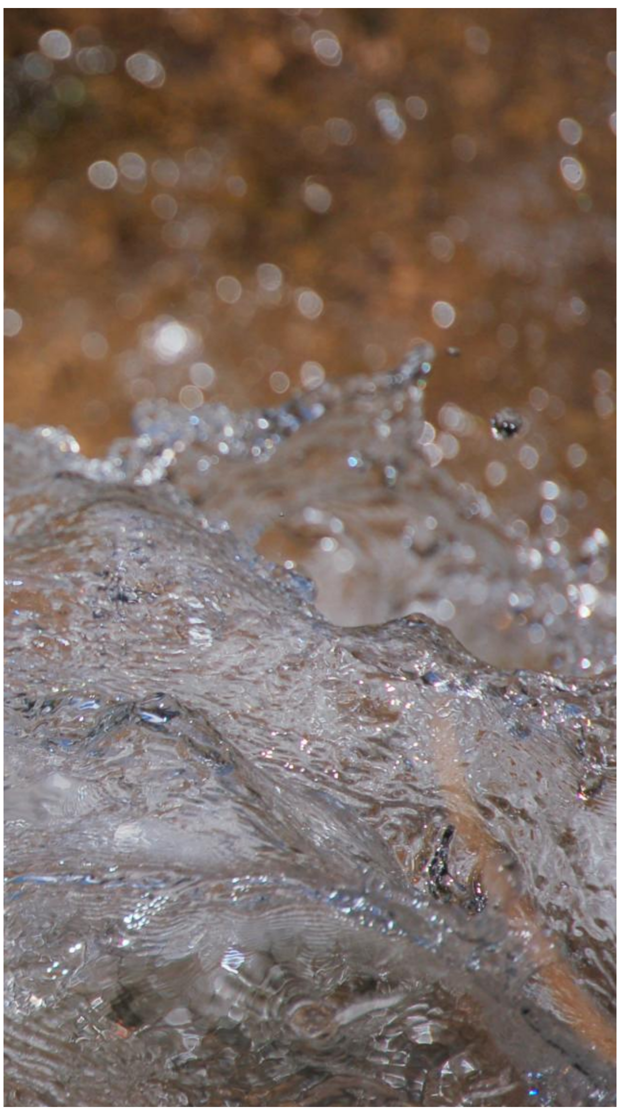
Part Nine

Onaping Drinking Water System



The Onaping drinking water system consists of three wells located close to Highway 144 and supplies approximately 2,150 residents in the towns of Onaping and Levack.

Approved on September 2, 2014
Minor edits on March 1, 2017
Amendments on March 16, 2021

Table of Contents

Chapter 46 - Onaping Drinking Water System

The Onaping drinking water system consists of three wells located close to Highway 144. Wells #3, 4 and 5 are located within the Wickwas pumphouse and are also commonly known as the Hardy wells. Water is drawn from deep drilled wells and is treated with chlorine gas.

Well #5 was added to the system in late 2009 and was part of a large upgrade to connect the Onaping and Levack distribution systems. Historically, Xstrata owned and operated Wells #3 and 4 to supply Onaping, while Vale owned and operated the Levack wells to supply Levack. As of November 2009, the City of Greater Sudbury gained ownership of the Onaping drinking water system, which now supplies approximately 2,150 residents in the towns of Onaping and Levack. The Levack wells are no longer connected to the municipal system and currently only serve Vale's operations, therefore source protection planning work was not required for the Levack system. See Map 9.1 for the distribution system. Table 9.1 presents pumping rates for the Onaping drinking water system from 2002-2007.

Table 9.1 – Summary of water usage in the Onaping drinking water system for 2002-2007

	Wells 3 and 4*
Daily Permitted Amount (m^3/day)	5,237
Monthly Permitted Amount (m^3/month)	159,292
Average Actual Monthly Volume (m^3/month)	58,993
Percentage of Monthly Permitted Volume	37%
Maximum Actual Monthly Volume (m^3)	79,303
Percentage of Monthly Permitted Volume	50%
95th Percentile (m^3)	73,711
Percentage of Monthly Permitted Volume	46%

*At the time of this assessment, well #5 was not in use yet and thus was not included in this summary.

Chapter 47 - Onaping Wells Contributing Area

The contributing area for the Onaping wells was developed as part of the City of Greater Sudbury Municipal Groundwater Study. The capture zones for the wells intersected with Windy Lake and the contributing area was therefore extended to include the Windy Lake catchment. The southern and eastern limits of the contributing area were defined as a 500 m buffer added to the developed capture zones. The estimated contributing area to these wells is 89 km^2. See Map 9.2 for an illustration of the contributing area.

Chapter 48 - Water Budget and Stress Assessment

The Onaping drinking water system lies within the Vermilion watershed. As previously described in Chapter 28, the Vermilion watershed was given a water quantity stress level of low and therefore did not need to progress to the next level of a water quantity assessment. Given the isolated nature of the municipal wells, it was decided by the Greater Sudbury Source Protection Area technical team that a Tier 1 water budget should be completed for each drinking water system. The methodology applied is described in greater detail in Chapter 3 and in Appendix 2.

48.1 Onaping Watershed Water Budget

The water balance for the Onaping drinking water system was based on the delineated watershed described in the previous chapter. Table 9.2 summarizes the elements of the water balance estimate. There are no major streamflows in this watershed and Windy Lake covers approximately 13% of the contributing area. As described in Table 9.2, the average annual recharge was calculated to be the average annual water surplus, 408 mm.

Table 9.2 – Water budget for the Onaping watershed

	Water Balance Element (mm)							
Month	Rainfall	Snowfall	Snowmelt	Total Input	PET*	AET**	Water Surplus	Water Deficit
January	2.8	61.8	6.1	8.9	0.0	0.0	8.9	0.0
February	3.1	48.4	13.8	16.9	0.0	0.0	16.9	0.0
March	19.5	45.6	68.2	87.7	0.0	0.0	87.7	0.0
April	51.2	13.0	126.3	177.5	19.5	19.5	158.0	0.0
May	80.8	1.0	8.6	89.3	75.0	73.7	15.6	0.0
June	78.4	0.0	0.0	78.4	110.7	102.5	0.0	-24.1
July	78.8	0.0	0.0	78.8	130.5	109.2	0.0	-30.4
August	85.3	0.0	0.0	85.3	112.5	92.5	0.0	-732
September	107.1	0.0	0.0	107.1	69.3	67.3	39.8	0.0
October	81.9	2.4	2.4	84.4	30.1	30.1	54.3	0.0
November	45.1	33.3	19.4	64.4	0.8	0.8	63.6	0.0
December	9.8	55.8	15.0	24.8	340.0	0.0	24.8	0.0
Annual Total	643.7	261.3	259.9	903.5	548.3	495.6	469.7	-61.7
Annual Recharge							**408.0**	

*PET – Potential Evapotranspiration **AET – Actual Evapotranspiration

48.2 Onaping Watershed Stress Assessment

The water quantity stress assessment results are provided in Table 9.3. For Wells #3 and 4, it was assumed that the permitted pumping rates were 100% consumed from the groundwater system[1]. Municipal demand calculated for this contributing catchment included the municipal demand in the community of Levack. The calculated water removed by the Onaping groundwater wells was approximately 0.8 mm, which represented 14% of the permitted pumping rate. In addition, there are several other groundwater removals in the Onaping watershed, including the industrial water use in Levack.

Groundwater recharge was assumed as equal throughout the year. Recharge rates were two orders of magnitude above demand and monthly stress did not exceed 2% in this watershed. Stress level was calculated to be just below 2% under the current and future municipal demand forecast. On an annual basis, calculated groundwater stress levels were about 1.7% at present and future scenarios, respectively. Therefore, the Onaping watershed was characterized as 'low' stress level under all monthly and annual scenarios. See Appendix 2 for more details.

48.3 Water Budget and Stress Assessment Uncertainty

Uncertainty in the Tier 1 process takes into account the quality of the available data. Municipal water removals and water use trends were obtained from the City of Greater Sudbury and from industry, and large volume permits to take water were checked for actual use and active status. For each Tier 1 water budget, the water surplus was in the range of that reported in the literature (e.g. Richards 2002). For all groundwater sources the estimated uncertainty is low.

[1] At the time of this assessment, Well #5 was not in use and therefore not included in the estimates. However, permitted water removal rates for the Onaping Drinking Water System have not changed, and therefore the estimates are still accurate.

Table 9.3 – Water quantity stress assessment for the Onaping watershed

	Supply (m^3/s)		Demand (m^3/s)				Stress (%)	
Month	Recharge	Reserve	Municipal	PTTW	Total	Forecast	Present	Forecast
January	1.15	0.12	0.01	0.01	0.02	0.02	2.13	2.19
February	1.15	0.12	0.01	0.01	0.02	0.02	2.20	2.28
March	1.15	0.12	0.01	0.01	0.02	0.03	2.34	2.42
April	1.15	0.12	0.01	0.01	0.02	0.02	2.14	2.21
May	1.15	0.12	0.01	0.01	0.02	0.02	1.83	1.89
June	1.15	0.12	0.01	0.02	0.03	0.03	2.47	2.55
July	1.15	0.12	0.01	0.01	0.02	0.02	1.92	1.98
August	1.15	0.12	0.01	0.01	0.02	0.02	2.11	2.17
September	1.15	0.12	0.01	0.02	0.03	0.03	2.47	2.56
October	1.15	0.12	0.01	0.01	0.02	0.02	1.86	1.92
November	1.15	0.12	0.01	0.01	0.02	0.02	2.02	2.08
December	1.15	0.12	0.01	0.02	0.02	0.03	2.39	2.47
Annual	**1.15**	**0.12**	**0.01**	**0.01**	**0.02**	**0.02**	**2.16**	**2.23**

Chapter 49 - Onaping Water Quality Risk Assessment

The following sections provide the results for the water quality risk assessment process for the Onaping drinking water system.

49.1 Onaping Wellhead Protection Areas and Vulnerability Scoring

The wellhead protection areas were delineated according to Rules 47 through 50 and followed the methodology outlined in Chapter 2. The resulting vulnerable areas are illustrated on Map 9.3 for each well in the Onaping drinking water system. The maximum time of travel to the Onaping wells is less than two years, therefore there is only WHPA-A and WHPA-B for these wells.

Vulnerability scoring for the wellhead protection areas followed Rules 82 through 85 and the methodology outlined in Chapter 2. Map 9.4 illustrates the vulnerability scoring for the Onaping drinking water system.

Vulnerable Area Delineation Uncertainty

Modeling groundwater flow is complex and requires good information and adequate data to be certain of the model results. The groundwater model represents a first step in providing a general understanding of groundwater flow conditions. A degree of uncertainty is always present when using a model to interpret real world situations. In general, geological, hydrogeological and methodological factors contribute to the level of uncertainty within a model. Table 9.4 summarizes the uncertainty in these factors for the Onaping drinking water system. For a detailed description of each factor, refer to Appendix 2.

As illustrated in Table 9.4, there is generally a moderate level of uncertainty related to components of the groundwater modeling process. The delineation of the wellhead protection areas used a conservative approach and thereby overestimates the size of the protection area. In general, the uncertainty associated with the groundwater model increases with the relative size of the protection area as the number of compounding factors increase. The Onaping wellhead protection areas are less than a 2 year time of travel and therefore the overall uncertainty of the delineation is low.

Vulnerability Assessment Uncertainty

The vulnerability scores are based on the Intrinsic Susceptibility Index (ISI) and the wellhead protection area (as explained in Chapter 2). Therefore, the uncertainty associated with each score is a function of these two variables. The uncertainty of the wellhead protection areas has been described above.

Table 9.4 – Summary of the wellhead protection area delineation uncertainty for the Onaping drinking water system

Geological Factors	Depth to aquifer, thickness of overburden	Sufficient data from Vale database in northern portion of the model. Sparse data density through most of model including near water supply wells.
	Soil and Rock Characteristics	Data entry estimations, reporting inconsistencies, averaging by assigning Geologic Survey of Canada codes, very few grain size analyses
Hydrogeological Factors	Hydraulic Parameters	Difference between calculated hydraulic conductivity and value assigned in the model, low density of data, no porosity data
	Hydraulic Head Measurements	Questionable accuracy of values in WWIS, no data from some areas
	Recharge	Recharge assigned according to top layer
	Boundary Conditions	Rivers assigned constant head; no sensitivity analyses
Methodological Factors	Model Used for WHPA Delineation	MODFLOW / MODPATH are industry standards. Only saturated zone flow considered. Natural attenuation not considered.
	Model Calibration and Sensitivity Analysis	Calibrated hydraulic conductivity and recharge only; no sensitivity analyses
	Pump Rate Used for Model	95th percentile of monthly pumping rate is considered a conservative estimate
	Capture Zones Delineation	Low uncertainty because steady state is reached within 2 years

Uncertainty Level

High Uncertainty (Hydraulic Head Measurements) | Moderate Uncertainty (Depth to aquifer, Soil and Rock Characteristics, Hydraulic Parameters, Recharge, Boundary Conditions, Model Calibration and Sensitivity Analysis) | Low Uncertainty (Model Used for WHPA Delineation, Pump Rate Used for Model, Capture Zones Delineation)

49.2 Onaping Drinking Water Quality Threats Activities

The assessment of potential threats to drinking water quality followed Technical Rules (2009) 118 to 125 and the methodology is outlined in Chapter 2. The list of prescribed drinking water threats is located in Table 1.7 in Part 1 of this report.

Identification of areas where threats can occur

The areas where a potential threat is or would be significant, moderate or low are illustrated on Map 9.4. According to the Technical Rules (2009):

- Areas with a vulnerability score of 8 or greater has the potential for a significant, moderate or low threat.
- Areas with a vulnerability score of 6 or greater has the potential for a moderate or low threat to occur.*
- Areas with a vulnerability score of 4 or greater has the potential for a low threat to occur.*
- Areas with a vulnerability score of less than 4 cannot contain a drinking water threat.*

*DNAPLs are an exception because they are always a significant threat in WHPA-A, B, C/C1 regardless of the vulnerability score.

The MECP has established an online tool that incorporates the Provincial Table of Drinking Water Threats into an interactive mapping tool, accessible via http://swpip.ca/. With the address search function, this tool lets you identify what vulnerable area(s) a property is located in and what the vulnerability score is at that location. It also identifies a list of circumstances of all is or would be significant, moderate or low drinking water threats. For more detailed instructions on how to use the above mentioned website refer to Appendix 5.

Managed Lands

The storage, handling and application of agricultural source material, non-agricultural source material, pesticides and fertilizers can result in potential contamination of municipal water supplies. The methodology used to calculate percentage of managed lands in the vulnerable areas is described in Chapter 2.

The percentage of managed lands in the Onaping wellhead protection area was assessed to be under 40% (low) and is illustrated on Map 9.5.

Impervious Surfaces

Impervious surfaces are measured as an indicator of the amount of area where road salt can be applied. The percentage of surface area within a vulnerable area which will not allow surface water or precipitation to be absorbed into the soil is measured. According to these calculations, the Onaping wellhead protection area has less than 1% impervious area, as illustrated on Map 9.6. The calculation of impervious surface resulted in the vulnerable area being designated as a low threat for the application of road salt, as shown in Table 9.6.

The methodology used to calculate percentage of impervious surfaces in the vulnerable areas is described in Chapter 2.

Livestock Density

The calculation of livestock density is based on the calculation of nutrient units per acre of agricultural managed lands. The methodology used to calculate the livestock density in the vulnerable areas is described in Chapter 2. There are no agricultural lands in the Onaping wellhead protection area, therefore the area has a score of under 0.5 nutrient units per acre. The results are illustrated on Map 9.7.

The combination of livestock density and managed land calculations assigns a threat rating for the application of commercial fertilizer. In the Onaping WHPA, it is considered a moderate threat, as shown in Table 9.5.

Enumeration of Threats

Table 9.5 lists as estimate of the number of significant, moderate and low drinking water quality threats in the Dowling drinking water system in accordance with the Drinking Water Threats Tables.

Table 9.5 – Drinking water quality threats for the Onaping drinking water system

Drinking Water Threat Category	Number of Occurrences with Threat Classification		
	Significant	Moderate	Low
WHPA A & B - Areas with a vulnerability score of 10			
The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposed of sewage.	2		
The application of commercial fertilizer to land.		1	
The handling and storage of fuel.		1	
The application of road salt.			1
Local threat: Transportation of hazardous substances along transportation corridors.	2	2	

49.3 Onaping Drinking Water Threats Conditions

A drinking water condition is a situation that results from a past activity and meets the criteria laid out in Chapter 2. For a more detailed review of methodology for identifying drinking water conditions, refer to Part 1, Chapter 2.

The areas where a significant, moderate or low condition could exist are the same for as the areas where a potential threat could occur. For an illustration, please see Map 9.4.

Currently, there are no known conditions within the Onaping vulnerable areas.

49.4 Onaping Drinking Water Quality Issues

Drinking water quality issues were assessed based on the methodology outlined in Chapter 2 and Rules 114 and 115.

Currently, there are no known drinking water quality issues in the Onaping drinking water system.

Chapter 50 - Data Availability

The analyses for this drinking water system were carried out using the best data available to meet the assessment report requirements. Completing scientific assessments on the quality and quantity of water undoubtedly raises a number of questions and uncertainties regarding the methodologies used, availability of data, reliability of data, and overall outcome. As new information arises, either from increased or continuous monitoring, improved models, or a change in methodology, the results from this report will have to be updated to reflect the additional information.

The assessment report is an ever evolving document as new information becomes available and refinements in approaches are made. Changes in land use will also impact the identification of potential threats to water quality and quantity.