

Chapter 9: Town of Bradford-West Gwillimbury

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Town of Bradford-West Gwillimbury

9.1 Introduction

This chapter contains information on one drinking water system for the Town of Bradford-West Gwillimbury in the South Georgian Bay-Lake Simcoe Source Protection Region. 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.~~

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

9.2 Drinking Water Systems

The Town of Bradford West-Gwillimbury operates a groundwater based water supply within one community. Although, the Town of Bradford West-Gwillimbury operates no surface water intakes a large portion of the town's water is supplied from the Alcona Water Treatment Plant

in Innisfil. As shown in Table 9-1 and Figure 9-1 the groundwater supply is within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR). Table 9-1 also indicates the Source Protection Region and corresponding lead Source Protection Authority (SPA) for the municipal water supplies.

Table 0-1: Municipal Groundwater Supplies in the Town of Bradford West-Gwillimbury.

Local Municipality	Community Water Supply	Source Protection Region & Source Protection Authority (SPA)
Town of Bradford West-Gwillimbury	Bradford/Bondhead Distribution and Supply Wells	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA

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Despite serving the Town of Bradford West Gwillimbury, the primary well field (known as the Church well field) is physically located within the Township of King, in the Regional Municipality of York, to the east of the community of Bradford. The wells are located in the Lake Simcoe Watershed.

9.3 Bradford/ Bondhead Distribution & Supply Wells

The Town of Bradford-West Gwillimbury currently operates two (2) municipal wells to service the water supply needs of the residents. The two wells operate under Permit To Take Water (PTTW) # 2672-9G3PFY (valid until 2024) and include Church Wells No. 1 and No. 2. As previously noted, despite serving the Town of Bradford West Gwillimbury, the Church wells are physically located within the Township of King, in the Regional Municipality of York, to the east of the community of Bradford.

It should be noted that five (5) additional non-operational wells previously included in the list of municipal supplies, are scheduled for decommissioning in 2014 and no longer supply water to the Bradford West Gwillimbury drinking water system. These five non-operational wells include the Soda Pop, Bingham, Doane, Simcoe, and 8th Line wells. The population previously served by these wells is now serviced by the Alcona Water Treatment Plant in Innisfil (see Chapter 10). Before the five (5) non-operational wells could be removed from the Assessment Report, the Town of Bradford – West Gwillimbury was obligated to complete a set of requirements outlined in Section 14 of O.Reg 287/07. As all of the Section 14 requirements were met successfully, the non – operational wells and all of the technical information associated with these wells has been removed from the Assessment Report.

The Bradford-West Gwillimbury Water Supply is one of the more extensively studied water supplies in the Province of Ontario. Jagger Hims Limited (now GENIVAR) has completed several extensive studies on behalf of the Town since 1993. This ongoing work includes monitoring and preparation of annual documentation for compliance with the current Permit to Take Water. In 2008, Jagger Hims Limited completed a report entitled “Vulnerability Assessment” that described additional work to improve understanding of the groundwater setting and aquifer vulnerability to follow on from work undertaken as part of the South Simcoe Municipal Groundwater Study. The Vulnerability Assessment report contains an extensive list of references regarding the Bradford-West Gwillimbury Water Supply.

The South Simcoe Groundwater Study, as led by the LSRCA and the Nottawasaga Valley Conservation Authority (NVCA), with the assistance of funding from the MOE, was initiated in 2002. This work followed the Terms of Reference for Technical Studies published by MOE¹ (2002) and included the construction, calibration, and application of a numerical groundwater flow model to delineate Wellhead Protection Areas (WHPA) for the two (2) currently operational municipal wells, and the five (5) offline wells that were operational at the time of the study. The work included an inventory of potential contaminant sources within these

¹ Now, MECP (The Ministry of the Environment, Conservation and Parks)

WHPAs. This work was documented in a series of reports produced by Golder Associates Ltd. (Golder) and Waterloo Hydrogeologic, Inc. (WHI) in 2004. The detailed documentation for the Bradford-West Gwillimbury Water Supply is Appendix F of the main report (Golder, 2004).

The sequence of sediments above bedrock beneath the Community of Bradford typically contains three aquifer layers. The upper layer of the bedrock is also an aquifer, however it is not extensively exploited as a water supply source. Jagger Hims Limited (2008) refers to the three aquifer layers, from deep to shallow, as the *Bradford Aquifer*, the *West Gwillimbury Aquifer*, and the *Shallow Aquifer* and provides correlation between these names and names used by other studies.

The John Fennell Reservoir and rechlorination facility was brought on line in April 2006 and provides water to the Town of Bradford West Gwillimbury from the Alcona Water Treatment Plant in Innisfil (See Chapter 10). In 2010, the surface water supply provided approximately 50% of the Town's water supply requirements.

A description of the currently operational Church wells is summarized below:

Church Wells

The Church Wells are screened between 90 and 95 m deep in a granular overburden formation that is interpreted to be within the *Bradford Aquifer*. The Church wells are physically located within the Township of King, within The Regional Municipality of York, to the east of the Community of Bradford. The Church Wellfield began operation in 1968 and currently provides the majority of the water supply for the Town of Bradford (65% in 2006). Church Well No. 2 was constructed in 1975 and is operated as the lead well (50% of total groundwater production).

9.3.1 Ground Water 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 Bradford-West Gwillimbury groundwater supply has been delineated following the process recommended in the Technical Rules. The areas determined to contribute groundwater to the wells within 25 years were delineated as a 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 Bradford-West Gwillimbury water supply. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO). Details of the work performed to assess the Groundwater Vulnerability in for the Bradford-West Gwillimbury water supply are documented in Jagger Hims Limited (2008) and Golder *et al* (2004).

9.3.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Bradford-West Gwillimbury Water Supply wells are shown in Figure 9a-1. The WHPA was delineated in 2004 by Golder and WHI using a 3-dimensional numerical groundwater flow model. The WHPA locations have been adjusted to reflect an updated survey completed by the SGBLS in 2009. WHPA-A has been added to include the 100 m radius from each municipal well. WHPA delineation and adjustment details are documented in GENIVAR, 2010a.

WHPA-C1 has been delineated to reflect the 10 year time-of-travel to the municipal wells. Jagger Hims Limited (2008) estimated a 5 year time-of-travel line for each wellhead based on the relative distances. The estimated 5 year time-of-travel has not been used herein as the methodology employed to delineate this line is not acceptable as per the Technical Rules. Consideration should be given for future studies to revisit the WHPA and particularly to generate a 5 year time-of-travel estimate using the numerical groundwater flow model.

As the two (2) operational Church Wells are located in King Township, the WHPA for the Bradford-West Gwillimbury Water Supply extends into parts of King Township and the Town of East Gwillimbury, in The Regional Municipality of York.

9.3.1.2 Groundwater Vulnerability

The Groundwater Vulnerability within the WHPA of the two (2) municipal wells for Bradford-West Gwillimbury is shown in Figure 9a-2. The Groundwater Vulnerability was determined by Jagger Hims Limited (2008) using an Aquifer Vulnerability Index (AVI) approach. The Groundwater Vulnerability for the municipal water supply aquifers within the WHPA are considered to be Low.

9.3.1.3 Transport Pathway Increase

Technical Memorandum A2 (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 that have not been sealed present the greatest potential for increasing the rated vulnerability. The available data from the Provincial Water Well Information System 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 features that fit the criteria for Transport Pathways were identified within the WHPA for the Bradford-West Gwillimbury wells. The Groundwater Vulnerability map (Figure 9a-2) was therefore used to generate the Vulnerability Scores.

9.3.1.4 WHPA-E ~~/WHPA-F~~

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

9.3.1.5 Vulnerability Score

The WHPA zones for the Bradford-West Gwillimbury Water Supply, as shown in Figure 9a-1, and the Groundwater Vulnerability, as shown in Figure 9a-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 9a-3 illustrates the Vulnerability Scores for the Bradford-West Gwillimbury Water Supply. Figure 9a-3 will be used to assess Drinking Water Threats in Section 9.3.3.

9.3.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating of either High or Low be assigned with each Vulnerable Area as outlined in Technical Rules 13-15 (Part I.4 – Uncertainty Analysis – Water Quality (MOE, 2008a)). 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 Bradford WHPA was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Bradford WHPAs is High. The full results of the WHPA delineation Peer Review process, for Bradford is available in Appendix BWG and discussed in Chapter 5 (Methods Overview).

The Uncertainty Assessment methodology considers the type, quantity and quality of available data, the methods used to determine the Vulnerability Assessment components, and the nature of the groundwater flow system.

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Bradford-West Gwillimbury Water Supply WHPA is Low. The Vulnerability Rating for the Bradford-West Gwillimbury Water Supply has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). A Low Uncertainty Rating corresponds to a relatively high degree of confidence that the Vulnerability Assessment for the water supply wells reflects the conditions that dictate the Vulnerability of the municipal wells to contamination from activities at surface.

9.3.2 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 Bradford-West Gwillimbury 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 Bradford-West Gwillimbury Water Supply are provided in Technical Memorandum D1 – Drinking Water Issues Evaluation – Bradford Water Supply (Appendix BWG).

No Drinking Water Issues have been identified for the Bradford-West Gwillimbury Water Supply.

Several naturally occurring water quality parameters are present in the water in concentrations that may exceed the aesthetic or operational guidelines of the Ontario Drinking Water Quality

Standards (ODWQS). Treatment to sequester iron is successful in reducing the iron concentrations and colour to improve the aesthetic quality of the delivered water.

In the Church Wells sodium concentrations have been observed to be increasing, however the increase is not expected to exceed ODWQS. This increasing trend is likely the result of natural water quality in the deep aquifer that results from the natural occurrence of sodium in the bedrock formation underlying the Bradford Aquifer, this trend was determined based on the water quality results from the vulnerability assessment produced by Jagger Hims Ltd in March 2008.

9.3.3 Drinking Water Threats Evaluation

An assessment of drinking water threats for the Bradford-West Gwillimbury groundwater Supply was completed in accordance with the methodology described in Technical Memorandum – 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 Bradford-West Gwillimbury Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

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

9.3.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for Bradford-West Gwillimbury Water Supply is provided in Chapter 5 section 5.3.5.1.

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

9.3.3.2 List of Drinking Water Threats – Conditions

The following information sources were consulted to identify existing conditions that could affect the Bradford-West Gwillimbury Water Supply:

- Files provided by the ~~Ministry of the Environment~~ 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~~ Ministry of the Environment, Conservation and Parks website containing registry of Brownfield Sites.
- Records from previous contaminant source inventories that identified situations that may qualify as conditions.
- Interviews of Town Bradford-West Gwillimbury staff to identify potential conditions within the identified WHPA for the drinking water supply

No confirmed Conditions have been identified for the Bradford-West Gwillimbury Water Supply.

No potential Conditions have been identified for consideration at this time.

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

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. ~~The maps combined with the Technical Rules threat circumstances can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The circumstances can be found at: <https://threats.swpip.ca/>. 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: <http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php>.~~

Field Code Changed

9.3.3.3.1 Pathogen Parameters

~~The Technical Rules can be used in conjunction with the Vulnerability Scores. The Key Table on Figure 9a-4 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 Bradford-West Gwillimbury 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.

9.3.3.3.2 Chemical Parameters

~~The Technical Rules can be used in conjunction with the Vulnerability Scores. The Key Table on Figure 9a-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 Bradford-West Gwillimbury Water Supply. Activities that are or would be significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is 10.

9.3.3.3.3 DNAPL Chemical Parameters

Figure 9a-6 illustrates the area of the 10-year time-of-travel zone (WHPA-C1) where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threats for the Bradford-West Gwillimbury Water Supply. ~~The Key Table~~ The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 9a-6 ~~can be used to can be used to~~ identify the circumstances in which these activities would be Significant or Moderate Drinking Water Threats.

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

Further to Section 9.3.3.2, no Conditions have been confirmed within the WHPA for the Bradford-West Gwillimbury Water Supply.

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

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

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

Figure 9a-3 illustrates the Vulnerability Score map for Bradford-West Gwillimbury Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

9.3.3.5 Enumerating Drinking Water Threats

9.3.3.5

The number of Significant Drinking Water Threats for the Bradford-West Gwillimbury Church Well Supply has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO). The Church wells, and most of the associated WHPA, are physically located within the Township of King, within The Regional Municipality of York. Therefore, refinement of the Significant Drinking Water Threats enumeration was undertaken by staff members from the Regional Municipality of York for the portion of the WHPA that lies within York Region. The Threats within the portion of the WHPA that lies within Bradford-West Gwillimbury were refined by LS SPA staff using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report. There are no significant threats associated with Conditions or Drinking Water Issues.

Table 9-2 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Bradford-West Gwillimbury Church Well Supply. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10 and for parcels within WHPA B & C that are identified as potentially having Threats related to DNAPLs.

Fifteen (15) activities that are considered to be potential Significant Drinking Water Threats were identified in association with thirteen (13) land parcels in the WHPA for the Church Wells as shown in Table 9-2. Two (2) parcels are identified as having application of pesticide to land. One (1) parcel was identified for application of commercial fertilizer to land. One (1) parcel was

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identified for handling and storage of commercial fertilizer. One (1) parcel was identified for potential handling/storage of fuel. Ten (10) parcels are identified as having potential for handling and storage of DNAPLs. One (1) of these parcels marginally intersects the 100 m radius around the wells (WHPA-A).

Table 0-2: Number of Significant Drinking Water Threats for the Bradford-West Gwillimbury Church Wells.

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.	0
3.	The application of agricultural source material to land.	0
4.	The storage of agricultural source material to land.	0
5.	The management of agricultural source material.	0
6.	The application of non-agricultural source material to land.	0
7.	The handling and storage of non-agricultural source material.	0
8.	The application of commercial fertilizer to land.	1
9.	The handling and storage of commercial fertilizer to land.	1
10.	The application of pesticide to land.	2
11.	The handling and storage of pesticide.	0
12.	The application of road salt.	0
13.	The handling and storage of road salt.	0

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Threat Number	Threat	Significant threat counts Number of threats
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.	10
17.	The handling and storage of an organic solvent.	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
<u>22.</u>	<u>The establishment and operation of a liquid hydrocarbon pipeline</u>	<u>0</u>
Totals:		155* significant threats (on 13 properties)

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*4 verified existing Threats and 11 potential Threats that require further verification (2015)

Note for the table above: The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel

9.3.3.5.1 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 Technical Rules~~[the Table of Drinking Water Threats](#).

Managed Lands were identified and the managed lands proportions were determined for the WHPA of the Bradford-West Gwillimbury Water Supply as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 9.3.3.5). 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 9a-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Bradford-West Gwillimbury Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

9.3.3.5.2 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 Technical Rules~~[the Table of Drinking Water Threats](#).

The Livestock Density was determined for the delineated WHPA zones of the Bradford-West Gwillimbury Water Supply as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 9.3.3.5). The Livestock Density is used in the identification of threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 9a-8 illustrates the distribution of livestock density within the delineated WHPA zones for the Bradford-West Gwillimbury Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The livestock density figures reflect the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

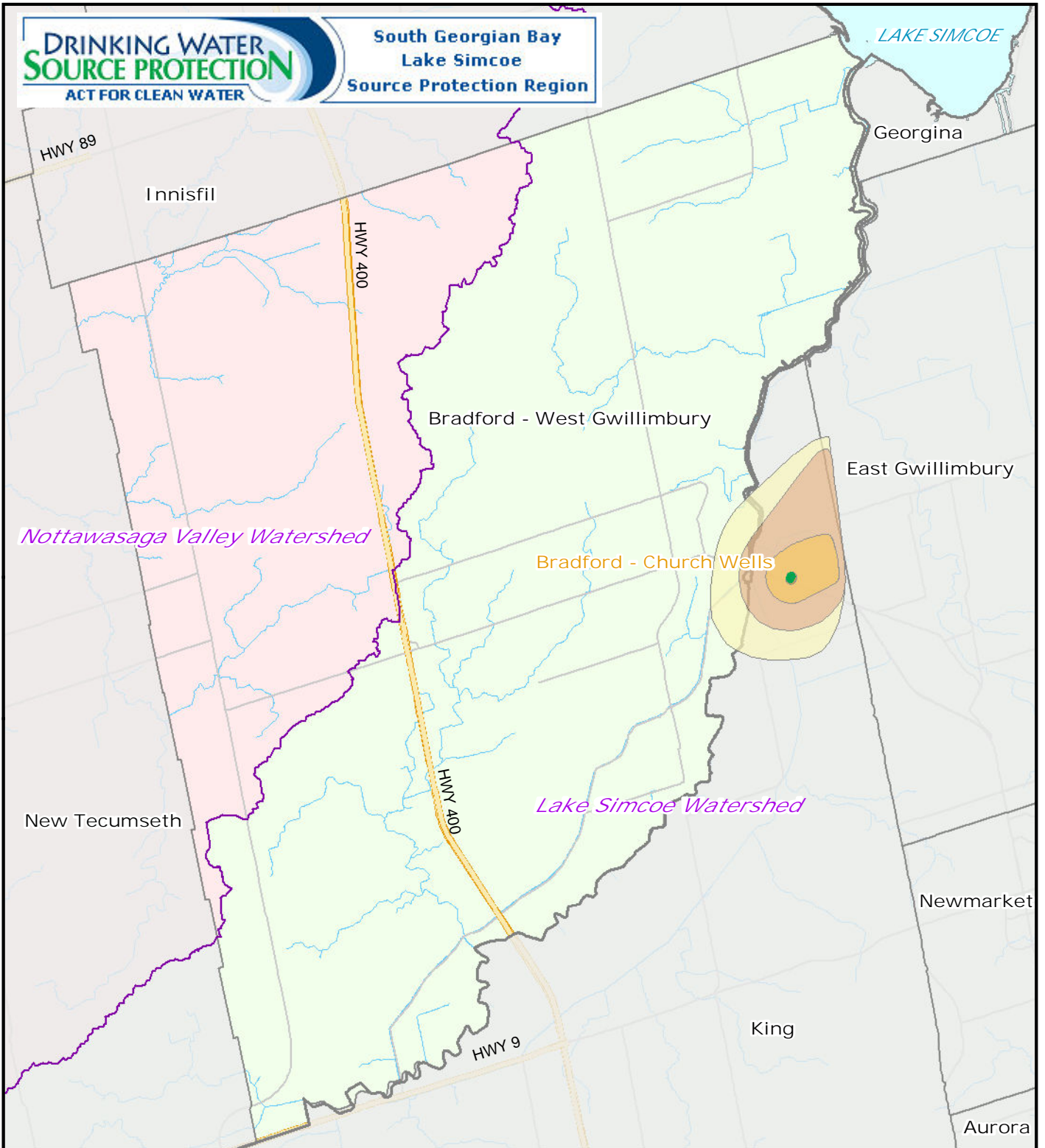
9.3.3.5.3 Impervious Surfaces









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 Technical Rules](#)~~the Table of Drinking Water Threats~~.

The proportion of impervious surfaces within the delineated WHPA zones for the Bradford-West Gwillimbury Water Supply was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). [Methodology in Technical Memorandum A5.1 \(Appendix MO\) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules](#). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 9.3.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 9a-9 illustrates the distribution of impervious surfaces within the delineated WHPA zones for the Bradford-West Gwillimbury Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.



-  Municipal Supply Well in Bradford-West Gwillimbury
-  WHPA-A (100m)
-  WHPA-B (2-years time of travel)
-  WHPA-C1 (10-years time of travel)
-  WHPA-D (25-years time of travel)
-  SWP Watershed Area
-  Upper Tier Municipality
-  Lower Tiers Municipality

**Drinking Water System
Vulnerable Areas in
Town of Bradford-West Gwillimbury**

Created by: LSRCA
Date: 2014-03-31



Scale: 1:110,000

0 1 2km

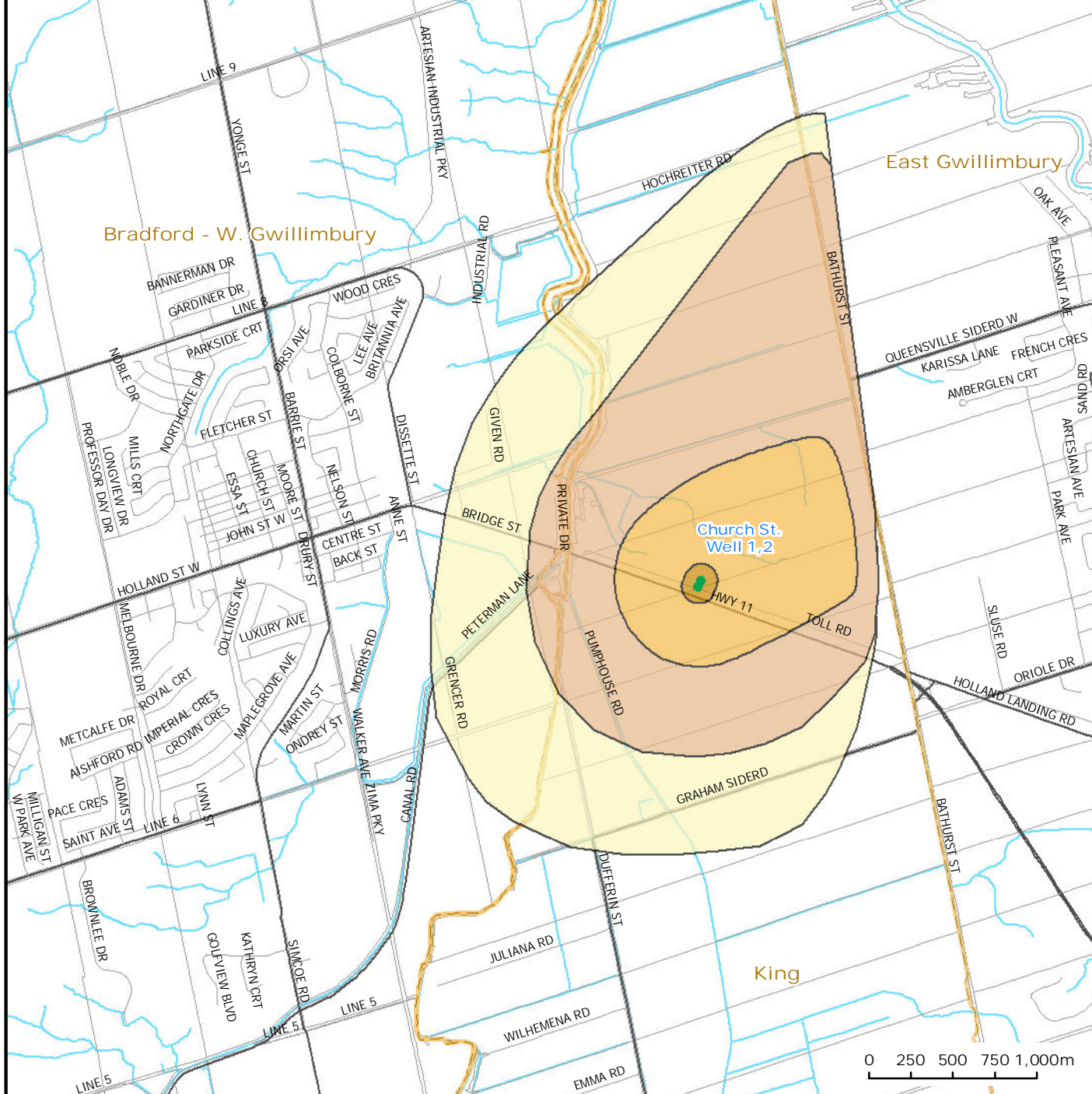
UTM Zone 17N, NAD83



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 9-1



- Municipal Supply Well in Bradford-West Gwillimbury
- WHPA-A (100m)
- WHPA-B (2-years time of travel)
- WHPA-C1 (10-years time of travel)
- WHPA-D (25-years time of travel)
- Municipality Boundary
- Water Course

**Wellhead Protection Areas
Bradford-West Gwillimbury**

Created by: LSRCA Scale: 1:35,000
Date: 2014-04-08 UTM Zone 17N, NAD83



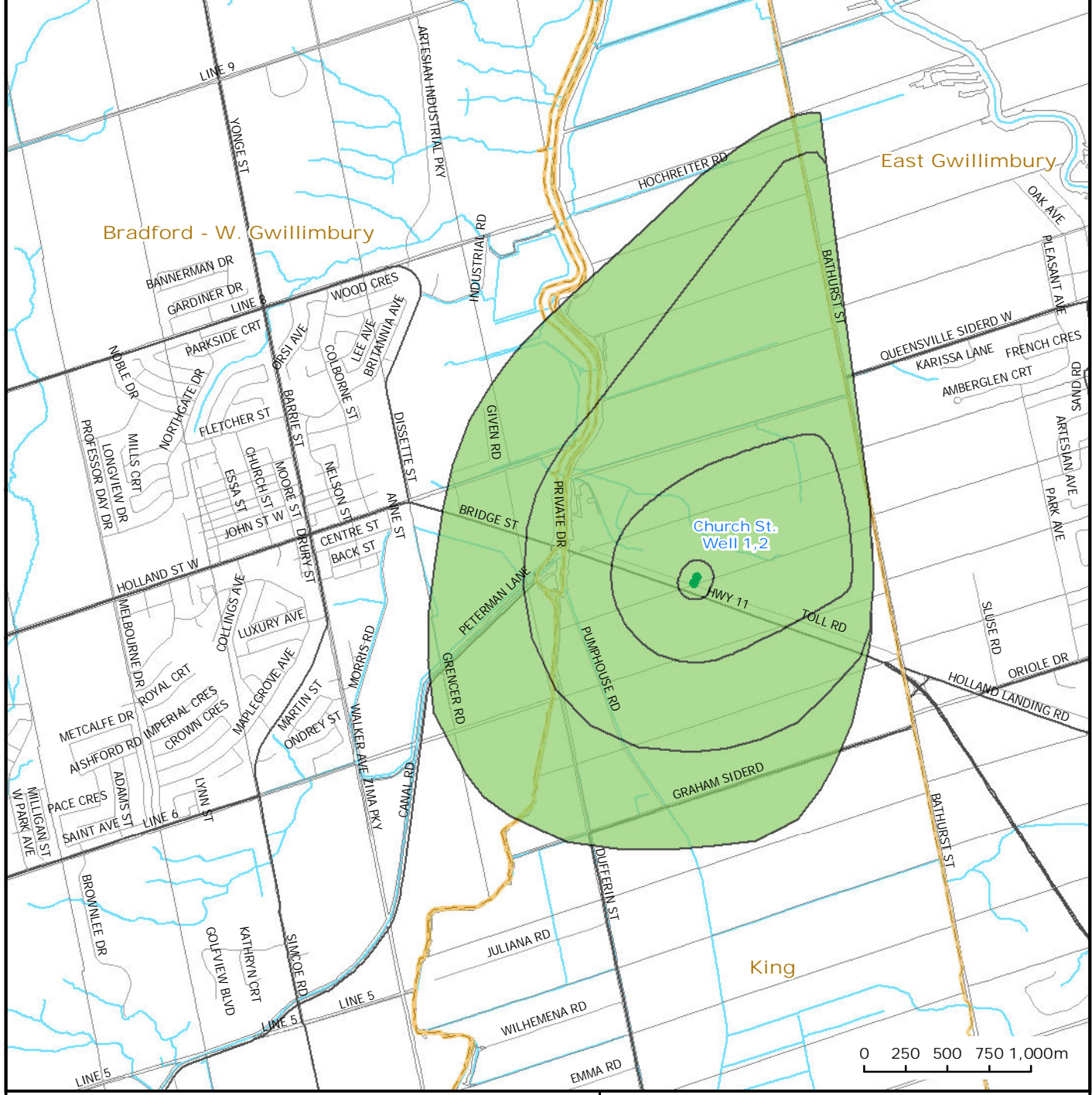
GENIVAR



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Figure 9a-1



- Municipal Supply Well in Bradford-West Gwillimbury
- Vulnerability**
- High
- Medium
- Low
- Municipality Boundary
- Water Course

**Groundwater Vulnerability
Bradford-West Gwillimbury**

Created by: LSRCA Scale: 1:35,000
Date: 2014-04-08 UTM Zone 17N, NAD83



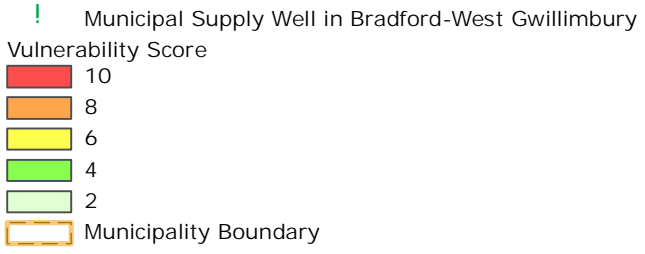
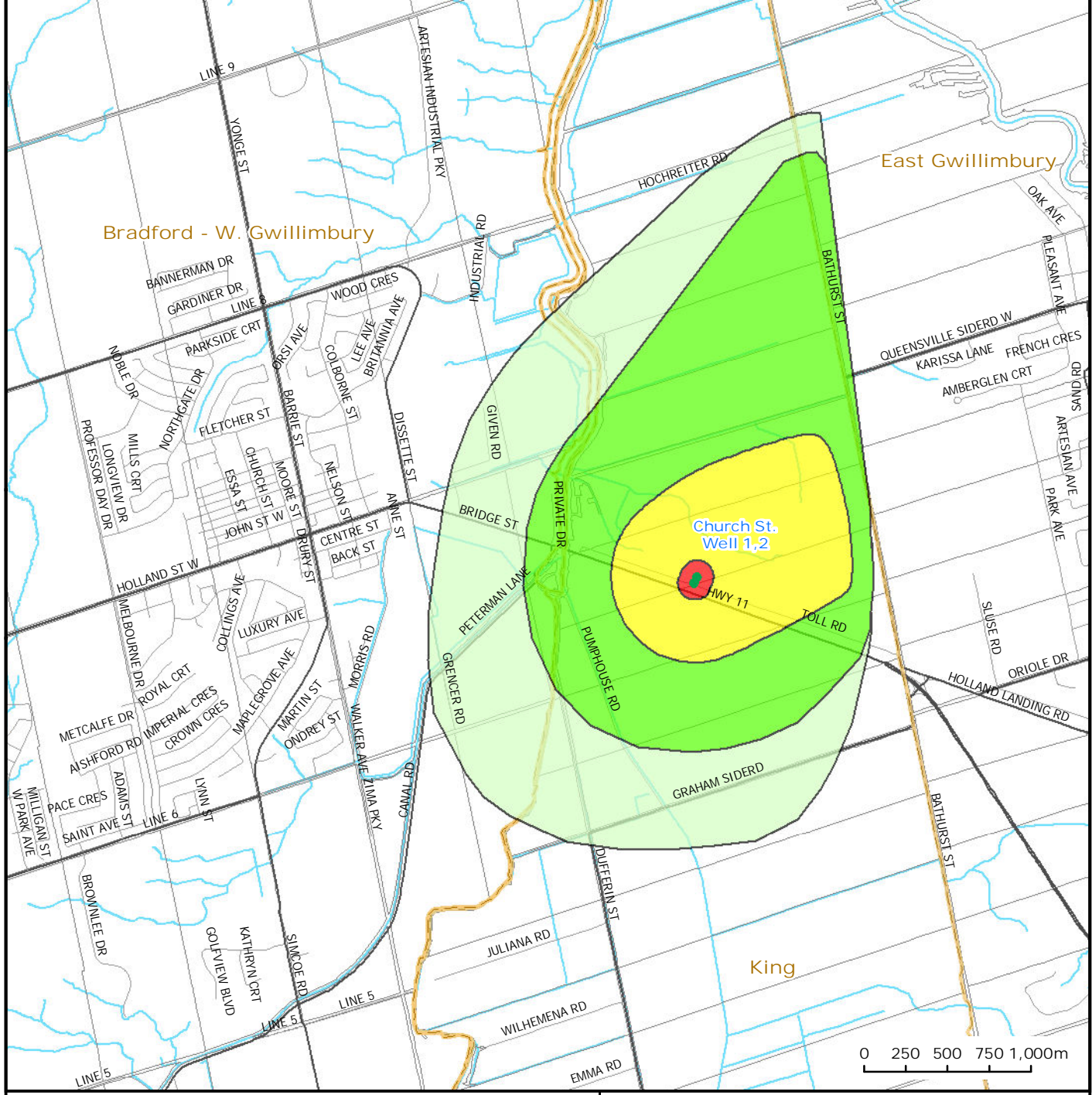
GENIVAR



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Figure 9a-2



**Vulnerability Score
Bradford-West Gwillimbury**

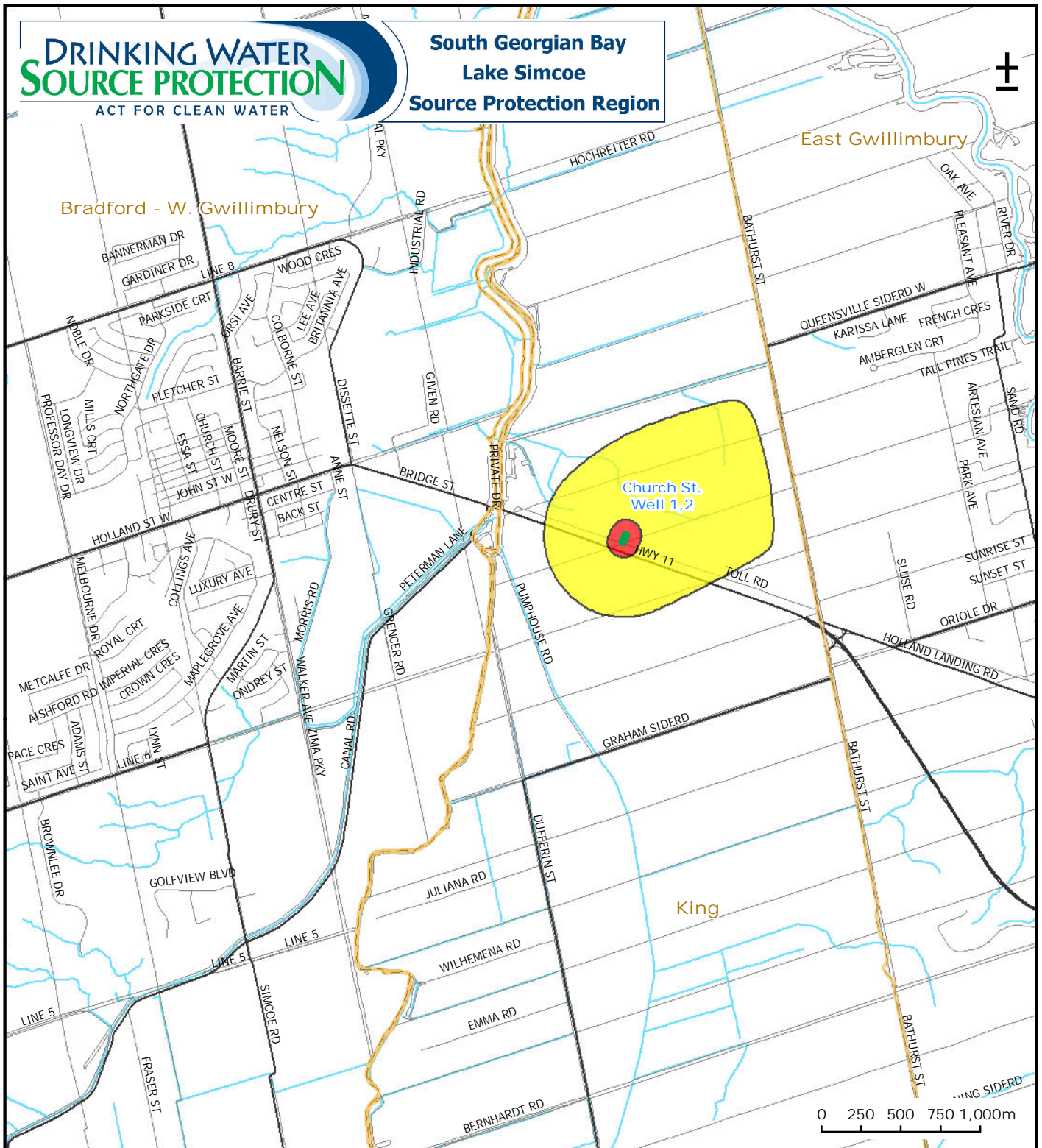
Created by: LSRCA Scale: 1:35,000
Date: 2014-04-08 UTM Zone 17N, NAD83



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Figure 9a-3



- Municipal Supply Well in Bradford-West Gwillimbury
- Vulnerability Score
- 10
- 8
- 6
- 4
- 2
- Municipality Boundary

Areas Where Pathogens Are or Would be Significant, Moderate, or Low

Created by: LSRCA Scale: 1:35,000
Date: 2014-04-08 UTM Zone 17N, NAD83



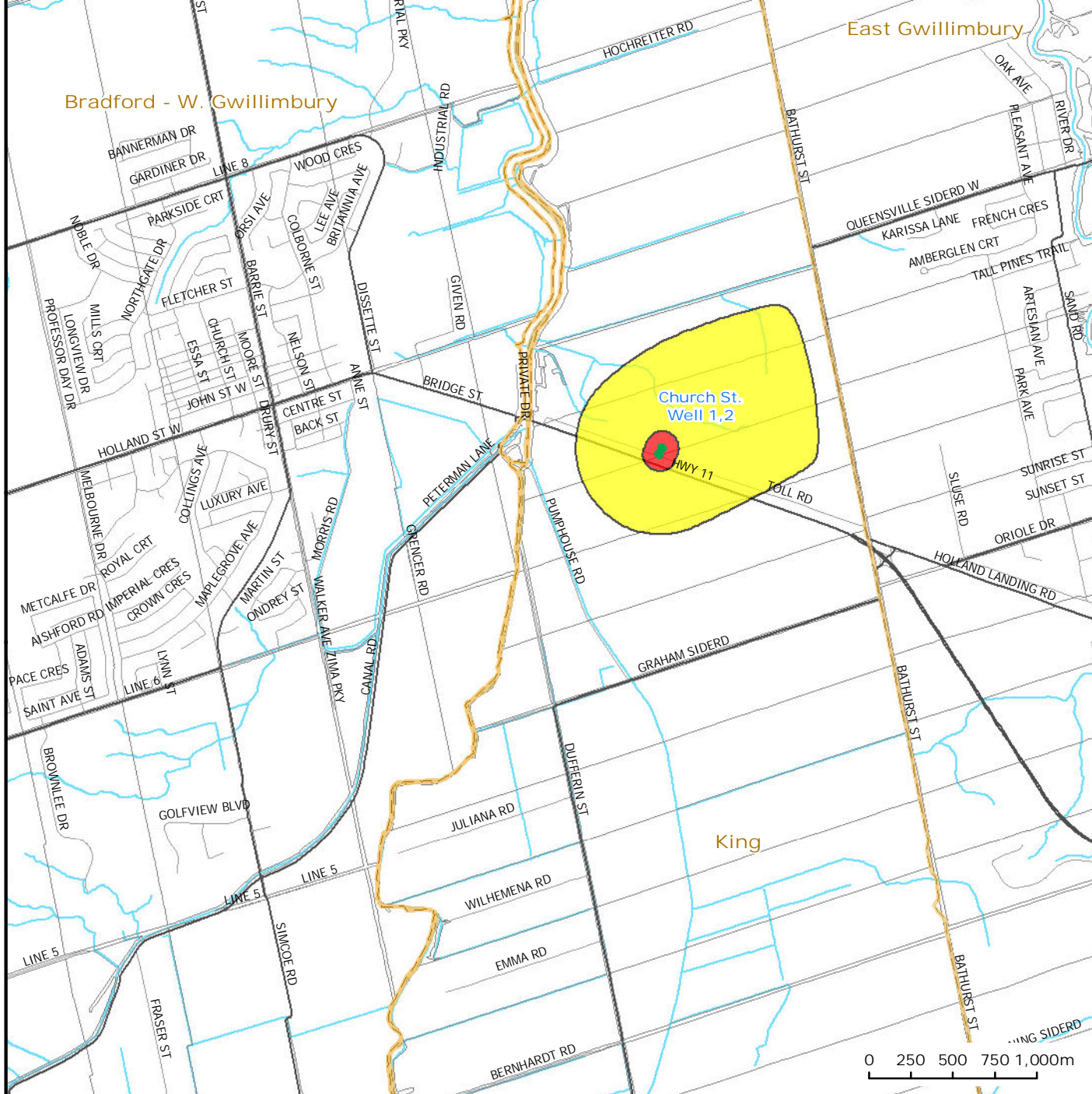
GENIVAR



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Figure 9a-4



! Municipal Supply Well in Bradford-West Gwillimbury

Vulnerability Score

- 10
- 8
- 6
- 4
- 2

Municipality Boundary

Areas Where Chemicals Are or Would be Significant, Moderate, or Low **Threats**

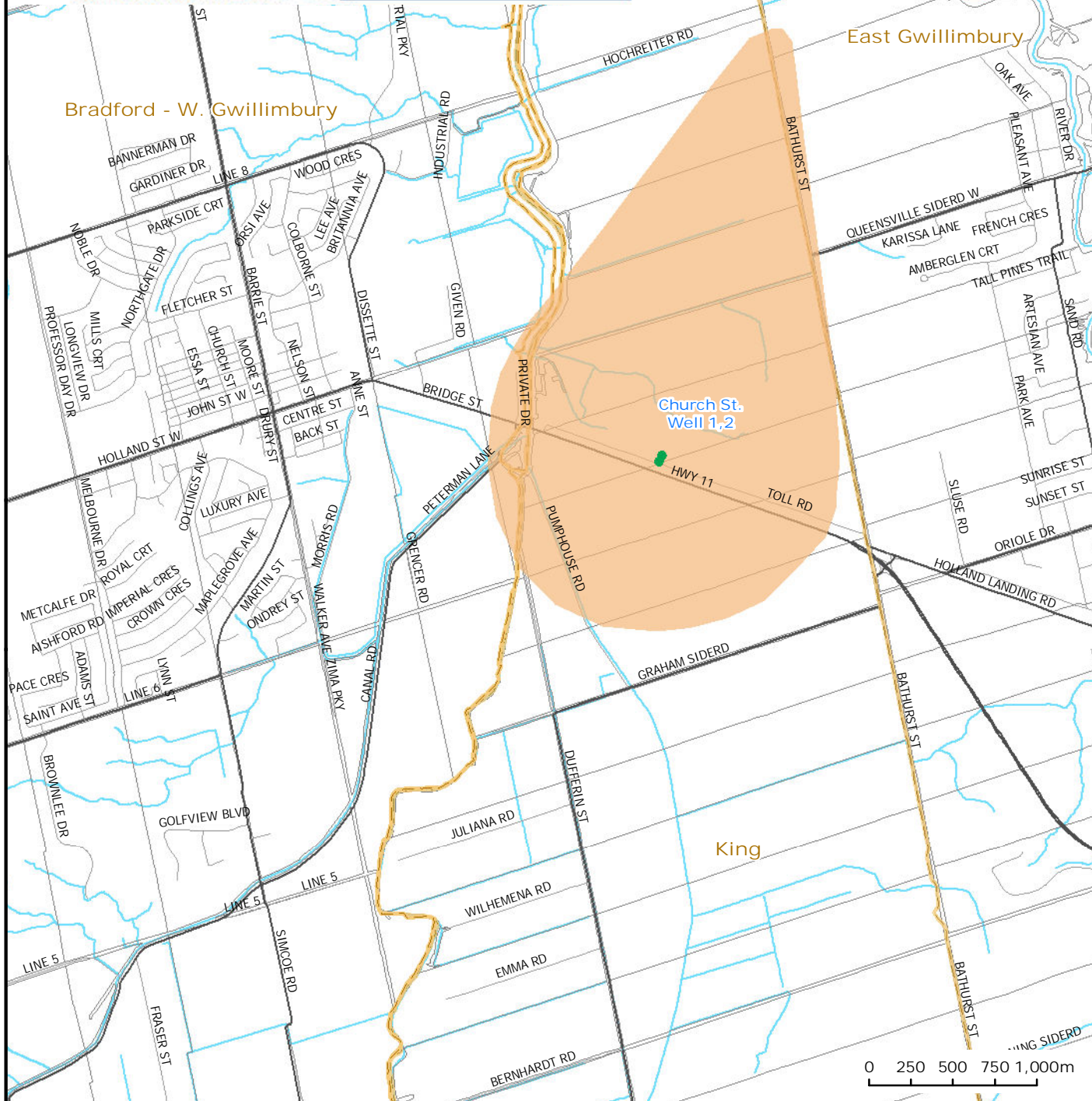
Created by: LSRCA Scale: 1:35,000
Date: 2014-04-08 UTM Zone 17N, NAD83



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 9a-5



- Municipal Supply Well in Bradford-West Gwillimbury
- WHPA-C1: 10-year Time-of-Travel
- Municipality Boundary

Areas Where DNAPLs Are or Would be Significant, Moderate, or Low **Threats**

Created by: LSRCA Scale: 1:35,000
Date: 2014-04-08 UTM Zone 17N, NAD83



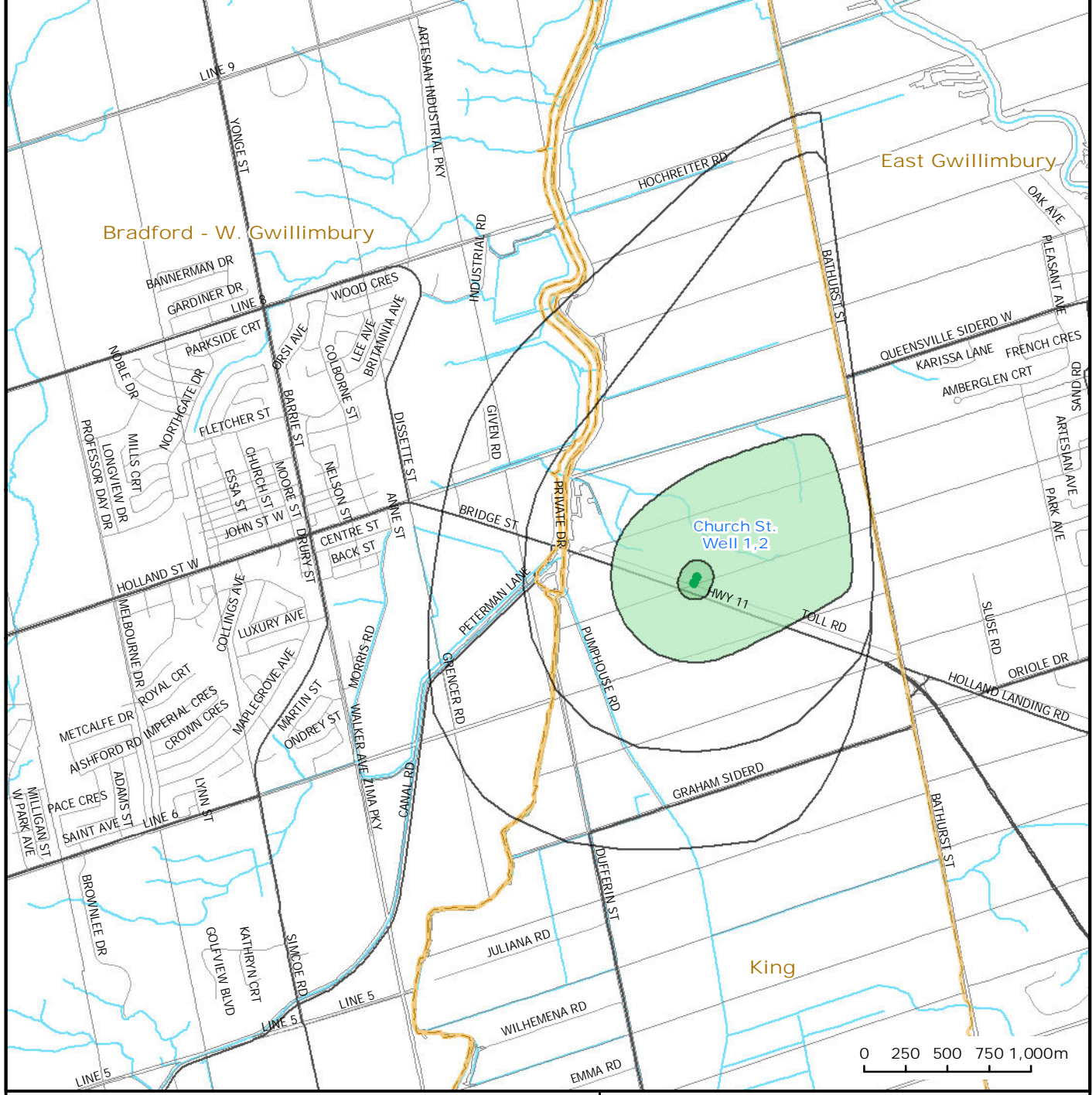
GENIVAR



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 9a-6



- Municipal Supply Well in Bradford-West Gwillimbury
- Managed Lands <40%
- Managed Lands 40-80%
- Managed Lands >80%
- Municipality Boundary

**Managed Land
Bradford-West Gwillimbury**

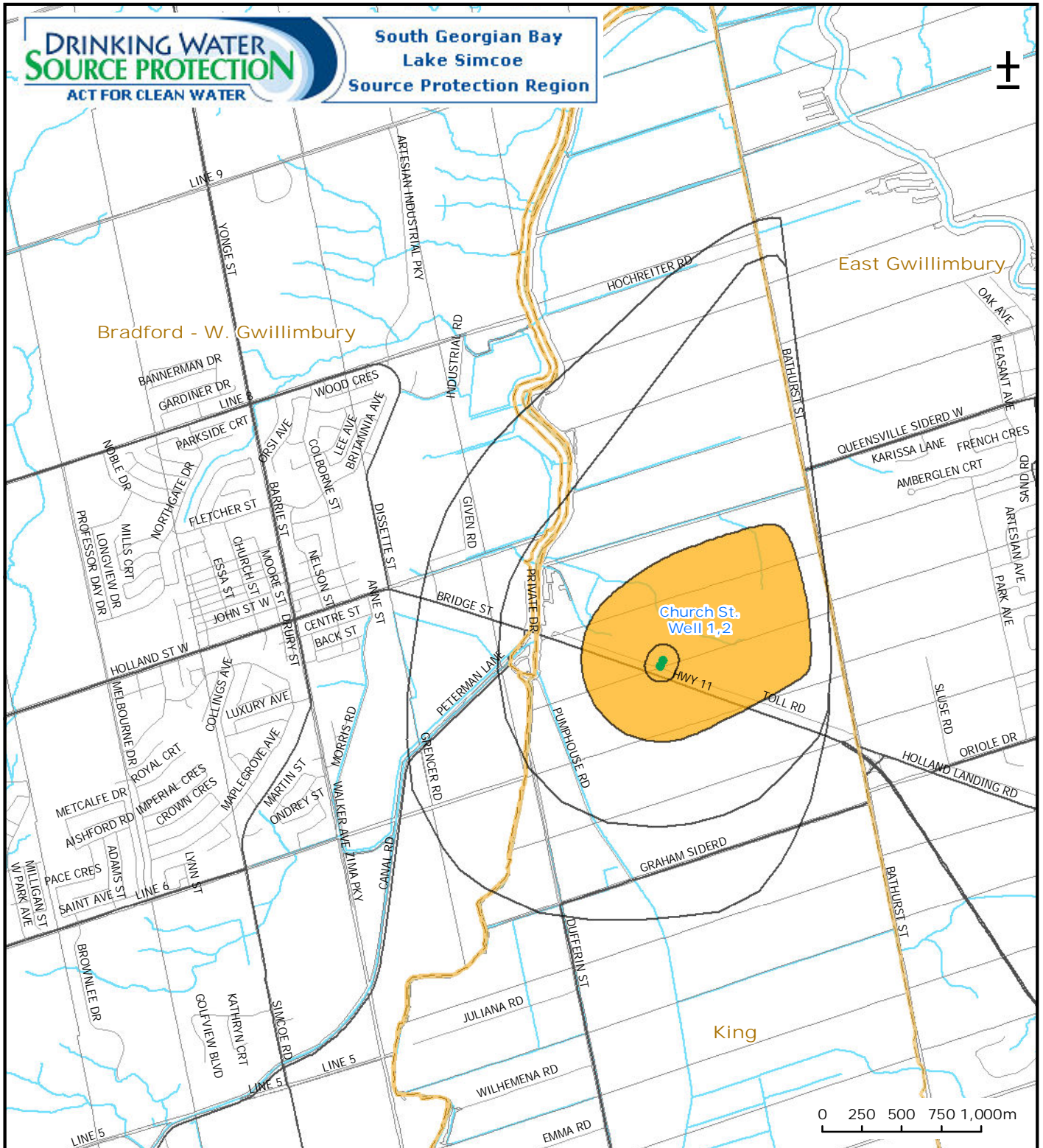
Created by: LSRCA Scale: 1:35,000
Date: 2014-04-08 UTM Zone 17N, NAD83








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 9a-7



-  Municipal Supply Well in Bradford-West Gwillimbury
-  <0.5 NU/Acre
-  0.5-1.0 NU/Acre
-  >1.0 NU/Acre
-  Municipality Boundary

**Livestock Density
Bradford-West Gwillimbury**

Created by: LSRCA Scale: 1:35,000
Date: 2014-04-08 UTM Zone 17N, NAD83



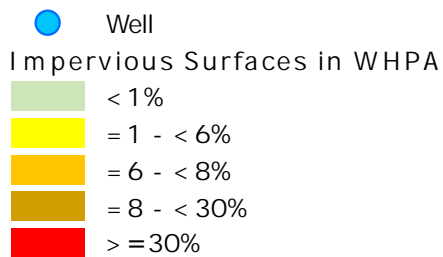
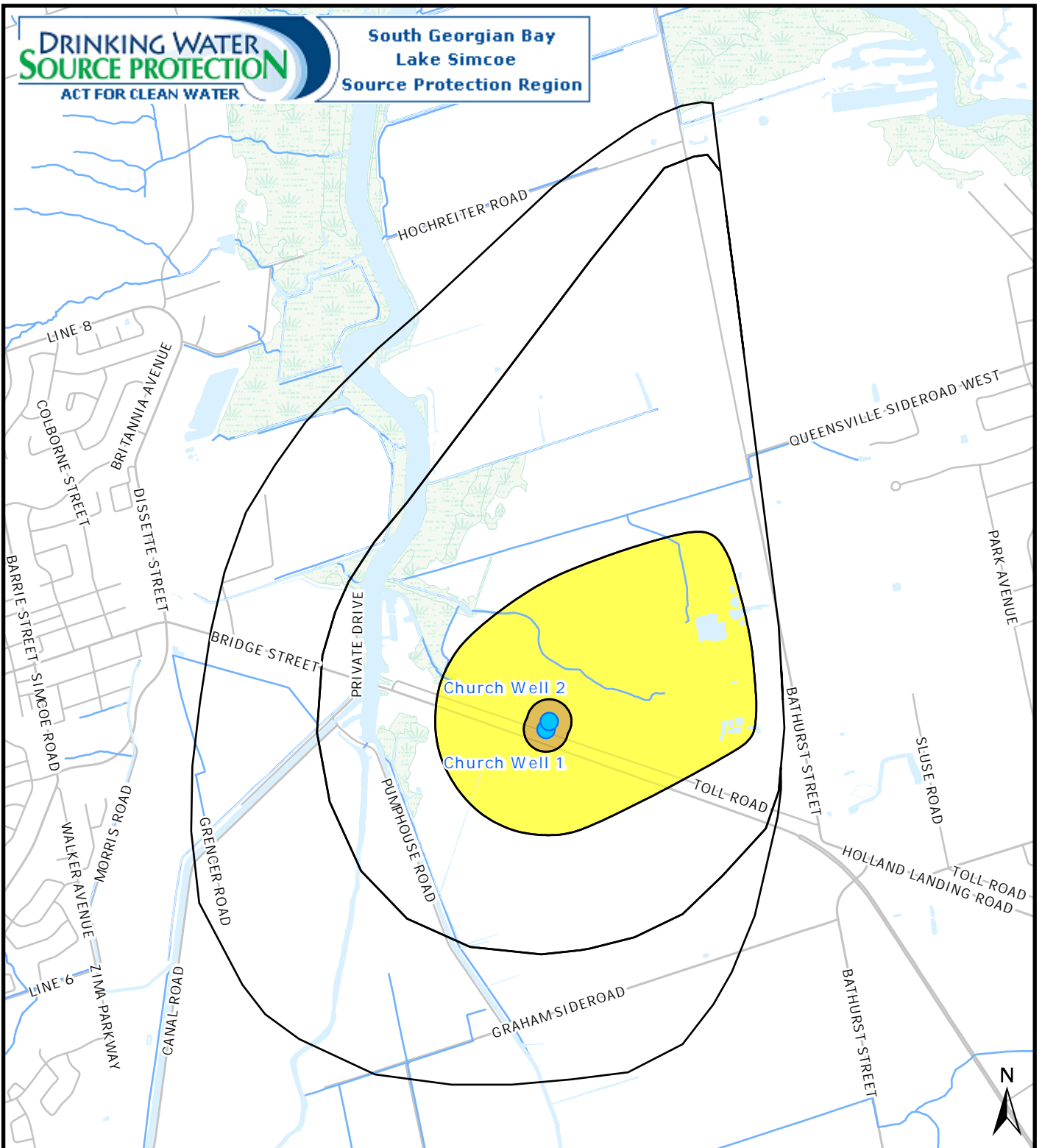
GENIVAR



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.



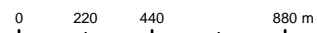
Figure 9a-8



Impervious Surfaces - Bradford WHPA

Created by: LSRCA, 2025-08-05

Scale 1: 25,000



UTM Zone 17N, NAD83



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Figure 9a-9