

Chapter 13: Town of Innisfil

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13 Town of Innisfil

13.1 Introduction

This chapter contains information on one drinking water system for the Town of Innisfil that falls within the Nottawasaga Valley Source Protection Area (SPA). ~~Various consultants have completed the work presented, which has also been reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff and members of the Technical Work Group or the Source Protection Committee~~ ~~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 or Intake Protection Zone), and the assignment of Vulnerability Score for the delineated area. An Uncertainty Rating is also provided for the Vulnerable Area delineation and the Vulnerability Assessment as per Technical Rules 13-15 (Part I.4 – Uncertainty Analysis – Water Quality (MOE, 2008a)) to express the level of confidence in the results based on the information that was available for the study.

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

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

13.2 Drinking Water Systems

The Town of Innisfil, located in the southeastern portion of Simcoe County, operates groundwater based water supplies in three (3) communities and surface water based supplies in one (1). As shown in Figure 13-1 both the groundwater and surface water supplies are within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR). This chapter presents information on the one municipal supply located in Nottawasaga Valley SPA- the Churchill drinking water system. It should be noted that an additional well system (the Cookstown System), previously included in the list of water supplies for the Town of Innisfil is scheduled for decommissioning in the summer of 2014. The Cookstown system consists of 4 wells (Well 1, Well 2, Well 3R and Well 4) located in the southwest portion of Town of Innisfil. The wells, which are currently non-operational, previously served the community of Cookstown. The community of Cookstown is now supplied with surface water from the Alcona Water Treatment Plant. Before the Cookstown system could be removed from the Assessment Report, the Town of Innisfil was obligated to satisfy a set of requirements outlined in Section 14 of Ontario Regulation 287/07. As all of the Section 14 requirements were met successfully, the Cookstown system and all associated technical information has been removed from the Assessment Report.

Municipal Groundwater Supply in the Town of Innisfil within the Nottawasaga Valley SPA included in this report:

- Churchill (Drinking Water Information System Number 220005063) with 3 wells screened in the A1 and A4 confined overburden aquifers

Municipal Groundwater Supplies in the Town of Innisfil within the Lake Simcoe and Couchiching/Black River SPA but not included in this report:

- Innisfil Heights (Drinking Water Information System Number 220005081) with 2 wells screened in the A2 confined overburden aquifer
- Stroud (Drinking Water Information System Number 220006204) with 3 wells screened in the A3 confined overburden aquifer

Municipal Surface Water Intake in the Town of Innisfil within the Lake Simcoe and Couchiching/Black River SPA but not included in this report:

- Alcona (Drinking Water Information System Number 220007472) with 1 well from Lake Simcoe

While the Alcona Surface Water intake and Innisfil Heights and Stroud Water Supply systems are within Innisfil and the SGBLS Source Protection Region, they are located in the Lake Simcoe

Watershed. Information on these three systems can be found in the Lake Simcoe and Couchiching-Black River Assessment Report in Part 1, Chapter 10.

The Glen Ave Well Supply WHPAs from the Township of Essa also extend into the Town of Innisfil. Information on the Glen Ave system can be found in Chapter 12 of this report (Table 13-1).

Table 13-1: WHPA that cross into the Town of Innisfil in the SGBLS SPR

Local Municipality that WHPA extends into	Municipality where wellhead is located	Name of Water Supply	Source Protection Region (SPR) and Source Protection Authority (SPA)	Location where entire Assessment can be obtained
Town of Innisfil	City of Barrie	Barrie	SGBLS SPR and Nottawasaga Valley SPA	This report (Chapter 9)
Town of Innisfil	Township of Essa	Glen Ave	SGBLS SPR and Nottawasaga Valley SPA	This report (Chapter 12)

13.3 Churchill Well Supply

The Churchill Well Supply System is located in the central portion of the Town of Innisfil, approximately 8 km directly south of the Community of Stroud, at the intersection of Highway 11 and the 4th Line. The Churchill Well Supply consists of three water supply wells: Well 1, Well 2 and Well 3. The wells serve the Community of Churchill. Well 2 is drilled in a shallow confined overburden aquifer while Wells 1 and 3 are located in a deep confined overburden aquifer. The wells were constructed in 1972, 1987 and 1989 respectively.

According to the current Permit to Take Water (PTTW) 6313-7JMRFS, issued October 7, 2008 and which expires September 1, 2018, the maximum daily taking for Well 1 is 262 m³/day, the maximum daily taking for Well 2 is 295 m³/day, and the maximum daily taking for Well 3 is 743 m³/day.

All wells were drilled into confined aquifers. Well 1 is a nominal 152 mm diameter well constructed to a depth of 130 m with 3.66 m of 14 and 18 slot stainless steel screen. Well 2 is a 152 mm diameter well constructed to a depth of 47 m with 2.7 m of 14 and 12-slot stainless steel screen. Well 3 is a 203 mm diameter well constructed to a depth of 112.8 m with 6.1 m of 35 slot stainless steel screen.

Wells 1 and 3 are located in a deep confined aquifer (A4) found locally in the elevation range of approximately 125 to 140 meters above sea level (masl). Well 2 is constructed in a confined aquifer unit (A1-SA4), found locally in the elevation range of 225 to 260 masl. The A1 aquifer unit extends as far as 3.5 km to the east and to the north as far as the Community of Stroud and most likely outcrops south of Kempenfelt Bay. The aquifer is cut off to the west by the Innisfil Creek valley and to the south the aquifer becomes discontinuous. The deeper aquifer (A4) appears to be a thin east-west trending unit whose axis passes through or near the Community of Churchill. The A4 aquifer extends east as far as Cook's Bay, and may extend west beyond the boundaries of the Town of Innisfil. The confining material overlying the shallowest municipal aquifers consists of up to 35 m of till materials near the Community of Churchill, which thins to as little as 5 m in the valley of Innisfil Creek. The deeper aquifers are overlain by as much as 100 m of tills and lacustrine silt and clay materials, occasionally interbedded with discontinuous aquifers. Limestone bedrock is found at an elevation of 125 to 140 masl, and is considered to be in direct contact with the lower overburden aquifer in many places.

The screen interval for Well 1, Well 2 and Well 3 have been assigned to the A4, A1-SA4 and A4 Aquifers respectively, in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The Groundwater Vulnerability rating was determined for the A1-SA4 Aquifer for Well 2 and for the A4 Aquifer for Well 1 and Well 3.

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

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

13.3.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Well 1 and Well 3 in the Churchill Well 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 Churchill well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 13a-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

The WHPA for Well 2 in the Churchill Well Supply was delineated in 2005 by Golder using a fixed-radius method. 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 Well 2 locations and the WHPA.

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-C for Well 2, representing the 5 year TOT zone, was re-calculated using the same calculation parameters as used by Golder and as documented in Technical Memorandum A2 – 5 year Time-of-Travel Estimation Methods (Appendix MO). The WHPA-B for Churchill Well 2 lies within the 100 m radius, WHPA-A.

The WHPA for Wells 1 and 3 reflect groundwater flow from north to south. This is reasonable based on available data describing regional groundwater flow patterns.

13.3.1.2 Groundwater Vulnerability

The Churchill wells draw water from two confined overburden aquifer layers (regional aquifer systems A1-SA4 and A4). The Groundwater Vulnerability for the municipal overburden 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 Churchill Well Supply is shown in Figure 13a-2. The Groundwater Vulnerability for the two municipal water supply aquifers within the WHPA is considered to be Low.

13.3.1.3 Transport Pathway Increase

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

Private wells, and particularly wells that either do not contain seals that will prevent water from moving down around the outside of the well pipe, and wells that are no longer used and/or that have not been sealed present the greatest potential for increasing the rated Vulnerability. The available data from the Provincial Water Well Information System (WWIS) database was screened to identify wells that penetrate to the water supply aquifers and have potential to

increase the Vulnerability of the natural stratigraphic profile. There is potential that other wells may exist that are not included in the database, particularly in areas now serviced by municipal water that formerly obtained water supply from private wells.

No wells were identified within the Churchill WHPA that are considered to have the potential to be a Transport Pathway. The Groundwater Vulnerability map (Figure 13a-2) is therefore proposed to be used to generate the Vulnerability Scores.

13.3.1.4 WHPA-E /WHPA-F

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

13.3.1.5 Vulnerability Score

The WHPA zones for the Churchill Water Supply, as shown in Figure 13a-1, and the Groundwater Vulnerability, as shown in Figure 13a-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 13a-3 illustrates the Vulnerability Scores for the Churchill WHPA. Figure 13a-3 will be used to assess Drinking Water Threats in Section 13.3.3.

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

13.3.2 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 Churchill municipal water supply has 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 Churchill are provided in Technical Memorandum H3 – Drinking Water Issues Evaluation – Innisfil (Appendix I).

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

The occasional presence of coliform bacteria in raw or treated water is not considered to represent a specific Drinking Water Issue as these parameters have only been rarely observed under circumstances that are not consistent. Aesthetic/operational parameters that exceed guidelines include hardness, organic nitrogen and turbidity which are likely to be naturally-occurring. Trihalomethanes are present in trace concentrations as by-products of disinfection by chlorination in the treated water. Concentrations are typically well below Ontario Drinking Water Quality Standards (ODWQS) values and do not display increasing trends.

13.3.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Churchill 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 Churchill 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

13.3.3.1 List of Drinking Water Threats – Activities

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

13.3.3.2 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 Churchill Water Supply system:

- files provided by the Ministry of the Environment, [Conservation and Parks](#) local offices pertaining to licenses, and records of spills in the area of the delineated WHPA
- records available from the Ministry of the Environment, [Conservation and Parks](#) website containing registry of Brownfield Sites
- records from available technical studies and previous contaminant source inventories that identified situations that may qualify as conditions
- interviews of Town of Innisfil staff to identify potential conditions within the identified WHPA for the Drinking Water Supply

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

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

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps [combined with the ~~table of Drinking Water Threats~~ Technical Rules threat circumstances can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. 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 ~~circumstances tables~~ can be found at ~~the <https://threats.swpip.ca/>, <https://swpip.ca/>, [Government of Ontario's Drinking Water Threats and Circumstances](#)~~ ~~Government of Ontario's Drinking Water Threats and Circumstances.~~

13.3.3.3.1 Pathogen Parameters

The ~~MECP table of Drinking Water Threats~~ ~~Technical Rules~~ ~~Key Table on Figure 13a-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 Churchill Water Supply (~~Figure 13a-4~~). 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.

13.3.3.3.2 Chemical Parameters

The ~~MECP table of Drinking Water Threats~~ ~~Key~~ ~~Technical Rules~~ ~~Table on Figure 13a-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 Churchill Water Supply (Figure 13a-5). 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.

13.3.3.3 DNAPL Chemical Parameters

Figure 13a-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 Churchill Water Supply. [The Technical Rules](#) [The MECP table of Drinking Water Threats](#) [Key Table on Figure 13a-6](#) can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 13.3.3.2, no Conditions have been confirmed within the WHPA for the Churchill 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 13a-3 illustrates the Vulnerability Score map for Churchill Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

13.3.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Churchill Water Supply has been determined using the methodology outlined in Technical Memorandum A5 (Appendix A) 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 13-2 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Churchill Well Supply. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

Thirty-four (34) activities that are considered to be potential Significant Drinking Water Threats were identified in association with nineteen (19) land parcels in the WHPA for the Churchill Well Supply. Fourteen (14) parcels around Well 1 and Well 2 were identified as having potential Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the areas where the Vulnerability Score is 10.

Two (2) parcels around Well 3 are identified as having activities that are Significant Drinking Water Threats for application of commercial fertilizer and pesticide to land.

Two (2) parcels around Well 2 are identified as having potential activities that are Significant Drinking Water Threats for livestock grazing or pasture land, application of agricultural source material to land, and application of pesticide to land. Seven (7) residential parcels that are all or partly within the WHPA-A for Well 2 are also identified as potentially having Threats related to application of commercial fertilizer to land.

Table 13-2: Number of Significant Drinking Water Threats for the Churchill Drinking Water Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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

Threat Number	Threat	Significant Threat Counts Number of Threats
13	The handling and storage of road salt	0
14	The storage of snow	0
15	The handling and storage of fuel	1
16	The handling and storage of dense non-aqueous phase liquid	0
17	The handling and storage of an organic solvent	0
18	The management of runoff that contains chemicals used in the de-icing of aircraft	0
21	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard	2
22	The establishment and operation of a liquid hydrocarbon pipeline. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0
-	Total Number	3034*significant threats (on 19 properties)

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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. *4 verified existing Threats and 30 potential Threats that require further investigation

~~13.3.3.4~~ **13.3.3.5.1 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 [Part XII of the Technical Rules \(December 2021\), Table of Drinking Water Threats](#).

Managed Lands were identified and the managed lands proportions were determined for the WHPA of the Churchill Well Supply as outlined in Technical Memorandum A5 (Appendix MO). [The calculation of Managed Lands was updated to reflect the methodology in the most recent technical bulletin \(November, 2009\)](#). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.3.3.5). 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 13a-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Churchill Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The high proportion of managed lands within WHPA-B for Well 3 results in additional activities being identified as Significant Drinking Water Threats for application of fertilizer.

~~13.3.3.4~~ **13.3.3.5.2 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 [Part XII of the Technical Rules \(December 2021\), Table of Drinking Water Threats](#).

The Livestock Density was determined for the delineated WHPA zones of the Churchill Well 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 13.3.3.5). 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 13a-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Churchill 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

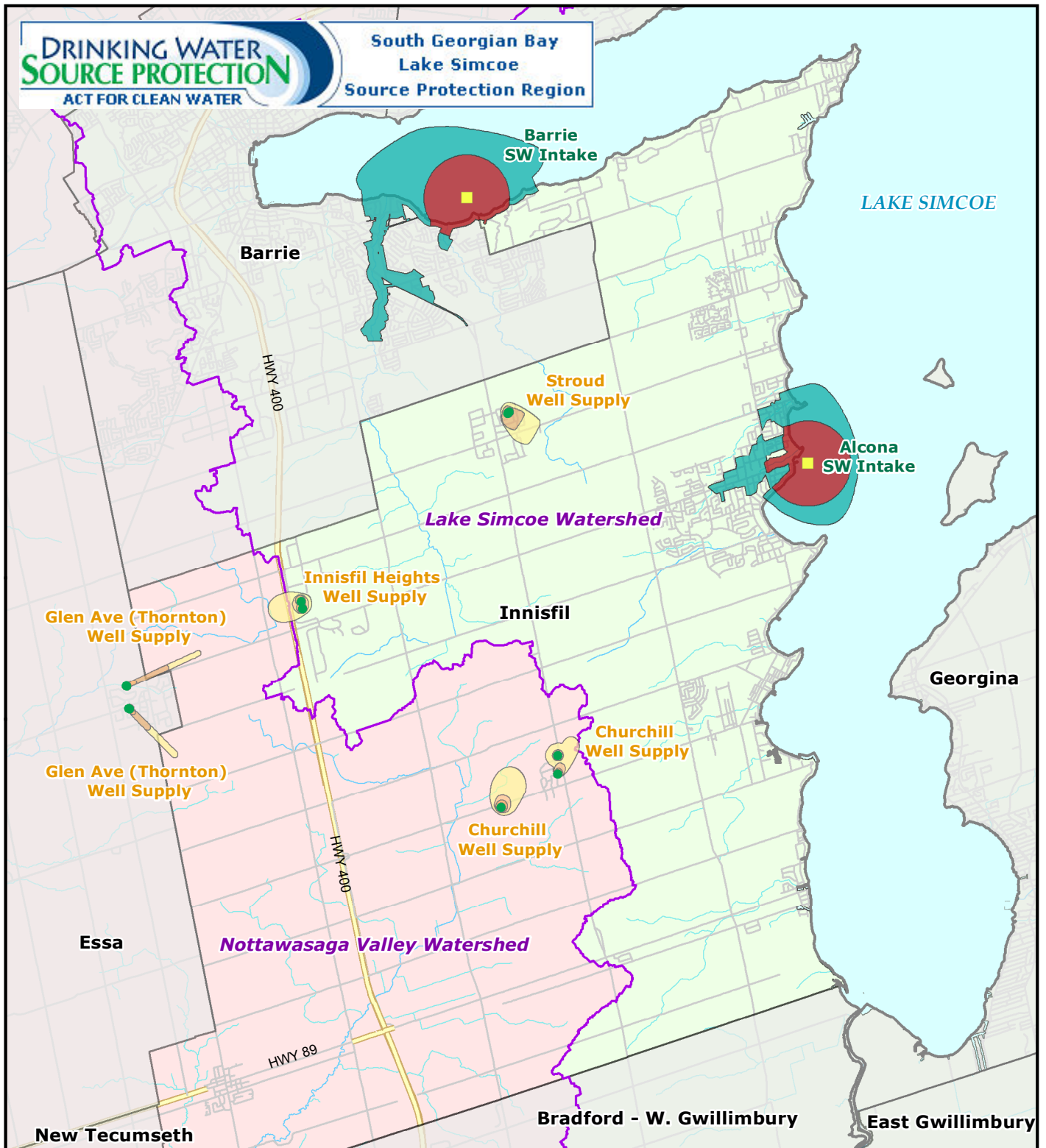
determined in accordance with Technical Memorandum A5 (Appendix MO). The high Livestock Density within the WHPA-B for Well 2 results in additional activities being identified as Significant Drinking Water Threats for application of fertilizer.

13.3.3.4.313.3.5.3 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 ~~Part XII of the Technical Rules (December 2021)~~. [Table of Drinking Water Threats](#).

The proportion of Impervious Surfaces within the delineated WHPA zones for the Churchill Well Supply was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). [Methodology in Technical Memorandum A5.1 \(Appendix MO\) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules](#). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.3.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

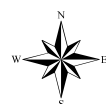
Figure 13a-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Churchill Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.



- Municipal Surface Water Intakes
- IPZ-1 (1000m on water or 120m inland)
- IPZ-2 (2 hr time of travel)
- Municipal Supply Well in Town of Innisfil
- WHPA-A (100m)
- WHPA-B (2 years time of travel)
- WHPA-C (5 years time of travel)
- WHPA-C1 (10 years time of travel)
- WHPA-D (25 years time of travel)

**Drinking Water System
Vulnerable Areas in
Town of Innisfil**

Created by: LSRCA
Date: 2017-07-14



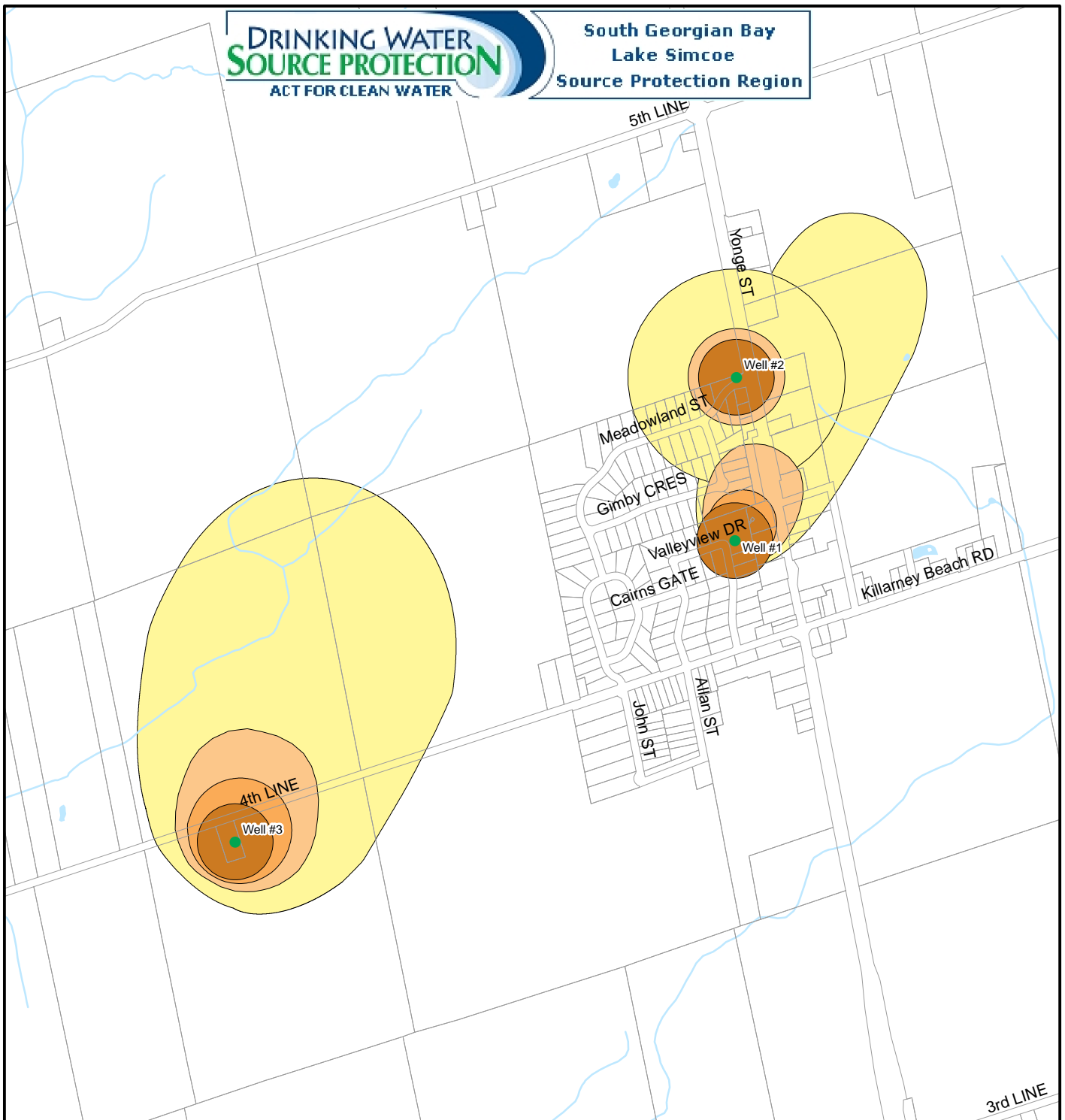
Scale: 1:130,000
0 1.5 3km
UTM Zone 17N, NAD83



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



Figure 13-1



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



200 100 0 200 Metres

**WELLHEAD PROTECTION AREAS -
CHURCHILL, INNISFIL**

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

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.03

FILE. NO.:0-071948.03F9.2-1

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.



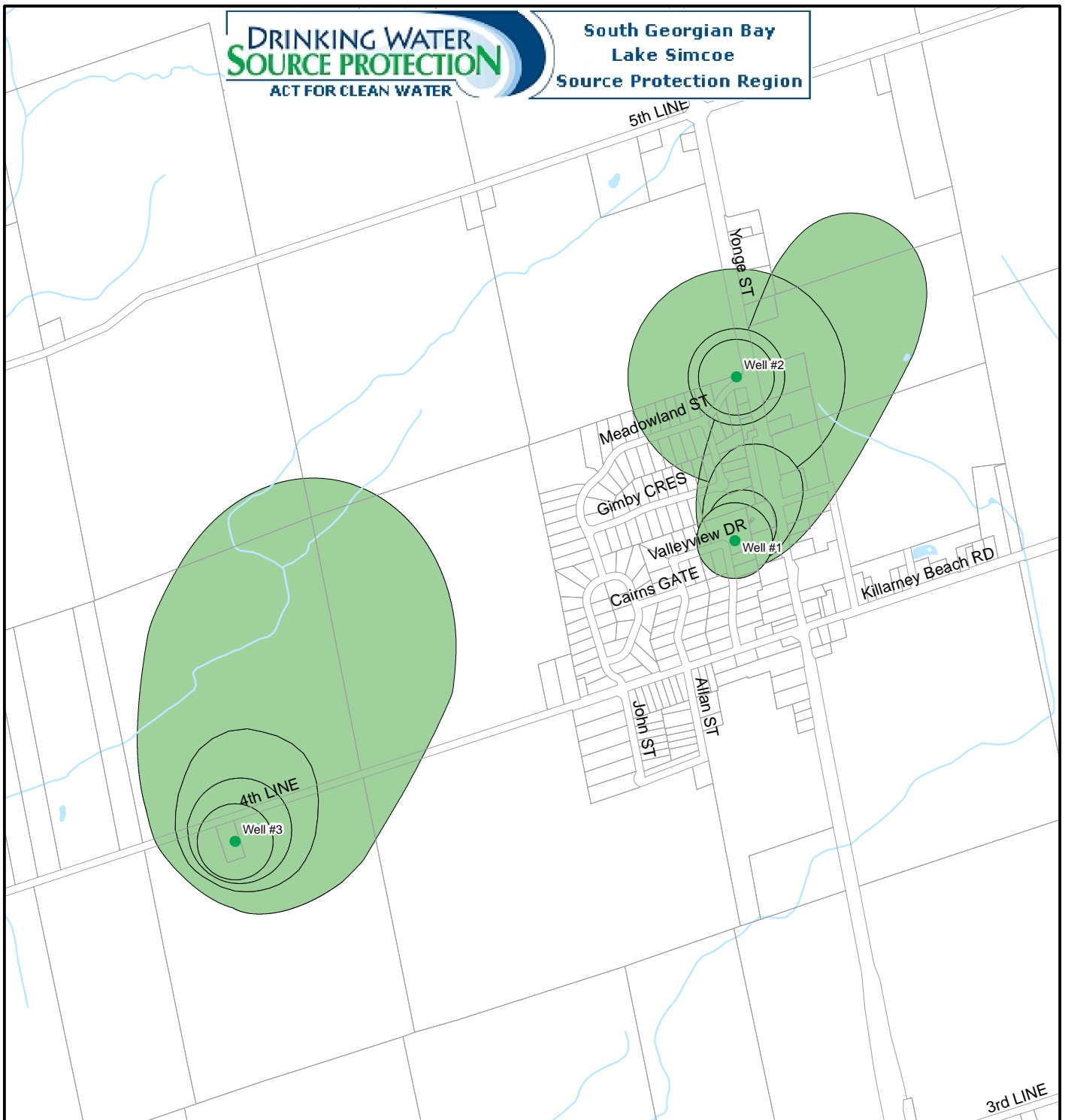
GENIVAR



Ontario

FIGURE

13a-1



LEGEND

- MUNICIPAL WELL LOCATION

AQUIFER VULNERABILITY INDEX

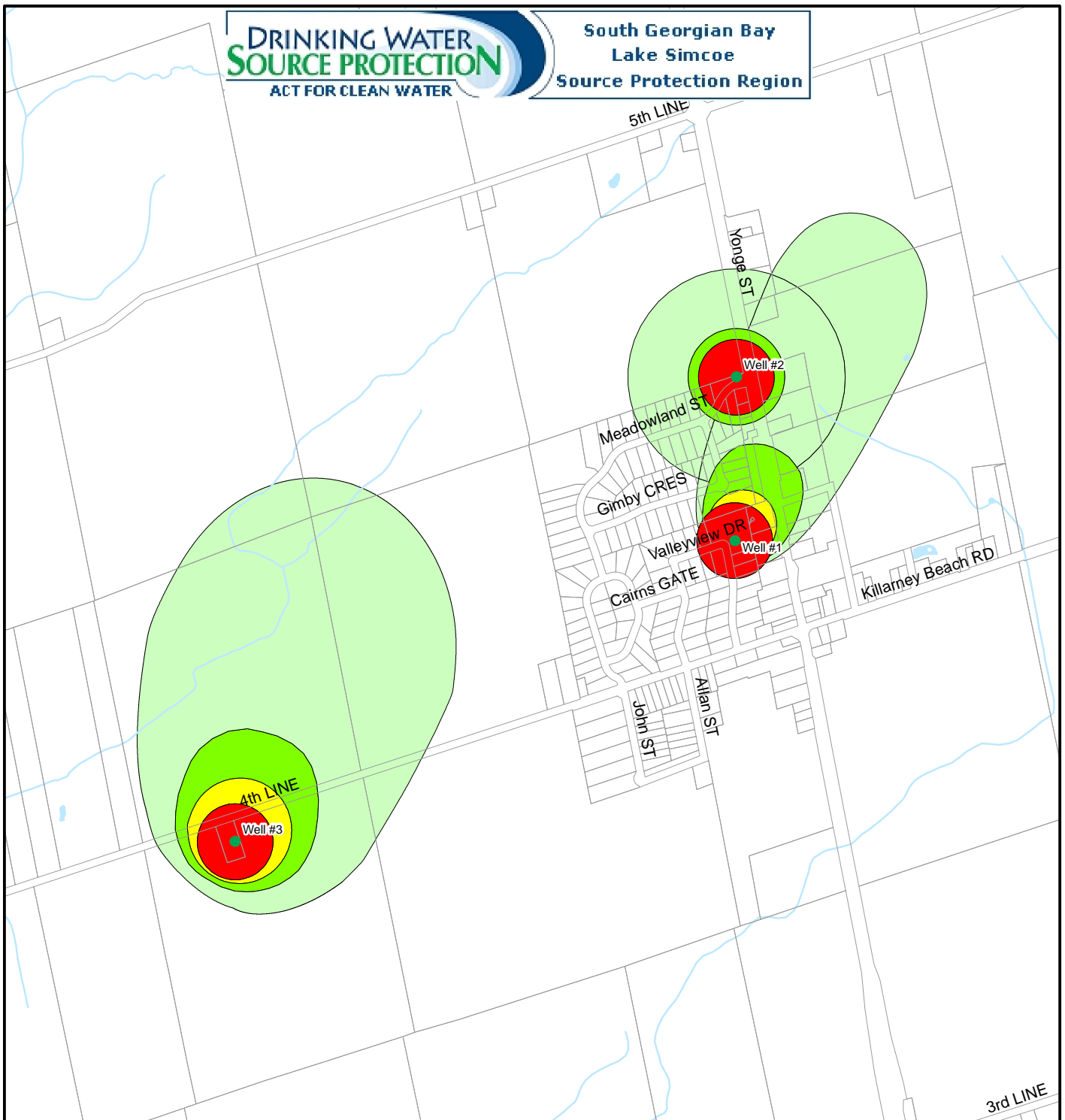
- HIGH
- MEDIUM
- LOW

**GROUNDWATER VULNERABILITY -
CHURCHILL**

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

DATE: JUNE 2010	SCALE: 1:15000
PROJECT: 0-071948.03	FILE. NO.: 0-071948.03F9.2-2

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.

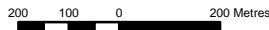


LEGEND

● MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6
- 4
- 2



**VULNERABILITY SCORES -
CHURCHILL**

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

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.03

FILE. NO.:0-071948.03F9.2-3

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.



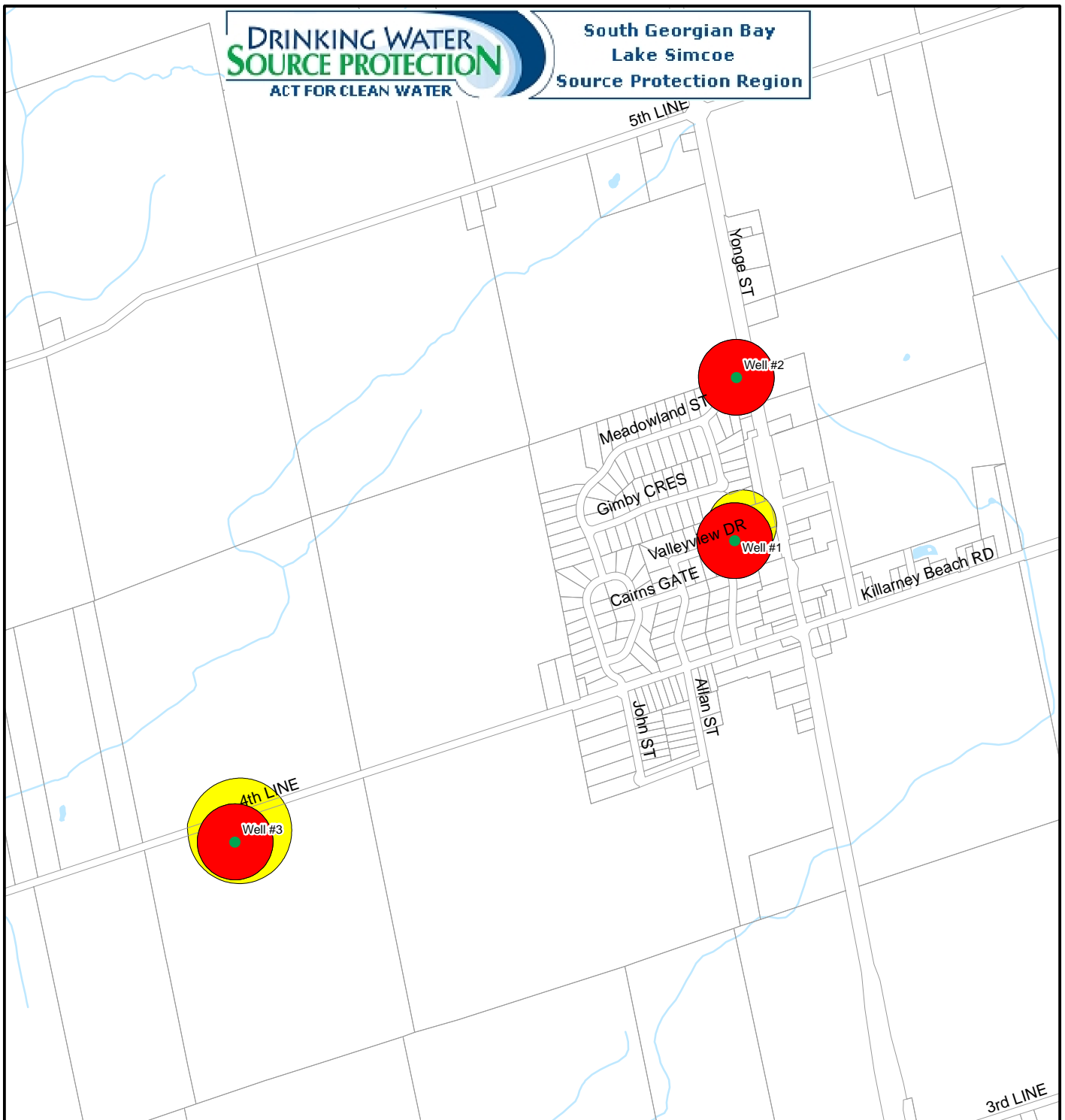
GENIVAR



Ontario

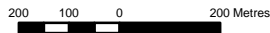
FIGURE

13a-3



LEGEND

- MUNICIPAL WELL LOCATION
- VULNERABILITY SCORING**
- 10
- 8
- 6



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

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

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

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.03

FILE. NO.:0-07194803F9.2-4

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.



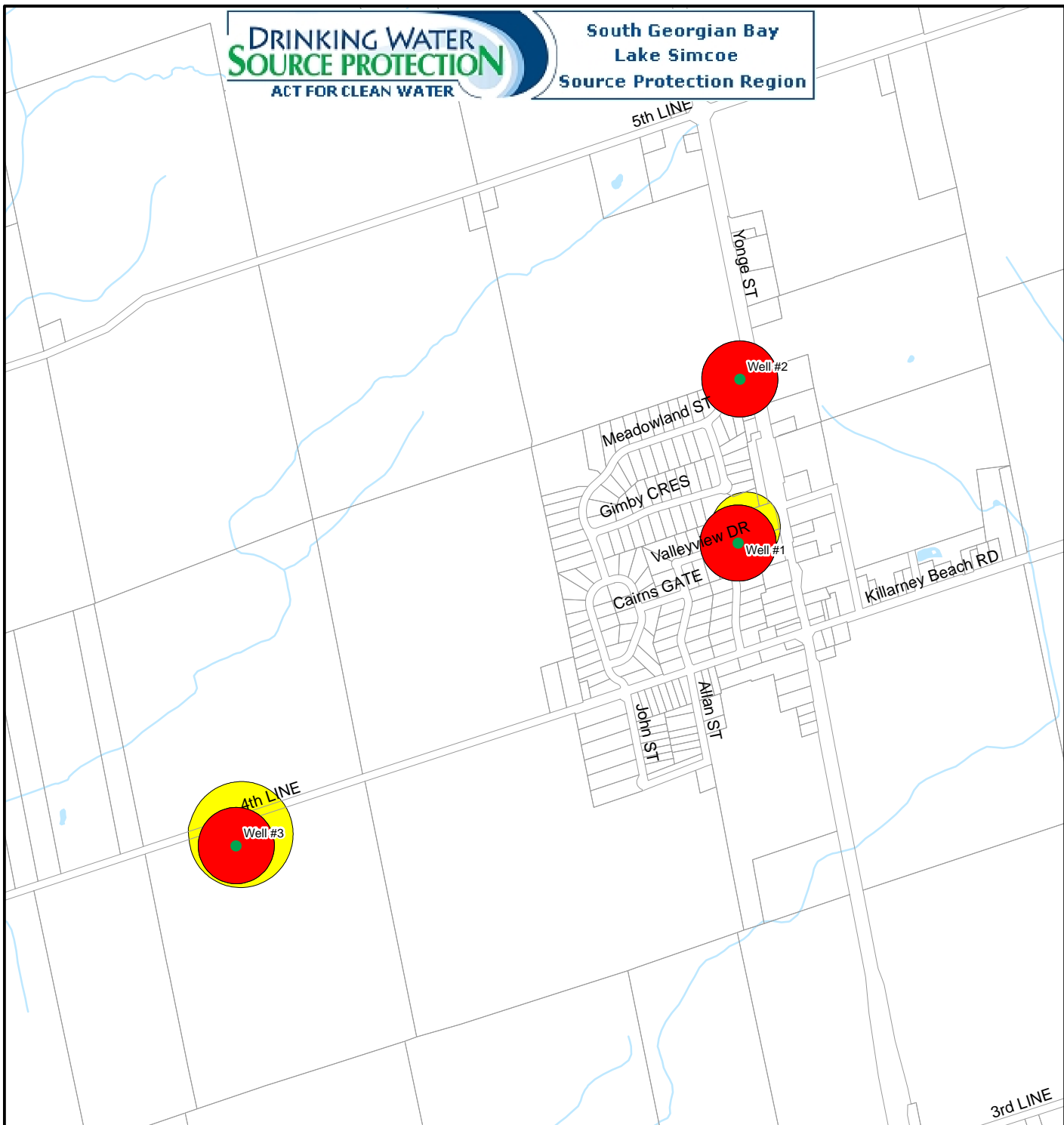
GENIVAR



Ontario

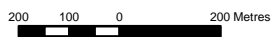
FIGURE

13a-4



LEGEND

- MUNICIPAL WELL LOCATION
- VULNERABILITY SCORING**
- 10
- 8
- 6



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 - CHURCHILL

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

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.03

FILE. NO.:0-07194803F9.2-5

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.



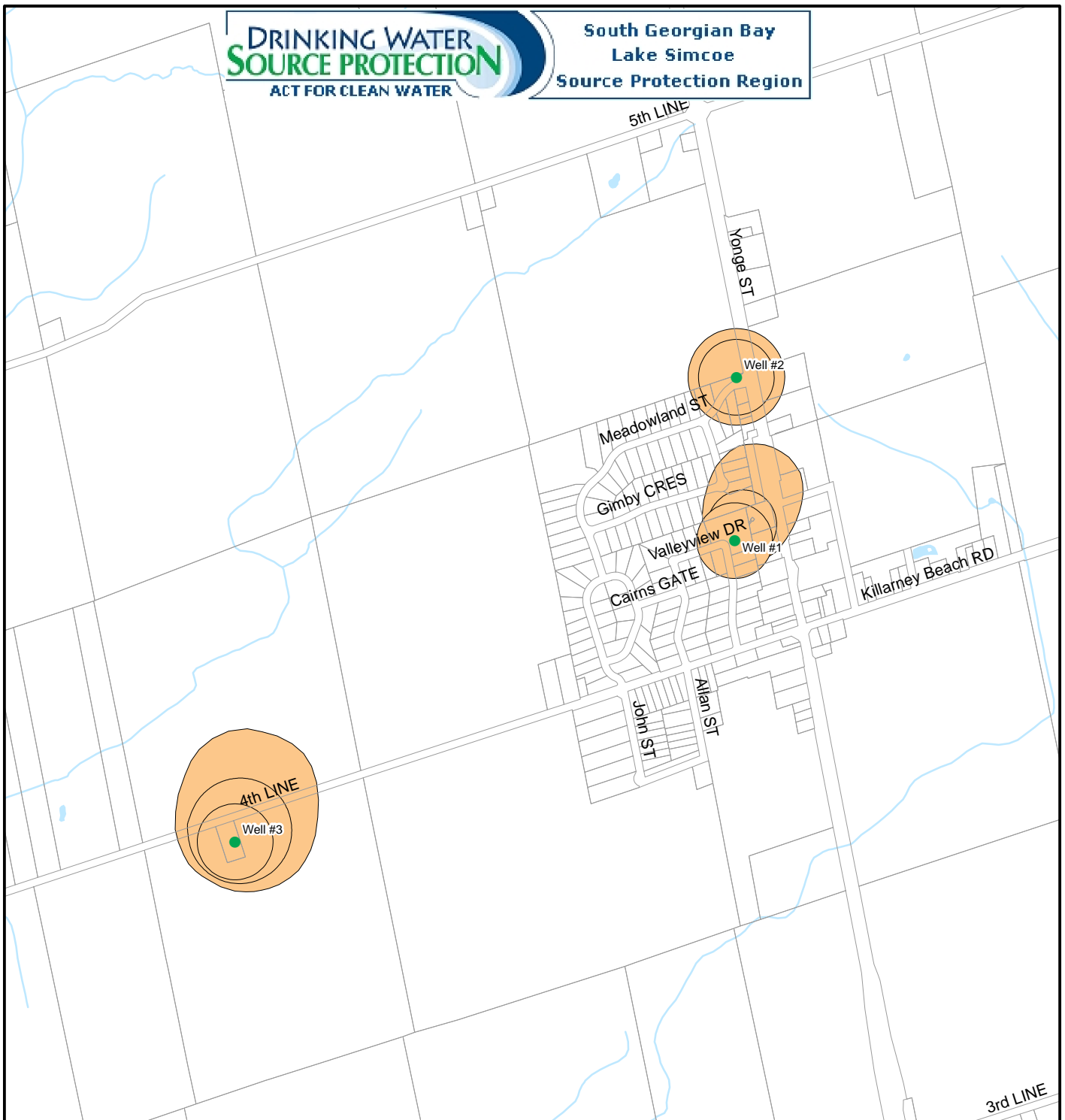
GENIVAR



Ontario

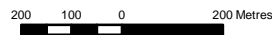
FIGURE

13a-5



Legend

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



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

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

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

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

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.03

FILE. NO.:0-07194803F9.2-6



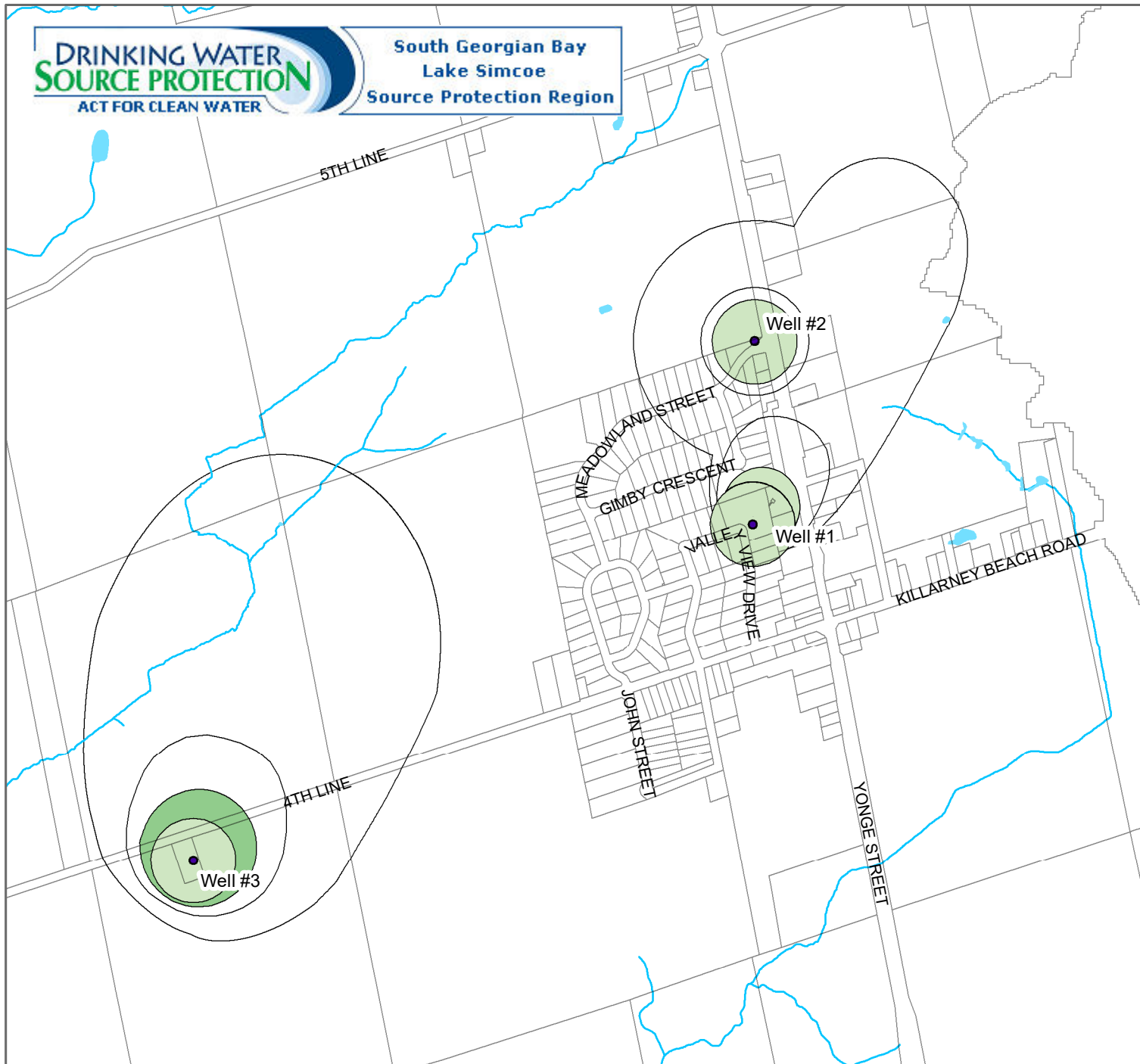
GENIVAR



Ontario

FIGURE

13a-6



**Managed Lands -
Town of Innisfil
Churchill
(Well 1, 2 & 3)**

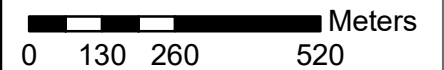


Legend

- Well Locations

Percent Managed Lands

- <40
- 40-80
- >80



Created by: NVCA
Date: 2020-08-25

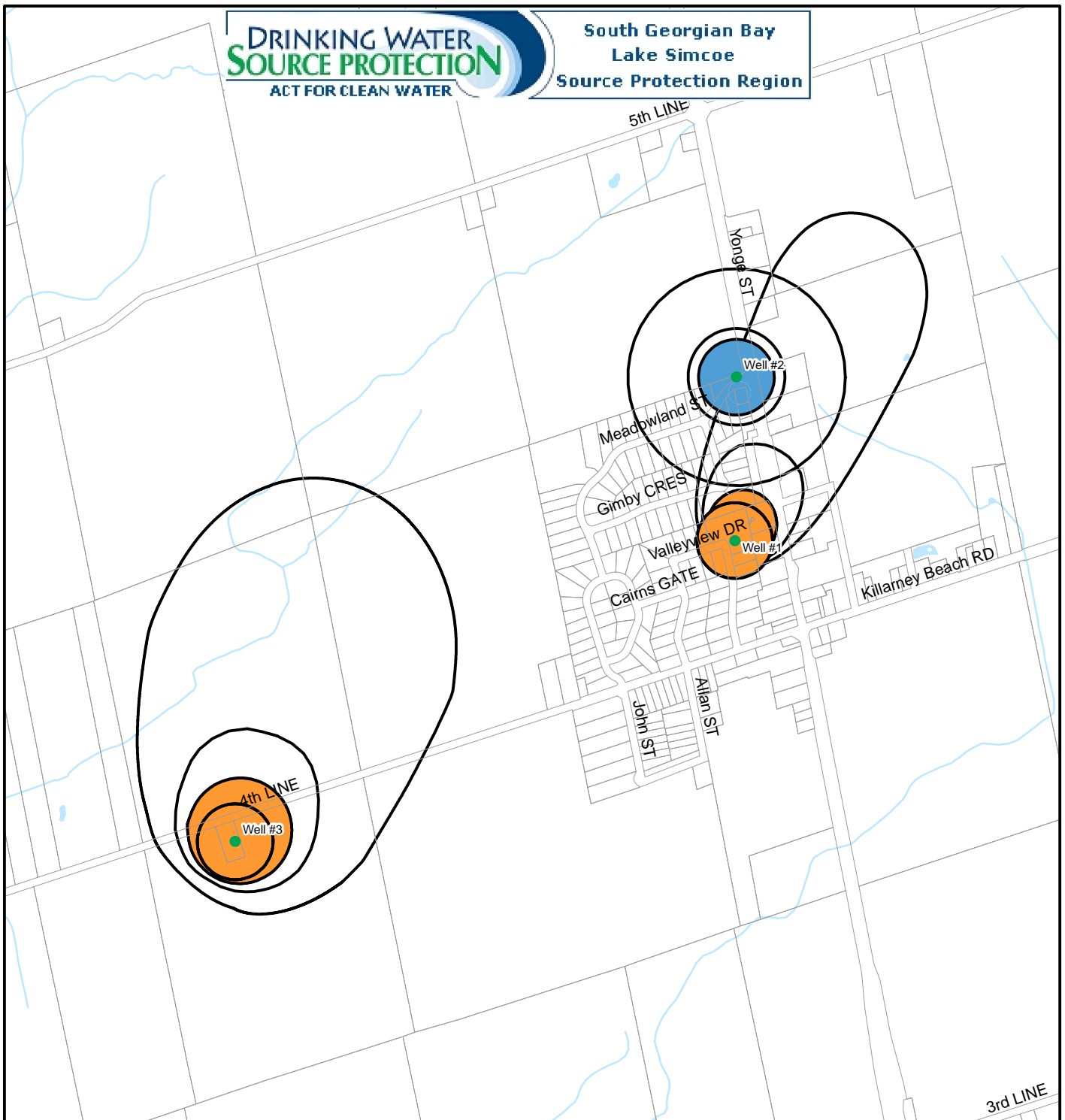
Scale: 1:13,505

UTM Zone 17N, NAD83



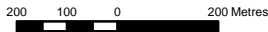
Ontario **Figure 13a-7**

This map was originally created for the Nottawasaga Valley Conservation Authority Water Budget Model - Geological/Hydrostratigraphic Model Development June 2009, for the purposes of completing the South Georgian Bay Lake Simcoe Assessment reports. While every effort has been made to accurately depict the base data, errors may exist.



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)



**LIVESTOCK DENSITY -
CHURCHILL**

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

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.03

FILE. NO.: 0-07194803F9.2-8

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

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



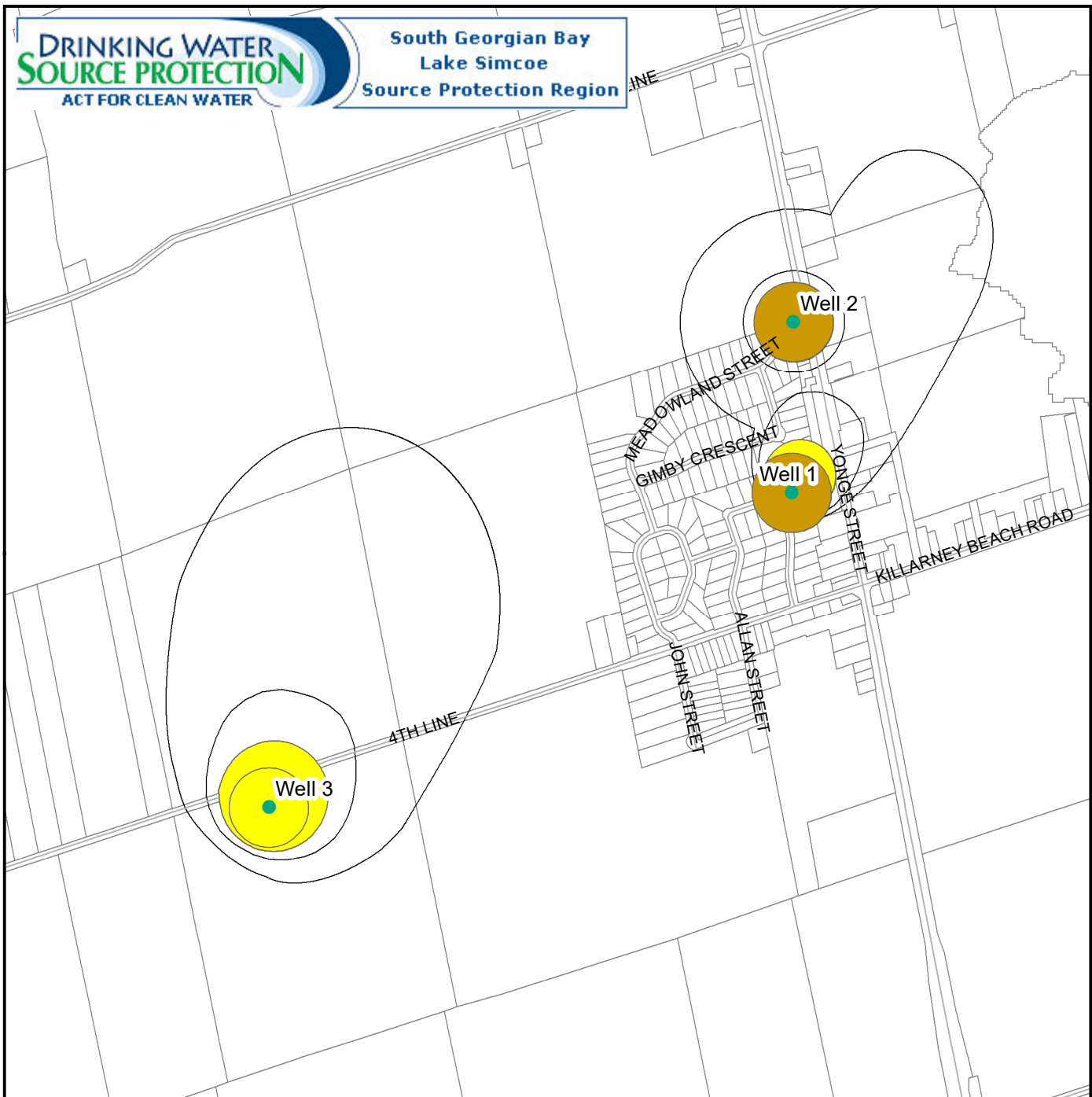
GENIVAR



Ontario

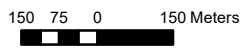
FIGURE

13a-8



Legend

- Municipal Well Location
- <1%
- =1 - <6%
- =6 - <8%
- =8 - <30%
- =>30%



IMPERVIOUS SURFACES - CHURCHILL

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.

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 been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.

Created by: NVCA
Date: 2025-09
Scale: 1:15,000
UTM Zone 17N, NAD83



Ontario

Figure 13a-9