Chapter 8: Town of Penetanguishene

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8.1 Introduction

This chapter contains information on three drinking water systems for the Town of Penetanguishene. Golder Associates Ltd has 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~~Golder Associates Ltd has completed the work presented, all of which was reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff, Town of Penetanguishene staff, and members of the Source Protection Committee~~.

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

8.2 Drinking Water Systems

The Town of Penetanguishene operates groundwater based water supplies in three (3) communities and has no surface water intakes. As shown in Table 8-1 and Figure 8-1 all of the groundwater supplies are within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR). Table 8-1 also indicates the Source Protection Region and corresponding lead Source Protection Authority (SPA) for the municipal water supplies.

Table 8-18 1: Municipal Groundwater Supplies in the Town of Penetanguishene.

Local Municipality	Community Water Supply	Source Protection Region / Lead Conservation Authority/Environmental Association (CA/EA)
Town of Penetanguishene	Payette	SGBLS SPR & Severn Sound SPA
Town of Penetanguishene	Robert Street West (note: this well is currently not operational)	SGBLS SPR & Severn Sound SPA
Town of Penetanguishene	Lepage Subdivision	SGBLS SPR & Severn Sound SPA

Also, the Lepage and Robert Street West WHPAs extend out of the Town into the Township of Tiny. No WHPAs from other municipalities cross into the Town of Penetanguishene (Table 8-2).

Table 8-28 2: WHPA that cross into and out of the Town of Penetanguishene 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 Tiny	Town of Penetanguishene	Lepage Subdivision	SGBLS SPR & Severn Sound SPA	This Chapter
Township of Tiny	Town of Penetanguishene	Robert Street West	SGBLS SPR & Severn Sound SPA	This Chapter

8.3 Payette Well Supply

The Payette Well Supply is one of three systems that the Town obtains water from and consists of three wells (Wells 1, 2 and 3). The Payette Drive wells (~~MOE~~MECP Drinking Water Information System (DWIS) 220001147) operate under ~~MOE~~MECP[1] Permit to Take Water (PTTW) 5371-6BEK5K. The PTTW was issued on April 27, 2005 and expires on September 30, 2014.

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005).

The major aquifer unit in the study area is referred to as Aquifer A3. It is quite variable in composition, ranging from fine sand to coarse gravel. The thickness of the unit is variable depending on location, but generally ranges from 15 to 50 m. This till unit is the source of groundwater for the major municipal wellfields. It is continuous across most of the numerical model area, and appears to be thickest (up to 50 m) to the west of Midland and south of the Payette Drive Wellfield. In most areas, Aquifer A3 is underlain by up to approximately 20 metres of basal till. This unit appears to be non-existent in some areas, notably in the vicinity of the Robert Street, Payette Drive and parts of the Vindin Wellfield and Well 9 of the Town of Midland well system (See Chapter 7 for information on the Midland system). In these areas, Aquifer A3 is directly underlain by bedrock. The Aquifer A3 is overlain by a confining layer in the vicinity of Penetanguishene Harbour, Midland Bay and Georgian Bay. It is combined with the Aquifer A2 in some areas (i.e., Payette Drive, Vindin Street).

Aquifer A2 is present across almost the entire study area, although it is combined with the Aquifer A3 in places, as noted above. It is a discrete unit in the immediate vicinity of the Robert Street wellfield and the central Midland area, as well as in the highlands to the west. The thickness of this aquifer ranges up to 40 metres or more to the west and 20 metres under Midland. Aquifer A2 is confined over much of the study area. It is unconfined in the vicinity of Penetanguishene Harbour and in the central part of the Town, to the west of the Vindin Street wellfield and to the northeast under Midland. Exceptions to this are the areas in the vicinity of Robert Street and the Sunnyside wells (Town of Midland), where the aquifer is confined, and is under flowing artesian conditions.

The Payette Drive Wells are constructed in Aquifer A3, which is combined with Aquifer A2 in this area. The aquifer is interpreted to extend to Robert Street and under Penetanguishene Harbour as well as further to the west in the Township of Tiny. Artesian conditions are present within the confined lower aquifer near Penetanguishene Harbour (i.e., at Fox Street), downgradient of a primarily unconfined recharge area. A perched upper aquifer is present at the wellfield site and under other parts of Tay Peninsula (the Peninsula) located between Penetanguishene Harbour and Midland Bay. The aquifer is underlain by limestone bedrock in this area; however a basal confining layer is identified to the east and north. It is further noted that Aquifer A3 thins under parts of the Peninsula where the bedrock surface increases. The hydrogeological system at the Robert Street wells consists of distinct Aquifer A2 and A3 units,

[1] Previously, the MOE (The Ministry of the Environment)

both of which are confined and under strongly artesian conditions. The hydrogeology in the upland recharge area south of the Robert Street wells is poorly defined due to the absence of deep drilling log data. Monitoring wells drilled in the vicinity of the closed Midland/Penetanguishene/Tiny (MPT) landfill indicate that the area upgradient of Robert Street is in large part unconfined.

8.3.1 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 Payette water supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that contribute groundwater to the wells were delineated as WHPA. The Groundwater Vulnerability Assessment was carried out as follows:

- Review of WHPA Delineation;
- Assess groundwater Vulnerability (AVI Method);
- Assign Vulnerability Score prior to modifiers (Transport Pathways);
- Consider modifications to Vulnerability Score based on Transport Pathways;
- Assign final Vulnerability Score; and,
- Determine level of uncertainty in Vulnerability assessment.

Detailed methods describing the Vulnerability Analysis completed by Golder (2010b) are provided in Appendix P. Note that the methods used to assign vulnerability scores in the Golder report differ slightly than those within this Assessment Report. The Golder report includes a modification to vulnerability based on water quality. While Directors approval to use this alternate approach was requested under Technical Rule 15.1, approval was only given to increase vulnerability from low to medium, and not to increase vulnerability to high. As permission to only partially increase the vulnerability score was approved, it was recommended not to increase vulnerability due to water quality. An explanation from MOE detailing the reason why the alternate method could not be used is provided in Appendix P.

8.3.1.1 Wellhead Protection Area (WHPA) Delineation

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Town. A detailed description of the groundwater flow modelling undertaken for these wells can be found in the NSGS report (Golder, 2005). An industry standard groundwater modeling software package, MODFLOW, was used to develop the capture zones for the wells in the Town. The capture zones provided are based on previous investigations and have not been altered.

The Payette WHPAs are illustrated on Figure 8a-1. The WHPAs extend north-easterly towards, and beneath, St. Andrews Lake; southwestwards towards and beneath Penetanguishene Harbour; and east-south-easterly to the groundwater divide.

8.3.1.2 Groundwater Vulnerability

The Groundwater Vulnerability within the Payette WHPAs is shown in Figure 8a-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Town in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town are located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability was not considered to accurately reflect the Vulnerability of the municipal supply aquifer in most areas, particularly where it is overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed as part of the NSGS were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 8a-2, Medium Vulnerability is indicated in the western part of the Payette WHPA within WHPA-B through D, and the remaining areas are scored as Low Vulnerability.

8.3.1.3 Transport Pathway Increase

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). The presence of the Transport Pathways should be accounted for in the Vulnerability assessment and include:

- Private water wells, unused water wells and abandoned water wells;
- Construction of underground services;
- Subsurface excavations; and,

- Pits and quarries.

There were no adjustments made to the Vulnerability Scoring for the Payette system, with the exception of private wells.

Due to the substantial depth of the municipal aquifer, it is considered unlikely that underground services or excavations would reach the aquifer. One sand and gravel operation was identified in the west portion of the Payette WHPA-C1 and WHPA-D, however, its depth was not considered sufficient to warrant an increase in the Vulnerability scoring.

Constructed Transport Pathways to an aquifer, for example water wells, can have a locally significant impact on the Vulnerability of an aquifer. The SSEA surveys were aimed at identifying and locating wells within the WHPAs and included a categorization of those wells which pose the highest risk to the aquifer. The wells were classified based on: (1) the physical condition of the well (i.e., Class A, B or C), based on height of the casing above grade and likely condition of the well cap; and (2) increasing risk (category 1, 2, and 3) based on the aquifer they were completed in. Wells with a risk rating of 3C were included as Transport Pathways as they are considered to have the highest risk as this comprises the wells completed to the municipal aquifer which have below standard well casing height. The high risk rating does not imply that these wells necessarily represent a Transport Pathway that is or could cause impact to the municipal aquifer. It implies that, based on the physical condition and depth of the well, there is an increased risk associated with these locations. These are the only wells (3C) that have been used to modify the Vulnerability Scoring, based on the rationale provided in Golder, 2010b. No 3C wells were identified in the Payette WHPA.

8.3.1.4 Vulnerability Score

The WHPA zones for the Payette Water Supply, as shown in Figure 8a-1, the Groundwater Vulnerability, as shown in Figure 8a-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 8a-4 illustrates the Vulnerability Scores for the Payette Water Supply. Figure 8a-4 will be used to assess Drinking Water Threats in Section 8.3.3.

8.3.1.5 WHPA-E ~~/ WHPA-F~~

None of the wells in this study have been identified as Groundwater Under the 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.~~

8.3.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010b and independent peer review. In

situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010b.

The independent peer review of WHPA delineation was undertaken by Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Payette WHPAs is High. The full results of the WHPA delineation Peer Review process, for Payette is available in Appendix P and discussed in Chapter 5 (Methods Overview). Based on the rationale provided for the Vulnerability Assessment (see below), Golder 2010b, characterized uncertainty of the WHPA delineation as Low. As this differs from that provided by the peer review, the most conservative, 'High' Uncertainty ranking will currently apply.

The uncertainty associated with the Vulnerability Assessment was evaluated using a qualitative process outlined in Golder, 2010b. 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.

Considering all of the available data, the uncertainty of the Vulnerability for the Payette Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

8.3.2 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.

The Town of Penetanguishene Drinking Water Issues evaluation was based on a review of water quality data from the NSGS (Golder, 2005), annual drinking water quality reports, and water quality digital data provided by the Town covering 2000 to 2007. Additionally, raw water quality samples were collected by Golder from the Payette Street wells in March 2009 (Golder, 2010b) as part of the Issues evaluation.

Water quality data for the municipal supply wells was assessed to identify parameters (including pathogens) for which there were indications of elevated concentrations. These parameters were further reviewed to determine if: (i) current or projected concentrations exceed the Ontario Drinking Water Quality Standards (ODWQS), (ii) if the parameter was considered to be anthropogenic or natural in origin, and (iii) if the parameter should be made a Drinking Water Issue. The projected concentrations were based on linear regression analysis for the available dataset. Where projected trends at 50 years indicated concentrations which were close to but not exceeding the ODWQS, the most recent data was evaluated to determine if

there was indication of an increase in the trend or stabilization in the concentrations. If recent data indicated concentrations above the projected trend line, the parameter was included as a Drinking Water Issue.

No Drinking Water Issues were identified for the Payette Well Supply.

An increasing trend in chloride concentrations has been observed at Payette Street wells. The increasing trend is most discernible at Well 1, with less obvious trends at Well 2, and stable concentrations at Well 3. The projected trends for the chloride concentrations do not exceed the ODWS within 50 years and therefore are not considered a Drinking Water Issue. Chloride is listed in the ODWQS as an aesthetic objective, however, its origins are considered to be anthropogenic in this area. The chlorides are likely the result of non-point source inputs such as road salt.

8.3.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Payette Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010b (Appendix P). 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 Payette Water Supply 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.

8.3.3.1 List of Drinking Water Threats – Activities

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

The key data sources used to identify Threats on properties included:

- Municipal Property Assessment Corporation (MPAC) (2007) assessment information;
- North Simcoe Groundwater Study (NSGS) Contaminant Source Inventories;
- Hazardous Waste Information Network (HWIN) (2009);
- MOE Records Database (2009);
- Mapping provided by SSEA including landuse (November 2009), storm water and sanitary serviced areas;
- SSEA Livestock Survey (2001) and Biosolids (2007) database; and,
- SSEA Pre-Screening Report (2007).

Section 8.3.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Payette drinking water system.

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

8.3.3.2 List of Drinking Water Threats – Conditions

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. The MOE Records database (2009) included a compilation of files from the MOE District office for properties within approximately 500 m of a municipal well. The database included a number of records relating to Certificates of Approval, Records of Site Condition, miscellaneous reports, waste generator registration information, permits, applications and correspondence. The files in this list of potential Conditions were reviewed in greater detail to determine if there was sufficient evidence to confirm a Condition based on the Technical Rules criteria. The scoring of Condition Threats implemented by Golder uses the precautionary approach of assuming a Hazard Score of 10 since the Condition review methodology did not include detailed evaluation of all potential evidence/documentation that the contamination has not and will not move off-site. This type of information is typically not readily available for contaminated sites.

No confirmed Conditions have been identified for the Payette water supply. No potential Conditions have been identified for consideration at this time.

8.3.3.3 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~~

8.3.3.3.1 Pathogen Parameters

The Technical Rules be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 8a-6 ~~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 Payette Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

8.3.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 8a-7 ~~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 Payette Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

8.3.3.3.3 DNAPL Chemical Parameters

Figure 8a-8 illustrates the area within 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 Payette Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 8a-8 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

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

Further to Section 8.3.3.2, no Conditions have been confirmed within the WHPA for the Payette 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 8a-4 illustrates the Vulnerability Score map for the Payette Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

~~8.3.3.5~~ *Enumerating Drinking Water Threats*

~~8.3.3.4.1~~8.3.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 8.3.2 and 8.3.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. Detailed methodology can be found in Golder, 2010b. Additional refinement of the Significant Drinking Water Threats enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

A number of data sources were utilized as part of the Activity Threat Assessment. The data sources used to obtain Threat information for the GIS based algorithm developed for the project are described in Golder 2010b and summarized in section 8.3.3.1. In most cases, the detailed information required to document the MOE/MECP Circumstances was not readily available. The approach was designed to represent typical Activities occurring at different property types. The approach is considered conservative and, in many cases, likely results in a higher Threat ranking than may otherwise actually be present in many cases. The assumed Circumstances and MOE Hazard Scores are described in Golder, 2010b, and were based on MPAC property codes (and MOE LUT Activities – which has since been replaced with the MECP Threat Lookup Tool: hhtps://threats.swpip.ca). It is noted that the assessment has not involved field verification or site visits to validate information.

The Threat ranking algorithm was designed to perform the Threat rankings in an automated manner for properties within the WHPAs. The Threat ranking algorithm process begins with a yes/no question for each Prescribed Threat (e.g., Application of Agricultural Source Material (ASM) to Land, Application of Road Salt) to assess if the Activity is occurring on the property. If the answer was no, then no Threat was identified, and the algorithm did not calculate a Risk Score for that Threat. If the answer was yes, the algorithm proceeded to the Hazard Score related to the assumed Circumstance using the MOE LUT database.

The input data lead the algorithm to relevant reference IDs in the MOE Drinking Water Threats Tables that reflect the Circumstances identified on the property. A lookup table is used to link the selected Circumstance to an MOE Hazard Score which, when multiplied by the Vulnerability Score, provides the resultant Risk Score for the Threat in question. When multiple chemical parameter Circumstances are present for a given Threat, Risk Scores are calculated for each parameter and the highest score is tabulated for the Threat. It is noted that the Vulnerability Score used to rank a property is based on the maximum Vulnerability Score intersected by the parcel for the WHPA being evaluated. Finally, if the calculated Risk Score for a Threat is greater than or equal to 80, the Threat is ranked as Significant.

Two unique 'polygon' Threats were assigned to each WHPA with a Vulnerability Score of 10 in accordance with the common methodology developed by SGBLS (SGBLS, 2010). For the Threat 'sewage system or sewage works – sanitary sewers and related pipes', one Threat was assigned to each WHPA to account for the potential Threat that could exist related to the sanitary network. One Threat was assigned to represent the entire network since detailed information regarding distribution and conveyance capacities was not readily available within some study areas. The second polygon Threat assigned was related to domestic fuel storage (i.e. Fuel Storage) which may be on a property as a primary source of heating fuel. One fuel storage Threat was assigned to each WHPA where there was a high probability that natural gas was not available in the area. Generally in urban areas, where natural gas was probable, the polygon Fuel Threat was not assigned.

Some Threats such as the Application of Agricultural Source Material to Land have Circumstances based on datasets that are on a scale larger than individual properties. These Circumstances included percent Managed Lands, Livestock Density and Impervious Surfaces. Therefore, additional calculations were required to determine these Circumstances for each WHPA. The percent Managed Lands and Livestock Density calculations were completed for this project using a methodology developed in consultation with the South Georgian Bay-Lake Simcoe Source Protection Region and was based on the MOE Technical Bulletin for Managed Land and Livestock Density Calculations (MOE, September 2009). The percent Managed Land and the Livestock Density of an area is used as an estimation to represent the quantity of nutrients present as a result of nutrient generation, storage and land application within a WHPA. Managed Lands, Livestock Density and Impervious Surfaces are discussed in more detail below.

~~8.3.3.4.1.1~~8.3.3.5.1.1 *Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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~~Technical Rules.

Managed Lands were identified and the Managed Lands proportions were determined for the Payette WHPA as outlined in Golder, 2010b.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 8.3.3.5.2). Figure 8a-9 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Payette Water Supply where Vulnerability Scores were 6 or greater for WHPA-A to WHPA-D. The Managed Land within all of the Payette WHPA is within the lowest threshold of 0 to 40%.

~~8.3.3.4.1.2~~8.3.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

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~~Technical Rules.

The Livestock Density was determined for the Payette WHPA as outlined in Golder, 2010b. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 8.3.3.5.2). Figure 8a-10 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Payette 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 expected, the livestock density calculations result in <0.5 NU/acres within all of Payette WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

~~8.3.3.4.1.3~~8.3.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) (~~August 2009~~December 2021) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and -E~~ E~~. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in ~~Part XII of~~ the Technical Rules ~~(December 2021)~~~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Payette WHPA was determined in accordance with the methodology in Golder, 2010b. 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 8.3.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 8a-11 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Payette Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8% to 80% has been assigned within all lands contained within the WHPA limits.~~

~~8.3.3.4.2~~8.3.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 8-3 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Payette Water Supply.

A total of eight (8) activities that are considered to be Significant Drinking Water Threats were identified in association with eight (8) land parcels in the WHPA for the Payette Water Supply. One (1) parcel was identified as having Significant Threat activities relating to the use of a private sewage disposal system. Six (6) Threats have been identified that relate to the potential handling and storage of DNAPLs. One (1) threat and parcel has been included to address the potential presence of municipal sanitary sewers and connections within the WHPA where the Vulnerability Score is 10. There are no Threats related to Issues or Conditions identified in the Payette WHPA.

Table 8-~~38 3~~: Number of Parcels with Significant Threat Activities for the Payette Water Supply.

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

Threat Number	Threat	Significant threat counts Number of threats
17.	The handling and storage of an organic solvent.	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0
-	**Totals:**	**8*** significant threats (on **8** properties)

*3 verified existing Threats and 5 potential Threats that require further investigation

8.4 Robert Street Well Supply

The Robert Street Well Supply is one of three systems that the Town obtains water from and consists of two wells (Wells 2 and 3). The Robert Street wells are not currently operational due to water quality Issues which are discussed in Section 8.4.2 but are authorized under PTTW 97-P-1081.

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005).

The major aquifer unit in the study area is referred to as Aquifer A3. It is quite variable in composition, ranging from fine sand to coarse gravel. The thickness of the unit is variable depending on location, but generally ranges from 15 to 50 m. This till unit is the source of groundwater for the major municipal wellfields. It is continuous across most of the numerical model area, and appears to be thickest (up to 50 m) to the west of Midland and south of the Payette Drive Wellfield. In most areas, Aquifer A3 is underlain by up to approximately 20 metres of basal till. This unit appears to be non-existent in some areas, notably in the vicinity of the Robert Street, Payette Drive and parts of the Vindin Wellfield and Well 9 of the Town of Midland well system (See Chapter 7 for information on the Midland system). In these areas, Aquifer A3 is directly underlain by bedrock. The Aquifer A3 is overlain by a confining layer in the

vicinity of Penetanguishene Harbour, Midland Bay and Georgian Bay. It is combined with the Aquifer A2 in some areas (i.e., Payette Drive, Vindin Street).

Aquifer A2 is present across almost the entire study area, although it is combined with the Aquifer A3 in places, as noted above. It is a discrete unit in the immediate vicinity of the Robert Street wellfield and the central Midland area, as well as in the highlands to the west. The thickness of this aquifer ranges up to 40 metres or more to the west and 20 metres under Midland. Aquifer A2 is confined over much of the study area. It is unconfined in the vicinity of Penetanguishene Harbour and in the central part of the Town, to the west of the Vindin Street wellfield and to the northeast under Midland. Exceptions to this are the areas in the vicinity of Robert Street and the Sunnyside wells (Town of Midland), where the aquifer is confined, and is under flowing artesian conditions.

The Payette Drive Wells are constructed in Aquifer A3, which is combined with Aquifer A2 in this area. The aquifer is interpreted to extend to Robert Street and under Penetanguishene Harbour as well as further to the west in Tiny Township. Artesian conditions are present within the confined lower aquifer near Penetanguishene Harbour (i.e., at Fox Street), downgradient of a primarily unconfined recharge area. A perched upper aquifer is present at the wellfield site and under other parts of Tay Peninsula (the Peninsula) located between Penetanguishene Harbour and Midland Bay. The aquifer is underlain by limestone bedrock in this area; however a basal confining layer is identified to the east and north. It is further noted that Aquifer A3 thins under parts of the Peninsula where the bedrock surface increases. The hydrogeological system at the Robert Street wells consists of distinct Aquifer A2 and A3 units, both of which are confined and under strongly artesian conditions. The hydrogeology in the upland recharge area south of the Robert Street wells is poorly defined due to the absence of deep drilling log data. Monitoring wells drilled in the vicinity of the closed Midland/Penetanguishene/Tiny (MPT) landfill indicate that the area upgradient of Robert Street is in large part unconfined.

8.4.1 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 Robert Street water supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that

contribute groundwater to the wells were delineated as WHPA. The Groundwater Vulnerability Assessment was carried out as follows:

The Groundwater Vulnerability Assessment was carried out as follows:

- Review of WHPA Delineation;
- Assess groundwater Vulnerability (AVI Method);
- Assign Vulnerability Score prior to modifiers (Transport Pathways);
- Consider modifications to Vulnerability Score based on Transport Pathways;
- Assign final Vulnerability Score; and,
- Determine level of uncertainty in Vulnerability assessment.

Details of the methods for the Vulnerability Analysis and details of the work performed to assess the Groundwater Vulnerability for the Robert Street Water Supply are provided are provided in Golder, 2010b.

8.4.1.1 Wellhead Protection Area (WHPA) Delineation

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Town. A detailed description of the groundwater flow modelling undertaken for these wells can be found in the NSGS report (Golder, 2005). An industry standard groundwater modeling software package, MODFLOW, was used to develop the capture zones for the wells in the Town. The capture zones provided are based on previous investigations and have not been altered.

The Robert Street WHPAs are illustrated on Figure 8a-1. The Robert Street WHPA extends south-westerly to the uplands areas west of the Town. A significant portion of the recharge to this well system occurs in the rural areas beyond the limits of the Town.

8.4.1.2 Groundwater Vulnerability

The Groundwater Vulnerability within the Robert Street WHPAs is shown in Figure 8a-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Town in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town are located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability was not considered to accurately reflect the Vulnerability of the municipal supply aquifer in most areas, particularly where it is overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the

Vulnerability. The layers from the calibrated numerical model developed as part of the NSGS were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 8a-2, Low Vulnerability is indicated over most of this area with the exception of a small portion of the WHPA-C1.

8.4.1.3 Transport Pathway Increase

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). The presence of the Transport Pathways should be accounted for in the Vulnerability assessment and include:

- Private water wells, unused water wells and abandoned water wells;
- Construction of underground services;
- Subsurface excavations; and,
- Pits and quarries.

There were no adjustments made to the Vulnerability Scoring for the Robert Street system, with the exception of private wells. Due to the substantial depth of the municipal aquifer, it is considered unlikely that underground services or excavations would reach the aquifer.

Constructed Transport Pathways to an aquifer, for example water wells, can have a locally significant impact on the Vulnerability of an aquifer. The SSEA surveys were aimed at identifying and locating wells within the WHPAs and included a categorization of those wells which pose the highest risk to the aquifer. The wells were classified based on: (1) the physical condition of the well (i.e., Class A, B or C), based on height of the casing above grade and likely condition of the well cap; and (2) increasing risk (category 1, 2, and 3) based on the aquifer they were completed in. Wells with a risk rating of 3C were included as Transport Pathways as they are considered to have the highest risk as this comprises the wells completed to the municipal aquifer which have below standard well casing height. The high risk rating does not imply that these wells necessarily represent a Transport Pathway that is or could cause impact to the municipal aquifer. It implies that, based on the physical condition and depth of the well, there is an increased risk associated with these locations. These are the only wells (3C) that have been used to modify the Vulnerability Scoring, based on the rationale provided in Golder, 2010b.

3C wells were identified in the Robert Street WHPA (four locations). The Vulnerability at these well locations was increased one level within a 30 m buffer of the well. Location of the Transport Pathways is shown in Figure 8a-4.

8.4.1.4 Vulnerability Score

The WHPA zones for the Robert Street Water Supply, as shown in Figure 8a-1, the Groundwater Vulnerability, as shown in Figure 8a-2, and increases due to Transport Pathways (Section 8.4.1.3) were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5:

Methods Overview, Section 5.2.4). Figure 8a-4 illustrates the Vulnerability Scores for the Robert Street Water Supply. Figure 8a-4 will be used to assess Drinking Water Threats in Section 8.4.3.

8.4.1.5 WHPA-E ~~/ WHPA-F~~

None of the wells in this study have been identified as Groundwater Under the 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.~~

8.4.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010b and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010b.

The independent peer review of WHPA delineation was undertaken by Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Robert Street WHPAs is High. The full results of the WHPA delineation Peer Review process, for Robert Street is available in Appendix P and discussed in Chapter 5 (Methods Overview). Based on the rationale provided for the Vulnerability Assessment (see below), Golder 2010b, characterized uncertainty of the WHPA delineation as Low. As this differs from that provided by the peer review, the most conservative, 'High' Uncertainty ranking will currently apply.

The uncertainty associated with the Vulnerability Assessment was evaluated using a qualitative process outlined in Golder, 2010b. 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.

Considering all of the available data, the uncertainty of the Vulnerability for the Robert Street Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

8.4.2 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.

The Town of Penetanguishene Drinking Water Issues evaluation was based on a review of water quality data from the NSGS (Golder, 2005), annual drinking water quality reports, and water quality digital data provided by the Town covering 2000 to 2007. Additionally, raw water quality samples were collected by Golder from the Payette Street wells in March 2009 (Golder, 2010b) as part of the Issues evaluation.

Water quality data for the municipal supply wells was assessed to identify parameters (including pathogens) for which there were indications of elevated concentrations. These parameters were further reviewed to determine if: (i) current or projected concentrations exceed the Ontario Drinking Water Quality Standards (ODWQS), (ii) if the parameter was considered to be anthropogenic or natural in origin, and (iii) if the parameter should be made a Drinking Water Issue. The projected concentrations were based on linear regression analysis for the available dataset. Where projected trends at 50 years indicated concentrations which were close to but not exceeding the ODWQS, the most recent data was evaluated to determine if there was indication of an increase in the trend or stabilization in the concentrations. If recent data indicated concentrations above the projected trend line, the parameter was included as a Drinking Water Issue.

Trichloroethylene (TCE) was identified as a Drinking Water Issue for the Robert Street Well Supply.

Elevated concentrations of industrial organic compounds have been detected at the Robert Street wellfield. Analyses of groundwater obtained in 1991 from the Robert Street wells indicated concentrations of TCE ranging up to 314 µg/L in Well 2 and 42.7 µg/L in Well 3 Sampling conducted in 1997 indicated TCE concentrations of 64.3 µg/L in Well 2 and 8.2 µg/L in Well 3. Most recent samples collected in 2006 indicated TCE concentrations of 62 µg/L in Well 2 and 15 µg/L in Well 3. These concentrations exceed the ODWQS of 5 µg/L for TCE.

In addition to the contamination observed at the Robert Street wells, TCE and cis-DCE (cis-dichloroethylene) have been identified at the Beacon Bay Marina well (well record 5723680). Concentrations of these parameters at this well in 1991 were at a maximum of 0.2 and 2.8 µg/L respectively. Concentrations increased in both 1994 and 1995, to 4.4 µg/L (TCE) and 27.6 µg/L (cis-DCE) by 1995.

The results of the sampling, which indicate higher contaminant concentrations in Well 2, suggest that the organic plume is in the eastern part of the capture zone. Since the TCE was identified at the Robert Street wells the Town of Penetanguishene has undertaken investigations in the area to provide a better understanding of the hydrogeology and TCE identified (Dixon 1992, 1996, 1997). The source of the TCE contamination to the Robert Street wells is not known with certainty. TCE has been identified in the immediate vicinity of the MPT landfill site. The WHPAs for the Robert Street wells extends to this area. The County has an active sampling program of monitoring wells at the MPT landfill site which monitors water quality, including TCE, in the area. The County's biennial monitoring report identifies multiple sources of TCE, including land used adjacent and in the immediate vicinity of the MPT landfill.

The County further notes that the TCE present in many of the wells monitored are up gradient or cross gradient from the landfill identifying other sources of TCE.

The monitoring of TCE at the Robert Street wells presents a challenge as the wells are not currently operational and do not have treatment for TCE and the TCE concentrations are above the Provincial Water Quality Objectives which limits discharge options. The most recent monitoring of TCE at the Robert Street wells occurred in 2006 which required approval from the MOE/MECP to discharge to the adjacent Copeland Creek.

The Robert Street wells are not currently used by the Town. Before these wells are brought back on-line, a treatment facility will be constructed to treat the volatile organic compounds found at these wells. Recognizing these realities and the overall objectives of source water protection, it was determined through consultation with the SGBLS, SSEA and the Town of Penetanguishene to identify the TCE as a Drinking Water Issue. The Issue Contributing Area has been defined as the entire WHPA for the Robert Street wells (Figure 8a-5).

When a Drinking Water Issues is identified, the Technical Rules require the following to be prepared:

- A List of prescribed drinking water threats activities that may lead to the Issue is to be prepared (See section 8.4.3.1). No additional local circumstances were identified by the SPC that may be lead to the Drinking Water Issue.
- Conditions that may contribute to the Issue were investigated and two conditions related to the Issue were identified (Section 8.4.3.2)
- A list of the threat activities, land uses and circumstances that could contribute to the Drinking Water Issue has been prepared and a Map has been prepared to illustrate the Issues Contributing Area where these activities are or would a Significant, drinking water threat (Section 8.4.3.3.4).
- All current activities, land uses and circumstances that could contribute to the Drinking Water Issue within the Issues Contributing Area have been identified and included in the table of enumerated significant threats (Section 8.4.3.5.2).

8.4.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Robert Street Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010b (Appendix P). 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 Robert Street Water Supply 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.

8.4.3.1 List of Drinking Water Threats – Activities

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

The key data sources used to identify Threats on properties included:

- Municipal Property Assessment Corporation (MPAC) (2007) assessment information;
- North Simcoe Groundwater Study (NSGS) Contaminant Source Inventories;
- Hazardous Waste Information Network (HWIN) (2009);
- MOE Records Database (2009);
- Mapping provided by SSEA including landuse (November 2009), storm water and sanitary serviced areas;
- SSEA Livestock Survey (2001) and Biosolids (2007) database; and,
- SSEA Pre-Screening Report (2007).

Section 8.4.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Robert Street drinking water system.

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

8.4.3.2 List of Drinking Water Threats – Conditions

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. The MOE Records database (2009) included a compilation of files from the MOE District office for properties within approximately 500 m of a municipal well. The database included a number of records relating to Certificates of Approval, Records of Site Condition, miscellaneous reports, waste generator registration information, permits, applications and correspondence. The files

in this list of potential Conditions were reviewed in greater detail to determine if there was sufficient evidence to confirm a Condition based on the Technical Rules criteria. The scoring of Condition Threats implemented by Golder uses the precautionary approach of assuming a Hazard Score of 10 since the Condition review methodology did not include detailed evaluation of all potential evidence/documentation that the contamination has not and will not move off-site. This type of information is typically not readily available for contaminated sites.

Two confirmed Conditions have been identified for the Robert Street water supply. No potential Conditions have been identified for consideration at this time.

Two Conditions were identified in the Town WHPAs with a summary of information provided in Golder, 2010b. The first Condition is related to the TCE observed at the Robert Street Wells 2 and 3. TCE concentrations at these locations fit the criteria of a Condition as they are the result of past Activities and concentrations exceed the potable groundwater standards. The source of the TCE Condition is not known with certainty. TCE has been identified in the immediate vicinity of the former MPT landfill site (currently used as a transfer station) and is within the Robert Street WHPA-D. The Condition at the Robert Street wells, based on the Risk Score calculation, is considered a Significant Drinking Water Threat.

The second Condition is related to the TCE identified at the MPT landfill site. Concentrations of TCE at site monitoring wells have ranged from greater than 0.001 mg/L to 0.697 mg/L (Jagger Hims, 1994) and are observed to still exceed the ODWQS limits in some monitoring locations based on recent monitoring data. The County has an ongoing sampling program for monitoring wells at the MPT landfill which monitors water quality, including TCE, in the area. Based on the Risk Score calculation, this Condition is considered a Moderate Drinking Water Threat. However, since there is a Drinking Water Issue identified in the Robert Street WHPA for TCE, this Condition is automatically bumped to a Significant Drinking Water Threat (see Section 8.4.2).

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

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

8.4.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 8a-6 ~~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 Robert Street Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

8.4.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 8a-7 ~~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 Robert Street Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

8.4.3.3.3 DNAPL Chemical Parameters

Figure 8a-8 illustrates the area within 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 Robert Street Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 8a-8 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

8.4.3.3.4 TCE Drinking Water Issue

TCE was identified as a Drinking Water Issue. As per the Technical Rules, land use activities that can release parameters that are identified as a Drinking Water Issue within the identified Issues Contributing Area are to be considered as Significant Drinking Water Threats. ~~Appendix P provides a list of the land uses that can potentially release TCE to the environment within the identified Issues Contributing Area (Figure 8a-5).~~

Figure 8a-5 illustrates the Issues Contributing Area where activities ~~and circumstances listed in Appendix P~~ are considered to be a Significant Drinking Water Threat for the Robert Street Well Supply.

Table 8-4: Number of Significant Circumstances that are or would be Significant Threats for TCE in the WHPA-ICA.

Parameter	Threat Subcategory	Quantity Threshold for a Significant Threat (ICA)
Trichloroethylene (TCE)	Landfilling (Hazardous Waste or Liquid Industrial Waste)	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Landfilling (Municipal Waste)	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Liquid Industrial Waste Injection into a well	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Storage of Subject Waste at a Waste Generation Facility: site requires generator registration under Section 3 of O. Reg. 347	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Industrial Effluent Discharges	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Wastewater Collection Facilities and Associated Parts	Any quantity for IPZs/WHPA-Es; > 1000 m3/day for WHPAs
Trichloroethylene (TCE)	Wastewater Treatment Facilities and Associated Parts	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Handling and Storage of a Dense Non-Aqueous Phase Liquid (DNAPL)	Any quantity for IPZs/WHPA-Es and WHPAs

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

Further to Section 8.4.3.2, two Conditions have been confirmed within the WHPA for the Robert Street 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 8a-4 illustrates the Vulnerability Score map for the Robert Street Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

8.4.3.5 Enumerating Drinking Water Threats

~~8.4.3.4.1~~8.4.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 8.4.2 and 8.4.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 8.3.3.5.1. Detailed methodology can be found in Golder, 2010b. Additional refinement of the Significant Drinking Water Threats enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

~~8.4.3.4.1.1~~8.4.3.5.1.1 *Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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~~Technical Rules.

Managed Lands were identified and the Managed Lands proportions were determined for the Robert Street WHPA as outlined in Golder, 2010b.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 8.4.3.5.2). Figure 8a-9 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Robert Street Water Supply where Vulnerability Scores were 6 or greater for WHPA-A to WHPA-D. The Managed Land within all of the Robert Street WHPA is within the lowest threshold of 0 to 40%.

~~8.4.3.4.1.2~~8.4.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

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~~Technical Rules.

The Livestock Density was determined for the Robert Street WHPA as outlined in Golder, 2010b. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 8.4.3.5.2). Figure 8a-10 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Robert Street 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. The livestock density calculations result in <0.5

NU/acres within all of Robert Street WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

~~8.4.3.4.1.3~~8.4.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) (~~August 2009~~December 2021) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and -E~~ E~~. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in ~~Part XII of~~ the Technical Rules ~~(December 2021)~~~~in the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Robert Street WHPA was determined in accordance with the methodology in Golder, 2010b. 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 8.4.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 8a-11 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Robert Street Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8% to 80% has been assigned within all lands contained within the WHPA limits.~~

~~8.4.3.4.2~~8.4.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 8-4 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Robert Street Water Supply.

A total of eleven (11) activities that are considered to be Significant Drinking Water Threats were identified in association with nine (9) land parcels in the WHPA for the Robert Street Water Supply. One (1) potential Threat was identified related to the handling and storage of fuel. Additionally, 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. Seven (7) Threats have been identified that relate to the potential handling and storage of DNAPLs and one (1) Threat was identified that relates to the potential handling and storage of organic solvents. One (1) threat and parcel has been included to address the potential presence of municipal sanitary sewers and connections within the WHPA where the Vulnerability Score is 10.

The total number of Significant Threats includes those that were increased to Significant because of the Drinking Water Issue. These parcels are located within the Issue Contributing Area and have a Prescribed Threat related to TCE. Two Significant threats related to Conditions

as described in section 8.4.3.2, both related to the Drinking Water Issue of TCE, were identified in the Robert Street WHPA.

Table 8-5~~8~~ ~~4~~: Number of Significant Threat Activities for the Robert Street Water Supply.

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

Threat Number	Threat	Significant threat counts Number of threats
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0
-	**Totals:**	**11*** significant threats (on **9** properties)

*1 verified existing Threat and 10 potential Threats that require further investigation (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

8.5 Lepage Well Supply

The Lepage Well Supply is one of three systems that the Town obtains water from and consists of two wells (Wells 1and 2). The Lepage wells (DWIS 22006838) operate under PTTW 91-P3062 issued on March 9, 2001 and expires on March 15, 2011.

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005).

The major aquifer unit in the study area is referred to as Aquifer A3. It is quite variable in composition, ranging from fine sand to coarse gravel. The thickness of the unit is variable depending on location, but generally ranges from 15 to 50 m. This till unit is the source of groundwater for the major municipal wellfields. It is continuous across most of the numerical model area, and appears to be thickest (up to 50 m) to the west of Midland and south of the Payette Drive Wellfield. In most areas, Aquifer A3 is underlain by up to approximately 20 metres of basal till. This unit appears to be non-existent in some areas, notably in the vicinity of the Robert Street, Payette Drive and parts of the Vindin Wellfield and Well 9 of the Town of Midland well system (See Chapter 7 for information on the Midland system). In these areas, Aquifer A3 is directly underlain by bedrock. The Aquifer A3 is overlain by a confining layer in the

vicinity of Penetanguishene Harbour, Midland Bay and Georgian Bay. It is combined with the Aquifer A2 in some areas (i.e., Payette Drive, Vindin Street).

Aquifer A2 is present across almost the entire study area, although it is combined with the Aquifer A3 in places, as noted above. It is a discrete unit in the immediate vicinity of the Robert Street wellfield and the central Midland area, as well as in the highlands to the west. The thickness of this aquifer ranges up to 40 metres or more to the west and 20 metres under Midland. Aquifer A2 is confined over much of the study area. It is unconfined in the vicinity of Penetanguishene Harbour and in the central part of the Town, to the west of the Vindin Street wellfield and to the northeast under Midland. Exceptions to this are the areas in the vicinity of Robert Street and the Sunnyside wells (Town of Midland), where the aquifer is confined, and is under flowing artesian conditions.

The Lepage Wellfield is interpreted to be constructed in the Aquifer A2; however this unit may be connected to Aquifer A3 in this area. The aquifer is locally unconfined, but becomes confined under Penetanguishene Harbour, as well as to the west, in the upland recharge area. In general, the groundwater flow in Aquifer A3 is from recharge areas in the uplands to the west of Midland and south of Penetanguishene and from the central part of the Tay Peninsula, discharging to Penetanguishene Harbour and Midland Bay. St. Andrews (Penetanguishene) and Little Lake (Town of Midland) and possibly, but to a lesser extent, Lalligan Lake (southwest of Penetanguishene in the Township of Tiny), are recharge areas.

The former two lakes have no outlets, and therefore any water flowing into them either evaporates or infiltrates into the underlying aquifers. The discharge areas surrounding Penetanguishene Harbour and in the vicinity of the Vindin Street (Midland) wells are under flowing artesian conditions.

8.5.1 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 Lepage water supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that contribute groundwater to the wells were delineated as WHPA. The Groundwater Vulnerability Assessment was carried out as follows:

- Review of WHPA Delineation;

- Assess groundwater Vulnerability (AVI Method);
- Assign Vulnerability Score prior to modifiers (Transport Pathways);
- Consider modifications to Vulnerability Score based on Transport Pathways;
- Assign final Vulnerability Score; and,
- Determine level of uncertainty in Vulnerability assessment.

Details of the methods for the Vulnerability Analysis and details of the work performed to assess the Groundwater Vulnerability for the Lepage Water Supply are provided are provided in Golder, 2010b. Note that the methods used to assign vulnerability scores in the Golder report differ slightly than those within this Assessment Report. The Golder report includes a modification to vulnerability based on water quality. While Directors approval to use this alternate approach was requested under Technical Rule 15.1, approval was only given to increase vulnerability from low to medium, and not to increase vulnerability to high. As permission to only partially increase the vulnerability score was approved, it was recommended the not to increase vulnerability due to water quality.

8.5.1.1 Wellhead Protection Area (WHPA) Delineation

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Town. A detailed description of the groundwater flow modelling undertaken for these wells can be found in the NSGS report (Golder, 2005). An industry standard groundwater modeling software package, MODFLOW, was used to develop the capture zones for the wells in the Town. The capture zones provided are based on previous investigations and have not been altered.

The Lepage WHPAs are illustrated on Figure 8a-1. The WHPAs extend westerly towards the upland areas. The capture zones are narrow in comparison to the Payette and Robert Street systems due to the relatively low pumping rates at these wells.

8.5.1.2 Groundwater Vulnerability

The Groundwater Vulnerability within the Lepage WHPAs is shown in Figure 8a-3.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Town in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town are located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability was not considered to accurately reflect the Vulnerability of the municipal supply aquifer in most areas, particularly where it is overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer

units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed as part of the NSGS were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 8a-3 High Vulnerability is indicated throughout most of WHPA-A, B and C1, with the exception of Medium to Low Vulnerability at the outer reaches of the WHPA.

8.5.1.3 Transport Pathway Increase

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). The presence of the Transport Pathways should be accounted for in the Vulnerability assessment and include:

- Private water wells, unused water wells and abandoned water wells;
- Construction of underground services;
- Subsurface excavations; and,
- Pits and quarries.

There were no adjustments made to the Vulnerability Scoring for the Lepage system, with the exception of private wells. Due to the substantial depth of the municipal aquifer, it is considered unlikely that underground services or excavations would reach the aquifer.

Constructed Transport Pathways to an aquifer, for example water wells, can have a locally significant impact on the Vulnerability of an aquifer. The SSEA surveys were aimed at identifying and locating wells within the WHPAs and included a categorization of those wells which pose the highest risk to the aquifer. The wells were classified based on: (1) the physical condition of the well (i.e., Class A, B or C), based on height of the casing above grade and likely condition of the well cap; and (2) increasing risk (category 1, 2, and 3) based on the aquifer they were completed in. Wells with a risk rating of 3C were included as Transport Pathways as they are considered to have the highest risk as this comprises the wells completed to the municipal aquifer which have below standard well casing height. The high risk rating does not imply that these wells necessarily represent a Transport Pathway that is or could cause impact to the municipal aquifer. It implies that, based on the physical condition and depth of the well, there is an increased risk associated with these locations. These are the only wells (3C) that have been used to modify the Vulnerability Scoring, based on the rationale provided in Golder, 2010b. No 3C wells were identified in the Lepage WHPA.

8.5.1.4 Vulnerability Score

The WHPA zones for the Lepage Water Supply, as shown in Figure 8a-1, and the Groundwater Vulnerability, as shown in Figure 8a-3, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 8a-4 illustrates the

Vulnerability Scores for the Lepage Water Supply. Figure 8a-44 will be used to assess Drinking Water Threats in Section 8.5.3.

8.5.1.5 WHPA-E ~~/ WHPA-F~~

None of the wells in this study have been identified as Groundwater Under the 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.~~

8.5.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010b and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010b.

The independent peer review of WHPA delineation was undertaken by Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Lepage WHPAs is High. The full results of the WHPA delineation Peer Review process, for Lepage is available in Appendix P and discussed in Chapter 5 (Methods Overview). Based on the rationale provided for the Vulnerability Assessment (see below), Golder 2010b, characterized uncertainty of the WHPA delineation as Low. As this differs from that provided by the peer review, the most conservative, 'High' Uncertainty ranking will currently apply.

The uncertainty associated with the Vulnerability Assessment was evaluated using a qualitative process outlined in Golder, 2010b. 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.

Considering all of the available data, the uncertainty of the Vulnerability for the Lepage Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

8.5.2 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.

The Town of Penetanguishene Drinking Water Issues evaluation was based on a review of water quality data from the NSGS (Golder, 2005), annual drinking water quality reports, and water quality digital data provided by the Town covering 2000 to 2007. Additionally, raw water quality samples were collected by Golder from the Payette Street wells in March 2009 (Golder, 2010b) as part of the Issues evaluation.

Water quality data for the municipal supply wells was assessed to identify parameters (including pathogens) for which there were indications of elevated concentrations. These parameters were further reviewed to determine if: (i) current or projected concentrations exceed the Ontario Drinking Water Quality Standards (ODWQS), (ii) if the parameter was considered to be anthropogenic or natural in origin, and (iii) if the parameter should be made a Drinking Water Issue. The projected concentrations were based on linear regression analysis for the available dataset. Where projected trends at 50 years indicated concentrations which were close to but not exceeding the ODWQS, the most recent data was evaluated to determine if there was indication of an increase in the trend or stabilization in the concentrations. If recent data indicated concentrations above the projected trend line, the parameter was included as a Drinking Water Issue.

Water quality at the Lepage wells is satisfactory and no obvious trends are discernable for the indicatory parameters (Golder, 2010b).

No Drinking Water Issues were identified for the Lepage Well Supply.

8.5.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Lepage Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010b (Appendix P). 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 Lepage Water Supply 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.

8.5.3.1 List of Drinking Water Threats – Activities

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

The key data sources used to identify Threats on properties included:

- Municipal Property Assessment Corporation (MPAC) (2007) assessment information;
- North Simcoe Groundwater Study (NSGS) Contaminant Source Inventories;
- Hazardous Waste Information Network (HWIN) (2009);
- MOE Records Database (2009);
- Mapping provided by SSEA including landuse (November 2009), storm water and sanitary serviced areas;
- SSEA Livestock Survey (2001) and Biosolids (2007) database; and,
- SSEA Pre-Screening Report (2007).

Section 8.5.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Lepage drinking water system.

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

8.5.3.2 List of Drinking Water Threats – Conditions

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. The MOE Records database (2009) included a compilation of files from the MOE District office for properties within approximately 500 m of a municipal well. The database included a number of records relating to Certificates of Approval, Records of Site Condition, miscellaneous reports, waste generator registration information, permits, applications and correspondence. The files in this list of potential Conditions were reviewed in greater detail to determine if there was sufficient evidence to confirm a Condition based on the Technical Rules criteria. The scoring of Condition Threats implemented by Golder uses the precautionary approach of assuming a Hazard Score of 10 since the Condition review methodology did not include detailed evaluation of all potential evidence/documentation that the contamination has not and will not move off-site. This type of information is typically not readily available for contaminated sites.

No confirmed Conditions have been identified for the Lepage water supply. No potential Conditions have been identified for consideration at this time.

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

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

8.5.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 8a-6 ~~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 Lepage Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

8.5.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 8a-7 ~~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 Lepage Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

8.5.3.3.3 DNAPL Chemical Parameters

Figure 8a-8 illustrates the area within 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 Lepage Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 8a-8 ~~can be used to can be~~

~~used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

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

Further to Section 8.5.3.2, no Conditions have been confirmed within the WHPA for the Lepage 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 8a-4 illustrates the Vulnerability Score map for the Lepage Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

8.5.3.5 Enumerating Drinking Water Threats

~~8.5.3.4.1~~8.5.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 8.5.2 and 8.5.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 8.3.3.5.1. Detailed methodology can be found in Golder, 2010b. Additional refinement of the Significant Drinking Water Threats enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

~~8.5.3.4.1.1~~8.5.3.5.1.1 *Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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.~~Technical Rules.

Managed Lands were identified and the Managed Lands proportions were determined for the Lepage WHPA as outlined in Golder, 2010b.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 8.5.3.5.2). Figure 8a-9 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Lepage Water Supply where Vulnerability Scores were 6 or greater for WHPA-A to WHPA-D. The majority of the Managed Land within the Lepage WHPA has is between 40 to 80%, with a small section having the lowest threshold of 0 to 40%.

~~8.5.3.4.1.2~~8.5.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

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~~Technical Rules.

The Livestock Density was determined for the Lepage WHPA as outlined in Golder, 2010b. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 8.5.3.5.2). Figure 8a-10 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Lepage 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. The livestock density calculations result in <0.5 NU/acres within all of the Lepage WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

~~8.5.3.4.1.3~~8.5.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021)~~)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and -E~~, E~~. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in ~~Part XII of~~ the Technical Rules ~~(December 2021)~~~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Lepage WHPA was determined in accordance with the methodology in Golder, 2010b. 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 8.5.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 8a-11 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Lepage Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 1% to 8% has been assigned within all lands contained within the WHPA limits.~~

~~8.5.3.4.2~~8.5.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 8-5 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Lepage Water Supply.

A total of fourteen (14) activities that are considered to be Significant Drinking Water Threats were identified in association with fourteen (14) land parcels in the WHPA for the Lepage Water Supply. Thirteen (13) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are no Threats related to Issues or Conditions identified in the Lepage WHPA.

Table 8-~~68 5~~: Number of Significant Threat Activities for the Lepage Water Supply.

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

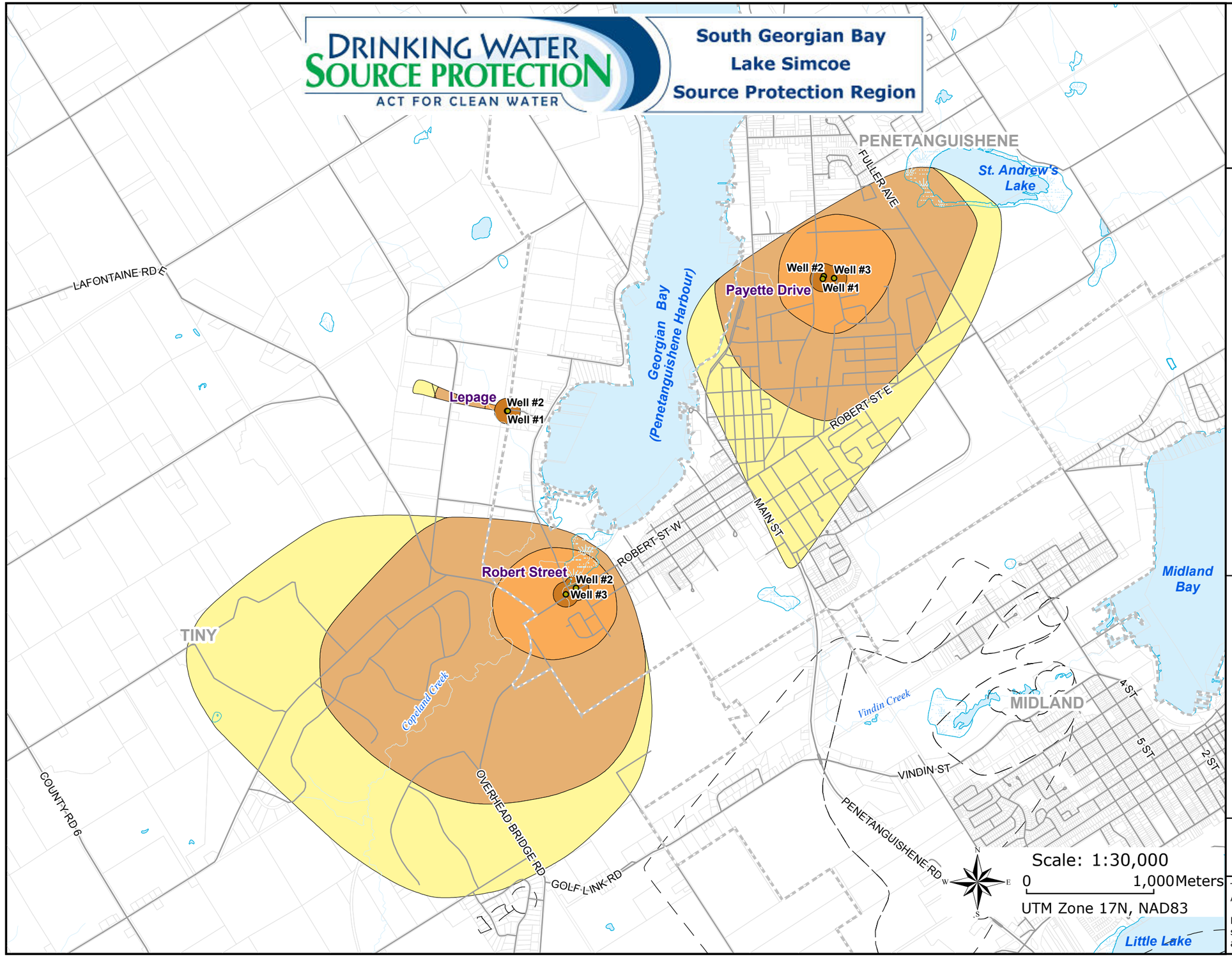
Threat Number	Threat	Significant threat counts Number of threats
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0
-	**Totals:**	**14*** significant threats (on **14** properties)

*1 verified existing threat and 13 potential Threats that require further investigation (2015)

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Town of Penetanguishene Wellhead Protection Areas



- Municipal Wells
- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

WHPA TOT

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C1 (10 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number: PenetangCaptureZones.mxd
Date: 2010-07-21

Ontario

8a-1

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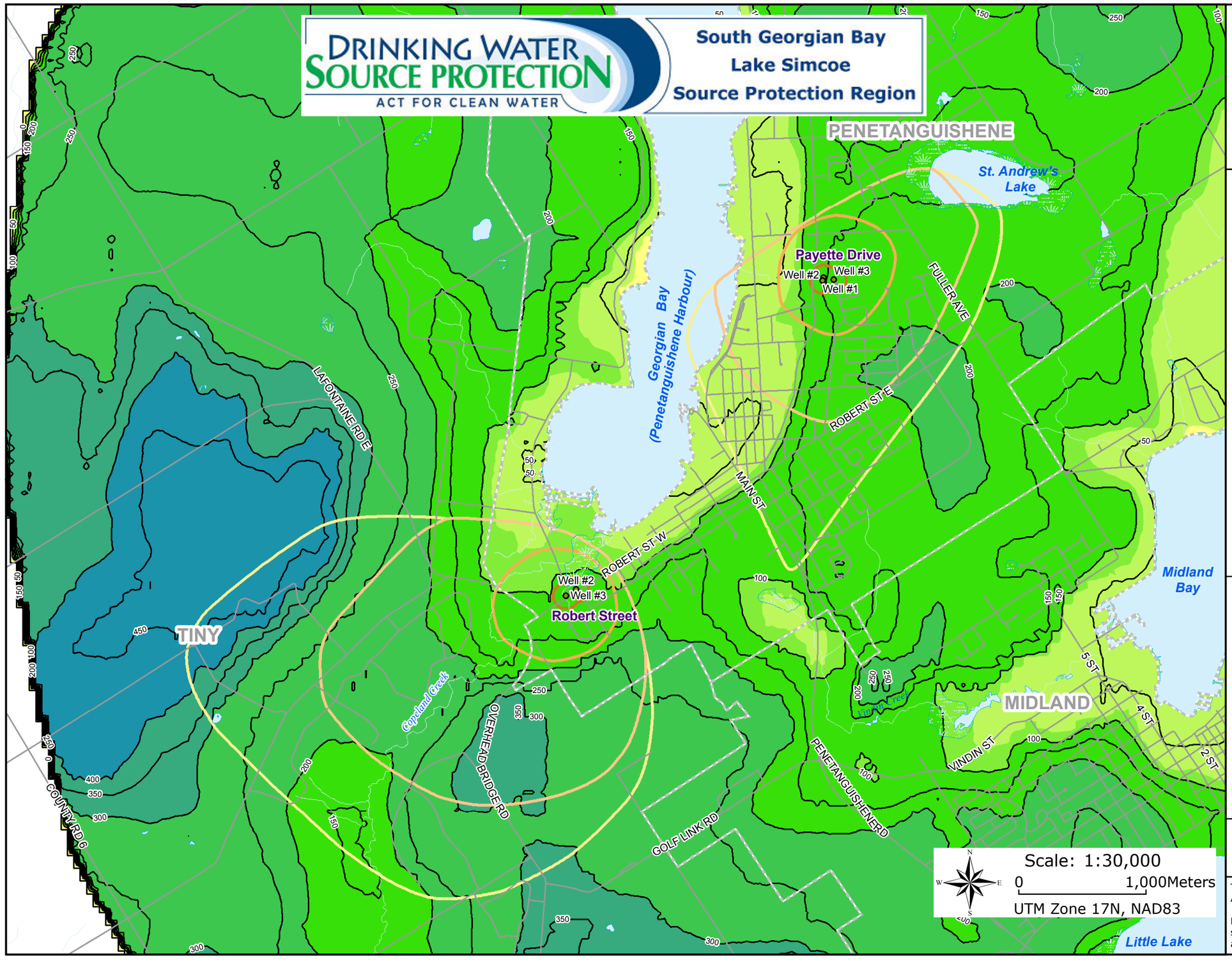
Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Town of Penetanguishene
Model Calculated AVI
To Top Of Aquifer A3



- Municipal Well
- Contour (50 AVI)

Model Calculated Aquifer Vulnerability Index (AVI)

- 0- 30
- 31 - 80
- 81 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 1,300

WHPA TOT

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C1 (10 yr TOT)
- WHPA-D (25 yr TOT)
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary

Notes:
Low Vulnerability (AVI > 80)
Medium Vulnerability (AVI 30 to 80)
High Vulnerability (AVI < 30)

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number: PenetangAVI_TopofA6.mxd
Date: 2010-07-20

Ontario

8a-2

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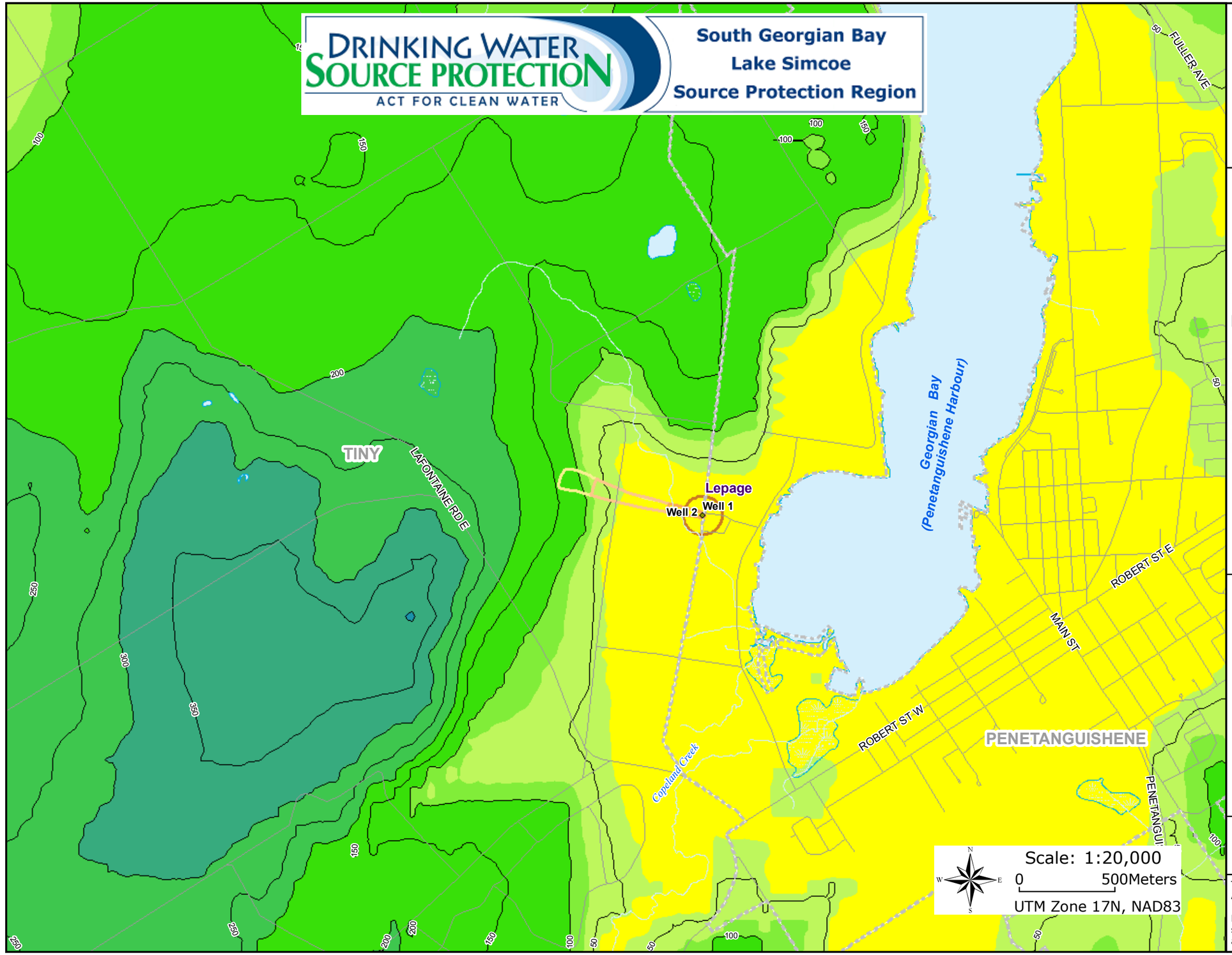
DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Town of Penetanguishene
Model Calculated AVI
To Top Of Aquifer A2



- Municipal Wells
- Contour (50 AVI)

Model Calculated Aquifer Vulnerability Index (AVI)

- 0 - 30
- 31 - 80
- 81 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 800

WHPA TOT

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C1 (10 yr TOT)
- WHPA-D (25 yr TOT)
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary

Notes:
Low Vulnerability (AVI > 80)
Medium Vulnerability (AVI 30 to 80)
High Vulnerability (AVI < 30)

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number: PenetangAVI_TopofA2.mxd
Date: 2009-11-05

Ontario

8a-3

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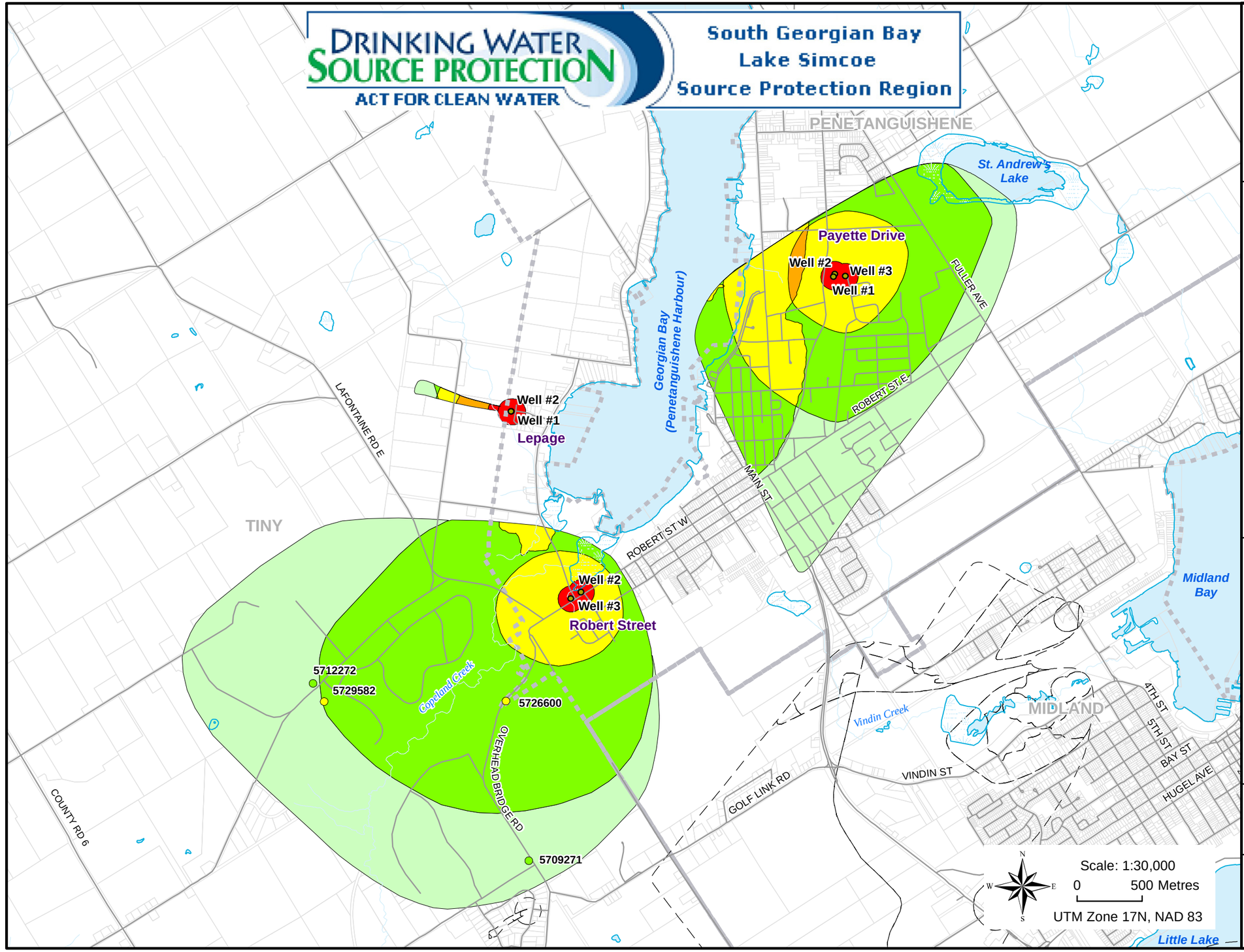
DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Town of Penetanguishene Wellhead Protection Areas Final Vulnerability Scoring



- Municipal Wells
- 5705838 3C Well Pathway

Vulnerability Score

- 10
- 8
- 6
- 4
- 2
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

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Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
FinalPenetangCaptureZone.mxd
Date: 2011-07-25

Ontario

8a-4

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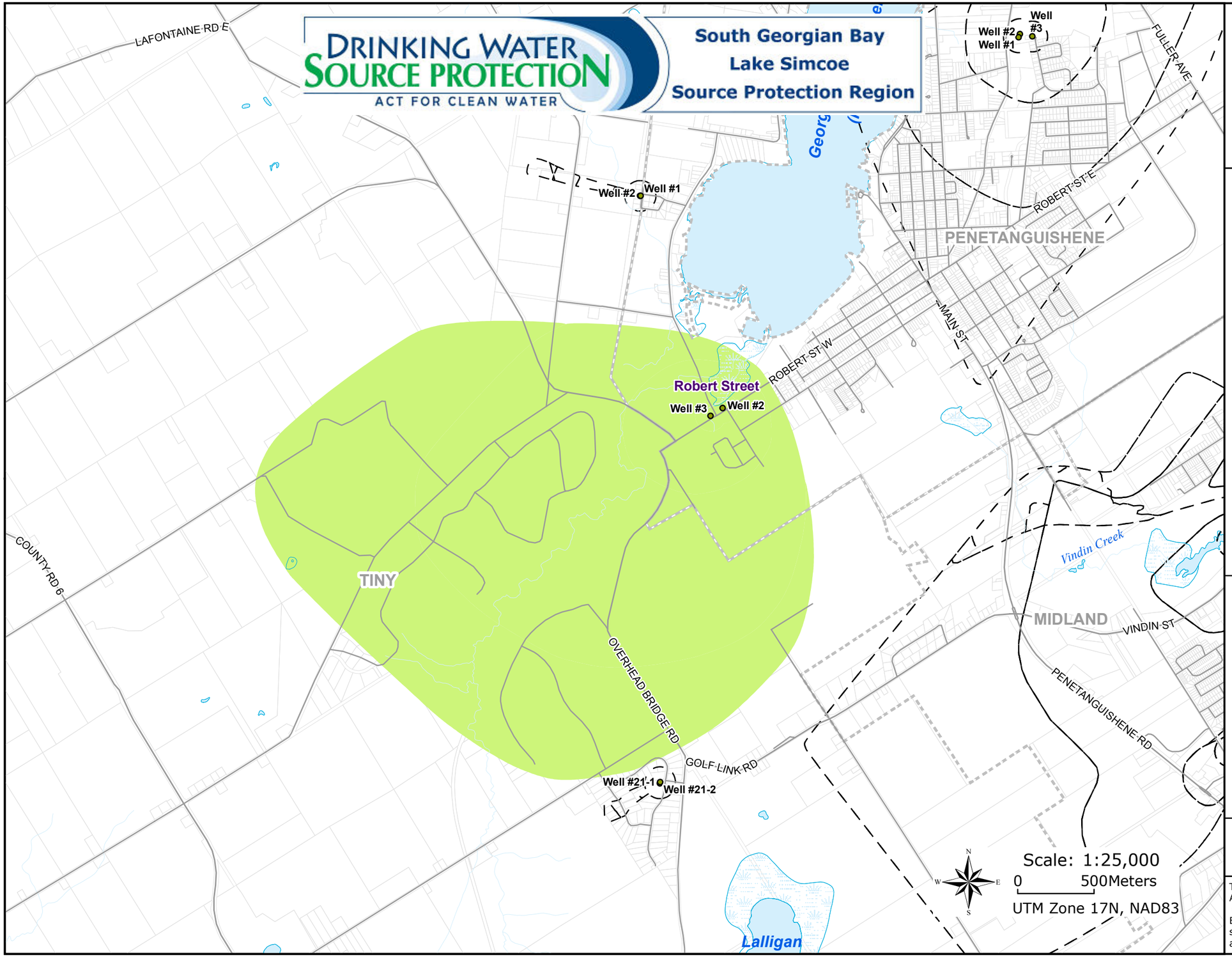
DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Town of Penetanguishene
Robert Street
Drinking Water Issues
Contributing Areas



- Municipal Well
- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary
- Parcel Fabric
- Issue Contributing Area Well 2, 3 Trichloroethylene
- Adjacent Well Field WHPA

Scale: 1:25,000
0 500Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
Penetang_Robert_Issue_Contributing.mxd
Date: 2010-06-08

Ontario

8a-5

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Town of Penetanguishene Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen

PENETANGUISHENE
TINY
MIDLAND

St. Andrew's Lake
Georgian Bay (Penetanguishene Harbour)
Midland Bay
Little Lake
Copeland Creek
Vindin Creek

Payette Drive
Well #2
Well #3
Well #1

Well #2
Well #1
Lepage

Well #2
Well #3
Robert Street

LAFONTAINE RD E
FULLER AVE
ROBERT ST E
MAIN ST
ROBERT ST W
OVERHEAD BRIDGE RD
COUNTY RD 6
GOLF LINK RD
VINDIN ST
4TH ST
5TH ST
BAY ST
HUGEL AVE

Municipal Wells

Vulnerability Score
- 10
- 8
- 6

Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:30,000
0 500 Metres
UTM Zone 17N, NAD 83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number: Penetang_Pathogen.mxd
Date: 2011-07-27

Ontario

8a-6

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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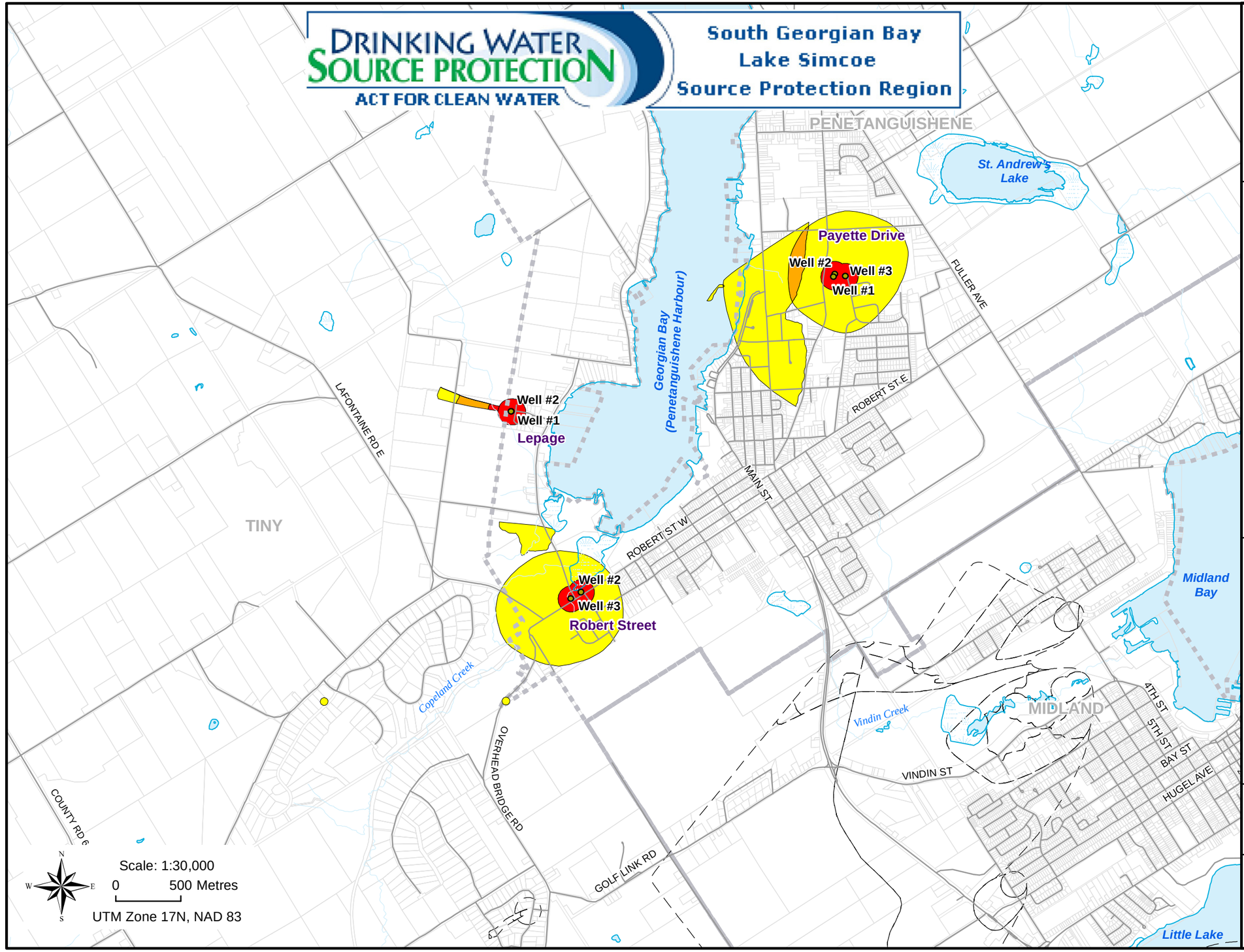
DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Town of Penetanguishene Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical



- Municipal Wells

Vulnerability Score

- 10
- 8
- 6

- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

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Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number: Penetang_Chemical.mxd
Date: 2011-07-27

Ontario

8a-7

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Town of Penetanguishene Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs

PENETANGUISHENE
TINY
MIDLAND

St. Andrew's Lake
Georgian Bay (Penetanguishene Harbour)
Midland Bay
Little Lake
Copeland Creek
Vindin Creek

Payette Drive
Well #2
Well #3
Well #1

Well #2
Well #1
Lepage

Well #2
Well #3
Robert Street

LAFONTAINE RD E
FULLER AVE
ROBERT ST E
MAIN ST
ROBERT ST W
OVERHEAD BRIDGE RD
COUNTY RD 6
GOLF LINK RD
VINDIN ST
4TH ST
5TH ST
BAY ST
HUGEL AVE

Municipal Wells

WHPAs

- WHPA A, B, C1
- WHPA D with Vulnerability >= 6

Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:30,000
0 500 Metres
UTM Zone 17N, NAD 83

Golder Associates
Barrie, Ontario

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Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number: Penetang_DNAPLs.mxd
Date: 2011-07-27

Ontario

8a-8

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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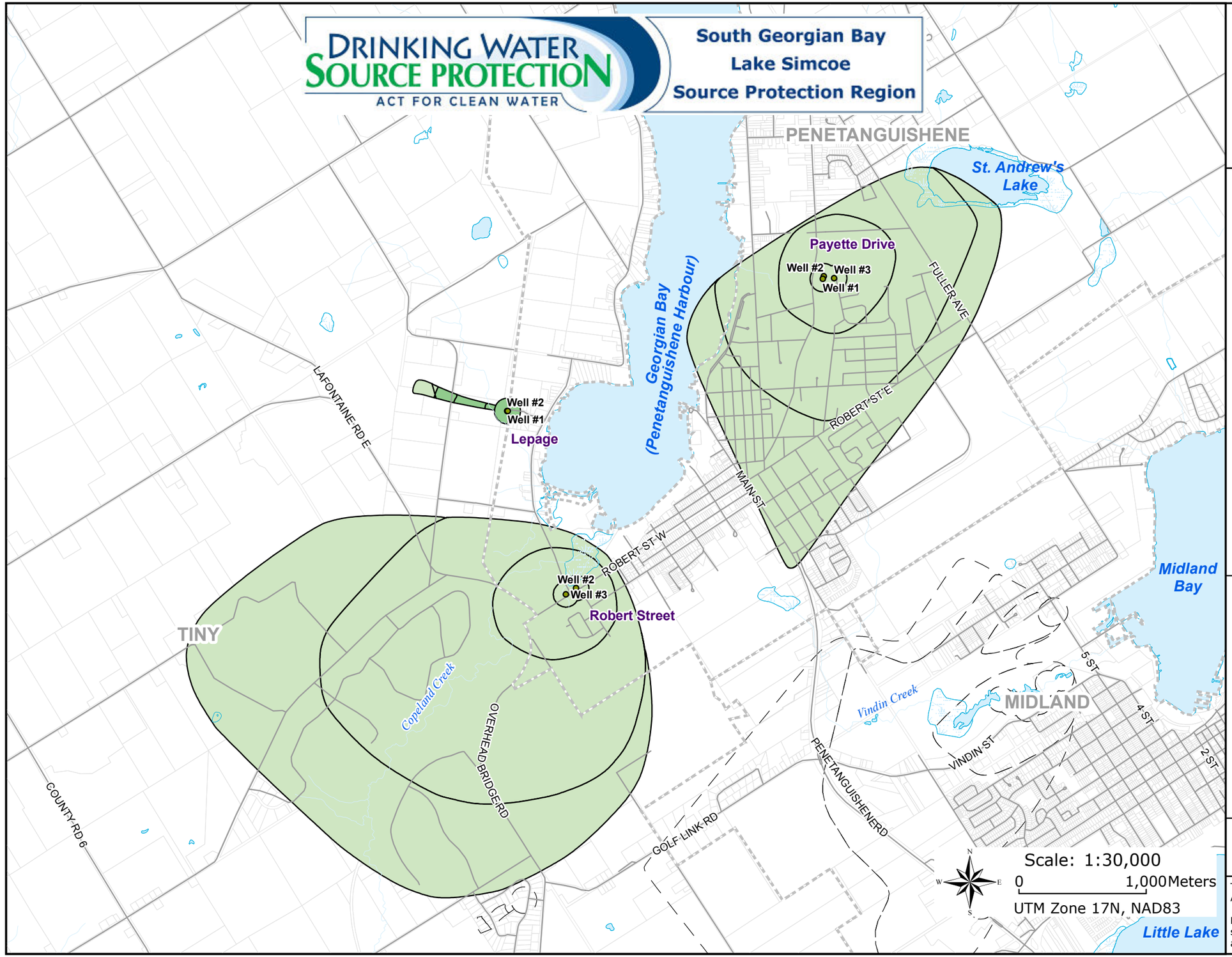
DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Town of Penetanguishene Wellhead Protection Areas Managed Lands



- Municipal Wells

Percent of Managed Lands

- 0% - 40%
- 40%-80%
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Adjacent Well Field WHPA
- Parcel Fabric
- Municipal Boundary

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number: PenetangManagedLands.mxd
Date: 2010-21-07

Ontario

8a-9

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Town of Penetanguishene Wellhead Protection Areas Livestock Density

PENETANGUISHENE
St. Andrew's Lake
Georgian Bay (Penetanguishene Harbour)
Payette Drive
Well #2
Well #3
Well #1
FULLER AVE
ROBERT ST E
MAIN ST
LAFONTAINE RD E
Well #2
Well #1
Lepage
ROBERT ST W
Well #2
Well #3
Robert Street
TINY
Copeland Creek
OVERHEAD BRIDGE RD
COUNTY RD 6
GOLF LINK RD
PENETANGUISHENE RD
Midland Bay
Vindin Creek
MIDLAND
5 ST
4 ST
2 ST
VINDIN ST
Little Lake

Municipal Wells
Livestock Density
< 0.5 NU/Acre
Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Adjacent Well Field WHPA
Parcel Fabric
Municipal Boundary

N
W
E
S

Scale: 1:30,000
0 1,000 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PenetangNU.mxd
Date: 2010-21-07

Ontario

8a-10

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

TOWN OF PENETANGUISHENE
WELLHEAD PROTECTION AREAS
IMPERVIOUS SURFACES

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

PENETANGUISHENE
TINY
MIDLAND (T)

St. Andrew's Lake
Georgian Bay (Penetang Harbour)
Georgian Bay (Midland Bay)
Vindin Creek
Copeland Creek

Payette Drive
Well #1
Well #2
Well #3

Lepage
Well #1
Well #2

Robert Street
Well #1
Well #2
Well #3

LAFONTAINE RD E
FULLER AVE
MAIN ST
ROBERT ST W
VINDIN ST
GOLF LINK RD
OVERHEAD BRIDGE RD
COUNTY RD 6
4TH ST
BAY ST
HUGEL AVE
2ND ST
YONGE ST

N
W
E
S

0 250 500 1,000 Metres

LEGEND

- Municipal Wells

IMPERVIOUS SURFACE

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

- WHPA Boundary
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary
- Adjacent Well Field WHPA

The Impervious Surfaces are illustrated for WHPA A-D where the vulnerability score is > 6.

Severn Sound Environmental Association

DATE: AUGUST 2025

SCALE: 1:25,000

Ontario

FIGURE
8a-11

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