6.0 DESCRIPTION OF THE ENVIRONMENT

This chapter provides a characterization and description of the existing environmental conditions for the Côté Gold Project (the Project), based on baseline studies, for the period between March 2012 and July, 2013. Studies were conducted for the physical, biological and human environments within the defined study areas.

The description of the existing environment provided in this Chapter aims to familiarize the reader with the local setting in relation to the Project site depicted in Figure 5-2 of Chapter 5. Baseline studies and other studies referenced herein are provided in Appendices E to T.

The objectives of the baseline studies are to characterize the physical, biological and human environment aspects of potentially affected areas, along with reference locations (such as upstream locations), where appropriate for comparison. Environmental baseline data (description of the existing environment):

- helps inform Project planning and design (for example, knowledge of rock characteristics assists in determining how best to handle and store the material) and modelling/calculations (for example, water balance calculations, air quality and noise models, etc.);
- allows for an assessment of likely effects of the Project, including comparisons with established environmental guidelines, thresholds and limits, where applicable, and in the planning and design of mitigation to avoid or reduce predicted adverse effects; and
- provides a reference for future environmental monitoring, where such follow-up is required and appropriate (that is, it allows a comparison to be made of pre-development and post development conditions).

The baseline studies were based on the following disciplines under the physical, biological and human environments:

- air quality;
- noise and vibration;
- geochemistry and geology;
- hydrogeology;
- hydrology and climate;
- geochemistry and geology;
- surface and groundwater quality (including sediment quality);
- terrestrial biology for the Project site;
- terrestrial biology for the transmission line alignment alternatives (TLAs);
- aquatic biology;

- land and resource use;
- Aboriginal traditional knowledge and land use;
- built heritage resources;
- archaeology;
- visual aesthetics; and
- socio-economics.

6.1 Study Areas

Study areas were defined separately for the physical, biological and human environments. Study areas establish the geographic extent within which information was obtained from both primary and secondary sources, as applicable for environmental effects assessment purposes. The study area definitions are provided in Chapter 9.

6.2 Baseline Studies

Studies have been completed using standard field protocol and scientific methodology as indicated under each of the respective disciplines, to accurately document spatial and temporal variability, and have considered the information needs of regulatory agencies for approval of previous similar Ontario mining projects. Baseline studies have been informed by consultation with interested stakeholders and Aboriginal communities, as documented in Chapter 4, and through personal communications received during data collection for baseline studies. The baseline studies have included the collection of site-specific information to support the EA, including information and data from documentation and published material from government and other sources and databases. Information from other field investigations or work not formally documented, if applicable, may also have been used in the preparation of the EA report.

6.3 Physical Environment

All baseline and other studies for the physical environment disciplines are presented in the respective technical support documents (TSDs) in Appendix E to J. These reports include tabulated baseline data, figures indicating sampling or monitoring locations and detailed results. The following sections concisely present a synthesis of the respective studies for each discipline.

6.3.1 Climate

Climate data typically includes information on precipitation, temperature and wind and is used in water balance and flood design calculations to assess general site design and operation conditions, as well as for air quality and noise modelling to further support the assessments of potential effects.

The climate baseline study is presented in the Hydrology and Climate TSD in Appendix I.

6.3.1.1 Methodology

A preliminary review of available literature and regional information was undertaken using information provided by Environment Canada, the Ministry of Natural Resources and Forestry (MNRF), Water Survey of Canada (WSC) and Ontario Power Generation (OPG). Baseline data was primarily obtained from the MNRF, Environment Canada, WSC and OPG. Regional baseline data was also obtained from regional meteorological stations maintained by Environment Canada located in Timmins (120 km north of the Project site and located adjacent to the discontinued Timmins Victor Power A station), Chapleau (110 km northwest if the Project site) and Sudbury (140 km southeast of the Project site), Ontario.

Climate data has been collected at these stations for several decades, and the data from the Environment Canada 30-year Climate Normal Statistics for 1971 to 2000 at each location was used (Environment Canada, 2012a) and supplemented by more recent records to provide a longer-term average climate record, including the Environment Canada Intensity-Duration-Frequency (IDF) data for climate monitoring stations with sufficient record period (Environment Canada, 2012b).

An on-site meteorological station was established at the Project site in May, 2012 by Golder and IAMGOLD (UTM 5267365 N, 433039 E, NAD83, Zone 17N). Daily temperature, relative humidity, wind speed and direction and solar radiation data was collected from sensors mounted on a 10 m tower to supplement the baseline study. A precipitation collector located near the station's base collected total precipitation data, including snowfall. Meteorological data was logged each hour by dataloggers to collect climate data for the Project site over the short-term, to supplement long-term data for the region obtained from the various regional stations described.

6.3.1.2 Results and Discussion

Regional Climate

Located in the Boreal Shield ecozone of Ontario (Natural Resources Canada, 2012), the Project site is characterized by long, cold winters and short, warm summers with little to no annual water deficit (Energy, Mines and Resources Canada, 1990). The average annual precipitation for the region is in the range of 800 mm to 900 mm (average is approximately 856.3 mm), with between 31% and 38% falling as snow and a decreasing precipitation gradient towards the northwest. Annual water losses, based on total water lost to the atmosphere through evapotranspiration (ET) and to deep groundwater resources is in the range of 400 mm to 600 mm (MNR, 1984). Annual water surplus is in the range of 200 mm to 500 mm.

The total precipitation gradient shows a decreasing trend northward (to Timmins) and westward (to Chapleau), consistent with gradients noted by Fisheries and Environment Canada (1978).

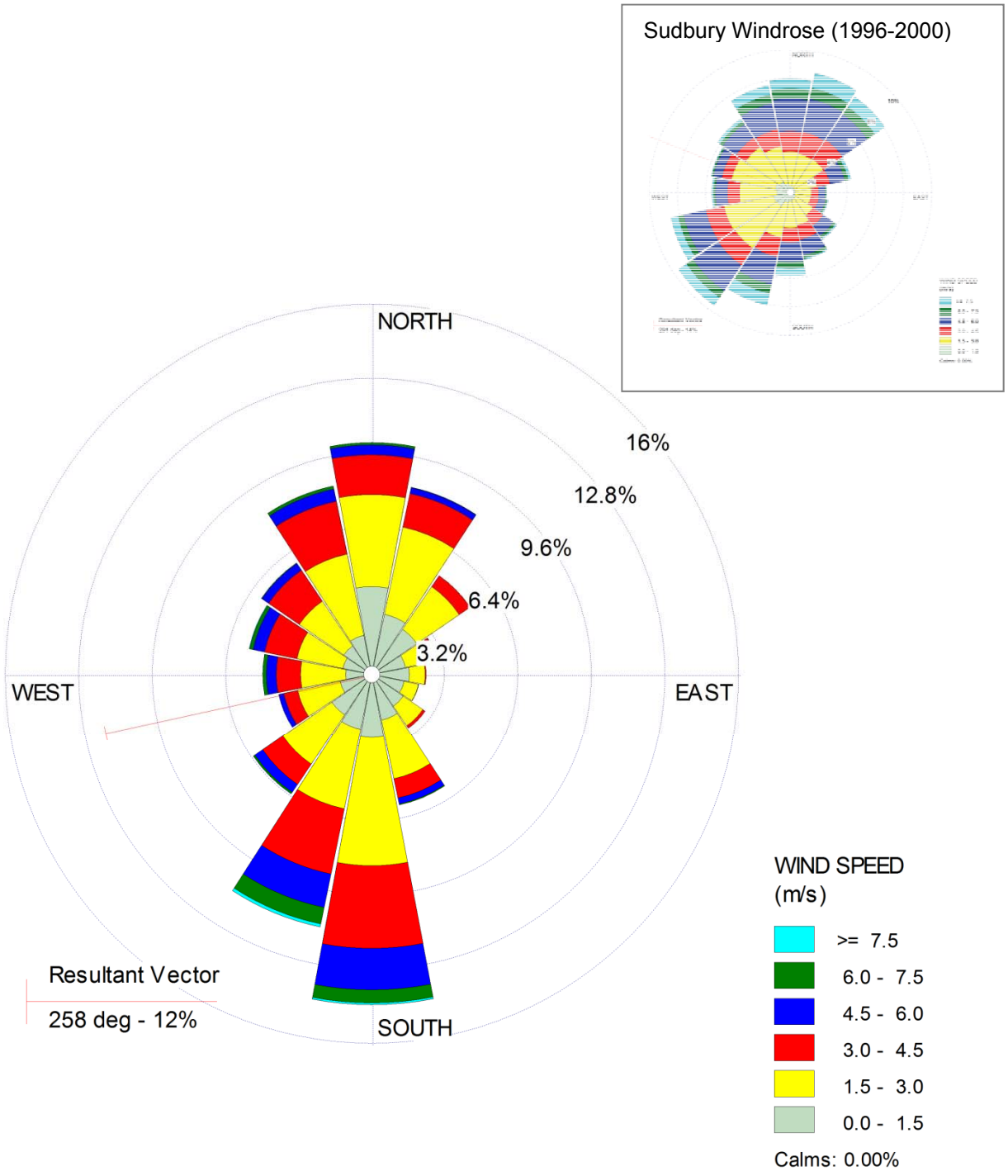
Approximately 37% of the annual precipitation falls as snow in Timmins, and 29% falls as snow in Sudbury.

Annual average temperatures at these regional sites are in the range of approximately -17ºC to 19ºC, with minimum daily average temperatures occurring in January and maximum daily average temperatures occurring in July.

Winds in the region do not show spatial consistency and are primarily from the south or southwest during the summer months and from the north or northwest during the winter months. Wind data, as Climate Normals for the regional weather stations, are available from the National Climate Data and Information Archive (Environment Canada, 2013). According to the Environment Canada Climate Normals for Timmins (ID 6020379) and monthly distribution of wind direction for North Bay and Sudbury, the winds are predominantly from the north or south during the winter and spring months, and south to southwest during summer and fall months. The average wind speed in this region ranges from 9.8 km/h to 13.5 km/h, with the highest average wind in the fall and spring, and the lowest mean wind speed in the summer (6.8 km/h).The average monthly wind speed at the Sudbury station ranges from 13.2 km/h to 17.4 km/h.

The wind rose diagram for the Project site for wind speed and direction data collected from August, 2012, to August, 2013, is depicted in Graphic 6-1, including an inset of the Sudbury wind rose diagram for comparison (see Appendix F for relevant data). Wind speeds at the Project site ranged from approximately 27 km/h to 5.4 km/h, predominantly towards the south and south-west.

Graphic 6-1: Windrose Diagram for Côté Gold Project Site (August, 2012 to August, 2013) with Sudbury Windrose Inset



Local Climate

Data collected from the Project site meteorological station indicates that precipitation at the Project site falls within the range of average annual precipitation for the region, as do daily average temperatures. This comparison was facilitated by combining on-site precipitation data with data estimated from the regional climate monitoring stations via the inverse squared method (Dingman, 1994). This method weighs data from each regional station based on the distance from the Project site to generate representative data. This gap-filled data set is compared to the regional station data in Table 6-1.

Table 6-1: Regional and Local Meteorological Comparison

Location	Overlapping Period of Record	Côté Gold Project Site	Sudbury A	Timmins A	Chapleau A	North Bay A
Average Daily Temperature (ºC)	May 18, 2012 – July 31, 2013	5.8	6.6	4.4	4.7	7.3
Total Precipitation (mm)	June 12, 2012 – July 31, 2013[1]	826.8	961.3	765.2	941.0	1017.9

[1] Precipitation data not available for Timmins for the period 18 May to 12 June, 2012.
Source: Golder (2013).

Based on the results obtained, hydrological modelling (see Appendix I) indicates that in a 1:50 year wet annual climate condition, the Project site is projected to receive up to approximately 1,008 mm in total annual precipitation (approximately 250 mm more than the average annual precipitation). In a 1:25 wet annual condition, total annual precipitation is projected to be approximately 990 mm, and in a 1:10 wet annual condition up to approximately 959 mm. The probable maximum precipitation (PMP) over 24 h would be up to approximately 506 mm over a 25 km^2 drainage area. In contrast, in a 1:50 year dry annual climate condition, the Project site is projected to receive approximately 720.7 mm in total annual precipitation.

The average daily temperature recorded at the Project site between May, 2012, and July, 2013, was 5.8°C, consistent with regional long-term climate conditions (see Table 6-9 above).

6.3.1.3 Summary

Located in the Boreal Shield ecozone of Ontario, the Project site is characterized by long, cold winters and short, warm summers with little to no annual water deficit. Long-term climate statistics for the regional climate stations maintained by Environment Canada (EC) are maintained in Timmins, Chapleau and Sudbury, and indicate a total annual precipitation of 800 mm to 900 mm, with 29% to 37% falling as snow. Annual average temperatures range from -17°C to 19°C, with minimum daily temperatures occurring in January and maximum daily temperatures occurring in July.

6.3.2 Air Quality

Air quality data is used to characterize the existing air quality in the vicinity of the proposed Project and its dynamics for the assessment of potential effects.

The air quality baseline study is appended to the Air Quality TSD in Appendix F.

6.3.2.1 Methodology

Site specific background air quality data is not available for the Project site. However, estimates of background concentrations for commonly assessed air quality parameters (ozone; nitrogen oxides: NO, NO_2 and NO_x, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), as well as for particulate matter ($PM_{2.5/10}$), can be determined from Provincial air quality measurements.

Climate data was obtained from the Environment Canada Climate Normals (1971-2000, 2012a), to aid in understanding air quality over the Project site and region. Three climate stations are located within 250 km of the site, and include Timmins, Sudbury, and Sault Ste. Marie. The nearest station is in Timmins, approximately 130 km from the site. Climate Normals for precipitation, temperature, wind speed, and wind direction were obtained for the three stations.

Baseline air quality data, particularly data for air quality parameters anticipated from operations, was obtained from a number of sources, including the Environment Canada National Air and Pollution Surveillance (NAPS, 2008) Network and the Atmospheric Environment Service's Canadian Air and Precipitation Monitoring Network (CAPMoN, 2011).

Regional background air quality and precipitation quality is also monitored at stations operated by CAPMoN. CAPMoN provides air chemistry and precipitation chemistry data for chloride, calcium, magnesium, sulphate, sodium, ammonium, potassium, sulphur dioxide, nitrate and nitric acid concentrations. Air quality concentrations for key metals and metalloids (arsenic, cadmium, lead and mercury) are not measured at these stations. Background concentrations of these parameters are generally assumed to be nil for effects assessment modelling purposes. The air quality at the urban sites in Sudbury, Sault Ste. Marie, and North Bay are more influenced by urban populations relative to the remote Project site; the data for these stations is therefore considered to be conservative when used as baseline.

Air quality monitoring equipment was installed at the Project site in early May, 2013. To measure baseline concentrations of total suspended particles (TSP, including metals), particulate matter (PM_{10}), sulphur dioxide (SO_2), nitrogen oxides (NO_x) and nitrogen dioxide (NO_2) for comparison to the long-term data from the regional climate stations. Sampling was conducted over a period of approximately three months, from 5 May to 8 August, 2013, as per the Ministry of the Environment and Climate Change's (MOECC) Operations Manual for Air Quality Monitoring in Ontario (2008). The MOECC Sudbury office conducted a field audit of the Project site on 13 July, 2013, and found no issues with the site or equipment operation.

To supplement on-site air quality information, TSP and PM_{10} concentrations were measured using high-volume (Hi-Vol) samplers on a 1-in-6 day sampling schedule at the remote rural monitoring point. SO_2 and NO_2 were measured using passive samplers, with monthly samples collected during the monitoring period.

6.3.2.2 Results and Discussion

Results obtained from the regional meteorological stations is representative of conditions over the regional study area, and takes into account sections of the local study area sections along the proposed transmission line alignments extending up to the City of Timmins. Data collected from the meteorological station at the Project site is considered to be representative of conditions over the local study area.

A general description of the climate in the regional study area is reported in the air quality baseline study (see Appendix F), to understand the setting for air quality in the region and Project site. The climate in the regional study area may be described as humid continental, with warm and often hot summers and long, cold, snowy winters. The predominant wind direction is from the north (winter) or south (summer) and the average wind speed in this region ranges from 9.8 km/h to 13.5 km/h. The climate baseline is described in more detail in Section 6.3.1.

There are no anthropogenic sources of air emissions near the Project site other than cottages in the region, and the regional study area is similar throughout with an absence of large urban centres and industrial sources. As a result, the air quality in the regional study area is deemed good. Air emissions coming on southern borne winds and natural source emissions, including VOCs from vegetation or natural forest fires will also influence air quality at large.

The baseline air quality data for the following significant emissions anticipated from the Côté Gold Project include:

- particulate matter, including TSP, PM_{10}, and $PM_{2.5}$;
- oxides of nitrogen (NO_x), reported as NO_2;
- carbon monoxide (CO);
- sulphur dioxide (SO_2) resulting from sulphur in the diesel fuel; and
- metals.

Particulate Matter

Particulate matter (PM) for the Project will consist primarily of fugitive dusts generated from blasting, aggregate crushing, screening, and material handling activities. Airborne particles are categorized as primary (being emitted directly from the source into the atmosphere) and secondary (being formed in part by chemical and physical transformations).

A summary of the baseline TSP and PM_{10} data collected is presented in Table 6-2. A summary of available background TSP, PM_{10}, and $PM_{2.5}$ air quality data collected by the MOECC and Environment Canada is provided in Table 6-3 and Table 6-4. TSP is no longer routinely monitored at either the NAPS or MOECC stations, thus the most recent five-year dataset (1991-1995) for Sudbury was included as a reference.

Table 6-2: Background Particulate Matter (PM) at the Project Site

Station	Parameter	24 hr AAQC* (µg/m^3)	Average Concentration (µg/m^3)	90th Percentile 24-hr average (µg/m^3)
Project site	TSP	120	23.1 (arithmetic mean)	37.0
			21.4 (geometric mean)	
	PM_{10}	50[1]	13.9	20.6

[1]Ontario AAQC; Sample Size = 10.
Ontario Ambient Air Quality Criteria (AAQC, 2012a) are presented as a reference. New Canadian Ambient Air Quality Standards (CAAQS) for $PM_{2.5}$ will come into effect in 2015, replacing the current Canada Wide Standards (CWS).

Table 6-3: Background TSP at Sudbury, 1991 to 1995

Parameter	24 hr AAQC[1] (µg/m^3)	Station	Measurement	1991	1992	1993	1994	1995
TSP (µg/m^3)	120	Sudbury	Arithmetic Mean	39	34	35	34	40
			Geometric Mean	34	30	31	31	37
			90th Percentile	68	57	55	53	68

[1]Ontario AAQC.
Ontario Ambient Air Quality Criteria (AAQC, 2012a) are presented as a reference. New Canadian Ambient Air Quality Standards (CAAQS) for $PM_{2.5}$ will come into effect in 2015, replacing the current Canada Wide Standards (CWS).

Table 6-4: Background PM_{10} and $PM_{2.5}$ at MOECC Stations

Parameter	24 hr AAQC ($\mu g/m^3$)	Station	Measurement	2007	2008	2009	2010	2011
PM_{10} ($\mu g/m^3$)	50 (Ontario AAQC)	Sudbury	Average	19.3	15.8	13.7	13.5	10.5
			90th Percentile	33	28	23	33	18
$PM_{2.5}$ ($\mu g/m^3$)	30 $\mu g/m^3$ (CWS)	Sudbury	Average	4.9	4.1	3.4	3.6	4.0
			90th Percentile	12	9	8	9	9
		Sault Ste. Marie	Average	5.3	4.4	3.8	3.8	4.4
			90th Percentile	13	10	9	9	10

Ontario Ambient Air Quality Criteria (AAQC, 2012a) are presented as a reference. New Canadian Ambient Air Quality Standards (CAAQS) for $PM_{2.5}$ will come into effect in 2015, replacing the current Canada Wide Standards (CWS).

Nitrogen Oxides

Ambient NO_2 concentrations measured at Sudbury, North Bay and Sault Ste. Marie for the five year period 2007-2011 are presented in Table 6-5; these are considered representative of background concentrations. The data from the passive samplers at the Project site, also indicated in Table 6-4, indicate levels for NO_2 that range from 0.4 $\mu g/m^3$ to 0.8 $\mu g/m^3$ (0.2 ppb to 0.4 ppb). The data is consistent with the MOECC and NAPS monitoring data.

Carbon Monoxide

Carbon monoxide (CO) is generally not considered to be a key pollutant from above-ground mining operations or for discussions of off-site effects; it is more significant for underground mines where worker exposure is of concern. Over 75% of the CO produced in Ontario is from the transportation sector, while 25% is due to the combined effect of power generation, buildings, heating and industrial operations.

Table 6-5: Background NO_2 and SO_2 at MOECC Stations and Project Site Station

Parameter	Standard / AAQCs		Station	Measure	2007	2008	2009	2010	2011	2013
	24-hour	1-hour								
SO_2 ppb	100 ppb - 275 µg/m^3	250 ppb - 690 µg/m^3	Project site	Maximum	—	—	—	—	—	0.5
			[1]Sudbury	Average	2.3	2.0	1.1	1.3	1.5	—
				90th Percentile	4	3	2	2	2	—
			[1]Sault Ste. Marie	Average	1.8	1.2	0.6	0.7	0.8	—
				90th Percentile	3	3	1	1	1	—
NO_2 ppb	100 ppb - 200 µg/m^3	200 ppb - 400 µg/m^3	Project Site	Average	—	—	—	—	—	0.3
			[1]Sault Ste. Marie	Average	5.0	5.5	5.1	5.5	5.3	—
				90th Percentile	11	12	11	6	12	—
			[1]North Bay	Average	7.4	7.5	8.2	7.6	7.4	—
				90th Percentile	17	18	20	7	17	—

Source: [1]Environment Canada (2013).

Other Parameters Associated with Ore Mining and Processing

Several metal species are expected to be present in the processed ore once the Project is in operation, and will subsequently be emitted as trace constituents of the particulate matter. A number of these metals have Ambient Air Quality Criteria (AAQCs) in Ontario (MOE, 2012) based upon potential health impacts.

The baseline air sampling at the Project site included analysis of TSP collected to quantify the existing metal concentrations; a summary of the measured concentrations for common metals detected at the rural monitoring point is provided in Table 6-6.

Table 6-6: Background Metals, Sulphur, and Particulate SO_4 at the Project Site

Station	Parameter	24 hr AAQC (µg/m^3)	Detection Limit (µg/m^3)	Average Concentration (µg/m^3) [1]	Maximum Concentration (µg/m^3) [1]
Project site	Arsenic (As)	0.3	0.0036	< MDL	< MDL
	Cadmium (Cd)	0.025	0.0012	< MDL	< MDL
	Chromium (Cr)	0.0007	0.0012	0.0009	0.0029
	Copper (Cu)	50	0.0012	0.036	0.055
	Iron Oxide (Fe_2O_3)	25	0.0061	0.062	1.94
	Magnesium (Mg)	n/a	0.012	0.074	0.251
	Mercury (Hg)	2	n/a	0.0024	n/a
	Manganese (Mn)	0.4	0.0006	0.0055	0.012
	Nickel (Ni)	0.2	0.0018	0.0014	0.0059
	Lead (Pb)	0.5	0.0018	0.0013	0.0030
	Sulphur (S)	—	0.0150	0.357	0.95
	Titanium (Ti)	120	0.0006	0.0063	0.029
	Zinc (Zn)	120	0.003	0.0073	0.012
	Sulphate (SO_4)	—	0.045	1.07	2.86

[1]The metal concentrations cited are in the TSP fraction.
Mercury (Hg) concentration based upon 2002 MOECC data, not the on-site air sampling.
MDL = metal detection limit.

Representative ambient monitoring data is not available for hydrogen cyanide (HCN) for the regional study area; the background concentration was therefore assumed to be equal to that of HCN in the northern hemisphere's non-urban troposphere which ranges from 160 ppt to 166 ppt, or 0.18 µg/m^3 (Cicerone and Zellner, 1983; Jaramillo *et al.*, 1989). For mercury (Hg), the only reasonable data available for a baseline concentration was the ambient concentration measured by the MOECC in Mississauga in 2002 (0.0024 µg/m^3).

Air Precipitation Chemistry

The CAPMon station operated by Environment Canada in Algoma, approximately 200 km southwest of the Project site, monitors regional background air quality and precipitation quality. Data for chloride (Cl^-), calcium (Ca), magnesium (Mg), sulphate (SO_4), sodium (Na), ammonium (NH_4^+), potassium (K), SO_2, nitrate (NO_3^-) and nitric acid (HNO_3) concentrations. Available data is summarized in the baseline study of the Air Quality TSD for future reference purposes (see Appendix F).

6.3.2.3 Summary

Air quality at the urban sites in Sudbury, Sault Ste. Marie and North Bay is more influenced by urban populations. In contrast, the Project site is somewhat more remote and located in a rural setting. Regional air quality data from MOECC stations at these urban centres is therefore considered to be conservative when used as existing baseline data for the regional study area. Regional study area air quality is considered to be good due to the rural setting, and is influenced by natural and man-made emissions borne on southern winds.

Air quality data collected at the Project site for TSP, PM_{10}, select metals, NO_2 and SO_2, representative of existing air quality in the local study area, indicates good air quality. Concentrations are below current ambient air quality criteria. This result can be attributed to the rural setting as there are no significant anthropogenic sources of air emissions near the Project site.

6.3.3 Noise and Vibration

Noise (sound) and vibration data is used to characterize existing conditions in the vicinity of the Project to assess the potential effects due to noise and vibration levels caused by the Project, and to ensure that MOECC sound guideline values can be met at the receptor locations closest to the Project site and emission sources.

The noise and vibration baseline study is appended to the Noise and Vibration TSD in Appendix G.

6.3.3.1 Methodology

Noise baseline monitoring took place in July, 2013. Noise monitoring was conducted in accordance with MOECC NPC-103 guidelines (1978), and sound level measurements were taken for at least 48 hours (two full days). To ensure that measurements would be taken over the quietest hours of a week, measurements were conducted for a seven day period. One representative rural location was selected within the regional study area to measure background baseline noise levels, as similar ambient noise levels are expected throughout the regional study area (including the local study area). This monitoring point was located in a remote area within the regional study area, designated the Jack Rabbit Trench Site (UTM 433 145 E, 5 268 956 N) away from noise sources such as recreational or construction activities in the area, near to the Project site.

Continuous noise monitoring was carried out from 23 to 27 July, 2013, to collect existing noise levels for daytime (07:00 to 19:00), evening (19:00 to 23:00) and night-time (23:00 to 07:00). Acoustic parameters were logged every hour over the monitoring period.

Ambient sound level measurements were carried out using a Larson-Davis Model 831 Integrating Sound Level Meter (SLM) equipped with long-term measurement gear, including wind screen and bird spikes. This model uses a Larson Davis Model PRM831 preamplifier and

a Larson Davis Model 377B02 precision air-condenser microphone. The SLM meets IEC 61672-1 Type 1 requirements. The SLM was calibrated by an independent certification lab, and was field calibrated with a Larson-Davis Model CA200 precision acoustic calibrator set to generate a 114 dB tone at 1,000 Hz before and after the measurements. Long-term noise monitoring was carried out with the SLM set to the "A" weighting scale (denoted as dBA), to simulate the response of the human ear. This scale has several noise level references, for example, thunder and factories usually range around 110 dBA, the average home or conversation can be recorded at 50 dBA and leaves rustling are at 10 dBA.

6.3.3.2 Results and Discussion

Noise

Existing noise levels in the vicinity of the Project site reflect a rural sound environment and are generally characterized by sounds of nature and minimal road traffic. The results of the noise monitoring program are detailed in Table 6-7. No audible man-made activities at the monitoring location during installation and teardown of the equipment were noticed. The full monitoring dataset is presented in the baseline study of the Air Quality TSD (see Appendix G). The data indicates that the existing off-site noise levels are reflective of a Class 3 rural acoustical environment, as per classifications under the NPC-232 guideline publication (MOE, 1995) – a rural area with background noise dominated by natural sounds with infrequent human activity and no clear stationary sources of noise emissions.

When assessing the audibility of the Project at sensitive receptors, the average existing 1-h L_{eq} daytime (44 dBA) and averaged evening/night time (34 dBA) noise levels measured at the monitoring location can be used.

Vibration

As the Project site is in an area classified as a rural (Class 3) acoustic environment, vibrations are imperceptible and intermittent in nature. As a result, vibration monitoring was not conducted for baseline purposes.

6.3.3.3 Summary

The noise survey data indicates that the environment in the regional and local study areas is characteristic of a rural (Class 3) area, in accordance with MOECC guideline publication NPC-232. Due to this classification, vibrations were not assessed for baseline purposes. Average noise levels are 34 dBA (evening/night) and 44 dBA (daytime) on a 1-h L_{eq} basis.

Table 6-7: Summary of Noise Levels at the Monitoring Point near the Project Site

Min or Max	Time of Day[1]	1 Hour Leq (dBA)	L_{90}
Min	Daytime	29	20
	Evening	24	21
	Night Time	23	19
Max	Daytime	44	43
	Evening	48	45
	Night Time	44	32
Average	Daytime	44	n/a
	Evening	35	n/a
	Night Time	32	n/a

[1]Times of day are defined as daytime (07:00 to 19:00), evening (19:00 – 23:00), and night time (23:00 – 07:00), as per NPC-232. Data for inclement weather was discounted from the data set and reported.

6.3.4 Geochemistry and Geology

The geochemistry and geology baseline study describes the geology and geochemical characterization of the mine rock and ore, focusing on the Project site. Though geochemistry and geology itself are not evaluated for effects, the information provided by this baseline study is important in understanding the potential effects that may be caused by the excavated ore and mine rock. As such, there is no formal regional or local study area for this discipline.

Geochemical analyses were conducted on the ore and mine rock of the Project site, and more specifically from the area of the proposed open pit and mine rock area (MRA), in order to support the characterization to determine the potential for Acid Rock Drainage (ARD) and Metal Leaching (ML). The information is complemented by the characterization of the site and regional geology.

Information on the Project geochemistry and geology is presented in the Geochemical Characterization Report in Appendix E. Geological information is also presented in the hydrogeology baseline study in the Hydrogeology TSD in Appendix H.

6.3.4.1 Methodology

Based on a review of information provided by IAMGOLD to AMEC in May, 2013, that included previous geochemical and geotechnical studies, and mine plan information, AMEC developed a geochemical testing program to augment the geochemical database existing at that time. The subject work also integrates ML/ARD data previously collected by Knight Piésold and was accepted by AMEC on the basis of the documentation provided (Knight Piésold, 2012).

The methodology used for the collection and characterization of mine waste materials was based on the Ontario *Mining Act* requirements, which indicates industry best practice and standard approaches and methodologies for ARD/ML sampling and characterization (Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND, 2009)).

A preliminary assessment of rock samples from the Côté Gold Project was conducted. Static analyses included: elemental analyses, whole rock analyses, static acid base accounting (ABA), kinetic testing with humidity cells, short term leach tests, mineralogy (X-ray diffraction), and net acid generation analyses.

6.3.4.2 Results and Discussion

Regional Geology

The description of the lithological and structural characteristics of the geological setting in which the Project is located is used to complement the geochemical baseline study and provide information for the quantitative and qualitative assessment of effects, as well as to complement hydrogeological studies and assessments. Regional and local geological information as it pertains to the Project site is also summarized in the NI 43-101 Technical Report for the Côté Gold Project (Roscoe Postle Associates Ltd., 2012).

The Project and regional study area is situated in the Swayze Greenstone Belt in the south-western extension of the Abitibi greenstone belt, and forms part of the well-defined Rideout syncline. The Swayze area went through a complex and protracted structural history of polyphase folding, development of multiple foliations, ductile high-strain zones, and late brittle faulting.

The Swayze Greenstone Belt includes a diversity of extrusive and intrusive rock types. Compositions of rock types are ranging from ultramafic through felsic, as well as both chemical and clastic sedimentary rocks. Igneous rocks mainly consist of both volcanic and plutonic rocks, from the Late Archean. The regional bedrock geology, including the Project site, is shown in Figure 6-1.

The regional landscape displays relatively subdued topography ranging from approximately 350 masl to 410 masl, reflecting the effects of glaciations and the infill of low-lying areas with glacial debris. Glacial till and fluvial deposits cover the area. Mapping of Quaternary geology shows glaciofluvial ice-contact deposits, including esker, kame and moraine material. Regional overburden geology, including the Project site, is shown in Figure 6-2.

Local Geology

The geology of the Project site and local study area can be generally characterized by mafic metavolcanic, metasedimentary and pyroclastic bedrock overlain by a thin veneer of glacial till at higher elevations less than 1 m thick, and peat and glaciolacustrine deposits at lower

elevations. Bedrock is typically encountered within 4 m depth from the ground surface, with the greatest depth to bedrock observed at 22.6 m.

The northern part of the Project site is located within the transition from felsic to intermediate metavolcanic intrusive rocks into intermediate to felsic metavolcanic intrusive rocks. The southern portion of the Project site is located within Chester Township, overlying a narrow greenstone belt assemblage. This assemblage separates the Kenogamissi granitoid complex to the north from the Ramsey-Algoma granitoid complex to the south.

The Côté Gold deposit is in the southern margin of the syncline in the Chester Granitoid Complex (CGC). The Project's gold deposit is an intrusion hosted, disseminated gold deposit that initially has been interpreted as an Archean-aged gold porphyry deposit. Gold mineralization is associated with altered and brecciated intrusive rocks. Roughly, it can be pictured as a core breccia mass within diorite, surrounded by granodiorite. The volume of magmatically brecciated rock has been overprinted by the gold-mineralizing hydrothermal system, which has developed less definable zones of propylitic and potassic alteration.

Topography

The Project site is located within an area with moderately hilly boreal mixed wood (Birch, Pine, Poplar and Spruce) forest, bogs, fens and lakes commonly less than 10 m deep. Elevations range from 375 m above sea level (masl) to 425 masl, averaging approximately 400 masl near the Project site. The area of the Project site is characterized by bedrock outcrops and glacial till and is typical of the Canadian Shield. The glaciated country has a gently rolling topography that seldom exceeds 50 m. The higher ground usually has a veneer of glacial soil over bedrock, with thicker overburden present in the low-lying areas between the hills.

Mineralogy and Lithology

The main lithological units within the Côté Gold deposit include:

- tonalite;
- diorite;
  - hydrothermal breccia;
  - diorite magmatic breccia;
  - magmatic mixing breccia;
  - heterolithic quartz carbonate breccia;
- diabase dykes;
- mafic dykes; and
- intermediate and felsic dykes.

Overburden encountered in boreholes and test pits throughout the site include organics or peat, clay, clay/silt, silt/clay, silt, silt/sand, sand/silt, sand, sand/gravel, gravel, gravel/cobbles and till. In the area over the proposed open pit, overburden is generally confined to relatively narrow and steep sided bedrock valleys or troughs. The overburden in this area is mostly comprised of granular materials, sand or sand/gravel, with finer materials closer to the surface of silt with peat/organic material. Lake bottom sediments at Côté Lake range in thickness from approximately 8 m to 17 m, comprising of organic silt and fine grained materials. On average, overburden thickness over the proposed open pit is 5 m, ranging from approximately 0.1 m and 22 m. Overburden was generally neutral to alkaline, with low concentrations of sulphur (<0.03%, mostly occurring as sulphate) and variable carbonate per tonne of overburden neutralization potential (NP, 1 to 100 kg $CaCO_3$/tonne).

Similar conditions are present over the proposed MRA, with an average overburden thickness of 5 m, ranging from 0.6 m to greater than 22 m. The central portion of the proposed TMF area contains low-lying swampy terrain, with higher elevation lands along the proposed TMF perimeter. Overburden thickness in the proposed TMF area averages about 6 m, ranging from 1 m to greater than 17 m in low-lying areas. Conditions in the TMF also indicate neutral to alkaline conditions for overburden, with low sulphur content.

Bedrock in the area of the proposed open pit is comprised mainly of tonalite, diorite, breccias, diabase dykes and mafic dykes. The rock mass is weakly joined with an east-west fault and northwest-southeast dykes intersected. All samples contained at least 45% combined quartz and plagioclase (albite) which are the two dominant minerals throughout all of the lithologies. Almost all of the samples contained calcite with concentrations ranging from 0.2 to 20.5%. Some samples (14) contained minor dolomite (0.1 to 1.6%) ankerite (12 samples, 0.1 to 1.9%). Pyrite was identified in seven samples at trace concentrations (0.1 or 0.2%).

Five sediment samples were collected from the lakes surrounding the open pit (Côté Lake, Clam Lake, Three Duck Lakes and Unnamed Pond #1). Each sample was composed of a range of materials and textures, but was generally mixed in varying degrees with organic material, silt, sand and gravel.

Leachable Metals

A preliminary assessment of rock samples from the Côté Gold Project was conducted during 2013. The results of the testing suggest that the mine rock is not potentially acid-generating (NAG) and has low levels of soluble metals. Preliminary testing of ore samples suggests that the tailings will be NAG, and will likely have associated low levels of soluble metals release.

Mine rock and overburden materials samples were analyzed by Acid Base Accounting (ABA), Shake Flask Extraction (SFE) and Synthetic Precipitation Leaching Procedure (SPLP). Generally and for all materials, results exhibited neutral to slightly alkaline pH and ranged from pH 7.6 to a maximum of pH 9.5. Other results included:

- the overburden materials from all areas within the Project site sampled generally exhibit a low potential for metal leaching/acid rock drainage (ML/ARD);
- generally low concentrations of total sulphur (<0.03%) predominantly as sulphate were reported.
- the highest sulphide content (0.12%) was in overburden from the Bagsverd Creek area.
- no PAG samples on the basis of NPR < 2 were identified for overburden materials;
- as for the overburden materials, the generally low S content, occurring mostly as sulphate, and the observed range in NP is consistent with a generally low potential for ML/ARD in rock from the TMF and Bagsverd Creek diversion areas;
- the sediment materials exhibit a low potential for ML/ARD with low total sulphur concentrations;
- most mine rock sampled from the proposed open pit exhibited little potential for ML/ARD;
- generally low concentrations of total sulphur (<0.24% at 90th percentile) predominantly as sulphide are observed;
- the maximum reported sulphide content was 1.4% and the most commonly observed sulphide is pyrite;
- the materials exhibit a wide range in NP predominantly as carbonate (in the order of 1 to 450 kg $CaCO_3$/t);
- most samples are NAG (NP ratio >2), mean NP ratio of the mine rock was 19;
- dissolved metal concentrations in the SFE tests for mine rock were all below O.Reg. 560/94 threshold values.
- calcite is the most commonly observed carbonate mineral with lesser amounts of dolomite and sometimes ankerite identified.

6.3.4.3 Summary

The Project area is located in the Swayze greenstone belt, an extension of the Abitibi greenstone belt located within the Superior province. The Swayze belt contains both extrusive and intrusive rocks with compositions ranging from ultramafic to felsic. It also contains chemical and clastic sedimentary rocks which mainly occur near the top of successions.

The Côté Gold deposit is hosted within the Chester Granitoid Complex (CGC), which is the northern edge of the Ramsey-Algoma granitoid complex. The CGC is synvolcanic and was emplaced along the now southern margin on the Rideout syncline. It is a stratified trondhjemite-diorite laccolith containing numerous screens and inclusions of mafic volcanic rocks.

Results indicate the overburden throughout the Project site area characterized by neutral to alkaline pH, variable carbonate content and low concentrations of sulphur and sulphides, resulting in material with a low potential to exhibit ML/ARD. Similar findings were observed for mine rock samples analyzed from the proposed open pit, MRA and TMF areas. Mine rock in particular exhibits low potential for ML/ARD with low sulphur content, and was mostly found to be NAG.

Geochemical investigations will continue to characterize mine rock, tailings and other materials to be produced or used by the Project to guide design and engineering studies.

6.3.5 Hydrogeology

Baseline hydrogeological conditions at the Project site are described in terms of the geological setting, physical characterization and assessment of groundwater quantity. The hydrogeology baseline study information is used to support water balance calculations, water management strategies, for future reference in identifying environmental changes and for the assessments of potential effects to groundwater regimes.

The hydrogeology baseline study is presented in the Hydrogeology TSD in Appendix H.

6.3.5.1 Methodology

Existing and available information for the Project area is somewhat sparse and the datasets that are available are mostly regional in nature and coverage. Previous reports prepared for IAMGOLD and other primary sources were included as part of the initial desktop study. This data was used to establish general geologic and hydrogeologic frameworks for the Project site, and included:

- Technical Report on the Côté Gold Project, Chester Township, Ontario, Canada. NI 43-101 Report (Roscoe Postle Associates Ltd., 2012);
- Technical Report on the Côté Lake Deposit, Chester Property, Ontario, Canada. NI 43-101 Report (Roscoe Postle Associates Ltd., 2011);
- Hydrogeological Assessment, Chester Project, Gogama, Ontario (AMEC Earth and Environmental Limited, 2010);
- Certified Groundwater Monitoring Plan, Trelawney Chester 2 Mine, Gogama, Ontario, Canada (AMEC Earth and Environmental Limited, 2011);
- data from exploration drill holes provided by IAMGOLD; and
- review of available geological mapping from the Ontario Ministry of Northern Development and Mines (MNDM).

To assess the hydrogeological conditions within the Project site area, a baseline hydrogeological field investigation was initiated in early 2012. The baseline hydrogeological field

investigation focused on near surface (shallow bedrock and overburden) conditions in the vicinity of the proposed open pit, TMF and MRA.

Separate field investigations were carried out throughout 2012 and 2013, while routine groundwater quality monitoring was carried out by IAMGOLD. In addition, investigations were directed to characterising the hydraulic properties of deep bedrock in the open pit area:

- a total of 150 boreholes were drilled in the vicinity of various Project components (depth range less than 20 m into the bedrock);
- 260 test pits were excavated throughout the Project site;
- a total of 62 groundwater monitoring wells (nested and single wells) were installed to allow for water level monitoring and water quality sampling. Wells were installed with screens located in various overburden layers, where present, and bedrock material;
- 20 monitoring wells were outfitted with automatic water level sensor dataloggers to obtain continuous (hourly) water level records;
- manual monitoring of groundwater levels at approximately 50 monitoring well locations three times per year (June, August and November/December), using electronic water level indicators;
- *in situ* hydraulic conductivity (permeability) testing of overburden (slug tests) and bedrock (slug tests and packer tests); and
- six angled drill holes were advanced into the deep bedrock within the proposed open pit to facilitate hydrogeological and geomechanical testing of major lithological units and structural features (e.g. dykes and faults) along ultimate pit walls.

Samples for characterization purposes were obtained *in situ* during drilling through Standard Penetration Tests (STPs) at continuous depth intervals of approximately 0.75 m, and core sampling. All samples were oriented and logged.

In addition, soil (overburden) samples obtained from the test pits and boreholes were submitted to the Golder laboratory in Sudbury, Ontario. Laboratory testing included particle size analysis using sieve and hydrometer methods (ASTM D422). Where the particle or grain size was appropriate (i.e., effective grain size [d_{10}] between approximately 0.01 mm and 3.0 mm), the results were used to estimate hydraulic conductivity using the Hazen method (Fetter, 1994).

Hydraulic properties of the overburden and shallow bedrock were characterized through *in situ* borehole permeability testing (slug tests and packer hydraulic conductivity testing) and monitoring well rising head slug tests in shallow vertical geotechnical boreholes in 2012. Deep angled boreholes were also drilled to angled depths of 771 m in the proposed open pit footprint, and packer tests were conducted to investigate bedrock structure and groundwater flow paths.

6.3.5.2 Results and Discussion

Hydraulic Conductivity

A wide range of hydraulic conductivity estimates were derived for overburden and bedrock in the local study area. Overburden materials ranged from fine grained tills to granular materials of higher permeability. The range and geometric mean for estimates of the hydraulic conductivity of overburden and bedrock are summarized in Table 6-8 and Table 6-9.

Results from the slug tests and grain size analyses for overburden materials and slug and packer tests for bedrock throughout the Project site were highly variable.

Hydraulic conductivity for fine grained to coarse granular overburden materials ranged from 8.5×10^{-8} m/s to 2.5×10^{-3} m/s. The hydraulic conductivity values observed are typical of those for fine grained, fine granular and coarse materials, which make up the overburden of the area. Granular till materials with higher permeability were observed at depth in several boreholes, particularly in the low-lying areas along the Mollie River and the Bagsverd Creek valleys, resulting in higher variability in hydraulic conductivity in these areas.

The hydraulic conductivity of the shallow bedrock (upper 10 m) encountered throughout the Project site is highly variable, ranging from 1.0×10^{-11} m/s to 3.4×10^{-4} m/s. Hydraulic conductivity was less variable and decreased with increasing depth. The shallow bedrock is fractured, resulting in higher permeability, while deeper bedrock is unfractured with low hydraulic conductivity. Drilling in the area of the proposed open pit has shown that fracturing of the bedrock decreases with depth, reflecting the results obtained for hydraulic conductivity in the bedrock.

Table 6-8: Summary of Hydraulic Conductivity Estimates for Overburden (Slug Tests)

General Overburden Category	Material Type	Slug Test Results			
		Number of Tests	Hydraulic Conductivity		
			Measure	K (m/s)	K (m/d)
Coarse Granular	Till	13	Max	$2.5E^{-03}$	213.0
			Min	$1.2E^{-06}$	0.1
			Geomean	$1.9E^{-05}$	1.6
	Gravel Gravel/Sand Sand/Gravel	15	Max	$3.6E^{-04}$	31.1
			Min	$5.7E^{-06}$	0.5
			Geomean	$4.7E^{-05}$	4.0
Fine Granular	Sand	13	Max	$9.5E^{-05}$	8.2
			Min	$8.5E^{-08}$	0.0
			Geomean	$5.7E^{-06}$	0.5
	Sand/Silt Silt/Sand	11	Max	$1.4E^{-05}$	1.2
			Min	$7.1E^{-07}$	0.1
			Geomean	$4.3E^{-06}$	0.4

General Overburden Category	Material Type	Slug Test Results			
		Number of Tests	Hydraulic Conductivity		
			Measure	K (m/s)	K (m/d)
Fine Grained	Silt	4	Max	$1.8E^{-06}$	0.2
			Min	$3.7E^{-07}$	0.0
			Geomean	$1.1E^{-06}$	0.1

Source: Golder (2013).

Table 6-9: Summary of Hydraulic Conductivity Estimates for Bedrock

Depth (m btor) [1]	Number of Tests	Estimated Hydraulic Conductivity		
		Measure	K (m/s)	K (m/d)
0 - 10	56	Max	$3.4E^{-04}$	29.59
		Min	$1.0E^{-11}$ [2]	0.00
		Geomean	$1.0E^{-07}$	0.01
10 - 50	22	Max	$6.7E^{-06}$	0.58
		Min	$1.0E^{-11}$ [2]	0.00
		Geomean	$4.6E^{-08}$	0.00
50 - 200	36	Max	$4.0E^{-06}$	0.35
		Min	$1.0E^{-11}$ [2]	0.00
		Geomean	$3.0E^{-09}$	0.00
Over 200	57	Max	$5.5E^{-08}$	0.00
		Min	$1.0E^{-11}$ [2]	0.00
		Geomean	$2.6E^{-10}$	0.00

[1] Depths are provided in metres below top of bedrock surface encountered
[2] Hydraulic conductivity values of $1.0E^{-11}$ were assigned to packer test intervals where no measurable flow was observed
m btor = meters below top of rock.
Source: Golder (2013).

Groundwater Levels and Flow

The water level data provides an indication of groundwater level fluctuation and groundwater flowpaths in the regional and local study area and Project site. Groundwater levels were monitored manually at all groundwater monitoring wells between 2012 and 2013, and continuous (hourly) water level information was obtained from 20 groundwater monitoring wells by means of automatic water level sensor dataloggers.

The depth to groundwater observed between May and December, 2012, at monitoring locations throughout the Project site, averaged 0.53 m below ground surface (bgs), and ranged from approximately 5.13 mbgs in areas of higher elevation and/or steeper topography, to 1.07 m above ground surface (ags; groundwater discharge) at lower elevations near swampy areas and surface water features. Discharge was generally observed at the base of steep slopes adjacent to low-lying swampy areas and wetlands.

Higher groundwater elevations (typically in the range of 385 masl to 390 masl) were generally observed in the south of the Project site near the proposed open pit footprint, and lower

groundwater elevations (370 masl) in the lower elevation lands of the proposed TMF footprint, during field investigations between 2012 and 2013. The seasonal range of groundwater levels at most monitoring locations was less than 1.5 m, except along the Bagsverd Creek valley, where seasonal levels varied by up to 3 m. As a result, regional horizontal groundwater flow at the site is generally inferred to be from the south-southwest to the north-northeast. This is further reflected by assessing the vertical hydraulic gradients over the Project site.

Vertical hydraulic gradients were variable throughout the site, strongly influenced by local relief. On a more localized scale, horizontal groundwater flow is inferred to be topographically controlled and the water table generally provides a subdued reflection of the topography, with flow from recharge areas at higher elevation to discharge areas at lower elevation, commonly adjacent to surface water features. Due to this regime, low-lying areas are characterized by ponds and open water marshes with intervening short streams, which become seasonally saturated during the spring melt and storm events. As a result, the rate of recharge to the groundwater system is expected to be low, in the range of 50 mm/yr or less.

Groundwater levels rise quickly in response to recharge from snow melt and larger rainfall events, as evidenced by monitoring data from late-April, 2013 (see Appendix H). During the rest of the year, groundwater levels remain fairly consistent with steady decreases in response to lack of recharge between rainfall events. Levels remained consistent or decreased slightly during the winter.

For the range of hydraulic conductivities and local scale hydraulic gradients, groundwater velocities range from a high of 0.32 m/day to lows of less than 0.005 m/day.

Groundwater Use

A search of the MOECC Water Well Record database was conducted to determine if there are any registered water wells in the vicinity of the Project site (i.e. within the local study area of the and Project site). The results of the search indicate that there are six water wells located within a radius of approximately 15 km of the Project site (see Figure 6-3). The 15 km distance is considered to be well beyond the distance within which potential Project related groundwater effects would be expected to occur. Two of the wells are located on IAMGOLD property at the Chester 1 Camp (approximately 3 km east of the proposed open pit, drilled in 2010). One well, drilled in 1974, is indicated as a domestic well and is approximately 5 km northeast of the Project site near Mesomikenda Lake and is the water well for the IAMGOLD camp. Three wells are indicated as public supply wells and are located between 8 km and 11 km southeast of the Project site.

Water Well Records may not reflect actual well locations, due to several factors including a shift in the mapping coordinate system between the commonly used NAD27 and NAD83 datums. Prior to 1988, shallow dug or owner constructed wells were not required to be registered and there may be shallow overburden wells in the area that are not identified by the Water Well

Records. However, such wells are likely to be limited to residential areas, and these are not known to be located within the vicinity of the Project site.

MOECC records also indicate that there are two active permits to take water (PTTW) within the 15 km radius of the Project site. Both of these permits were issued to Trelawney (now IAMGOLD) for dewatering of the Bates Shaft at the Chester Mine (initial and maintenance dewatering permits). These permits were issued in 2010 and are valid until 31 July, 2015. The Bates Shaft location for these permits is shown in Figure 6-3.

6.3.5.3 Summary

The Project site is located in the Swayze greenbelt with a relatively subdued topography, in an area of thin glacial till/soil over bedrock on topographic highs and overburden thickness of up to 20 m in low lying areas.

The hydraulic conductivity of overburden throughout the Project site is highly variable. The coarse granular materials are the most permeable; with a geometric mean hydraulic conductivity of approximately 5×10^{-5} m/s and a maximum of 2.5×10^{-3} m/s. The fine granular and fine grained materials displayed geomean values of approximately 5×10^{-6} m/s and 1×10^{-6} m/s respectively. The hydraulic conductivity of the coarse granular deposits displayed high values in the order of 2×10^{-3} m/s, which is typical of sand and gravel mixtures.

Granular till materials with higher permeability were observed at depth in several boreholes, particularly in the low-lying areas along the Mollie River and the Bagsverd Creek valleys, with hydraulic conductivities typical of sand and gravel mixtures detected. A wide range of bedrock hydraulic conductivity values have been measured, ranging from 3.4×10^{-4} m/s within the upper 10 m of fractured bedrock, to 1×10^{-11} m/s in deeper unfractured bedrock. Hydraulic conductivity generally decreases with depth which is typical in the Canadian Shield.

Groundwater is recharged as infiltrating precipitation, and groundwater flows generally follow the topographic gradients of the land towards surface water features. Regional groundwater is inferred to flow from the south-southwest to the north-northeast. But on a local level, groundwater flow is controlled by the local topography, flowing from high-elevation recharge areas to discharge at low-lying areas and nearby surface water features and wetlands.

MOECC Water Well Records indicate that there are six water wells located within a 15 km radius from the Project site. This distance is considered to be well beyond the distance at which potential Project related groundwater effects would be expected to occur. Two are located on IAMGOLD property, approximately 3 km from the proposed open pit. One well, drilled in 1974, is indicated as a domestic well and is located 5 km northeast of the Project site near Mesomikenda Lake and serves as the water well for the IAMGOLD camp. Three wells are indicated as public supply wells and located between 8 km and 11 km southeast of the Project site.

MOECC records also indicate the two currently existing permits to take water (PTTW) within 15 km from the Project site. These permits are both currently held by IAMGOLD, and were issued for dewatering of the Bates Shaft at the Chester Mine.

6.3.6 Hydrology

Hydrological data is used in water balance calculations and engineering design input, to determine the receiving water assimilative capacity, and it also provides a reference to identify environmental changes. The information from this baseline study will also aid in the assessment of potential water quality and water taking/discharging effects on fish and aquatic habitat.

The hydrology baseline study is presented in the Hydrology and Climate TSD in Appendix I.

6.3.6.1 Methodology

A preliminary review of available literature and regional information was undertaken primarily using information provided by Environment Canada, MNRF, Water Survey of Canada (WSC) and Ontario Power Generation (OPG). The Project site is located within the Upper Mattagami River Watershed and the corresponding Ontario 20 m digital elevation model was extracted directly from the Land Information Ontario data of the MNRF.

Regional hydrological monitoring stations maintained by WSC are located on the Mollie River (unregulated flow) and at Minisinakwa Lake (regulated flow), as well as by the OPG at the Mesomikenda Lake dam (regulated flow). The regulated flow systems are governed by the Mattagami River Water Management Plan (MRWMP; MNR, 2006) and the Mattagami Conservation Authority Provincial Drinking Water Source Protection Program (2012).

Surface water flowpaths at the Project site are monitored by 15 hydrological stations selected and installed in March, 2012, distributed throughout the local study area in relation to the proposed site layout. Surface water sampling and monitoring data was collected at these stations. Automatic water level dataloggers have been installed in 14 of the hydrological stations and used in conjunction with instantaneous discharge measurements to develop a characterization of the stream flow regime in the vicinity of the Project site. Additionally, a barometric pressure datalogger was installed at an elevation above the expected high water level at one surface water monitoring location at Three Duck Lakes (location MP), in order to correct water level pressures to a representative water level. Surveying was completed by L. Labelle Surveys in June and October, 2012. Stream flow measurements, conducted by Golder, were made at each location between March, 2012 and July, 2013, although hydrological monitoring is ongoing at the site.

Collected data was also used to develop rating curves to obtain continuous estimates of streamflow for each of the monitoring locations. Rating curves, affected by beaver activity, were adjusted to reflect flow conditions pre- and post- beaver activity. Bathymetric data was collected

by IAMGOLD, and supplemented with data collected during spring and summer, 2013, for several lakes in and near the Project site.

6.3.6.2 Results and Discussion

The Project site is located within the Upper Mattagami River Watershed, which drains northward through the City of Timmins and ultimately to James Bay. Surface water flows at the Project site are controlled by a number of lakes and creeks, which flow to the Mollie River and Mesomikenda Lake prior to discharging to Minisinakwa Lake and ultimately the Mattagami River.

Regional Hydrology

Mean annual runoff for the region is in the range of 300 mm to 350 mm, increasing towards the northeast and southwest of the Project Site. Groundwater recharge to streamflow in the region is estimated at an annual average of 0% to 20% (MNR, 1984), indicating that surface water flow is dominant in the regional systems and groundwater recharge is low compared to evapotranspiration losses.

Regional hydrology is described in relation to the water management and protection plans in place. The Mattagami River Water Management Plan (MRWMP) was developed to incorporate the concerns of various stakeholders for the uses of the Mattagami River system. The MRWMP mandates operating levels for all 18 dams and generating stations in the Mattagami watershed.

Two dams are located in close proximity to the Project site – the Mesomikenda Lake Dam (owned by OPG) and the Minisinakwa Lake Dam (owned by MNRF). For the Mesomikenda Lake Dam, the key drawdown period is in winter to reduce spring runoff peaks (target minimum elevation is 362.30 masl). The water level must then be raised to the summer operating level (364.94 masl to 365.30 masl) by the time the water temperature reaches 5°C and maintained to July 15th for waterfowl nesting purposes. For the Minisinakwa Lake Dam, the operating level schedule is similar to that for the Mesomikenda Lake Dam. The winter target minimum is 347.78 masl, and the summer operating level (348.40 masl) must be attained by the time the water temperature reaches 5°C for fish spawning purposes.

The Mattagami River upstream of the City of Timmins' Water Filtration Plant is within the Intake Protection Zone (IPZ) 3, in the context of the Mattagami Conservation Authority Provincial Drinking Water Source Protection Program. This plan aims to minimize and mitigate potential threats the drinking water supply for the City of Timmins. The Project site is located 110 km upstream of the City of Timmins' municipal water intake, and within the IPZ 3. Policies proposed for mining developments in the IPZ 3 include a recommendation that long-term water management planning is addressed through the development of closure plans, and as mandated by O. Reg. 240/00.

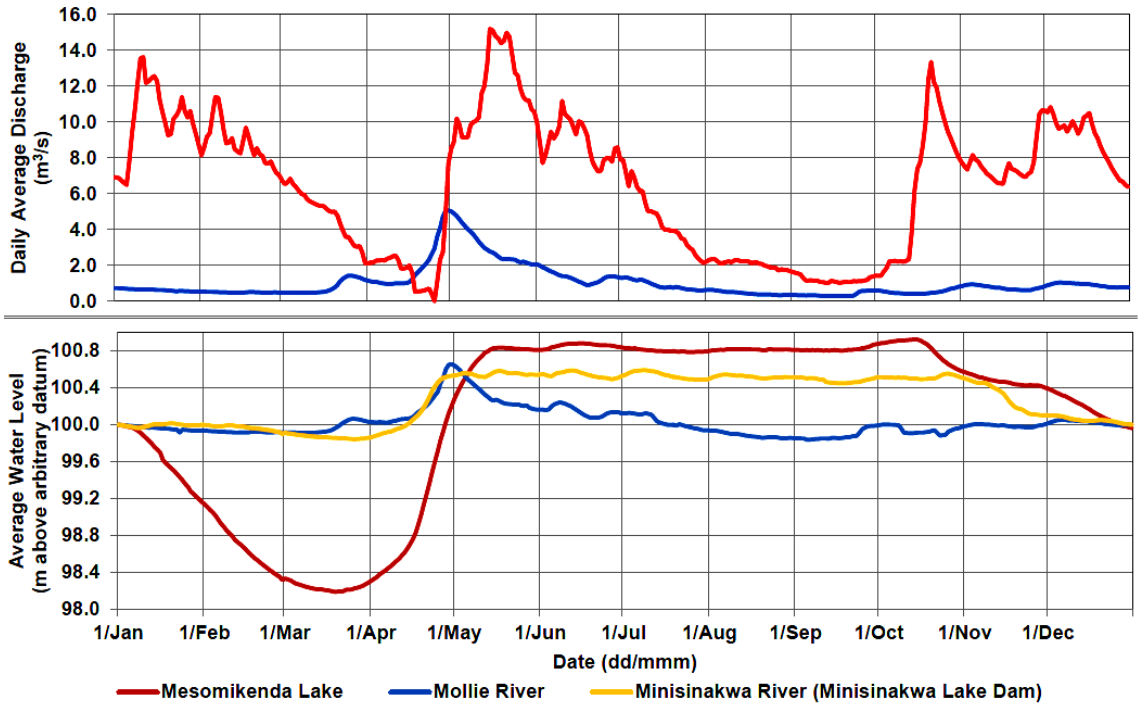
Regional discharge and water level data obtained from available hydrological monitoring locations indicate that the Mesomikenda Lake displays three distinct peak flow periods that coincide with dam operation rules. The unregulated Mollie River has a typical single spring runoff peak flow. Regional discharge and water level data for the available hydrological monitoring stations is shown in Graphic 6-2.

Local Hydrology

Surface water in the area of the Project site is controlled by topography and geology. Watersheds at the Project site form part of the headwaters of the Mattagami River Watershed, just north of the divide that separates the James Bay Watershed from the Great Lakes Watershed. The Upper Mattagami River Watershed was used as the base watershed to further delineate local watersheds. Two subwatersheds drain the Project site, namely the Mollie River Subwatershed and the Mesomikenda Lake Subwatershed (see Figure 6-4).

The Mollie River Subwatershed connects several lakes that discharge through the proposed open pit and MRA locations. The river's headwaters include Moore Lake, discharging through Attach Lake, Chester Lake, Côté Lake, and Three Duck Lakes. Other contributing lakes include Clam Lake, Weeduck Lake and smaller surrounding headwater ponds. The Mollie River discharges to Dividing Lake and into Lake Minisinakwa near the town of Gogama. The upstream watershed is approximately 9,000 ha (90 km^2).

Graphic 6-2: Average Daily Regional Discharge and Monthly Water Levels for the Regional Study Area



Source: Golder (2013).

The Mesomikenda Lake Subwatershed is larger (approximately 63,000 ha or 630 km^2) and drains the Somme River and Bagsverd Creek. The Somme River drains the Somme Lake and Wolf Lake, while Bagsverd Creek drains the Schist Lake, Bagsverd Lake and other nearby unnamed water features (Unnamed Lake #1 and #2 have been named for the purpose of the Project studies). The Somme River and Bagsverd Creek both drain into Neville Lake, which in turn discharges to Mesomikenda Lake. Mesomikenda Lake discharges to the Makani River and Minisinakwa Lake upstream of the Mattagami River.

The hydrology in the vicinity of the Project is shown in Figure 6-5.

Water level changes in close proximity to the Project site were recorded at Bagsverd Creek, Somme River and Mollie River (at the Three Duck Lakes outlet) between March, 2012, and July, 2013. Over this period, water levels fluctuated between 0.1 m to 1.9 m, and in some cases this was the result of beaver activity downstream of the water level sensor installations. Water level rise typically followed extended rain or snowmelt. The greatest water level elevation was recorded at the Little Clam Lake outflow (388 masl).

Streamflow estimates over the same period for the Mesomikenda Lake and Mollie River Subwatersheds shows a wide range of flows, with the greatest maximum and average discharge values at the outlets of the main drainage features, Bagsverd Creek, Somme River and Mollie River.

6.3.6.3 Summary

The Project site is located within the Upper Mattagami River Watershed, in close proximity of the James Bay and Great Lakes Watersheds, which drains northward through the City of Timmins and ultimately to James Bay. Surface water flows at the Project site are controlled by a number of lakes and creeks which flow to the Mollie River and Mesomikenda Lake prior to discharging to the Minisinakwa Lake and ultimately the Mattagami River. The Mattagami River upstream of the City of Timmins Water Filtration Plant (including the Project site) is within the Intake Protection Zone (IPZ) 3 in the context of the Mattagami Conservation Authority Provincial Drinking Water Source Protection Program.

Regional hydrological monitoring stations maintained by the Water Survey of Canada (WSC) are located on the Mollie river (unregulated flow), and at the Minisinakwa Lake (regulated flow), as well as by Ontario Power Generation (OPG) at the Mesomikenda Lake dam (regulated flow). The regulated flow systems are governed by the Mattagami River Water Management Plan (MRWMP).

Surface water flowpaths at the Project site are currently monitored by 14 hydrological stations distributed throughout the Mesomikenda Lake and Mollie River Subwatersheds. Streamflow estimates at these stations indicate great fluctuation over most of the year, though water levels remained relatively stable with low variation (0.1 m to 0.9 m) which was caused in some cases by beaver activity.

6.3.7 Surface Water, Sediment, and Groundwater Quality

Water and sediment quality are important parameters for both the physical and biological environments, defining the health of aquatic ecosystems and providing a basis for calculating allowable effluent discharge loadings, design input for potable water treatment systems and for the assessment of potential effects.

The water quality baseline study is presented in the Water Quality TSD (see Appendix J). Other information was also included based on the Hydrogeology and Hydrology and Climate TSDs (see Appendices H and I), as well as the Aquatics Biology TSD (see Appendix N).

6.3.7.1 Methodology

Surface Water Quality

The surface water quality baseline program was initiated in September 2011, and originally established in conjunction with Trelawney Mining and Exploration Inc. (Trelawney). This program was revised in the spring of 2012 by Golder and IAMGOLD with respect to sampling locations and frequency. Sampling locations include those paired with the 15 hydrological monitoring stations (see Section 6.3.5), seven other surface water quality sampling locations, totalling 22 sampling locations to better characterize surface water quality conditions of the study areas, particularly at the Project site. For purposes of the baseline study, the data considered is for the period of September, 2011, to May, 2013, though monthly or quarterly sampling is ongoing and will continue throughout the EA review process. An additional 12 water column profile locations were also sampled for surface water quality from May to August, 2013, and these results are also included. Water column profiling was completed to evaluate the potential for thermal and chemical stratification within key lakes across the study areas.

Surface water samples were collected in laboratory supplied bottles, pre-charged with preservatives and filed-filtered (0.45 µm), as necessary. These are collected as grab samples from approximately 10 cm below the water surface. Temperature, pH, dissolved oxygen and conductivity were recorded in the field using an YSI multiparameter meter. Samples are analyzed for a broad set of parameters; the complete list of water quality parameters is provided in Table 6-10.

For water column profile samples, samples were obtained from approximately 1 m below the surface (“top” sample) and from 1 m above the lake bed (“bottom” sample) using a Kemmerer sampler. Measurements of pH, oxygen-reduction potential (ORP), temperature, electrical conductivity and dissolved oxygen were collected using an YSI multiparameter meter at regular intervals from the surface to the lake bed, by boat.

In addition to the water quality monitoring programs, spot water quality was also assessed during aquatic (fish and benthos) sampling programs to document water quality conditions at that time. This included *in situ* measurements of temperature, dissolved oxygen (DO), pH, and

conductivity as vertical profiles (every 1 m in depth) at most lakes and at the surface or mid-column in creeks, rivers and ponds. This is further detailed in Section 6.4.8.

Surface water quality results are compared, as a reference, to the Ontario Drinking Water Standards (ODWS; MOE, 2003), the Ontario Provincial Water Quality Objectives (PWQO; MOE, 1999) and the Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQG; CCME, 2013).

Sediment Quality

Sampling of sediment quality was conducted in water bodies and watercourses across the site during an aquatic baseline survey conducted in 2011. Samples were collected from the top (0 cm to 10 cm) horizon at wetland/lake sampling stations using a grab sampler from depositional environments. Sample analyses included: pH and total organic carbon (TOC), metals, such as silver, aluminum, arsenic, barium, beryllium, bismuth, calcium, cadmium, cobalt, chromium, copper, iron, mercury, potassium, magnesium, manganese, molybdenum, nickel, lead, antimony, selenium, titanium, tellurium, uranium, vanadium and zinc, as well as phosphorus, boron, sulphur, and silicon.

Sediment quality results were compared, as a reference, to the 2008 MOECC Provincial Sediment Quality Guidelines (PSQG) Lowest Effect Levels (LELs) and Severe Effect Levels (SELs), as well as reference area values:

- No effect: no toxic effects are observed on aquatic organisms (concentrations are less than the method detection limits);
- Lowest Level Effect (LEL): the level of affected sediment that the majority of benthic invertebrates inhabiting the sediment can tolerate (sediment considered clean to marginally affected); and
- Severe Effect Level (SEL): the level of affected sediment where a pronounced disturbance can be expected for benthic invertebrate sediment dwellers (sediment considered heavily affected).

Additionally substrate material was characterized visually and sediment was retrieved from deep water areas by petite-Ponar dredge for the aquatic biology baseline study during 2012. This is detailed in Section 6.4.8.

Groundwater Quality

Groundwater quality monitoring locations were established in early 2012, designated to cover the areas of the Project site where key conceptual mine components are expected to be located. In 2012, groundwater quality was monitored at 37 locations of paired (shallow and deep) or single monitoring wells, and was monitored three times (in the spring, summer and fall). The monitoring wells have been installed in the field with a lockable cap. In 2013, the

number of monitored wells was reduced to 27. The monitoring well network was designed to cover the areas of the Project site where key conceptual mine components are expected to be located, including the areas for the proposed open pit, MRA and TMF. Although groundwater sampling is ongoing and will continue throughout the EA review process, the data considered for baseline reporting is for May to December, 2012 (monitoring events were conducted in May-June, August and November-December, 2012).

Groundwater samples were collected in laboratory supplied bottles as per the surface water sampling protocol, and were also shipped for analyses to AGAT Laboratories. Groundwater chemistry was analysed for major ions, metals, nutrients and physical parameters (e.g., conductivity and total dissolved solids). Groundwater quality results are compared, as a reference, to Ontario Drinking Water Standards (ODWS), Provincial Water Quality Objectives (PWQO) and the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life. Table 6-10 shows the complete list of parameters sampled per monitoring program for surface and groundwater quality.

Table 6-10: Water Quality Parameters Analysed

Parameters	2012 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013 Water Column Profile Quality Program	Groundwater Quality Baseline Monitoring Program (thrice per year)
pH	X	X	X	X
Alkalinity	X	X	X	X
Acidity	2 analyses	X	X	X
Electrical Conductivity (EC)	X	X	X	X
Dissolved Oxygen (DO)	—	—	X	—
Total Dissolved Solids (TDS)	X	X	X	X
Total Suspended Solids (TSS)	X	X	X	X
Hardness	X	X	X	X
Dissolved Organic Carbon (DOC)	X	X	X	—
Total Organic Carbon (TOC)	4 analyses	X	X	—
Chemical Oxygen Demand (COD)	4 analyses	X	X	—
Calcium (Ca)	X	X	X	X

Parameters	2012 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013 Water Column Profile Quality Program	Groundwater Quality Baseline Monitoring Program (thrice per year)
Magnesium (Mg)	X	X	X	X
Potassium (K)	X	X	X	X
Sodium (Na)	X	X	X	X
Chloride (Cl)	X	X	X	X
Fluoride (F)	X	X	X	X
Sulphate (SO_4^{2-})	X	X	X	X
Aluminum (Al)	X	X	X	X
Antimony (Sb)	X	X	X	X
Arsenic (As)	X	X	X	X
Barium (Ba)	X	X	X	X
Beryllium (Be)	X	X	X	X
Boron (Bo)	X	X	X	X
Cadmium (Cd)	X	X	X	X
Chromium (Cr)	X	X	X	X
Cobalt (Co)	X	X	X	X
Copper (Cu)	X	X	X	X
Iron (Fe)	X	X	X	X
Lead (Pb)	X	X	X	X
Manganese (Mn)	X	X	X	X
Mercury (Hg)	X	X	X	X
Molybdenum (Mo)	X	X	X	X
Nickel (Ni)	X	X	X	X
Selenium (Se)	X	X	X	X
Silver (Ag)	X	X	X	X

Parameters	2012 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013 Water Column Profile Quality Program	Groundwater Quality Baseline Monitoring Program (thrice per year)
Strontium (Sr)	X	X	X	X
Thallium (Th)	X	X	X	X
Titanium (Ti)	X	X	X	X
Tungsten (W)	X	X	X	X
Uranium (U)	X	X	X	X
Vanadium (V)	X	X	X	X
Zinc (Zn)	X	X	X	X
Zirconium (Zr)	X	X	X	X
Total Cyanide (Tot. CN)	X	X	X	—
Free Cyanide (CN)	—	—	X	X
Sulphur (S)	3 analyses	—	—	X
Nitrate (NO_3^-)	4 analyses	X	X	X
Nitrite (NO_2^-)	4 analyses	X	X	X
Ammonia (Tot. NH_3)	X	X	X	X
Total Kjeldahl Nitrogen (N)	4 analyses	—	—	—
Total Phosphorus (Tot. P)	X	X	X	–
Phosphate (PO_4^{3-})	X	—	—	—
Soluble Reactive Phosphorus (P)	4 analyses	—	—	—
Oil and Grease	5 analyses	X	X	—
Phenols	—	—	X	—
Polycyclic Aromatic Hydrocarbons (PAH)	—	—	X	—
Polychlorinated Biphenyls (PCB)	—	—	X	—
Escherichia coli	—	—	X	—

Parameters	2012 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013 Water Column Profile Quality Program	Groundwater Quality Baseline Monitoring Program (thrice per year)
Total Coliform	—	—	X	—
Radium-226	Monthly from November 2012	X	X	—

– = no analysis completed
X = analysis completed
Source: Golder (2013).

A Quality Assurance/Quality Control (QA/QC) program involving the collection of duplicate samples, field blanks and trip blanks was conducted by IAMGOLD personnel for each monitoring event. A prefix was added to these samples' labels and these QA/QC measures are in addition to internal QA/QC requirements and programs of the analytical laboratory to ensure the integrity of the resulting sampling data. The QA/QC program and results are presented in the baseline study of the Water Quality TSD (see Appendix J).

6.3.7.2 Results and Discussion

Water quality results were compared to several water quality criteria for reference purposes only, and are not related to the effects assessment. Criteria and standards utilized for this comparison include the Ontario Provincial Water Quality Objectives (PWQO) and the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQG). Comparisons against the Ontario Drinking Water Standards (ODWS) relate specifically to health-related parameters (Maximum Acceptable Concentration; MAC, or Interim Maximum Acceptable Concentration; IMAC). Aesthetic Objectives (AO) and Operational Guidelines (OG) are not health-related (intended to be applied when considering water treatment, disinfection and distribution) and are not applicable for the Project site and are therefore not considered for comparative purposes.

Surface Water Quality

Surface water quality sampling results from throughout the Project site and sampled locations were compared to the aforementioned standards and guidelines as a reference; with the exception of aluminum that is presented as dissolved ('clay-free') concentrations. Parameter concentrations were examined to determine if they were consistently (i.e., > 50% of the time) or occasionally (i.e., < 50% of the time) higher than the water quality standards and guidelines.

Surface water quality results have typically been consistent between seasons, with variable iron, manganese, zinc and dissolved aluminum concentrations at some locations. Most other concentrations were near or below detection limits. The pH of samples was slightly acidic to slightly alkaline. Concentrations of total phosphorous, iron, zinc, copper and dissolved aluminum

occasionally or consistently exceeds regulatory guidelines (i.e., PWQO and CWQG). It should be noted that the PWQO for total phosphorus is an interim aesthetic guideline and should be supplemented by site-specific studies to develop site-specific criteria. Occasional occurrences of DOC, TDS, iron, manganese, pH, aluminum and zinc concentrations greater than the ODWS were also noted.

Water quality value exceedances are generally interpreted to be naturally occurring in the vicinity of the proposed Côté Gold Project. Some exceedances in select locations may be related to historical operations. The following table (see Table 6-11) presents a summary of the number of results that were greater than specified criteria values for surface water quality. Full surface water quality results are presented in Appendix J.

Water column profile parameters were measured at 17 locations within Bagsverd Lake, Neville Lake, Mesomikenda Lake, Chester Lake, Clam Lake, Three Duck Lakes, Delaney Lake and Dividing Lake. Profile plot results for temperature, dissolved oxygen (DO) and electrical conductivity (EC, to a lesser extent) showed stratification at most locations, though this is less pronounced in the data obtained during May, 2013. This suggests a turnover in lake condition during May, 2013. Marked decreases in temperature and DO with depth in the August, 2013, data reflect fully stratified summer conditions. The results indicate that some lakes were likely experiencing a turnover during spring, 2013, transitioning to fully stratified conditions that were consequently observed during summer monitoring. The pH was typically lower with depth (lowest pH recorded was 6.25), and EC increased with depth at some locations thus decreasing the oxidation-reduction potential.

Table 6-11: Surface Water Quality Results – Values Greater than Criteria

Parameter	Criteria [1]		Total Number of Samples	Sample Values not Meeting Criteria			
	CWQG	PWQO		CWQG		PWQO	
				Number	%	Number	%
Field pH	6.5-9	6.5-8.5	215	22	10	22	10
Lab pH	6.5-9	6.5-8.5	241	53	22	53	22
Dissolved Aluminum (Al)	100	75	241	23	9	50	21
Copper (Cu)	2	5	241	19	7.9	—	—
Iron (Fe)	300	300	241	31	13	31	13
Total Phosphorous (Tot. P)	20	20	241	65	27	65	27
Zinc (Zn)	30	20	241	30	12	41	17
Cadmium (Cd)	0.058	0.1	241	1	0.41	1	0.41
Lead (Pb)	1	3	241	1	0.41	—	—
Silver (Ag)	0.1	0.1	241	1	0.41	1	0.41
Thallium (Th)	0.8	0.3	241	—	—	1	0.41

CWQG - Canadian Water Quality Guidelines from CCME.
PWQO - Provincial Water Quality Objectives.
[1] For guidelines dependent on one or more of pH, temperature and hardness, an assumed pH of 7, temperature of 15°C, and hardness of 30 mg/L as $CaCO_3$ was applied.
Source: Golder (2013).

The following table (see Table 6-12) presents a summary of the number of results that were greater than specified criteria values for water column profile results. Full water column profile results are presented in Appendix J.

Table 6-12: Water Column Profile Sample Results – Values Greater than Criteria

Parameter	Criteria (1)		Total Number	Sample Values not Meeting Criteria			
	CWQG	PWQO		CWQG		PWQO	
				Number	%	Number	%
Field pH	6.5-9	6.5-8.5	22	3	14	3	14
Lab pH	6.5-9	6.5-8.5	22	16	73	16	73
Dissolved Aluminum (Al)	100	75	22	3	14	11	50
Zinc (Zn)	30	20	22	2	9	3	14
Cadmium (Cd)	0.058	0.1	22	1	4.5	—	—
Free Cyanide (Free CN)	5	5	22	1	4.5	1	4.5

CWQG - Canadian Water Quality Guidelines
PWQO - Provincial Water Quality Objectives
[1] For guidelines dependent on one or more of pH, temperature and hardness, an assumed pH of 7, temperature of 15°C, and hardness of 30 mg/L as $CaCO_3$ was applied.
Source: Golder (2013).

Sediment Quality

Sampling results from the 2011 monitoring indicated good sediment quality, with the majority of parameter concentrations below the 2008 MOECC Provincial Sediment Quality Guidelines (PSQG). PSQG Lowest Effect Levels (LELs) were exceeded for the majority of the TOC results. A few total organic carbon results also exceeded PSQG Severe Effect Levels (SELs); however this is typical of lakes in northern Ontario, based on experience with previous comparable projects. Provincial SELs were found to be exceeded for iron and manganese concentrations in the Mollie River. In some of the surface waters, Federal Threshold Effect Level exceedances were observed for copper (AMEC, 2011). It is noted that the PSQGs were developed and strongly weighted by data for sediments in the Great Lakes basins, which tend to have a substantially lower natural content of many metals relative to sediments in Canadian Shield lakes (Prairie and McKee, 1994). Natural background concentrations, particularly in mineralized areas of the Canadian Shield lakes can naturally exceed LELs.

Sediment quality, as visually characterized during the aquatic biology baseline study, is described for each water feature studied in Section 6.4.8.

Groundwater Quality

Results were compared to the aforementioned standards and guidelines as a reference regarding the magnitude of concentrations present in the groundwater samples. This assists in the identification of parameters that may require further consideration in the context of the EA. The dissolved (filtered) metal concentrations, rather than the total concentrations, were

measured in the groundwater samples for comparison to the standards and guidelines, as these are more relevant for groundwater because total concentrations include the proportion of metals present as suspended solids, which do not travel through most subsurface substrates. Parameter concentrations were examined to determine if they were consistently (i.e., > 50% of the time) or occasionally (i.e., < 50% of the time) higher than the water quality standards and guidelines.

Results indicated that several parameter concentrations occasionally exceeded regulatory criteria during one or more monitoring events in 2012. Most recorded pH values were acidic to near-neutral – the lowest pH recorded was 5.5. About a quarter of the samples' aluminum, copper, iron, tungsten and zinc concentrations were consistently greater than regulatory guidelines (i.e., PWQO and CWQG). Some samples showed exceedances for concentrations of arsenic, cadmium, chromium, cobalt, molybdenum, silver, uranium and vanadium. A small number of samples also showed exceedances for free cyanide and un-ionized ammonia concentrations. The concentrations of other parameters analyzed were found to less than the specified criteria.

The following table (see Table 6-13) presents a summary of the number of results that were greater than specified criteria values for water column profile results. Full groundwater quality results are presented in Appendix J.

Other than exploration drilling at the Project site, there is currently limited development activity in the area. As such, all elevated parameter concentrations detected during baseline monitoring for surface and groundwater represent background conditions and will continue to be monitored to assess trends in water quality.

Table 6-13: Water Column Profile Sample Results – Values Greater than Criteria

Parameter	Criteria[1]			Total	Sample Values not Meeting Criteria					
	ODWS	CWQG	PWQO		ODWS		CWQG		PWQO	
					Number	%	Number	%	Number	%
Field pH	—	6.5-9	6.5-8.5	105	—	—	23	22	23	22
Total Suspended Solids (TSS)	—	25000	—	106	—	—	106	100	—	—
Aluminum (Al)	—	100	75	106	—	—	17	16	19	18
Arsenic (As)	25	5	5	106	1	0.9	7	6.6	7	6.6
Cadmium (Cd)	5	0.058	0.1	106	—	—	10	9.4	3	2.8
Chromium (Cr)	50	8.9	8.9	106	—	—	3	2.8	3	2.8

Parameter	Criteria[1]			Total	Sample Values not Meeting Criteria					
	ODWS	CWQG	PWQO		ODWS		CWQG		PWQO	
					Number	%	Number	%	Number	%
Cobalt (Co)	—	—	0.9	106	—	—	—	—	6	5.6
Copper (Cu)	—	2	5	106	—	—	25	23	9	8.5
Iron (Fe)	—	300	300	106	—	—	23	22	23	22
Molybdenum (Mo)	—	73	40	106	—	—	5	4.7	9	8.5
Silver (Ag)	—	0.1	0.1	106	—	—	4	3.8	4	3.8
Tungsten (W)	—	—	30	106	—	—	—	—	22	21
Uranium (U)	20	15	5	106	1	0.9	2	1.9	10	9.4
Vanadium (V)	—	—	6	106	—	—	—	—	2	1.9
Zinc (Zn)	—	30	20	106	—	—	32	30	39	37
Un-ionized Ammonia (NH_3)	—	19	20	101	—	—	1	1	1	1
Free Cyanide (CN)	200	5	5	106	—	—	3	2.8	3	2.8

ODWS – Ontario Drinking Water Standards
CWQG - Canadian Water Quality Guidelines
PWQO - Provincial Water Quality Objectives
[1] For guidelines dependent on one or more of pH, temperature and hardness, an assumed pH of 7, temperature of 15°C, and hardness of 30 mg/L as $CaCO_3$ was applied.
Source: Golder (2013).

6.3.7.3 Summary

The Project site is located within the Upper Mattagami River Watershed, in close proximity to the James Bay and Great Lakes Watersheds, which drains north through the City of Timmins and ultimately to James Bay. Surface water flows at the Project site are controlled by a number of lakes and creeks that flow to the Mollie River and Mesomikenda Lake, prior to discharging to Minisinakwa Lake and ultimately to the Mattagami River.

Baseline water quality results were compared to several water quality criteria for reference purposes only. Criteria and standards utilized for this comparison include the Ontario Provincial Water Quality Objectives (PWQO), the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQG), and the Ontario Drinking Water Standards (ODWS). Samples were analyzed for general chemistry parameters, metals, major ions and organics (oil and grease - mineral, animal/vegetable and total) and other applicable parameters.

Surface water quality sampling was completed at 22 locations, which included sampling points at the 15 hydrological stations near the Project site. The results indicate that the concentrations of some parameters at some sampling stations were consistently or occasionally greater than

water quality standards and guidelines (PWQO and CWQG). These include aluminum, cadmium, copper, iron, lead, silver, thallium, total phosphorus and free cyanide. The overall water quality observed in the study area is considered typical of lakes and watercourses present in the regions of the Canadian Shield. This is because flow is influenced by bedrock outcrops and concentrations that exceed water quality criteria likely reflect the influence of natural bedrock weathering processes on surface water quality.

An additional 12 locations were monitored for water column profiling. The results indicate that most lakes experience a turnover during spring, and the profiles of dissolved oxygen, temperature, and conductivity (to a lesser extent) indicate that the water column is stratified from mid- to late-spring and through the summer months.

Sediment quality sampling was conducted in water bodies and watercourses across the site in 2011, and tested for general chemistry parameters and metals. Results indicated good sediment quality, with the majority of parameter concentrations below quality guidelines (PSQG). However, LELs were exceeded for most TOC results, and some also exceeded SELs, though this is typical in northern Ontario lakes. Provincial SELs were also exceeded for iron and manganese concentrations in the Mollie River, while Federal Threshold Effect Level exceedances were observed for copper in some surface waters. These exceedances are considered to be natural background concentrations, as mineralized areas of the Canadian Shield can naturally exceed PSQGs. Sediment quality is visually characterized for each water feature sample with the aquatic biology baseline study.

Groundwater quality results indicate that field pH, aluminum, arsenic, cadmium, chromium, cobalt, copper, iron, molybdenum, silver, tungsten, uranium, vanadium, zinc, un-ionized ammonia and free cyanide were occasionally present in concentrations greater than water quality standards and guidelines (CWQG and PWQO). In addition, arsenic and uranium were occasionally greater than ODDS (MAC), though this is not uncommon for regions in the Canadian Shield. All other parameters and/or concentrations analysed were consistently below water quality criteria.

Surface water, sediment and groundwater quality sampling is ongoing, and water quality exceedances are generally interpreted to be naturally occurring in the vicinity of the proposed Côté Gold Project. For some metals, concentrations in groundwater were greater than concentrations in surface water samples, though this is expected as groundwater experiences a higher degree of water-rock interactions, both mechanically and chemically.

6.4 Biological Environment

All baseline and other studies for the biological environment disciplines are presented in the respective TSDs in Appendix K, L and M. These reports include tabulated baseline data, figures indicating sampling or monitoring locations and detailed results. The following sections concisely present a synthesis of the respective studies for each discipline.

For the terrestrial biology baseline studies (vegetation, wildlife and natural and protected areas), the following sources and databases were used for background information and desktop studies:

- Ministry of Natural Resources and Forestry (MNRF);
- Natural Heritage Information Centre (CHIC, 2013);
- Provincially Significant Wetlands (PAW);
- Areas of Natural and Scientific Interest (ANSI);
- Environment Canada;
- *Species at Risk Act* (SARA, 2012);
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2012);
- Species at Risk in Ontario (SARO, 2012); and
- Committee on the Status of Species at Risk in Ontario (COSSARO, 2012).

Other databases were also considered as applicable to each class and discipline type. Baseline data was gathered using standard approaches of literature review, observation, sample collection, data analysis and discussions with the MNRF. The terrestrial biology baseline studies serve to characterize the existing biological environment and support the assessment of potential effects.

Terrestrial biology baseline studies were carried out by Golder Associates (Project site) and AMEC (Transmission Line Alignment, TLA), and these are presented in the Vegetation, Wildlife and Transmission Line Terrestrial Biology TSDs (see Appendices K, L and M respectively). Separate terrestrial biology baseline studies were conducted for the Project site and TLAs as a linear component, i.e., the TLAs, is characterized and assessed for potential effects differently compared to a mining project area. The terrestrial baseline studies are discussed in the following sections.

6.4.1 Site Aerial Reconnaissance

For several of the terrestrial biology baseline studies, aerial reconnaissance surveys were conducted.

An aerial reconnaissance survey was conducted on April 21, 2012, to determine the accuracy of desktop study data for land cover, to select survey locations for plant community and breeding bird surveys, and to locate raptor nests potentially used by bald eagles (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*) in the local study area and Project site. In addition, the perimeter of water bodies large enough to support raptors was also surveyed.

A winter aerial survey over the local study area around the Project site was conducted on February 27, 28 and March 1, 2013, as detailed for the transmission line terrestrial biology (see

Section 6.4.4.1). The aim of this survey was to detect mammal tracks and sightings of wildlife over the local study area and Project site.

Survey routes were flown at a height of 60 m to 100 m at approximately 60 km/h during good weather conditions. Two observers conducted the surveys, one seated in the front as navigator and observer, and the second in the back as recorder and observer. Stick nests observed were recorded (images, number of individuals, maturity level if possible, location, nest occupied/unoccupied, ecosite phase/wetland type used by the birds) and marked with a Global Positioning System (GPS) unit. Incidental wildlife sightings were also recorded.

6.4.2 Terrestrial Biology – Site Vegetation

The vegetation baseline study describes the existing conditions of the plants in the study areas for the purpose of mapping of plant cover (habitats), listing of plant species, and identification of habitat with the potential to support plant species at risk. This information in turn is used for future reference in identifying environmental changes and for assessment of effects.

Soils are also considered under the vegetation baseline study, as it relates to the biological environment. Baseline soils assessments aimed to characterize soil conditions in the defined study areas in support of habitat and ecological land classification (ecosite identification), for future reference in identifying environmental changes and for assessments of effects.

The site vegetation baseline study is presented in the Vegetation TSD (see Appendix K).

6.4.2.1 Methodology

An Ecological Land Classification (ELC) system was used to define ecosites within digitally derived Land Cover 2000 polygons (land cover) (ELCWG, 2009; Spectranalysis Inc., 2004). Using an ELC approach, the baseline ecosites were mapped for the local study area. Generally, ecosite mapping is undertaken as a part of an EA, as it provides a means of relating vegetation conditions with other environmental components such as soils and terrain. Ecosites can also be used in the process of evaluating the effects of proposed mining developments and associated infrastructure (International Union for Conservation of Nature and International Council on Mining and Minerals, 2003).

Plant community mapping was initially completed as a desktop exercise using information acquired during the desktop review. Figure 6-6 shows the distribution of available land cover throughout the regional and local study areas, including the Project site.

Preliminary desktop mapping of upland and wetland plant communities were ground-truthed and detailed plant species inventories were completed from September 1 to 10, 2012 and from July 6 to 8, 2013. Golder biologists surveyed a representative subset of each land cover type identified during the desktop review. Plant community survey plots were established in a

representative location within an ecosite to determine the general vegetation cover and terrain (see Appendix K for details and figures on survey locations).

The plant communities were classified to the ecosite level of detail using the Ecosites of Ontario (Banton *et al.*, 2009) ELC system, which includes both terrestrial and wetland plant community types. At each location surveyed, plant species were inventoried, and the percent cover of each vegetation stratum (layer of vegetation, e.g., tree stratum or shrub stratum) was estimated. Ecosites were characterized by noting species composition, abundance and cover within the various strata present.

Uncommon vascular and non-vascular plant species were documented during the plant community surveys and, where required, collected for taxonomical identification. The two tallest trees at each survey plot were cored, and the diameter at breast height (DBH) and height of those trees were recorded. If there were no trees over 5 m in a survey plot, no cores were taken. General site conditions (e.g., slope, aspect, percent surface substrate, and surface expression) were also recorded at each survey location.

Soil was described using guidance provided by the Field Guide to the Substrates of Ontario (Johnson *et al.*, 2010). Substrate observations from inspection pits dug with Dutch augers were used to determine effective texture of the substrate and moisture regime at locations representing the prevailing substrate conditions. If more than one texture, moisture regime or vegetation condition was encountered, the most common or modal condition was chosen to describe the polygon. Subsurface investigations were carried out to further characterize the geotechnical and hydrogeological properties of overburden soils and bedrock in the study areas in the vicinity of the proposed open pit, watercourse realignments and other surface infrastructure components. Physical-chemical soil characteristics were characterized for hydrogeology and geochemistry and geology baseline purposes under the physical environment (Sections 6.3.3 and 6.3.4).

6.4.2.2 Results and Discussion

The regional and local study areas are located in the northeastern region of Ontario in Ecoregion 3E (Lake Abitibi Ecoregion). The vegetation in this ecoregion is boreal, with Black Spruce (*Picea mariana*), White Spruce (*Picea glauca*), Balsam Fir (*Abies balsamea*), Jack Pine (*Pinus banksiana*), Tamarack (*Larix laricina*), White Birch (*Betula papyrifera*), Trembling Aspen (*Populus tremuloides*) and Balsam Poplar (*Populus balsamifera*) constituting the main forest species. Species characteristic of the more southerly Great Lakes–St. Lawrence Forest Region, such as Eastern White Pine (*Pinus strobus*) and Red Pine (*Pinus resinosa*), grow on sandy ridges and other warmer-than-normal sites and now tend to be found only in small, isolated pockets (Crins *et al.*, 2009).

There is a history of forestry and fire in the general area and this is reflected in the vegetation structure. Wetlands are characteristically bowl bogs that are treed and surrounded by peat margin swamps.

Results from the desktop study provided an ecological context to natural features observed within the study areas, and also guided field investigations.

Land Cover

The regional study area comprises 3,788 km^2 and is classified into 12 land cover types. Land cover types were generated using satellite imagery and the resolution of the land cover data does not allow for distinguishing between specific ecosites (see Table 6-14). Undisturbed upland communities composed the majority (77%) of the regional study area, 42% of which is dense mixed forest. Wetland communities represented only 4% of the land cover in the regional study area, with treed bog encompassing 84% of the total wetland cover types.

The local study area comprises 119 km^2 and is classified into 10 land cover types (see Table 6-15). The habitat is covered by 65% of undisturbed upland communities, and 42% of the total cover consisting of dense mixed forest. Wetland communities, comprised predominantly of treed bogs, made up approximately 6% of the total cover. The remainder of the local study area is composed of disturbed communities and water.

Land cover types of restricted distribution are defined as those that represent 1% or less of the land base within the local study area. Open bog was the only land cover type identified as representing less than or equal to 1% of the local study area and may offer unique habitat for listed plant species.

Table 6-14: Total Area and Proportion of Land Cover Types in the Regional Study Area

Land Cover Type [1]	Total Area (km^2)	Percent Cover of the Regional Study Area
Upland Communities		
Forest – dense coniferous	971.04	25.63
Forest – dense deciduous	142.71	3.77
Forest – dense mixed	1,599.15	42.21
Forest - sparse	207.16	5.47
Subtotal	*2,920.06*	*77.08*
Wetland Communities		
Wetland	9.82	0.26
Bog – open	7.57	0.20
Bog – treed	121.47	3.21
Fen - treed	5.05	0.13
Subtotal	*143.91*	*3.80*

Land Cover Type [1]	Total Area (km^2)	Percent Cover of the Regional Study Area
Other		
Water – deep clear	399.39	10.54
Settlement/Infrastructure	3.10	0.08
Forest Depletion – cuts	308.78	8.15
Jack Pine Regeneration/Cuts	12.91	0.34
Subtotal	*724.18*	*19.11*
Total	**3,788.15**	**100**

[1] Source: Spectranalysis Inc. (2004).

Table 6-15: Total Area and Proportion of Land Cover Types in the Local Study Area

Land Cover Type [1]	Total Area (km^2)	Percent Cover of the Local Study Area
Upland Communities		
Forest – dense coniferous	21.05	17.75
Forest – dense deciduous	2.01	1.70
Forest – dense mixed	49.38	41.64
Forest - sparse	4.55	3.84
Subtotal	*76.99*	*64.93*
Wetland Communities		
Wetland	6.15	5.19
Bog – open	0.02	0.02
Bog – treed	1.09	0.92
Subtotal	*7.26*	*6.13*
Other		
Water – deep clear	15.90	13.41
Forest Depletion – cuts	9.02	7.61
Jack Pine Regeneration/Cuts	9.39	7.92
Subtotal	*34.31*	*30.64*
Total	**118.56**	**100.00**

[1] Source: Spectranalysis Inc. (2004).

Plant Community Surveys

Observations recorded during the plant community surveys indicate that habitat in the local study area is typical to that described by Environment Canada for Ecoregion 3E-5. Mixed forest habitat within the local study area is dominated by jack pine, white spruce, balsam fir, trembling aspen, and white birch. Poorly drained areas were dominated by black spruce. In total, 50 plots were sampled in the local study area.

A total of 121 plant species were identified during plant community surveys within the local study area. This includes 11 tree species, 39 species of small trees, shrubs and woody vines, 10 species of ferns and allies, 15 species of graminoids, 27 species of forbs, nine species of mosses, and 10 species of lichens. All plant species recorded during the plant community surveys and descriptions of surveyed ecosites are presented in the baseline study (see Appendix K).

A list of ecosites that were identified through ground-truthing within each of the land cover types in the local study area is presented in Table 6-16.

Table 6-16: Ecosites per Land Cover Type and Number of Vegetation Survey Plots in the Local Study Area

Land Cover Type [1]	Ecosites of Ontario Classification [2]		Total Number of Vegetation Plots Surveyed
	Ecosite Code	Ecosite Name	
Forest – dense coniferous	B012TI	Very Shallow, Dry to Fresh: Pine – Spruce Conifer	1
	B137Tt	Sparse Treed Bog	1
	B139N	Poor Fen	1
Forest – dense deciduous	B088Tt	Fresh, Clayey: Aspen – Birch Hardwood	1
	B104Tt	Fresh, Silty to Fine Loamy: Aspen – Birch Hardwood	1
	B120Tt	Moist, Fine: Elm – Ash Hardwood	1
Forest – dense mixed	B012Tt/TI	Very Shallow, Dry to Fresh: Pine – Spruce Conifer	4
	B014Tt	Very Shallow, Dry to Fresh: Conifer	1
	B016Tt/TI	Very Shallow, Dry to Fresh: Aspen – Birch Hardwood	2
	B018Tt	Very Shallow, Dry to Fresh: Maple Hardwood	1
	B049TI	Dry to Fresh, Coarse: Jack Pine – Black Spruce Dominated	1
	B053TI	Dry to Fresh, Coarse: Conifer	1
	B098Tt	Fresh, Silty to Fine Loamy: Jack Pine – Black Spruce Dominated	1
	B099Tt/TI	Fresh, Silty to Fine Loamy: Pine – Black Spruce Conifer	2
	B104Tt	Fresh, Silty to Fine Loamy: Aspen – Birch Hardwood	3
	B108TI	Fresh, Silty to Fine Loamy: Mixedwood	1
	B126Tt	Treed Bog	1
	B130TI	Intolerant Hardwood Swamp	1
	B224Tt	Mineral Rich Conifer Swamp	1
Forest - sparse	B016TI	Very Shallow, Dry to Fresh: Aspen – Birch Hardwood	2
	B049TI	Dry to Fresh, Coarse: Jack Pine – Black Spruce Dominated	1
	B098TI	Fresh, Silty to Fine Loamy: Jack Pine – Black Spruce Dominated	1

Land Cover Type [1]	Ecosites of Ontario Classification [2]		Total Number of Vegetation Plots Surveyed
	Ecosite Code	Ecosite Name	
Forest Depletion - cuts	B012Tt	Very Shallow, Dry to Fresh: Pine – Spruce Conifer	2
	B014Tt	Very Shallow, Dry to Fresh: Conifer	1
	B009S	Very Shallow, Dry to Fresh: Sparse Shrub	1
	B034Tl	Dry, Sandy: Jack Pine – Black Spruce Dominate	1
	B098Tl	Fresh, Silty to Fine Loamy: Jack Pine – Black Spruce Dominated	2
	B099Tl	Fresh, Silty to Fine Loamy: Pine – Black Spruce Conifer	1
Jack Pine Regeneration /Cut	B010S	Very Shallow, Dry to Fresh: Shrub	2
	B047S	Dry to Fresh, Coarse: Shrub	2
	B096S	Fresh, Silty to Fine Loamy: Shrub	2
	B099Tl	Fresh, Silty to Fine Loamy: Pine – Black Spruce Conifer	1
	B138S	Open Bog	1
Wetland	B126Tl	Treed Bog	1
	B136Tl	Sparse Treed Fen	1
	B138S	Open Bog	1
	B142N	Mineral Meadow Marsh	1

Source: [1] Spectranalysis Inc. (2004); [2] Banton *et al.* (2009).

Plant community composition indices were calculated by ecosite and include:

- total number of unique vascular species (i.e., observed only once) to a single ecosite - to express habitat uniqueness; and
- species richness – to indicate the variability in the number of species observed in a given ecosite type.

The highest plant species richness values were detected within the B012Tt/Tl, B016Tt/Tl, B098Tt/Tl, B099Tt/Tl, B104Tt ecosites, with 49, 40, 42, 46, and 40 plant species, respectively. The lowest plant species richness was observed within ecosites B009S (14 species), B139N (13 species) and B142N (7 species).

Ecosites B120Tl and B139N have the highest number of unique species, with six and four, respectively. Several ecosites did not contain any unique species, including B009S, B010S, B018Tt, B034Tl, B088Tt, B108Tl, B138S, and B224Tt.

Tree core data was also collected during plant community surveys. Tree cores were taken from the two tallest trees (>5 m) in each survey plot. Tree core data is used to estimate the average age. Height data was also collected. Cores were not taken from balsam poplar and white birch trees, unless they were the only species present in a survey plot, as these species are difficult

to age due to heart rot or poor tree ring development. The results, for future reference purposes, are presented in the baseline study (see Appendix K).

Species at Risk - Vegetation

No provincially rare plant species listed under the Provincial ESA or federally listed species are known to inhabit the regional study area (SARO, 2013; NHIC, 2013; SARA, 2013). No provincially rare plant species were detected within the local study area during the field programs and no occurrences were recorded for these species within the local study area by the MNRF (NHIC, 2013). No provincially tracked plant species were observed during the 2012 and 2013 field surveys.

Soil

The composition of soils throughout the study areas consists of an organic layer (peat in many cases) overlying silt and/or sand with occasional till overlying bedrock. Most soil types identified in the study areas are dry and/or rapidly drained with a dry to fresh moisture regime, except in some low lying areas and wetlands where soils are poorly drained fibric peat or sand and silty clays with a moist to very wet moisture regime. Bedrock is very close to or at the surface in most areas, with the exception of valley bottom areas and low-lying wet areas. Soil and overburden in general ranges in depth from 0 m to 18 m over the study areas, and soil pH values range from 6.8 to 7.3. Overburden materials are characterized in Section 6.3.4.

6.4.2.3 Summary

The vegetation baseline studies for the regional and local study areas around the Project site demonstrate that the vegetation communities are typical to Ecoregion 3E (Environment Canada, 2012b) and of the mixed boreal forest region of northern Ontario. A total of 121 plant species were identified within the local study area around the Project site. The majority of the recorded plant species are native to Ontario and no provincially or federally listed or rare species were identified through field studies.

Upland forested and non-forested communities comprise 65% of the local study area around the Project site. According to the FRI and LIO, wetlands cover 6% of the local study area around the Project site, and include fen, shallow marsh, meadow marsh, swamp thickets and treed deciduous and coniferous swamp.

Upland deciduous/mixedwood forest, upland coniferous forest and wetland coniferous swamp communities co-dominate the regional study area overall. Upland communities and ecosites consisted of deciduous, mixed wood, coniferous and cultural habitats. Wetland communities and ecosites consisted of swamp, fen and marsh-type wetlands.

Results indicate that soils throughout the study areas consist of an organic layer overlying silt and/or sand with occasional till overlying bedrock. Soils are predominantly dry and rapidly

drained, though low land and wetland areas have poorly drained fibric peat or sand and silty clays. Bedrock is at, or near the surface over most of the study areas, with soil and overburden at a neutral pH range and with greater soil depth in low lying areas (ranging from 0 m to 18 m).

6.4.3 Terrestrial Biology – Site Wildlife

Like the vegetation baseline, wildlife baseline studies are used to describe the different animal species in the study areas and their habitat, and to identify species at risk, for the eventual assessment of potential effects.

Wildlife species and habitat types were evaluated by means of fieldwork and helicopter aerial surveys along select routes, transects and survey/sampling points within the study areas between 2012 and 2013.

The site wildlife baseline study is presented in the Wildlife TSD (see Appendix L).

6.4.3.1 Methodology

Bird Surveys

Several bird surveys were completed as part of the baselines studies for the Project. Most survey were focused on a particular group or species of bird, all surveys noted all bird sightings to describe the existing species and support habitat use and identification. Additional details on survey methods and locations, with associated figures and/or photographs, are presented in the baseline study (see Appendix L).

Raptor Surveys

As mentioned in Section 6.4.1, aerial surveys were conducted to identify raptor nests and incidental bird observations in 2012 and 2013.

Breeding Bird Point Count Surveys

The purpose of these surveys was to determine the importance of habitats used by migratory upland bird species for breeding and foraging activities, as well as to obtain data to describe species occurrence and relative abundance. Most migratory bird species are protected under the *Migratory Birds Convention Act* (MBCA, 1994). The surveys were conducted in two stages, with early breeding surveys completed on June 1 to 7, 2012, and late breeding surveys completed on July 7 to 11, 2012. An additional round was completed between June 4 and 8, 2013, to provide greater spatial coverage.

The surveys commenced 30 minutes before sunrise and ended no later than 10:00 a.m., and survey locations were chosen to represent a portion of each of the habitat types identified in the local study area (Ralph, 1993). The centres of each survey location (plot) were spaced 250 m apart in forested habitats and 400 m apart in open habitats (i.e. grasslands, open wetlands), to

avoid double counting of individuals. Each plot was circular with a 100 m radius (50 m radius plus an additional 50 m radius buffer). The centre location of each plot was GPS recorded. Observers waited two minutes at the start at each plot to allow birds to habituate to the observer's presence, followed by a 10 minute survey period. All species seen or heard in the plot were recorded, and descriptive plant community information was also collected to facilitate characterization of bird habitat. Site conditions during the surveys were also noted. During the winter survey, microphones were also used to record birds at each plot after the two minute waiting period, for further species identification purposes.

Only observations within 50 m of the observers were used in statistical analyses. To limit human error in distance estimation, which can cause bias in bird density estimates, an effective detection radius (EDR; Buckland *et al.*, 2001) was calculated. This was used as a detectability correction factor for density estimates. Incidental sightings noted outside of the survey locations were recorded to provide a more comprehensive species list, but were excluded from all analyses.

Data collected included:

- UTM coordinates of survey locations (plots);
- date and time of observation;
- number of individuals;
- species;
- habitat; and
- behavioural activity (e.g. flushed, territorial calls or displays, nests or nests with eggs and flyovers).

Marsh Bird Surveys

Marsh bird surveys were completed on June 1 to 7 and July 7 to 11, 2012, in coordination with the breeding bird point count surveys. An additional round was carried out on June 4 to 8, 2013 to provide greater spatial coverage. In total, nine marsh bird surveys were completed in the local study area.

The surveys commenced 30 minutes before sunrise and ended no later than 10:00 a.m., as per the breeding bird point count surveys, during suitable weather conditions (i.e., low wind and no rain). Marsh bird survey points were placed at least 250 m apart. Surveys were conducted for 15 minutes at each point using a semi-circular 100 m radius area in which all birds seen or heard were recorded. Surveys began with a five minute silent listening period, followed by a five minute call broadcast period. Birds seen beyond this area were recorded as incidentals. Due to a limited sample size, data was used to provide a description of habitat use and presence/absence of species.

Waterbird Breeding Ground Surveys

Surveys were designed to collect data on waterbirds breeding within the local study area, and were completed between May 9 to 13 and June 6 to 7, 2012, once the majority of late-nesting species had arrived in the area.

Surveys were conducted from dawn to 13:30 p.m. Observers scanned wetlands from the shore to prevent flushing birds. Each waterbird species detected was recorded under the following categories:

- lone pair;
- lone male;
- lone female;
- grouped males;
- grouped female;
- unknown sex; and
- broods (sub-categories: downy young/no feathers, partly feathered and fully feathered).

Eight 500 m transects were used for the surveys, with a 100 m interval between them along the Bagsverd Creek (by canoe). Additionally, 17 point count locations were distributed along shorelines within the local study area, surveyed from the shore or from a canoe with an observation distance of 100 m.

Whip-poor-will and Common Nighthawk Surveys

Whip-poor-wills (*Antrostomus vociferous*) are designated as Threatened under the Ontario *Endangered Species Act* (ESA), and are documented as occurring in the Chester Township (Copeland pers. comm., 2012). Identification of the habitat they use is typically required by the MNRF due to their status. Common nighthawks (*Chordeiles minor*) also occur in the Chester Township (Copeland pers. comm., 2012) and are designated as a species of Special Concern under the ESA.

The surveys were completed in accordance with the Draft Whip-poor-will Survey Protocol obtained through the MNRF Sudbury District Species at Risk Biologist (Cobb pers. comm., 2011). Both of these bird species are nocturnal and use open habitat, thus, the surveys for both of these species was conducted simultaneously, using the same approach, from June 5 to 8 and July 6 to 7, 2012, to maximize detection probability of the birds as per the protocol, particularly for whip-poor-wills.

Surveys were completed at a total of 30 locations (13 locations during the first survey and 17 locations during the second survey), to determine the occurrence and relative abundance of whip-poor-wills and nighthawks in representative areas. The surveys were conducted when the

face of the moon was at least 50% illuminated and above the horizon, as whip-poor-will detectability is shown to double in nights when the moon is as described and not obscured by clouds (Wilson and Watts, 2006). Each survey was conducted by two observers, separated by 150 m to 500 m (depending on background noise), listening for the birds from pre-determined points. Time of detection, GPS location and estimated distance to the birds were recorded. Territory delineations were completed using the data under guidance provided by the Sudbury District MNRF SAR biologist (Cobb pers. comm., 2012). Due to limited sample size, no statistical analyses were conducted for common nighthawk data. Data was generally used to provide a description of habitat use and presence/absence of species.

Owl Surveys

Owl surveys were completed from April 12 to 14, 2012 and April 27 to 28, 2012, to identify species occurrence due to the variation in peak calling dates for different owl species. These were conducted at pre-selected survey locations along existing roads and trails within the study areas, using the Guidelines for Nocturnal Owl Monitoring in North America (Takats *et al.*, 2001) and the Ontario Nocturnal Owl Survey (Bird Studies Canada, 2012b). The survey locations were established along existing roads and trails in the regional and local study areas. Thirty-two call locations were surveyed during the first round and 30 during the second round. These locations were stratified by habitat type and separated by at least 1.5 km to avoid overlap of owl territories and reduce the probability of double-counts.

Call playbacks were used to optimize the detection of species, and surveying was limited to 30 minutes after sunset to approximately midnight. Surveying was not completed when wind speeds were greater than 20 km/h or when it was raining or snowing, as these factors influence owl behaviour and reduces surveying success. Due to a limited sample size, data was used to provide a description of habitat use and presence/absence of species.

Reptile and Amphibian Surveys

Turtle Surveys

Turtle surveys were conducted to determine the occurrence of Blanding's and Snapping (or Basking) turtles (*Emydoidea balndingii* and *Chelydra serpentina,* respectively). Blanding's turtle is designated as Threatened (Schedule 1) under SARA and the Ontario ESA, and the Snapping turtle as Special Concern under the *Species at Risk Act* (SARA) and the Ontario ESA.

The survey methods for Snapping turtles serves effectively to confirm the presence of Blanding's turtle as well, as both can be seen basking in the early spring and are likely still present in their overwintering habitat. The surveys were completed as follows, as per the guidelines provided by the MNRF Sudbury District Species at Risk Biologist (Cobb pers. comm., 2012):

- two rounds on May 8 to 13, 2012 and June 6 to 9, 2012; and
- five rounds of surveys were completed between May 16 and June 12, 2013.

A total of 147 surveys were completed at 44 locations during favourable weather conditions - sunny to partially sunny conditions. A canoe was used to survey the Bagsverd Lake, Clam Lake and Unnamed Lake, and survey locations were at least 250 m apart. Other habitats were also observed and incidental observations were recorded. Where possible, surveys were combined with waterbird surveys during favourable weather conditions to gain efficiencies, and were completed between 10 a.m. and 5 p.m., depending on air temperature. At each location, turtles were observed for, and available habitat was characterized to assess the potential for Blanding's turtle to occur. Due to a limited sample size, data was used to provide a description of habitat use and the presence/absence of species.

Amphibian Surveys

Amphibians are primary components on the structure of most healthy ecosystems. Due to their porous skin and aquatic lifestyles, they are good indicators for the health of an ecosystem. One round of three minute surveys was completed at four survey locations, following the Marsh Monitoring Program (Bird Studies Canada 2009, 2012a) for guidance, on June 5 to 8, 2012. Amphibians were also surveyed opportunistically during whip-poor-will and common nighthawk and owl surveys along the regional study area sections along the TLAs, and throughout all other surveying efforts.

Each survey location was separated by at least 500 m to reduce the possibility of double-counting of calls or choruses between locations. Surveys were initiated half an hour after sunset and ended near midnight during evenings with little or no wind a minimum temperature of 5°C. Species were identified through their distinctive calls and estimates of breeding chorus size was also determined on a call index scale. Water pH and air temperature were also recorded. Individual amphibian species were identified based on their distinctive calls and a rough estimate of breeding chorus size was made on a call index scale (0 = none, 1 = 1 individual, 2 = few, 3 = several, calls distinguishable and overlapping, and 4 = large numbers, full continuous chorus). Due to a limited sample size, data was used to provide a description of habitat use and presence/absence of species.

Mammal Surveys

Habitat and significant wildlife land uses within the regional and local study areas were identified by means of the Forestry Management Plan (FMP) for the Spanish Forest (MNR, 2008). A list of wildlife species with the potential to inhabit the study areas was compiled as part of an ecological risk assessment performed for the Chester Township (SARA Group, 2009), and other databases as previously indicated were used to expand this list, prior to surveying.

Aerial surveys were conducted to detect mammals and their tracks, dens, nests and other signs, as indicated in Section 6.4.1.

Winter Track Count Surveys

Winter track counts were completed to determine the relative activity, habitat use and distribution of wildlife active in the winter months within the local and regional study areas.

Transects were pre-selected using land cover polygons (Spectranalysis Inc., 2004), such that they intersected with major habitats present in the regional and local study areas (adjusted as necessary for safe surveying on the ground). Seventeen transects (totalling 17.4 km) were surveyed between March 3 to 5, 2013, and 18 transects (totalling 18 km) were surveyed on March 14 to 17, 2013. The transects were surveyed, when possible, 24 hours after a snowfall of greater than 2 cm to allow animals to make tracks after a snowfall event. Tracks noted 1 m on either side of the transects were logged and recorded using GPS. Observations were also made at select points along the transects.

These surveys and incidental observations during formal wildlife and vegetation surveys were used to describe the mammalian baseline study.

The number of tracks was standardized by the number of days since the last snowfall/wind event (track accumulation period; TAP) as these can influence the visibility of tracks in snow. The adjusted track density (TKD) was the number of tracks per kilometre sampled in a habitat segment per TAP to the nearest quarter day. These calculations were used to determine relative activity levels of carnivores, furbearers and ungulates within the regional study area. Data from the aerial surveys provided additional presence/absence data.

Bat Surveys

A desktop study was conducted to identify potential bat areas for survey purposes. Information from the Forest Resource Inventory (FRI) data, digital remote imagery and results from the 2012 plant community surveys were used to identify potential communities and areas with the potential to support maternity roost trees. Mixedwood or deciduous forests with deciduous trees greater than 25 cm in diameter were considered candidate sites for maternity roosts (MNR, 2011b). Potential hibernacula include caves and abandoned mines, as well as openings with high humidity and stable interior air temperatures above 0°C (MNR, 2000). Bat surveys were conducted in accordance with guidance provided by the MNR (Copeland pers. comm., 2013).

Acoustic recording of echolocating bats is an effective method to determine the presence and relative abundance of bats (Kunz and Parsons, 2009). Six acoustic monitoring stations were established in the local study area, using a Binary Acoustics Technology AR125 detector at locations based on the desktop study. The detectors were deployed on June 12, 2013 and left to collect data for at least 10 nights in June and early July. A transect survey was also conducted on June 12-13, 2013, using a mobile Acoustics Technology AR125 detector, to supplement presence/absence data. The transect was 70 km in total, at 30 km/h to reduce the chance of recording the same individual multiple times (Britzke and Herzog, 2013). Acoustical data was analysed with the Sonobat© 3.2.0 automated classifier software package.

Areas identified as potential hibernacula through the desktop study were visited in the field on 12-13 June and 4 July, 2013, to determine their suitability. A total of 119 sites were visited and assessed. Six locations with the deepest rock cracks and openings between boulders were chosen for further bat hibernacula assessment. Stationary bat detectors (Acoustics Technology AR125) were installed within 10 m of the features on August 20 and 21, 2013 and collected on September 4, 2013. One evening visual surveys were also conducted at each location. These surveys were initiated 30 minutes before sunset and were conducted for a minimum of three hours, under good weather conditions.

Species at Risk - Wildlife

The potential presence of nationally and provincially listed species at risk (SAR) was determined by searching the NHIC, SARA, COSEWIC and SARO databases, as well as existing species' range information and through discussions with the planning biologists for the Timmins District MNR (Copeland 2012 pers. comm.). Wildlife surveys included the search for the presence/absence of SAR wildlife within the study areas.

SAR designations for species in Ontario are initially determined by COSSARO, and if approved by the MNRF, species are added to the provincial *Endangered Species Act* (ESA), which came into effect June 30, 2008 (Government of Ontario, 2007).

6.4.3.2 Results and Discussion

Wildlife characteristic of the region includes white-tailed deer (*Odocoileus virginianus*), moose, black bear, lynx (*Lynx canadensis*), snowshoe hare (*Lepus americanus*), wolf (*Canis lupus*) and coyote (*Canis latrans*) (Environment Canada, 2010).

A list of wildlife species with the potential to inhabit the regional study area was compiled as part of an ecological risk assessment performed for the Chester Township (SARA Group, 2009). This inventory includes commonly observed species inhabiting Chester Township. This list, along with data obtained from publicly available databases (NHIC, 2013), Atlas of the Breeding Birds of Ontario (Bird Studies Canada, 2013), Atlas of the Mammals of Ontario (Dobbyn, 1964), Ontario Herpetofaunal Atlas (Oldham and Weller, 2000), and MNRF was used to generate a list of wildlife species with potential to occur in Chester Township. The complete list of species and other results for wildlife are presented in the baseline study (see Appendix L).

Bird Surveys

Raptors

Six raptor species were observed during aerial reconnaissance and field surveys in the regional and local study areas. These are listed in Table 6-17.

As shown in the baseline study (see Appendix L), one occupied bald eagle nest was observed in the regional study area, north of the proposed TMF location, during the aerial reconnaissance flight and a second occupied bald eagle nest was observed adjacent to Côté Lake in the local study area. No other stick nests were observed in the regional study area. Bald eagle is listed as Special Concern under the ESA (2007). All other raptor species observed are considered secure provincially (NHIC, 2013).

Table 6-17: Raptor Observations in the Regional and Local Study Areas, 2012 and 2013

Scientific Name	Common Name	SRank [1]	Local Study Area	Regional Study Area
Haliaeetus leucocephalus	bald eagle	Not listed	X	X
Buteo platypterus	broad-winged hawk	Not listed	X	—
Falco columbarius	merlin	S5B	X	—
Circus cyaneus	northern harrier	S4B	—	X
Pandion haliaetus	osprey	S5B	X	—
Buteo jamaicensis	red-tailed hawk	S5	—	X

[1] Based on MNRF provincial ranking definitions:
S5 - Secure in Ontario
S4B - Apparently secure and breeding in Ontario
S5B - Secure and breeding in Ontario
Source: Golder (2013).

Breeding Birds

A total of 79 species of birds and two unidentified species groups were recorded during the 2012 and 2013 breeding bird point count surveys, including incidental observations. The complete list is presented in the baseline study (see Appendix L).

Fifty-two species of upland breeding birds were recorded during breeding bird surveys within 50 m of the observers, for surveys in the regional study area (see Table 6-18). Sauer *et al.* (2012) describes population change information for North American bird species, as estimated from the North American Breeding Bird Survey. Population trends for the Boreal Hardwood Transition Region, including central Ontario, are available from 1966 to 2011 for 51 of the recorded species (North American Bird Conservation Initiative Canada, 2012).

Table 6-18: Recorded Upland Breeding Bird Species in the Regional Study Area and Population Trends

Common Name	Scientific Name	Population Trend [1]
Ruffed grouse	*Bonasa umbellus*	Declining
Ruby-throated hummingbird	*Archilochus colubris*	Increasing
Pileated woodpecker	*Dryocopus pileatus*	Increasing
Hairy woodpecker	*Picoides villosus*	Increasing
Yellow-bellied sapsucker	*Sphyrapicus varius*	Increasing
Northern flicker	*Colaptes auratus*	Declining
Alder flycatcher	*Empidonax alnorum*	Change not significant
Least flycatcher	*Empidonax minimus*	Declining
Yellow-bellied flycatcher	*Empidonax flaviventris*	Change not significant
Red-eyed vireo	*Vireo olivaceus*	Increasing
Blue-headed vireo	*Vireo solitarius*	Increasing
Gray jay	*Perisoreus canadensis*	Change not significant
Black-capped chickadee	*Poecile atricapillus*	Increasing
Boreal chickadee	*Parus hudsonica*	Declining
Brown creeper	*Certhia americana*	Increasing
Red-breasted nuthatch	*Sitta canadensis*	Increasing
Winter wren	*Troglodytes troglodytes*	Increasing
Marsh wren	*Cistothorus palustris*	Declining
Ruby-crowned kinglet	*Regulus calendula*	Declining
Golden-crowned kinglet	*Regulus satrapa*	Increasing
American robin	*Turdus migratorius*	Declining
Swainson's thrush	*Catharus ustulatus*	Declining
Veery	*Catharus fuscescens*	Declining
Cedar waxwing	*Bombycilla cedrorum*	Declining
Blackburnian warbler	*Setophaga fusca*	Increasing
Black-and-white warbler	*Mniotilta varia*	Declining
Bay-breasted warbler	*Setophaga castanea*	Declining
Black-throated blue warbler	*Setophaga caerulescens*	Increasing
Canada warbler	*Cardellina canadensis*	Declining
Chestnut-sided warbler	*Setophaga pensylvanica*	Change not significant
Magnolia warbler	*Dendroica magnolia*	Increasing
Yellow-rumped warbler	*Dendroica coronata*	Change not significant
Northern parula	*Setophaga americana*	Increasing
Yellow warbler	*Dendroica petechia*	Declining
Common yellowthroat	*Geothlypis trichas*	Declining
American redstart	*Setophaga ruticilla*	Declining
Mourning warbler	*Oporornis philadelphia*	Declining
Nashville warbler	*Oreothlypis ruficapilla*	Change not significant
Pine warbler	*Setophaga pinus*	Increasing
Northern waterthrush	*Parkesia noveboracensis*	Declining
Ovenbird	*Seiurus aurocapillus*	Change not significant

Common Name	Scientific Name	Population Trend [1]
Black-throated green warbler	*Setophaga virens*	Increasing
Chipping sparrow	*Spizella passerina*	Declining
Lincoln's sparrow	*Melospiza lincolnii*	Declining
Song sparrow	*Melospiza melodia*	Declining
Swamp sparrow	*Melospiza georgiana*	Increasing
White-throated sparrow	*Zonotrichia leucophrys*	Declining
Eastern towhee	*Pipilo erythrophthalmus*	Declining
Evening grosbeak	*Coccothraustes vespertinus*	Declining
Pine siskin	*Carduelis pinus*	Declining
White-winged crossbill	*Loxia leucoptera*	Change not significant

[1] Population trends as reported in Sauer *et al.* (2012), species with a not significant rank are those whose populations changes have a P>0.05.
Source: Golder (2013).

The Ontario Landbird Conservation Plan for Region 12 (Boreal Hardwood Transition Region) was used to identify bird species of conservation priority within the regional study area (Ontario Partners in Flight (PIF), 2008). Under the Ontario Landbird Conservation Plan (PIF, 2008) species are classified by geographic scale as continentally and/or regionally important. A total of 18 upland breeding bird species observed in the regional study area were assigned conservation priority in Region 12. Canada warbler and bay-breasted warbler are classified as a species of both continental and regional concern in the bird conservation region. Northern flicker is classified as only of region concern in the conservation region. Nashville warbler, white-throated sparrow, and swamp sparrow are classified as continental species of stewardship responsibility. Blackburnian warbler, black-throated green warbler, chestnut-sided warbler, mourning warbler, and yellow-bellied sapsucker are continental and regional species of stewardship responsibility. Black-throated blue warbler, common yellowthroat, least flycatcher, ruffed grouse, sedge wren (*Cistothorus platensis*), and veery are regional species of stewardship responsibility.

Relative abundance of bird species (birds per hectare) was calculated for each land cover type (see Table 6-19). Jack pine regeneration/cut land cover had the highest relative abundance, while deciduous forest land cover had the highest species richness. No significant difference in relative abundance between the land cover types was found.

Table 6-19: Relative Abundance and Observed Species Richness of Upland Breeding Birds among Habitats (2013)

Land Cover Type	Number of Plots	Relative Abundance [1]		Species Richness [2]	
		Mean ± 1SE	Min - Max	Mean ± 1SE	Min - Max
Dense Coniferous Forest	25	3.58 ± 0.19	0.69 – 4.82	4.36 ± 0.27	1 – 6

Land Cover Type	Number of Plots	Relative Abundance [1]		Species Richness [2]	
		Mean ± 1SE	Min - Max	Mean ± 1SE	Min - Max
Jack Pine Regeneration/Cut	14	3.98 ± 0.43	1.38 – 6.19	4.57 ± 0.48	2 – 8
Deciduous Forest	6	3.67 ± 0.88	1.38 – 6.19	4.83 ± 1.08	2 – 9
Dense Mixed Forest	36	3.36 ± 0.25	0.69 – 6.19	4.42 ± 0.31	1 – 8
Sparse Forest	7	3.05 ± 0.83	0.69 – 6.19	3.43 ± 0.90	1 – 7
Wetland	10	2.13 ± 0.26	0.69 – 3.44	2.70 ± 0.30	1 – 4

[1] Abundance = the number of birds per ha
[2] Richness = the number of bird species identified
SE = standard error; Min = minimum; Max = maximum
Source: Golder (2013).

Northern flicker (*Colaptes auratis*), evening grosbeak (*Coccothraustes vespertinus*) and chipping sparrow (*Spizella passerine*) were only observed in dense coniferous land cover, while yellow-bellied sapsucker (*Sphyrapicus varius*) was only observed in jack pine regeneration/cut land cover. Eastern towhee (*Pipilo erythrophthalmis*), pileated woodpecker (*Dryocopus pileatus*), hairy woodpecker (*Picoides villosus*), Lincoln's sparrow (*Melospiza lincolnii*), song sparrow (*Melospiza melodia*), gray jay (*Perisoreus Canadiensis*), ruffed grouse (*Bonasa umbellus*) and ruby-throated hummingbird (*Archilochus colubris*) were only observed in dense forest mixed land cover. American three-toed woodpecker (*Picoides dorsalis*), marsh wren (*Cistothorus palustris*), swamp sparrow (*Melospiza georgiana*) and white-winged crossbill (*Loxia leucoptera*) were only observed in wetland land cover.

Nashville warbler (*Oreothlypis ruficapilla*) was the most abundant species observed in dense coniferous forest, dense mixed forest, jack pine regeneration/cuts, sparse forest, and wetland land cover types. Red-eyed vireo (*Vireo olivaceus*) was the most abundant species observed in deciduous forest land cover. Yellow-rumped warbler (*Dendroica coronate*), Nashville warbler, common yellowthroat (*Geothlypis trichas*), red-eyed vireo and ruby-crowned kinglet (*Regulus calendula*) were the only species observed in all land cover types.

Woodland habitat breeding species (e.g., red-eyed vireo and black-throated green warbler) were the most abundant species observed during the upland breeding bird surveys within the regional study area, and accounted for 75% of the upland breeding bird species observed. Shrubland breeding birds (e.g., white-throated sparrow) accounted for 17% of the species observed, while wetland (e.g., marsh wren) and urban (e.g., American robin and blue jay; *Cyanocitta cristata*) breeding birds each accounted for 4% of the species recorded in the regional study area. Most upland breeding birds observed within the regional study area are insectivorous (i.e., they eat insects), although they will also occasionally eat seeds, fruit, and other arthropods (Birds of North America Online, 2013). Some exceptions to this are American crow, which is omnivorous (i.e., eat a variety of foods), and cedar waxwing, which is primarily fructivorous (i.e., eats fruit).

SAR species recorded during breeding bird point count surveys are further discussed under Species at Risk.

During the winter track count surveys in the local study area, grouse species tracks were recorded. Individual species cannot be determined from the tracks, but likely are those of three grouse species typically found in the region – the sharp-tailed grouse (*Tympanuchus phasianellus*), ruffed grouse (*Bonasa umbellus*) and spruce grouse (*Falcipennis canadienses*). There are no known listed species of grouse with the potential to inhabit the regional study area. The highest average track densities for grouse were detected in dense deciduous forests and forest depletion-cuts.

Marsh Birds

No focal marsh bird species were observed during any of the marsh surveys during 2012 or 2013.

Waterbirds

Waterbirds are considered to be common and relatively abundant in the area. A total of 10 waterbird species were observed during field surveys. Bufflehead (*Bucephala albeola*) and common merganser (*Mergus merganser*) were only observed in lake habitat. Blue-winged teal (*Anas discors*) and wood duck (*Aix sponsa*) were only observed in river habitat. American black duck (*Anas rubripes*) was observed in both lake and river habitat, but mostly along river habitat. Common goldeneye (*Bucephala clangula*) was the most abundant species observed in lake habitat, while American black duck (*Anas rubripes*) was the most abundant species in river habitat.

During a second round of surveys, ring-necked duck (*Aythya collaris*), hooded merganser (*Lophodytes cucullatus*) and common loon (*Gavia immer*) were observed in lake habitat. Ring-necked ducks were the most observed species and the only species recorded with a brood (nine young). Canada goose (*Branta Canadiensis*), mallard (*Anas platyrhynchos*), common loon and ring-necked duck were observed incidentally in the local study area during surveys.

Whip-poor-wills and Common Nighthawks

During the surveys, whip-poor-wills were heard calling from only one location within the regional study area, and none within the local study area. Whip-poor-will territories were delineated where simultaneous whip-poor-will calls were noted in the regional study area. Based on remote imagery interpretation, the whip-poor-will territories appear to be in a cut area surrounded by dense coniferous forest habitat, suggesting that habitat use by whip-poor-wills in the regional study area is consistent with the habitat requirements documented in the literature (MNR, 2009b).

Common nighthawks were heard calling at one location within the local study area and three locations within the regional study area. Common nighthawks were observed in jack pine regeneration/cut areas and open bog land cover types which are consistent with the habitat requirements documented by the MNR (2009a). Common nighthawks are listed as Special Concern provincially (Ontario ESA, 2007), and Threatened federally (COSEWIC, 2012).

Owls

Five species of owls were observed in the regional study area and two species in the local study area. Northern saw-whet owl (*Aegolius acadicus*) and great horned owl (*Bubo virginianus*) were the only species of owl observed in the local study area. These two species, as well as long-eared owl (*Asio otus*), northern hawk owl (*Surnia ulula*) and an unidentified owl species were recorded in the regional study area.

All of the observed owl species are considered provincially secure species (S4 ranking; NHIC, 2013).

Reptiles and Amphibians

Turtles

Reptile surveys for basking turtle species resulted in no recordings of Blanding's turtles (*Emydoidea balndingii*) within the local study area. Painted turtles (*Chrysemys picta marginata*) were observed along Bagsverd Creek and Unnamed Lake #2, as well as at Clam Lake. The habitat in these three lakes was considered to have low potential to support Blanding's turtle, due to the presence of dense shrub vegetation along the banks and limited basking locations.

Biologists recorded incidental wildlife observations while completing other terrestrial biological surveys and searched possible turtle nesting locations that were encountered. Egg shells of an unknown turtle species were observed in the regional study area. Minnow biologists also recorded observations of basking turtles, and turtles were captured in sampling equipment while conducting aquatic surveys (Section 6.4.8). Incidental observations of turtles recorded by Minnow augmented the basking turtle survey observations with five painted turtles being captured in hoop nets set in Unnamed Lake #2.

Amphibians

In total, four species of amphibians were heard calling during the amphibian surveys in the local study area and two species were heard calling within the regional study area. American toad (*Bufo Americanus*) and bullfrog (*Rana catesbeiana*) were observed only in the local study area. Other species included the gray treefrog (*Hyla versicolor*) and the spring peeper (*Pseudacris crucifer*).

Amphibian species identified during the surveys are classified as secure provincially and federally. Based on available range maps (Royal Ontario Museum, 2013) there are no amphibians in Chester Township that are considered at risk. As a result, any amphibians occurring within the regional study area are expected to be common and widespread species across northern Ontario.

Mammals

Winter Track Counts

Lynx (*Lynx sp*.) are listed as secure in Ontario (SARO, 2013) and not at risk federally (SARA, 2013). Tracks were observed during the winter track count surveys, and the highest average track density for lynx was in the regional study area dense mixed forest. Lynx generally occur only where there are sufficient numbers of snowshoe hares (their primary prey species), and home range sizes vary with the abundance of prey and the season (Dobbyn, 1994).

Snowshoe hares (*Lepus americanus*) are considered federally and provincially secure (SARA and SARO, 2013). Snowshoe hare tracks were the most numerous tracks recorded during the winter track surveys in the regional study area. Tracks were recorded in all habitat types, except wetlands, and were highest in dense mixed forest (which correlates with the track density recorded for lynx).

Marten (*Martes Americana*) are an economically important species, historically trapped for fur in North America. They are listed as secure in Ontario (SARO, 2013) and not at risk federally (SARA, 2013). Fisher (*Martes pennant*) is considered widespread in Canada and the central United States. Marten and fisher tracks were combined for the winter track count analysis as there is overlap between female fisher and male marten tracks. Marten and fisher tracks were only observed in dense coniferous and dense mixed forest, and were highest in dense mixed forest.

Two weasel species have the potential to occur in the regional study area, namely the short-tailed weasel (*Mustela ermine*, also known as ermine or stoat) and least weasel (*Mustela nivalis*). Both are considered federally and provincially secure (SARA and SARO, 2013).Short-tailed weasel distribution overlaps with that of least weasels, though dietary preferences divide the species into different niches. Least weasels are the smallest members of the order Carnivora in North America (Sheffield and King, 1994). Weasel tracks were combined for the winter track count analyses as it is difficult to differentiate tracks between the two species. Track densities were highest in dense mixed forest.

American red squirrels (*Tamiasciurus hudsonicus*) are not listed federally or provincially (SARA and COSEWIC, 2012; SARO, 2013). Tracks for squirrels were found in all habitat types except for sparse forest and forest depletion/cut habitats. Track density was highest in dense mixed forest.

Other small mammals that may be present in the regional study area include deer mouse (*Peromyscus maniculatus*), woodland jumping mouse (*Napaeozapus insignis*), meadow jumping mouse (*Zapus hudsonius*), meadow vole (*Microtus pennsylvanicus*), rock vole (*Microtus chrotorrhinus*), southern red-backed vole (*Clethrionomys gapperi*) and southern bog lemming (*Synaptomys cooperi*) (Burt and Grossenheider, 1976). There are no known sensitive small mammal species that have ranges that overlap with the regional study area. Since small mammal tracks are difficult to differentiate among species, all small mammal tracks were combined for winter track count analyses. Small mammal tracks were only recorded in dense coniferous forest, dense mixed forest, jack pine regeneration/cut and wetlands. Track density was highest in dense coniferous forest.

Bats

Five bat species and one unidentified bat species were recorded during acoustic surveys. Little brown myotis (*Myotis lucifugus*) was recorded at five of the six stationary acoustic stations. Northern long-eared myotis (*Myotis septentrionalis*) was not recorded in the regional or local study areas. Other recorded bat species include the hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), big brown bat (*Eptesicus fuscus*) and red bat (*Lasiurus borealis*).

A desktop study was conducted to identify areas with the potential to support bat maternity roosts and hibernacula. Six were identified as suitable to support maternity roosts and 119 locations as potentially suitable for bat hibernacula. Visual surveys conducted to verify potential hibernacula locations resulted in no bats being observed entering or exiting the identified features. Stationary acoustic detectors at the identified features recorded between one and eight total bat passes per night. Neither the visual surveys nor the stationary acoustic surveys provided evidence that there is an increase in cave bat activity at the identified features during August and early September, when an increase in activity of cave hibernating bats is expected to occur.

Species at Risk (SAR) - Wildlife

A background review of publically available information indicates that there is potential for 23 sensitive species to occur in the region containing the Project. Of these, 18 species are considered at risk provincially (10 are designated Special Concern, five are Threatened, and two are considered Endangered (ESA, 2007). One species (rusty blackbird (*Euphagus carolinus*)) was designated Special Concern under federal legislation (SARA, 2013). One species (tri-coloured bat (*Pipistellus subflavus*)), while not at risk currently, has been designated by COSEWIC as Endangered and one additional species (barn swallow (*Hirundo rustica*)) has been designated by COSEWIC as Threatened (COSEWIC, 2013).

SAR - Birds

Two Threatened (SARA, 2013) upland breeding bird species were observed in the regional study area during upland breeding bird surveys: olive-sided flycatcher and Canada warbler.

Olive-sided flycatchers prefer to nest on the edge of natural openings (e.g., rivers, muskegs, bogs, swamps) in open to semi-open mature forest stands in the boreal forest (COSEWIC, 2007). A large proportion of their breeding range is in Canada (54%) and they have suffered a 29% decline in population size in North America and Canada from 1996 to 2006 (COSEWIC, 2007).

Canada warblers are a forest nesting bird that uses many different breeding habitats (e.g., deciduous, coniferous, mixed, riparian shrub, and old growth forest), which often have a well-developed shrub understory (COSEWIC, 2008). They breed in all provinces except Nunavut, Newfoundland, and Labrador, and approximately 80% of their breeding range is in Canada (COSEWIC, 2008).

SAR - Reptiles and Amphibians

Based on the available range maps (NHIC, 2013; Royal Ontario Museum, 2012), one sensitive amphibian and two sensitive reptiles have potential to occur in the regional study area. The Project site is located at the northern extent of Blanding's turtle (*Emydoidea blandingii*) and snapping turtle (*Chelydra serpentine*) ranges and their presence is expected to be uncommon. Blanding's turtles are considered Threatened, both provincially and federally, while snapping turtles are considered Special Concern provincially and federally. No turtle SAR were detected within the study areas during field surveys.

Based on available range maps (Royal Ontario Museum, 2012) there are no amphibians in Chester Township that are considered at risk. No provincially or federally listed amphibian species were identified within the study areas during field surveys. Amphibian species identified during the surveys are classified as secure provincially and federally.

SAR - Mammals

Eastern wolf (*Canis lupus lycaon*) has been designated as a species of Special Concern provincially and eastern cougar (*Puma concolor*) is designated as Endangered on the Species at Risk in Ontario list. Despite many sightings of eastern cougar in the past two decades from eastern Canada, there are insufficient data to evaluate the taxonomy or assign a status to this cougar, according to COSEWIC (2013), and no specimens exist to substantiate its occurrence in the province (NHIC, 2013). For these reasons, it is unlikely that cougar occur in the Project site area. These large mammal SAR species were not identified during field surveys within the study areas.

Tri-coloured bat (*Pipistrellus subflavus*), little brown myotis bat (*Myotis lucifugus*), and northern long-eared bat (*Myotis septentrionalis*) are listed by COSEWIC as Endangered. In Ontario small-footed bat (*Myotis leibii*) is designated a species of conservation concern, and little brown myotis bat and northern long-eared bat are designated as Endangered species on the SAR in Ontario list.

Little brown myotis were recorded in the regional and local study area (discussed under Mammals). No other SAR bat species were identified in the study area during surveys.

6.4.3.3 Summary

This report provides preliminary baseline data to describe the vegetation, habitat and wildlife within the regional and local study areas around the Project site. Based on the results of the records review and field surveys, the following points can be highlighted:

A total of 121 plant species were identified within the local study area, with no rare or SAR species reported.

Breeding bird surveys identified a total of 79 species, and two unidentified species. Focal marsh bird species were not observed during marsh bird surveys. Waterbird surveys observed 10 species during the first round, and five during the second round. Whip-poor-wills were heard calling at one survey location within the regional study area and may occur in the regional study area. Two owl species were heard in the local study area during surveys. In the regional study area, these same two owl species as well as two other owl species and an unidentified owl species were heard calling. Grouse tracks were observed during track count surveys. Grouse showed equal preference between the dense deciduous forest and forest depletion – cuts, with approximately equal total grouse track density occurring in each land cover type.

Reptile and amphibian surveys observed painted turtles at one location along Bagsverd Creek, Unnamed Lake #1 and Clam Lake. No Blanding's turtles were observed. Three amphibian species were heard calling during surveys in the local study area, and four within the regional study area. Amphibian species identified are all considered provincially and federally secure.

The highest total track densities occurred in dense mixed forest for lynx, American marten and fisher, snowshoe hare, weasel, and red squirrel. The highest total track density for small mammal species occurred in dense coniferous forest. American marten and fisher were only observed in dense coniferous and dense mixed forests.

Five species of bat and one unknown species were recorded at the stationary monitoring stations during bat acoustic surveys. Little brown myotis bats were recorded at five of the six stations. Northern long-eared myotis bats were not recorded. Silver-haired bat was the most commonly recorded species. Surveys along transects recorded only silver-haired and hoary bats. Activity of little brown myotis bats was low during August and early September. Swarming activity was not observed during any of the visual surveys, as evidenced by the acoustic survey results.

Desktop research for SAR indicated that there is potential for 18 provincially listed wildlife species, one federally listed wildlife species, and two provincially tracked wildlife species to occur in regional study area and surroundings. Seven of these species were documented in the regional study area. Four species listed as Special Concern (bald eagle, Canada warbler,

common nighthawk, and olive-sided flycatcher), one species listed as Threatened (whip-poor-will), and one species listed as Endangered (little brown myotis bat) under the Ontario ESA were observed during the field surveys. In addition, one species listed as Special Concern (rusty black bird) under SARA was observed during the field surveys.

6.4.4 Transmission Line Alignment Aerial Reconnaissance

Terrestrial biology baseline studies for the regional and local study area sections along the proposed transmission line alignment alternatives (TLAs) followed similar methodologies as for the site terrestrial biology baseline studies and considered the same databases and information sources.

The terrestrial biology baseline study for the TLAs is presented in the Transmission Line Terrestrial Biology TSD (see Appendix M). For several of the studies, aerial reconnaissance surveys were conducted.

Aerial surveys to locate raptor nests were undertaken by AMEC in April 17 and 18, 2013, over the local study area bordering the TLA alternatives. As per the MNRF guidelines, nests occupied by adults incubating eggs or those with unattended eggs were identified as “active”, and all others as “inactive at the time of survey”. Incidental sightings of other wildlife, tracks or dens were documented and recorded with a GPS unit.

An aerial survey to locate mammals and their dens or tracks, and to select survey locations for other surveys, was undertaken by AMEC in winter on February 27, 28 and March 1, 2013, and a spring survey on April 16 and 17, 2013. Sightings of birds and or nests or other wildlife related sightings were documented recorded with a GPS unit.

Survey routes were flown approximately 30 m to 45 m above-ground at approximately 70 km/h to 80 km/h. The surveys included five north-south 50 km long transect lines, spaced at 500 m intervals, common to both TLA alternatives. Five additional transect lines for each TLA alternative were also flown, each approximately 72 km in length. Two observers carried out the survey – one in the front seat (main observer) and the second in the back seat (observer/recorder), or with both observers in the back seats on either side of the helicopter. Weather conditions, including temperature, cloud cover and visibility were recorded on the days of the survey.

6.4.5 Terrestrial Biology – TLA Vegetation

The vegetation baseline study focused along the Project’s TLA alternatives is used to describe the different plant species in the study areas and their habitat, and to identify species at risk, for the assessment of potential effects.

The vegetation baseline study along the regional and local study area sections of the TLAs is presented in the baseline appended to the Transmission Line Terrestrial Biology TSD (see Appendix M).

6.4.5.1 Methodology

Forest Resource Inventory (FRI) mapping for vegetation communities within the regional study area (MNR, 2010b) was obtained from the MNRF prior to undertaking field surveys. Vegetation surveys were conducted on May 31, June 1 and from June 6 to June 15, 2013, and focused on stratifying efforts between community types by traversing between a series of scattered waypoints. Approximately 170 plant community polygons were visited. During the vegetation surveys, the study team recorded any signs of wildlife or wildlife activity encountered (see Appendix M for further details on survey locations and polygons).

Forest habitat types in Ecoregion 3E have typically been described using the Field Guide to Forest Ecosystems of Northeastern Ontario (Taylor *et al.*, 2000) commonly referred to as the Forest Ecosystem Classification of Northeastern Ontario (FEC). However, the FEC mainly classifies mature, undisturbed forests whereas the Boreal ELC classifies forests as well as other vegetation types such as wetlands (non-forested), cliffs, rock barrens and communities created by human disturbance (cultural areas). An FEC ecosite code was assigned to each forested polygon identified through FRI mapping.

Ecosite determination depends partially on vegetation communities and the classification of soils based on the Ontario Institute of Pedology's Field Manual for Describing Soils in Ontario (OIP, 1993). Soil classifications were not undertaken as a component of the vegetation community analysis in the study area sections along the TLAs; however, through vegetation species composition, an understanding of the soil composition in the area (Ecoregion 3E; Crins *et al.*, 2009) and as determined by a review of soils mapping, probable FEC ecosites can be extrapolated given the range of soil parameters within ecosites.

A plant species inventory was taken for each ecosite code and the community was documented with photographs in the baseline study (see Appendix M). Ecosite codes were later translated to Boreal ELC codes (B-codes) using guides created by the MNRF (Lalonde *et al.*, 2012; Pokharel *et al.*, 2012) and soil information obtained through the MNRF LIO map database (MNR, 2013b).

Wetlands are often described using the Ontario Wetland Evaluation System (OWES) for northern Ontario as well as the Boreal ELC. Wetlands are classified to the ecosite level as fen, bog, swamp, marsh and shallow water (although often combined with marsh-type) and are characterized by dominant vegetation form.

Wetlands were identified through a combination of FRI and LIO mapping. Forested polygons which were assigned a B-code indicative of a swamp community (through the FRI – ecosite determination methodology described above) were considered to be wetlands and given an appropriate OWES code. For those vegetation polygons which were considered to be wetlands,

as determined using the LIO wetland unit vector polygon layer, a multi-spectral image classification remote sensing technique was employed to determine wetland type.

6.4.5.2 Results and Discussion

The regional and local study areas are located in the northeastern region of Ontario in Ecoregion 3E (Lake Abitibi Ecoregion). The vegetation in this ecoregion is boreal, with Black Spruce (*Picea mariana*), White Spruce (*Picea glauca*), Balsam Fir (*Abies balsamea*), Jack Pine (*Pinus banksiana*), Tamarack (*Larix laricina*), White Birch (*Betula papyrifera*), Trembling Aspen (*Populus tremuloides*) and Balsam Poplar (*Populus balsamifera*) constituting the main forest species. Species characteristic of the more southerly Great Lakes–St. Lawrence Forest Region, such as Eastern White Pine (*Pinus strobus*) and Red Pine (*Pinus resinosa*), grow on sandy ridges and other warmer-than-normal sites, and now tend to be found only in small, isolated pockets (Crins *et al.*, 2009).

There is a history of forestry and fire in the general area and this is reflected in the vegetation structure. Wetlands are characteristically bowl bogs that are treed and surrounded by peat margin swamps.

Results from the desktop study provided an ecological context to natural features observed within the study areas, and also guided field investigations.

Land Cover and Plant Community Surveys

The regional and local study areas are comprised of 33 distinct plant communities (upland and wetland) as summarized in Table 6-20. Upland deciduous/mixedwood forest, upland coniferous forest and wetland coniferous swamp communities co-dominate the regional study area. Land cover and ecosite figures, photographic records of the ecosites/vegetation communities, the compiled plant species list and associated ranks and protective status are provided in the baseline study (see Appendix M). A total of 152 plant species were identified during field surveys in the local study area sections along the TLAs. Of these, 97% are native to Ontario.

Table 6-20: Ecosites and Plant Communities Occurring in the Regional and Local Study Areas Sections along the Transmission Line Alignment Alternatives

Vegetation Community [1]	Area (ha)	Percent Cover
Upland Communities		
Upland Deciduous/Mixedwood Forest		
B055/ES3 (Dry to Fresh, Coarse: Aspen - Birch Hardwood / White Birch – Trembling Aspen – Black Spruce – Coarse Soil)	11,885	16.1
B104/ES7m (Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood / Trembling Aspen – White Birch – Medium Soil)	6,284	8.5
B104/ES6m (Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood / Trembling Aspen – Black Spruce – Balsam Fir – Medium Soil)	2,666	3.6

Vegetation Community [1]	Area (ha)	Percent Cover
B055/ES7c (Dry to Fresh, Coarse: Aspen - Birch Hardwood / Trembling Aspen – White Birch – Coarse Soil)	2,366	3.2
B040/ES6c (Dry, Sandy: Aspen – Birch Hardwood / Trembling Aspen – Black Spruce – Jack Pine – Coarse Soil)	892	1.2
B104/ES16 (Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood / Yellow Birch)	523	0.7
B058/ES15 (Dry to Fresh, Coarse: Maple Hardwood / Red Maple)	190	0.3
B088/ES7f (Fresh, Clayey: Aspen - Birch Hardwood / Trembling Aspen – White Spruce – White Birch – Fine Soil)	103	0.1
B039/ES19 (Dry, Sandy: Red Pine – White Pine Mixedwood / White Pine – Red Pine – Mixedwood)	24	0.03
Total Upland Deciduous/Mixedwood Forest	**24,935**	**33.8**
Upland Coniferous Forest		
B083/ES6f (Fresh, Clayey: Black Spruce - Pine Conifer / Black Spruce – Trembling Aspen – Fine Soil)	7,022	9.5
B034/ES2 (Dry, Sandy: Jack Pine – Black Spruce Dominated / Jack Pine – Coarse Soil)	6,355	8.6
B049/ES4 (Dry to Fresh, Coarse: Jack Pine - Black Spruce Dominated / Black Spruce – Jack Pine – Coarse Soil)	3,147	4.3
B082/ES5f (Fresh, Clayey: Black Spruce - Jack Pine Dominated / Black Spruce – Fine Soil)	1,632	2.2
B114/ES5m (Moist, Fine: Black Spruce - Pine Conifer / Black Spruce – Medium Soil)	488	0.7
B050/ES3 (Dry to Fresh, Coarse: Pine - Black Spruce Conifer / White Birch – Trembling Aspen – Black Spruce – Coarse Soil)	446	0.6
B014/ES1r (Very Shallow, Dry to Fresh: Conifer / White Spruce – White Birch – Very Shallow Soil – Species Rich)	99	0.1
Total Upland Coniferous Forest	**19,187**	**26.0**
Anthropologically-Disturbed Upland Communities		
B044 (Dry to Fresh, Coarse: Field)	20	0.03
B045 (Dry to Fresh, Coarse: Meadow)	28	0.04
Anthropogenic Ecosite	1,361	1.8
Total of all Upland Communities	**42,124**	**57.4**
Wetland Communities		
Wetland Deciduous Swamp		
B130/ES10/dS (Intolerant Hardwood Swamp / Trembling Aspen – Black Spruce – Balsam Poplar – Moist Soil / deciduous Swamp)	156	0.2
Wetland Coniferous Swamp		
B127/ES11/cS (Organic Poor Conifer Swamp / Black Spruce – Labrador-tea – Organic Soil / coniferous Swamp)	3,776	5.1
B224/ES9r/cS (Mineral Rich Conifer Swamp / White Spruce – Balsam Fir – White Cedar – Moist Soil – Species Rich / coniferous Swamp)	3,078	4.2

Vegetation Community [1]	Area (ha)	Percent Cover
B222/ES8/cS (Black Spruce – Feathermoss – Sphagnum – Moist Soil / Mineral Poor Conifer Swamp / coniferous Swamp)	2,822	3.8
B223/ES9p/cS (Mineral Intermediate Conifer Swamp / Black Spruce – Larch – Moist Soil – Species Poor / coniferous Swamp)	1,447	2.0
B129/ES13p/cS (Organic Rich Conifer Swamp / Black Spruce – Larch – Speckled Alder – Organic Soil – Species Poor / coniferous Swamp)	2,193	3.0
B129/ES13r/cS (Organic Rich Conifer Swamp / White Cedar – Black Spruce – Organic Soil – Species Rich / coniferous Swamp)	1,290	1.7
B128/ES12/cS (Organic Intermediate Conifer Swamp / Black Spruce – Larch – Labrador-tea – Organic Soil / coniferous Swamp)	797	1.1
B137/ES14/cS (Black Spruce – Leatherleaf – Organic Soil / Sparse Treed Bog / coniferous Swamp)	403	0.5
Total Wetland Coniferous Swamp	**15,807**	**21.4**
Non-forested Wetland Communities		
B136/lsF (Sparse Treed Fen / low shrub-dominated Fen)	956	1.3
B139/B140/lsF (Poor Fen / Open Moderately Rich Fen / low shrub-dominated Fen)	403	0.5
B142/B144/neM (Mineral Meadow Marsh / Organic Meadow Marsh / narrow-leaved emergent vegetation-dominated Marsh)	1,080	1.5
B148/B149/reM (Mineral Shallow Marsh / Organic Shallow Marsh / robust-leaved emergent vegetation-dominated Marsh)	31	0.04
B134/B135/tsS (Mineral Thicket Swamp / Organic Thicket Swamp / tall shrub-dominated Swamp)	2,731	3.7
Total Non-forested Wetland Communities	**5,206**	**7.1**
Total of all Wetland Communities	**21,167**	**28.7**
Water	**6,972**	**9.5**
Total Regional Study Area	**—**	**100**

[1] Multiple classifications systems possible. Primarily based on community characteristics as described in the Ecosites of Ontario (ELCWG, 2009) and secondarily based on characteristics as described in the Field Guide to Forest Ecosystems of Northeastern Ontario (Taylor *et al.*, 2000).

Upland forested and non-forested communities comprise 66.9% of the regional study area (49,328 ha, ~493 km^2). According to the FRI and LIO, wetlands cover 28.7% (21,167 ha, ~212 km^2) of the regional study area and include fen, shallow marsh, meadow marsh, swamp thickets and treed deciduous and coniferous swamp. Water bodies cover 9.5% of the regional study area (6,972 ha, ~70 km^2). Detailed descriptions of each land cover and ecosite type are provided in the baseline study (see Appendix M).

Upland Deciduous/Mixedwood forests are those dominated by deciduous tree cover, but may contain coniferous trees. Upland Coniferous forests are those dominated by coniferous tree cover, but may contain deciduous trees.

The wetland deciduous swamp is dominated by Trembling Aspen with Black Spruce and Balsam Poplar. Wetland Coniferous swamps and non-forested wetland communities are

dominated by different tree or shrub (generally <1 m tall) species for each ecosite type. Swamp wetlands are wooded wetlands with greater than 25% cover of trees or shrubs. Treed swamps have greater than 25% tree cover and shrub swamps have greater than 25% shrub cover, but less than 25% tree cover. In swamps, standing to gently flowing waters occur seasonally or persist for long periods on the surface. Frequently there is an abundance of pools and channels indicating subsurface water flow. The substrate is usually continuously waterlogged. Waters are neutral to moderately acid in reaction and show little deficiency in oxygen or in mineral nutrients (MNR, 2013b). A fen is a wetland where the non-direct water source comes from streams or springs with dissolved minerals, such as calcium and magnesium as well as carbonates. As a result, fens can be alkaline to mildly acidic. While fens may be treed or treeless, tree cover cannot exceed 25%. A marsh is a wetland where tree and shrub cover are less than 25% and vegetation is dominated by emergent herbaceous species. Open water may or may not be present but water remains within the rooting zone of plants during at least part of the growing season. Waters are usually neutral to slightly alkaline and there is relatively high oxygen saturation.

The anthropologically disturbed upland communities include agricultural fields, grass-dominated meadows, roads and associated corridors, as well as residential areas, gravel pits and other areas that have been cleared of vegetation. These communities cover 1.8% of the regional study area (1,361 ha, ~14 km^2).

Species at Risk - Vegetation

A total of 152 plant species were identified during field surveys in the local study area sections along the TLAs. Of these, 97% are native to Ontario and none are listed provincially or federally as SAR. No provincially tracked plant species were observed during the 2012 or 2013 field surveys.

6.4.5.3 Summary

The vegetation baseline studies for the regional and local study area sections along the TLAs demonstrate that the vegetation communities are typical to Ecoregion 3E-5 and of the mixed boreal forest region of northern Ontario. A total of 152 plant species were identified during field surveys along the TLA local study area sections. The majority of the recorded plant species are native to Ontario and no provincially or federally listed or rare species were identified through field studies. Additionally, no restricted vegetation distribution habitats were identified through field studies in the study areas.

Upland forested and non-forested communities comprise 66.9% of the regional study area sections along the TLA alternatives. According to the FRI and LIO, wetlands cover 35% of the regional study area sections along the TLA alternatives, and include fen, shallow marsh, meadow marsh, swamp thickets and treed deciduous and coniferous swamp.

Upland deciduous/mixedwood forest, upland coniferous forest and wetland coniferous swamp communities co-dominate the regional study area overall. Upland communities and ecosites consisted of deciduous, mixed wood, coniferous and cultural habitats. Wetland communities and ecosites consisted of swamp, fen and marsh-type wetlands.

6.4.6 Terrestrial Biology – TLA Wildlife

Like the vegetation baseline, wildlife baseline studies are used to describe the different animal species in the study areas and their habitat, and to identify species at risk, for the assessment of potential effects.

Wildlife species and habitat types were evaluated by means of fieldwork and helicopter aerial surveys along select routes, transects and survey/sampling points within the study areas between 2012 and 2013. The wildlife baseline study is presented in the baseline report appended to the Transmission Line Terrestrial Biology TSD (see Appendix M).

6.4.6.1 Methodology

Bird Surveys

Raptor Surveys

As mentioned in Section 6.4.4, aerial surveys were conducted to identify raptor nests and incidental bird observations in 2012 and 2013. Further details on survey locations, figures and/or photographs are presented in the baseline study (see Appendix M).

Breeding Bird Point Count Surveys

Surveys along the proposed TLA sections of the regional and local study areas were conducted on May 29 to June 4 and June 8 to June 18, 2013, and totalled 182 point count stations in a range of habitats and plant communities.

Surveys were carried out in accordance with the protocols described for the Atlas of Breeding Birds of Ontario (Cadman *et al.*, 2007) and the Forest Bird Monitoring Program (Environment Canada, Canadian Wildlife Service), by two qualified biologists. Point count stations were at least 300 m from each other. Surveys were initiated before sunrise and continued for five hours after sunrise, dependant on weather conditions. Observers listened for 10 minutes, recording observations within 50 m, from 50 m to 100 m, and in flyovers.

Marsh Bird Surveys

Two marshes were surveyed along the TLA regional and local study area sections, comprised of suitable emergent plant communities which could provide potential habitat for marsh birds, on June 19 and 20, 2013. The surveys were carried out as per the Bird Studies Canada Marsh Bird

Survey Protocols (Bird Studies Canada, 2009, 2012a), to describe species occurrence and habitat use of bird species that nest in marsh habitat.

Focused marsh bird surveys were conducted between sunrise and 10:00 a.m. during suitable weather conditions. Stations were at least 250 m apart, with surveys lasting 15 minutes at each location with a semi-circular observation radius of 100 m. Calls were also broadcast to try and elicit calls from inconspicuous marsh bird species. Due to a limited sample size, data was used to provide a description of habitat use and presence/absence of species.

Owl and Crepuscular Bird Surveys

Surveys for owls and crepuscular birds (including whip-poor-wills and common nighthawk) along the regional and local study areas of the TLAs were conducted concurrently with amphibian surveys (described below), on May 28 to June 1, 2013 and June 7 to 22, 2013, to maximize the spatial extent of observations.

Surveys were initiated 30 minutes after sunset up to midnight, depending on weather conditions, and followed the protocol outlined in the Whip-poor-will Roadside Survey Participant's Guide (Bird Studies Canada, 2012b). Due to a limited sample size, data was used to provide a description of habitat use and presence/absence of species.

Reptile and Amphibian Surveys

Details of survey locations, figures and/or photographs are presented in the baseline study (see Appendix M).

Reptile Surveys

Reptiles (including turtles) were surveyed opportunistically in conjunction with other targeted surveys along the regional and local study area sections of the TLAs. Evidence of potential snake hibernacula sites and nesting, overwintering and basking sites for turtles was surveyed.

Targeted basking turtle surveys were conducted on June 19 and 20, 2013 at two marshes considered to contain suitable habitat for turtles (e.g., shallow water rich in nutrients, dense vegetation). Survey stations were at least 250 m apart. Due to a limited sample size, data was used to provide a description of habitat use and presence/absence of species.

Amphibian Surveys

Amphibian surveys along the regional and local study area sections of the TLAs were conducted opportunistically during crepuscular bird and owl surveys, as well as during other plant and wildlife surveys. Calling frogs were recorded and visual searches for frogs, salamanders and snakes, as well as suitable habitat, egg masses and larvae of amphibians, were conducted during breeding bird, marsh bird and plant community surveys.

Mammal Surveys

Further details on survey locations, as well as figures and/or photographs are presented in the baseline study (see Appendix M).

Winter Track Count Surveys

Aerial surveys were conducted to detect mammals and their tracks, dens, nests and other signs, as indicated in Section 6.4.4.1. Transect lines provided 100% coverage of habitat within a 1 km buffer on either side of the proposed and alternative transmission lines.

Weather conditions during the February, 2013, survey were fair to excellent with 10 km to unlimited visibility, calm to moderate winds and no precipitation to light snow. Tracks were readily detected on a base of snow 30 to 90 cm (1 to 3 ft) in depth. Weather conditions during the April, 2013, survey were fair to excellent with unlimited visibility. Winds ranged from calm to moderate with no precipitation to light rain. Due to fresh snow fall and warm temperatures the day before the April aerial surveys, only fresh mammal tracks (within the past 15 – 20 hours) could be identified in the remaining 40 cm (1.3 ft) snow base.

Incidental mammal observations made while conducting other targeted surveys were also recorded. Mammal species were detected by visual observation, tracks, scat, dens, nests, gnaw marks or vocalizations.

Bat Surveys

Three habitat types for bats are recognized by the MNRF: i) maternity colonies or maternity roosting habitat, ii) hibernacula and iii) migratory stopover areas (MNR, 2011b). During the spring and early summer, most Ontario bat species rely on forest habitat that supports a healthy density of large-diameter cavity trees. Females form maternity colonies in tree cavities that provide a warm, humid microclimate that optimizes gestation and postnatal growth of offspring (Kunz and Anthony, 1982).

Although bats are known to follow linear landscape features that offer suitable foraging and roosting habitat, there are currently no known criteria to reliably identify migratory stopover areas. Therefore, no attempt was made to identify migratory stopover areas within the study areas.

Surveys were conducted between May 28 and June 2, 2013, to determine whether the local study area contained suitable maternity roosting habitat for bats and special attention was given to the two species of Ontario bats listed as Endangered under the ESA (Little Brown Myotis and Northern Myotis bats). As the Bats and Bat Habitats: Guidelines for Wind Power Projects (MNR, 2011b) is currently the most comprehensive guideline for conducting bat surveys in Ontario, habitat survey methods were in accordance with this document.

Forest stands 80 years old or greater were identified within the Project area from desktop studies. Within identified old-age forest stands, circular plots with an area of 0.05 ha were surveyed for the presence of potential maternity roost trees. These included trees that had a large (≥ 25cm) diameter at breast height (dbh) and that exhibited one or more of the following features (in order of importance):

- contained habitable cavities originating from knots, woodpecker holes, cracks;
- had a large amount of loose peeling bark;
- were in an area where the canopy was relatively open; and
- were in an early stage of decay (decay class 1-3; Watt and Caceres, 1999).

A total of 144 plots were surveyed, ensuring adequate coverage and representation of all habitat types. The average number of potentially suitable roost trees per hectare was then calculated for each array and areas with potential roost tree densities equal to or greater than 10 trees per hectare were identified to be potential significant maternity roosting habitat for bats.

A number of rocky outcroppings and areas of exposed bedrock were identified in proximity to the Project area during aerial surveys. Additionally, a number of abandoned mine sites exist in proximity to the regional study area. Eleven pre-existing mine sites in close proximity to the Project site consisted of 7 vertical shafts, 1 adit and 3 mines for which there was no feature data available. These 11 sites were further investigated to assess their suitability as potential bat hibernacula. Shafts and adits have the potential to provide suitable hibernation conditions and comprise the bulk of all known mines used by bats. There was also insufficient information to excuse mines with no data from additional investigation. From August 29 to September 1, 2013, efforts were made to locate the 11 mines. Three of these could not be surveyed because two were on private property (AMIS 00093 and AMIS 00062) and one (AMIS 00283) could not be located despite an intensive search. Other sites were surveyed, in addition to the previously mentioned protocol, as per the USFWS (2013) document Bat Survey Protocol for Assessing Use of Potential Hibernacula. Measures were taken to prevent the potential spread of WNS following the National White-Nose Syndrome Decontamination Protocol (USFWS, 2012), and other preventative and safety measures were also employed.

Acoustic surveys were also carried out. Nocturnal bat activity was documented from sunset to sunrise for seven nights from May 29 to June 5, 2013, with six Songmeter SM2Bat+ (Wildlife Acoustics Inc.) ultrasonic recording devices deployed throughout the local study area. Detectors were positioned 3 m to 4 m above ground at locations where higher levels of bat activity were likely to occur, such as woodland and/or wetland edges, cluttered interior forests and clearings along open forest roads, in areas that targeted the two bat SAR species. Recordings were identified to species using Sonobat© 2.97 software.

During the acoustic bat surveys, an unusually high level of bat activity was recorded at a bat detector site along the Shining Tree TLA alternative, just south of where the TLA common to both alternatives splits at the edge of a linear wetland (location D1, see Appendix M). Four

potential explanations or hypotheses were proposed to explain this activity: 1) the survey detector is near a bat hibernaculum; 2) the detector is near significant maternity roosting habitat; 3) the detector is near a favourable foraging site; and 4) bats commute/migrate along the linear wetland. Additional surveys were therefore conducted in proximity to site D1 between August 30 and September 9, 2013.

To address hypotheses 1 and 2, a ground survey covering an approximate 100 m diameter from site D1 was conducted to identify any features of interest in the vicinity of D1 (such as potential hibernacula or roost trees) that could explain the high level of bat activity detected. Although no obvious bat hibernaculum was identified, a bat detector was deployed at this site to monitor acoustic bat activity for ten consecutive nights. Two other bat detectors were also deployed, one at the original D1 location and one 100 m downstream of D1 along the linear wetland. A comparison of bat activity among these three detectors assisted in addressing hypotheses 1, 3 and 4.

Species at Risk - Wildlife

A preliminary review of potential SAR present in the regional study area were identified through consultation with the MNRF, a review of the MNRF's NHIC and a review of bird, herptile and mammal, atlases for Ontario. The presence of these species protected under federal and provincial legislation was surveyed concurrently with survey methods presented in previous sections. Existing information was used to identify habitats with potential to support plant and wildlife species at risk. Based on a comparison of this information to the current Project site conditions, an assessment of the potential for occurrences of SAR was made.

SAR designations for species in Ontario are initially determined by COSSARO, and if approved by the MNRF, species are added to the provincial *Endangered Species Act* (ESA), which came into effect June 30, 2008 (ESA, 2007).

The legislation prohibits the killing or harming of species identified as 'endangered' or 'threatened' in the various schedules to the *Act*. The ESA provides habitat protection to those species listed as endangered under the former *Endangered Species Act* (listed in Schedule 1 of the current legislation) and recently listed species (under separate regulations). The ESA does not immediately provide general or species-specific habitat protection to endangered species and threatened species included in Schedules 3 and 4 of the ESA until regulations identifying species-specific habitat come into effect. However, all endangered and threatened species listed in the ESA are afforded protection of significant habitat under the Provincial Policy Statement (Ministry of Municipal Affairs and Housing, 2005). Sensitive species refer to those listed in the ESA, the SARA (Schedule 1), or those considered vulnerable or imperilled in the province (provincial ranking of S1-S3).

6.4.6.2 Results and Discussion

Bird Surveys

Data from the Atlas of Breeding Birds in Ontario (OBBA; Cadman *et al.*, 2007) and eBird.org describes 107 species as possible, probable or confirmed breeders in the vicinity of the regional study area sections along the TLAs (Audubon and Cornell Lab of Ornithology, 2013). However, due to the northern position of the regional study area, the avian diversity of the region may be under-reported in this database as surveys in this region are not as comprehensive.

Raptors

Fifteen stick nests were recorded in the local study area and extending into the regional study area sections along the TLAs (see Table 6-21). Eight of these nests were confirmed to be active. The location of active and inactive nests is shown in Figure 6-7.

An active bald eagle nest was observed near Côté Lake and the proposed open pit location – it was confirmed that this is the same nest identified by field surveys in the local study area around the Project site. Two inactive nests in good condition were detected at the southern end of the Cross-Country TLA and, for Project planning purposes, should be considered active (based on definitions provided by the MNRF).

Table 6-21: Stick Nests in the Local and Regional Study Areas along the Proposed Transmission Line Alignments (2013)

Common Name	Number of Stick Nests Observed		Total Nests	Total Active Nests
	Active	Inactive at time of survey		
Bald Eagle	1	0	1	1
Bald Eagle / Osprey	0	2	2	0
Common Raven	6	1	7	6
Sharp-shinned Hawk	1	0	1	1
Unidentified Hawk	0	4	4	0

Two other large stick nests were observed at the southern end of the Cross-Country TLA and likely belong to either Bald Eagle or Osprey. These two nests were inactive at the time of the survey but appeared in a good condition and were considered to be useable.

Five of the common raven nests were located on towers of the existing transmission line along the Shining Tree alignment. A Red-tailed Hawk nest was later recorded during crepuscular breeding bird surveys in proximity to the existing hydro corridor.

Other Birds

A total of 84 bird species were recorded within the local study area during standardized point counts surveys, 12 of which had not previously been identified in the local study area (see Table 6-22).

Although not identified during the breeding bird surveys, the presence of suitable habitat suggests 24 additional bird species identified in the records review are potentially breeding in the local study area. Of the 124 total species identified through the review of background information and field surveys, 117 total bird species are expected to be breeding or potentially breeding within the local study area. Eighty-seven of the 117 (74.4%) bird species are seasonal migrants, occurring in northern Ontario only during the summer breeding season.

Table 6-22: Breeding Bird Survey Results in the Local Study Area Sections along the Transmission Line Alignment Alternatives, 2013

Common Name	Number of Point Counts Observed	Percentage Occurrence (per 182 Stations)	Total Birds Observed [1]	Average Birds per Count [2]
Nashville Warbler	152	83.52	322	1.77
Magnolia Warbler	129	70.88	248	1.36
Ovenbird	127	69.78	315	1.73
Red-eyed Vireo	121	66.48	224	1.23
White-throated Sparrow	117	64.29	279	1.53
Yellow-rumped Warbler	108	59.34	187	1.03
Swainson's Thrush	102	56.04	141	0.77
Winter Wren	100	54.95	143	0.79
Ruby-crowned Kinglet	95	52.20	148	0.81
Hermit Thrush	88	48.35	134	0.74
Red-breasted Nuthatch	67	36.81	82	0.45
Yellow-bellied Sapsucker	64	35.16	84	0.46
Northern Parula	63	34.62	89	0.49
Black-throated Blue Warbler	58	31.87	84	0.46
Ruffed Grouse	56	30.77	62	0.34
Golden-crowned Kinglet	54	29.67	63	0.35
Black-capped Chickadee	53	29.12	61	0.34
Blue-headed Vireo	46	25.27	51	0.28
Yellow-bellied Flycatcher	45	24.73	66	0.36
Blackburnian Warbler	43	23.63	56	0.31
Common Raven	43	23.63	63	0.35
Black-throated Green Warbler	39	21.43	66	0.36
Blue Jay	38	20.88	46	0.25
Black-and-white Warbler	29	15.93	35	0.19
Downy Woodpecker	25	13.74	25	0.14
Mourning Warbler	23	12.64	27	0.15
American Crow	22	12.09	23	0.13
Least Flycatcher	22	12.09	34	0.19
Chestnut-sided Warbler	20	10.99	33	0.18
Brown Creeper	19	10.44	19	0.10

Common Name	Number of Point Counts Observed	Percentage Occurrence (per 182 Stations)	Total Birds Observed [1]	Average Birds per Count [2]
Veery	18	9.89	31	0.17
Common Yellowthroat	17	9.34	33	0.18
Alder Flycatcher	16	8.79	23	0.13
American Redstart	16	8.79	19	0.10
American Robin	16	8.79	21	0.12
Northern Flicker	15	8.24	16	0.09
Common Loon	14	7.69	15	0.08
Pileated Woodpecker	14	7.69	15	0.08
Bay-breasted Warbler	13	7.14	20	0.11
Canada Goose	10	5.49	67	0.37
Swamp Sparrow	10	5.49	18	0.10
Tennessee Warbler	10	5.49	15	0.08
Hairy Woodpecker	9	4.95	9	0.05
Purple Finch	9	4.95	11	0.06
Canada Warbler	8	4.40	9	0.05
Dark-eyed Junco	8	4.40	10	0.05
Broad-winged Hawk	7	3.85	7	0.04
Woodpecker sp	7	3.85	8	0.04
Boreal Chickadee	6	3.30	6	0.03
Gray Jay	6	3.30	8	0.04
Northern Waterthrush	6	3.30	8	0.04
Cape May Warbler	5	2.75	5	0.03
Cedar Waxwing	5	2.75	5	0.03
Evening Grosbeak	5	2.75	5	0.03
Palm Warbler	5	2.75	6	0.03
Rose-breasted Grosbeak	5	2.75	5	0.03
Belted Kingfisher	4	2.20	4	0.02
Chipping Sparrow	4	2.20	5	0.03
Lincoln's Sparrow	4	2.20	5	0.03
Philadelphia Vireo	4	2.20	4	0.02
American Bittern	3	1.65	3	0.02
Wilson's Snipe	3	1.65	3	0.02
Black-backed Woodpecker	2	1.10	2	0.01
Blackpoll Warbler	2	1.10	2	0.01
Common Grackle	2	1.10	5	0.03
Sandhill Crane	2	1.10	2	0.01
American Goldfinch	1	0.55	1	0.01
American Kestrel	1	0.55	1	0.01
Barred Owl	1	0.55	1	0.01
Bufflehead	1	0.55	3	0.02
Common Goldeneye	1	0.55	1	0.01
Hooded Merganser	1	0.55	2	0.01
Mallard	1	0.55	3	0.02
Olive-sided Flycatcher	1	0.55	1	0.01
Orange-crowned Warbler	1	0.55	1	0.01
Osprey	1	0.55	1	0.01
Pine Grosbeak	1	0.55	1	0.01
Red Crossbill	1	0.55	1	0.02

Common Name	Number of Point Counts Observed	Percentage Occurrence (per 182 Stations)	Total Birds Observed [1]	Average Birds per Count [2]
Ring-billed Gull	1	0.55	3	0.01
Ruby-throated Hummingbird	1	0.55	1	0.01
Scarlet Tanager	1	0.55	1	0.01
Spotted Sandpiper	1	0.55	1	0.01
Spruce Grouse	1	0.55	2	0.01
Wilson's Warbler	1	0.55	1	0.01
Yellow Warbler	1	0.55	1	0.01

[1] Calculated from the sum of the survey maximum number of birds detected at each point count station. Two surveys conducted per station.
[2] Calculated from sum of the maximum number of birds observed divided by the number of point count station (n=38).

The five most common birds include the Nashville warbler (*Oreothlypis ruficapilla*), ovenbird (*Seiurus aurocapilla*), white-throated sparrow (*Zonotrichia albicollis*), magnolia warbler (*Setophaga magnolia*) and red-eyed vireo (*Vireo olivaceus*). In general, species diversity was greater at study sites with more mature forest consisting of mixed canopy species composition and where habitat diversity was greater.

Owl and Crepuscular Birds

One common nighthawk was recorded during crepuscular bird surveys in the local study area along the TLAs, though no eastern whip-poor-wills were recorded. Other incidental crepuscular and nocturnal bird species recorded incidentally during crepuscular bird surveys included northern saw-whet owl (*Aegolius acadicus*), barred owl (*Strix varia*), American woodcock (*Scolopax minor*) and Wilson's snipe (*Gallinago delicata*). One great grey owl (*Strix nebulosa*) was recorded during the spring aerial survey. American woodcock and Wilson's snipe were uncommon in the local study area, possibly due to the high prevalence of forested land in the local study area.

Reptiles and Amphibians

Reptiles

One snapping turtle (*Chelydra serpentine*, considered as Special Concern under SARA and the Ontario ESA) was incidentally recorded along Highway 144 during field surveys in 2013, near La Motte Lake Provincial Park. This recording was outside of the regional and local study area sections, between the two proposed TLAs.

Additionally, the eastern garter snake (*Thamnophis sirtalis*, provincially secure species with a rank of S5; NHIC, 2013) was observed during field surveys in the local study area sections along both of the proposed TLAs.

Amphibians

Five amphibian species were identified in the review of the MNRF's Ontario Herpetofaunal Atlas (Oldham and Weller, 2000) as occurring within the vicinity of the regional study area. During field surveys, seven species of amphibians were documented including green frog (*Lithobates clamitans*), American toad (*Bufo Americanus*, or as per new taxonomy, *Anaxyrus americana*), northern leopard frog (*Lithobates pipiens*), spring peeper (*Pseudacris crucifer*), wood frog (*Lithobates sylvanica*), mink frog (*Lithobates septemtrionalis*) and four-toed salamander (*Hemidactylium scutatum*).

These species are generally associated with wetlands and vernal pools during the breeding season and aside from the green frog, are largely terrestrial outside the breeding season in the summer months. The most abundant amphibian detected was the spring peeper, which was ubiquitous throughout the regional study area and was recorded in great numbers along roadside ditches during crepuscular bird surveys. American toad was also recorded regularly during crepuscular bird surveys.

Mammals

Winter Track Counts

Based on the habitat ranges provided by the Atlas of the Mammals of Ontario (Dobbyn, 1994), 41 mammals have the potential to inhabit the vicinity of the regional study area. Species observed during surveys is listed in Table 6-23. Note that bats are discussed separately.

Table 6-23: Mammals Observed During Field Surveys along the Transmission Line Alignments

Common Name	Scientific Name	Observed on Site	Provincial S-Rank [1]	Provincial Designation (ESA) [2]	Federal Designation (SARA) [3]
Masked Shrew	*Sorex cinereus*	—	S5	—	—
Smoky Shrew	*Sorex fumeus*	—	S5	—	—
Pygmy Shrew	*Sorex hoyi*	—	S4	—	—
Water Shrew	*Sorex palustris*	—	S5	—	—
Northern Short-tailed Shrew	*Blarina brevicauda*	—	S5	—	—
Star-nosed Mole	*Condylura cristata*	—	S5	—	—
Little Brown Myotis Bat	*Myotis lucifugus*	X	S4	END	—
Northern Myotis Bat	*Myotis septentrionalis*	—	S3	END	—
Silver-haired Bat	*Lasionycteris noctivagans*	X	S4	—	—
Hoary Bat	*Lasiurus cinereus*	X	S4	—	—
Snowshoe Hare	*Lepus americanus*	X	S5	—	—
Eastern Red Bat	*Lasiurus borealis*	X	S4	—	—
Eastern Chipmunk	*Tamias striatus*	—	S5	—	—
Least Chipmunk	*Tamias minimus*	—	S5	—	—
Woodchuck	*Marmota monax*	—	S5	—	—

Common Name	Scientific Name	Observed on Site	Provincial S-Rank [1]	Provincial Designation (ESA) [2]	Federal Designation (SARA) [3]
Red Squirrel	*Tamiasciurus hudsonicus*	X	S5	—	—
Northern Flying Squirrel	*Glaucomys sabrinus*	—	S5	—	—
Beaver	*Castor canadensis*	X	S5	—	—
Deer Mouse	*Peromyscus maniculatus*	—	S5	—	—
Southern Red-backed Vole	*Clethrionomys gapperi*	—	S5	—	—
Heath Vole	*Phenacomus intermedius*	—	None	—	—
Rock Vole	*Microtus chrotorrhinus*	—	S4	—	—
Meadow Vole	*Microtus pennsylvanicus*	—	S5	—	—
Muskrat	*Ondatra zibethicus*	—	S5	—	—
Southern Bog Lemming	*Synaptomys cooperi*	—	S4	—	—
House Mouse	*Mus musculus*	—	SE	—	—
Meadow Jumping Mouse	*Zapus hudsonicus*	—	S5	—	—
Woodland Jumping Mouse	*Napaeozapus insignis*	—	S5	—	—
Porcupine	*Erethizon dorsatum*	X	S5	—	—
Coyote	*Canis latrans*	—	S5	—	—
Grey Wolf	*Canis lupus*	X	S4	NAR	NAR
Red Fox	*Vulpes vulpes*	X	S5	—	—
Black Bear	*Ursus americanus*	X	S5	NAR	NAR
Raccoon	*Procyon lotor*	—	S5	—	—
American Marten	*Martes americana*	X	S5	—	—
Fisher	*Martes pennanti*	—	S5	—	—
Short-tailed Weasel	*Mustela erminea*	—	S5	—	—
Long-tailed Weasel	*Mustela frenata*	—	S4	—	—
American Mink	*Mustela vison*	X	S5	—	—
Striped Skunk	*Mephitis mephitis*	X	S5	—	—
River Otter	*Lutra canadensis*	X	S5	—	—
Canada Lynx	*Lynx canadensis*	X	S5	NAR	—
Elk	*Cervus elaphus*	—	SNA	—	—
White-tailed Deer	*Odocoileus virginianus*	X	S5	—	—
Moose	*Alces alces*	X	S5	—	—

X = species observed in the regional and local study areas.
— = species not observed during surveys, but with the potential to occur in the general vicinity of the regional study area (Dobbyn, 1994).
END = Endangered
NAR = Not at Risk
[1] S-Rank - S3: Uncommon or vulnerable species; S4 - Apparently Secure Species; S5 – Secure Species.
[2] SARO - Species at Risk in Ontario (listed under *Endangered Species Act*).
[3] SARA - *Species at Risk Act, 2003* – Schedule 1: Full protection under SARA.

Evidence of moose was observed throughout the regional study area including 21 individual sightings during the winter aerial survey and one sighting during the spring aerial survey. In May and June, moose were commonly observed incidentally along Highway 144 and Highway 560

and as well as at various other roadsides. Winter moose sightings and tracks were typically associated with clearcuts and regenerating forests, particularly those dominated by poplar and abundant young saplings that provide a food source to moose. The majority (13) of winter moose sightings were observed along the Shining Tree TLA, eight were observed along the Cross-Country TLA and one was observed along the TLA section common to both proposed TLAs. Several small to very large clear-cut and young regeneration areas (post-clear-cut) were identified as potential moose habitat along both TLAs during the two aerial surveys.

Black bears were commonly observed at roadsides near the regional study area and at points along the existing Shining Tree TLA. During the spring aerial survey, a black bear was seen sitting next to the entrance to a winter den which was located in an open coniferous forest with young deciduous saplings. Nine clusters of bear "nests" were identified during aerial surveys and ranged from one to 15 "nests" per cluster. As the bear breaks the twigs and branches to reach these leaf buds, the twigs collect around the bear to form a loose "nest" structure where they are sitting. These "nests" are easily distinguished from raptor stick nests which have a tighter formation and are cup-shaped. These "nests" were most abundant along the Shining Tree TLA.

Wolf tracks were observed at low to medium (two to three sets of tracks) densities. During the winter aerial survey, all wolf tracks were restricted to the Shining Tree TLA, south of where it splits from the Cross-Country TLA. During spring surveys, tracks were equally distributed between both TLAs.

Bats

Bat species observed in the regional and local study area sections along the TLA and Project site are listed in Table 6-23. Species recorded included hoary bat, little brown myotis bat, silver-haired bat, eastern red bat. Bat species were detected primarily through the bat acoustic detection surveys.

No exposed bedrock containing suitable hibernacula features for bats was identified during ground surveys and karst geology is not present within the regional study area suggesting it is unlikely that natural bat hibernacula exist. Of the 11 mine sites suspected to contain features potentially suitable for bats, none qualified as candidate bat hibernacula.

Additionally, 16 potential maternity roost trees were identified during surveys. As expected, a large proportion (7 out of 14; 50%) consisted of Trembling Aspen or at least a poplar species (14 out of 16 trees were identifiable to species). The density of potential maternity roosting trees at each array of sampling plots ranged from 0 to 6.7 trees/hectare with an average of 2.2 ± 1.9 trees/hectare. MNR (2011b) specifies 10 trees/hectare as the minimum roost tree density threshold for identifying potentially significant bat maternity roosting habitat. As the sampled areas within the Project site had densities below this threshold and was extensively sampled, the Project area likely does not contain suitable maternity roosting habitat for bats, particularly for species of the genus *Myotis* and *Perimyotis*.

Acoustic surveys during spring and early summer (2013) confirmed the presence of the little brown myotis bats within the local study area sections along the TLAs. This species was only recorded at sites near wetlands. Hoary bat and silver-haired bat were also confirmed through acoustic surveys. Eastern red bat was confirmed through acoustic surveys only during the late summer/fall. As the eastern red bat is a migratory species, this detection period coincided with its expected arrival, as they tend to arrive or depart from sites later than other bat species (Barclay, 1984). Several bat calls could not be confidently identified to a single species, and five unconfirmed species could still be present within the local study area sections and Project site, though to a much lesser degree. These species include the eastern small-footed myotis bat, the northern myotis, the tricoloured bat and the big brown bat. Big brown bat calls are often not distinguished from silver-haired bat calls. Since no calls characteristic of the big brown bat were recorded, the majority of calls classified as silver-haired bat/big brown bat were likely produced by silver-haired bats.

As noted in the methodology, additional surveys were carried out to evaluate four hypotheses to explain the unusually high level of bat activity recorded at a bat detector site along the Shining Tree TLA alternative, just south of where the TLA common to both alternatives splits (D1, see results in Appendix M), at the edge of a linear wetland, during regular acoustic surveys. Bat activity at this location during summer bat surveys was at least 11.3 times greater than at any other survey site (1,498 passes/night). The activity level for the little brown myotis and other *Myotis* bat species at this location exceeded that recorded in other locations by approximately 50 to 100 times, and was consistent between the first two nights. Although 65% of the recordings at this location were from the silver-haired and silver-haired/big brown bat groups, 98% of passes from these groups occurred on just Night 1. The difference in activity patterns between the two species groups may have reflected differences in how each group used the site. Silver-Haired Bats are latitudinal migrants and therefore Night 1 may have represented a migration event for this species. In contrast, it can be surmised that high activity levels during spring / early summer were most likely due to a high abundance of insects at the time of survey.

Species at Risk (SAR) - Wildlife

A preliminary review of potential SAR present in the regional and local study area sections along the TLAs were identified through consultation with the MNRF, a review of the MNRF's NHIC (2013) and a review of bird, herptile and mammal atlases for Ontario. The presence of these species, protected under federal and provincial legislation was surveyed concurrently with survey methods presented in previous sections. Detected SAR for the local study area sections along the TLAs, including the Project site, are shown in Figure 6-8.

SAR - Birds

According to the OBBA, the following SAR (provincially designated as Threatened) could occur within the regional study area: chimney swift (*Chaetura pelagica*), barn swallow (*Hirundo rustica*) and eastern whip-poor-will (*Antrostomus vociferous*). The following species of Special Concern (provincially designated) could also occur within the regional study area: bald eagle (*Haliaeetus leucocephalus*), black tern (*Chlidonias niger*), Canada warbler (*Cardellina*

canadensis), common nighthawk (*Chordeiles minor*) and olive-sided flycatcher (*Contopus cooperi*). The rusty blackbird (*Euphagus carolinus*) is listed federally as Special Concern and may also occur within the vicinity of the regional study area. SAR listed in the NHIC (2013) for the regional study area includes bald eagle and black tern.

Five avian SAR were observed during the 2013 field surveys, including bald eagle, Canada warbler, common nighthawk, rusty blackbird and olive-sided flycatcher.

One active bald eagle nest was recorded during the spring aerial survey. This nest was located between Upper Three Duck Lake and Côté Lake near the southern end of the Cross-Country alignment. Suitable nesting habitat for bald eagles occurred along portions of the local study area where numerous tall red pines were present in proximity to lakes. Such habitats were present along the southern half of the Cross-Country alignment and sporadically along the Shining Tree alignment.

Ten Canada warblers were identified at 10 point count stations. The sightings were recorded in upland habitats adjacent to, or within 100 m of wetland habitats characteristic of Canada warbler nesting habitats. The presence of multiple singing male Canada warblers and suitable breeding habitat strongly suggests that this species is breeding within the local study area.

During breeding bird surveys, two olive-sided flycatchers were identified within the local study area. One of these observations occurred during breeding bird point count surveys and both observations were made at clearcuts, which matches the typical habitat preferred by this species (open areas containing tall trees or snags for perching).

No rusty blackbirds were identified within the local study area during breeding bird surveys, though one was recorded incidentally during other survey work. Based on vegetation surveys and observations made during breeding bird surveys, rusty blackbird breeding habitat is present in the many forested wetlands, swamps, bogs, muskeg and riparian areas within the local study area.

During crepuscular bird surveys, a single common nighthawk was identified in the local study area. Aerial surveys confirmed that little open habitat is present that may provide suitable common nighthawk nesting habitat. The existing Shining Tree TLA provides an open corridor that is regularly maintained to prevent excessive woody growth, and is used for recreational activities by local cottagers, making it unattractive habitat. As such, critical habitat for common nighthawks is considered highly limited within the local study area.

SAR - Reptiles and Amphibians

The Project site is located at the northern extent of Blanding's turtle (*Emydoidea blandingii*) and snapping turtle (*Chelydra serpentine*) ranges. Blanding's turtles are considered Threatened,

both provincially and federally, while snapping turtles are considered Special Concern provincially and federally.

No turtles were detected within the regional and local study area sections along the TLAs during field surveys. However, a snapping turtle was observed on Highway 144 between the study areas of the proposed TLAs (near La Motte Lake Provincial Park), and thus the presence of this species cannot be discounted from the area.

No provincially or federally listed amphibian species were identified within the regional and local study area sections along the TLAs during field surveys.

SAR - Mammals

Eastern wolf (*Canis lupus lycaon*) has been designated as a species of Special Concern provincially and eastern cougar (*Puma concolor*) is designated as Endangered, on the Species at Risk in Ontario list. Despite many sightings of eastern cougar in the past two decades from eastern Canada, there is insufficient data to evaluate the taxonomy or assign a status to this cougar, according to COSEWIC (2012), and no specimens exist to substantiate its occurrence in the province (NHIC, 2013). For these reasons, it is unlikely that cougar occur in the Project site area. These large mammal SAR species were not identified during field surveys within the study areas.

Little brown myotis bat (*Myotis lucifugus)* is listed by COSEWIC and SARO (2013) as Endangered. Newly listed species designated as Endangered receive species and habitat protection under the Ontario ESA. In addition, both maternity roosts and hibernacula are considered significant wildlife habitat for this species (MNR, 2011b) because they are areas where large numbers of bats congregate. Though the species was recorded during surveys in the regional and local study area sections along the TLAs, no candidate bat hibernacula or potential bat maternity roosting habitat was identified within or in the vicinity of the local study area. This species was only recorded at sites near wetlands and likely uses the area for foraging.

6.4.6.3 Summary

The baseline studies identify vegetation and wildlife communities located within the regional and local study area sections along the TLAs and describe their existing conditions. Vegetation and wildlife communities identified herein are typical of those inhabiting the mixed-boreal forest region of northern Ontario. Upland communities and ecosites consisted of deciduous, mixedwood, coniferous and cultural habitats. Wetland communities and ecosites consisted of swamp, fen and marsh-type wetlands.

Species observed during surveys in the regional and local study areas are considered to be largely abundant and common to Ecoregion 3E-5.

Breeding bird and other bird surveys identified a total of 84 species. Of the 124 total species identified through the review of background information and field surveys, 117 total bird species are expected to be breeding, or potentially breeding within the local study area.

One snapping turtle (*Chelydra serpentine*, considered as Special Concern under SARA and the Ontario ESA) was incidentally recorded along Highway 144 during field surveys in 2013, outside of the regional and local study area. Eastern garter snakes were observed during surveys, and seven amphibian species were observed. The most abundant amphibian detected was the spring peeper, which was ubiquitous throughout the regional study area and was recorded in great numbers along roadside ditches.

Evidence of moose was observed throughout the regional study area including 21 individual sightings during the winter aerial survey and one sighting during the spring aerial survey. Black bears were commonly observed at roadsides near the regional study area and at points along the existing Shining Tree TLA, and bear “nests” were most abundant along this TLA alternative. Wolf tracks were observed at low to medium (two to three sets of tracks) densities. During the winter aerial survey, all wolf tracks were restricted to the Shining Tree TLA, south of where it splits from the Cross-Country TLA. However, tracks observed during spring surveys suggest that wolves are equally distributed between both TLAs.

Four species of bat were recorded during bat surveys along the TLAs. Little brown myotis bats were recorded at five of the six stations. No exposed bedrock containing suitable hibernacula features for bats were identified during ground surveys and karst geology is not present within the regional study area suggesting it is unlikely that natural bat hibernacula exist. Of the 11 mine sites suspected to contain features potentially suitable for bats, none qualified as candidate bat hibernacula.

Based on field surveys, five avian Species at Risk (SAR), one mammalian SAR and one reptilian SAR were identified as occurring within or in the vicinity of the local study area sections along the TLAs. Bald eagle, Canada warbler and olive-sided flycatcher were recorded in forested habitats within the local study area and are provincially designated as Special Concern. Canada warbler and olive-sided flycatcher are also federally designated as Threatened. Rusty blackbird was observed incidentally in proximity to open wetland habitat and is federally designated as Special Concern. The little brown myotis bat is provincially designated as Endangered and was also recorded in the local study area. A snapping turtle (provincially and federally designated as Special Concern) was observed in close proximity to the local study area and likely occurs in the open water and wetland habitats present in the local study area.

6.4.7 Significant Wildlife Habitat and Protected Areas

Significant Wildlife Habitat and protected areas in the vicinity of the Project site and TLA alignments were assessed based on desktop studies of existing and publicly available information.

Information on these habitats and protected areas are presented in the Vegetation, Wildlife and Transmission Line Terrestrial Biology TSDs (see Appendices K, L and M respectively).

6.4.7.1 Methodology

The Forestry Management Plan (FMP) for the Spanish Forest was used to identify significant wildlife land uses within the regional study area (including the Project site and TLAs; MNR, 2011a, 2010a). Natural areas listed in the NHIC Natural Areas Database were also considered, as well as information from sources including the MNRF, the International Biological Program, the Federation of Ontario Naturalists, the Nature Conservancy of Canada and Bird Studies Canada. In addition, the MNRF's Land Information Ontario (LIO) database provides information on Provincially Significant Wetlands and other unevaluated wetlands.

Natural areas include evaluated wetlands, Earth and Life Science Areas of Natural and Scientific Interest, provincial and national parks, conservation areas, International Biological Program Sites and nature reserves. Wildlife Concentration Areas are areas having significant importance to wildlife during a critical component of their life history, and include: Moose Late Winter Habitat, Bat Hibernaculum/Nursery, Colonial Waterbird Nesting Area, Freshwater Mussel Concentration Area, Mixed Wader Nesting Colony, Raptor Winter Concentration Area, Shorebird Migratory Concentration Area and Waterfowl Concentration Area.

6.4.7.2 Results and Discussion

The Significant Wildlife Habitat Criteria Schedules for Ecoregion 3E (MNR, 2012a) list those vegetation communities with Eastern White Pine, Red Maple (*Acer rubrum*) and Yellow Birch (*Betula alleghaniensis*) as candidate rare vegetation communities. While some of those B-codes corresponding to these candidate rare vegetation communities are present within the regional study area along the TLA alternatives (B039 for Eastern White Pine; B058 for Red Maple; and, B040, B055, B088 and B104 for Yellow Birch; see Table 6-17 in Section 6.4.2), these stands do not have a greater than 10% absolute cover or greater than 35% relative cover of the target tree species and, as such, cannot be confirmed as Significant Wildlife Habitat.

Based on a review of ecosites present, six of the 11 Draft SWH for Ecoregion 3E Criterion Schedules for Seasonal Concentration Areas of Animals have the potential to occur within the local study area. These include Moose Late Winter Cover, Waterfowl Staging Areas (Aquatic), Bat Maternity Colonies, Turtle Wintering Areas, Reptile Hibernacula and Colonially Nesting Bird Breeding Habitat (Tree/Shrubs). Extensive field surveys during 2013 did not identify any SWH in the form of Seasonal Concentration Areas of Animals within the local study area. However, the landscape present within the local study area suggests a moderate to high probability that Moose Late Winter Cover and Reptile Hibernacula are present. There is a low to moderate probability that Bat Maternity Colonies are present within the local study area as well as a low probability that Waterfowl Stopover and Staging Areas (Aquatic) or Turtle Wintering Areas occur.

The Draft Significant Wildlife Habitat (SWH) Ecoregion 3E Criterion Schedules from the MNRF outline 11 habitats meeting the criteria for Rare Vegetation Communities. The field surveys

conducted in 2013 for terrestrial biology (site and TLA) indicate that none of these Rare Vegetation Communities are present within the local study area.

The Draft SWH Habitat Ecoregion 3E Criterion Schedules outline 13 wildlife habitats meeting the criteria for Specialized Habitat for Wildlife. Based on a review of Ecosites present, six of these Specialized Habitats for Wildlife could occur within the local study area. Field studies confirmed the presence of significant Bald Eagle Nesting Habitat, Raptor Nesting Habitat, Amphibian Breeding Habitat (Wetlands).

There is also a high probability of SWH in the form of Mast Producing Area within the local study area. Waterfowl Nesting Areas and Amphibian Breeding Habitat have a moderate likelihood of occurring in the local study area.

The Draft SWH Ecoregion 3E Criterion Schedules also outline four wildlife habitats meeting criteria for Habitat for Species of Conservation Concern. Based on the baseline surveys and review of ecosites and wildlife present, no significant Marsh Bird, Open Country Bird, or Shrub/Early Successional Bird Breeding Habitat and Habitats for Special Concern and Rare Wildlife Species are present in the study areas.

Three wildlife habitats meeting the criteria for Animal Movement Corridor Habitat were reviewed, based on ecosites and wildlife present. Significant Amphibian, Cervid and Furbearer Movement Corridor Habitat are considered highly likely within the regional study area (including the local study area) along the TLAs.

No protected areas are situated within the local or regional study areas, except for three Provincial Parks which are located within the regional study area: the Biscotasi Lake/Spanish River Provincial Park, Mississagi River Provincial Park and La Motte Provincial Park (see Figure 6-9). Biscotasi Lake Provincial Park is located approximately 14 km to the southwest of the Project site, and the Mississagi River Provincial Park is located immediately south of it. The Spanish River Provincial Park is 7 km east of the Biscotasi Lake Provincial Park and approximately 13 km south of the Project site. La Motte Provincial Park is 8 km northeast of Gogama, which is to the northeast of the local study area. These parks are discussed further in Section 6.5.1.

6.4.7.3 Summary

Desktop studies indicated the potential for six Significant Wildlife Habitats (SWH) to occur in the local and regional study areas, based on the Draft SWH Ecoregion 3E Criterion Schedules from the MNRF. Fieldwork did not identify any SWH in the form of Seasonal Concentration Areas of Animals within the local study area. However, the landscape present within the local study area suggests a moderate to high probability that Moose Late Winter Cover, Reptile Hibernacula and Mast Producing Area are present.

Field surveys indicate that no Rare Vegetation Communities are present within the local study area.

Based on a review of Ecosites present, field studies confirmed the presence of Specialized Habitats for Wildlife, namely significant Bald Eagle Nesting Habitat, Raptor Nesting Habitat, Amphibian Breeding Habitat (Wetlands).

The Draft SWH Ecoregion 3E Criterion Schedules also outline four wildlife habitats meeting criteria for Habitat for Species of Conservation Concern. Based on the baseline surveys and review of ecosites and wildlife present, no significant Habitat for Species of Conservation Concern was confirmed.

Significant Amphibian, Cervid and Furbearer Movement Corridor Habitat are considered highly likely within the regional study area (including the local study area) along the alternative TLAs.

Three Provincial Parks which are located within the regional study area: the Biscotasi Lake/Spanish River Provincial Park, Mississagi River Provincial Park and La Motte Provincial Park. The closest to the Project site is the Biscotasi Lake/Spanish River Provincial Park, approximately 13 km south and southwest of the Project site.

6.4.8 Aquatic Biology

The aquatic biology baseline study describes and characterizes the current biology of water bodies, such as lakes and rivers, in the study areas – especially fish and benthic invertebrate (such as dragon flies and caddisflies) habitat and population. Baseline information is used in the assessment of potential effects. The baseline study is presented in an appendix of the Aquatic Biology TSD (see Appendix N).

6.4.8.1 Methodology

Aquatic assessments of 24 water bodies within the boundaries of the proposed open pit and associated potential MRA and TMF were conducted during summer 2012, spring 2013, and fall 2013 by Minnow Environmental Inc. (Minnow), including:

- Bagsverd Creek;
- Bagsverd Lake;
- Bagsverd Pond;
- Beaver Pond;
- Chester Lake;
- Clam Lake;
- Côté Lake;
- Delaney Lake;

- East Beaver (Chester) Ponds;
- Little Clam Lake;
- Lower Three Duck Lakes;
- Mesomikenda Lake;
- Middle Three Duck Lakes;
- Mollie River (Chester Lake to Côté Lake) and Clam Creek;
- Neville Lake;
- North Beaver Pond;
- Schist Lake;
- Unnamed Lake #1;
- Unnamed Lake #2;
- Unnamed Lake #3;
- Unnamed Pond;
- Upper Three Duck Lake;
- Wee Duck Lake; and
- West Beaver (Moore Creek Pond).

The hydrology in the vicinity of the Project site is shown in Figure 6-5. Studies included the characterization of fish habitat and fish community structure within the water bodies in the local study area. . Additional data on aquatic resources are available from the Baseline Aquatic Study performed in 2011 by AMEC (2011b), associated with a sampling program conducted during the summer and fall of 2010. These studies included water quality/hydrogeology analysis, benthic invertebrate surveys, aquatic macrophyte community assessment, and fish community assessment and habitat characterization.

Habitat evaluations were conducted using standard habitat evaluation procedures (e.g., Dodge *et al.*, 1989; MNR, 1993; Bain and Stevenson, 1999). The wetted area/perimeter of each water body was visually assessed on foot and/or by boat. Surface areas for water bodies were determined from digitized aerial photographs using appropriate computer software. Spot depths were measured to the nearest decimetre using a portable sounding unit, or to the nearest centimetre using a meter stick for shallow ponds and creeks.

Substrate material was visually assessed, and sediment was retrieved by a petite-Ponar dredge (Wildlife Supply Co., Buffalo, NY) for the assessment of deep water areas. *In situ* water temperature, dissolved oxygen (DO), pH and specific electrical conductance (EC) were measured as vertical profiles at 1 m intervals at most lakes and at the surface or mid-column in creeks, rivers and ponds using a calibrated Multiparameter Display System YSI 556 MDS

equipped with a YSI 6820 Sonde (YSI Inc., Yellow Springs, OH). Secchi depth and/or observations of water colour and clarity were also recorded. Analysis of *in situ* water quality data included referential comparisons with applicable Provincial Water Quality Objectives (PWQOs) for the Protection of Aquatic Life.

A variety of fishing gear was used to collect fish using non-lethal techniques, including boat electro-fishing, hoop nets, short duration gill net sets, minnow traps and seine nets. Fishing techniques and equipment were selected based on the habitat of the given water body (e.g., size and depth, creek vs. lake, etc.) and the target species (e.g., large vs. small-bodied). Species were identified during sampling – species listed under SARA and the Ontario ESA were surveyed for, but samplings of the water bodies did not provide evidence of any aquatic species at risk (SAR, such as Lake Sturgeon). Catch-per-unit-effort (CPUE), representing the number of fish caught over a specified unit of time and/or area was later calculated for each fish species by fishing method and water body.

Fish condition was also assessed. The length and weight of a sub-set of fish from each water body was measured, along with observations of external condition and fish age or life stage. Tissue samples were collected from any large-bodied sport fish that died during capture or handling (up to five per water body surveyed). Tissue samples were archived and frozen for potential future analysis (if required). Small-bodied fish that died during capture were frozen whole for potential future analysis.

6.4.8.2 Results and Discussion

Results are focused on the water bodies expected to be the most affected by proposed Project activities, with general descriptions provided for other water bodies in the local study area. The hydrology of the Project site is shown in Figure 6-5.

Côté Lake

Habitat Description

It is planned that Côté Lake will be drained for the development of the proposed open pit, as described in Chapter 5. The lake covers approximately 19.4 ha along the northern border of the proposed open pit. Flow from the Mollie River represents the main input to the lake, with a total estimated volume of 463,000 m^3 and a maximum depth of approximately 4.3 m. The lake discharges primarily to Upper Three Duck Lakes. A DO of near 0 mg/L was observed at a depth of 3 m and the lake is neutral to slightly acidic (pH = 7.05 at the surface, 6 43 at depth). The lake is yellow-brown in colour with moderate clarity (Secchi depth = 2.2 m).

The substrate consists mostly of silt and clay-sized fines with high organic content. The shoreline consists almost entirely of organic muck with limited amounts of bedrock. Wetlands with sedges (*Carex* sp.) and sparse growth of cattail (*Typha latifola*) and shrubs such as sweet gale (*Myrica gale*), speckled alder (*Alnus incana*), leatherleaf (*Chamaedaphne calyculata*) and

meadowsweet (*Spiraea* sp.) were found bordering the water line. Standing deadwood was also found around much of the shoreline, particularly along the eastern and northern shorelines.

Fish Community and Population

A total of eight fish species were detected at the Côté Lake. The large-bodied fish community is dominated by northern pike (*Esox lucius*) and yellow perch (*Perca flavescens*), with a moderate abundance of white sucker (*Catostomus commersonii*) and lake whitefish (*Coregonus clupeaformis*), and low numbers of burbot (*Lota lota*). The small-bodied fish community included moderate numbers of golden shiner (*Notemigonus crysoleucas*) and blacknose shiner (*Notropis heterolepis*). Data from 2010 indicated that walleye (*Sander vitreus*) could also be present (AMEC, 2011b), though this species was not detected during the 2012 survey at the lake. No COSEWIC (2012) listed fish species were observed at the lake in 2010 or 2012 (see Table 6-24 at the end of the results).

Yellow perch was the most abundant species, with 1,315 individuals caught during surveys. Individuals represented all life stages and adults were among the largest captured in any of the lakes during the 2012 and 2010 surveys. Northern pike were estimated at 442 individuals, with a density of 22.3 northern pike/ha, which is comparable to other regional lakes of comparable size and geographic latitude. Northern pike lengths were within the range representative of young-of-the-year (YOY) and adult age classes, with body condition comparable to other regional lakes and to the data from 2010, suggesting that fish health has been consistent between years. White sucker population was estimated at 906 individuals with a density of 46.7 white sucker/ha. This population density is moderate compared to published literature values which range from 11 to 82 white sucker/ha. Most of the captured white suckers were within juvenile to adult size classes, with body condition comparable to those of white suckers in region lakes. Lake Whitefish captured were all adults and were the largest of all lake whitefish captured at any of the lakes during surveys.

Fish Habitat Evaluation

Vegetation associated with wetlands on the east and west shorelines of Côté Lake likely provide a moderate amount of spawning habitat for northern pike. Abundant submerged aquatic vegetation provides excellent juvenile rearing and adult foraging and cover habitat for northern pike. Overhanging vegetation provides yellow perch with excellent spawning, rearing and foraging/cover habitat, and likely accounts for the numerical dominance of this species in the lake. Due to the general variety and abundance of aquatic vegetation at the lake, there is excellent spawning and rearing/foraging habitat available for golden shiner. A general lack of cobble, gravel and sand substrate suggest very limited habitat for other fish species.

Clam Lake

Habitat Description

Clam Lake is approximately 80.5 ha in surface area, with eastern portions along the proposed open pit border. The lake is supplied by Unnamed Pond. Clam Lake discharges from its northeast arm east into the Mollie River via Clam Creek. Minimal flow was observed at the outlet, suggesting an intermittent discharge. Prior to surveys and as apparent by observations of recently exposed shoreline, Clam Lake water level had fallen by 1 m to 1.2 m, related to the breaching of a culvert beaver dam at the lake outlet. Prior to this breach, the lake had an estimated volume of 3.83×10^6 m^3 and an average depth of 4.8 m. The lake has three basins that each reached a maximum depth of >10 m prior to the dam breach, and has numerous islands, rocky shoals and shallow bays.

The northeast arm connects to the main body of the lake by two large culverts installed during the historical construction of a gravel berm providing access to a mine shaft located on the eastern shoreline of the lake. Historical mining activities have left the east shoreline shaft and another, completely submerged near the west shoreline. Both are associated with small waste rock piles that occur directly on the shoreline of Clam Lake.

DO is ≤2 mg/L at depths greater than 6 m (hypoxia), with a surface water pH of 7.14, becoming slightly acidic with depth (6.04 at the bottom). Clam Lake is slightly yellow-brown with relatively high clarity (Secchi depth = 3.46 m).

The substrate in deep littoral areas (greater than 2 m depth) consists of silt with moderate to high organic content. Shallow substrate is variable and generally comprised of gravel, cobble and bedrock, with silt at depths of approximately 1 m and greater. Aquatic macrophytes are sparse, and vegetation is generally limited to individual yellow pond lily plants. Large-leaved pondweed burred and bladderwort submergent beds occur at the southeast arm and a small embayment on the west shoreline. Cattail and submergent vegetations also occur in the northeast arm.

The shoreline is generally treed, primarily with black spruce and jack pine. With the exception of the southeast and northeast arms, no wetlands were found adjacent to Clam Lake. Substantial marsh/bog wetlands border the southeast and northeast shorelines, with cattails, sedges and shrubs.

Fish Community and Population

Ten fish species were detected in Clam Lake. The large-bodied fish community was dominated by smallmouth bass (*Micropterus dolomieu*), with moderate abundance of northern pike and low abundance of white sucker and burbot. Yellow perch were also very common, but almost all of the individuals captured were YOY. Blacknose shiner were the most abundant small-bodied fish species encountered, with moderate relative abundance of golden shiner and low relative

abundance of spottail shiner (*Notropis hudsonius*), Iowa darter and Johnny darter (*Etheostoma nigrum*). No COSEWIC (2012) listed fish species were captured at Clam Lake in 2012 or during the previous survey by AMEC (2011). Smallmouth bass captured were within size ranges representative of all life stages and comparable between 2012 and 2010. Measurements were not taken on sufficient numbers of individuals of other species at Clam Lake in 2012 to evaluate body condition. Species captured at Clam Lake are listed in Table 6-24 at the end of the results.

Fish Habitat Evaluation

The fish habitat evaluation of Clam Lake was complicated by the recent change in water level associated with the dam breach at the lake outlet. Although access may now be somewhat limited during spring spawning (due to the lowering of the lake level), some spawning habitat was still available and was considered good quality along the southeast and northeast arms of the lake for several fish species. The occurrence of sand-gravel in shallow littoral areas and mixed substrates in shallow/deep littoral areas likely provides marginal to good rearing habitat and good foraging habitat for juvenile and adult white sucker, respectively. Clam Lake contains excellent habitat for all life stages of smallmouth bass. Specifically, an abundance of sandy-silt, gravel or rocky substrate throughout the littoral areas provides excellent spawning habitat.

Little Clam Lake

Habitat Description

Little Clam Lake is an approximately 6.6 ha headwater lake located just west of the proposed open pit and immediately north of Clam Lake. The most significant inputs to the lake are likely received via a small wetland located at the northeast border of the lake. A beaver dam is located at the northern-most point of Little Clam Lake, with intermittent discharge from this location entering a wetland depression that has no defined channel. A southwest outlet drains to the northeast arm of Clam Lake, although discharge from this location likely occurs only during high flow periods. The lake has a volume of approximately 134,000 m^3, and contains a simple, elongate basin that reaches a maximum depth of approximately 6 m in the south portion of the lake.

DO concentrations of ≤2 mg/L occur at depths >4 m, and the water is slightly acidic (pH = 5.8) and exhibited the lowest pH of all surveyed lakes.

Substrate is comprised mainly of organic silt, though in the littoral zone it transitions from mainly cobble to mostly silt with abundant woody debris at 1 m to 2 m from the shore. Aquatic vegetation growth is mostly sparse, consisting of scattered submergent burred, bladderwort, fern pondweed (*Potamogeton robbinsii*), milfoil (*Myriophyllum* sp.) and stonewart (*Chara* sp.), as well as some floating yellow pond lily.

The shoreline consists predominantly of cobble with occasional bedrock outcrops, and areas of organic silt and/or sand/gravel associated with wetlands adjacent to the shoreline and the

southeast outlet. Black spruce and jack pine dominate the trees around the shoreline. Small areas of sedge-leatherleaf wetland can be found along the north-eastern, west-central and south-western shorelines, with sparse cattail.

Fish Community and Population

The fish community in Little Clam Lake included a total of five species. Northern pike and yellow perch were the only large-bodied fish observed, with roughly similar relative abundance observed between these species. The small-bodied fish community consisted mainly of golden shiner, with moderate abundance of blacknose shiner and low numbers of Iowa darter. No COSEWIC (2012) listed fish species were observed during the July 2012 survey or during the previous survey conducted by AMEC (2011).

Northern pike captured in Little Clam Lake during the July 2012 field survey were mainly juveniles and adults. The body condition of these fish was within the range observed for northern pike from other regional lakes and from those observed during the 2010 survey. Yellow perch were within size ranges representative of all life stages with the condition of juvenile/adult specimens comparable to that of yellow perch captured at other regional lakes.

Species captured at Little Clam Lake are listed in Table 6-24.

Fish Habitat Evaluation

Marginal spawning, rearing and foraging habitat for northern pike and yellow perch was found in Little Clam Lake as a result of sparse aquatic vegetation growth. The lake provides a limited amount of spawning, rearing and foraging habitat for golden shiner due to the relatively low abundance of weedy areas. Sandy-rocky areas likely provide some good spawning substrate for blacknose shiner, and fallen trees and wetland areas with overhanging vegetation and rooted material may provide marginal spawning habitat, with the shallow littoral area containing organic substrate and vegetation that is likely good habitat for rearing/foraging for Iowa darter.

Upper Three Ducks Lake

Habitat Description

It is anticipated that during mine development, the inlet arm of Upper Three Duck Lake will be separated from the main basin to enable mining of the open pit. Physical habitat characterization focused on the inlet arm of Upper Three Duck Lake during the 2012 survey, and fish community characterization for the lake was previously completed by AMEC (2011).

Upper Three Duck Lake inlet arm extends east-west approximately 760 m and has an approximate surface area of 21.9 ha. Water flows into Upper Three Duck Lake from Côté Lake at the southwest corner of the inlet arm. The maximum depth observed was approximately 3 m, with much of the area approximately 2 m deep.

DO concentrations were relatively high (6.88 mg/L at surface) and, as a reference, above the PWQO warm water habitat minimum of 5.0 mg/L. Water pH was near neutral (7.33 at surface), with no substantial change observed from surface to bottom.

Littoral substrate of the Upper Three Duck Lake inlet arm generally consists of silt, although compact sand to silty-sand often forms the dominant substrate of shallow littoral areas on the north side and around a small 'sunken island' in the centre. A diverse assemblage of aquatic vegetation formed extensive beds, particularly within the littoral area of the northern portion of the inlet, around the central sunken island, and near the inlet. Aquatic macrophytes along most of the southern portion of the inlet arm were less abundant and generally included patchy growth of the species indicated above at the same relative water depths.

The shoreline predominantly consists of a combination of sand, cobble and organics, with minor amounts of bedrock. Shoreline areas are generally forested to the waterline, with eastern white cedar and black spruce representing the dominant species. Riparian understory found immediately adjacent to the shoreline is sparse, but when present mainly includes shrubs such as leatherleaf and sweet gale. No substantial wetland areas border the inlet arm of Upper Three Duck Lake.

Fish Community and Population

The fish community of Upper Three Duck Lake was assessed in 2010 by AMEC (2011), with a total of seven species captured in the lake. Yellow perch, northern pike, smallmouth bass and lake whitefish were the most numerous species. Iowa darter was the only small-bodied fish captured. No COSEWIC (2012) listed fish species were observed at Upper Three Duck Lake during the 2010 field survey. Northern pike, white sucker, walleye, smallmouth bass and lake whitefish captured in 2010 included juvenile and/or adult size classes. The size range of yellow perch captured in the Three Duck Lakes chain was representative of YOY, juvenile and adult fish. The condition of juvenile and adult northern pike, white sucker, walleye and lake whitefish, and all yellow perch life stages was comparable to that of other lakes in the region.

Fish Habitat Evaluation

The inlet arm of Upper Three Ducks Lake provides varied habitat for the various life stages of the species inhabiting the lake. The inlet arm of Upper Three Duck Lake had marginal spawning habitat for northern pike due to limited wetland areas immediately adjacent to the arm. Dense aquatic beds containing a diversity of plant species would provide excellent rearing and foraging/cover habitat for northern pike, as well as excellent habitat for spawning and all life stages of yellow perch. An abundance of sandy-silt, gravel or rocky substrate in the northern portion of the inlet arm provides excellent smallmouth bass spawning habitat, whereas the rocky shoreline and shoal areas found primarily along the southern portion of the inlet provide good juvenile rearing and adult foraging habitat.

Bagsverd Lake

Habitat Description

Two arms of Bagsverd Lake may be altered as a result of mine development options currently being considered. Specifically, the south and east arms may be affected by watercourse re-alignment options, to accommodate either the open pit or the TMF. Physical habitat and fish community characterization focused on the South and East arms of Bagsverd Lake during the July 2012 study.

Bagsverd Lake is an approximately 215 ha lake located about 1 km north of the proposed open pit. The lake is characterized by complex basin morphology that includes two main basins that each reach a maximum depth of approximately 10 m, several islands and rocky shoals, two main creek inlets, three intermittent stream inlets, and two large 'arms' located to the south and east of the lake (South and East Arms, respectively). The mean depth of Bagsverd Lake is approximately 3.6 m, with a total estimated volume of approximately 7.69 x 10^6 m^3.

The South Arm of Bagsverd Lake extends east-west approximately 1,600 m as a narrow (100 m to 280 m wide) depression with a surface area of approximately 30 ha, and most of the South Arm has a depth of approximately 1 m. The South Arm is fed from the west by a perennial stream that carries the combined flow from Moore Lake, West Beaver Pond and Little Clam Lake and from the southeast by an intermittent stream that originates at Bagsverd Pond.

The East Arm of Bagsverd Lake (approximately 42.7 ha) is also the outlet of Bagsverd Lake. In addition to flow from the main lake basin, the East Arm is fed by an intermittent, unnamed creek that drains a small headwater pond directly south of the East Arm. The outlet bay of the East Arm contains a relatively diverse morphology, including small islands, a sand-clay shallows, and rocky shoals. The outlet bay reaches a maximum depth of 4 m.

DO concentrations were high (>7 mg/L), observed from surface to bottom. The pH of the water was slightly basic (7.73 at surface), with no substantial change from surface to bottom. A mean Secchi depth of 2.9 m indicated moderate water clarity and light penetration throughout the water column.

Substrate in the littoral areas generally consists of soft silt with high organic content, although areas dominated by compact fine sand are found in deeper areas near the outlet. Near the shoreline, cobble, boulder and bedrock may extend approximately 1 m to 2 m offshore before transitioning to silt and/or sand substrate. Aquatic vegetation included very dense floating and submergent macrophyte growth of fragrant white water lily (*Nymphaea odorata*), water shield (*Brasenia schreberi*) yellow pond lily, mermaid's hair, burreed and large-leaved pondweed. Very little aquatic vegetation was found through the east portion of the arm including areas near the outlet to the main lake basin.

The shoreline consists primarily of cobble/ boulder, with some exposed bedrock and organic areas. Shoreline areas are generally forested, with eastern white cedar often providing near shore cover in the form of overhanging boughs, recently fallen trees, submerged logs and/or other woody debris. Sedges and shrubs, including leatherleaf, sweet gale, bog laurel and/or bog rosemary, are the predominant understory species along the shoreline wetlands. Though similar, no substantial wetland areas were found along the border of the East Arm. Exposed bedrock, occasionally occurring as steep rock faces, often results in the forest edge beginning several meters away from the waterline along the East Arm.

Fish Community and Population

Seven species of fish were captured in the South Arm of Bagsverd Lake. Although only six species of fish were captured in the East Arm of Bagsverd Lake during the July 2012 field survey, it is likely that two additional species (walleye and fathead minnow) captured at the South Arm also inhabit the East Arm (see Table 6-24 at the end of the results).

The large-bodied fish community included moderate to high numbers of northern pike, white sucker, yellow perch and walleye (South Arm only), whereas the small-bodied fish community was represented by a relatively low abundance of golden shiner, blacknose shiner and fathead minnow (South Arm only). Spottail shiner, which was observed in East Arm of Bagsverd Lake, may also use habitat of the South Arm. No COSEWIC (2012) listed fish species were observed during the July 2012 field survey. Northern pike captured included YOY, juvenile and adult size classes and body condition was similar to that of other lakes in the region. In contrast, white sucker were all juveniles or adults (no YOY), having lower body condition compared to all other regional lake white sucker populations surveyed in 2012 and 2010. Yellow perch population included YOY to adult life stage, and although body condition appeared slightly lower for larger adults compared to other regional lakes, the condition of most yellow perch fell within a normal range for the area. Walleye captured during the survey were all juveniles or adults, and body condition was also within the range of that observed at nearby lakes.

Fish Habitat Evaluation

Excellent spawning and rearing habitat for northern pike was found in the South Arm of Bagsverd Lake as a result of the extensive wetland area and presence of moderately to very dense aquatic macrophyte beds, while good spawning, rearing (juvenile) and foraging/cover (adult) habitat for northern pike and yellow perch was found in the East Arm. Habitats in the Southern and East Arms of Bagsverd Lake provide varied and good habitat for the various life stages of the fish species inhabiting the lake. Although habitat features in the Southern Arm also provide good juvenile rearing and adult foraging opportunities for blacknose and spottail shiner, the absence of any substantial sandy areas suggests marginal to limited habitat for spawning.

Unnamed Lake #1

Habitat Description

Unnamed Lake #1 is an 18.8 ha lake, situated within the Bagsverd Creek watershed, approximately 6 km north of the Project site. The lake is primarily fed from the east by Bagsverd Creek, while a small, first-order tributary that drains a series of ponds and headwater lakes also feeds into the west. The lake has an estimated volume of 141,000 m^3, and consists of a simple, shallow main basin with a maximum depth of approximately 1.5 m.

DO concentrations were below 2 mg/L (i.e., hypoxic) near the lake bottom. The pH was slightly basic (7.94) at the surface to neutral (6.86) near the bottom, with changes at depth likely reflecting the change to a reducing condition related to low DO at the bottom.

The lakes substrate consists almost entirely of silt and clay-sized fines containing high organic content, with two relatively sandy areas in the lake that extend approximately 15 m from shore. Littoral areas ≤1 m deep throughout the lake generally contain very soft organic substrate or soft sand-silt that supports dense submergent macrophyte growth of mermaid's hair and burreed which can be interspersed with emergent aquatic plants such as cattails and sedges closer to the shoreline.

The shoreline of Unnamed Lake #1 primarily consists of organic materials, bedrock and sand generally contain dense sweet gale and bog laurel that overhangs the water's edge, whereas rocky areas are usually treed to the shoreline by upland mixed forest including primarily black spruce and trembling aspen. The eastern end of the lake contains an extensive wetland area through which Bagsverd Creek flows.

Fish Community and Population

A total of nine species were detected in Unnamed Lake #1 (see Table 6-24). The large-bodied fish community was dominated by yellow perch with a moderate number of northern pike and white sucker as well as a small number of walleye. The small-bodied fish community included a moderate number of blacknose and golden shiner and a small number of central mudminnow (*Umbra limi*) and Iowa darter. No COSEWIC (2012) listed fish species were observed at Unnamed Lake #1 during the July 2012 survey.

The northern pike population was estimated to be approximately 387 individuals with an average density of 20.5 northern pike/ha. The northern pike density in Unnamed Lake was very similar to that of Côté Lake as well as to other Ontario and Minnesota lakes of comparable size and latitude. Northern pike were within the range representative of YOY to adult age classes and included some of the largest individuals among all study lakes. Body condition was generally comparable to other regional lakes. The white sucker population in Unnamed Lake was estimated to be approximately 54 individuals with a corresponding population density of 2.9 white sucker/ha. The density estimates were sufficiently low, compared to published density

estimates for comparable regional lakes, suggesting that conditions in the lake are not optimal for white sucker. Most of the white suckers captured were in the juvenile to adult size classes, with body condition comparable to that of regional lakes. Yellow perch captured in Unnamed Lake were within size ranges representative of YOY and adults, although all but one of the yellow perch captured were YOY. The absence of juveniles and very low number of adults suggests limited foraging habitat, heavy predation and/or other factors that may influence the population in the lake. The walleye population in Unnamed Lake was estimated to be approximately 27 individuals, with a corresponding population density of 1.4 walleye/ha. Walleye population of Unnamed Lake #1 was small relative to most typical northern temperate lakes, according to published density estimates, suggesting conditions in the lake were not optimal for walleye production. Interestingly, walleye captured at Unnamed Lake #1 were among the largest caught at any of the surveyed lakes in both 2012 and 2010. Moreover, their body condition was also slightly greater than of the other study lakes.

Fish Habitat Evaluation

Excellent spawning and rearing (juvenile) habitat for northern pike and excellent spawning, rearing and foraging habitat for yellow perch were found in Unnamed Lake, as a result of abundant shallow wetland areas adjacent to the shoreline and/or shallow vegetated areas within the lake. A general lack of cobble, gravel and/or sand substrate results in marginal quality habitat available for spawning white sucker, walleye and burbot. The combination of submergent vegetation and open-water areas also provides good habitat for juvenile/adult white sucker and juvenile walleye. Excellent spawning and rearing/foraging habitat for golden shiner is afforded by a good variety and dense occurrence of aquatic vegetation. Sand substrate suitable for blacknose shiner spawning occurs in Unnamed Lake, with aquatic vegetation found throughout the lake providing good rearing and foraging/cover habitat. In general, the lake provides good and varied habitat for the life stages of the fish species inhabiting the lake.

Mollie River and Clam Creek

Habitat Description

The Mollie River traverses the proposed open pit location. Through this section, the Mollie River includes low- and high-gradient erosional habitats. Three small, intermittent first-order streams feed into the Mollie River between Chester and Côté lakes which originate from beaver pond systems (i.e., East Beaver Pond and Unnamed Pond/Beaver Pond), and Clam/Little Clam lakes, the latter of which is referred to as Clam Creek.

Mollie Rivers low-gradient habitat is characterized by a meandering channel with stream morphology represented mainly by slow run and pools. The main channel of low-gradient habitat at the Mollie River averages approximately 10.6 m wide upstream of the confluence with Clam Creek, and approximately 14.2 m wide near the outlet at Côté Lake. Water depth at low-gradient habitat of the Mollie River generally ranges from approximately 0.7 m to 1.5 m in run habitat, with pool areas reaching maximum depths of approximately 2.5 m to 3.0 m, during the July 2012 survey.

Substrate of Mollie River low-gradient habitat generally includes a moderate to thick layer of organic muck over clay pan. In-stream vegetation is very dense near the East Beaver Pond creek confluence, with 90% to 100% areal coverage. This decreases downstream, to between 50% and 80%. Submergent vegetation, represented mainly by burreed and pondweed, is the dominant vegetation. The low-gradient habitat of the Mollie River is generally bordered by wetland, with the average wetland width approximately 115 m wide, including mainly sedge and speckled alder, with shoreline areas often lined by sweet gale and/or leatherleaf. Forest next to the low-gradient area wetlands is generally dominated by coniferous species including black spruce and jack pine.

High-gradient habitat occurs at two locations in the Mollie River between Chester and Côté lakes, including a relatively long 440 m reach beginning at the outlet of Chester Lake, and an approximately 10 m long reach located a short distance downstream of the East Beaver Pond creek confluence. This high gradient habitat is represented by a combination of riffle, run and pool stream morphology.

Substrate at the high-gradient habitat consists of large cobble and boulder that is often deeply embedded in sand. Aquatic vegetation included aquatic mosses and sparse periphytic algae, with few vascular plants. However, abundant large woody debris and overhanging vegetation provide considerable amounts of in-stream cover. The shoreline is treed with eastern white cedar, jack pine and black spruce being most common.

Clam Creek is also situated within the proposed open pit mine footprint, with its outlet discharging into the Mollie River approximately 750 m upstream of Côté Lake. Clam Creek is an intermittent stream, with minimal discharge observed at the outlet of Clam Lake at the time of the field survey. Lower Clam Creek is entirely represented by low-gradient habitat. Water depths ranged from approximately 0.1 m near the wetland shoreline to approximately 3.5 m near the Mollie River.

Substrate consists entirely of soft organic silt at lower Clam Creek. Aquatic vegetation of lower Clam Creek includes dense growth of bladderwort and stonewort, patchy burreed in submergent and emergent forms, and sparse occurrence of the emergent plant, water arum (*Calla palustris*). Large woody debris is also abundant. Lower Clam Creek is bordered mainly by sedge wetland with varying amounts of speckled alder, leatherleaf, sweet gale and/or bog rosemary (*Andromeda glaucophylla*). Forest next to the low-gradient area wetlands is generally dominated by coniferous species including black spruce and jack pine.

Fish Community and Population

A total of six fish species were captured at Mollie River low-gradient habitat areas during the July 2012 field survey (see Table 6-24).

The large-bodied fish community was dominated by yellow perch, with moderate numbers of northern pike and white sucker. The small-bodied fish community included moderate numbers

of golden shiner as well as low numbers of blacknose shiner and Iowa darter. No COSEWIC (2012) listed fish species were observed in the Mollie River during the July 2012 survey. At Clam Creek, fish community species composition would be expected to be similar between the lower reaches of Clam Creek and low-gradient habitat of the Mollie River. No fishing was conducted in the high-gradient areas of the Mollie River, although the fish community of these areas was likely to be similar to that of Bagsverd Creek. Northern pike, yellow perch and white sucker captured in the Mollie River likely included juvenile and/or young adult life history stages, whereas all captured small-bodied fish were likely adults.

Fish Habitat Evaluation

Wetlands located along the margins of the Mollie River provide excellent spawning habitat for northern pike, whereas dense macrophyte coverage and abundant overhanging vegetation along the main channel provides excellent rearing habitat. Abundant submerged aquatic vegetation and overhanging vegetation throughout the main channel of the Mollie River likely provides excellent spawning, juvenile rearing and adult foraging and cover habitat for yellow perch. Although low-gradient areas that predominate much of the Mollie River provide good rearing and foraging habitat for white sucker, the lack of rocky structure and the shallow nature of these areas results in marginal habitat for juvenile and adult walleye. Rocky habitat associated with higher gradient areas of the Mollie River likely provides a marginal amount of habitat for rearing juvenile burbot. The Mollie River likely provides good spawning and rearing/foraging habitat for golden shiner as a result of a diverse and abundant aquatic plant community. For blacknose shiner, sand substrate suitable for spawning may be found near high gradient areas of the stream, with abundant aquatic vegetation within this reach also providing good rearing and foraging/cover habitat. High gradient areas observed below Chester Lake provide good spawning, rearing and foraging habitat for longnose dace. Wetland areas, overhanging vegetation and dense coverage of rooted macrophytes provide good spawning, rearing and foraging habitat for Iowa darter throughout the Mollie River.

Fish habitat quality in lower Clam Creek is generally similar to that in the Mollie River, but there is less available. A notable exception is the occurrence of excellent northern pike spawning habitat in lower Clam Creek which, similar to the Mollie River, reflects wetland areas located immediately adjacent to the main channel providing abundant vegetation.

Bagsverd Creek

Habitat Description

Bagsverd Creek originates at the outlet of Bagsverd Lake and flows north approximately 3.9 km before discharging into Unnamed Lake #1. From Unnamed Lake, Bagsverd Creek continues to flow north approximately 3.7 km, and then east approximately 2.0 km where it discharges into Neville Lake. Five distinct habitats are generally distinguishable in Bagsverd Creek that are largely reflective of area topography, including a permanent pond, low-, moderate- and high-gradient erosional habitats, and deep pool habitat.

Bagsverd Creek discharges from Bagsverd Lake over a bedrock face with a vertical drop of approximately 1.2 m and immediately flows into a permanent pond. Immediately downstream of the permanent pond to approximately 2.25 km downstream of Bagsverd Lake, Upper Bagsverd Creek contains a high proportion of moderate-gradient habitat with three significant high-gradient areas also found over this distance. Finally, the area extending from approximately 2.25 km downstream of Bagsverd Lake to Unnamed Lake #1 is mainly characterized by low-gradient habitat.

DO concentrations appeared to remain relatively high (i.e., 7.35 mg/L and 7.58 mg/L in the Upper and Lower sections, respectively) and, as a reference, above the PWQO minimum of 5.0 mg/L for warm water habitats. Surface water pH was near neutral (i.e., 7.66 and 7.13 in the Upper and Lower sections, respectively) in Bagsverd Creek.

The permanent pond has simple basin morphology, reaching a maximum depth of almost 5 m near the inlet. Substrate at deep littoral areas of the pond includes mostly silt- to clay-sized fines with high organic content. At shallow littoral and shoreline areas, including the entire outlet portion of the pond, bedrock, boulder and cobble are the predominant substrate. Macrophytes are relatively scarce throughout the pond, and limited to patchy distribution of emergent cattail, horsetail (*Equisetum* sp.) and/or burreed, as well as to sparse growth of floating vegetation represented by yellow pond lily.

Moderate-gradient habitat in Upper Bagsverd Creek is characterized by a meandering channel with run habitat interspersed with small pools. The majority of flow is often constricted to a 1 m to 1.5 m wide swath as a result of very dense in-stream aquatic vegetation growth. Substrate in these areas may include densely packed clay, sand-gravel mixes and/or soft silt. Pools that reach approximately 1 m to 1.4 m deep are also commonly found within moderate-gradient areas, with substrate of these pools generally varying between hard-packed clay and soft silt. Large boulders are commonly found within moderate-gradient habitat of Upper Bagsverd Creek. Aquatic vegetation in these reaches includes very dense growth of emergent burreed, and rarely, horsetail, as well as submergent vegetation represented mainly by mermaid's hair, burreed, stonewort (*Chara* sp.) and/or pondweed (*Potamogeton* sp.). In addition to these species, quillwort (*Isoetes* sp.) and filamentous green algae (Chlorophyta), and floating vegetation such as yellow pond lily, can be found in patches or mixed amongst the dominant emergent and submergent vegetation types indicated above. Collectively, in-stream vegetation can commonly cover 90% to 100% of the stream bed in moderate-gradient areas. Notably, freshwater sponge (*Spongilla* sp.), which are often considered indicative of relatively clean waters, were also observed in moderate gradient habitat of Upper Bagsverd Creek. Wetland areas comprised principally of sweet gale, meadowsweet and sedges, typically border moderate-gradient habitat of Upper Bagsverd Creek, with the average wetland width approximately 80 m.

Relatively high-gradient areas occur at three locations in Upper Bagsverd Creek, including at or near the permanent pond outlet and at areas located approximately 1.17 km and 2.23 k downstream of Bagsverd Lake. High-gradient habitat generally contains riffle and/or riffle run

stream morphology with some pool habitat. Substrate of high-gradient habitat generally consists of large cobble and boulder, and as a result, interstitial and/or sub-surface flow is commonly observed. In-stream vegetation of high-gradient habitat generally includes aquatic mosses (*Bryophyta* sp.) as well as filamentous green algae, with vascular plants limited to sparse growth of submergent burreed. Mixed forest typically extends to the shoreline.

Low-gradient habitat of Upper Bagsverd Creek is characterized by a meandering channel with slow run habitat, small to large pools, and frequently ponded areas as a result of beaver activity. Substrate of low-gradient habitat mainly includes organic muck (i.e., silt with high organic content) of varying thickness over hard-packed clay. However, gravel/boulder, hard-packed silt and hard-packed clay were also present over short distances in some shallow areas. In-stream vegetation is generally very dense in the main channel of low-gradient habitat, with 90% to 100% coverage not uncommon. Submergent vegetation was most abundant during surveys. Extensive wetland areas generally border low-gradient habitats of Upper Bagsverd Creek, with the total wetland width averaging approximately 400 m. Wetland vegetation is generally dominated by a combination of sedges, sweet gale, leatherleaf, alder and/or meadowsweet shrubs and larch trees. Forest adjacent to the low-gradient area wetlands primarily included coniferous species such as black spruce, jack pine and larch.

Lower Bagsverd Creek located 3.13 km downstream of Unnamed Lake #1, is primarily represented by low-gradient habitat. Deep pool is then the predominant habitat type for approximately the next 740 m downstream, with a mix of high- and low-gradient habitat occurring over the final 1.78 km before Lower Bagsverd Creek discharges into Neville Lake. Low-gradient habitat is similar as that described for Upper Bagsverd Creek. Deep pool habitat in Lower Bagsverd Creek is characterized by meandering channel with a series of deep scour pools separated by short distances of slow run habitat. Large pools with depths of approximately 2.0 to 2.5 m are separated by run habitat measuring about 0.7 m to 0.9 m deep. Aquatic vegetation is relatively sparse (approximately 20% coverage), with submergent burreed and mermaid's hair generally present only in shallow run habitat between pools and along pool margins. Sparse growth of emergent aquatic grasses and spike rush can also be found along the shoreline. Wetlands areas adjacent to deep pool habitat differ from those of low-gradient habitat areas, and are generally characterized by larger shrub species such as speckled alder, red-osier dogwood (*Cornus stolonifera*) and, less frequently, willows (*Salix* sp.).

High-gradient habitat occurs at three locations in Lower Bagsverd Creek, all of which can be found within 640 m of each other, and represents only a small portion of Lower Bagsverd Creek. Substrate at high-gradient habitat consists of 5 cm to 15 cm diameter cobble and boulder. Aquatic vegetation included aquatic mosses and algae apparent as periphyton, with vascular plants limited to sparse growth of burreed occurring in an emergent form. Forested areas generally extend to the shoreline at all three high-gradient areas.

Fish Community and Population

The Bagsverd Creek fish community included a total of eight fish species, with similar species composition in Upper and Lower areas of the creek (see Table 6-24 at the end of the results). The large-bodied fish community of both Upper and Lower Bagsverd Creek included moderate to low numbers of northern pike and yellow perch, and relatively low numbers of white sucker and burbot. Small-bodied fish were represented by low numbers of golden shiner, longnose dace (*Rhinichthys cataractae*), central mudminnow and/or Iowa darter. The fish community of the low- to moderate-gradient and deep pool habitats differed from that of high-gradient habitat. Of the four species collected only at high-gradient habitat, longnose dace was the only species that would not typically be expected to be found at the low- to moderate gradient and deep pool habitats. No COSEWIC (2012) listed fish species were observed at Bagsverd Creek during the July 2012 survey.

Northern pike captured in Bagsverd Creek included YOY, juvenile and/or young adults. Based on a visual assessment, the yellow perch and longnose dace populations of Bagsverd Creek likely included all age classes, whereas the burbot population was limited only to juveniles. Although only a single age class of white sucker, golden shiner, central mudminnow and Iowa darter was observed in Bagsverd Creek, it is expected that the creek would support all age classes of these species.

Fish Habitat Evaluation

Overall, Bagsverd Creek provides a variety of habitats throughout its length for the inhabiting fish species, however, no spawning habitat and very poor adult foraging habitat occurs for burbot in Bagsverd Creek. Excellent spawning and rearing (juvenile) habitat for northern pike and excellent spawning, rearing and foraging habitat for yellow perch was found in Bagsverd Creek based on the presence of abundant shallow wetland areas adjacent to the shoreline and/or shallow vegetated areas throughout the upper and lower reaches. Northern pike foraging habitat is also found in Bagsverd Creek, but because water depths tend to be shallow and high summer water temperatures may seasonally reduce the quality of habitat for larger adults, it is considered marginal to good. Good spawning and rearing/foraging habitat for golden shiner was also found in Bagsverd Creek as a result of a good diversity and high abundance of aquatic plants. Sand substrate suitable found in moderate-gradient areas of Bagsverd Creek provides good spawning habitat for blacknose shiner, with the combination of dense aquatic vegetation and sandy to muddy substrate providing good rearing and foraging habitat for this species throughout Bagsverd Creek. Coarse sand and gravel at moderate- to high-gradient areas of Bagsverd Creek provide longnose dace with excellent spawning habitat and rearing habitat.

Unnamed Pond

Habitat Description

Unnamed pond is a small, approximately 3 ha headwater bog-lake located on the southern border of the proposed open pit. No tributaries flow into Unnamed Pond, and flow from

Unnamed Pond occurs intermittently, discharging to the north into a wetland that includes Beaver Pond, which subsequently drains to the Mollie River upstream of Clam Creek. Unnamed Pond #1 may also have a southwest outlet that drains to the southeast arm of Clam Lake via a small, 300 m long wetland, although discharge from this location would only likely occur during high flow periods.

The pond's average depth is 1 m. Water colour is stained dark yellow-brown, which was consistent with wetland bog drainage sources. DO (5.61 mg/L) was only slightly above the PWQO minimum of 5.0 mg/L for warm water habitats, as a reference. Despite containing plant species that are normally associated with bog environments and suggestive of strongly acidic conditions, the pH of the water was near neutral (pH = 6.88).

The littoral substrate was entirely soft organic muck (i.e., silt with high organic content including coarse woody debris). Aquatic vegetation was generally limited to sparse, patchy growth of submergent stonewort throughout the lake, as well as very small patches of submergent bladderwort and emergent cattail found occasionally near shore. The entire shoreline of Unnamed Pond is bordered by a floating sphagnum mat that contains a high diversity of plants characteristic of bog environments including *Sphagnum* moss, sedges, herbaceous plants and various shrubs. Black spruce was the dominant tree species found adjacent to the sphagnum mat.

Fish Community and Population

The Unnamed Pond fish community included a total of four species (see Table 6-24 at the end of the results). The large-bodied fish community was dominated by yellow perch, with moderate abundance of northern pike and low abundance of white sucker. The small-bodied fish community of Unnamed Pond only included Iowa darter, which was captured in low numbers. No COSEWIC (2012) listed fish species were observed at Unnamed Pond in 2012.

Northern pike captured represented YOY, juvenile and adult age classes. The condition of these fish was within the range of that of northern pike populations from other area lakes. Similarly, yellow perch captured at Unnamed Pond included YOY to adult age classes, with condition of these fish typical of other nearby lakes. White sucker only included adults.

Fish Habitat Evaluation

Areas adjacent to Unnamed Pond #1, including the floating sphagnum mats, provide good spawning habitat for northern pike, with sparse submergent aquatic vegetation coupled with overhanging vegetation. The overhead protection offered by the floating sphagnum mats also provides good to marginal juvenile rearing and adult habitat for northern pike and good spawning, rearing and foraging habitat for yellow perch. No white sucker spawning habitat was observed, and this species likely migrates to outlet areas to spawn.

The occurrence of large-bodied fish in Unnamed Pond was somewhat surprising given the shallow lake depth, which would be expected to freeze to near-bottom for much of the winter. Nevertheless, the occurrence of all age classes of northern pike and yellow perch in the lake suggests that these populations are self sustaining.

Bagsverd Pond

Habitat Description

Bagsverd Pond is an approximately 3.5 ha headwater lake located about 750 m north of the proposed open pit and immediately south of the South Arm of Bagsverd Lake. No tributaries feed into Bagsverd Pond, with intermittent flow discharging from the north end of the lake into a small, undefined channel that drains into the far eastern portion of the South Arm of Bagsverd Lake.

The average depth of the pond is approximately 2 m. The waters are dark brown in colour, suggesting high carbon content associated with drainage from damp forest soils. DO concentrations were relatively high (7.46 mg/L) and well above the PWQO of 5.0 mg/L, as a reference. The Bagsverd Pond water is near neutral (pH = 6.74).

The littoral substrate of Bagsverd Pond is represented almost entirely by organic silt. Sparse growth of aquatic macrophytes occurs in Bagsverd Pond, consisting mostly of floating yellow pond lily and, to a much lesser extent, submergent burreed. The shoreline has abundant standing deadwood together with sweet gale and leatherleaf lowland shrubbery.

Fish Community and Population

The Bagsverd Pond fish community consisted of one large-bodied species and five small-bodied species. A single white sucker was caught in an overnight gill net set, suggesting that any large-bodied fish were present only in low abundance. The small-bodied fish community included very high numbers of fathead minnow (*Pimephales pomelas*), finescale dace and northern redbelly dace (*Phoxinus neogaeus* and *P. eos*, respectively), moderate numbers of central mudminnow and low numbers of Iowa darter, suggesting that large predatory fish were not likely present in Bagsverd Pond. No COSEWIC (2012) listed fish species were observed at Bagsverd Pond during the July 2012 survey.

Fish Habitat Evaluation

No white sucker spawning habitat was observed in Bagsverd Pond, and therefore white sucker likely colonized the lake historically by migrating upstream from Bagsverd Lake as YOY or juveniles. The outlet creek likely is used for spawning by Bagsverd Pond resident white sucker. Overall, marginal rearing and foraging habitat is available in Bagsverd Pond for white sucker juveniles and adults.

The presence of very large numbers of fathead minnow, finescale and northern redbelly dace suggests excellent habitat for spawning, rearing and foraging. Lower numbers of Iowa darter and central mudminnow may be related to limited access to suitable spawning habitat (i.e., ponded areas of rivers or fibrous root beds for Iowa darter, and stream channels/brooks for central mudminnow).

Beaver Ponds

Habitat Description

Beaver Pond is an approximately 3.4 ha pond located within the footprint of the proposed open pit and was formed as a result of beaver activity and road construction. The pond area lies within an approximately 3.43 ha wetland that receives intermittent discharge originating from the south, at Unnamed Pond. Discharge from Beaver Pond occurs intermittently, exiting from the north end of the pond across the access road, and entering a small, defined channel that drains into the Mollie River just upstream of the Clam Creek confluence. The mean depth of Beaver Pond was between 0.15 m to 0.25 m.

The water of Beaver Pond was near neutral (pH = 6.51), stained dark yellow-brown, and had low DO (5.19 mg/L) near the PWQO minimum of 5.0 mg/L during July 2012, as a reference.

The littoral substrate and shoreline areas of Beaver Pond consist almost entirely of relatively compact organics that overly till, with gravel occurring along the north shoreline associated with road construction. Dense growth of aquatic macrophytes occurs in Beaver Pond, represented mainly by submergent bladderwort and emergent sedges and cattail, as well as some burreed and yellow pond lily. Collectively, this vegetation results in almost 100% coverage of open water areas. There is also an abundance of standing and fallen deadwood. Wetland areas surrounding the pond include cattail, sedges and alder, with willow and raspberry (*Rubus* sp.) shrubs and jewelweed (*Impatiens capensis*) herbs common along the northern shoreline.

Fish Community and Population

Five small-bodied fish species were captured at Beaver Pond (see Table 6-24 at the end of the results). Very high numbers of fathead minnow, finescale dace, northern redbelly dace and pearl dace (*Margariscus margarita*) occurred in Beaver Pond, with Iowa darter also captured in relatively low abundance. These fish species are characteristic of cool to warm headwater areas. No COSEWIC (2012) listed fish species were observed at Beaver Pond during the July 2012 survey.

East Beaver (Chester) Ponds

Habitat Description

The East Beaver (Chester) Ponds include a series of three beaver ponds that collectively have an open water surface area of approximately 4.7 ha. The ponds are situated to the southeast of

the proposed open pit, and immediately east of the Mollie River near the outlet of Chester Lake. The ponds have been formed as a result of the combination of beaver activity and road construction, and include an upper pond, a large, curved middle pond, and a smaller lower pond.

Water levels had recently fallen considerably in the middle and lower ponds, resulting in substantial areas of exposed substrate. No defined tributaries feed into the East Beaver Ponds, while discharge likely occurs intermittently with the discharge exiting to the west and draining into an undefined wetland that borders the Mollie River. No water depths were taken at the East Beaver Ponds during the July 2012 field survey. The middle East Beaver Pond was stained dark yellow-brown and very turbid (clarity approximately 0.1 m), with moderate surface DO (6.20 mg/L) and near neutral pH (6.60).

The littoral and shoreline substrate of East Beaver Pond consists mostly of thick organic muck over cobble/boulder and till. Bedrock was also present at some areas of the upper and middle ponds. Aquatic plant growth generally consisted of very sparse naiad (*Najas* sp.) growth with some stonewort, and small, isolated patches of emergent sedge and arrowhead. The East Beaver Ponds are generally treed to the edge of the former pond shorelines (i.e., prior to water levels dropping), with the surrounding coniferous forest dominated by jack pine and, to a lesser extent, black spruce.

Fish Community and Population

The fish community included three small-bodied species (fathead minnow, finescale dace and northern redbelly dace), all found in high abundance. These species are characteristic of headwater systems in Northern Ontario. No COSEWIC (2012) listed fish species were observed at the East Beaver Ponds during the July 2012 survey.

West Beaver (Moore Creek) Pond

Habitat Description

West Beaver Pond is an approximately 5.4 ha pond located 1.4 km northwest of the proposed open pit. The pond has been formed as a result of a beaver dam at its northeast end, and Chester Lake Road at its western end. A gravel berm, potentially associated with a former road, occurs approximately 50 m east of Chester Lake Road, near the pond inlet. The pond also contains a relatively large floating u-shaped fen ‘island’ in its main basin. Perennial flow originating at Moore Lake flows into the west end of the pond, with discharge from the pond feeding into the South Arm of Bagsverd Lake.

Water depth of the West Beaver Pond generally ranged from 1 m to 2 m, although the area between Chester Lake Road and the gravel berm was generally less than 0.5 m deep. No water quality data was collected at the West Beaver Pond during the July 2012 field survey.

Littoral and shoreline substrate between Chester Lake Road and the gravel berm is generally dominated by gravel overlain by a variable thickness layer of organic material, whereas organic silt, muck and/or root wad vegetation are the dominate substrate at the main pond basin. Dense aquatic vegetation, including submergent pond weeds and bladderwort, floating water shield and yellow pond lily, and patchy emergent cattail growth occurs throughout the pond. Wetland areas surrounding the pond include floating mats of sedges, sweet gale, alder and dead black spruce with some marsh cinquefoil and bog laurel also present. Sedge-alder wetlands along the pond margins generally transition to black spruce and jack pine dominated forest.

Fish Community and Population

The fish community at West Beaver Pond consisted of eight species, including one large-bodied and seven small-bodied species (see Table 6-24 at the end of the results). A single juvenile white sucker, captured during an overnight gill net set, was the only large-bodied fish species observed at the West Beaver Pond. The small-bodied fish community was dominated by minnow species, with high abundance of fathead minnow and finescale, northern redbelly and pearl dace collected together with low numbers of golden shiner. Central mudminnow occurred at moderate abundance, whereas low numbers of Iowa darter were also encountered. Consistent with other water bodies sampled during the July 2012 field study, no COSEWIC (2012) listed fish species were observed at the West Beaver Pond.

North Beaver Pond

Habitat Description

The North Beaver Pond is an approximately 0.68 ha pond located about 260 m north of the proposed open pit, and about 30 m north of the Upper Three Duck Lake inlet arm. The pond, which was formed as a result of the combination of beaver activity and road construction, lies within an approximately 3.4 ha depression that has no defined inlet source. Flow from North Beaver Pond occurs intermittently, with the discharge exiting from the south end of the pond draining across the access road and entering a small, 0.3 m wide channel that drains into the Upper Three Duck Lake. Water depth of the North Beaver Pond generally ranged between 0.2 m and 0.5 m, and appeared markedly lower than historical levels, with large areas of exposed substrate surrounding the water line.

During surveys, pH was near neutral (6.51) and DO was low (3.59 mg/L). The littoral substrate and shoreline of North Beaver Pond consists mostly of soft organic muck with abundant coarse particulate matter and large woody debris. Dense aquatic vegetation, including submergent burreed, stonewort and fern pondweed together with yellow pond lily, provides nearly 100% coverage of the pond bed. In addition, standing deadwood, logs and fallen trees provide additional cover for fish. Riparian areas adjacent to the water contain cattail, burreed and sedges, with the pond set in mixed forest dominated by black spruce and white birch, with some eastern white cedar.

Fish Community and Population

The fish community of North Beaver Pond consisted solely of two small-bodied species; finescale dace and northern redbelly dace, which were both captured in relatively high abundance. Consistent with other pond fish communities, the fish species observed at North Beaver Pond are considered characteristic of headwater environments in Northern Ontario. No COSEWIC (2012) listed fish species were observed at North Beaver Pond during the July 2012 survey.

Table 6-24: Fish Species Captured in the Vicinity of the Côté Gold Project

Surface Water Body	Fish Species Captured	
	Large-Bodied	**Small-Bodied**
Côté Lake	• Northern Pike • Yellow Perch • White Sucker • Lake Whitefish • Burbot	• Blacknose Shiner • Golden Shiner
Clam Lake (main basin)	• Northern Pike • Yellow Perch • White Sucker • Burbot • Smallmouth Bass	• Blacknose Shiner • Iowa Darter • Spottail Shiner
Clam Lake (east arm)	• Northern Pike • Yellow Perch	• Blacknose Shiner • Golden Shiner • Iowa Darter • Johnny Darter
Little Clam Lake	• Northern Pike • Yellow Perch	• Blacknose Shiner • Golden Shiner • Iowa Darter
Bagsverd Lake (south and east arms only)	• Northern Pike • Yellow Perch • White Sucker • Walleye	• Blacknose Shiner • Golden Shiner • Spottail Shiner • Fathead Minnow
Upper Three Ducks Lake	• Northern Pike • Lake Whitefish • Smallmouth Bass • Walleye • White Sucker • Yellow Perch	• Iowa Darter
Unnamed Lake #1	• Northern Pike • Yellow Perch • White Sucker • Walleye	• Blacknose Shiner • Golden Shiner • Iowa Darter • Central Mudminnow • Mottled Sculpin
Mollie River	• Northern Pike • Yellow Perch • White Sucker	• Blacknose Shiner • Golden Shiner • Iowa Darter

Surface Water Body	Fish Species Captured	
	Large-Bodied	Small-Bodied
Bagsverd Creek	• Northern Pike • Yellow Perch • White Sucker • Burbot	• Golden Shiner • Central Mudminnow • Longnose Dace
Unnamed Pond	• Northern Pike • Yellow Perch • White Sucker	• Iowa Darter
Bagsverd Pond	• White Sucker	• Iowa Darter • Central Mudminnow • Fathead Minnow • Northern Redbelly Dace • Finescale Dace
Beaver Pond	—	• Iowa Darter • Central Mudminnow • Fathead Minnow • Pearl Dace • Northern Redbelly Dace • Finescale Dace
East Beaver Pond	—	• Fathead Minnow • Northern Redbelly Dace • Finescale Dace
West Beaver Pond	• White Sucker	• Finescale Dace • Golden Shiner • Iowa Darter • Central Mudminnow • Fathead Minnow • Pearl Dace • Northern Redbelly Dace • Finescale Dace
North Beaver Pond	—	• Northern Redbelly Dace • Finescale Dace

Source: Minnow, 2012.

Additional baseline data collection is currently ongoing and is targeting Bagsverd Creek, Bagsverd Lake, Chester Lake, Clam Lake, Delaney Lake, Errington Creek, Three Duck Lakes, Mesomikenda Lake, Neville Lake, Rene Lake, Schist Lake, Unnamed Lake and Weeduck Lake. This information will be provided as it becomes available.

6.4.8.3 Summary

Mollie River, Bagsverd Creek and Clam Creek are characterized by slow flows, except for shallow and rocky portions. Due to extensive macrophyte coverage observed along the banks, the surveyed watercourses provide suitable spawning grounds for Northern Pike. Ponds surrounding the Project site generally had, except for Unnamed Pond #1, emergent macrophytes and wood debris. Alders, sedges, shrubs, and grasses dominated the banks. The banks of the surveyed lakes were mostly bordered by wetlands and/or forests to the shoreline.

Black Spruce and Cedar mainly overhung the shorelines with alders, shrubs, sedges and grasses in the understory at the lakes' edges. Within the lakes, emergent macrophytes were observed in the periphery, providing spawning habitat for Yellow Perch and Northern Pike. Lake depths vary from approximately 3 m in Côté Lake, 1.6 m in Unnamed Lake #1 and up to 5.8 m in Little Clam Lake. Most lakes had a neutral to slightly acidic pH, with warm waters, shallow Secchi depths (mostly yellow-brown coloured water with moderate clarity) and DO levels typical for regional lakes.

Large-bodied fish species (Northern Pike, Yellow Perch, White Sucker) were captured in Côté Lake, Unnamed Lake #1, Bagsverd Lake (south and east arms), Clam Lake (main basin), Unnamed Pond, Mollie River and Bagsverd Creek. In Clam Lake (east arm) and Little Clam Lake, Northern Pike and Yellow Perch, but no White Sucker, were captured. Except for the presence of White Sucker in Bagsverd Pond and West Beaver Pond, no large-bodied fish were captured in other sampled ponds (i.e., Beaver Pond, East Beaver Pond, and North Beaver Pond). Some of the water bodies also supported Lake Whitefish and Walleye, which also represent sport fish. Samplings of the water bodies did not provide evidence of any aquatic SAR (such as Lake Sturgeon) under COSEWIC.

6.5 Human Environment

The human environment baseline studies provide information for the characterization of population and demographics, economy, labour, business, infrastructure and social services, and community well-being. This in turn is used for determining potential socio-economic effects and benefits of the Project.

For the human environment baseline studies, publicly available information and databases from sources including the MNRF, the Ontario Ministry of Northern Development and Mines (MNDM), Statistics Canada, the Canada Land Inventory and others were obtained. Primary data collection, including key informant questionnaires sent to stakeholders and Aboriginal community representatives in towns, townships and First Nation reserves, was also used to define land and resource use.

Information sources and databases included:

- Ministry of Natural Resource and Forestry (MNRF);
- Ontario Ministry of Northern Development and Mines (MDNM);
- Statistics Canada;
- Canada Land Inventory; and
- Other Federal and Provincial ministries and databases as appropriate.

Cottages, residential areas and tourist establishments are shown in Figure 6-10. To address potential deficiencies, secondary source information was obtained from the Internet, if available,

and the accuracy of non-published sources was verified, where possible, through the questionnaires.

6.5.1 Land and Resource Use

The land and resource use baseline study describes how people use the land and the resources within a defined study area around and including the Project site. Examples of land and resource use include hunting, fishing, farming, forestry, plant harvesting, snowmobiling, camping, and boating. The baseline study is presented as an appendix of the Land and Resource Use TSD (see Appendix O).

6.5.1.1 Methodology

The data presented in this report contains secondary information gathered from publically available data sources including websites and published documents. Information was also gathered informally during public consultation and discussions with local stakeholders and through interviews conducted in person or by telephone with local and regional land and resource users and stakeholder organizations.

Requests for detailed information from the MNRF on bear hunting (licensed outfitters and harvest data), trapping (trapline holders and harvest data), and outfitters have been made and this information is outstanding. Discussions with land and resource users will continue and new information with respect to capacity issues and baseline conditions will be shared in an addendum as it becomes available.

6.5.1.2 Results and Discussion

Regional Land Use Planning

Municipal/local land use plans are addressed in the Socio-Economic Baseline Study (Section 6.5.5). Regional land use plans and policies are important to determine if the intended use of the Project site is consistent with these policies and, therefore, if the proposed Project is compatible with existing and committed land uses.

In areas of Northern Ontario with no municipal organization, land use planning is managed by a variety of authorities including:

- Ministry of Municipal Affairs and Housing (MMAH), through the *Planning Act*, identify planning areas and initiates zoning controls in some areas without municipal organizations or planning boards.
- Planning boards that coordinate land use planning activities and can develop official plans and zoning by-laws for areas that do not have municipal organizations (MMAH, 2013).

- Ministry of Northern Development and Mines (MNDM) advocates on behalf of Northern Ontario, delivering programs and services related to economic development (MNDM, 2013).
- MNRF manages Crown land (MNR, 2013a) and Provincial Parks (MNR, 2013b) in Ontario.
- The federal government (Aboriginal Affairs and Northern Development Canada, AANDC) manages lands for First Nation Reserves (AANDC, 2013).

Most of the land in the regional study area is Crown land. Ontario's Living Legacy Land Use Strategy (1999) governs land uses on Crown land. The land use policy areas outlined in the Crown Land Use Policy Atlas (MNR, 2011c) are detailed in Table 6-25. In general, lakes and areas surrounding lakes are identified for recreational and tourism purposes. Many trout lakes in the area are designated for the management of these fish. Land in the regional study area is primarily designated for timber production, mineral exploration and development, and trapping. Some areas in the regional study area are dedicated to provincial park lands.

The Project site overlaps with area G1809, Gogama Resource Area, designated primarily to timber production, mineral exploration and development.

Table 6-25: Land Uses Policy Areas in the Regional Study Area

Primary Land Use Code	Name	Description
G1809	Gogama Resource Area	General Use Area with primary intent on timber production and mineral exploration and development. Additional tourism development is also encouraged as a secondary use, together with limited public recreation facilities. This area also contains lakes designated for lake trout management.
G1813	Predominant Cottaging Area	General Use Area with primary intent on recreational use including a combination of public recreation, cottaging and commercial tourism. Forestry operations continue to be important in non-shoreline areas.
G1810	Kasasway Lake Area	General Use Area with primary intent on public recreation and commercial tourism. Resource extraction continues to be important in non-shoreline areas.
G1770	General Mixed Use Areas	General Use Area with primary intent on expansion of the forest, mining and trapping sectors. This is intermixed with locally dominant recreation and tourism.
G1814	Onaping-Threecorner Lake Area	Generally Use Area with primary intent on a combination of public recreation, cottaging and commercial tourism. Resource extraction is also a priority in non-shoreline areas.

Primary Land Use Code	Name	Description
P1572	Biscotasi Lake Addition	The Biscotasi Lake Provincial Park is located within the Spanish River Signature Site, one of 9 such areas featured in the Ontario's Living Legacy Land Use Strategy. Signature Sites are identified for their range of natural and recreational values and their potential to contribute to future recreation and tourism.
P192	Spanish River	The Spanish River Provincial Park is a provincially significant canoe route offering novice to intermediate river canoeing and backcountry travel on a challenging and scenic waterway. It also contains many significant natural heritage areas and is known to have one of the largest remaining old pine forests in Ontario.
P1804	La Motte Lake	The La Motte Lake Provincial Park does not contain any facilities but offers sport fishing, canoeing and wildlife viewing.

Source: Crown Land Use Policy Atlas (MNR, 2011c).

As mentioned in the hydrology baseline study (Section 6.3.6), the Mattagami Region Conservation Authority has the mandate to protect and manage the entire Upper Mattagami River watershed and a portion of the Abitibi River watershed (including Gogama and Shaw Wellfields). The Mattagami River watershed includes the City of Timmins as well as the communities of Gogama, Westree and the Mattagami First Nation Reserve. The main purpose of the Source Protection Plan is to protect existing and future drinking water sources in the Mattagami Region Source Protection Area by identifying what needs to be done to protect the City's source of drinking water, and what steps need to be taken to reduce the risks of existing significant threats and to prevent new risks from developing.

The plan specifically applies to three types of vulnerable areas:

- surface water intake protection zones;
  - Zone 1, area immediately adjacent to Timmins Water Filtration Plant on Mattagami River,
  - Zone 2, area next to Zone 1 where potential spills could reach the Plant before an operator could take action; and
  - Zone 3, areas within the watershed providing source water.
- significant groundwater recharge areas; and
- highly vulnerable aquifers.

The majority of waterways of the regional study area and all waterways within the local study area are within Intake Protection Zone (IPZ) 3. IPZ 3 includes a 120 m setback around all first order streams (upstream of Zone 2) and a 500 m buffer around all dams and generating stations for development control (Burnside & Associates Ltd., 2009). Within the plan, Section 5.5 covers the Mining Strategic Action Policy that recommends that the MNDM consider the Plan when

reviewing or certifying new mine closure plans. It also recommends the closing of mines through environmentally sound closure designs and within the regulatory framework of the *Mining Act*.

Mineral Exploration, Forestry and Agriculture

A large portion of the regional study area is under active mining claims or mining leases. IAMGOLD currently has mining claims in the regional study area, and other individual and small junior companies have mining claims near the Proposed Project site. Several of the claims held by these other companies were previously sold to Trelawney and subsequently are now owned by IAMGOLD.

Within the regional study area there are twleve permitted aggregate operators, and three aggregate operators in the local study area. Aside from two approved aggregate pits in the vicinity of the Project site, there are no aggregate operations within the footprint of the proposed Project components.

The majority of forests in Ontario are on Crown land and their management is the responsibility of the MNRF in accordance with the *Crown Forest Sustainability Act* (1994). There is a 10-year Forest Management Plan (FMP) and current annual work schedule for the Gogama MNRF area, which includes forestry activities such as harvesting, planting and maintenance of the planted areas. Currently active forest activities are in the Spanish Forest Management Unit (FMU), which overlaps with the Chester Township. The Spanish Forest, Pineland Forest, Romeo Mallet Forest and Timiskaming Forest FMUs intersect the regional study area and local study area (MNR, 2011a). The Spanish Forest FMU overlaps with the Project site, the local study area and most of the regional study area. The Pineland Forest FMU occurs to the north of the Project site, within the regional study area. The Timiskaming Forest FMU partially overlaps with the regional study area, and sections along the proposed TLA alternatives. The Romeo Malette Forest FMU overlaps with the proposed TLA alternatives. The EACOM Timber Corporation (EACOM, 2012) is in charge of managing the Spanish Forest in a sustainable manner under a Sustainable Forest License (SFL; MNR). EACOM is also part of the Timiskaming Forest Alliance Inc. which manages the Timiskaming Forest FMU under a SFL. The Pineland Forest FMU is managed under a SFL by the Pineland Timber Company Ltd., and is managed by EACOM. The Romeo Mallet Forest FMU is managed under a SFL by Tembec Forest Industries Inc.

The majority of the land in the regional study area is classified under the Canada Land Inventory as having little to no capacity for arable culture or permanent pasture (Agriculture and Agri-Food Canada, 2011). Thirty farms in the Unorganized North Sudbury Subdivision overlap with the regional study area (Statistics Canada) representing 0.01% of total farms in Ontario. No active farming activities overlap with or are immediately adjacent to the Project site.

Tourism and Recreation

Tourism and recreation in the region is related primarily to outdoor pursuits such as hunting, fishing, camping, snowmobiling, and hiking, each of which occurs primarily in the Spanish Forest. There are two Provincial Parks in the region: Biscotasi Lake/Spanish River Provincial Park (a waterway park located approximately 40 km southwest of Gogama) and La Motte Lake Provincial Park (10 km northeast of Gogama). Tourism is a major source of employment in the North East Ontario Tourism Region. This sector is highly dependent on hunting and fishing as well as other wilderness pursuits such as snowmobiling, canoeing and camping. Additional information on the tourism economic sector is provided in Section 6.5.6.

Hunting and fishing activities are managed by the MNRF. In Ontario, Wildlife Management Units (WMU) are areas where human interactions with wildlife are managed to ensure ecosystem sustainability. The regional and local study areas overlap with WMU 29, 31, 38 and 39.

According to the MNRF, the regional study area is popular for hunting moose, small game, bears and upland game birds, though game bird hunting is not regulated beyond requiring a hunting license. The Project site is used in the fall for hunting, but it is not the most used area in the regional study area. Demand for moose exceeds supply in most areas of Ontario (MNR, 2013e), though data collected by the MNRF show that numbers of hunters and moose harvesting in the area have been relatively stable, with some decreases in WMU 31. For white-tailed deer, the data shows that most hunting activity takes place in WMU 39, and rising. Within each WMU there are several Bear Management Areas (BMA) - areas of Crown land licensed annually to tourism operators to provide black bear hunting services. The regional study area overlaps 29 BMAs and the local study area overlaps with 13 BMAs.

Trapping of furbearing animals is also managed through regulations and policies administered by the MNRF. Trappers must complete mandatory training, obtain a license (renewed yearly) and trap only during open season, with the exception of Aboriginal trappers who may harvest animals at anytime of the year. Every trapper on Crown land is assigned a specific trapping area and given the exclusive rights to that area. The regional study area transects 41 trap areas and the local study area transects 23 trap areas. There are 35 trapper cabins in the regional study area and six in the local study area. Trapline areas and trapper cabins in the area are shown in Figure 6-11. One of the cabins, located on Upper Three Duck Lake is directly within the proposed footprint of the Project components IAMGOLD maintains regular communication with the holder of this trapper cottage. Two other cabins are within 5 km of the Project components, located on Schist Lake and on Bagsverd Creek just west of Neville Lake.

The MNRF manages fisheries for the province by issuing sport fishing and conservation fishing licenses. Since 2008, new fisheries management zones have been created to make fishing regulations easier to understand. The regional and local study areas are located within Fisheries Management Zone (FMZ) 8 and 10. Additionally, some fish sanctuaries are present in the regional study area in Mesomikenda Lake and Minisinakwa Lake. No fishing is allowed within

those fish sanctuaries annually from April 15 to June 1 to allow for the conservation of aquatic species.

There are no known commercial fisheries in the regional study area. There are 80 bait harvesting areas that transect the regional study area and 38 that transect the local study area. The MNRF identified two licensed bait harvesters in the regional study area (pers. comm., MNR, 2013d). The bait harvester covering Chester Township identified that bait harvesting typically occurs annually between May and September.

Mesomikenda Lake has residential cottages and an established cottager association with whom IAMGOLD maintains contact. Many fly-in outfitting camps are located in the regional study area, but not within the proposed footprint of the Project components.

Many of the tourism operations in the region are remote and only accessible by boat or plane. A number of tourism facilities have been identified that provide accommodation (cottages and camps), hunting, fishing, and other outdoor adventure services. Most are located near Gogama (Minisinakwa Lake) and northeast of the Project site near Rice and Pebonishewi Lakes. These are operated by the following organizations:

- from Gogama by Derry Air, Air Ivanhoe, John Theriault Air, Gogama Air Outfitters, Mackenda Wilderness Lodge (formerly Kenda Wilderness Lodge);
- on Lake Azure by Camp Gilla;
- on Biscotasing Lake by Grey Owl Camps and Ritchie's End of the Trail Lodge;
- on Kenogaming Lake by Kenogaming Lake Lodge;
- on Lake Mattagami by Green Wilderness Lodge;
- on Minisinakwa Lake by Gogama Lodge, Morin's All Season Resort, Twin J Hide-A-Way and Quiet Watters Cottages; and
- on Lake Tatachikapika by Tata Chika Pika Lodge.

These outfitters provide a wilderness experience and include activities such as fishing and hunting. Other outfitter camps are also accessible by car and are typically located off of local roads. Interviews were conducted with a number of these outfitters. The majority of the outfitters operate during the warm weather season (May through October) while a few offer all season or late winter services.

Other recreational interests in the area include canoeing and portage routes, located in the regional study area. The 4M Circle Canoe Route is the canoe route located closest to the proposed Project site, and is shown in Figure 6-12. The local MNRF office does not track the use of these routes; they indicated receiving approximately 10 calls per year for parties wanting to take the canoe route. The route has an extensive history and there is a lot of local knowledge about it, and it is easily accessible (pers. comm., MNR, 2012b).

A portion of an Ontario Federation of Snowmobile Clubs (OFSC) trail is located in the regional study area that connects the Mattagami First Nation with Gogama. Many snowmobile trails exist in the area, but are not maintained by the OFSC. These trails are located on the side of major roads as well as on the portage trails and existing forestry roadways. These trails are typically used by local residents.

Environmentally Important Areas

As mentioned in Section 6.4.7, there are no National or Regional Parks in the regional or local study area. No ecological reserves have been identified in the study areas. Three Provincial Parks are located partially within the regional study area only; the La Motte Lake Provincial Park, the Biscotasi Lake/Spanish River Provincial Park, and the Mississagi River Provincial Park. These parks provide for recreational activities, including camping, boating, and fishing. Provincial Parks are managed by the MNRF.

The La Motte Lake Provincial Park (575 ha) is approximately 10 km northeast of Gogama and is an area of second growth mixed forest. It is not an operating park (i.e., no facilities exist to encourage recreation activities), but a recreational area where visitors can enjoy sport fishing, canoeing and wildlife viewing has been developed (Parks Ontario, 2010).

The Biscotasi Lake/Spanish River Provincial Park (35,386 ha) is an operating waterway park located approximately 40 km southwest of Gogama. The park is known for its canoeing, fishing and camping. It is also home to many large mammals such as Moose, Black Bear and River Otter and supports an abundant birdlife including Bald Eagles, Ospreys and others (Parks Ontario, 2008). Backcountry camping and a boat launch (Duke Lake) are available. There are no drive-in campsites or developed facilities.

The Mississagi Provincial Park (8,328 ha) is an operating natural environment park located north of Elliot Lake (Parks Ontario, 2013). A small portion of this park transects the south extent of the regional study area.

Two conservation areas have been identified along the outer edges of the regional study area. The Akonesi Chain of Lakes Complex Conservation Reserve (1,470 ha) is located 11 km northwest of Gogama. This conservation reserve is known for its glacial formation and old growth jack pine. Conservation reserves were established to protect natural areas (MNR, 2001). Commercial timber harvesting, mining, aggregate extraction and commercial hydroelectric development is prohibited within conservation reserves.

An Enhanced Management Area (EMA) associated with Biscotasi Lake Provincial Park has been established southwest of the Provincial Park. The EMAs were established to provide additional land use direction for areas that hold special values or features. The Biscotasi Lake EMA covers 32,859 ha (MNR, 2002).

6.5.1.3 Summary

The regional study area is primarily used for resource development (mineral exploration, forestry), cottaging and outdoor, wilderness pursuits such as canoeing, trapping, hunting and fishing. It appears that some recreational uses (such as fishing and hunting) may not be as popular in the area as in adjacent areas; however, cottaging and canoeing are valued.

The Project site overlaps with Intake Protection Zone 3 of the Mattagami River Source Water Protection Plan area, which provides drinking water for the City of Timmins and other downstream communities.

Mining and forest related activities are the predominant types of industrial or commercial land uses in the regional study area. While mineral exploration activities in the area have been ongoing for over a century, no major mine development has occurred in the regional study area, although interest in mineral development is evident due to a number of mineral developers active in the area. Forestry has been and continues to be an important commercial use. The regional study area has active forestry uses and transects four Forest Management Units (FMUs) including the Spanish Forest, Pineland Forest, Romeo Mallet Forest, and Timiskaming Forest FMUs. There is no active agriculture in the region.

Hunted species in the regional study area include black bear, moose and white-tailed deer. Trapping in the regional study area is conducted on provincially regulated trapline areas. Twenty-three traplines intersect with the local study area and 41 with the regional study area. Various species are trapped based on quotas identified by the Ministry of Natural Resources. No commercial fisheries occur in the regional study area, but sport fishing is popular throughout the area lakes. Outdoor recreation users use the land within the regional study area for activities such as hiking, camping, canoeing, and snowmobiling.

No National Parks, regional parks, or ecological reserves are located in either the regional or local study areas. Two Provincial Parks are partially located within the regional study area; the La Motte Lake Provincial Park and Biscotasi Lake/Spanish River Provincial Park. Biscotasi Lake has an associated Enhanced Management Area to the southwest. A conservation reserve (Akonesi Chain of Lakes Complex) is located just north of Gogama.

6.5.2 Aboriginal Traditional Knowledge and Land Use

Aboriginal traditional knowledge and land use baseline studies describe the current Aboriginal (First Nation and Métis) traditional land and resource uses in a defined study area around and including the Project site that could be affected by the Project. The activities practiced by Aboriginal peoples considered in the baseline study include hunting, fishing, harvesting of plants and cultural and ceremonial practices. The resources that are needed to continue these uses are also described, and the study is presented as an appendix to the Traditional Land Use TSD (see Appendix P).

6.5.2.1 Methodology

IAMGOLD and AMEC first approached Mattagami and Flying Post First Nation in July 2012 about a conducting a traditional land use and knowledge study to determine if there could be any potential effects to these resources as a result of the Project.

As agreed upon through discussions between IAMGOLD and the Mattagami First Nation and Flying Post First Nations, IAMGOLD provided funding to the Wabun Tribal Council so that their preferred consultant, W.C McKay Consulting Services (W.C. McKay) could conduct a traditional knowledge and traditional land use study (TK/TLUs) with the Wabun member communities potentially affected by the Project. The TK/TLUs were conducted under data sharing agreements between the Mattagami First Nation and Flying Post First Nation and IAMGOLD. All information provided by knowledge holders, as stated in the agreement, was collected under consent.

This TK/TLUs was initiated in June, 2013. AMEC provided a range of materials and support activities in order to obtain information. W.C. McKay interviewed 22 elders and land users, who ranged in age from 50 to 80 years old. A standard list of questions for knowledge holders and land users was prepared for the TK/TLUs but was not provided to IAMGOLD as part of the final report. Interviews were video recorded with consent from the interviewee and notes were prepared from the interview. Information obtained through previous studies conducted for similar purposes was included. Mapping information collected from the interviewees was digitized using GIS and added to the existing data sets for the communities. Maps and the electronic spatial date of the study information collected were provided to AMEC.

Similar requests have also been made on separate occasions to the Métis Nation Ontario (MNO). To date, they have not provided information to support this baseline report; however, IAMGOLD has provided capacity funding to the MNO, and it is understood by IAMGOLD that this work is underway. The data presented for the Métis in this Report is therefore secondary information gathered from publically available data sources including websites and published documents. Discussions with Aboriginal communities and land users are ongoing in order to obtain more information, and any received information will be provided as it becomes available.

6.5.2.2 Results and Discussion

The information below was provided by the Mattagami and Flying Post TK/TLUs.

<u>Cultural Sites and Uses</u>

The study identified the following cultural sites and uses in the immediate vicinity of the Project area:

- waterfowl hunting route;
- portage route;

- a wildlife point (bald eagle nest);
- a waterfowl hunting point; and
- a “Sensitive Area” near Mesomikenda Lake.

No detailed information was provided in the report about the waterfowl hunting route or the portage route such as whether it is currently being used, by how many community members, or how frequently it is being used. The waterfowl hunting route initiates from a secondary road west of Highway 144 and passes west of Côté Lake and ends near Chester Lake. It also passes through the TMF and the open pit. The portage route follows the lake system that encircles the Project footprint, passing through Chester Lake, Clam Lake, the southern end of Bagsverd Lake, Weeduck Lake, and Upper, Middle, and Lower Three Duck Lakes.

The waterfowl hunting point is identified as being on the south-west corner of the proposed MRA (approximately 0.45 km west of Chester Lake), though no other information has been provided relating to frequency of use and by how many hunters use the point.

Within the proposed Project site, a bald eagle nest was indicated approximately 0.35 km north of Three Duck Lakes (Upper), on the western edge of the TMF. This is likely the same unidentified eagle or osprey nest observed during terrestrial biology surveys indicated in Figure 6-7 at the same described location.

A travel route was indicated, described as connecting Biscotasing Lake to the Mattagami First Nation (presumably Reserve 71, as shown in Figure 1-1 or Figure 6-1). However, details of this route were not provided and it is unknown if this route crosses or passes near the Project site.

A site described as a “sacred spring water site with related pictographs in the area” (W.C. McKay, 2013) was also reported. This site, Bethnal Springs, is considered to be culturally significant by the communities. It is located approximately 30 km northeast of the Project site.

Traditional Wildlife and Plant Resources

Sensitive Areas for traditional uses are described as “an area where hunting, fishing and gathering take place” (W.C. McKay 2013). There are six Sensitive Areas throughout Mattagami and Flying Post First Nations’ traditional territory, though none are within or crossing the proposed Project site.

The resources harvested within these six areas collectively are:

- 8 – 10 moose taken annually;
- 200 pickerel taken annually;
- 10 – 30 ducks gathered annually;

- 75 partridge gathered annually; and
- blueberries are gathered every year.

The TK/TLUs do not specify the species of ducks gathered. The TK/TLUs also discussed partridges. An assumption is made that partridge refers to grouse as partridges are rare in the boreal forest and prefer agricultural areas as habitat. The volume of blueberries collected is also not specified. The report does not detail that these resources are collected at, or near the Project area or in the Sensitive Area near Mesomikenda Lake.

Regional Métis Practices

The Métis continue to reside in the Timmins region today. They are represented through the provincial organization of the Métis Nation Ontario (MNO). The Côté Gold Project is located within the MNO, Region 3.

The MNO has negotiated harvesting rights with the MNRF. The MNRF recognizes the MNO harvest card system and under this system, Métis citizens may harvest plants, fish, wildlife and firewood taken for heating, food, medicinal, social or ceremonial purposes. The harvest is organized by region and a Captain of the Hunt administers the cards regionally.

Métis Traditional Plant Use

The MNO published a Traditional Plant Use Study for Southern Ontario that was funded by Ontario Power Generation. The MNO state that Métis plant use differs from First Nations' use of plants. The Métis report that they use "wild plants for medicinal, spiritual, food or crafts" (Métis Nation Ontario, 2010) and that trading and sharing wild plants is common practice. The study is specific to the Darlington area on the north shore of Lake Ontario. It is unclear whether Métis citizens in the Project area would gather the same species if they are available locally and whether they would have the same uses for the plants identified. The plants include mushrooms (chantarelles and 'birch mushrooms') and many other species including ferns, fruiting plants (e.g., blueberries, raspberries), herbs and trees, and are used for food, medicine, ceremony or construction.

Métis Traditional Use of Wildlife

No publicly available information on Métis harvesting wildlife species specific to the Project area is available. However, the MNO indicate in their recent *Special Impact Report* that there are some key groups of species that are likely to be important in many, if not all Métis communities in Ontario (MNO, 2012). These species include:

- large mammals: moose, deer, caribou;
- upland birds: ruffed grouse;

- migratory birds: various duck species, geese; and
- various fish: trout, pike, walleye, whitefish, sturgeon.

6.5.2.3 Summary

The Mattagami First Nation and Flying Post First Nation were provided funding by IAMGOLD to complete a traditional knowledge and traditional land use study. They have identified some cultural resources that may be affected by the Project including a wildlife point (bald eagle nest), portage route, waterfowl hunting route and a waterfowl hunting point. No information has been provided by the community on the current use of these sites or the value ascribed to them.

Other resources that may be used by the Mattagami and Flying Post First Nation in the Project area include pickerel, moose, ducks, partridge (grouse), and blueberries.

Specific traditional land uses and traditional knowledge related to the Project area from the Métis have not yet been received. According to reports published by the Métis Nation of Ontario, important plant species in general for the Métis include mushrooms; specifically birch and chanterelle mushrooms, ferns, and berries. Important wildlife includes grouse, deer, moose, ducks and geese. Fish species in the area that may be used by the Métis include trout, pike, walleye, and whitefish.

6.5.3 Built Heritage Resources

Built heritage assessments address the above-ground structures and resources that have been constructed, and are 40 years of age or older in the study areas. This principle is an accepted federal and provincial practice for the preliminary identification of cultural and built heritage resources that may be of heritage value or interest. Data collected is used to assess the potential effects of the Project on built heritage resources.

Identification of built heritage resources is presented in the Built Heritage TSD (see Appendix Q).

6.5.3.1 Methodology

The Ministry of Tourism, Culture and Sport (MTCS) is responsible for the administration of the *Ontario Heritage Act* (OHA). The OHA provides the framework for provincial and municipal responsibilities and powers in the conservation of cultural heritage resources. The OHA gives MTCS the responsibility for the conservation, protection and preservation of Ontario's culture heritage resources. MTCS describes heritage buildings and structures, cultural heritage landscapes and archaeological resources as cultural heritage resources.

Built heritage consists of individual, person-made or modified buildings or structures including, but not limited to: residences; industrial, institutional, religious, agricultural and commercial buildings; bridges; and monuments. Examples of cultural heritage landscapes are: historic

settlements, farm complexes, waterscapes, roadscapes, and railways. These landscapes emphasize the interrelationship between people and the natural environment and convey information about the processes and activities that have shaped a community.

A survey of the Project property was conducted in 2012 when weather and lighting conditions permitted good visibility of land features. A GPS was used to record the locations of diagnostic artefacts and all fixed reference landmarks. All field activities and conditions were mapped and photo-documented. Twelve cultural heritage landscapes (CHL) and nineteen built heritage resources (BH) were examined.

6.5.3.2 Results and Discussion

Preliminary investigations indicate that there is a cultural landscape consisting of a 1930s era gold mining camp with associated mining sites and remains.

Early prospecting near the local study area commenced around 1900, with the first claim staked in 1908. In 1930 Alfred Gosselin found a large gold showing on the eastern shore of Three Duck Lakes. This led to further activity through the entire area. In the Geology of the Three Ducks Area, Laird mentions Gosselin's south mining camp at Mesomikenda Lake (Laird, 1932). Mining camps from the early 1900's were crudely constructed of logs without thought for long-term habitation.

No built heritage resources other than the mining ruins have as-yet been identified in the local study area. The lands directly associated with the Côté Gold Project do not appear to be currently used for a particular purpose other than as a resource extraction area and recreation area. The 31 identified heritage resources are summarized in Table 6-26.

Table 6-26: Cultural Heritage Landscapes and Built Heritage Resources in the Regional Study Area

No.	Resource Category	Location	Brief Description
1	CHL	Trail Marker	The remnant of a square stump that served as a marker of what had been a portage route.
2	CHL	Trail Marker	The remnant of a Culturally Modified Tree with a blaze marking at what had been a portage route.
3	CHL	Portage Route along Three Duck Lakes	A landing location for what had been a portage route.
4	CHL	Portage Route from the middle Three Duck Lakes to the pond to the east.	A clearing in a wooded area of what had been a portage route.
5	CHL	Portage Route	A clearing in a wooded area of what had been a portage route.
6	CHL	Portage Route	A clearing in a wooded area of what had been a portage route.

No.	Resource Category	Location	Brief Description
7	CHL	Portage Route	An approach to a clearing at the edge of a lake that marked what had been a portage route.
8	CHL	Portage Route	The remnant of a Culturally Modified Tree with a blaze marking at what had been a portage route.
9	CHL	Portage Route	An approach to a clearing at the edge of a lake that marked what had been a portage route.
10	CHL	Portage Route from Bagsverd to Three Duck Lakes	The remnant of a Culturally Modified Tree with a blaze marking at what had been a portage route.
11	CHL	Portage Route from Bagsverd to Three Duck Lakes	The remnant of a Culturally Modified Tree with a blaze marking at what had been a portage route.
12	CHL	Portage Route	A clearing in a wooded area of what had been a portage route.
13	BH	Shannon Cabin Site	The remnants of a barrel stove.
14	BH	Shannon Cabin Site	The remnants of a cross cut saw.
15	BH	Clam Lake, Gold Mining Company Site	Cabin ruins.
16	BH	Clam Lake, Gold Mining Company Site	Cabin ruins.
17	BH	Headframe Point site	Ruins of the hoist room foundation.
18	BH	Young-Shannon Mine, near Côté Lake	Ruins of the former mill site.
19	BH	Young-Shannon Mine, near Côté Lake	Ruins of the corner of the mill.
20	BH	Young-Shannon Mine, near Côté Lake	Remnants of part of a steam engine that once powered the mill.
21	BH	Gosselin Mining Site	Ruins of a row boat.
22	BH	Gosselin Mining Site	Remnants of a wagon hub.
23	BH	Gosselin Mining Site	A large rusted barrel.
24	BH	Gosselin Mining Site	The cookery ruins.
25	BH	Gosselin Mining Site	The cookery ruins.
26	BH	Gosselin Mining Site	The bunkhouse ruins.
27	BH	Gosselin Mining Site	The wall ruins of the bunkhouse.

No.	Resource Category	Location	Brief Description
28	BH	Gosselin Mining Site	The remains of the bunkhouse door.
29	BH	Gosselin Mining Site	The remains of a window.
30	BH	Gosselin Mining Site	Ruins of the privy/ outhouse.
31	BH	Cryderman Site	Ruins of a small building.

CHL: Cultural Heritage Landscape.
BH: Built Heritage.

6.5.3.3 Summary

Twelve cultural heritage landscapes and nineteen built heritage resources were identified within the regional study area. Among the cultural heritage landscapes are: five remnants of Culturally Modified Trees (CMT) that served as Aboriginal and early Euro-Canadian trail markers; and seven remains of early trail systems, reflected today in open corridors through wooded areas. Build heritage resources include structural remains and implements related to early mining activities. No built heritage resources other than ruins from previous mining activities in the area have as-yet been identified in the local study area.

6.5.4 Archaeology

Archaeological baseline studies are undertaken by a licensed archaeologist who identifies material cultural, physical features and sites, that may have historical or cultural value or interest for Aboriginal and non-Aboriginal communities and society, within or near the proposed Project site.

Identification of archaeological resources for the Project is presented in the Archaeology TSD (see Appendix R).

6.5.4.1 Methodology

For the Côté Gold Project, as required and in accordance with the *Ontario Heritage Act* (OHA, O. Reg. 170/04), and the Ministry of Tourism, Culture and Sport Standards and Guidelines for Consultant Archaeologists (MTCS, 2011), Stage 1 and 2 Archaeological Resource Assessment studies were undertaken for archaeological sites in the vicinity of the Project site in October, 2011 and June, 2012, and the area for the proposed TMF was assessed in June and July, 2012.

The Stage 1 assessment consisted of a detailed evaluation of the Project area's archaeological potential to determine the likelihood that the Project could potentially affect areas containing significant archaeological resources. The evaluation consisted of background and overview studies that relied on desktop research and some property inspection. This preliminary work identified high potential areas and existing sites for Stage 2 and possibly Stage 3 work. Stage 2

work involved consultation and information sharing with the Mattagami and Flying Post First Nations, to solicit local traditional knowledge regarding archaeological sites and areas that may have been used in past for cultural purposes. Stage 2 work also included extensive subsurface testing in areas of high archaeological potential for pre-contact First Nations and early historic mining archaeological sites.

It should be noted that no baseline study was conducted for paleontological resources. Fossils are not expected to be present as all the rocks in the area are from the Late Archean, as noted in Section 6.3.4.2, and predate any plant or animal life on earth.

6.5.4.2 Results and Discussion

To date, through the Stage 1 and 2 studies, a total of 37 archaeological site and features have been located and recorded within the Project property (see Table 6-27). The sites include 18 pre-contact archaeological sites, eleven historic archaeological sites and eight ancient trails and portages. These are represented in the context of the Project site in Appendix R.

Some of the prime areas of potential tested in the spring of 2012 included areas near the shorelines of the Mollie River, Côté, Clam, Little Clam, Weeduck, Three Duck, Chester, and Bagsverd Lakes. Parts of these shorelines exhibited both pre-contact and historic archaeological potential.

As per applicable regulations, 28 of these sites (18 pre-contact and 10 historic) have been registered with the Province of Ontario and each has been assigned a Borden Number in the provincial database. These sites are now afforded protection under OHA.

The recommendation from the Stage 2 studies includes Stage 3-4 fieldwork for these registered sites, in order to obtain the necessary permits for further activities. Some of this work began in the fall of 2012 and further work is being undertaken during the 2013 field season.

Table 6-27: Summary of Archaeological Sites Scheduled for Stage 3-4 Archaeological Work in 2013

Site Name	Borden Number	Age and Cultural Determination (Preliminary Determination)
Flat Rock Site	CjHl-2	Pre-contact
Makwa Point	CjHl-3	Pre-contact
Chester 1	CjHl-4	Pre-contact
Chester 3	CjHl-5	Pre-contact
Chester 4	CjHl-6	Pre-contact
Chester 5	CjHl-7	Pre-contact
Chester 6	CjHl-8	Pre-contact
Lookout Site	CjHl-9	Pre-contact

Site Name	Borden Number	Age and Cultural Determination (Preliminary Determination)
Upper Duck Pine Point	CjHl-10	Pre-contact
Two Pike Point	CjHl-11	Pre-contact
Côté Lake 1	CjHl-12	Pre-contact
Côté Lake 2	CjHl-13	Pre-contact
Rocky Narrows 1	CjHl-14	Pre-contact
Rocky Narrows 2	CjHl-15	Pre-contact
Rocky Island Campsite	CjHl-16	Pre-contact
Table Point Site	CjHl-17	Pre-contact
Clam Lake Gold Mining Company	CjHl-18	Historic
Chester 2	CjHl-19	Historic
Gosselin Mining Site	CjHl-20	Historic
Shepherd Mining Site	CjHl-21	Historic
Headframe Point	CjHl-22	Historic
Large Pit Mine Site	CjHl-23	Historic
Weeduck Cabin Site	CjHl-24	Historic
Shannon Cabin	CjHl-25	Historic
Cryderman Site	CjHl-26	Historic
Upper Duck to Middle Duck Portage	n/a	Portage/Ancient Trail
Bagsverd to Wee Duck Portage	n/a	Portage/Ancient Trail
Middle Duck East Portage	n/a	Portage/Ancient Trail
Lower Duck Portage	n/a	Portage/Ancient Trail
Mollie River to Chester Lake Portage	n/a	Portage/Ancient Trail
The Northern Bagsverd Portage	n/a	Portage/Ancient Trail
The Southern Bagsverd Portage	n/a	Portage/Ancient Trail
Bagsverd Creek 1	CjHl-27	Pre-contact
Bagsverd Creek 2	CjHl-28	Historic
Bagsverd Creek 3	CjHl-29	Historic
Somme River Portage	CkHl-3	Portage

6.5.4.3 Summary

Archaeological assessments conducted for the Project followed applicable regulations and guidelines as per the OHA and MTCS. Some of the prime areas of potential tested in the spring of 2012 included areas near the shorelines of the Mollie River, Côté, Clam, Little Clam, Weeduck, Three Duck, Chester, and Bagsverd Lakes. Parts of these shorelines exhibited both pre-contact and historic archaeological potential.

Stage 1 and Stage 2 investigations identified a total of 37 archaeological sites, and features have been located and recorded within the Project property. This includes 18 pre-contact archaeological sites, 10 historic archaeological sites and nine ancient trails and portages. As required by regulations, 28 archaeological sites (18 pre-contact and 10 historic) have been registered with the Province of Ontario and assigned a Borden Number in the provincial database.

6.5.5 Visual Aesthetics

The visual aesthetics study characterizes the existing landscape and view from locations near the proposed Project site, by means of photographs taken from vantage or receptor point locations that may have the potential to view some of the Project components during the various Project phases. This description is used for the quantitative and qualitative assessment of visual effects. The Visual Aesthetics TSD is presented in Appendix S.

6.5.5.1 Methodology

Field Survey

Two fieldwork campaigns were carried out in winter and summer, 2013, to capture the existing visual landscape around the proposed low-grade ore stockpile, the TMF and the MRA locations. These are the only proposed Project components that have the potential to be seen, based on the location of receptors identified near the Project site and the components' design.

Twenty receptor locations were visited during the winter field campaign. This included locations along Highway 144 where there are existing forest clearings near the road. The number of receptors was reduced to eight during the summer field campaign based on the results of the viewshed analysis. Potential receptors, whose visual aesthetics could potentially be affected by Project components, included cabins, cottages and a campsite located on Schist Lake, Mesomikenda Lake, Annex Lake and Dividing Lake (see Figure 6-5 for lake locations).

One or more photographs were taken in the direction of the Project for each of the receptor locations. A levelled tripod was set up to hold the camera (Canon T3i Rebel) for picture taking. The following information was recorded for each photograph: date and time, Global Positioning System (GPS) coordinates, azimuth, height above sea level and the height of the camera above the ground. Most of the receptors were located by a lake. Photographs were taken from either the dock of the cottages or from the shore towards the planned MRA in order to get a clear shot.

6.5.5.2 Summary of Results

The existing landscape at, and around the Project site is typical of the Northern Ontario landscape, characterized by densely populated coniferous and deciduous trees, rivers and lakes.

The winter landscape from receptor sites was typically overcast with snow during fieldwork. Most rivers and lakes were frozen and the area was generally covered by a thick layer of snow. Views included trees, rivers and/or lakes and natural forest clearings or setting. The summer landscape was sunny with a few clouds to overcast from receptor sites. Trees were leaved and forests appeared denser as a result. Lakes were calm and reflected the surrounding landscape during clear sky days.

6.5.6 Socio-Economics

This baseline study describes the current socio-economic conditions in the study areas around and including the Project site, that may likely be affected by the Project. Socio-economic conditions include regional community population size and demographics (such as age, gender), the economy, community services and infrastructure (such as education, health care, utilities, transportation systems). The socio-economic baseline study is presented as an appendix to the Socio-Economic TSD (see Appendix T).

6.5.6.1 Methodology

Data was collected initially through secondary sources such as statistical data, published reports, community and organization's websites and media reports. Additional information was collected through stakeholder interviews and from documents those stakeholders provided.

Data limitations pertinent to this report include limitations inherent in the 2006 and 2011 Census data available through Statistics Canada. Not all data from the 2011 National Household Survey portion of the 2011 Census was available at the time of writing. When reporting census data that was based on a 20% sample of households, Statistics Canada rounds the data and may not report data for small populations to ensure confidentiality of the information. The rounding of data in small populations causes the calculated total of responses to appear inconsistent with the reported total. Moreover, the switch from a mandatory to a voluntary long-form census data for First Nation communities is limited for both 2006 and 2011 (Statistics Canada).

Additional data on First Nations was incorporated from Aboriginal Affairs and Northern Development's (AANDC) community profiles, which is maintained and updated by the communities themselves. However, not all First Nations publicize this information including communities in the regional study area.

Where Statistics Canada data has not yet been released from the 2011 Census, data from the 2006 Census was used (where available). Some Census data for Gogama was not available, and was included as part of Unorganized North Sudbury Subdivision.

To address potential deficiencies, secondary sources obtained from the internet were used when and if available. The accuracy of non-published sources was verified through discussions/contacts with stakeholders and Aboriginal community representatives.

6.5.6.2 Results and Discussion

Overview of Communities

Gogama

Gogama is the nearest community to the proposed Project. It is located on Highway 144, between Sudbury (to the south) and Timmins (to the north) and is located on Lake Minisinakwa 22 km northeast (cross country) from the proposed Project. It is managed by a local services board (GLSB) responsible for water supply, sewage, garbage collection, fire protection and recreation and library services (GLSB, 2013). The 2011 Census indicated a population of 277 (Statistics Canada, 2012).

Gogama's economy has long been driven by forestry – currently the EACOM Timber Corporation owns and operates the Gogama Sawmill in the community. Increasingly the community has been focusing on outdoor activities such as fishing, hunting, camping and hiking, while mining prospectors have come to the area since the 1930's, as indicated in Section 6.5.1.2.

City of Timmins

The City of Timmins is located on the Mattagami River 130 km northeast of the proposed Project site. The City was established for, and is sustained by, natural resource development industries, specifically, mining and forestry. Its population was 43,165 in 2011 (Statistics Canada, 2012). Two community colleges and a French-language university campus are located in Timmins (City of Timmins, 2011). In 1973, the provincial government amalgamated all the municipal jurisdictions within an approximately 3,200 km^2 area, including the Town of Timmins, South Porcupine, Schumacher and Porcupine (Whitney Township) (City of Timmins, 2012a).

In 2010, Timmins had the second-highest household income in Northern Ontario after Sudbury. Its economy is closely tied with the mining industry – the city estimates that 11.0% of jobs in Timmins are directly in the mining sector and 3.0% more are indirectly supported by the mining industry (City of Timmins, 2011).

City of Greater Sudbury

The City of Greater Sudbury, located 200 km southeast of the proposed Project site, was created in 2001 by merging the cities and towns of the former regional municipality of Sudbury with several previously unincorporated geographic townships. By land mass, Greater Sudbury is the largest city in Ontario and by population it is the largest city in northern Ontario with 160,770 residents (City of Greater Sudbury, 2013).

Sudbury was founded on mining and forestry. Throughout the 1900s, Sudbury experienced several boom-and-bust cycles caused by changes in mineral prices and resource depletion (Jewiss, 1983). In the past decade, the city has diversified and in addition to mining, it has

become a regional service centre (e.g. health, education, recreation, retail) and now has the highest per capita income in Northern Ontario (Southcott, 2008). Today, the City of Greater Sudbury focuses on six key sectors for economic development (City of Greater Sudbury, 2013a): mining; advanced education, research and innovation; tourism; healthcare expertise; retail and services; and arts and culture.

Unorganized North Sudbury Division

Unorganized North Sudbury comprises all portions of the Sudbury District that are not organized into incorporated municipalities, including the community of Gogama, Benny, Biscotasing, Cartier, Estair, Foleyet, Mattagami, Metagama, Paget, Shining Tree, Sultan, West River, Westree, Whitefish Falls and Willisville. The population of the division totalled 2,306 in the 2011 Census. Major industries of the area are forestry and other resource-based industries, business services and recreation (Statistics Canada, 2007a, 2012).

Unorganized Timiskaming West

The District of Timiskaming is located south of Timmins and east of the proposed Project site. Only a small portion of the District of Timiskaming overlaps with the regional study area. Communities in the division include Boston Creek, Dane, Gowganda, Kenabeek, Kenogami Lake, King Kirkland, Lorrain Valley, Maisonville, Mowat Landing, Paradis Bay, Savard, Sesekinika, Tarzwell and Tomstown. The population of all these communities combined amounted to 2,925 in the 2011 Census. Resource-based industries are the major employer in the area including agriculture, forestry and mining and some manufacturing and business services (Statistics Canada, 2007a, 2012).

Mattagami First Nation

Mattagami First Nation is an Anishnaabe community with one reserve (Mattagami 71) located about 20 km north east of Gogama on the northwest side of Mattagami Lake. Mattagami First Nation's reserve is accessible by road from Highway 144. The on-reserve population of the First Nation was 193 people in the 2011 Census (Statistics Canada, 2012) and the band has 531 registered members as of June 2013 (AANDC, 2013).

Local Ojibwe and Oji-Cree lived a nomadic life on the land hunting, fishing, trapping and gathering before the arrival of Europeans. Mattagami First Nation was established in 1906 with the signing of Treaty 9.

Chief Walter Naveau, elected in 2007, serves with a four member Council. Mattagami First Nation has a developed economy including restaurants, a gas bar and a range of mining related business services. Three construction companies are owned or part-owned by members of the First Nation (Mattagami First Nation pers. comm., July, 2013c). Hydro development, forestry initiatives, value added businesses and tourism opportunities are areas of planned future growth for the community.

Flying Post First Nation

Flying Post First Nation, an Ojibwe-Cree First Nation, has a 5,957 hectare reserve, Flying Post 73, located northwest of Timmins, along the Ground Hog River about an hour north of Malette Road. That reserve, however, is uninhabited. The band office is located in Nipigon, a town near Lake Nipigon. The membership is geographically dispersed, with 17 members residing in the regional study area.

The Band is administered by Chief Murray Ray and four Councillors. Flying Post First Nation joined the Wabun Tribal Council in 2007 and is now a member First Nation represented by that organization (Wabun Tribal Council, 2013). Currently the Chief and Council are negotiating with AANDC on a land claim with the intent of moving the First Nation's reserve closer to the City of Timmins. Flying Post's membership has been severely affected by the loss of forestry-related jobs in the Nipigon area (pers. comm. Flying Post First nation, 2013b).

Brunswick House First Nation

Brunswick House First Nation (BHFN) is an Ojibwe-Cree First Nation located on Highway 101N, about 10 km from the town of Chapleau. It encompasses the 9,054 hectare Mountbatten 76A Indian Reserve and the 259.8 ha Duck Lake 76B Indian Reserve.

Brunswick House First Nation, created with the signature of Treaty 9 over 1905 and 1906, is based on their traditional territory in the area of the Hudson's Bay Company post called New Brunswick House on the northern end of Missinaibi Lake. The First Nation has been led since 2011 by Chief Andrew Neshawabin and three Councillors. In 1925, the 7,000 km^2 Chapleau Game Preserve was established around the reserve that prohibited traditional hunting and trapping. As a result, BHFN had to move to a new land base. In 1970 the community traded land to gain the smaller Duck Lake 76B Indian Reserve, which had the advantages of being only 10 km from the town of Chapleau on Highway 101N. This improved the Band's wellbeing by providing them with better access to essential health and education services (Wabun Tribal Council, 2013).

Today, this First Nation has a partnership with Hydromega for the development of a water power project on the Kapuskasing River (Brunswick House First Nation, 2013).

Matachewan First Nation

Matachewan First Nation, a Cree First Nation located in Timiskaming District, is located about 60 km west of Kirkland Lake off Highway 66. Its reserve, the 4,158 ha Matachewan 72, was formed with the signature of Treaty 9 in 1906. The current Chief, Alex Batisse, was elected in 2011 (Wabun Tribal Council, 2013).

The community has been working to increase their involvement in mining, forestry and other regional business opportunities. They built the Endysian Camp, a facility to house transient mine

workers for Northgate Minerals/AuRico Gold in 2011 and they have been actively negotiating agreements with other resource development companies.

Métis Nation of Ontario

The Métis are defined as people of mixed First Nation and European ancestry who identify themselves as Métis, as distinct from First Nations people, Inuit or non-Aboriginal people. The self-identified Métis population of Sudbury in the 2006 Census was 5,425 individuals and 1,690 individuals in Timmins (Statistics Canada, 2007b). Historic Métis are represented at the local level by Métis Nation of Ontario (MNO) Charter Community Councils located in Sudbury, Timmins and Chapleau. Roger Giroux is the President of the Sudbury Métis Council; David Hamilton is the President of the Chapleau Council and Natalie Durocher is the President of the Timmins Council (MNO, 2011a; MNO, 2011b).

Population and Demographics

Population Totals and Age-Sex Breakdown

For northeastern Ontario, the key population trends are:

- stabilization of the population while reducing its percentage of the provincial population. Both a relative decline in population compared to the rest of Ontario (4.2% in 2011 from 5.4% in 1996) and an absolute decline in population of 1.4% from 2006 (Ontario Ministry of Finance, 2012);
- high growth rates in most Aboriginal communities;
- return of growth to many of the larger urban centres; and
- less marked declines in mining-dependent communities than in forestry-dependent communities.

The regional study area's population grew by 1.3% over the period from 2006 to 2011. Gogama, the closest community to the Project site, reported a total population at the time of the 2011 census of 277, down 29.7% from the 2006 census (see Table 6-28). The unorganised subdivisions of North Sudbury and Timiskaming West also lost population between the 2006 and 2011 census. This decline may be explained by fluctuations in the forestry and mining activities in the area.

Table 6-28: Population in the Regional Study Area Communities, 2001 to 2011

Area	Population			% Change 2001 to 2011
	2011	2006	2001	
Gogama	277	394	475[1]	-29.7[2]
City of Timmins	43,165	42,997	43,686	-1.2

Area	Population			% Change 2001 to 2011
	2011	2006	2001	
City of Greater Sudbury	160,770	157,857	155,219	3.6
Unorganized North Sudbury Subdivision	2,306	2,415	2,910	-20.8
Unorganized Timiskaming West Subdivision	2,925	3,205	3,270	-10.6
Mattagami First Nation	193	189	166	16.3
Flying Post First Nation	0	40	0	0.0
Brunswick House First Nation [3]	189	82	107	76.6
Matachewan First Nation	83	72	61	36.1
Regional Study Area	209,548	206,785	205,358	2.0
Regional Study Area (Urban)	203,935	200,854	198,905	2.5
Regional Study Area (Rural)	5,231	5,620	6,180	-15.4
Regional Study Area (First Nation Reserve)	465	383	334	39.2
Ontario	12,851,821	12,160,282	11,410,046	12.6

[1] Estimated from Unorganized North Sudbury Subdivision trends; not reporting entity in 2001.
[2] 2006 to 2011 change; 2001 to 2011 estimated to be 41.7%.
[3] 2011 Census data not available; instead, membership counts reported to AANDC were used.
Source: Statistics Canada, 2007a; Statistics Canada, 2012; AANDC, 2013.

In Gogama and the unorganised subdivisions, the proportion of the population aged 0 to 14 and 15 to 19 is less than the Ontario average. The proportion of the population over 65 is higher than the Ontario average, thus contributing to a higher median age than the provincial average.

Mattagami First Nation, the closest Aboriginal community to the Côté Gold Project, saw an on-reserve population increase by 2.1% from 189 persons in 2006 to 193 persons in 2011 (Statistics Canada, 2012). The Flying Post First Nation reserve, located west of Timmins recorded 40 people living on-reserve in the 2006 Statistics Canada survey, although the population currently resides in Nipigon. The registered population on-reserve for Brunswick House First Nation in 2010 was 186 (AANDC, 2012).

Data from 2006 indicates that Mattagami and Brunswick House First Nations have a large portion of their populations under the age of 19, about 15% more than the provincial average. As a result, the communities also have a low median age compared to the provincial average.

According to the 2011 Census, the median age in non-First Nation communities in the regional study area is higher than the provincial average. In rural areas that are not First Nations

reserves, there are less children and more elderly individuals, and the Gogama community in particular is described as a retirement community (pers. comm., GLSB, May 2013). For First Nation reserves, populations are typically much younger than the provincial average. Age structure data from the 2011 Census was not available for the First Nation communities of Mattagami First Nation and Flying Post First Nation. Therefore, demographic information is constructed from the results of interviews with their leadership (see Table 6-29).

Migration

Migration data from the 2011 Census released in June, 2013, is currently repressed for census areas with small populations, including Gogama, all First Nation reserves in the regional study area and the unorganized subdivisions of North Sudbury and Timiskaming West (Statistics Canda, 2013). Timmins and Sudbury migration levels were similar to the provincial averages, with populations steadily increasing as international immigrants are attracted to regional employment opportunities.

Table 6-29: Demographics of Regional Study Area Communities, 2011

Area	Population by Age (%)				Median Age	% Age 15+
	0-14	15-19	20-64	65+		
Gogama	8.9	5.4	57.1	28.6	53.2	93.6
City of Timmins	17.3	6.9	62.1	13.8	40.7	82.7
City of Greater Sudbury	15.6	6.6	61.8	16.1	42.3	84.4
Unorganized North Sudbury Subdivision	10.2	4.3	64.4	21.5	53.4	91.1
Unorganized Timiskaming West Subdivision	12.1	5.0	64.1	18.8	51.4	87.9
Mattagami First Nation	17.6	5.7	68.9	7.8	n/a	82.4
Flying Post First Nation[1]	16.1	6.7	67.1	10.1	n/a	84.0
Brunswick House First Nation	29.4	5.9	58.8	5.9	27.5	70.6
Matachewan First Nation	15.8	5.3	63.2	15.8	39.5	84.2
Regional Study Area Average	15.9	6.6	61.9	15.7	42.2	84.2
Regional Study Area (Urban)	16.0	6.6	61.8	15.6	42.0	84.0
Regional Study Area (Rural)	11.3	4.7	64.2	20.0	55.1	88.7
Regional Study Area (First Nation Reserve)	18.5	6.0	65.9	9.7	10.5	81.5
Ontario	17.0	6.7	61.7	14.6	40.4	83.0

[1] Off-reserve membership.
Source: Statistics Canada, 2012; Flying Post First Nation pers. comm., June, 2013b; Mattagami First Nation pers. comm., July, 2013b.

Aboriginal Identity and Linguistic Characteristics

Aboriginal population data from the Statistics Canada 2011 Census is not available for rural communities and reserves. Data from the District of Sudbury suggests that Aboriginal identity population in the regional study area's urban communities is on the rise, but also in the rural areas, with increases in the order of 2%. A substantial and rising share of the region's residents identify as Aboriginal, 8.0% in Timmins and 8.2% in Sudbury compared to an Ontario average of 2.4%. The proportion of the population who identified themselves as Aboriginal was highest outside of reserves, in the North Sudbury Subdivision and Timmins. Métis make up the largest group of those identifying themselves as Aboriginal (over 50% in Timmins and approximately 50% in Sudbury). Most First Nations people living in Timmins and Sudbury are not members of a First Nations Community with a reserve in the regional study area.

Across the region 40.9% of those in the regional study area are bilingual compared to an Ontario average of 11.0%. According to the 2011 Census, across the regional study area, over

50% of the population speaks English, but not French. Most residents in Gogama indicated French as their mother tongue (56.1%). Approximately 10.5% of the population identified their mother tongue as another language, most commonly Polish. Of the Aboriginal identity population, only 6.2% in Timmins indicated having knowledge of Aboriginal languages, and 3.8% in Sudbury. Ojibwe is the Aboriginal language of those living in Mattagami and Matachewan First Nation reserves, and Oji-Cree is the Aboriginal language for residents of Brunswick House First Nation (Statistics Canada, 2007a).

Education Attainment

Education levels in Northern Ontario continue to be lower than the averages for Ontario and the differences in levels of education between northern Ontario and the rest of Ontario are continuing to increase. Aboriginal communities in the Project area have a lower education attainment than the province as a whole. Education facilities and further details in the regional study area are discussed under Infrastructure and Services.

Health Conditions

The regional study area communities are situated within the Porcupine Health Unit (PHU) and Sudbury and District Health Unit (SDHU). Community-level health statistics are not publicly available. According to the Canadian Community Health Survey (2009/2010), which does not include information from First Nation reserves, approximately 62% of the population in the area communities consider their health to be very good to excellent.

Other numbers indicate that diabetes in the regional study area communities is slightly higher than the Ontario average reported through the survey. Heavy drinking, characterized as having five or more drinks, per occasion, at least once a month during the past year, was approximately 5% higher in the PHU and SDHU than provincial averages. Teenage pregnancy rates are approximately twice that of Ontario as a whole. In general, all health indicators considered in the PHU and SDHU, as identified in the Canadian Community Health Survey, were slightly to notably higher than the Ontario averages, suggesting a lower level of health than the provincial average for communities in the regional study area.

Regional Economy

Agriculture

Neither the soil nor the climate of northeastern Ontario makes the region advantageous for agricultural production. Some agricultural operations do operate in the broader region and regional study area, particularly close to urban areas, mostly in Unorganized Timiskaming region and the Greater Sudbury region.

Agriculture provided income for 445 operators and 312 employees in 2011, with most (44%) raising livestock (particularly cattle and horses). Greenhouse, bursary and floriculture production

made up 6.8% of producers, and the remainder (34.5%) was made up of other crop farming, typically hay or trees (Census 2011).

Recreation and Tourism

Communities in the regional study area have worked to develop tourism as a source of revenue and as a driver for the development of local services and infrastructure. Tourism is an important part of Gogama's economy and existing campgrounds are at capacity with returning visitors (pers. comm., GLSB, May 2013). Visitor spending in the region reached a total of $245.4 million in 2010, of which $47.8 million was spent in Sudbury (Ontario Ministry of Tourism, Culture and Sport, 2012). Ninety percent of visitors are from Canada, mostly from within Ontario, and 8% from the United States.

Mining

The regional economy has been strengthened by a sustained boom in commodity prices, particularly in gold, which has helped expand the mining industry. In 2011, the production of and exploration for minerals in Ontario generated $10.7 billion, accounting for more than 1.6% of the total value of GDP in Ontario. Mining in Ontario accounted for 16,067 employees earning $1.7 billion in wages and salaries. This sector accounted for 35.8% of the jobs and 37.2% of the wages and salaries of people in the Sudbury region. Local taxes paid by mining companies amounted to $31.9 million in 2011 (Dungan and Murphy, 2012).

Employment in mining and mining services has been growing over the last five years, and remuneration is in line with the exceptionally high productivity of workers in mining in Ontario (Dungan and Murphy, 2012).

Both Sudbury and Timmins have a century of history as mining centres, with over a dozen mines operating within their combined city limits. In addition, Sudbury has been shifting over the past decade to becoming a producer of metals to developing a cluster of mining supply and technology services, with a focus on underground hardrock mining technologies.

Employment, Labour Force and Income Levels

Based on data from the 2006 Census, three out of every four jobs in Northeastern Ontario were in service industries such as trade, health, education and public administration (Statistics Canada, 2007). In the Project area, total resource-based (mining and forestry) jobs represented 9.7% of the labour force. The dependency on resource-based jobs was much higher in the Project area than for the province as a whole (2.9%; Statistics Canada, 2007). The Project area communities as a whole had 6.6% and 5.9% of the labour force in construction and manufacturing respectively. People working in mining make up 14.5% of the workforce of Timmins and 8.6% of the workforce of Sudbury compared to 0.4% for Ontario as a whole. Both city governments are supportive of the mining industry. Labour force in non-basic industries in

the area was concentrated in other services (often but not necessarily associated with tourism), business services and health care and social services.

Sudbury is the largest community in the Project area, and as such, is a service provider in the immediate region, followed by Timmins. The labour force participation in the Project area was 63.3%, which is lower than for Ontario as a whole, which is 67.1%.

In 2010, the Sudbury District (which includes Gogama) received 378,243 person-visits, 90% of which were from Ontario. These visitors spent $47.8 M in the region, and direct, indirect and induced effects from that spending resulted in the estimated increase of regional gross domestic product (GDP) by $26.5M and supported 491 jobs earning a total income of $16.5 M. Using the 2006 census data (as 2011 census data are not yet released), these jobs would represent 4.9% of the District's labour force of 10,065 (Statistics Canada, 2007).

The northern economy in 2006 had a higher share of its employment in mining and forestry compared to all of Ontario as a whole (3.9% versus 0.2%) and a higher share of public sector employment, e.g., public administration, education and health care (Statistics Canada, 2007a). Data for 2003 indicate that employees in Northern Ontario were more unionized than employees across the province (40.5% versus 28.5%; Statistics Canada, 2006).

The number of people participating in the labour force in the regional study area is 106,465 persons, based on District of Sudbury data for 2011. The unemployment rate for urban communities in the regional study area was 7.7% in 2011, lower than the Ontario rate of 8.3%. The unemployment rate for rural communities in 2006 was 10.6% and for First Nation reserves was 23.4%. Although data for 2011 is not available for these communities, the unemployment rate for the District of Sudbury fell from 11.6% in 2006 to 9.8% in 2011. The report noted that the mining industry has been experiencing some headwinds, due to falling prices for some metals. People working in mining make up 14.5% of the workforce of Timmins and 8.6% of the workforce of Sudbury compared to 0.4% for Ontario as a whole.

While First Nation communities tend to have higher unemployment rates and lower participation rates than those of nearby communities, limited data is available for the specific communities in the Project area. Mattagami First Nation reports that, as of June 2013, the on-reserve unemployment rate was approximately 20%, and they estimate that about 75% of off-reserve membership would return to the First Nation should employment opportunities become available (Mattagami First Nation pers. comm., July, 2013c). The Township of Nipigon, where many members of the Flying Post First Nation reside, is a local centre for manufacturing and business services. The unemployment rate in that community in 2006 was 8.5%. However, the Flying Post First Nation estimates the unemployment rate of its members to be lower than this, at around 5% (Flying Post First Nation pers. comm., June, 2013a).

In the human environment regional study area, median personal income and median household income were less than the provincial averages ($27,258 and $60,455, respectively). Earnings in

the regional study area were relatively high for northern Ontario, particularly for full-time workers, though these earnings differed noticeably between men and women (Standards Canada, 2013). Data for Aboriginal groups resident in the Project area were not available from published sources.

Infrastructure and Services

Official Community Plans

The Ontario *Planning Act (1990)* requires municipalities to prepare and adopt an Official Plan to establish general planning goals and policies that guide the use of land in the community. In accordance with the requirements of the *Planning Act*, an Official Plan needs to be reviewed every five years (Ministry of Municipal Affairs and Housing, 2012). The Unorganized subdivisions of North Sudbury and Timiskaming West do not have Official Plans, including Gogama which is part of the unorganized subdivision of North Sudbury. Planning in these regions is guided by the MNRF for Crown land use.

Gogama has two schools, English public and French Catholic. The Gogama Public School offers instruction in English from Junior Kindergarten to Grade 8. The Gogama Public School is operated by the District School Board Ontario North East (based in Timmins). The French Catholic school (École Notre-Dame-du Rosaire) offers French school from Junior Kindergarten to Grade 8 (Gogama, 2012). The French Catholic school in Gogama is operated by the Gogama Roman Catholic Separate School Board. Education after Grade 8 is provided in larger centers such as Sudbury or Timmins. Similarly, post-secondary education is available at many institutions in Timmins and Sudbury.

The City of Timmins Official Plan (updated in 2008; approved by the Ministry of Municipal Affairs and Housing in 2010) provides the community's vision for growth and guides physical development and redevelopment within the city boundaries from 2008 – 2028. The Official Plan notes that to sustain the role of Timmins as a regional service center supported primarily by the natural resource sector, it must be sustained through adequate infrastructure and public service facilities to accommodate future growth and adequate supply of serviced land to meet immediate and long-term requirements for all forms and types of land uses.

The City of Greater Sudbury adopted its most recent Official Plan in 2006 and finalized it in 2008. The Official Plan includes the amalgamation of the 13 previous planning documents covering the former regional municipality of Sudbury. The city covers a large area, and as such the Official Plan covers rural areas beyond the city centre as well as the downtown core. The City's economic development strategy mentioned in the Official Plan notes that one of the main engines of growth is to provide the best mining and supply services in the world.

Transport

The main transport route in the region and in close proximity to the Project site is Highway 144, and it connects Sudbury with Timmins, passing by Gogama, the closest community to the Project site. It is a two-lane highway stretching 271 km between Sudbury and Timmins, and approximately 85 km of it are being resurface between 2012 and 2014. The highway also provides access for the Mattagami First Nation reserve, the nearest First Nation reserve to the Project site.

An Environmental Assessment is being developed for Highway 144 from approximately 6 km south of Chelmsford to approximately 8 km north of Dowling, to address short- and long-term traffic needs for those communities. Maintenance of local roads in Gogama is overseen by the Gogama local roads board.

Airports with regular commercial air service are present in both Timmins and Sudbury, which connect the region to major urban centres in Ontario. Railroads also traverse the region, serviced by VIA Rail, with a stop point in Sudbury on the route from Toronto towards Winnipeg. For passengers travelling to Gogama, there is also bus service provided by Ontario Northland.

Housing and Accommodation

Based on census data for the region, average housing values are highest for Sudbury and the Unorganized North Sudbury census subdivision (up to approximately $165,000).

Housing in the unorganized districts within the regional study area were, on average, newer than these in urban communities, but may be reflective of the rural real estate market. A small percentage of housing in the regional study area require major repairs, and is similar to provincial averages for Timmins (7.9%) and Sudbury (7.8%).

Mattagami First Nation provided a list of housing stock in the community, which consists of seven apartments, 13 townhouses or duplexes and 55 single family homes. There is a waiting list for housing in the community, and a share of housing is band-owned and rented to tenants.

The tightness of the real estate market in the region has become an issue in Timmins, particularly for mining companies. The city intends to expand the water capacity in the northern part of the city for development. Similarly, the rental market in Timmins and Sudbury has tightened from 2012 to 2013 (vacancy rate in Timmins have fallen from 1.5% in 2012 to 1.1% in 2013, and in Sudbury from 3.1% to 2.9%). Average monthly rents in the region range from approximately CAN$570 for Bachelor apartments to approximately CAN$1,000 for 3+ bedroom apartments.

Average household size for the regional study area communities has remained stable between the 2006 and 2011 Censuses, and ranges from maximum of 3.1 members per household in 2006 to 2.8 in 2011.

Homelessness is an important issue in the regional study area, and Sudbury and Timmins are the only communities with non-profit housing for low income families. Based on city reports and the Cochrane District Social Services Administration Board, there is currently insufficient non-profit housing and homelessness poses a great challenge for the region. Temporary accommodation information from Gogama, Timmins and the City of Greater Sudbury shows that there are a total of 37 hotels/motels/inns in the regional study area. There are also 22 lodges/resorts/cottages, 21 camp grounds and 17 bed and breakfasts. The majority of each of these types of accommodations is found in Sudbury, with the exception of lodges/resorts/cottages which are mostly found in Gogama. Statistics indicate that occupancy rates for north eastern Ontario for 2012/2013 was at 57.5% and 67.8% in Sudbury (PKF Consulting, 2013).

Public Utilities – Water Services

Water and waste water is managed by the local services board in Gogama. In unorganised North Sudbury subdivision and unorganised Timiskaming west subdivision, water and wastewater is privately managed on individual lots. Outside the urban centre of Sudbury, most rural areas are also on private water and wastewater systems. The City of Timmins has two water treatment plants.

Drinking water for Gogama is supplied from a municipal groundwater well, treated by the Green Wilderness Lodge Water Treatment Plant. Approximately 400 users use this supply, consuming an average of 190 m^3/d. The system is estimated to be able to support 1,000 users before requiring new investment. The Gogama Local Service Board (GLSB) manages a sewage lagoon approved to treat an average daily flow of 300 ^{3}/day of sewage. According to the MOECC, this facility is near the maximum approved capacity. IAMGOLD has supported the GLSB in completing a review of the Certificate of Approval and the facility design to determine if additional capacity is available.

Timmins has three waste water treatment facilities and three sewage lagoons located in the Mattagami Region Source Protection area. The City of Timmins Water Filtration Plant services the municipality with water from the Mattagami River (54,500 m^3/day), servicing a population of 43,000. The Mattagami River provides sufficient flow for existing drinking water purposes and could support an increase in population (Mattagami Region Conservation Authority, 2010). The Mattagami River Waste Water Treatment Plant provides treatment services for Timmins, Mountjoy and Schumacher, treating approximately 20,000 m^3/d, with a capacity of 34,000 m^3/day and servicing a population of 35,250. The plant has sufficient capacity to service an increase in population. The Whitney and Tisdale Waste Water Treatment Plant services Porcupine and South Porcupine, treating approximately 3,200 m^3/d with a capacity of 6,800 m^3/day. Treated water is discharged to the Porcupine River. The Whitney and Tisdale plant also operates and maintains Bob's Lake Lagoon, which services 54 houses in Bob's Lake subdivision. This lagoon discharges treated water to the Porcupine Lake.

Sudbury's water and waste water infrastructure consists of two primary water and 10 waste water treatment facilities. The Wanapitei Water Treatment Plant draws from the Wanapitei River, supplying approximately 60% of Sudbury's drinking water, with a maximum flow capacity of 54,000 m^3/day (average 29,006 m^3/d). The David Street Water Treatment Plant is a surface water plant drawing from Ramsey Lake, supplying the remainder of Sudbury's drinking water. Development around the Ramsey Lake has compromised the security of the water source and efforts are being made by Sudbury and the Provincial Water Source Protection Committee to improve source water quality (City of Greater Sudbury, 2011). Despite an increase in water consumption since 2006, Sudbury has sufficient capacity to deal with a population increase (City of Greater Sudbury, 2011).

First Nations own their water and waste water systems and are responsible for their daily operation and management. The AANDC provides funding and advice to develop or maintain these facilities. On June 19, 2013, Bill S-8 *Safe Drinking Water for First Nations Act* was passed into law (AANDC, 2013). The Mattagami First Nation is serviced by a groundwater supply system (two wells with disinfection equipment and distribution system) constructed in 1995, with a capacity of 60 m^3/day. The water plant was upgraded in 2011 to meet current demand, and can support an increase in population to an unknown degree (pers. comm. Mattagami First Nation, 2013b). Waste is stored in septic tanks. Water systems for the Brunswick House and Matachewan First Nations were not available.

Public Utilities – Electricity

Hydro One Networks Inc. provides electricity for Gogama, Timmins, Sudbury, Mattagami First Nation and the unorganized communities in the regional study area. In Sudbury, the Greater Sudbury Hydro Inc. services 48,000 customers in the City of Greater Sudbury, and natural gas is provided by Union Gas in Sudbury and Timmins.

Brunswick House First Nation, in partnership with the Hydromega waterpower project, is developing an energy project at the Kapuskasing River. Solar panels have been installed on the roof of the community centre to connect to the Ontario power grid (Brunswick House, 2013).

Wawaitin Station is the closest hydroelectric generating station downstream of the Mesomikenda Lake Dam (approximately 92 km northeast of the Project site). There is no power generating capacity at the Mesomikenda outfall, although it is operated by Ontario Power Generation to assist in the downstream power generating objectives. Mesomikenda Lake's water level is controlled by a dam, owned and operated by the Ontario Power Generation.

Solid Waste

Solid waste is managed in Gogama by the Gogama Local Services Board (GLSB), offering garbage collection on a fee for service basis. The local landfill has a recycling program, with landfilling capacity for several years (GLSB pers. comm., September 2012).

Timmins operates six landfill sites, including recycling. In 2011, waste production was estimated at 11,393 tonnes (30.6% recycled material; City of Timmins, 2012b). The Deloro landfill site has sufficient capacity to manage Timmins solid wastes for 50 to 60 years based on current fill rates (City of Timmins, 2012b).

Sudbury operates four landfill sites, with a combined estimated lifespan of over 25 years. Waste diversion projects for electronic waste and restrictions on landfill disposal are also employed, along with recycling (City of Greater Sudbury, 2013).

Mattagami First Nation manages and operates a landfill near the community. Waste management information for other First Nation reserves in the regional study area was unavailable.

Social, Recreational and Community Services and Infrastructure

Local services in Gogama include a public playground, community centre, ice rink, baseball field, library, heritage museum, two community restaurants, a lodge and snowmobile club. Gogama's close proximity to lakes and wilderness areas create opportunities for recreational fishing, hunting and snowmobiling. The community seeks to upgrade recreational services, but demand is insufficient, possibly due to a small number of children in the community (GLSB pers. comm., July 2013).

Timmins offers a wide range of social, recreational and community services, including learning centres and safety committees. There are several Aboriginal support organizations such as the Timmins Native Friendship Centre and the Kunuwanimano Chile and Family Services society. Timmins has four public skating/hockey arenas, one indoor swimming pool arena, public library, several baseball and soccer fields, gold courses, public playgrounds, tennis courts, mountain bike trails and green open and recreational spaces. The Mattagami River runs through the city with marinas and boat launches. The city hosts several festivals and outdoor competitions and community events.

Sudbury provides numerous social and community services, including learning and public health programs, charities and community centres. The N'Swakamok Native Friendship Centre runs programs committed to preserving language and culture, among other services and programs. The Big Nickel, Science North (northern Ontario's most popular tourist attraction) and the Dynamic Earth are situated in Sudbury, being two of Canada's largest and most innovative science centres. There are numerous heritage museums, and several festivals are hosted in the city throughout the year. Green open and recreational spaces are available throughout the city and from the surrounding 330 lakes in the region, including several recreational areas for biking, hiking and other outdoor activities. Hockey arenas are also available in the city as it is a popular sport.

The Mattagami First Nation supports a group of community members who organize and promote local activities, events and gatherings (Mattagami First Nation, 2013). The First Nation

gymnasium is used as a multi-use facility to host different events, activities and programs. There is a baseball diamond and covered outdoor rink that are both seasonally used. Several social support and training programs are also offered. Flying Post First Nation provides social services to Elders and disabled members of the community, including snowploughing and seasonal yard work and housekeeping. The Brighter Futures, Building Healthy Communities subsidy program is accessible to all members of the Flying Post community. Brunswick House First Nation runs a community centre which hosts and helps to organize workshops and events (Brunswick House First Nation, 2013). Social services information for Matachewan First Nation was unavailable.

Employment Assistance Programs

In Gogama, employment assistance is paid in full by the federal government to residents, and there is no local employment assistance office.

In Sudbury and Timmins, employment support is available through Ontario Works. There are also employment counsellors and the Employment Resource Centre in Sudbury. Northern College, in Timmins, offers community employment services to link employers with employees.

Gezhtoojig Employment and Training in Sudbury offers employment, business, and training services to all Anishnabek people (Gezhtoojig Employment and Training, 2013).

Child Care

In Gogama, there are no child care services, and families seek help from other family members or close friends. There are currently no plans to build a child care facility due to insufficient demand.

The City of Timmins offers numerous child care options and the Timmins Transition Services provide a list of 13 local daycare centres (Timmins Transition Services, 2013). Sudbury has a number of services available to residents to help them find appropriate child care options. The Greater Sudbury Area is currently seeking additional staff in early childhood education, human resources, health and fitness and in employment placement (Sudbury YMCA, 2013).

The Timmins Native Friendship Centre and Kunuwanimano Child and Family Services offer daycare services for Aboriginal people (Timmins Native Friendship Centre, 2012). Sudbury's Child and Community Resources Inclusion Support Program provides assistance to include children with special needs in licensed early learning and child care programs in the City of Greater Sudbury and First Nations of Manitoulin. The M'Chigeeng Binoojiinh Gamgoonhs First Nations Day Care is licensed for a total of 70 children and priority is given to those living in the reserve.

Shelters and Victims' Services

Gogama does not have any women's shelters or offer other services to victims of abuse.

Timmins and Area Women in Crisis operates three women's shelters in Timmins, offering services to victims of abuse. The shelters are currently operating at capacity and expansion is required (Timmins Daily Press, 2010). There are several other organizations and shelters, including shelters for homeless people. In Sudbury, several local agencies have formed the Homelessness Network, led by the *Centre de santé communautaire de Sudbury*, and it is comprised of eight community agencies.

Kunuwanimano Child and Family Services provide social services to help eliminate all forms of abuse to First Nations. Several services are provided to the community, and cover an area ranging from Homepaybe to Matachewan First Nation, including eleven First Nation communities. The Kunuwanimano head office is in the Wahgoshig First Nation, and the main office is located in Timmins (2013).

Generally, regional data and information from urban and First Nation communities indicates that there are insufficient shelters in the regional study area.

Religious Services and Spirituality

Gogama has two parishes, Notre Dame du Rosaire Church (Roman Catholic) and the Gogama Community Church which holds services at the Gogama Public School.

Timmins and Sudbury's prominent religion, based in the 2011 National Household Survey from Service Canada, is Roman Catholic (Timmins 62%, Sudbury 59%). In Sudbury, 21% of the population is Protestant.

Mattagami First Nation hosts religious services which are predominantly gospel and Christian. There are no future plans to have other church groups and/or services in the community (Mattagami First Nation pers. comm., July 2013). Religious and spiritual information for other First Nations was unavailable.

Education

Enrolment in Ontario's publicly funded schools has been in decline since 2002-2003. Northern Ontario's primary and secondary school enrolment trends have been in decline for the past nine years and are predicted to continue on a similar path until 2020. The decline could be attributed to a declining birth rate across the province (Ontario Ministry of Education, 2012).

Gogama has one French Catholic school, operated by the Gogama Roman Catholic Separate School Board. The Gogama Public School closed in 2012 due to low demand and student numbers. Students attend high school in Timmins (GLSB pers. comm., 2013).

Timmins and Sudbury operate numerous elementary and secondary schools that are Catholic, English, French or Public, and enrolment statistics are steady to slightly increasing for Timmins, and stable to slightly decreasing for Sudbury (Ontario Ministry of Education, 2012). Additionally, post-secondary education institutions are present in Timmins and Sudbury, including the Northern College of Applied Arts and Technology Porcupine Campus, Cambrian College, Laurentian University and the Northern Ontario School of Medicine.

The Mattagami First Nation provides elementary schooling from Junior Kindergarten to Grade 8 at the Mary Jane Naveau Memorial School. Eleven children attend secondary schools in Timmins and travel by bus (Mattagami First Nation pers. comm., 2013). Flying Post First Nations youths attend school in their own home towns (Flying Post First Nation pers. comm., 2013a). Brunswick House First Nation provides bus transportation for elementary and high school students attending school in Chapleau (211 Ontario North, 2012). Matachewan First Nation does not have educational facilities for local students and bus children to area elementary and secondary schools (Matachewan First Nation, 2013). First Nation communities obtain federal funding support for members interested in post-secondary education (e.g., AANDC's Post-Secondary Student Support Program). At present, 11 Mattagami First Nation members are pursuing a post-secondary education and 27 students from Flying Post First Nation as well. None of these students were identifyed as directly pursing an eductation related to the mining industry (Flying Post First Nation, 2013).

Health Infrastructure and Services

Health care services are provided through the nursing station in Gogama operated as a satellite facility sponsored by the *Centre de Santé Communautaire de Sudbury.* The nursing station is staffed by a full time nurse practitioner specialising in primary care from Monday to Thursday. Physicians visit the nursing station on an as-needed basis (Gogama, 2012).

The Timmins and District Hospital is Gogama's and Timmins' district hospital, also servicing the Cochrane District, Timiskaming, Sudbury and Algoma Districts. The hospital has capacity with 161 hospital beds, approximately 850 frontline staff and 70 physicians (2013). Several job postings for various health departments indicate that services may be at, or near, capacity.

Sudbury offers a wide range of health services, particularly at Health Sciences North, with 3,900 employees, a medical staff of more than 250, 600 volunteers and a diverse range of medical services. The Sudbury and District Health Unit is part of a provincial network of 36 non-profit public health agencies, funded jointly by local and provincial governments. As in Timmins, numerous job postings for various health departments indicate that services may be at, or near, capacity.

The Mattagami First Nation has a nursing station, with average capacity, There are no future plans for further development (Mattagami First Nation, July 2013). The Flying Post First Nation Health Services administers an Aboriginal Healthy Babies Healthy Children program for parenting support and healthy child development (Flying Post First Nation, 2013). Brunswick

House First Nation offers a health centre with the services of a visiting registered nurse (three days per week) and hygienist (every three months). The centre also provides workshops and seminars and coordinates clinics in areas. Matachewan First Nation manages several health care programs for its First Nation members in the community.

Emergency and Policing Services

Emergency services (fire, police and ambulance) are available in Gogama, though they are in a difficult position at the edge of the service area for Manitoulin-Sudbury district services. Fire protection is delivered through the Gogama Volunteer Fire Protection Team. The police service is provided by the Ontario Provincial Police (OPP), which has a detachment in Gogama reporting to the South Porcupine Detachment. Permanent staff includes one Sergeant and six Constables. According to the OPP, crime levels are down in Gogama in 2013. The emergency ambulance service based in Gogama is provided by trained personnel. The Manitoulin-Sudbury District Service Board provides additional emergency services, with one ambulance which is only available 40 hours a week (Cochrane District Social Services Administration Board, 2013).

The Cochrane District Social Services Administration Board (CDSSAB) acts as emergency response services for nearby mining companies and has not experienced an increase in demand on services from the recent developments in the region, such as the Detour Gold Mine. The CDSSAB does not foresee any changes in demand on its services associated with the Côté Gold Project (CDSSAB pers. comm., 2013).

The Timmins Fire department services the City of Timmins, including Mountjoy, South Porcupine, Schumacher, Whitney, Connaught and Timmins. Twenty-eight full time firefighters are employed by the city, based out of the Timmins Fire Department along with 21 volunteers.

Sudbury's fire services are provided by the Fire Services Division comprised of career and volunteer fire fighters. Approximately 107 career staff and 350 volunteer fire fighters are available to respond to emergencies every year (City of Greater Sudbury, 2013).

Timmins and Sudbury are fully serviced with police services. The Timmins Police Service complies with the intensive Major Case Management Protocol, resulting in more staff hours being required to complete an investigation. Also, specialized training and equipment are required to retrieve information from technological devices, as crimes become more tech savvy (Timmins Police Service, 2011). Sudbury's Greater Sudbury Police staffs 264 uniformed personnel, 107 civilian, 160 volunteers, 33 auxiliary, 29 summer students and sustains a fleet of 152 vehicles and trucks.

The Nishnawbe-Aski Police Service (NAPS) is the largest First Nations police service in Canada, policing an area encompassing almost two-thirds of Ontario. It is funded by the federal government (52%) and the province (48%; 2012). Approximately 134 uniformed officers are employed along with 30 civilians, who police 353 communities across northern Ontario. First Nation communities have seen a rise in the abuse of prescription drugs, mental health problems

in NAPS officers, underfunding and recruitment and retention challenges (NAPS, 2012). NAPS detachments include the Brunswick House First Nation, Matachewan First Nation and Mattagami First Nation.

Emergency services in Timmins are also provided by the CDSSAB, with over 94 Basic Life Support Paramedics. One of two ambulances is available in the city. In the City of Greater Sudbury, the Emergency Medical Services Division is the sole provider of ambulance services and primary and advanced medical care to, from, and between medical treatment facilities. Seven ambulances are available in the city during low demand periods, and 10 during peak periods (weekdays). There are five Paramedic Response Units (City of Greater Sudbury, 2013).

Gogama also provides emergency ambulance services to the Mattagami First Nation, as required. One ambulance is on call. Under extreme conditions, emergency support is provided by Air Ornge, as well as the Timmins Fire and rescue. Flying Post First Nation provides a medical van for Elders and disabled members to transport them for emergencies or appointments (Flying Post First Nation pers. comm., 2013a).

6.5.6.3 Summary

The regional study area includes the areas of Gogama, Timmins, Sudbury, the Unorganized North Sudbury Subdivision, Unorganized Timiskaming West, Mattagami First Nation, Flying Post First Nation, Brunswick House First Nation and Matachewan First Nation. Timmins and Sudbury are urban communities which have increasingly become service hubs for mining, education and health services. The rural areas of Gogama and the unorganized subdivisions have, over the past decade, have seen negative population growth and a greying demographic composition. The First Nation reserves have younger populations and have seen positive population growth, although some (Mattagami and Matachewan in particular) seem to be undergoing a demographic transition to a larger working-age population. The majority of their members live off-reserve.

The local study area communities of Gogama and Mattagami First Nation have struggled to keep working-age residents in their communities. In Gogama this has resulted in the population falling by 30% between the 2006 and 2011 Censuses. Over the same period, the population on Mattagami First Nation's reserve stayed more-or-less stable, while the off-reserve membership rose from 57.3% to 64.6%. The population that remains is older: Gogama's population over 65 is almost double the Ontario average and its leadership describe it as a retirement community. Mattagami First Nation's population below the age of 15 fell from 26.3% in 2006 to 17.6% in 2011, although this is still higher than the average for the regional study area of 15.9%. Despite outmigration, Mattagami First Nation's working age population share (those from 20 to 64 years of age) is 68.9%, the highest among all of the regional study area communities.

The regional study areas population grew by 1.3% over the period from 2006 to 2011. The majority (97.3%) of regional study area residents live in one of the two cities in the regional study area, Timmins and Sudbury. Both Cities have grown in population while rural populations

shrank. The result of these population trends is stable demands for community services and infrastructure in the urban regional study area communities and declining demands in rural regional study area communities. Regional study area communities continue to plan strategically and make investments in public infrastructure and services to address these challenges. High commodity prices have strengthened the regional study area's economy over the last decade, particularly in urban areas. The unemployment rate has fallen, incomes have risen and the real estate market has increased demands so much so that there are serious concerns about a housing shortage in Timmins. Urban areas have also benefitted economically from their role as regional service hubs providing a wide range of services in health, education, retail and recreation.

The culture of the region has been influenced by the Aboriginal peoples who resided in the area and the pattern of settlement from French and English Canada. Gogama in particular has a strong Franco-Ontarian influence in its culture. According to information from Statistics Canada, more than half of its residents, 56.1%, consider French their mother tongue and 64.3% of residents are bilingual. Across the region 40.9% of those in the regional study area are bilingual compared to an Ontario average of 11.0%. A substantial and rising share of the region's residents identify as Aboriginal, 8.0% in Timmins and 8.2% in Sudbury compared to an Ontario average of 2.4%. Among those who identify as Aboriginal, there are multiple identities, with about half of the population identifying as Métis and half as First Nation.

The regional economy has been strengthened by a sustained boom in commodity prices, particularly in gold, which has helped expand the mining industry. The regional study area has a long history of mining and the industry has played a role in forming its institutions, culture and infrastructure. Both Timmins and Sudbury have had, or have mines in production within their city limits. People working in mining make up 14.5% of the workforce of Timmins and 8.6% of the workforce of Sudbury compared to 0.4% for Ontario as a whole. Both City governments are supportive of the mining industry. Many of the largest private-sector employers in both cities are mining or mining service firms. For the region, however, the strong relationship with natural resource based activities leaves it vulnerable to global markets and commodity prices. This is of increasing concern with the recent fall in the prices of commodities, particularly gold – of which the price fell by 12.1% from June 2011 to June 2013 forcing mining companies to consider layoffs to compensate.

The regional study area's infrastructure and social services for Timmins and Sudbury provide adequate services for current demands and needs. However increased access to affordable housing is needed to help improve the status of the homeless, particularly in Timmins. Generally, water and wastewater treatment is adequate throughout the regional study area, including the First Nation communities, although Gogama's wastewater treatment is currently near capacity.

Northern Ontario's primary and secondary school enrolment trends have been in decline for the past nine years and are predicted to continue on a similar path until 2020. With an aging workforce, decline in birth rates and youth-outmigration, future enrolment trends are predicted to

continue to decline. First Nation communities have seen divergent trends within the regional study area, with the share of the population below 15 falling in Mattagami First Nation to provincial norms while Brunswick House continues to have a very youthful and growing population which will place increased pressure on the primary and secondary schools its children attend.

Timmins, Sudbury and Gogama's health infrastructure and services are well equipped and do not currently face capacity issues. Police services needs in Gogama, Timmins, and Sudbury are currently being met and are not judged to be at-capacity. First Nations policing, however, is facing challenges owing to cuts in funding to the NAPS program although these impacts vary between First Nations. Mattagami First Nation does not currently face major issues with public order.

Emergency response services in Gogama are in a difficult position at the edge of the service area for Manitoulin-Sudbury district services. However, in crisis situations they have been able to draw on services from CDSSAB and do not currently have capacity issues. The regional study area is accessible by road, rail and air services. The level of service is best for Highway 144 in the local study area with declining service levels near Sudbury where traffic volumes are highest within the regional study area.