SARA GROUP

Sudbury Area Risk Assessment
Volume II

Appendix L:

Drinking Water Survey
Data Report

EXECUTIVE SUMMARY

A Human Health Risk Assessment (HHRA) is currently being undertaken in the Greater Sudbury area as part of the Sudbury Soils Study. The Chemicals of Concern (COC) for the Sudbury Soil Study are arsenic, cobalt, copper, lead, nickel and selenium. One potential exposure route for humans for these COC is via drinking water, which needs to be considered in the HHRA. The majority of households in the region are serviced by a municipal water supply, which is routinely monitored by both the City of Greater Sudbury and the Ontario Ministry of the Environment for a suite of metals, including the COC for the Sudbury Soils Study. However, there is no such monitoring program for the number of homes in the area that rely on surface water (lakes, primarily) and groundwater wells for their drinking supply. One area of uncertainty in the HHRA is the concentration of metals in private wells and households drawing from surface water.

During the fall of 2004 a Drinking Water Survey was conducted to fill this data gap. Drinking Water samples were collected from 94 residential properties, including both private wells drawing water from groundwater and residences drawing surface water from lakes. Where applicable, the results of the analysis were compared to provincial drinking water guidelines set out in the Safe Drinking Water Act, 2002. There are no provincial drinking water standards for either cobalt or nickel. The concentrations of all other COC in the water supplies surveyed were below their respective drinking water guideline. These data will be used as part of the exposure assessment for the Sudbury HHRA.

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SUDBURY AREA RISK ASSESSMENT
DRINKING WATER SURVEY

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L-1.0 INTRODUCTION

The Sudbury Basin is an area rich in mineral deposits, particularly the nickel and copper ores that have drawn people to the region for the past 125 years. Recent studies have identified areas in Sudbury with elevated metal levels in the soil. These areas are generally close to the historic smelting sites of Coniston, Falconbridge and Copper Cliff. Although these metals do occur naturally in all soils, the studies generally indicate higher levels in surface soil (the top 5 cm) as a result of local mining, smelting and refining operations.

In 2001, the Ontario Ministry of the Environment (MOE) released a report that identified concentrations of nickel, cobalt, copper and arsenic in the area that exceeded generic MOE soil quality guidelines. Under Ontario legislation, this triggers the need for more detailed study. Therefore, the MOE made two recommendations:

- That a more detailed soil study be undertaken to fill data gaps; and,
- That a human health and ecological risk assessment be undertaken.

These recommendations initiated the Sudbury Soils Study, a collaborative project started in 2002 to evaluate heavy metal levels in the soils of the Sudbury area. As part of the project, an integrated Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) was initiated in Sudbury to evaluate potential risk from airborne particulate emissions of the Chemicals of Concern (COC) resulting from past smelting operations on the local environment and Sudbury area residents. The COC for the risk assessments have been identified as arsenic, cobalt, copper, lead, nickel and selenium (referred to as "metals").

One area of uncertainty in the HHRA is the metal concentration in local drinking water supplies. The Drinking Water Survey, conducted during the fall of 2004, was undertaken to address this uncertainty.

Drinking water in the City of Greater Sudbury and surrounding area comes from both surface and groundwater sources and is of either private or municipal supply. The four possible drinking water sources and the approximate number of homes in the Sudbury area supplied by each of these sources is as follows (Richards, 2002):

- Municipal supply, drawn from surface water (41,000 homes)
- Municipal supply, drawn from groundwater (17,000 homes)
- Private supply, drawn from surface water (1,000 homes)

- Private supply, drawn from groundwater (1,300 homes with wells in bedrock and 5,700 homes with wells in overburden).

To appropriately assess the risk related to exposure of Sudbury residents to each of the COC, the HHRA will address all four sources of drinking water. The majority (88%) of households in the City of Greater Sudbury are serviced by a municipal water supply and the remaining households obtain water from a private supply (surface water or groundwater).

The municipal supply is monitored by the City of Greater Sudbury Public Works Department. This department conducts routine analyses for all of the COC for the Sudbury Soils Study as part of its routine monitoring to satisfy the requirements of Ontario Regulation 170/03, Safe Drinking Water Act, 2002). The analysis for inorganics (Table C of the Ontario Drinking Water Standards) includes As, Co, Cu, Ni, Pb, and Se. The water quality reports from this monitoring will be used to assess exposure to the six COC in drinking water for the HHRA.

A data gap identified by the SARA Group involved the remaining residents whose drinking water originated from a private supply. Private drinking water supplies in the Sudbury area are drawn from surface water, shallow overburden wells, and deeper bedrock wells. Metal concentrations are rarely monitored in private water supplies. There are 8,218 unserviced households in the Sudbury area, for which there are 4,136 MOE well records (Richards, 2002). The number of dug wells without MOE well records for a given township can be as many as the number of recorded wells; therefore it was estimated that there may be at least 2,000 wells in the Sudbury area without water well records. The field sampling program discussed in this document focuses on residential groundwater and surface water supplies from these unserviced areas.

L-1.1 Objective of the Drinking Water Survey

The objective of the Drinking Water Survey was to obtain site-specific data on the range of concentrations of metals found in private drinking water sources in the Sudbury area. The results will be used as part of the exposure assessment component of the ongoing HHRA.

L-2.0 METHODOLOGY

A description of the methods used to identify sampling areas and the sampling method for this survey are provided in the SARA document "Drinking Water Survey Work Plan, August 5, 2004" (Appendix A). This internal report provides the methods for the Drinking Water Survey.

The methods used to locate potential wells, collect and label water samples, conduct the laboratory analysis and ensure the quality assurance and quality control of the samples is provided in the following sections.

L-2.1 Selection of Drinking Water Samples

A target of 80-100 groundwater wells and 20 surface water sources (*i.e.* lakes) was established for estimating exposure through private well water. The following is the procedure followed for obtaining a water sample.

L-2.1.1 Locating Potential Wells

An advertisement (Appendix B) was placed in local Sudbury newspapers notifying residents that volunteers were sought to participate in a survey of metals in drinking water. Homeowners were provided with a contact number. Interested participants were screened using a questionnaire (Appendix C) to determine whether their water supply met the following selection criteria:

- Was the well located in one of the areas of interest - selected according to soil metal concentrations, density of overburden wells, and location of groundwater recharge zones?
- Is the well drawn from a private supply?

In areas where sufficient wells were not located, additional participants were located through door-to-door canvassing.

L-2.1.2 Site Information

If a household met the criteria for sampling additional information was collected. Upon arrival, a detailed well/pump inventory was completed (Appendix D) in consultation with the property owner. The inventory included the following information:

- Landowner contact information;
- Location of the property and well;
- Water source (overburden, bedrock, lake) and water usage (domestic, farm, outdoor use);
- Condition of, and details about the well and pump;
- Potential sources of contamination (*i.e.* proximity to barnyard, gas tank, septic bed, *etc.*);

- Any past or current water quality problems;
- Use of any water treatment;
- MOE Well Record Number (if available); and
- Name and contact information of the well driller.

L-2.2 Water Sample Collection

Samples were collected at the kitchen tap, as it is the primary site for drinking water. The cold water tap was turned on, and the water run for 2 minutes to ensure the sample represented water from the surface water or well source, and not water which had been in the homeowners' pipes. A 300 mL non-acidified high-density polyethylene (HDPE) plastic bottle was used to collect the sample. The bottle was labelled prior to sampling. The bottle was rinsed twice with tap water and then filled to the shoulder of the bottle. Care was taken to ensure the bottle lip did not make contact with the tap.

The cap was secured to the bottle, and the amount of sediment in the sample was noted. Once back in the vehicle, the bottle was placed into a cooler for storage until shipment to SGS Lakefield Laboratories for analysis.

Water samples were not filtered, because drinking water guidelines are based on unfiltered samples. Furthermore, filtering the sample is not representative of what the homeowners are consuming, as the majority of homes do not have filter systems.

L-2.3 Water Sample Labeling

The tap water samples were labelled with the following information:

- Sample Number ("SARA-XX")
- Type of water collected (surface or groundwater)
- Data of collection
- If the sample was a replicate this was indicated.[1]

L-2.4 Sample Handling and Shipping

The collected water samples were stored on ice in a cooler until they were ready to be shipped to the laboratory for analysis.

[1] Triplicate samples were collected for each of the samples selected for QA/QC analysis

Samples were shipped to:

SGS Lakefield Research Limited
P.O. Box 4300, 185 Concession Street
Lakefield, ON
K0L 2H0
Phone (705) 652-2038; Fax (705) 652-6441

Chain-of-custody forms were sent with each sample shipment. These clearly identified the samples contained within the shipment package, as well as the analysis to be conducted on each sample. All information from the chain of custody forms was recorded electronically on a daily basis and entered into a prepared spreadsheet. This ensured that all collected samples were submitted and analysed.

L-2.5 Analytical Parameters

All collected samples were analyzed by Inductively Coupled Plasma Mass Spectrophotometry (ICP-MS) at SGS Lakefield Laboratories for the following metals, metalloids, and other parameters:

- pH
- Aluminium
- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lea
- Magnesium
- Manganese
- Molybdenum
- Nickel
- Selenium
- Sodium
- Vanadium
- Zinc

L-2.6 Minimum Detection Limits

The instrument minimum detection limits (MDLs) for the Chemicals of Concern provided by SGS Lakefield Laboratories are shown in Table L2.1.

Table L2.1 Minimum Detection Limits (MDL) for COC

Parameter	MDL (µg/L)
Arsenic	2
Cobalt	0.3
Copper	0.5
Nickel	1
Lead	0.1
Selenium	3

All samples were prepared according to certified protocols, and analysis was performed by SGS Lakefield Laboratories within 3 days of receiving the samples.

L-2.7 QA/QC: Triplicate Samples and Certified Reference Material

To assess the quality assurance (QA) of the data set triplicate water samples were collected at one in every 25 sites (4 triplicates in total). The purpose of these samples was to measure the variation among samples taken from a given site. The QA was determined by calculating the percent difference within each group of triplicate samples. A percent difference within 20 percent was deemed acceptable. When the percent difference was greater than 20 percent the concentration levels were taken into consideration. The sites where triplicate samples were taken were randomly selected during the drinking water survey.

As an additional QA/QC measure, a certified reference material (CRM) was also submitted for analysis. The values obtained for the CRM were not known by the laboratory. The reference material sent to the laboratory was a liquid 5% Nitric acid (HNO_3) matrix, Catalogue Number 600-211-800, Lot SC4153138. A copy of the certification for the CRM is provided in Appendix E.

L-3.0 RESULTS

L-3.1 Sampling Locations

A total of 94 drinking water samples were collected (Table L3.1). Eighteen of these were taken from homes drawing from a surface water supply, while 76 were from homes drawing from a groundwater supply. This sample size was considered acceptable for defining metal levels in private residential water supplies.

The locations of all drinking water samples collected during the survey are shown in Figure L-3-1.

The 18 homes drawing from surface water were situated on 8 different lakes, including: Clearwater, Lohi, McFarlane, Long, Raft, Whitewater, Grant and Hanmer Lakes.

The 76 groundwater samples came from the following townships: Balfour, Blezard, Broder, Capreol, Dill, Dowling, Garson, Graham, Hanmer, McLennan, Neelon, Onaping, Rayside, Snider, and Waters. The number of private wells sampled in each township is presented in Table L3.1.

Table L3.1 Number of Lakes and Wells Samples During the Drinking Water Survey

Townships	# Wells Sampled	Lakes	# Samples Obtained
Balfour	5	McCrea	0
Blezard	2	Clearwater	3
Broder	11	Hannah	0
Capreol	6	Lohi	2
Dill	8	Middle	0
Garson	3	Pine	0
Graham	3	Silver	0
Hanmer	4	McFarlane	3
Neelon	3	Long Lake	6
McLennan	1	Raft	1
Rayside	10	Whitewater Lake	1
Waters	11	Grant Lake	1
Onaping/Dowling	3/2	Hanmer Lake	1
Snider	3		
Sudbury	1		
Total	76	Total	18

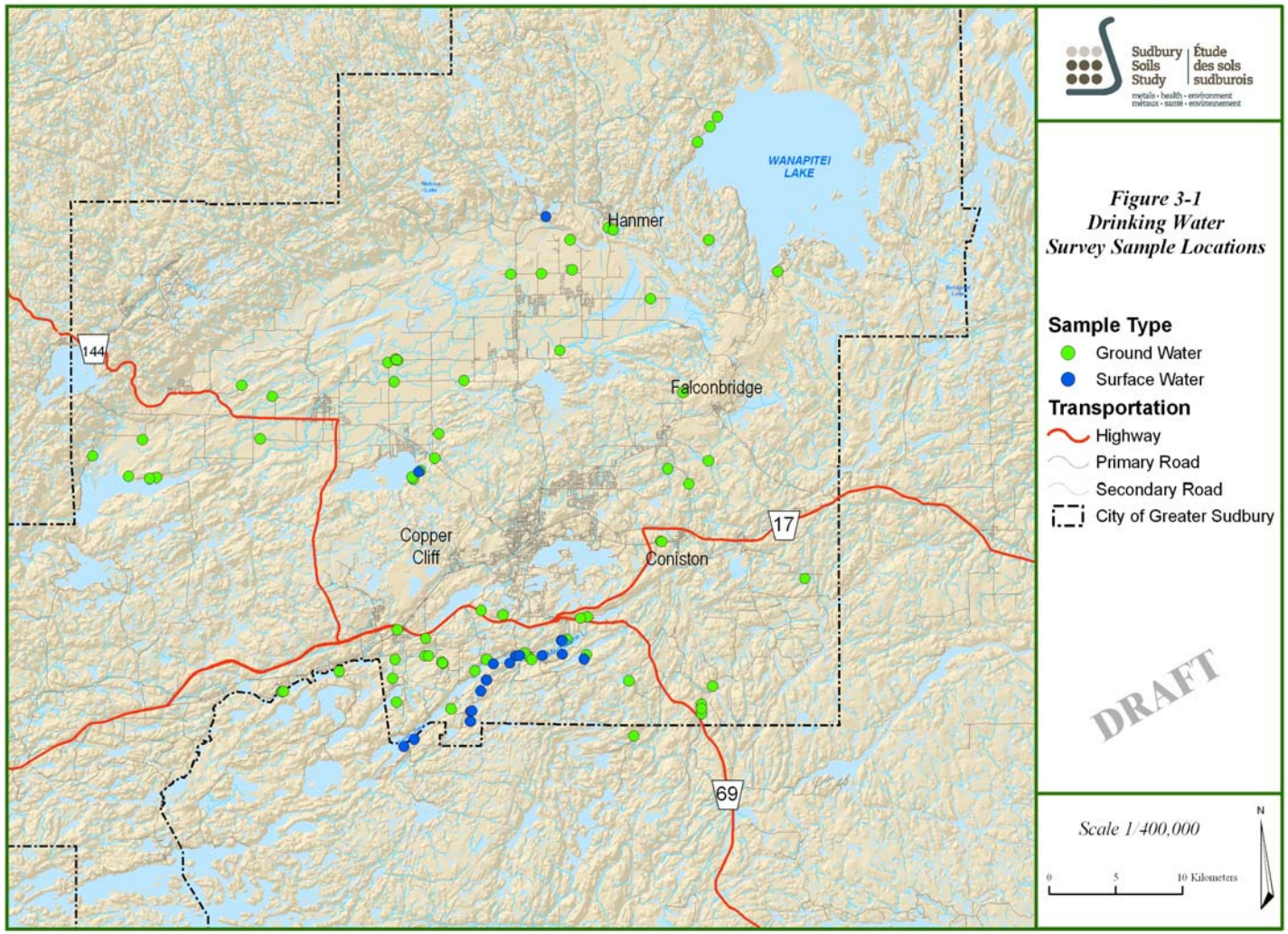

Figure L-3-1 Drinking Water Survey Sample Location

L-3.2 Guideline Values

Drinking water in Ontario is regulated by the Ontario Safe Drinking Water Act (SDWA) (2002). The guideline values set forth in the SDWA were used to assist in the interpretation of the results of this drinking water survey. Within the Act there are 3 types of values - Maximum Acceptable Concentration (MAC), Aesthetic Objectives (AO) and Operational Guidelines (OGs). The MAC is a health-related drinking water standard established for substances having known or suspected adverse health effects above a certain concentration. AOs are not health-related, but may affect the taste, odour, colour, or clarity of the water; and OGs are set to ensure efficient treatment and distribution of water (Ontario SDWA, 2002). One of these values exists for all COC, except cobalt and nickel. Table L3.2 outlines the guideline values for all metals, metalloids, and other elements measured in the drinking water samples.

Table L3.2 Guideline Values for Metals in Ontario Drinking Water

Metal	Units [a]	Guideline Value	
		MAC	AO/OG
Aluminium	µg/L	---	100
Antimony	µg/L	6	---
Arsenic	µg/L	25	---
Barium	µg/L	1000	---
Boron	µg/L	5000	---
Cadmium	µg/L	5	---
Chromium	µg/L	50	---
Copper	µg/L	---	1000
Iron	µg/L	---	300
Lead	µg/L	10	---
Manganese	µg/L	---	50
Selenium	µg/L	10	---
Sodium	µg/L	20	200,000
Uranium	µg/L	20	---
Zinc	µg/L	---	5000
pH	units		6.5-8.5[b]

[a] µg/L = parts per billion (ppb)

[b] Based on aesthetic considerations, *Guidelines for Drinking-water Quality*, 1984

L-3.3 QA/QC

Four groups of triplicate water samples were collected for analysis. Each triplicate group was numbered from 1-4. Percentage difference for each metal, between the triplicates, was used as an indicator of analytical and data quality. A total of 20 metals plus pH were measured. The QA/QC results for the COC are in Table L3.3, and the QA/QC for all metals is located in Appendix F. The percentage difference value for all metals for all triplicates was below 20% with the exception of the metals presented in Table 3.4.

Table L3.3 Percentage Difference Between COC for Triplicate Samples

		pH	As	Co	Cu	Ni	Pb	Se
		units	µg/L					
Trip 1a		7.61	1	0.15	106	47.9	0.3	1.5
Trip 1b		7.65	2	0.15	92.9	47.4	0.8	1.5
Trip 1c		7.64	1	0.15	87	50.8	0.1	1.5
% difference	1a and 1b	0.53%	100.00%	0.00%	-12.36%	-1.04%	166.67%	0.00%
	1a and 1c	0.39%	0.00%	0.00%	-17.92%	6.05%	-66.67%	0.00%
Trip 2a		7.48	1	6.8	51	123	0.2	1.5
Trip 2b		7.49	1	6.2	48	111	0.3	1.5
Trip 2c		7.47	1	6.3	47	114	0.4	1.5
% difference	2a and 2b	0.13%	0.00%	-8.82%	-5.88%	-9.76%	50.00%	0.00%
	2a and 2c	-0.13%	0.00%	-7.35%	-7.84%	-7.32%	100.00%	0.00%
Trip 3a		7.67	1	0.15	67.5	53.2	0.2	1.5
Trip 3b		7.47	1	0.15	67.5	56.7	0.2	1.5
Trip 3c		7.61	1	0.15	53.2	54.1	0.1	1.5
% difference	3a and 3b	-2.61%	0.00%	0.00%	0.00%	6.58%	0.00%	0.00%
	3a and 3c	-0.78%	0.00%	0.00%	-21.19%	1.69%	-50.00%	0.00%
Trip 4a		8.11	9	0.15	98.5	1 <MDL	0.05	1.5
Trip 4b		8.16	9	0.15	105	1 <MDL	0.2	1.5
Trip 4c		8.17	8	0.15	91	1 <MDL	0.05	1.5
% difference	4a and 4b	0.62%	0.00%	0.00%	6.60%	-	300.00%	0.00%
	4a and 4c	0.74%	-11.11%	0.00%	-7.61%	-	0.00%	0.00%

All the values with a percent difference greater than 20 percent were examined in greater detail (Table L3.4). The following points are noted:

- Seven of the values having a percent difference greater than 20% were close to the minimum detection limit and therefore are not given much weight, with slight changes in the concentration resulting in large changes in percent difference;
- One value was marginally over 20 %;
- Two values were in disagreement and were marginally over 20 % (i.e. 23 % or less); and

- Four values had two of the three values in agreement.

Table L3.4 Triplicate Samples with Percentage Difference Greater than 20%

Triplicate Group	Metal	MDL (µg/L)	Triplicate Values[(a)] (µg/L)	Number of samples in disagreement	Values[(a)] not in agreement (µg/L)	Notes	Issue? (Y/N)
1	Arsenic	2.00	**1**, 2, 1	1	**1**,2	Close to the MDL	N
1	Lead	0.10	**0.3**, 0.8, 0.1	2	**0.3**, 0.8, 0.1	Close to the MDL	N
1	Zinc	1.00	**13**, 13, 10	1	**13**, 10	Value in disagreement is lower than other two values, marginally over 20% (23% difference)	N
2	Cadmium	0.10	**0.3**, 0.2, 0.3	1	**0.3**, 0.2	Close to the MDL	N
2	Iron	10.00	**22**, 19, 29	1	**22**, 29	Other 2 samples in agreement	N
2	Lead	0.10	**0.2**, 0.3, 0.4	2	**0.2**, 0.3, 0.4	Close to the MDL	N
3	Copper	0.50	**67.5**, 67.5, 53.2	1	**67.5**, 53.2	Value in disagreement is lower than other two values, marginally over 20% (21% difference)	N
3	Iron	10.00	**92**, 82, 45	1	**92**, 45	Value in disagreement is lower than other two values	N
3	Lead	0.10	**0.2**, 0.2, 0.1	1	**0.2**, 0.1	Close to the MDL	N
3	Vanadium	0.90	**1**, 0.45, 1	1	**1,** 0.45	Close to the MDL	N
3	Zinc	1.00	**24**, 23, 16		**24**, 16	Value in disagreement is lower than other two values	N
4	Manganese	0.10	**17.2**, 21.2, 18.7	1	**17.2**, 21.2	Marginally over 20% (23% difference)	N
4	Lead	0.10	**0.05**, 0.2, 0.05	1	**0.05**, 0.2	Close to the MDL	N
4	Zinc	1.00	**4**, 7, 4	1	**4**, 7	Other 2 samples in agreement	N

(a) Value in bold represents the original sample

In summary, we are satisfied with the results of the triplicate analysis as a measure of reproducibility of the analytical procedure for water samples.

Certified Reference Material (CRM)

Table L3.5 shows the reported values of the CRM in comparison to the certified values. The reported values from the laboratory were within 12% of the certified value for the CRM. This indicates excellent accuracy of the analytical laboratory. The CRM results for all metals other than the COC are provided in Appendix E.

Table L3.5 Results[(a)] of Analysis of the Certified Reference Material for the COC

	As	Co	Cu	Ni	Pb	Se
Reported Values	37100	35300	495000	684000	129000	5650
Certified Values	35000	35280	498900	622000	124700	5020
Percent Difference	-6.00 %	0.06 %	-0.78 %	9.97 %	3.45 %	12.55 %

(a) All values are presented in μg/L

L-3.4 Concentrations of Metals in Surface Water Supplies

A summary of the range of concentrations of the COC in surface water is provided in Table L3.6. The complete results for all metals analyzed are provided in Appendix G.

No surface water sample concentrations exceeded any of the values set out in the Safe Water Drinking Act guidelines (Table L3.2). The results indicate that:

- Arsenic was not detected in any of the surface water samples (<2 μg/L);
- Cobalt was detected in one sample at a value that was marginally above the DL of 0.3 μg/L;
- Copper was detected in all samples (MDL 0.5 μg/L). The range in concentration was 20.9 μg/L (Lohi Lake) to 302 μg/L (Clearwater Lake). The maximum value measured during the survey is much lower than the AO guidance value (1000 μg/L);
- Nickel was detected in all samples (MDL 1 μg/L). The range was from 9.96 μg/L (Hanmer Lake) to 126 μg/L (Whitewater Lake); there is no drinking water standard for nickel;
- Lead was detected in all samples (MDL 0.05 μg/L). The range in concentration was from 0.5 μg/L (Clearwater) to 5 μg/L (Long Lake). The maximum value was much lower than the MAC guidance value (10 μg/L);
- Selenium was not detected in any of the surface water samples (<3 μg/L); and

- The range in pH was from 6.41 to 8.37 (Clearwater). There were four samples that were marginally below the aesthetic considerations (6.5-8.5) as outlined in *Guidelines for Drinking-water Quality*, 1984; two samples (pH = 6.41, 6.49), from Clearwater Lake, and two samples (pH= 6.45, 6.48) from Lohi Lake. There are no health-based guideline values for pH.

Table L3.6 Range of Concentrations (μg/L) of COC in Surface Water

Area	n	Range (μg/L)						pH Range
		As	Co	Cu	Ni	Pb	Se	
Clearwater	3	< 2	< 0.3-0.4	49-302	47.3-71.3	0.5-3.2	< 3	6.41-8.37
Grant Lake	1	< 2	< 0.3	73.1	55.4	0.8	< 3	7.44
Hanmer Lake	1	< 2	< 0.3	32.4	9.96	1	< 3	6.76
Lohi Lake	2	< 2	< 0.3	20.9-136	54.58-62.8	0.4-1.4	< 3	6.45-6.48
Long Lake	6	< 2	< 0.3	53-141	40.9-59.5	0.2-5	< 3	7.2-7.37
McFarlane	3	< 2	< 0.3	63.9-106	45.3-53.2	0.2-1	< 3	7.57-7.67
Raft Lake	1	< 2	< 0.3	199	78.2	0.7	< 3	6.9
Whitewater	1	< 2	< 0.3	56.2	126	1.2	< 3	7.82

L-3.5 Concentrations of Metals in Groundwater Supplies

A summary of the range of concentrations of the COC in wells drawing from groundwater supplies is shown in Table L3.7. The complete results for all metals analyzed are provided in Appendix G.

No groundwater sample concentrations exceeded any of the values set out in the Safe Water Drinking Act guidelines (Table L3.2). The results reveal that for the 76 samples:

- Arsenic was detected in 15 of the groundwater samples (MDL 2 μg/L). The maximum concentration value (23 μg/L) occurred in the Broder area and was below the MAC guidance value (25 μg/L);
- Cobalt was detected in 16 of the samples (MDL 0.3 μg/L). The maximum concentration (8.7 μg/L) occurred in the Broder area;
- Copper was detected in 68 of the groundwater samples (MDL 0.5 μg/L). The maximum value (216 μg/L) measured during the survey is much lower than the AO guidance value (1000 μg/L);

- Nickel was detected in 41 samples (MDL 1 µg/L). The maximum concentration (123 µg/L) occurred in the Broder area; there is no drinking water standard for nickel;
- Lead was detected in 64 samples (MDL 0.1 µg/L). The maximum concentration (8 µg/L) occurred in the Capreol area. The maximum value was lower than the MAC guidance value (10 µg/L);
- Selenium was not detected in any of the ground water samples (DL = 3 µg/L); and
- The range in pH was from 5.54 to 8.29 (Clearwater). There were two samples that were below the aesthetic considerations (6.5-8.5) as outlined in *Guidelines for Drinking-water Quality*, 1984; one sample (pH = 5.54) from the Waters area, and one sample (pH=6.2) from the Balfour area. There are no health-based guideline values for pH.

Table L3.7 Range of Concentrations (µg/L) of COC in Groundwater Wells

Area	n	Range (µg/L)						
		As	Co	Cu	Ni	Pb	Se	pH Range
Balfour	5	<dl - 21	<dl - 0.7	<dl - 31.8	<dl - 2.51	<dl - 1.1	<dl	6.2 - 8.02
Blezard	2	<dl - 7	<dl - 0.4	1.7 - 97.6	<dl - 2.22	0.2 - 0.4	<dl	7.13 - 8.02
Broder	11	<dl - 23	<dl - 8.7	<dl - 146	<dl - 123	<dl - 2.0	<dl	6.38 - 8.23
Capreol	6	<dl	<dl	19 - 182	1.63 - 9.42	0.3 - 8.0	<dl	6.76 - 8.07
Dill	8	<dl - 5	<dl - 4.3	<dl - 206	<dl - 28.2	<dl - 7.6	<dl	6.73 - 8.19
Dowling	2	<dl	<dl	<dl - 37	<dl - 1.01	<dl - 0.5	<dl	7.37 - 8.02
Garson	3	<dl - 14	<dl	1.7 - 39.8	<dl - 21.79	<dl - 0.2	<dl	7.26 - 8.02
Graham	3	<dl	<dl - 0.6	<dl - 3.5	<dl - 7.64	<dl - 0.1	<dl	7.51 - 8.06
Hanmer	4	<dl - 5	<dl	1.2 - 80.7	<dl - 2.26	<dl - 0.8	<dl	7.19 - 7.97
McLennan	1	<dl	<dl	46.6	<dl	0.8	<dl	6.99
Neelon	3	<dl	<dl - 0.4	0.5 - 52.9	1.39 - 6.75	0.2 - 2.3	<dl	7.47 - 8.08
Onaping	3	<dl - 2	<dl	<dl - 67.6	<dl - 6.81	<dl - 0.4	<dl	7.63 - 8.29
Rayside	10	<dl - 9	<dl - 3.8	<dl - 54	<dl - 12.4	<dl - 1.9	<dl	7.28 - 8.13
Snider	3	<dl	<dl	4.3 - 101	<dl - 24.4	0.2 - 0.6	<dl	7.29 - 8.1
Sudbury	1	<dl	<dl	107	<dl	0.3	<dl	7.68
Waters	11	<dl - 9	<dl - 1.5	7.1 - 216	<dl - 116	<dl - 2.9	<dl	5.54 - 8.11

* <dl means that the value was below the detection limit

L-3.6 Metals Other than COC in Groundwater and Surface water Supplies

Barium, boron, cadmium, chromium, lead, antimony, uranium and zinc were all below the drinking water guidelines for the MAC. There are currently no drinking water guidelines available for silver, beryllium,

bismuth, calcium, potassium, lithium, magnesium, molybdenum or vanadium. Four water samples exceeded the aesthetic objective for iron and eight samples exceeded the manganese aesthetic objective. Four samples contained molybdenum above the MDL (MDL 0.3 μg/L), and 16 samples contained vanadium above the MDL (MDL 0.9 μg/L).

L-3.7 Notification of Results to Homeowners

Letters reporting the values of metal levels in drinking water were provided to each household sampled. An example of the letter that was sent to landowners is provided in Appendix H. In the letter, the drinking water results from each property were compared to the MAC, AO or OG where this value was applicable.

L-4.0 SUMMARY

The concentration of metals obtained during the Drinking Water Survey will be incorporated into the HHRA model. The levels of COC in the drinking water were below the guidance values set out in the SDWA, 2002. All residents were notified of their individual results, and any questions they had were addressed accordingly.

L-5.0 REFERENCES

Ministry of the Environment, Drinking Water Systems Regulation O.Reg. 170/03 - Safe Drinking Water Act, 2002

Richards, P.A. 2002. Hydrogeology of the Sudbury Area; *in* The Physical Environment of the City of Greater Sudbury, Ontario Geological Survey, Special Volume 6, p.103-126

World Health Organization, Guidelines for Drinking Water Quality, 2004

SUB APPENDIX L-A

DRINKING WATER SURVEY WORKPLAN, AUGUST 5, 2004

SUB APPENDIX L-B
AD FOR DRINKING WATER SURVEY

SUB APPENDIX L-C

PRELIMINARY QUESTIONS FOR WELL WATER INVENTORY

SUB APPENDIX L-D

WELL AND PUMP INVENTORY

SUB APPENDIX L-E

CERTIFIED REFERENCE MATERIAL

SUB APPENDIX L-F

QUALITY ASSURANCE AND QUALITY CONTROL

SUB APPENDIX L-G

METAL CONCENTRATIONS IN GROUNDWATER AND SURFACE WATER

SUB APPENDIX L-H

DRINKING WATER LETTER TEMPLATE