CHAPTER 10: TOWNSHIP OF CLEARVIEW

TABLE OF CONTENTS

10 TOWNSHIP OF CLEARVIEW ................................................................................................................................. 9
  10.1 Introduction.................................................................................................................................................................. 9
  10.2 Drinking Water Systems................................................................................................................................................ 9
  10.3 Buckingham Woods Well Supply .............................................................................................................................. 11
    10.3.1 Groundwater Vulnerability Assessment .................................................................................................................. 11
    10.3.1.1 Wellhead Protection Area (WHPA) Delineation ................................................................................................. 12
    10.3.1.2 Groundwater Vulnerability ................................................................................................................................ 12
    10.3.1.3 Transport Pathway Increase .................................................................................................................................. 13
    10.3.1.4 WHPA-E / WHPA-F ........................................................................................................................................... 13
    10.3.1.5 Vulnerability Score ............................................................................................................................................ 13
    10.3.1.6 Uncertainty Rating .............................................................................................................................................. 13
  10.3.2 Drinking Water Issues Evaluation .......................................................................................................................... 14
  10.3.3 Drinking Water Threats Evaluation ................................................................................................................................. 15
    10.3.3.1 List of Drinking Water Threats – Activities ........................................................................................................ 15
    10.3.3.2 List of Drinking Water Threats – Conditions ...................................................................................................... 16
    10.3.3.3 Identifying Areas of Significant/Moderate/Low Threats – Activities ...................................................................... 16
    10.3.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions .................................................................. 17
    10.3.3.5 Enumerating Drinking Water Threats .................................................................................................................. 18
  10.4 Colling-Woodlands Well Supply .......................................................................................................................... 22
    10.4.1 Groundwater Vulnerability Assessment ...................................................................................................................... 22
    10.4.1.1 Wellhead Protection Area (WHPA) Delineation .................................................................................................... 23
    10.4.1.2 Groundwater Vulnerability .................................................................................................................................. 23
    10.4.1.3 Transport Pathway Increase .................................................................................................................................. 24
    10.4.1.4 WHPA-E / WHPA-F ........................................................................................................................................... 24
    10.4.1.5 Vulnerability Score ............................................................................................................................................ 24
    10.4.1.6 Uncertainty Rating .............................................................................................................................................. 25
  10.4.2 Drinking Water Issues Evaluation .......................................................................................................................... 25
  10.4.3 Drinking Water Threats Evaluation ................................................................................................................................. 26
### 10.4.3 List of Drinking Water Threats

- **Activities**: Page 27
- **Conditions**: Page 27

### 10.4.3.3 Identifying Areas of Significant/Moderate/Low Threats

- **Activities**: Page 27
- **Conditions**: Page 28

### 10.4.3.5 Enumerating Drinking Water Threats

- Page 29

### 10.5 Creemore Well Supply

- **Groundwater Vulnerability Assessment**: Page 33
  - **Wellhead Protection Area (WHPA) Delineation**: Page 34
  - **Groundwater Vulnerability**: Page 34
  - **Transport Pathway Increase**: Page 35
  - **WHPA-E / WHPA-F**: Page 35
  - **Vulnerability Score**: Page 35
  - **Uncertainty Rating**: Page 35

### 10.5.2 Drinking Water Issues Evaluation

- Page 36

### 10.5.3 Drinking Water Threats Evaluation

- **List of Drinking Water Threats – Activities**: Page 37
- **List of Drinking Water Threats – Conditions**: Page 38
- **Identifying Areas of Significant/Moderate/Low Threats – Activities**: Page 38
- **Identifying Areas of Significant/Moderate/Low Threats – Conditions**: Page 39
- **Enumerating Drinking Water Threats**: Page 40

### 10.6 New Lowell Well Supply

- **Groundwater Vulnerability Assessment**: Page 44
  - **Wellhead Protection Area (WHPA) Delineation**: Page 45
  - **Groundwater Vulnerability**: Page 45
  - **Transport Pathway Increase**: Page 46
  - **WHPA-E / WHPA-F**: Page 46
  - **Vulnerability Score**: Page 46
  - **Uncertainty Rating**: Page 47

### 10.6.2 Drinking Water Issues Evaluation

- Page 47

### 10.6.3 Drinking Water Threats Evaluation

- **List of Drinking Water Threats – Activities**: Page 49
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.6.3.2</td>
<td>List of Drinking Water Threats – Conditions</td>
<td>49</td>
</tr>
<tr>
<td>10.6.3.3</td>
<td>Identifying Areas of Significant/Moderate/Low Threats – Activities</td>
<td>49</td>
</tr>
<tr>
<td>10.6.3.4</td>
<td>Identifying Areas of Significant/Moderate/Low Threats – Conditions</td>
<td>50</td>
</tr>
<tr>
<td>10.6.3.5</td>
<td>Enumerating Drinking Water Threats</td>
<td>51</td>
</tr>
<tr>
<td>10.7</td>
<td>McKean Subdivision Well Supply</td>
<td>56</td>
</tr>
<tr>
<td>10.7.1</td>
<td>Groundwater Vulnerability Assessment</td>
<td>56</td>
</tr>
<tr>
<td>10.7.1.1</td>
<td>Wellhead Protection Area (WHPA) Delineation</td>
<td>57</td>
</tr>
<tr>
<td>10.7.1.2</td>
<td>Groundwater Vulnerability</td>
<td>57</td>
</tr>
<tr>
<td>10.7.1.3</td>
<td>Transport Pathway Increase</td>
<td>58</td>
</tr>
<tr>
<td>10.7.1.4</td>
<td>WHPA-E / WHPA-F</td>
<td>58</td>
</tr>
<tr>
<td>10.7.1.5</td>
<td>Vulnerability Score</td>
<td>58</td>
</tr>
<tr>
<td>10.7.1.6</td>
<td>Uncertainty Rating</td>
<td>59</td>
</tr>
<tr>
<td>10.7.2</td>
<td>Drinking Water Issues Evaluation</td>
<td>59</td>
</tr>
<tr>
<td>10.8</td>
<td>Stayner Well Supply</td>
<td>67</td>
</tr>
<tr>
<td>10.8.1</td>
<td>Groundwater Vulnerability Assessment</td>
<td>68</td>
</tr>
<tr>
<td>10.8.1.1</td>
<td>Wellhead Protection Area (WHPA) Delineation</td>
<td>68</td>
</tr>
<tr>
<td>10.8.1.2</td>
<td>Groundwater Vulnerability</td>
<td>69</td>
</tr>
<tr>
<td>10.8.1.3</td>
<td>Transport Pathway Increase</td>
<td>69</td>
</tr>
<tr>
<td>10.8.1.4</td>
<td>WHPA-E / WHPA-F</td>
<td>70</td>
</tr>
<tr>
<td>10.8.1.5</td>
<td>Vulnerability Score</td>
<td>70</td>
</tr>
<tr>
<td>10.8.1.6</td>
<td>Uncertainty Rating</td>
<td>70</td>
</tr>
<tr>
<td>10.8.2</td>
<td>Drinking Water Issues Evaluation</td>
<td>71</td>
</tr>
<tr>
<td>10.8.3</td>
<td>Drinking Water Threats Evaluation</td>
<td>71</td>
</tr>
<tr>
<td>10.8.3.1</td>
<td>List of Drinking Water Threats – Activities</td>
<td>72</td>
</tr>
<tr>
<td>10.8.3.2</td>
<td>List of Drinking Water Threats – Conditions</td>
<td>72</td>
</tr>
</tbody>
</table>
10.8.3.3 Identifying Areas of Significant/Moderate/Low Threats – Activities ..... 73
10.8.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions .. 73
10.8.3.5 Enumerating Drinking Water Threats .................................................. 74
List of Tables

Table 10-1: Municipal Groundwater Supplies in the Township of Clearview............. 10
Table 10-2: Number of Significant Drinking Water Threats for the Buckingham Woods Wells 1 and 2 Drinking Water Supply................................................................. 19
Table 10-3: Number of Significant Drinking Water Threats for the Colling-woodlands Drinking Water Supply.......................................................................................... 30
Table 10-4: Number of Significant Drinking Water Threats for the Creemore Drinking Water Supply............................................................................................................. 41
Table 10-5: Number of Significant Drinking Water Threats for the New Lowell Wells 1 and 2 Drinking Water Supply.................................................................................. 52
Table 10-6: Number of Significant Drinking Water Threats for the New Lowell Well 6 Drinking Water Supply.................................................................................................. 53
Table 10-7: Number of Significant Drinking Water Threats for the McKean Drinking Water Supply.................................................................................................................. 64
Table 10-8: Number of Significant Drinking Water Threats for the Stayner Wells 1 and 3 Drinking Water Supply.......................................................................................... 76
Table 10-9: Number of Significant Drinking Water Threats for the Stayner Well 2 Drinking Water Supply........................................................................................................... 77

List of Figures

Figure 10-1: Vulnerable Areas in the Township of Clearview........................................... 80
Buckingham Woods Well Supply
Figure 10a-1: Wellhead Protection Areas - Buckingham Woods........................................ 81
Figure 10a-2: Groundwater Vulnerability - Buckingham Woods...................................... 82
Figure 10a-3: Vulnerability Scores - Buckingham Woods.................................................. 83
Figure 10a-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats - Buckingham Woods................................................................. 84
Figure 10a-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats - Buckingham Woods................................................................. 85
Figure 10a-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats - Buckingham Woods................................................................. 86
Figure 10a-7: Managed Lands - Buckingham Woods.......................................................... 87
Figure 10a-8: Livestock Density - Buckingham Woods.......................................................... 88
Figure 10a-9: Impervious Surfaces - Buckingham Woods. .................................................. 89

**Colling-woodlands Well Supply**
Figure 10b-1: Wellhead Protection Areas - Colling-woodlands. .............................................. 90
Figure 10b-2: Groundwater Vulnerability - Colling-woodlands. ............................................. 91
Figure 10b-3: Vulnerability Scores - Colling-woodlands......................................................... 92
Figure 10b-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats - Colling-woodlands............................................................... 93
Figure 10b-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats - Colling-woodlands............................................................... 94
Figure 10b-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats - Colling-woodlands............................................................... 95
Figure 10b-7: Managed Lands - Colling-woodlands............................................................ 96
Figure 10b-8: Livestock Density - Colling-woodlands.......................................................... 97
Figure 10b-9: Impervious Surfaces - Colling-woodlands.................................................... 98

**Creemore Well Supply**
Figure 10c-1: Wellhead Protection Areas – Creemore.......................................................... 99
Figure 10c-2: Groundwater Vulnerability - Creemore......................................................... 100
Figure 10c-3: Vulnerability Scores - Creemore. ................................................................. 101
Figure 10c-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats – Creemore. ............................................................... 102
Figure 10c-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats - Creemore............................................................... 103
Figure 10c-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats - Creemore............................................................... 104
Figure 10c-7: Managed Lands - Creemore. .................................................................. 105
Figure 10c-8: Livestock Density - Creemore. ................................................................. 106
Figure 10c-9: Impervious Surfaces - Creemore. ................................................................. 107

**New Lowell Well Supply**
Figure 10d-1: Wellhead Protection Areas - New Lowell. .................................................. 108
Figure 10d-2: Groundwater Vulnerability - New Lowell .................................................. 109
Figure 10d-3: Vulnerability Scores - New Lowell .......................................................... 110
Figure 10d-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats – New Lowell .......................................................... 111
Figure 10d-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats – New Lowell .......................................................... 112
Figure 10d-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats – New Lowell .......................................................... 113
Figure 10d-7: Managed Lands - New Lowell ................................................................. 114
Figure 10d-8: Livestock Density - New Lowell ............................................................. 115
Figure 10d-9: Impervious Surfaces - New Lowell ......................................................... 116

McKean Subdivision Well Supply
Figure 10e-1: Wellhead Protection Areas - McKean ................................................... 117
Figure 10e-2: Groundwater Vulnerability - McKean ................................................... 118
Figure 10e-3: Vulnerability Score - McKean ............................................................... 119
Figure 10e-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats – McKean ................................................... 120
Figure 10e-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats – McKean ................................................... 121
Figure 10e-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats – McKean ................................................... 122
Figure 10e-7: Managed Lands - McKean ................................................................. 123
Figure 10e-8: Livestock Density - McKean ................................................................. 124
Figure 10e-9: Impervious Surfaces – McKean ............................................................. 125

Stayner Well Supply
Figure 10f-1: Wellhead Protection Areas - Stayner ..................................................... 126
Figure 10f-2: Groundwater Vulnerability - Stayner ..................................................... 127
Figure 10f-3: Vulnerability Score - Stayner ................................................................. 128
Figure 10f-4: Areas where Pathogens are or would be Significant, Moderate or Low Threats – Stayner ................................................... 129
Figure 10f-5: Areas where Chemicals are or would be Significant, Moderate or Low Threats – Stayner ................................................... 130
Figure 10f-6: Areas where DNAPLs are or would be Significant, Moderate or Low Threats - Stayner

Figure 10f-7: Managed Lands - Stayner

Figure 10f-8: Livestock Density - Stayner

Figure 10f-9: Impervious Surfaces - Stayner
10 TOWNSHIP OF CLEARVIEW

10.1 INTRODUCTION

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

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

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

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

10.2 DRINKING WATER SYSTEMS

The Township of Clearview, located in the northwest corner of Simcoe County, operates groundwater based water supplies in six (6) communities and does not have a surface water intake. As shown in Table 10-1 and Figure 10-1 all of the groundwater supplies are within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR). Table 10-1 also indicates the Source Protection Region and corresponding lead Source Protection Authority (SPA) for the municipal water supplies.
Table 10-1: Municipal Groundwater Supplies in the Township of Clearview.

<table>
<thead>
<tr>
<th>Local Municipality</th>
<th>Community Water Supply</th>
<th>Drinking Water Information System (DWIS) Number</th>
<th>Source Water Aquifer</th>
<th>Number of Wells</th>
<th>Source Protection Region &amp; Source Protection Authority (SPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Township of Clearview</td>
<td>Buckingham Woods</td>
<td>250001420</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Colling-Woodlands</td>
<td>260005398</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Creemore</td>
<td>220001101</td>
<td>Confined overburden aquifer</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>New Lowell</td>
<td>220003706</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>McKean Subdivision</td>
<td>260005411</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stayner</td>
<td>220001138</td>
<td></td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Chapter 10: Township of Clearview
10.3 BUCKINGHAM WOODS WELL SUPPLY

The Buckingham Woods Water Distribution System is on Lot 42, Concession 12 in the Township of Clearview and services an estimated 18 houses in the Buckingham Woods Subdivision. The water supply consists of three wells: Well 1, Well 2, and Well 3.

The Buckingham Woods Water Distribution System operates under Permit to Take Water 2214-6VARE6 issued on November 29, 2006 and valid to October 31, 2016. Wells 1 and 2 are permitted to pump at maximum rates of 91 L/min (131 m³/day) and Well 3 is permitted to pump at a maximum rate of 85 L/min (122 m³/day). Well 2 is a standby/backup well and has not recently been used. The wells can operate up to a maximum combined taking of 253 m³/day. Well 3 has only been connected to the Buckingham Woods Water Distribution System more recently and therefore only limited information was provided on it.

Wells 1 and 2 were constructed in 1977 and 1978 respectively. Well 1 was drilled to a depth of 31.4 m below ground level (bgl) and screened from 13.1 mbgl to 15.5 mbgl. Well 2 was drilled to a depth of 16.8 mbgl and screened from 12.8 mbgl to 15.2 mbgl. Wells 1 and 2 were screened within a confined sand aquifer.

At the Buckingham Woods Water Distribution System, one aquifer was encountered. A clay aquitard extends from ground surface to approximately 12 mbgl. The aquitard confines a 4 m thick artesian sand aquifer. The aquifer is underlain by 15 m thick layer of clay which overlies limestone bedrock, observed at a depth of approximately 31 mbgl. Due to the flowing artesian conditions, the static water levels at Wells 1 and 2 are approximately at 0.6 m above ground level (agl) (2004).

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

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

10.3.1 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 Buckingham Woods Water Supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that determined to contribute groundwater to the wells within 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Buckingham Woods WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

10.3.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Buckingham Woods Water Distribution System wells 1 and 2 were delineated in 2005 by Golder using a 2-dimensional analytical groundwater flow model. Well 3 was constructed and commissioned subsequent to the 2005 study. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy of the wells for delineation of the WHPA. Golder (2010) provided updated WHPA for Wells 1, Well 2 and Well 3 as shown in Figure 10a-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2005) study delineated time-of-travel zones (TOT) for 50 days, 2 years, 10 years and 25 years. The updated WHPA as shown in Figure 10a-1 includes the 2 year, 5 year and 25 year TOT zones.

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

10.3.1.2 Groundwater Vulnerability


The Groundwater Vulnerability within the WHPA of the three municipal wells in the Buckingham Woods Water Distribution System is shown in Figure 10a-2. The Groundwater Vulnerability for the municipal water supply aquifers A3 within the WHPA is considered to be High beneath much of the delineated WHPA with areas of Medium Vulnerability observed near the municipal wells.
10.3.1.3 **Transport Pathway Increase**

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

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

No wells were identified within the Buckingham Woods WHPA that are considered to have the potential to be a Transport Pathway. The majority of the delineated WHPA has a Vulnerability Rating of High and could not be increased further. The Groundwater Vulnerability map (Figure 10a-2) is therefore proposed to be used to generate the Vulnerability Scores.

10.3.1.4 **WHPA-E / WHPA-F**

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

10.3.1.5 **Vulnerability Score**

The WHPA zones for the Buckingham Woods Water Supply, as shown in Figure 10a-1, and the Groundwater Vulnerability, as shown in Figure 10a-2, were used to assign a Vulnerability Score by using the matrix from Table 5-3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 10a-3 illustrates the Vulnerability Scores for the Buckingham Woods WHPA. Figure 10a-3 will be used to assess Drinking Water Threats in Section 10.3.3.

10.3.1.6 **Uncertainty Rating**

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

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Buckingham Woods WHPA is High. The Vulnerability Rating for the Buckingham Woods Water Supply has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). In this case, the High Uncertainty Rating reflects that additional data to describe the continuity, thickness and types of soils within the delineated WHPA could potentially be used to improve the understanding of local hydrostratigraphy and to increase the confidence in the Vulnerability Analysis. For further information, refer to Technical Memorandum A1 (Appendix MO).

10.3.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114.(1)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.

Available data describing raw water quality and treated water quality for the Buckingham Woods Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for Buckingham Woods are provided in Technical Memorandum E1 – Drinking Water Issues Evaluation – Clearview (Appendix C).

No Drinking Water Issues were identified for the Buckingham Woods Water Supply.

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

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

10.3.3  Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Buckingham Woods Water Supply was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). A Drinking Water Threat is defined as “an Activity, or Condition that adversely affects or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water, and includes any Activity or Condition that is prescribed by the regulations as a drinking water threat.” An Activity is one or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the Buckingham Woods Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

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

10.3.3.1  List of Drinking Water Threats – Activities

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

No additional Drinking Water Threats were identified for consideration. No local circumstances for prescribed Threats were identified.
10.3.3.2 List of Drinking Water Threats – Conditions

Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO). The following information sources were consulted to identify existing Conditions that could affect the Buckingham Woods Water Supply system:

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

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

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

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php

10.3.3.3.1 Pathogen Parameters

The Key Table on Figure 10a-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Buckingham Woods Water Supply. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

10.3.3.3.2 Chemical Parameters

The Key Table on Figure 10a-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Buckingham Woods Water Supply, Activities that are or would be Significant Drinking Water Threats for chemicals
can be observed within areas where the Vulnerability Score is equal to or greater than 8.

10.3.3.3.3 DNAPL Chemical Parameters

Figure 10a-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Buckingham Woods Water Supply. The Key Table on Figure 10a-6 can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 10.3.3.2, no Conditions have been confirmed within the WHPA for the Buckingham Woods 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 10a-3 illustrates the Vulnerability Score map for Buckingham Woods well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.
10.3.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Buckingham Woods Water Supply has been determined using the methodology outlined in Technical Memorandum A5 (Appendix A). There are no Significant Threats associated with Conditions or Drinking Water Issues. Table 10-2 documents the enumeration of existing activities that are considered to be potential Significant Drinking Water Threats within the WHPA for Well 1 and 2 for the Buckingham Woods Water Distribution System. There were no activities identified within the WHPA for Well 3 that would be considered to be potential Significant Drinking Water Threats. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

Six (6) activities that are considered to be potential Significant Drinking Water Threats were identified in association with six (6) land parcels in the WHPA for the Buckingham Woods Water Distribution System. Five (5) parcels are identified as having potential significant threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are five (5) residential parcels within this area.
Table 10-2: Number of Significant Drinking Water Threats for the Buckingham Woods Wells 1 and 2 Drinking Water Supply.

<table>
<thead>
<tr>
<th>Threat</th>
<th>VS=10 # of Threats</th>
<th>WHPA B &amp; C # of Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3. The application of agricultural source material to land.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The storage of agricultural source material.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. The management of agricultural source material.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. The application of non-agricultural source material to land.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. The handling and storage of non-agricultural source material.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. The application of commercial fertilizer to land.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. The handling and storage of commercial fertilizer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. The application of pesticide to land.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. The handling and storage of pesticide.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. The application of road salt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. The handling and storage of road salt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. The storage of snow.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. The handling and storage of fuel.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>16. The handling and storage of a dense non-aqueous phase liquid.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. The handling and storage of an organic solvent.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. The management of runoff that contains chemicals used in the de-icing of aircraft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. The use of land as livestock grazing or pasturing land, an outdoor confinement area, or a farm-animal yard.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| TOTAL NUMBER OF SIGNIFICANT THREATS:                                  | 6                   |
| TOTAL PARCELS WITH SIGNIFICANT THREATS:                              | 6                   |

Note: The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel.
10.3.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and –E . This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Buckingham Woods Water Distribution System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.3.3.5). The Managed Lands are used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 10a-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Buckingham Woods Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

10.3.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Buckingham Woods Water Distribution System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.3.3.5). Nutrient Units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 10a-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Buckingham Woods Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

10.3.3.5.3 Impervious Surfaces

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

The proportion of impervious surfaces within the delineated WHPA zones for the Buckingham Woods Water Distribution System was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.3.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 10a-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Buckingham Woods Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.
10.4 COLLING-WOODLANDS WELL SUPPLY

The Colling-woodlands Water Supply System is located on two wellfields (Lot 40, Concession 11 and Lot 40, Concession 12) in the Township of Clearview and services an estimated 70 houses in the Colling-woodlands Subdivision. The water supply consists of five wells: Well 1, Well 2, Well 3, Well 4, and Well 5.

The Colling-woodlands Water Supply System operate under Permit to Take Water 00-P-1069 issued on August 24, 2000. Wells 1, 2, 3, and 4 are permitted to pump at maximum rates of 45 L/min (65 m³/day) and Well 5 is permitted to pump at a maximum rate of 68 L/min (98 m³/day). The five wells can operate up to a maximum combined taking of 358 m³/day.

Wells 1, 2, 3, 4, and 5 were constructed in 1981, 1980, 1986, 1986, and 1990, respectively. Well 1 was drilled to a depth of 8.2 m below ground level (bgl) and screened from 7.3 mbgl to 8.2 mbgl. Well 2 was drilled to a depth of 8.2 mbgl and screened from 7.3 mbgl to 8.2 mbgl. Well 3 was drilled to a depth of 8.5 mbgl and screened from 7.6 mbgl to 8.5 mbgl. Well 4 was drilled to a depth of 7.3 mbgl and screened from 6.4 mbgl to 7.3 mbgl. Well 5 was drilled to a depth of 11.3 mbgl and screened from 8.5 mbgl to 10.0 mbgl. Wells 1, 2, 4, and 5 were screened in a confined sand and gravel aquifer and Well 3 was screened in a confined sand aquifer.

At the Colling-woodlands Water Supply System, one aquifer was encountered. A stony clay aquitard extends from ground surface to approximately 7 mbgl. The aquitard confines an artesian sand aquifer, approximately 1.2 m thick at Wells 1 through 4 and 4 m thick at Well 5. The aquifer is underlain by 15 m thick layer of clay which overlies limestone bedrock, encountered at a depth of approximately 31 mbgl. Due to the flowing artesian conditions, the static water levels at Wells 1 through 5 were approximately at 0.2 m above ground level (agl) in 2004.

The screen intervals for Wells 1, 2, 4, and 5 have been assigned to the A4 Aquifer and the screen interval for Well 3 has been assigned to the A3 Aquifer in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The Groundwater Vulnerability rating will be determined for the A3 and A4 Aquifers.

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

10.4.1 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 Colling-woodlands Water Supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that determined to contribute groundwater to the wells within 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the Vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Colling-woodlands WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

### 10.4.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for Well 1, Well 2, Well 3, Well 4 and Well 5 of the Colling-woodlands Water Supply System were delineated in 2005 by Golder using a 2-dimensional analytical groundwater flow model. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. A minor translation was required to adjust the Colling-woodlands well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 10b-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2005) study delineated time-of-travel zones (TOT) for 50 days, 2 years, 10 years and 25 years. WHPA-C, representing the 5 year TOT zone, was estimated under this study as per Technical Memorandum A2 – 5 year Time-of-Travel Estimation Methods (Appendix MO). The 5 year TOT zone was estimated as the average velocity between the 2 year TOT zone and the extent of the delineated 10 year TOT zone. It is possible that the 10 year TOT zone may reflect steady-state capture in which case the length of the 5 year TOT zone may be underestimated.

The WHPA for Wells 1, 2, 3, 4 and 5 reflect groundwater flow from southwest to northeast. This is reasonable based on available data describing regional groundwater flow patterns.

### 10.4.1.2 Groundwater Vulnerability

The Colling-woodlands wells draw water from confined overburden aquifer layers (regional aquifer systems A3 and A4). The Groundwater Vulnerability for the municipal overburden aquifers in the area was determined using the regional Aquifer Vulnerability Index (AVI methods outlined in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO). The regional Groundwater Vulnerability is

The Groundwater Vulnerability within the WHPA of the municipal wells in the Collingwoodlands Water Supply System is shown in Figure 10b-2. The Groundwater Vulnerability for the two municipal water supply aquifers within the WHPA is typically medium in the vicinity of the wells and varies between Low and Medium beneath WHPA-C and WHPA-D. The Groundwater Vulnerability at the outermost extent of WHPA-D was observed to be High. This would be consistent with the observation above that the WHPA may have achieved steady-state capture within this time interval.

10.4.1.3  Transport Pathway Increase

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

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

No wells were identified within the Collingwoodlands WHPA that are considered to have the potential to be a Transport Pathway. The Groundwater Vulnerability map (Figure 10b-2) is therefore proposed to be used to generate the Vulnerability Scores.

10.4.1.4  WHPA-E / WHPA-F

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

10.4.1.5  Vulnerability Score

The WHPA zones for the Collingwoodlands Water Supply, as shown in Figure 10b-1, and the Groundwater Vulnerability, as shown in Figure 10b-2, were used to assign a Vulnerability Score by using the matrix from Table 5-3 (Chapter 5: Methods Overview,
Section 5.2.4. Figure 10b-3 illustrates the Vulnerability Scores for the Collingwoodlands WHPA. Figure 10b-3 will be used to assess Drinking Water Threats in Section 10.4.3. The observed pattern of Vulnerability Scores reflects that the increased Vulnerability at the maximum extent of the WHPA.

10.4.1.6 Uncertainty Rating

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

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Colling-woodlands WHPA is High. The Vulnerability Rating for the Colling-woodlands Water Supply has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). In this case, the High Uncertainty Rating reflects that additional data to describe the continuity, thickness and types of soils within the delineated WHPA could potentially be used to improve the understanding of local hydrostratigraphy and to increase the confidence in the Vulnerability Analysis. For further information, refer to Technical Memorandum A1.

10.4.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify chemical or bacterial situations in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114.(1)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.
Available data describing raw water quality and treated water quality for the Colling-
woodlands Water Supply have been reviewed to identify Drinking Water Issues that are
considered likely to result in a deterioration of the quality of water for use as a source of
drinking water. Details of the Drinking Water Issues Evaluation for Colling-woodlands are provided in Technical Memorandum E1 – Drinking Water Issues Evaluation –
Clearview (Appendix C).

**No Drinking Water Issues were identified for the Colling-woodlands Water Supply.**

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

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

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

**10.4.3 Drinking Water Threats Evaluation**

An assessment of Drinking Water Threats for the Colling-woodlands Water Supply was
completed in accordance with the detailed methodology presented in Technical Memo –
A5 (Appendix MO). A Drinking Water Threat is defined as “an activity, or condition that
adversely affects or has the potential to adversely affect, the quality and quantity of any
water that is or may be used as a source of drinking water, and includes any activity or
condition that is prescribed by the regulations as a drinking water threat.” An Activity is
one or a series of related processes, natural or anthropogenic that occurs within a
geographical area and may be related to a particular land use, whereas a Condition
refers to the presence of a contaminant in the soil, sediment, or groundwater resulting
from past activities. Therefore, it is not only presently existing Threats that must be
regulated, but future ones as well.

The Drinking Water Threats Assessment for the Colling-woodlands Water Supply builds
on the information from the Vulnerability Analysis and Issues Evaluation and includes
preparation of:

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

10.4.3.1 List of Drinking Water Threats – Activities

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

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

10.4.3.2 List of Drinking Water Threats – Conditions

Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO). The following information sources were consulted to identify existing Conditions that could affect the Colling-woodlands Water Supply system:

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

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

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

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php
10.4.3.3.1 Pathogen Parameters
The Key Table on Figure 10b-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Colling-woodlands Water Supply. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

10.4.3.3.2 Chemical Parameters
The Key Table on Figure 10b-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Colling-woodlands Water Supply. Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than 8.

10.4.3.3 DNAPL Chemical Parameters
Figure 10b-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Colling-woodlands Water Supply. The Key Table on Figure 10b-6 can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

10.4.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions
Further to Section 10.4.3.2, no Conditions have been confirmed within the WHPA for the Colling-woodlands 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 \( \geq 8 \) 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 \( \geq 6 \) 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 \( \geq 8 \) and \(< 10 \) and there is no evidence of off-site contamination.

Figure 10b-3 illustrates the Vulnerability Score map for Colling-woodlands well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

### 10.4.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Colling-woodlands Water Supply has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO). There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 10-3 documents the enumeration of existing activities that are considered to be potential Significant Drinking Water Threats within the WHPA for the Colling-woodlands Water Supply System. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

Fifteen (15) activities that are considered to be potential Significant Drinking Water Threats were identified in association with fifteen (15) land parcels in the WHPA for the Colling-woodlands Water Supply System. Fourteen (14) parcels were identified as having significant threat activities relating to residential landuse via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are fourteen (14) residential parcels within this area.
Table 10-3: Number of Significant Drinking Water Threats for the Colling-woodlands Drinking Water Supply.

<table>
<thead>
<tr>
<th>Threat</th>
<th>VS=10</th>
<th>WHPA B &amp; C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>threats</td>
<td>parcels</td>
</tr>
<tr>
<td>1 The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act.</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>2 The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>3 The application of agricultural source material to land.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 The storage of agricultural source material.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 The management of agricultural source material.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 The application of non-agricultural source material to land.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 The handling and storage of non-agricultural source material.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 The application of commercial fertilizer to land.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 The handling and storage of commercial fertilizer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 The application of pesticide to land.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 The handling and storage of pesticide.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 The application of road salt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 The handling and storage of road salt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 The storage of snow.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 The handling and storage of fuel.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>16 The handling and storage of a dense non-aqueous phase liquid.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 The handling and storage of an organic solvent.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 The management of runoff that contains chemicals used in the de-icing of aircraft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 The use of land as livestock grazing or pasturing land, an outdoor confinement area, or a farm-animal yard.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL**                                                                | 15     | 15         | 0      | 0       |

**TOTAL NUMBER OF SIGNIFICANT THREATS:** 15                               |

**TOTAL PARCELS WITH SIGNIFICANT THREATS:** 15                           |

Note: The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel.
10.4.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Colling-woodlands Water Supply System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.4.3.5). The Managed Lands is used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 10b-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Colling-woodlands Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

10.4.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Colling-woodlands Water Supply System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.4.3.5). Nutrient Units per farm are used in the identification of threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 10b-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Colling-woodlands Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

10.4.3.5.3 Impervious Surfaces

Technical Rule 16(11) (August 2009) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.
The proportion of impervious surfaces within the delineated WHPA zones for the Colling-woodlands Water Supply System was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.4.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 10b-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Colling-woodlands Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.
10.5 CREEMORE WELL SUPPLY

The Creemore Water Distribution System is located on Mary Street in the Community of Creemore and services an estimated population of 13,000. The water supply consists of two wells: Well 1, and Well 2.

The Creemore Water Distribution System operates under Permit to Take Water 4101-6W6JVE issued on December 12, 2006 and expires on May 15, 2011. Wells 1 and 2 are permitted to pump at maximum rates of 1,023 L/min (1,473 m³/day). The two wells can operate up to a maximum combined taking of 2,688 m³/day.

Wells 1 and 2 were constructed in 1974 and 1995, respectively. Well 1 was screened from 42.6 mbgl to 45.6 mbgl. Well 2 was screened from 40.8 mbgl to 43.8 mbgl. The two wells were screened in the deeper aquifer of a combined aquifer unit.

At the Creemore Water Distribution System, two combined aquifers were encountered. An unconfined aquifer extends from ground surface do a depth of approximately 25 mbgl. This aquifer is underlain by another aquifer to form a combined, unconfined aquifer unit. The combined aquifers are underlain by shale bedrock, encountered at a depth of approximately 48 mbgl. Further from the site, the two aquifers are separated by a clay aquitard which bounds the upper aquifer and confines the deeper, regionally extensive aquifer. Further from Creemore, the confining clay aquitard extends from ground surface to approximately 20 mbgl. The static water levels at Wells 1 and 2 were approximately 3.4 m below top of casing (btoc) (2000) and 3.4 mbtoc (1995), respectively.

The screen intervals for Wells 1 and 2 have been assigned to the A4 Aquifer in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The Groundwater Vulnerability rating will be determined for the A4 Aquifer.

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

10.5.1 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 Creemore Water Supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that determined to contribute groundwater to the wells within 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the Vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Creemore WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

10.5.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for Well 1 and Well 2 in the Creemore Water Distribution System were delineated in 2005 by Golder using a 3-dimensional numerical groundwater flow model. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. A minor translation was required to adjust the Creemore well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 10c-1. WHPA delineation and adjustment details are documented in Genivar. 2010a.

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

The WHPA for Wells 1 and 2 reflect groundwater flow from west to east. This is reasonable based on available data describing regional groundwater flow patterns.

10.5.1.2 Groundwater Vulnerability


The Groundwater Vulnerability within the WHPA of the municipal wells in the Creemore Water Distribution System is shown in Figure 10c-2. The Groundwater Vulnerability for the two municipal water supply aquifers within the WHPA is considered to be Medium near the wells and much of WHPA-B. The Groundwater Vulnerability is High beneath much of the WHPA-C1 and WHPA-D.
10.5.1.3  Transport Pathway Increase

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

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

No wells were identified within the Creemore WHPA are considered to have the potential to be a Transport Pathway. The Groundwater Vulnerability cannot be increased in areas where it has been assigned a value of High. The Groundwater Vulnerability map (Figure 10c-2) is therefore proposed to be used to generate the Vulnerability Scores.

10.5.1.4  WHPA-E / WHPA-F

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

10.5.1.5  Vulnerability Score

The WHPA zones for the Creemore Water Supply, as shown in Figure 10c-1, and the Groundwater Vulnerability, as shown in Figure 10c-2, were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 10c-3 illustrates the Vulnerability Scores for the Creemore WHPA. Figure 10c-3 will be used to assess Drinking Water Threats in Section 10.5.3.

10.5.1.6  Uncertainty Rating

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

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Creemore WHPA is High. The Vulnerability Rating for the Creemore Water Supply has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). In this case, the High Uncertainty Rating reflects that additional data to describe the continuity, thickness and types of soils within the delineated WHPA could potentially be used to improve the understanding of local hydrostratigraphy and to increase the confidence in the Vulnerability Analysis. For further information, refer to Technical Memorandum A1 (Appendix MO).

### 10.5.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114.(1)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.

Available data describing raw water quality and treated water quality for the Creemore Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for Creemore are provided in Technical Memorandum E1 – Drinking Water Issues Evaluation – Clearview (Appendix C).

**No Drinking Water Issues were identified for the Creemore Water Supply.**

Several parameters were observed on occasion or in low concentrations that are consistently less than the Ontario Drinking Water Quality Standard (ODWQS) values, including hardness. Trends of increasing concentrations that would exceed the ODWQS value within 50 years were not observed,
Sodium concentrations have exceeded the guideline of 20 mg/L used by the Medical Officer of Health for sodium restricted diets but are not projected to exceed the ODWQS objective of 200 mg/L within 50 years.

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

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

### 10.5.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Creemore Water Supply was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). A Drinking Water Threat is defined as “an Activity, or Condition that adversely affects or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water, and includes any Activity or Condition that is prescribed by the regulations as a drinking water threat.” An Activity is one or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the Creemore Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

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

### 10.5.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Creemore Drinking Water Supply is provided in Chapter 5, section 5.5.1.
No additional Drinking Water Threats were identified for consideration. No local circumstances for prescribed Threats were identified.

10.5.3.2 List of Drinking Water Threats – Conditions

Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO). The following information sources were consulted to identify existing Conditions that could affect the Creemore Water Supply system:

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

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

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

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: [http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php](http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php)

10.5.3.3.1 Pathogen Parameters

The Key Table on Figure 10c-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Creemore Water Supply. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

10.5.3.3.2 Chemical Parameters

The Key Table on Figure 10c-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Creemore Water Supply,
Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than 8.

10.5.3.3 DNAPL Chemical Parameters

Figure 10c-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Creemore Water Supply. The Key Table on Figure 10c-6 can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 10.5.3.2, no Conditions have been confirmed within the WHPA for the Creemore 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 10c-3 illustrates the Vulnerability Score map for Creemore Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.
10.5.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Creemore Water Supply has been determined using the methodology outlined in Technical Memorandum A5 (Appendix A). There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 10-4 documents the enumeration of existing activities that are considered to be potential Significant Drinking Water Threats within the WHPA for the Creemore Water Distribution System. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10 and for parcels within WHPA B & C that are identified as potentially having a threat related to Dense Non-Aqueous Phase Liquids (DNAPL).

Twenty-four (24) activities that are considered to be potential Significant Drinking Water Threats were identified in association with thirteen (13) land parcels in the WHPA for the Creemore Water Distribution System. Nine (9) parcels were identified as having potential significant threat activities relating to residential landuse via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are nine (9) residential parcels within this area. One (1) parcel was identified for the potential application of agricultural source material and pesticide to land. Ten (10) parcels were identified for the potential application of commercial fertilizer to land as a result of the delineated managed land proportion for WHPA-A. Two (2) parcels within WHPA-C1 were identified as significant threat activities due to potential for handling/storage of DNAPL.
Table 10-4: Number of Significant Drinking Water Threats for the Creemore Drinking Water Supply.

<table>
<thead>
<tr>
<th>Enumeration of Significant Threats (Wellhead Protection Areas)</th>
<th>Significant Threat Counts by Vulnerability Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VS=10</td>
</tr>
<tr>
<td></td>
<td>threats</td>
</tr>
<tr>
<td>1 The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act.</td>
<td></td>
</tr>
<tr>
<td>2 The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.</td>
<td>9</td>
</tr>
<tr>
<td>3 The application of agricultural source material to land.</td>
<td>1</td>
</tr>
<tr>
<td>4 The storage of agricultural source material.</td>
<td></td>
</tr>
<tr>
<td>5 The management of agricultural source material.</td>
<td></td>
</tr>
<tr>
<td>6 The application of non-agricultural source material to land.</td>
<td></td>
</tr>
<tr>
<td>7 The handling and storage of non-agricultural source material.</td>
<td></td>
</tr>
<tr>
<td>8 The application of commercial fertilizer to land.</td>
<td>10</td>
</tr>
<tr>
<td>9 The handling and storage of commercial fertilizer.</td>
<td></td>
</tr>
<tr>
<td>10 The application of pesticide to land.</td>
<td>1</td>
</tr>
<tr>
<td>11 The handling and storage of pesticide.</td>
<td></td>
</tr>
<tr>
<td>12 The application of road salt.</td>
<td></td>
</tr>
<tr>
<td>13 The handling and storage of road salt.</td>
<td></td>
</tr>
<tr>
<td>14 The storage of snow.</td>
<td></td>
</tr>
<tr>
<td>15 The handling and storage of fuel.</td>
<td>1</td>
</tr>
<tr>
<td>16 The handling and storage of a dense non-aqueous phase liquid.</td>
<td></td>
</tr>
<tr>
<td>17 The handling and storage of an organic solvent.</td>
<td></td>
</tr>
<tr>
<td>18 The management of runoff that contains chemicals used in the de-icing of aircraft.</td>
<td></td>
</tr>
<tr>
<td>21 The use of land as livestock grazing or pasturing land, an outdoor confinement area, or a farm-animal yard.</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>22</td>
</tr>
</tbody>
</table>

Note: The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel.
10.5.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and -E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Creemore Water Distribution System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.5.3.5). The Managed Lands are used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 10c-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Creemore Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

10.5.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and -E. This mapping is not required where the vulnerability scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Creemore Water Distribution System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.5.3.5). Nutrient Units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 10c-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Creemore Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

10.5.3.5.3 Impervious Surfaces

Technical Rule 16(11) (August 2009) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and -E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.
The proportion of Impervious Surfaces within the delineated WHPA zones for the Creemore Water Distribution System was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.5.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 10c-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Creemore Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.
10.6 NEW LOWELL WELL SUPPLY

The New Lowell Water Distribution System is located on two wellfields in the Community of New Lowell. The water supply consists of three wells: Well 1, Well 2 and Well 6. Two former wells, Well 3 and Well 4 were removed from the water supply system since the previous study by Golder Associates (2005).

The New Lowell Water Distribution System operates under a Permit to Take Water issued on February 6, 2001 that expires on March 31, 2011. Well 1 is permitted to pump at a maximum rate of 250 L/min (360 m³/day), Well 2 is permitted to pump at a maximum rate of 150 L/min (216 m³/day). Well 6 is permitted to pump at a maximum rate of 174 L/min (251 m³/day). The wells can operate up to a maximum combined taking of 1,035 m³/day. Wells 3 and 4 were abandoned in mid-2009.

Wells 1, 2, and 6 were constructed in 1978, 1978 and 1995, respectively. Well 1 was screened from 54.2 mbgl to 57.3 mbgl. Well 2 was screened from 58.5 mbgl to 60.1 mbgl. Well 6 was screened from 51.8 mbgl to 54.6 mbgl. The three wells were screened in a confined sand to gravelly sand aquifer.

At the New Lowell Water Distribution System, two aquifers were encountered. A localized confined sand to gravelly sand aquifer exists from approximately 50 mbgl to 65 mbgl. The aquifer is confined by a regionally extensive layer of clay and/or till and is underlain by a bedrock aquifer. The static water levels at Wells, 1, 2 and 6 were reported as 9.5 mbgl (1978), 12.1 mbgl (1978) and 13.9 mbgl (1995), respectively.

The screen intervals for Wells 1, 2 and 6 have been assigned to the A4 Aquifer in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The groundwater vulnerability rating has been determined for the A4 Aquifer.

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

10.6.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply. The Vulnerability Analysis considers the WHPA and the Groundwater Vulnerability, as well as the potential for the vulnerability to be increased by man-made (anthropogenic) structures, through Transport Pathways, by developing a “Vulnerability Score” within the WHPA. Conversion of Vulnerability categories (High, Medium and Low) to Vulnerability Scores (10, 8, 6, 4 and 2) results in a new map for each WHPA that expresses the relative degree to which a Threat could affect the drinking water supply. A higher value Vulnerability Score will always be assigned to the immediate vicinity of the well and to any areas that are shown to be vulnerable.

The Groundwater Vulnerability for the New Lowell Water Supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that determined to contribute groundwater to the wells within 25 years were delineated.
as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the Vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the New Lowell WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

10.6.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for Well 1, Well 2 and Well 6 in the New Lowell Water Distribution System were delineated in 2005 by Golder using a 2-dimensional analytical groundwater flow model. The delineated WHPA also considered the operation of Well 3 and Well 4 within the WHPA for Well 1 and Well 2. Removal of Well 3 and Well 4 will result in the combined WHPA as determined in 2005 providing a more conservative estimate of the capture zone. Future work in this area should include a re-evaluation of the WHPA utilizing only the wells currently in operation. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. A minor translation was required to adjust the New Lowell well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 10d-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

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

The WHPA for Wells 1, 2 and 6 reflect groundwater flow from southwest to northeast. This is reasonable based on available data describing regional groundwater flow patterns.

10.6.1.2 Groundwater Vulnerability


The Groundwater Vulnerability within the WHPA of the municipal wells in the New Lowell Water Distribution System is shown in Figure 10d-2. The Groundwater Vulnerability for the two municipal water supply aquifers within the WHPA is considered to be Low.
10.6.1.3 **Transport Pathway Increase**

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

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

Four (4) wells were identified within the New Lowell WHPA that are considered to have the potential to be a transport pathway. The wells are located within areas of Low Vulnerability Rating. The Vulnerability Rating of the 30 m radius around each well has been increased from Low to Medium. One of the identified wells is within WHPA-A (the 100m radius) – the change in Vulnerability Rating will not influence the Vulnerability Score in this area. Mapping of the transport pathways and increased vulnerability were presented in the technical study completed by GENIVAR (2010). Ultimately the locations of transport pathways and increased vulnerability are reflected in the maps of Vulnerability Scores (See Section 10.6.1.5).

10.6.1.4 **WHPA-E / WHPA-F**

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

10.6.1.5 **Vulnerability Score**

The WHPA zones for the New Lowell Water Supply, as shown in Figure 10d-1, the Groundwater Vulnerability, as shown in Figure 10d-2, and the increased vulnerability discussed in Section 10.6.1.3, were used to assign a Vulnerability Score by using the matrix from Table 5-3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 10d-3 illustrates the Vulnerability Scores for the New Lowell WHPA. Figure 10d-3 will be used to assess Drinking Water Threats in Section 10.6.3. The Transport Pathways are illustrated as circles with 30 m radius in the WHPA.
10.6.1.6 Uncertainty Rating

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

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the New Lowell WHPA is High. The Vulnerability Rating for the New Lowell Water Supply has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). In this case, the High Uncertainty Rating reflects that additional data to describe the continuity, thickness and types of soils within the delineated WHPA could potentially be used to improve the understanding of local hydrostratigraphy and to increase the confidence in the Vulnerability Analysis. For further information, refer to Technical Memorandum A1.

10.6.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify chemical or bacterial situations in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114.(1)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.

Available data describing raw water quality and treated water quality for the New Lowell Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for New Lowell are provided in Technical Memorandum E1 – Drinking Water Issues Evaluation – Clearview (Appendix C).

No Drinking Water Issues were identified for the New Lowell Water Supply.
Several parameters were observed on occasion or in low concentrations that are consistently less than the Ontario Drinking Water Quality Standard (ODWQS) values, including ammonia, hardness, methane, organic nitrogen and sulphide. Trends of increasing concentrations that would exceed the ODWQS value within 50 years were not observed.

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

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

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

10.6.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the New Lowell Water Supply was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). A Drinking Water Threat is defined as “an activity, or condition that adversely affects or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water, and includes any activity or condition that is prescribed by the regulations as a drinking water threat.” An Activity is one or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the New Lowell Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

- A list of Drinking Water Threats for Activities,
- A list of Drinking Water Threats for Conditions,
- Maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Activities,
- Maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Conditions, and
- An enumeration of Drinking Water Threats.
10.6.3.1 List of Drinking Water Threats – Activities
The list of Prescribed Drinking Water Threats considered in the assessment for the New Lowell Drinking Water Supply is provided in Chapter 5, section 5.5.1.

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

10.6.3.2 List of Drinking Water Threats – Conditions
Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO). The following information sources were consulted to identify existing Conditions that could affect the New Lowell Water Supply system:

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

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

10.6.3.3 Identifying Areas of Significant/Moderate/Low Threats – Activities
The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php

10.6.3.3.1 Pathogen Parameters
The Key Table on Figure 10d-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the New Lowell Water Supply. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.
10.6.3.3.2 Chemical Parameters
The Key Table on Figure 10d-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the New Lowell Water Supply. Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than 8.

10.6.3.3.3 DNAPL Chemical Parameters
Figure 10d-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the New Lowell Water Supply. The Key Table on Figure 10d-6 can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

10.6.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions
Further to Section 10.6.3.2, no Conditions have been confirmed within the WHPA for the New Lowell 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 10d-3 illustrates the Vulnerability Score map for New Lowell well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.
10.6.3.5  **Enumerating Drinking Water Threats**

The number of Significant Drinking Water Threats for the New Lowell Water Supply has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO). There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 10-5 and Table 10-6 document the enumeration of existing activities that are considered to be potential Significant Drinking Water Threats within the WHPA for the New Lowell Water Distribution System. Table 10-5 documents the enumeration for the WHPA at Wells 1 and 2, while Table 10-6 documents the enumeration for the WHPA at Well 6. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

Twenty-two (22) activities that are considered to be potential Significant Drinking Water Threats were identified in association with eleven (11) land parcels in the WHPA for Well 1 and 2 for the New Lowell Water Distribution System. Nine (9) parcels were identified as having potential significant threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are nine (9) residential parcels within this area. One (1) parcel was identified for the potential application of agricultural source material and pesticide to land. Ten (10) parcels were identified for the potential application of commercial fertilizer to land due to the identified managed lands proportion.

Twenty-six (26) activities that are considered to be potential Significant Drinking Water Threats were identified in association with twenty-six (26) land parcels in the WHPA for Well 6 of the New Lowell Water Distribution System. Twenty-five (25) parcels were identified as having potential significant threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are 25 residential parcels within this area.
Table 10-5: Number of Significant Drinking Water Threats for the New Lowell Wells 1 and 2 Drinking Water Supply.

<table>
<thead>
<tr>
<th>Threat</th>
<th>Significant Threat Counts by Vulnerability Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VS=10</td>
</tr>
<tr>
<td></td>
<td>#</td>
</tr>
<tr>
<td></td>
<td>threats</td>
</tr>
<tr>
<td></td>
<td>threats</td>
</tr>
<tr>
<td>1 The establishment, operation or maintenance of a waste disposal site</td>
<td>9</td>
</tr>
<tr>
<td>within the meaning of Part V or the Environmental Protection Act.</td>
<td></td>
</tr>
<tr>
<td>2 The establishment, operation or maintenance of a system that</td>
<td>1</td>
</tr>
<tr>
<td>collects, stores, transmits, treats or disposes of sewage.</td>
<td></td>
</tr>
<tr>
<td>3 The application of agricultural source material to land.</td>
<td>10</td>
</tr>
<tr>
<td>4 The storage of agricultural source material.</td>
<td>1</td>
</tr>
<tr>
<td>5 The management of agricultural source material.</td>
<td>1</td>
</tr>
<tr>
<td>6 The application of non-agricultural source material to land.</td>
<td>21</td>
</tr>
<tr>
<td>7 The handling and storage of non-agricultural source material.</td>
<td></td>
</tr>
<tr>
<td>8 The application of commercial fertilizer to land.</td>
<td>10</td>
</tr>
<tr>
<td>9 The handling and storage of commercial fertilizer.</td>
<td>1</td>
</tr>
<tr>
<td>10 The application of pesticide to land.</td>
<td>1</td>
</tr>
<tr>
<td>11 The handling and storage of pesticide.</td>
<td>1</td>
</tr>
<tr>
<td>12 The application of road salt.</td>
<td></td>
</tr>
<tr>
<td>13 The handling and storage of road salt.</td>
<td></td>
</tr>
<tr>
<td>14 The storage of snow.</td>
<td></td>
</tr>
<tr>
<td>15 The handling and storage of fuel.</td>
<td>1</td>
</tr>
<tr>
<td>16 The handling and storage of a dense non-aqueous phase liquid.</td>
<td></td>
</tr>
<tr>
<td>17 The handling and storage of an organic solvent.</td>
<td></td>
</tr>
<tr>
<td>18 The management of runoff that contains chemicals used in the</td>
<td></td>
</tr>
<tr>
<td>de-icing of aircraft.</td>
<td></td>
</tr>
<tr>
<td>21 The use of land as livestock grazing or pasturing land, an</td>
<td></td>
</tr>
<tr>
<td>outdoor confinement area, or a farm-animal yard.</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>22</td>
</tr>
<tr>
<td>TOTAL NUMBER OF SIGNIFICANT THREATS:</td>
<td></td>
</tr>
<tr>
<td>TOTAL PARCELS WITH SIGNIFICANT THREATS:</td>
<td></td>
</tr>
</tbody>
</table>

Note: The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel.
Table 10-6: Number of Significant Drinking Water Threats for the New Lowell Well 6 Drinking Water Supply.

<table>
<thead>
<tr>
<th>Threat</th>
<th>Significant Threat Counts by Vulnerability Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS=10</td>
<td>WHPA B &amp; C</td>
</tr>
<tr>
<td># threats parcels threats parcels</td>
<td></td>
</tr>
<tr>
<td>1 The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act.</td>
<td></td>
</tr>
<tr>
<td>2 The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.</td>
<td>25 25</td>
</tr>
<tr>
<td>3 The application of agricultural source material to land.</td>
<td></td>
</tr>
<tr>
<td>4 The storage of agricultural source material.</td>
<td></td>
</tr>
<tr>
<td>5 The management of agricultural source material.</td>
<td></td>
</tr>
<tr>
<td>6 The application of non-agricultural source material to land.</td>
<td></td>
</tr>
<tr>
<td>7 The handling and storage of non-agricultural source material.</td>
<td></td>
</tr>
<tr>
<td>8 The application of commercial fertilizer to land.</td>
<td></td>
</tr>
<tr>
<td>9 The handling and storage of commercial fertilizer.</td>
<td></td>
</tr>
<tr>
<td>10 The application of pesticide to land.</td>
<td></td>
</tr>
<tr>
<td>11 The handling and storage of pesticide.</td>
<td></td>
</tr>
<tr>
<td>12 The application of road salt.</td>
<td></td>
</tr>
<tr>
<td>13 The handling and storage of road salt.</td>
<td></td>
</tr>
<tr>
<td>14 The storage of snow.</td>
<td></td>
</tr>
<tr>
<td>15 The handling and storage of fuel.</td>
<td>1 1</td>
</tr>
<tr>
<td>16 The handling and storage of a dense non-aqueous phase liquid.</td>
<td></td>
</tr>
<tr>
<td>17 The handling and storage of an organic solvent.</td>
<td></td>
</tr>
<tr>
<td>18 The management of runoff that contains chemicals used in the de-icing of aircraft.</td>
<td></td>
</tr>
<tr>
<td>21 The use of land as livestock grazing or pasturing land, an outdoor confinement area, or a farm-animal yard.</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>26 26 0 0</td>
</tr>
<tr>
<td><strong>TOTAL NUMBER OF SIGNIFICANT THREATS:</strong></td>
<td>26</td>
</tr>
<tr>
<td><strong>TOTAL PARCELS WITH SIGNIFICANT THREATS:</strong></td>
<td>26</td>
</tr>
</tbody>
</table>

Note: The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel.
10.6.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the New Lowell Water Distribution System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.6.3.5). The Managed Lands is used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 10d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the New Lowell Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

10.6.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the New Lowell Water Distribution System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.6.3.5). Nutrient Units per farm are used in the identification of threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 10d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the New Lowell Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

10.6.3.5.3 Impervious Surfaces

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

Chapter 10: Township of Clearview
The proportion of Impervious Surfaces within the delineated WHPA zones for the New Lowell Water Distribution System was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.6.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 10d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the New Lowell Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.
10.7 McKean Subdivision Well Supply

The McKean Subdivision Water Distribution System is located on a single wellfield (Lot 35, Concession 8) in the Township of Clearview and services an estimated population of 500 (137 lots) in the McKean Subdivision. The water supply consists of three wells: Well 1, Well 2, and Well 3.

The McKean Subdivision Water Distribution System operates under Permit to Take Water 3237-6CQPT8 issued on May 27, 2005 and expires on May 31, 2010. Well 1 is permitted to pump at a maximum rate of 163 L/min (235 m³/day), Well 2 is permitted to pump at a maximum rate of 114 L/min (164 m³/day), and Well 3 is permitted to pump at a maximum rate of 456 L/min (657 m³/day). The wells can operate up to a maximum combined taking of 1,055 m³/day.

Wells 1, 2, and 3 were constructed in 1986, 1986, and 1989, respectively. Well 1 was screened from 12.8 mbgl to 16.8 mbgl. Well 2 was screened from 11.3 mbgl to 15.2 mbgl. Well 3 was screened from 8.6 mbgl to 13.2 mbgl. The three wells were screened in a confined aquifer.

At the McKean Subdivision Water Distribution System, two aquifers were encountered. An unconfined aquifer extends to a depth of approximately 2.0 mbgl to 4.0 mbgl. The unconfined aquifer extends to the north and west and pinches out to the south and east. A clayey-sand till aquitard underlies the aquifer and is approximately 0.6 m to 2.4 m thick. This aquitard increases to thicknesses of 10 m further from the wellfield. At the wellfield, the aquitard confines a localized artesian aquifer approximately 2 m to 10 m thick. Limestone and shale bedrock was encountered at a depth of approximately 50 m. The static water levels at Wells, 1, 2, and 3 were reported as approximately 1.0 mbgl (2004).

The screen intervals for Wells 1, 2, and 3 have been assigned to the A4 Aquifer in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The Groundwater Vulnerability rating will be determined for the A4 Aquifer.

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

10.7.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply. The Vulnerability Analysis considers the WHPA and the Groundwater Vulnerability, as well as the potential for the vulnerability to be increased by man-made (anthropogenic) structures, through Transport Pathways, by developing a “Vulnerability Score” within the WHPA. Conversion of Vulnerability categories (High, Medium and Low) to Vulnerability Scores (10, 8, 6, 4 and 2) results in a new map for each WHPA that expresses the relative degree to which a Threat could affect the drinking water.
supply. A higher value Vulnerability Score will always be assigned to the immediate vicinity of the well and to any areas that are shown to be vulnerable.

The Groundwater Vulnerability for the McKean Water Supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that determined to contribute groundwater to the wells within 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the Vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the McKean WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

### 10.7.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for Well 1, Well 2 and Well 3 in the McKean Subdivision Water Distribution System were delineated in 2005 by Golder using a 2-dimensional analytical groundwater flow model. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. A minor translation was required to adjust the McKean well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 10e-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

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

The WHPA for Wells 1, 2 and 3 reflect groundwater flow from southwest to northeast. This is reasonable based on available data describing regional groundwater flow patterns.

### 10.7.1.2 Groundwater Vulnerability


The Groundwater Vulnerability within the WHPA of the municipal wells in the McKean Subdivision Water Distribution System is shown in Figure 10e-2. The Groundwater Vulnerability for the municipal water supply aquifer is considered to be High near the
municipal wells and much of WHPA-A and WHPA-B and Medium beneath WHPA-C and WHPA-D.

10.7.1.3 Transport Pathway Increase

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

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

Approximately five wells were identified within the McKean WHPA that are considered to have the potential to be a Transport Pathway. The wells are located within areas of Medium or High Vulnerability Rating. The Vulnerability Rating of the 30 m radius around each well within the Medium Vulnerability can therefore be increased from Medium to High. The Vulnerability Rating where the Transport Pathways are located within the area of High Vulnerability cannot be increased further. Mapping of the transport pathways and increased vulnerability were presented in the technical study completed by GENIVAR (2010). Ultimately the locations of transport pathways and increased vulnerability are reflected in the maps of Vulnerability Scores (See Section 10.7.1.5).

10.7.1.4 WHPA-E / WHPA-F

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

10.7.1.5 Vulnerability Score

The WHPA zones for the McKean Water Supply, as shown in Figure 10e-1, the Groundwater Vulnerability, as shown in Figure 10e-2, and the increased vulnerability discussed in Section 10.7.1.3 were used to assign a Vulnerability Score by using the matrix from Table 5-3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 10e-3 illustrates the Vulnerability Scores for the McKean WHPA. Figure 10e-3 will be used to
assess Drinking Water Threats in Section 10.7.3. The Transport Pathways are illustrated as circles with 30 m radius in the WHPA.

### 10.7.1.6 Uncertainty Rating

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

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the McKean WHPA is High. The Vulnerability Rating for the McKean Water Supply has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). In this case, the High Uncertainty Rating reflects that additional data to describe the continuity, thickness and types of soils within the delineated WHPA could potentially be used to improve the understanding of local hydrostratigraphy and to increase the confidence in the Vulnerability Analysis. For further information, refer to Technical Memorandum A1 (Appendix MO).

### 10.7.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114.(1)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.

Available data describing raw water quality and treated water quality for the McKean Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for McKean are provided in
No Drinking Water Issues were identified for the McKean Water Supply.

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

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

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

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

10.7.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the McKean Water Supply was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). A Drinking Water Threat is defined as “an Activity, or Condition that adversely affects or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water, and includes any Activity or Condition that is prescribed by the regulations as a drinking water threat.” An Activity is one or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the McKean Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

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

10.7.3.1 List of Drinking Water Threats – Activities
The list of Prescribed Drinking Water Threats considered in the assessment for the McKean Drinking Water Supply is provided in Chapter 5, section 5.5.1.

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

10.7.3.2 List of Drinking Water Threats – Conditions
Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO). The following information sources were consulted to identify existing Conditions that could affect the McKean Water Supply system:

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

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

10.7.3.3 Identifying Areas of Significant/Moderate/Low Threats – Activities
The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php

10.7.3.3.1 Pathogen Parameters
The Key Table on Figure 10e-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the McKean Water Supply.
Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

10.7.3.3.2 Chemical Parameters
The Key Table on Figure 10e-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the McKean Water Supply. Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than 8.

10.7.3.3 DNAPL Chemical Parameters
Figure 10e-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the McKean Water Supply. The Key Table on Figure 10e-6 can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

10.7.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions
Further to Section 10.7.3.2, no Conditions have been confirmed within the WHPA for the McKean 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 10e-3 illustrates the Vulnerability Score map for McKean well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

### 10.7.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the McKean Water Supply has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO). There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 10-7 documents the enumeration of existing activities that are considered to be potential Significant Drinking Water Threats within the WHPA for the McKean Subdivision Water Distribution System. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10.

Forty-two (42) activities that are considered to be potential Significant Drinking Water Threats were identified in association with thirty-one (31) land parcels in the WHPA for the McKean Subdivision Water Distribution System. Twenty-nine (29) parcels were identified as having potential significant threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10. There are 29 residential parcels within this area. Nine (9) of the parcels that are intersected by WHPA-B were also identified for the potential application of commercial fertilizer to land as a result of the managed land proportion. One (1) parcel was identified for the potential application of agricultural source material, commercial fertilizer, and pesticide to land.
Table 10-7: Number of Significant Drinking Water Threats for the McKean Drinking Water Supply.

<table>
<thead>
<tr>
<th>Threat</th>
<th>VS=10 #</th>
<th>VS=10 parcels</th>
<th>WHPA B &amp; C #</th>
<th>WHPA B &amp; C parcels</th>
</tr>
</thead>
<tbody>
<tr>
<td>The establishment, operation or maintenance of a waste disposal site</td>
<td>29</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>within the meaning of Part V or the Environmental Protection Act.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The establishment, operation or maintenance of a system that collects,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>stores, transmits, treats or disposes of sewage.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The application of agricultural source material to land.</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The storage of agricultural source material.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The management of agricultural source material.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The application of non-agricultural source material to land.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The handling and storage of non-agricultural source material.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The application of commercial fertilizer to land.</td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The handling and storage of commercial fertilizer.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The application of pesticide to land.</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The handling and storage of pesticide.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The application of road salt.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The handling and storage of road salt.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The storage of snow.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The handling and storage of fuel.</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The handling and storage of a dense non-aqueous phase liquid.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The handling and storage of an organic solvent.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The management of runoff that contains chemicals used in the de-icing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>of aircraft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The use of land as livestock grazing or pasturing land, an outdoor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confinement area, or a farm-animal yard.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>42</td>
<td>31</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL NUMBER OF SIGNIFICANT THREATS:</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL PARCELS WITH SIGNIFICANT THREATS:</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel.
10.7.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHA of the McKean Subdivision Water Distribution System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.7.3.5). The Managed Lands are used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material, and commercial fertilizer.

Figure 10e-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the McKean Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

10.7.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the McKean Subdivision Water Distribution System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.7.3.5). Nutrient Units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 10e-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the McKean Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

10.7.3.5.3 Impervious Surfaces

Technical Rule 16(11) (August 2009) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.
The proportion of impervious surfaces within the delineated WHPA zones for the McKean Subdivision Water Distribution System was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.7.3.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 10e-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the McKean Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.
10.8 STAYNER WELL SUPPLY

The Stayner Water Distribution System is located on two wellfields (Lot 24, Concession 1 and Lot 20, Concession 11) in the Township of Clearview and services an estimated population of 3,600 (1,575 units) in the Community of Stayner. The water supply consists of three wells: Well 1, Well 2, and Well 3. Well 3 is located beside Well 1 as shown in Figure 10f-1.

The Stayner Water Distribution System operates under Permit to Take Water 92-P-3011 issued on July 12, 2002 and expires on July 15, 2012. Well 1 is permitted to pump at a maximum rate of 909 L/min (1,309 m³/day), and Wells 2 and 3 are permitted to pump at maximum rates of 1,818 L/min (2,618 m³/day). The three wells can operate up to a maximum combined taking of 6,545 m³/day.

Wells 1, 2, and 3 were constructed in 1967, 1968, and 1989, respectively. Well 1 was drilled to a depth of 28.0 m below ground level (bgl) and screened from 23.0 mbgl to 27.8 mbgl. Well 2 was drilled to a depth of 61.7 mbgl and screened from 25.7 mbgl to 31.3 mbgl. Well 3 was drilled to a depth of 39.0 mbgl and screened from 26.5 mbgl to 31.1 mbgl. Wells 1 and 2 are screened in a middle aquifer and Well 3 is screened in a lower aquifer.

At the Stayner Water Distribution System, three separate aquifers were observed. At the Well 2 location, a sandy clay with gravel aquitard, approximately 6 m thick, confines an upper aquifer (A4), approximately 18 m thick. This sand and gravel aquifer is under flowing artesian conditions and pinches out further from Well 2. A second aquitard consisting of stratified clay and sand and gravel extends approximately 8 m below the upper aquifer. The middle sand and gravel aquifer exists below this aquitard and is approximately 6 m at Well 2.

At Wells 1 and 3, a clay aquitard extends from ground level to approximately 6 m to 9 mbgl. This clay aquitard confines the middle sand and gravel aquifer (A2-A3), approximately 12 m thick at Wells 1 and 3.

This aquifer is underlain by a clay and till aquitard, approximately 5 m to 8 m thick. The clay and till aquitard confines the lower sand and gravel aquifer which is approximately 15 m thick. The upper aquifer is localized at Well 2 and the middle and lower aquifers are regionally extensive and vary in thicknesses. The static water levels at Well 3 was reported as approximately 17.7 m below top of casing (btoc) (2000).

The screen intervals for Wells 1, 2 and 3 have assigned to the A2, A4 and A3 Aquifers, respectively, in the draft regional hydrostratigraphic model prepared by Golder and Aquaresource (2009). The groundwater vulnerability rating will be determined for the A2, A3 and A4 Aquifers.

Information presented for the Stayner section of this Chapter is based on Genivar 2010a report.
10.8.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply. The Vulnerability Analysis considers the WHPA and the Groundwater Vulnerability, as well as the potential for the vulnerability to be increased by man-made (anthropogenic) structures, through Transport Pathways, by developing a “Vulnerability Score” within the WHPA. Conversion of Vulnerability categories (High, Medium and Low) to Vulnerability Scores (10, 8, 6, 4 and 2) results in a new map for each WHPA that expresses the relative degree to which a Threat could affect the drinking water supply. A higher value Vulnerability Score will always be assigned to the immediate vicinity of the well and to any areas that are shown to be vulnerable.

The Groundwater Vulnerability for the Stayner Water Supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that determined to contribute groundwater to the wells within 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Stayner WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

10.8.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for Well 1, Well 2 and Well 3 in the Stayner Water Distribution System were delineated in 2005 by Golder using a 3-dimensional numerical groundwater flow model. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. The updated well locations and the WHPA are shown in Figure 10f-1. WHPA delineation and adjustment details are documented in Genivar, 2010a.

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

The WHPA for Wells 1 and 3 reflect groundwater flow from southwest to northeast. The WHPA for Well 2 reflects groundwater flow from west to east. The groundwater flow patterns are reasonable based on available data describing regional groundwater flow patterns.
10.8.1.2 Groundwater Vulnerability


The Groundwater Vulnerability within the WHPA of the municipal wells in the Stayner Water Distribution System is shown in Figure 10f-2. The Groundwater Vulnerability for the municipal water supply aquifers within the WHPA was observed to vary from low to high. The Groundwater Vulnerability is typically Medium in the immediate vicinity of the wells and High beneath WHPA-D.

The AVI determined for Regional Aquifer A2 is used for the WHPA for Wells 1 and 3, and the AVI for Regional Aquifer A4 is used for the WHPA for Well 2. This results in a contrast in the vicinity of Well 2 between the relatively shallow aquifer that supplies water to Well 1 and the deeper aquifer that supplies water to Well 2. As only one WHPA is distinguished for the Well 1 and Well 3 well pair, the most conservative (highest) Vulnerability was associated with the aquifer that supplies Well 1 was used.

10.8.1.3 Transport Pathway Increase

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

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

Three (3) wells were identified within the Stayner WHPA that are considered to have the potential to be a Transport Pathway. The wells are located within areas of Low and Medium Vulnerability Rating. The Vulnerability Rating of the 30 m radius around each well has been increased from Low to Medium or from Medium to High. Mapping of the transport pathways and increased vulnerability were presented in the technical study completed by GENIVAR (2010). Ultimately the locations of transport pathways and
increased vulnerability are reflected in the maps of Vulnerability Scores (See Section 10.8.1.5).

10.8.1.4 WHPA-E / WHPA-F

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

10.8.1.5 Vulnerability Score

The WHPA zones for the Stayner Water Supply, as shown in Figure 10f-1, the Groundwater Vulnerability, as shown in Figure 10f-2, and the increased vulnerability discussed in Section 10.8.1.3 were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 10f-3 illustrates the Vulnerability Scores for the Stayner WHPA. Figure 10f-3 will be used to assess Drinking Water Threats in Section 10.8.3. The Transport Pathways are illustrated as circles with 30 m radius in the WHPA.

10.8.1.6 Uncertainty Rating

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

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

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

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Stayner WHPA is High. The Vulnerability Rating for the Stayner Water Supply has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). In this case, the High Uncertainty Rating reflects that additional data to describe the continuity, thickness and types of soils within the delineated WHPA could potentially be used to improve the understanding of local
hydrostratigraphy and to increase the confidence in the Vulnerability Analysis. For further information, refer to Technical Memorandum A1.

10.8.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify chemical or bacterial situations in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114.(1)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.

Available data describing raw water quality and treated water quality for the Stayner Water Supply have been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for Stayner are provided in Technical Memorandum E1 – Drinking Water Issues Evaluation – Clearview (Appendix C).

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

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

The organic parameter N-Nitrosodimethylamine (NDMA) has been detected on rare occasions, and in trace concentrations, in the Well 2 raw water. Concentrations are well below ODWQS values and detections are not consistent.

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

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

10.8.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Stayner Water Supply was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). A Drinking Water Threat is defined as “an activity, or condition that
adversely affects or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water, and includes any activity or condition that is prescribed by the regulations as a drinking water threat.” An Activity is one or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the Stayner Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

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

### 10.8.3.1 List of Drinking Water Threats – Activities

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

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

### 10.8.3.2 List of Drinking Water Threats – Conditions

Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO). The following information sources were consulted to identify existing Conditions that could affect the Stayner Water Supply system:

- Files provided by the Ministry of the Environment local offices pertaining to licenses, and records of spills in the area of the delineated WHPA.
- Records available from the Ministry of the Environment website containing registry of Brownfield Sites.
- Records from available technical studies and previous contaminant source inventories that identified situations that may qualify as conditions.
- Interviews of Township of Clearview staff to identify potential conditions within the identified WHPA for the drinking water supply.
No confirmed Conditions have been identified for the Stayner Water Supply. No potential Conditions have been identified for consideration at this time.

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

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: [http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php](http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php)

10.8.3.3.1 Pathogen Parameters

The Key Table on Figure 10f-4 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Stayner Water Supply. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

10.8.3.3.2 Chemical Parameters

The Key Table on Figure 10f-5 can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Stayner Water Supply. Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than 8.

10.8.3.3.3 DNAPL Chemical Parameters

Figure 10f-6 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Stayner Water Supply. The Key Table on Figure 10f-6 can be used to identify the circumstances in which these Activities associated with DNAPL threats would be Significant Drinking Water Threats.

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

Further to Section 10.8.3.2, no Conditions have been confirmed within the WHPA for the Stayner 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 10f-3 illustrates the Vulnerability Score map for Stayner well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

### 10.8.3.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Stayner Water Supply has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO). There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 10-8 and Table 10-9 document the enumeration of existing activities that are considered to be potential Significant Drinking Water Threats within the WHPA for the Stayner Water Distribution System. Table 10-8 documents the enumeration for the WHPA for Wells 1 and 3. Table 10-9 documents the enumeration for the WHPA for Well 2. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10 and for parcels within WHPA B & C that are identified as potentially having a threat related to DNAPL.

Eleven (11) activities that are considered to be potential Significant Drinking Water Threats were identified in association with eleven (11) land parcels in the WHPA for Well 1 and 3 for the Stayner Water Distribution System. Eight (8) parcels were identified as having significant threat activities relating to residential land use via the use of private individual sewage disposal systems. Natural gas is available for use as a residential heating fuel in the Stayner community. In order to address the potential that some residents may not be connected to the natural gas system, one threat activity has
been considered within WHPA-A to reflect potential storage of fuel for home heating purposes on eight (8) residential parcels. One additional parcel was identified with potential for fuel storage relating to the observed land use. One parcel was also identified for potential handling/storage of DNAPL.

Six (6) activities that are considered to be potential Significant Drinking Water Threats were identified in association with three (3) land parcels in the WHPA for Well 2 of the Stayner Water Distribution System. One (1) parcel was identified as having significant threat activities relating to residential land use via the use of private individual sewage disposal systems and the potential storage of fuel for home heating purposes. Two (2) parcels were identified for the application of agricultural source material and pesticide to land.
### Table 10-8: Number of Significant Drinking Water Threats for the Stayner Wells 1 and 3 Drinking Water Supply.

<table>
<thead>
<tr>
<th>Sort</th>
<th>Threat</th>
<th>VS=10 # of Threats</th>
<th>WHPA B &amp; C # of Threats</th>
<th>TOTAL # of Threats</th>
<th>TOTAL # of Parcels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.</td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The application of agricultural source material to land.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>The storage of agricultural source material.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>The management of agricultural source material.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>The application of non-agricultural source material to land.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>The handling and storage of non-agricultural source material.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>The application of commercial fertilizer to land.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>The handling and storage of commercial fertilizer.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>The application of pesticide to land.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>The handling and storage of pesticide.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>The application of road salt.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>The handling and storage of road salt.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>The storage of snow.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>The handling and storage of fuel.</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>The handling and storage of a dense non-aqueous phase liquid.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>The handling and storage of an organic solvent.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>The management of runoff that contains chemicals used in the de-icing of aircraft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>The use of land as livestock grazing or pasturing land, an outdoor confinement area, or a farm-animal yard.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL**

|                  | 10 | 10 | 1   | 1   |

**TOTAL NUMBER OF SIGNIFICANT THREATS:** 11

**TOTAL PARCELS WITH SIGNIFICANT THREATS:** 11

Note: The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel.
Table 10-9: Number of Significant Drinking Water Threats for the Stayner Well 2 Drinking Water Supply.

<table>
<thead>
<tr>
<th>Enumeration of Significant Threats (Wellhead Protection Areas)</th>
<th>Significant Threat Counts by Vulnerability Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VS=10</td>
</tr>
<tr>
<td></td>
<td>threats</td>
</tr>
<tr>
<td>1. The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act.</td>
<td>1</td>
</tr>
<tr>
<td>2. The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.</td>
<td>2</td>
</tr>
<tr>
<td>3. The application of agricultural source material to land.</td>
<td>2</td>
</tr>
<tr>
<td>4. The storage of agricultural source material.</td>
<td></td>
</tr>
<tr>
<td>5. The management of agricultural source material.</td>
<td></td>
</tr>
<tr>
<td>6. The application of non-agricultural source material to land.</td>
<td></td>
</tr>
<tr>
<td>7. The handling and storage of non-agricultural source material.</td>
<td></td>
</tr>
<tr>
<td>8. The application of commercial fertilizer to land.</td>
<td></td>
</tr>
<tr>
<td>9. The handling and storage of commercial fertilizer.</td>
<td></td>
</tr>
<tr>
<td>10. The application of pesticide to land.</td>
<td>2</td>
</tr>
<tr>
<td>11. The handling and storage of pesticide.</td>
<td></td>
</tr>
<tr>
<td>12. The application of road salt.</td>
<td></td>
</tr>
<tr>
<td>13. The handling and storage of road salt.</td>
<td></td>
</tr>
<tr>
<td>14. The storage of snow.</td>
<td></td>
</tr>
<tr>
<td>15. The handling and storage of fuel.</td>
<td>1</td>
</tr>
<tr>
<td>16. The handling and storage of a dense non-aqueous phase liquid.</td>
<td></td>
</tr>
<tr>
<td>17. The handling and storage of an organic solvent.</td>
<td></td>
</tr>
<tr>
<td>18. The management of runoff that contains chemicals used in the de-icing of aircraft.</td>
<td></td>
</tr>
<tr>
<td>21. The use of land as livestock grazing or pasturing land, an outdoor confinement area, or a farm-animal yard.</td>
<td></td>
</tr>
</tbody>
</table>

| TOTAL                                                               | 6       | 3       | 0       | 0       |
|TOTAL NUMBER OF SIGNIFICANT THREATS:                                  |         |         |         |         |
|TOTAL PARCELS WITH SIGNIFICANT THREATS:                              |         |         |         |         |

Note: The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel.
10.8.3.5.1 Managed Lands

Technical Rule 16(9) (August 2009) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Stayner Water Distribution System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.8.3.5). The Managed Lands is used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 10f-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Stayner Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

10.8.3.5.2 Livestock Density

Technical Rule 16(10) (August 2009) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and –E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Stayner Water Distribution System as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.8.3.5). Nutrient Units per farm are used in the identification of threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 10f-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Stayner Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

10.8.3.5.3 Impervious Surfaces

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

The proportion of impervious surfaces within the delineated WHPA zones for the Stayner Water Distribution System was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.8.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 10f-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Stayner Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.
This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
Legend

- MUNICIPAL WELL LOCATION
- WHPA-A: 100 m RADIUS
- WHPA-B: 2-YEAR TIME-OF-TRAVEL
- WHPA-C: 5-YEAR TIME-OF-TRAVEL
- WHPA-D: 25-YEAR TIME-OF-TRAVEL

WELLHEAD PROTECTION AREAS - BUCKINGHAM WOODS, CLEARVIEW

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

DATE: JULY 2010
SCALE: 1:15000
PROJECT: 0-071948.01
FILE NO.: 0-07194801F6.1-1

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

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

<table>
<thead>
<tr>
<th>Pathogens</th>
<th>Vulnerability Score</th>
<th>Number of circumstances in Table of Drinking Water Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Significant (PW10S)</td>
</tr>
<tr>
<td>Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. Pathogens are not a threat in WHPA C, C1 or D:</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. Pathogens are not a threat in WHPA C, C1 or D:</td>
<td>8</td>
<td>0</td>
</tr>
</tbody>
</table>

*Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.

### AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - BUCKINGHAM WOODS

**ASSESSMENT OF DRINKING WATER THREATS**

**SELECTED MUNICIPAL GROUNDWATER SUPPLIES**

South Georgian Bay Lake Simcoe Source Protection Region

**DATE:** JULY 2010

**SCALE:** 1:15000

**PROJECT:** 0-071948.01

**FILE NO.:** 0-07194801F6.1-5

---

### CHEMICALS

**LEGEND**

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

**VULNERABILITY SCORING**

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

### CHEMICALS

<table>
<thead>
<tr>
<th>Vulnerability Score</th>
<th>Number of circumstances in Table of Drinking Water Threats</th>
<th>Significant</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>528 (CW10S)</td>
<td>824 (C210M)</td>
<td>211 (CW10L)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>5 (CW8S)</td>
<td>792 (CW8M)</td>
<td>717 (CW8L)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>5 (CW6M)</td>
<td>1126 (CW6L)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 Areas with vulnerability scores less than 6 cannot have significant, moderate or low threats. 2 The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). 3 Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: [http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php](http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php)).*
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.

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

**DNAPLs**

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

**VULNERABILITY SCORING**
- 6

**AREAS WHERE DNAPLS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - BUCKINGHAM WOODS**

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

**DATE:** JULY 2010  
**SCALE:** 1:15000  
**PROJECT:** 0-071948.01  
**FILE. NO.:** 0-07194801F6.1-6  
**FIGURE:** 10a-6

**DNAPLs**

<table>
<thead>
<tr>
<th>Vulnerability Score / WHPA(^1)</th>
<th>Number of circumstances in Table of Drinking Water Threats(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHPA A, B, C, CI (&lt; 5 year TOT)</td>
<td>Significant Moderate Low</td>
</tr>
<tr>
<td>25 (all) (DWAS(^3))</td>
<td>0 0 0</td>
</tr>
<tr>
<td>0</td>
<td>3 (DW6M) 22 (DW6L)</td>
</tr>
</tbody>
</table>

\(^1\) Areas with vulnerability scores less than 6 can not have significant, moderate or low threats.  
\(^2\) The number of circumstances was determined from information distributed along with the Table of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009).  
\(^3\) Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.

Legend

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

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

MANAGED LANDS - BUCKINGHAM WOODS

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

DATE: JULY 2010
PROJECT: 0-071948.01
FILE. NO.: 0-07194801F6.1-7

FILE. NO.: 0-07194801F6.1-7

FIGURE 10a-7
The Livestock Density proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
FILE. NO.:0-07194801F6.2-1
PROJECT: 0-071948.01
FILE. NO.:0-07194801F6.2-1

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

DATE: JULY 2010
SCALE: 1:10000

Legend

MUNICIPAL WELL LOCATION

WHPA-A: 100 m RADIUS
WHPA-B: 2-YEAR TIME-OF-TRAVEL
WHPA-C: 5-YEAR TIME-OF-TRAVEL
WHPA-D: 25-YEAR TIME-OF-TRAVEL

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

Date: July 2010
Scale: 1:10000
Project: 0-071948.01
File No.: 0-07194801F6.2-2

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

DATE: JULY 2010  SCALE: 1:10000
PROJECT: 0-071948.01  FILE. NO.:0-07194801F6.2-3

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

<table>
<thead>
<tr>
<th>Vulnerability Score</th>
<th>Number of circumstances in Table of Drinking Water Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significant</td>
</tr>
<tr>
<td>10</td>
<td>16 (PW10S)</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. Pathogens are not a threat in WHPA C, C1 or D. The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009).

Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: [http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php](http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php)).

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

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

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

**ASSESSMENT OF DRINKING WATER THREATS SELECTED MUNICIPAL GROUNDWATER SUPPLIES**

South Georgian Bay Lake Simcoe Source Protection Region

**DATE:** JULY 2010  
**SCALE:** 1:10000  
**PROJECT:** 0-071948.01  
**FILE. NO.:** 0-07194801F6.2-4

**GENIVAR**  
**Ontario**

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

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

**CHEMICALS**

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

**ASSESSMENT OF DRINKING WATER THREATS**

SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe Source Protection Region

**FILE. NO.: 0-07194801F6.2-5 PROJECT: 0-071948.01 DATE: JULY 2010**

**SCALE: 1:10000**

**PROJECT: 0-071948.01 FILE. NO.: 0-07194801F6.2-5**

**FIGURE 10b-5**

---

### Chemicals

- **Vulnerability Score**
- **Number of circumstances in Table of Drinking Water Threats**

<table>
<thead>
<tr>
<th>Vulnerability Score</th>
<th>Significant</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>528 (CW10S^1)</td>
<td>824 (CW10M)</td>
<td>211 (CW10L)</td>
</tr>
<tr>
<td>8</td>
<td>5 (CW8S)</td>
<td>792 (CW8M)</td>
<td>717 (CW8L)</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>5 (CW6M)</td>
<td>1126 (CW6L)</td>
</tr>
</tbody>
</table>

^1 Areas with vulnerability scores less than 6 cannot have significant, moderate or low threats. The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). ^2 Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
The Managed Land proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
The Impervious Surfaces proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

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

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

DATE: JULY 2010
SCALE: 1:15000
PROJECT: 0-071948.01
FILE. NO.:0-07194801F6.3-1

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

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

**GROUNDWATER VULNERABILITY - CREEMORE**

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

DATE: JULY 2010
SCALE: 1:15000
PROJECT: 0-071948.01
FILE. NO.: 0-07194801F6.3-2

FIGURE 10c-2
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.

### Areas Where Chemicals are or Would Be Significant, Moderate, or Low Threats - Creemore

#### Assessment of Drinking Water Threats

Selected Municipal Groundwater Supplies

**South Georgian Bay Lake Simcoe Source Protection Region**

**Date:** JULY 2010  **Scale:** 1:15000

**Project:** 0-071948.01  **File No.:** 0-07194801F6.3-5

**Figure:** 10c-5

---

### Chemicals

<table>
<thead>
<tr>
<th>Vulnerability Score</th>
<th>Number of circumstances in Table of Drinking Water Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significant</td>
</tr>
<tr>
<td>10</td>
<td>528 (CW10S)</td>
</tr>
<tr>
<td>8</td>
<td>5 (CW8S)</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

1. Areas with vulnerability scores less than 6 cannot have significant, moderate or low threats.
2. The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009).
3. Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
The Livestock Density proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
The Impervious Surfaces proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.
Legend

- MUNICIPAL WELL LOCATION
- WHPA-A: 100 m RADIUS
- WHPA-B: 2-YEAR TIME-OF-TRAVEL
- WHPA-C: 5-YEAR TIME-OF-TRAVEL
- WHPA-D: 25-YEAR TIME-OF-TRAVEL

WELLHEAD PROTECTION AREAS - NEW LOWELL, CLEARVIEW

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

DATE: JULY 2010
SCALE: 1:20000

FILE. NO.: 0-071948.01
PROJECT: 0-07194801F6.4-1

FIGURE 10d-1

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

AQUIFER VULNERABILITY INDEX
- HIGH
- MEDIUM
- LOW

GROUNDWATER VULNERABILITY - NEW LOWELL

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

DATE: JULY 2010  SCALE: 1:20000
PROJECT: 0-071948.01  FILE. NO.:0-07194801F6.4-2

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

Pathogens

<table>
<thead>
<tr>
<th>Vulnerability Score</th>
<th>Number of circumstances in Table of Drinking Water Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significant</td>
</tr>
<tr>
<td>10</td>
<td>16 (PW10S)</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

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

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

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

DATE: JULY 2010
PROJECT: 0-071948.01
FILE. NO.:0-07194801F6.4-6

GENIVAR
Ontario

LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

10
8
6

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.

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

**DNAPLS**

<table>
<thead>
<tr>
<th>Vulnerability Score / WHPA¹</th>
<th>Number of circumstances in Table of Drinking Water Threats²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significant: Moderate: Low</td>
</tr>
<tr>
<td>WHPA A, B, C, C1 (&lt; 5 year TOT)</td>
<td>25(all) (DWAS³)</td>
</tr>
</tbody>
</table>

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

**AREAS WHERE DNAPLS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - NEW LOWELL**

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

**DATE:** JULY 2010  **SCALE:** 1:20000
**PROJECT:** 0-071948.01  **FILE. NO.:** 0-07194801F6.4-8  **FIGURE** 10d-6
MANAGED LANDS - NEW LOWELL
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe Source Protection Region

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

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

DATE: JULY 2010
PROJECT: 0-071948.01
FILE. NO.: 0-07194801F6.4-9
SCALE: 1:20000

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

- MUNICIPAL WELL LOCATION
- LIVESTOCK DENSITY (<0.5 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (0.5-1.0 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (>1.0 NUTRIENT UNITS/ACRE)

LIVESTOCK DENSITY - NEW LOWELL

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

DATE: JULY 2010
SCALE: 1:20000
PROJECT: 0-071948.01
FILE. NO.: 0-07194801F6.4-10

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

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

DATE: JULY 2010
SCALE: 1:10000
PROJECT: 0-071948.01
FILE. NO.:0-07194801F6.5-1

Legend
- MUNICIPAL WELL LOCATION
  - WHPA-A: 100 m RADIUS
  - WHPA-B: 2-YEAR TIME-OF-TRAVEL
  - WHPA-C: 5-YEAR TIME-OF-TRAVEL
  - WHPA-D: 25-YEAR TIME-OF-TRAVEL

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

Groundwater Vulnerability - McKEAN

Legend:
- Municipal Well Location

Aquifer Vulnerability Index:
- High
- Medium
- Low

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
The figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

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

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

**PATHOGENS**

**AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - NOTTAWA-McKEAN**

**ASSESSMENT OF DRINKING WATER THREATS SELECTED MUNICIPAL GROUNDWATER SUPPLIES**

South Georgian Bay Lake Simcoe Source Protection Region

**DATE:** JULY 2010  
**SCALE:** 1:10000  
**PROJECT:** 0-071948.01  
**FILE. NO.:** 0-07194801F6.5-6

**FIGURE 10e-4**

<table>
<thead>
<tr>
<th>Vulnerability Score</th>
<th>Number of circumstances in Table of Drinking Water Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significant</td>
</tr>
<tr>
<td>10</td>
<td>16 (PW10S)</td>
</tr>
<tr>
<td>8</td>
<td>16 (PW8M)</td>
</tr>
</tbody>
</table>

1 Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. Pathogens are not a threat in WHPS C, C1 or D; 2 The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). 3 Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).
This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

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

**CHEMICALS**

<table>
<thead>
<tr>
<th>Vulnerability Score</th>
<th>Number of circumstances in Table of Drinking Water Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significant</td>
</tr>
<tr>
<td>10</td>
<td>528 (CW10S)</td>
</tr>
<tr>
<td>8</td>
<td>5 (CW8S)</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

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

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

**DNAPLS**

<table>
<thead>
<tr>
<th>Vulnerability Score / WHPA</th>
<th>Number of circumstances in Table of Drinking Water Threats*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significant</td>
</tr>
<tr>
<td>WHPA A, B, C, CI</td>
<td></td>
</tr>
<tr>
<td>(&lt; 5 year TOT)</td>
<td>25(all) (DWAS)</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

*Areas with vulnerability scores less than 6 can not have significant, moderate or low threats.

The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php).

**AREAS WHERE DNAPLs ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - NOTTAWA-McKEAN**

**ASSESSMENT OF DRINKING WATER THREATS SELECTED MUNICIPAL GROUNDWATER SUPPLIES**

South Georgian Bay Lake Simcoe Source Protection Region

**DATE:** JULY 2010  
**SCALE:** 1:10000  
**PROJECT:** 0-071948.01  
**FILE NO.:** 0-07194801F6.5-8

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

Legend

- MUNICIPAL WELL LOCATION
- LIVESTOCK DENSITY (<0.5 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (0.5-1.0 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (>1.0 NUTRIENT UNITS/ACRE)

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

DATE: JULY 2010
SCALE: 1:10000
PROJECT: 0-071948.01
FILE. NO.: 0-07194801F6.5-10

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

Legend

IMPERVIOUS SURFACE
- <1%
- >1% and <8%
- >8% and <80%

MUNICIPAL WELL LOCATION

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

DATE: JULY 2010
PROJECT: 0-071948.01
FILE. NO.: 0-07194801F6.5-11

FILE. NO.: 0-07194801F6.5-11

FIGURE 10e-9
Legend

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

WELLHEAD PROTECTION AREAS - STAYNER, CLEARVIEW

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

DATE: JULY 2010
SCALE: 1:30000
PROJECT: 0-071948.01
FILE. NO.:0-07194801F6.6-1

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

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

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

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

---

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

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

**DATE:** JULY 2010  
**SCALE:** 1:30000  
**PROJECT:** 0-071948.01  
**FILE. NO.:** 0-07194801F6.6-6  
**FIGURE** 10f-4

---

### Vulnerability Score

<table>
<thead>
<tr>
<th>Vulnerability Score</th>
<th>Number of circumstances in Table of Drinking Water Threats</th>
</tr>
</thead>
</table>
| 10                  | Significant: 16 (PW10S)  
                         Moderate: 4 (PW10M)  
                         Low: 0 |
| 8                   | Significant: 0  
                         Moderate: 16 (PW8M)  
                         Low: 4 (PW8L) |
| 6                   | Significant: 0  
                         Moderate: 0  
                         Low: 16 (PW6L) |

*Areas with vulnerability scores less than 6 cannot have significant, moderate or low threats. Pathogens are not a threat in WHPA C, C1 or D. The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). Referred to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: http://www.ene.gov.on.ca/newwater/cleanwater/provincialTables.php).*
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.
This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

**DNAPLS**

<table>
<thead>
<tr>
<th>Vulnerability Score / WHPA</th>
<th>Number of circumstances in Table of Drinking Water Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHPA A, B, C, C1 (≤ 10 year TOT)</td>
<td>Significant</td>
</tr>
<tr>
<td>6</td>
<td>25(all) (DWAS)</td>
</tr>
</tbody>
</table>

**LEGAL**

Legend:
- MUNICIPAL WELL LOCATION
- WHPA-C1: 10-YEAR TIME-OF-TRAVEL

**VULNERABILITY SCORING**

- 6

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

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

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

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

DATE: JULY 2010 SCALE: 1:30000
PROJECT: 0-071948.01 FILE. NO.:0-07194801F6.6-9

GENIVAR Ontario

FIGURE 10f-7

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

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

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

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

- IMPERVIOUS SURFACE
  - <1%
  - >1% and <8%
  - >8% and <80%

MUNICIPAL WELL LOCATION

IMPERVIOUS SURFACES - STAYNER

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

DATE: JULY 2010  SCALE: 1:30000
PROJECT: 0-071948.01  FILE. NO.:0-07194801F6.6-11

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

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