Chapter 16: Township of Springwater

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16 Township of Springwater

16.1 Introduction

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

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

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

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

16.2 Drinking Water Systems

The Township of Springwater, located north of the City of Barrie within Simcoe County, operates groundwater based water supplies in nine (9) communities and has no surface water intakes. As shown in Figure 16-1 all of the groundwater supplies are within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR).

Municipal Groundwater Supplies in the Township of Springwater within the Nottawasaga Valley Source Protection Area (SPA) included in this report:

- Anten Mills (Drinking Water Information System Number 220005447) with 3 wells screened in the A3 confined overburden aquifer
- Del Trend (Drinking Water Information System Number 220009149) with 3 wells screened in the A3 confined overburden aquifer
- Midhurst (Drinking Water Information System Number 2200055474) with 6 wells screened in the A3 semi-unconfined aquifer
- Minesing (Drinking Water Information System Number 220005465) with 4 wells screened in the A2 and A3 confined overburden aquifers
- Phelpston (Drinking Water Information System Number 260048282) with 2 wells screened in the A2 confined overburden aquifer
- Snow Valley Highlands (Drinking Water Information System Number 260048204) with 4 wells screened in the A3 confined overburden aquifer (A3)
- Vespra Downs (Drinking Water Information System Number 210001786) with 2 wells screened in the A3 confined overburden aquifer

Municipal Surface Water Intakes in the Township of Springwater within the Severn Sound SPA but not included in this report:

- Elmvale (Drinking Water Information System Number 220000700) with 2 wells screened in the A3 confined overburden and bedrock aquifer
- Hillsdale (Drinking Water Information System Number 220003911) with 3 wells screened in the A2, A3, and A4 confined overburden and bedrock aquifers

While still in Springwater and in the SGBLS SPR, two of the water supply systems are located outside of the Nottawasaga Valley watershed. Information on the Elmvale and Hillsdale Well supplies (located in the Severn Sound watershed) can be found in the Severn Sound Assessment Report, Chapter 11.

In addition to the groundwater systems within Springwater, a number of vulnerable areas from surrounding municipalities extend into the Township (Table 16-1). This includes WHPAs from the Barrie and Angus water supplies. Information on these systems can be found in Chapters 9, and 12 respectively of the Nottawasaga Valley Assessment Report. Also, the Hillsdale Water Supply has been found to extend out of the Township of Springwater and into the Township of Oro-Medonte (Table 16-1).

Table 16-1: WHPA that cross into and out of the Township of Springwater in the SGBLS SPR.

Local Municipality that WHPA extends into	Municipality where wellhead is located	Name of Water Supply	Source Protection Region & Source Protection Authority (SPA)	Location where entire Assessment can be obtained
Township of Springwater	City of Barrie	Barrie	SGBLS SPR and Nottawasaga Valley SPA	This report (Chapter 9)
Township of Springwater	Township of Essa	Angus	SGBLS SPR and Nottawasaga Valley SPA	This report (Chapter 12)
Township of Oro-Medonte	Township of Springwater	Hillsdale	SGBLS SPR and Severn Sound SPA	Severn Sound Assessment Report (Chapter 11)

16.3 Anten Mills Well Supply

The Anten Mills Water Supply is located at 35 Luella Boulevard (Lot 1, Concession 7), in the Township of Springwater and services an estimated population of 650 (70 units) in the Community of Anten Mills. The water supply consists of three wells: Well 1, Well 2 and Well 3.

The three wells operate under Permit to Take Water 7511-5MLRGP dated on June 27, 2003 and expires on May 16, 2013. Well 1 is permitted to pump at a maximum rate of 290 L/min (418 m^3/day), Well 2 is permitted to pump at a maximum rate of 250 L/min (360 m^3/day), and Well 3 is permitted to pump at a maximum rate of 909 L/min (780 m^3/day). The wells can operate up to a maximum combined taking of 1,558 m^3/day from the system.

Wells 1, 2, and 3 were constructed in 1973, 1975, and 2002, respectively. All three wells were drilled into a confined sand/gravel aquifer encountered at an approximate depth of 24 meters below ground level (mbgl). Well 1 was drilled to a depth of 69.5 mbgl and screened from 65.2 mbgl to 68.3 mbgl. Well 2 was drilled to a depth of 69.2 mbgl and screened from 65.0 mbgl to 68.0 mbgl. Well 3 was drilled to a depth of 67.0 mbgl and screened from 59.1 mbgl to 66.8 mbgl.

At the Anten Mills Water Supply, two aquifers were encountered. An unconfined sand aquifer extends from ground level to a depth of approximately 15 mbgl. This aquifer is underlain by a 9 m thick layer of sandy silt till which confined a sand/gravel aquifer, approximately 52 m thick. The upper, unconfined aquifer extends to the south and east of the Community of Anten Mills. The confined sand/gravel aquifer is regionally extensive.

The screen interval for Wells 1, 2 and 3 have been assigned to the A3 Aquifer, in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The Groundwater Vulnerability rating will be determined for the A3 Aquifer.

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

16.3.1 Groundwater Vulnerability Assessment

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

map for each WHPA that expresses the relative degree to which a Threat could affect the drinking water supply. A higher value Vulnerability Score will always be assigned to the immediate vicinity of the well and to any areas that are shown to be vulnerable.

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

16.3.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Anten Mills Water Supply were delineated in 2005 by Golder using a 2-dimensional analytical groundwater flow model. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. A minor translation was required to adjust the Anten Mills well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 16a-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

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

The WHPA for the Anten Mills Water Supply reflect groundwater flow is mostly from northeast to southwest. This is reasonable based on available data describing regional groundwater flow patterns.

16.3.1.2 Groundwater Vulnerability

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

The Groundwater Vulnerability within the WHPA of the municipal wells in the Anten Mills Water Supply is shown in Figure 16a-2. The Groundwater Vulnerability for the municipal water supply aquifer within the WHPA is considered to be Low.

16.3.1.3 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 to be potential Transport Pathways within the Anten Mills WHPA. The Groundwater Vulnerability map (Figure 16a-2) is therefore proposed to be used to generate the Vulnerability Scores.

16.3.1.4 WHPA-E

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

16.3.1.5 Vulnerability Score

The WHPA zones for the Anten Mills Water Supply, as shown in Figure 16a-1, and the Groundwater Vulnerability map, as shown in Figure 16a-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 16a-3 illustrates the Vulnerability Scores for the Anten Mills WHPA. Figure 16a-3 will be used to assess Drinking Water Threats in Section 16.3.3.

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Anten Mills WHPA is High. The Vulnerability Rating for the Anten Mills 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).

16.3.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114.(1)(a-b)). 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 Anten Mills Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for the Township of Springwater water supplies are provided in Technical Memorandum O1 – Drinking Water Issues Evaluation – Springwater (Appendix S).

No Drinking Water Issues were identified for the Anten Mills Water Supply.

Some organic parameters, such as alachlor, aldrin + dieldrin, benzene, carbaryl, carbofuran, cyanazine, monochlorobenzene, temephos and terbufos, were detected in trace concentrations in the treated water on very rare occasions. These parameters are associated with herbicides, pesticides and insecticides but specific source has not been identified. The systems that identified these parameters are within areas where the surrounding land use is agricultural. Detections are not persistent and concentrations are typically well below Ontario Drinking Water Quality Standards (ODWQS) objectives.

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

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

16.3.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Anten Mills 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 Anten Mills 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
- an enumeration of Drinking Water Threats

16.3.3.1 List of Drinking Water Threats – Activities

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

16.3.3.2 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 Anten Mills Water Supply system:

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

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

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

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at Government of Ontario's Drinking Water Threats and Circumstances.

16.3.3.3.1 Pathogen Parameters

The Key Table on Figure 16a-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Anten Mills 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.

16.3.3.3.2 Chemical Parameters

The Key Table on Figure 16a-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Anten Mills 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.

16.3.3.3.3 DNAPL Chemical Parameters

Figure 16a-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 Anten Mills Water Supply. The Key Table on Figure 16a-6 can be used to can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 16.3.3.2, no Conditions have been confirmed within the WHPA for the Anten Mills 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 16a-3 illustrates the Vulnerability Score map for Anten Mills well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

16.3.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Anten Mills 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 16-2 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Anten Mills Water Supply. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

Twenty (20) activities that are considered to be potential Significant Drinking Water Threats were identified in association with twenty (20) land parcels for the Anten Mills WHPA. Nineteen (19) parcels were identified as having potential significant threats related 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 20 residential parcels within this area.

Table 16-2: Number of Significant Drinking Water Threats for the Anten Mills Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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	19	19
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	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
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	20*	20

Notes for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel
2. *15 verified existing Threats and 5 potential Threats that require further investigation

16.3.3.5.1 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 Anten Mills 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 16.3.3.5). The Managed Lands are used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 16a-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Anten Mills Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.3.3.5.2 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 Anten Mills 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 16.3.3.5). Nutrient units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 16a-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Anten Mills 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).

16.3.3.5.3 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 Anten Mills 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 16.3.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 16a-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Anten Mills Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.4 Del Trend Subdivision Well Supply

The Del Trend Water Supply is located at 5 Paddy Dunn's Circle (Lot 16, Concession 4), in the Township of Springwater services an estimated population of 611 in the Springwater Country Estates and the Carson Ridge Estates subdivisions in the Community of Midhurst. The Del Trend Water Supply consists of three wells: Well 1, Well 2, and Well 3, respectively. Well 1 is currently used as a stand-by well.

The three wells operate under Permit to Take Water 2372-75VHJ5 dated on August 10, 2007 and expires on August 1, 2017. Wells 1 and 2 are permitted to pump at a maximum rate of 324 L/min (467 m^3/day) and Well 3 is permitted to pump at a maximum rate of 546 L/min (786 m^3/day). The wells can operate up to a maximum combined taking of 1,074 m^3/day from the system.

Wells 1, 2, and 3 were constructed in 1991, 1991, and 1998, respectively. The three wells were drilled into a confined sand/gravel aquifer encountered at an approximate depth of 60 m below ground level (bgl). Well 1 was drilled to a depth of approximately 85.9 mbgl and screened from 68.6 mbgl to 73.2 mbgl. Well 2 was screened from 64.0 mbgl to 68.6 mgbl. Well 3 was drilled to a depth of approximately 75.6 mbgl and screened from 61.3 mbgl to 71.3 mbgl.

At the Del Trend Water Supply, three aquifers were encountered. An unconfined sand or sand and gravel aquifer extends from ground level to a depth of approximately 7 mbgl. This aquifer is underlain by a 10 m thick layer of clayey silt, clay, and sandy clay which confines an artesian sand aquifer. This confined, artesian sand aquifer is approximately 27 m thick and is underlain by a 16 m thick silty and clayey aquitard. This aquitard confines an artesian sand/gravel aquifer, approximately 23 m thick. Below this sand/gravel aquifer lies another aquitard. The unconfined sand or sand and gravel aquifer extends to the south and terminates to the north of Del Trend. The confined sand aquifer extends north and south of Del Trend. The confined sand/gravel aquifer is interpreted to be part of a regionally extensive tunnel valley aquifer network which lies below Matheson Creek, Willow Creek, and Kempenfelt Bay. The static water levels at the wells range from 7 mbgl to 18 mbgl (2005).

The screen intervals for Wells 1, 2 and 3 have been assigned to the A3 Aquifer, in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The groundwater vulnerability rating will be determined for the A3 Aquifer.

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

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

16.4.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Del Trend Water Supply were delineated in 2005 by Golder using the 3-dimensional numerical groundwater flow model constructed to delineate the WHPA for the City of Barrie. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. Golder (2010) reviewed the well locations and provided an updated WHPA for use in this study. The updated well locations and the WHPA are shown in Figure 16b-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2005) study delineated time-of-travel zones (TOT) for 50 days, 2 years, 10 years and 25 years. WHPA-C1, representing the 10 year TOT zone will be used to determine the vulnerability scores for the assessment of drinking water threats.

The WHPA for the Del Trend Water Supply lies within the WHPA delineated for the Midhurst Well 5. This overlap should not affect the Vulnerability or Scoring for these WHPA.

The WHPA for the Del Trend Water Supply reflect groundwater flow from northeast to southwest. This is reasonable based on available data describing regional groundwater flow patterns.

16.4.1.2 Groundwater Vulnerability

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

The Groundwater Vulnerability within the WHPA of the municipal wells in the Del Trend Water Supply is shown in Figure 16b-2. The Groundwater Vulnerability for the municipal water supply aquifer within the WHPA is considered to be Low.

16.4.1.3 Transport Pathway Increase

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

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

No wells were identified to be potential Transport Pathways within the Del Trend WHPA. The Groundwater Vulnerability map (Figure 16b-2) is therefore proposed to be used to generate the Vulnerability Scores.

16.4.1.4 WHPA-E / WHPA-F

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

16.4.1.5 Vulnerability Score

The WHPA zones for the Del Trend Water Supply, as shown in Figure 16b-1, and the Groundwater Vulnerability map, as shown in Figure 16b-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 16b-3 illustrates the Vulnerability Scores for the Del trend WHPA. Figure 16b-3 will be used to assess Drinking Water Threats in Section 16.4.3.

16.4.1.6 Uncertainty Rating

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

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Del Trend WHPA is High. The Vulnerability Rating for the Del Trend 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.

16.4.2 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 Del Trend Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for the Township of Severn Groundwater are provided in Technical Memorandum O1 – Drinking Water Issues Evaluation – Springwater (Appendix S).

No Drinking Water Issues were identified for the Del Trend Water Supply.

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

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

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

16.4.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Del Trend 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 Del Trend 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
- an enumeration of Drinking Water Threats

16.4.3.1 List of Drinking Water Threats – Activities

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

16.4.3.2 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 Del Trend Water Supply system:

- files provided by the Ministry of the Environment local offices pertaining to licenses, and records of spills in the area of the delineated WHPA
- records available from the Ministry of the Environment website containing registry of Brownfield Sites.
- records from available technical studies and previous contaminant source inventories that identified situations that may qualify as conditions

- interviews of Township of Springwater staff to identify potential conditions within the identified WHPA for the drinking water supply

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

16.4.3.3 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 include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at Government of Ontario's Drinking Water Threats and Circumstances.

16.4.3.3.1 Pathogen Parameters

The Key Table on Figure 16b-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Del Trend 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.

16.4.3.3.2 Chemical Parameters

The Key Table on Figure 16b-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Del Trend 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.

16.4.3.3.3 DNAPL Chemical Parameters

Figure 16b-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 Del Trend Water Supply. The Key Table on Figure 16b-6 can be used to can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 16.4.3.2, no Conditions have been confirmed within the WHPA for the Del Trend 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 16b-3 illustrates the Vulnerability Score map for Del Trend well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

16.4.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Del Trend 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 16-3 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Del Trend Water Supply. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

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

Table 16-3: Number of Significant Drinking Water Threats for the Del Trend Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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	3	3
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	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
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	4*	4

Notes:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel
2. *3 verified existing Threats and 1 potential Threat that require further investigation

16.4.3.5.1 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 Del Trend 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 16.4.3.5). The Managed Lands is used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 16b-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Del Trend Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.4.3.5.2 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 Del Trend 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 16.4.3.5). 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 16b-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Del Trend 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).

16.4.3.5.3 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 Del Trend 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 16.4.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 16b-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Del Trend Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.5 Midhurst Well Supply

The Midhurst Water Supply is located at 54 Idlewood Drive (Lot 15, Concession 3), 19 Greenpine Avenue (Lot 14, Concession 4), 1021 Carson Road (Lot 16, Concession 5) , and 1432 Snow Valley Road in the Township of Springwater and services 3,780 units in the Community of Midhurst. The Midhurst Water Supply consists of six wells: Well 2, Well 3, Well 4, Well 5 , and Midhurst Valley Well 1 and 2. Wells 2 and 3 are located at the Idlewood Pumphouse, Well 4 is located at the Greenpine Pumphouse, and Well 5 is located at the Carson Road Pumphouse. The Midhurst Valley wells are located at Snow Valley Road and Wilson Drive.

The Midhurst Supply Wells (excluding the Midhurst Valley wells) operate under Permit to Take Water 6B9S5G dated April 27, 2005 and expires February 28, 2011. Well 2 is permitted to pump at a maximum rate of 430 L/min (622 m^3/day), Well 3 is permitted to pump at a maximum rate of 2,000 L/min (2,900 m^3/day), Well 4 is permitted to pump at a maximum rate of 1,360 L/min (2,000 m^3/day), and Well 5 is permitted to pump at a maximum rate of 1,140 L/min (1,068 m^3/day). The wells can operate up to a maximum combined taking of 6,479 m^3/day from the system.

The anticipated maximum permitted rate of taking for the Midhurst Valley Wells 1 and 2 will be 73 L/s with an average daily demand is 40.4 L/s. However, the PTTW will restricted to a maximum of 36.5 L/s taken from either well or a combination of the wells.

Wells 2, 3, 4, and 5 were constructed in 1971, 1983, 1990, and 2000, respectively. The four wells were drilled into a sand aquifer, encountered at a depth of 37 mbgl (Wells 2, 3, and 5) and 49 mbgl (Well 4). Well 2 was drilled to a depth of 78.7 mbgl and screened from 73.2 mbgl to 77.8 mbgl. Well 3 was drilled to a depth of approximately 96.9 mbgl and screened from 70.7 mbgl to 78.6 mbgl. Well 4 was drilled to a depth of approximately 79.0 mbgl and screened from 69.8 mbgl to 75.9 mbgl. Well 5 was drilled to a depth of approximately 92.0 mbgl and screened from 78.9 mbgl to 88.7 mbgl.

Midhurst Valley Well 1 was constructed in 2014 and is screened in Aquifer A4 in coarse sand and gravel. The well was constructed as a nominal 200 mm (8”) diameter well with a 50-slot screen from 81.1 m to 89.9 mbgs. Additional fill has since been added to the site and well casing has been raised 3.7m. The deeper aquifer A3/A4 is separated from the upper units by a clay layer from 66.1 to 71.3 mbgs. Aquifer testing confirms that the well is capable of yielding 36.5 L/s.

Midhurst Valley Well 2 was constructed in 2021 and is screened in Aquifer A4 in medium to coarse sand. The well was constructed as a nominal 10” diameter well with a 45-slot screen from 90.5 mbgs to 99.1 mbgs. The deeper aquifer A3/A4 is separated from the upper units by a

clay layer from 65.2 mbgs to 71.9 mbgs and another clay layer from 81.7 mbgs to 88.1 mbgs. The aquifer testing confirms that the well is capable of yielding 36.5 L/s.

At the Midhurst Water Supply, four aquifers were encountered. At Wells 2, 3, and 5, an unconfined sand or sand and gravel aquifer extends from ground level to a depth of 7 mbgl. This aquifer is underlain by a clayey silt, clay, and sandy clay aquitard, approximately 15 m thick, which confines another sand or sand and gravel aquifer approximately 18 m thick. This aquifer is underlain by an aquitard, approximately 4 m thick, which confined an artesian sand/gravel aquifer. The upper two aquifers form a combined aquifer to the north, west, and east of the wells and separate into two aquifers to south of the wells. The confined sand/gravel aquifer is interpreted to be part of a regionally extensive tunnel valley aquifer network which lies below Matheson Creek, Willow Creek, and Kempenfelt Bay. At Well 4, an unconfined sand or sand and gravel combined aquifer extends from ground level to a depth of 27 mbgl. This confined aquifer is underlain by an aquitard, approximately 22 m thick, which overlies and confines a 22 m thick artesian sand/gravel aquifer. The static water levels at the four wells ranged from 7 mbgl to 18 mbgl in 2005. The Midhurst Valley wells are screened within Aquifer A4 which is typically found below 150 masl in the Midhurst area.

The screen intervals for Wells 2, 3, 4 and 5 have been assigned to the A3 Aquifer in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The Groundwater Vulnerability rating will be determined for the A3 Aquifer and A4 for the Midhurst Valley wells.

Information presented for the Midhurst section of this Chapter is based on the Genivar 2010a report and the WSP Golder 2022 report for the Midhurst Valley wells.

16.5.1 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 Midhurst Water Supply has been delineated following the process recommended in the Technical Rules (MECP, 2021). 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 Midhurst WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

16.5.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the wells in the Midhurst Water Supply, excluding the Midhurst Valley wells, were delineated in 2005 by Golder using the 3-dimensional numerical groundwater flow model constructed to delineate the WHPA for the City of Barrie. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. Golder (2010) reviewed the well locations and provided an updated WHPA for use in this study. The updated well locations and the WHPA are shown in Figure 16b-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2005) study delineated time-of-travel zones (TOT) for 50 days, 2 years, 10 years and 25 years. WHPA-C1, representing the 10-year TOT zone will be used to determine the Vulnerability Scores for the assessment of Drinking Water Threats.

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

Modelling of the Midhurst Valley Wells 1 and 2was conducted using an updated version of the pre-existing Barrie (or Kempenfelt Bay) groundwater model. This model was originally constructed and approved in the early 2000's in support of the South Simcoe Groundwater Study using the numerical model code FeFLOW. The refined model (2018 Kempenfelt Bay model) was calibrated in transient mode to monthly baseflow estimates along Willow Creek. The WHPAs were assessed under future conditions with an average pumping rate of 1,745 m^3/day at each well (combined average daily demand of 3,490 m^3/day) in accordance with the approved Class EA. The combined WHPA covers an area of approximately 6.4 km^2 and extends in an easterly direction away from the wells. The AVI scoring for the new well indicates a 'low'

aquifer vulnerability as supported by the substantial thicknesses of clay and/or till observed above Aquifer A3/A4).

16.5.1.2 Groundwater Vulnerability

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

The Groundwater Vulnerability within the WHPA of the municipal wells in the Midhurst Water Supply is shown in Figure 16b-2. The Groundwater Vulnerability for the municipal water supply aquifer within the WHPA is considered to be Low.

16.5.1.3 Transport Pathway Increase

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

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

No wells were identified to be potential Transport Pathways within the Midhurst WHPAs. The Groundwater Vulnerability map (Figure 16b-2) is therefore proposed to be used to generate the Vulnerability Scores.

16.5.1.4 WHPA-E

None of the wells in this study have evidence of having the hydraulic connection between the well and the surface water bodies near the well. ,Therefore delineation of a WHPA-E was not required.

16.5.1.5 Vulnerability Score

The WHPA zones for the Midhurst Water Supply, as shown in Figure 16b-1, and the Groundwater Vulnerability map, as shown in Figure 16b-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 16b-3 illustrates the Vulnerability Scores for the Midhurst WHPA. Figure 16b-3 will be used to assess Drinking Water Threats in Section 16.5.3.

16.5.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating of either High or Low be assigned with each Vulnerable Area as outlined in the Technical Rules (MECP, 2021). 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 Midhurst WHPAs excluding the Midhurst Valley wells was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Midhurst WHPAs is High. The full results of the WHPA delineation Peer Review process, for Midhurst is available in Appendix S and discussed in Chapter 5 (Methods Overview).

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

The Vulnerability Rating for the Midhurst 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).

It is noted that for the Midhurst Valley well WHPAs, AVI vulnerability and resulting vulnerability scoring are estimated to have a low uncertainty rating (WSP Golder, 2022).

16.5.2 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 Midhurst Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for the Township of Springwater Groundwater are provided in Technical Memorandum O1 – Drinking Water Issues Evaluation – Springwater (Appendix S).

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

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

Nitrate concentrations in the Midhurst Valley wells are between 7 mg/L and 9 mg/L; elevated, but below the drinking water objective of 10 mg/L. It is expected that the nitrate concentrations will decrease with time as the land use changes from agricultural to residential. In addition, the water treatment plant is being constructed with nitrate treatment (WSP Golder, 2022).

16.5.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Midhurst 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 Midhurst 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
- an enumeration of Drinking Water Threats

16.5.3.1 List of Drinking Water Threats – Activities

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

16.5.3.2 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 Midhurst Water Supply system:

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

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

16.5.3.3 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 include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at the Government of Ontario's Drinking Water Threats and Circumstances.

16.5.3.3.1 Pathogen Parameters

Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10 (Figure 16b-4). Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

16.5.3.3.2 Chemical Parameters

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 (Figure 16b-5).

16.5.3.3.3 DNAPL Chemical Parameters

Figure 16b-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 Midhurst Water Supply.

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

Further to Section 16.5.3.2, no Conditions have been confirmed within the WHPAs for the Midhurst 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 16b-3 illustrates the Vulnerability Score map for Midhurst well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

16.5.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Midhurst 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 16-4 to Table 16-6 document the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPAs for the Midhurst Water Supply. Table 16-4 documents the enumeration for the WHPA for Wells 2 and 3, Table 16-5 documents the enumeration for the WHPA for Well 4, Table 16-6 documents the enumeration for the WHPA for Well 5, and Table 16-7 documents the combined enumeration for the WHPA for Midhurst Valley Wells 1 and 2. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

For the WHPA around Wells 2 and 3, twenty (20) activities that are considered to be Significant Drinking Water Threats were identified in association with twenty (20) land parcels. Nineteen (19) parcels were identified as having significant Threats related 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 19 residential parcels within this area.

For the WHPA around Well 4, nine (9) activities that are considered to be Significant Drinking Water Threats were identified in association with nine (9) land parcels. Eight (8) parcels were identified as having significant Threats related to residential land use via the use of private individual sewage disposal. 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 WHPA around Well 5, nine (9) activities that are considered to be Significant Drinking Water Threats were identified in association with eight (8) land parcels. Seven (7) parcels were identified as having significant threats related 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. Additionally, one (1) specific residential parcel is confirmed to have a basement oil tank for home heating purposes.

For the WHPA related to the Midhurst Valley Wells 1 and 2, nine (9) potential significant drinking water threats found on eight (8) properties, seven (7) for the handling and storage of DNAPL, one (1) for the handling and storage of fuel, and one (1) for the establishment, operation, or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage.

In total, 47 activities on 44 land parcels were identified as having potential to be potential Significant Drinking Water Threats to the six municipal wells in the Midhurst Water Supply including the Midhurst Valley wells.

Table 16-4: Number of Significant Drinking Water Threats for the Midhurst Wells 2 & 3 Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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	19	19
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

Threat Number	Threat	Significant Threat Counts Number of Threats	Significant Threat Counts Number of Parcels
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
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
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	20*	20

Notes for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel
2. *19 verified existing Threats and 1 potential Threat that require further investigation

Table 16-5: Number of Significant Drinking Water Threats for the Midhurst Well 4 Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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	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
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	9*	9

Notes for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel
2. *8 verified existing Threats and 1 potential Threat that require further investigation

Table 16-6: Number of Significant Drinking Water Threats for the Midhurst Well 5 Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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

Threat Number	Threat	Significant Threat Counts Number of Threats	Significant Threat Counts Number of Parcels
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
14	The storage of snow	0	0
15	The handling and storage of fuel	2	2
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	9*	8

Notes for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel
2. *7 verified existing Threats and 2 potential Threats that require further investigation

Table 16-7: Number of Significant Drinking Water Threats for the Midhurst Valley Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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	1	1
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
14	The storage of snow	0	0

Threat Number	Threat	Significant Threat Counts Number of Threats	Significant Threat Counts Number of Parcels
15	The handling and storage of fuel	1	1
16	The handling and storage of dense non-aqueous phase liquid	7	6
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	9*	8*

Notes for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel
2. *9 potential Threats that require further investigation

16.5.3.5.1 Managed Lands

Technical Rule 16(9) (MECP, 2021) 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 Midhurst 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 16.5.3.5). 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 16b-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Midhurst Water Supply including the Midhurst Valley wells where Vulnerability Scores were greater than 6.

16.5.3.5.2 Livestock Density

Technical Rule 16(10) (MECP, 2021) 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 Midhurst 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 16.5.3.5). 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 16b-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Midhurst Water Supply including the Midhurst Valley wells where Vulnerability Scores were greater than 6. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

16.5.3.5.3 Impervious Surfaces

Technical Rule 16(11) (MECP, 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 the Table of Drinking Water Threats.

The proportion of Impervious Surfaces within the delineated WHPA zones for the Midhurst Water Supply was determined in accordance with Technical Rule 16(11) (MECP, 2021) and is based on the percentage of impervious surface within the WHPAThe results from this analysis were used in the enumeration of Significant Drinking Water Threats. The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 16b-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Midhurst Water Supply including the Midhurst Valley wells where Vulnerability Scores were greater than 6.

16.6 Minesing Well Supply

The Minesing Water Supply is located on at 2347 Ronald Road, in the Township of Springwater and services an estimated population of 627 (219 units) in the Community of Minesing. The Minesing Water Supply consists of four wells: Well1, Well 2, Well 3, and Well 4.

The Minesing Water Supply operates under Permit to Take Water 6733-6GDQYK dated October 24, 2005 and expires September 30, 2015. Wells 2 and 3 are permitted to pump at a maximum rate of 227 L/min (327 m^3/day) while Well 4 is permitted to pump at a maximum rate of 287 L/min (412 m^3/day). The wells can operate up to a maximum combined taking of 739 m^3/day from the system. Well 1 was only recently connected to the system and limited information was provided on this well.

Wells 2, 3 and 4 were constructed in 1973, 1989, and 1992, respectively. The three wells were drilled into two separate aquifers: Well 2 was drilled into a confined sand/gravel aquifer while Wells 3 and 4 were drilled into a different confined sand aquifer. Well 2 was drilled to a depth of 35.7 mbgl and screened from 29.5 mbgl to 34.7 mbgl. Well 3 was drilled to a depth of approximately 61.1 mgbl and screened from 30.5 mbgl to 35.7 mbgl. Well 4 was drilled to a depth of approximately 39.8 mbgl and screened from 34.4 mbgl to 38.1 mbgl. The localized unconfined to confined sand aquifer was encountered at ground level and at depths of 9 mbgl. This sand aquifer is approximately 25 m thick and is underlain by an aquitard 15 m to 25 m thick. This aquitard confines a sand/gravel aquifer approximately 25 m thick. The sand aquifer varies from unconfined, at the Minesing wells, to confined, east of the Community of Minesing. The sand/gravel aquifer is regionally extensive and increases in thickness to the west and south and thins to the east and north. The static water levels at the wells are approximately 21 mbgl (2005).

The screen interval for Wells 1, 2, 3 and 4 have been assigned to the A2, A2, A3 and A3 Aquifers respectively in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The groundwater vulnerability rating will be determined for the A2 and A3 Aquifers.

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

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

16.6.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Minesing Water Supply were delineated in 2005 by Golder using a 3-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 (2010) reviewed the well locations and provided an updated WHPA for use in this study. The updated well locations and the WHPA are shown in Figure 16c-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2005) study delineated time-of-travel zones (TOT) for 50 days, 2 years, 10 years and 25 years. WHPA-C1, representing the 10 year TOT zone will be used to determine the Vulnerability Scores for the assessment of Drinking Water Threats.

The WHPA for the Minesing Water Supply reflects groundwater flow from northeast to southwest. This is reasonable based on available data describing regional groundwater flow patterns.

16.6.1.2 Groundwater Vulnerability

The Minesing Water Supply draw water from overburden aquifer layers (regional aquifer systems A2 and A3). The Groundwater Vulnerability for the municipal aquifers in the area was determined using the regional Aquifer Vulnerability Index (AVI methods outlined in Technical

Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO). The regional Groundwater Vulnerability is illustrated in Technical Memorandum B1 – Regional Groundwater Vulnerability Mapping.

The Groundwater Vulnerability within the WHPA of the municipal wells in the Minesing Water Supply is shown in Figure 16c-2. The Groundwater Vulnerability for the municipal water supply aquifer within the WHPA is considered to be Low in the areas of the wells and increases from Medium to High within WHPA-D.

16.6.1.3 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.

Wells were identified to be potential Transport Pathways within the Minesing WHPA in two locations. The 30-m radius around the identified wells is located within areas of Low Vulnerability. The Vulnerability Rating has been increased at these locations from Low to Medium. Mapping of the transport pathways and increased vulnerability were presented in the technical study completed by Genivar (2010). Ultimately the locations of transport pathways and increased vulnerability are reflected in the maps of Vulnerability Scores (See Section 16.6.1.5).

16.6.1.4 WHPA-E / WHPA-F

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

16.6.1.5 Vulnerability Score

The WHPA zones for the Minesing Water Supply, as shown in Figure 16c-1, the Groundwater Vulnerability, as shown in Figure 16c-2, and the increased Vulnerability discussed in Section 16.6.1.3, were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 16c-3 illustrates the Vulnerability Scores for the Minesing Water Supply. Figure 16c-3 will be used to assess Drinking Water Threats in Section 0. The Transport Pathways are illustrated as circles with 30 m radius in the WHPA.

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Minesing WHPA is High. The Vulnerability Rating for the Minesing 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.

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

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

Parameters whose concentrations occasionally exceed Aesthetic/Operational guidelines under the Ontario Drinking Water Quality Standards (ODWQS) include turbidity. These parameters are likely naturally-occurring.

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

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

16.6.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Minesing 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 Minesing 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
- an enumeration of Drinking Water Threats

16.6.3.1 List of Drinking Water Threats – Activities

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

16.6.3.2 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 Minesing Water Supply system:

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

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

16.6.3.3 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 include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at Government of Ontario's Drinking Water Threats and Circumstances.

16.6.3.3.1 Pathogen Parameters

The Key Table on Figure 16c-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Minesing 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.

16.6.3.3.2 Chemical Parameters

The Key Table on Figure 16c-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Minesing 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.

16.6.3.3.3 DNAPL Chemical Parameters

Figure 16c-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 Minesing Water Supply. The Key Table on Figure 16c-6 can be used to can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 16.6.3.2, no Conditions have been confirmed within the WHPA for the Minesing 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 16c-3 illustrates the Vulnerability Score map for Minesing well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

16.6.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Minesing 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 16-8 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Minesing Water Supply. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 8 or 10.

Eight (8) activities that are considered to be Significant Drinking Water Threats were identified in association with eight (8) land parcels in the Minesing WHPA. Seven (7) parcels were identified as having significant threats related to mostly 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 eight (8) residential parcels within this area.

Table 16-8: Number of Significant Drinking Water Threats for the Minesing Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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

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	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
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	8*	8

Notes for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel
2. *6 verified existing Threats and 2 potential Threats that require further investigation

16.6.3.5.1 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 Minesing 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 16.6.3.5). The Managed Lands is used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 16c-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Minesing Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.6.3.5.2 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 Minesing 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 16.6.3.5). 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 16c-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Minesing 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).

16.6.3.5.3 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 Minesing 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 16.6.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 16c-9illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Minesing Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.7 Phelpston Well Supply

The Phelpston Water Supply is located at 2 Hall Street (Lot 10, Concession 5), in the Township of Springwater and services an estimated population of 270 (90 units) at the Shamrock Meadows subdivision in the Community of Phelpston. The Phelpston Water Supply consists of two wells: Well 1 and Well 2.

The Phelpston Water Supply operates under Permit to Take Water 6334-72JP7N dated April 25, 2007 and expires September 30, 2013. Well 1 is permitted to pump at a maximum rate of 380 L/min (547 m^3/day) while Well 2 is permitted to pump at a maximum rate of 455 L/min (655 m^3/day). The wells can operate up to a maximum combined taking of 1,202 m^3/day from the system.

The two wells were drilled into a confined sand aquifer. Well 1 was drilled to a depth of 40.0 mbgl. Well 2 was drilled to a depth of 47.0 mbgl.

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

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

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

16.7.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Phelpston Water Supply was 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 Phelpston well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 16d-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

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

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

16.7.1.2 Groundwater Vulnerability

The Phelpston Water Supply draws water from a confined overburden aquifer layer (regional aquifer system A2). The Groundwater Vulnerability for the aquifer in the area was determined using the regional Aquifer Vulnerability Index (AVI methods outlined in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO). The regional Groundwater Vulnerability is illustrated in Technical Memorandum B1 – Regional Groundwater Vulnerability Mapping.

The Groundwater Vulnerability within the WHPA of the two municipal wells in the Phelpston Water Supply is shown in Figure 16d-2. The Groundwater Vulnerability for the municipal water supply aquifers within the WHPA is considered to be Medium with areas rated as High near the municipal wells and in the furthest extents of WHPA-D.

16.7.1.3 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 to be potential Transport Pathways within the Phelpston WHPA. The Groundwater Vulnerability map (Figure 16d-2) is therefore proposed to be used to generate the Vulnerability Scores.

16.7.1.4 WHPA-E / WHPA-F

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

16.7.1.5 Vulnerability Score

The WHPA zones for the Phelpston Water Supply, as shown in Figure 16d-1, and the Groundwater Vulnerability, as shown in Figure 16d-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 16d-3 illustrates the Vulnerability Scores for the Phelpston WHPA. Figure 16d-3 will be used to assess Drinking Water Threats in Section 0.

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

Review process, for Phelpston is available in Appendix S and discussed in Chapter 5 (Methods Overview).

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Phelpston WHPA is High. The Vulnerability Rating for the Phelpston 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).

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

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

Parameters whose concentrations occasionally exceed Aesthetic/Operational guidelines under the Ontario Drinking Water Quality Standards (ODWQS) include turbidity. This parameter is likely naturally-occurring.

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

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

16.7.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Phelpston 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 Phelpston 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
- an enumeration of Drinking Water Threats

16.7.3.1 List of Drinking Water Threats – Activities

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

16.7.3.2 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 Phelpston Water Supply system:

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

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

16.7.3.3 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 include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at the Government of Ontario's Drinking Water Threats and Circumstances.

16.7.3.3.1 Pathogen Parameters

The Key Table on Figure 16d-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Phelpston 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.

16.7.3.3.2 Chemical Parameters

The Key Table on Figure 16d-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Phelpston 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.

16.7.3.3.3 DNAPL Chemical Parameters

Figure 16d-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 Phelpston Water Supply. The Key Table on Figure 16d-6 can be used to can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 16.7.3.2, no Conditions have been confirmed within the WHPA for the Phelpston 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 16d-3 illustrates the Vulnerability Score map for Phelpston well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

16.7.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Phelpston 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 16-9 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Phelpston Water Supply. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

Seventeen (17) activities that are considered to be potential Significant Drinking Water Threats were identified in association with twelve (12) land parcels in the WHPA for the Phelpston Water Supply. Nine (9) parcels are identified as having significant Threat activities related 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 for potential application of agricultural source material and pesticide to land. Four (4) parcels that intersect WHPA-A, -B and -C were identified for the potential application of commercial fertilizer due to a combination of the managed land proportion in WHPA-A and B, and livestock density in WHPA-C. One (1) parcel was identified for potential handling and storage of DNAPLs.

Table 16-9: Number of Significant Drinking Water Threats for the Phelpston Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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	1	1
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	4	4
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

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	1	1
16	The handling and storage of dense non-aqueous phase liquid	1	1
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	17*	12

Notes for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel

2. *9 verified existing Threats and 8 potential Threats that require further investigation

16.7.3.5.1 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 Phelpston 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 16.7.3.5). 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 16d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Phelpston Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.7.3.5.2 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 Phelpston 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 16.7.3.5). 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 16d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Phelpston 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).

16.7.3.5.3 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 Phelpston 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 16.7.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 16d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Phelpston Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.8 Snow Valley Highlands Well Supply

The Snow Valley Highlands Water Supply is located at 2602 George Parkway and 29A Eder Trail, in the Township of Springwater and services an estimated population of 1,197 (162 units) in the Community of Snow Valley Highlands. The Snow Valley Highlands Water Supply consists of four wells: Well 1, Well 2, Well 3, and Well 4. Wells 1 and 2 are located at 2602 George Parkway and Wells 3 and 4 are located at 29A Eder Trail.

The Snow Valley Highlands Water Supply operates under Permit to Take Water 7650-6CFRPK dated January 10, 2006 and expires March 31, 2011. Well 1 is permitted to pump at a maximum rate of 786 L/min (1,132 m^3/day). Well 2 is permitted to pump at a maximum rate of 1,044 L/min (1,503 m^3/day). Well 3 is permitted to pump at a maximum rate of 1,135 L/min (1,634 m^3/day) and Well 4 is permitted to pump at a maximum rate of 1,135 L/min (1,634 m^3/day).

Wells 1 and 2 were constructed in 1988 and 1989, respectively. The Snow Valley Highlands Water Supply was drilled into a confined sand/gravel aquifer, encountered at a depth of 50 m below ground level (bgl). Well 1 was drilled to a depth of 66.3 mbgl and screened from 59.4 mbgl to 65.5 mbgl. Well 2 was drilled to a depth of 67.4 mbgl and screened from 60.9 mbgl to 67.1 mbgl. Well 3 was drilled to a depth of 72.5 mbgl. Well 4 was drilled to a depth of 72.5 mbgl.

At the Snow Valley Highlands Water Supply, four aquifers were encountered. An unconfined sand aquifer extends from ground level to varying depths – it is irregular and combines with the underlying, irregular sand aquifer. The underlying sand aquifer extends to a depth of approximately 38 mbgl and is confined by an irregular aquitard that ranges from thin to non-existent. The sand aquifer is underlain by a clay aquitard approximately 13 m thick which confines a 20 m thickness of sand/gravel aquifer. This aquifer is underlain by an 11 m thick aquitard layer that confines the fourth 8 m thick aquifer layer. The lower aquifers are regionally extensive. The static water levels at Wells 1 and 2 range from 10 mbgl to 14 mbgl.

The screen intervals for Wells 1, 2, 3, and 4 have been assigned to the A3 Aquifer in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The groundwater vulnerability rating will be determined for the A3 Aquifer.

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

16.8.1 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 Snow Valley Highlands 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 Snow Valley Highlands WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

16.8.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Snow Valley Highlands Water Supply were delineated in 2005 by Golder using a 2-dimensional analytical groundwater flow model. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. A minor translation was required to adjust the Snow Valley Highlands well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 16e-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

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

The WHPA for the Snow Valley Highlands Water Supply reflect groundwater flow from southwest to northeast. This is reasonable based on available data describing regional groundwater flow patterns

16.8.1.2 Groundwater Vulnerability

The Snow Valley Highlands Water Supply draws water from overburden aquifer layers (regional aquifer system A3). The Groundwater Vulnerability for the municipal aquifers in the area was

determined using the regional Aquifer Vulnerability Index (AVI methods outlined in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO). The regional Groundwater Vulnerability is illustrated in Technical Memorandum B1 – Regional Groundwater Vulnerability Mapping.

The Groundwater Vulnerability within the WHPA of the municipal wells in the Snow Valley Highlands Water Supply is shown in Figure 16e-2. The Groundwater Vulnerability for the municipal water supply aquifer within the WHPA is considered to be Low.

16.8.1.3 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 to be potential Transport Pathways within the Snow Valley Highlands WHPA. The Groundwater Vulnerability map (Figure 16e-2) is therefore proposed to be used to generate the Vulnerability Scores.

16.8.1.4 WHPA-E / WHPA-F

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

16.8.1.5 Vulnerability Score

The WHPA zones for the Snow Valley Highlands, as shown in Figure 16e-1, and the Groundwater Vulnerability map, as shown in Figure 16e-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

16e-3 illustrates the Vulnerability Scores for the Snow Valley Highlands WHPA. Figure 16e-3 will be used to assess Drinking Water Threats in Section 0.

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Snow Valley Highlands WHPA is High. The Vulnerability Rating for the Snow Valley 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.

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

No Drinking Water Issues were identified for the Snow Valley Highlands Water Supply.

Trihalomethanes 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 Standards (ODWQS) values and do not display increasing trends.

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

16.8.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Snow Valley Highlands 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 Snow Valley 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
- an enumeration of Drinking Water Threats

16.8.3.1 List of Drinking Water Threats – Activities

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

16.8.3.2 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 Snow Valley Highlands Water Supply system:

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

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

16.8.3.3 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 include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at the Government of Ontario's Drinking Water Threats and Circumstances.

16.8.3.3.1 Pathogen Parameters

The Key Table on Figure 16e-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Snow Valley 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.

16.8.3.3.2 Chemical Parameters

The Key Table on Figure 16e-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Snow Valley 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.

16.8.3.3.3 DNAPL Chemical Parameters

Figure 16e-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 Snow Valley Highlands Water Supply. The Key Table on Figure 16e-6 can be used to can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 16.8.3.2, no Conditions have been confirmed within the WHPA for the Snow Valley 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 16e-3 illustrates the Vulnerability Score map for Snow Valley Highlands well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

16.8.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Snow Valley Highlands 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 16-10 and Table 16-11 document the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Snow Valley Highlands Water Supply. Table 16-10 documents the enumeration for the Well 1 and Well 2 WHPA and Table 16-11 documents the enumeration for the WHPA for Well 3 and Well 4. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

For the WHPA around Well 1 and 2, fourteen (14) activities that are considered to be potential Significant Drinking Water Threats were identified in association with fourteen (14) land parcels. Twelve (12) threat activities/parcels were identified to represent the private individual sewage disposal systems within WHPA-A. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are 12 residential parcels within this area. One (1) parcel was identified for potential handling and storage of DNAPLs.

For the WHPA around Well 3 and 4, four (4) activities that are considered to be potential Significant Drinking Water Threats were identified in association with four (4) land parcels. Three (3) threat activities/parcels were identified to represent the private individual sewage disposal systems within WHPA-A. One (1) threat activity and parcel has been included to

represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are three (3) residential parcels within this area.

In total there were 18 activities identified on 18 land parcels that are considered to be Significant Drinking Water Threats for the Snow Valley Highlands Water Supply.

Table 16-10: Number of Significant Drinking Water Threats for the Snow Valley Highlands (Wells 1 and 2) Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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	12	12
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

Threat Number	Threat	Significant Threat Counts Number of Threats	Significant Threat Counts Number of Parcels
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
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	1	1
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	14*	14

Notes for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel
2. *11 verified existing Threats and 3 potential Threats that require further investigation

Table 16-11: Number of Significant Drinking Water Threats for the Snow Valley Highlands (Wells 3 and 4) Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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	3	3
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

Threat Number	Threat	Significant Threat Counts Number of Threats	Significant Threat Counts Number of Parcels
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
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
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	4*	4

Notes for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel
2. *3 verified existing Threats and 1 potential Threat that requires further investigation

16.8.3.5.1 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 Snow Valley 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 16.8.3.5). The Managed Lands is used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 16e-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Snow Valley Highlands Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.8.3.5.2 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 Snow Valley 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 16.8.3.5). 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 16e-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Snow Valley Highlands 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).

16.8.3.5.3 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 Snow Valley Highlands 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 16.8.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 16e-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Snow Valley Highlands Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.9 Vespra Downs Well Supply

The Vespra Downs Water Supply is located at 13 Parr Boulevard, in the Township of Springwater and services an estimated population of 540 (12 units) along Parr Boulevard, in the Community of Vespra Downs. The Vespra Downs Water Supply consists of two wells: Well 1 and Well 2.

The Vespra Downs Water Supply operates under Permit to Take Water 0621-62MR3A dated July 7, 2004 and expires August 31, 2014. Wells 1 and 2 are permitted to pump at maximum rates of 313 L/day (450 m^3/day). The production wells can operate up to a maximum combined taking of 900 m^3/day.

Wells 1 and 2 were constructed in 1993 and 1991, respectively. The Vespra Downs Water Supply was drilled into a confined sand/gravel aquifer, encountered at a depth of 57 m below ground level (mbgl). Well 1 was drilled to a depth of approximately 70.4 mbgl and screened from 58.2 mgbl to 64.3 mbgl. Well 2 was drilled to a depth of approximately 60.7 mbgl and screened from 57.6 mbgl to 60.7 mbgl.

At the Vespra Downs Water Supply, three aquifers were encountered. An unconfined sand and gravel aquifer extends from ground level to 24 mbgl. This aquifer is underlain by a layer of silt, approximately 8 m thick which confines a sand aquifer, approximately 6 m thick. This aquifer extends to the east and pinches out to the north and west of the Community of Vespra Downs. The confined sand aquifer is underlain with a 19 m thick layer of silt and clayey sand which confines a 12 m thick sand aquifer. The deeper confined sand aquifer is regionally extensive and increases in thickness further from the well site. The static water levels at Wells 1 and 2 were approximately 10 mbgl (2005).

The screen intervals for Wells 1 and 2 have been assigned to the A3 Aquifer in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The Groundwater Vulnerability rating will be determined for the A3 Aquifer.

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

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

16.9.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the wells in the Vespra Downs Water Supply was 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 Vespra Downs Water Supply well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 16f-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

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

The WHPA for the Vespra Downs Water Supply reflect groundwater flow from northeast to southwest. This is reasonable based on available data describing regional groundwater flow patterns

16.9.1.2 Groundwater Vulnerability

The Vespra Downs Water Supply draw water from overburden aquifer layers (regional aquifer system A3). The Groundwater Vulnerability for the municipal aquifers in the area was determined using the regional Aquifer Vulnerability Index (AVI methods outlined in Technical

Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO). The regional Groundwater Vulnerability is illustrated in Technical Memorandum B1 – Regional Groundwater Vulnerability Mapping.

The Groundwater Vulnerability within the WHPA of the municipal wells in the Vespra Downs Water Supply is shown in Figure 16f-2. The Groundwater Vulnerability for the municipal water supply aquifer within the WHPA is considered to be Low.

16.9.1.3 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 private wells that would be considered to be Transport Pathways were identified, however two areas were identified where the protective soil cover may have been removed for aggregate extraction were identified to be potential Transport Pathways within the Vespra Downs WHPA-B and WHPA-C. The Transport Pathways are located within areas of Low Vulnerability. The Vulnerability Rating has been increased at these locations from Low to Medium. Mapping of the transport pathways and increased vulnerability were presented in the technical study completed by GENIVAR (2010). Ultimately the locations of transport pathways and increased vulnerability are reflected in the maps of Vulnerability Scores (See Section 16.9.1.5).

16.9.1.4 WHPA-E / WHPA-F

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

16.9.1.5 Vulnerability Score

The WHPA zones for the Vespra Downs Water Supply, as shown in Figure 16f-1, the Groundwater Vulnerability, as shown in Figure 16f-2, and the increased Vulnerability discussed in Section 16.9.1.3, were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 16f-3 illustrates the Vulnerability Scores for the Vespra Downs WHPA. Figure 16f-3 will be used to assess Drinking Water Threats in Section 16.9.3. The Transport Pathways are illustrated as the outline of the licensed extraction site in the WHPA.

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Vespra Downs WHPA is High. The Vulnerability Rating for the Vespra Downs 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).

16.9.2 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 Vespra Downs Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for the Township of Springwater are provided in Technical Memorandum O1 – Drinking Water Issues Evaluation – Springwater (Appendix S).

No Drinking Water Issues were identified for the Vespra Downs Water Supply.

Parameters whose concentrations occasionally exceed Aesthetic/Operational guidelines under the Ontario Drinking Water Quality Standards (ODWQS) include turbidity. These parameters are likely naturally-occurring.

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

16.9.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Vespra Downs 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 Vespra Downs 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
- an enumeration of Drinking Water Threats

16.9.3.1 List of Drinking Water Threats – Activities

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

16.9.3.2 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 Vespra Downs Water Supply system:

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

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

16.9.3.3 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 include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at Government of Ontario's Drinking Water Threats and Circumstances.

16.9.3.3.1 Pathogen Parameters

The Key Table on Figure 16f-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Vespra Downs 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.

16.9.3.3.2 Chemical Parameters

The Key Table on Figure 16f-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Vespra Downs 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.

16.9.3.3.3 DNAPL Chemical Parameters

Figure 16f-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 Vespra Downs Water Supply. The Key Table on Figure 16f-6 can be used to can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 16.9.3.2, no Conditions have been confirmed within the WHPA for the Vespra Downs 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 16f-3 illustrates the Vulnerability Score map for Vespra Downs well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

16.9.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Vespra Downs 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 16-12 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Vespra Downs Water Supply. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 8 or 10.

Ten (10) activities that are considered to be potential Significant Drinking Water Threats were identified in association with ten (10) land parcels in the Vespra Downs WHPA. Eight (8) parcels were identified as having significant threats related 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 twelve (12) residential parcels within this area. One (1) parcel was identified for potential handling and storage of DNAPLs.

Table 16-12: Number of Significant Drinking Water Threats for the Vespra Downs Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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
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	1	1
16	The handling and storage of dense non-aqueous phase liquid	1	1
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	10*	10

Notes for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel
2. *8 verified existing Threats and 2 potential Threats that require further investigation

16.9.3.5.1 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 Vespra Downs 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 16.9.3.5). 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 16f-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Vespra Downs Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

16.9.3.5.2 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 Vespra Downs 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 16.9.3.5). 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 16f- 8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Vespra Downs 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).

16.9.3.5.3 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 Vespra Downs 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 16.9.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 16f-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Vespra Downs Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

Figure 16-1: Vulnerable Areas in the Township of Springwater.

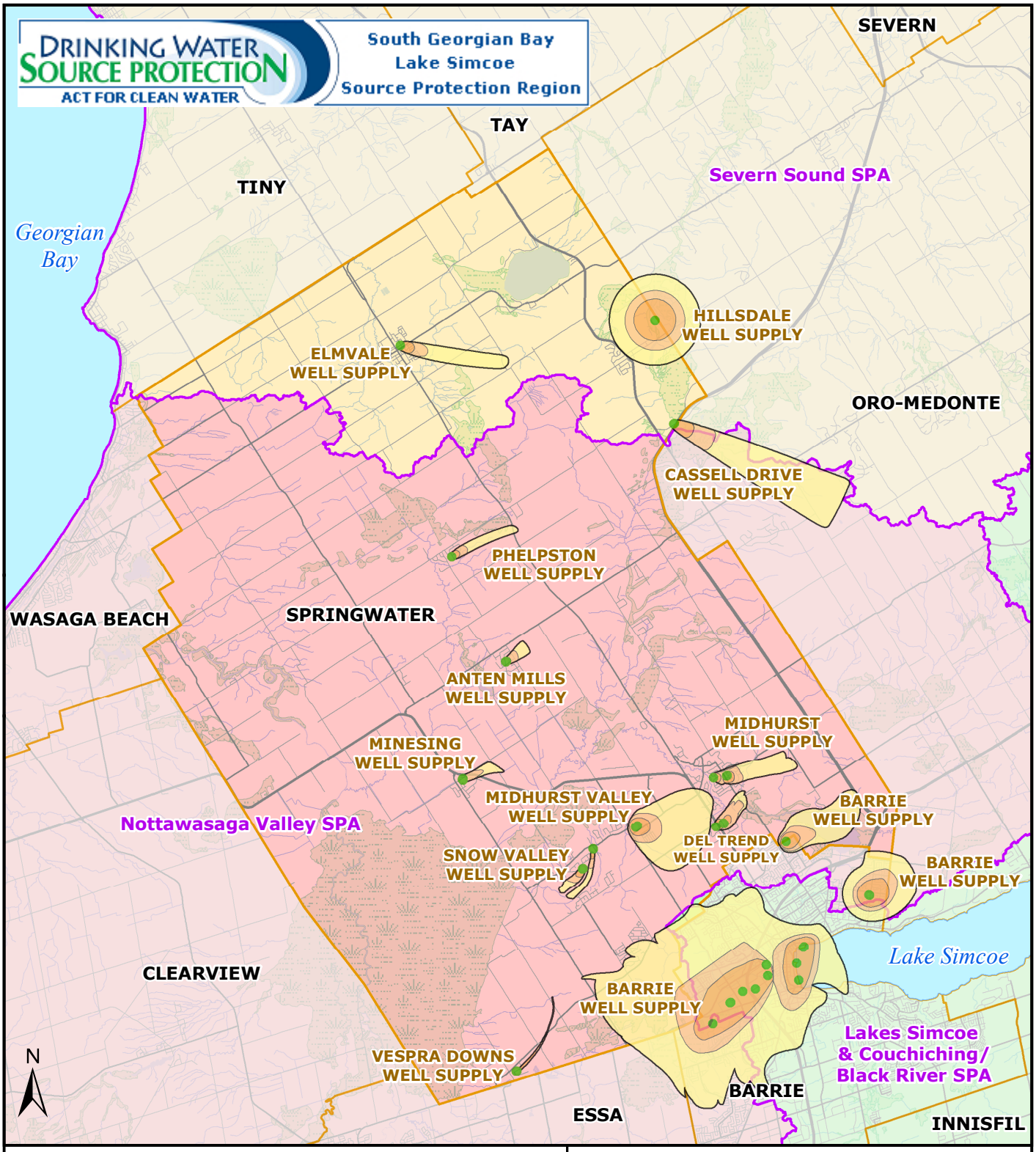


Figure 16a-1: Wellhead Protection Areas - Anten Mills.

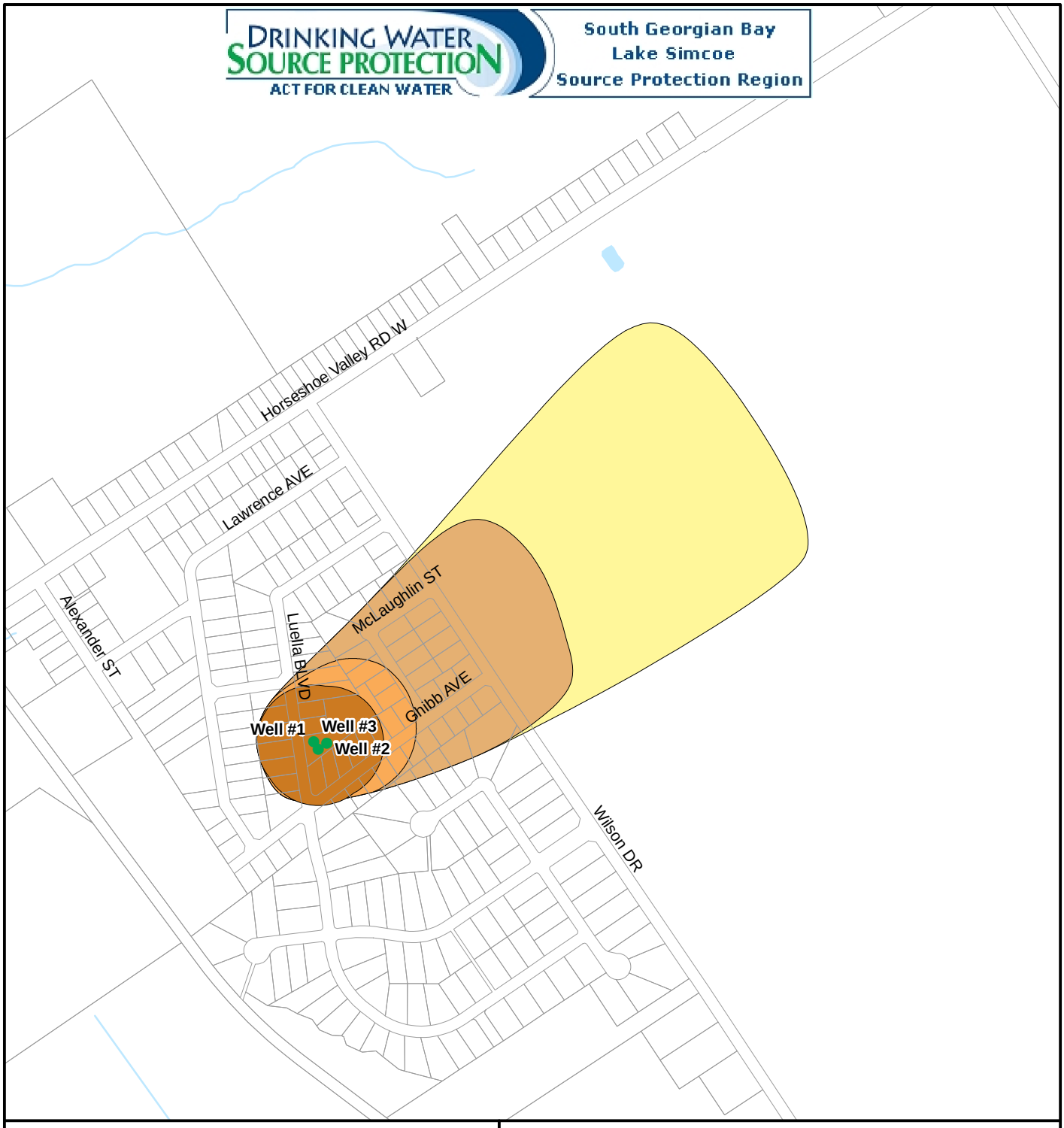


Figure 16a-2: Groundwater Vulnerability - Anten Mills.

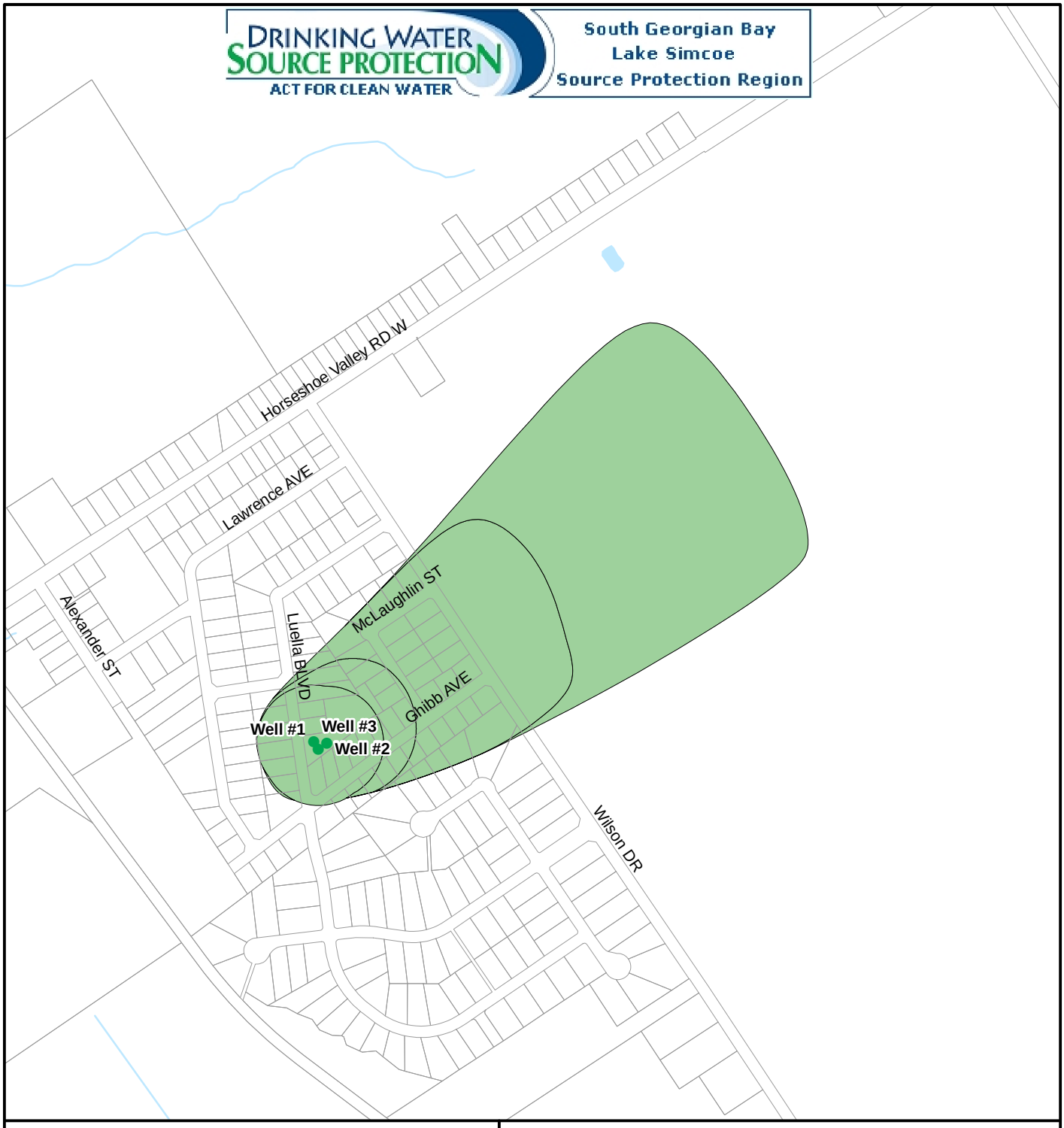
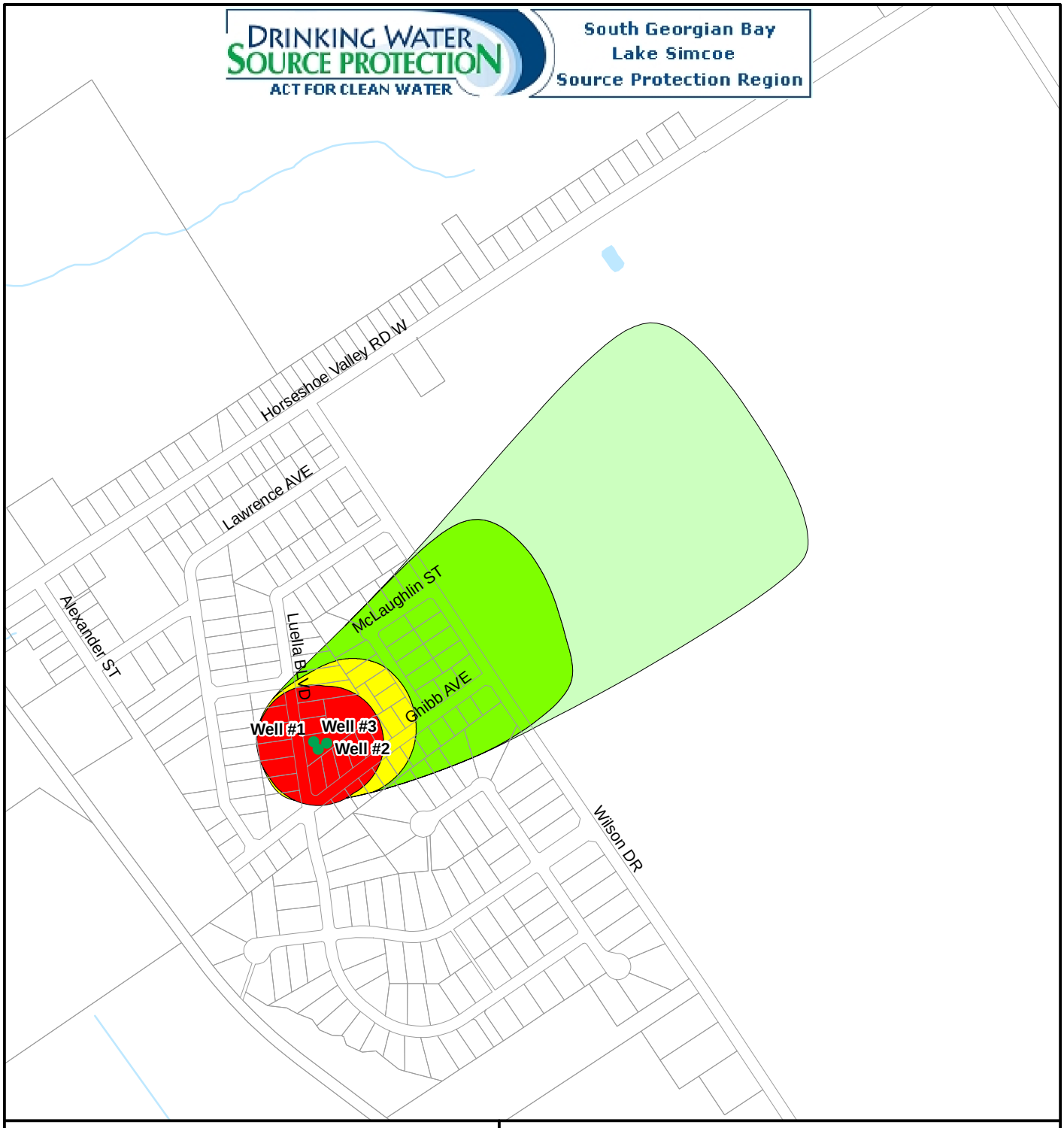


Figure 16a-3: Vulnerability Scores - Anten Mills.



VULNERABILITY SCORES - ANTEN MILLS

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

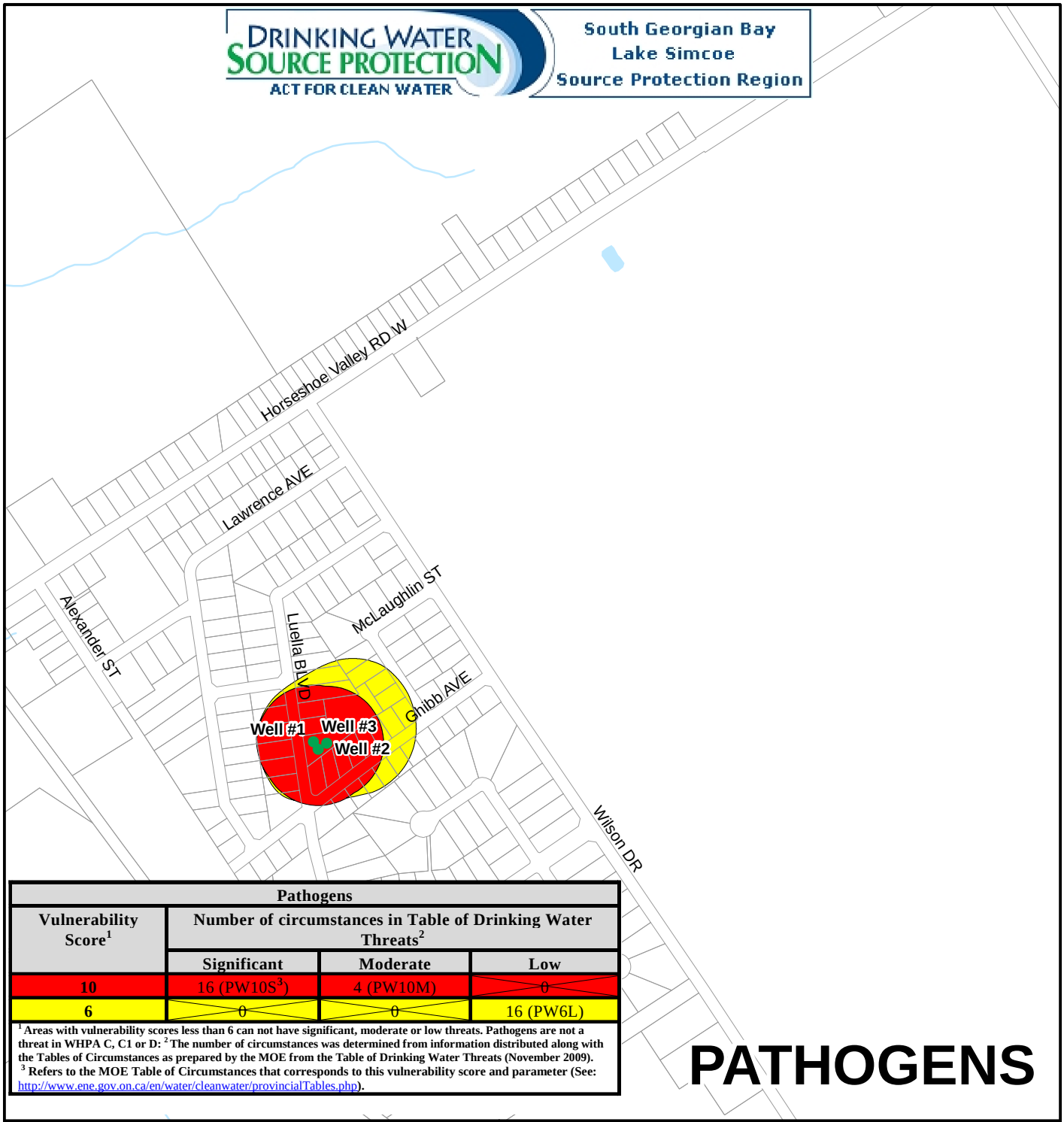
DATE: JUNE 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.1-3

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 **16a-3**

Figure 16a-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats - Anten Mills.



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

100 50 0 100 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 - ANTEN MILLS

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

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

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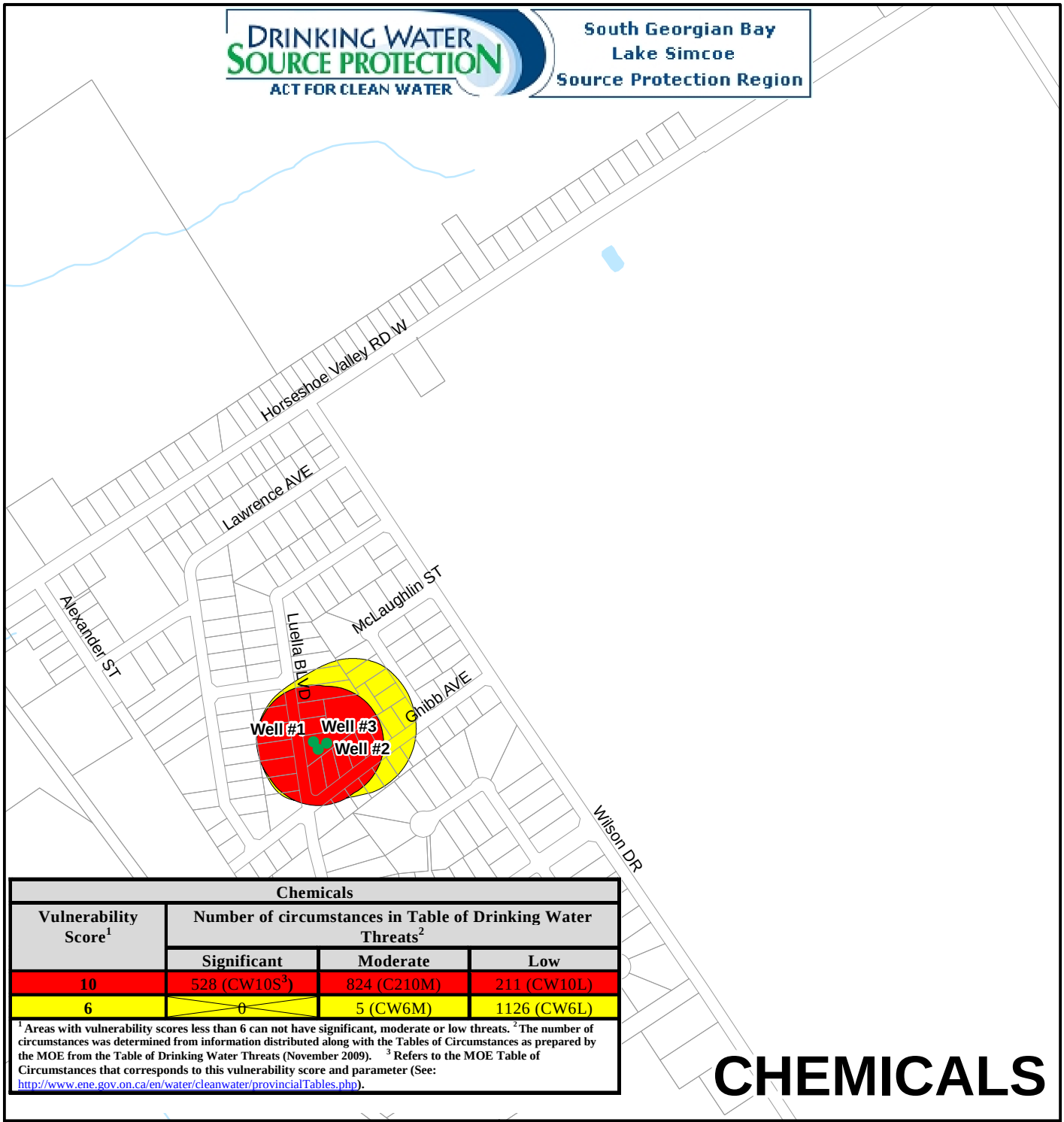
GENIVAR Ontario

FIGURE **16a-4**

Figure 16a-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats - Anten Mills.



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

100 50 0 100 Metres

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

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.

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

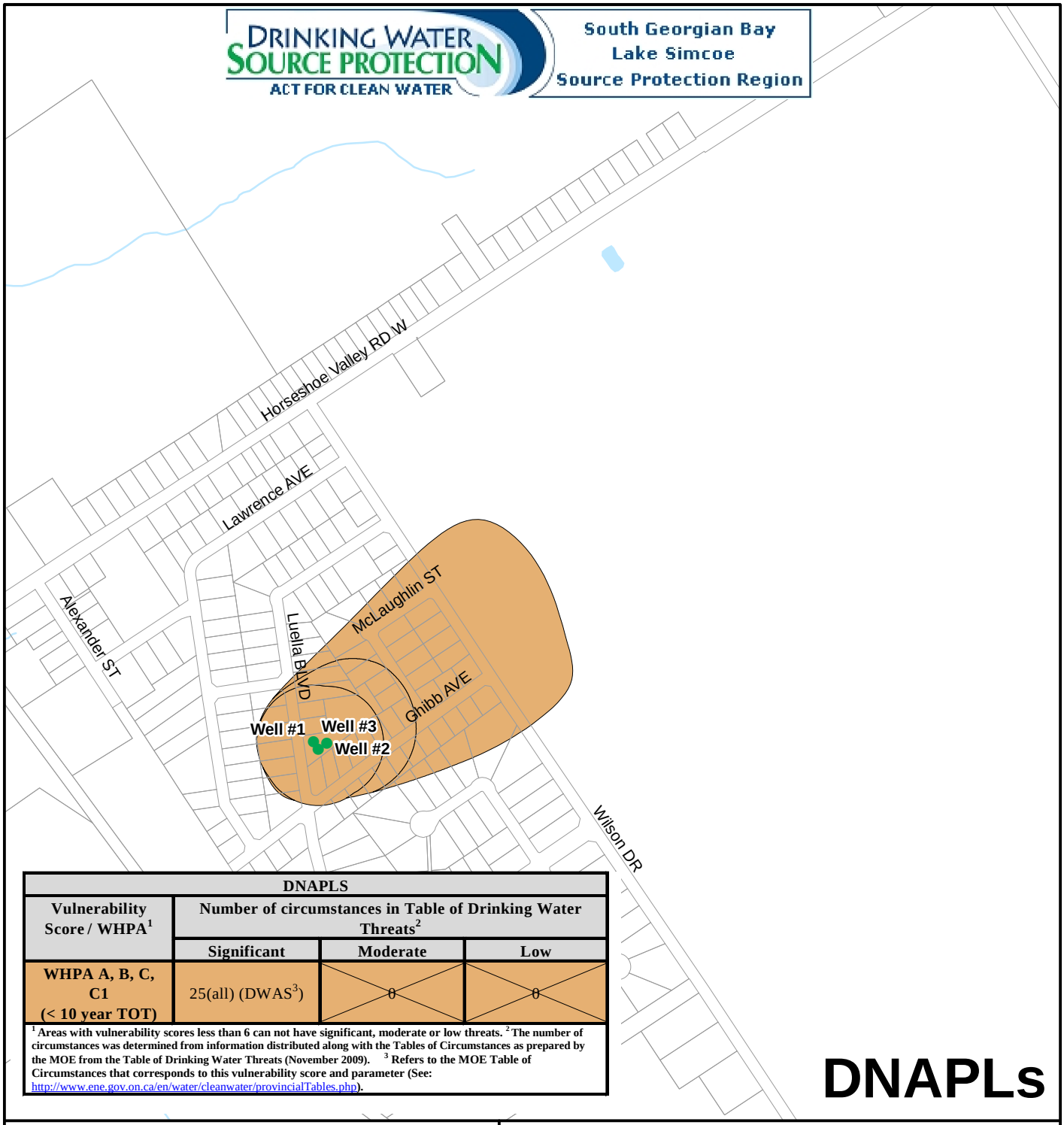
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JUNE 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.1-5

GENIVAR Ontario

FIGURE **16a-5**

Figure 16a-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats - Anten Mills.



DNAPLS			
Vulnerability Score / WHPA[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
WHPA A, B, C, C1 (< 10 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-C1: 10 YEAR TIME-OF-TRAVEL

N W E S

100 50 0 100 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 - ANTEN MILLS

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

DATE: JUNE 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.1-6

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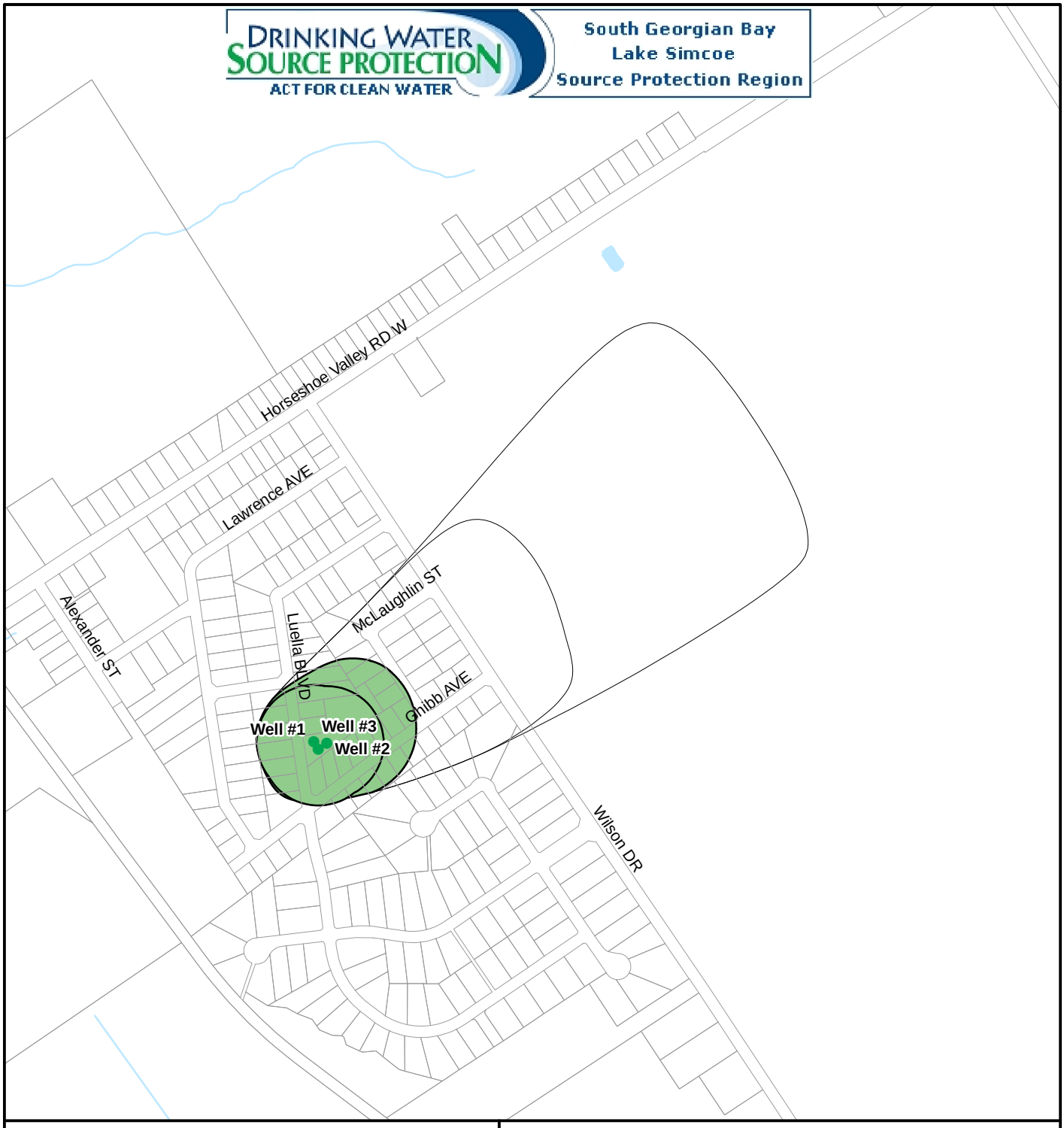
GENIVAR Ontario

FIGURE **16a-6**

Figure 16a-7: Managed Lands - Anten Mills.



MANAGED LANDS - ANTEN MILLS

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.

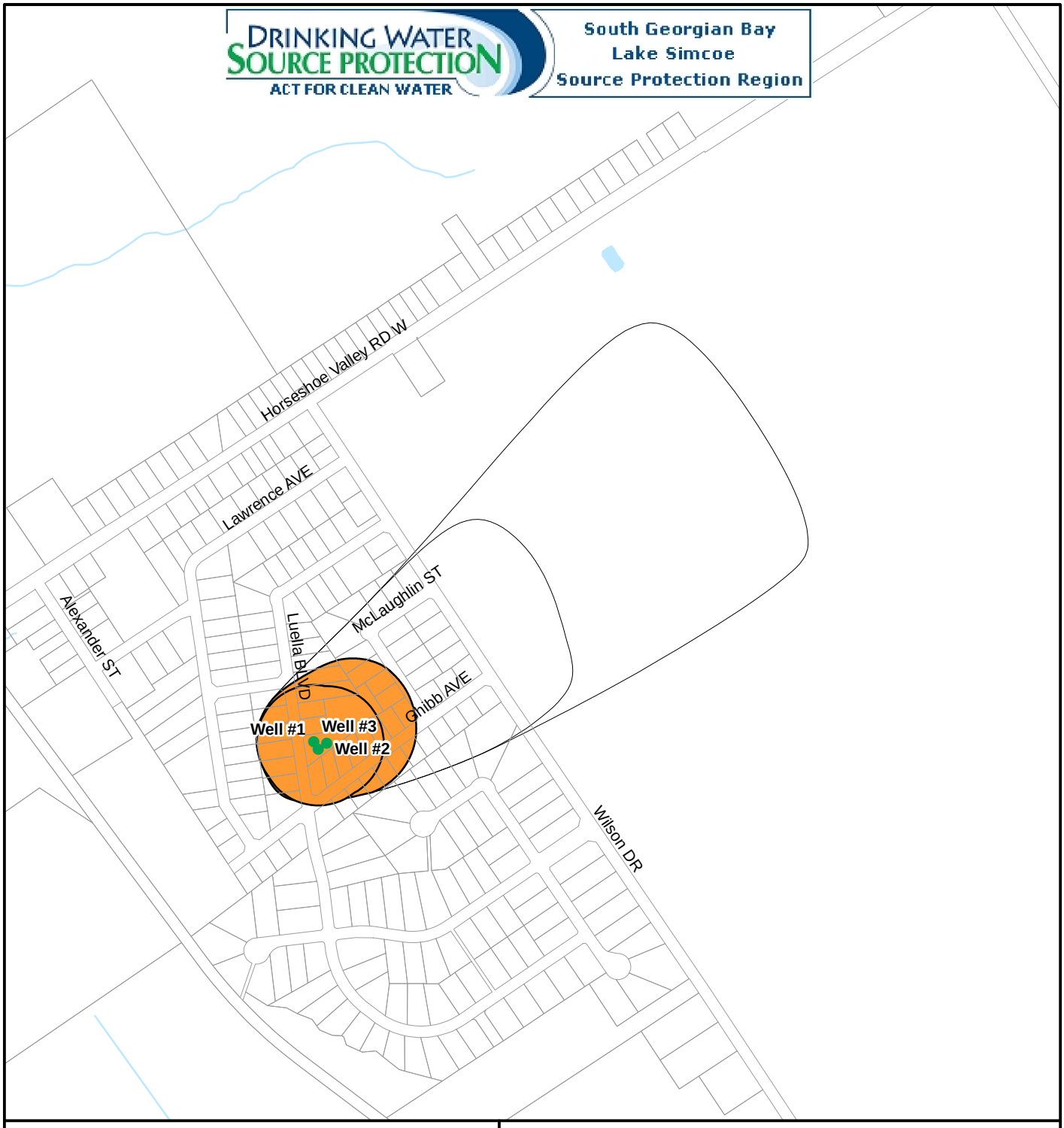
DATE: JUNE 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.1-7

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.

GENIVAR Ontario

FIGURE **16a-7**

Figure 16a-8: Livestock Density - Anten Mills.



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

100 50 0 100 Metres

LIVESTOCK DENSITY - ANTEN MILLS

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.

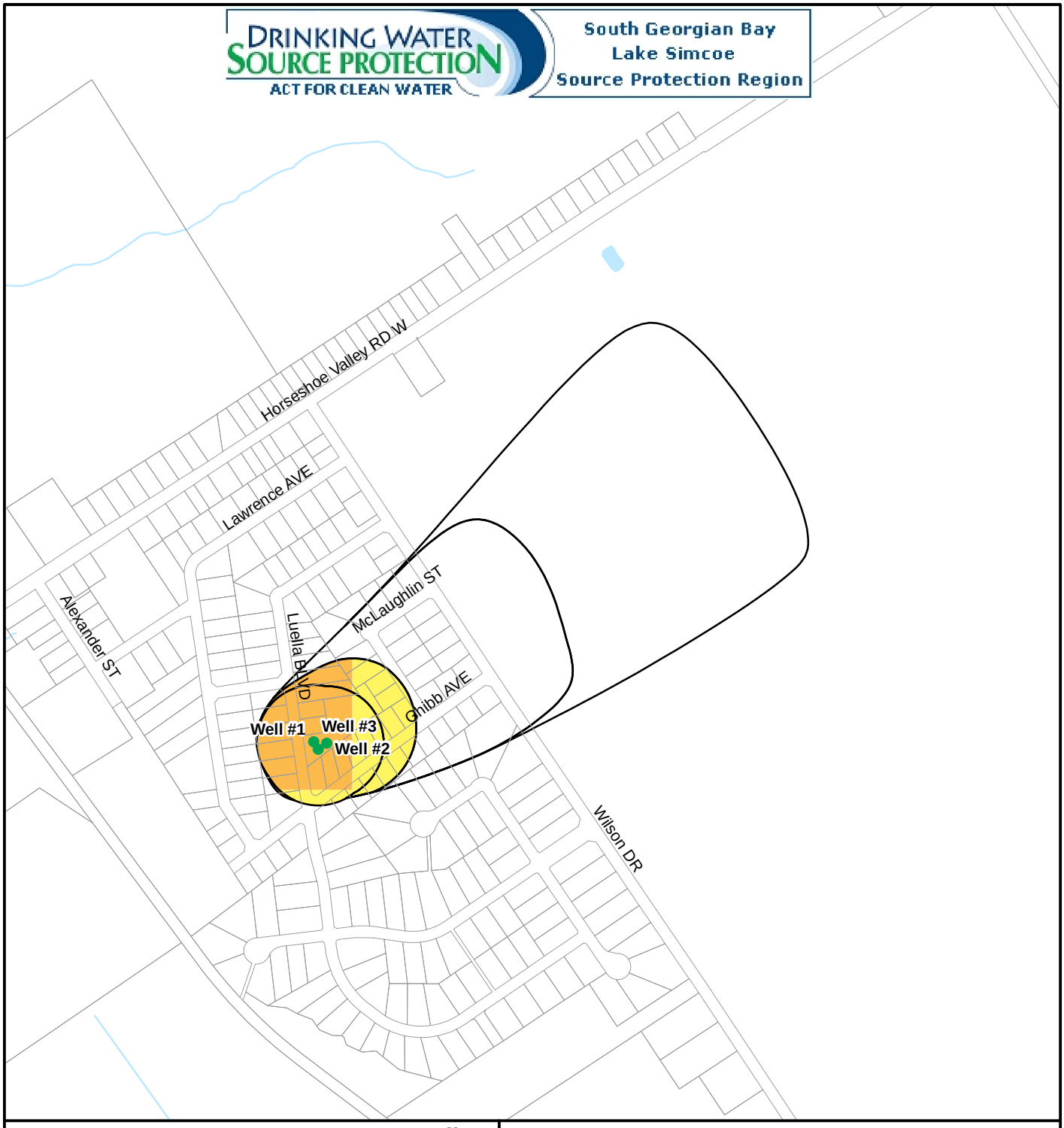
DATE: JUNE 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.1-8

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 **16a-8**

Figure 16a-9: Impervious Surfaces - Anten Mills.



IMPERVIOUS SURFACES - ANTEN MILLS

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: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.1-9

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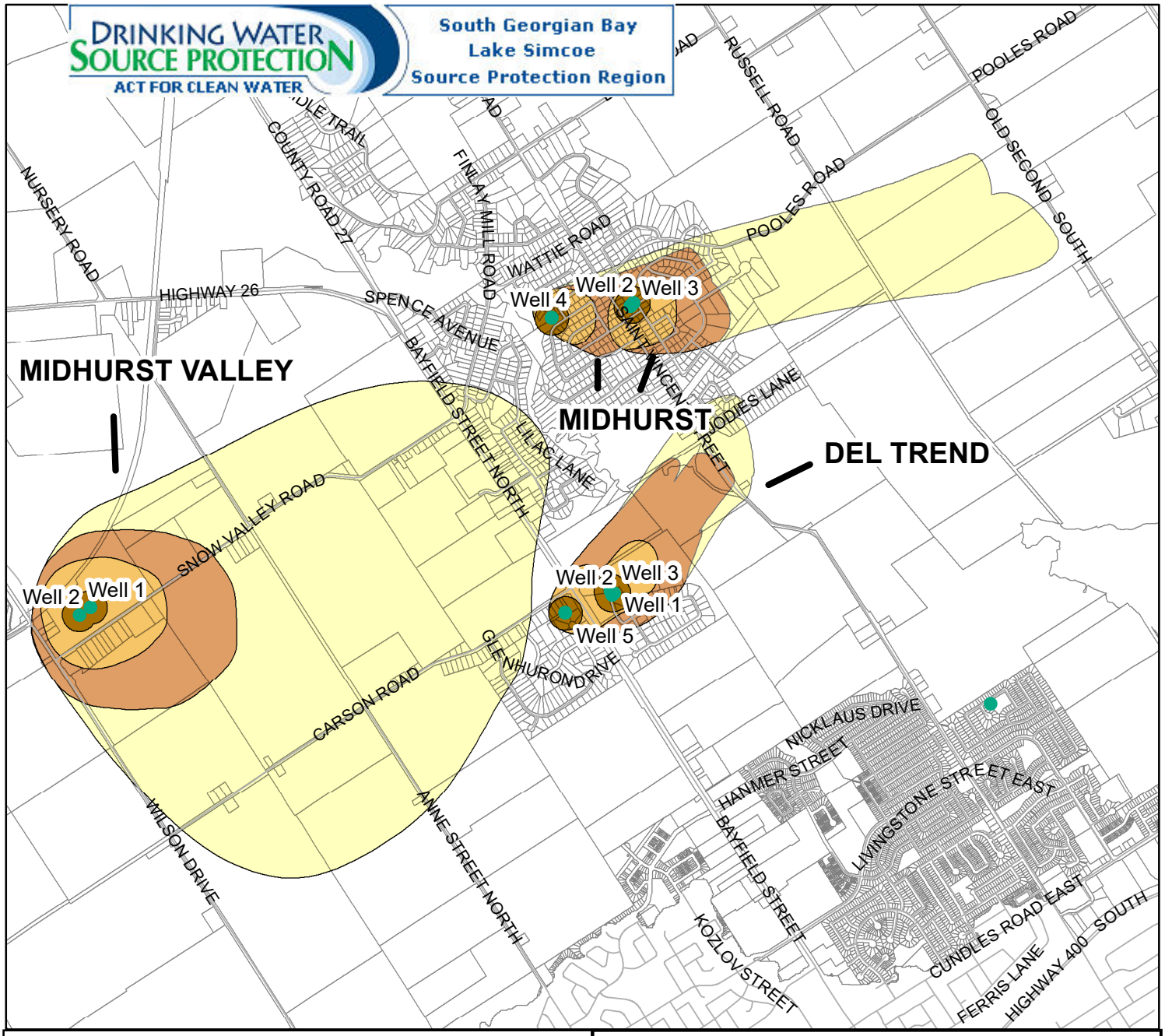
GENIVAR Ontario

FIGURE **16a-9**

Figure 16b-1: Wellhead Protection Areas - Del Trend/Midhurst.



WELLHEAD PROTECTION AREAS- MIDHURST VALLEY/DEL TREND/MIDHURST

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

Created by: NVCA
Date: 2022-05

Scale: 1:35,000

UTM Zone 17N, NAD83

Ontario

Figure 16b-1

This map was produced for the South Georgian Bay Lake Simcoe Protection Region for the purpose of completing the South Georgian Bay Lake Simcoe Assessment Report.
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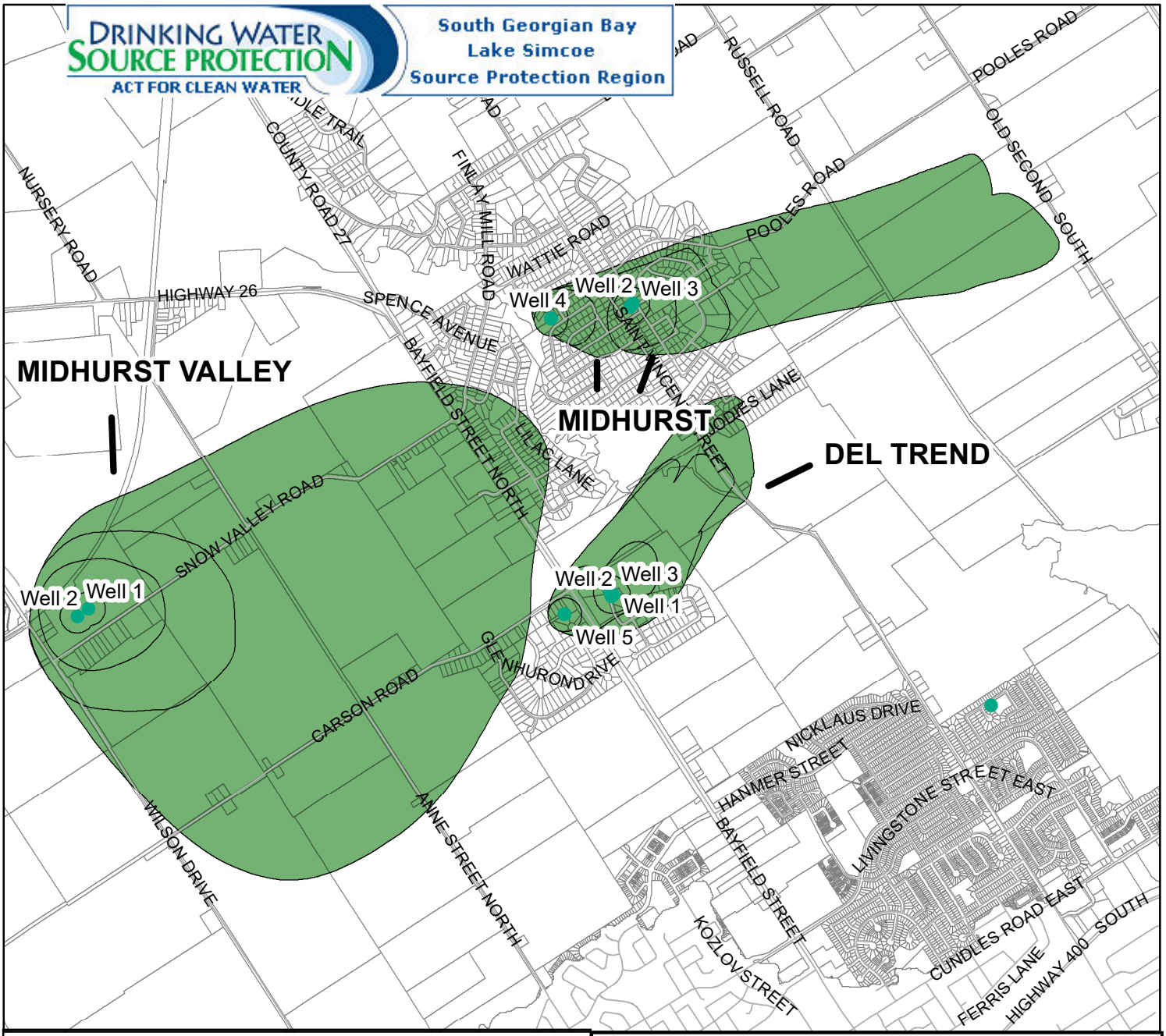
While every effort has been made to accurately depict the base data, errors may exist.

Figure 16b-2: Groundwater Vulnerability - Del Trend/Midhurst.



GROUNDWATER VULNERABILITY-MIDHURST VALLEY/DEL TREND/MIDHURST

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

Created by: NVCA
Date: 2022-05

Scale: 1:35,000

UTM Zone 17N, NAD83

Ontario

Figure 16b-2

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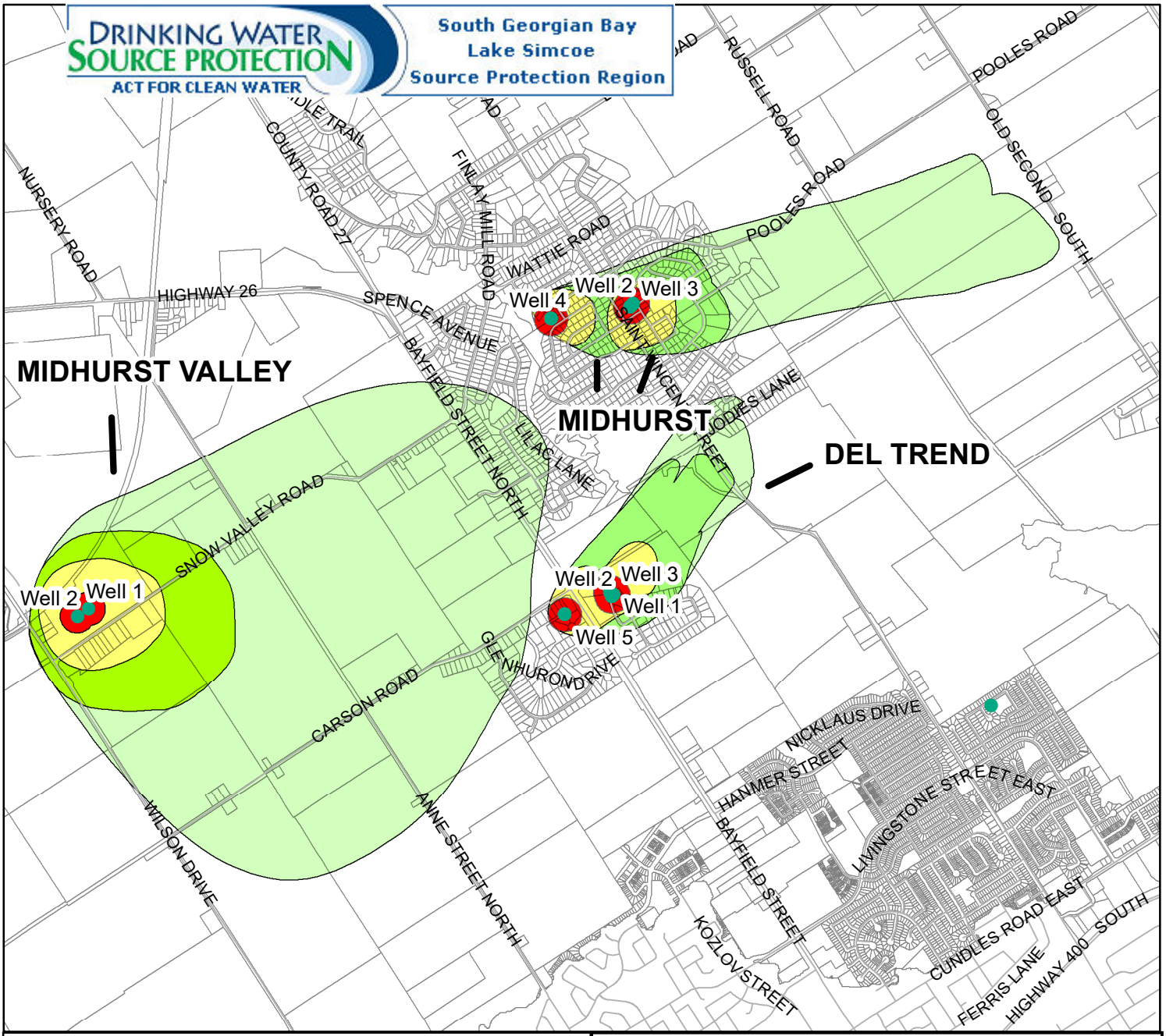
Figure 16b-3: Vulnerability Scores - Del Trend/Midhurst.



Legend

- MUNICIPAL WELL LOCATION

VulnerabilityScore

- 10
- 8
- 6
- 4
- 2

N W E S

400 200 0 400 Meters

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VULNERABILITY SCORES-
MIDHURST VALLEY/DEL TREND/MIDHURST

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

Created by: NVCA
Date: 2022-05

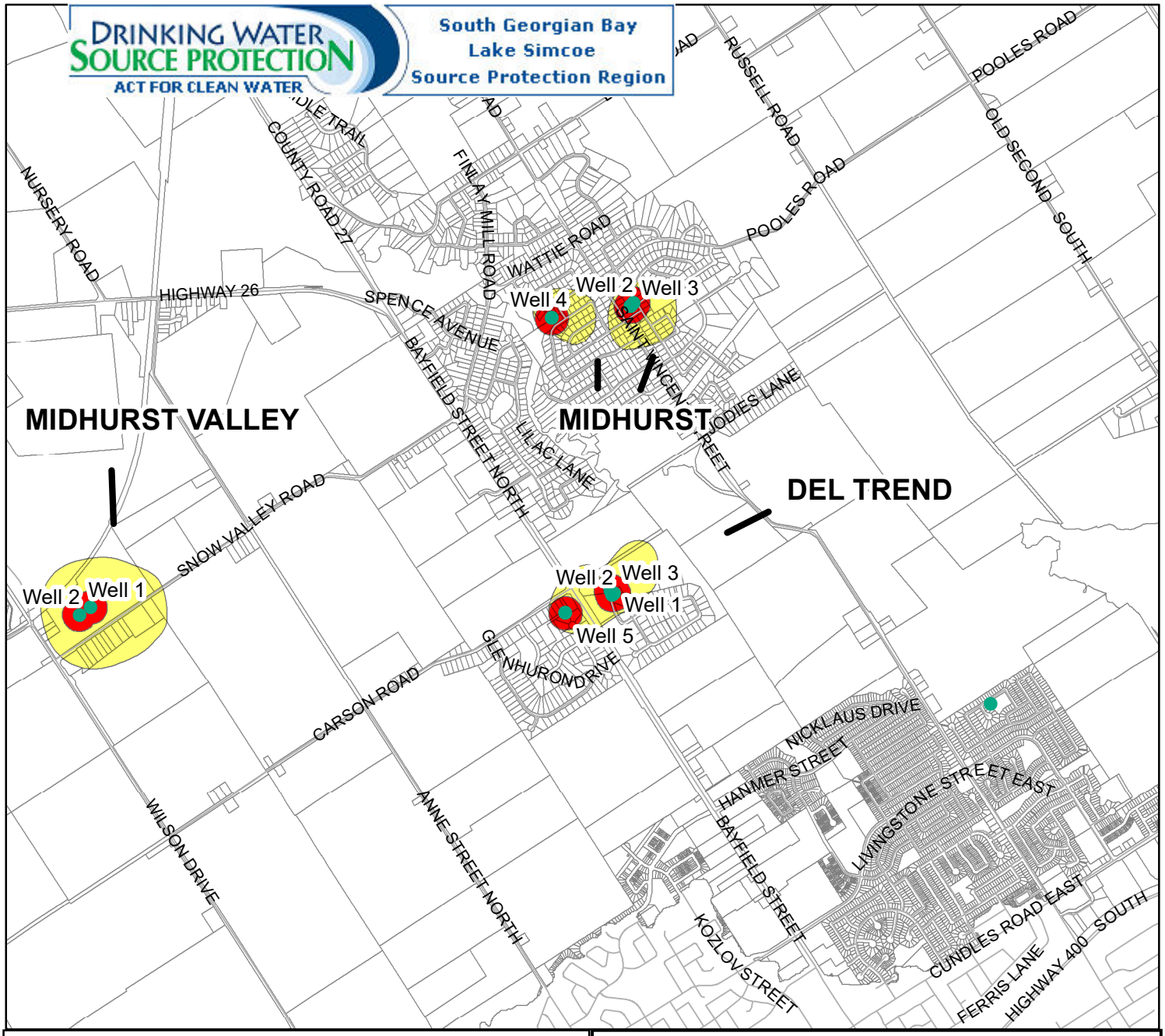
Scale: 1:35,000

UTM Zone 17N, NAD83

Ontario

Figure 16b-3

Figure 16b-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats – Del Trend/Midhurst.



Legend

- MUNICIPAL WELL LOCATION

VulnerabilityScore

- 10
- 8
- 6

N W E S

400 200 0 400 Meters

AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS- MIDHURST VALLEY/DEL TREND/MIDHURST

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.

Created by: NVCA
Date: 2022-05

Scale: 1:35,000

UTM Zone 17N, NAD83

Ontario

Figure 16b-4

This map was produced for the South Georgian Bay Lake Simcoe Protection Region for the purpose of completing the South Georgian Bay Lake Simcoe Assessment Report.
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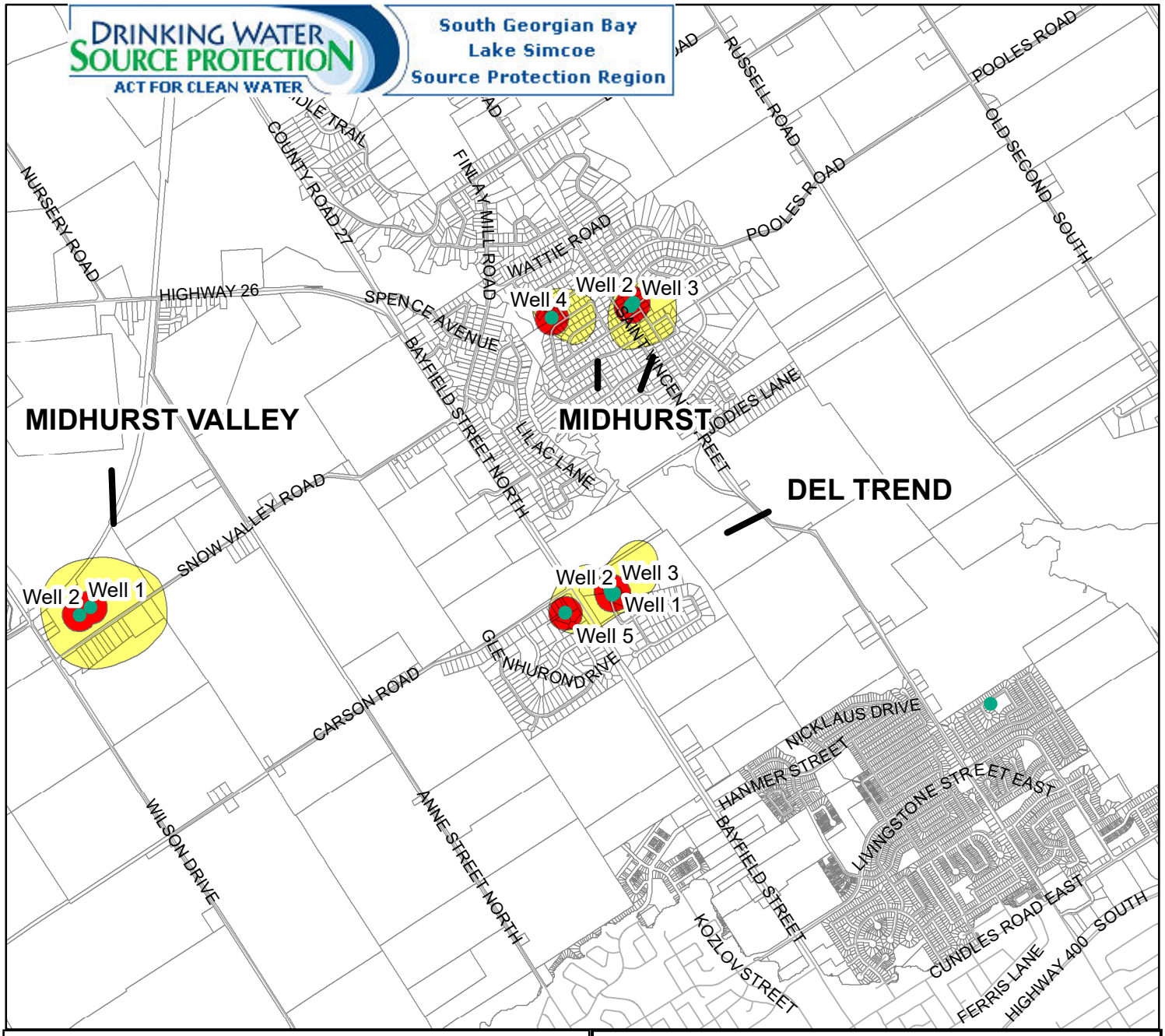
While every effort has been made to accurately depict the base data, errors may exist.

Figure 16b-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats – Del Trend/Midhurst.



Legend

- MUNICIPAL WELL LOCATION

VulnerabilityScore

- 10
- 8
- 6

N W E S

400 200 0 400 Meters

AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS- MIDHURST VALLEY/DEL TREND/MIDHURST

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.

Created by: NVCA
Date: 2022-05

Scale: 1:35,000

UTM Zone 17N, NAD83

Ontario

Figure 16b-5

This map was produced for the South Georgian Bay Lake Simcoe Protection Region for the purpose of completing the South Georgian Bay Lake Simcoe Assessment Report.
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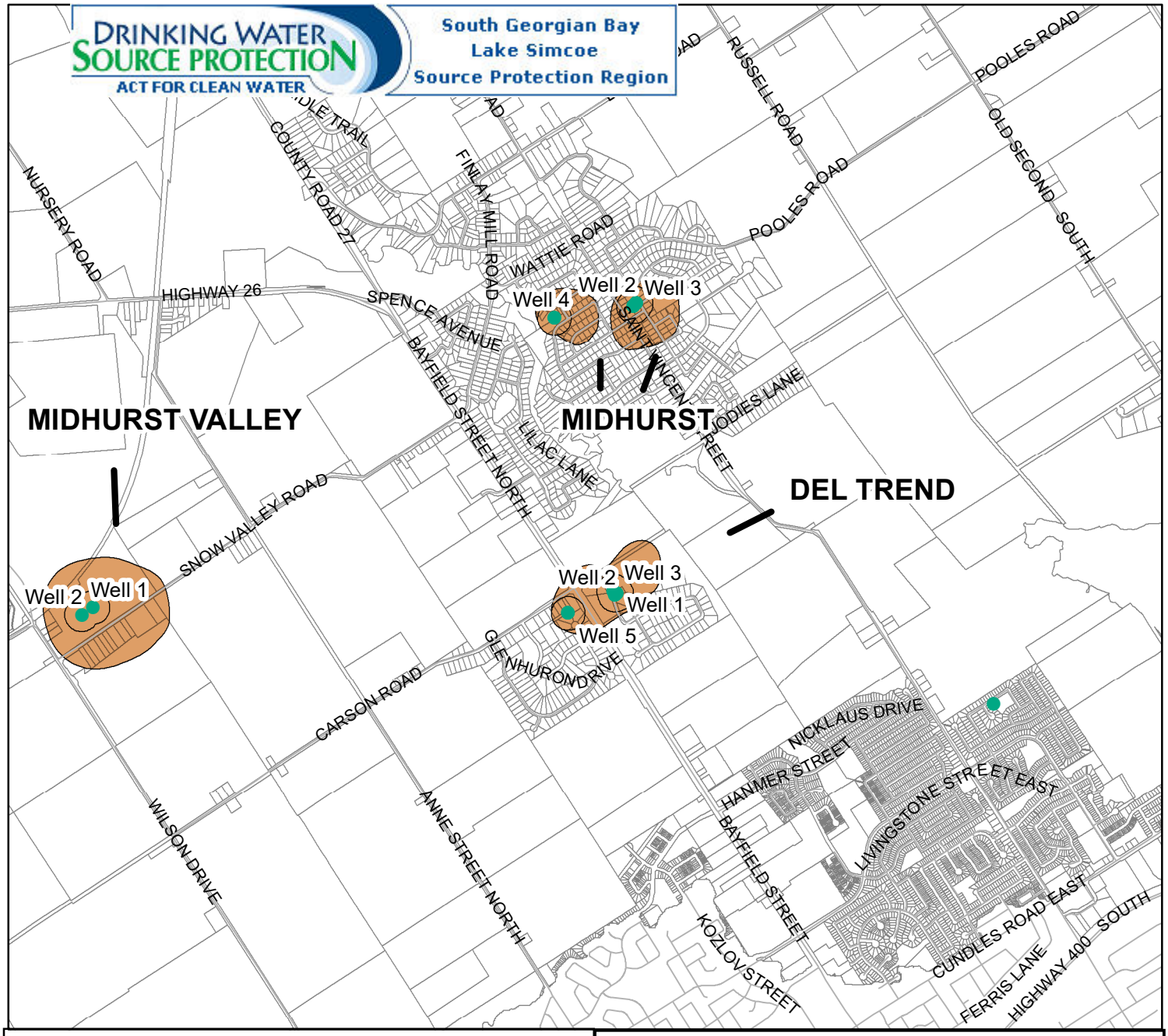
While every effort has been made to accurately depict the base data, errors may exist.

Figure 16b-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats – Del Trend/Midhurst.



AREAS WHERE DNAPLS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS- MIDHURST VALLEY/DEL TREND/MIDHURST

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.

Created by: NVCA
Date: 2022-05

Scale: 1:35,000

UTM Zone 17N, NAD83

Ontario

Figure 16b-6

This map was produced for the South Georgian Bay Lake Simcoe Protection Region for the purpose of completing the South Georgian Bay Lake Simcoe Assessment Report.
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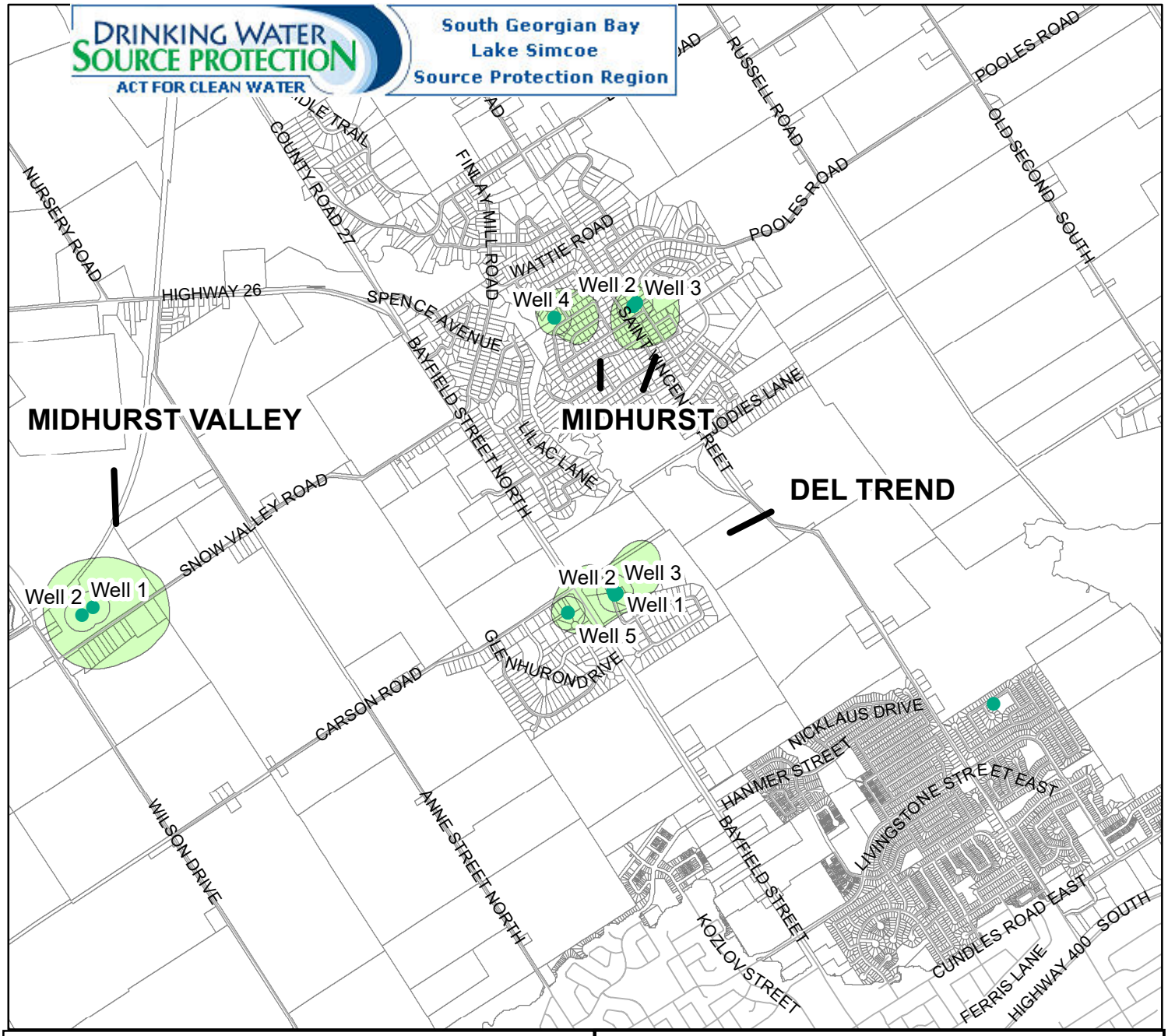
While every effort has been made to accurately depict the base data, errors may exist.

Figure 16b-7: Managed Lands - Del Trend/Midhurst.



Legend

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

400 200 0 400 Meters

MANAGED LANDS-
MIDHURST VALLEY/DEL TREND/MIDHURST

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

The Managed Lands proportion is illustrated where the vulnerability score is greater than 6.

Created by: NVCA
Date: 2022-05

Scale: 1:35,000

UTM Zone 17N, NAD83

Ontario

Figure 16b-7

This map was produced for the South Georgian Bay Lake Simcoe Protection Region for the purpose of completing the South Georgian Bay Lake Simcoe Assessment Report.
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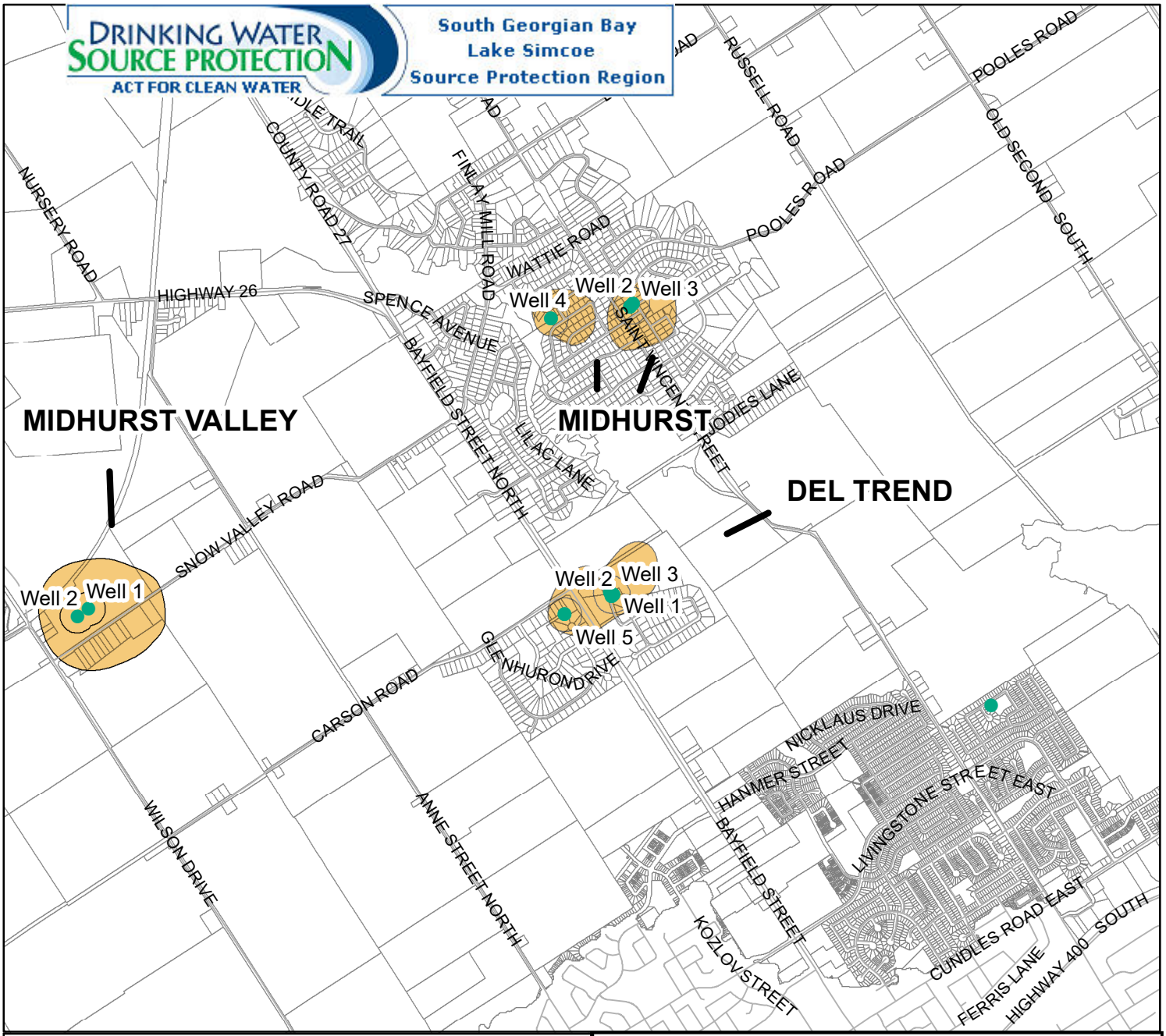
Figure 16b-8: Livestock Density - Del Trend/Midhurst.



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

400 200 0 400 Meters

LIVESTOCK DENSITY-
MIDHURST VALLEY/DEL TREND/MIDHURST

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

The Livestock Density proportion is illustrated where the vulnerability score is greater than 6.

Created by: NVCA
Date: 2022-05

Scale: 1:35,000

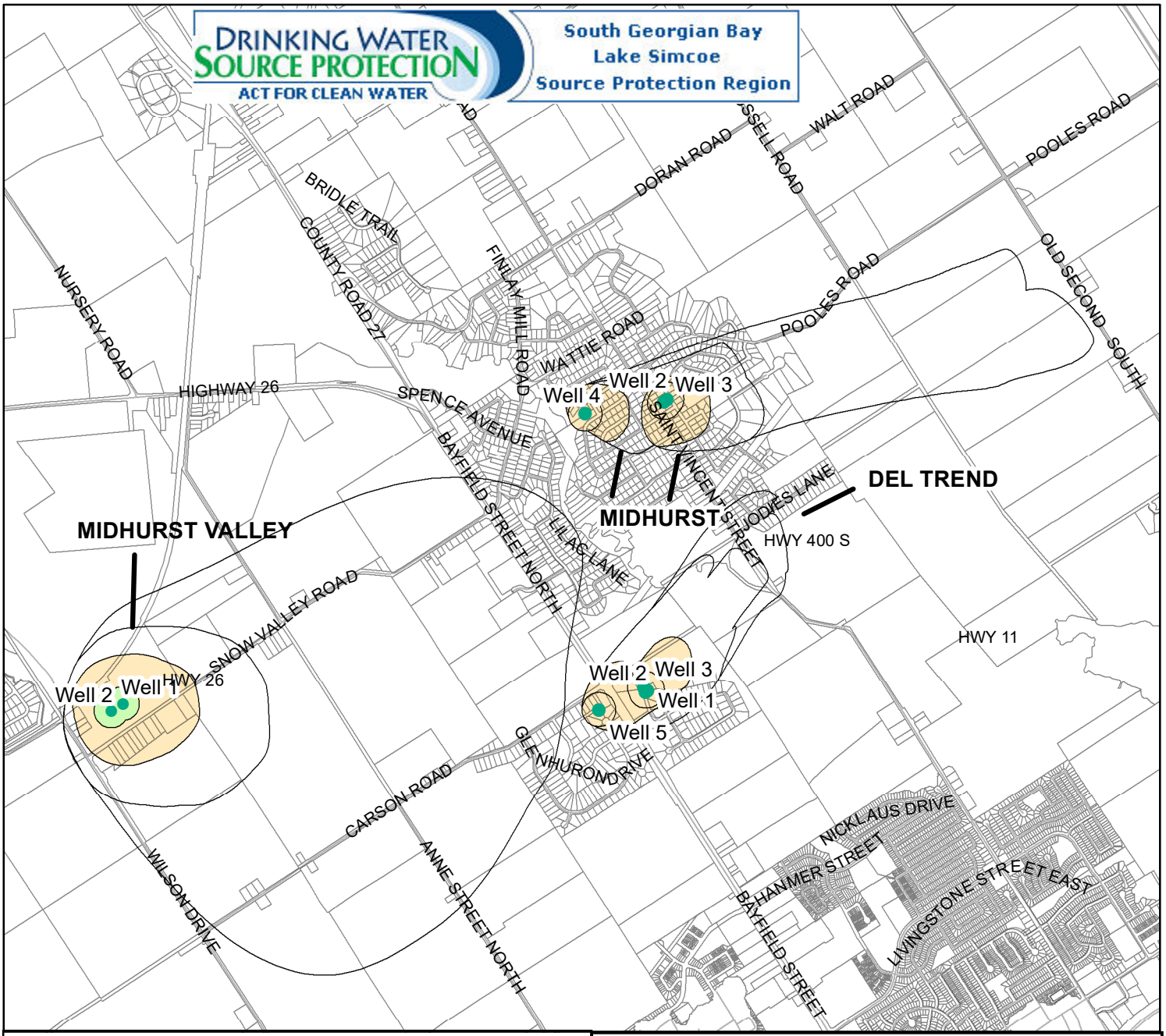
UTM Zone 17N, NAD83

Ontario

Figure 16b-8

This map was produced for the South Georgian Bay Lake Simcoe Protection Region for the purpose of completing the South Georgian Bay Lake Simcoe Assessment Report.
Base data have benn compiled from various sources, under data sharing agreements.
While every effort has been made to accurately depict the base data, errors may exist.

Figure 16b-9: Impervious Surfaces - Del Trend/Midhurst.



IMPERVIOUS SURFACES-
MIDHURST VALLEY/DEL TREND/MIDHURST

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

The Impervious Surfaces proportion is illustrated where the vulnerability score is greater than 6.

Created by: NVCA
Date: 2022-07

Scale: 1:35,000

UTM Zone 17N, NAD83

Ontario

Figure 16b-9

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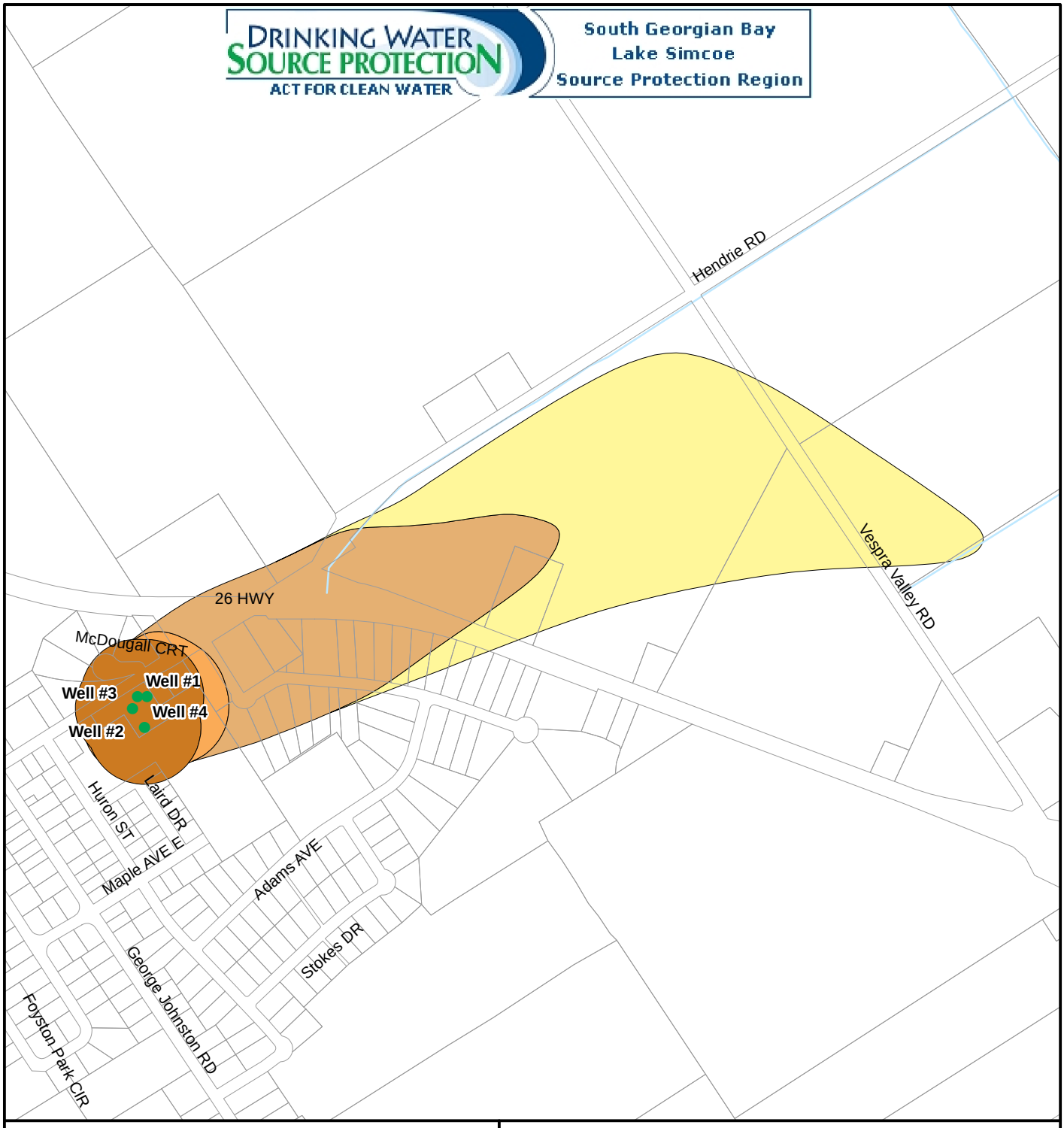
Figure 16c-1: Wellhead Protection Areas - Minesing.



Legend

- MUNICIPAL WELL LOCATION
- WHPA-A: 100 m RADIUS
- WHPA-B: 2-YEAR TIME-OF-TRAVEL
- WHPA-C1: 10-YEAR TIME-OF-TRAVEL
- WHPA-D: 25-YEAR TIME-OF-TRAVEL

N W E S

100 50 0 100 Metres

WELLHEAD PROTECTION AREAS - MINESING

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

DATE: JULY 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.6-1

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 **16c-1**

Figure 16c-2: Groundwater Vulnerability - Minesing.

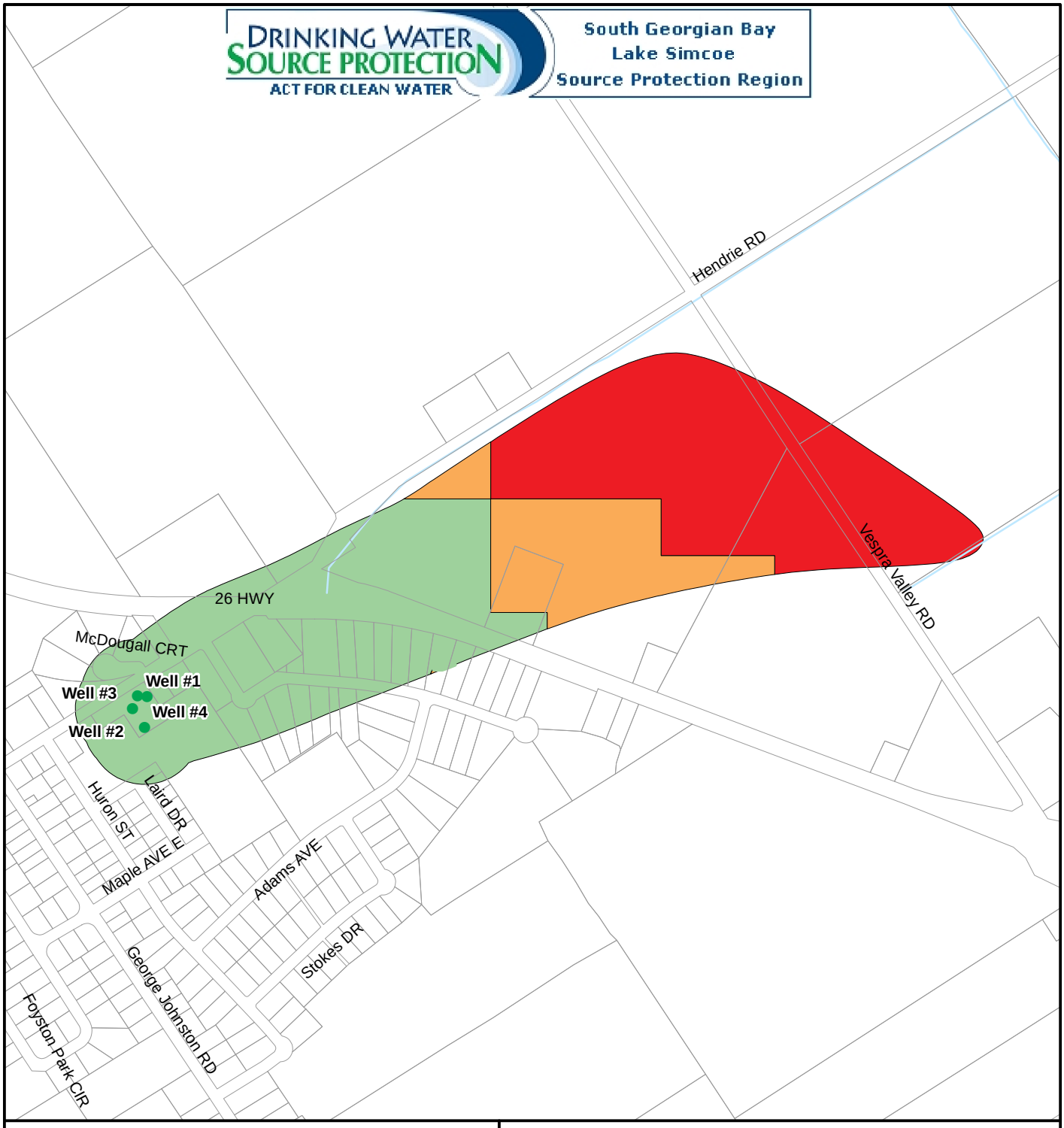
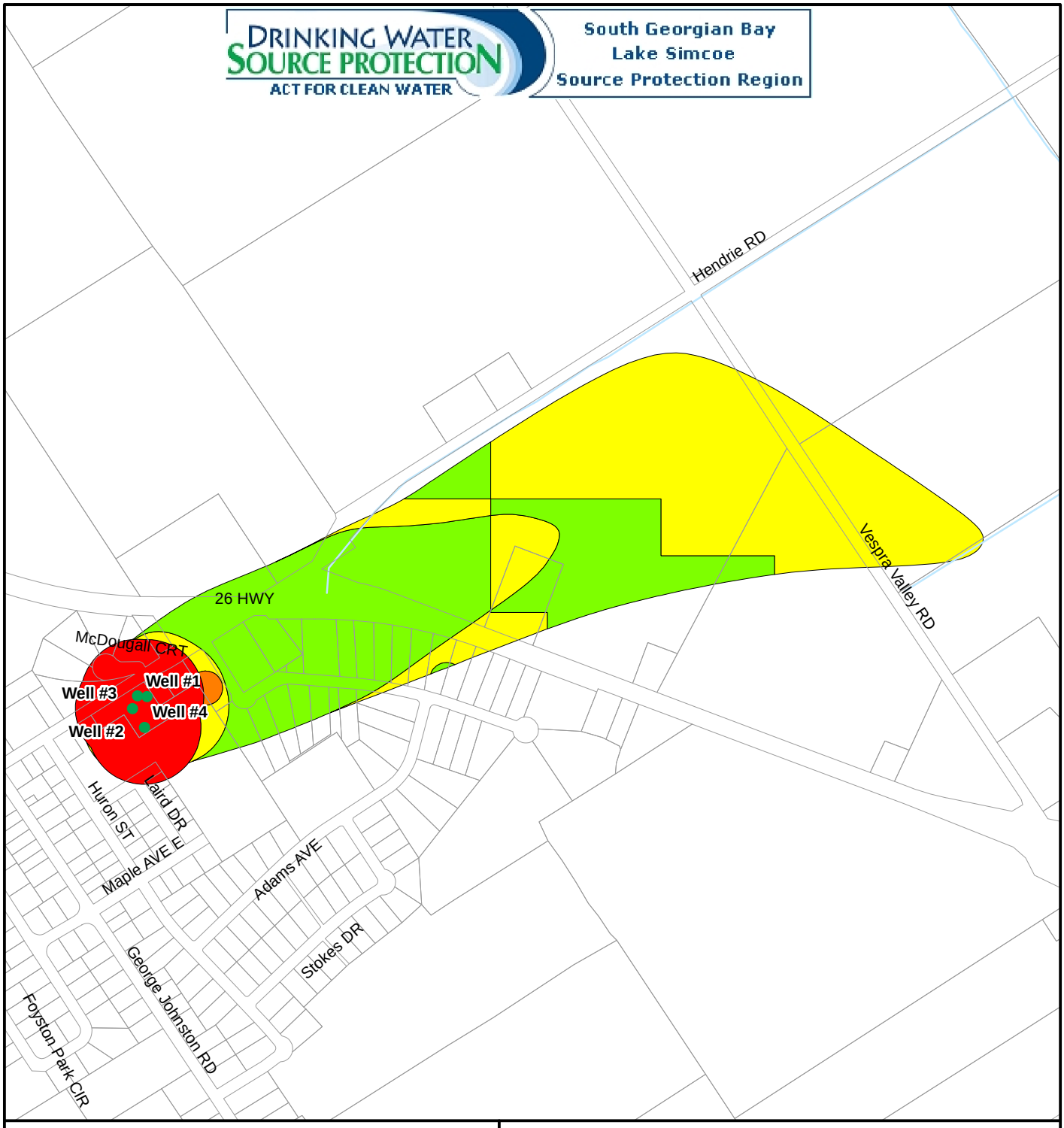


Figure 16c-3: Vulnerability Scores - Minesing.



VULNERABILITY SCORES - MINESING

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

DATE: JULY 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.6-5

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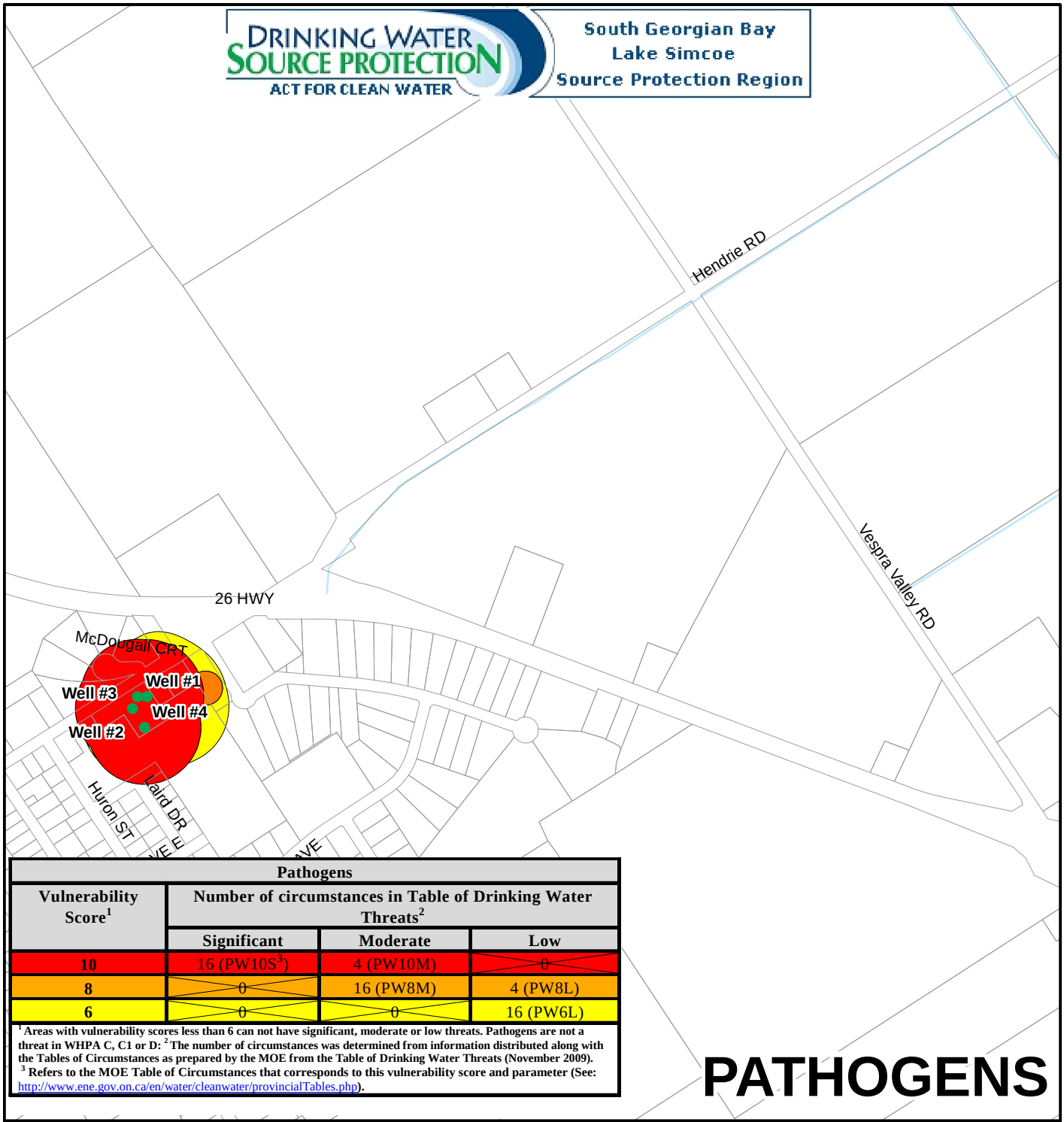
GENIVAR Ontario

FIGURE **16c-3**

Figure 16c-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats – Minesing.



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

100 50 0 100 Metres

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

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: JULY 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.6-6

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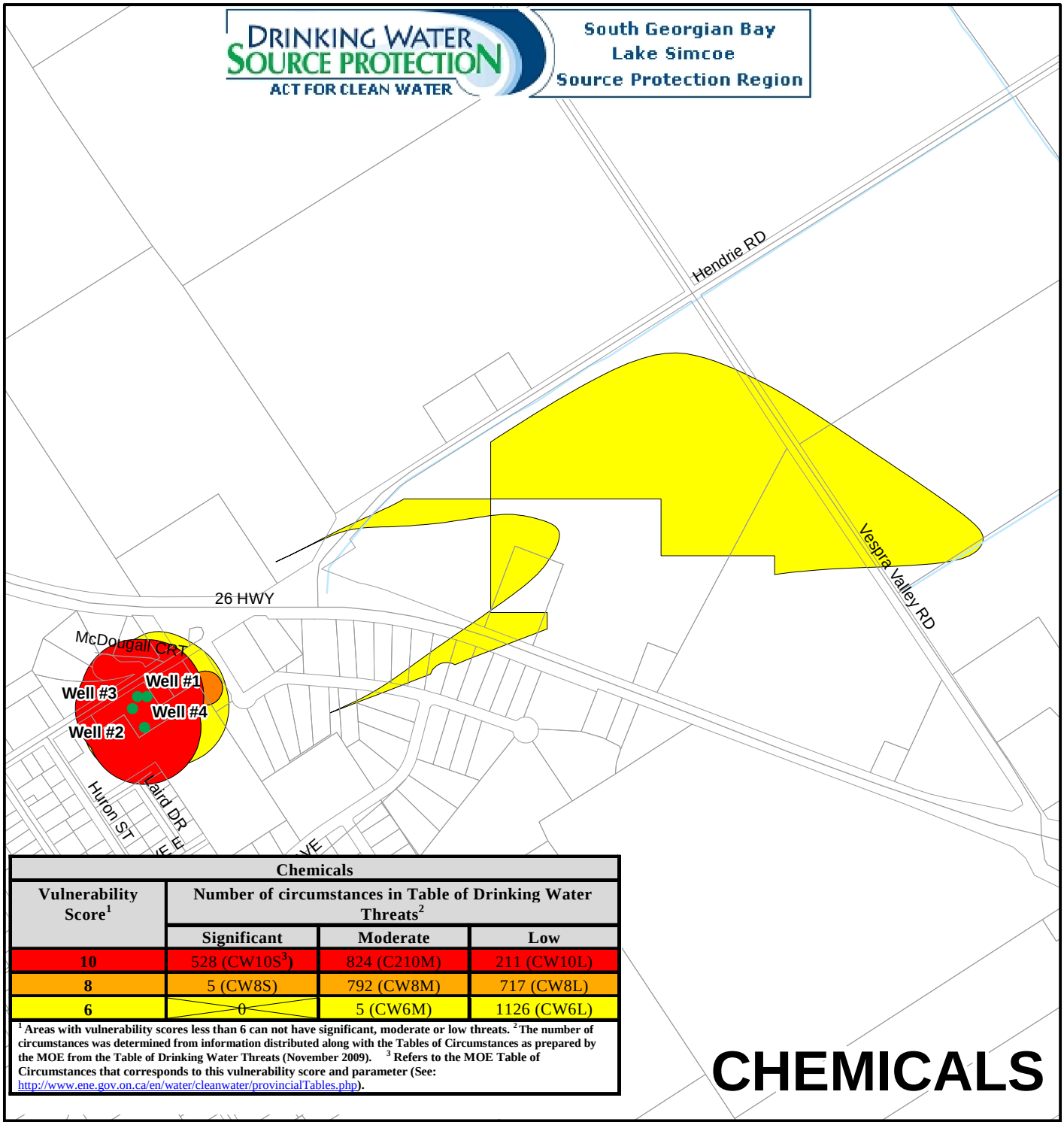
GENIVAR Ontario

FIGURE **16c-4**

Figure 16c-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats – Minesing.



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

100 50 0 100 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 - MINESING

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

DATE: JULY 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.6-7

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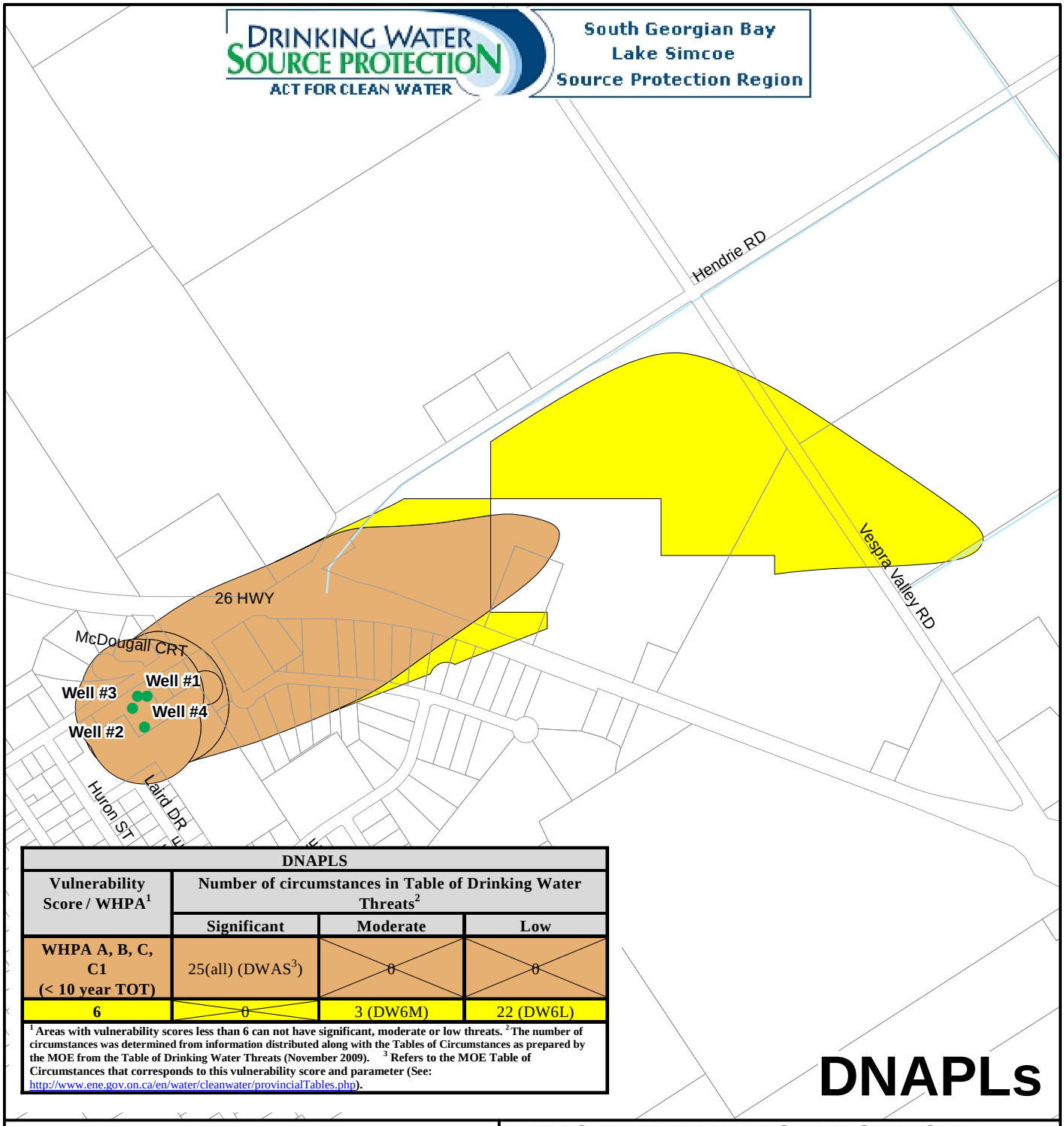
GENIVAR Ontario

FIGURE **16c-5**

Figure 16c-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats – Minesing.



DNAPLS			
Vulnerability Score / WHPA[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
WHPA A, B, C, C1 (< 10 year TOT)	25(all) (DWAS[3])	~~0~~	~~0~~
6	~~0~~	3 (DW6M)	22 (DW6L)

[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-C1: 10 YEAR TIME-OF-TRAVEL

VULNERABILITY SCORING

- 6

N W E S

100 50 0 100 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 - MINESING

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

DATE: JULY 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.6-8

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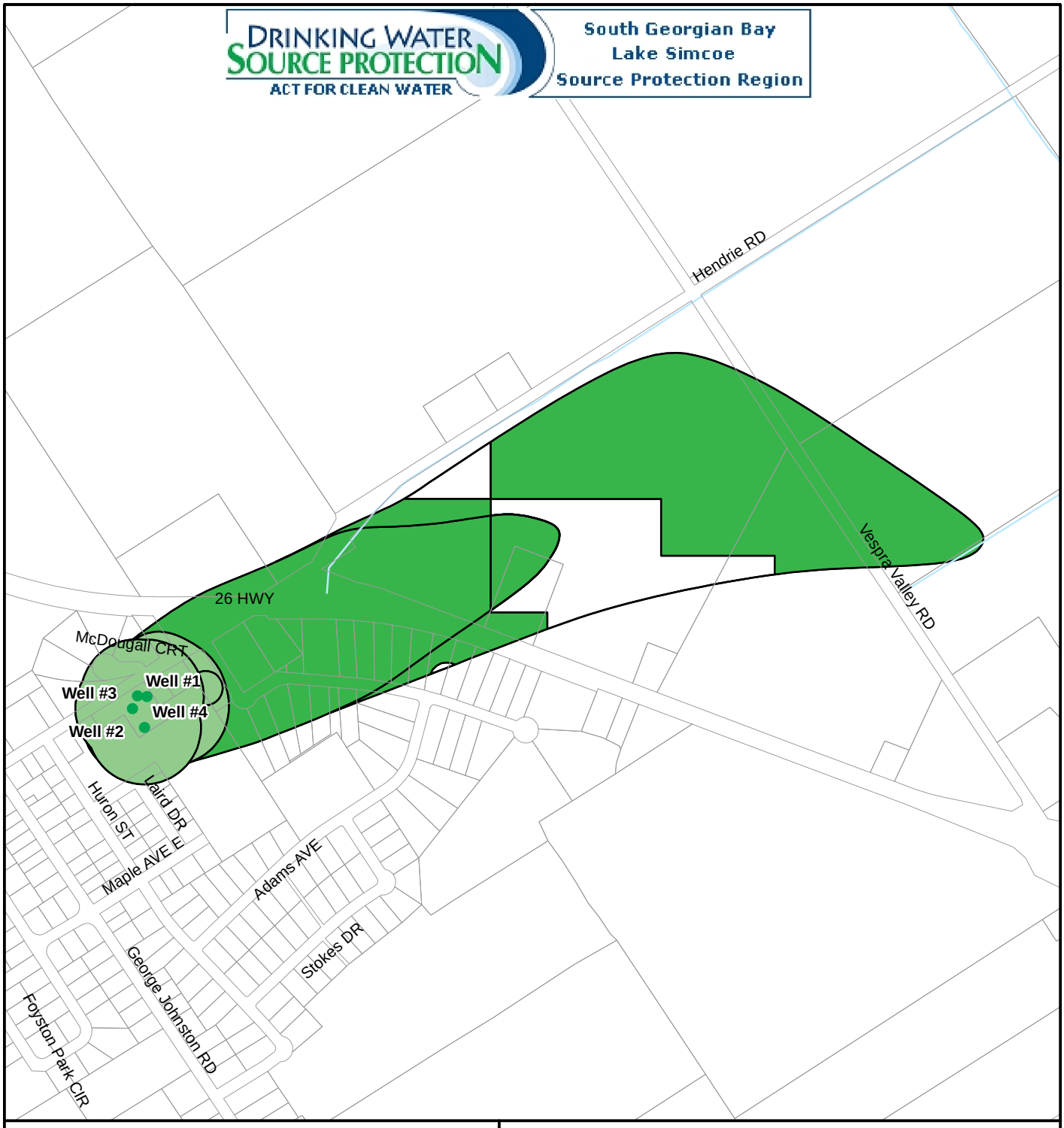
GENIVAR Ontario

FIGURE **16c-6**

Figure 16c-7: Managed Lands - Minesing.



MANAGED LANDS - MINESING

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

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

DATE: JULY 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.6-9

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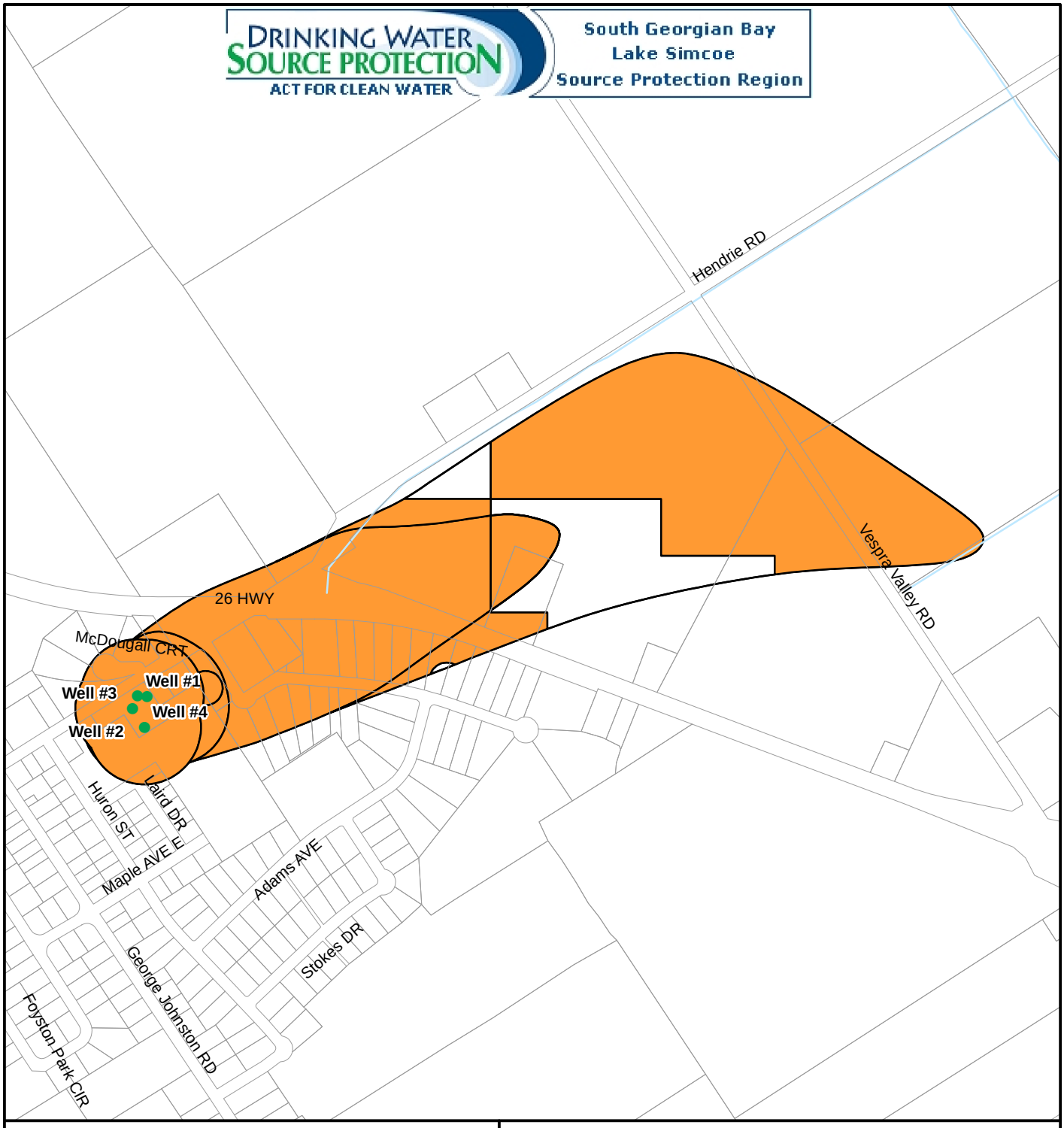
GENIVAR Ontario

FIGURE **16c-7**

Figure 16c-8: Livestock Density - Minesing.



LIVESTOCK DENSITY - MINESING

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

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

DATE: JULY 2010	SCALE: 1:10000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.6-10

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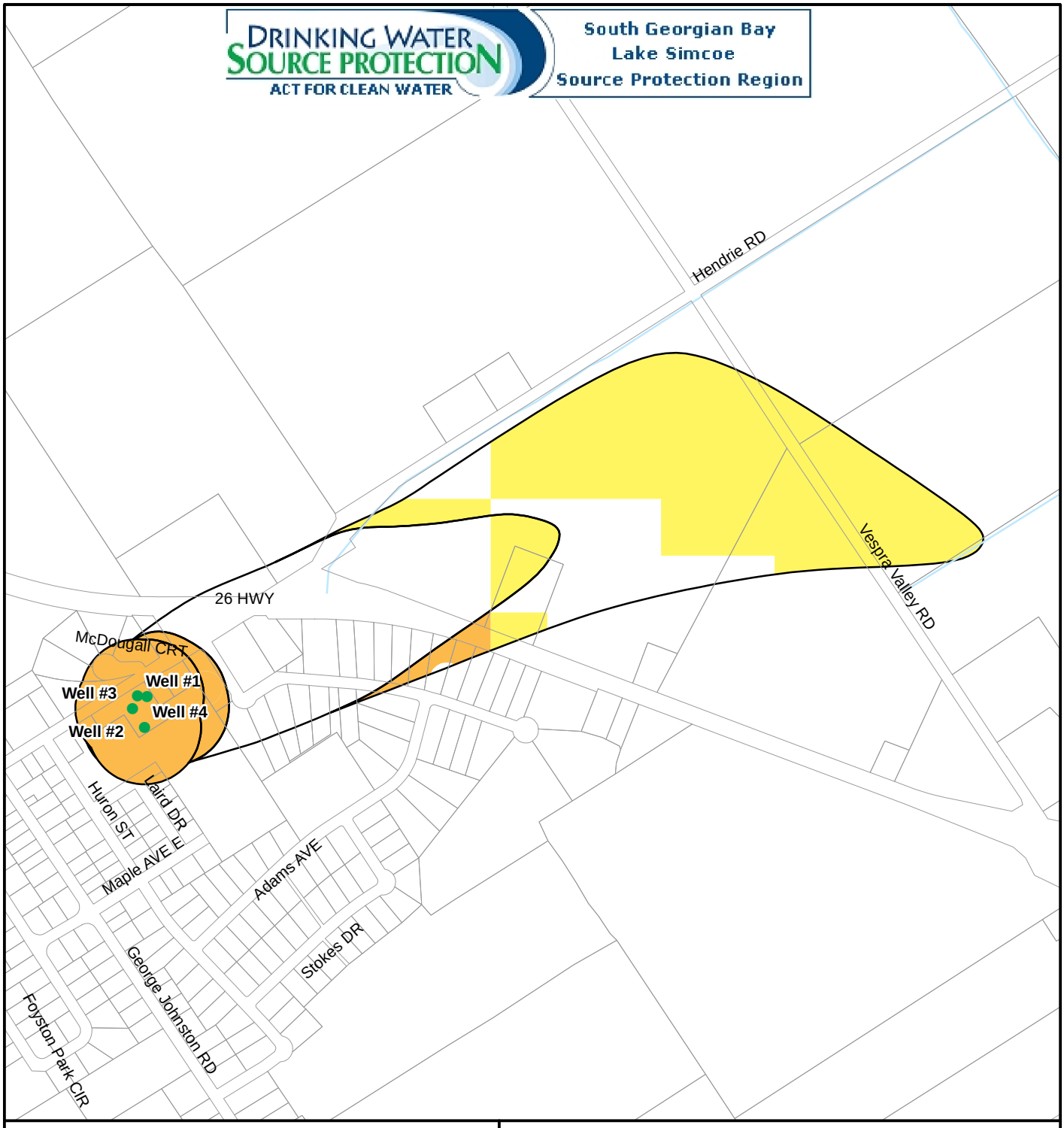
GENIVAR Ontario

FIGURE 16c-8

Figure 16c-9: Impervious Surfaces - Minesing.



IMPERVIOUS SURFACES - MINESING

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

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

DATE: JULY 2010 | SCALE: 1:10000

PROJECT: 0-071948.10 | FILE. NO.:0-07194810F16.6-11

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 **16c-9**

Figure 16d-1: Wellhead Protection Areas - Phelpston.

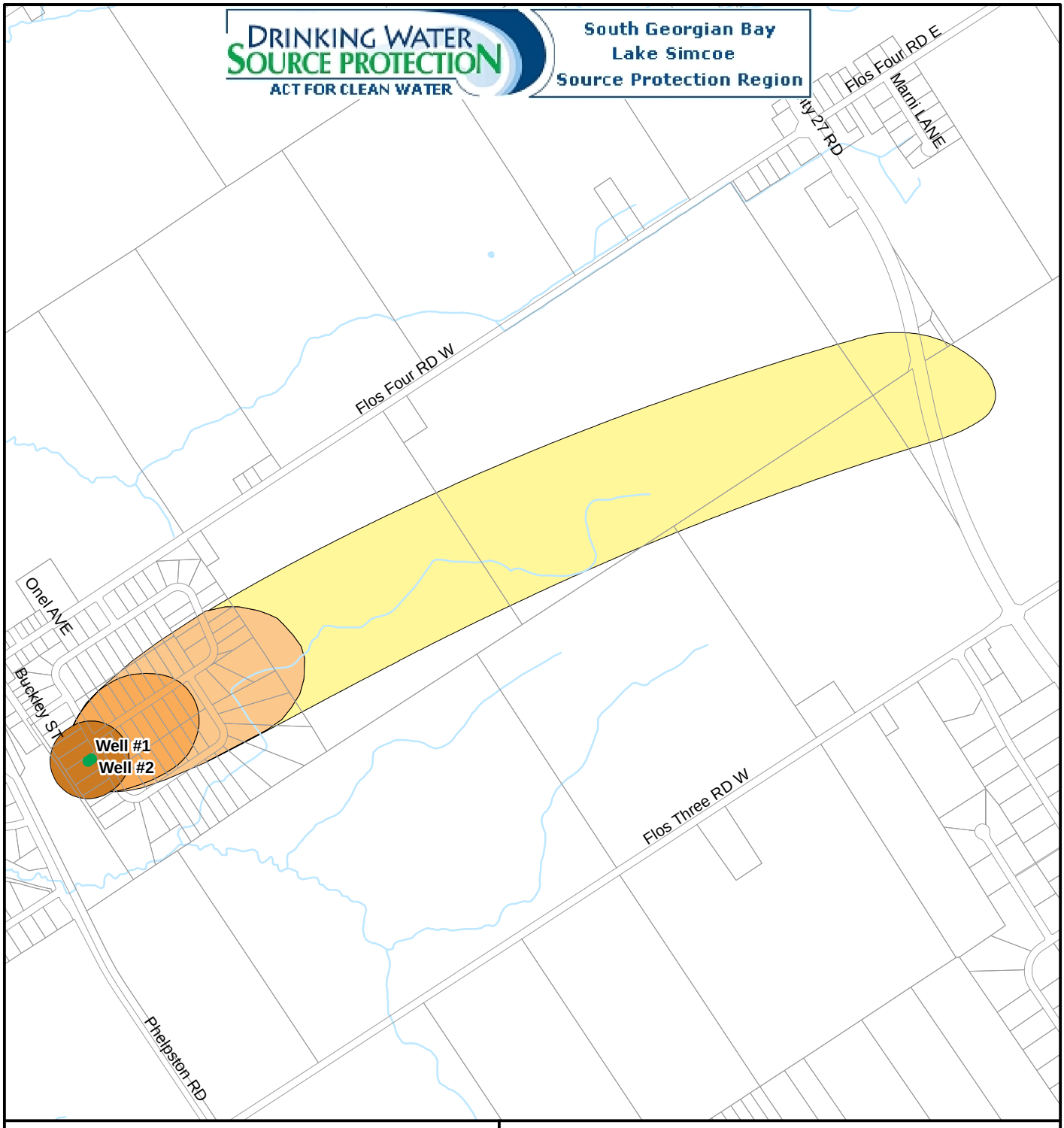
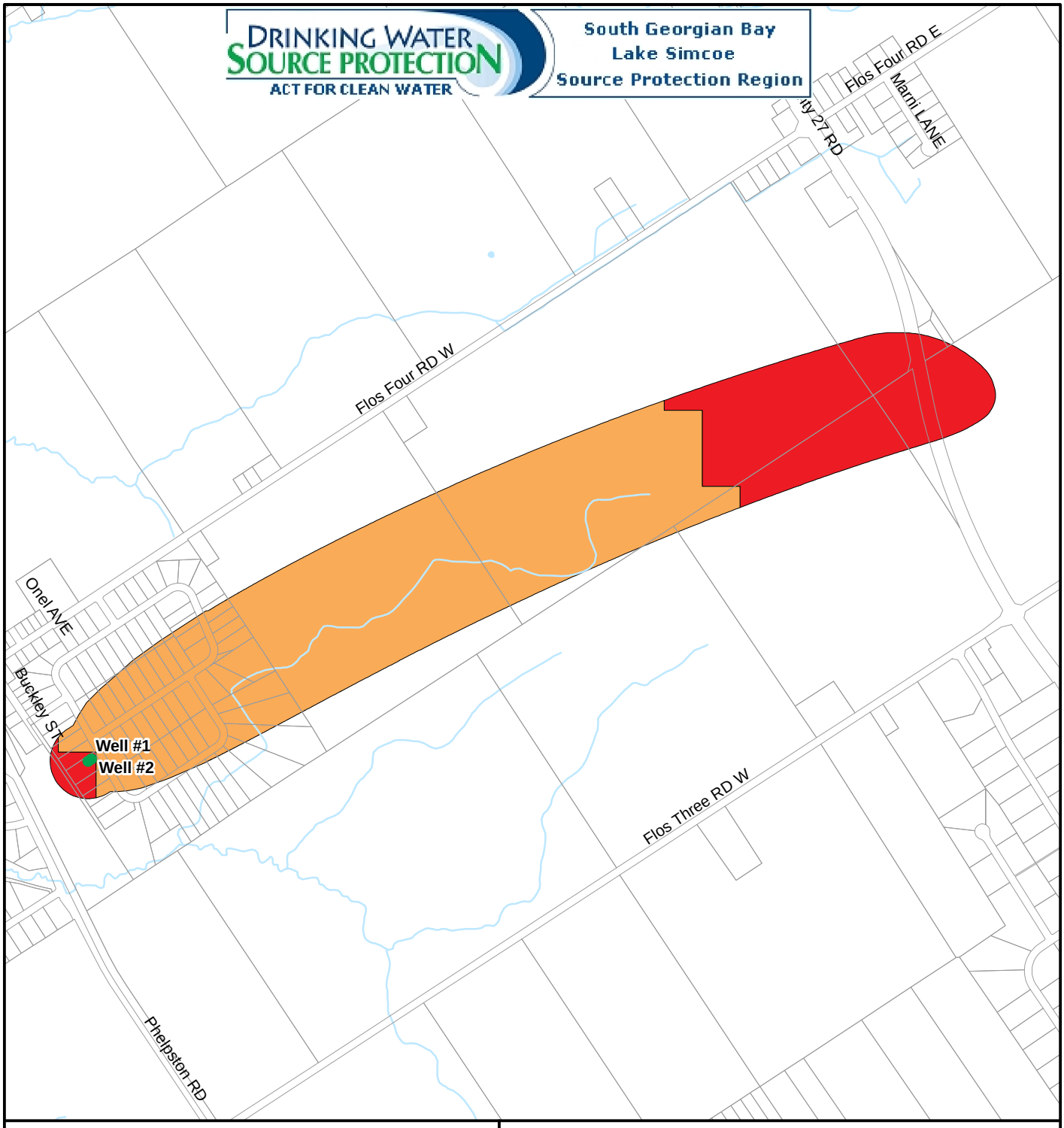


Figure 16d-2: Groundwater Vulnerability - Phelpston.



GROUNDWATER VULNERABILITY - PHELPSTON

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

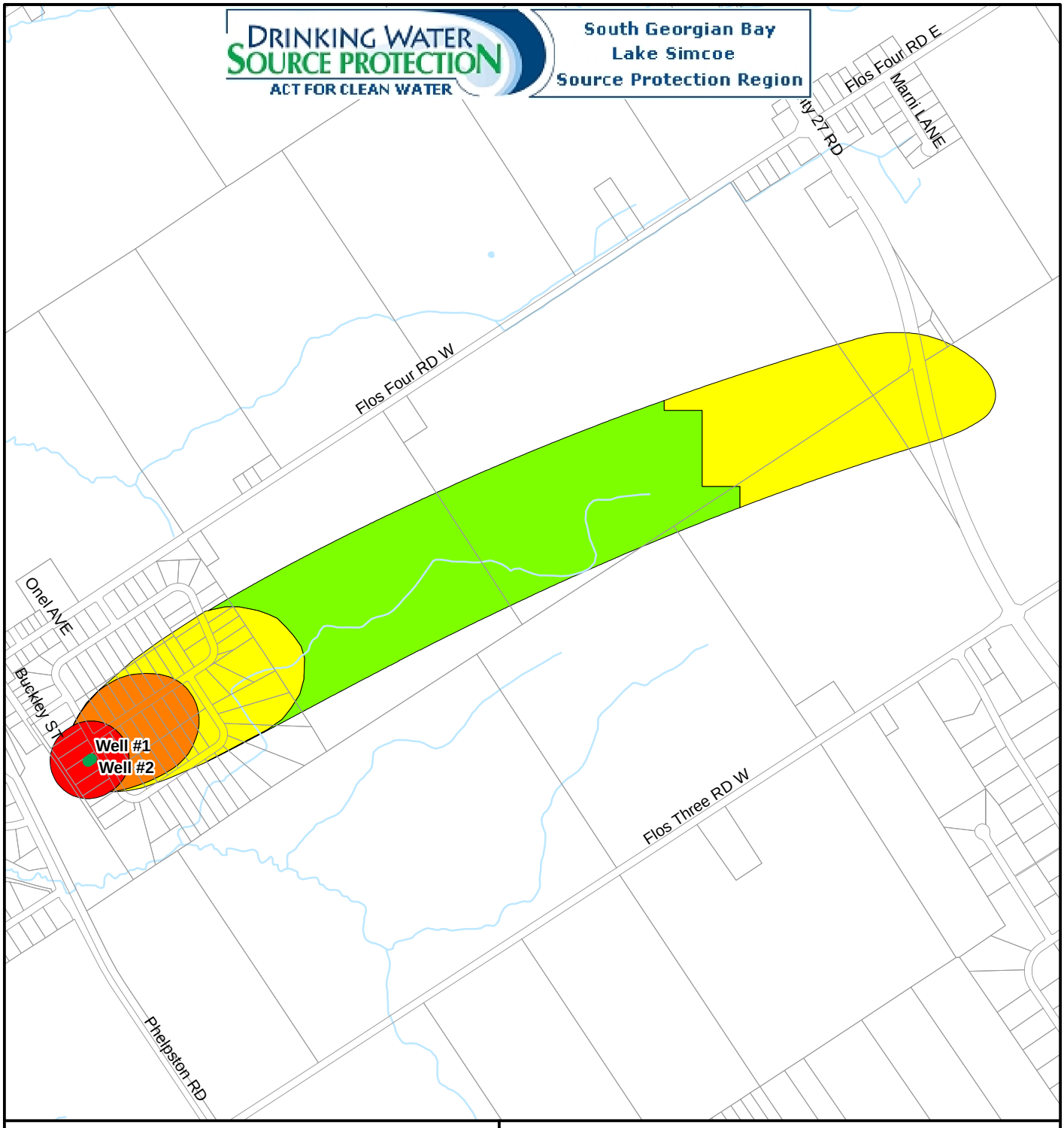
DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.7-2

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 **16d-2**

Figure 16d-3: Vulnerability Scores - Phelpston.



VULNERABILITY SCORES - PHELPSTON

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

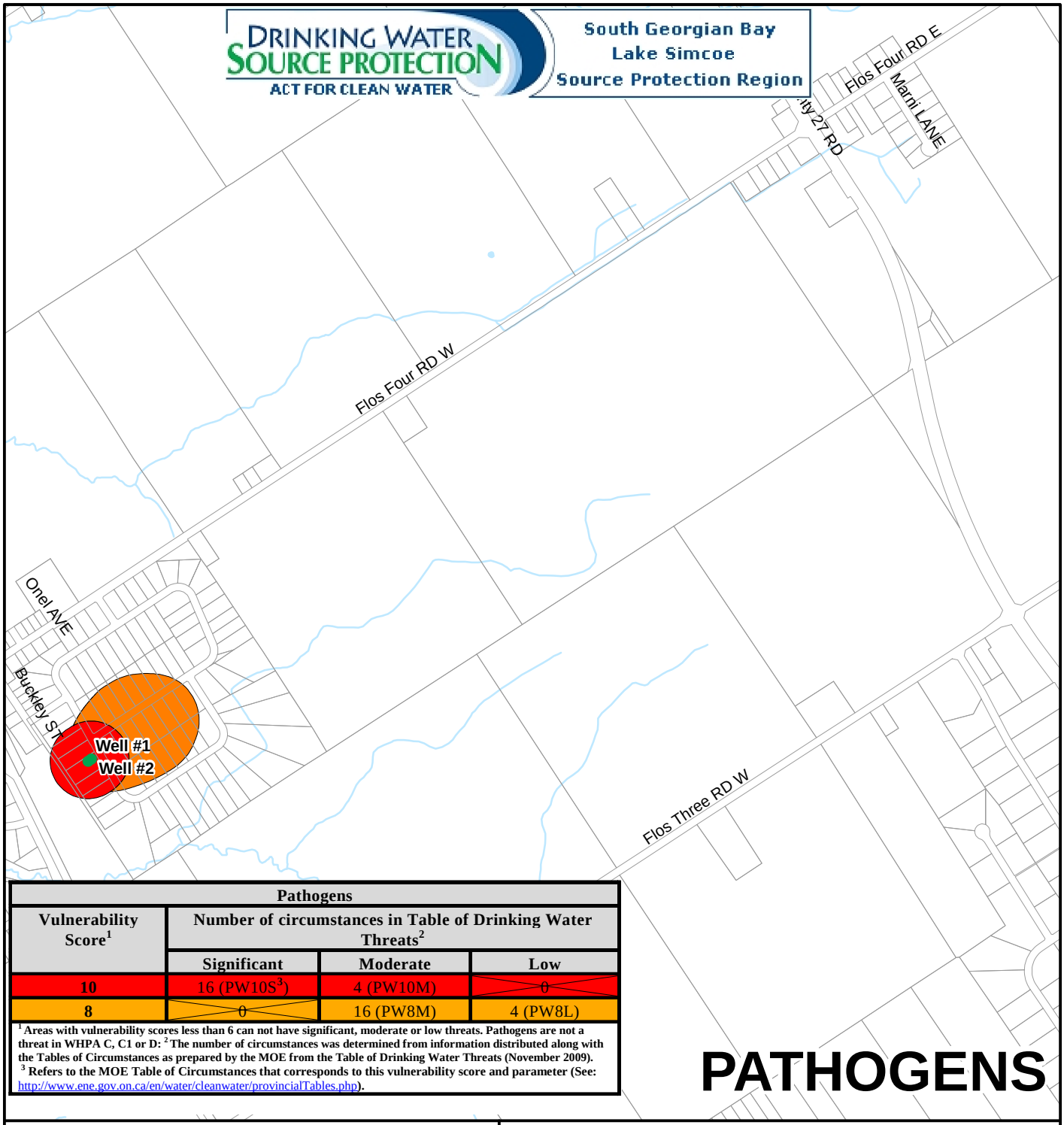
DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.7-3

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 **16d-3**

Figure 16d-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats – Phelpston.



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)

[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 - PHELPSTON

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

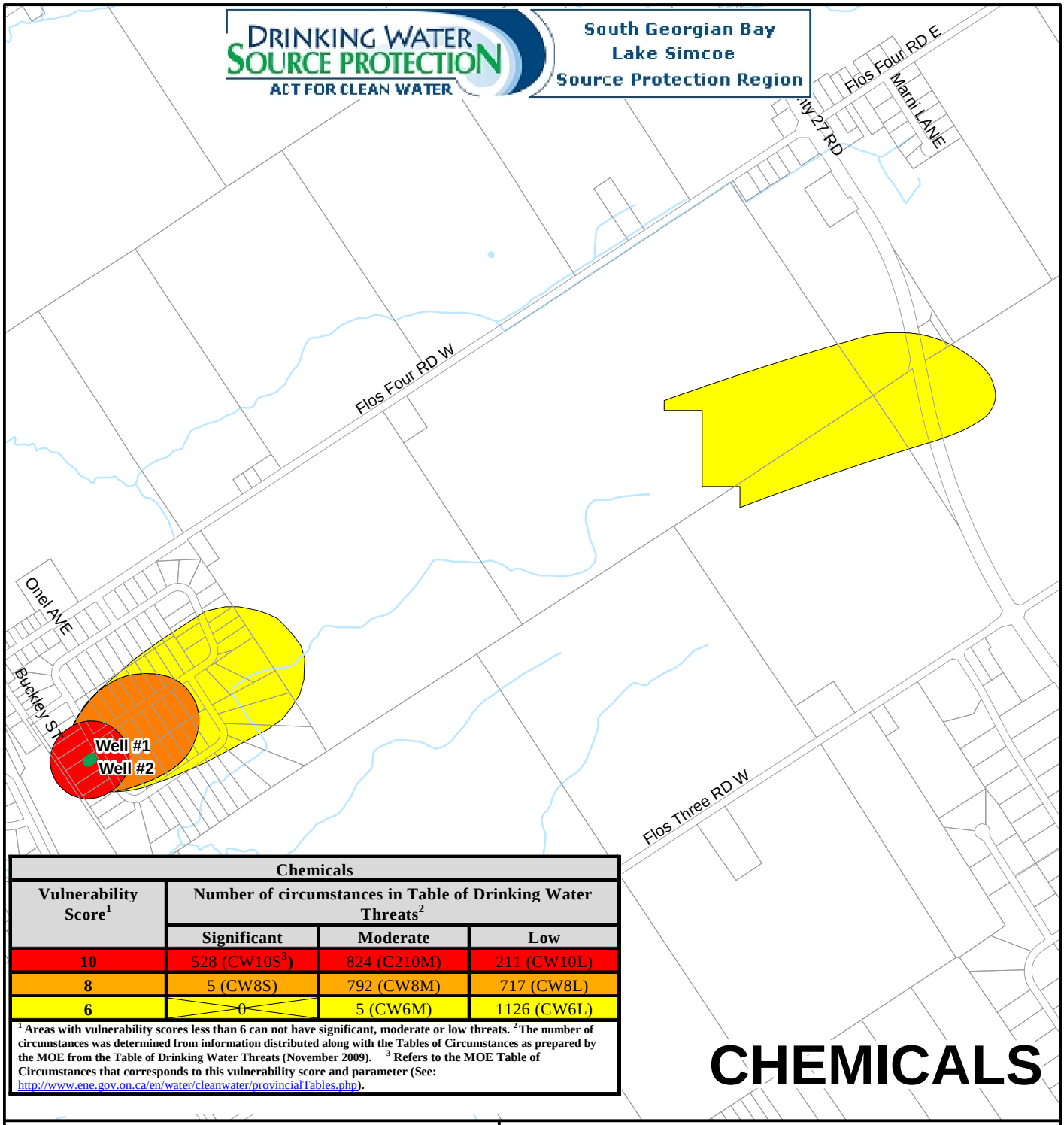
DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.7-4

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 **16d-4**

Figure 16d-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats – Phelpston.



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

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

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.

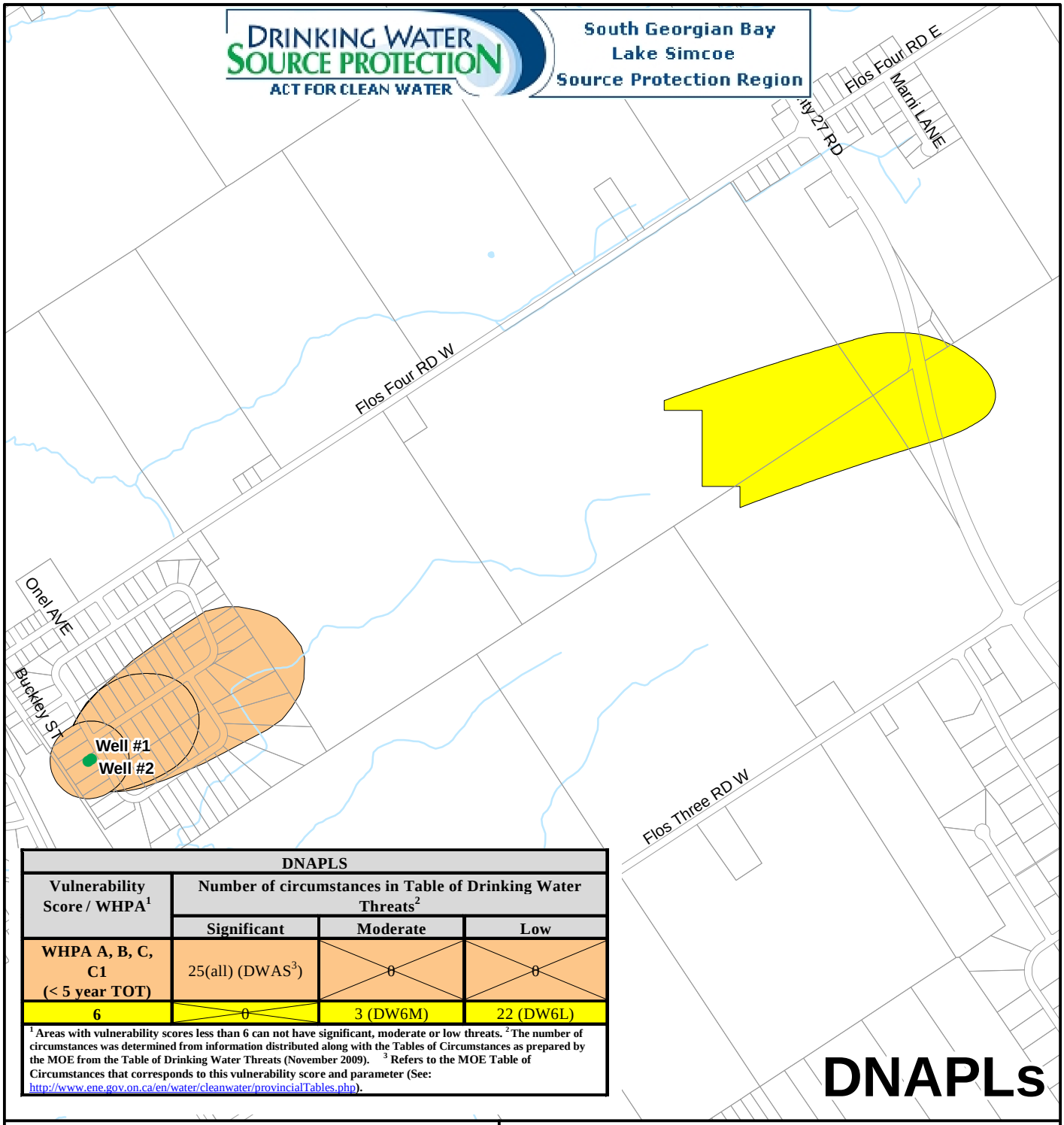
DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.7-5

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 **16d-5**

Figure 16d-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats – Phelpston.



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~~
6	~~0~~	3 (DW6M)	22 (DW6L)

[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

VULNERABILITY SCORING

- 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.

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

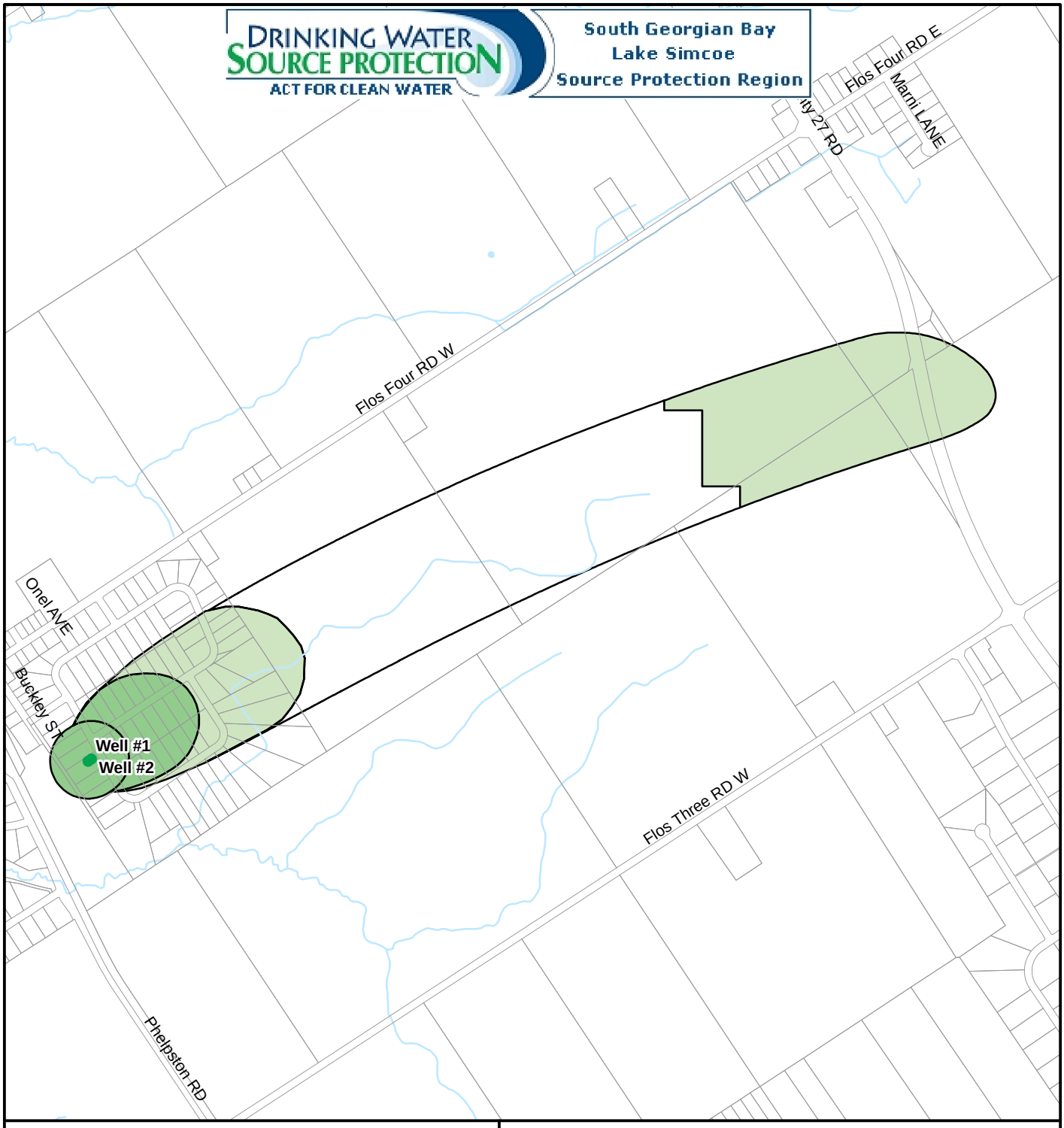
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.7-6

GENIVAR Ontario

FIGURE **16d-6**

Figure 16d-7: Managed Lands - Phelpston.



MANAGED LANDS - PHELPSTON

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

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

DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.7-7

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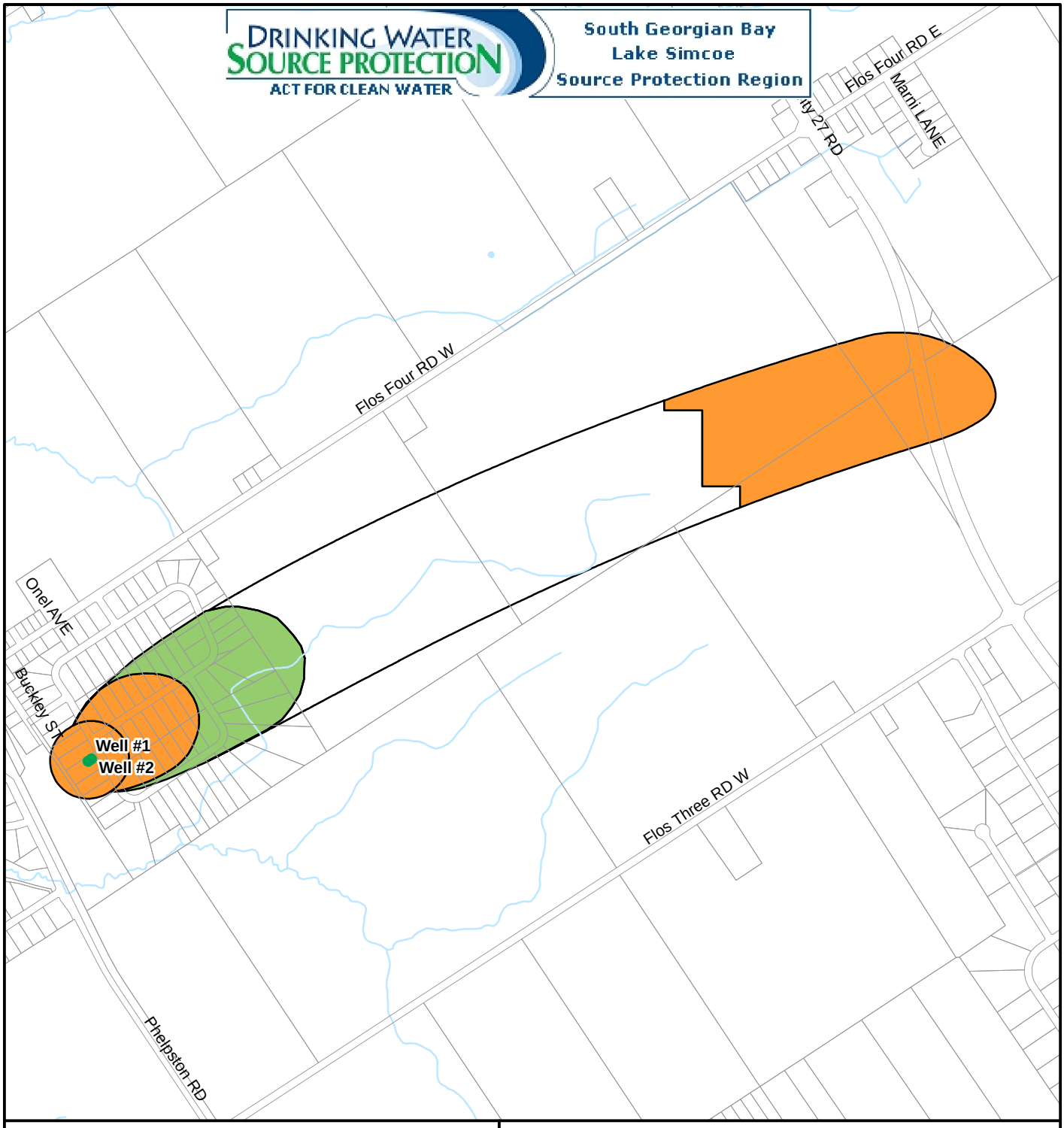
GENIVAR Ontario

FIGURE **16d-7**

Figure 16d-8: Livestock Density - Phelpston.



LIVESTOCK DENSITY - PHELPSTON

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

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

DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.7-8

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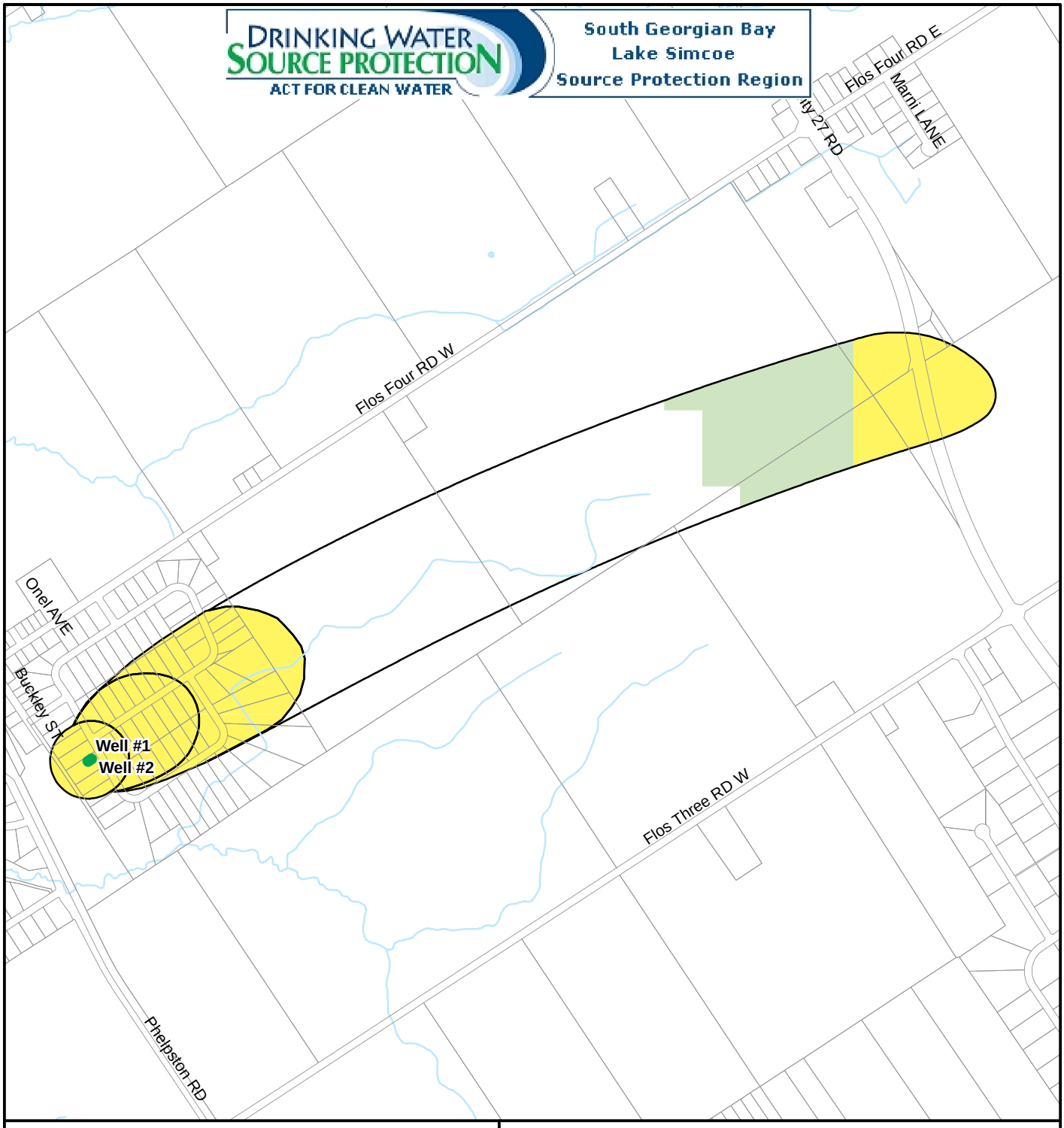
GENIVAR Ontario

FIGURE **16d-8**

Figure 16d-9: Managed Lands - Phelpston.



IMPERVIOUS SURFACES - PHELPSTON

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

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

DATE: JULY 2010 | SCALE: 1:15000

PROJECT: 0-071948.10 | FILE. NO.:0-07194810F16.7-9

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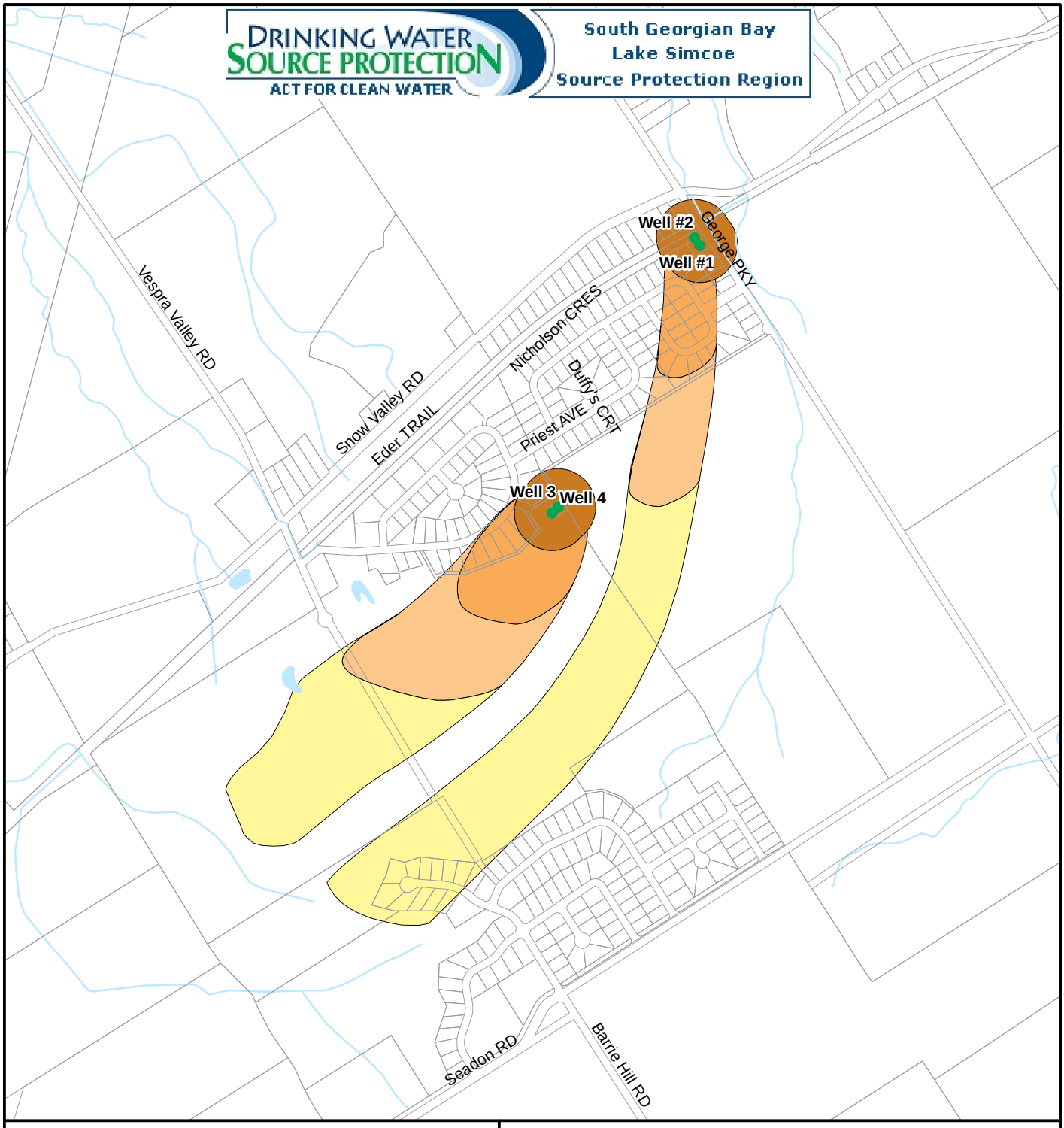
GENIVAR Ontario

FIGURE **16d-9**

Figure 16e-1: Wellhead Protection Areas - Snow Valley Highlands.



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 - SNOW VALLEY, SPRINGWATER

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

DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.8-1

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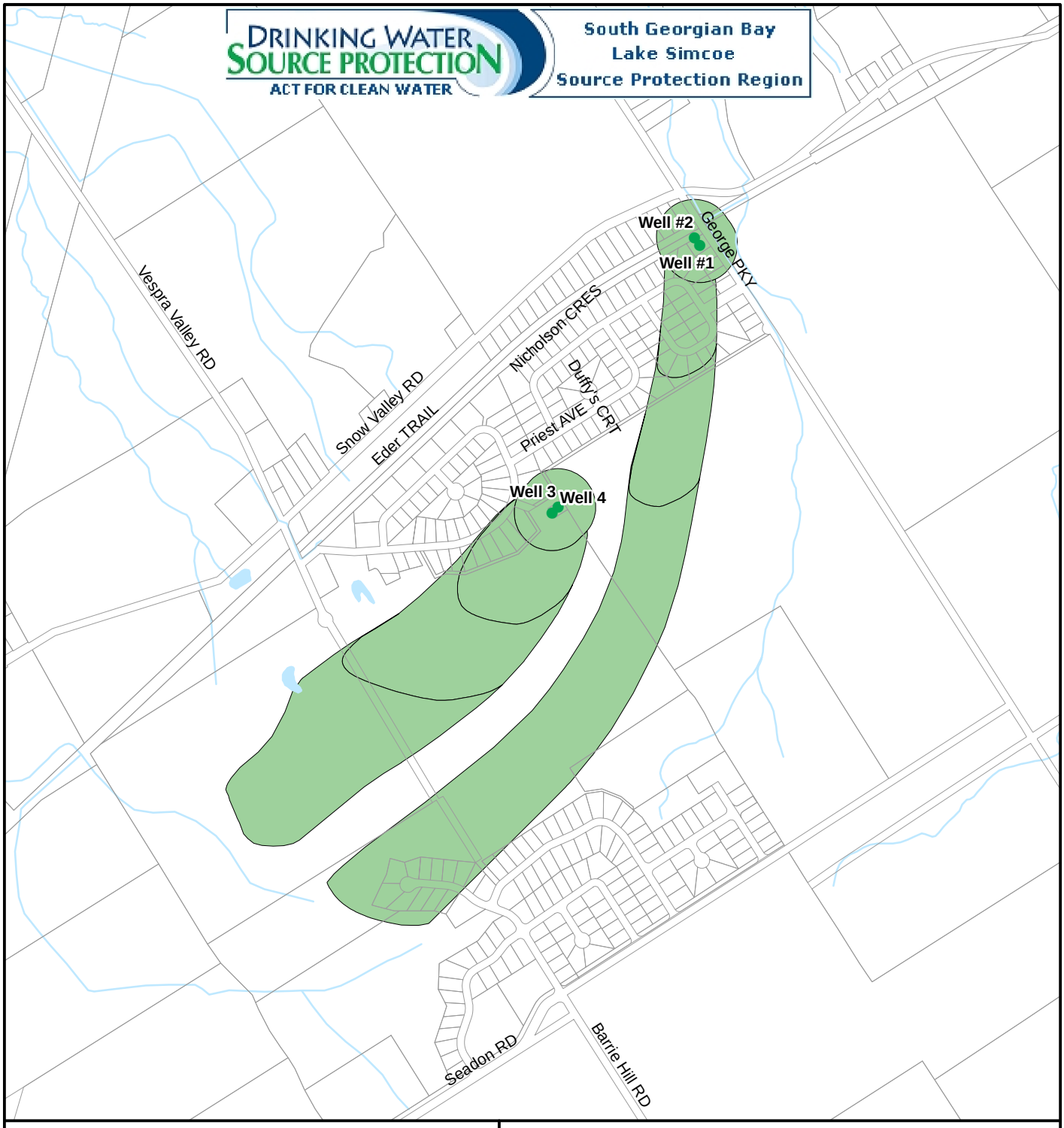
GENIVAR Ontario

FIGURE **16e-1**

Figure 16e-2: Groundwater Vulnerability - Snow Valley Highlands.



GROUNDWATER VULNERABILITY - SNOW VALLEY

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

DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.8-2

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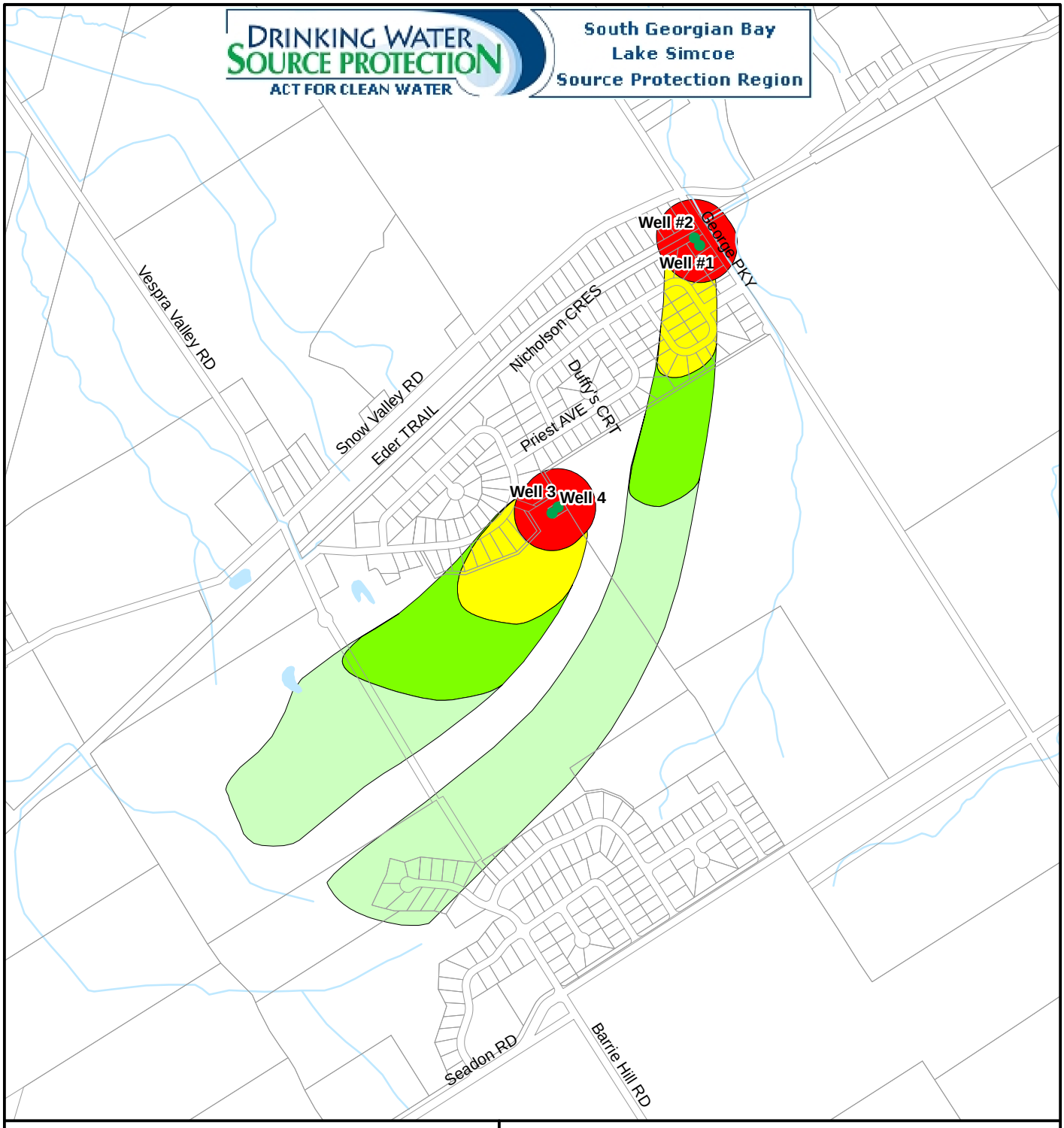
GENIVAR Ontario

FIGURE **16e-2**

Figure 16e-3: Vulnerability Scores - Snow Valley Highlands.



VULNERABILITY SCORES - SNOW VALLEY

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

DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.8-3

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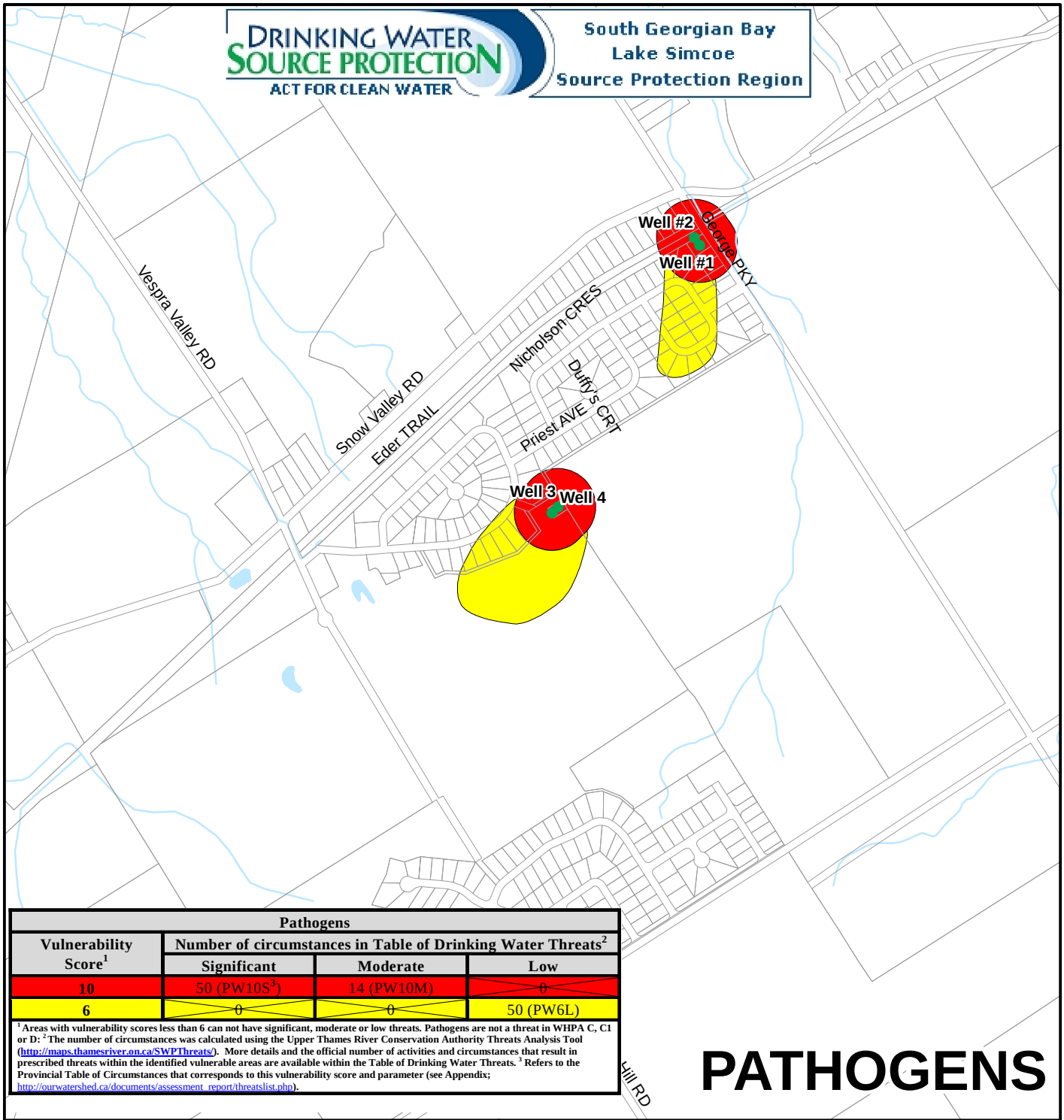
GENIVAR Ontario

FIGURE **16e-3**

Figure 16e-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats – Snow Valley Highlands.



Pathogens			
Vulnerability Score[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
10	50 (PW10S[3])	14 (PW10M)	~~0~~
6	~~0~~	~~0~~	50 (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 calculated using the Upper Thames River Conservation Authority Threats Analysis Tool (http://maps.thamesriver.on.ca/SWPThreats/). More details and the official number of activities and circumstances that result in prescribed threats within the identified vulnerable areas are available within the Table of Drinking Water Threats. [3] Refers to the Provincial Table of Circumstances that corresponds to this vulnerability score and parameter (see Appendix; http://ourwatershed.ca/documents/assessment_report/threatslist.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 - SNOW VALLEY

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

DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.8-4

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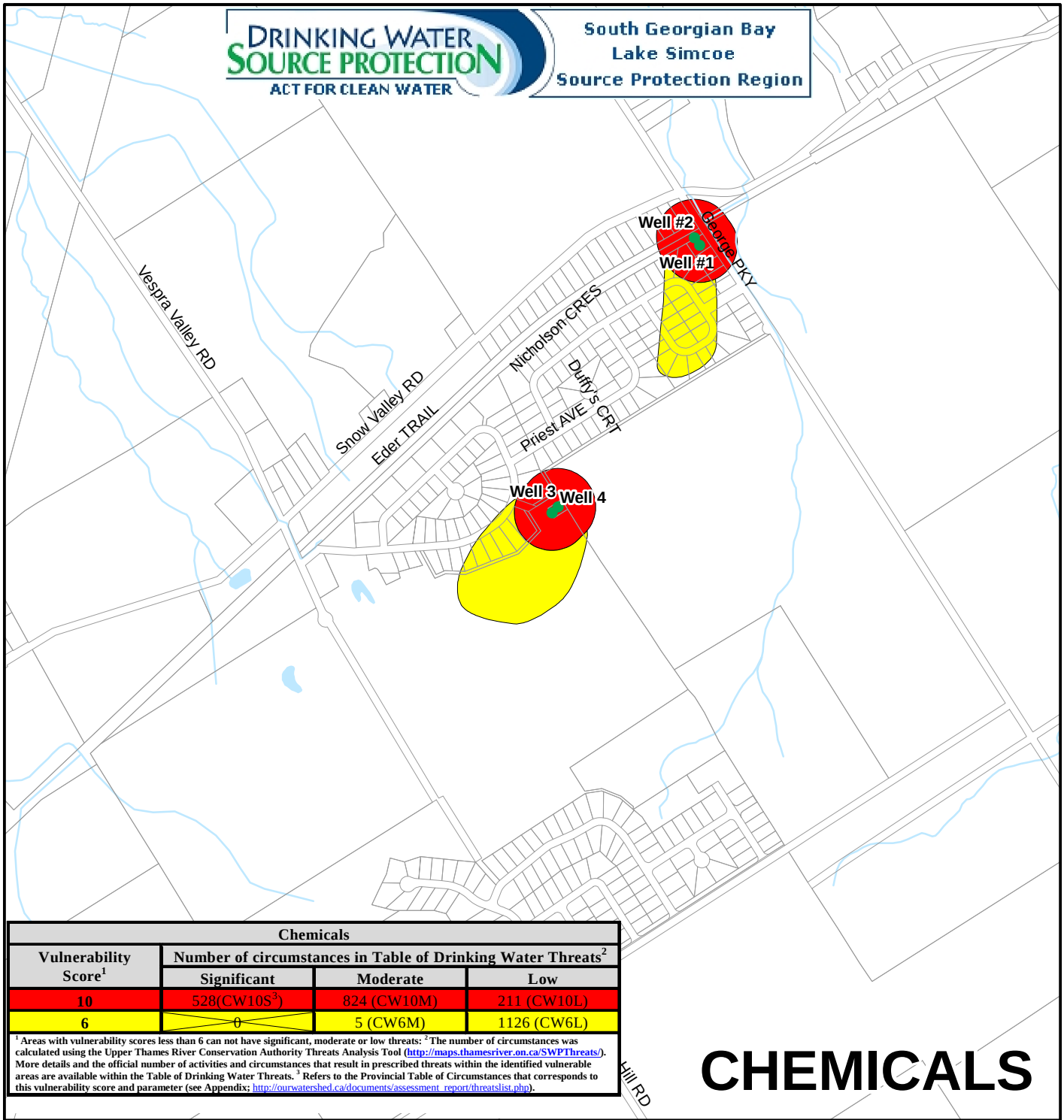
GENIVAR Ontario

FIGURE **16e-4**

Figure 16e-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats – Snow Valley Highlands.



Chemicals			
Vulnerability Score[1]	Number of circumstances in Table of Drinking Water Threats[2]		
	Significant	Moderate	Low
10	528(CW10S[3])	824 (CW10M)	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 calculated using the Upper Thames River Conservation Authority Threats Analysis Tool (http://maps.thamesriver.on.ca/SWPThreats/). More details and the official number of activities and circumstances that result in prescribed threats within the identified vulnerable areas are available within the Table of Drinking Water Threats. [3] Refers to the Provincial Table of Circumstances that corresponds to this vulnerability score and parameter (see Appendix; http://ourwatershed.ca/documents/assessment_report/threatslist.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 - SNOW VALLEY

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

DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.8-5

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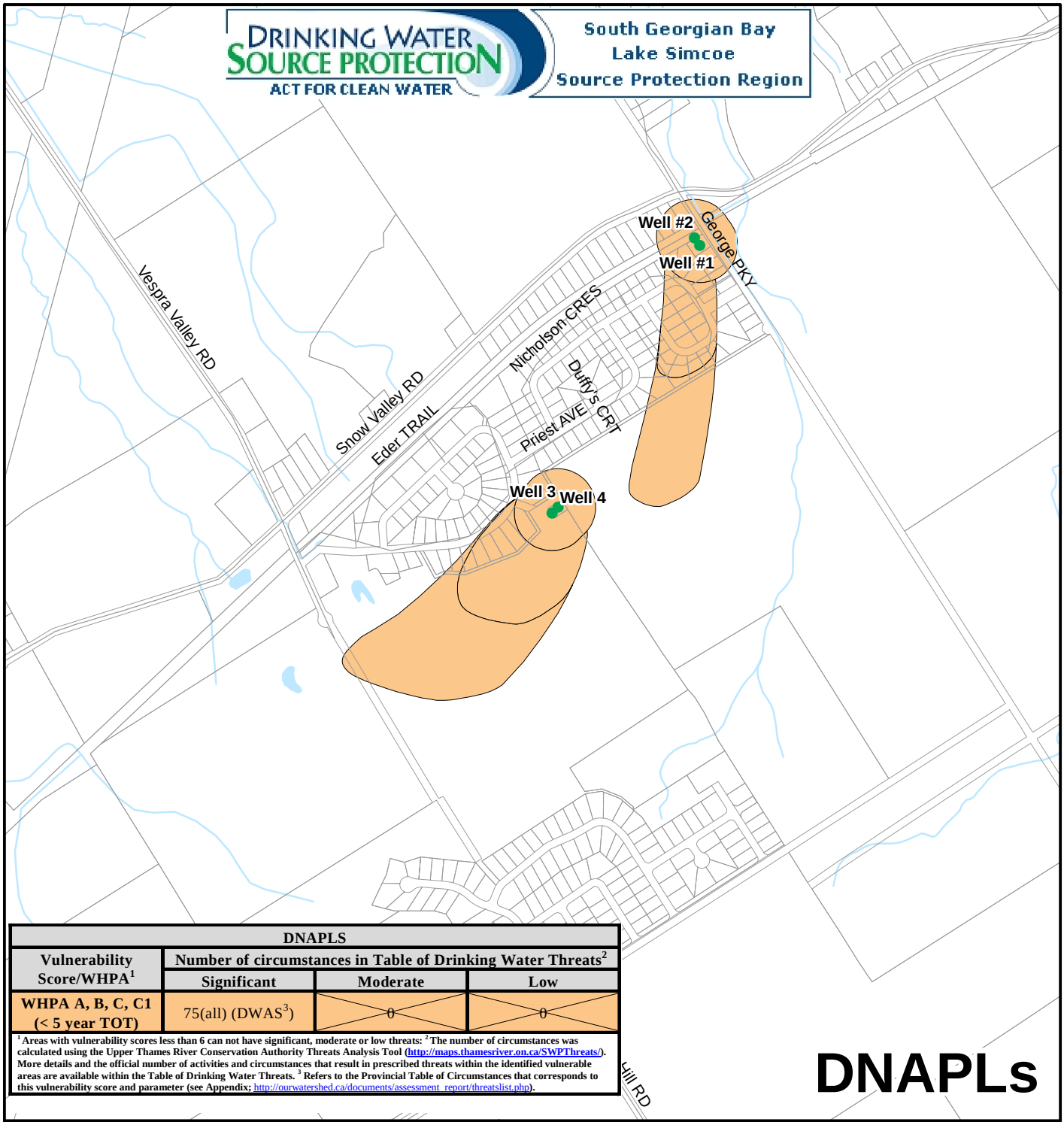
GENIVAR Ontario

FIGURE **16e-5**

Figure 16e-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats – Snow Valley Highlands.



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)	75(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 calculated using the Upper Thames River Conservation Authority Threats Analysis Tool (http://maps.thamesriver.on.ca/SWPThreats/). More details and the official number of activities and circumstances that result in prescribed threats within the identified vulnerable areas are available within the Table of Drinking Water Threats. [3] Refers to the Provincial Table of Circumstances that corresponds to this vulnerability score and parameter (see Appendix; http://ourwatershed.ca/documents/assessment_report/threatslist.php).

DNAPLs

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

N W E S

150 75 0 150 Metres

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

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: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.8-6

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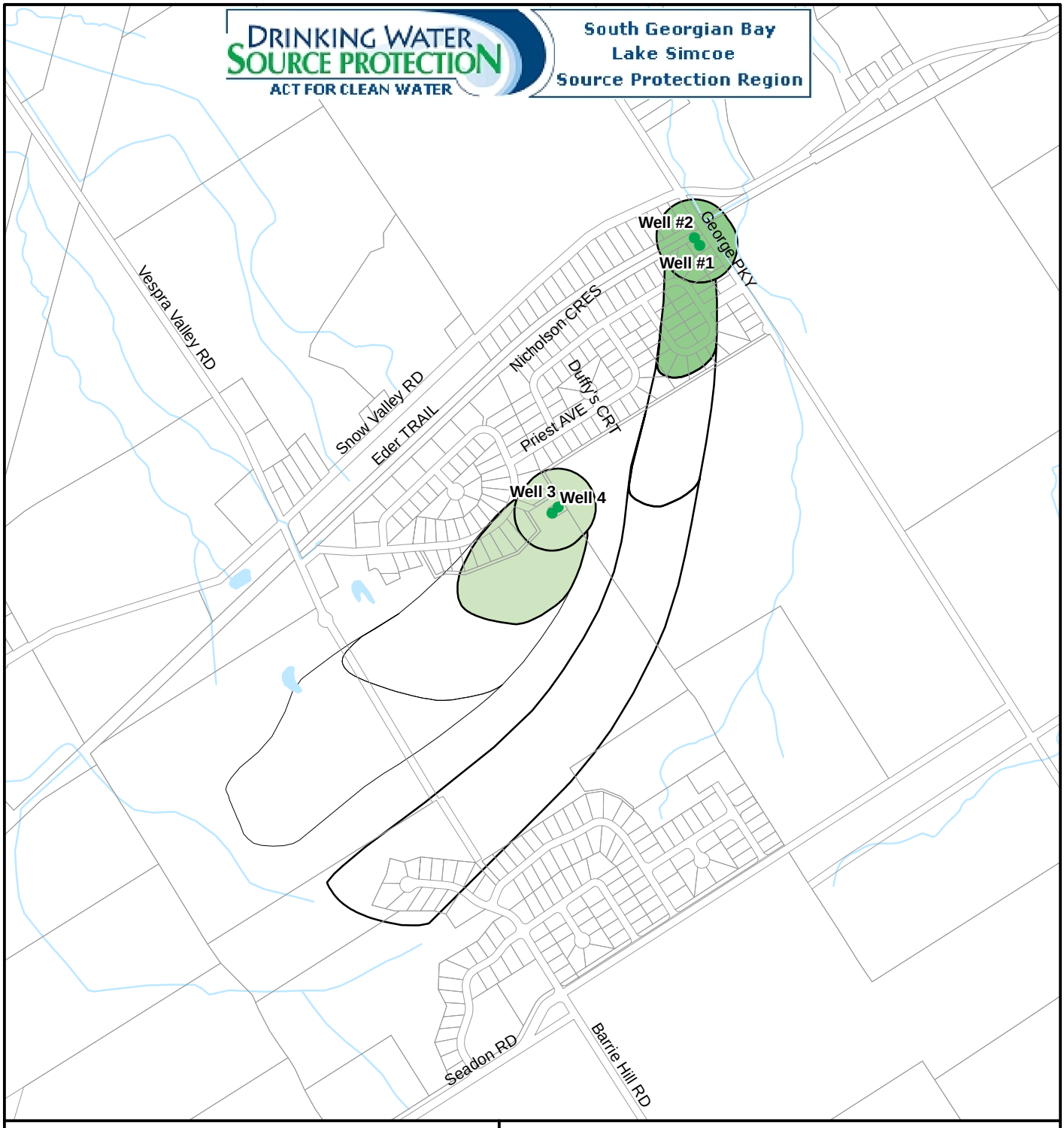
GENIVAR Ontario

FIGURE **16e-6**

Figure 16e-7: Managed Lands - Snow Valley Highlands.



MANAGED LANDS - SNOW VALLEY

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

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

DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.8-7

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GENIVAR Ontario

FIGURE **16e-7**

Figure 16e-8: Livestock Density - Snow Valley Highlands.

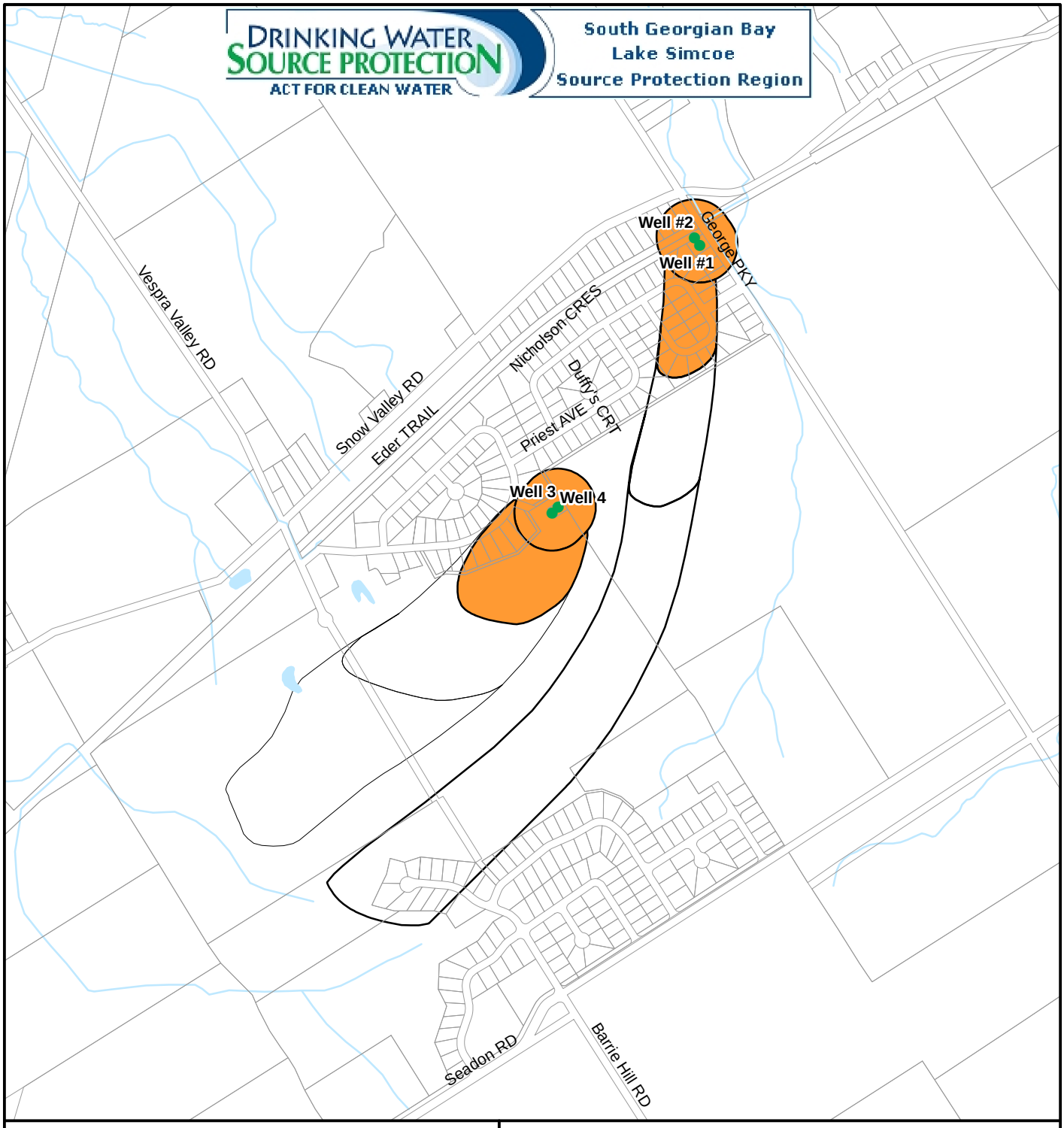
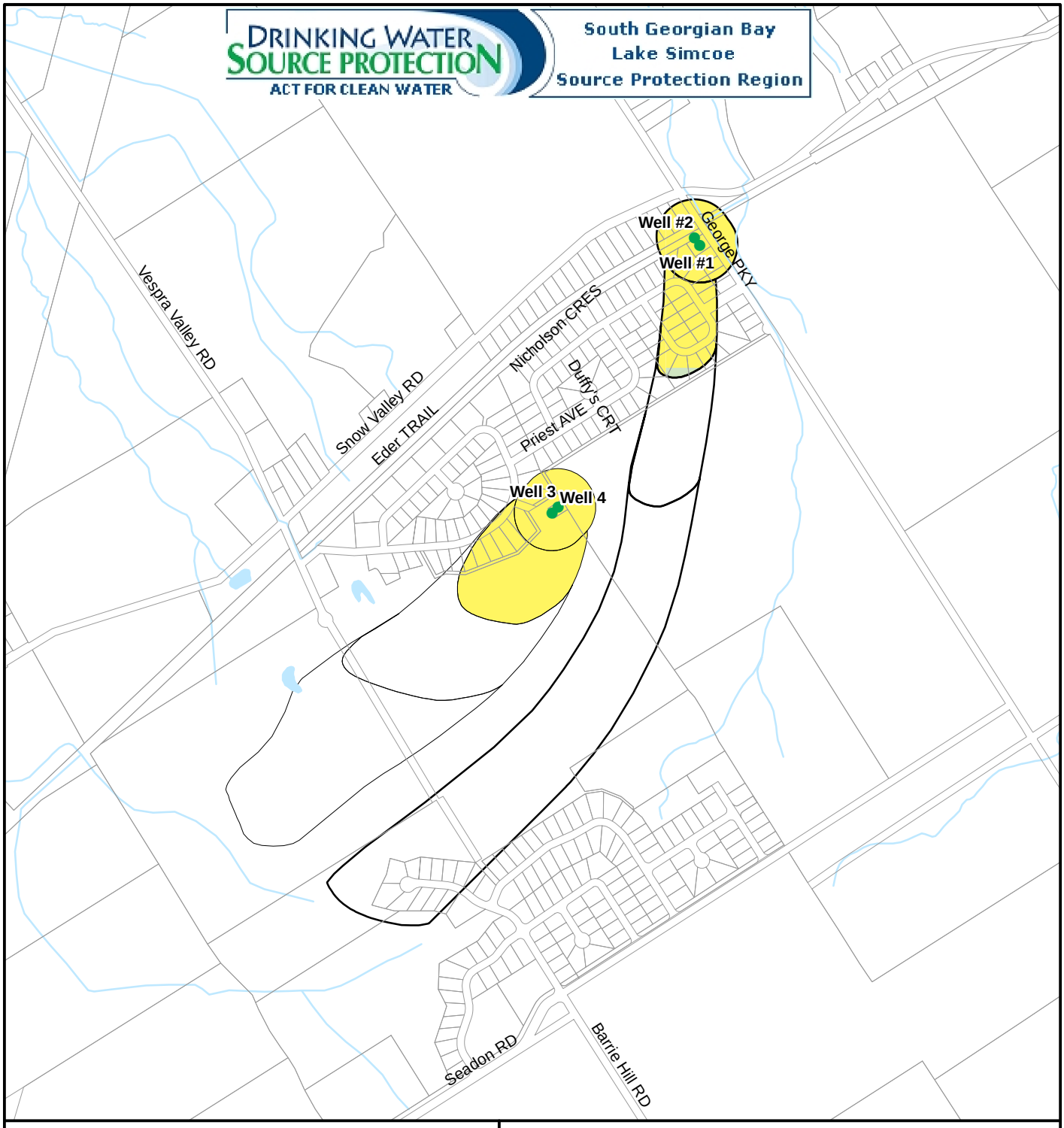


Figure 16e-9: Impervious Surfaces - Snow Valley Highlands.



IMPERVIOUS SURFACES - SNOW VALLEY

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

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

DATE: JULY 2010	SCALE: 1:15000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.8-9

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.

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FIGURE **16e-9**

Figure 16f-1: Wellhead Protection Areas - Vespra Downs.

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 - VESPRA DOWNS, SPRINGWATER

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

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

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FIGURE **16f-1**

Figure 16f-2: Groundwater Vulnerability - Vespra Downs.

GROUNDWATER VULNERABILITY - VESPRA DOWNS

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

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.9-2

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FIGURE **16f-2**

Figure 16f-3: Vulnerability Scores - Vespra Downs.

VULNERABILITY SCORES - VESPRA DOWNS

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

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.9-5

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.

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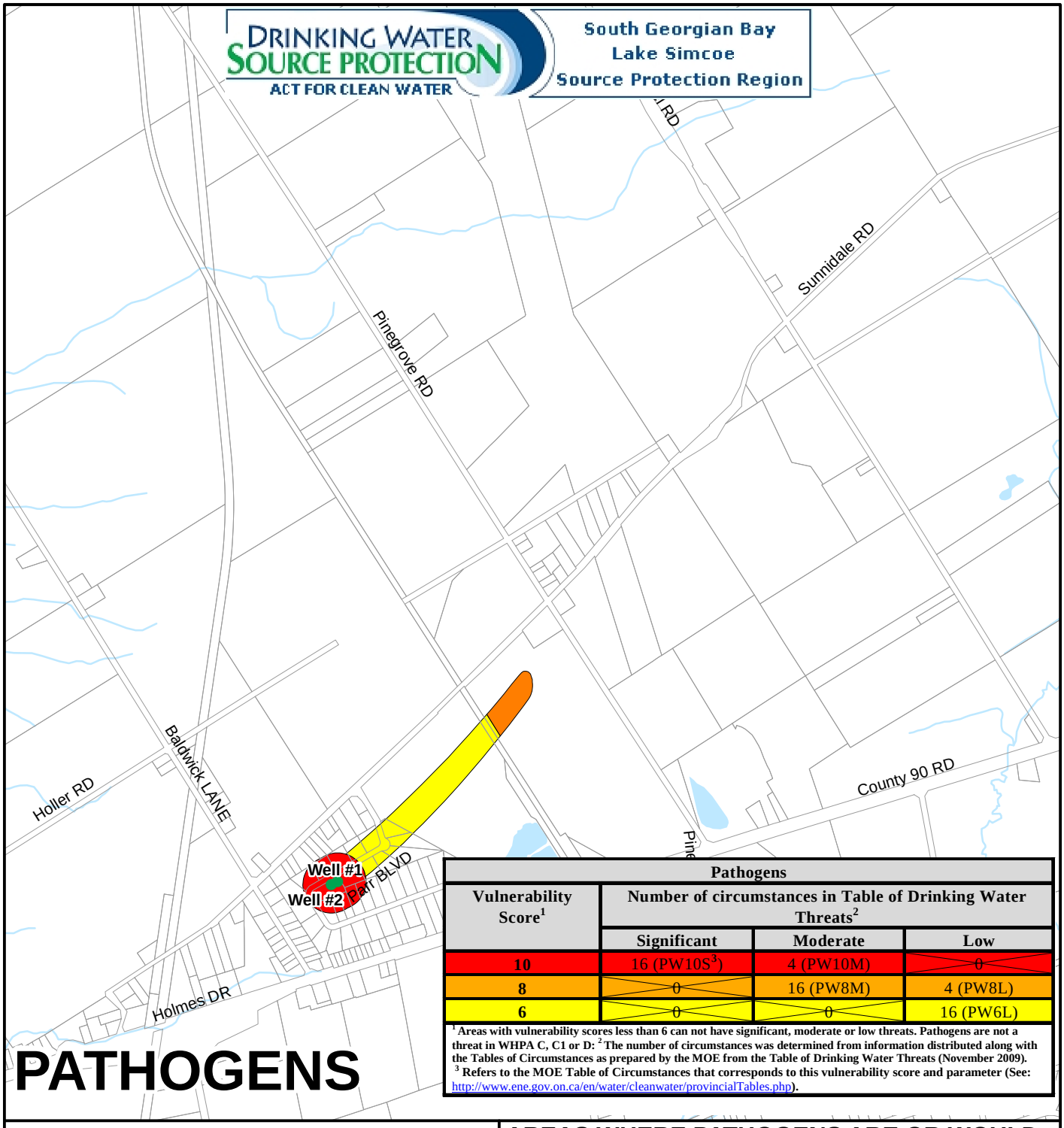
FIGURE **16f-3**

Figure 16f-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats – Vespra Downs.



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

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.

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

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

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.9-6

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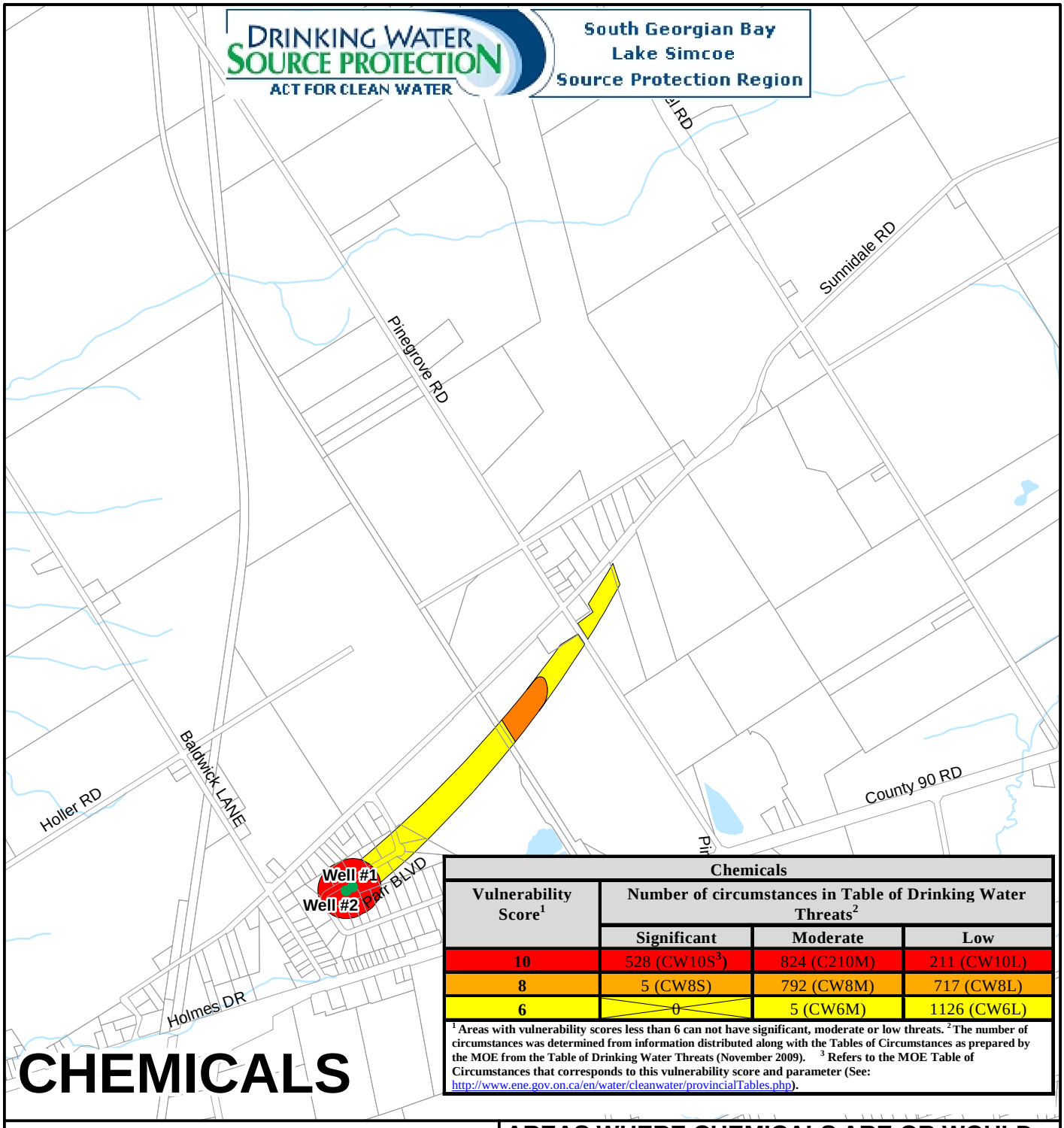
FIGURE **16f-4**

Figure 16f-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats – Vespra Downs.



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

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.

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

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

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.9-7

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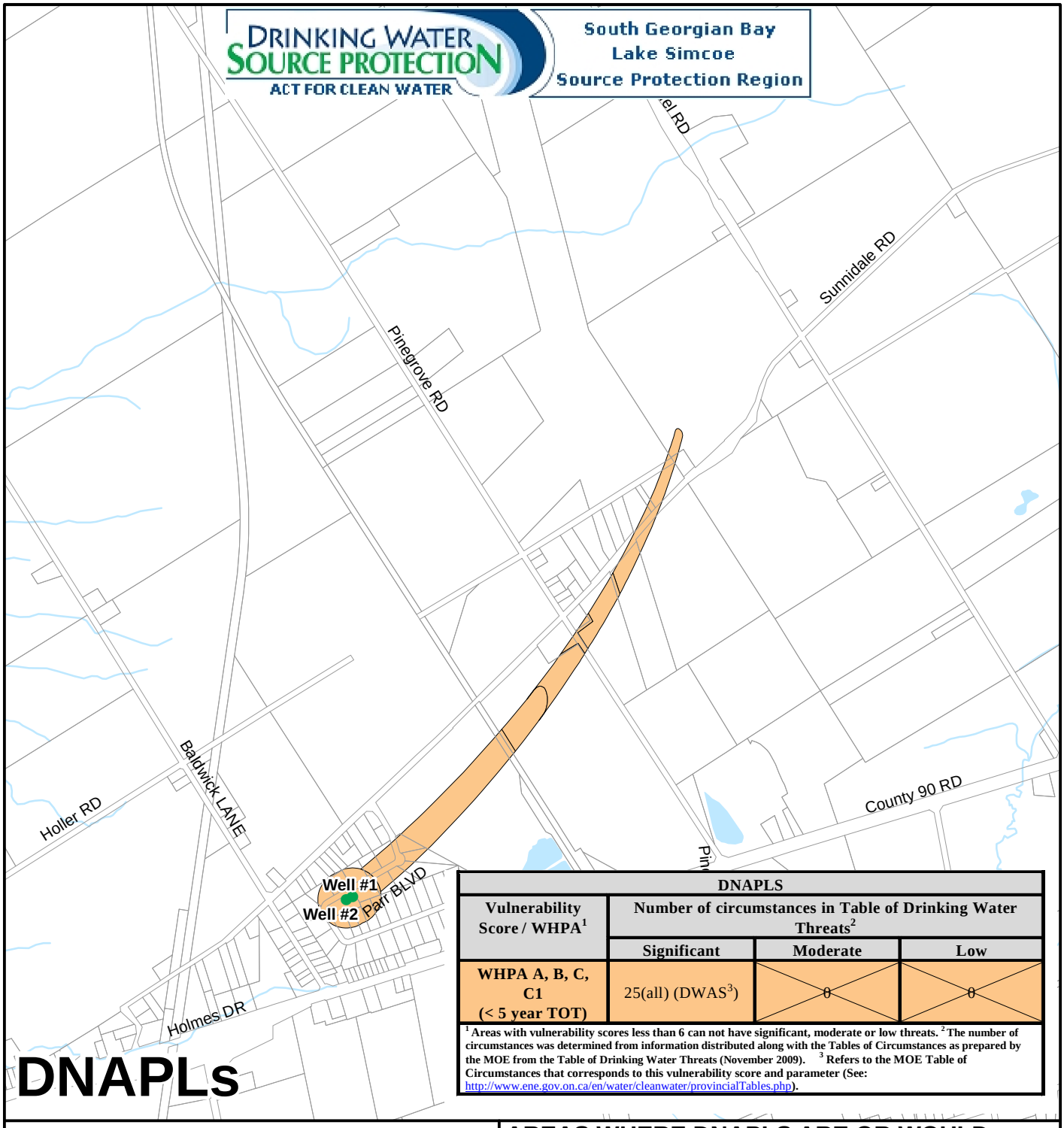
FIGURE **16f-5**

Figure 16f-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats – Vespra Downs.



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

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.

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

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

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.9-8

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FIGURE **16f-6**

Figure 16f-7: Managed Lands - Vespra Downs.

MANAGED LANDS - VESPRA DOWNS

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

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

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

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FIGURE **16f-7**

Figure 16f- 8: Livestock Density - Vespra Downs.

LIVESTOCK DENSITY - VESPRA DOWNS

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

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

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.9-10

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FIGURE **16f-8**

Figure 16f-9: Impervious Surfaces - Vespra Downs.

IMPERVIOUS SURFACES - VESPRA DOWNS

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

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

DATE: JULY 2010	SCALE: 1:20000
PROJECT: 0-071948.10	FILE. NO.:0-07194810F16.9-11

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FIGURE **16f-9**