6 DRINKING WATER VULNERABILITY ANALYSIS AND THREATS EVALUATION

6.1 TYPES OF VULNERABLE AREAS

This chapter provides an overview of the methodology and definitions developed by the Ministry of the Environment to identify drinking water threats. The ministry developed mandatory *Technical Rules* that must be followed by all Source Protection Committees, as well as extensive guidance and full funding to carry out this technical assessment. These processes are important components in the multi-barrier approach to protecting drinking water sources from contamination and overuse. Source protection technical work is focused on the identification and assessment of drinking water quality and quantity threats and issues affecting four different types of vulnerable areas.

6.1.1 Wellhead Protection Areas (WHPA)

Wellhead Protection Areas are areas on the land around a municipal well, the size of which is determined by how quickly water travels underground to the well, measured in years. For source protection planning, the *Clean Water Act, 2006* required that a standard 100-metre radius circle be provided around each municipal well; this is called WHPA-A. WHPA-B represents the 2-year time of travel; WHPA-C represents the 5-year time of travel; and WHPA-D represents the 25-year time of travel. WHPA-E represents municipal wells that are under the direct influence of surface water. The size and shape of each WHPA (B, C, D or E) is a function of how water travels underground. Time of travel is important because it is an indication of how quickly a contaminant can move from a WHPA into a municipal well. Time of travel can be influenced by a number of factors such as the slope of land, and the type of soil (for example, water travels faster through sand than it does through clay). Wellhead Protection Areas are drawn based on scientific research that took all these factors into consideration. **Table 6-1** provides a list of the number of WHPAs throughout the CTC Source Protection Region. This research was undertaken in the development of the Assessment Reports and details about each specific well can be found in those documents. The maps in **Appendix F** of this document show where significant drinking water threat polices will apply in the specific WHPAs in the CTC Source Protection Region.

Table 6-1: Well Count by Municipality

Source Protection Area	Upper Tier Municipality	Lower Tier Municipality (Water System)	Well Count
Credit Valley	Dufferin County	Mono (Island Lake)	2
		Mono (Coles)	2
		Mono (Cardinal Wood)	3
		Amaranth (Amaranth-Pullen)	1
		Orangeville (Orangeville)	12
	Wellington County	Erin (Bel-Erin)	2
		Erin (Erin)	2
		Erin (Hillsburgh)	2
	Halton Region	Halton Hills (Acton)	5
		Halton Hills (Georgetown)	7
	Peel Region	Caledon (Alton, Caledon Village)	4
		Caledon (Cheltenham)	2
		Caledon (Inglewood)	2
Toronto and Region	Peel Region	Caledon (Caledon East)	3
		Caledon (Palgrave)	3
	York Region	Whitchurch-Stouffville	5
		King (King City)	2
		King (Nobleton)	3
		Vaughan (Kleinburg)	2
	Durham Region	Uxbridge (Uxville Well)	2
Central Lake Ontario	No municipal wells		
TOTAL			**66**

6.1.2 Intake Protection Zones (IPZ)

Intake Protection Zones are the area on the water and land surrounding a municipal surface water intake. The size of each zone is determined by how quickly water flows to the intake, in hours. Because surface water travels much faster than groundwater, the IPZ is drawn primarily for emergency response purposes. There are three categories of IPZs; the IPZ-1 is a one-kilometre circle around the intake if it is located in one of the Great Lakes; the IPZ-2 is the area where water can reach the intake in a specified time, two hours was used in the CTC. According to the MOE *Technical Rules*, there can be no significant

threats in an IPZ-1 or IPZ-2 if it is located in one of the Great Lakes (e.g., Lake Ontario). An IPZ-3 is delineated if modelling demonstrates that spills from a specific activity that is located outside IPZ-1 and IPZ-2 may be transported to an intake and result in a deterioration of the water quality at an intake. Since the vulnerability scores of IPZ-1 and IPZ-2 are not high enough to identify significant threats, the modelling approach can also be used for activities within IPZ-1 and IPZ-2 to determine if spills from a specific activity within these zones may reach the intake and result in deterioration of the water quality at an intake. If modelling in IPZ-1, -2, or -3 demonstrates this deterioration, the modelled threats are deemed significant drinking water threats under the provincial rules. The modelling results are also used to delineate event based areas within IPZs where modelled activities are deemed significant. **Table 6-2** provides a list of the surface water intakes (all are located in Lake Ontario) in the CTC Source Protection Region.

Table 6-2: Intake Protection Zones-3 by Municipality

Source Protection Area	Upper Tier Municipality	Water System	Number of Intakes
Credit Valley	Peel Region	Lorne Park	1
		Lakeview	1
Toronto and Region	City of Toronto	R.C. Harris	2
		R.L. Clark	1
		F.J. Horgan	1
		Island	5
	Durham Region	Ajax	1
Central Lake Ontario	Durham Region	Oshawa	2
		Whitby	1
		Bowmanville	1
TOTAL			**16**

6.1.3 Highly Vulnerable Aquifers (HVA)

An aquifer is an area underground that is highly saturated with water – enough water that it can be withdrawn for human use. A Highly Vulnerable Aquifer is one that is particularly susceptible to contamination because of its location near the ground's surface or where the types of materials in the ground around it are highly permeable. For example, clay is more impermeable and typically acts to

protect the aquifer below it, compared to sand and fractured bedrock which are both highly permeable and do not have these protective characteristics.

6.1.4 Significant Groundwater Recharge Areas (SGRA)

Significant Groundwater Recharge Areas are areas on the landscape that are characterized by porous soils, such as sand or gravel, which allows water to seep easily into the ground and flow to an aquifer. A recharge area is considered significant when it helps maintain the water level in an aquifer that supplies a community or private residence with drinking water. Numerical thresholds are used to calculate where these significant recharge areas are located.

6.1.5 Wellhead Protection Area-Q (Water Quantity)

Water quantity vulnerable areas are determined differently than other vulnerable areas. Through a tiered process of water budget analyses as set out in the *Technical Rules* under O. Reg. 287/07, SPCs are required to identify any areas with water quantity stress, determine the stress level in the Wellhead Protection Area-Q (WHPA-Q), and where the level is deemed significant or moderate, also identify the type and location of the activities that pose a drinking water quantity threat. At the final stage (Tier 3 Water Budget analysis), any WHPA-Q areas where significant or moderate drinking water stress has been identified is an area where significant drinking water quantity threat activities can occur. Within these areas, future activities which take water without returning it to the same source or which reduce recharge to the aquifer are significant water quantity threats. If the area has a significant risk level assigned then existing activities are also significant water quantity threats. There are two types of WHPA-Q; WHPA-Q1, and WHPA-Q2. WHPA-Q1 refers to the area where activities that take water without returning it to the same source may be a threat. WHPA-Q2 refers to the area where activities that reduce recharge may be a threat. Source Protection Plan policies must be developed to address significant water quantity threats. See **Chapter 10.13** for more details on the water quantity policies.