figure 9b-2. The Groundwater Vulnerability for the municipal

water supply aquifers A1-SA4 within the WHPA is considered to be Medium near the municipal wells and low beneath WHPA-B through WHPA-D.

9.5.1.3 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.

A cluster of wells pathways was identified within the Medonte Hills WHPA that are considered to have the potential to be Transport Pathways. They are located within an area of Low Vulnerability. The Vulnerability Rating at the well locations and the 30 m radius around them has been increased from Low to Medium Vulnerability.

9.5.1.4 WHPA-E

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

9.5.1.5 Vulnerability Score

The WHPA zones for the Medonte Hills Water Supply as shown in Figure 9b-, and the Groundwater Vulnerability, as shown in Figure 9b-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 9b-3 illustrates the Vulnerability Scores for the Medonte Hills WHPA. Figure 9b-3 will be used to assess Drinking Water Threats in Section 9.5.3.

9.5.1.6 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 (MOEMECP, 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 Medonte Hills WHPAs was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Medonte Hills WHPAs is High. The full results of the WHPA delineation Peer Review process, for Medonte Hills is available in Appendix OM 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 Medonte Hills WHPA is High. The Vulnerability Rating for the Medonte Hills 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.

9.5.2 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 Medonte Hills 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 Medonte Hills are provided in Technical Memorandum L1 – Drinking Water Issues Evaluation – Oro-Medonte (Appendix OM).

No Drinking Water Issues were identified for the Medonte Hills Water Supply.

Trihalomethanes and other disinfection by-products 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.

The rare presence of coliform bacteria in raw or treated water is not considered to represent a specific Drinking Water Issue as these parameters have only been rarely observed under circumstances that are not considered to be persistent.

9.5.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Medonte Hills 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 Medonte Hills 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.

9.5.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Medonte Hills 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.

9.5.3.2 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 Medonte Hills 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 Oro-Medonte staff to identify potential conditions within the identified WHPA for the drinking water supply.

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

9.5.3.3 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 the table of drinking water threat circumstances can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: https://swpip.ca/

9.5.3.3.1 Pathogen Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9b-4 to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Medonte Hills 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.

9.5.3.3.2 Chemical Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9b-5 to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Medonte Hills 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.

9.5.3.3.3 DNAPL Chemical Parameters

Figure 9b-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of at least 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Medonte Hills Water Supply. The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9b-6 to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 9.5.3.2 no Conditions have been confirmed within the WHPA for the Medonte Hills 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 9b-3 illustrates the Vulnerability Score map for Medonte Hills well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

9.5.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Medonte Hills 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 9-4 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Medonte Hills Water Supply. Significant Drinking Water Threats were identified within WHPA-A.

Ten (10) activities that are considered to be Significant Drinking Water Threats were identified in association with ten (10) land parcels in the WHPA for the Medonte Hills Water Supply. Nine (9) parcels are identified as having significant threat activities relating to residential land use 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 nine (9) residential parcels within this area.

Table 9-4: Number of Significant Drinking Water Threats for the Medonte Hills Drinking Water Supply.

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

Threat Number	Threat	Significant threat counts Number of threats	Significant threat counts Number of parcels
14.	The storage of snow.	0	0
15.	The handling and storage of fuel.	1	1
16.	The handling and storage of dense non-aqueous phase liquid.	0	0
17.	The handling and storage of an organic solvent.	0	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0	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	0
20.	Any activity that reduces the recharge of an aquifer.	0	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0	0
-	Totals:	10*	10

*9 verified existing Threats and 1 potential Threat that requires further verification (2015)

9.5.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) 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 Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Medonte Hills 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 9.5.3.5). 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 9b-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Medonte Hills Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

9.5.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) 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 Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Medonte Hills 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 9.5.3.5). 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 9b-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Medonte Hills 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).

9.5.3.5.3 Impervious Surfaces

Technical Rule 16(11) (August 2009) 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 Table of Drinking Water Threats.

The proportion of Impervious Surfaces within the delineated WHPA zones for the Medonte Hills Water Supply was determined in accordance with the methodology in Technical Memorandum

A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 9.5.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

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

9.6 Robin Crest Well Supply

The Robin Crest and Medonte Hills (Section 9.5) Water Supplies provide water for the community of Moonstone, located in the north part of the Township of Oro-Medonte, approximately 25 km north of Barrie. The Robin Crest Water Supply consists of two wells: Well 1-2019 and Well 2, and they are located approximately 350 m west of the 8th Concession Line North. Along with the Medonte Hills wells, the Robin Crest wells serve an estimated population of 505 persons based on 2001 data. The Robin Crest Well 1-2019 was constructed in late 2018 and replaced well TW1/76 (which was decomisssioned the same year) and the Robin Crest Well 2 has been in operation since 1999. The Medonte Hills Water Supply is discussed in the previous section (Section 13.7) in detail. One set of figures has been used to present the required map products for both systems.

According to the Permit to Take Water (PTTW) # 4037-BB3KMN issued April 9, 2019 and which expires January 5, 2028, the rated capacity for Well 1-2019 in the Robin Crest Water Supply is 576 m^3/day and for Well 2 is 842 m^3/day.

Robin Crest Well 1-2019 was constructed with a nominal 155 mm diameter steel casing from surface to 62.4 mbgl, with a 4.6 m long 150 mm diameter 20, 25, and 30-slot stainless steel screen. Robin Crest Well 2 was constructed with a 203 mm diameter steel casing from surface to a depth of 61.9 m, with a 4.88 m long 203 mm diameter 90, 60, and 30-slot stainless steel screen.

The two wellfields that supply Moonstone extract water from a confined sand and gravel aquifer identified at approximately 205 to 215 masl (60 to 70 mbgl) at the Medonte Hills Water Supply and approximately 210 to 230 masl (52 to 72 mbgl) at the Robin Crest Water Supply. The minimum thickness of the overlying confining layer, approximately 15 m, is encountered at the Medonte Hill wellfield. The aquitard is reported to consist of clayey silt or clay till. At least two more aquifers were identified in the vicinity of the wellfields which are located above the municipal aquifer. An apparent fourth aquifer at the Robin Crest Water Supply may be a lower component of the municipal aquifer that is not identified at the Medonte Hills Water Supply because the upper contact of bedrock is locally elevated. The recharge area for the municipal aquifer is believed to be located southwest of the wellfields in the vicinity of Mount St.Louis.

The screen intervals for the Robin Crest Wells 1 and 2, have been assigned to the A1-SA4 Aquifer in the draft regional hydrostratigraphic model prepared by AquaResource and Golder (2009). The Groundwater Vulnerability rating will be determined for the A1-SA4 Aquifer.

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

9.6.1 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 Robin Crest 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 Robin Crest WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

9.6.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Robin Crest wells were originally 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 Robin Crest well locations and the WHPA. The Robin Crest WHPA-A was updated by LSRCA in 2020 to incorporate very minor changes to the size and shape of the WHPA due to the decommissioning of Well TW 1/76 in 2018 and the addition of the replacement well (Well 1-2019) in 2019, located approximately 10m awa from the original well. The well locations and the WHPA are shown in Figure 9b-. WHPA delineation 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 southwest to northeast. This is reasonable based on available data describing regional groundwater flow patterns.

9.6.1.2 Groundwater Vulnerability

The Robin Crest wells draw water from a confined overburden aquifer layer (regional aquifer A1-SA4). The Groundwater Vulnerability for the municipal overburden aquifers 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 Robin Crest Water Supply is shown in Figure 9b-2. The Groundwater Vulnerability for the municipal water supply aquifers A1-SA4 within the WHPA is considered to be Low.

9.6.1.3 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 Robin Crest WHPA that are considered to have the potential to be Transport Pathways. The Groundwater Vulnerability for the Robin Crest WHPA as presented on Figure 9b-2 is proposed to be used to generate the Vulnerability Scores.

9.6.1.4 WHPA-E

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

9.6.1.5 Vulnerability Score

The WHPA zones for the Robin Crest Water Supply, as shown in Figure 9b-, and the Groundwater Vulnerability, as shown in Figure 9b-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 9b-3 illustrates the Vulnerability Scores for the Robin Crest WHPA. Figure 9b-3 will be used to assess Drinking Water Threats in Section 9.6.3.

9.6.1.6 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 Robin Crest WHPAs was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Robin Crest WHPAs is High. The full results of the WHPA delineation Peer Review process, for Robin Crest is available in Appendix OM 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 Robin Crest WHPA is High. The Vulnerability Rating for the Robin Crest 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.

9.6.2 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 Robin Crest 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 Robin Crest are provided in Technical Memorandum L1 – Drinking Water Issues Evaluation – Oro-Medonte (Appendix OM).

No Drinking Water Issues were identified for the Robin Crest Water Supply.

Trihalomethanes and other disinfection by-products are present in trace concentrations in the treated water as by-products of disinfection by chlorination. Trihalomethane concentrations are typically well below Ontario Drinking Water Quality Standard (ODWQS) values and do not display increasing trends.

The rare presence of coliform bacteria in raw or treated water is not considered to represent a specific Drinking Water Issue as these parameters have only been rarely observed under circumstances that are not considered to be persistent.

9.6.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Robin Crest Water Supply was originally completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). The threats assessment process was repeated in 2020 to account for the decommissioning of well TW 1/76 in 2018 and addition of the replacement well (Well 1-2019) in 2019. No additional threat parcels were identified. 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 Robin Crest 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.

9.6.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Robin Crest 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.

9.6.3.2 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 Robin Crest 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 Oro-Medonte staff to identify potential conditions within the identified WHPA for the drinking water supply.

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

9.6.3.3 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 table of drinking water threat circumstances can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: https://swpip.ca/

9.6.3.3.1 Pathogen Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9b-4 to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Robin Crest 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.

9.6.3.3.2 Chemical Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9b-5 to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Robin Crest 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.

9.6.3.3.3 DNAPL Chemical Parameters

Figure 9b-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 Robin Crest Water Supply. The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9b-6 to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 9.6.3.2, no Conditions have been confirmed within the WHPA for the Robin Crest 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. Conditions can only be identified as a significant risk if they are located in Issue Contributing Areas and may contribute to the Issue associated with these areas.

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 9b-3 illustrates the Vulnerability Score map for Robin Crest well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

9.6.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Robin Crest 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 9-5 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Robin Crest Water Supply. Significant Drinking Water Threats were identified within WHPA-A.

Eight (8) activities that are considered to be Significant Drinking Water Threats were identified in association with eight (8) land parcels in the WHPA for the Robin Crest Water Supply. Seven (7) parcels are identified as having Significant Threat activities relating to residential land use 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 seven (7) residential parcels within this area.

Table 9-5: Number of Significant Drinking Water Threats for the Robin Crest Drinking Water Supply.

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

Threat Number	Threat	Significant threat counts Number of threats	Significant threat counts Number of parcels
14.	The storage of snow.	0	0
15.	The handling and storage of fuel.	1	1
16.	The handling and storage of dense non-aqueous phase liquid.	0	0
17.	The handling and storage of an organic solvent.	0	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0	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	0
20.	Any activity that reduces the recharge of an aquifer.	0	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0	0
-	Totals:	8*	8

*7 verified existing Threat and 1 potential Threat that requires further verification (2015)

9.6.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) 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 Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Robin Crest 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 9.6.3.5). 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 9b-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Robin Crest Water Supply.

9.6.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) 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 Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Robin Crest 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 9.6.3.5). 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 9b-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Robin Crest Water Supply. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

9.6.3.5.3 Impervious Surfaces

Technical Rule 16(11) (August 2009) 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 Table of Drinking Water Threats.

The proportion of Impervious Surfaces within the delineated WHPA zones for the Robin Crest Water Supply was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant

Drinking Water Threats (Section 9.6.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 9b-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Robin Crest Water Supply.

9.7 Sugarbush Well supply

The Sugarbush Water Supply is located in the central part of the Township of Oro-Medonte off of Horseshoe Valley Rd. and the 6th Line North. The Sugarbush Water Supply consists of three wells: Well 1, Well 2 and Well 3. Well 1 is located on Huron Woods Drive, Well 2 is located on the 6th Concession Road and Well 3 is located just outside of the subdivision to the southeast. The wells serve an estimated population of 812 (296 lots) based on 2001 data but has recently been upgraded to service an additional 60 lots. Well 1 and Well 2 have been in operation since 2000 and 1973, respectively. Well 3 was connected to the system in 2008.

According to the Permit to Take Water (PTTW) # 1483-5MYQ36, issued in July 2003 and which expires on May 31, 2013, the rated capacity for Well 1 is 851 m^3/day and the rated capacities for Well 2 and Well 3 are 1,635 m^3/day each.

Well 1 was constructed with a nominal 152 mm diameter steel casing from surface to a depth of 76.2 m with a nominal 152 mm diameter 12 and 10-slot stainless steel screen set from 76.2 to 82.3 mbgl. Well 2 was constructed with a nominal 152 mm diameter steel casing from surface to a depth of 75.2 m, with a nominal 152 mm diameter 20-slot stainless steel screen set from 75.2 to 78.0 mbgl. Well 3 construction details have not yet been provided to us as it was connected to the system only very recently.

The wells are completed in sand aquifer which is present beneath the aquitard over the elevation range of 230 to 248 masl (66 to 84 mbgl) at Well 1 and approximately 10 m lower at Well 2. Another shallow aquifer is present above the municipal aquifer. Both aquifers are believed to pinch out east of the wellfield and may be combined as a single unconfined aquifer to the north. The recharge area is believed to be located to the southeast.

The screen interval for Well 1, Well 2 and Well 3 has been assigned to the A2, 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 and A3 Aquifers.

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

9.7.1 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 Sugarbush 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 Sugarbush WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

9.7.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Sugarbush wells were first delineated in 2005 by Golder using a 2-dimensional analytical groundwater flow model. The previous WHPA did not consider operation of Well 3. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. Golder (2010) applied a 3-dimensional numerical groundwater flow model to produce an updated WHPA for the Sugarbush Water Supply. The updated well locations and the WHPA are shown in Figure 9c-1. WHPA delineation and adjustment details are documented in Genivar, 2010.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2010) study delineated time-of-travel zones (TOT) for 2 years, 5 years and 25 years.

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

9.7.1.2 Groundwater Vulnerability

The Sugarbush wells draw water from confined overburden aquifer layers (regional aquifers A2 and A3). The Groundwater Vulnerability for the municipal overburden aquifers 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 Sugarbush Water Supply is shown in Figure 9c-2. The Groundwater Vulnerability for the municipal water supply aquifers A2 and A3 within the WHPA is considered to be Low.

9.7.1.3 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 Sugarbush WHPA that are considered to have the potential to be Transport Pathways. The Groundwater Vulnerability map (Figure 9c-2) is therefore proposed to be used to generate the Vulnerability Scores.

9.7.1.4 WHPA-E

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

9.7.1.5 Vulnerability Score

The WHPA zones for the Sugarbush Water Supply, as shown in Figure 9c-1, and the Groundwater Vulnerability, as shown in Figure 9c-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 9c-3 illustrates the Vulnerability Scores for the Maplewood WHPA. Figure 9c-3 will be used to assess Drinking Water Threats in Section 9.7.3.

9.7.1.6 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 Sugarbush WHPAs was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Sugarbush WHPAs is High. The full results of the WHPA delineation Peer Review process, for Sugarbush is available in Appendix OM 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 Sugarbush WHPA is High. The Vulnerability Rating for the Sugarbush 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).

9.7.2 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 Sugarbush 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 Sugarbush are provided in Technical Memorandum L1 – Drinking Water Issues Evaluation – Oro-Medonte (Appendix OM).

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

Trihalomethanes and other disinfection by-products 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.

The rare presence of coliform bacteria in raw or treated water is not considered to represent a specific Drinking Water Issue as these parameters have only been rarely observed under circumstances that are not considered to be persistent.

9.7.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Sugarbush 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 Sugarbush 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.

9.7.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Sugarbush 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.

9.7.3.2 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 Sugarbush 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 Oro-Medonte staff to identify potential conditions within the identified WHPA for the drinking water supply.

No confirmed Conditions have been identified for the Sugarbush Water Supply. No local circumstances for prescribed Threats were identified.

9.7.3.3 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 table of drinking water threat circumstances can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: https://swpip.ca/

9.7.3.3.1 Pathogen Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9c-4 to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Sugarbush 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.

9.7.3.3.2 Chemical Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9c-5 to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Sugarbush 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.

9.7.3.3.3 DNAPL Chemical Parameters

Figure 9c-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of at least 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Sugarbush Water Supply. The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9c-6 to identify the circumstances in which these Activities associated with DNAPL threats would be Significant or Moderate Drinking Water Threats.

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

Further to Section 9.7.3.2, no Conditions have been confirmed within the WHPA for the Sugarbush 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 9c-3 illustrates the Vulnerability Score map for Sugarbush well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

9.7.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Sugarbush 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 9-6, Table 9-7, and Table 9-8 document the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPAs for Sugarbush Well 1, Well 2, and well 3, respectively. Activities that are considered to be potential Significant Drinking Water Threats were identified within WHPA-A.

For the Sugarbush Well 1 WHPA, twelve (12) activities that are considered to be Significant Drinking Water Threats were identified in association with twelve (12) land parcels. Eleven (11) parcels are identified as having Significant Threat activities relating to residential land use 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 12 residential parcels within this area.

For the Sugarbush Well 2 WHPA, eight (8) activities that are considered to be Significant Drinking Water Threats were identified in association with eight (8) land parcels. Seven (7) parcels are identified as having potential significant threat activities relating to residential land use 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 nine (9) residential parcels within this area.

For the Sugarbush Well 3 WHPA, seven (7) activities that are considered to be Significant Drinking Water Threats were identified in association with seven (7) land parcels. Seven (7) parcels are identified as having potential significant threat activities relating to residential land use via the use of private individual sewage disposal systems.

Table 9-6: Number of Significant Drinking Water Threats for the Sugarbush (Well 1) Drinking Water Supply.

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

Threat Number	Threat	Significant threat counts Number of threats	Significant threat counts Number of parcels
14.	The storage of snow.	0	0
15.	The handling and storage of fuel.	1	1
16.	The handling and storage of dense non-aqueous phase liquid.	0	0
17.	The handling and storage of an organic solvent.	0	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0	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	0
20.	Any activity that reduces the recharge of an aquifer.	0	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0	0
-	Totals:	12*	12

*11 verified existing Threat and 1 potential Threat that requires further verification (2015)

Table 9-7: Number of Significant Drinking Water Threats for the Sugarbush (Well 2) Drinking Water Supply.

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

Threat Number	Threat	Significant threat counts Number of threats	Significant threat counts Number of parcels
14.	The storage of snow.	0	0
15.	The handling and storage of fuel.	1	1
16.	The handling and storage of dense non-aqueous phase liquid.	0	0
17.	The handling and storage of an organic solvent.	0	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0	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	0
20.	Any activity that reduces the recharge of an aquifer.	0	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0	0
-	Totals:	8*	8

*7 verified existing Threats and 1 potential Threat that requires further verification (2015)

Table 9-8: Number of Significant Drinking Water Threats for the Sugarbush (Well 3) Drinking Water Supply.

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

Threat Number	Threat	Significant threat counts Number of threats	Significant threat counts Number of parcels
14.	The storage of snow.	0	0
15.	The handling and storage of fuel.	0	0
16.	The handling and storage of dense non-aqueous phase liquid.	0	0
17.	The handling and storage of an organic solvent.	0	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0	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	0
20.	Any activity that reduces the recharge of an aquifer.	0	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0	0
-	Totals:	7	7

9.7.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) 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 Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Sugarbush 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 9.7.3.5). 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 9c-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Sugarbush Water Supply.

9.7.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) 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 Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Sugarbush 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 9.7.3.5). 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 9c-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Sugarbush Water Supply where Vulnerability Scores. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

9.7.3.5.3 Impervious Surfaces

Technical Rule 16(11) (August 2009) 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 Table of Drinking Water Threats.

The proportion of Impervious Surfaces within the delineated WHPA zones for the Sugarbush Water Supply was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant

Drinking Water Threats (Section 9.7.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 9c-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Sugarbush Water Supply.

9.8 Warminster Well Supply

The Warminster Water Supply is located in the northeastern part of the Township of Oro-Medonte, west of Orillia. The Warminster Water Supply consists of two wells: Well 1 and Well 3. Well 2 was abandoned in 2004. The wells are located in the adjacent Severn Township. The wells serve an estimated population of 615 based on 2001 data. Well 1 was constructed in 1972 and Well 3 is in operation since approximately 2008.

According to the Permit to Take Water (PTTW) #2448-7RBQJA, issued on April 22 2009 and which expires on February 15 2018, the maximum rated capacity for Well 1 is 600 m^3/day. Well 1 is the lead well while Well 3 serves as the back-up well.

Well 1 was constructed with a nominal 152 mm diameter 9.1 m long 25 and 30-slot stainless steel screen. Well 3 construction details will be incorporated into the final document.

The wells are constructed in a confined overburden aquifer. An aquifer (sand) is present over the elevation range of approximately 260 to 270 masl (20 to 30 mbgl) at the abandoned Well 2 which was located within the community, where it is overlain by 15 m of aquitard materials recorded as being clay with sand or gravel (till). The aquifer is interpreted to end approximately 2 km north of Warminster, where ground surface slopes downwards to the north. The aquifer in the vicinity of Well 1 and Well 3 is considered to be distinct from that at the abandoned Well 2. At the abandoned Well 2, the aquifer is present between approximately 235 to 245 masl (17 to 27 mbgl) and is reportedly overlain by 10 m of clay. Recharge for the municipal aquifers is believed to be derived locally.

The screen interval for Well 1 and Well 3 has been assigned to the A1-SA3 Aquifer, in the draft regional hydrostratigraphic model prepared by AquaResource and Golder (2009). The Groundwater Vulnerability rating will be determined for the A1-SA3 Aquifer.

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

9.8.1 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 Warminster 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 Warminster WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

9.8.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Warminster wells were delineated in 2010 by Golder using a 3-dimensional numerical groundwater flow model. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. The updated locations were considered in the WHPA analysis. The updated well locations and the WHPA are shown in Figure 9d-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 (2010) study delineated time-of-travel zones (TOT) for 2 years, 5 years and 25 years.

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

9.8.1.2 Groundwater Vulnerability

The Warminster wells draw water from confined overburden aquifer layers (regional aquifer A1-SA3). The Groundwater Vulnerability for the municipal overburden aquifers was determined using the regional Aquifer Vulnerability Index (AVI methods outlined in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix A). 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 Warminster Water Supply is shown in Figure 9d-2. The Groundwater Vulnerability for the municipal water supply aquifers A2 and A3 within the WHPA is considered to be Medium in the area of the municipal wells and beneath much of WHPA-B and WHPA-C. The Groundwater Vulnerability is typically Low beneath the outer parts of WHPA-C and WHPA-D.

9.8.1.3 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 Warminster WHPA that are considered to have the potential to be a Transport Pathway. The Groundwater Vulnerability map (Figure 9d-2) is therefore proposed to be used to generate the Vulnerability Scores.

9.8.1.4 WHPA-E / WHPA-F

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

9.8.1.5 Vulnerability Score

The WHPA zones for the Warminster Water Supply, as shown in Figure 9d-1, and the Groundwater Vulnerability, as shown in Figure 9d-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 9d-3 illustrates the Vulnerability Scores for the Warminster WHPA. Figure 9d-3 will be used to assess Drinking Water Threats in Section 9.8.3.

9.8.1.6 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 Warminster WHPAs was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Warminster WHPAs is High. The full results of the WHPA delineation Peer Review process, for Warminster is available in Appendix OM 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 Warminster WHPA is High. The Vulnerability Rating for the Warminster 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).

9.8.2 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 Warminster 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 Warminster are provided in Technical Memorandum L1 – Drinking Water Issues Evaluation – Oro-Medonte (Appendix OM).

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

Sodium concentrations have exceeded the guideline of 20 mg/L used by the Medical Officer of Health for sodium restricted diets but are not projected to exceed the ODWQS objective of 200 mg/L within 50 years.

Trihalomethanes and other disinfection by-products 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.

The rare presence of coliform bacteria in raw or treated water is not considered to represent a specific Drinking Water Issue as these parameters have only been rarely observed under circumstances that are not considered to be persistent.

9.8.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Warminster 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 Warminster 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.

9.8.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Warminster 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.

9.8.3.2 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 Warminster 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 Oro-Medonte staff to identify potential conditions within the identified WHPA for the drinking water supply.

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

9.8.3.3 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 table of drinking water threat circumstances can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: https://swpip.ca/

9.8.3.3.1 Pathogen Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9d-4 to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Warminster 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.

9.8.3.3.2 Chemical Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9d-5 to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Warminster 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.

9.8.3.3.3 DNAPL Chemical Parameters

Figure 9d-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of at least 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Warminster Water Supply. The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores on Figure 9d-6can to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 9.8.3.2, no Conditions have been confirmed within the WHPA for the Warminster 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 9d-3 illustrates the Vulnerability Score map for Warminster Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

9.8.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Warminster 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. Based on the Threat refinement work, there are no current activities identified that are considered Significant Drinking Water Threats in the WHPA for the Warminster Well Supply. There are also no Significant Threats associated with Conditions or Drinking Water Issues.

9.8.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) 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 Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Warminster 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 9.8.3.5). 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 9d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Warminster Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

9.8.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) 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 Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Warminster 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 9.8.3.5). 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 9d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Warminster 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).

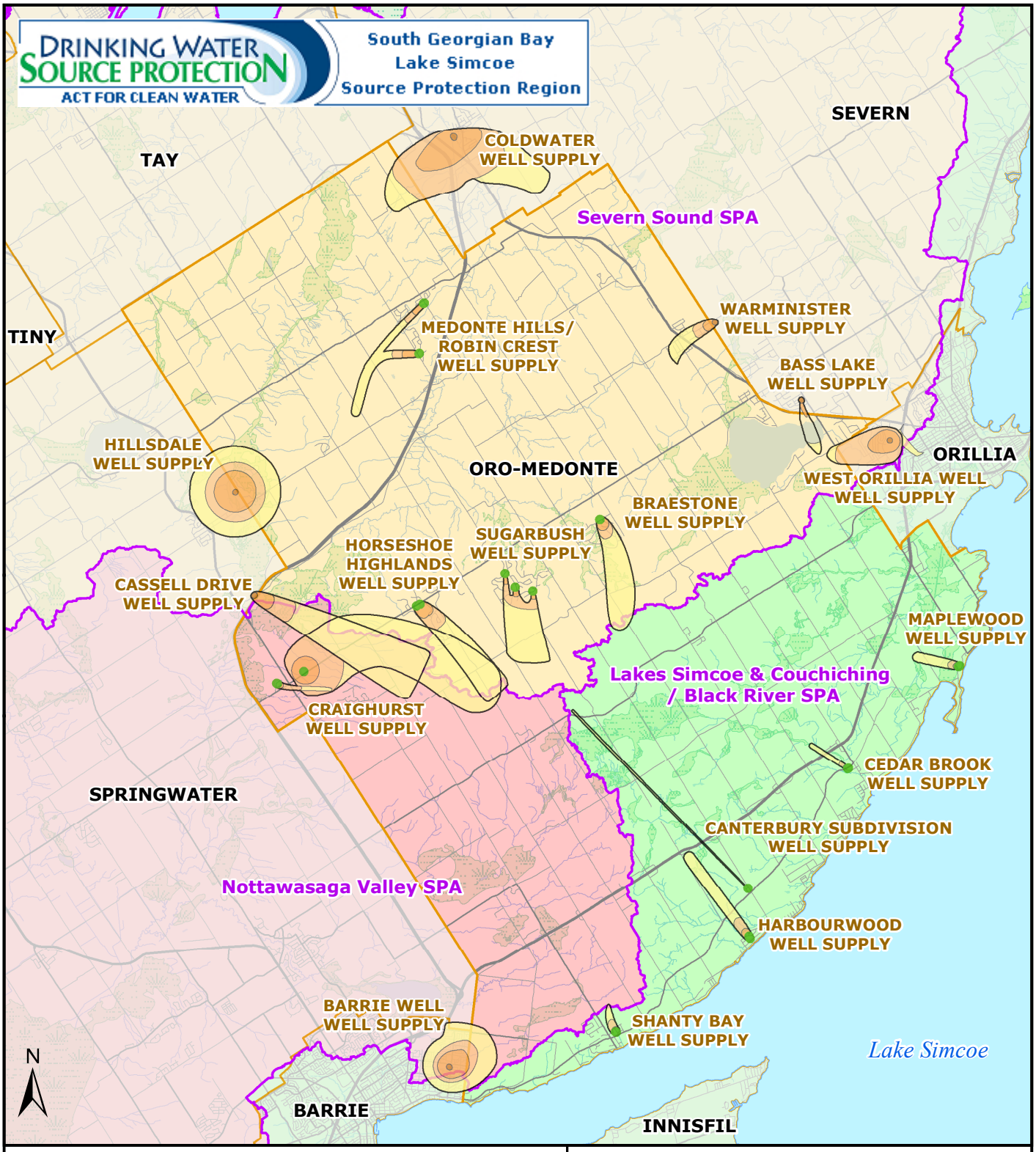
9.8.3.5.3 Impervious Surfaces

Technical Rule 16(11) (August 2009) 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 Table of Drinking Water Threats.

The proportion of Impervious Surfaces within the delineated WHPA zones for the Warminster Water Supply was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 9.8.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

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

Figure 9-1: Drinking Water System Vulnerable Areas, Township of Oro-Medonte



- Municipal Supply Wells
- WHPA-A (100m)
- WHPA-B (2 years time of travel)
- WHPA-C (5 years time of travel)
- WHPA-D (25 years time of travel)
- Source Protection Area Boundary
- Municipality Boundary

Drinking Water System Vulnarable Areas Township of Oro-Medonte

Created by: LSRCA, 2024-01-25

Scale 1:200,000

0 3 6 9km

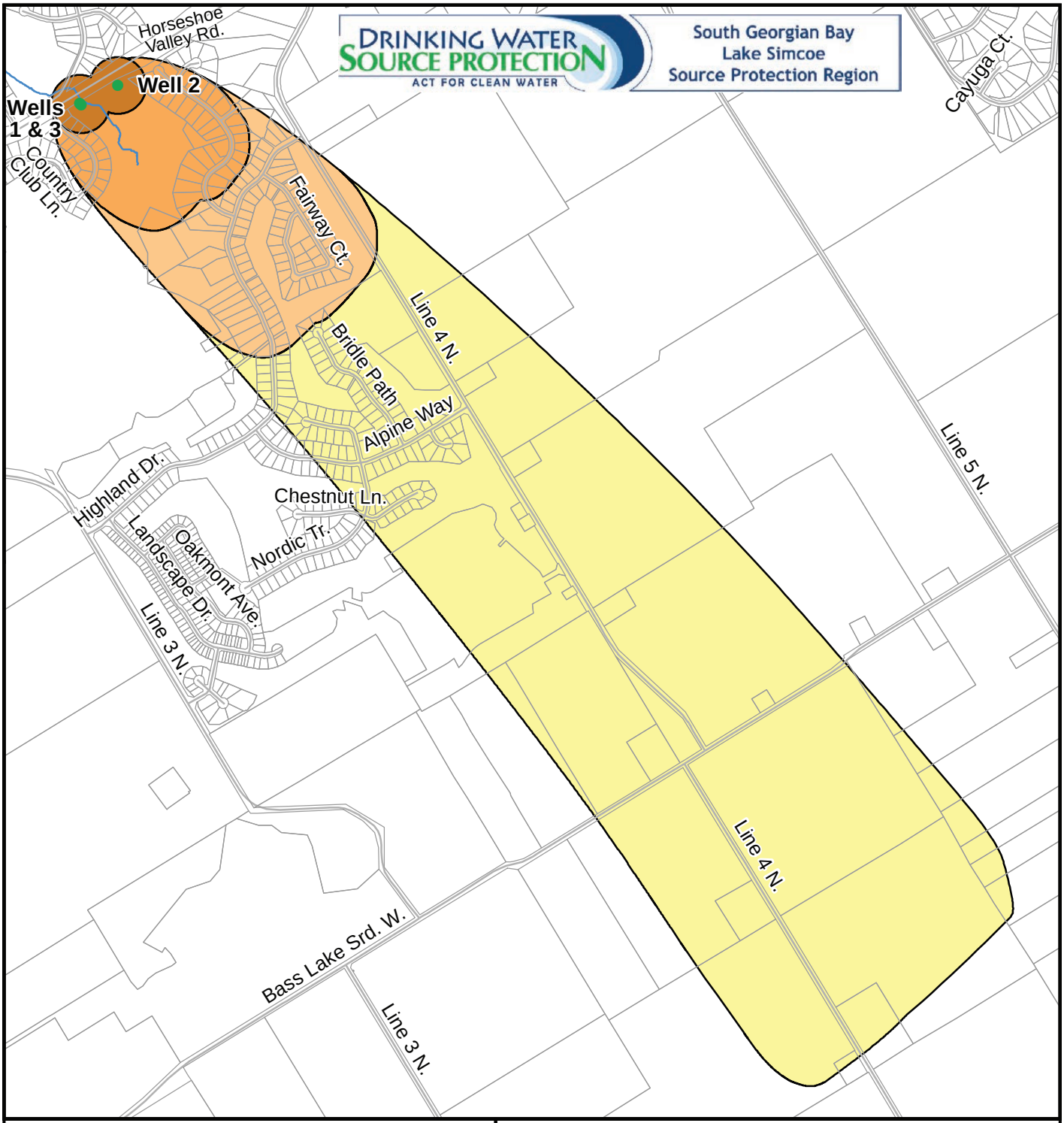
UTM Zone 17N, NAD83

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

Ontario

Figure 9 -1

Figure 9a-1: Wellhead Protection Areas - Horseshoe Highlands



Legend

- MUNICIPAL WELL LOCATION
- ROAD
- PROPERTY BOUNDARY
- WATERCOURSE

200 100 0 200 Metres

N W E S

WELLHEAD PROTECTION AREA

- 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

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 - HORSESHOE HIGHLANDS

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

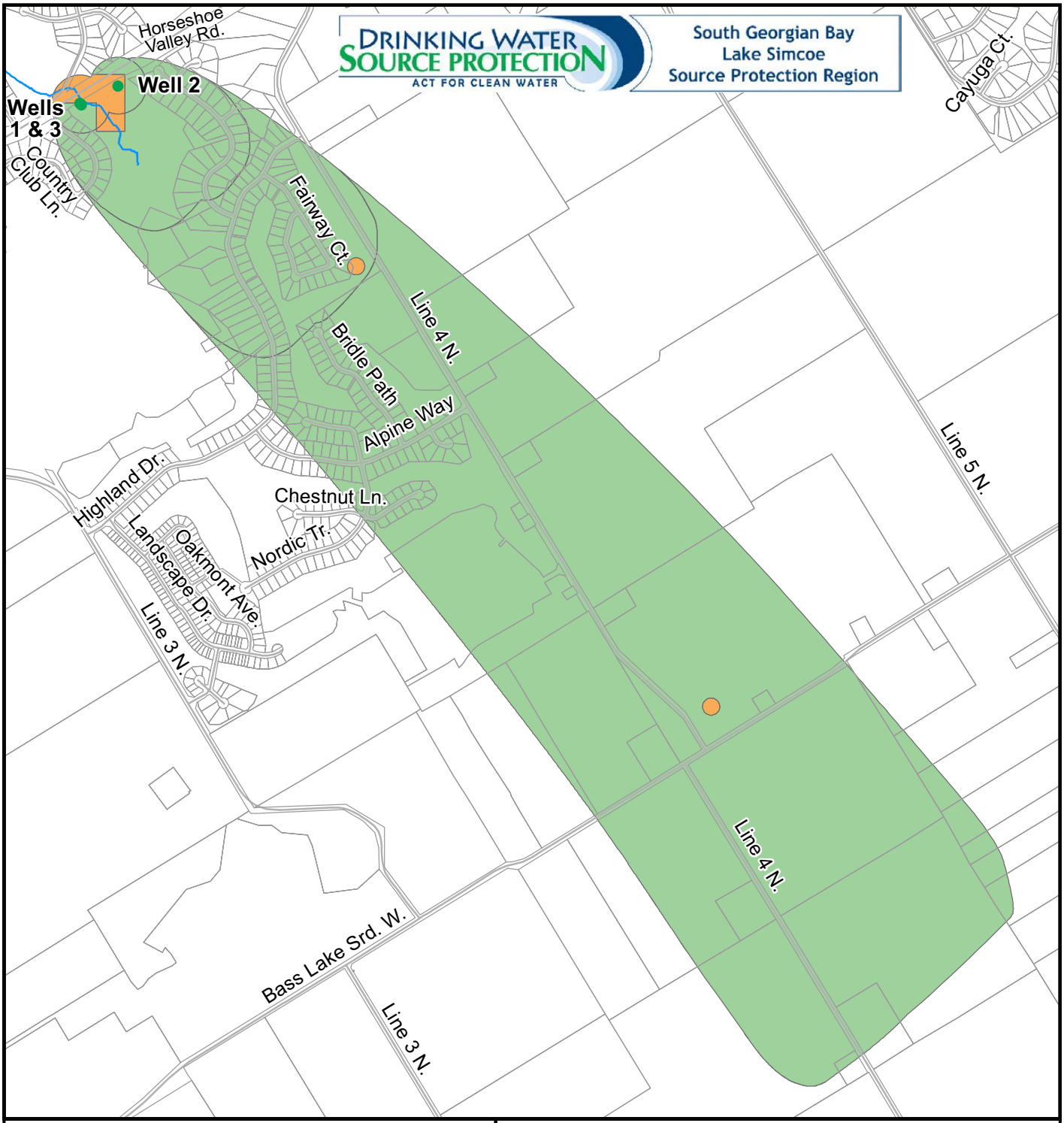
DATE: OCTOBER 2022

SCALE: 1:20,000

WSP GOLDER Ontario

FIGURE **9a-1**

Figure 9a-2: Vulnerability Scores - Horse Shoe Highlands



Legend

- MUNICIPAL WELL LOCATION
- ROAD
- PROPERTY BOUNDARY
- WATERCOURSE

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

N W E S

200 100 0 200 Metres

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GROUNDWATER VULNERABILITY - HORSESHOE HIGHLANDS

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

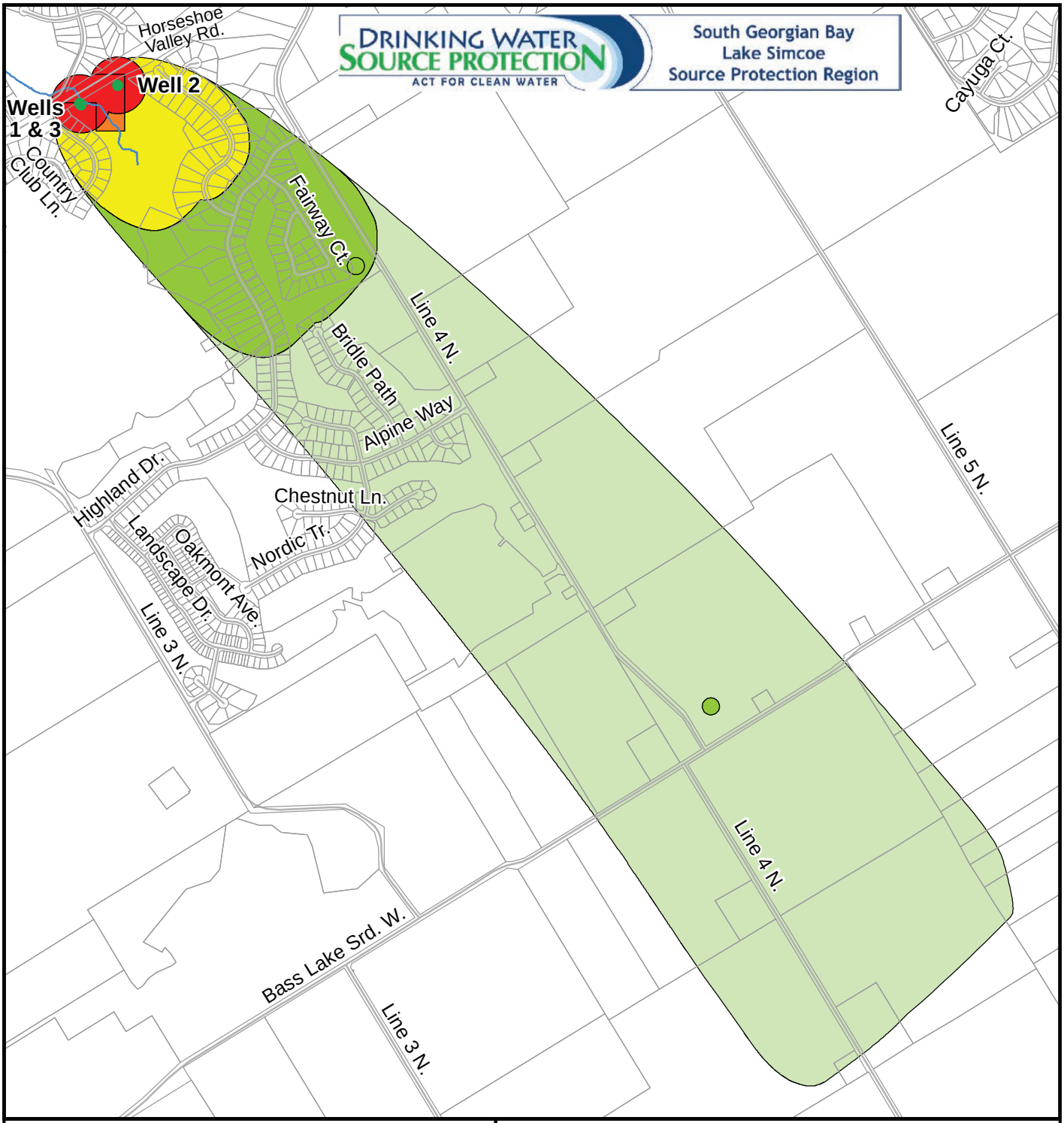
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: OCTOBER 2022	SCALE: 1:20,000

Lake Simcoe Region conservation authority | Ontario | WSP GOLDER

FIGURE **9a-2**

Figure 9a-3: Vulnerability Scores - Horseshoe Highlands



Legend

- MUNICIPAL WELL LOCATION
- ROAD
- PROPERTY BOUNDARY
- WATERCOURSE

200 100 0 200 Metres

N W E S

VULNERABILITY SCORING

- 10
- 8
- 6
- 4
- 2

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VULNERABILITY SCORES - HORSESHOE HIGHLANDS

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

DATE: OCTOBER 2022

SCALE: 1:20,000

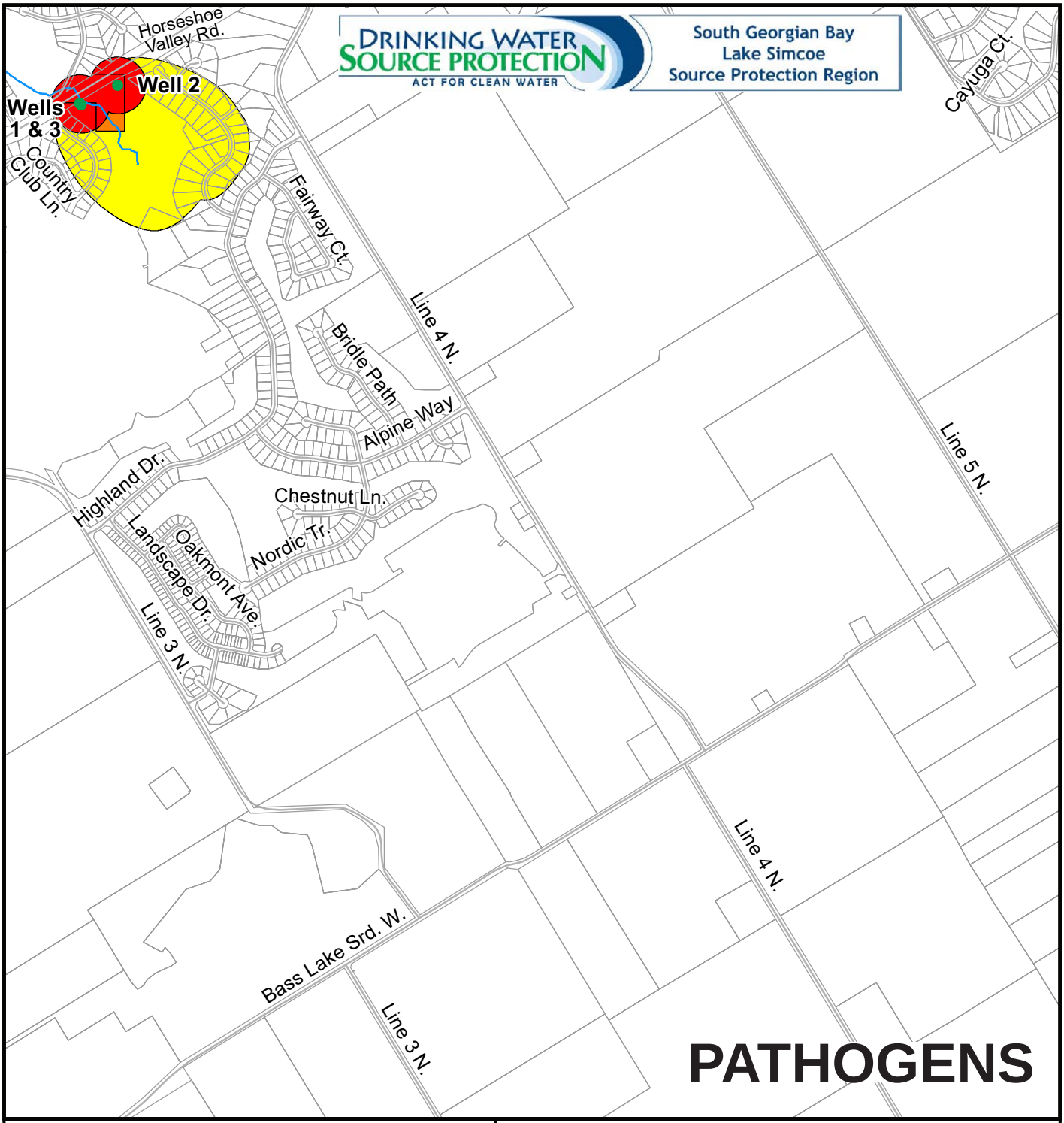
Lake Simcoe Region conservation authority

Ontario

WSP GOLDER

FIGURE
9a-3

Figure 9a-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats -Horseshoe Highlands



Legend

- MUNICIPAL WELL LOCATION
- ROAD
- PROPERTY BOUNDARY
- WATERCOURSE

VULNERABILITY SCORING

- 10
- 8
- 6

N, W, E, S

200 100 0 200 Metres

AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW HORSESHOE HIGHLANDS

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: OCTOBER 2022

SCALE: 1:20,000

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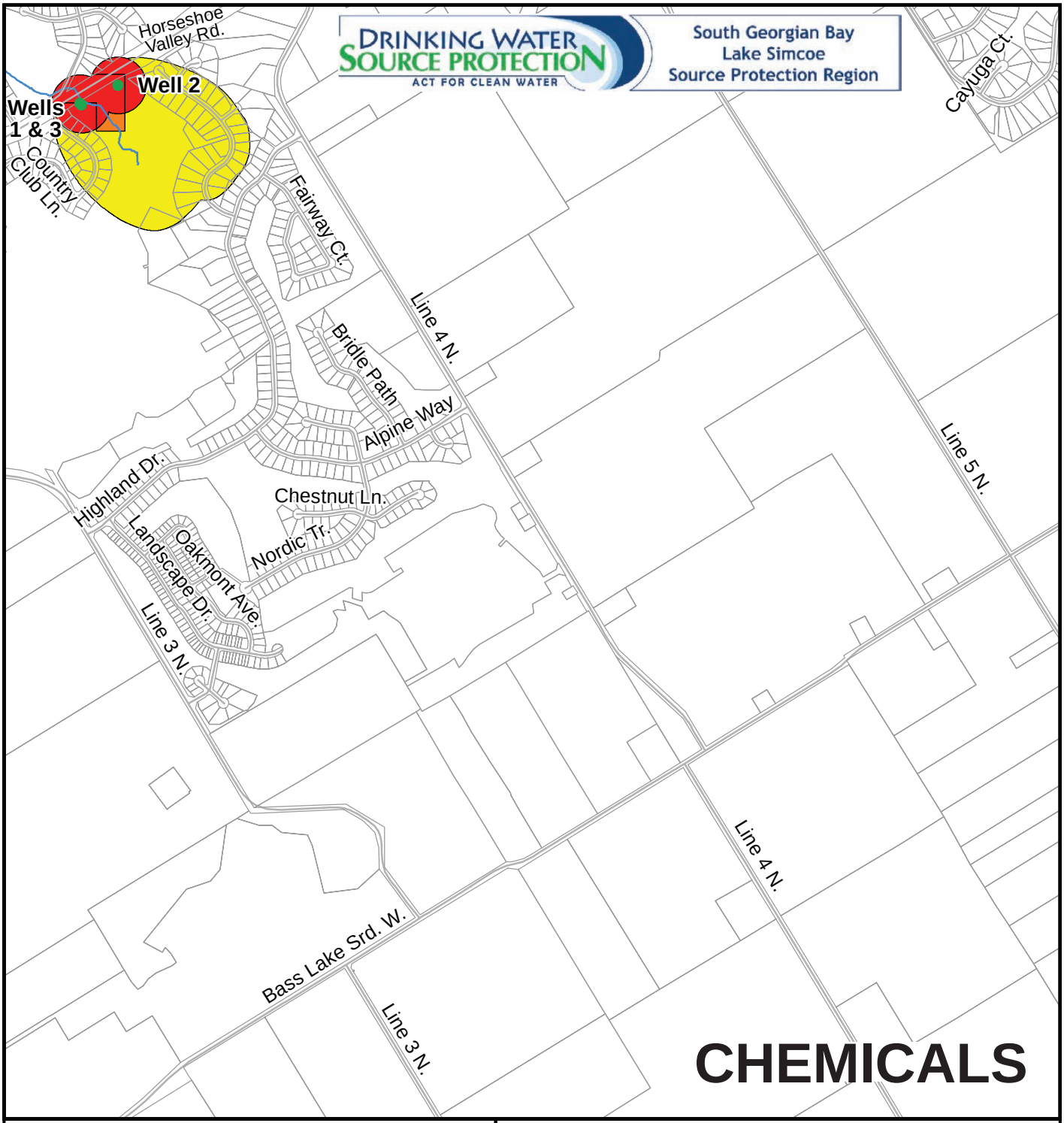
Ontario

WSP GOLDER

FIGURE 9a-4

Figure 9a-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats - Horseshoe Highlands



Legend

- MUNICIPAL WELL LOCATION
- ROAD
- PROPERTY BOUNDARY
- WATERCOURSE

VULNERABILITY SCORING

- 10
- 8
- 6

N, W, E, S

200 100 0 200 Metres

AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW HORSESHOE HIGHLANDS

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.

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.

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SCALE: 1:20,000

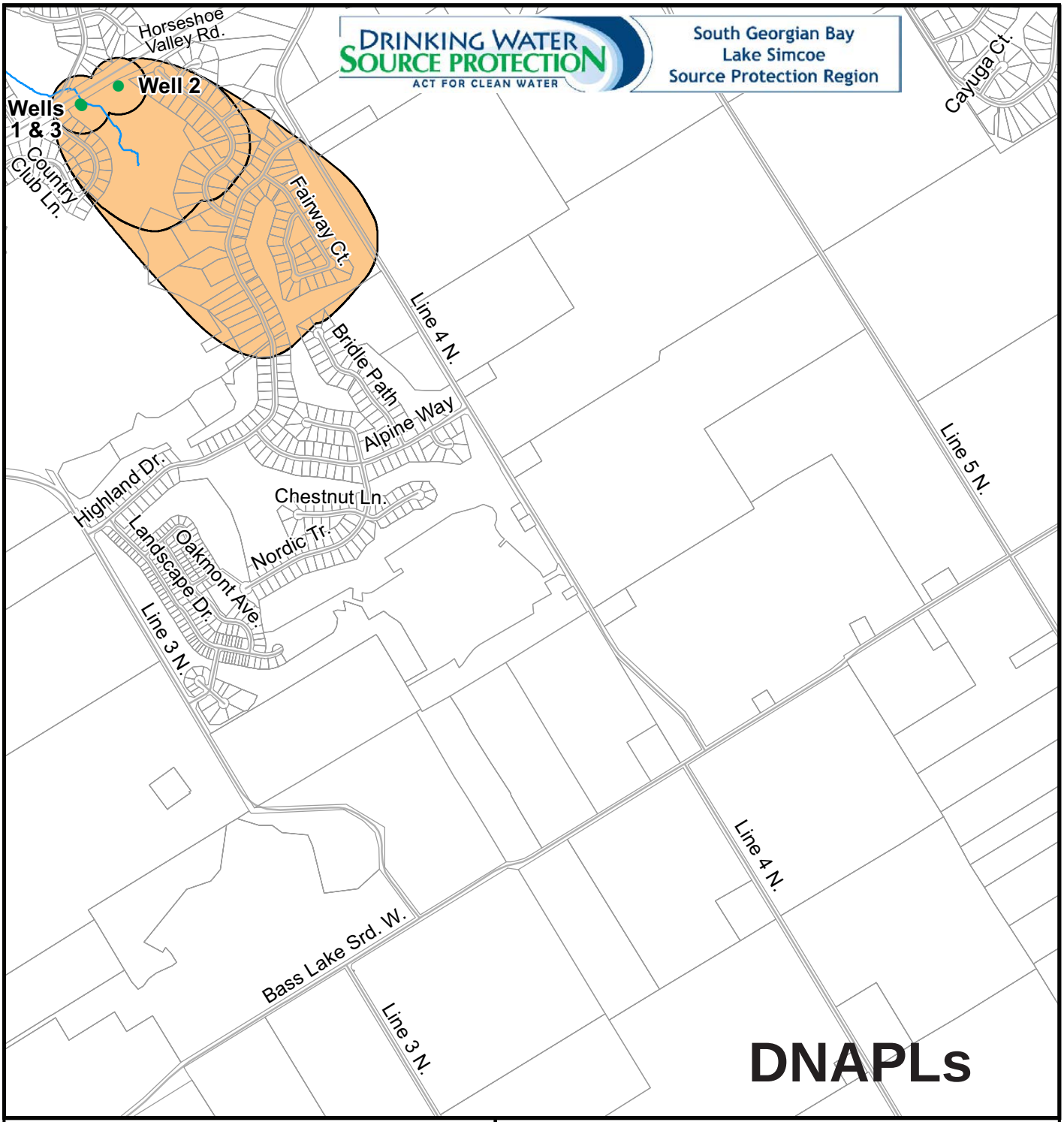
Lake Simcoe Region conservation authority

Ontario

WSP GOLDER

FIGURE 9a-5

Figure 9a-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats -Horseshoe Highlands



Legend

- MUNICIPAL WELL LOCATION
- ROAD
- PROPERTY BOUNDARY
- WATERCOURSE
- WHPA-C 5 YEAR TIME-OF-TRAVEL

N W E S

200 100 0 200 Metres

AREAS WHERE DNAPLs ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW HORSESHOE HIGHLANDS

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.

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.

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SCALE: 1:20,000

Lake Simcoe Region conservation authority

Ontario

WSP GOLDER

FIGURE 9a-6

Figure 9a-7: Managed Lands – Horseshoe Highlands

Legend

- MUNICIPAL WELL LOCATION
- ROAD
- PROPERTY BOUNDARY
- WATERCOURSE

200 100 0 200 Metres

N W E S

Percent Total Managed Lands

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

Wellhead Protection Areas

- WHPA-A
- WHPA-B
- WHPA-C
- WHPA-D

MANAGED LANDS - HORSESHOE HIGHLANDS

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 great than 6.

DATE: OCTOBER 2022

SCALE: 1:20,000

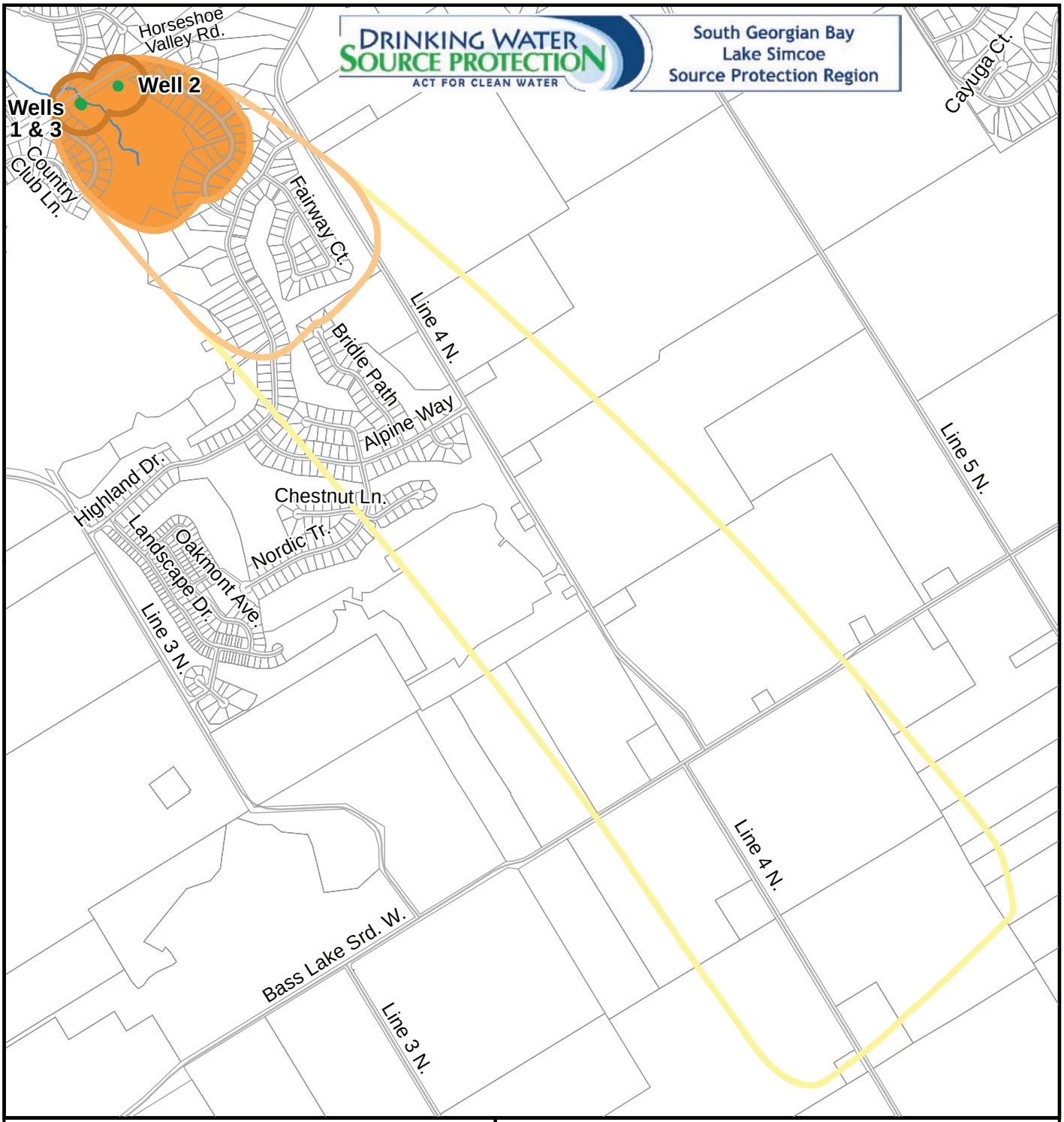
Lake Simcoe Region conservation authority

Ontario

WSP GOLDER

FIGURE 9a-7

Figure 9a-8: Livestock Density – Horseshoe Highlands



Legend

- MUNICIPAL WELL LOCATION
- ROAD
- PROPERTY BOUNDARY
- WATERCOURSE

200 100 0 200 Metres

N W E S

LIVESTOCK DENSITY

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

*NUTRIENT UNITS/ ACRE

Wellhead Protection Areas

- WHPA-A
- WHPA-B
- WHPA-C
- WHPA-D

LIVESTOCK DENSITY- HORSESHOE HIGHLANDS

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 great than 6.

DATE: OCTOBER 2022

SCALE: 1:20,000

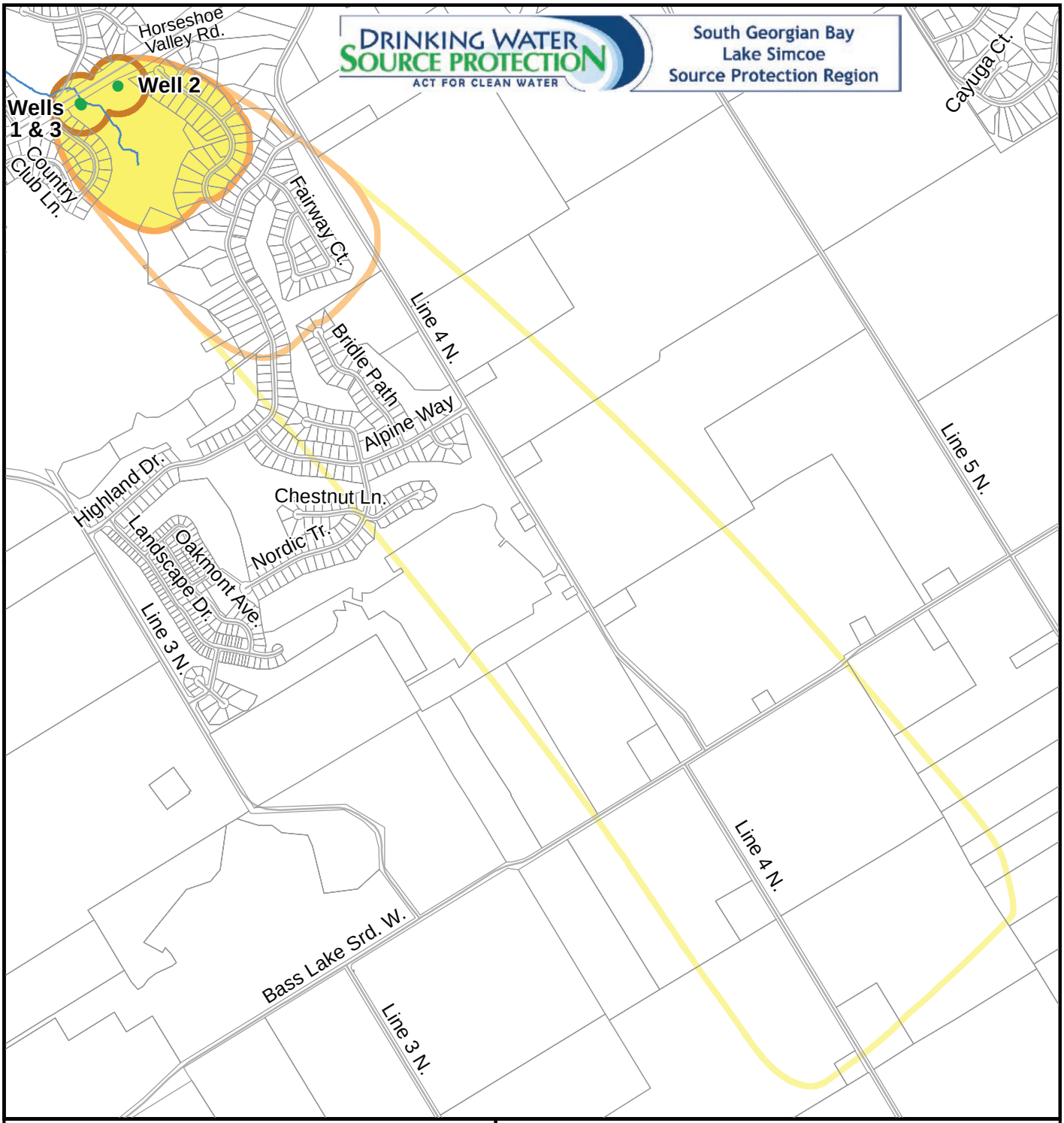
Lake Simcoe Region conservation authority

Ontario

WSP GOLDER

FIGURE 9a-8

Figure 9a-9: Impervious Surfaces – Horseshoe Highlands



Legend

- MUNICIPAL WELL LOCATION
- ROAD
- PROPERTY BOUNDARY
- WATERCOURSE

200 100 0 200 Metres

N W E S

Impervious Surface

- = 1%
- >1% and = 8%
- > 8% and = 80%

Wellhead Protection Areas

- WHPA-A
- WHPA-B
- WHPA-C
- WHPA-D

IMPERVIOUS SURFACES- HORSESHOE HIGHLANDS

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 great than 6.

DATE: OCTOBER 2022

SCALE: 1:20,000

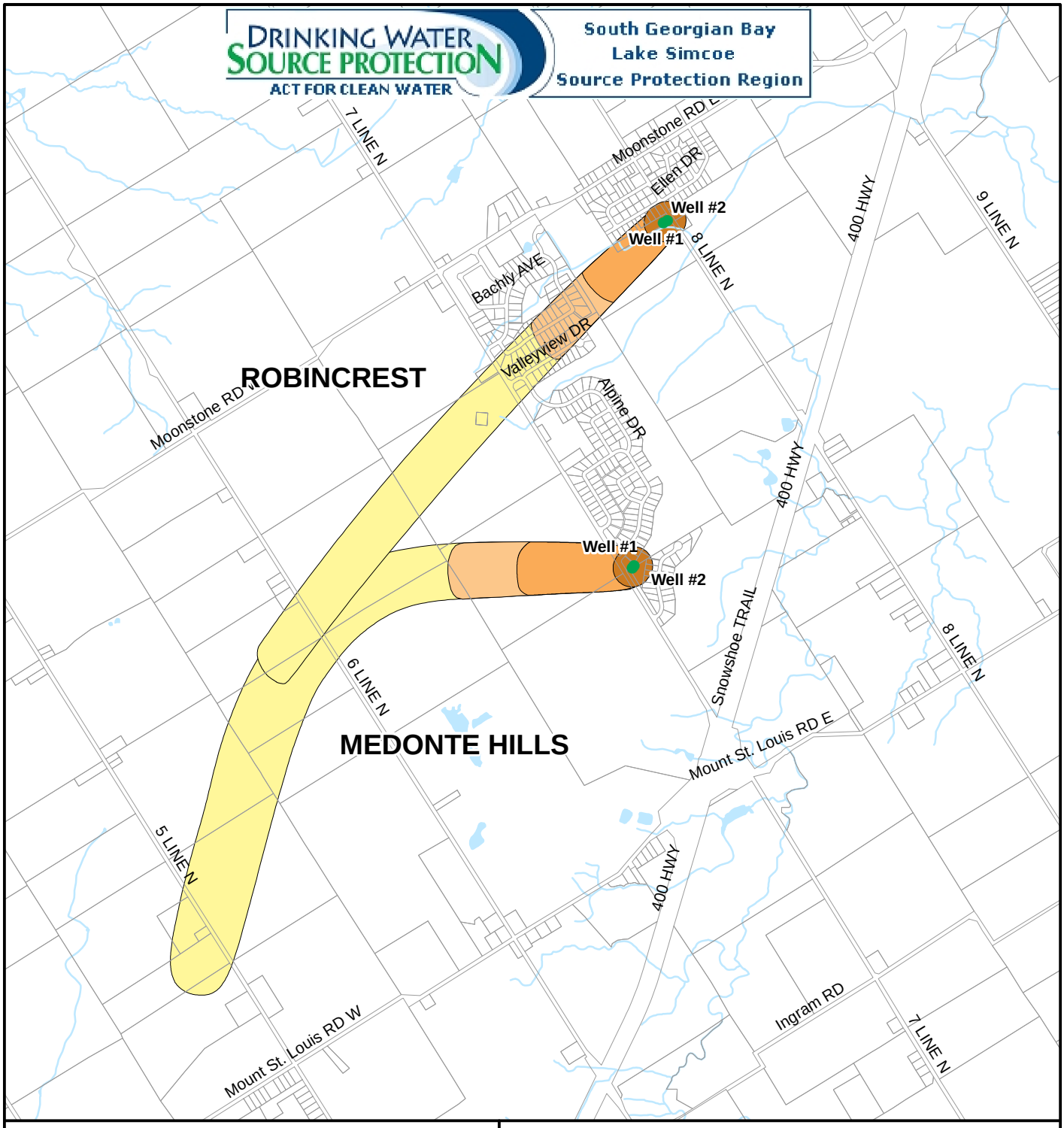
Lake Simcoe Region conservation authority

Ontario

WSP GOLDER

FIGURE 9a-9

Figure 9b-1: Wellhead Protection Area - Medonte Hills/Robin Crest



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

300 150 0 300 Metres

WELLHEAD PROTECTION AREAS - MEDONTE HILLS/ROBINCREST, ORO-MEDONTE

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

DATE: JUNE 2010	SCALE: 1:30000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.7-1

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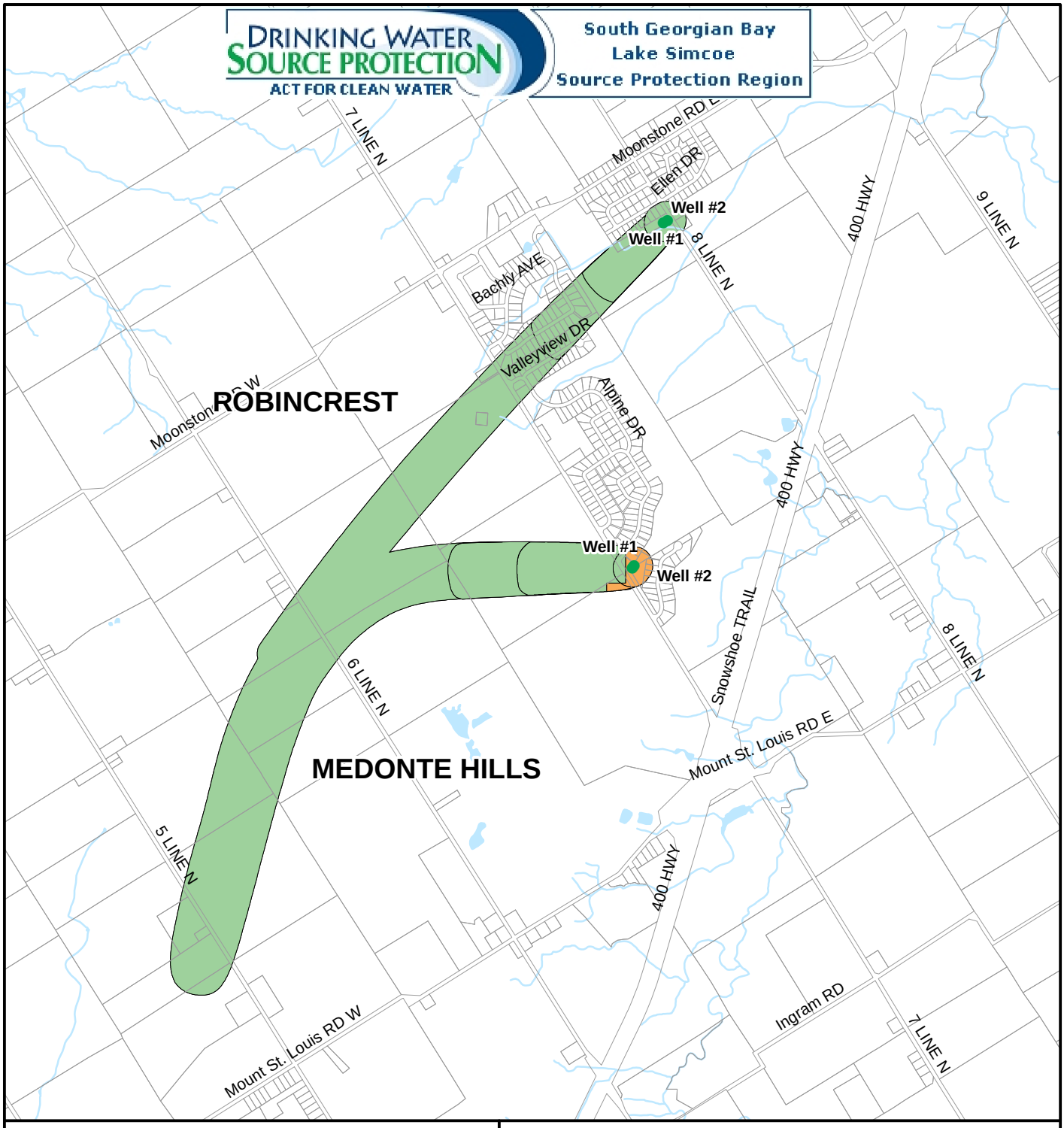
GENIVAR Ontario

FIGURE **9b-1**

Figure 9b-2: Groundwater Vulnerability - Medonte Hills/Robin Crest



LEGEND

- MUNICIPAL WELL LOCATION

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

N W E S

300 150 0 300 Metres

GROUNDWATER VULNERABILITY - MEDONTE HILLS/ROBINCREST

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

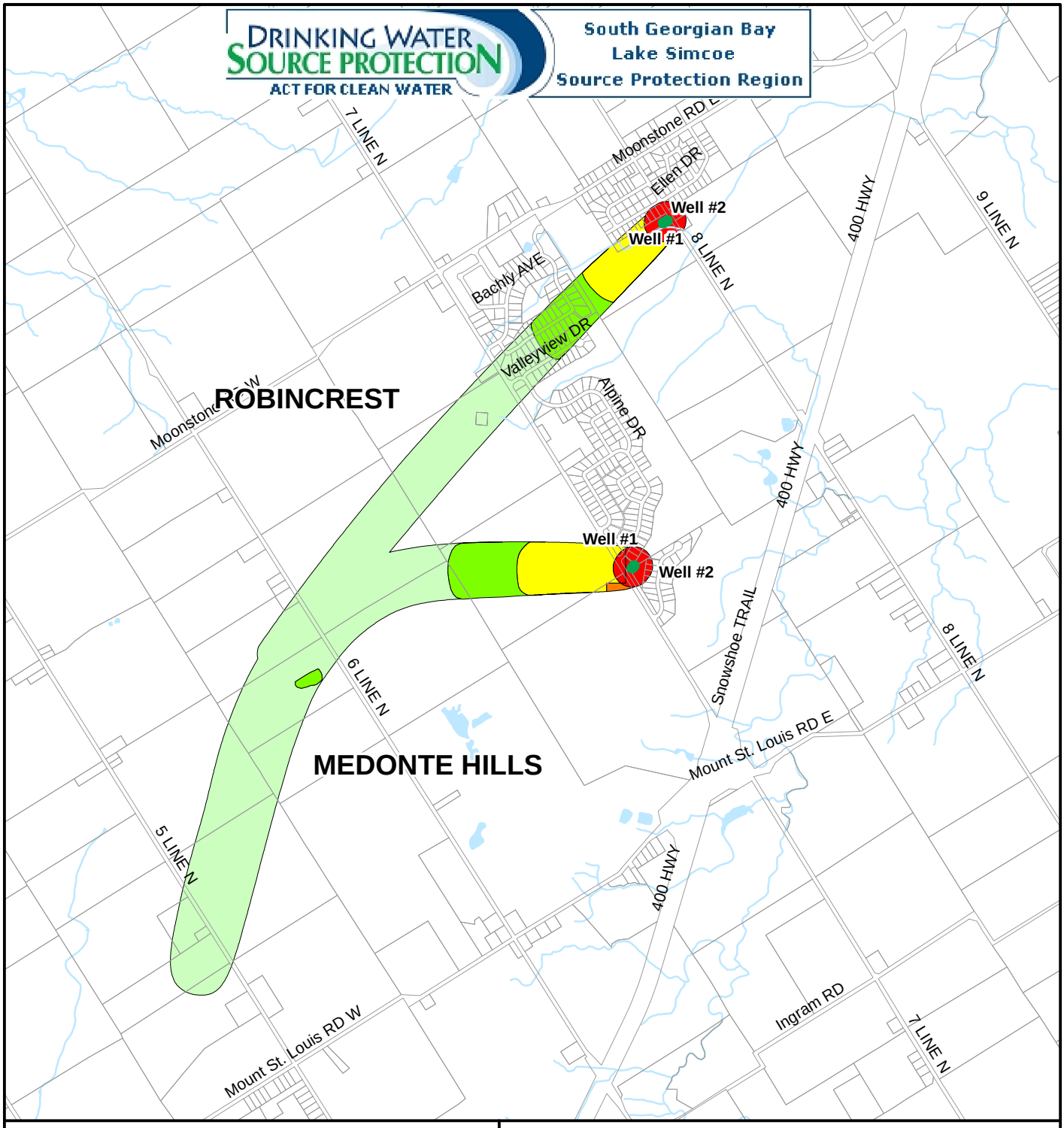
DATE: JUNE 2010	SCALE: 1:30000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.7-2

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 **9b-2**

Figure 9b-3: Vulnerability Scores - Medonte Hills/ Robin Crest



LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6
- 4
- 2

N W E S

300 150 0 300 Metres

VULNERABILITY SCORES - MEDONTE HILLS/ROBINCREST

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

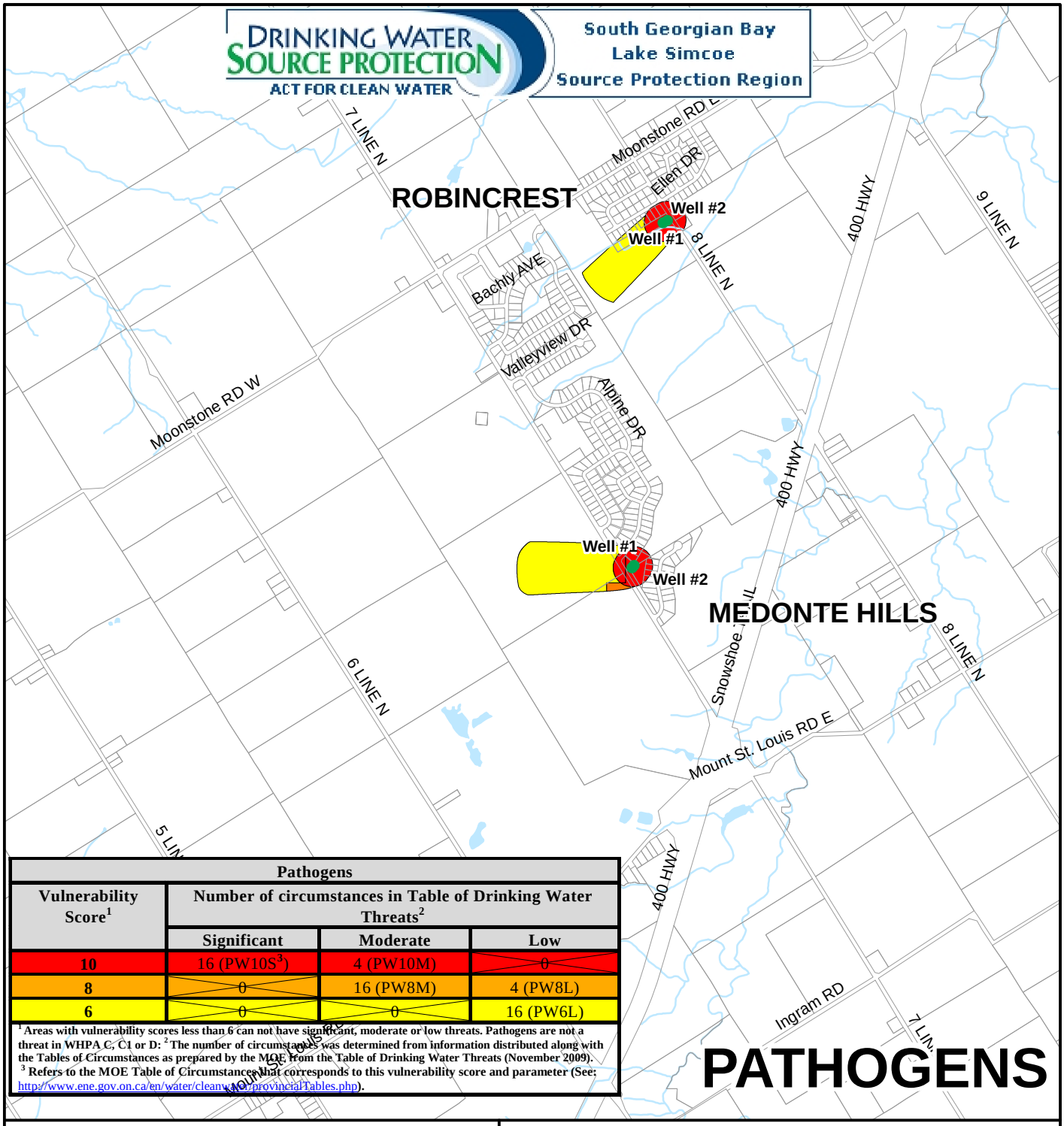
DATE: JUNE 2010	SCALE: 1:30000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.7-5

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 **9b-3**

Figure 9b-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats - Medonte Hills/Robin Crest



Pathogens			
Vulnerability Score[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
10	16 (PW10S[3])	4 (PW10M)	~~0~~
8	~~0~~	16 (PW8M)	4 (PW8L)
6	~~0~~	~~0~~	16 (PW6L)

[1] Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. Pathogens are not a threat in WHPA C, C1 or D: [2] The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009).
[3] Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).

LEGEND
- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING
- 10
- 8
- 6

N W E S

300 150 0 300 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.

AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - MEDONTE HILLS/ROBINCREST

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

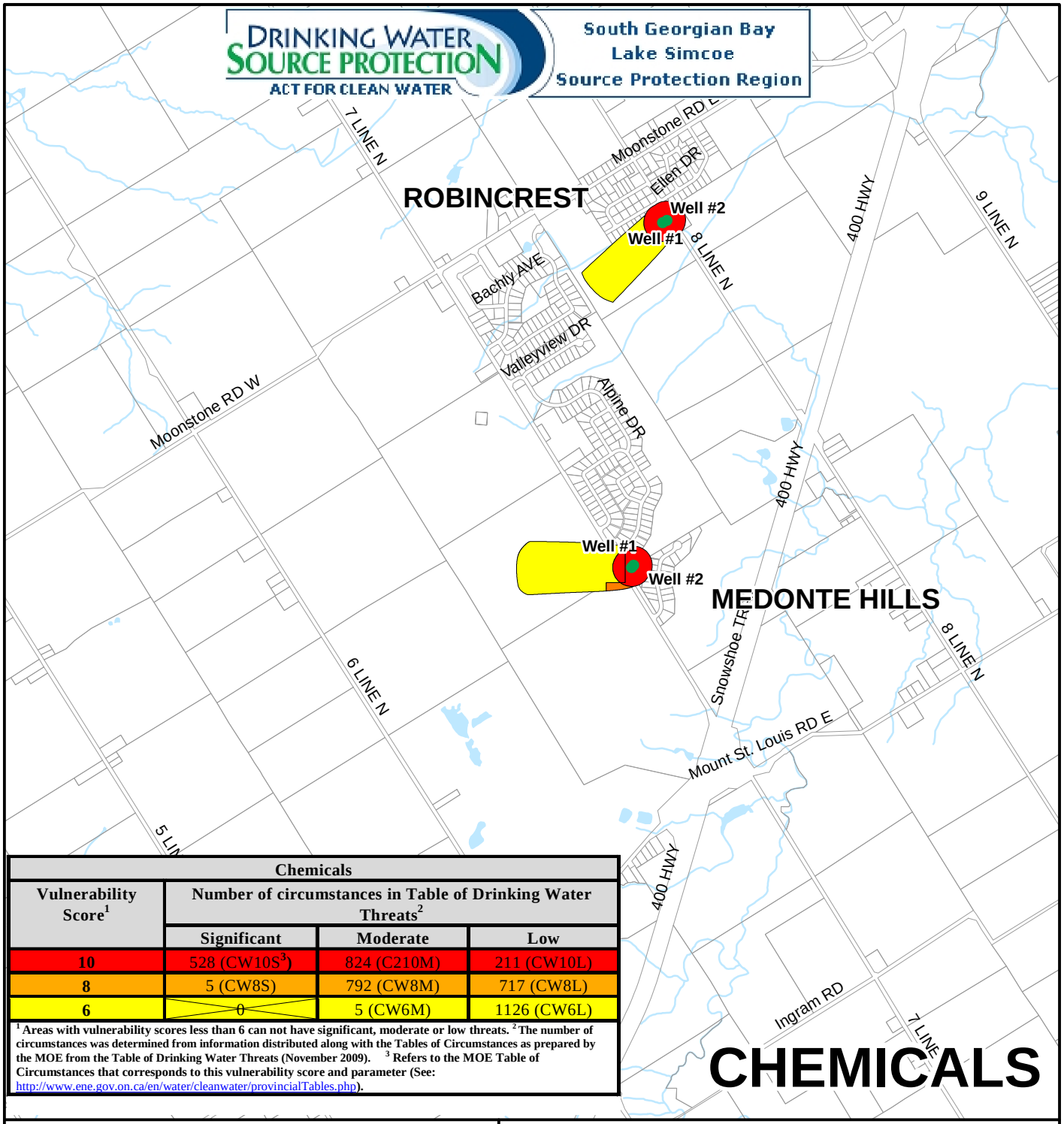
DATE: JUNE 2010	SCALE: 1:30000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.7-6

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 **9b-4**

Figure 9b-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats -Medonte Hills/Robin Crest



Chemicals			
Vulnerability Score[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
10	528 (CW10S[3])	824 (C210M)	211 (CW10L)
8	5 (CW8S)	792 (CW8M)	717 (CW8L)
6	~~0~~	5 (CW6M)	1126 (CW6L)

[1] Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. [2] The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). [3] Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).

LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6

N W E S

300 150 0 300 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.

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AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - MEDONTE HILLS/ROBINCREST

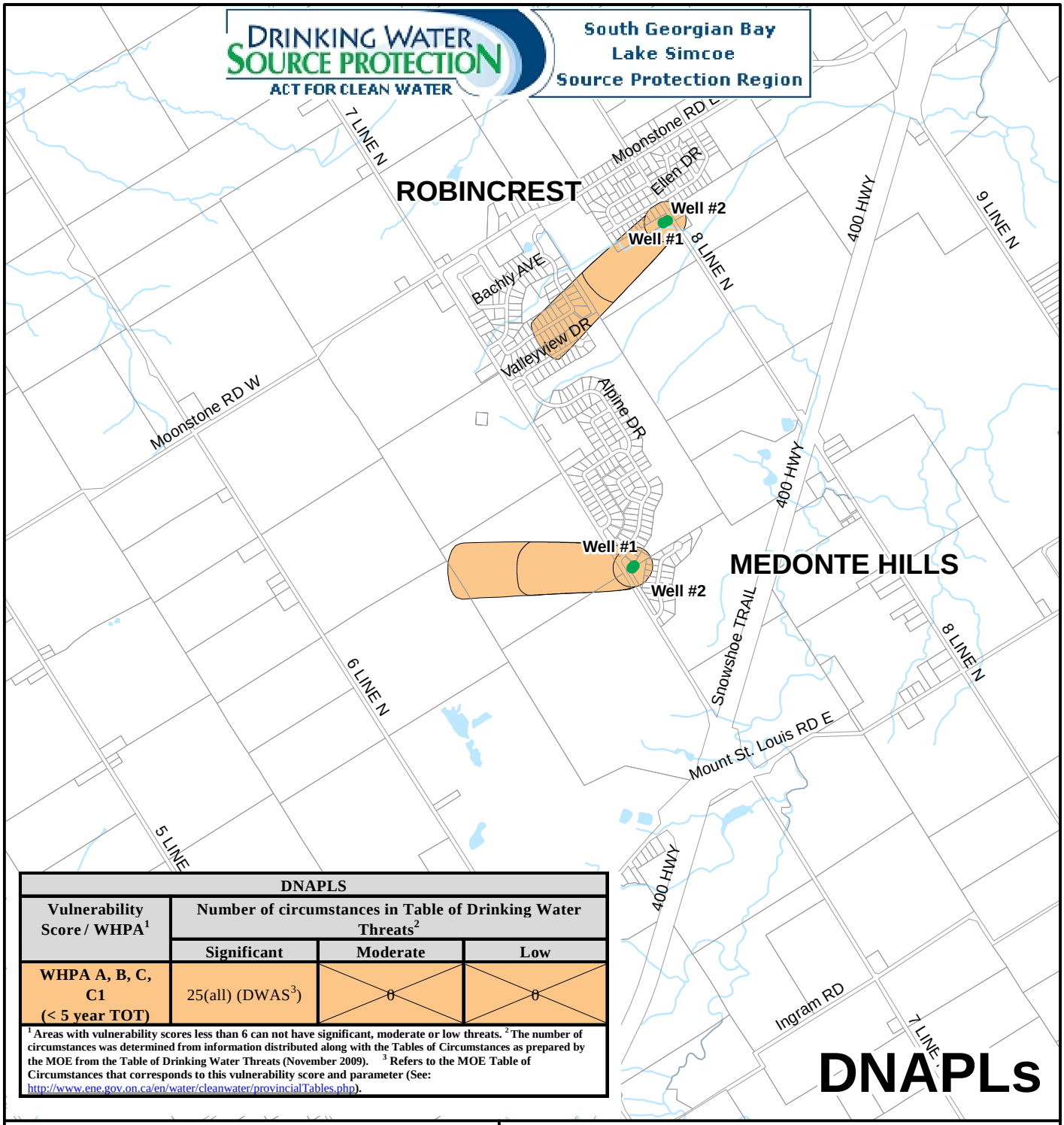
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JUNE 2010	SCALE: 1:30000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.7-7

GENIVAR Ontario

FIGURE **9b-5**

Figure 9b-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats - Medonte Hills/Robin Crest



DNAPLS			
Vulnerability Score / WHPA[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
WHPA A, B, C, C1 (< 5 year TOT)	25(all) (DWAS[3])	0	0

[1] Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. [2] The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). [3] Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).

LEGEND

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

N W E S

300 150 0 300 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.

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AREAS WHERE DNAPLS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - MEDONTE HILLS/ROBINCREST

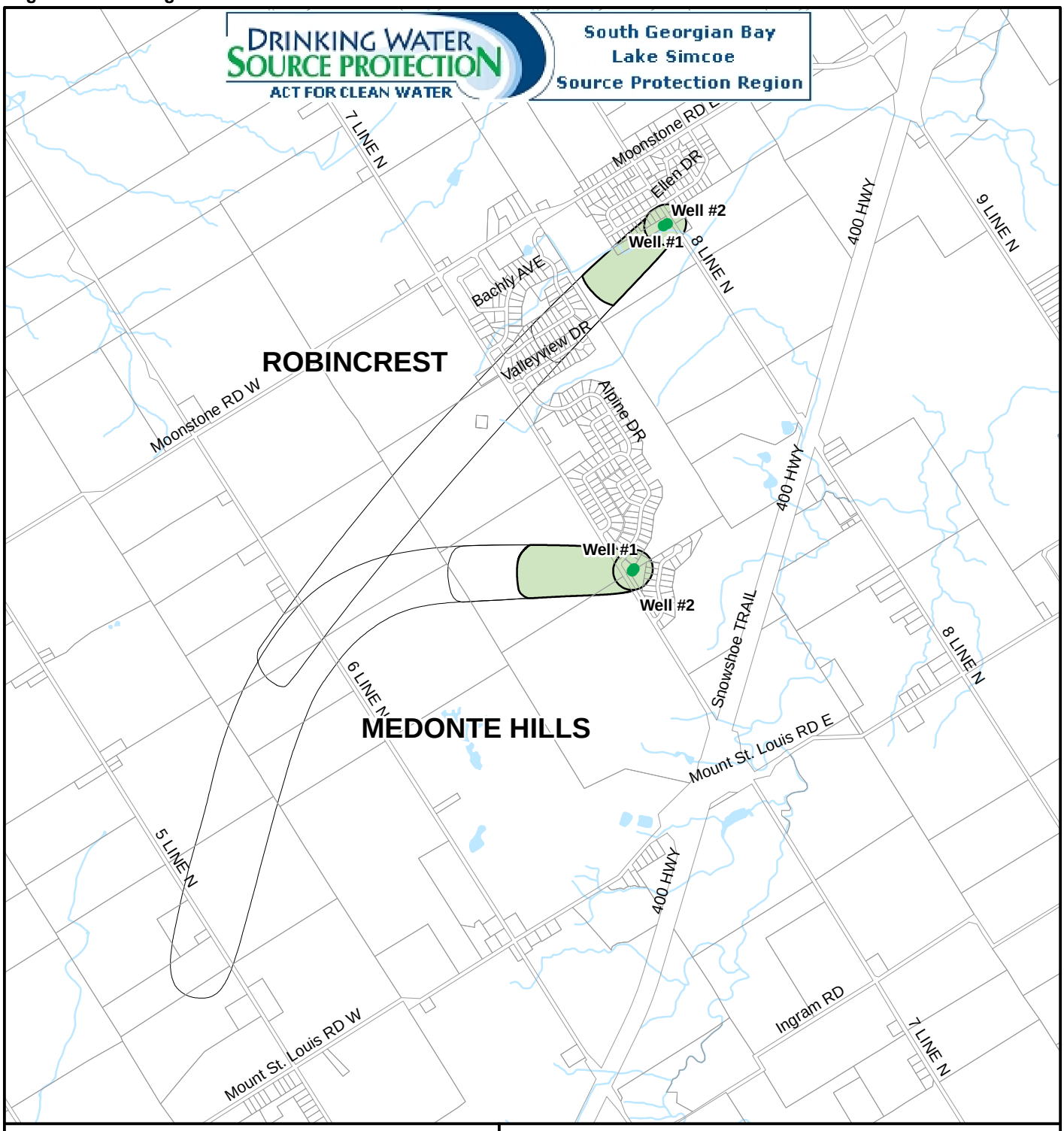
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JUNE 2010	SCALE: 1:30000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.7-8

GENIVAR Ontario

FIGURE **9b-6**

Figure 9b-7: Managed Lands – Medonte Hills/Robin Crest



MANAGED LANDS - MEDONTE HILLS/ROBINCREST

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: JUNE 2010	SCALE: 1:30000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.7-9

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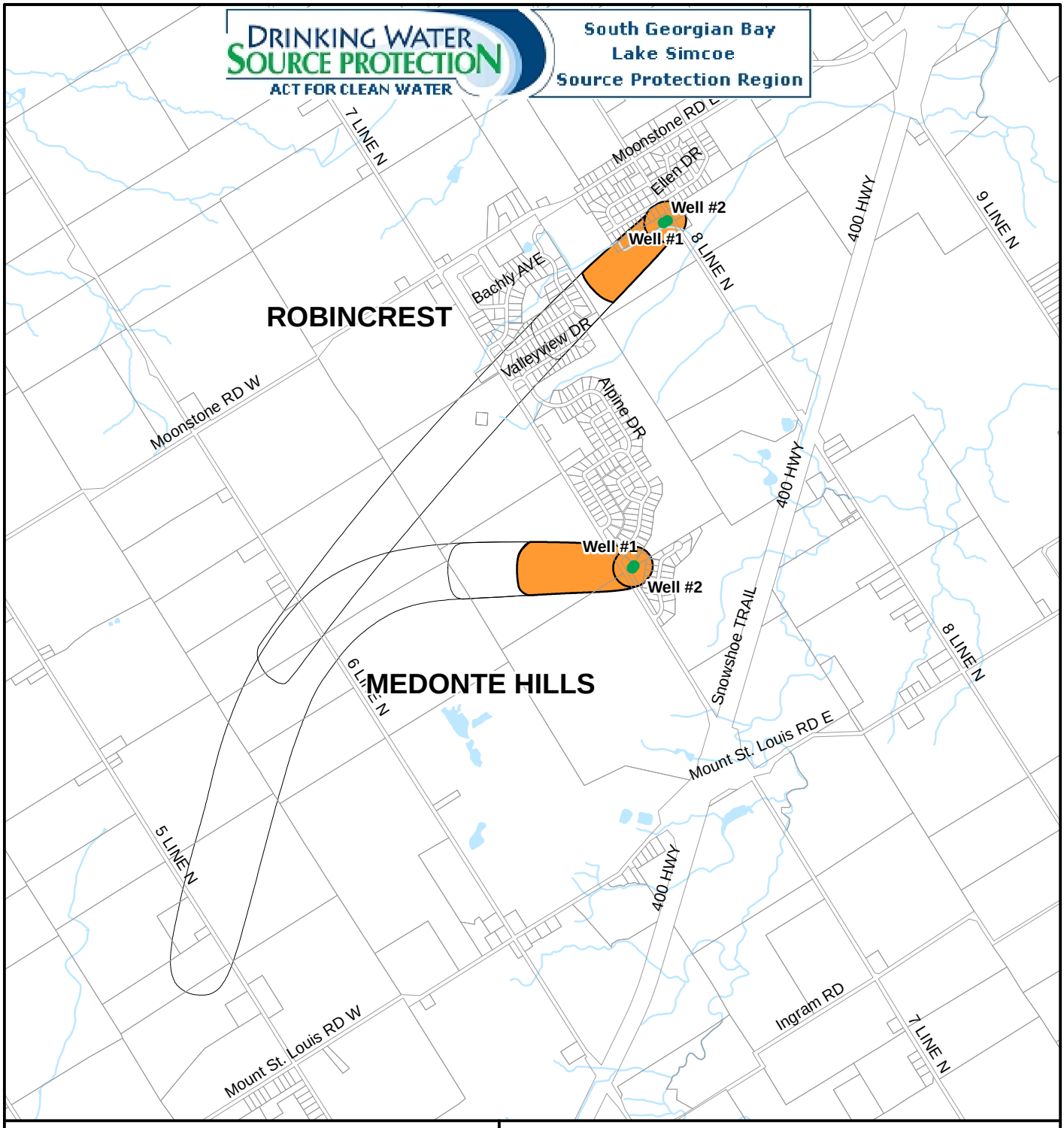
GENIVAR Ontario

FIGURE **9b-7**

Figure 9b-8: Livestock Density – Medonte Hills/Robin Crest



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

300 150 0 300 Metres

LIVESTOCK DENSITY - MEDONTE HILLS/ROBINCREST

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: JUNE 2010	SCALE: 1:30000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.7-10

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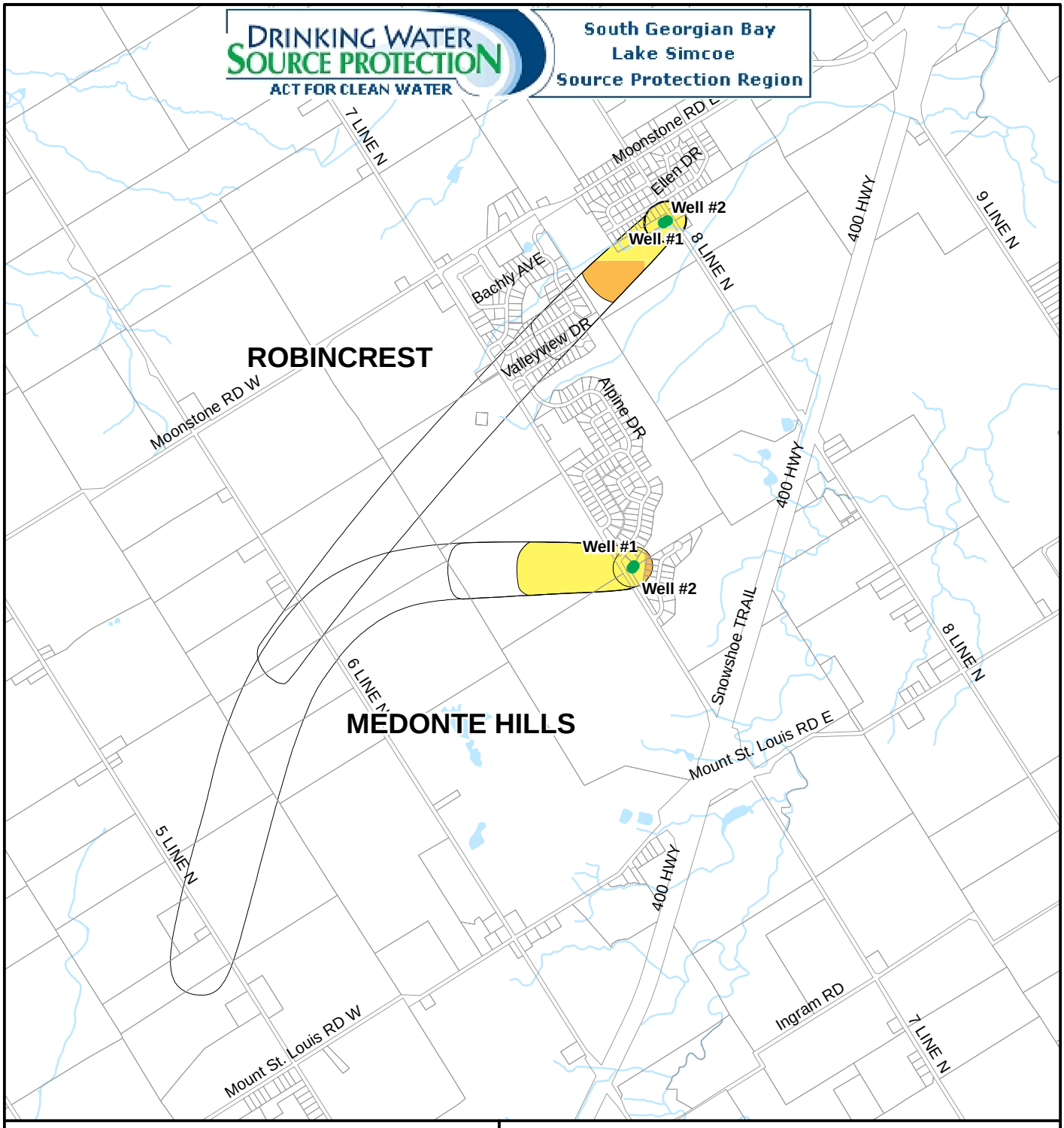
GENIVAR Ontario

FIGURE **9b-8**

Figure 9b-9: Impervious Surfaces – Medonte Hills/Robin Crest



Legend

MUNICIPAL WELL LOCATION

IMPERVIOUS SURFACE

<1%

>1% and <8%

>8% and <80%

N W E S

300 150 0 300 Metres

IMPERVIOUS SURFACES - MEDONTE HILLS/ROBINCREST

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.

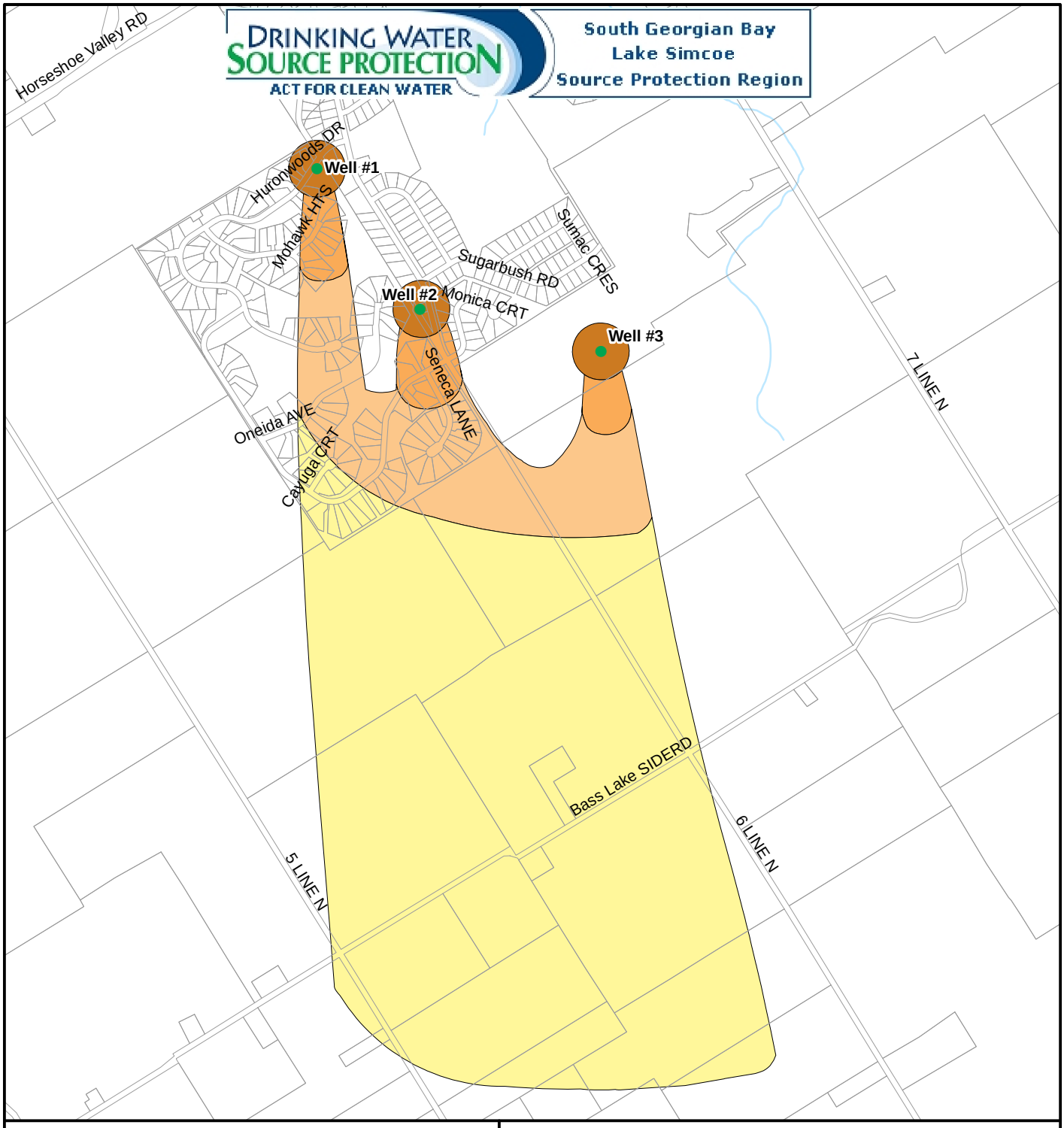
DATE: JUNE 2010 | SCALE: 1:30000

PROJECT: 0-071948.07 | FILE. NO.:0-07194807F13.7-11

GENIVAR Ontario

FIGURE **9b-9**

Figure 9c-1: Wellhead Protection Area - Sugarbush



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

200 100 0 200 Metres

WELLHEAD PROTECTION AREAS - SUGARBUSH, ORO-MEDONTE

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

DATE: JUNE 2010	SCALE: 1:20000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.10-1

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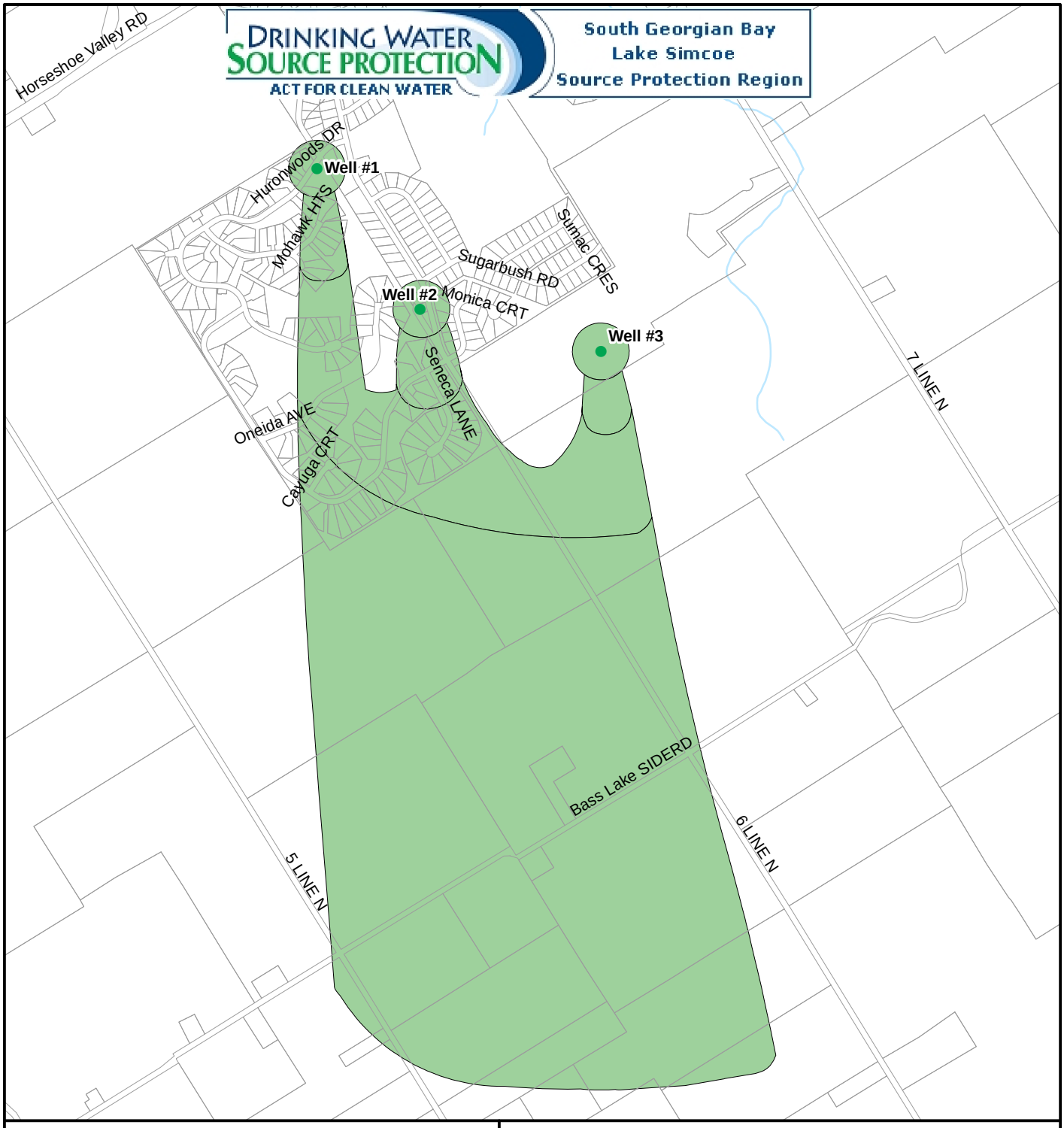
GENIVAR Ontario

FIGURE **9c-1**

Figure 9c-2: Groundwater Vulnerability - Sugarbush



LEGEND

- MUNICIPAL WELL LOCATION

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

N W E S

200 100 0 200 Metres

GROUNDWATER VULNERABILITY - SUGARBUSH

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

DATE: JUNE 2010	SCALE: 1:20000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.10-2

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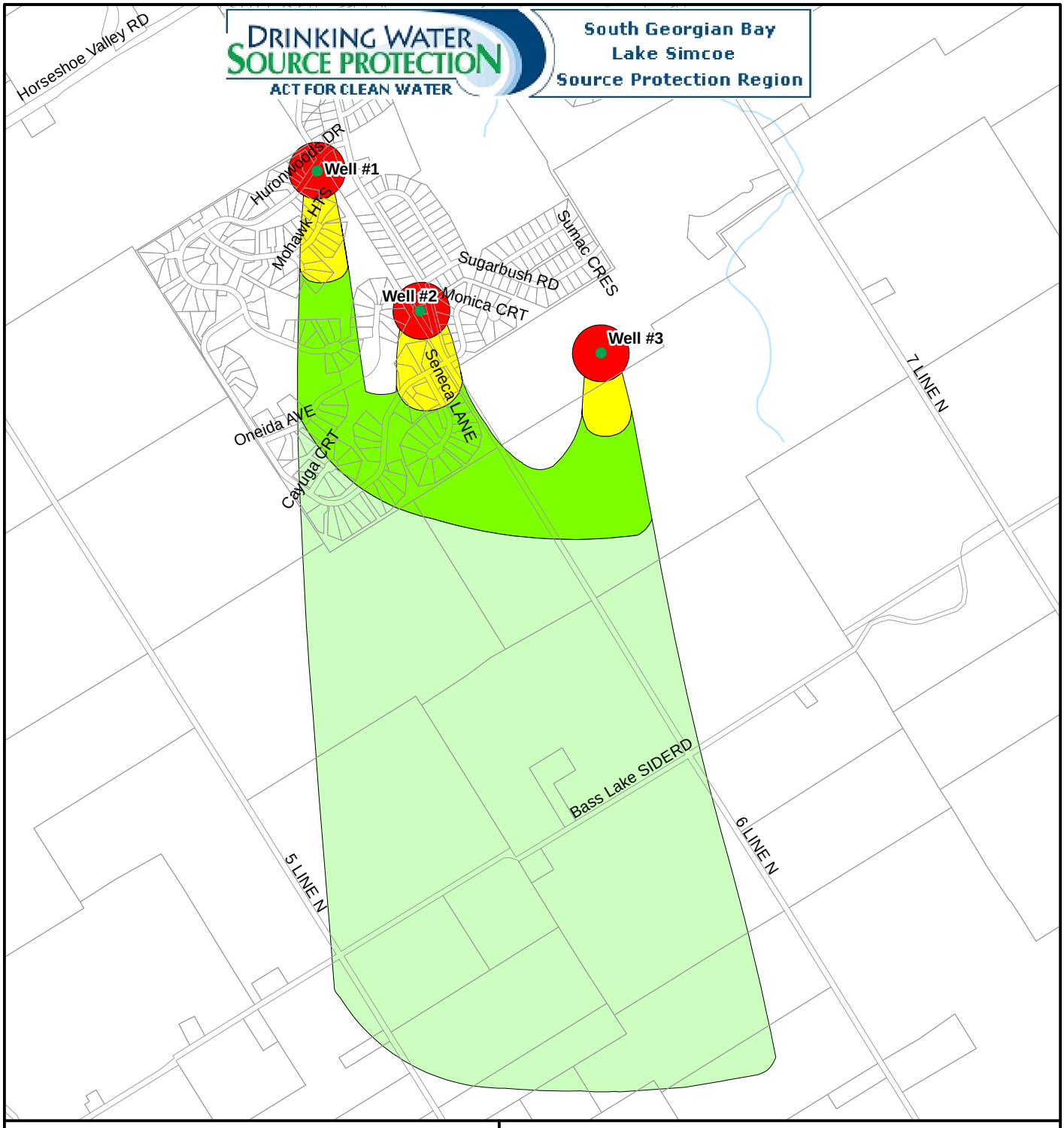
GENIVAR Ontario

FIGURE **9c-2**

Figure 9c-3: Vulnerability Scores - Sugarbush



VULNERABILITY SCORES - SUGARBUSH

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

DATE: JUNE 2010	SCALE: 1:20000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.10-3

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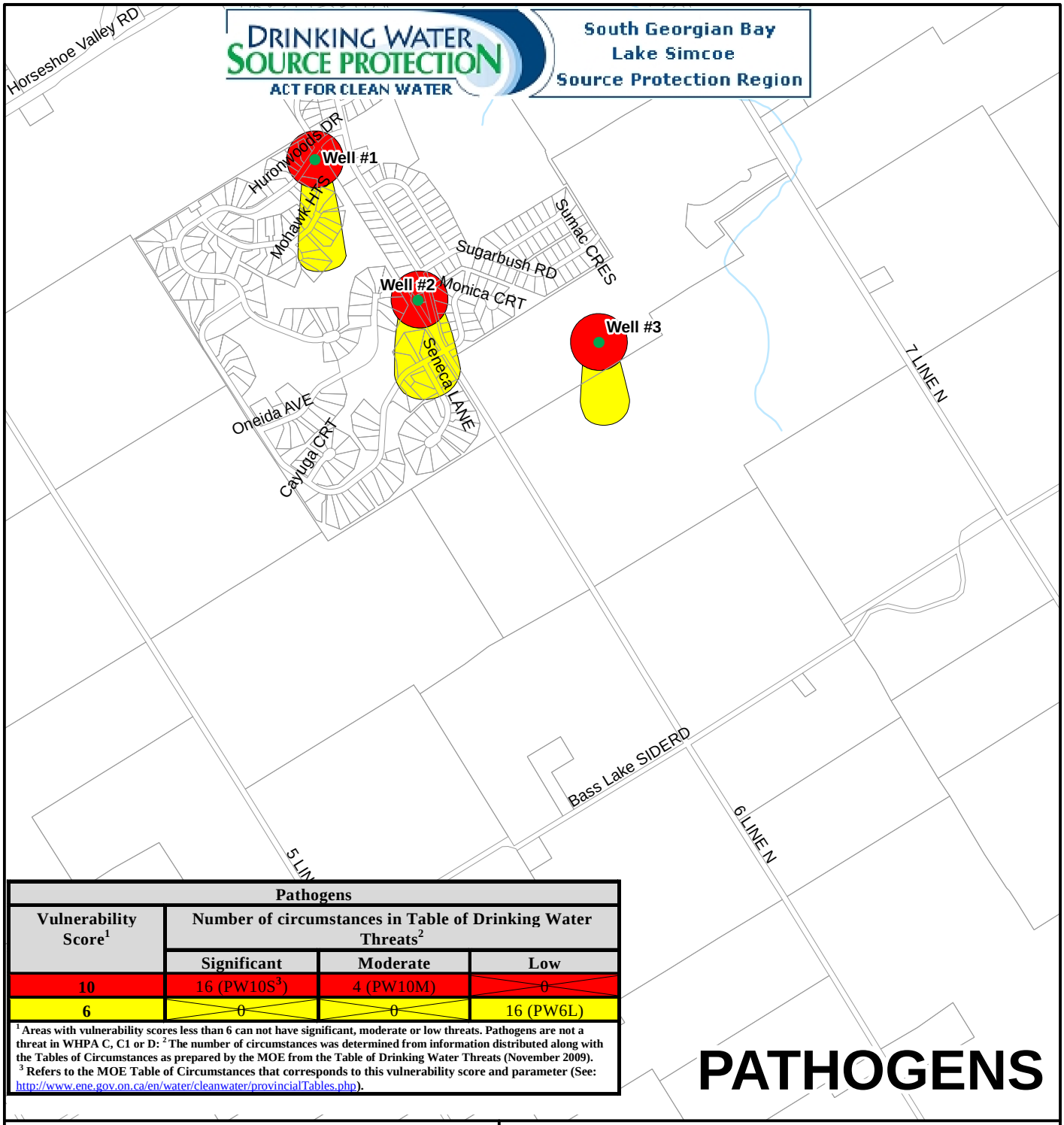
GENIVAR Ontario

FIGURE **9c-3**

Figure 9c-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats -Sugarbush



Pathogens			
Vulnerability Score[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
10	16 (PW10S[3])	4 (PW10M)	~~0~~
6	~~0~~	~~0~~	16 (PW6L)

[1] Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. Pathogens are not a threat in WHPA C, C1 or D: [2] The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009).
[3] Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).

PATHOGENS

LEGEND
- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING
- 10
- 8
- 6

N W E S

200 100 0 200 Metres

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

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. 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.

DATE: JUNE 2010	SCALE: 1:20000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.10-4

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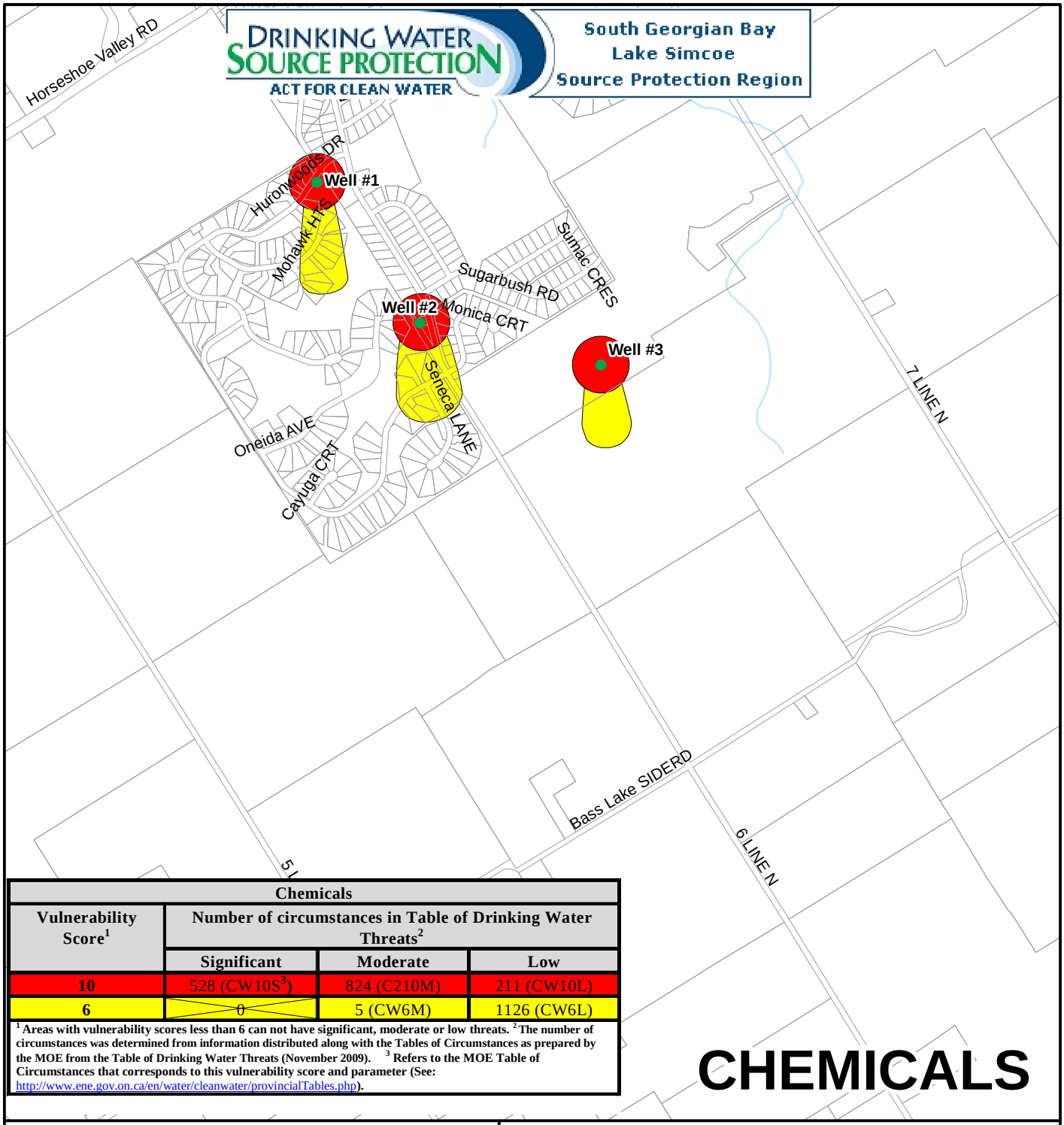
GENIVAR Ontario

FIGURE **9c-4**

Figure 9c-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats -Sugarbush



Chemicals			
Vulnerability Score[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
10	528 (CW10S[3])	824 (C210M)	211 (CW10L)
6	~~0~~	5 (CW6M)	1126 (CW6L)

[1] Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. [2] The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). [3] Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).

CHEMICALS

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.

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

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

DATE: JUNE 2010	SCALE: 1:20000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.10-5

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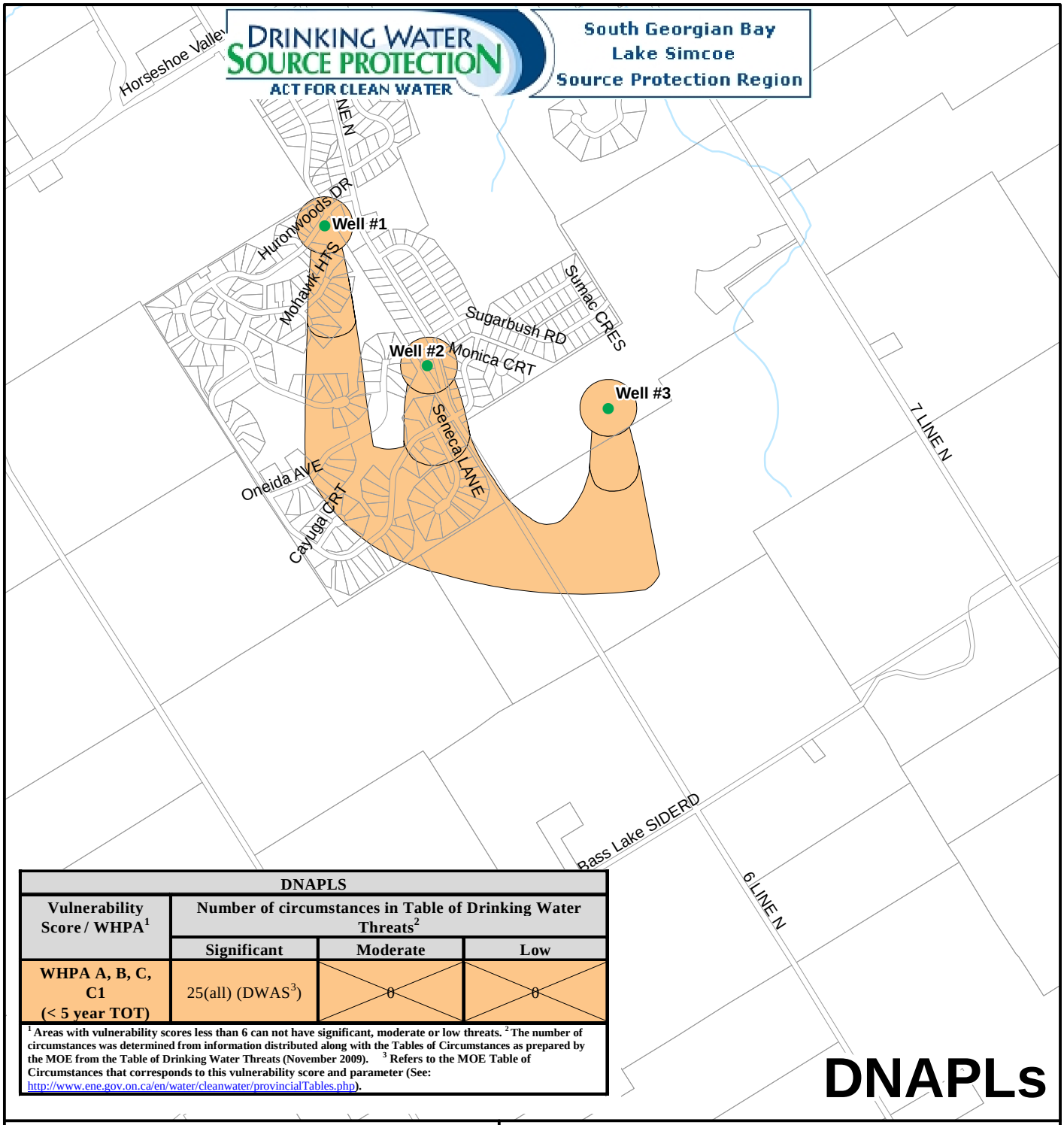
GENIVAR Ontario

FIGURE **9c-5**

Figure 9c-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats -Sugarbush



DNAPLS			
Vulnerability Score / WHPA[1]	**Number of circumstances in Table of Drinking Water Threats[2]**		
	Significant	**Moderate**	**Low**
WHPA A, B, C, C1 (< 5 year TOT)	25(all) (DWAS[3])	0	0

[1] Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. [2] The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). [3] Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).

DNAPLs

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.

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

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

DATE: JUNE 2010	SCALE: 1:20000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.10-6

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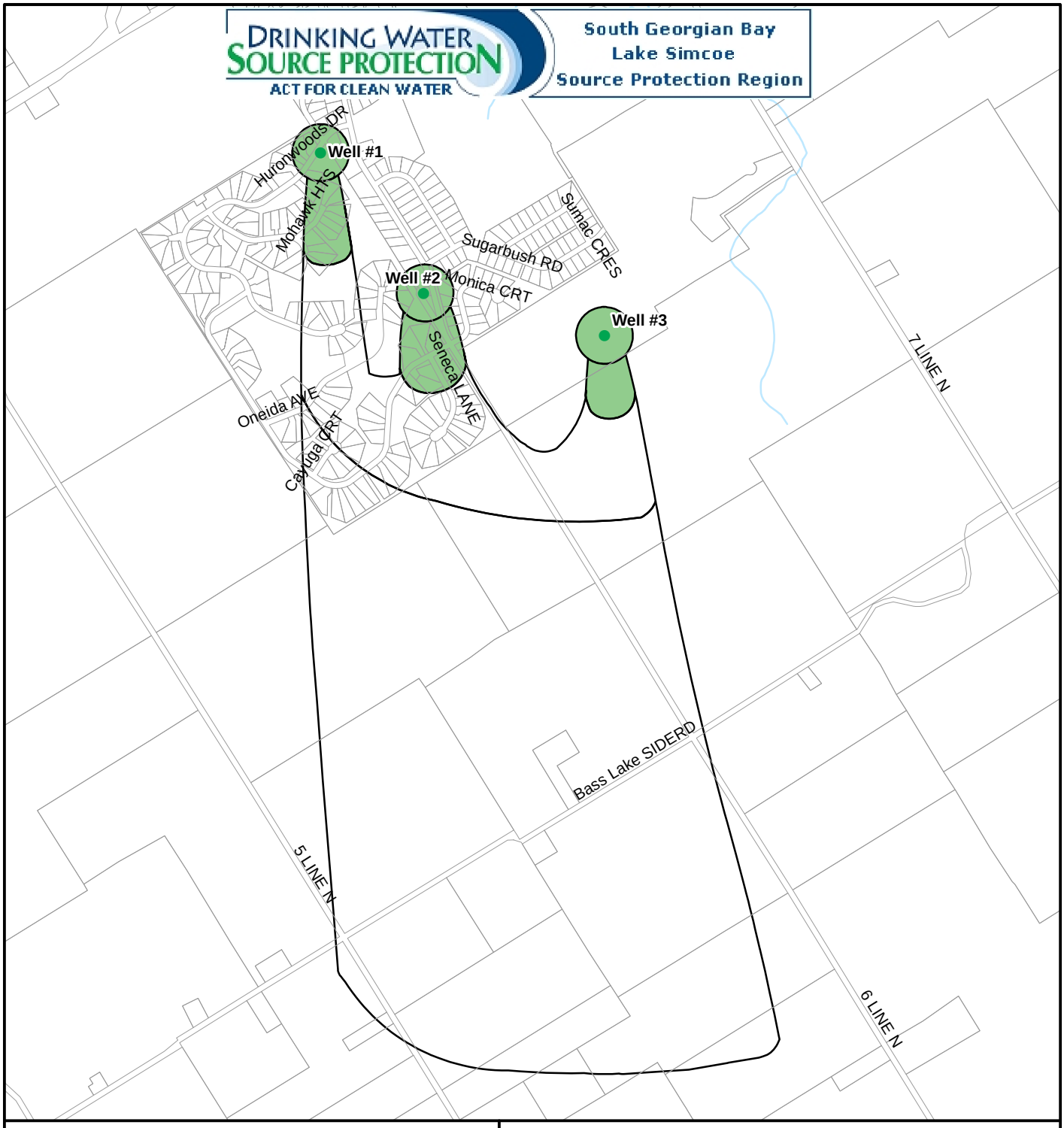
GENIVAR Ontario

FIGURE **9c-6**

Figure 9c-7: Managed Lands - Sugarbush



MANAGED LANDS - SUGARBUSH

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: JUNE 2010	SCALE: 1:20000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.10-7

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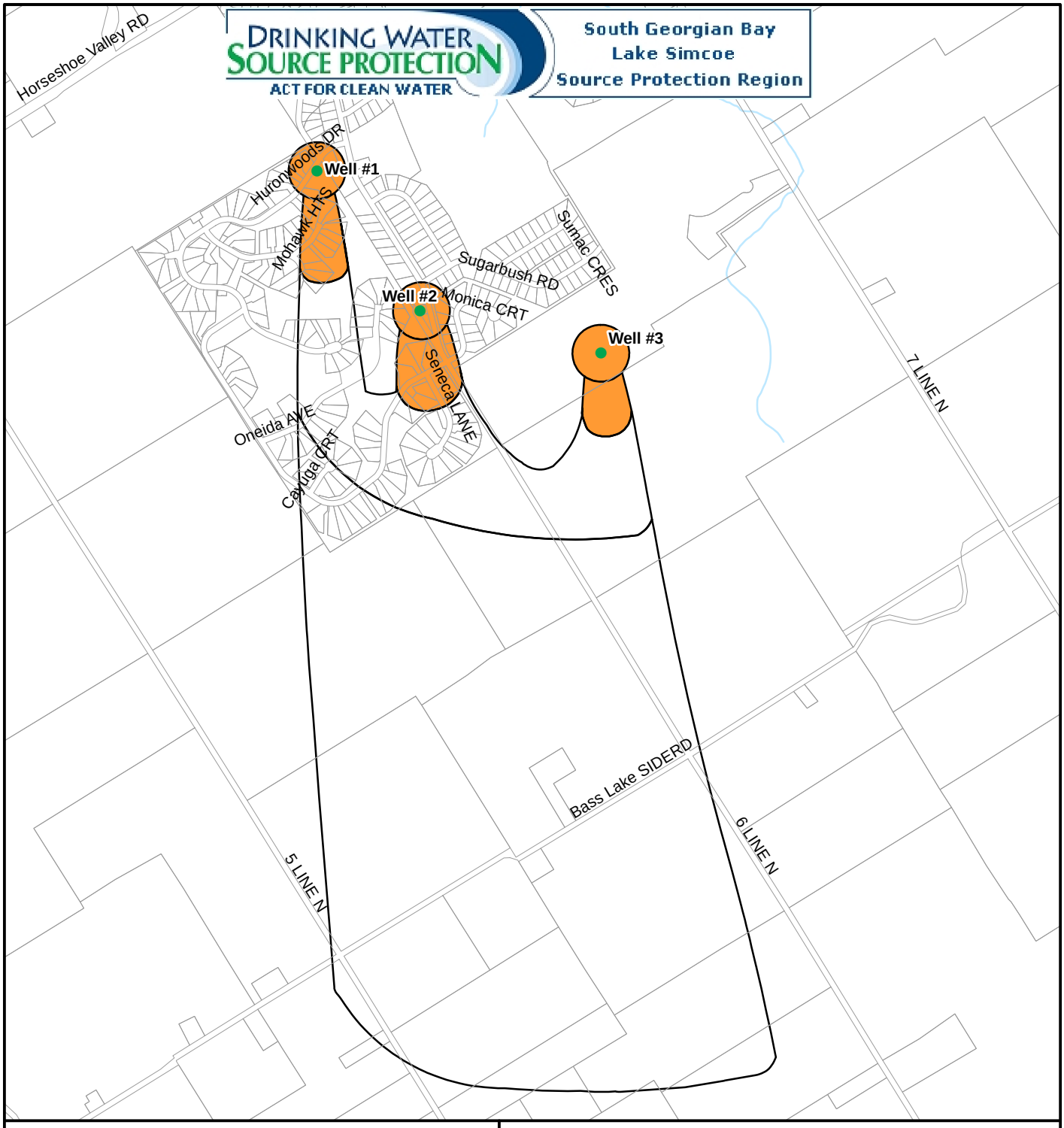
GENIVAR Ontario

FIGURE **9c-7**

Figure 9c-8: Livestock Density - Sugarbush



LIVESTOCK DENSITY - SUGARBUSH

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.

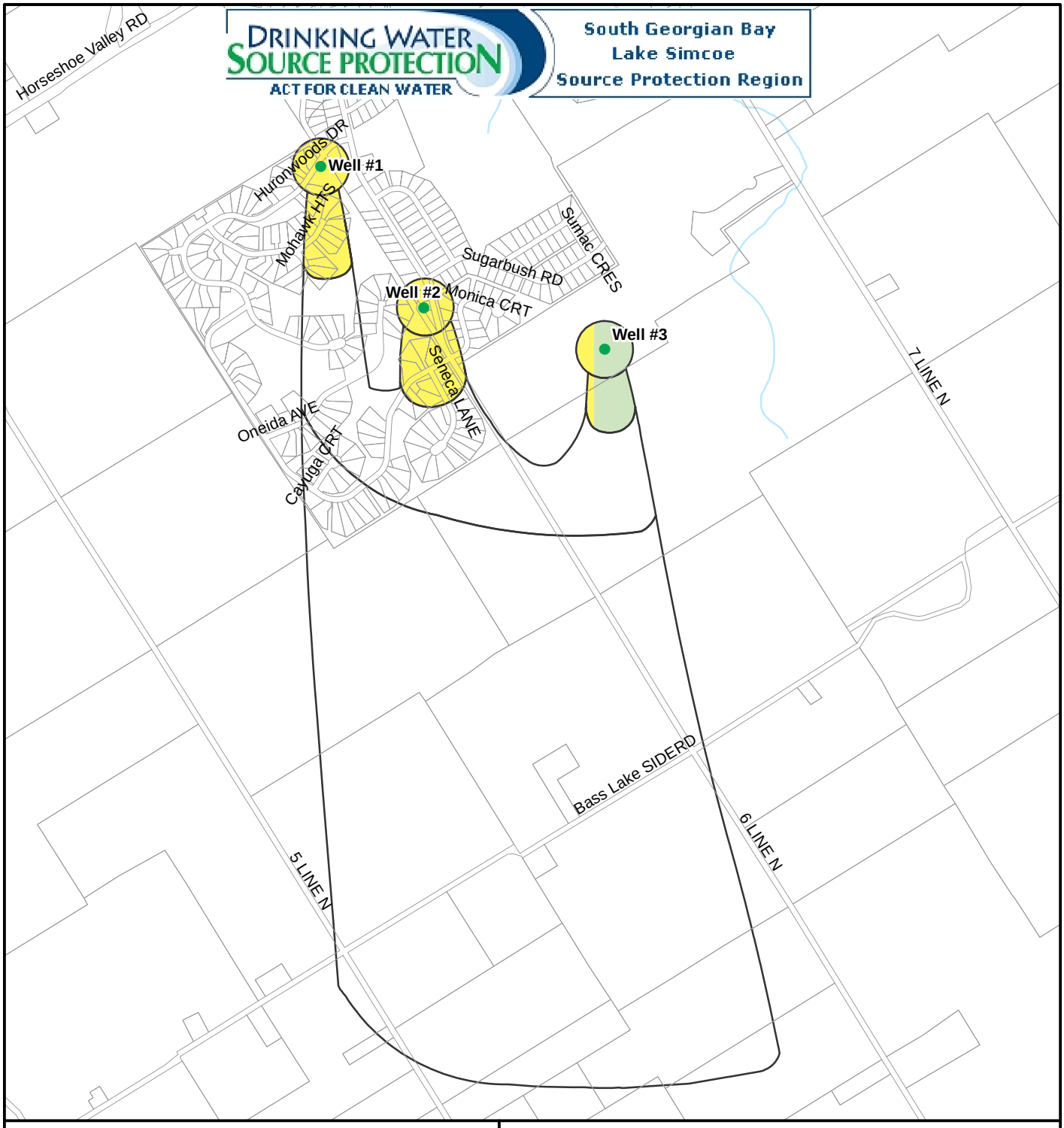
DATE: JUNE 2010	SCALE: 1:20000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.10-8

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 **9c-8**

Figure 9c-9: Impervious Surfaces - Sugarbush



IMPERVIOUS SURFACES - SUGARBUSH

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.

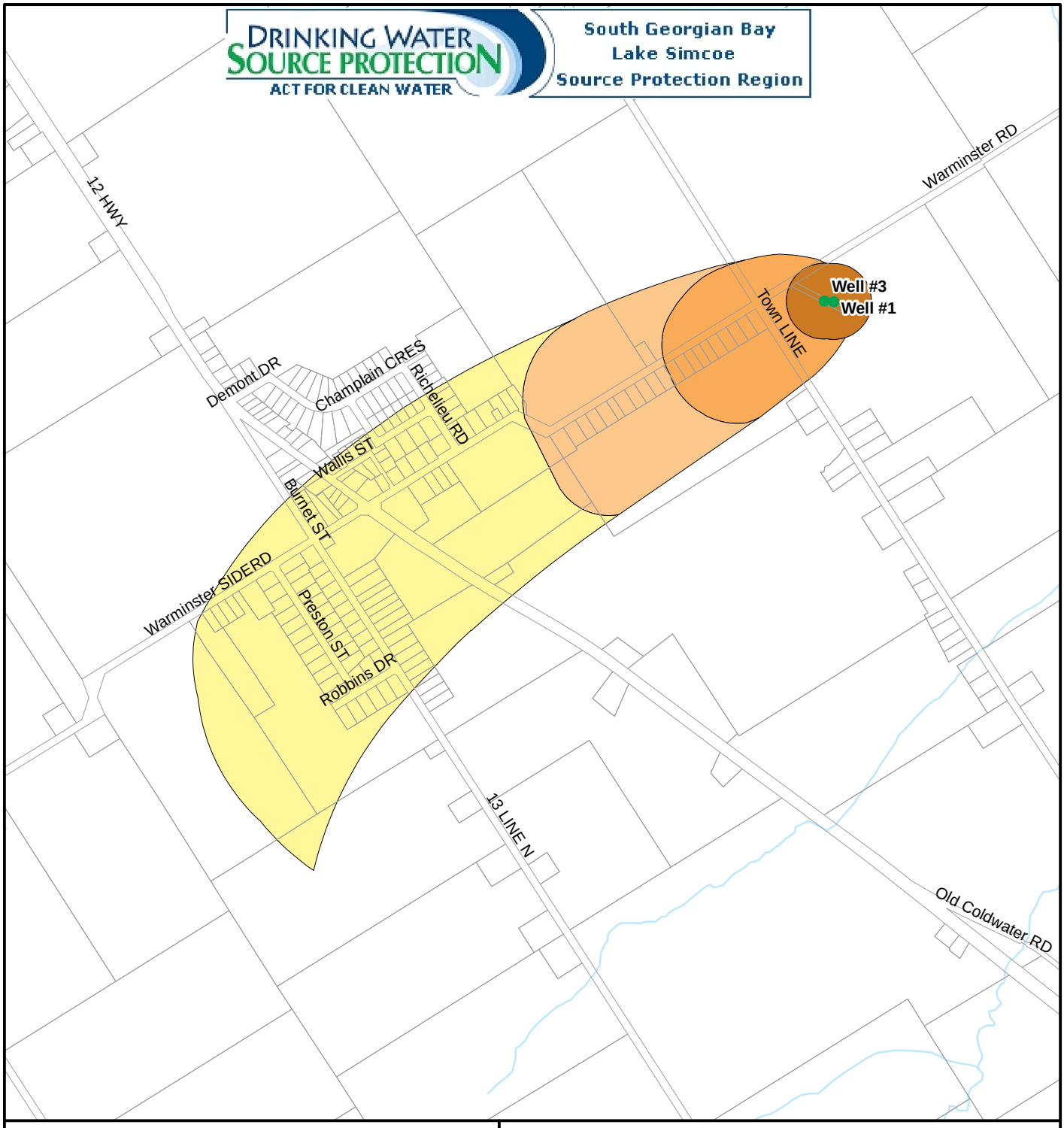
DATE: JUNE 2010	SCALE: 1:20000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.10-9

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 **9c-9**

Figure 9d-1: Wellhead Protection Area - Warminster



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

150 75 0 150 Metres

WELLHEAD PROTECTION AREAS - WARMINSTER, ORO-MEDONTE

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

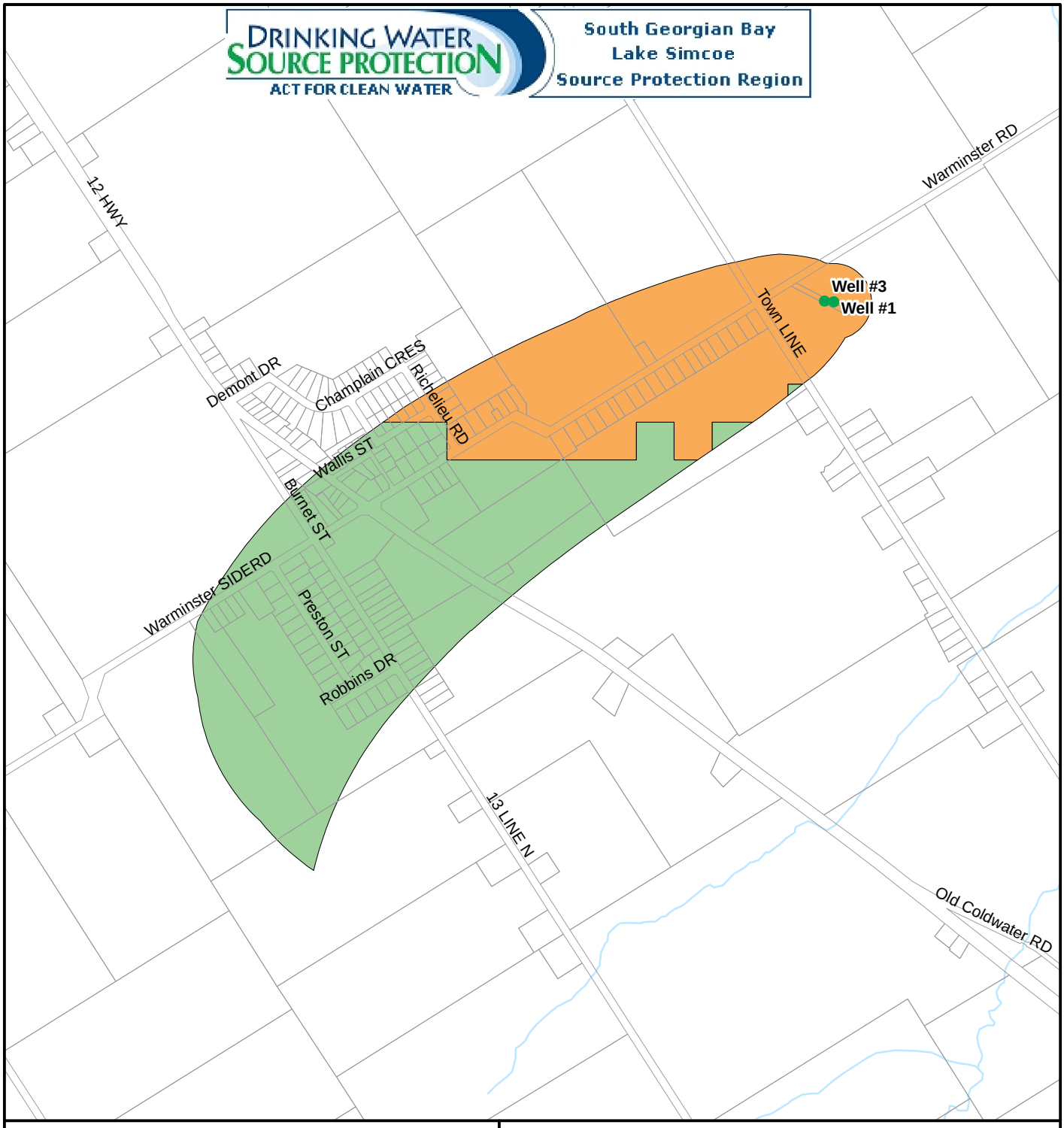
DATE: JUNE 2010	SCALE: 1:15000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.11-1

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 **9d-1**

Figure 9d-2: Groundwater Vulnerability - Warminster



LEGEND

- MUNICIPAL WELL LOCATION

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

N W E S

150 75 0 150 Metres

GROUNDWATER VULNERABILITY - WARMINSTER

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

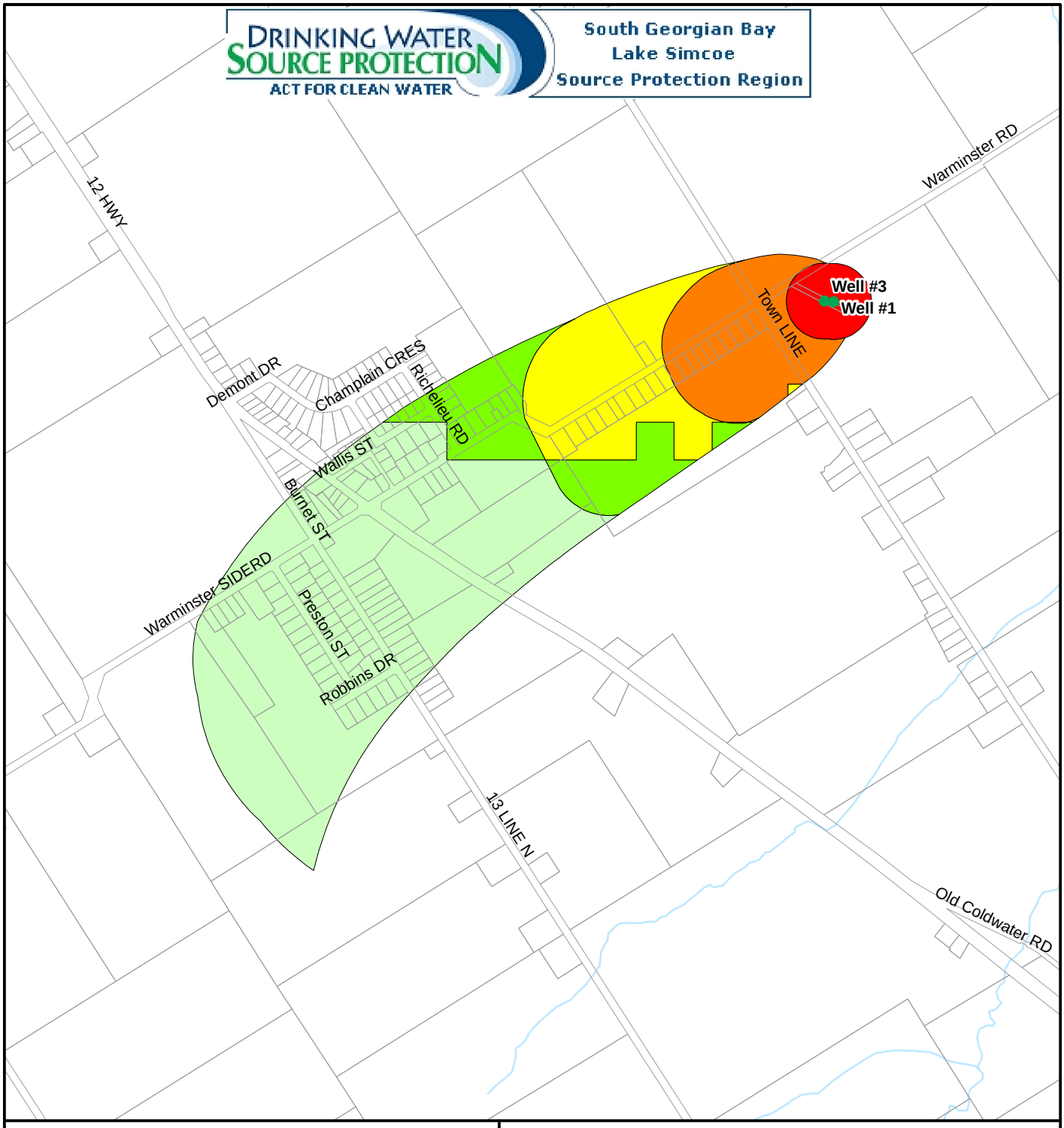
DATE: JUNE 2010	SCALE: 1:15000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.11-2

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 **9d-2**

Figure 9d-3: Vulnerability Score - Warminster



LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6
- 4
- 2

N W E S

150 75 0 150 Metres

VULNERABILITY SCORES - WARMINSTER

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

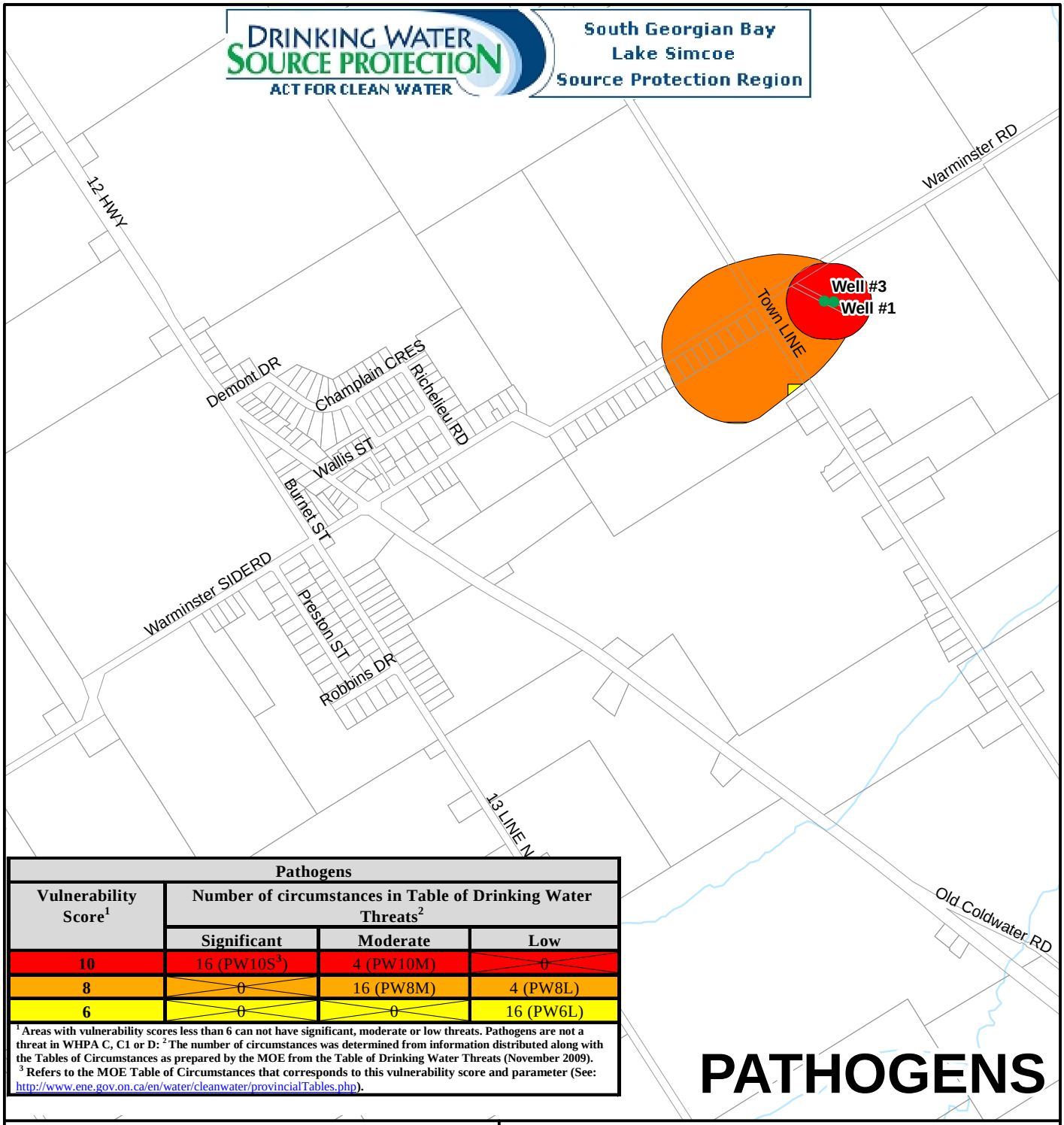
DATE: JUNE 2010	SCALE: 1:15000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.11-3

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 **9d-3**

Figure 9d-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats -Warminster



Pathogens			
Vulnerability Score[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
10	16 (PW10S[3])	4 (PW10M)	~~0~~
8	~~0~~	16 (PW8M)	4 (PW8L)
6	~~0~~	~~0~~	16 (PW6L)

[1] Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. Pathogens are not a threat in WHPA C, C1 or D: [2] The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009).
[3] Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).

PATHOGENS

LEGEND
- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING
- 10
- 8
- 6

N W E S

150 75 0 150 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.

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

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

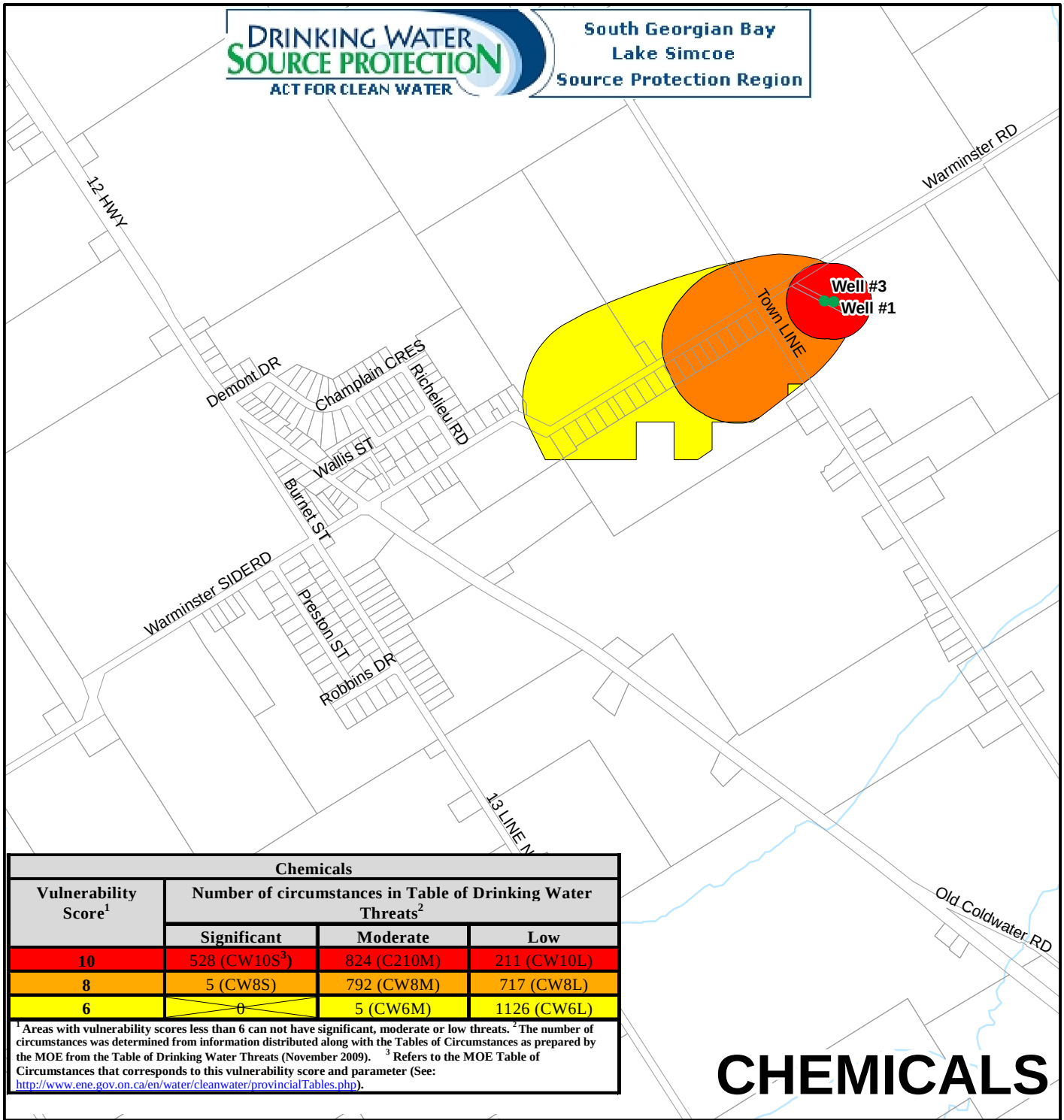
DATE: JUNE 2010	SCALE: 1:15000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.11-4

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 **9d-4**

Figure 9d-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats -Warminster



Chemicals			
Vulnerability Score[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
10	528 (CW10S[3])	824 (C210M)	211 (CW10L)
8	5 (CW8S)	792 (CW8M)	717 (CW8L)
6	~~0~~	5 (CW6M)	1126 (CW6L)

[1] Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. [2] The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). [3] Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).

CHEMICALS

LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6

N W E S

150 75 0 150 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.

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

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

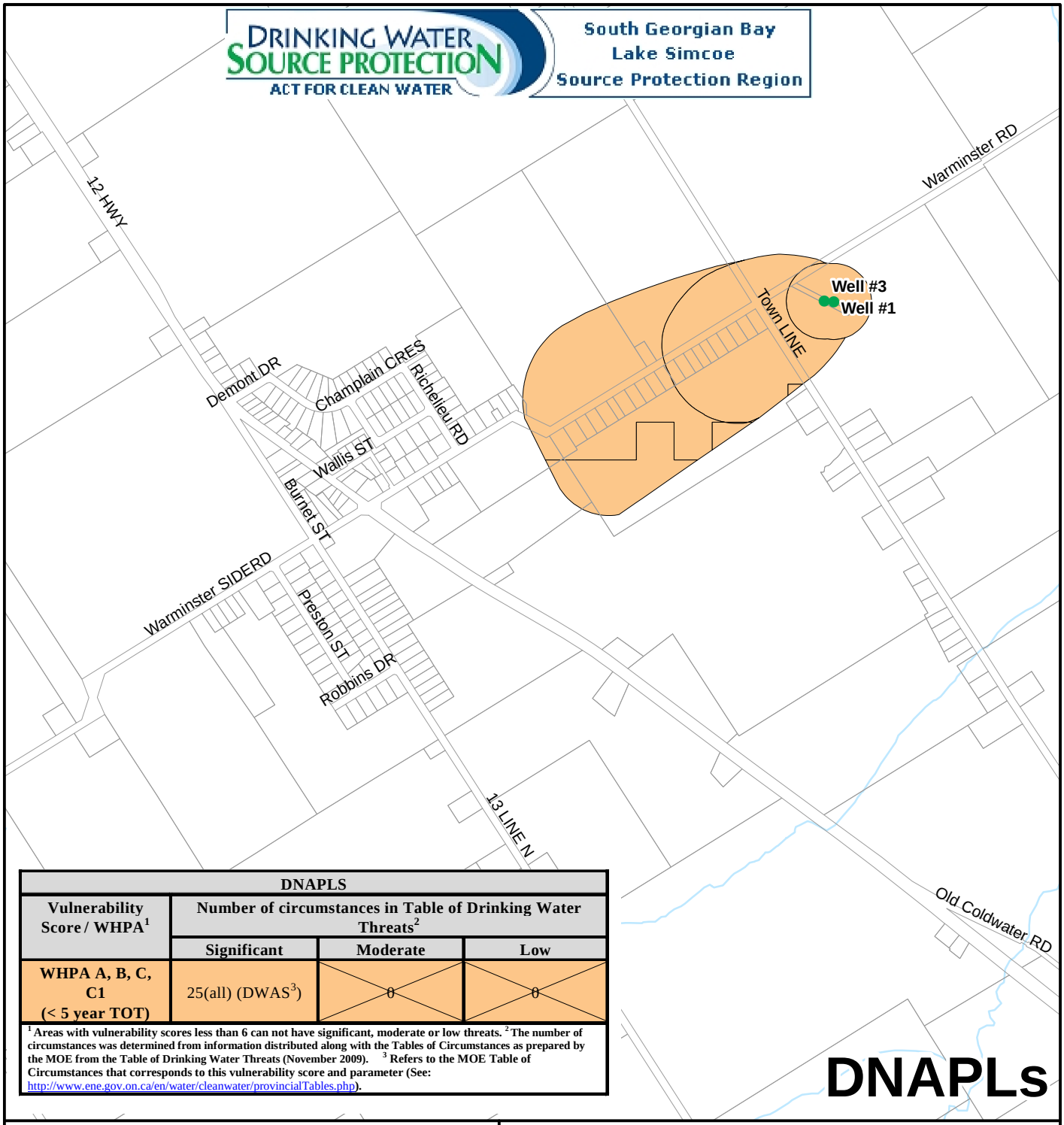
DATE: JUNE 2010	SCALE: 1:15000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.11-5

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 9d-5

Figure 9d-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats -Warminster



DNAPLS			
Vulnerability Score / WHPA[1]	**Number of circumstances in Table of Drinking Water Threats[2]**		
	Significant	**Moderate**	**Low**
WHPA A, B, C, C1 (< 5 year TOT)	25(all) (DWAS[3])	0	0

[1] Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. [2] The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). [3] Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).

DNAPLs

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

N W E S

150 75 0 150 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.

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

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

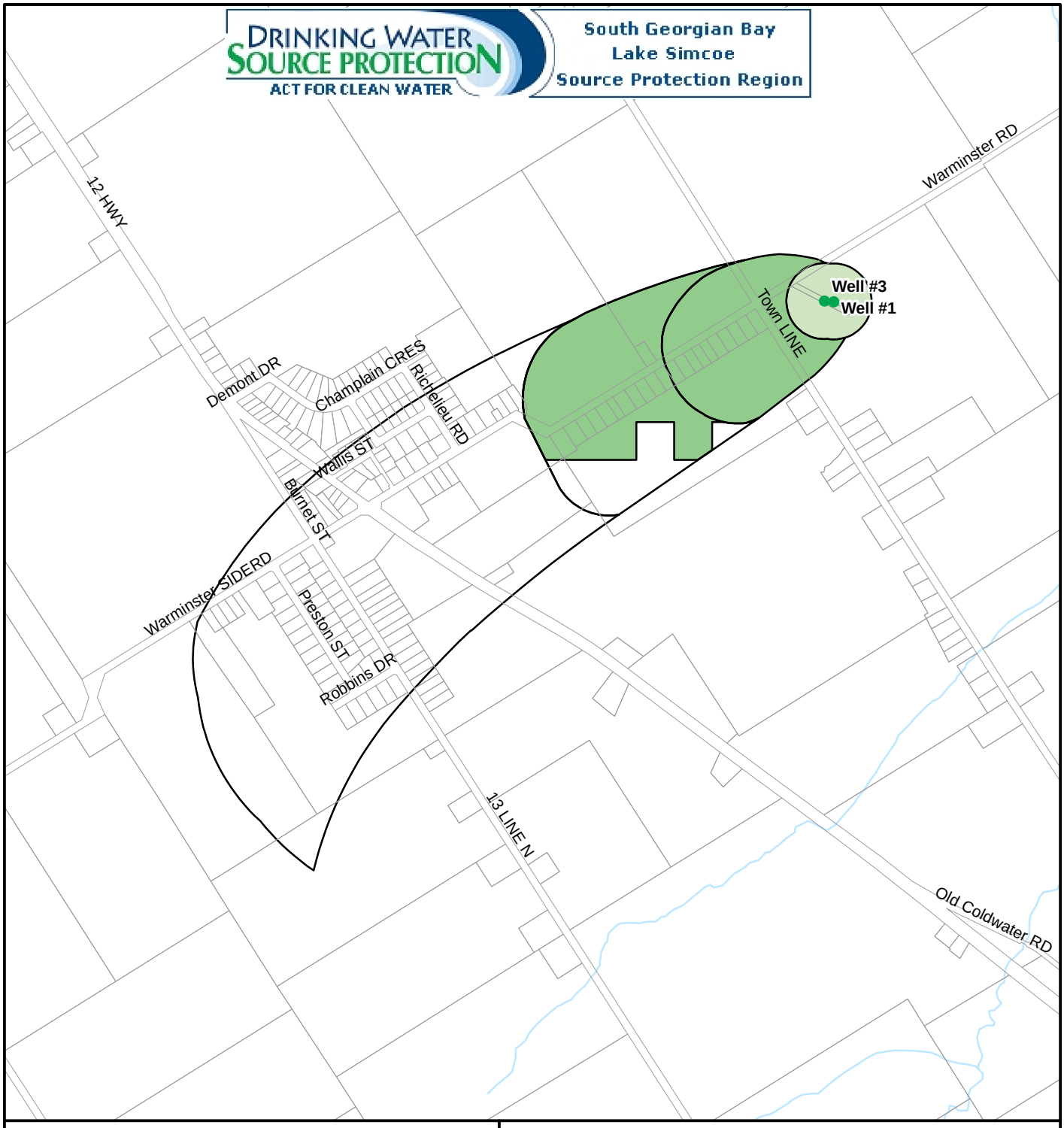
DATE: JUNE 2010	SCALE: 1:15000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.11-6

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 **9d-6**

Figure 9d-7: Managed Lands - Warminster



Legend

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

N W E S

150 75 0 150 Metres

MANAGED LANDS - WARMINSTER

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: JUNE 2010	SCALE: 1:15000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.11-7

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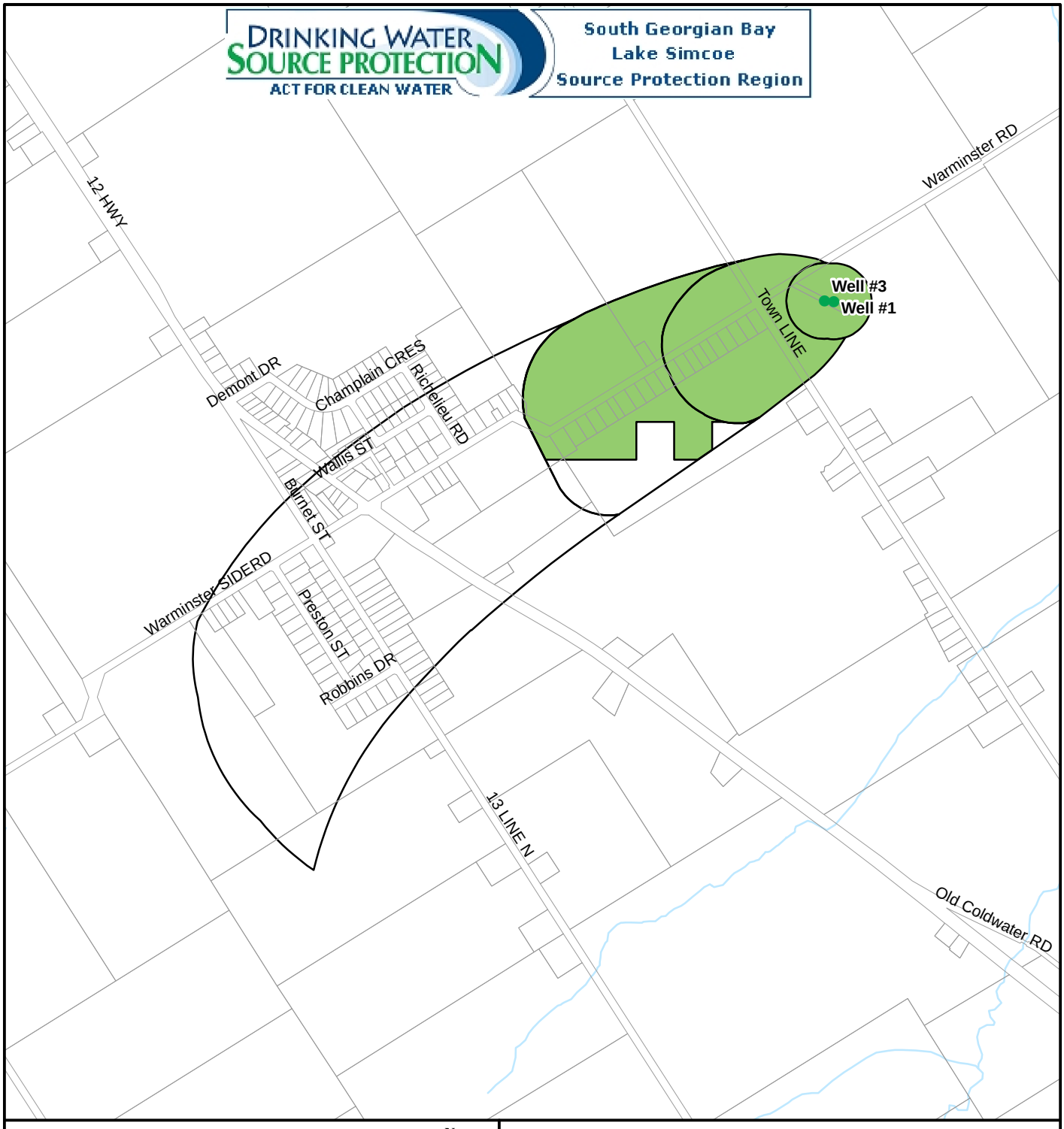
GENIVAR Ontario

FIGURE **9d-7**

Figure 9d-8: Livestock Density - Warminster



LIVESTOCK DENSITY - WARMINSTER

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: JUNE 2010 | SCALE: 1:15000

PROJECT: 0-071948.07 | FILE. NO.:0-07194807F13.11-8

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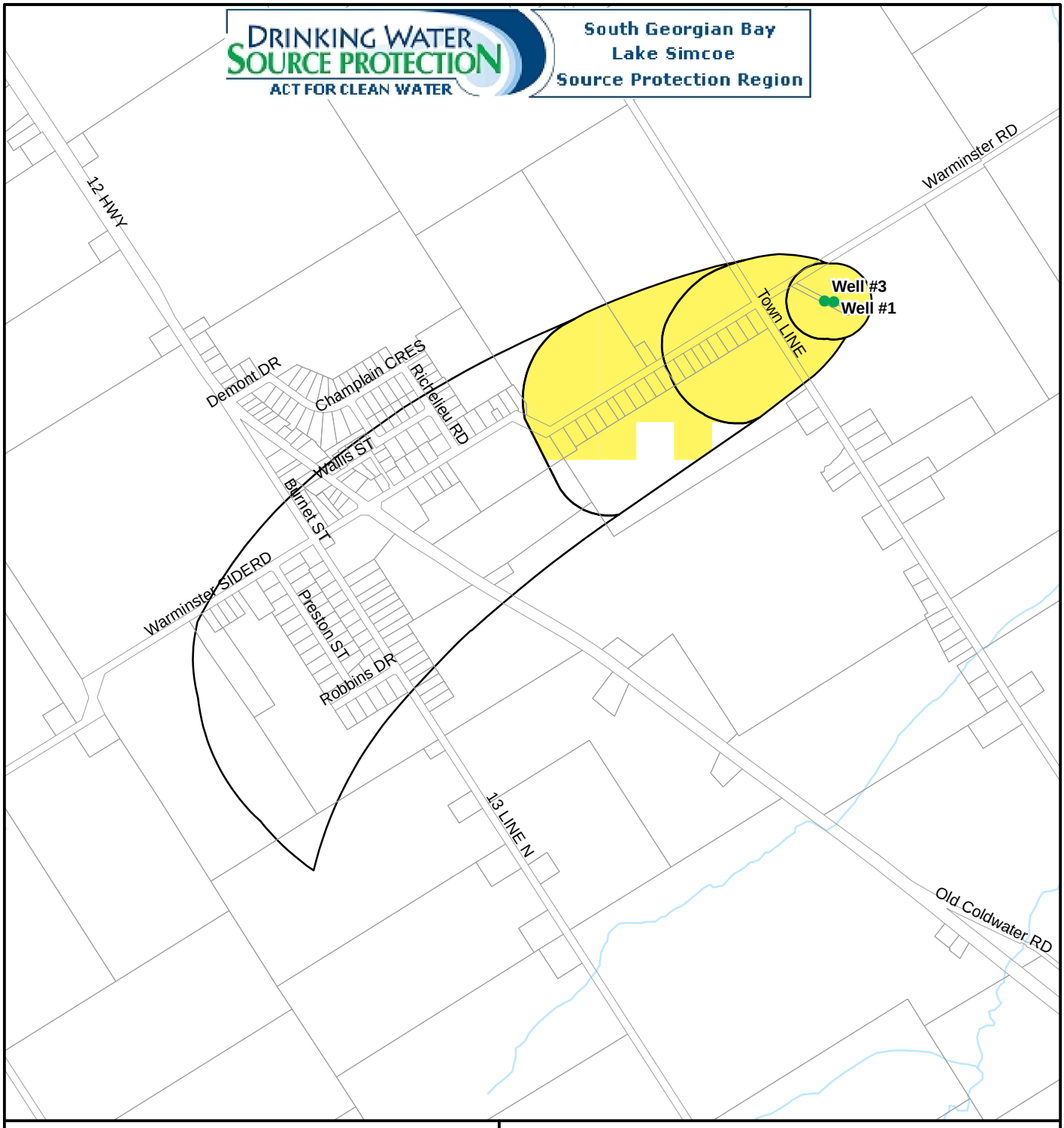
GENIVAR Ontario

FIGURE **9d-8**

Figure 9d-9: Impervious Surfaces - Warminster



IMPERVIOUS SURFACES - WARMINSTER

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: JUNE 2010	SCALE: 1:15000
PROJECT: 0-071948.07	FILE. NO.:0-07194807F13.11-9

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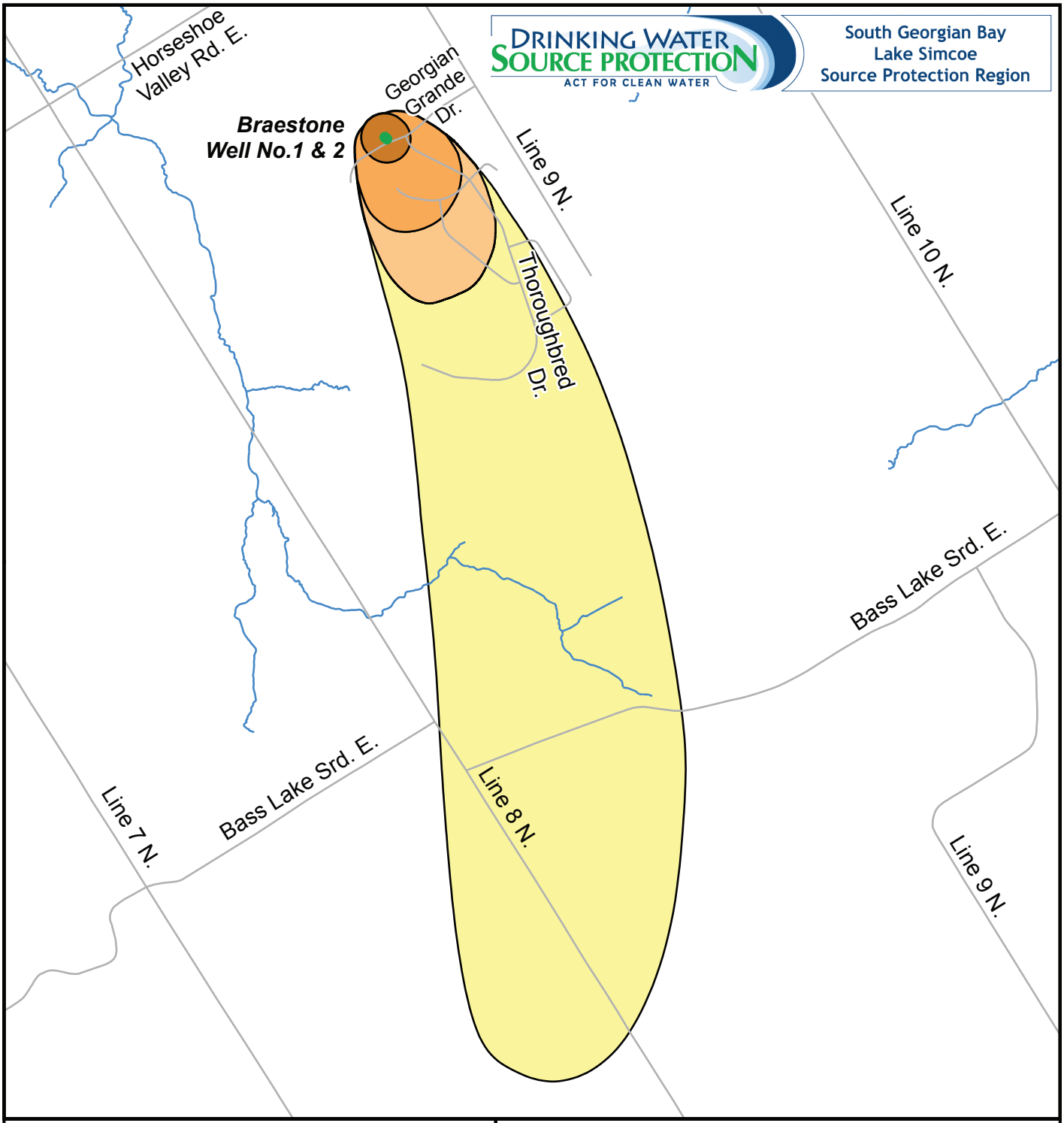
GENIVAR Ontario

FIGURE **9d-9**

Figure 9e-1: Wellhead Protection Areas - Braestone



Legend

- MUNICIPAL WELL LOCATION
- ROADS
- WATERCOURSE

200 100 0 200 Metres

N W E S

WELLHEAD PROTECTION AREA

- 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

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WELLHEAD PROTECTION AREAS - BRAESTONE, ORO-MEDONTE

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

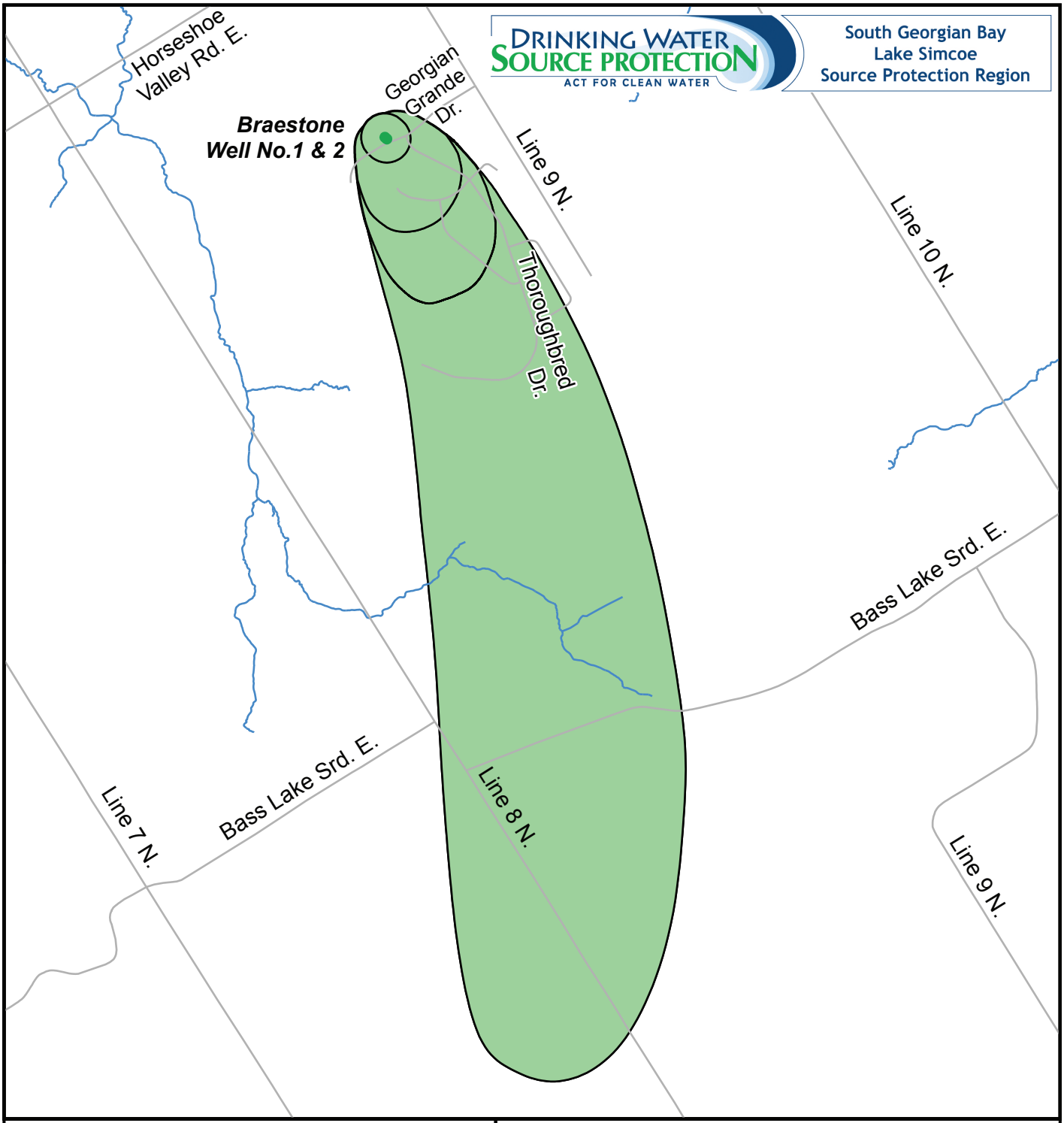
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: OCTOBER 2020	SCALE: 1:24,000

GOLDER Ontario

FIGURE **9e-1**

Figure 9e-2: Groundwater Vulnerability - Braestone



Legend

- MUNICIPAL WELL LOCATION
- ROADS
- WATERCOURSE

200 100 0 200 Metres

N W E S

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

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GROUNDWATER VULNERABILITY - BRAESTONE, ORO-MEDONTE

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

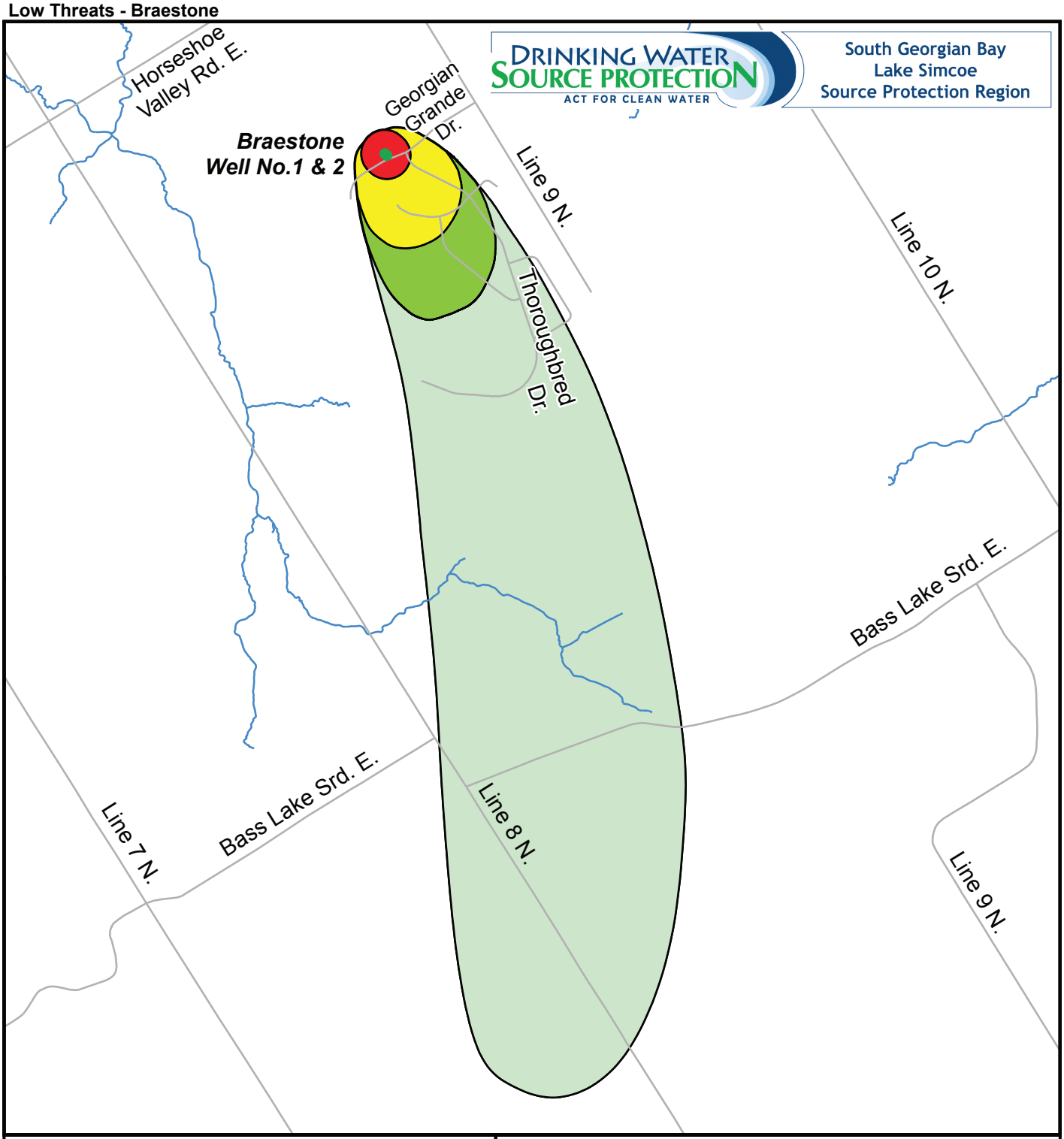
DATE: OCTOBER 2020

SCALE: 1:24,000

GOLDER Ontario

FIGURE 9e-2

Figure 9e-3: Vulnerability Scores - Braestone Figure 9a-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats - Braestone



Legend

- MUNICIPAL WELL LOCATION
- ROADS
- WATERCOURSE

200 100 0 200 Metres

N W E S

VULNERABILITY SCORING

- 10
- 8
- 6
- 4
- 2

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VULNERABILITY SCORES - BRAESTONE, ORO-MEDONTE

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

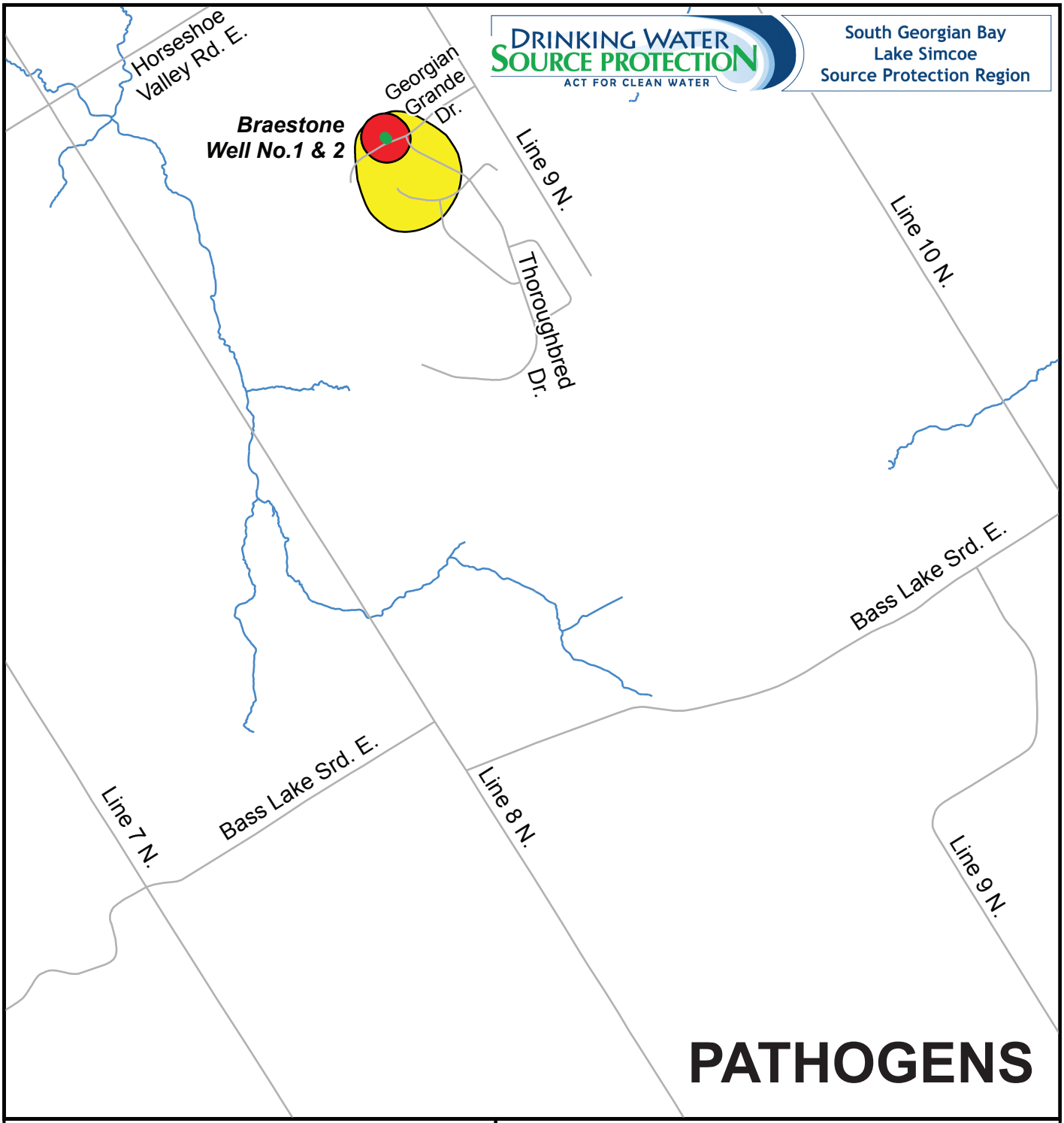
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: OCTOBER 2020	SCALE: 1:24,000

GOLDER Ontario

FIGURE **9e-3**

Figure 9e-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats - Braestone, Oro-Medonte



Legend

- MUNICIPAL WELL LOCATION
- ROADS
- WATERCOURSE

200 100 0 200 Metres

N W E S

VULNERABILITY SCORING

- 10
- 8
- 6

AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW BRAESTONE, ORO-MEDONTE

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: OCTOBER 2020

SCALE: 1:24,000

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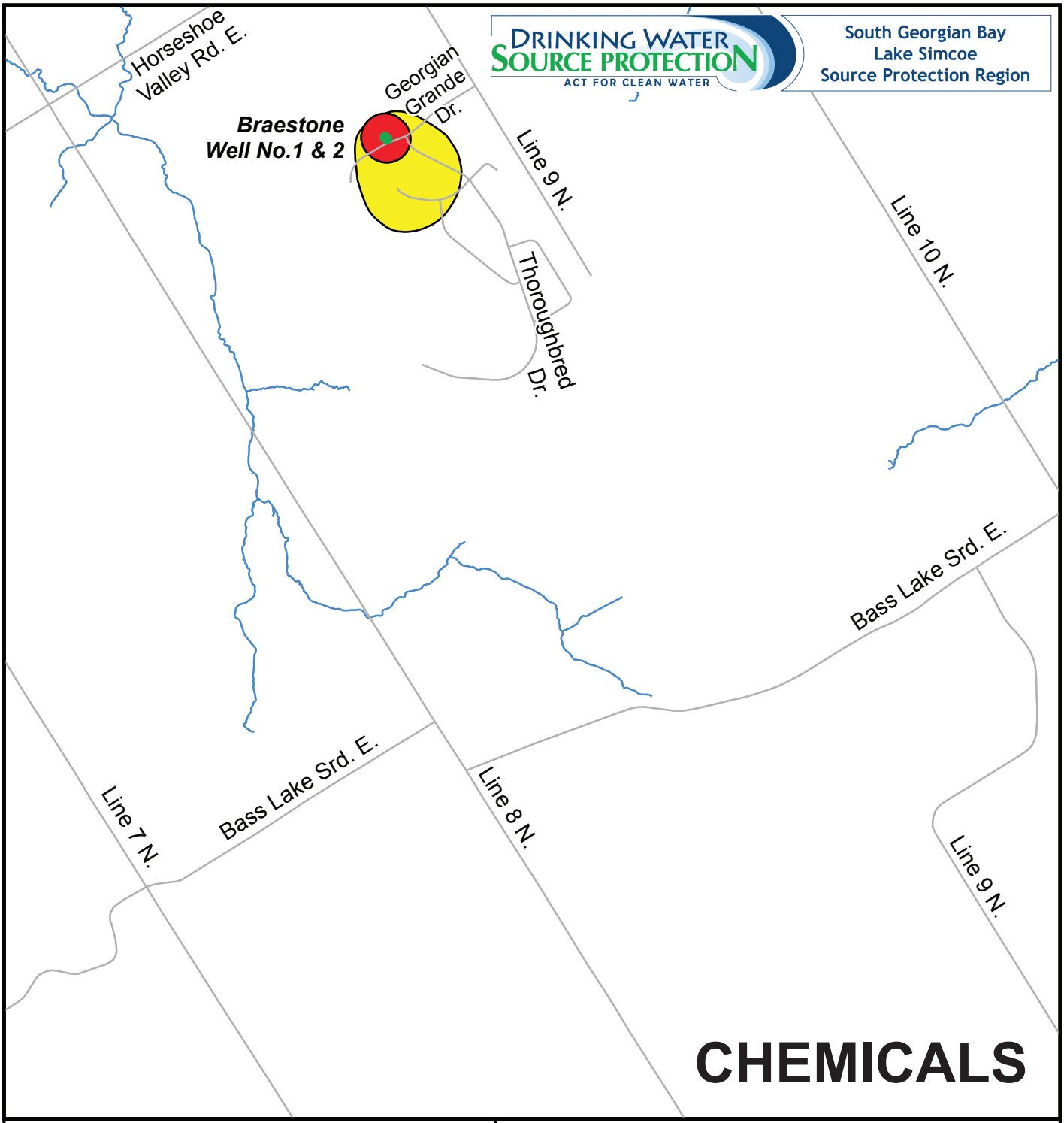
GOLDER Ontario

FIGURE 9e-4

Figure 9e-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats - Braestone



Legend

- MUNICIPAL WELL LOCATION
- ROADS
- WATERCOURSE

200 100 0 200 Metres

N W E S

VULNERABILITY SCORING

- 10
- 8
- 6

AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW BRAESTONE, ORO-MEDONTE

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.

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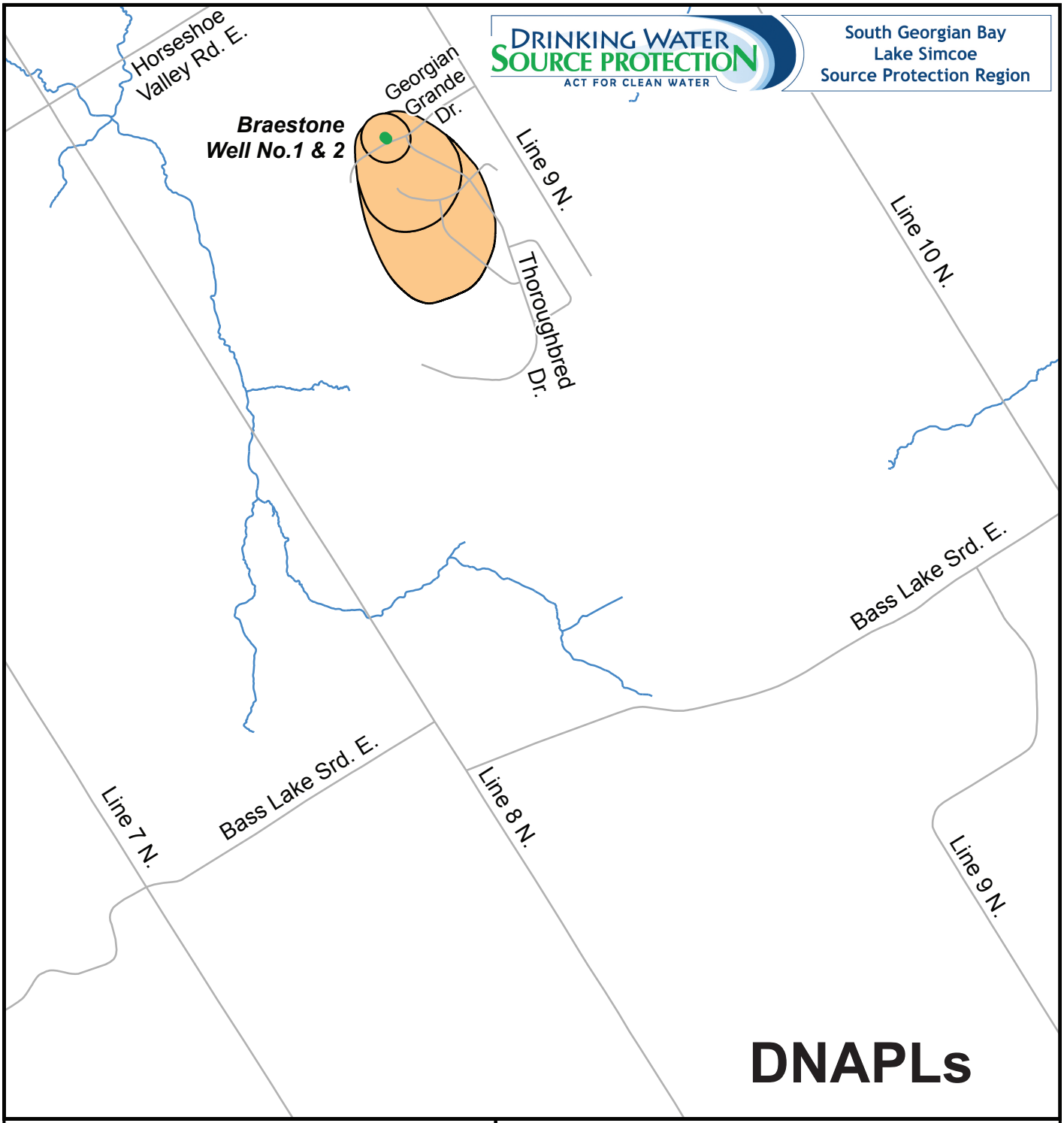
DATE: OCTOBER 2020

SCALE: 1:24,000

GOLDER Ontario

FIGURE 9e-5

Figure 9e-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats - Braestone



Legend

- MUNICIPAL WELL LOCATION
- ROADS
- WATERCOURSE
- WHPA-C 5 YEAR TIME-OF-TRAVEL

N W E S

200 100 0 200 Metres

AREAS WHERE DNAPLs ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW BRAESTONE, ORO-MEDONTE

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: OCTOBER 2020

SCALE: 1:24,000

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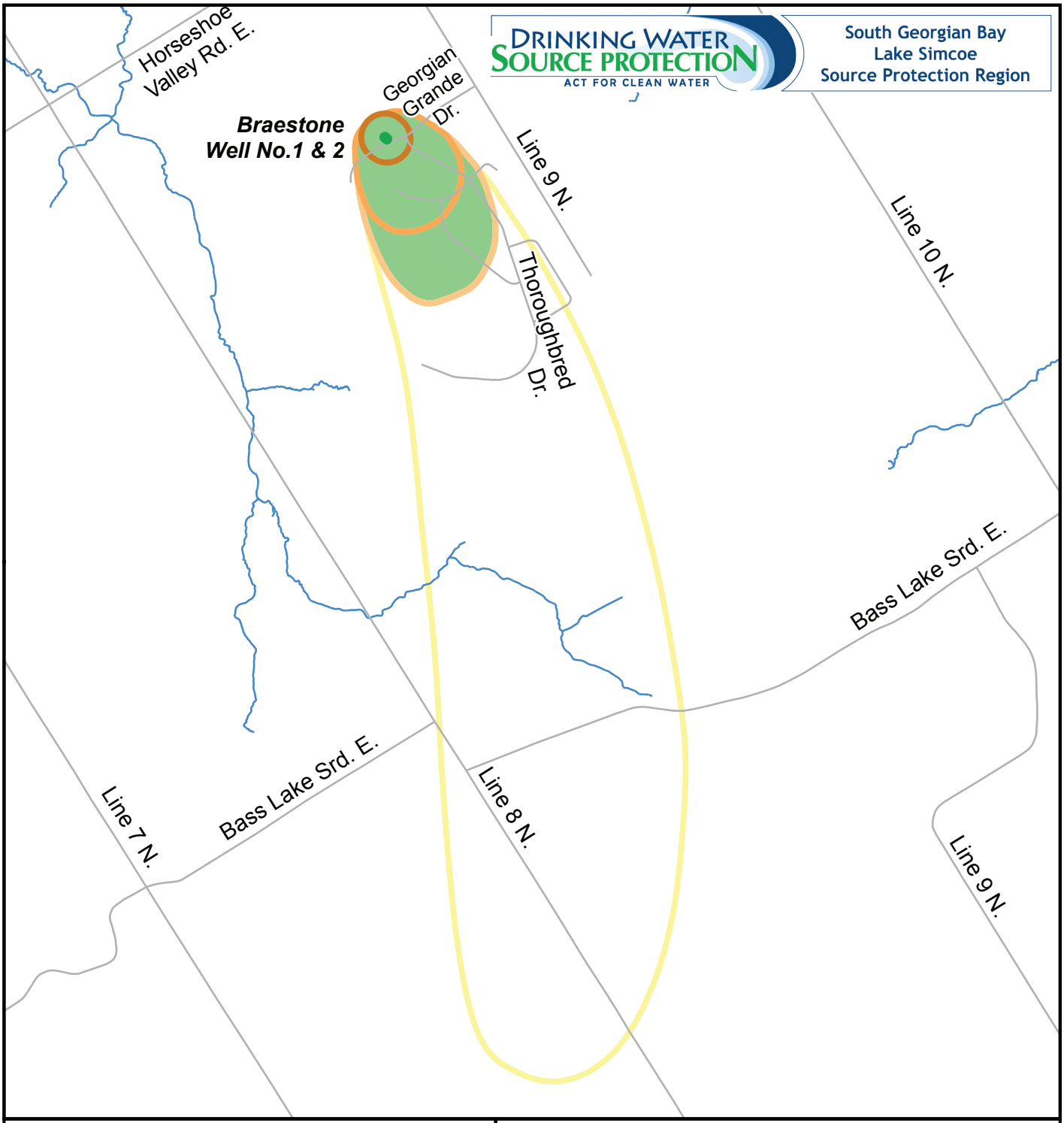
GOLDER Ontario

FIGURE 9e-6

Figure 9e-7: Managed Lands – Braestone



MANAGED LANDS - BRAESTONE, ORO-MEDONTE

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 great than 6.

DATE: SEPTEMBER 2020

SCALE: 1:24,000

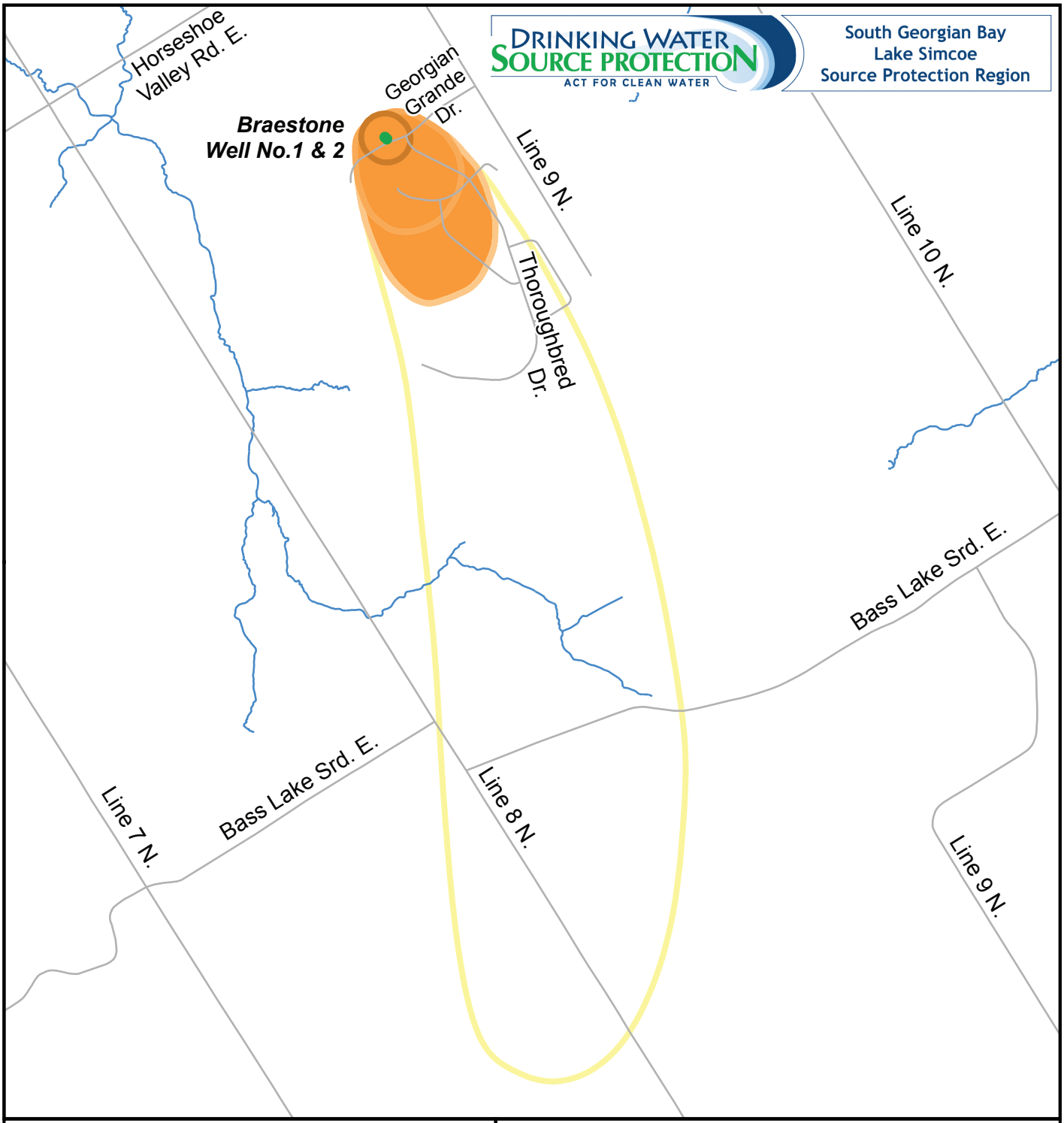
Severn Sound Environmental Association

Ontario

FIGURE 9e-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.

Figure 9e-8: Livestock Density – Braestone



LIVESTOCK DENSITY- BRAESTONE, ORO-MEDONTE

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

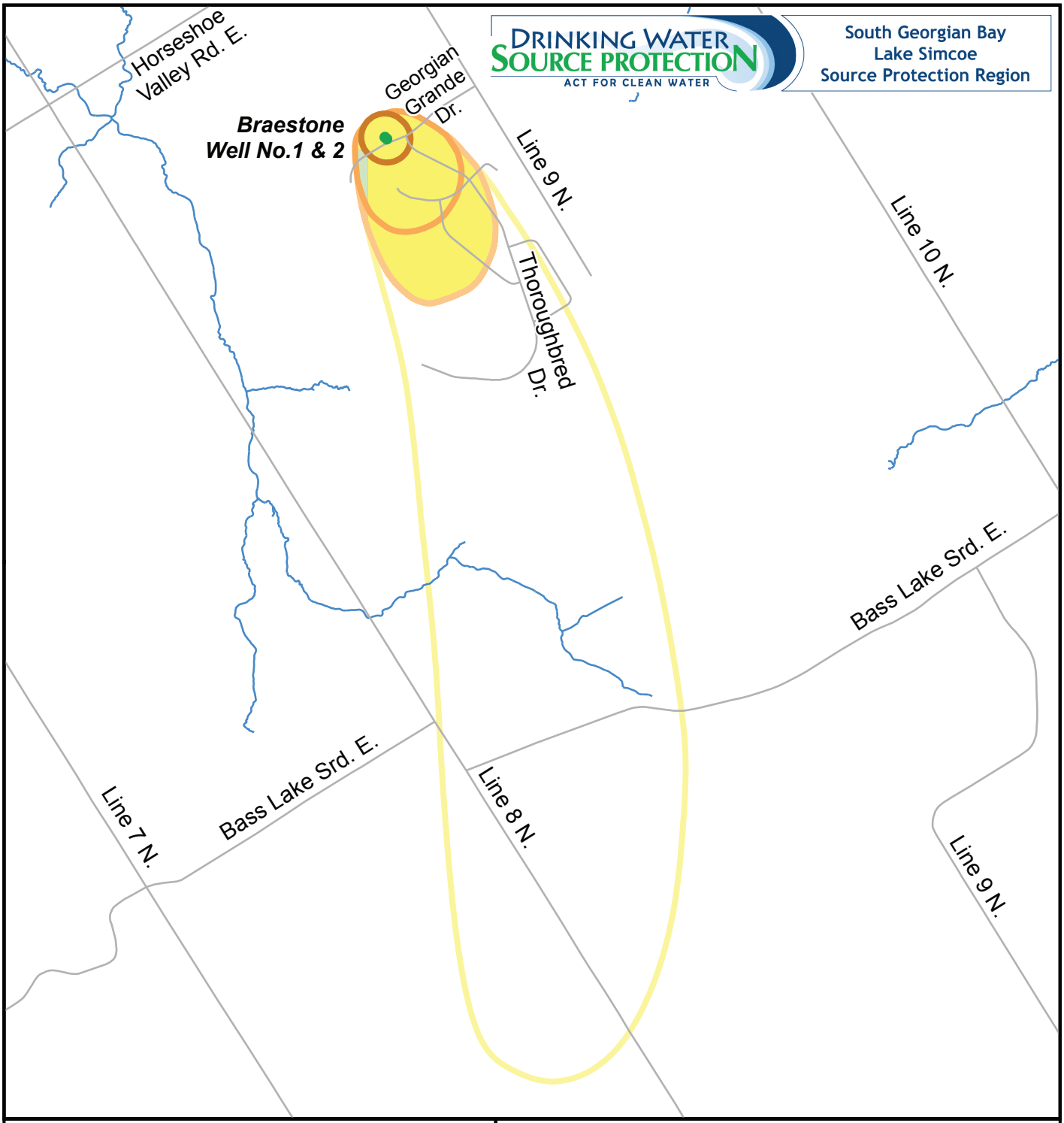
The Livestock Density proportion is illustrated for the parts of WHPA A-D where the vulnerability score is great than 6.

DATE: SEPTEMBER 2020

SCALE: 1:24,000

FIGURE **9e-8**

Figure 9e-9: Impervious Surfaces – Braestone



IMPERVIOUS SURFACES- BRAESTONE, ORO-MEDONTE

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 great than 6.

DATE: SEPTEMBER 2020

SCALE: 1:24,000

FIGURE 9e-9