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Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

November 1, 2019

Louise Klein
2047 Bass Lake Road
Bobcaygeon, Ontario

Re: Residential Surface Water Characterization
258 and 456 Bass Lake Road and Watson's Bridge, Bobcaygeon, ON
Cambium Reference No. 9883-001

Dear Ms. Klein,

Cambium Inc. (Cambium) was retained by Ms. Louise Klein to complete a surface water characterization for the properties at 258 Bass Lake Road and 456 Bass Lake Road as well as Watson's Bridge in Bobcaygeon, Ontario, in the County of Peterborough. All surface water monitoring stations were along Nogies Creek, where the aforementioned residents source their drinking water.

BACKGROUND

The objective of the residential surface water characterization program is to continue to develop baseline surface water quality data downstream of the proposed development of a nearby quarry. One surface water station was established upstream of the proposed quarry and two surface water stations were established downstream of the perceived area of influence of the quarry and associated potential surface water impacts. The surface water monitoring stations are described in more detail in the Surface Water Sampling section of this report.

The primary concern related to the development of the quarry is the discharge of sediment to the environment; therefore, the water quality was analyzed for total suspended solids, and total dissolved solids. As explosives will be used at the quarry site, there is a potential for ammonia to enter downstream surface water systems. Since ammonia is readily converted to nitrates in the environment, ammonia, nitrate, and nitrite were analyzed. Lastly, due to a concern with arsenic concentrations, an inorganic (metal) scan was included as a part of the analysis. Two additional parameters were added to the analysis in 2016, which included total reactive phosphorous and *Escherichia coli* (*E. coli*).

SURFACE WATER SAMPLING

LOCATION OF SURFACE WATER SAMPLING STATIONS

Cambium staff established surface water monitoring stations SW101-12, SW102-12, and SW103-12 on August 10, 2012 (Figure 1). These three surface water monitoring stations were sampled on September 24, 2019 as part of the surface water sampling program. A description of the surface water monitoring stations is as follows:

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- Surface water monitoring station SW101-12 is at 258 Bass Lake Road and was established upstream (north) of a dock, at a constriction of the creek. The Universal Transverse Mercator (UTM) coordinates for station SW101-12 are 17 T 697097 4941861.
- Surface water monitoring station SW102-12 is at 456 Bass Lake Road, which is the residence of Mr. David Klein. This station was established in a clear run of the creek, downstream of the property. The UTM coordinates for station SW102-12 are 17 T 696295 4942960.
- Surface water monitoring station SW103-12 is at Watson's Bridge, a small bridge crossing Nogies Creek. The surface water sample was collected on the upstream side of the bridge using a pole sampler from the bridge surface. Station SW103-12 is upstream of the proposed quarry and may serve as a background location in the future. The UTM coordinates for station SW103-12 are 17 T 695864 4945808.

SAMPLING METHODOLOGY

To properly characterize the water supplying the residences, it was important to obtain a raw water sample that has not passed through a treatment system. As the residents reportedly source their drinking water from Nogies Creek, Cambium personnel obtained the water samples directly from the Creek to avoid any treatment systems that may be present at the three locations.

All samples were collected by submerging a clean container into the mid-course of the water body, using a pole-sampler from the shoreline of Nogies Creek, then decanting the water directly into the sample bottle.

Weather on the day of the sampling event was partly cloudy and an average of 14°C. Precipitation events prior to the sampling event on September 24, 2019 were reported on September 19 through September 24 for a total of 2.5 mm. Data was retrieved from the Environment Canada Meteorological Station at Trent University in Peterborough, Ontario with Climate ID number 6166456 (Environment Canada, 2019).

All surface water samples were submitted for analysis of the parameters listed on the Certificate of Analysis attached and summarized in Table 1.

RESULTS

All collected surface water samples were stored in coolers with freezer packs and maintained at, or less than, 10°C during transport to the SGS Environmental Analytical Laboratory in Lakefield, Ontario (SGS). SGS is accredited by the *Canadian Association for Laboratory Accreditation Inc.* (CALA), for specific environmental tests listed in the scope of accreditation approved by CALA.

The Certificate of Analysis for the water quality results for the September 2019 sampling event are attached. The surface water data has been compared with the *Ontario Drinking Water Quality*

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Standards, as developed by the Ministry of the Environment, Conservation and Parks (MECP) for the *Safe Drinking Water Act, 2002* (Ministry of the Environment, 2006).

SURFACE WATER QUALITY

Water quality from the two downstream monitoring stations (SW101-12 and SW102-12) was compared to the water quality from the upstream station (SW103-12), the Ontario Drinking Water Quality Standards (ODWQS), the Provincial Water Quality Objectives (PWQO), and historical results. The chemical results of the surface water samples collected during the September 2019 sampling event on Nogies Creek were similar to those reported during previous sampling events.

In 2019, a majority of parameters were less than the ODWQS criteria limits in surface water collected at all surface water monitoring stations, including the parameters of concern (TSS, total ammonia, and nitrate), and in many cases the concentrations were less than the method detection limit (MDL).

Historically, hardness concentrations in surface water collected at all three surface water stations has consistently exceeded the ODWQS criteria limit, as was the case in September 2019 (with the exception of surface water from station SW103-12). As Nogies Creek flows through sedimentary limestone bedrock described as the *Bobcaygeon Formation*, (Chapman & Putnam, 1984), elevated parameters of alkalinity, calcium, hardness, magnesium, and pH would be anticipated.

Organic nitrogen concentrations in surface water from all surface water stations has historically exceeded the ODWQS limit of 0.15 mg/L. In 2019 the lab reported that the concentration of organic nitrogen was below the detection limit of 0.5 mg/L; as such the sample may had exceeded the ODWQS limit. It should be noted that the source water is surface water derived so exceedances of organic nitrogen are anticipated (in comparison to a groundwater source to which the ODWQS more applies where organic nitrogen would not be typically present).

E. coli concentrations in surface water collected from the three monitoring stations (SW101-12, SW102-12, and SW103-12) were as follows: 66, 71, and 29 Colony Forming Units per 100 millilitres (cfu/100 mL), respectively. The count is based on a 100 mL sample, and constitutes the geometric mean of levels of *E. coli* in the 100 mL sample (Ministry of the Environment, February 1999). *E. coli* was chosen because of all the bacteria in the coliform group, this parameter is most closely associated as an indicator of fecal contamination in surface water systems (Ministry of the Environment, February 1999). Elevated concentrations of this parameter in surface water systems are typically linked to events of high precipitation which could carry this type of bacteria from agricultural areas, overloaded sewage systems, or animal and bird point sources, to downstream receptors. The ODWQS states a drinking water limit of 0 *E. coli* per 100 mL, whereas the PWQO has a recreational limit of 100 per 100 mL sample. Anything greater than this limit, with regard to the PWQO, and the area should be considered unsuitable for recreational

use. The presence of fecal coliforms in surface water acts as an indicator that there may be disease-carrying organisms within the same environment as the fecal coliforms (Oram, 2014). To ensure that no human health related impacts are encountered, a treatment system should be considered that ensures adequate disinfection of any drinking water, tailored to the source water quality of Nogies Creek.

Generally, although some variation was observed, most parameters report concentrations that were similar to, or less than, those reported in 2018 and ultimately reflect baseline water quality conditions in Nogies Creek.

CLOSING

If you have questions or comments regarding the surface water sampling completed at your site, please do not hesitate to contact the undersigned at (705) 742-7900 ext. 203.

Best regards,

Cambium Inc.

Steven Beckett, EIT
Technician

Kevin Warner, M.Sc., P.Geo (Ltd).
Senior Project Manager

KW/swb

Encl. *Table 1* *Surface Water Quality Results*
Laboratory Certificates of Analysis CA14841-SEP19
Figure 1 *Surface Water Sampling Locations*

P:\9800 to 9899\9883-001 Louise Klein - 2019 Surface Water Characterization - 2047 Bass Lake Road, Nogies Creek\Deliverables\REPORT - AMR\Draft\2019-10-28 LTR Klein Residential Surface Water Characterization 2019.docx

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REFERENCES

Chapman, L., & Putnam, D. (1984). *The Physiographic Regions of Southern Ontario, Third Edition.* Ontario Ministry of Natural Resources.

Environment Canada. (2019). *Daily Data Report - September 2019 Peterborough Trent University*. Retrieved 12 12, 2017, from Canadian Daily Climate Data: https://climate.weather.gc.ca/climate_data/daily_data_e.html?hlyRange=2005-05-12%7C2019-10-27&dlyRange=2005-05-17%7C2019-10-27&mlyRange=2006-04-01%7C2006-12-01&StationID=43763&Prov=ON&urlExtension=_e.html&searchType=stnName&optLimit=yearRange&StartYear=18

Ministry of the Environment. (2006). *Technical Support Document for Ontario Drinking Water Quality Standards, Objectives and Guidelines.*

Ministry of the Environment. (February 1999). *Water Management - Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of the Environment and Energy.* Ontario Ministry of the Environment and Energy.

Oram, B. (2014). *E. coli in Water*. Retrieved 12 13, 2016, from Water Research Centre: http://www.water-research.net/index.php/e-coli-in-water

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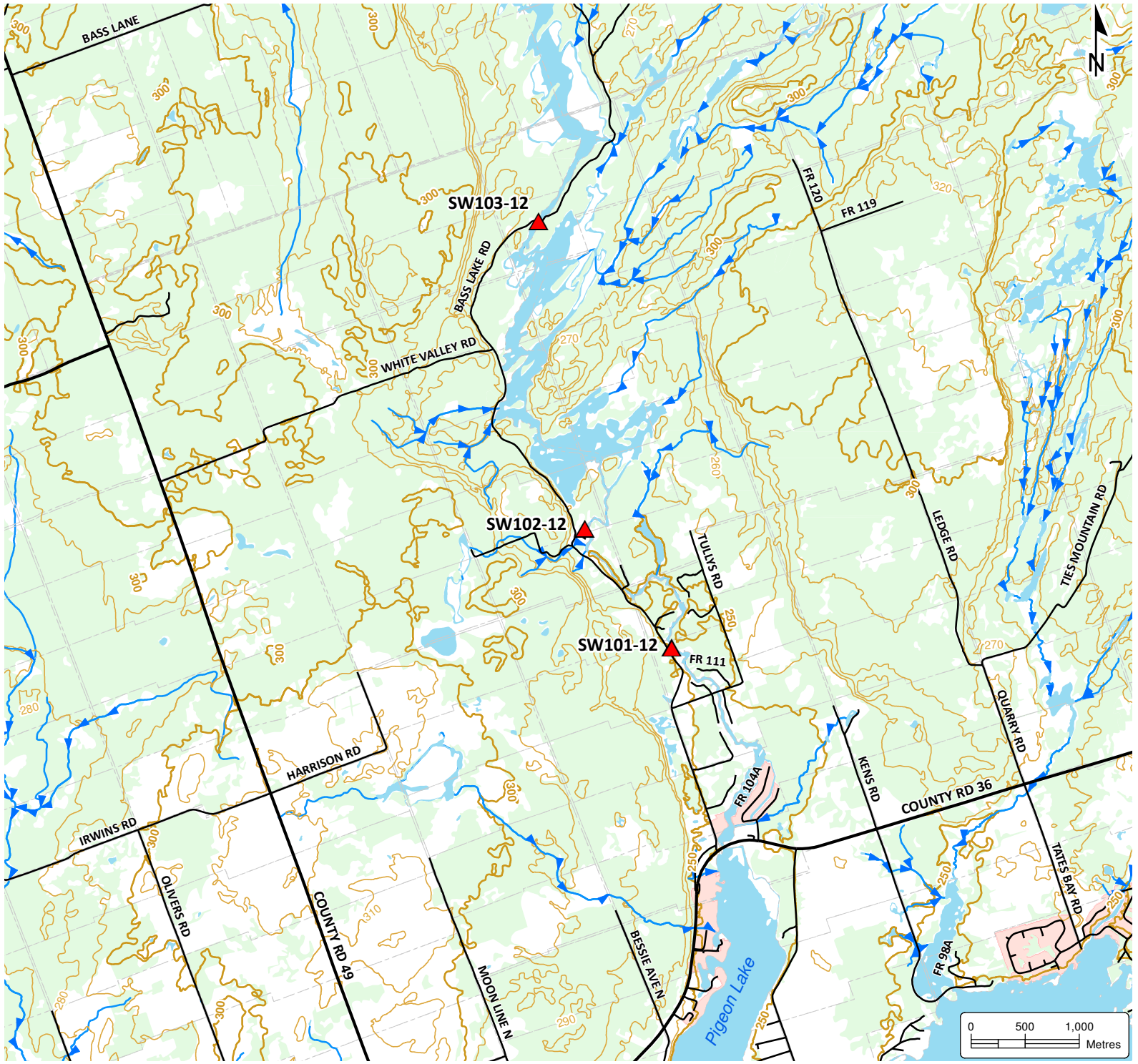

2019 SURFACE WATER CHARACTERIZATION

LOUISE KLEIN
2047 Bass Lake Road,
Bobcaygeon, Ontario

Legend

- Surface Water Monitoring Locations
- Highway
- Major Road
- Minor Road
- Watercourse, Permanent
- Contour (index)
- Contour (10m)
- Lot
- Water Area
- Watercourse
- Wooded Area
- Built-Up Area

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2010 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

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SURFACE WATER SAMPLING LOCATIONS

Project No.: 9883-001	Date: November 2019
Scale: 1:50,000	Projection: NAD 1983 UTM Zone 17N
Created by: TLC	Checked by: KDW
Figure: 1	

Table 1
Summary of Surface Water Quality
Louise Klein - Surface Water Quality Testing
Cambium Reference No. 9883-001

Sample ID				SW101-12	SW101-12	SW101-12	SW101-12	SW101-12	SW101-12	SW101-12	SW101-12
Sample Date / Analysis	Units	ODWQS	PWQO	10-Aug-12	27-Sep-13	20-Aug-14	11-Sep-15	28-Sep-16	26-Oct-17	11-Oct-18	24-Sep-19
Alkalinity	mg/L as CaCO3	500	NV	105	93	99	126	106	107	103	103
Conductivity	µS/cm	NV	NV	227	204	201	240	219	219	219	223
pH	units	6.5 - 8.5	6.5 - 8.5	8.12	7.99	8.06	7.99	8.06	8.07	8.22	8.03
TDS	mg/L	500	NV	143	166	129	134	116	131	94	129
TSS	mg/L	NV	NV	< 2	3	2	<2	2	2	< 2	5
Cl	mg/L	250	NV	2.5	3.2	2.6	3.0	4.0	3.0	3.0	4.0
NH3+NH4	as N mg/L	NV	NV	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1	0.2
SO4	mg/L	500	NV	2.9	4.0	200.0	4.0	4.0	3.0	3.0	< 2
NO2	as N mg/L	1	NV	< 0.06	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
NO3	as N mg/L	10	NV	< 0.05	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Organic N	mg/L	0.15	NV	**0.4**	**0.28**	**0.21**	**0.35**	<0.15	< 0.15	**0.26**	< 0.5
TKN	as N mg/L	NV	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Hardness	mg/L as CaCO3	100	NV	**117**	**106**	**103**	**130**	**110**	98	**115**	**116**
Aluminum (total)	mg/L	0.1	0.075	0.0161	0.0120	0.0121	0.0130	0.0100	0.0090	0.0070	0.0060
Antimony (total)	mg/L	0.006	0.02	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0009
Arsenic (total)	mg/L	0.025	0.005	0.0004	0.0003	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003
Barium (total)	mg/L	1	NV	0.0477	0.0325	0.0406	0.0527	0.0375	0.0346	0.0334	0.0392
Beryllium (total)	mg/L	NV	1.1	< 0.00002	< 0.00002	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Boron (total)	mg/L	5	0.2	0.0142	0.0088	0.0130	0.0125	0.0120	0.0100	0.0110	0.0050
Cadmium (total)	mg/L	0.005	0.0005	< 0.000003	< 0.000003	< 0.000003	< 0.000003	< 0.000003	< 0.000003	0.000005	< 0.000003
Calcium (total)	mg/L	NV	NV	38.0	35.7	34.0	42.4	37.2	33.6	38.7	38.8
Chromium (total)	mg/L	0.05	NV	< 0.0005	< 0.0005	< 0.00003	0.00016	0.0003	0.00006	0.00035	< 0.00008
Cobalt (total)	mg/L	NV	0.0009	0.000033	0.000008	0.000044	0.000021	0.000019	0.000021	0.000050	0.000008
Copper (total)	mg/L	1	0.005	< 0.0005	< 0.0005	0.00031	0.00024	0.00034	0.0004	0.00209	0.0003
Iron (total)	mg/L	0.3	0.3	0.085	0.044	0.050	0.076	0.058	0.042	0.029	0.041
Lead (total)	mg/L	0.01	0.005	0.00011	0.00004	0.00001	0.00003	0.00001	0.00003	0.00012	0.00003
Magnesium (total)	mg/L	NV	NV	5.52	4.22	4.33	5.81	4.09	3.44	4.41	4.59
Manganese (total)	mg/L	0.05	NV	0.0315	0.0116	0.0215	0.0330	0.0134	0.0153	0.0169	0.0209
Molybdenum (total)	mg/L	NV	0.04	0.00017	0.00007	0.00012	0.00004	0.00007	0.00009	0.00008	0.00008
Nickel (total)	mg/L	NV	0.025	0.0003	0.0005	< 0.0001	< 0.0001	< 0.0001	0.0002	0.0002	< 0.0001
Phosphorus (total)	mg/L	0.03	NV	< 0.009	< 0.009	0.026	0.0101	0.005	< 0.003	0.003	0.015
Potassium (total)	mg/L	NV	NV	0.633	0.956	0.504	0.768	0.863	0.794	0.868	0.691
Selenium (total)	mg/L	NV	0.1	< 0.001	< 0.001	< 0.001	0.00006	0.00005	0.00006	0.00005	0.00005
Silicon (total)	mg/L	NV	NV	3.65	2.15	2.16	3.27	3.25	2.56	2.65	1.82
Silver (total)	mg/L	NV	0.0001	< 0.00001	< 0.00001	< 0.000002	0.000005	< 0.000002	< 0.00005	< 0.00005	< 0.00005
Sodium (total)	mg/L	NV	NV	1.57	2.01	1.49	1.91	1.84	1.58	1.90	2.32
Strontium (total)	mg/L	NV	NV	0.131	0.122	0.117	0.133	0.110	0.127	0.118	0.124
Thallium (total)	mg/L	NV	0.0003	< 0.0002	< 0.0002	0.000008	<0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Tin (total)	mg/L	NV	NV	0.00029	0.00003	< 0.00001	0.00094	< 0.00001	< 0.00001	0.00008	< 0.00006
Titanium (total)	mg/L	NV	NV	0.0004	0.0004	0.0005	0.0003	0.0010	0.0004	-	0.0003
Vanadium (total)	mg/L	NV	0.006	0.00024	0.00012	0.00024	0.00018	0.00008	0.00010	-	0.00006
Zinc (total)	mg/L	NV	0.02	0.00200	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.00500	< 0.002
Bismuth (total)	mg/L	NV	NV	-	-	-	-	< 0.000007	< 0.000007	0.00001	< 0.000007
Lithium (total)	mg/L	NV	NV	-	-	-	-	0.00060	0.00070	0.00080	0.00080
Uranium (total)	mg/L	NV	5	-	-	-	-	0.00007	0.00014	0.00010	0.00008
Tungsten (total)	mg/L	NV	30	-	-	-	-	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Yttrium (total)	mg/L	NV	NV	-	-	-	-	0.00005	0.00004	0.00002	0.00002
E. Coli	cfu/100mL	0	100	-	-	-	-	**36**	**30**	**16**	**66**
Phosphates (total reactive phophorous)	mg/L			-	-	-	-	< 0.03	< 0.03	< 0.03	< 0.03

Notes:

1. Ontario Drinking Water Quality Standard (ODWQS)
2. Provincial Water Quality Objectives
3. Bold and shaded values exceed ODWQS Criteria
4. Bold and italicized values exceed PWQO Criteria
5. NV indicates no value

Table 1
Summary of Surface Water Quality
Louise Klein - Surface Water Quality Testing
Cambium Reference No. 9883-001

Sample ID				SW102-12	SW102-12	SW102-12	SW102-12	SW102-12	SW102-12	SW102-12	SW102-12
Sample Date / Analysis	Units	ODWQS	PWQO	10-Aug-12	27-Sep-13	20-Aug-14	11-Sep-15	28-Sep-16	26-Oct-17	11-Oct-18	24-Sep-19
Alkalinity	mg/L as CaCO3	500	NV	103	94	98	126	107	103	106	102
Conductivity	µS/cm	NV	NV	225	201	197	239	218	216	218	223
pH	units	6.5 - 8.5	6.5 - 8.5	8.16	8.01	8.04	8.14	8.02	8.06	8.21	8.06
TDS	mg/L	500	NV	151	151	131	143	117	129	103	129
TSS	mg/L	NV	NV	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl	mg/L	250	NV	2.5	3.2	2.5	3.0	4.0	3.0	3.0	4.0
NH3+NH4	as N mg/L	NV	NV	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2
SO4	mg/L	500	NV	3.0	4.0	3.1	4.0	5.0	3.0	3.0	< 2
NO2	as N mg/L	1	NV	< 0.06	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
NO3	as N mg/L	10	NV	< 0.05	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Organic N	mg/L	0.15	NV	**0.4**	**0.17**	0.11	**0.36**	**0.27**	< 0.15	**0.32**	< 0.5
TKN	as N mg/L	NV	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Hardness	mg/L as CaCO3	100	NV	**115**	**109**	**103**	**124**	**109**	89	**115**	**126**
Aluminum (total)	mg/L	0.1	0.075	0.0123	0.0071	0.0088	0.0100	0.0070	0.0040	0.0030	0.0030
Antimony (total)	mg/L	0.006	0.02	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0009
Arsenic (total)	mg/L	0.025	0.005	0.0004	0.0004	0.0003	0.0004	0.0003	0.0003	0.0003	0.0003
Barium (total)	mg/L	1	NV	0.0460	0.0330	0.0402	0.0534	0.0358	0.0340	0.0326	0.0385
Beryllium (total)	mg/L	NV	1.1	< 0.00002	< 0.00002	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Boron (total)	mg/L	5	0.2	0.0140	0.0090	0.0130	0.0136	0.0110	0.0100	0.0100	0.0050
Cadmium (total)	mg/L	0.005	0.0005	< 0.000003	< 0.000003	0.000003	0.000003	0.000003	< 0.000003	< 0.000003	< 0.000003
Calcium (total)	mg/L	NV	NV	37.0	36.4	33.9	40.8	36.9	30.3	38.7	42.9
Chromium (total)	mg/L	0.05	NV	< 0.0005	< 0.0005	0.00008	<0.00003	0.00028	0.00006	0.00015	0.00013
Cobalt (total)	mg/L	NV	0.0009	0.000032	0.000011	0.000038	0.000017	0.000014	0.000023	0.000016	0.000009
Copper (total)	mg/L	1	0.005	0.0010	< 0.0005	0.00044	0.00026	0.00019	0.0004	0.00031	0.0002
Iron (total)	mg/L	0.3	0.3	0.100	0.040	0.047	0.076	0.055	0.036	0.018	0.042
Lead (total)	mg/L	0.01	0.005	0.00012	0.00005	0.00002	0.00002	0.00001	0.00003	0.00003	0.00052
Magnesium (total)	mg/L	NV	NV	5.38	4.35	4.34	5.45	4.03	3.23	4.38	4.70
Manganese (total)	mg/L	0.05	NV	0.0371	0.0119	0.0167	0.0359	0.0136	0.0148	0.0103	0.0243
Molybdenum (total)	mg/L	NV	0.04	0.00011	0.00007	0.00009	<0.00001	0.00007	0.00009	0.00008	0.00008
Nickel (total)	mg/L	NV	0.025	0.0003	0.0005	0.0001	0.0001	< 0.0001	0.0004	< 0.0001	< 0.0001
Phosphorus (total)	mg/L	0.03	NV	0.011	0.015	0.018	0.009	0.009	< 0.003	0.005	0.015
Potassium (total)	mg/L	NV	NV	0.613	0.984	0.507	0.742	0.891	0.748	0.848	0.745
Selenium (total)	mg/L	NV	0.1	< 0.001	< 0.001	< 0.001	0.00006	0.00004	0.00006	0.00005	0.00006
Silicon (total)	mg/L	NV	NV	3.66	2.24	2.35	3.20	3.18	2.56	2.70	1.99
Silver (total)	mg/L	NV	0.0001	0.00002	< 0.00001	< 0.000002	0.000003	< 0.000002	< 0.00005	< 0.00005	< 0.00005
Sodium (total)	mg/L	NV	NV	1.52	1.79	1.52	1.87	1.82	1.48	1.86	2.30
Strontium (total)	mg/L	NV	NV	0.127	0.125	0.117	0.128	0.111	0.118	0.118	0.128
Thallium (total)	mg/L	NV	0.0003	< 0.0002	< 0.0002	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Tin (total)	mg/L	NV	NV	0.00032	0.00011	< 0.00001	0.00149	< 0.00001	< 0.00001	0.00014	< 0.00006
Titanium (total)	mg/L	NV	NV	0.0002	0.0002	0.0004	0.0002	0.0009	0.0001	-	0.0002
Vanadium (total)	mg/L	NV	0.006	0.00021	0.00013	0.00020	0.00016	0.00010	0.00008	-	0.00006
Zinc (total)	mg/L	NV	0.02	< 0.002	< 0.002	0.00300	0.00200	< 0.002	< 0.002	0.00200	< 0.002
Bismuth (total)	mg/L	NV	NV	-	-	-	-	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Lithium (total)	mg/L	NV	NV	-	-	-	-	0.00060	0.00080	0.00070	0.00070
Uranium (total)	mg/L	NV	5	-	-	-	-	0.00006	0.00012	0.00010	0.00008
Tungsten (total)	mg/L	NV	30	-	-	-	-	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Yttrium (total)	mg/L	NV	NV	-	-	-	-	0.00003	0.00002	0.00001	0.00002
E. Coli	cfu/100mL	0	100	-	-	-	-	**47**	**10**	**4**	**71**
Phosphates (total reactive phophorous)	mg/L			-	-	-	-	< 0.03	< 0.03	< 0.03	< 0.03

Notes:

1. Ontario Drinking Water Quality Standard (ODWQS)
2. Provincial Water Quality Objectives
3. Bold and shaded values exceed ODWQS Criteria
4. Bold and italicized values exceed PWQO Criteria
5. NV indicates no value

Table 1
Summary of Surface Water Quality
Louise Klein - Surface Water Quality Testing
Cambium Reference No. 9883-001

Sample ID				SW103-12	SW103-12	SW103-12	SW103-12	SW103-12	SW103-12	SW103-12	SW103-12
Sample Date / Analysis	Units	ODWQS	PWQO	10-Aug-12	27-Sep-13	20-Aug-14	11-Sep-15	28-Sep-16	26-Oct-17	11-Oct-18	24-Sep-19
Alkalinity	mg/L as CaCO3	500	NV	102	95	103	114	103	99	105	96
Conductivity	µS/cm	NV	NV	223	206	206	227	207	209	224	213
pH	units	6.5 - 8.5	6.5 - 8.5	7.98	7.95	7.95	8.05	7.70	8.00	8.12	8.04
TDS	mg/L	500	NV	126	160	134	109	110	123	117	126
TSS	mg/L	NV	NV	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl	mg/L	250	NV	2.5	3.3	2.8	3.0	3.0	3.0	3.0	4.0
NH3+NH4	as N mg/L	NV	NV	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1
SO4	mg/L	500	NV	3.1	4.1	4.0	4.0	5.0	3.0	3.0	3.0
NO2	as N mg/L	1	NV	< 0.06	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
NO3	as N mg/L	10	NV	< 0.05	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Organic N	mg/L	0.15	NV	**0.4**	**0.2**	**0.3**	**0.3**	<0.15	< 0.15	**0.28**	< 0.5
TKN	as N mg/L	NV	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Hardness	mg/L as CaCO3	100	NV	**114**	**112**	**107**	**116**	100	85	**118**	97
Aluminum (total)	mg/L	0.1	0.075	0.0117	0.0056	0.0129	0.0060	0.0080	0.0050	0.0010	0.0030
Antimony (total)	mg/L	0.006	0.02	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0009
Arsenic (total)	mg/L	0.025	0.005	0.0004	0.0005	0.0004	0.0004	0.0003	0.0003	0.0003	0.0004
Barium (total)	mg/L	1	NV	0.0446	0.0326	0.0365	0.0449	0.0276	0.0297	0.0324	0.0334
Beryllium (total)	mg/L	NV	1.1	< 0.00002	< 0.00002	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Boron (total)	mg/L	5	0.2	0.0138	0.0095	0.0120	0.0113	0.0100	0.0100	0.0110	0.0040
Cadmium (total)	mg/L	0.005	0.0005	< 0.000003	< 0.000003	< 0.000003	< 0.000003	0.000003	< 0.000003	< 0.000003	< 0.000003
Calcium (total)	mg/L	NV	NV	37.1	37.4	35.4	37.9	33.7	29.0	39.9	32.1
Chromium (total)	mg/L	0.05	NV	< 0.0005	< 0.0005	0.00035	0.00055	0.00028	0.00397	0.00012	0.0001
Cobalt (total)	mg/L	NV	0.0009	0.000034	0.000026	0.000041	0.000024	0.000017	0.000075	0.000019	0.000015
Copper (total)	mg/L	1	0.005	< 0.0005	< 0.0005	0.00043	0.00024	0.00026	0.00069	0.00031	0.0003
Iron (total)	mg/L	0.3	0.3	0.211	0.042	0.076	0.176	0.042	0.104	0.026	0.064
Lead (total)	mg/L	0.01	0.005	0.00011	0.00003	< 0.00001	0.00001	0.00002	0.00006	0.00006	0.00001
Magnesium (total)	mg/L	NV	NV	5.27	4.44	4.40	5.15	3.96	3.14	4.52	4.20
Manganese (total)	mg/L	0.05	NV	**0.0910**	0.0121	0.0160	0.0500	0.0094	0.0120	0.0151	0.0258
Molybdenum (total)	mg/L	NV	0.04	0.00008	0.00008	0.00009	<0.00001	0.00011	0.00012	0.00009	0.00009
Nickel (total)	mg/L	NV	0.025	0.0003	0.0006	0.0002	0.0003	< 0.0001	0.0003	< 0.0001	0.0002
Phosphorus (total)	mg/L	0.03	NV	0.020	0.012	0.014	0.010	0.009	< 0.003	0.005	0.012
Potassium (total)	mg/L	NV	NV	0.762	0.997	0.677	0.934	0.888	0.746	0.936	0.915
Selenium (total)	mg/L	NV	0.1	< 0.001	< 0.001	< 0.001	0.00006	0.00006	0.00007	0.00004	0.00005
Silicon (total)	mg/L	NV	NV	3.70	2.32	2.33	3.05	2.50	2.76	2.66	1.68
Silver (total)	mg/L	NV	0.0001	< 0.00001	< 0.00001	< 0.000002	0.000004	< 0.000002	< 0.00005	< 0.00005	< 0.00005
Sodium (total)	mg/L	NV	NV	1.52	1.69	1.60	1.88	1.73	1.40	1.94	2.23
Strontium (total)	mg/L	NV	NV	0.129	0.126	0.116	0.124	0.104	0.118	0.123	0.120
Thallium (total)	mg/L	NV	0.0003	< 0.0002	< 0.0002	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Tin (total)	mg/L	NV	NV	0.00028	0.00006	< 0.00001	0.00083	< 0.00001	< 0.00001	0.00009	< 0.00006
Titanium (total)	mg/L	NV	NV	0.0003	0.0001	0.0003	0.0001	0.0007	0.0001	-	0.0001
Vanadium (total)	mg/L	NV	0.006	0.00021	0.00017	0.00020	0.00017	0.00013	0.00012	-	0.00012
Zinc (total)	mg/L	NV	0.02	< 0.002	< 0.002	0.01300	< 0.002	< 0.002	0.00200	0.00200	0.00700
Bismuth (total)	mg/L	NV	NV	-	-	-	-	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Lithium (total)	mg/L	NV	NV	-	-	-	-	0.00060	0.00080	0.00070	0.00070
Uranium (total)	mg/L	NV	5	-	-	-	-	0.00012	0.00012	0.00011	0.00012
Tungsten (total)	mg/L	NV	30	-	-	-	-	< 0.00002	0.00004	< 0.00002	< 0.00002
Yttrium (total)	mg/L	NV	NV	-	-	-	-	0.00003	0.00002	0.00001	0.00001
E. Coli	cfu/100mL	0	100	-	-	-	-	**45**	**36**	**28**	**29**
Phosphates (total reactive phophorous)	mg/L			-	-	-	-	< 0.03	< 0.03	< 0.03	< 0.03

Notes:

1. Ontario Drinking Water Quality Standard (ODWQS)
2. Provincial Water Quality Objectives
3. Bold and shaded values exceed ODWQS Criteria
4. Bold and italicized values exceed PWQO Criteria
5. NV indicates no value

SGS Canada Inc.
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Project : 9883-001 Nogies Crek-NPLA

01-October-2019

Cambium Inc.
Attn : Kevin Warner

52 Hunter Street East
Peterborough, ON
K9H 1G5, Canada

Phone: 705-742-7900
Fax:

Date Rec. : 24 September 2019
LR Report: **CA14841-SEP19**
Reference: 9883-001Kevin Warner

Copy: 1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	6: RL	7: SW101	8: SW102	9: SW103
Sample Date & Time						24-Sep-19 09:15	24-Sep-19 09:00	24-Sep-19 08:40
Temp Upon Receipt [°C]	---	---	--	---	---	14.0	14.0	14.0
Alkalinity [mg/L as CaCO3]	25-Sep-19	15:49	26-Sep-19	14:51	2	103	102	96
Conductivity [uS/cm]	25-Sep-19	15:49	26-Sep-19	14:51	2	223	223	213
pH [no unit]	25-Sep-19	15:49	26-Sep-19	14:51	0.05	8.03	8.06	8.04
TDS [mg/L]	24-Sep-19	17:07	26-Sep-19	11:09	30	129	129	126
TSS [mg/L]	25-Sep-19	17:13	30-Sep-19	11:25	2	5	< 2	< 2
Cl [mg/L]	27-Sep-19	12:25	28-Sep-19	07:35	1	4	4	4
NH3+NH4 [as N mg/L]	24-Sep-19	21:43	25-Sep-19	14:14	0.1	0.2	0.2	0.1
SO4 [mg/L]	27-Sep-19	12:27	28-Sep-19	07:34	2	< 2	< 2	3
NO2 [as N mg/L]	27-Sep-19	09:25	28-Sep-19	08:08	0.03	< 0.03	< 0.03	< 0.03
NO3 [as N mg/L]	27-Sep-19	09:25	28-Sep-19	08:08	0.06	< 0.06	< 0.06	< 0.06
Organic N [mg/L]	24-Sep-19	17:10	01-Oct-19	16:40	0.5	< 0.5	< 0.5	< 0.5
TKN [as N mg/L]	24-Sep-19	17:10	25-Sep-19	12:40	0.5	< 0.5	< 0.5	< 0.5
Tot.Reactive P [mg/L]	24-Sep-19	17:28	27-Sep-19	11:20	0.03	< 0.03	< 0.03	< 0.03
Hardness [mg/L as CaCO3]	30-Sep-19	11:29	01-Oct-19	16:40	0.05	116	126	97.3
Al (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.001	0.006	0.003	0.003
Sb (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.0009	< 0.0009	< 0.0009	< 0.0009
As (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.0002	0.0003	0.0003	0.0004
Ba (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00002	0.0392	0.0385	0.0334
Be (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.000007	< 0.000007	< 0.000007	< 0.000007

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Project : 9883-001 Nogies Crek-NPLA
LR Report : **CA14841-SEP19**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	6: RL	7: SW101	8: SW102	9: SW103
B (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.002	0.005	0.005	0.004
Cd (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.000003	< 0.000003	< 0.000003	< 0.000003
Ca (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.01	38.8	42.9	32.1
Cr (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00008	< 0.00008	0.00013	0.00010
Co (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.000004	0.000008	0.000009	0.000015
Cu (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.0002	0.0003	0.0002	0.0003
Fe (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.007	0.041	0.042	0.064
Pb (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00001	0.00003	0.00052	0.00001
Mg (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.001	4.59	4.70	4.20
Mn (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00001	0.0209	0.0243	0.0258
Mo (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00004	0.00008	0.00008	0.00009
Ni (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.0001	< 0.0001	< 0.0001	0.0002
P (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.003	0.015	0.015	0.012
K (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.009	0.691	0.745	0.915
Se (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00004	0.00005	0.00006	0.00005
Si (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.02	1.82	1.99	1.68
Ag (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00005	< 0.00005	< 0.00005	< 0.00005
Na (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.01	2.32	2.30	2.23
Sr (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00002	0.124	0.128	0.120
Tl (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.000005	< 0.000005	< 0.000005	< 0.000005
Sn (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00006	< 0.00006	< 0.00006	< 0.00006
Ti (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00005	0.00032	0.00020	0.00014
V (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.00001	0.00006	0.00006	0.00012
Zn (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40	0.002	< 0.002	< 0.002	0.007
Bi (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40		< 0.000007	< 0.000007	< 0.000007
Li (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40		0.0008	0.0007	0.0007
U (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40		0.000076	0.000075	0.000117
W (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40		< 0.00002	< 0.00002	< 0.00002
Y (tot) [mg/L]	30-Sep-19	11:29	01-Oct-19	16:40		0.000017	0.000015	0.000010
Ecoli [cfu/100mL]	25-Sep-19	10:15	26-Sep-19	14:12	0	66	71	29

Temperature of Sample upon Receipt: 14 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:005246

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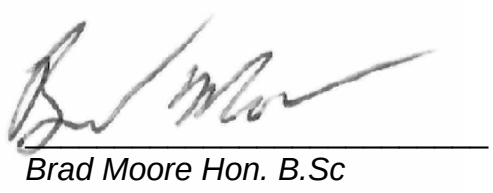
Project : 9883-001 Nogies Crek-NPLA
LR Report : **CA14841-SEP19**



Brad Moore Hon. B.Sc
Project Specialist,
Environment, Health & Safety